DC Battery Charger

Model 9650 Series

Model 9650DC: Solar Phovoltaic Controller

Model 9650AC: AC-Powered Uninterruptible Power Supply

Applications

- Solar Photovoltaic Systems
- Uninterruptible Power Supply Systems
- Battery Charger
- Available in 12, 24, and 48 vdc Battery Systems
- For Charging NCad. Sealed and Wet Type Lead And Batteries.

Advanced Charging Features

- Automatic 3-Stage Charge Control, with Temperature Compensation
- Automatic Equalize Charge
- Voltage and Current Control
- Battery Monitoring
- Low Ripple Output

Greater Convenience and Cost Savings

- Digital Display of Current and Voltage
- Available in Connector or Terminal Interface
- Operates in Ambient Temperatures of -40°C to +60°C
- Weather-Resistant Enclosure
- Alarm conditions and charge cycle are displayed using LED's

Increased Safety

- Current Control in the Positive Circuit
- Over-Voltage and Over-Current Disconnect
- Reverse Polarity Protected
- Alarm Relay, Dry Contact; Form C
- Low Voltage Load Disconnect

Photovoltaic (PV) Charger.

The Model 9650DC charger optimizes the voltage and current (power) produced by the PV Array, and regulates the charge into the battery. The PV Array has an optimum peak power (volts **x** current = power in watts) output where its' efficiency is greatest. With other charging systems, if the load draws too much current, the voltage drops disproportionately and the power output drops. The Model 9650DC allows the PV Array to operate near its peak power point (i.e. 32 volts **x** 10 amps = 320 watts) and allows the battery and load to draw the maximum current (i.e. 25 volts **x** 12 amp = 304 watts). Note there is a 5% to 10% conversion loss (320-304 = 16 watts loss) and the battery is receiving 20% more current. As the battery reaches full charge, the power tracking becomes less significant because voltage is higher and current drops off.

The Series 9650 chargers incorporate a DC to DC sitching circuit which converts the PV Arrays power output to the voltage and current levels required by the battery and the load.

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UPS/DC, AC-Powered Uniterruptible Power Supply System for DC Loads. Model 9650AC uses an AC input and DC output to power the load. Typical UPS systems use an AC input and an AC output to power the load. Since most electronic load circuits require DC power, this technology provides for greater reliability, efficiency, and lower cost.

The Model 9650AC is similar to the 9650DC except there is a transformer, diode bridge, and capacitor circuit added, to step down the AC voltage and rectify it to DC. The transformer also provides line isolation.

The Series 9650 chargers allows the technician in the field to adjust the set points for different battery types (NiCad. and lead acid) and amp hour capacities. The following parameters are adjustable:

- Maximum current output (I max)
- Float voltage (VF)
- Equalize current termination (IOCT)-also referred as overcharge state.

Upon adjusting the above parameters, the following points are automatically set:

- Trickle charge termination (VT)
- Transition voltage (V12)

The automatic application of equalize and float charging ensures the battery is brought up to full charge with the minimum amount of water loss, or gassing. Temperature compensation is one of the most important features, providing optimum charging during changes in the environment. These charging features greatly improve the life and reliability of using NiCad. sealed and maintenance fee batteries.

National Electric Codes (NEC) requirements are met with the elimination of the diode or transistors in the negative circuit. Current sensing is in the positive circuit and galvanically isolated. A short in the negative circuit external to the charger will not affect the current control.

The output current is controlled and the voltage is regulated; however, should these circuits fail, a relay within the charger will open the circuit to the battery. The same relay is used to help prevent system damage if the battery is connected with reverse polarity.

The Series 9650 chargers are available with either a terminal strip or connector. Using a connector improves safety and reliability because there are no exposed terminals which can accidentally become shorted, and the connections are shielded against the environment.

Enclosure: Corrosion resistant, hard anodized aluminum cover and chassis, equipped for rack, table, or wall mounting The enclosure is sealed and weather resistant. The control panel consists of digital volt and amp meters, input power, on/off circuit breaker, battery on/off circuit breaker, and operational LED monitors.

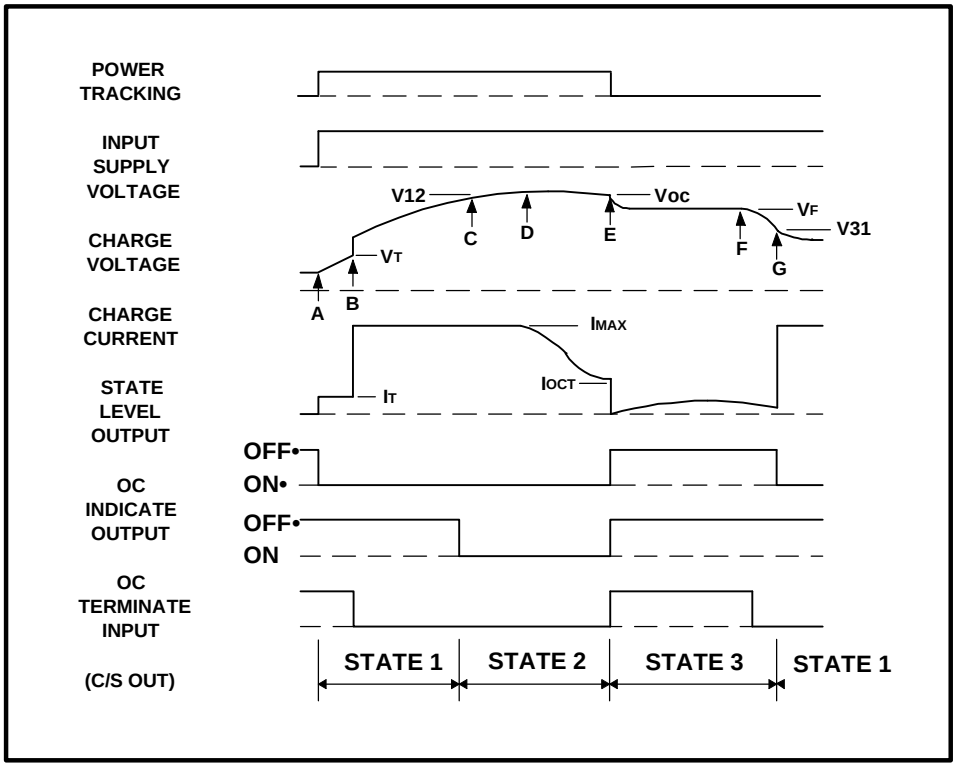
Series 9650 Alarms and Protection Features:

1. Over-voltage. Should output voltage rise above a factory preset level, the controller will disconnect the battery from the controller via an internal relay. A visual LED alarm is provided in the front panel. Alarm Relay is triggered. This circuit failure will require manual reset, by switching off input power.

2. Over-current. Should the output current raise above a factory preset level, the controller will disconnect the battery from the controller via an internal relay. A visual LED alarm is provided in the front panel. Alarm Relay is triggered. This circuit failure will require manual reset, by switching off input power.

3. No Load. The charger monitors the output current to make sure that there is a battery and load connected. This set point is field connected. A visual LED alarm is provided and the Alarm Relay is triggered. Alarm con-

DC Battery Charger



Explanation: Automatic three stage:

A. Input power turns on (sun rises), battery charges at Imax rate.

B. Battery voltage reaches Vt. If charger fails to rise above Vt at the end of the day (and x-number on amp-hours were charged) the battery is dead and the system fail LED is active. Vt is a USV. Voltage rising above Vt activates the Bulk LED.

C. Power Tracking takes place in stages A through E. The is a setting Vmax the set he upper charging voltage. During these stages the controller will adjust the I time V to get the max wattage. When the battery reaches Vmax or Voc (same value), power tracking is turned off.

D. Transition voltage V12 is reached and the charger indicates that it is now in the absorption/equalize state, state 2. The absorption/equalize LED comes on and the bulk LED goes off. V12 is USV.

E. Battery voltage approaches the over-charge level Voc and the charge current begins to taper.

F. Charge current tapers to Ioct. At the current set-point, Ioct, the charger changes to the float state and holds the battery voltage at Vf. Ioct and Vf are USV. The Float LED is on and the absorption/equalize LED goes off.

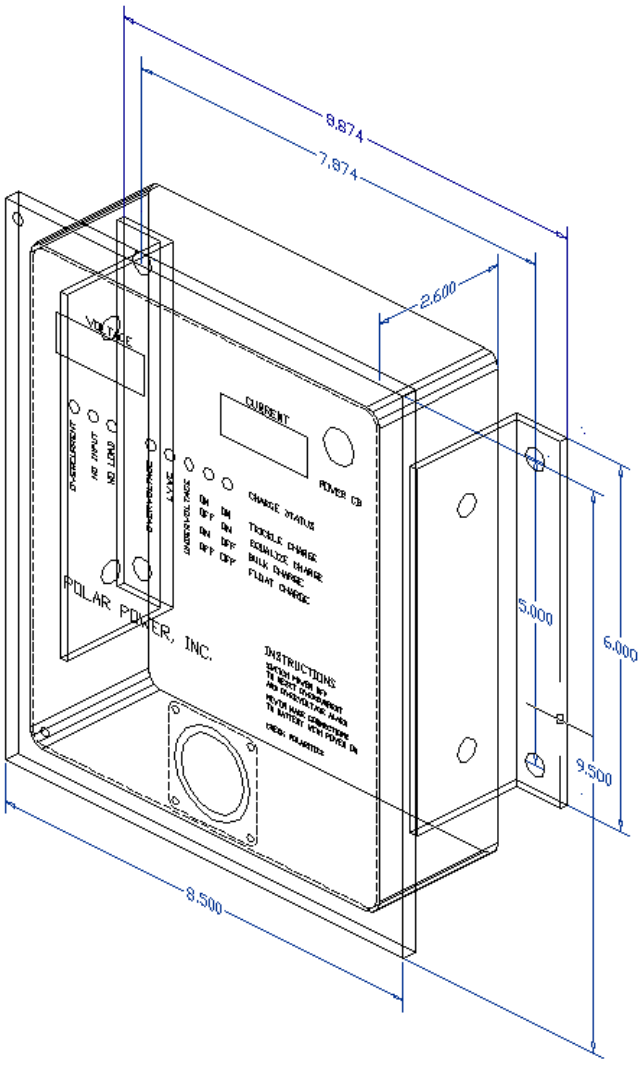
G. Here a load (>Imax) begins to discharge the battery.

H. The load discharges the battery such that the battery voltage falls below V31. The charger is now in state 1, again.

dition is automatically reset when the circuit senses the load. False alarms can occur when there is a small load and the charger switches from equalize to float. When charging at equalize (overcharge) battery is brought to a high potential; switching to float, which is at a lower potential, creates a short term condition where the battery potential is higher than the charger output. No current can flow from the charger creating the alarm condition. As the battery voltage decays to the float voltage the alarm goes away.

4. Low-Voltage Load Disconnect. This feature disconnects the load to protect the battery from being over-discharged. The disconnect point is field adjustable. The load reconnects automatically after the battery voltage climbs 3-4 volts above the disconnect setting.

5. Remote temperature sensor. This sensor monitors the battery temperature and adjusts the float voltage for optimum charging. The sensor incorporates a thermister. Any changes to the cable length or the incorporation of terminals or connectors will require recalibration of the float voltage.



The Models 9650DC and 9650AC are fully automatic chargers. No operator intervention is required once calibrated and installed. Other than calibration every two years, there is no maintenance.

Due to the reverse polarity circuit and relay, it is important to:

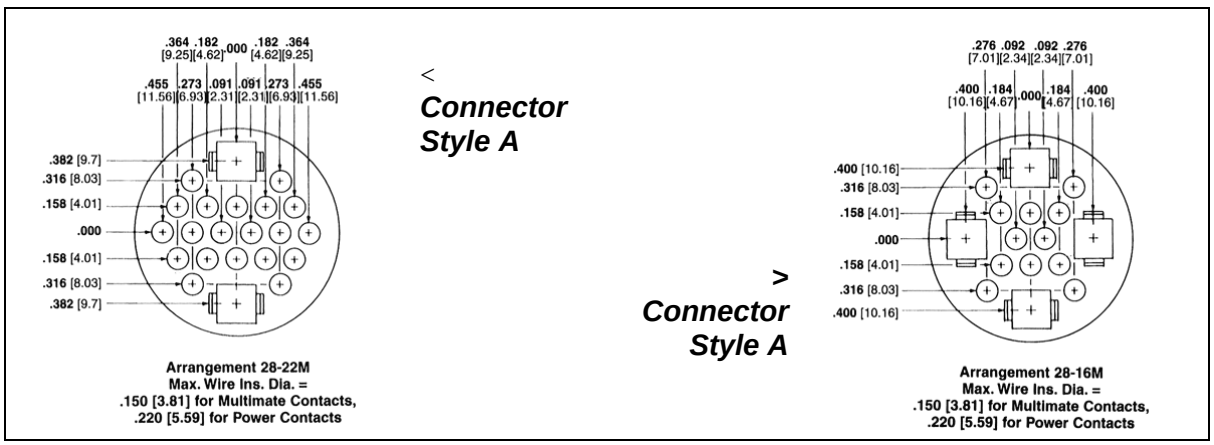
1) connect the battery
2) close the battery circuit breaker/switch
3) close the input (power) circuit breaker.

Battery Charger

Battery Charger Monitor
Model 9600
Pin Assignments

Connector Style A Pin Number	Connector Style B Pin Number	Terminal Board	Function	
1	10	TP2-1*	24 Vdc input positive	14 Awg
7	7	TP2-2	24 Vdc input negative	
10	1	TP1-4	12 Vdc output positive	
15	22	TP1-5	12 Vdc output negative	
4	4	TP2-5	Temperature sensor (black wire)	22 Awg
5	5		Temperature sensor ground-shield	
6	6	TP2-6	Temperature sensor (white wire)	
8	8	JP-1	Alarm reset	
9	9	JP-1	Alarm reset	
11	11	TP1-1	Alarm relay NO	
12	12	TP1-2	Alarm relay common	
13	13	TP1-3	Alarm relay NC	
14	14	TP2-4	Heater	18 Awg
16	16	TP2-3	Heater	reserved

***** 10-11 Circuit breaker to circuit breaker TP2-1



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Battery Charger Monitor Model 9600. All adjustments except two are independent from each other. Only Voltage or Current Offset calibration will affect the fill scale reading. This interactive adjustment must be repeated twice to achieve expected results.

Calibration details. Figure 1 below shows location of the calibration potentiometers. Calibration details are provided in Table 1 below.

Table 1. Solar Battery Charger Calibration Details.

Pot Reference Designation	Function	Comment
R9	Output Voltage setpoint. CW- higher, CWW- lower	Adjust output voltage only when SBC is in the Float charging mode.
R85	No load setpoint. CCW - lower setting CW- higher setting	Set the load to the exact value at which the indicator should come on, turn the pot CCW to extinguish the indicator, and turn the pot CW to just obtain the indication.
R12	Switchover Current (from the bulk charge to the float mode) CW- higher CWW – lower	When the SBC is in the equalize charge mode, and the charging current is equal to the Switchover current, turn the pot CCW to switch to the Float mode. If the SBC switches at to high current, turn the pot one turn CW when the SBC is still supplying large current, wait till current drops to the Switchover current, and turn the pot CCW to switch to the Float mode.
R42	Load Disconnect CW - higher CCW - lower	The difference between cut in and cut out is fix with a resistor and is approx 2 Vdc. The pot control the point where the heater starts.
R16	Output Current limit. CW – lower CCW – higher	Apply the load which will draw current higher than the desired set point. turn the pot CW to reduce the current to the desired level. WARNING: Do not set the Output Current limit to the maximum level (all the way CCW). Doing so, will disable the proper battery cycling
R43	Voltmeter reading Offset	Set the output voltage to 20 VDC using R9 pot, and adjust the R43 pot to obtain the correct reading.
R14	Voltmeter reading Gain	Set the output voltage to 31 VDC using R9 pot, and adjust the R14 pot to obtain the correct reading.
R71	Ammeter Reading Office	Apply the output current equal to 1 ADC, and adjust the R71 pot to obtain the correct reading.
R46	Ammeter Reading Gain	Apply the output current equal to 12 ADC for the DC SBC and 6 ADC for the AC SBC, and adjust the R46 pot to obtain the correct reading.