MPPT25 MAXIMUM POWER POINT TRACKING SOLAR BATTERY CHARGE CONTROLLER

The Intronics Power Inc. MPPT25 Solar Charge Controller continually tracks the maximum power point of the solar panel array, adjusting the circuit parameters approximately two times per second to maximize energy transfer from the array to the battery bank.

FEATURES

- Automatic tracking of solar panel maximum power point
- Two or three stage charging (selectable)
- High energy conversion efficiency (94-97%)
- Tracking of MPPT to within 2%
- Temperature compensated
- LCD display and LED status indicators
- User adjustable set points
- 12V or 24V system capability (selectable)
- 25 amp output rating
- Maximum panel input voltage 80 VDC
- Maximum battery voltage 65 VDC
- 25 amp auxiliary load output
- Reverse connection protection
- Output current automatically limited to 27 amps
- All common grounds

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CHANGING SEQUENCE

BULK CHARGE

The MPPT25 delivers the maximum power available from the solar array to the battery bank.

ABSORPTION (If enabled)

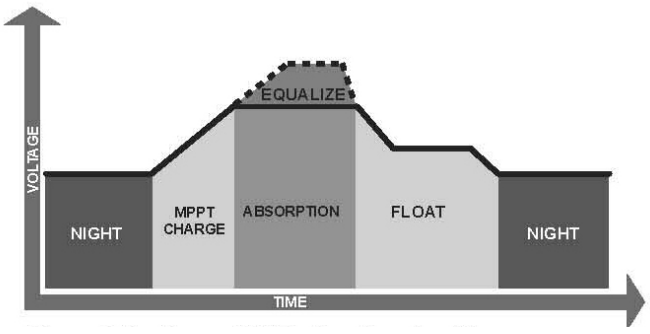
When the battery voltage reaches the battery absorption voltage set point, the controller maintains the battery charge at that voltage for two hours. If the system voltage falls below the absorption voltage set point due to clouds, system loads, etc, the controller returns to bulk mode. When the battery voltage rises again to the absorption set point, the controller maintains that voltage until a total of two hours (per day) has elapsed.

FLOAT

The controller maintains the battery voltage at the float voltage set point. There are two float voltage set points (selectable)

EQUALIZATION (If enabled)

The controller will raise the battery voltage to 15V (12v system) or 30V (24V system) for a total of one hour per month to ensure that all batteries and cells in the battery bank are at an equal state of charge. Not recommended for gel or AGM batteries.



INSTALLATION

1. Connect the BAT+ and BAT- cables from the battery bank to the marked terminals on the controller. Be sure polarity is not reversed. If these cables are reversed, the protective fuse will blow, and will need to be replaced.
2. Connect the PANEL+ and PANEL- cables to the marked terminals on the controller. Do not short the cables or connect them with reversed polarity, or the fuse will blow and will need to be replaced.
3. Connect the cables to any auxiliary 12V or 24V loads to the AUX+ and AUX- terminals on the controller. If the cables are shorted or load is greater than the fuse rating, the fuse will blow and need to be replaced. DO NOT CONNECT ANY INVERTER TO THE CONTROLLER. INVERTERS SHOULD BE CONNECTED DIRECTLY TO THE BATTERY BANK.
   - See the Auxiliary Output Section

The controller can be mounted on a flat surface or on a wall. Be sure it is in a dry protected location. If it is not close to the battery bank, be sure to use heavy cable to reduce voltage loss in the cables. #10 gauge or 4mm wire or heavier is recommended. Be sure the batteries are in a protected area with good ventilation. Install the controller far enough from the batteries that it will not be exposed to battery acid splashes or fumes.

There are three other pages of data available on the display, generally used only in setting up the system. See **SETUP**.

DISPLAY AND STATUS INDICATORS

In normal operation, the display shows:
Input voltage from the solar panel (Vp) VOLTS
Input current from the panel (Ip) AMPERES
Battery voltage (Vb) VOLTS
Output current to the battery (Ib) AMPERES

The leftmost LED shows the battery state of charge: for 12V or 24V systems
Steady Green: Fully charged, above 13.5/27.0V
Blinking Green: Nearly full above 12.5/25.0V
Steady Yellow; Partial charge above 12.0/24.0V
Blinking Yellow: Partial charge above 11.75/23.5V
Steady Red: Low charge above 11.5/23V
Blinking Red Low charge less than 11.5/23V
Note: these indications are only approximate guides to the battery state of charge, due to the effects of system loads, battery condition, etc.

The middle LED (white) is on if the auxiliary output is on.

The rightmost LED (blue) indicates that the panel is connected and is charging the battery bank.

SETUP

To set up the controller, you must detach the end panel from the aluminum housing by removing the four screws.

You will see two small pushbuttons and two DIP switches. The leftmost pushbutton is RESET. It will erase any stored Equalize and Absorb data and start a fresh search for the panel MPPT.

The second pushbutton is used to navigate between the four display screens. Pushing it once and holding it down will change the display from the normal display to Page 2, which shows:

Aux Output Mode (Refrigeration or Lights)
System nominal voltage (12V or 24V)
Float Voltage at 25 degrees C (13.5/27V or 13.9/27.8V)
Controller temperature in degrees C

Pushing it again and holding it down while the display shows Page 2 will change the display to Page 3 which shows:

Absorb disabled/enabled
Equalize enabled/disabled
Absorb charge time so far this day
Equalize time deficit

Pushing it again and holding it down while the display shows Page 3 will change the display to Page 4 which shows diagnostic information for troubleshooting, including software revision, PWM duty cycle, and float/absorb/equalize voltage limits.

Releasing the pushbutton will return the display to Page 1 after a few seconds delay.

DIP SWITCHES

There are two dipswitches, the small one has two switches, and the large has four switches.

Large Dipswitch

The rightmost switch is Auxiliary Output Mode. If the DC loads are for lights or other devices that need to be available at night, set the switch UP.
If the DC loads are things like refrigeration or pumps that can be used during the day, and are not necessary at night, set the switch DOWN.
See the Auxiliary section for more explanation

The second rightmost switch is System Voltage Select.
If your system is 24V nominal, set the switch UP.
If your system is 12V nominal, set the switch DOWN.

The second leftmost switch is Float Voltage select. Setting the switch UP enables High Float (13.9/ 27.8 volts), setting it DOWN enables Low Float (13.5/27.0 volts)
High Float is recommended for flooded batteries. Low Float is recommended for sealed, gel and AGM batteries. You may need to experiment to find the appropriate setting for your batteries. The nominal float voltage for 25 degrees C can be seen on Page 2 of the LCD display. The actual float voltage will be different from the displayed value if the temperature is not 25 degrees C.
The temperature can be seen on Page 2 of the display. The leftmost switch is not used.

Small Dipswitch

The right switch is Equalize Enable. Setting the switch UP enables equalization.
The left switch is Absorb Enable. Setting the switch UP enables absorption (three stage charging)
The Equalize and Absorb settings can be seen on Page 3 of the display.

ABSORPTION

There are two setup options for the charging algorithm. If Absorb is enabled, the controller will charge the batteries with the maximum current available from the solar panels. This is called Bulk charging. Once the battery voltage reaches the Absorption voltage (Float voltage plus .75/1.5v), it will maintain the batteries at the absorption voltage until it has been at that voltage for a total of one hour per day. Then the controller will reduce the battery to the Float voltage, and maintain it at that voltage for the remainder of the day. If the panels cannot supply enough current to hold the batteries at the Absorption or Float voltage, the controller will supply the maximum current available to the batteries.

If Absorption is not enabled, the controller will supply the maximum current available to the batteries (Bulk charge) until they reach the Float voltage, and will then maintain them at the float voltage if possible.
On page 3 of the LCD display you can see the total minutes of absorption so far in the day.

EQUALIZATION

If Equalization is enabled, the controller will raise the battery voltage to the Equalization voltage (Float voltage plus 1.25/2.5 volts) for a total of 1.5 hours per month. It will do this in increments when the panels are able to supply sufficient current to do so, while keeping track of the equalization time. You can see the total running deficit of equalization time on Page 3 of the LCD. If the deficit is zero, the battery is fully equalized.

Auxiliary Output

The Auxiliary output is used for DC loads, such as DC lights, radios, water pumps and refrigerators. It should NOT be connected to any inverters.

There are two setup options for the auxiliary output, Lights and Refrigeration. Loads such as lights must have power available at all times if possible. Therefore, if the Auxiliary Output is set up in Lights mode, the output will be on unless the battery voltage falls below the Low Voltage Disconnect voltage of 11.25V for more than one minute. When the battery voltage rises above the Reconnect voltage of 12/24V, the output is again turned on. This ensures power is always available, assuming the batteries are not excessively discharged.

However, loads such as water pumps and refrigeration can be run when more power is available during the day, and not at night when power may be more necessary for loads such as lights.

If the controller is set up in Refrigeration mode, the output will go on when the battery voltage is above 13/26 volts, and will stay on for a minimum of 15 minutes. If the voltage then falls below 13/26 volts, the output will go off. The 15 minute delay ensures that the refrigerator or pump does not cycle excessively, which can damage the motor, and consume more energy. Also the higher connect and disconnect voltages help ensure that the load will tend to run during the day when there is more energy available, while conserving battery charge for the priority loads (generally supplied by an inverter) at night.
Whether in Lights or Refrigeration mode, if the DC loads can draw more than 15 amperes, you should use the Auxiliary Output to control a relay which in turn runs the loads. This will protect the controller from possible over current problems, and also conserve energy.

TEMPERATURE COMPENSATION

The Float, Absorb and Equalize voltage set points are temperature compensated at -5 mV per degree Centigrade per cell.

SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS

Maximum Panel Voltage	75V
Maximum Battery Voltage	55V
Maximum Output Current to the Battery	30A
Maximum Current on the Auxiliary output	30A

NORMAL OPERATING CONDITIONS

Nominal Battery Voltage 12VDC/24VDC (selectable)	
Nominal Solar Array Voltage 12VDC-65VDC	
Solar Array Input Current	0-25 Amperes
Battery Output Current	0-25 Amperes
Controller output power	0-325 watts
(12V system)	0-325 watts
(24V system)	0-650 watts
Controller Self Consumption <1 Watt	
Dimensions 6” x 6” x 3” high	
Weight 3.25 lb	
Fuse 30 amp standard automotive blade fuse.	

RECOMMENDATIONS
Panels

The controller will work with panels with maximum open circuit voltages up to 65 volts. Check the specs of your panels to find their ratings. Higher voltage panels need smaller cable sizes and lose less energy in the cabling. Lower voltage panels can be connected in series for higher output voltages. Industrial style panels often have ratings of 200-300 watts and max power voltages of 40-55 volts. The Intronics MPPT 25 will work well with such panels.

SYSTEM VOLTAGE

For small systems, 12V has the advantages of readily available DC lights and radios, etc. For larger systems, 24 volts is recommended, as the controller can supply twice the power, and the cable sizes can be smaller. Inverters for both 12V and 24V are readily available.

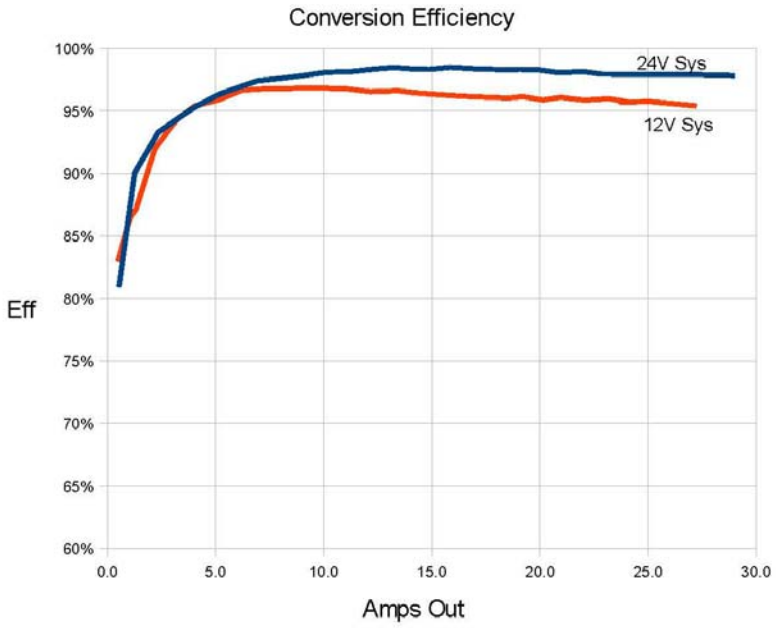
BATTERY

There are as many opinions on battery choices and the proper settings for battery charging as there are experts. Consult the battery manufacturer's recommendations for more information, and suggestions as to appropriate settings.

We recommend flooded batteries for consumer stationary applications because they tend to be more robust, less costly, and the electrolyte levels can be checked and topped up.
If you use flooded batteries, (preferably deep cycle, or golf cart types), we suggest you try using the Low Float setting with Absorb and Equalize enabled. If the battery will be used only occasionally, we suggest disabling Absorb and enabling Equalize. If it seems like the battery is not being fully charged, try using the High Float setting. If the liquid level in the battery does not need topped up more than twice a year, High Float will keep the battery somewhat more fully charged. If excessive gassing and loss of electrolyte occurs, move back to Low Float, and/or disable Absorb and/or Equalize.

If you use AGM, sealed, or gel batteries, we suggest Low Float, Absorb disabled, and Equalize disabled.

For batteries other than lead acid, consult the battery manufacturer's recommendations.



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