MPPT75HV MAXIMUM POWER POINT TRACKING SOLAR BATTERY CHARGE CONTROLLER

The Intronics Power Inc. MPPT75HV 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
- One, 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
- 12/24/36/48 Volt system capability (selectable)
- 75 amp output rating
- Maximum panel input voltage 80 VDC
- Maximum battery voltage 65 VDC
- 25 amp auxiliary load rated output
- Output current automatically limited to 78 amps
- Self Consumption <1 Watt
- All common grounds
- MCU controlled ventilation fan
- All stainless steel hardware

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CHARGING SEQUENCE

BULK CHARGE

The MPPT75HV delivers the maximum power available from the solar array to the battery bank until the battery voltage reaches one of the following setpoints, as determined by the dipswitch settings.

FLOAT

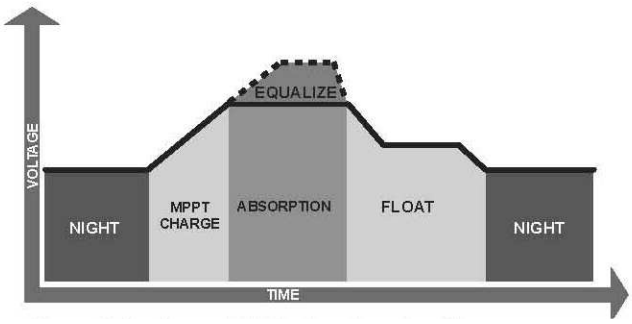
The controller maintains the battery voltage at the float voltage set point. There are two float voltage set points (selectable).

ABSORPTION (If enabled)

The fourth leftmost (SW5) is used to enable or disable the Absorption function.
UP Absorb Enabled
DOWN Absorb Disabled
If Absorption is enabled, the controller will raise the battery voltage to the Absorption voltage (Float voltage plus .75/1.5/2.25/3 volts) for a total of 2 hours per day. After the battery has been maintained at the Absorption voltage for 2 hours in the current day, the controller will maintain it at the float voltage.

EQUALIZATION (If enabled)

The controller will raise the battery voltage to the Equalization set point 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.



DISPLAY

The blue button on the top of the controller is used to navigate between LCD display pages.
Page 1 shows:
Panel voltage (Vp) Panel current (Ip)
Battery voltage (Vb) Battery current (Ib)

Pushing the blue button once and holding it down will change the display from the normal display to Page 2, which shows:

Aux Output Mode (Pump or Lights)
System nominal voltage (12/24/36/48 volts)
Float Voltage at 25 degrees C (13.5/27/40.5/54 or 13.9/27.8/41.7/55.6 volts)
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 enabled/disabled
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.

Pushing the button after Page 4 will display Page 5, which shows the amp hours so far today, plus the amp hours for each of the previous five days.

Pushing the button after Page 5 will display Page 6, which shows the maximum amps so far today, plus the maximum amps for each of the previous five days.

Pushing the button after Page 6 will display Page 7 which is used for setpoint adjustments.

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

LEDs

The leftmost LED shows the battery state of charge:

Steady Green:
Fully charged, above 13.5/27.0V/40.5/54 volts
Blinking Green:
Nearly full above 12.5/25.0/37.5 volts
Steady Yellow:
Partial charge above 12.0/24.0/36/48 volts
Blinking Yellow:
Partial charge above 11.75/23.5/35.25/47 volts
Steady Red:
Low charge above 11.5/23/34.5/46 volts
Blinking Red:
Low charge less than 11.5/23/34.5/46 volts

Note: these indications are only approximate guides to the battery state of charge, due to the effects of system loads, temperature, 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.

DIP SWITCHES

The DIP switches are visible in the small cutout in the end panel of the controller. Set them appropriately for your application.

SYSTEM VOLTAGE

The leftmost two switches (SW8 and SW7) determine the system voltage:

SW8	SW7	System Voltage
DOWN	DOWN	12V
UP	DOWN	24V
DOWN	UP	36V
UP	UP	48V

The system voltage can be seen on Page 2 of the display.

The third leftmost switch (SW6) sets the nominal float voltage for HIGH or LOW float:
UP is HIGH float:
13.8/27.8/41.2/55.5 volts at 25 degrees C
DOWN is LOW float:
13.5/27.0/40.5/54.0 volts at 25 degrees C

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.

EQUALIZE

The fifth leftmost switch (SW4) is used to enable or disable the Equalize function.
UP Equalize Enabled
DOWN Equalize Disabled

If Equalization is enabled, the controller will raise the battery voltage to the Equalization voltage (Float voltage plus 1.25/2.5/3.75/5 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 sixth leftmost switch (SW3) is used to set the aux mode to Pump or Light mode
UP Pump Mode
DOWN Light mode

The Auxiliary output is used for DC loads, such as DC lights, radios, and water pumps. It should NOT be connected to any inverters or refrigerators. Inverters and DC refrigerators generally include low and high voltage battery protection, and should be connected directly to the battery bank.

There are two setup options for the auxiliary output, Lights and Pumps. 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/22.5/33.75/45 volts for more than one minute.

When the battery voltage rises above the Reconnect Voltage of 12V/24/36/48 volts, 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 can be run when more power is available during the day, and not at night when power may be more necessary for essential loads such as lights.

If the controller is set up in Pump mode, the output will go on when the battery voltage is above 13/26/39/52 volts, and will stay on for a minimum of 15 minutes. If the voltage then falls below 13/26/39/52 volts, the output will go off.
The 15 minute delay ensures that the 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 Pump 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.
The next switch (SW2) is not used.

SETPOINT ADJUSTMENTS

For controller revision levels 2.20 and higher, the charge voltage setpoints can be adjusted higher or lower from -9% to +9% in steps of 1%. This procedure is intentionally made a little complicated so the setpoints cannot easily be changed unintentionally. Using this feature will equally adjust all voltage setpoints (float H/L, absorb and equalize) by the desired percentage.
To perform the adjustment, press the blue PAGE DISPLAY button 6 times until Page 7 is displayed. The display will show the current setpoint adjustment from the nominal setting. Hold the PAGE DISPLAY button depressed, and repeatedly set the rightmost switch (SW1) on and off three times. The display will change to indicate the controller is in adjustment mode. Now you can press and release the PAGE DISPLAY button to increase the setpoints one percent at a time. Increasing the setpoint adjustment past 9% will change the adjustment to -9%. Further button presses will again increase the adjustment one percent at a time, so any adjustment from -9% to +9% is possible. After you have made the desired setpoint adjustment, using a pen point or similar item, press the RESET button to lock in the changes and resume normal operation.

FAN

The cooling fan is turned on and off as needed by the controller. If the controller temperature is over 39 deg C and the output current is over 10 amps, the fan will go on. If the output current is over 20 amps, the fan will go on regardless of temperature.

INSTALLATION

MOUNTING

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 2.5mm wire or heavier is recommended. The connector will accept up to #4 gauge (5mm) wire.

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.

CONNECTIONS

1. Loosen all the terminals on the connector by turning the screws counterclockwise. Look inside the wire entry holes while doing so to familiarize your self as to how the connector functions. Tightening the screw raises the bottom of the contact and clamps the wire against the top of the connector assembly. If you don't make a good connection, the high currents can heat and destroy the connector.

2. Connect any 12/24/36 or 48V auxiliary loads to the AUX+ and AUX- terminals on the controller. DO NOT CONNECT ANY INVERTERS TO THE AUX OUTPUT. INVERTERS SHOULD BE CONNECTED DIRECTLY TO THE BATTERY BANK.
See the Auxiliary Output section.

3. Identify the + and - cables from the panel array. Make any parallel or series connections of the panels separately from the controller. There should be only two wires from the panels connected to the controller. Do not use the controller terminals to make connections between panel strings.
Connect the - cable from the panels to the **PAN-** terminal on the controller.

4. Identify the + and - cables from the battery bank. Make any parallel or series battery connections separately from the controller. Do not use the controller terminals to make connections between battery strings. Connect the battery- cable to the **BAT-** terminal on the controller. Measure the voltage between the **PAN-** terminal and the + cable from the panels to verify that you have not made any errors. Be sure the polarity is correct. Then connect the + cable from the panels to the **PAN+** terminal on the controller. The controller should now start operating.

Measure the voltage between the **BAT-** terminal on the controller and the + cable from the battery bank to verify that you have not made any errors. Be sure the polarity is correct. Then connect the + cable from the battery bank to the **BAT+** terminal on the controller. With a pen or similar item, press the reset button through the small hole on the end panel near the DIP switches. The controller fan should go on, and the controller will sweep through the PWM ratio to find the Maximum Power Point of the panel array and battery bank. The blue LED and fan will go on and the other LEDs will go off. After about 20 seconds, the battery charge indicator will go on and the controller will operate normally.

Pull on the cables to be sure they are firmly clamped in the connector.

After a few hours, retighten the connections to be sure they are good and tight. Also, check and retighten them again after a month or so, and at least every few months after that.

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 80V
Maximum Battery Voltage 65V
Maximum Output Current to the Battery 78A
Maximum Current on the Auxiliary Output 25A

NORMAL OPERATING CONDITIONS

Nominal Battery Voltage 12/24/36/48VDC (selectable)
Nominal Solar Array Voltage 12VDC-65VDC
Solar Array Input Current 0-75 Amperes
Battery Output Current 0-75 Amperes
Controller Output Power
0-975/1950/2925/3900 watts (12/24/36/48V system)
Controller Self Consumption <1 Watt
Display accuracy (Page 1) +-5%
Dimensions 7.25” x 6” x 3” high
Weight 3.50 lb

RECOMMENDATIONS

Panels

The controller will work with panel arrays 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 30-60 volts. The Intronics MPPT75HV will work well with such panels, individually or in series/parallel arrays.
If your panels can generate enough power to produce more than 80 amperes of battery charge current, it is not a problem. The MPPT75HV will automatically limit the output to 78 amps. That way, you can oversize your panel array so as to be sure to have the necessary power during periods of less than optimal sun.

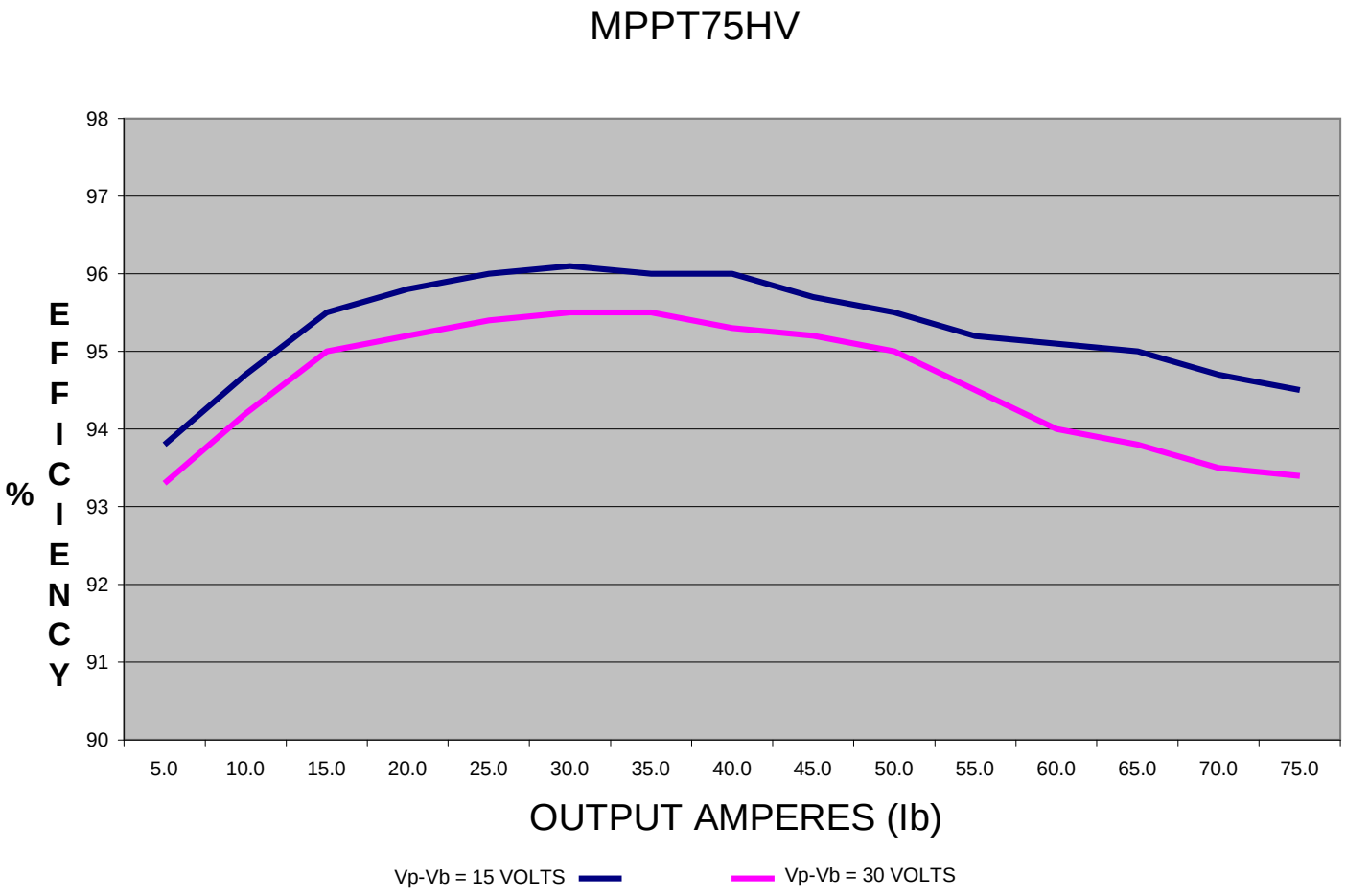
System Voltage

For small systems, 12V has the advantages of readily available DC lights and radios, etc. For larger systems, 24 or 48 volts is recommended, as the controller can supply more power, and the cable sizes can be smaller. Inverters for 12, 24 and 48 volts are readily available. Some specialized systems including small electric vehicles use 36 volt systems.

Batteries

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.
You can also use the setpoint adjustment feature (page 7 of the display) to adjust all setpoints up or down as desired.



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