Epic PWRgate

WEST MOUNTAIN RADIO

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INTRODUCTION

Thank you for choosing the **Epic PWRgate** ….the high power OR Gate with a built-in smart battery charger. It makes a true solid-state UPS for the ham shack. The **Epic PWRgate** is West Mountain Radio's third generation PWRgate product. It uses advanced technology to achieve a very low power loss, and has maximum flexibility to charge modern batteries.

The **Epic** eliminates the danger of connecting a power supply directly across a battery, which can damage many power supplies. The **Epic** also avoids introducing hum and RF interference, caused by most lead-acid battery chargers, by using a standard power supply. Furthermore, most lead-acid battery chargers are designed for flooded lead-acid marine or automotive batteries, and are inappropriate for charging sealed lead-acid gel, AGM and Li type batteries.

The **Epic** transfers 40 amperes at 12 volts DC in a continuous safe manner. It connects a battery and a power supply to a load, while electrically isolating both the battery and the supply from each other. Whenever the power supply is on, the supply feeds the load. It also charges the battery with a high-current safe battery charger. Whenever the power supply is off, the battery will feed the load. If either the power supply or the battery is malfunctioning, neither draws current from the other. The switching is instantaneous.

If the power supply is OFF and a solar panel input is present, the battery will charge from the solar panel.

The **Epic** is very useful in the ham shack, and even more useful in a repeater installation. Communication equipment will remain operative during AC power blackouts and power supply failures. Power supplies and batteries can be swapped out while equipment continues to be powered and without glitches.

Additionally, the **Epic** and a power supply may be used solely as a permanently installed battery charger. This also may be configured to run a radio station directly from the battery.

Please read the following instructions BEFORE installing the Epic

Epic PWRgate Features

- Instant switch from a power supply to/from a battery
- Only a 0.05V drop from the power source to the output (compare to 0.33V on Super PWRgate PG40S)
- Properly charges a Standard Lead Acid, AGM Lead Acid or LiFePO4 battery
- Operates at a considerable lower temperature than Super PWRgate PG40S, thus eliminating the large heat sink.
- Support for direct connection to a solar panel for battery charging of all chemistry types
- Continuous output current of up to 40A fully supported
- Charge rates up to 10A supported
- USB port for monitoring the system or to program specific charge parameters
- Complete LED status indicators of unit status
- Battery charge susped switch to eliminate charger notice for 30 minutes
- May be programmed for vehicle use where charging is suspended when the vehicle is not running
- Optional temperature probe to control charging based on battery temperature

Package Contents

- Epic PWRgate Unit
- USB-micro Cable, 6 ft
- 4 Powerpole® Retention Clips
- User Manual
- Reference Card for LED Indicators

WARNINGS

The following may damage the unit:

- Supplying over 16V to the power supply jack
- Supplying over 30V to the solar panel jack
- Operating in an environment over 110 degrees F
- Drawing more than 40A on the output jack for more than a short time
- Connecting a battery of the wrong type (as selected by the jumpers) may damage the battery and/or cause the battery to start on fire or explode
- The Epic does not have internal fuses. It is advisable to have a safety fuse close the battery (like 50A)
- If the output is connected directly to your equipment (as opposed to connected to a RIGrunner or PWRguard), then that cable should be fused

INSTALLATION & SET-UP

Choosing a Mounting Location

Pick a location that is central to the power supply, battery, as well as the load or 12V distribution panel. Radios and many 12V devices draw large amounts of current. All wires have resistance, so it is good practice to keep them as short as possible and to use a larger gauge wire to minimize voltage drop.

The **Epic** can be installed in any orientation. It is recommend to use in a cool dry location and preferably well ventilated. If placed in direct sunlight, it will absorb heat and get unnecessarily hot.

The **Epic** can be mounted using #8 hardware in the mounting holes.

Powerpole® connectors can be installed by soldering or crimping. Be sure to make good connections. For detailed Powerpole® connector installation tips see RIGrunner support pages at http://www.westmountainradio.com/ppinfo.

Connecting the power supply

The power supply wire should be heavy gauge and as short as possible; recommend #10 wire 3 feet to no longer than 6 feet long. Most power supplies have 1/4 inch studs. Note that West Mountain Radio carries 3 and 6 feet long power supply cables, #10 red and black insulated wire with 1/4 inch ring terminals on one end and Powerpole® on the other.

Be sure to connect the RED Powerpole® connects to the RED wire and connect to the PLUS terminal on the supply. Similarly, make sure that the

BLACK Powerpole® connect to the BLACK wire and connect to the NEGATIVE terminal on the supply. Check that the connections at the power supply are well tightened.

Plug this cable from the power supply into the **Epic** connector marked Power Supply. Confirm that the Powerpole® are plugged together securely, and that the wire is straight at the connection point and is not under strain or bent over.

Power Supply - Connectors are intended for a power supply connected to AC. The normal voltage is 13.8V to 14.5V. It is recommended this voltage be at or slightly higher than the charge voltage for the battery being used: 13.9V for a standard Lead Acid, 14.3V for a AGM, and 14.5V for a LiFePO4. Expect the voltage to the equipment to be at approximately this same voltage. The unit will operate under battery power if no power is on this input. Set the internal jumpers to select the right type of battery or use the USB interface to set a custom charge profile.

Connecting the Battery

The battery wire should be heavy gauge and as short as possible; recommend #10 wire, 3 feet long. In addition, a fuse must be installed in the positive lead directly at the battery terminal. **Note, any short in the battery wire, connector, or load could result in fire and battery explosion.**

Caution: Handle batteries with knowledge and appropriate care. Batteries have dangerous chemicals that can seep out. Batteries can emit extremely explosive hydrogen gas that is explosive. Batteries, especially automotive and marine flooded lead acid, must be used in a strong, ventilated enclosure. Sealed lead acid batteries are much safer but must be correctly handled with care.

NEVER make the last connection directly to a battery causing a spark that could cause the battery to explode, sending debris and acid in all directions. Batteries can get very hot when improperly charged or if a cell gets shorted. Batteries will explode during charging or discharging for a variety of reasons. Batteries are safe when handled properly.

Choose a 12 volt battery with an ampere-hour rating according to your power needs. If the batteries are placed indoors they must be sealed for safety reasons. Again, it is very important to place a fuse at the positive battery terminal. Additional assistance may be found:
http://www.westmountainradio.com/capacity_calculator.php

West Mountain Radio carries size 24 Gelled and AGM batteries, as well as smaller and larger batteries.

Large batteries have side, post, or threaded terminals. Deep cycle, marine, AGM, and others usually have 3/8 inch and 5/16 inch studs. Therefore, it is recommended to use a short 3 feet #10 wire, Powerpole® on one end, an in-line fuse (40 A max), and ring terminals for the battery end. West Mountain Radio carries a battery fuse kit, wire, and Powerpole®.

Fully charged 12 volt Lead Acid batteries exhibit around 13.5 volts open circuit. When supplying current, the battery's internal resistance diminishes the voltage. For instance, a 70 A-h battery will drop to 12.3 volts at 10 amperes at half discharge. The **Epic** will give a drop of 0.05 volts at 1 ampere, thereby providing 12.25 volts to the radio. Li batteries do not have this drop until they are over 90% depleted.

Gelled Cells
The battery charger uses the station power supply. For ham radio operators this is usually a 13.8 volt supply. To achieve maximum battery charging, the power supply may be adjusted to 13.90VDC. The charger will now permit the battery to reach a peak voltage of 13.8 volts during the peak voltage cycle. The float state will remain at 13.5 Volts.

Note: Always use a accurate digital display voltmeter to assure accurate readings.

AGM Cells
The charger can also be configured for an AGM type sealed battery. To do this precisely, the power supply should be re-adjusted to provide 14.3 volts. In addition, a jumper must be set to AGM inside the **Epic**. Take the top cover off.

Note: Always use a accurate digital display voltmeter to assure accurate readings.

All major radio manufacturers specify that their radios will operate up to 15 Volts DC. Therefore using the **Epic** at an elevated voltage of 14.3 volts is fine.

Li Cells
Use 14.5V for batteries, such as the Bioenno. Be sure to set the jumper inside the unit. Check with the battery manufacturer for other Li batteries. If the charge voltage is not 14.5V, then remove the jumpers and use the USB port to set the charge voltage and set the power supply slightly over that setting.

Large batteries have side, post, or threaded terminals. Deep cycle, marine, AGM, and others usually have 3/8 inch and 5/16 inch studs. Therefore, it is recommended to use a short 3 feet #10 wire, Powerpole® on one end, an in-line fuse (40 A max), and ring terminals for the battery end. West Mountain Radio carries a battery fuse kit, wire, and Powerpole®.

Connecting the Load or Power Strip

Output - Connectors are intended to power equipment. It may go to a single piece of equipment or to a distribution panel (i.e. RIGrunner). There is no fuse or internal current limiting. Expect this voltage to be about 0.05V lower than the input voltage from the power supply or voltage from the battery; whichever is higher.

Manufacturers list the lowest recommended DC supply voltage range for the specific radio model. Some radios are listed as 13.8 VDC +- 15%, and others as 13.8 VDC +-10%. 12 volt power supplies are regulated to provide 13.8 volts DC. The **Epic** has a diode in series that has a voltage drop of 0.05V.

The load wire should be heavy gauge and as short as possible. If connecting directly to a radio or other device, you will need to install Powerpole® on those cords. Modern radios use **RED** wire for positive, and BLACK wire for negative (or common or ground). Refer to the equipment manual if you have non-standard equipment. Plug this wire into the **Epic** terminal marked **OUT**.

If you are connecting the output to a power strip, such as a RIGrunner, it is recommended to use #10 wire, 3 to 6 feet long. At least one end will need Powerpole® installed; the other end can wire directly to the power strip or use connectors. Note that West Mountain Radio carries 3 feet and 6 feet long extension cables, #10 red and black insulated wire, with Powerpole® on both ends.

Plug this wire from the power strip or equipment into the **Epic** connector marked **OUT** (output). Confirm that the Powerpole® are plugged together securely, and that the wire is straight at the connection and is not under strain or bent over.

Solar Panel - Connectors are intended to connect to a solar panel, NOT A CHARGE CONTROLLER. When the power supply is not present (or off) and there is over 13V on this input, the battery will be charged from this input. This is an optional input to be used only when system uses a solar panel.

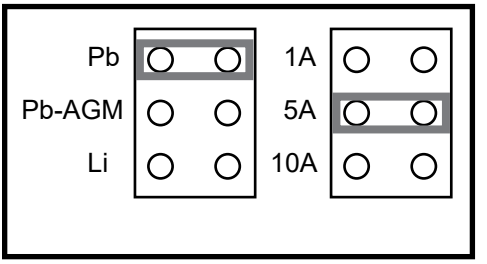
Internal Jumpers

Remove the case screws to access the internal jumpers. Select the correct chemistry and maximum charge current. Lead Acid batteries maximum charge current is usually 10% of the AmpHour rating. Li batteries usually use the AmpHour rating, some specify 50% to be safe, or others may specify being able to handle double.

The jumper selection shown would be correct for a standard Lead Acid battery

that is 50AH. This is the standard configuration for the **Epic**.

These jumpers are only checked when the unit is powered up. It is, therefore, recommended to only change jumper position when everything is disconnected.



Custom set the charging parameters by removing both jumpers and use the USB interface on page 9.

System Checkout

When the power supply and battery are connected, and the **Epic** is driving a radio, a quick checkout procedure should be followed:

- Run your radio, and unplug the power supply. The radio should operate without interruption now from the battery.
- Plug the power supply back in, and the radio will now be powered from the supply. If you have an ammeter on the supply it will show current.

It is recommended to use and in-line meter, such the Power Analyzer sold by West Mountain Radio. It measures volts, amperes, watts, ampere-hours, and watt-hours simultaneously.

Place the Power Analyzer in-line with the power supply to measure its output. Unplug the load from the **Epic** to measure the battery's charging current. Plug the Power Analyzer into the **Epic's** output to measure either the power supply current if the supply is connected, or the battery's output current if the supply is disconnected or is turned off.

Refer to the charging circuit description to verify the different states when measuring the charging current.

Epic PWRgate Charger

The charging circuit is a smart battery charger. The charging circuit, which is always connected to the battery, uses the power supply as the current source. It charges the battery automatically by knowing the battery's voltage. It also changes charging state if the power supply goes from "off" to "on", following a power outage, and it also changes state if the battery voltage drops when supplying heavy current. These conditions are interrelated to provide proper charging automatically.

The charger is a safe battery charger. It supplies the rated current if the battery

is heavily discharged. Current drops in a smooth and progressively diminishing manner as the battery nears full charge. Note, that the charger is a feedback device and it cannot overcharge a 12 volt battery. Also, it will not charge a battery that has a dead cell.

The charging circuit has three jumper selectable charging current settings, 1A, 5A, 10A, to be chosen appropriately for the battery's rating. Other settings may be selected via the USB cable.

Push Button - A switching regulator is used for battery charging. This may generate some RF noise. In addition, charging can take current from the power supply that some might prefer be used for transmit. Although noise is always present, this button has been added to suspend the battery charging in case noise is present. Pressing the button will terminate charging for 30 minutes. Press the button to restart the charging early.

Epic PWRgate LED Status Indicators	
SOLAR LED	
Green - Solid	Voltage Good / In Use for Charging
Green - Flashing	Voltage Good / Not in Use for Charging
POWER SUPPLY LED	
Green	Power Good / In Use
Red	Low Voltage / Internal Component Damaged
Off	No Power Supply Detected
BATTERY LED	
Green - Solid	Power from Battery Good
Green - Quick Flashing	Battery detected / Charger Off (Check: Charger disabled via USB, Charging suspended by button press, or battery temp is out of range)
Green - Flashing	**Warning** - Battery Supplying <12V
Red - Flashing	**Warning** - Powering from Battery <11.7V
Red	Battery Bad / Charger Damaged Disconnect Battery!
Blue	Battery fully Charged and Ready
Blue - Pulsating	Battery Charging (illumination pulse will increase as battery at higher charge)
Blue - Periodic Flicker	Battery Trickle Charging
Red / Blue Alternating	**Warning** - Battery Supplying <11.7V / Charging from Solar
Off	No Battery Detected

USB Port

The USB port may be accessed by removing the plastic plug on the upper right of the unit. A COM port terminal program may be used to see the data or the WMR diagnostics program for RIGblasters may be used. Drivers are not needed for Windows 10. If using an older version of Windows, download and install the drivers before plugging the cable into the USB port on the PC.
Download the FREE WMR Diagnotics Utility software at:
http://www.westmountainradio.com/diagnostics

When the USB port is connected to the **Epic**, the device status is shown. This includes the voltages on each port, the charger status, and the charge current.

If both jumpers have been removed, then the USB port may be used to set custom charging parameters. Press “S” to set the charge parameters.

USB Settable Parameters

Prompt	Range	Description
Battery Type	1 - Disable 2 - Std. Lead 3 - AGM 4 - LiFePo4	1 Disables the charger. Options 2-4 fill in the default values for the remaining parameters. Only pressing ENTER will not reset the other parameters.
Max Charge Voltage	9V to 16V	This is the target voltage that the battery should be charged to.
Max Charge Current	1A to 10A	This is the maximum current the Epic charger will allow to flow into the battery during charging.
Min Charge Current	0.1A to 1.9A	Charging stops when the current draw drops below this level.
Trickle Current	0.1A to 1.9A	After the battery is fully charged, this is the current that is allowed to flow into the battery to maintain it.
Recharge Voltage	9V to 16V	When the voltage drops below this on a battery that has been charged, the charger starts up again.
Max Charge Minutes	30 to 65535	Charging is stopped and the battery is considered bad if charging went on for this period of time.
Retry After Abort Minutes	30 to 65535	After charging was aborted, it will restart after this many minutes.
Min Supply Voltage for Charging	9V to 16V	Normally 13V, but can be set to 14V if used in a vehicle and desired to charge while alternator is on.
Lowest Charge Temp	-127 to 127 degrees F	This prompt only appears if the temp probe is used. Charging will terminate if the temperature falls below this.
Highest Charge Temp	-127 to 127 degrees F	This prompt only appears if the temp proble is used. Charging will terminate if the temperature goes over this.

USB Monitor Example

```
Charging   PS=14.05V   Batt=12.47V,  9.6A    Sol=0.00V   Min=14
Charging   PS=14.05V   Batt=12.47V,  9.5A    Sol=0.00V   Min=14
Charging   PS=14.05V   Batt=12.48V,  9.6A    Sol=0.00V   Min=14
Charging   PS=14.05V   Batt=12.48V,  9.6A    Sol=0.00V   Min=15
```

PS = power supply voltage
Bat = battery voltage and charge current
Sol = solar panel voltage
Min = number of minutes in this state (charging)
Temp = temperature in degrees F if the probe is installed

SPECIFICATIONS

Maximum Voltage: PS 16V / Solar 30V
Maximum Current: 40 Amperes
Voltage Drop: 0.05 VDC
Connectors: Anderson Powerpole®, 40A
Size: 4.5 x 3.375 x 1.25 in
Weight: 0.35 lbs
Mounting Holes: Four - 0.175 d, #8 hardware

Charging Circuit Specifications:

Jumper ⇨	Lead Acid	AGM	LiFePO4
Charge Voltage	13.85	14.4	14.6
Charge Current	1, 5 or 10 amps	1, 5, 10 amps	1, 5, 10 amps
Stop Charge Current	0.5A	0.25A	0.25A
Trickle Charge	0.15A	0.15A	0A
Recharge Voltage	12.2V	12.2V	12.8V
Max Charge Time	25 hrs	25 hrs	25 hrs
Retry Time	4 hrs	4 hrs	4 hrs
Chemistry	Lead Acid	AGM	LiFePO4
Min PS Volts	13.0V	13.0V	13.0V
Lowest Temp (F)	0	0	35
Highest Temp (F)	120	120	110
Use Temp for Charge	Yes	Yes	No

***Note: The above parameters may also be changed via the USB interface.**

Epic PWRgate Warranty

Epic PWRgate is warranted against failure due to defects in workmanship or materials for one year after the date of purchase from West Mountain Radio. Warranty does not cover damage caused by abuse, accident, misuse, improper or abnormal usage, failure to follow instructions, improper installation, alteration, lightning, or other incidence of excessive voltage or current. If failure occurs within this period, return the *Epic PWRgate* or accessory to West Mountain Radio at your shipping expense. The device or accessory will be repaired or replaced, at our option, without charge, and returned to you at our shipping expense. Repaired or replaced items are warranted for the remainder of the original warranty period. You will be charged for repair or replacement of the *Epic PWRgate* or accessory made after the expiration of the warranty period.

West Mountain Radio shall have no liability or responsibility to customer or any other person or entity with respect to any liability, loss, or damage caused directly or indirectly by use or performance of the products or arising out of any breach of this warranty, including, but not limited to, any damages resulting from inconvenience, loss of time, data, property, revenue, or profit, or any indirect, special incidental, or consequential damages, even if West Mountain Radio has been advised of such damages.

Except as provided herein, West Mountain Radio makes no express warranties and any implied warranties, including fitness for a particular purpose, are limited in duration to the stated duration provided herein.

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