# PWRgate PG40

**Simple backup 12 volt power system with Powerpoles®**

## owners manual

**2ND EDITION**

**IF YOU CAN'T FIND IT HERE GO TO OUR SUPPORT PAGE:**
**http://www.westmountainradio.com/supportrr.htm**


**West Mountain Radio**

http://www.westmountainradio.com

18 Sheehan Avenue, Norwalk, CT 06854 tel 203 853 8080  fax 203 299 0232

## Specifications

| | |
|---|---|
| Maximum Voltage: | 16 Volts dc |
| Maximum Current: | 40 Amperes |
| Circuit: | Diode OR-Gate |
| Diodes: | Two Schottky 80 Ampere, 20 Volt |
| Voltage Drop | 0.4 Vdc Quiescent |
| | 0.6 Vdc at 40 Amperes |
| Charging Circuit: | Schottky diode and current limiting resistor. |
| Connectors: | Anderson Powerpoles, 45A |
| Size: | 5.25 x 3.90 x 1.65 in, 13.4 x 9.9 x 4.2 cm |
| Weight: | 0.9 lbs, 0.4 kg |
| Mounting Holes | Two, 0.175 d, at 4.95 distance, for #8 hardware. |




# PWRgate Model PG40 Instructions

Thank you for purchasing the PWRgate….a simple 12 volt backup power system.

A PWRgate transfers up to 40 amperes at up to 16 volts dc continuously. It is a safe way to connect both a battery and a power supply to a load, while electrically isolating both the battery and the supply from each other. Whenever your 13.8 Volt power supply is on, the supply feeds the load. Through a PWRgate your power supply also charges the battery, keeping the battery healthy and ready for use. Whenever the power supply is off, the battery feeds the load. If either the power supply or the battery is malfunctioning, neither draws current from the other. Switching is instantaneous.

A PWRgate is a simple backup power system. Communication equipment will remain operative on battery during ac power blackouts. Power supplies and batteries can be swapped out while equipment remains on. No glitches.

Before installing the PWRgate, please read the following instructions.

## Choosing a mounting location

Pick a location that is close, or central to, your power supply, battery, and load. Some 12 volt equipment may draw large amounts of current. Remember, all wires have resistance so wires must be kept as short as possible and should have a large wire size in order to minimize the voltage drop.

The PWRgate can be installed in any orientation in a cool dry location that is well ventilated. Be careful not to restrict the cooling in any way. Do not place in direct sunlight, near heaters or heat sources.

The PWRgate can be mounted using number 8 hardware, using the two mounting holes.

## Connecting the power supply

Anderson Powerpoles are used for all PWRgate connections. See the inside cover and our support page http://www.westmountainradio.com/supportrr.htm "Powerpole Connector Installation Tips" for extensive Powerpole instructions.

The power supply wire should be heavy gauge and as short as possible. We suggest #10 wire, less than 6 feet long. West Mountain Radio carries 3 and 6 ft long ready made power supply cables, #10 red and black insulated wire, with 1/4 in ring terminals to fit most power supplies on one end and a pair of Powerpoles on the other.

When connecting, make sure that the RED Powerpole connects to the RED wire and connects to the PLUS terminal on the supply. Similarly, make sure that the BLACK Powerpole connects to the BLACK wire and connects to the NEGATIVE terminal on the supply. Check to see that the connections at the power supply are well tightened.

Plug the wire from the power supply into the PWRgate connector marked PS (power supply). Always confirm that the Powerpoles are plugged together securely.

## Connecting the load or power strip

If you are connecting directly to a radio or other device, you will need to install Powerpoles on their cords. Modern radios use RED wire for positive, and BLACK wire for negative (or common or ground). Double check this if you have non-standard equipment. Plug this wire into the PWRgate terminal marked OUT.

If you are connecting the output to a RIGrunner power strip you may use a West Mountain Radio 3 ft or 6 ft extension cables with #12 red and black insulated wire and pairs of Powerpoles on both ends.

At this point, check the system operation with the power supply. Simply turn on the power supply, and turn on the equipment, the equipment should work normally.

## Connecting the Battery

The battery wire should be as heavy and as short as possible. We suggest #10 wire less than 3 feet long. Batteries have less voltage than power supplies therefore voltage drop is more important. WARNING: a fuse must be installed physically as close to the positive terminal of the battery as possible. A short circuit in a battery wire, connected to a large battery, will instantaneously cause the burn white hot.…avoid this situation! We did not put a fuse in the PWRgate as it would NOT protect the wire itself against a short.

Batteries have side posts, top posts, studs or fin terminals. Deep cycle, marine, AGM, etc. usually have two different sized polarized 3/8 inch and 5/16 inch studs. West Mountain Radio carries power supply cables and battery fuse kits. We also have lugs to convert top posts to studs.

## Batteries

**Caution: Handle batteries with knowledge and extreme care! Automotive and marine batteries have dangerous chemicals that can spill out. These batteries emit hydrogen that will explode from a small spark sending shrapnel and acid in all directions.**

**Batteries can get very hot when improperly charged or shorted, and explode. Shorted battery wires can and will cause fires, use a fuse located directly at the battery plus terminal.**

Chose a 12 volt battery with an ampere-hour rating according to your power needs. Find a battery with an true ampere hour rating, do not pay attention to “cranking amps”.

Automotive and marine batteries are not safe as they will spill acid and give out explosive hydrogen fumes. They are much more dangerous than gell cell or absorbed glass matt (AGM) batteries. Gell and AGM batteries will not spill, will not explode and last longer.

Automotive and marine batteries are normally only used in protected, well ventilated, locations.

Automotive and Marine lead-acid types offer the best price to power ratio but they are dangerous. Marine batteries will tolerate deep discharges slightly better than auto batteries, but the can easily be damaged by repeated deep discharge. Gell cells and absorbed glass mat



(AGM) batteries have many advantages and are usually worth the extra price. Select a battery that offers both safety and performance. See our RIGrunner links page for links to web sites with extensive battery information, **http://www.westmountainradio.com/linksrr.htm.**

## System checkout.

When the power supply and battery are connected, and the PWRgate is powering a load, a quick checkout is as follows. Simply turn on your equipment, unplug the power supply; the equipment should operate without interruption, now powered by the battery. Plug the power supply back in, and the equipment will now be powered from the ac power supply. You may notice a slight drop in the voltage, this is normal. A power supply is a nominal 13.8 volts and a battery is 12 volts.

If you would like use an ammeter, or a Whattmeter (sold by West Mountain Radio) to verify operation, follow this. Simply measure the current from the power supply when it is connected and powering the equipment. Measure the battery current when the supply is switched off or is disconnected. To measure the battery charging current, place the ammeter in the battery lead, make sure the power supply is on and the output is disconnected.

## Voltages

Radio manufacturers list the recommended dc supply voltage range for a specific radio model. Some radios are listed as 13.8 Vdc +- 15%, and others as 13.8 Vdc +-10%. Note that they are not rated for 12 volt operation but 13.8 volts.

12 volt power supplies should be adjusted to supply to provide 13.8 volts dc. The PWRgate has a diode in series with a voltage drop of 0.4V regardless of current. Therefore, the PWRgate output will be 13.4 volts.

Fully charged 12 volt batteries exhibit somewhat over 12 volts just after charge. But when they are supplying current, the voltage is diminished by the battery's internal resistance, typically to 12 volts nominal. The PWRgate will give a drop of 0.4 volts, thereby providing 11.6 volts to the radio.

Additional voltage drops can easily occur due to the high current and the resistance in the wires, the fuses, and the connectors. Therefore it is imperative to keep all wires as heavy and short as possible, as low an AWG number as practical, and as few connectors as possible. Also use a large supply fuses, 30 or 40 A to keep the fuse voltage drop low.

## PWRgate charging circuit

The charging circuit is a simple "float" charger in order to maintain a battery near full charge. The circuit is provided so that any 13.8 volt power supply will function safely as charger. It can supply about 1 ampere if the battery is heavily discharged. As the battery voltage rises, the charging current decreases until it supplies only a current equal to the quiescent discharge rate of the battery.

If a large battery were heavily discharged, it could take over a week to re-charge the battery using this circuit. Nevertheless, in most applications, the battery is only called on when a power failure occurs, hopefully infrequently. The charging circuit is useful to prevent self discharge of a battery keeping it healthy and ready for use. Otherwise batteries left unattended will go bad in a few months!

## PowerPole connector installation tips:

Assemble the red and black plastic housings together correctly on the first try, they fit snugly and can be difficult to get apart. See the picture below for ARES /RACES standard orientation that the RIGrunner uses. Note that you can assemble the red and black insulated housings in other ways for special applications.

Put the connector housings together before putting the connector pins in, this is easier, especially when using heavy paired wire.

Before soldering or crimping the contacts on to heavy paired wire, orient the contacts so that they are both facing the the correct direction so that they go in the housings without twisting the wire.

The plastic housings are held together with dovetail joints. Always slide these joints together! They will be damaged if you try to snap them together or apart. They ONLY slide together in one direction. This should be obvious by looking at them carefully.

Do not use roll pins on PowerPoles! Some people supply roll pins with PowerPoles. Do not use them, they can and will fall out, and knowing Murphy, right in to your new radio causing smoke! Anderson does not supply or recommend roll pins, they supply not roll pins but much more expensive spiral pins, which are better. We have tested both, even the proper spiral pins will fall out. If the pair of heavy wires are squeezed together near the back of the connector, like you might do when you pull the connector out, it will spread the bodies apart slightly and out falls the pin.

We spoke to Anderson about this concern and they said that they recommend using an cyanocrylic (Crazy Glue) glue to hold the connector bodies permanently together. The do not recommend their spiral pins for critical applications. Normally the dovetail joints in the housing hold well but if you like glue them don't use pins. Just make sure you have them assembled correctly BEFORE you put on the glue, they will be permanently bonded together, all it takes is a small drop in the seam between the red and black.

The contacts go in the housings in only one way. Insert the contacts with their sharp edge down against the flat spring that is in the housing. They should slide in and click. If you do not hear a click or they are not fully seated, fix them. When they are inserted fully you should notice that the contact and it's wire "floats" slightly inside it's housing. If it feels tight it may not be snapped in fully or you have made the contact wider than it originally was during crimping or soldering.

Tug slightly on the assembled connector to make sure the contacts are locked in place. If you have trouble getting the contact to lock in to the housing you may have squashed the contact wider deformed it some how. Look at the side profile of the contacts before and after crimping, you may have to bend it back straight before inserting it in to the housing.

When soldering the contact pins, be careful not to use too much solder. Keep the solder inside, where the wire goes. If a blob of solder gets on the outside of the connector body you may have trouble putting the contact into the housing. If you get solder on the contact surface area you will not make a good contact.

When crimping the contact pins use a crimp that contains the wire completely inside the pin and doesn't spread the connector apart. A good crimp is one where the dimensions of the crimped portion are no more than an uncrimped pin. If the crimp is flattened out you will not be able to easily push the pin in to the body. If you bend the contact blade in relation to the crimp area you should straighten it before putting it in to the body.

It is possibly to use larger or smaller gauge wire with the 30 and 45 amp connectors. The 30 amp connector pins will work with difficulty with #10 wire if you cut the end cleanly and carefully put each and every strand of that wire in to the pin. It may be is easier to use 45 amp connectors on #10 wire. Using 16 gauge or smaller wire in a 30 amp contact requires that you double or triple up the wire to fill the crimp receptical of the contact to get a good crimp.

A properly crimped contact should have a minimum hold on the wire of more than 25 pounds. A pair of connectors should snap together with 6 to 8 pounds force.

Last but not least, MAKE SURE you have the polarity correct before plugging in you equipment. "Measure twice, cut once" as the saying goes.

**For more detailed instructions see our support page:**
**http://www.westmountainradio.com/supportrr.htm**

## PWRgate Warranty

The PWRgate is warranted against failure due to defects in workmanship or materials for one year after the date of purchase from West Mountain Radio or an authorized dealer. If purchased from an authorized dealer it must be returned with a copy of the original sales receipt or proof of purchase.

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 PWRgate or accessory to West Mountain Radio at your shipping expense with a full explanation and necessary proof of purchase. 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 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.

## Caution:

**Handle batteries with knowledge and extreme care! Automotive and marine batteries have dangerous chemicals that can spill out. These batteries emit hydrogen that will explode from a small spark sending shrapnel and acid in all directions.**

**Batteries can get very hot when improperly charged or shorted, and explode. Shorted battery wires can and will cause fires, use a fuse located directly at the battery plus terminal.**

## Note:

**If you remove the cover pay attention to the labels on the PCB when replacing. If the labels were incorrect, connecting it backwards would cause the charging circuit to be inoperative.**