

# POWER-GATE INSTALLATION INSTRUCTIONS

## DR-Series Rectifier Isolator GEN 4.1 v6

Congratulations on your POWER-GATE purchase! POWER-GATE is designed to provide years of trouble-free operation. Please read the instructions in their entirety prior to undertaking installation. Like any work performed around batteries, electrical circuits, vehicles, and moving parts, exercise caution to insure safe installation and use. If you are not familiar with batteries, electrical circuits, or basic auto/marine-electrical architecture, seek the assistance of a professional installer. Failure to install POWER-GATE correctly may cause poor performance, premature product failure, personal injury, or possibly damage to the vehicle or vehicle accessories.



**The manufacturer is not responsible for damage incurred due to improper installation.**

### PRE-INSTALLATION

#### PACKING LIST:

- POWER-GATE Dual Rectifier
- Control Harness, 1 meter length
- Nylon insert nuts, 3/8-16 (3)
- Brass washers, #24 Small Pattern (3)
- Installation and Data sheets

#### WHAT YOU WILL NEED:

- Copper lugs for cable terminations
- Drill and appropriate mounting hardware
- Digital multi-meter
- 3/8 torque wrench
- 16 AWG black wire for ground extension
- Wire stripper
- Lug crimper
- Soldering torch, solder, and flux



**MOUNTING:** Mount module on a flat surface. Failure to do so may cause "twisting" of the internal assembly and lead to mechanical breakdown.

### CONNECTING LUGS TO CABLES

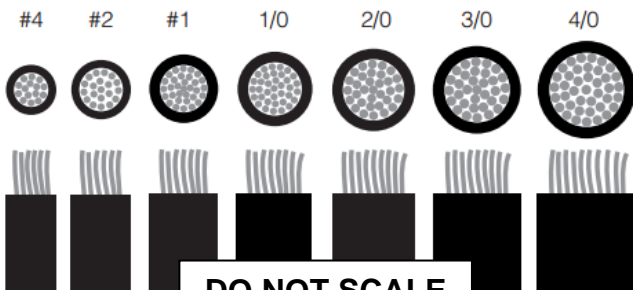
POWER-GATE™ is engineered to transfer electricity at peak performance levels approaching 99.9%. Unfortunately, most installers often overlook electrical joints between cables, lugs, and battery terminals. POWER-GATE™ is one part of a complete electrical system; cables and connection points require just as much attention as the connections to POWER-GATE™ itself.

- Cables should be flexible, free of oxidation, and coated with neoprene or some sort of insulation.
- Cable cross-section should be appropriately sized for the distance and peak current being transferred.
- DR100 thru DR300, use at least #4 cable and preferably larger for better efficiency.
- DR400 applications, use at least 2/0 cable.
- DR500 applications, use at least 3/0 cable.
- DR600 applications, use at least 4/0 cable.
- Don't guess the correct cable size.
- Lugs made of copper, silver-plated copper, or tin-plated copper are good conductors.

Creating a good joint between cables and connectors ensures efficient transfer of electricity. Lugs should be soldered to cables or hydraulically crimped with industry standard crimping equipment. To properly connect cable to lug:

1. Strip cable's insulation material exposing copper strands of cable.
2. "Tin" copper strands by first covering with solder flux. Heat copper strands with torch until solder melts into copper strands. The goal is to pre-saturate or solder-pot the copper strands with solder.
3. Insert solder slugs into lug barrel followed by tinned cable.
4. Use torch to heat lug and cable. When the solder slugs melt, molten solder from tinned cable and solder slugs will combine while inserting cable into lug.
5. Remove heat and allow lug and cable to cool.
6. Once cool, use heat shrink wrap or electrical tape to create moisture barrier between cable insulation and lug.

This method should produce a sound electrical joint. Later, use a digital multi-meter to insure connection is efficient at elevated current.



### CONNECTING CABLES TO POWER-GATE™

POWER-GATE™ does not use cooling fins commonly present on high-current switches. It is critical that cable connections to connection posts provide optimum surface area contact for two reasons: proper cooling and proper current conductivity.



Nut

Washer

Lug

Brass Flange

### CRITICAL TORQUE VALUE

It is critical that a calibrated torque wrench is utilized when attaching nylon insert nuts to brass posts. Improper under-torque may cause unnecessary electrical resistance while improper over-torque may spin the brass assembly internally or possibly break off the brass post.

DO NOT EXCEED 15 Newton-meters on the 3 primary connection posts.

### INSTALLATION INSTRUCTIONS

- Step 1** With engine off, remove all wires and cables from negative terminals of all batteries.
- Step 2** Slip existing cable/wire off primary alternator output post. Insulate with electrical tape and secure from rotating parts. They will not be used for this installation, but should you restore the vehicle back to stock, they'll be needed so don't throw them away.
- Step 3** Select desired location for POWER-GATE Dual Rectifier; keep the following points in mind:
  - Distance between alternator, isolator, and batteries.
  - Easy access to POWER-GATE
  - Footprint doesn't conflict with other wires, cables, reservoirs, rotating parts etc...
  - Adequate distance from high-heat sources like exhaust manifold
- Step 4** **Mount device on a flat surface** using the four mounting holes and appropriate hardware for your given installation. **Uneven twisting or torsional stress may cause damage to the internal electronics assembly.**
- Step 5** **Connect POWER-GATE ground wire to good electrical ground, ideally directly to a battery negative post on the battery itself before proceeding to Step 6**
- Step 6** Install fresh piece of cable from alternator output post to POWER-GATE anode post denoted as "Alternator" on label.
- Step 7** Install fresh piece of cable with one end terminating on Main Battery cathode post (denoted as "Main Battery on label," and the opposing end terminating at the positive terminal on the Main Battery itself.
- Step 8** Install fresh piece of cable with one end terminating on Auxiliary Battery cathode post (denoted as "Aux. Battery" on label), and the opposing end terminating at the positive terminal on the Auxiliary Battery itself.
- Step 9** Install fresh piece of cable between the ground (negative) posts of both the Main and Aux. batteries. This will insure the ground reference for both batteries, as compared to the voltage regulator, is accurate.
- Step 10** Connect control harness wires as detailed on the following page.
- Step 11** Install high current fuses or circuit breakers per diagram on following page.
- Step 12** **BEFORE RECONNECTING BATTERIES**, verify that your installation matches the diagram.
- Step 13** Restore ground connections on both batteries.

### POST INSTALLATION CHECKOUT

Assumptions:

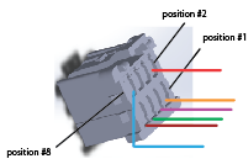
- Both AUXILIARY and MAIN batteries are connected and have a normal static voltage of 12 to 13 volts.
- Cables and connections are pristine and electrically sound, not poor, corroded, or high resistance.
- Alternator is in good working order and with the vehicle running, the output voltage is between 13 to 14.9 VDC (26 to 29.8 VDC for 24 volt vehicles).
- With the vehicle running, both green LEDs should be illuminated, provided the alternator is creating output. When the vehicle is turned-off, the green LEDs should extinguish.

Using your digital multi-meter, perform the following checks:

1. Read the DC voltage from the anode to ground. This should reflect the DC voltage of the alternator.
2. Read the DC voltage from the cathode "A" to ground. This should reflect the DC voltage of the MAIN battery.
3. Read the DC voltage from the cathode "B" to ground. This should reflect the DC voltage of the AUXILIARY battery.
4. With one probe on the anode and one probe on one cathode, the multi-meter will reflect the difference between these two points and should reflect less than 0.05 volts. If greater, shut the vehicle down and call support. There should never be more than 0.05 volts drop between the anode and cathode blades at **maximum rated current**.

**Red LED will illuminate under these conditions:**

- 1) Blinking RED LED indicates over-current. Amount of current exceeds device rating. Reduce current.
- 2) Steady-on RED LED indicates sensed fault condition. Remove device from service and contact manufacturer.



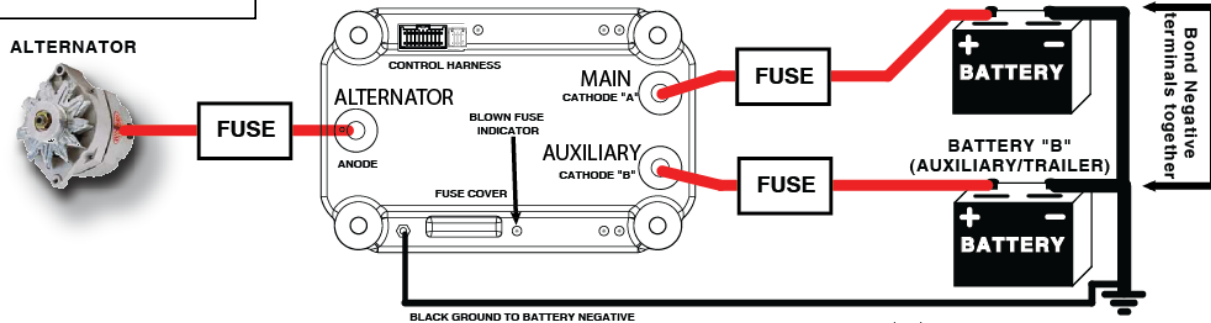
**CONTROL HARNESS 6057**

- |   |                   |        |
|---|-------------------|--------|
| 1 | STARTER           | Orange |
| 2 | MAIN TRIGGER +    | Red    |
| 3 | IGNITION *        | Violet |
| 5 | Econo Trigger     | Green  |
| 7 | Combine Trigger - | Brown  |
| 8 | Combine Trigger + | Blue   |

(Not used for DR's)

(Only used on newer Ford/GM vehicles)

**BATTERY "A"  
(MAIN/STARTING)**



**DO NOT CONNECT BOTH IGNITION AND STARTER EXCITATION WIRES. USE ONE OR THE OTHER.**

**IGNITION ALTERNATOR EXCITATION (violet wire):**

Upon application on the ignition line of a voltage greater than the turn-on threshold (~2 V), the device will first wait four seconds before initiating the alternator excitation sequence. This allows cranking to occur without a possible depleted auxiliary battery loading down the engine. After the four seconds has elapsed, the MOSFET array connected to the main battery will turn on to connect the battery to the alternator, allowing the regulator to begin operation. The array will remain on for approximately half a second. During this time, the device will be looking for the moment when the alternator voltage rises above that of the main battery. If this occurs, the excitation sequence is ended and the device will transition into its standard ideal diode mode. If not, once the half-second on-time has elapsed, the main array will shut off. Approximately 3 seconds later, the device will try exciting the alternator once again (with a half-second on-time). This process will occur a maximum of five times. If the alternator fails to begin charging after the fifth time, the device will immediately go to sleep and wait for another positive-going ignition signal. The user will note the Yellow LED will be on when the excitation sequence is active.

**STARTER ALTERNATOR EXCITATION (orange wire):**

Upon application on the starter line of a voltage greater than the turn-on threshold (~2 V) for at least 80 milliseconds, the device will wake up from its sleep mode and wait for a disappearance of the starter signal, indicating the starter has been released and, presumably, the cranking process has completed. The device will then wait four seconds before initiating the alternator excitation sequence. After the four seconds has elapsed, the MOSFET array connected to the main battery will turn on to connect the battery to the alternator, allowing the regulator to begin operation. The array will remain on for approximately half a second; during this time, the device will be looking for the moment when the alternator voltage rises above that of the main battery. If this occurs, the excitation sequence is ended and the device will transition into its standard ideal diode mode. If not, once the half second on-time has elapsed the main array will shut off. Approximately 3 seconds later, the device will try exciting the alternator once again (with a half-second on-time). This process will occur a maximum of five times. If the alternator fails to begin charging after the fifth time, the device will immediately go to sleep and wait for another positive-going starter signal.

**ECONO TRIGGER (green wire):**

For vehicles with an engine start/stop feature, or "smart" alternators that turn off to extend fuel economy, connect the Econo Trigger (Green) and Ignition Trigger (Violet) to ignition switched 12 volts. If the DR senses the alternator voltage to be less than battery voltage, the excitation circuit will automatically re-trigger allowing the alternator to create output when the vehicle computer brings the alternator out of so-called Econo Mode. Some vehicles check continuity between alternator and battery once ignition is turned on. For this reason, it's recommended that the Starter (Orange) wire not be used when the Econo Trigger (Green) wire is used. Use the Ignition Alternator Excitation (violet wire) instead of the Starter Excitation trigger (Orange).

**EXTERNAL LED / LAMP / ALARM WIRING  
DR ACCESSORY HARNESS 6050 Rev A**

The manufacturer strongly recommends the use of remote-mounted visual indicators (LED or lamp) and/or audible indicators (alarm or buzzer) informing the driver of either normal operation or a fault condition. Should a fault condition occur, it is necessary to remove the Dual Rectifier from the electrical circuit and contact the manufacturer for diagnostic support or replacement.

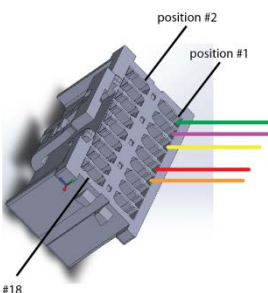
Customer should match the LED / Lamp and/or alarm(s) to the voltage rating of the native electrical system. For example, a 12 volt vehicle will use a 12 volt Dual Rectifier with 12 volt LEDs and alarms. A 24 volt vehicle will use a 24 volt Dual Rectifier with 24 volt LEDs and alarms.

**Current draw not to exceed 60mA**

Wires coming from the connector are switched to ground when active, so the cathode of the LED should connect to the harness wire, and the anode should connect to the positive source voltage.

6050 Rev A External LED Harness, DR 4.1

- |       |                                    |        |
|-------|------------------------------------|--------|
| 1     | Auxiliary Leg Status               | Green  |
| 2     | Empty                              |        |
| 3     | Alternator Excite / Combine Active | Violet |
| 4     | Empty                              |        |
| 5     | Main Leg Status                    | Yellow |
| 6     | Empty                              |        |
| 7     | Empty                              |        |
| 8     | Empty                              |        |
| 9     | Auxiliary Leg Fault                | Red    |
| 10    | Empty                              |        |
| 11    | Main Leg Fault                     | Orange |
| 12-18 | Empty                              |        |



**HOW POWER-GATE™ FUNCTIONS**

The POWER-GATE™ Dual Rectifier is an extremely efficient, one-way electrical valve. It provides electrical conduction from anode to cathode more efficiently than the cables attached to it. In normal operation, the alternator is supplying current to both the MAIN and AUXILIARY batteries. When the alternator is spinning and creating charging output, both rectifiers should be "on" and conducting current from anode to cathode as indicated by the GREEN LEDs and ultra-low voltage drop. POWER-GATE™ will allow the independent discharge of either battery. In other words, loads attached to AUXILIARY battery can discharge the AUXILIARY without affecting the MAIN battery, or visa-versa. When the vehicle is turned-off, the GREEN LEDs will not illuminate. When the vehicle is turned-on and the alternator is creating power, the GREEN LEDs will be illuminated indicating the current is being conducted from anode (alternator) to each respective battery.

POWER-GATE™ is always on; there's no on/off switch. It continuously draws 0.002 to 0.025 amps (which is less than the power consumption of your vehicle's clock) from whichever battery that is higher in voltage in order to protect the batteries.

The GREEN LED indicates proper operation.

If the GREEN LED is not illuminated, it means one or more of the following:

- the voltage at the anode is less than the voltage at the cathode, as would be the condition if the vehicle is off, or if the alternator is not creating charging current/voltage.
- Battery voltage is less than operational minimum of 5.5 volts

POWER-GATE™ is encapsulated to provide rigidity, and protection from chemicals, dirt, and moisture. It is non-serviceable and non-repairable.

**COMBINE BATTERY FEATURE**

Joining the Brown and Blue wires together will enable the battery combine feature, if programmed into the device. When enabled, the YELLOW LED will illuminate, and current can flow from battery A to battery B, and battery B to battery A. The direction of current flow will depend on the state of charge of the batteries in the system. To disable the combine feature, open the connection between the Brown and Blue wires. A switch can be fitted between the Brown and Blue wires for convenience. The switch need only handle micro-amps so any single pole, single throw switch, or an on-off-(on momentary) DPDT switch will do. **If left in the enable mode, battery isolation will NOT take place.**

Many use this as a "self-jumping" feature. If the main battery is low and it's desirable to "join" the aux. battery during cranking, enabling the combiner will serve this purpose. The device requires a minimum of 5.5VDC from one of the batteries to operate properly and damage to the device may occur if the combine feature is enabled when the batteries are in an unhealthy state.

**DEVICE FAILURE**



Should POWER-GATE cease to function correctly for any reason, it is important to remove the device from the electrical circuit. Like any component in an electrical distribution circuit, if it is not functioning correctly, the POWER-GATE will dissipate heat as current passes through it. If ignored, heat related damage could result if a faulty device is not removed. Perfect Switch, LLC cannot be responsible in any way for ancillary damage to the vehicle and equipment installed in, on, or about the vehicle. Electronic components can cease to function at any time. It is the operator's responsibility to frequently assess the health of the electrical system to ensure a safe and reliable working environment.

**PROTECTION FUSE**

Should the protection fuse blow open, the RED "Fuse Open" LED will illuminate, and remove POWER-GATE from operation immediately and contact manufacturer for further instructions. Failure to remove POWER-GATE from operation may cause irreparable damage to the internal semiconductors.

**POWER-GATE ONE-YEAR LIMITED WARRANTY**

Perfect Switch, LLC, warrants the POWER-GATE against all defects in materials and workmanship for a period of one year from the date of the original purchase, subject to the following terms and conditions:

This warranty does not apply if the serial number or housing of the product has been removed or if the product has been subjected to physical abuse, improper installation, water damage, corrosion due to sea salt, road salts, or deicing chemicals, transient voltage spikes, or modification.

To obtain warranty service, please contact the manufacturer for a Return Materials Authorization (RMA) number. The product must be returned, insured and shipping prepaid, to Perfect Switch, LLC at the address below, in its original packaging or a suitable equivalent, along with the purchaser's receipt and written description of the problem.

Perfect Switch, LLC's responsibility under this warranty is limited to repair or replacement of the product or refund of its purchase price, at the sole discretion of Perfect Switch, LLC. Perfect Switch, LLC disclaims all other warranties, expressed or implied, including warranties of merchantability and fitness for any particular purposes whatsoever, and no other remedy shall be available including without limitation, incidental or consequential damages, loss of time, inconvenience, or commercial loss. In no event shall Perfect Switch, LLC's liability exceed the purchase price of the product in question.

Some states do not allow the exclusion or limitation of incidental or consequential damages of how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific rights. You may have other legal rights which may vary from state to state. Perfect Switch, LLC, wants you to be satisfied with its products. Should you have any difficulties with the operation or performance of your POWER-GATE multi-battery accessory, please the manufacturer.

