

# POWER-GATE INSTALLATION INSTRUCTIONS

## RB-Series Bi-Directional Relay, GEN 4 Small Package, v2

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 Relay
- Vinyl Post insulators (2)
- Nuts, 5/16 - 18 (2)
- Brass washers, (2)
- Ground ring terminal
- Installation sheet
- Control cable assembly (if needed)

#### WHAT YOU WILL NEED:

- Copper lugs for cable terminations
- Digital multi-meter
- 1/4 inch nut driver
- 5/16 inch nut driver or wrench (spanner)
- 5/16 inch torque wrench
- 16-20 AWG black wire for ground extension
- Wire stripper
- Lug crimper
- Soldering torch, solder, and flux

### 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.
- Lugs made of copper or silver-plated copper are good conductors.

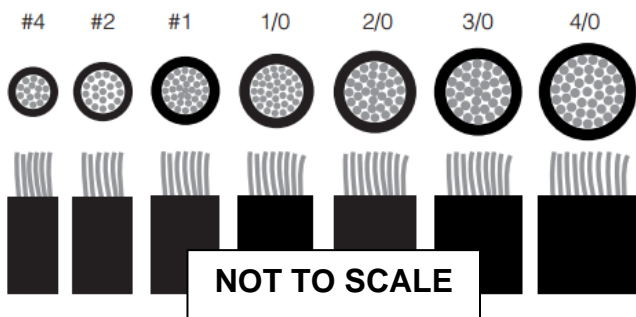
Creating a good joint between cables and connectors insures efficient transfer of electricity. Lugs should be soldered to cables; hand crimping *does not* provide enough compression for a good joint. To properly connect cable to lug:

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 multimeter 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 brass 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.

Use 15 Newton-meters on the 2 primary connection posts.

### INSTALLATION INSTRUCTIONS

- Step 1** With engine off, remove all wires and cables from negative terminal of all batteries.
- Step 2** Select desired location for POWER-GATE Relay; keep the following points in mind:
- Distance to the load (s) and battery.
  - 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 3** Mount POWER-GATE using the four mounting holes being careful not to exceed 5 foot-pounds of torque.
- Step 4** Connect POWER-GATE ground wire (source negative) to good electrical ground (ex. battery negative terminal) **before proceeding to Step 5.**
- Never remove relay ground from battery ground unless the battery is disconnected or device damage will occur.*
- Step 5** Connect cable(s) to POWER-GATE "Terminal 1." and "Terminal 2" as shown in the diagram and insulate appropriately. Torque nylon insert nut to 15 newton-meters
- Step 6** Control or activation voltage is connected to pin 6 (Orange) of the control harness. Connect control cable assembly as shown in diagram and insulate appropriately.
- Step 7** If your device is configured with **autonomous operation**, it is designed to respond to system voltage automatically and is fitted with an "on/off unit reset" button which must be depressed to activate the device.
- Step 8** **BEFORE RECONNECTING BATTERIES**, verify that your installation matches the diagram.
- Step 9** Restore ground connections on battery.

If device is Autonomous, then disregard.

### HOW POWER-GATE™ FUNCTIONS

The POWER-GATE™ Module is an extremely efficient electrical switch. When activated, it conducts more efficiently than the cables attached to it. Its operation is similar to other relays, but with three MAJOR differences: The contact voltage drop is extremely low and MOST importantly remains low with continued operation; the energy required to activate the relay is extremely low...less than 1% of most solenoid switches and electrical relays, and there is no arc when the switch opens or closes.

The **GREEN POWER OK LED** will illuminate when the supply voltage is present.

The **GREEN Relay ON/OFF Status LED** will illuminate when the relay is closed. When the relay is closed, the MOSFET array is enhanced and current will flow between Terminals 1 and 2.

The **RED Fault LED** will illuminate when a fault condition is detected (over-voltage, under-voltage, over-current, short-circuit, and/or over-temperature).

The **RED Fuse Open LED** will illuminate when the fuse has opened. It can only be replaced with Littelfuse Part Number 0322020.

The chart below illustrates how to use the diagnostic LEDs to determine relay state.

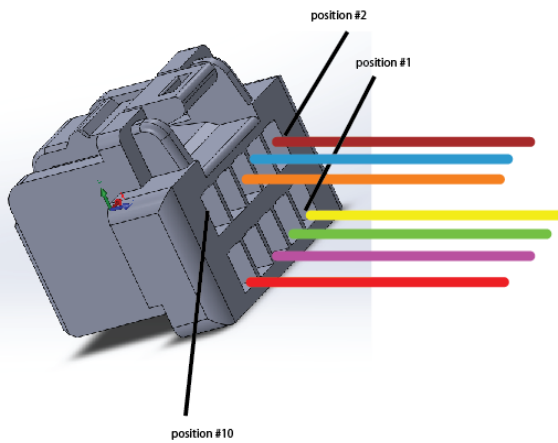
**Note: depending on device programming, not all features and/or states may be observed.**

Operating Mode	Power OK LED	ON/OFF Status LED	Fault LED	Fuse Open LED	Relay State
Normal On (no fault conditions)	ON	ON	OFF	OFF	CLOSED
Normal Off (no fault conditions)	ON	OFF	OFF	OFF	OPEN
Under / Over Voltage override disabled / off no over-current no short circuit	ON	OFF	Steady ON	OFF	OPEN
Under / Over Voltage Override enabled / on no over-current no short circuit	ON	ON	Steady ON	OFF	CLOSED
Over-Current Short Circuit Circuit Break no over-temperature	ON	OFF	See blinking pattern chart	OFF	OPEN
Over-temperature	ON	OFF	See blinking pattern chart	OFF	OPEN
Fuse Blown	OFF	OFF	OFF	Steady ON	OPEN

#### FAULT LED BLINKING CHART

Operating Mode	Number of Blinks	Blink On-Time	Blink Off-Time	Off-Time Between Blink Sets
Level 1 Over-Current	1	260 ms	260 ms	2 s
Level 2 Over-Current	2	260 ms	260 ms	2 s
Level 3 Over-Current	3	260 ms	260 ms	2 s
Level 4 Over-Current	4	260 ms	260 ms	2 s
Level 5 Over-Current	5	260 ms	260 ms	2 s
Short Circuit	6	260 ms	260 ms	2 s
<b>To reset an over-current fault condition, fully disconnect load from the output, de-power and remove device ground to reset processor. Then restore ground and power to input. If device still indicates an over-current fault with no load applied, device is faulty.</b>				
Over Temperature	N/A	130 ms	130 ms	N/A
Level 1 Circuit Break	N/A	1 s	1 s	N/A
Level 2 Circuit Break	N/A	500 ms	500 ms	N/A

**Note :** Device programming varies depending on user's options.



## HARNESS EXPLANATION

Standard harness denoted.  
For Specification Code Harness, see attached harness document.

Pins two and four (Brown and Blue) are used for device override functionality, if override functionality is programmed.

Pins one, three, five and nine are LED status wires.

## ENABLE / RESET SWITCH

If necessary, your device is fitted with an Autonomous ON/OFF Unit Safety Switch. The device should be "enabled" only after installation is complete. If the device shuts down due to an over-current or short-circuit condition, after the condition is corrected, the device may be reset by depressing the switch. When troubleshooting an over-current or short-circuit condition, always power-off the device.

Connector housing: Molex 503149-1000  
Crimp Terminal: 502579-0100  
Wires: 24 AWG, -40 to +105 degC minimum insulation rating,  
2 meter length

Pinout:

1 - Fuse Status	(Yellow)
2 - Override Trigger -	(Brown)
3 - Array On/Off Status -	(Green)
4 - Override Trigger +	(Blue)
5 - Power OK	(Violet)
6 - Main Trigger +	(Orange)
7 - Empty	
8 - Empty	
9 - Fault	(Red)
10 - Empty	

All lines are active-low and should be voltage-/current-limited to 60 V/50 mA, respectively.

## RB-Series Relays



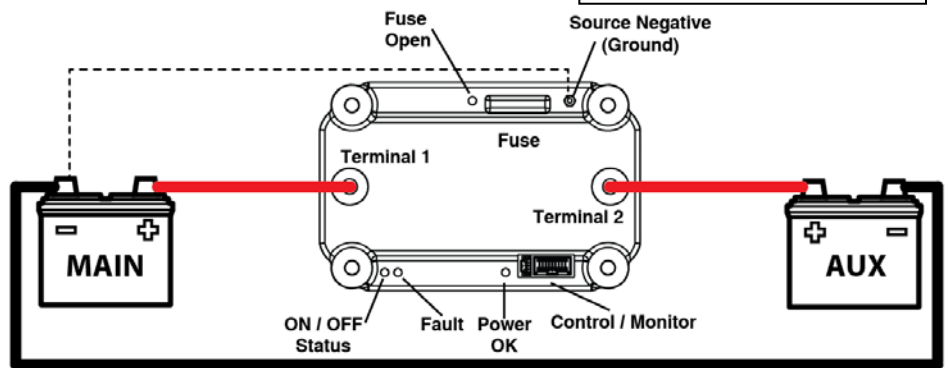
Never remove relay ground from system ground unless the battery is disconnected or damage will occur!

POWER-GATE™ is encapsulated with dielectric gel to provide rigidity, and protection from chemicals, dirt, moisture, and vibration.

## SPECIFICATION CODE INFORMATION

Spec Code \_\_\_\_\_ Harness # \_\_\_\_\_

## SAMPLE DIAGRAM



## OVERRIDE TRIGGER

During under-voltage and over-voltage conditions, the override trigger will force the relay closed. Attach any SPST switch between pins 2 and 4 on the control harness to utilize override trigger. The override trigger will NOT close the relay under the following conditions:

1. Over-current, short-circuit, or over-temperature fault conditions are present
2. Primary relay trigger is open
3. Override is not programmed for your device

## 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 de-icing 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 device, please contact the manufacturer.

## SLEEP MODE

Sleep Mode (if enabled) will decrease power draw from the MAIN Battery during long periods of inactivity. A continuously resetting 24-hour timer determines when the device enters Sleep Mode. When all the following conditions occur concurrently, the device will enter Sleep Mode:

1. (A) Relay open, or (B) Relay is closed with a load current of less than 5 amps
2. Under-Voltage delay timer(s) not running, or have already timed out
3. Over-Voltage delay timer(s) not running, or have already timed out
4. Over-Current delay timer(s) not running
5. No Over-Temperature conditions present

The Relay will exit Sleep Mode and re-start the 24-hour timer if any of the above conditions are false.

The Relay will not enter Sleep Mode during over-current or short-circuit fault conditions.

Once the 24-hour timer expires, the device will enter Sleep Mode for 10 seconds. Every 10 seconds, the device will check conditions 1 through 5 and if unchanged, the device will stay in Sleep Mode indefinitely. With respect to conditions 1 through 5, the device will wake from Sleep Mode and start the 24-hour timer if one or more conditions become false.

If either the trigger or override switch is toggled during Sleep Mode, the device will wake and the 24-hour timer will start.

LED's will be off when device is in Sleep Mode.

