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Preliminary, Not Yet Released OEC9123

Dual RPM Activated Switch

Features

- Two independent RPM on/off points
- Fast update rate, typically every 50 milliseconds
- Rated to industrial temperature range of -40c to +85c (-40F to +185F)
- Solid state relays provide electrical isolation and will not wear out or arc like mechanical relays
- Functional range of 10 RPM to 19,990 RPM
- Typical full range accuracy of (+/-) 0.2%
- Wide power supply range of 8 – 32Vdc
- Multiple installation options: surface mount in provided enclosure, or flush mount with (or without) enclosure
- Directly measure RPM from:
  - Low side of ignition coil
  - Fuel injector
  - Inductive pickup
  - ECM/ECU signal output

General Description

The OEC9123 will measure RPM from a variety of signal sources, and switch two independently controlled loads on/off according to user preset values. The on/off points are preset using three momentary pushbuttons. The number of signal pulses per revolution (PPR) is preset using the same pushbuttons.

When an ***on*** preset RPM is reached, the corresponding SSR (solid state relay) closes until either the RPM drops below that preset or the RPM rises above the independent ***off*** preset. This provides the option of an RPM "window".

The solid state relays can switch loads up to 2 amps AC or DC. Because these are true relays, they can be used to switch power, ground, and even analog signals, provided the differential voltage across the solid state relay contacts does not exceed 60 volts.

The lid of the enclosure is a high quality printed circuit board with all electronic components mounted to the back. This allows the switch to be surface mounted using the enclosure, or flush mounted as a faceplate for a seamless installation.

Electrical Connections

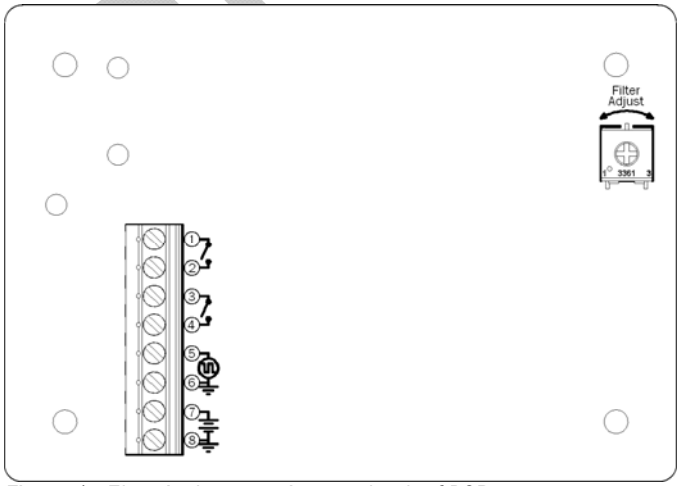


Figure 1 - Electrical connections on back of PCB

in	Function
1 2	Relay Contacts (A). Connection between Pin 1 and 2 will close when RPM is in preset range
3 4	Relay Contacts (B). Connection between Pin 3 and 4 will close when RPM is in preset range
5	Signal Positive. Connect to signal source
6	Signal Ground. Internally connected to Pin 8
7	Main power. +8vdc min / +32vdc max.
8	Power ground.

	User Adjustment
Filter Adjust	Full CCW is min, Full CW is max. Used to filter noise from incoming signal. Preset to max prior to shipping. (See *Operation/Filter Adjust* for details)

Specifications

	Conditions	Min	Max	Units
Supply Voltage:		8	32	Volts
Supply Current:	Vin = 8 Vdc	50	200	mA
	Vin = 32 Vdc	20	60	mA
Operating Temperature Range:		-40 to +85 Degrees -40 to +185 Degrees		Celsius Fahrenheit
Accuracy:	Typical		0.2%	%
Input Signal Voltage:	*Note 1*	3.5	32	Volts
Maximum RPM Signal Current:	@ 3.5Vpp @ 32Vpp	40 2.4		uA mA
Maximum RPM Signal Frequency:	PPR = 255	84,957		Hz
Signal Falling Edge Delay (Filter Adjust):		0	400	µs
Update Time:	Typical		50	ms
Switched Voltage:	AC or DC	0	60	V(peak)
Switched Current:	Each Output	0	2.0	Amps

Note 1: *The incoming signal may be AC or DC; however any portion of the signal which is negative with respect to GND will be truncated by the input circuitry. The input signal voltage must not exceed -32v or circuit damage may occur.*

Operation

The RPM switch is simple to set up and use. No calibration is needed, and accuracy will not drift with changes in temperature. Each of the two on/off points operates independently of each other.

While simple (there are only five values to set) the switch is highly flexible, and is designed to accommodate the widest variety of input sources possible. Therefore the user should look through this section carefully to determine the best method of acquiring the RPM signal for their application.

The input electronics are designed to accommodate the two most common methods of directly measuring RPM; the low side of an ignition coil, and a magnetic pickup. Additionally, the tachometer output from an ECM/ECU or any repetitive signal (digital logic, industrial sensors, etc.) of at least 3.5 volts is easily usable.

The switch uses a microcontroller to measure the time between falling edges of the RPM signal, therefore duty cycle is irrelevant to the reading. This method also gives higher accuracy and much faster response time than the more common method of counting pulses in a fixed period of time.

The Pulses/Rev (or PPR) should be set to half the number of cylinders on a four-stroke engine. This is because it takes two revolutions (4 cycles) for all cylinders to have fired once. For example: an eight cylinder engine will have eight sparks in two revolutions or four sparks in one revolution, therefore PPR should be set to four. Five cylinder engines are supported with the PPR = 2.5 setting, and 3 cylinder engines with the PPR = 1.5 setting.

The Pulses/Rev should be set to the number of gear teeth on the flywheel if an inductive or Hall Effect pickup is being used to measure the flywheel rotation. If the switch is getting its signal from an engine ECM/ECU or other 5 volt logic source, the PPR will need to be determined from a service manual or experimentally, using a known, accurate tachometer for comparison. Some engines have inductive pickups preinstalled on the timing gear, camshaft, or distributor shaft. If your engine does not have a single ignition coil, (such as you would find on a newer vehicle with a coilpack or on a diesel which has no ignition system) you will need to use one of these alternate sources.

Operation (Continued)

Typically, the higher the PPR setting, the faster the switch will respond. The switch can only operate as fast as the incoming tachometer signal, and a low RPM using a slow signal source (such as a fuel injector) will generate very long pulse widths. For example, at 500 RPM using a fuel injector as the signal (which would use the 0.5 PPR setting) the time between pulses would be 0.24 seconds. The same reading using the low side of an ignition coil (which would use the 4 PPR setting) would be measured in 0.03 seconds. If using the 0.5 PPR, the switch will attain its maximum response time of 50ms at approximately 2500 RPM.

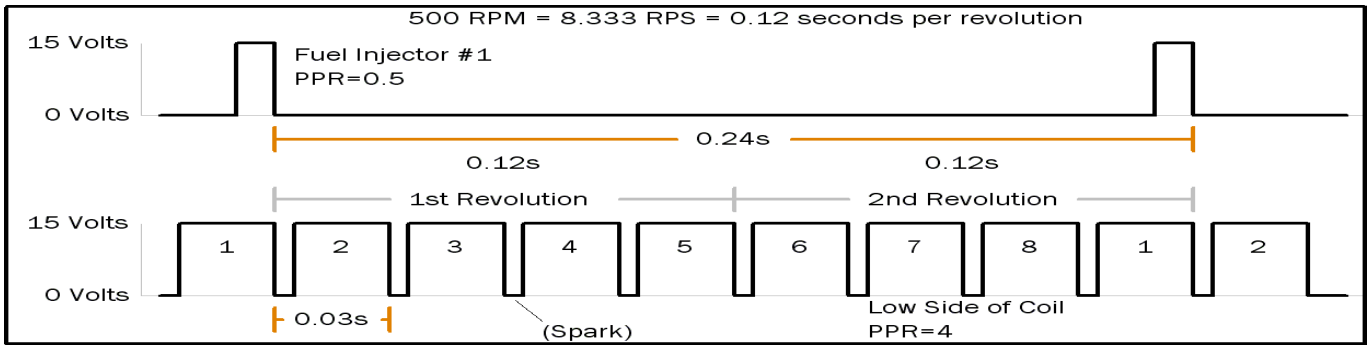


Figure 2 - Comparison of time between falling edges of two common signal sources on an 8 Cylinder Engine, at 500 RPM

Filter Adjust:

The switch was designed to read several different signal sources using the same input circuitry. Because some sources are inherently noisier than others, the option of using an adjustable filter was included. The filter works by adding a delay to the falling edge of the incoming RPM signal. This delay is adjustable from 10ns to 400ns using the potentiometer marked "Filter Adjust" on the back of the PCB. The filter is intended to be used when taking a signal from the low side of the ignition coil. Inductive, hall effect and ECM/ECU outputs usually will not need filtering.

Adjusting Presets

The switch powers up ready to operate. It will immediately begin reading the incoming signal (if present), and display the RPM relative to the "Pulses/Rev" preset value. The outputs will activate/deactivate if in range.

There are five variable presets which may be adjusted. Pressing the "Options…" button will cycle through them all, and return to "RUN" mode when finished. Presets are immediately saved to the onboard EEPROM when cycling to the next preset and will be recalled on power up.

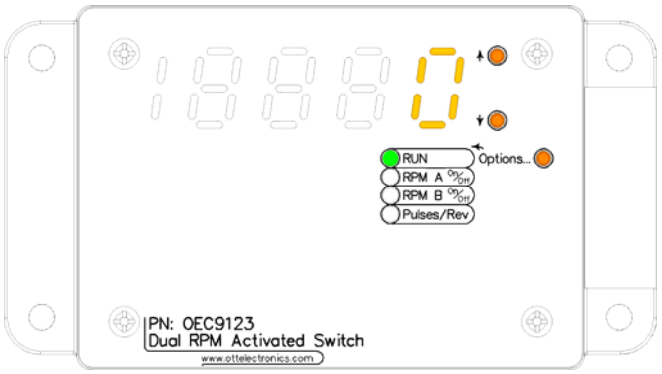


Figure 3 – Switch powers up in "RUN" mode, shown here displaying 0 RPM.

Setting RPM-A Trip Point - *The RPM-A Trip Point is the RPM at which the switch will activate the RPM-A relay, completing the electrical connection between pins 1 & 2.*

To set: press and release the "Options…" button from "RUN" mode. The "RUN" LED will go out and the "RPM A" LED will illuminate. Use the Up/Down buttons to set the RPM-A Trip Point to the desired value. The minimum is 100 RPM, the maximum is 19,980 RPM.

When finished, press the "Options…" button to save the value and move to setting the RPM-A Clear Point.

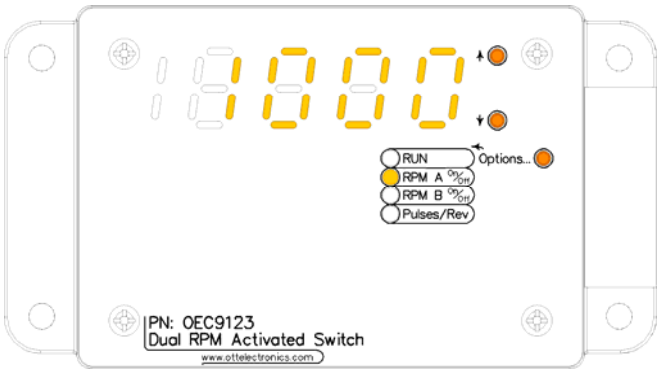


Figure 4 – Setting RPM-A Trip Point. RPM A LED will illuminate solid.

Adjusting Presets (Continued)

Setting RPM-A Clear Point - *The RPM-A Clear Point is the RPM at which the switch will deactivate the RPM-A relay, disconnecting the electrical connection between pins 1 & 2.*

The "RPM A" LED will now be blinking which indicates you're setting the Clear Point. Use the Up/Down buttons to set the RPM-A Clear Point to the desired value. The minimum is 10 RPM over the RPM-A Trip Point (the switch will automatically increase the value if needed), the maximum is 19,990 RPM. Since 19,990 RPM is well beyond the range of most engines, this can be used if no Clear Point is wanted.

When finished, press the "Options…" button to save the value and move to setting RPM-B Trip Point.

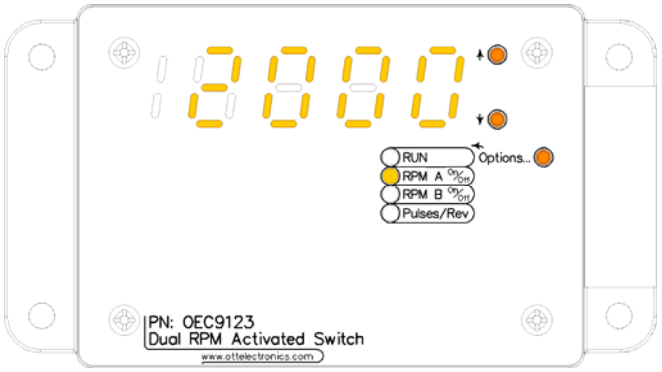


Figure 5 – Setting RPM-A Clear Point. RPM A LED will blink rapidly.

Setting RPM-B Trip Point - *The RPM-B Trip Point is the RPM at which the switch will activate the RPM-B relay, completing the electrical connection between pins 3 & 4.*

The "RPM A" LED will go out and the "RPM B" LED will illuminate. Use the Up/Down buttons to set the RPM-B Trip Point to the desired value. The minimum is 100 RPM, the maximum is 19,980 RPM.

When finished, press the "Options…" button to save the value and move to setting the RPM-B Clear Point.

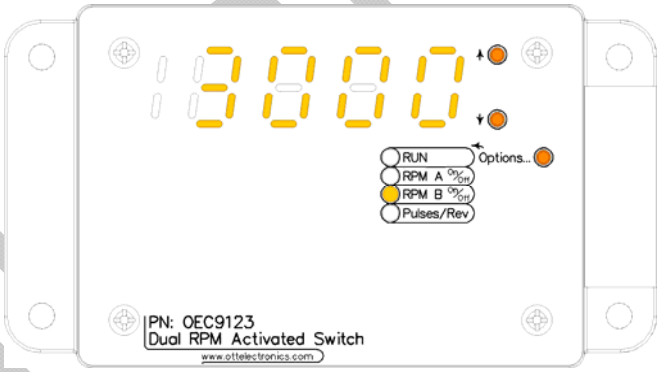


Figure 6 – Setting RPM-B Trip Point. RPM B LED will illuminate solid.

Setting RPM-B Clear Point - *The RPM-B Clear Point is the RPM at which the switch will deactivate the RPM-B relay, disconnecting the electrical connection between pins 3 & 4.*

The "RPM B" LED will now be blinking which indicates you're setting the Clear Point. Use the Up/Down buttons to set the RPM-B Clear Point to the desired value. The minimum is 10 RPM over the RPM-B Trip Point (the switch will automatically increase the value if needed), the maximum is 19,990 RPM. Since 19,990 RPM is well beyond the range of most engines, this can be used if no Clear Point is wanted.

When finished, press the "Options…" button to save the value and move to setting Pulses/Rev.

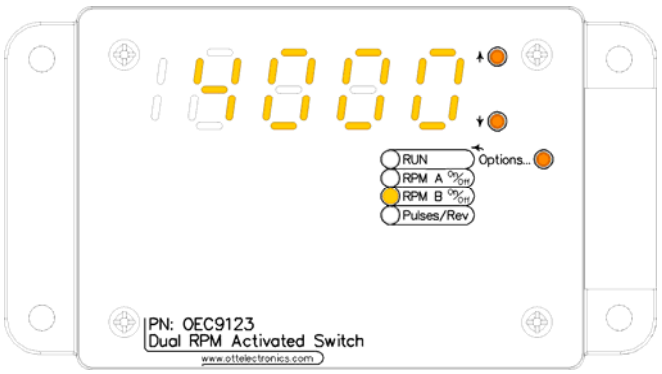


Figure 7 – Setting RPM-B Clear Point. RPM B LED will blink rapidly.

Adjusting Presets (Continued)

Setting Pulses/Rev - *The Pulses/Rev is the number of pulses the switch should expect the tachometer signal to have for each revolution of the engine.*

The “RPM B” LED will go out and the “Pulses/Rev” LED will illuminate. The current value of PPR will be on the numeric display. Use the Up/Down buttons to set the Pulses/Rev to the desired value. The minimum is 0.5 (displayed as 0_5 on the display), the maximum is 255.

There are three “half” mode PPR values allowed.
0.5 (Shown as 0_5) is included to accommodate taking a signal from a single fuel injector.
1.5 (Shown as 1_5) is included to accommodate 3 cylinder engines.
2.5 (Shown as 2_5) is included to accommodate 5 cylinder engines.

When finished, press the “Options…” button to save the value and return to RUN mode.

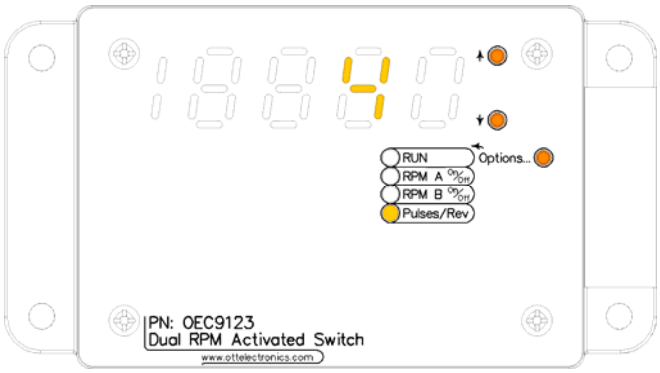


Figure 8 – Setting Pulses Per Revolution.

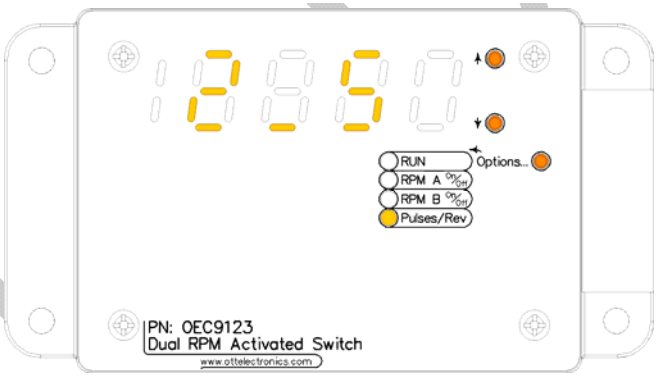
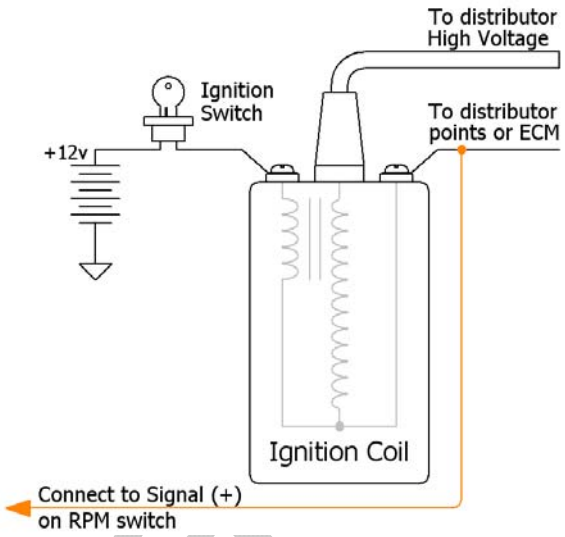


Figure 9 – Example of 2.5 being displayed as 2_5 for Pulses/Rev setting.

Typical Applications

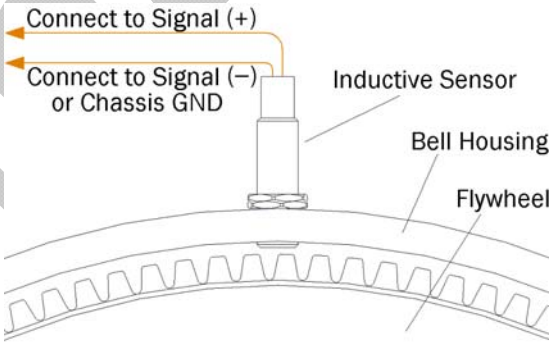
Installation using low side of ignition coil:

- Preferred method of connection on engines with single ignition coil
- PPR value should be set to ½ the number of cylinders for a 4 stroke engine



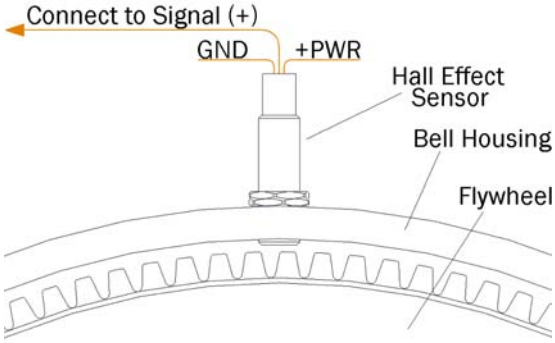
Installation using passive inductive pickup:

- Good combination of accuracy and low-RPM response time due to large PPR value
- PPR preset should be equal to number of gear teeth if reading from flywheel
- Requires drilling/tapping flywheel bell housing if not OEM installed
- Common method of installation for large diesel engines
- Sometimes installed by vehicle OEM as a crankshaft position sensor



Installation using powered Hall Effect pickup:

- Good combination of accuracy and low-RPM response time due to large PPR value
- PPR preset should be equal to number of gear teeth if reading from flywheel
- Requires drilling/tapping flywheel bell housing if not OEM installed
- Sometimes installed by vehicle OEM as a crankshaft position sensor
- Identical to passive inductive pickup in function, but with additional wiring



Installation using Engine ECM/ECU signal out:

- Good option provided the PPR value is known
- Requires more advanced electrical skills to properly connect

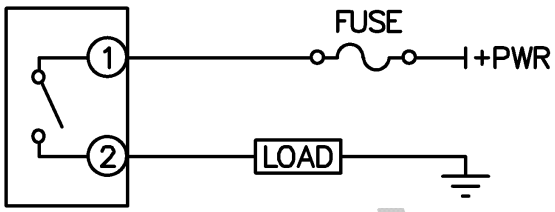
Installation using fuel injector power:

- Poor low RPM response time
- Requires knowing how FI is wired (switched PWR or GND)
- Will be unreliable in EFI systems which have multiple injection pulses per cycle

Typical Applications (Continued)

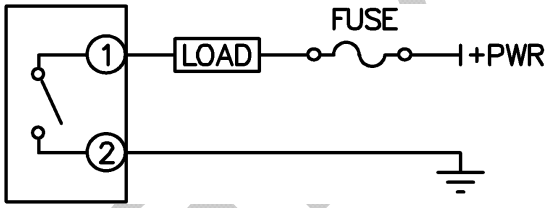
Output switching, high side:

- Most common method, maximum safety



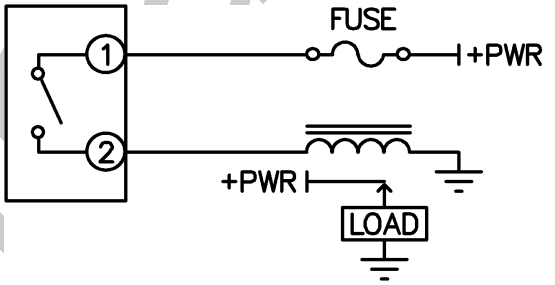
Output switching, low side:

- Less common due to potential safety hazard if low side of load shorts to chassis

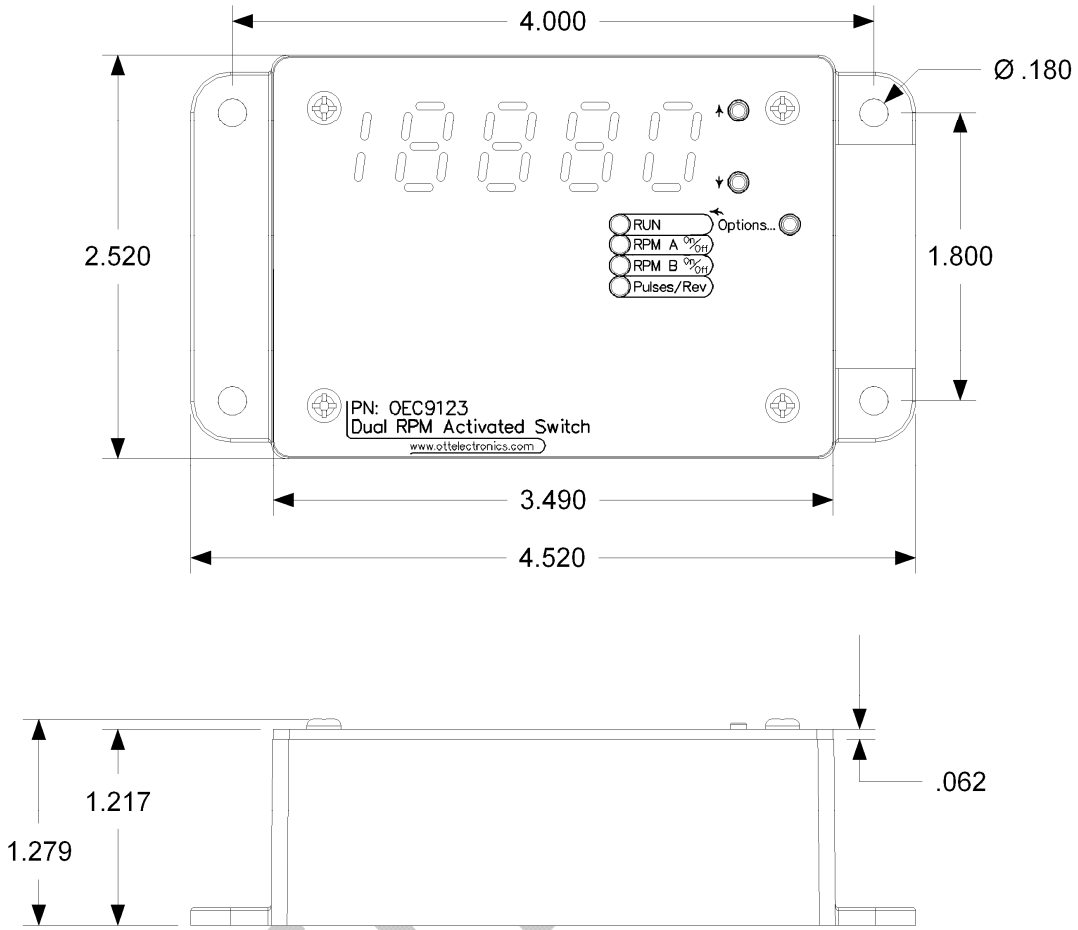


Output switching, relay:

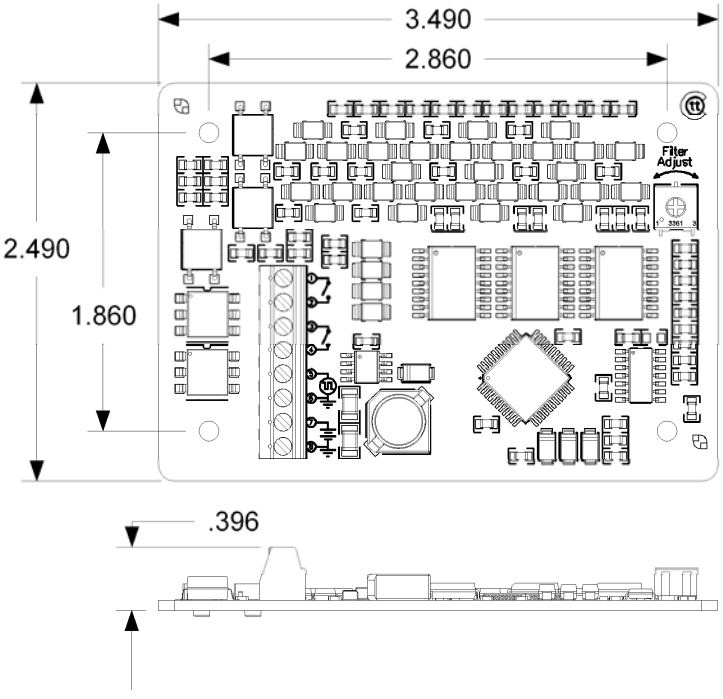
- Required for loads over 2 amps
- May slow response time due to mechanical action of relay



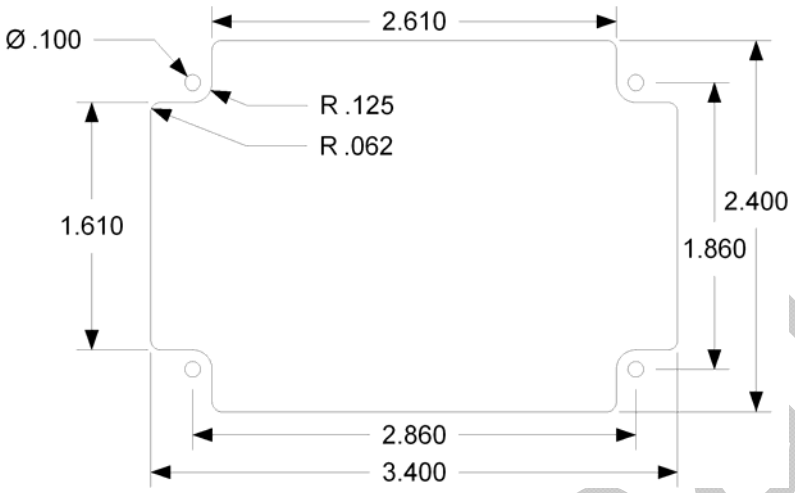
Dimensions, Assembled (Inches)



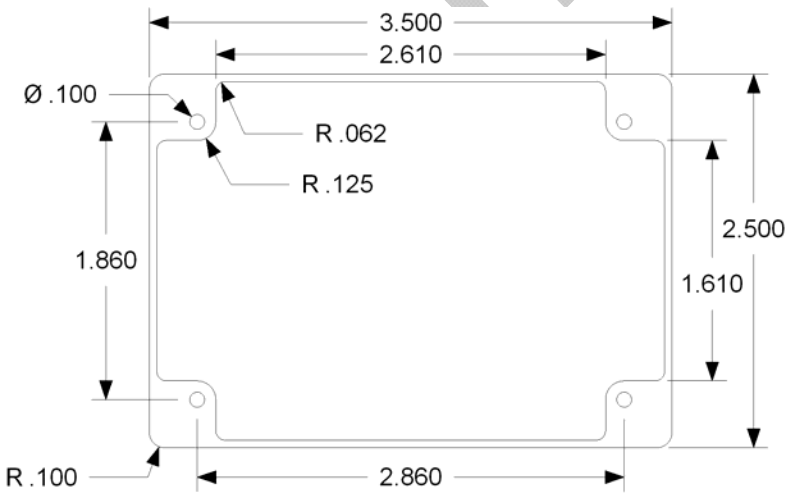
Dimensions, PCB Only (Inches)

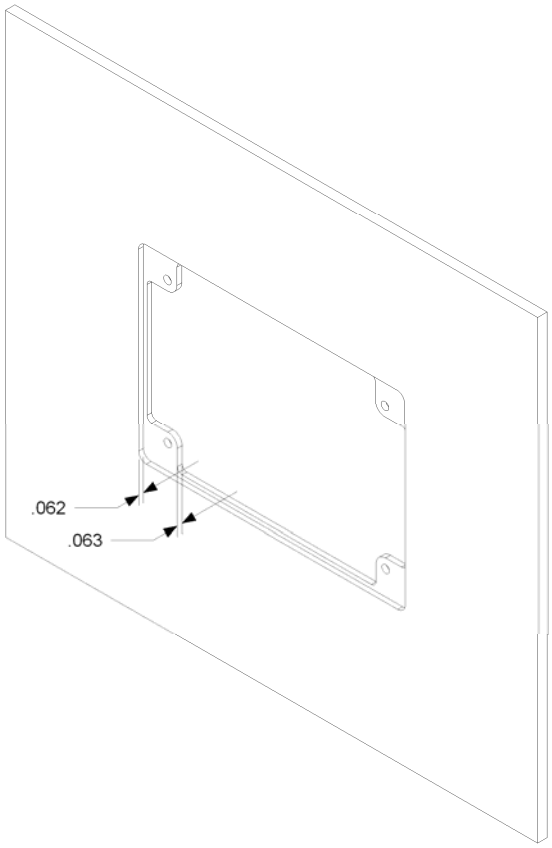


Panel Mount Dimensions (Inches)



Flush Mount Dimensions (Inches)





Warranty

LIMITED WARRANTY: Ott Electronics Corp. expressly warrants that for a period of 90 days from the date of purchase, this product will be free of defects in material (parts) and workmanship (labor). Within the warranty period, a unit will be tested, repaired or replaced at our option, free of charge. Shipping instructions for any product requiring warranty repair may be requested at http://www.ottelectronics.com/contact.html Please provide a copy of your original packing slip, invoice, or other proof of date of purchase. If your unit is out of warranty we will quote repair charges necessary to bring your unit up to factory standards. All transportation costs including but not limited to: duties, tariffs, taxes or fees, will be the responsibility of the customer.

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