J&S Electronics

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(714) 534-6975 www.jandssafeguard.com

Universal Installation (various triggering methods shown)

Triggering from points or OEM electronic Ignition

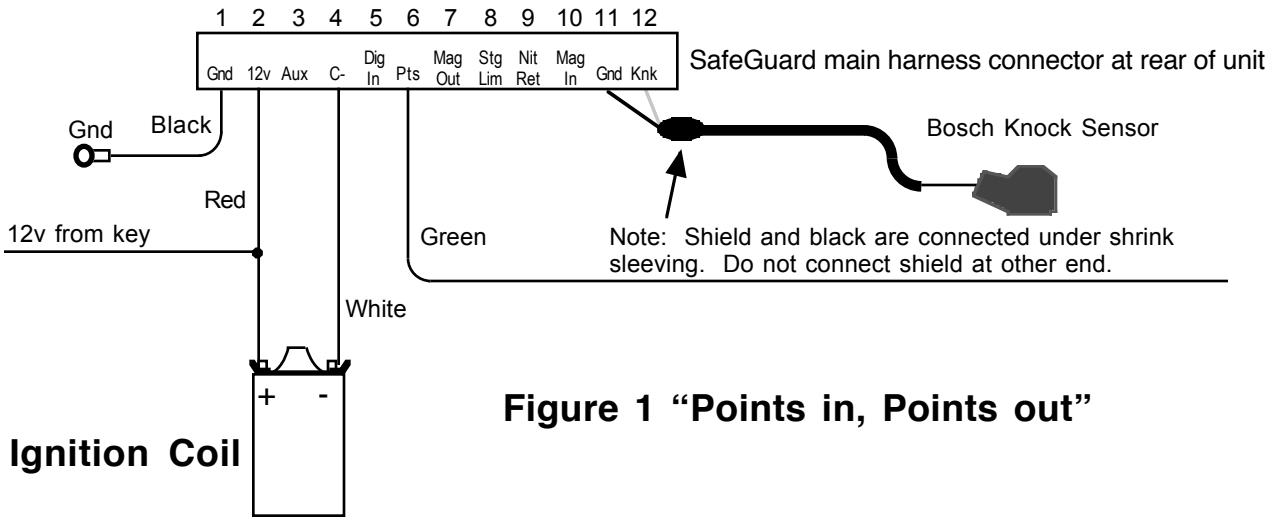

Figure 1 "Points in, Points out"

Do Not Use Solid Core Plug Wires

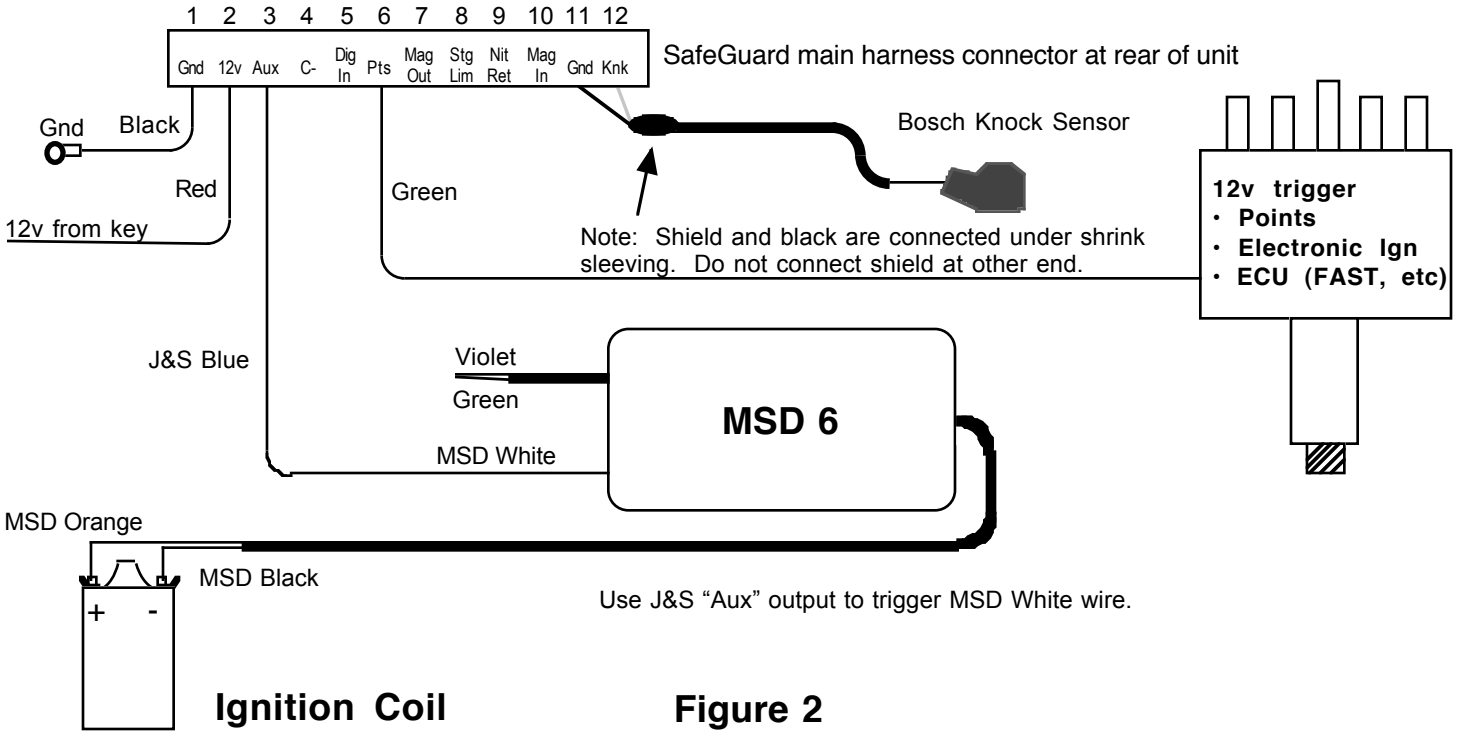

Figure 2

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Do Not Use Solid Core Plug Wires

Mag Pickup Color Codes

Type	+	-
Ford	Orange	Violet
Chrysler	Orange	Violet
GM HEI	White	Green
MSD	Violet	Green

Triggering from Magnetic Pickup

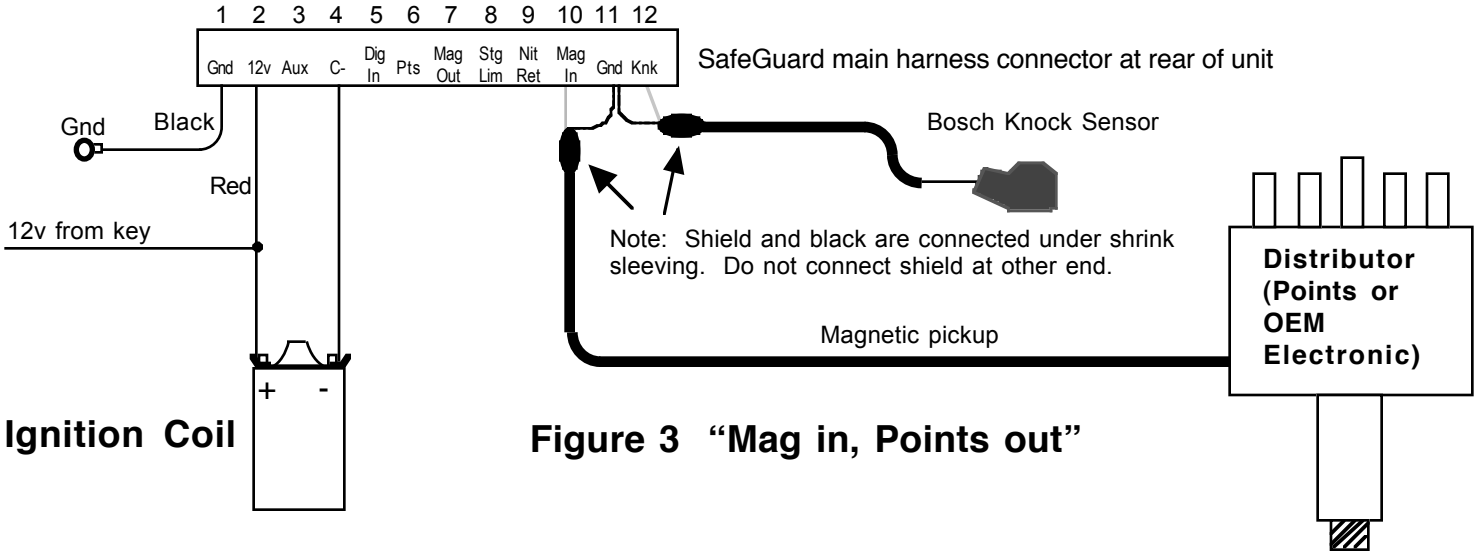

Figure 3 "Mag in, Points out"

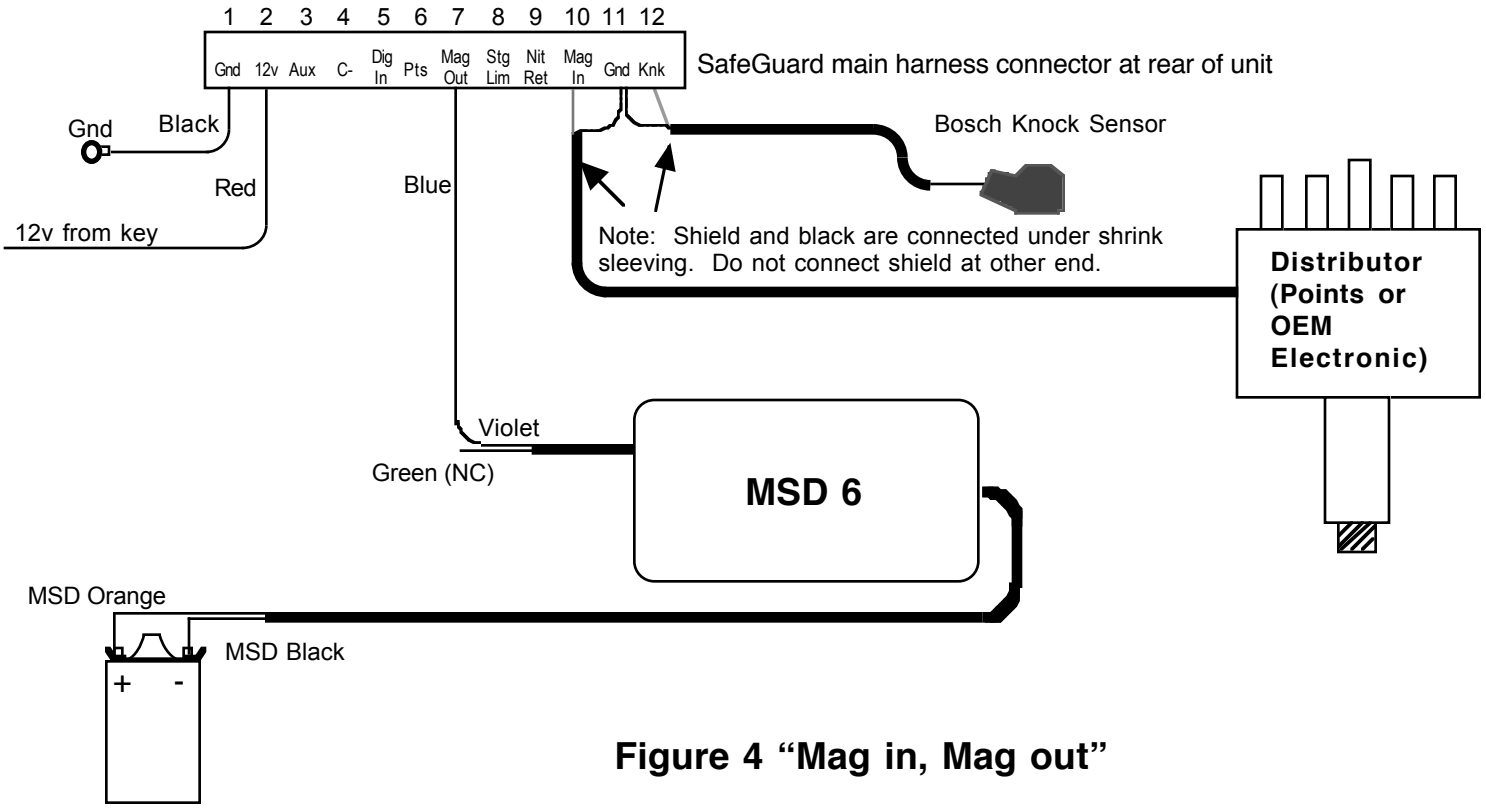

Figure 4 "Mag in, Mag out"

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Instructions for knock sensor cable:

To make your installation easier, we have pre-installed the knock sensor connector.

1) Install the knock sensor.

2) Connect the sensor cable.

3) Feed the other end of the cable through the firewall.

4) After determining where the SafeGuard will be mounted, route the cable to the SafeGuard.

5) Insert the Red wire of the knock sensor cable into the pin labeled “Knk”.

6) Insert the Black wire of the knock sensor cable into the adjacent pin, labeled “Gnd”.

7) If you wish to shorten the cable, cut to length, strip the jacket back about 1.5”. Before discarding the cut end, inspect the solder joint under the heat shrink. You will see that the shield is connected to Black. Use this a a guide to prep the cable after shortening. Solder and cover with heat shrink.

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SafeGuard Installation

1) The SafeGuard control unit must be mounted inside the passenger compartment. We recommend hiding it under the carpet on the passenger side.

2) The supplied harness is ten feet in length. This allows you to connect either in the engine compartment or directly to the ECU. If you choose to install in the engine bay, feed all the wires through the firewall. Make sure you leave enough wire inside the car so you can adjust the unit on your test drive.

3) In general, the unit installs between the factory ignition module and the coil negative, but the unit has been designed to accomodate many other triggering modes.

4) The J&S Green wire will connect to the "points" or distributor end of the cut ignition wire and the J&S White wire will connect to the coil side of the cut wire. Dress the J&S wires, cut them to proper length, and crimp on the matching connectors.

5) Ground the J&S Black wire.

6) Using the wire splice provided, connect the J&S Red wire to the coil positive wire.

7) The mounting hole in the Bosch sensor is 8mm or 5/16". Locate a bolt in the block with an 8mm or 5/16" bolt to mount thesensor, and torque to about 15ft. lbs. Route the gray knock sensor cable, and connect to the sensor.

8) The unit requires a source of manifold vacuum. With switch 8 up, the unit is not armed to detect knock until the vacuum is less than five inches. Switch 8 down, the unit is not armed to detect knock until the vacuum goes below 15 in. The brass tee fittings included in the kit let you tap in to the 1/8" teflon tubing used on most boost gauges.

9) **Switch Settings** Set the Mode Select switches at the front of the unit as follows:
Switch 1 is the 10°/20° range switch. Down is 10° max retard, up is 20° max retard. For now, leave it **up.**
Switch 2 is the retard all/retard separate switch. Up is retard all. Temporarily set switch 2 up.
Switches 3 and 4 select the number of cylinders. Use the following table:

S3	S4	
1	1	8 cyl
0	1	6 cyl
1	0	5 cyl
0	0	4 cyl

NOTE: 0 = down

If RX7 version, set S3 and S4 both down.

Switch 5 configures a pullup or pulldown resistor on the digital input pin. **In general, leave up (pullup).**
If installing between ECU and MR2 or RX7 igniter, set to down.

Switch 6 configures the unit to trigger on rising edge if up, or falling edge if down. **In general, leave up,** unless installing between ECU and factory ignition module. Note that Honda ignition module is reversed.

Switch 7 configures the polarity of the output pulse on both the "Aux" pin and the "Mag Out" pin. Spark on rising edge if up, falling edge if down. In general, leave up, unless installing between ECU and stock ignition module. Note that Honda ignition module is reversed.

Switch 8 is the FI/NA mode switch. Up is forced induction, down is naturally aspirated. With switch 8 up, the unit is not armed to detect knock until the vacuum is less than five inches. Switch 8 down, the unit is not armed to detect knock until the vacuum goes below 15 in.

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10) Start the car. The Status LED should blink during cranking. If it doesn't blink, the unit is not receiving or processing triggers. If the car runs normally, skip to step 13. If the engine doesn't start, leave the key on, and use a voltmeter to make sure that 12 volts is getting to the connector on the Black and Red wires. Make sure there is at least 8 volts during cranking.

11) After verifying power and ground, turn off the key, and unplug the unit from the harness. Form a paper clip to fit in the harness connector to jumper the **Green** and **White** wires. Make another starting attempt. Do not touch the paper clip while the engine is running. High voltages are present from the ignition coil. If the engine still doesn't start, you will need to check the connections on the Green and White wires at the coil.

12) Once the car runs with the paper clip installed, you must still verify that Green goes to the trigger source. Note that if Green and White were reversed, the engine would still run with the jumper installed.

13) Once you have the car running normally on the J&S unit, you are ready to test the knock sensor. The unit will not detect knock unless the following conditions are met:

1) RPM must be above 1250 RPM
2) Vacuum drops below five inches (S8 up) or fifteen inches (S8 down). Note that RX7 version is FI only.

14) Temporarily unplug the vacuum/boost line from the back of the unit. This forces the on board MAP sensor to 0 psi. Plug the hosse to prevent vacuum leak. Temporarily set mode switches 1 and 2 both up. This will make it easier to tell if the unit retards during the verification test.

15) Set the sensitivity control to mid-range, and hold the RPM to at least 1500. The unit is prohibited from retarding if the RPM is less than 1250 RPM. You should be able to hear the engine slow down as you tap rapidly on the knock sensor with a screwdriver. You can also see the timing retard with your timing light, and the Monitor LED on the front panel will glow dimly, increasing in brightness with increasing knock retard. If you have the J&S Knock/Retard Bargraph display, you can also see the amount of retard.

16) Once you have verified that the unit will retard, set mode select switch #2 down. This returns the unit to the individual cylinder retard mode. Switch 1 up sets the maximum knock retard range to 20°. Leave up unless you KNOW you will not need more than 10° knock retard.

17) **Sensitivity Adjust:** Now you are ready for your test drive. A common mistake is to set the sensitivity control to maximum. This will usually cause the unit to over-retard due to engine noise. Note that the unit can be fooled by false knock on decel or light engine loads, so adjust the sensitivity under moderate load, such as accelerating from 60 to 80 on the highway. Set the control for no retard indication while cruising.

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18) **Boost Retard:** Switch **8** up calibrates the MAP sensor for Boost Retard. The Start knob sets at what boost pressure the boost retard begins. Fully CCW, the boost retard starts at zero psi. The TP (Test Point) is calibrated in volts per psi. Zero volts equals zero psi. If you set the voltage to five volts, the boost retard will not start until five psi.

19) **Vacuum Advance: Switch 8** down calibrates the MAP sensor for Vacuum Advance. The start knob sets at what vacuum the retard will begin. Fully CCW, the retard starts as the vacuum goes below ten inches, which is equivalent to minus 5 psi. If you want the unit to start retarding as the vacuum goes below ten inches, set the voltage on the test point to 0 volts. If you don't want any vacuum advance, set the knob so the test point reads at least 5.0 volts. Or just turn the Rate knob fully CCW.

20) **Start knob:** This sets at what manifold pressure (or vacuum) the boost retard activates. Since we want to pre-empt knock, start the retard a little early. Use the "Start" test point on the front panel to help you set this up. Adjust the knob until the voltage on the "Start" test point corresponds to the manifold pressure (or vacuum) level you want the retard to begin. For example, if you don't want boost retard until 5 psi, adjust the "Start" knob so the "Start" test point reads 5v.

21) **Rate knob:** This is used to set the amount of retard per psi of boost. The rate is adjustable from zero degrees fully CCW, to two degrees per psi fully CW. Use the "Rate" test point on the front panel. For example, for one degree retard per psi, adjust the "Rate" knob so the "Rate" test piunt reads 1v.

22) **Rev Limits:** These two knobs set the top end and staging rev limits. The corresponding test points are URL for Upper Rev Limit and LRLfor Lower Rev Limit. The test points are calibrated in volts per thousand RPM. The rev limits can be changed while the engine is running, but won't take effect until the RPM is momentarily brought below 2500 RPM.

The Staging Limit is activated by connecting12v to pin 8 of the rear connector, labeled "Stg Lim". Note that pin 1 is the leftmost pin, looking into the connector from the rear.

When 12v is removed from the "Stg Lim" pin, the top end rev limit is in force.

23) **Nitrous Retard:** This knob sets the amount of retard when the pin on the rear connector labeled "Nit Ret" is connected to 12v. To set, start the engine, observe timing with a light, apply 12v to the "Nit Ret" pin and adjust the knob until the desired retard is achieved. Range is zero to twenty degrees.

24) **Cranking Retard:** This knob sets the amount of retard during startup. This is useful on high compression engines with locked out timing. The unit re-advances quickly, at the rate of one degree per spark event, so you may not be able to measure it with a timing light. Range is zero to twenty degrees.

25) **Status LED:** The Status LED is located above the jack on the front panel, and pulses with each trigger event. During cranking, the pulses are slow enough to see, then merge together as the engine comes up to idle speed. The Status LED is off above 980 RPM. Above 1250 RPM, the LED glows in proportion to the amount of knock retard.

26) **Bargraph Test:** When the key is first turned on, the Staus LED on the front panel should blink for two seconds. If you have the optional bargraph display, it will count up and back over a two second period. The test can be aborted by moving the key to start. Some ECU's emit a pulse at power up which will abort the test automatically. If you have one of these, you will see the first LED on the bargraph blink briefly when the key is turned on.

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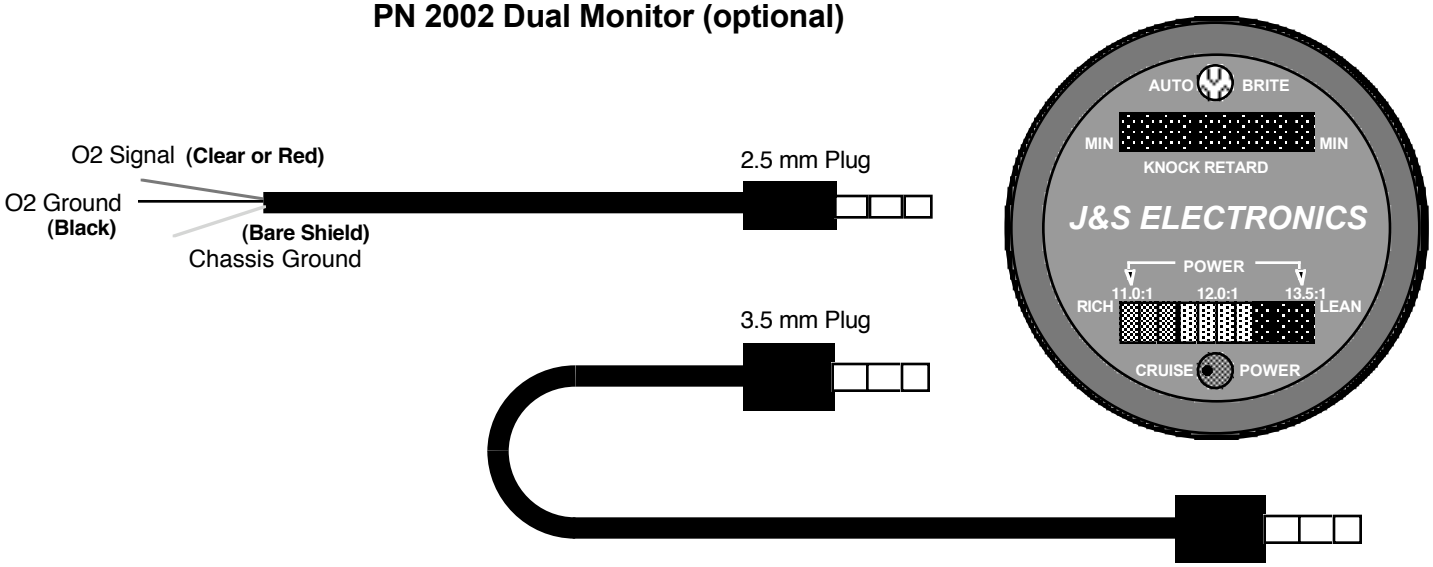
PN 2002 Dual Monitor (optional)



Two cables are supplied with the gauge. The cable with the two 3.5 mm plugs connects the retard display to the SafeGuard, while the 2.5 mm shielded cable connects the O2 display to the O2 wires.

Conect the White wire of the shielded cable to O2 signal, the Black to O2 reference or ground, and the bare shield wire to chassis ground. For one wire sensors, connect both the Black and the shield wires to ECU ground.

Bargraph Test
The SafeGuard has software to test the retard display. On power-up, you will see the display march up and back over a two second period. This tests the monitor, the cable, and the connector. It also verifies that the software is up and running. The test is aborted if the key is moved to the start position.

Operation

Retard Display
The Retard Display shows how much timing is being taken out by the SafeGuard. When the SafeGuard is set for 20° knock control range (mode switch #1 up), each LED is worth two degrees of retard. If the SafeGuard is set for "Retard All" (mode switch #2 up), and it is taking out say, 12° of timing, then you would see the 6th LED on. If the SafeGuard is set for "Retard Separate", then the display becomes more complex. Since the SafeGuard can retard each cylinder by a separate amount, you will see one LED on for each cylinder that is being retarded, and the position of that LED indicates how far. For example, let's say that one cylinder is retarded 4°, another 6°, and another 8°, then you would see the 2nd, 3rd, and 4th LED's on. With the SafeGuard mode switch #1 down, these readings are cut in half.

Air/Fuel Ratio Display
The Air/Fuel section of the gauge will work with any standard O2 sensor, though it is calibrated for a Bosch LSM-11 sensor, operating at 1450°F. The Air/Fuel ratio display reads the voltage produced by the O2 sensor. With the switch set to "Cruise" mode, the display reads from about 0.35v (lean) to about 096v (rich). This mode is used to help you get the mixture in the ballpark. When the mode is switched to "Power", the display "zooms in" to the critical range of 0.81v to 0.90v for fine tuning.