

Flyin' Miata

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Installation of the AEM Non-gauge type wide band oxygen sensor (WBO2)

5-9-08

- 1) Begin the installation by disconnecting the positive terminal on the battery.
- 2) Mount the WBO2 sensor. The sensor element needs to be installed in a standard O2 fitting in the exhaust pipe before the catalytic converter.

On turbocharged cars the sensor can be mounted in the downpipe in the location used for the standard O2 sensor. On FM turbo cars there will be a fitting in the lower portion of the downpipe right before the catalytic converter. This is the best place to install the WBO2 because the more consistent exhaust gas temperatures will ensure the most accurate performance. If the downpipe does not have a fitting in the lower portion, AEM does include a steel threaded sleeve that can be welded onto the downpipe. The O2 sensor must be mounted in such a way that the sensing tip is lower than any other part of the sensor.

On supercharged cars the O2 sensor should be mounted in a location that receives exhaust gasses from all 4 cylinders. If the factory manifold or aftermarket header does not have the O2 sensor fitting in this location, the fitting supplied from AEM must be welded onto the header in a location that contains gasses from all 4 cylinders. The O2 sensor must be mounted in such a way that the sensing tip is lower than any other part of the sensor.

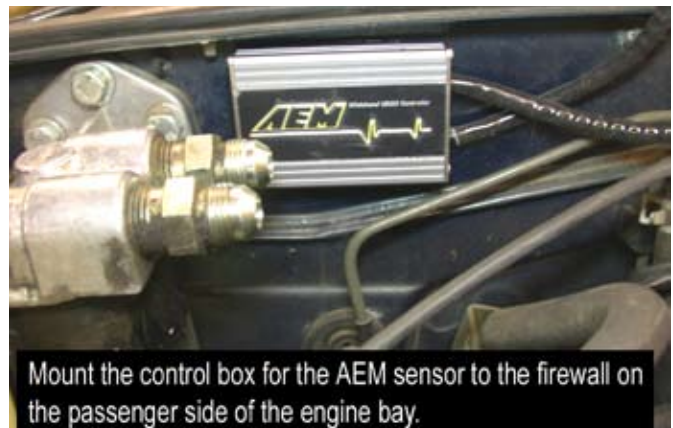
- 3) Mount the control box. The small aluminum bodied-control box for the WBO2 sensor can be mounted anywhere in the car. We like mounting it on the fire wall on the passenger side of the engine bay as shown in the photo.

- 4) There are two wire harnesses coming out of the control box. One is pre-terminated with a connector for use at the oxygen sensor itself. The other harness contains the power, ground and signal connections.

Route the harness for the O2 sensor to the O2 sensor taking care that is protected from heat and sharp edges. Plug the harness into the O2 sensor.

- 5) We are only concerned about 4 wires in the second wire harness coming from the control box and they are:

- Red: switched 12 volts
- Black: power ground
- Orange: WBO2 0-5 volt output
- Brown: signal (ECU) ground
- White: 0-1v linear output (do not use)



Mount the control box for the AEM sensor to the firewall on the passenger side of the engine bay.

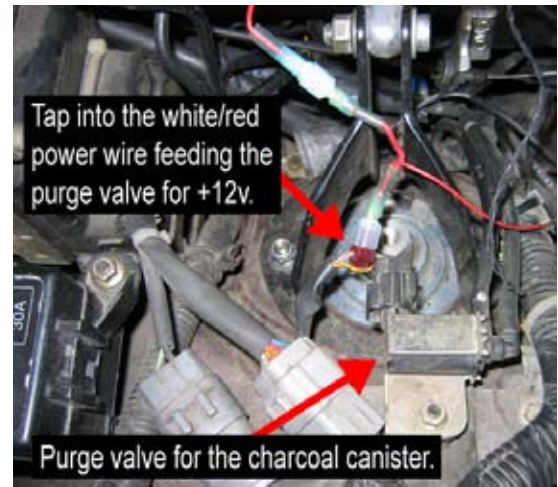
- 6) Connect the red wire from the WBO2 sensor to the white/red wire going to the purge solenoid for the charcoal canister.
- 7) Connect the black wire from the WBO2 sensor to a bolt going in to the chassis ground in this area.

The following instructions apply to the Link ECU only. This procedure will NOT work on the stock ECU. If you're going to use this WBO2 with a different aftermarket ECU, you'll need to figure out that wiring.

Steps for 1990 to 1993 cars

If this car is a 1994 to 1997 skip to step 8 on the next page.

- 8) Connect the brown wire from the WBO2 sensor to the ground connection at the rear of the head on the driver's side of the car. If the car is fitted with a Link ECU, this is where the ground wire modification was made.



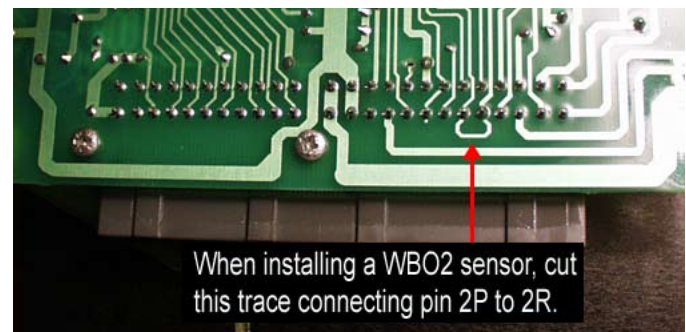
Here are diagrams of the ECU terminals viewed from the wire side

2Y	2W	2U	2S	2Q	2O	2M	2K	2I	2G	2E	2C	2A	1U	1S	1Q	1O	1M	1K	1I	1G	1E	1C	1A
*	L/O	Y	*	L/W	R	(R/B) *	LG/R	B/W	Y/L	W	B/LG	B	R/B	L/O	LG/B	G	*	LG/Y	*	BR/Y	Y/B	V	L/R
(LB)	Y/R	Y/B	*	*	R/G	R/L	LG/W (%)	*	R/W (%)	*	B/LG	B	BR/W (B/L)	*	B/G	(L/Y)	R	*	L/B	BR	W/Y	W/G	W/R
2Z	2X	2V	2T	2R	2P	2N	2L	2J	2H	2F	2D	2B	1V	1T	1R	1P	1N	1L	1J	1H	1F	1D	1B

The next step will require the removal of one of the ECU terminals. To do this, use a sharp straight tool like a pin. Looking into the plastic connector opposite the wires, there is a plastic tab that locks each metal terminal into the plastic. Lift up this terminal with the pin and pull the wire out of the plastic.

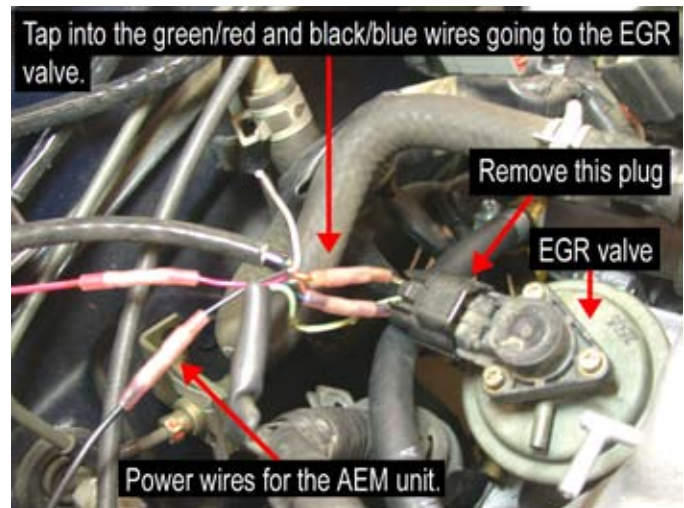
- 9) The WBO2 signal comes into the ECU on terminal 2P. Move the red/green wire from 2P over to 2R.
- 10) On the back side of the ECU's printed circuit board, cut the jumper that connects 2P to 2R. See the photo at right. This is not a wire, but a copper trace on the pc board that connects these two pins. Cut the trace with a pocketknife tip or X-Acto knife.

- 11) Run a new wire from the orange wire on the AEM WBO2 sensor (0 to 5 volt output) to position 2P in the ECU harness. A pre-terminated yellow wire for the ECU harness is included with the AEM sensor for this purpose from Flyin' Miata. If you are removing the factory O2 sensor, hook the 0-5v signal wire from the AEM to the single signal wire from the factory O2 sensor, then in the ECU harness move pin 2N to 2P. This is easier than running a new wire.



Steps for 1994 to 1997 cars

- 8) Un-plug the electrical connector from the EGR valve.
- 9) Cut back the black sheathing covering the three wires going to the connector.
- 10) Tap the orange wire from the WBO2 sensor into the green/red wire.
- 11) Tap the brown wire from the WBO2 sensor into the black/blue wire.



- 12) The plug for the EGR sensor must remain unplugged while the WBO2 sensor is being used.

Setting up the FM LINK ECU to use an AEM WBO2 sensor

When using a WBO2 sensor, the O2 sensor targets programmed into the Link ECU must be changed to reflect the output voltage of the WBO2 sensor. The default values are for the OEM O2 sensor. The O2 sensor targets are stored in zones Z26 through Z31.

- 1) Go to the edit Z menu with your keypad and enter the O2 targets for the “AEM WBO2 non-gauge type” in zones Z26 through Z31 as shown in the table below.
- 2) On 94-97 cars, the EGR function will need to be turned off. This is done with the keypad in the **TPS** screen. While pressing both Select keys, press the Edit down key to turn off the EGR. Pressing the Edit up key turns EGR back on.
- 3) On 90-97 cars, in the **INJ/O2** screen, choose **WBO2** sensor instead of **OEM O2** sensor. To do this, press both Adjust keys and press the Edit up key for the WBO2 sensor or Edit down for the OEM sensor.
- 4) Now, when the car is running, the reading on the far right in the **INJ/O2** screen will be the voltage from the WBO2 sensor multiplied by 25.6 then subtracted from 128 as shown in this equation.

$$\text{WBO2} = 128 - (\text{WBvoltage} * 25.6)$$
- 5) At this point the FM ECU will auto tune using the signal from the WBO2 sensor just as it tunes with the standard OEM sensor, but now the boosted rows can be safely tuned as well. The 400, 500 and 600 rows can now be tuned in the same manner as the 100, 200 and 300 rows, by driving the car in the center of each row in the ZONEF screen. Please refer to the current ECU tuning manual for details on fuel tuning.

Forced Induction	Vacuum			Boost		
	29 kPa	60 kPa	100 kPa	140 kPa	180 kPa	227 kPa
Row Pressure Center	29 kPa	60 kPa	100 kPa	140 kPa	180 kPa	227 kPa
Link Zone	Z26	Z27	Z28	Z29	Z30	Z31
AEM WBO2 (no display)	22	24	29	44	58	76
Desired A/F ratio	14.8	14.7	14.0	12.5	11.5	10.5