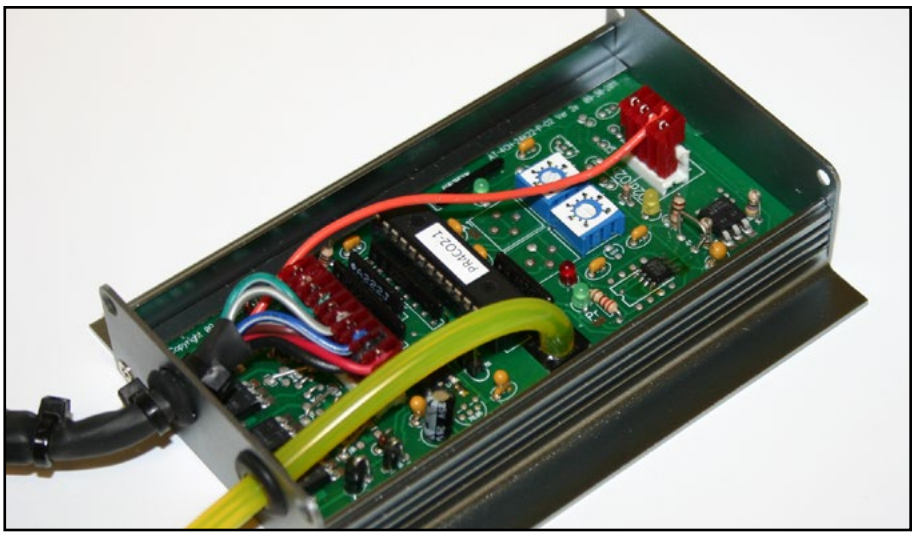
Flyin' Miata

Voodoo box installation and tuning 07-16700



The Voodoo Box intercepts the stock injector signals. When the car is under boost, the signals are modifed to deliver more fuel. Under normal driving conditions - cruise, starting, idling and the like - the injector signal is unchanged. This unit also includes an O2 spoof to eliminate lean tip-in. It does this by modifying the factory O2 sensor under boost while in closed loop.

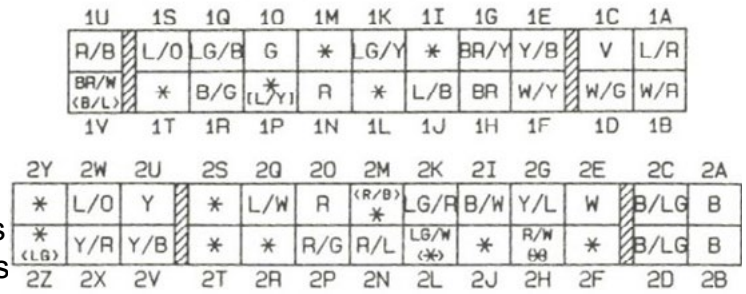
1) Disconnect the negative terminal on the battery. Find the factory ECU. It is above the clutch pedal underneath the dash on 99+ Miatas, behind the passenger seat on 94-97 cars, and under the passenger footrest on 90-93 cars. Undo the plugs attached to the ECU. The ECU harness plugs below are viewed from the harness / wire side with the tab on top.

3) Use the included butt connectors to connect the Voodoo Box to the stock ECU. You'll need to cut the original wire, twist the appropriate Voodoo box wire around one of the cut and stripped ends, crimp it into the butt connector, then crimp the other end into the butt connector. Cut and connect one wire at a time to ensure that you don't confuse the different wires. Once connected, give a slight tug to ensure that the wires are firmly held in the butt connector. CONFIRM YOUR CONNECTIONS WITH A MULTIMETER! If the wire color and location don't agree with our schematics, match the location instead of the color. The O2 wire on the Voodoo box may be a different color, if you have a wire that doesn't match, trace it. If it ends up by itself, that's the O2 wire (in the picture above, the O2 wire is orange). Once all of the wires have been connected, CAREFULLY heat shrink the new butt connectors. The heat shrink helps seal the connector and acts as a strain relief, so it's a good thing to do. Be sure you don't melt any other wires with the heat gun.

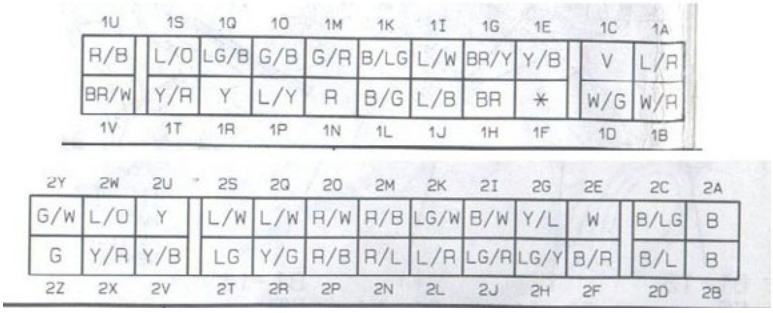
4) Using the supplied tee connector, tap into the vacuum line running to the boost gauge. Attach the new vacuum line to the Voodoo Box. MAKE SURE THIS IS SECURE!

5) Once it's properly tuned, use double-sided tape to attach the Voodoo Box to the stock ECU case.

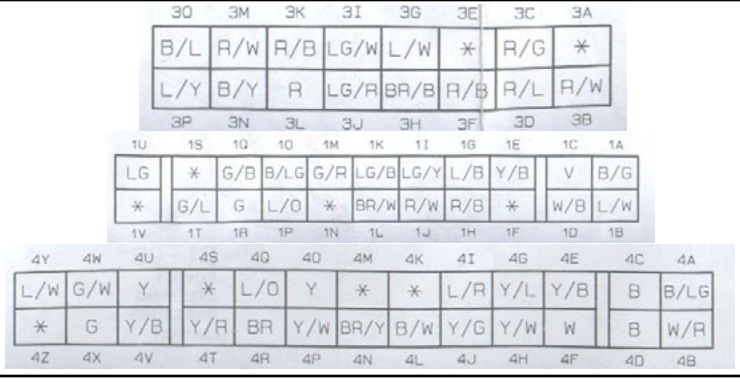
1990-93
Voodoo Box: ECU
red: white with red stripe, pin 1B
black: black, pin 2B
blue / white: yellow, pin 2U
grey / white: yellow with black stripe, pin 2V
green / white: not used, except 2Y on 93 CA cars
brown / white: not used, except 2Z on 93 CA cars
orange: red with blue stripe, pin 2N



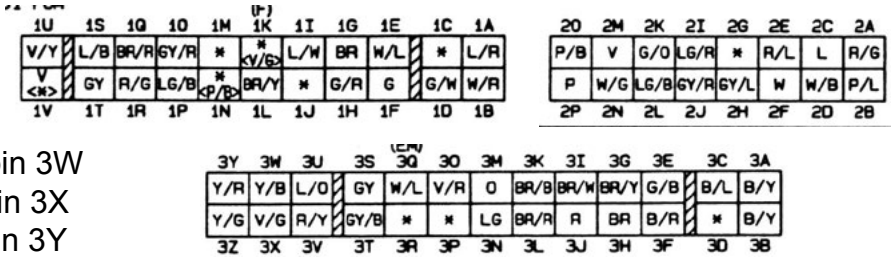
1994-95
Voodoo Box: ECU
red: white with red stripe, pin 1B
black: black, pin 2B
blue / white: yellow, pin 2U
grey / white: yellow with black stripe, pin 2V
green / white: green with white stripe, pin 2Y
brown / white: green, pin 2Z
orange: red with blue stripe, pin 2N



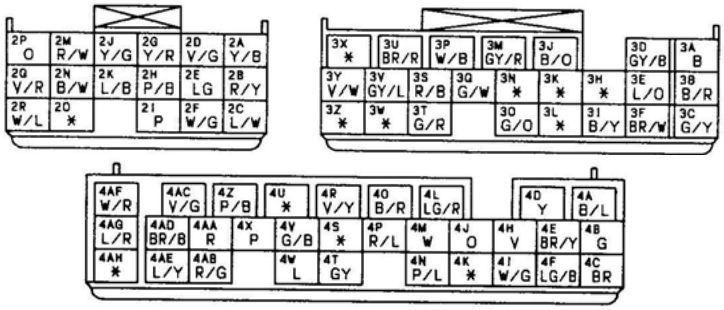
1996-97
Voodoo Box: ECU
red: white with red stripe, pin 4B
black: black, pin 4D
blue / white: yellow, pin 4U
grey / white: yellow with black stripe, pin 4V
green / white: green with white stripe, pin 4W
brown / white: green, pin 4X
orange: red with green stripe, pin 3C



1999-00:
Voodoo Box: ECU
red: white with red stripe, pin 1B
black: black with yellow stripe, pin 3A
blue / white: yellow with black stripe, pin 3W
grey / white: violet with green stripe, pin 3X
green / white: yellow with red stripe, pin 3Y
brown / white: yellow with green stripe, pin 3Z
orange: blue, pin 2C



2001-05
Voodoo Box: ECU
red: white with red stripe, pin 4AF
black: black, pin 3A
blue / white: yellow with black stripe, pin 2A
grey / white: violet with green stripe, pin 2D
green / white: yellow with red stripe, pin 2G
brown / white: yellow with green stripe, pin 2J
orange: blue, pin 4W

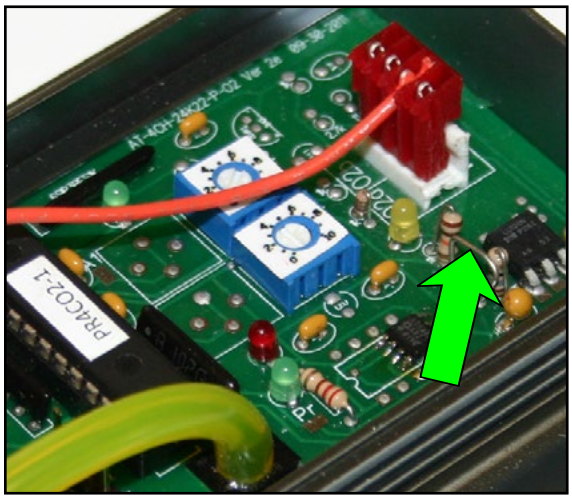


90 - 93 cars (except for 93 California cars) will only use two injector wires, not four. This is because the earlier cars run batch injection (not sequential), meaning that two injector fire at a time. This works, but isn't as precise and isn't as good for power or emissions. On the earlier cars, just ignore two of the injector wires, per the wiring instructions.

If you are attaching the Voodoo box to an OTM, use the following for your reference along with your car's factory wiring diagram to determine the correct placement of your wires. The Voodoo box doesn't care which stock injector wire matches up with each Voodoo box injector wire.

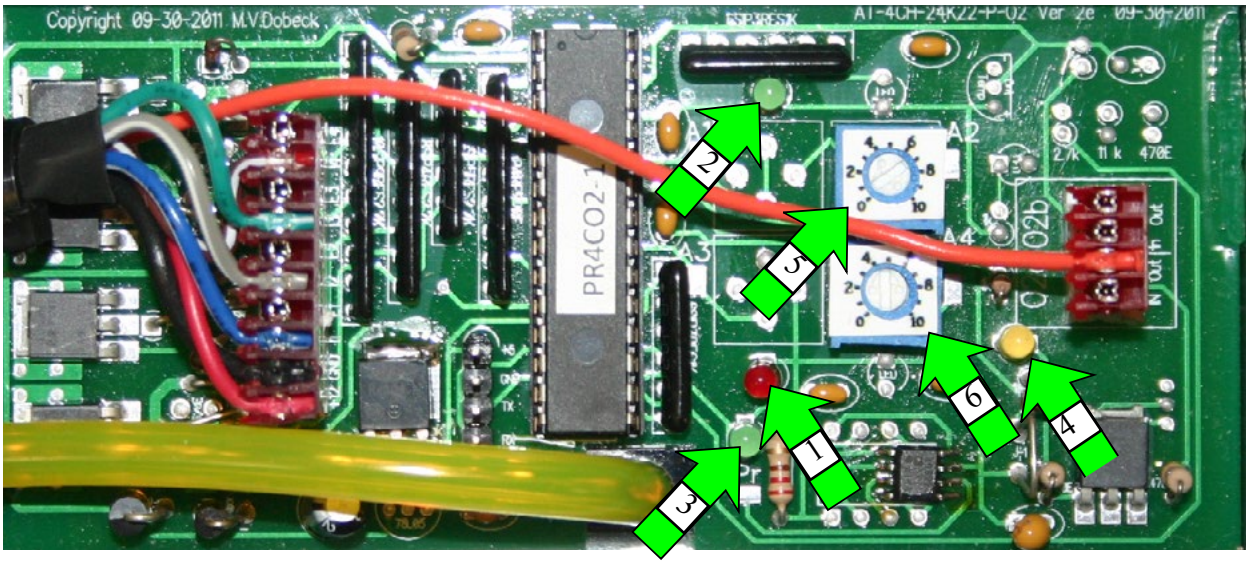
red: switched B+ from the main relay
black: chassis ground
blue / white: injector (for sequential and batch injection)
grey / white: injector (for sequential and batch injection)
green / white: injector (for sequential injection only)
brown / white: injector (for sequential injection only)
orange: primary O2 sensor signal

If you have a 94 - 05 or 93 California Miata (which have sequntial injection), skip this step. If you have a 90 - 93 non-California car (which have batch injection), you'll need to cut the wire indicated below, and bend the two halves such that they no longer contact each other. If you've bought a used Voodoo box, this wire may not be there. If the wire isn't there, seven wires = sequential, five wires = batch.



90 - 92 and 93 non-California Miatas:

Cut this wire to prevent the Voodoo box from throwing an error code on a batch injection car. Cutting this wire turns a sequential (94 - 05 or 93 California) Voodoo box into a batch (90 - 93 and 93 non-California) Voodoo box. Once this wire has been cut, the Voodoo box will still work for sequential cars, but it will not error-check channels / injectors three and four. In other words, if there's a connection issue with one of those injectors, the Voodoo box will not illuminate the error light.



1) The red LED (1) indicates that the board has power. This should be on when the car is on.

2) The upper green LED (2) indicates an incorrect / poor connection. If this is blinking randomly, you need to troubleshoot your wiring connections. In normal operation, it will be off. It will, however, be on when the ignition is on (meaning the Voodoo box has power) but the engine isn't running (meaning the injectors aren't firing). Since the Voodoo box has power but doesn't see the injectors, it will turn the error light on. Once the car is started, the error light will go out.

A note about lights 3 and 4: The instructions below relating to these lights are for getting the adjustments close, but the ultimate decider in whether or not the Voodoo box is tuned properly is the car's behavior and the air/fuel ratio under certain situations. In other words, if the behavior and the ratios are right but the lights aren't doing what is said below, that's okay.

3) The lower green LED (3) indicates that fuel is being added. This should be on whenever you're in boost, it should come on just after "0" on your boost gauge.

4) The yellow LED (4) indicates that the O2 sensor is being "spoofed". This should blink when in boost, it should start blinking just before "0" on your boost gauge. You'll need to adjust the A2 potentiometer / pot (5) set this correctly. If you go lean when you first tip into the throttle, lower this value. If you find that the car is running rich under vacuum, increase this value.

3) Set pot "A4" (6) to achieve the desired air/fuel (A/F) ratio under boost. This should be determined with a wideband O2 sensor. We recommend 10.0:1 - 12.5:1, depending on how much boost (more boost = richer / lower numbers) and how good your gas is (93 can go a little leaner, 91 should be richer). Bear in mind that the A/F ratio should be something of a ramp - in other words, it should be roughly 13 when you first tip in and roughly 11 (depending on gas) at full boost. Adjust A4 until you get the appropriate behavior / values. Remember, you're not going to get anything exact, you're looking for a general average that's correct.

Tuning Instructions/Suggestions

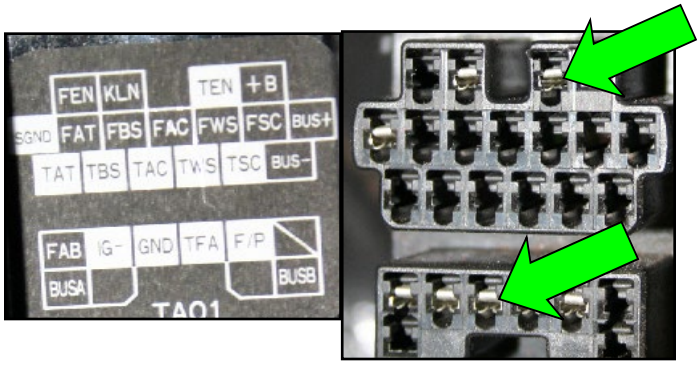
There are certain tools that will allow you to tune your Voodoo turbo system properly. The most important tool for fuel tuning is a wideband oxygen sensor with a display. This will allow you to precisely monitor your air/fuel ratio in real-time whereas the stock narrowband O2 sensor that comes in your car will not. (The stock NBO2 will only tell you 3 things- leaner than stoich, stoichiometric, and richer than stoich.) If you purchase your own WBO2 you can tune your Voodoo box yourself based on the recommended A/F targets listed earlier in this manual. If you do not, you can have the car tuned at a dyno shop. They should have a WBO2 attached to their dyno. Once the car is tuned properly (and we recommend a little bit conservatively) you should not have to mess with it- unless you travel somewhere that has fuel of a lower octane. In this case it is best to keep out of full throttle if you do not have the tools available to reduce your boost level or retard your timing manually.

If you do not tune the Voodoo box with a WBO2 you will need to set things conservatively. You may be able to run the base boost (as determined by the wastegate) and run with the fuel turned up. This will be richer than necessary, but it'll be safe (at least temporarily). If at any time your car feels like it is bogging, struggling, not revving freely when you are in boost, etc. you are lean and you need to increase fuel or reduce boost immediately to prevent engine damage. Please consider this only a temporary option until you can gain access to a WBO2 for proper fuel tuning - too rich is less damaging than too lean, but it's still not good.

Note- all other factors held constant, the 99-05 Miatas have more headroom in the fuel system than the 90-97 Miatas. This means that the later cars can support more boost than the earlier cars will. While we have seen the M2 cars support between 190-220 rwhp (depending on external factors), the testing (which isn't as thorough yet) we have done on M1 cars shows support for around 160-180 rwhp. If you want to eek a little more you can usually go with around a 15% larger injector- more than this limits your car's ability to maintain a stoichiometric idle and cruise for closed loop conditions which is a problem for emissions and fuel economy. This means that 90-93 cars (blue top injector) can use 94-97 tan top injectors, 94-97 cars can use 270cc injectors, and 99-00 cars (maroon injector) can use 01-05 purple injectors. We have seen 01-05 cars support RWHP in the low 200s on stock injectors, and honestly if you want more power than that you should upgrade to a standalone ECU since the 6 degrees max static retard from our adjustable timing wheel will not cut it. (01-05 cars have higher compression.)

Now on to timing tuning. A tool that is useful for tuning the timing on 99-05 Miata is an OBD-2 scantool that has the ability to monitor voltage output from your factory knock sensor. This will detect knock long before you can hear it. If you have a 90-97 Miata or no scantool, you will have to listen for knock when tuning your timing and (assuming your A/F ratios are good) back off a couple degrees when you advance to the spot where you hear any. ALL TUNING MUST BE DONE WITH THE TOP UP AND WINDOWS UP! You'll never hear a ping with the windows or top down. If you set up the timing in the winter you will likely have to back it off some more when it turns to summer as warmer intake temps will increase the likelihood of knock.

The Voodoo box only controls fuel. With any turbo kit you must also control your timing as stock timing is too much for boost. If you have a 90-97 Miata you can dial in a static amount of timing retard by adjusting your Cam Angle Sensor and checking its position with a timing light. Refer to a service manual for how to do this. (When using a timing light jump GND to TEN in your diagnostics connector (box with the flip up lid by the driver's side shock tower) so that you force the factory ECU into open loop.) We recommend starting with 4 degrees of timing, which is 6 degrees retarded from OEM 10 degrees. Retarding your timing will move the notch clockwise on the backing plate marks. As conditions allow, you can advance from there (bringing it back counter clockwise). For 99-05 cars we include an adjustable timing wheel with our Voodoo and Voodoo 2 kits. There are separate instructions for that timing wheel, please follow those instructions.



Note- In general, we don't recommend over 8 psi when your available retard is 6 degrees. (Maybe a little less for California, maybe a little more for Texas etc.) Remember with a static retard your off-boost timing is down as well which reduces throttle response and raises your exhaust gas temps. If you want more boost you should upgrade to a standalone ECU such as our Hydra for 90-05 Miata.

We have recommended boost levels for our Voodoo and Voodoo 2 turbo kits, however within the nature of tuning and variability there is some fudge factor. For example, if you live in California (the worst gas in the U.S. for turbo cars, 91 octane that is more like 89-90) and you are tuning for the best-running car possible, you simply won't be able to run as much boost as someone with the same car and the same kit in Texas (The best pump gas we've seen, 93 octane that smells like race gas).

What we are aiming for with optimal tuning is to get your car to the best of its ability given its surroundings. For 90-97 cars start at 5 psi and work up from there as you tune. For 99-05 cars start at 6. If you have an intercooled kit you will simply end up tuned with more boost than you would have if you did not have the IC. Your fuel and timing tuning along with available octane should dictate the boost level that you can attain.

1) Make sure your vacuum line is secure! If this comes off, your engine is not long for this world.

2) Set your initial boost low using washers as described in the turbo kit installation instructions. Shortening the distance between the wastegate itself (the pin coming out of the turbo) and the actuator (gold can) lowers the boost (washers between gold bracket and bolt head), increasing that distance (washers between the gold bracket and the stainless bracket) raises boost. We preload the arm length to around 6 psi - if you want to be conservative you may want to back it off. Test and repeat as necessary. If you lose that little C clip you're on your way to Home Depot. A good way to avoid losing the clip is to have a magnet next to the clip when you pry it off.

3) Start the car and check your timing. Set your timing as appropriate to 4 degrees of advance (as described above) as a starting point. If at any time in the procedure below you hear knock, rather than retard the timing any more you need to lower your boost. If you want more boost you'll need a standalone ECU and larger injectors.

4) With the car running, you'll need to set your O2 signal modifier (A2 pot). You'll need to find a helper and go drive the car. Be in a higher gear and use the gas pedal to load up the engine slowly in order to set the following: Adjust the A2 pot so that the light comes on just before 0 on the boost gauge (atmospheric pressure). Fine tuning may be needed, but this should be close for optimal fuelling. If the car is too rich around 0 on the boost gauge you'll need to increase the on-point of the A2 pot (i.e., make the lightcome on later / higher on the boost gauge). If it's too lean around 0 on the boost gauge, you'll need to decrease it. Keep in mind that the lights for these onsets should not come on during idle, cruise, or very light acceleration - only when transitioning into boost.

5) Once you are ready, drive the car and stay out of boost. (Having a passenger help is much safer for tuning the Voodoo box, by the way.) Turn your fuel delivery output (pot A4) to 6 (roughly one o'clock) to start on the conservative side. 90-97 cars will most likely be at max fuel output while 99-05 cars may hit 8psi and still be rich at max (meaning fuel output can be turned down to hit the desired A/F target and increase HP).

6) Slowly introduce boost while monitoring your boost gauge and A/F ratio. The idea here is to get as much boost as you can (within the guidelines above) while being able to maintain your target A/F ratio (above) all the way to redline. One way to do this is to leave your fuel output high and increase your boost on the WG actuator 1/2 turn at a time until you hit your A/F target all the way to redline. If you lean out anywhere, including at high RPM, lower your boost. If the fueling is rich when you first get into boost, but good otherwise, try backing off on the O2 adjustment (arrow #5 / pot A2). Once you're satisfied with the fueling, put the top back on the Voodoo box. Don't run more than 9 psi unless you fully understand what you're doing.

7) Once your fuel delivery and boost pressure is set you will determine if any more base timing can be dialed in to the system. You want the most base timing you can get while NEVER hearing any knock. Advance your timing 1 degree at a time and test. If you reach a point where you experience knock, set your timing 2 degrees retarded from that point to remain conservative. Any time you get different gas or it gets a lot warmer out listen again for knock and retard 1 degree as necessary. (Remember, each marker on your timing plate is 2 degrees. The 10 degree marker is labeled.)