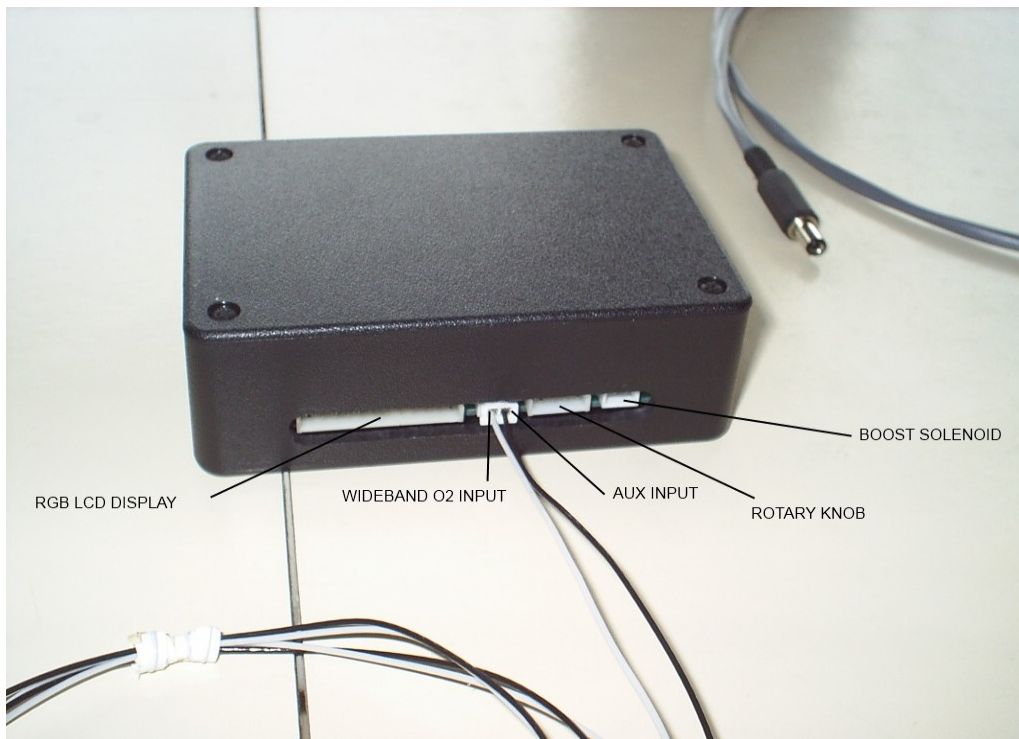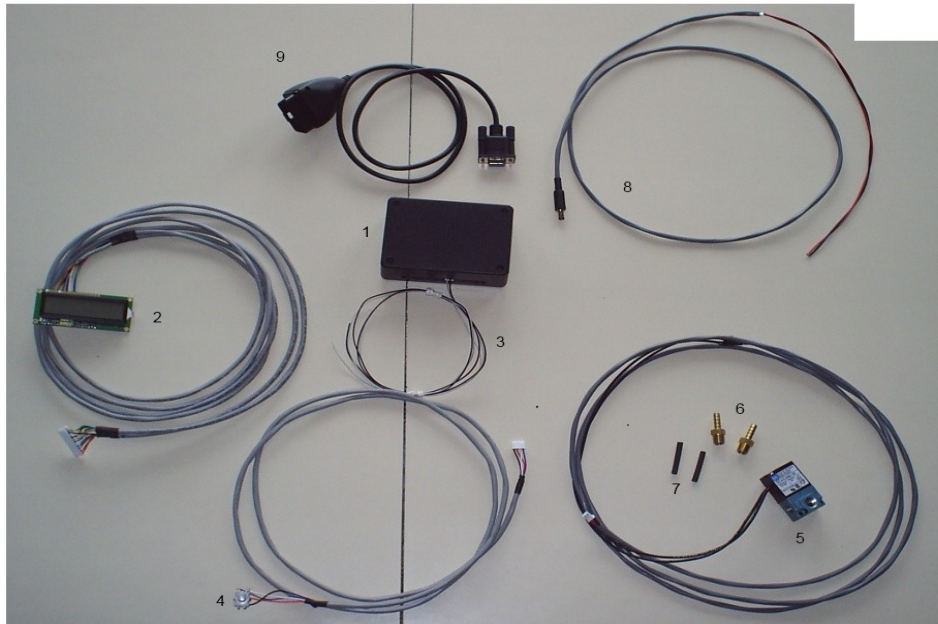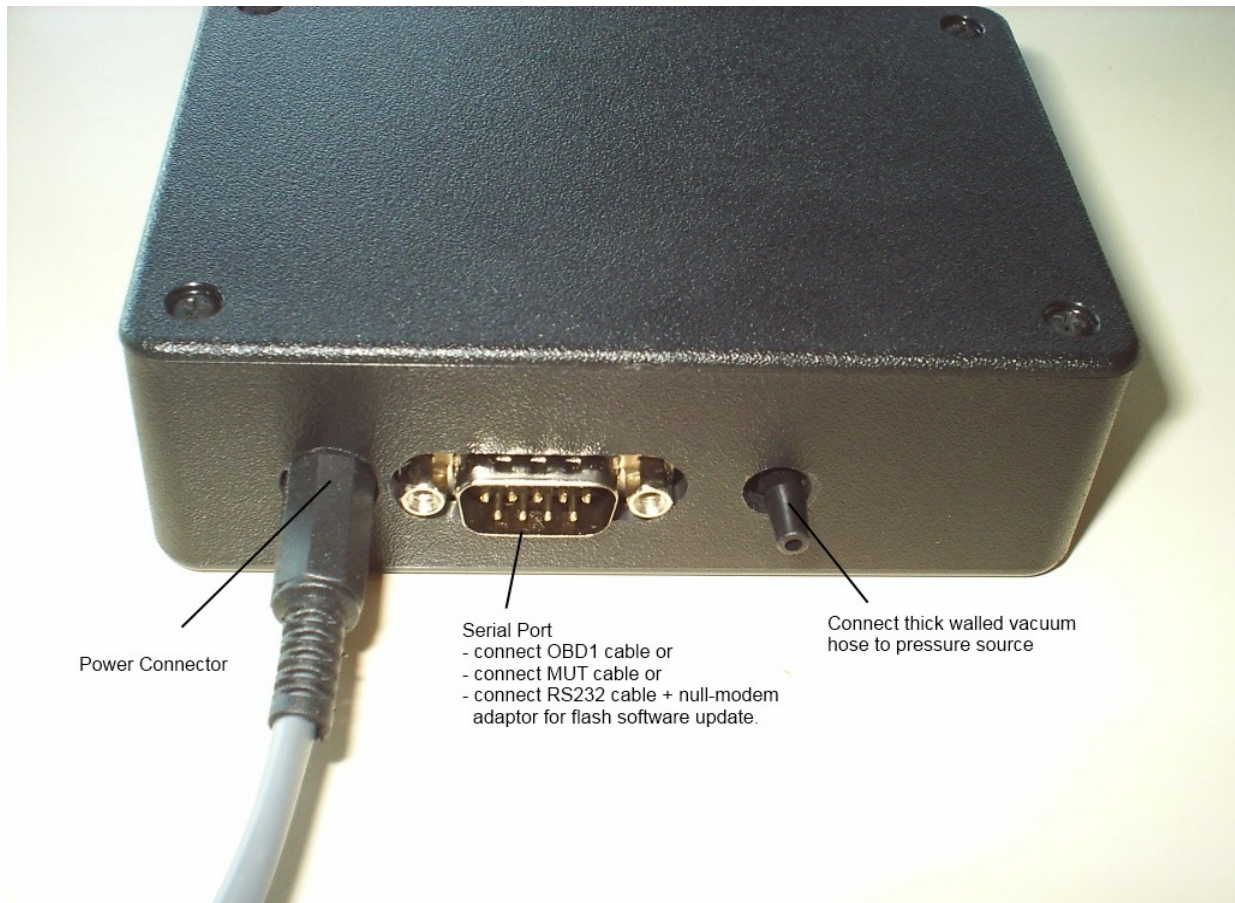# List of items:

1. Main black box
2. RGB LCD Screen
3. Wideband O2 input / Aux. input wire
4. Rotary Encoder with built-in push button
5. Boost solenoid & boost solenoid cable
6. Barb hose fitting
7. Heat shrink tubing for connecting boost solenoid wire
8. Power cord
9. MUT cable (OPTIONAL) for 94-99 3/S vehicles

Power Connector

Serial Port
- connect OBD1 cable or
- connect MUT cable or
- connect RS232 cable + null-modem
  adaptor for flash software update.

Connect thick walled vacuum
hose to pressure source

The serial port can take three types of inputs.

Input type 1: Accepts notebook/laptop version OBD1 datalogging cables without any adaptors.
If you have a palm version OBD1 datalogging cable you will need a null-modem adaptor to change the gender and pinout.

Input type 2: Accepts my MUT cable without the need of any adaptors.

Input type 3: Accepts RS232 cable from a PC for the purpose of upgrading/flashing newer software.
Note the RS232 cable requires a null-modem adaptor.

Picture of null modem adaptor (orange label), this is what you need. Be sure to get a FEMALE to FEMALE null-modem adaptor version.

NULL-MODEM ADAPTOR
FEMALE TO FEMALE GENDER NEEDED

Note the Orange label spells out NULL-MODEM.

INCORRECT ADAPTOR, THIS
ONLY CHANGES THE GENDER.

Note: the Yellow labels spells out GENDER CHANGER.

Miscellaneous items you may need

- thick walled vacuum hose (*for pressure sensor*)
- OBD1 datalogging cable (laptop/notebook version) if you have an OBD1 car
- knob (*for rotary encoder*)
- Add-a-fuse (*for hooking up power*)
- sharp xacto knife
- diagonal cutters
- roto-zip for grinding
- clear silicone

The rotary knob itself has a D-shape shaft but I found these to fit anyways. Ebay has hundreds of different style knobs available.

Installation of boost solenoid:

Factory setup below:

factory boost solenoid

Rear turbo wastegate

Rear Intake

Y-pipe

Front turbo wastegate
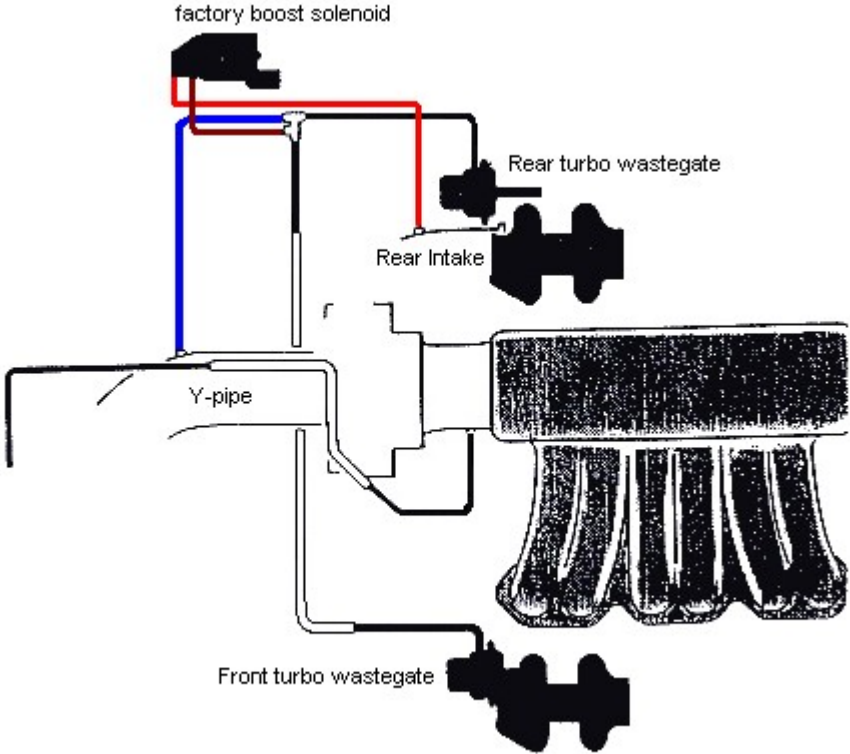
Next we disconnect the factory boost solenoid vacuum hoses and cap them. Next we install the new boost solenoid, take note of the orientation. The boost solenoid has ports 1, 2 and 3 labeled on them. Port 2 goes to wastegate, and port 3 goes to Y-pipe (boost source). Port 1 is left open, you could add a sintered vent/muffler to keep dirt out.

factory boost solenoid

Disconnect and cap

Rear turbo wastegate

Rear Intake

Y-pipe

Front turbo wastegate
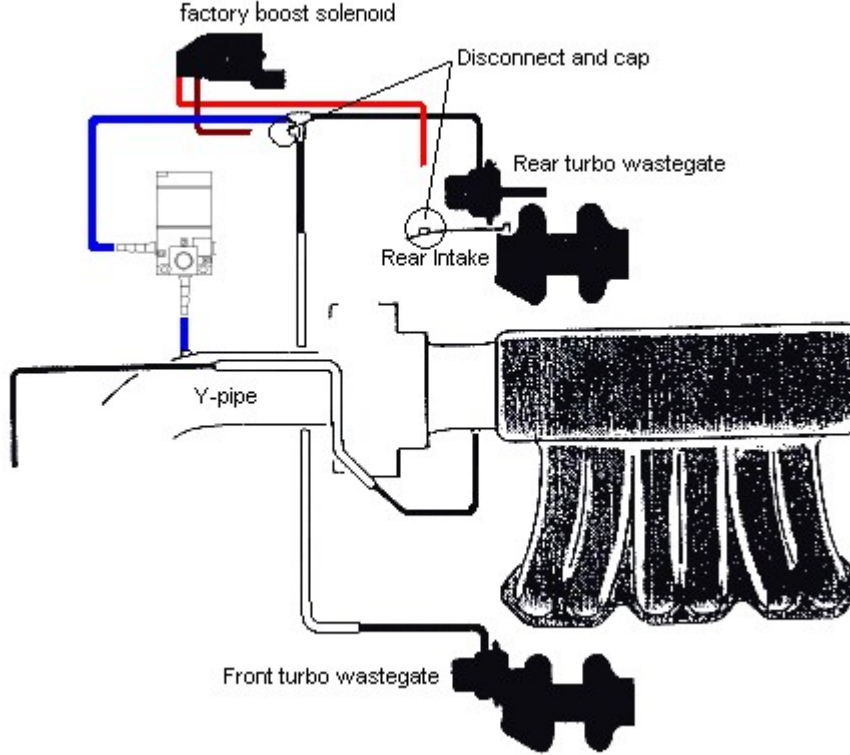
Factory boost solenoid can be completely removed.
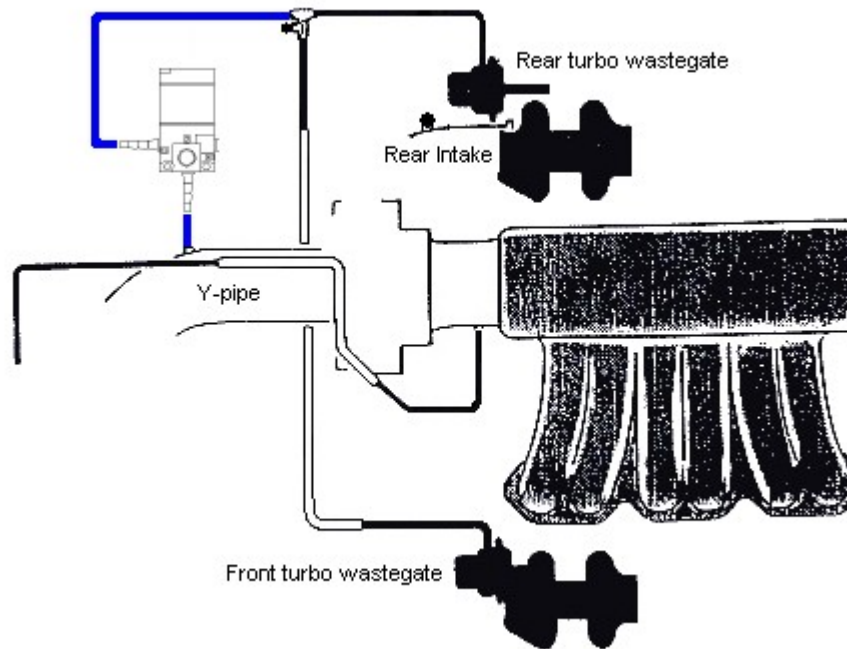
The black box pressure sensors needs to measure boost, so grab a thick walled vacuum hose and feed it through the firewall and 'T' into something, perhaps the Blow Off Valve, etc. While feeding the vacuum hose through the firewall it might be a good idea to feed the boost solenoid harness through the same time. Keep in mind that you want the connector of the boost solenoid harness to be inside the vehicle so it can be hooked up to the black box.

Next hookup the boost solenoid to the boost solenoid harness. Insert heat shrink tube into each wire, solder each wire and pull heat shrink tube over solder connection and use a heat gun (or hairdryer) to shrink and protect. Boost solenoids are not polarity sensitive so it does not matter which wire goes to which.

The best location to install the black box itself is behind the ECU where there's a lot of empty space and also minimize the length of the vacuum hose.
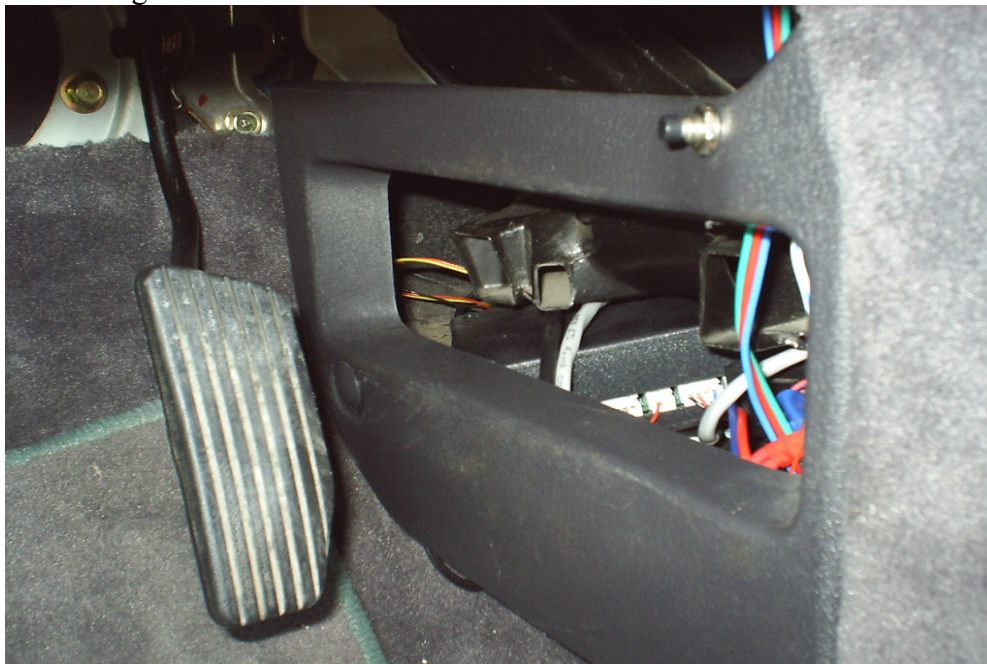
In the picture below I used a product called Add-A-Fuse to provide 12 volt ignition power to both my wideband O2 controller and the black box. The power cord I provided has two wires red and black. Red goes to 12 volt ignition, and black goes to ground.
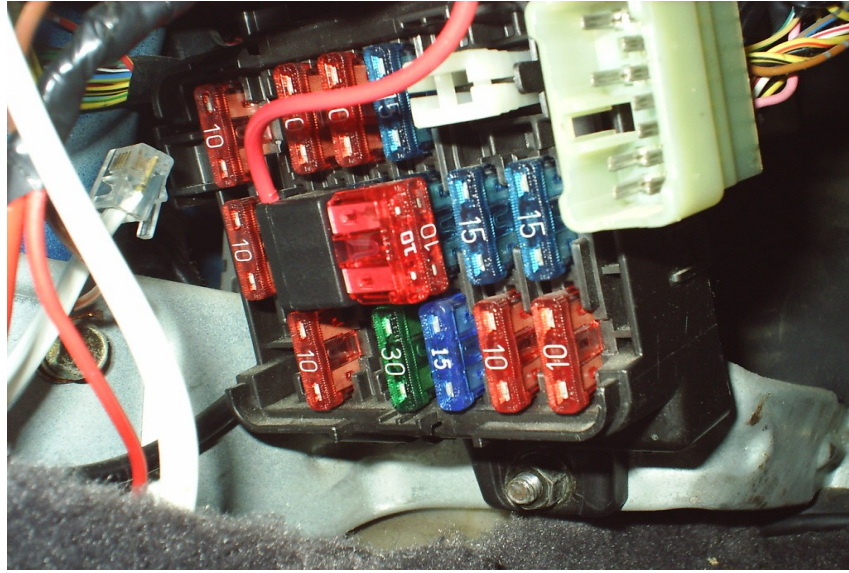

INSTALLING LCD SCREEN IN THE RPM METER

You may consider purchasing an extra cluster panel from ebay and work on that. This way you can take your time to do a good job. When you disassemble the cluster panel you do not have to remove trip reset pin, but it does make the job easier if it's out of the way. The easiest way to remove the pin is when the cluster panel is still attached to the car, push it down to reset and pull it out very quickly. If it didn't come out on your first attempt repeat by push down to reset and pull. Trying to remove it when the cluster panel is off the car will make it challenging. If you get frustrated and can't get it out, don't worry, it's not necessary to remove it. I've installed the LCD screen twice:

The first attempt I installed an amber LCD screen pretty high up on the RPM meter. Because it was so high up, I had to grind away part of the PCB see image below.
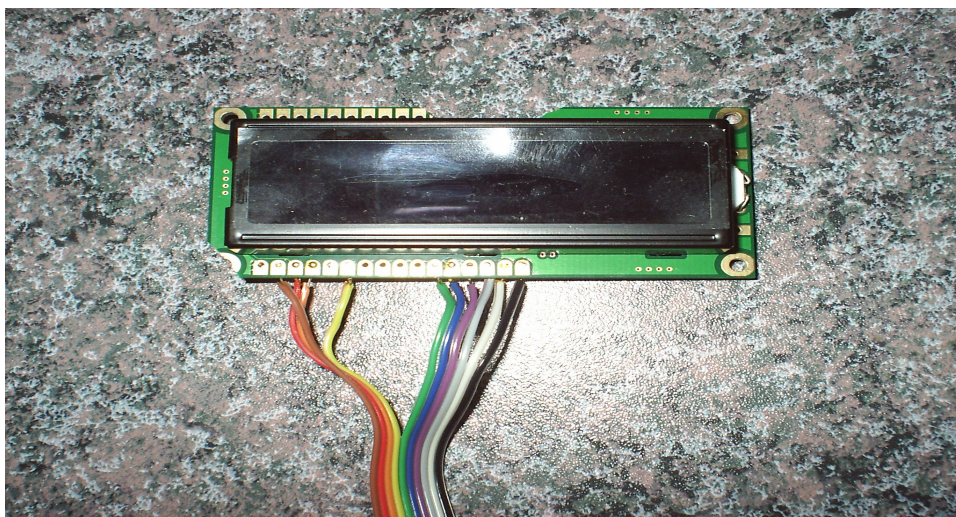
Here's the amber LCD screen installed behind the RPM meter.
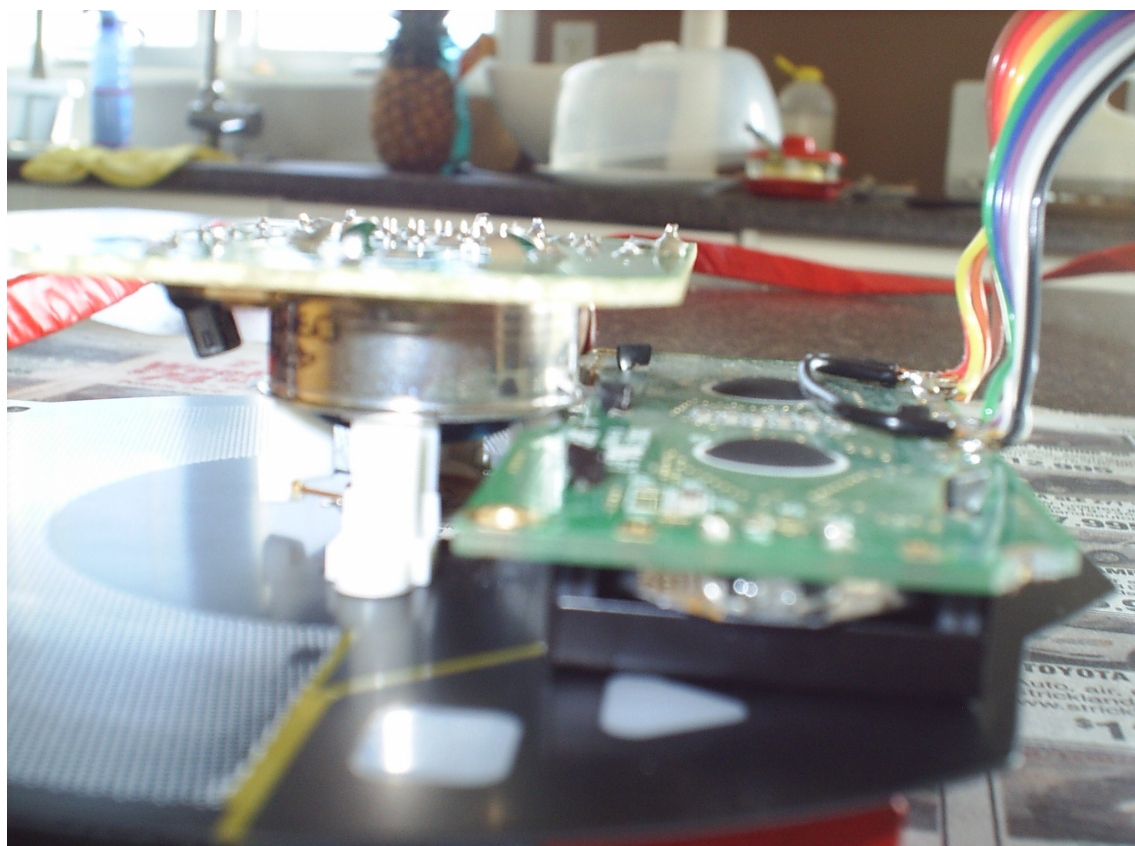
In the background you can see I use hot glue gun, I don't recommend this as it doesn't give you enough time to align it properly. Instead I recommend clear silicone, as it gives you lots of time to work with before it dries, and is easily removable afterwards.

The amber LCD as you can see sits a bit too high. I did have to grind away some the night light clear plastic reflector to get it that high. The data display on the screen is just fake, I was just formatting/spacing the text. I could not read the display in sunlight so I abandon it.

On my second attempt I used a sunlight readable LCD screen display and I also got a bit lazy and didn't feel like disassembling the RPM display, as a result the LCD display will lower.
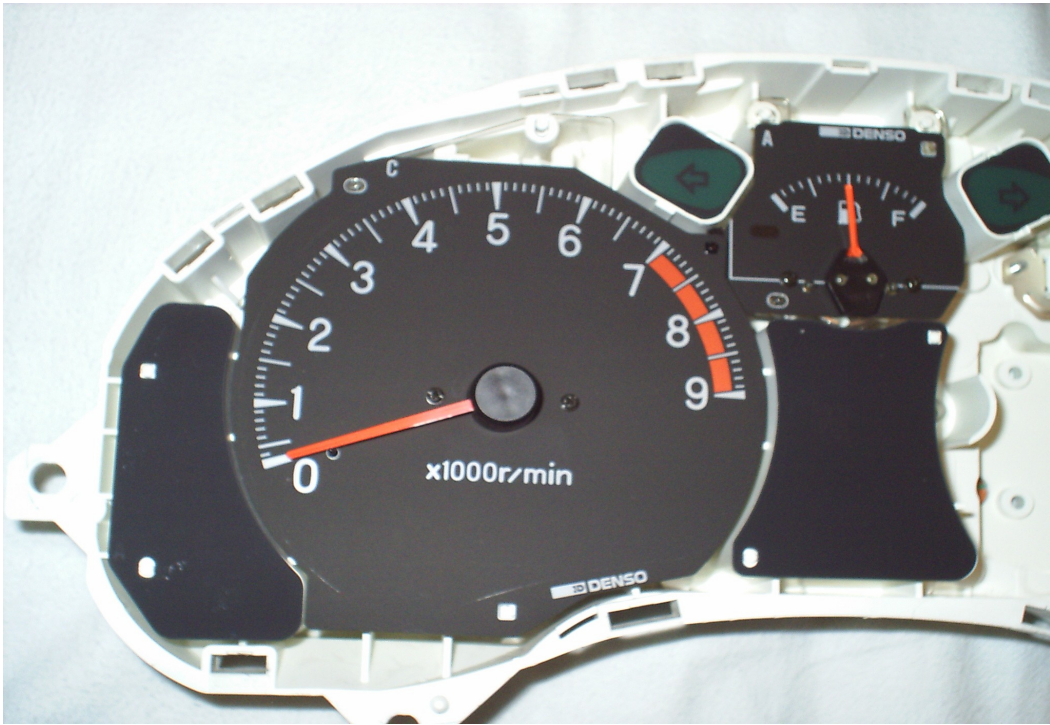
RPM gauge meter removed from cluster panel to show what's behind there.
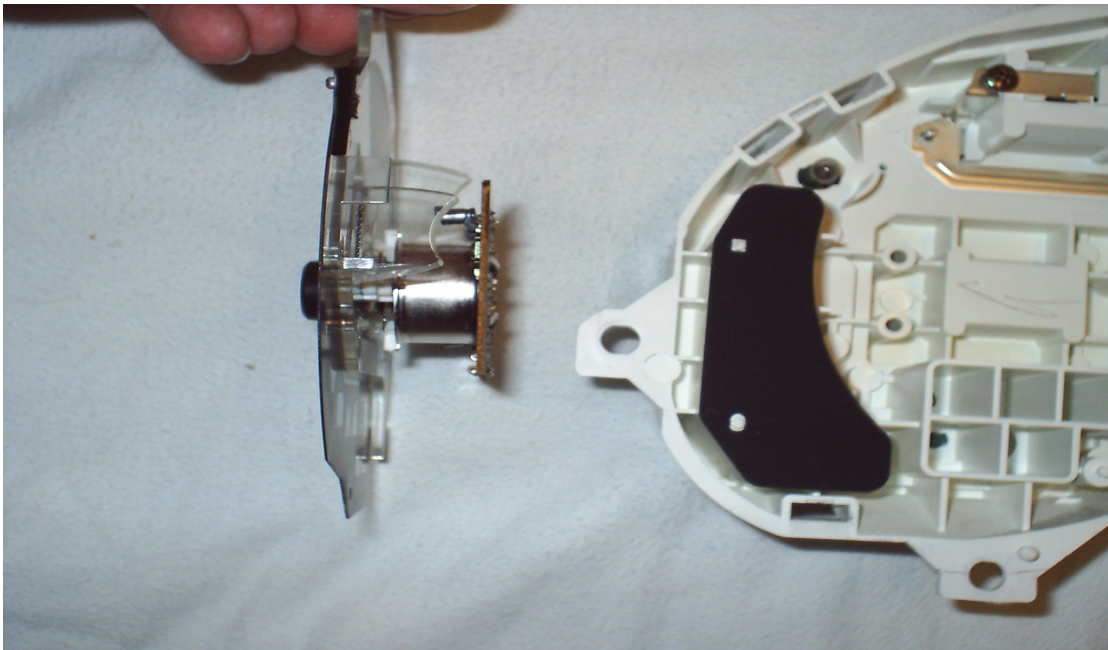
As you can see, Mitsubishi had 11 unused future expansion lights. I grind all of that away to make room for the LCD screen.
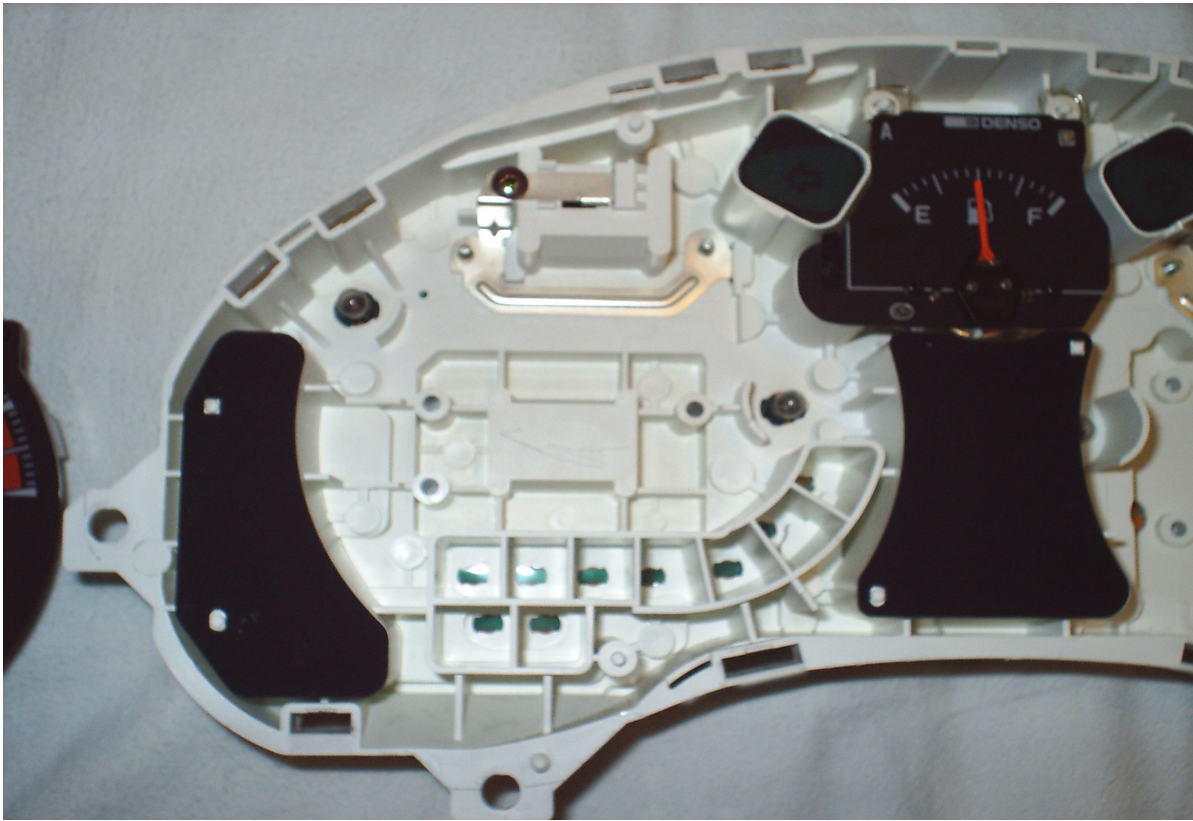
RPM gauge meter laying face down.
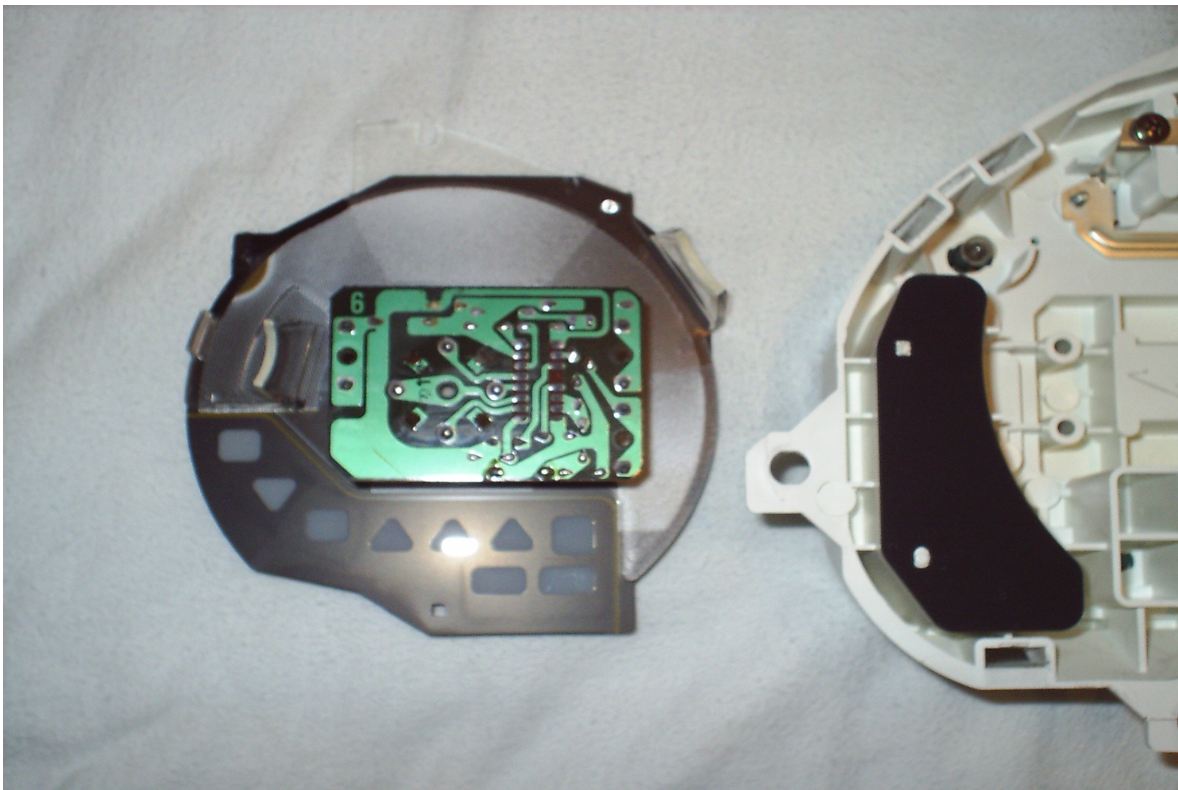
Using diagonal pliers I snapped and grinded down the white plastic to make room.
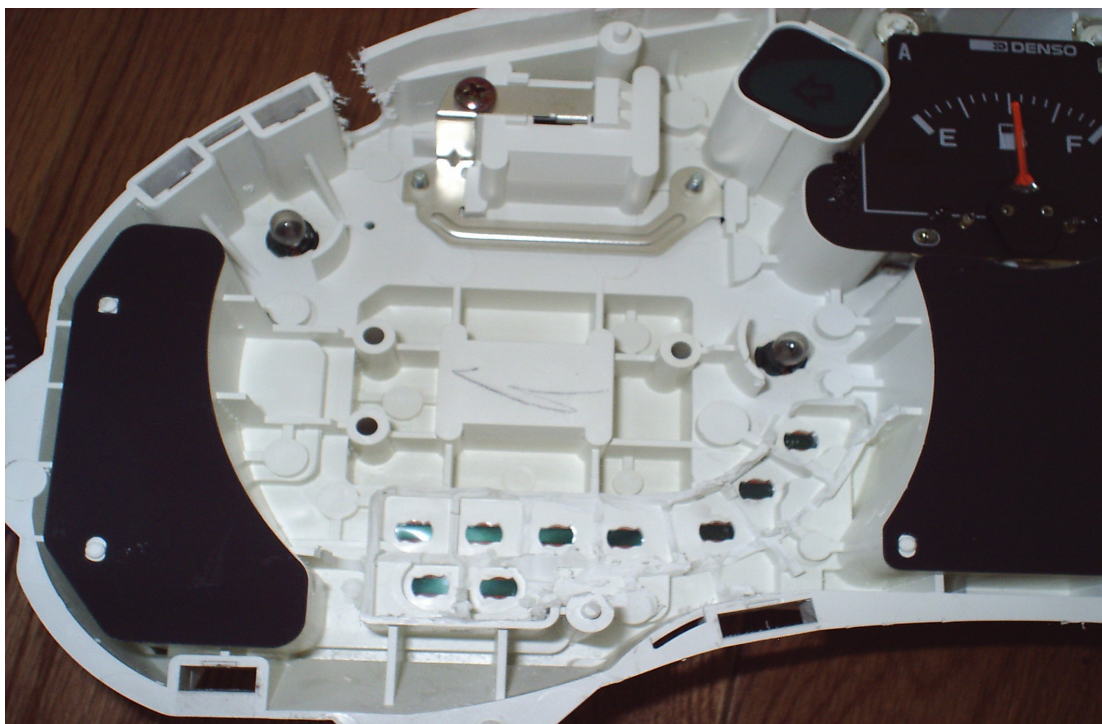
Here I mark the backside of the RPM meter of where the LCD will sit and also mark the location of the cutout. Using a new xacto knife and metal ruler I score the cutout many times.
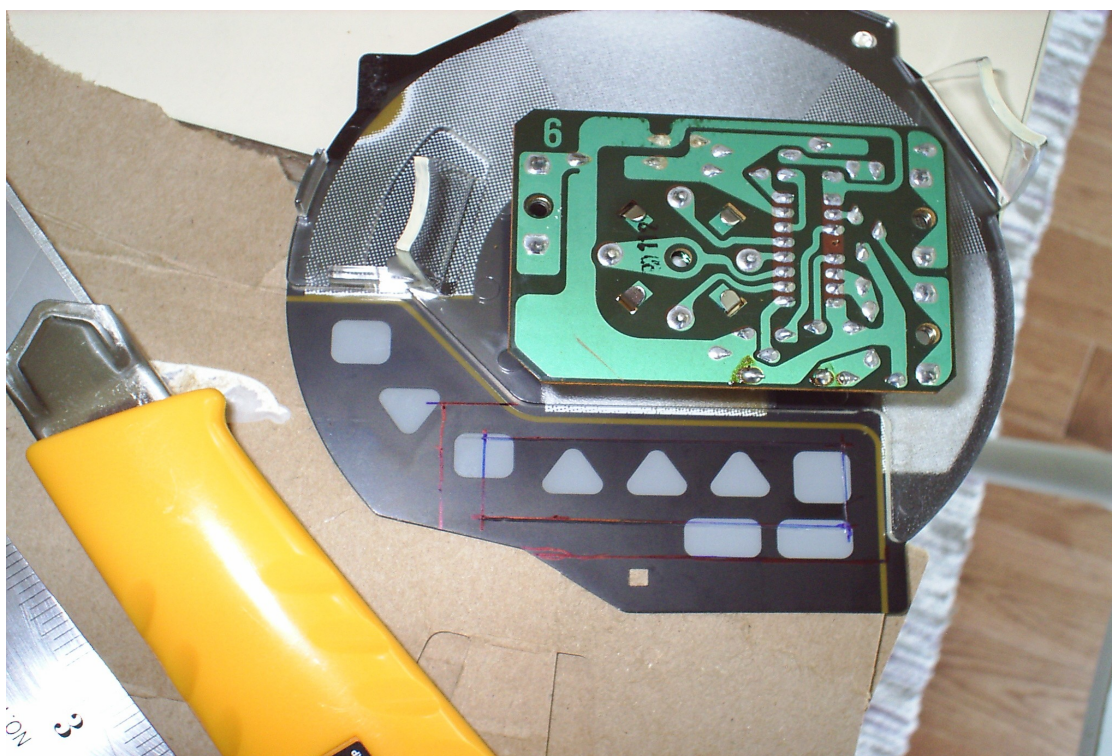
My LCD screen has a protective film still on it so I use a marker to see and verify how much of the screen will be covered/uncovered. I opted not to show the entire LCD screen, but only the portion of the screen that actually displays characters, as this will give me some lee way if my installation is not 100% aligned. The RPM meter transparent plastic night light has a rounded corner so I grinded some of that away so the LCD screen would fit straight and true.
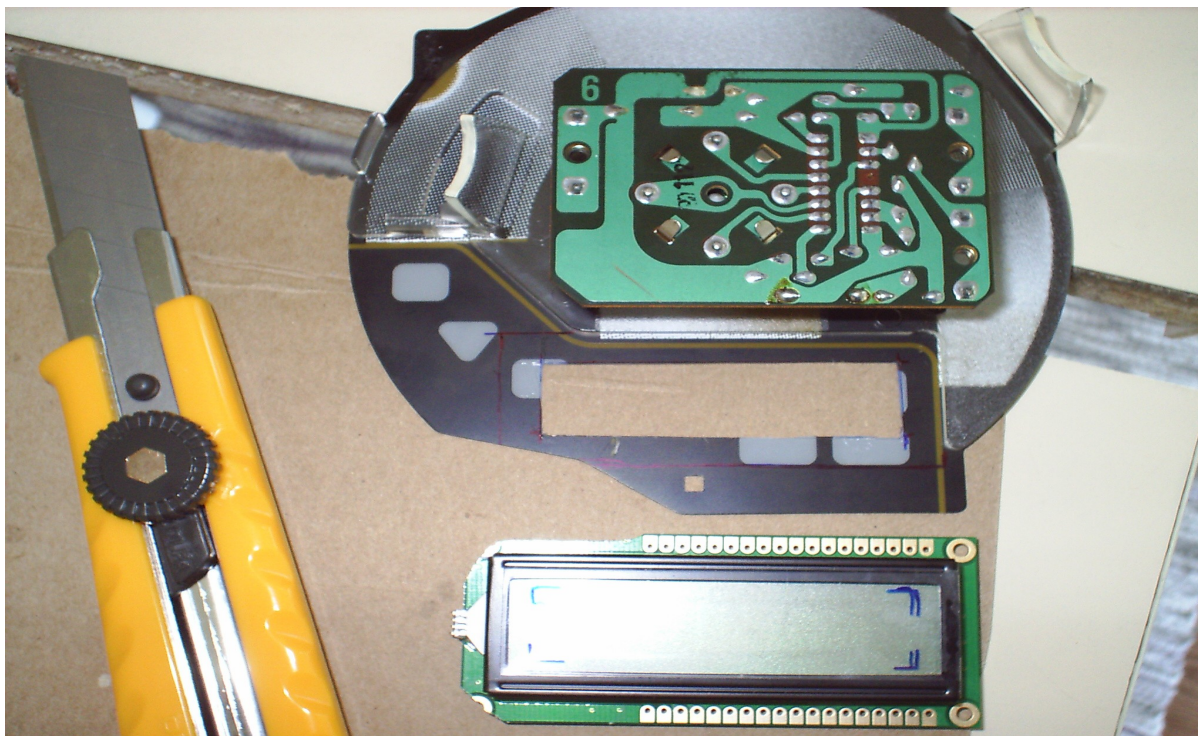
Here's the RPM meter temporarily installed in the cluster panel without the LCD screen to see how close of fit it will be.

LCD screen is siliconed to the back.
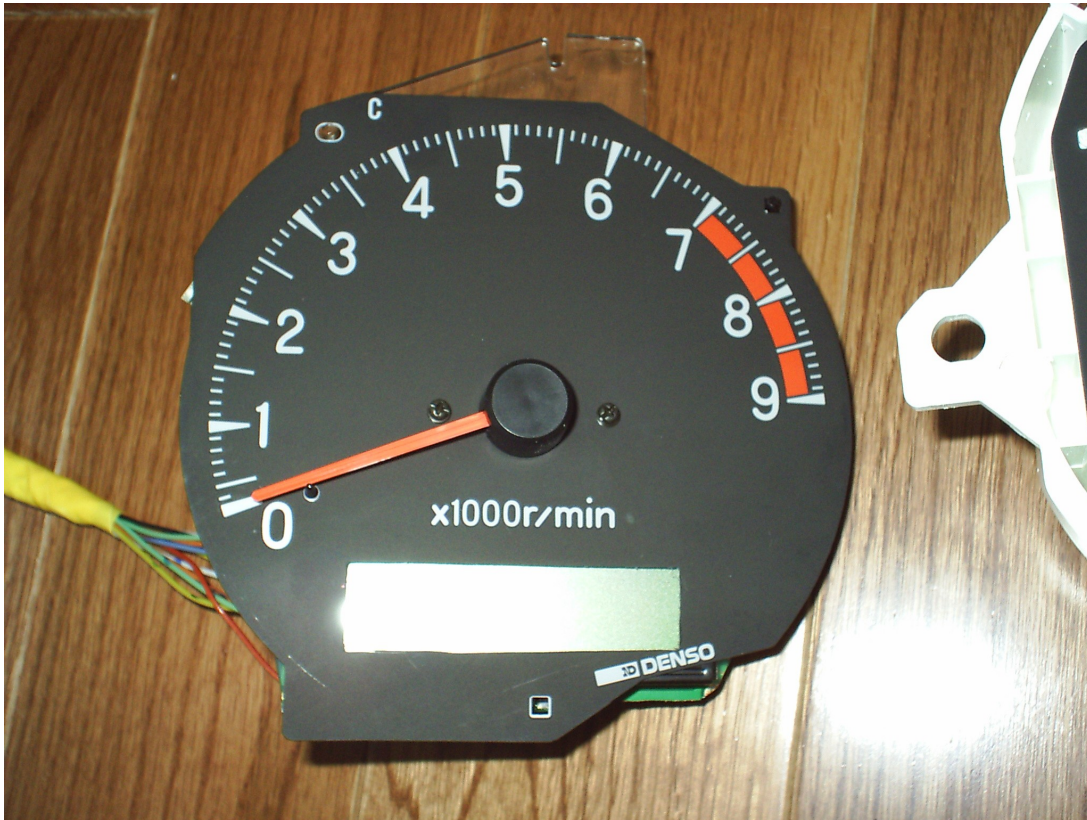
LCD screen installed back in the car.

SETUP CONFIG

To enter config menu, press down on the rotary knob and then power up the device. Release when you see the Copyright message displayed on the screen. It will soon flash the message Config Menu and the software version number.

ECU Type=OBD1. Use this for 1991-1993 Dodge Stealth / 3000 GT / GTO , or 1990 – 1994 DSM.

ECU Type=MUT. Use this for 1994-1999 Dodge Stealth / 3000 GT / GTO, or 1997+ DSM.

ECU Type=MUToverOBD2. Use this for 95-96 DSM, or if you're unable to communicate as MUT.

PSI Add step = xx. For use with an external pressure sensor, to make your display read 0.00 PSI.

WBO2 input= EGRT. Use this if you have your WBO2 wire fed into an unused Exhaust Gas Recirculation Temperature input on your ECU.

WBO2 input =wire . Use this if your WBO2 wire is wired directly to the EBC.

WBO2 input =none. If you have no WBO2 at all, set this to none and the default AFR will display 10.0.

WBO2 low = 10. Set the lowest AFR value your wideband reads.

WBO2 high= 20. Set the highest AFR value your wideband reads.

WBO2 factor=1.00. Multiplies the WBO2 wire by this value – use in case of weak signal.

WBO2 offset=0.0 . Adds a small correction value to your WBO2 results.

Contrast=50. Adjusts the contrast display, low value=darker, high value=lighter. If the display flickers, the contrast value is set too high, go to a lower number.

Push to toggle color. Sets the default power on color, Red, Green, Blue, or none.

Car type = 3/S for 3000GT / Stealth cars. This compensates the difference between timing and knock.

Car type = DSM for Talons, Eclipse, Lasers.

Aux input= latch. If the auxiliary input receives a ground signal, it will stay trigger permanently until the unit is powered off. ie. Water/Alchy injection fluid level indicates empty, it will stay triggered.

Aux input= normal. When auxiliary input receives a ground signal, it only stays triggered while the ground signal is present.

PSI Sensor= Int. Use internal pressure sensor 0.0psi to 36.3psi. Note that it does not measure vacuum.

PSI Sensor= Ext. Use external 4.0 BAR greddy pressure sensor (vacuum to 43.5psi) .

ECU Clock=100%. 100% = normal ECU clock speed. If you added a 15% faster clock speed crystal, enter 115%.

Knock Alert > xx. If knock exceeds this threshold, it will warn the driver.

CoolantAlert > xxx. If coolant temperature exceeds this threshold, it will warn the driver.

ScreenRefresh=xx. Think of this as a screen refresh delay. A low number updates the LCD screen with new data quickly, and a high number updates the screen less frequently. During the winter months you might want to increase this number because LCD screens are sluggish in the cold.

Push to exit config menu – quits the config menu and takes you to normal operation.

OPERATION OF DEVICE

Default screen when powering up.

14.7   0.0   0
WBO2   PSI   KNOCK

First value shows the wideband O2 AFR. The second value is the pressure sensor in PSI. The third value is knock sum reported from the ECU. If you temporarily wish to change the background display color, or turn it off completely push down on rotary knob and it will cycle through red, green, blue colors. When the black box is powered off these changes we be lost, as it's only meant to be temporary. If you wish to have the colors changed permanently use the config menu.

To navigate to other screens use the rotary knob. Turning the rotary knob clockwise will display ECU related data and turning counter clockwise will show boost controller menus.

BOOST CONTROLLER MENUS

xx.xPSI Peak
xx Knock Peak

Displays highest recorded boost pressure and knock values. To the right you may notice a small graph. It's a small datalog of PSI vs RPMs.   The PSI scales from 1 to 17psi. Because the display is not a graphics display but a character display, the scale for 9psi will be absent. You can easily see your boost response curve.

By pressing down on the knob, you reset the values.

Dutycycle=xx.x

This works just like many electronic boost controllers out there. Small duty cycle numbers gives you low boost, large duty cycle numbers gives you high boost. Start off with small numbers and gradually work your way up.

Dutycycle offset

Allows you to add or subtract duty cycle per RPM, starting at 4000 RPMs, 4500 RPMs, etc. Add duty cycle if you have wastegate creep problem, subtract duty cycle if you have boost creep problem.

-DC% / Knock = x.xx

If we get engine knock, this will reduce our duty cycle numbers and lower our boost pressure.   The greater amount of knock, the more duty cycle is reduced. TIP: On 3/S vehicles, the maximum amount of knock that can be read is 28. On DSM vehicles the maximum amount of knock is 43.

Alarm Boost=xx.x PSI

When boost reaches this amount or more, the boost solenoid will shut down for 1 second, reducing turbo boost pressure to wastegate levels.

Dutycycle temp

This allows you to add or subtract duty cycle based on temperature. Takes temperature readings from MAF.

Aux Duty =xx.x

When the aux input is triggered by a ground signal, whatever duty cycle is programmed in here will be applied to the overall duty cycle. So for example, if it's set to -10.0 the duty cycle will drop by 10. If it's set to +15, it will increase duty cycle by 15. This feature can be used to run a low boost and high boost setting. Ideal for users that would like the system to automatically switch to low boost mode when alchy runs dry.

PSI Start=xx.x

Default set to 1.0 PSI. This parameter allows your turbocharger(s) to spool up more quickly by delaying the opening of the wastegate. By keeping the wastegate completely closed the turbocharger reaches your desired boost pressure sooner.   Having an on/off approach as some electronic boost controllers use can easily create boost spikes, so we use two parameters to ramp in this change and the boost spike problem is gone. "PSI Start" is where the ramp begins, and "PSI End" is where the ramp change is completed.   For a more aggressive spool up increase the PSI Start parameter.

PSI End=xx.x

Default set to 2.0 PSI. The stock wastegate spring is 6psi on the 3S vehicles, and with a default value of 2.0 PSI any spool up assistance is effectively off. To turn on spoolup assistance, this value must be increased past 6 psi to realize any spool up gain. For example, if you want 18psi as your target boost value, I would suggest using "PSI END=16.0". This means anything below 16PSI is using a higher duty cycle temporarily to assist in spool up, however when it reaches past 16PSI it is using your normal target duty cycle numbers. If you want to be more aggressive try increasing the "PSI Start" value too.

View tuner msg

If you missed the "Tune is lean" message earlier, you can repeat the message again. It will display Knock, AFR, PSI, and RPM of the trouble spot.

ECU INFORMATION

100   115   98   81
TRIM LOW MED HIG

TRIM = Instant O2 feedback trim. Anything above 100 is adding fuel, anything below 100 is subtracting fuel.

LOW = Low Hz fuel trim

MED = Medium Hz fuel trim

HIG = High Hz fuel trim

NOTE: For MUT users, if you press down on the knob it will switch from the default front O2 trims to the rear O2 trims.

Throttle 13.1 %
Airflow xx Hz

Throttle displays TPS sensor reading from 0 to 100%. Generally our cars will show more than 10% throttle at idle, anything below generally sets off bad TPS sensor code.

Airflow reported to the ECU. If you have a fuel controller that intercepts this signal from the MAF, you will see the change reflected here.

Coolant   200F
Air intake 80F

Shows engine coolant temperature and air intake temperature.

Timing   xx
Engine RPMs xxxx

Shows engine timing number and engine RPMs.

Inj Pulse 4.1 ms
Injector DC 5 %

Inj Pulse = fuel injector pulse width in milliseconds.
Injector DC = Injector Duty cycle from 0 – 100%.

Front O2   0.96 V
Rear O2   0.94 V

Front and rear O2 sensor voltages from 0 to 1.00 Volts

Battery   13.1 V
Barometer 0.97 BAR

Battery voltage at the ECU, not necessarily the battery voltage at the battery because of voltage losses of wire, etc.   Barometer reading from MAF.

Idle Switch Off
Throttle xx.x %

The idle switch is located on the throttle body. At idle with the foot off the throttle the Idle Switch should read On. The throttle % lets you know at which point it switches from Off to On.

Active Faults
Push to Scan

This will display current CEL fault codes that were triggered recently.

Stored Faults
Push to Scan

This will display past CEL fault codes.

Clear Faults
Push to clear

Clears all engine fault codes.

ACTIVE TUNE MONITORING

Between season changes, our tunes may drift so this EBC is monitoring for this. If knock of 5 or more is detected and the WBO2 AFR is considered lean for the given boost pressure, it will alert the driver with a message of " **Tune is lean**" with flashing red lights. It will then display the following screen

xx KNOCK, xx.x PSI,
x.xx AFR, xxxx RPMS

OVERBOOST MESSAGE

Should you accidentally exceed your Alarm Boost setting, you will receive an overboost message flashing in red along with the peak overboost in PSI.   The solenoid will shut down for 5 seconds dropping your boost down to wastegate pressure.

UPGRADING SOFTWARE

There are two ways of upgrading software. The first method is to use a PC with a serial port and using a null-modem serial cable, or a null-modem adaptor and a regular serial cable. Plug the cable to the back of the black box and run the software I provide for flashing. The entire process takes about 60 seconds or less. The second method involves purchasing another microprocessor with the new software loaded and swapping. Swapping is made easy because the microprocessor sits on a socket so no soldering required.

SOFTWARE REVISION HISTORY

v1.0 Initial beta version
v1.1 New feature: Overboost warning message will flash red if it occurs, along with the associated boost pressure. Boost solenoid shut down time extended from 1 to 5 seconds.
v1.2 New feature: A knock warning message will show up if the user defined knock threshold is exceeded. MUToverOBD2 protocol added.
v1.3 Bug fix: Knock alert values were displayed incorrectly, an extra 0 was appended to values 1-9 causing some confusion to the user.
V1.4 – v1.7 "PSI Start" "PSI End" features allows improved turbo spool up by ramping in a high duty cycle to user's defined duty cycle. User can define how fast or how slow the LCD screen information is refreshed.

SOURCING BOOST SOLENOIDS

Go on www.ebay.com and search for "*AEM boost solenoids*". I found one vendor selling them for $25 + $5 shipping that included brass fittings. These AEM boost solenoids are manufactured by Mac valves (part number 35A-AAA-DDBA-1BA). You can also purchase these boost solenoid directly from www.macvalves.com for $17.50.

DISCLAIMER

Increased turbo boost pressure could harm your engine and/or turbocharger, the user assumes full responsibility for any damages that may occur.