

# **The ECU+ Fuel/Timing/Datalogging Piggyback Engine Computer**

## **Installation/Users Manual**

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## 1 Introduction

Thanks for purchasing the ECU+ fuel and timing computer. The ECU+ is an inexpensive, compact, full-featured piggyback computer that modifies the MAS airflow and the cam and

crank angle sensor signals on your 1990-1999 4G63-equipped turbo Eclipse, Talon, Laser or Galant VR-4, or 2003-2005 Lancer Evolution, giving you complete control over fuel delivery and timing of your vehicle. The ECU+ is typically used on high-performance vehicles with larger turbos, upgraded exhausts and higher-flow injectors to fine-tune your vehicle's performance.

The ECU+ can modify the fuel and timing of your engine at some 33 "points," depending on the engine's air flow, RPM and throttle position. In addition, the ECU+ supports full datalogging of most engine sensors at 25 samples per second. Datalogged information can be viewed and analyzed with the included Palm OS or Windows software.

## 2 Warning

The ECU+ system is an sophisticated device intended for off-road use, and is not in any way certified for use on public streets. The ECU+ provides you with the ability to adjust the air/fuel and timing mixture of the engine in your car. If used improperly, the ECU+ **can destroy your engine**. Neither the dealer nor the manufacturer of the ECU+ may be held responsible for any damage to your vehicle as a result of the installation, use or misuse of this product. Additionally, you should never adjust your engine's settings or attempt to "run" either the ECU+ Win or ECU+ Palm software while the vehicle is in motion.

## 3 System Requirements

The ECU+ supports the following vehicles:

- 1990-1991 Mitsubishi Galant VR-4
- 1990-1994 Plymouth Laser, Mitsubishi Eclipse or Eagle Talon, AWD or FWD, turbo only
- 1995-1999 Mitsubishi Eclipse or Eagle Talon, AWD or FWD, turbo only
- 2003-2005 Mitsubishi Lancer Evolution VIII

The ECU+ head unit connects via a serial port to a Palm organizer and/or a laptop PC for data display, logging and analysis.

The ECU+ Palm software, which runs on the Palm Organizer, requires Palm OS 3.5.1 or later. The Palm organizer itself must have a serial connection ("HotSync cable") to connect to the head unit.

The ECU+ Win software requires a Intel, AMD or compatible PC running Windows 98, 98SE, ME, 2000, or XP. A Pentium II/366 Mhz or faster CPU is recommended. If the PC is a laptop, it can be used directly with the ECU+ head unit via a serial connection (be that a true serial port, or a pseudo-serial port, like a USB-to-serial adapter).

If you have a laptop, you don't necessarily need the Palm organizer. If not, you'll need a separate PC to run the ECU+ Win analysis software.

## 4 Packing List

When you purchased the ECU+, you should have received the following items:

- ECU+ head unit – this is the "black box." When shipped in the plug-n-play (PnP) version, the head unit is pre-wired into a Field adapter harness.
- A software CD-ROM containing the ECU+ Windows and Palm software, as well as this manual and other documentation.

- Three wiring harnesses for connection to the car. One harness will be a 2-pin cable, while the two others will be 12-pin cables. These harnesses are not included in the plug-n-play model.
- Wire ties.
- A 9-pin straight-through serial cable. Male to female. This is used to interface between the ECU+ head unit and the laptop
- A null modem adapter, female to female. This adapts the Palm organizer to the serial cable.

## **5 Head Unit Hardware Installation**

The ECU+ “head unit” is the black box of the ECU+ system. This device connects into your car's wiring harness and intercepts various engine sensor signals. The head unit modifies these signals based on your inputs, and passes them on to the stock ECU. This section will explain how to install the ECU+ head unit in your car.

### ***5.1 Tools Required***

The ECU+ head unit can be installed by anyone with some basic electrical experience. If you can hook up a new car stereo, the ECU+ head unit installation will be a breeze. To complete the installation, you'll need the following tools:

- A set of common screwdrivers and a socket set (for removing the stock ECU).
- Wire cutters and a small knife.
- Electrical tape.
- A pencil-type soldering iron and solder.
- A simple multimeter for measuring voltages.
- Lots of patience.

### ***5.2 Wiring Basics***

To install the non-PnP ECU+, you'll be splicing into the stock wiring harness that connects the engine sensors to the stock ECU. You'll make one of two types of connections: tapping or splicing into the stock wiring harness.

#### **5.2.1 Tapping Wires**

For most of the signals that the ECU+ head unit needs to see, you'll be strictly tapping into the stock wiring harness. That is, you won't be cutting the wires at all, but just stripping back enough insulation so that you can “tap” the wire. Here's what you'll do:

1. Strip about an inch of insulation from the stock ECU wire.
2. Strip an inch and a half of insulation from the end of the corresponding ECU+ wire.
3. Twist the bare ECU+ wire around the bare stock wire, then solder the two together to make a solid connection.
4. Wrap this exposed connection with electrical tape.

## 5.2.2 Splicing Wires

A few of the ECU+ head unit connections require that you actually splice into the stock wiring harness. This involves cutting a wire in the stock harness and connecting a ECU+ wire to either end. To splice an end, follow these steps:

1. Cut the stock ECU wire with wire cutters.
2. Strip about an inch of insulation from the stock ECU wire.
3. Strip an inch of insulation from the end of the corresponding ECU+ wire.
4. Twist the two wires together and solder the connection. The two wires will be a 'V' shape.
5. Bend the ECU+ wire backwards and wrap the exposed connection with electrical tape.

## 5.2.3 Wiring Tips

- The stock wiring harness generally only exposes a few inches of wire from the stock ECU. Try to make your connections about half-way between the stock ECU connector and where it disappears under the dash.
- Make sure your hands are clean before wrapping the connection – even the slightest bit of oil will foul the adhesive on the tape.
- Check and double-check that you're connecting the right wires before soldering. It's much easier to re-do a connection before soldering than after.
- A good online resource, including photos, for how to make these connections is at <http://www.mmxpress.com/technical/connections.htm>

## 5.3 Locating and Removing the Stock ECU

The procedure for removing the stock ECU is a function of the type of car you're installing the ECU+ in.

For the Talon, Eclipse and Laser vehicles (all years), the stock ECU is mounted vertically and is located behind the radio in the center console. Remove both the driver and passenger kick panels, and you'll find the ECU bolted in with three bolts. Remove the bolts and the stock ECU will slide out. On the 1990-1994 cars, the stock ECU slides out on the passenger side. On the 1995-1999 cars, it slides out on the driver's side.

For the Galant VR-4, the stock ECU is bolted underneath the dash on the far right side. Remove the two bolts holding it in place, and it'll drop out.

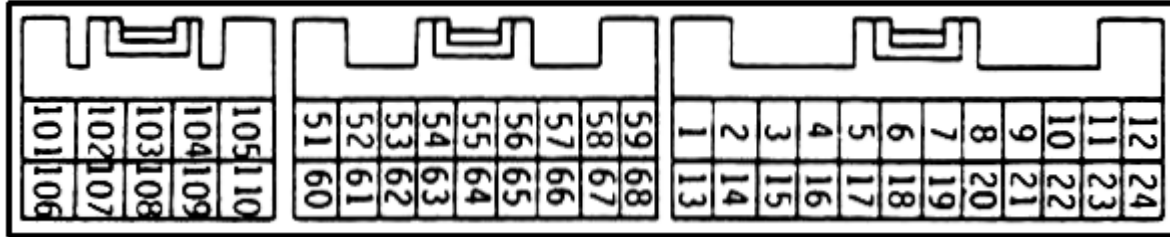
For the Evolution VIII, the stock ECU is behind the glove box. Remove the glove box (there's a tab on the left side that'll free the glove box and allow it to drop out) and unbolt the two bolts holding the stock ECU in place. The stock ECU will drop straight down into the passenger side floor.

## 5.4 Making the Connections

With the stock ECU removed from your vehicle, it's time to do the hookup to the ECU+ wiring harnesses. All of the cars that the ECU+ supports have similar wiring, but the wire locations on the stock ECU are different.

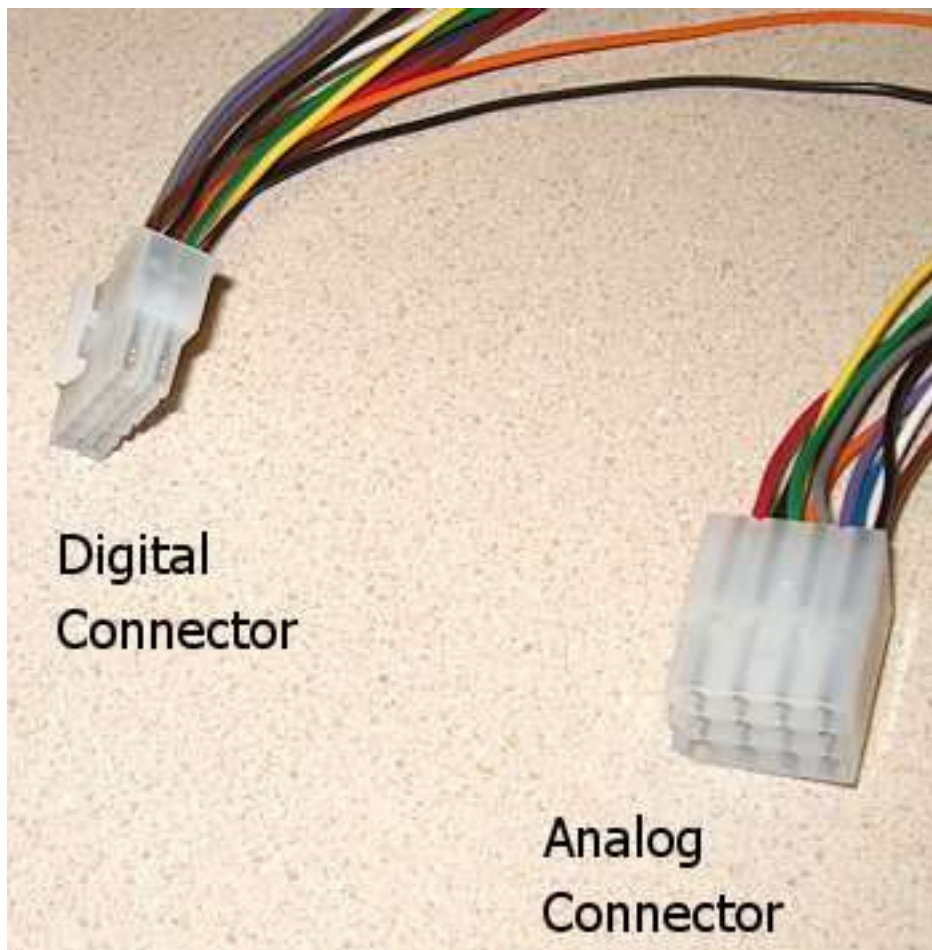
### 5.4.1 1990-1994 Galant VR-4, Laser Talon and Eclipse

On the 1990-1994 Talon, Eclipse, Laser and Galant VR-4, the stock ECU contains three connectors, numbered as shown in Illustration 1. This view shows the stock ECU as you'll view it, facing the connectors.



*Illustration 1 - The first generation stock ECU pinout*

To hook up the ECU+ head unit, you'll be wiring between the stock ECU and one of the three ECU+ harnesses. The ECU+ harnesses are identified by the connector type on the end: power (the two-pin connector), digital (the rectangular 12-pin connector) and analog (the larger, square 12-pin connector).



*Illustration 2 - The digital and analog connectors*

The analog and digital connectors each contain 12 wires, numbered 1-12, with the color

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pattern [brown #1, black #1, red, orange, yellow, green, blue, violet, grey, white, brown #2 and black #2]. The brown and black #1 wires include a knot in the wire for identification purposes. When making connections, be careful to not mix up the brown/black #1 wires and brown/black #2 wires, and also double-check which connector contains the digital and which connector contains the analog connections.

The following tables show how the connections are done.

First, hook up the power harness for the ECU+. This is the small two-pin connector. Be very careful here to not reverse the order of the connections.

Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Power (+12 volts)	102	Power	1	Red	Tap
Ground	101	Power	2	Black	Tap

*Table 1 - The power connections*

Next, hook up the analog connections. This is the harness with the larger square connector on it. Note some things:

- The ECU+ analog connector is numbered in very small digits on the connector body. Use a flashlight to see the numbers.
- All of the connections here are taps.
- The black wire for the sensor ground is the **second** black wire, in the last hole of the connector.
- The MAP sensor input supports the SenSym ASCX30 or GM 3-bar MAP sensors.
- If you have a supported wideband O2 sensor, hook it up to the spare 2 input.
- Spare 0 through 2 are extra analog inputs that support datalogging of any voltage source between 0 and 5 volts. Do **not** hook up any devices that produce voltages less than 0 volts or greater than 5 volts. Doing so may damage the ECU+ head unit.



Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Sensor Ground	17	Analog	12	Black #2	Tap
O2 Sensor	4	Analog	5	Yellow	Tap
Throttle Position Sensor	19	Analog	7	Blue	Tap
Air Temperature Sensor	8	Analog	6	Green	Tap
Coolant Temperature Sensor	20	Analog	4	Orange	Tap
MAP Sensor (optional)	None	Analog	1	Brown #1	Direct
Spare 0 Analog Input (optional)	None	Analog	2	Black #1	Direct
Spare 1 Analog Input (optional)	None	Analog	9	Grey	Direct
Spare 2 Analog Input or Wideband O2 sensor (optional)	None	Analog	10	White	Direct

Table 2 - The analog connections

Next hook up the tap digital connections. The digital connector is the rectangular-shaped connector with the latch on the top. As with the analog connector, this connector is numbered on the connector body. Note that in the following table, both the brown and black wires are the **second** brown and black wires on the connector. The brown is in the next-to-last connector location, the black is in the last.

Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Injector #1	51	Digital	11	Brown #2	Tap
Ignition Power Transistor #1/4	54	Digital	12	Black #2	Tap
Speed Sensor	18	Digital	7	Blue	Tap

Table 3 - The digital tap connections

Finally, hook up the splice connections. In each case, you'll cut the stock ECU wire, and solder the sensor side to an ECU+ input wire, and solder the ECU+ output wire to the stock ECU.

Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Mass Air Sensor (Sensor to ECU+)	10	Digital	5	Yellow	Splice
Mass Air Sensor (ECU+ to ECU)		Digital	10	White	Splice

Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Crank Angle Sensor (Sens to ECU+)	21	Digital	9	Grey	Splice
Crank Angle Sensor (ECU+ to ECU)		Digital	4	Orange	Splice
Cam Angle Sensor (Sens to ECU+)	22	Digital	1	Brown #1	Splice
Cam Angle Sensor (ECU+ to ECU)		Digital	8	Violet	Splice

Table 4 - The digital splice connections

Now skip to the section Finishing Up the Hardware Installation, on page 16.

### 5.4.2 1995 and Up Talon, Eclipse and Evolution VIII, PnP ECU+

On the 1995-1999 Talon and Eclipses, and the Evolution VIII, the stock ECU contains four connectors, numbered as shown in Illustration 3. This view shows the stock ECU as you'll view it, facing the connectors.

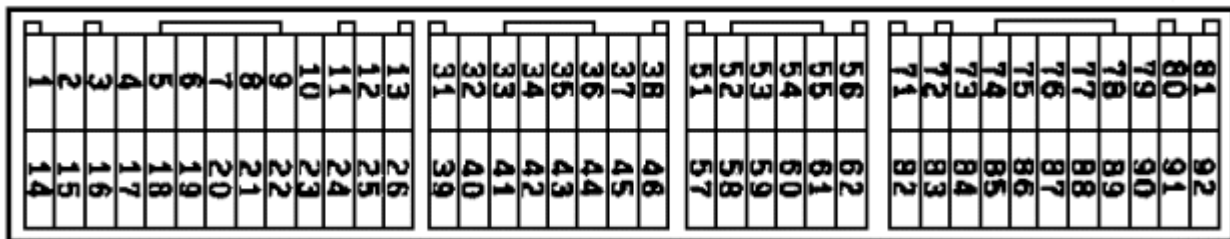


Illustration 3 - The second generation stock ECU pinout

To install the plug-n-play (PnP) version of the ECU+, simply unplug the stock connectors from the stock ECU, and plug them into the mating connector on the ECU+ wiring harness. The ECU+ wiring harness contains a similar set of connectors – plug these into the stock ECU. Each of the connectors are of different size – it's not possible to mix them up.

Next, you have to decide how to hook up the rear O2 sensor signal. The ECU+ head unit has a simulated rear O2 output for off-road use. This signal simulates the signal that the stock ECU will see from a functional rear O2 sensor. If you've removed the catalytic converter from your car, the rear O2 sensor signal from the sensor will often trigger a "Check Engine" light. The ECU+'s simulated rear O2 signal can avoid that.

To connect the simulated rear O2 signal, locate the wire from the ECU+ head unit containing this signal. Then locate pin #75 on the wiring harness, which is tapped with a red wire to the ECU+ head unit. Cut the harness wire between the male harness connector and where it splices into the red wire, and solder in the simulated rear O2 signal to the wire containing the splice. See Illustration 6 for more detail. If you're not using the simulated rear O2 sensor signal, leave the ECU+ head unit wired as it is from the factory.

Lastly, hook up the optional remaining analog connections for a MAP sensor and/or the spare analog inputs. Note some things:

- All of the wires from the head unit are labelled as to their function.
- The MAP sensor input supports the SenSym ASCX30 or GM 3-bar MAP sensors.

- If you have a supported wideband O2 sensor, hook it up to the spare 2 input.
- Spare 0 through 2 are extra analog inputs that support datalogging of any voltage source between 0 and 5 volts. Do **not** hook up any devices that produce voltages less than 0 volts or greater than 5 volts. Doing so may damage the ECU+ head unit.

Each of these analog connections should be soldered directly to the appropriate input on the ECU+ head unit.

Now skip to the next section, Finishing Up the Hardware Installation, on page 16.

### 5.4.3 1995 and Up Talon, Eclipse and Evolution VIII, non-PnP ECU+

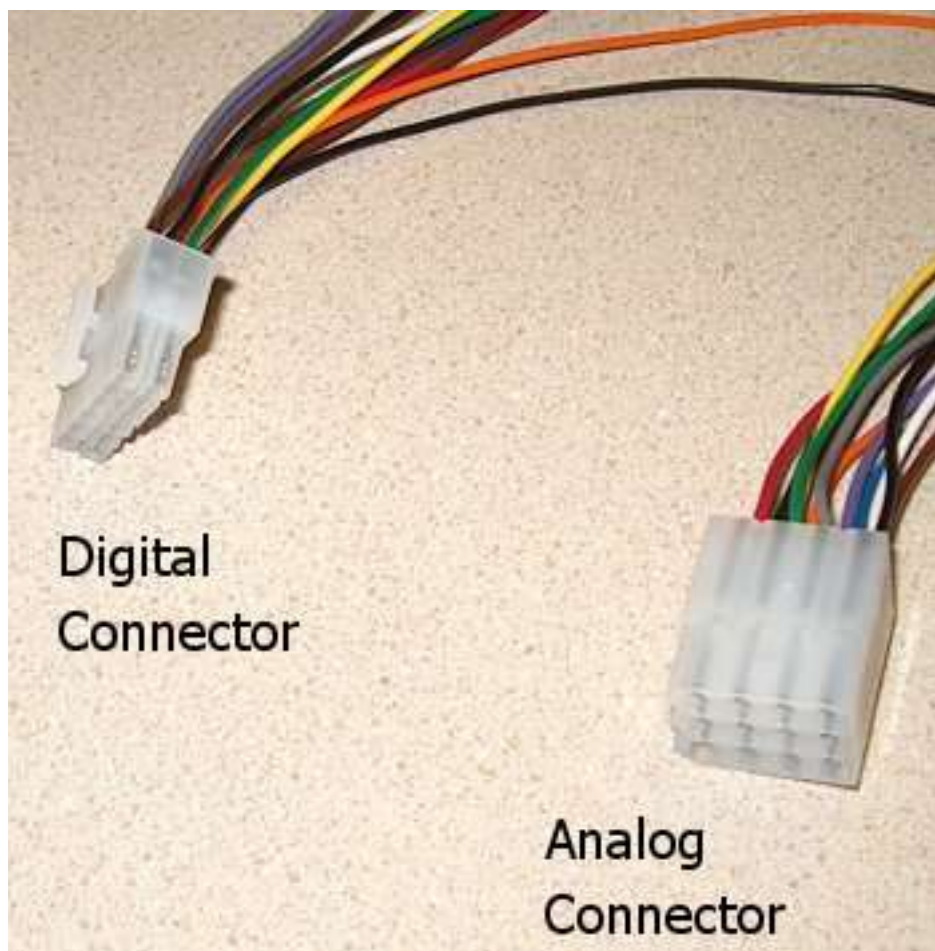
On the 1995-1999 Talon and Eclipses, and the Evolution VIII, the stock ECU contains four connectors, numbered as shown in Illustration 4. This view shows the stock ECU as you'll view it, facing the connectors.

81	92
80	91
79	90
78	89
77	88
76	87
75	86
74	85
73	84
72	83
71	82

56	62
55	61
54	60
53	59
52	58
51	57

38	48
37	45
36	44
35	43
34	42
33	41
32	40
31	39

13	26
12	25
11	24
10	23
9	22
8	21
7	20
6	19
5	18
4	17
3	16
2	15
1	14



*Illustration 5 - The digital and analog connectors*

The analog and digital connectors each contain 12 wires, numbered 1-12, with the color pattern [brown #1, black #1, red, orange, yellow, green, blue, violet, grey, white, brown #2 and black #2]. The brown and black #1 wires include a knot in the wire for identification purposes. When making connections, be careful to not mix up the brown/black #1 wires and brown/black #2 wires, and also double-check which connector contains the digital and which connector contains the analog connections.

The following tables show how the connections are done.

First, hook up the power harness for the ECU+. This is the small two-pin connector. Be very careful here to not reverse the order of the connections.

Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Power (+12 volts)	12	Power	1	Red	Tap
Ground	13	Power	2	Black	Tap

*Table 5 - The power connections*

Next, hook up the analog connections. This is the harness with the larger square connector

on it. Note some things:

- The ECU+ analog connector is numbered in very small digits on the connector body. Use a flashlight to see the numbers.
- All of the connections here are taps.
- The black wire for the sensor ground is the **second** black wire, in the last hole of the connector.
- The MAP sensor input supports the SenSym ASCX30 or GM 3-bar MAP sensors.
- If you have a supported wideband O2 sensor, hook it up to the spare 2 input.
- Spare 0 through 2 are extra analog inputs that support datalogging of any voltage source between 0 and 5 volts. Do **not** hook up any devices that produce voltages less than 0 volts or greater than 5 volts. Doing so may damage the ECU+ head unit.

Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Sensor Ground	92	Analog	12	Black #2	Tap
Front O2 Sensor	76	Analog	5	Yellow	Tap
Throttle Position Sensor	84	Analog	7	Blue	Tap
Air Temperature Sensor	72	Analog	6	Green	Tap
Coolant Temperature Sensor	83	Analog	4	Orange	Tap
MAP Sensor (optional)	None	Analog	1	Brown #1	Direct
Spare 0 Analog Input (optional)	None	Analog	2	Black #1	Direct
Spare 1 Analog Input (optional)	None	Analog	9	Grey	Direct
Spare 2 Analog Input or Wideband O2 sensor (optional)	None	Analog	10	White	Direct

Table 6 - The analog connections

Next hook up the tap digital connections. The digital connector is the rectangular-shaped connector with the latch on the top. As with the analog connector, this connector is numbered on the connector body. Note that in the following table, both the brown and black wires are the **second** brown and black wires on the connector. The brown is in the next-to-last connector location, the black is in the last.

Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Injector #1	1	Digital	11	Brown #2	Tap
Ignition Power Transistor #1/4	10	Digital	12	Black #2	Tap
Speed Sensor	86	Digital	7	Blue	Tap

Table 7 - The digital tap connections

Next hook up the splice connections. In each case, you'll cut the stock ECU wire, and solder the sensor side to an ECU+ input wire, and solder the ECU+ output wire to the stock ECU.

Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Mass Air Sensor (Sensor to ECU+)	90	Digital	5	Yellow	Splice
Mass Air Sensor (ECU+ to ECU)		Digital	10	White	Splice
Crank Angle Sensor (Sens to ECU+)	89	Digital	9	Grey	Splice
Crank Angle Sensor (ECU+ to ECU)		Digital	4	Orange	Splice
Cam Angle Sensor (Sens to ECU+)	88	Digital	1	Brown #1	Splice
Cam Angle Sensor (ECU+ to ECU)		Digital	8	Violet	Splice

*Table 8 - The digital splice connections*

Next, you have to decide how to hook up the rear O2 sensor signal. The ECU+ head unit has a simulated rear O2 output for off-road use. This signal simulates the signal that the stock ECU will see from a functional rear O2 sensor. If you've removed the catalytic converter from your car, the rear O2 sensor signal from the sensor will often trigger a "Check Engine" light. The ECU+'s simulated rear O2 signal can avoid that. Use one of the two tables below:

When using the simulated rear O2 signal, you'll cut the wire on pin 75 of the stock ECU, and connect the ECU+ simulated rear O2 output to the pin 75 input of the stock ECU. Additionally, you can connect this simulated rear O2 signal back into the ECU+ for monitoring the signal that the ECU+ head unit is generating.

Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Rear O2 Sensor (From Sensor)	75	None			
Rear O2 Sensor (ECU+ to ECU)		Analog	11	Brown #2	Splice
Rear O2 Sensor (Monitor)		Analog	3	Red	Tap

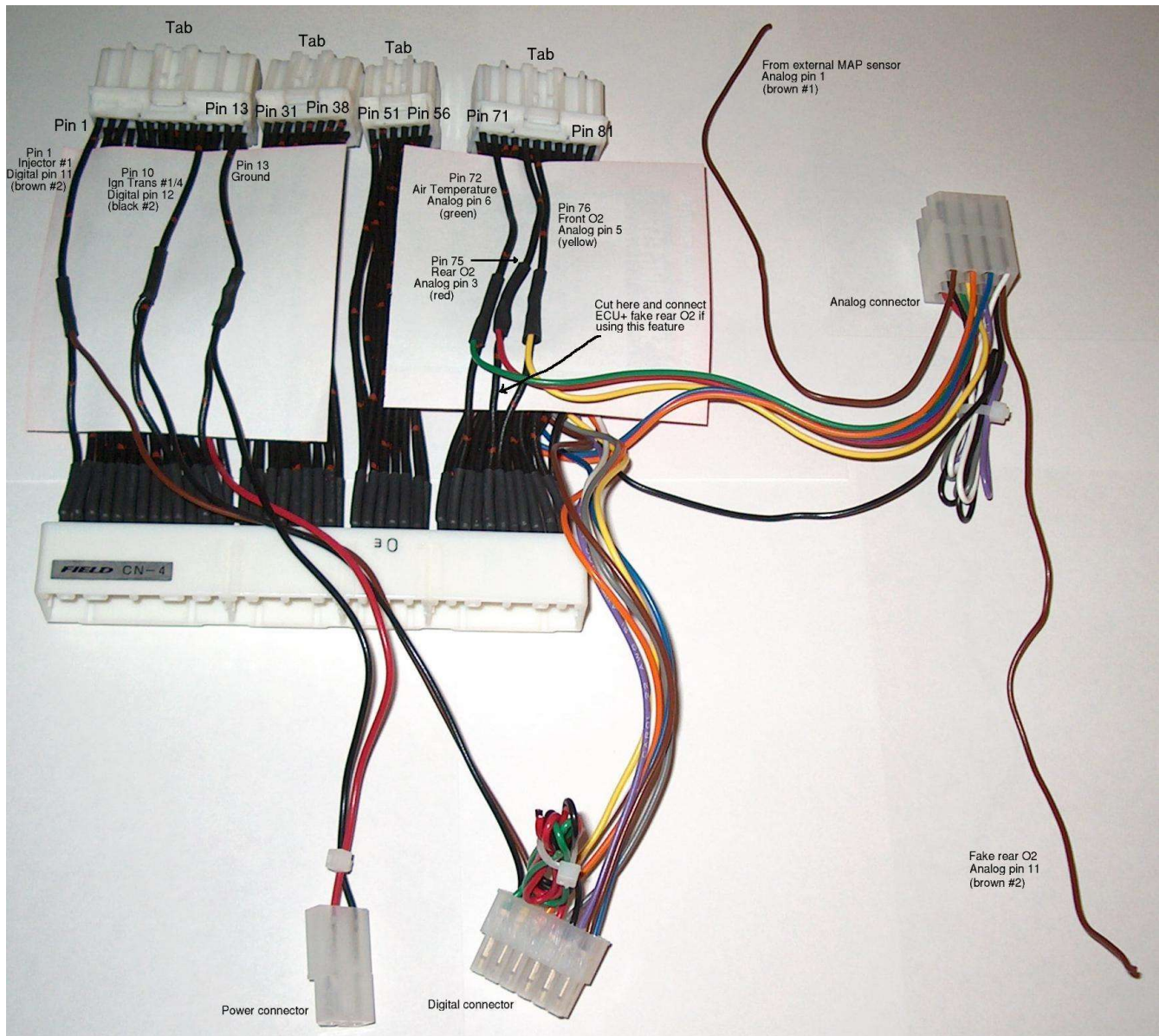
*Table 9 - The analog splice connections when using the simulated rear O2 signal*

If you're not using the simulated rear O2 signal, just tap the rear O2 signal as shown below:

Function	Stock ECU Pin #	ECU+ Connector	ECU+ Pin #	ECU+ Wire Color	Connection Type
Rear O2 Sensor	75	Analog	3	Red	Tap

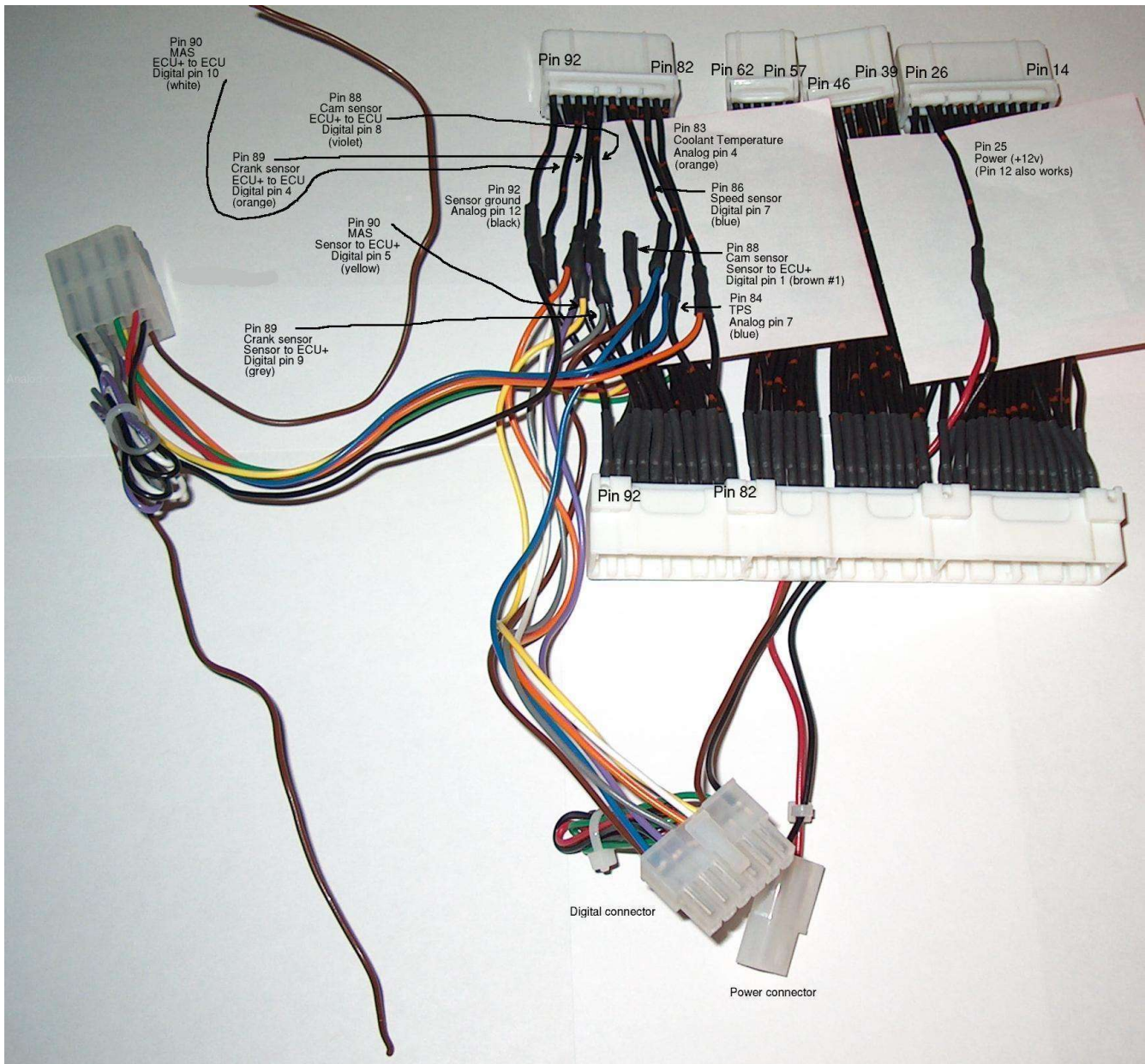
*Table 10 - The analog tap connections when not using the simulated rear O2 signal*

When complete, installation into the 1995 and up Talon, Eclipse and Evolution VIII harness should resemble Illustration 6 and Illustration 7 below, which shows the ECU+ connectors wired into a Field CN-4 "patch harness." The top of the illustration shows the "plugs" from the stock sensors which plug into the male connector on the stock ECU.



*Illustration 6 - Final connections, top view*





*Illustration 7 - Final installation, bottom view*

Now skip to the next section, Finishing Up the Hardware Installation, on page 16.

## **5.5 Finishing Up the Hardware Installation**

When you're all done making the ECU+ connections, you'll have some unused wires in both the analog and digital connectors. Tie these wires together with wire ties and wrap them in electrical tape. Next, secure all three of the ECU+ harness wire bundles by applying wire ties to each bundle. In particular, be sure to use a wire tie very near each of the three connectors – this will ensure that there's no stress on the pins in the cables.

Next, for the non-PnP ECU+, you'll want to verify that you've wired the ECU+ power correctly. Using a voltmeter, hook up to the ECU+ two-pin power connection and turn your car's ignition to the on position. Your multimeter should read between **positive** 12 and 15 volts. If not, double-check your connections. With the wiring completed, you should plug the ECU+ head unit into the newly-wired harnesses.



Next, connect the included 9-pin serial cable to the appropriate connector on the ECU+ head unit.

Before starting your car for the first time, install the ECU+ software and follow the instructions in the next few sections to use either the Palm or the Windows software to setup the ECU+ head unit. In particular, be sure that the cam and crank angle sensor types are set appropriately for your car. Once these are set correctly, turn off your ignition and leave it off for a few seconds, then start your car. It should run normally, just like it did before you installed the ECU+. If not, see the next section for troubleshooting information.

## ***5.6 Troubleshooting the Hardware Installation***

In the previous section, you installed your ECU+ head unit. Here are some things to check if your car doesn't run normally after the install.

- For all problems, double- and triple-check the wiring. Un-tape the connections and look at them. Is a good solder joint being made? Are the wires connected according to the tables?
- If your car won't start, chances are that either the cam or crank angle sensor signals aren't working. Verify that the head unit is using the proper signal type. As a last resort, remove the ECU+ head unit from its connectors and manually jumper together the cam and crank sensor signals.
- If the car idles very fast and seems to be running rich, the MAS signal is probably not being regenerated. Again, check the wiring. Does the software indicate that the input MAS signal is 0 Hz? If so, the MAS input may be disconnected. If not, the MAS output may be disconnected.

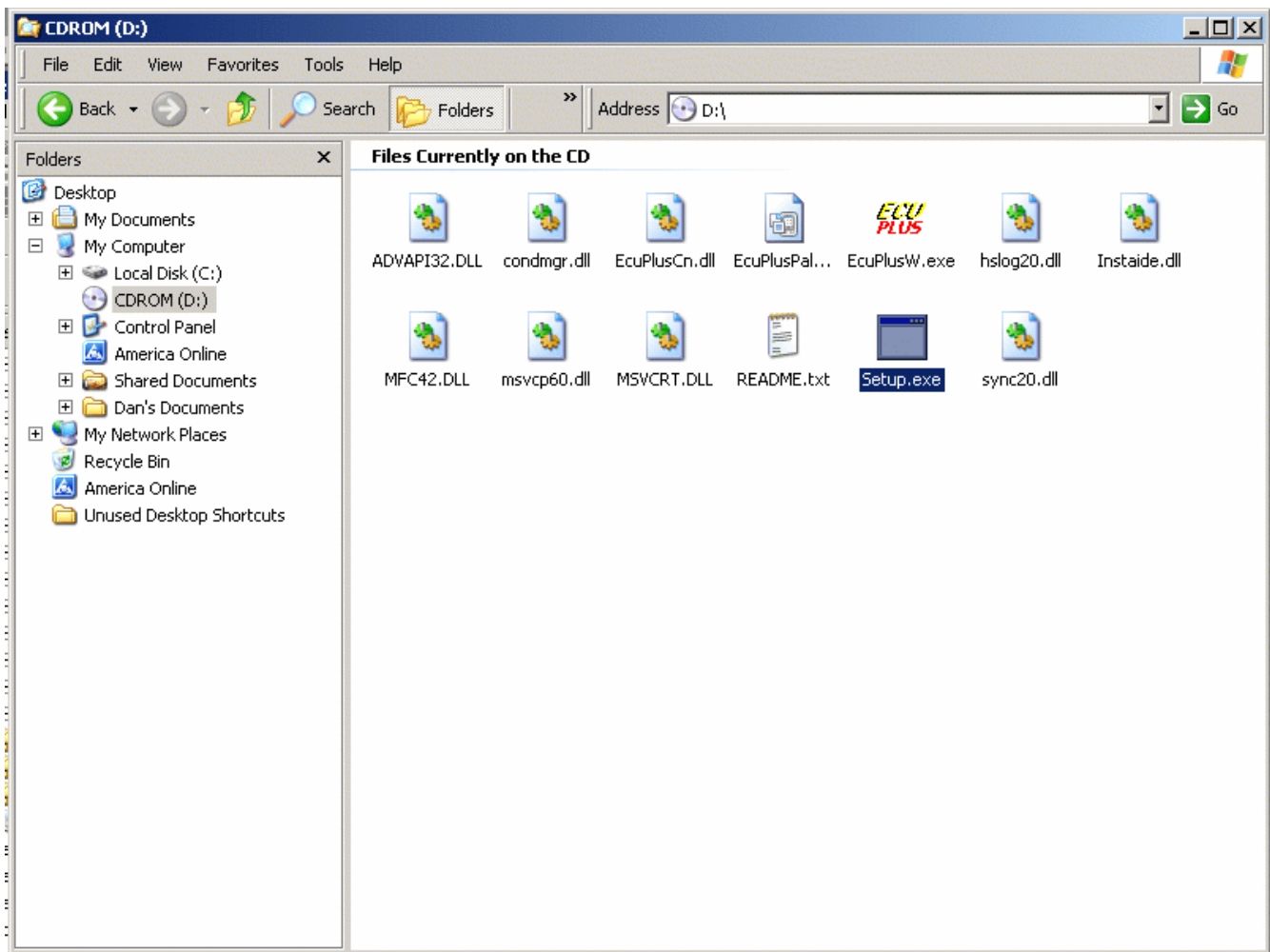
As a last resort, contact your ECU+ dealer and see what suggestions they might have. The ECU+ is tested at the factory, and should work for your car.

## **6 Software Installation**

The ECU+ system contains three pieces of software which need to be installed:

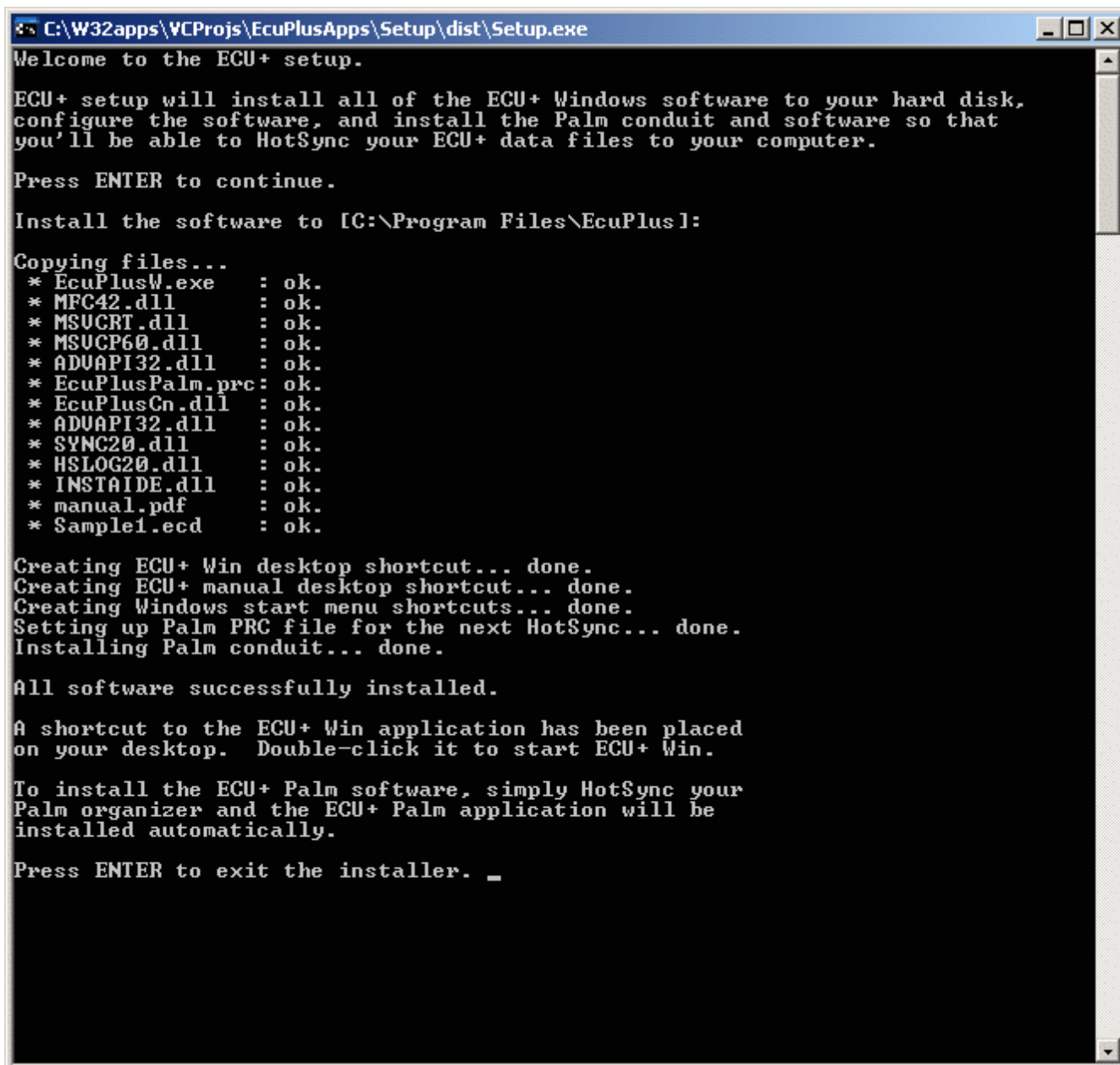
- The ECU+ Win software, which is a graphical Microsoft Windows-based display, tuning and analysis tool.
- The ECU+ Palm software, which provides a graphical interface on your Palm device for display and tuning of the ECU+ head unit.
- The ECU+ Palm conduit, which allows the Palm organizer to HotSync data between it and your PC/laptop running ECU+ Win.

To install the software, insert the CD-ROM supplied with the system into your CD-ROM drive. Then use the Windows Explorer tool to navigate to the CD-ROM, and double-click the Setup.exe program.



*Illustration 8 - Installing from CD*

The ECU+'s text-based install will begin, and you'll be prompted for a directory to install the software to. Enter a suitable directory, and the installer will install the software for you. You should see a screen something like:

The image is a screenshot of a Windows 95/98 style window titled "C:\W32apps\VCProjs\EcuPlusApps\Setup\dist\Setup.exe". The window has a black background with white text. The text inside the window reads: "Welcome to the ECU+ setup.", "ECU+ setup will install all of the ECU+ Windows software to your hard disk, configure the software, and install the Palm conduit and software so that you'll be able to HotSync your ECU+ data files to your computer.", "Press ENTER to continue.", "Install the software to [C:\Program Files\EcuPlus]:", "Copying files...", followed by a list of files being copied with status "ok": EcuPlusW.exe, MFC42.dll, MSVCRT.dll, MSUCP60.dll, ADVAPI32.dll, EcuPlusPalm.prc, EcuPlusCn.dll, ADVAPI32.dll, SYNC20.dll, HSL0G20.dll, INSTAIDE.dll, manual.pdf, and Sample1.ecd. Then it says: "Creating ECU+ Win desktop shortcut... done.", "Creating ECU+ manual desktop shortcut... done.", "Creating Windows start menu shortcuts... done.", "Setting up Palm PRC file for the next HotSync... done.", "Installing Palm conduit... done.", "All software successfully installed.", "A shortcut to the ECU+ Win application has been placed on your desktop. Double-click it to start ECU+ Win.", "To install the ECU+ Palm software, simply HotSync your Palm organizer and the ECU+ Palm application will be installed automatically.", and finally "Press ENTER to exit the installer. \_".

```
C:\W32apps\VCProjs\EcuPlusApps\Setup\dist\Setup.exe
Welcome to the ECU+ setup.

ECU+ setup will install all of the ECU+ Windows software to your hard disk,
configure the software, and install the Palm conduit and software so that
you'll be able to HotSync your ECU+ data files to your computer.

Press ENTER to continue.

Install the software to [C:\Program Files\EcuPlus]:

Copying files...
* EcuPlusW.exe      : ok.
* MFC42.dll         : ok.
* MSVCRT.dll        : ok.
* MSUCP60.dll       : ok.
* ADVAPI32.dll      : ok.
* EcuPlusPalm.prc   : ok.
* EcuPlusCn.dll     : ok.
* ADVAPI32.dll      : ok.
* SYNC20.dll        : ok.
* HSL0G20.dll       : ok.
* INSTAIDE.dll      : ok.
* manual.pdf        : ok.
* Sample1.ecd       : ok.

Creating ECU+ Win desktop shortcut... done.
Creating ECU+ manual desktop shortcut... done.
Creating Windows start menu shortcuts... done.
Setting up Palm PRC file for the next HotSync... done.
Installing Palm conduit... done.

All software successfully installed.

A shortcut to the ECU+ Win application has been placed
on your desktop. Double-click it to start ECU+ Win.

To install the ECU+ Palm software, simply HotSync your
Palm organizer and the ECU+ Palm application will be
installed automatically.

Press ENTER to exit the installer. _
```

*Illustration 9 - A successful install*

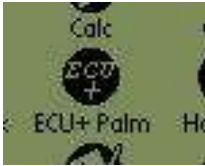
The installer will install the Windows software (ECU+ Win) as well as the Palm conduit. To install the Palm software (ECU+ Palm), simply HotSync your palm with this computer and the Palm software will be automatically installed on your Palm organizer. Note: you may need to restart the Palm Desktop software before starting the HotSync.

## 7 Using the ECU+ Palm Software

### 7.1 Introduction

The ECU+ Palm software interfaces to your ECU+ head unit and allows you to tune the ECU+, perform a capture, or just monitor your engine's sensors.

### 7.2 Starting the ECU+ Palm Software



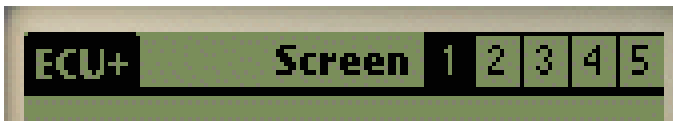
*Illustration 10 - The ECU+ Palm icon*

To start the ECU+ Palm software, tap its icon (see Illustration 10) on your Palm organizer. This will start up the ECU+ Palm software, and display its initial screen (see Illustration 11).



*Illustration 11 - The ECU+ Palm initial screen*

### **7.3 Changing Screens - The Button Bar**



*Illustration 12- The button bar*

Using the ECU+ Palm software is simple. The software includes four different screens which allow you to display the engine's sensor values or tune the fuel and timing maps. To switch between screens, simply tap one of the four buttons along the top button bar (see Illustration 12). Selecting '2' will select screen 2, selecting '3' will select screen 3, and so on. Each screen serves a particular function:

### **7.4 Screen 1**

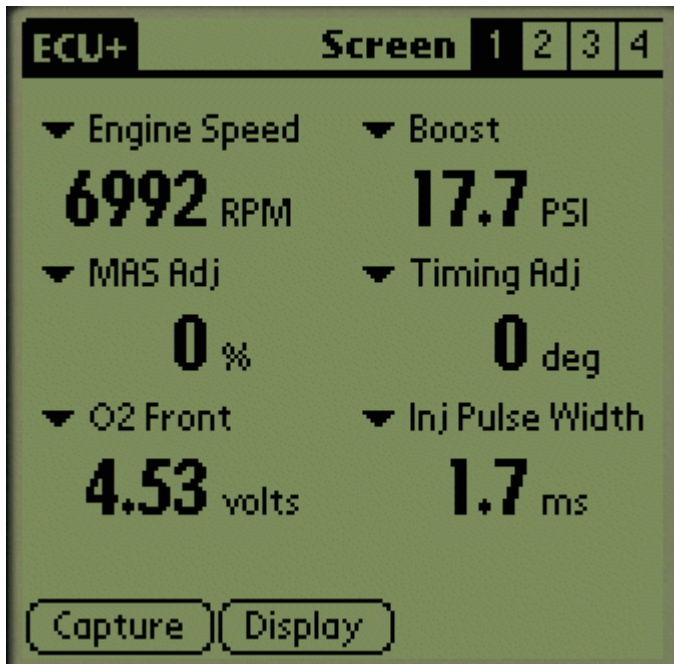


Illustration 13- Screen 1

Screen 1 is a general-purpose sensor display screen with large text. Six sensor values are displayed here, and the values shown are updated continuously.

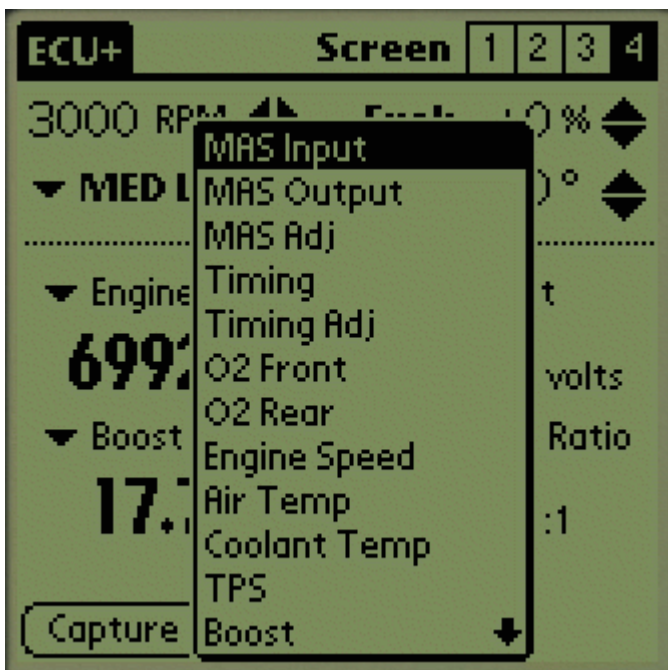


Illustration 14- Selecting a sensor

To change which sensors are displayed here, tap the down-arrow button above a given value, and select a new sensor (see Illustration 14). The ECU+ Palm software will remember how you've configured this (and other) screens between sessions.

The sensors that you can display are:

- **MAS Input** - This is the frequency of your MAS (mass-air sensor), as seen by the ECU+

head unit, in Hz. The MAS measures the amount of air entering your engine, where higher frequencies indicate more air.

- **MAS Output** - The frequency of the MAS sensor that the ECU+ sends on to your stock ECU. The stock ECU uses this value to determine how long to hold open the injectors, and thus, how much fuel to supply to the engine. Higher output frequencies tell the stock ECU to supply more fuel. The MAS output frequency is the same as the MAS input frequency, except as modified by the MAS adjustment and the injector scaling value.
- **MAS Adjustment** - The current adjustment to the MAS output frequency, as a percentage. You configure the fuel maps that the ECU+ head unit uses, and the head unit changes the MAS output frequency as you requested. The MAS adjustment shows the current adjustment that's in effect. Note that the MAS adjustment doesn't include any inherent change in the MAS output frequency caused by the injector scaling value.
- **Timing** - The current engine timing, as a number of degrees. The engine timing determines where in the piston revolution that the spark plug fires, and is measured in degrees before or after top-dead-center (TDC) of the piston. This value is positive if the spark fires before TDC, and negative if after.
- **Timing Adjustment** - As with the MAS Adjustment, this is the current timing adjustment (in degrees) that the ECU+ head unit is using. To adjust the engine timing, the ECU+ head unit slides the cam and crank angle sensor signals of your engine forward or backward by a specified number of degrees, and passes these modified signals on to the stock ECU.
- **O2 Front** - This is the reading of the front oxygen (O2) sensor in your car, in volts. The front oxygen sensor, normally located just beyond the turbocharger in the exhaust downpipe, outputs a voltage roughly corresponding to how rich your engine is running. Higher voltages indicate a richer mixture (more fuel for every molecule of air) while lower voltages indicate a leaner mixture (less fuel for every molecule of air). This signal is typically between zero and 1 volt, and will switch back and forth between rich and lean when your car is idling or at part throttle in normal driving situations. Note: when O2 sensors get old or are failing, they often have little or no output voltage, or are very "slow" to react to changes in fuel mixture. Also, a lack of voltage can indicate that the heater inside the O2 sensor is defective.
- **O2 Rear** - The voltage from the rear O2 sensor, if applicable. The rear O2 sensor, when installed, is on the far side of the catalytic converter (cat), and is often used by the stock ECU to detect when the cat has been removed or is defective. Removal of the cat will often trigger a "check engine" light from the stock ECU. Note that the ECU+ head unit can generate a simulated version of this rear O2 sensor signal, which can be fed to the stock ECU to avoid the check engine light. This capability is for off-road situations only.
- **Engine Speed** - Your engine's speed, as a number of revolutions per minute (RPM).
- **Air Temp** - The temperature of the air entering your engine, in degrees fahrenheit, as measured by the air temperature sensor. The air temperature sensor is located in the air intake, and is generally an integral part of the MAS. This temperature readout here will generally be a bit hotter than the true air temperature outside of your car.
- **Coolant Temp** - The temperature of the coolant in your engine, as measured by the coolant temperature sensor.
- **TPS** - The voltage from your engine's throttle position sensor. The TPS measures how far you've pressed on the accelerator, as a voltage between zero and 5 volts. The ECU+ head unit considers a voltage above 4 volts to be wide-open-throttle (WOT), or below 0.75 volts to be closed throttle.

- **Boost** - Your turbocharger boost level, in pounds per square inch (PSI). Note that this reading requires an optional MAP sensor. If you haven't installed a MAP sensor, this reading will be zero. Typically readings for a car at WOT will be 12-25 PSI, though this value varies widely depending on your turbocharger.
- **Inj Pulse Width** - This is the pulse width, or on-time, of your engine's injectors, measured in milliseconds (ms, or thousandth's of a second). To squirt fuel into your engine, the stock ECU turns on the injectors for a fraction of a second - the longer the injectors are on, the more fuel is squirted. This value will typically read out around 2 ms at idle, and much more at WOT.
- **Inj Duty Cycle** - The "duty cycle," or ratio of on-time to total-time, for your engine's injectors. This is displayed as a percentage. The stock ECU has a fixed amount of time available to it in which it can squirt the injectors. This fixed time is inversely proportional to the engine RPM (higher RPMs - less time). The injector duty cycle measures what percentage of the total time available that the injectors were on. 72% would indicate that the injectors were on 72% of the time that was available.
- **Vehicle Speed** - This is the car's approximate speed, as measured by the vehicle's speed sensor. Note that this is an approximate value that is pretty close for stock vehicles. However, changing tire or wheel size on your vehicle will affect the accuracy of this read-out.
- **Spare 0, 1 and 2**. These are spare analog inputs to the ECU+ head unit that can be used for any signal that ranges between zero and 5 volts. The voltage displayed here is the voltage of these spare inputs, and can be used for things like a wideband O2 sensor or EGT (exhaust gas temperature) probe. If you've hooked up a wideband O2 sensor to spare 2, this value can instead display the vehicle's air/fuel ratio, where 10:1 is very rich, and 20:1 is very lean.

## 7.5 Screen 2

ECU+	Screen	1	2	3	4
MAS Input Freq	2458	Hz			
MAS Output Freq	2458	Hz			
MAS Adjustment	0	%			
Timing	15	deg			
Timing Adjustment	0	deg			
Front O2 Voltage	4.08	volts			
Rear O2 Voltage	1.30	volts			
Engine Speed	6992	RPM			
Air Temperature	57	deg F			
Coolant Temperature	87	deg F			
TPS	1.55	volts			
<div> <div>Capture</div> <div>Display</div> </div>					

Illustration 15- Screen 2

Screen 2 is the catch-all sensor display screen. This screen displays as many of the sensor values as possible on one screen. As with screen 1, the displayed values are updated



continuously. Tap the scroll bar on the right side to see the rest of sensor values.

## 7.6 Screen 3

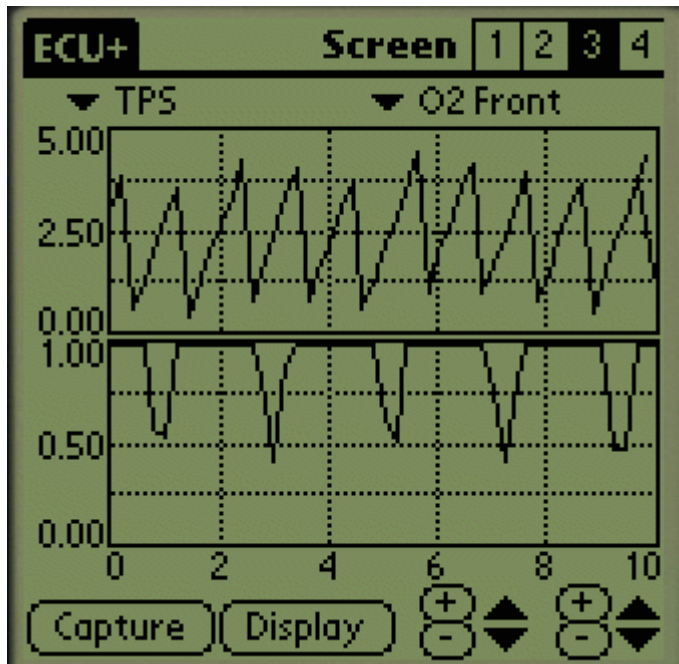


Illustration 16- Screen 3

Screen 3 is the graphing screen. Two sensor values will be graphed here in real time. As with screen 1, which two sensors you'd like to graph can be selected by tapping the down-arrow button on the text fields at the top. At the bottom, two sets of buttons are available to zoom in and out on a graph. The first set of buttons is for the top graph, and the second set of buttons is for the bottom graph. For each, tap the '+' button to zoom in, and the '-' button to zoom out. Tap the up button to scroll the graph upward, or the down button to scroll the graph downward. Note that the ECU+ Palm software displays exactly 10 seconds worth of data here in real-time - it's not possible to scroll backwards to see old data.

## 7.7 Screen 4



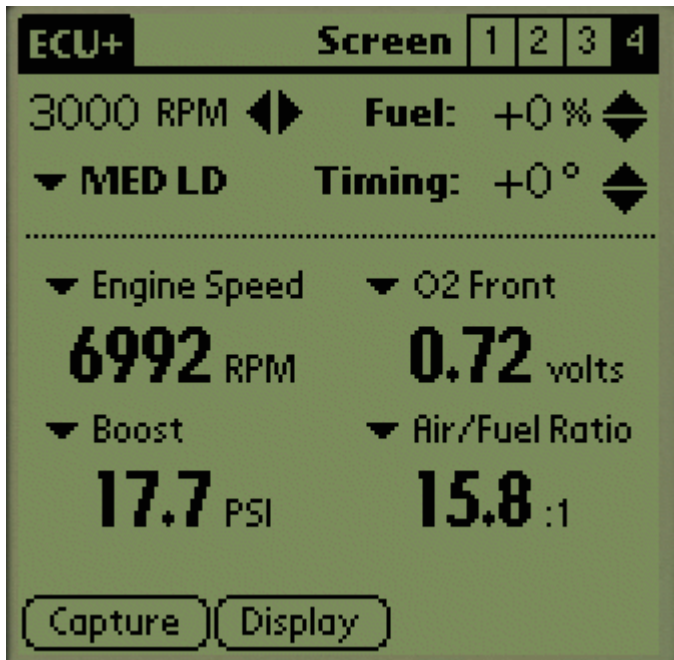


Illustration 17- Screen 4

Screen 4 is the tuning screen. Four sensor values are displayed and updated continuously. In addition, you can use the top section of the screen to display and modify the fuel and timing maps for your ECU+ head unit. The head unit contains 33 fuel and 33 timing map “cells” which allow you control your engine's behaviour. The fuel and timing map cells are arranged as follows:

<b>RPM</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>	<b>WOT</b>
Idle	0	Not used	Not used	Not used
1000	0	0	0	0
2000	0	0	0	0
3000	0	0	0	0
4000	0	0	0	0
5000	0	0	0	0
6000	0	0	0	0
7000	0	0	0	0
8000	0	0	0	0

Table 1 - The fuel table

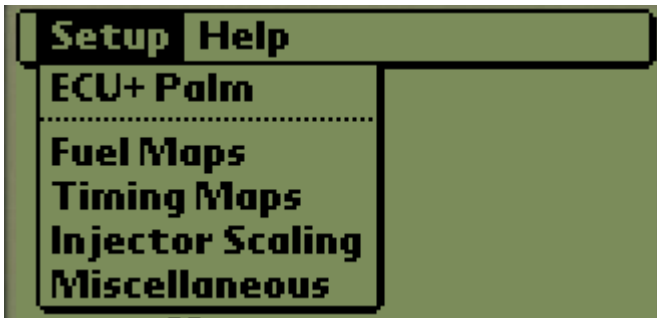
There are 33 cells for both the fuel and timing maps - one for idle, and one each for low, medium, and high loads, and one for wide-open-throttle (WOT) conditions. Each of these can be set individually - the fuel maps cell values can range from -50% to +50%, and the timing map cell values can vary between -15 degrees and +15 degrees.

To configure a given load and RPM combination, tap the down arrow above the load value to select a load, and tap the right or left buttons next to the RPM display to select the combination you want. Then tap the up or down buttons for the fuel or timing table entry you

want to change. Note that the left and right buttons next to the RPM display will cycle through all of the load and RPM values in order - that is, keep tapping the right button to cycle through all of the low load RPMs, then the medium load RPMs, and so on.

Screen 4 is particularly useful when tuning your car on a vehicle dyno. You can set the sensor displays to things that are useful for a dyno run, like RPM, front O2 voltage, air/fuel ratio and engine timing, and then rev your engine to match a given RPM/load setting. Then adjust the fuel and timing settings to achieve the O2 voltage and engine timing that you desire.

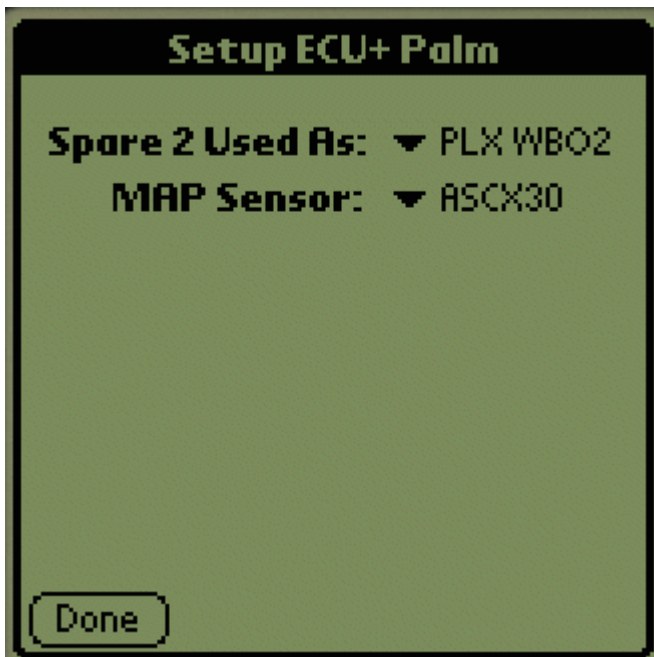
## **7.8 The Menu Bar**



*Illustration 18- The menu bar*

The menu bar (see Illustration 18) provides access to the less common screens available in the ECU+ Palm application. To bring up the menu bar, tap the Palm's menu key. From the menu bar, various setup and help screens are available.

### **7.8.1 The ECU+ Palm Setup Screen**



*Illustration 19- The ECU+ Palm setup screen*

The ECU+ Palm setup screen lets you configure several parameters related to the ECU+

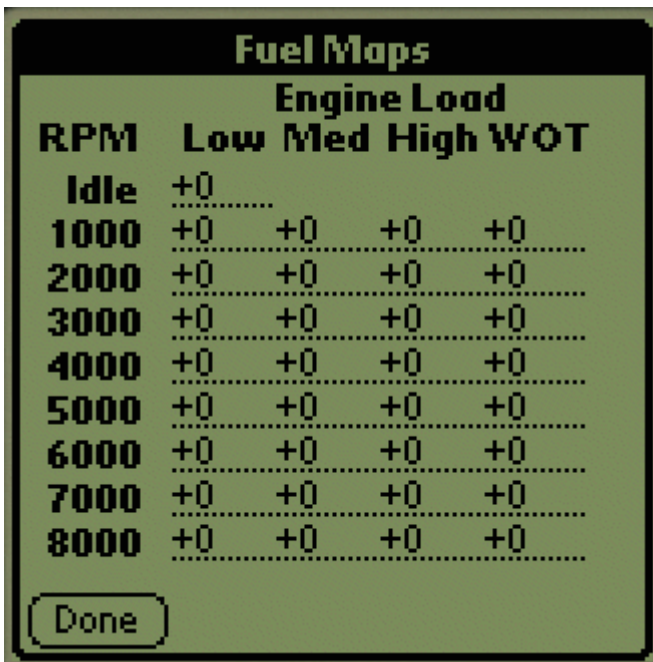
Palm application:

- *Spare 2 Function* – The spare 2 analog input can be used as a general-purpose 5 volt input, or it can be hooked to a variety of wideband O2 sensors. Currently supported wideband O2 sensors are:
  - The PLX (<http://www.plxdevices.com>) M-200, M-250, M-300, M-400 and M-500 controllers.
  - The FJO (<http://www.fjoracing.com>) Wideband AFR Analysis System.
  - The Innovative Motorsports (<http://www.innovativemotorsports.com>) LM-1 Digital Air/Fuel Meter.
- *MAP Sensor Type* – To display and capture boost, the ECU+ requires an external MAP sensor. Two map sensors are currently supported:
  - The “GM 3-Bar” map sensor, available from any GM dealer.
  - The SenSym ASCX30 two-bar map sensor, available from DigiKey (<http://www.digikey.com>).

To change either of these parameters, tap the down arrow next to the value. Tap the *Done* button when you're finished.

Note that both of these parameters change how the ECU+ Palm application interprets the spare 2 and boost voltages, respectively. You'll need to make matching changes to the ECU+ Win software.

### 7.8.2 The Fuel Maps Setup Screen



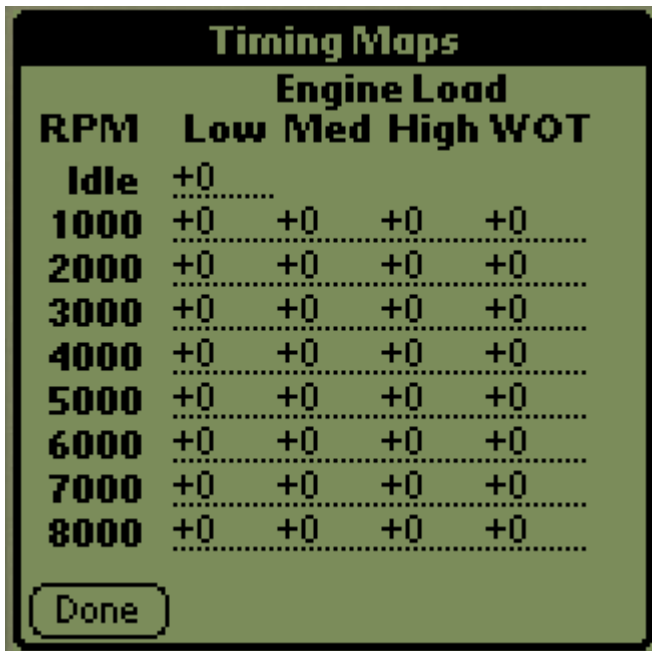
Fuel Maps				
RPM	Engine Load			
	Low	Med	High	WOT
Idle	+0			
1000	+0	+0	+0	+0
2000	+0	+0	+0	+0
3000	+0	+0	+0	+0
4000	+0	+0	+0	+0
5000	+0	+0	+0	+0
6000	+0	+0	+0	+0
7000	+0	+0	+0	+0
8000	+0	+0	+0	+0

Done

Illustration 20- The fuel maps setup screen

The fuel maps setup screen (see Illustration 20) displays all 33 of the fuel map cells currently in use by the ECU+ head unit. To change a value, tap a cell value and use the Palm's grafitti input to change the value. When you're done, tap the *Done* button.

### 7.8.3 The Timing Maps Setup Screen



The Timing Maps Setup screen displays a table for configuring timing maps. The table has columns for RPM (Idle, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000) and Engine Load (Low, Med, High, WOT). All values are currently set to +0. A 'Done' button is at the bottom left.

RPM	Engine Load			
	Low	Med	High	WOT
Idle	+0			
1000	+0	+0	+0	+0
2000	+0	+0	+0	+0
3000	+0	+0	+0	+0
4000	+0	+0	+0	+0
5000	+0	+0	+0	+0
6000	+0	+0	+0	+0
7000	+0	+0	+0	+0
8000	+0	+0	+0	+0

Done

Illustration 21- The timing maps setup screen

The timing maps setup screen works exactly like the fuel maps screen, but it modifies the head unit's 33 timing maps instead of the fuel maps. Tap Done to exit this screen.

### 7.8.4 The Injector Scaling Setup Screen



The Injector Scaling Setup screen shows two fields for injector size, both currently set to 450 cc. A 'Done' button is at the bottom left.

Stock Inj Size: 450 cc

Current Inj Size: 450 cc

Done

Illustration 22- The injector scaling setup screen

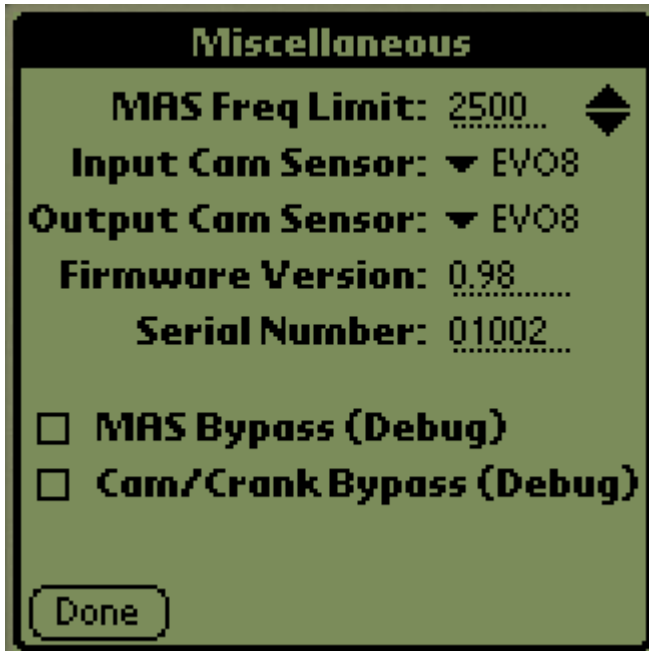
Injector scaling allows the ECU+ to compensate for larger or smaller injectors, while giving you the full -50% to 50% adjustment range in the fuel maps. To use the injector scaling feature, tap either the stock or current injector size field, and use the Palm's Graffiti input to

enter a new injector size value. From then on, the ECU+ will automatically scale the MAS output to compensate for the injector ratio defined here.

Values between 420 cc and 780 cc can be entered here.

Tap the *Done* button to exit this screen.

### 7.8.5 The Miscellaneous Setup Screen



*Illustration 23- The miscellaneous setup screen*

The miscellaneous setup screen lets you configure various head unit parameters that don't fit anywhere else. The configuration values are as follows:

- **MAS Freq Limit** - This is the highest MAS output frequency that the ECU+ will generate on its output. This is used to limit the output MAS frequency to a given value, generally to avoid fuel cut on your vehicle. Tap the up or down arrows to change this value. Note that due to the limited precision of the ECU+ head unit, only certain frequencies can be set here. Values between 1000 and 2500 Hz can be set here.

- **Input Cam Sensor** - This sets the type of cam sensor used on your car. Tap the down arrow next to the type to set a new value.

- **Output Cam Sensor** - This sets the type of cam sensor that the ECU+ head unit should generate. As with the Input Cam Sensor type, tap the down arrow to set a new value. Both the input and output cam sensor types should generally match your car - this setting is intended for those people using a different cam sensor than stock on their car. Note that when making changes to either cam sensor type, the ECU+ head unit must be power-cycled for the setting to take effect. Thus, to change either of these settings:

1. Turn your car off, and turn the ignition to its "ready to start the car" position. In this position, the ECU+ head unit is powered up but the car isn't running.
2. Tap the down arrow on the Palm to select the new sensor type.
3. Wait a few seconds for the ECU+ head unit to store the new value to its non-volatile memory.

4. Turn your car's ignition all the way off, and wait a few seconds.

5. Start your car.

- *Firmware Version* – This displays the current version of firmware running in your ECU+ head unit.
- *Serial Number* – This displays the serial number of your ECU+ head unit.
- *MAS Bypass* - This is a debugging option that forces the ECU+ to track your MAS sensor signal with no changes. This effectively causes your car's MAS sensor signal to pass transparently through the ECU+ head unit.
- *Cam/Crank Bypass* - Similar to the MAS Bypass option, this forces your car's cam and crank sensor signals to pass transparently through the ECU+ head unit. Note that neither the MAS Bypass nor the Cam/Crank Bypass check-boxes are remembered by the ECU+ head unit - these are both switched off when the head unit is powered down, and have to be re-enabled each time you start your car.

### 7.8.6 The About Screen

The about screen displays the version number of the ECU+ Palm software.

## 7.9 Capturing Data

The ECU+ Palm software can capture and store away "datalogging" information from the ECU+ head unit. These captures grab all of the engine sensor values 25 times per second and store them away in a Palm "database" which can be viewed, or more importantly, HotSync'd to a PC for use with the ECU+ Win software.

To start capturing data, tap the *Capture* button located at the bottom of each screen. The ECU+ Palm software will begin capturing data and display a status box that shows how many seconds of data have been captured so far.

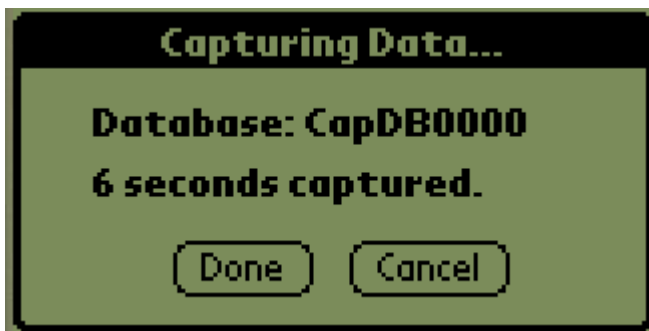


Illustration 24- The capture dialog

Tap the *Done* button to save the captured data, or *Cancel* to discard it. Note that the Palm software saves captured data to a one-up database filename, which will match the filename (with a .ecd extension) when this data is HotSync'd to a PC.

## 7.10 Displaying Captured Data

The ECU+ Palm software contains a simple viewer for displaying captured data. To invoke the viewer, tap the *Display* button at the bottom of each screen. This will invoke a display data dialog in which you can display the contents of a capture.

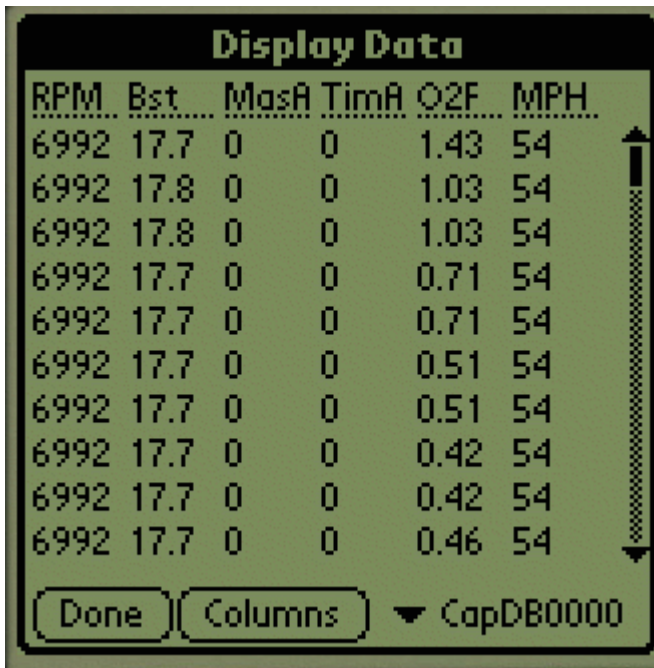


Illustration 25- The data display dialog

Tap the down arrow next to *Select a File*, and then select the database you'd like to display. This will display the captured data in a simple columnar format, with a scroll bar that can be used to move up and down in the data. The viewer can display six sensor values (plus elapsed time) at once, and you can select which columns you'd like to see by tapping the *Columns* button and selecting the appropriate sensors. As with all of the other ECU+ Palm screens, your column selections will be remembered between sessions.

Tap the *Done* button when you've finished viewing a database.

### 7.11 Upgrading the ECU+ Palm Software

Occasionally, there will be updates to the ECU+ Palm software posted on the ECU+ web site. To take advantage of these updates, download the software and extract the .zip file to a temporary location on your laptop. You'll find a file called EcuPlusPalm.prc. Drag and drop this file into the Palm Desktop's Quick Install tool, and next time you HotSync your Palm with your laptop, the new ECU+ Palm software will be automatically installed on your Palm.



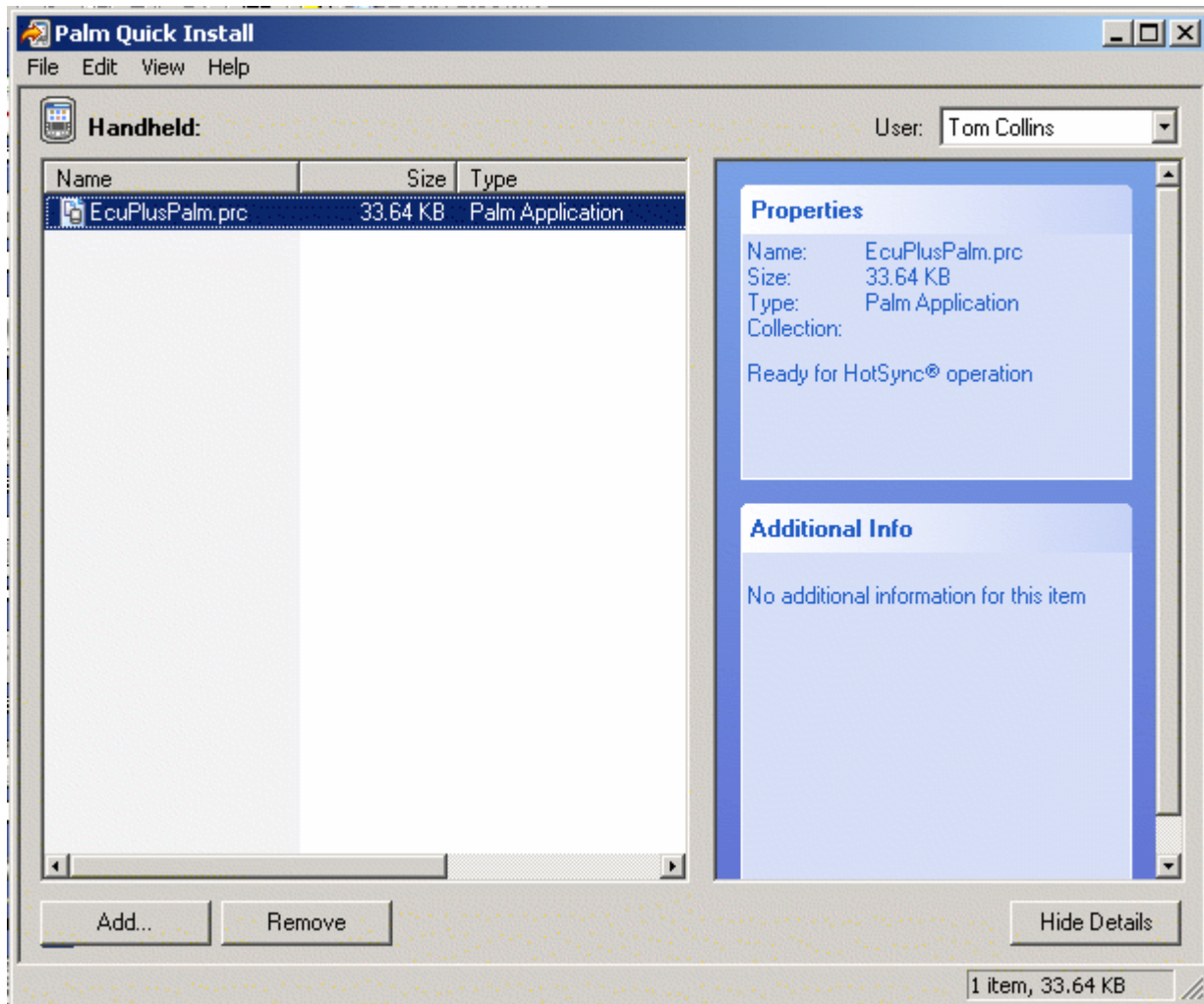


Illustration 26- The Palm Quick Install tool

## 7.12 HotSync'ing Captured Files to Your PC

When you do a capture via the ECU+ Palm software, the captured data is stored in your Palm as a Palm database. These databases will be automatically transferred from the Palm to your laptop whenever you do a HotSync operation. If you've installed the Palm Desktop software in the standard place on your laptop, you'll find these captured data files in the directory:

**C:\Program Files\Palm\LastnameF**

where LastnameF is your last name and first initial.

## 8 Using the ECU+ Win Software

### 8.1 Introduction

The ECU+ Win software, like the ECU+ Palm software, interfaces to your ECU+ head unit and allows you to tune the ECU+, perform a capture, or just monitor your engine's sensors. Unlike the Palm software, though, the ECU+ Win software also includes advanced data analysis and display capabilities that allows you to easily and accurately configure the ECU+



head unit to make your car perform at peak levels.

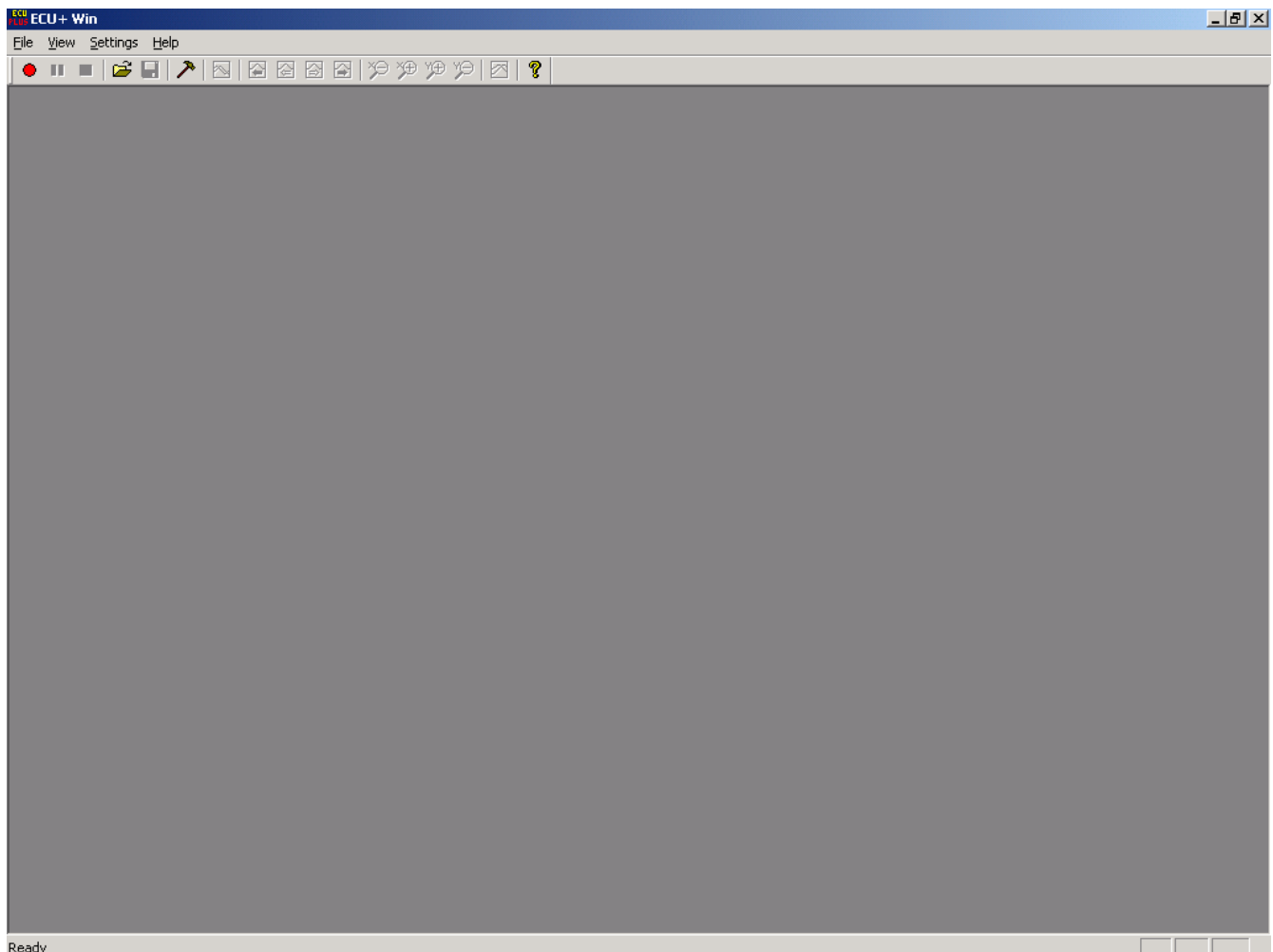
## **8.2 Starting the ECU+ Win Software**

To start the ECU+ Win software, double-click the icon on your desktop.



*Illustration 27- The ECU+ Win icon*

The ECU+ Win software should start up and display its main screen (see Illustration 28).



*Illustration 28- The ECU+ Win main screen*

Because of the amount of information that the ECU+ Win software can display, you might

want to maximize the application.

## 8.3 A Guided Tour of the Software

The ECU+ Win application is a relatively complex piece of software. Let's take a look at it one section at a time.

### 8.3.1 The Menu Bar



Illustration 29- The menu bar

The menu bar (see Illustration 29) is at the top of the screen, and includes the usual Windows *File*, *View*, *Help* and other menu items. The menu bar will change slightly depending on what you are doing, but will always include *File*, *View* and *Help*. The sub-menus that are available on the menu bar are as follows:

#### 8.3.1.1 The File Menu

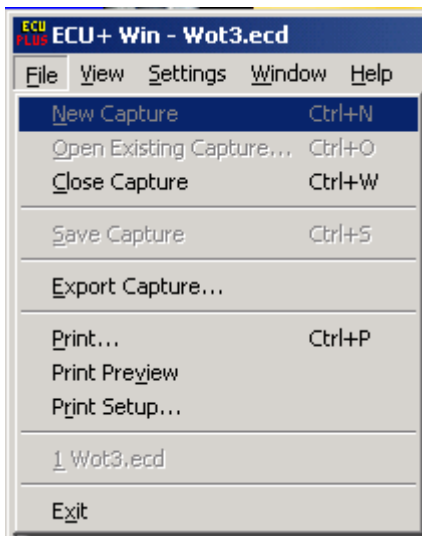


Illustration 30- The file menu

The file menu (see Illustration 30) is used to Open, Save, Close or Export a capture file, to start a New capture, or to exit the ECU+ Win application. You can also print the contents of a graph (discussed later in this manual) from the file menu. Depending upon what you're doing with the ECU+ Win software, one or more of the items on the file menu may be greyed out or not available.

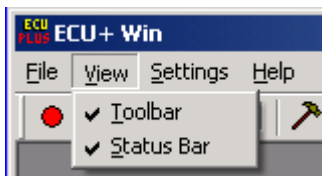
The items on the file menu are as follows:

- **New Capture** - This connects to the ECU+ head unit and begins capturing data from it, while displaying the data in real time. This is equivalent to the Palm software's *Capture* button. Use this menu item to capture new data from your car.
- **Open Existing Capture** - This opens up an existing file on disk containing captured data, and displays the data for viewing or analysis. Use this menu item to display previously-

captured data.

- *Close Capture* - When doing a new capture, this finishes the capture and prompts to save the data to disk. When viewing an existing capture, this closes the capture file and prompts to save the data if it's changed.
- *Save Capture* - This saves any changes you've made to an open capture file, but doesn't close the file.
- *Export Capture* - This allows you to export the currently open capture to a new file, in comma-separated value (CSV) format. You'll be prompted for the name of the new file. CSV is a common format that can be read by many applications. Most often, you'll use a spreadsheet program (like Microsoft Excel) to read a CSV file for complex analysis and processing.
- *Print* - This prints the current graph view.
- *Print Preview* – Previews the graph view before printing.
- *Print Setup* - Lets you to configure your printer margins and other settings.
- *Numbered files* - The ECU+ Win software remembers the names of several recent capture files that you've opened, and displays them with a number next to them. Selecting a numbered file opens that file quickly, without going through the Open Existing Capture menu item.
- *Exit* - This exits the ECU+ Win application, and prompts to save any unsaved capture files.

#### **8.3.1.2 The View Menu**



*Illustration 31- The view menu*

The view menu (see Illustration 31) allows you to toggle on and off the toolbar and status bars for more on-screen real estate. Simply select a menu item to toggle it on and off.

#### **8.3.1.3 The Window Menu**

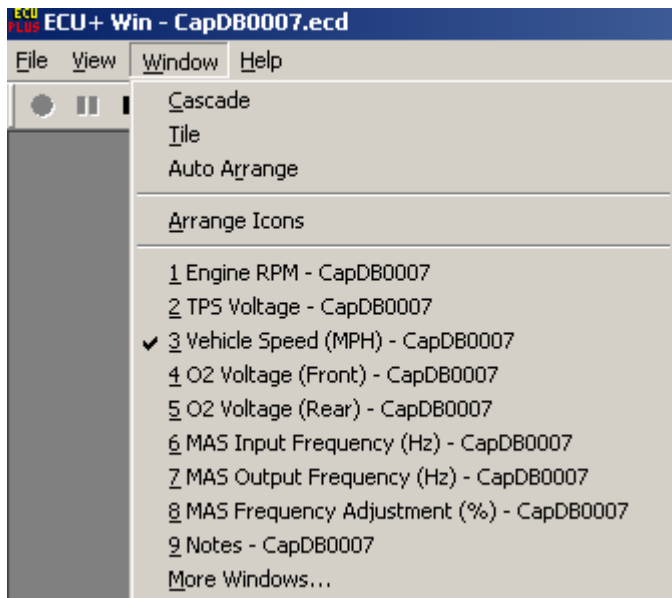


Illustration 32 - The window menu

The window menu (see Illustration 32) allows you to arrange the windows in the display area. *Cascade*, *Tile* and *Arrange Icons* work as in other Windows software, but *Auto Arrange* is unique, tiling the visible view windows in a sensible manner. The numbered windows on this menu makes the selected window current (in front) and un-minimizes it if necessary. The *More Windows* dialog does the same thing, but is used when more than 9 windows are shown in the display area.

Note that the *Window* menu will only be available when displaying an existing capture file or capturing data to a new file.

#### 8.3.1.4 The Settings Menu

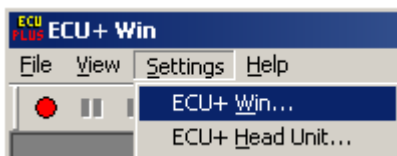


Illustration 33 - The settings menu

The *Settings* menu (see Illustration 33) allows you to configure the ECU+ Win software as well as the ECU+ head unit. Select either from the menu, and then follow the instructions below for setting each up.

#### 8.3.1.5 The Help Menu

The *Help* menu has a single menu item which displays the *About* dialog for the ECU+ Win application. The about dialog just displays the software version and copyright information.

### 8.3.2 The Toolbar



Illustration 34- The toolbar

The toolbar (see Illustration 34) is a quick way to access various ECU+ Win menu items with just a single click. The items on the toolbar, and the menu item equivalences are from left to right:

- **New Capture** - The record icon. This begins capturing data from the ECU+ head unit. This is equivalent to *File->New Capture*.
- **Pause Capture** - The pause icon. This button temporarily pauses the current capture so that you can scroll back and look at old data. Click this button once to pause the capture, and then again to restart the capture. Any data received from the ECU+ head unit while the capture is paused is lost. There is no menu item equivalent to this button.
- **Close Capture** - The stop icon. This closes a new capture or existing capture file, and prompts to save the data if it's changed. This is equivalent to *File->Close Capture*.
- **Open Existing Capture** - The open folder icon. This opens an existing capture file for analysis. This is equivalent to *File->Open Existing Capture*.
- **Save Capture** - The floppy disk icon. This manually saves the current capture if it's changed. This is equivalent to *File->Save Capture*.
- **Setup Head Unit** - The hammer icon. This brings up the dialog box to configure the ECU+ head unit's fuel and timing maps, etc. This is equivalent to *Settings->ECU+ Head Unit*.
- **Add Overlay** - The two-graph icon. This adds a new overlay to the current capture file for comparison purposes. This is equivalent to *Graph Context Menu->Overlaid Plots->Add New*.
- **Overlay Shifting** - The next four icons (which show a graph and an arrow) are shortcuts used for shifting the most recent overlay to the left or right. The icons represent shifting left 1/4 page, left by one, shift right by one, and right by 1/4 page, respectively. These are equivalent to *Graph Context Menu->Overlaid Plots->Shift Last*.
- **Graph Zooming** - The next four icons (magnifying glass-like) are used to zoom a graph's X or Y axis in or out, and are equivalent to *Graph Context Menu->Zoom X(Y) Axis->In(Out)*. They zoom the current graph out on the X axis, in on the X axis, out on the Y axis and in on the Y axis, respectively.
- **Dyno Analysis** - The dyno icon. This brings up the dyno analysis dialog. This is equivalent to *Graph Context Menu->Analyze->Dyno Analysis*.
- **Help** - The question mark icon. Displays the current ECU+ Win "About" dialog. This is equivalent to *Help->About ECU+ Win*.

Note that the toolbar can be toggled on and off with the View->Toolbar menu item. If you never use the toolbar, you may want to turn it off.

### 8.3.3 The Status Bar

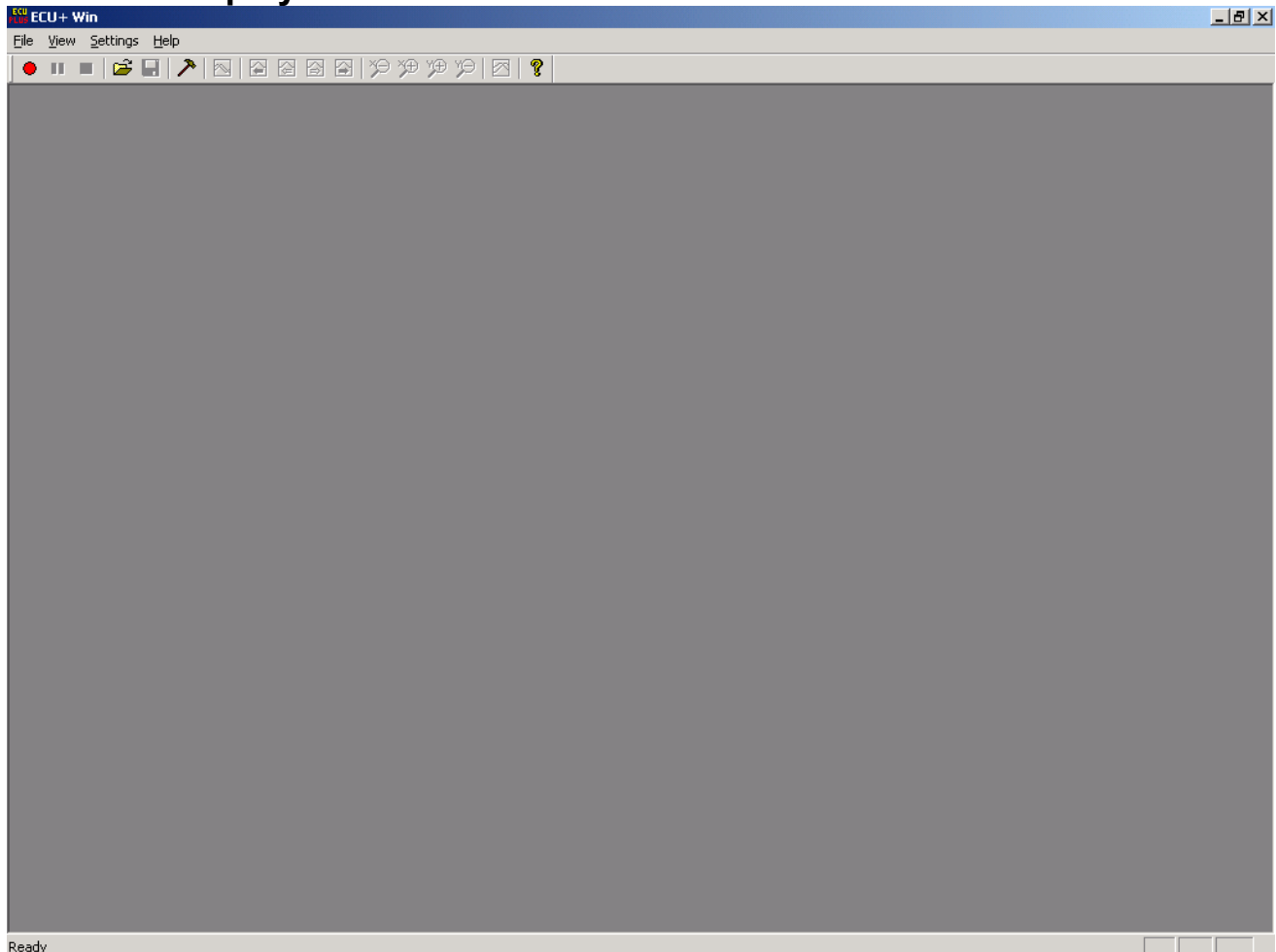


Illustration 35- The status bar

The status bar (see Illustration 35) is used to display the settings of the keyboard caps-lock

(CAP), num-lock (NUM) and scroll lock (SCRL) keys, as well as longer descriptions of menu items. The status line can be safely turned off with the *View->Status Bar* menu item.

### 8.3.4 The Display Area



*Illustration 36- The display area*

The display area makes up the bulk of the ECU+ Win's screen space. Inside the display area, the software will display “views” of a live or captured data file. A view is just a sub-window in which data is displayed. Views will either be text boxes, containing data values numerically, or graphs showing data in graph form. More information on views is available in section *Setting Up Views* on page .

## 8.4 Creating a New Capture

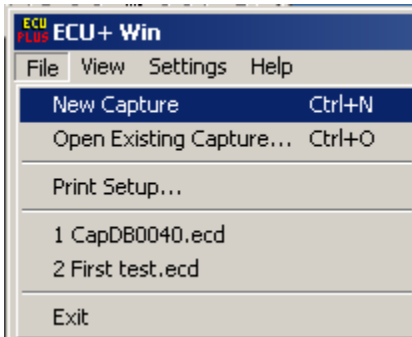


Illustration 37 - The new capture menu item

The ECU+ Win software can capture and store away "datalogging" information from the ECU+ head unit. These captures grab all of the engine sensor values 25 times per second and store them away in a file on your computers hard disk. This captured data can contains a permanent record of your engine's operation, and can be later loaded back into the ECU+ Win software for analysis or comparison to other captures.

To create a new capture file, use the *File->New Capture* menu item, or click on the record icon in the toolbar. The ECU+ Win software will then open up the serial port and try to connect to the ECU+ head unit. Once the connection is established, the software will open up the views that you've configured and begin capturing data from the head unit. While the capture is going on, you can open, close or resize any of the views in the display area. At any point during the capture, you can use *File->Close* or click the stop icon in the toolbar to stop capturing. When you stop capturing, ECU+ Win will prompt for you to save the file, and display the standard Windows file-save dialog. At any point during the capture, you can also pause the capture by clicking the pause icon in the toolbar. Any data accumulated from the head unit while paused will be lost.

## 8.5 Opening an Existing Capture File

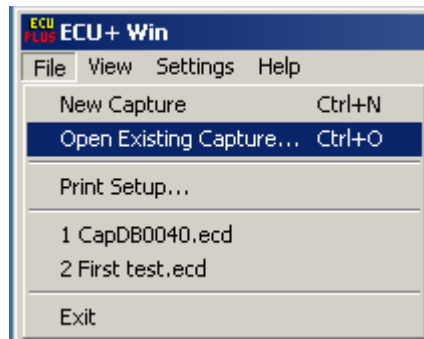


Illustration 38 - The open existing capture menu item

Captures that you've aquired with either the ECU+ Win or the ECU+ Palm software can be loaded into ECU+ Win by "opening" an existing capture file. To do this, use either the *File->Open Existing Capture* menu item, or click the open folder icon on the toolbar and select the capture file you'd like to view. ECU+ Win will open this file and display its contents within the views you've configured. When you're done with this capture, use *File->Close capture* to close it out.

Note: Only one capture file can be open at a time. You can, however, overlay one capture on top of another. See the section *Overlaying Multiple Capture Files* on page 54 to see how this

powerful technique works.

## 8.6 Configuring the ECU+ Head Unit

You can use the ECU+ Win software to configure your ECU+ head unit's settings. To start the configuration dialog, either click the hammer icon in the toolbar, or use the *Settings->ECU+ Head Unit* menu item. This opens the head unit configuration dialog, which has four tabs for configuring the fuel maps, the timing maps, the injector scaling and other miscellaneous values. Let's take a look at them in turn:

### 8.6.1 Setting Up the Fuel Maps

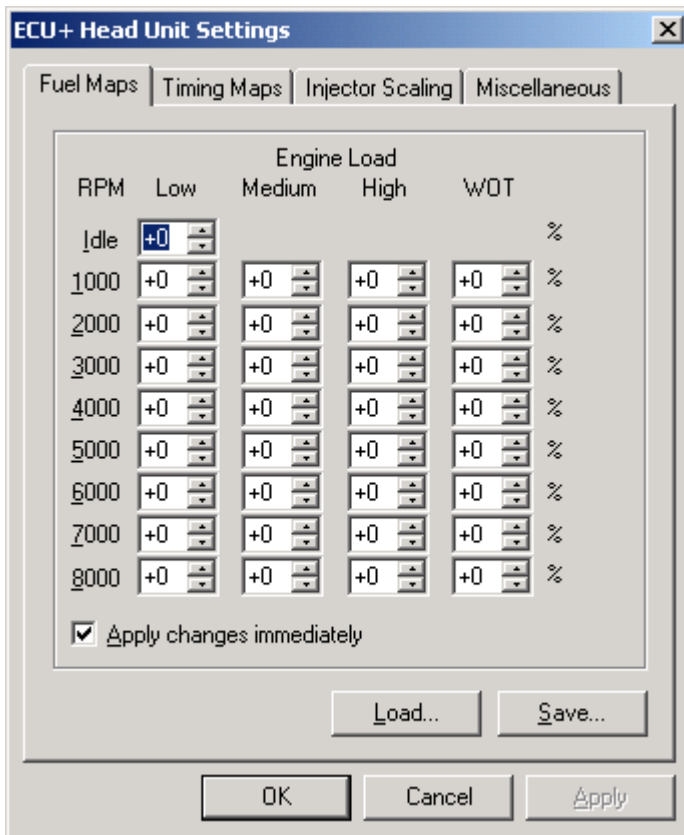


Illustration 39- The fuel maps tab

The fuel maps tab lets you configure the ECU+ head unit's fuel maps. The fuel maps tell the ECU+ head unit how to modify the engine's mass air sensor (MAS) signal. To cause the stock ECU to increase or decrease the fuel flow to your engine, the ECU+ head unit modifies the MAS signal. The MAS produces a frequency proportional to the amount of air entering the engine. By modifying the MAS signal, the ECU+ head unit "lies" to the stock ECU about how much air is entering the engine, which causes the stock ECU to change its fuel flow proportionally – less air means less fuel.

The fuel maps contain 33 different "cells" - one for idle, and 8 sets for low, medium, and high engine "loads," as well as 8 for wide-open throttle conditions. Each cell represents how the ECU+ head unit should modify the MAS frequency when the engine is running at that particular load and RPM combination.

An example: let's say your car is accelerating at wide open throttle, and the engine is at 4000



RPM, and the cell value for 4000 RPM/WOT is -10%. If the engine's MAS frequency is 2200 Hz (representing some fixed amount of air flow), the ECU+ head unit will change this frequency to  $90\% \times 2200 \text{ Hz}$ , or 1980 Hz, and pass this new frequency on to the stock ECU. The stock ECU will then reduce the corresponding fuel flow by 10%, thus causing your car to run 10% leaner at that RPM at WOT.

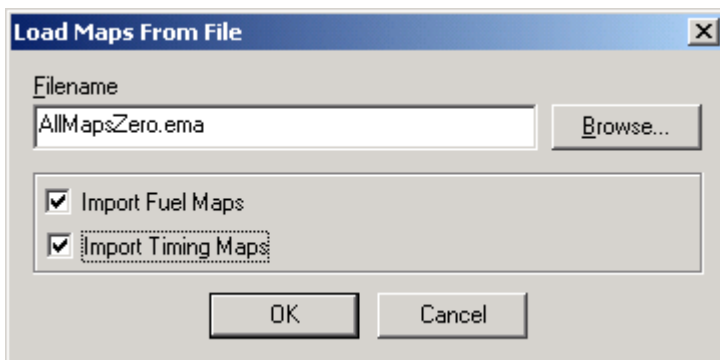
To set a given fuel map cell to a value, you can either type in a number into the appropriate cell, or click the up and down arrows next to that cell. You can also use the keyboard's up and down arrows to increase or decrease the value in a cell.

Each fuel map cell can take on values from -50% to +50%, where negative numbers decrease your engine's fuel flow (causing the engine to run leaner), and positive numbers increase it (causing the engine to run richer).

Note that the ECU+ head unit interpolates values between the discrete levels in the fuel map table. That is, if your fuel map cell value is -10% at 6000 RPM and -12% at 7000 RPM, and your engine is running at 6500 RPM, the ECU+ head unit will adjust the fuel by -11%.

The final option on the fuel maps dialog tells the ECU+ Win software to send fuel map changes to the ECU+ head unit immediately. If this isn't checked, values are only sent over when you click "Ok."

Within the fuel maps tab, you can load or save the maps from the ECU+ head to a file on disk. When saving maps, you're prompted for a filename only – both the fuel and timing maps are always saved. When loading maps, you'll be presented with this dialog:



You can select to load just the fuel maps, just the timing maps, or both. By default, maps stored on disk have the .ema file extension, though you can also retrieve the maps used in a previous capture by specifying the .ecd capture file here.

### 8.6.2 Setting Up the Timing Maps

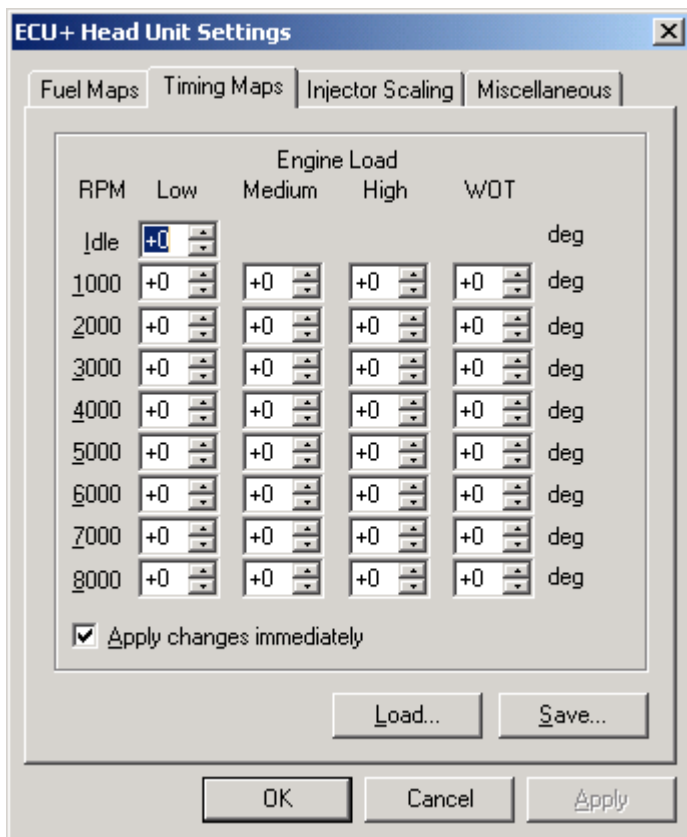


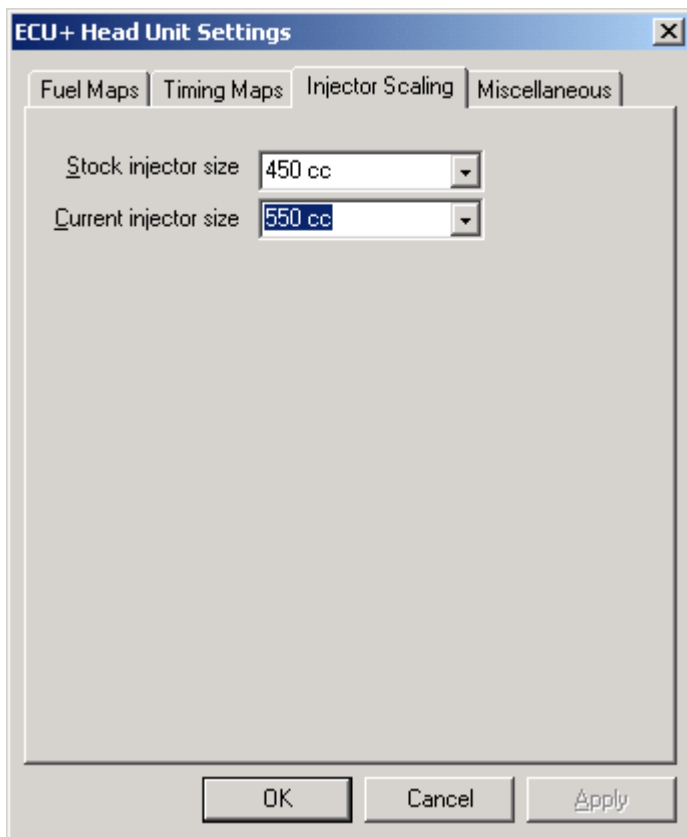
Illustration 40- The timing maps tab

The timing maps tab lets you configure the ECU+ head unit's timing maps. The timing maps tell the ECU+ head unit how to modify the engine's cam and crank angle sensor signals. When the ECU+ head unit modifies the cam and crank angle sensor signals, it causes the stock ECU to fire the spark plugs either sooner or later than stock, thus affecting the engine timing.

The timing maps contain the same 33 cells that the fuel maps do, corresponding to a given engine load and RPM. You can change the values with the keyboard or mouse, just as with the fuel map values. The timing maps specify a timing offset of between -15 and +15 degrees, where a positive value causes the spark to fire earlier in the engine cycle, and a negative value causes a later spark. Thus, positive values increase the engine's timing advance, and negative values decrease the engine's timing advance.

As with the fuel maps, you can load and save sets of maps to disk from this tab.

### 8.6.3 Injector Scaling Configuration



*Illustration 41- The injector scaling tab*

The injector scaling tab allows the ECU+ to compensate for larger or smaller injectors, while giving you the full -50% to 50% adjustment range in the fuel maps. To use the injector scaling feature, select a new injector size for either the stock or current injectors. From then on, the ECU+ will automatically scale the MAS output to compensate for the injector ratio defined here.

Values between 420 cc and 780 cc can be entered here, and you can pick the values in from the dropdown list, or type them in.

## 8.6.4 Miscellaneous Configuration

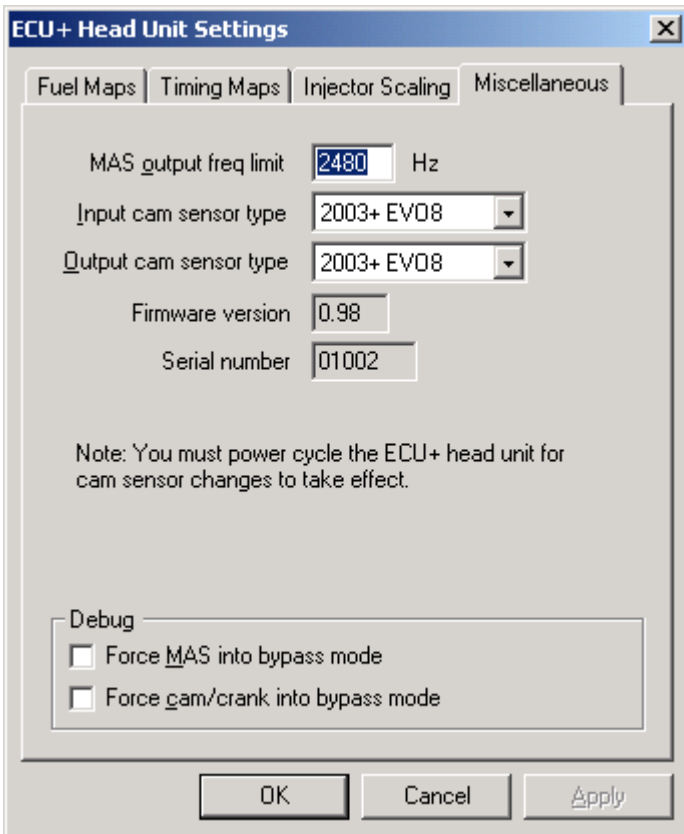


Illustration 42- The miscellaneous settings tab

The miscellaneous settings tab lets you configure some random values in the ECU+ head unit. These are:

- **MAS Output Freq Limit** - This is the highest MAS output frequency that the ECU+ will generate on its output. This is used to limit the output MAS frequency to a given value, generally to avoid fuel cut on your vehicle. Type in a new number to change this value. Note that due to the limited precision of the ECU+ head unit, only certain frequencies can be set here. Values between 1000 and 2500 Hz can be set here.
- **Input Cam Sensor Type** - This sets the type of cam sensor used on your car. Click the dropdown button next to the type to set a new value.
- **Output Cam Sensor Type** - This sets the type of cam sensor that the ECU+ head unit should generate. As with the Input Cam Sensor type, click the dropdown arrow to set a new value. Both the input and output cam sensor types should generally match your car - this setting is intended for those people using a different cam sensor than stock on their car. Note that when making changes to either cam sensor type, the ECU+ head unit must be power-cycled for the setting to take effect. Thus, to change either of these settings:
  1. Turn your car off, and turn the ignition to its "ready to start the car" position. In this position, the ECU+ head unit is powered up but the car isn't running.
  2. Tap the down arrow on the Palm to select the new sensor type.
  3. Wait a few seconds for the ECU+ head unit to store the new value to its non-volatile memory.

4. Turn your car's ignition all the way off, and wait a few seconds.
  5. Start your car.
- *Firmware Version* – This displays the version of the firmware running in the ECU+ head unit. Use this when submitting bug reports.
  - *Serial Number* – This displays the serial number of your ECU+ head unit.
  - *Force MAS Into Bypass Mode* - This is a debugging option that forces the ECU+ to track your MAS sensor signal with no changes. This effectively causes your car's MAS sensor signal to pass transparently through the ECU+ head unit.
  - *Force Cam/Crank Into Bypass Mode* - Similar to the MAS Bypass option, this forces your car's cam and crank sensor signals to pass transparently through the ECU+ head unit. Note that neither the MAS Bypass nor the Cam/Crank Bypass check-boxes are remembered by the ECU+ head unit - these are both switched off when the head unit is powered down, and have to be re-enabled each time you start your car.

## 8.7 Configuring the ECU+ Win Software

To configure the ECU+ Win software, use the *Settings->ECU+ Win* menu item. This opens the ECU+ Win configuration dialog. As with the ECU+ head unit settings dialog, this one has four tabs:

### 8.7.1 View Configuration

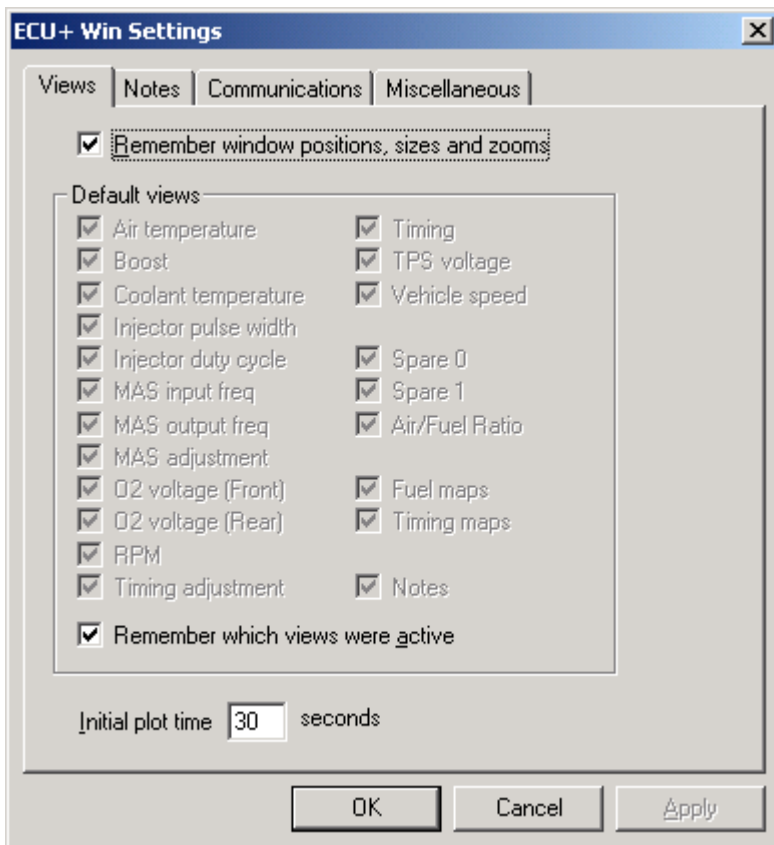


Illustration 43- The view configuration tab

The view configuration tab tells the ECU+ Win software what views you'd like to see by

default. When you start a new capture or open an existing capture file, the ECU+ Win software starts up and displays one or more views of the data associated with this capture. If *Remember which views were active* is checked, the ECU+ Win software will display the same set of views that were active the last time you showed a capture. If this is un-checked, the checked views will be shown instead,

The checkbox *Remember window positions, sizes and zooms* determines whether the ECU+ Win software will restore the views in the same window position, minimized status, and overlap as before.

Lastly, the *Initial plot time* text field sets how many seconds the X axis of the graph views will display by default.

## 8.7.2 Notes Configuration

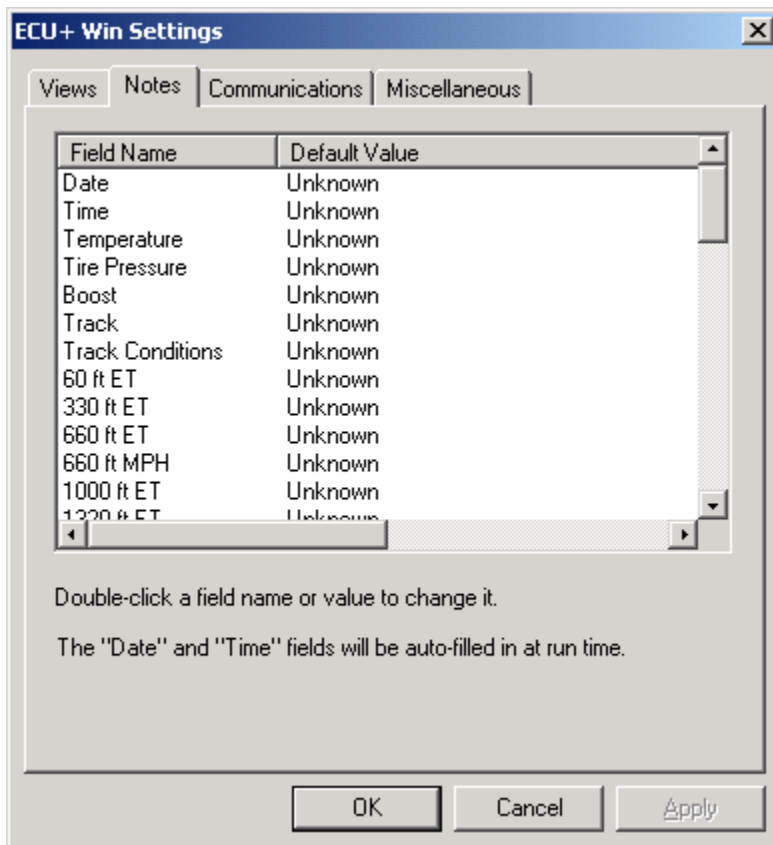
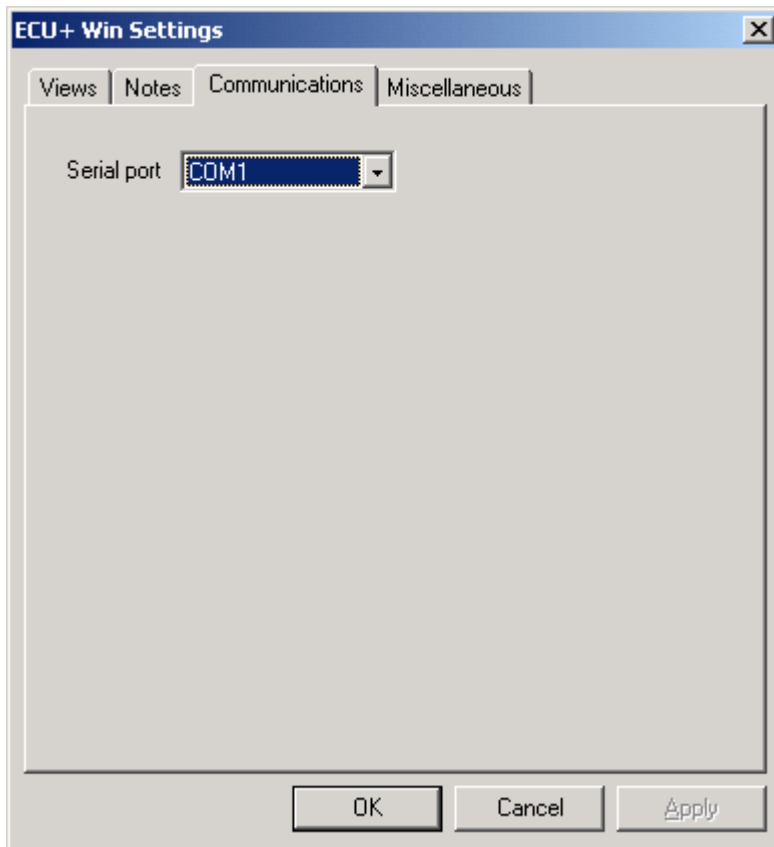


Illustration 44- The notes configuration tab

The Notes configuration tab allows you to configure which notes get added to new captures by default. When you start a new capture, the ECU+ Win software automatically copies the values defined here into the notes view for that capture. You can add or delete values from this dialog to configure what notes are used by default. If a field named "Date" and/or a field named "Time" is defined here, it's filled in by the ECU+ Win software when the new capture is started.

Double-click a field name or value to change it, and then press ENTER.

### 8.7.3 Communications Configuration



*Illustration 45- The communications configuration tab*

The communications configuration tab sets up what serial port your laptop will use when talking to the ECU+ head unit. Typical values used are COM1 (with a laptop that has a “real” serial port), or COM5 (with a laptop using a USB-to-serial adapter). Click the dropdown arrow to change this value.

### 8.7.4 Miscellaneous Configuration



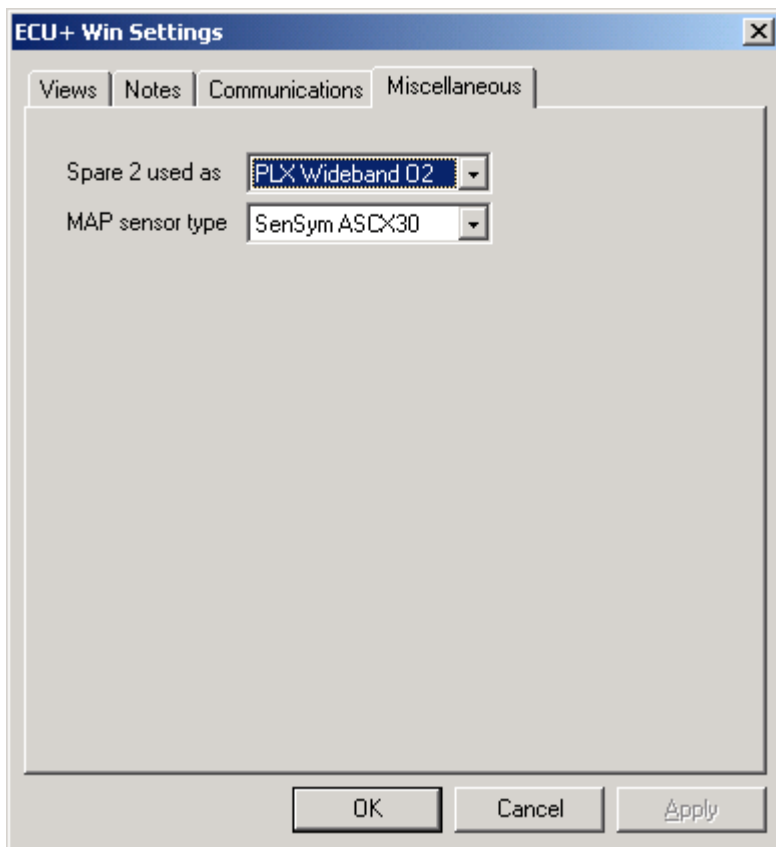


Illustration 46- The miscellaneous configuration tab

The miscellaneous configuration tab lets you configure several miscellaneous parameters:

- *Spare 2 Function* – The spare 2 analog input can be used as a general-purpose 5 volt input, or it can be hooked to a variety of wideband O2 sensors. Currently supported wideband O2 sensors are:
  - The PLX (<http://www.plxdevices.com>) M-200, M-250, M-300, M-400 and M-500 controllers.
  - The FJO (<http://www.fjoracing.com>) Wideband AFR Analysis System.
  - The Innovative Motorsports (<http://www.innovativemotorsports.com>) LM-1 Digital Air/Fuel Meter.
- *MAP Sensor Type* – To display and capture boost, the ECU+ requires an external MAP sensor. Two map sensors are currently supported:
  - The “GM 3-Bar” map sensor, available from any GM dealer.
  - The SenSym ASCX30 two-bar map sensor, available from DigiKey (<http://www.digikey.com>).

Click the dropdown for either of these to change the current values..

Note that both of these parameters change how the ECU+ Win software interprets the spare 2 and boost voltages, respectively. You'll need to make matching changes to the ECU+ Win software.

## 8.8 The About Dialog

The About dialog, accessible from the menu item Help->About ECU+ Win, displays the version of the ECU+ Win software and a copyright notice.

## 8.9 The Views

When displaying the contents of a captured data file, the ECU+ Win software opens up multiple views of the data in the display section of the software. There are several types of views that the software can display. Some views display several values, some are graphs that can be scrolled around in, and some are just simple text displays. Let's take a look at them:

### 8.9.1 The Engine Monitor View

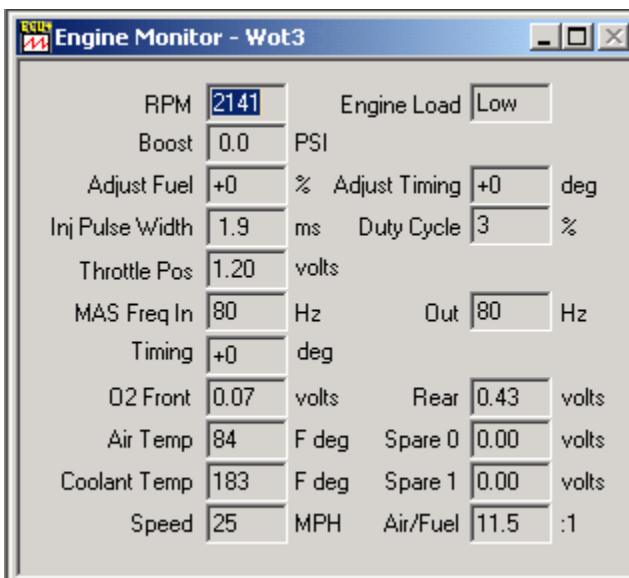


Illustration 47- The engine monitor view

The engine monitor view (see Illustration 47) is your one-stop shop for everything that the ECU+ head unit knows about your engine's sensors. It displays a variety of information about the engine's sensors and what the head unit is doing. When doing a new capture of live data, the engine monitor displays the current data from the engine sensors in real time. When viewing a capture file from disk, the contents of the engine monitor reflect the cursor position on the current graph view. Thus, the engine monitor displays the current engine data at all times as a "snapshot" of what's going on.

Note: the engine monitor is the only view that can't be closed by clicking the 'X' in the upper right of the window.

### 8.9.2 The Notes View

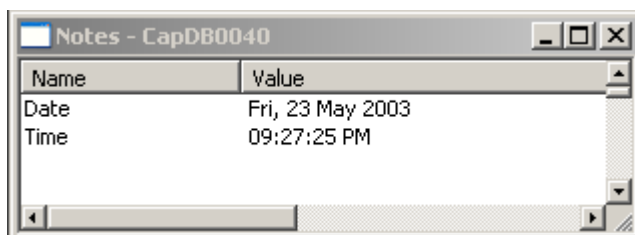


Illustration 48- The notes view

The notes view displays any notes associated with the current capture. You can edit a note's name or value by double-clicking on the field, making your change, and then pressing ENTER.

### 8.9.3 The Plot Color Legend View

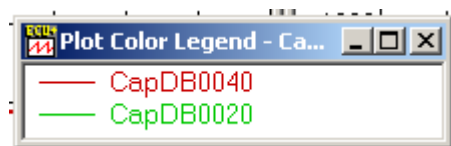


Illustration 49- The plot color legend view

The plot color legend view (see Illustration 54) is a simple box that shows what colors are being used in the graph views when multiple files are overlaid.

### 8.9.4 The Fuel Maps and Timing Maps Views

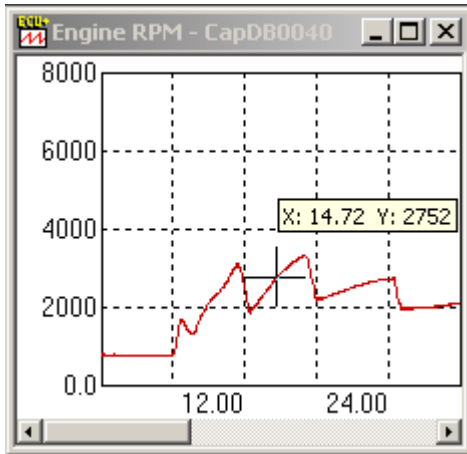
RPM	Engine Load			
	Low	Medium	High	WOT
Idle	+0			
1000	+0	+0	+0	+0
2000	+0	+0	+0	+0
3000	+0	+0	+0	+0
4000	+0	+0	+0	+0
5000	+0	+0	+0	+0
6000	+0	+0	+0	+0
7000	+0	+0	+0	+0
8000	+0	+0	+0	+0

Illustration 50 - The fuel maps view

The fuel and timing maps can also be displayed in the ECU+ Win software's display area. These views show the fuel and timing maps as they existed when the current capture was made. Additionally, the fuel or timing map value that corresponds to the current (new capture) or cursor (existing capture file) data value is shown highlighted in this view.

Remember that the ECU+ head unit interpolates between fuel or timing map cell values, so this highlighted value doesn't necessarily reflect the exact fuel or timing offset that the ECU+ head unit is using – rather, it's the closest one. So, for example, if your engine RPM is 3400 RPM, the 3000 RPM map cell will be highlighted, when in fact the ECU+ head unit is actually using the value about half-way between 3000 and 4000 RPM.

## 8.9.5 The Graph Views



*Illustration 51 - A graph view*

The graph views are the most complex and powerful of the views to use. A graph view shows a single value from a capture in an X-Y plot, where the X axis is time, in seconds, and the Y axis is the single value. Graph views can be moved around, resized and zoomed. Let's see how these features work:

### 8.9.5.1 The Cursor and Moving Around

The cursor in a graph view (shown as a small cross that tracks the graph) represents the "current" spot on a graph. When you hover your mouse over a graph view, the cursor tracks the horizontal position of the mouse, and pops up a Windows tooltip showing you the current X and Y axis values of the cursor on that graph. If there are any other graph views displayed, a similar tracking cursor is displayed which follows the mouse on all of the graphs at the same time. If you have a engine monitor view active, the values in the engine monitor reflect the current cursor position.

To move the cursor around on a graph view, simply move the mouse. If you'd like to see other parts of the graph, you can use the X and Y scroll bars. Note that the X axis of each graph view is synchronized with the X axis of all of the other graph views.

### 8.9.5.2 Zooming In And Out

Sometimes a graph view won't reflect exactly the X and Y ranges you'd like to see. The ECU+ Win software gives you multiple ways of zooming in and out:

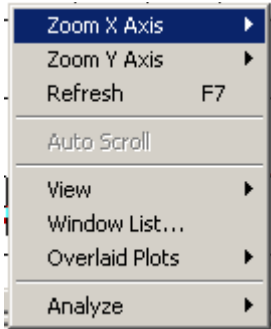
- The keyboard shortcuts F8, Shift+F8 and Ctrl+F8 are configured to zoom the X axis in, out, and to "full size" (as large as it can go), respectively.
- Similarly, F9, Shift+F9 and Ctrl+F9 zoom the Y axis.
- Other zoom options are available in the graph view Context menu (more on this in the next

section).

- And last but not least, you can use the left mouse button to manually zoom to a specific range – first, select the upper left corner, and press the left mouse button, then while holding down the mouse, drag the dotted box to the lower right corner and release the mouse.

### **8.9.5.3 Using the Graph Context (RMB) Menu**

Each graph view has what's called a "Context" or right-mouse-button menu, which you can access by right-clicking on the graph. This invokes a new menu:



*Illustration 52 - The graph view context menu*

The context menu has several items. The first three items apply to the current graph only, while the remaining options apply to the ECU+ Win software. The menu items are as follows:

#### **8.9.5.3.1 Zoom X Axis and Zoom Y Axis**

Use these menu items to zoom the X or Y axis of the graphs. Any X axis changes apply to all graphs, while any Y axis changes apply to the current graph only. You can zoom each axis in, out or to full size, or you can set the X and Y axis values to a specific size. The Y axis zoom has an additional option, "Fit Visible," which will scale the Y axis to match the visible data in that graph.

#### **8.9.5.3.2 Refresh**

This menu item redraws the current graph.

#### **8.9.5.3.3 Auto Scroll**

When capturing new data, this option is enabled. With the option checked, new data will cause all of the graph views to scroll rightward. If you un-check the option, the graph will not scroll with new data. Compare this option to the pause icon – pause throws away new data while keeping the graph stationary, while Auto Scroll keeps the graph stationary while continuing to acquire new data.

#### **8.9.5.3.4 View and Window List**

These menu items will be described in the section Setting Up Views on page .

#### **8.9.5.3.5 Overlaid Plots**

This menu item will be discussed in the section Overlaying Multiple Capture Files on page 54.

### 8.9.5.3.6 Analyze

This menu item will be described in the section Analysis Tools on page 56.

## 8.9.6 Setting Up Views

After starting a new capture or opening an existing capture file, the ECU+ Win software will open a collection of views to show you the data associated with the capture. Each view will open in a window in the display area of the software. You can then use the mouse or the Windows minimize and maximize buttons to resize each window. Your best bet, though, is to display the views you're interested in, and then use the *Window->Auto Arrange* menu item to tile the windows.

If you've minimized a view window, or it's underneath another window and you can't see it, you can use either the Window menu, and then select a window by number to show it, or right-click on another window, and select *Window List*.

To close out a view window, click the 'X' in the window's upper right corner. To display a new view window, use the right-click context menu, and select *View*. This will display a sub-menu that looks like this:

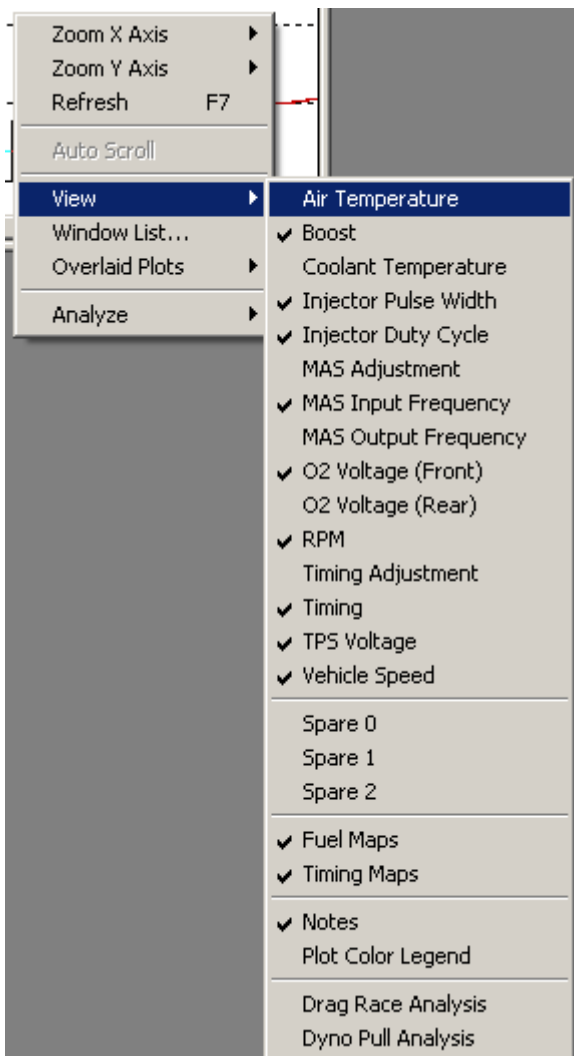


Illustration 53 - The context view menu

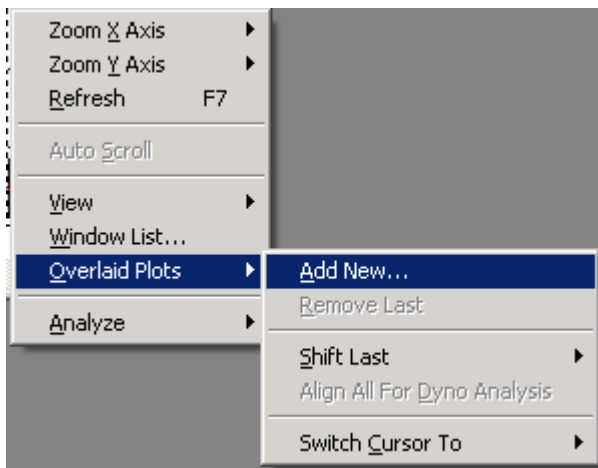
Click an item on this menu to activate or de-activate that view. Views that are checked are currently displayed, though they may be displayed in minimized view windows.

The key points to remember are:

- Use *Context Menu->View* to activate a view, or
- Use *Window->Window List* to un-minimize a view window or display it in front of the other windows

### 8.9.7 Overlaying Multiple Capture Files

When displaying a capture file, it's often handy to be able to view several capture files at the same time for comparison. The ECU+ Win software lets you do just that with the concept of "overlaid plots." Here's how it works:



*Illustration 54- The overlaid plots menu*

1. Open up an existing capture file, and arrange the view windows the way you like them.
2. Use the right-click context menu on one of the graphs, then select Overlaid Plots->Add New. The standard Windows file-open dialog will appear. Select another capture file.
3. The ECU+ Win software will overlay this new capture directly on top of the original capture file, using a different color for each capture on the graph.



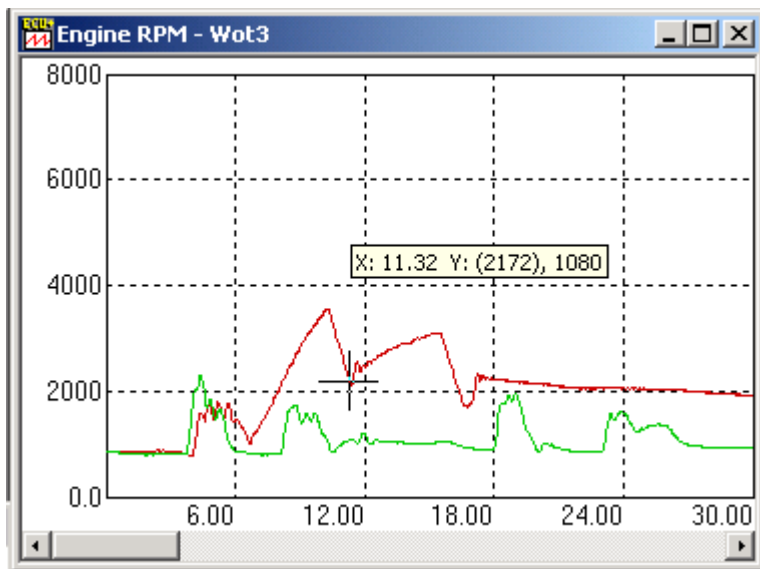


Illustration 55- Two overlaid captures

4. When you hover the mouse over the graph, the Windows tooltip will display the Y axis values for all of the overlaid captures. The current capture's value is in parenthesis. You can switch which capture is current with the TAB and shift-TAB keys.
5. Next use the “Shift Last” menu item (or the more-convenient “Align All for Dyno Analysis” menu item) to align the two plots in time:

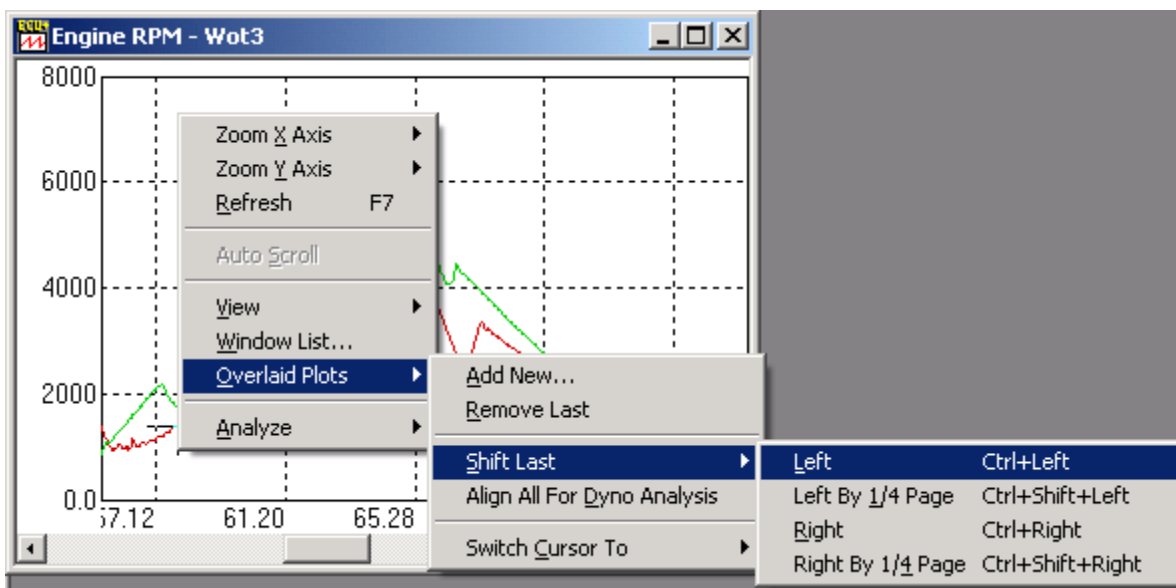


Illustration 56- Aligning two captures

6. When you're all done, use the “Remove Last” menu item to remove the last capture from the graph views.

Being able to overlay multiple captures is a very powerful technique to compare your vehicle's performance before and after a hardware modification or when tuning your car's fuel and timing via the ECU+ head unit. In the next section, we'll see some more powerful techniques with the Analysis Tools of the ECU+ Win software.

## 8.10 Analysis Tools

The ECU+ Win software offers two powerful analysis tools that will help you to tune your car for best performance. They are the Drag Race Analysis and the Dyno Analysis.

### 8.10.1 Drag Race Analysis

You can access the drag race analysis from the graph view context menu as *Analyze->As a Drag Race*. What this analysis tool does is to treat the capture as though it was a run down a ¼ mile dragstrip, and calculates the elapsed time, vehicle MPH and distance 25 times a second. Additionally, it'll display typical drag race statistics, like 60' time and ¼ mile trap speed.

To use this tool, select *Analyze->As a Drag Race* from the graph view context menu. You'll see a dialog like Illustration 57:

Drag Race Analysis - CapDB0040

Input  
Approx Run Start Time  secs

Summary

60'	<input type="text"/>	secs	<input type="text"/>	MPH
330'	<input type="text"/>	secs	<input type="text"/>	MPH
660'	<input type="text"/>	secs	<input type="text"/>	MPH
990'	<input type="text"/>	secs	<input type="text"/>	MPH
1320'	<input type="text"/>	secs	<input type="text"/>	MPH

Details

Time	Distance	MPH
------	----------	-----

Illustration 57 - The drag race analysis dialog

With the dialog visible, enter in the approximate start time of the drag race and click the *Calculate* button. The ECU+ Win software will try to find a spot past the start time in which the car was over 60 MPH, and then search backwards to find the time when the car was stopped. It'll treat the stopped time as the start of the drag race and compute the vehicle's ¼ mile performance.

You can use the drag race analysis on a real dragstrip (or a deserted road) to see how your car was doing at various points in the run, and to compare the car's performance before and after a modification.

Use the *Add Summary to Notes button* to remember the values calculated here. This adds the summary values to the notes view for this capture file.

Some considerations when using the drag analysis:

- The calculations use the vehicle's speed sensor, so if you've got non-stock gearing or tires, the analysis may not match exactly what you'd get from a real dragstrip run.
- The calculations assume no tire spin, which is fairly accurate for AWD cars. FWD cars will be less accurate.

### 8.10.2 Dyno Analysis

The dyno analysis tool, accessible from the graph context menu (*Analyze->As a Dyno Pull*) or from the dyno icon on the toolbar, is perhaps the most useful tool in the ECU+ Win software. What the dyno analysis tool does is to treat a short, single-gear acceleration as a dyno pass. From the data in the capture file, ECU+ Win will calculate your engine's horsepower and torque and plot it in an X-Y graph that can be zoomed or printed just like the other graph views. Here's how to use it:

1. Find a deserted back road where you can do some test runs. The road should be flat and straight. You'll use a road sign or marker on the road as a "launch" spot.
2. Start a new capture on the ECU+ Win software.
3. Drive your car along the back road in 2<sup>nd</sup> (or 3<sup>rd</sup>, if you have access to a drag strip) gear, and "lug" the car at the lowest possible RPM. As soon as you pass the launch spot, floor the accelerator and let the car accelerate to redline. Then coast back down and pull off of the road.
4. Stop the capture and save the file. It may be useful to name the file so that you can easily recognize it later ("20040301 Run3 – Boost at 19 PSI.ecd").
5. Later at home, or after stopping the vehicle, open this new capture in the ECU+ Win software, and manually zoom the X axis so that just the acceleration time is visible. This will be easy to find, as the TPS sensor will show the car at WOT, and pretty much everything will be increasing with time.

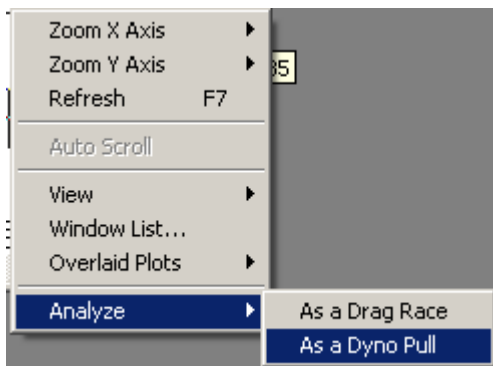


Illustration 58 - The dyno analysis menu item

6. Open the dyno analysis. ECU+ Win will have filled in the start and stop times from your zoomed graph. Update the other inputs on the left side, and press the *Calculate* button. The ECU+ Win software will now display your car's horsepower and torque graph, just as though you had done a run on a real dyno. See Illustration 59 for a sample graph.

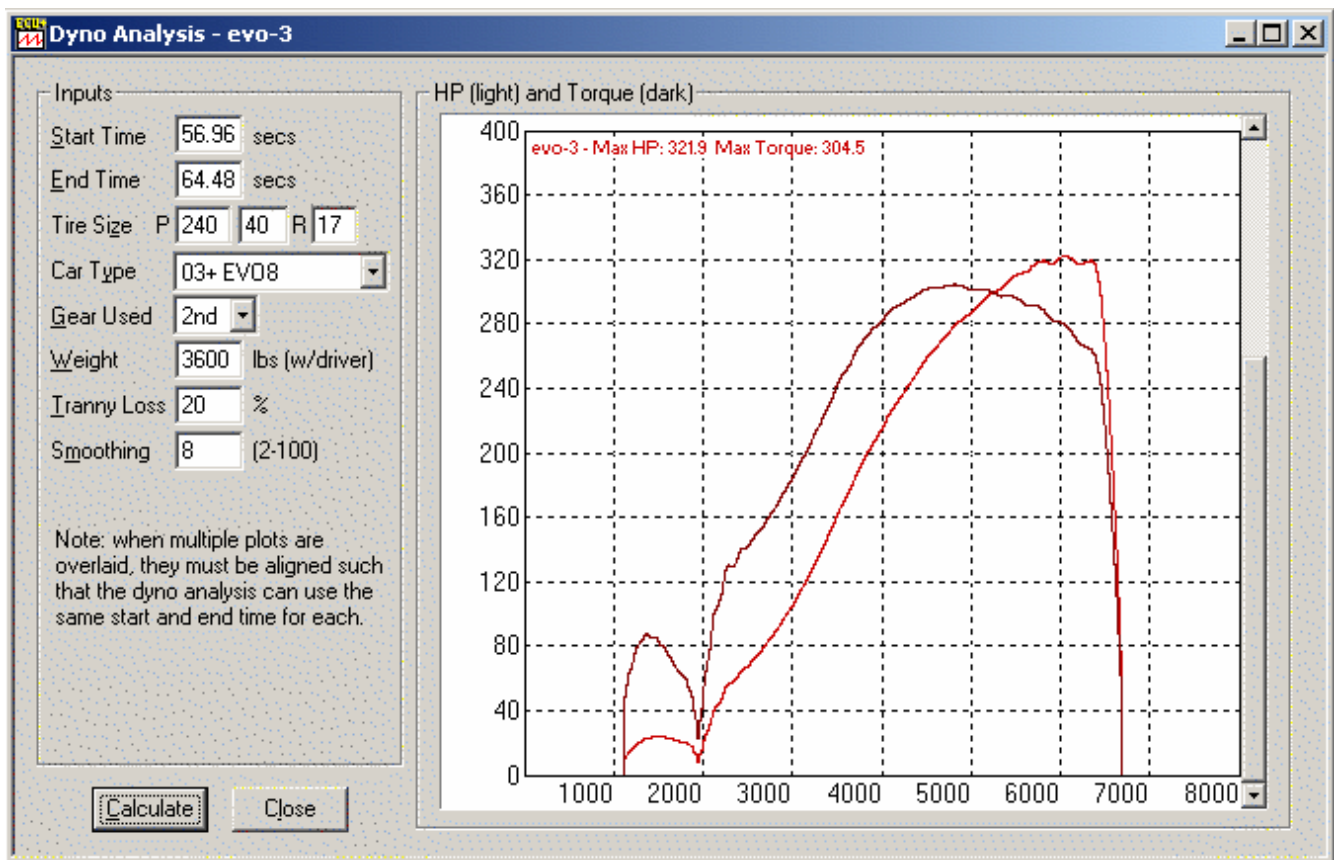


Illustration 59 - A dyno analysis

With the dyno analysis done, you can zoom the dyno graph with the mouse, or right-click for a context menu that has the usual zoom capabilities. You can also print the dyno analysis with the *File->Print* menu item. Use the *Close* button to close the dyno analysis.

The dyno analysis uses the engine's RPM to compute all of its results. Because the vehicle's speed (and thus acceleration, and thus torque and horsepower) is calculated based on the car type, car weight, gear used, and tire size, it's important to set these parameters consistently from one dyno run to the next in order to see reliable plots.

Some things to consider when doing a dyno analysis:

- The dyno analysis uses the *Tranny Loss* parameter to compute the engine's crank horsepower from the measured (wheel) horsepower. If you'd like to plot wheel horsepower, put zero in this field.
- The *Smoothing* parameter smooths the engine RPM before doing the dyno calculation. Larger numbers give smoother plots. Generally, values in the 8-12 range work best.
- The ECU+ Win software will remember your dyno analysis parameters from one session to the next, so it makes sense to put in the correct values for tire size and weight.
- When testing the effects of a performance modification (like a new air filter, or a change in the fuel maps), it's important to do your "dyno runs" in similar weather, and always use the same launch point on the road.
- You can overlay two or more captures, and then do a dyno analysis. The dyno analysis will show you the dyno results from each of the captures, all overlaid on the same dyno plot. This is incredibly useful when tuning your car. The only caveat is that you must align

the two overlaid graphs such that the dyno analysis time is the same for each. As an example, if graph 1 did a second gear acceleration starting at 32 seconds, and graph 2 started at 28 seconds, you'll need to move the second overlay to the right by 4 seconds. Use the graph context menu item *Overlaid Plots->Shift Last->Align For Dyno Analysis* to do this automatically.

- The dyno numbers are mathematically correct, but may not exactly reflect the numbers that you'll get on a true vehicle dyno. Nonetheless, what's important is not the absolute horsepower and torque numbers, but instead that you can see whether changes you make to your vehicle increase or decrease its performance.

## 9 Tuning Your Engine With the ECU+

This section provides some general information on tuning your car with the ECU+. Before starting, please read and heed the following warning:

### YOU CAN DESTROY YOUR ENGINE WITH THE ECU+!

**Neither the manufacturer nor the distributor of this device are responsible for any damage done to your vehicle due to the use of this device.**

Always remember the above when tuning your vehicle. If you're conservative when tuning, you'll be able to use the ECU+ to make small, incremental improvements to your vehicle's performance, and most important of all, not destroy your engine in the process. It's sometimes said that engines make maximum horsepower just before they blow up...

To avoid destroying your engine, keep in mind that an excessively lean mixture and timing that is too-far advanced can lead to detonation. Excessive detonation will destroy your engine's internals. So be very very careful when reducing fuel flow or advancing timing with the ECU+ system.

### 9.1 "Tools" Required

When tuning your car, you should have the following "tools" available:

1. The ECU+ system (of course), with the ECU+ Win software running on an in-car laptop.
2. A boost gauge, and possibly the ECU+ map sensor, wired into the system.
3. An Exhaust Gas Temperature (EGT) gauge. This allows you to monitor your vehicle's exhaust gas temperature. Rapidly increasing EGT values
4. A wideband O2 sensor. These are expensive, standalone boxes that can display your vehicle's air-fuel ratio very accurately. If this isn't available, the front O2 sensor in your vehicle will make a (poor) substitute.
5. A friend to ride in the car with you. Your friend will pilot the laptop while you pilot the car. Note: please don't refer to your friend as a "tool" - he might not appreciate it. :)

### 9.2 Making Runs

The best way to tune with the ECU+ is to make a series of dyno runs. See the section Dyno Analysis on page . You should select a flat, deserted road and make a series of runs, one per capture file. Between each run, make a single change in the fuel, timing or other

parameters. Then pull off the road and use the dyno analysis capabilities of the software to compare the most recent run to the previous run and see how the horsepower and torque curves compare. This will tell you whether you're making adjustments in the right direction or not.

You should start out by striving for consistency. The same section of road. Going WOT at exactly the same RPM and launch point on the road. The same dyno numbers and curves when you don't change anything. Once you've got a consistent set of dyno plots, change the fuel, or timing, and make some more runs. See if the car gained horsepower in a portion of the graph, or if it lost horsepower. Continue iterating until you've got the best performance from your engine.

### **9.3 General Tuning Techniques**

- Before beginning tuning, setup the injector scaling values. These establish a baseline fuel offset for the injectors in your car.
- You should start with a base set of fuel maps, and tune from there. To determine the base fuel maps, consider the size of your car's injectors as compared to stock, and determine the base fuel maps from that. Use the ratio of your current injector size to the stock injector size as the base. For example, if you have 550 cc injectors in your car now, and the car came with 440 cc injectors, you should use a base map value of -20%. That is, you'll use  $(100\% - 20\%) * (550 \text{ cc} / 440 \text{ cc})$  to get back to 100%, or stock levels of fuel flow.
- With the injector scaling values in place, set all of the cells in the fuel and timing maps to all zero.
- Tweak the idle fuel map cell for best idle. You'll probably find that the larger the current injector, the harder it is to achieve a smooth idle.
- On the road, make several runs with the fuel and timing maps set to zero. Try to launch your car from a roll consistently so that the resultant dyno plots are almost identical.
- Next, make changes to the fuel maps for WOT conditions and do some more runs. Power is generally gained by reducing the fuel map values, thus making the engine run leaner. From the factory, most cars run very rich at WOT, and the ECU+ allows you to compensate for that. For each change you make, make no more than a 2% change from the last run. Change one or two fuel map cells at a time. When you bring the car to a stop, you'll want to look at the front O2 voltage, which should be around 0.90 volts. Also look at the timing view and see how it compares to the previous run. If you find that the timing suddenly drops off at high RPMs, there's a good chance that the stock ECU heard some knock from the motor. This indicates that you're running too lean – fix that right away. Also, when you're doing the runs, always watch your EGT gauge for rapidly rising temperature. Again, this indicates an overly-lean condition. If you have a wideband O2 sensor hooked up to the ECU+, use that for tuning. Try to get your air/fuel ratios in the 12:1 range.
- Once you've optimized the WOT fuel tables, transfer the same values to the high load fuel table cells.
- With the fuel table optimized, try tweaking the timing tables at WOT. Make only 1 degree timing changes between runs. Generally, you'll want to advance the engine timing, thus moving the spark time backwards so that it fires earlier before top-dead-center (TDC) of the piston. This means putting positive numbers in the timing map cells. As with the fuel tables, make small changes and see what happens.

## 10 Troubleshooting Software Problems

This section provides some tips for diagnosing and fixing common software-related problems.

### 10.1 ECU+ Win Problems

#### 10.1.1 The Software Never Connects

*When I click on the "New Capture" button, a "Connecting" box pops up that says "Connecting to the ECU+ head unit...", but a connection never happens.*

To "connect," the ECU+ Win software looks for a specific stream of data from the head unit. Whenever the head unit is turned on, it transmits this stream of data. If the ECU+ Win software never sees the stream of data, it'll never "connect."

There are several things you'll want to check:

1. Is the ECU+ hooked up to the serial port? You'll use the straight-through DB-9 serial port to connect to your laptop. Double-check the connections, ensuring that the serial cable is secure and tightened down on both the ECU+ head unit and laptop end.
2. Are you connected to the serial port on your laptop. On a laptop, serial ports are male DB-9 connectors.
3. Does Windows recognize your serial port, and is it ok? Bring up the Windows Device Manager (usually under My Computer->Properties->Hardware->Device Manager). You should have a "Ports" entry for your serial port, and if you display its properties, Windows should say "this device is working properly."
4. Make sure the ECU+ Win software is using the correct serial port.
5. Make sure there are no hardware conflicts. Sometimes Windows will "detect" a serial mouse when none exists. Manually disable these in the device manager.
6. Does the Palm software work ok? If so, the head unit is fine.
7. Your car's ignition must be in the on (not accessory) position to power up the ECU+ head unit.

As a last resort, you can use the HyperTerminal application to check to see if the ECU+ head unit data stream is getting into your laptop. Here's how:

1. Close down all applications. Start HyperTerminal.
2. The "New Connection" dialog comes up first, type in "TestCom1" and then Ok.
3. On the next screen, set the "Connect using" field to COM1 (or whatever serial port you're using) and then Ok. Next a "COM1 Properties" dialog will come up. Set "Bits per second" to 19200, "Data bits" to 8, "Parity" to None, "Stop bits" to 1, and "Flow control" to None. Then Ok.
4. With the ignition in the on position, you should see junk streaming onto your HyperTerminal screen. At the bottom status line, it should say "Connected <time> Auto detect 19200 8-N-1".

If the HyperTerminal test shows data coming into your laptop, then the ECU+ Win application should work..



### 10.1.2 Glitches

*I sometimes get glitches on my capture files when using ECU+ Win, but there are no glitches with the Palm software. What's up?*

The ECU+ Win application is a fairly CPU-intensive piece of software. If your laptop is slow, ECU+ Win may not be able to keep up with the incoming data stream. This causes “glitches” to appear in the captures. There are several things you can do to improve this:

1. Close all other applications when doing a capture.
2. Don't resize or move windows while doing a capture.
3. Within ECU+ Win, try to keep the number of graph views to a minimum. Redrawing the graphs takes the most CPU time of anything in the ECU+ Win application.
4. Minimize the ECU+ Win application while doing a capture.

### 10.1.3 Can't Open Serial Port

*When I start a capture, ECU+ Win says it can't open the serial port. What could be wrong?*

There are several possible reasons for this error. First, is the ECU+ Win software setup for the correct serial port? Step through the diagnosis in the section “The Software Never Connects” first. Once you've established that you have the correct serial port configuration, check to see if some other device is using the serial port. Often, the Palm desktop and HotSync applications will take over the serial port. Disable these applications and see if the problem goes away.

## 11 Support and Getting Help

Because the ECU+ system is a complex device, you may have problems with the software or installation. You have several lines of support open to you:

- For hardware installation problems, contact the dealer that you purchased the ECU+ system from. They're best equipped to handle these type of problems.
- For software support, again your dealer is a good first place to start.
- For tuning help, your best bet is the forums at [forums.ecuplus.com](http://forums.ecuplus.com). The forums are a great place to hang out and learn about how others are using their ECU+.
- For any type of support, you also have the option of e-mailing the ECU+ developer – just send an e-mail to [support@ecuplus.com](mailto:support@ecuplus.com). E-mails will generally be answered within 24 hours.
- If your ECU+ was working fine, but “breaks,” contact your dealer for information about their return and repair policies.