E-Manage Ultimate

Installation & Setup on a VQ30DE/DE-K (A32/A33 ECU)

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Version 1.1

Table of Contents

List of Figures

Table of Contents (cont'd)

List of Pictures

Page

List of Tables

Page

1.0 Introduction

So I am finally getting around to putting together a bit of a write-up for installing the E-Manage Ultimate (hereafter called the EU). Before getting into things, there are some points to note first:

1. This is not an in-depth "how-to" on automotive/electrical wiring. I am assuming that you can competently use wire strippers, a soldering iron or crimper, heat shrink, electrical tape, etc depending on the connection type you choose to use. **Always disconnect the battery before doing wiring!**

2. This guide has been written based on the 4th and 5th gen Nissan Maxima ECU's (i.e.—the A32 & A33). All pin locations and wire colors have been taken from the 1998 and 2001 Factory Service Manuals (FSM's). There may or may not be differences in wire color between your car and what I've listed here. **Whether the color matches or not you should ALWAYS verify that you have the correct wire (before cutting it) by checking the pin location at the connector!**

3. I am assuming that you have copies of the Installation and Operation Manuals that came with the EU. If you bought it second hand, or lost your copies, etc, these manuals can be downloaded from the Greddy USA website at http://www.greddy.com/tech/ There are also copies on the Mohdparts website which you can download at http://www.mohdparts.com/emanage/index.html#E-manage Ultimate: **This guide is meant to be a supplement to the Greddy Manuals, not a replacement.**

4. The guide has been written based on a "from scratch" install (i.e.—you are using the full EU harness with all 3 connectors and did not have an Emanage Blue installed before). If you had the Blue before with the Main harness (18-pin) and Ignition harness (12-pin) then you will only need to get the new 14-pin harness (Greddy part #15901501 – 1.2m harness, or part #15901502 – 2.5m harness).

5. The guide has been written more or less in a sequential format. It was intended to be followed through step by step by those unfamiliar with the EU, so a lot of information is included that some more experienced enthusiasts may not need. Feel free to skip at will. ;) There are references included in various sections that can be pulled out and used easily on their own without all the text (such as diagrams, pin-outs, software setup screen shots etc – see the Table of Contents).

6. And now a disclaimer: **Without exception, I will not be held liable whatsoever should you damage your car or any of its systems in any manner by using this guide. It is provided for reference only and is completely "use at your own risk!" The user should verify the accuracy of the information contained herein prior to installation/operation of the EU on his or her vehicle.** Having said that, I have made every effort to ensure the information in this guide is accurate; however, if perchance you find an error please email me at dvrditar@hotmail.com or send me a PM via maxima.org and I will correct it. If there are topics I have not addressed in this guide that you would like to see, please let me know and I will consider publishing future versions if warranted.

7. And one more: **Any sample EU maps/tables, etc contained herein are provided strictly for illustrative or instructive purposes only. Do NOT assume a given map will be immediately applicable to or safe to use on your car, even if it has been used on another car (some haven't)!**

OK let's get on with it!

1.1 What You Will Need

What you will need will vary depending on the type of connections you are making and what kind of optional harnesses and add-on devices you are using. I've listed the main items below that will be typical for most installations (this is not a comprehensive list):

Bare Bones Installation:

- Emanage Ultimate Unit and supplied Allen key
- Emanage Ultimate Harness (full harness with A, B, C connectors)
- Laptop (see the Greddy Installation manual for minimum system specs)
- USB A to B cable (typical USB printer cable)
- Phillips screwdriver (#2 if memory serves correctly)
- Electrical tools (soldering iron, solder, tape, heat shrink, wire cutter/stripper, crimper, extra wire, DB or other non-bulleted connectors, etc—depends on choice of connection type)

Typical Installation—Includes Bare Bones List PLUS:

- 6 resistors, each being 330 or 390 ohm, ½ watt (only needed if CEL for DTC P1320 pops up)
- Wideband O2 sensor (necessary for fuel tuning). Popular units include Zeitronix, PLX, Innovative etc, but must have linear output capability (see Sections 2.2 & 2.4)
- Greddy A/F sensor harness (see Sections 2.2 & 2.4)

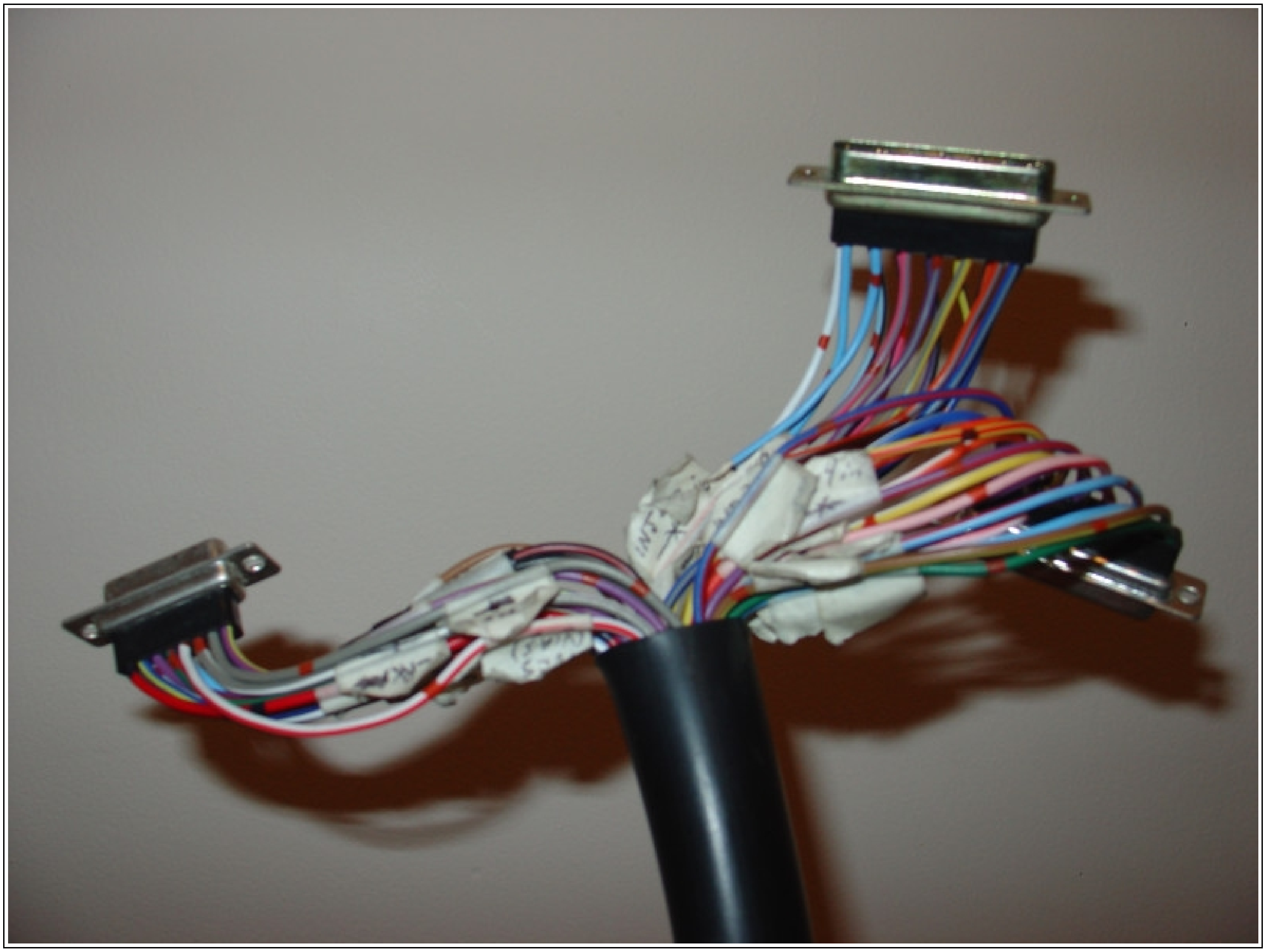
Other Optional Connectors/Devices:

- Greddy or other supported factory pressure sensor (mainly for boosted applications, or to eliminate the MAF sensor) (see Sections 2.2 & 2.4)
- Greddy pressure sensor harness, or substitute (see Sections 2.2 & 2.4)
- Remote datalogging switch (see Sections 2.2 & 2.4)
- Serial cable, for Greddy gauges etc

2.0 Sorting Out the Wires

The EU comes with a bunch of bullet connectors. It's your choice whether to use these connectors or not. Many people have just cut them off and soldered everything. However, I used D-Sub connectors (think serial type—commonly found at any electronics store—Radio Shack has them too I think). Since I was working with Greddy in developing/testing the EU out on the VQ30 I needed a way to easily disconnect and reconnect my connections and switch wires around, attach oscilloscope leads, etc. The D-Sub connectors worked well in that regard although they did take more effort in constructing all the crimped connections necessary. I have included a picture of my connector setup for those who may be interested but it really is up to you which route you wish to go. There are other electrical connectors available as well. **Whichever way you choose, you want to make sure you check each connection as you make it. Poor connections will make for troubleshooting hassles, noisy signals, or at worst, an un-drivable car.** *For most installations in which the EU is being left in the car permanently, I would recommend soldering and heat shrinking everything (this is just my preference for solid connections).*

Picture 1: D-Sub Connectors



You'll notice in the picture above that I took the time to identify and label each wire with small tags (just masking tape or anything else suitable) prior to crimping and inserting them into the connectors. I also did the same thing on the ECU side, so that every wire was identified prior to making all the connections. There are some 40 plus individual connections with the EU so *I highly recommend doing this, no matter what connection type you use*. It will make the install easier, especially if you have to go back and troubleshoot anything.

In order to make the task of matching up all the wires and connections easier, I have created tables listing all of the applicable ECU and EU pins and wire colors, for both the A32 and A33 ECU's. You will notice that there are a few channels on the EU that can be used in different ways and/or wired to different sensors/lines on the ECU (will be discussed later). The EU pin-out diagram can be found on page 11 in the Installation Manual. Following the tables I have included the A32 and A33 ECU pin-out diagrams also.

Table 1: A32 (4th Gen) ECU and EU Pin Locations and Wire Colors

	E-Manage Ultimate			A32 ECU (4th Gen)			
	Pin	**Color**	**Description**	**Pin**	**Color**	**Description**	**Connection Type**
Connector A (12 pin)	1	Light Blue / White	Ignition Input CH6	1	Yellow / Red	Ignition Coil - Cylinder 1	Intercept
	2	Pink / White	Ignition Input CH5	2	Green / Red	Ignition Coil - Cylinder 2	Intercept
	3	Purple / White	Ignition Input CH4	3	Blue / Red	Ignition Coil - Cylinder 3	Intercept
	4	Orange / White	Ignition Input CH2	7	Grey	Ignition Coil - Cylinder 4	Intercept
	5	Blue / White	Ignition Input CH1	8	Purple / White	Ignition Coil - Cylinder 5	Intercept
	6	Light Blue / Black	Ignition Output CH6	9	Grey / Red	Ignition Coil - Cylinder 6	Intercept
	7	Pink / Black	Ignition Output CH5	23	White	Throttle Position Sensor	Either
	8	Purple / Black	Ignition Output CH4	25	Black	ECU Ground (1)	Tap
	9	Yellow / Black	Ignition Output CH3	29	Pink / Blue	Vehicle Speed Sensor	Either
	10	Yellow / White	Ignition Input CH3	44	White	Crank REF Sensor (2)	Tap
	11	Orange / Black	Ignition Output CH2	49	White	Crank POS Sensor	Tap
	12	Blue / Black	Ignition Output CH1	54	White	Mass Airflow (MAF) Sensor	Either
Connector B (18 pin)	13	Light Blue	Airflow (Frequency) Input / VTEC Input	58	Sky Blue	Intake Air Temp Sensor	Tap
	14	Yellow	Airflow2 (Voltage) Input / VTEC Output	59	Yellow	Coolant Temp Sensor	Tap
	15	White	Airflow1 (Voltage) Input	64	White	Knock Sensor	Tap
	16	Grey	Throttle Position Sensor Input	67	Red	ECU Power (+12V) (3)	Tap
	17	Blue / Red	Injector Input CH1	102	Red / Black	Injector - Cylinder 1	Intercept
	18	Orange / Red	Injector Input CH2	104	Red / Yellow	Injector - Cylinder 3	Intercept
	19	Yellow / Red	Injector Input CH3	106	Blue / White	Injector - Cylinder 5	Intercept
	20	Purple / Red	Injector Input CH4	109	Red / Green	Injector - Cylinder 2	Intercept
	21	Purple	Airflow (Frequency) Output / VTM Output	111	Black / Orange	Injector - Cylinder 4	Intercept
	22	Green	Airflow1 (Voltage) Output	113	Purple / Red	Injector - Cylinder 6	Intercept
	23	Brown	RPM Input Signal				
	24	Black	Ground (ECU Ground)				
	25	Red	Ignition Power (ECU Power)				
	26	White / Red	Injector Input CH7 / A				
	27	Green / Red	Injector Input CH8 / B				
	28	Pink / Red	Injector Input CH5 / C				
	29	Light Blue / Red	Injector Input CH6 / C				
	30	Black / Red	Injector Ground (Sensor Ground)				
Connector C (14 pin)	31	White / Grey	Analog (Voltage) Input				
	32	Blue / Yellow	Knock Signal 1 / Water Temp				
	33	Grey / White	Crank Angle Signal Input				
	34	Blue / Grey	Injector Output CH1				
	35	Orange / Grey	Injector Output CH2				
	36	Yellow / Grey	Injector Output CH3				
	37	Green / Grey	Analog (Voltage) Output				
	38	Purple / Yellow	Knock Signal 2 / Intake Temp				
	39	Grey / Black	Cam Angle Signal Input				
	40	Brown / Yellow	Vehicle Speed Signal Output				
	41	Light Blue / Yellow	Vehicle Speed Signal Input				
	42	Purple / Grey	Injector Output CH4				
	43	Pink / Grey	Injector Output CH5				
	44	Light Blue / Grey	Injector Output CH6				

(1) Can also use pin #'s 10, 19, 32, 108, 116, or 124 for ECU Ground

(2) For 1999's the Crank REF Sensor is Pin 46 instead of 44

(3) Can also use pin # 72 for ECU Power Supply (+12v)

Table 2: A33 (5^{th} Gen) ECU and EU Pin Locations and Wire Colors

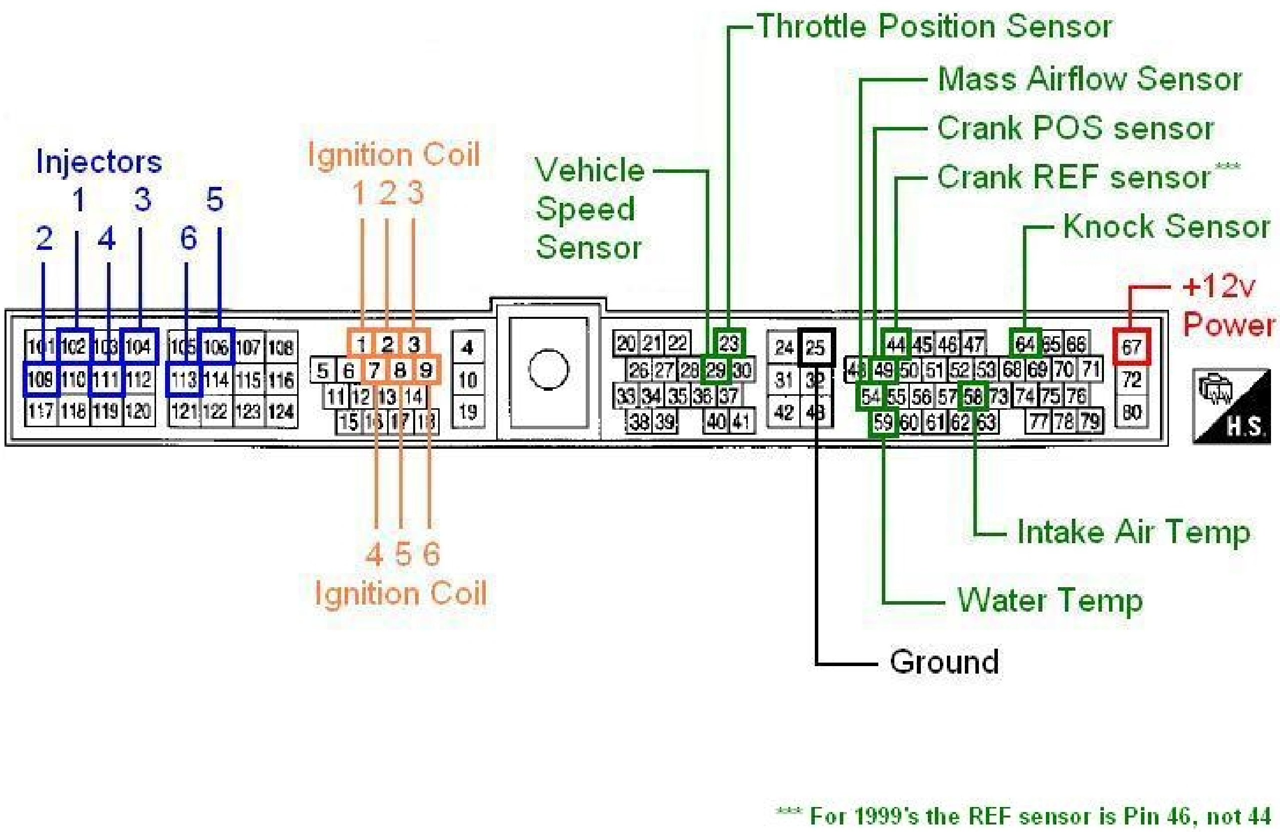
	E-Manage Ultimate			A33 ECU (5^{th} Gen)			
Connector	Pin	Color	Description	Pin	Color	Description	Connection Type
Connector A (12 pin)	1	Light Blue / White	Ignition Input CH6	16	Yellow / Green	VIAS Control Solenoid (1)	Either
	2	Pink / White	Ignition Input CH5	21	Yellow / Red	Ignition Coil - Cylinder 1	Intercept
	3	Purple / White	Ignition Input CH4	22	Green / Red	Ignition Coil - Cylinder 2	Intercept
	4	Orange / White	Ignition Input CH2	23	Blue / Red	Ignition Coil - Cylinder 3	Intercept
	5	Blue / White	Ignition Input CH1	30	Grey	Ignition Coil - Cylinder 4	Intercept
	6	Light Blue / Black	Ignition Output CH6	31	Purple / White	Ignition Coil - Cylinder 5	Intercept
	7	Pink / Black	Ignition Output CH5	32	Grey / Red	Ignition Coil - Cylinder 6	Intercept
	8	Purple / Black	Ignition Output CH4	48	Black	ECU Ground (2)	Tap
	9	Yellow / Black	Ignition Output CH3	61	White	Mass Airflow (MAF) Sensor	Either
	10	Yellow / White	Ignition Input CH3	64	Yellow / Green	Intake Air Temp Sensor	Tap
	11	Orange / Black	Ignition Output CH2	70	Yellow	Coolant Temp Sensor	Tap
	12	Blue / Black	Ignition Output CH1	75	White	Crank REF Sensor	Tap
Connector B (18 pin)	13	Light Blue	Airflow (Frequency) Input / VTEC Input	85	White	Crank POS Sensor	Tap
	14	Yellow	Airflow2 (Voltage) Input / VTEC Output	86	Pink / Blue	Vehicle Speed Sensor	Either
	15	White	Airflow1 (Voltage) Input	91	Blue / White	Throttle Position Sensor	Either
	16	Grey	Throttle Position Sensor Input	93	White	Knock Sensor	Tap
	17	Blue / Red	Injector Input CH1	101	Red / Black	Injector - Cylinder 1	Intercept
	18	Orange / Red	Injector Input CH2	102	Blue / White	Injector - Cylinder 5	Intercept
	19	Yellow / Red	Injector Input CH3	103	Red / White	Injector - Cylinder 2	Intercept
	20	Purple / Red	Injector Input CH4	104	Purple / Red	Injector - Cylinder 6	Intercept
	21	Purple	Airflow (Frequency) Output / VTM Output	105	Red / Yellow	Injector - Cylinder 3	Intercept
	22	Green	Airflow1 (Voltage) Output	107	Red / Blue	Injector - Cylinder 4	Intercept
	23	Brown	RPM Input Signal	110	Red / Green	ECU Power (+12V) (3)	Tap
	24	Black	Ground (ECU Ground)				
	25	Red	Ignition Power (ECU Power)				
	26	White / Red	Injector Input CH7 / A				
	27	Green / Red	Injector Input CH8 / B				
	28	Pink / Red	Injector Input CH5 / C				
	29	Light Blue / Red	Injector Input CH6 / C				
	30	Black / Red	Injector Ground (Sensor Ground)				
Connector C (14 pin)	31	White / Grey	Analog (Voltage) Input				
	32	Blue / Yellow	Knock Signal 1 / Water Temp				
	33	Grey / White	Crank Angle Signal Input				
	34	Blue / Grey	Injector Output CH1				
	35	Orange / Grey	Injector Output CH2				
	36	Yellow / Grey	Injector Output CH3				
	37	Green / Grey	Analog (Voltage) Output				
	38	Purple / Yellow	Knock Signal 2 / Intake Temp				
	39	Grey / Black	Cam Angle Signal Input				
	40	Brown / Yellow	Vehicle Speed Signal Output				
	41	Light Blue / Yellow	Vehicle Speed Signal Input				
	42	Purple / Grey	Injector Output CH4				
	43	Pink / Grey	Injector Output CH5				
	44	Light Blue / Grey	Injector Output CH6				

(1) Optional connection, not needed unless changing VIAS switchover point

(2) Can also use pin #'s 57, 106, or 108 for ECU Ground

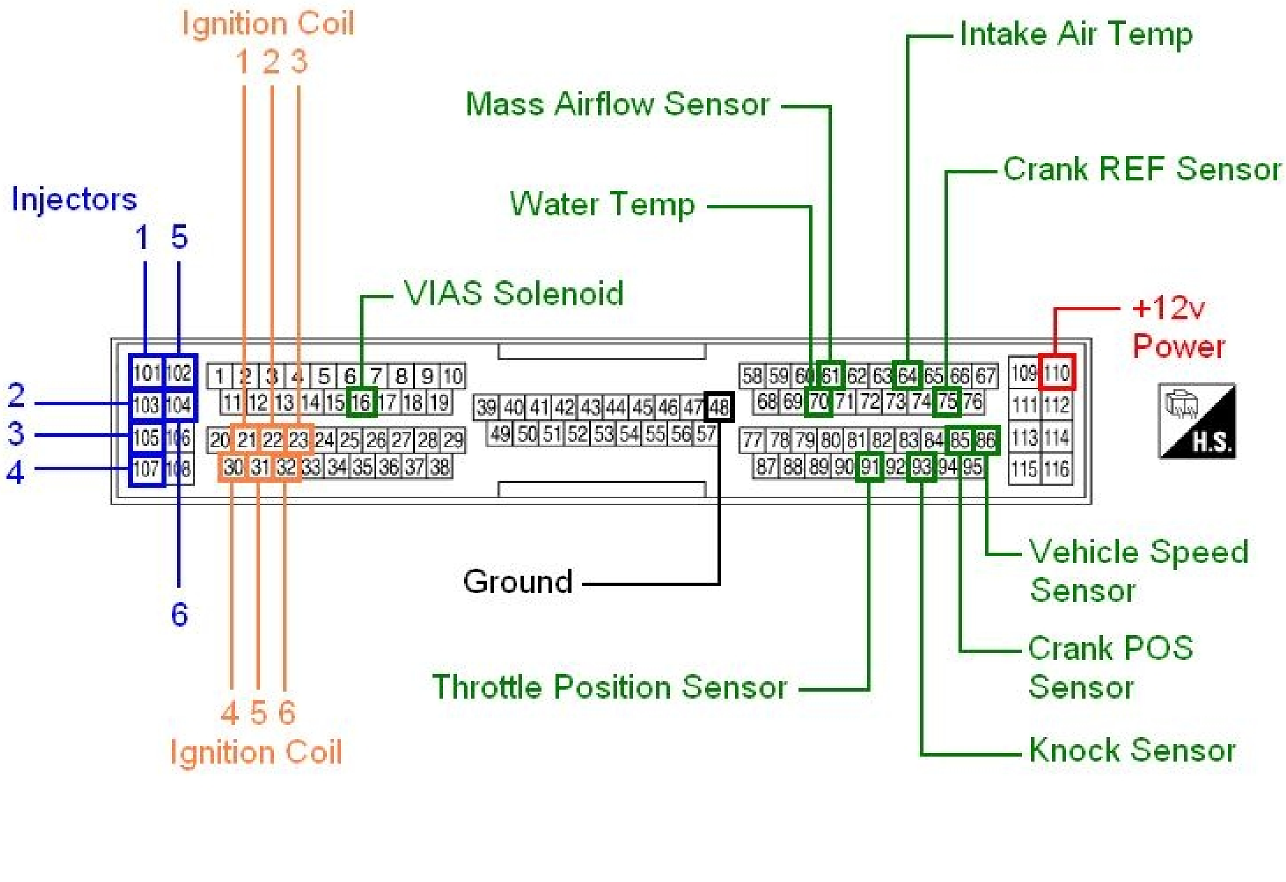
(3) Can also use pin # 112 for ECU Power Supply (+12v)

Figure 1: E-Manage Ultimate - 4th Gen Pin-out (A32 ECU)



E-Manage Ultimate - 4th Gen Pinout (A32 ECU)

Figure 2: E-Manage Ultimate - 5th Gen Pin-out (A33 ECU)



E-Manage Ultimate - 5th Gen Pinout (A33 ECU)

2.1 Connection Types

You will notice in Tables 1 and 2 that I've listed a "connection type" for each wire on the ECU. Each connection you make to the ECU will be either an "intercept" or a "tap." As I mentioned earlier, I'm not going to detail how to physically make an electrical connection; however, for clarity's sake I will explain a bit about what an intercept and a tap are with regards to the EU hookup. If this is old-hat to you feel free to skip this section (or any other for that matter)! ;)

An "intercept" connection is usually used on a signal line when the EU will be changing or modifying the signal on the way into or out of the ECU. To physically make this type of connection, the ECU line will need to be cut, and one side of it connected to an INPUT line on the EU, and the other side connected to an OUTPUT line on the EU. Which side becomes the input and which becomes the output is dependent on the signal type. For a sensor line, the EU input will generally be the side coming from the sensor, and then the output will go to the ECU. Essentially the EU is intercepting the signal coming from the sensor, and changing it before outputting it again to the ECU. However, if the line is for an actuator or solenoid, such as an ignition coil or injector, then the connection will be reversed. The EU input side will be the side coming from the ECU, and the output side will go to the device being driven.

A "tap" connection is usually used on a signal line when the EU needs to know what the signal is, but does not need to alter it. In other words, the signal coming from the sensor is allowed to go to the ECU without being changed by the EU along the way. The EU just reads the signal, but doesn't change it. Think of it like a phone tap. In addition to "tapping" sensor connections, this type of connection is also used for power and ground connections, etc. Unlike an "intercept", when making a "tap" connection you do not need to cut the ECU line. You will just need to expose a section of bare wire and connect the appropriate EU wire to it.

2.2 Optional Connections

You will notice in Tables 1 and 2 that I've listed some ECU connection types as "either," meaning that the connection type can be either a tap or an intercept depending on how you plan to use the EU. There are also a few choices on how to use some of the EU lines themselves, which becomes apparent when reading through the left side of the Tables. And finally, there are external ports on the EU (i.e.—separate from connectors A, B, & C) that can be used for additional devices/hookups which do not appear in the Tables. I will briefly discuss a few of the options and choices relevant to the Maxima but please refer to the Greddy Manuals for further details.

<u>EU pin 13: Airflow (Frequency) Input / VTEC Input</u>
<u>EU pin 14: Airflow2 (Voltage) Input / VTEC Output</u>

These lines can be used for inputting a frequency-type airflow meter, or for inputting a second airflow meter if the car has one. Neither of these cases apply to the Maxima, so in our case these lines can be used as an auxiliary input & output to drive a non-pulse width modulated device. For most installations the input line will not be used. But the output line produces a 12 volt signal when turned on so it is useful for driving relays, solenoids, etc. This output is controlled by the Auxiliary Output Setting map in the software (more on this later).

EU pin 21: Airflow (Frequency) Output / VTM Output

This line is typically used on Hondas or on cars with frequency-type airflow meters, neither of which is applicable to the Maxima and therefore this line is not needed on most installations.

EU pin 26: Injector Input CH7 / A
EU pin 27: Injector Input CH8 / B

These lines can be used as extra injector channels (for example, on V8 engines) or as additional output channels A & B. These outputs are applicable to any car and can be used to drive sub-injectors, relays, solenoids or any device that requires 12 volts or ground to be supplied. On the Maxima, probably the most common use for one of these channels is to drive the solenoid actuator for an intake manifold power valve (think VIAS ;). On my car, I also used one of these channels to complement a low-temperature thermostat by activating my fans earlier than the stock ECU settings.

EU pin 31: Analog (Voltage) Input
EU pin 37: Analog (Voltage) Output

These lines are an additional input & output designed to be used with any kind of sensor or actuator that outputs a voltage signal. Some examples include: changing the output of a factory pressure sensor to eliminate a boost cut, forcing an ECU into open loop by altering the throttle position sensor (TPS) signal, offsetting the output from an O2 sensor, or altering any other voltage signal you wish to. The input line can also be used by itself with a "tap" connection simply to datalog/monitor a signal.

EU pin 32: Knock Signal 1 / Water Temp
EU pin 38: Knock Signal 2 / Intake Temp

These lines are for inputting knock sensor (KS), coolant (water) temperature sensor, or intake air temperature (IAT) sensor signals. Unfortunately, this is one area where I would have liked the EU to have 1 or 2 extra lines. There are only 2 lines for 3 sensors, so if you wish to have all 3 connected then you will need to use the analog input for the 3rd. Note that if you wish to trigger a relay based on IAT or water temperature then the appropriate line has to be used, leaving the KS as the extra signal (if you still want both temperatures inputted). If you can forego one of the temperature inputs then you can hook the KS up; however, way back when I installed my EU it could not reliably read the KS signal (and couldn't even as of version 1.15). Apparently now with the recently released version 2.00 it should work, but I have not had a chance to verify this. Since I wanted both temperature sensors to be inputted, I used the Analog Input above for my KS. Doing this I was able to at least see the voltage waveform from the KS, but it was up to me to interpret what the signal indicated, in terms of what was knock and what wasn't.

ECU pin 16: VIAS Control Solenoid (Applicable to A33 5th Gen Only)

I've listed this an optional connection for any 5th gen owners who might want to change their VIAS activation point. If you wish to activate the VIAS at a higher rpm than the stock ECU does, then an intercept will be needed (but you may have a CEL). If you are only planning to open the VIAS earlier, then a tap is sufficient. Either way, wiring this line to output channel A or B (EU pin 26 or 27) is the easiest way to do it. More details on wiring & activating the VIAS on both the A32 and A33 will be provided in upcoming sections.

ECU: Throttle Position Sensor (TPS)
ECU: Vehicle Speed Sensor (VSS)
ECU: Mass Airflow Sensor (MAF)

I don't really consider these 3 lines optional, as they should all be connected, but I've listed their connection types as “either.” If you want to be able to change the output signal going to the ECU then use an intercept, otherwise a tap is fine.

The main reason to intercept the TPS would be to force the ECU to stay in open loop by feeding it a high TPS signal. **However, note that in this case you must connect the sensor to the EU analog input/output lines rather than the dedicated TPS line.** There really is no need to do this on a naturally aspirated (N/A) Maxima, so for most installations the TPS can just be tapped.

The VSS would be intercepted when eliminating a governor based on road speed (like on some GXE's). I am not sure how well this feature works; to date I have not heard any reports either bad or good. For most installations the VSS can just be tapped.

For a basic N/A setup, the MAF can just be tapped. However, if you plan on pulling the MAF out of the car and tuning via a manifold pressure sensor, then you will need to intercept this signal.

Option Ports and Switch Port

There are 2 additional “Option” ports on the front of the EU. They can be used for several things but are most commonly used for a pressure sensor on boosted cars and for a wideband O2 sensor. Greddy sells a pressure sensor as well as harnesses for those add-ons. The EU will also recognize several types of factory pressure sensors. **If you plan to use a wideband O2 with the EU (and you should), note that it must be able to produce a linear 0-5v signal for the EU to properly read the air/fuel ratio (AFR).**

There is also a switch port which can be used to stop/start the internal datalogger on the EU or to enable/disable a power shift rev limiter. Greddy sells a switch, but it is very easy to make your own and FAR cheaper so I don't recommend buying theirs.

2.3 Basic Wiring Diagrams

The previous sections contain a lot of reference material, including the tables and pinout diagrams but in this section we'll get down to the wiring diagrams themselves. If you follow these diagrams when connecting all the wires up, you should be able to get everything hooked up fairly easily, as almost all the information you'll need to make the connections is on the diagrams. Greddy did include wiring diagrams in their Installation Manual, which are not bad, but are kind of small and don't contain all the pin numbers and wire colors for the Maxima. Therefore I've made my own and added more information. The following diagrams are based on a typical install, and some of the optional items can be done differently but I've tried to note this where possible. To save space I've used abbreviations for the color coding; you'll find a legend following the wiring diagrams (Table 3). Also, **as noted previously, some wire colors on your car may be different; you should always check the ECU pin location to ensure you have the correct wire**.

Figure 3: A32 Wiring – Power, Ground, MAF, TPS

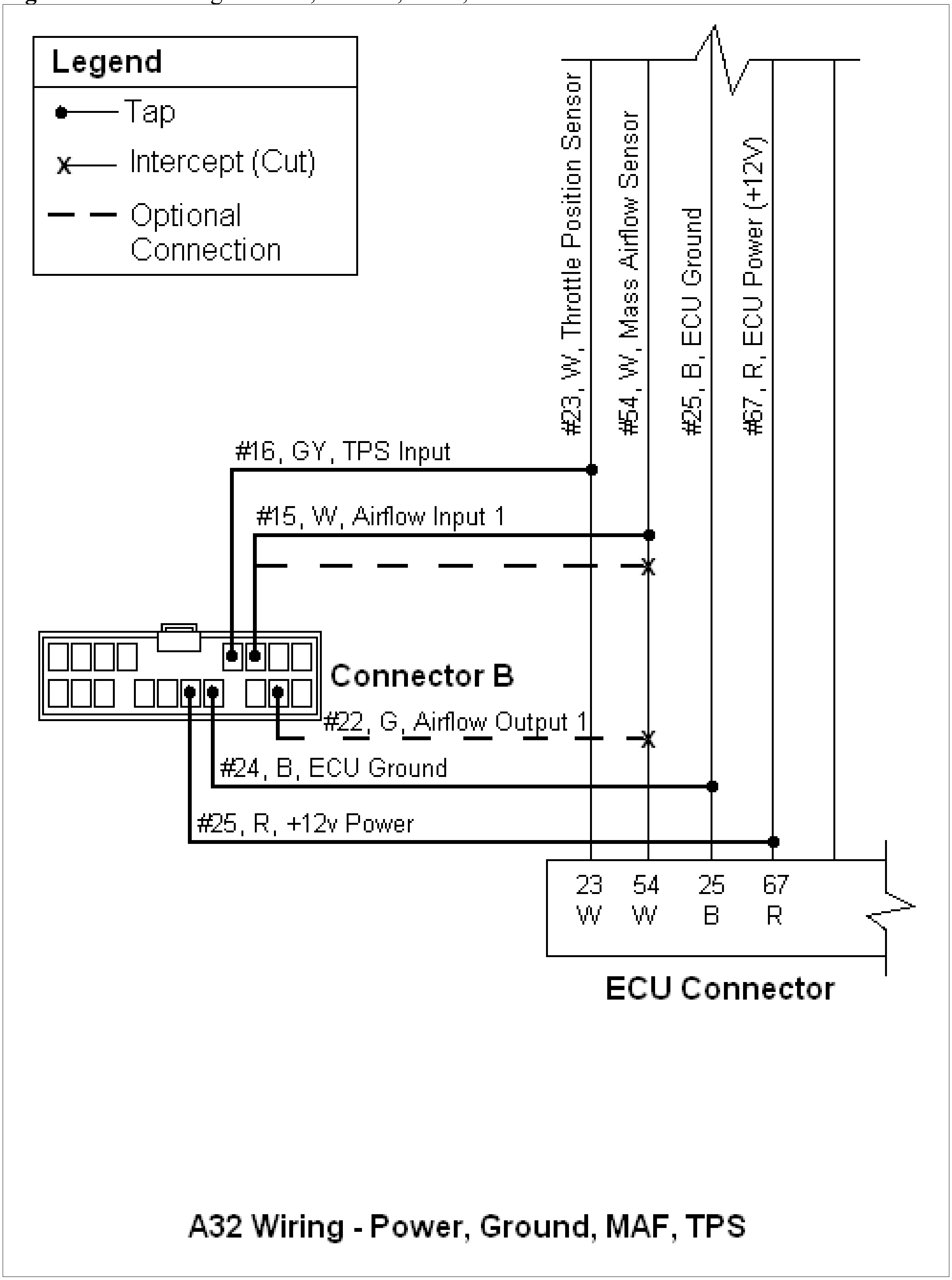


Figure 4: A32 Wiring – Injectors

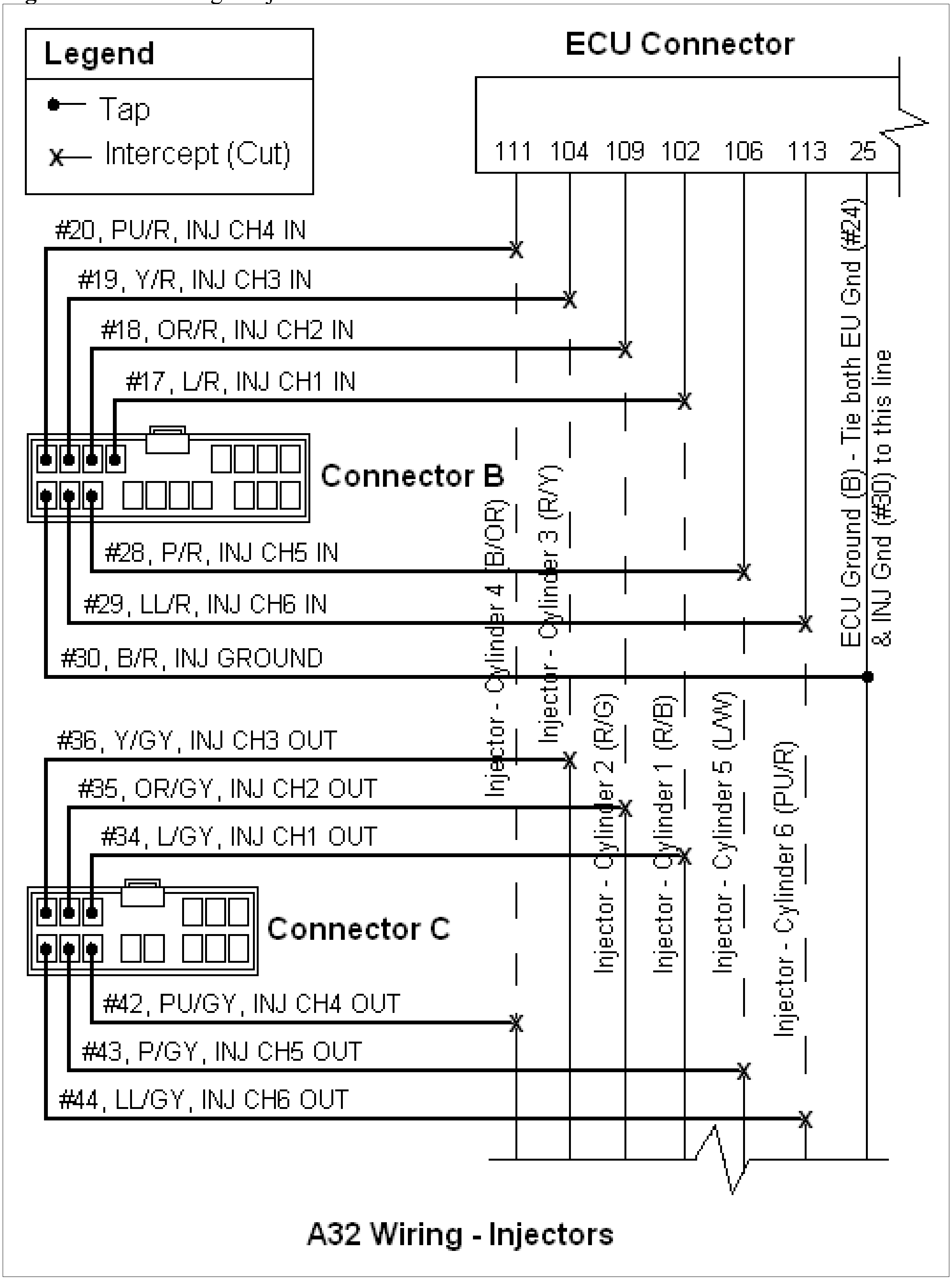


Figure 5: A32 Wiring – Ignition Coils

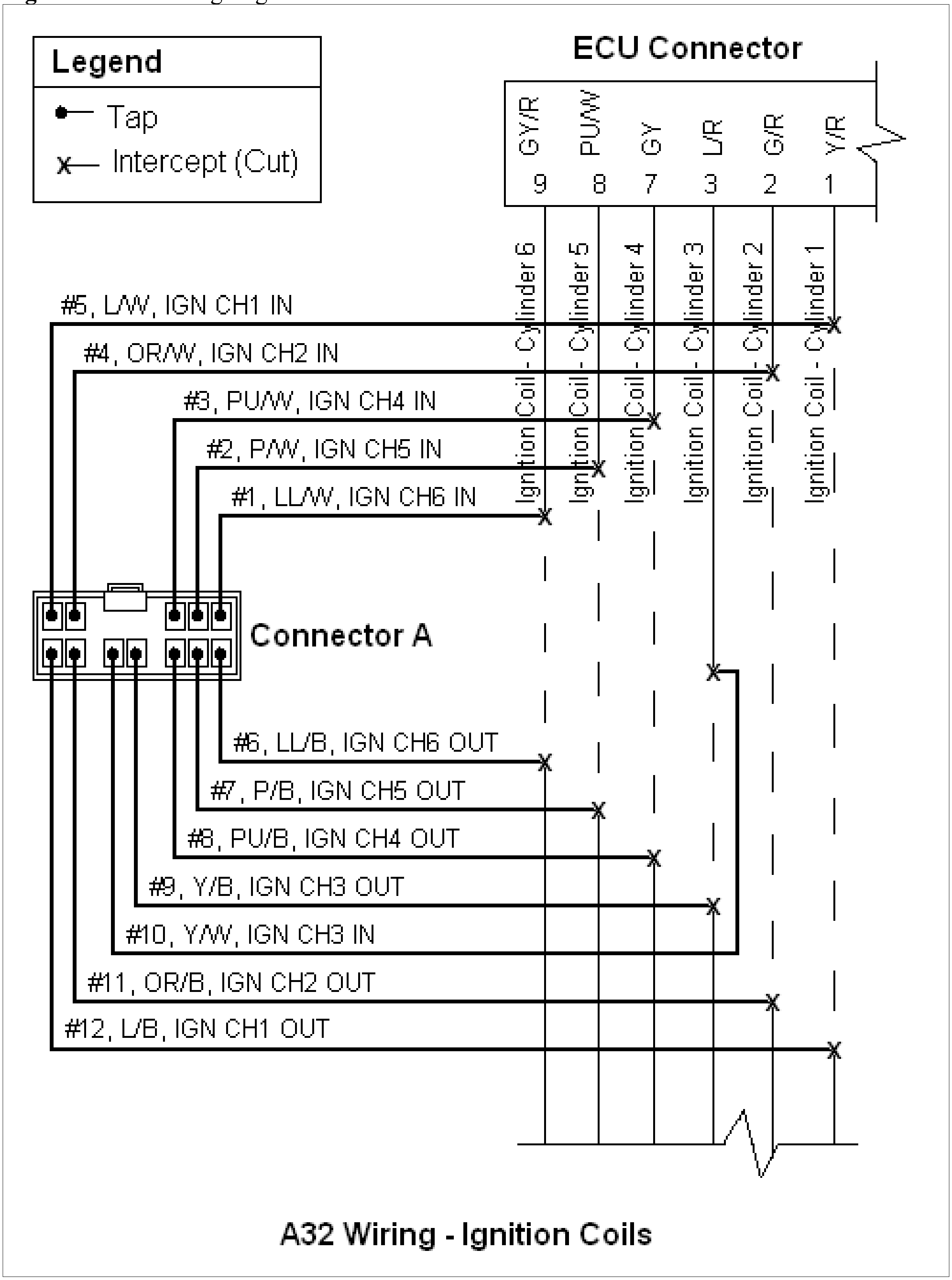


Figure 6: A32 Wiring – Miscellaneous Sensors

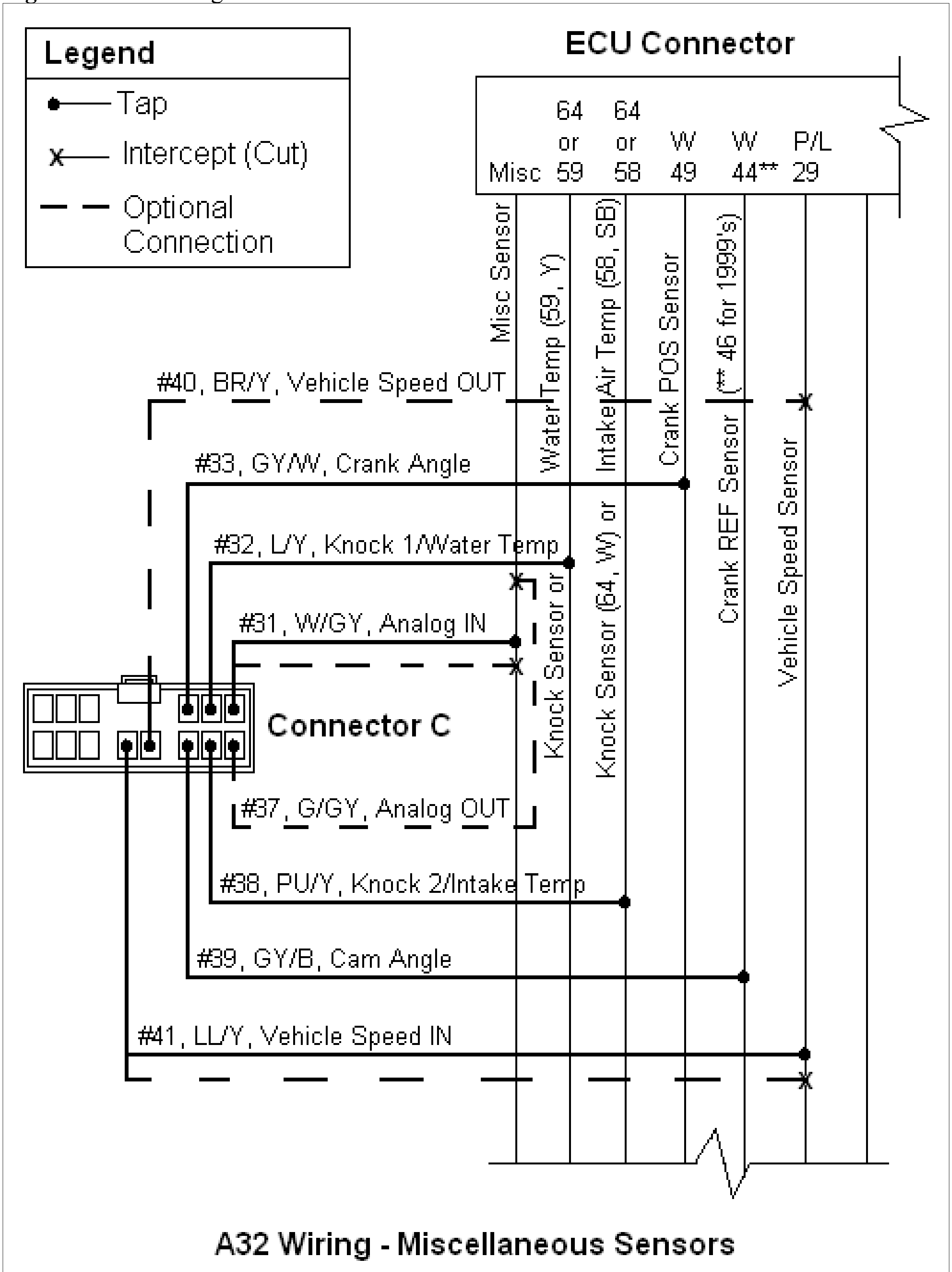


Figure 7: A32 Wiring – Optional Outputs

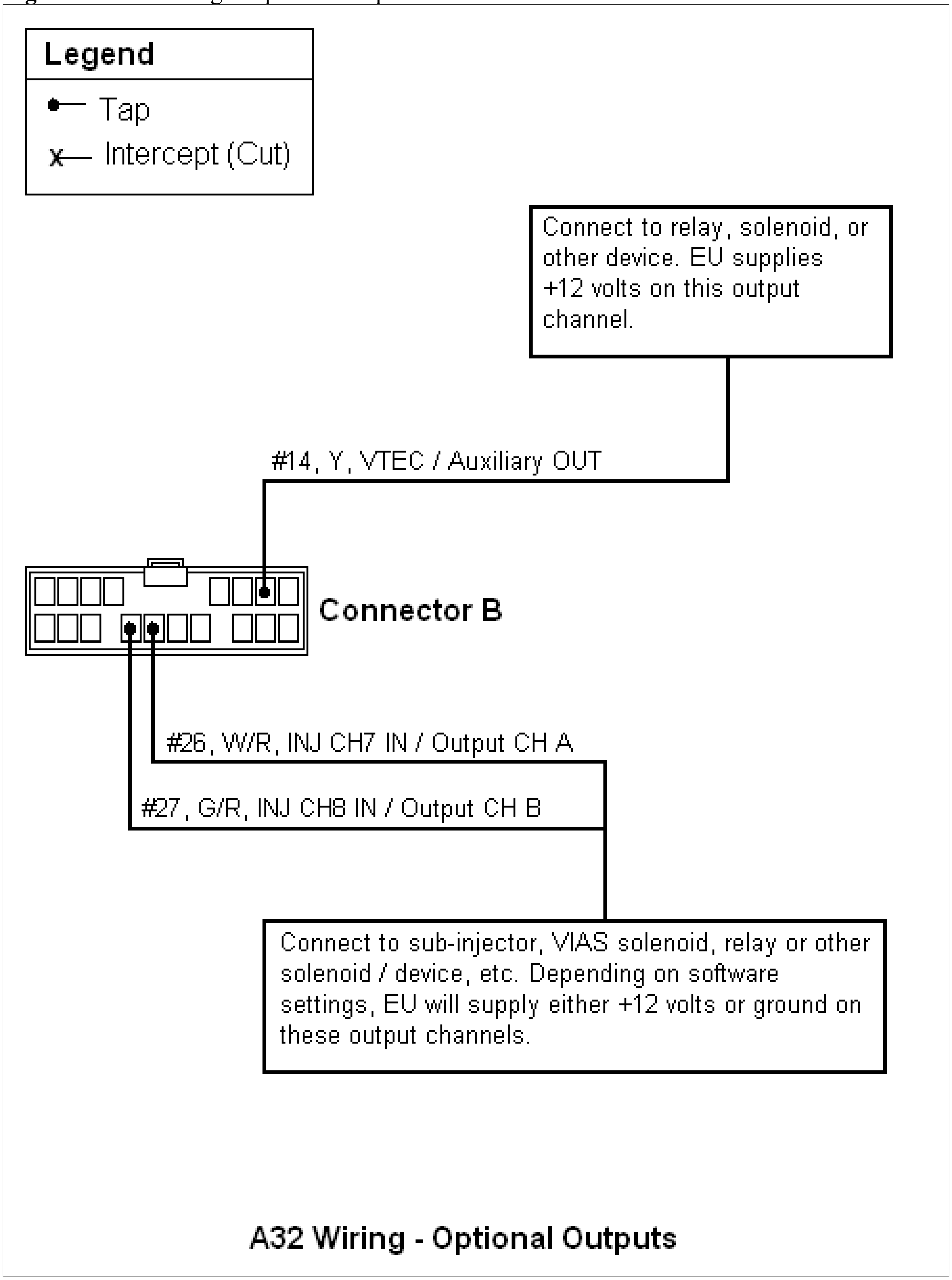


Figure 8: A33 Wiring – Power, Ground, MAF, TPS

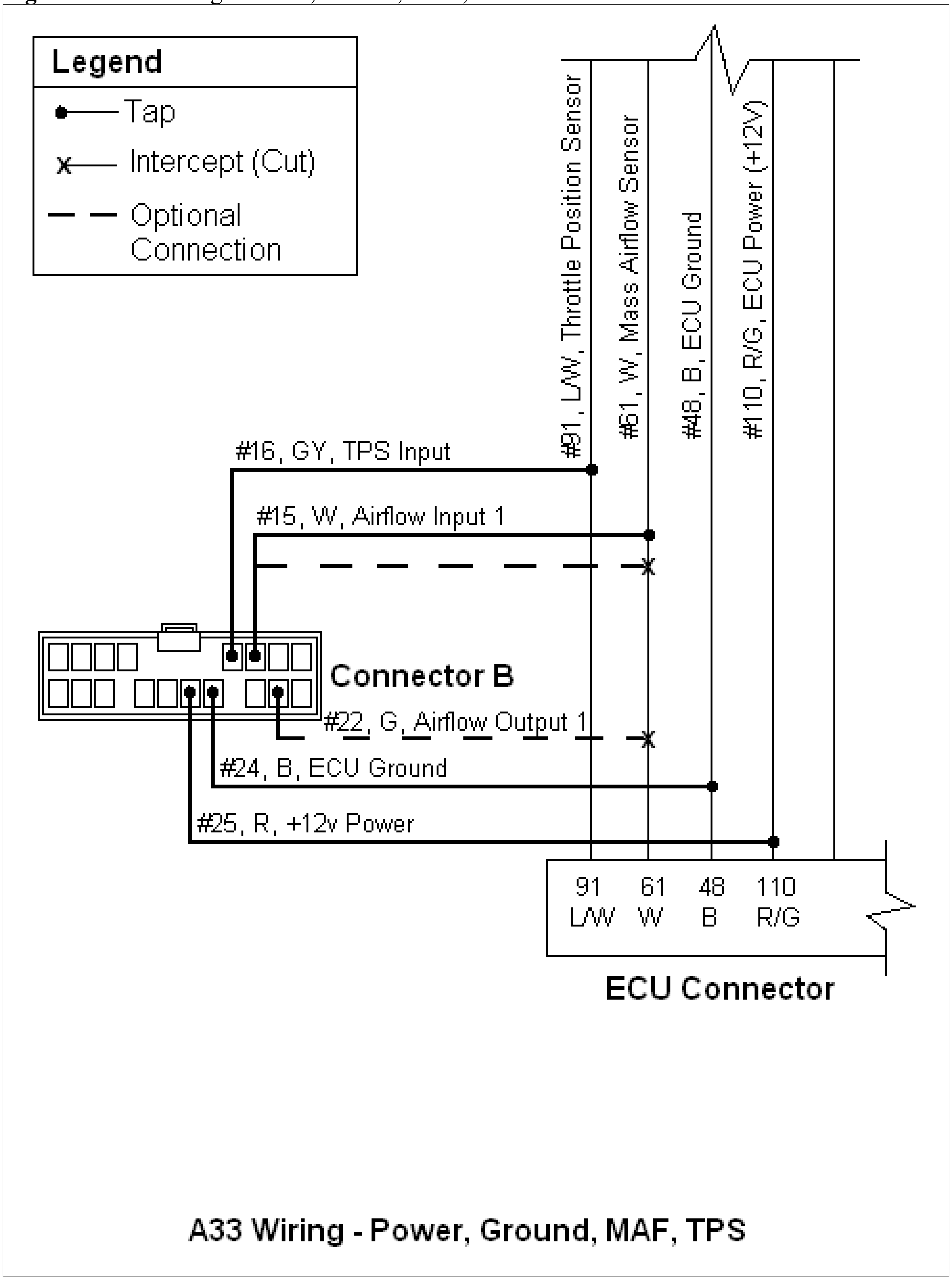


Figure 9: A33 Wiring – Injectors

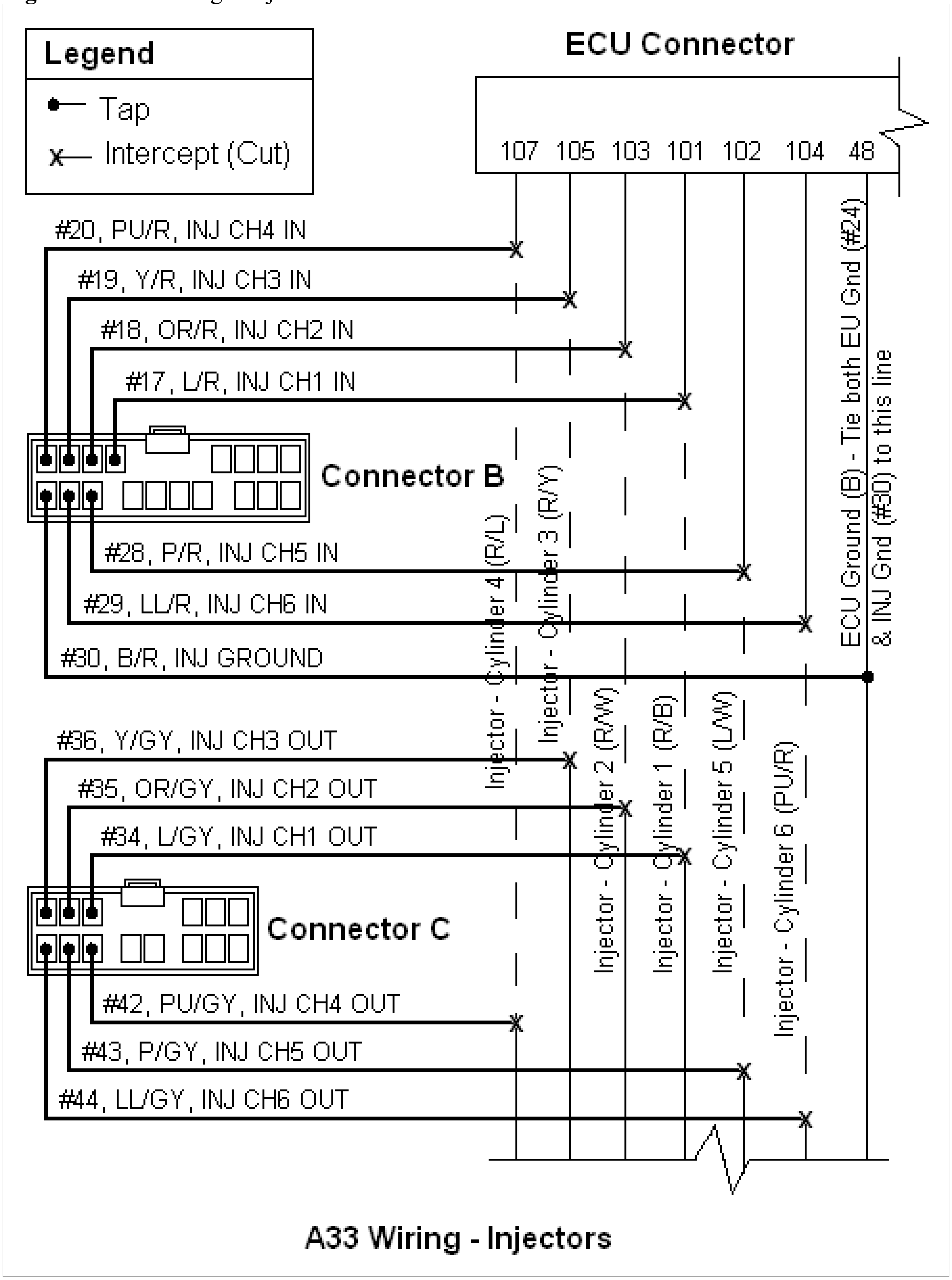


Figure 10: A33 Wiring – Ignition Coils

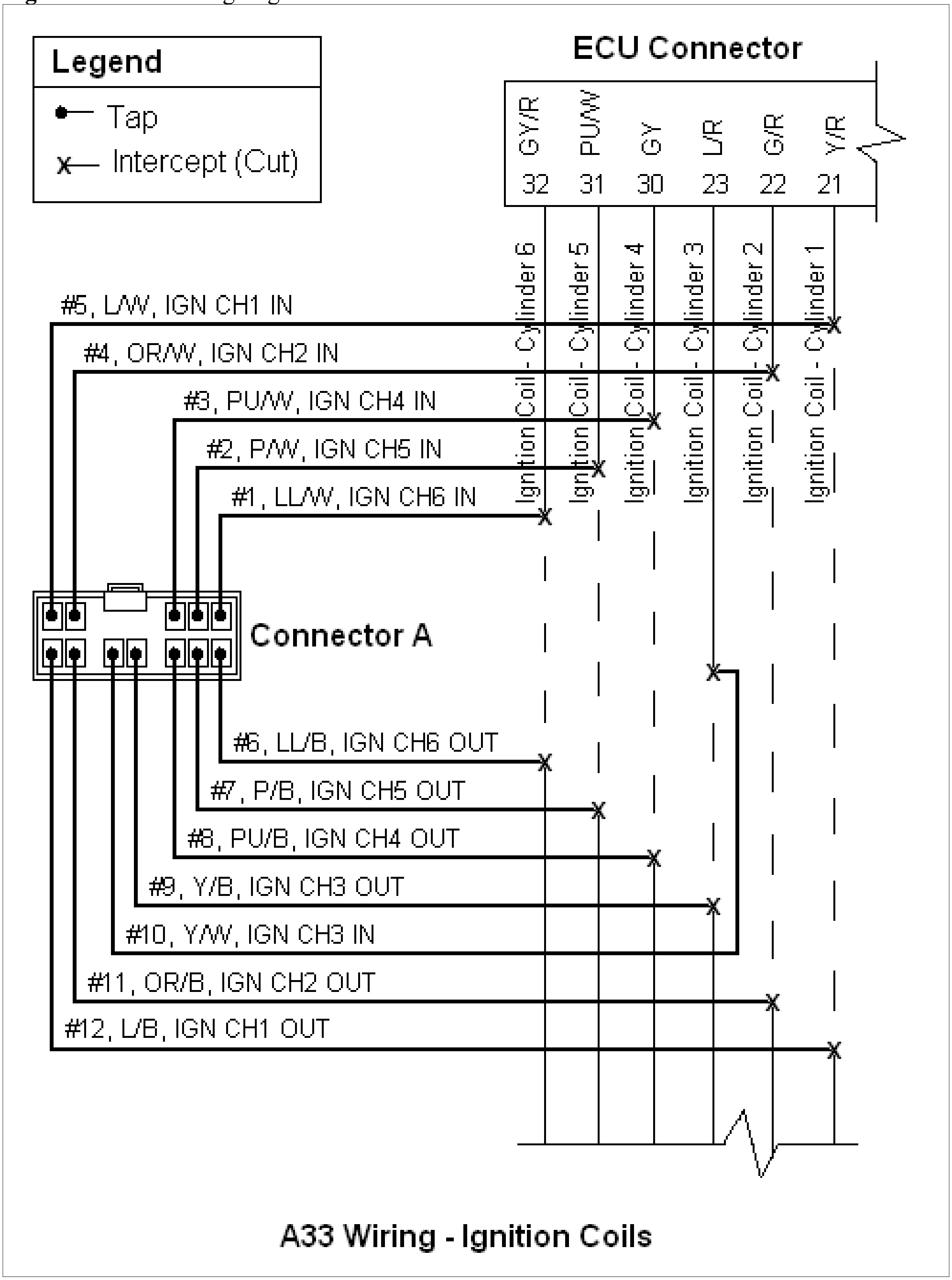


Figure 11: A33 Wiring – Miscellaneous Sensors

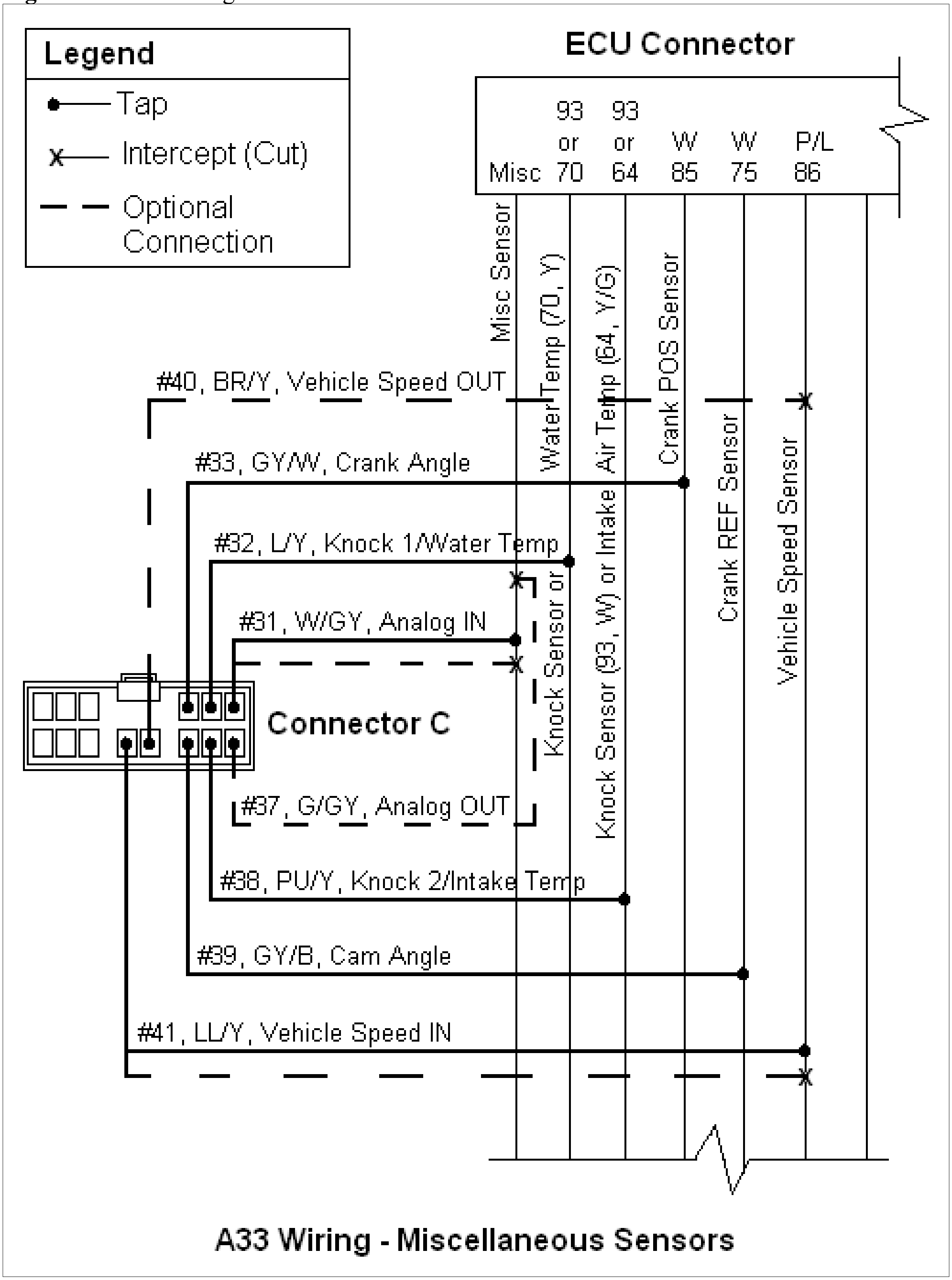


Figure 12: A33 Wiring – Optional Outputs

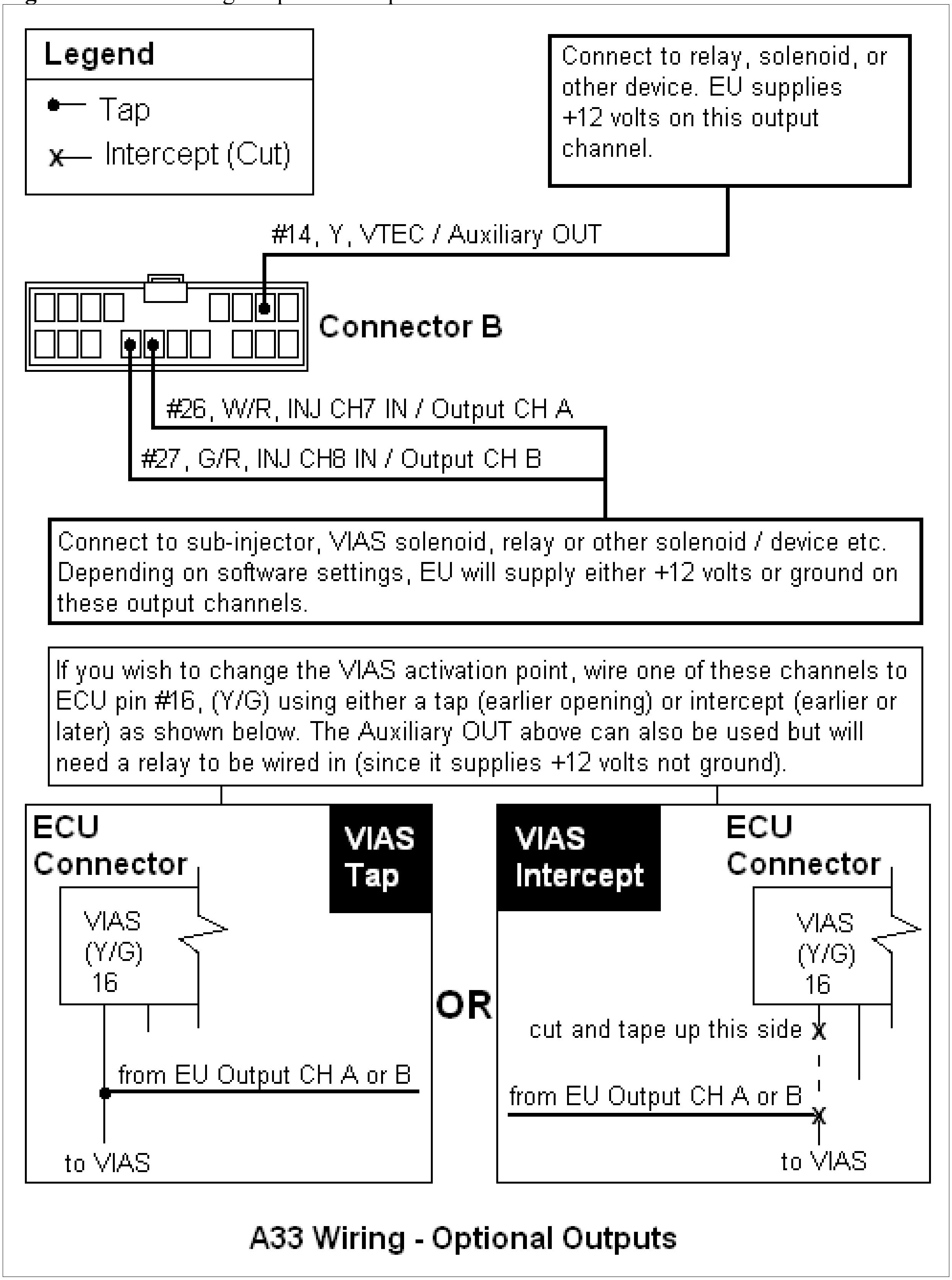


Table 3: Color Code Legend for Wiring Diagrams

Abbr.	Wire Color	Abbr.	Wire Color	Abbr.	Wire Color
B	Black	Y	Yellow	PU	Purple
W	White	LG	Light Green	GY	Grey
R	Red	BR	Brown	SB	Sky Blue
G	Green	OR	Orange	LL	Light Blue
L	Blue	P	Pink		

2.4 Option 1 and 2 and Switch Port Wiring

If you're inputting a pressure sensor or wideband O2 into the Option 1 or Option 2 ports on the front of the EU you'll need the corresponding harnesses from Greddy (part #'s 16401406 and 15900912). If you're using the Greddy 3 bar pressure sensor, there's no wiring required, just match the supplied connectors up. However, if you're using a factory pressure sensor, you may need to cut off the connector for the Greddy sensor and just splice the wires. I'm not going to provide diagrams for wiring up a factory pressure sensor, wideband O2, or switch with the EU since they are all 1 or 2 simple connections. I will just describe them:

Pressure Sensor Harness: Connect the red wire to the B+ (voltage supply) on the OEM sensor; connect the white wire to the sensor's signal line; connect the black wire to the sensor's ground line.

Wideband O2 Harness: Connect the white wire to the O2 sensor's signal line; connect the grey wire to the sensor's ground line.

Remote Datalogging Switch: You will need a momentary (pulse) type switch, a 1/8" male stereo plug, and some spare wire (20 gauge should be fine). These are all readily available from electronics stores. Connect one side of the switch to the tip and one side to the base (ground) on the mini stereo plug.

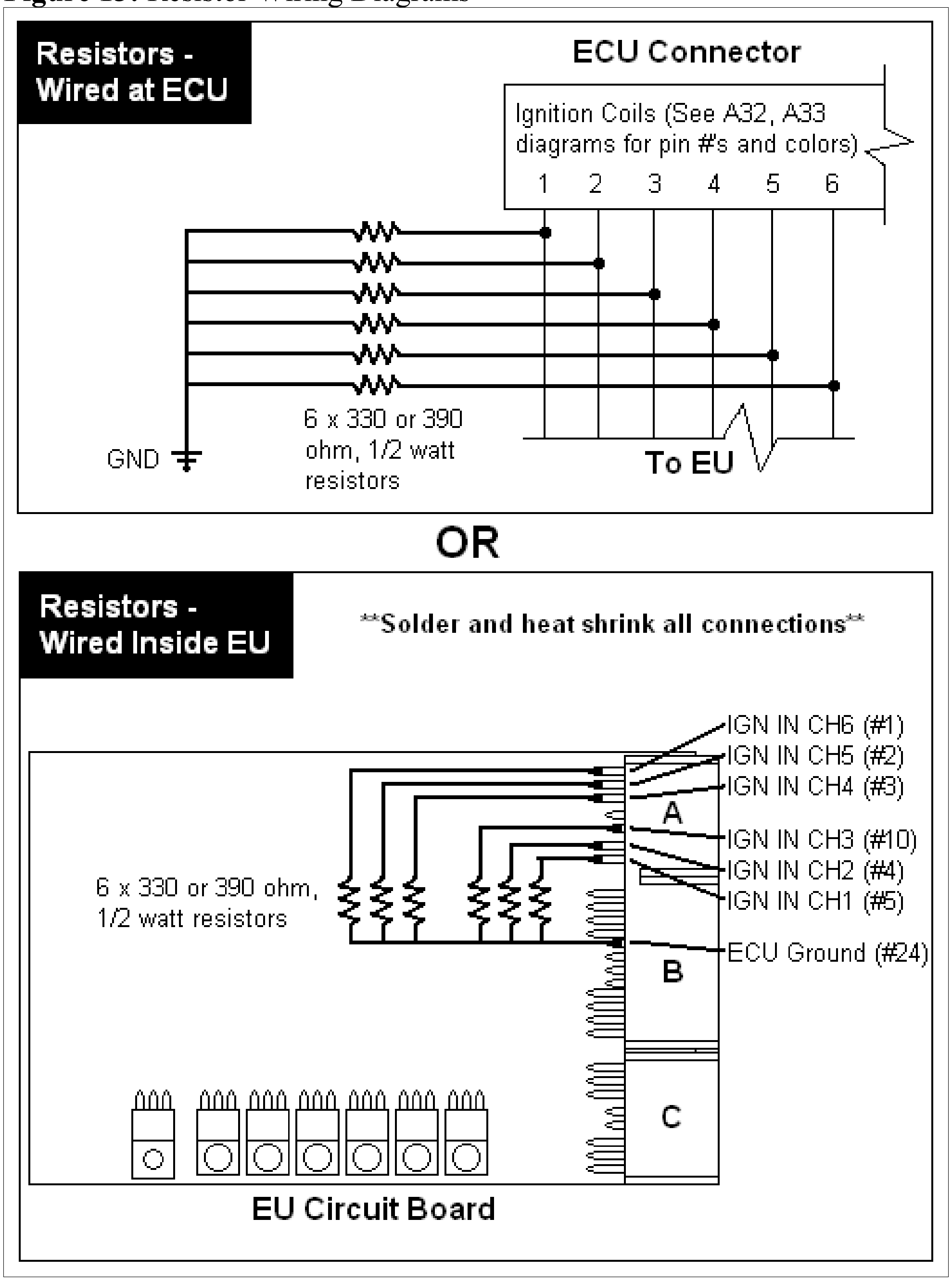
2.5 Resistors

At this point, as far as wiring goes there's only one more thing to address: adding resistors. When the ignition lines are intercepted by the EU in many cases the stock ECU will throw an Ignition Signal code/CEL (P1320, or 0201 in Nissan nomenclature). This is because the ECU does not see the electrical load on the circuit and thinks it is open. To re-introduce a load on the circuit, we can wire in small resistors. So far, it seems that most A32/A33's have needed these. It's possible this issue *might* have been eliminated with the most recent EU circuit board revision (version D). I can't say for sure though. It is up to you whether you wish to go ahead and wire the resistors in initially or wait and see if the CEL pops up. If you have a version D board, I'd probably wait and see what happens. **Note that the car should run fine, even if the P1320 code/CEL pops up, as long as the wiring is correct.**

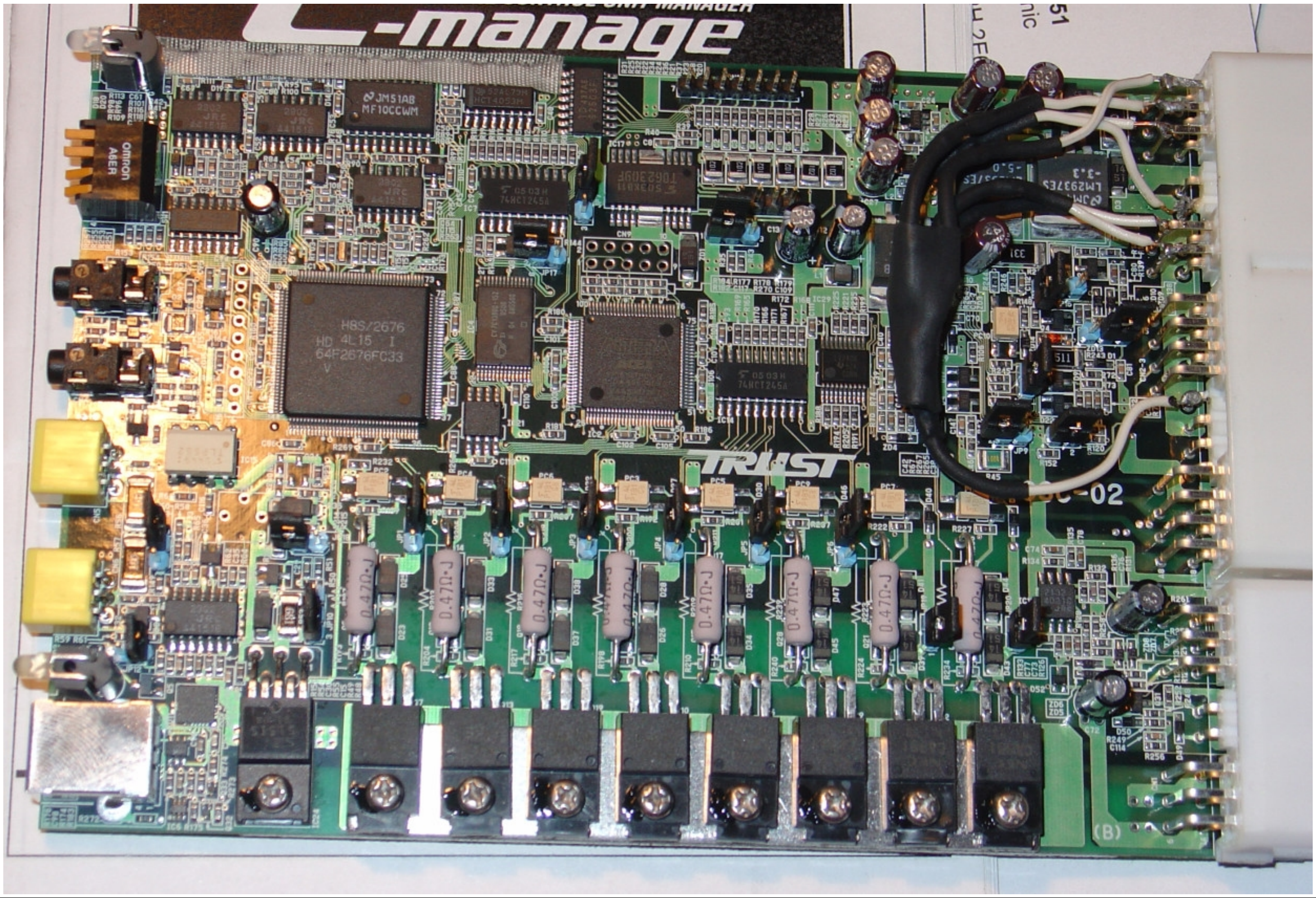
If you do get the CEL/code, you will need to wire one resistor onto each ignition coil line coming from the

ECU and tie it to ground *before the line is intercepted by the EU*. This can be done either on the wires themselves at the ECU harness, or inside the EU on the ignition INPUT pins. Personally, I chose to do it inside the EU, as it makes for a cleaner install and if you remove the EU at any point and reconnect the intercepted lines, you won't have the extra resistors left on the lines. The resistors should be 330 ohm, ½ watt rated. If your local electronics store doesn't have that size you can also use 390 ohm, ½ watts or apparently some have used ¼ watts without problem too. To help visualize how to wire in the resistors, I've provided a diagram below as well as a picture showing the resistors wired internally on my EU. Credit goes to John at J&S for suggesting the resistor fix.

Figure 13: Resistor Wiring Diagrams



Picture 2: Resistor Wiring – Inside the EU



2.6 Jumper Settings

So by now if you've been following through your wiring should be complete and you're getting close to being able to fire up the car. But before we do that we have to make sure the internal jumpers on the EU are set properly in accordance with the optional inputs and wiring methods you've chosen. Not doing so could damage the EU or other components on the car. Furthermore, setting some of the jumpers incorrectly could limit the options you have available in the tuning software. Table 4 below gives the typical jumper settings for the VQ30, as well as the Greddy factory defaults. *In most cases both the A32 and A33 can use the factory settings, but there are a few differences*. **You should always verify each jumper setting by looking at the little pin number(s) printed beside it on the EU circuit board**, rather than just using the diagram in the manual.

Table 4: Jumper Settings

Jumper	Description	OPEN	1 - 2	2 - 3	Default	A32/A33
JP1	Injector Input / Output CH1	IN / OUT	Addition Only	--	OPEN	**OPEN**
JP2	Injector Input / Output CH2	IN / OUT	Addition Only	--	OPEN	**OPEN**
JP3	Injector Input / Output CH3	IN / OUT	Addition Only	--	OPEN	**OPEN**
JP4	Injector Input / Output CH4	IN / OUT	Addition Only	--	OPEN	**OPEN**
JP5	Injector Input / Output CH5	IN / OUT	Addition Only	--	OPEN	**OPEN**
JP6	Injector Input / Output CH6	IN / OUT	Addition Only	--	OPEN	**OPEN**
JP7	Ignition Input Signal	--	Normal	Honda Distributor	1 - 2	**1 - 2**
JP8	Ignition Output Signal	--	5V	12V	1 - 2	**1 - 2**
JP9	Airflow Input / Output	Normal	Mazda Hot Wire	--	OPEN	**OPEN**
JP10	Airflow Input 2 / VTEC Output	--	GT-R RB26DETT	VTEC OUT	1 - 2	**2 - 3**
JP11	OPTION 1	Normal	Greddy Temp Sensor	--	OPEN	**OPEN**
JP12	OPTION 2	Normal	Greddy Temp Sensor	--	OPEN	**OPEN**
JP13	Knock Signal 1 / Water Temp	Normal	Pull Up	--	OPEN	**1 - 2 ****
JP14	Knock Signal 2 / Intake Temp	Normal	Pull Up	--	OPEN	**1 - 2**
JP15	RPM Signal Input	--	Normal Input	Coil (-)	1 - 2	**1 - 2**
JP16	Frequency Input / VTEC Output	Karman IN	VTEC IN	VTEC IN (K20A)	OPEN	**OPEN**
JP17	Frequency Output / VTM Output	VTM	Karman Output	--	1 - 2	**1 - 2**
JP18	Injector Input / Output CH1-6	IN / OUT	Addition Only	--	OPEN	**OPEN**
JP19	Injector Signal CH A	I/J Addition	I/J, Sub I/J, NVCS, Relay (-)	--	1 - 2	**1 - 2**
JP20	Injector Signal CH B	I/J Addition	I/J, Sub I/J, NVCS, Relay (-)	--	1 - 2	**1 - 2**

**** Note: some cars may need JP13 set to OPEN when using Water Temp (e.g. - if coolant temp gets high and/or fans don't come on).**

3.0 Updating the Software and Firmware

After the jumpers are set correctly and all wiring is complete, the next step is to plug in the EU unit and update the firmware and software. The software (Greddy calls it the support tool) runs on the laptop and interfaces with the EU unit via the USB cable. The firmware is the programming information stored in the EU itself that tells it how to run everything, so that it can control the car properly with or without the laptop being hooked up. **The firmware and software versions should always match.** The steps below outline the process that should be followed when setting up the firmware/software for the first time.

1. Verify all wiring, connections, and jumper settings, then plug the EU into the car with the battery disconnected (you should have already disconnected it during the wiring process).
2. Reconnect the battery, and make sure the ignition key is in the OFF position (i.e. - no power going to the EU yet).
3. Install the Support Tool software onto the laptop from the CD that came with the EU. If you don't have a CD, you can download the full package (version 1.09) from Mohdparts.com
4. Download the most current software/firmware update from either Mohdparts.com or http://www.greddy.com/tech/.As of the time of this writing, the most current version is 2.00.
5. Apply the update to the laptop software (usually just a matter of opening the downloaded executable file and letting it self-install).

6. Connect the laptop to the EU unit using the USB cable (IGN key still OFF), then open the software.
7. Once the software is up and running, turn the ignition key to ON **but don't start the car.**
8. The software will now check the firmware on the EU unit and if the firmware is older (and it should be if you updated the software), then it will tell you that it located a newer version and ask if you'd like to update the firmware.
9. Click OK. It should then start transferring the new firmware file from the laptop onto the EU. **Do not touch the key or the USB cable while it's updating!** Let it do its thing, and when it's done it will pop up a window that says "Update complete! Turn the main unit OFF."
10. Click OK on the window, and then turn the ignition key to OFF. It's okay to keep the software running.
11. **Wait a few seconds before turning the key back to ON (this is important)**, and again, **don't** start the car.
12. With the key back to ON, the software should once again recognize the EU as being online. Verify that the firmware was uploaded successfully by clicking on "Help – Version Information." All 3 lines should show the same version number.

You are now finished the updates, and it's time to do some parameter setup in the software before firing up the car for the first time.

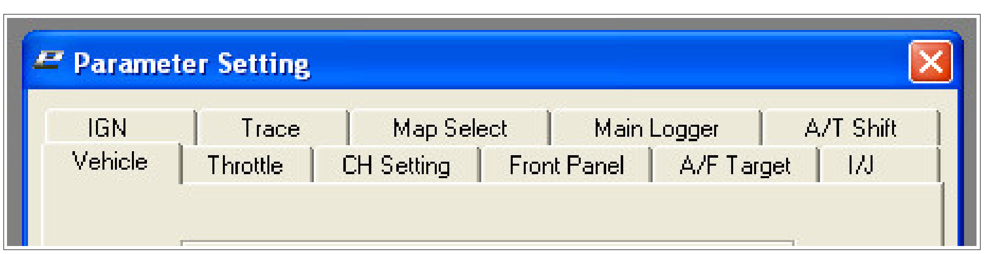
3.1 Initial Software Setup

I'm not going to describe in detail the software interface, as the Greddy Operation Manual does that adequately. You should get familiar with what the various icons on the toolbar are, the map tree, the datalogger window, etc, but at this point I'm going to assume you've already done that and start talking about setting up the EU specifically for the VQ30 engine.

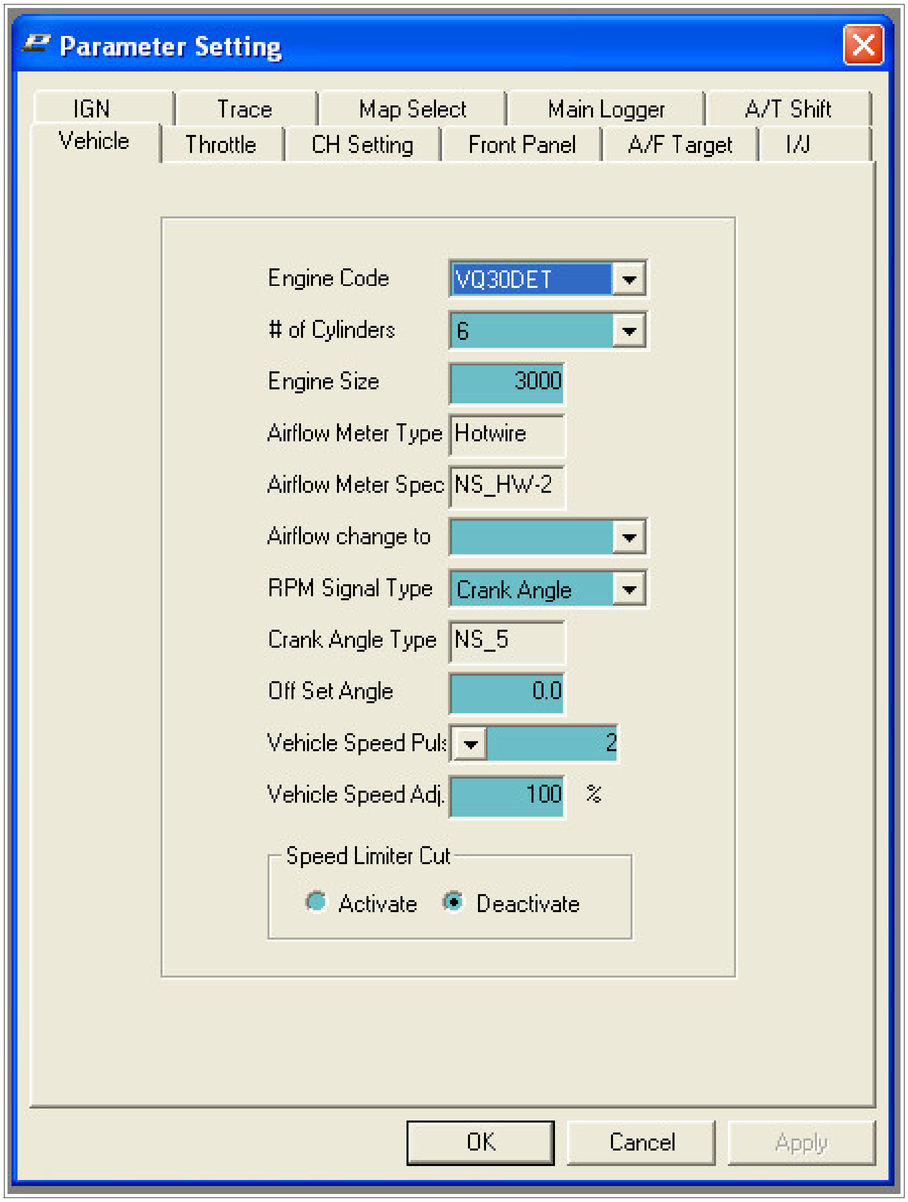
To get the car to run, we have to set up a few key parameters first. The EU does not need to be tuned for the car to run properly. It is able to allow the stock ECU to control the car by simply passing through the input and output signals as if it were not even there; but in either case it does require a few parameters to be set first.

Click on the **Parameter Setting** icon (blue car): 

The **Parameter Setting** window will pop up with 11 tabs across the top. Not all tabs need to be set up in order for the car to run, but it's easiest to do most of it at one time at the beginning. You can always edit settings later on also if you need to once the critical ones have been set. Alright, so let's select the **Vehicle** tab if it is not already selected:

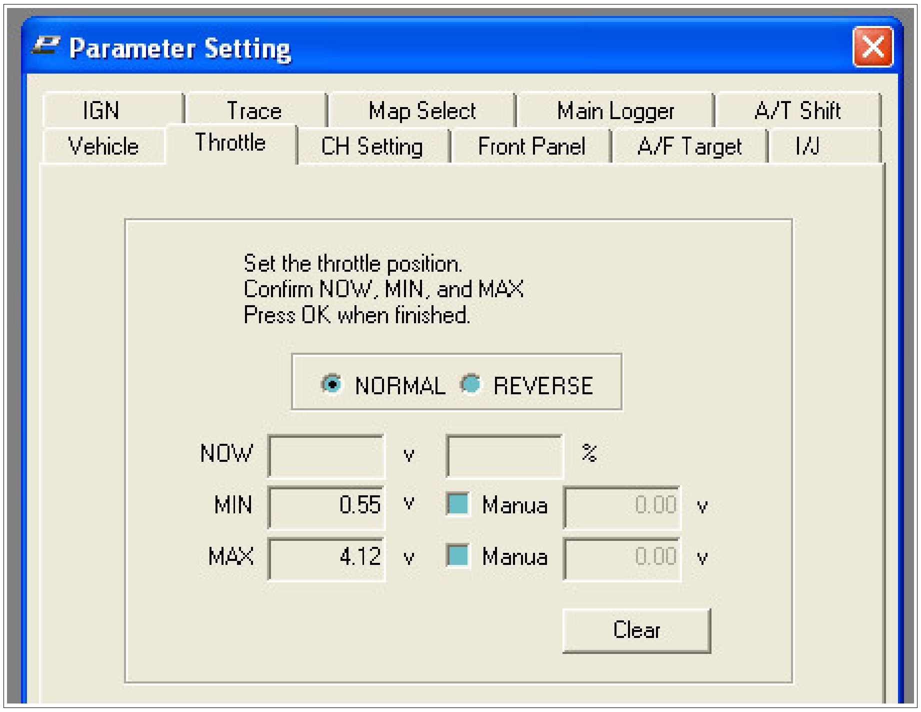


The first item you'll see on the **Vehicle** tab is the **Engine Code** box. Choose **VQ30DET** from the drop down list. Once you do this, most of the other information fills in automatically. At this point only 2 other items need to be changed. For the **RPM Signal Type** choose **Crank Angle** from the list, and for the **Vehicle Speed Pulse** choose 2. Your screen should now look like this:

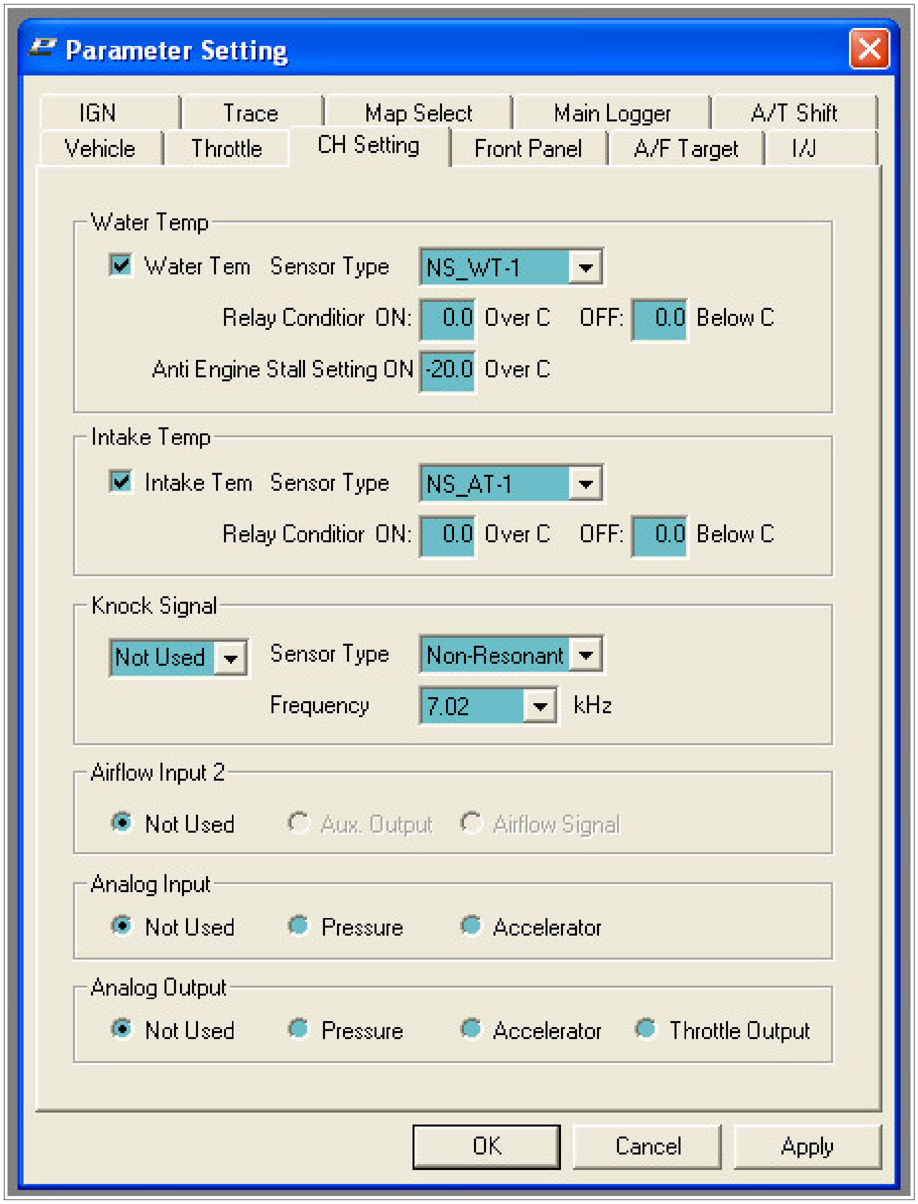


If it's all good, move to the next tab, the **Throttle** tab. This tab is used to tell the EU what the voltages are at minimum and maximum throttle positions. To do this, turn the ignition key to ON (**but don't start the car**), then slowly push the throttle down to the floor as far as it will go and hold it for a brief second. You should see numbers automatically fill in the **MIN** and **MAX** boxes, and you will also see what the current voltage from the TPS is in the **NOW** box as well as the throttle position **%** the EU is calculating to the right of that box. If you wish, lift off the throttle completely and push it down completely a couple times and watch the values change. When you are finished you can turn the key back to OFF, and the values in the **MIN** and

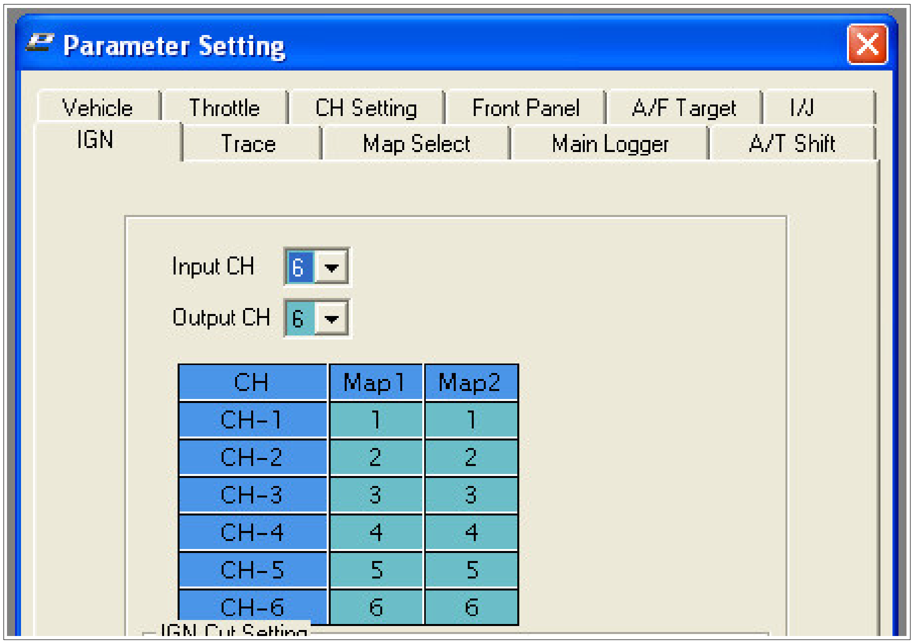
MAX boxes should be something like 0.xx and 4.xx volts, respectively, as shown in the screen shot below. Note that you can also manually add the min/max voltages by clicking the check boxes and typing the numbers in; but this should not be necessary.



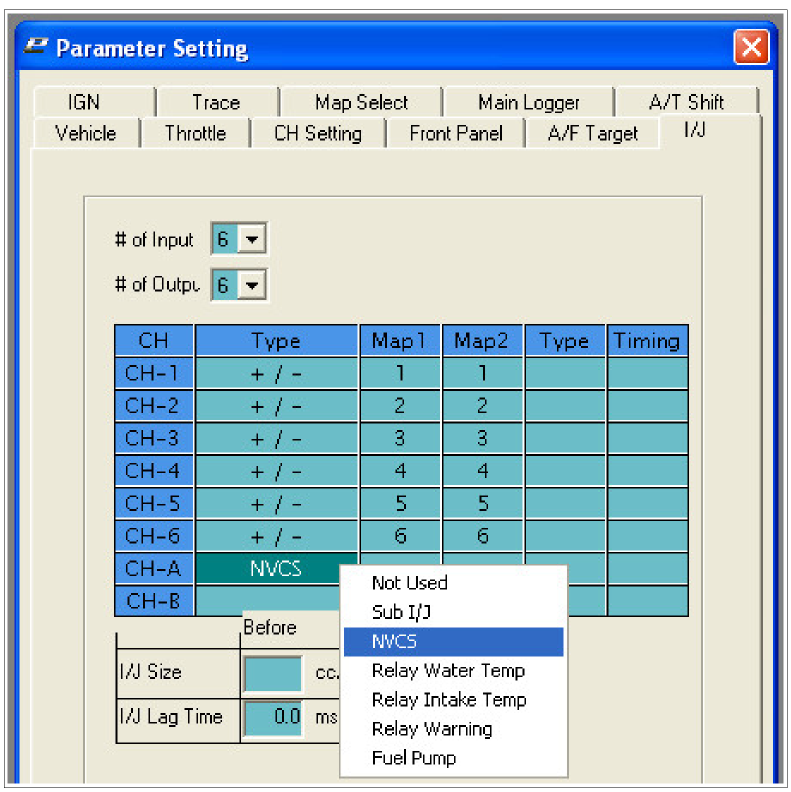
OK, on to the **CH Setting** tab. Remember those lines (pins 32 & 38) that could be used to input up to 2 of 3 signals: the knock sensor, intake air temperature sensor, or the coolant temperature sensor? Well on this tab you tell the EU which ones you've hooked up. You should verify that the appropriate boxes are checked and that NS_WT-1 (for Nissan water temp) or NS_AT-1 (Nissan air temp) are selected. The sample screen shot on the next page shows the basic set up using both temperature sensors but not the knock sensor. If you have wired it up and wish to input it, select the line you used for it from the drop down box in the **Knock Signal** section, and leave one of the other temperature sensors unchecked. So far I haven't had time to experiment with the knock sensor resonance settings (this functionality was new in version 2.00), so I can't tell you what the correct settings are for the A32/A33 sensor. If you discover them on your own please email/PM me and let me know!



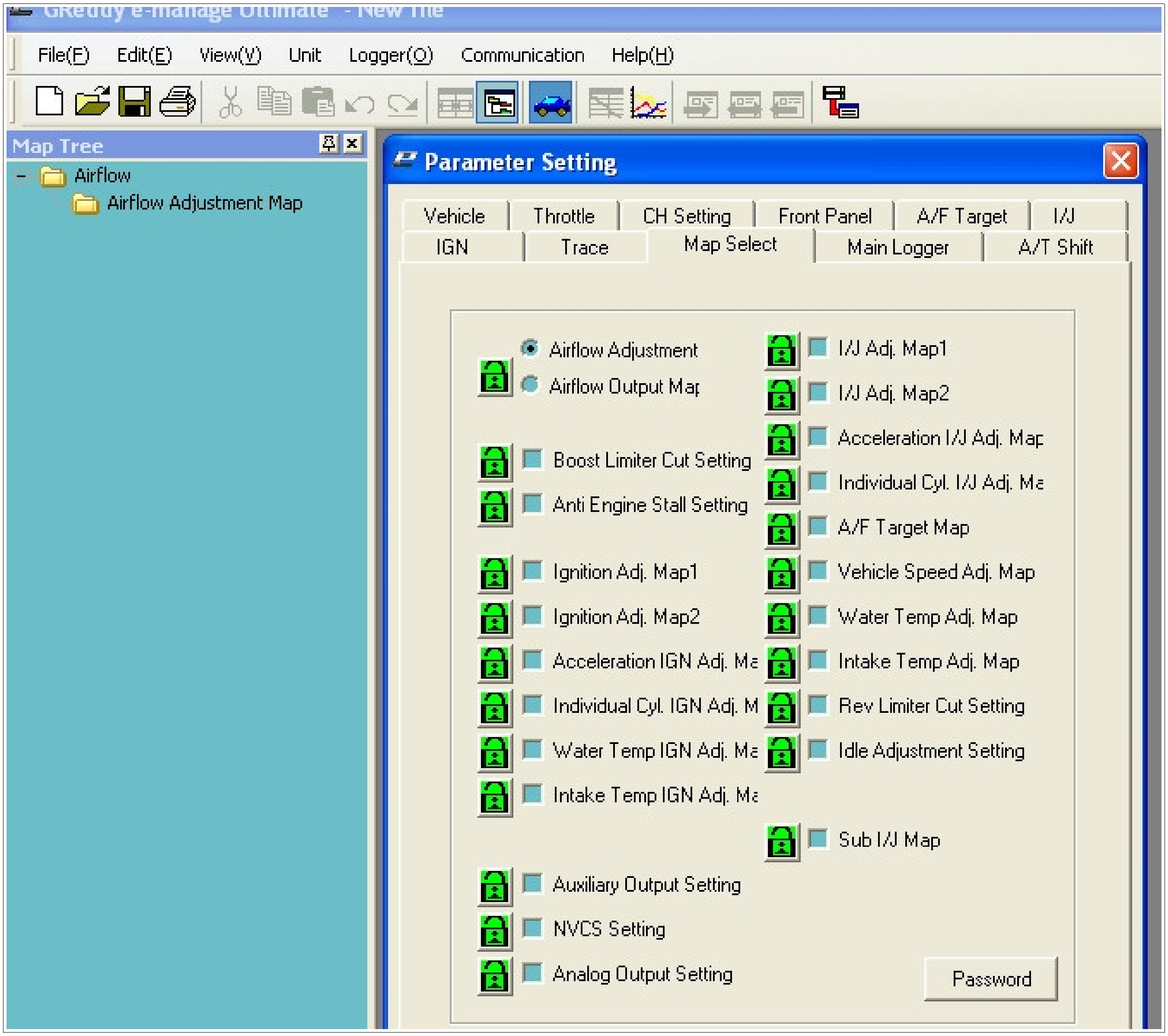
Next up: the **IGN** tab. The top portion of this window should fill in automatically once the engine type is set under the Vehicle tab but just make sure that it looks like the picture on the following page. We'll come back to the bottom part of the window later on, it's not necessary for firing the car up for the first time.



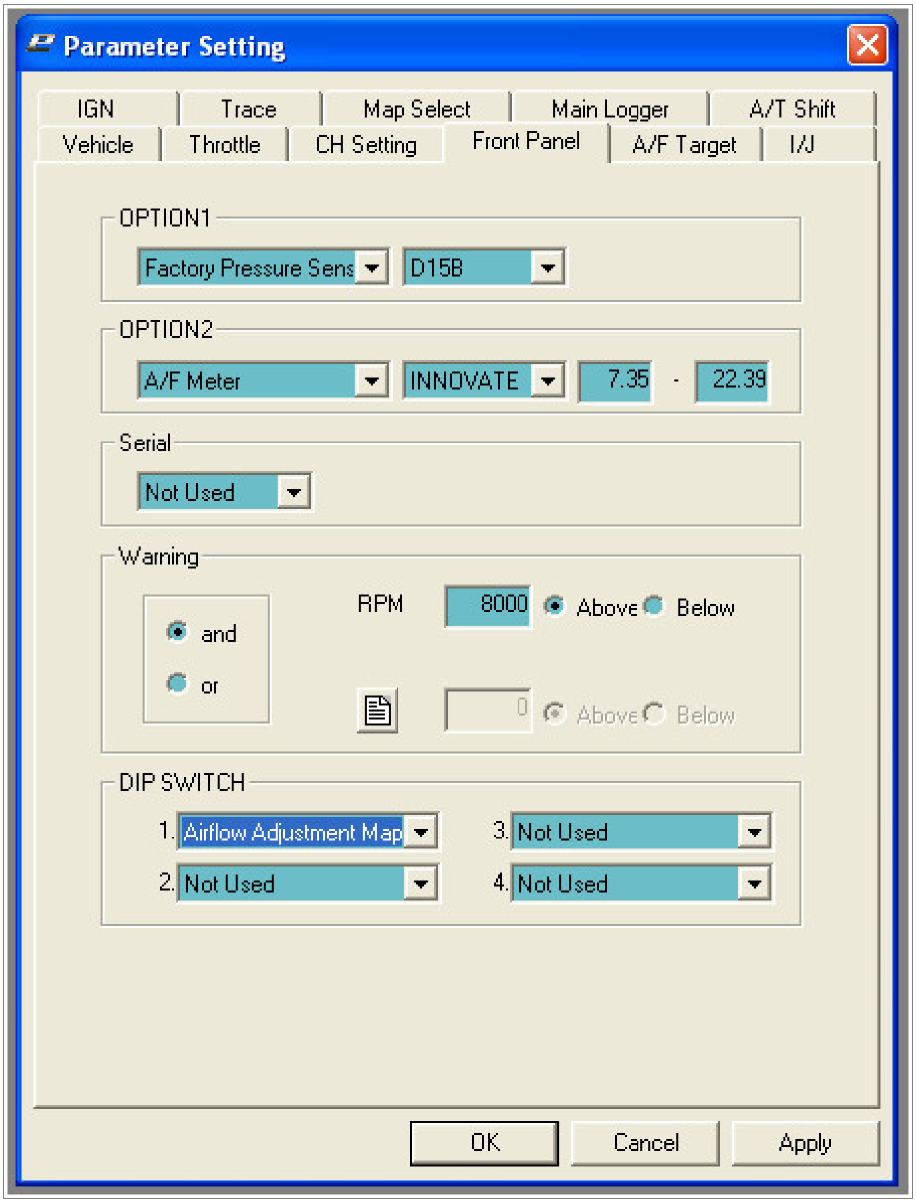
After you've checked the Ignition tab, skip over and up to the the **I/J** tab and select it. Like the Ignition tab, a lot of this window fills in on its own based on the engine code but if you have wired any devices such as a VIAS solenoid or relay up to the output CH A or B then here's where you'll configure them. Left click on the **Type** cell for the CH you want, and then right click and select your choice. The picture below shows the proper injector settings, as well as CH A set to NVCS (for a VIAS solenoid) and nothing set on CH B.



Alright now we're on to the **Map Select** tab. This tab is used to select which maps you want to be activated (used by the EU), and to lock them and/or set passwords to protect them. To activate a map, select its check box. You'll notice that after clicking **Apply** the map will then show up in the tree on the left. We'll talk about a few of the maps later on, but for now all we need to do is activate the **Airflow Adjustment** map. Your window should look like the following:



Next up: the **Front Panel** tab. This tab is for setting up anything connected via the front: the OPTION ports, the switch port, serial port, and the 4 little yellow DIP switches. If you have connected a wideband O2 sensor or pressure sensor, select them from the drop down lists under the appropriate OPTION port. You'll notice when you choose **A/F Meter** a couple more boxes appear. The first box is the O2 sensor type, and the second 2 are for you to tell the EU what A/F ratios 0 volts and 5 volts output from your WB will correspond to. You can get this information from the WB manufacturer. In the following screen shot I've used port 1 for a pressure sensor from a Honda Civic (engine code D15B) and port 2 for an Innovative WBO2 sensor, with 0 volts set equal to an AFR of 7.35 and 5 volts equal to an AFR of 22.39. If you look at the bottom, you'll see the DIP switch assignment boxes. For each DIP switch on the front cover of the EU, you can assign a corresponding map that it will turn on or off. For now you'll notice the only map available from the drop down lists is the Airflow Adjustment Map, since this is the only map we've activated at this point. Eventually, I'd probably use 2 of the switches for fuel and ignition timing maps. But for now you can either leave the DIP switches set to "Not Used," or select the Airflow Adjustment Map as shown, but if you do that, make sure the DIP switch is turned ON on the front of the EU.



OK! Almost ready to fire. Setting up the other tabs is not necessary at this point, just to fire the car up. I'll touch on most of them in the upcoming sections anyways. So, close out the **Parameter Setting** window by hitting **Apply** and then **OK**. It's probably a good idea to save the file as well, since you'll just add more tuning info to it as you go. Note that you can save any number of *.EM2 files on your computer and upload them to the EU unit at will. If you wish to save, go to **File, Save** and give your new file a name. You can then turn the ignition key to **ON.** The EU should be recognized by the software as being online, and it will probably want to start communicating in real-time, which is fine. In this mode, any changes you make on the laptop will be immediately implemented on the EU unit itself after you've hit Enter or clicked OK, etc. But just to make sure our brand new settings get uploaded to the EU, click on **Communication, Export Data** (or hit the icon). Once this is complete, you should now be able to start the car and it should run and idle as normal. The EU will be passively allowing the stock ECU to control the car without adjusting anything itself.

Congratulations, it's all gravy from here (or at least more fun than wiring)! In the following sections I will talk a bit more about how to set up the major EU features and tuning maps.

4.0 A Few Words About Maps

When we refer to a "map" in the EU, we are really talking about a table of numeric values the EU will use to adjust some type of signal, either coming into or out of the stock ECU. To open a map for editing, it must first be activated using the **Map Select** tab under the **Parameter Setting** window so that it appears in the Map Tree. Double-clicking it in the Tree will then open it. Any number of maps can be active at once. Most of the major maps will contain 16 rows and 16 columns, for a total of 256 cells, or adjustment points. Typically each cell will be referenced by an rpm value (the column) and a corresponding value on the load axis (the row) (i.e. - for X load, at Y rpm, adjust by the amount Z (or -Z) entered in the cell). The load on the engine can be referenced in several ways but MAF voltage, manifold pressure, or TP% are the variables usually used for this purpose. The load variable can be changed by selecting from a drop-down list above the axis. Also note that by clicking on **Change Scale** you can edit the axes themselves (i.e. - you can change the intervals, or values in each axis). Clicking **Change Scale** again will save the changes.

So how do you choose which load variable to use? Well it's a matter of preference and engine setup. For many, simply using MAF voltage is fine, since it is easy to understand, easy to datalog and measure, and intuitively relates to air flow. Also, most other piggybacks use MAF voltage and if you've used one before you'll already have a feel for what kind of MAF voltages you'll see at WOT, cruise, etc. However, those with boosted cars and pressure sensors would likely choose manifold pressure, since they are more likely to be concerned with tuning under boost pressures. Another option is using TP%, for example with an aggressive cam that idles poorly (fluctuating vacuum would make a pressure sensor less desirable in that scenario). However, TP% is not well suited for applications where engine load can easily change even though the TP has not changed.

I should also mention that *it is possible to have more than 1 map of the same type active at once, thus increasing the resolution (number of tuning points/axis points). If there are overlaps in the maps, the effect will be cumulative.* That is, for a given rpm and load point, the total adjustment applied by the EU will be the sum of the 2 cells (1 in each map). Using dual maps is also a way to use 2 types of load variables, but given the closed loop capabilities of the A32/A33, for most users only WOT needs to be tuned and 1 map should therefore be sufficient for all but the more heavily modified cars (and by that I mean boosted, much larger injectors etc, not your typical bolt-on car).

4.1 Setting up Variable Intake Control

The EU can be used to open/close the valve on a variable intake/runner system. To wire up a VI actuator, such as the VIAS solenoid on the DEK engine, you will have had to connect the EU to either the solenoid's ground (GND) line or its power (+12V) wire as described earlier in this guide. If you have used the GND line (meaning that the EU will ground the circuit to activate the solenoid), then you must connect to either CH A or B outputs on the EU (pins 26 or 27) and use the **NVCS Setting** map. If you have used the power side, then you should connect the EU's auxiliary output line (pin 14), and use the **Auxiliary Output** map. I'll describe the set up steps for each below. Note that some of this you will have done/can do during the initial setup.

Ground Line Activation – NVCS Map

- Open the **Parameter Settings** window and select the **I/J** tab.
- In the row for either CH A or B (whichever line you've used), left click in the **Type** cell, then right click and select **NVCS**. Click **Apply**.
- Switch to the **Map Select** tab, and check the box beside **NVCS Setting**. Click **Apply** and you should see "NVCS Setting" show up in the map tree on the left. Click OK to close the window.
- Double click the **NVCS Setting** map in the Map Tree to open it for editing.
- Change the load variable if you wish, or change the scales if need be. Then left-click and drag to select the area of the map where you want the VI to be active. Once it's highlighted, click again and you will see the cells change from "OFF" to "ON."

In the example below, the VI would open under all load points once 5000 rpm is reached:

NVCS Map

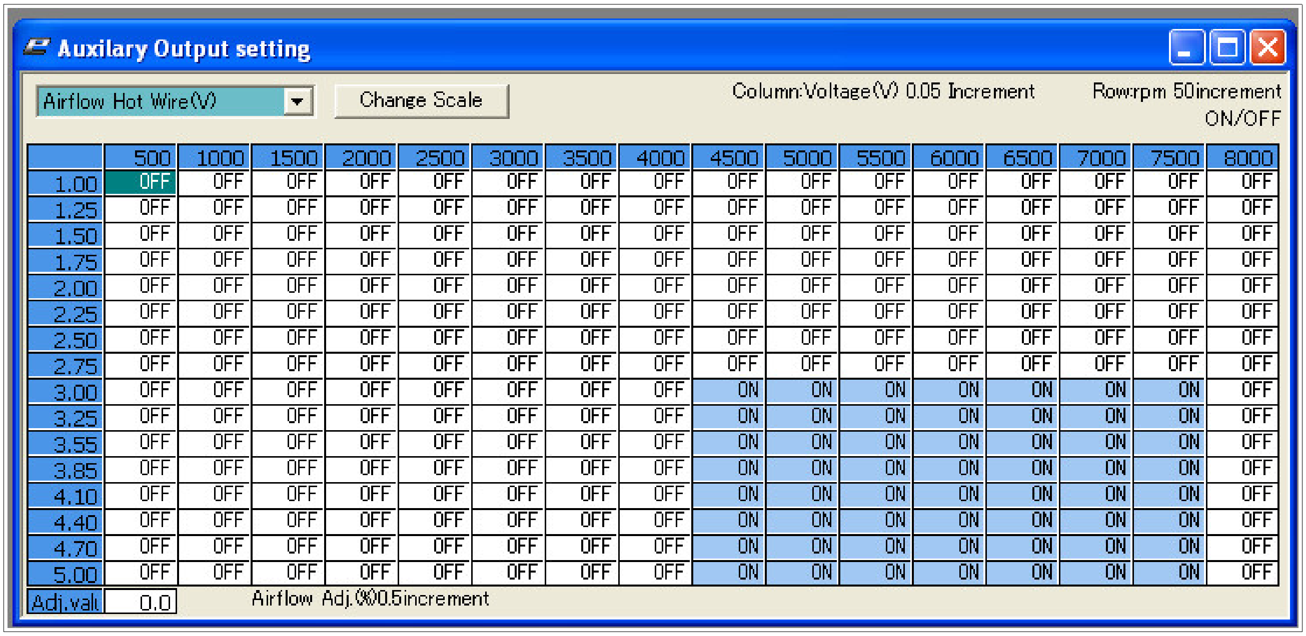
Airflow Hot Wire(V) | Change Scale | Column:Voltage(V) 0.05 Increment | Row:rpm 50increment ON/OFF

	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
2.00	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
2.20	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
2.40	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
2.60	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
2.80	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
3.00	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
3.20	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
3.40	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
3.60	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
3.80	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
4.00	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
4.20	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
4.40	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
4.60	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
4.80	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON
5.00	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON

Power Line Activation – Auxiliary Output Map

- Open the **Parameter Settings** window and select the **Map Select** tab.
- Check the box beside **Auxiliary Output Setting**. Click **Apply** and you should see "Auxiliary Output Setting" show up in the map tree on the left. Click OK to close the window.
- Double click the **Auxiliary Output Setting** map in the Map Tree to open it for editing.
- Change the load variable if you wish, or change the scales if need be. Then left-click and drag to select the area of the map where you want the VI to be active. Once it's highlighted, click again and you will see the cells change from "OFF" to "ON."

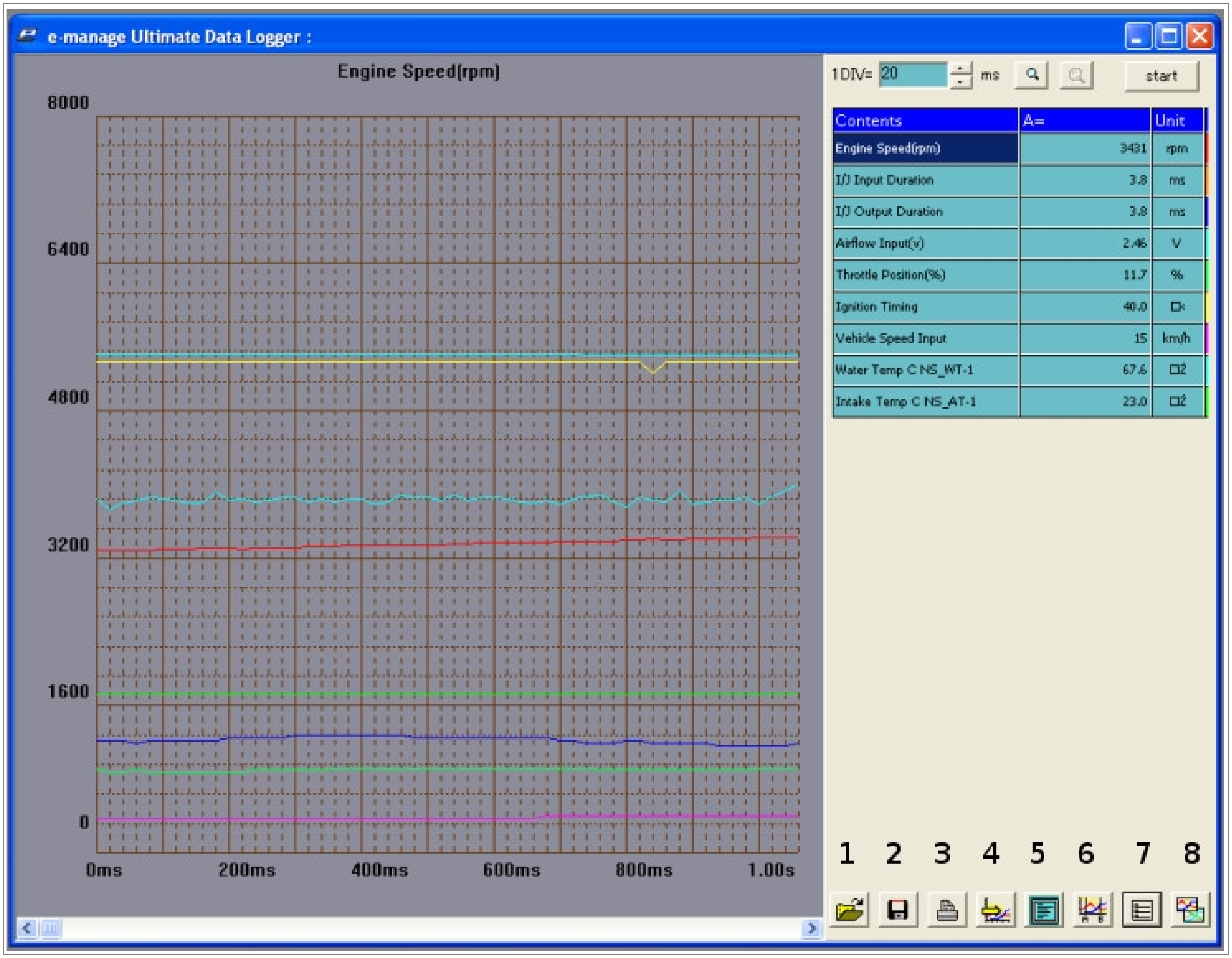
In the example below, the VI would open from 4500 to 7500 rpms, and only once the MAF voltage reaches at least 3.00 volts:



	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
1.00	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1.25	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1.50	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1.75	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2.00	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2.25	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2.50	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2.75	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3.00	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	OFF
3.25	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	OFF
3.55	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	OFF
3.85	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	OFF
4.10	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	OFF
4.40	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	OFF
4.70	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	OFF
5.00	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	OFF

4.2 Using the Software (Laptop) Datalogger

Unlike the various maps, the Greddy Operation Manual doesn't really say much about using the datalogger, so I'll describe all of its features here in more depth than I might otherwise. To start the datalogger, simply choose **Data Log** from the **Logger** menu (no kidding!), hit Ctrl+T, or click the icon on the toolbar (2nd to the right of the blue car icon, looks like a graph with lines). If you are connected to the EU unit and the car is on or running you will see something similar to the first screen shot on the following page. The graph area on the left displays the datalogged sensors and/or parameters in real time (hence the scrolling lines/numbers). The vertical axis is the parameter/sensor value, and the horizontal axis is time (zero is whenever you started the log or opened the window). On the right, the parameters/sensors being datalogged are listed, along with their current value, unit and color assigned to them. On top of this list are a few zoom control functions as well as the "start/stop" button. On the bottom right are several more control icons, which I'll explain shortly (I've numbered them 1-8 but you won't actually see these numbers on the EU).



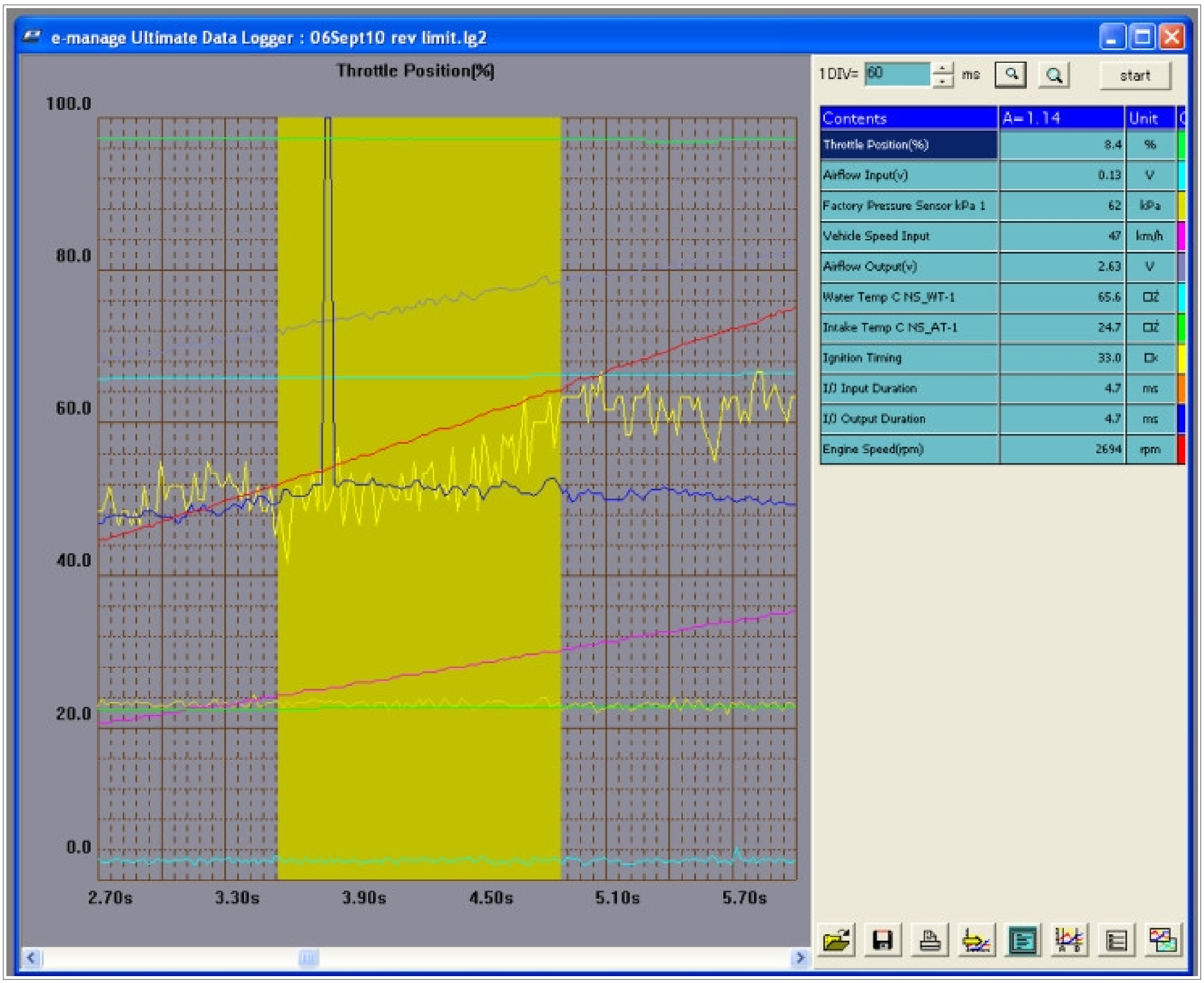
Now at this point, if you haven't hit the "Start" button, the Datalogger is acting more like a scan tool, it's monitoring and displaying in real time the data being inputted and outputted to/from the EU, ECU, and sensors. But nothing is being saved to a file. As you would imagine, hitting **Start** (which changes to **Stop** if it's already started) controls the actual recording of data. Once you have stopped recording the data will remain in memory, and you can look back through the log, but note that it **will be cleared by starting a new datalog!** Therefore, if you wish to save the recorded data for later review you can save it to a log file that can be played back any time, even on a desktop or laptop which is not connected to the EU. All you need is the EU software (and the log file obviously). To save the log file, hit Icon #2, which looks like the standard Windows "Save" icon. You can save it as either Greddy's .lg2 format or as a text file. To open a previously saved log, use Icon #1, which looks like the standard Windows "Open" icon (surprise, surprise).

Ok, now on to the rest of the control functions and icons.

Zooming

Especially when reviewing large recorded logs, it can be very helpful to zoom in to certain regions. The datalogger provides several ways to zoom in (and out). For example, you can use the magnifying glass icons at the top, which will increase or decrease the zoom in preset time steps. Note that everything is measured by the size of the time step shown between the *dashed* lines on the graph (the EU calls it one division). The smallest step is 20 ms, since this is the fastest sampling interval the EU can achieve. So at the highest zoom level (most zoomed in), each dashed line-to-dashed line division represents 20 ms. You don't have to use the preset steps though, you can also use the arrows to zoom up or down 1 ms at a time, or enter a value directly into the box beside them.

There is one more method for zooming in (but not out), and it's perhaps the easiest and most useful. Simply right-click and drag across the graph on the area you'd like to zoom in on. You'll see the cursor change to a double arrow and a yellow block will appear showing you the area that will be zoomed in on. The screen shot below illustrates this (although the mouse cursor didn't show up for some reason). You can drag from right to left as well as left to right, it doesn't matter.



Changing Parameter Colors and Scales

Things can get hard to read if you have lots of lines on the graph at once so it can often be helpful to change the color or scale range assigned to a parameter (e.g. - do you really need the engine rpm axis going up to 10,000 if you're not revving past 7500 anyways?). You'll notice that if you left-click on a parameter in the list it will become highlighted, and in the graph on the left, its name will show up and the vertical scale will change to reflect the range of values applicable to it. **If you need to change the minimum and/or maximum values shown on the scale, simply double-click the parameter name**, and a window will pop up letting you change them. *It can sometimes be useful to play with a parameter's scale simply to cause the line to shift position on the graph relative to other lines (i.e. - artificially create some separation although keeping the same values)*. Changing the color is more useful though and will usually be done first. **To change the color of the line displayed for a given parameter, double-click its corresponding color box in the list.**

Panning

There are two ways to pan around the graph: simply left-click and drag the graph left or right (the cursor changes to a grabbing hand), or use the scroll bar at the bottom of the graph. I prefer to use the scroll bar, as I find the dragging method can be too slow at times.

Displaying the Parameter Values for a Specific Time Point

Say for example you've zoomed in using the right-click-and-drag method and your graph now goes from 3.0 ms to 4.0 ms on the log, but you want to know exactly what your AFR and timing were at 3.7 ms (it's a point of interest for some reason). You could eyeball it off the graph, but the EU can tell you exactly. Simply left-click once on the graph at the time point you want (in this example 3.7 ms). You'll see a red vertical line appear on the graph, and up in the parameter list on the right, the data for that time point will appear in the column beside the parameter names. You'll notice that at the top it will say “A=3.70,” which is the time point you've chosen.

Icon 3

Hmm... looks like a printer, I wonder if... yep, you guessed it. ;)

Icon 4

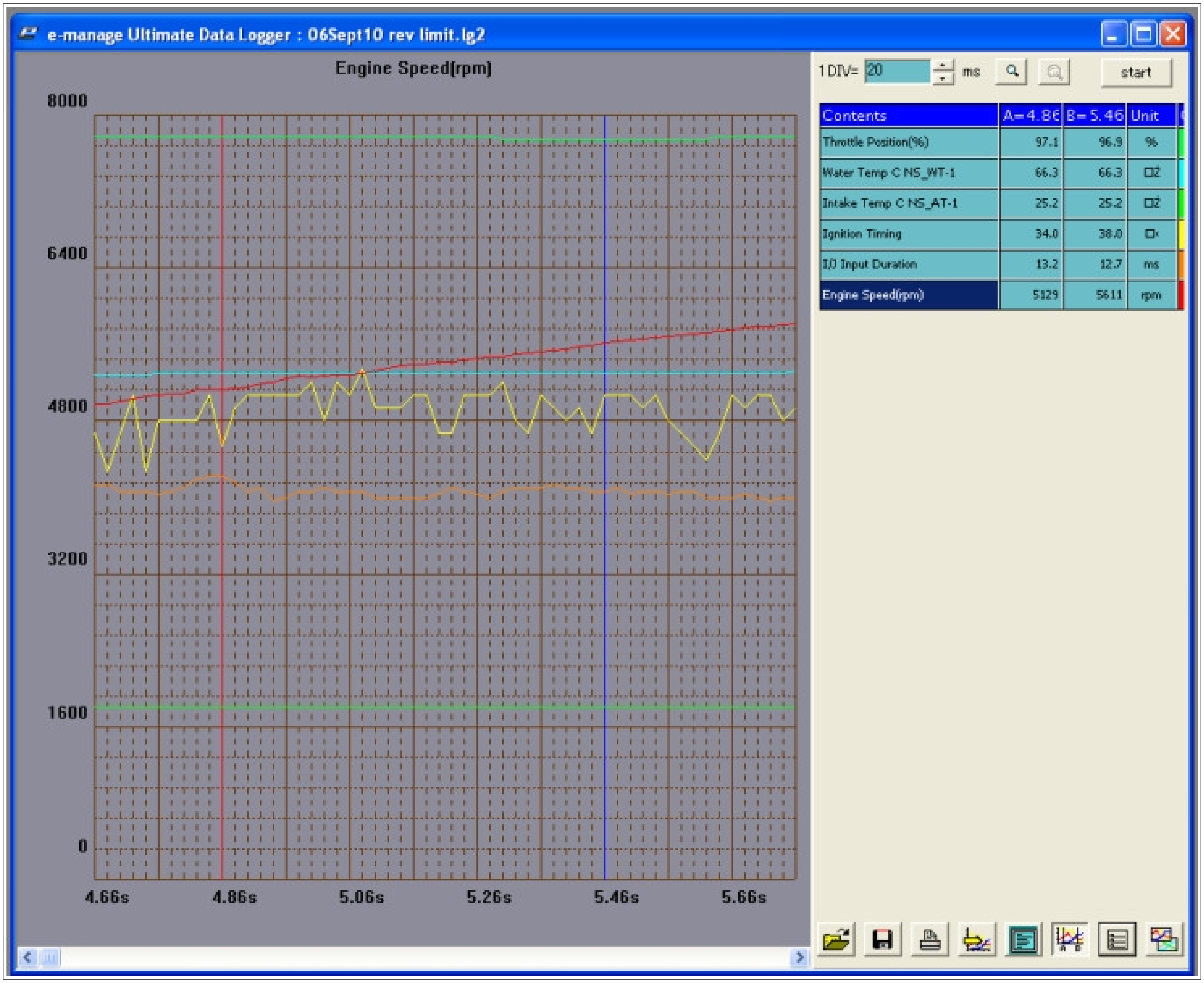
Downloads data from the main unit. Remember way back in Sections 2.2 and 2.4 where I mentioned the switch port and the internal datalogger on the EU? If you'd captured a log on the main unit and then connected the laptop later on, you'd use Icon 4 to download the data from the main unit into the laptop software. Instructions on setting up the internal datalogger will be forthcoming a few sections later.

Icon 5

Refreshes/clears the graph display and resets the time scale.

Icon 6

The “A-B” toggle is useful for comparing the data for two time points side by side. Clicking this icon will add an additional column (title “B=”) to the parameter list beside “A=”. You would then left-click for time point “A,” as described above, and right-click for time point “B.” The vertical lines will be red for “A” and blue for “B.” Click the icon again to untoggle the feature. The screen shot on the next page shows “A” set to 4.86 ms and “B” set to 5.46 ms. Note the A and B columns side by side and the red and blue vertical lines.



Icon 7

Clicking this icon brings up a window allowing you to choose which parameters and/or sensors are displayed in the parameter list (and thus on the graph). **Note that the EU will automatically log all parameters available if the laptop is connected while logging, but this window allows you to control what's actually shown.** Sometimes you may want only a few parameters displayed at a time. Some parameters may be greyed out, which means they are not available to you (usually because you haven't wired the particular sensor or device in or haven't turned something on in the settings etc). But generally, anything you can connect the EU to or wire in can be logged.

Input/Output Terminology

I talked about this in previous sections but I'll reiterate it here, since a few parameters you're likely to log will have both an input and output (2 separate parameters). **The terminology is always relative to the EU: anything "input" is a signal coming INTO the EU, and "output" is going out FROM the EU.** Seems straightforward, right? So this means that most sensor signals will be coming to the EU first as inputs, then outputted to the stock ECU. Conversely, most actuator/solenoid/device signals, including ignition coils and injectors, will be coming from the stock ECU first, inputting to the EU, and then outputted to the device itself. So for example, when you see I/J Input and Output Durations/DC's, or Airflow Inputs and Outputs, etc listed, keep this in mind and you'll be able to understand what each parameter is.

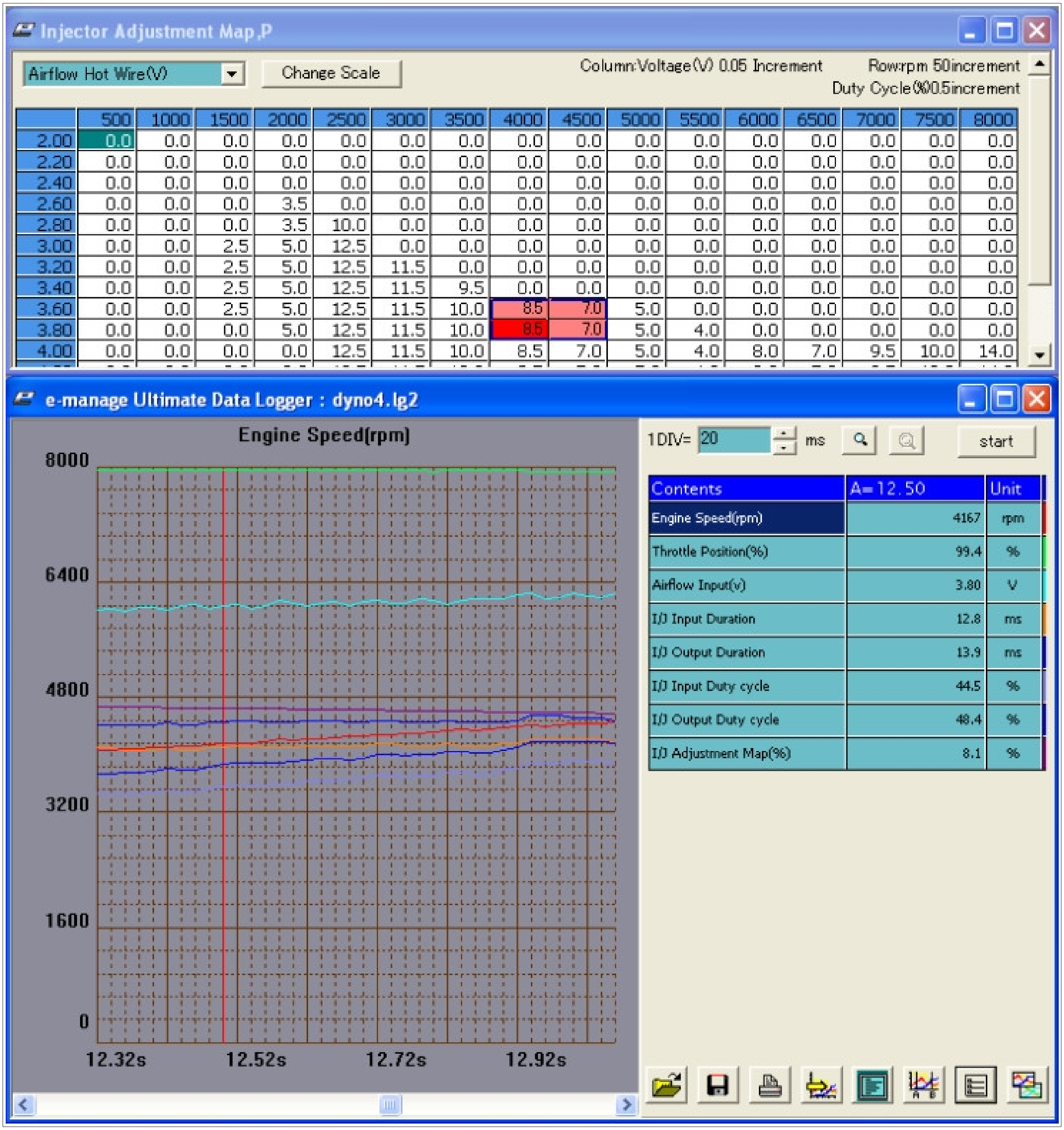
Icon 8

Opens another datalogger window without closing the first.

4.3 Map Tracing

I've put this topic right after the section on datalogging because they are often closely related. The map trace is a display feature which helps you to see quickly, at a glance, which cells in a given map the EU is currently using to make adjustments. For example, if you're reviewing a certain time point in a datalog and have an I/J Adjustment map open at the same time, you can quickly correlate between the durations and AFR's you're seeing on the log and what you had programmed in the map, as the trace will highlight the appropriate map cell(s). If I recall correctly (I don't have the car running right now), the trace feature also operates in real time. If you have the laptop plugged in and the car running, you can watch the colored cells move around the map as you drive, rev the engine etc. To start it click on the icon to the right of the blue car.

As far as settings for this feature go, if you bring up the **Parameter Settings** window (blue car icon) and choose the **Trace** tab, you can choose various colors for the map trace, whether it operates continuously or at preset intervals, and how many cells are shown at a time. See the Greddy Operation manual, page 20, for more info, but I've included a sample screen shot on the following page, showing a datalog with the corresponding I/J Adj. map being “traced” on top. If you look at the parameter list you'll see that, for the chosen time point, the engine rpm was 4167, the MAF voltage was 3.80 volts, and the EU had adjusted the fuel by adding 8.1% DC. Comparing these numbers to the highlighted portion on the I/J Adj. map we can see that the 8.1% adjustment was an interpolation between 4 cells but in effect between the programmed 8.5% at 4000 rpms and 7.0% at 4500 rpms.



	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
2.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.60	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.80	0.0	0.0	0.0	3.5	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.00	0.0	0.0	2.5	5.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.20	0.0	0.0	2.5	5.0	12.5	11.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.40	0.0	0.0	2.5	5.0	12.5	11.5	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.60	0.0	0.0	2.5	5.0	12.5	11.5	10.0	8.5	7.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
3.80	0.0	0.0	0.0	5.0	12.5	11.5	10.0	8.5	7.0	5.0	4.0	0.0	0.0	0.0	0.0	0.0
4.00	0.0	0.0	0.0	0.0	12.5	11.5	10.0	8.5	7.0	5.0	4.0	8.0	7.0	9.5	10.0	14.0

4.4 Air-Fuel Target (Auto Tune)

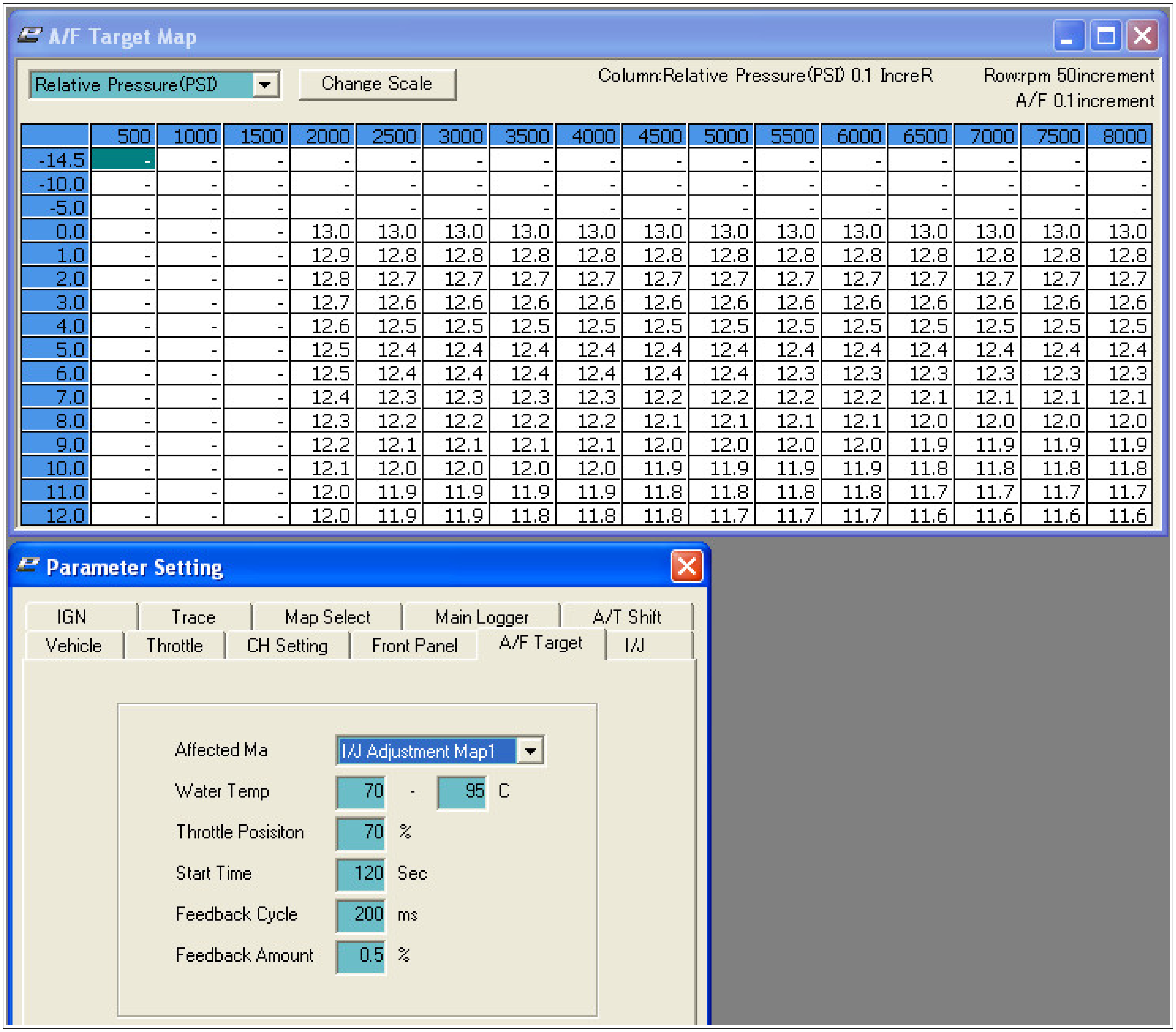
The A/F Target map (also called the Auto Tune) can be used to simplify and speed up the process of tuning your AFR. I would not recommend keeping this function active continuously; in my opinion it is best used to speed up the tuning process initially only (or after a major mod that will significantly alter your AFR's). Once the Auto Tune gets the AFR's close, then I'd finish the fine tuning by hand if necessary and *disable this feature so that it will not change the AFR's on you further without your knowledge!*

Unless you are heavily modified with significantly larger than stock injectors or boosted, you generally only need to tune your AFR's under WOT. The stock ECU will adjust well enough under closed loop conditions to keep the AFR near 14.7, or stoichiometric. For those who may not know, closed loop refers to the engine running condition under which the ECU continually receives feedback from the O2 sensors and adjusts the fueling constantly to achieve a 14.7 AFR. Closed loop generally functions when the car is warm and is idling, cruising, or lightly accelerating. Many seem to hold the belief that once you get higher than about 3000 rpms or 40% throttle, closed loop deactivates and the car goes into open loop, and does not use O2 feedback anymore to adjust fueling, but refers instead to preset, static tables to determine the AFR's. Whether the division is actually at 3000 rpms/40% throttle or not, I can't say for sure but it seems to have become an unofficial rule of thumb. At any rate, WOT is what you are mainly concerned about.

Ok, so first off, you should have set up your WBO2 sensor during the initial setup. **You can't tune your AFR's effectively without a WB!** Verify that it is reading correctly, calibrate it if necessary. Now once again bring up the **Map Select** tab in the **Parameter Settings** window. Turn on the **A/F Target Map** and hit **Apply**, then flip over to the the **A/F Target** tab. At the top you'll see a drop down box for the **Affected Map** setting; this is used to select the map that the Auto Tune is going to program for you. Most commonly this will be one of your I/J Adj. maps. It will program the map based on the AFR targets (goals) you set in another map, namely the A/F Target Map (we'll get to that one in a second).

Continuing on with the settings on the **A/F Target** tab, next up is the **Water Temp** range during which the Auto Tune is enabled. For most cases, you'll want to choose a range during which the engine is fully warmed up. Then choose the **Throttle Position** at which the Auto Tune becomes active. Generally, something on the order of 60 or 70% or higher is a good choice for tuning WOT. The **Start Time** is the amount of time the Auto Tune waits before it starts reading the O2 sensor and changing values. This is provided to compensate for O2 sensor warm up times. Usually 60-120 seconds (1-2 minutes) is enough time. Check your WB literature if you're not sure. **Feedback Cycle** refers to how often the Auto Tune will check the WB reading (i.e. - the sample rate) and make an adjustment on the Affected Map. The **Feedback Amount** is the magnitude of the adjustment the Auto Tune will make during each Feedback Cycle. Generally you don't want the Feedback Cycle too fast (smaller number), or the EU will pick up too many inconsistencies in the readings from the WB. Instead of hitting the average reading, so to speak, it will make adjustments when they're not really warranted. If the Feedback Amount is too large, then it will be hard for the EU to converge to the target, and it may end up adjusting back and forth across the target AFR. Both the Cycle and the Amount work together, and settings may be different for each car, depending on how much adjustment is required etc. Experiment for yourself, but the default settings (200ms and 0.5%) are a good starting point.

So now that we've set up the conditions under which the Auto Tune will run and the Affected Map it will program, we have only left to program the AFR targets we want it to hit for various load and rpm points. To do this we use the **A/F Target Map**. It should now be in your map tree if you've followed along, so double click it to open it. Choose and scale your load axis and rpm intervals as you wish, *but I'd recommend using the same axis configurations on this map as you do on the Affected Map (e.g. - usually I/J Adj. Map 1)*. Programming the A/F Target map is pretty straightforward then, simply enter the AFR targets in the cells, to the nearest tenth. For example, enter 13.3 in a cell if you want the Auto Tune to target an AFR of 13.3 at that load and rpm point. It would then make adjustments on the Affected Map (plus or minus) for the same load and rpm point until it achieves that ratio (as per the WB readings it samples). The screen shot below shows sample A/F Target tab settings as well as a sample A/F Target Map using pressure as the load axis. You'll note from the settings that the Affected Map will be I/J Adj. Map 1, and an AFR of 13.0 has been targeted at 0 PSI, down to high 11's under higher boost. **Note the disclaimer that this fuel table is for illustrative purposes only – all I did was toss in a couple numbers and let it interpolate on its own – it does not represent an actual tune!**



	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
-14.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.0	-	-	-	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
1.0	-	-	-	12.9	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
2.0	-	-	-	12.8	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
3.0	-	-	-	12.7	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6
4.0	-	-	-	12.6	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
5.0	-	-	-	12.5	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4
6.0	-	-	-	12.5	12.4	12.4	12.4	12.4	12.4	12.4	12.3	12.3	12.3	12.3	12.3	12.3
7.0	-	-	-	12.4	12.3	12.3	12.3	12.3	12.2	12.2	12.2	12.2	12.1	12.1	12.1	12.1
8.0	-	-	-	12.3	12.2	12.2	12.2	12.2	12.1	12.1	12.1	12.1	12.0	12.0	12.0	12.0
9.0	-	-	-	12.2	12.1	12.1	12.1	12.1	12.0	12.0	12.0	12.0	11.9	11.9	11.9	11.9
10.0	-	-	-	12.1	12.0	12.0	12.0	12.0	11.9	11.9	11.9	11.9	11.8	11.8	11.8	11.8
11.0	-	-	-	12.0	11.9	11.9	11.9	11.9	11.8	11.8	11.8	11.8	11.7	11.7	11.7	11.7
12.0	-	-	-	12.0	11.9	11.9	11.8	11.8	11.8	11.7	11.7	11.7	11.6	11.6	11.6	11.6

As I mentioned earlier, once you've gotten the AFR's close enough with the Auto Tune (use the datalogger to verify this), I'd recommend disabling the feature and adjusting manually from there. To deactivate the Auto Tune, open the **Parameter Settings** window again, select the **A/F Target** tab, select **Not Used** from the first drop down box, and click **Apply**. It might also be a good idea to flip over to the **Map Select** tab and uncheck the **A/F Target Map** box as well before hitting **OK** to close the window.

4.5 Manual Air-Fuel Tuning

So instead of the Auto Tune programming your fuel maps, in this section we'll talk about doing it yourself. The EU allows you to input fueling adjustments in terms of injector duty cycle (DC) or in terms of duration. For those who may need these terms defined, **DC is the percentage of time an injector is open compared to the maximum time it can possibly be open during a given engine cycle** (4 strokes, or 2 crank revolutions). *A general rule of thumb for injectors is that they should not be operated for any significant time above around 80% DC. If your injectors are reaching that level during WOT or high rpm runs it's probably time to think about upgrading to larger ones.*

Duration is the actual amount of the time (in milliseconds (ms)) the injector is being held open, or "pulsed," hence it is also called the "pulse width" (PW). For tuning on the EU, I prefer to use duration, and it's what I recommend. It gives you a bit finer level of adjustability, which can be nice when trying to tweak that tune to perfection or extend the rev limit as smoothly as possible (more on that later ;). Plus, it's not an rpm dependent, calculated value like DC is.

Notwithstanding, if you wish to use DC, you can, by choosing it from the **Units** menu, but once you have built a map, **DO NOT SWITCH UNITS FROM DUTY CYCLE TO DURATION without re-mapping all the values!!** In previous versions the EU did not make the conversion correctly, and would incorrectly calculate the durations as being half of what they should be if you switched a pre-built map over from DC. I cannot verify at this time if that has been corrected in version 2.0, but it does not appear to have been. So be forewarned!

Ok, so first off, you should have set up your WBO2 sensor during the initial setup. **You can't tune your AFR's effectively without a WB!** Verify that it is reading correctly, calibrate it if necessary. Now once again bring up the **Map Select** tab in the **Parameter Settings** window. You will see there are a few maps related to fuel, but for many cars it's sufficient to use **I/J Adj. Map 1** and to tune for WOT only. I may discuss more advanced tuning in a future update, but for now, we're focused on WOT tuning.

So once you have activated I/J Adj. Map 1, open it from the map tree and set up your load and rpm scales. If you wish to assign it to a DIP switch, you could also do that at this point (see Section 3.1, page 33). You can use MAF voltage for the load axis, or if you prefer, pressure or TP%. You will now need to log a WOT run in the car and evaluate your AFR's across the rpm band (use the datalogger). For each rpm/load point applicable to WOT, read your AFR from the logger. If you are too lean, you will need to add fuel in that particular cell of the table; if you are rich you may want to lean things out somewhat. Inputting a positive number will ADD fuel. Inputting a negative number (use a minus sign in front of it) will SUBTRACT fuel. **Note that the number of milliseconds you are inputting (if using duration) is a direct adjustment to the injector pulse width, post stock ECU. However, it is NOT the net total pulse width, it is an adjustment ON TOP OF the stock signal.** (e.g. - if the stock ECU was outputting 12 ms at 80% throttle and 6000 rpms, and you put in -1.2 in that cell, the actual net pulse width will then become 10.8 ms). If you were to view the datalog for such a scenario, at 6000 rpms and 80% throttle you should therefore see: Input Duration = 12 ms, Injector Adjustment Map = -1.2 ms, and Output Duration = 10.8 ms displayed.

Alright, so make your adjustments and then go for another WOT run, logging it as always. Pick off the new AFR's now. Did you get closer to your targeted AFR? If not, repeat the process. The amount of the adjustment you should use can be theoretically calculated, but it doesn't take many iterations to get close to your target and it's not a bad thing to make a couple rounds of guess-timates on your own the first time; it will give you a better feel for how much a fraction of a millisecond (or 1 or 2 milliseconds, etc) will affect your AFR. Just don't make large changes initially! You'd be surprised how much impact a small change can have, especially on larger injectors. I've attached a sample I/J Adj. map screen shot below. This map was a rough/base tune, used on a N/A car with DEK injectors at stock fuel pressure to achieve a 13.0-13.2 AFR across the board under WOT without affecting closed loop. **As always, note that your car and its mods will be different so use at your own risk!**

Injector Adjustment Map,P

Airflow Hot Wire(V) | Change Scale | Column:Voltage(V) 0.05 Increment | Row:rpm 50increment | Duration(ms)0.02increment

	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6400	6500	7000	7500	8000
2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.80	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
3.00	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
3.20	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
3.40	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
3.60	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
3.80	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
4.00	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
4.20	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
4.40	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
4.60	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
4.80	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00
5.00	0.00	0.00	0.00	0.00	0.00	-0.72	-0.82	-0.90	-1.20	-0.90	-0.86	-0.74	10.20	8.00	8.00	0.00

You may be wondering why the PW's (durations) spike up a lot higher at 6500 rpms and beyond. Well, read on!

4.6 Extending the Rev Limiter

Alright, so this is what many are after. It's one of the biggest selling points of the EU for the Maxima crowd, since our engine management options are few and far between (more like slim to none). First off, if you've taken a look through the Map Select tab on the Parameter Settings window you've probably noticed the map called "Rev Limiter Cut Setting." *Do NOT use it. Leave it unchecked, forgotten - pretend it doesn't exist even though it tempts you with its title! Let me repeat that*: **do NOT use the Rev Limiter Cut Setting map!**

It is not programmed properly for use with the VQ30 ECU and will not do anything to help you get past your rev limit! In fact it will only cause you more headaches in trying to defeat your stock limiter.

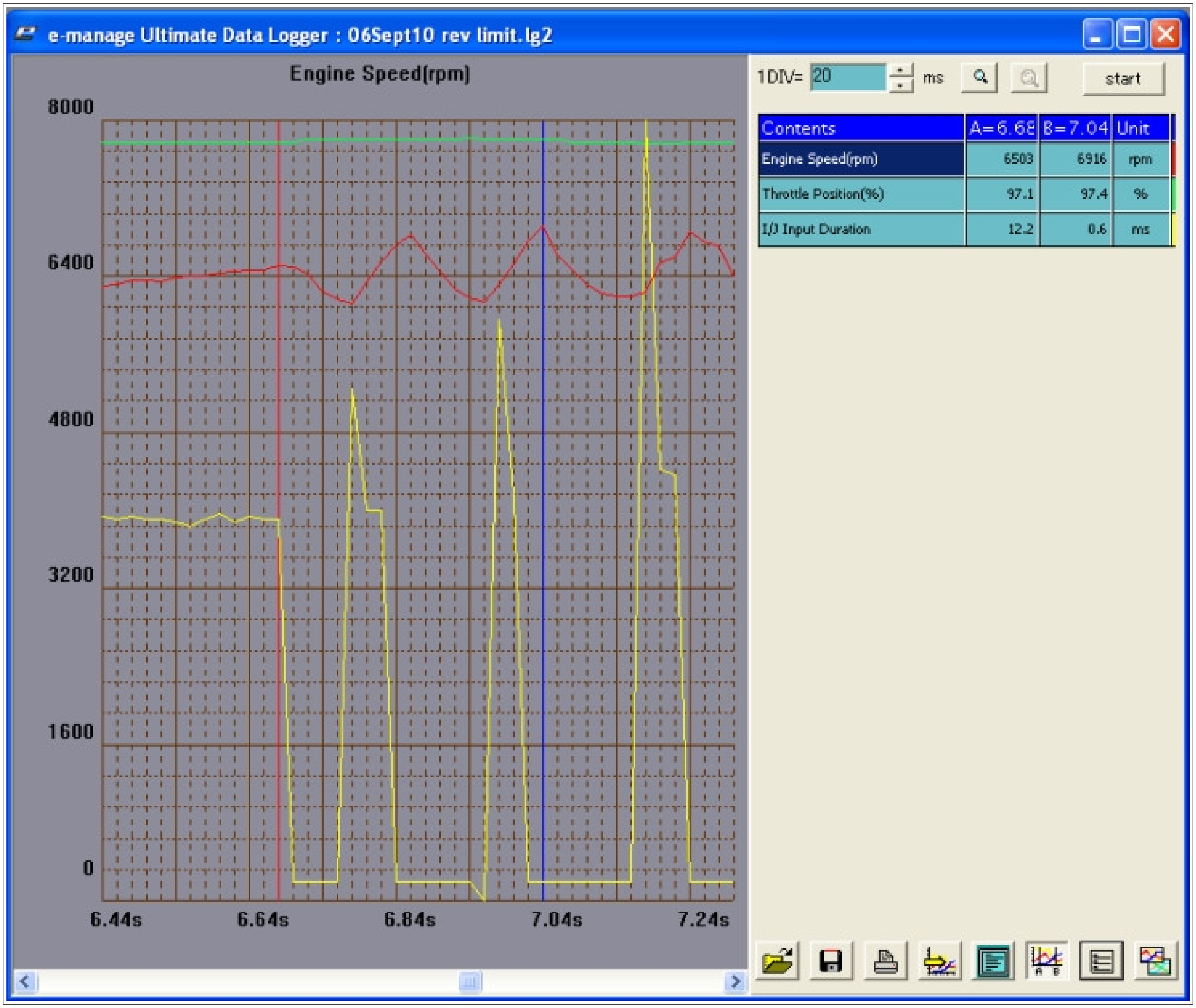
Ok with that out of the way now, it might be helpful to understand exactly how the stock ECU rev cut functions. First off, it does not cut the ignition signals at all; they continue to fire past 6500 rpms, which is good news, otherwise the EU wouldn't be able to extend the limit. In fact, reasonable timing advance in the stock ECU map(s) continues until at least 8000 rpm. Past that I don't know, since I haven't revved higher than that. And I sure wouldn't recommend finding out either unless you have modified your engine's internals. ;) Also, when the ECU cuts fuel at the rev limit (6500 rpm on most A32/33's) it does not *completely* cut fuel either. The injectors continue to fire in sequence, but with *extremely* reduced durations (PW's on the order of 0.6 – 1.2 ms for most A32/33's, depending on injector size, fuel pressure, etc). Which is good news again because it's on this basis that the EU can work.

So lets see, since there is a stock pulse maintained, albeit tiny, and the EU can piggyback any stock fuel signal and adjust it up or down to a 20 ms maximum, which is more than enough since 100% DC at 6500 rpms is about 18.46 ms... Hmmm, what if we just added a LOT more fuel in the I/J Adj. Map(s) past the cut, would that work? Yep, it really is that simple! Well not quite, there can occasionally be some tricky stuff to throw a wrench into things right AT the cut point, but in theory, yes it's that simple. And that's why you see the high adjustments in the previous screen shot past the 6500 rpm rev limit.

So to actually do this you need to datalog (don't forget to save) one or two WOT throttle runs right up until you bounce off the stock limiter. Don't stop short of it, you need to actually have the limiter kick in. I'd suggest doing the runs in both 1st and 2nd gear, just to give you a few runs to compare/average values (but you'll likely find that the data you're after won't change much between the gears and runs). Third gear can wait until you've got it well set up for 1st and 2nd, as it's a lot harder on the engine and you'll be going a whole lot faster too. **From the datalogs you want to determine 3 things: the rpm point at which the stock cut occurs (will usually be 6500), what the stock ECU PW's are *just* before the cut (the Input Duration), and what the stock ECU PW's drop to past the cut (again the Input Duration, but higher than 6500 rpms).** Usually, due to engine momentum the rpms will actually fluctuate up past 6500 and down quickly around that cut point, and you'll see this show up on the datalogger. The first screen shot on the following page illustrates the type of datalog you are likely to see (zoomed in on the rev cut area, 2nd gear run only).

Notice the rpm fluctuation above and below the 6500 rpm cut (red line) and the corresponding spiking in stock ECU input durations (the yellow line). Also, if you look at the "A" and "B" time points (compare the values to the right of the parameter list as well as the red and blue vertical lines on the graph, respectively), you will notice that the rev cut did indeed occur at about 6500 rpms, and that the stock input duration was 12.2 ms before the cut, and afterwards, when the rpms jumped up higher to 6916 on the selected spike, it dropped to a mere 0.6 ms. So for this car, we now know that past the rev limit we need to maintain 12.2 ms. *Therefore, if the stock ECU is still putting out 0.6 ms, then we need to add 12.2 - 0.6 = 11.6 ms into our I/J Adj. map past the cut point.* Note that this calculation doesn't account for any additional adjustments you may want to make for the purpose of tuning your AFR ratio, it's just based on the ECU's tune. So, adding that into the mix, the formula for the required EU adjustment post-cut then becomes:

Required Adjustment = **Input Duration At/Before Cut** – **Input Duration After Cut** + **Optional AFR Tuning Adjustment**



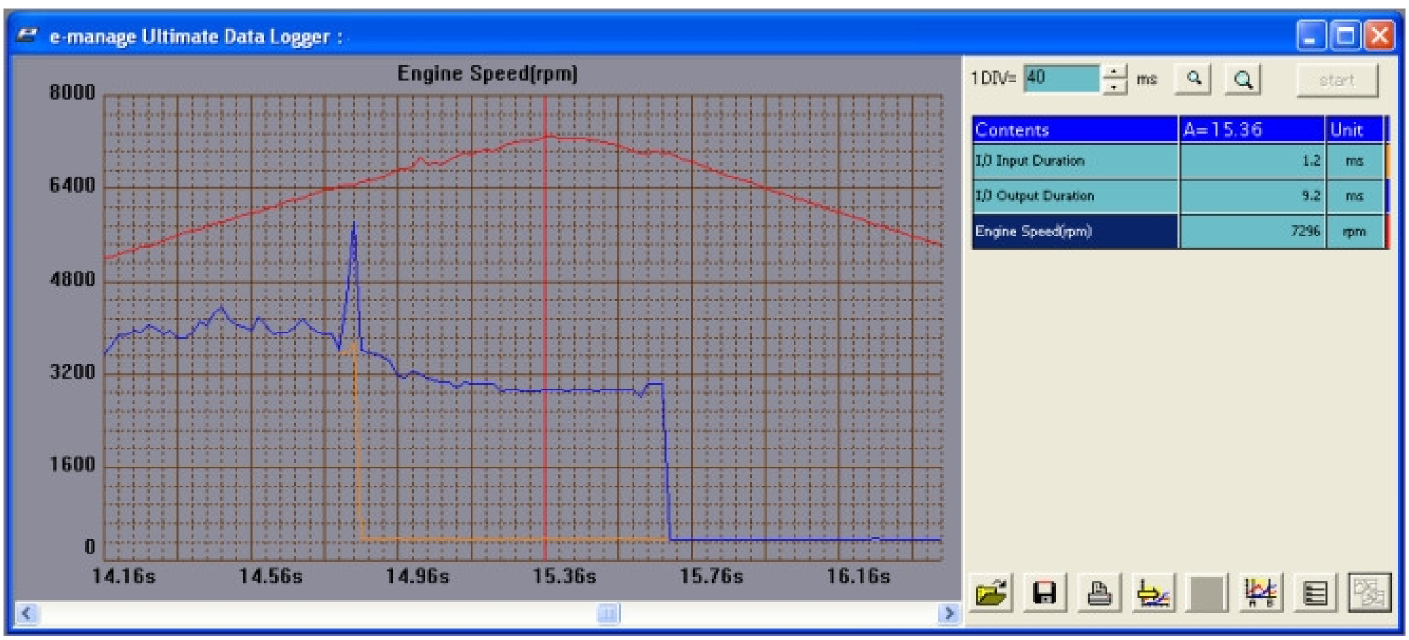
Now that's all well and good for rpms higher than the stock cut, but what about right AT the cut, transitioning that point where the stock ECU is cutting the input duration way down and the EU has to suddenly ramp the output duration way up? We don't generally want to add the fuel in much later than the cut point, otherwise the engine will momentarily run very lean and stumble noticeably, and likely won't get past the cut. Similarly, we don't want to add the fuel too soon before the cut, or we'll run pig rich momentarily and stumble again (since the ECU will not have cut fuel yet).

At first glance it would seem best then to have the EU start ramping fuel up as close to the cut as possible, hitting the full Required Adjustment right as the ECU is dropping down to minimal PW's (i.e. - just AT the cut), the idea being to minimize the inevitable pre-cut rich spike and avoid post-cut lean stumble. And since the EU's minimum control interval is 50 rpms, you would think that the I/J Adj. map columns should be set to 6450 and 6500 rpms, with 6450 rpms being the start of the ramp up and 6500 rpms being the end (i.e. - containing the Required Adjustment to go past the limiter). *Note that the ramp up start rpm is actually the cell before the "cut" rpm cell, since the EU interpolates between adjacent cells.*

However, in reality, there are other factors at play and the above scenario may not be ideal. You will likely have to experiment with the ramp up point and fuel adjustments on your car to get past the cut as smoothly as possible. For example, if you look back at the last I/J Adj. map screen shot, you'll notice that based on the datalogging that was done, the smoothest settings were found to be 6400 rpms (-0.74 ms) ramping up to 10.2 ms at 6500 rpms. That should be your guide really, how smooth it feels (or doesn't), correlated to what kind of lean spike or rich spike you're seeing pre/post-cut on the datalogger, and also compared to what the AFR is. *(BTW, it's not shown on the sample datalogs I've provided, but pay attention to the WB readings while doing this also, as keeping the AFR's in the ideal range will also contribute to smooth acceleration).*

I know on my car I had to datalog 3 or 4 runs and adjust the rpm ramp up point/fuel amounts a few times to ensure the rev extension was as smooth as possible in the first 3 gears. I also needed a 100 rpm ramp up interval, as opposed to 50. After some tweaking I was able to get it smoothed out enough that I could go through the rev limit with almost no perception of stumble, you could hardly feel anything in the car. You'll probably not be able to get it absolutely, perfectly smooth, given the 50 rpm interval limitation of the EU, but it can be gotten pretty darn close after some iterative datalogging runs and map tweaks.

As a final note on this topic I've included the following screen shot of a datalog from a successful rev limit increase. It could use a bit of improvement yet in getting the fueling a bit smoother, but it's not too bad. (No, this is not from my car in it's current state. I'd have used it as a smooth example but couldn't find any recent logs, must have accidentally erased some). Anyways, note the small (but inevitable) rich spike just before the cut (the blue output duration line spiking up from ~6400 to 6500), followed by the relatively steady fueling post-cut (again, the blue output duration line). A reasonably smooth rev limit extension should result in a similar datalog, if not better even.



4.7 Adjusting Ignition Timing

Adjusting ignition timing with the EU is very straightforward, but important to do carefully. Getting the ignition timing set optimally can unlock a lot of power, but the optimal advance is often close to the point of knock and/or detonation, which can be catastrophic, especially on boosted cars. Similar to air/fuel tuning, timing will only need to be adjusted under open loop, WOT conditions for most cars except possibly those that are boosted or very heavily modified. The stock ECU provides a reasonably good level of timing advance under closed loop conditions (idle, cruise, partial throttle). In most cases one map will be enough to tune with (usually Ignition Adj. Map 1). By now you should have the procedure for activating and displaying maps down pat (go to **Parameter Settings**, then **Map Select** tab, check the **Ignition Adjustment Map 1** box, and hit **Apply**). Once the map is active, double-click it in the tree to open it and proceed to set up your load axis and rpm scales as usual. If you wish to assign the map to a DIP switch, you could also do that at this point too (see Section 3.1, page 33).

Before you start messing with timing adjustments though, especially timing *advance* (as opposed to retard), you should make sure your AFR's are good across the rpm range under WOT. And by good I mean safe, as in not lean. The engine will be more tolerant to any accidentally induced knock while adjusting timing if the AFR is on the rich side rather than the lean side. Also, you should tune the timing using the type of fuel you are intending the map to be run with. Don't program a super aggressive "race gas" map and then run the same map using good ol' 91 octane! You could be asking for trouble.

Also, **you should have some kind of way to monitor engine knock!** Headphones are a good choice, as you can audibly hear the pinging/knock amplified. Now I realize that most people will not have such a system readily at hand, but some kind of knock sensor monitoring should be used. I would not rely on ears alone. Most people cannot hear the onset of knock over the engine and intake induction noise at high rpms with the natural ear. At the time of this writing, I have not yet had a chance to personally verify if the EU can properly read the A32/A33 knock sensor. If you have gotten it to work reliably, please let me know what settings you used! Otherwise, you can monitor the knock sensor voltage via the analog input, or via a scan tool or some other means.

To adjust timing then in the Ignition Adj. map, simply enter the number of degrees you wish to retard or advance into the cell for a given load and rpm point. **When first adjusting timing, go slowly, adjusting only a degree or 2 at a time, at most!** In fact, the EU will let you adjust in 0.5 degree increments, if you wish to use them. **Use negative numbers for retard, and positive numbers for advance, but note that just like the I/J Adj. maps, the number you are inputting is an adjustment on TOP OF the stock timing, NOT the total net timing**. *You can view the total net timing by using the datalogger, which determines it using the crank sensors and ignition pulses*.

The screen shot on the following page shows a sample basic Ignition Adj. map for a turbo'd VQ30. You'll see that some timing advance has been programmed in the N/A area (WOT, no boost yet), but as you go down the map into the boosted area, the timing adjustment shifts from advance back through stock timing and into retard. **As always, note that your car and its mods will be different so use at your own risk!**

Ignition Adjustment Map,P

Relative Pressure(PSI) | Change Scale

Column:Relative Pressure(PSI) 0.1 IncreR Row:rpm 50increment
Adj. Value() 0.5increment

	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000
-14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-11.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-5.8	0.0	0.0	0.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	0.0	0.0
-2.9	0.0	0.0	0.0	4.0	4.0	4.0	4.0	2.5	2.5	2.5	4.0	4.0	4.0	4.0	0.0	0.0
0.0	0.0	0.0	0.0	6.0	6.0	6.0	6.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0	0.0	0.0
1.5	0.0	0.0	0.0	3.0	3.0	3.0	3.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	0.0	0.0
3.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	1.0	1.0	1.0	1.0	0.0	0.0
4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	0.0	0.0
7.5	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	0.0	0.0
9.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	0.0	0.0
10.5	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	0.0	0.0
13.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	-7.0	0.0	0.0
14.5	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	0.0	0.0
16.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	0.0	0.0

4.8 2-Step Launch Limiter

If you're like me and you love to drag race, then this is going to be one of your favorite features, as it is mine. For those who may not know, the 2-step is an ignition cut-based rev limiter that functions only while the car is stopped, sitting on the line ready to launch. You can set it to any rpm you wish, and once you pop the clutch (or release the brake if you're auto) and the car moves it will deactivate allowing you to accelerate normally. The 2-step allows you to gain that extra consistency in your launch for better 60 ft times, and for boosted cars, also helps to build boost while sitting stationary at the line prior to launching. It really is a cool thing! It's actually very easy to set up on the EU also, but takes some experimenting with to determine what settings will give the best launch (this is entirely based on individual car mods and track conditions).

First off, I should just mention that to use the 2-step, you need to have tapped the VSS signal (which you will have if you following my wiring diagrams). To program the 2-step, go back to the **Parameter Settings** window again (sheesh everything starts here huh) and select the **IGN** tab. The bottom box area where it says “IGN Cut Setting” is where you'll set the feature up. In this area the items applicable to the 2-step are: **Start rpm**, **IGN cut rpm, Throttle Position**, **IGN Adjustment**, and **Start->Normal (# of VS Pulses)**.

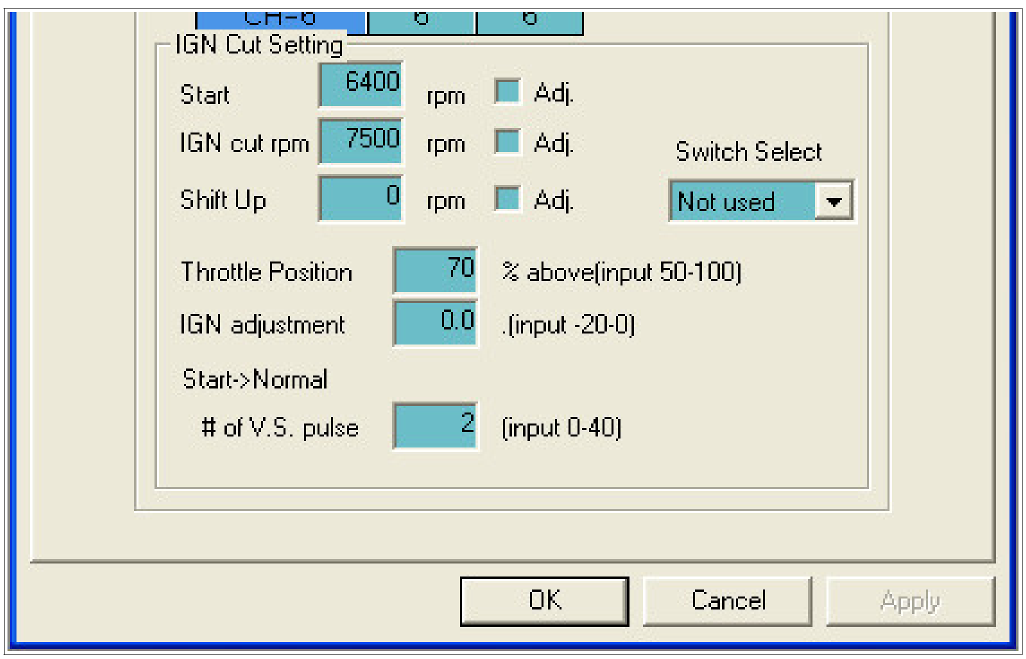
In order for the 2-step to activate, 2 conditions must be met simultaneously. First, the wheels must not be turning (i.e. - no pulses coming in from the VSS sensor). Second, the TP must be above the % you specify in the **Throttle Position** box. So put in any value above 50% that you'd like, but I usually set it somewhere around 70-80%, sufficiently high enough to make sure the 2-step doesn't activate until I've got my foot pretty much on the floor ready to accelerate at WOT.

Once the 2-step activates, it will not deactivate until it detects a certain # of pulses from the VSS (which correspond to the wheels turning). Makes sense right? So, in the **Start->Normal** box, enter the # of VSS pulses you'd like the EU to detect before releasing the 2-step limiter and allowing you to rev on up and accelerate normally. This value will need to be set via experimentation and personal preference. It will be different on different track/street surfaces and I've found is primarily related to wheel spin. If you're on slicks at the track and you have little or no wheel spin, you'll want the 2-step to deactivate pretty quickly so that you can get on with the business of accelerating - so something like 2 pulses is in the ballpark. But if you're spinning quite a lot, you'll want to set that number higher, so the rpm cut stays on and you don't rev up quickly, worsening the wheel spin.

The **Start rpm** is simply the rpm you want the limiter set at. The EU will hold the car at this rpm level until the required # of VSS pulses to deactivate (Start->Normal setting) are detected or until you back off the throttle to a point lower than the set TP%. The **IGN cut rpm** is a maximum rev limit applicable for power shifting (not discussed here) and is actually not used for the 2-step but it fills in automatically with whatever number you set the Start rpm to initially, so you'll want to bump this number up high to your normal fuel cut-based rev limit or just past it (e.g. 7200, or 7300 rpm etc)

Finally, the **IGN Adjustment** allows you to retard timing while the cut is active. To use this you'd input the number of degrees of retard you'd like into the box, and **also check the Adj. box beside the Start rpm** cell. Why would you want to use this? Well, to decrease engine torque, and hence control wheel spin off the line if you were really having trouble with it. To me this isn't the first thing to try though, I'd rather come off the line hard at full power so I'd seek other means of addressing traction issues first.

And that's basically it, pretty straightforward. I've attached a sample screen shot below showing the settings I used last year at the track. They worked pretty well for me but yours could be different.



If you'd like to see a small video showing the 2-step in action on my car, click this link: http://www.youtube.com/watch?v=0ZHfiOOxOCM

4.9 Removing the MAF Sensor

Please note that in this section I will be talking about physically removing the MAF from the car and running using a pressure sensor, not just tuning the EU using a pressure sensor for the load axis, which you can still do easily while yet leaving the MAF in the car and operational.

To properly remove the MAF and run/tune the car using a MAP sensor, you'll need to have a WBO2 sensor for tuning AFR's (should be a given) PLUS you'll need to have satisfied 3 wiring conditions (see previous Sections for details if necessary):

1) You must have used an "intercept" connection on the MAF, meaning you'll have used both the Airflow Input and Output lines.
2) You must have wired in a pressure sensor.
3) You must have wired in the Intake Air Temperature sensor

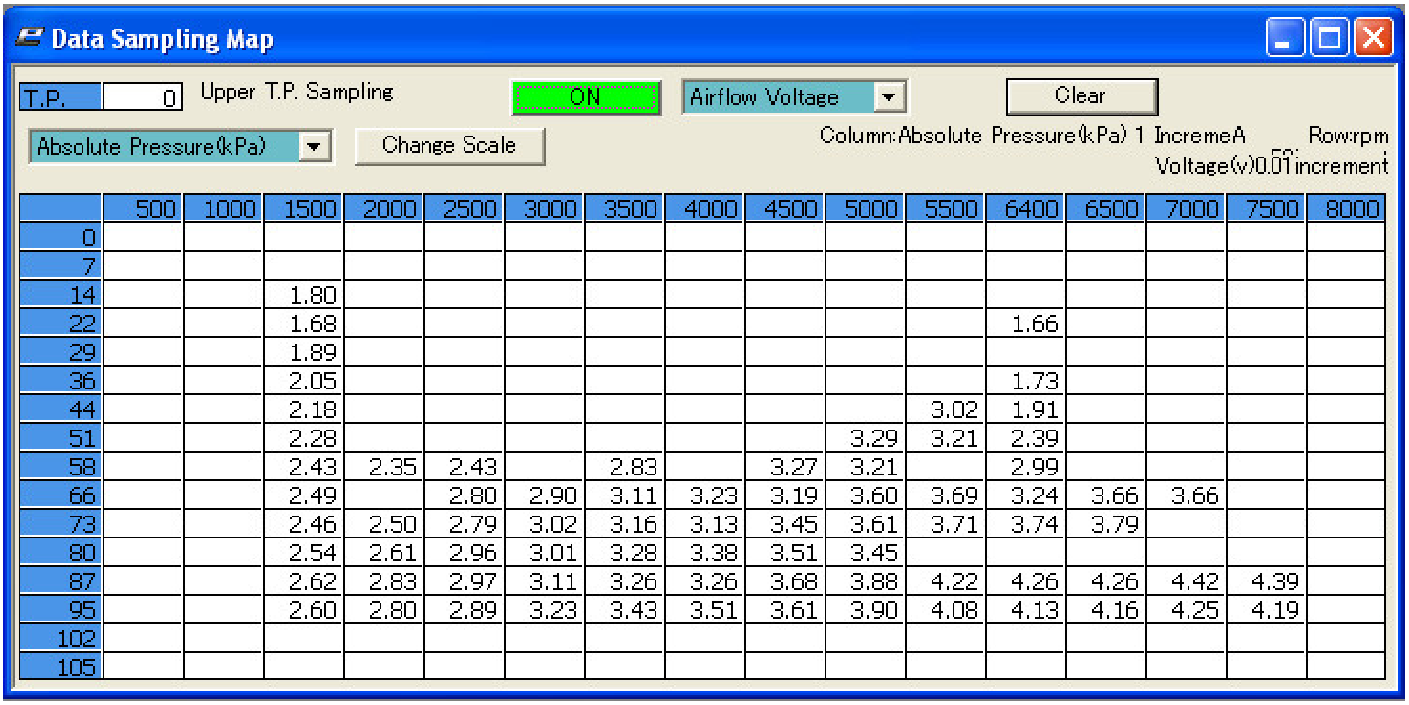
Once configured properly, the EU allows you to remove the MAF by continuously feeding fake MAF signals to the stock ECU (as if the MAF were still there), while controlling tuning itself using a pressure sensor (a MAP sensor) to determine engine load. How does it know what fake signals to feed the ECU? Well, you must tell it. Which means that you will have to build a MAF to MAP conversion map, so that the EU will know, for any given combination of manifold pressure and rpm, what fake MAF voltage it should be sending the stock ECU. This is not as easy as making a few WOT timing or fuel adjustments though, as **you will need to program the conversion map for all engine running conditions: idle, cruise, part throttle, WOT, etc**. In the EU this conversion map is called the **Airflow Output** map (Parameter Settings --> Map Select). Do not activate this map while the car is running if it is zeroed out and you have not programmed it, or your car will stall out!

In an attempt to make the task of building the conversion map easier, Greddy has provided a **Data Sampling map**, which is kind of like a datalogger in table format. To open it **click on the last icon in the main toolbar**. This map looks like most of the other maps, with a few extras.

In the top left corner, the "Upper T.P. Sampling" box is provided. This is the TP% at which point the map will become active and start data sampling as you run/drive the car (e.g. - if you wanted WOT only, you could enter say, 70%). Below that value it will not be active. If you want the map to be active at any TP%, leave the box at zero.

Just underneath the TP box is the drop down list for the load variable you will be referencing (or converting to in this case, so choose pressure here). Then at the top of the map you'll see an "OFF/ON" button, another drop down list, and a "Clear" button. The ON/OFF button starts/stops the data sampler (as long as the TP% setting is met). The Clear button does just what it says, clears the map entirely. And finally, **the drop down list at the top is used to choose which sensor/parameter you'd like to data sample. In our case, this will now be the MAF (i.e. - airflow voltage)**.

The screen shot on the following page shows a typical Data Sampling map. You can see some values for airflow voltage have already been filled in automatically. For example, at 3500 rpms and 58 kPa absolute pressure, the MAF signal was 2.83 volts. Or at 5500 rpms and 87 kPa absolute pressure, the MAF signal was 4.22 volts.



	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6400	6500	7000	7500	8000
0																
7																
14			1.80													
22			1.68									1.66				
29			1.89													
36			2.05									1.73				
44			2.18								3.02	1.91				
51			2.28							3.29	3.21	2.39				
58			2.43	2.35	2.43		2.83		3.27	3.21		2.99				
66			2.49		2.80	2.90	3.11	3.23	3.19	3.60	3.69	3.24	3.66	3.66		
73			2.46	2.50	2.79	3.02	3.16	3.13	3.45	3.61	3.71	3.74	3.79			
80			2.54	2.61	2.96	3.01	3.28	3.38	3.51	3.45						
87			2.62	2.83	2.97	3.11	3.26	3.26	3.68	3.88	4.22	4.26	4.26	4.42	4.39	
95			2.60	2.80	2.89	3.23	3.43	3.51	3.61	3.90	4.08	4.13	4.16	4.25	4.19	
102																
105																

Unfortunately Greddy did not program any averaging or other kind of sampling algorithm into the Data Sampler, which means that it continually overwrites in a given cell with the current, instantaneous value. This can cause a bit of a headache as it can create anomalous data readings that will seem out of place when compared to the cells around them. Nonetheless the Data Sampler is a useful tool to begin building your conversion map (**Airflow Output map**). I found that I was able to fill in a good portion of the map using the Data Sampler, but that eventually I started to get too many anomalies and so I turned it off, weeded out the bad data, and started interpolating and extrapolating the remaining portions of the map using Microsoft Excel. *I would recommend using Excel or a similar program that's capable of doing 3-axis surface mapping to develop the conversion map and then copy/re-enter the information into the Airflow Outflow map.* That way you can visually verify that the map you've developed is nicely smooth and contains the right slopes that approximately follow the VE (volumetric efficiency) map your engine is likely to have. (You can approximate what your VE curves might look like based on a dyno'd torque curve, which will have a similar shape).

There are 2 reasons it's worth spending the time to get the Airflow Output map as smooth and well developed as possible: 1) So your driveability will remain as good as stock, and 2) so you don't end up having to make large fuel and timing corrections everywhere when you start tuning (since the faked MAF signals will be close to what they actually would be if the MAF were still physically metering the air flow).

Once you're satisfied with your new Airflow Output map, you can activate it (you can only have either the Airflow Adjustment map or the Airflow Output map active at one time, which makes sense). But before you pull the MAF out for good I'd suggest first testing the car's driveability by unplugging the MAF sensor and running the car through all engine/driving conditions cautiously. Also monitor the AFR and ignition timing as you go to ensure nothing dangerous or seriously abnormal is occurring. Does the car feel any different to drive? If you've done the map well, you shouldn't be able to tell the difference, and no MAF related CEL's should appear either. Stop if you encounter problems and go back and tweak/correct the map.

I've provided another screen shot below, showing a sample Airflow Output map (N/A only). **As always, note that your car and its mods will be different – your car's driveability can be significantly affected since the map applies across all driving conditions – so it's especially "use at your own risk!"**

Airflow Outout Map

Absolute Pressure(kPa) | Change Scale | Column:Absolute Pressure(kPa) 1 IncremeA | Row:rpm Voltage(v)

	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6400	6500	7000	7500	8000
0	1.06	1.09	1.14	1.29	1.44	1.58	1.70	1.85	1.99	2.14	2.29	2.52	2.54	2.62	2.68	2.73
7	1.08	1.11	1.18	1.34	1.50	1.65	1.80	1.96	2.12	2.28	2.48	2.77	2.79	2.92	3.02	3.08
14	1.10	1.16	1.26	1.40	1.57	1.75	1.92	2.09	2.27	2.43	2.62	2.89	2.91	3.01	3.10	3.16
22	1.12	1.21	1.34	1.50	1.72	1.92	2.09	2.28	2.48	2.60	2.77	2.99	3.01	3.08	3.14	3.20
29	1.16	1.29	1.46	1.67	1.88	2.07	2.24	2.42	2.59	2.76	2.90	3.07	3.09	3.17	3.22	3.26
36	1.20	1.40	1.62	1.86	2.05	2.23	2.38	2.54	2.71	2.85	2.97	3.14	3.16	3.23	3.29	3.32
44	1.32	1.55	1.78	2.01	2.20	2.38	2.55	2.70	2.84	2.96	3.05	3.19	3.21	3.29	3.33	3.37
51	1.41	1.68	1.94	2.14	2.36	2.53	2.70	2.86	3.00	3.12	3.23	3.39	3.41	3.48	3.54	3.58
58	1.49	1.79	2.05	2.27	2.48	2.66	2.88	3.04	3.20	3.35	3.50	3.66	3.68	3.76	3.82	3.86
66	1.60	1.90	2.16	2.40	2.62	2.82	3.02	3.20	3.37	3.52	3.64	3.80	3.82	3.89	3.95	3.99
73	1.78	2.04	2.32	2.52	2.75	2.92	3.10	3.28	3.45	3.59	3.71	3.87	3.90	3.97	4.02	4.06
80	1.84	2.14	2.40	2.61	2.88	3.07	3.28	3.48	3.64	3.80	3.95	4.14	4.17	4.26	4.34	4.38
87	1.99	2.24	2.48	2.69	2.91	3.11	3.31	3.50	3.68	3.84	3.98	4.17	4.20	4.31	4.39	4.43
95	2.07	2.36	2.62	2.82	3.05	3.23	3.43	3.58	3.75	3.92	4.04	4.22	4.25	4.33	4.42	4.46
102	2.15	2.44	2.71	2.90	3.14	3.32	3.54	3.70	3.86	3.99	4.13	4.29	4.31	4.39	4.46	4.50
105	2.18	2.46	2.74	2.93	3.16	3.34	3.57	3.73	3.90	4.04	4.16	4.35	4.37	4.45	4.50	4.54

Once you are satisfied with the map then you will need to tune the car. Set up your maps based on pressure and tune to your heart's content (see the previous sections for more details), but take note of the air temperature at which you are doing all this (i.e. - the air temperature at which you developed the map and initially tuned it) for future reference. **One drawback to using pressure as the load variable is that your AFR's will need to be adjusted based on different air temperatures**. This is because as the temperature changes, the air will change density, and thus so will the mass of air entering the engine. This is of no concern to a MAF based system since the MAF sensor directly measure the *mass* of air flowing, but the pressure sensor cannot do so. As the air gets colder, it will get denser. *Therefore, it's probably best to do your initial conversion and tune in colder temperatures. If the temperature then warms up and you haven't had a chance to re-tune you will become safely richer, rather than leaner, since the air is becoming less dense*. The good news though is that you probably won't have to fully re-develop your I/J Adj. map (your VE won't have changed much), and you should be able to simply adjust everything across the board using the **Intake Temp Adj. Map** (**Parameter Settings**, **Map Select** tab to activate). The map is small, and requires you only to enter a single fuel adjustment for the chosen temperature (as the sample below shows).

Intake Temp Adjustment Setting

Temp(C)1 increment | Duration(ms)0.02increment

Temp	-7	0	7	15	23	31	40	47	55	63	71	80	87	95	103	111
Adj.valı	0.00	0.06	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.10 Using the Internal Datalogger

In Section 4.2 I described how to use the software (laptop) datalogger. In this section I'll talk about using the internal datalogger on the EU unit itself.

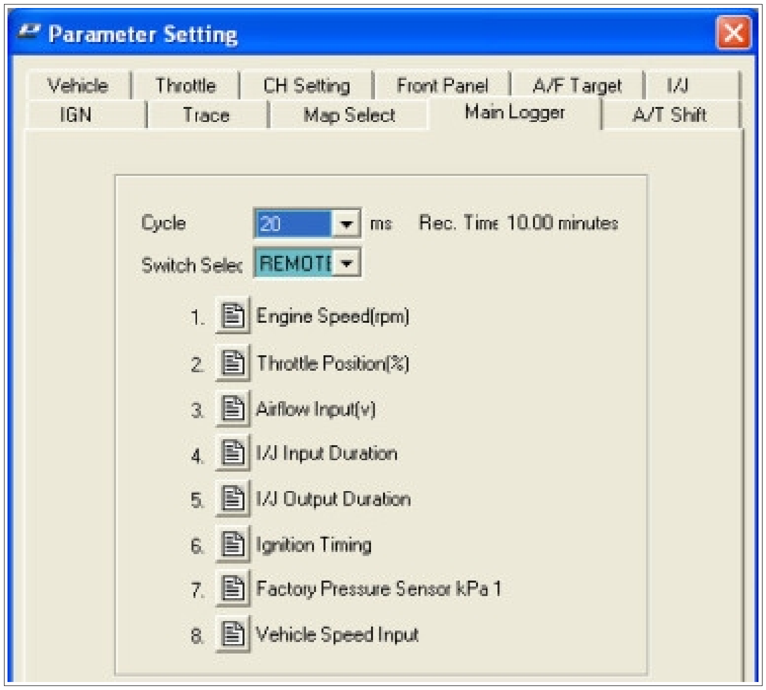
The main unit can datalog on its own without the laptop connected. And as mentioned in Section 4.2, you can download the log onto the laptop later. However, unlike the software datalogger, the main unit can only datalog up to 8 parameters at once (the laptop can log as many parameters as are available), and it has a finite amount of memory. How long it can datalog before running out of memory depends on the sampling frequency you set for it. At the largest frequency (fastest sample rate) you will get 10 minutes. At the smallest frequency (slowest sample rate) you will get 500 minutes. The fastest sampling rate interval is 20 ms, or one sample 50 times per second (the software logger samples at this rate automatically), and the slowest sampling rate interval is 1000 ms, or a measly 1 sample per second. You can also choose intermediate steps of 50, 100, 200, and 500 ms. Which one you'd choose depends on the situation and how accurate the data needs to be (e.g. - how much detail you need about how a given parameter(s) is changing with time).

For example, if you wanted to log a pass down the ¼ mile track you'd likely use the fastest sampling rate. You don't need the full 10 minutes of data anyways for one pass, and you probably DO want the higher accuracy gained from the fast sample rate. Let's say though, that you needed to take an hour's drive or two out of town, which would involve mostly freeway cruising, and you were mainly interested in your average speed and AFR during that time. Well in this case you could choose a smaller sample period such as 200 or 500 ms, which would give you 100 or 250 minutes, respectively, since your cruising speed isn't likely to change all that much (or very quickly) for the most part, and neither should your AFR. Plus you are only looking for rough averages for the trip and don't need to analyze the log in detail as you might if you were using it to fine tune the car's fuel and ignition settings.

The choices you have for sample rate frequencies and corresponding memory time availabilities are as follows:

Sampling Cycle (ms)	Sampling Frequency (times per second)	Recording Time (min)
20	50	10
50	20	25
100	10	50
200	5	100
500	2	250
1000	1	500

So to set up the internal datalogger's settings in the software, bring up the **Parameter Settings** window and select the **Main Logger** tab. Choose your sample period from the **Cycle** drop down list, and note that the EU updates the text line beside it showing you how much recording time you'll have. Next, choose **Remote** from the **Switch Select** list. This will assign the starting and stopping of the datalogger to the switch connected to the switch port on the front of the EU. (Note that you can also use a switch in Option Port 1 or 2, but usually you'll have those occupied with a WBO2 sensor and/or pressure sensor etc). Finally, choose the parameters 1 through 8 (or fewer) that you'd like logged by clicking on the icon(s). Those icons bring up the same Input Data Setup window you'd use to select the parameters displayed on the software datalogger (refer to section 4.2 for details). When you're done, click **Apply** or **OK** to close the window. The screen shot below shows typical settings for the internal datalogger.



You may recall that I mentioned needing a momentary (pulse) type switch to be wired in to the switch port for the datalogger (see Section 2.4). This is because the datalogger switch does not function like a common light switch that is constantly either on or off. Instead it functions via pulses: one pulse to start logging, and another pulse to stop logging. In other words, to start the datalogger recording, press the switch once. When you are ready to stop recording, press it again. It's not difficult, but at any given time you need to be a bit aware of whether you have stopped or started the logger. If you start it without having downloaded the previously recorded log onto the laptop you'll overwrite it. In other words, be careful not to accidentally pulse the switch thinking you're stopping a logging session, when in fact you'd already stopped it with the last pulse and now you've just started a new session and overwritten the previous log!

Thankfully though, you can tell when the unit is datalogging by watching the Active LED on the front panel (the light on the left side is the Active LED). It will be flashing orange while the datalogger is recording (and will otherwise be a steady green if all is normal).