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## Introduction

Congratulations on your decision to install an Autronic engine management system to your vehicle. Autronic systems have been successfully installed on many vehicles such as rally cars, off road vehicles, street cars, powerboats, offshore powerboats, and in other forms of racing.

Autronic is designed to enable users to precisely control ignition timing and fuel-air mixture. Precise ignition and mixture control also leads to excellent drivability and fuel economy.

## ***Before You Begin***

### **1) READ THIS ENTIRE MANUAL BEFORE STARTING.**

The greater your knowledge of the operation of the Autronic ECU, the easier you will find it to understand what you are doing, and why.

2) Read any additional material accompanying this manual that updates the document since it was written.

3) You may need special parts or additional tools or test equipment in order to complete installation. Make sure you have these items on hand before you begin to avoid frustration. Contact your Autronic dealer if you have difficulty.

4) Do not take any shortcuts. Mistakes in the early stages of installation can cause you major headaches later on, be it in a few days or a few months time. Mistakes or shortcuts will cost you money and frustration in finding and fixing unnecessary problems. You have the opportunity to make your Autronic's ECU operation extremely dependable and easy to use by doing it right the first time.

**Do not plug the ECU into the harness and start the engine without the board being mounted in the ECU case. This is the most common cause of ECU damage.**

5) Avoid open sparks, flames, or operation of electrical devices near flammable substances.

6) Always disconnect the Battery cables when doing electrical work on your vehicle.

7) All fuel system components and wiring should be mounted away from heat sources, shielded if necessary, and well vented.

8) Make sure there are no leaks in the fuel system and that all connections are secure.

9) Disconnect the Autronic ECU from the electrical system whenever doing any arc welding on the vehicle by unplugging the wiring harness connector from the ECU.

## **Software.**

### ***PC hardware requirements.***

The calibration and data logging software supplied with Autronic SMD ECU may be used with computers operating under Windows 95/98/ME/XP or MS-DOS 3.0 or later.

### ***Computer Required Hardware***

The computer must have the following hardware

- VGA graphics adaptor (or compatible adaptors).
- Minimum of 4MB random accesses memory.
- One serial communication port or USB port (requires USB to serial adaptor)
- One 3.5" any capacity or 5.25" high capacity floppy.

### **The following functions are available using this program:-**

1. Real-time display of the current operating status of the ECU and engine.
2. Display of error/fault condition history information recorded in the ECU and the cancellation of stored error history.
3. Display of the relative timing of the engine position reference signals for ease of setup.
4. Setup of ECU data logging.
5. Data logging using PC memory.
6. Display of logged ECU or PC memory data.

### **Calibration Adjustment:-**

- Non-interactive calibration of the ECU. (Off-line calibration editing).
- Interactive calibration of the ECU (online calibration editing).
- Disk file storage and retrieval of calibrations.
- Free transfer of calibrations between file, screen and ECU.
- Calibration process does not effect normal ECU operation ie:- No hiccups during online adjustment.
- Calibration may be password secured in ECU to prevent unauthorised access.
- User ID may be included with calibration in ECU when required.

### ***Software installation Windows Software.***

- Step 1. Start Windows
- Step 2. Place floppy disk in A: drive.
- Step 3. Click on the “Start” button and then click on “Browse”.
- Step 4. Select the A: drive and double click the file on the A drive.
- Step 5. Click the OK button.
- Step 6. Read the options displayed and click the “Next” buttons to complete the installation.
- Step 7. Double click on the icon on the desktop to run the software.

### ***Software Installation MS-DOS Software.***

- Step 1. Start Windows
- Step 2. Place floppy disk in A: drive.
- Step 3. Click “Start” and then “Run” Type A:\INSTALL.EXE and Click “Ok”.
- Step 4. Select version to install and press Enter.
- Step 5. Select “Complete Installation” and press Enter.
- Step 6. Press Enter again to start the installation. After Installation is complete, select Exit and press Enter.
- Step 7. Double click on the icon on the desktop to run the software.

**General keys**

Esc .....	Opens or closes, menus.
Tab.....	Next item.
Alt + menu letter.....	Opens menu.
Q.....	Closes windows.
Space.....	Find a site, places the curser at the current site.
Page Up.....	Previous table.
Page Down.....	Next table.
Ctrl + F10.....	Base fuel table.
Shift + F10.....	Base ignition table.
G.....	Displays table in 3D graph.
Alt + X.....	Exits the program.
F1.....	Help
F2.....	Saves the current file.
F3.....	Go online to ECU.
F4.....	Lock (store) changes into ECU.

**Edit keys.**

Enter.....	Type a new value into a table.
=.....	Make small increases in table value.
-.....	Make small decreases in table value.
Shift + +.....	Make large increases in table value.
Shift + -.....	Make large decreases in table value.
Delete.....	Delete a axis value (e.g:- RPM or Load axis value)
Insert.....	Insert a axis value (e.g:- RPM or Load axis value)
E.....	Edit axis value.
Shift + Right.....	Copies a site value to the right of current site.
Shift + Left.....	Copies a site value to the left of current site.
Shift + UP.....	Copies a site value to the above site.
Shift + Down.....	Copies a site value to the site below.

**Autotune keys**

F5.....	Run or stop Autotune.
C.....	Course tune.
F.....	Fine tune.
R.....	Remove attribute.
A.....	Set user attribute.
Ctrl + K.....	Copy row attribute.
Ctrl + M.....	Copy Column attribute.
Ctrl + K.....	Show attribute.

**Data Logging keys.**

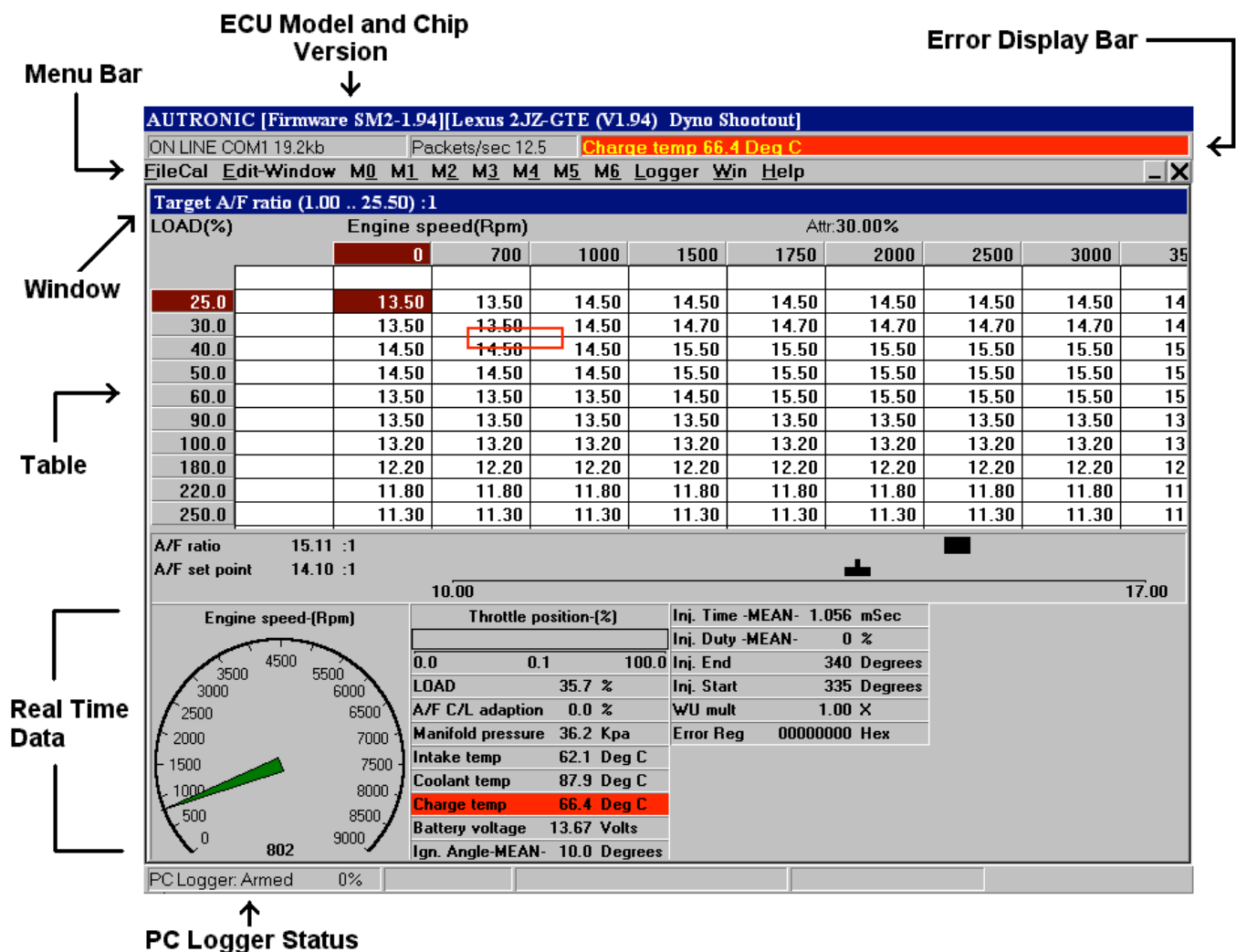
F8.....	Starts and stops PC logger.
F10.....	Graph logged data.
Z or Arrow Up.....	Zoom in on graphed data.

## Software Interface and Menus

The options available under menu “Edit-Window” will change depending on which table or window is displayed. Always check this menu for possible options. Some of the hot keys on the previous page will only be available when certain tables or windows are displayed.

Example:- The setup options for Autotune are only visible in the Edit-Window menu when the Base Fuel Delivery table is displayed.

The drop down menus can be selected by pressing the ESC key or by pressing Alt + the underscored letter of the menu item. e.g:- Alt + 1 will open the M1 menu.



Real time display of engine parameters are displayed below open tables. The items displayed can be selected from the “PC Limits/Log setup” under the “Logger” menu.

The User ID/Error bar will turn red and display any error or engine parameters outside the limits set in the “PC Limits/Log setup” under the “Logger” menu. These limits can be set so you do not have to monitor engine parameters while tuning for example, as the Software will do this for you.



**Mode Flags.**

(If you have a Subaru 2001-04 ECU then ignore this section).

Autronic ECU use mode flags to select functions not selectable from the software menus.

In this example we will set mode flag 1. Setting mode flag 1 can be done in the software by selecting from items in the menus and it is not necessary to do the settings via the mode flags but for this example we will do it this way.

The example engine has the following,

Number of ignition coils	1
Ignition amplifier	MSD (CDI ignition)
Cylinder Reference signal	-ve (falling signal)
Cylinder pulse signal	+ve (rising signal)

Using mode flag 1 information below we can find the value required is 49.

Function	Value	Flag Value
Ignition Coils	1	1
Ignition Amplifier	MSD	32
Cylinder Reference signal	Falling signal	16
Cylinder Pulse signal	Rising signal	0
		Mode Flag 1 = 49

1	1 COIL IGNITION SYSTEM	1
	2 COIL IGNITION SYSTEM	2
	3 COIL IGNITION SYSTEM	3
	4 COIL IGNITION SYSTEM	4
1	NEGATIVE TRIGGERED IGNITION AMPLIFIER (MODULE) eg:- Bosch HEI	ADD 0
1	POSITIVE TRIGGERED IGNITION AMPLIFIER (MODULE) eg:- MSD	ADD 32
1	CYLINDER REFERENCE PULSE INPUT POSITIVE (RISING SIGNAL) TRIGGERED	ADD 0
1	CYLINDER REFERENCE PULSE INPUT NEGATIVE (FALLING SIGNAL) TRIGGERED.	ADD 16
1	CYLINDER PULSE INPUT POSITIVE (RISING SIGNAL) TRIGGERED.	ADD 0
1	CYLINDER PULSE INPUT NEGATIVE (FALLING SIGNAL) TRIGGERED.	ADD 64
1	CYLINDER PULSE INPUT POSITIVE & NEGATIVE (RISING & FALLING SIGNAL) TRIGGERED.	ADD 128

## Software Tables.

The base Fuel and Ignition tables and most other tables have user selectable X and Y axis sites. See the “Edit” keys section for keys to insert, delete and edit a axis value.

### Fuel and Ignition.

The fuel and ignition tables have RPM and Load axis. Any axis value inserted, deleted or edited in either fuel or ignition table will be mirrored in the both tables.

The load axis when throttle mapping an engine relates to the throttle position. e.g:- Load axis 30 = 30% throttle position. When pressure mapping the Load sites relate to manifold pressure in Kpa absolute.

Example:-

Load axis of 100 = 0 kpa gauge pressure.

Load axis of 50 = -50 kpa gauge pressure.

Load axis of 200 = 100 kpa gauge pressure.

To convert psi to Kpa absolute,  $\text{Psi} \times 6.8 + 100 = \text{KPA absolute}$ .

### Idle ignition table.

The idle ignition table can be very useful to maintain a stable idle rpm on engines without idle control valves.

By setting up the table as below the engine idle rpm will drop only slightly when AC or auto transmission is put into drive. In this example the idle speed of the engine is 800 RPM.

RPM				
750	800	1500	2000	3000
30	0	0	25	35

When a load is placed on the engine and the RPM drops below 800 RPM the ignition timing advances, this can help prevent the engine RPM dropping as the engine produces more power with the extra advance. The ignition timing values at 2000 and 3000 RPM allow the engine to smoothly come back to idle.

### Auxiliary output tables.

PWM table.

This table can be use to control any device requiring pulse width modulated signal. Values anywhere from 0 to 100 can be selected, with 0 = off and 100 = on.

The PWM frequency and Y axis can be defined in the “PWM & on/off setup” under menu M4.

On/Off table.

This table can control any device requiring on or off operation. 0 = off and 1 = on.

The on/off Y axis can be defined in the “PWM & on/off setup” under menu M4.

## Basic Software setup.

The Software has many options that can be set. For 95% of applications most of these will not need changing from the defaults. The warmup/cold start setting and acceleration table values should not need to be modified if the main fuel and ignition tables have been correctly tuned.

If the acceleration enrichment table is modified before the main fuel table is fully tuned this can lead to confusing engine tune problems.

**All PnP boards are supplied with a startup calibration program already loaded.  
The following setup information is only required if vehicle is modified beyond standard  
and bigger injectors are used.**

Information required before you start.

Engine size in cubic centimetres (CC)  $CC = CI * 16.378$ .

Number of cylinders.

Compression ratio.

Injector flow at 100% duty.

Injector ohms resistance.

Starting the calibration program.

Connect the PC Data Cable to the PC and ECU. Turn on the ignition switch.

Select the windows "Start" button and then select "Run", type ECUCAL and click the "OK" button.

Select from M1, Base settings.

1. Set the "Overall fuel cal mul" using the following formula.

$$\text{OVERALL FUEL CAL MUL.} = 8.112 * D / I$$

MULT (mSEC)

Where:-

D = CYLINDER DISPLACEMENT (in c.c.)

I = INJECTOR FLOW RATE (in c.c/minute) @ operating pressure.

Using Petrol (Gasoline) with a density of 0.765 g/c.c.

Select from M1, Injectors.

Select injector with the same part number or ohms resistance.

## Engine Setup.

**Most hardware settings are already set in your PnP board, and do not need to be changed.**

Select from M1, Engine Setup.

1. Select method of mapping.

Options are,

Manifold pressure (normally used in EVO and Subaru).

Throttle position.

Thr/Manifold (See Advanced software setup).

Engines with one throttle butterfly for every intake port and not turbocharged, select Throttle position. When throttle mapping, the map sensor hose is not connected and is vented to atmosphere.

Engines with one throttle butterfly for every intake port and turbocharged, select Thr/Manifold position. (See Advanced software setup for information on this).

All other engines select Manifold pressure. Map sensor hose is connected to the intake manifold after the throttle body.

2. Select engine cycles.

4 Stroke (Mitsubishi EVO and Subaru).

2 Stroke or rotary

3. Set Cylinders.

On rotary engines this is the number of firings per crankshaft revolution not the number of rotors. (Mitsubishi EVO and Subaru = 4 ).

4. Set number of ignition coils. e.g:- A six cylinder engine with three double ended coils you set the coils to 3. (Mitsubishi EVO and Subaru = 2).

5. Set Ignition trigger, to -ve or +ve.

+ve = CDI ignitions e.g:- MSD or Autronic direct fire CDI

-ve = Ignition modules e.g:- Bosch 008

For EVO use: Ignition output +ve edge

For Subaru use: Ignition output +ve edge

6. Set Cylinder reference.

Options, -ve or +ve edge.

This is the sensor triggering edge for the number one cylinder reference signal.

Bosch or Siemens hall effect sensors, optical sensors or if using a reductor interface produce +ve (rising signal) as metal trigger the sensor and -ve (falling signal) as metal leaves the sensor.

For EVO use: Cylinder reference -ve edge

For Subaru use: Cylinder reference +ve edge

## 7. Set Cylinder pulse, options are,

-ve

+ve edge

+ve AND -ve edge.

This is the sensor triggering edge for the cylinder pulse signal.

For EVO use: Cylinder pulse +ve edge

For Subaru use: Cylinder pulse +ve edge

Normally you don't have to change anything from already loaded values.

**Injector selection.**

Select from M1, Engine Setup.

If the injector you are using is in the list then select this. Most injectors with around 16 ohms resistance select "Bosch L late EG 901"

EVO and Subaru select "Bosch L late EG 901"

Injectors sent to Autronic for testing or those that have been tested previously can be defined in the USER DEFINE Sel. Ask a Autronic dealer to see if these parameters are available for your injectors.

**Base Fuel Delivery.**

Select from M2 Base Fuel Delivery, or press Ctrl + F10.

**If using stock injectors and camshafts, you normally can start with already loaded values, and fine tune them.**

If not follow steps below.

Setup the fuel tables using the information below. See Keyboard Keys for information on inserting, deleting, editing Load and RPM sites.

Generally RPM sites every 500 RPM are all that is required in most cases.

- i. Engine is to be setup using throttle position as the primary load input.

Engines using throttle position for mapping should have the load sites setup as per the sample with a lot of small throttle position sites.

< Base Fuel Delivery (Vol. Eff) % (0 to 200) >				
ENGINE SPEED RPM				
LOAD	0	2000	PEAK TORQUE RPM	PEAK POWER RPM
0.0	25.0	25.0	25.0	30.0
2.0	30.0	30.0	30.0	35.0
5.0	50.0	45.0	45.0	40.0
10.0	60.0	55.0	55.0	45.0
30.0	70.0	60.0	60.0	50.0
70.0	80.0	80.0	100.0	90.0
100.0	80.0	80.0	110.0	100.0

- ii. Engine is to be setup using manifold absolute pressure as the primary load input. (Default primary load input for EVO and Subaru)  
Engines using manifold pressure for mapping should have the load sites setup as per the sample. Engines not turbocharged or supercharged will not require load sites greater than 100.

< Base Fuel Delivery (Vol. Eff) % (0 to 200) >				
ENGINE SPEED RPM				
LOAD	0	2000	PEAK TORQUE RPM	PEAK POWER RPM
30.0	60.0	70.0	80.0	70.0
50.0	65.0	75.0	90.0	85.0
70.0	70.0	80.0	100.0	100.0
90.0	70.0	80.0	110.0	100.0
100.0	70.0	80.0	110.0	100.0
200.0	75.0	80.0	110.0	100.0
400.0	80.0	80.0	110.0	100.0

!! **CAUTION** !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

This preliminary selection will generally result in a safe RICH fuel calibration, but extreme caution should be exercised until the fuel delivery has been fully matched to the engines exact requirements.

### ***Base Ignition Timing.***

Select from M2 Base Ignition Timing, or press Shift + F10.

**The PnP boards are already loaded with standard base timing values. These tables are a guide to ignition timing requirements.**

Example:- Mitsubishi EVO5 with 9.3:1 compression ratio, 1bar boost and 96 octane fuel would require only 8 degrees timing at the engines maximum torque rpm.

These examples are based on air fuel ratios of 10.8 to 11.2 at 1bar boost.

See following sample tables for a guide to ignition table requirements.

**Turbocharged Mitsubishi EVO5 9.3:1 compression ratio, 96 octane fuel.**

	RPM						
Load	0	1000	2000	3000	4000	5000	6000
30	25	25	35	40	40	40	40
50	20	20	30	35	35	35	35
70	10	10	20	30	30	30	33
90	10	10	20	30	30	30	32
100	10	10	20	30	30	30	31
150	10	10	12	17	17	17	18
200	8	8	10	8	8	8	9
220	6	6	8	6	6	6	7

Subaru WRX 8.0:1 compression ratio, 96 octane fuel.

				RPM			
Load	0	1000	2000	3000	4000	5000	6000
30	18	15	30	35	40	40	40
50	24	15	30	35	35	35	35
70	24	15	30	35	30	30	33
90	34	15	30	35	30	30	32
100	20	18	30	35	30	30	31
150	18	18	24	24	24	26	26
200	15	15	21	21	21	22	24
220	10	15	18	18	18	20	21
250	5	10	14	12	12	14	16

Base Ignition Timing table.

### ***Relay/Analog O/P***

Select from M1, Relay/Analog O/P

1. Aux output.  
Select device you wish to control. See Advanced Software setup for information on idle and boost control valve setup.

## Subaru 1995-96 PnP notes

### ***Jumper Settings***

Jumper on base board near connector, selects Aux O/P to boost control or idle control.

1-2 = Boost control

3-4 = Idle control

### ***Pinout***

Antilag SW = Pin B14 (Ground to activate)

Inj5 = Purge (Pin A6)

Inj6 = Fan2 (Sub cooling fan Pin A4)

Inj7 = Fan1 (main cooling fan A17)

### ***ECU Board Installation***

Remove existing ECU board and install Autronic board.

The map sensor hose and PC data cable socket need to be assessable from the outside of the case. The best method is to drill two holes in the side of the case top and fit two grommets that these can pass through.

Connect air temp sensor to air flow meter wires

Air temp sensor	Air flow meter
wire colour	wire colour
RED	WHITE
BLACK	BLACK

Connect vacuum hose from intake manifold to the internal map sensor on the PnP board.

### ***Idle Control Setup***

This ECU has the option for idle control or boost control by changing a jumper on the base board. To select idle control put the jumper on pins 3 and 4 of the twin jumper near Pin A1 on the main connector.

To use idle control, select "Ford 2 wire Aux out" for IAC Output under menu M1 > Relay/Analog O/P. Also set "Boost" to Disabled. Then go to menu M6 > IAC Control and enable idle control.

If using boost control rather than the idle speed, this relies on a fixed throttle opening and an ignition ramp in the idle ignition timing table. The hose from the idle valve to the intake ducting needs to be blocked. This can be done by pushing an aluminium plug inside this hose, or using a blank off cap on the outlet of the valve.

The ECU is loaded with a calibration that has idle ignition timing values to suit a 950 rpm idle speed with no accessories on.



The throttle stop must be adjusted so the engine will idle at exactly 950 rpm with the AC off and the cooling fans not operating.

To get this idle speed do the following over and over until you have a 950 rpm idle. Not 960 or 940 but 950 rpm.

1. With the engine stoped adjust the idle stop.
2. Turn ignition on.
3. Remove connector from throttle position sensor for more the 20 seconds.
4. Replace TPS connector
5. With the throttle pedal open the throttle to maximum and hold there for 5 seconds
6. Release throttle and start engine.
7. Check idle speed if not correct repeat this sequence.

If after the engine is fully tuned the idle speed is no longer 950 rpm then repeat the above until correct.

## Subaru 1997-98 PnP notes

### ***Jumper Settings***

Jumper JP1 on base board near connector, selects crank and cam signal for cars with and without immobiliser.

1-5 and 4-8 = Cars without immobiliser

2-6 and 3-7 = Cars with immobiliser

### ***Pinout***

Antilag SW = Pin A5 (Ground to activate)

Inj5 = Purge (Pin C15)

Inj6 = Fan2 (Sub cooling fan Pin C8)

Inj7 = Fan1 (main cooling fan Pin C16 )

Inj8 = Pin A16

### ***ECU Board Installation***

Remove existing ECU board and install Autronic board. The original ECU had three sockets, this ECU has four. Only three sockets are used. The original ECU case top needs to be modified so it will fit the wider connector.

The map sensor hose and PC data cable socket need to be assessable from the outside of the case. The best method is to drill two holes in the side of the case top and fit two grommets that these can pass through.

Connect air temp sensor to air flow meter wires.

Air temp sensor	Air flow meter
wire colour	wire colour
RED	GREEN
BLACK	BLACK/GREEN

Connect vacuum hose from intake manifold to the internal map sensor on the PnP board.

### ***Idle Control Setup***

This ECU has the option for idle control or boost control by changing a jumper on the base board. By default the jumper and software is set for boost control. To select idle control put the jumper on pins 3 and 4 of the twin jumper near Pin A1 on the main connector.

To use idle control select "Ford 2 wire Aux out" for IAC Output under menu M1 > Relay/Analog O/P. Also set "Boost" to Disabled. Then go to menu M6 > IAC Control and enable idle control.

If using boost control rather than the idle speed, this relies on a fixed throttle opening and an ignition ramp in the idle ignition timing table. The hose from the idle valve to the intake ducting needs to be blocked. This can be done by pushing an aluminium plug inside this hose, or using a blank off cap on the outlet of the valve.

The ECU is loaded with a calibration that has idle ignition timing values to suit a 950 rpm idle speed with no accessories on.

The throttle stop must be adjusted so the engine will idle at exactly 950 rpm with the AC off and the cooling fans not operating.

To get this idle speed do the following over and over until you have a 950 rpm idle. Not 960 or 940 but 950 rpm.

1. With the engine stoped adjust the idle stop.
2. Turn ignition on.
3. Remove connector from throttle position sensor for more the 20 seconds.
4. Replace TPS connector
5. With the throttle pedal open the throttle to maximum and hold there for 5 seconds
6. Release throttle and start engine.
7. Check idle speed if not correct repeat this sequence.

If after the engine is fully tuned the idle speed is no longer 950 rpm then repeat the above until correct.

## Subaru 1999-00 PnP notes

### ***Jumper Settings***

#### **Lower Board (Near main connector)**

JP1 - Do not use

JP2 – Selects CAM/CRANK Pinouts (Twin jumpers)

A: Jumpers parallel to connector (for cars with immobiliser)

- C5 = Crank
- C6 = CAM

B: Jumpers right angle to connector

- C5 = CAM
- C6 = Crank

JP3 - Links CAM ( crank –ve to ground not required if P.C. link track intact)

JP4 – Do not use

JP5 - Air temp select

A: Link close to main connector selects external air intake temp sensing to main connect C19

I : For NTC sensor install JP7 on upper main board

II: For Autronic air temp sensor REMOVE JP7 on upper main board.

B: Link away from main connector selects internal air temp sensor. JP7 on upper main board MUST be removed

JP7 – Install for road car application only

I: Causes fan2 relay o/p (A13) to energise with a/c relay o/p (A22)

JP8 – Install for rally applications only

Prevents a/c request I/P (B11) from controlling a/c relay o/p (A22)

JP9 – Twin jumpers

For rally applications install jumpers at right angle to main connector. Inj 5 to B7 (shift light). Inj 7 to A22

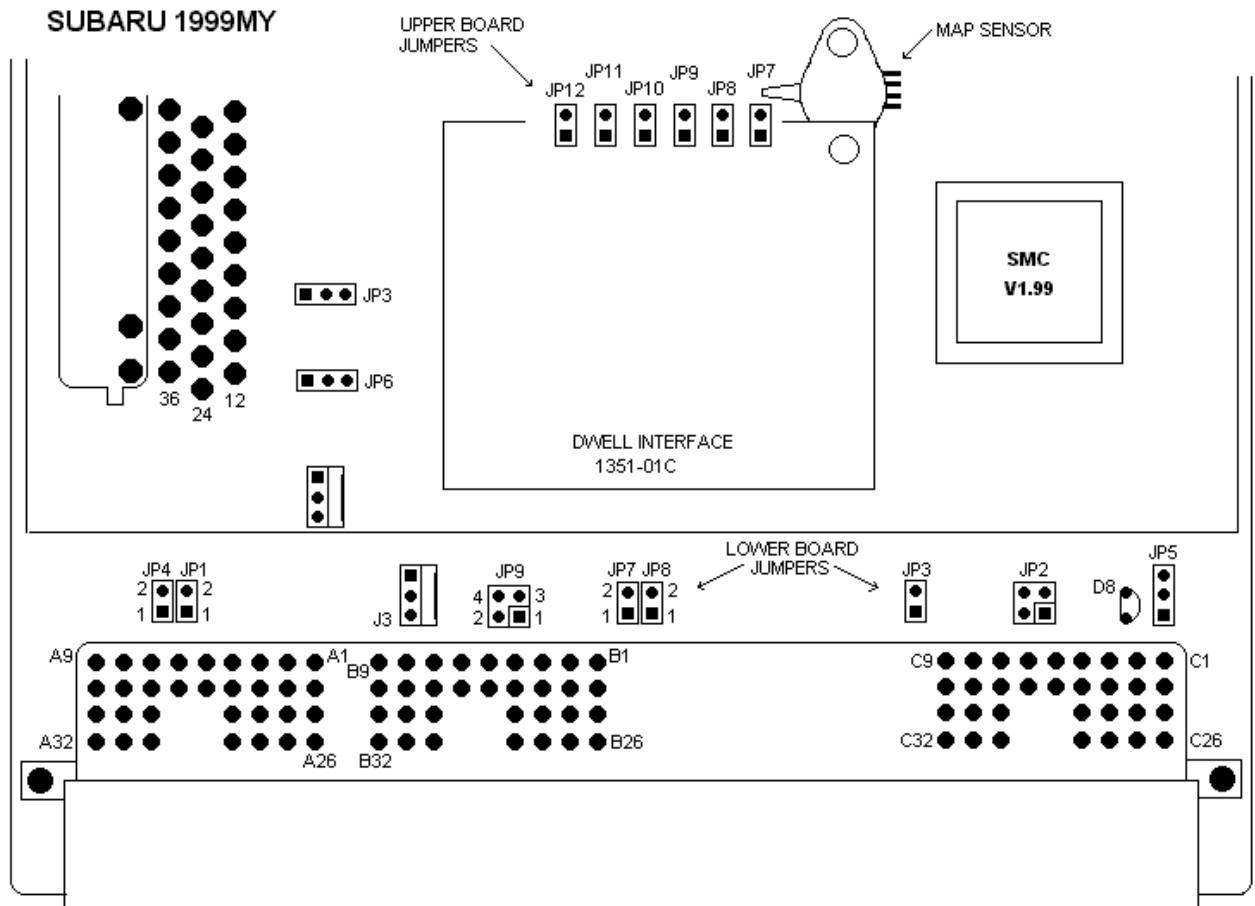
For road application install jumpers parallel (and cut 2 link track. Either side of JP9)

Inj 7 o/p then controls purge (B7 o/p)

Inj 5 o/p overrides a/c o/p (A22) control

#### **Upper Board**

JP9 – Jumper ON = Enable stepper idle control.



## Hardware modifications required

For road cars:

1. Mount Autronic Air temp sensor . The air temp sensor must be mounted so that it is in the air steam after the intercooler.  
The throttle body housing or ducting after the intercooler can be removed and a 1 1/32" hole drill & taped 1/8" NPT. The sensor may also be mounted in the intake manifold.

2. Connect air temp sensor wires to mass air flow meter wires.

Remove air flow meter connector and join wires as follows,

Air temp sensor Black wire = Black/Green = ECU pin C31.

Air temp sensor Red wire = Green.

Remove green wire from pin C1 in ECU harness connector and move it to C19.

**Note: On STi models there is already a wire in C19 that goes to the air flow meter. Use this wire to connect to the red wire on sensor.**

3. Mount pressure and vacuum safe hose from intake manifold to the internal map sensor on the PnP board.

For Group N rally cars using Airflow meters see external documents or contact your dealer.

**Subaru 1999-00 pin-out**

C5* or C6	Crankshaft position sensor signal (+)
C23	Crankshaft position sensor signal (-)
C30	Crankshaft position sensor shield
C6* or C5	Camshaft position sensor signal (+)
C23	Camshaft position sensor signal (-)
C30	Camshaft position sensor shield
C1	Mass air flow sensor signal (+)
C30	Mass air flow sensor shield
C31	Mass air flow sensor signal (-)
C20	TPS signal
C12	TPS + 5 Volt
C24	TPS, coolant, air temp ground
B11	A/C switch
C25	Ignition switch
A7	Ignition output cyl 1 & 2
A16	Ignition output cyl 3 & 4
A31	Cyl 1 injector
A32	Cyl 2 injector
A25	Cyl 3 injector
A18	Cyl 4 injector
A14	IAC Stepper signal 1
A5	IAC Stepper signal 2
A15	IAC Stepper signal 3
A4	IAC Stepper signal 4
A1* or A21	Fuel pump relay
A4+A13	Electrical fan
A28	Diagnostic light on dash
A19	Waste gate control
B22	Anti Lag I/P SW
B7	Purge control
C24	Ground TPS, air temp, water temp
A9	Ground injectors
C21	O2 sensor signal ( connect lamda meter here for Autotune)
C30	O2 sensor shield
C28	Coolant sensor signal
C19	Air temp sensor signal
C1* or C21	Ground control system

**\* Cars with immobiliser**

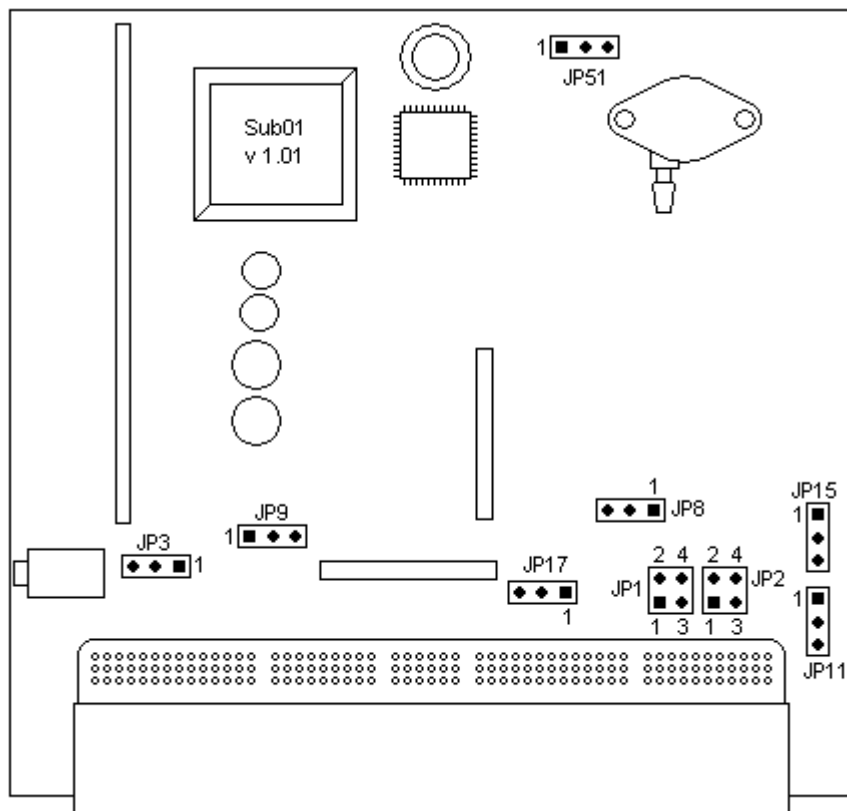
**Subaru 2001-04 PnP notes*****Jumper Settings***

## Hardware Setup Jumpers

Jumper	Type	Function and Settings
JP1	4 pin twin	1-2 & 3-4 Aust and EU 1-3 & 2-4 Asia
JP2	4 pin twin	1-2 & 3-4 Aust and EU 1-3 & 2-4 Asia
JP3	3 pin single	2-3 WRX and 1-2 STi
JP51	3 pin single	1-2 Internal MAP sensor 2-3 Subaru MAP sensor

## Switch Input Jumpers

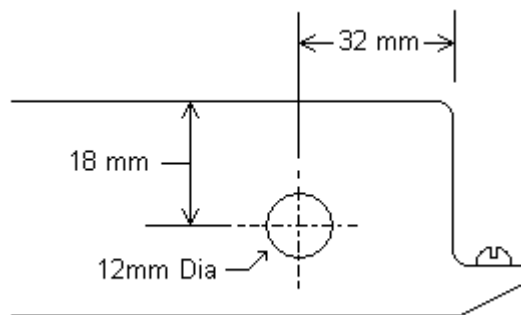
Input	Jumper	Settings
Analog 2	No Jumper	always B16
Analog 3	JP17	1-2 is average of B13 & B23 (each of these pins has a resistive divider for +2.5 volts on I/P) 2-3 is B6
SW I/P 1	JP9	1-2 is A8 2-3 is C2
SW I/P 2	JP1	1-3 is A14 3-4 is A5
SW I/P 3	JP2	1-3 is A2 3-4 is A6 (This I/P has a pulldown resistor)
SW I/P 4	JP15	1-2 is A9 2-3 is A20
SW I/P 5	JP11 JP11 JP8	1-2 is A3 2-3 is A16 1-2 is B12



## ECU Board Installation

Remove the original ECU board and replace with the Autronic board. The ECU as shipped is setup to use the external MAP sensor. This sensor is suitable for up to 1.6 bar boost. If higher boost is to be used then connect pressure and vacuum safe hose from intake manifold to the internal map sensor on the PnP board, and change jumper JP51. Also select "Internal" for the map sensor in the software.

The map sensor hose and PC data cable socket need to be assessable from the outside of the case. The best method is to drill two holes in the side of the case. Below is the location to drill the hole for the data cable socket. The hole for the map sensor hose should have a grommet fitted to protect the hose.



## Air temperature sensor

The ECU is supplied with an air temperature sensor. This is used if the original air flow meter is removed. To use this sensor select "Autronic" in the software and connect the sensor to the air flow meter wires.

Air temp sensor Black wire = Brown (AFM Pin 5)

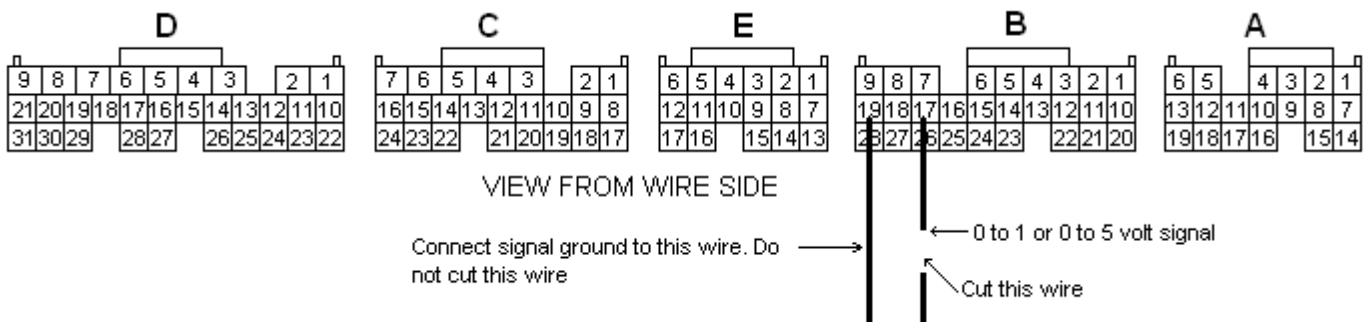
Air temp sensor Red wire = Blue/White (AFM Pin 4)

## Analyser 02 Input

To connect exhaust gas analyser 02 output for Autotuning or data logging cut wire B17 and connect as below.

Analyser 0 to 1 or 0 to 5 volt output = B17

Analyser signal ground = B19





## Mitsubishi EVO PnP notes

### ***EVO Immobiliser***

All ECU's are configured to suit cars originally fitted with an immobiliser. Some model cars do not have immobiliser and require jumper JP30 links changed or wires A22 and A8 to be swapped in the main harness connector.

JP30 is located on the bottom side on the board near the connector.

Cars with immobiliser have pins 1 - 3 linked also pins 2 - 4 linked

Cars without immobiliser have pins 1 - 2 linked also pins 3 - 4 linked

### ***Hardware modifications required***

For road cars:

4. Mount Autronic Air temp sensor in manifold. An alternative position is in the pipe bend just before the throttle body. The air fuel ratio control will be more accurate at varying engine temperatures with the sensor in the inlet manifold.

Connect the air temperature sensor wires to the air flow meter wires.

Air Temp Sensor	Red	Black
Air Flow Meter	Red/Blue	Black
ECU pin number	D2	D22

Do not plug air flow meter connector back onto the air flow meter.

5. Mount pressure and vacuum safe hose from manifold to the internal map sensor on the PnP board.

For Group N rally cars using Airflow meters see external documents or contact your dealer.

**Mitsubishi Evo pin out**

<b>1</b>		<b>13</b>	<b>1</b>	<b>8</b>	<b>1</b>	<b>6</b>	<b>1</b>		<b>11</b>
	<b>A</b>			<b>B</b>		<b>C</b>		<b>D</b>	
<b>14</b>		<b>26</b>	<b>9</b>	<b>16</b>	<b>7</b>	<b>12</b>	<b>12</b>		<b>22</b>

A1	Cyl 1 injector (Inj 1O/P)
A2	Cyl 3 injector (Inj 2O/P)
A6	Inj 8 O/P Antilag O/P
A8	Fuel pump relay
A10	Cyl 1/4 ign drive (dwell pcb pin T5)
A11	Boost control O/P
A12	Power on from relay (Ign on +12 volt)
A13	GND
A14	Cyl 2 injector (Inj 4O/P)
A15	Cyl 4 injector (Inj 3O/P)
A20-A21	Cooling fan (Inj O/P 6)
A23	Cyl 2/3 ign drive (dwell pcb pin T8)
A22	Water spray (EVO-V only) inj O/P 7
A26	GND
B6	ECU diagnostic light (on dash)
B8	Injector relay (Inj O/P 5)
C8	Tacho output (from dwell pcb T12)
C5	S10 gnd ,(no 5 on computer conn)
C6	Rxd, to diag connector under dash.(no 3 on computer conn)
C12	Txd, to diag connector under dash.(no 2 on computer conn)
D2	Air temp sensor signal
D6	Oxygen sensor I/P, (Analyser input for Autotune)
D9	Anti-lag switch EVO7 & EVO 8
D10	12 Volt battery
D11	Throttle pos sensor + 5 Volt
D13	Coolant temp sensor
D14	Throttle pos sensor input
D18	Cylinder Ref I/P
D19	Cylinder pulse I/P
D22	Throttle pos, coolant, air temp sensor gnd
D21	Anti-lag switch EVO4,5 and 6 (EVO7 intercooler spray)

## **Honda 1992-95 PnP.**

### ***Pinout.***

Antilag SW = Pin A22

Inj5 = VTEC

Inj6 = Fan1 (main cooling fan)

Inj7 = Pin A11

Inj8 = Antilag O/P (pin A20)

### ***Hardware Modifications.***

Air temp sensor options:

#### **2. Autronic air temp sensor.**

Check track on board between pins on resistor R3 is intact. If not, then link with wire.

Remove jumper JP7 on top board. (jumper nearest to map sensor).

Select Autronic air temp sensor in software.

Connect Autronic sensor to original sensor wires as follows,

Autronic sensor	Original sensor
wire colour	wire colour
RED	RED/YELLOW
BLACK	GREEN/BLUE

#### **2. Original 02 sensor.**

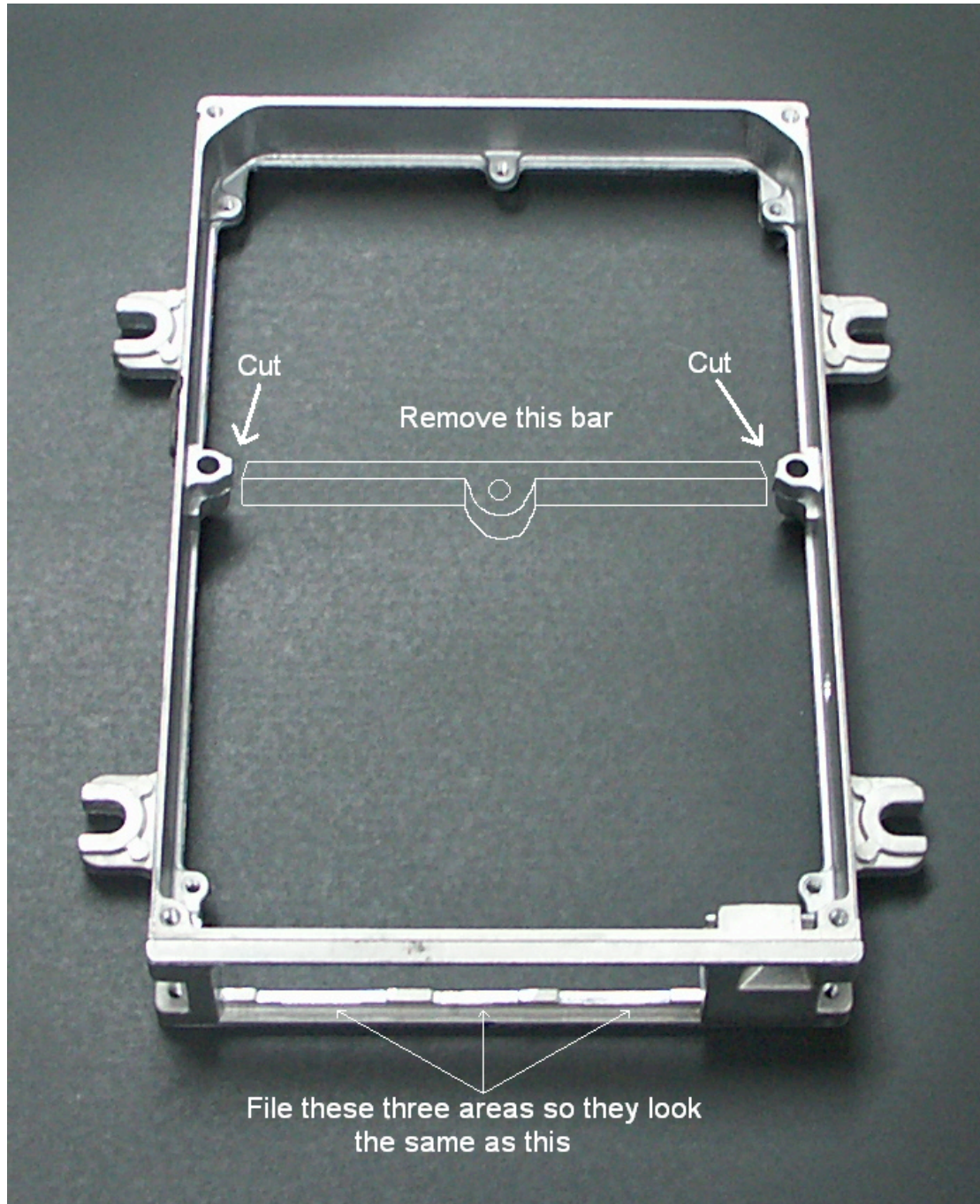
Cut board track between pins on resistor R3

Add jumper to JP7 on top board. (jumper nearest to map sensor).

Select NTC air temp sensor in software.

### **1992-95 OBD1 Case Modifications**

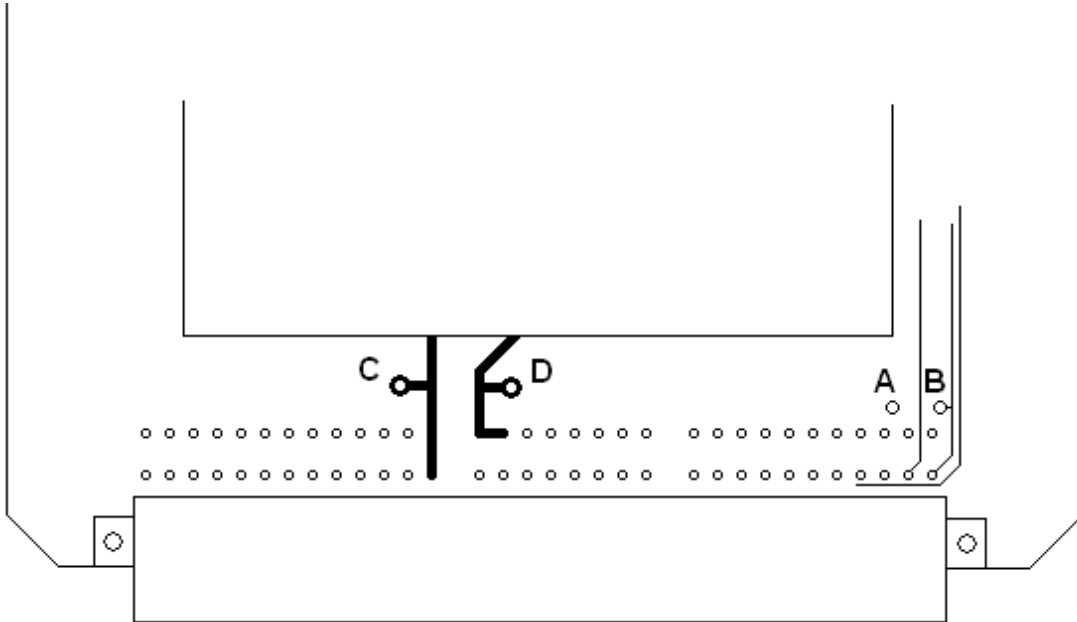
Modify the case by removing the crossbar and removing with a file three connector location tabs as shown below.



When fitting the top cover on the case, this should be fitted so the centre bolt hole does not touch the mounting bolt on the PnP map sensor. It is recommended that a rubber grommet be fitted to this hole.

## ***O2 Input for Exhaust Gas Analyser***

On the board between the main connector and top board are four holes. Two of these are for connecting the O2 input from the Autronic exhaust gas analyser while tuning. The other two holes can be used to power the analyser if mounting a analyser socket in the case.

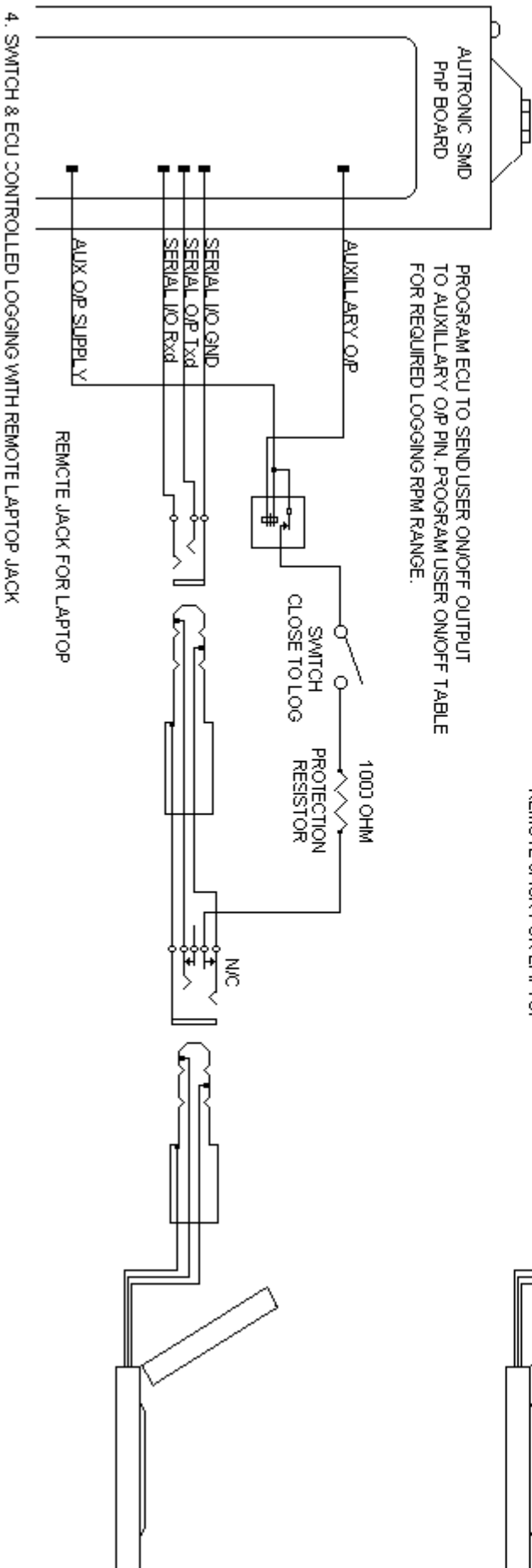
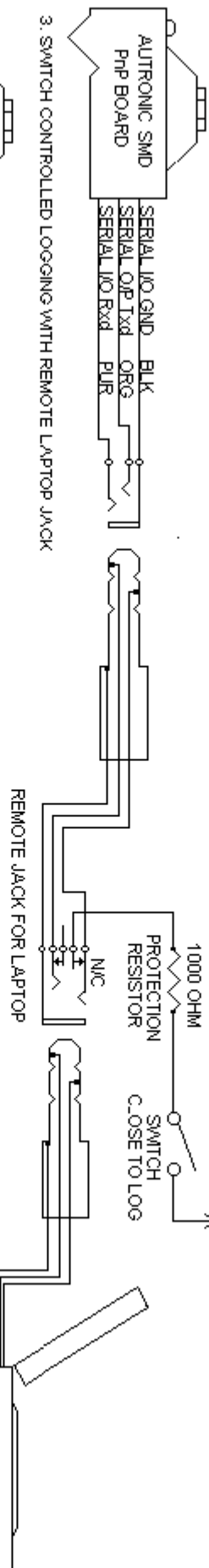
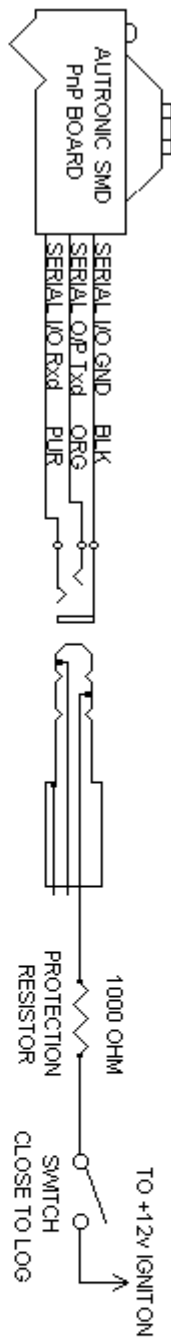
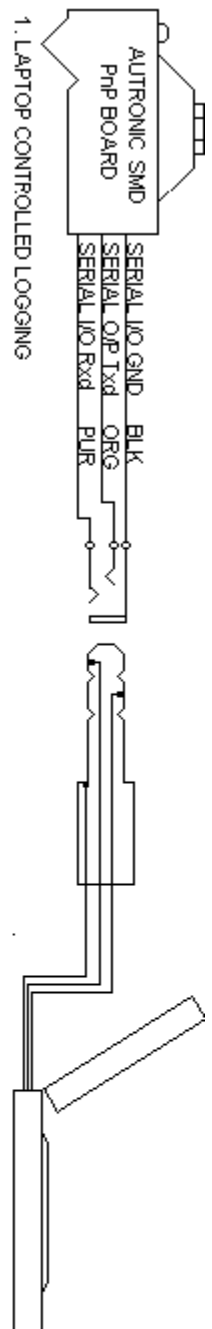


- A. O2 input signal
- B. Analyser signal ground
- C. Ground (chassis)
- D. +12v (ignition switched)

If using A as the input for the analyser. Remove the wire from pin D14 in the main connector while tuning.

Use 0 to 5 volt output on analyser and change function 10 setting from 30 to 34.4 to correct AF reading.

## Data logging setup.



***Datalogging notes:***

- 1000 ohm protection resistor prevents damage to wiring due to ground short circuit in serial connector if it becomes partial disengaged from jack.
- Preferably use ¼ inch remote jack, these are more durable and easier to use than 1/8 inch switched jacks, especially if dash mounted. A 1/8" female to ¼ " male stereo adaptor can be installed on the PC data cable to adapt to the larger ¼ inch jack.
- Plugging laptop into remote jack inhibits logging activation by switch. Laptop can then control logging. Setup logger and extract logged data from ECU (See Options 3 & 4).

## Sensors

### ***Air Temperature Sensor***

For road cars, mount sensor and connect to ECU. For wiring see Subaru or EVO notes.

The air temperature sensor is used to compensate for changes in air density due to air temperature. Cold air is denser than warm air and therefore requires a greater volume of fuel to maintain the same air/fuel ratio. This effect is most noticeable in forced induction engines. The Autronic will automatically compensate using the signal received from the air temperature sensor.

**This sensor is of Autronic manufacture and should not be replaced by some other type of sensor. On some versions of the ECU's a NTC sensor can be used rather than the Autronic.**

The sensor should be mounted to provide the best representation of the actual temperature of the air entering the combustion chamber, ie. after any turbo or supercharger, and intercooler, and as close to the head as possible. The sensor needs to be in the moving air stream to give fast response times and reduce heat-soak effects.

Once a suitable position has been located for the air temperature sensor a hole should be drilled and tapped to accept the sensor. Remove the manifold or inlet tract from the engine before machining the sensor mount. Do not allow any metal particles to enter the inlet manifold of the engine as these will be drawn into the engine and damage it. Wash all components before reassemble.

### ***Throttle Limit Learning***

The ECU is equipped with an automatic adaptive learning function that simplifies the procedure of throttle position sensing. Setup is much simplified, not requiring any diagnostic aid, calibrator or laptop computer. The procedure is as follows:

1. Ignition switch on, engine stopped.
2. Disconnect throttle position electrical connector for at least 20 seconds.
3. Reconnect throttle position electrical connector.
4. Ensure that throttle is closed for at least 5 seconds.
5. Fully open the throttle for at least 5 seconds.

New limits of throttle travel will have been learnt and stored in the ECU during the above procedure. Additional ECU functions ensure that throttle stop and sensor wear are compensated for over the life of the engine. The above procedure need only be repeated if the butterfly / sensor assembly is serviced or replaced.



## Advanced Software Setup

### Boost Control Valve

This information only required is standard boost control valve is replaced. Software boost control settings for standard valve are preset in default calibration in PnP board.

#### Air Conections

Port 1 From T Piece  
 Port 2 Vent (To atmosphere)  
 Port 3 Blank

Mount T piece in line from Manifold (Boost pressure feed) and Wastegate actuator.

Both T piece and adjustable restrictor should be mounted reasonably close to wastegate actuator

#### SM2 ECU Settings

Select boost control to PWM2 O/P  
 and  
 select PWM2 O/P frequency = 40Hz

Mode Flag 6  
 $128 + 12 = 140$

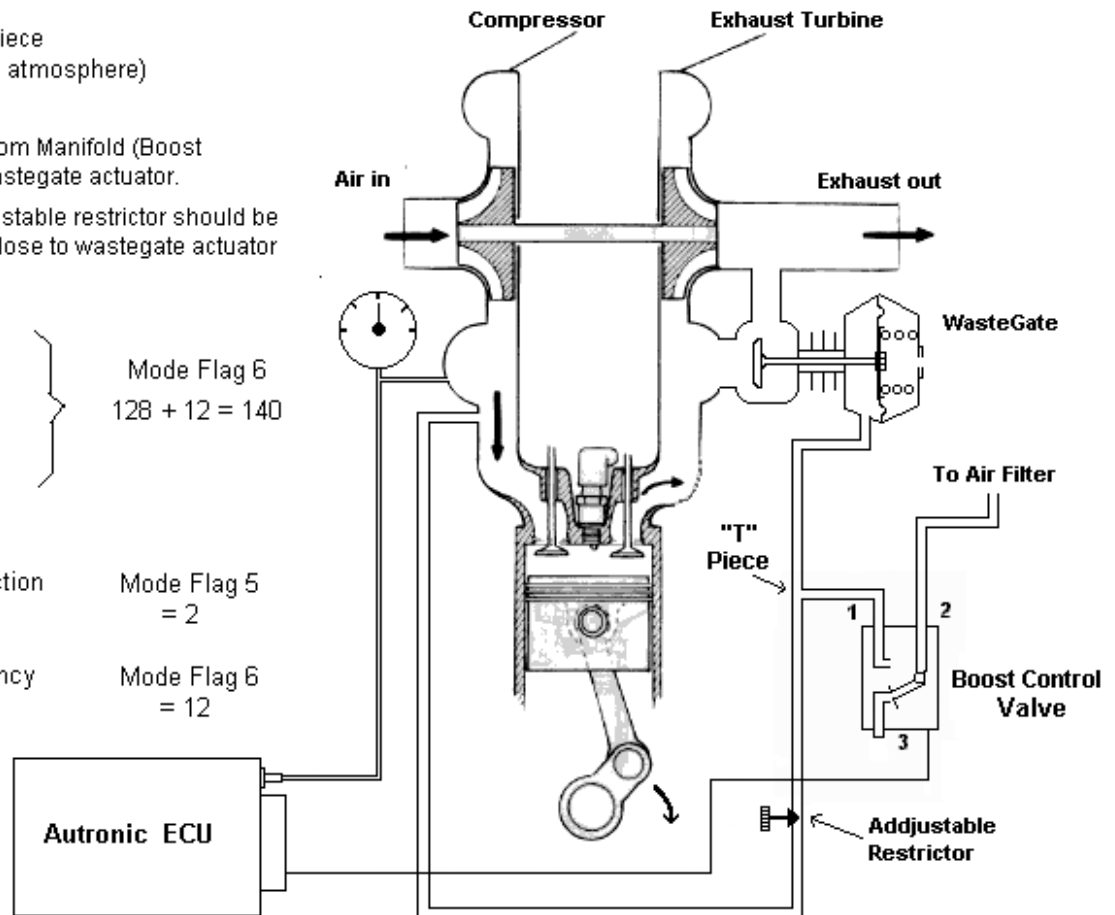
#### SMC ECU Settings

Set auxillary O/P function to boost control

Mode Flag 5  
 = 2

Set PWM O/P frequency to 40Hz

Mode Flag 6  
 = 12



Adjustable restrictor can be replaced with a fixed restrictor. The restrictor hole size for the small Autronic boost control valve on a turbocharger with and internal wastegate should be around 0.8mm. Set boost control range in software to 100 to 150 and the dynamic comp to 1 or 2.

**BOOST CONTROL CALIBRATION TABLES.** One turbocharger wastegate control calibration table is available. The table allows engine speed and engine coolant temperature dependent setting of the boost level controlled by the boost control function. The coolant temperature dependency of the table (if used) allows boost to be, reduced at elevated engine coolant temperatures in order to minimise the possibility of engine damage. The table can have up to 10 engine speed calibration sites and 5 engine coolant temperature calibration sites. Calibration range is 110 to 500 KPa.

**BOOST CONTROL THROTTLE MODIFIER CALIBRATION** The boost level determined by the above calibration table may be made throttle position dependent by setting this table to effect a reduction in boost under conditions less than full throttle. The table may have up to 4 throttle position dependent calibration sites and the range for calibration is 0 to 300KPa.

**BOOST CONTROL RANGE OFFSET.** Use to correct actual decreces or increces in boost that occur above or below the desired boost levels set in boost table at varing engine RPM's. Correction values of -250Kpa to 250Kpa can be used.

**BOOST RANGE** = 50 kpa + (maximum boost – preset boost at waste gate) Ex, wastegate manually set to 40 kpa (0,4 Bar) and max boost is 120 kpa (1,2 Bar),  $50+(120-40)=130$  Boost range should be set to 130 kpa.

**OVERBOOST PROTECTION.** (2 adjustments) Two stage overboost protection is adjustable for detection level and detection tire so that damaging overboost causes engine shutdown but pressure spikes are ignored.

## Closed Loop Control

The Subaru and Mitsubishi models have Closed Loop control (CLC).

CLC is used to correct air fuel ratios to maintain Stoichiometric air fuel ratio of 14.7:1 to ensure correct operation of catalytic converter.

The CLC has two modes, city and highway. City mode only operates when the engine is no longer in warm up enrichment. The highway mode is optional, and can be selected in the software set up. Highway mode is achieved when the ECU logic determines the engine is in highway mode.

The Open Loop air fuel table is used to setup city and highway AF ratios.

The CLC will only operate on air fuel ratios Stoichiometric (14.7) or leaner. In city mode it will ignore air fuel ratios leaner than stoichiometric and maintain stoichiometric air fuel ratio.

In example 1 the CLC would operate from 30 to 90% load.

In example 2 the CLC would operate from 30 to 90% load and maintain 14.7 during city mode.

In highway mode it would maintain any air fuel ratio less than 14.7, in this case it would be from 30 to 60% load.

Example 1.

	RPM				
	1000	2000	3000	4000	5000
Load					
30	14.7	14.7	14.7	14.7	14.7
50	14.7	14.7	14.7	14.7	14.7
60	14.7	14.7	14.7	14.7	14.7
90	14.7	14.7	14.7	14.7	14.7
100	12.7	12.7	12.7	12.7	12.7

Example 2.

	RPM				
	1000	2000	3000	4000	5000
Load					
30	14.7	17.0	17.0	17.0	17.0
50	14.7	17.0	17.0	17.0	17.0
60	14.7	14.7	14.7	14.7	14.7
90	14.7	14.7	14.7	14.7	14.7
100	12.7	12.7	12.7	12.7	12.7

For the CLC to operate correctly the engine must be first tuned within 1 or 2% of required CLC air fuel ratios.

### Setup:

1. Enable Open Loop Table.
2. Enable ECU Internal CLC.
3. Enable Open Loop Lean Highway (If required).
4. Set Gain = 10. (Default value)
5. Set Adapt Rate = 30. (Default value)

You can change the Stoichiometric air fuel ratio from the default of 14.7 to a new value in the "Engine Setup" table.

## Idle Valve Setup

Mitsubishi and Subaru PnP boards have idle control software settings preset to defaults that in most cases do not need to be changed.

1. From menu M6 select the "Idle Spd Ctrl" table. Set the idle speed for the engine in relation to battery voltage.
  - a. If you want to idle the engine at 800 rpm, then make the highest voltage site (13.50 volts in this case) 800 rpm.
  - b. Set the lower voltage site (12.00 volts in this case) to the idle speed you require when battery voltage is low.

WINTON RACEFUEL FINE TUNED AT WINTON							
File Edit General M1 M2 M3 M4 M5 M6 Logger Help							AUTRONIC
Idle spd ctrl(50 .. 6000)Rpm							
Battery voltage (Volts)		Attr%30.00					
	12.00	13.50					
	1000	800					
A/F ratio	:1						
A/F set point	:1						
Engine speed	Rpm	10.00 17.00					
Throttle position	%	LOAD					
Charge temp	Deg C	Manifold pressure Kpa(abs)					
Intake temp	Deg C	Coolant temp Deg C					
IAC valve posn	%	Battery voltage Volts					
IAC set point	Rpm	Idle mix setting %					
Ign. Angle-MEAN-	Degrees	Inj. Time -MEAN- mSec					
		Inj. Duty -MEAN- %					
12:40:52a	BAUD 9.6	0.0/s	ECUCAL		14377980		
F1 Help	Alt+X Exit	F2 Save cal file	F4 Store cal in ECU		PClog■Key F8■ 0%Off		

2. Select from menu M6 the “Idle setup” table. This is where the idle valve range and other parameters are setup. ISC = Idle Speed Control.

ISC adaptation rate:

The rate at which the idle valve becomes active below the throttle limit.

ISC range:

The RPM range the valve has control over. Set this 50 RPM more than the valve range. See below how to determine the valve range.

ISC dynamic comp:

How fast the idle control attempts to correct changes in RPM. If the engine RPM hunts up and down try increasing this value.

ISC reset engine spd:

The engine speed at which the idle control is deactivated. This can help engine braking.

ISC fuel comp:

Fuel compensation can be used where extra enrichment is required during idle control.

ISC throttle limit:

The throttle position range of idle control. In this case idle control will be from 0 to 2%.

To determine the range of an idle valve set the idle speed in the “idle speed” table to a very low value (100 rpm) so the valve is not operating. If the engine stalls you will need to temporally set the idle speed via the throttle stop to a rpm where the engine will idle. Note the idle speed of the engine, in this case let's say it is idling at 1000 rpm.

Now from the “idle speed” table set the idle speed to 5000 rpm. Note the engine speed, in this case let's say the engine speed is 2200 rpm. Using this information do the following to determine the idle control range,

$2200 - 1000 = 1200$  rpm range, we need to add about 50 rpm to this to get the final range,  
 $1200 + 50 = 1250$ .

EVO IAC starting values:

IAC= enabled

IAC Range = 3000

IAC adaptionrate = 500

IAC dynamic comp = 0

IAC stall saver = 2

IAC reset engine speed = 4500

IAC fuel comp = 0

IAC throttle inhibit = 1

IAC min = 0

Subaru IAC starting values:

IAC Range = 3850

IAC adaption rate = 1000

IAC dynamic comp = 10

IAC stall saver = 2

IAC reset engine speed = 5000

IAC fuel comp = 0

IAC throttle inhibit = 2

IAC min = 0

3. In menu M5 you will find other items to control idle,
- “W-U fastIdle inc” Set the idle speed in relation to engine temperature.  
Use to make the engine idle fast while warming up.
  - “P-S fastIdle inc” Set the extra rpm you require added to the idle speed  
after starting the engine.
  - “P-S fastIdle timeout” The period of time after starting the engine you wish  
to maintain the extra idle rpm selected in “P-S fastIdle inc”.
4. In menu M1 Stepper setup you will find the stepper settings.

EVO starting stepper values:

Stepper motor = enabled  
Set direction = reversed  
Preferred-dir re-cal = fully closed  
Power up re-cal mode = disabled  
Stepper travel = 220  
Smart re-cal count = 20

Subary starting stepper values:

Stepper motor = enabled  
Set direction = reversed  
Preferred-dir re-cal = fully closed  
Power up re-cal mode = preferred dir  
Stepper travel = 220  
Smart re-cal count = 20

## ***Turbocharger Anti-Lag System***

Autronic turbo-charger anti-lag system uses a coordinated fuel and ignition control strategy in conjunction with a large effective throttle opening to produce a substantial reduction in turbo-charger "lag". The system is effective from a standing start, throughout up & down shifts and when accelerating out of corners. The system can be used with a large fixed throttle opening, or in conjunction- with electro-mechanical throttle by-pass valve or a throttle "kicker" solenoid. The system incorporates an optional turbo-charger cool-down function that ensures rapid cool-down prior to engine shutdown.

This anti-lag system allows the engine's large throttle opening or bypass to produce a considerable amount of hot high velocity exhaust gas that sustains high turbo-charger speed.

This is achieved with a higher than normal idle speed (2000 to 4000 RPM typ.). The cool-down mode uses a different strategy to produce a large volume of cool exhaust gas for rapid turbo cool-down and it simultaneously controls idle engine speed with the large throttle opening required.

### **CAUTION**

This anti-lag system, like all others, causes considerable heating of engine, exhaust valves, exhaust manifold, turbo-charger and exhaust system. Consideration must be given to the possibility of component damage or possible vehicle fire.

Set-up of the anti-lag system MUST NOT be attempted without monitoring EXHAUST GAS TEMPERATURE (EGT) in the vicinity of the turbine wheel. A knowledge of the maximum safe working temperature of the turbo-charger turbine is essential. A turbo tacho and a pressure gauge to measure the turbo compressor outlet pressure are also useful tools to assist in the setup of anti-lag.

### **Operating Modes**

1. Throttle opening/bypass controlled anti-lag, using a mechanical or electro-mechanical throttle opener or bypass. ECU activation of the anti-lag function with dash mounted inhibit switch.
2. ECU controlled throttle opening/bypass using an electro-mechanical throttle opener or bypass valve. Dash mounted switch allows driver selection of and-lag function.
3. Fixed throttle opening with full automatic control by ECU with manual override or manual control of and-lag and cool-down function

Notes:- Modes 1 & 2 do not effectively use the fast cool-down function.

Anti-lag action is terminated by excessive engine temperature(> 110 degC)

Mode 3 is the simplest mode to use, since it requires no additional engine mounted hardware (eg: throttle kickers or solenoid controlled by-pass valves). The cool-down mode is also most effective in this mode.

### **MODE 1.**

### **MODE 2.**

**MODE 3.**

Mode 3 use a fixed large throttle opening (typically 8 to 20%). This modes anti-lag function uses this large opening, high idle speed (typically 2500 to 4000 RPM) and ignition retard to produce a considerable amount of hot high velocity exhaust gas that sustains high turbo-charger speed. The cool-down mode uses a different strategy to produce a much cooler exhaust gas temperature and simultaneously control idle engine speed with this large initial throttle opening, when anti-lag is not active.

Activation.

1. Manual:- Ground anti-lag I/P pin to switch from cool-down to anti-lag mode.
2. Automatic:- Anti-lag activated by engine RPM exceeding 5000 RPM and remains active for 15 seconds after RPM falls below 5000RPM.
3. Auto/Manual:- As per automatic mode above but inhibited if Anti-lag I/P not grounded.

**ANTI-LAG SETUP**

Throttle opening, ignition retard and the resulting anti-lag no-load RPM must be chosen to produce the best compromise between excessive exhaust temperature and good anti-lag action. More throttle requires greater ignition retard to control no-load throttle closed RPM, and results in higher EGT. Anti-lag ignition timing for small capacity 4 valve central spark plug combustion chamber engines should be in range -20 to -30 deg. For large capacity 2 valve engines -2 to -20 deg should suffice. Ignition timing retard should be maintained up to a MAP value as high as possible but must be eliminated before 1 atmosphere is reached to ensure adequate off-boost performance. Below anti-lag RPM normal ignition timing should be restored so that engine torque increases with decreasing RPM in order to stabilise RPM. Additional fuel during anti-lag is often required to help control EGT. A value between 10 and 20% extra is usually beneficial. The User defined PWM table functions as the anti-lag ignition offset table 1% = 1 deg retard.

eg:- Anti-lag idle @ 2600 RPM approx. User Define PWM output %(0 to 100)

Load/RPM Example

	RPM		
<u>LOAD</u>	<u>2400</u>	<u>2600</u>	<u>4000</u>
97.0	0.0	40.0	50.0
98.0	0.0	0.0	0.0

TPS/RPM Example

	RPM		
<u>TPS</u>	<u>2400</u>	<u>2600</u>	<u>4000</u>
12.0	0.0	40.0	50.0
15.0	0.0	0.0	0.0

Engine idles @ 2600 RPM with 88 to 92 kPa MAP below butterfly with 30 – 40 = -10 deg ignition. Gives 130 to 150 kPa MAP above butterfly.

**!!!! IMPORTANT!!!!**

1. Irrespective of the actual throttle opening used the ECU must be reset so that the selected open is seen by the ECU as 0% open. Throttle limit learning must be performed each time a new throttle stop setting is set.
2. Before attempting anti-lag set-up it is most important that correct fuel and ignition calibration be achieved for "normal" engine operation.



## **COOL-DOWN SETUP**

The cooldown function produces a stable idle with an exhaust sound similar to that produced by engines fitted with long duration camshafts. This disappears as soon as the engine is laboured at low RPM or loaded at higher RPMs. Spark plugs normally remain clean even during extend periods of cool-down idling. Cool down MIN RPM and MAX RPM settings are set to values above and below the Desired cool-down idle RPM. These values should be at least 800 RPM apart to prevent idle instability. The cool-down mode MAX THROTTLE setting is usually set to 5% for best drivability.

eg:- Cool-down idle @ 1700 RPM  
COOLDOWN MIN RPM - 1400 RPM  
COOLDOWN MAX RPM - 2400 RPM  
COOLDOWN MAX THROTTLE = 5%.

**Throttle/Manifold mapping.**

(Normally not used with Mitsubishi, Subaru and Honda) .

Engines with one throttle butterfly per intake port and turbocharged must use this method of mapping.

The Base Fuel Deliver table is throttle mapped and the Base Ignition Timing table is pressure mapped.

In the fuel table the Load values relate to throttle position. e.g:- Load site 10 = 10% throttle position. The sites marked \* are the sites that require tuning in the Base Fuel Delivery table. See below.

				RPM			
Load	0	1000	2000	3000	4000	5000	6000
0	*	*	*	*	*	*	*
1	*	*	*	*	*	*	*
3	*	*	*	*	*	*	*
5	*	*	*	*	*	*	*
10	*	*	*	*	*	*	*
30	*	*	*	*	*	*	*
70	*	*	*	*	*	*	*
100	*	*	*	*	*	*	*
150							
200							
220							

Base Fuel Delivery table.

The Base Ignition Timing table is setup using load sites for pressure mapped engines.

				RPM			
Load	0	1000	2000	3000	4000	5000	6000
0							
1							
3							
5							
10							
30	*	*	*	*	*	*	*
70	*	*	*	*	*	*	*
100	*	*	*	*	*	*	*
150	*	*	*	*	*	*	*
200	*	*	*	*	*	*	*
220	*	*	*	*	*	*	*

Base Ignition Timing table

**Autotune.****Software Setup****Step 1.**

Select menu M1, Engine setup.

Set "A/F ratio sensor" = Linear I/P A/F meter.

**Step 2.**

Select menu M1, ECU A/F control.

Set "Open loop table" = Enabled.

**Step 3.**

Select menu M2, Open loop A/F ratio

Setup this table with the "Target" air fuel ratios you wish the Autotune software to tune the engine.

Below is an example table for a turbocharged engine. There are many engine variables that effect the required air fuel ratio, plus fuel octane and the application the engine will be used. A engine used for drag racing can use leaner mixtures than an endurance engine.

	RPM					
Load	1000	1500	2000	3000	4000	6000
30	13.5	13.5	14.7	14.7	14.7	14.7
50	13.5	13.5	14.7	14.7	14.7	14.7
70	13.5	13.5	14.7	14.7	14.7	14.7
90	13.5	13.5	13.5	14.7	14.7	14.7
100	12.7	12.7	12.7	12.7	12.7	12.7
150	11.8	11.8	11.8	11.8	11.8	11.8
200	11.2	11.2	11.2	11.2	11.2	11.2
220	10.8	10.8	10.8	10.8	10.8	10.8

Open loop A/F ratio table.

**Step 4.**

Select menu M2, Base fuel delivery.

Only with the base fuel table displayed will the Edit menu will have the option "Setup Autotune".

Select "Setup Autotune" under the Edit menu.

Use the TAB key to move between windows and arrow keys to select the options.

**Options.****Color.**

Un-Protected = Sites tuned can be manually changed without clearing the attribute of the site.

Protected = Tuned sites cannot be manually changed without clearing the attribute of the site

**Fine accuracy.**

For a quick rough tune set this to 5%. The default accuracy is 2%.

Sensor Position = Select the mount position of the sensor.

No further items require changes.

## Hardware setup.

Connect analyser to the O2 input and sensor ground on the car, normally this is done by disconnecting the stock O2 sensor and connecting there. Make sure which wire is ground and which is O2 input (the 12 volt pin for sensor heating is not to be used).

If your analyser was purchased with a "Pwr/Log" cable see Fig2 for setup. Analysers without the "Pwr/Log" cable will require modification to provide the connection, see Fig1.

Other make analysers can be used providing they meet the linear output requirements of 0 to 1 volt = 10.0:1 to 30.0:1 air fuel ratio.

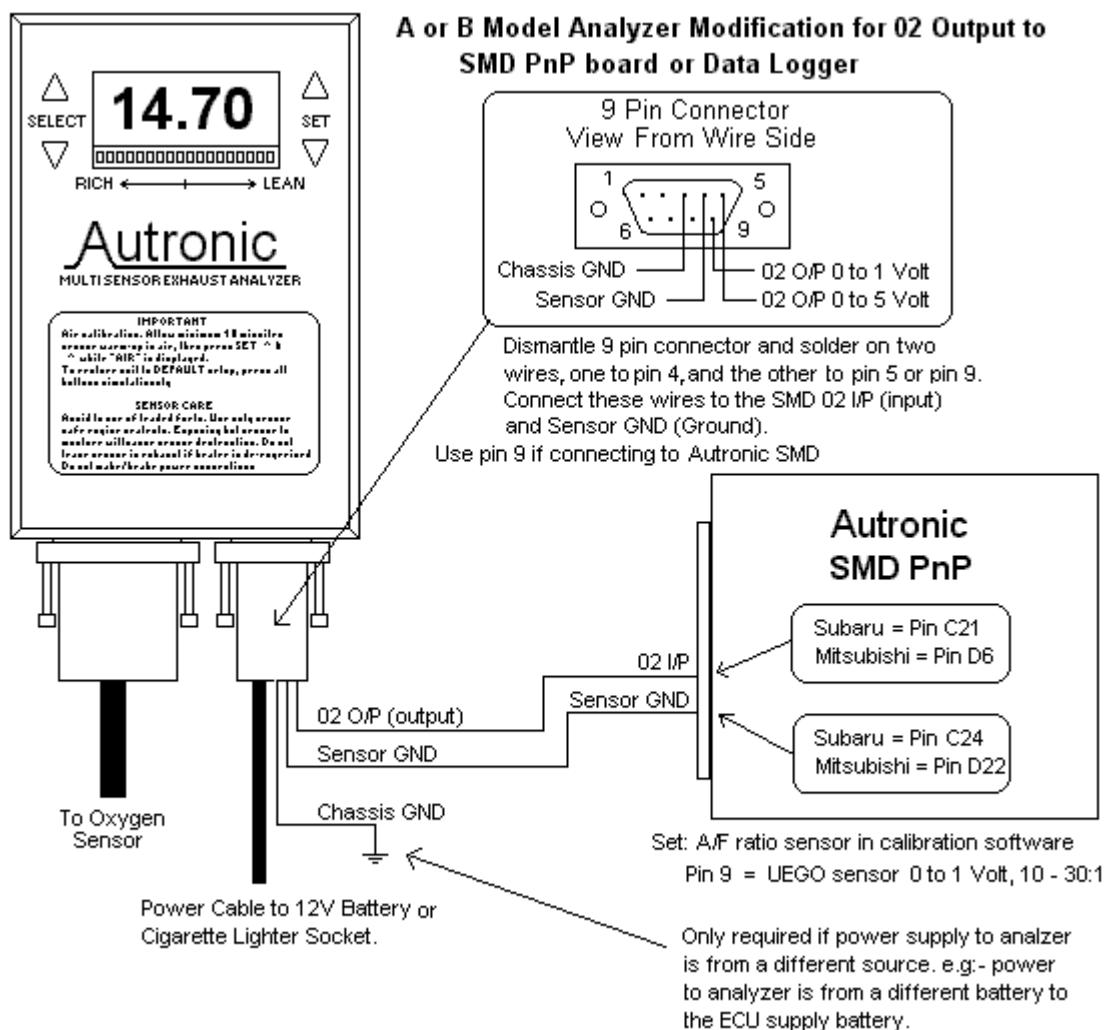


Fig1 Setup without Pwr/Log cable.

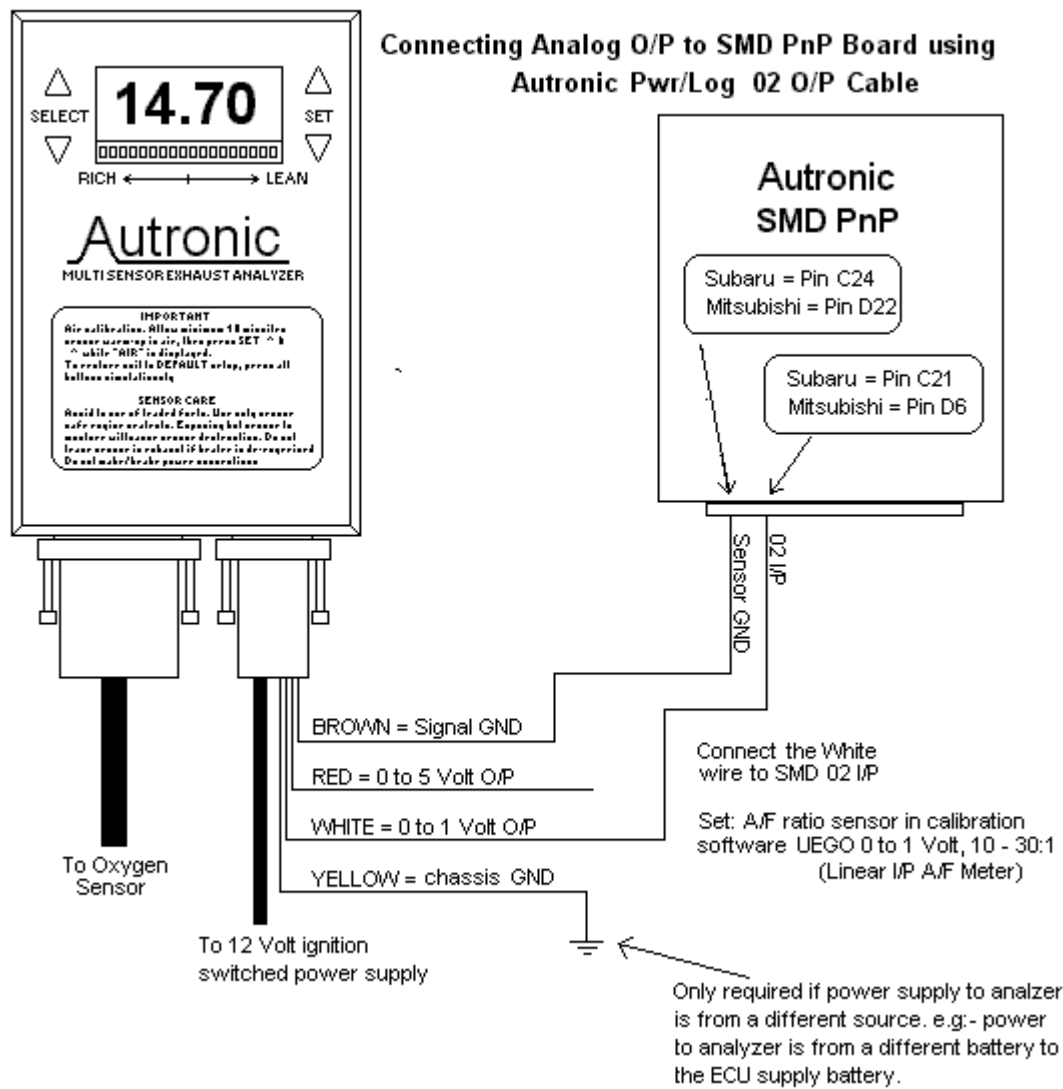


Fig2 Setup using “Pwr/Log” cable.

## ***Running Autotune.***

The Edit menu has many Autotune options and functions available while the base fuel table is displayed, so look in this menu for options. From this menu select "Autotune Setup", and select 5% accuracy, protected, new map and location of the O2 sensor.

To run Autotune press F5 while the base fuel table is displayed. Autotune a RPM/Load site around 3000 rpm and 100% load. Press F5 to stop tuning and then copy the value in this site to all other sites in the table and press F4 to lock the changes in the ECU. Then continue Autotuning sites adjacent to this site. By tuning sites next to an all ready tuned site, speeds up the tuning. When sites are tuned select 2% accuracy and already mapped and go back over any sites coloured yellow and retune them.

When an RPM/Load site is tuned the site has it's attribute set. To make manual changes to a site after the attribute is set requires the attribute being removed. The key R will remove the attribute. You can show the attribute of all the sites in the table by pressing Ctrl+P.

It is recommended you set the engine parameter limits in the "PC Limits/Log setup" under the Logger menu to minimum or maximum values suitable for your engine before running Autotune. If any of these limits are exceeded Auto-tuning will stop tuning and the user ID bar will turn red and display and limit that has been excide, also the PC speaker will sound a waring.

During the tuning Load and RPM sites will be coloured Yellow (attribute set) if the site is tuned within 2% of the accuracy you have set in the Autotune setup. When a site is tuned to the accuracy you have specified then the site will be coloured Green.

To tune sites requires the engine RPM and Load to be held for 1 to 2 seconds for tuning to occur. Most low engine RPM sites (under 3000 RPM in most cases) can be tuned by road driving the car. The use of different gears a little brake pedal or a hill will help to tune most sites.

The high RPM sites will require in most cases the use of a dyno that will hold a fixed RPM or vehicle speed. The other option is tune these sites on the road by using the PC data logger to log the engine at WOT, then use the maths key to tune these sites

The preferred method to tune the sites on a dyno is to fix the engine RPM and progressively open the throttle stoping at each load site for a few seconds. When all sites are coloured set the fixed RPM to the next RPM site and repeat the process.

After you have finished tuning, any sites not able to be reached can be manual adjusted to values similar to near tuned sites and then there attribute set by pressing the key A.

## **Starting the engine for the first time.**

### ***Items required.***

You will require the following items before attempting to start the engine.

Ignition timing light.

Exhaust gas analyzer.

Have these connected before attempting to start the engine.

### ***Software.***

1. With the PC connected to the SMD and the calibration software running, turn on the ignition (you should hear the fuel pump start and then turn off) and select "Go online" from the File menu or press F3.
2. Calibrate the throttle  
See throttle limit learning under the Sensor section of this manual.
3. Before starting the engine check the on screen real time engine data to see if everything makes sense  
e.g:- air and water temperatures are correct, throttle position is linear from 0 to 100%.

### ***Starting the engine.***

1. Start the engine.  
Check the analyser to see the air fuel ratio is between 12.7 and 11.0, if not change the overall fuel cal mul under "Base settings" in menu M1.

As the engine warms up the air fuel ratio will get leaner. When the engine is up to operating temperature the engine should be idling on 13.0 to 14.7 air fuel ratio. If not change the overall fuel cal mul.

Press F4 to lock the changes into the SMD. After checking the ignition timing go to the main fuel table and make changes to get the final tune either manually or use Autotune.

2. Use the timing light to check the ignition timing matches the "Ign. Angle-MEAN-" displayed in the real time engine data.

## Software Table Descriptions

### ***Base Fuel Delivery Calibration***

Basic fuel delivery calibration table providing fine (0.1%) adjustment of fuel. This table, the engine "load", barometric pressure and corrections dependent upon intake and coolant temperature, acceleration and deceleration and external trims determine the actual rate of fuel delivery for all engine operating conditions. The table data values being a representation of the engines "Volumetric efficiency" allows considerable simplification of the calibration procedure. Up to 32 engine speed and 16 engine load dependent calibration sites may be chosen at random calibration intervals giving up to 512 adjustment points. The engine load variable used in this table and others that follow below is a function of throttle position if throttle position is chosen as the primary input and a function of manifold absolute pressure if pressure is the primary input.

### ***Base Ignition Timing Calibration***

Basic ignition timing calibration table for "normal" engine operation, excluding cranking, idling and over-run conditions. The table uses the same site calibrations as the base fuel delivery table and therefore is of equal size. Timing is selectable in 0.25 Degrees increments over a range from 0 to 50 Degrees crank angle. The calibration from this table is combined with temperature dependent corrections and, an external trim to produce the actual engine "running" ignition timing.

### ***Overrun Ignition Timing Calibration***

Engine speed dependent ignition timing calibration for stable combustion under closed throttle conditions. The adjustment range is the same as the base ignition timing calibration table above. The table comprises a single row using the same engine speed calibration sites as the base fuel delivery table above.

### ***Cranking Ignition Timing***

Ignition timing for engine cranking calibration allows the selection of an engine speed dependent timing characteristic that minimises the possibility of starting gear damage due to engine kick-tack yet aids in the rapid acceleration of the engine up to running speed. The range of calibration is as for the base ignition table and up to 5 engine speed calibration sites may be chosen.

### ***Idling Ignition Timing Calibration***

Idling ignition timing calibration allows optimal timing during this condition for good idle quality and improved idle speed stability. The range of calibration is as for the base ignition table and up to 5 engine speed calibration sites may be chosen.

### ***Coolant Ignition Timing Modifier Calibration***

Base ignition timing modification dependent upon engine coolant temperature and engine load to ensure efficient operation during warm-up and to minimise the possibility of engine damage if over-heating occurs. Table size is 12 engine coolant temperature calibration sites by 6 engine load calibration sites and the correction range is +/- 31.75 degrees.



***Altitude Ignition timing Modifier Calibration***

Base ignition timing modification, dependent upon barometric pressure and engine load to ensure efficient operation at high altitude. Table size is 7 engine load calibration sites by 2 barometric pressure calibration sites and the correction range is +/- 31.75 degrees.

***Fuel Injection Delivery Timing***

Calibration of the actual positioning of the fuel injection pulse within the engine cycle, dependent upon engine speed and engine load. Calibration may be selected at up to 20 engine speed sites and 5 engine load sites with a resolution of 2.8 crankshaft degrees.

***Individual Cylinder Fuel Delivery Trimming***

Individual calibration trim tables for each injection group (ie:- cylinder) to correct for injector calibration differences or individual cylinder efficiency differences due to non-ideal manifolding. These tables share common calibrations sites with the injection timing calibration data (20 X 5) and allow +/- 61% adjustment range in 0.4% increments.

***Manifold Absolute Pressure Sensor Failure limp Home Calibration***

Calibration table that allows the throttle position sensor to act as a back-up in the event of a pressure sensor failure, thus ensuring almost normal engine operation. This is used for limp home in applications where pressure is the primary engine load input. This table can have up to 8 engine speed calibration sites and 6 throttle position calibration sites. Calibration range is 20 to 420 KPa in 0.1 KPa increments.

***Throttle Position Sensor Failure limp Home Calibration***

Calibration table that provides a limp-home function if the throttle position sensor is faulty. This table uses the same engine speed calibration sites as the manifold pressure failure table limp-home table. Calibration range is 0 to 100% in 0.1 % increments.

***Transient Engine Operation Calibration***

Calibrations to optimise the operation of the engine during- acceleration and deceleration. These calibrations all have common engine speed calibration sites (up to 8 max).

- IGNITION ADVANCE ATTACK RATE. Sets the maximum rate at which the ignition timing is allowed to advance. Can be used to improve driveability and/or reduce exhaust emissions. Calibration range 6 to 1590 deg/sec.
- IGNITION ADVANCE RETARD RATE.  
Set the maximum rate at which the ignition timing is allowed to retard. Can be used in conjunction with above to improve driveability and/or reduce exhaust emissions. Calibration range. 6 to 1590 deg/sec.
- CLOSED THROTTLE ACCELERATION MULTIPLIER. Sets the amount of additional fuel delivered for increasing throttle openings starting from a closed throttle condition. Controls the delivery of fuel for acceleration from small throttle openings

- OPEN THROTTLE ACCELERATION MULTIPLIER. Sets the amount of additional fuel delivered for increasing throttle openings starting from a part throttle condition. Controls the delivery of fuel for acceleration from large throttle openings.
- PART THROTTLE ACCELERATION LIMIT. Sets the throttle position above which the closed throttle acceleration multiplier no longer has an effect on acceleration fuel delivery. This calibration is dependent upon the relative size of the throttle butterflies to the engine capacity. Calibration range is 0 to 100% of throttle opening.
- ACCELERATION ENRICHMENT DECAY TIME. Sets the duration of the acceleration enrichment. Calibration range is 0.08 to 2 SEC.
- ACCELERATION ENRICHMENT RECOVERY TIME/ DECELERATION ENLEANMENT DECAY TIME. Sets the time taken for the acceleration enrichment to recover in readiness for the next acceleration enrichment. Also controls the duration of enleanment when a throttle opening reduction occurs. Calibration range is 0.08 to 2 SEC.
- DECELERATION ENLEANMENT MULTIPLIER. Sets the amount of fuel delivery reduction immediately following any throttle opening reduction.

### ***Charge Temperature Estimation Calibration***

Calibration that allows the estimation of the heat transferred to the incoming charge by the hot manifold and intake port, so that an actual charge temperature may be estimated for the calculation of correct fuel delivery. This table can have up to 16 engine speed calibration sites and 10 engine "load" calibration sites. Calibration represents % contribution that coolant temperature has in determining the charge temperature, its range is 0 to 100% in 0.5% increments. This calibration is particularly useful for 2 stroke engines where the charge temperature is almost totally determined by crankcase temperature:

### ***Warm-Up Enrichment***

This calibration table allows engine coolant temperature and engine "load" dependent control of additional fuel delivery. It controls additional fuel delivery after the initial post start enrichment period has finished, and its main function is to ensure stable engine operation during engine warm-up. It can also be used to enrich the air/fuel mixture at high engine loads if an engine overheated condition is detected in order to minimise the risk of engine damage. Calibration may be selected at up to 13 engine coolant temperature sites and 10 engine "load" sites and the adjustment range is 1.00 to 1.99 times the base fuel delivery.

### ***Post Start Enrichment Calibration***

Additional fuel delivery immediately after start-up is controlled by this table, this additional delivery decays away with time to the warm-up enrichment value from the table above. Calibration range is 1.00 to 3.99 times the base fuel delivery. This calibration function is only engine coolant temperature dependent and it uses the same engine coolant temperature 'calibration sites as chosen for the warm-up enrichment calibration table above.

### ***Post Start Enrichment Timeout Calibration***

The decay time for the additional fuel delivery immediately after start-up is controlled by this table. Calibration range is 0 to 20 SEC. This calibration function is only engine coolant temperature dependent and it uses the same engine coolant temperature calibration sites as chosen for the warm up enrichment calibration table above.

### ***Warm-Up Acceleration Enrichment Multiplier***

Calibration multiplier for additional engine coolant temperature dependent acceleration enrichment. Calibration range is 1.0 to 8.0 times the "warm" engine value. This calibration uses the same engine coolant temperature calibration sites as chosen for the warm-up enrichment calibration table above.

### ***Warm-Up Fast Idle Rpm Calibration***

Calibration for idle speed increase required of automatic idle speed control function during low temperature engine operation. This calibration table may also be used to increase the idle speed if engine overheating occurs so that engine driven cooling fan efficiency is improved helping to elevate the condition. Calibration range is 0 to 1020 RPM. This calibration uses the same engine coolant temperature calibration sites as chosen for the warm-up enrichment calibration table above.

### ***Post Start Fast Idle Rpm Calibration***

Calibration for idle speed increase immediately following start-up. Decays away with time to warm-up fast idle RPM calibration. Calibration range is 0 to 1020 RPM. This calibration uses the same engine coolant temperature calibration sites as chosen for the warm up enrichment calibration table above.

### ***Post Start Fast Idle Rpm Timeout Calibration***

Decay time for post start fast idle increase. Calibration range is 0 to 41 SEC. This calibration uses the same engine coolant temperature calibration sites as chosen for the warm-up enrichment calibration table above.

### ***Wastegate Control***

2. BOOST CONTROL CALIBRATION TABLES. One turbocharger wastegate control calibration table is available. The table allows engine speed and engine coolant temperature dependent setting of the boost level controlled by the boost control function. The coolant temperature dependency of the table (if used) allows boost to be, reduced at elevated engine coolant temperatures in order to minimise the possibility of engine damage. The table can have up to 10 engine speed calibration sites and 5 engine coolant temperature calibration sites. Calibration range is 110 to 500 KPa.
3. BOOST CONTROL THROTTLE MODIFIER CALIBRATION The boost level determined by the above calibration table may be made throttle position dependent by setting this table to effect a reduction in boost under conditions less than full throttle. The table may have up to 4 throttle position dependent calibration sites and the range for calibration is 0 to 300KPa.

### ***Engine Speed Limit***

Engine rev limiting may be made coolant temperature dependent with this table. A maximum of 6 engine coolant temperature calibration sites may be selected. Calibrations may be selected in the range 0 to 30000 RPM in 1 RPM increments. Additional control variables allow the characteristics of the rev limiter function to be tailored for the application.

### ***Overrun Fuel Delivery Cut Off***

Two engine coolant temperature dependent engine speed calibrations may be defined, one specifies the minimum engine speed that fuel delivery shutoff can commence under trailing throttle conditions and the other the minimum engine speed down to which fuel shutoff will be sustained. Higher engine speeds can be selected during engine warm-up to minimise the drivability problems associated with fuel delivery shutoff. The engine coolant temperature calibration sites chosen for the engine speed limit calibration function are also used by this function. Calibrations may be selected in the range 0 to 30000 RPM in 1 RPM increments.

### ***Base Idle Speed control Calibration***

Base idle speed calibration adjustment to provide the idle speed steeping for the automatic idle stabilisation function. This table allows battery voltage dependent idle speed selection if desired. This function helps ensure battery charge is maintained under all conditions. A maximum of 3 battery voltage calibration sites may be selected. Calibrations may be selected in the range 300 to 5000 RPM in 1 RPM increments.

### ***User Defined Duty Ratio Output Calibration***

This user-defined table is a 16 by 10 table that allows the user to define the output-characteristics of a spare pulse width modulated output as a function of any 2 variables that the ECU measures. A typical application would be the control of the actuation of an auxiliary upstream butterfly depending upon throttle position and engine speed in a turbocharged application in order to minimise turbocharger lag.

### ***User Defined On/Off Output Calibration***

This user defined table is a 6 by 4 table that allow the user to define the on /off characteristics of a spare relay output as a function of any 2 variables that the ECU measures. A typical application might be the control of camshaft timing adjustment actuator depending upon engine speed and load.

### ***Idle Mixture Control range Calibration***

The idle mixture trim screwdriver adjustment can be configured to operate over any defined engine speed and load range with up to +/- 25% of adjustment range. This allows the control to suit road and race tuned engines and also allows the action of the control to be inhibited if government authority regulations exclude any idle mixture adjustment. Calibration may be selected at up to 2 engine speed sites and 2 engine load sites with an adjustment range of 0 to +/- 25% in 0.1% increments.

### ***Barometric Pressure Estimation Offset Calibration***

Calibration table that allows the ECU to estimate barometric pressure at times other than before engine start-up using the internal MAP sensor. The table may have a maximum of 3 engine speed calibration sites and 6 throttle position sites. Calibration range is 0 to 50 KPa IN 0.2 KPa increments.

### ***Open Loop Air fuel Ratio Calibration***

This 16 by 10 calibration table is for use in applications where closed loop air fuel ratio operation is required. Details of this function are presently supplied to customers only on request.

## ***Miscellaneous Calibration***

Many variables exist that work with the above calibration functions, some are selected automatically by the laptop program depending upon the users response to questions asked by the program, others may be adjusted directly from a special screen display. These calibrations include:

- SELECT NUMBER OF ENGINE CYLINDERS.
- SELECT 4 CYCLE OR 2 CYCLE ENGINE.
- SELECT MANIFOLD ABSOLUTE PRESSURE/THROTTLE POSITION OR BOTH AS ENGINE LOAD INPUT.
- SELECT ENGINE COMPRESSION RATIO.  
Correct selection ensures precise correction for baro and exhaust backpressure changes.
- OVERALL FUEL DELIVERY MULTIPLIER.  
Provides correct scaling for, all fuel delivery tables and allows changes to injector sizing and/or fuel pressure without having to re-calibrate the fuel delivery tables.
- SELECTION OF INJECTION RESPONSE COMPENSATION.  
Selects the correct response characteristics for all commonly available injectors.
- OVERBOOST PROTECTION. (2 adjustments) Two stage overboost protection is adjustable for detection level and detection time so that damaging overboost causes engine shutdown but pressure spikes are ignored.
- ACCELERATION ENRICHMENT. (2 adjustments) Throttle sensitivity and maximum acceleration fuel delivery allow trimming of the minimum and maximum limits of enrichment.
- COOLING FAN CONTROL ADJUSTMENTS. (off) Allows co-ordination of two cooling fans according to vehicle speed, engine coolant temperature and air conditioner operation.
- AUTOMATIC IDLE SPEED STABILISATION CONTROL ADJUSTMENTS (2 off).  
Allows the trimming of the control characteristics of the idle stabilisation function for optimal operation (supplied default values normally ok).

## ECU Self Diagnostic

### ***Error Indicator Light***

The ECU's red LED indicator flashes error codes to indicate fault conditions.

Error conditions include:-

- Faulty sensors.
- Out of range signals.
- Electrical interference.
- Operation endangering engine life.
- Internal ECU malfunction

This indicator is located near the main connector, and some models (eg:- SMD) allow connection of a remote indicator light. Each time the ECU is activated (ignition on) previously detected HISTORY or old error conditions are indicated. After the completion of the HISTORY error codes, error codes are displayed as the errors are detected. An error code will remain stored in ECU memory until the fault is repaired and the engine is warmed-up (from cold to normal operating temperature) 20 times. This error memory feature allows the engines' user reasonable time to fault find difficult intermittent faults, or drive in limp-home mode to qualified service for repair. When the repair is effected the old stored error codes may be erased by using the laptop calibration program.

Error code format:-

- Error codes are all 2 digits, each digit comprising a number of 1/2 second on, 1/2 second off flashes.
- The 2 digits of each code are separated by 2.5 seconds.
- Error codes are separated by 5 second pause.
- As detected error codes can occur 10 seconds after the completion of the ignition on HISTORY CODES.

Normal Engine and ECU operation should present only 2 flashes 2.5 seconds apart at ignition on. Indicating that the ECU is without any stored error HISTORY and presently not detecting any new errors.

**Error Warning / Diagnostic Light Fault Codes**

CODE	ERROR DESCRIPTION
ON	INTERNAL ERROR 120
CONTINUOUSLY	RETURN TO FACTORY FOR REPAIR.
FLASHING FAST	INTERNAL ERROR 121 RETURN TO FACTORY FOR REPAIR.
11	NO ERROR.
13	THROTTLE I/P.
14	02 I/P.
21	AIR INTAKE TEMPERATURE I/P
22	COOLANT TEMPERATURE I/P.
23	BAROMETRIC PRESSURE.
25	VEHICLE (WHEEL) SPEED I/P.
26	OVER BOOST ERROR.
31	PRESSURE I/P.
33	CYLINDER PULSE I/P MISSING.
34	"SYNC" REFERENCE PULSE I/P MISSING.
41	EBP I/P.
43	"SYNC" ERROR DETECTED WHILE ENGINE RUNNING.
53	SUPPLY OVER VOLTAGE ERROR.
73	POWER FAIL DETECTOR ERROR CONTACT SUPPLIER.
82	CMOS RAM MEMORY LOSS.
99	EEROM ERROR CONTACT SUPPLIER.



**Example of error indication****Air Intake temperature error**

User action	System Error	ECU error HISTORY memory	ECU indication
No power	nil	nil	
Ign on	nil	nil	1 flash, pause 2.5 sec, 1 flash = code 11, no error HISTORY. no flashes for 10 sec = pause. no further flash = no existing/new errors.
Disconnect air temp sensor	21	nil	2 flashes, pause 2.5 sec, 1 flash = code 21 Air intake temperature sensor fault.
Ign off	21	21	
Ign on	21	21	2 flashes, pause 2.5 sec, 1 flash = HISTORY code 21 Air temperature sensor previously faulty. No flashes for 10 sec = pause after error code. Or 2 flashes, pause 2.5 sec, 1 flash = Air temperature sensor still faulty
Reconnect air temp sensor	nil	21	
Ign off	nil	21	
Ign on	nil	21	2 flashes, pause 2.5 sec, 1 flash = HISTORY code 21 Air intake sensor previously faulty. No flashes for 10 sec = pause after history code. No more flashes = no existing/new errors.

## Mode Flags

### ***SMD v 1.99 Mode Flags (Subaru & Mitsubishi PnP)***

MODE FLAG NO.	FUNCTION	VALUE
DO NOT ACCESS MODE FLAGS 0 TO 4 VIA MODE FLAGS, ALL FUNCTIONS SELECTABLE VIA SOFTWARE MENUS		
5	ENABLE ANTI-LAG FUNCTION TO AUXILIARY O/P	ADD 132
5	ENABLE ANTI-LAG FUNCTION TO INJ8 O/P	ADD 128
5	DIRECT USER DEFINED PWM O/P FUNCTION TO AUXILIARY O/P.	ADD 4
6	INHIBIT ANTI-LAG O/P IF LOAD > 100.0	ADD 128
7	SELECT SUBARU TRIGGER OPTION.	1
7	SELECT MITSUBISHI TRIGGER OPTION	2
7	SELECT 150/90 DEG (V6) IGNITION OPTION.	4
7	ACTIVATE COOL DOWN TIMEOUT	ADD 8
7	SELECT ANTI-LAG DROPPED INJECTION COOL-DOWN FUNCTION.	ADD 16
7	SELECT ANTI-LAG THROTTLE CLOSED INHIBIT FUNCTION.	ADD 32
7	SELECT AUTOMATIC ANTI-LAG (ANTI-LAG TO ON FOR 15.0 SEC AFTER RPM EXCEEDS 5000).	ADD 64
7	SELECT ANTI-LAG CONTROL BY SWITCH I/P (GROUND I/P TO ACTIVATE).	ADD 128
8	IGNITION TRIGGERING OF ALL CYLINDERS 1 To 8 ALLOWED.	0
8	INHIBIT CYLINDER 1 IGNITION	ADD 1
8	INHIBIT CYLINDER 2 IGNITION	ADD 2
8	INHIBIT CYLINDER 3 IGNITION	ADD 4
8	INHIBIT CYLINDER 4 IGNITION	ADD 8
8	INHIBIT CYLINDER 5 IGNITION	ADD 16
8	INHIBIT CYLINDER 6 IGNITION	ADD 32
8	INHIBIT CYLINDER 7 IGNITION	ADD 64
8	INHIBIT CYLINDER 8 IGNITION	ADD 128

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<b>MODE FLAG NO.</b>	<b>FUNCTION</b>	<b>VALUE</b>
9	IGNITION TRIGGERING OF ALL CYLINDERS 9 TO 16 ALLOWED.	0
9	INHIBIT CYLINDER 9 IGNITION	ADD 1
9	INHIBIT CYLINDER 10 IGNITION	ADD 2
9	INHIBIT CYLINDER 11 IGNITION	ADD 4
9	INHIBIT CYLINDER 12 IGNITION	ADD 8
9	INHIBIT CYLINDER 13 IGNITION	ADD 16
9	INHIBIT CYLINDER 14 IGNITION	ADD 32
9	INHIBIT CYLINDER 15 IGNITION	ADD 64
9	INHIBIT CYLINDER 16 IGNITION	ADD 128
10	USE IDLE IGNITION TIMING TABLE @ IDLE.	0
10	USE MAIN IGNITION TIMING TABLE @ IDLE.	1
10	IGNITION TIMING MODIFIER 1 CHARGE TEMPERATURE DEPENDENT.	ADD 0
10	IGNITION TIMING MODIFIER 1 COOLANT TEMPERATURE DEPENDENT.	ADD 2
13	EXTRA CYLINDER PULSE SYNC FUNCTION.	ADD 128

**SMC v 1.92 Mode Flags (Honda Civic PnP)**

<b>MODE FLAG NO.</b>	<b>FUNCTION</b>	<b>VALUE</b>
0	SELECT MANIFOLD ABSOLUTE PRESSURE MAPPED CALIBRATION	0
0	SELECT THROTTLE POSITION MAPPED CALIBRATION	1
0	SELECT THROTTLE MAPPED FUEL DELIVERY WITH PRESSURE OVERRIDE (IGNITION PRESSURE MAPPED)	8
0	SELECT FOR 4 CYCLE ENGINE	ADD 0
0	SELECT FOR 2 CYCLE ENGINE (AND ROTARY ENGINES)	ADD 4
0	ENABLE OPEN LOOP A/F RATIO TABLE	ADD 16
0	ENABLE OPEN LOOP LEAN HWY MODE	ADD 32
0	ACTIVATE CLOSED LOOP A/F CONTROL	ADD 64
0	SELECT SPECIAL IGNITION OUTPUT DWELL SETTING (CONSULT YOUR DEALER ABOUT SPECIAL IGNITIONS).	ADD 128
1	1 COIL IGNITION SYSTEM	1
	2 COIL IGNITION SYSTEM	2
	3 COIL IGNITION SYSTEM	3
	4 COIL IGNITION SYSTEM	4
1	SPECIAL IGNITION INHIBIT FUNCTION (DO NOT USE !!!)	ADD 8
1	NEGATIVE TRIGGERED IGNITION AMPLIFIER (MODULE) eg:- Bosch HEI	ADD 0
1	POSITIVE TRIGGERED IGNITION AMPLIFIER (MODULE) eg:- - MSD	ADD 32
1	CYLINDER REFERENCE PULSE INPUT POSITIVE TRIGGERED	ADD 0
1	CYLINDER REFERENCE PULSE INPUT NEGATIVE TRIGGERED	ADD 16
1	CYLINDER PULSE INPUT POSITIVE TRIGGERED.	ADD 0
1	CYLINDER PULSE INPUT NEGATIVE TRIGGERED	ADD 64
1	CYLINDER PULSE INPUT POSITIVE & NEGATIVE (RISING & FALLING SIGNAL) TRIGGERED.	ADD 128

SMC 1.92

<b>MODE FLAG NO.</b>	<b>FUNCTION</b>	<b>VALUE</b>
2	NO AIR/FUEL RATIO SENSOR	0
2	PROPORTIONAL AIR/FUEL RATIO I /P 0 - 1.0 Volt => 10:1 to 30:1 AIR/FUEL RATIO	1
2	BOSCH OR "AUTRONIC" 4 WIRE 02 SENSOR	2
2	ENABLE DIGITAL I/P AIRFLOW METER (CONSULT YOUR DEALER ABOUT THIS SPECIAL FEATURE).	ADD 8
2	SELECT NTC INTAKE TEMP SENSOR (IGNORE WHEN USING AUTRONIC AIR TEMP SENSOR - FOR SPECIAL APPLICATIONS ONLY. REQUIRES ECU MODIFICATION)	ADD 16
3	AUX COOLING FAN (FAN 2) TO INJ7 O/P (ONLY AVAILABLE IF INJ7 O/P NOT USED FOR FUEL INJ).	0
3	MODIFY AUX COOLING FAN FUNCTION FOR CHARGE COOLING FUNCTION ON INJ7 O/P.	1
5	ENABLE AUXILIARY O/P FUNCTION AS IDLE SPEED CONTROL (FOR BOSCH 2 WIRE IDLE CONTROL ACTUATOR).	0
5	ENABLE AUXILIARY O/P FUNCTION AS IDLE SPEED CONTROL. (FOR PROPORTIONAL TYPE VALVE).	1
5	ENABLE AUXILIARY O/P FUNCTION AS BOOST CONTROL.	2
5	DIRECT MAIN COOLING FAN (FAN1) TO AUXILIARY O/P.	3
5	DIRECT USER DEFINED PWM O/P OR ANTI-LAG FUNCTION TO AUXILIARY O/P.	4
5	ENABLE AUXILIARY O/P FUNCTION AS FUEL USED O/P.	5
5	RE-DIRECT USER ON/OFF O/P FUNCTION FROM EITHER INJ5 OR INJ8 TO AUXILIARY O/P.	6
5	SELECT (THROTTLE POSITION AS CALIBRATION VARIABLE FOR USER DEFINED PWM OR ANTI-LAG FUNCTION.	ADD 0
5	SELECT "LOAD" AS CALIBRATION VARIABLE FOR USER DEFINE PWM OR ANTI-LAG FUNCTION.	ADD 8
5	SELECT THROTTLE POSITION AS CALIBRATION VARIABLE FOR USER DEFINED ON/OFF O/P.	ADD 0
5	SELECT "LOAD" AS CALIBRATION VARIABLE FOR USER DEFINED USER DEFINED ON/OFF O/P.	ADD 16
5	ENABLE ON/OFF O/P FUNCTION TO AUXILIARY O/P OR INJ5 O/P OR INJ8 O/P (AUX O/P OR INJ5 O/P IF ANTI-LAG SELECTED)	ADD 32
5	ENABLE MAIN COOLING PAN (FAN1) FUNCTION TO AUXILIARY O/P OR INJ6 O/P	ADD 64
5	ENABLE ANTI-LAG FUNCTION TO AUX O/P OR INJ8 O/P	ADD 128

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<b>MODE FLAG NO.</b>	<b>FUNCTION</b>	<b>VALUE</b>
6	PWM O/P FREQUENCY = 10Hz	0
6	PWM O/P FREQUENCY = 20Hz	ADD 4
6	PWM O/P FREQUENCY = 30Hz	ADD 8
6	PWM O/P FREQUENCY = 40Hz	ADD 12
6	PWM O/P FREQUENCY = 50Hz	ADD 16
6	PWM O/P FREQUENCY = 60Hz	ADD 20
6	PWM O/P FREQUENCY = 70Hz	ADD 24
6	PWM O/P FREQUENCY = 80Hz	ADD 28
6	PWM O/P FREQUENCY = 90Hz	ADD 32
6	PWM O/P FREQUENCY = 100Hz	ADD 36
6	PWM O/P FREQUENCY = 110Hz	ADD 40
6	PWM O/P FREQUENCY = 120Hz	ADD 44
6	PWM O/P FREQUENCY = 130Hz	ADD 48
7	SELECT 150/90 DEG (V6) IGNITION OPTION.	4
7	SELECT ANTI-LAG DROPPED INJECTION COOL-DOWN FUNCTION.	ADD 16
7	SELECT ANTI-LAG THROTTLE CLOSED INHIBIT FUNCTION.	ADD 32
7	SELECT AUTOMATIC ANTI-LAG (ANTI-LAG TO ON FOR 15.0 SEC AFTER RPM EXCEEDS 5000).	ADD 64
7	SELECT ANTI-LAG CONTROL BY SWITCH I/P (GROUND I/P TO ACTIVATE).	ADD 128
8	IGNITION TRIGGERING OF ALL CYLINDERS 1 To 8 ALLOWED.	0
8	INHIBIT CYLINDER 1 IGNITION	ADD 1
8	INHIBIT CYLINDER 2 IGNITION	ADD 2
8	INHIBIT CYLINDER 3 IGNITION	ADD 4
8	INHIBIT CYLINDER 4 IGNITION	ADD 8
8	INHIBIT CYLINDER 5 IGNITION	ADD 16
8	INHIBIT CYLINDER 6 IGNITION	ADD 32
8	INHIBIT CYLINDER 7 IGNITION	ADD 64
8	INHIBIT CYLINDER 8 IGNITION	ADD 128
9	IGNITION TRIGGERING OF ALL CYLINDERS 9 TO 16 ALLOWED.	0
9	INHIBIT CYLINDER 9 IGNITION	ADD 1
9	INHIBIT CYLINDER 10 IGNITION	ADD 2
9	INHIBIT CYLINDER 11 IGNITION	ADD 4
9	INHIBIT CYLINDER 12 IGNITION	ADD 8
9	INHIBIT CYLINDER 13 IGNITION	ADD 16
9	INHIBIT CYLINDER 14 IGNITION	ADD 32
9	INHIBIT CYLINDER 15 IGNITION	ADD 64
9	INHIBIT CYLINDER 16 IGNITION	ADD 128

SMC 1.92

MODE FLAG	FUNCTION	VALUE
10	USE IDLE IGNITION TIMING TABLE @ IDLE.	0
10	USE MAIN IGNITION TIMING TABLE @ IDLE.	1
10	IGNITION TIMING MODIFIER 1 CHARGE TEMPERATURE DEPENDENT.	ADD 0
10	IGNITION TIMING MODIFIER 1 COOLANT TEMPERATURE DEPENDENT.	ADD 2
11	WIRING LOOM HAS POWER SUPPLY AND FUEL PUMP/INJECTOR SUPPLY RELAYS (I.E:- ECU POWER FEED IS TO PIN 25 OR 26 FROM A RELAY THAT DE-ENERGIZES DURING BATTERY REVERSAL).	0
11	WIRING LOOM HAS FUEL PUMP/INJECTOR SUPPLY ONLY. (IE:- ECU POWER FEED IS TO PIN 29 DIRECT FROM IGNITION SWITCH/RELAY.	1
12	DISABLE SOFT REV LIMIT	0
12	ENABLE SOFT REV LIMIT FUEL CUT	ADD 1
12	ENABLE SOFT REV LIMIT SPARE CUT	ADD 2
13	MISSING PULSE CYL I/P SYNC (eg Motronic) SET = MISSING TOOTH COUNT.	0 TO 7
13	SUBARU 1999-2000 TRIGGER PATTERN SELECT	32
13	MITSUBISHI EVO 4, 5 AND 6 TRIGGER PATTERN SELECT	64
13	EXTRA CYLINDER PULSE SYNC FUNCTION.	128
14	CYL PULSE PRE-SCALE FACTOR	( 0 = disables )
15	CYL PULSE PRE-SCALE OFFSET	0 TO Mode Flag 14 - 1

**SPECIAL FEATURES**

EITHER CLOSE LOOP A/F RATIO CONTROL OR ANTI-LAG CAN  
BE SELECTED BUT BOTH CANNOT OPERATE SIMULTANEOUSLY

IDLE SPEED CONTROL = CHARGE COOLING MINIMUM RPM  
RESET ENGINE SPEED.

FAN 2 ON VEH               = MAP THRESHOLD FOR CHARGE COOLING  
SPEED THRESH.

AIRCON RESTART       = ANTI-LAG COOL-DOWN MODE MIN RPM  
ENGINE SPEED.

AIRCON CUTOFF       = ANTI-LAG COOL-DOWN MUCH MAX RPM  
ENGINE SPEED.

AIRCON RESTART       = ANTI-LAG COOL-DOWN MAX THROTTLE  
DELAY TIME           (10 SEC = 20% THROTTLE).