Manifold Absolute Pressure Electronic Control Unit (MAP-ECU)

Performance Motor Research Limited

Specifications and Instructions

Firmware Version 1.2

www.mapecu.com
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Information

Please read this manual carefully and only attempt installation if you completely understand all aspects covered in this manual.

Warning!

Installation and use of this product should only be attempted by trained and experienced automotive specialists who are experienced with automotive electrical, mechanical and electronic fuel management technology. Installation by untrained or inexperienced personnel can result in damage to this product or your vehicle.

When installing this unit, observe the operating procedures of any tools, especially soldering irons. Misuse of these tools can cause serious injury.

Never tune the MAP-ECU on public roads, this can be dangerous for you and others.

Never attempt to operate the vehicle and tune the MAP-ECU at the same time.

When tuning a vehicle always ensure there is adequate ventilation for exhaust fumes as they are harmful.

Avoid open sparks, flames or operation of electrical devices near flammable materials.

Ensure there are no leaks from the vehicle fuel system.

Ensure all electrical wiring is well secured and insulated in accordance with the vehicle manufacturers standards.

The MAP-ECU is designed for negative earth 12V environments only.

Always use a professional Air/Fuel Ratio meter when tuning the MAP-ECU.

Improper tuning of the MAP-ECU can result in permanent damage to your engine. Performance Motor Research Limited accepts no responsibility for damage due to improper installation and tuning.

Performance Motor Research Limited provides no warranty and accepts no responsibility for damage from using any base tables from other vehicles.

Installation of this unit requires modifications to the vehicle's electrical system. Modifications should only be carried out with the ignition key removed and the negative terminal of the battery disconnected.

Never 'short-out' any connections as this could damage the MAP-ECU or your vehicle's electrical system.

Ensure all connectors are inserted fully and the locking clip(s) are engaged.

Only used vacuum line specified and ensure it is inserted fully over the barbed fitting. Ensure you do not exert too much force and damage the vacuum sensor.

Ensure the vacuum line is free of kinks or any form of damage. Ensure there is no possibility that the vacuum line can be damaged or blocked by the installation. This may cause erratic operation or damage to your vehicle.

Ensure the MAP-ECU is installed securely and the wiring is not strained in any way. The MAP-ECU is **NOT** designed to be installed in harsh or wet environments, e.g. engine bay, outside the vehicle. The MAP-ECU should be installed as close as possible to the OEM ECU provided it is installed in accordance with the previous statement.

Disconnect the PC serial cable when tuning is completed. Do not leave the cable connected to the MAP-ECU during normal operation.

Specifications

The product, software and manual are subject to change without notice.

Parts List

Ensure your product is complete before proceeding. You should receive the following:

1. MAP-ECU module
2. Wiring harness
3. CD-ROM
4. This manual
5. PC serial cable (2 Metre)
6. Air Temp Sensor

Introduction

The Manifold Absolute Pressure Electronic Control Unit (MAP-ECU) is designed to replace both (AFM) Air Flow Meter (Flap and Hotwire types) and Von Karmen Vortex Frequency (VKF) based airflow meters in all ECU based automobiles. The unit does not replace the existing ECU, but simply generates the required airflow signal based on Manifold Absolute Pressure (MAP) and RPM. The MAP-ECU is fully programmable with a 374 Zone table controlling either Karmen Vortex Frequency (VKF), Hotwire or Flap Air Flow Meter (AFM) voltage output. In addition, the MAP-ECU has a 'self-learn' facility where by it can monitor either the existing frequency or voltage signal and populate the map during normal driving. Programming is carried out using the MAP-CAL PC based software supplied with the unit. **Note**: Older generation non-computer based ECU's are not compatible with the MAP-ECU. All signals, e.g. TPS, AFM, VKF and O2 must be within the 0-5V range. Some older units use 0-12V signals. Refer the 'Specifications' section for more information.

Features

The MAP-ECU has the following features:

- Powerful integrated microprocessor with non-volatile flash memory for program and data.
- Built-in +30 PSI pressure sensor.
- Factory customisable pressure scale.
- Self-learn facility for initial set-up.
- Serial port for PC communications.
- High-resolution 374 Zone map with 200 rpm increments up to 2000 rpm and 500 rpm increments to 8000 rpm.
- Two (2) multi-function high current switched outputs configurable as follows:
  - NOS solenoid drive
  - RPM>0
  - O2 Sensor Heater
  - Pressure Switch
- Von Karmen Vortex Frequency airflow meter replacement mode, e.g. Mitsubishi™, DSM™
- Mass Air Flow meter replacement mode, 'flap' or 'hot-wire' types.
- RPM sensing from ignition system, 1-16 cylinders.
- TPS input for acceleration enrichment.
- O2 Sensor input for monitoring and logging.
- Upgradeable software stored in Flash memory that can be downloaded via the built-in serial port. No additional interface modules are required.

Abbreviations

Throughout this manual, many abbreviations will be used as follows:

AFM	Air Flow Meter (Flap or Hot Wire types where air mass is represented as a DC voltage from 0 to 5 Volts).
ECU	Electronic Control Unit (Computer) that runs the engine.
Flash	A technology used to implement NVRAM where special programming voltages are not required.
NVRAM	Non-Volatile Random Access Memory. Retains it contents when power is removed.
NOS	Nitrous Oxide System
PC	Industry Standard Personal Computer running Microsoft™ Windows 95™, Windows 98™, Windows NT™ or Windows 2000™ operating system.
PSI	Pounds Per Square Inch
TPS	Throttle Position Sensor.
VKF	Von Karmen Vortex Frequency. Air mass is represented as a variable frequency from 16Hz to 3400Hz.
WOT	Wide-Open-Throttle, i.e. maximum throttle position.

Description

The MAP-ECU generates an output to simulate an air flow meter based on manifold pressure (vacuum and boost) versus RPM. The unit can generate either a square wave frequency (VKF) or Voltage (AFM) depending on the model selected. This allows removal of restrictive air flow meters for performance installations where a larger intake is required. The MAP-ECU samples manifold pressure and RPM continuously and calculates new output values based on the 374 Zone table approximately every ten (10) milliseconds, i.e. 100 times per second.

Von Karmen Vortex Frequency output is a continuous square wave from 16Hz to 3400Hz with 1Hz resolution. Air flow meter voltage output is 0 to 5V DC with 1.221mV resolution.

The TPS input is used to provide acceleration enrichment to the output signal as described later in this manual.

The O2 Sensor input is purely used for passive monitoring via the PC based MAP-CAL application. An O2 Sensor Heater drive output is also available for 4-wire sensors.

A pressure switch function is available for boost pressures from 0-30 PSI in 0.1 PSI increments.

Note: 0 PSI is defined as atmospheric pressure, i.e. 1 Bar.

A NOS activation function is available to drive a solenoid based on RPM and TPS.

A RPM>0 function is available to simulate the Fuel Pump enable signal generated by some air flow meters.

A O2 Sensor Heater drive function is available for 4-Wire O2 Sensors.

Customised Pressure Scale

The MAP-ECU can be ordered with a customized pressure scale to suit different purposes with a maximum of nineteen (17) lines and a constant pressure step between lines. The standard scale is –10 PSI to +30 PSI in steps of 2.5 PSI which should cater for the majority of applications. Maximum boost pressure is limited by the pressure sensor at +30 PSI. For example, a MAP-ECU may be required for a naturally aspirated engine where positive manifold pressure is unlikely. In this case, a unit with a high-resolution vacuum scale can be ordered, such as –12 PSI to 0 PSI in 1 PSI steps. The unit would be programmed with a scale from –12 PSI to +4 PSI as the full 17 lines will be allocated but the user does not have to populate the positive pressure part of the table.

How the Output is Calculated

Output values are computed based on RPM and Pressure. In these examples the pressure scale is the default –10 PSI to +30 PSI in 2.5 PSI steps where line 1 is –10 PSI. Up to four (4) table values are used for each computed value, as it is virtually impossible for the inputs to line up with table intersections, e.g. 1000 RPM and +2.5 PSI. The MAP-ECU takes the input RPM and Pressure and computes the value based on the four (4) values in the table. E.g. The input RPM is 2250 RPM and pressure is +1 PSI. The table has values for 2000 RPM and 2500 RPM for each pressure. Because the pressure lies between 0 and 2.5 PSI, the MAP-ECU will use Zones 518, 520, 618 and 620.

Suppose the area of the table looks like this:

PSI/RPM	2000	2500
0	^{518}200	^{520}300
2.5	^{618}210	^{620}310

The MAP-ECU will look at the RPM and calculate that 2250 is half way (50%) between Zone 518 and Zone 520 and will calculate the half way point between those values. In this case 200 and 300, so the result is 250 (200+((300-200)*50%). It will then do the same for the next line, Zone 618 and Zone 620 and come up with 260 ((210+(310-210)*50%). The MAP-ECU will calculate that 1 PSI is between 0 and 2.5 PSI so will do the same with the computed values 250 and 260,

i.e. Result=250+((260-250)*40%) or **254**. This is the value used to drive the AFM Voltage output or VKF frequency output depending on the mode.

Specifications

Parameter	Specification
Input voltage	10-16 VDC, negative earth, polarity and over voltage protected.
Input current	Maximum 100mA, not including switched outputs.
Serial Communications	DB9 Female connector, RS232, 9600 baud, 8 bits, Even Parity, 1 stop bit. Text interface or PC based MAP-CAL application.
Pressure Sensor	30psi air pressure sensor, absolute reference (not atmosphere). Barbed fitting accepts ¼" vacuum hose.
Switched Outputs 1 & 2	4A output switched ground, +12VDC. Programmable for Pressure Switch **or** O2 Heater **or** RPM=0 **or** NOS Activation functions.
Pressure Switch Function	Adjustable from 0 to +30psi in 0.1psi steps.
O2 Heater Function	O2 Sensor Heater drive for 4-wire O2 sensors.
RPM=0 Function	Simulates nil airflow output of some air flow meters (disengages fuel pump relay).
NOS Activation Function	Minimum RPM, Maximum RPM and Minimum TPS parameters used to activate a NOS solenoid valve.
RPM Sense input	Ignition coil –VE connection, 400V maximum, sensed on transition to ground (0V) or ignition trigger signal, 0 to 5 V square wave direct from ECU.
RPM	0-8000 RPM
AFM Input	Connect to stock Air Flow Meter output, 0-5VDC, input protected to 16VDC for 30 seconds. Resolution of 1.221mV.
AFM Output	0 to 5 VDC at 10mA, short circuit protected for 60 seconds. Resolution of 1.221mV. Programmable zero point.
VKF Input	'Clean' 0 to 5 VDC square wave, 16Hz-3400Hz, input protected to 16 VDC for 30 seconds. Resolution of 1Hz.
VKF Output	0-5VDC square wave, 16Hz-3400kHz, open collector output with 4K7 pull-up resistor. Maximum sink current of 50mA. Resolution of 1Hz.
TPS Input	Throttle Position Sensor input. 0 to 5 VDC, input protected to 16 VDC for 30 seconds. Eight (8) zones of TPS enrichment in 1000 rpm steps.

Parameter	Specification
O2 Sensor Input	Oxygen Sensor input used for logging and monitoring only. 1 to 4 VDC, input protected to 16 VDC for 30 seconds.
Cylinders	1-16 and 'coil pack' environments.
Table Resolution	374 Zones, RPM versus Manifold Pressure. 0-2000 RPM in 200 RPM increments, 2000-8000 RPM in 500 RPM increments. Manifold pressure -10 PSI to +30 PSI in 2.5 PSI increments.
Table Editing	By Line, Row or Zone.
Number of writes to NVRAM	10,000
Retention life of NVRAM	10 years
Size (L x W x H)	78mm x 180mm x 36mm
Weight	380 grams (0.84 lbs)

Configuration

Programming of the MAP-ECU is achieved through the PC based MAP-CAL application provided with the unit via a serial COM port and the provided cable. All configuration parameters are modified using this interface and saved in Flash NVRAM. Parameters that need to be configured are as follows:

- Number of Cylinders
- VKF/AFM selection
- AFM Zero/Baro Adjust
- TPS Idle
- TPS Max (WOT)
- TPS Enrichment Table
- MAP Enrichment Table
- O2 Sensor Heater Threshold Voltage
- NOS Min/Max RPM & Min TPS
- Pressure Switch Threshold
- Switched Output Configuration

Number of Cylinders

The number of cylinders variable (1-16) is purely used to calculate RPM based on the number of ignition pulse received on the input. The software assumes a 4-cycle engine with an ignition pulse for each spark plug, i.e. ignition coil pulses. Connection is usually to the negative (-) terminal of the ignition coil or to the ignition drive signal from the ECU. Should the vehicle have a distributor-less ignition system, and the ignition input connected to only one coil, the number of cylinders variable will need to be altered. A typical distributor based four (4) cylinder engine will generate two (2) ignition pulses per revolution. If the engine is distributor-less, there will be only one ignition pulse every two revolutions, therefore the cylinders variable should be set to one (1). In four –cycle engines using a coil per spark plug, using a Cylinders value of one (1) should result in the correct RPM reading for any number of cylinders.

Voltage/Frequency Select

This setting is a binary selection of either Hotwire/Flap AFM (Voltage) or Von Karmen Vortex Frequency (VKF). This option controls both the auto-learn input selection and output control. In AFM mode, values in the table are used to determine the output voltage of the MAP-ECU (0-5VDC) on the AFM output where 0=0V and 4095=5V. Each increment is 1.221 mV. In VKF mode, the value in the table controls frequency output on the VKF output. A setting of 0 means no output, i.e. no frequency, and a setting of 2000 means 2kHz. Values in between control the frequency based on 1Hz increments, i.e. 100=100Hz. The minimum frequency is 16Hz.

AFM Zero/Baro Adjust

This value is used for both AFM and VKF MAP-ECU's and performs different functions.

The AFM Zero Adjust value is only used for AFM mode. This value (0-4095) controls the zero airflow voltage presented to the existing ECU when the engine is at rest, i.e. 0 RPM. If the engine has this type of airflow meter, then the value should be set accordingly. It is unlikely that zero airflow is exactly 0 Volts or 5 Volts and therefore will be set accordingly. If the MAP-ECU is installed in parallel with the stock AFM, it is possible to monitor this signal with the ignition ON but without the engine running to get the exact value. The MAP-CAL application will allow the user to sample this input voltage. Refer to the MAP-CAL Software Users Guide for more information on editing and configuring this parameter.

When the MAP-ECU is a VKF type, this value controls the voltage presented to the stock ECU Barometric pressure input if there is one present. If a satisfactory signal was not supplied to the stock ECU, and engine check light may appear. This value can also be adjusted to make fine air/fuel mixture adjustments across the entire table simulating barometric pressure variations, e.g. high pressure will require more fuel and lower pressure less fuel.

Note: When the unit is in Auto-Learn mode and power is applied, the MAP-ECU will check the AFM voltage input with the engine at 0 RPM and store the 'no flow' value as the AFM Zero. This is because the 'no flow' value may be in the range of 0-4095 and allows the MAP-ECU to present the most accurate data to the existing ECU at start-up. With a VKF MAP-ECU, this input can be connected to the Barometric Pressure sensor output of the stock air flow meter in order to learn the default voltage setting.

TPS Idle

TPS Idle is the voltage presented to the MAP-ECU when the throttle is at idle. This is used in conjunction with TPS Max to determine whether the TPS output uses normal or reverse voltage and the rate of change (integral) of TPS for accelerator enrichment. 0=0 Volts, 4095 = 5 Volts.

TPS Max

Like TPS Idle, this is the voltage presented to the MAP-ECU when the throttle butterfly is at WOT. It's value determines whether the TPS output uses normal or reverse voltage and the rate of change (integral) of TPS for accelerator enrichment. 0=0 Volts, 4095 = 5 Volts.

TPS Enrichment Table

This table determines the level of enrichment applied by the MAP-ECU to the output when fast transitions of the throttle are detected, similar to an accelerator pump. The faster the transition, the more enrichment is applied as a product of transition speed and TPS Percent. Transition speed is computed in the MAP-ECU using the integral of TPS input voltage. An integral value of 0-100 percent is generated by the MAP-ECU internally which is then multiplied by TPS Percent and the result used to enrich the MAP-ECU output. This means slow transitions of the throttle position result in little or no enrichment. Maximum enrichment can only be achieved by a throttle position change from Idle to WOT within approximately 200mS. Note that negative TPS transitions have no effect, i.e. additional leaning of the output signal is not provided. Valid settings for TPS Percent are integers from 0 to 100. It is vital that TPS Idle and TPS Max are set correctly otherwise TPS enrichment will not operate correctly. The TPS Enrichment table is configured as eight (8) Zones in 1000 RPM increments, e.g. 1000, 2000, 3000, etc.

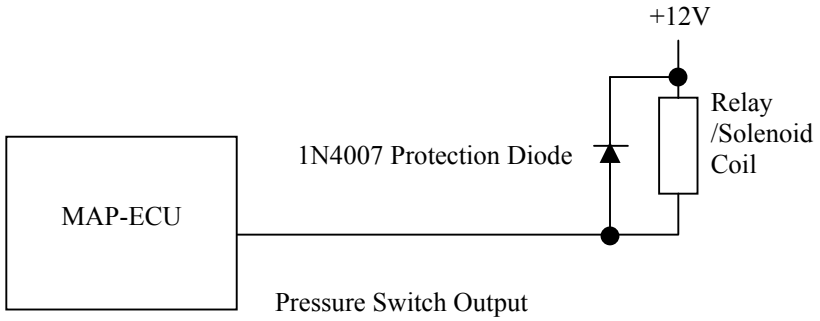
MAP Enrichment Table

This table determines the level of enrichment applied by the MAP-ECU to the output when fast transitions of Manifold Pressure are detected, similar to the TPS Enrichment Table. This function is provided for vehicles where a TPS signal is not available. The faster the transition, the more enrichment is applied as a product of transition speed and MAP Percent. Transition speed is computed in the MAP-ECU using the integral of Manifold Pressure. An integral value of 0-100 percent is generated by the MAP-ECU internally which is then multiplied by MAP Percent and the result used to enrich the MAP-ECU output. This means slow transitions of the Manifold Pressure result in little or no enrichment. Maximum enrichment can only be achieved by a large change in Manifold Pressure, e.g. Idle to WOT within approximately 200mS. Note that negative Manifold Pressure transitions have no effect, i.e. additional leaning of the output signal is not provided. Valid settings for MAP Percent are integers from 0 to 100. The MAP Enrichment table is configured as eight (8) Zones in 1000 RPM increments, e.g. 1000, 2000, 3000, etc.

Pressure Switch

The MAP-ECU has the ability to control a device based on pressure, e.g. Intercooler water mist pump relay, etc. The pressure output signal is switched to ground, i.e. 0V suitable for relay or solenoid control to 4A @ 12 VDC. If an inductive load, such as relay or solenoid, is used on the pressure switch output, install a 1N4007 Diode (or similar) across the coil in order to protect the output against back EMF surges. **Warning**: Install the Diode correctly, with the band connected to the +12V supply in order to avoid damaging the electronic switch.

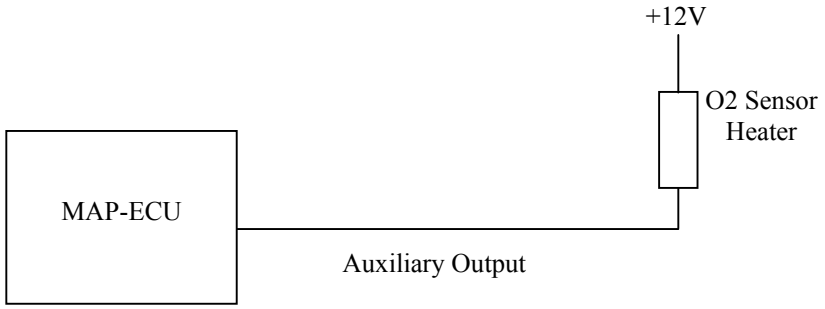
E.g.



O2 Sensor Heater

One of the Switched Outputs can be configured to drive a 4-wire O2 sensor heating element as follows:

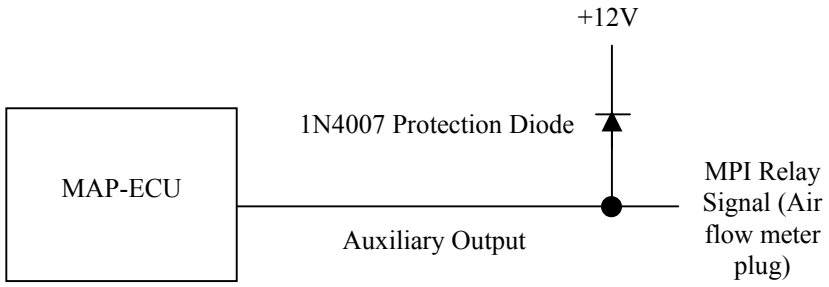
E.g.



RPM>0 (Airflow Signal)

One of the Switched Outputs can be configured to simulate the airflow signal generated by some air flow meters to energise the fuel pump, e.g. Mitsubishi™ MPI control relay.

E.g.

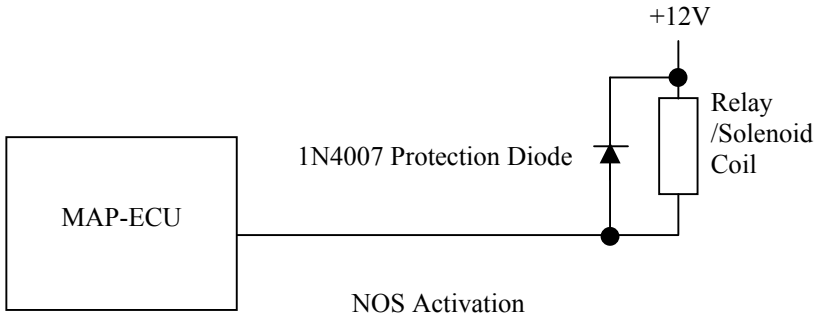


Note: The protection diode is mounted externally as the +12V circuit operating the relay maybe different to that supplying the MAP-ECU. This configuration minimises the chance of current leakage running the car battery flat.

NOS Activation

One of the Switched Outputs can be configured to drive a NOS activation solenoid. Activation is based on Minimum RPM, Maximum RPM and Minimum TPS. If an inductive load, such as relay or solenoid, is used on the pressure switch output, install a 1N4007 Diode (or similar) across the coil in order to protect the output against back EMF surges. **Warning**: Install the Diode correctly, with the band connected to the +12V supply in order to avoid damaging the electronic switch.

E.g.



Auto Learn

Auto Learn mode monitors RPM and Pressure inputs until there is an intersection point in the table, e.g. 600 RPM and –2.5 PSI, and then samples the current input and copies it into non-volatile memory. The MAP-ECU will actually take samples up to 10% outside of the intersection Zone, i.e. –2.5 PSI +/- 0.25 PSI and 600 RPM +/- 60 RPM. This means if the MAP-ECU measures 660 RPM and 2.75 PSI, it will store the measured input into the table at Zone 404. Auto-learn is enabled and disabled via the ECU Configuration screen of the MAP-CAL application. Once a change to auto-learn mode (off **or** on) is made from the MAP-CAL application, the MAP-ECU **must** be power cycled for the change to take affect. Auto-learn will only store a sample if the zone is zero (0). If there is any value other than zero (0) stored in the zone already, no sample will be stored.

Before Enabling Auto Learn

Before enabling auto-learn, the MAP-ECU must be prepared. This means "zeroing" all the zones you wish to over-write, either individually, or using the 'Fill Table' options from the MAP-CAL application. If you are installing a MAP-ECU without a base table, i.e. completely un-programmed, it is recommended that all zones are set to zero (0). Once the zones are zero (0), enable auto-learn as per the MAP-CAL application instructions.

Auto-Learn Set-up Procedure

In order to set-up the MAP-ECU for auto-learn, follow this procedure:

1. Install the unit as per the appropriate (AFM or VKF) wiring diagram included in this manual.
2. Install the MAP-CAL application on your computer as per the installation instructions.
3. Connect an available serial port (COM port) to the MAP-ECU using the RS232 cable provided. If the cable is not long enough, a cable of up to 10M can be used as per the wiring diagram in this manual. Shielded cable should be used where possible to minimise interference.
4. Execute the MAP-CAL application by selecting 'Start', 'Programs', 'MAP ECU' program group and the 'MAP-ECU' icon.
5. If required, configure the serial port to suit your computers configuration. The default is COM 1. This can be accomplished from the 'Serial Configuration' option from the 'Edit' menu.
6. Power up the MAP-ECU by either starting the vehicle or turning the ignition to 'ON'.
7. Put the MAP-ECU 'online' by clicking the 'Online' button. Select the option to read the configuration from the MAP-ECU. Refer to the MAP-CAL application manual for more details.

8. When the MAP-ECU is fully ‘online’, i.e. data loaded, ensure all zones are set to zero ‘0’ by viewing the data in ‘Table Mode’. **Note**: In AFM mode, column 0 reflects the ‘AFM Zero’ setting.
9. Check that RPM is correct, adjust the ‘Cylinders’ value until the correct reading is obtained. Note that the MAP-ECU RPM may vary to that shown on the vehicles rev counter as it is generally more accurate.
10. Check the pressure reading is correct. At idle most vehicles ‘pull’ approximately –10 PSI.
11. If you wish to fill the table with zeros, select ‘Fill Table’ from the ‘Edit’ menu. Enter ‘0’ into the data entry box and click ‘Fill All’. Select ‘Yes’ to update the MAP-ECU. It will take some time to update the entire MAP-ECU. Progress can be monitored via messages in the ‘Status” box.
12. Select ‘ECU Configuration’ from the ‘Edit’ menu.
13. ‘Check’ the ‘Auto Learn’ option box and click the ‘OK’ button. This should configure the MAP-ECU to auto-learn mode.
14. Either take the MAP-ECU offline by clicking the ‘Offline’ button or exit the MAP-CAL application (Ctrl-X).
15. Power cycle the MAP-ECU by turning the ignition key all the way ‘OFF’, wait 5 seconds and turn it ‘ON’ again. You may wish to start the vehicle to begin the auto-learning process.
16. Bring the MAP-CAL application ‘online’ as instructed and read the MAP-ECU data as before.
17. View the MAP-ECU data in ‘Table Mode’. Some data may have been recorded during the engine start process. If not, take the vehicle for a short, gentle drive. Re-connect the computer and check if some data has been written.
18. If the table is still filled with zeros, check the wiring, pressure sensor line and that ‘Auto-learn’ is enabled. Especially check the ‘AFM In’ or ‘VKF In’ value changes when the vehicle is driven.
19. If data is being recorded, drive the vehicle as per normal and attempt to explore as many load points throughout the entire RPM range. This may require several hours or days depending on the situation. Running the vehicle on a dyno is usually the fastest way to explore the greatest range of load points.

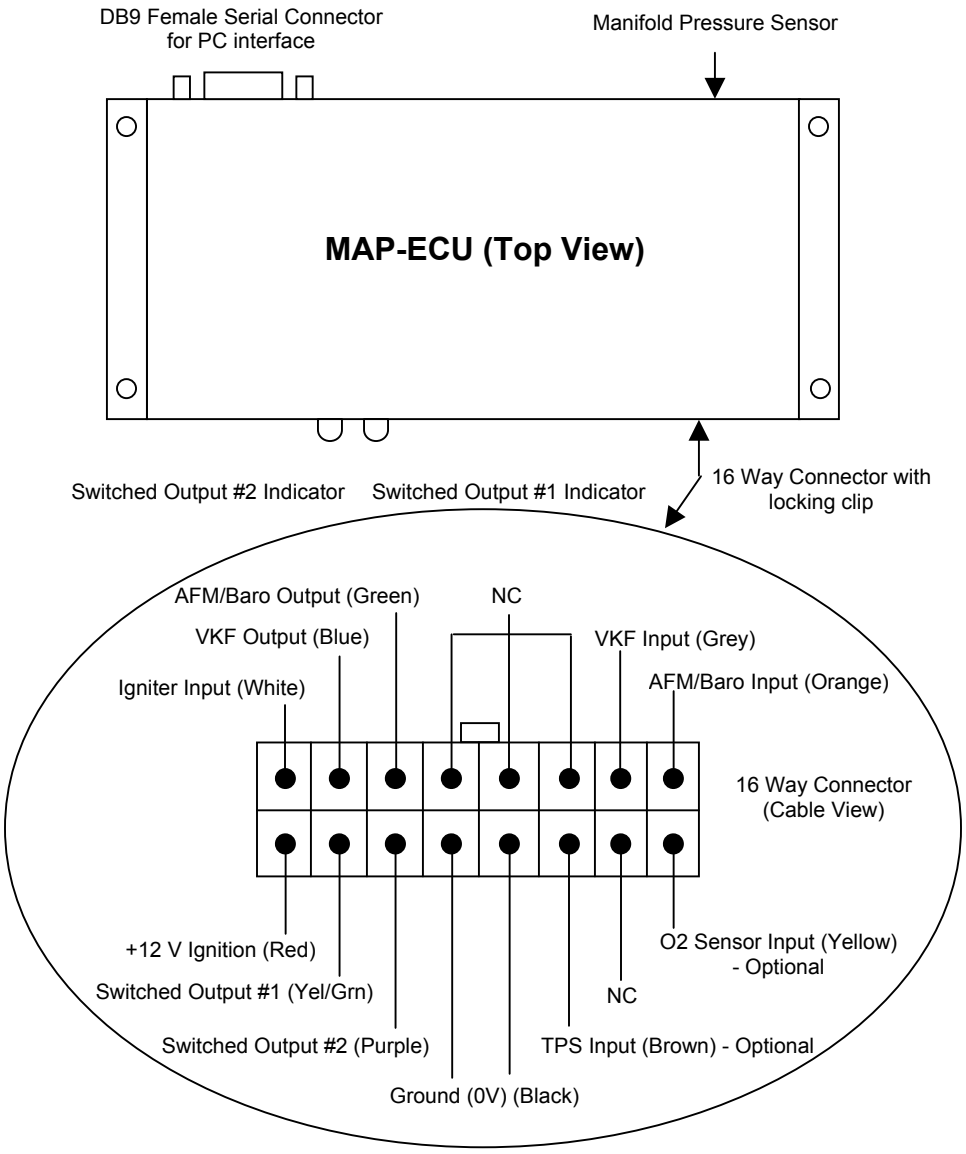
Recommendations

Auto-learn mode is only intended to provide a baseline set up for the table, i.e. should –10 PSI @ 800 RPM be 32Hz or 100Hz, using the existing airflow meter before it’s removal, not as a final table set up mechanism. The user is expected to fill out the complete table using standard techniques once auto learn has provided this baseline data and then tune the vehicle as per any MAP based after market ECU. Only professionally trained personnel using a professional Air/Fuel ratio meter and dyno should attempt the tuning process as terminal damage can be inflicted on an engine with improper configuration.

Do run your vehicle on the MAP-ECU unless there is valid data in **all** Zones, i.e. never leave zeros (0) in any Zones unless in Auto-Learn mode.

Note: Auto Learn mode is 'remembered' over power cycles to the MAP-ECU. This means if you enable Auto Learn mode and then turn the engine off (which will remove power to the MAP-ECU), when you next start the engine, the MAP-ECU will automatically enter Auto Learn mode. This feature is present so a unit can be installed in a vehicle over a period of time that includes stop and start without the need to re-enter Auto Learn mode.

Wiring Diagram



Plug Type: Molex MiniFit Jnr 5557, 16 Way (p/n 39-01-2165)

Terminal: Molex 5556 Crimp (Gold plated), Female (p/n 39-00-0154)

Serial Port Cable Wiring

DB9 Female	DB9 Male
5	5
2	2
3	3

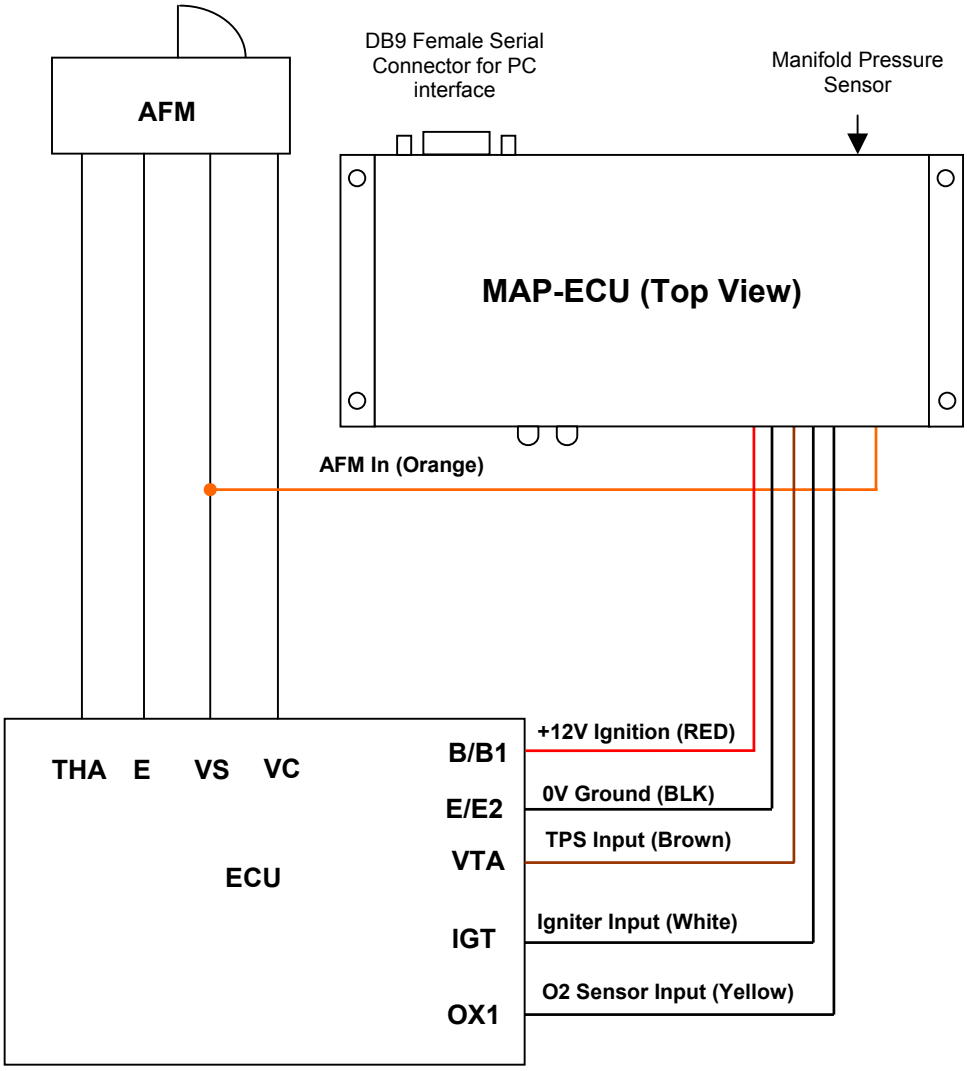
Installation Notes and Recommendations

1. It is recommended that all wiring be kept as short as possible to avoid stray signals, especially the O2 Sensor wire (YELLOW).
2. “Crimp-over-wire” type connectors should be avoided. All connections should be soldered and protected with heat-shrink sleeves.
3. The manifold pressure line must be connected after the throttle body, i.e. off the plenum chamber. If no plenum chamber exists, a pressure collector will be required with connections to each throttle body after each throttle butterfly. The pressure line must be automotive standard vacuum line rated to the required pressure with a small internal diameter of no more than 4mm. The recommended vacuum line has an inside diameter of 7/64” (~2.8mm) and outside diameter of ¼” (~6.5mm).
4. The air temperature sensor supplied can be installed in the intake, usually the airbox, of Naturally Aspirated engines or plenum chamber of Force feed engines
5. By installing a set of inline connectors between the stock AFM and engine bay loom, reinstallation of the stock system can be achieved easily. Depending on the AFM, four (4) or six (6) way connectors are sufficient. If the connectors chosen do not have splash resistant rubber boots on the wires, some silicon rubber can be injected into the open ends once the connectors are assembled.

Installation Instructions

Hotwire/Flap (AFM) Auto Learn Mode

The following diagram illustrates installation of an Air Flow Meter MAP-ECU in auto-learn mode (e.g. Toyota 3S-GTE):



Mandatory Wiring

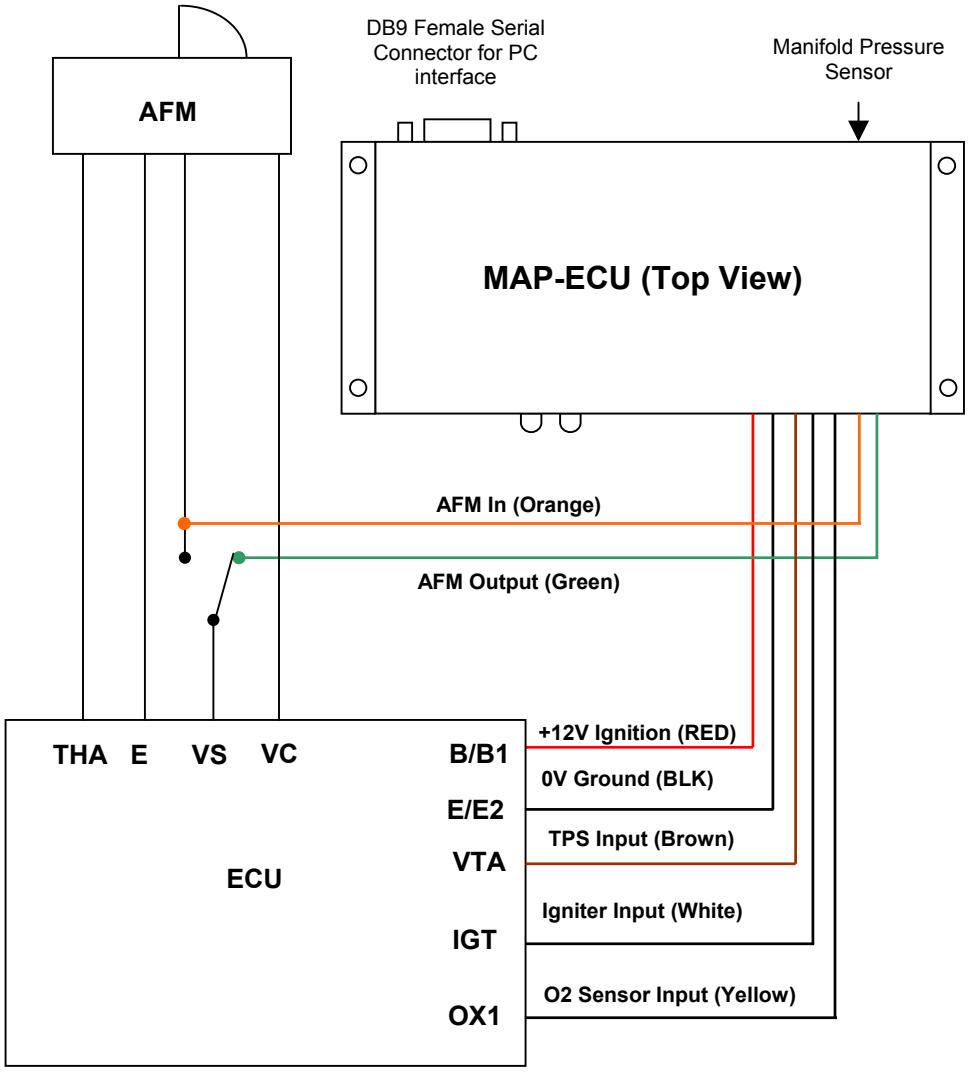
1. Locate a switched +12V (ignition key activated) wire leading to the stock ECU and connect the RED wire of the MAP-ECU.
2. Locate a 0V (Ground/Earth) wire leading to the stock ECU and connect the BLACK wires of the MAP-ECU. It is recommended that you use one of the ground wires rather than connecting to the body work in order to avoid earth loops.
3. Locate the AFM signal wire leading to the stock ECU and connect the ORANGE wire of the MAP-ECU.
4. Locate the Igniter signal from the stock ECU to Igniter module, or –VE terminal of the ignition coil and connect the WHITE wire of the MAP-ECU.

Optional Wiring

1. Should you wish to monitor the TPS signal or use the TPS signal for fuel enrichment, locate the TPS signal wire leading to the stock ECU and connect the BROWN wire from the MAP-ECU.
2. Should you wish to monitor the O2 Sensor voltage, locate the O2 sensor signal wire and connect the YELLOW wire from the MAP-ECU.

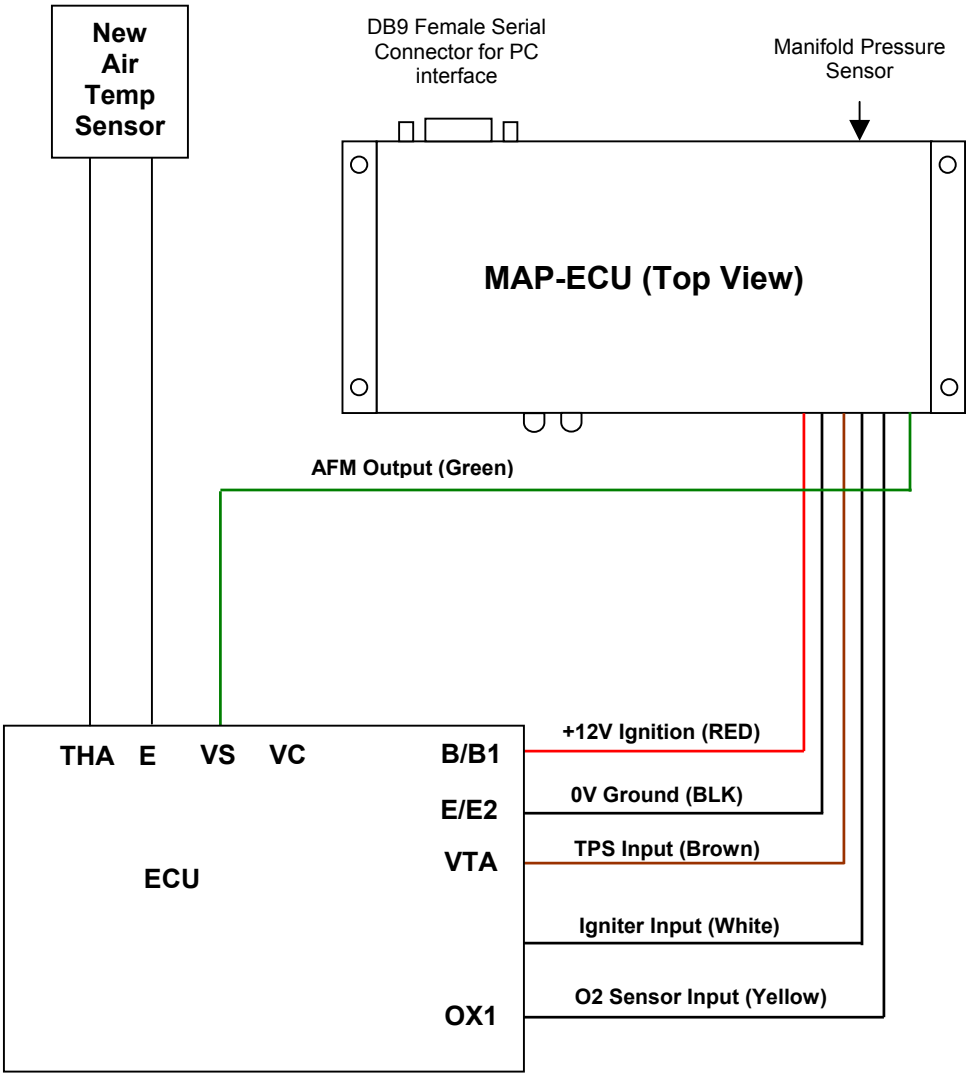
Hotwire/Flap (AFM) Comparison Configuration

The following diagram illustrates installation of an Air Flow Meter MAP-ECU in comparison mode, i.e. easily switched between AFM and MAP-ECU for comparison purposes, e.g. on a dyno. The AFM must be removed when running on MAP-ECU. A high quality single pole, single throw switch is required (not supplied). This is **not** suitable as a permanent configuration.



Hotwire/Flap (AFM) Normal Operation

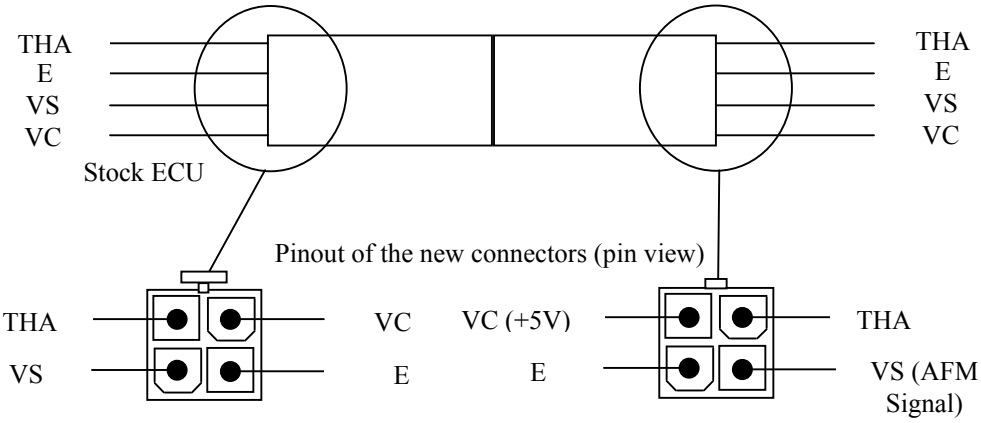
The following diagram illustrates installation of an Air Flow Meter MAP-ECU in normal operation (Toyota 3S-GTE):

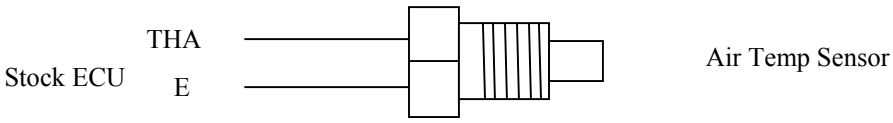


Mandatory Wiring

1. Locate a switched +12V (ignition key activated) wire leading to the stock ECU and connect the RED wire of the MAP-ECU.
2. Locate a 0V (Ground/Earth) wire leading to the stock ECU and connect the BLACK wires of the MAP-ECU. It is recommended that you use one of the ground wires rather than connecting to the body work in order to avoid earth loops.
3. Locate the AFM signal wire leading to the stock ECU, cut the wire and connect the GREEN wire of the MAP-ECU to the stock ECU. The original AFM signal is not used.
4. Locate the Igniter signal from the stock ECU to Igniter module, or –VE terminal of the ignition coil and connect the WHITE wire of the MAP-ECU.
5. Disconnect the stock Air Flow Meter from the wiring loom and cut off the stock plug leaving approximately 50-100mm of cable attached to the plug. Connect the air temp sensor between 0V (ground/earth) and air temp sensor signal wire. Where the AFM is connected to the stock ECU by four wires, a second plug can be fitted to the stock AFM cable should reconnection of the stock unit be required in the future. **Note**: The air temperature sensor should be located in the plenum chamber of turbo or supercharged engines. Naturally aspirated engines can use an intake tract based air temp sensor.

New connectors spliced into the air flow meter loom for simple reconnection.





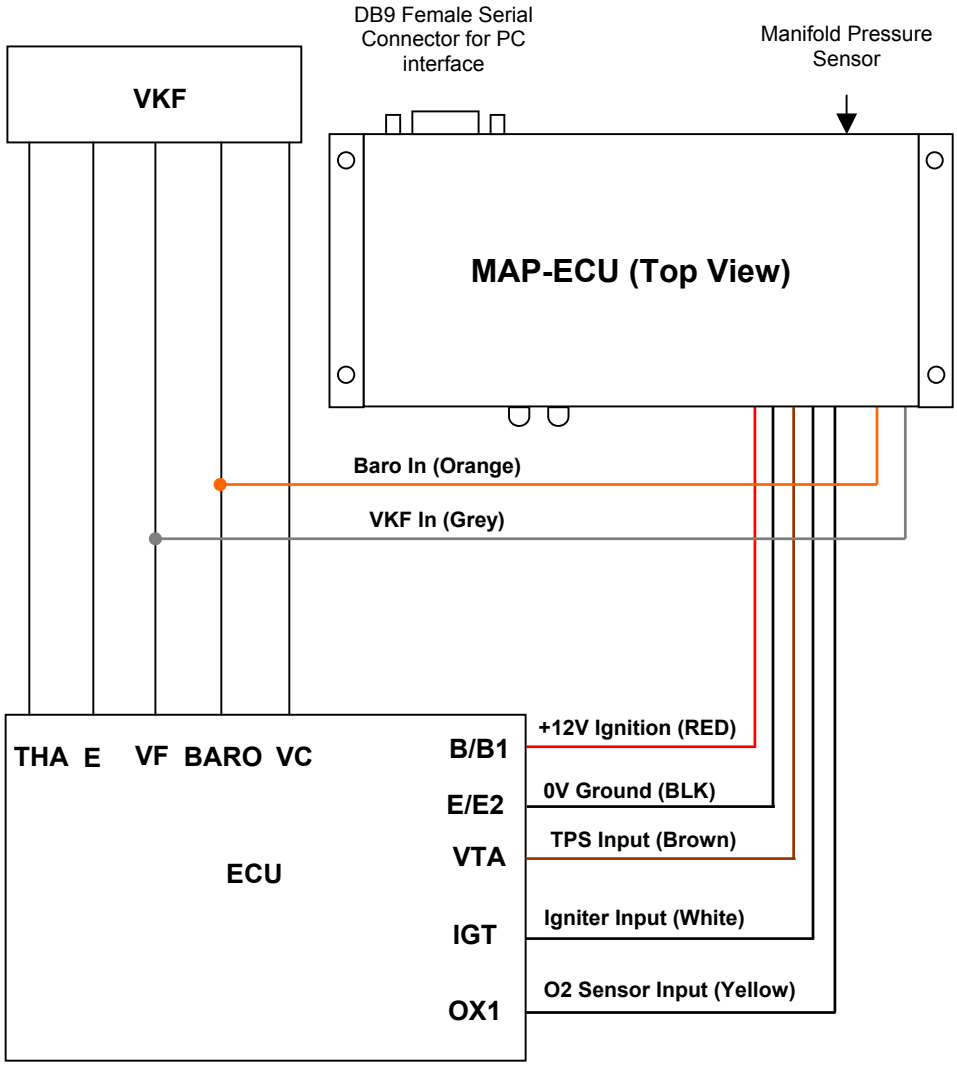
Note: Thread is 1/8” BSP (tapered)

Optional Wiring

1. Should you wish to monitor the TPS signal or use the TPS signal for fuel enrichment, locate the TPS signal wire leading to the stock ECU and connect the BROWN wire from the MAP-ECU.
2. Should you wish to monitor the O2 Sensor voltage, locate the O2 sensor signal wire and connect the YELLOW wire from the MAP-ECU.
3. Should your AFM generate an airflow signal to enable the fuel pump, connect it to a Switched Output and configure the MAP-ECU accordingly. This is accomplished on the ‘ECU Configuration’ menu.

Karmen Vortex Frequency (VKF) Auto Learn Mode

The following diagram illustrates installation of a Von Karmen Vortex Frequency MAP-ECU in auto-learn mode (Mitsubishi™):



Mandatory Wiring

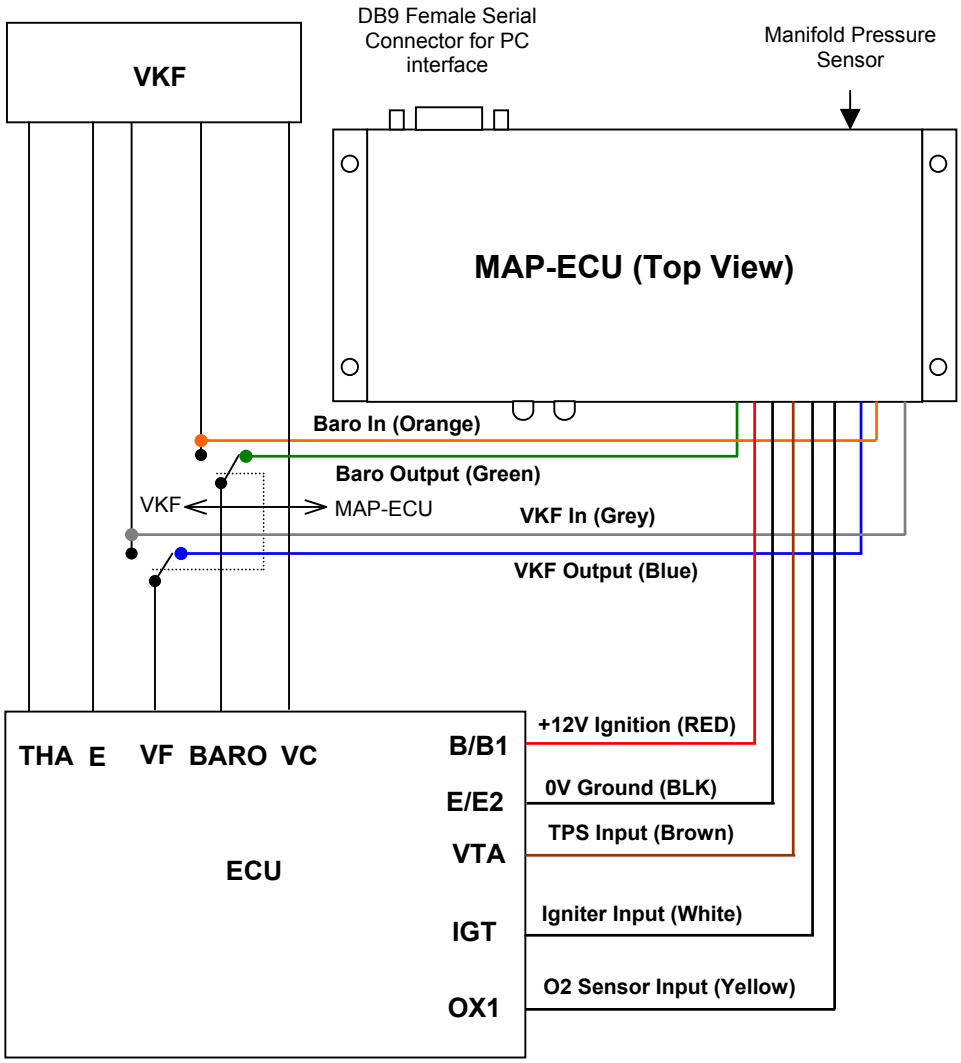
1. Locate a switched +12V (ignition key activated) wire leading to the stock ECU and connect the RED wire of the MAP-ECU.
2. Locate a 0V (Ground/Earth) wire leading to the stock ECU and connect the BLACK wires of the MAP-ECU. It is recommended that you use one of the ground wires rather than connecting to the body work in order to avoid earth loops.
3. Locate the VKF signal wire leading to the stock ECU and connect the GREY wire of the MAP-ECU.
4. Locate the Baro signal wire leading to the stock ECU and connect the ORANGE wire of the MAP-ECU.
5. Locate the Igniter signal from the stock ECU to Igniter module, or –VE terminal of the ignition coil and connect the WHITE wire of the MAP-ECU.

Optional Wiring

1. Should you wish to monitor the TPS signal or use the TPS signal for fuel enrichment, locate the TPS signal wire leading to the stock ECU and connect the BROWN wire from the MAP-ECU.
2. Should you wish to monitor the O2 Sensor voltage, locate the O2 sensor signal wire and connect the YELLOW wire from the MAP-ECU.

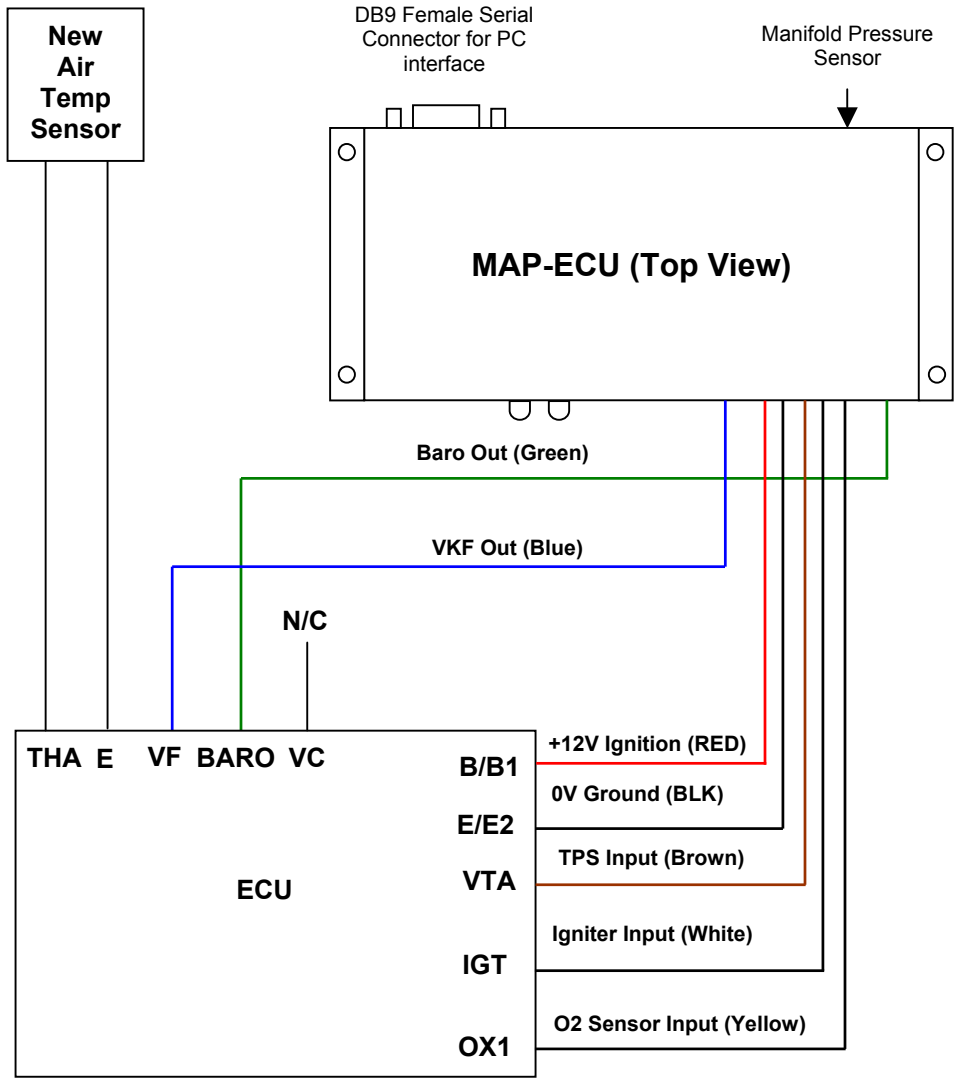
Karmen Vortex Frequency (VKF) Comparison Mode

The following diagram illustrates installation of a VKF MAP-ECU in comparison mode, i.e. easily switched between VKF and MAP-ECU for comparison purposes, e.g. on a dyno. The VKF must be removed when running on MAP-ECU. A high quality double pole, single throw switch is required (not supplied). This is **not** suitable as a permanent configuration.



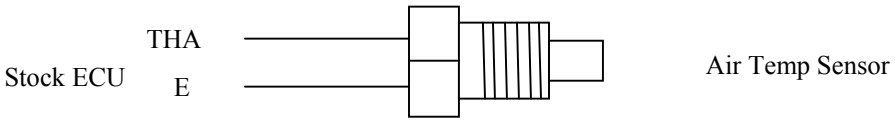
Karmen Vortex Frequency (VKF) Normal Operation

The following diagram illustrates installation of a Von Karmen Vortex Frequency MAP-ECU in normal operation (Mitsubishi™):



Mandatory Wiring

1. Locate a switched +12V (ignition key activated) wire leading to the stock ECU and connect the RED wire of the MAP-ECU.
2. Locate a 0V (Ground/Earth) wire leading to the stock ECU and connect the BLACK wires of the MAP-ECU. It is recommended that you use one of the ground wires rather than connecting to the body work in order to avoid earth loops.
3. Locate the VKF signal wire leading to the stock ECU, cut it and connect it to the BLUE wire of the MAP-ECU. The VKF signal from the stock air flow meter is no longer used.
4. Locate the Baro signal wire leading to the stock ECU, cut it and connect it to the GREEN wire of the MAP-ECU. The Baro signal from the stock air flow meter is no longer used.
5. Locate the Igniter signal from the stock ECU to Igniter module, or –VE terminal of the ignition coil and connect the WHITE wire of the MAP-ECU.
6. Connect the new air temperature sensor to the stock air flow meter cable. **Note**: The air temperature sensor should be located in the plenum chamber of turbo or supercharged engines. Naturally aspirated engines can use an intake based air temp sensor.



Note: Thread is 1/8” BSP (tapered)

Optional Wiring

1. Should you wish to monitor the TPS signal or use the TPS signal for fuel enrichment, locate the TPS signal wire leading to the stock ECU and connect the BROWN wire from the MAP-ECU.
2. Should you wish to monitor the O2 Sensor voltage, locate the O2 sensor signal wire and connect the YELLOW wire from the MAP-ECU. Should your AFM generate an airflow signal to enable the fuel pump, connect it to a Switched Output and configure the MAP-ECU accordingly. This is accomplished on the ‘ECU Configuration’ menu.