MAPECU™3
Flex Fuel™, USB & Optional WiFi

Performance Motor Research Limited

Specifications and Instructions V3.5

www.mapecu.com
Contact: Performance Motor Research Limited
info@mapecu.com
Support Forum: www.mapecu.com/forum

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 MAPECU3 on public roads, this can be dangerous for you and others.

Never attempt to operate the vehicle and tune the MAPECU3 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 MAPECU3 is designed for negative earth 12V environments only.

Always use a professional Air/Fuel Ratio meter and preferably a knock monitor when tuning the MAPECU3.

Improper tuning of the MAPECU3 can result in permanent damage to your engine. Performance Motor Research Limited accepts no responsibility for damage due to improper installation and tuning. Tuning any motor vehicle ECU is a combination of art and science. There are many articles on tuning modern EFI vehicles that should be consulted and there is no substitute for experience. Uttermost care must be exercised when tuning a motor vehicle, especially fuel and timing under heavy load conditions.

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 MAPECU3 or your vehicle's electrical system.

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

Only use 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 MAPECU3 is installed securely and the wiring is not strained in any way. The MAPECU3 is NOT designed to be installed in harsh or wet environments, e.g. engine bay, outside the vehicle. The MAPECU3 should be installed as close as possible to the OEM ECU provided it is installed in accordance with the previous statement.

Disconnect the USB cable when tuning is completed. Do not leave the cable connected to the MAPECU3 during normal operation.

Do not connect the MAPECU3 Ignition Control wiring directly to Ignition Coils. The high voltages involved with damage the MAPECU3.

Specifications

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

Parts List

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

1. MAPECU3 module
2. 16-Way wiring harness (1 Metre)
3. 18-Way wiring harness (1 Metre)
4. CD-ROM
5. USB Type A to Type B cable (2 Metre)
6. Inlet Air Temp (IAT) Sensor harness (2 Metre)
7. Inlet Air Temp (IAT) Sensor (1/8”-27 NTPF Thread)
8. Square drive screw adaptor
9. “Quickstart” instructions
10. 2200 Ohm Resistor (Red/Red/Red) to replace OEM IAT
11. Vacuum hose (1 Metre)

Optional Components:

1. 3-Way external MAP Sensor wiring harness
2. WiFi Module
3. WiFi Side Plate
4. WiFi Antenna

Introduction

The Manifold Absolute Pressure Electronic Control Unit (MAPECU3) is a high performance piggy back ECU designed to convert Flap, Hotwire and Karman Vortex Frequency (KVF) based Mass AirFlow (MAF) meters in all ECU based automobiles to Speed Density (MAP). The unit does not replace the existing ECU, but simply generates the required airflow signal based on Manifold Absolute Pressure (MAP) and RPM.

MAPECU3 is fully programmable with a 494 Zone table controlling either Karman Vortex Frequency (KVF), Hotwire or Flap Air Flow Meter (MAF) voltage output. In addition, the MAPECU3 has a 'self-learn' facility whereby it can monitor either the existing frequency or voltage signal and populate the map during normal driving. Programming is carried out using the MAPCAL3 PC based software supplied with the unit. **Note**: Older generation non-microprocessor based ECU's may not compatible with the MAPECU3. All signals, e.g. TPS, MAF, KVF and O2 must be within the 0-5V range. Some older units use 0-10V signals. A 10V MAF Adaptor is available as an option for vehicles with a 10V MAF. Refer our website (www.mapecu.com) and the 'Specifications' section for more information.

Features

The MAPECU3 has the following features:

- 0-10,000 RPM. 200 RPM increments 0-2000, 500 RPM increments 2000-10,000 for Fuel and O2 Adjust tables. 500 RPM increments 0-10,000 for Timing and Auxiliary Injector tables.
- Built-in MAP sensor, +42 PSI. Pressure scale is user configurable using MAPCAL3.
- Timing adjustment +/-30 degrees per zone - 8 Igniter inputs/outputs.
- Electronic Boost Control.
- O2/AFR sensor voltage adjust table for OBDII ECU's.
- Auxiliary Injector table can drive up to six (6) high impedance injectors.
- Combined Speed Cut Defeat (SCD) and Speed Adjust.
- Voltage based Fuel Cut Defeat (FCD) x 2 with safety release features.
- Three (3) general purpose analogue outputs for Fuel Cut Defeat, O2 adjust, etc.
- Launch Control - Target RPM, Speed, Ignition Retard, Clutch Switch input with Anti-lag output (NEW).
- Lean Boost Retard – AFR and Boost pressure inputs will retard ignition timing if the AFR's are too lean under boost.
- Two Complete (2) maps (Primary/Secondary) for Fuel, Timing, Auxiliary Injector, O2 Adjust & EBC - selectable using one of the configurable inputs.
- Support for an optional external MAP sensor.
- Plug compatible with the existing MAP-ECU2 harnesses.

- IAT sensor input to MAPECU3 for temp compensation.
- Coolant Temperature (CLT) sensor input for cold start compensation (NEW).
- Exhaust Gas Temperature (EGT) input for logging (NEW).
- 2D compensation tables (NEW).
- Key-on barometric sensing and compensation
- Self-learn facility for initial set-up.
- USB port which can power the unit for out of the vehicle configuration.
- Three (3) multi-function high current switched outputs configurable as follows:
  - NOS solenoid drive
  - RPM>0
  - Pressure Switch
  - RPM Switch
  - EBC
  - Auxiliary Injector
  - Igniter Feedback (IGF) (NEW)
  - Anti-lag Solenoid (NEW)
- Karman Vortex Frequency airflow meter replacement mode, e.g. Mitsubishi™, DSM™
- Mass Air Flow (MAF) meter replacement mode, ‘flap’ or ‘hot-wire’ types.
- TPS input for acceleration enrichment.
- O2 Sensor input for monitoring and logging.
- Flex Fuel™ Ethanol support (NEW)
- RPM Limiter Function (NEW)
- Boost Cut Function (NEW)
- Upgradeable software stored in Flash memory that can be downloaded via the built-in USB port. No additional interface modules are required.
- Optional WiFi module.

Abbreviations

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

AFR	Air/Fuel Ratio
BAR	Barometric Pressure. 1 Bar = 1 Atmosphere
CLT	Coolant Temperature
EBC	Electronic Boost Control
ECU	Electronic Control Unit (Computer) that runs the engine.
EGT	Exhaust Gas Temperature
FCD	Fuel Cut Defeat
Flash	A technology used to implement NVRAM where special programming voltages are not required.
IAT	Inlet Air Temperature
kPa	Kilopascal. 1 Bar = 100kPa
KVF	Karman Vortex Frequency. Air mass is represented as a variable

	frequency from 1Hz to 3400Hz.
LED	Light Emitting Diode.
MAF	Mass Air Flow meter (Flap or Hot Wire types where air mass is represented as a DC voltage from 0 to 5 Volts).
MAP	Manifold Absolute Pressure
NA	Naturally Aspirated
NVRAM	Non-Volatile Random Access Memory. Retains it contents when power is removed.
OEM	Original Equipment Manufacturer
NOS	Nitrous Oxide System
PC	Industry Standard Personal Computer running Microsoft™ Windows2000™, WindowsXP™, Windows Vista™ or Windows7™ operating system.
PSI	Pounds Per Square Inch
SCD	Speed Cut Defeat
SCA	Speed Cut Adjust
TPS	Throttle Position Sensor.
Wastegate	Turbocharger exhaust gas bypass valve activated by pressure.
WOT	Wide-Open-Throttle, i.e. maximum throttle position.

Description

The MAPECU3 generates an output to simulate an air flow meter based on manifold pressure (vacuum and boost) versus RPM. The unit can generate either a digital square wave frequency (KVF) or analog Voltage (MAF) depending on the model selected. This allows removal of restrictive air flow meters for performance installations where a larger intake is required. The MAPECU3 samples manifold pressure and RPM continuously and calculates new output values based on the 494 Zone table approximately every ten (1) milliseconds, i.e. 1000 times per second. MAPECU3 has sixteen different Elimination and Intercept modes, including using TPS for low vacuum vehicles. The Intercept modes simplify installation and tuning as entering zero’s in the fuel table allows the input signal to pass through the MAPECU3 unchanged and therefore the vehicle operates as if the MAPECU3 is not in circuit. The tuning process then involves making changes in key areas of the table rather than having to tune the entire table as in MAF Elimination mode.

Karman Vortex Frequency output is a continuous square wave from 1Hz to 3400Hz with 1Hz resolution in normal mode and 3Hz to 9999Hz in High Frequency mode. 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. Enrichment Clamp function (NEW).

A pressure switch function is available for boost pressures from 0-57 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, Pressure, Speed and TPS.

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

Full timing advance and retard control up to +/-30 degrees in 1 degree increments using a high resolution 380 zone table. Control is via 8 independent igniter inputs/outputs.

Solenoid based Electronic Boost Control - +9.5 PSI to +35 PSI in 0.1 PSI increments. (10 target boost zones and solenoid duty cycle zones for each 1000 RPM). Handles both internal and external wastegates. Version 3.1 added a Fast Spool mode for internal wastegate equipped turbochargers.

O2 voltage adjustment (+/- Adjust in 0.01 volts increments) - Allows voltage adjustment of up to two independent OEM O2 sensors connected to the OEM ECU so you can even change the AFR in closed loop mode of OBD-II vehicles.

Auxiliary Injector control using a high resolution 380 zone table. Adjustment is in % duty cycle from 0 to 100% in 1% increments.

Frequency based Speed Cut Defeat. Frequency is clamped between 100 and 9999Hz in 100Hz increments.

Frequency based Speed Adjust. Frequency and adjusted by 0% to 200% in 1% increments.

Voltage based Fuel Cut Defeat, including clamp release pressure. Input voltage is clamped between 0 to 5.0Volts in 0.1 Volt increments and released at any boost pressure in 1psi increments to raise the fuel cut rather than just eliminate it.

Ignition based Launch Control. Launch RPM set between 0 and 10,000 in 100 RPM increments. Launch control activation is via an optional clutch switch with vehicle speed input and anti-lag solenoid output (NEW).

Flex Fuel ethanol support. Automatically adjust fuelling and ignition timing based on the real-time output from a GM™ Flex Fuel™ sensor connected to the MAPECU3. (NEW)

Advanced IAT, CLT and Barometric pressure compensation functionality. (NEW)

Exhaust Gas Temperature (EGT) input for logging (NEW).

Coolant Temperature (CLT) input and compensation (NEW).

RPM Limiter (NEW).

Boost Cut Function (NEW).

Two (2) complete sets of tables for configuration, Fuel, Timing, O2 Adjust, Auxiliary Injector and EBC selected using a configurable input and optional switch.

Customised Pressure Scale

The MAPECU3 can be configured for different pressure scales to suit different purposes with a maximum of nineteen (19) lines and a constant pressure step between lines. Pressure scale configuration is via MAPCAL3. Current pressure scales provided are as follows:

- -15inHg to +1.5psi in 0.5psi steps for low vacuum Naturally Aspirated engines
- -30inHg to +3psi in 1psi steps for Naturally Aspirated engines
- -24.4inHg to +15psi in 1.5psi steps for very low boost engines
- -24.4inHg to +24psi in 2psi steps for low boost engines
- -25.5inHg to +32.5psi in 2.5psi steps for medium boost engines
- –20nHg to +42psi in 3psi step for highly boosted engines
- -20.4inHg to +16psi in 1.5psi steps using the Toyota™ 17030 external MAP sensor*
- -21.4inHg to +26psi in 2psi steps using the Toyota™ 17050 external MAP sensor*
- -27.5inHg to +13.5psi in 1.5psi steps using the GM™ 2-Bar external MAP sensor*
- -24.4inHg to +15psi in 1.5psi steps using the GM™ 2-Bar external MAP sensor*
- -30inHg to +30psi in 2.5psi steps using the GM™ 3-Bar external MAP sensor*
- -32inHg to +56psi in 4psi steps using the AEM™ 5-Bar external MAP sensor*

* Requires optional MAPECU3 3-Way harness (**MAPECU3-3-1M** for a 3ft harness and **MAPECU3-3-2M** for a 6ft harness) and appropriate MAP sensor.

GM™ External MAP Sensor Part Numbers

2-Bar MAP Sensor

Description	GM™ Part Number
2-Bar MAP Sensor	16040609 or 12569241
2-Bar MAP Sensor Harness	15305891

Old Style 3-Bar MAP Sensor

Description	GM™ Part Number
3-Bar MAP Sensor	16040749
3-Bar MAP Sensor Harness	12085502

New Style 3-Bar MAP Sensor

Description	GM™ Part Number
3-Bar MAP Sensor	12223861
3-Bar MAP Sensor Harness	15305891

Note: Performance Motor Research Limited accepts no liability for incorrect GM™ part numbers or for changes to part numbers in the future. Check with your parts supplier before purchasing the equipment.

How the Fuel Output is Calculated

Output values are computed based on RPM and Pressure. In these examples the pressure scale is the default –10 PSI to +42 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 MAPECU3 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. The pressure lies between 0 and 2.5 PSI, therefore the MAPECU3 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 MAPECU3 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 MAPECU3 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 MAF Voltage output or KVF frequency output depending on the mode. This technique is called interpolation.

How the Timing Output is Calculated

The timing adjustment value is calculated from the 380 zone timing table in the same way as the fuel value is calculated using interpolation. The result is a number in the range –30 (retard) to +30 (advance) degrees. The timing values in the MAPECU3 are **not** base timing values, they are **adjustments** on top of the OEM ECU timing. A value of zero (0) means no change to standard base timing, i.e. the MAPECU3 is not adjusting timing from the OEM ECU base configuration and the MAPECU3 is passing the timing signal "straight-through". If the OEM ECU has a setting of +6 degrees at 0psi and 1500 RPM (zone 510) and the MAPECU3 has –2 degrees in zone 510, the overall timing will be adjusted to +4 degrees, i.e. 4 degrees advance which is retarded 2 degrees from stock. The default values in the timing tables is zero (0), no adjustment.

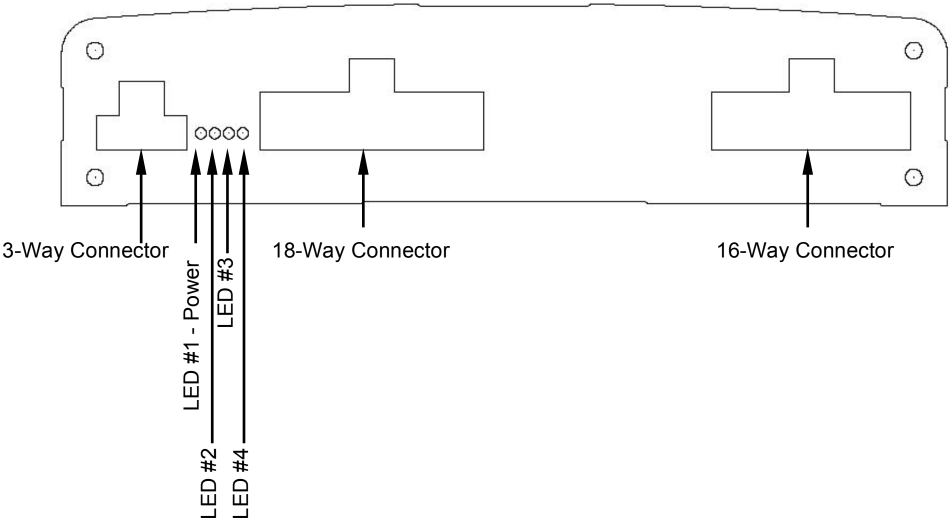
Specifications

Parameter	Specification
Input voltage	10-16 VDC, negative earth. Polarity and over voltage protected.
Input current	Maximum 200mA, not including switched outputs.
PC Communications	USB 2.0 with supplied driver.
Pressure Sensor	42 PSI air pressure sensor, absolute reference (not atmosphere). Barbed fitting accepts 1/8" vacuum hose.
Switched Outputs 1-3	4A output switched ground, +12VDC. Programmable using MAPCAL3.
Pressure Switch Function	Adjustable from 0 to +42 PSI in 0.1 PSI steps.
RPM=0 Function	Simulates nil airflow output of some air flow meters (disengages fuel pump relay).
NOS1 Activation Function	Minimum RPM, Maximum RPM and Minimum TPS, Minimum Pressure, Maximum Pressure, Minimum Speed parameters used to activate a NOS solenoid valve.
NOS2 Activation Function	Minimum RPM, Maximum RPM and Minimum TPS parameters used to activate a NOS solenoid valve.
Igniter Inputs 1-8	Positive or negative going pulse train inputs, typically 5VDC, protected to 16VDC.
RPM	0-10,000 RPM
MAF Input	Connect to OEM Air Flow Meter output, 0-5VDC, input protected to 16VDC for 30 seconds. Resolution of 1.221mV.
MAF Output	0 to 5 VDC at 10mA, short circuit protected for 60 seconds. Resolution of 1.221mV. Programmable zero point.
Analog Output #1 & #2	0 to 5 VDC at 10mA, short circuit protected for 60 seconds. Resolution of 19.5mV.
KVF Input	'Clean' 0 to 5 VDC square wave, 1Hz-9999Hz, input protected to 16 VDC for 30 seconds. Resolution of 1Hz in normal mode, 3Hz in High Frequency mode.
KVF Output	0-5VDC square wave, 1Hz-3400kHz in normal mode, 48Hz-9999Hz in High Frequency mode, open collector output with 4K7 ohm pull-up resistor. Maximum sink current of 50mA. Resolution of 1Hz in normal mode, 3Hz in High Frequency mode.
TPS Input	Throttle Position Sensor input. 0 to 5 VDC, input protected to 16 VDC for 30 seconds. Ten (10) zones of TPS enrichment in 1000 rpm steps.

Parameter	Specification
O2 Sensor Input	Oxygen Sensor input used for logging and monitoring only. 0 to 5 VDC, input protected to 16 VDC for 30 seconds.
Fuel Table Resolution	494 Zones, RPM versus MAP. 0-2,000 RPM in 200 RPM increments, 2,000-10,000 RPM in 500 RPM increments. Manifold pressure -10 PSI to +42 PSI in 2.5 PSI increments.
Timing Table Resolution	380 Zones, RPM versus MAP. 0-10,000 RPM in 500 RPM increments. Timing adjustment in degrees (+/-30)
O2 Adjust	494 Zones, RPM versus MAP. 0-2,000 RPM in 200 RPM increments, 2,000-10,000 RPM in 500 RPM increments. Manifold pressure -10 PSI to +42 PSI in 2.5 PSI increments.
Auxiliary Injector	380 Zones, RPM versus MAP. 0-10,000 RPM in 500 RPM increments. Injector adjustment in duty cycle (%)
Number of writes to NVRAM	100,000
Retention life of NVRAM	100 years @ 25 degrees centigrade
Size (L x W x H)	78mm x 180mm x 36mm
Weight	400 grams (0.88 lbs)

Error Codes

The MAPECU3 uses the Switched Output LED's to indicate critical error conditions. The following LED sequences indicate errors:



LED Sequence	Error Code	Resolution
LED 3 & 4 Flashing Alternately	MAPECU3 Firmware has been erased from MAPCAL3 or there is a Firmware checksum error	Reload Firmware using the **Upgrade Firmware** option in MAPCAL3.
LED 3 Flashing Quickly	Igniter configuration error. MAPECU3 has detected more Ignition channels active than configured,	Configure Ignition channels correctly in ECU Configuration.

Configuration

Programming of the MAPECU3 is achieved through the PC based MAPCAL3 application provided with the unit via a USB 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:

- Mode: Elimination, Intercept modes (1 of 16)
- Igniter/Distributor Configuration
- MAF Zero/Baro Adjust
- TPS Idle
- TPS Max (WOT)
- TPS Enrichment Table
- MAP Enrichment Table
- Enrichment Clamp Table (NEW)
- 1 x NOS Min/Max RPM, Min TPS, Min/Max Pressure & Min Speed
- 1 x NOS Min/Max RPM & Min TPS
- 2 x FCD Clamp Voltage and Release Pressure
- Speed Cut Defeat
- Speed Cut Adjust
- RPM Switch
- Launch Control RPM, Speed, Ignition Retard and Anti-lag output (NEW)
- Lean Boost Ignition Retard, Boost pressure, AFR and Retard Degrees.
- Pressure Switch Threshold
- Electronic Boost Control Mode, Sensitivity, Gain, Target Boost and Duty Cycle
- Digital Switched Output Configuration
- Digital and Analog Input Configuration
- 2D Table IAT, CLT and Barometric compensation (NEW)
- Pressure scale configuration
- Flex Fuel parameters and compensation tables for E85 support (NEW)
- RPM Limiter (NEW)
- Boost Cut function (NEW)

Modes

There are sixteen Elimination and Intercept modes available to MAPECU3, as follows:

1. MAF Elimination
2. MAP Replacement
3. MAF Intercept, MAP Y-axis
4. MAF Intercept, MAF Y-axis
5. KVF Elimination
6. HF KVF Elimination
7. KVF Intercept, MAP Y-axis
8. HF KVF Intercept, MAP Y-axis
9. KVF Intercept, KVF Y-axis
10. HF KVF Intercept, KVF Y-axis
11. MAF Elimination, TPS Y-axis
12. KVF Elimination, TPS Y-axis
13. HF KVF Elimination, TPS Y-axis
14. MAF Intercept, TPS Y-axis
15. KVF Intercept, TPS Y-axis
16. HF KVF Intercept, TPS Y-axis

MAF Elimination

MAF Elimination mode removes the restrictive OEM voltage based air flow meter using the MAPECU3 fuel table.

MAP Replacement

MAP Replacement mode replaces the OEM voltage based MAP sensor using the MAPECU3 fuel table.

MAF Intercept, MAP Y-axis

This mode retains the OEM MAF sensor and uses the fuel table to adjust the MAF sensor voltage by up to +/-2.50V. The load axis of the fuel table (Y-axis) is driven by the MAPECU3 MAP sensor.

MAF Intercept, MAF Y-axis

This mode retains the OEM MAF sensor and uses the fuel table to adjust the MAF sensor voltage by up to +/-2.50V. The load axis of the fuel table (Y-axis) is driven by the MAF sensor input voltage.

KVF Elimination

KVF Elimination mode removes the restrictive OEM frequency based Karman Vortex air flow meter using the MAPECU3 fuel table. Output frequency range is 1Hz-3400Hz in 1Hz steps.

HF KVF Elimination

HF KVF Elimination mode removes the restrictive OEM frequency based air flow meter using the MAPECU3 fuel table. Some modern vehicles, e.g. BMW™ Mini™, use traditional Hotwire MAF's but instead of a voltage output, have a digital frequency output. Output frequency range is 3Hz-9999Hz in 3Hz steps.

KVF Intercept, MAP Y-axis

This mode retains the OEM Karman Vortex air flow meter and uses the fuel table to adjust the KVF frequency by up to +/-1700Hz in 1Hz steps. The load axis of the fuel table (Y-axis) is driven by the MAPECU3 MAP sensor.

HF KVF Intercept, MAP Y-axis

This mode retains the OEM High Frequency air flow meter and uses the fuel table to adjust the output frequency by up to +/-4998Hz in 3Hz steps. The load axis of the fuel table (Y-axis) is driven by the MAPECU3 MAP sensor.

KVF Intercept, KVF Y-axis

This mode retains the OEM Karman Vortex air flow meter and uses the fuel table to adjust the KVF frequency by up to +/-1700Hz in 1Hz steps. The load axis of the fuel table (Y-axis) is driven by the frequency of the OEM KVF sensor.

HF KVF Intercept, KVF Y-axis

This mode retains the OEM High Frequency air flow meter and uses the fuel table to adjust the output frequency by up to +/-4998Hz in 3Hz steps. The load axis of the fuel table (Y-axis) is driven by the frequency of the OEM KVF sensor.

MAF Elimination, TPS Y-axis

MAF Elimination mode removes the restrictive OEM voltage based air flow meter using the MAPECU3 fuel table, but uses the TPS input as the load input of the fuel table, i.e. Y-axis. This mode is designed for Naturally Aspirated engines that do not have reliable vacuum for MAP based load sensing due to a large cam, etc.

KVF Elimination, TPS Y-axis

KVF Elimination mode removes the restrictive OEM frequency based air flow meter using the MAPECU3 fuel table, but uses the TPS input as the load input of the fuel table, i.e. Y-axis. This mode is designed for Naturally Aspirated engines that do not have reliable vacuum for MAP based load sensing due to a large cam, etc. Output frequency range is 1Hz-3400Hz in 1Hz steps.

HF KVF Elimination, TPS Y-axis

HF KVF Elimination mode removes the restrictive OEM High Frequency based air flow meter using the MAPECU3 fuel table, but uses the TPS input as the load input of the fuel table, i.e. Y-axis. This mode is designed for Naturally Aspirated engines that do not have reliable vacuum for MAP based load sensing due to a large cam, etc. Output frequency range is 3Hz-9999Hz in 3Hz steps.

MAF Intercept, TPS Y-axis

This mode retains the OEM MAF sensor and uses the fuel table to adjust the MAF sensor voltage by up to +/-2.50V. The load axis of the fuel table (Y-axis) is driven by the TPS input and is designed for Naturally Aspirated engines that do not have reliable vacuum for MAP based load sensing due to a large cam, etc.

KVF Intercept, TPS Y-axis

This mode retains the OEM Frequency based air flow meter and uses the fuel table to adjust the output frequency by up to +/-1700Hz. The load axis of the fuel table (Y-axis) is driven by the TPS input and is designed for Naturally Aspirated engines that do not have reliable vacuum for MAP based load sensing due to a large cam, etc.

HF KVF Intercept, TPS Y-axis

This mode retains the OEM High Frequency based air flow meter and uses the fuel table to adjust the output frequency by up to +/-4998Hz. The load axis of the fuel table (Y-axis) is driven by the TPS input and is designed for Naturally Aspirated engines that do not have reliable vacuum for MAP based load sensing due to a large cam, etc.

Igniter/Distributor Configuration

Configures the number of igniter inputs/outputs enabled as well as RPM calculations. An incorrect setting can lead to incorrect RPM reading and timing input/output malfunctions. **Note**: If Switched Output #2 LED begins flashing there may be a mismatch between this configuration and the number of active igniter inputs. See Error Codes section of this manual.

The following table illustrates the igniter configuration options:

Configuration	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
3 Cylinder Distributor	I1							
3 Cylinder Coil on Plug	I1	I2	I3					
4 Cylinder Distributor	I1							
4 Cylinder Wasted Spark (Inline)	I1, I4	I2, I3						
4 Cylinder Wasted Spark (Flat)	I1, I2	I3, I4						
4 Cylinder Coil on Plug (Inline)	I1	I3	I4	I2				
4 Cylinder Coil on Plug (Flat)	I1	I3	I2	I4				
5 Cylinder Distributor	I1							
5 Cylinder Coil on Plug	I1	I3	I5	I4	I2			
6 Cylinder Distributor	I1							
6 Cylinder Wasted Spark (Inline)	I1, I6	I5, I2	I3, I4					
6 Cylinder Coil on Plug (inline)	I1	I5	I3	I6	I2	I4		
V6 Wasted Spark	I1, I4	I2, I5	I3, I6					
V6 Coil on Plug	I1	I2	I3	I4	I5	I6		
V8 Distributor	I1							
V8 Wasted Spark (Chev Small Block)	I1, I6	I8, I5	I4, I7	I3, I2				
V8 Coil on Plug (Chev Small Block)	I1	I8	I4	I3	I6	I5	I7	I2
V8 Wasted Spark (LS1)	I1, I6	I8, I5	I7, I4	I2, I3				
V8 Coil on Plug (LS1)	I1	I8	I7	I2	I6	I5	I4	I3
V10 Distributor	I1							
V10 Wasted Spark	I1, I6	I10, 5	I9, 8	I4, 7	I3, 2			
V8 Dual Distributor	I1	I2						

NOTE: CHANNELS MUST FOLLOW FIRING ORDER. INCORRECT ORDER CAN CAUSE DAMAGE TO COILS AND/OR ENGINE.

NOTE: DO NOT CONNECT THE MAPECU3 IGNITION CONTROL WIRING DIRECTLY TO IGNITION COILS. THE HIGH VOLTAGES INVOLVED WITH DAMAGE THE MAPECU3.

TPS Idle

TPS Idle is the voltage presented to the MAPECU3 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 MAPECU3 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.

Note: It is vital that TPS Idle and TPS Max are configured correctly for the TPS modes otherwise the fuel table lookup with be incorrect.

TPS Enrichment Table

This table determines the level of enrichment applied by the MAPECU3 to the fuel 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 MAPECU3 using the integral of TPS input voltage. An integral value of 0-100 percent is generated by the MAPECU3 internally which is then multiplied by TPS Percent and the result used to enrich the MAPECU3 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 ten (10) Zones in 1000 RPM increments, e.g. 1000, 2000, 3000, etc.

MAP Enrichment Table

This table determines the level of enrichment applied by the MAPECU3 to the fuel 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 MAPECU3 using the integral of Manifold Pressure. An integral value of 0-100 percent is generated by the MAPECU3 internally which is then multiplied by MAP Percent and the result used to enrich the MAPECU3 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 ten (10) Zones in 1000 RPM increments, e.g. 1000, 2000, 3000, etc.

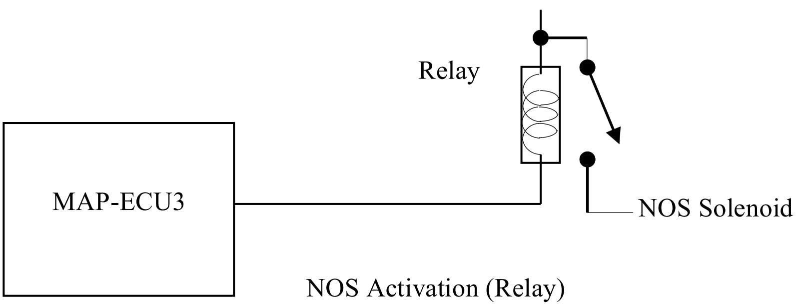
Enrichment Clamp Table (NEW)

This table allows the user to clamp the maximum amount of enrichment possible per 1000 RPM. This is useful when a very sensitive TPS enrichment is required with the clamp preventing over fuelling. Values of 0-100% are allowed and are applied to the combined TPS/MAP enrichment result.

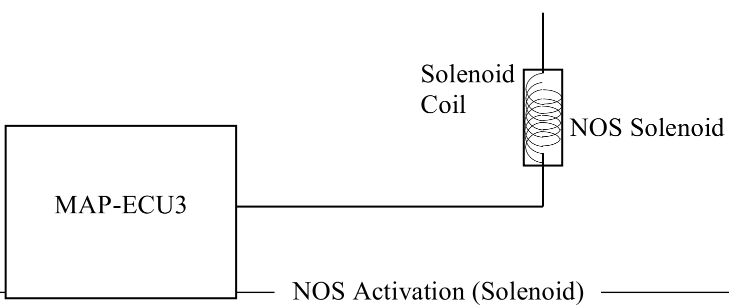
NOS Activation

With MAPECU3 V3.2 there are two (2) independent NOS activation channels, NOS1 and NOS2. NOS1 has additional setting to make it s very advanced NOS controller. The Switched Outputs can be configured to drive a NOS activation solenoid or relay. NOS2 activation is based on Minimum RPM, Maximum RPM and Minimum TPS. NOS1 adds Maximum Pressure, Minimum Pressure and Minimum Speed. The NOS activation output signal is switched to ground, i.e. suitable for relay or direct control of the NOS solenoid to 2A @ 12 VDC.

E.g.



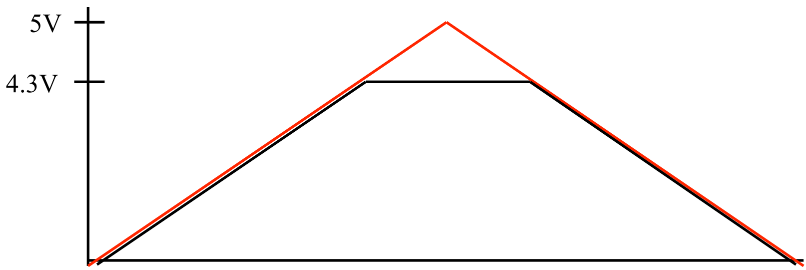
NOS Activation (Relay)



NOS Activation (Solenoid)

Fuel Cut Defeat

There are two (2) independent FCD channels, FCD and FCD2. The Clamp Voltage is the voltage at which the FCD clamps a voltage used by the OEM ECU for Fuel Cut Defeat. Fuel Cut voltage is usually derived from a MAP sensor or the MAF. For correct operation, an analogue input and output must be assigned to the FCD or FCD2 function. The Clamp Voltage is the clamp voltage from 0 to 5.0 Volts in 0.1 Volt increments. For example, if 4.3 is entered, the output will track the input until 4.3 Volts is reached where it will clamp regardless of how high the input voltage tracks. Once the input voltage drops below 4.3 Volts, the output will once again track the input voltage. The FCD clamp voltage should be set to 0.1 Volts less than the fuel cut threshold. The following diagram illustrates how FCD clamps the output voltage to 4.3V:



Red Line = Input Voltage
Black Line = Output Voltage

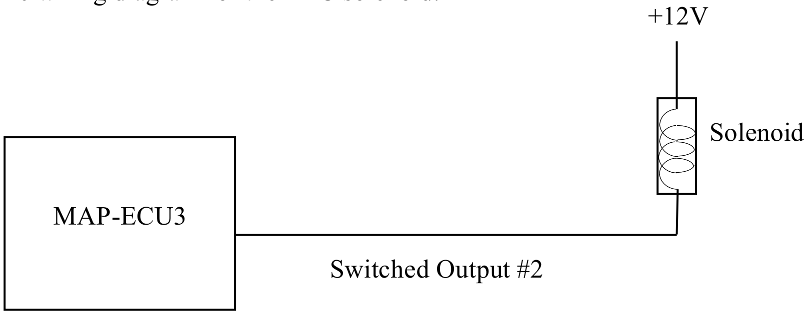
In addition, there is a Release Pressure value in the range 0-57psi in 1psi steps. The Release Pressure is the pressure at which the FCD will unclamp the input voltage to invoke fuel cut. This allows the user to raise the fuel cut rather than eliminate it completely, which is much safer for the engine. To disable the Release Pressure feature, set it to one (1) PSI more than maximum boost, e.g. when running the internal MAPECU3 MAP sensor, set it 36psi.

Fuel Cut Defeat using the fuel table

The MAPECU3 fuel table can be used to remove fuel cut without having to run the MAF signal through an FCD. If the vehicle fuel cut is based on MAF voltage, MAP sensor voltage or KVF frequency, and the MAPECU3 fuel table is used to eliminate or intercept any of these, then it can also be configured to eliminate fuel cut. For example, if the MAPECU3 is in MAF Elimination mode and fuel cut is invoked when the MAF voltage is greater than 4.5 volts, then make sure the highest voltage in the fuel table is 4.50. If you want fuel cut to be invoked at a high pressure, enter the fuel cut voltage, e.g. 4.60 volts in the fuel table at that pressure.

Electronic Boost Control

Electronic Boost Control (EBC) can only be enabled on Switched Output #2. Configuration parameters include Gain, Sensitivity, Internal/External Wastegate Select, Maximum Boost and Target Duty Cycle. The following diagram illustrates the electronic wiring diagram for the EBC solenoid.

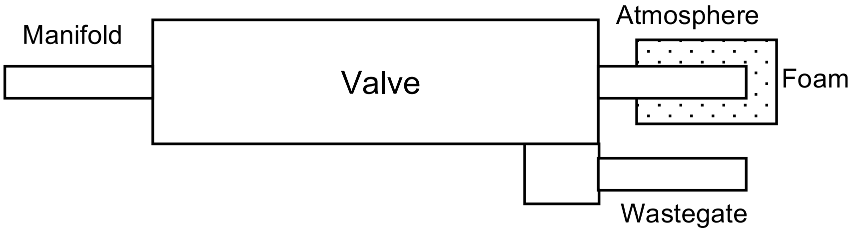


Note: The MAPECU3 already contains a diode connected to each Switched Output and +12V to suppress Back-EMF from the solenoid.

EBC can be configured in *Internal, Internal Fast Spool* or *External* modes. *Internal* mode is Normal EBC mode and means the solenoid bleeds boost pressure to atmosphere from the wastegate control actuator using the duty cycle principle. *Internal Fast Spool* opens the solenoid when +1psi of boost is detected and does not allow any pressure to reach the solenoid until the Sensitivity percentage of Target Boost is reached. This eliminates wastegate creep and is therefore called Fast Spool. The MAPECU3 will pulse the solenoid 20 times per second (20Hz).

The ratio of ON time versus OFF time is called Duty Cycle and is usually expressed as a percentage, e.g. 10% Duty Cycle means the solenoid is OFF 90% of the time and ON 10% of the time as per the following diagram:

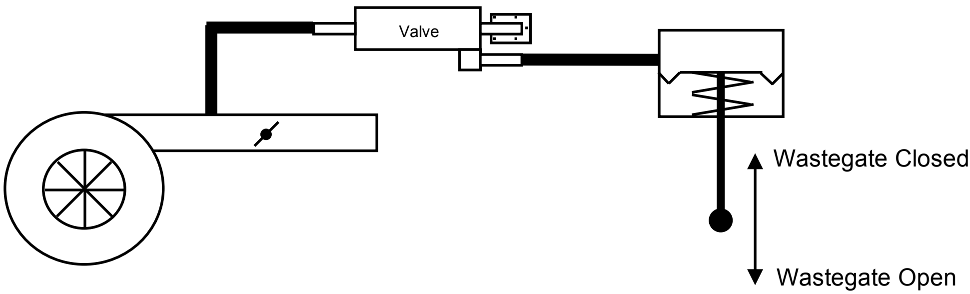
The recommended solenoid is the Delco™ 3-Way Boost Control Solenoid, part number ACD# 214-474 (GM# 1997152) and matching connector with wiring harness part number ACD#PT374 (GM# 12102747). The following diagram illustrates the Delco™ solenoid:



The is system is called a "Closed Loop" system because it continually monitors manifold pressure and alters the duty cycle to prevent excessive boost pressure, unless Over Boost Control is disabled, see below.

Internal/Internal Fast Spool Wastegate

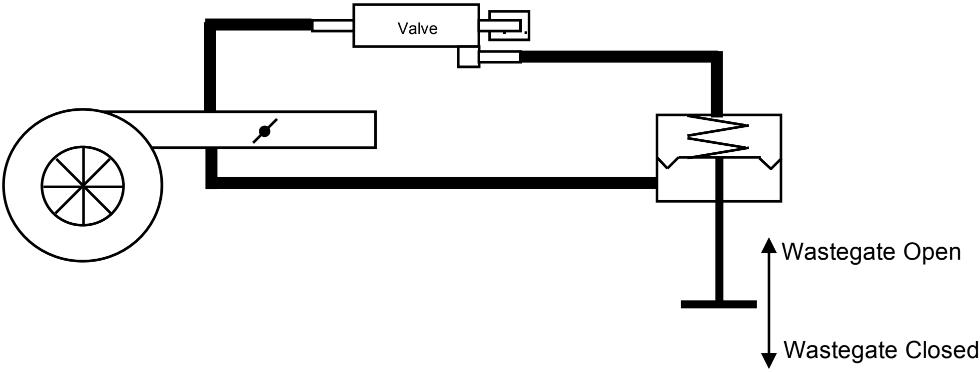
The following diagram illustrates how to configure an internal wastegate:



In this mode, **more** duty cycle bleeds more boost pressure from the wastegate control actuator line, therefore **increases** boost. Fast Spool opens the solenoid (100% Duty Cycle) at +1psi so the wastegate actuator only sees atmospheric pressure until Sensitivity percentage of Target Boost is reached. Then the Duty Cycle is reduced from 100% to the configured Target Duty Cycle. For example in Fast Spool mode, if Sensitivity is set to 80%, Duty Cycle is set to 60% and Target Boost is 20psi, the solenoid will change the duty cycle from 100% (fully open) up to 16psi (80% of 20psi) to 60% at 16psi to soften the boost curve. If Over Boost Control is enabled and boost pressure exceeds 20psi, the MAPECU3 EBC will reduce duty cycle until boost equals 20psi or less. If Over Boost Control is disabled, then the MAPECU3 EBC will output 60% duty cycle regardless of boost.

External Wastegate

The following diagram illustrates how to configure an external wastegate:



In External mode, **more** duty cycle bleeds more boost pressure from the wastegate canister, therefore **reduces** boost.

Sensitivity

The EBC Sensitivity value (0-100%) determines the percentage of target boost pressure when the MAPECU3 starts operating the solenoid. A EBC Sensitivity value of 100% means the solenoid begins operating at 100% of target boost pressure and will probably result in over boost. A setting of 0% means the solenoid begins operating at 0% of target boost which is the **recommended** setting for **Internal** mode. The **recommended** sensitivity value for **External** mode is 80% where the solenoid will begin operating at 80% of maximum boost ensuring a ‘soft’ boost curve with minimum overshoot.

Gain

The Gain setting (1-255) determines the speed the MAPECU3 adjusts solenoid duty cycle based on changes to manifold pressure. A Gain value of 1 means maximum gain (speed) and a setting of 255 means minimum gain (speed). Gain can be adjusted to ensure boost is controlled in the smoothest possible manner. The **recommended** gain setting is ‘20’ during normal operation, with lower values when determining the duty cycle, e.g. ‘3’. Should boost pressure becomes erratic, the gain may need to be reduced. Each increment is equal to 128^{th}/sec.

Disable Over Boost Control

MAPECU3 has a feature where the EBC can be placed in Duty Cycle only mode by disabling Over Boost Control. That means the EBC will pulse the solenoid at the defined Duty Cycle regardless of the boost pressure. **Warning**: Careless use of this feature can result in over boost and damage to your engine.

EBC Pressure

EBC pressure is set at 1000 RPM increments and has the range +9.5 PSI to +35 PSI in 0.1 PSI increments. These values are the **maximum boost pressure** for the MAPECU3 EBC computations and is used in conjunction with Sensitivity to control solenoid operation.

Note: When adjusting EBC Pressure, EBC Duty needs to be adjusted at the same time. If you enter a target duty cycle of 70% and Maximum boost of 15 PSI, the EBC assumes 70% duty cycle is required for 15 PSI and will ramp duty cycle up according to boost. If 80% duty cycle is required for 15 PSI, the target duty will not be achieved. Similarly, if 60% duty cycle is required for 15 PSI boost and target duty cycle is set to 70%, the EBC will reduce the duty cycle (EBC Cduty %) when overshoot occurs. The speed at which the EBC adjusts EBC Cduty % is determined by Gain. This is why Gain should be set to high speed (low values) while determining the optimum duty cycle. Duty cycle settings will be very dependant on wastegate actuator tension therefore a conservative approach to setting duty cycle is recommended.

EBC Duty %

EBC Duty Cycle is set at 1000 RPM increments and has the range 0 to 100% in 1% increments. These values set the **target duty cycle** for the solenoid to achieve the target boost level. For example, if EBC is configured for *Internal* mode a Toyota™ CT-26 turbocharger with 9 PSI wastegate required 80% duty cycle to achieve 14 PSI boost. The values in these zones of the table are copied to "EBC Cduty %" line when the MAPECU3 is powered up. If the EBC Duty Cycle entered results in over boost, the EBC Cduty values will be altered to limit boost to that entered in the EBC Pressure zones. Always alter duty cycle values in small increments and very carefully. Lower Gain values are recommended when determining the correct duty cycle values. See below for more information.

EBC CDuty %

EBC CDuty zones are copies of EBC Duty zones and are used by the MAPECU3 EBC computations should the duty cycle need alteration to prevent over boost. For example, if EBC is configured for *Internal* mode and EBC Duty is set to 70% and the MAPECU3 detects an over boost condition, i.e. manifold pressure greater than EBC Pressure, the MAPECU3 will reduce the EBC CDuty % until the desired EBC Pressure is achieved. **Note**: EBC Duty % will not be altered, it is up to the operator to decide what value should be entered as EBC Duty % but it is highly recommended that if the MAPECU3 alters EBC CDuty, that value should be entered into EBC Duty %.

EBC and Launch Control

When Launch Control is configured to aid 'flat-shifting', EBC Duty cycles will need to be adjusted as boost will be maintained between shifts and therefore maximum boost will be exceeded. Testing has proved that lower duty cycles are required with internal wastegates when using Launch Control to aid flat-shifting compared to normal shifting. The difference between duty cycle between 'flat-shifting' and normal driving depends on the wastegate actuator and EBC settings. Some experimentation will be required to find the correct settings as every vehicle combination is different.

Knock Configuration

Knock control allows the MAPECU3 to retard timing when Knock (Detonation) is detected using a external Knock sensor and processor module. There are a number of configuration parameters for Knock Control as explained in this section.

Note: Ignition Timing control must be wired and operational for Knock retard to function.

Note: You cannot connect the KVF Input directly to the OEM Knock sensor. A dedicated Knock sensor and signal processor are required as defined later in this manual.

Sensitivity

Sensitivity is the number of Knock pulses per ½ second required within the RPM range configured to invoke timing retard. Values can range from 1 to 100.

Retard Degrees

Retard Degrees is the number of degrees timing is retarded when the number of Knock pulses is greater than Sensitivity and RPM is within the range specified. Values can range from 1-30 degrees.

Retard Seconds

Retard Seconds is the number of seconds ignition timing is held retarded when all conditions are met. Values can be in the range 1-30 seconds.

Minimum RPM

Minimum RPM defines the low boundary for the Knock control window. Knock signals will be logged and displayed on the Dashboard but the MAPECU3 will not retard ignition timing if RPM is less than this value. You may select a RPM band to eliminate low RPM noise that may be incorrectly interpreted as detonation. Values can be in the range 0 to 10,000 RPM but must be less than Maximum RPM.

Maximum RPM

Maximum RPM defines the upper boundary for the Knock control window. Knock signals will be logged and displayed on the Dashboard but the MAPECU3 will not retard ignition timing if RPM is greater than this value. Values can range from 0 to 10,000 RPM but must be greater than Minimum RPM.

Recommended Knock Components and Wiring

The following components are recommended to for Knock detection:

- ESC Control Module – GM# 16128261
- ESC Control Module Connector – GM# 12101871
- Knock Sensor – GM# 10456288
- Knock Sensor Connector – GM# 12102621

Note: It is not recommended that Knock Retard is configured when the vehicle has active OEM Knock sensors otherwise both the OEM ECU and the MAPECU3 will retard timing when knock is measured.

Compensation Configuration (NEW)

Version 3.5 comprehensively enhances the Inlet Air Temperature (IAT) and Barometric pressure (Baro) compensation functionality and introduces Coolant Temperature (CLT) cold start compensation. In previous versions, a non-modifiable constant was used for IAT and Baro compensation. V3.5 introduces separate modifiable 2D tables for IAT, Baro and CLT compensations.

IAT Compensation

The MAPECU3 can compensate the fuel output signal based on inlet air temperature (IAT) provided the IAT sensor is connected and enabled using MAPCAL3. Lower air temperatures mean higher density air requiring more fuel to maintain the correct AFR. Higher temperatures air temperatures mean lower density air requiring less fuel to maintain the correct AFR. The MAPECU3 is configured for zero IAT compensation at 30 degrees centigrade. IAT less than 30 degrees centigrade means higher density air, usually requiring more fuel to maintain the correct AFR. IAT greater than 30 degrees centigrade means lower air density, usually requiring less fuel to maintain the correct AFR. The user can now has complete control over IAT compensation over the temperature range including positive or negative compensation.

Baro Compensation

The MAPECU3 can compensate the fuel output signal based on barometric air pressure variations. When the internal MAP sensor is in use, barometric air pressure is sampled when the ignition is turned and before the starter is engaged. This value is stored for the journey. When an external MAP sensor is in use, the internal MAP sensor is used for continuous barometric pressure measurement. Normal barometric air pressure is 1013mb or 1 Bar. Higher barometric pressure means higher density air, usually requiring more fuel to maintain the correct AFR. Lower barometric air pressure means lower air density, usually requiring less fuel to maintain the correct AFR. The user can now has complete control over Baro compensation over the pressure range including positive or negative compensation.

CLT Compensation

The MAPECU3 can now compensate fuel based on the OEM coolant temperature (CLT) sensor for cold start compensation. This is particularly useful when larger than stock fuel injectors are fitting and the user needs to lean the AFR's on cold start. A 2D table with 10 zones is provided with zero compensation at 100°C (212°F).

Auto Baro Output Adjust

When the MAPECU3 is configured in KVF mode, the Baro output voltage can be configured to self adjust based on the barometric pressure sampled as per Baro Compensation. An output voltage of 4 Volts equals a barometric pressure of 1013mb.

Speed Cut

When the MAPECU3 is configured in MAF mode the digital frequency input (KVF Input) and output (KVF Output) can be used for Speed Cut Adjust (SCA) and Speed Cut Defeat (SCD).

MAPCAL3 combines speed cut and speed adjust functions into one function. This enables the user to simultaneously adjust speed to compensate for different wheels and also clamp the speed for speed cut.

Speed Cut Defeat

This value clamps the frequency used by the OEM ECU for speed cut. Speed Cut Defeat (SCD) frequency is usually derived from a speed sensor or the speedometer. For correct operation, a digital input and output must be assigned to the SPD function. Speed Cut Defeat has two modes, High and Low. In *High* mode the SPD value is the clamp frequency from 100 to 10,000Hz in 100Hz increments. If 2100 is entered, the output will follow the input until 2100Hz is reached where it will clamp regardless of how high the input frequency tracks. Once the input frequency drops below 2100Hz, the output will once again follow the input frequency. High mode is configured by selecting Switched Output #3 to SPD HIGH. The SPD clamp frequency should be set to 100Hz less than the speed cut threshold. In *Low* mode, the SPD value has a range of 1Hz to 250Hz in 1Hz steps for lower frequency and improved resolution. Low mode is configured by selecting Switched Output #3 to SPD LOW.

Note: Speed Cut Defeat utilises the KVF Input and therefore cannot be used if the MAPECU3 is in one of the KVF modes.

Speed Cut Adjust

This value adjusts the frequency used by the OEM ECU for speed. Speed Cut Adjust (SCA) frequency is usually derived from a speed sensor or the speedometer. For correct operation, a digital input and output must be assigned to the SPD function. The SPD value is the adjust percentage from 0.01 (1%) to 2.00 (200%) in 0.01 (1%) increments. If 0.99 is entered, the output will be 99% of the input, e.g. Input=1000Hz, Output=990Hz. . If 1.10 is entered, the output will be 110% of the input, e.g. Input=1000Hz, Output=1100Hz.

Note: Speed Cut Adjust utilises the KVF Input and therefore cannot be used if the MAPECU3 is in one of the KVF modes.

Lean Boost Retard

Lean Boost Retard is a safety function that requires an accurate Wideband AFR meter connected to theMAPECU3. It will retard ignition timing by a configured amount if the Air/Fuel Ratio becomes too lean under boost. It also has an indicator output function available on the Switched Outputs to alert the driver that lean boost retard has activated.

Minimum Pressure

The Lean Boost Retard minimum pressure is the minimum boost required before the function is activated. For example, if protect is only desired above 5psi, then set this value to 5. Pressures can range from 0 through 57psi.

Minimum AFR

The Lean Boost Retard minimum AFR is the minimum Air/Fuel Ratio required before the function is activated. For example, if protection is only desired if the AFR is more lean that 11.5:1, then 11.5 should be entered into the field. MAPCAL3 will configure the MAPECU3 based on the O2 lookup table configured in MAP-CAL Configuration.

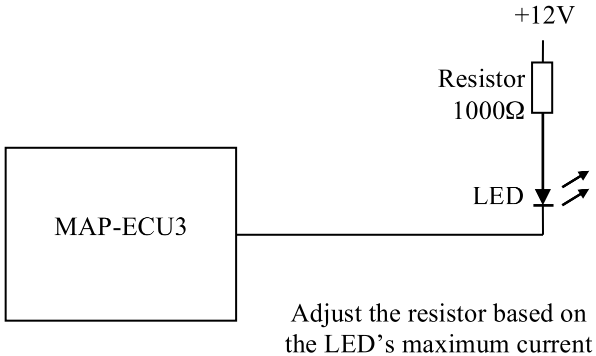
Retard Degrees

Lean Boost Retard degree is the number of degrees ignition timing will be retarded if boost is above minimum boost and the Air/Fuel Ratio is leaner than minimum AFR.

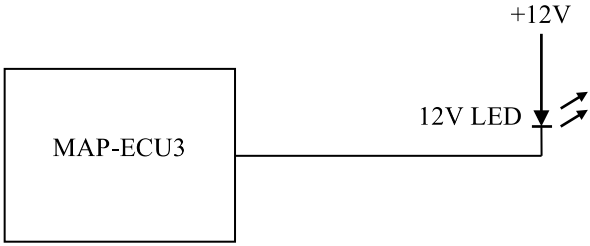
LBR Switched Output

The Lean Boost Retard feature can be configured to one of the switched outputs to drive an indicator light or buzzer to warn the driver. The following wiring diagrams illustrate two options for indicators:

Example of LBR indicator based on a regular high intensity Light Emitting Diode (LED):



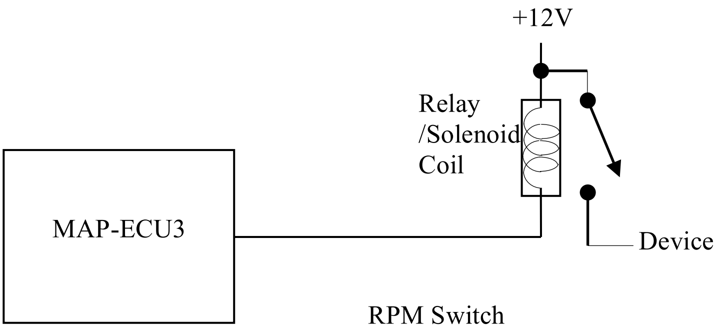
Example of LBR indicator based on a 12V (integrated resistor) high intensity Light Emitting Diode (LED) or light bulb:



RPM Switch

One of the Switched Outputs can be configured to drive an RPM switch, e.g. Shift light or VTEC™ change over. Activation is based on an RPM value 0-10,000 in 100 RPM increments. The RPM switch output signal is switched to ground, i.e. suitable for relay or solenoid control to 2A @ 12 VDC.

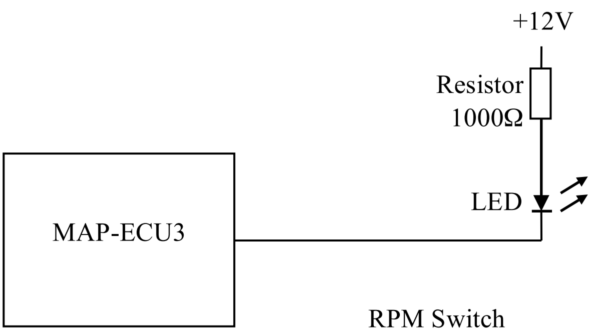
E.g.



RPM Switch

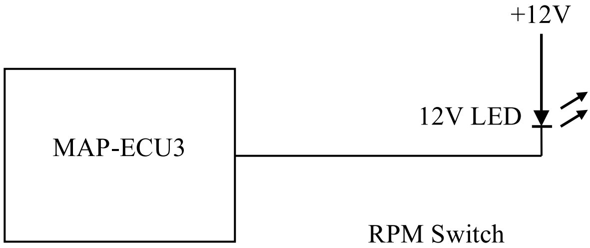
Note: The MAPECU3 already contains a diode connected to each Switched Output and +12V to suppress Back-EMF from the solenoid.

Example of shift light based on a regular high intensity Light Emitting Diode (LED):



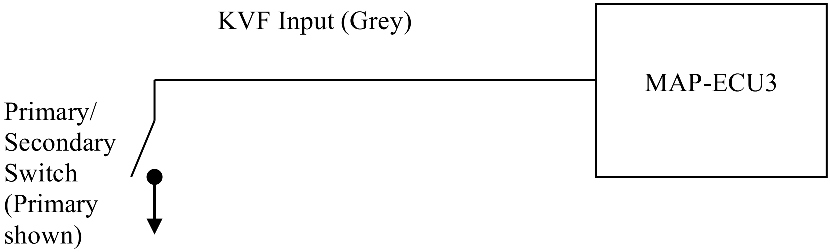
RPM Switch

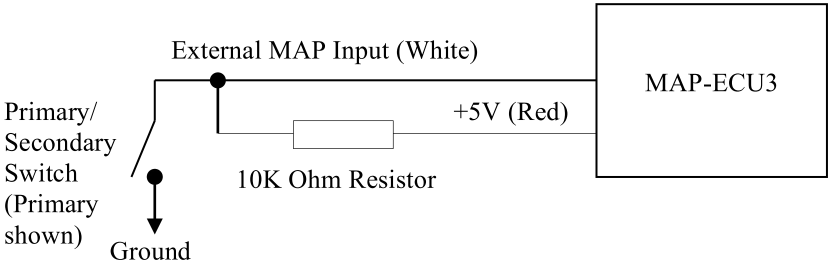
Example of shift light based on a 12V (integrated resistor) high intensity Light Emitting Diode (LED):

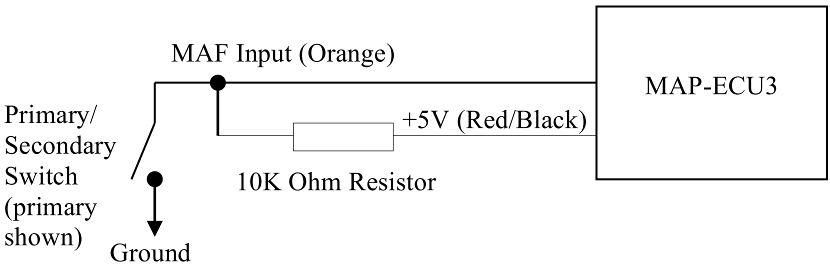


Primary/Secondary Table Selection

The MAPECU3 has two (2) totally independent sets of tables and configuration parameters, referred to as the Primary and Secondary tables. Table selection can be allocated to one of the unused inputs, e.g. KVF Input, MAF Input or External MAP Input, using MAPCAL3. The following diagrams illustrate the various input configurations:







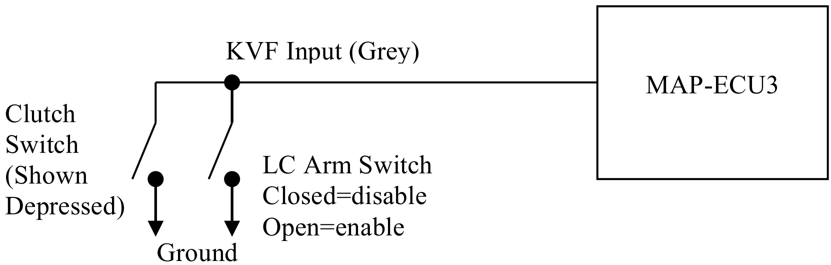
Override Pri/Sec Switch

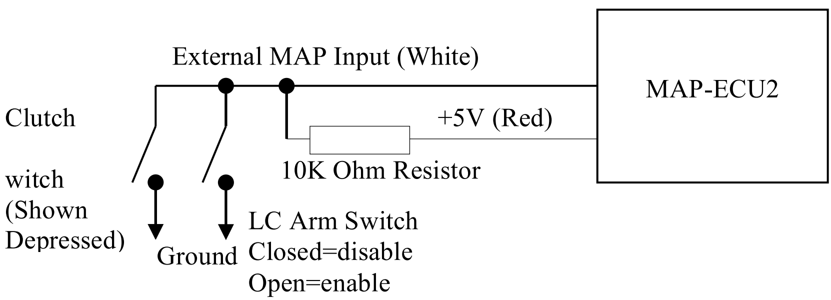
When this option is unchecked, the MAPECU3 controls Primary/Secondary table selection through the configured Pri/Sec input. MAPCAL3 cannot alter which table is selected. When this option is checked, MAPCAL3 takes control over Primary/Secondary table selection when connected to a MAPECU3.

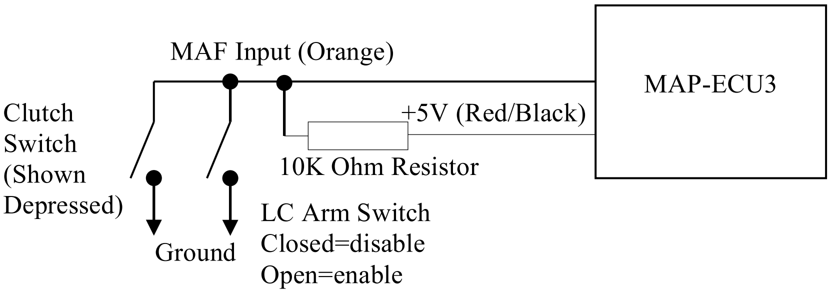
Launch Control

Launch control (sometimes called "2-step") has been enhanced and requires four (4) configuration parameters, RPM, Minimum Speed (optional), Ignition Retard Degrees (optional) and a clutch switch input. Launch Control RPM is the desired RPM for optimum launch or 'flat-shifting'. Once the clutch switch is activated (open), the MAPECU3 will attempt to clamp RPM to the Launch Control RPM value by 'missing' ignition pulses until minimum Speed is reached to reduce wheel spin off the line. The MAPECU3 will also retard ignition timing if configured to do so. This function only operates when the MAPECU3 is configured to control timing. The clutch switch must be configured to 'open' when the clutch is depressed and 'close' when the clutch disengaged. It is also recommended that a launch control arming switch is wired in parallel with the clutch switch to disable launch control. A magnetic reed switch is recommended for the clutch switch where the magnet is secured to the moving clutch pedal mechanism and the switch to a portion of the pedal box. The Clutch Switch function can be allocated to one of the unused inputs, e.g. KVF Input, MAF Input or External MAP Sensor input.

Note: Unburnt fuel will enter the exhaust system causing backfires and high exhaust temperatures during operation therefore Launch Control Operation should be minimised. Launch Control may not function correctly with some OBD-II vehicles that monitor igniter feedback pulses. Launch Control is only recommended with manual transmissions and vehicles without catalytic converters.







Igniter Feedback (IGF) Signal (NEW)

MAPCAL3 V3.4 introduced an IGF generator for Toyota™ vehicles. The MAPECU3 generates a fake IGF signal to prevent a ignition misfire CEL during Launch Control operation. Switched Output #1 can be configured to "IGF" and connected to the OEM ECU input replacing the OEM igniter.

Anti-Lag (NEW)

MAPCAL3 V3.5 adds a new feature to Launch Control, an anti-lag solenoid output when launch control is active. This output can be used to drive a solenoid to control air bypass.

Note: Launch Control can also be used for "Flat-shifting" where the RPM is set to an ideal holding RPM during shifts. "Flat-shifting" means the throttle pedal is held flat down during gear shifts. The engine RPM is controlled by Launch Control when the clutch is depressed rather than lifting the throttle. Turbocharged vehicles benefit greatly by maintaining boost during gear shifts as boost is not dumped through the blow off valve.

MAF Out RPM=0/Baro Out/Hz Out RPM=0 Setting

The setting labeled 'MAF 0' has three (3) possible functions:

1. When a MAPECU3 is configured for MAF Elimination, e.g. **Hotwire** or **Flap** Air Flow Meter or MAP sensor, this value controls the voltage sent to the OEM ECU when the MAF or MAP sensor senses no airflow, i.e. Ignition on but engine not running. This needs to be programmable as the zero setting is never exactly 0 Volts or 5 Volts and depends on the MAF or MAP sensor. Incorrectly setting this value may result in an engine 'Check' light. **Note**: This is especially critical with OBDII vehicles. **Note**: When replacing a MAP sensor, MAF 0 will be the voltage output of the MAP sensor at atmospheric pressure.
2. When a MAPECU3 is in Karman Vortex Frequency (KVF Elimination) mode, this controls the voltage output from one of the configurable Analog Outputs, e.g. MAF Out, and applied to the Barometric Pressure input of the OEM ECU. **Note**: An Analog Output must be configured for BARO from the pull-down list. **Note**: Only some OEM ECU's have a Barometric Pressure Voltage input, otherwise this function is not used. This allows the user to have fine control of the fuel/air mixture over the entire range if required. If the Barometric Pressure input to the factory ECU is not connected, an engine 'Check' light may result. **Note**: The Baro Output setting can be set using the 's' sample key when the MAF Input signal is connected to the Barometric Pressure sensor output of the stock KVF air flow meter.
3. When the MAPECU3 is in High Frequency Karman Vortex Frequency (HF KVF Elimination) mode, this setting changes to the Hz output when RPM=0, i.e. Ignition on but engine not running. Some vehicles, e.g. BMW™ Mini™ R56 models utilise a high frequency MAF that outputs approx 2000Hz at ignition on but engine not running, i.e. no airflow.

Note: When the unit is in Auto-Learn mode and power is applied, the MAPECU3 will check the MAF voltage input with the engine at 0 RPM and store the 'no flow' value as the MAF Zero. This is because the 'no flow' value may be in the range of 0-4095 and allows the MAPECU3 to present the most accurate data to the existing ECU at start-up. With a KVF MAPECU3, this input can be connected to the Barometric Pressure sensor output of the OEM air flow meter in order to learn the default voltage setting.

MAF2 Out RPM=0

MAF2 Out RPM=0 is only enabled in dual fuel table mode and sets the MAF2 output voltage when RPM=0 as per MAF Out RPM=0.

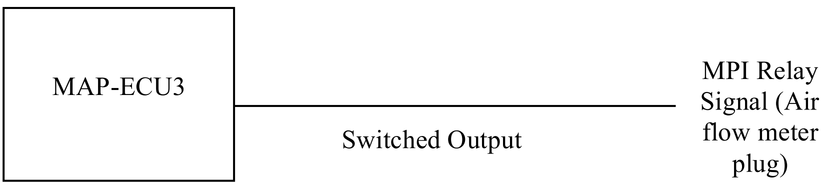
MAF/KVF Clamp

The user can configure an overall MAF or VKF output clamp that clamps the output from the fuel table. In any of the MAF and MAP modes, the MAF/MAP Clamp is a voltage in the range of 0.0 to 5.0Volts in 0.1V steps. In any of the KVF modes, the KVF Clamp is a frequency in the range 100 to 10000Hz in 100Hz steps.

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.

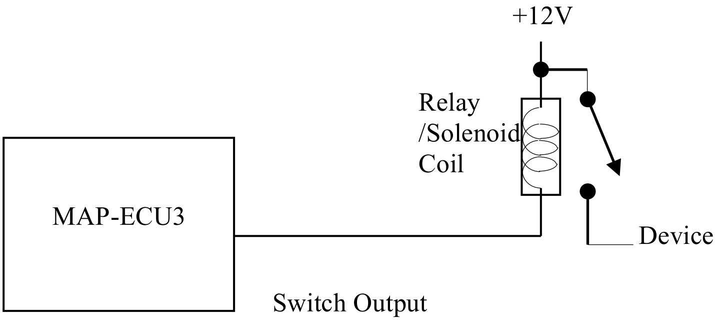
E.g.



Pressure Switch

The MAPECU3 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. suitable for relay or solenoid control to 2A @ 12 VDC.

E.g.



Boost Ignition Cut (NEW)

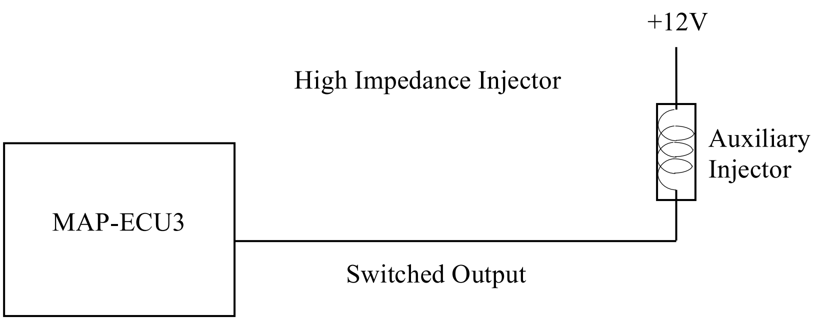
MAPCAL3 V3.5 introduces a general purpose Ignition Cut function based on Boost Pressure. When the MAP sensor registers boost above the configured maximum, ignition will be cut in a similar manner to Launch Control to reduce boost. This is a safely feature to prevent over boost and therefore save an engine from damage due to excessive boost. Ignition Cut pressure can be configured from 0 to 57psi in 1psi steps.

RPM Limiter (NEW)

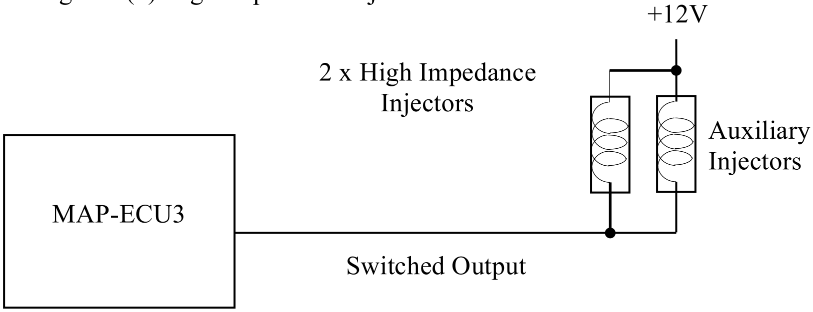
MAPCAL3 V3.5 introduces a general purpose RPM Limiter function which is independent from Launch Control. When the MAPECU3 registers RPM greater than the configured maximum RPM, ignition will be cut in a similar manner to Launch Control to control RPM. This is a safety feature to provide a "valet mode" or to limit maximum RPM to save an engine from damage. RPM Limiter can be configured from 5,000 to 10,000 RPM in 100 RPM steps.

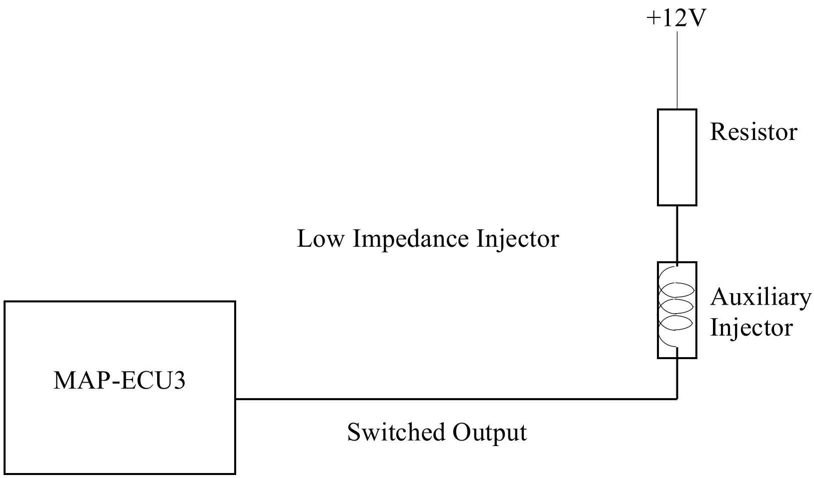
Auxiliary Injector

The MAPECU3 has a 380 zone table dedicated to controlling auxiliary injector(s) on Switch Output #1, #2 and/or #3. The purpose of an auxiliary injector is to supplement the OEM fuel injectors under heavy boost, NOS activation, etc. Placement of auxiliary injector(s) in the intake manifold is critical and should only be attempted by experienced installers. The auxiliary injector is controlled using duty cycle, as per the previous discussion on Electronic Boost Control and are fired in **batch** mode. The auxiliary injector is fired following each igniter pulse detected by the ignition timing control circuitry of the MAPECU3. The table is populated with values from 0% to 90% duty cycle. Two Saturation high impedance injectors can be driven from each Switched Output allowing up to six (6) auxiliary injectors. The auxiliary injector is connected to the MAPECU3 as per the following diagrams:



Driving two (2) High Impedance Injectors





Note: Low impedance injectors **must** be **Saturation** types designed for a series resistor, **not** Peak-hold low impedance injectors.

Note: Typically low impedance injectors measure 3 ohms and the series resistor should be a 10ohm, 10W device.

Note: The MAPECU3 already contains a diode connected to each Switched Output and +12V to suppress Back-EMF from the injectors.

TDC Offset

This value corrects any offset between the crankshaft position sensor signal and Top Dead Centre (TDC) for Base Timing calculations. Values range from –100 to 100 degrees. The TDC input expects a 5V peak-to-peak square wave input signal. Most vehicles use Variable Reluctance sensors for crankshaft position and therefore the external MAPECU3 Variable Reluctance Interface module is required to process the signal.

Note: TDC input utilises the KVF Input and therefore cannot be used if the MAPECU3 is in KVF learn or one of the KVF Intercept modes.

RPM Input

The KVF Input can be configured for the RPM input instead of using the Ignition control lines of the 18-Way harness. The RPM input expects a 5V peak-to-peak square wave input signal and should be connected to a 'tach' signal on the OEM ECU harness.

Dual Fuel Table Mode

The MAPECU3 can be configured in Dual Fuel Table Elimination mode by configuring one of the Analog Voltage Outputs to MAF2. In this mode, the Secondary Fuel table is active at all times to drive the MAF2 output. If a MAF2 Analog Voltage input is also assigned, the MAPECU3 can operate in Dual Fuel Intercept mode. Dual Fuel Table mode is provided for vehicles where two independent fuel tables are required to replace or intercept two different MAF or MAP sensors. A good example is the R56 BMW™ Mini™ Cooper™ S which has two MAP sensors, each with different pressure and therefore voltage ranges.

Note: The Primary/Secondary functionality is effectively disabled when Dual Fuel Table mode is enabled as both fuel tables are used simultaneously.

Flex Fuel (NEW)

MAPCAL3 V3.5 adds Flex Fuel support to the MAPECU3 with real-time adjustments based on a GM™ Fuel Composition sensor connected directly to the MAPECU3. Normally the Primary tables are tuned for normal pump gas, i.e. 0% ethanol, and the Secondary tables are tuned for maximum ethanol content, e.g. 85%. The maximum allowable ethanol content is 100%.

Primary Table Ethanol Content (0-100%)

The field tells the MAPECU3 the ethanol content of the fuel used to tune the Primary tables and therefore the minimum allowed ethanol content. This is normally 0%.

Secondary Table Ethanol Content (0-100%)

The field tells the MAPECU3 the ethanol content of the fuel used to tune the Secondary tables and therefore the maximum allowed ethanol content. This is normally 85%.

Fuel, Ignition Timing & Auxiliary Injector Compensations Table

This table controls the interpolation between the Primary and Secondary tables when ethanol content is somewhere between minimum and maximum. The example above shows the default linear curve which can be fine tuned as required. Interpolation is separated for Fuel, Ignition Timing and Auxiliary Injector tables.

Fuel Temperature Compensation

If a MAPECU3 Flex Fuel Temperature Module is installed along with the GM™ Fuel Composition sensor, then the MAPECU3 can adjust fuel and ignition timing based on fuel temperature.
Note: There is zero (0) compensation at 15°C (59°F) where the cells are greyed out and non-modifiable. Generally you would enter positive compensation for colder more dense fuel and negative compensation for warmer less dense fuel.

Please note that Comp % is a percentage from -0.99% to +0.99% and is ***PER DEGREE***. Normally you would enter the same percentage across all fields, e.g. -0.11 or +0.11 as per this example.

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 MAPECU3 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 MAPECU3 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 MAPCAL3. Once a change to auto-learn mode (off **or** on) is made from MAPCAL3, the MAPECU3 **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 MAPECU3 must be prepared. This means "zeroing" all the zones you wish to over-write, either individually, or using the bulk edit functions of MAPCAL3. If you are installing a MAPECU3 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 MAPCAL3 instructions.

Auto-Learn Set-up Procedure

In order to set-up the MAPECU3 for auto-learn, follow this procedure:

1. Install the unit as per the appropriate (MAF or KVF) wiring diagram included in this manual.
2. Install MAPCAL3 on your computer as per the installation instructions.
3. Connect an available USB port to the MAPECU3 using the cable provided. If the cable is not long enough, a cable of up to 5 Metres can be used as per the wiring diagram in this manual.
4. Execute MAPCAL3 by selecting 'Start', 'Programs', 'MAP-CAL' program group and the 'MAP-CAL2' icon.
5. Power up the MAPECU3 by either starting the vehicle or turning the ignition to 'ON'.
6. Put the MAPECU3 'online' by clicking the 'Connect' button. Select the option to read the configuration from the MAPECU3. Refer to MAPCAL3 manual for more details.
7. When the MAPECU3 is fully 'online', i.e. data loaded, ensure all zones are set to zero '0' by viewing the data in 'Table Mode'. **Note**: In MAF mode, column 0 reflects the 'MAF Zero' setting.
8. Check that RPM is correct, adjust the Ignition configuration until the correct reading is obtained. Note that the MAPECU3 RPM may vary a little to that shown on the vehicles rev counter as it is generally more accurate.

9. Check the pressure reading is correct. At idle most vehicles 'pull' approximately –20inHg.
10. If you wish to fill the fuel table with zeros, go 'Offline' by pressing the 'Disconnect' button. Use the mouse to select the top left zone of the fuel table (Table mode only), hold the mouse button down and drag the mouse to select the entire table. Release the mouse button once the entire table is selected. Press '0' once and the whole table will be zeroed out. Press the 'Connect' button to connect with the MAPECU3 and click 'Yes' to update the MAPECU3. It will take some time to update the entire MAPECU3. Progress can be monitored via messages in the 'Status" box.
11. Select 'ECU Configuration' from the 'Edit' menu.
12. 'Check' the 'Auto Learn' option box and click the 'OK' button. This should configure the MAPECU3 to auto-learn mode.
13. Either take the MAPECU3 offline by clicking the 'Disconnect' button or exit MAPCAL3 (Ctrl-X).
14. Power cycle the MAPECU3 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.
15. Bring MAPCAL3 'online' as instructed and read the MAPECU3 data as before.
16. View the MAPECU3 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.
17. If the table is still filled with zeros, check the wiring, pressure sensor line and that 'Auto-learn' is enabled. Especially check the 'MAF In' or 'KVF In' value changes on the MAPCAL3 Dashboard when the vehicle is driven.
18. 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

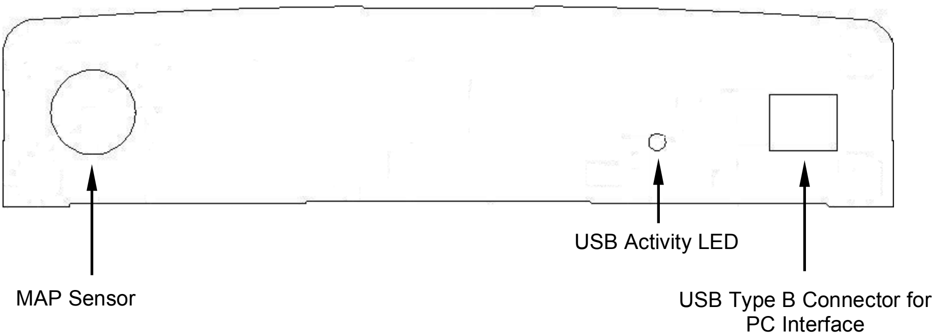
Auto-learn mode is only intended to provide a baseline set up for the table, i.e. should –20inHg @ 800 RPM be 32Hz or 100Hz, using the existing airflow meter before it's removal, not as a final table set up mechanism. The user is expected to fill out the complete table using standard techniques once 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.

Note: Do not run your vehicle on the MAPECU3 unless there is valid data in **all** Zones, i.e. never leave zeros (0) in any Fuel Zones unless in Auto-Learn mode.

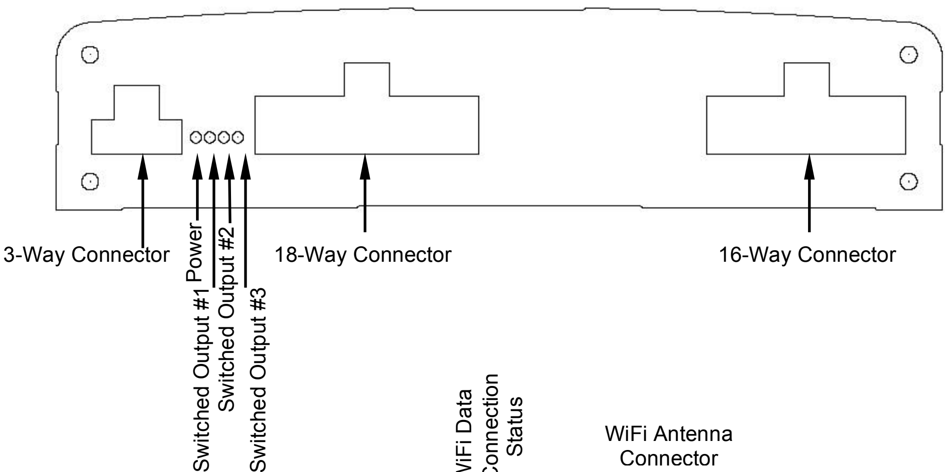
Note: Auto Learn mode is 'remembered' over power cycles to the MAPECU3. This means if you enable Auto Learn mode and then turn the engine off (which will remove power to the MAPECU3), when you next start the engine, the MAPECU3 will automatically enter Auto Learn mode. This feature is present so a unit can be installed in a vehicle over a period of time, including stop and start, without the need to re-enter Auto Learn mode.

Connections

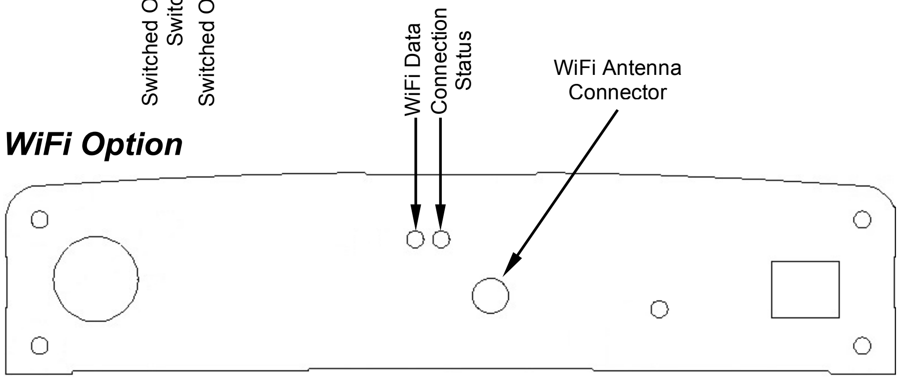
Below is the left hand side of the MAPECU3 showing USB connector and vacuum hose layout:



Below is the right hand side of the MAPECU3 showing connector and LED indicator layout:



WiFi Option



MAP Sensor Connection

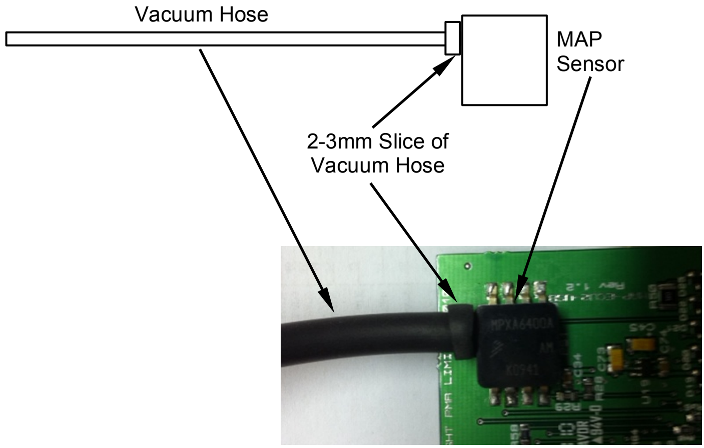
There are two (2) version of MAPECU3 hardware, internally referred to as MAPECU3 and MAPECU3A. The only difference between MAPECU3 and MAPECU3A is the type of MAP sensor installed.

The recommended vacuum hose for the MAP sensor has a 7/64" (2.8mm) ID and is manufactured by Gates Corporation, part number 27041.

In order to secure the vacuum hose to the MAP sensor nipple, we recommend you cut a 2-3mm length of the same vacuum hose and slide to over the end and outside of the remaining length of hose. You can stretch the slice of vacuum hose sufficiently using needle nose pliers to slide it over the remaining vacuum hose. This technique is better than a hose clamp for securing any vacuum hose.

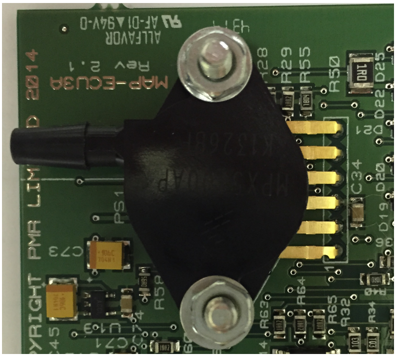
MAPECU3 MAP Sensor

Please see the diagram and picture below:



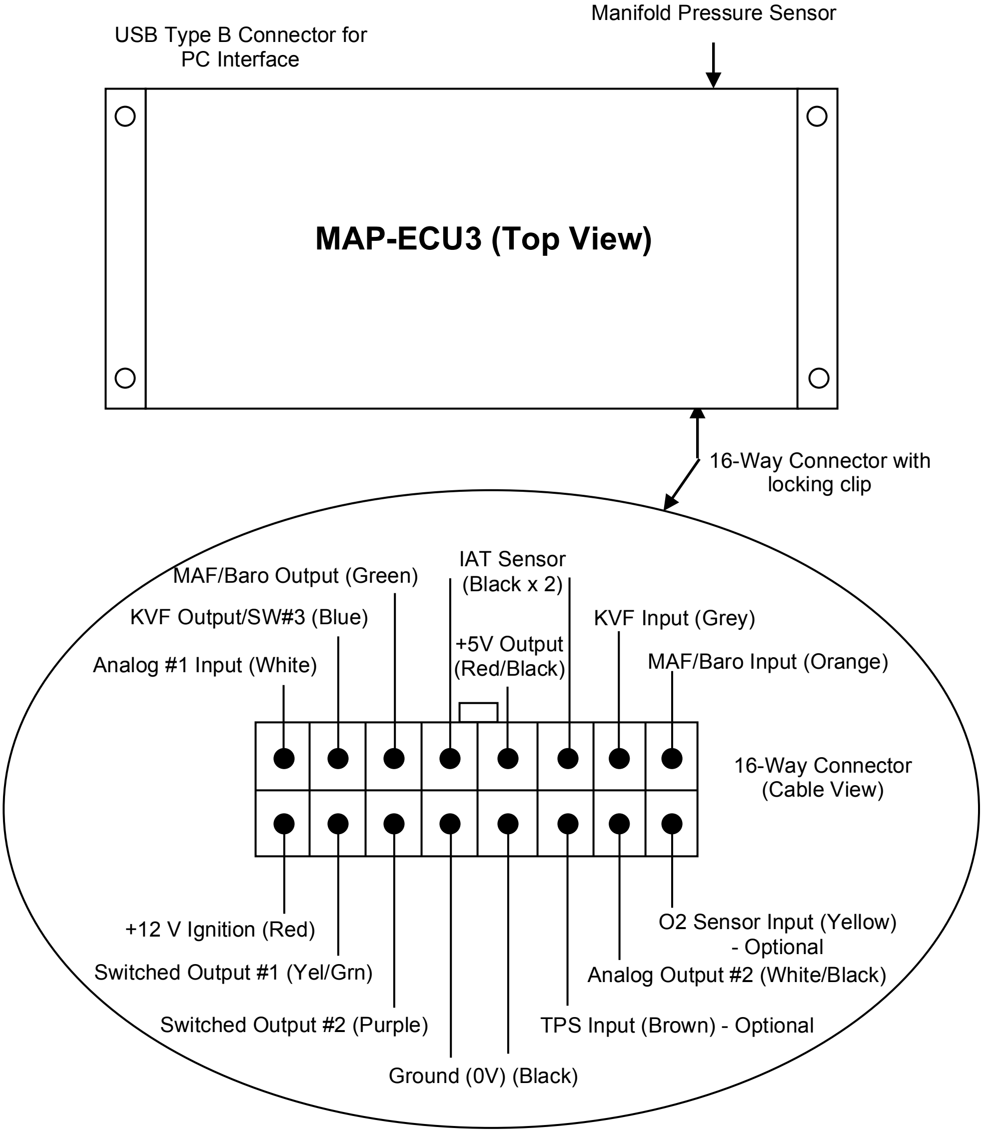
MAPECU3A MAP Sensor

The MAPECU3A MAP sensor is physically larger with a more substantial nipple like MAPECU and MAPECU2. The picture below is from a MAPECU3A:

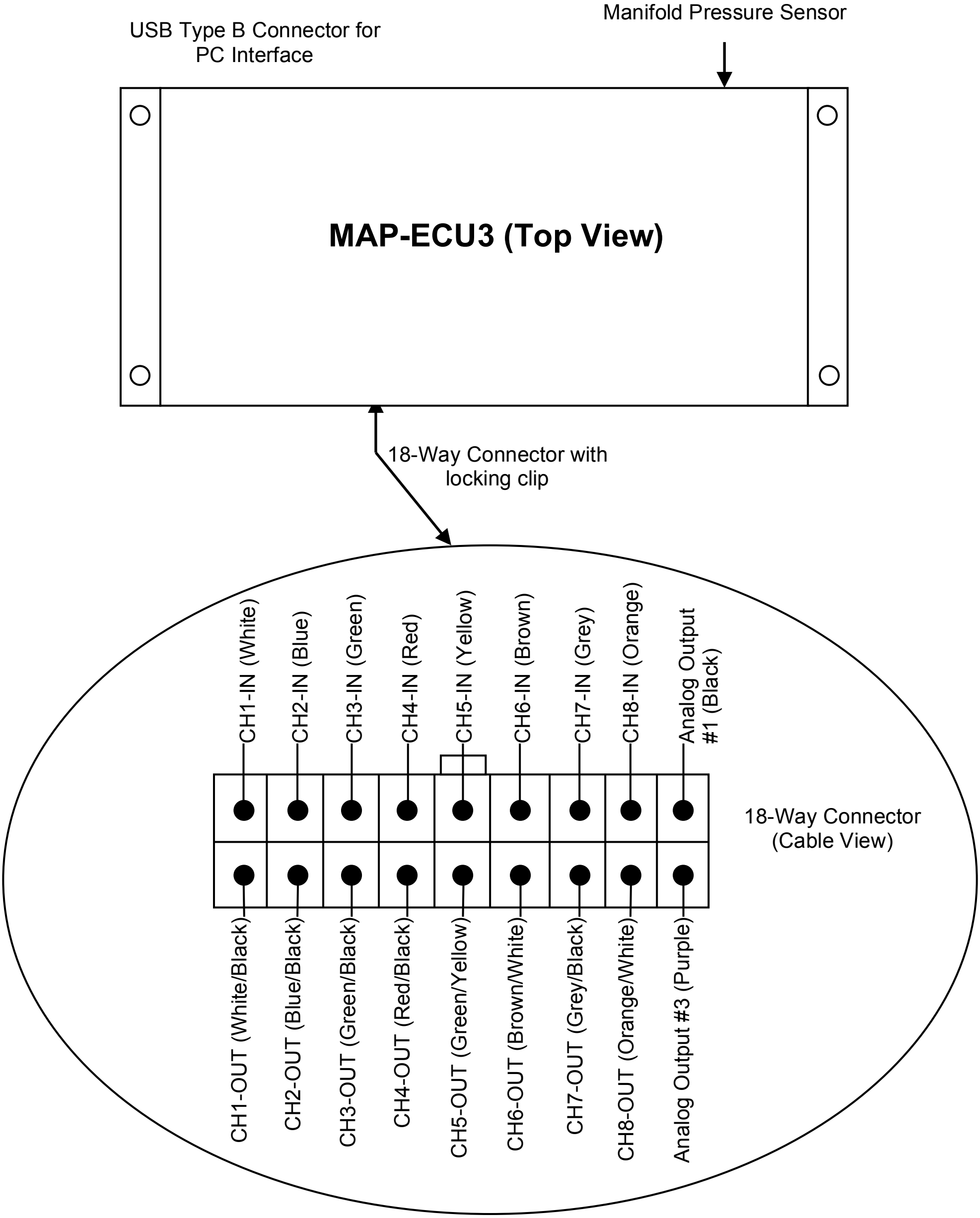


WARNING! DO NOT ATTEMPT TO REMOVE THE VACUUM HOSE BY BENDING IT SIDEWAYS OTHERWISE YOU MAY BREAK THE NIPPLE OFF THE SENSOR. PULL THE VACUUM HOSE OFF STRAIGHT OR CUT OFF THE SLICE OF VACUUM HOSE THAT SECURES THE REMAINING HOSE.

16-Way Connector Diagram



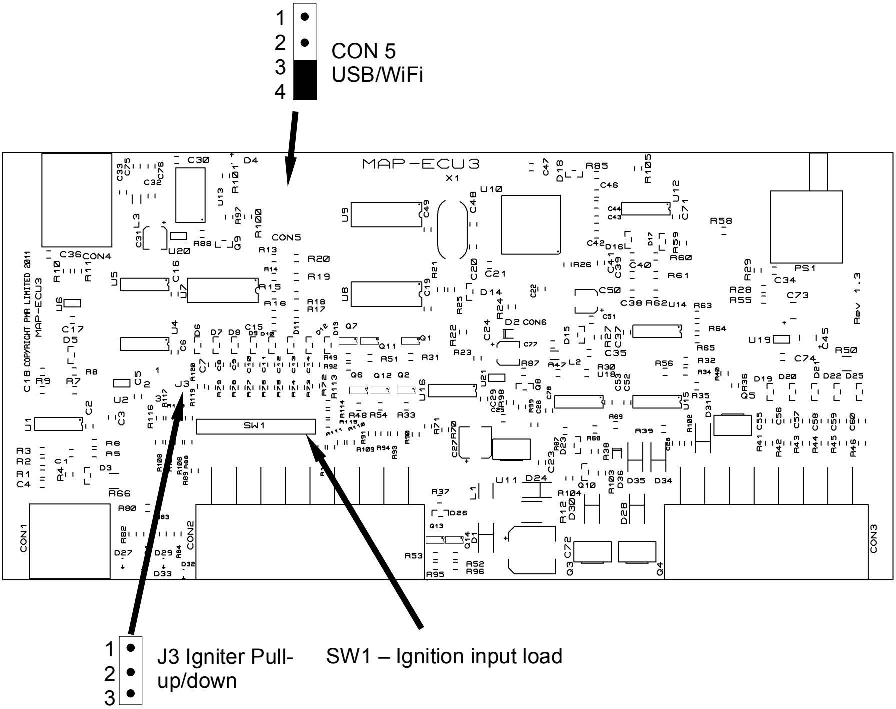
18-Way Connector Diagram



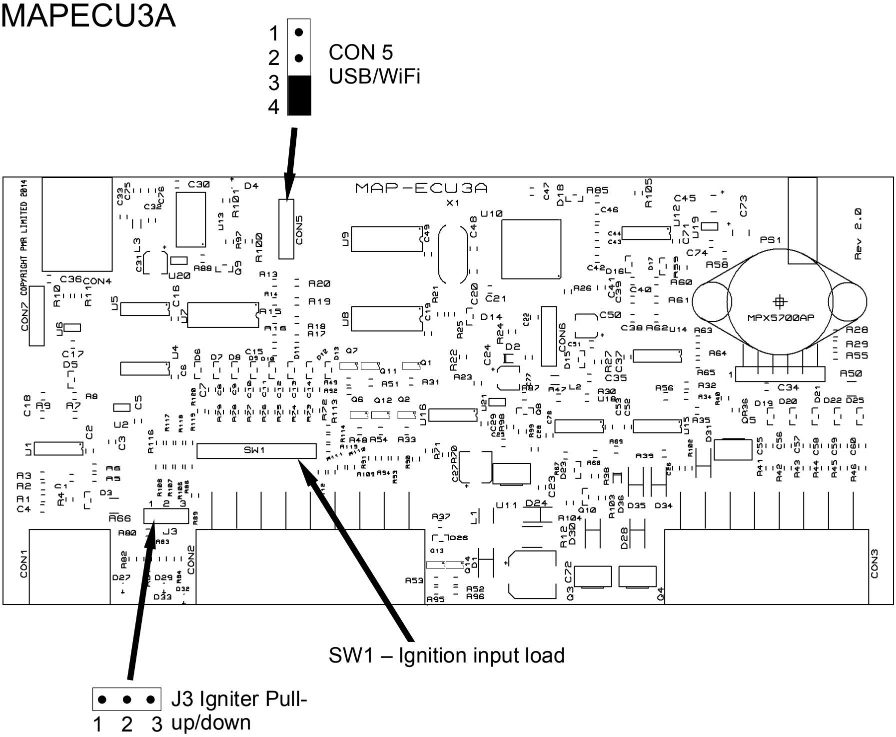
Configuration Jumpers

MAPECU3

The diagram below shows the MAPECU3 configuration jumpers that must be configured for correct operation:

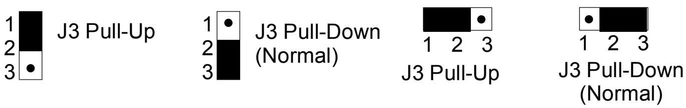


MAPECU3A



Igniter Pull-Up/Pull-Down (J3)

Igniter input loading must be a ”Pull-Up” or “Pull-Down” type depending on the type of vehicle. Most OEM ECU’s require a ‘Pull-Down’ type and is the default configuration for the MAPECU3. Some vehicles, e.g. some Honda™ ECU’s require a pull-up input.



Igniter Drive

The MAPECU3 has a resigned ignition drive circuit that dispenses with the igniter drive jumpers found in the MAP-ECU2. The MAPECU3 is essentially in “High” drive at all times. The MAPECU3 output drives are also improved in that they are no longer 0.6V above ground as the MAP-ECU2 was. This means diodes are not longer required with some coil-on-plug vehicles, e.g. Nissan™ 350Z.

Input Load Selection (SW1)

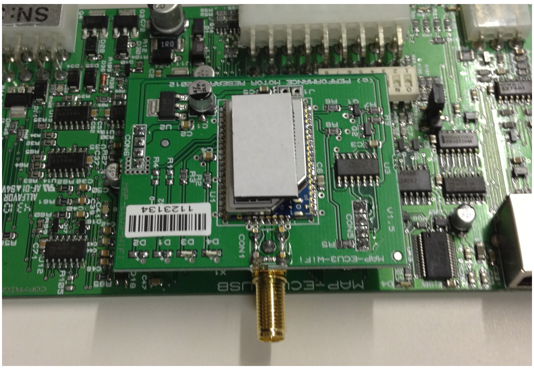
MAPECU3 has switch able ignition input load resistors depending on the vehicle application. A 8-Way switch (SW1) allows the user to select between high impendence inputs (switches OFF) or low impendence inputs (switches ON). There is one switch per input channel, labelled 1-8.

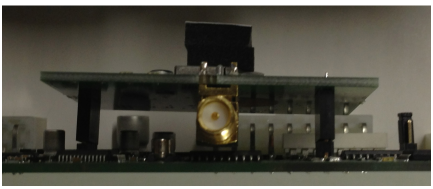
With MAP-ECU2, low impendence mode required external 220 ohm resistors. These are no longer required with the MAPECU3 as all the user needs to do is move the switch to ON to select low impendence.

The switches are shipped in the ON position from the factory and are protected with removable plastic tape. To changes the switch position, remove the plastic tape and move the switch with a ball-point pen or similar instrument.

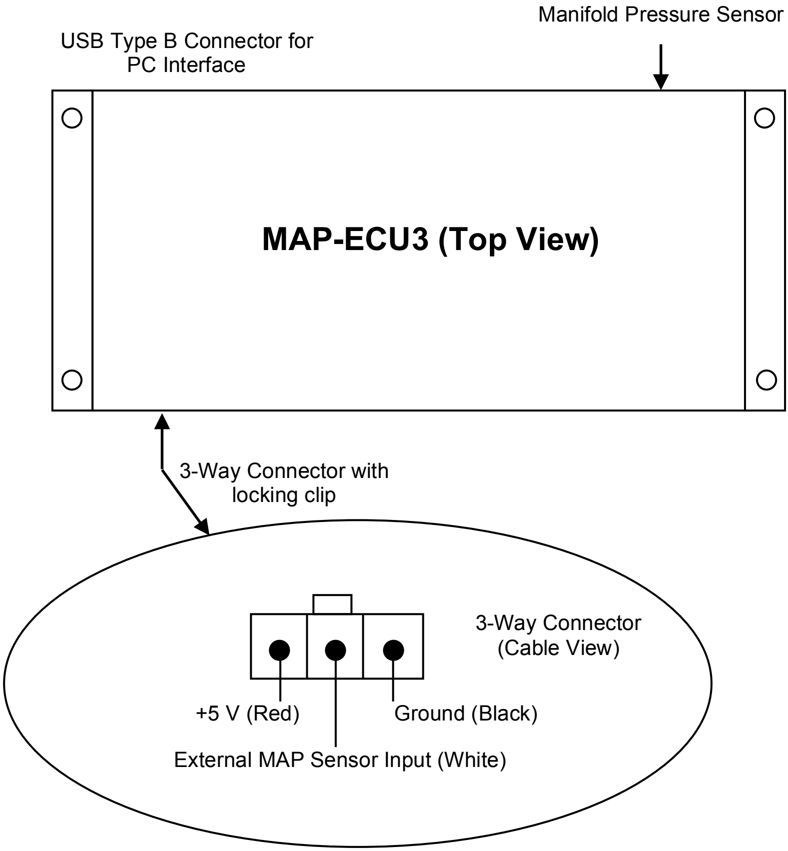
USB/WiFi Selection (CON5)

The MAPECU3 can have an optional WiFi module plugged into CON5 & CON6. When the WiFi module is not in place, a jumper plug MUST be installed on pins 3 & 4 of CON5, see above. This jumper must be removed when the WiFi module is installed. When a WiFi module is in place, it looks like this:

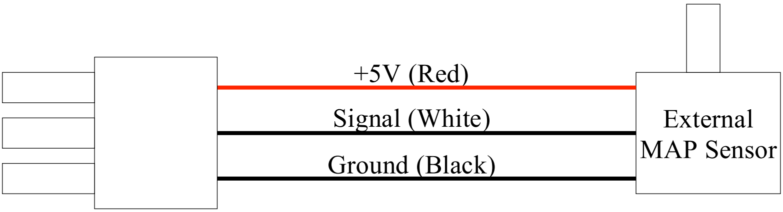




3-Way Connector Diagram



Various External MAP Sensors can be connected to the MAPECU3, e.g. GM 2-Bar, GM 3-Bar, AEM 5-Bar. Configuration is completed using MAPCAL3. An external MAP sensor must be a linear 5 Volt type where minimum voltage equals vacuum and maximum voltage is maximum boost. The wiring is as follows:

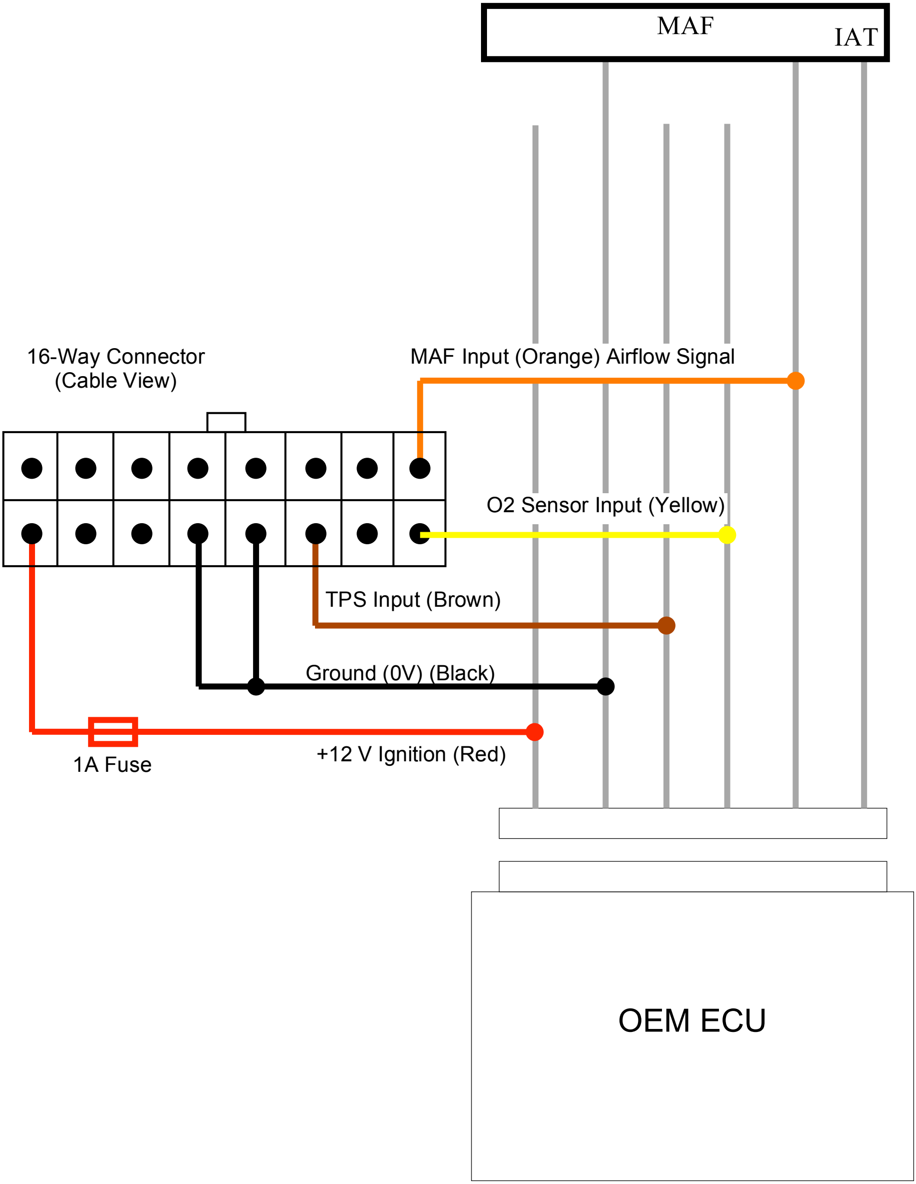


Installation Notes and Recommendations

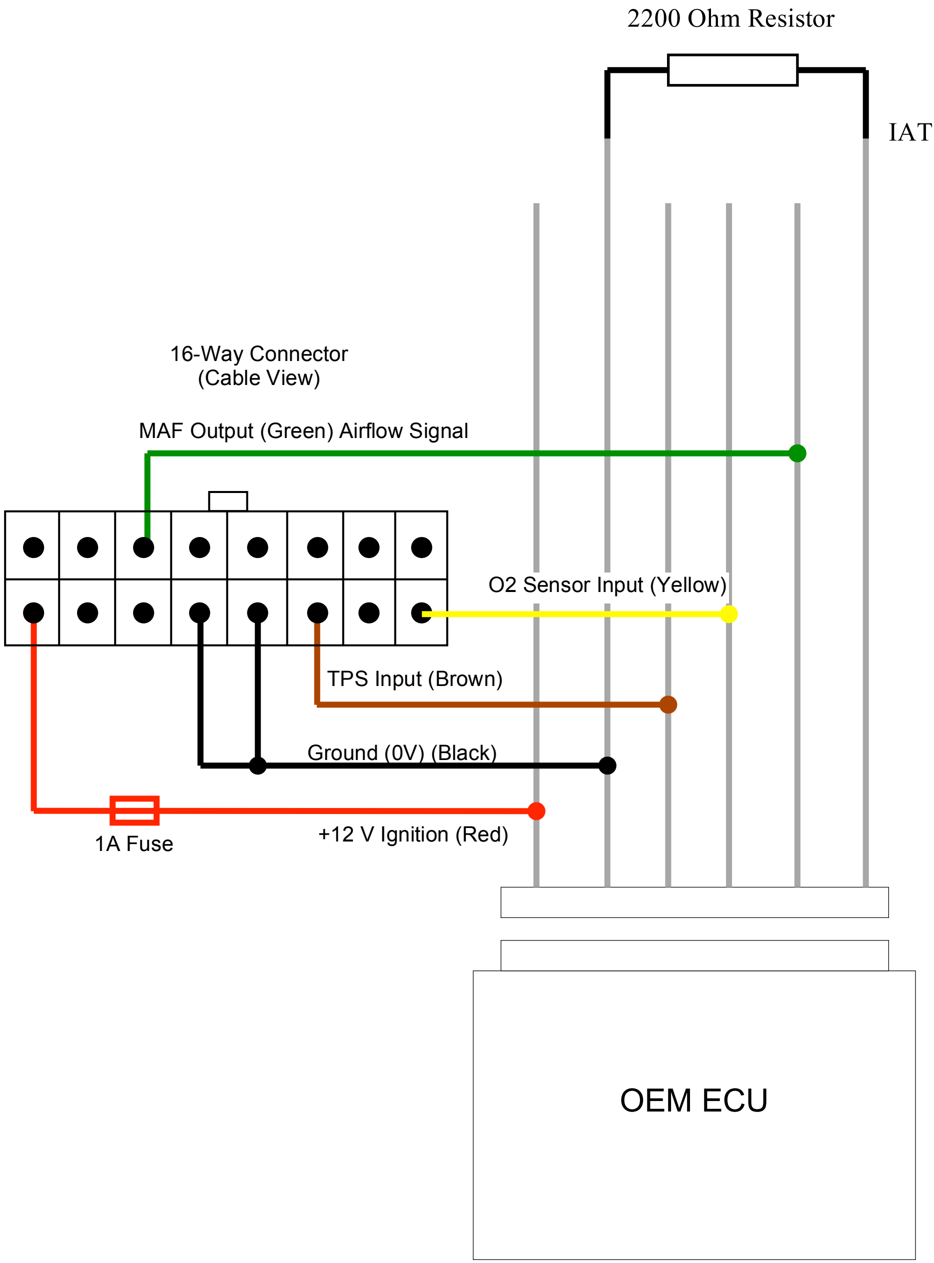
1. It is recommended that all wiring be kept as short as possible to avoid stray signals, especially the O2 Sensor wire (YELLOW).
2. “Crimp-over-wire” type connectors should be avoided. All connections should be soldered and protected with heat-shrink sleeves.
3. The manifold pressure line must be connected to a dedicated vacuum port after the throttle body, i.e. off the plenum chamber. If no plenum chamber exists (e.g. ITB), a pressure collector will be required with connections to each throttle body after each throttle butterfly. The pressure line must be automotive standard neoprene rubber 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). If a long vacuum line is required, hard PTFE tubing with short neoprene rubber couplers can be used at each end. PTFE tubing does not swell or collapse like neoprene vacuum hose under large pressure changes. Silicone hose is not recommended.
4. The inlet air temperature (IAT) sensor supplied can be installed in the intake, usually the air box. Ensure the IAT is not placed high in the engine bay where it is subject to ‘heat soak’. When the engine is turned off and the IAT is heated by under hood temperatures, the fuel mixture will be lean on hot restart because the IAT is artificially hot. It is also a good idea to insulate the body of the IAT from any metal pipe work to minimise heat soak.

Installation Instructions

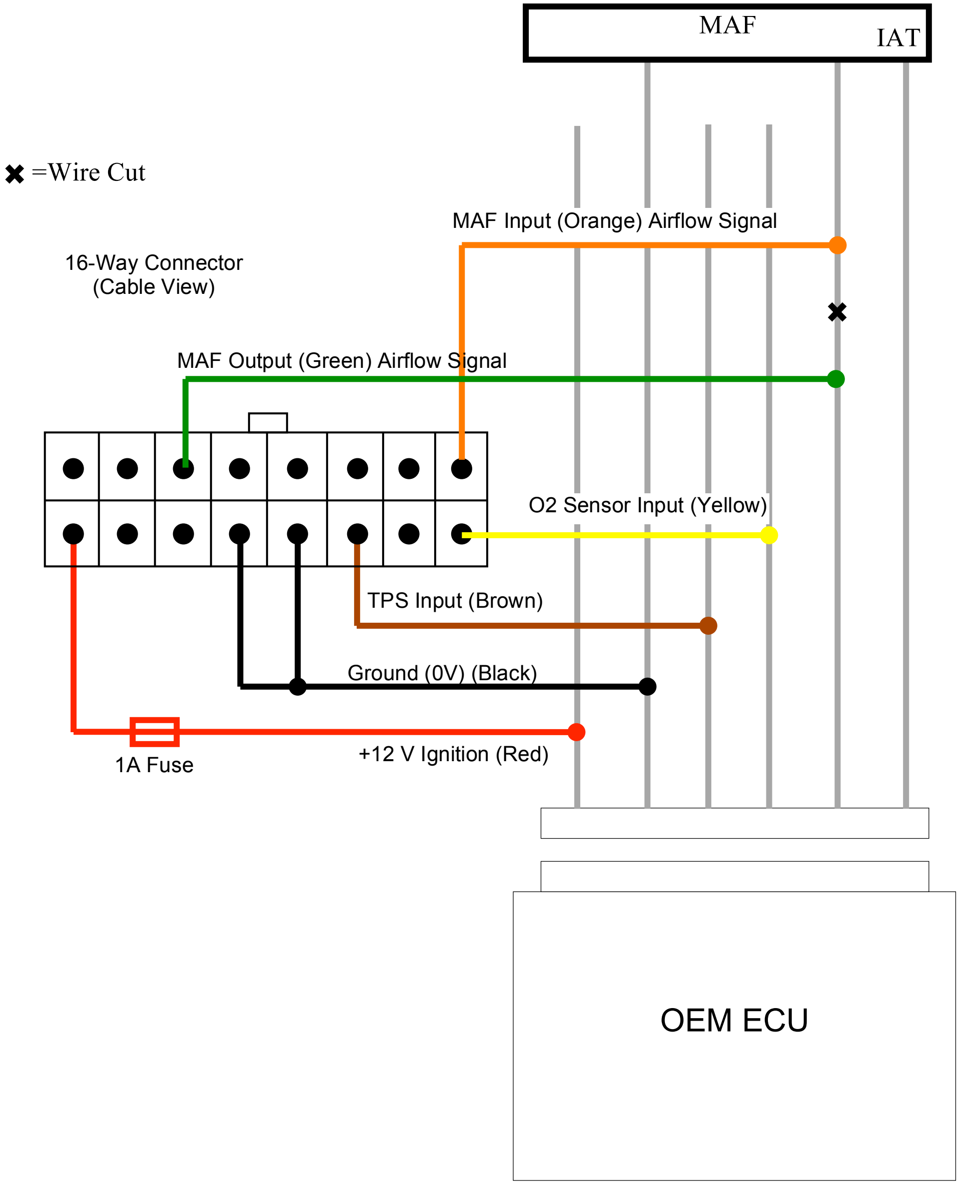
Hotwire/Flap MAF Wiring (Learn Mode)



Hotwire/Flap MAF Wiring (Eliminate Mode)



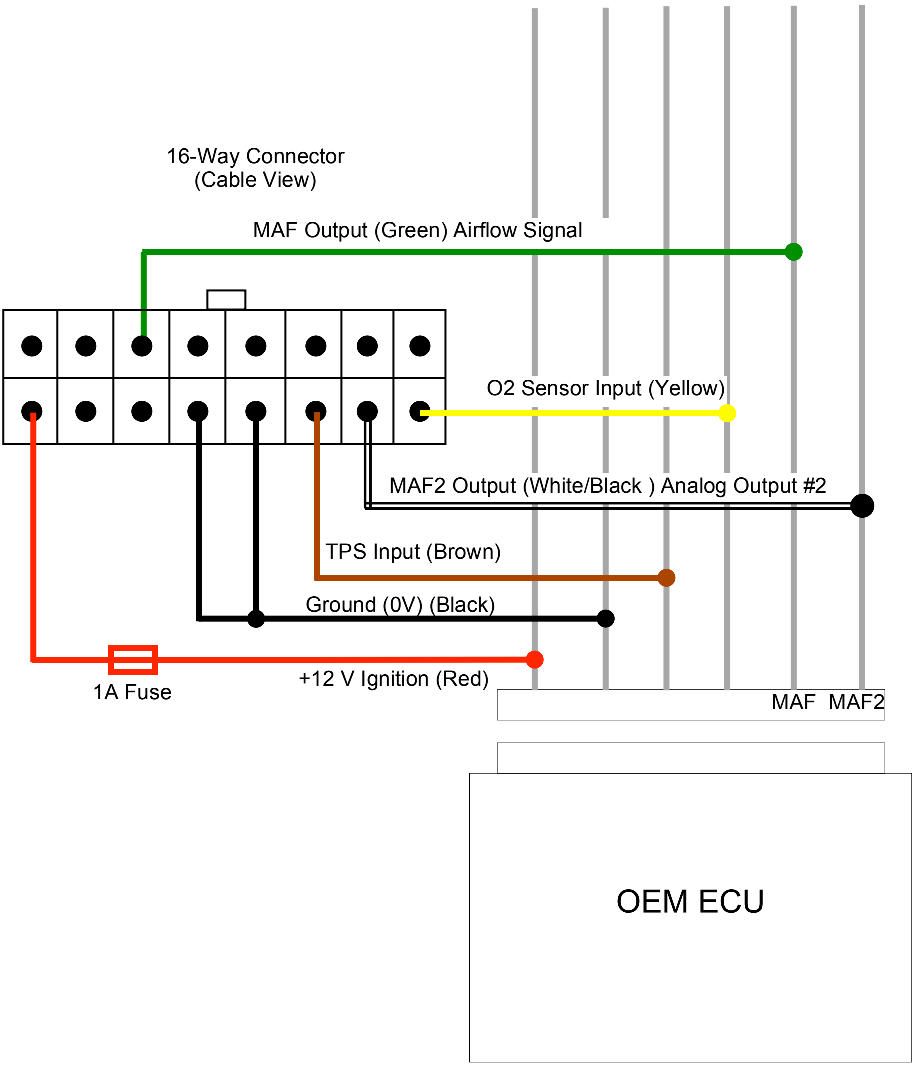
Hotwire/Flap MAF Wiring (Intercept Mode)



Dual Hotwire/Flap MAF Wiring (Eliminate Mode)

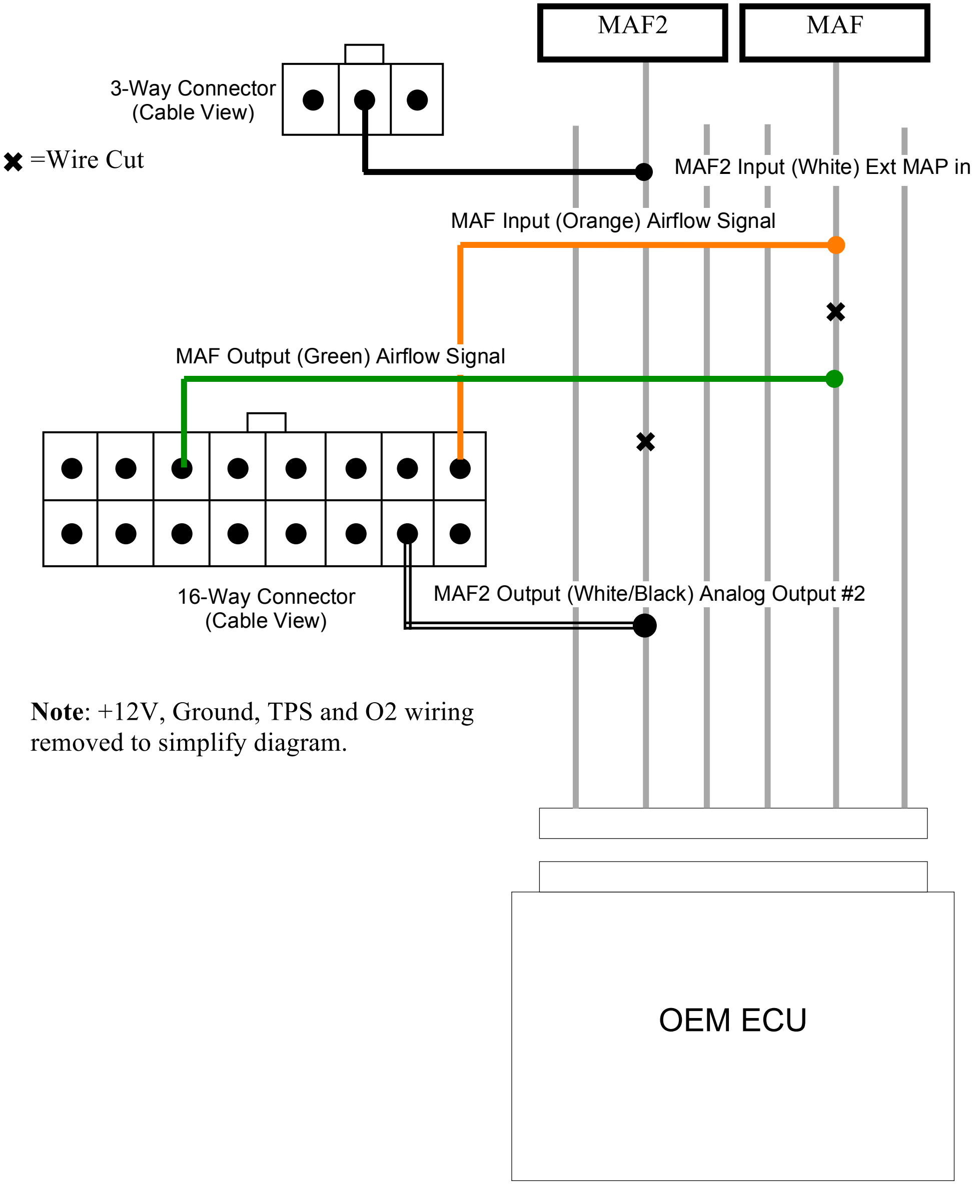
In this example Analog Output #2 has been configured as MAF2 placing the MAPECU3 into Dual Fuel Table Mode.

Note: The same wiring and configuration is used for replacing dual MAP sensors.



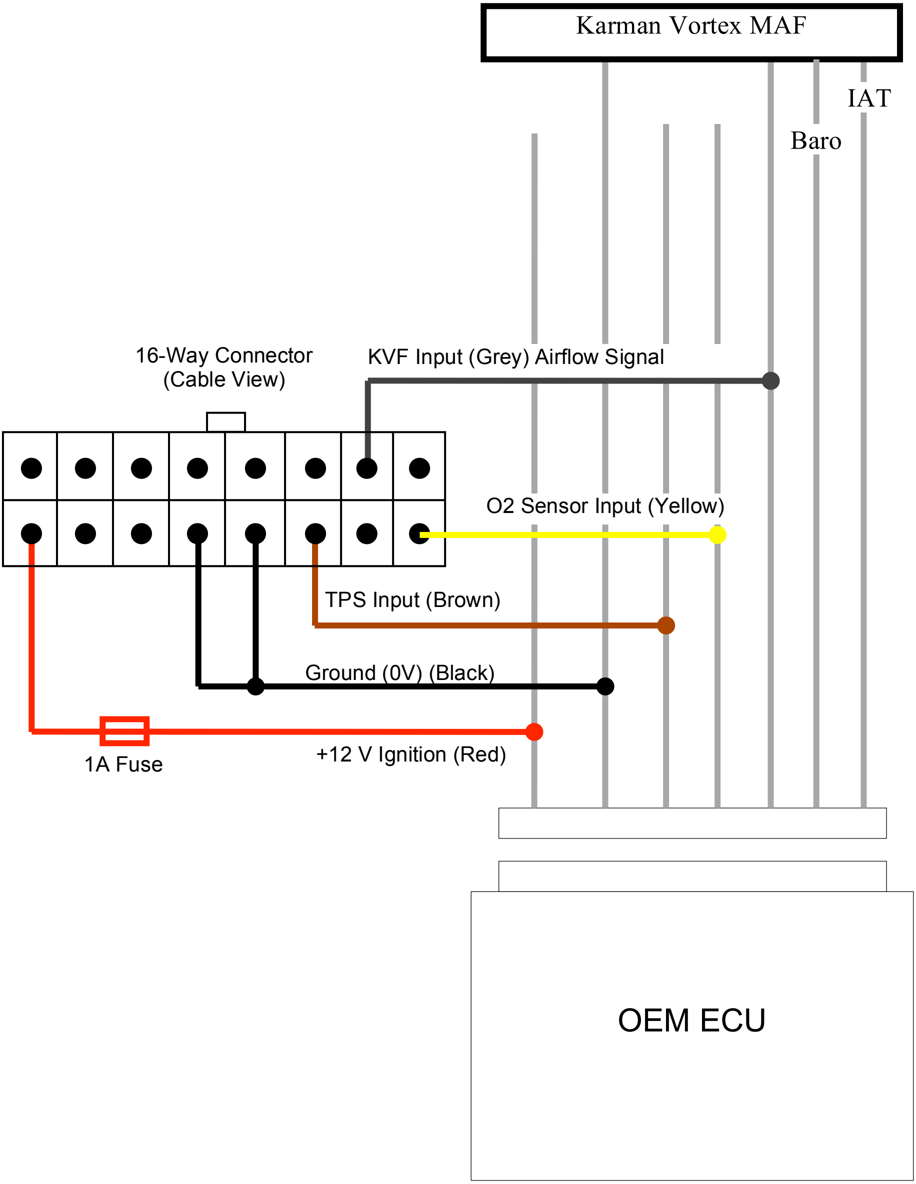
Dual Hotwire/Flap MAF Wiring (Intercept Mode)

In this example Analog Output #2 has been configured as MAF2 and the External MAP Sensor Input as MAF2 to put the MAPECU3 into Dual Fuel Table Intercept Mode.

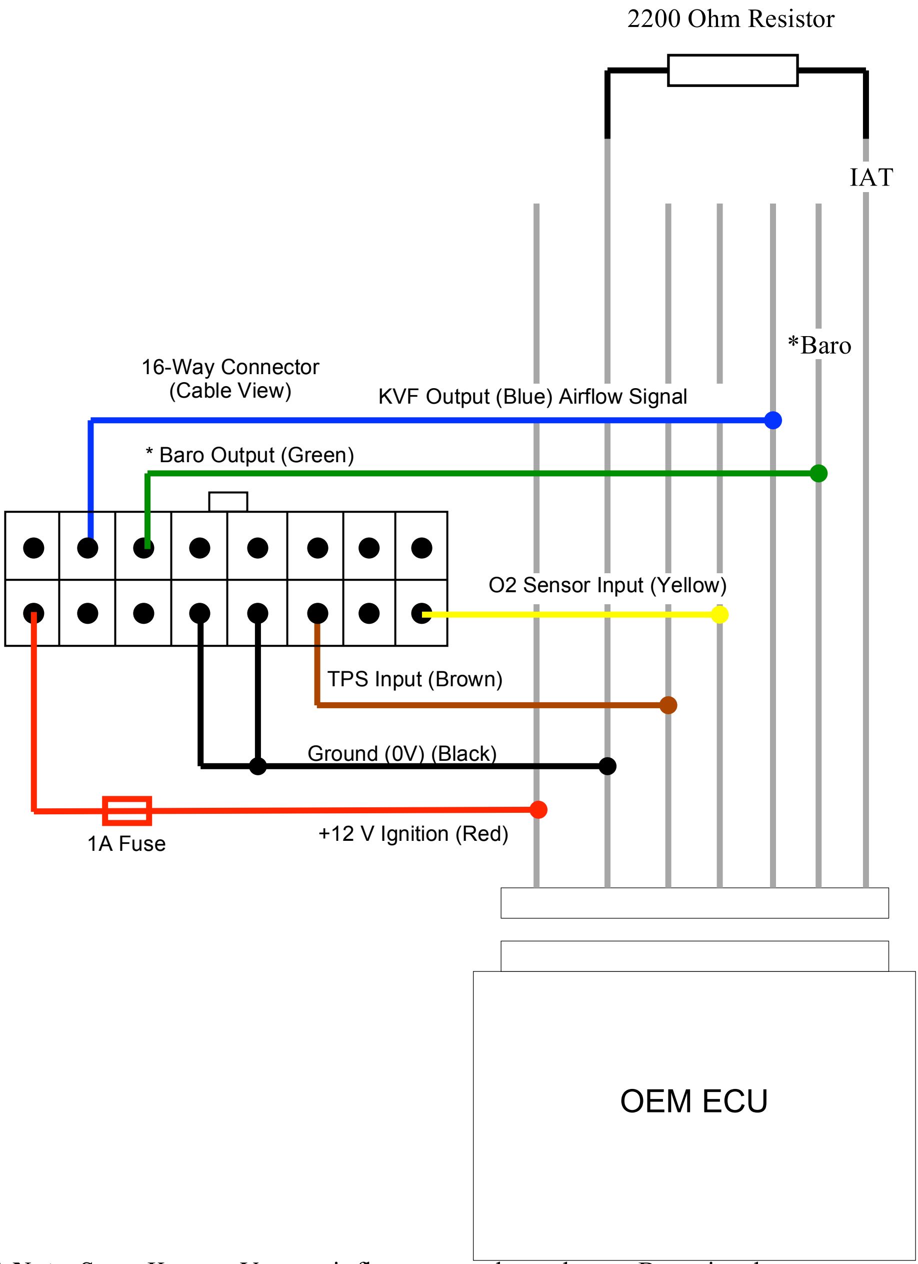


Note: +12V, Ground, TPS and O2 wiring removed to simplify diagram.

Karman Vortex Wiring (Learn Mode)

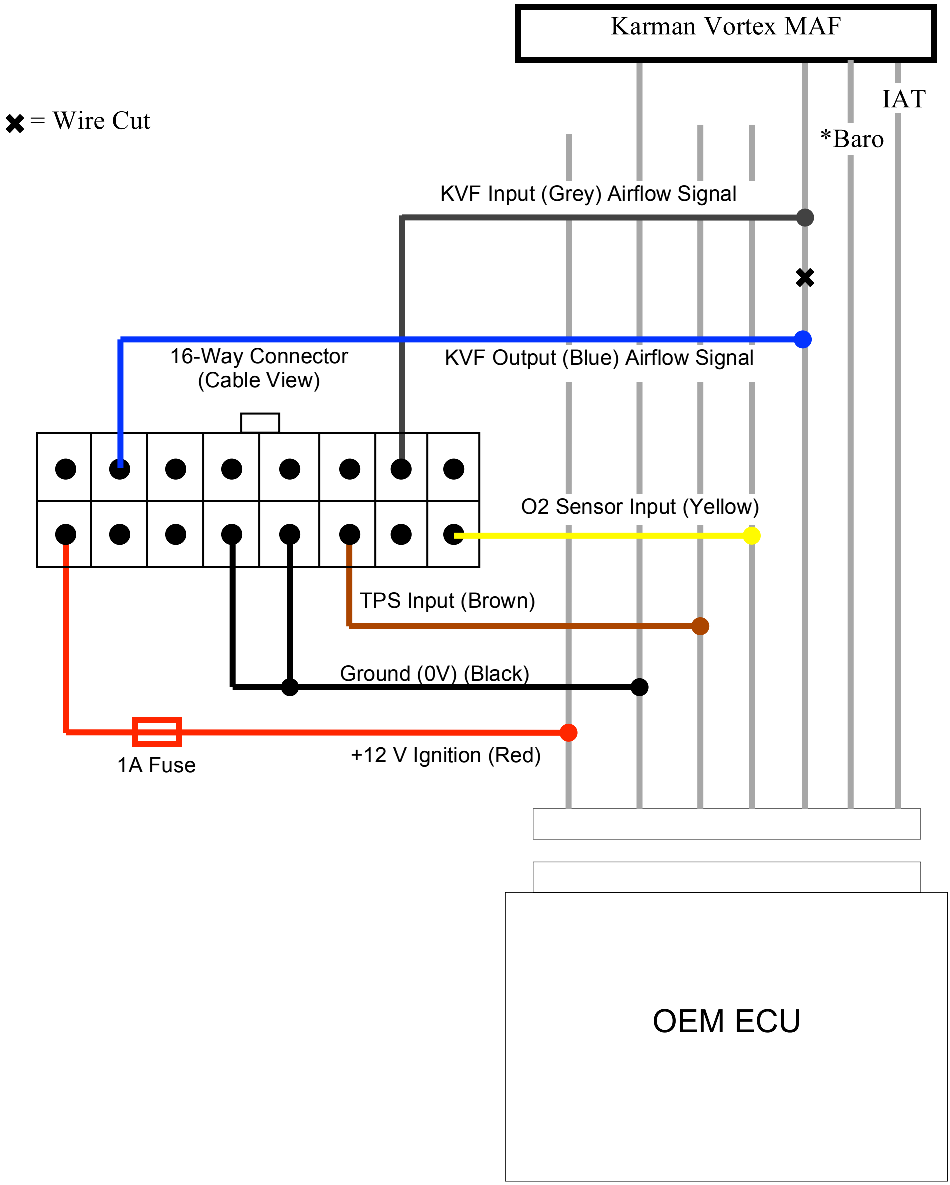


Karman Vortex Wiring (Normal Mode)



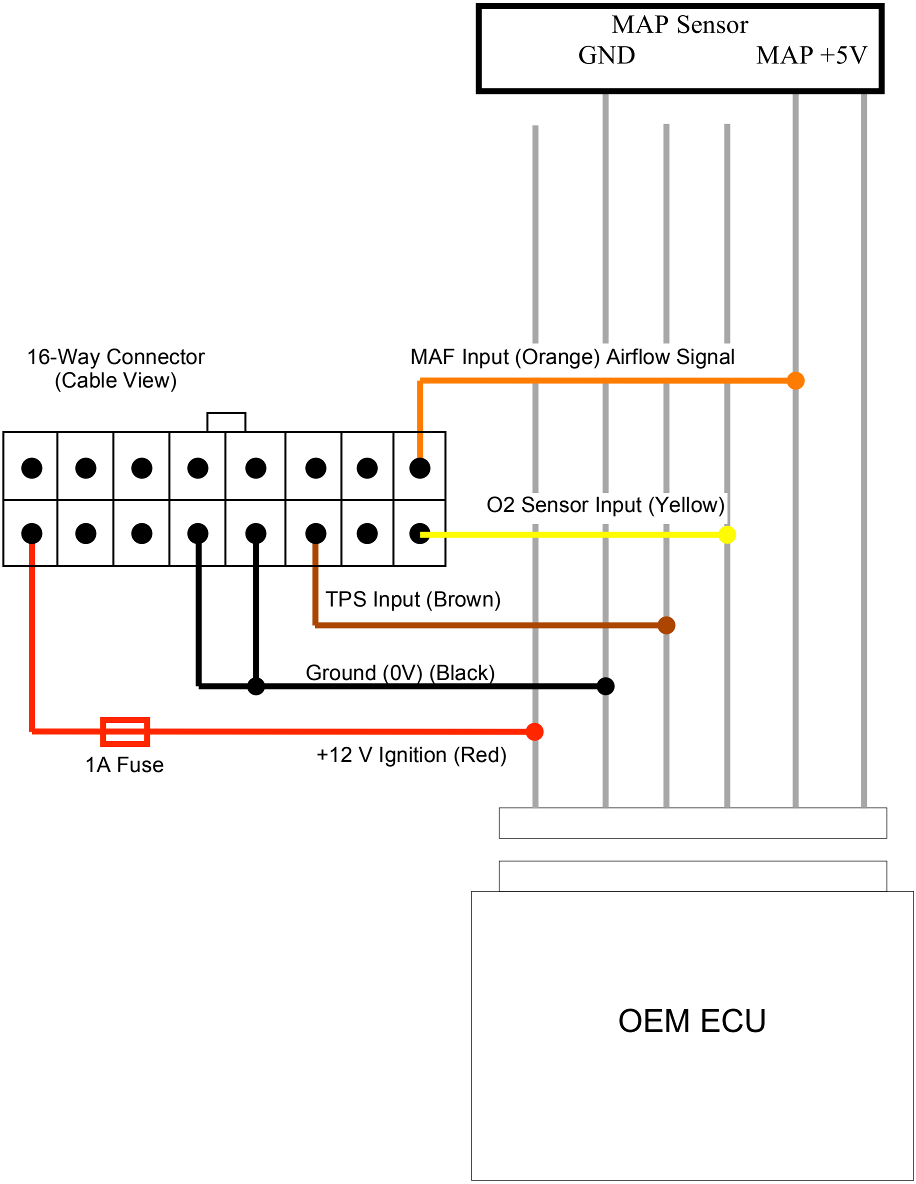
* **Note**: Some Karman Vortex air flow meters do not have a Baro signal.

Karman Vortex Wiring (Intercept Mode)

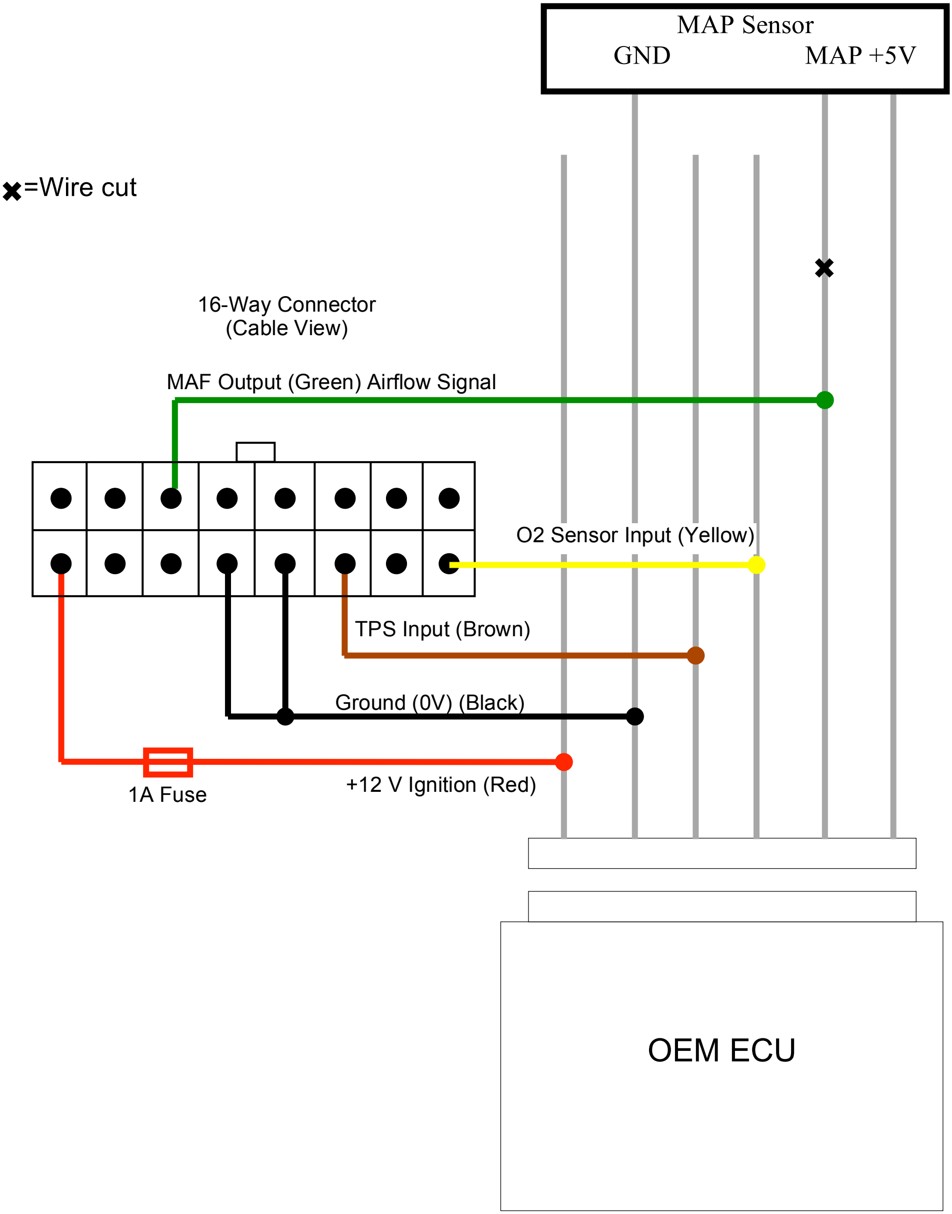


* **Note**: Some Karman Vortex air flow meters do not have a Baro signal.

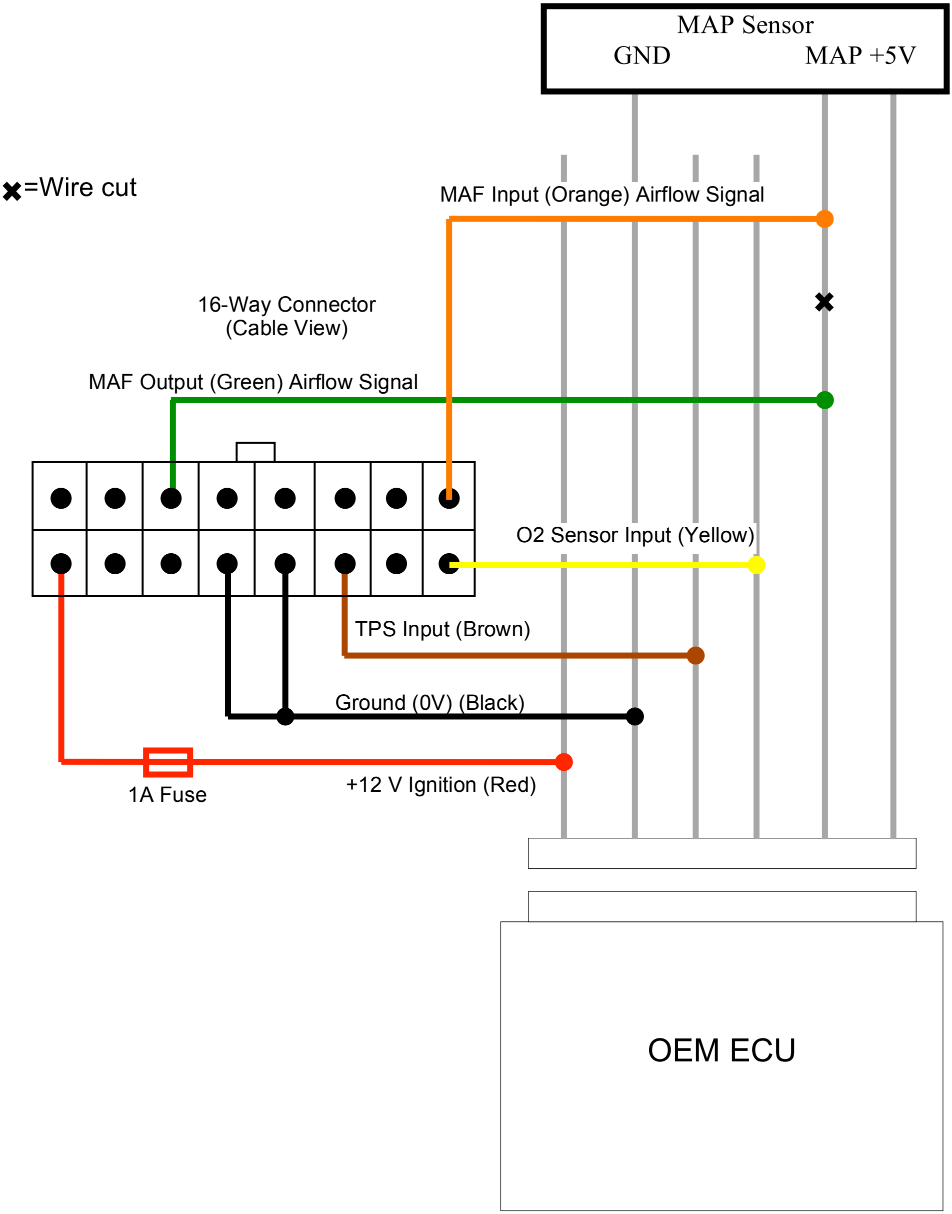
MAP Sensor Wiring (Learn Mode)



MAP Sensor Wiring (Replacement Mode)

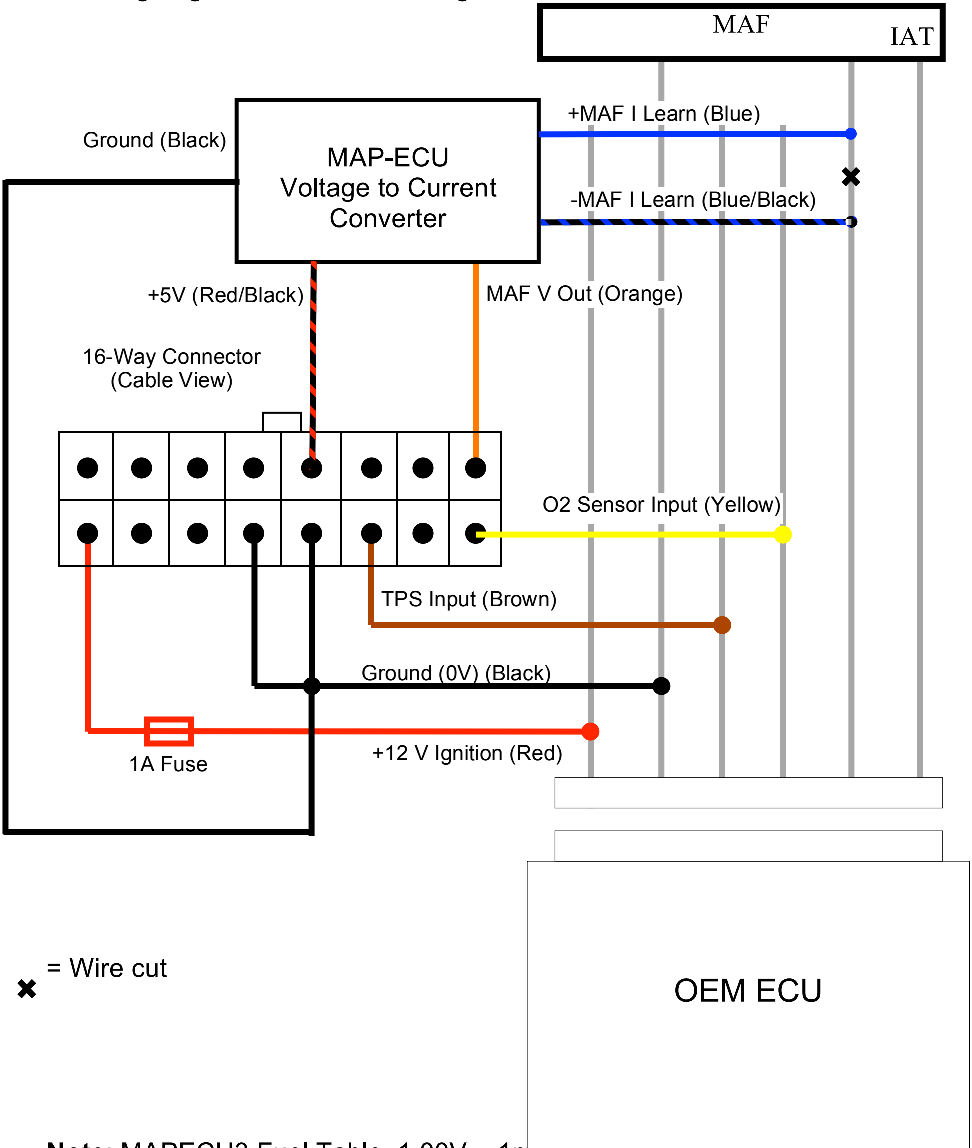


MAP Sensor Wiring (Intercept Mode)



Current MAF Wiring (Learn Mode)

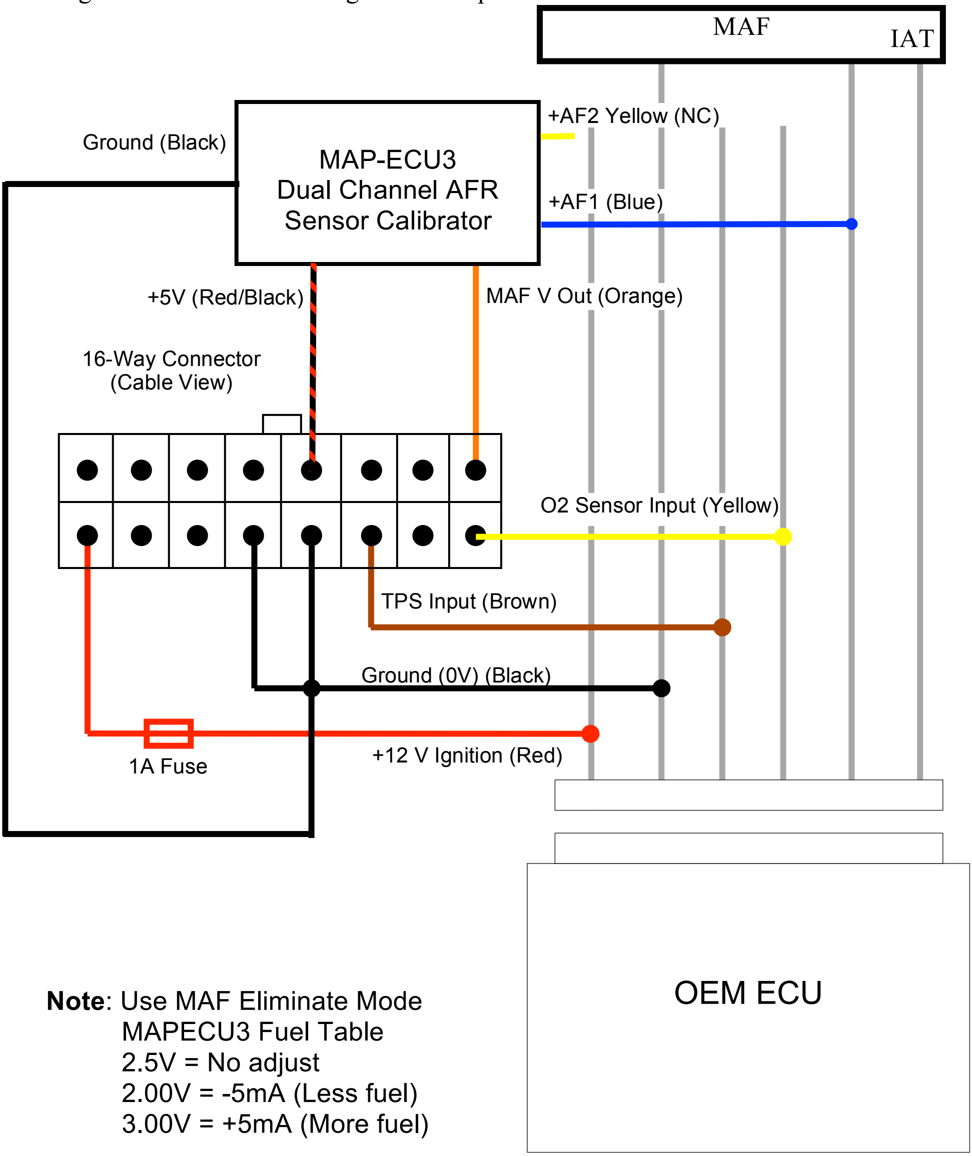
Some vehicles, e.g. 2004 Mitsubishi ™ Lancer Ralliart 2.4L NA 4cyl engine (4G69), use a *current* based MAF instead of a voltage or frequency MAF. A MAP-ECU Voltage to Current Adaptor is required for these installations. The following diagram illustrates the wiring for Learn mode:



Note: MAPECU3 Fuel Table, 1.00V = 1mA (0.001A)

Current MAF Wiring (Intercept Mode)

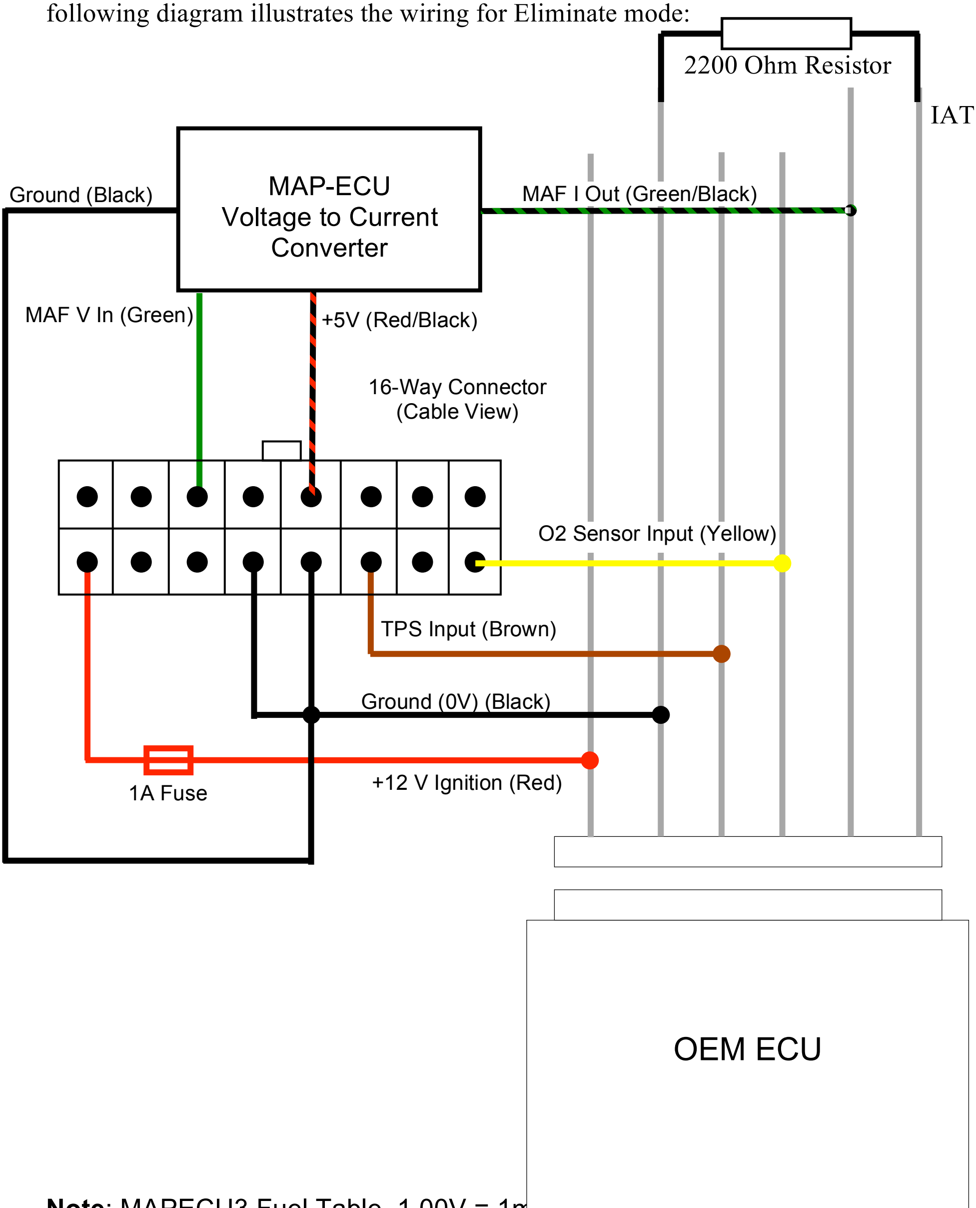
Some vehicles, e.g. 2004 Mitsubishi ™ Lancer Ralliart 2.4L NA 4cyl engine (4G69), use a *current* based MAF instead of a voltage or frequency MAF. A MAPECU3 AFR Calibrator is required for Intercept installations. The following diagram illustrates the wiring for Intercept mode:



Note: Use MAF Eliminate Mode
MAPECU3 Fuel Table
2.5V = No adjust
2.00V = -5mA (Less fuel)
3.00V = +5mA (More fuel)

Current MAF Wiring (Eliminate Mode)

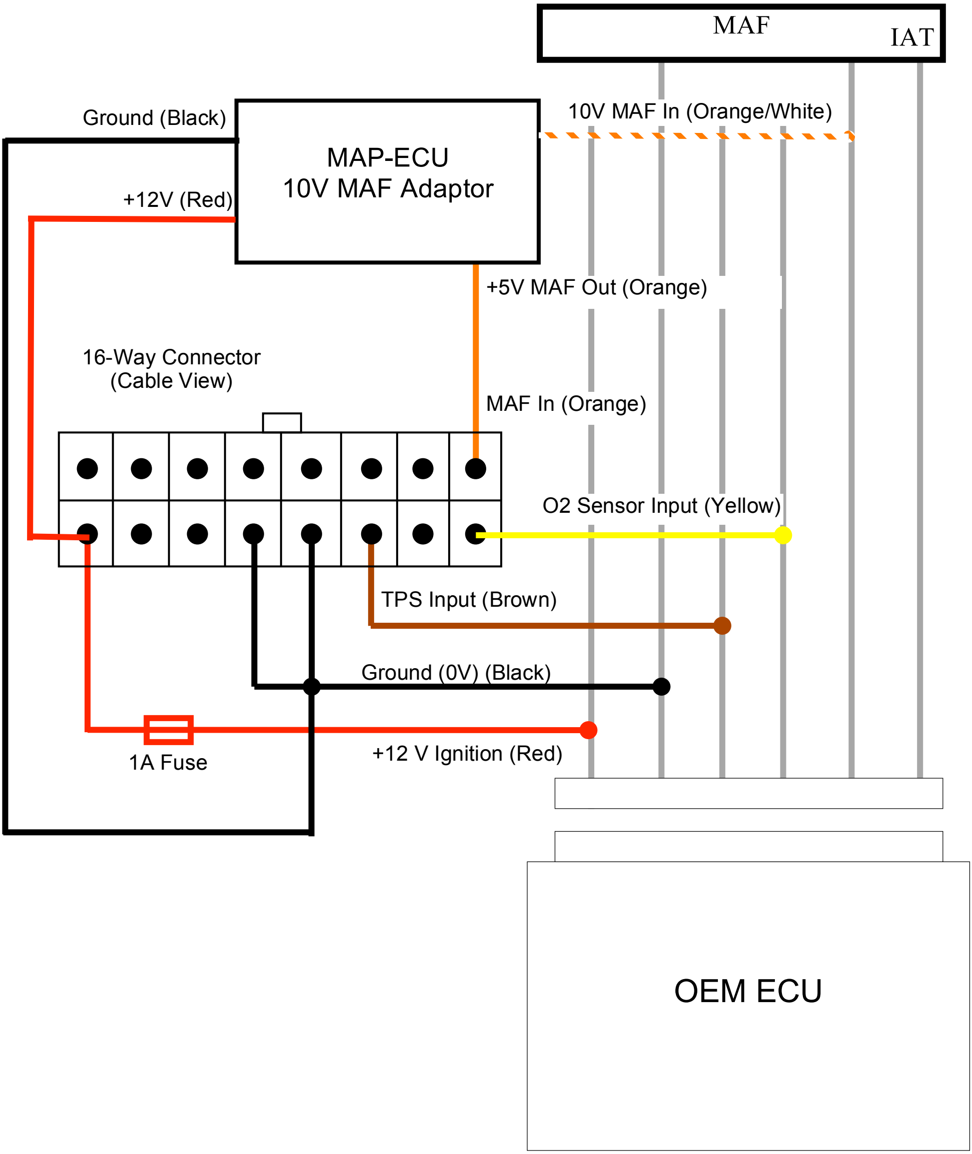
Some vehicles, e.g. 2004 Mitsubishi ™ Lancer Ralliart 2.4L NA 4cyl engine (4G69), use a *current* based MAF instead of a voltage or frequency MAF. A MAP-ECU Voltage to Current Adaptor is required for these installations. The following diagram illustrates the wiring for Eliminate mode:



Note: MAPECU3 Fuel Table, 1.00V = 1mA (0.001A)

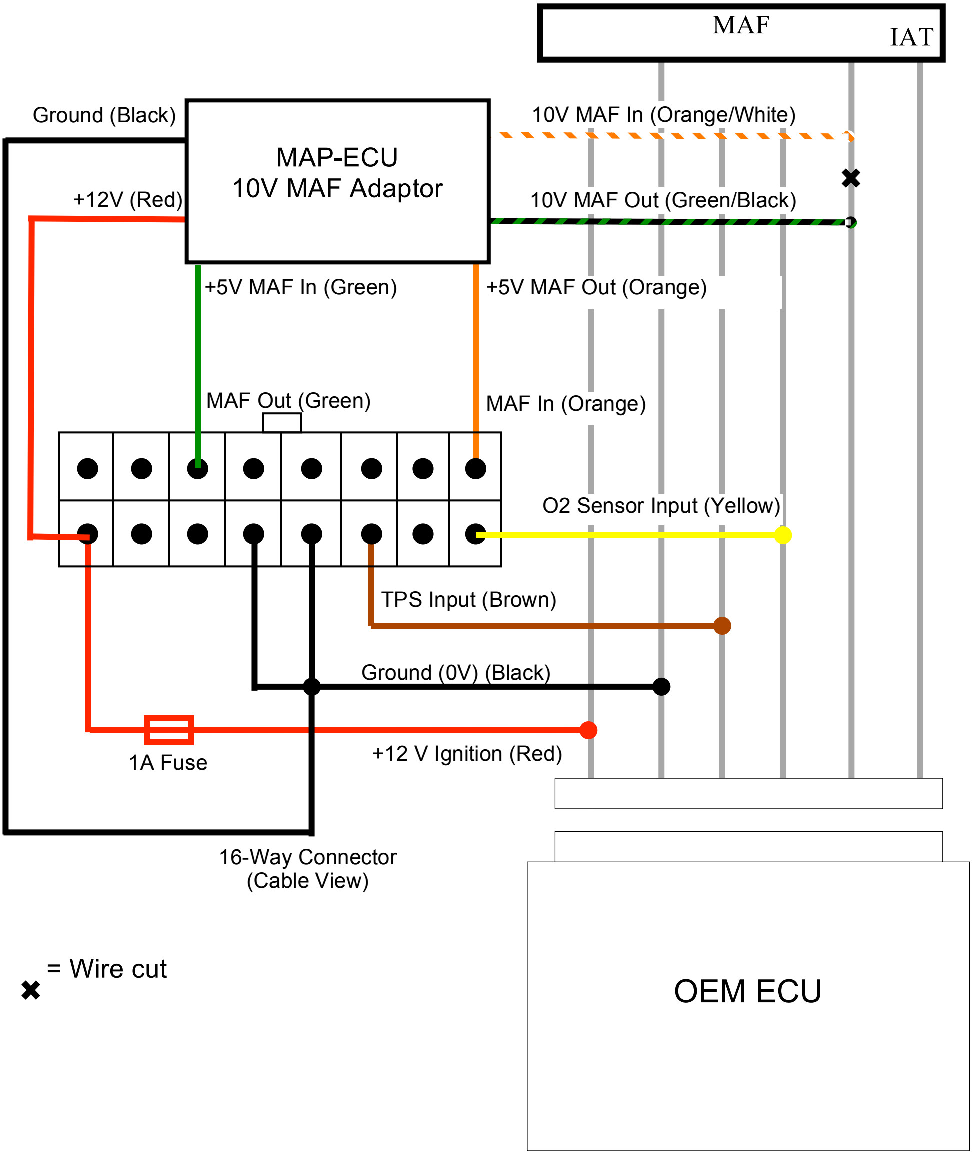
10V MAF Wiring (Learn Mode)

Some vehicles, e.g. mid-80's Bosch™ Motronic™ ECU's use a 10V MAF instead of a normal 5V MAF. The following diagram illustrates the wiring for a 10V MAF Learn mode:



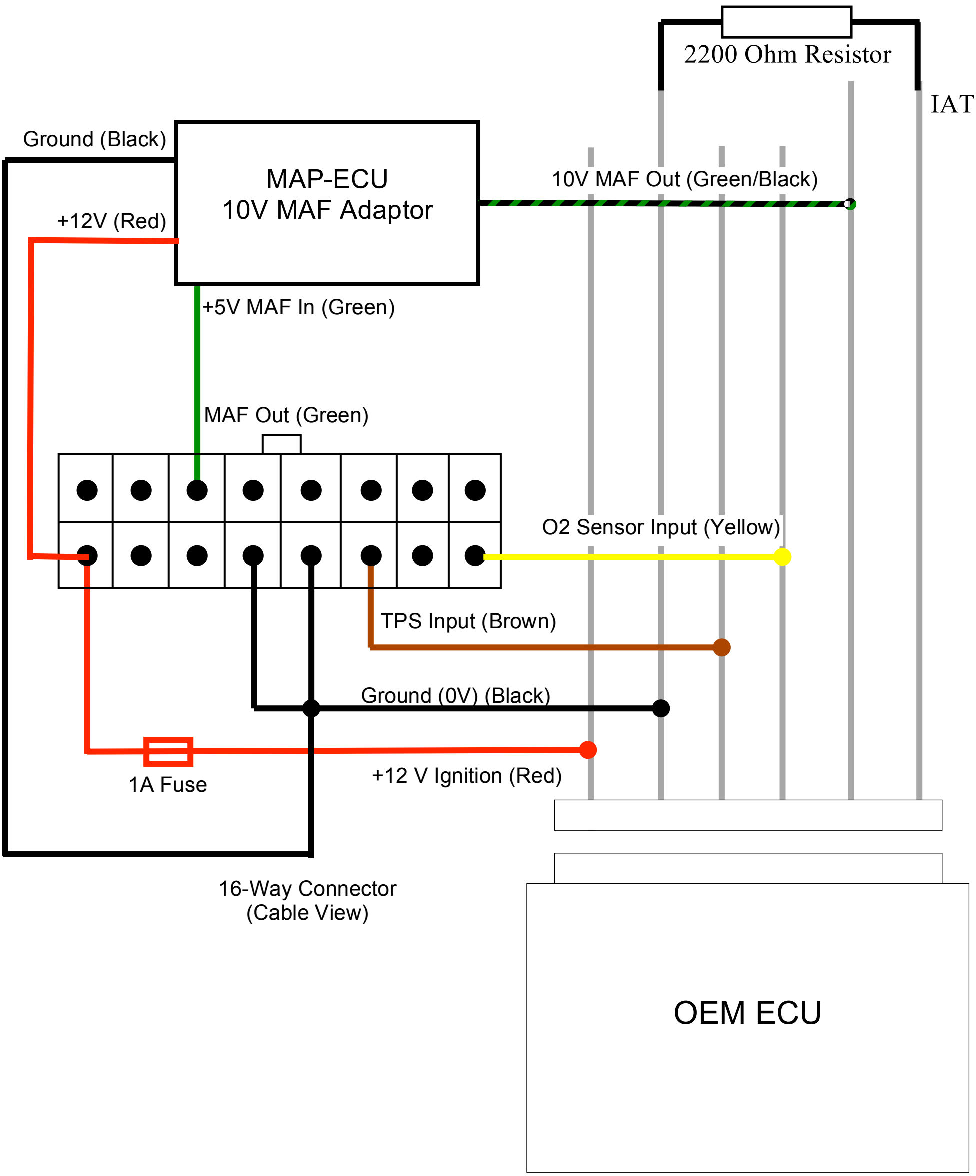
10V MAF Wiring (Intercept Mode)

Some vehicles, e.g. mid-80's Bosch™ Motronic™ ECU's use a 10V MAF instead of a normal 5V MAF. The following diagram illustrates the wiring for a 10V MAF Intercept mode:



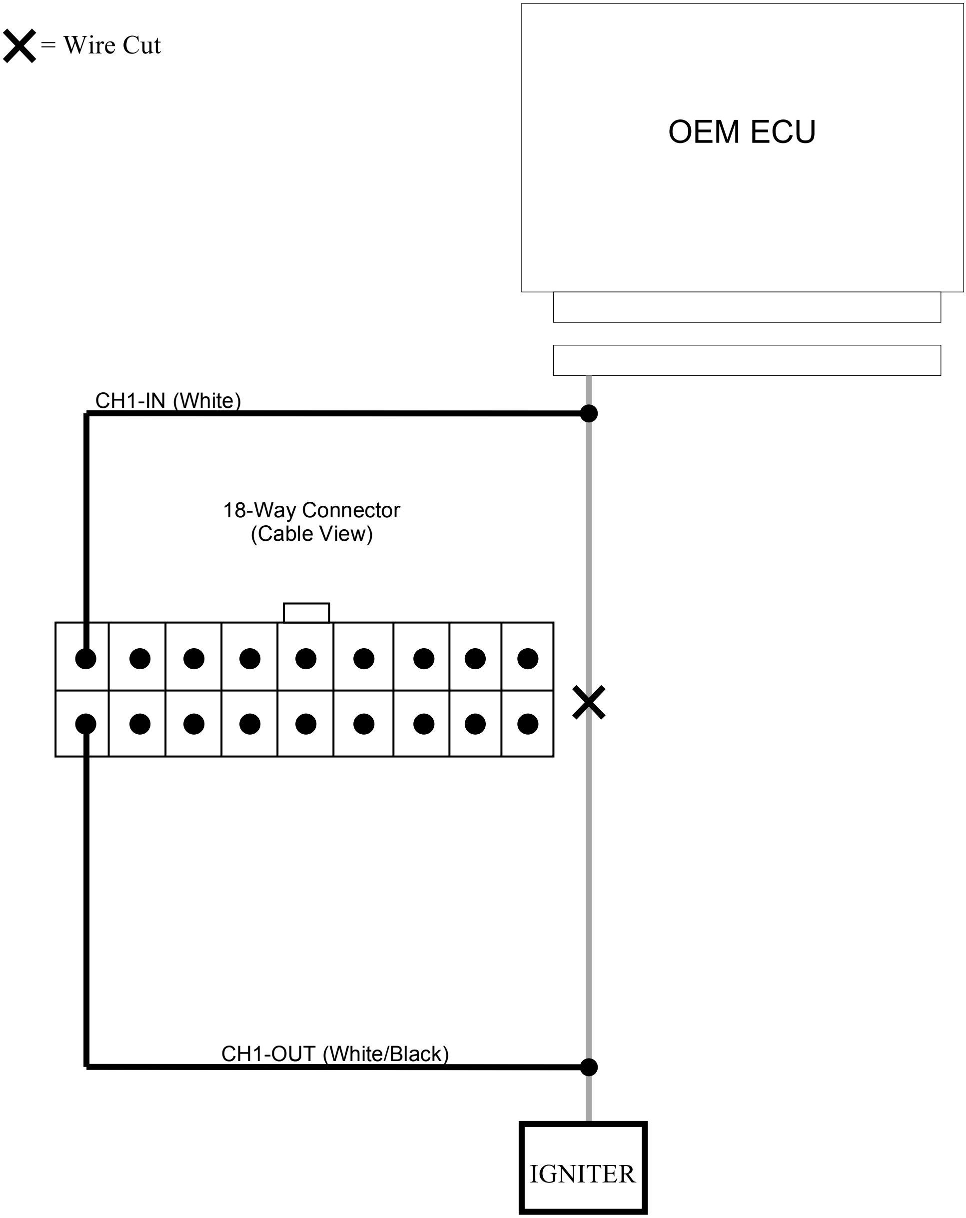
10V MAF Wiring (Eliminate Mode)

Some vehicles, e.g. mid-80's Bosch™ Motronic™ ECU's use a 10V MAF instead of a normal 5V MAF. The following diagram illustrates the wiring for a 10V MAF Learn mode:

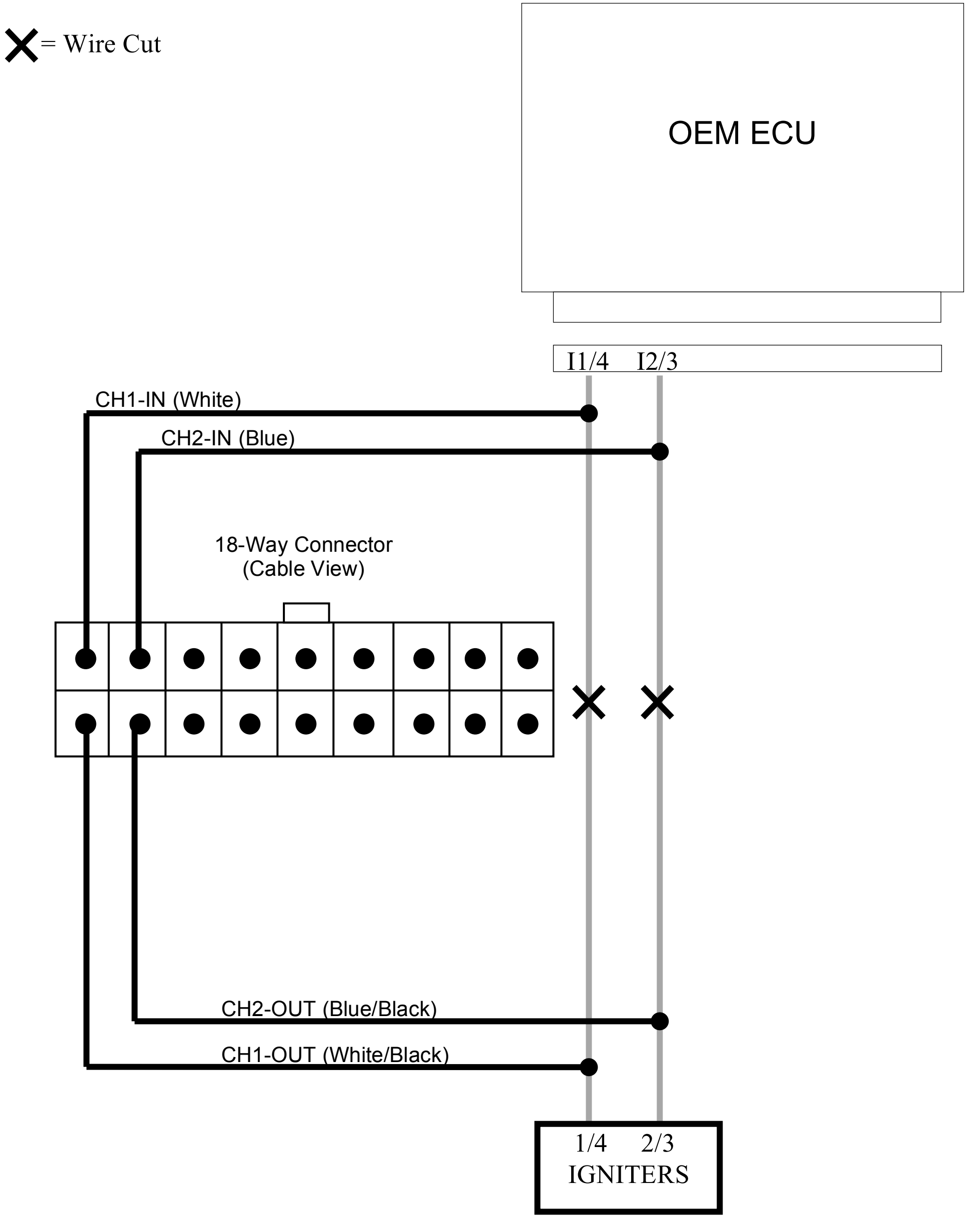


Timing Control Wiring

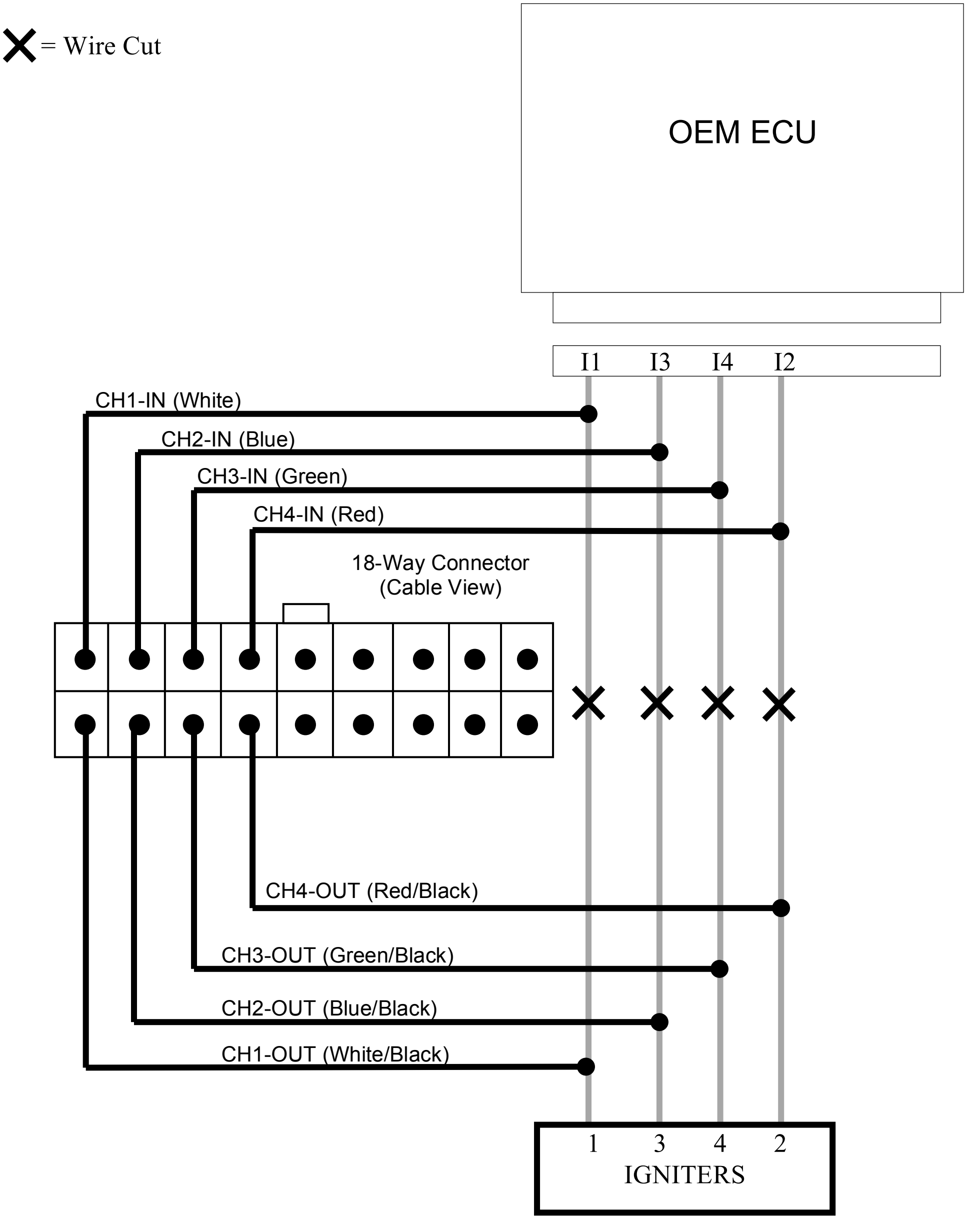
Distributor (3, 4, 5, 6, 8 & 10 Cylinder)



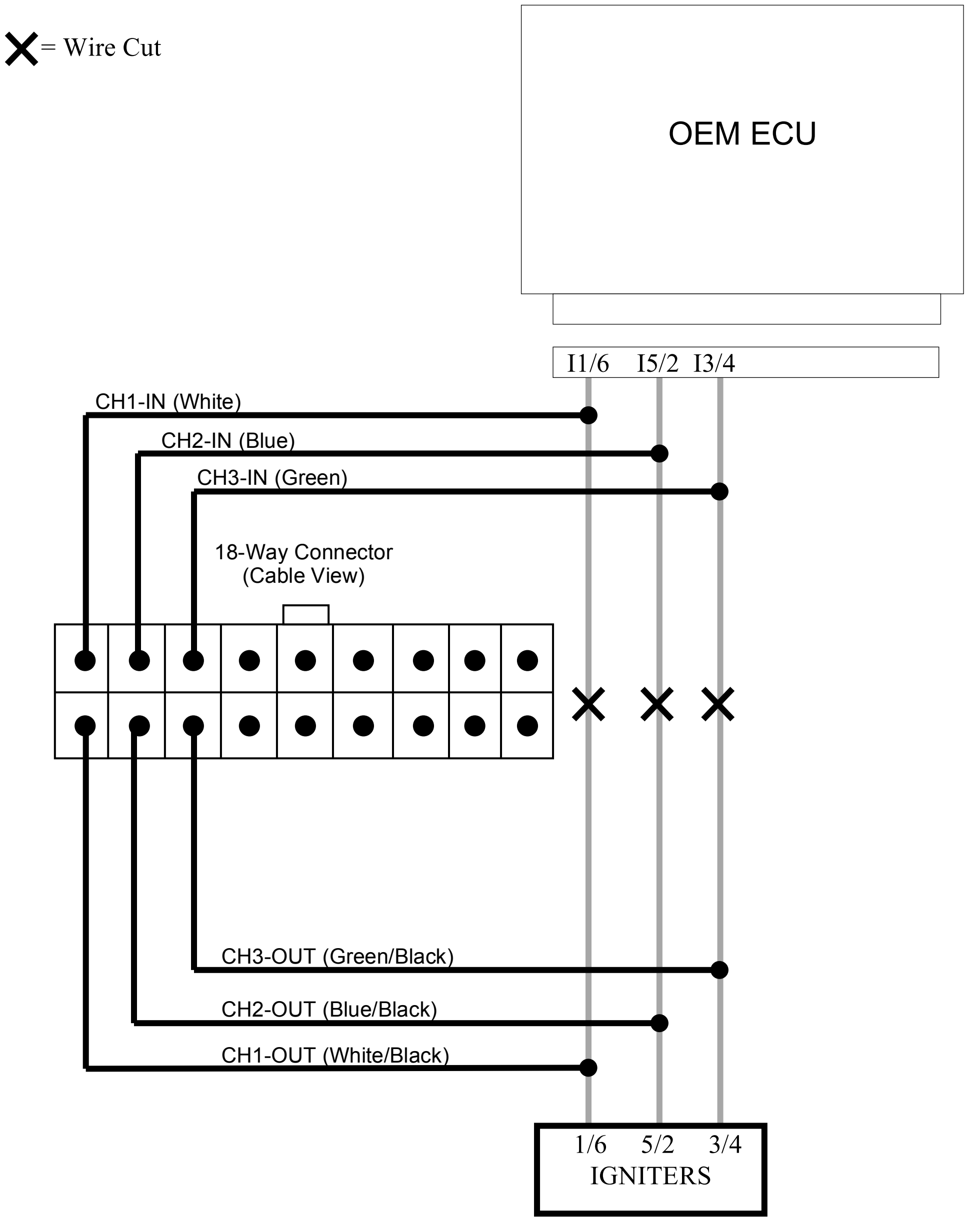
Inline 4 Cylinder Wasted Spark Igniters



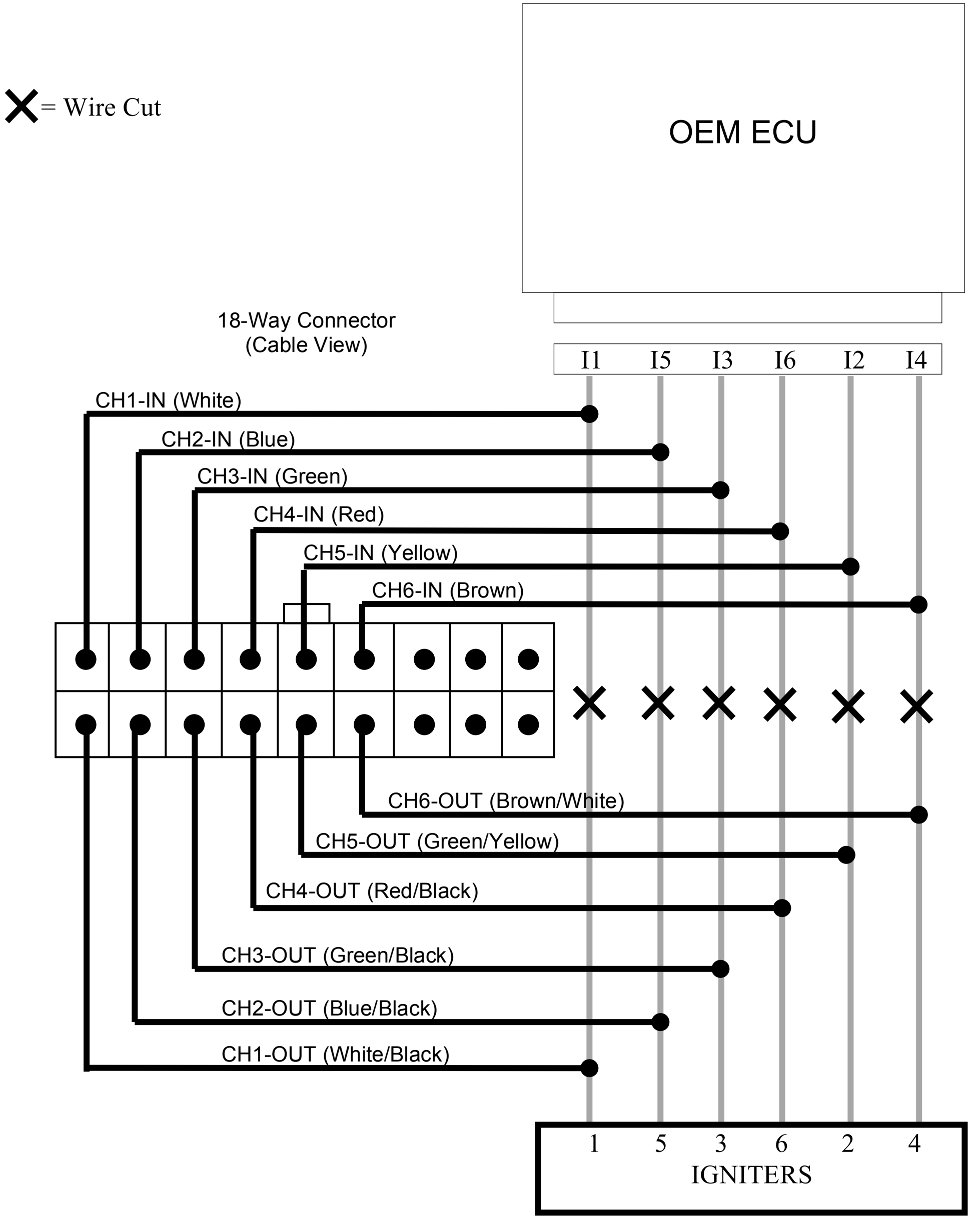
Inline 4 Cylinder Coil on Plug



Inline 6 Cylinder Wasted Spark Igniters

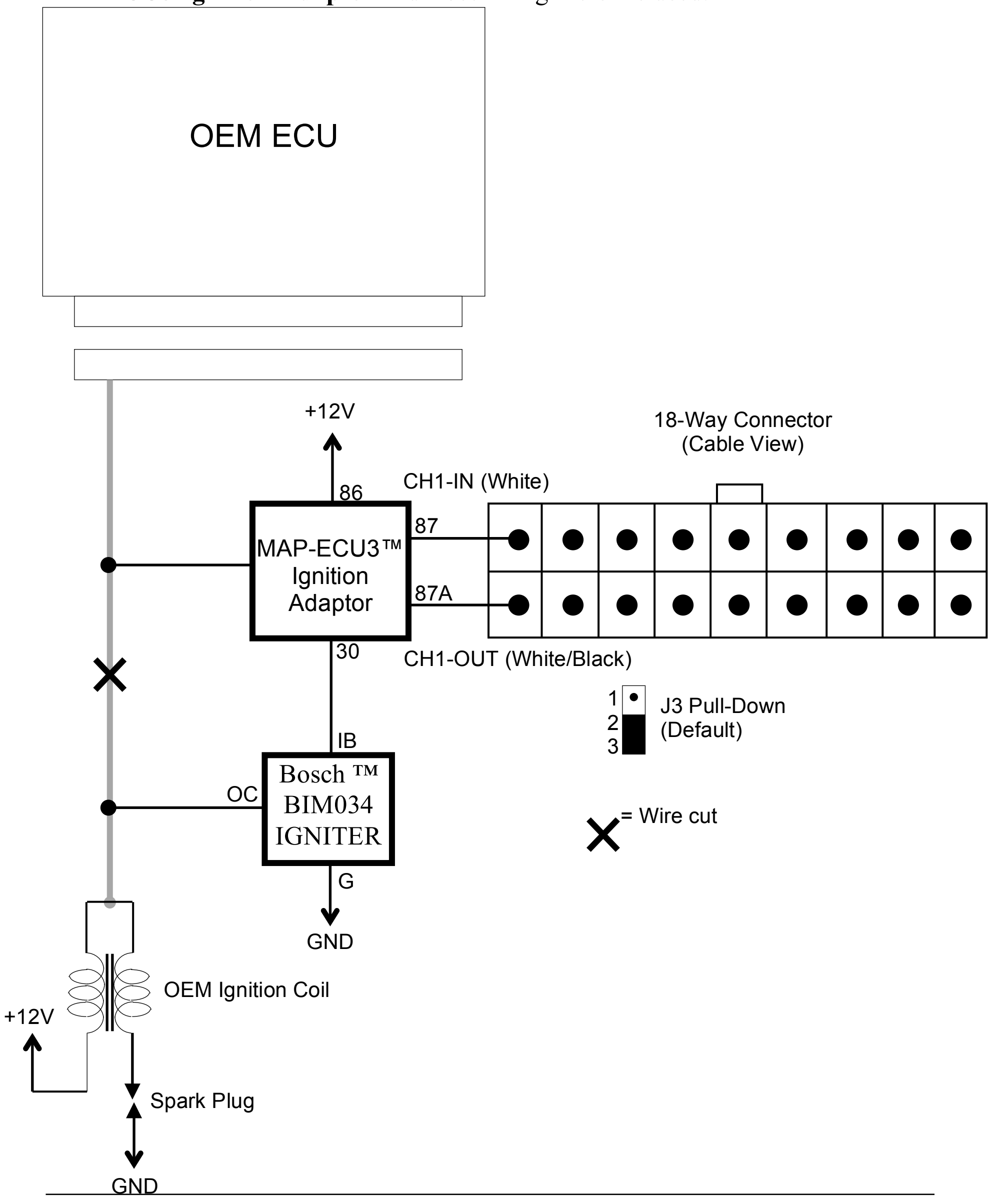


Inline 6 Cylinder Coil on Plug



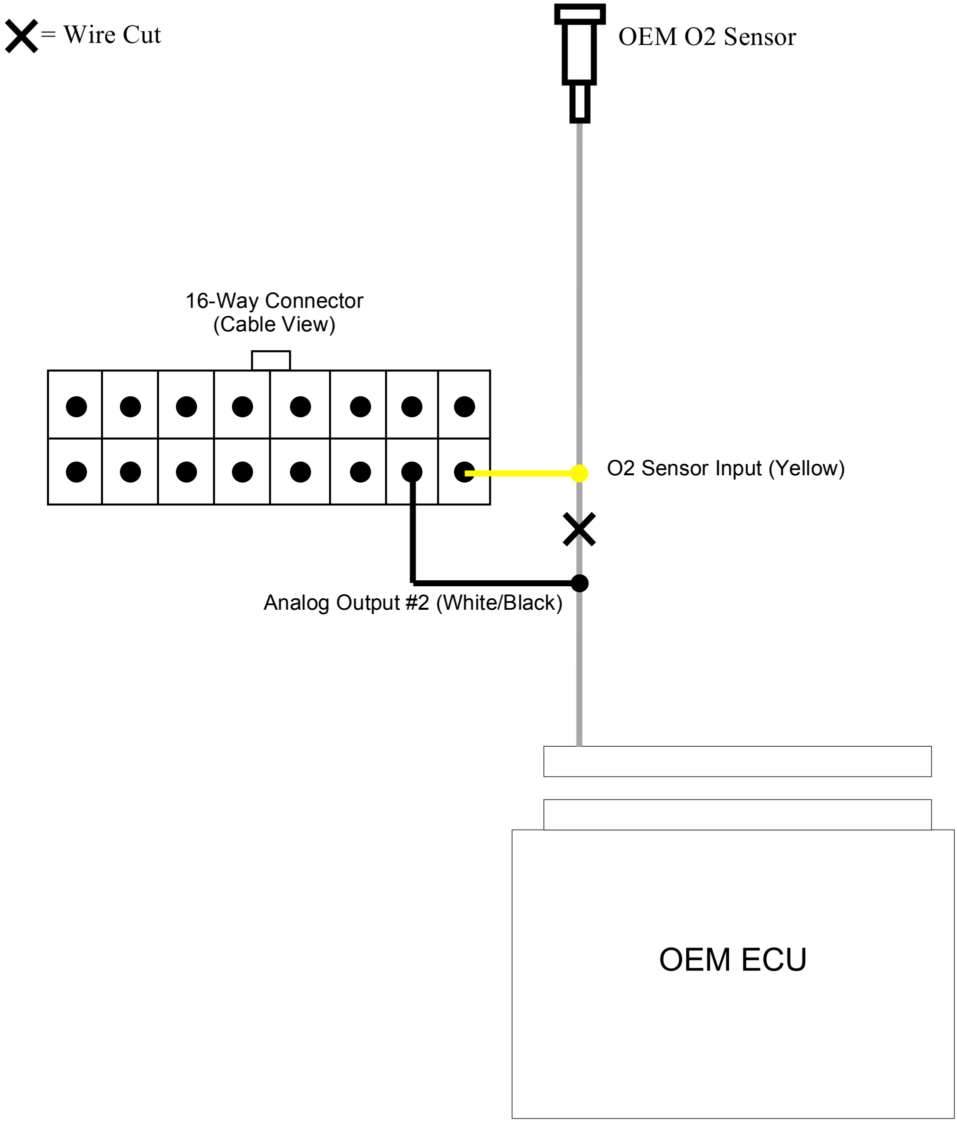
OEM ECU with Internal Igniter(s)

The following diagram illustrates an OEM ECU that drives Ignition Coil(s) directly in distributor, wasted spark and coil-on-plug configurations. In this example only one ignition coil is shown for simplicity, e.g. Distributor configuration. If the vehicle has multiple ignition coils, the same number **MAPECU3 Ignition Adaptor** and Bosch™ Igniters are used.



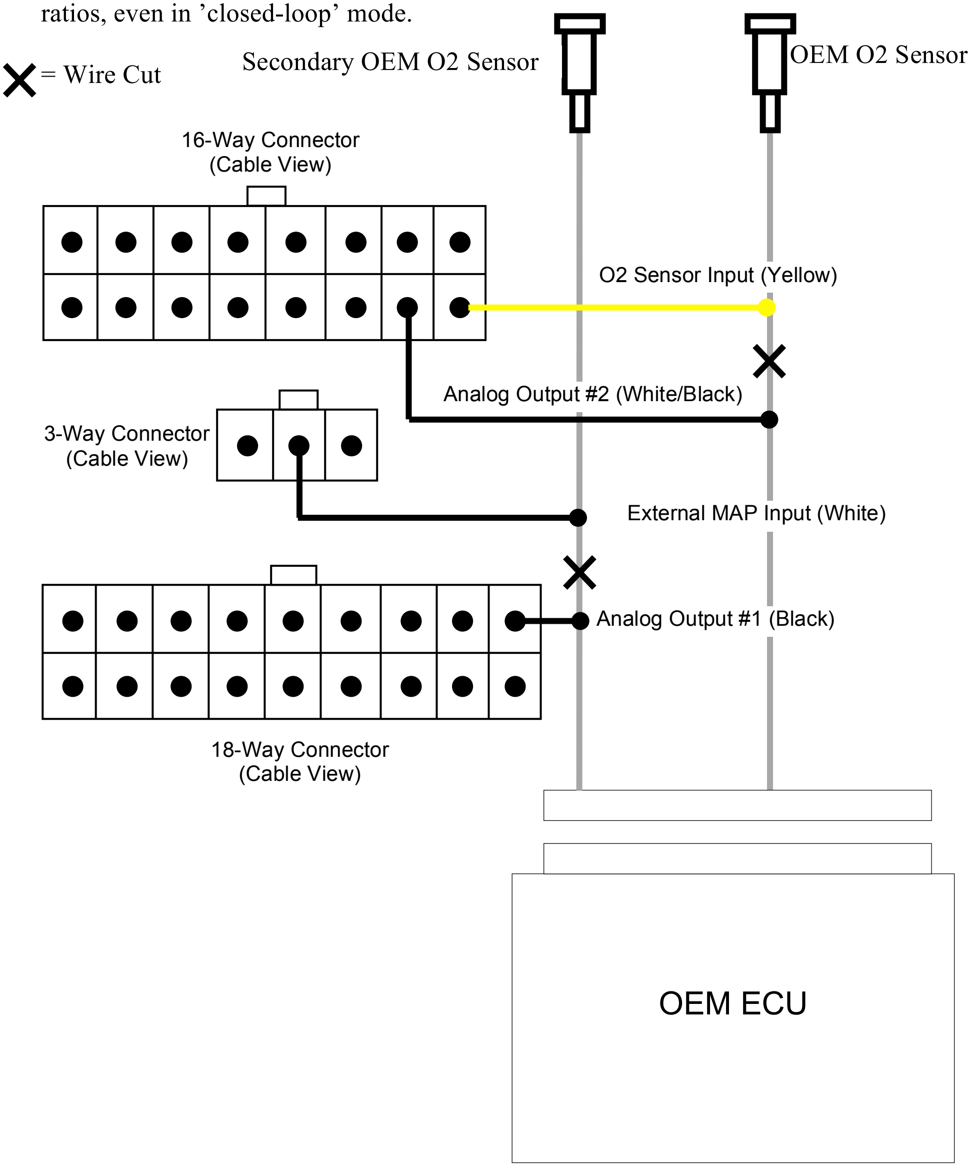
O2 Adjust Wiring (1, 2 & 4-Wire Sensors)

In the example below, the OEM O2 sensor (1, 2 & 4-wire) voltage is feed into the MAPECU3 O2 Input and the adjusted output is feed into the OEM ECU from Analog Output #2. Either Analog Output #1 or #2 can be used for the adjusted output. Using this mode, adjustments can be made to OEM Air/Fuel ratios, even in 'closed-loop' mode.



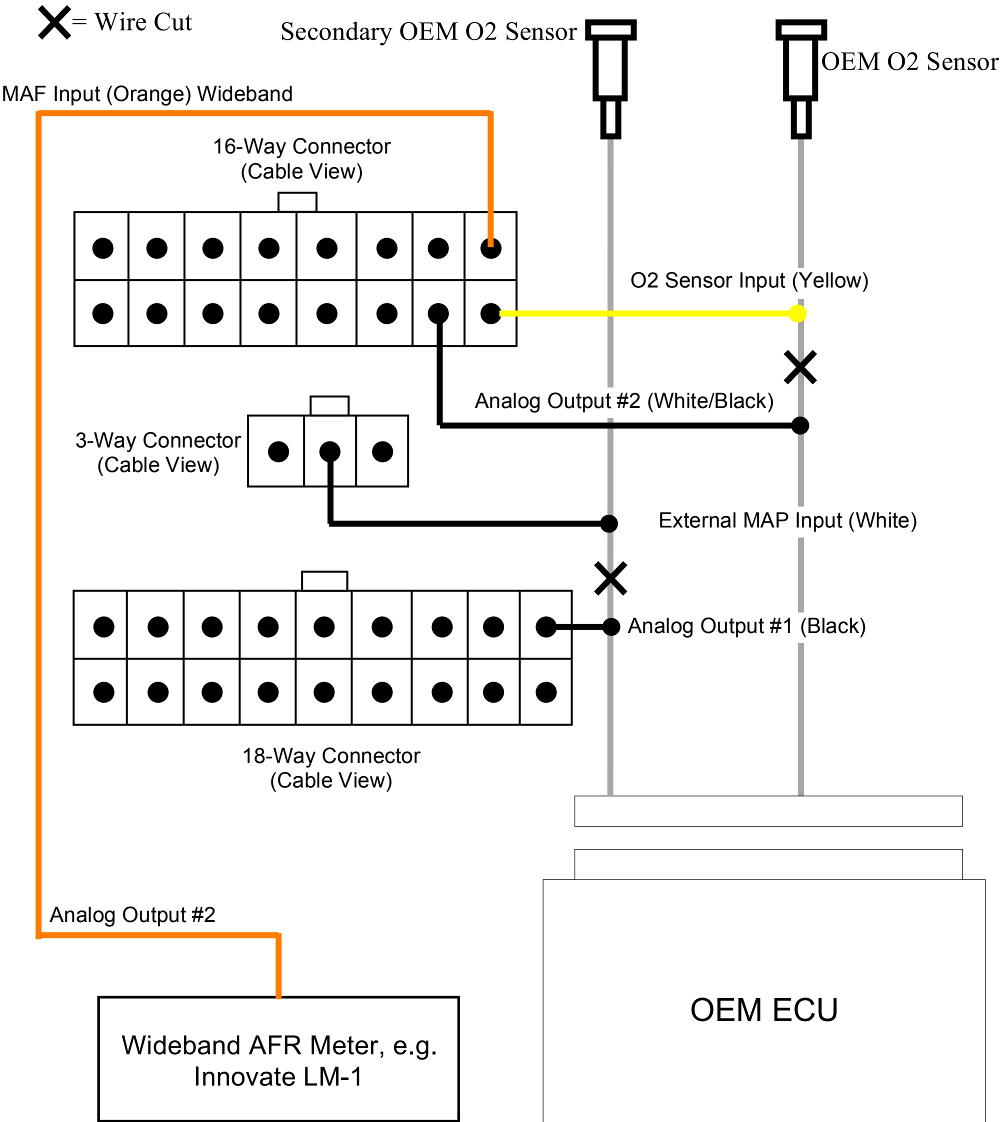
O2B Adjust Wiring (1, 2 & 4-Wire Sensors)

In the example below, the secondary OEM O2 sensor voltage is feed into the MAPECU3 External MAP Input and the adjusted output is feed into the OEM ECU from Analog Output #1. Either Analog Output #1 or #2 can be used for the adjusted output. Using this mode, adjustments can be made to OEM Air/Fuel ratios, even in 'closed-loop' mode.



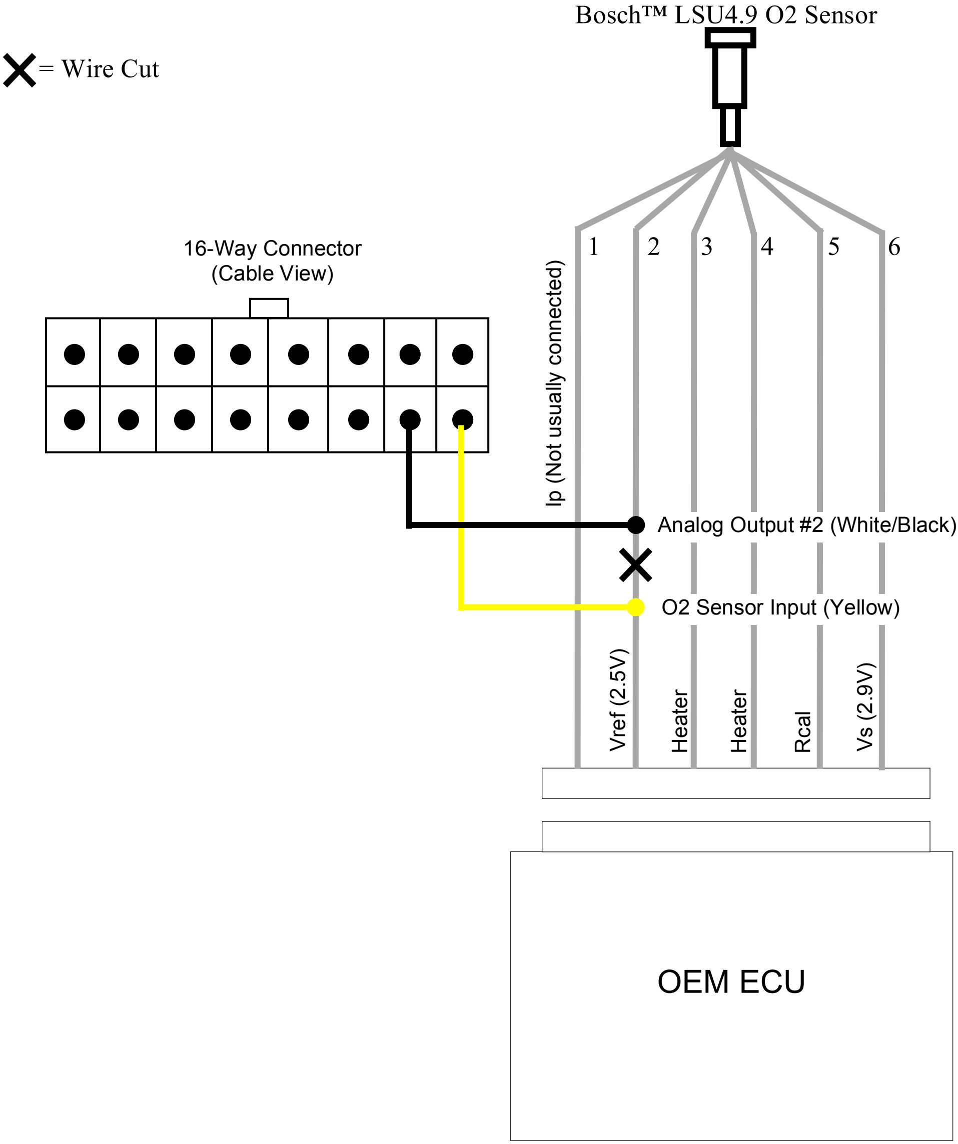
O2B Adjust Wiring with Wideband

In the example below, the MAF In Orange wire is configured for a Wideband AFR meter (Innovate LM-1) in addition to running dual O2 Adjust channels.



O2 Adjust Wiring (5/6-Wire Sensor)

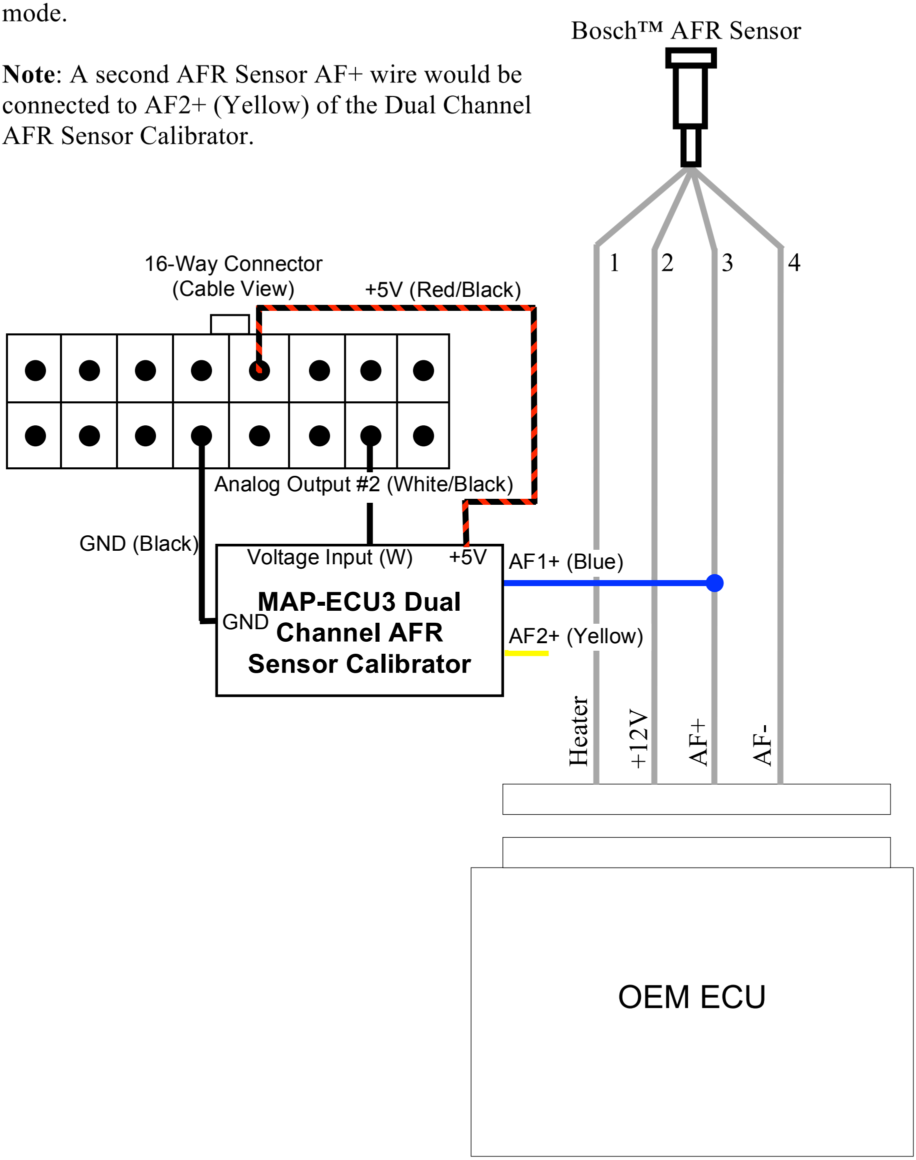
In the example below, a Bosch™ LSU4.9 Wideband O2 sensor (5/6-wire) 2.5V reference voltage is feed into the MAPECU3 O2 Input and the adjusted output is feed into the OEM ECU from Analog Output #2. Either Analog Output #1 or #2 can be used for the adjusted output. Using this mode, adjustments can be made to OEM Air/Fuel ratios, even in 'closed-loop' mode.



AFR Sensor Adjust Wiring

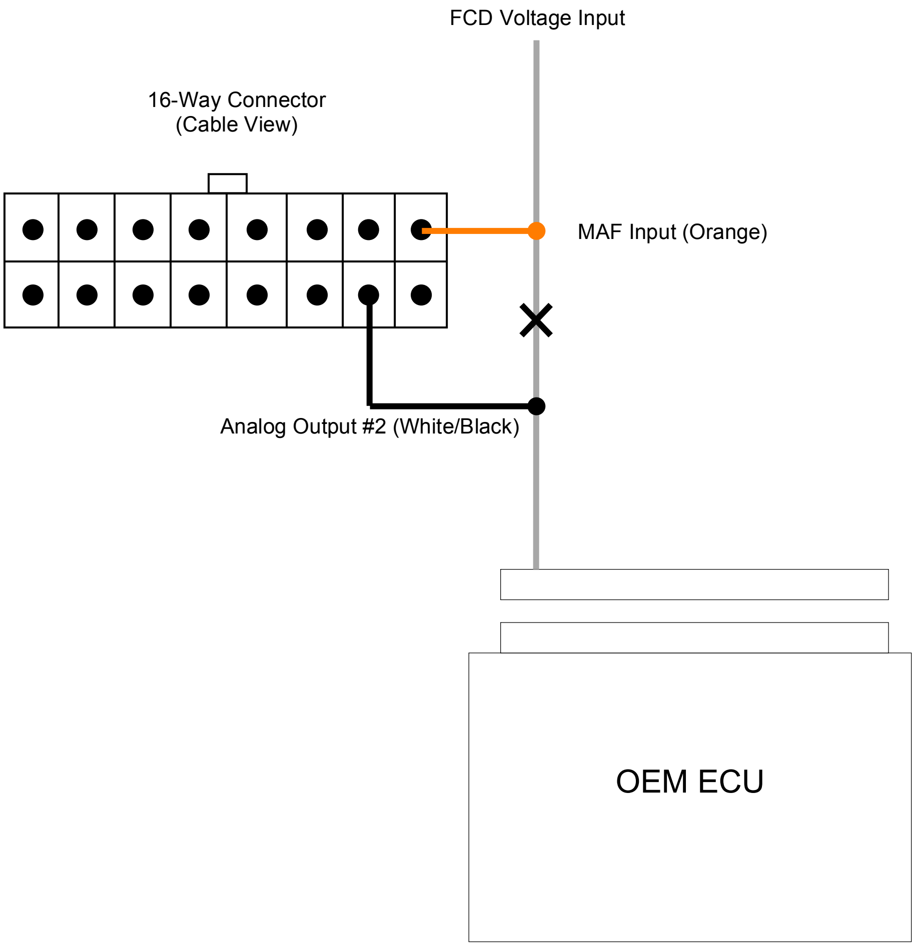
In the example below, a Bosch™ AFR (4-wire) current based sensor (as used in modern Toyota™ 4x4's) requires a MAPECU3 AFR Sensor Calibrator to adjust the AFR. The control signal in this example is Analog Output #2. Either Analog Output #1 or #2 can be used to control the AFR Sensor Calibrator. Using this mode, adjustments can be made to OEM Air/Fuel ratios, even in 'closed-loop' mode.

Note: A second AFR Sensor AF+ wire would be connected to AF2+ (Yellow) of the Dual Channel AFR Sensor Calibrator.



Fuel Cut Defeat Wiring

In the example below, the MAF Input is configured as the FCD Input and Analog Output #2 as FCD output. Typically, FCD voltage is derived from a MAP sensor or Air Flow Meter. The MAF Input (shown below) or External MAP Sensor Input can be used as the FCD input. MAF Output (KVF Mode), Analog Output #1 or Analog Output #2 can be used as the FCD Output.

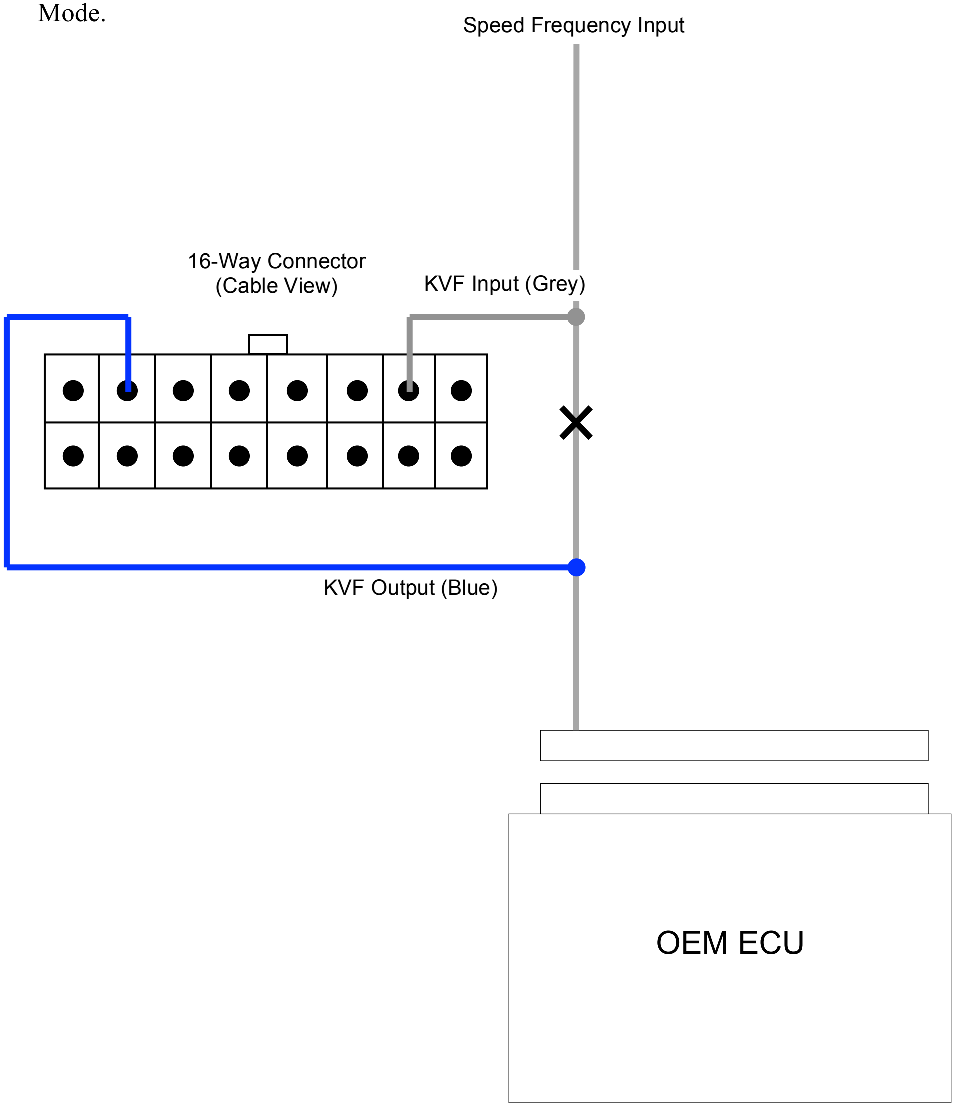


Note: If the MAPECU3 is providing the MAF, MAP or KVF signal from it's fuel table, an additional FCD function is not required as the fuel table can clamp the signal. See **Fuel Cut Defeat using the fuel table** elsewhere in this manual.

Speed Cut Defeat/Adjust

In the example below, the KVF Input is used as the frequency input and the KVF Output is used as the frequency output. The same configuration is used for Speed Cut Defeat and/or Speed Cut Adjust as the functions are combined.

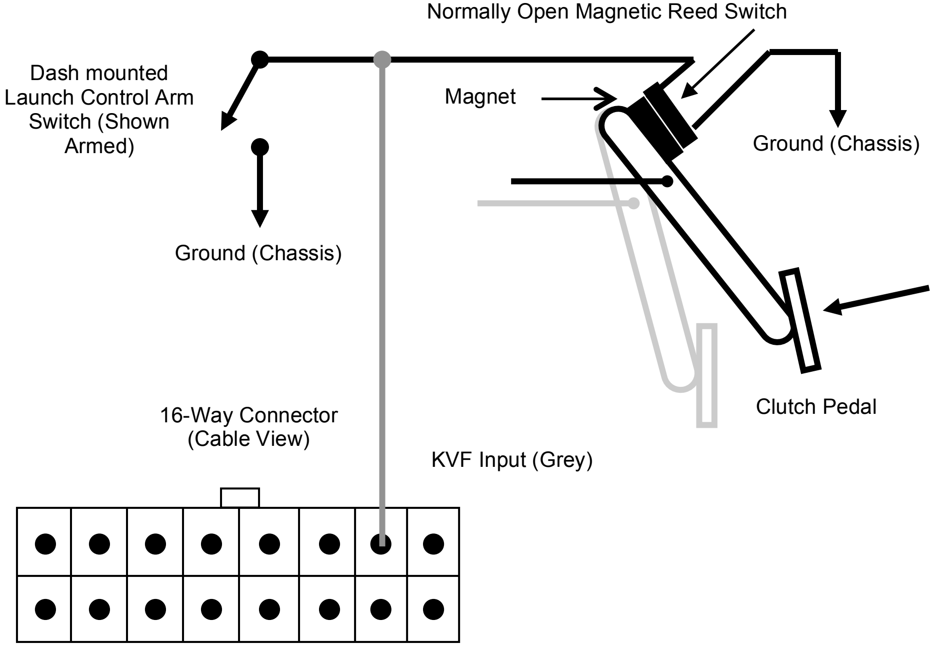
Note: Speed Cut Adjust can also be used for Vehicle Speed Adjustment.
Note: Speed Cut Defeat/Adjust is **only** available when the MAPECU3 is in MAF Mode.



Launch Control Wiring

KVF Input

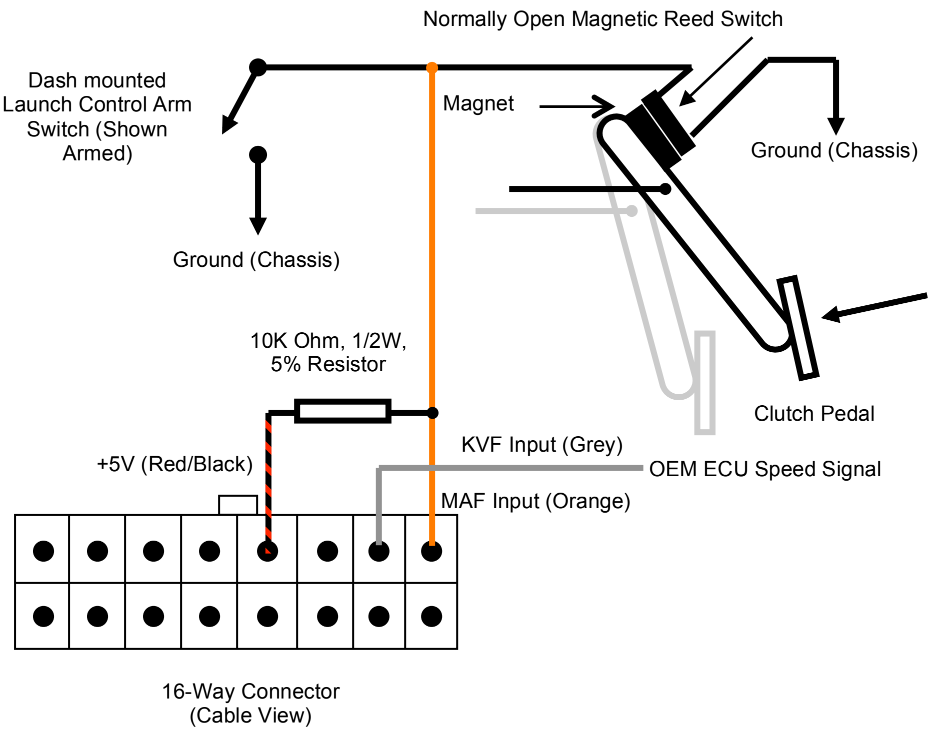
The following diagram illustrates the electrical installation of a magnetic reed switch on the clutch pedal and the launch control arming switch. The arming switch is usually mounted on the dashboard. The example below uses the KVF Input (Grey). The magnetic reed switch is 'closed' when your foot is off the clutch pedal, and 'open' when the clutch pedal is to the floor. The arming switch is shown in the 'Armed' position (open). When the arming switch is closed, Launch Control is disabled. **Note**: The minimum speed option is not available when using the KVF input for the clutch switch.



Note: A micro switch can be used instead of a Normally Open (NO) magnetic reed switch. Connect the common of the micro switch to Ground and the Normally Open (NO) connection to the LC Input. The micro switch should be closed when your foot is off the clutch pedal.

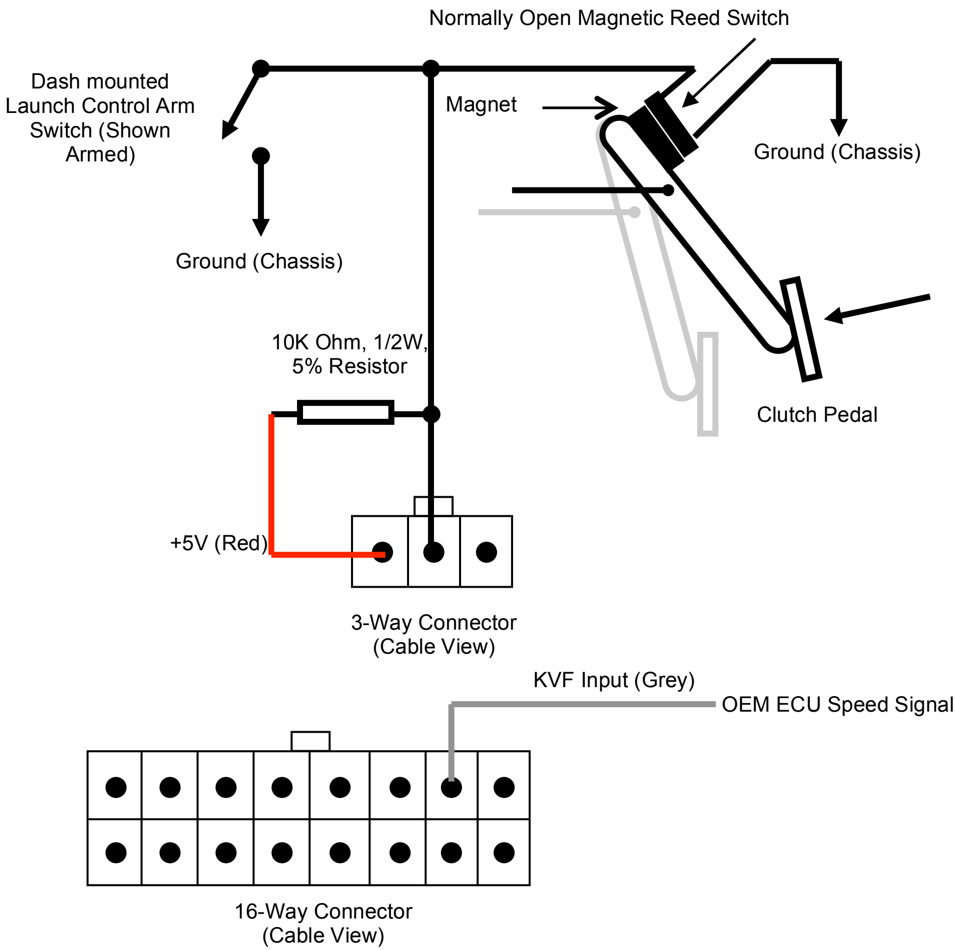
MAF Input

The following diagram illustrates the electrical installation of a magnetic reed switch on the clutch pedal and the launch control arming switch. The arming switch is usually mounted on the dashboard. The example below uses the MAF Input (Orange) for the clutch switch and the KVF input as an optional Minimum Speed input. The magnetic reed switch is 'closed' when your foot is off the clutch pedal, and 'open' when the clutch pedal is to the floor. The arming switch is shown in the 'Armed' position (open). When the arming switch is closed, Launch Control is disabled.



External MAP Input

The following diagram illustrates the electrical installation of a magnetic reed switch on the clutch pedal and the launch control arming switch. The arming switch is usually mounted on the dashboard. The example below uses the External MAP Input (White) of the optional 3-Way harness for the clutch switch and the KVF input as an optional Minimum Speed input. The magnetic reed switch is 'closed' when your foot is off the clutch pedal, and 'open' when the clutch pedal is to the floor. The arming switch is shown in the 'Armed' position (open). When the arming switch is closed, Launch Control is disabled.

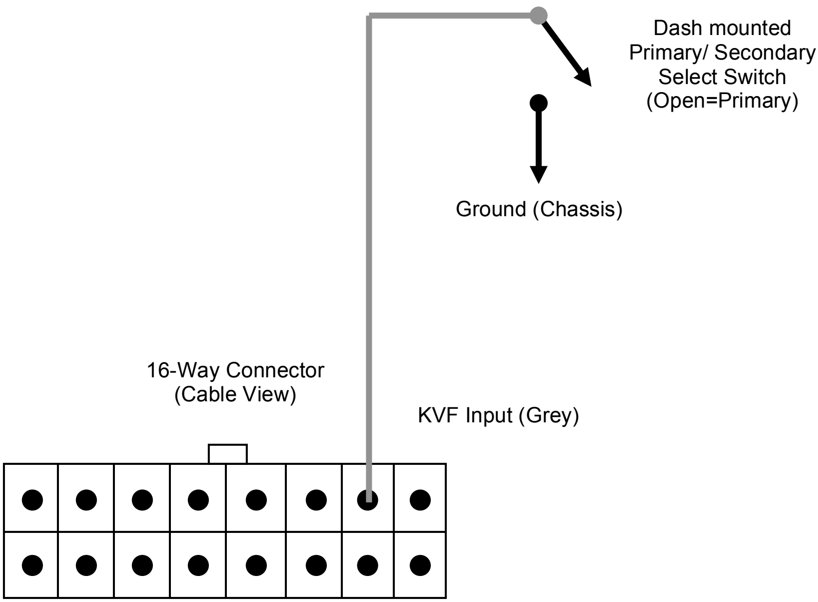


Primary/Secondary Select Wiring

The MAPECU3 controls Primary/Secondary table selection through the configured Pri/Sec input when Override Pri/Sec Switch is disabled. MAPCAL3 cannot alter which table is selected. When Override Pri/Sec Switch is enabled, MAPCAL3 takes control over Primary/Secondary table selection when connected to a MAPECU3.

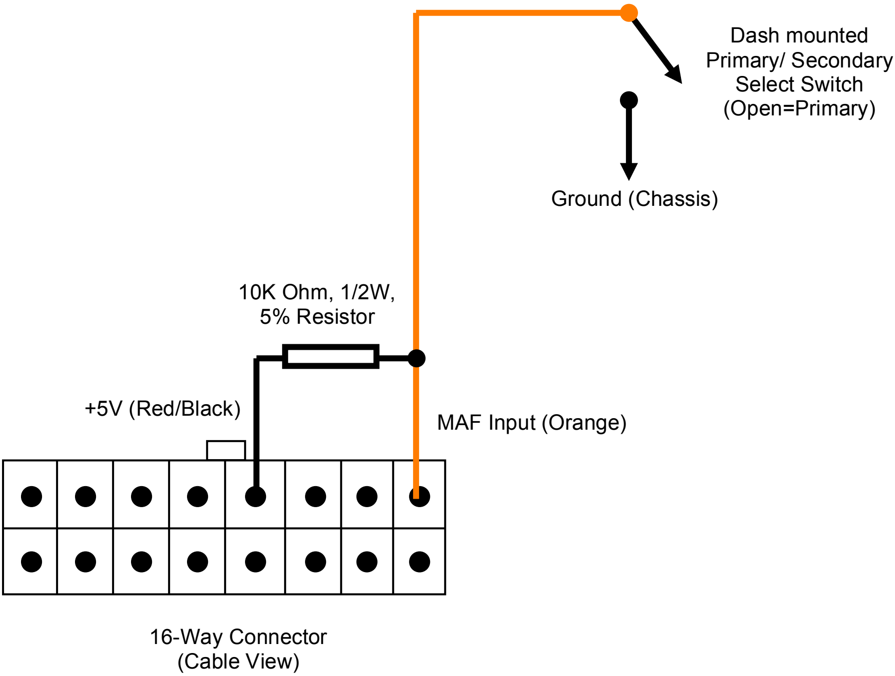
KVF Input

The diagram below illustrates the wiring diagram when the KVF Input is used for Primary/Secondary table selection:



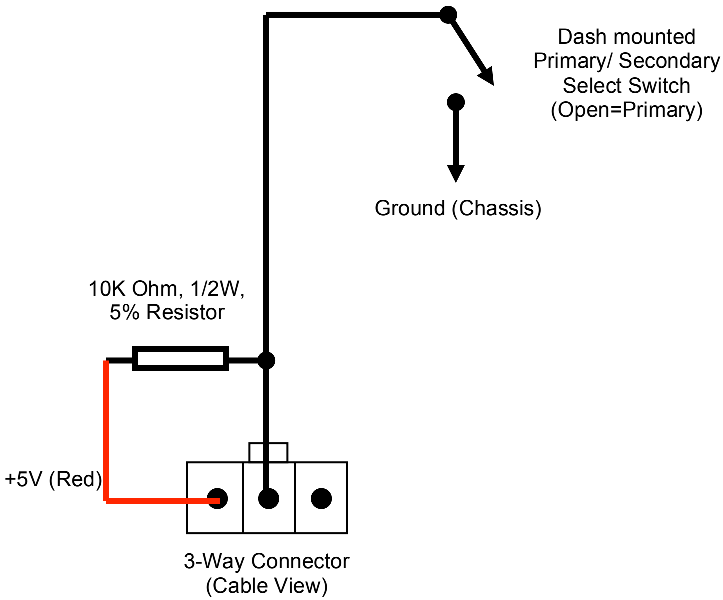
MAF Input

The diagram below illustrates the wiring diagram when the MAF Input is used for Primary/Secondary table selection:



External MAP Input

The diagram below illustrates the wiring diagram when the External MAP Input is used for Primary/Secondary table selection:



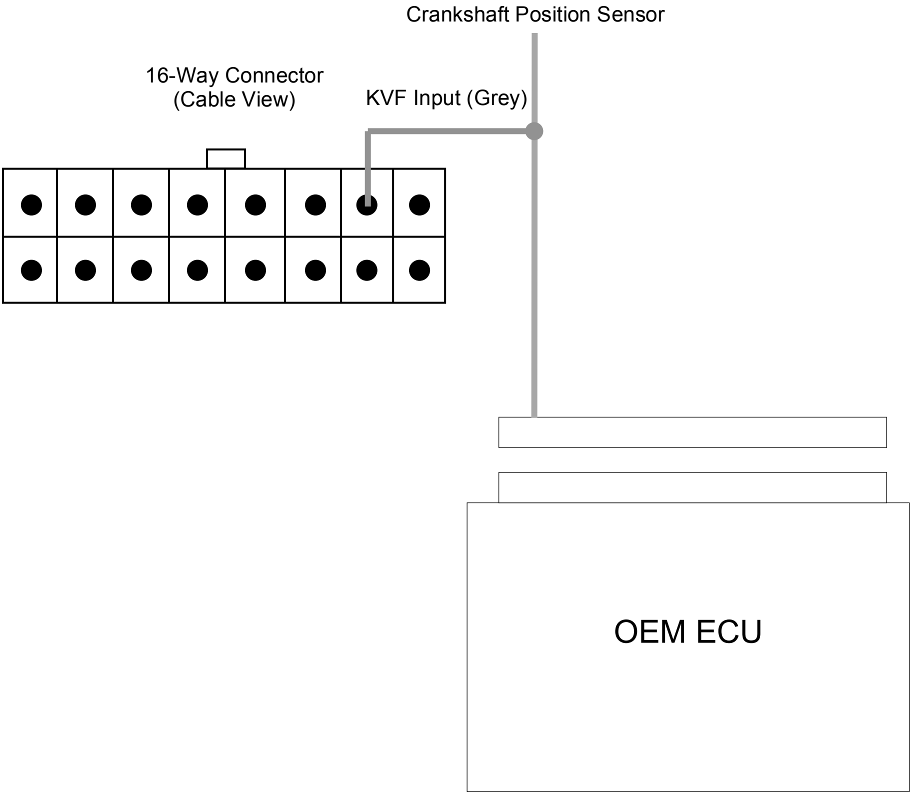
Base Timing Interface Wiring

Hall Effect Sensor

In order to display Base Timing in MAPCAL3, the MAPECU3 requires a crankshaft position sensor input for Top Dead Centre (TDC). The KVF Input is used for the TDC sensor input. The KVF Input requires a 5V peak-to-peak digital square wave where as most crankshaft position sensors are Variable Reluctance based which generate a non-digital signal. Some vehicles utilise a Hall Effect sensor which does generate a digital square wave signal that can be feed directly into a MAPECU3 as per the example below.

Note: Base Timing display is **not** available when the MAPECU3 is in any of the KVF Intercept Modes or KVF Learn mode.

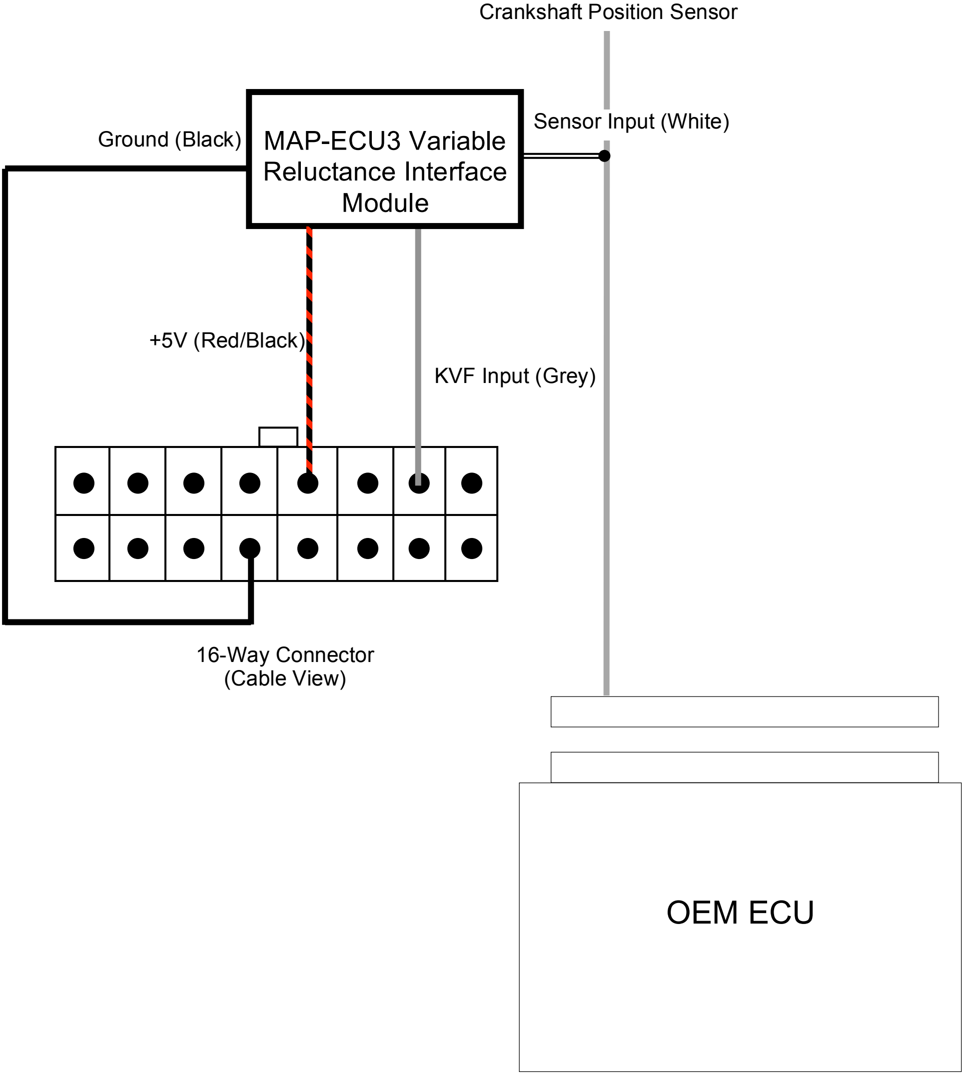
Note: Base Timing Display will alter if the Crankshaft Position Sensor moves during variable valve timing adjustments. This may affect Base Timing display on any engine with variable valve timing.



Variable Reluctance Sensor

Some vehicles utilise a Variable Reluctance sensor which does not generate a digital square wave signal that can be feed directly into a MAPECU3, and therefore requires an interface module as per the example below.

Note: Base Timing display is **not** available when the MAPECU3 is in any of the KVF Intercept Modes or KVF Learn mode.

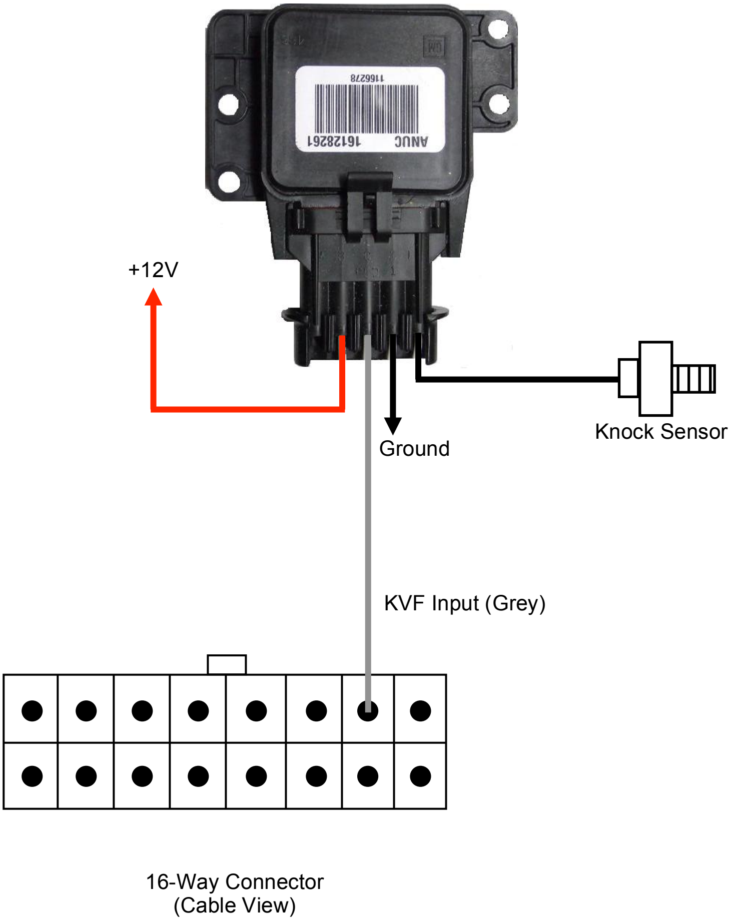


Knock Interface Wiring

In order to display Knock and retard timing based on Knock, an external Knock processor and sensor are required. The following components are recommended to for Knock detection:

- ESC Control Module – GM# 16128261
- ESC Control Module Connector – GM# 12101871
- Knock Sensor – GM# 10456288
- Knock Sensor Connector – GM# 12102621

The Knock Sensor must be bolted securely to the engine block. The diagram below illustrates the wiring of the above components to the MAPECU3:

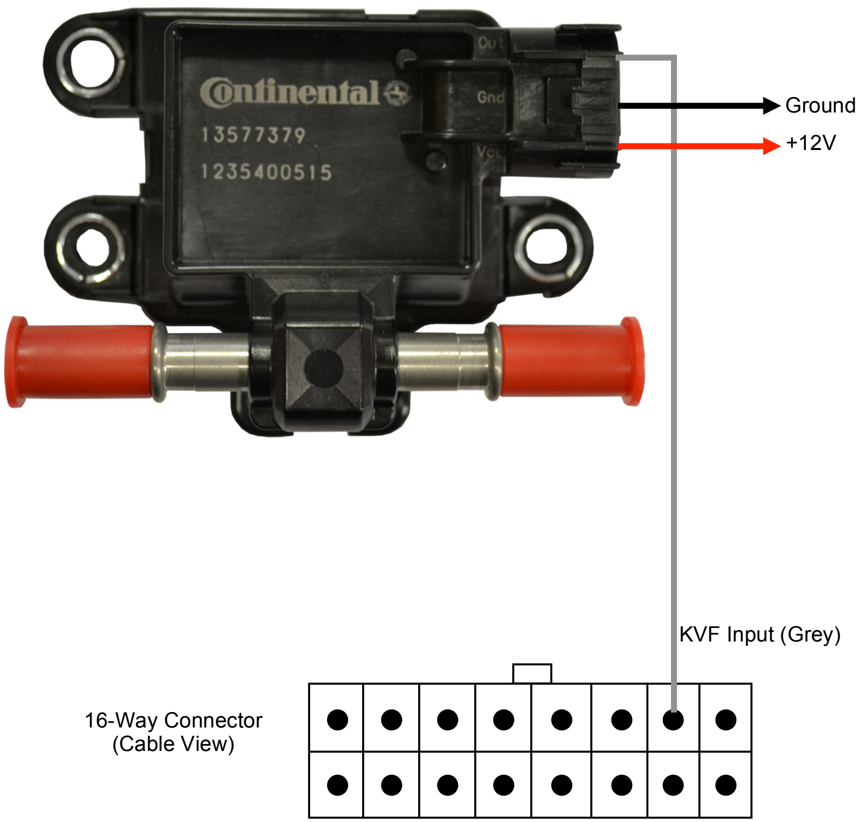


Flex Fuel Sensor Wiring (NEW)

Ethanol Percentage Only Mode

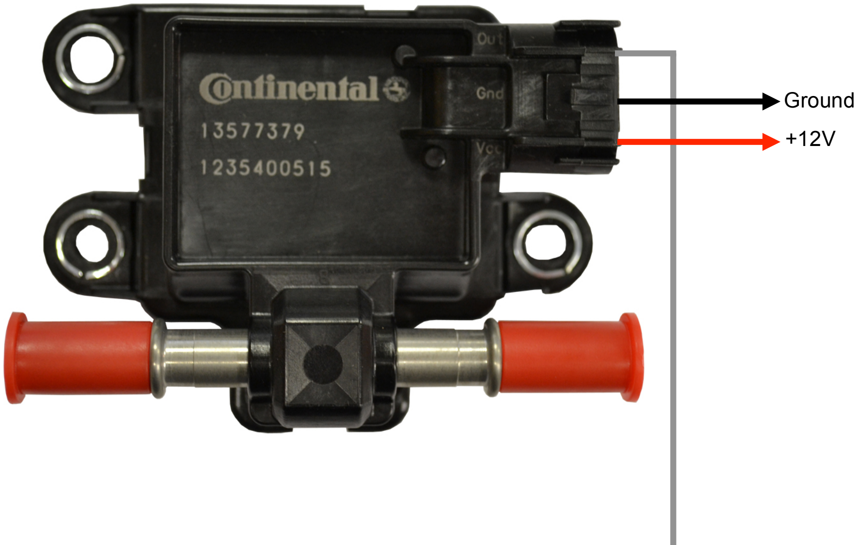
MAPCAL V3.5 includes Flex Fuel support where by the MAPECU3 will adjust between the Primary and Secondary fuel, ignition timing and auxiliary injector tables. A GM™ Fuel Composition sensor, as illustrated below, must be connected to the KVF Input. The KVF input must be configured as "Flex Fuel". In the default mode ***without*** a MAPECU3 Flex Fuel Temperature module, ethanol content is detected from the sensor and adjustments are made between the primary and secondary tables according to the 2D interpolation tables. The part number of the GM™ sensors are as follows:

- GM™ Fuel Composition Sensor: 13577394, 13577379, 13577739
- Delphi GT150 Connector



Ethanol Percentage & Temperature Mode

With the addition of the MAPECU3 Flex Fuel Temperature module, the MAPECU3 can also compensate for ethanol temperature. The wiring diagram for Flex Fuel ethanol content and temperature is as follows:



Warning: DO NOT CONNECT TO +12V!