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Installation Instructions and Setup Guide | Jason Russell

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Table of Contents

Initial Information

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No applicability of the hardware, firmware, other software, instructions, or documentation for a particular purpose is claimed.
All installers, diy-ers, and users are responsible for testing, installing, programming and using their units.
You understand that modifications are suitable to ruin your engine. Modifications usually invalidate any emission related certification, and most often invalidates the license to use the equipment (eg. car, snowmobile) at all. For off-road use only.
You understand that like any electronic or mechanical equipment, they can fail. Failing equipment in a vehicle can be fatal.
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In short, we can not cover every conceivable scenario. Please be aware of the consequences and plan accordingly. Be safe!

Planning Guide

Things you need to know before ordering an ECU:

- Crank trigger type
- Trigger wheel
- Cam trigger type (if applicable)
- Number of Cylinders
- Number of coils
- Type of coil (logic level or high current)
- Number of fuel injectors
- Type of fuel injectors (high impedance or low impedance)

- Type and value of temperature sensors
- Any accessories or options you may want
- MAP sensor range (2.5 bar, 3bar, 4bar, or external)

Order info, options, ignition outputs, EGT, Knock,

Getting Started

Grounds

From the outset it cannot be stressed enough just how important grounding is. 95% of all noise issues are due to poor grounding.
Grounds are connected strong, but near the ECU. There are two branches so the fluctuation of power signals do not interfere with the measured signals (most importantly: the trigger):
Power Ground handles the noisy and high currents generated by driving injectors, coils and solenoids.
Sensor Ground handles 0 to 5v signals from crank, throttle and temperature sensors. VR-trigger sensor at low RPM (cranking) is the most sensitive to noise.
The GROUND rules:

- connect GND and the 4 GND5 with short (preferably 10..15cm, max 20..30cm from EC36), strong (preferably 0.75mm2 or stronger) wires.
    - Power Grounds & Sensor Grounds MUST terminate at the same point - Common Ground. Run the wires into a single ring crimp so that there is no chance of one ground coming free.
- Keep the Power Ground connection (EC36 pin26, 5,21,22,32) pins to the Common Ground point short max 0.1 .. 0.3m,
    - use strong wires. Preferably all 5 wires should be 0.75mm2 or stronger. Some installations (particularly with no PWM-ing) could tolerate somewhat longer wires, but why risk it ? (ground problems are like ghosts, very hard to track down). The length of wire(s) from this common ground point to battery / chassis can be longer (and usually are long). Strong wires must be preferred (total 4mm2), and not longer than necessary. But at least nowhere near as sensitive as the wires right at the ECU.
    - connect the ground of the sensors to the Common Ground point or to the sensor ground branch, that is EC36pin26.
    - Connect Power Grounds to the Common Ground point, or anywhere you like (except the sensor-ground branch)
- Failure to connect Sensor Ground and Power Ground will damage your VEMS. Even on the test bench !

Power Grounds

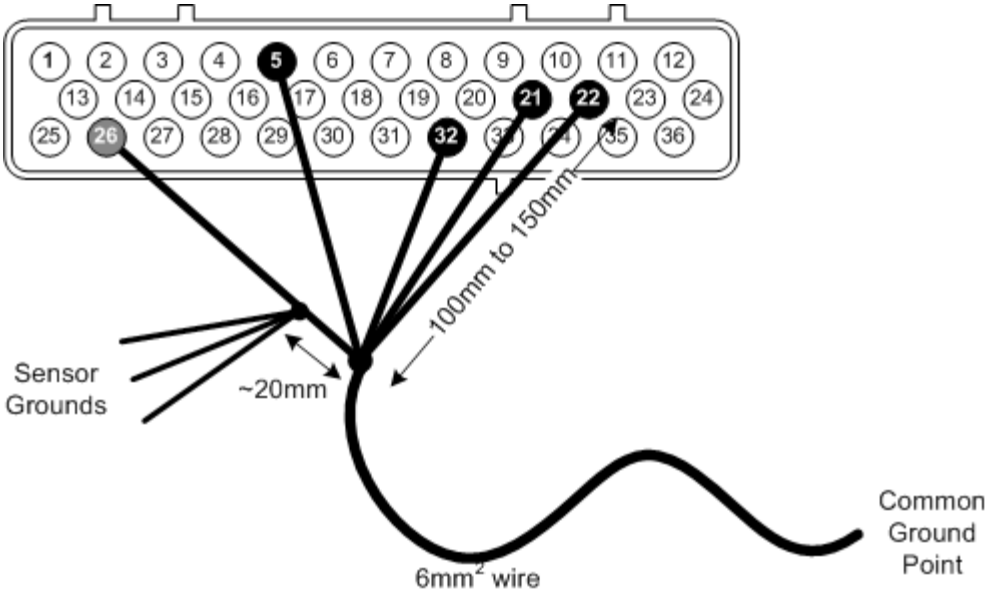
Also called as "GND5" in some documents

- EC36-pin5 to Common Ground
- EC36-pin21 to Common Ground
- EC36-pin32 to Common Ground

- EC36-pin22 to Common Ground

Sensor Ground

- EC36-pin26 to Common Ground. NOTE: Sensor Ground pin has many connections (CAS, TPS, IAT, CLT ...) make provision for this in your wiring loom.

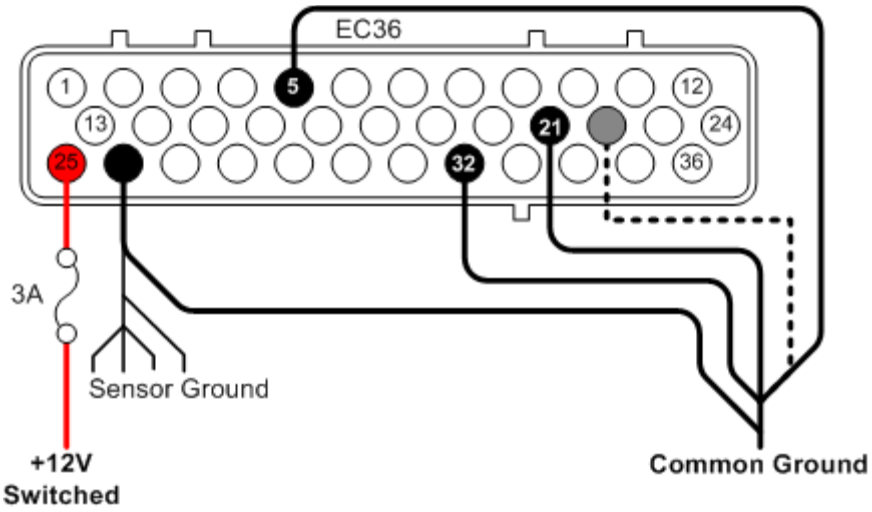


+12V Supply

- EC36-pin25 3A Fused +12v supply

Note that if you have moved the battery to the rear of the car you may want to run separate wires for the starter/alternator and for the cars electrical system to the battery. Otherwise the several meters long cable will cause a significant voltage drop during cranking that will cause the ECU to reset when the battery starts to run low. This may prevent the car from starting even if the engine cranks over.

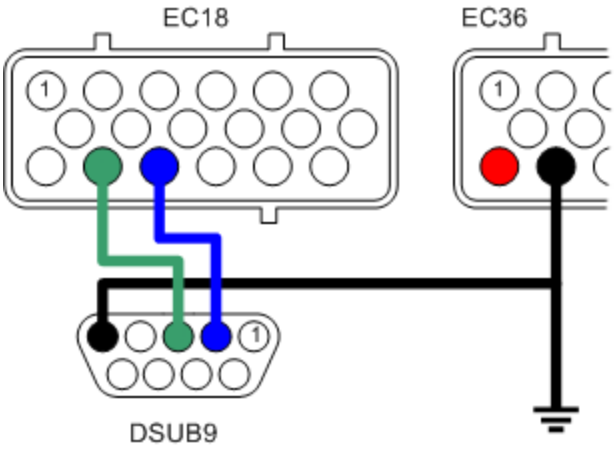
Once you have connected and checked the continuity of ground you can connect your VEMS unit to the EC36 plug and apply the power supply. There is little point in connecting power until the serial connector is added though.



Connecting serial port

To allow the connection of the VEMS unit to your PC a serial port plug must be connected as follows.

- EC18-pin14 to DSUB9-pin3
- EC18-pin15 to DSUB9-pin2
- EC36-pin26 to DSUB9-pin5 (GND).



VemsTune

VemsTune is our tuning software. We've taken great care to make it robust and comprehensive while allowing very quick configuration and tuning for the person calibrating the engine. It can be downloaded freely from http://www.vems.hu/vt/. Select “Latest Nightly” in most normal cases, unless you have problems and support instructs otherwise. The built-in help is extremely comprehensive and covers nearly every detail of the ECU configuration.

Connect essential sensors

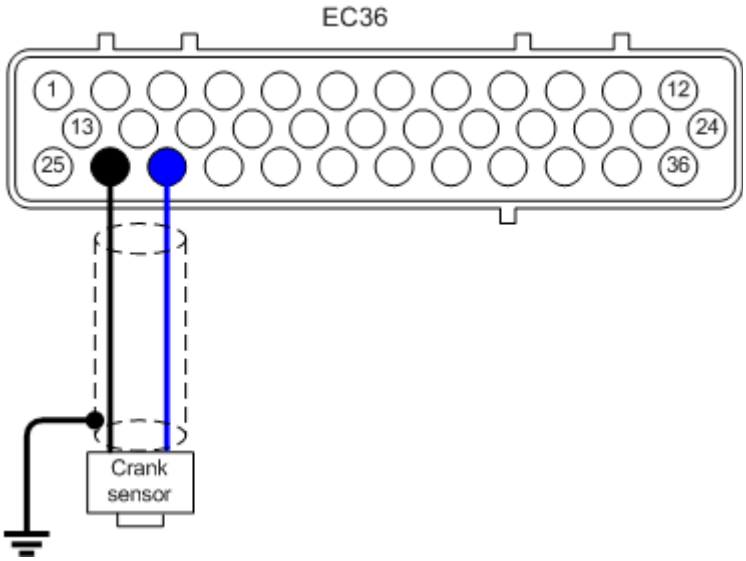
Crank Trigger

The trigger is the engine management system's most fundamental sensor, without one VEMS cannot calculate engine speed or crank angle. If you are connecting VEMS to an engine that has an existing engine management system, if not then a triggering method will need to be put in place.
The simplest type of trigger is to use the existing distributor to provide a pulse for each cylinder. This type of trigger is more than adequate for driving ignition through a distributor and batch fire injection.

Connecting the primary trigger (Crank)

Magnetic sensor / Variable reluctance (VR)
Mechanical considerations (need to be written somewhere and referenced from here)
The VR sensing circuitry is very sensitive to electrical noise, shielded cable (coax) must be used and good grounding is vital.

- EC36-pin27 VR+ Note that some other ECUs trigger on positive-going edge so their schematic might mark the + and GND swapped: so don't blindly follow naming from autodata pinout or some schematic, keep in mind that + and - might need to be swapped. Measure to be sure: InputTrigger/TriggerLog

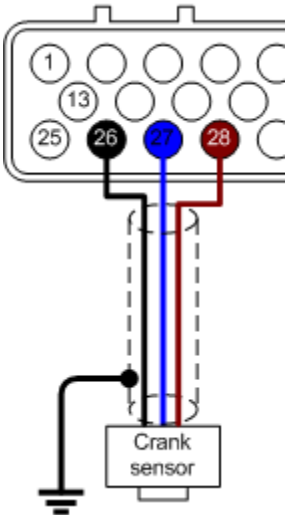


- EC36-pin26 VR-

Shielding should be grounded to engine block close to the VR Sensor.

Hall Sensor
VEMS is available configured for Hall sensors, these are more noise tolerant and require a +5V (or sometimes +12V for some sensors) supply.

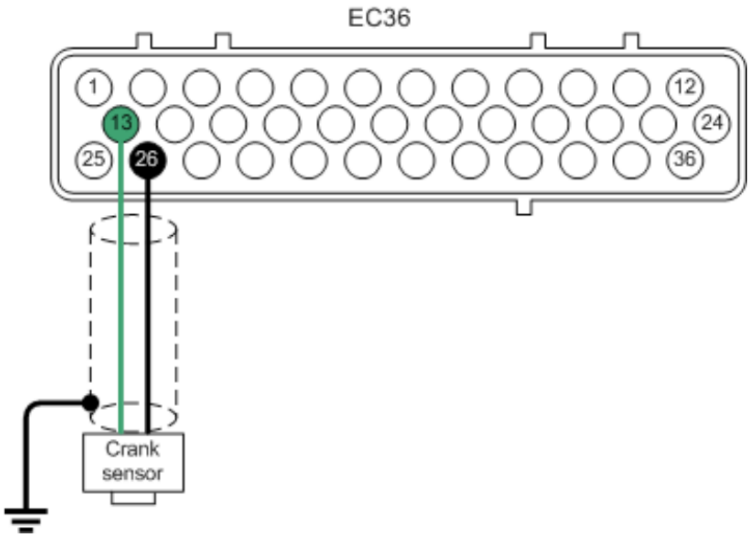
- EC36-pin27 Hall signal
- EC36-pin26 Ground
- EC36-pin28 +5V



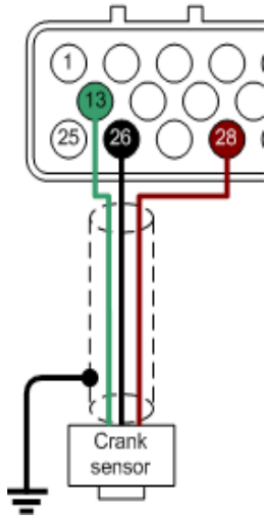
Configuring the crank trigger

Connecting the Secondary Trigger (Cam)

VR type



Hall Effect Type



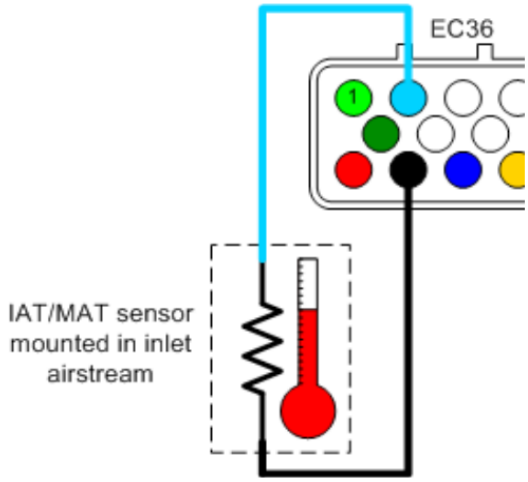
Configuring the Secondary Trigger (Cam)

Temperature Sensors

VEMS uses two temperature sensors: Inlet Air Temperature which is used in speed/density systems to calculate the amount of fuel required. And Coolant Temperature which is used to meter the required amount of warm-up fuel enrichment.

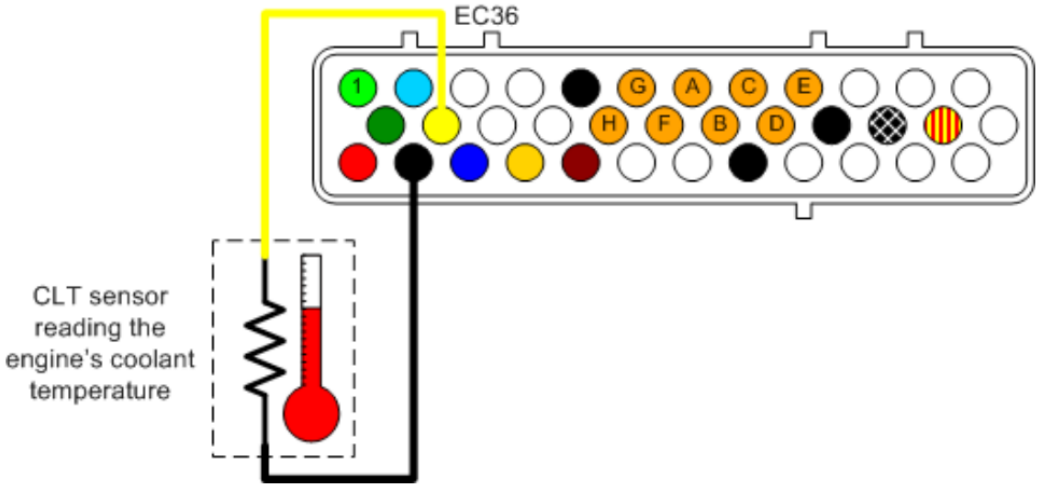
IAT – Inlet Air Temperature

- EC36-pin2 Signal
- EC36-pin26 Ground



CLT – Coolant Temperature

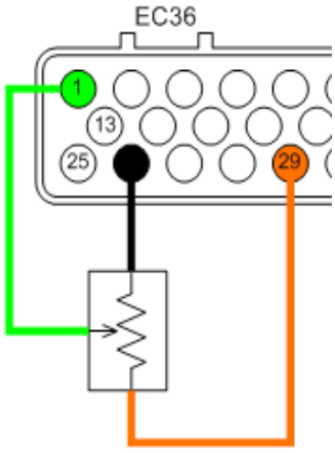
- EC36-pin14 Signal
- EC36-pin26 Ground



TPS – Throttle Position Sensor

The throttle position sensor is used by VEMS to provide fuel requirements in Alpha-N configuration and acceleration enrichment.

- EC36-pin29 TPS (+5v) out
- EC36-pin1 Wiper out (0-5v)
- EC36-pin26 Ground



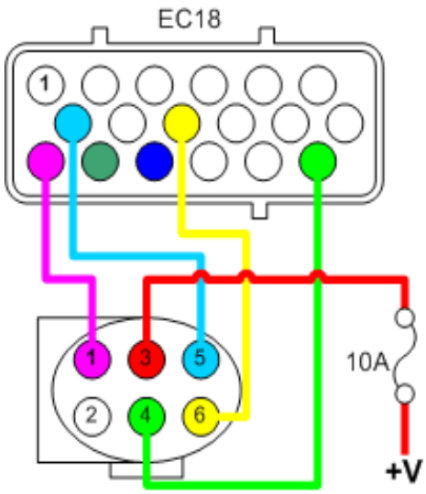
Configuring the TPS sensor

In VemsTune, go to the Tools Menu and Select “TPS Calibration Wizard.” When you start the calibration the wizard will instruct you on when to depress the throttle pedal and when to release it, also when to click. Any time you adjust your physical throttle stop, this should be done as well.

Secondary Sensors

WBO2

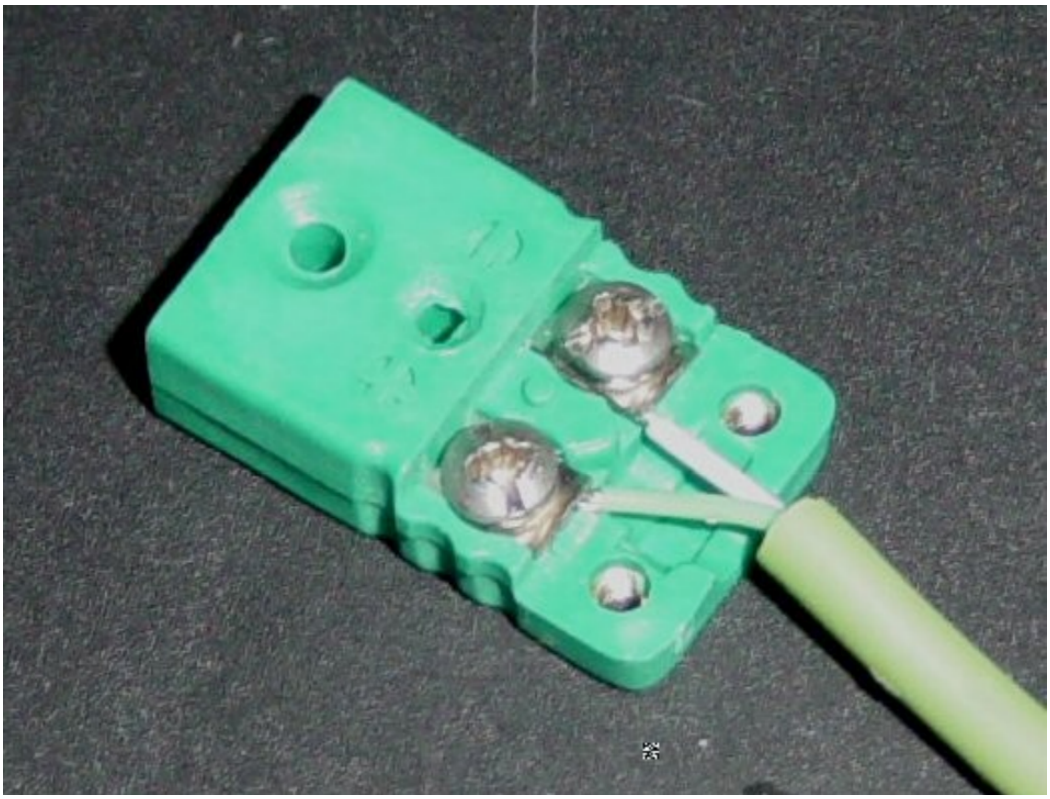
- EC18-pin13 to WB6-pin1 (Nerst Cell Signal)
- EC18-pin7 to WB6-pin5 (WBO2 Pump-)
- EC18-pin18 to WB6-pin4 (WBO2 Heater)
- EC18-pin9 to WB6-pin6 (WBO2 Pump+)



EGT

There are 2 standards that are the most common. You must make sure the + and - are connected properly. Everything is the same between the standards other than the colors. They are fully interchangeable.

	British standard	American Standard
connector	green	yellow
wire insulation	green	yellow
+ wire	green	yellow
- wire	white	red

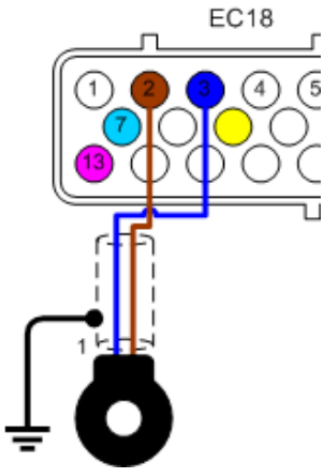


Knock

Tuning the knock sensor is not a trivial task, and can take a considerable amount if time and experimentation to get right. Configuring the knock dynamics of an engine and over coming issues of mechanical noise can take a lot of time and effort, therefore you must not rely on the knock sensor to prevent knock, this can only be done by sensible tuning and using the correct octane fuel for your application.

Although VEMS will work with a variety of knock sensors the ones that have been tried and tested are Bosch, although other 2 or three wire sensors may work. Do not use a single wire knock sensor as they use the common ground of the block to create the circuit, using the block will inject too much noise into the sensitive knock circuitry.

To configure knock, see the Knock Sampling item under the Inputs menu of VemsTune. Press F1 to bring up the built-in help and there's a thorough explanation there.



•EC18-pin3 Knock sensor signal (Bosch type pin1)
•EC18-pin2 Knock sensor ground (Bosch type pin2)

Some Bosch type sensors are 3 wire type, pin3 is the cable's shield. On either type of sensor the shield should be grounded near or on the engine block.

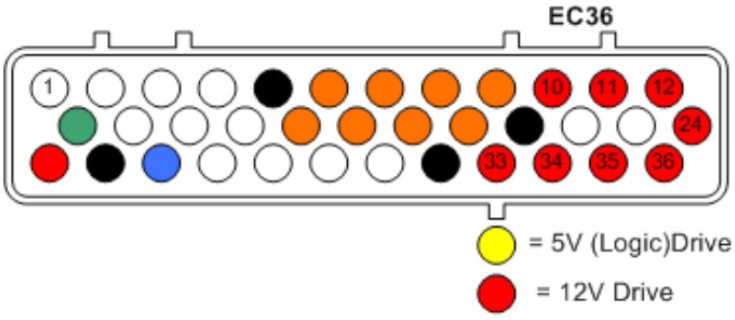
Primary Outputs

NOTE: VEMS acts as a switch between the Component (injector, relay, ignition coil) and ground. VEMS does not provide the power to these components.

Connecting Ignition Components

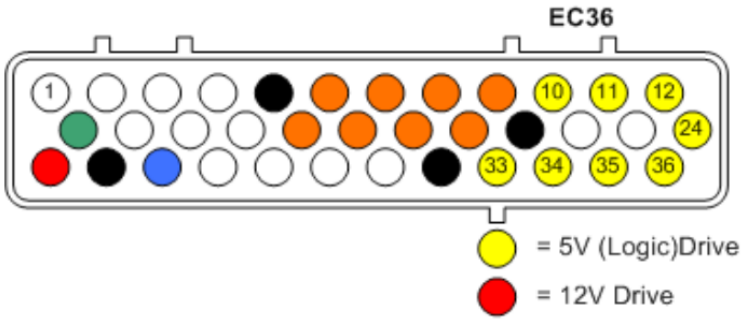
The unit can be ordered with one of five possible Ignition Channel Options.

Option 8 All 8 channels are high current control channels: (most common)



12V Drive	
Coil 0	EC36pin35
Coil 1	EC36pin33
Coil 2	EC36pin34
Coil 3	EC36pin36
Coil 4	EC36pin11
Coil 5	EC36pin12
Coil 6	EC36pin24
Coil 7	EC36pin10

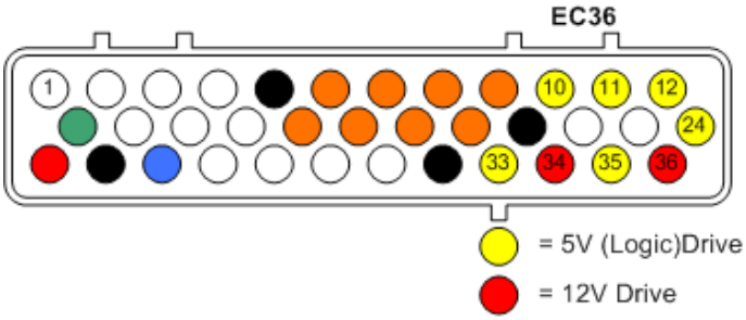
Option 0 All 8 ignition channels are using logic level(+5v) control for coils that have built in igniters or systems where you wish to use an existing igniter pack:



5V (Logic) Drive

Coil 0	EC36pin35
Coil 1	EC36pin33
Coil 2	EC36pin34
Coil 3	EC36pin36
Coil 4	EC36pin11
Coil 5	EC36pin12
Coil 6	EC36pin24
Coil 7	EC36pin10

Option 2+6 Two channels are high current, the other 6 are logic level:



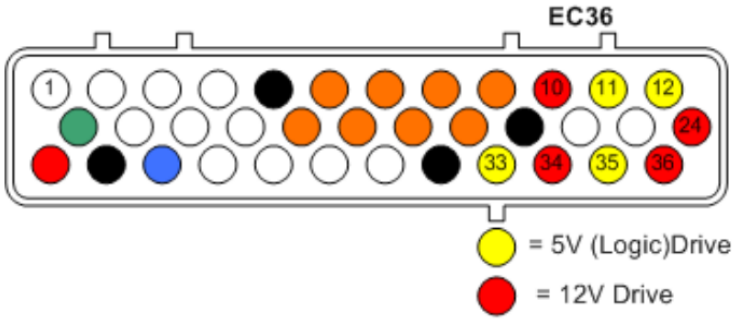
12V Drive

Coil 2	EC36pin34
Coil 3	EC36pin36

5V (Logic) Drive

Coil 0	EC36pin35
Coil 1	EC36pin33
Coil 4	EC36pin11
Coil 5	EC36pin12
Coil 6	EC36pin24
Coil 7	EC36pin10

Option 4+4 Four high current channels, Four logic level:



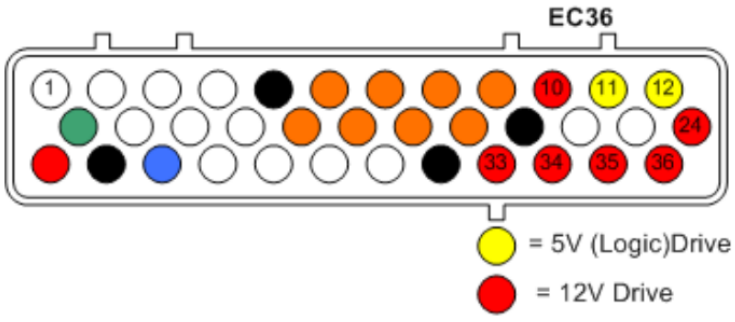
12V Drive

Coil 2	EC36pin34
Coil 3	EC36pin36
Coil 6	EC36pin24
Coil 7	EC36pin10

5V (Logic) Drive

Coil 0	EC36pin35
Coil 1	EC36pin33
Coil 4	EC36pin11
Coil 5	EC36pin12

Option 6+2 Six high current channels, two logic level:



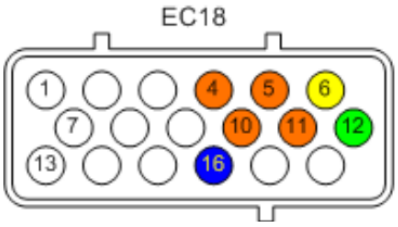
12V Drive

Coil 0	EC36pin35
Coil 1	EC36pin33
Coil 2	EC36pin34
Coil 3	EC36pin36
Coil 6	EC36pin24
Coil 7	EC36pin10

5V (Logic) Drive

Coil 4	EC36pin11
Coil 5	EC36pin12

Alternative Connection If you are using an external ignition module/igniter pack you can also use the Stepper Motor outputs as control channels:



Coil 0	EC18pin4
Coil 1	EC18pin10
Coil 2	EC18pin5
Coil 3	EC18pin11

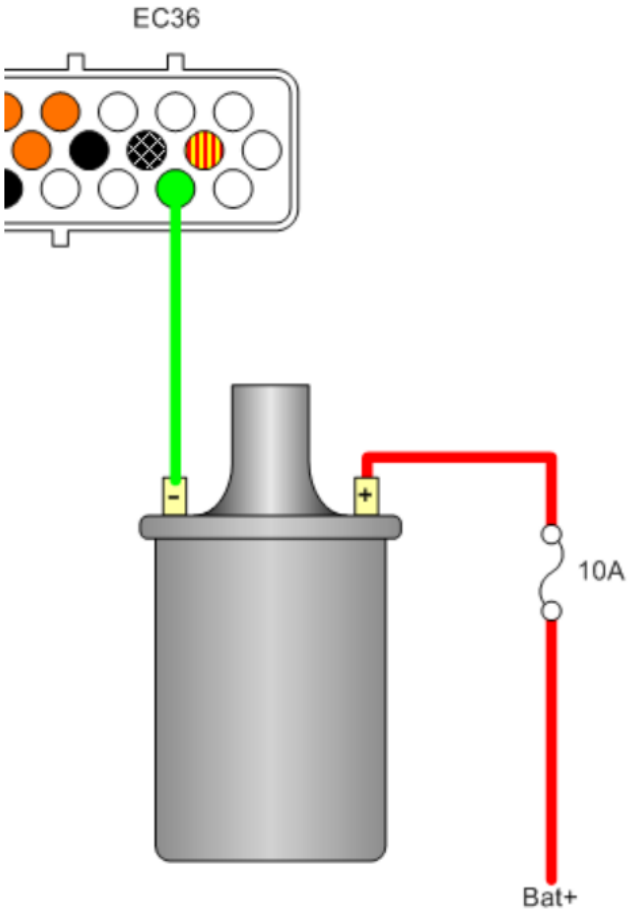
This method is suitable for 4 cylinder COP/CNP or 4, 6 and 8 cylinder wasted spark.

Example coil connections

The following connections suggest the pin numbers as a suggestion only. The actual connections will depend on the Ignition Channel Options as above.

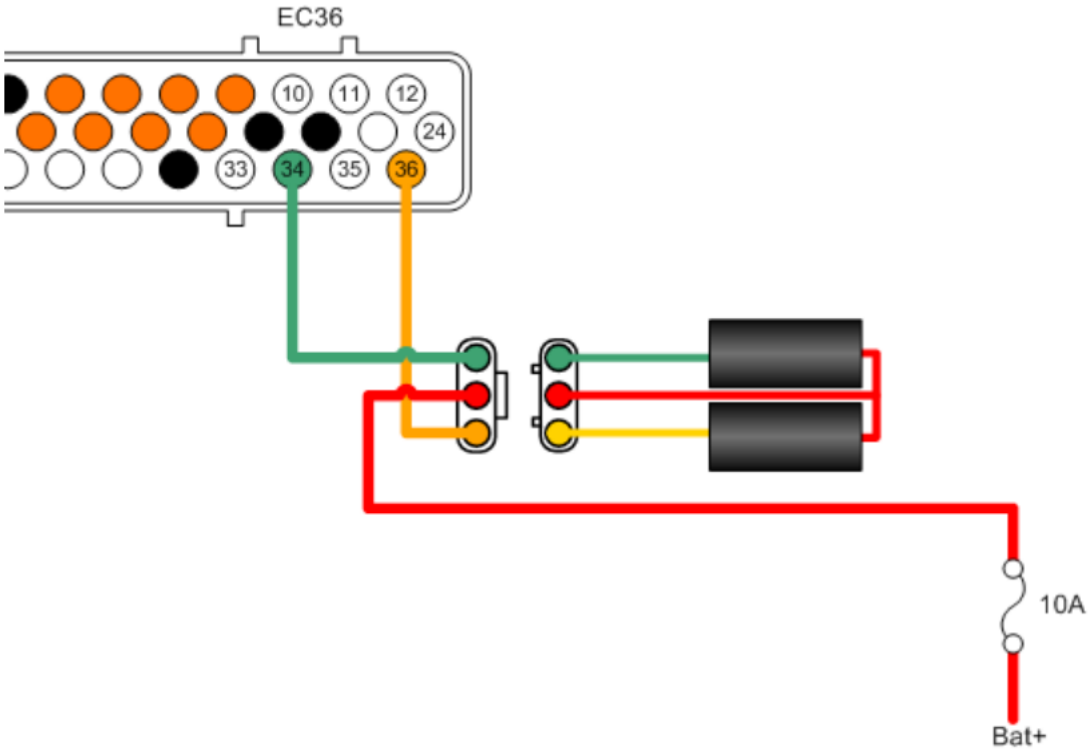
Single coil

In some instances you will want to keep the distributor, in this case VEMS can be configured to use the original coil as shown.

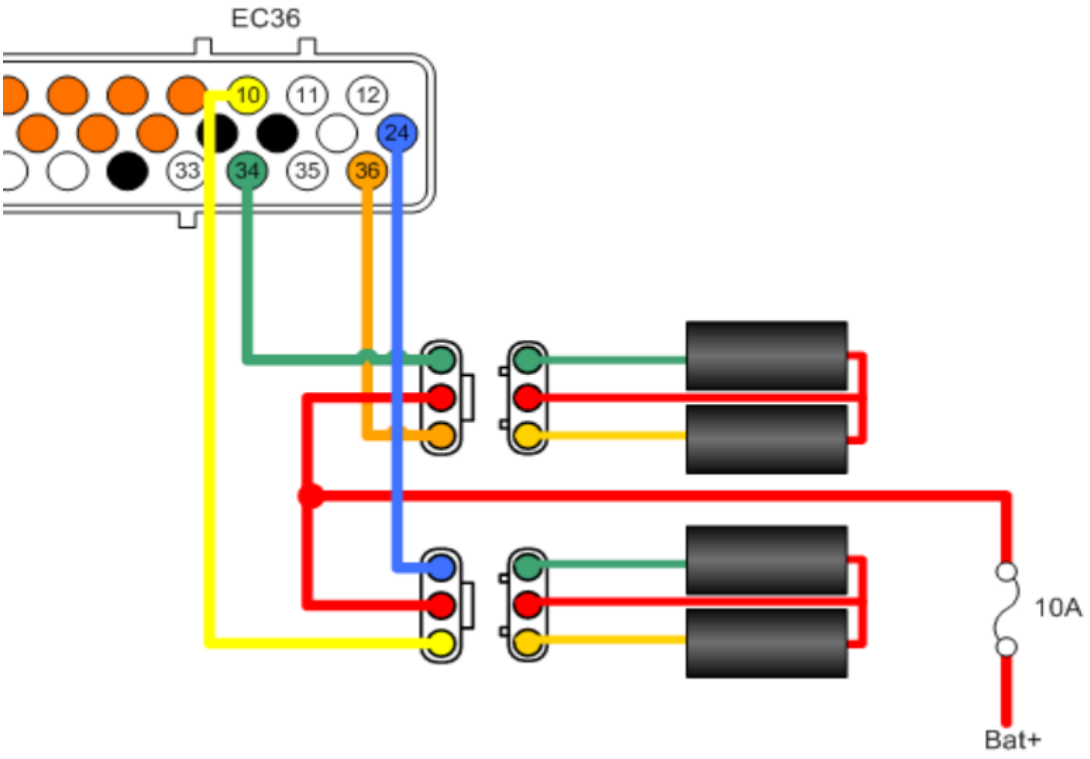


Coil pack

Connecting a two coil (4 cylinder wasted spark)

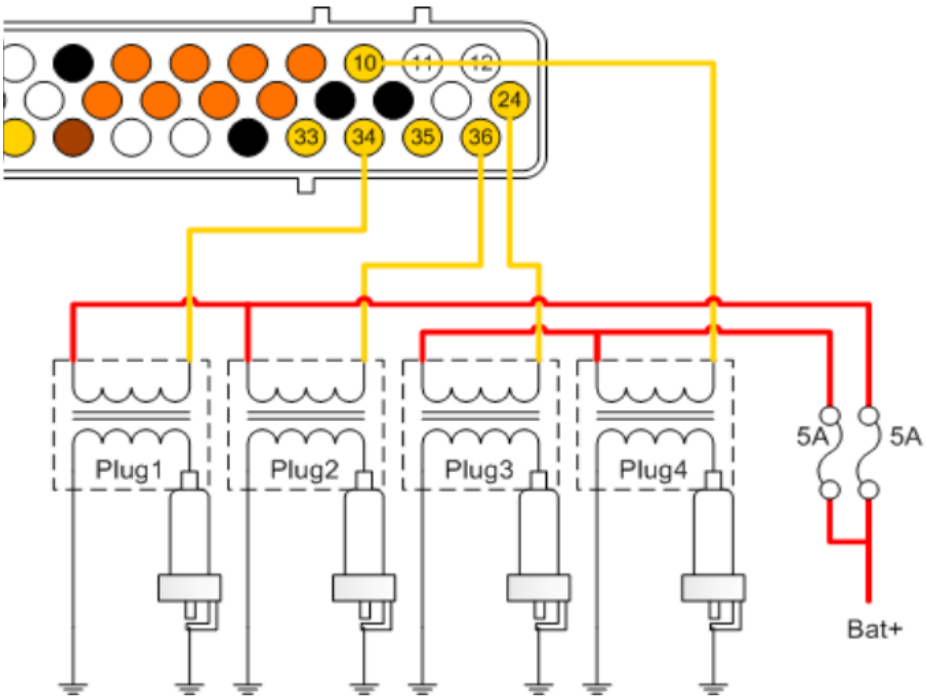


Additional coil packs, for applications such as 8 cylinder wasted spark

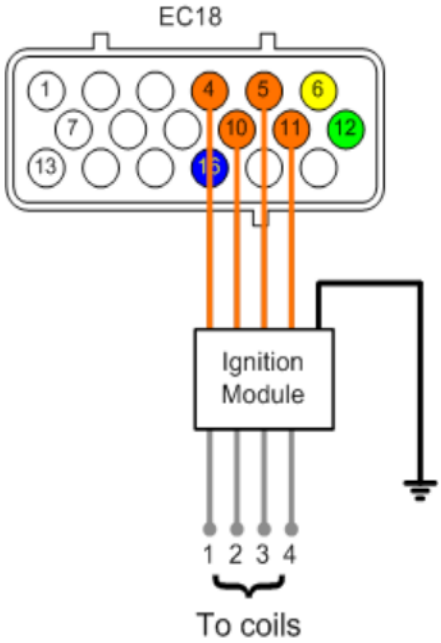


Coil on plug (COP)

Individual Coil connections are shown, the pins connect to the negative '-' side of the coil.



Using the Stepper Motor Driver to control Ignition

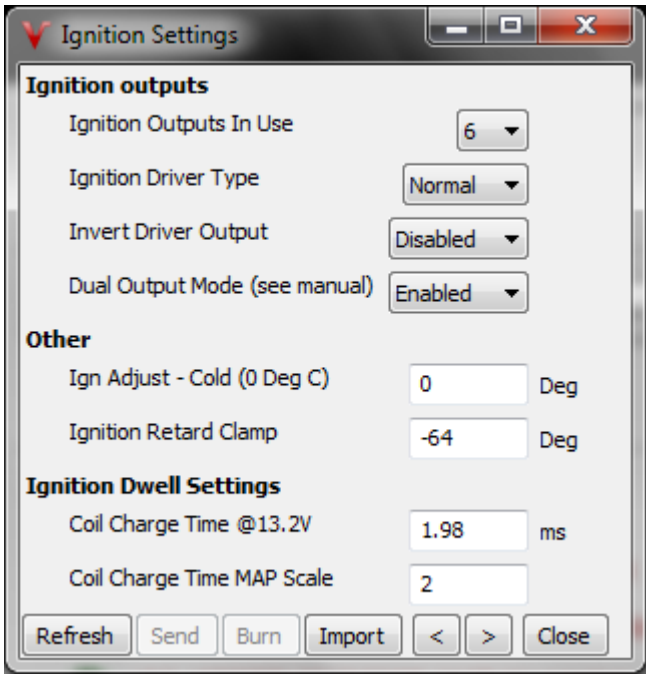


In some cases it has been found that we need to drive external ignition amplifiers (ignitors) using the higher current stepper motor driver.

If you have been using the EC36 plug, the wires must be swapped from the Ingition pins on the EC36 plug and moved to the EC18 plug as follow

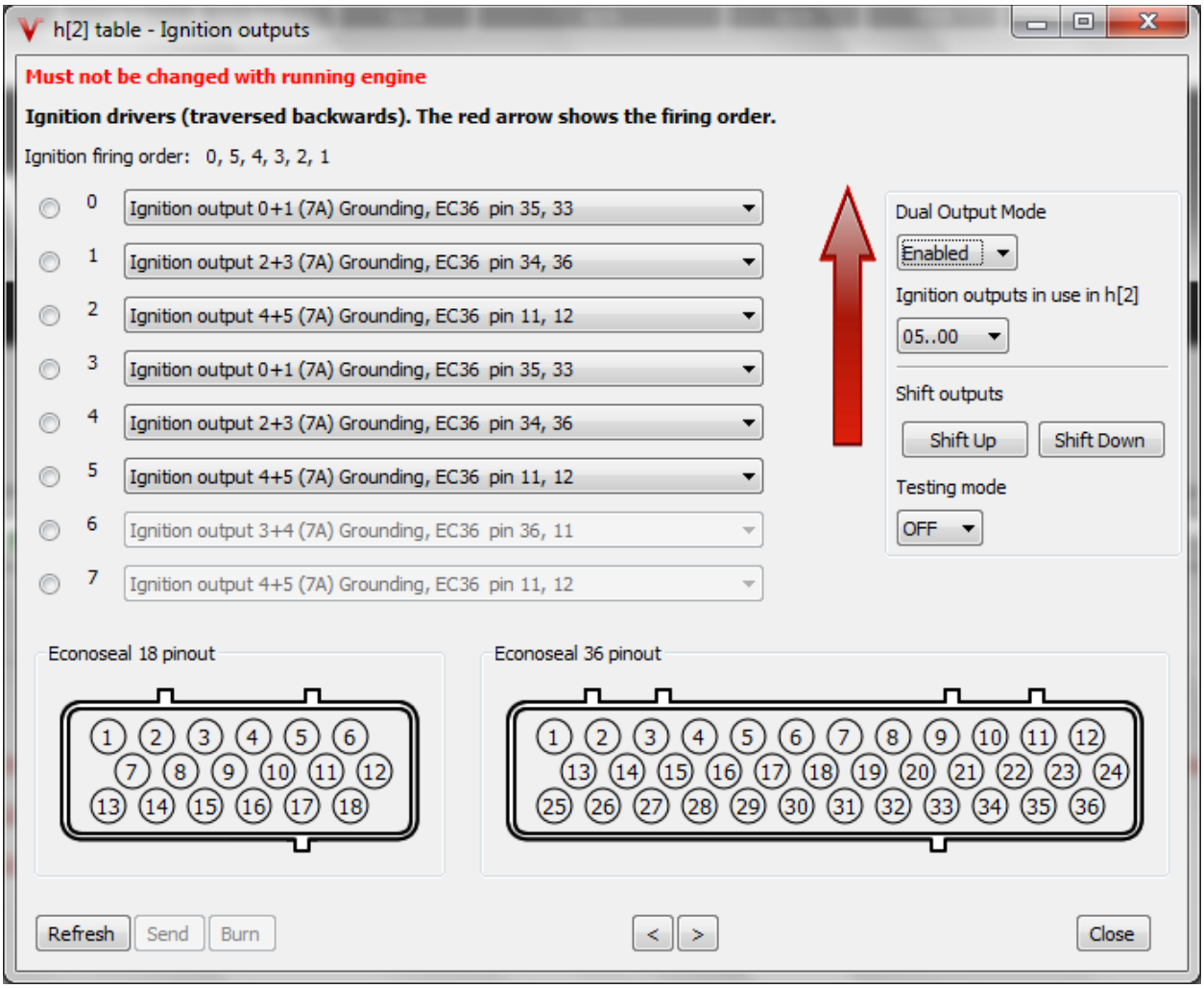
•Coil 00 EC36-pin35 to Stepper A EC18-pin4
•Coil 01 EC36-pin33 to Stepper B EC18-pin10
•Coil 02 EC36-pin34 to Stepper C EC18-pin5
•Coil 03 EC36-pin36 to Stepper D EC18-pin11

Ignition Setup



Set the dwell and number of ignition channels used on the Base Setup → Ignition settings menu.

Set the firing order in the Base Setup → Ignition Outputs Visual menu. The firing order starts with index 0, wraps around the bottom and works it's way up. You can easily adjust this using the Shift Outputs: Shift Up and Shift Down buttons.



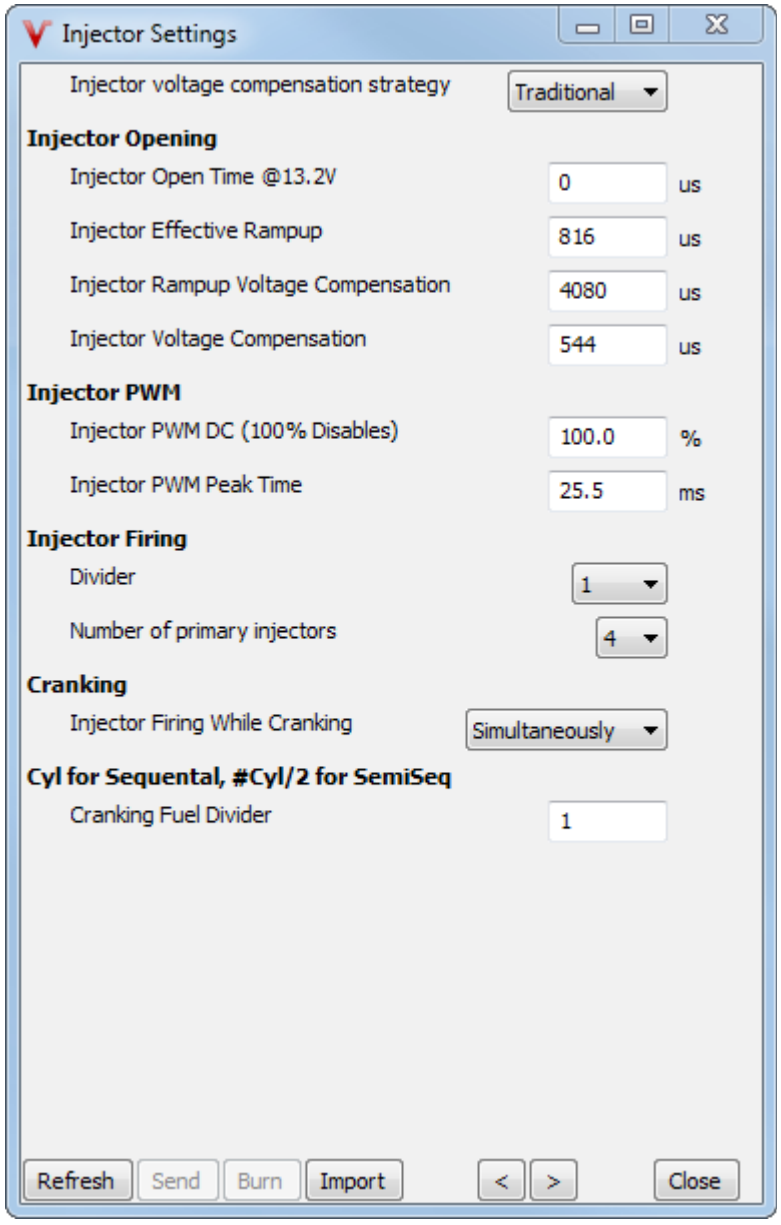
If you have a coil on plug or coil near plug coil setup, you can still run wastespark by enabling the Dual Output Mode. With this setting, each ignition entry will be two pins. You must make sure they are on opposing cylinders in the firing order.

Index engine

Tools required: Timing light

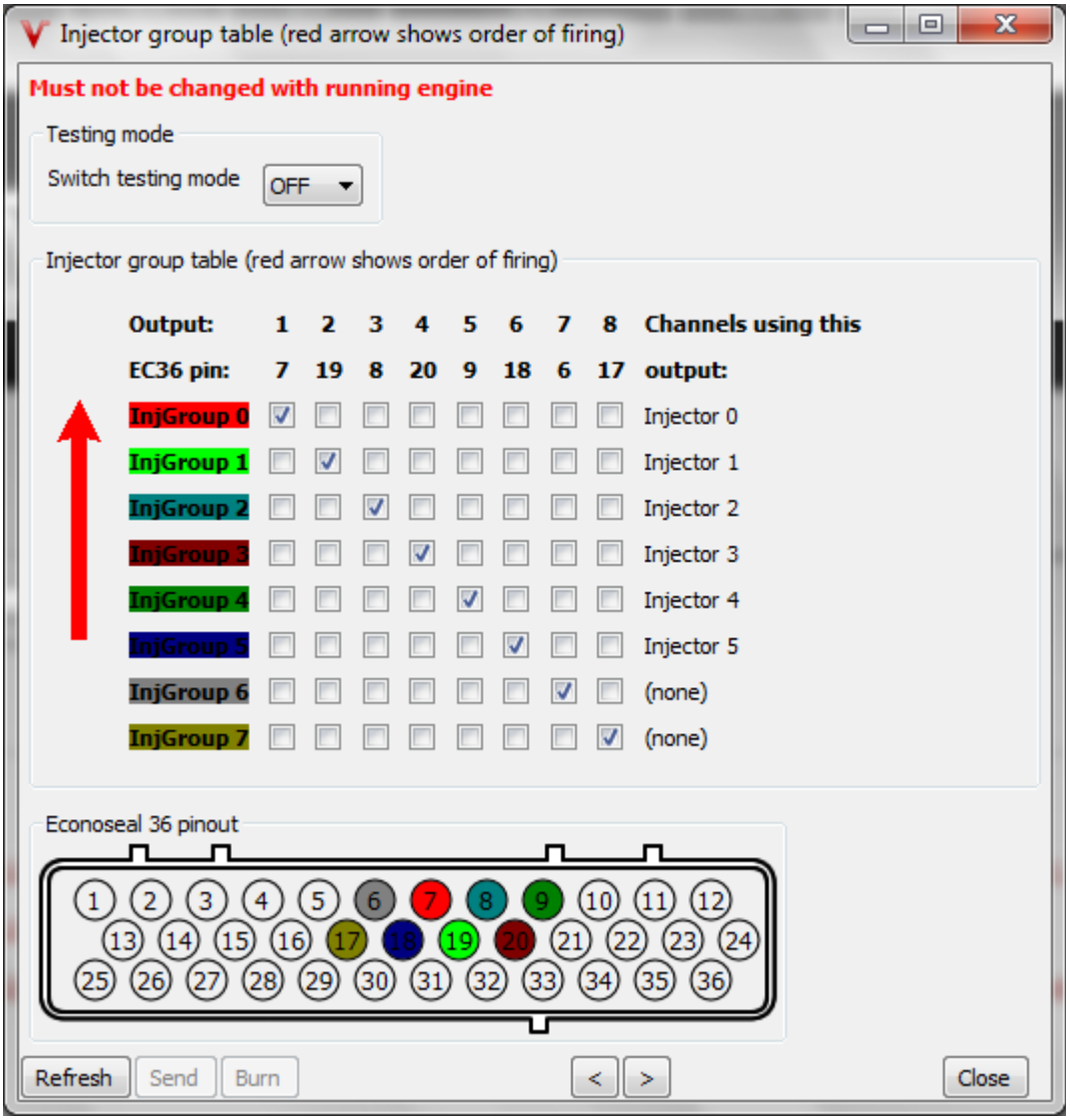
With injectors still disconnected, strobe the crank pulley with the timing light on each cylinder following the firing order to make sure each cylinder is firing where it should be.

Injector Model



Choose the number of primary injectors, usually the number of cylinders. Divider is usually 1. For high impedance injectors, PWM DC should be 100% and Peak Time should be 25.5ms.

Injector Outputs



Setting the injectors like this will work fine, it's not important which injector fires when except for emissions. You can set the injectors to firing order, but it is generally recommended to wire up the injectors to the cylinder firing order. For instance, Injector 1 goes to the first cylinder that fires. Injector two goes to the second cylinder that fires.

Secondary Outputs

Fuel Pump

Idle Air Controller

Boost control solenoid

Inputs

Clutch switch

Activation switches

Analog input

Wheelspeed VSS – EC18 pin 8

Ethanol content – Usually input on wheelspeed2 direct from Continental 13577394 sensors

Misc Outputs

Tach

Shift Light

List of Authorized Resellers

Appendix

Connector pinout