OMEM 600

Hardware Instructions

1 Introducing Omex Engine Management 5

1.1 Notation Used in This Manual 5

2 Quick Start 6

3 Setup 8

3.1 Sensors 8

3.1.1 Crank Sensor 8
3.1.2 Throttle Position Sensor 10
3.1.3 MAP Sensor 10
3.1.4 Coolant Temp Sensor 11
3.1.5 Air Temperature Sensor 12
3.1.6 Barometric Pressure 12
3.1.7 Road Speed Sensor 13

3.2 Map axes 14

3.3 Fuel Setup 14

3.3.1 Battery Voltage Compensation 15

3.4 Ignition Setup 17

3.5 Rev Limits 18

3.6 Dashboard 18

4 Engine Start Condition 19

4.1 Ignition 19

4.2 Fuel 19

5 Idle Strategies 20

5.1 Scatter Spark Idle 20

5.2 Air Bypass Idle 21

5.3 High Idle 21

5.4 Air Con Idle 21

6 Transient Conditions 23

6.1 Acceleration Fuel 23

6.2 Deceleration Fuel Cut Off 24

7 Correction Factors 25

7.1 Coolant Temperature 25

7.2 Air Temperature 25

7.3 Barometric Pressure 25

8 Oxygen Feedback 26

8.1 Narrowband 26

8.2 Wideband 28

9 Auxiliary Inputs and Outputs 29

10 Cooling Fans 31

11 Knock Control 32

12 Full Throttle Gearshift 34

13 Traction Control 35

14 Rev Limits 36

15 Turbo Boost Control 37

16 Anti-lag 38

17 Alt Function 39

18 User1 40

19 VTEC Cam Control 41

20 Synchronisation 42

21 Dwell Control 44

22 Security 45

23 Wiring 47

23.1 Semi Assembled Loom Construction 47

23.2 Ready Built Harness.. 47

23.3 ECU Connector Pins 48

23.4 Component Pin-outs.. 49

23.5 Diagrams 50

1 Introducing Omex Engine Management

Thank you for choosing Omex Engine Management. This manual is written to help the user through the specifics of the OMEM600 ECU. **It is essential that the user reads all of the Omex manuals before attempting to install the system and before attempting to start the engine.** Incorrect use of the Omex system could potentially lead to damage to the engine and personal injury. If you have any doubts about fitting these parts or using the software then please contact Omex for help.

As the system is computer based, technical support is given on the assumption that the user is able to perform simple Windows based operations. The user will also need access to email as Omex will nearly always require a copy of the map in the ECU to give support.

Omex may not be held responsible for damage caused through following these instructions, technical, or editorial errors or ommisions. If you have any doubts about fitting these parts or using the software then please contact Omex for help.

1.1 Notation Used in This Manual

Menu commands are signified in bold type with a pipe symbol **|** between each level of the menu.

For example, **File | Open** indicates that you should click on the **Open** option in the **File** menu.

`UPPER CASE TEXT` is used to indicate text that should be typed in by the user.

2 Quick Start

It is not possible to start a new calibration from File | New. Please contact Omex for a suitable start-up map. There are many options and tables that need to be set in the background and are not covered by this manual, and many that are not accessible by the user.

The following is a guide to starting your engine after ECU installation to ensure all is working before taking it to be mapped.

Wiring
Wire your semi-assembled harness or ready-built harness as shown in the Wiring section of this manual.

Trigger Wheel
If installing a trigger wheel of missing tooth type,

- Accurately mark TDC.
- Turn the engine to approximately 90^{o} BTDC.
- Mount your crank position sensor (CPS) anywhere around the perimeter of the timing wheel pointing towards the centre of the wheel with a sensor to wheel gap of approximately 0.5mm.
- Mount the trigger wheel with the missing tooth pointing at the sensor.

If machining a trigger pattern into the front pulley then it is usually easiest to machine all of the teeth in, mount the front pulley, and then remove the tooth pointing at the sensor at 90^{o} BTDC.

Software
- Install the MAP3000 software by inserting disk 1 into the floppy drive and following the on-screen instructions.
- Save the start-up map from the start-up disk to the hard-drive in the location c:\program files\map3000\calibrations.
- Open MAP3000 from the ‘Start bar’
- Join the data lead between the ECU and the PC’s COM port
- **ECU | Baud Rate** set to **38400**
- **ECU | Send new calibration**
- Ignition ON (do not crank the engine)
- Select your start-up map and press ‘open’
- When the calibration has been sent to the ECU cycle ignition power OFF / ON

Throttle position
- Press the start button 
- The Parameters window shows a number for **TPS raw**. At the idle position, the throttle pot needs to be physically turned until this number is around 20. Tighten the throttle pot then open to WOT (wide open throttle) and check the **TPS raw** number. This number should be less than 255. If the number is 255, then the throttle pot is at its stop so needs to be turned back until it reads less than 255.
- The number for **TPS raw** at WOT needs to be inputted to the options box as **TPS max**. The number for **TPS raw** at idle needs inputting to the options box as **TPS min**.

Sensor Test
The parameters window shows of the sensor inputs. Check that these are all showing sensible numbers.

Engine Start
When attempting to start the engine for the first time you may need to change the injector scaling as the fuel requirements, injector flowrates, and fuel pressure vary between engines. The option **Microsec/bit** is a linear scaling factor. A higher number is more fuel, a lower number is less.

Ignition Timing

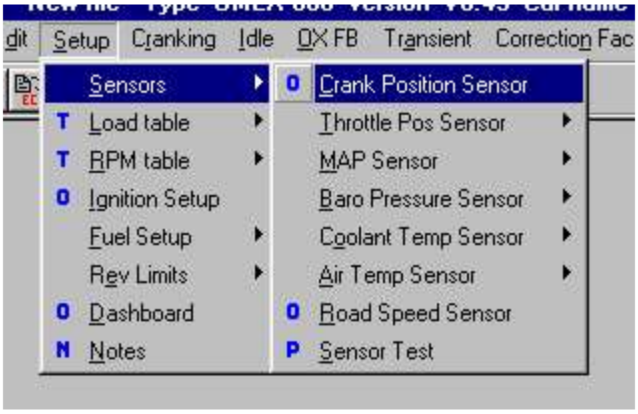
The ECU recognises the engine position by a missing or extra tooth on a pattern of evenly spaced teeth. Different manufacturers have this reference in a different place on the trigger wheel so the ECU needs to have adjustment for this. The numbers are known for most manufacturers and will be set in the start-up map but if they are unknown or if you are using an Omex external 36-1 wheel, you will need to find this value yourself. To find this value you will need a strobe light and an accurate TDC mark on the engine.

- Press the start button 
- Hold the engine at 2000-3000 rpm (ie out of the idle condition where the ignition timing is stable)
- Check the engine speed shown on the strobe light. Some strobe lights will see the wasted spark on DIS systems and so will show double engine speed and so also double ignition timing. If this is the case then halve all ignition timing figures shown on the strobe light.
- Check the ignition timing with a strobe light and compare this number to the number in the parameter **Spark Total**.
- If the strobe light shows a number lower than the ECU then decrease the value of option **Timing Alignment**. If the strobe light shows a number higher than the ECU then increase the value of option **Timing Alignment**. **Timing alignment** is measured in internal units - a change of 1 is a change of 30 crank degrees so user changes to **Timing Alignment** should be very small. The value for **Spark Total** on the PC will not change, but the timing mark on the engine will move, so each adjustment will require the strobe light resetting. Repeat these changes until the strobe light timing figure agrees with the timing figure shown by **Spark Total**.

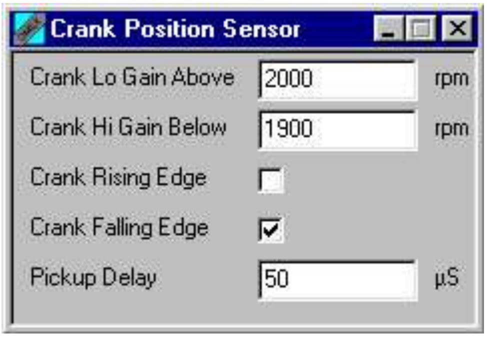
3 Setup

3.1 Sensors

3.1.1 Crank Sensor



The ECU needs to know engine speed and position in order to supply the correct fuelling and ignition timing. This is often achieved using the standard sensors, but can involve putting new sensors on the engine. Engine speed is typically measured using a pattern of teeth on the crank (known as a trigger wheel).



The crank sensor input can be from either a Magnetic Variable Reluctance (VR) sensor or a Hall Effect sensor. The two types of sensor require different hardware on the ECU board, so are selected by physical jumpers. See jumpers section.

Crank Lo Gain Above	Some VR crank sensors give too high an output at high engine speeds. This feature allows the sensitivity of the ECU to be switched to lower above the set engine speed to allow for this. Typically 1500rpm.
Crank Hi Gain Below	High channel sensitivity when below this value. Should be set below the on value (hysteresis). Logic level sensors (hall effect) set to 0
Crank Rising Edge	rising edge of the crank signal is used as the significant edge if ON. Typically **OFF**
Crank Falling Edge	falling edge of the crank signal is used as the significant edge if ON. Typically **ON**
Pickup Delay	used to compensate for the systems timing pickup and ignition coil delays. Typical value 50

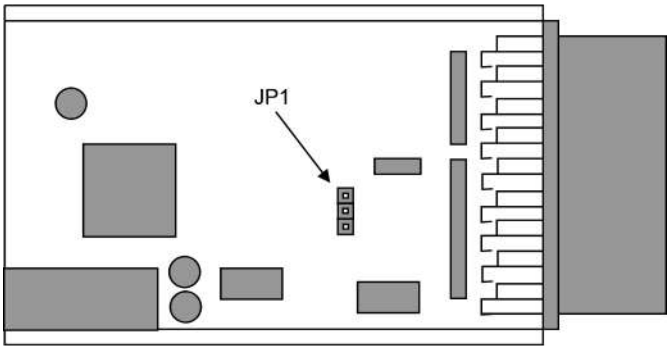
Trigger Wheels

Many older engines do not have a trigger wheel. In this is the case an external wheel must be fitted. Contact Omex for suggested trigger patterns. There is a minimum diameter for these wheels dependent on the sensor used, the trigger pattern, and the engine operating speeds. Contact Omex for advice. The wheel needs to be mounted on the front pulley. It may also be possible to machine this pattern into the front pulley wheel, remembering that the pattern must be in a ferrous material for the sensor to work. Omex can supply general purpose trigger wheels in diameters of 100mm and 140mm.

If installing a trigger wheel of missing tooth type see the Quick Start section of this manual for guidance.

Jumpers

To allow for different input ranges of the crank sensors, physical jumpers need to be set. The following diagram shows an aerial view of the ECU board with the main wiring connector on the right-hand side.

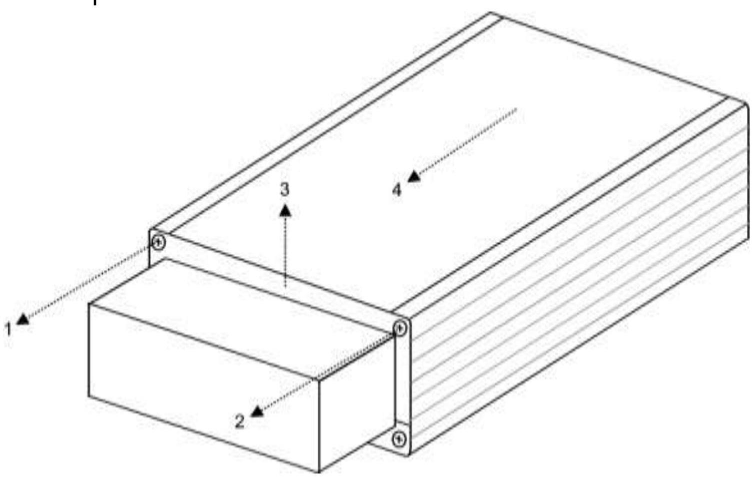


Crank sensor (JP1)

Sensor Type	
Typical MVR	
High Output MVR	
Hall Effect	

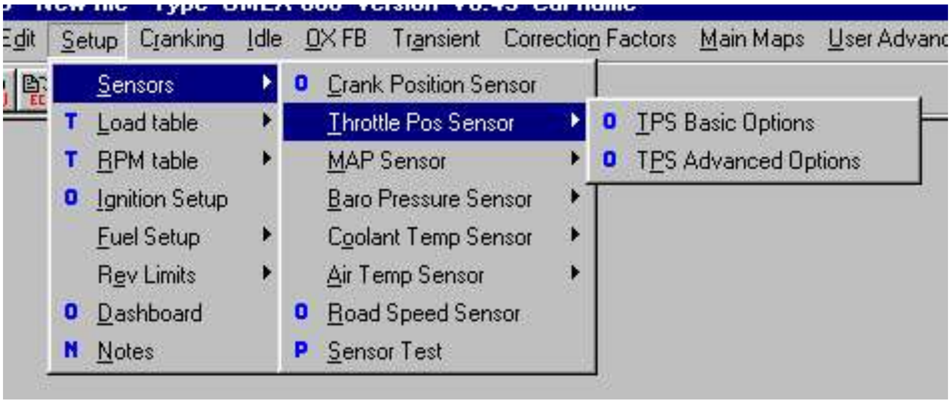
To change the jumpers you will need to part-disassemble the ECU to gin access to the board. As shown in the diagram;

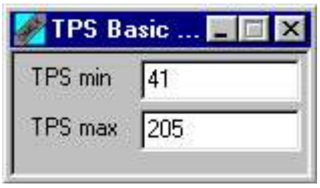
- remove screws 1 and 2
- slide up the end plate 3
- slide off the the lid plate 4



3.1.2 Throttle Position Sensor

The ECU needs an input of engine load. The Omex ECU can use an input of throttle position (TPS) or manifold absolute pressure (MAP). Most normally aspirated engines will use an input of throttle position as this gives excellent throttle response. Forced induction engines need to use MAP as there is no direct relationship between throttle angle and engine load due to the variable of boost pressure. However, forced induction still requires throttle position sensor (TPS) input for idle condition information and possibly acceleration / deceleration fuelling.

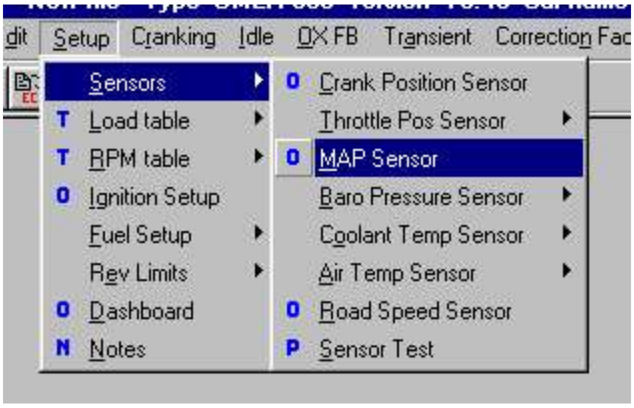


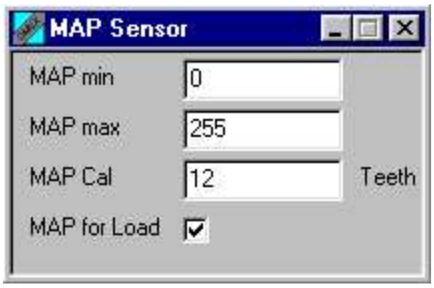


The parameter **TPS raw** gives the raw number output of the sensor which is scaled by options **TPS min** and **TPS max** to give a throttle that works between 0 and 100. To calibrate, see Quick Start section of this manual.

3.1.3 MAP Sensor

The ECU needs an input of engine load. The Omex ECU can use an input of throttle position (TPS) or manifold absolute pressure (MAP). Most normally aspirated engines will use an input of throttle position as this gives excellent throttle response. Forced induction engines need to use MAP as there is no direct relationship between throttle angle and engine load due to the variable of boost pressure. However, forced induction still requires throttle position sensor (TPS) input for idle condition information and possibly acceleration / deceleration fuelling.





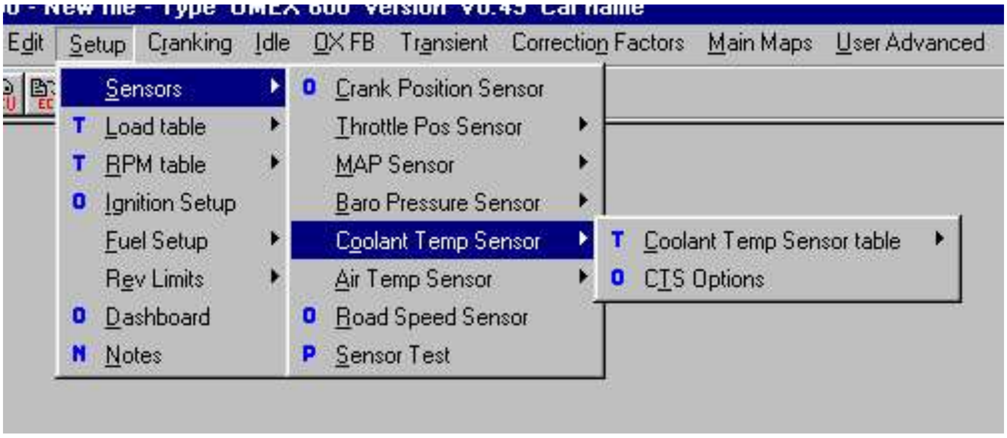
An external three wire 0 - 5 V output MAP sensor can be used to sense engine load. MAP sensor ratings are absolute rather than boost pressure so 1bar is for normally aspirated (NA) non-boosted engines and barometric compensation, 2bar for up to 1bar boost, 2.5bar for up to 1.5bar boost, and 3bar for up to 2bar boost.

If you are using MAP for load then set **MAP for Load ON**.

MAP min and **MAP max** will only need changing from **1** and **255** if you are using an oversized MAP sensor. If this is the case then contact Omex for advice.

MAP Cal time over which the ECU averages the MAP input measured in internal units. Typically 12

3.1.4 Coolant Temp Sensor

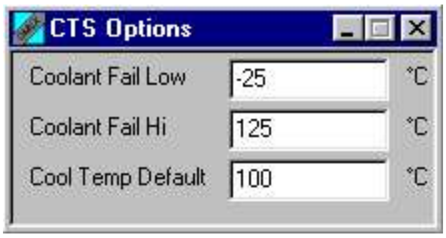


The coolant temperature sensor (CTS) is required to give the ECU information on the temperature of the engine's coolant, allowing the user to set up correction factors for cold starting and running.

The coolant temperature sensor used by the Omex ECU is a resistive sensor. The raw output of this sensor is calibrated in the ECU to give the information in a more usable form, ^{o}C. Sensors are calibrated in the **Coolant Temp Sensor table**. The values for many sensors are known but you may need to calibrate your sensors. It is essential that these sensors are calibrated correctly as many functions are temperature based.

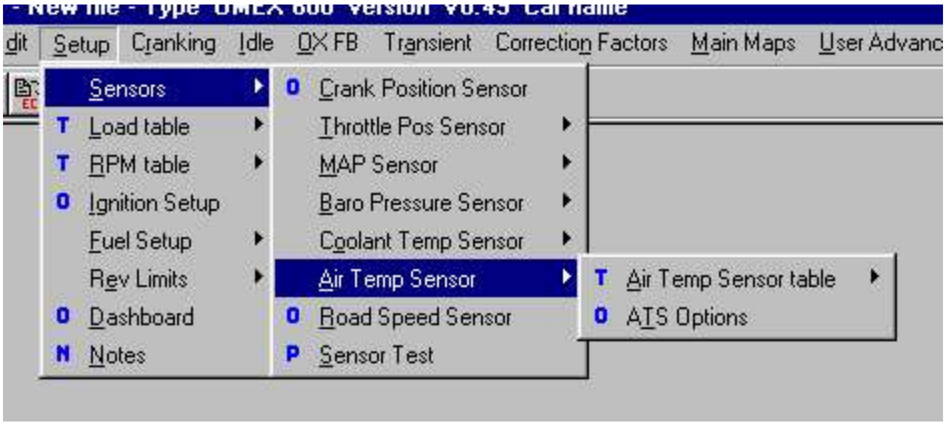
To calibrate a sensor;

- **ECU | Connect**
- Power on
- **Setup | Sensors | Coolant Temp Sensor | Coolant Temp Sensor table | Table view**
- Place the sensor and a thermometer in a kettle or pan of water
- The ECU will highlight the current raw input value from the sensor. Above this input value, enter the current thermometer reading in degrees centigrade.
- Heat the water. As the temperature increases, repeat the temperature readings.
- When the water is fully heated, repeat the process as the water cools
- Using the graph view, smooth the curve to remove any mistakes, and extrapolate to unobtainable temperatures.



Coolant Fail Low and **Hi** are the failure points of the sensors. Example- If the minimum readable temperature of a sensor is –25 then **Coolant Fail Low** should be set at –24. If the maximum readable temperature of the sensor is 125 then **Coolant Fail Hi** should be set to 124. **Coolant Temp Default** is the temperature to which the input defaults if the sensor goes into failure.

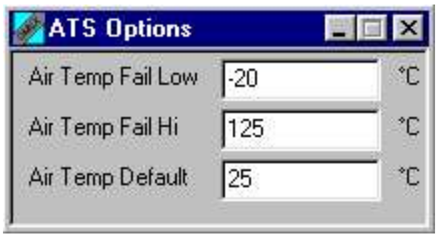
3.1.5 Air Temperature Sensor



The air temperature sensor (ATS) is used to give the ECU information on the temperature of the inlet air. This allows the user to make corrections to the fuelling and ignition timing based on inlet air temperature. The air temperature should be measured as close to the inlet as possible, preferably in the inlet airbox, or with forced induction engines, in the inlet plenum.

The air temperature sensor used by the Omex ECU is a resistive sensor. The raw output of this sensor is calibrated in the ECU to give the information in a more usable form, ^{o}C. Sensors are calibrated in the **Air Temp Sensor table**. The values for many sensors are known but you may need to calibrate your sensors. It is essential that these sensors are calibrated correctly as many functions are temperature based.

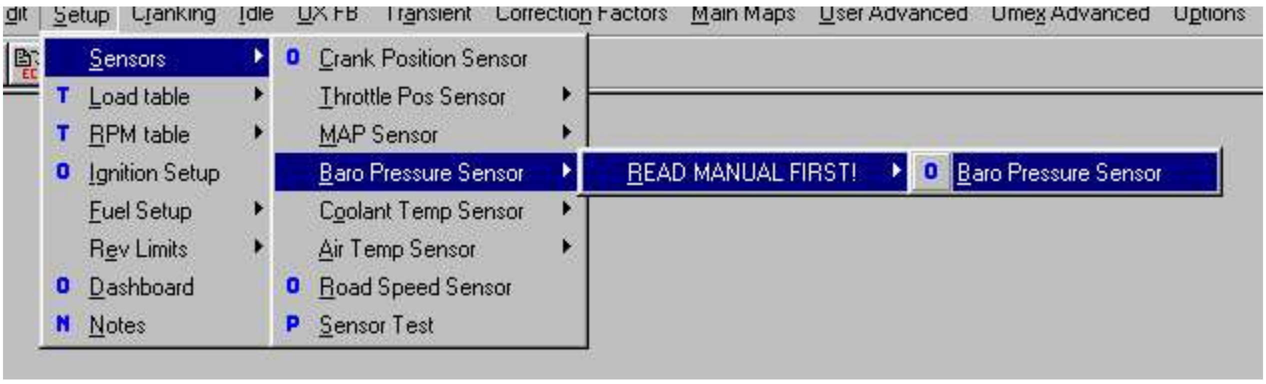
To calibrate your sensor, see the calibration of the coolant temperature sensor.



Air Temp Fail Low and **Hi** are the failure points of the sensors. Example- If the minimum readable temperature of a sensor is –25 then **Air Temp Fail Low** should be set at –24. If the maximum readable temperature of the sensor is 125 then **Air Temp Fail Hi** should be set to 124. **Air Temp Default** is the temperature to which the input defaults if the sensor goes into failure.

3.1.6 Barometric Pressure

As the air pressure changes, so does the amount of oxygen per volume of air. Changes in most countries are relatively little, but if driving in large mountain ranges such as the Andies, these changes can be significant.

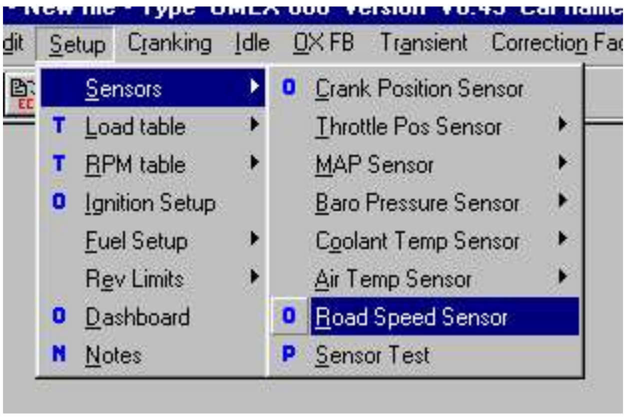


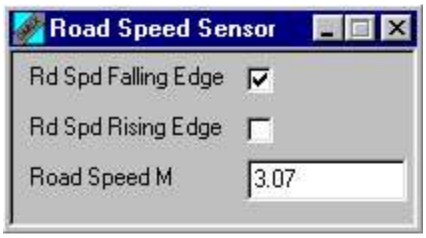
The options list has values for calibrating the pressure sensor. Contact Omex for numbers for your sensor.

The **Baro On** option should only be checked if the engine is being mapped and run with a sensor connected. If you wish to use a baro sensor it must be connected and setup before mapping.

3.1.7 Road Speed Sensor

An input of road speed can be taken to allow traction control features. The input should be a pre-differential input, eg propshaft rpm or electronic speedo input, or driven wheel if using a locked diff. If you are using an LSD, a driven wheel input can be used but is not ideal. Please contact Omex for input suggestions.

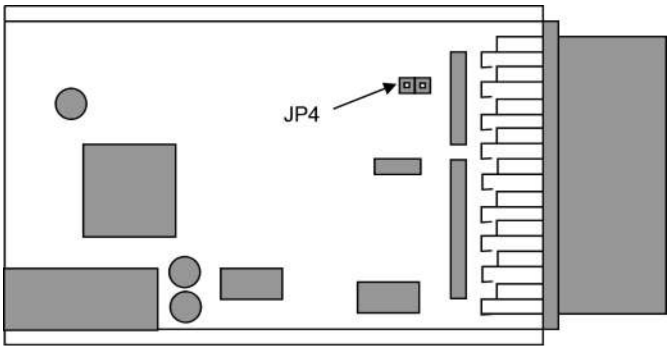




The ECU needs to convert the frequency of pulses to road speed. The option Road Speed M allows you to do this. Adjust this number until the parameter Road Speed shows the correct speed.

Jumper

To allow for different types of sensor, physical jumpers need to be set. The following diagram shows an aerial view of the ECU board with the main wiring connector on the right-hand side.

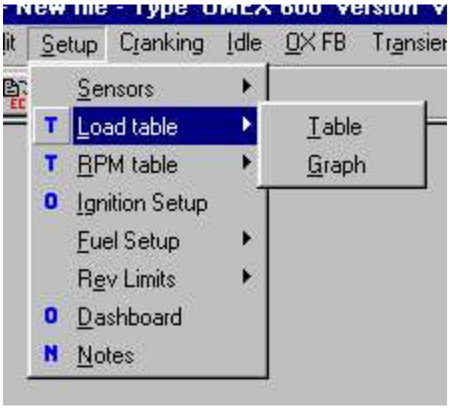


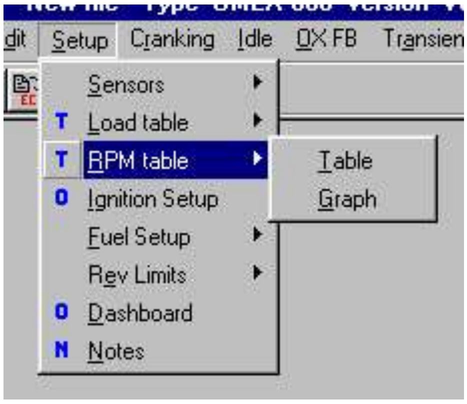
Sensor Type	Jumper position
MVR	OFF
Hall Effect	ON

To disassemble the ECU to reach the jumpers, see the Crank Position Sensor section of this manual.

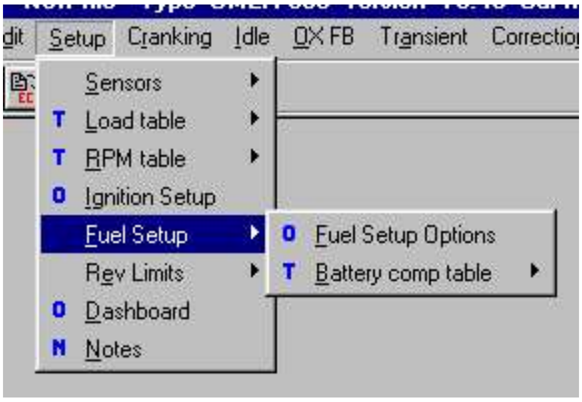
3.2 Map axes

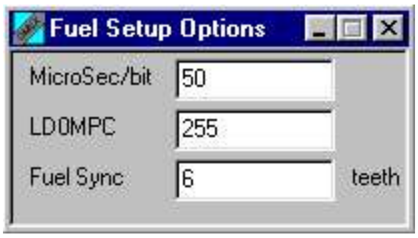
The load and speed sites for the main maps can be set using the Load table and the RPM table.





3.3 Fuel Setup





The amount of fuel injected each cycle is dependent on the time the injector is open. This time period (or pulse width) is calculated by the ECU using factors for volumetric efficiency, air temperature, air pressure, cold start enrichment, injector flow rate and battery voltage etc.

Volumetric efficiency VE, the major factor, is determined by the throttle position or inlet manifold absolute pressure as measured with the TPS or MAP sensor, and engine speed using a three-dimensional look-up table. This 3D table is a simple grid with LOAD along one axis and engine speed along the other. It is what is programmed by the user, ie the map.

The LOAD axis has 11 sites. The engine speed axis is divided into 21 sites. These sites can be set by the user in the **RPM Table** and **Load Table** to give the desired resolutions at different areas of the map.

At each intersection of an engine speed site and a throttle position site there is a grid value. This is the volumetric efficiency value or V.E. and is directly proportional to the pulse width and therefore the amount of fuel injected.

These values are determined by running the engine on a dynamometer at each obtainable point and adjusting the VE values to obtain optimum performance. (ie mapping the engine).

If the engine is running at an exact engine speed site and an exact throttle position site then the VE value at the intersection of these two sites will determine the amount of fuel injected. If running at a condition where it is not exactly on a mapped site, the ECU interpolates between the nearest sites.

The fuel map can be viewed in 3 ways (see MAP2000 for how to change view types) – pulsewidth (msec), duty cycle (percentage opening), or raw. Raw numbers are the numbers used whilst mapping. Pulsewidth and duty cycle are calculated by the PC and are used for reference.

Base fuel pulsewidth = raw (map) value x **Microsec/bit**

As a starting point it is quite acceptable to set **Microsec/bit** to 50. This will give a very good starting point for most engine setups. Once a sample full throttle point around maximum torque has been trial mapped, the **Microsec/bit** can be adjusted to give a maximum fuel map setting of 200 or so.

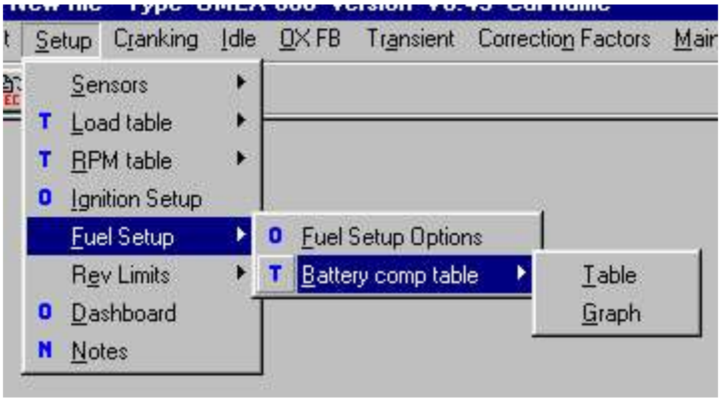
Fuel Sync is the overall injection start point delay measured in internal units, A change in value of 1 is a change in start point of 30 crank degrees. This number can be changed to give the best emissions or power.

Injectors

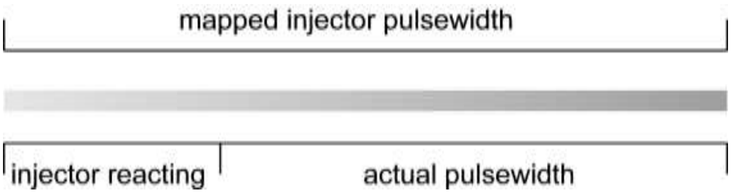
There are two electrical types of injector, high impedence, and low impedence. High impedence is approximately 12 ohms, and low impedence is approximately 3 ohms. The OMEM600 ECU is designed to use high impedence injectors, but can be used with low impedence if ballast resitors are used. The ballast resistors are shown in the wiring diagram.

Injectors are available in a range of flowrates. Please contact Omex for advice when selecting suitably sized injectors.

3.3.1 Battery Voltage Compensation



An injection period is made up physically of 2 time periods. The end period is when the injector is open and flowing fuel, and the first period is when the injector is opening its valve and there is no flow of fuel. At low injector durations, this period where the injector is reacting but not flowing fuel can be significant.



This time period of no flow varies in length with battery voltage and with fuel pressure. This also varies between injector models. Were an engine to run at a constant voltage, then there would be no problems as the injector reaction time would be a constant length. However, the injectors do see a varying voltage so the ECU needs to allow for this varying period of no fuel flow, and as all types of injector react differently, it needs to be told this information by the user. The information is held in the ECU in the **Battery Comp table**.

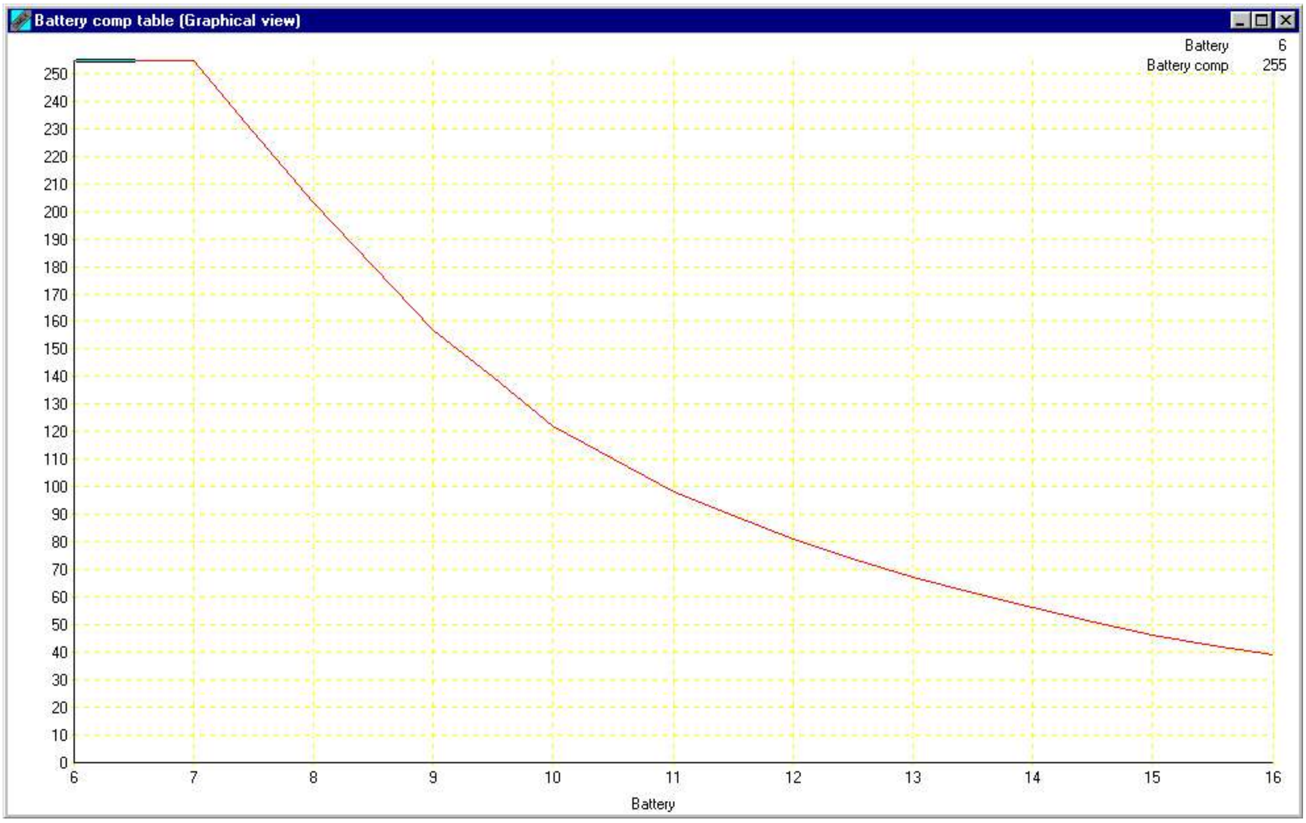
The battery voltage compensation data can usually be supplied by the injector manufacturers. For example, the Weber IW 058 injector data is for 3bar fuel pressure,

Battery Volts	Offset time mSec
8.0	2.03
10.0	1.22
12.0	0.81
14.0	0.56
16.0	0.39

The Omex ECU can not take the data in the form of offset time in msec, it instead requires the table to hold the data as a number between 0 and 255 which is then scaled. If using offsets from injector manufacturers simply multiply the offset time, usually stated in mSec, by 100.

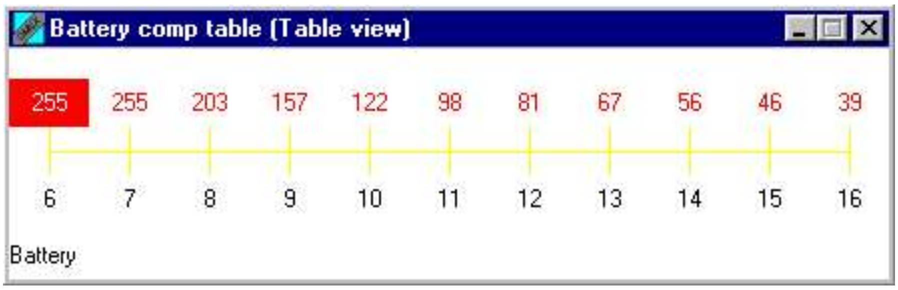
Battery Volts	Battery Comp
8.0	203
10.0	122
12.0	81
14.0	56
16.0	39

The missing values for odd voltages are best blended using the graphical display of **View | Battery Comp Table | graph**

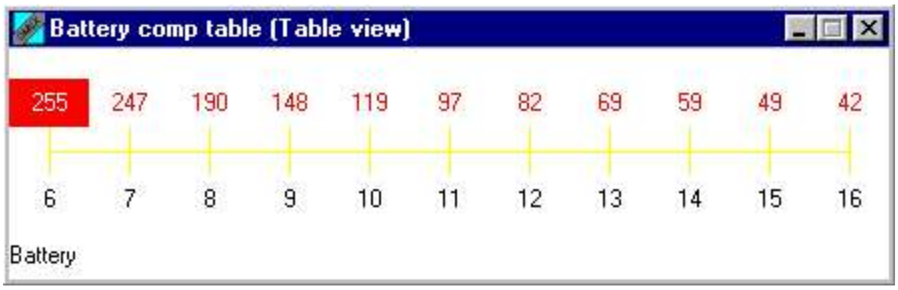


The values for known injectors at 3bar fuel pressure are as follows

IW058 (OMEM3004)



IWP043 (OMEM3002) and IWP069 (OMEM3003)

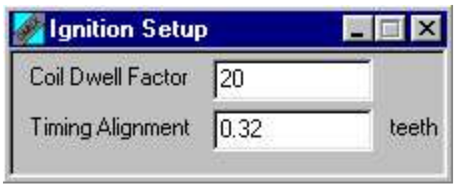


If this information is unavailable for your injector, then you will need to find these values yourself.

- Connect a power supply to run the injectors and ECU at variable voltages
- Fully map the engine at a normal running voltage
- Find a steady point somewhere off idle eg 10% load 3000 rpm, and note the lambda reading at this point
- Change the voltage of the power supply to one of the voltages on the **Battery Comp table**
- The lambda reading may change. If so, change this voltage's value in the **Battery Comp table** to return the lambda to the original reading
- Repeat this for all of the possible voltages

If a power supply is unavailable, then an attempt can be made to bring down the voltage in road cars by turning on lights, a/c etc.

3.4 Ignition Setup

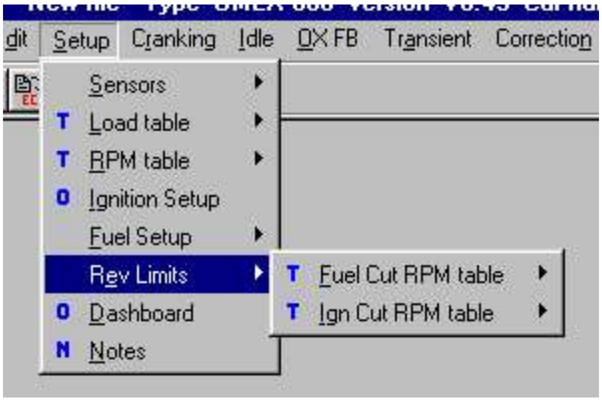


Ignition timing is controlled by a map of numbers. There are 11 load sites and 21 speed. These sites can be set in the **Load Table** and the **RPM Table**. Interpolation is used between sites to ensure smooth curves.

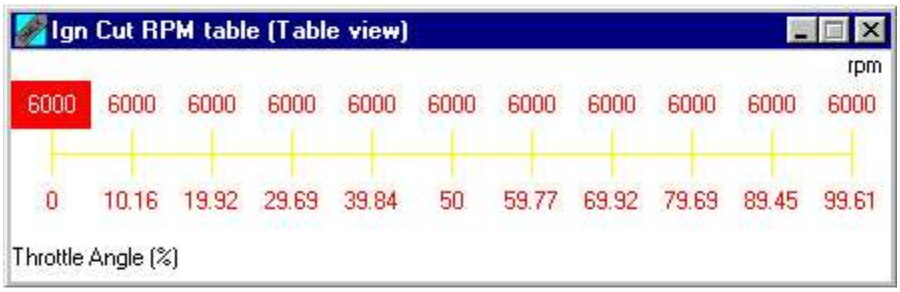
Coil Dwell factor is a multiple in the equations which ultimately lead to the coil dwell time. A typical modern coil requires a value of 20. Increasing this number can lead to failure of the ECU ignition output drivers.

As the reference point (missing or extra tooth) on a crank trigger wheel varies rotationally between manufacturers and between individual‘s installations of trigger disks, the ECU needs to be told where the referance point is. The option **Timing Alignment** describes this and can be adjusted to suit each trigger wheel type. A change in value of 1 gives a change in timing position of 30 degrees. The correct numbers are known for many popular manufacturers. Please contact Omex for advice.

3.5 Rev Limits

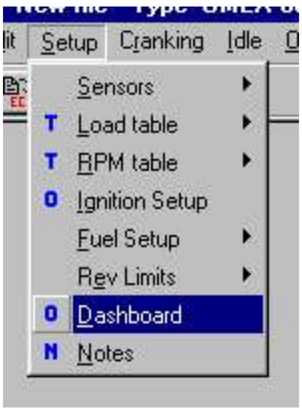


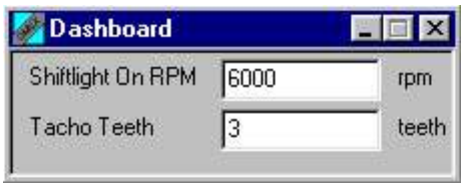
The tables Ign Rev Limit and Fuel Rev Limit allow differing rev limits based upon throttle position for when using anti-lag. If you are not using anti-lag, set all of the throttle positions in the table to the same engine speed. An example of a 6000rpm limit is as follows.



At this engine speed, the soft cut will be invoked. If the engine speed is exceeded by 50 rpm, then the hard cut is invoked. For information about soft and hard cuts see the advanced rev limits section.

3.6 Dashboard





The frequency of pulses for the tacho is set by the option **Tacho Teeth**. Adjust this number until the tacho reads the correct engine speed.

4 Engine Start Condition

During cranking, the fuel and ignition are not controlled by the main fuel and igntion maps, but instead by tables and options.

The cranking condition is defined by the engine speed options **Min RPM** and **Start Exit RPM**. **Min RPM** is the engine speed at which the engine is considered to start cranking (typically 50 rpm), and **Start Exit RPM** is the engine speed above which the engine is considered to be under normal running ie no longer cranking.

4.1 Ignition

Whilst cranking, the ignition timing is determined by the **Start Ignition** option. This is set in degrees and would normally be a low value eg 2 degrees.

4.2 Fuel

Start Fuel Pulse Table- This is a single shot of fuel that may be injected into the engine at the start of cranking. The value in the table-selected dependent on temperature is multiplied by **Microsec/bit** to give the fuel pulse in micro-seconds

Start Fuel Throttle Table – This is the amount of fuel injected in cranking, dependent on throttle position, while the engine is starting. This value is VE (same as main map) so is multiplied by **Microsec/bit** to give the fuel pulsewidth.

Start Fuel Coolant Table – Extra fuel added to the Crank Fuel due to temperature.

Start Fuel Decay Table – This determines how quickly the additional start fuel decays over time. This is a linear decay in seconds after cranking commences.

5 Idle Strategies

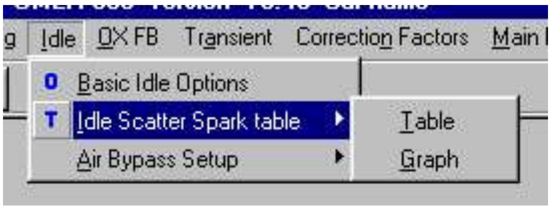
The 600 series ECU can control idle using spark scattering, push/pull motors and stepper motors.

The idle condition is entered by the options **Idle on Below RPM**, and **Idle Below Throttle.** The engine condition must be below both of these two values to enter idle.

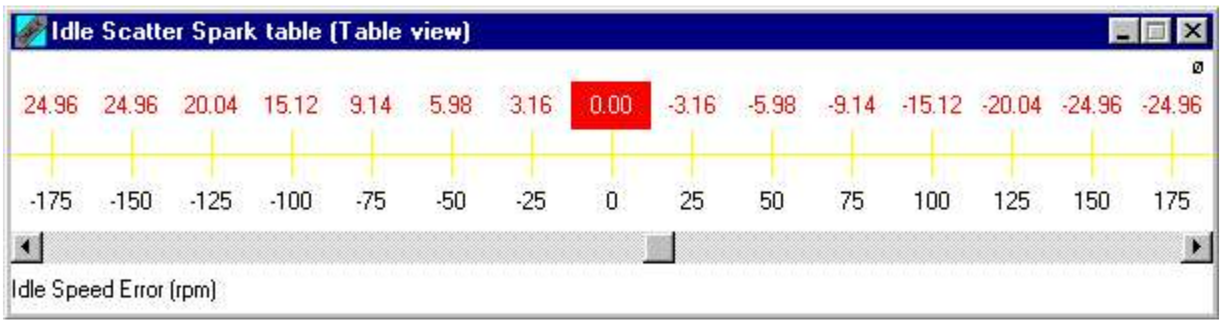
The target idle speed that the ECU attempts to maintain is set by **Idle FB Target**.

A high idle will be required in some conditions. The ECU can set a high idle speed based on coolant temperature (**Idle Hi Below Cool**), or as engine speed drops towards idle to prevent engine stalling (**Idle Hi Time**). The target idle increase above the normal idle speed for high idle is **Idle Hi FB Target+**. When returning to the normal target idle speed the target speed is reduced over a period of time set by **Idle Hi Decay**.

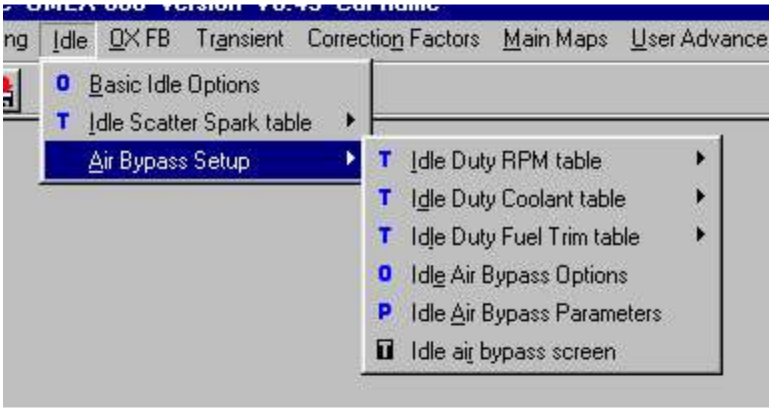
5.1 Scatter Spark Idle



The **Idle Spark Table** shows the change in ignition timing based upon rpm away from the target engine speed. When the idle is high, negative values are required to decrease the idle rpm, and when the idle is low, positive values are required to increase the idle rpm. As the engine moves further away from the target idle, the numbers should increase.



5.2 Air Bypass Idle

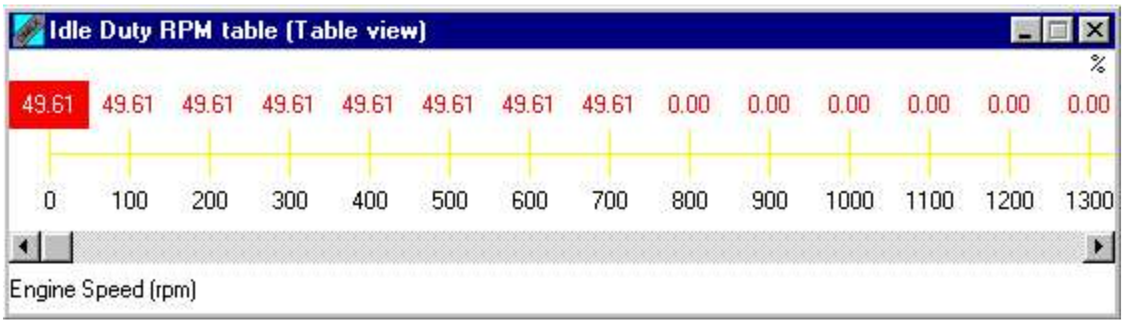


There are three types of air bypass motor. 2 wire push/pull, 3 wire push/pull, and stepper motor.

Idle Duty Max is the duty cycle above which the idle motor does not flow extra air.
Idle Duty Min is the duty cycle below which the idle motor does not flow any air.

The **Idle Duty Coolant table** gives the % opening of the idle motor required at each temperature to achieve the base target idle.

The **Idle Duty RPM table** is a modifier based on engine speed for if the engine speed moves below the target idle ie anti-stall. The target idle speed should have a modifier of **0**. Engine speeds well below target should have a large positive number to open the idle motor to stop the engine stalling. The example below is typical for a 1000rpm idle.



The idle is then fine-tuned and maintained by the feedback loop. **Idle FB- max** and **Idle FB+ max** are the feedback limits for the idle motor. The update rate of this feedback loop is set by **Idle FB Rate**. This would typically be **40**ms with a stepper motor or **200**ms with a PWM device.

The **Idle Fuel table** is required for engines that are using air bypass with throttle position as the main load sensor. On TPS load based engines, the ECU does not measure the extra air flow due to the opening of the idle motor, so does not compensate with extra fuel in the main fuel map to maintain the target lambda (air/fuel ratio). An oxygen sensor cannot make adjustments to the fuelling fast enough to cope with these changes. This table allows a fuel trim based on idle motor duty to maintain a constant lambda value. This is not required for MAP based systems.

5.3 High Idle

When the engine enters Hi idle conditions, the option **Hi Idle Duty** is the increase in duty cycle required to reach the **Hi Idle Target RPM**

5.4 Air Con Idle

When an air conditioning pump switches ON, the load on the engine increases and so the idle speed will momentarily decrease. The idle feedback loop will allow the idle speed to recover, but the

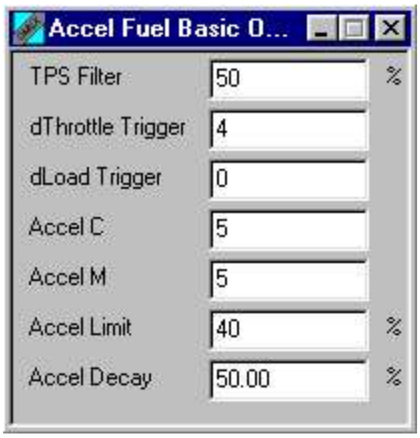
Idle A/C Duty+ option is an instant increase in idle motor duty when the A/C input is ON so that the momentary dip in engine speed is reduced.

6 Transient Conditions

The fuel map contains the fuel for steady state running. Fuel transients such as acceleration and deceleration of the engine especially at gear changes may require different fuelling. To prevent excessively lean or rich stumbles and emission control problems the ECU has three functions; throttle triggered acceleration fuel enrichment, MAP triggered acceleration fuel enrichment, and deceleration fuel cut off.

6.1 Acceleration Fuel

Basic



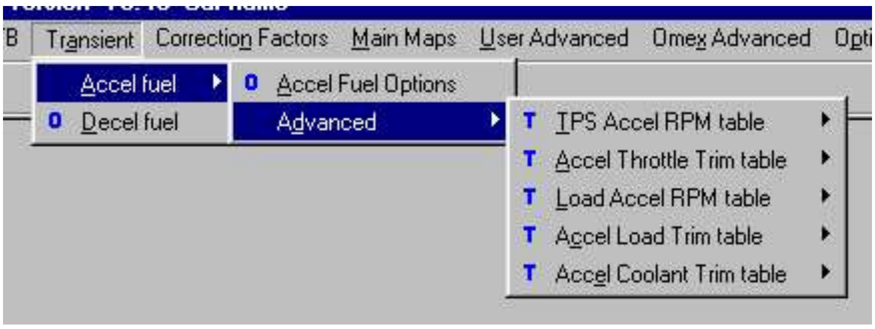
Acceleration fuelling can be triggered by a rate of change of value of throttle position or of MAP value or both. This is descibed by the options **dThrottle Trigger** and **dLoad Trigger**.

Once triggered, the ECU will output an amount of fuel (**Accel c**) and then an extra amount dependent on the accel rate above the trigger value (**Accel m**).

The amount of acceleration fuel is capped to a maximum regardless of the calculated value by the option **Accel Limit**.

The acceleration fuel is decayed as described by **Accel Decay**. If zero, the accel fuel would decay to 0 after 1 injection event.

Advanced

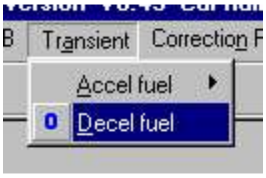


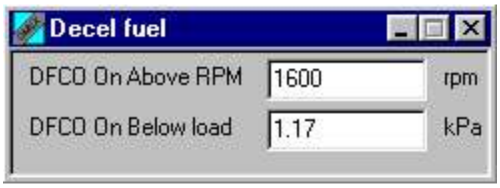
The engine usually requires less acceleration fuel at high rpm, so the **TPS Accel RPM table** and **Load Accel RPM table** describe the percentage of the calculated fuel supplied at differing engine speeds.

The **Accel Throttle Trim table** and **Accel Load Trim table** allow the accel fuel to modified for the throttle position or manifold pressure at which the accel fuel was tripped, therefore giving varying accel fuel at different engine loads.

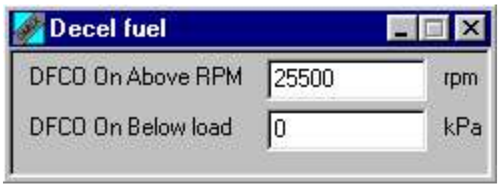
When the engine is in warm-up, it may require extra acceleration fuelling. This is described in the **Accel Coolant Trim table** as a percentage extra acceleration fuel.

6.2 Deceleration Fuel Cut Off



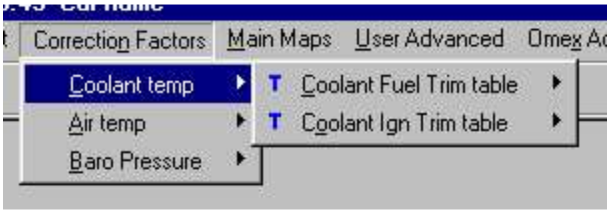


When this function is active ie above the engine RPM and below the engine load, the injection pulsewidth is reduced to a minimum. This feature is not normally used on high performance and race cars. To disable this feature set as follows.



7 Correction Factors

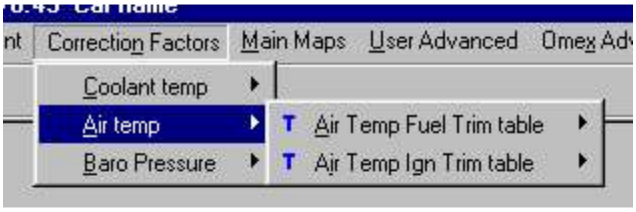
7.1 Coolant Temperature



When the engine is cold, it requires an extra amount of fuel. This extra fuel is added as a percentage set in the **Coolant Fuel Trim table** of percentage increase against engine coolant temperature.

Ignition can be trimmed based upon coolant temperature. This is only used for extremes of temperature. This is described by the **Coolant Ignition Trim table**.

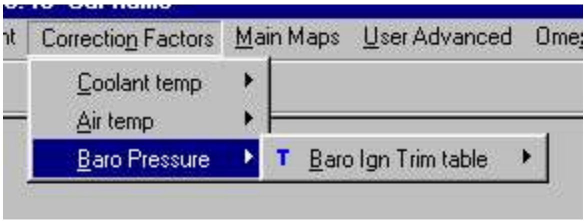
7.2 Air Temperature



If you wish to change the fuelling with air inlet temperature, then the **Air Temp Fuel Trim table** allows the user to make a percentage change in fuel based on AIT.

Ignition can be trimmed based upon air inlet temperature. This is only used for extremes of temperature. This is described by the **Air Temp Ign Trim table**.

7.3 Barometric Pressure



The fuel and ignition can be trimmed to allow for changes in barometric pressure as sensed by a 1bar pressure sensor. The ignition trim is defined in the **Baro Ign Trim table**. The fuel trim values are a known mathematical equation so are inbuilt and are non-adjustable.

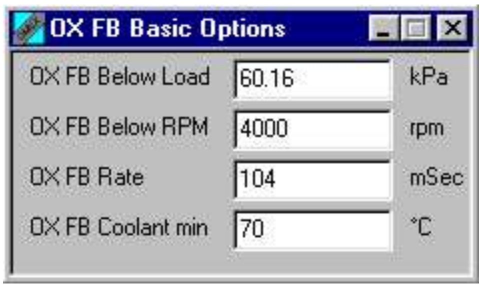
8 Oxygen Feedback

The ECU can take inputs from either narrowband or wideband oxygen sensors. This information is then used to make constant trims to the fuelling.

There is a large amount of theory, and many different options, involved in setting up the complicated oxygen feedback as this ECU is capable of meeting very strict emissions requirements. Fortunately, these complicated equations have already been tackled, and nearly all engines require the same settings for oxygen feedback, so it can be set relatively easily.

8.1 Narrowband

Basic

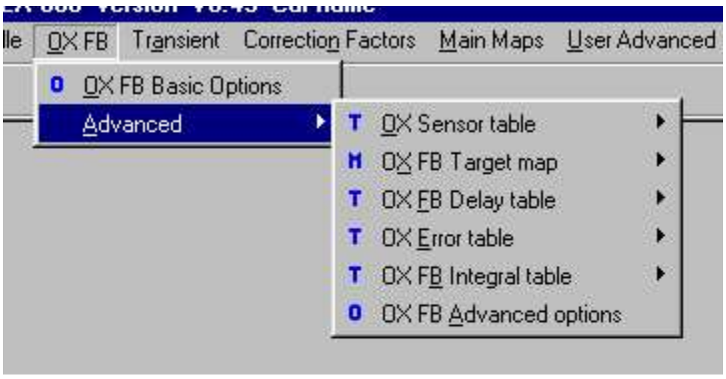


A narrowband exhaust gas oxygen sensor may be employed to trim the fuelling to maintain a stoichiometric (lambda=1) air/fuel mixture to enable an exhaust catalyst to function efficiently and reliably. Any 4 wire (ie heated) narrow band lambda sensor can be used.

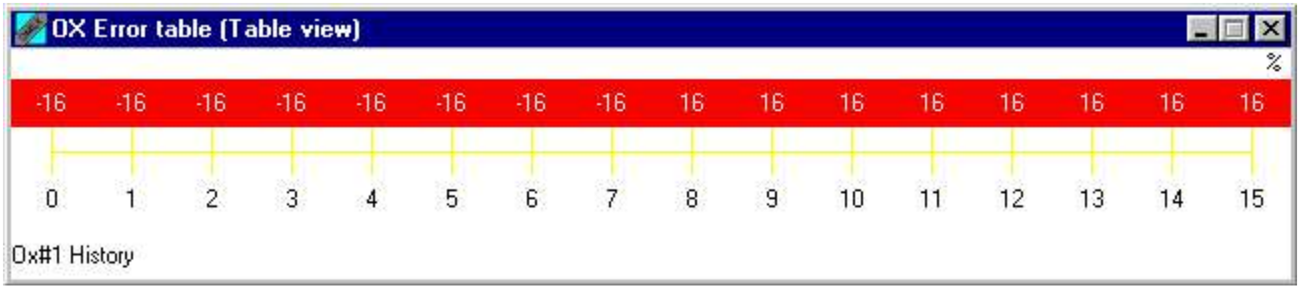
Start-up maps from Omex will be programmed with oxygen feedback numbers for narrowband sensor feedback so in most cases all that is required is to turn on the function.

- **OX FB Below Load** and **OX FB Below RPM** are the engine load and engine RPM values below which the oxygen feedback is active. Typically these cover the emissions test and gentle driving conditions. eg 4000rpm and 40% load
- **OX FB Coolant min** is the minimum engine coolant temperature at which the engine is able to run at lambda 1 ie the temperature at which it no longer requires warm-up fuel enrichment. Typically 60-70C.
- **OX FB Rate** is the update rate of the sensor, typically 100. Setting this to 0 disables the oxygen feedback.

Advanced

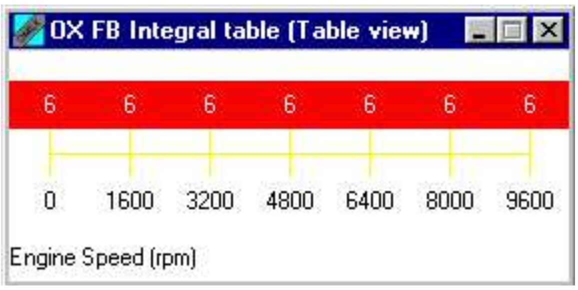


The following is a list of the maps, tables and options, typical values, and their use in oxygen feedback. It is strongly recommended that these values are not changed without consulting Omex.

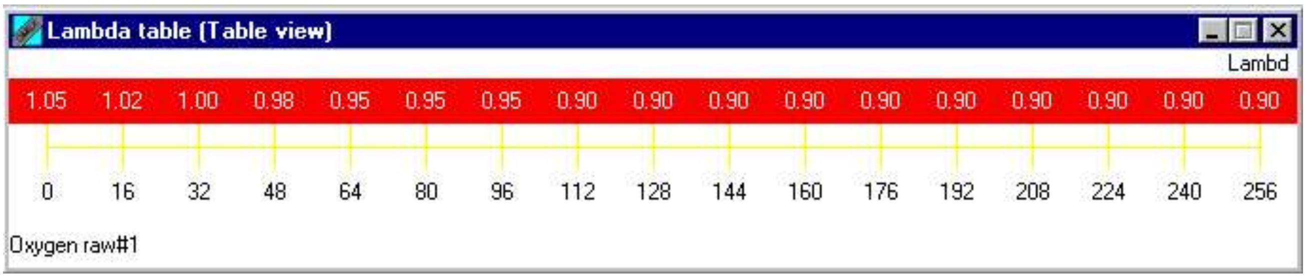


Oxygen Error table – If the feedback rate is not fast enough (the engine swings from rich to lean for long periods of time), then these numbers may be increased

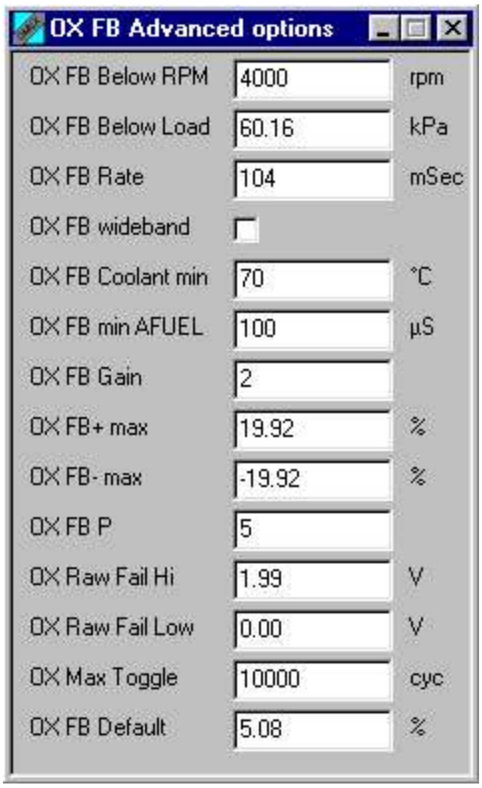
OX FB Integral Table | Table input the following values.



Lambda Table | Table input the following values. This shows that at a raw value of below 32, the engine is lean, and at a raw value of above 48 the engine is rich.



The **Lambda Target Map** shows the target lambda value for all engine speed and load conditions. In the case of narrowband oxygen feedback the whole table should be set to a value of 1.



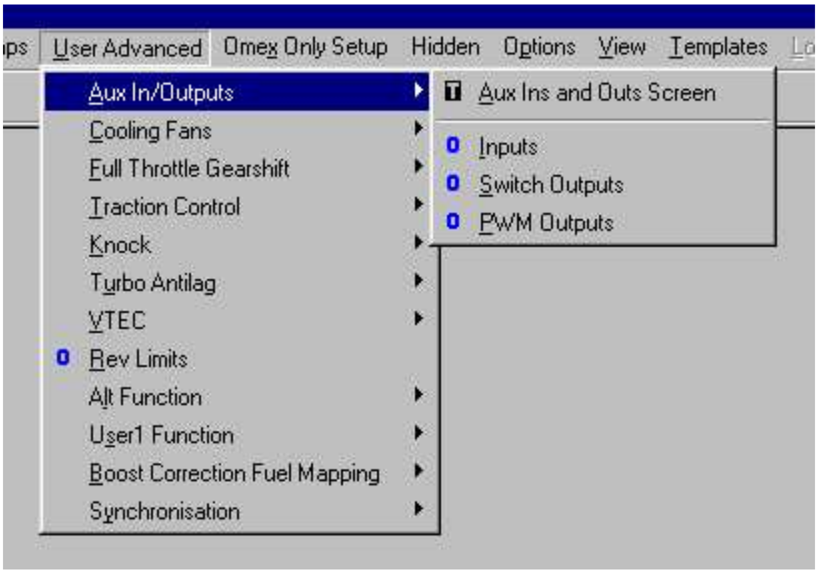
OX FB +max and **OX FB –max** are the percentage fuel trim limits for the oxygen feedback.

The oxygen sensor takes a few seconds to warm up after startup as can be seen by its gradual increase from 1 on the **oxygen raw** parameter. Before the sensor is warm we wish to ignore its value as it will trigger fuelling changes that are not needed. The delay after engine start before starting oxygen feedback is set in the **OX FB Delay Table**.

8.2 Wideband

Contact Omex.

9 Auxiliary Inputs and Outputs



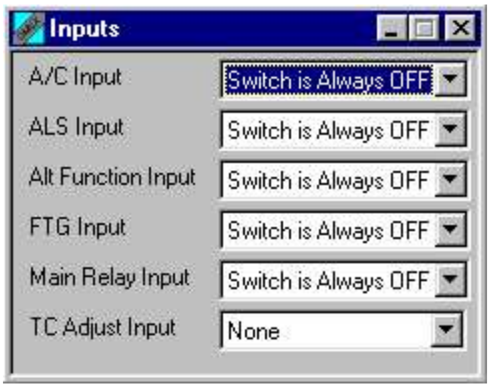
Many functions have dedicated pins, but there are also 3 auxiliary inputs and 4 auxiliary outputs that may be assigned to whichever functions are required in your installation.

Each function is assigned to an input or output. Each input or output may only be assigned to one function.

For details of how to wire the auxiliary inputs and outputs please see the wiring section of this manual.

The drop-down menus have many options for which inputs and outputs can be selected. Use only the AUX options.

Inputs

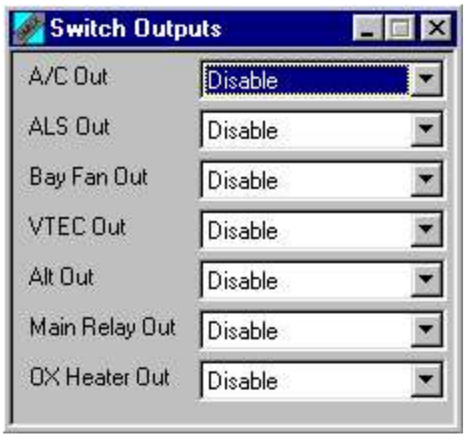


When assigning inputs, note that AUX IN 3 is a switch input only so cannot be used for TC Adjust Input.

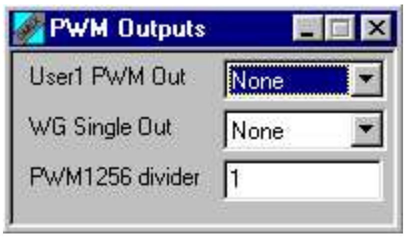
For a function to be always active (sometimes useful with the Alt function) select Switch Always ON.

For the function to be ON or OFF when the input is ON, select AUX IN X ON or AUX IN X OFF respectively.

Switch outputs



PWM outputs

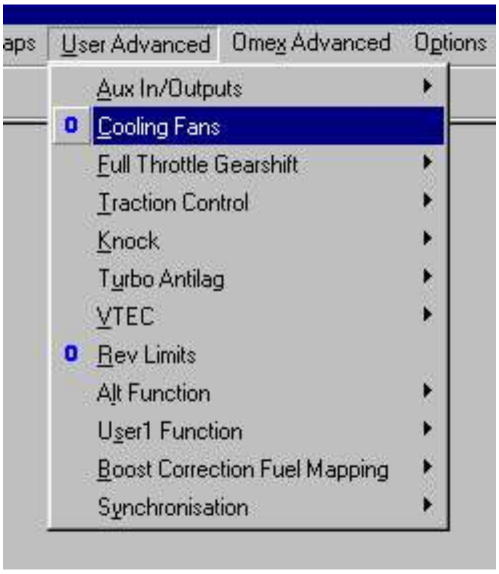


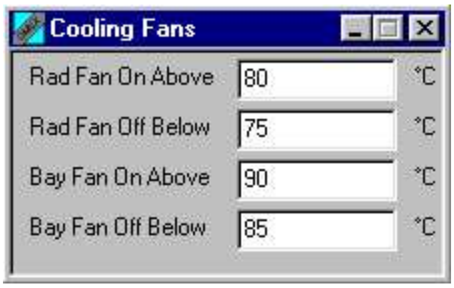
The PWM outputs may only be assigned to AUX OUT 1.

The base frequency of this PWM output is 250Hz. The option **PWM1256 divider** allows this frequency to be reduced if the PWM device requires this. Values are shown below.

Frequency (Hz)	Divider
250	1
125	2
84	3
62.5	4
50	5
42	6
36	7
32	8
28	9
25	10

10 Cooling Fans



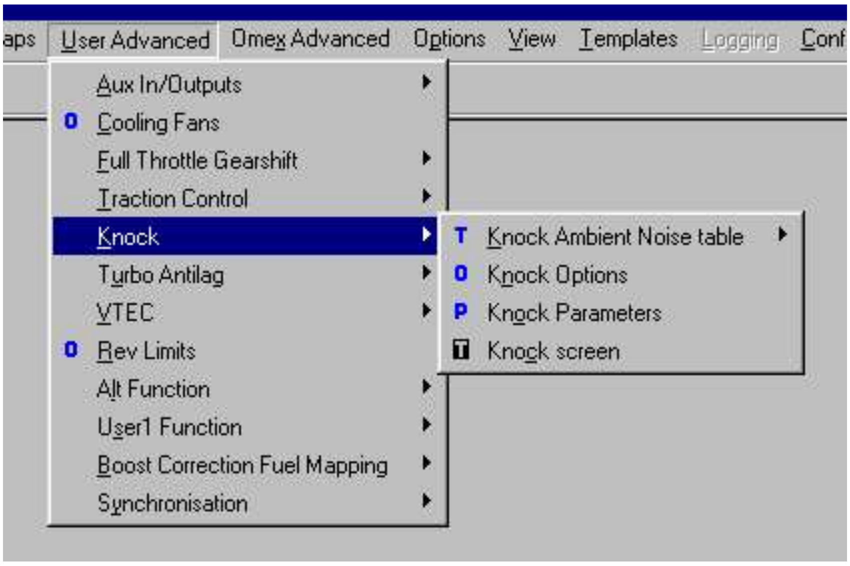


The ECU has two software outputs switchable on coolant temperature values. These would normally be used for cooling fans. The two outputs may be set to two different fans or set at different temperatures for twin speed fans.

Rad Fan On	temperature at which the rad fan output is on
Rad Fan Off	temperature at which the rad fan output is off. Set a few degrees lower than Rad Fan On to allow hysterisis
Bay Fan On	bay fan on at this temperature
Bay Fan off	bay fan off at this temperature. Set to a few degrees below Bay Fan On to allow hysterisis

The rad fan is a dedicated output pin on the ECU (6C blue black). Bay fan is not dedicated and so needs to be set as one of the auxiliary outputs.

11 Knock Control



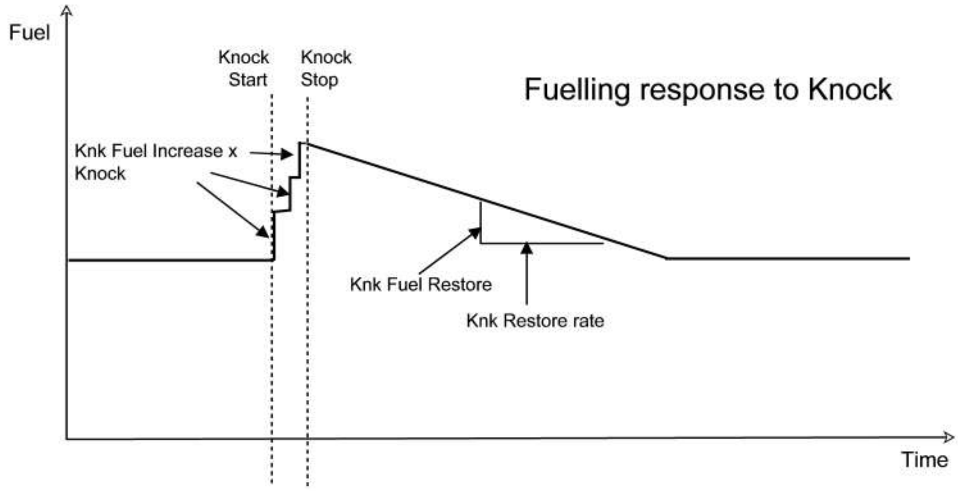
Engines make mechanical noise that varies dependent on engine speed. The **Knock Ambient Noise Table** describes this normal background engine noise when running out of knock. The parameter **KNKRAW** shows the current noise measured by the knock sensor. Logging the parameter **KNKRAW** on a full load engine run whilst using a safe ignition map allows you to draw the table of normal noise.

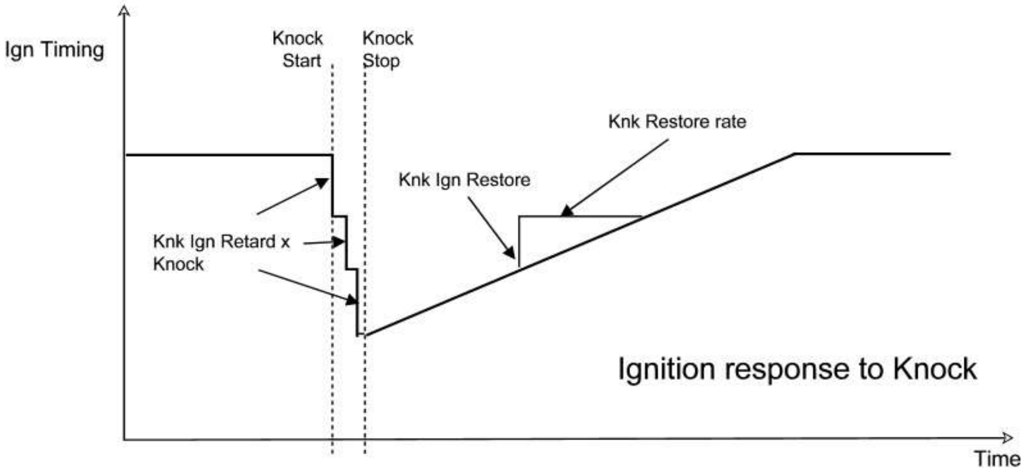
When **KNKRAW** exceeds the **Knock Ambient Noise table** values, the engine is assumed to be in knock. The level of noise above the normal noise is shown by the parameter **Knock**.

When knock is discovered, the ECU needs to react by retarding the ignition to stop knock, and increase the fuelling to cool the cylinder.

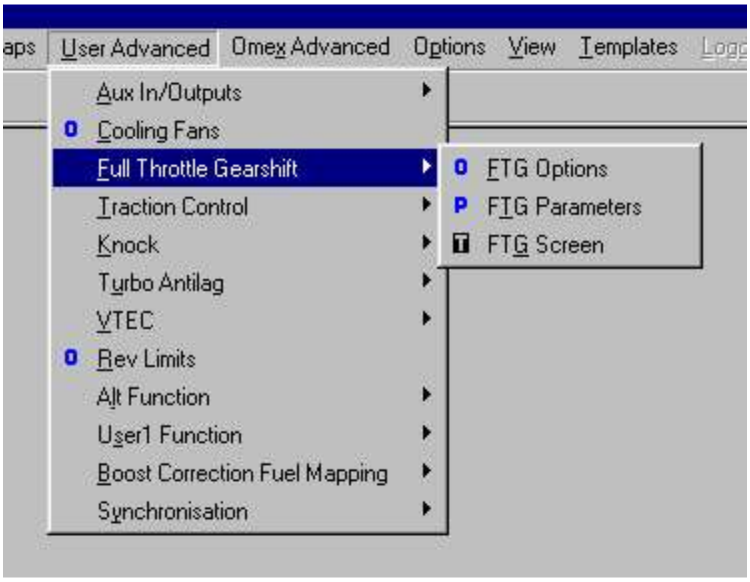
The **Knock** value causes an ignition retard (**Knk Ign Retard**) and an increase in fuel (**Knk Fuel Increase**) proportional to the Knock level. The ECU will make these changes to the timing and fuelling every 4ms until knock has stopped. The extra fuel and the ignition retard are capped to a maximum regardless of the calculated values by **Knk Fuel max** and **Knk Ign Retard max**.

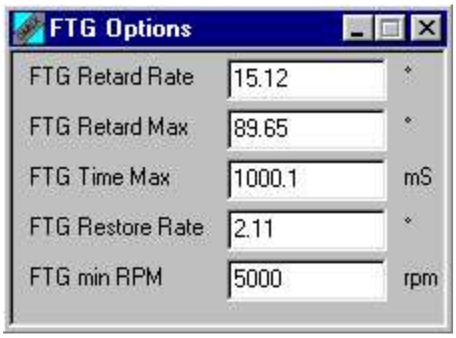
After knock has stopped, the fuelling and ignition values need to be returned to normal. The rate is set by **Knk Restore Rate** (engine revolutions) and then **Knk Fuel Restore** (% fuel per rate) **and Knk Ign Restore** (degrees ignition timing per rate).


Fuel
Knock Start
Knock Stop
Fuelling response to Knock
Knk Fuel Increase x Knock
Knk Fuel Restore
Knk Restore rate
Time

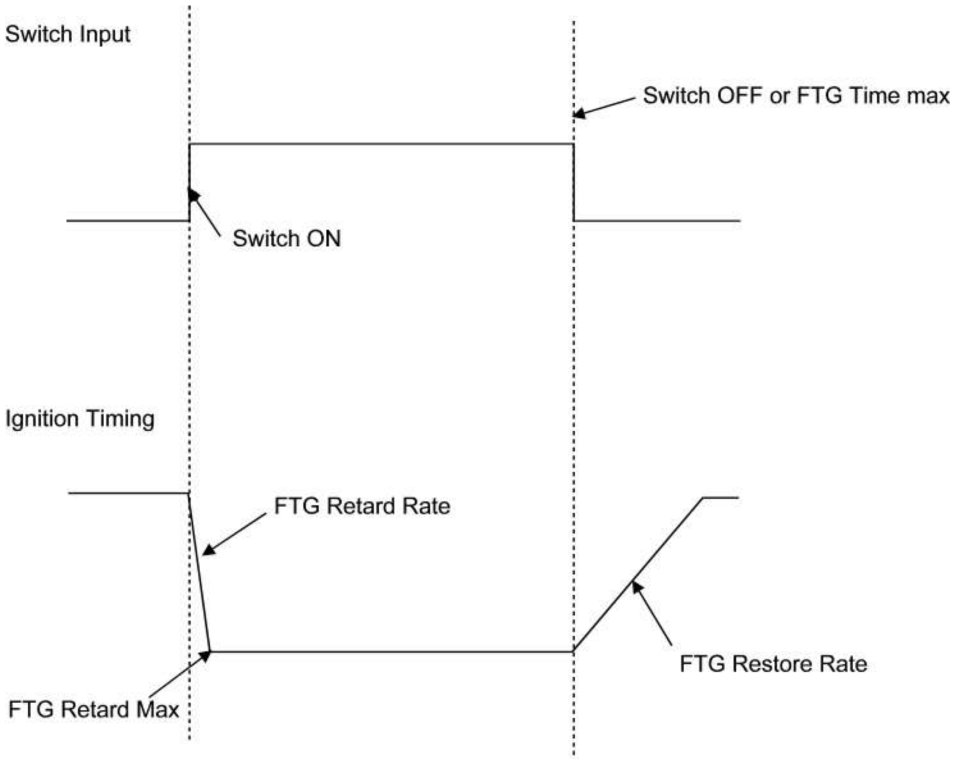

Ign Timing
Knock Start
Knock Stop
Knk Restore rate
Knk Ign Restore
Knk Ign Retard x Knock
Ignition response to Knock
Time

12 Full Throttle Gearshift





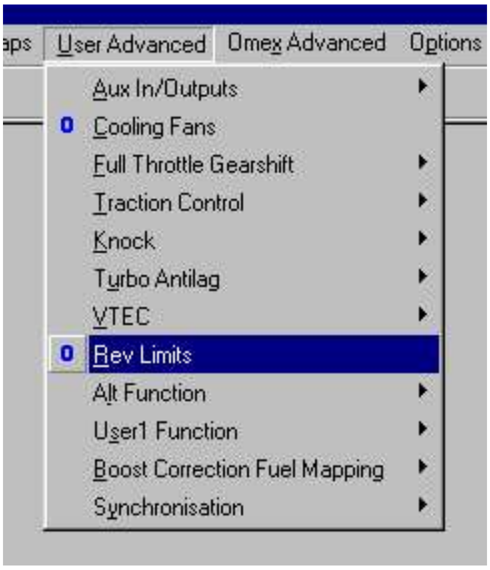
The full throttle gearshift is a switched ignition retard function. When the input for this function is satisfied (normally by a physical input switch on the clutch pedal or gearstick), the ECU retards the ignition at a rate, **FTG Retard Rate**, up to a maximum retard, **FTG Retard Max** (The maximum retard is relative to the current map value, not absolute). When the input switch changes to **OFF**, the ignition retard will be returned at a rate, **FTG Restore Rate**, until the normal ignition timing is reached. If the input does not go to **OFF**, the timing will be returned after a time set by **FTG Time max**. The retard rate is degrees per 4ms and would typically be very fast (10-15) then the advance slower (2-3). The option **FTG min RPM** is the minimum engine RPM at which a full throttle gearshift retard can be performed. This prevents the engine RPM from dipping when depressing the clutch whilst stationary.

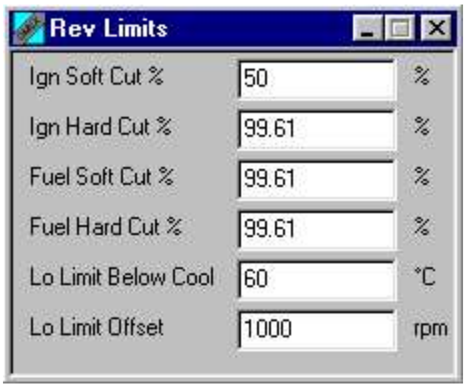


13 Traction Control

Please contact Omex if you would like to use this feature.

14 Rev Limits



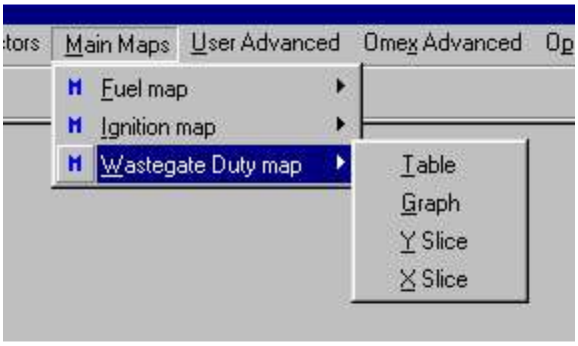


The tables Ign Rev Limit and Fuel Rev Limit allow differing rev limits based upon throttle position for when using anti-lag. If you are not using anti-lag, set all of the throttle positions in the table to the same engine speed. At this engine speed, the soft cut will be envoked. If the engine speed is exceeded by 50 rpm, then the hard cut percentage is added to the soft cut percentage. The ignition percentage is the percentage of sparks removed. The fuel cut is the percentage of fuel pulses removed. Fuel cut should be cut 100% even on its soft cut option.

A second rev limit can be imposed when the engine is below a specified temperature.

Lo Limit Below Cool	the temperature below which the cold rev limit is set
Lo Limit Offset	the reduction in rev limit when rev limit coolant is satisfied

15 Turbo Boost Control

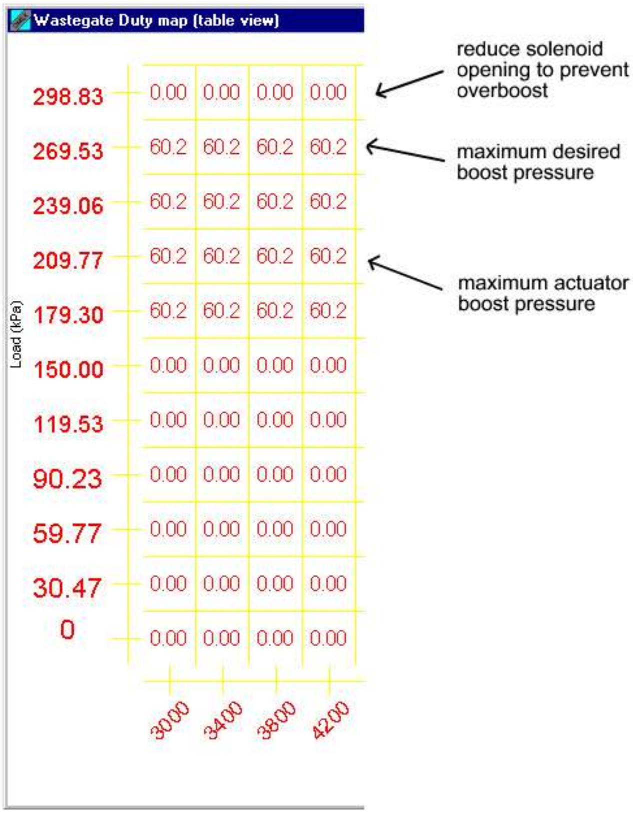


Boost pressure is regulated by the turbo wastegate which is opened at a boost pressure set by the actuator. To increase the boost pressure at which the wastegate is opened, the actuator needs to see a lower pressure than actually exists in the manifold. The ECU is able to control a solenoid to lower the pressure that the actuator sees, therefore increasing the boost pressure at which it opens the wastegate. The ECU can therefore never reduce the maximum boost to below that of the actuator setting, it can only be increased.

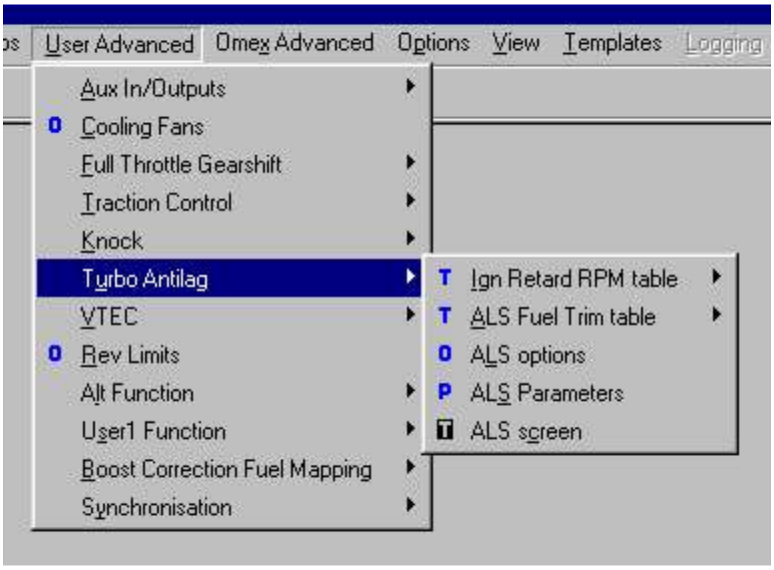
As the solenoid is a PWM device, the map describes the duty cycle of the solenoid against engine load (boost pressure) and engine speed. A value of zero would not activate the solenoid, and a value of 100 would have the solenoid open fully.

Normally, the engine would be first mapped without the boost control activated. The fuel and ignition values can then be guessed for the load sites not yet reached. The **Wastegate Duty map** is used to increase the boost to the required level, then these sites can be fully mapped.

The **Wastegate Duty map** is engine load (boost pressure) vs engine speed. At the engine speeds where extra boost pressure is desired, the solenoid may be opened just before the boost reaches the maximum permitted by the actuator to allow the engine to boost to the desired pressure. At boost pressures above the desired pressure, the solenoid should be closed again to prevent overboost.



16 Anti-lag



Anti-lag keeps the boost pressure high and the turbocharger spinning by keeping the gas flow high, but maintains drivability by controlling the torque. The gas flow can be achieved by jacking the throttle with a solenoid, air bypass valves, or if a low level of anti-lag is used, often by opening the idle motor. To control torque, the ECU retards the ignition and cuts fuel and sparks.

In reducing engine torque, anti-lag produces very high exhaust gas temperatures which can cause damage to the manifold and turbo. If using anti-lag, monitor exhaust gas temperature very closely when setting-up and consult your turbo manufacturer for guidance on maximum temperatures.

When the antilag input is satisfied, three tables are used to maintain engine speed based on throttle position – an ignition retard table, an ignition cut table, and a fuel cut table. Once the engine speed exceeds the speed in the table, the relevant soft cut option is invoked. If the speed is exceeded by 50rpm the hard cut option is added to increase the effect. The first torque reducer to use is the ignition retard, then the ignition cut, and finally if required, the fuel cut.

The **Ign Cut RPM table** and **Fuel Cut RPM table** found on the Anti-lag screen are copies of those found in **Setup | Rev Limiters**.

If using the idle motor to give anti-lag airflow, then the option **ALS Idle** is the percentage duty cycle added to the idle motor to open it when the **ALS input** is satisfied. This would often be 100%.

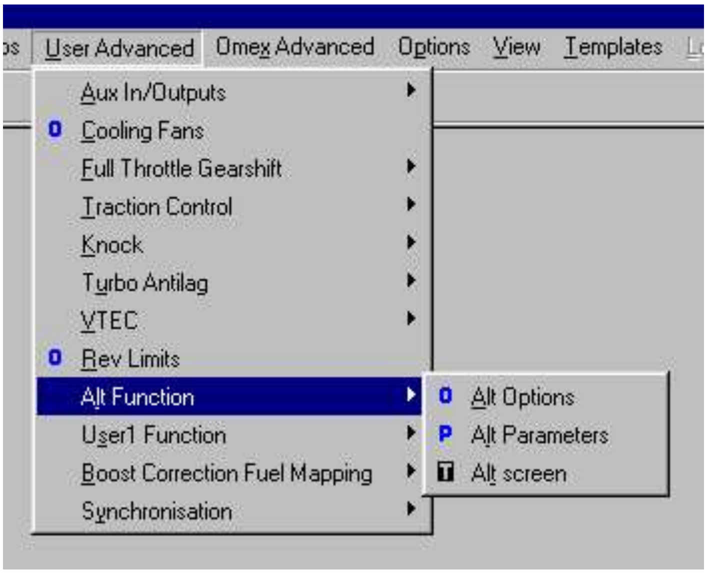
ALS Air Max is the air temperature above which ALS turns off and the ECU shuts its controlled valves.

ALS Off Road Speed – If the ECU has a road speed input, this option allows the anti-lag to be deactivated above a set road speed. This allows the anti-lag to be used as a launch control for engines that require boost at low RPM for launch.

ALS Active Time is the longest time the ECU will stay in anti-lag mode before turning off to prevent excessive exhaust gas temperatures if coasting downhill. **ALS Inhibit Time** is the minimum time after turning anti-lag off that it can turn on again.

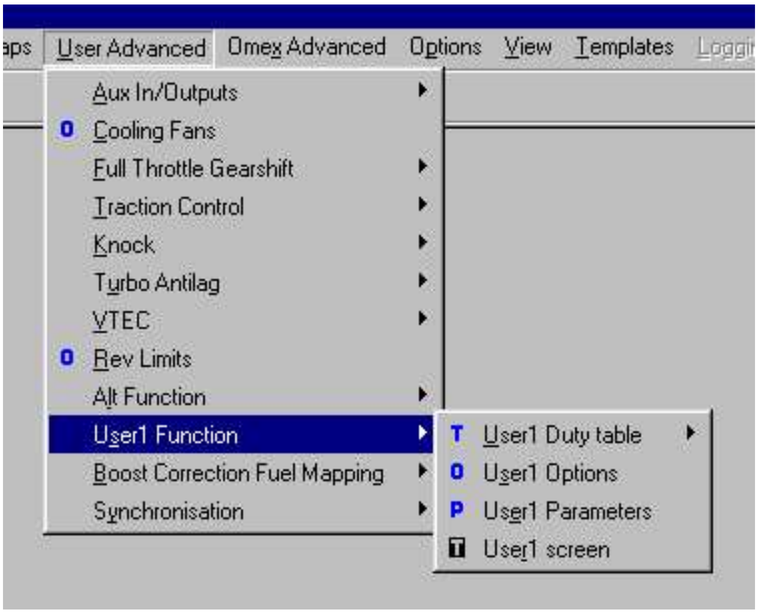
It is possible on some engines to create more boost in anti-lag mode by increasing the fuel. This is done using the **ALS Fuel Trim table**.

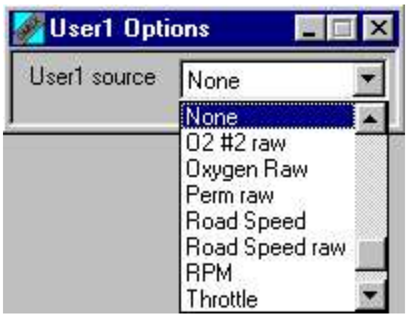
17 Alt Function



The Alt function is a possible fuel trim, ignition trim, and physical switch output based upon an entry condition set by the user. The entry condition can be a physical input switch, engine speed, engine load, throttle position, or a combination of these. The engine entry conditions have separate on and off points to give hysteresis. For the trims to be available simply on a switch, then set the rpm, TPS, and load on/off conditions to conditions the engine is always under. For the trims to be active under certain engine conditions without any switch input then set **Alt Function Input** to **Switch is Always ON**.

18 User1





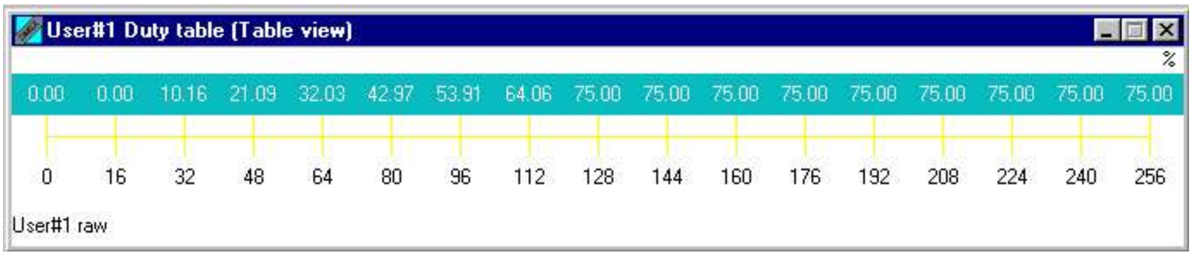
The ECU has a table **User1 table**. This table can use a raw source (scaled to 0-255) for the lower (input) axis of the table to drive a PWM output, the duty cycle of which is defined on the upper axis of the table.

The raw input is selected by option **User1 source**. Useful selectable sources are;

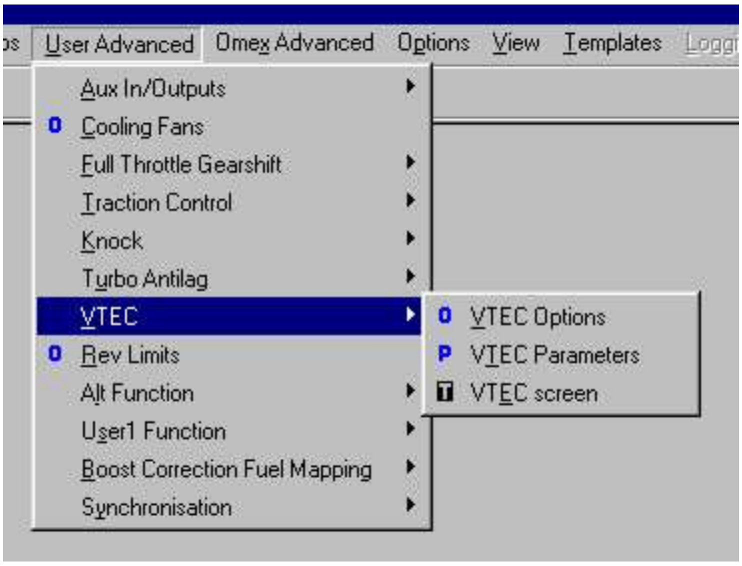
Air temperature
Baro pressure
Battery voltage
Coolant temperature
Engine Speed
Injector duty
Knock
Lambda
MAP
Throttle position

The PWM output number used is defined by the option **User1 PWM out** and can only be set to AUX1

A typical use would be a carbon canister valve drive as part of emission control.
User1_source = injector duty.

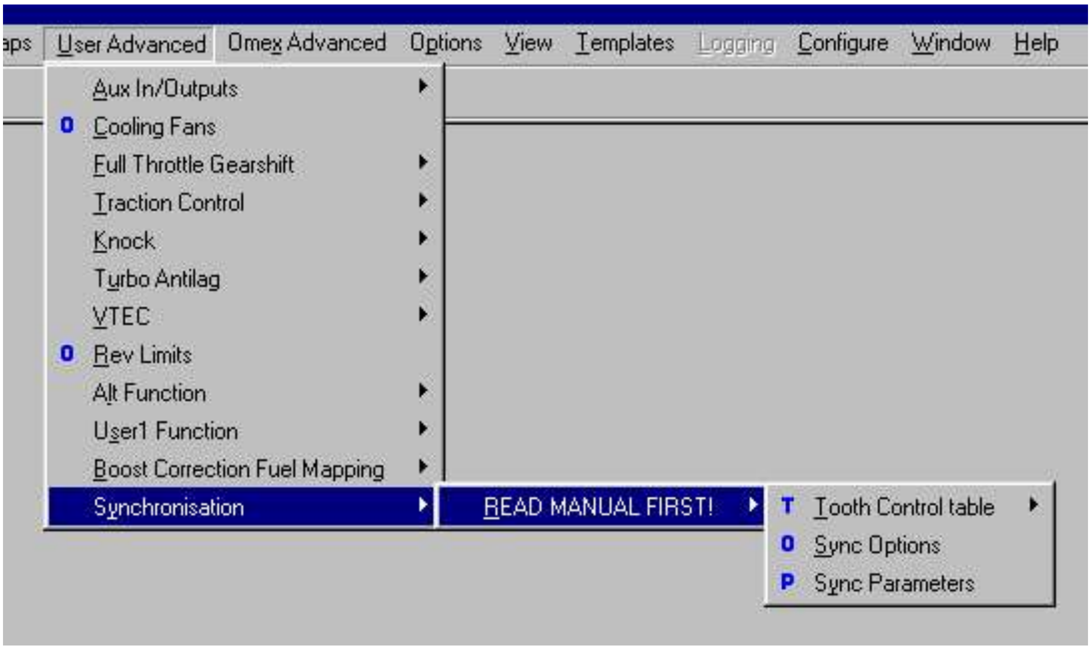


19 VTEC Cam Control



The simple on/off VTEC control is switchable on engine RPM, throttle position, and engine load with hysterisis provided by separate on and off points. In the VTEC condition there is also a fuel and ignition trim.

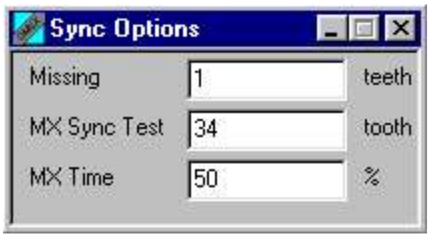
20 Synchronisation



The ECU requires an input of engine position and speed. This is done with a pattern of teeth on the crank pulley. The pattern is generally evenly spaced teeth with missing or extra teeth as reference points. As different manufacturers use different trigger patterns, the ECU is programmable to suit. The information required in the ECU for many of the popular patterns is already known, some of which are listed below. If you have a different pattern on your engine please contact Omex for advice.

It is very easy to make an engine run, but not run properly by incorrectly entering these options and tables. If possible please contact Omex for a new start-up map or email an existing map to Omex be changed to a different trigger pattern.

36-1 Ford

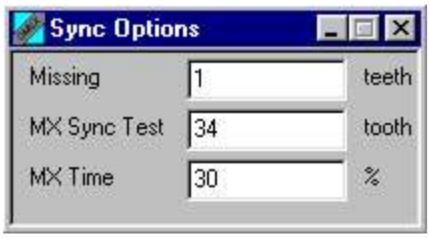


Tooth Control table:

5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

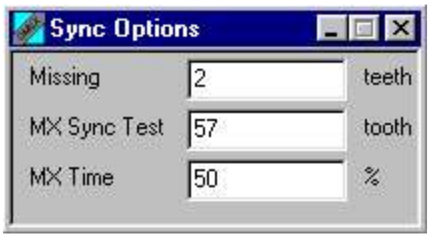
5	4	4	5	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59

36-1 Omex



Tooth Control table same as Ford.

60-2 Bosch

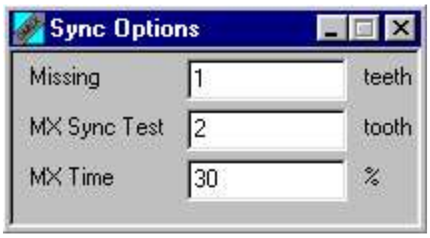


Tooth Control table:

5	4	4	4	4	5	4	4	4	4	5	4	4	4	4	5	4	4	4	4	5	4	4	4	4	5	4	4	4	4
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

5	4	4	4	4	5	4	4	4	4	5	4	4	4	4	5	4	4	4	4	5	4	4	4	4	5	4	4	3	3
30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59

Rover K-Series

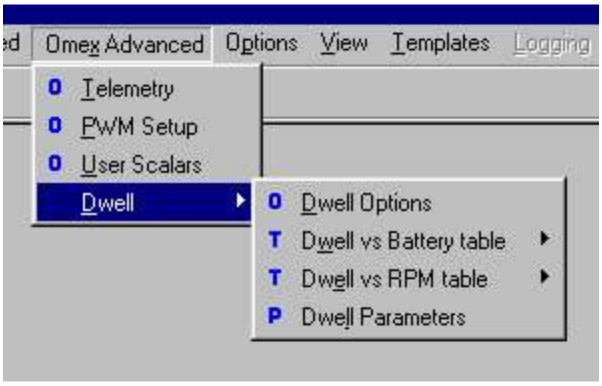


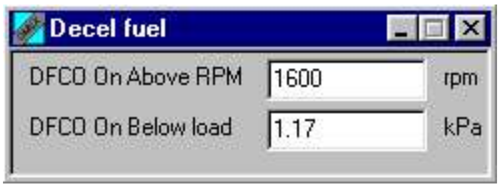
Tooth Control table:

4	4	5	4	4	5	4	4	5	4	4	5	4	5	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	5
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

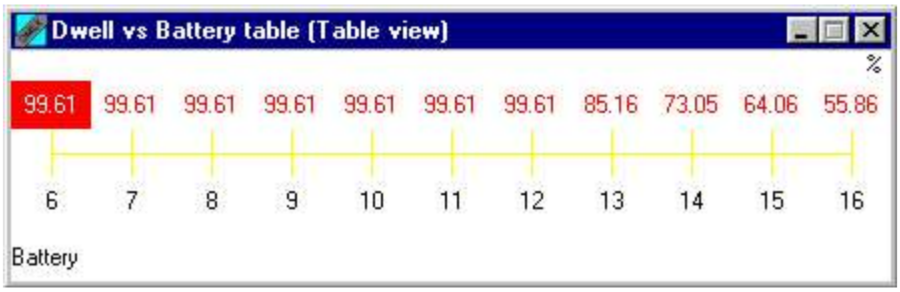
4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59

21 Dwell Control





The coil dwell time is set by option **Coil Dwell Factor**. This is unitless so contact Omex for typical values. A typical non-amplified DIS coil would have a value of **20**. If the engine required the charge times to be varied with respect to battery voltage or engine speed, it can be done through using the **Dwell vs Battery table** and **Dwell vs Speed table.** Setting these table values to 100% gives a constant dwell time. Typical values are shown below.



The options **Dwell max** and **Dwell min** are the limits of dwell time measured in internal units. Contact Omex if you want to change these values.

22 Security

The ECU has security features that allow calibrations to be password protected. All Omex maps are sent with the password cleared to allow all users access to the ECU. If you are using security, clear the password at the beginning of a mapping session and set at the end. If setting a password, keep notes of it and make sure that you have a copy of the last calibration in the ECU.

Setting a password

When connect to an ECU, a password may be set. To set a password;

- Connect to the ECU
- Select **ECU | Set Password...**
- A dialog box appears prompting for a password. The password may be any alphanumeric 6 character password.

- Enter a password and click **OK**.

Clearing a password

Once connected to a password protected ECU, the password may be cleared. Clearing the password removes the security such that any PC can connect to this ECU.

To clear the password;

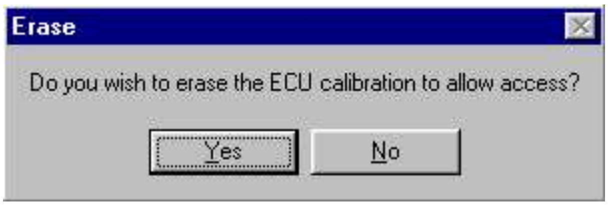
- Connect to the ECU
- Select **ECU | Clear Password...**

Clearing a protected ECU

If using an ECU where the password is unknown it is possible to use the ECU. The information in the ECU will be lost so the original map will never be accessed, and the ECU will instead be filled with random numbers.

- **ECU | Connect**
- A dialog box appears prompting for a password.

- As the password is unknown click **Cancel**.
- A dialog box appears asking if you wish to erase the calibration to allow access. Click **Yes**.



- The PC will now write random values to the ECU, and connect.
- **ECU | Send new calibration**. Select your new start-up map.
- Clear the password as shown above.

23 Wiring

23.1 Semi Assembled Loom Construction

The Omex 600 semi-assembled loom (OMEM1502) contains all of the wires except for;

Auxiliary inputs
Auxiliary outputs
Idle control

If you wish to use any auxiliary functions or air bypass idle control, then you will need the auxiliary wire pack (OMEM1504).

The engine bay is a harsh environment for wiring harnesses with oil, water, solvents, high temperatures, high vibration, and high electrical noise. The semi-assembled wiring harness is made from automotive grade cable and the shielded cables are already made-up at the ECU connector to prevent electrical noise problems.

The following should be noted when constructing the loom;

- The ECU should be mounted away from sources of extreme heat (such as exhaust), and away from direct water spray.
- The connector terminals should be either crimped with the correct tool or crimped and soldered.
- The looming material holding the wires in the loom should totally cover the wires to prevent chaffing of the wire insulation.
- If the loom is to go through panels, grommets should be used.
- The loom should be tied to mounting points using cable ties or p-clips to limit the additional stresses of the loom moving.

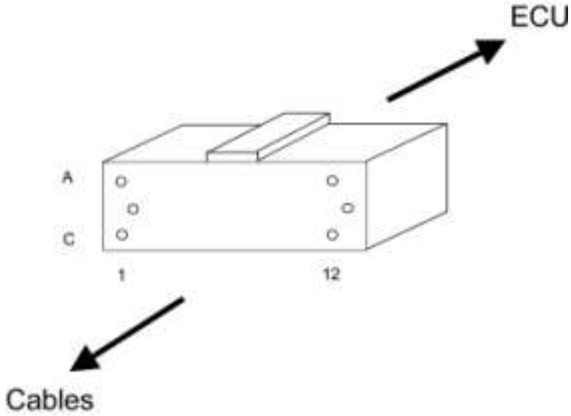
23.2 Ready Built Harness

The Omex general-purpose ready built harness has the idle and auxiliary wires joined to multi-pin connectors to allow the user to wire as they wish following the diagrams in this manual.

23.3 ECU Connector Pins

It is occasionally neccessary whilst fault finding to trace through your wiring harness to check continuity. The following are the pin-outs for the ECU plug as found on the end of the wiring harness. Where there are two colours, the first is the main colour and the second is the tracer eg

Yellow violet – yellow with violet tracer



number	colour code	function
1A	Violet	Ignition 1
2A	Yellow violet	Aux Out 4
3A	Brown pink	Idle 4
4A	Red	Battery power
5A	Black	Power ground 1
6A	Grey	Sensor ground
7A	Black screened red	Crank sensor
8A		Timing ground
9A	White violet	Coolant temperature sensor
10A	White yellow	Aux In 1
11A		
12A	Yellow	Ignition 2
1B	Brown	Injection 1
2B	White	Injection 2
3B	Brown violet	Idle 3
4B	Yellow green	Aux Out 1
5B	Blue white	Fuel pump
6B	Green	MAP sensor
7B	Black	Power ground 2
8B	Blue grey	Shift light
9B	Green white	Air temperature sensor
10B	Grey screened	Knock sensor
11B	White orange	Aux In 2
12B	Yellow red	Aux Out 2
1C		
2C	Brown orange	Idle 2
3C	Brown yellow	Idle 1
4C	Yellow black	Aux Out 3
5C		
6C	Blue black	Rad fan relay
7C	White red	Oxygen (lambda) sensor
8C	Orange	Throttle position sensor
9C	Pink	5V out
10C	Blue screened red	Road speed sensor
11C	White pink	Aux In 3
12C	Blue yellow	Tacho

23.4 Component Pin-outs

Throttle position sensors			
Part Number	**Description**	**Pins**	**Omex Wire Colour**
OMEM2002 OMEM2003	DCOE Carbs	1 Signal 2 Sensor Earth 3 +5v	Orange Grey Pink
OMEM2004	DHLA Carbs	1 Signal 2 Sensor Earth 3 +5v	Orange Grey Pink
OMEM2005	Jenvey	1 Signal (red) 2 +5v (blue) 3 Sensor Earth (black)	Orange Pink Grey

MAP Sensors			
Omex Part Number	**Description**	**Pins**	**Omex Wire Colour**
OMEM2001 OMEM2002 OMEM2003	1 Bar 2 Bar 3 Bar	1 Signal 2 Sensor Earth 3 +5v	Green Grey Pink

Coils			
Omex Part Number	**Description**	**Pins**	**Omex Wire Colour**
Single coil	Single coil	+ve +12V Supply -ve Ign1 and Ign2	Switched Violet and Yellow
Sagem / Valio Coil OMEM3501	4 Cyl DIS	1 Ign 1 2 Ign 2 3 +12v Supply 4 n/f	Violet Yellow Switched
Ford Coil OMEM3503	4 Cyl DIS 3 pin	1 Ign 1 2 +12v 3 Ign 2	Violet Switched Yellow

Temperature Sensors			
Omex Part Number	**Description**	**Pins**	**Omex Wire Colour**
OMEM2200	Coolant Temp (CTS)	1 Sensor Out 2 Sensor Earth	White / Violet Grey
OMEM2201	Air Temp (ATS)	1 Sensor Out 2 Sensor Earth	White / Green Grey

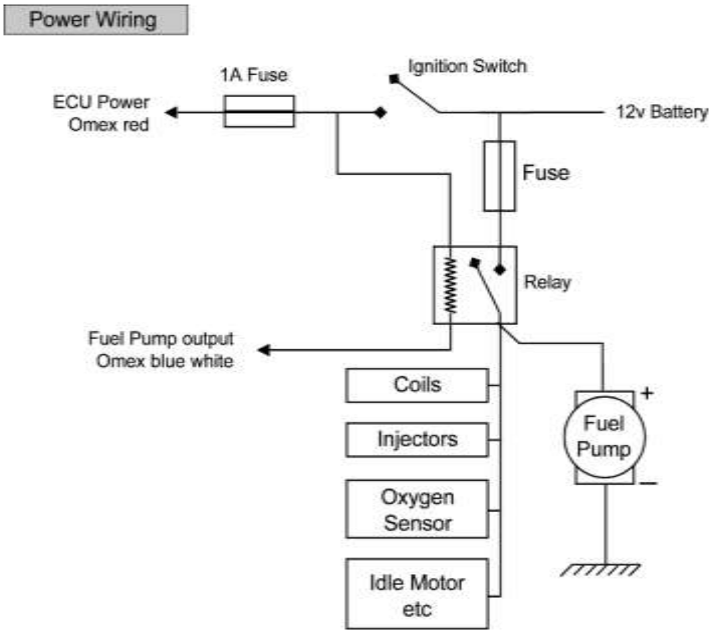
Crank Position Sensors (CPS)			
Omex Part Number	**Description**	**Pins**	**Omex Wire Colour**
OMEM2401	2 hole mounting	1 Sensor Out 2 Sensor Earth	Red Screened Black Screened

Oxygen (Lambda) Sensors			
Omex Part Number	**Description**	**Pins**	**Omex Wire Colour**
OMEM2300	4 wire	Sensor Out (Black) Sensor Earth (Grey) Heater (White) Heater (White)	White red Grey +12v Switched Earth

23.5 Diagrams

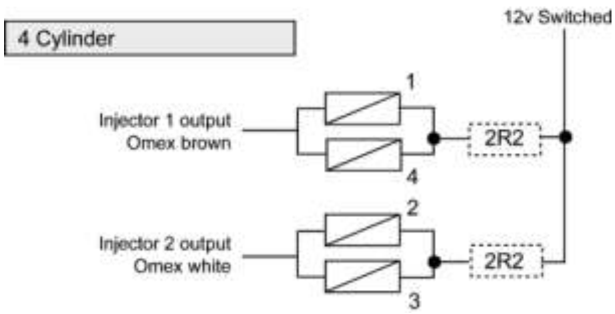
The diagrams section shows how various inputs, outputs etc should be wired.

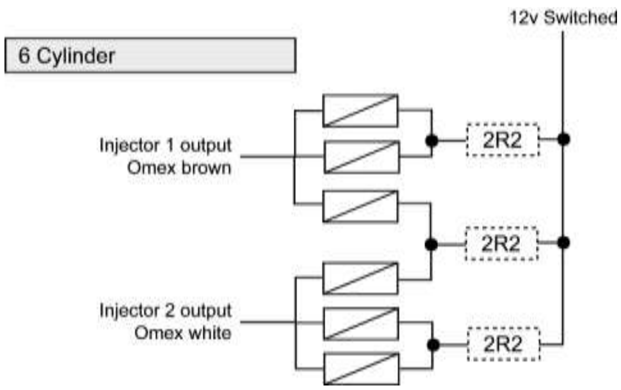
Power

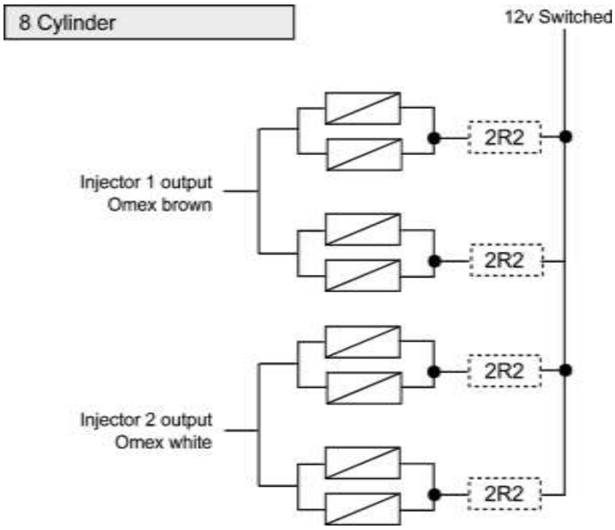


Injectors

The 600 ECU has 2 outputs that are able to control high impedence injectors (over 6 ohms) If you have lower impedence injectors they will require ballast resistors as shown in the diagrams.

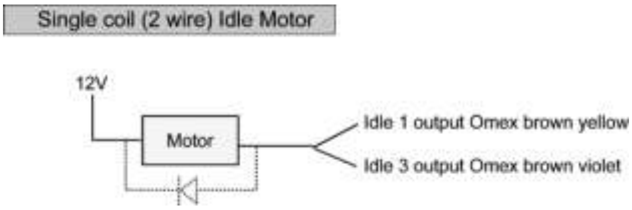


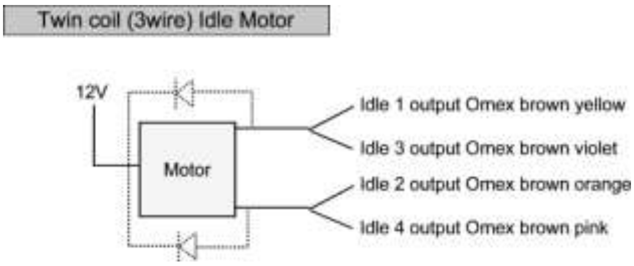




Idle Air Bypass

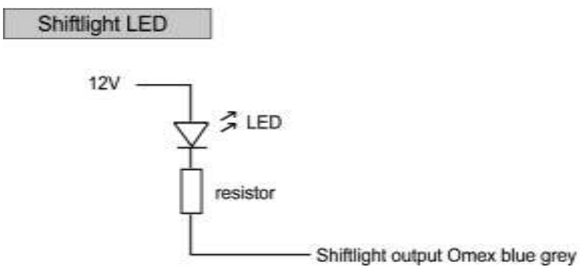
Idle motors are connected as shown in the following two diagrams. Due to high electrical current, the control wires must go to two ECU pins. Some idle motors have in-built diodes (this can be tested using the diode test function on most multimeters) and so should be connected to have the diode(s) in the orientation shown on the diagrams below. If there is no diode, then they should be added externally, minimum rating 50V 1A.

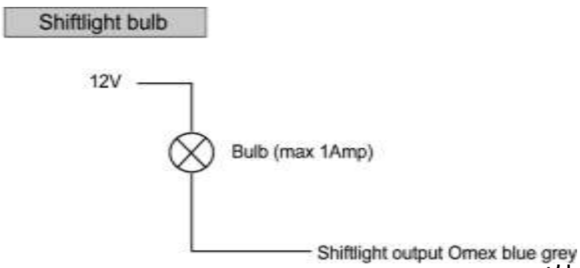




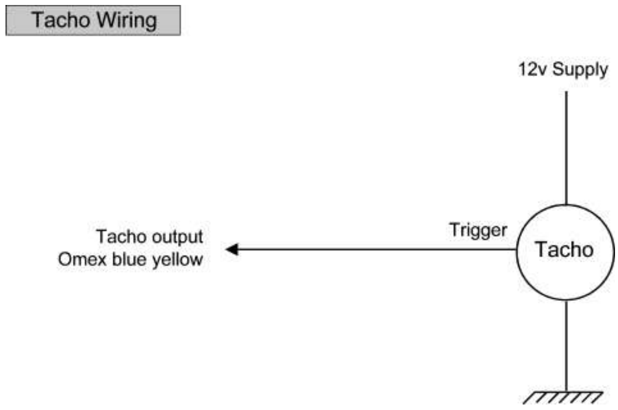
Shift Light

The shiftlight output can control either an LED or bulb. LEDs are available from Omex.



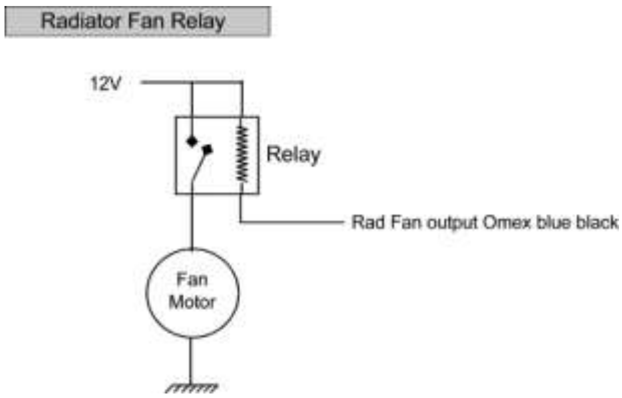


Tacho



Radiator Fan

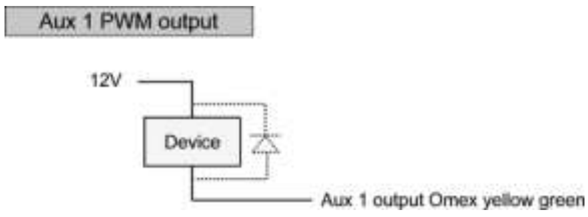
The radiator fan output cannot handle enough current to control the fan motor directly. It must therefore have a separate fan relay.



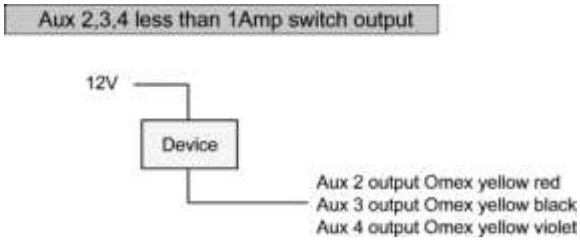
Auxiliary outputs

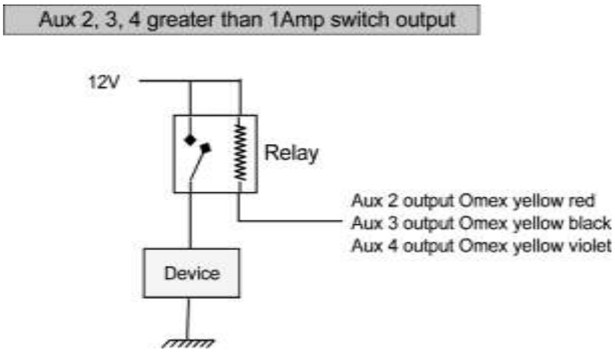
Please read the Auxiliary Inputs and Outputs section of this manual for advice on which outputs to use.

Auxiliary output AUX1 is used only as a pulsewidth output for devices such as boost solenoids. Some PWM devices have in-built diodes (this can be tested using the diode test function on most multimeters) and so should be connected to have the diode in the orientation shown on the diagrams below. If there is no diode, then one should be added externally, minimum rating 50V 1A.



Auxiliary outputs 2 and 3 are used only as lowside switches. They have a maximum electrical current handling limit of 1Amp so if used with devices requiring more than 1Amp, they must be used with a relay.

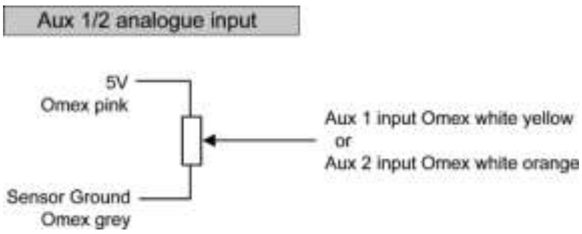


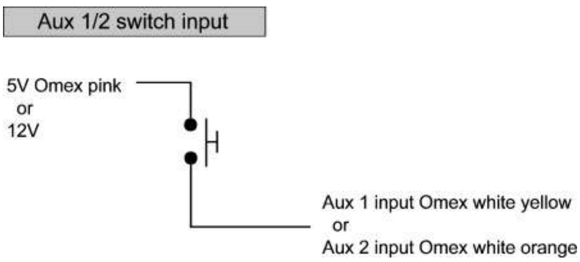


Auxiliary inputs

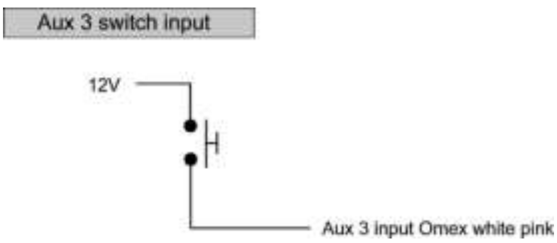
Please read the Auxiliary Inputs and Outputs section of this manual for advice on which inputs to use.

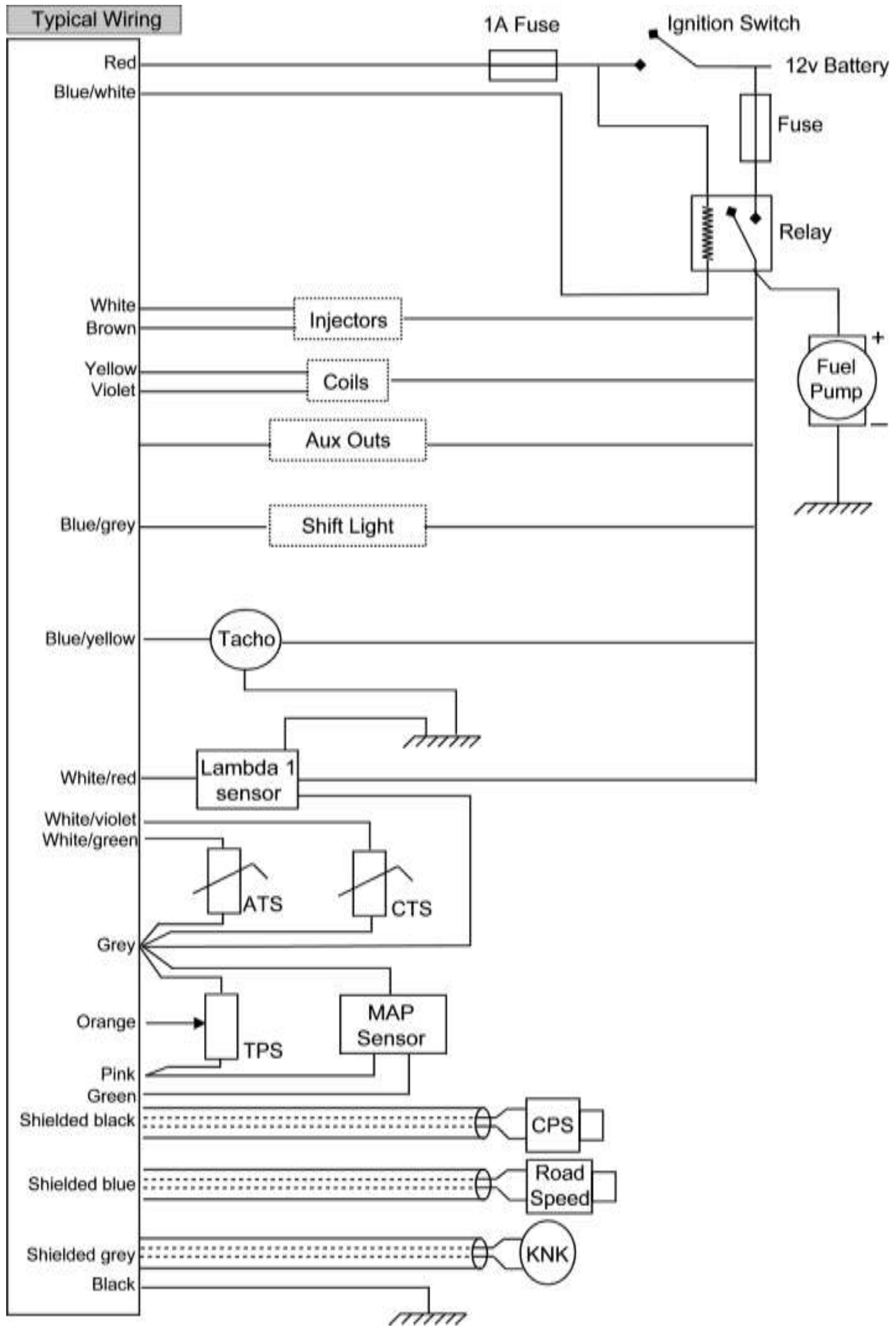
Auxiliary inputs 1 and 2 can be either analogue or switch inputs.





Auxiliary input 3 is a switch input only.




Typical Wiring
1A Fuse
Ignition Switch
12v Battery
Fuse
Relay
Red
Blue/white
White
Brown
Injectors
Yellow
Violet
Coils
Fuel
Pump
Aux Outs
Blue/grey
Shift Light
Blue/yellow
Tacho
White/red
Lambda 1
sensor
White/violet
White/green
ATS
CTS
Grey
Orange
TPS
MAP
Sensor
Pink
Green
Shielded black
CPS
Shielded blue
Road
Speed
Shielded grey
KNK
Black