Lumenition®

COMPETITION ENGINE

MANAGEMENT SYSTEM

Instructions for the Installation
of Lumenition Parts

Installation Kit
Instruction Manual

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INTRODUCTION.

This instruction manual covers the installation of the Lumenition range of standard looms into vehicles and the associated sensors. There is also a guide to the fuel system requirements for an electronically injected vehicle.

There are a number of standard looms available from Lumenition that have been designed to support the available functions of the Cxxx range of Engine Management ECUs. These include; ignition only or fuel and ignition in 4, 6 and 8 cylinder engine. Each loom has connections for all the necessary input sensors for each application. In some cases short adapter looms may be required and these are supplied in the relevant installation kit.

The installation of the ECU, the setting up and programming of the engine management system are covered in other Lumenition documents that are supplied with the ECU and the Handheld Controller.

CONTENTS OF KIT.

Based around four basic loom types a number of harness kits have been devised to cater for various vehicle applications. each kit will contain a main general purpose wiring harness and supplementary installation parts.

All Kits.	*5* x Loom Ties	
	6 x Mounting Screws	
	10 x Large Cable Ties	
	1 x Upshift Lamp Terminals and Housing.	
	1 x Instruction Manual.	
LOOM	*Ignition Only*	1 x 22143
	Fuel 4 Cyl	1 x 22162
	Fuel 6 Cyl	1 x 22155
	Fuel 8 Cyl	1 x 22156

If the parts supplied in your Installation Kit do not match those required for your vehicle please contact Lumenition Engineering for further advice.

All other parts are available from Lumenition to complete your installation including sensors, ignition and fuel components and adaptor harneses for particular equipment. Contact Lumenition Motorsport Sales or consult the Lumenition Specification sheets.

LOOM DESCRIPTION.

For continued reliability in use it is essential that any form of engine management has a high quality loom which provides all of the inter-connections necessary to run the engine. The ECU requires accurate information from its sensors and continuous connection to its output stages. Lumenition looms have been designed to ensure that the engine management system can be installed with the minimum of work and provide all the necessary wiring with high quality connections ready made.

The looms are designed to be general purpose to cover a wide range of applications. To make this possible the spur lengths for each of its connectors are fairly long. Reduction of spur lengths or altering the loom is not recommended and can result in possible running problems or unreliability.

Each loom has a Part No. printed onto a sleeve on the main power spur. Each separate spur has a sleeve indicating its function near to its connector. Exceptions to this are the ECU connector and the two sets of ring terminals for the main power and coil connection. These terminals are marked with **red** and **black** sleeves.

The looms are designed so that the ECU, relays, power feed and instrument panel connectors are mounted inside the vehicle. The conduit protected section of the loom can pass through a bulkhead and the rest of the connections are made in the engine compartment.

The ECU has been designed to trigger the Lumenition CEM units for ignition. These are supplied as separate items (CEM) and suitable connectors are provided on the loom. For distributorless operation coils are available to suit 4 and 6 cylinder applications.

To guide you, prior to installation into the vehicle, find some clean bench or floor space and lay the loom out in full so that you can see how it might be best routed. This will help to decide whether you can use existing mounting places and holes through the bodywork. It may also be useful at this stage to collect together all the Installation Kit parts that will be fitted and see exactly how and where they join onto the loom. There is a layout guide for each of the looms at the end of this section of the manual.

INSTALLATION.

Each installation will be different, and every installer will have their own preferred method for carrying out that installation. There are however a few general principles and certain specific requirements that should be adhered to when considering Lumenition Engine Management Systems. Plan your installation carefully and problems will be kept to a minimum. When finally fitted the loom should be neatly routed without strain on the connectors and protected from mechanical damage by moving or hot engine parts. Loom and cable ties are provided in the harness kit for fixing the loom in place both to the vehicle bodywork and to other parts.

Usually installers will mount all of the mechanical parts and sensors to the engine then place the loom into the vehicle connecting everything together. Because of the connector types and the spur markings it is difficult to confuse the connections when you are using all Lumenition supplied parts. Where the loom is connected to the vehicles existing wiring and where non Lumenition sensors are being used these guidelines **must** be followed to ensure that the whole system will operate correctly and reliably from the start.

PASSENGER COMPARTMENT

- **Power Feed.** Two large ring terminals are provided for connection directly to the battery terminals. **Red** is battery positive and **Black** is battery negative. If the vehicle is required to be fitted with an isolator switch then this must be connected between the red terminal and the battery positive. **N.B.** Under no circumstances should the vehicle isolator switch be wired into the negative (Earth) feed for the system as component damage may occur if the switch is operated with the system powered.
  N.B. *It is also worth noting at this point that converting a carburetted vehicle to Electronic Fuel Injection will result in a far greater loading on the vehicle's electrical system. It may be necessary to increase battery and charging capacity to compensate.*
- **Relays.** The relay/s should be mounted inside the vehicle as they are not weather proof. They are fused at 15 Amps with standard blade fuses. The loom relay connectors are locking type and will not release if the cable is pulled but the weight of the loom should not be left hanging from the relay connections.

- **Ign Sense.** This connection switches the main power relay to provide power for the whole system. This should be connected to 12v via an isolating switch, usually the Ignition switch on competition car dash panels. If power is removed from this terminal the main relay will open causing the system to shut down.
- **Fuel Pump +ve.** To ensure that the high pressure fuel pump is controlled by the ECU it must be powered from this wire only to its positive terminal. The negative terminal of the fuel pump is connected to earth. Wired in this way the pump will be stopped automatically when the engine stalls.
- **Tacho.** This wire will supply a signal directly from the coil negative terminal to a voltage triggered tachometer. This wire is included in the system for convenience and as such connection is not vital for system operation.
- **Upshift.** This two wire connector give the installer the option of putting an RPM switched lamp into the dash. The connections are +12v and Switch. A lamp (not exceeding 5 Watts) can be wired straight across the terminals. As described in the ECU Handbook the upshift driver is very low power and for best visual effect it is recommended that a large **High Intensity LED** is used. Lumenition Part no. UPS001. Alternatively a 12v relay with a coil resistance of greater than 200 ohms may be used. Part No. UPS003.
- **ECU.** The 20 way locking connector will mate with a Cxxx ECU. The locking catch must be depressed before the connector is released and can be pulled free from the ECU. Excessive strain, twisting, pulling or flexing of the loom in this area can cause severe problems. When planning the layout make sure to allow for the connections to the ECU.

ENGINE BAY.

- **Throttle Position.** The throttle position sensor supplied in the IK is suitable for direct fitting to the Lumenition range of Throttle Bodies. This sensor has been specified and supplied for motor sport use with high track force and return spring tension, this gives extra signal stability under vibration but can accelerate wear. The drive shaft is 8mm "D" section and the fixing centres are M5 on a 33mm pcd. The installer must make any adapters necessary for fitment to alternative throttle systems.
  Other throttle position sensors can be used (see ECU Handbook) and Lumenition can supply connector kits to terminate these sensors to suit our looms. The pinout of the loom TPS connector is shown. See Loom Connector Pinouts.
- **Engine Pickup.** The engine speed signal can be derived in two ways. A low data rate (LDR) signal can be taken from a Lumenition converted or an OEM hall effect electronic distributor. A high data rate (HDR) signal is generated by a variable reluctance sensor measuring a toothed wheel fixed to the crankshaft. The loom connector is intended to go directly to a Lumenition optical switch. Adapter leads are available from Lumenition for some compatible hall effect distributors as DFKs and for some variable reluctance sensors as CFKs. If users need to make their own connections then mating parts are available and the connector pinouts for the different sensor types are shown. See Loom Connector Pinouts.
- **Air Temp.** Care should be taken to shield the sensor from heat sources (water hoses, exhaust etc.) and for best results the head of the sensor should be sited in moving air. A mounting boss and template are supplied to fit the sensor into the airbox / air filter plate. When correctly fitted no fixings are present inside the air cleaner box. Alternatively the sensor can be mounted using its own M10 x 1.25mm thread.
- **Coolant Temp.** This sensor should be mounted into the water jacket of the engine block or head. The M12 x 1.5mm thread size is compatible with most recently designed engines.
- **MAP.** For some applications it is better to use a manifold absolute pressure sensor to provide engine load information. This unit can be

mounted onto the bulkhead and a non collapsible pressure hose taken from the sensor input to the inlet manifold pressure take off point. The hose should be fixed at each end with small clips to prevent it from blowing off.
There are some alternatives to the Lumenition MAP sensor but there are limitations to their use (see ECU Handbook). The pinout of the MAP sensor connector is given to allow you to make an adapter loom.

- **HEGO.** A connector is provided to interface to the Lumenition Heated Exhaust Gas Oxygen sensor. This measures the mixture going into the engine from the exhaust gases. Although not used currently to control the ECU it provides useful information that can be displayed on the calibration screen as an aid to mapping. It is not essential for the operation of the engine management. Other manufacturers EGO sensors may be used (see ECU Handbook) and Lumenition can supply connector kits to terminate these sensors to suit our looms. See Loom Connector Pinouts.

LOOM CONNECTOR PINOUTS.

Socket

Throttle Pot

1 Signal
2 5v Supply
3 Sensor Gnd

HEGO

1 Signal
2 Heater Earth
3 Heater +12v

LDR Engine Pickup

1 8v Supply
2 Earth
3 Signal

HDR Engine Pickup

1 Sensor -ve
2 Screen
3 Sensor +ve

LDR pickup. The 8v supply is intended to power hall effect switches or our own optical switch. No other devices should be connected to this socket.

HDR pickup. Variable reluctance crank sensors come in 2 or 3 wire types. The 2 wire devices have no screen connection. The sensor must be connected in the correct polarity which can only be determined by refering to available data or by observing the electrical output in use. The +ve wire is the usual signal with the -ve often given as ground or earth in the data books. If the polarity is not correct then accuracy of the signal will suffer and cause problems in ECU operation.

IGNITION CONNECTION.

Loom connections are provided for CEM ignition amplifiers, coil supply voltage and coil negative. The coil connections are M5 ring terminals which will connect directly to the CEC provided in the IK. The CEM can then be connected to the coil as described in its fitting instruction. The red terminal is coil positive. The black terminal connects to coil negative and gives a tacho signal for voltage triggered tachometers. **NOTE** *It is vital that the HT distribution is fully suppressed for correct function of all the electronic parts*.

For distributor triggered systems the single CEM input is from the connector marked "IGN AMP (A)" only.

For HDR systems which are not distributorless then an adapter lead is supplied which joins connectors IGN AMP (A) and IGN AMP (B/C) to the single CEM.

If you are running a distributorless system using two or three CEMs it is important that each individual CEM and coil combination is mated to the correct ignition amplifier output.

On a 4 cylinder engine IGN AMP (A) will be cylinders 1 and 4, IGN AMP (B) will be cylinders 2 and 3.

On 6 cylinder engines the pairing is dependent upon the firing order of the engine. The CEMs will fire in the order A,B,C,A,B,C.

Example. A common Straight 6 firing order is 1,5,3,6,2,4

IGN AMP A goes to 1 and 6
IGN AMP B to 5 and 2,
IGN AMP C to 3 and 2.

A common V6 firing order is 1,4,2,5,3,6 giving A = 1/5, B = 4/3 and C = 2/6.

There is a short adapter lead (WH153) to split IGN AMP (B/C) into two separate connectors.

When running HDR triggering on an 8 cylinder engine it is possible to run two separate 4 cyl or a single two tier distributor as on some Ferrari engines. In this case IGN AMP A will drive the coil for cylinder 1 and IGN AMP B will drive the other.

When wiring up a multi-CEM system the **Red** sleeved terminal can be used to supply power to both the CEMs and the coil or coils used. The Brown coil negative wire from each CEM will then go to the coil negative terminal for the corresponding cylinders for A, B and C.

If the loom connection for the Tacho is being used the **Black** terminal should be connected to one of the coil negative terminals only.

NOTE. *A tachometer that is calibrated for use with a distributorless ignition must be used otherwise it will read half or third speed. For 8 cylinder engines using two distributors a 4 cylinder tacho can be used.*

INJECTOR CONNECTION.

The 4 and 6 cylinder fuel injection looms have been designed to fit both straight and Vee format engines. For Vee engines the loom will lay up one side of the engine and return the other side. The 8 cylinder loom is designed for Vee format engines. Straight 8 engine owners will have to make up their own loom.

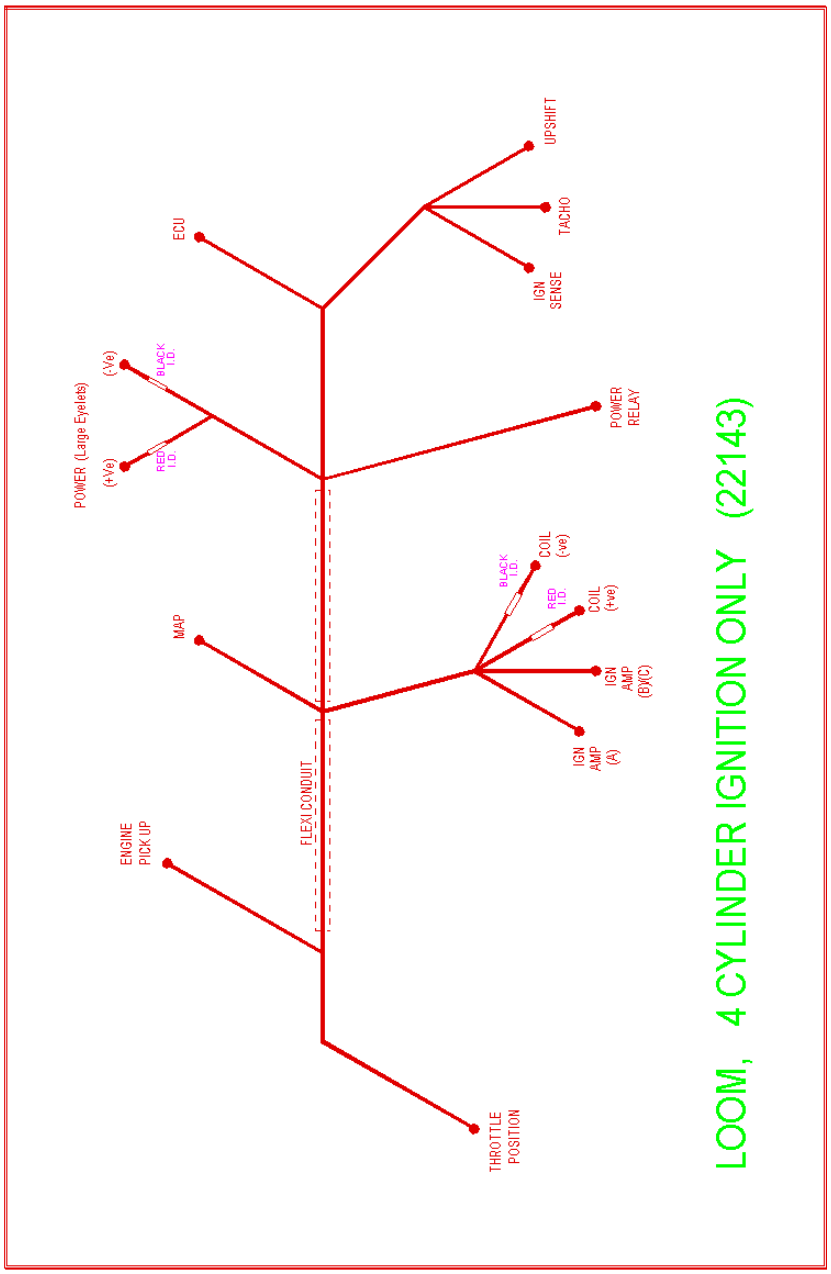
Each injector connector is identified as A, B or C. When using LDR triggering the injection is synchronous and all injectors fire together. This means that any connector can be put to any injector. When the engine is HDR triggered ideally the ident letter on the injector driver should match that of the cylinder firing as given in the previous section covering ignition connection. Incorrect connection will not prevent the engine from running but may mean that you are not getting the best performance at lower rpm.

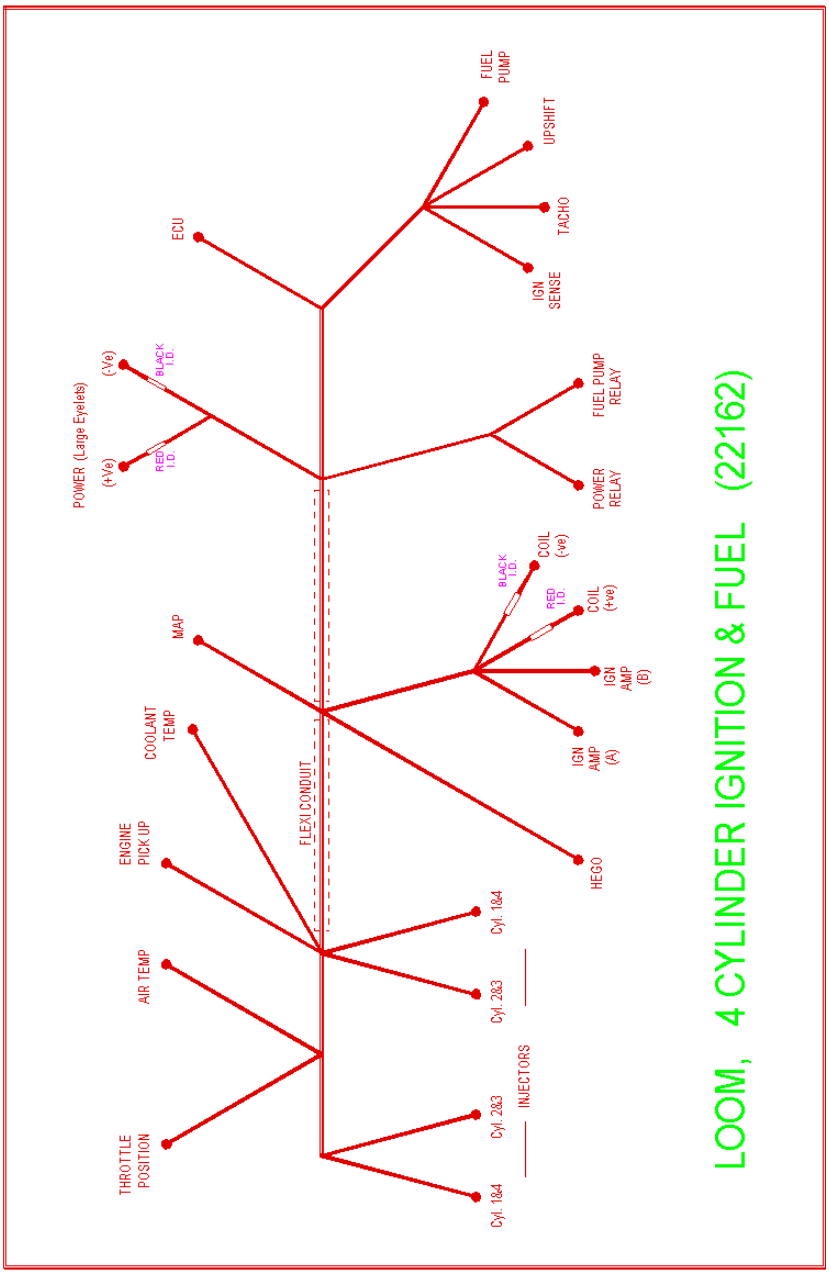
UNUSED CONNECTORS.

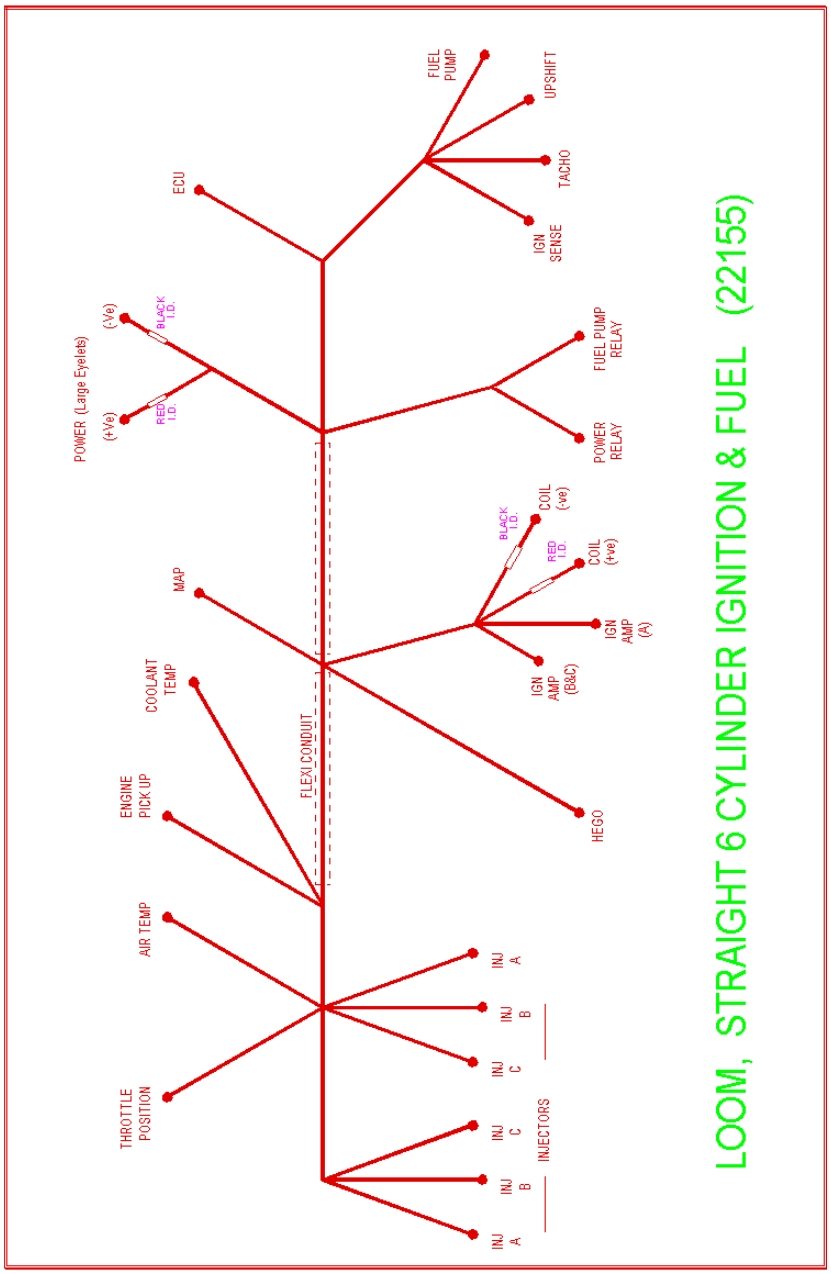
For most installations there will be some unused connectors on the loom. These should be neatly tied back and if possible protected from damage and weather. You may upgrade or add on to the system at a later time and find you need to use these connectors.

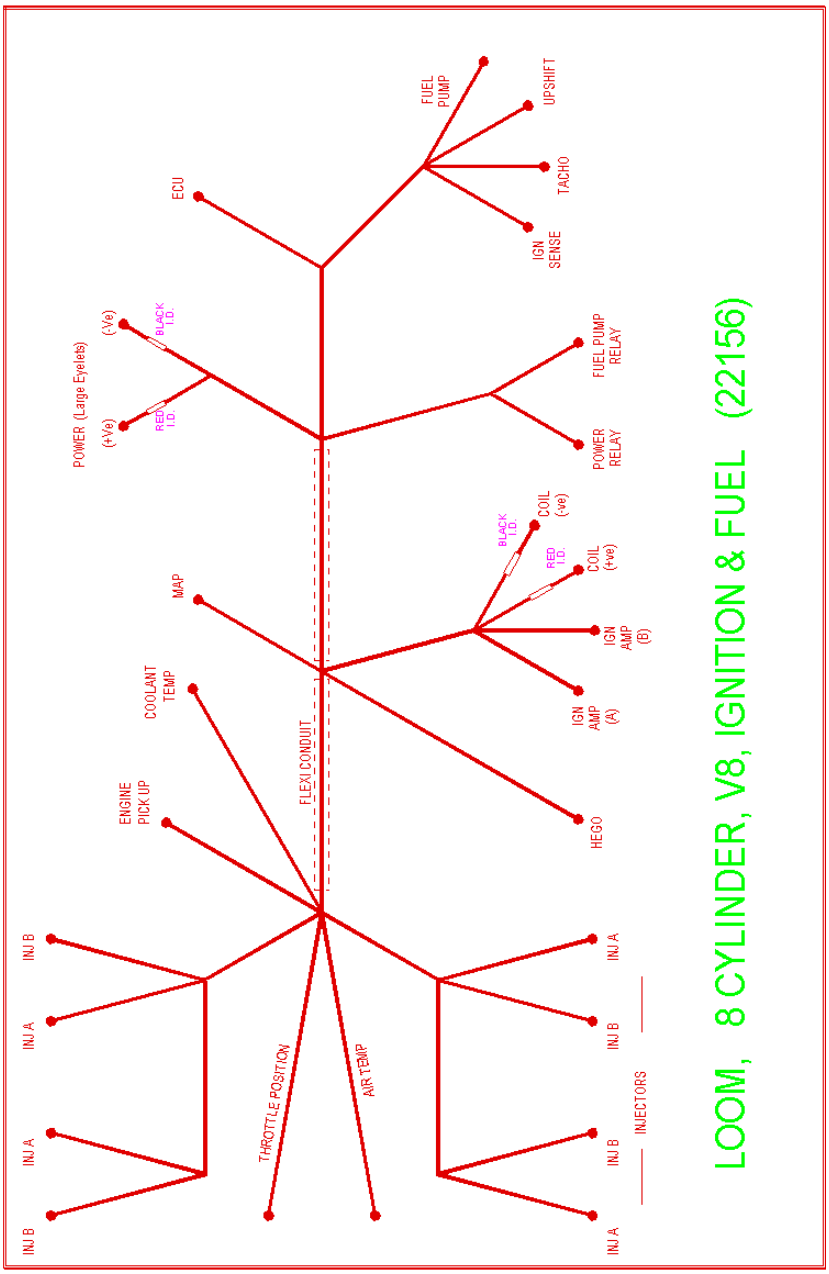
LOOM LAYOUTS.

To help when planning your installation the following pages show each of the loom layouts together with their connector idents.


LOOM, 4 CYLINDER IGNITION ONLY (22143)
UPSHIFT
TACHO
IGN SENSE
ECU
POWER RELAY
POWER (Large Eyelets)
(-Ve)
(+Ve)
BLACK I.D.
RED I.D.
COIL (-ve)
COIL (+ve)
IGN AMP (B)(C)
IGN AMP (A)
MAP
FLEXI CONDUIT
ENGINE PICK UP
THROTTLE POSITION


LOOM, 4 CYLINDER IGNITION & FUEL (22162)
FUEL PUMP
UPSHIFT
TACHO
IGN SENSE
ECU
POWER (Large Eyelets)
(-Ve)
(+Ve)
BLACK I.D.
RED I.D.
FUEL PUMP RELAY
POWER RELAY
COIL (-ve)
COIL (+ve)
IGN AMP (B)
IGN AMP (A)
HEGO
MAP
COOLANT TEMP
ENGINE PICK UP
AIR TEMP
THROTTLE POSITION
FLEXI CONDUIT
Cyl. 1&4
Cyl. 2&3
INJECTORS


LOOM, STRAIGHT 6 CYLINDER IGNITION & FUEL (22155)
FUEL PUMP
UPSHIFT
TACHO
IGN SENSE
ECU
POWER (Large Eyelets)
(-Ve)
(+Ve)
BLACK I.D.
RED I.D.
FUEL PUMP RELAY
POWER RELAY
COIL (-ve)
COIL (+ve)
IGN AMP (A)
IGN AMP (B&C)
MAP
COOLANT TEMP
ENGINE PICK UP
AIR TEMP
THROTTLE POSITION
FLEXI CONDUIT
HEGO
INJ A
INJ B
INJ C
INJECTORS


LOOM, 8 CYLINDER, V8, IGNITION & FUEL (22156)
ECU
FUEL PUMP
UPSHIFT
TACHO
IGN SENSE
POWER (Large Eyelets)
(-Ve)
(+Ve)
BLACK I.D.
RED I.D.
FUEL PUMP RELAY
POWER RELAY
COIL (-ve)
COIL (+ve)
IGN AMP (B)
IGN AMP (A)
MAP
COOLANT TEMP
ENGINE PICK UP
FLEXI CONDUIT
HEGO
INJ B
INJ A
INJ A
INJ B
INJ B
INJ A
INJ B
INJ A
THROTTLE POSITION
AIR TEMP
INJECTORS

FUEL SYSTEM.

INTRODUCTION.

This section of the manual describes the fuel systems requirements and guidelines for the best performance from the electronic engine management. Although the ECU can control the ignition and injector timings it is important for the fuel supply to the injectors to be maintained under all circumstances to ensure accurate response from the mapping.

REQUIREMENTS.

Electronic injectors rely upon a fuel supply at a constant pressure in order to allow regulation of the mixture purely as a function of opening time. This is achieved by using a high pressure fuel pump and pressure regulator. The system is closed and unused fuel is constantly being fed back into the fuel tank. An example of this is shown.

FUEL DELIVERY

As is seen in the diagram the fuel is drawn from the tank by a high pressure fuel pump. These pumps are specifically designed for electronic fuel injection. If you are converting a vehicle from carburettor to injection then the existing fuel pump must be replaced. This type of pump should be mounted below or at the lowest level of the fuel tank to maintain a head of fuel and prevent the pump from running dry.

A suitable pump is supplied in the HPF001 kit together with a filter and a 5m length of fuel pipe. The inlet is 12mm / 0.5" push on pipe. The outlet is an 8mm or 5/16" push on pipe.

Although the fuel pump inlet is fitted with a mesh filter it is necessary to put a fuel filter in line to prevent any contamination of the injectors which will result in blockage. This filter should be changed at regular intervals to maintain system performance.

The fuel line components should be joined using high pressure hose of 5/16" internal diameter.

FUEL PRESSURE.

The fuel pressure in the system is maintained by the use of a regulator. This is sited at the furthest end of the fuel rail from the pump. If the engine is Vee format an requires two fuel rails then both should be joined at the far end before going to the regulator, or a regulator with two inputs is required. Most regulators have a vacuum connection so that the fuel pressure is adjusted to compensate for manifold depression. Without this connection the effective pressure at the fuel injectors would be varying giving rise to changes in fuel flow. On engines where the manifold is under pressure (i.e. turbocharged) then this connection is essential to maintain effective injector pressure at high boost.

The Lumenition regulator (REG001) is adjustable between 2.5 and 5 bar, has two pressure inlets for Vee fuel rails and a vacuum connection.

RETURN TO TANK.

The regulator maintains pressure by returning excess fuel back to the fuel tank. This means that a new inlet must be put into the fuel tank. On vehicles already fitted with fuel injection there should be a return to tank available. When converting from carburettors to fuel injection the this must be added to the existing fuel tank or a new tank obtained.

SWIRL POT.

So that fuel pressure is maintained it is essential that the fuel pickup for the pump is constantly supplied. To ensure that this happens when the vehicle is in use baffling or a similar arrangement may be necessary in the fuel tank. Alternatively it may be worth considering the use of a swirl pot which is a small reservoir tank supplied at low pressure from the main tank.

INJECTORS

Electronic injectors are a form of solenoid valve. The valve is opened by the ECU for a short time. During that time a specific amount of fuel (under pressure) will flow into the inlet manifold where the injector is mounted. The amount of fuel injected is governed by a) the injection time, b) the size of the injector orifice and c) the fuel pressure. Injectors are available in differing physical patterns and fuel flow characteristics to suit various OEM engines. Lumenition Throttle Bodies and fuel rails are designed to accept the common multi-point injectors with O-ring seating at both ends. Low resistance (2.5 ohms) or high resistance (16 ohms)

can be used on four cylinder engines but 6 and 8 cylinder engines should have only high resistance injectors fitted when using our ECUs.

CHOOSING INJECTORS

The most important factor when considering injectors for your engine is whether a set will flow enough fuel at the operating fuel pressure to maintain a good air/fuel ratio at high engine speed. The injectors must be capable of this without being turned on all the time or "going static". Technical data on particular injectors can be hard to find. Some injection specialists may have suitable test data or information that they have collected over time. But a reasonable guide is to look at the original application for the injectors and compare that engines performance with that expected from your own. For example the Bosch injectors fitted to the 16v Vauxhall Astra engine can produce 150 bhp in standard operating conditions. These injectors will easily supply fuel for a 200 bhp engine.

If technical data is available it is usually given as a flow rate at a particular fuel pressure. E.g. 200cc/min at 2.5 bar. A rule of thumb that can be used gives the approximate bhp per injector as a fifth of its flow rate in cc/min. If the intended fuel system pressure differs from that given in the injector data then the following calculation will give the approximate new flow.

New Flow = Old Flow x Square root (New pressure / Old Pressure)

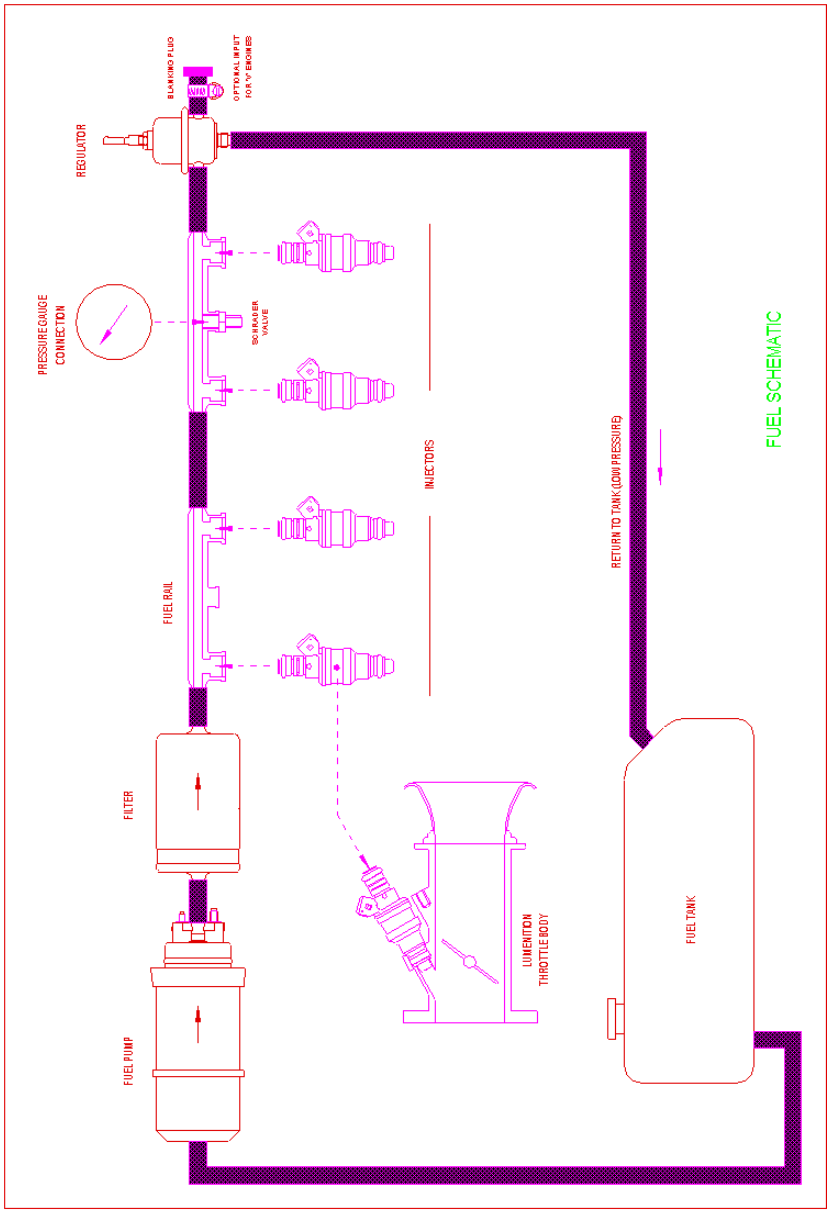
E.g. If we increase the pressure for the injectors given above to 4 bar then we get.

New Flow = 200 x Sqrt (4 / 2.5) = 253 cc/min

By our rule of thumb this gives about a 10 bhp increase in power capability for the injector. Of course, this doesn't mean that by raising the system fuel pressure on any engine that you will automatically get more bhp. You only get a richer mixture.

It is not recommended that fuel pressure is increased beyond about 4 to 5 bar. High pressure can reduce the injectors ability to open resulting in less fuel rather than more. There are some injectors that are specifically designed to run at very high pressures but they are limited to special applications. If your original or chosen injectors cannot supply enough fuel for your expected engine power output under reasonable pressure then it is time to look for some higher flow injectors.

FUEL SYSTEM SCHEMATIC.


FUEL SCHEMATIC
BLANKING PLUG
OPTIONAL INPUT FOR 'V' ENGINES
REGULATOR
PRESSURE GAUGE CONNECTION
SCHRADER VALVE
INJECTORS
FUEL RAIL
RETURN TO TANK (LOW PRESSURE)
FILTER
FUEL PUMP
LUMENITION THROTTLE BODY
FUEL TANK