



## Engine Management Systems

### 1. ECU & Sensors Summary of Part Nos.

The type of ECU is determined only by the configuration of the engine to which it will be applied: similarly the key sensors required follow the same reasoning. It is not always necessary to buy new sensors: however, if there is any doubt it is suggested that the complete set will save some time and perhaps some difficulties.

Ignition Only			Fuel & Ignition			Part Ref
Low Cyl.	High Cyl.	Dis'less Cyl.	Low Cyl.	High Cyl.	Dis'less Cyl.	
4 6 8	4 6 8	4 6	4 6 8	4 6 8	4 6	
1 1 1						C 400
	1 1 1	1 1				C 410
			1 1 1			C 451
				1 1	1	C 460
				1	1	C 660
1 1 1	1 1 1	2 3	1 1 1	1 1 1	2 3	CEM
1 1 1	1 1 1		1 1 1	1 1 1		CEC
		1			1	CEC 004
		1			1	CEC 006
1 1 1	1 1 1	1 1				WH 143
			1	1	1	WH 162
			1	1	1	WH 155
			1	1		WH 156
		1			1	WH 152
	1			1		WH 158
	1 1			1 1		WH 159
		1			1	WH 167
		1			1	WH 168
1 1 1	1 1 1	1 1	2 2 2	2 2 2	2 2	LR 183
			1 1 1	1 1 1	1 1	ATS 001
1 1 1	1 1 1	1 1	1 1 1	1 1 1	1 1	TPS 002
			1 1 1	1 1 1	1 1	WTS 002



## Engine Management Systems

### 2. Calibrator

PC Software Calibrator program	CAL500
Windows based software	CAL600

### 3. Sensors

Throttle sensor incl mating connector as a spare part	TPS 001
mounting clamp for TPS	TPS 002
mating connector only	MK 004
	AK 009
Air Temp sensor with mechanical boss as a spare part	ATS 001
mounting boss for ATS	ATS 002
	MK 005
Fused Relay for main pwr and/or fuel pump	LR 183
Coolant Temp sensor	WTS 002

### 4. Wiring Harness and Tools

PC coms Lead for C400	WH 169
PC coms Lead for K400	WH 170
Main Harness	
Ignition Only	WH 143
Fuel & Ign: 4 cylinder	WH 162
6 cylinder	WH 155
8 cylinder	WH 156
Adaptor Ign Amp	
6 cyl distributorless	WH 152
6 cyl high data rate & distrib	WH 158
4 & 8 cyl high data & distrib	WH 159
Adaptor Crank sensor:	
GM16V Bosch Motronic	CFK 001
Ford Zetec	CFK 002
Magnetti Marelli	CFK 003
Adaptor: Distributor:	
Ford, Bosch	DFK 001
(Hall Effect) GM, Vaux, OHC	DFK 002
VW, Motronic	DFK 003
Universal Tooth wheel (36-1)	MTW 001
Crank shaft sensor (uses CFK 002)	15201
Complete kit	TWK 001



## Engine Management Systems

### 4. Wiring Harness and Tools (cont'd)

Tool for pins in Econseal connectors	AK 005
Complete 3 way pr connectors pins tool etc	AK 006
20 way ecu connector kit	AK 007
Single 3 way Econseal connector + pins	AK 008
Single 3 way Econseal connector + sockets	AK 009

### 5. Displays and Outputs

10 L.E.D. Air fuel ratio Meter	AFR 003
19 L.E.D. Air fuel ratio Meter	AFR 004
Lambda sensor & mounting boss	HEG 001
sensor as a spare part	HEG 002
mounting boss only	MK 003
mating connector only	AK 009
Up shift LED for use with WH series harness	UPS 001
as above with mating connector	UPS 002
Relay for use with ECU upshift output	UPS 003

### 6. Ignition Parts

Lumenition Optical Trigger	CET 150
mating connector only	AK 009
Ignition amplifier module (variable dwell)	CEM
mating connector only	AK 008
Coil, single output low resistance	CEC
Coil 4 cyl Distributorless	CEC 004
mating connector only	AK 010
Coil 6 cyl Distributorless	CEC 006
mating connector only	AK 011
Wiring lead for Coil CEC 004	WH 167
Wiring lead for Coil CEC 006	WH 168
Connector Block to assist with coil wiring	AK 012

*For Fitting kits for OE distributors see separate listings.*



## Engine Management Systems

### 7. Throttle Bodies and their Accessories

40 mm dia with idle Hoiz Mtg shrt body (pair)	THP 401
42 mm dia with idle direct to head for K-Series	TBM 002
45 mm dia Side D (pair for 4 cyls)	TBP 452
45 mm dia with idle Side D (pair for 4 cyls)	TBP 457
48 mm dia Side D (pair for 4 cyls)	TBP 482
48 mm dia with idle Side D (pair for 4 cyls)	TBP 487
45 mm dia with idle Side D (single ie for 2)	TBS 457
48 mm dia with idle Side D (single ie for 2)	TBS 487
45 mm dia with idle Down D (pair for 4)	TDP 451
48 mm dia with idle Down D (pair for 4)	TDP 481
8 studs etc metric M8	MK 001
8 studs etc imp 5/16 UNF	MK 002
Lever System Single overhead	CLS 001
Double overhead	CLS 002
Air horn lever mounting (K-Series and downdraught)	MK 008
Air Horn 45 mm dia: 40 mm long	AH 450
45 mm dia: 90 mm long tapered	AH 455
48 mm dia: 40 mm long	AH 480
48 mm dia: 90 mm long tapered	AH 485

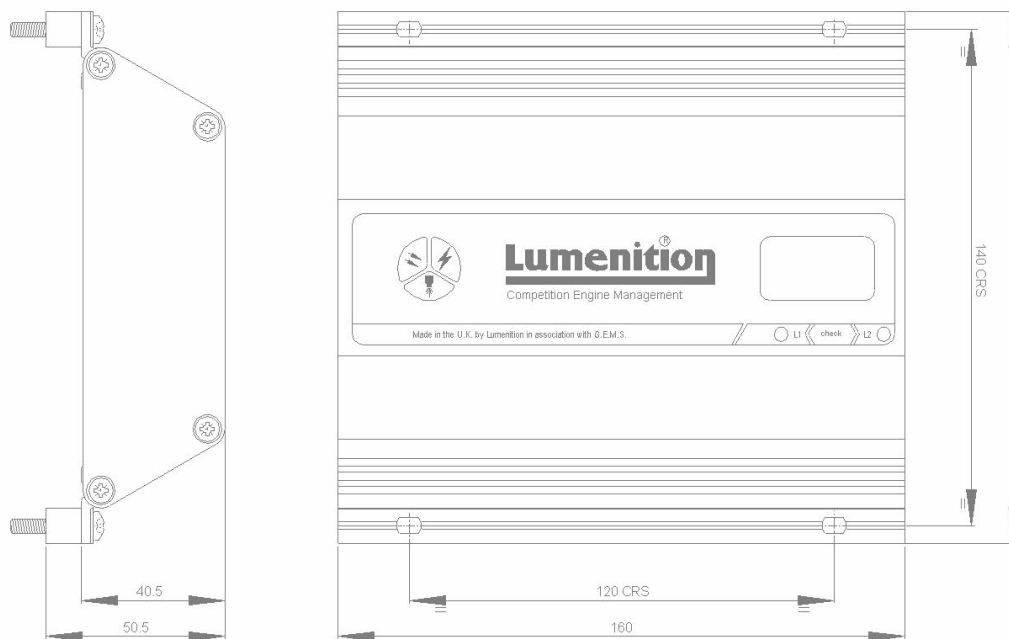
### 8. Fuel system and Accessories

Complete Fuel System Pump, Filter, Hose etc	HPF 001
Pump only	HPF 184
Filter only	HPF 206
Adjustable fuel pressure regulator	REG 001
Low flow 190cc/min approx	INJ 001
Med flow 300cc/min approx	INJ 002



## Engine Management Systems

### C 400 Range of ECU's



The range divides generally into two groups for 'ignition only' or for 'fuel and ignition'. Each group has three sub-groups depending on the triggering style and ignition system in use. [See Spec Sheet No 1 for configurations]

It is always possible to use a fuel and ignition on a fuel only application where future upgrade is envisaged.

Some of the features are resident in the ecu software, and therefore cannot be changed by the user; but most of the features are designed to be selected or have parameters changed by the user and his Calibrator.



## **Engine Management Systems**

### **User Features**

REAL TIME programming of all Features can be performed with the engine running or only powered up.

FUEL MAP is structured as a tables of 22 speed sites against 11 load sites, [800 to 9200 rpm and 0% to 100% load). The value in each of these sites may be set by the user, but the axis structure is fixed.

IGNITION TIMING map is similar to the fuel map [22 x 11], working on the same calibration points.

EDITING of both maps while the engine is running may only be done to the cell closest to the running values; but with a stationary engine any cell may.

REV LIMITER may be set to inhibit both fuel and ignition in 100 rpm steps to 20,000 rpm. With either fuel cut or ignition cut delayed by 200 rpm.

UP-SHIFT SPEED is pre-set like the Rev limiter to turn on a lamp driver above the set engine speed.

ACCELERATOR ENRICHMENT is calibrated to give extra fuel for a period following a rapid increase in throttle angle.

WARM UP FACTOR injects extra [Max x5] fuel, reducing until the Engine Temperature reaches the threshold temperature.

CRANKING FUELLING adds fuel while cranking at all temperatures, where the manifold design demands it.

CRANKING ADVANCE delays spark to avoid kick back on some high compression engines.

THROTTLE POSITION maximum and minimum are both pre set, to avoid very accurate positioning of sensor.

MANIFOLD PRESSURE maximum and minimum similarly are pre set on the Turbo versions.



## **Engine Management Systems**

### **Internal Automatic Calculations**

Compensates for BAROMETRIC PRESSURE from an internally mounted air pressure sensor, providing compensation for altitude and weather conditions.

Compensates the air fuel ratio as a function of AMBIENT AIR TEMPERATURE.

Uses BATTERY VOLTAGE to adjust the timing of the injector signals.

Uses LINEAR INTERPOLATION, between set points, to give smooth transitions between one set point and the next.

Drive the fuel pump relay only as long as the engine is running, ie FUEL SHUT OFF if engine stalls.

### **External Sensors**

THROTTLE POSITION SENSOR to fix the load site used on both fuel and ignition maps, with normally aspirated engines. And with all engines to determine the cut in point of accel enrichment fuel.

Manifold pressure sensor is needed on turbo engines to fix the load site on the maps.

Engine speed and position is determined from either a conventional distributor, or various crank sensors, including some modern tooth counting versions.

AIR TEMPERATURE and ENGINE TEMPERATURE Sensors are needed to generate correction factors for systems that include fuel control.

EXHAUST OXYGEN SENSOR may be connected to the ecu, and the reading is available on the hand held while setting up. The values have no internal significance to the ecu.



## Engine Management Systems

### ECU outputs

Four output channels can be used for upto EIGHT INJECTORS, either in simultaneous or banked mode.

Ignition output, TRIGGER PULSE to the Power Module.

FUEL PUMP ON/OFF [via heavy duty relay]: the fuel pump will only be kept on by the ecu, if it is receiving regular pulses from the engine. Stalling the engine cuts of the pump.

UP SHIFT Lamp driver; a low power output to light a lamp when the revs exceded the preset value. Alternatively this can be used for switching on 'extras' needed at high revs.

### Ordering Data

C 400	ECU for ignition only applications triggering from a distributor only.
C 410	ECU with the decoder for toothed wheel triggering - ignition only outputs.
C 451	ECU for Fuel and Ignition ouputs - distributor triggering.
C 460	ECU for Fuel and Ignition, with toothed wheel triggering; but 4 and some 8 applications.
C 660	ECU for regularly timed 6 cylinder applications
K 400	ECU for K-series plug and play compatible

#### ***Installation Note***

Ecu's are not intended for mounting in an engine bay, but should be mounted where they are protected from heat, and other adverse environments.



## Engine Management Systems

### Sensors

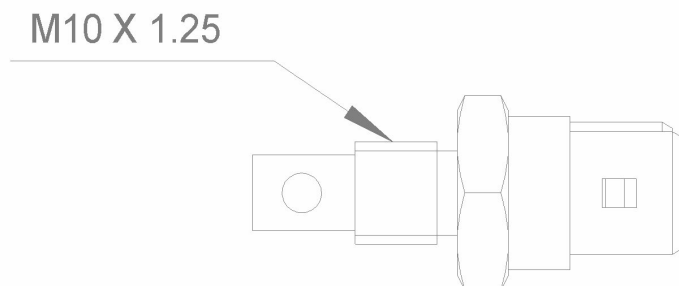
#### 1. Throttle Position Sensor

On non-turbo applications this sensor provides the input to fix the load site on each map. This sensor is needed on all applications, even on Turbo vehicles when boost pressure provides the prime load site input. This sensor uses a high spring force, to keep the wiper on track in tough applications, such as hill climbing and rallies, giving rise to a small reduction in life.



#### 2. Air Temperature Sensor

The air temperature sensor is needed where a suitable sensor is not already fitted to the vehicle, to tell the ECU about the incoming air. The ECU then adjusts fuel injector "on" timing. It is not required for ignition only applications, and it uses the standard automotive connector - "2 pin Junior Timer".





## Engine Management Systems

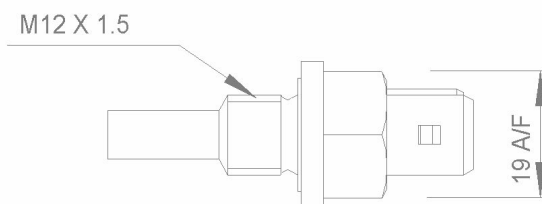
### 3. Loom Relay

This is required with all Lumenition Wiring Harnesses, to control the main power feeds. And a second one is needed on Fuel Mapped applications to allow the ecu to control the Fuel Pump.

*Note: The mounting base is only supplied as part of Lumenition Wiring Harnesses.*

### 4. Water Temperature Sensor

This is required to input the temperature of the Coolant to the ecu, where a suitable sensor is not already fitted to the vehicle. Uses the standard automotive connector - "2 pin Junior Timer".





## **Engine Management Systems**

### **5. Oxygen Sensor (HEGO)**

This sensor may be used with a simple display (AFR001/2) or with an engine management system. The C Series Lumenition ECU's have facilities to read this sensor displaying the Lambda Value on the CAL 101 during tuning; but they do not interfere with the mixture settings fixed by the fuel map during tuning.

This sensor needs to be operated at between 200 degC and 400 degC, and therefore contains a heating element to bring it upto to temperature in about 2 mins.

Simple mounting is achieved by drilling a hole in the exhaust manifold and welding on a boss.



## Engine Management Systems

### Ordering Data

ATS 001	An air temperature sensor with its boss for mounting into inlet air ways.
ATS 002	As a spare; no mounting boss.
HEG 001	Sensor and Mountings.
HEG 002	Replacement sensor alone.
LR 183	Relay to control Power and/or Fuel Pump
MK 003	Mounting Boss and screw-in blanking plug for HEGO sensors
MK 004	Mounting Clamp for the TPS ...
MK 005	Mounting Boss for the ATS ...
TPS 001	Throttle position potentiometer, terminated and complete with mating connectors and assembly tool.
TPS 002	Throttle Pot, as a spare for replacement or direct connection to WH ...
WTS 002	Water Temperature sensor only.



## Engine Management Systems

### Wiring Harness and Tools

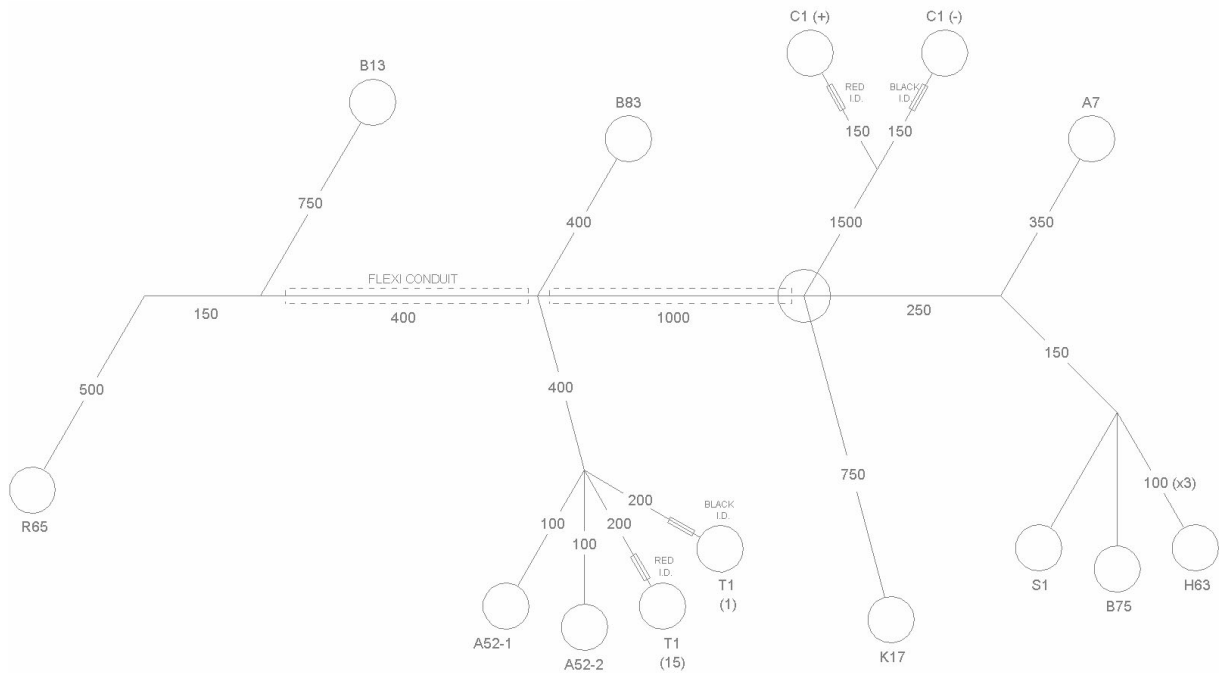
Lumenition provide 4 standard vehicle wiring harnesses or looms (see over). They are long enough to fit most types of vehicle; so that the ecu can be mounted in the cockpit away from the heat and environment of the engine compartment.

Although they may be too long for some applications, it is recommended that they are still used, because the process of wiring up in situ takes time and then it is not always easy to make sure of good and reliable connections that will last the life of the installation.

The main harness is made to be suitable for as many as possible situations, so that there are times when it needs a further "mini" wiring harness. For example it is possible that an application may use either 1, 2 or 3 separate power modules, WH 152, 158 & 159 are then used. Specification Sheet 1 shows the correct combination to be used on each application type.

Similarly where OE trigger sensors are being used then adaptors are also needed. The DFK range of adaptors is used for distributor sensors and the CFK range for crank sensors.

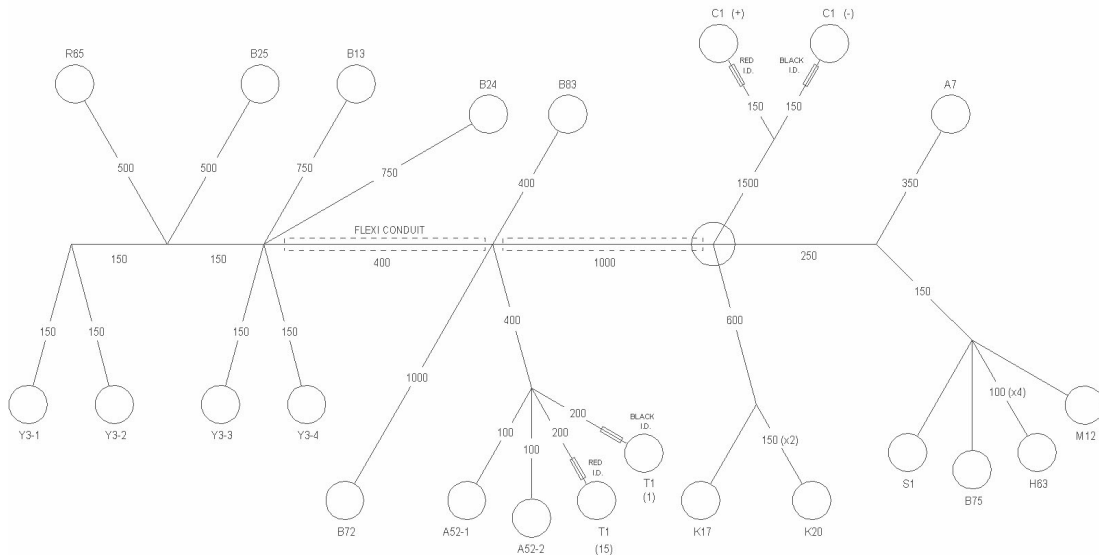
### For Ignition only systems WH 143



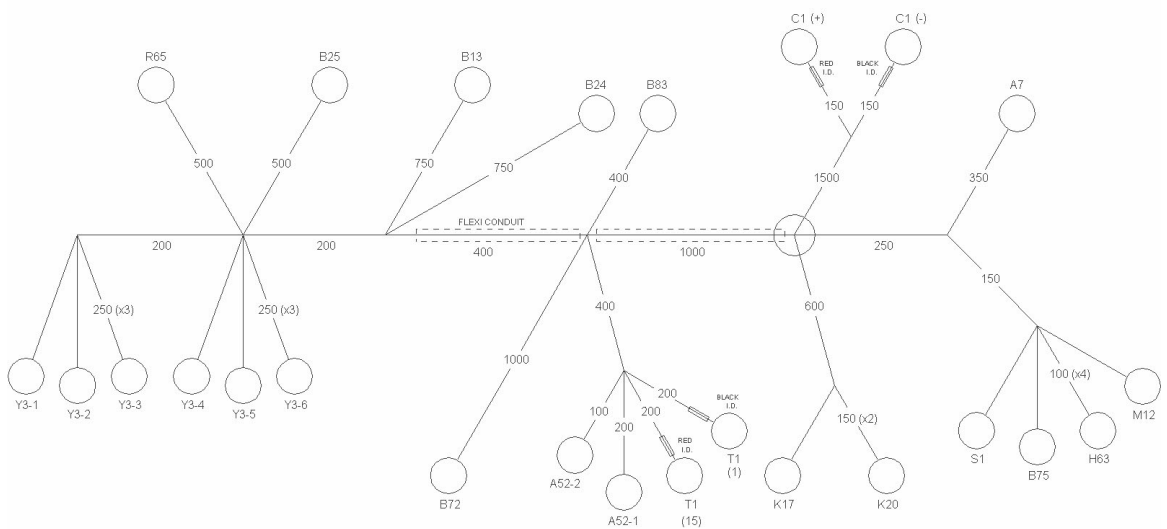


## Engine Management Systems

### 2. For 4 Cylinder Fuel & Ignition applications WH162



### 3. For 6 Cylinder Fuel & Ignition applications WH 155



**Notes:**

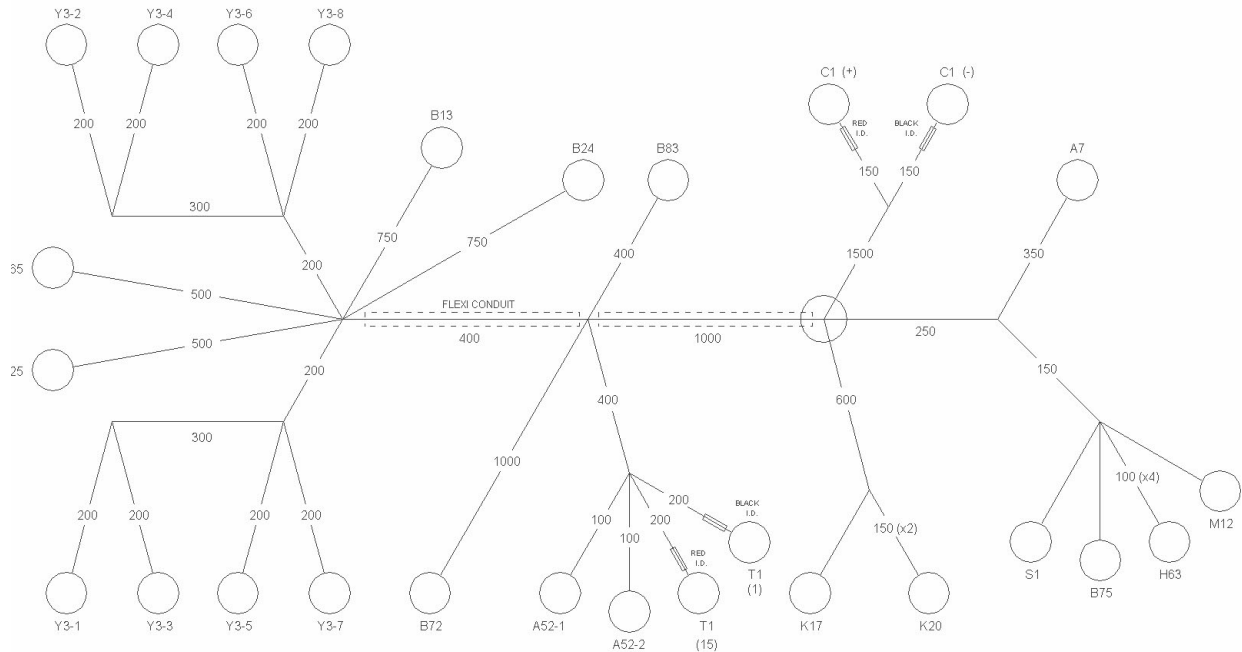
The lengths between points where cables join and leave the Harness are given in mm.

The main trunk of the harness is well protected by flexi conduit, and the main branching points are intended to be situated for example- one in the engine bay - one behind the dash - and one for the ecu in possibly the passenger foot well.



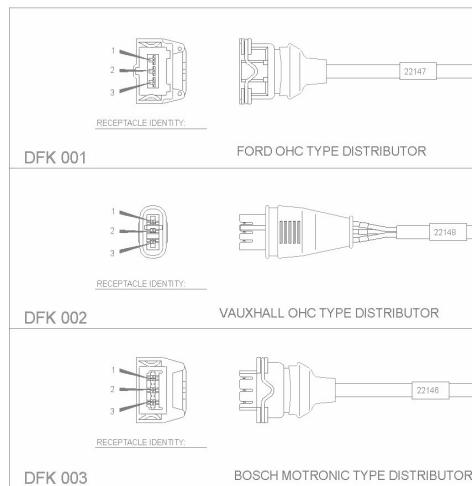
## Engine Management Systems

### 4. For V 8's Fuel & Ignition Applications WH156



- |                          |                         |                         |
|--------------------------|-------------------------|-------------------------|
| A7: ECU                  | H63: Up shift output    | A52: Ign Amp            |
| K17: Main Power Relay    | B13: Crank Sensor       | K20: Fuel Pump Relay    |
| B24: Coolant Temp Sensor | M12: Fuel Pump Feed     | B25: Air Temp Sensor    |
| R65: Throttle Psn Sensor | B72: Exhaust Gas Sensor | S1: Ignition Sw Supply  |
| B75: Tacho output        | T1: Coil Supply         | B83: Boost Press Sensor |
| Y3: Injector supply      | C1: Battery Supply      |                         |

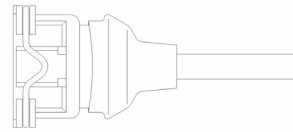
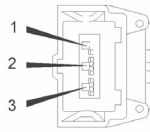
### 4. Distributor Adaptor Pin out



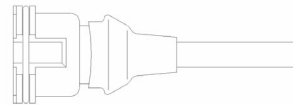
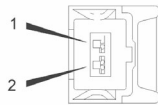


## Engine Management Systems

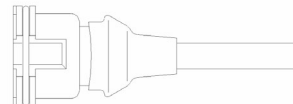
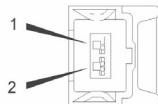
### 5. Crank Adaptor Connector Pin out



RECEPTACLE IDENTITY: \_\_\_\_\_



RECEPTACLE IDENTITY: \_\_\_\_\_



RECEPTACLE IDENTITY: \_\_\_\_\_

## Ordering Data

WH 143	Main Harness for all ignition only applications
WH 155	Main Harness for 6 cylinder fuel and ignition applications
WH 156	Main Harness for 8 cylinder fuel and ignition applications
WH 162	Main Harness for 4 cylinder fuel and ignition applications
WH 152	Auxillary Harness for 6 cyl Distributorless
WH 158	Auxillary Harness for 6 cyl and a Distributor
WH 159	Auxillary Harness for 4 and 8 cyl high data rate and a distributor
DFK 001	Adaptor Connector Harness for Ford, Bosch distributors
DFK 002	Adaptor Connector Harness for GM Vaux OHC distributors
DFK 003	Adaptor Connector Harness for VW Motronic distributors
CFK 001	Adaptor Connector Harness for Bosch Motronic crank sensor
CFK 002	Adaptor Connector Harness for Ford Zetec crank sensor
CFK 003	Adaptor Connector Harness for Magnetti Marelli crank sensor
AK 005	Tool to insert/remove Econoseal pins/skts
AK 006	Econoseal 3 pin connector pair with pins sockets and tool
AK 007	20 way connector kit for mating to ecu
AK 008	Econoseal half with pins
AK 009	Econoseal half with sockets



## Engine Management Systems

### Ignition Systems

Each type of ECU is configured to suit a particular triggering method, which can either be from a distributor or from a crank sensor.

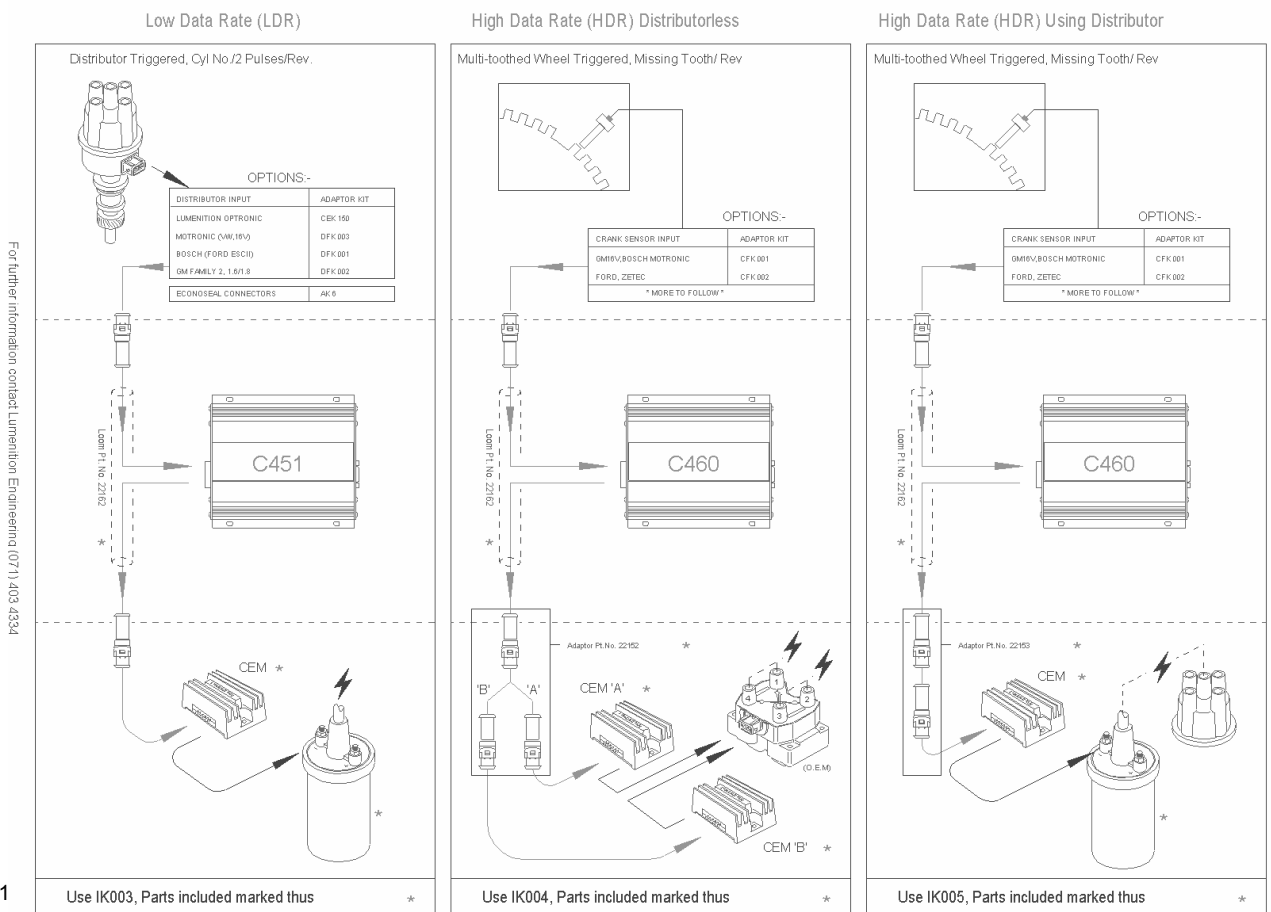
#### 1. Low Data Rate

Here there is only one triggering pulse for each cylinder from the original distributor. The ECU's calculation of speed is then the average speed measured from spark to spark, not always the best calculation under high acceleration conditions.

All the spark timing is controlled from the ECU, and so any old-fashioned advance mechanisms (bob weights and vacuum, etc.) must be firmly locked up before anything new is installed. But the rotor arm and HT side will be used as normal to direct the spark to the correct cylinder.

#### 2. High Data Rate

When the engine is fitted with a suitable pick up and toothed wheel, the ECU will have reference pulses every few degrees of rotation from which to calculate instantaneous speed. The High Data Rate ECU's can be set up to accommodate a number of differing formats of teeth per rev, and also the position of the marker (usually missing teeth) before TDC on cylinder No 1.

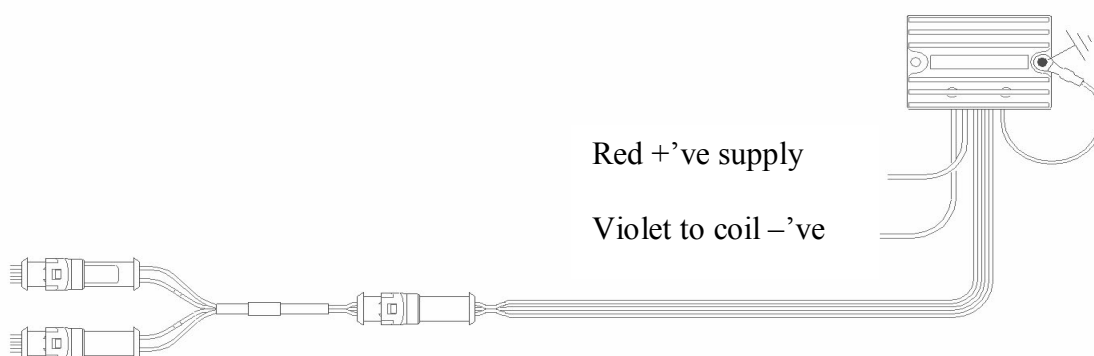




## Engine Management Systems

### 3. Using the original distributor

The distributor may be retained for routing the HT to the correct spark plug. With low data rate triggering the power module is plugged directly into the Main Wiring Harness (outlet A) but with high data rate triggering an adapter harness is used to connect the A and B outlets to one power module.



HT Connection to  
Distributor as Usual to  
fire correct spark plug

Diagrammatic only, some power  
and earth wiring omitted

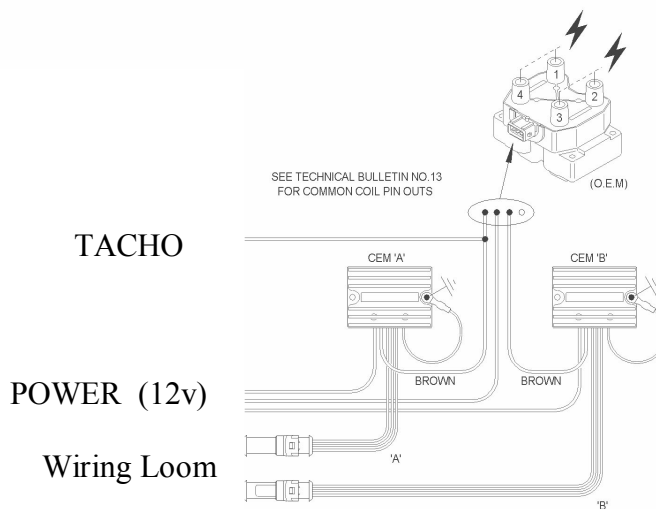


## Engine Management Systems

### 4. Distributorless Working

In order to drive a multi headed coil, two or three power modules must be used, and they are triggered in turn by the ECU.

#### Outline of 4 Cylinder Connections



Main  
Wiring  
Harness

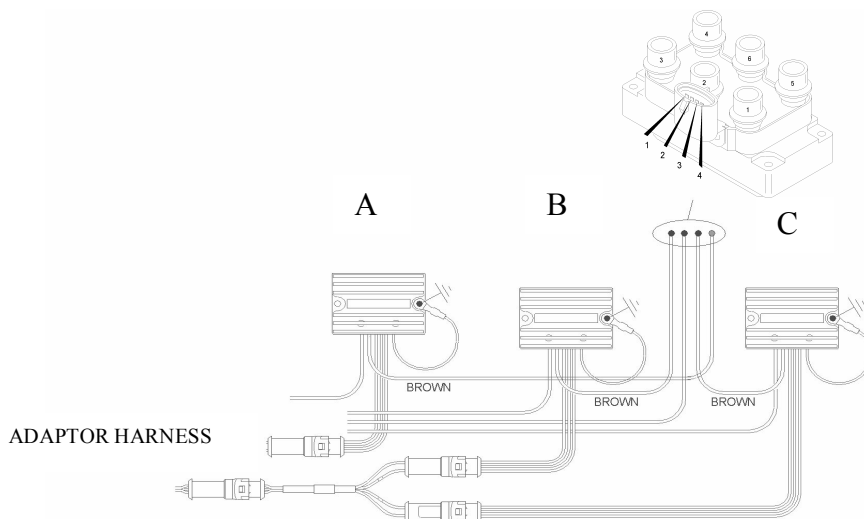
Connection to  
Power Modules

Use Adapter Kit  
if convenient

Four Way  
Coil

Module Firing Order A (No1) - B - A - B -

#### Outline of 6 Cylinder Connections



Module Firing Order A (No1) - B- C - etc.

*Diagrammatic only, some power  
and earth wiring omitted.*



## Engine Management Systems

For the correct combinations of ECU type , Main Wiring Harness, Adapter Wiring Harnesses, Coils, etc., see Specification Sheet No1.

### Ordering Data

CEC	Single Output Coil Low resistance for high spark rate and use with variable dwell systems. Complete with mounting bracket screws boots etc
CEC 004	4 Turret Coil for use on 4 cylinders, in the wasted spark mode, with variable dwell systems- with fixing screws.
CEC 006	6 Turret coil, similar to above
CEM	Constant energy module
CET 150	Lumenition Optical Trigger
AK 009	Connector etc for mating with CET 150
AK 008	Connector etc for mating with CEM
AK 010	Connector etc for mating with either CEC004
AK 011	Connector etc for mating with either CEC006
AK 012	Connector Block to allow wiring from CEM's to CEC's
WH167	Coil low tension lead for CEC004
WH168	Coil low tension lead for CEC006

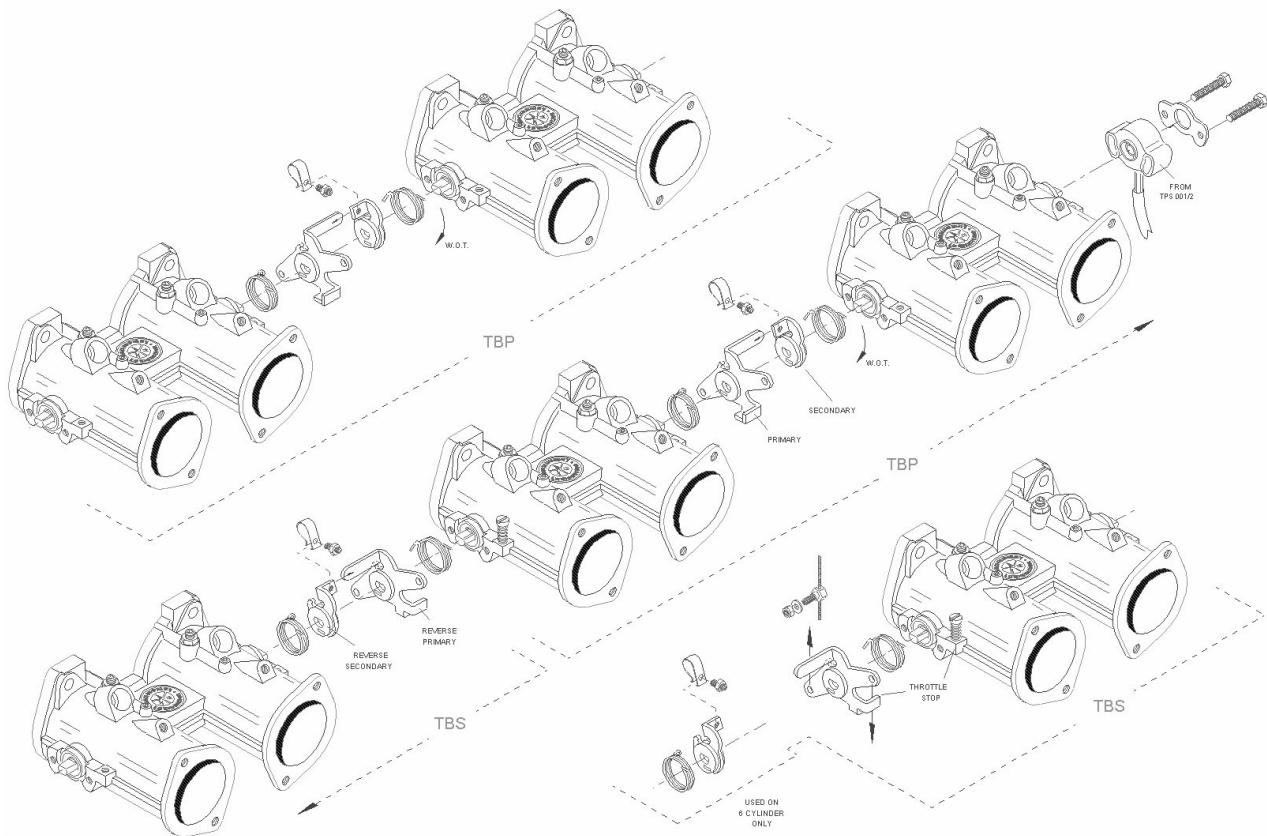


## Engine Management Systems

### Throttle Bodies and their Accessories

Two styles of throttle bodies are available, side draft and down draft. There is no reason why any throttle body should not be used in either configuration, but the Lumenition range has been designed to fit the differing mounting configurations usually associated with these applications.

Each throttle body has twin butterflies, and they are usually packed in pairs for 4 cylinders T(win) B(ody) P(air) or T(win) D(owndraft) P(air). The side draft versions are also available boxed as singles (TBS . . .), and these can also be used to make a six in line configuration, as they contain sufficient lever pieces for either set up, see below.



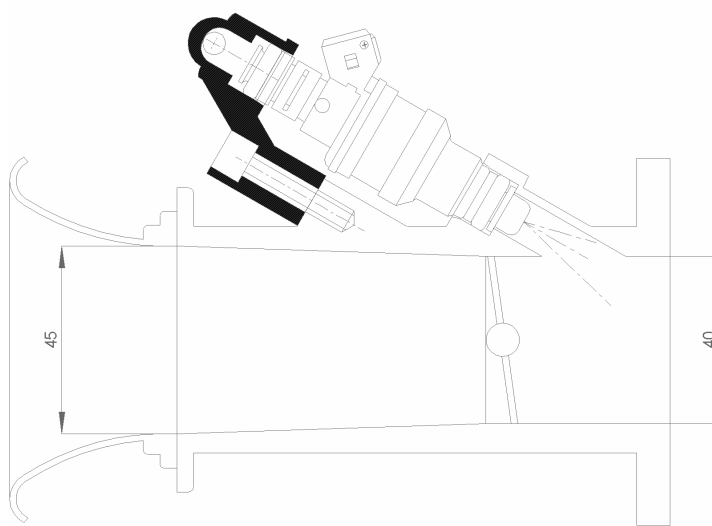


## Engine Management Systems

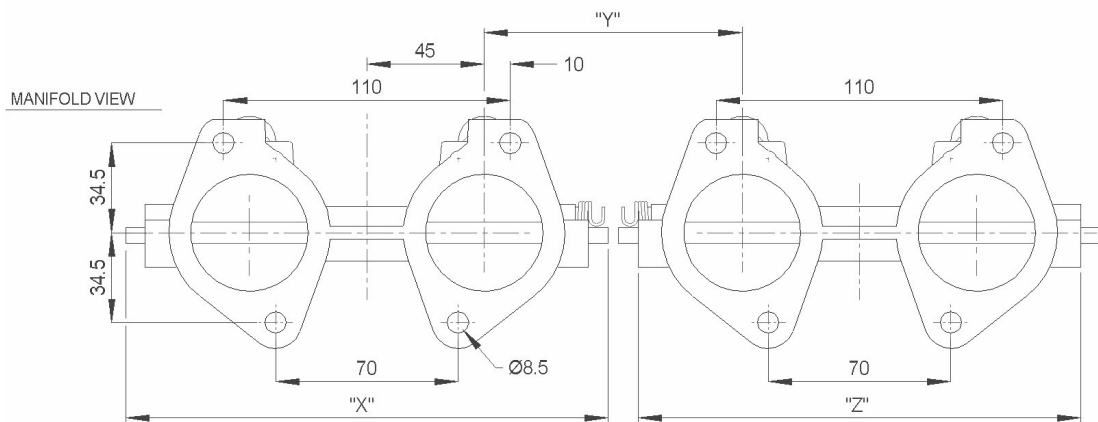
### Side Draft Installation Dimensions

L1

L2



For values of "L1" & "L2"  
see Ordering Data on Page 4.

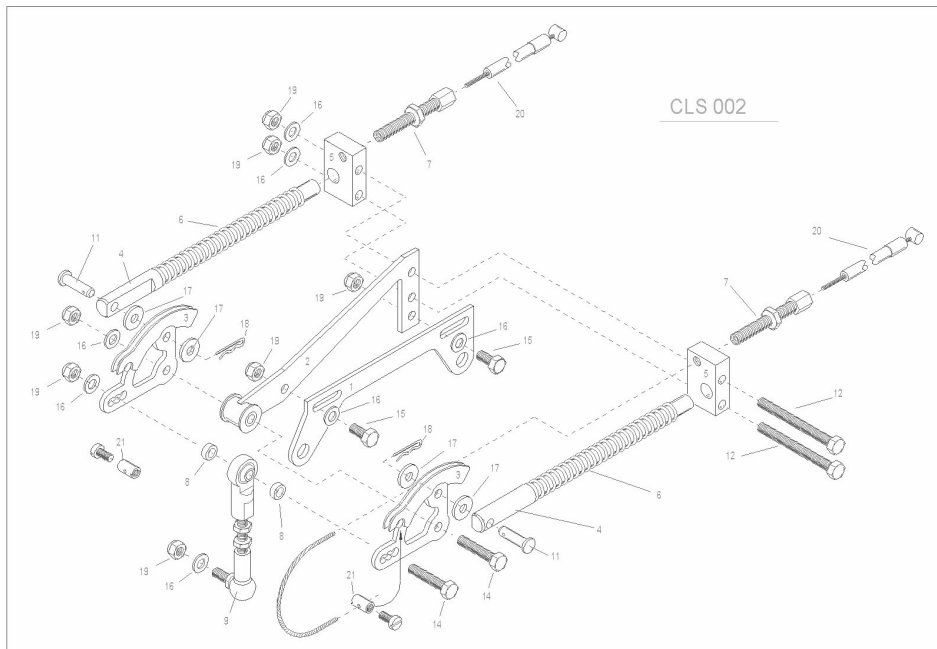
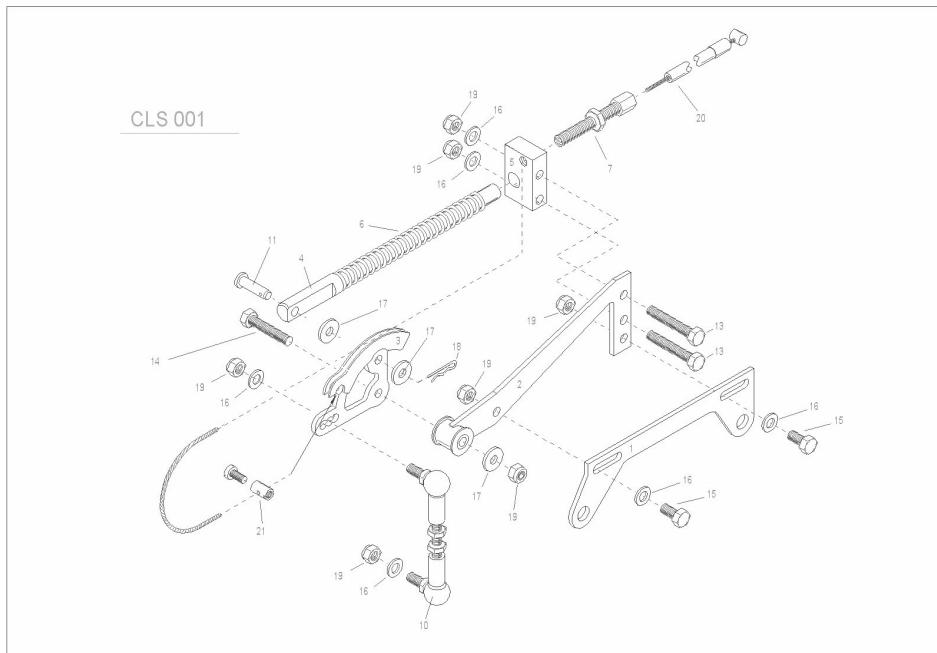




## Engine Management Systems

### Cable Linkage Accessories

In order to make a neat and simple connection to the throttle cable a quadrant and lever assemble is available. There are two styles one of which connects to a single cable, suitable for all road applications, and the other connects to twin cables in, for example, some competition applications.





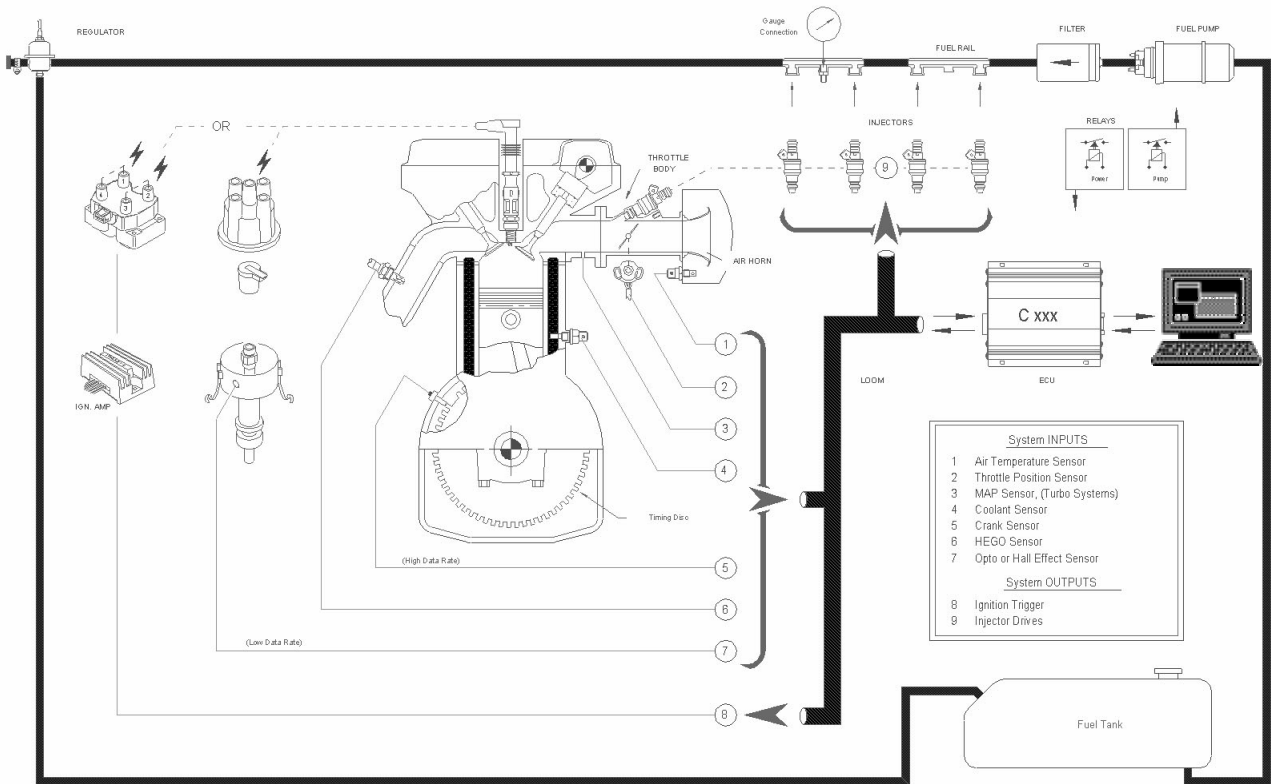
## Engine Management Systems

### Ordering Data

		Inlets	Manifold	Dia	"L1"	"L2"
AH 450	Air Horn	1		45	40	
AH 455	Air Horn	1		45 taper	90	
AH 480	Air Horn	1		48	40	
AH 485	Air Horn	1		48 taper	90	
						"L2"
TBP 452	Twin Body Pair	4	DCOE	45	118	
TBP 457	Twin Body Pair with idle bleed adjustment	4	DCOE	45	118	
TBP 482	Twin Body Pair	4	DCOE	48	118	
TBP 487	Twin Body Pair with idle bleed adjustment	4	DCOE	48	118	
TBS 457	Twin Body Single with idle bleed adjustment	2	DCOE	45	118	
TBS 487	Twin Body Single with idle bleed adjustment	2	DCOE	45	118	
TDP 45I	Twin Downdraft Pair	4	IDF	45	84	84TDP 481
	Twin Downdraft Pair	4	IDF	48	84	
THP 40I	Twin Horizontal Pair	4	DCOE	40	93.5	
MK 001	8 off M8/M8 studs washers, etc					
MK 002	8 off 5/16th UNC/UNF studs washers, etc					
CLS 001	Single Cable Linkage Set					
CLS 002	Double Cable Linkage Set					



## Engine Management Systems



Lumenition Engine Management