



## ***Performance Kit Fitting Instructions***

### ***K24001 Ford Duratec 2.0 Ltr I4 (DHE 420)***



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# **ALPHA**

## **PERFORMANCE KIT**

### **Introduction**

This Alpha Performance Engine Management system has been designed and developed for a standard specification Ford I4 Duratec 2.0 litre (DHE420) engine. It has been designed to run and control the engine in a specialist vehicle application. It is not intended as an up-grade for a standard specification Ford production car, as it is not designed to interface with any on-board systems associated with most standard production vehicle, as these are subject to change.

### **Fuel Supply System Requirements**

For vehicles not previously equipped with a fuel injection system -

To eliminated fuel pick-up and surge problems it is recommended that some form of swirl pot is employed, as shown on the fuel circuit diagram provided (See Appendix E)

Alternatively a range of in-tank modules are available from WEBCON UK LTD. These units comprise the following items in one assembly.

- Swirl Pot
- In-tank Filter
- Fuel Pump
- Fuel Level Sender Unit

Also where required the following individual items are available from WEBCON UK LTD.

- Fuel Pump
- Fuel Pump Mounting Bracket
- In-Tank Fuel Filter/Union
- In-Tank Fuel Hose (PTFE)
- Fuel Tank Pipe Unions

Please check the contents of this kit prior to commencing the installation. The fitting instructions should also be read through and fully understood before attempting to install the system to prevent mistakes being made. The fitting instructions are written in order that a competent auto technician shall be able to install this performance kit for any particular engine.

## Performance Kit Contents

### Kit K24001- Alpha Performance Kit - Ford Duratec 2.0ltr

Ref. Number	Component	Qty.	Part Number
1	Injector Blanking Plug	4	9990303100
2	Inlet Manifold	1	MM5050
3	M8 Nuts	15	9990009700
4	Inlet Manifold Mounting Studs M8 x 31mm	15	9990130800
5	8mm Plain washers	15	9990006000
6	8mm Lock Washers	15	9900450600
7	Throttle Linkage Kit	1	LP7000
8	Throttle Body 45 RH	1	9990120500
9	Throttle Body 45 LHP	1	9990120600
10	Flange Gaskets	4	9990124500
11	Air Filter	1	AFA013
12	Air Filter (include. Air Temp Sensor)	1	AFA013/ATS
13	Grommet	2	9990281200
14	Air Horn	4	AH901
15	Air Horn Retaining Clip	4	9990299800
16	Ambient Air Temperature Sensor	1	WAS008
17	Breather Hose 12.0mm I.D. x 750mm	1	9990203700
18	Elbow Union	1	9990048300
19	'T' Piece Union	1	9990282400
20	'U' Shaped Breather Hose	1	9990193400
21	Straight Connecting Union	1	9990116400
22	Air Manifold	2	9990301700
23	Air Manifold Pipe	1	9990301600
24	Crankcase Purge Hose 9.5mm x 700mm	1	9990268900
25	Fuel Injectors IWP042	4	WFI196
26	Fuel Injectors Mounting Kits	4	9990268600
27	Fuel Hose 7.4mm x 2 Mtr.	1	9990268800
28	Hose Clips	13	9990273700
29	Fuel Filter Banjo Union	1	9990139100
30	Fuel Filter Banjo Bolt	1	9990139200
31	Fuel Filter	1	WFF213
32	Gland Seals 12.0mm	2	9990224200

33	Fuel Filter Union (straight)	1	9990138900
34	Gland Seal 14.0mm	1	9990173800
35	Fuel Filter Mounting Kit	1	9990159400
36	Fuel Pressure Regulator	1	WFR335
37	Coolant Temperature Sensor	1	WTS185
38	Lambda (oxygen) Sensor	1	ALS331
39	Lambda Sensor Mounting Boss	1	9990200700
40	Inertia Switch	1	9990205700
41	Electronic Control Unit (ECU)	1	PI400
42	Wiring Harness	1	9990304000
43	Cable Ties	10	9990033400
44	Gearshift / Diagnostic Warning Light	1	9990128200

## Installation Instructions

As vehicle engine installations will vary, some minor modifications may be required. i.e. Brake Servo vacuum connection, see note 1.

*This Engine Management System is supplied with the following induction system components pre-assembled –*

- 1 X Inlet Manifold
- 2 X Alpha Twin Throttle Bodies
- 4 X Injectors
- 1 X Throttle Linkage Mounting
- 2 X Air Filters

The Throttle Bodies are preset and should not require any adjustment if the assembly is left untouched.

However, it maybe necessary to separate the Throttle Bodies from the Inlet Manifold in order to accommodate the fitting of a brake servo vacuum connection, or to change the Throttle Lever to allow the Throttle Linkage to be fitted above the Throttle Bodies. Where this is necessary please refer to the 'Throttle Body Fitting' and 'Throttle Body (Idle speed) Adjustment Procedure' detailed in the 'Reassembly Instructions'.

*The Alpha Engine Management System also comprises the following main electronic items:*

- 1 X Electronic Control Unit
- 1 X Wiring Harness
- 1 X Oxygen Sensor

## Injector location blanking

The original Fuel Injectors are located in the Cylinder Head and are not used in this installation.

It is necessary to blank off the original Injector locations with the four **Blanking Plugs (1)** provided.

N.B. The **Blanking Plugs (1)** are an interference fit and will require drifting into position in the Cylinder Head, with suitable soft mallet/drift. It may assist fitting if the plugs place in a freezer before fitting, this will cause slight contraction of the Plugs.

## Inlet Manifold / Throttle Body Assembly Fitting

The **Inlet Manifold (2)** has a casting boss on No.1 and No.4 cylinder inlet tracts, to accept a servo line connection where required. As there are no standardised fittings for brake servo vacuum line connections, either one of these bosses may be drilled and threaded (tapped) to accept the intended servo line connection.

1. Where applicable, remove the original inlet manifold mounting studs from the cylinder head. This can be achieved by locking together two of the **M8 nuts (3)** provided.
2. Fit the seven new **Inlet Manifold Mounting Studs (4)** into the cylinder head, by once more locking together two of the **M8 nuts (3)** provided.

**N.B.** Do not over tighten - Max. Torque 7 Nm (5 lb/ft).

3. Fit the new **Inlet Manifold (2) / Throttle Body Assembly** to the cylinder head using four 'O' ring seals, and secure using the new **M8 nuts (3) Plain Washers (5)**, and **Lock Washers (6)** provided.

## Throttle Linkage Fitting

The **Throttle Linkage System Kit LP7000 (7)** supplied is designed to be mounted below the **Throttle Bodies**. Where preferred the linkage can also be mounted above the **Throttle Bodies**, by using the alternative Mounting Bracket and Lever provided.

Where possible it is recommended that the throttle linkage with the corresponding lever be fitted to the **Throttle Bodies (8 & 9)** before fitting to the **Inlet Manifold (2)**.

**N.B.** The preassembled Throttle bodies are supplied with the underside linkage mounting plate fitted to the right-hand Body.

Detailed instructions for assembly and fitting of the throttle linkage are included within the **Throttle Linkage System Kit (7)**.

## Engine Breather System

The design of the engine breather system (as detailed below), is intended to minimise the amount of crankcase emissions escaping into the atmosphere.

Where preferred the breather connection leading from the engine cam cover can be routed via a catch tank, before connection to the air filters, (this may be required for competition use).

1. Route the Engine Breather Hose leading from the Air Filter back plates around the rear of the engine then connect the **'U' Shaped Breather Hose (20)** to the breather connection on the Engine Cam Cover.
2. Connect the **Crankcase Purge Hose (24)** leading from the elbow union in the **Air Manifold Pipe (23)** to the Crankcase Breather Valve located in the Engine Block beneath the Inlet Manifold.

**N.B.** The **Crankcase Purge Hose (24)** may be shortened as necessary

## Fuel System Installation

When fitting an external Fuel Pump (not supplied), the pump should be positioned near and below the fuel tank to ensure that the pump is gravity fed, (see fuel circuit diagram Appendix D).

It is advisable to use an internal or external Swirl Pot to ensure the fuel pump has a consistent fuel supply particularly at low fuel tank levels.

**N.B.** Damage to the fuel pump will occur if the Fuel Pump is run dry. Mount the Fuel Pump using a Mounting Bracket Kit, both items are available from WEBCON UK LTD.

In-tank modules incorporating Fuel Pump / Swirl Pot / Fuel Gauge Sender are also available.

1. Fit the **Fuel Banjo Union & Bolt (29 & 30)** to the **Fuel Filter (31)**, using two **Gland Seals (32)**. Fit the remaining (straight) **Union & Seal (33 & 34)** to the **Fuel Filter (31)**.
2. Fit the **Fuel Filter (31)** in the fuel line between the Fuel Pump and the **Fuel Injectors (25)**, using the **Mounting Bracket Kit (35)**.

**N.B.** Steel fuel line (8mm or 5/16" Dia.) should be used for the fuel supply and return lines between the front and rear of the vehicle. Use the **Fuel Hose (27)** for making connections to the Injectors, Filter and Fuel Pump. Secure all fuel hose connections using the **Hose Clips (28)**.

3. Using a section of **Fuel Hose (27)**, connect the **Fuel Pressure Regulator (36)** into the fuel circuit return line leading back to the fuel tank (after the fuel injectors), as shown in the diagram.

**N.B.** The Fuel Hose leading from the Fuel Injectors must connect to the side connection of the **Fuel Pressure Regulator (36)**, (the connection in the base of the Regulator must be connected to the return line back to the Fuel Tank - see fuel circuit diagram Appendix D).

## Coolant Temperature Sensor

The **Coolant Temperature Sensor (37)** replaces the original Ford sensor located in the Water Housing below the Ignition Coil. Recommended tightening torque, <25 Nm.

## Cooling System Thermostat Control

The cooling system is controlled by a 'waxstat' Thermostat with an electrical over-ride. The electric control is normally provided by the Ford ECU, however this function can be controlled by the fitting of a Thermo-switch, ideally situated in the by-pass (heater circuit). Alternatively an electric water pump system can be used. Please contact **Webcon UK** for details relating to either option. A conventional thermostat system is also available from **Raceline Engineering**. The **Coolant Temperature Sensor (37)** will also fit this item.

## Lambda (Oxygen) Sensor

The **Lambda Sensor (38)** can either replace the existing lambda sensor or can be fitted into the exhaust pipe. A 16mm (5/8") hole should be drilled in the exhaust pipe. Ideally the sensor should be mounted vertically or as near to vertical as possible. The **Lambda Sensor Boss (39)** should then be welded into the hole with an airtight weld. A layer of anti-seize compound (**NOT** copper based) should be put on the threads of the lambda sensor before it is screwed and tightened into the boss. Recommended tightening torque, 40 Nm.

## Inertia Switch

It is important that the **Inertia Switch (40)** is securely mounted to the vehicles chassis to ensure that the switch is tripped in the event of a vehicle accident. **N.B.** The switch must be mounted in an upright position, with the rubber switch cover upper most. Ensure the Inertia Switch (steel ball) plunger is depressed to make circuit continuity.

## Electronic Control Unit (ECU)

It is essential that the management system is supplied with a good source of electric power at all times. A minimum working voltage should be no less than 10 volts, this is especially so during cold start cranking.

The **Electronic Control Unit ECU (41)** must always be located away from any direct heat source of the engine. It is not waterproof and for this reason it must be located inside the passenger compartment of the vehicle.

The **ECU** is supplied with the correct ignition and fuel injection calibration map that is fully optimised for the Duratec **2000cc** engine. For up-rated **Raceline** engine specifications, please contact the ALPHA group or Raceline for more information if required.

## Wiring Harness Installation and Connection

The **Wiring Harness (42)** must not run near any direct heat source. Ensure the wiring harness, and in particular the engine speed sensor lead, is routed to avoid the following components and associated wiring –

- Ignition HT leads
- Alternator
- Starter Motor

**N.B.** If the wiring harness is routed too close to any of the above, signals may be induced in the harness that the **ECU** can misinterpret, causing uneven running or it can prevent the engine from starting.

1. The bulkhead grommet on the harness is designed for a 1.75 inch (44 mm) hole. Make any holes in the bulkhead as high up as is practical to avoid water leaks. Also, ensure the grommet is fitted correctly and securely, as the hole will very quickly cut into the harness if not adequately protected.

2. Route the Wiring Harness for connection to the items as detailed below. Carefully avoid sharp edges and moving parts, then allowing for engine movement, secure with the **Cable Ties (43)**, where necessary.

**N.B.**The 35-Way connector (**A**) will fit through the grommet hole.

**Harness Connections** - Refer to Appendix A for layout of harness

- A** - Connect to the **ECU (41)** 35 pin socket
- E** - Connect to engine rpm sensor in engine block
- H** - Connect to **Injector 4**
- I** - Connect to **Injector 3**
- J** - Connect to **Injector 2**
- K** - Connect to **Injector 1**
- Q** - Connect to the **Coolant Temperature Sensor (37)**
- S** - Connect to the **Throttle Position Sensor** mounted on the Throttle Body
- T** - Not Used
- CC** - Ignition Retard – Test only (not used)
- DD** - Not used
- EE** - **Gearshift / Diagnostic Warning Light** [Low Throttle Position] (43) – see detail below.
- FF** - **ECU Relay**. Relay holder should be securely fixed to chassis  
(Relay pre-fitted to the holder)
- GG** - **Fuel Pump Relay**. Relay holder should be securely fitted to chassis  
(Relay pre-fitted to the holder)
- HH** - **MAIN GROUND CONNECTION - MUST BE FITTED TO THE NEGATIVE TERMINAL NOT THE CHASSIS!**
- II** - **Fuel Pump** Positive connection, fit securely to the fuel pump positive terminal
- JJ** - **ECU Relay Fuse** (15 Amp Blade Type) fitted to the side of the ECU relay holder
- KK** - **Fuel Pump Relay Fuse** (15 Amp Blade Type) fitted to the side of the Fuel Pump relay holder
- MM** - **MAIN 12V CONNECTION - MUST BE FITTED TO THE BATTERY POSITIVE TERMINAL**
- PP** - **Fuel Pump** Negative connection, fit securely to the fuel pump negative terminal
- SS** - Connect to **Tachometer / Rev. Counter**
- JJJ** - Connect to the **Air Temperature Sensor**.(16)
- QQQ** - **IGNITION SWITCHED 12 VOLT POSITIVE BATTERY SUPPLY - MUST BE TAKEN DIRECT FROM THE IGNITION SWITCH**
- YYY** - Connect to the **Inertia Switch (40)**, should be securely mounted up-right to chassis
- HHHH** - **Ignition Coil** - Connect to the Ignition Coil mounted to the back of the cylinder head
- NNNN** - **ECU Communications**. Locate in a suitable place so that an ALPHA PRO4 system dealer has easy access to the connector for communication purposes
- VVVV** - Connect to the **Lambda (oxygen) Sensor (38)** mounted in exhaust system
- WWWW** - **Stepper Motor** (Not Used)
- YYYY** - **Auxiliary 12V Output** (Ignition Switched) – Use with **EE** for **Warning Light (44)**.
- XXXX** - **Wastegate Control** (Not Used)
- ZZ** - **Auxiliary Ground**. (Not Used)

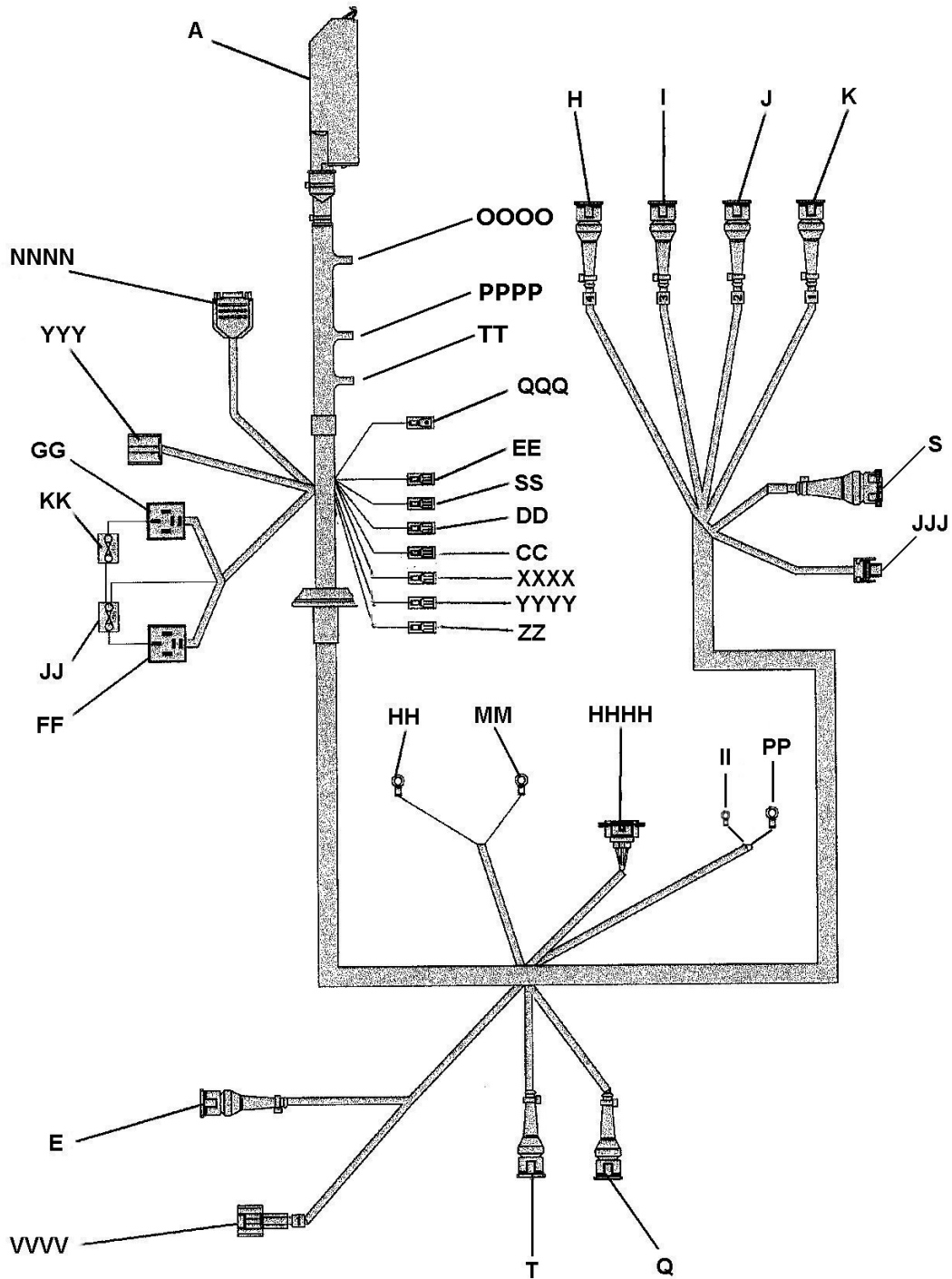
**Gearshift / Diagnostic Warning Light** (Low Throttle Position)

The Warning Light (44) is supplied fitted to The Wiring Harness connections EE and YYYY. It is intended that the Warning Light (44) be fitted to the vehicle instrument facia, by extending the wiring as required.

**N.B.** The Warning Light (44) has dual functionality –

- It will illuminate at 6800rpm (400rpm below the pre-set rev limiter).
- It will also illuminate if the Throttle Position Sensor (TPS) is below the correct setting voltage (0.745-0.755) or when connector **S** completely disconnected.

### Appendix A : Wiring Harness



## Appendix B : Harness Connections / Wiring Colour Coding

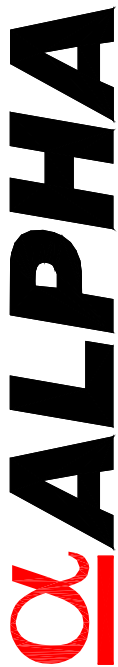
Connector I.D.	Item	Connector Type	Connector Colour	Pin No.	Wire Colour	Connects To Item	Pin No.
A	ECU	AMP Minitimer	Black	See Appendix C			
E	RPM Sensor	Ford	Black	1 2	Red Blue	A A	4 1
H	Injector 4	AMP Minitimer	Black	1 2	Black/Yellow Green	A FF via TT	33 87
I	Injector 3	AMP Minitimer	Black	1 2	Brown/Yellow Green	A FF via TT	18 87
J	Injector 2	AMP Minitimer	Black	1 2	Green/Yellow Green	A FF via TT	32 87
K	Injector 1	AMP Minitimer	Black	1 2	Purple/Yellow Green	A FF via TT	35 87
Q	Coolant Temp. Sensor	AMP Minitimer	Blue	1 2	Blue Blue/Yellow	A via OOOO A	11 29
S	Throttle Position Sensor	AMP Minitimer	Black	1 2 3	Blue Purple/Blue Red/Green	A via OOOO A A	11 17 30
T	Air Valve V.A.E. (Not Used)	AMP Minitimer	Grey	1 2	Brown/Blue Green	A FF via TT	34 87
CC	Ignition Retard – Test only	Female Spade	Black	1	Blue/Red	A	13
DD	Not Used	Female Spade	Black	1	Blue/Green	A	14
EE	Gearhifft / Diagnostic Warning Light	Female Spade	Black	1	Blue/White	A	7
FF	ECU Relay	Relay Holder	Black	30 85 86 87	Purple Black White Green	JJ HH via PPPP QQQ A	N/A N/A N/A 12
GG	Fuel Pump Relay	Relay Holder	Black	30 85 85 86 87 87	Purple Purple/White Purple/White Green/Yellow Red Red	KK A SS YYY VVVV II	N/A 28 N/A NC 3 N/A
HH	Battery Negative	8mm Ring	Black	N/A	Black Black	A via PPPP PP	19 N/A
II	Fuel Pump Positive	4.3mm Ring	Red	N/A	Red	GG	87
JJ	Main Fuse 15A	Fuse Holder	Black	N/A	Brown Brown Purple Purple	MM KK A FF	N/A N/A 20 30
KK	Fuel Pump Fuse 15A	Fuse Holder	Black	N/A N/A	Brown Purple	JJ GG	N/A 30
MM	Battery positive	8mm Ring	Red	N/A	Brown	JJ	N/A
PP	Fuel Pump Negative	6mm Ring	Black	N/A	Black	HH (direct)	N/A
SS	Tachometer (Rev Counter Signal)	Female Spade	Black	N/A	Purple/White	A via GG	28
JJJ	Air Temperature Sensor	Packard	Black	A B	Brown/Green Blue	A A via OOOO	31 11
QQQ	Ignition SW Supply	Male	Clear	N/A	White	FF	86

	12v	Spade			White	HHHH	2
YYY	Inertia Switch	AMP Econoseal	Black	C NC	Green Green/Yellow	FF via TT GG	87 86
HHHH	Ignition Coil	FORD 89F6 14A484 HCB	Black	1 2 3	Purple/Green White Orange/Brown	A QQQ A	25 N/A 26
NNNN	ECU Communications		White	1 to 9	Can Vary	A	6/8/19/ 2021/2 2/27
VVVV	Oxygen Sensor	Super Seal	Black	1 2 3 4	Yellow Black Red Black	A A via PPPP GG HH via PPPP	2 19 87 N/A
WWWW	Stepper Motor	Not Fitted					
XXXX	Wastegate Control	Female Spade	Black	N/A	Blue/Orange	A	16
YYYY	Switched 12v (Aux. Output)	Female Spade	Black	N/A	Green	FF via TT	87
ZZ	Auxiliary Ground	Female Spade	Black	N/A	Black	HH via PPPP	N/A
TT	12V Power (switched)	Bonded Joint	N/A	N/A	Green	Various (detailed above)	As above
PPPP	Power Ground	Bonded Joint	N/A	N/A	Black	Various (detailed above)	As above
OOOO	Sensor Ground	Bonded Joint	N/A	N/A	Blue	Various (detailed above)	As above

**Appendix C : Pin Outs from ECU**

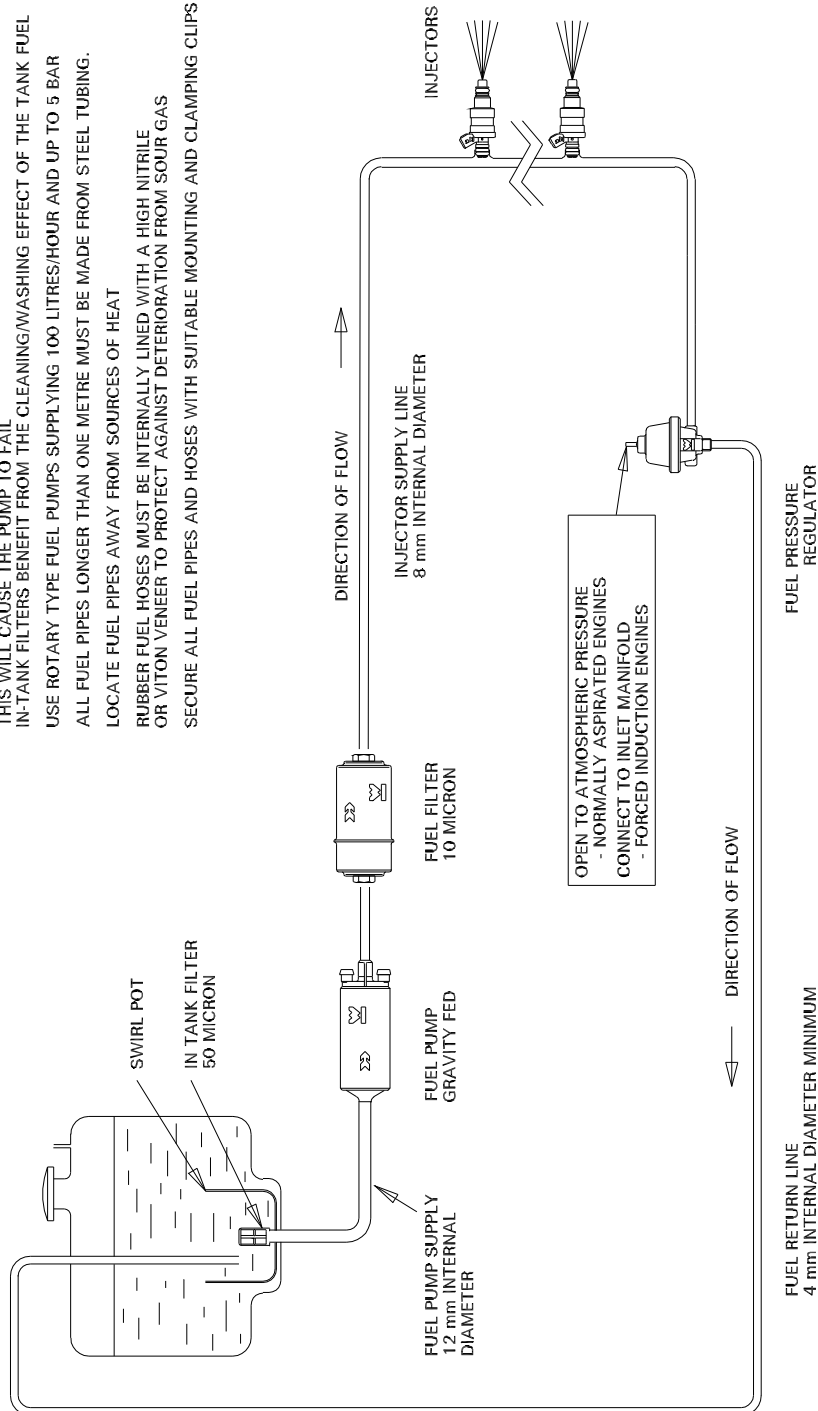
Pin	Description	Connector	Pin No.	Wire Colour
1	Engine Speed Sensor Ground	E	2	Blue
2	Lambda Sensor Input	VVVV	1	Yellow
3	Stepper Motor (Not Used)	-	-	Slate/Red
4	Engine Speed Sensor Input	E	1	Red
5	Not used	-	-	-
6	Communication	NNNN	7	can vary
7	Gear Shift / Diagnostic Light	EE	N/A	Blue/White
8	Communications (Not Used)	NNNN	4	can vary
8	Stepper Motor (Not Used)	-	-	Slate/White
9	Not Used	-	-	-
10	Stepper Motor (Not Used)	-	-	Slate/Green
11	Sensor Ground (TPS)	S via OOOO	1	Blue
11	Water Temp Sensor Ground	Q via OOOO	1	Blue
11	Air Temp Sensor Ground	JJJ via OOOO	B	Blue
11	Air Pressure Sensor Ground	-	-	-
12	Ignition Voltage (Key-on +12v)	FF via TT	87	Green
13	Ignition Retard – Test only	CC	N/A	Blue/Red
14	Input Switch (Not Used)	DD	1	Blue/Green
15	Pressure Sensor Input (Not Used)	-	-	-
16	Wastegate Control	XXXX	N/A	Blue/Orange
17	Throttle Position Input	S	2	Purple/Blue
18	Injector Channel 3	I	1	Brown/Yellow
19	Battery Negative	HH via PPPP	N/A	Black
20	Voltage Supply (Battery +12V)	JJ	N/A	Purple
20	Communications	NNNN	8	can vary
21	Communications	NNNN	3	can vary
22	Communications	NNNN	6	can vary
23	Ground (Not Used)	-	-	-
24	Ignition Signal Ground	HH via PPPP	1	Black/Red
25	Ignition Signal Output 1	HHHH	1	Purple/Green
26	Ignition Signal Output 2	HHHH	3	Orange/Brown
27	Communications (Not Used)	NNNN	5	can vary
28	Fuel Pump	GG	1	Purple/White
28	Tachometer Signal	SS via GG	1	Purple/White
29	Coolant Temp Sensor Input	Q	2	Blue/Yellow
30	Reference Voltage (5v)	S	3	Red/Green
31	Air Temperature Sensor Input	JJJ	A	Brown/Green
32	Injector Channel 2	J	1	Green/Yellow
33	Injector Channel 4	H	1	Black/Yellow
34	Cold Start Air Valve (not used)	T	1	Brown/Blue
35	Injector Channel 1	K	1	Purple/Yellow

## Appendix D : Fuel Circuit Diagram



### FUEL CIRCUIT DIAGRAM

- IN TANK SWIRL POT ELIMINATES FUEL PICK-UP AND SURGE PROBLEMS
- DO NOT USE AN IN-LINE FUEL FILTER BEFORE THE FUEL PUMP AS THESE BECOME BLOCKED WITH DIRT PARTICLES, REDUCING THE FLOW OF FUEL TO THE PUMP THIS WILL CAUSE THE PUMP TO FAIL
- IN-TANK FILTERS BENEFIT FROM THE CLEANING/WASHING EFFECT OF THE TANK FUEL
- USE ROTARY TYPE FUEL PUMPS SUPPLYING 100 LITRES/HOUR AND UP TO 5 BAR
- ALL FUEL PIPES LONGER THAN ONE METRE MUST BE MADE FROM STEEL TUBING.
- LOCATE FUEL PIPES AWAY FROM SOURCES OF HEAT
- RUBBER FUEL HOSES MUST BE INTERNALLY LINED WITH A HIGH NITRILE OR VITON VENEER TO PROTECT AGAINST DETERIORATION FROM SOUR GAS
- SECURE ALL FUEL PIPES AND HOSES WITH SUITABLE MOUNTING AND CLAMPING CLIPS



## Reassembly Instructions

## Throttle Body Fitting

1. Mount each **Throttle Body (8 & 9)** to the **Inlet Manifold (2)**, using the **Flange Gaskets (10)**. Secure the **Throttle Bodies** in position with the remaining **M8 Nuts (3)**, **Plain Washers (5)** and **Lock Washers (6)**, tighten gradually in a diagonal formation.
2. With both **Throttle Bodies (8 & 9)** fitted to the **Inlet Manifold (2)**, the throttles can be initially balanced, by first ensuring that the idle speed adjustment screws, (located on the central chamber of each throttle body), are unscrewed. Next manually holding the throttle closed on the left-hand throttle body, thus compressing the sprung loaded plunger of the balance lever on the right-hand throttle body.
3. Next whilst holding the throttle closed, turn the balance adjustment screw until it contacts the balance tab of the throttle lever on the right-hand throttle body. This should ensure that all throttle plates are fully closed. Open and close the throttle a few times to make sure they are fully closing (throttle plate contact with the barrel wall should be audible in each barrel).

**N.B.** On completion of the fitting of the performance kit, the throttle stop screws (idle screws) require setting as detailed in '**Throttle Body (Idle speed) Adjustment Procedure**'.

Once the engine has been started the throttle bodies must be balanced using a suitable air flow meter. An air flow meter is available from WEBCON UK LTD. '**Synchrometer**' Pt. No. **9800100000**.

## Air Filter Fitting

1. Remove the top plate and filter element from both **Air Filter Units (11 & 12)**, then fit the two **Grommets (13)** into the two holes in the filter base plates.
2. Fit the **Air Horns (14)** into the **Air Filter Unit Base Plates (11 & 12)**, the base plate will locate in the groove channel of the air horns.  
N.B. The Air Horns are a slight interference fit in the Air Filter Base Plates and need to be pushed gradually into position. Care should also be taken when fitting to avoid cuts to the hands, as the air filter base plates may have sharp edges.
3. Push **Air Horns (14)** and **Air Filter Unit Base Plates (11 & 12)**, onto the **Throttle Bodies (8 & 9)** and secure with the **Retaining Clips (15)**.

**N.B.** Do not fit the air filter elements and top plates until the air flow through the Throttle Bodies has been checked, to ensure each barrel is flowing exactly the same amount of air. Where this is not the case please refer to the '**Throttle Body (Idle speed) Adjustment Procedure**'

## Air Temperature Sensor

The **Air Temperature Sensor (16)** should be fitted into the **Base Plate** of the **Air Filter Unit (12)**, or as close to the **Inlet Trumpets** where possible.

## Engine Breather System

The design of the engine breather system (as detailed below), is intended to minimise the amount of crankcase emissions escaping into the atmosphere.

Where preferred the breather connection leading from the engine cam cover can be routed via a catchment bottle, before connection to the air filters.

3. Cut two lengths of **Breather Hose (17)** 550mm & 170mm long. Fit the **Elbow Union (18)** into the 170mm section then join both sections together with the straight through connections of the **'T' Piece Union (19)**. Next join the **'U' Shaped Breather Hose (20)** to the 550mm section using the **Straight Connecting Union (21)**.
4. Fit the assembled breather hose into the **Grommets (13)** in the Air Filter Base Plates, (the **Elbow Union (18)** fits into the left-hand Air Filter Base Plate and the **'T' Piece Union (19)**. Into the right-hand Base Plate). Route the pipework around the rear of the engine then connect the **'U' Shaped Breather Hose (20)** to the breather connection on the Engine Cam Cover.
5. Assemble the two **Air Manifolds (22)** using the **Air Manifold Pipe (23)**, then connect to the four balance pipes on the two **Throttle Bodies (8 & 9)**.

**N.B.** The Air Manifold legs can be shortened as preferred.

6. Connect the **Crankcase Purge Hose (24)** between the elbow union in the **Air Manifold Pipe (23)** and the Crankcase Breather Valve located in the Engine Block beneath the Inlet Manifold.

**N.B.** The **Crankcase Purge Hose (24)** may be shortened as necessary.

## Fuel Injectors

1. Fit the **Fuel Injectors (25)** to the **Throttle Bodies (8 & 9)** using the **Injector Mounting kits (26)** provided.
2. Join together the fuel unions supplied in the Injector Mounting Kits, for each Throttle Body, by cutting two sections of **Fuel Hose (27)** 65 mm long. Then cut a section of **Fuel Hose (27)** 80 mm long and join between the two 65 mm sections, secure all connections using six **Hose Clips (28)**.
3. Fit the fuel union/hose assembly to the **Fuel Injectors (25)**, and secure using the two collets and circlip provided in each Injector Mounting kit.

## Throttle Body (Idle speed) Adjustment Procedure

Equipment required:-

- Syncrometer [Webcon Pt.No. 9800100000]
- Accurate Rev Counter
- Timing Gun - Ignition Timing Strobe Light

**IMPORTANT: The Throttle Bodies are supplied preassembled, and should not require any further adjustment. To achieve the very best results from the Alpha PRO4 Engine Management System, it is essential that the air flow through each barrel of the Throttle Bodies is exactly the same, and that the Throttle Position Sensor (TPS) is set to the correct voltage. When operating correctly good cold starting, stable hot and cold idle speed control and excellent light throttle driveability will be achieved. It will also ensure that the closed loop lambda control required for exhaust emissions testing (SVA) is operating within its optimum control range.**

**Should it be necessary to make any adjustments, the following procedure should be adhered to.**

1. Where it has been necessary to remove the Throttle Bodies, after refitting only the balance lever that connects the two Throttle Bodies should require adjustment as detailed in operation 5 below. This is providing the throttle stop screws (located on the central chamber of each throttle) remain as received unaltered from the factory setting.

N.B. If the idle stop screws have been altered it may be necessary to reset the stop screws as detailed in the '**Throttle Body Fitting**' instruction detailed above.

2. After resetting the Throttle Stop Screws carry out operations 3 & 4 below, if adjustment was not required proceed to operation 5.
3. With the ignition turned on adjust the voltage at the Throttle Position Sensor (TPS). To do this, connect a volt meter to terminal 1 blue wire and terminal 2 (centre) blue/purple wire of the harness connector **S**. The Throttle Position Sensor voltage reading requires setting to between 0.670 – 0.680 volts. Once again, open and close the throttle a few times to make sure they are fully closing and that the voltage reading remains between 0.670 – 0.680 volts.
4. Open the throttle by adjusting the throttle stop screw on the left-hand Throttle body to achieve a reading between 0.745 – 0.755 volts. Adjustment the stop screw on the right-hand Throttle Body should be made after the next operation, to still maintain the same air flow through all four barrels of the Throttle Bodies at idle. When correctly adjusted this will also ensure that when the accelerator pedal is lightly depressed all four Throttle Plates open equally. This will eliminate any tendency of a lean misfire (spitting) due to the unequal opening of the Throttle Plates.

5. Start and run the engine until normal operating temperature is reached, (use the 'Syncrometer' to maintain the same amount of air flow through each Throttle Body). With the engine at normal operating temperature repeat this operation to ensure all the barrels of the throttle bodies flow the same amount of air. The air flow through each barrel should be approximately 4 Kg/Hr. If there is a higher reading on one barrel of a particular Throttle Body, ensure that the air by-pass screw on that barrel is fully closed. The adjacent air by-pass screw on the same body should then be adjusted (opened) to attain the same air flow reading on both barrels

6. With the engine at normal operating temperature the ECU is designed to maintain an idle speed of 900rpm by controlling the ignition advance. However, when the Throttle Bodies and TPS are correctly set, the ignition timing advance should be 5 degrees **After** Top Dead Centre (ATDC). To accurately check the timing it will be necessary to mark the timing cover. If the ignition timing advance is greater or less than 5 deg. ATDC\* the idle stop screw may require slight adjustment, the TPS voltage must then be reset to between 0.745 – 0.755 volts.

\* An average reading maybe required due to the ECU idle control strategy, particularly if some re-adjustment to the throttle stop screw / TPS is required.

N.B. If difficulty is experience achieving the correct settings, a default idle speed TPS setting can be obtaining by disconnecting the TPS (connector **S**). This will allow the throttle air flow settings to be changed

without the need to make re-adjustments to the TPS. After, then achieving the correct throttle (air flow) setting the TPS must be reconnected, and the final adjustment made to the TPS (0.745 – 0.755 volts). When the TPS is disconnected the Diagnostic Warning Light (**43**) will illuminate and will remain lit when reconnected if the TPS voltage is less than 0.740v.

Appendix E : Spares

**Wiring Loom Spares**

<b>Component</b>	<b>Webcon Part No.</b>
35 way connector	9990098600
3 way connector	9990166900
3 way connector boot	9990175700
2 way connector (brown)	9990166700
2 way connector boot	9990175600
2 way connector boot (90 deg)	9990157900
Terminal pins (standard) for above connectors (0.5-1.5 wire)	9990098900
Terminal pins (high spec.) for above connectors (0.5-1.0 wire)	9990204700
Terminal pins (high spec.) for above connectors (1.0-2.5 wire)	9990204800
Relay Holder	9990179400
Fuse Holder	9990206900
Packard 2 way connector kit (Air temperature sensor)	9990224500
Augat 4 way connector (Lambda sensor)	9990206600
Terminal pin for Augat connector	9990206500
Wire seal for Augat connector	9990206700
AMP Econoseal connector kit (Inertia switch)	9990208300
Ignition coil connector	Moulding
	terminal pin (small) 1&3
	terminal pin (large) 2
	wire seal
	9990241600
	9990241700
	9990241800
	9990241900

**N.B.** For details of other fuel system items not listed above please contact Webcon UK Ltd.

**NOTES :**





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