

Converting to a Zetec engine.

Your Xflow or Pinto getting a bit tired? Well for a fair while yet the Ford Zetec engine will be a good alternative. Why? Well because it will fit on your existing gearbox for one. And its also a very long lived engine as well as producing better hp with way better fuel economy.

The down side? Well...its quite a tall engine (a little lower than the Pinto) and they are all fuel injected. Not an issue if you convert to fuel injection but if you want carbs you will also have to sort out an ignition system as the Zetec engine does not have a distributor.

So, what will you need? The engine, obviously. Also I am going to assume you wish to keep the fuel injection. The engine wiring loom and the ECU complete, you will also need the ignition key and key sensor. You will also need a high pressure fuel pump (external pumps are available now easily and cheaply) you don't need most of the internal wiring from the donor, except the inertia switch, key sensor and the OBD plug that is.

Donor cars. The Focus and the Mondeo are common sources of the engines, they are different to each car so if you get a Mondeo engine you want the Mondeo wiring and ECU etc. and likewise the Focus ECU etc. if you get the focus engine. One big difference is the ECU's and engine sensors. The Focus has a 60 pin ecu the Mondeo has a 104 pin ECU and the engine sensors are different and in different places.

I will describe the Focus installation, not because it has a simpler ECU (its actually a later ECU from the Mondeo) but because I have done one and can show you how.

Other issues? The Ford inlet manifold is large....very large. It will likely foul the steering column. You can modify the steering column (an option...) or, buy or make a new inlet manifold. The manifolds that are available on the market just now require a new alternator to be fitted, if you make your own its easy to keep the ford alternator and simplify things somewhat. The ford engines use a serpentine belt to power the alternator, water pump, power steering and air con. You dont want the PAS or Air con. So to drive the water pump some ingenuity is needed. As for the exhaust, you can do what most Duttoners would do and keep the factory manifold and fit an exhaust pipe to suit. Also because of the position of the inlet manifold the brake master cylinder will likely have to be moved/modified.

First, you need to consider where the ECU will live. It needs to be kept cool and dry so a space under the dash is best. I also bought a cheap waterproof laptop / tablet bag to fit my ECU into belt and braces you might say.



The engine mounts need to be made. There are kits available on the likes of Ebay that provide all you need, but we in the Dutton world have some advantages over some other kit cars when it comes to mounting the Zetec. The front upper chassis member is just about perfect to use for the original engine mount. Well a modified version of it... with the gear box mount it just needs an engine mount low down on the off side of the engine to counteract engine torque.



A little bracing from the top cross member down to the lower cross member, and its fine. You can also see that I have modified the ford gear box bell housing to accept the Zetec starter motor. The idea for this came from another Dutton owner Daniel Bosworth, who did the same to his car. You could fit a starter motor from one of the FWD CVH engined cars (Escort, Orion, Fiesta) but to do that you need to hack saw off some of the ally sump on the Zetec engine to get them to fit.

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The lower
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modification I made. By using the sandwich plate from the Focus you can work out where to cut and weld some steel to modify the bell housing.

The engine is a little smaller than the Pinto.....BUT with all the inlet manifold and exhaust fitted your going to end up with a crowded engine bay. Ingenuity is needed to find suitable homes for some things (brake master cylinder for one...!)

The inlet manifold is an issue, the ford one is plastic and VERY large, the steering column as I have said could be modified (lowered by about 1-2 inches might do it) but even then your likely to have to put a bulge in the bonnet to accommodate the Ford throttle body as it points upwards. You can easily buy after market manifolds but I chose to make one. You need to keep the ford plastic manifold and cut away the fuel injector mounting plate. Then make (or buy) a manifold adaptor out of steel onto which you need to weld some inlet runner pipes. Over this you'll need a plenum chamber, I used 1mm steel sheet bent into a tube and welded it to the inlet runners. By angling it from front to rear it could bypass the ford alternator allowing it to be retained.

<p>Injector plate removed from the plastic manifold. The manifold to the right clamps this to the cylinder head, I used "instant gasket" to seal the joint face, it seems to work fine. The ford gaskets are rubber and left in place on the other side (against the head itself)</p>		<p>Manifold plate with inlet runners.</p>	
<p>Plenum made and welded on....the inlet runners are "shorter" to the rear. But the same length overall, as they protrude further into the plenum.</p>		<p>You can see how the throttle body fits to the manifold and angles down under the chassis cross member.</p>	

It looks like a fair bit of hassle but I feel it was worth it.

Wiring! The ford ECU needs a fair bit of electrics to get it all working as it should. Now don't worry its actually very straight forward. Other than extending the wiring for the throttle body everything can be made to fit from the standard loom. You could if you wish just use those plugs and connections from the standard loom as required, and leave the

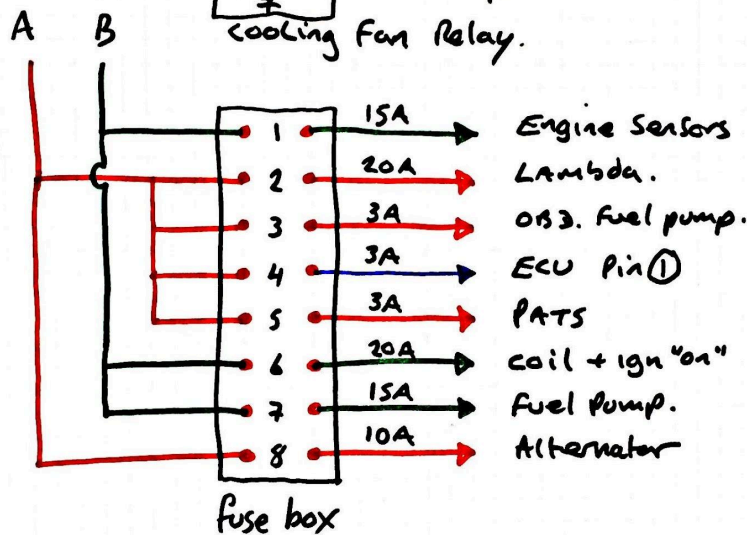
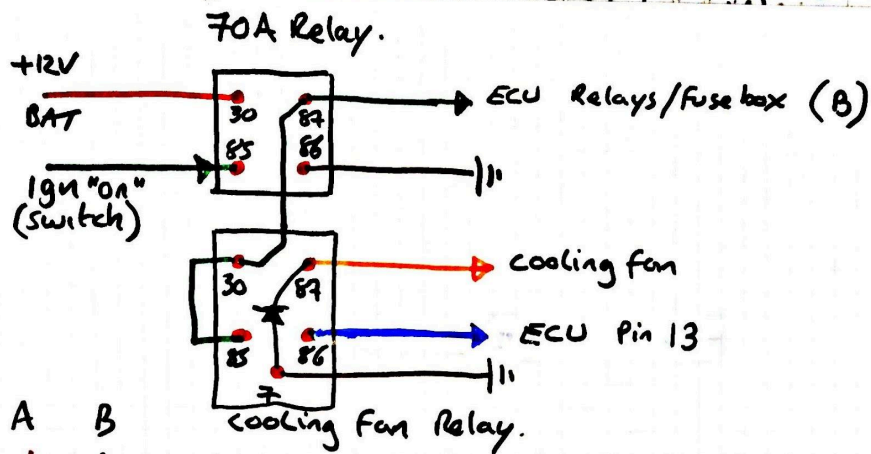
excess plugs cable tied up out of the way. All that would be required is about 11 connections to a fuse box from one of the Ford square multi plug loom connections. OR you can do what I did. Strip the loom of all of its insulation (mostly plastic conduit) and remove the wires not needed. Sounds very daunting I know but it really wasn't. A fair bit of help was obtained from the locost forums www.locostbuilders.co.uk and various books I have bought. It helps that unlike the Mondeo 104 pin ECU the Focus 60 pin ECU's all seem to share the same pin out arrangement and often the same wiring colours. (don't take this for granted you need to check your wiring very thoroughly to make sure) the wiring for the 60 pin ECU's is listed here.

Pin No-Colour-Function	37-Green/yellow-Engine control relay
1-Red-Battery	38-Grey/orange-Immobiliser control module
2--	39-Black/orange-Immobiliser LED
3-White/blue-Vehicle speed sensor (VSS)	40-Black/yellow-Earth
4-White/purple-Audio/cruise/trip	41-Blue-Alternator
5-White/green-Immobiliser control module	42--
6-White/red-Air con	43-White-Clutch pedal position (CPP)
7-White/purple-Cylinder head temp (CHT)	44-White-Heated oxygen sensor (HO2S)1
8-Green/black-Fuel pump relay	45-Grey-Alternator
9-Purple/blue-Mass air flow (MAF)	46-Brown - CPP, CHT, HO2S, IAT, TP
10-Green/yellow-Air con	47-White-Throttle position sensor (TP)
11--	48-White/red-Heated oxygen sensor (HO2S)2
12-Black/white-Injector 1	49--
13-Black/blue-Engine coolant blower motor relay 1	50-White/blue-Mass air flow (MAF)
14-Black/orange-Injector 4	51-Black/blue-Heated oxygen sensor (HO2S)2
15-Black/yellow-Injector 2	52-Black/green-Ignition aux circuits relay
16-Black/yellow-Earth	53-Black/blue-Fuel pump relay
17-Orange/black-Data link connector	54-Black/yellow-AC compressor clutch relay
18-Blue/black-Data link connector	55-Brown/red-Crankshaft position (CKP)
19-Grey/orange-Data link connector	56-White/red-Crankshaft position (CKP)
20-Black-Earth	57-Green/yellow-Engine control relay
21-Black/yellow-Idle air control (IAC)	58-Black/red-Ignition coil
22-Black/blue-Evaporative emissions (EVAP)	59-Black green-Ignition coil
23--	60-Black/yellow-Earth
24-White/purple-Camshaft position sensor (CMP)	
25-White/purple-Intake air temp (IAT)	
26-Yellow-Throttle position (TP)	
27--	
28-White-Power steering pressure(PSP)	
29--	
30-Brown/white-Camshaft position sensor (CMP)	
31-Black/white-Engine coolant blower motor relay 2 AC	
32-Black/red-Starter motor relay	
33-Black/yellow-Heated oxygen sensor	

(HO2S)1
 34-Black/blue-Injector 3
 35--
 36--

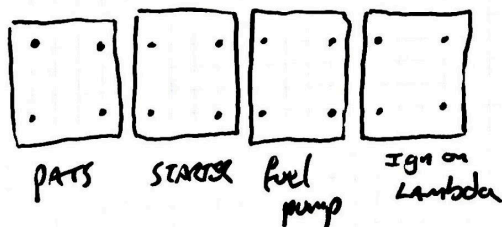
A few of these wires can be removed....you don't need the air con stuff for a start. The ECU has a few earth's listed these all need to be made. The ECU itself needs to be earthed. You only need one HOS (heated oxygen sensor) or Lambda not two (unless your keeping the Catalytic converter) and only one cooling fan (you would have a hard time finding room for two) the power steering switch needs to be earthed out as it can affect the tick over. (the ECU speeds up the tick over as you steer to prevent stalling. Earthing out the switch prevents this function) Once you have stripped the wiring loom down and removed the excess wires (or just the unwanted plugs, if your unsure about removing the wires) you then route the loom to suit the new lay out and re-wrap the loom.

Your going to need some relays and fuses to run the Fuel injection and the following wiring diagram will assist you here.

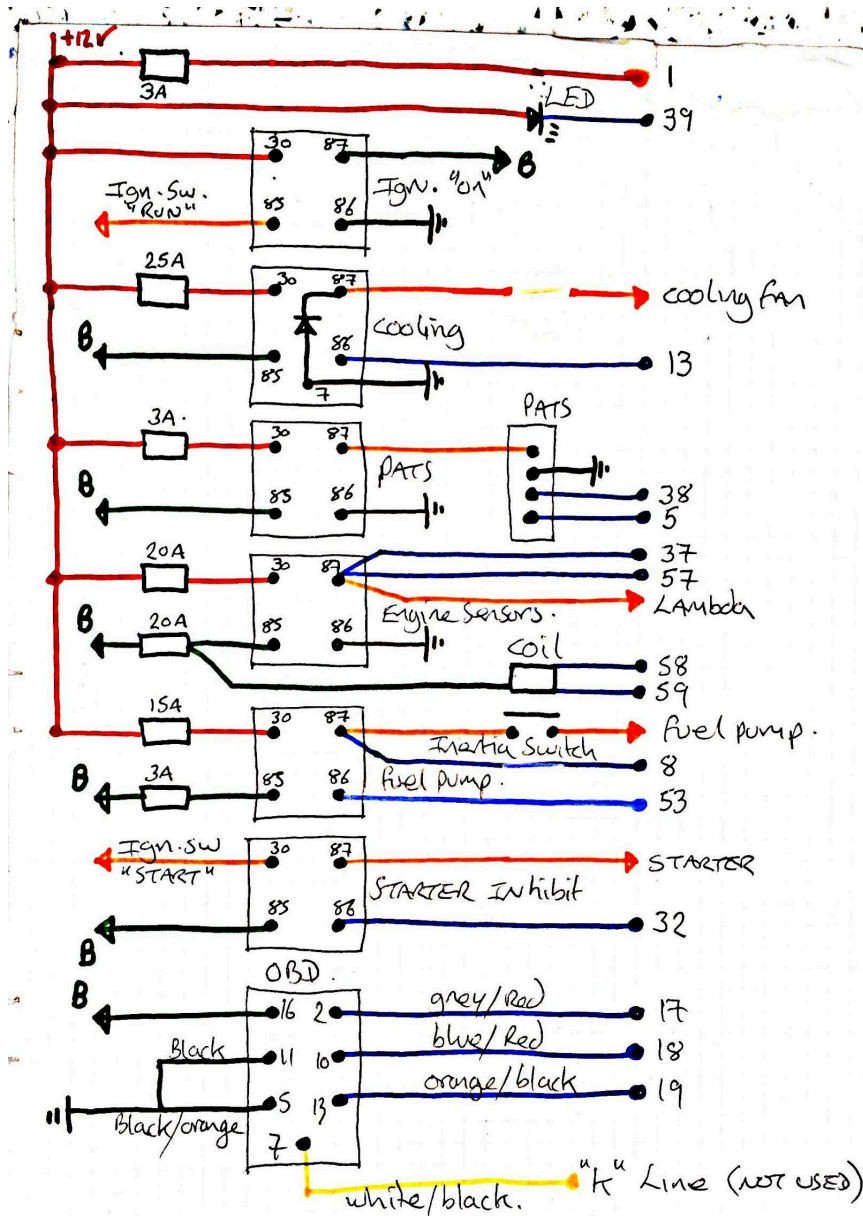


A = BAT. 12V.

B = Ign 12V.

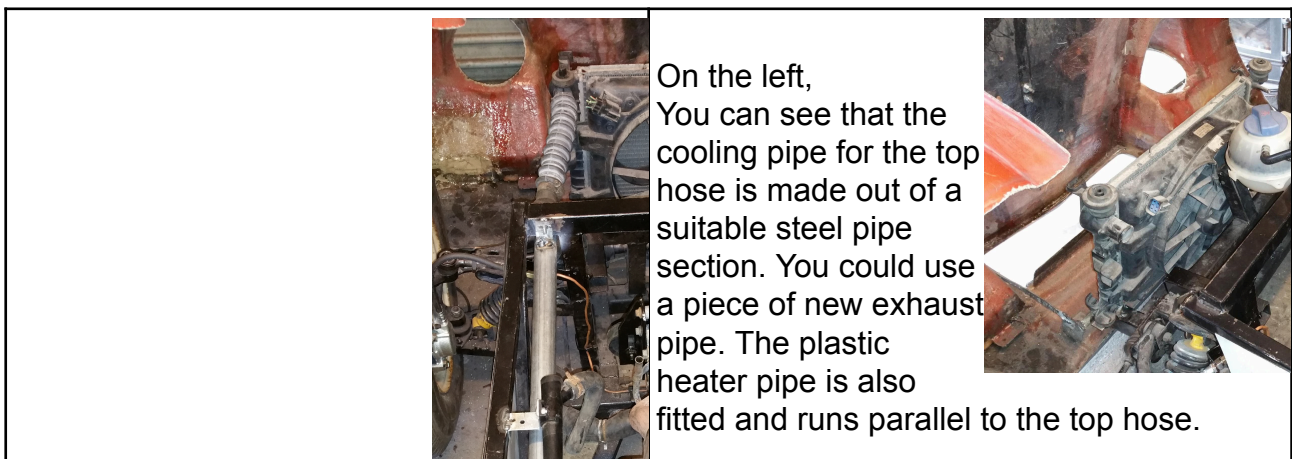


In the diagrams above I show the two relays that I have kept separate from the other ECU relays. This is for ease of wiring the main vehicle electrics. The main ignition "ON" relay can be used for all of the cars electrics and the fan relay is best kept away from the ECU wiring because its such a high power item and it could affect the sensitive ECU by stray electrical fields the fan can generate. Its the reason the fan relay has an "anti spike diode" this is inbuilt into the relay it's self. And the relay has an extra pin underneath very much smaller than the others numbered "7" and this pin is connected to earth. The Fuse box is shown and the order the fuses are in. no particular reason for this other than its the order I wired it up. I have also showed the order of the other four relays used for the ECU are fitted to my car. (for my own reference, future fault finding) the fuse box has two wires labled "A" and "B" they refer to permanent 12v (baterly) "A" and ignition live "B". "B" getting its supply from the relay above.



You can see that in the diagram above it repeats the two relays shown in the other wiring diagram earlier, this is for ease of showing the relationship to all the relays and fuses used for the ECU the order of the relays also does not reflect the order they are used in the diagram above and again it reflects the order I wired them up in my car. There is a common link to the wiring diagrams though. The battery live connections are in red, the ignition switched lives are green. The connections to the ECU are in blue, along with the pin they connect to. And finally the connections to "other" places are in orange. I have also showed the OBD plug connections, it is a very useful feature to keep if your going to the trouble of using the Ford ECU you may as well get the fault finding it incorporates. The "LED" shown is for the alarm/immobiliser that comes with the ECU and is a very useful feature when fault finding besides being a visible deterrent to would be thieves. You could fit as I did, a time clock from a Ford Fiesta. Its a small and easy to fit with an LED built in. The "PATS" part is the "Passive Anti Theft System" basically its the immobiliser control and detects the coded key that came with the car.

Cooling. The Zetec being a FWD engine has its thermostat housing on the back of the block when in RWD mode. This makes it very tight for bulkhead clearance. Its also a plastic affair.....its very easily damaged. You can buy after market aluminium replacements, they are not needed if you plan ahead. Just reuse the ford thermostat housing and route the top radiator hose out to the side of the car and then forward. The hose run to the top radiator connection will be VERY long, but lots of folks have done this mod this way and they seem to work ok. If your fitting a heater to your car keep the Zetec heater pipes especially the metal or plastic one that runs across the front of the exhaust manifold. It makes plumbing the heater up so much easier. These engines are designed to warm up very quickly and the heater pipes form part of the circuit so if you don't use the heater you will have to research how to connect the heater pipes to prevent air locks. Simple I believe but I want the heater. Its getting warm in about 1 minute so ideal for winter driving. For the radiator I used a Fiesta one. Its about perfect for the Dutton nose cone and would be useful for many of our cars. Its worth noting that the Focus engine uses only one temp sender for all functions, ECU, temp. Gauge, and for the cooling fan. They are all controlled by the ECU. If you want a temp gauge you will need another temp sender fitting somewhere. (you can get ally cooling hose joiners with temp. sender threads in them.)



	Also to the right and above you can see the expansion tank I have chosen to use. Its from a VW golf.
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To mount the engine in the car so that nothing poked through the bonnet it is fitted so that the sump pan is about 1 inch below the lower chassis rails. That means that the rocker cover just sits under the bonnet. You can buy modified sump pans, you will also need the oil pick up pipe modifying. To do that you need one from a series three Mondeo (the "black top " engine) as the Focus and early Mondeo's are plastic, only the later Mondeo Zetec engine has a steel oil pick up pipe.

Since you wont want the power steering or Air con. The alternator and water pump will need a different drive belt, and some method of tensioning the belt.



The original idler gear can be removed as can the tensioner that mounts under the alternator, between the two you can assemble a new ribbed tensioner wheel. The tensioner will be manual but since the original one is usually seized its a good solution. The new tensioner fits on a home made bracket that is bolted to the old PAS mounting bracket.