



## EDGE PERFORMANCE AS

*DIRECTPORT FUEL INJECTION - with 4-1 intake plenum*

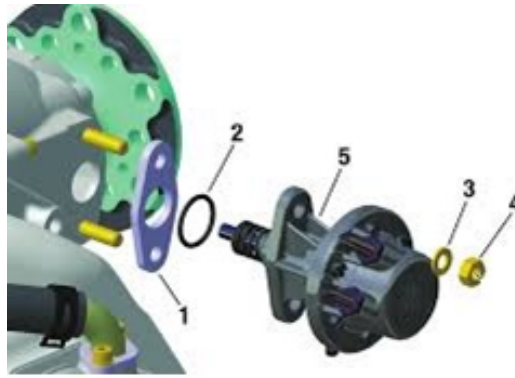
*(ROTAX 912i / 914i)*

# *Installation manual*



## Introduction

- First of all, thank you for choosing EdgePerformance AS as your EFI supplier. We know there are other companies making kits as well, but we are pleased to know that our devotement, quality and highly modern components and kits made you choose us as your supplier.
- The warranty from Rotax will be voided once the engine is modified. Any 12 month old engine is out of warranty.
- This installation manual covers the basic details on how to install the components to complete a conversion from carburetors to modern fuel injection. Pictures are for illustration purpose only. Do not proceed if you are in any doubt. Consult with your local dealer or with us immediately.
- Common sense and good workmanship practice must be used. All fuel connections MUST be tightened and properly sealed. This system works under high pressure 45psi/3Bar.
- Make sure to route all fuel lines/hoses away from any heat source. Do not tie down lines and hoses to tight. Keep in mind that all hose connection must have proper slack and that they do not make contact with any sharp corners or edges.
- Use thread-sealant (Loctite) where required. Use correct torque values. Refer to your Rotax “Line and Heavy maintenance manual for proper torque values”.
- All electrical connections are HIGHLY critical. Use ONLY high quality crimpers, tefzel aviation grade wires and terminals. Keep in mind that every unnecessary connection, terminal, relay etc. is a possible source for error. KIS – Keep It Simple! Proper and correct wiring of the harness and sensors can be found in the included ECU manual and in the wiring diagram on page 14.
- On aircrafts with only one fuel tank, a 1/4” or a 5/16” hose/line is required for fuel feed and return. On installations with two or more fuel tanks, a fuel selector with return feed to the fuel tank you are drawing fuel from must be installed to make sure the return fuel ends up in the tank you are drawing fuel from. Alternatively, you can use a header/collector tank with a volume of 0.5-2L.
- IF IN DOUBT AT ANY STAGE OF THE INSTALLATION, PLEASE ASK!



1. Remove the existing mechanical fuel pump. Start by removing the 6mm and 8mm fuel hoses. Remember to close the fuel valve before you start on this task. Next, remove the 2x M8 nuts and washers. Pull out the fuel pump and remove the isolator plate, gaskets and o-ring. Remove the M8 stud bolts by using a stud bolt extractor or simple by installing two nuts and unscrewing them.



2. Clean the mating surface on the gearbox where the pump was attached with brake-cleaner, acetone or mineral spirit. Apply a thin coat of liquid silicone gasket sealer (**Loctite 5910**) or similar. Install and tighten the included M8 socket head screws with the copper sealing washers under the bolt head to **14NM**.



3. Now remove the LH/RH carburetors. Before you remove them, detach the air filters or airbox. Disconnect the choke and throttle cables. Disconnect the fuel hoses and hoses for coolant if you have carb heaters installed. Now loosen the Philips screw on the rubber socket flanges and firmly pull of the carburetors.



4. Loosen the hose clamp on each side that secures the balancing cross tube. Remove it from each intake manifold. Next, undo the 4x M6 socket head screws and remove the intake manifolds. Make sure to seal of the intake ports in the cylinder head with either a clean cloth, paper or a plastic plug as supplied with new engines in the exhaust ports. Replace the old intake O-rings (4pcs) with the new once supplied.

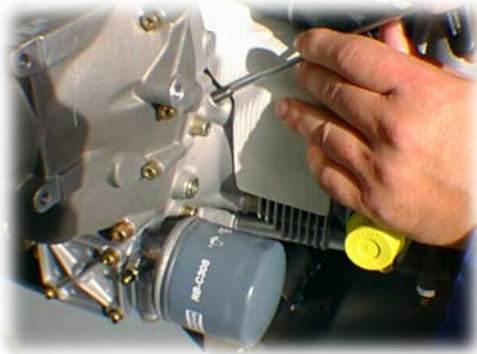


5. Remove the flywheel plastic cover by undoing the 3x 10mm M6 hex bolts.



6. Remove the M8x20 socket head screw in the engine case right behind the gearbox. Use a flashlight in order to see where the V-groove for the locking pin bolt is. With the flywheel cover of, use a ratchet wrench with a 22mm socket and turn the crankshaft in the orientation of normal rotation until you see the V-groove in the crankshaft.

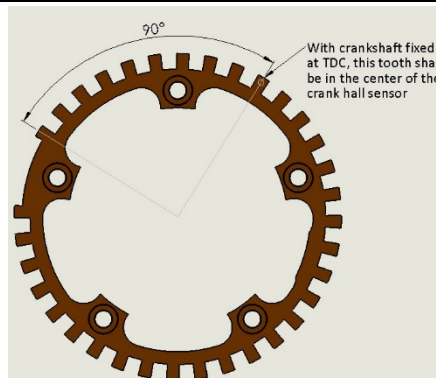




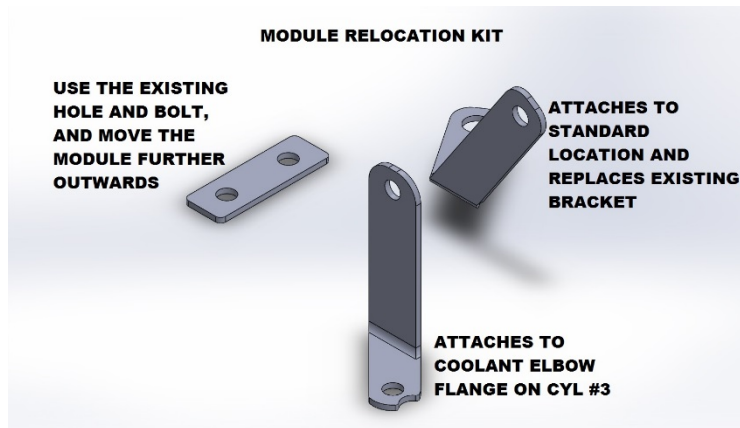
7. Install the locking pin bolt (**Rotax part nr 240880**) and tighten firmly.



8. Now that the crankshaft is fixed, carefully apply some heat to the hex flywheel bolt with a heating gun or a propane torch. Perform extreme caution when using a heat source around flammable liquids. Take great precautions, and have a fire extinguisher nearby, just in case. Now apply a generous amount of force in order to undo the flywheel bolt. Normally a 50-60cm long wrench is required in order to loosen the bolt.



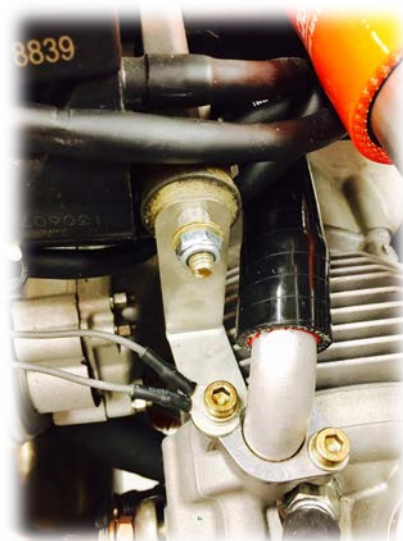
9. Install the crankshaft trigger wheel on the flywheel hub with the M5 bolts facing outwards. Apply **engine oil** on the flywheel bolt after cleaning it properly, and tighten the bolt to **45NM+180° or 32.2ft.lb + 180°**. Install the hall sensor mount as shown above with the supplied 2x M6x25 socket bolts. Apply (**Loctite 243**) and tighten to **12NM**. The yellow marked tooth shall be centered on the hall sensor with Cyl-1 at TDC, or with the crankshaft fixation bolt installed (**PN 876-640**)



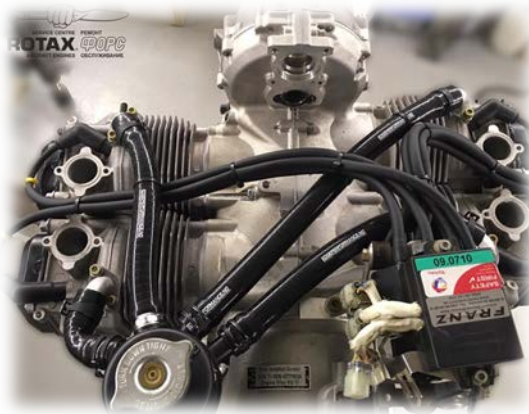
10. Install the provided relocation brackets for the ignition module. Various styles of brackets will come with the various intake designs. These may need to be modified or replaced in certain cases.



11. Picture show the location of the bracket that attaches to the water elbow flange on cylinder #3.



12. Terminate the two ignition grounding wires to the bracket bolt.



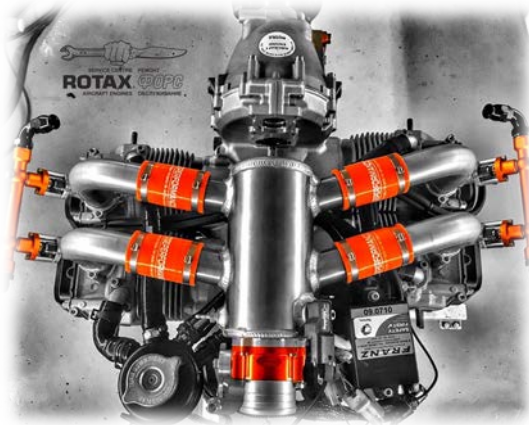
13. Replace the coolant hoses and re-orientate the coolant elbow on cylinder 4 as shown on the picture, and install the 90° hose elbow cut to length. Use a M18x1 thread die and tap to clean the threads on the elbow and flange. Clean with **Loctite Super Cleaner 7063** or mineral spirits, and re-assemble with **Loctite 243 or 577**. Torque the flange back onto the head with **10Nm**.



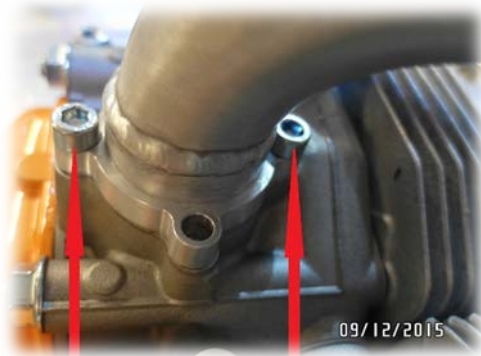
14. Picture showing a typical installation of the EFI system onto a Rotax 912ULS engine.



15. Alternative intake design when installed on engines with hydraulic propeller governor, DUC hydraulic actuator etc.



16. Install the 4-1 intake system on the engine. Ensure that the sealed off intake ports are free from any cloth, paper or plugs and insert the supplied new O-rings for the intake flanges. Orientate each intake flange with the mating flange on the cylinder heads.



17. Install 2x M6 socket bolts in each of the four intake flanges. Tighten the bolts to **12NM**. Bolt lengths vary from intake to intake.



18. Ensure that the O-ring between the throttle body and the mating flange on the intake is installed. Apply **(Loctite 243)** and tighten the 4x M5x12mm socket screws to **6NM**. (NOTE - Comes pre-assembled in most cases)



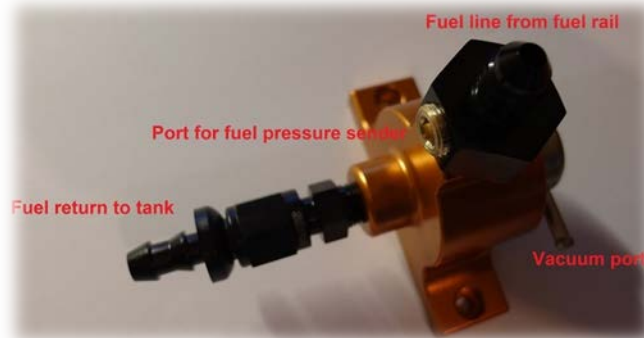


19. Use the 90° cable adjuster bend for the choke cable from you BING carburetor. The the nut from the second bend so that you have two nuts, and are able to clamp it onto the throttle bracket.

*NOTE – The throttle cable travel is 51mm.*



20. Cut the 25mm hose coming from the water collector tank, and install the coolant sensor adapter. It is usually convenient to use a 90° hose elbow. The “CLT” sensor is used for ECU engine temp feedback, mainly for cold or hot start, as well as enrichment when the engine runs hot.



21. Now that most of the components are installed to the engine, it is time to start installing the parts to the airframe. The FPR (Fuel Pressure Regulator) is pre-set to 3Bar/45psi, which it will only indicate with one pump running and the engine of. It rises or lowers the fuel pressure 1:3 with the manifold pressure. Bolt it onto the firewall or somewhere convenient. Ensure that there is nothing blocking the top of it as the filter screen in the Bosch regulator should be inspected and if needed cleaned every 100hrs. There is also a 1/8”-27NPT port for an optional fuel pressure sender. Remember to connect the vacuum line from the regulator to the vacuum distribution manifold as shown below.



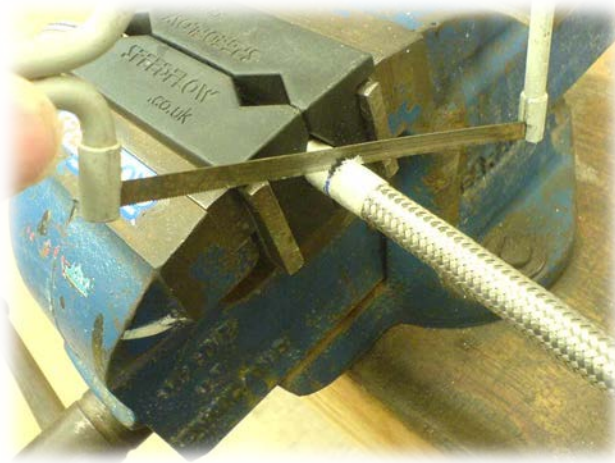
22. The dual fuel pumps has internal check-valves in case one pump were too fail, there will be no back flow. They shall be wired with separate ground wires and separate switched +12v wires. Only run one pump at the time. One is master and the second pump is back-up. Use 14-16 gauge shielded tefzel wire. The left side of the unit with the hexagonal end has an integrated 30 micro sinter fuel filter. This filter should be inspected and if needed cleaned every 100Hr. Ensure that there are no leaks after installation and prior to starting the engine. Pumps are to be replaced every 1000hr/5years whatever encounters first. The pump assembly shall be mounted with the pumps level and as low as possible.



23. The pre-fuel filter type and make may vary from time to time. However, the filter should be installed before the pumps. Note the arrow or in/out orientation indicating the direction of flow. Always try to install the filter in horizontal orientation.



24. The PTFE (Teflon) AN hoses and hose fittings shall be cut to desired lengths and installed accordingly. A good tip is to have a roll of black PVC electrical tape handy. Apply 2-3 rounds of tape where the hose is to be cut. Use preferably a hose cutter plier or an angle grinder with a 1mm disc. SAFETY FIRST, USE PROPER PPE. If you use the angle grinder, ensure to clean the hose internally properly with compressed air and flush with some solvent before installation. Apply some engine oil on the fitting threads when mating the two half's. See detailed assembly pictures below in 6 steps.



25. Cutting the hose on the tape marked position.



26. Sliding on the sleeve nut. Do this before you remove the tape.



27. Spread the steel braiding to expose the PTFE tube.



28. Install the olive insert ring onto the PTFE hose.



29. Install the hose-fitting end.



30. Clamp the assembly in the vise jaws and start to torque. Remember to lubricate the threads with some engine oil.





31. Keep torquing until the hose end and the sleeve almost mates.



32. This is roughly how the AN hose and fitting assembly should look like when assembled.



33. The vacuum distribution manifold should be mounted with the four ports facing downwards. From the left side port, route a vacuum hose line from the barb fitting on the intake plenum to this fitting. Blind the MAP port if you are *not* using an external MAP sensor. The EP ECU has a barometric sensor in the ECU, which shall vent to atmosphere or be connected to the static port line. In the case of using the EP ECU blind the MAP port. From the EFIS port to the EFIS/MAP sensor. FPR port goes to the fuel pressure regulator and the TURBO port goes to the barb on the boost controller solenoid port (#1) if one is installed.



34. You will need 3x switches and 3x breakers in your panel. Skip the “optional” breakers. The breakers act as “short circuit protection” NOT as over current protection. That is why they are set so high. You don’t want the ECU to switch off in case an injector would fail and draw lots of amperage, or the fuel pump due to a clogged or frozen fuel filter.

- 15-20A breaker + 20A rated switch ON/OFF for “Main Pump”
- 15-20A breaker + 20A rated switch ON/OFF for “Aux Pump”
- 10-15A breaker for “ECU” + 10-15A rated toggle switch for “ECU ON/OFF”



35. If you are doing your own harness, modifying it or doing the electrical wiring for the ECU, Pumps etc, ensure to use high quality TEFZEL mil-spec aviation grade tin plated copper wire. Do not use cheap automotive PVC cable. Remember, the wiring job is the most critical on the entire installation.



36. Use only AMP terminals with double metal crimp jacket. Don’t try to save 10 bucks here!

37.

38. The ECU ***MUST*** be installed inside the cockpit. Typically behind the firewall in order to keep it dry and free for the head exposure and heat soaking in the engine cowling compartment. A CNC machined waterproof chassis is also available upon request for seaplane or amfib installations.

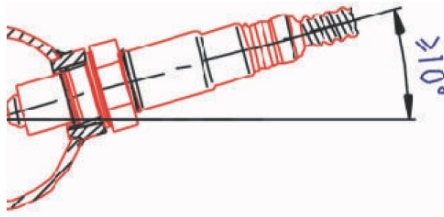








Mounting recommendation



OPTIONAL O2 LAMBDA INTERGRATION

40. Drill a 18-20mm hole in the outlet of the muffler as close as possible. Ensure that the sensor will not interfere with engine mount etc. TIG welding is recommended. Remove the muffler or ensure that all electrical cables to the battery are disconnected before you perform any welding. IMPORTANT – The sensor must be orientated anywhere from vertical top mounted or at a maximum angle of +/- 80°.

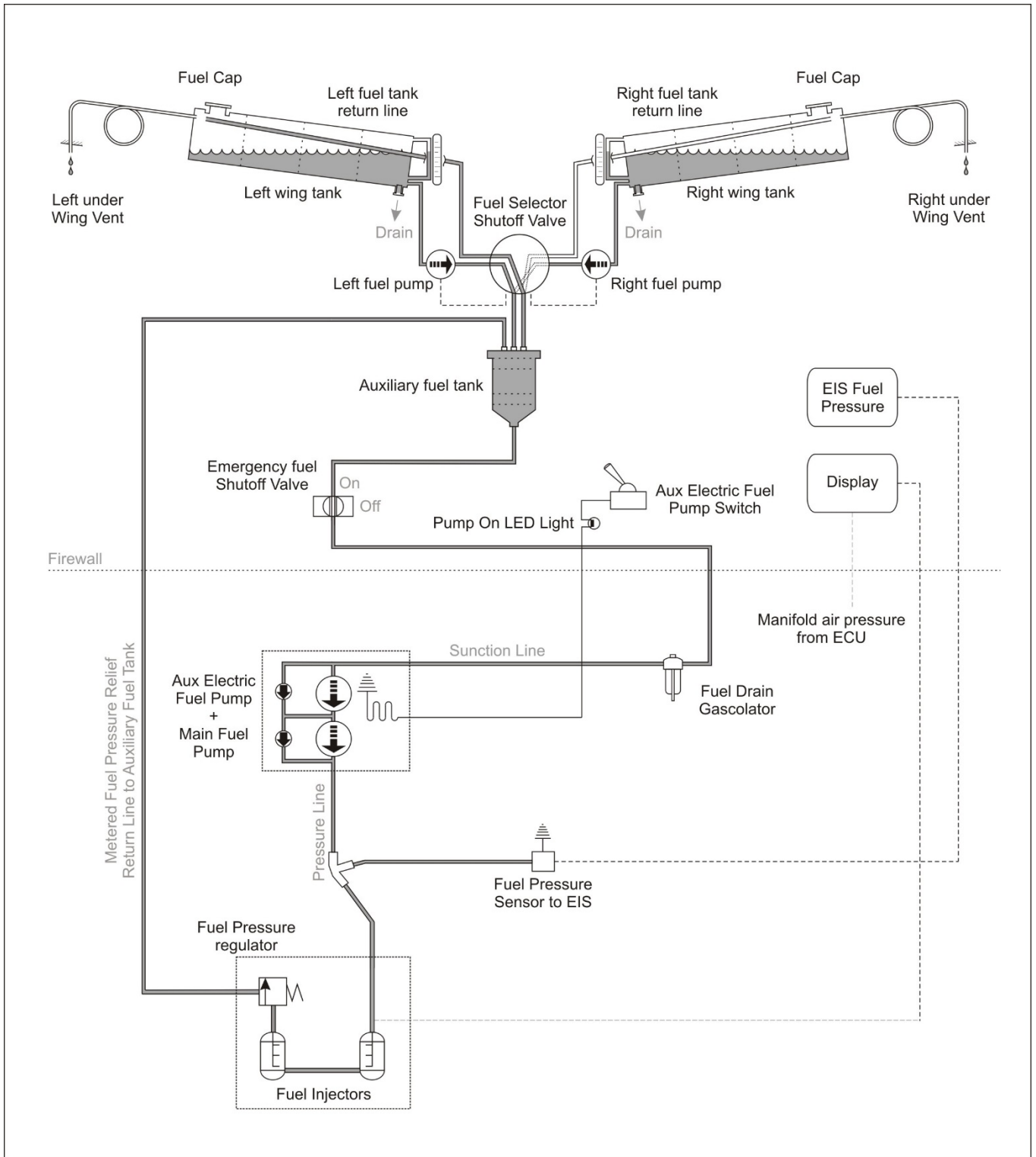


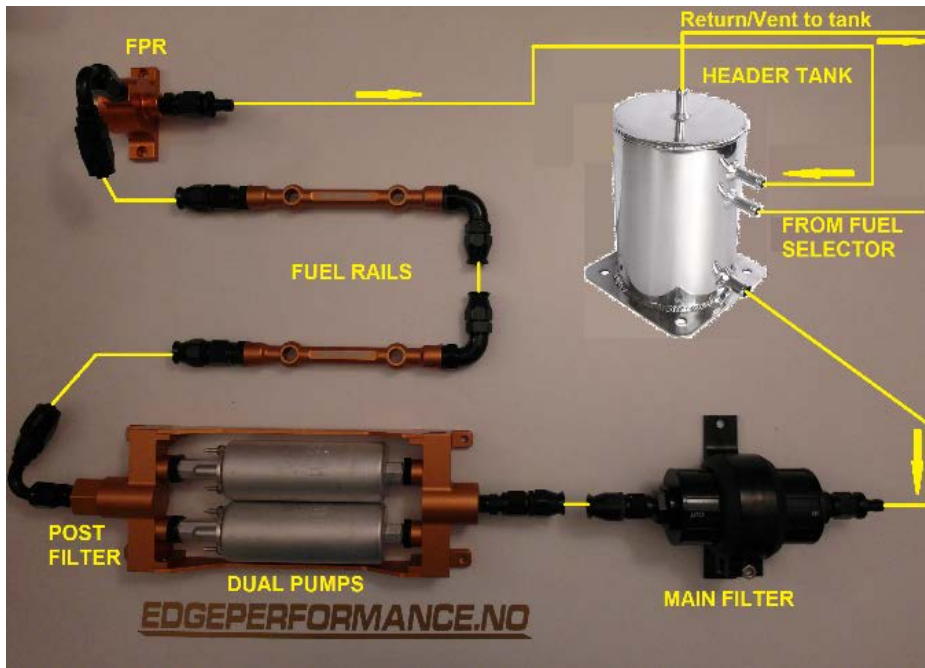
41. This picture shows the typical location of the O2 lambda sensor. The sensor is not intended to run on AVGAS. The sensor will correct the air/fuel mixture during low loads and normal operation, but not do any corrections on high loads. This ensures smooth running and optimal A/F ratio as well as a clean burning engine.



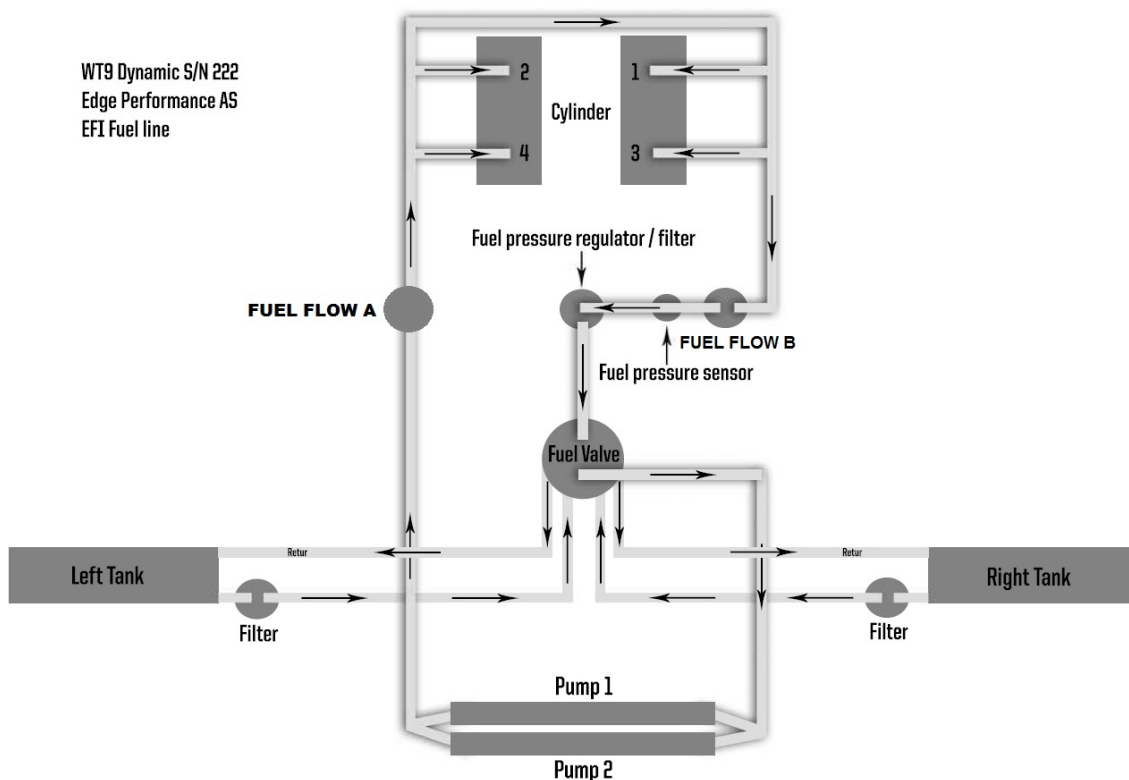
42. IF PURCHASED - Install the wideband O2 lambda sensor gauge in the instrument panel if there is space. The cutout hole is 52mm. The instrument gauge measures 62.2x18.9mm in total dimensions (OD x Thickness). Wire accordingly and connect to the ECU harness:
43. **O2** 3-pin connector. Pin-1 RED +12v, Pin-2 PURPLE signal, Pin-3 BLACK ground

44. This is a typical high wing dual wing tank diagram. Left and right fuel tank through a left/right or both fuel selector. From the fuel selector to a header tank (0.5-2L). From the header tank to the pre-filter. From the pre-filter to the fuel pumps. From the pumps to fuel rails. From the fuel rail crossover tube, and to the second fuel rail, and finally to the FPR (Fuel Pressure Regulator). Return from the bottom port of the FRP back to the header tank.



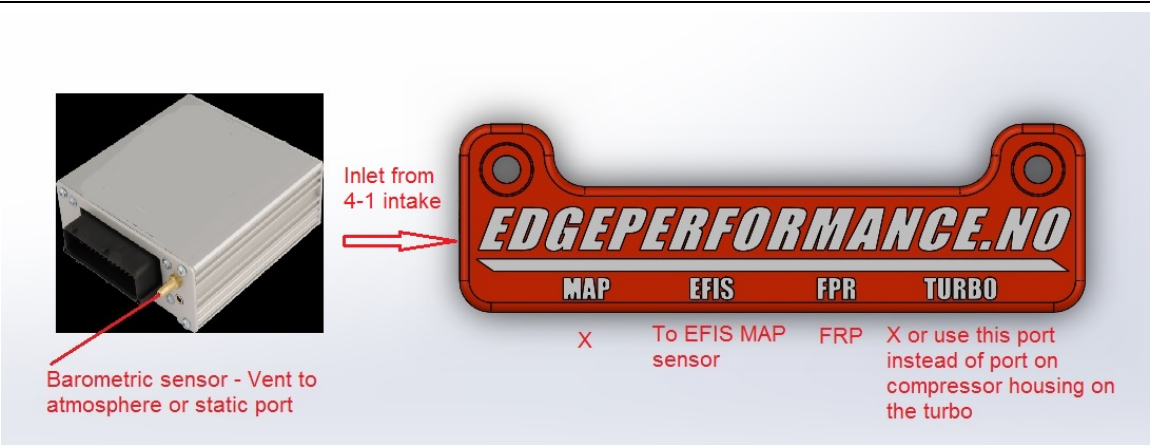


45. Normal 4-1 EFI fuel system diagram.



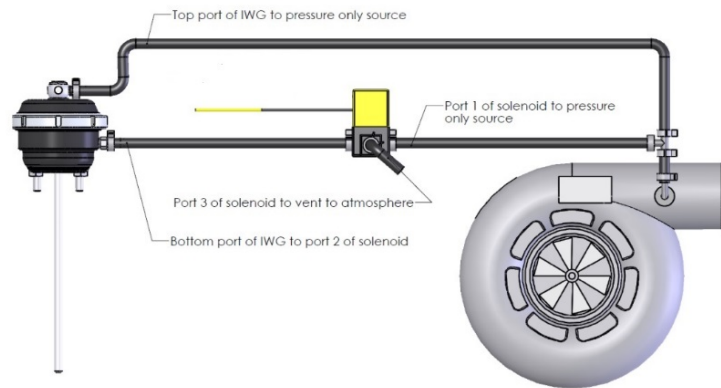
46. Fuel plumbing diagram for low wing dual tank instalation.





47. Vacuum line connection diagram with EP ECU with EFI + Turbo.

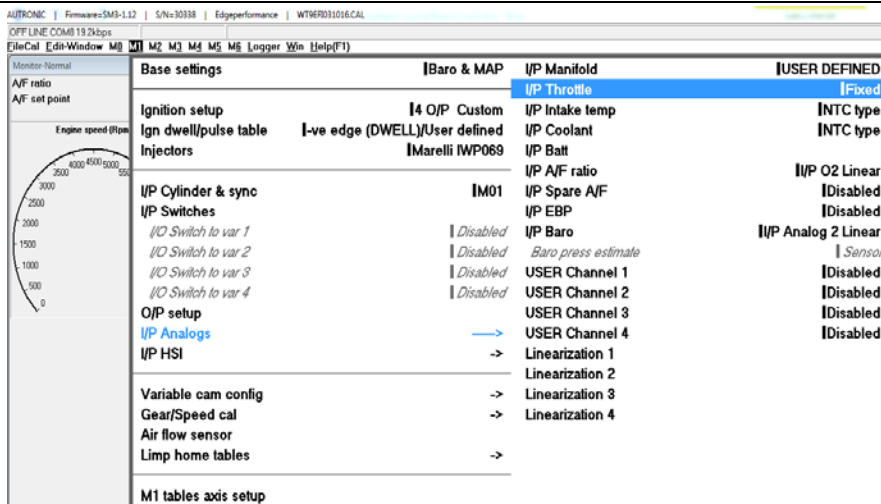
- Connect the Top port of the wastegate and port 1 of the solenoid to a pressure only source (by teeing into source)
- Port 2 of the solenoid to the bottom port of the wastegate
- Port 3 of solenoid vent to atmosphere



48. Internal wastegate vacuum connection diagram with boost controller

49. After the installation has been completed, turn on the fuel pump and test that both are working, verify fuel pressure 45psi/3bar +/- 5% and look after any signs of fuel leak.
50. After start up, let the engine warm up and reach normal operating temperatures before verifying the Air/Fuel ratio.
51. Once warmed up (min 50°C on the oil) set the idle to 1450-1550rpm with the idle set screw on the throttle body.
52. The engine should start and run relatively smooth right from the start. Small correction for cold/warm starting may be necessary in certain cases. Consult with EP or your local dealer for this.
53. Monitor EGT and/or AFR (Lambda O2) values. Here are some guidelines in terms of what you can expect or want to aim for **NOTE – ON A NORMALLY ASPIRATED ENGINE:**
  - EGT cruise – 780-820°C
  - EGT full throttle – 760-780°C
  - AFR 1500-3000rpm – 12.8-13.5
  - AFR 3000-4600rpm – 13.6-13.8
  - AFR 4600-5200rpm – 13.0-13.3
  - AFR 5200-5800rpm – 12.5-12.8 - MAY BE SET RICHER ON HIGH BOOST TURBO APPLICATIONS

54. If minor changes must be made to the ECU map, there is included a DB9 to mini jack ECU communication cable, and a DB9 serial to USB serial converter. Download the ECU software (sm4v029k) from: <http://autronic.com.au/downloads.html>
55. Once installed, connect the cable to the ECU and laptop, power on the ECU and launch the software.
56. No changes should be done without training, proper instructions or without support from your local EP dealer. Always make sure to save the existing map to your laptop before making any changes. Saving the map is done by pressing F2. Storing changes into the ECU is done by pressing F4. When saving any changes to a new map, go to the top left corner menu (File/Cal) and then save cal as. Right click with your right mouse button and choose save as a new cal file. Enter a new name or revision number to the map to keep track on them.
57. Before disconnecting the ECU from the data cable press F3 and (go offline).



58. After starting the engine and setting the idle, go to M1, I/P Analogs and I/P Throttle. Now you can set the TPS idle and WOT limit. The TPS voltage is displayed in the picture as show in point 54.

I/P Throttle			Throttle position-(%)		Charge temp	Deg C
Parameters	Value		0.0	100.0	Battery voltage	Volts
1	I/P Throttle	Fixed	LOAD	%	TPS volts	Volts
2	Error limit lo	0.000	Manifold pressure	Kpa	TPS learn zero	Volts
3	Error limit hi	5.000	Ign. Angle-MEAN-	Degrees	Error Reg	Hex
4	0% limit	0.630	Inj. Time -MEAN-	mSec	Er.Throttle	On/Off
5	100% limit	4.721	Inj. Duty -MEAN-	%		
			Inj. End	Degrees		
			Inj. Start	Degrees		
			Intake temp	Deg C		
			Coolant temp	Deg C		

59. The TPS comes pre-set, but the idle set point may change as the user sets the idle stop. The TPS volts is displayed at the bottom of your screen. Read of the TPS volts at idle and insert the value in row 4. **0% limit**. Next set full throttle and insert the TPS volt into row 5. **100% limit**.

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