EDGE PERFORMANCE

“EP918Ti”

(185HP)

(PRELIMINARY)

Engine Installation Manual

When Performance Meets Perfection And Reliability.

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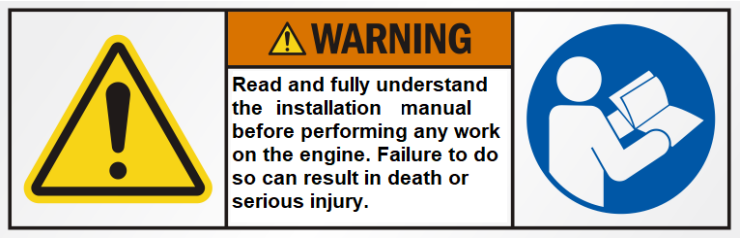


1) Introduction & Safety Information

- The EP918Ti is based on the Rotax® 916iS core engine. The engine itself is not mechanically altered as per how it comes from the Rotax factory. In short terms, what we do with the engine is adding our own dual FADEC ECU, wiring harness, ignition amplifiers, intake manifold assembly and add a camshaft position sync sensor. And clearly, we do quite a lot of changes to the engine ECU parameters over the stock 916iS. The Rotax® 916iS installation manual may be used as a foundation for the engine installation, while this manual serves as a appendix, taking care of what is unique for the EP918Ti.

WARNING
Engine and gearbox are delivered in "dry" conditions (without fuel, oil and coolant). Before putting the engine into operation it must be filled with oil and cooling liquid. Use only oil and coolant as specified.

System Limit Min. Max.	Min.	Max.
ECU	- 40 °C (- 40 °F)	80 °C (176 °F)
EGT Sensors (electronic box)	- 40 °C (- 40 °F)	80 °C (176 °F)
Fusebox	- 40 °C (- 40 °F)	80 °C (176 °F)

ENGINE STORAGE

The engine is preserved at EdgePerformance thus guaranteeing proper protection against corrosion damage for at least 12 months after the date of delivery from EP.
This warranty is subject to the following conditions:
• The engine must be stored in the GENUINE-ROTAX®-packing as supplied by EP
• The covers on various openings must not be removed
• The engine must be stored in a suitable place (at min. -40 °C/-40 °F and max. +80 °C/ 176 °F)
• The bag (blue) surrounding the engine must not be damaged or removed, as it protects the engine from corrosion and oxidation
If the engine is stored for a period longer than 12 months (or it is not stored in the GENUINE- ROTAX®-packing) then maintenance tasks must be carried out every 3 months as per the currently valid Maintenance Manual Line.

Unpacking the engine

When the engine is delivered, check for damage of the packaging. If the package is damaged, contact a EdgePerformance, an Authorized Distributor or their independent Service Center for EdgePerformance aircraft engines.
To unpack a new engine and for checking the state of delivery, proceed as follows:
1. Remove the wooden cover.
2. Remove the bag and protective wrapping around the engine.
3. Check that the serial number and engine type on the type plate are identical to those shown on the delivery note.
If the serial number or the engine type is deviating from the delivery contact EdgePerformance.
4. Check the engine for damage or corrosion. If the engine is damaged or corroded, contact EdgePerformance, an Authorized Distributor or their independent Service Center for EdgePerformance aircraft engines.
5. Screw off the transport bracket screws from wooden bottom of the box.
6. Remove transport brackets from engine.

2) Electrical System

Fig.1 showing the two generators, dual rpm speed sensors, fuse box and ECU. There are 3 ECU connectors. A1 and A2 which is for the main “black” (LANE A) ECU and B1 for the “orange” backup (LANE B) ECU.

Figure 1

ATTENTION

A connection between regulator plate A and airframe ground should only be done during supply of the EMS System by an external power source (e.g. during engine start).

The Regulator B M6 ground stud needs to be connected with the Airframe Ground !!

Attach all the "A" ground wire terminals to Reg.plate A

Attach all the "B" ground wire terminals to Reg.plate B

INTERFACE OVERVIEW

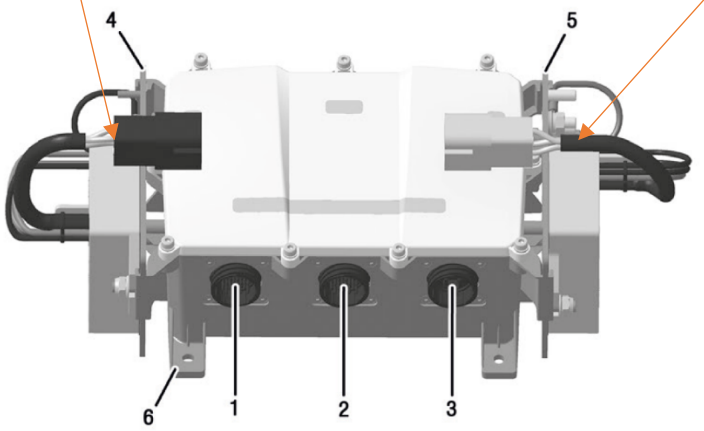
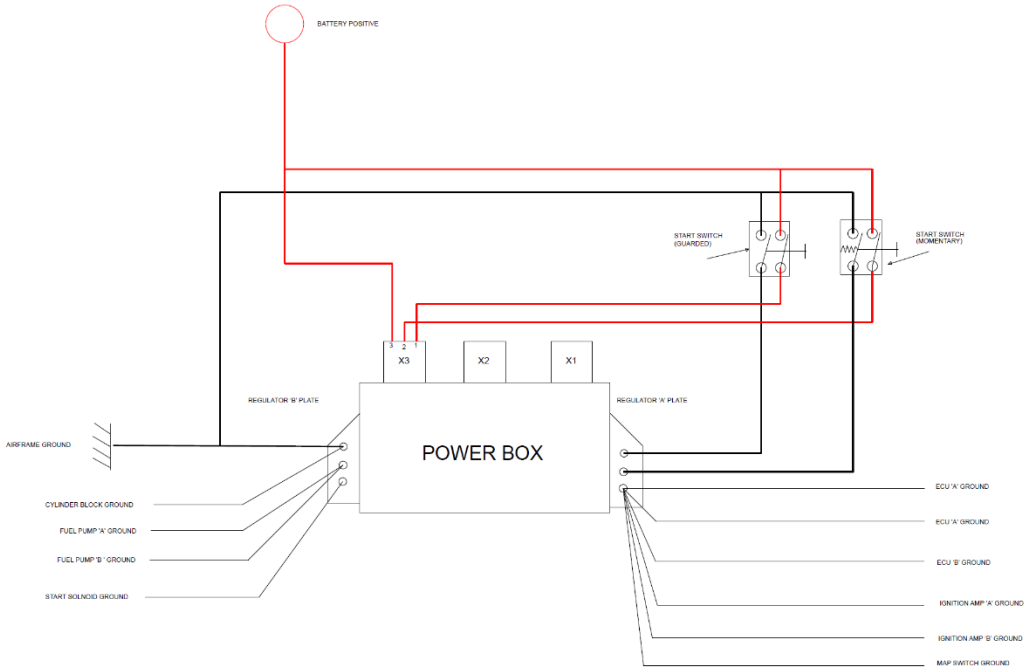


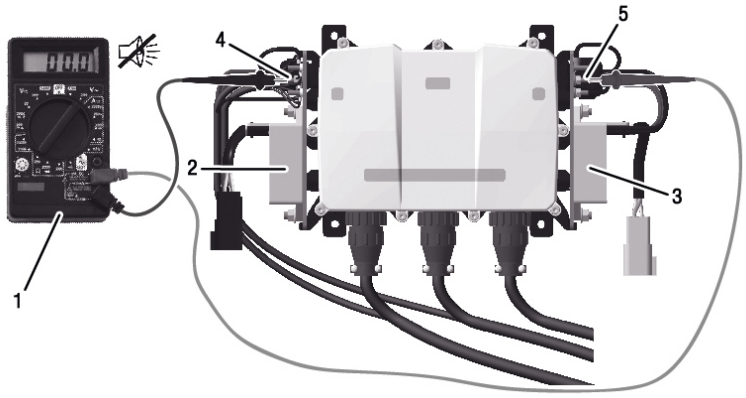
Figure 3.5: Fusebox connections

1 *X1 Connector (electrical interface)*
2 *X2 Connector (electrical interface)*
3 *X3 Connector (electrical. interface)*
4 *Regulator Plate A (electrical interface)*
Fusebox mounting points (mechanical



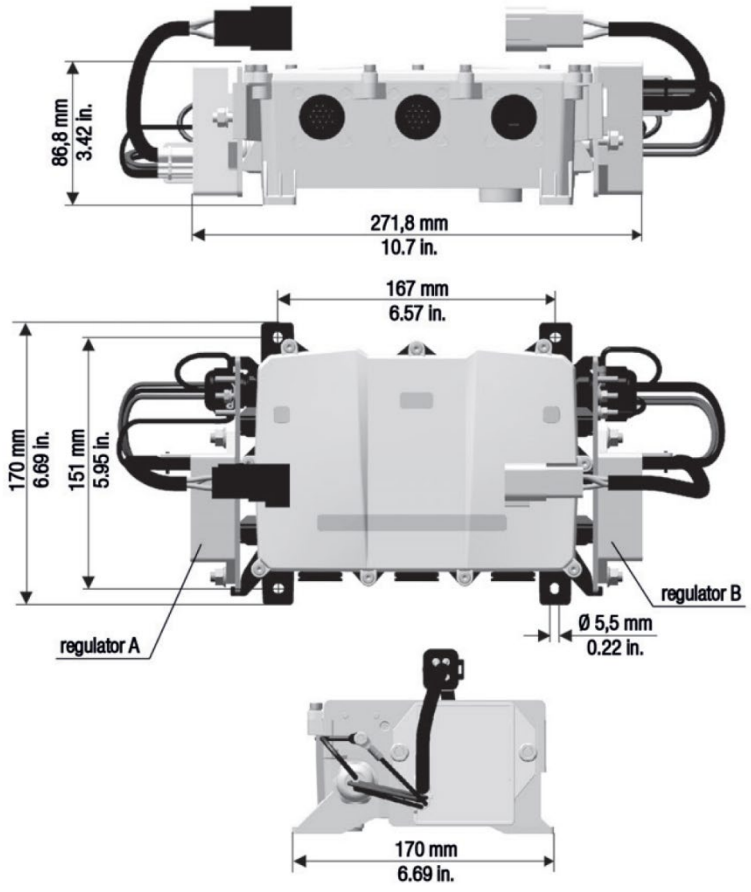
START POWER CONTROL - Momentary (must not be active after engine start) 28 V DC 20 A
BATTERY BACKUP CONTROL - Toggle (must not be active during normal operation) 28 V DC 20 A

Separation of EMS and Airframe circuit - Test to ensure there is no continuity between Fusebox Regulator A and Fusebox Regulator B in static condition (Fusebox is not supplied with power by an external power source). To determine the ECU BUS voltage at the transient moment of the engine start an oscilloscope must be used and also the total consumption of all electrical loads needs to be checked.



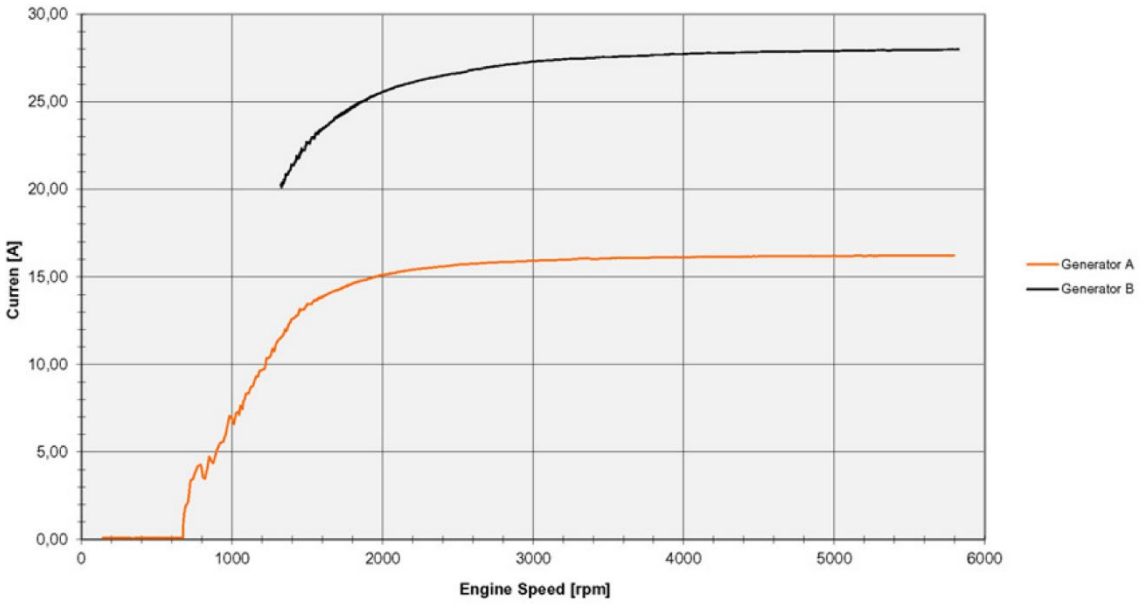
MECHANICAL INTERFACES

Fusebox mount-ing points



3) Wiring Instructions & Diagrams

When installing the engine and routing the various harness and wires throughout the engine compartment and



through the firewall, it is extremely important to cautiously route and secure the wirings. Making sure that there are no sharp edges, corners or parts than can rub, chafe or in any way damage the wiring.

Use only aviation grade TEFZEL wiring with appropriate gauge cross section, aviation grade terminals and the correct tools for stripping and crimping. A safe and correct wiring job in essential to ensure safe and proper engine operation. Failure to do so can result in injury or death.

The main wiring harness comes pre-installed to the engine, and all sensor connectors are labeled for easy identification. The only connection the installed must perform is:

- Generator A
- Generator B
- X1, X2, X3 on the fuse box
- Ground plate A grounds
- Ground plate B grounds
- Ve+
- Engine ground with ground strap to Reg.plate B
- Chassis connector as per Fig. 2

The EP918Ti is wired the same way as a iS engine, except we use on mil-spec connector for the chassis connections, rather than the HIC connectors. The switches all work in the same manner.

- Lane A\B Switched
- Lane A\B Warning lights
- Start button
- Boost select *
- Fuel pump 1\2
- Start power switch (Momentary)
- Back-up battery switch

* Not present on the 916iS

EDGE PERFORMANCE EP-917-TI CHASSIS CONNECTION INSTRUCTIONS

HIGH POWER CONNECTION

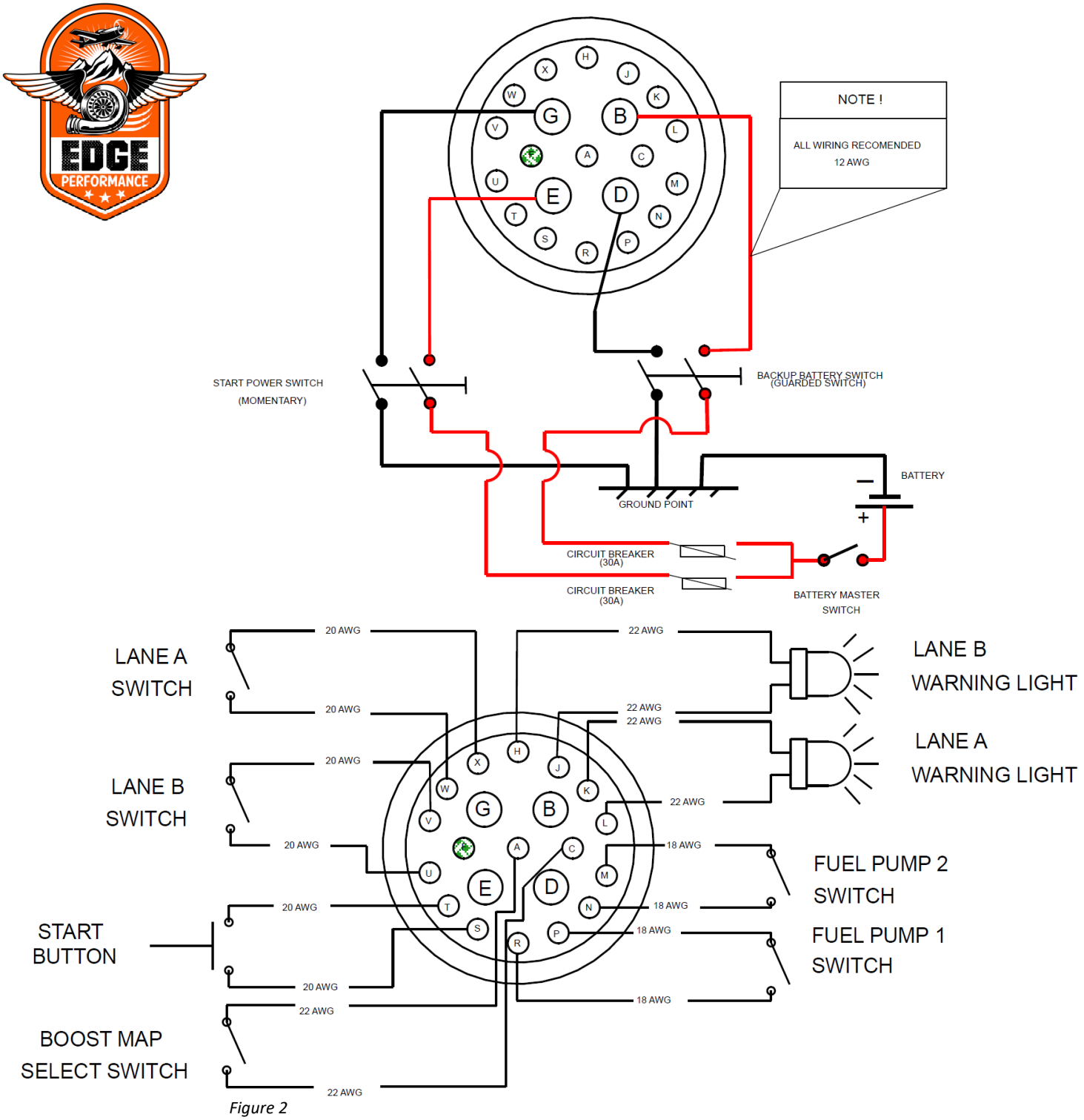
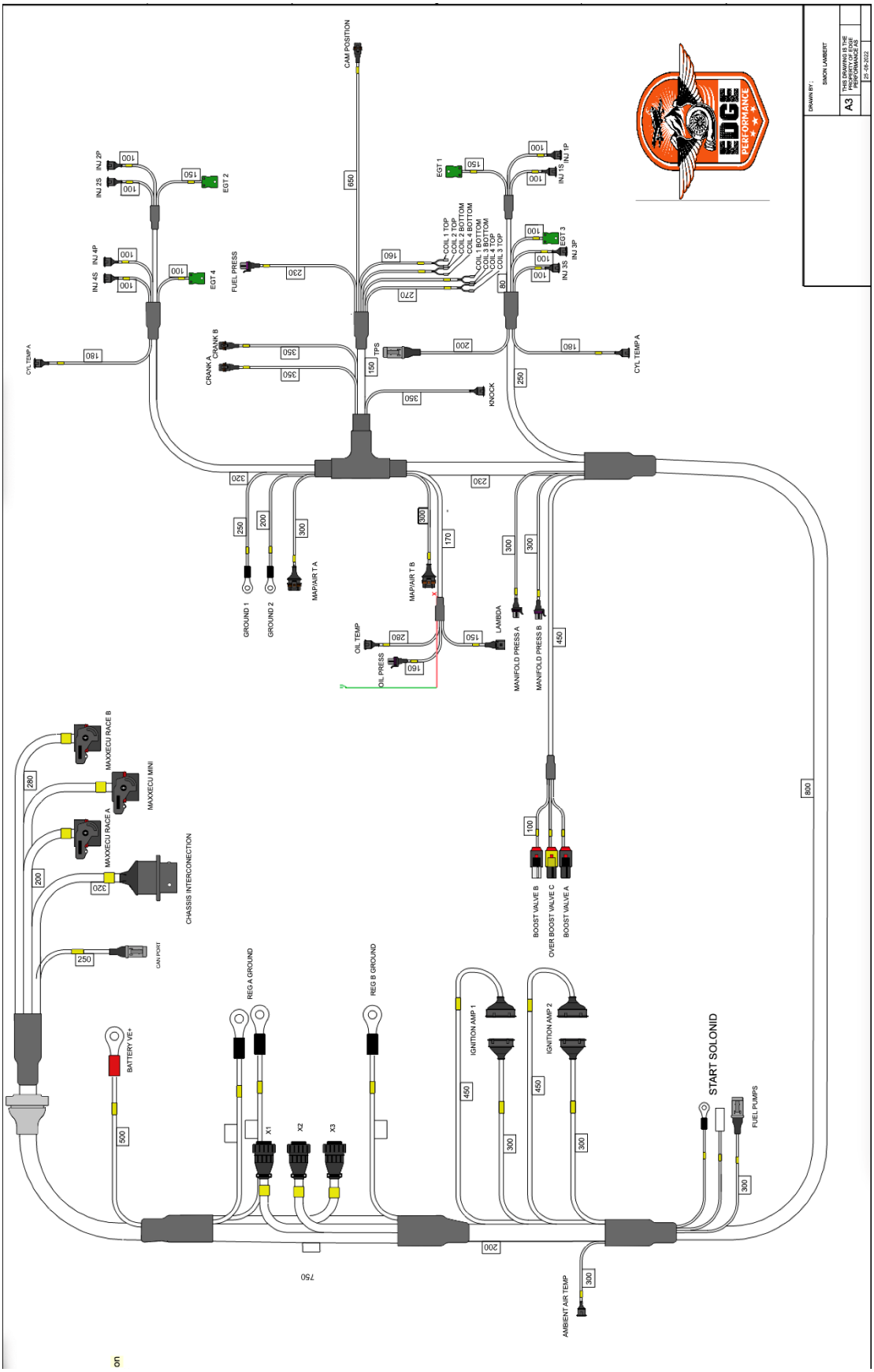


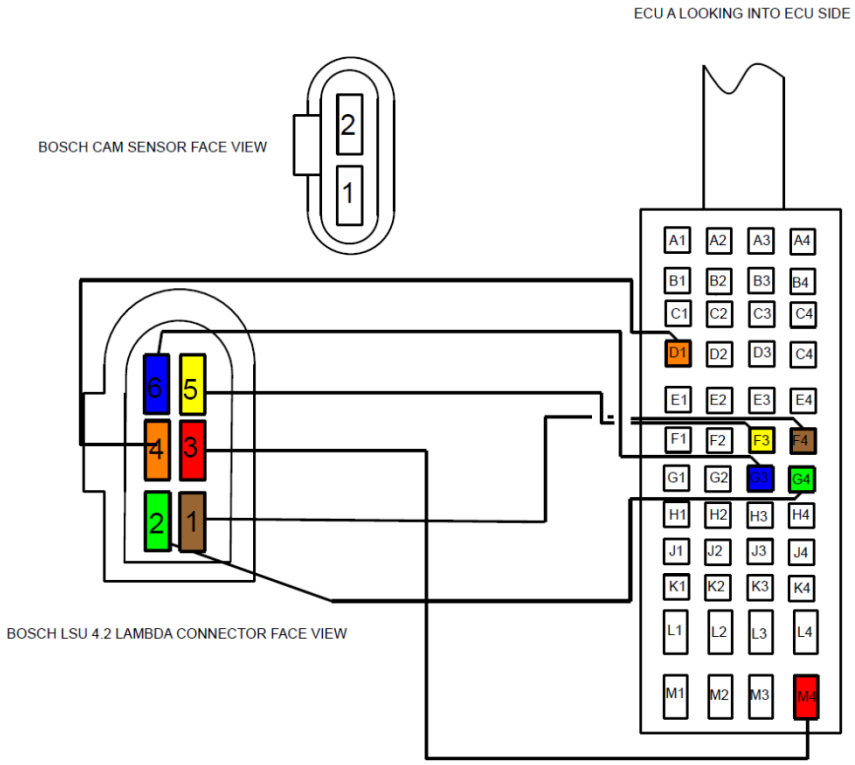
Figure 2

Main Wiring Harness

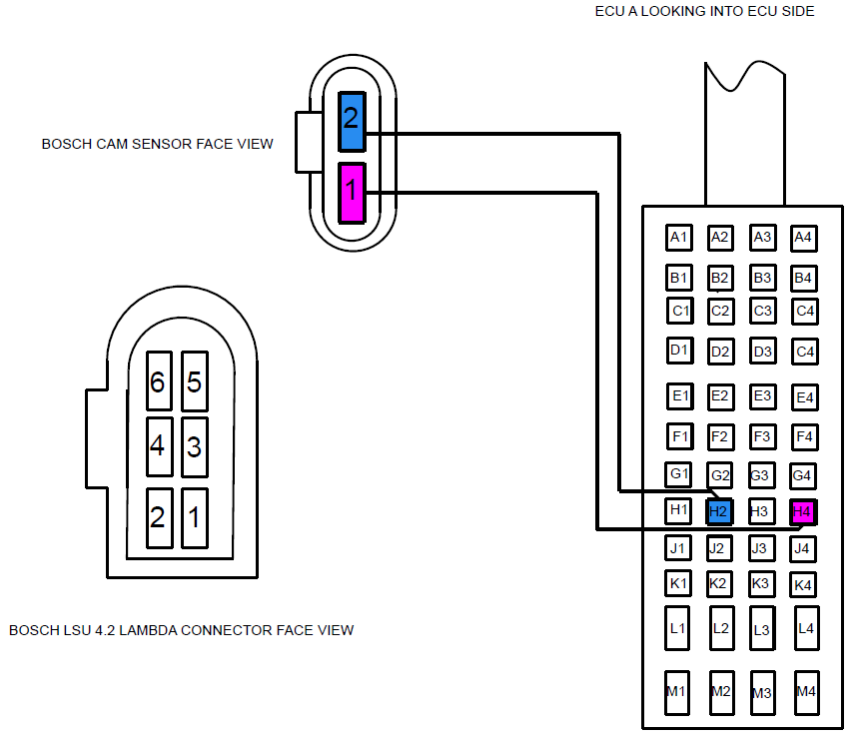


Diagnostic diagrams

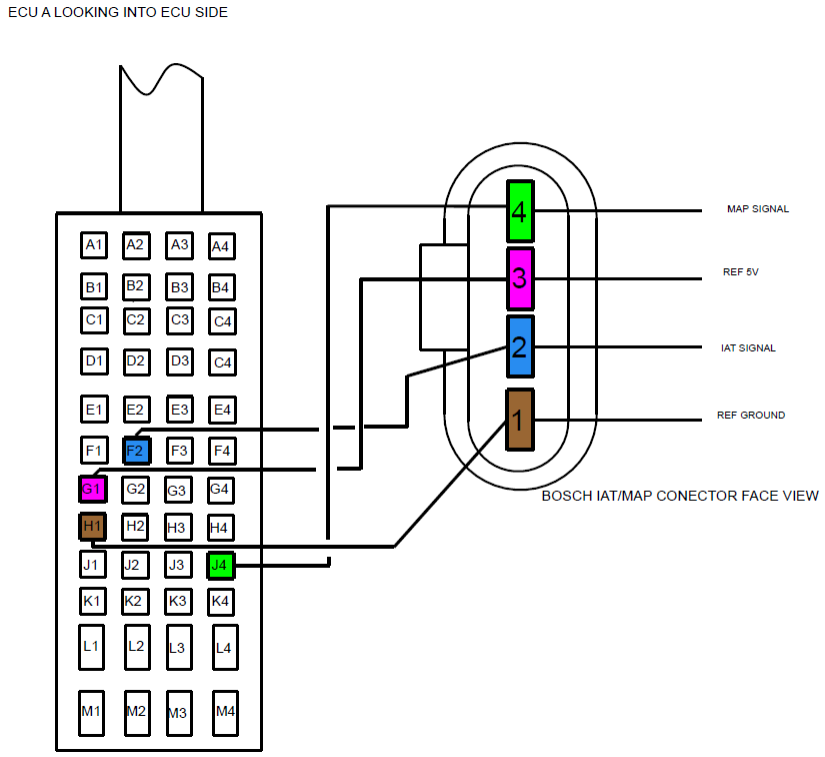
Lambda pin-out



Cam sensor



IAT\MAP Sensor



Wiring schedule schematics
See EP918TI Rev.3

List of engine sensors
The engine uses the following sensors for ECU A and ECU B:

ECU A (LANE A)	ECU B (LANE B)
Ignition Amplifier A	Ignition Amplifier B
Crank Sensor A	Crank Sensor B
Cylinder Head Temp (Coolant) A	Cylinder Head Temp (Coolant) B
Combined IAT\MAP A	Combined IAT\MAP B
Throttle Position A	Throttle Position B
Camshaft Sensor	Boost Valve B
Knock Sensor	Injector 1\2\3\4S
Oil Pressure	Ignition Coil 1\2\3\4B
Oil Temperature	Charge Pressure B
Fuel Pressure	
Boost Valve A	
OBV (Over Boost Valve)	
Injector 1\2\3\4P	
Ignition Coil 1\2\3\4T	
EGT 1\2\3\4	
Ambient Air Temperature	
Charge Pressure A	

4) Mechanical & Pneumatic Interface

The engine has a mechanically operated throttle actuation system. It utilizes a patented 50mm “shaftless” throttle body design unique for all EdgePerformance engines. It is constructed with a “return to full open” spring, allowing the engine to go to full throttle in case the throttle cable would fail. Ideally, we use a 1.6mm 7x7 or 7x19 steel throttle cable with a 6-7mm sleeve. Alternatively, one can use a vernier style push-pull cable with some light modification to the throttle swivel arm. The throttle throw from idle to full throttle is close to 51mm, slightly less than a stock Rotax engine. Ensure that there are throttle stop limits on the idle side especially where one pulls to idle, to ensure that that throttle cable is not over stressed which can ultimately result in ground incidents or in flight WOT. The throttle body has a M5 allen idle set screw with an 8mm locking nut. Warm up the engine, adjust the idle to 1650-1800rpm ensuring it runs smooth. The nature of the gearbox design of the 915\916iS will result in a slight noisy rattle on low rpms typically below 2500rpm, but this is totally fine and normal. When adjusting the idle set screw, hold the allen screw with a 4mm allen wrench, unlock the locking nut and adjust until desired idle rpm is reached. While holding the allen screw fixed with the allen key, gently secure the locking nut. There is also an idle bleed screw which should be used for fine tuning of the idle. As the idle comes pre-set from factory, normally only small adjustments should be made on the idle bleed screw before adjusting the mechanical idle set screw. If one makes significant adjustments on the idle set screw (more than 200rpm) the TPS 0% voltage should be recalibrated in the software. Consult with EdgePerformance or one of EdgePerformance dealers for assistance with this.

Idle bleed screw **Idle coarse adjustment screw**

The TPS is programmed to be linear, in comparison to the Rotax iS engines. Therefor 35-40% throttle is closer to 75-85% on the iS engines which uses a non-linear TPS curve.

The engine utilizes the stock iS boost controller solenoids and over boost solenoid \ bleed off valve.
The pneumatic hoses must not be shortened. If and when replaced it is important that they do not deviate from the original lengths (+10\-10mm). This will affect the wastegate operation and manifold pressure.

The intake manifold plenum has a 4mm brass barb fitting next to IAT\MAP sensor A, which shall connect to the boost reference port on the fuel pressure regulator. One can also tee into this line if one wants to install a

standalone MAP gauge. It is however very important that this hose does not get pinched by tight zip ties or rubs\chafes against sharp objects as it will affect the air-to-fuel ratio.

Intercooling

When installing an intercooler there are several import points to pay attention to. We will address some of them below. Our testing has shown that a 10°C increase in IAT can result in a 5HP power loss. So, if one has an IAT of 80°C compared to 50°C one has already lost 15HP. So, it quickly becomes clear how much proper intercooling will affect the final engine power output.

The intercooler supplied with the engines are adequate, and they are the same ones as supplied for the 915\916iS engines. But it cannot just be plumbed inside the engine cowling space without any ducting. Ideally one should have a fairly large dedicated NACA inlet, or other suitable air inlet which guid the air to the intercooler core. It is also very important that this ducting is properly sealed with rubber seals against the intercooler core to ensure that all the cold outside air is forced to pass through the intercooler core. Depending on the pressurization inside the engine cowlings, it can in certain applications be necessary to have dedicated baffling leading the air passing through the intercooler out of the cowling. Inside an ideal cowling there should be low pressure which helps with cooling air scavenging. Ideally one should try to achieve an IAT of 40-50°C in cruise and not exceeding 65-70°C during high power settings. The critical IAT limit is 80°C. When reaching this limit, the ECU will start to taper off the boost to further prevent engine damage and detonation. The ignition timing retards, and fuel is added to help cool the induction air charge, which in terms result in a less efficient running engine. But again, the lower the IAT, the more power the engine will create and the more efficient it will operate.

5) Fuel System

The engines are delivered with a set of dual high pressure fuel pumps. These have built in check valves and are designed with dual o-ring seals on all connections. They have 6\32 terminals and power and ground from the 4-pin fuel pump connector connects via ring terminals The screws are fairly thin and fragile, so do not use a lot of forced when securing the ring terminals. Excessive torque on the terminal stud nuts can result in them shearing off. The pumps are self-priming and can lift approx. 60cm with no issues, but it is good practice to always have the pumps installed as low below the fuel tanks as possible. The fuel plumbing from the fuel source to the inlet port of the dual pumps should not have a smaller inside diameter than 8mm (5\16”). And with as few fittings as possible to not restrict the fuel supply. Also, the use of banjo fittings should be avoided at all cost on the low pressure suction side on any fuel injection high flow fuel systems. This can lead to pump fuel starvation, cavitation and premature wear and failure of the fuel pumps.

With the engines there are AN6 hose end fittings and AN6 PTFE brained hose which should be used on the high-pressure side of the fuel system. Meaning from the pump outlet to the fuel rail, from the other fuel rail to the inlet of the fuel pressure regulator. As for the airframe fuel system, consult with the aircraft manufacturer and supplement with the Rotax 916iS IM. If using a gascolator, it should be a high-pressure, low restriction type intended for high flow fuel injection systems. As small amounts of water droplets in the fuel system on EFI engines will not cause “carburetor icing”, we rarely install gascolators. All planes should have drain valves on all fuel tanks, and any water droplets not drained out from the fuel system will be consumed by the engine without any pilot notice.

The fuel system is operating at 3Bar (45PSI) with one pump ON and the engine OFF. With two pumps ON the fuel pressure will rise slightly, which is normal. The ECU having fuel pressure input will compensate the injector PWM signal for abnormal changes in fuel pressure. The fuel pressure regulator has a boost reference port so that the fuel pressure rises and falls with manifold pressure. This is normal. If a pump would start to go bad or a

fuel filter would start to become contaminated and restrictive, the ECU will notice this and correct the injector opening times, ensuring correct air-to-fuel ratio. But one should always monitor fuel pressure with the engine OFF before start-up, on run-up and in-flight to be able to diagnose at an early point if something is about to fail. The pumps have fuses built in inside the fusebox and does therefor not require external circuit breakers.

The included Bosch high pressure fuel filter installs between the fuel pump outlet and the fuel rail inlet. The filter can be installed both inside the airframe or in the engine compartment. This filter is equivalent to the Rotax iS fuel filter and should be replaced every 200 hours, or if contaminated.