TITLE : Installation of FloScan Fuel Flow Transducers

APPLICABILITY : **All Europa variants**
Mod Type : **Retro-fit**

1. Introduction

The fitting of fuel flow transducers, in conjunction with a suitable display/analysis unit can provide accurate fuel consumption data. This can be a significant safety improvement, particularly during long range touring. This modification covers the fitting of the FloScan fuel flow transducers only. They may be used with a variety of display/analysis units such as:-

a) Grand Rapids EIS2000 (see grtavionics.com)

b) Stratomaster Infinity FF1 or FF3 (From Parts for Aircraft, 02877 765796)

c) JPI FS-450 (see jpinstruments.com), used in FAA approved systems.

d) A wide range of combined EFIS/engine monitoring systems

2. Parts List

Qty	Part No.	Description	Source
1+	FloScan 201A-6	Fuel flow transducer	Various, normally supplied by the display manufacturer
2+	AN840-6D	Hose adaptors	Various
?	FloScan 150-004	Pulsation damper	Parts for Aircraft
	Note 1.The FloScan 201B flow transducer is functionally identical but some 100 grams heavier than the 201A-6. Note 2.The hose adapter (-6D) is for 3/8 (8mm) ID hose.		

List of related drawings

Drawing No.	Title / Description	Issue
Figure 1	Suspended mounting of transducer	1
Figure 2	Fuel system schematic for 912 engines	1
Figure 3	Fuel system schematic for 914 engines	1
Figure 4	Fuel flow checking set up for 912 engines	1
Figure 5	Fuel flow checking set up for 914 engines	1

3. Action

3.1 FloScan transducers are designed to be rigidly mounted with the electrical connections pointing up (to allow vapour venting). Locating the transducers aft of the firewall is preferred.

3.2 If it is unavoidable, the transducers may be suspended in flexible pipe work if the precautions set out below are met. In this case the electrical connections must pass through a suitable fire resistant bulkhead fitting.

3.3 Flow turbulence may cause erratic reading from the transducer. This can be avoided by ensuring that at least 100mm of straight (or gently curving) pipe precedes the transducer and 50mm after the transducer. In extreme cases the FloScan pulsation damper may be required to achieve accurate results.

3.4 **912 engine**. The 912 engine uses a mechanical fuel pump located at the front of the engine. The return flow to the tank is controlled by a fixed flow restrictor. While the return flow will vary with engine speed (mechanical pump pressure) and use of the electric pump this variation is relatively small. Europa operators have obtained satisfactory results with a single flow transducer (suitably calibrated). Alternately a return flow transducer can be utilised as with the 914 engine.

3.5 **914 (turbo) engine**. The 914 engine uses two electric fuel pumps and no mechanical pump. The volume of fuel returned to the tank via the return pipe varies considerable with power setting. With this engine two flow transducers must be used to measure the flow to and from the engine. The display/analysis unit must therefore be capable of calculating the net flow to the engine. To minimise fire risk the two transducers should be rigidly mounted aft of the fire wall.

3.6 **Suspended Mounting**. See figure 1 below

i) Both the inlet and outlet hoses must be flexible and the same size as the original.

ii) The hoses must be supported by a clip either side of the transducer which should be no more than 400mm apart.

iii) The unit must be mounted with the electrical connections oriented upwards to ensure against vapour entrapment. The mounting must not allow the unit to rotate in use.

iv) The transducer must be wrapped in fire sleeve. A small hole should be made in the sleeve for the wires to exit. This hole must be sealed with RTV sealant.

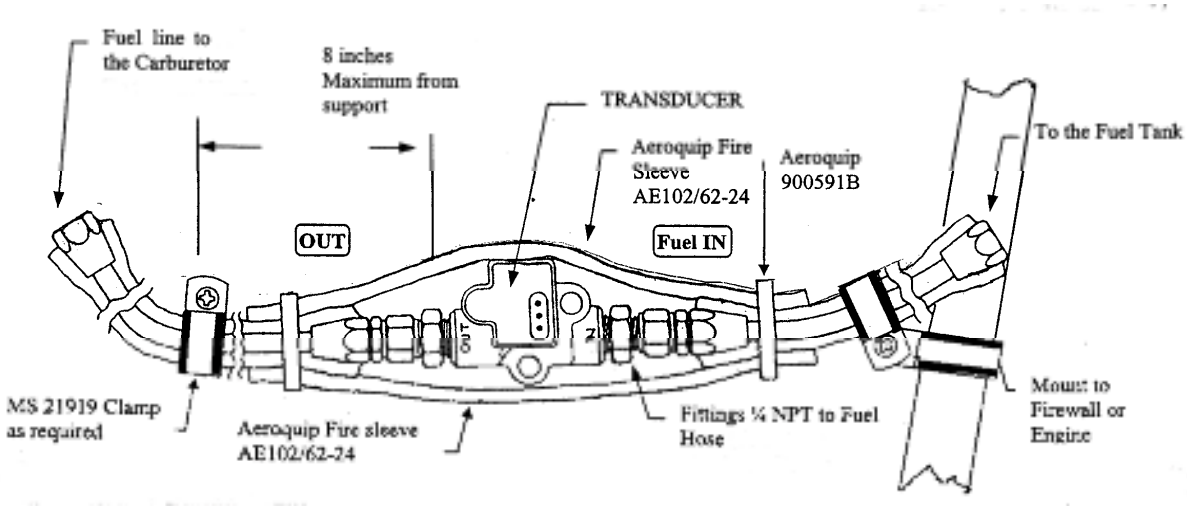


Figure 1 Suspended mounting of transducer

3.7 **Wiring**

Carefully wire the units according to the instructions supplied with the display/analysis unit.

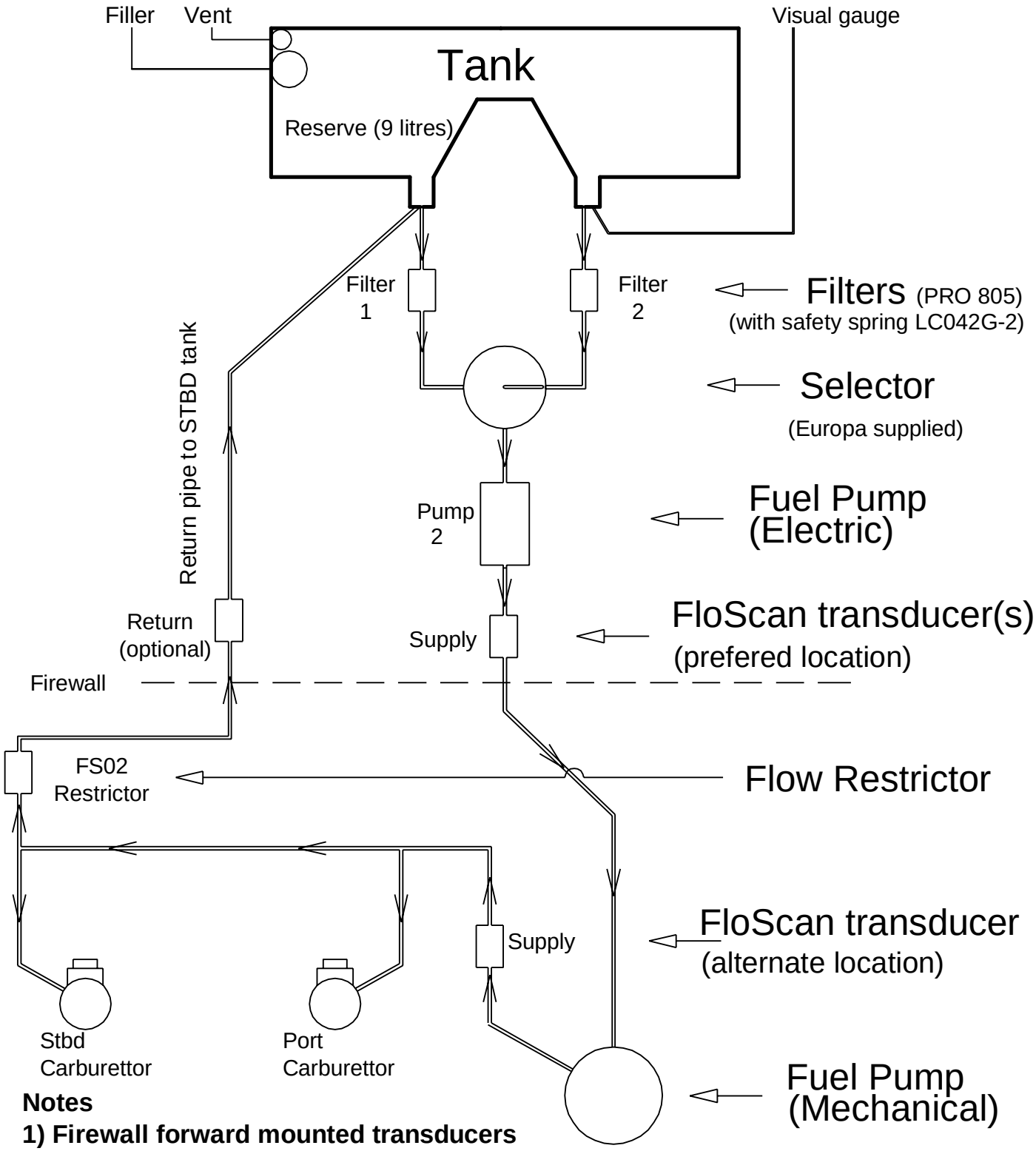
4. Weight and Balance

	Weight (lb/kg)	CG (in/mm)	Moment
Existing A/C			
Weight Added			
Post Mod A/C			
The change in weight due to the transducers is very small, some 0.35lbs. The location will depend on the installation. If other changes to the aircraft are made a full weight and balance must be completed.			

Amend the aircraft weight and balance schedule accordingly.

Rotax 912 Fuel System

Example Europa Installation



Notes

1) Firewall forward mounted transducers must be protected in fire sleeve

2) Transducer wiring must be upright

3) All pipework protected by Firesleave from firewall forward

I. F. Rickard 03/09

Figure 2. Fuel system schematic for Rotax 912 engines

Rotax 914 Fuel System

Example Europa Installation

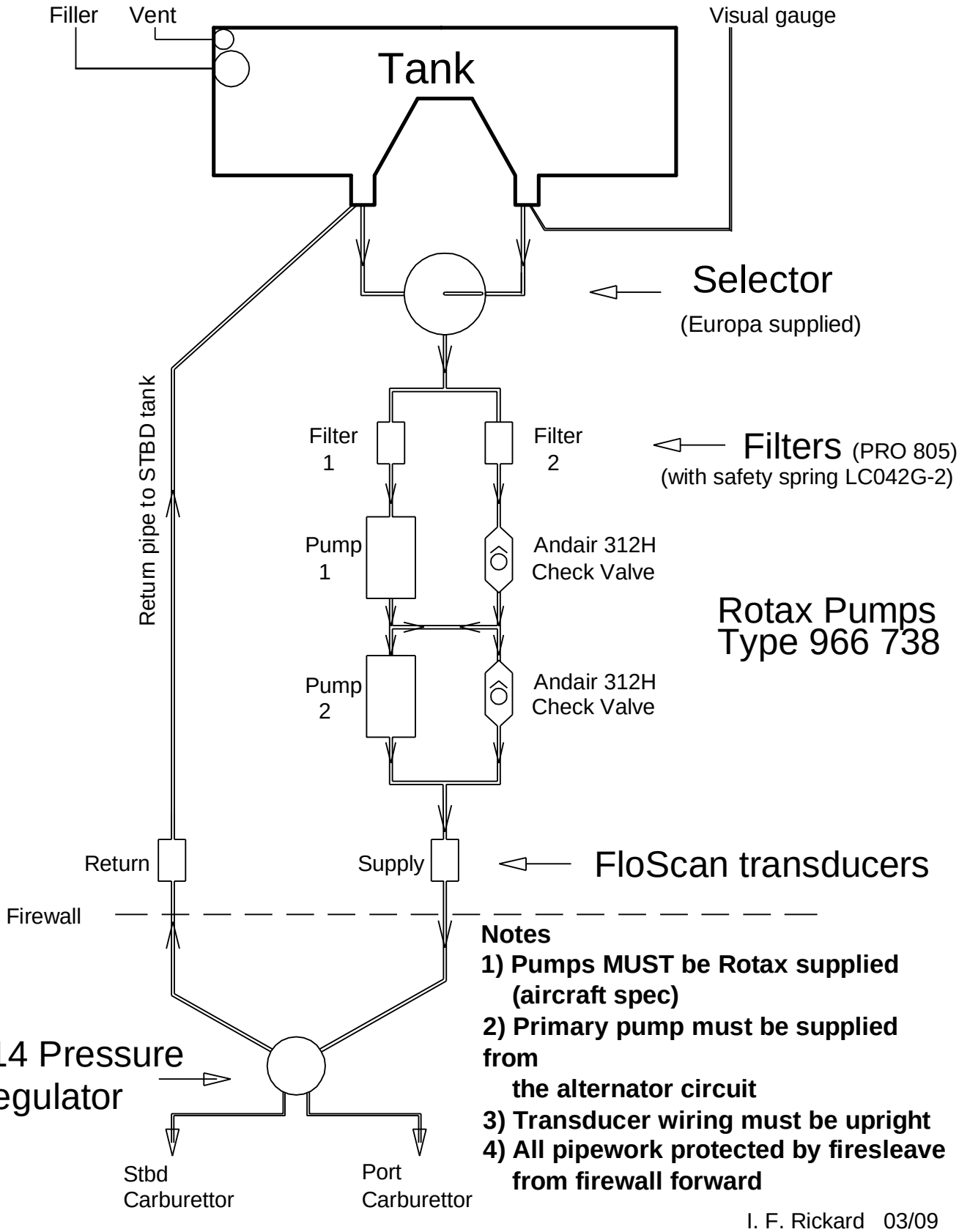


Figure 3. Fuel system schematic for Rotax 914 engines

5. Flight Test and Special Instructions

Before the modified aircraft may be flown:-

1) An LAA inspector must check the installation of the fuel flow monitoring system.
2) A fuel flow check must be carried out according to the method shown below and the results recorded in the logbook and the results verified by an LAA inspector. It is acceptable to conduct this check with the engine-off and with the electrical pump running only.

One of the most common causes of engine failures on homebuilt aircraft is inadequate fuel flow leading to fuel starvation or vapour lock.

The purpose of the fuel flow check is to ensure that there is at least a 25% surplus of fuel flow available over and above the maximum amount required by the engine at full throttle and maximum rpm, without allowing the carburettor inlet fuel pressure to drop below the minimum recommended by the engine manufacturer.

The required set-up for carrying out the test is as shown in figures 4 or 5 depending on engine type.

Below is listed the maximum fuel flows for the Rotax 912, 912S and 914 engines along with the minimum fuel flows that must be recorded during the fuel flow check.

Rotax Engine model	Maximum fuel flow Litres / hr	Min flow to be recorded: Litres / hr
912	24	30.00
912S	27	33.75
914	33	41.25

For the 912 / 912S engines, start the electric pump running and open the stop tap fully then, with the hose end over the measuring container, progressively open the other tap until the fuel pressure drops to 0.15 bar (2.2 psi) which is the minimum fuel pressure required to operate the 912 series engines safely. The fuel flowing into the measuring container is the excess capacity of the fuel pump and fuel system. Shut the stop tap and empty the measuring container ready for the flow check.

Now, re-open the stop tap and start timing as you do so. Double check that the fuel pressure is set correctly at 0.15 bar. Repeat the flow check using the reserve side of the fuel tank. Collect at least 2 litres for accurate results.

For the 914 engines, apply an air pressure of 0.5 bar (7.25 psi) to the airbox port of the regulator – a mountain bike fork pump with a pressure gauge on it may be used for this. With the hose end over the measuring container, switch on one pump and start timing as you do so. Repeat the flow check using the reserve side of the fuel tank and also both sides of the fuel tank with the other pump only. Collect at least 2 litres for accurate results.

To calculate the fuel flow in litres per hour: (Litres collected / seconds) x 3600 = litres / hr.

The fuel flows recorded should be well in excess of the minimum figures stated. If they are not, it is likely that some restriction does exist within the fuel system and this must be investigated before further flight.

3) With the above found to be satisfactory, a logbook entry must be made, making reference to the modification number and the inspector must sign a Permit Maintenance Release (PMR).
4) The display/analysis unit MUST be calibrated during initial testing.

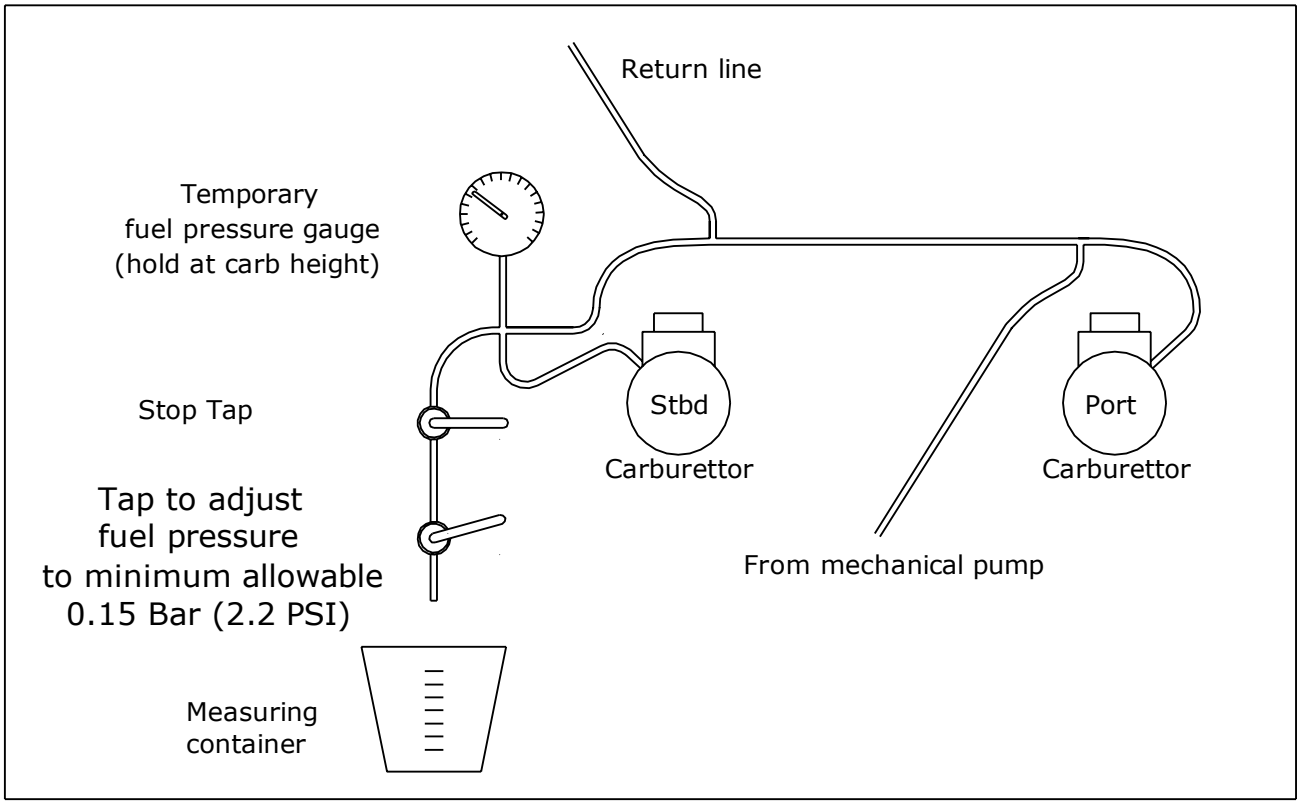


Figure 4. Fuel Flow set-up for Rotax 912 engine installation

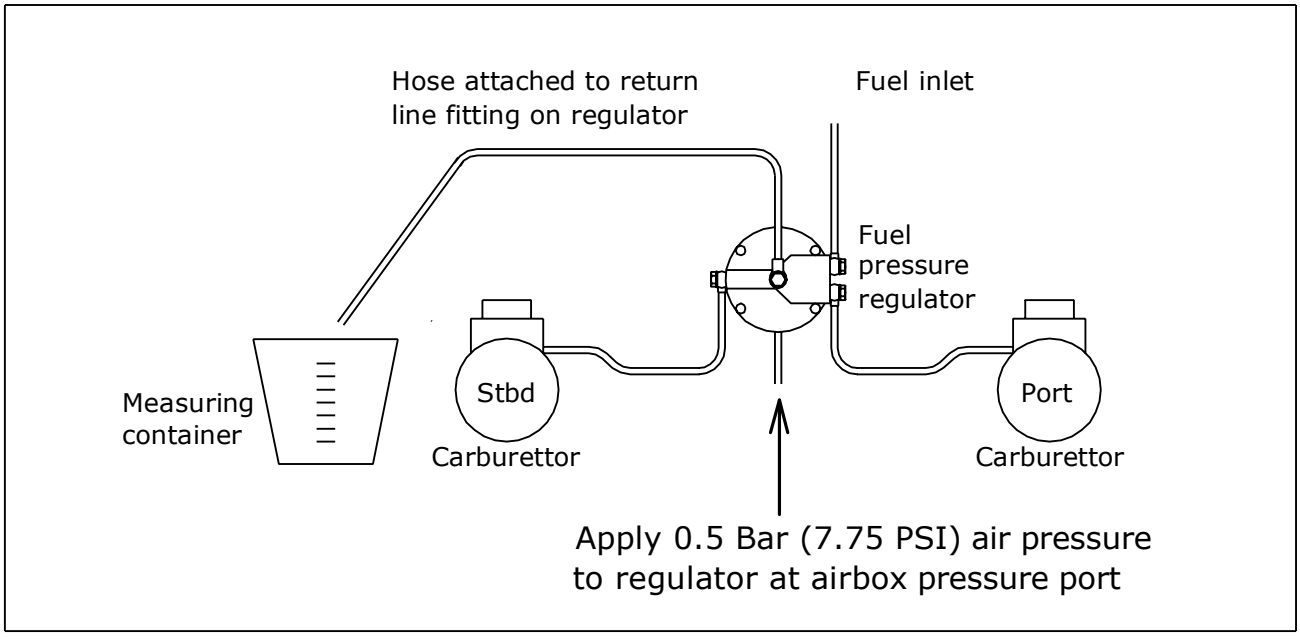


Figure 5. Fuel Flow set-up for Rotax 914 engine installation

Approved:	F Donaldson B.Tech C.Eng FRAeS Chief Engineer	Signed	F R Donaldson