

**Rotec**  
**User's Manual**

**Table of Contents**

Introduction	<b>1</b>
Installation	
Fuel Flow Sensor	<b>2</b>
Instrument	<b>7</b>
Wiring the Sensor and GPS to Rotec	<b>8</b>
Operation	<b>9</b>
Sensor Calibration Adjustments	<b>11</b>
Methods to measure fuel used	<b>13</b>
Technical Specifications	<b>14</b>
Log Sheet	<b>17</b>
Troubleshooting Guide	<b>18</b>

## Introduction

Rotec is a fuel management system for non type certified aircraft.

It provides the pilot with a wide variety of information such as what **RANGE** can be achieved and your **RESERVE** flying time once you reach your destination. This is calculated per second which allows you to trim your throttle setting to optimise the fuel consumption with ease. Both these functions require a signal from your GPS in order for the flight computer to know your ground speed and distance to destination. The instrument will also display **TIME** left based on your current fuel consumption, **TANK** (quantity of fuel left in tank) as well as **FLOW** rate per hour. If your GPS does not have an output signal you can subtract the time displayed by your GPS from the time displayed by Rotec and that will give you your **RESERVE** time.

Rotec incorporates microprocessor technology to provide an extremely high level of accuracy and reliability. It stores all configuration and fuel data information in memory indefinitely without power connected.

The Rotec system comes complete with a factory calibrated fuel flow sensor, harness . The flow sensor is unique in design and has an excellent output resolution. Our flow sensor has been used in the automotive racing industry for many years. Data collected for 7 years in our test aircraft allows us to deliver this product with confidence. With a little calibration fine tuning from the user it will perform with accuracy and reliability.

## Installation

### Fuel Flow Sensor

It is recommended that the flow sensor be installed on the pressure side of the fuel pump. The sensor does not have any filter so be careful not to allow any debris to fall in while doing the installation.

The sensor has hose tail fittings on each end so that it will plug into a fuel line. Installation is very easy for fuel systems using rubber fuel lines.

**The flow sensor is very difficult to unplug if there is a problem and it is best to cut away the fuel line from the barbed hose tail instead of putting unnecessary force on the sensor body if ever it has to be removed.**

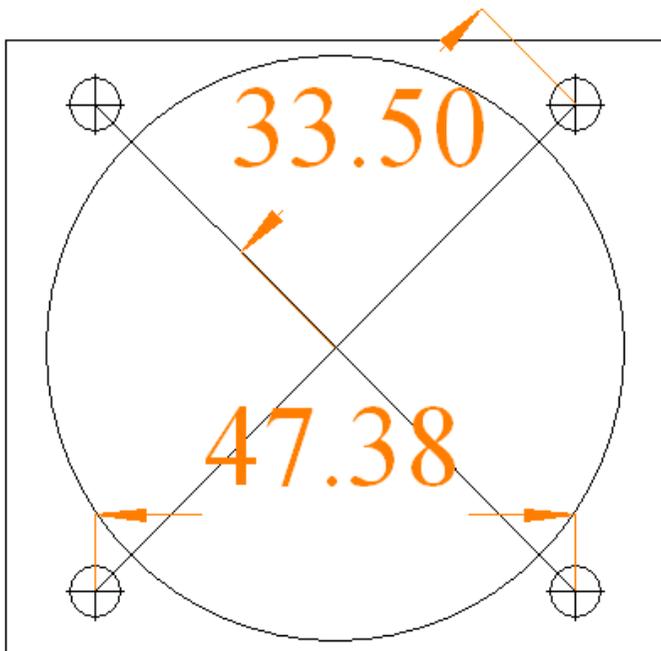
If a circulatory fuel system is used, make sure that the sensor is installed between the fuel pressure regulator or "T" piece (allowing fuel back to the tank) and the TBI. Some aircraft using two TBI's for example use a 4 port fuel distributor. You could then fit the flow sensor going to one TBI only and double the PERCENT value to 200 so that the instrument indicates the correct fuel flow.

Cut the fuel line between the fuel filter and engine. There is no orientation for the flow sensor and can be fitted in any direction.

## Instrument

### - Panel Mounted

The panel mounted version fits in the standard 2 1/4 inch (57mm) hole, but if you will cut a hole for the first time a 55mm hole saw will be big enough. It fits from the back of the panel and four self tapping screws secure it from the front.



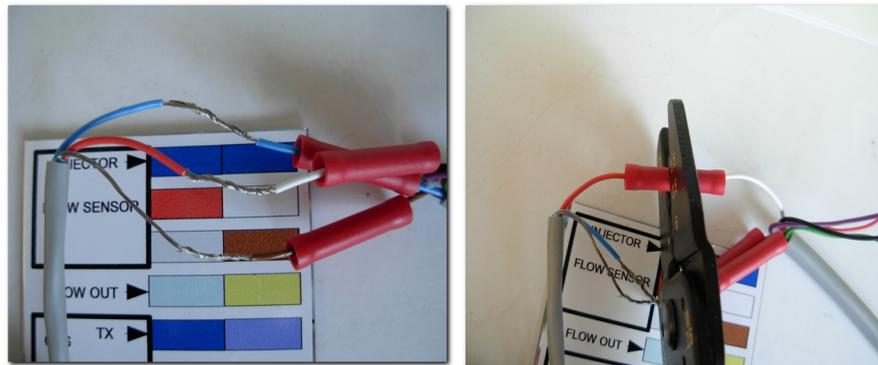
### Panel mount dimensions

### - Stick On Box

For pilots who do not have much space left on their instrument panel we have developed a stick on box system. The dimensions are 70mm wide, 50mm high and 25mm thick. It is light enough to be simply double sided taped on to the panel or be mounted at any convenient location.

## Wiring the Sensor and GPS to Rotec

Supplied is a colour coded chart to guide you with the wire connections. The harness from the Instrument, Flow sensor, GPS and power supply all come together and we recommend soldering or crimping. In the kit we supply you with sleeves if you do not have a soldering iron.



### Wire colours and connections:

Blue of sensor - Blue of Instrument Harness  
Red of Sensor – White of Instrument Harness  
Bare wire of Sensor – Brown of Instrument Harness  
GPS TX – Purple of Instrument Harness  
0v or Ground of GPS – Green or Instrument Harness  
12v – Red of Instrument Harness  
0v or Ground – Black of Instrument Harness

## GPS

If you intend connecting your Rotec to a GPS, make sure that your GPS first has the facility to communicate with other equipment via a serial port RS 232, secondly that the format of data can be set to NMEA 183 at 4800 baud. You will need to provide the correct connector and cable from your GPS as every GPS is different. On the GARMIN range of GPS for instance, the basic cable has only two wires for power supply. The cable that you need has to have a transmit wire (TX) as well. Remember that if you are connecting a GPS to the Instrument that you also have to give it 12v power. So we recommend that you splice the 12v of the gps in with the 12v power and Red wire of the Instrument Harness

## FUEL

The sensor comes already wired to a 5m, three core cable. The three wires are red, blue and the third bare wire has no insulation.

If the cable length is too long and you want to avoid cutting it., then coil the excess on itself but do not leave it in a circular coil as it can cause interference to other instruments. Rather clamp in a flattened sausage shape with some cable ties.

## POWER

8 to 14 Volts DC regulated , wired from the Avionics switch and **NOT** the master switch.

## Operation

Some values have to be entered such as Fuel on board before a flight and some parameter settings. All controls are done via 3 tact switches.

Left switch - **Move** character position to the right

Middle switch - Increment value or **Scroll**

Right switch - **Enter**

Information is scrolled in normal flight and recalculated every second :

**TANK** - quantity of fuel left in the tank.

**FLOW** - Current Fuel Flow per hour.

Please note fuel units of measurement are factory calibrated in Litres. They can be calibrated for any other measurement unit but will still display in decimals of the unit.

**RANGE** - GPS is required to know the current ground speed and calculate the distance left until the tank is empty.

**TIME** - Time endurance left is based on the current tank level and fuel flow until the tank is empty.

**RESERVE** - a GPS is required to provide the distance to your final planned destination and calculate the flight time left in tank after landing. **RESERVE OUT** is displayed if your destination can not be reached.

If a GPS is not connected, only TANK, FLOW and TIME are displayed.

### Information that can be edited into the instrument :

**TANK** - Necessary if fuel is added to the tank.

**PARAM A** – Factory Setting, can be adjusted by the user.

**PERCENT** - Other parameter as above, for further fine tuning.

**SCROLL** - Time in seconds used for the pause between each information displayed.

**GPS** - A Y/N setting if a GPS is connected or not.

**GALLON** - A Y/N setting if the fuel measured is in gallons, if NO then Litres is displayed

## Sensor Calibration Adjustments

**DST UNIT** - A N/S/K setting if the destination units you want displayed are Nautical Miles, Statute Miles or Kilometers.

**PARAM B** – Factory Setting, should not be adjusted unless correspondence has taken place and advised by Rotec

The instrument scrolls at regular intervals the various information. If you want to temporarily **freeze** the display on the FLOW for example: As soon as the FLOW is displayed depress the switch in any position. To return to the normal scroll, depress the switch in any position again.

If any key is depressed for more than 3 seconds, the unit enters into the **EDIT** mode.

It will start with TANK and the quantity is displayed between [...] (square brackets). If TANK is not the item to be edited, depress the **Scroll** key to go to the next field to be edited, in this case PARAM A etc...

When reaching the desired field, depress the **Enter** key. The left most character flicks and can be changed using the **Scroll** key. To go to the next character, depress the **Move** key.

When the editing is complete, depress the **Enter** key. The instrument will return to the normal scroll mode.

Generally, only the TANK field should be edited. The other fields are edited only during the calibration phase and at installation.

Once you become used to using the switch and editing the TANK field, it will only take a few seconds of your time after each time you top up the fuel tank. The advantage of this is that instead of pushing a single button to tell the instrument that you have filled up the tank, you can specify the actual tank level if you only filled up a few litres instead of topping up.

The fuel flow sensor has been factory calibrated. The only calibration value that has to be entered into the instrument before your first flight is Param A that comes with your flow sensor:

Even though the sensor is calibrated and gives accurate results on a test bench, it needs to be adjusted to give accurate results in an actual installation. The initial accuracy of the sensor is subject to the placement of the sensor in the fuel line relative to the fuel pump, fuel pressure regulator or curves in the fuel line. Therefore the factory calibration needs to be adjusted to accommodate for this.

### Step 1

Make sure that your PERCENT setting is correct for your type of installation. Normal is 100, if you can only meter fuel on one TBI of a 2 TBI system for example you would have to multiply by 2. So PERCENT would then be 200

### Step 2

Before your first flight test, make sure that your fuel tank is topped up to your reference mark so that you can compare how much fuel was actually used compared to the instrument results. Set your engine RPM to the normal cruise settings and go for a normal cross country flight. Do not worry if the flow rate is way off what you know your cruise fuel consumption should be. This will be sorted out using the recalibration formula once you have landed. To be able to confirm that the instrument data is correct, it is important to know how much fuel you are putting into your tank and your total tank capacity (see Methods to measure fuel used).

Use at least 20 litres of fuel before doing a calibration adjustment, even if it means doing a couple of flights if you have a very efficient aircraft.

## Methods to measure fuel used

### Step 3

Use this formula, or alternatively use the spread sheet provided on the CD to work out the new PARAM A value.

Fuel consumed : **FC**

Fuel consumed calculated by Rotec: **FI**

FORMULA : **New PARAM A = FC x PARAM A / FI**

For a safety margin it is good to have the instrument over-read, or reduce the total TANK capacity so that there are a few litres in reserve. Over time, increase or decrease PARAM A to have the desired results. After a few flights with and without passengers, or doing just circuit flying and cross country flying you will know whether the instrument has changes in accuracy over a flow range or not.

Further fine tuning can be accomplished with better resolution by using PERCENT. If the fuel consumption is too low, then increase the PERCENT value by the proportional value. If you want a 5% increase in flow rate and PERCENT was at 100, then change it to 105.

Refer to the troubleshooting guide to find out more how PARAM B can be used to improve performance across the flow range.

To have confidence in your Rotec, the fine tuning process should be done until the results are regular and accurate. Diligent log keeping ensures accuracy and safety. (see the **log sheet** at the end of the manual)

The only way to confirm that your Rotec is accurate or to be able to adjust the sensor calibration is to compare the actual fuel used to what the instrument displays. To do this you need a way of measuring the actual fuel used .

**If the tank is fairly narrow** you can have markings on your aircraft's tank at every litre. You will need to empty completely the aircraft's tank. Then top up the tank one litre at a time and mark at a convenient place. This can be done with a one litre Coke bottle or is easier to do if you can graduate the tank at the local petrol station.

**If the tank is wide** and does not allow enough spacing between each litre mark, then only have one mark towards the fullest part to which level the tank is always refilled. Using a see-through plastic 25 litre container, mark every litre on the outside of the plastic tank. Preferably mark away from the nozzle side as fuel dripping will eventually remove the markings. After each flight, top up the tank from the plastic fuel container to the full marking on the tank. That way, an exact quantity (to the nearest litre) relevant to the previous flight can be entered on the log sheet and compared to the Rotec reading.

# Technical Specifications

## Fuel Flow Sensor

Minimum flow rate detection is 1.5 L/H

## Instrument Dimensions

height: 60mm

width: 70mm

length: 30mm

weight: 115g

## Power Requirements

voltage: 8 to 14 Volts DC regulated , wired from the Avionics switch and **NOT** the master switch

## Valid Ranges

tank: 0 to 999.9

flow: 0 to 99.9

distance: 0 to 9999.9

time: 00:00 hours:minutes

reserve: 00:00 hours:minutes

## Display Units

fuel: in litres. It can be calibrated for any other measurement unit but will still display in decimals of the unit.

distance: statute miles,nautical miles,kilometers

