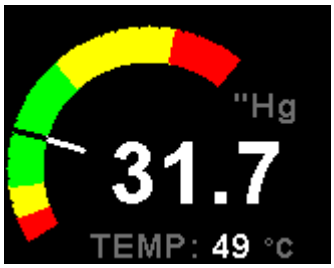
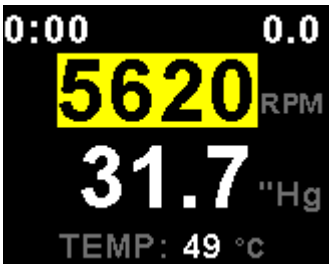
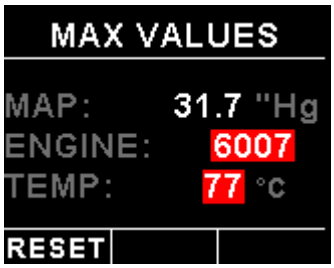
Vega MAP-3

Manifold Pressure, RPM and Temperature Indicator

Operating Manual – English 1.01







Introduction

The MAP-3 is a 2 1/4" sunlight readable Manifold pressure indicator which can simultaneously display RPM and temperature from a universal RPM and temperature input.

The manifold pressure display is also available in the form of a scalable analog bar graph, if the RPM input is not displayed.

The MAP-3 also has a Hobbs meter (can be set to the current engine time) which is password protected, an engine running timer / flight timer and a programmable maintenance timer to schedule routine engine maintenance.

The MAP-3 also features a programmable low/high alarm for manifold pressure, RPM and temperature. A handy magneto check function is also available to easy diagnose magneto problems. The MAP-3 also records the maximum manifold pressure, RPM and temperature reached in permanent memory.

The MAP-3 can also be interfaced via the CAN bus to an external RDAC unit (Remote Data Acquisition Computer). This allows for easier installation as the RDAC unit is normally mounted in the engine compartment.

1 Features

- **Large 1.8" high resolution 160x128, sunlight readable, wide viewing angle, 1000 cd/m2 TFT LCD display**
- **Manifold pressure, RPM and Temperature indicator**
- **Manifold pressure can be displayed in millibar (mB) or in inches of Mercury ("Hg")**
- **Scalable analog manifold pressure bar graph**
- **Temperature can be displayed in degrees Celsius or in degrees Fahrenheit**
- **Includes a settable Hobbs meter which is password protected**
- **Includes an engine running and flight timer**
- **Includes a programmable maintenance timer for scheduled routine engine maintenance**
- **Includes a magneto check function**
- **Records maximum MAP, RPM and temperature reached in permanent memory**
- **A programmable low/high alarm for manifold pressure, RPM and temperature**
- **External RDAC (Remote Data Acquisition Computer) interfacing via the CAN bus**
- **Standard 2 1/4" aircraft enclosure (can be front or rear mounted)**
- **Rotary control plus 2 independent buttons for easy menu navigation and user input**
- **Wide input supply voltage range of 8 to 30V DC with built in voltage reversal and over voltage protection for harsh electrical environments**
- **1 year limited warranty**

2 MAP-3 Layout

Sunlight readable color graphic display:
Backlight can be adjusted in the menu system

2 1/4" enclosure.
Can be front or rear mounted

F1 / Up Button:
Menu System: Softkey button
Normal Display: Start / Stop the flight timer (Manual flight only, RPM display on)

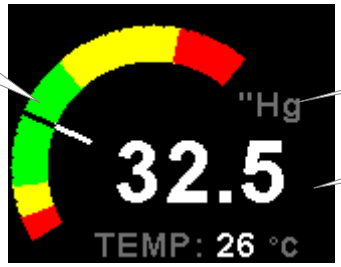
F2 / Down Button:
Menu System: Softkey button
Normal Display: Enable magneto check function (RPM display on)

Rotary Control (Up/Down) & Enter Button:
Press the rotary control during the normal display screens to access the menu system. Rotate anti/clockwise for up/down menu scrolling. Rotate the rotary control during the normal display mode to view the Timers and Max Values display.

3 Main Displays

The MAP-3 has 2 different display screens. The main display screen can be selected to display Manifold pressure only or Manifold pressure and RPM combined.

3.1 Manifold Pressure Only Display



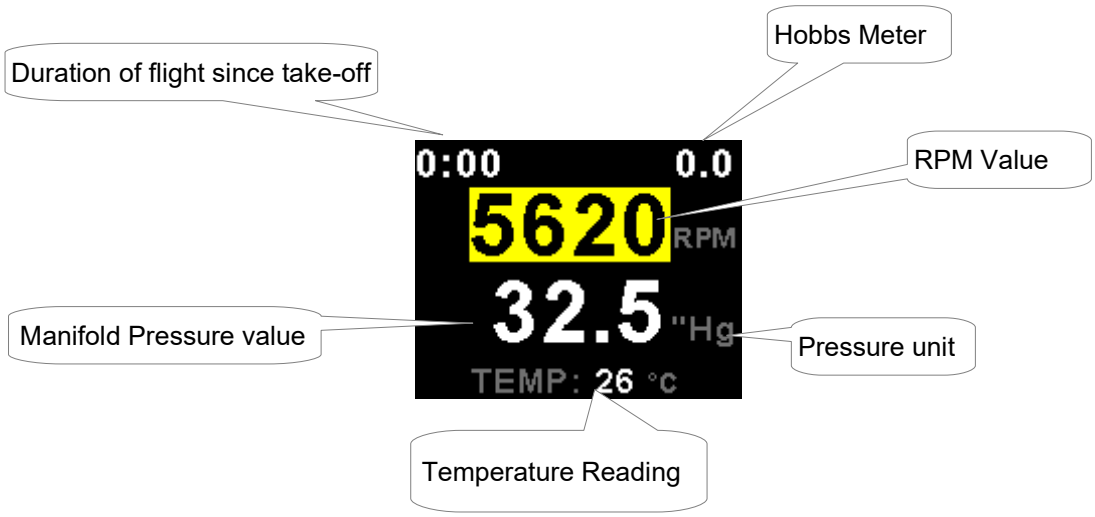
Manifold pressure graphic display

Pressure unit

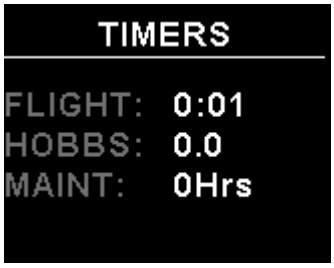
Pressure value

Temperature Reading. If the temperature display is set to off then the maximum manifold pressure value will be displayed.

3.2 Manifold Pressure and RPM Display

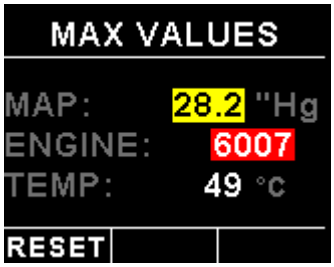


3.3 Timers display



This display can be accessed by rotating the rotary control during the normal display mode. The flight, Hobbs and Maintenance Timers are shown.

3.4 Maximum Values display



This display can be accessed by rotating the rotary control during the normal display mode. Press the F1/Up button when the max values display is showing to reset the maximum values to the current values.

Note: The maximum values are stored in non-volatile memory and are recalled on power-up.

3.5 Magneto check function (RPM Display showing)

Press the F2/Down button once you have reached your normal run-up RPM. The display will show the RPM deviation from when the magneto function was activated. Any RPM drops will be displayed as a negative RPM value, a positive reading indicates an increase in RPM.

Switch the mag to left or right. The MAP-3 should display a negative (drop in) RPM. Then switch the mags to “Both”. The MAP-3 reading should go back to zero or near zero. A problem should show up as an excessive drop in one mag and the return to zero or close to zero incorrectly.

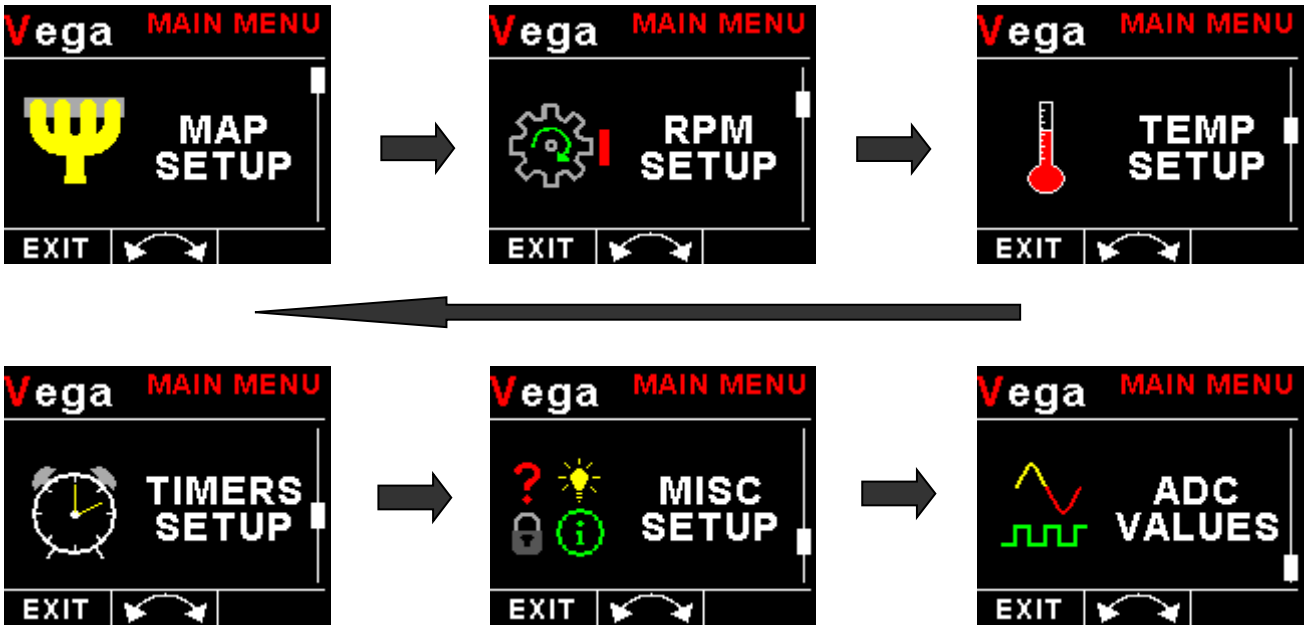
The MAP-3 will return to the normal display after 60 seconds or if any key is pressed.

3.6 Start / Stop flight display

Press the F1/Up button during the normal display mode to manually start/stop a flight. This key is only active if the MAP-3 is setup to select the manual flight option under the “TIMERS” setup menu.

4 Menu System

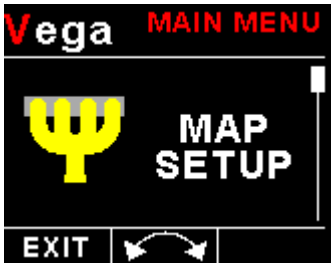
Press the rotary control button during the normal display mode to enter the menu system. Use the rotary control to navigate through the menu system.



4.1 Exiting the menu system

Press the F1/Up button to exit the menu system when the “EXIT” soft key is shown. All changes made during navigation of the menu system will be saved in non-volatile memory upon exiting. The instrument will not save any changes if you remove power before exiting the menu system.

4.2 MAP Setup (Manifold Pressure Setup)



MAP Unit:
Select if you want the manifold pressure displayed in mB (millibars) or “Hg (inches of mercury).

Display Max:
Select the maximum pressure that you want the manifold bargraph to show. This can give you increased display resolution.

Display Min:
Select the minimum pressure that you want the manifold bargraph dial to show. This can give you increased display resolution.

High Alarm:
This enables or disables the manifold pressure high alarm.

High Alarm:
Enter the pressure threshold for when the high alarm must be activated. Any pressure above this value will activate the alarm.

High Caution:
Enter the pressure value for the high caution. This is the lower value of the upper yellow band.

Low Caution:
Enter the pressure value for the low caution. This is the upper value of the lower yellow band.

Low Alarm:
This enables or disables the manifold pressure low alarm.

Low Alarm:
Enter the pressure threshold for when the low alarm must be activated. Any pressure below this value will activate the alarm.

Filter:
This function can be used to select the signal filter time constant. Selections are *"NONE"*, *“FAST”* or *“SLOW”*. This selection influences the rate at which your manifold pressure can change its reading.

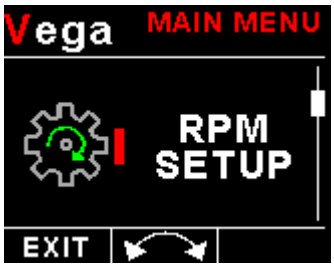
Cal:
Internal sensor calibration:
During the factory calibration a factor has been determined and entered here that will give you accurate manifold pressure. The original calibration factor has been written onto the back of your instrument. The manifold pressure can only be calibrated in mB.

RDAC Calibration:
The sender in the RDAC is shipped uncalibrated. To calibrate the manifold pressure, compare and adjust the calibration factor until the manifold reading is the same as the barometic pressure. The manifold pressure can only be calibrated in mB.

Data:
Select the data source of the manifold pressure. Options include internal (using the internal sensor within the MAP-3) or from an optional external RDAC unit.

RDAC Address:
Select the CAN address of the RDAC unit.

4.3 RPM Setup



RPM Display:
Select if you want the RPM to be displayed on the main display or not. Select “OFF” if you are not using the RPM part of the MAP-3 indicator.

Display:
Select if you want the RPM to be displayed in *"RPM" or "PERCENT".*

RPM 100%:
Select the maximum value that you want the RPM to correlate to 100%. This is only shown if *"Percent"* is selected for display.

Display Max:
Select the maximum RPM that you want the RPM dial to show. This can give you increased display resolution.

Display Min:
Select the minimum RPM that you want the RPM dial to show. This can give you increased display resolution.

High Alarm:
This enables or disables the RPM high alarm.

High Alarm:
Enter the RPM threshold for when the high alarm must be activated. Any RPM above this value will activate the alarm.

High Caution:
Enter the RPM value for the high caution. This is the lower value of the upper yellow band.

Low Caution:
Enter the RPM value for the low caution. This is the upper value of the lower yellow band.

Low Alarm:
This enables or disables the RPM low alarm.

Low Alarm:
Enter the RPM threshold for when the low alarm must be activated. Any RPM below this value will activate the alarm.

Pulses/Rev:
Enter the number of pulses per RPM. For engines with an uneven number of cylinders like three cylinder four stroke engines you can enter values containing fractions (usually 1.5 in this example). Most four stroke engines would generate one pulse for every two revolutions per cylinder. A four cylinder automotive four stroke engine would thus generate 2 pulses per revolution. A typical Rotax DCDI two stroke engine would generate 6 pulses per revolution. The well known Rotax 912/914 engine generates one pulse per revolution.

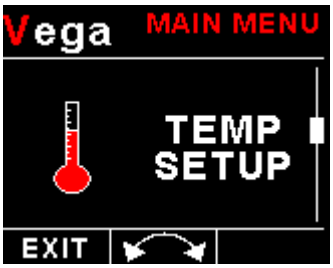
Increment:
Select the step size between successive RPM values eg. if the RPM value is 4003 RPM and the "INCREMENT" is 5 then the actual value shown is 4005 RPM.

Label:
Enter a label for the RPM so you can identify it easily.

Data:
Select the data source of the RPM signals. Options include internal (using the internal electronics within the MAP-3) or from an optional external RDAC unit.

RDAC Address:
Select the CAN address of the RDAC unit.

4.4 Temp Setup



Temp Display:
Select if you want the temperature to be displayed on the main display or not. Select “OFF” if you are not using the temperature part of the MAP-3 indicator.

Temp Unit:
Select whether you want the temperature to be displayed in degrees Celsius (ºC) or in degrees Fahrenheit (ºF).

HIGH ALARM:
This enables or disables the temperature high alarm.

HIGH ALARM:
Enter the temperature threshold for when the high alarm must be activated. Any temperature above this value will activate the alarm.

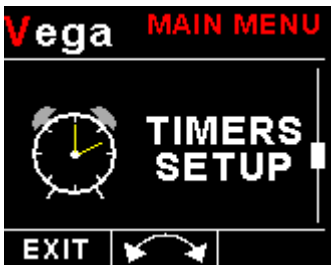
LOW ALARM:
This enables or disables the temperature low alarm.

LOW ALARM:
Enter the temperature threshold for when the low alarm must be activated. Any temperature below this value will activate the alarm.

Label:
Enter a label for the temperature display so you can identify it easily.

CAL:
Adjust the calibration factor until the temperature sensor matches that of a precision thermometer. Calibration can only be done in Celcius (ºC).

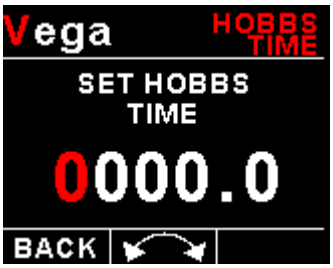
4.5 Timers Setup



HOBBS RPM:

Enter the RPM limit in which the Hobbs timer/Maintenance timer must start incrementing.

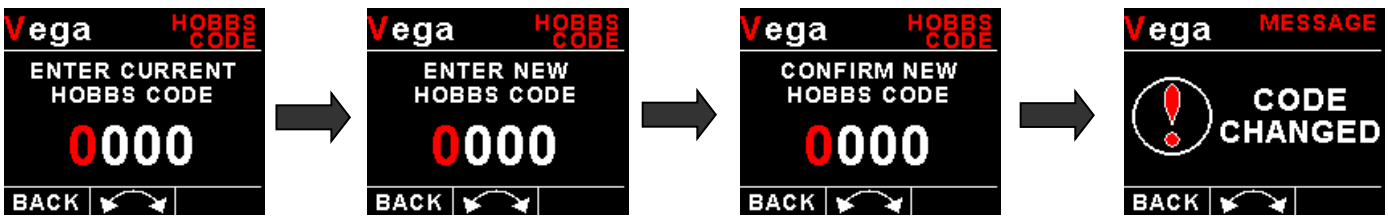
SET HOBBS TIME:



This function allows you to set the engine Hobbs meter to any value. Typically, you would use this function to set the Hobbs meter to the current known engine time. Use the rotary control to change the value. Press the rotary control to accept and exit the menu option. If the Hobbs code is set to another value beside zero, then the pilot will be prompted to enter the Hobbs access code before allowing him to change the Hobbs time. This feature is useful for charted and flying school planes.

HOBBS CODE:

This menu option allows you to change the Hobbs access code. You will first be prompted to enter the current code followed by entering in a new code followed by re-entering the new code. If the new code and the re-entered code is the same, then the Hobbs access code will be changed. Default code is 0000.



SET MAINT TIMER:

This function allows you to set an engine maintenance timer. This timer is set in engine hours and it will count down to zero when the engine RPM is greater then the "*HOBBS RPM"*. A good use for this function is to set the hours until your next spark plug change or engine inspection. Use the rotary control to change the value.

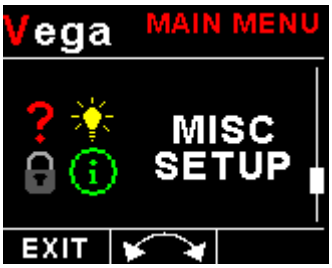
FLIGHT:

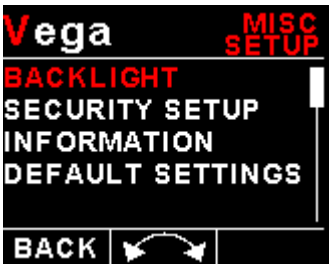
Select whether you want the MAP-3 to automatically detect a flight or whether the pilot must press the F1/Up button to start/stop a flight. We recommend you select automatic flight detection.

RPM T/O:

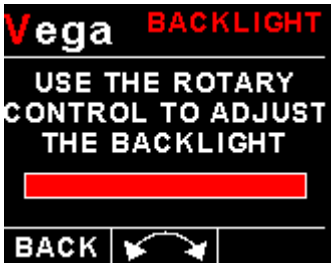
This menu option is only shown if the "DETECT" flight mode is selected. Enter the RPM take off threshold that you want the flight timer to start incrementing.

4.6 MISC Setup (Miscellaneous Setup)





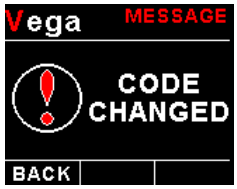
Backlight:



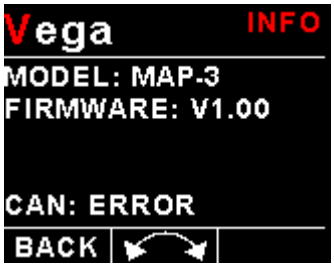
Select this menu option to adjust the backlight brightness.

Security Setup:

Select this menu option if you want to password protect the menu system.

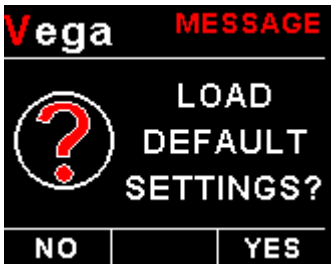


Information:



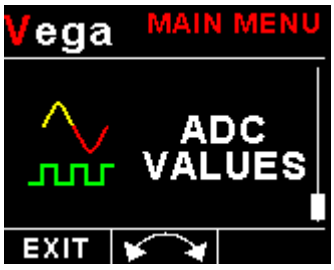
This menu option displays information about the unit.

Default Settings:

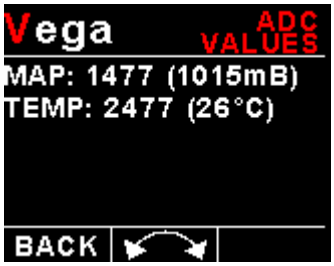


Select this menu option to reset all the settings to factory defaults.

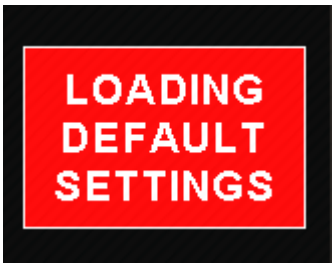
4.7 ADC Values



This menu displays the ADC values that have been read from the pressure and temperature sensor.



5 Loading factory default settings



Press and hold the F1/Up button and rotary control during power up to load the pre-programmed factory default settings. The following screen will be displayed:

Factory default settings can also be loaded in the Miscellaneous setup menu.

6 Error Messages

Unit settings CRC error. Load default settings to restore to factory defaults. If the error message still persists then it could possibly be a non-volatile memory failure in which case the instrument will then have to be returned to the factory.

Internal flash CRC error. The instrument does a firmware check on the program when power is applied to the instrument . If the program is corrupt in any way then the internal flash CRC error will be displayed. Reload the instruments firmware and load default settings. If the error message still persists then it could possibly be an internal flash memory failure in which case the instrument will then have to be returned to the factory.

Calibration constants CRC error. The instrument could possibly have a non-volatile memory failure in which case the instrument will then have to be returned to the factory.

Hobbs / Maintenance Timer CRC error. Try entering new values for the Hobbs meter and Maintenance timer and see if the error message disappears. If the error message still persists then it could possibly be a non-volatile memory failure in which case the instrument will then have to be returned to the factory.

Max Values CRC error. Load default settings to restore to factory defaults. If the error message still persists then it could possibly be a non-volatile memory failure in which case the instrument will then have to be returned to the factory.

7 MAP-3 Specifications

Operating Temperature Range	-10ºC to 60ºC (14ºF to 140ºF)
Storage Temperature Range	-20ºC to 80ºC (-4ºF to 176ºF)
Humidity	<85% non-condensing
Power Supply	8 to 30Vdc SMPS (switch mode power supply) with built in 33V over voltage and reverse voltage protection
Current Consumption	Approx. 73mA @ 13.8V (backlight highest setting), 33mA @13.8V (backlight lowest setting)
Display	1.8” 160x128 pixel active matrix TFT display. 1000 cd/m2 Sunlight readable with anti-glare coating LED Backlight is user configurable
Alarm Output	Open collector transistor switch to ground Maximum rating 0.5A
MAP sensor ADC resolution	12 bit
Dimensions	see Vega series dimensional drawing
Enclosure	2 1/4” ABS, black in color, front or rear mounting. Flame retardant.
Weight	Approx. 120 grams (Instrument excluding cables)
Non-volatile memory storage	100000 write cycles
Pressure range	Absolute, 0.25 bars to 2.5 bars
Maximum error over full range	Less than 1% of full scale when operated at calibration temperature
Never exceed pressure	5 bars
RPM input	Range: 0-99999 RPM. Minimum signal for stable display: 5Vpp. Fully A/C coupled, maximum voltage +/- 40V. RF noise filter plus Schmitt trigger based input
Sensor Output Voltage	+5Vdc. Max 50mA
Temperature Sender type	Semiconductor LM335 (Onsemi Semiconductor)
Temperature Sender range	-99ºC to 150ºC (-99ºF to 302ºF)

8 Operating the alarms

The alarm output can be used to switch an external alarm indicator. The external alarm switch is an open collector transistor switch to ground with a maximum rating of 0.5A DC. It is possible to wire the alarm contacts of several Stratomaster instruments in parallel should this be desired. To avoid false activation of the alarms, the alarm function is only active 10 seconds after the instrument has powered up.

9 Firmware Upgrading

The MAP-3 can be upgraded in the field by connecting the RS232 port to a PC and running the firmware update program. **Note that only the RS232 port can be used to upgrade the firmware.**

Please see the Vega firmware upgrading document for more information.

10 Installation

Manifold Pressure Installation

Standard polyester or silicon hosing with an inside diameter of 3-4mm is suitable as pressure hosing. For high pressure applications the hose should be clamped onto the connector to avoid it slipping off due to expansion of the hose. For applications where a pressure leak may prove troublesome, such as a typical engine manifold application, a restrictor valve should be inserted into the hose so that only very little gas leakage will be present in a case of failure or if the instrument is removed with the engine running.

RPM Installation

After you have connected the RPM input terminal to the signal source you will need to set the number of pulses per revolution under the “RPM SETUP” menu. The calibration itself depends on your engine and rotor type and what kind of signal you are using. Typical sources are:

- Magneto coils (suitable signal at the kill switch)
- Primary (low voltage) side of ignition coil, at contact breaker or electronic ignition module
- RPM counter output of electronic ignition systems (for example Bosch Motronic)
- RPM pickup devices such as hall-effect sensors on flywheels etc.

Installation of the MAP-3 is quite straight forward in most cases. The drawing in section 10.1 shows a typical MAP-3 installation. Please see the engine connection diagrams for the engine RPM connection to the MAP-3.

The RPM input is quite universally usable. The RPM input can be used with signals from about 5Vpp to as much as 100Vpp and the input is AC coupled for easy installation. A noise filter is included that results in the input ignoring any noise signals as long as this is below the detection threshold of about 2.5Vpp. The input impedance of the rev counter input is approximately 10Kohm. You can use series resistors as well as load resistors for applications that have unusual signals.

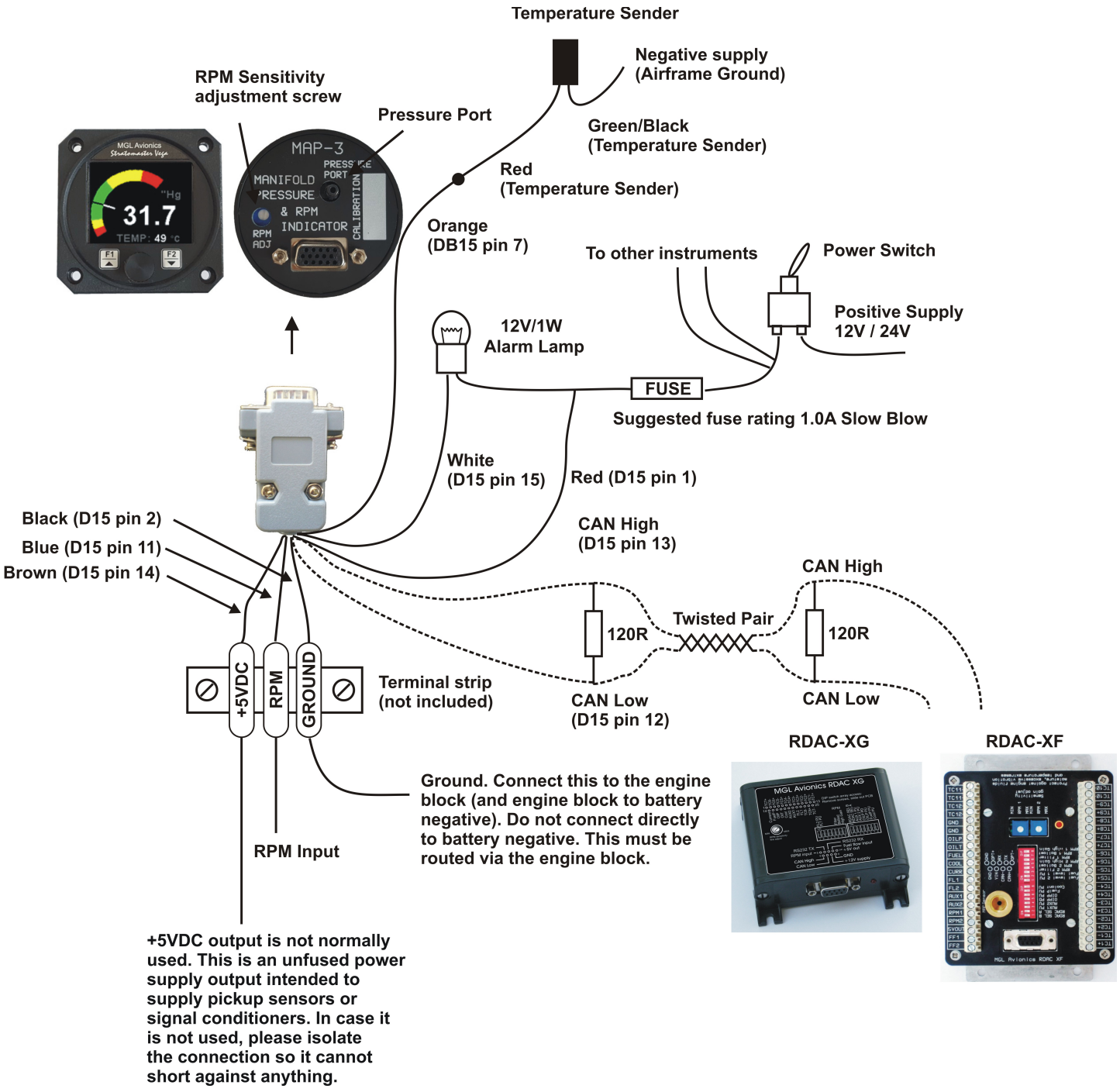
For installations such as with the Rotax DCDI two-stroke engines, the RPM input is simply connected to the grey rev counter wire from the engine. These engines produce six pulses per rev (set this up in the relevant menu item). Most engines produce 0.5, 1 or 2 pulses per revolution. This needs to be setup in the “RPM SETUP” menu item.

Please note: The +5V supply line is unprotected and intended only for the supply of a hall-effect , optical or gear tooth sensors. Connecting any voltages (such as the 12V supply) to this line could destroy the instrument. The +5V line may supply currents of up to 50mA. Should your sensor require greater currents you must supply it from another source.

Please note: It is essential that a single wire be connected from the minus terminal of the instrument to the engine block. This wire must not be used to share currents with other electrical users as this can affect accuracy of readings.

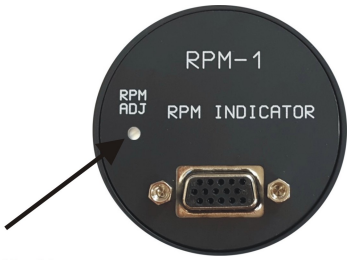
10.1 Connection Diagram

The use of an external 1A fuse is recommended. Connect the supply terminals to your aircrafts power supply. The MAP-3 can be used on both 12V and 24V without the use of any pre-regulators. Ensure that the supply voltage will not drop below 8V during operation as this may result in incorrect readings.



Adjusting RPM sensitivity

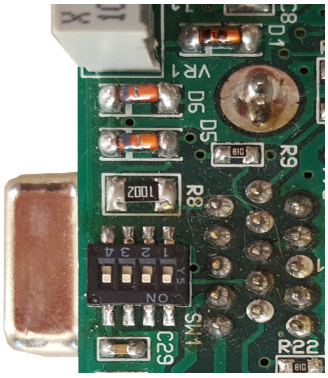
The MAP-3 has a sensitivity adjustment trimmer at the rear of the instrument. Adjust this trimmer using a small screwdriver such that you get stable RPM readings over the entire RPM band of your engine. If your sensitivity is too high, you may get unstable RPM readings (usually at higher RPM as electrical noise in the ignition system increases). If the sensitivity is too low the RPM reading may remain at zero. Fully clockwise = maximum sensitivity.



RPM Sensitivity adjustment screw

MAP-3 Input Dipswitch settings

Setting dipswitch 4 to the “ON” position (default) enables a high frequency filter in the RPM signal path. Some installations (direct coupling to a Magneto device for example) will require this to be switched “OFF”. Dipswitch 4 is the closest switch to the edge of the PCB.



External RDAC (Remote Data Acquisition Computer) Connection

The MAP-3 can use an external RDAC unit as the source for the MAP and RPM. Using an external RDAC may be beneficial as it will reduce the wiring from the engine compartment to the cockpit. Only the CAN High and CAN Low connections need to be made between the RDAC unit and the MAP-3 in order for this to work. Select *“RDAC”* for the data source in the “MAP SETUP” and “RPM SETUP” menu if using the external RDAC option.

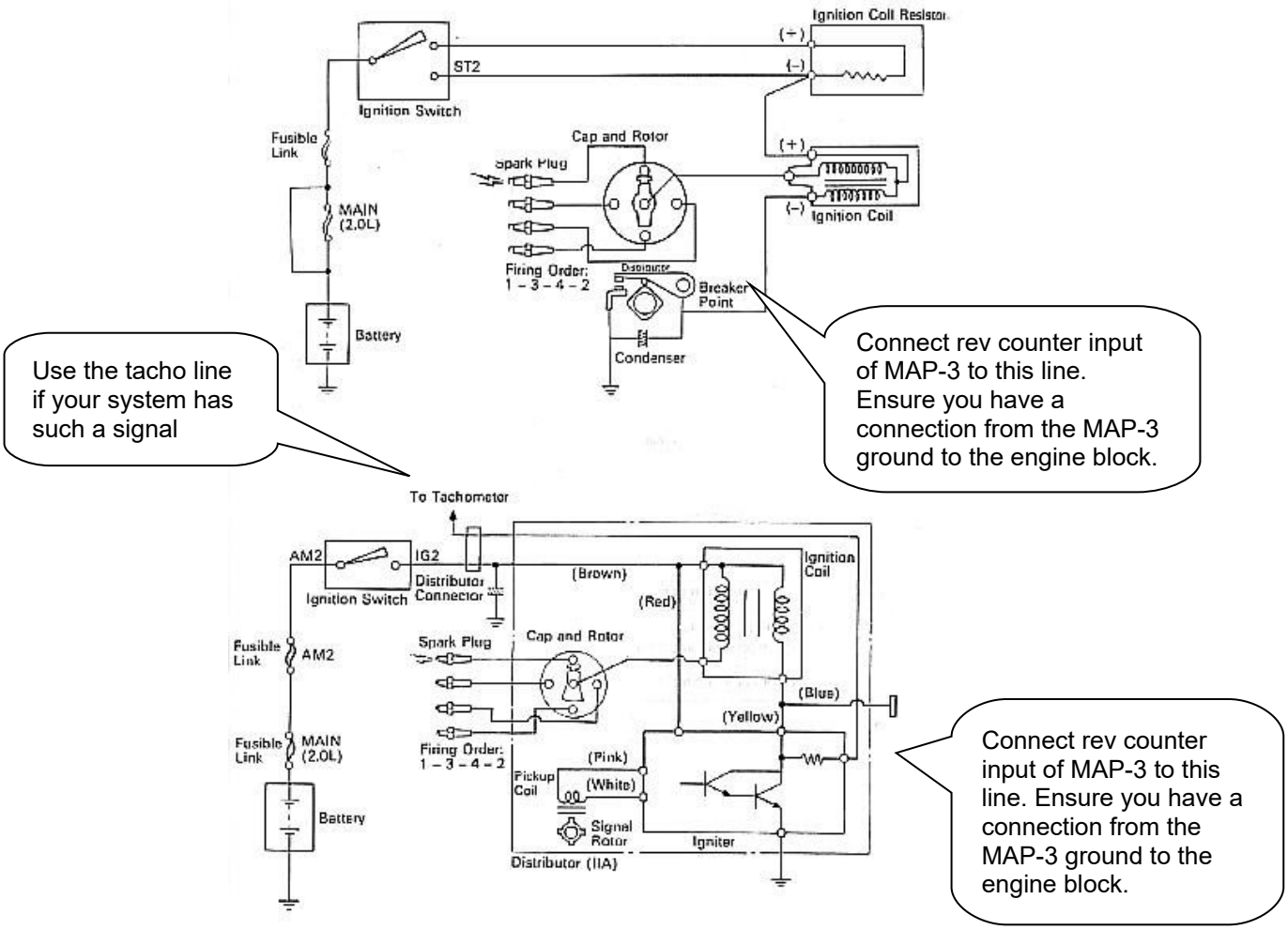
10.2 MAP-3 Cable connections

Main connector (D15 connector: Unit Female, Cable Male)

D15 Pin	Color	Function
1	Red	8-30Vdc power via power switch / circuit breaker and fuse.
2	Black	Ground. Connect the ground to the engine block, and the engine block to the battery negative. Do not connect the MAP-3 ground directly to the battery negative. This must be routed via the engine block.
3	-	RS232 Transmit data (Firmware upgrading)
4	-	RS232 Receive data (Firmware upgrading)
7	Orange	Temperature Sensor Input
11	Blue	RPM Input
12	Purple	CAN Low (Used for optional external RDAC)
13	Pink	CAN High (Used for optional external RDAC)
14	Brown	+5Vdc Power out Sensor power
15	White	Alarm Output (Open collector)

10.3 Connecting the MAP-3 to automotive engines

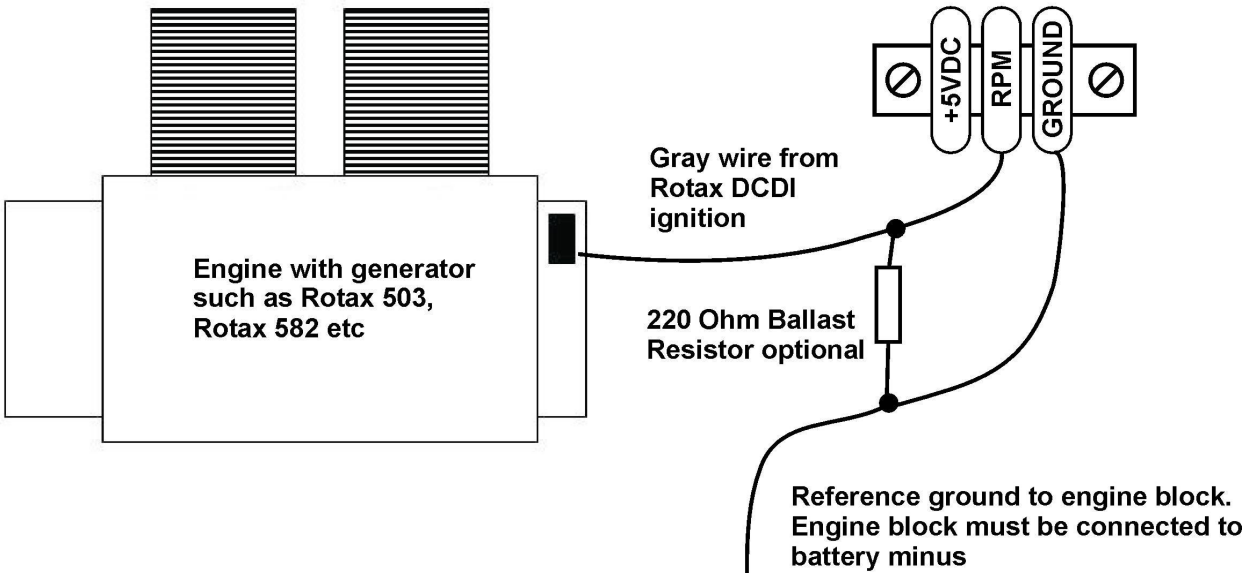
Conventional contact breaker ignition system



Electronic ignition system with conventional ignition coil

10.4 Connecting the MAP-3 to a 2 stroke Rotax engine

Typical connection in case of a Rotax two stroke engine with Ducati dual ignition:



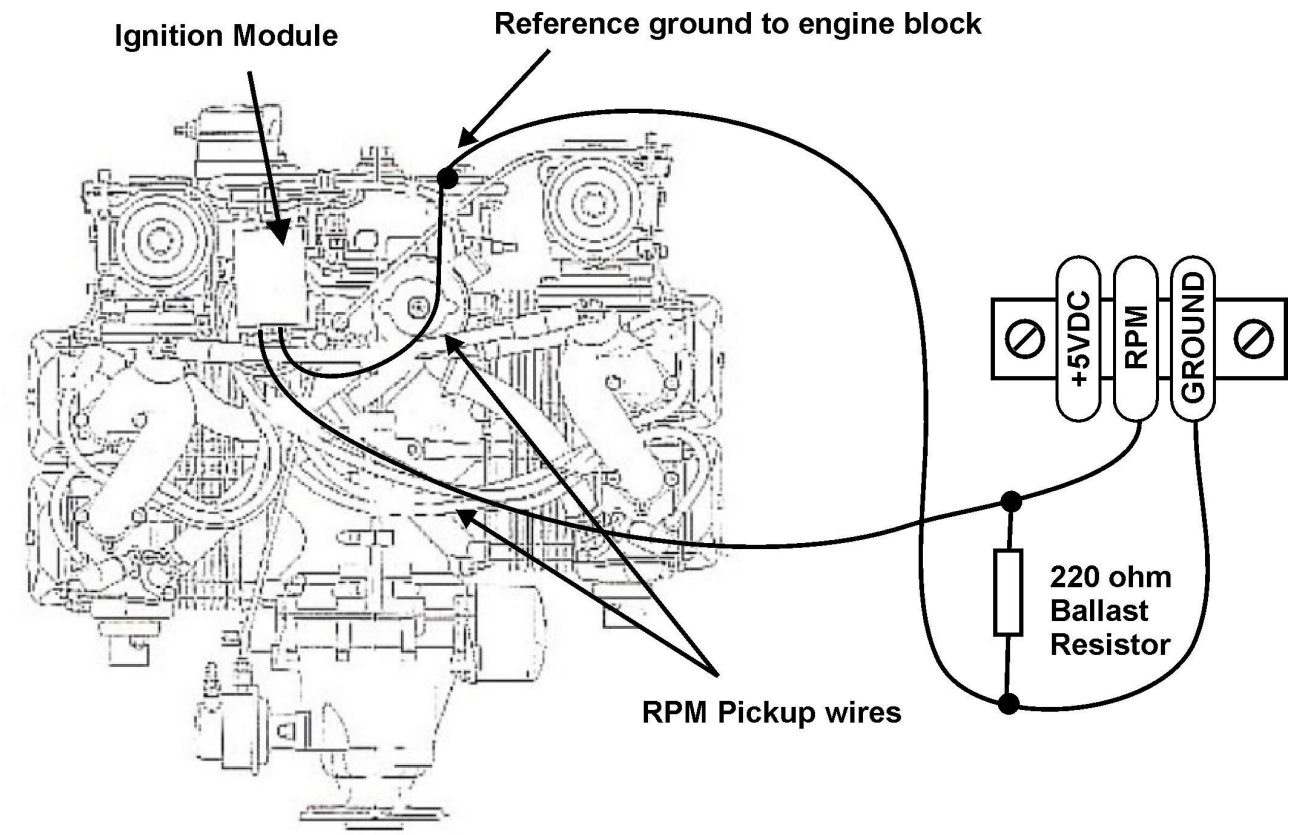
The follow values must be used for the pulses per revolution under the “RPM SETUP” menu.

Rotax 503,582,618 DCDI - value 6.0

Rotax 912,914 - value 1.0

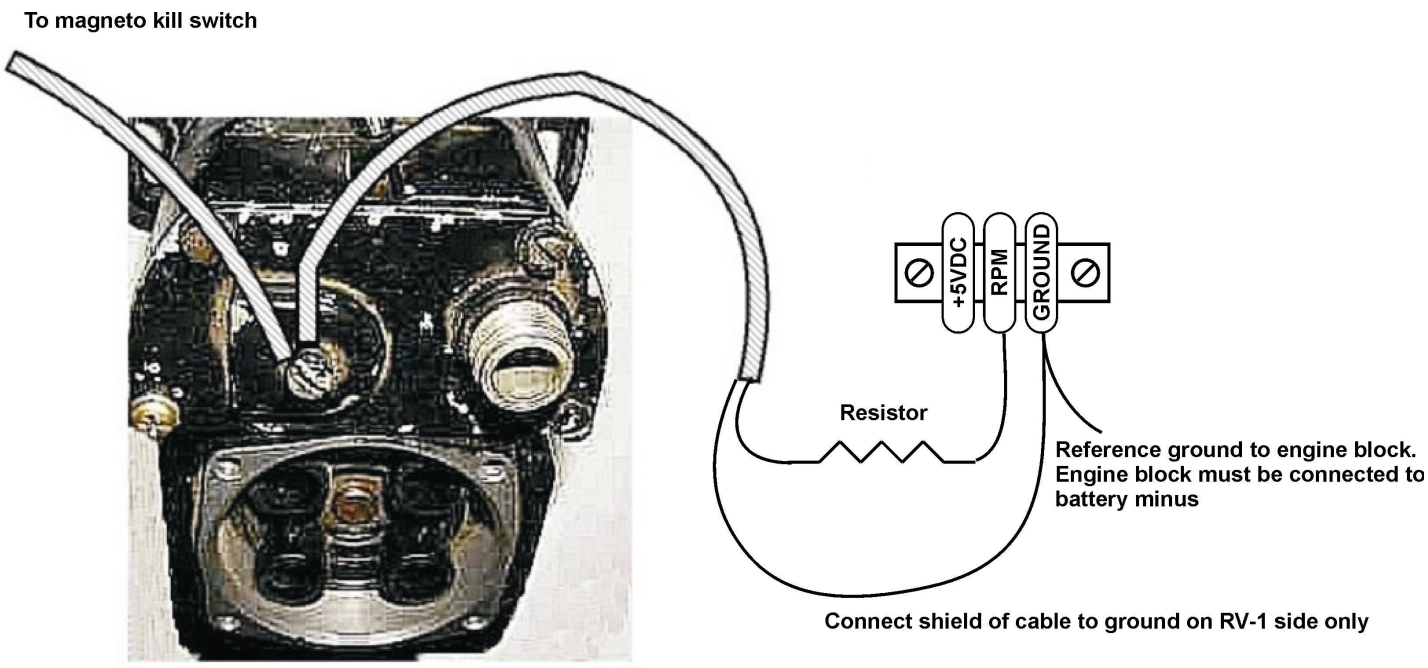
Note: Some Rotax engines may require that a 220 ohm ballast resistor is fitted between the rev counter input and the ground terminal. This resistor should be fitted if you cannot obtain stable RPM throughout the range regardless of any setting of the rev counter sensitivity adjustment.

10.5 Connecting the MAP-3 to a Rotax 912/914



Connect the rev counter wires (blue/yellow and white/yellow) as follows: One of the two wires needs to be connected to ground (engine block), the other to the RPM counter input. For this engine we recommend that you use the supplied 220 ohm ballast resistor. Select a value of 1.0 for pulses per revolution under the “RPM SETUP” menu.

10.6 Connecting a Bendix magneto as a RPM source

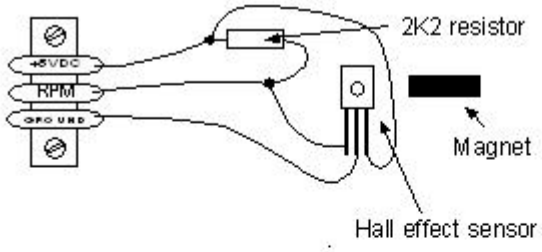


Typical connection to a Bendix P-Terminal. This terminal will have a wire going to your magneto kill switch or starter switch. Please note that various kinds of terminals are used on the many different types of Bendix magnetos

The above drawing shows the connection required if you would like to connect a magneto as RPM source. Shown is a typical Bendix magneto as used on Lycoming and other aircraft engines. You should find a wire connected to a terminal on the magneto that originates from your magneto kill switch (or starter switch). The terminal is often referred to as a “P-terminal”. Connect a wire as shown and connect this to the engine RPM input of the MAP-3. We strongly recommend that a resistor is inserted into your wire as shown. A good value would be 10.000 ohms (10K). A normal 1/4 W resistor is just fine. The above circuit can also be used on other magneto systems such as found on Jabiru and similar engines.

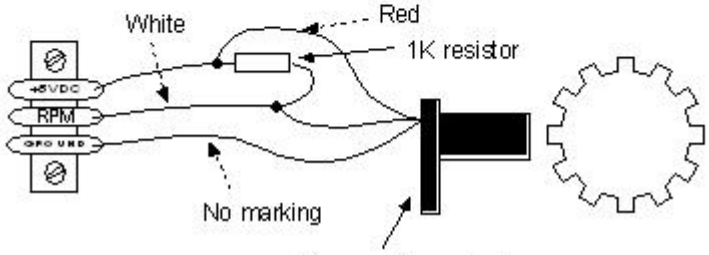
The supplied 220 Ohm ballast resistor should not be used on the above installation.

10.7 Various other pickup / sensor installation possibilities



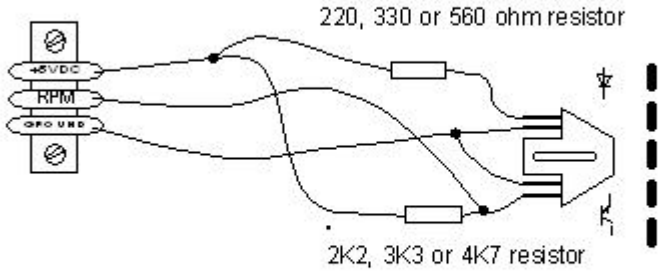
Magnetic pickup with Hall effect sensor

Typical hall effect sensor installation detects the passing of a magnet suitably fixed to prop flanges or shafts.



The gear tooth sensor is a popular pickup used on the pre-rotation gear of a gyro plane (rotor speed indication).

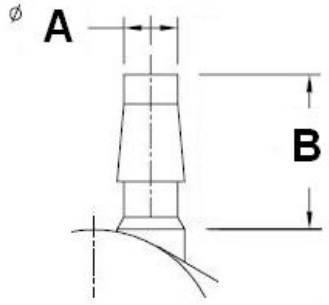
Magnetic pickup with active gear tooth sensor



The optical reflective pickup can provide a simple means of contactless RPM sensing in difficult installations.

Optical, reflective sensor

10.8 Pressure Port Dimensions



	Inches		Millimeters	
	Min	Max	Min	Max
A	0.182	0.194	4.62	4.93
B	0.420	0.440	10.67	11.18

11 Cleaning

The unit should not be cleaned with any abrasive substances. The screen is very sensitive to certain cleaning materials and should only be cleaned using a clean, damp cloth.

Warning: The MAP-3 is not waterproof, serious damage could occur if the unit is exposed to water and/or spray jets.

12 Warranty

This product carries a warranty for a period of one year from date of purchase against faulty workmanship or defective materials, provided there is no evidence that the unit has been mishandled or misused. Warranty is limited to the replacement of faulty components and includes the cost of labor. Shipping costs are for the account of the purchaser.

Damage as a result of applying excessive pressure to the static pressure port are excluded from warranty.

Note: Product warranty excludes damages caused by unprotected, unsuitable or incorrectly wired electrical supplies and or sensors, and damage caused by inductive loads.

13 Disclaimer

Operation of this instrument is the sole responsibility of the purchaser of the unit. The user must make themselves familiar with the operation of this instrument and the effect of any possible failure or malfunction.

This instrument is not certified by the FAA. Fitting of this instrument to certified aircraft is subject to the rules and conditions pertaining to such in your country. Please check with your local aviation authorities if in doubt. This instrument is intended for ultralight, microlight, homebuilt and experimental aircraft. Operation of this instrument is the sole responsibility of the pilot in command (PIC) of the aircraft. This person must be proficient and carry a valid and relevant pilot's license. This person has to make themselves familiar with the operation of this instrument and the effect of any possible failure or malfunction. Under no circumstances does the manufacturer condone usage of this instrument for IFR flights.

IMPORTANT NOTICE:
You must make your own determination if the products sold by MGL Avionics are safe and effective for your intended applications. MGL Avionics makes no representations or warranties as to either the suitability of any of the products we sell as to your particular application or the compatibility of any of the products we sell with other products you may buy from us or anywhere else, and we disclaim any warranties or representations that may otherwise arise by law. Also, we offer no specific advice on how to install any of the products we sell other than passing along anything that may have been provided to us by the manufacturer or other issues. If you are in need of further information or guidance, please turn to the manufacturer, FAA Advisory Circulars and guidance materials, the Experimental Aircraft Association, or other reputable sources.

The manufacturer reserves the right to alter any specification without notice.

Other instruments in the *Stratomaster Vega* series

AHRS-1	Artificial Horizon and Magnetic Compass Indicator
ALT-5	Altimeter and Vertical Speed Indicator (VSI)
ASI-4	Airspeed Indicator (ASI)
ASV-1	Altimeter, Airspeed (ASI) and Vertical Speed Indicator (VSI)
EMS-1	Engine Monitoring System
FF-4	Fuel Computer
INFO-1	Information Display (G-Force meter, UTC and Local Time, Slip Indicator, Outside Air Temperature (OAT), Battery Voltage, Current and charge display, Flight Timer & Flight Log, Stopwatch, Countdown Timer and Alarm)
MAG-1	Magnetic Compass Indicator
MAP-3	Manifold Pressure and RPM Indicator
RPM-1	Universal Engine / Rotor RPM Indicator
TC-4	4 Channel Thermocouple (EGT/CHT) Indicator
TP-3	4 Channel Universal Analog Input (Pressure/Temperature/Current/Volts) Indicator