# Stratomaster Maxi Single

# E1

## Universal engine monitor



The E1 universal engine monitor combines in one compact 3.5" format instrument all that is needed to monitor most smaller aircraft engines from two-stroke ultralight engines to medium sized four strokes such as from Rotax, Continental and Lycoming.
Also most automotive engine conversions can benefit from the use of the E1 engine monitor.
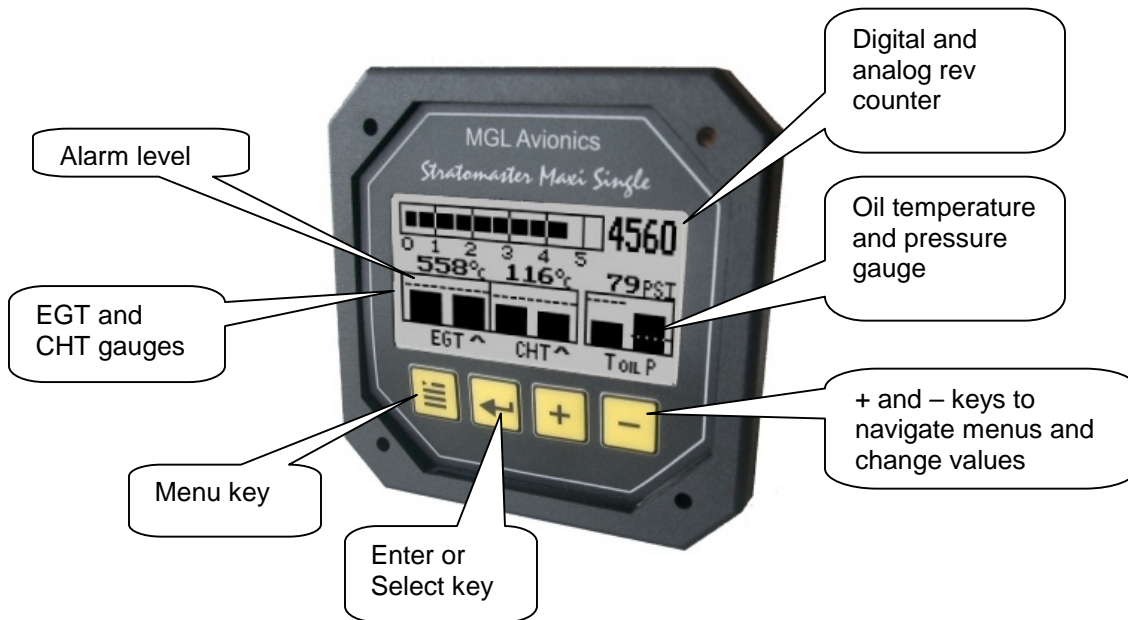
The E1 offers the following abilities:

1) Universal, programmable rev counter (engine RPM) with digital and analog readout.
2) Programmable engine hobbs meter and running timer (flight timer).
3) Up to four thermocouple channels for EGT and CHT probes, fully programmable.
4) A water temperature or oil temperature monitor.
5) Oil pressure monitor.
6) Rotax 912/914 mode with up to four EGT and support for the two built in CHT sensors.

All temperature monitors have user programmable alarm levels, oil temperature and water temperature have both low and high temperature alarms. Oil pressure has both high and low pressure alarms.
Many different probe types can be supported.

## Layout of display and controls



Digital and analog rev counter

Alarm level

Oil temperature and pressure gauge

EGT and CHT gauges

+ and – keys to navigate menus and change values

Menu key

Enter or Select key

## Operating alarms

The E1 has two different alarm levels, one indicates on the display by means of flashing the affected item, the second level activates the external alarm.
External alarms are usually wired to a suitable alarm lamp.
Once a new alarm condition is found, the external alarm is activated which switches on the alarm light. At the same time the affected item on the screen will flash.
The pilot can acknowledge the alarm by pressing any key, this will deactivate the external alarm and switch the alarm light off.
The item that caused the alarm will however continue to flash on the display until the alarm condition no longer exists.
Should a new alarm condition appear, the external alarm will again become active.

## Setting up the E1

Before the E1 can be used with your engine, you need to setup the instrument so it knows what to measure and how to display this.
Basic setup involves the following steps:

a) Select the operating mode – this will select what you want to monitor, for example if you have a Rotax 582 water cooled two stroke engine you may want to monitor two EGT channels as well as the water temperature. The rev counter is always selected so you do not need to choose it.
b) Select the Ranges – here you select what ranges to use for the various bargraphs. Staying with the Rotax 582, you will select a Range of perhaps 700 degrees C for the EGT channels and 90 degrees C for the water temperature. 7000 RPM would be a good choice for the engine rev bargraph.

c) Set up the alarm limits. For the Rotax 582 you would choose 650 degrees C for the EGT and perhaps 85 degrees C for the water temperature. You might also decide to monitor the low limit of the water temperature. For this engine, you could choose 55 degrees C.
d) Enable the alarms. Staying with this example, enable the EGT alarm and both water temperature high and low alarms.
e) Select your probe type. For the rev counter you would select 6.0 pulses per revolution if you are connecting to the grey rev counter wire on the DCDI system. For the water temperature you would most likely use the MGL type if you bought your probe from MGL Avionics.

The following text describes the menu system.

Press the Menu key to enter the menu. You can move forward and backwards in the menu by using the + and – keys. To change or select a menu item, move the highlight to the desired item and then press the Select (Enter) key. To end an edit or function, press the Menu key again.

To exit the menu and continue normal operation, press the Menu key again.
Note: all changes done will only be stored if you exit the Menu and return to the main display.
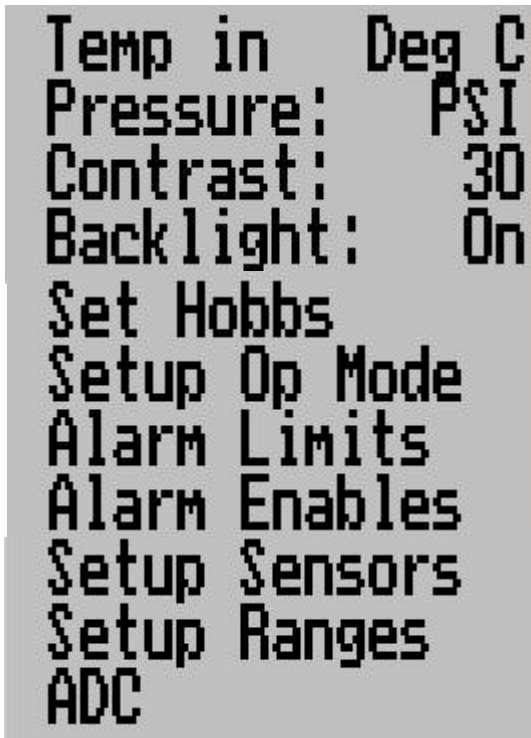


This image shows the available main menu entries. These are described in detail in the next pages.

## Temp in …

Choose your temperature units. You can select Degrees Celsius or Degrees Fahrenheit.

## Pressure:

This setting allows you to select the unit of pressure in BAR or PSI. Ignore this if you are not going to use the oil pressure gauge.

## Contrast …

This function allows you to change the display contrast to your liking. You can select values from about 15 to 45. Most common values are around 30.

## Backlight …

This function allows you to switch the display backlight on or off. You can reduce the current consumption of the E1 if you switch the backlight off. This may be of interest if you use the instrument on a small battery of limited capacity.

## Set Hobbs

This function allows you to set the hobbs meter to your current engine running time.

```
0312:10
^^
```

Use the plus and minus buttons to change the indicated part of the hobbs reading. Use the Select button to change from hour hundreds to hours to minutes.
When you are done, press the Menu button to exit the function.

## Setup Op Mode

This function allows you to select the basic mode of operation of your instrument. You can choose from a large number options. Select the number of CHT and EGT channels to use, if you need to monitor water temperature or oil temperature and pressure.

You will see a display similar to the one shown here that shows one of the modes. Simply use the plus and minus keys to select your desired mode. If you cannot find the exact mode required, choose the nearest possible one. Press the menu key to exit this function.

```
Operating mode
   selection

    4xEGT
Oil temperature
  Oil pressure

Select with +/-
```
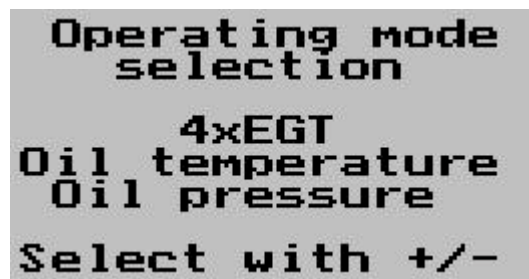
**Rotax 912/914 mode**
One of the supported modes is specifically designed to support the Rotax 912 and Rotax 914 engine models. In this mode the screen is setup as follows:
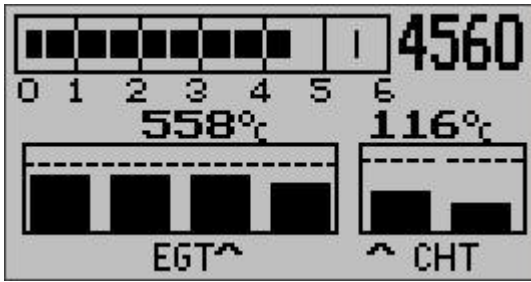
 Rotax 912/914 mode display.

In this mode the oil/water temperature input becomes CHT channel one and the oil pressure input becomes CHT channel two.

In order to correctly display the CHT temperatures using the standard Rotax CHT probes you will use the setups for the oil temperature. Ths reason for this is that the sensors that Rotax uses for this are standard NTC temperature probes.

In the sender setup you will select the "Rotax" temperature sender type. You will use the oil temperature alarm enables and limits. You will also use the oil temperature span setup to configure the range of your bargraph.

We suggest the following settings for the Rotax engines:
CHT (oil) Temperature high limit: 135 degrees C.
CHT (oil) Temperature low limit: Off.
CHT (oil) Temperature span: 150 degrees C.
EGT alarm limit: 850 degrees C.
EGT span: 900 degrees C.
RPM Span: 6000 RPM.

## Alarm limits

This function allows you to select the individual alarm limits for each measured item.
For EGT and CHT channels you can select the level above which the alarm will activate. For all other items you can select both upper and lower alarm limits.
You may want to use the lower temperature alarm limits to indicate if your coolant or oil is at a too low temperature.



Should the alarm limit fall in the displayable area of the bargraph, it will be shown using a dotted line.
Check your bargraph ranges (spans) in the relevant setup function.

## Alarm Enables

In this function you enable and disable every individual alarm type. If you disable an alarm, it will never activate.

```
EGT Alarm      ON        OILT High      ON
CHT Alarm      ON        OILT Low      OFF
H2O High       ON        OILP High     OFF
H2O Low       OFF        OILP Low       ON
```

## Setup Sensors

This function allows you to select various sensor types that you can connect to the E1.

```
RPM calib    6.0
TProbe:    Rotax
OP Res:      200
OP max:      100
PR dir       INC
```

### RPM Calib

Enter the number of pulses per revolution that your engine produces.
You can enter fractions of a pulse in case of engines that generate a non-integer number of pulses per revolution.

Typical settings:

Rotax 503,582 DCDI – 6.0
Rotax two stroke Single ignition 1.0 or 2.0.
Rotax 912,914 – 1.0
Most other four strokes: 1.0 or 2.0 depending on number of cylinders

### Tprobe:

Choose the probe type that you are using for the water or oil temperature gauge.
You can choose from the following:

MGL: This is a TS920 or TS921 type NTC sender, commonly used for water temperature
Rotax: This is a VDO oil temperature sender. It is often also used for water temperature
LM335: This is a semiconductor sender type made by MGL Avionics. It can be used for both water and oil temperature and has a large range.
Westach: This is a probe made by the company Westach for both oil and water temperature

### OP Res:

Here you enter the full span resistance of the oil pressure sender. Oil pressure measurement is based on most VDO senders. These have a resistance of 200 ohms full span.
You can select resistance spans from 50 to 1000 ohms.

**OP Max:**

Enter the maximum Pressure reading for your sender. Most senders have a 10 Bar rating, some models go to only 5 Bar.

If your senders resistance increases with pressure, enter the pressure that the sender will be exposed to if a resistance equal to the value you have entered above is reached.

If your senders pressure decreases with pressure, this is the pressure that should be indicated if the sensor reads close to zero ohms resistance. As the sensor reaches the resistance entered above, a pressure of zero is assumed.

**OP DIR**

Select if your oil pressure senders resistance increases or decreases with pressure.
Most senders increase resistance as pressure increases but there are some models available that operate inverse to this.


Typical oil pressure sender setup:

The oil pressure sender used in Rotax 912 engines is typical for most senders. This sender requires the following setup:
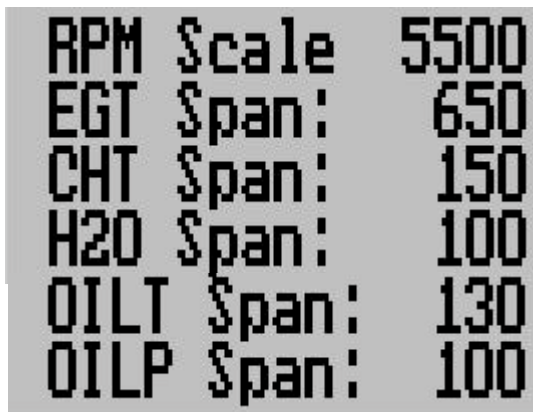
OP Res: 200
OP Max: 10.0
OP DIR INC

## Setup Ranges

This function allows you to setup the bargraph ranges.
Bargraphs for temperatures will start at a temperature that is equal to ½ of the selected span while the bargraph for pressure will always start at zero.

Example:

With EGT Span set to 700 degrees, the bargraph will start rising if the temperature exceeds 350 degrees. The bargraph will reach the top of its area when the temperature is 700 degrees or more.

```
RPM Scale  5500
EGT Span:   650
CHT Span:   150
H2O Span:   100
OILT Span:  130
OILP Span:  100
```

The oil pressure span is entered in steps of 0.1 bar (or the equivalent PSI).

Typical spans:

Four stroke engines: 900 degrees C, alarm at 850 degrees C.
Two stroke engines: 700 degrees C, alarm at 650 degrees C.
Water temperature: 110 degrees C, alarm at 95 degrees C.
Oil temperature: 150 degrees C, alarm at 135 degrees C.
Oil pressure: 7.0 bar, low alarm at 2 bar.

Consult your engine manual on the required limits for your engine.

## ADC

This function is for technical personal. It is not used for ordinary operation of the unit. This function can be accessed if both "+" and "-" are pressed at the same time as the instrument is switched on.

Technical specifications:

Display temperature range (operational): -20 to +80 degrees C
Supply voltage: +8 to +18V. +24/28V with optional pre regulator.
Supply current: 30mA/90mA (backlight off/on)
Thermocouples: K-type
Measurement range: 0 to 1200 degrees C
Technology: Fully cold junction compensated using precision internal temperature reference.
Measurement accuracy: +/- 5 degrees typical over full temperature range, subject to quality of probe used. We recommend Stratomaster EGT and CHT probes.
Measurement interval:  0.5 seconds (all channels). 1000 samples/second, DSP noise filter.
Inputs: Differential, can use grounded and isolated probes.
Common mode voltage range: -2V to +3V
Temperature input: NTC or LM335, types as per setup document
Pressure input: VDO or equivalent pressure sender, resistance rises with pressure.
Resistance range 50-1000 ohm selectable for 10 bar pressure.
Alarm contact:
Maximum permissible current through alarm output: 500mA.
Typical load for alarm: 12V/1W lamp.
Weight: 190 grams

Warranty:
MGL avionics warrants their products for a period of one year from date of purchase against faulty workmanship. Warranty is limited to the replacement of faulty components and includes the cost of labor. Shipping costs are for the account of the purchaser.

Note for operation on supplies with inductive loads:

Any operation of electronic instrumentation on power supplies that are subject to high voltages caused by operation of inductive loads (starter motors, solenoids, relays) are required to be fitted with suitable protection.
All Smart Singles are guaranteed to withstand temporary over voltage up to 40V without additional protection. We recommend that measures are taken to prevent voltage transients in excess of this limit.
MGL Avionics recommends the fitment of a fuse in line with a 33V transorb (available from MGL Avionics at low cost) to protect electronic instruments, radios and intercom systems. Only one such arrangement is required for a cluster of instruments.
Please note that product warranty excludes damages caused by unprotected, unsuitable or incorrectly wired electrical supplies.

# Installation of the E1

The drawing on the following page shows the connections required to operate the E1.

The Thermocouple channels are labeled TC1 to TC4.
In cases of mixed use of these channels, the lower numbered channels are used for EGT while the higher numbered are used for CHT probes.
If only two probes of mixed use are used, TC1 is for EGT and TC2 is used for CHT.
In cases where two channels are used only TC1 and TC2 are used.

Connect probes according to the colors of the wires. MGL probes. Supplied probes are marked with a yellow and a red lead.
If you use other probes and are not certain of their polarity, simply connect one up as TC1 and switch on the instrument. Warm the probe using your hand. If the indicated temperature decreases you need to change the polarity around.

Shown is typical wiring used to connect a 12V lamp as external alarm indicator. If you have more than one instrument you can wire all contacts in parallel so you can use a single lamp if so desired.

Power supply here assumes a 12V DC source. It is recommended to install suitable protection against over voltage such as can be generated by solenoids and starter motors

Be sure to install a reference connection between the minus terminal of the instrument and the engine block. If the engine block is not connected to a good reference, readings may show large errors. This reference connection must not be used as ground line for other current users. A straight, good quality connection is required that is not shared with anything else.

Some RPM pickups may require loading with a ballast resistor, if this is the case for your engine, connect as required.

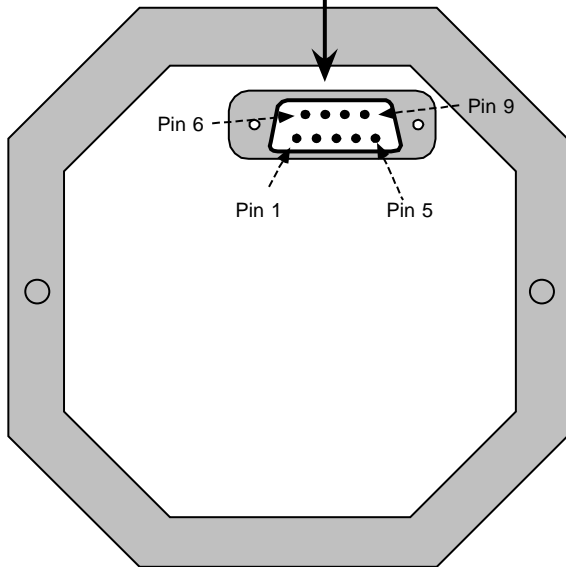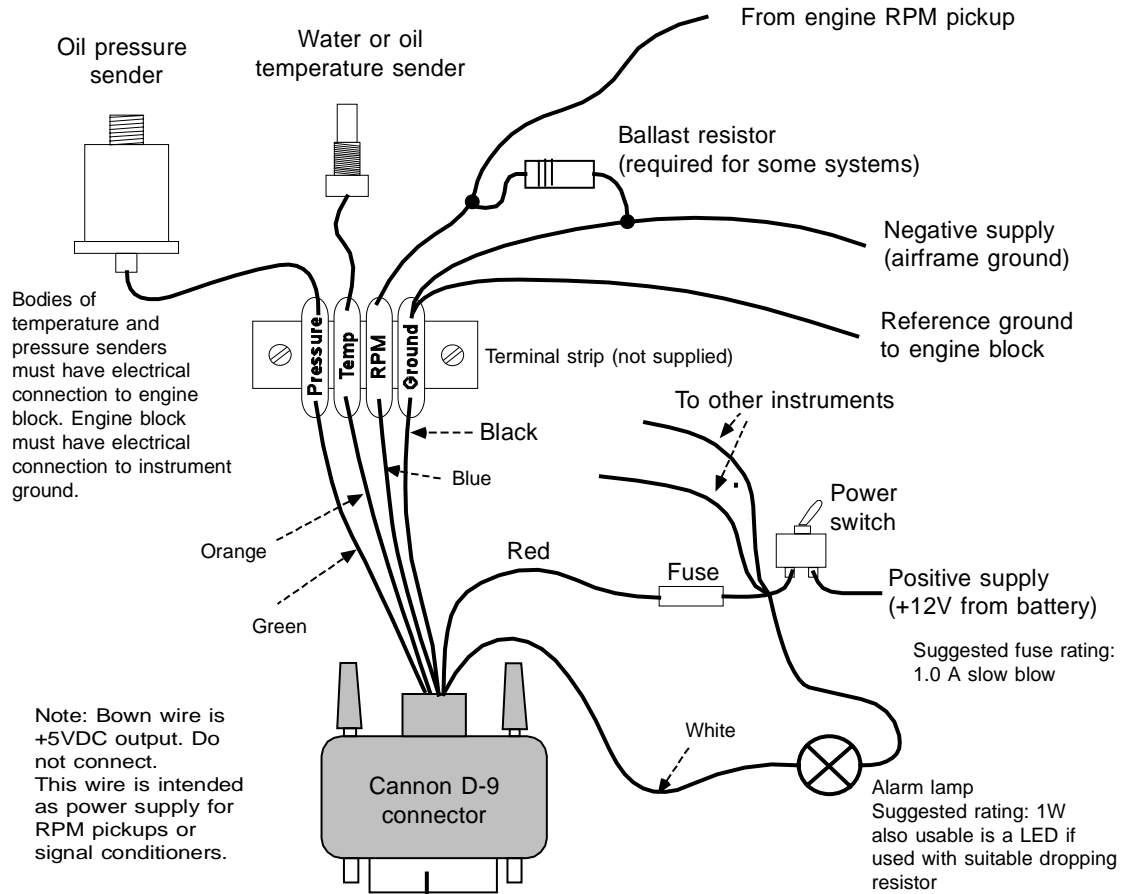**Extending leads of probes and senders**

Thermocouple leads as used with the EGT and CHT probes can be extended either with ordinary copper cable or with special K-Type extension cable. The choice of either depends on your desired accuracy.
If it is possible in your installation to ensure that both ends of a copper extension cable will be at the same temperature (or very close), then it is quite possible to use the copper cable. In most open-air installations this will be the case.
Should this not be possible or you require best possible accuracy at all times, you can obtain a special K-type extension cable. This cable is made from the same metals as your probes cable but uses ordinary plastic sleeving to save costs.
In either case, ensure that the cable is not routed close to sources of electromagnetic interference of any kind. The voltages present in this cable are very small and are subject to changes applied by external fields. This can lead to false temperature indications.
You can check your installation by using a hand-held transmitter, such as an airband radio. If you transmit a signal, no change in temperature reading should occur.

Oil pressure
sender

Water or oil
temperature sender

From engine RPM pickup

Ballast resistor
(required for some systems)

Negative supply
(airframe ground)

Reference ground
to engine block

Bodies of
temperature and
pressure senders
must have electrical
connection to engine
block. Engine block
must have electrical
connection to instrument
ground.

Pressure   Temp   RPM   Ground

Terminal strip (not supplied)

Black

Blue

To other instruments

Orange

Green

Red

Fuse

Power
switch

Positive supply
(+12V from battery)

Suggested fuse rating:
1.0 A slow blow

Note: Bown wire is
+5VDC output. Do
not connect.
This wire is intended
as power supply for
RPM pickups or
signal conditioners.

White

Cannon D-9
connector

Alarm lamp
Suggested rating: 1W
also usable is a LED if
used with suitable dropping
resistor

Pin 6

Pin 9

Pin 1

Pin 5

Cannon D-9 connector
pin mapping and cable colors

1 - ground - Black
2 - temperature probe - Orange
3 - oil pressure - Green
4 - not used
5 - RPM pickup - Blue
6 - power (+12V) - Red
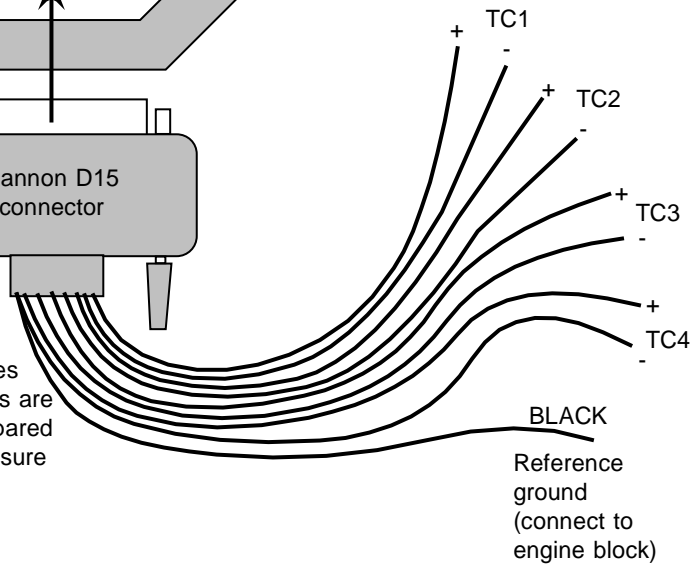7 - power out - Brown (do not connect)
8 - not used
9 - alarm output -White
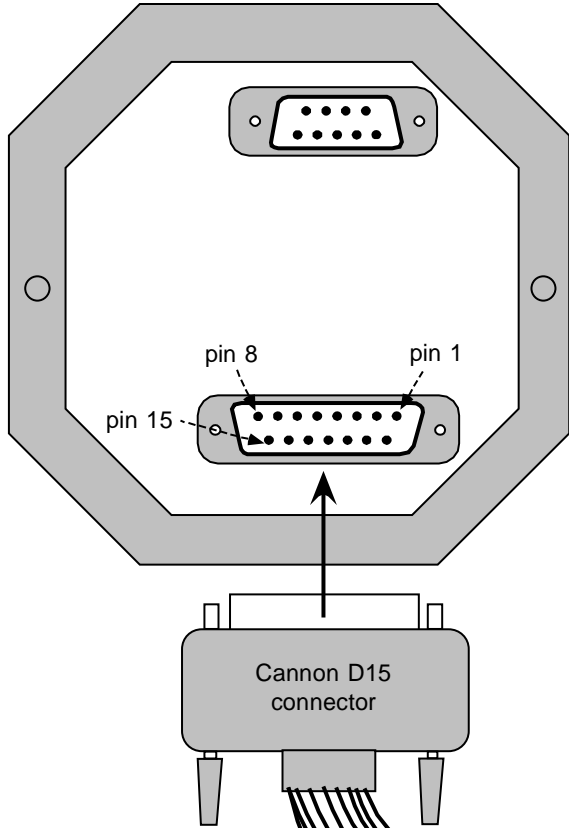
Thermocouple input wire codes

Blue ----------- - TC1 +    pin 1
Brown ---------- - TC1 -    pin 2
Green ---------- - TC2 +    pin 3
Purple --------- - TC2 -    pin 4
Yellow -------- - TC3 +    pin 5
Grey ------------ - TC3 -    pin 6
Orange ------- - TC4 +    pin 7
Pink ----------- - TC4 -    pin 8
Black ---------- - Ground    pin 15

In case of MGL K-type
probes:

+ = Yellow probe lead
- = Red probe lead

pin 8          pin 1

pin 15

Cannon D15
connector

Join instrument wires to probe wires
close to instrument so the junctions are
at a very similar temperature compared
to the D-15 connector. This will ensure
maximum possible accuracy.

+ TC1
-

+ TC2
-

+ TC3
-

+ TC4
-

BLACK

Reference
ground
(connect to
engine block)