



# TP-1

## Dual channel universal Temperature / Pressure Gauge

Operating Manual – English 1.10



## Introduction

The TP-1 is a 2 1/4" dual channel temperature/pressure gauge with universal inputs that can interface to many sensors such as oil temperature, coolant temperature, oil pressure, fuel pressure, manifold pressure, boost pressure and many more.

The TP-1 gauge can be setup for a single, dual or combination temperature / pressure display.

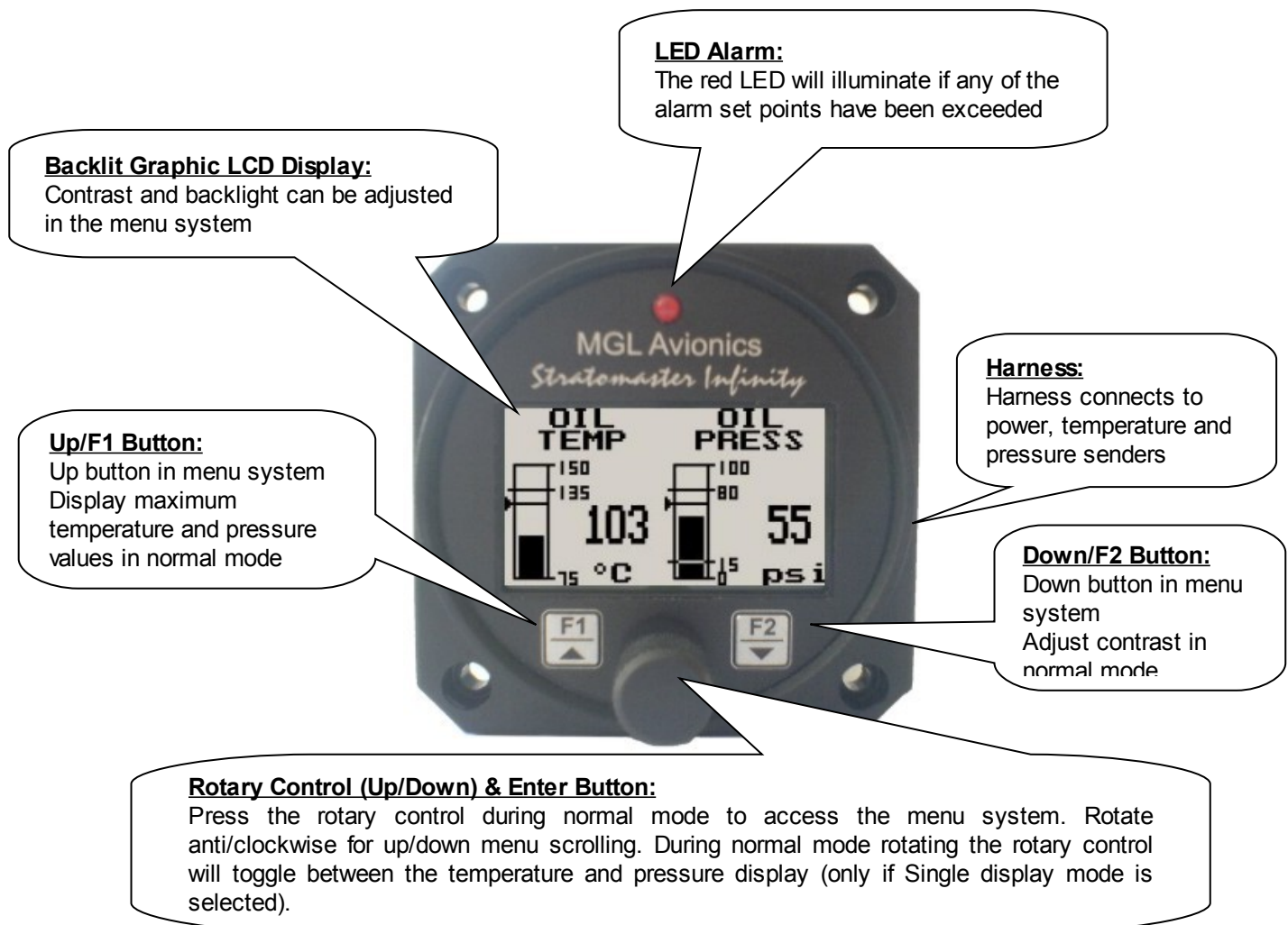
Temperature can be measured using standard automotive resistive senders (e.g. VDO, Westach) as well as the MGL Avionics precision LM335 semiconductor sensor. Pressure can be measured using standard automotive resistive senders (e.g. VDO 2,5 and 10 Bar), Rotax 4-20mA senders as well as 0-5V output pressure senders (e.g. UMA). In addition the temperature and pressure inputs can be programmed to a user defined curve for custom senders.

Both the temperature and pressure readings have a programmable low and high alarm. This results in a contact closure that is typically used to switch a warning lamp on. The TP-1 also records the maximum temperature and pressure values reached in permanent memory.

## 1 Features

- Dual channel universal input temperature and pressure gauge
- Temperature can be measured using standard automotive resistive senders (e.g. VDO, Westach) as well as the MGL Avionics precision LM335 semiconductor sensor
- Pressure can be measured using standard automotive resistive senders (e.g. VDO 2,5 and 10Bar), Rotax 4-20mA senders as well as 0-5V output pressure senders (e.g. UMA)
- Temperature and pressure inputs can be programmed to a user defined curve for custom senders
- Can be setup for a single, dual or combination temperature / pressure display.
- Both temperature and pressure readings have a programmable low and high alarm
- Records maximum temperature and pressure reached in permanent memory
- Supports Rotax 4-20mA pressure sender as used in 912/914 engines
- 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
- External alarm output as well as a red LED illuminates when the alarm has been activated
- Large backlit graphic LCD with adjustable contrast
- Wide input supply voltage range of 8 to 30V DC with built in voltage reversal and over voltage protection for harsh electrical environments
- Light weight design
- 1 year limited warranty

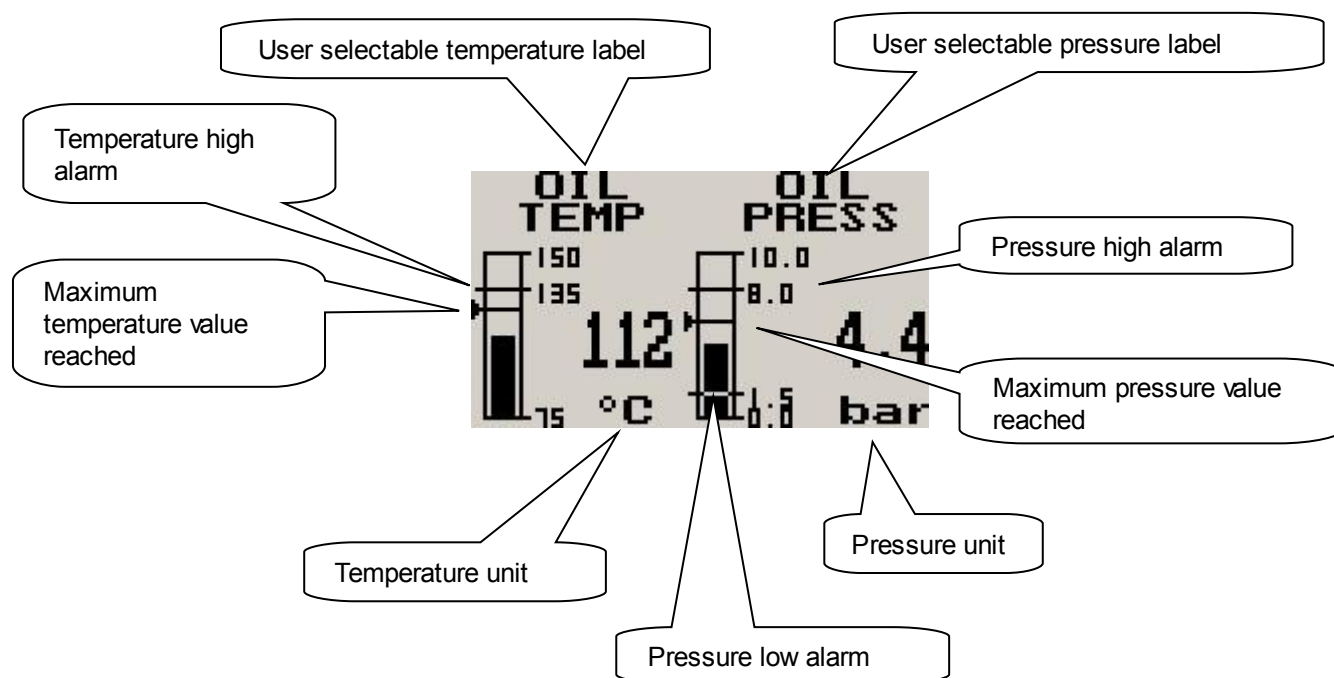
## 2 TP-1 Layout



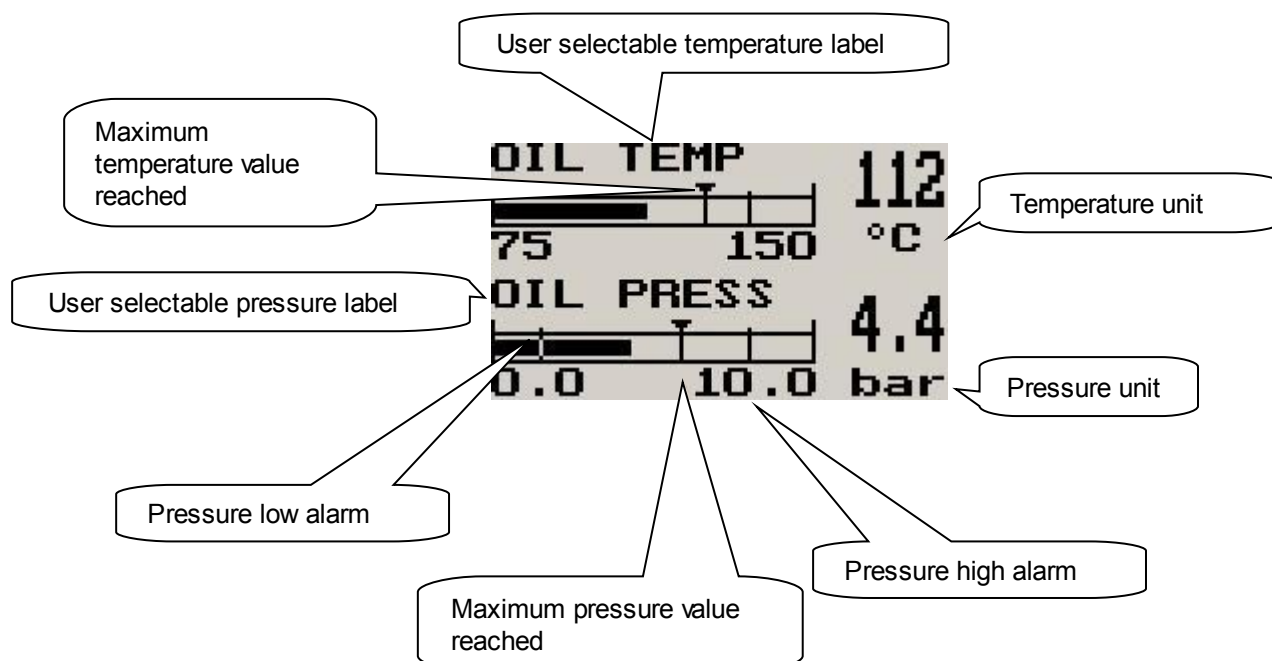
### 3 Main Display

The TP-1 has 4 different temperature/pressure display screens. These screens can be setup under the “DISPLAY SETUP” menu option. The display can be setup to display pressure and temperature as vertical or horizontal bar graphs as well as dual or single displays. If the TP-1 is setup to display single values then rotating the rotary control will toggle between the temperature and pressure displays.

#### Display Mode 1: Dual/Vertical mode

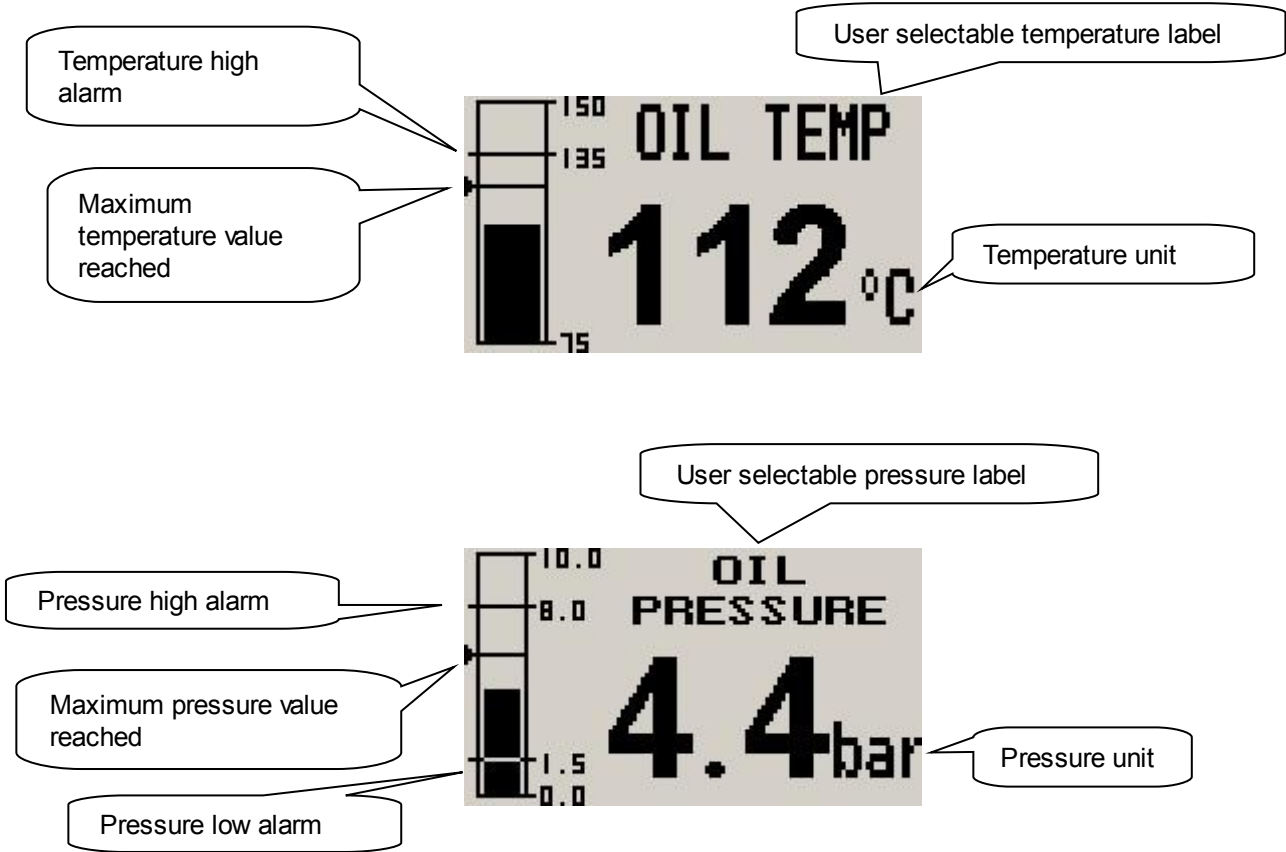


#### Display Mode 2: Dual/Horizontal mode



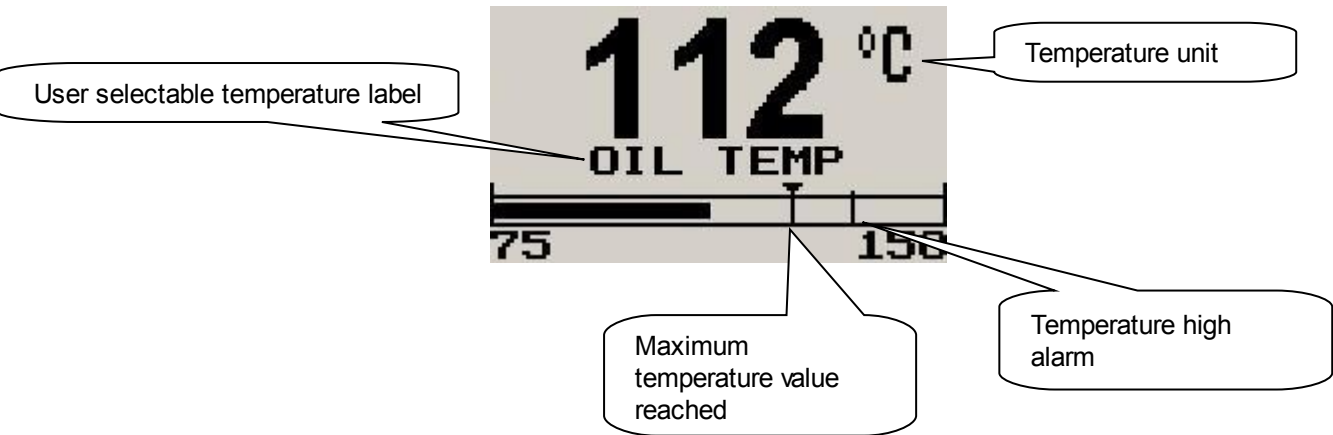
Display Mode 3: Single/Vertical mode

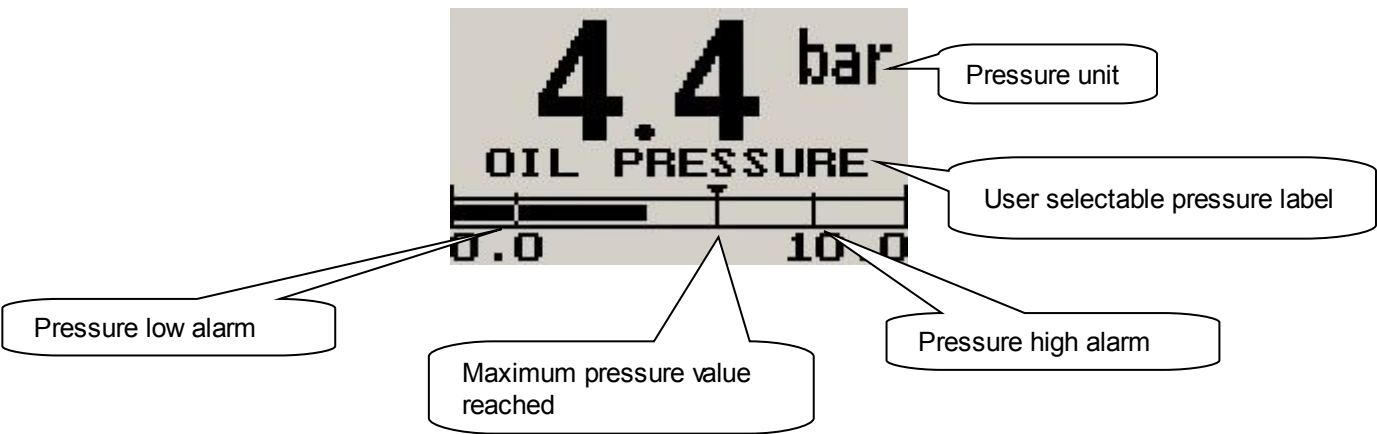
You can toggle between temperature and pressure by rotating the rotary control.



Display Mode 4: Single/Horizontal mode

You can toggle between temperature and pressure by rotating the rotary control.





### 3.1 Permanent maximum values display

This display can be accessed by pressing the F1 key during the normal display mode. Pressing the F1 key again will reset the permanent maximum values to the current temperature and pressure values. Pressing any other key will cause the TP-1 to return to the normal display mode. To avoid false recordings, the maximum values function is only activated 10 seconds after the instrument has powered up.



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

### 3.2 Contrast display

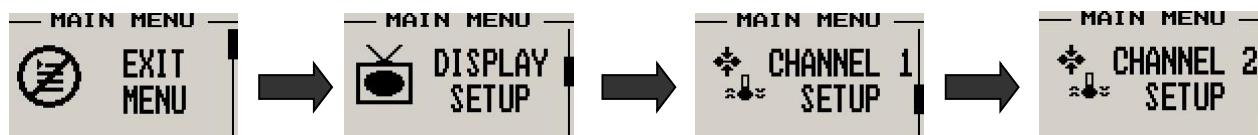
This display can be accessed by pressing the F2 key during the normal display mode. This is a quick access key to the same contrast menu as in the menu system.



Use the up and down keys or the rotary control to adjust the display contrast.

## 4 Menu System

Pressing the rotary control button during the normal display mode will cause the TP-1 to enter the menu system. Use the up/down keys or the rotary control to navigate through the menu system.



### 4.1 Exit Menu

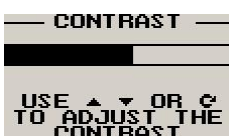
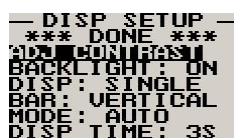


Pressing the rotary control on this menu item will cause the TP-1 to exit the menu system. All changes made during navigation of the menu system will be saved in non-volatile memory on exiting the menu system. If you remove power before exiting the menu the instrument will not save any changes.

### 4.2 Display Setup



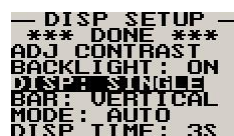
Move the highlight over this menu item and press the rotary button to return to the main menu.



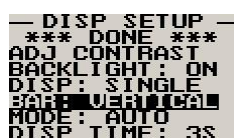
Select this menu option to adjust the display contrast.



Select this menu option to turn the backlight on or off.



If "SINGLE" is selected then only temperature or pressure is shown at one time. If "DUAL" is selected then both temperature and pressure are shown on the same screen.



Select whether you want the temperature and pressure bar to be shown vertically or horizontally.



Select whether you want the single temperature/pressure display to alternate automatically or manually. This display is only shown if display mode is setup to show "SINGLE".

```

— DISP SETUP —
*** DONE ***
ADJ CONTRAST
BACKLIGHT: ON
DISP: SINGLE
BAR: VERTICAL
MODE: AUTO
DISP TIME: 33

```

Set the time that the single display modes must be displayed for. This display is only shown if auto is selected for the display mode.

## 4.3 Channel 1 / Channel 2 Setup

The TP-1 can be setup to display temperature or pressure for each individual input channel.

```

— MAIN MENU —
* CHANNEL 1
* SETUP

```

```

— MAIN MENU —
* CHANNEL 2
* SETUP

```

Setup is shown for Channel 1, Channel 2 is identical in setup

```

— CHANNEL 1 —
*** DONE ***
MODE: PRESSURE
TYPE: RESISTIVE
SENDER: VDO
MODEL: 10 BAR
LABEL: OIL
UNIT: BAR

```

Move the highlight over this menu item and press the rotary button to return to the main menu.

```

— CHANNEL 1 —
*** DONE ***
MODE: PRESSURE
TYPE: RESISTIVE
SENDER: VDO
MODEL: 10 BAR
LABEL: OIL
UNIT: BAR

```

```

— CHANNEL 1 —
*** DONE ***
MODE: TEMP
SENDER: VDO
LABEL: OIL
UNIT: °C
SPAN: 150 °C
TOPSCALE: ON

```

Select what type of sender is connected to the input channel. Select between pressure, temperature or off.

### 4.3.1 Pressure Setup

```

— CHANNEL 1 —
*** DONE ***
MODE: PRESSURE
TYPE: RESISTIVE
SENDER: VDO
MAX RES: 180Ω
MAX PRESS: 10.0
SENDER DIR: INC

```

Select if you are using a resistive, 4-20mA or 0-5V output pressure sender.

#### If the “Resistive” pressure sender is selected

```

— CHANNEL 1 —
*** DONE ***
MODE: PRESSURE
TYPE: RESISTIVE
SENDER: VDO
MODEL: 10 BAR
LABEL: OIL
UNIT: BAR

```

Select what type of resistive pressure sender you are using. Select “VDO” for VDO / resistive senders, “USER” for a custom sender.

```

— CHANNEL 1 —
*** DONE ***
MODE: PRESSURE
TYPE: RESISTIVE
SENDER: VDO
MODEL: 10 BAR
LABEL: OIL
UNIT: BAR

```

Select which VDO pressure sender you are using. A selection between a VDO 2, 5 or 10 Bar can be selected.

#### If the “0-5V” pressure sender is selected

```

— CHANNEL 1 —
*** DONE ***
MODE: PRESSURE
TYPE: 0-5V
SENDER: UMA
MODEL: TIE007
LABEL: OIL
UNIT: BAR

```

Select the type of 0-5V sender used. Select “UMA” for UMA senders or “USER” for a custom 0-5V sender.



```

CHANNEL 1
*** DONE ***
MODE: PRESSURE
TYPE: 0-5V
SENDER: UMA
MODE: 7PSI
LABEL: OIL
UNIT: BAR

```

For UMA senders select the UMA model number.

## If the “4-20mA” pressure sender is selected

Please note that only 1 4-20mA pressure sender can be interfaced to the TP-1.

```

CHANNEL 1
*** DONE ***
MODE: PRESSURE
TYPE: 4-20mA
SENDER: ROTAX
PRES 4mA: 0.0
PRES 20mA: 10.0
LABEL: OIL

```

Select the type of 4-20mA sender used. Select “ROTAX” for Rotax 912/914 sender or “USER” for a custom 4-20mA sender.

```

CHANNEL 1
*** DONE ***
MODE: PRESSURE
TYPE: 4-20mA
SENDER: ROTAX
PRES 4mA: 0.0
PRES 20mA: 10.0
LABEL: OIL

```

Enter the pressure specified at 4mA output.

```

CHANNEL 1
*** DONE ***
MODE: PRESSURE
TYPE: 4-20mA
SENDER: ROTAX
PRES 4mA: 0.0
PRES 20mA: 10.0
LABEL: OIL

```

Enter the pressure specified at 20mA output.

## If the “User” pressure sender is selected

```

CHANNEL 1
*** DONE ***
MODE: PRESSURE
TYPE: RESISTIVE
SENDER: USER
CAL SENDER
LABEL: OIL
UNIT: BAR

```

A custom sensor can be interfaced to the TP-1. This sensor can be a resistive, 4-20mA or 0-5V sender.

```

PRESS: 661
*** DONE ***
POINTS: 10
DISPLAY 1: 010
ADC 1: 1000
DISPLAY 2: 020
ADC 2: 0900
DISPLAY 3: 030

```

If the sender type is set to “USER”, then use this menu option to calibrate your pressure sender. See section 4.3.3 for more information.

## Menu options for all sender types

```

CHANNEL 1
*** DONE ***
MODE: PRESSURE
TYPE: RESISTIVE
SENDER: UDO
MODEL: 10 BAR
LABEL: OIL
UNIT: BAR

```

Choose one of a selection of labels to suit your pressure input so you can identify it easily.

```

CHANNEL 1
*** DONE ***
MODE: PRESSURE
TYPE: RESISTIVE
SENDER: UDO
MODEL: 10 BAR
LABEL: OIL
UNIT: BAR

```

Select whether you want to display the pressure in Bar, PSI or PSI(0.1). The PSI(0.1) is for low range pressure senders e.g. UMA 7PSI.

```

CHANNEL 1
MODE: PRESSURE
TYPE: RESISTIVE
SENDER: UDO
MODEL: 10 BAR
LABEL: OIL
UNIT: BAR
SPAN: 10.0 BAR

```

Set the range of the pressure sender. This is the maximum that the bargraph display will go to.

```

CHANNEL 1
TYPE: RESISTIVE
SENDER: UDO
MODEL: 10 BAR
LABEL: OIL
UNIT: BAR
SPAN: 10.0 BAR
UPSCALE: OFF

```

This allows the user to zoom into the top half of the bar graph resulting in a higher display resolution. This option set to “ON” is recommended.



```

— CHANNEL 1 —
SENDER: VDO
MODEL: 10 BAR
LABEL: OIL
UNIT: BAR
SPAN: 10.0 BAR
TOPSCALE: OFF
LOW ALARM: ON

```

Select whether to use the low pressure alarm.

```

— CHANNEL 1 —
MODEL: 10 BAR
LABEL: OIL
UNIT: BAR
SPAN: 10.0 BAR
TOPSCALE: OFF
LOW ALARM: ON

```

Use this to set the low pressure alarm set-point.

```

— CHANNEL 1 —
LABEL: OIL
UNIT: BAR
SPAN: 10.0 BAR
TOPSCALE: OFF
LOW ALARM: ON
LOW ALM: 1.5
HIGH ALARM: ON

```

Select whether to use the high pressure alarm.

```

— CHANNEL 1 —
UNIT: BAR
SPAN: 10.0 BAR
TOPSCALE: OFF
LOW ALARM: ON
LOW ALM: 1.5
HIGH ALARM: ON
HIGH ALM: 3.0

```

Use this to set the high pressure alarm set-point.

### 4.3.2 Temperature Setup

```

— CHANNEL 1 —
*** DONE ***
MODE: TEMP
SENDER: VDO
LABEL: OIL
UNIT: °C
SPAN: 150 °C
TOPSCALE: ON

```

Select what type of sender you are using. Select “VDO” for a VDO resistive sender, “WESTACH” for a Westach thermistor type sender, “MGL” for a MGL NTC resistive temperature sender, LM335 for a MGL precision temperature sender or “USER” for a custom sender. The TP-1 has a built in linearization curve for a standard 50°C to 150°C VDO resistive sender as well as for the MGL NTC resistive sender.

#### If the sender type is set to “User”

```

— CHANNEL 1 —
*** DONE ***
MODE: TEMP
SENDER: USER
LABEL: OIL
UNIT: °C
SPAN: 150 °C

```

```

— TEMP: 2351 —
*** DONE ***
POINTS: 10
DISPLAY 1: 010
ADC 1: 2250
DISPLAY 2: 050
ADC 2: 0728
DISPLAY 3: 066

```

If the sender type is set to “USER”, then use this menu option to calibrate your temperature sender. See section 4.3.3 for more information.

#### If the sender type is set to “LM335”

```

— CHANNEL 1 —
*** DONE ***
MODE: TEMP
SENDER: LM335
LABEL: OIL
UNIT: °C
SPAN: 150 °C

```

If the sender type is set to LM335, then use this menu option to calibrate your LM335 precision temperature sender. If recalibration is required then adjust the value using the up/down keys or the rotary control until the temperature matches the reference ambient temperature. Please note that the LM335 can only be calibrated in degrees Celcius irrespective if the TP-1 is setup to display temperature in Fahrenheit.

### Menu options for all sender types

```

— CHANNEL 1 —
*** DONE ***
MODE: TEMP
SENDER: VDO
LABEL: OIL
UNIT: °C
SPAN: 150 °C
TOPSCALE: ON

```

Choose one of a selection of labels to suit your temperature input so you can identify it easily.

```

— CHANNEL 1 —
*** DONE ***
MODE: TEMP
SENDER: VDO
LABEL: OIL
UNIT: °C
SPAN: 150 °C
TOPSCALE: ON

```

Select whether you want the temperature to be displayed in degrees Celcius (°C) or in degrees Fahrenheit (°F).

```

— CHANNEL 1 —
*** DONE ***
MODE: TEMP
SENDER: VDO
LABEL: OIL
UNIT: °C
SPAN: 150°C
TOPSCALE: ON

```

Set the range of the temperature sender. This is the maximum that the bargraph display will go to.

```

— CHANNEL 1 —
*** DONE ***
MODE: TEMP
SENDER: VDO
LABEL: OIL
UNIT: °C
SPAN: 150°C
TOPSCALE: ON

```

This allows the user to zoom into the top half of the bar graph resulting in a higher display resolution. This option set to “ON” is recommended.

```

— CHANNEL 2 —
MODE: TEMP
SENDER: VDO
LABEL: OIL
UNIT: °C
SPAN: 150°C
TOPSCALE: ON
LOW ALARM: UN

```

Select whether to use the low temperature alarm.

```

— CHANNEL 2 —
SENDER: VDO
LABEL: OIL
UNIT: °C
SPAN: 150°C
TOPSCALE: ON
LOW ALARM: 70

```

Use this to set the low temperature alarm set-point.

```

— CHANNEL 2 —
LABEL: OIL
UNIT: °C
SPAN: 150°C
TOPSCALE: ON
LOW ALARM: ON
LOW ALARM: 70
HIGH ALARM: ON

```

Select whether to use the high temperature alarm.

```

— CHANNEL 2 —
UNIT: °C
SPAN: 150°C
TOPSCALE: ON
LOW ALARM: ON
LOW ALARM: 70
HIGH ALARM: ON

```

Use this to set the high temperature alarm set-point.

### 4.3.3 Calibrating the user defined pressure and temperature sender

```

— PRESS: 462
*** DONE ***
POINTS: 10
DISPLAY 1: 1.0
ADC 1: 1000
DISPLAY 2: 2.0
ADC 2: 0900
DISPLAY 3: 3.0

```

```

— TEMP: 969
*** DONE ***
POINTS: 10
DISPLAY 1: 010
ADC 1: 1000
DISPLAY 2: 020
ADC 2: 0900
DISPLAY 3: 030

```

1. Enter the number of points that you want to calibrate.
2. Enter the display reading that you want to show when the sender is at that actual display reading.
3. Enter the ADC (analog to digital converter) reading that corresponds to this display reading. The ADC reading is shown at the top of the calibration menu if you are applying the actual stimulus from the temperature or pressure sender. You can also manually enter this value if the ADC value is known or pre-calculated.
4. Continue entering display and ADC values until all the points have been entered.
5. Verify the above calibration by checking the temperature/pressure display versus the actual applied sender stimulus.

## 5 Loading Factory default settings

Pressing and holding the F1 and F2 keys simultaneously on power up will cause the TP-1 to load preprogrammed factory default settings. The following screen will be displayed:



LOADING  
DEFAULT  
SETTINGS

## 6 Operating the alarms

If the alarm is activated, the corresponding item on the display will flash. At the same time the externally available alarm switch will close. The switch will remain closed until any button is pressed to acknowledge the alarm or until the condition(s) that activated the alarm no longer exist. 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.

## 7 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 TP-1 is not waterproof. Serious damage could occur if the unit is exposed to water and/or spray jets.

## 8 TP-1 Specifications

Operating Temperature Range	-10°C to 50°C (14°F to 122°F)
Storage Temperature Range	-20°C to 80°C (-4°F to 176°F)
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. 40mA @ 13.8V (backlight on) 9mA @13.8V (backlight off)
Display	114x64 graphic LCD display. Contrast and backlight is user configurable, green/yellow backlight
ADC	12bit over sampled successive approximation
Dimensions	see Infinity series dimensional drawing
Enclosure	2 1/4" ABS, black in color, front or rear mounting
Weight	Approx. 116 grams
Alarm contact current rating	Open collector transistor switch to ground. Maximum rating 0.5A DC
Non-volatile memory storage	100000 write cycles
Temperature sensors	<p><b>VDO Resistive Senders:</b> Standard 50°C to 150°C resistive temperature sender.</p> <p><b>MGL NTC Resistive Sender:</b> Echlin TS920SA automotive temperature sender</p> <p><b>MGL Precision LM335 semiconductor:</b> Based on National Semiconductor LM335 temperature sensor</p> <p><b>Westach Resistive Senders:</b> The TP-1 supports Westach thermistor type senders.</p> <p><b>User defined senders:</b> The TP-1 has a user sender calibration feature that can be customized for senders not listed above</p>
Pressure sensors	<p><b>VDO Resistive Sender:</b> The TP-1 supports the VDO 2, 5 and 10 Bar senders. VDO pressure senders used to measure fuel pressure require the fuel isolation kit available from VDO.</p> <p><b>Rotax 4-20mA Sender:</b> The TP-1 supports the 4-20mA pressure sender as used in Rotax 912/914 engines.</p> <p>The 4-20mA pressure sender uses pin 8 (Yellow) on the DB9 connector.</p> <p><b>0-5V Output Pressure Senders:</b> e.g. UMA that outputs a 0-5V signal.</p> <p>The TP-1 has built in linearisation curves for the UMA T1EU07, T1EU35, T1EU70A , T1EU70, T1EU100 and T1EU150</p> <p><b>User defined senders:</b> TP-1 has a user sender calibration feature that can be customized for senders not listed above.</p>

## 9 Installation

### Temperature senders

Four types of temperature senders can be fitted:

**VDO Resistive senders:** A standard 50°C to 150°C VDO resistive automotive sender can be used.

**MGL NTC resistive senders:** A suitable sender with the same thread used by Rotax can be obtained from MGL Avionics (manufacturer Echlin).

Most NTC senders require a single wire connected as shown. The sender is grounded via the engine block. The ground terminal of the gauge input should be connected to the engine block. Some NTC senders have two wires. In this case it is not required that the sender housing itself is connected to the engine block. Wire the second wire to the reference ground terminal.

**MGL Precision senders (National Semiconductors LM335):** These are senders containing a semiconductor temperature measurement device. They can be used for water or oil temperature. These senders are available in two types: an encapsulated version with a brass housing suitable for Rotax thread; a second uncommitted version contains only the sensor itself. This can be conveniently mounted inside an existing sender housing after you remove the original insides of the sender. This is intended to give you a solution for unusual or difficult to obtain senders.

Connect the Black wire to ground, the Red or green wire to the channel input.

**Westach Resistive senders:** The TP-1 supports the Westach thermistor type senders.

**User defined senders:** The TP-1 has a user sender calibration feature that can be customized for senders not listed above.

Connect the temperature sender to the orange (Pin 2) or green (Pin 3) wire on the DB9 connector

### Pressure senders

Four types of pressure senders can be fitted

**VDO Resistive senders:** The TP-1 includes linearisation curves for the VDO 2, 5 and 10 Bar pressure senders.

Connect your VDO/resistive sender to the orange (Pin 2) or green (Pin 3) wire on the DB9 connector.

**4-20mA Pressure Senders:** The TP-1 supports the 4-20mA pressure sender as used in Rotax 912/914 engines

Connect your VDO 4-20mA senders white wire to the yellow wire on the DB9 connector (Pin 8).

**0-5V output senders:** e.g. UMA that can be used with the TP-1 are those types that have their maximum output voltage of 5V at their maximum pressure output. The TP-1 has built in linearisation curves for the UMA T1EU07, T1EU35, T1EU70A, T1EU70, T1EU100 and T1EU150

Connect your UMA/Voltage output sender to the orange (Pin 2) or green (Pin 3) wire on the DB9 connector.

**User defined senders:** The TP-1 has a user sender calibration feature that can be customized for Resistive, 4-20mA as well as Voltage output senders.





## 9.2 UMA Voltage output pressure sender (0 to 5V output)

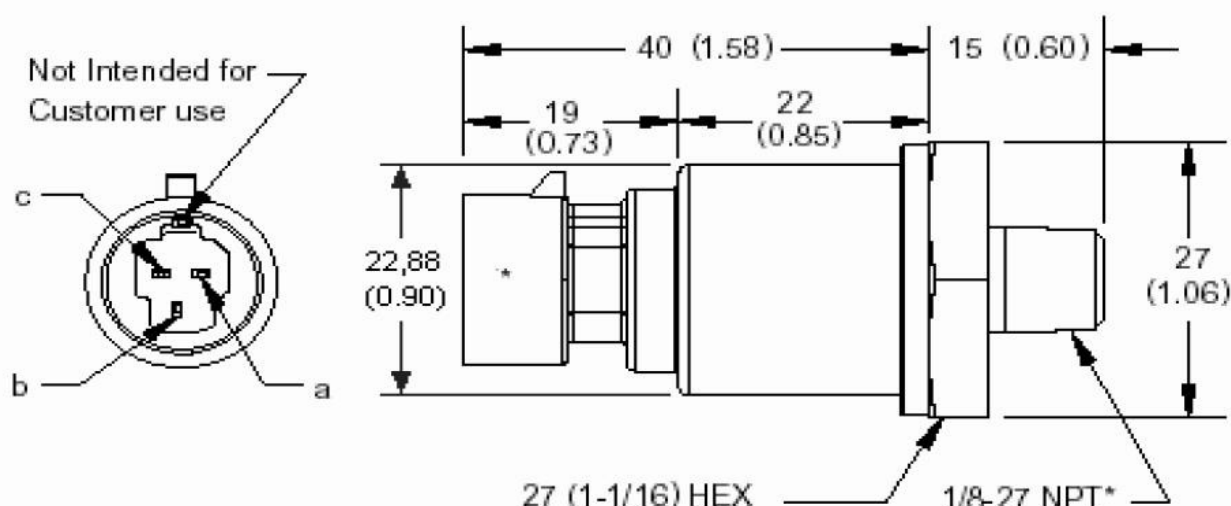


### Pinout:

White/Red: +12V  
White: Signal  
White/Blue: Ground  
Shield: Ground

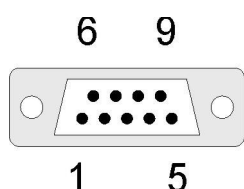
## 9.3 ROTAX 912/914 4-20mA Pressure sender

DIMENSIONS for reference only mm (in)



The sensor cable is approximately 3m long and has 3 leads. The black lead is not to be connected and has no function. The Red lead from the sensor has to be connected to the positive bus via a fuse or circuit breaker . The white lead (Output signal) has to be connected directly to the TP-1 Yellow wire (Pin 8).

## 9.4 TP-1 DB9 Cable connections



DB 9 Pin	Color	Function
1	Black	Ground
2	Orange	Channel 1 input (Pressure and Temperature sender input, resistive and 0-5V)
3	Green	Channel 2 input (Pressure and Temperature sender input, resistive and 0-5V input)
4	NC	Airtalk communication (Not connected) Used for firmware upgrading
6	Red	8-30Vdc power
8	Yellow	Pressure Sender input (4-20mA)
9	White	Alarm Output

## 10 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 labour. Shipping costs are for the account of the purchaser.

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

## 11 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, experimental and light sport 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.

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

## Other instruments in the *Stratomaster Infinity* series

<b>ALT-1</b>	Precision encoding altimeter and vertical speed indicator
<b>ALT-2</b>	Precision encoding altimeter and vertical speed indicator with a serial RS232 transponder output
<b>ASI-1</b>	Airspeed indicator (ASI) with automatic flight log
<b>ASX-1</b>	Encoding aviation altimeter with serial output and airspeed indicator (ASI)
<b>AV-1</b>	Artificial horizon and magnetic compass indicator
<b>BAT-1</b>	Battery voltage and current monitor
<b>E-3</b>	Universal engine monitor
<b>FF-1</b>	Fuel Computer (single or dual fuel tanks)
<b>GF-1</b>	+/-10G tilt compensated dual range G-force meter
<b>MAP-1</b>	Manifold pressure and RPM Indicator
<b>RV-1</b>	Universal engine RPM and rotor RPM Indicator
<b>RV-2</b>	Universal turbine RPM / RPM factor display
<b>RTC-2</b>	Aviation real time clock (RTC) and outside air temperature (OAT) display
<b>TC-1</b>	4-Channel thermocouple indicator
<b>TP-1</b>	Dual channel universal temperature/pressure gauge