

# Stratomaster Smart Single

## EMS-582



### Fully integrated Engine Monitoring System for water cooled engines

The EMS-582 unit is a 2.25" instrument incorporating all that is needed to accurately monitor the performance of a water-cooled two and four stroke engines. This instrument has originally been intended for the Rotax 582 DCDI engine but is equally useful for other makes of both two and four stroke engines.

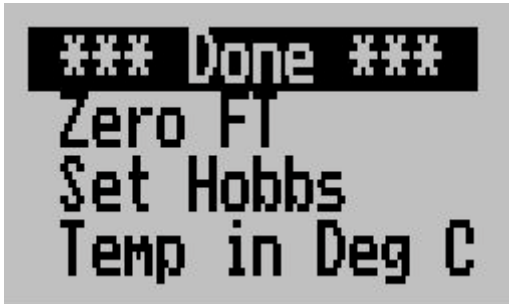
Included functions are:

- 2 channel EGT gauge (Exhaust gas temperature)
- 2 channel CHT gauge (Cylinder head temperature)
- 1 channel coolant temperature
- Digital engine RPM display
- Engine hobbs meter (can be set to current engine time)
- Engine running timer (can be used as flight timer), resettable to zero at any time.
- External alarm output to switch a lamp in case of exceeded temperature(s).
- Flashing on screen alarms.

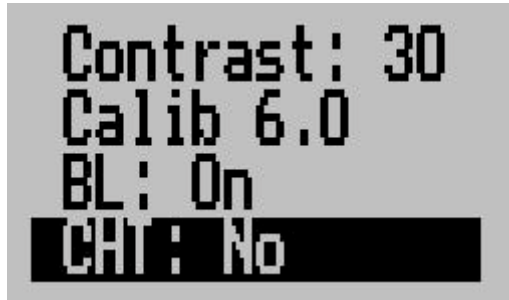
## Setting up the EMS-582

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 Menu key. To end an edit or function, press the Menu key again.

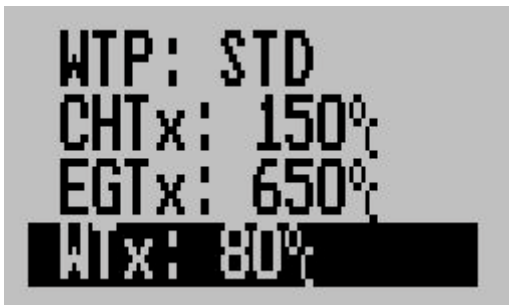
To exit the menu and continue normal operation, select the **\*\*\*Done\*\*\*** function and press the Menu key. Note, all changes you have initiated during your session will only be remembered by the instrument if you exit the menu using the **\*\*\*Done\*\*\*** function.



```
*** Done ***
Zero FT
Set Hobbs
Temp in Deg C
```



```
Contrast: 30
Calib 6.0
BL: On
CH: No
```



```
WTP: STD
CHTx: 150%
EGTx: 650%
Atx: 80%
```

### Zero FT

This function allows you to set the flight timer to zero. The flight timer counts hours and minutes while the engine is running.

### Set Hobbs

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

Use the plus and minus buttons to change the indicated part of the hobbs reading. Use the Menu button to change from hour hundreds to hours to minutes.

Moving the update cursor below the numbers past the minutes field on the right ends the edit of the hobbs meter reading and stores any changes.



```
0006:02
  ^
```

## **Temp in ...**

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

## **Contrast ...**

This function allows you to change the display contrast to your liking. You can select values from about 20 to 45. (May vary with different displays)

## **Calib ...**

Enter the number of pulses per revolution.

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

Typical settings:

Rotax 582 DCDI – 6.0

Rotax 532 Single ignition 1.0 or 2.0 depending on wiring.

Most four stroke engines four cylinder: 2.0

Most four stroke engines three cylinder: 1.5

Most four stroke engines two cylinder: 1.0

5 cylinder radial: 2.5

Using this function you can adapt the EMS-582 to most other makes of two-stroke and four stroke engines.

## **BL ...**

This function allows you to switch the display backlight on or off.

## **CHT**

Select if you would like to activate the 2 channel CHT display. This requires that you connect two CHT probes. These probes are optional as monitoring CHT on this engine is considered of lesser importance due to the monitoring of coolant temperature.

Please note that should you obtain CHT probes that you must fit K-Type thermocouple based senders.

Should you enable the CHT display, the CHT readings will alternate with the standard EGT readings every few seconds.

## **WTP**

Select if you are going to use the standard coolant temperature sender or the optional precision sender available from MGL Avionics. The standard sender has one wire, using the engine block as electrical connection while the precision sender has two wires. It is electrically isolated from the engine block and is based on a small temperature measurement chip.

Selecting the incorrect sender type will result in incorrect temperature readout.

## **CHTx ...**

This function allows you to select the CHT temperature alarm limit most suitable for your application. You select the limit applicable for the two cylinder head temperature channels (note that you need to enable them should you want to use them).

Typical CHT limits range from 150 degrees C for water cooled engines to about 250 degrees C for air cooled engines. The Rotax 582 engine should not exceed 150 degrees C cylinder temperature. Consult your engines handbook for the most suitable limit for your engine.

Note that it is possible to use the two CHT channels for much higher temperatures as well, such as found with exhaust gas temperature probes. This way it is possible to use the instrument to measure four channels of EGT for example.

For a table of temperature limits and ranges, please view the description under the following heading “**EGTx**”.

## **EGTx ...**

This function allows you to select the EGT temperature alarm limit most suitable for your application. You select the limit applicable for the two exhaust gas temperature channels. Typical EGT limits range from 650 degrees C for two stroke engines to about 900 degrees C for turbo charged four stroke engines. Consult your engines handbook for the most suitable limit for your engine. The Rotax 582 engine has a 650 degree C limit.

Note that it is possible to use the two EGT channels for much lower temperatures as well, such as found with cylinder head temperature probes. This way it is possible to use the instrument to measure four channels of CHT for example.

You can select from the following temperature limit and display range table:

<u>Limit (Alarm)</u>	<u>Range of display (bargraph only)</u>
150°C / 300°F	200°C / 400°F
180°C / 350°F	250°C / 500°F
200°C / 400°F	250°C / 500°F
250°C / 480°F	300°C / 580°F
300°C / 570°F	350°C / 660°F
400°C / 750°F	500°C / 930°F
650°C / 1200°F	700°C / 1300°F
720°C / 1320°F	800°C / 1500°F
760°C / 1400°F	820°C / 1520°F
815°C / 1500°F	850°C / 1560°F
850°C / 1560°F	900°C / 1650°F
900°C / 1650°F	1000°C / 1830°F

## **WTx ...**

This function allows you to select the temperature limit (alarm level) for your coolant temperature monitor. You can select from the following limits:

<u>Limit (Alarm)</u>	<u>Range of display (bargraph only)</u>
80°C / 176°F	90°C / 190°F
85°C / 185°F	100°C / 210°F
90°C / 194°F	110°C / 230°F
95°C / 203°F	120°C / 250°F
100°C / 212°F	120°C / 250°F
110°C / 230°F	130°C / 260°F

## **ADC**

This function is for technical personal. It is not used for ordinary operation of the unit.

## Technical specifications:

Display temperature range (operational): -20 to +80 degrees C  
Supply voltage: +8 to +18V. +24/28V with optional pre regulator.  
Supply current: 25mA/45mA (backlight off/on)

Thermocouples: K-type

Measurement range EGT: User programmable (digital to 1200 degrees C)

Measurement range CHT: User programmable (digital to 1200 degrees C)

Alarm level EGT: User programmable

Alarm level CHT: User programmable

Technology: Fully cold junction compensated using precision internal temperature reference.

Measurement accuracy: +/- 5 degrees typical over full temperature range if used with Stratomaster EGT and CHT probes.

Measurement interval: 2 seconds per channel.

Inputs: Differential, can use grounded and isolated probes.

Common mode voltage range: -2V to +3V

Measurement range Coolant standard sender: 20 to 110 degrees C

Measurement range Coolant precision sender: 20 to 180 degrees C

Accuracy standard sender: +/- 5% at 80 degrees C.

Accuracy precision sender: +/- 2% over full temperature range.

Alarm contact:

Maximum permissible current through alarm contacts: 500mA.

Maximum permissible voltage over alarm contacts: 50V.

Typical load for alarm contacts: 12V/1W lamp. Be aware of low resistance of higher wattage lamps. A cold filament resistance of 20 ohms or less will damage the internal alarm relay contact.

Rev counter:

Crystal based accuracy, resolution 20 RPM typical, dependent on number of pulses per revolution

from engine and "Calib" setup. Range 0-9999 revs.

Minimum signal for stable display: 2Vpp.

Fully A/C coupled, maximum voltage +/- 40V.

RF noise filter plus Schmidt trigger based input.

**Note: It is essential that a single wire be connected from the minus terminal of the instrument to the engine block (Brown wire on Rotax 582 engines). This wire must not be used to share currents with other electrical users as this will affect accuracy of indicated temperatures and can affect the REV counter reading adversely.**

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:

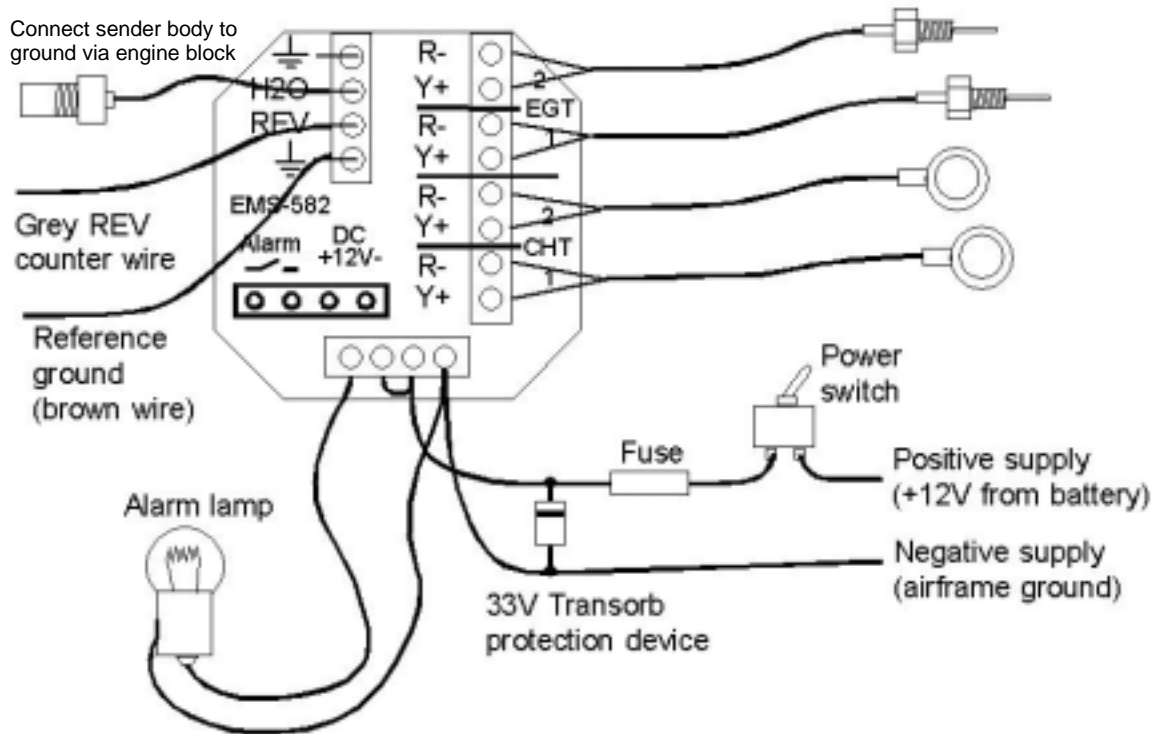
Any operation of electronic instrumentation on power supplies that are subject to high voltages caused by operation of inductive loads (starter motors, solenoids, relays) are required to be fitted with suitable protection.

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.

## Installing the EMS-582



The two CHT probes and two EGT probes are wired as shown above. Note that the CHT probes are optional. Most installations do not monitor CHT temperatures as coolant temperature is monitored.

Connect probes according to the colors of the wires. These are red and yellow for MGL probes.

The coolant temperature sender is available in two types. The standard sender included with the instrument package has a single terminal. Connect this terminal to the H2O input as shown above. The sender requires one further connection which is via the sender body, engine block and the reference wire. Please ensure that you have a good electrical connection on this reference ground as outlined further below. Any currents flowing through this connection caused by **OTHER** electrical users in your system **WILL** cause incorrect temperature readings.

Note that no sealant is required to fit the sender. The sender has a tapered thread that is self sealing. Good electrical connection between the sender body and the engine block is a requirement.

Shown is typical wiring used to connect a 12V lamp as external alarm indicator. Note that the two terminals used for the alarm are the contacts of a switch. The switch is closed when the alarm is

active. If you have more than one instrument with alarm contacts, you can wire all contacts in parallel so you can use a single lamp if so desired. A 12V/0.5W or 1W lamp is the usual choice.

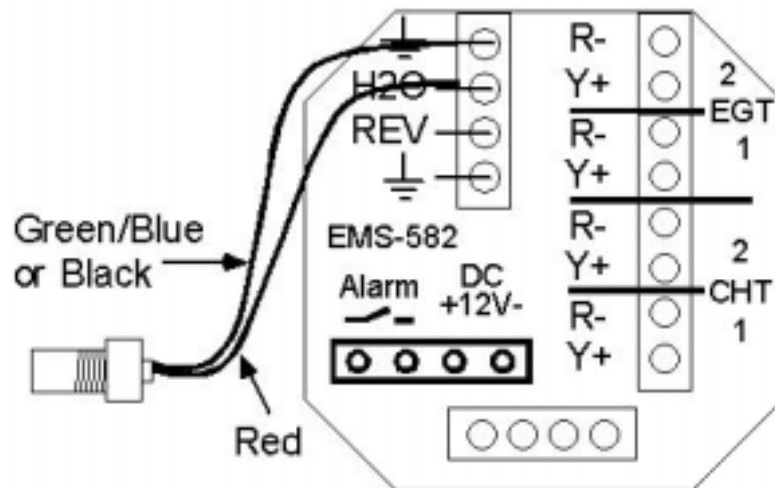
Power supply here assumes a 12V DC source. It is recommended to install suitable protection against over voltage such as can be generated by solenoids and starter motors. The above suggestion uses a fuse and a transorb. The transorb is available from MGL Avionics at very low cost. This device ensures that the voltage across it cannot rise above 33V, the transorb will cause the fuse to blow if prolonged over voltage is present.

Note that you only need a single fuse and transorb to protect a cluster of several instruments. Please install the transorb as close as possible from a wiring point of view to the instruments. You can use the protected power for your radio, intercom or other low current users. Keep this power rail separated from high current rails for lamps etc.

Be sure to install a reference connection between the minus terminal of the instrument and the engine block. On the Rotax 582, this is available on the connector block as the Brown wire. Finally, connect the Grey REV counter wire as shown above.

Should you find unstable RPM readings, you may have a burned magneto coil. This can happen if you have used low impedance rev counters before. In this case you can try fitting a 220 ohm resistor from the grey wire to the brown wire. Alternatively, you can connect the REV counter terminal to one of the yellow lighting coil wires if you have a rectifier/regulator fitted.

### Installing the precision coolant temperature probe



The precision temperature probe is available as an option. This probe is fully insulated from the engine block and it is recommended for difficult installations in the electrical sense.

The probe has two wires. Connect the red wire to the H2O probe and the remaining wire to the instruments ground terminal. The sender body does not have to have an electrical connection to the engine block and you can use sealant if you have to for some reason. The sender body does have a tapered thread that does not require sealant.

After you have installed the sender, please select the correct sender type in the menu (Item **WTP**). If you do not select the correct sender type, the temperature shown will be incorrect.

### 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.

Should you need to extend the precision water temperature sender, you can do so with ordinary copper cable. It is recommended that you choose a cable similar to the type used and continue the twist of the cable for its entire length.

The standard temperature sender does not have a lead fitted. Use a standard copper cable to make the connection. The length is not critical. Ensure that you have a lead from the engine block back to the ground terminal of the instrument. Do not route this return lead via the battery minus or other high current users as this may lead to false temperature readings due to voltage drops caused in the cable by these users.

#### **If you have difficulty obtaining a stable rev counter reading:**

The instrument relies on a reasonably clean and unambiguous signal being present. Signals containing noise and/or secondary signals may result in a “jumpy” or unstable RPM reading. For Rotax 582 DCDI engine it is often (but not always) beneficial to install a ballast resistor of 220 ohm or less value between the grey rev counter wire and ground. This can be done at the instrument REV counter terminals. It is further important that a direct connection between the instrument ground and the engine block exists. Install a wire separate from your supply minus if required.

In case of it not being possible to use the grey REV counter wire, consider using any of the two yellow lighting coil wires. You need to connect these to a regulator/rectifier or at least some form of ballast. Do not use these wires if no ballast of any kind is available as in this case the voltage on these wires may reach several thousand volts.

Ensure that your rev counter wire does not travel next to any wires containing pulsed signals such as ignition wires (spark plug wires). The very high voltage signals may couple onto your rev counter wire and these will be sensed by the EMS-582 as additional pulses.

On some engines rev counter signals may be too high in voltage. The EMS-582 does accept these voltages typically without damage but the relatively sensitive input may also “see” smaller artifacts of such a signal and count them as pulses, thus giving a wrong reading. In cases like this it is helpful to wire a resistor in series to the rev counter input of the instrument. Values like 10K, 22K or 33K may be helpful.

The input may also be used with a variety of sensors like gear tooth sensors, optical pickups or hall effect devices. Please see the owners manual of our RV-1 rev counter for more info.