

ST8130 Series Road Car Display Systems

Users Guide

Preface

Congratulations

Congratulations on choosing one of the models from the Stack ST8130 Series Road Car Display Systems. This series contains three models:

1. *The ST8130 System. This system is supplied with one of two types of speed sensor selected by the customer at time of ordering.*

ST492 pulse amplifier obtains speed information from the vehicle's transmission system.

ST670 wheel speed sensor obtains information about the vehicle's speed directly from one of its wheels.

2. *The ST8130P System. In addition to the ST8130 standard features this system is supplied with an extra pressure sensor to monitor Fuel Pressure.*

3. *The ST8130M System. In addition to the ST8130P standard features this system is supplied with the Stack Predictive Lap timing system.*

There is an optional Air temperature sensor (ST765) available for the ST8130 system only.

Each system will give you a wealth of information to enable you to obtain the maximum safe performance from your vehicle.

Registration Form

Please complete and return the registration form contained in the package. This will allow us to keep you up to date on the latest developments from Stack.

Purpose of this manual

This manual will help you install and use either model in the Stack ST8130 Series Road Car Display Systems. It explains how to set up and configure the system for your vehicle.

Edition Notice

This edition is for all versions of the ST8130 Series Road Car Display Systems distributed to customers worldwide. The units of measurement used to illustrate the use of the display systems in this edition are for the UK version. Units used in the various versions are shown in the following table.

| Parameter Type | UK Version | US Version | EU Version |
|---------------------|--------------|--------------|--------------|
| Speed | MPH or km/h* | MPH or km/h* | km/h or MPH* |
| Distance | Miles or km* | Miles or km* | Km or Miles* |
| Temperature | °C | °F | °C |
| Wheel Circumference | Millimetres | Inches | Millimetres |
| Fuel level | Litres | Gallons (US) | Litres |
| Pressure | PSI | PSI | Bar |

* Speed and distance units are user selectable by pressing switch 1 & 3 together.

Related Products From Stack Limited

If you need information about other Stack motor sport products, these can be obtained from Stack or from your local Stack dealer. Products available from Stack include:

- *Intelligent Tachometers*
- *Action Replay Tachometers*
- *Performance Analysers*
- *Speedometers*
- *Boost Gauges*
- *Analogue Sensors*
- *Digital Sensors*
- *Data Logging Systems*
- *Display and Logging Systems*
- *Radio Telemetry Systems*
- *Display and Analysis Software*

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Who to Contact at Stack in Case of Difficulty

Stack Limited and its approved distributors provide a comprehensive Technical Help service to assist with your enquiries. Contact your local Stack branch or distributor.

For a current list of distributors log onto the Stack websites at www.stackltd.com or www.stackinc.com and click on the Where to buy tab at the top of the home page.

For online technical support click on the Support tab at the top of the home page. Fill in the support form mandatory fields to gain access to a list of PDF manuals that can be instantly downloaded.

Contents

| | |
|--|----|
| Preface | i |
| Related Products From Stack Limited | iv |
| Who to Contact at Stack in Case of Difficulty | iv |
| Contents | v |
| Chapter 1. Introducing the Display Systems | 1 |
| ST8130 Models | 2 |
| How to use this Manual | 3 |
| Chapter 2. Getting Started | 4 |
| The Display Module | 5 |
| Wiring Harness | 6 |
| Connecting the Components | 7 |
| Chapter 3. Operating the Display System | 8 |
| Switching the Display System on | 8 |
| Changing the display layers | 8 |
| Peak Values (Tell Tales) | 14 |
| Alarms | 16 |
| Lap times | 19 |
| Gear shift light | 19 |
| Chapter 4. Configuring the Display System | 20 |
| Configuration mode | 20 |
| Wheel Pulses and Circumferences | 25 |
| Configuring the Fuel Pressure Sensor (ST8130P/M variant) | 29 |
| Calibrating the Fuel Level | 30 |
| Chapter 5. Installing the Display System | 35 |
| Who can install the Display System? | 35 |
| Tools needed to install the Display System | 35 |
| Preconfigured Display Systems | 35 |
| Custom Configured Display Systems | 35 |
| Fitting the Display Module | 36 |
| Switches | 37 |
| Warning lights | 38 |
| Engine Speed (RPM) Measurement | 38 |
| Connecting the Display System to the Ignition System | 39 |
| Pressure sensors | 41 |

| | |
|---|-----------|
| Temperature sensors | 43 |
| Wheel speed sensor (ST670-Option) | 44 |
| Pulse Amplifier Interface (ST492-Option) | 45 |
| Fuel Tank Sender | 48 |
| Lap timing sensor (Optional, Std on ST8130M) | 49 |
| Trackside Infra-Red Lap Beacon (Optional, Std on ST8130M) | 50 |
| Air Temperature Sensor (optional on ST8130 variant) | 51 |
| Wiring harness | 51 |
| Checks and Alarms | 53 |
| | |
| Chapter 6. Troubleshooting | 54 |
| | |
| Appendix A. Template for the Display Module | 65 |
| | |
| Appendix B. Wiring Harness Diagram | 68 |
| | |
| Appendix C. Summary of Switch Functions | 69 |
| | |
| Returned Goods Procedure | 71 |
| | |
| Index | 72 |

Chapter 1. Introducing the Display Systems

The models in the Stack ST8130 Series Road Car Display Systems monitor and display a range of values, known as performance parameters, needed for effective car and driver management in most driving situations. The models in the ST8130 Series are the ST8130, the ST813P and the ST8130M.

The models combine an analogue tachometer with a digital display for the following performance parameters:

- 1. Wheel speed*
- 2. Engine speed (RPM)*
- 3. Oil pressure*
- 4. Oil temperature*
- 5. Water temperature*
- 6. Fuel pressure (ST8130P/M variants)*
- 7. Air temperature (optional on ST8130 variants)*
- 8. Fuel level*
- 9. Battery Voltage*
- 10. Lap times (last completed and best) (ST8130M variants)*

You can view the peak values (tell-tales) for all the parameters.

Both systems provide an alarm light to alert the driver that a warning condition has been detected. The warning conditions are based on preset alarm values for the following performance parameters:

- 1. Low oil pressure*
- 2. High oil temperature*
- 3. High water temperature*
- 4. Low fuel pressure (ST8130P/M variants)*

5. Low air temperature / ice warning (optional on ST8130 variants).

The unit is delivered with the air temperature alarm disabled.

6. Fuel level.

The fuel level alarm is indicated by a separate warning light; the unit does not display any message for the fuel level alarm.

7. Battery voltage

When the warning condition alarm light is switched on, a warning message is shown on the digital display to identify the condition. You can enable or disable the warning system for each parameter individually.

You can cancel the warning message by pressing a switch. Doing this does not turn off the warning condition alarm light, which stays on until the condition no longer applies.

You can redefine the preset alarm values for each parameter to those which are more suitable for your vehicle.

The system provides outputs for two external warning lights:

- *a gear shift warning light that is based on an RPM value that you define for your vehicle*
- *an additional alarm warning light for the alarms described above*

Either model can also be fitted with an optional lap timing sensor.

An optional air temperature sensor may be installed on the ST8130 variant.

ST8130 Models

ST492 Option pulse amplifier. This system obtains the vehicle's speed from pulses generated by the rotation of a drive shaft or from the gearbox.

ST670 Option wheel speed sensor. This system obtains the vehicle speed from the rotations of one of the wheels on the vehicle.

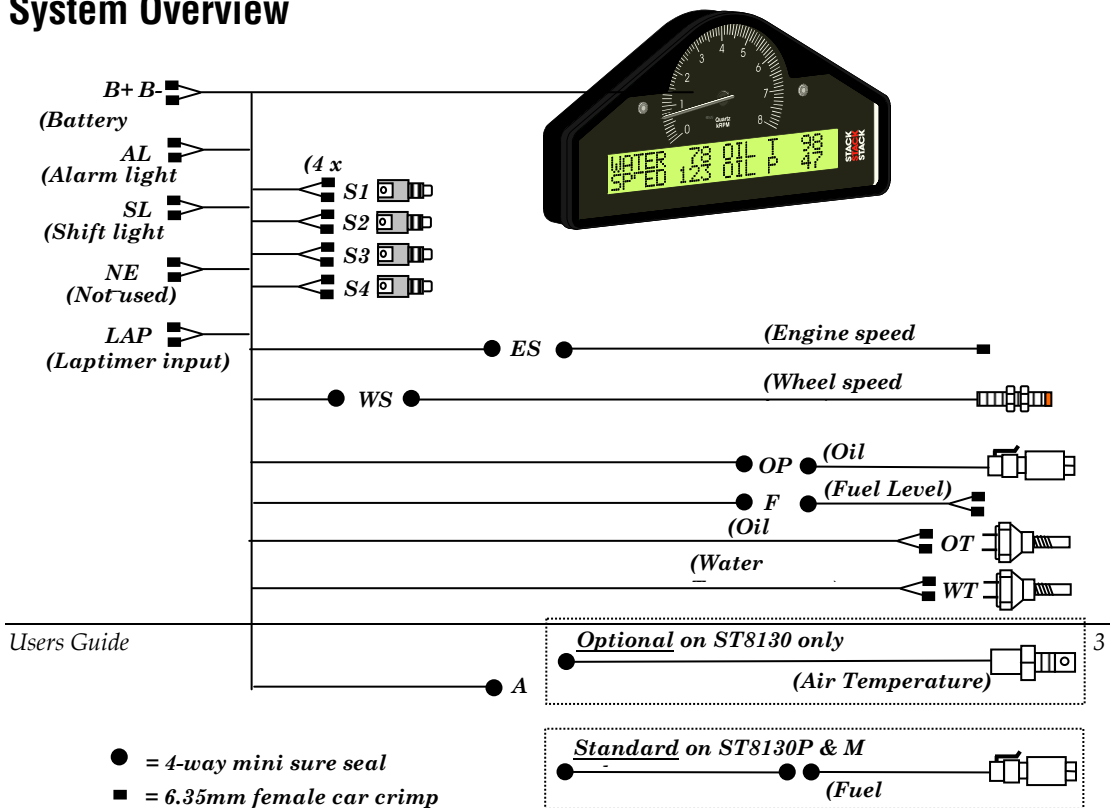
How to use this Manual

Stack recommends that you unpack and connect the components in the system before you install it in your vehicle. This will enable you to familiarise yourself with operating the display and configuring it for the vehicle in which you intend to install it.

This manual starts by taking you through the process of setting up the system before installation, operating the digital display, configuring the system, setting the alarm values and installing it in the vehicle. By the end of Chapter 2, you will have set up the system so that you will be assured that it is functioning normally. You can then read Chapter 3 and practice using its functions. Chapter 4 takes you through configuring it for your vehicle. Chapter 5 explains how to install it in the vehicle. Chapter 6 provides a set of trouble-shooting guidelines.

A full size template for the dashboard cut-out for the ST8130 systems is provided in Appendix A along with a dimensional drawing on page 33. There is a schematic diagram of the wiring harness in Appendix B.

System Overview



Chapter 2. Getting Started

This chapter guides you through the initial unpacking and setting up of the equipment for pre-installation checks and familiarisation with its operation.

Standard ST8130 Road Car Display System Items

The ST8130 Road Car Display System is supplied with the following standard components:

| Quantity | Description |
|---|--|
| 1 | Display Module (ST867) with 2 mounting brackets |
| 1 | Wiring Harness (ST872) |
| 1 | Fuel level Extender (ST918037) |
| 1 | Oil Pressure Sensor (ST747-M10 (EU) or ST747-1/8 NPTF (UK/USA)) |
| 2 | Oil & Water Temperature Sensors (ST762 (EU) ST764 (UK/USA)) |
| 4 | Switches (supplied with and to be connected to the wiring harness) |
| 1 | Speed Sensor (ST670) or Pulse Amplifier (ST492) |
| ST8130P variant only (As above plus the following parts) | |
| 1 | Fuel Pressure Sensor (ST747-M10 (EU) or ST747-1/8 NPTF (UK/USA)) |
| 1 | 1.4Mtr extender (ST918021). |
| ST8130M variant only (As ST8130P plus the following parts) | |
| 1 | Infra-red Lap Beacon (ST544) |
| 1 | Lap Timing Receiver (ST543) |

Optional ST8130 Road Car Display System Items

The ST8130 optional air temperature sensor consists of the following component:

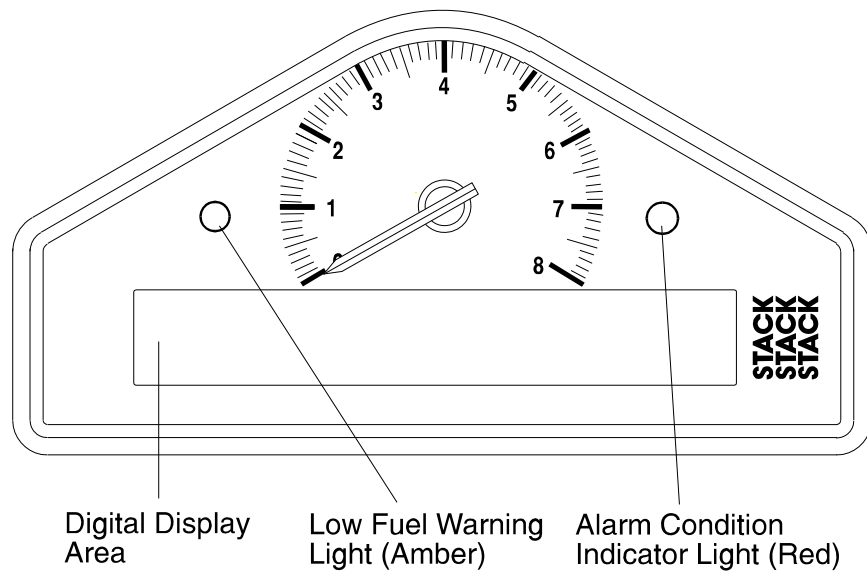
| Quantity | Description |
|----------|--------------------------------|
| 1 | Air Temperature Sensor (ST765) |

The optional lap timing system consists of the following components:

| Quantity | Description |
|----------|------------------------------|
| 1 | Infra-red Lap Beacon (ST544) |
| 1 | Lap Timing Receiver (ST543) |

The Display Module

The Display Module consists of an analogue tachometer, two indicator lights and a digital display panel.



The Display Module is connected to a variety of sensors by a wiring harness. The wiring harness has a 19-way military connector for connection to the Display Module.

Wiring Harness

Each of the wires in the harness is labelled.

| Labels on Short Cables | Connection To |
|------------------------|--|
| S1 to S4 | Switches 1 to 4 |
| WS | Wheel speed input (ST492 or ST670) |
| SL | Gear shift warning light |
| AL | Alarm warning light |
| NET | Data logging expansion pack |
| LAP | Optional in-car lap timing sensor (Std on ST8130M) |

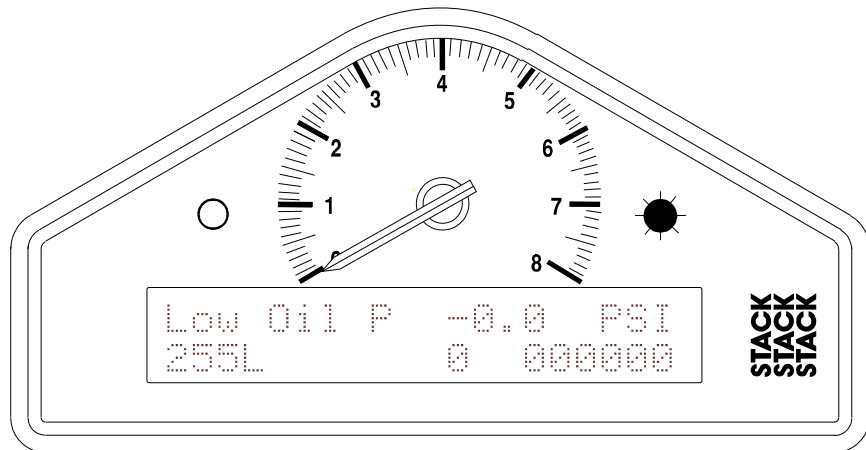
| Labels on Long Cables | Connection To |
|-----------------------|---|
| A | Air temperature sensor (optional on ST8130 variant) Fuel pressure sensor (Std on ST8130P/M variants) |
| ES | Engine speed (RPM) |
| OT | Oil temperature sensor |
| WT | Water temperature sensor |
| OP | Oil pressure sensor |
| F | Fuel level sensor |
| B + | 12v Supply (Battery) |
| B - | Battery negative (Chassis) |

Connecting the Components

1. *Connect the wiring harness to the display module.*
2. *Connect the four switches to the cables labelled S1 to S4.*
3. *Connect each of the sensors that you have purchased to the appropriate wire in the wiring harness, as shown above.*
4. *Connect a 12v DC power supply or battery to the power input cable. Never use a battery charger to supply power to the display module.*
5. *Switch on the 12v DC power supply.*

The Display Module should start up with an alarm signal indicating low oil pressure.

Note that whenever a warning message is shown on the top line of the digital display, the speed of the vehicle always continues to be shown in the centre of the bottom line.



You can now proceed to familiarise yourself with operating the Display Module.

Chapter 3. Operating the Display System

This chapter takes you through the operation of the system so that you can familiarise yourself with its use before you install it in the vehicle.

Switching the Display System on

You will have switched the system on already if you have followed the instructions in the previous chapter and have just set the system up for the first time before installing it.

When installed in the vehicle, the system is switched on when you switch the ignition on.

When the power is first switched on, the digital display will immediately show a "Low Oil P" warning and the alarm light will come on. The tachometer will reset itself by moving the needle until it touches the stop-pin and then moving it back to the zero RPM position. Press Switch 3 to clear the warning message from the display. (Switch 2 can also be used for this.)

The digital display panel and the analogue dial face are always backlit when the system is switched on.

If none of these actions occurs when you switch on, switch off the power to the system and consult the section on troubleshooting in this manual.

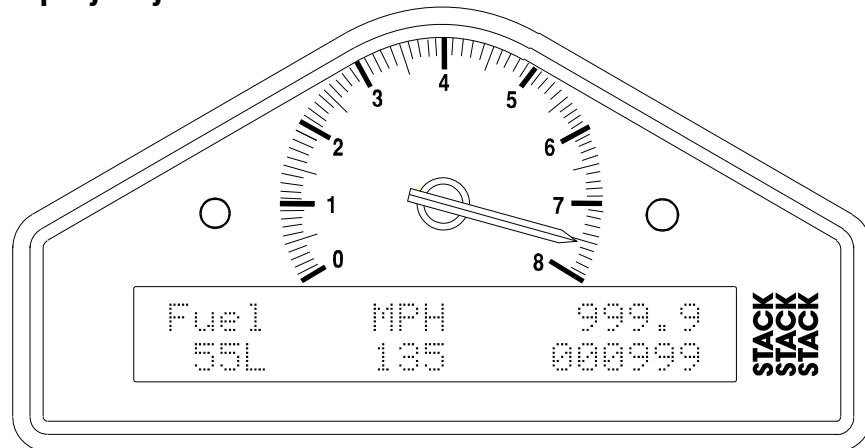
Changing the display layers

The digital display has five display layers. Each display layer shows three parameters and their values

Each of the display layers is displayed in turn by pressing switch 3. Press switch 3 when display layer 5 is being displayed in order to return to display layer 1.

⇒ *The format of the values in these displays will vary for systems supplied outside the UK, as the parameters are displayed in different units.*

Display Layer 1



Display layer 1 shows:

- *Fuel level (Note that when the amount of fuel in the tank is changed the displayed value changes slowly (about 1 litre every 5 seconds) to minimise the effects of fuel surge).*
- *Current speed (MPH or km/h)*
- *Trip indicator*
- *Odometer*

Note that when the UK version has been configured to show the speed in km/h, the trip and odometer continue to display distances in miles.

Press Switch 3 to change the display to layer 2.

Display Layer 2 (ST8130 & P variant)

| | | |
|--------------|------------|--------------|
| Oil T | MPH | Oil P |
| 110 C | 135 | 90 |

Display layer 2 shows:

- *Oil temperature (Oil T)*
- *Current speed (MPH or km/h)*
- *Oil pressure (Oil P)*

Note that the minimum oil and water temperature for which the display gives a true reading is 12°C or 53°F. The unit displays temperatures that are less than this as 0°C or 32°F.

Display Layer 2 (ST8130M variant)

| | | |
|--------------|------------|--------------|
| Water | MPH | Oil P |
| 75 C | 135 | 90 |

ST8130M display layer 2 shows:

- *Water temperature*
- *Current speed (MPH or km/h)*
- *Oil pressure (Oil P)*

Press Switch 3 to change display to layer 3

Display Layer 3 (ST8130 & P variant)

| | | |
|--------------|------------|--------------|
| Water | MPH | Oil P |
| 75 C | 135 | 90 |

Display layer 3 shows:

- *Water temperature*
- *Current speed (MPH or km/h)*
- *Oil pressure (Oil P)*

Display Layer 3 (ST8130M variant)

| | | |
|--------------|--------------|---------------|
| Oil T | 12.6V | Fuel P |
| 110 C | 135 | 65 |

ST8130M display layer 3 shows:

- *Oil temperature (Oil T)*
- *Battery Voltage*
- *Fuel Pressure (Fuel P)*

- ***Current speed (MPH or km/h)***

Press Switch 3 to change the display to layer 4.

Display Layer 4 (ST8130 variant)

| | | |
|--------------|------------|--------------|
| Air T | MPH | Batt |
| 5 C | 135 | 12.6V |

- *Air temperature (Air) (optional)*
- *Current speed (MPH or km/h)*
- *Battery Voltage (Batt)*

Press Switch 3 to change the display either to layer 5 if you have the lap timing kit installed or back to layer 1.

Display Layer 4 (ST8130P variant)

| | | |
|---------------|------------|--------------|
| Fuel P | MPH | Batt |
| 65 | 135 | 12.6V |

ST8130P display layer 4 shows:

- *Fuel Pressure (Fuel P)*
- *Current speed (MPH or km/h)*
- *Battery Voltage (Batt)*

Display Layer 4 (ST8130M variant)

| | | |
|----------------|------------|----------------|
| Lap 12 | MPH | Best |
| 1:35.10 | 135 | 1:35.06 |

ST8130M display layer 4 shows:

- *Number of the current lap*
- *Current speed (MPH or km/h)*
- *Last lap time*

- *Previous best lap time*

Press Switch 3 to change the display to layer 5.

Display Layer 5

| |
|---|
| <p>Lap 12 MPH Best 1:35.10 135 1:35.06</p> |
|---|

Display layer 5 shows:

- *Number of the current lap*
- *Current speed (MPH or km/h)*
- *Last lap time*
- *Previous best lap time*

Lap time can be recorded manually using Switch 4 or with the optional lap timing kit.

Display Layer 5 (ST8130M variant)

| |
|--|
| <p>- >< + 1:19:88 135 00.00</p> |
|--|

ST8130M display layer 5 shows:

- *A graphical comparison of this lap to a previously selected lap*
- *Running time from start of lap*
- *Current speed (MPH or km/h)*
- *Relative time of this lap to a previously selected lap*

Press Switch 3 to change the display back to layer 1.

Peak Values (Tell Tales)

The system can display the peak values (sometimes called ‘tell-tales’) that have been recorded during a run for all the monitored parameters.

Peak values are updated only when the engine speed has exceeded its "gate value" for RPM for at least one second. This allows the values to stabilise. Blipping the engine may not be enough to update the peak values. The gate value is a predefined RPM value that is used to control when the system updates the peak values. This is to prevent abnormal peak values from being recorded when, for example, the engine is either not running, is idling or is being warmed up.

The system stores either a maximum or a minimum value as the peak value, depending on the parameter, as in the following table:

| Parameter | Type of Peak Value | Gated to RPM |
|--|--------------------|--------------|
| Engine Speed (RPM) | Maximum | No |
| Wheel Speed | Maximum | No |
| Oil Pressure | Minimum | Yes |
| Oil Temperature | Maximum | Yes |
| Water Temperature | Maximum | Yes |
| Fuel Level | Value at Reset | No |
| Battery Voltage | Minimum | No |
| Air Temperature / Ice Warning (ST8130 variant) | Minimum | Yes |
| Fuel Pressure (ST813P/M) | Minimum | Yes |

Displaying the Peak Values

Press and hold Switch 1 to show the peak values for the parameters being displayed on the current layer. Release the switch to return to the normal display.

Note: The displayed peak fuel level is the value that was current when the peak values were last reset. The amount of fuel used since the peak value reset can be determined by subtracting the current value from the peak value.

Resetting the Peak Values

You can reset all of the peak values manually. All peak values are reset at the same time. If the engine is running at or above its gate value when the peak values are reset, they are set to the current value of each performance parameter.

To reset the peak values:

- *Press and hold Switch 1 to display the peak values.*
- *While holding Switch 1, press and hold Switch 4.*
- *With Switch 4 held down, you will see the display revert to the current values. The new peak values that are stored are those being displayed when you release Switch 4.*

If the engine is running below its gate value, the peak values are not reset to the current values but are set to the values in the following table:

| Parameter | New Peak Value |
|--------------------------------------|--|
| Engine RPM | Current value |
| Wheel speed | Current value |
| Oil Pressure | 999 PSI or 99.9 Bar |
| Oil Temperature | 0C or 0F |
| Water Temperature | 0C or 0F |
| Fuel Level | Current value |
| Battery Voltage | Current value |
| Air Temperature (ST8130 variant) | Current value |
| Fuel Pressure (ST8130P/M variant) | High range sensor 999 PSI or 99.9 Bar Low range sensor 99.9 PSI or 9.99 Bar |

Peak Value Memory

The peak values are stored in a memory, which is powered by an internal back-up battery. They remain stored in this memory when the external power source is disconnected from the system. The internal battery needs to be changed every 4-5 years. When the power from this battery drops below a safe level, an alarm is triggered and the warning "Internal Battery Low" is displayed.

Alarms

The Display System has built-in warnings to alert the driver when certain parameters either exceed or fall below their alarm values. For example, a warning is signalled if the oil pressure falls below its alarm value or if the oil temperature rises above its alarm value. You can adjust the preset alarm levels when you configure the Display System. See Chapter 4, Configuring the Display System in this manual.

Some of the warnings (see the following table) are triggered only after the engine speed has exceeded its "gate value" for RPM for at least one second. Blipping the engine may not be enough to trigger a warning. The gate value is a predefined RPM value that is used to control when the system is to trigger a warning. This prevents abnormal warnings from being triggered when, for example, the engine is either not running, is idling or is being warmed up. Once the engine has been running above the gated RPM for at least one second, any problems will trigger an immediate warning.

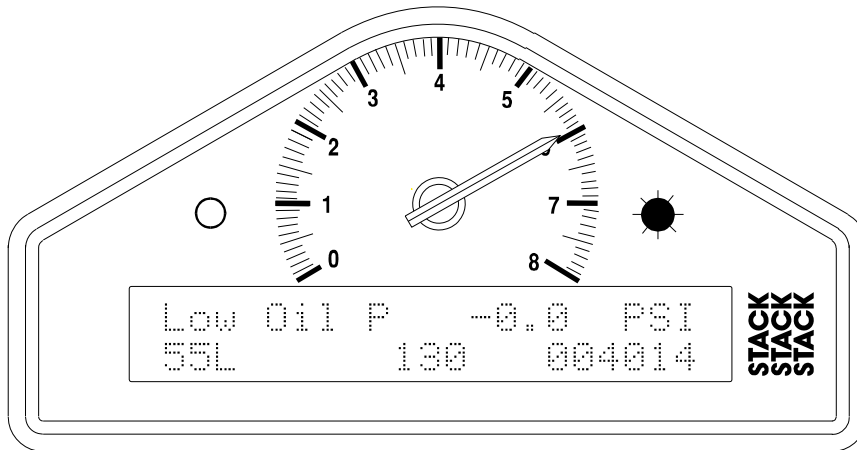
Note: The oil pressure alarm will come on at power-up until the engine is started and pressure exceeds the threshold set for the alarm.

The Display System has the following built-in alarms:

| Parameter | Alarm is triggered when the: | Gated to RPM |
|-----------------------------------|--|---------------------|
| Oil Pressure | Current value drops below the preset value | No |
| Oil Temperature | Current value exceeds the preset value | Yes |
| Water Temperature | Current value exceeds the preset value | Yes |
| Fuel Level (warning light only) | Current value drops below the preset value | No |
| Battery Voltage | Current value drops below the preset value | No |
| Air Temperature (ST8130 variant) | Current value drops below the preset value | No |
| Fuel Pressure (ST8130P/M variant) | Current value drops below the preset value | Yes |

Displaying an Alarm

When an alarm condition occurs, the built-in red warning light turns on and the digital display gives a warning message to show the type of alarm:



Note that the low fuel warning is indicated by the amber light.

Clearing an Alarm

Press Switch 2 or Switch 3.

Showing the Last Alarm

Press and hold Switch 2.

```
Low Oil P -0.0 psi  
55 L 130 004014
```

Lap times

The lap time for each lap is recorded either by the infra-red lap time sensor when passing the lap time beacon or when the driver presses Switch 4.

The most recent lap time is held in display layer 5 (layer 4 for ST8130M). Press Switch 3 to see this display layer. This display gives you time of the last recorded lap and the lap number of the current lap.

| |
|--|
| Lap 12 MPH Best 1:35.10 135 1:35.06 |
|--|

Resetting the Lap Time to Zero

Press and hold Switch 1 and then press Switch 4 to reset the lap count and lap time to zero. The lap timer starts recording the time immediately.

| |
|---|
| Lap 0 MPH Best 0:00.00 0 0:00.00 |
|---|

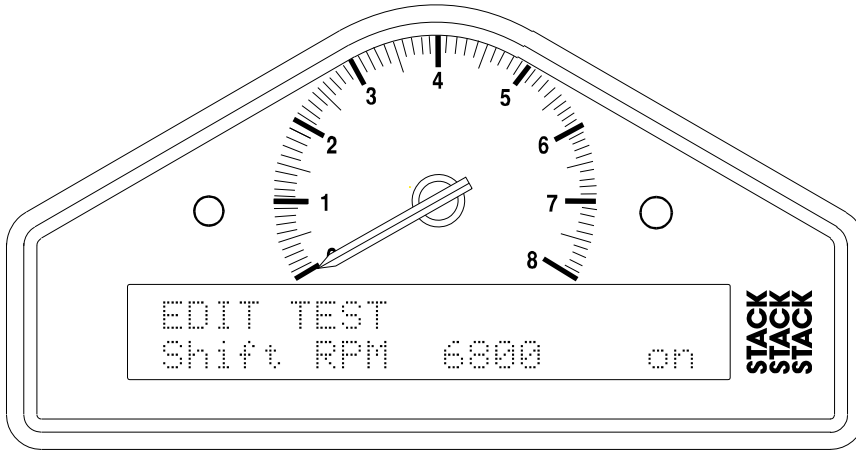
Gear shift light

The optional external gear shift light comes on when the engine RPM exceeds a predefined value. See "Configuring the Display System" for information about setting this value.

Chapter 4. Configuring the Display System

Configuration mode

You put the Display System into configuration mode by pressing Switches 1 and 2 together. This should give a display similar to the following:



You then work through the configurable parameters in a preset sequence.

Press Switch 3 to display the next configurable parameter.

Press Switch 4 to end configuration mode.

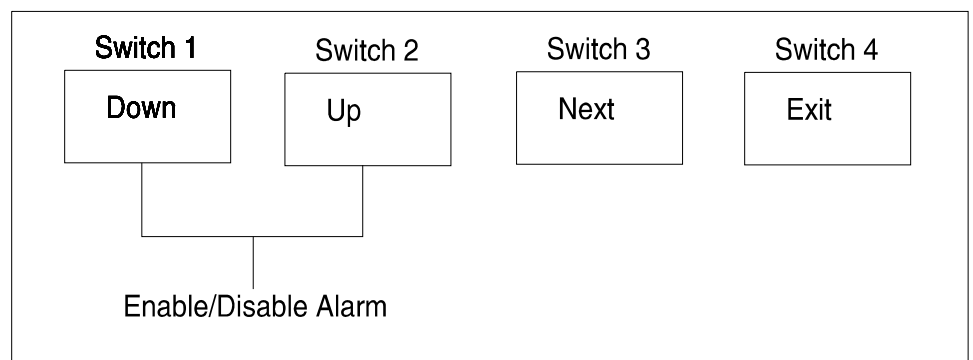
Setting or resetting configuration values

Use Switch 1 to decrease the value being configured and Switch 2 to increase it. The rate at which the value increases or decreases itself increases while the switch is being held down.

Switching Alarms on or off

You can enable (switch on) or disable (switch off) each of the alarm warnings by pressing and holding Switch 1 and then pressing Switch 2.

Note that you might change the preset value of the parameter slightly while pressing both switches. This does not matter if you are switching the alarm warning off and, if necessary, you can correct the preset value after you switch it on again.



Summary of Configuration Switches

Configurable Parameters

The configurable parameters are displayed in the following order:

| Configurable Parameter | Setting Required | Switchable Parameter |
|------------------------------|--|----------------------|
| Shift RPM | RPM at or above which the gear shift light is to come on | Yes |
| Low Fuel | Volume of fuel in tank at or below which the low fuel warning light is to be turned on. | Yes |
| Ice Warning (ST8130 variant) | Air temperature at or below which the Ice Warning alarm is to be signalled | Yes |
| High Oil T | Oil temperature at or above which the High Oil Temperature alarm is to be signalled. | Yes |
| High Water | Water temperature at or above which the High Water alarm is to be signalled. | Yes |
| Low Batt | Battery voltage at or below which the Low Batt alarm is to be signalled. | Yes |
| Low Fuel P (ST8130P/M) | Fuel pressure at or below which the Low Fuel Pressure alarm is to be signalled. | Yes |
| Low Oil P | Oil pressure at or below which the Low Oil Pressure alarm is to be signalled. | Yes |
| Fuel Tank Sender | The volume of fuel currently in the tank. See "Calibrating the Fuel Level" below for more details. | Not applicable |
| Gate RPM | Minimum RPM for oil temperature, oil pressure and water temperature warnings to operate. | Yes |
| E. S. Cylinders | Number of cylinders in engine (for RPM) | Not applicable |
| W.S. Pulses/Rev | See "Wheel Pulses and Circumferences" below for more details. | Not applicable |
| Wheel Cir | See "Wheel Pulses and Circumferences" below for more details. | Not applicable |

Examples displays for each of the configuration items are shown below.

Shift RPM:

EDIT TEST
Shift RPM 7000 on

Low Fuel:

EDIT TEST
Low Fuel 10 L on

Air Temperature (ST8130 variant):

EDIT TEST
Ice Warning- 7C on

High Oil Temperature:

EDIT TEST
High Oil T 130C on

High Water Temperature:

EDIT TEST
High Water 105C on

Low Battery Voltage:

EDIT TEST
Low Batt 10.0 on

Low Fuel Pressure (ST8130P/M variant):

**EDIT TEST
Low Fuel P 35 on**

Low Oil Pressure:

**EDIT TEST
Low Oil P 35 on**

Fuel Level Calibration:

**Sw1 & 2 to calibrate
Fuel Tank Sender**

Gate RPM:

**EDIT TEST
Gate RPM 3000 on**

Engine speed cylinders:

E.S. Cylinders 4

Wheel speed pulses:

W.S. Pulses/Rev 10

Wheel circumference:

Wheel Cir 1000 mm

Wheel Pulses and Circumferences

Calculations for the ST8130 (ST492 Pulse Amplifier)

You must supply a value for the wheel circumference that you obtain from one of the following calculations:

- 1. If you know the number of pulses generated for one mile (US version only):*

$$63360 \div \text{pulses per mile} = \text{wheel circumference}$$

(Set the number of pulses per rev to 1.)

Note: If the resulting circumference is less than 20.0 inches, double this value and set the number of pulses per rev to 2. This is to make the calculated speed and distance as accurate as possible.

Example:

Pulses per mile: 5000

$$\text{Circumference} = 63360 \div 5000 = 12.67 \text{ inches}$$

Double the two values:

$$\text{Wheel Cir (ins)} = 25.3 \text{ inches}$$

$$\text{W.S. Pulses/Rev} = 2$$

2. ***If you know the number of pulses generated for one kilometre (EU version only):***

$$1000000 \div \text{pulses per km} = \text{wheel circumference}$$

(Set the number of pulses per rev to 1.)

Note: If the resulting circumference is less than 500mm, double this value and set the number of pulses per rev to 2. This is to make the calculated speed and distance as accurate as possible.

3. ***If you know the number of pulses generated for one mile (UK version only):***

$$1609344 \div \text{pulses per mile} = \text{wheel circumference}$$

Set the number of pulses per rev to 1.

Note: If the resulting circumference is less than 500mm, double this value and set the number of pulses per rev to 2. This is to make the calculated speed and distance as accurate as possible.

Example:

Pulses per mile: 5000

$$\text{Circumference} = 1609344 \div 5000 = 321.9\text{mm}$$

Double the two values:

$$\text{Wheel Cir (mm)} = 644\text{mm}$$

$$\text{W.S.Pulses/Rev} = 2$$

4. ***If the pulses are coming from the wheel, i.e. you know the number pulses for each revolution of the wheel, enter the actual circumference and the number of pulses per revolution (see the following section)***

Calculations for the ST8130 (ST670 Wheel Sensor)

You must supply a value for the wheel circumference that you obtain from one of the following calculations:

If the sensor is mounted on a wheel, set this value to the circumference of the wheel and set the number of pulses per revolution to the number of targets on the wheel.

Note: If the circumference is less than 500mm or 20.0 inches, double both this value and the number of pulses per revolution. This is to make the calculated speed and distance as accurate as possible.

If the sensor is mounted on a driveshaft or the propshaft, set the circumference to:

*Actual wheel circumference ÷ differential ratio
-where the differential ratio is calculated as:
crownwheel (ring) teeth ÷ pinion teeth*

Note: If the resulting value is less than 500mm or 20.0 inches, double both this value and the number of pulses per revolution. This is to make the calculated speed and distance as accurate as possible.

Set the number of pulses per revolution to the actual number of pulses per revolution of the shaft.

Examples for 9 pinion teeth & 41 crownwheel (ring) teeth:**UK/EU****Differential ratio: $41 \div 9 = 4.55$** **Pulses per revolution: 4****Tyre circumference: 1800mm****Circumference = $1800 \div 4.55 = 395\text{mm}$** **Double the two values:****Wheel Cir (mm) = 790mm****W.S. Pulses/Rev = 8****US****Differential ratio: $41 \div 9 = 4.55$** **Pulses per revolution: 4****Tire circumference: 70.9 inches****Circumference = $70.9 \div 4.55 = 15.6\text{ inches}$** **Double the two values:****Wheel Cir(ins) = 31.2 inches****W.S. Pulses/Rev = 8**

Configuring the Fuel Pressure Sensor (ST8130P/M variant)

From 2005 Road Car Display Systems (8130P/M) are supplied with a Stack ST747 sensor to measure Fuel Pressure. This sensor is highly accurate and it is no longer physically required to change sensors for high or low fuel pressure.

Calibrating the Fuel Level

To calibrate the fuel level reading with the actual amount of fuel in the tank, you will need to start with a tank that contains the amount of fuel you require for its reserve and progressively fill it with known quantities of fuel. While filling the tank, you must use at least two and possibly as many as ten (the maximum permitted) calibration points to set values for accurate fuel level readings. More than five calibration points are recommended, with the first at zero (empty), the second at five litres, the third at ten litres and the remaining points divided equally across the amount of fuel still required to fill the tank completely.

Use the following procedure:

Set the Display System to configuration mode.

- 1. Decide how many calibration points and the amount of fuel for each that you are going to use. For example, to calibrate the readings for a 50 litre (10 gallon) tank for the following quantities, the following seven calibration points are suggested: 0, 5L (1gal), 10L (2gal), 20L (4gal), 30L (6gal), 40L (8gal), 50L (10gal).*

For a 100L (20gal) tank, ten calibration points are suggested: 0, 5L (1gal), 10L (2gal), 20L (4gal), 30L (6gal), 40L (8gal), 55L (11gal), 70L (14gal), 85L (17gal), 100L (20gal).

Empty the tank so that it contains only the amount you require as its reserve. Use the fuel pump to empty the tank. Add the reserve fuel, for example, two litres (0.5 gal.).

You may wish to enter these values into the table on p34. If you ever have to return the unit for servicing, supplying the values from this table will allow Stack to automatically recalibrate the fuel display so that you will not have to repeat this process.

You should now drive to your local petrol (gas) station a fill the car on level ground in order to complete the calibration process.

To make the calibration process more efficient it is recommended that you have one person to operate the petrol (gas) pump & one person to operated the switches for the Dash.

Note: The petrol (gas) pumps may shut off, if the petrol delivery is interrupted for a time.

2. Select the Fuel Tank Sender calibration display.

Hold Switch 1 down and press Switch 2. This gives a display similar to the following:

| |
|--|
| Tank Qty 0L Reading 255 |
|--|

1. Use Switches 1 and 2 to change the Tank Qty value to zero if it is not already zero. Switch 1 decreases the value shown while Switch 2 increases it. Record the Tank Qty and the Reading value in the table on p34.

When you have set the Tank Qty to the required value, press Switch 3 to set this value.

2. Press Switch 1 to continue to the next calibration point.

3. Fill the tank with a small, known amount of fuel, for example, five litres (one gallon). If the Reading value does not change, there is a problem with either the fuel sender or the wiring.

4. Wait for the Reading value to stabilise. This requires several seconds. While you are waiting for the Reading value to stabilise, use Switch 1 and Switch 2 to change the Tank Qty value to the amount of fuel now in the tank.

5. When the Reading value has stabilised, press Switch 3 to set this value

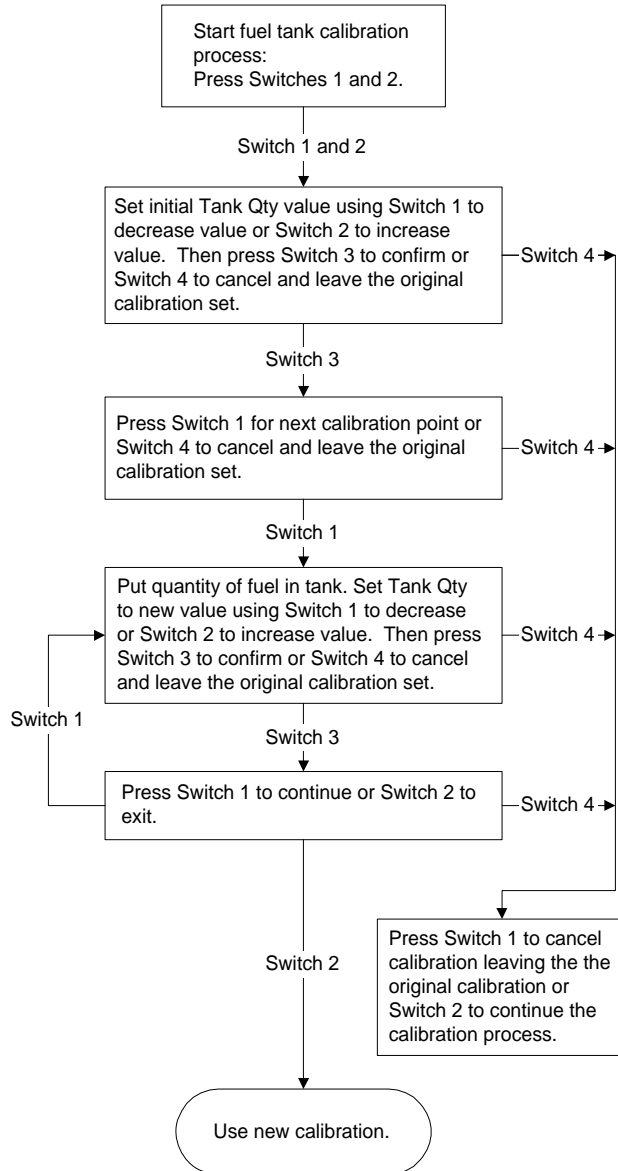
6. Repeat steps 6 through 9 above for each calibration until the tank is full or you have performed at least two or as many as ten calibration operations.

7. Press Switch 2 (Finished) when you have completed calibrating the fuel level readings.

You can press Switch 4 to go to the cancel calibration mode, then Switch 1 to Cancel or Switch 2 to Continue with calibration.

Cancelling the calibration leaves the original calibration set.

The flowchart below summarises the steps in the calibration process.



If the displayed reading values do not change by a significantly large amount from the empty to full condition, the fuel level sender in your vehicle may not be suitable for use with the ST8130 Road Car Display System. Check with your Stack dealer if this is the case.

When you wish to return to the normal display, press Switch 4.

Fuel Calibration Table

| | <i>Fuel Qty</i> | <i>Reading</i> |
|------------------|------------------------|-----------------------|
| <i>1</i> | | |
| <i>2</i> | | |
| <i>3</i> | | |
| <i>4</i> | | |
| <i>5</i> | | |
| <i>6</i> | | |
| <i>7</i> | | |
| <i>8</i> | | |
| <i>9</i> | | |
| <i>10</i> | | |

Chapter 5. Installing the Display System

Who can install the Display System?

The Display System can be installed by anyone competent in fitting electrical and mechanical accessories to cars.

Tools needed to install the Display System

ST8130 with ST670 Option

No special tools other than normal workshop tools are needed

ST8130 with ST492 Option

A trimmer tool or small flat jeweller's screwdriver (1.5mm or 1/16 inch blade) is required in order to adjust the pulse amplifier.

Preconfigured Display Systems

Use the instructions in the previous chapters to set up, operate and configure the ST8130 before installing it in the vehicle.

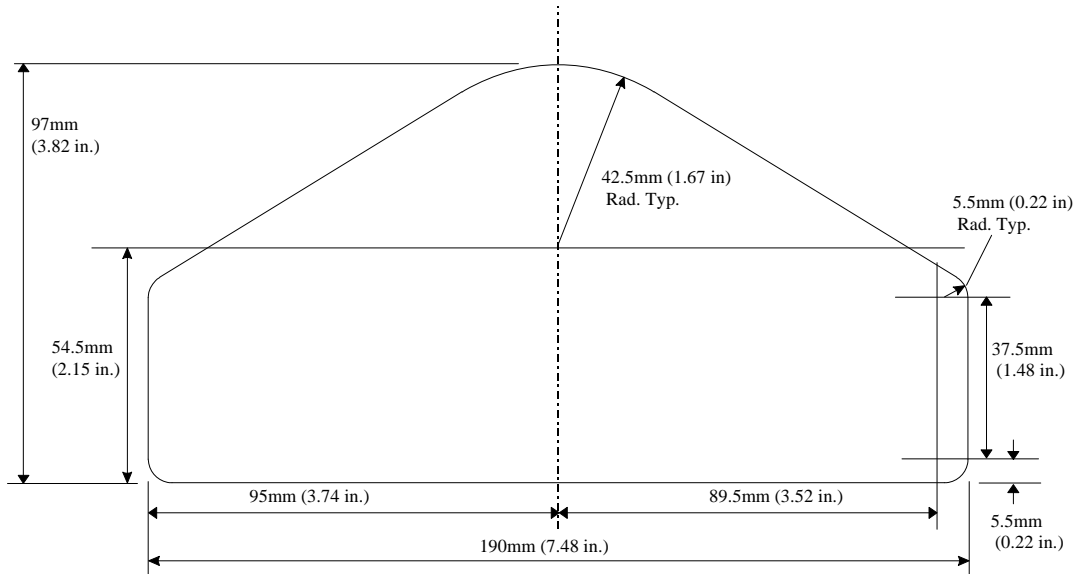
Custom Configured Display Systems

If you have purchased a Display System that has been custom configured for you, the system may include components not described in this manual. Refer to the additional instructions supplied with the system for such components.

This manual may refer to components not included in the system. You should ignore them.

Fitting the Display Module

The Display Module is fitted into a cut-out in the instrument panel/dashboard and secured using the two U-brackets at the rear. The dimensions for the cut-out are shown below. A full size template is supplied at the end of this manual.



Positioning the Display Module

Ensure that there is sufficient space behind the cut-out to allow the wiring harness to be connected to the 19-way connector without any tight bends to the wiring near the connector.

The Display Module must be positioned on the dashboard so that the driver can see it, either over the steering wheel or through it.

The Display Module should be aligned so that the driver looks at it square or from slightly above or below.

Switches

The four switches are used to control the functions of the Display System.

The normal functions of the four switches are:

| Switch | Functions |
|----------------|---|
| Switch 1 | Show the peak values. |
| Switch 2 | Clear an alarm or show the last alarm. |
| Switch 3 | Change the display layer or clear an alarm. |
| Switch 4 | Reset the trip distance to zero and start the lap timer. The trip distance is reset after each lap. |
| Switches 1 & 2 | Enter Set up mode. |
| Switches 1 & 3 | Change speed units to MPH or km/h & distance to miles or km |
| Switches 1 & 4 | Reset the peak values and lap times. |

You can install the switches in any convenient location. When installing the switches, you should take account of the following considerations:

- *The cable for each switch is approximately 400mm/16" in length from the 19-way military connector.*
- *It is important that the driver is able to reach Switch 3 easily in order to change the display and clear warning messages after alarms. This switch can be fitted on the steering wheel.*
- *When you configure the system, you use Switches 1 to 4 for selecting the parameters and setting their values. These switches should be installed so that you can reach them easily when you are viewing the digital display.*

Warning lights

The Display Module has two built-in warning lights. The left-hand (amber) light is the fuel level warning light and the right-hand (red) light alerts the driver whenever an alarm has been triggered.

As an option, you can install additional external warning lights for gear shift and alarm warnings. The external warning lights should be installed in any position that is in the driver's direct line of vision, as they need to be visible at all times.

Stack Ltd can supply suitable external warning lights for installation in the dashboard (ST536/537) as well as shrouded versions that can be mounted on top of the dashboard (ST533/534).

⇒ *If you are using your own warning lights, ensure that the bulb rating does not exceed 2 Watts; otherwise the Display Module will be damaged. If you need to use lamps greater than 2W, connect them to relays and use the output sockets from the Display Module to switch these relays.*

Engine Speed (RPM) Measurement

The engine speed (RPM) is measured by connecting the engine speed wire directly to the ignition system. A single wire, with the label ES, connects the Display System to the ignition system or low-tension side of the coil.

Connecting the Display System to the Ignition System

The Display System can be connected to engines with a variety of ignition systems. These are shown in the following table.

| Ignition System | Normally Fitted To | Connection Point |
|------------------------------------|-----------------------------|--|
| Bosch | Citroen AX 'Sport' and 'GT' | Tachometer output (coil negative) with 100K series resistor |
| Bosch 3-pin CD | Porsche 911 Carrera '76 | Pin 'C' (points connection) |
| Bosch 8-pin CD | Porsche 930 Turbo '76 | Pin 7 on ignition unit |
| General Motors GME-071 | Vauxhall Opel | Tachometer output (coil negative) with 10K series resistor |
| Lumenition Performance (Black) | Accessory only | Blue wire from distributor pick-up |
| Lumenition Optronik MK17 (Silver) | Accessory only | Brown wire on coil negative |
| Motorcraft | Ford | Coil negative with 47K series resistor |
| Performance Coil (Bosch Blue Coil) | Accessory only | Coil negative with 47K series resistor (use screened high tension leads) |

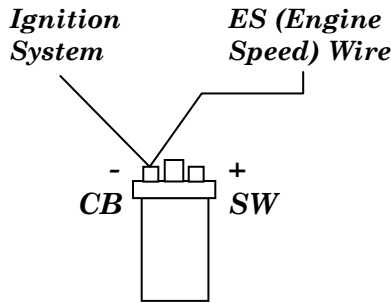
The following connections are shown in greater detail:

- *Standard contact breaker system*
- *Series Resistor Connection*
- *ECU Connection (+ Pull-up resistor)*

The connection of the Display System to these types of ignition system is described below:

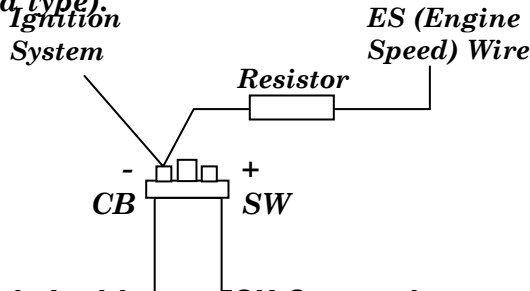
Standard contact breaker system

Connect the ES (Engine Speed) wire to the negative terminal on the coil.



Series Resistor Connection

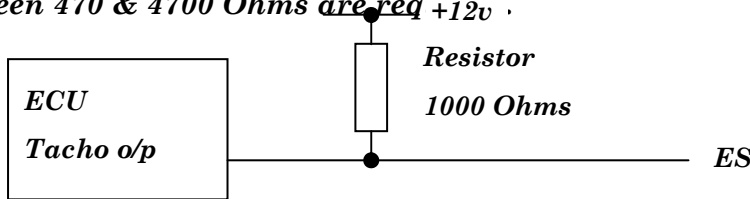
For systems which require series resistor on the ES (Engine Speed Wire) the resistor must be connected directly to the terminal to limit interference from the high tension leads (which must be the screened type).



Electronic Ignition or ECU Connection

Connect the ES (Engine Speed) wire directly to the "Tacho" output of the electronic ignition or ECU. If this results in a Zero RPM reading then ...

Some ECU's (MoTeC M800) require a Pull-up resistor connected between the ES wire & +12v (battery positive). Resistor values between 470 & 4700 Ohms are req +12v .



Pressure sensors

Fitting the pressure sensors

The ST8130 variant is supplied with one pressure sensor for Oil Pressure.

The ST8130P/M variant is supplied with two pressure sensors for Oil and Fuel Pressure.

The sensors will always be Stack ST747 pressure sensors with optional adapters to match the pressure ports of different types of engines.



| Country Code | Sensor type | Max Pressure | Thread Size |
|--------------|--|----------------|------------------------|
| EU | ST747-M10* | 10 bar/145 psi | M10 x 1 |
| US/ UK | ST747- 1/8 th NPTF | 10 bar/145 psi | 1/8 th NPTF |
| OPTION | ST747- 1/8 th BSP ⁺⁺ | 10 bar/145 psi | 1/8 th BSPT |

** Sensor is 1/8" NPTF thread supplied with M10 x 1 adapter*

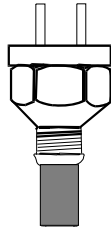
++Sensor is 1/8" NPTF thread supplied with 1/8" BSP adapter

Installing the pressure sensors

- *Position each sensor and its cable as far as possible from all sources of intense heat and from the ignition HT leads.*
- *The sensors can be either screwed in directly to the monitoring point or fitted separately by using suitable pressure hose to connect them to the monitoring point. By fitting the sensors separately, you will reduce the amount of vibration to which they are subjected and thereby extend their life.*
- *Do not over-tighten the sensors.*
- *The ST747 Fuel Pressure sensor supplied with the ST8130P/M variant must be connected to the A connector on the harness. A 1.4Mtr extender cable (ST918021) is supplied if the standard harness is too short.*

Temperature sensors

The Display System is supplied with two each of one of the following types of temperature sensor: Stack ST762 or ST764:



The ST762 temperature sensor has an M10 x 1 thread (EU versions).

The ST764 temperature sensor has two terminals and a 1/8" NPTF thread (UK/US version)

Each type of sensor can be used for monitoring both oil temperature and water temperature.

If you find that you have a sensor with an incorrect thread, please return it to Stack for replacement.

Fitting the temperature sensors

Mount each temperature sensor directly in the appropriate fluid line. Screw the sensor into a suitable mounting boss, so that its end lies in the middle of the flow of fluid.

- *Position the sensors and their cables as far as possible from sources of intense heat and from the ignition HT leads.*

Wheel speed sensor (ST670-Option)

ST670-Option Display Systems are supplied with one Stack ST670 proximity sensor as a standard feature which must be fitted if the vehicle is to comply with the legal requirement for an on-road speedometer. This sensor is used to measure wheel speed in order to display the vehicle's speed in MPH or km/h. The sensor provides an electrical pulse to the system each time a ferrous object, such as a wheel bolt, passes near to the end of the sensor. When you configure the system, you will need to supply the circumference of the wheel and the number of ferrous objects that will be counted for each revolution of the wheel. If you are not sure whether the object you have chosen to use is ferrous, you can check it with a magnet. If there is no attraction, the object is not ferrous.

Fitting the wheel speed sensor

- *Locate a suitable position for the wheel speed sensor so that one or more ferrous objects (such as bolt heads) will pass the end of the sensor as the wheel turns.*
- *If possible, choose the wheel that incurs the least amount of wheel spin, wheel lift or lock-up, as these will affect the speed reading.*
- *Avoid mounting the sensor too close to the brake disc to avoid excessive heating.*
- *Make a suitably rigid bracket for the sensor and fit it onto the vehicle. Fit the sensor to the bracket.*
- *Do not over-tighten the sensor.*
- *Adjust the distance between the end of the sensor and the target ferrous object(s), so that the gap is $1.5\text{mm} \pm 0.5\text{mm}$ / 60thou \pm 20thou. Make sure that no other objects pass within $4\text{mm} / \frac{5}{32}$ " of the end of the sensor while the wheel rotates.*
- *Once the system is powered up, a small LED built into the back of the sensor will light up each time a ferrous object passes within the defined distance from the end of the sensor.*
- *Position the sensors and their cables as far as possible from sources of intense heat and from the ignition HT leads.*

Pulse Amplifier Interface (ST492-Option)

Introduction

This amplifier is designed to convert the output of an existing sensor, which generates a pulsed signal which is not compatible with the ST8130 system's channel input requirements. This incompatibility may be caused by insufficient voltage or lack of output current drive capability.

The amplifier has negligible loading effect on the signal and includes the facility to adjust its sensitivity, so can be used with a wide variety of sensors.

N.B. For reasons of safety, NEVER connect the amplifier to an ABS speed sensor.

Installation

Mechanical

The amplifier should be mounted, using the self-adhesive dual locking material supplied, in a position away from strong sources of heat and H.T. leads. It should be noted that this adhesive will not reach full strength for up to 24 hours.

On one side of the module there is a small red LED and a potentiometer access hole. This potentiometer is used to alter the sensitivity and the LED is used to give visual confirmation of correct adjustment. Access to this part should therefore be considered when choosing a mounting position.

Using the 'dual-lock' fastener with Stack sensors

This is a high opening force 'Velcro-type' fastener system with identical mating halves. It is intended to be used for semi-permanent fixing applications and is not intended for frequent dismantling.

For best performance, the following precautions should be taken:

Bond strength is dependent upon the amount of adhesive to surface contact development. Firm application pressure develops better adhesive contact and thus improves bond strength.

To obtain maximum adhesion, the bonding surfaces must be clean, dry and well unified. Typical surface cleaning solvents are isopropyl alcohol/water mixture (rubbing alcohol) or heptane. Use proper safety precautions when handling solvents.

Ideal application temperature range is 21-38°C (70-100°F). Initial application to surfaces at temperatures below 10°C (50°F) is not recommended because the adhesive becomes too firm to adhere readily.

To mount a sensor or housing on the vehicle

Take one of the supplied pieces of 'dual-lock' fastener, remove the adhesive backing and attach to the sensor or housing.

Take a second strip of the fastener and attach to the first piece by pushing them together firmly, ensuring correct alignment.

Remove the adhesive backing off the second strip of fastener and attach the sensor or housing to the vehicle in the desired position. Push against the fastener firmly to ensure maximum adhesion.

Do not try to separate the 2 strips of fastener immediately

The acrylic adhesive backing should be given 24 hours to achieve full bond strength.

If you require further fastener strip or have any comments, questions or recommendations regarding its use, please contact Stack or your nearest distributor.

Electrical

The amplifier connects into the ST8130 system via a four way Mini Sure Seal (MSS) socket, the larger of the two connectors on the amplifier. Use the extender cable with an MSS connector at each end to connect the amplifier to the WS input on the harness.

The plug, the smaller of the two connectors on the amplifier, is the connection to the sensor. Use the cable with a MSS connector at one end and two wires at the other to connect the amplifier to the speed sensor.

For a two wire sensor, connect sensor wires to the red and black wires on the cable.

For a single wire sensor, connect the sensor wire to the red wire on the cable.

Adjustment

Once the system has been fully wired power should be applied.

At this stage it is desirable to arrange for the sensor to generate a low frequency signal by spinning the wheel slowly. The red LED at the end of the amplifier should be seen to flash as each signal is received. If the frequency is higher than approximately 10 flashes/second the LED may only appear to dim, as the flashing is too fast for the eye to see.

If this does not happen (the LED is always on or off) it will be necessary to adjust the input sensitivity of the amplifier to match the sensor. This is accomplished by turning the small screw head, which is recessed, in the hole adjacent to the LED. This should be adjusted until the LED flashes consistently.

The operation should be checked at the lowest possible frequency, as this is the most likely speed for problems to occur.

Following these adjustments, correct operation can be verified by observing the LCD speedometer at a range of speeds.

ST492 Technical Specification

| | |
|---|--|
| <i>Supply :</i> | <i>From ST8130 input</i> |
| <i>Output characteristics :</i> | <i>ST8130 compatible</i> |
| <i>Input impedance :</i> | <i>>50K Ohms</i> |
| <i>Operating temperature range :</i> | <i>-20 to +80 °C / -4 to 176 °F</i> |
| <i>Input threshold adjustment range :</i> | <i>-5 Volts to +12 Volts</i> |
| <i>Input hysteresis :</i> | <i>+/- 0.1 Volt</i> |
| <i>Maximum input frequency</i> | <i>2000 Hertz</i> |
| <i>Physical dimensions :</i> | <i>(mm) L 51, H 18, W 32</i> |
| | <i>(in) L 2, H ¾, W 1¼</i> |
| <i>Weight :</i> | <i>50g / 2oz maximum</i> |
| <i>Vibration testing :</i> | <i>20 G, 50Hz to 2000Hz, 1 Octave/min for 12 hours</i> |

Fuel Tank Sender

Plug the adapter (ST918037) supplied in the sensor bag to the 4-way sure seal connector marked F.

Single-Wire Sender

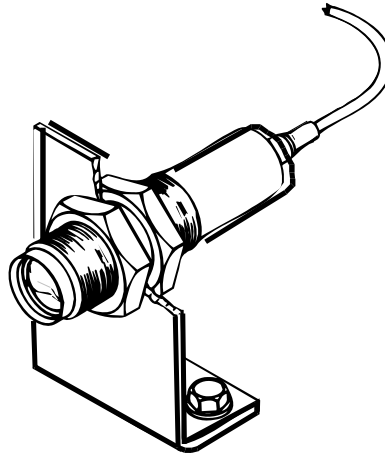
If your vehicle is fitted with a single-wire sender (rheostat), remove the existing wire from it and connect the red (F) wire to it.

Two-Wire Sender

If your vehicle is fitted with a two-wire sender (potentiometer), remove the existing wires and fit the red (F) wire to one of the terminals. If there is no change in fuel-level reading during calibration, fit the red wire to the other terminal.

Lap timing sensor (Optional, Std on ST8130M)

The lap timing sensor is actuated by an infra-red beacon positioned at the side of the circuit. The sensor is fixed to a rigid bracket mounted at a convenient position on the outside of the vehicle where it is able to detect the signals from the beacon.

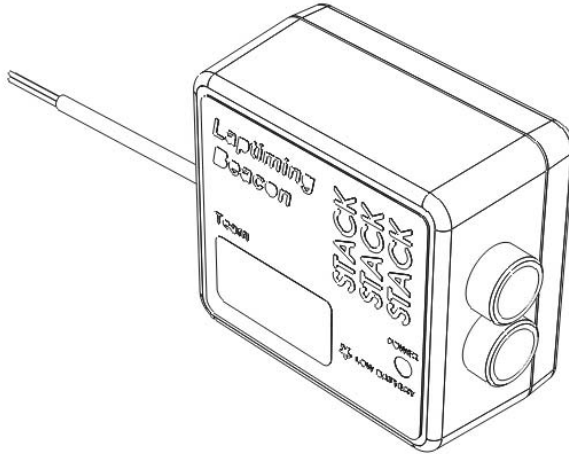


It is secured by two nuts (supplied) with an M18 x 1 mm thread.

This sensor must be positioned horizontally and square to the axis of the vehicle. In order to detect the signals from the beacon, it must be positioned outside the vehicle. It should, if possible, be positioned so that other vehicles that are being overtaken (or are overtaking) at the moment your vehicle passes the beacon do not block the signal.

Note that after detecting a signal, the system does not recognise any further signals from beacons for a period of ten seconds.

Trackside Infra-Red Lap Beacon (Optional, Std on ST8130M)



The ST544 trackside infra-red lap beacon should be located as follows:

- *As near to the start-finish line as possible*
- *At the same height as the on-vehicle detector*
- *Level, so that it emits a horizontal beam*
- *It must be between 2 and 30 metres (6 and 100 feet) from the vehicle when the vehicle passes it*

Avoid positioning it so that the sun is directly behind it when it is being used.

Where the unit is to be used for lengthy periods in very hot, sunny conditions, it should be protected by shading it from direct sunlight.

*Do not allow water to be sprayed onto the transmitter lenses.
During wet conditions, fit a protective shroud over the beacon.*

Power supply to Trackside beacon

The beacon operates from a 12v DC supply. A sealed lead-acid battery with a minimum rating of 2.5 Amp/hour is recommended. This provides about 15 hours of operation.

The condition of the battery is indicated by the colour of the LED indicator on the front panel of the unit:

1. **Green:** *The voltage is, at present, adequate for use*
2. **Red:** *The voltage is too low (replace the battery).*
3. **No Colour:** *Battery exhausted or disconnected.*

Air Temperature Sensor (optional on ST8130 variant)

If you have the optional ST765 air temperature sensor, this must be connected to the A connector on the harness.

Instructions for fitting are supplied with the ST765.

When the sensor is installed, the Ice Warning alarm test should be enabled and set to an appropriate value - see Chapter 4. Configuring the Display System.

Wiring harness

The Display Module, the sensors, switches and external lights for your Display System are connected together by means of the wiring harness supplied with the system.

The wiring harness can be fitted after the Display Module and all the sensors and switches have been installed.

This harness has been designed so that the various branches are long enough for most single seater and saloon cars. Occasionally, an individual branch may need to be extended or significantly shortened. If the standard harness is totally unsuitable for your vehicle, contact Stack for details of custom harnesses. Provided that you have chosen suitable locations for the switches, sensors and any external warning lights that you are installing, you should not need to extend any of the individual wires in the harness.

Extender wires for connecting the air temperature and wheel speed sensors to the wiring harness are available in the following lengths:

- *700mm / 2'3" (ST918020)*
- *1400mm / 4'7" (ST918021)*
- *2100mm. / 6'11" (ST918022)*

Fitting the wiring harness

When fitting the harness on the vehicle, you should observe the following:

- *Start by attaching the harness to the Display Module by connecting the 19-way military connector.*
- *Position the ends of all the wires at the locations of the sensors, lamps and switches to which each is to be connected, but do not connect them yet.*
- *All wires should be routed as far as possible and not less than 50mm/2" from ignition HT leads and distributor caps and any other sources of high voltages.*
- *When you pass any wire through a bulkhead or dashboard, fit a cable grommet or gland into the hole so that the edge of the hole cannot chafe the wire.*
- *Particular care is needed when passing wires through holes in carbon fibre, as the carbon can cut through cables very easily.*

- *The heatshrink sleeving around the sensor cables can be cut back, if necessary, to enable the sensor cables to go in separate directions earlier. It is recommended that you always leave at least 150mm/6” of heatshrink sleeving to provide additional strain relief for the cable where it enters the 19-way connector.*
- *Connect the wires when all the sensors are in position and you have secured the wiring harness.*

Wiring labels

See Chapter 2 if you need to check the labels used to identify the individual cables in the wiring harness

Checks and Alarms

You should check the system to ensure that all the sensors are detecting the correct values. You should also run the engine at its operational levels to check that the values displayed by the Display System are accurate. You should then check out the alarm systems to ensure that they are functioning correctly before going out onto the circuit.

Chapter 6. Troubleshooting

| No. | Symptom | Possible Cause | Remedy | Notes |
|-----|--|--|--|---|
| 1 | Display is dead (no backlight, nothing on display, no green dial lights) | Ignition is off | Turn ignition on | B + is 19w connector pin G. The power lead B - is 19w connector pin H. |
| | | Battery is dead | Recharge or replace battery | |
| | | Power connection to B + or B - is faulty | Check if battery is connected correctly. Check power lead continuity | |
| 2 | Display is dead (no backlight, nothing on display, green dial lights on but dim) or Low Battery warning on display | Battery is almost dead | Recharge or replace battery | |
| | | Power connection to B + or B - is faulty | Check power lead continuity | |
| 3 | Display flashes and dial pointer resets or vibrates | Battery is almost dead | Recharge or replace battery | |
| | | Power connection to B + or B - is faulty | Check power lead continuity | |

| No. | Symptom | Possible Cause | Remedy | Notes |
|-----|---|-------------------------------|--|--|
| 4 | The Low Oil P message does NOT appear on power up. | Pressure sensor has failed | Replace sensor | |
| | The warning light is not turned on. | Sensor connections are faulty | Check for continuity on sensor lead. | A reading of 999 on the display indicates an open circuit connection (pin D to the red sensor lead and pin H to the black sensor lead) |
| | | Oil pressure alarm disabled | Check that the oil pressure alarm is set on | |
| 5 | Display gives a fixed temperature reading of 999° C or 999° F | Temperature sensor has failed | Replace sensor | Disconnect sensor. If reading changes to 0, replace sensor. |
| | | Faulty sensor connections | Check the continuity of sensor leads: with the sensor disconnected and the display powered up, there should be 6.25V between the sensor leads. | Otherwise check harness for short circuit |

| No. | Symptom | Possible Cause | Remedy | Notes |
|-----|---|---------------------------------|--|---|
| 6 | Water or Oil temperature display gives a fixed temperature reading of 0°C or 0°F when the water temperature is either above 12 °C or 55°F | A temperature sensor has failed | Disconnect sensor and short its leads together. If the reading changes, replace the sensor | |
| | Air temperature display gives a fixed temperature reading of -99°C or -99°F when the ambient temperature is above -20° C or -4°F | Faulty sensor connections | Check continuity of sensor leads for open circuits. See No. 5 above. | Check the wiring harness for open circuits (pin E to the red OT sensor wire, pin P to the red WT wire and pin H to both the black OT and WT sensor wires) |
| 7 | Fixed pressure reading of 999 PSI or 99.9 Bar | Pressure sensor has failed | Replace sensor | |
| | Fixed pressure reading of 99.9 PSI or 9.99 Bar (low range fuel pressure sensor) | Faulty sensor connections | Check continuity of sensor leads for open circuits. See 5 above. | Pin D to the red OP wire, pin R to the red F wire and pin H to both the black OP and F sensor wires |
| 8 | Fixed pressure reading of -99 PSI or -9.9 Bar | Pressure sensor has failed | Replace sensor | Disconnect sensor. If reading changes to that in 7 above, replace sensor |
| | Fixed pressure reading of -9.9 PSI or -.99 Bar (low range fuel pressure sensor) | Faulty sensor connections | Check continuity of sensor leads for short circuits | Check the wiring harness for short circuit |

| No. | Symptom | Possible Cause | Remedy | Notes |
|------------|--|----------------------------|----------------------------|---|
| 9 | Fixed pressure reading of 0 PSI or 0.0 Bar or suspected low/slow reading | Pressure sensor has failed | Replace sensor | |
| | | Faulty sensor connections | Check pressure connections | Check plumbing for a blockage (kinks in flexible hoses) |
| 10 | All sensors show fixed high values | Switch 1 (Peaks) faulty | Replace switch | Disconnect switch. If values return to normal, replace switch. |
| | | Faulty switch wiring | Check switch wiring | Check wiring for short between connector pins K and H (earth) |
| 11 | Displays pressure values too low and temperature values too high | Low Battery voltage | Recharge battery | The system does not give accurate readings when voltage is below 9.0V |

| No. | Symptom | Possible Cause | Remedy | Notes |
|-----|--|------------------------------|---|--|
| 12 | Peak values not updated | Gate value set too high | Change Gate RPM in the display configuration menu | Peak values only updated while the engine RPM is greater than the Gate value |
| | | Internal memory battery dead | Return unit to Stack for new battery service | Display shows !! Internal Battery Low !! warning on power up |
| 13 | Switch 1: Show peak values does not work | Switch 1 faulty | Replace switch | Disconnect switch and short its leads. If display changes, replace Switch 1. Otherwise check wiring. |
| | | Faulty switch wiring | Check switch wiring for correct continuity | Pin K to red S1 wire less than 1.0 Ohm and Pin K to Pin H (earth) greater than 1M Ohms) |
| 14 | Switch 2: Show last alarm function does not work | Switch 2 faulty | Replace switch | Disconnect switch and short its leads. If display changes, replace Switch 2. Otherwise check wiring. |
| | | Faulty switch wiring | Check switch wiring for correct continuity. | Pin L to red S2 wire less than 1.0 Ohm and Pin L to Pin H (earth) greater than 1M Ohms) |

| No. | Symptom | Possible Cause | Remedy | Notes |
|-----|--|-------------------------------|---|--|
| 15 | Switch 3: Change display layer function does not work | Switch 3 faulty | Replace switch | Disconnect switch and short its leads. If display changes, replace Switch 3. Otherwise check wiring. |
| | | Faulty switch wiring | Check switch wiring for correct continuity. | Pin U to orange S3 wire less than 1.0 Ohm and Pin U to Pin H (earth) greater than 1M Ohms) |
| 16 | Switch 4 does not reset the trip value back to zero | Lap Marker Receiver triggered | Turn off Beacon | |
| | | Switch 4 faulty | Replace switch | Disconnect the switch and short the leads together. If the display changes replace Switch 4. Otherwise check wiring. |
| | | Faulty switch wiring | Check switch wiring for correct continuity. | Pin U to yellow S4 wire less than 1.0 Ohm and Pin U to Pin H (earth) greater than 1M Ohms) |

| No. | Symptom | Possible Cause | Remedy | Notes |
|-----|---|-----------------------------------|--|---|
| 17 | External warning light dead when the display warning light is OK | Bulb has burnt out | Replace bulb | Swap with the other light to confirm burnt-out bulb. If not burnt out, check wiring. |
| | | Faulty wiring to light | Check continuity of wiring. | Pin G to red AL wire less than 1.0 Ohm and Pin N to yellow AL wire less than 1.0 Ohm |
| | | Driver circuitry burnt out | Return unit | |
| 18 | External gear shift light dead | Bulb has burnt out | Replace bulb | Swap with the other light to confirm burnt-out bulb. If not, check wiring |
| | | Faulty wiring to light | Check continuity of wiring: | Pin G to red SL wire less than 1.0 Ohm and Pin M to green SL wire less than 1.0 Ohm |
| 19 | Display values and messages unclear or unreadable (poor contrast) | Display too hot or too cold | Ensure that the display is operated within the specified temperature range | Operating temperature is -20°C ($+5^{\circ}\text{F}$) to $+70^{\circ}\text{C}$ ($+158^{\circ}\text{F}$) |
| | | ECU interface shorted (if fitted) | Check the two core screen ECU wires for short circuits | ECU wire is 300mm / 12" inside the main sensor leads sleeve. Make sure that none of the wire ends are shorted |

| No. | Symptom | Possible Cause | Remedy | Notes |
|-----|--|---|---|--|
| 20 | No RPM speed reading | Incorrect wiring | Check the connection of the engine speed wire to the ignition system (or sensor, if used) | See instructions supplied in this manual. If connected directly to the coil, check that it is to the switched low tension side (usually the negative side). |
| 21 | Displayed RPM value too high or too low by a constant %age amount. | System configured with wrong number of engine cylinders. | Reconfigure system to correct number of cylinders. | Ignition systems may either: -produce "waste" sparks giving double the number of cylinders per revolution |
| | | Ignition system pulses per revolution not same as number of cylinders | Reconfigure system to correct number of pulses per revolution. | -use multiple coils where each additional coil gives proportionately fewer pulses per revolution. |
| 22 | Tachometer reading erratic, pointer jumps high or low | Incorrect wiring | Reconnect the tachometer as specified in this manual | |
| | | Signal from ignition system or coil is noisy | Condition the ES signal by placing a resistor in line with the ES wire | Resistor values: 10K ohms for dedicated tachometer output; 47K Ohms for coil connection (Non-CDI); 100K Ohms for coil connection (CDI). Resistors 1/2W 5% 350v |

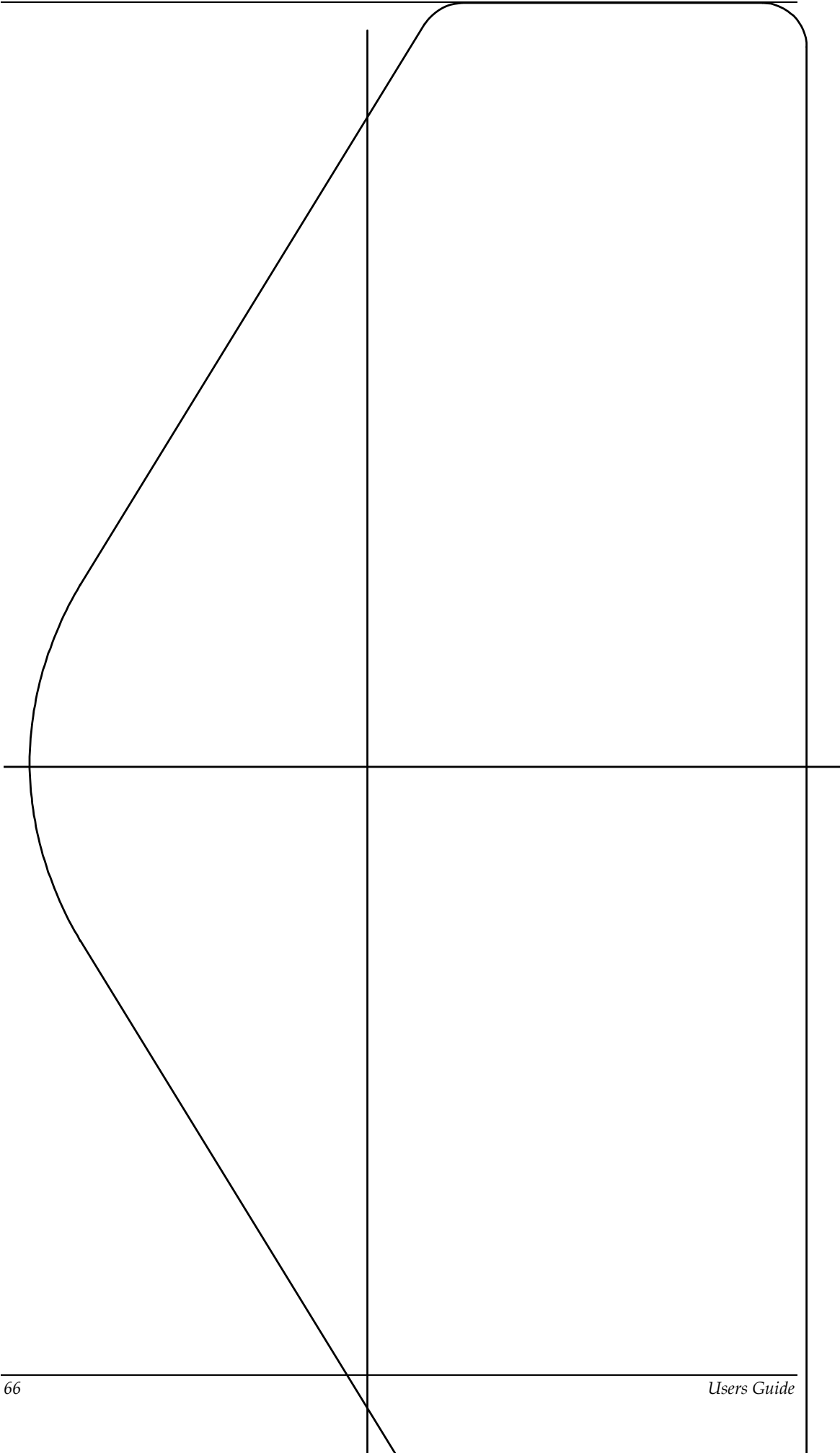
| No. | Symptom | Possible Cause | Remedy | Notes |
|-----|---|--|---|---|
| 23 | Displayed speed value too high or too low by a constant %-age amount. | System configured with wrong number of targets per wheel revolution | Reconfigure the system with correct values | |
| | | System configured with wrong circumference. | | |
| 24 | No speed reading Speed reading erratic, value jumps high or low | Faulty sensor and/or wiring | Check sensor indicator for correct operation | Rotate the wheel by hand and check that the sensor indicator lights up as each target passes the sensor |
| | | Incorrect sensor gap (too far or too close) | Check that the gap is approximately 1mm / 40thou | ST8130 (ST670) only |
| | | Sensor and targets moving apart | Fabricate a more rigid sensor bracket | |
| | | 1. Pulse amplifier not connected 2. Pulse amplifier out of adjustment | Rotate wheels and check the LED on the ST492 for pulse signals | ST8130 (ST492) only |
| 25 | Speed reading dies after a short time | Ambient temperature too high | Shield the sensor from radiated heat from brakes and bearings. Insulate sensor from conducted heat with fibre washers. Duct cooling air around the sensor | Maximum temperature for correct operation of the wheel speed sensor is +80°C (175°F) |

| No. | Symptom | Possible Cause | Remedy | Notes |
|-----|---|---|---|--|
| 26 | No alarms for water, oil or fuel (temperatures and pressures) being displayed | All the alarms have been switched off | Switch on the required alarms | Alarms only operate when the engine is running above the RPM gate value. |
| | | The engine RPM gate value is set too high | Reset the RPM gate to a lower value. | |
| 27 | Display and alarm light flash when the engine is running | Intermittent alarm caused by a parameter with its alarm level set too close to the normal operating value | Either change the value for the alarm or turn the alarm off | Press Switch 2 to see which sensor is causing the alarm |
| 28 | Fuel level reading does not change | <ol style="list-style-type: none"> 1. Fuel sender wiring not connected correctly 2. Faulty fuel sender 3. Fuel sender not suitable for use with ST8130 Display System 4. Fuel sender not calibrated | <ol style="list-style-type: none"> 1. Check wiring 2. Check fuel sender 3. Check with your Stack dealer for suitable alternative <p>See Chapter 4 for information on how to calibrate the fuel sender.</p> | <p>If there is no reading from the fuel sender, remove the fuel sender unit from the tank, earth it to the vehicle with a clip lead and move it by hand to verify that the</p> <p>voltage reading on the red lead changes. The voltage on the red lead should range from 0V to 5V.</p> |

| No. | Symptom | Possible Cause | Remedy | Notes |
|-----|---|--|--|---|
| 29 | Lap time is not displayed automatically | Lap marker receiver lead faulty | Check lap marker wiring | Press lap switch 4. |
| | (Automatic receiver is fitted) | Lap marker receiver faulty | Replace lap marker receiver | If display changes, replace receiver after checking its wiring. |
| 30 | The display unit functions correctly until the engine is started whereupon the digital display either freezes or flashes. The display functions correctly as soon as the engine is stopped. | High levels of electrical interference | Fit suppressors to the high tension leads. Use silicon resistive leads | |

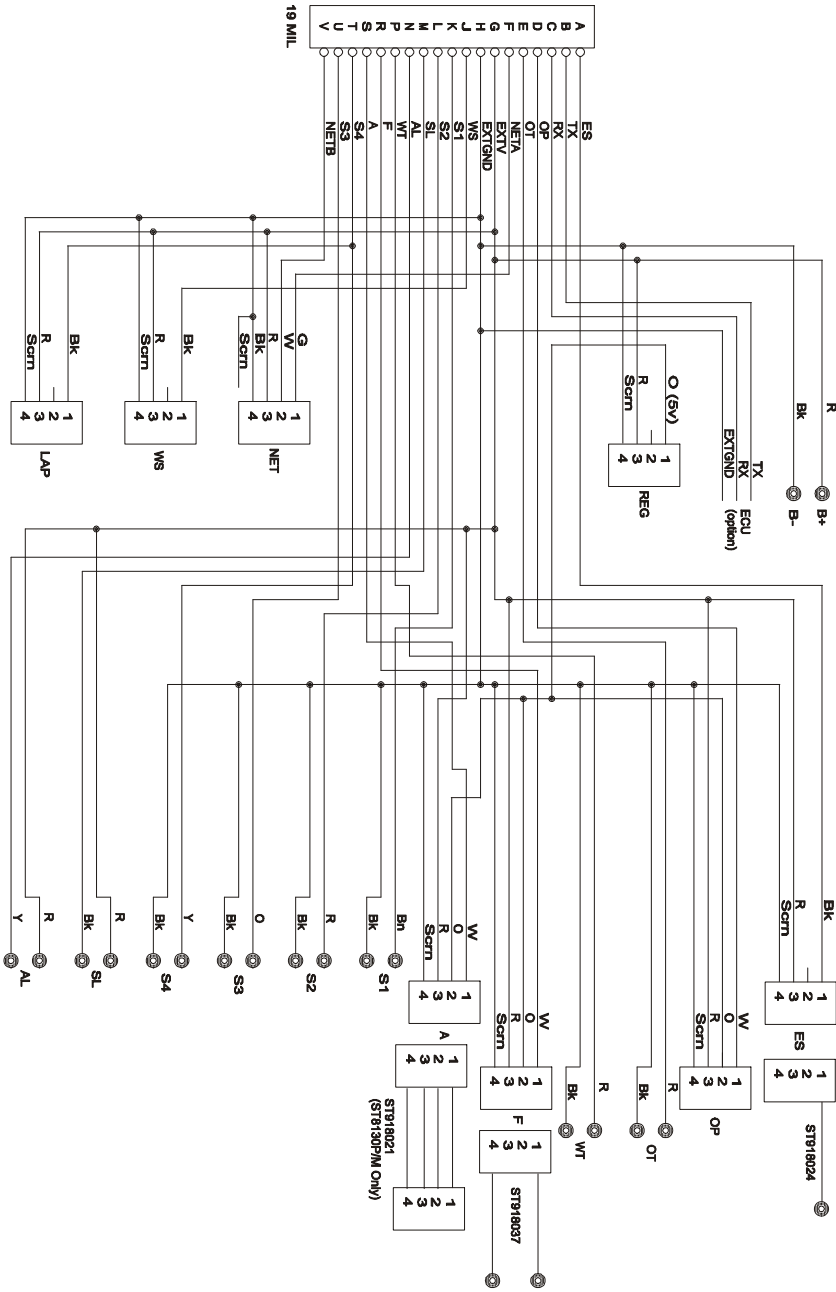
Appendix A. Template for the Display Module

Use the template on the following page for cutting out an aperture for the Display System.



Reverse
of
template

Appendix B. Wiring Harness Diagram



Appendix C. Summary of Switch Functions

Normal Operation

| Switch or Switches | Functions |
|-------------------------|---|
| Switch 1 | Show the peak values |
| Switch 2 | Clear Alarm or Show Last Alarm |
| Switch 3 | Clear Alarm or Change Display Layer |
| Switch 4 | Reset the trip distance to zero and start the lap timer. The trip distance is reset after each lap. |
| Switches 1 & 2 together | Put system into configuration mode. |
| Switches 1 & 3 together | Change speed units between MPH or km/h (UK version only). |
| Switches 1 & 4 together | Reset the peak values and lap times. |

System Configuration Mode

| Switch or Switches | Functions |
|---------------------------|--|
| Switch 1 | Decrease the alarm value of the parameter being displayed |
| Switch 2 | Increase the alarm value of the parameter being displayed |
| Switches 1 & 2 together | Enable or disable an alarm for the parameter being displayed |
| Switch 3 | Display the next configurable parameter |
| Switches 1 & 2 together | Enter Fuel Calibration mode (when applicable) |
| Switch 4 | Exit configuration mode and return to normal operation mode |

Fuel Calibration Mode

| Switch or Switches | Functions |
|---------------------------|---|
| Switches 1 & 2 together | Enter Fuel Calibration mode |
| Switch 1 | Decrease tank quantity value |
| Switch 2 | Increase tank quantity value |
| Switch 3 | Confirm value |
| Switch 4 | Cancel and leave original calibration set |

Returned Goods Procedure

In the unlikely event of a Stack part developing a fault and requiring repairs, you are kindly requested to contact your distributor or Stack Ltd for a Returns Authorisation Number (RAN).

A returns goods form and RAN will be supplied by email/Fax/Post to fill in. Please return the faulty part back to Stack Ltd either direct or via the distributor with this completed form.

Please Note: Returning a part without this form and RAN will lengthen the repair times and possibly increase the cost of the repair.

For a current list of distributors log onto the Stack websites at www.stackltd.com click on the "Where to buy" tab at the top of the home page and select Distributors.



To Contact Stack Ltd:

Email: sales@stackltd.com

Service Administrator: Tel: +44(0)1 869 240404

Tech Support: +44(0)1 869 240420

Fax: +44(0)1 869 245500

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Index

- Air temperature
 - alarm, 16, 21
 - display, 11
 - wiring label, 6
- Air temperature sensor
 - installation, 48
- Alarm warning light
 - external, 35
 - wiring label, 6
- Alarms
 - air temperature, 16, 21
 - battery voltage, 16, 21
 - clearing, 8, 17, 34
 - fuel level, 16
 - fuel pressure, 21
 - fuel pressure, 16
 - fuel warning, 21
 - oil pressure, 21
 - oil pressure, 16
 - oil temperature, 16
 - redisplaying, 17
 - showing last, 17
 - start-up, 7
 - switching on or off, 20
 - water temperature, 21
 - water temperature, 16
- Amplifier. *See* Pulse amplifier
- Analogue tachometer, 5
- Battery voltage
 - alarm, 16
 - display, 11
- Battery voltage alarm, 21
- Beacon, 47
 - battery condition lamp, 48
 - power supply, 48
- Calibration
 - fuel level, 28
 - wheel speed 24, 25
- Clearing an alarm, 17
- Configurable parameters, 21
- Configuring the display system, 19
 - switches to enter configuration mode, 34
- Contact breaker system connection, 37
- Custom configured ST8130, 32
- Datalogging subsystem
 - wiring label, 6
- Digital display panel, 5
- Dimensions, 33
- Display
 - backlighting, 8
- Display layers, 8
 - changing layer, 34
 - layer 1, 9
 - layer 2, 9, 10
 - layer 3, 10
 - layer 4, 11
 - layer 5, 11, 12
- Display module, 5
 - dimensions, 33
 - positioning, 33
 - template, 62
- Dual-Lock, 42
 - electronic ignition connection, 37
- Engine
 - cylinders, 21
 - ignition pickup, 36
- Engine speed (RPM), 35
- Engine speed (RPM), wiring label, 6
- External warning lights. *See* Warning lights
- Fitting the display module, 33
- Fuel level
 - alarm, 16
 - calibration, 28
 - display, 9
- Fuel Level
 - calibration Table, 31
- Fuel level sensor
 - wiring label, 6
- Fuel pressure
 - alarm, 16, 21
 - display, 11
- Fuel pressure sensor

- configuration, 27
- Fuel Tank Sender calibration, 21
- Fuel tank sender Installation, 45
- Fuel warning light, 21
- Gate RPM, 21
- Gate value, 14
 - delay, 13
- Gate value, 13, 16
- Gear shift RPM, 21
- Gear shift warning light, 18
 - wiring label, 6
- High oil temperature alarm, 21
- High water temperature alarm, 21
- Ice warning. *See* Air temperature
- Ignition connection, 36
- Infra-red beacon. *See* Beacon
- Installing the Stack ST8130, 32
- Internal Battery Low message, 15
- Labels on wiring, 6
- Lamps. *See* Warning lights
- Lap number
 - display, 11, 12
- Lap time, 18
 - display, 11, 12
 - recording manually, 12, 18
 - resetting, 18, 34
- Lap timing sensor
 - installation, 46
 - wiring label, 6
- Lights. *See* Warning lights
- LOW FUEL P, 21
- MSS connector, 44
- Odometer
 - display, 9
- Oil pressure
 - alarm, 16, 21
 - display, 9, 10
- Oil pressure sensor
 - wiring label, 6
- Oil temperature
 - alarm, 16, 21
 - display, 9, 10
- Oil temperature sensor
 - installation, 40
 - wiring label, 6
- Operating the system, 8
- Peak values, 13
 - displaying, 14, 34
 - resetting, 14, 34
- Peak Values
 - memory, 15
- Performance parameters, 1
- Points connection, 37
- power supply, 7
- Power supply, 6
- Pressure sensors, 38
- Pulse amplifier
 - adjustment, 44
 - connection, 44
 - installation, 42
 - specifications, 45
- Redisplaying last alarm, 17
- Resetting peak values, 14
- Resistor connection to coil, 37
- Returned goods procedure**, 68
- RPM Gate Value. *See* Gate Value
- Shift light. *See* Gear shift warning light
- Shift RPM. *See* Gear shift RPM
- Showing the last alarm, 17
- Speed sensor .
 - See* Pulse amplifier or
 - See* Wheel speed sensor
- Speedometer, 7
 - change from MPH to km/h, 34
 - display, 9
- ST492. *See* Pulse amplifier
- ST765. *See* Air temperature sensor
- ST8130 std components, 4
- ST8130 optional components, 5
- Stack distributors worldwide, iv
- Switches
 - functions - normal operation, 34
 - installation, 34
 - operation - configuration, 20
 - summary of functions, 66
 - wiring labels, 6
- Switching the system on, 8
- Tachometer, 5

- Tell-tales. *See* Peak values
- Temperature sensors
 - installation, 40
- Temperatures
 - minimum displayable, 10
 - oil. *See* Oil temperature. *See* Oil temperature
 - water. *See* Water temperature. *See* Water temperature
- Template for the Display Module, 62
- Tools needed, 32
- Trackside infra-red beacon. *See* Beacon
- Trip meter
 - display, 9
 - resetting, 34
- Troubleshooting, 51
- units of measurement, 8
- Units of measurement, ii
- Unpacking, 4
- Velcro. *See* Dual-Lock
- Warning lights
 - additional, 35
- Warning lights
 - alarms. *See* Alarm warning light
 - gear shift. *See* Gear shift warning light
 - installation, 35
 - maximum power, 35
- Water temperature
 - alarm, 16, 21
 - display, 10
- Water temperature sensor
 - installation, 40
 - wiring label, 6
- Wheel
 - circumference, 21, 24, 25
 - pulses per revolution, 21, 24, 25
- Wheel speed sensor
 - installation, 41
 - wiring label, 6
- Wiring harness, 6
 - extenders, 49
 - installation, 48
 - schematic diagram, 65
- Wiring labels, 6