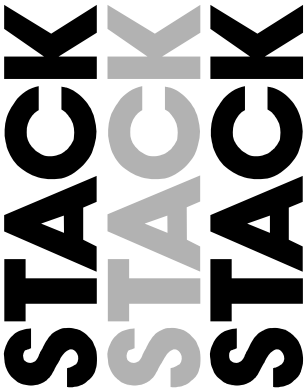


ST8110SR
Street/Race Display Systems

Users Guide

Part No 542058-002

Preface

Congratulations

Congratulations on choosing one of the models from the Stack Street/Race Display Systems range. This series contains two models:

1. The ST8130 normally aspirated road car display system (see separate Users Guide).
2. The ST8110SR boost pressure road car display system.

These systems 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 the Stack ST8110SR Street/Race Display System. It explains how to set up and configure the system for your vehicle.

Edition Notice

This edition is for all versions of the ST8110SR Street/Race Display System distributed to customers world-wide. The units of measurement used to illustrate the use of the display system 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*	MPH or km/h*
Distance	Miles or km*	Miles or km*	Miles or km*
Temperature	ºC	ºF	ºC
Wheel Circumference	Millimetres	Inches	Millimetres
Fuel level	Litres	Gallons	Litres
Pressure	PSI	PSI	Bar
Boost Pressure	Bar	PSI	Bar

* Speed and Distance units may be changed in the Configuration Mode.

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
- Boost Gauges
- Analogue Sensors
- Digital Sensors
- Data Logging Systems
- Display and Logging Systems
- Display and Analysis Software

United Kingdom Telephone Numbers:

Sales:	01869 240404
Fax:	01869 245500
Tech Support:	01869 240420
Email:	sales@stackltd.com
Web site:	www.stackltd.com

United States Telephone Numbers:

Sales:	888-867-5183
Fax:	888-364-2609

Contents

Chapter 1. Introducing the Display System

The models in the Stack ST8110SR Street/Race Display Systems monitor and display a range of values, known as performance parameters, needed for effective car and driver management. They combine an analogue tachometer with a digital display for the following performance parameters:

- Engine Speed (RPM)
- Wheel Speed
- Odometer and Trip-meter
- Boost Pressure
- Oil Pressure
- Oil Temperature
- Water Temperature
- Fuel Pressure
- Fuel Level
- Battery Voltage
- Lap Times (last completed and best)

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

Alarm lights and pop-up messages are provided to alert the driver that a warning condition has been detected. The warning conditions are based on user configurable alarm values for the following performance parameters:

- High Boost Pressure
- Low Oil Pressure
- High Oil Temperature
- High Water Temperature
- Low Fuel Pressure
- Low Fuel Level (no message)
- Low 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 default alarm values for each parameter to those which are suitable for your vehicle.

The system also provides outputs for two external warning lights:

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

The ST8110SR can also be fitted with an optional lap timing sensor.

Optional Wheel Speed Sensors

The ST8110SR can obtain its wheel speed signal from either of the following optional sensors:

- ST492 pulse amplifier. This system obtains the vehicle's speed from pulses generated by an existing electronic sensor which either measures the rotation of a drive shaft or is fitted in the gear box.
- ST670 wheel speed sensor. It obtains the vehicle speed from the rotations of one of the wheels on the vehicle.

If you have been supplied with the wrong type of wheel speed sensor, please contact Stack for advice.

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 and Chapter 6 provides a set of trouble-shooting guidelines.

A full size template for the dashboard cut-out for the Display System is provided in Appendix A and a schematic diagram of the wiring harness is in Appendix B.

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.

ST8110SR Street/Race Display System Items

The ST8110SR is supplied with the following standard components:

Quantity	Description
1	Display Module (ST867) with 2 mounting brackets
2	Oil & Fuel Pressure Sensors (ST747-M10 (EU), ST747-1/8" NPTF(UK/USA))
2	Oil & Water Temperature Sensors (ST762 (UK, EU) ST764 (US))
1	Boost Pressure Sensor (ST453)
1	Wiring Harness (ST872-806)
3	Switches (supplied with and to be connected to the wiring harness)
1	Pulse Amplifier (ST492) and extension leads or Wheel Speed Sensor (ST670)

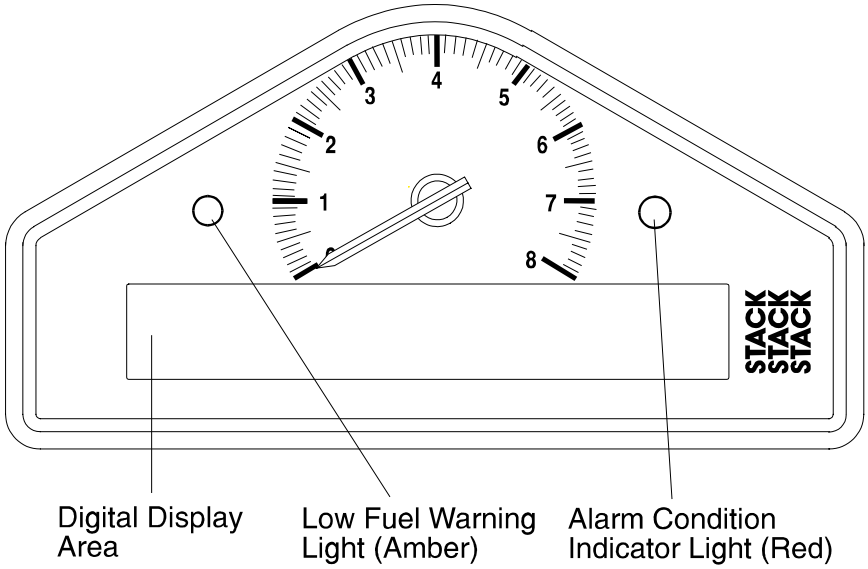
Optional Lap Timing System Items

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, S2 & S3	Switches 1 to 3
WS	Pulse amplifier or Wheel speed sensor
SL	Gear shift warning light
AL	Alarm warning light
NET	Data logging expansion pack
LAP	Optional in-car lap timing sensor

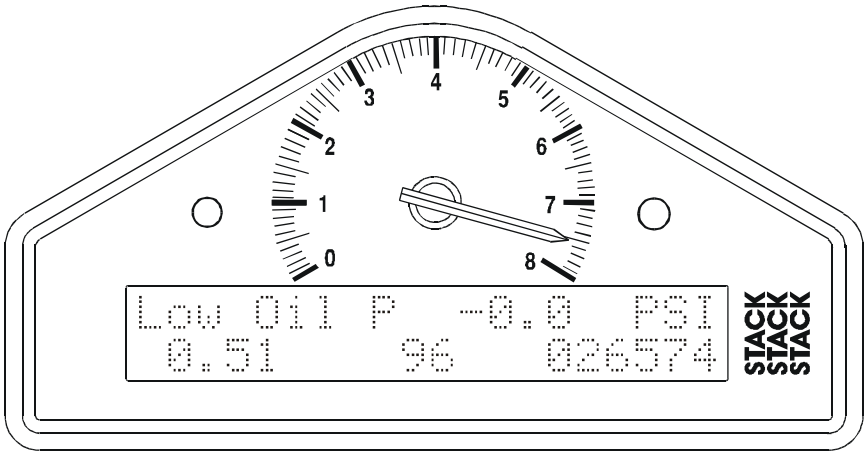
Labels on Long Cables	Connection To
ES	Engine speed (RPM)
BP	Boost pressure sensor
OT	Oil temperature sensor
WT	Water temperature sensor
OP	Oil pressure sensor
FP	Fuel pressure sensor
F	Fuel level sensor
B+	12v Supply (Battery)
B–	Battery negative

Connecting the Components

1. Connect the wiring harness to the display module.
2. Connect the three switches to the cables labelled S1, S2 and S3.
3. Connect each of the sensors that you have purchased to the appropriate wire in the wiring harness as shown in the table.
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 by resetting the tachometer needle and showing 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 display 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 2 to clear the warning message from the display.

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 troubleshooting section in this manual.

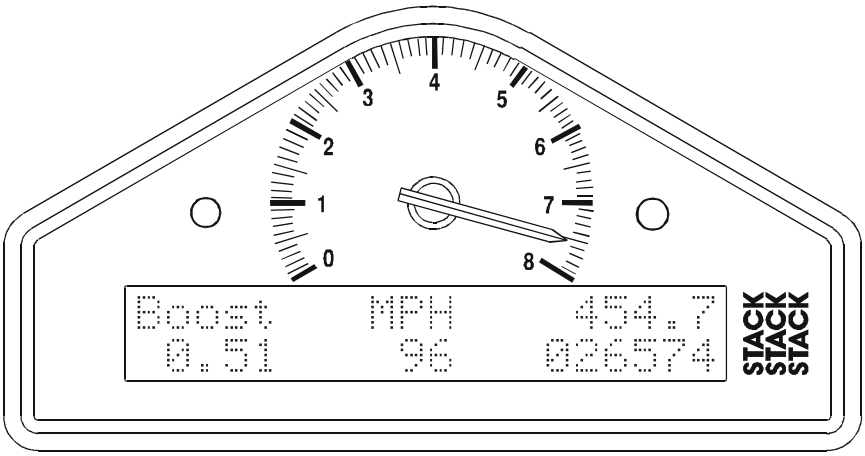
Changing the Display Layers

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

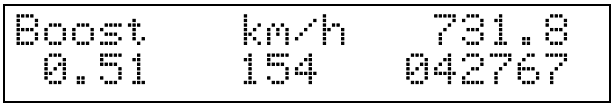
Each of the display layers is displayed in turn by pressing Switch 2. Press Switch 2 when an alarm message is being shown will remove that alarm; a further press will be required to change to the next display layer.

⇨ **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



MPH and miles display



km/h and kilometres display

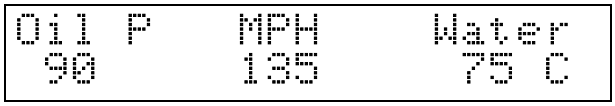
Display layer 1 shows:

- Boost pressure (Boost)
- Current speed (MPH or km/h)
- Trip-meter (miles or kilometres)
- Odometer (miles or kilometres)

Note the units for speed, trip-meter and odometer can be changed using the first menu in the Configuration Mode.

Press Switch 2 to see display layer 2.

Display Layer 2



Display layer 2 shows:

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

Note that the minimum 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.

Press Switch 2 to change display to layer 3

Display Layer 3

Display layer 3 shows:

- Fuel Pressure (Fuel P)
- Current speed (MPH or km/h)
- Fuel level
  Note that when the amount of fuel in the tank is changed the displayed value changes slowly (about 1 litre or 0.2 gallons every 5 seconds) to minimise the effects of fuel surge.

Press Switch 2 to display layer 4.

Display Layer 4

Display layer 4 shows:

- Battery Voltage (Batt)
- Current speed (MPH or km/h)
- Oil temperature (Oil T)

Note that the minimum oil 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.

Press Switch 2 to display layer 5.

Display Layer 5

Display layer 5 shows:

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

Lap time can be recorded manually by pressing Switch 3 or automatically with the optional lap timing kit.

Press Switch 2 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 throttle 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
Boost Pressure	Maximum	Yes
Oil Pressure	Minimum	Yes
Oil Temperature	Maximum	Yes
Water Temperature	Maximum	Yes
Fuel Pressure	Minimum	Yes
Fuel Level	Value at Reset	No
Battery Voltage	Minimum	No

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 3.
- With Switch 3 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 3.

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 Speed (RPM)	Current value
Wheel Speed	Current value
Boost Pressure	–99.9 PSI or –9.99 Bar
Oil Pressure	999 PSI or 99.9 Bar
Oil Temperature	0C or 0F
Water Temperature	0C or 0F
Fuel Pressure	999 PSI or 99.9 Bar
Fuel Level	Current value
Battery Voltage	Current value

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 throttle 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.

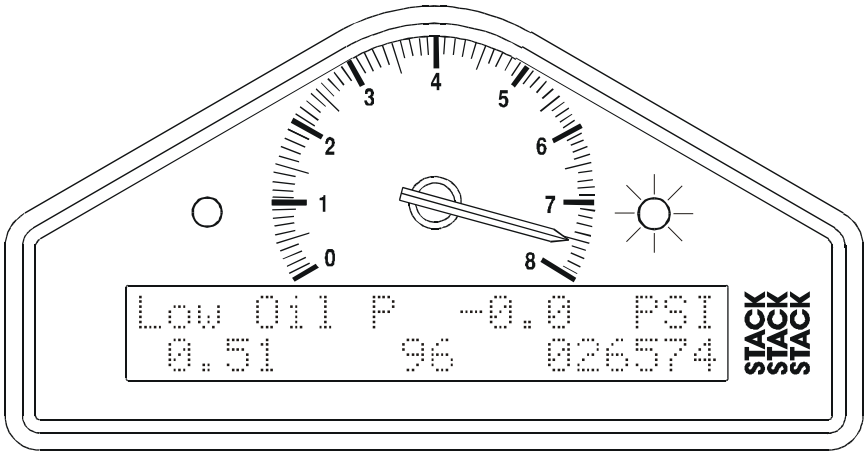
Note: The Oil Pressure alarm will come on at power-up until the engine is started and pressure exceeds the threshold set for the alarm.

The Display System has the following built-in alarms:

Parameter	Alarm is triggered when the:	Gated to RPM
Boost Pressure	Current value exceeds the preset value	Yes
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
Fuel Pressure	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 whilst the warning message is displayed.

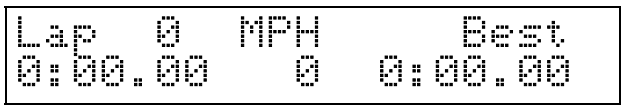
Lap times

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 3.

The most recent lap time is held in display layer 5. Press Switch 2 to cycle to this display layer. This display gives you the time taken to drive the last recorded lap and the lap number of the current lap.

Resetting the Lap Time to Zero

Press and hold Switch 1 and then press Switch 3 to reset the lap count and lap time to zero. The lap timer starts recording the time immediately.



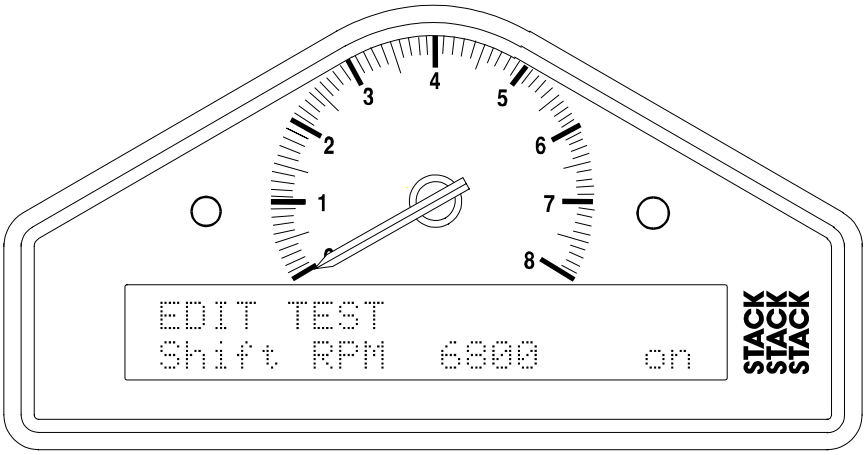
Gear shift light

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

The Display System is put 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.

Switch off the power to end configuration mode.

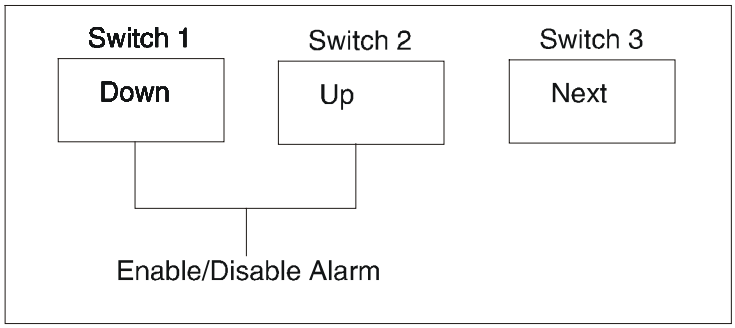
Setting or resetting configuration values

Use Switch 1 to decrease the value being configured and Switch 2 to increase it. The rate at which the value changes increases (accelerates) 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:

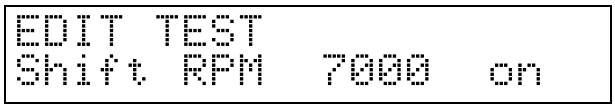
Configurable Parameter	Setting Required	Switchable Alarm
Speed Units	Switches the display between MPH and km/h units for speed. Also switches the odometer and trip-meter between miles and kilometres.	Not applicable
Shift RPM	RPM at or above which the gear shift light is to come on	Yes
Low Fuel	Volume of fuel in tank at or below which the low fuel warning light is to be turned on.	Yes
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
High Boost	Boost Pressure at or above which the High Boost 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	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" 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” for more details.	Not applicable
Wheel Cir	See “Wheel Pulses and Circumferences” for more details.	Not applicable

Configurable Parameter	Setting Required	Switchable Alarm
Lap Time	The duration in seconds for which the Lap Time pop-up is displayed.	Yes
Log RPM	RPM at or above which the optional logging system is started.	Yes

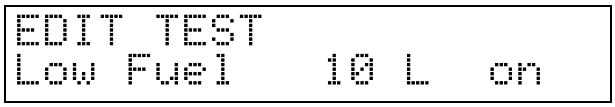
Examples of the displays for each of the configuration items are shown below.

Speed and Distance Units:

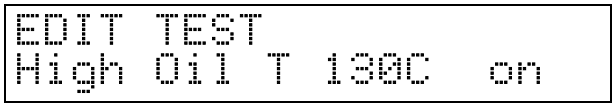
Shift RPM:



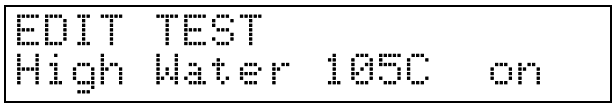
Low Fuel:



High Oil Temperature:



High Water Temperature:



High Boost Pressure:

```
EDIT TEST
High Boost 2.00   on
```

Low Battery Voltage:

```
EDIT TEST
Low Batt    10.0  on
```

Low Fuel Pressure

```
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:

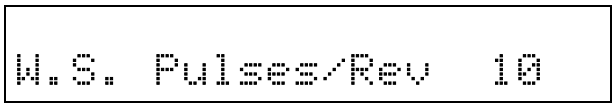
```
EDIT TEST
Gate RPM    3000  on
```

Engine Speed Cylinders:

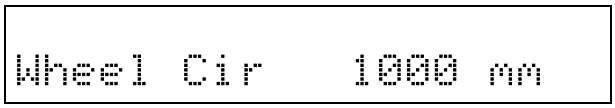
```

E.S. Cylinders     4
```

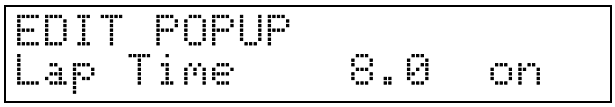
Wheel Speed Pulses:



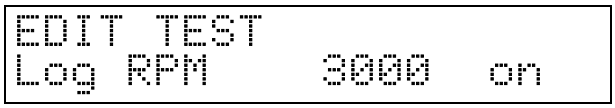
Wheel Circumference:



Lap Time Pop-up Duration:



Logging RPM:



Wheel Pulses and Circumferences

Calculations for the 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 ÷ pulses per mile = wheel circumference in inches

   Set the number of pulses per revolution 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
   Circumference = 63360 ÷ 5000 = 12.67 inches

   Double the two values:
   Wheel Cir (ins) = 25.3 inches
   W.S. Pulses/Rev = 2

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

   1000000 ÷ pulses per km = wheel circumference in mm

   Set the number of pulses per revolution 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 ÷ pulses per mile = wheel circumference in mm

   Set the number of pulses per revolution 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
   Circumference = 1609344 ÷ 5000 = 321.9mm

   Double the two values:
   Wheel Cir (mm) = 644mm
   W.S.Pulses/Rev = 2

4. If the pulses are coming from the wheel, ie, 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 ST670 Wheel Speed 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 20.0 inches or 500mm, 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 propshaft, set the circumference to:

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

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

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.

Examples for 41 crownwheel (ring) teeth and 9 pinion teeth:

US

Differential ratio: 41 ÷ 9 = 4.55
Tire circumference: 70.9 inches
Circumference = 70.9 ÷ 4.55 = 15.6 inches
Pulses per revolution: 4

Double the two values:
Wheel Cir(ins) = 31.2 inches
W.S. Pulses/Rev = 8

UK/EU

Differential ratio: 41 ÷ 9 = 4.55
Tyre circumference: 1800mm
Circumference = 1800 ÷ 4.55 = 395mm
Pulses per revolution: 4

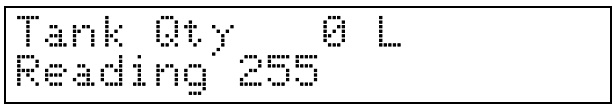
Double the two values:
Wheel Cir (mm) = 790mm
W.S. Pulses/Rev = 8

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. You must use at least two calibration points and possibly as many as ten (the maximum permitted) to set values for accurate fuel level readings. More than five 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:

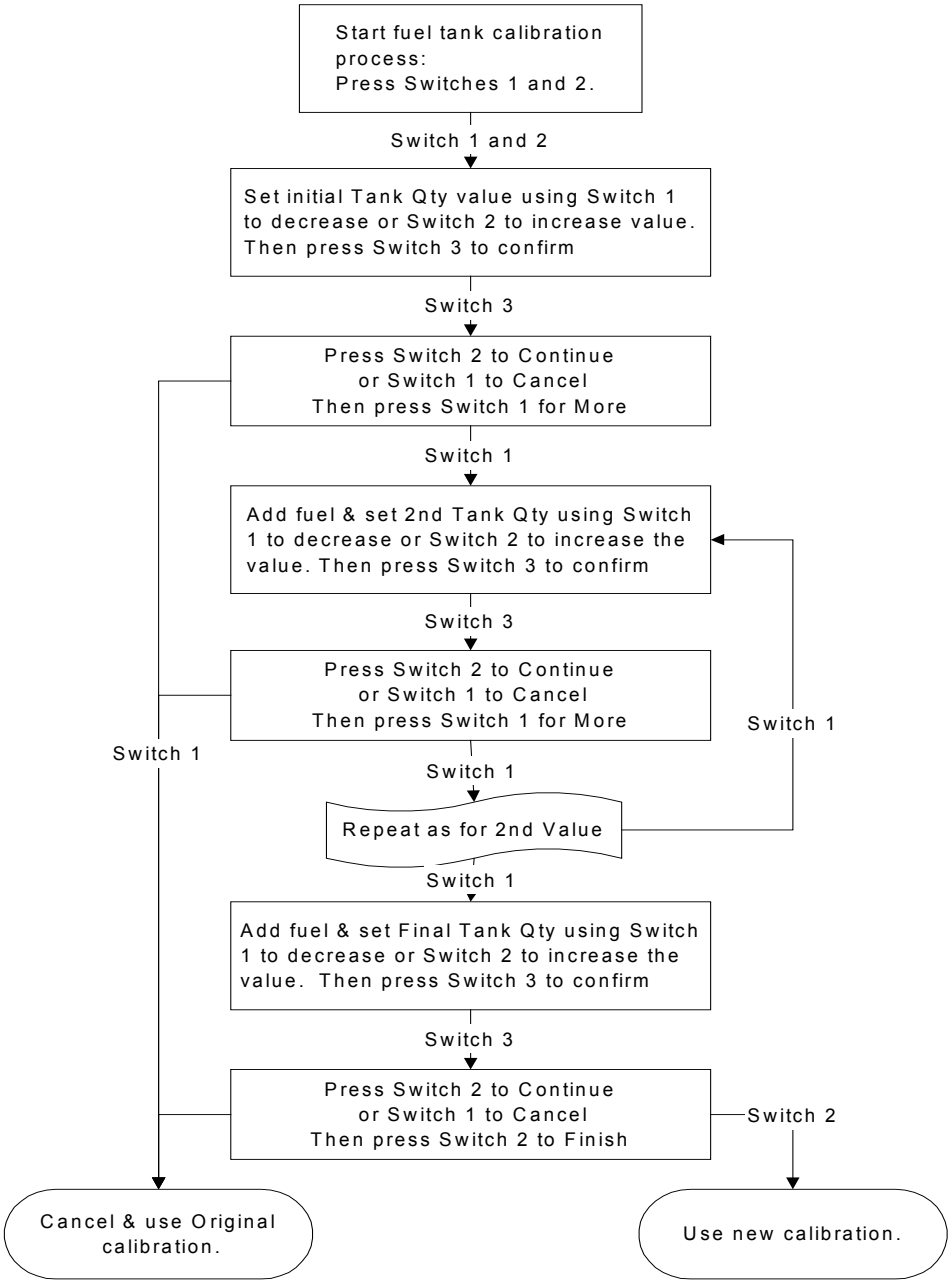
1. Decide how many calibration points and the amount of fuel for each that you are going to use. For example, to calibrate the readings for a 50 litre (10 gallon) tank for the following quantities, the following seven calibration points are suggested: 0, 5L (1 gal), 10L (2 gal), 20L (4 gal), 30L (6 gal), 40L (8 gal), 50L (10 gal).
   You should enter the calibration values into the table on p29. If you ever have to return the unit for servicing, supplying the values from that table will allow Stack to reinstate the fuel calibration so you will not have to repeat this process.
2. Empty the tank using the vehicle's fuel pump then add the reserve fuel, for example, two litres (0.5 gal). Now drive to your local petrol (gas) station and 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 and one person to operate the switches for the Display.
   Note: The petrol (gas) pumps may shut off if the petrol delivery is interrupted for any length of time.
3. Set the Display System to Configuration Mode. Then select the Fuel Tank Sender calibration display and hold Switch 1 down and press Switch 2. This gives a display similar to the following:



4. 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 p29.
   When you have adjusted the Tank Qty to the required value, press Switch 3 to set this value.
5. Press Switch 2 to Continue to the next calibration point. Press Switch 1 to Cancel the calibration process.
   If you have selected Switch 2 to Continue then:-
   Press Switch 1 for More calibration points. Press Switch 3 to Cancel & return to the previous menu.
6. Fill the tank with a small, known amount of fuel, for example, five litres or one gallon. If the Reading value does not change, there is a problem with either the fuel sender or the wiring.
7. Wait for the Reading value to stabilise; this may require several seconds. While you are waiting for the value to stabilise, use Switches 1 and 2 to change the Tank Qty value to the amount of fuel now in the tank.
8. When the Reading value has stabilised, press Switch 3 to set this value
9. Press Switch 2 to Continue to the next calibration point. Press Switch 1 to Cancel the calibration process.
   If you have selected Switch 2 to Continue, press Switch 1 for More calibration points.
10. Repeat steps 6 through 9 for each calibration until the tank is full or you have performed at least two or as many as ten calibration operations.
11. Press Switch 3 to Finish & Save this calibration when you have completed calibrating the fuel level readings.

    Switching off the power to the Display System or Cancelling the calibration process leaves the original calibration set.

    The flowchart on the next page summarises the steps in the calibration process.


Start fuel tank calibration process:
Press Switches 1 and 2.
Switch 1 and 2
Set initial Tank Qty value using Switch 1 to decrease or Switch 2 to increase value. Then press Switch 3 to confirm
Switch 3
Press Switch 2 to Continue
or Switch 1 to Cancel
Then press Switch 1 for More
Switch 1
Add fuel & set 2nd Tank Qty using Switch 1 to decrease or Switch 2 to increase the value. Then press Switch 3 to confirm
Switch 3
Press Switch 2 to Continue
or Switch 1 to Cancel
Then press Switch 1 for More
Switch 1
Switch 1
Switch 1
Repeat as for 2nd Value
Switch 1
Add fuel & set Final Tank Qty using Switch 1 to decrease or Switch 2 to increase the value. Then press Switch 3 to confirm
Switch 3
Press Switch 2 to Continue
or Switch 1 to Cancel
Then press Switch 2 to Finish
Switch 2
Cancel & use Original calibration.
Use new calibration.

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 Display System. Check with your Stack dealer if this is the case.

When you wish to return to the normal display, power the Display system off, then on.

Fuel Calibration Table

Point	Tank Qty	Reading
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

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

ST670 Wheel Sensor

No special tools other than normal workshop tools are needed.

ST492 Pulse Amplifier

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.

Pre-configured Display Systems

Use the instructions in the previous chapters to set up, operate and configure the ST8110SR before installing it in the vehicle.

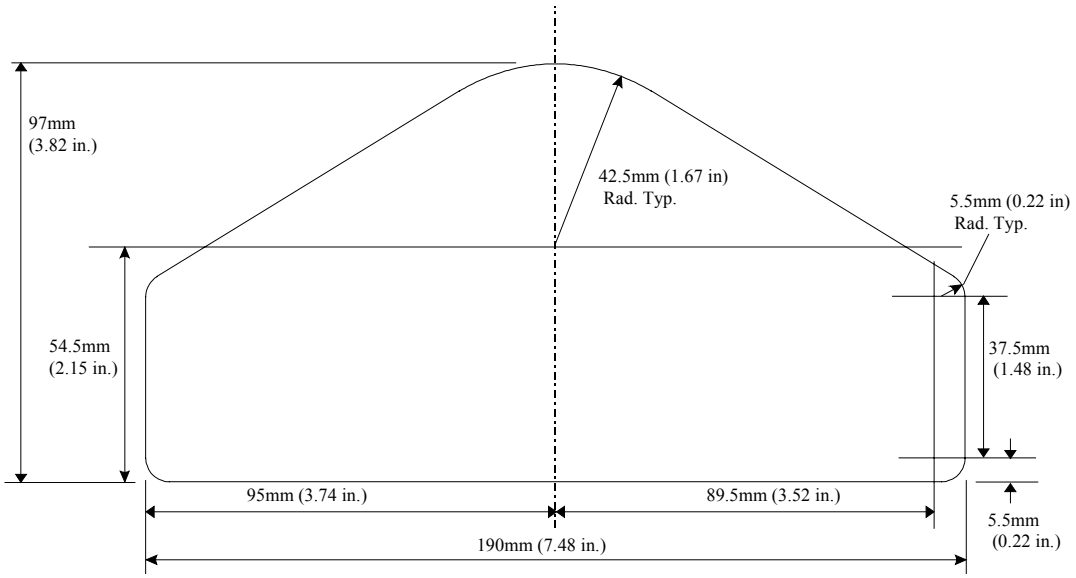
Custom Configured Display Systems

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 three switches are used to control the functions of the Display System.

The normal functions of the three switches are:

Switch	Functions
Switch 1	Show the peak values.
Switch 2	Change the display layer or clear an alarm. If held for more than 2 seconds, reset the trip-meter to zero.
Switch 3	Record the current lap time and restart the lap timer.
Switches 1 & 2	Enter Set up mode.
Switches 1 & 3	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 2 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 3 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 low 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 Optronic 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)

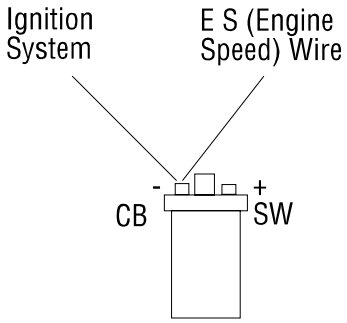
The following connections are shown in greater detail:

- Standard contact breaker system
- Series Resistor Connection

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

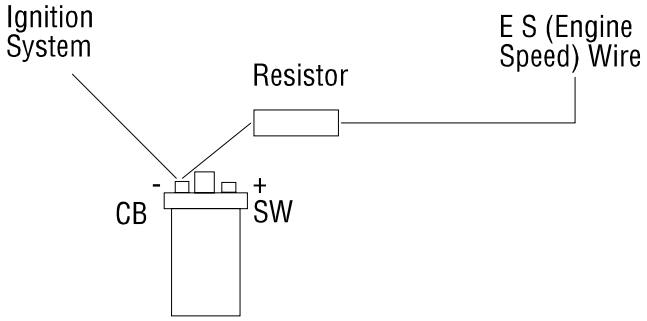
Standard Contact Breaker System

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



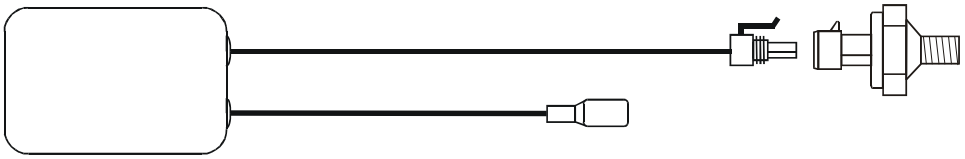
Series Resistor Connection

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).



Boost Pressure Sensor

The Display System is supplied with a single ST453 (0.3–3.5 Bar absolute) boost pressure sensor.



Fitting the pressure sensor

The sensor will not be damaged by most types of fluid, it should be mounted with its port pointing downwards and in a location above the connection point to ensure that any fluids which may enter the sensor will drain away. Ensure that the sensor is more than 75mm (3 inches) away from ignition leads and any other source of interference.

Fit the sensor interface to a rigid flat surface using the Dual Lock™ supplied. The adhesive takes approximately 60 minutes to gain full strength so do not try to separate the two parts of the Dual Lock™ during that time.

Pressure Connections

The sensor can be mounted directly to the engine or indirectly using a flexible hose connection. The sensor has a 1/8" NPTF male thread (EC systems are supplied with an M10 adapter part No. 154003) The line from the sensor to the plenum should be of a suitable vacuum-proof hose with no tight-radius bends liable to kink and block the line and secured clear of any linkages or other moving parts.

The plenum connection point must not be fitted to a venturi within or leading into the plenum as this will give a false reading.

Fluid Pressure Sensors

The Display System is supplied with two each of one of the following types of fluid pressure sensors: ST747 with optional adapters to match the pressure ports of different types of engines.

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

** Sensor is ¼" BSP thread supplied with M10 x 1 adapter*

+ Sensor is ¼" BSP thread supplied with 1/8" NPTF adapter

++Sensor is ¼" BSP thread supplied with 1/8" BSP adapter

Each type of sensor can be used for monitoring both oil pressure and fuel pressure.

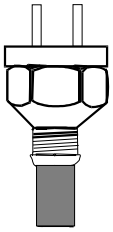
If you find that you have a sensor with an incorrect thread, please contact your Stack dealer for advice.

Fitting 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 should be fitted remotely to the monitoring point, using suitable pressure hose, to reduce the amount of vibration to which they are subjected and thereby extend their life.
- Do not over-tighten the sensors.

Temperature sensors

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



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

The ST764 temperature sensor has two terminals and a 1/8" NPTF thread (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 contact your Stack dealer for advice.

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)

The ST8110SR Display System may be 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 1.5mm ± 0.5mm/ 60thou ± 20thou. Make sure that no other objects pass within 4mm/ $^{5}/_{32}$" 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)

This amplifier is designed to convert the output of an existing sensor, which generates a pulsed signal which is not compatible with the ST8110SR 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.

Note: 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 Lock$_{TM}$ 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$_{TM}$ 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 21-38ºC (70-100ºF). Initial application to surfaces at temperatures below 10ºC (50ºF) 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$_{TM}$ 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 ST8110SR 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 an MSS connector at one end and two wires at the other to connect the amplifier to the speed sensor.

The connection to the sensor should be made using a single wire if the sensor is already connected to the vehicle electrical system for supply purposes or because it is already interfaced to other equipment. If the sensor is only to be connected to the Display System, then two wires must be used, because a signal 'common' is required.

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.

Fuel Tank Sender

Single-Wire Sender

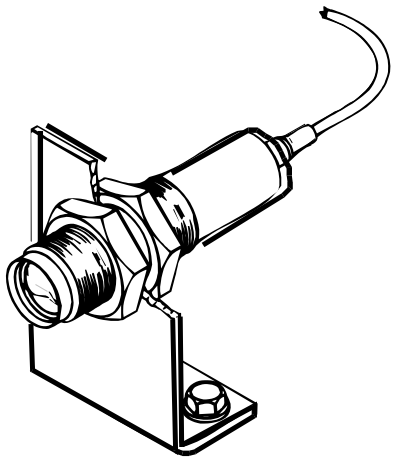
If your vehicle is fitted with a single-wire sender, remove the existing wire from it and connect the red (F) wire to it.

Two-Wire Sender

If your vehicle is fitted with a two-wire sender, 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)

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.

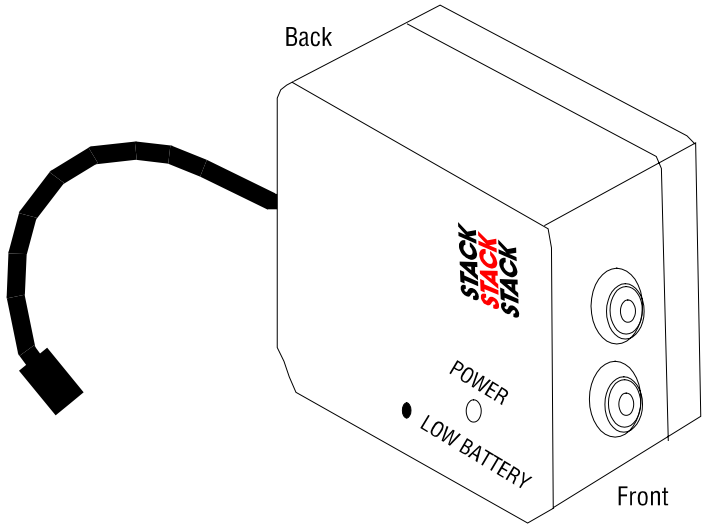


It is secured by two nuts (supplied) with an M18 x 1 mm thread.

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)



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.

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.

Extender cables for connecting the boost pressure and wheel speed sensors to the wiring harness are available in the following lengths:

- 700mm / 2'3"
- 1400mm / 4'7"
- 2100mm. / 6'11"

The ST884 Kit contains the following extenders:

- two 700mm/2'3" extenders
- two 1400mm/4'7" extenders
- one 2100mm/6'11" extender

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	The power lead **B+** is 19w connector pin G **B–** is 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 and the warning light is not turned on	Oil Pressure sensor has failed	Replace Oil Pressure sensor	
		Oil Pressure 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 temperature sensor	Disconnect the sensor. If the reading changes to 0, replace sensor. Otherwise check harness for short circuit
		Faulty temperature 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.	
6.	Water or Oil temperature display gives a fixed temperature reading of 0°C or 0°F when the engine temperature is 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	

No.	Symptom	Possible Cause	Remedy	Notes
7.	Fixed pressure reading of 999 PSI or 99.9 Bar	A pressure sensor has failed	Replace pressure sensor	
		Faulty pressure sensor connections	Check continuity of sensor leads for open circuits. See 5 above.	Pin D to the red OP wire, pin S to the red FP wire and pin H to both the black OP and FP 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
		Faulty sensor connections	Check continuity of sensor leads for short circuits	Check the wiring harness for short circuit
9.	Fixed pressure reading of 0 PSI or 0.0 Bar or suspected low/slow reading	Pressure sensor has failed	Replace sensor	
		Faulty pressure sensor connections	Check pressure connections	Check plumbing for a blockage or kinks in flexible hoses
10.	Boost shows a fixed pressure reading of -99.9 PSI or -9.99 Bar	ST453 sensor is disconnected	Reconnect sensor	
		Faulty sensor connections	Check continuity of sensor leads for open circuits.	Refer to harness diagram
		ST453 sensor has failed	Replace the sensor	
11.	Boost shows approximately 0.0 PSI or 0.00 Bar	ST453 not connected to intake correctly	Check hose and fittings	Sensor is reading ambient atmospheric pressure

No.	Symptom	Possible Cause	Remedy	Notes
12.	All sensors show fixed high values	Switch 1 (Peaks) faulty	Replace switch 1	Disconnect switch. If values return to normal, replace switch
		Faulty Switch 1 wiring	Check Switch 1 wiring	Check wiring for short between connector pins K and H (earth)
13.	Displays pressure values too low and temperature values too high	Low Battery voltage	Recharge battery	The system does not give accurate readings when the voltage is below 9.0V
14.	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

No.	Symptom	Possible Cause	Remedy	Notes
15.	Switch 1: Show peak values does not work	Switch 1 faulty	Replace switch	Disconnect switch and short its leads. If the display changes, replace Switch 1. Otherwise check wiring
		Faulty switch wiring	Check switch wiring for correct continuity	Pin K to brown S1 wire less than 1.0 Ohm and Pin K to Pin H (earth) greater than 1M Ohms)
16.	Switch 2: Cancel alarm, change display layer and reset trip-meter does not work	Switch 2 faulty	Replace Switch 2	Disconnect switch and short its leads. If the 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
17.	Switch 3 does not trigger a lap time	Lap Marker Receiver triggered	Turn off Beacon	
		Switch 3 faulty	Replace Switch 3	Disconnect the switch and short its leads. If a lap time is triggered, replace Switch 3. Otherwise check wiring.
		Faulty switch wiring	Check switch wiring for correct continuity	Pin T to orange S3 wire less than 1.0 Ohm and Pin T to Pin H (earth) greater than 1M Ohms)
18.	External warning light dead when the display warning light is OK	Bulb has burnt out	Replace the 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 to Stack for service	

No.	Symptom	Possible Cause	Remedy	Notes
19.	External gear shift light dead	Bulb has burnt out	Replace the 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
20.	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°F) to +70°C (+158°F)
21.	No engine speed (RPM) 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)

No.	Symptom	Possible Cause	Remedy	Notes
22.	Displayed RPM value too high or too low by a constant %-age amount.	System configured with the wrong number of engine cylinders	Reconfigure the system to correct the number of cylinders	Ignition systems may either: a) produce "waste" sparks giving double the number of cylinders per revolution b) use multiple coils where each additional coil gives proportionately fewer pulses per revolution
		Ignition system pulses per revolution not the same as the number of cylinders	Reconfigure the system to correct the number of pulses per revolution	
23.	Tachometer reading erratic or 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 engine speed signal by placing a resistor in line with the ES wire	Resistor values: 10K Ohms for dedicated tacho output; 47K Ohms for coil connection (Non-CDI); 100K Ohms for coil connection (CDI). Resistors 1/2W 5% 350v
24.	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 number of targets	
		System configured with wrong circumference	Reconfigure the system with correct circumference	

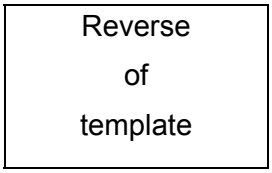
No.	Symptom	Possible Cause	Remedy	Notes
25.	No speed reading, speed reading erratic or value jumps high or low	Faulty sensor and/or wiring	Check sensor indicator for correct operation	Rotate the wheel by hand and check that the sensor indicator lights up as each target passes the sensor
		Incorrect sensor gap (too far or too close)	Check that the gap is approximately 1mm (40thou)	ST670 only
		Sensor and targets moving apart	Fabricate a more rigid sensor bracket	
		Pulse amplifier not connected	Rotate wheels and check the LED on the ST492 for pulse signals	ST492 only
		Pulse amplifier out of adjustment		
26.	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)
27.	No alarms for water, oil or fuel (temperatures and pressures) being displayed	All the alarms have been switched off	Switch on the required alarms	Gated 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	

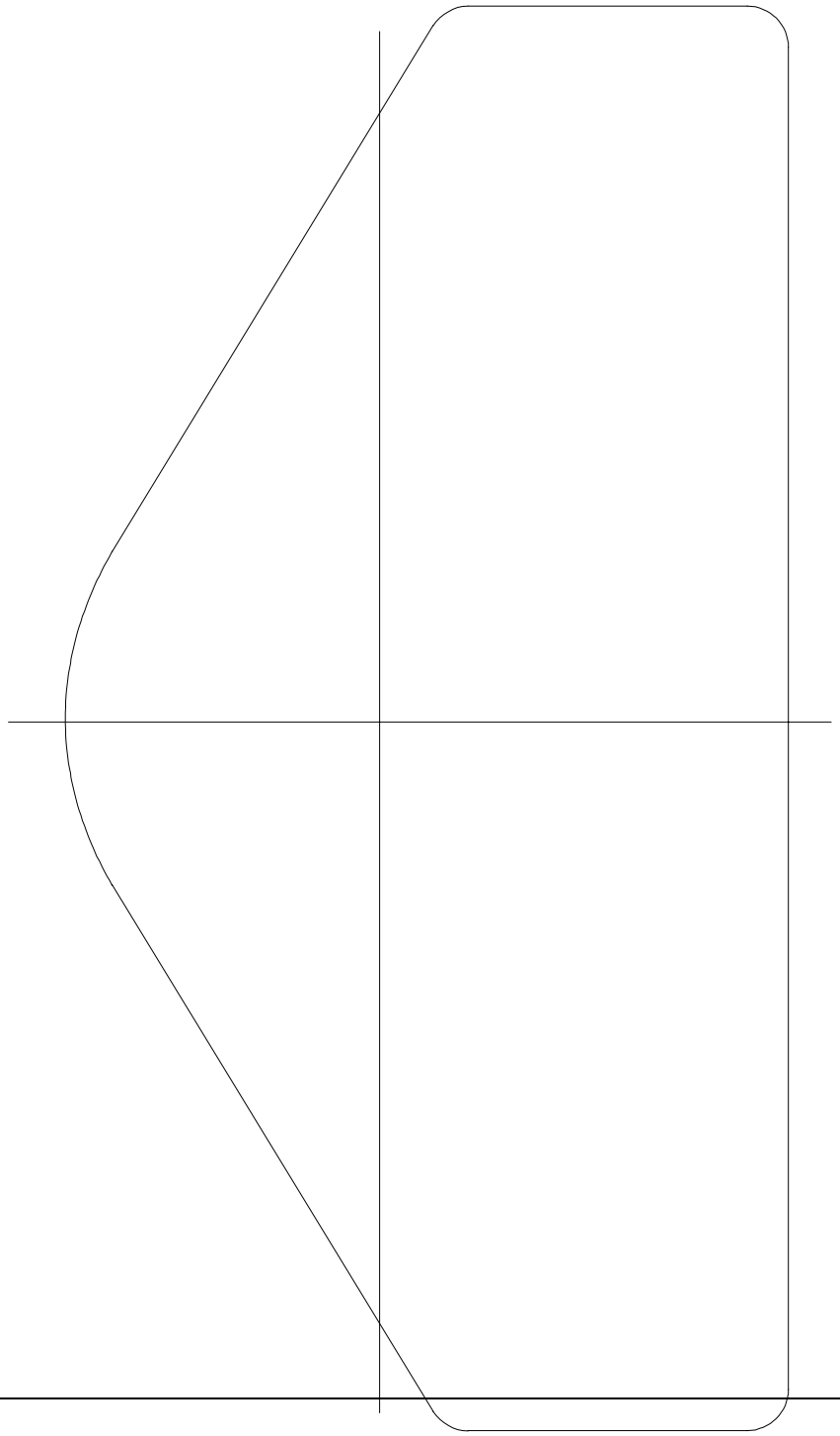
No.	Symptom	Possible Cause	Remedy	Notes
28.	Display and alarm light flash when the engine is running	Intermittent alarm caused by a parameter with its alarm level set too close to the normal operating value	Either change the value for the alarm or turn the alarm off	
29.	Fuel level reading does not change	Fuel sender wiring not connected correctly	Check wiring	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 voltage reading on the red lead changes. The voltage on the red lead should range from 0V to 5V
		Faulty fuel sender	Check fuel sender	
		Fuel sender not suitable for use with ST8110SR Display System	Check with your Stack dealer for suitable alternative	
		Fuel sender not calibrated	See Chapter 4 for information on how to calibrate the fuel sender	
30.	Lap time is not displayed automatically (Automatic receiver is fitted)	Lap marker receiver lead faulty	Check lap marker wiring	Press lap Switch 3. If display changes, replace receiver after checking its wiring
		Lap marker receiver faulty	Replace lap marker receiver	

No.	Symptom	Possible Cause	Remedy	Notes
31.	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	

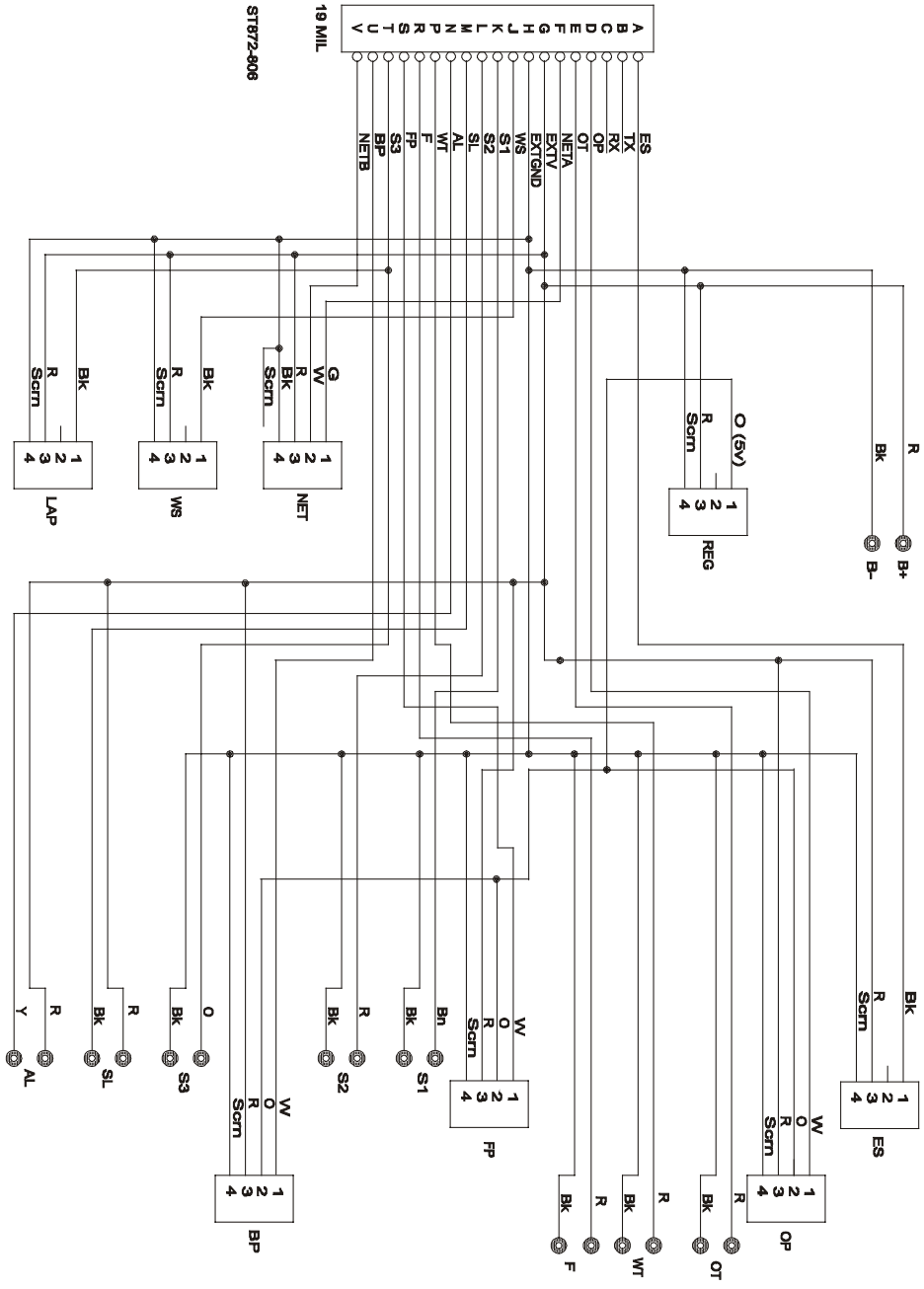
Appendix A Template for the Display Module

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





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 Change Display Layer If pressed for more than 2 seconds, reset the trip-meter to zero
Switch 3	Restart the lap timer
Switches 1 & 2 together	Put system into Configuration Mode
Switches 1 & 3 together	Reset the peak values and lap times

System Configuration Mode

Switch or Switches	Functions
Switch 1	Decrease the value of the parameter being displayed
Switch 2	Increase the value of the parameter being displayed
Switch 3	Display the next configurable parameter
Switches 1 & 2 together	Enable or disable an alarm for the parameter being displayed or enter Fuel Calibration mode (when applicable, see below)
Switches 1 & 3 together	Reinstate previously stored parameter value
Power Off	Exit configuration mode and return to normal operation mode

Fuel Calibration Mode

Switch or Switches	Functions
Switch 1	Decrease tank quantity value
Switch 2	Increase tank quantity value
Switch 3	Confirm value

Index