Keyser Display System

Users Guide

Part No. ST542129-001

Preface

The ST8100 Display System is supplied with the following standard components.

Congratulations

Congratulations on choosing the Keyser Display System. This 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 the Keyser Display System. It explains how to set up and configure the system for your vehicle.

Edition Notice

This edition of the Keyser Display System uses the units of measurement shown in the following table.

Parameter Type	Units
Temperature	Degrees F
Pressure	PSI

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.

- Harsh Environment Digital Video Recorders (DVR)
- Display and Data Logging Systems
- Tyre Pressure Monitoring Systems (TPMS)
- Display and Analysis Software
- Intelligent Tachometers
- Action Replay Tachometers
- Boost Gauges
- Auxiliary Gauges
- Analogue Sensors
- Digital Sensors
- Radio Telemetry Systems

Contents

Preface i
Contents iii
Chapter 1. Introducing the Display System 1
How to use this Manual 2
Chapter 2. Getting Started 4
The Display Module 5
Wiring Harness 5
Connecting the Components 6
Chapter 3. Operating the Display System 7
Switching the Display System on 7
Changing the display layers 7
Peak Values (Tell Tales) 9
Alarms 11
Lap times 14
Gear shift light 14
Chapter 4. Configuring the Display System 14
System Configuration Mode 14
Leaving configuration mode 14
Configuring the Multi-Stage Shift Light 14
Chapter 5. Installing the Display System 14
Who can install the Display System? 14
Tools needed to install the Display System 14
Preconfigured Display Systems 14
Fitting the Display Module 22
Switches 23
Warning lights 24
Engine Speed (RPM) Measurement 24
Pressure Sensors 26
Temperature sensors 27
Lap timing sensor (optional) 28
Trackside Infra-Red Lap Beacon (optional) 29
Wiring harness 31
Checks and Alarms 32
Chapter 6. Action Replay Mode 33
Making a Recording 33
Action Replay Menu 33

oil temperature, 8
oil temperature alarm, 12
oil temperature sensor, wiring label, 6
operating of the system, 7
optional components, 4
peak value memory, 11
peak values, 1
peak values (tell tales), 9
peak values, resetting, 10
performance parameters, 1
points connection, 25
power supply, 6
power supply to trackside beacon, 30
resetting the peak values, 10
resistor connection to coil, 25
RPM gate value, 9, 12
service and support, 46
service enquiries, 47
showing the last alarm, 13
Stack contact details, 50
Stack web-site, 46
standard components, 4
switches, 23
switching the system on, 7
tachometer, 5
temperature sensors, 27
Template for the Display Module, 43
tools needed, 21
trackside infra-red lap beacon, 29
unpacking, 4
warning lights, 24
warning messages, 1
water pressure, 8
water pressure alarm, 12
water pressure sensor, wiring label, 6
water temperature, 8
water temperature alarm, 12
water temperature sensor, wiring label, 6
wires in the harness, labels, 5
Wiring Harness, 5
Wiring Harness Schematic Diagram, 45
wiring harness, installation of, 31

additional external warning lights, 24
alarm for battery voltage, 12
alarm for fuel pressure, 12
alarm for oil pressure, 12
alarm for oil temperature, 12
alarm for water pressure, 12
alarm for Water Temperature, 12
alarm warning light, wiring label, 5
alarms, 11
alarms, switching on or off, 19
analogue tachometer, 5
battery voltage, 8
battery voltage alarm, 12
checks and alarms, 32
clearing an alarm, 13
configuring the display system, 16
configuring the multi-stage shift light, 19
contact breaker connection, 25
contacting your dealer, 46
data logging subsystem, wiring label, 5
digital display panel, 5
Display Layer 1, 8
Display Layer 2, 8
display layer 3, 9
display layers, 7
display module, 5
Display System, template, 43
(electronic ignition), 25
(engine management unit), 25
Engine speed (RPM), 24
engine speed (RPM), wiring label, 6
external warning lights, additional, 24
fastest lap time, 9
fitting the display module, 22
frequently asked questions, 46
fuel pressure, 8
fuel pressure alarm, 12
fuel pressure sensor, wiring label, 6
gate value, 9, 12
gear shift light, 15
gear shift warning light, 2
gear shift warning light, wiring label, 5
Installing, 21
labels on wiring, 5
lap number, 9
lap time, 9
lap times, 14
lap timing sensor, 28
lap timing switch, wiring label, 5
maximum oil temperature alarm, 17
maximum water temperature alarm, 17
minimum battery voltage alarm, 18
minimum fuel pressure alarm, 17
minimum oil pressure alarm, 18
minimum water pressure alarm, 18
multi-stage shift light, configuration, 19
oil pressure, 8
oil pressure alarm, 12
oil pressure sensor, wiring label, 6

Replaying the Recorded Data 34
Chapter 7. Troubleshooting 36
Appendix A. Template for the Display Module 43
Appendix B. Wiring Harness Schematic Diagram 45
Appendix C. Service and Support 46
Stack Contact Details 50
Index 51

Chapter 1. Introducing the Display System

The Keyser Display System monitors and displays a range of values, known as performance parameters, needed for effective car and driver management in most competitive situations.

The system combines an analogue tachometer with a digital display for the following performance parameters:

- Engine speed (RPM)
- Oil pressure
- Oil temperature
- Water temperature
- Fuel pressure
- Water pressure
- Battery voltage
- Lap times up to 45 minutes

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

The system provides a range of warning messages based on preset alarm values for the following performance parameters:

- Oil pressure
- Oil temperature
- Water temperature
- Fuel pressure
- Water pressure
- Battery voltage

You can enable or disable the warning system for each parameter individually.

You can redefine the preset alarm value for each parameter to a value that is more suitable for your vehicle.

Harnesses and Sensors – Where goods returned include harnesses and sensors we will provide an inspection of that equipment to assess the functionality. We are unable to repair harnesses or sensors that have been cut or become damaged due to use.

Note: a small number of our sensors can be serviced or repaired. Please discuss with your dealer who will advise you of which sensors are serviceable.

Loan/Replacement equipment – Stack operate a return to base service and repair policy. We do not offer an advance exchange or loan scheme.

Contact	International	United States
Sales	**(+44) 1869 240404**	**888-867-5183**
Fax	**(+44) 1869 245500**	**888-364-2609**
Email	**sales@stackltd.com**	**sales@stackinc.com**
Web	**www.stackltd.com**	**www.stackinc.com**

Cost and Duration of Service

All service and repair work is conducted at Stack's factory in the UK. Both the cost and the duration of the service will depend on:

- Your Geographical location.
- Whether the goods are covered by a warranty.
- The complexity of the repair work required once the initial inspection has been completed.

Cost and Duration of Inspection – Your dealer will be able to advise on the cost of the initial inspection work. As stated above it is your responsibility to arrange for the safe shipment of the goods.

The time required to complete any service or repair work is dependent on the outcome of the initial inspection. At the time of receiving your RAN form, we will provide an estimated delivery time, which is subject to the outcome of the initial inspection.

Priority Service – If you require your goods to be returned faster than the estimated delivery time, we can offer a priority service, for which there will be an extra charge. Again, the time required to complete any service or repair work is dependent on the outcome of the initial inspection.

Wherever possible we will return the goods within our priority delivery times:

- UK - 2-3 working days
- USA & Rest of World (RoW) - 7 working days

Cost and Duration of Service and Repair – On completion of the initial inspection, we will be able to quote the final cost and expected duration of the service and any repair work. We will contact you for authorisation to complete the work and request payment. If you choose not to proceed with this work, we will return the goods to you as we received them and you will only be charged for the initial inspection and return freight.

The system provides a gearshift warning light that illuminates above a RPM value that you define for your vehicle.

A powerful feature is the Keyser Display System's Action Replay mode. It can record data from various runs and then replay that logged data in real time on the display.

Warning Messages and Lap Times will pop up as they did during the run and the Shift Lamp will illuminate.

The replay may be paused so that data can be examined in detail. It is also possible to nudge backwards and forwards through the run to find a particular point of interest.

It is possible to upgrade the Action Replay Dash to full data logging capability by purchasing Stack's DataPro from your local agent.

How to use this Manual

Stack recommends that you unpack and connect the components in the system before you install it in your vehicle.

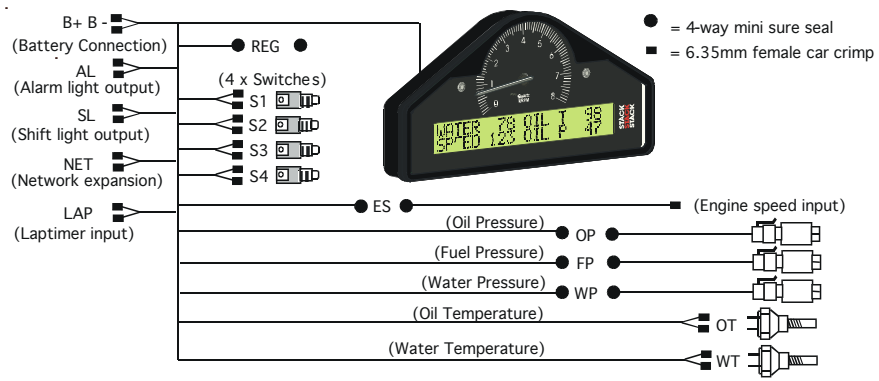
This will enable you to familiarise yourself with operating the display and configuring it for the vehicle in which you intend to install it.

This manual starts by taking you through the process of setting up the system before installation, operating the digital display, configuring the system and 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 template for the Display Module dashboard cut-out is provided in Appendix A and a schematic diagram of the wiring harness is in Appendix B.

Please note that this manual does not attempt to explain how to interpret or use the information from the Kyser Display

System as this is very specific to the type of vehicle in which it is installed and the type of competition in which that vehicle is engaged.



To arrange for your equipment to be returned for an initial inspection, please contact your dealer. The process for returning goods is as follows:

1. Contact the dealer from whom you purchased the goods.
2. Your dealer will complete and send you a Returns Authorisation form by fax or mail. This form includes a unique Returns Authorisation Number (RAN).
3. You must include that form with the goods when shipped. Your dealer will be able to advise you on the shipping of your goods.
4. At the time of shipping your goods you should arrange to make payment via your dealer for the initial inspection. Your dealer will advise you of this fee.

Your goods will then be returned to Stack's factory in the UK. The inspection and service process is explained below:

5. On receipt of your goods they will undergo the initial inspection by one of our engineers.
6. Our engineers will attempt to reproduce the fault as reported and an assessment will be made with regards the complexity of the corrective action:
   i) If the corrective action can be identified at this stage, we will contact you with details of the repair work required, as well as a quotation for that work.
   ii) If corrective action cannot be easily identified at this stage, a full diagnosis and a "Corrective Action Assessment" will be conducted. Using this information we can then contact you and advise on the next course of action and will quote on expected duration and cost of repairs where applicable.
7. Once we have received your authorisation to proceed with any repair work required, we will complete the work and request payment. A full final test will be conducted before the goods are packed ready for shipping.
8. Once we have confirmation that payment has been received for this service, the goods will be returned to you.

When contacting your Dealer with a Technical Support or Service enquiry it is important that you have to hand the following information:

- Serial Number (found on the rear of the product).
- The Model Number.
- The date of purchase.
- A copy of the packing list supplied with the product.
- If it is a Data Logging product, please provide the TAG number and the software licence number. Your Dealer will be able to advise you if you need help in locating those numbers.

This information will help your Dealer ensure that your enquiry is handled and processed in an efficient manner.

Service Enquiries

If you or your Dealer have identified a fault with your Stack equipment, it is possible to return the goods for inspection. Your Dealer will help you with this. Before you return your equipment, please be aware that:

- All services and repairs are subject to an initial inspection. No commitment can be made to repair the goods in full or within a specified budget or timescale until this inspection has been completed.
- An initial inspection fee will be charged for all services. Payment will be required before we conduct the inspection. On completion of the inspection you will be advised of any work and costs involved in repairing the goods. At this point you will have the choice to proceed with or terminate this service.
- It is your responsibility to safely ship (at your expense) the goods to Stack. It is also your responsibility to arrange for the safe return of the goods, unless the goods have been repaired under warranty, in which case Stack will organise for the safe return of these goods. Please ensure that the goods are adequately packaged and insured for the journey.

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 Keyser Display System Items

The Keyser Display System is supplied with the following standard components:

Quantity	Description
1	Display Module (ST867) with 2 mounting brackets
1	Wiring Harness (ST900156)
1	Pressure Sensors (ST747 - 1/8 NPTF Thread) for Oil Pressure
1	Pressure sensor (ST262245 - 1/8 NPTF Thread)
1	Packard to MSS Extender
2	Temperature Sensors (ST764 - 1/8 NPTF Thread)
4	Switches (ST514)

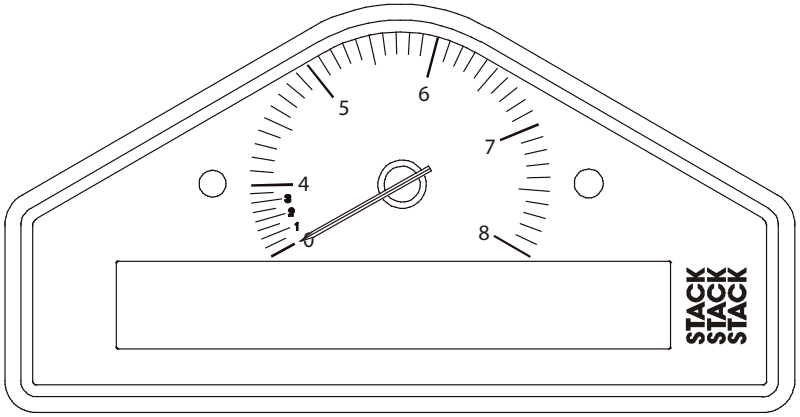
Optional Keyser Display System Items

The Keyser Display System is supplied with the following optional components:

Quantity	Description
1	RPM Sensor (Magneto adapter or ST697 H.T. Pick-up)
1	Infra-red Lap Time Receiver (ST543)
1	Infra-red Lap Time Beacon (ST544)
1	External Gear Shift Warning Lamp (ST534, ST537)
1	External Alarm Warning Lamp (ST533, ST536)
or	5 LED Multi-Stage Gear Shift Warning Lamp (ST539)

The Display Module

The Display Module consists of an analogue tachometer 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
REG	5 volt regulator stub
S1 to S4	Switches 1 to 4
LAP	Lap timing sensor
SL	Gear shift warning light
AL	Alarm warning light
NET	Data logging expansion pack

Appendix C. Service and Support

At Stack we pride ourselves on having, not only a very high-quality engineered product range, we also strive to offer a first class service when it comes to supporting our customers and installed product base.

Stack Web-site

If you have a question about a Stack product or if you are experiencing a problem, we have made a wealth of information available on our web-sites where you can find the answers you need.

International	United States
www.stackltd.com	www.stackinc.com

Frequently Asked Questions

Log-on to the Stack web-site, click on **Motorsport Division** and then the **Support** tab at the top of the home page. Then click on the **FAQ Page** item.

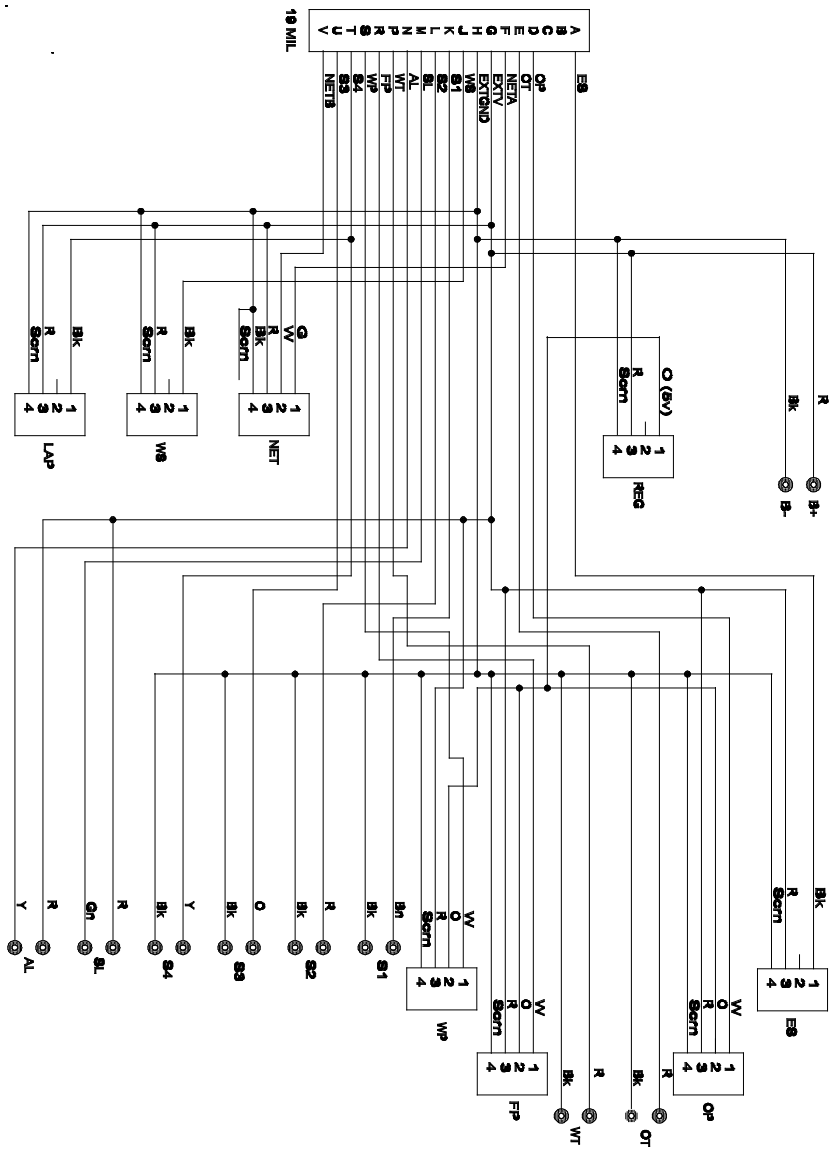
If you need a User Guide click on the **Manuals and Download Support Area** item. You will be asked to submit some basic information for Stack's internal use but, once submitted, you will have immediate access to downloadable versions of our product manuals. These manuals will give clear instructions on the installation and correct operation of your Stack product as well as including useful Troubleshooting sections.

If you still have unanswered questions then please contact the **Dealer** from whom you purchased the product.

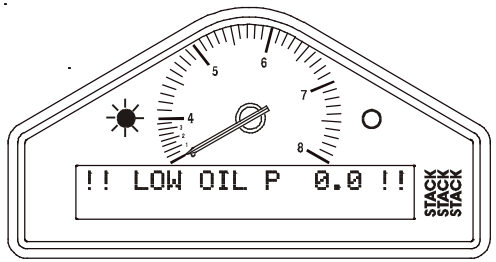
Contacting your Dealer

For a current list of dealers log-on to the Stack web-site, click on **Motorsport Division** and then the **Where to buy** tab at the top of the home page and select the **Distributors** menu item.

Appendix B. Wiring Harness Schematic Diagram



Labels on Long Cables	Connection To
ES	Engine Speed (RPM)
OT	Oil temperature sensor
WT	Water temperature sensor
OP	Oil pressure sensor
FP	Fuel pressure sensor
WP	Water pressure sensor
B +	Battery Positive
B -	Battery Negative (Earth)



This is normal in this environment.

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 2 or Switch 3 to clear the warning message from the display.

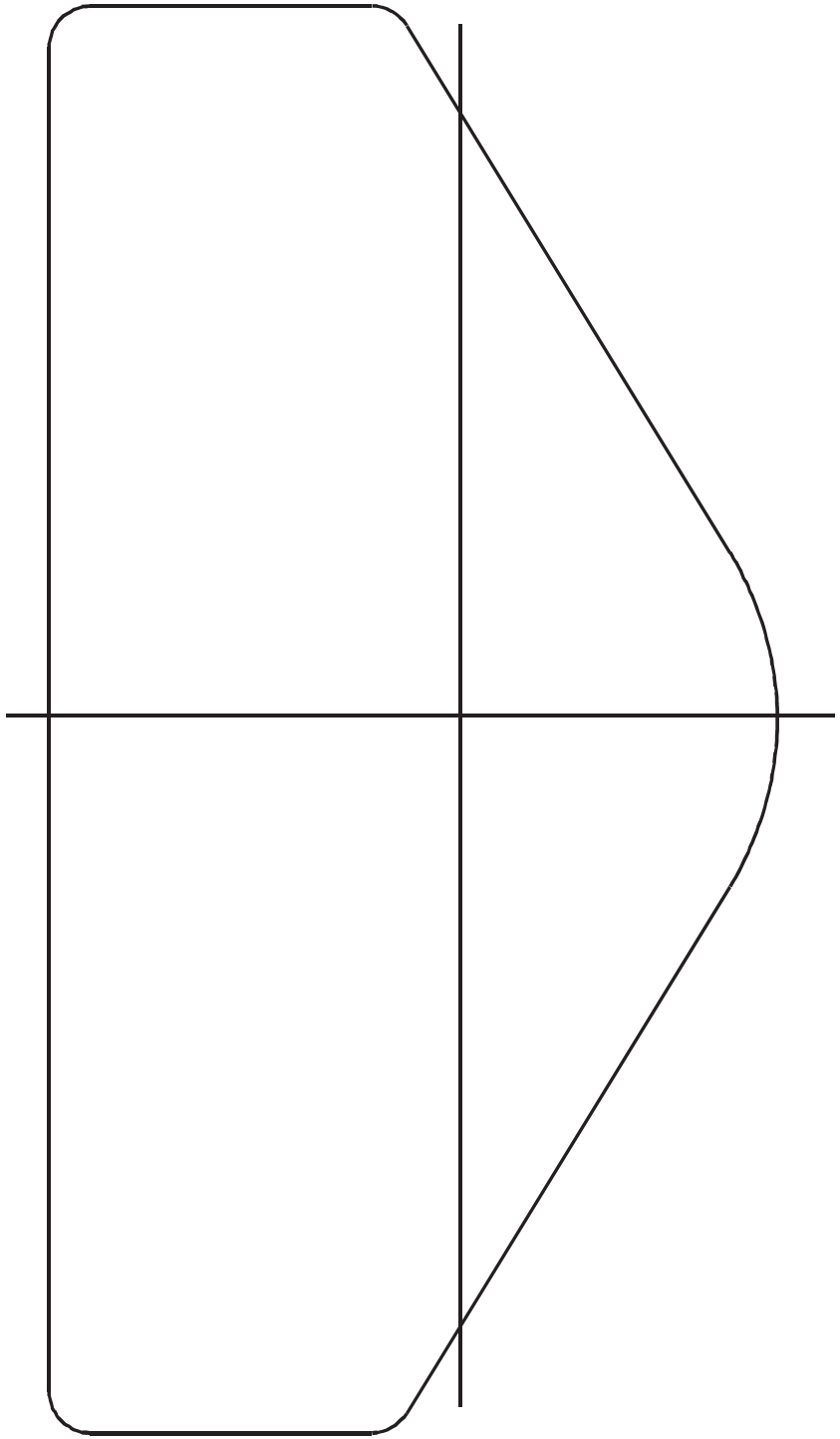
The digital display panel and the analogue dial face are always backlit when the system is switched on.

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

Changing the display layers

The digital display can show separate sets of parameters and their values on the various display layers.

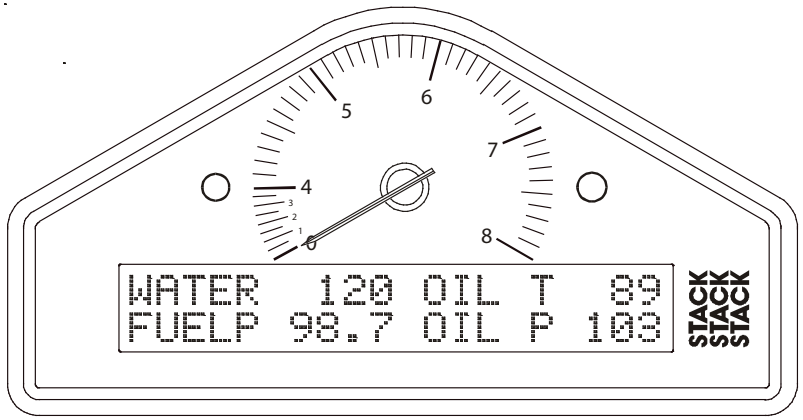
Each of the display layers can be displayed in turn by pressing Switch 3. Press Switch 3 when the last display layer is being displayed in order to return to the first display layer. The Display System will remember which display layer was showing when the unit was switched off and will redisplay that layer at power-up.



Appendix A. Template for the Display Module

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

Display Layer 1

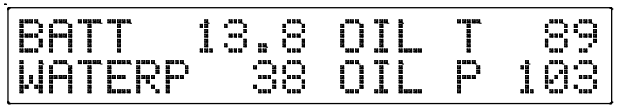


Display layer 1 shows:

- Water Temperature (WATER)
- Oil temperature (OIL T)
- Fuel pressure (FUELP).
- Oil Pressure (OILP)

Press Switch 3 to see display layer 2.

Display Layer 2

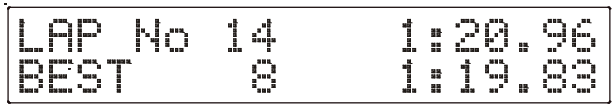


Display layer 2 shows:

- Battery voltage (BATT)
- Oil Temperature (OIL T)
- Water Pressure (WATERP)
- Oil Pressure (OILP)

Press Switch 3 to change display to layer 3.

Display Layer 3



Display layer 3 shows:

- Lap number of the last completed lap
- Lap time for the last completed lap
- Lap number of the fastest lap
- Fastest lap time (BEST)

Press Switch 3 to display layer 1 again.

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 follows:

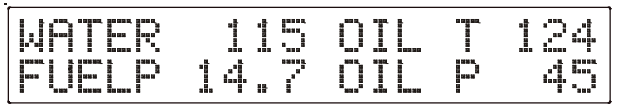
Symptom	Possible Cause	Remedy	Notes
Tachometer reading erratic, pointer jumps high or low	Incorrect wiring	Reconnect the tachometer as specified in this manual	
	Signal from ignition system or coil is noisy	Condition the ES signal by placing a resistor in line with the ES wire	Resistor values (1/2W 5% 350v) 10K ohms for dedicated tacho output; 47K ohms for coil connection (non-CDI); 100K ohms for CDI connection.
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 at the RPM gate value or above it.
	The engine RPM gate value is set too high	Reset the RPM gate to a lower value.	
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.
Display works OK until engine starts then Display freezes or resets continuously. Display recovers once engine stopped.	Interference from Ignition system & HT Leads	Fit Suppressed (Silicon) HT Leads. Fit a suppression capacitor (2.2uF) between the coil (battery connection) & chassis	Use 'Helical' suppressed leads in extreme cases
	Wiring close to HT leads & or injector leads, or HT leads tied to isolated metal work to which wiring is also tied.	Run wiring away from HT leads & injector leads	Recommended Minimum spacing 75mm (3.0")

Symptom	Possible Cause	Remedy	Notes
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 (+160*F)
	ECU interface shorted. Not normally fitted	Check the two core screen ECU wires for short circuits	ECU wire is 300mm inside the main sensor leads sleeve. Make sure that none of the wire ends are shorted
No 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).
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: 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 same as number of cylinders	Reconfigure system to correct number of pulses per revolution.	

Parameter	Type of Peak Value	Gated to RPM
Engine Speed (RPM)	Maximum	Yes
Oil Temperature	Maximum	Yes
Water Temperature	Maximum	Yes
Oil Pressure	Minimum	Yes
Fuel Pressure	Minimum	Yes
Water Pressure	Minimum	Yes
Battery Voltage	Minimum	Yes

Displaying the Peak Values

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



Resetting the Peak Values

You can reset all of the peak values, except the fastest lap time, 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 following values:

Parameter	New Peak Value
Engine RPM	0 RPM
Oil Pressure	999 PSI
Fuel Pressure	99.9 PSI
Oil Temperature	0°F
Water Temperature	0°F
Water Pressure	999 PSI
Battery Voltage	26.0V

Peak Value Memory

The peak values are stored in a memory that 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 system needs to be returned to Stack every 4-5 years for the internal battery to be changed. An alarm is triggered when the power from this battery drops below a safe level and the warning "MEM BATT" 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 fuel 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 while the engine speed exceeds its "gate value" for RPM for at least one second. Blipping the engine should 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 is to prevent abnormal warnings from being triggered when, for example, the engine is either not running, is idling or is being warmed up.

Symptom	Possible Cause	Remedy	Notes
Switch 4: does not set or display pop-up lap times when no automatic receiver in use	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)
Lap time is not displayed automatically (Automatic receiver is fitted)	Lap marker receiver lead faulty	Check lap marker wiring	Disconnect receiver and press lap Switch 4. If display changes replace receiver after checking its wiring.
	Lap marker receiver faulty	Replace lap marker receiver	
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 greater than 1.0 Ohm)
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 greater than 1.0 Ohm

Symptom	Possible Cause	Remedy	Notes
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)
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)
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)

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

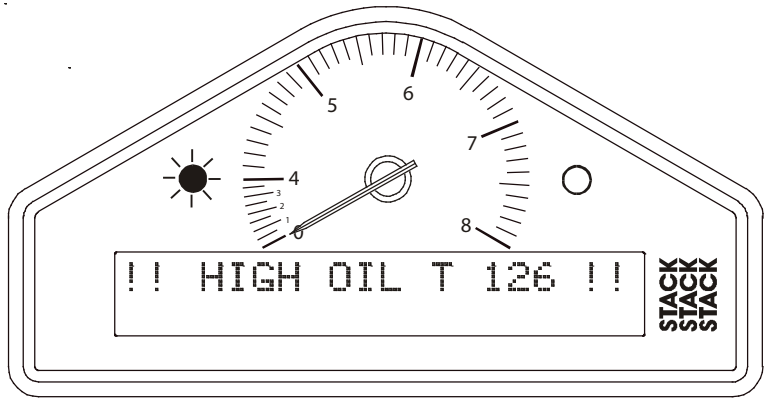
The Display System has the following built-in alarms:

Parameter	Alarm triggered when the	Gated to RPM
Oil Temperature	current value exceeds the preset value	Yes
Water Temperature	current value exceeds the preset value	Yes
Oil Pressure	current value drops below the preset value	No
Fuel Pressure	current value drops below the preset value	Yes
Water Pressure	current value drops below the preset value	Yes
Battery Voltage	current value drops below the preset value	No

Displaying an Alarm

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

If you purchased the optional External Alarm Warning Lamp, that lamp will illuminate at the same time.



Clearing an Alarm

Press Switch 2 or Switch 3 while the alarm is being displayed.

Showing the Last Alarm

Press and hold Switch 2..

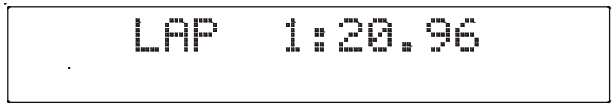
Symptom	Possible Cause	Remedy	Notes
Fixed pressure reading of 0.0 PSI or suspected low/slow reading	Pressure sensor has failed	Replace sensor	Swap with the other pressure sensor to confirm fault
	Faulty sensor connections	Check pressure connections	Check plumbing for a blockage (kinks in flexible hoses)
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)
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
Sensor reading incorrect	Another gauge connected to sensor	Disconnect other gauge	It is not permissible to connect a second gauge
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 “!! MEM BATT !!” warning on power up

Symptom	Possible Cause	Remedy	Notes
Display gives a fixed temperature reading of 999 F	Temperature sensor has failed	Replace sensor	Disconnect sensor. If reading changes to 0, replace sensor. Otherwise check harness for short circuit
	Faulty sensor connections	Check continuity of sensor leads	
Display gives a fixed temperature reading of 0* F when engine temperature is above 55 * F	A temperature sensor has failed	Replace sensor	Disconnect sensor and short its leads together. If the reading changes, replace the sensor.
	Faulty sensor connections	Check continuity of sensor leads for open circuits.	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)
Fixed pressure reading of 999.9 PSI	Pressure sensor has failed	Replace sensor	
	Faulty sensor connections	Check continuity of sensor leads for open circuits	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
Fixed pressure reading of –99.9 PSI	Pressure sensor has failed	Replace sensor	Disconnect sensor. If reading changes to 999, replace sensor
	Faulty sensor connections	Check continuity of sensor leads for short circuits	Check the wiring harness for short circuit

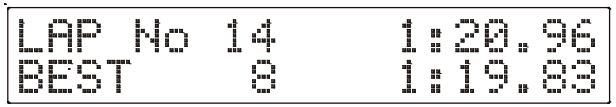
Lap times

The lap time is displayed for a preset time either when triggered by the infra-red lap time sensor passing the lap time beacon or when the driver presses Switch 4.

You can adjust the preset display time when you configure the Display System. *See Chapter 4, Configuring the Display System in this manual.*

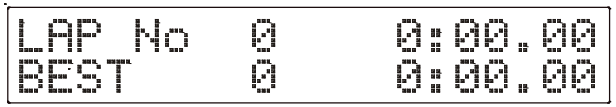


The most recent lap time is held in display layer 3. Press Switch 3 to see this display layer. This display gives you the lap number and time of the last recorded lap.



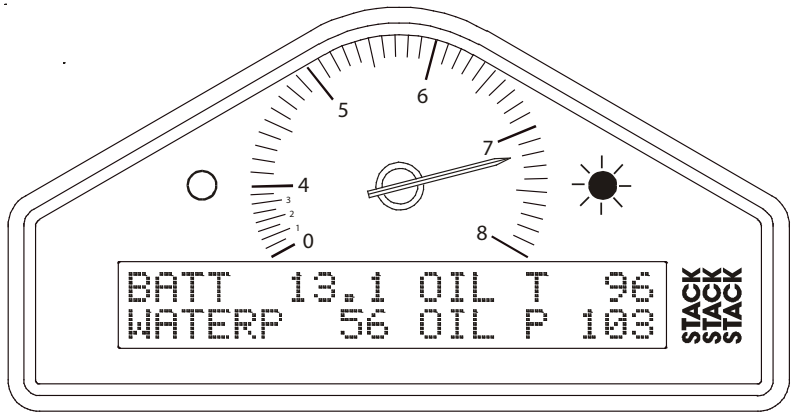
Resetting the Lap Time to Zero

Press and hold Switch 1 and then press Switch 4 to reset the lap count and lap times to zero.



Gear shift light

The gear shift light comes on when the engine RPM exceeds a predefined value. See Chapter 4, *Configuring the Display System* for information about setting this value.



If you purchased the optional External Gear Shift Lamp or Multi-stage Shift Light, that will illuminate at the same time.

Chapter 7. Troubleshooting

Symptom	Possible Cause	Remedy	Notes
Display is dead (no backlight, nothing on display, no green dial lights)	Ignition is off	Turn ignition on	The power lead is labelled B+ & B- The battery positive lead B+ is 19w conn pin G. 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	
Display is dead (no backlight, nothing on display, green dial lights on but dim) or !! LOW BATT !! warning on display	Battery is almost dead	Recharge or replace battery	
	Power connection to B- or B+ is faulty	Check power lead continuity	
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	
The !! LOW OIL P !! message does NOT appear on power up. The warning light is not turned on.	Pressure sensor has failed	Replace sensor	Swap with the fuel pressure sensor to confirm fault
	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	

Switch	Action
1	Nudge replay backwards XX seconds
2	Nudge replay forwards XX seconds
3	Change to next display layer or cancel a displayed message
4	Toggle Pause function; press once to pause, press again to restart
1 & 4	Exit back to the Run Selection Menu before the replay has finished.

Notes

It is not possible to display peak values during the replay. The original peak values are retained for viewing in Normal Mode.

The number of seconds which the replay can be nudged forwards or backwards can be adjusted in the Configuration Menus. The default is ±10 seconds. The switches do not auto-repeat so, for example, going forwards 40 seconds will require Switch 2 to be pressed four times. Pressing the nudge switches will cancel any displayed message before performing the nudge.

The display will change to a Run Navigation display while Switches 1, 2 or 4 are held, showing the switch function and the time position in the run.

Once the selected run has finished replaying, the Run Selection Menu will be redisplayed.

Chapter 4. Configuring the Display System

System Configuration Mode

You put the Display System into System Configuration Mode by pressing Switches 1 and 2 together. You then work through the configurable parameters in a preset sequence, pressing Switch 3 to display the next configurable parameter.

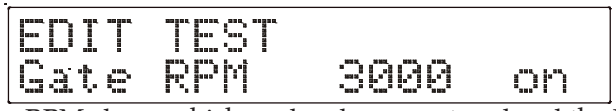
Setting or resetting configuration values

Use Switch 1 to decrease the value being configured and Switch 2 to increase it. The rate at which the value increases or decreases accelerates while the switch is being held down. Examples of the displays for each of the configuration items are shown below.

Engine speed cylinders:

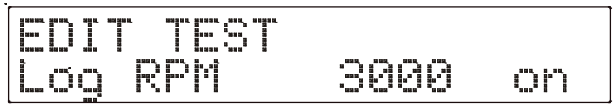
Set the number of cylinders for the engine (for RPM).

Gate RPM:



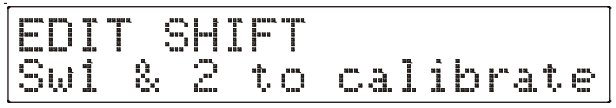
Set the RPM above which peak values are stored and the Fuel Pressure, Oil Temperature and Water Temperature warnings operate.

Logging RPM:



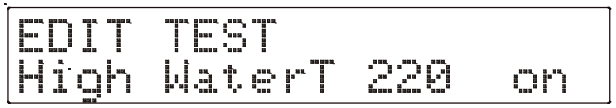
Set the RPM at which data recording is started.

Shift RPM:



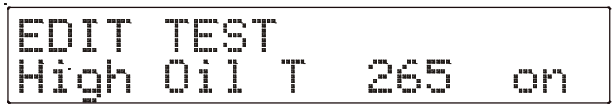
Refer to Configuring the Multi-Stage Shift Light later.

High water temperature:



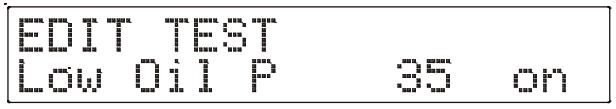
Set the value above which the water temperature alarm will occur.

High oil temperature:



Set the value above which the oil temperature alarm will occur.

Low fuel pressure:



Set the value below which the fuel pressure alarm will occur.

! *The Action Replay Menu will not be displayed if the Engine Speed is running, ie, RPM is above zero.*

A summary of the switch actions is shown in the table below:

Switch	Action
1	Select the previous run
2	Select the next run
3	No action; used to enter Action Replay mode at power-up
4	Play the selected run; if there are no runs, it won't play
1 & 3	Delete all the runs (see ! below)

! *A confirmation is required before the runs are deleted; press Switch 1 to cancel and Switch 2 to confirm. Once the runs are deleted, the number of runs will show zero*

Exit from Replay Mode by switching off the power. If Switch 3 is not held when the power is restored, the unit will revert to Normal display mode.

Replaying the Recorded Data

Once the selected run is replaying, the display layers work in the same way as they did when the run was being recorded.

You may press Switch 4 at any time to pause the replay. Pressing either Switch 1 or 2 will nudge the replay forwards or backwards by the preset number of seconds.

A summary of the switch actions is shown in the table below:

Chapter 6. Action Replay Mode

Making a Recording

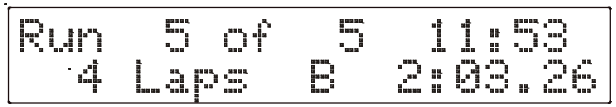
All of the parameters displayed on the Keyser Display System are recorded including the Lap Times.

Data recording starts when the Engine Speed rises above a preset RPM value. That value can be configured as described in Configuring the Display System above. Recording stops when the Stack system is switched off or after the Engine Speed has been at zero (engine not running) for more than five seconds.

The Display System can hold up to fifteen Runs; about two hours of data. Recorded data can be deleted from the Action Replay Menu (see below).

Action Replay Menu

The Action Replay Menu is displayed by holding down Switch 3 while the Display System is being powered up. The most recent run will be selected, eg,



The top line of the display shows the currently selected run, the maximum number of runs recorded and the duration of the selected run.

The bottom line shows the number of laps in the run and the best lap time.

Select the run which you wish to reply using Switch 1 and Switch 2 to scroll through the available runs. Then press Switch 4 to start replaying.

Low water pressure:

Set the value below which the water pressure alarm will occur.

Low battery voltage:

Set the value below which the battery voltage alarm will occur.

Lap time pop-up:

Set the time in seconds for which the Lap Time pop-up will be displayed when the vehicle passes the lap time beacon.

Action Replay Nudge Amount:

Set the number of seconds, in increments of 10 seconds, by which you want to skip through the data when either of the Nudge Keys are pressed (see Chapter 6. Action Replay Mode). We suggest that you use a small value for tracks which contain short laps and a larger value for longer circuits.

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.

Leaving configuration mode

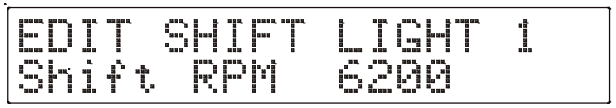
When you wish to return to the normal display, press Switch 4

Configuring the Multi-Stage Shift Light

The five LEDs of the ST539 Multi-Stage Shift Light can be made to illuminate in sequence with more coming on as the engine speed increases. For example, the first LED can be set to illuminate at 6200 RPM. Then both the first and second LEDs can be set to illuminate at 6400 RPM. An extra LED will illuminate in sequence at further RPM values until all five are lit.

Put the Display Module into System Configuration Mode by pressing Switches 1 and 2 together. Then work through the configurable parameters by pressing Switch 3 until the Edit Shift menu is displayed again.

Press Switches 1 and 2 together and the first Shift Light screen will be shown.



Set the RPM value above which Shift Light 1 will illuminate. Use Switch 1 to decrease the value being configured and

- 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 inches) 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 up to 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 on to the circuit.

Wiring harness

The Display Module and the sensors, switches and external lights f or 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 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.

Fitting the wiring harness

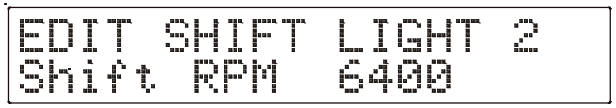
When fitting the harness on the vehicle, you should observe the following:

- Start by attaching the harness to the Display Module by connecting the 19-way military connector.
- First 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 as far as possible and not less than 50mm from sources of electrical noise such as ignition HT leads, distributor caps etc.
- When you pass any wire through a bulkhead or dashboard, fit a cable 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.

Switch 2 to increase it. The values change in 10 RPM increments.

! *If you have a single External Shift Light instead of the Multi-Stage Shift Light, it illuminates at the first shift point so Shift Light 1 is the only light which needs to be configured. Press Switch 4 to exit this menu early.*

Press Switch 3 to edit the second Shift Light RPM value.



Continue pressing Switch 3 to edit the remaining Shift Light values.

When all the individual Shift Lights have been configured, the Edit Shift screen will be re-displayed.

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.

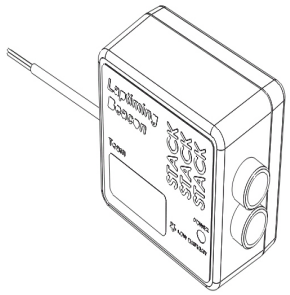
Tools needed to install the Display System

No special tools other than normal workshop tools are needed

Preconfigured Display Systems

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

Power supply to Trackside beacon



The beacon operates from a 12-volt DC supply. A sealed lead-acid battery with a minimum rating of 2.5 Amp/hour is recommended. This will provide 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:

Green	The voltage is, at present, adequate for use
Red	The voltage is low (replace or charge battery).
No Colour	Battery is exhausted or disconnected.

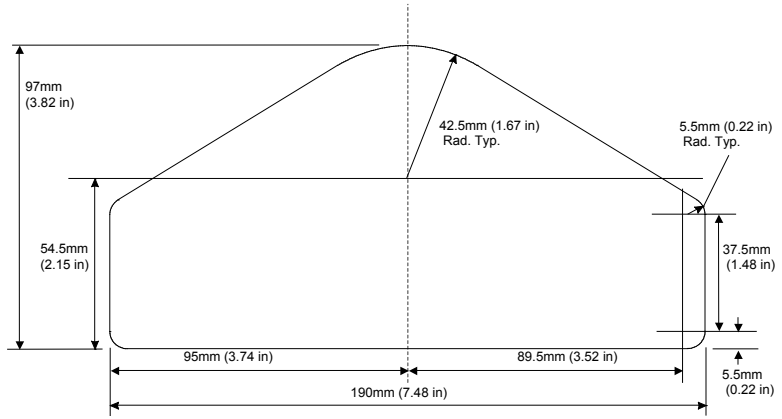
Trackside Infra-Red Lap Beacon (optional)

The ST544 trackside infra-red lap beacon has a threaded socket on its base for mounting to a standard photographic tripod. It 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 to 95ft) 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 peak over the beacon. Do not cover the beacon, for example using a plastic bag.

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 can be found in Appendix A.



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:

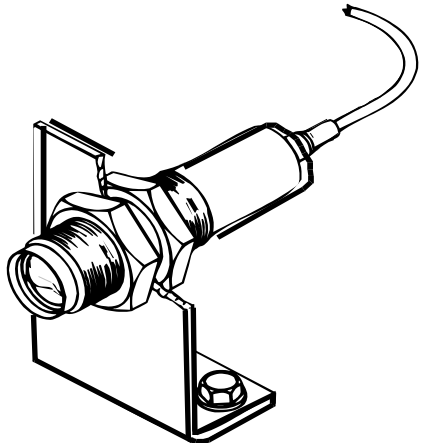
Switch	Functions
1	Show Peak Values
2	Show Last Alarm or Clear Alarm
3	Change Display Layer or Clear Alarm
4	Manual Lap Marker

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 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 layer and clear warning messages after alarms. This switch is normally fitted on the steering wheel.
- If the driver is also going to enter lap markers manually, Switch 4 should ideally 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.

Lap timing sensor (optional)

The ST543 lap timing sensor is actuated by an infra-red beacon positioned at the side of the track. 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 with M18 x 1mm threads.
- 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 situated 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.

! *After detecting a signal, the system does not recognise any further signals from beacons for a period of five seconds.*

- Do not screw the sensor directly into the engine block, as excessive vibration from some racing engines can affect the long-term life of the sensor.
- Do not over-tighten the sensor.

Temperature sensors

The Display System is supplied with two ST764 temperature sensors for monitoring oil temperature and water temperature:

The ST764 sensor has a 1/8" NPTF thread to match the temperature ports of US engines

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

Fitting the temperature sensors

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

Warning lights

The Display Module has two built-in warning lights. One of these is for the gear shift light and the other for warning the driver that an alarm has been triggered.

As an option, you can install additional external warning lights for these functions. 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 can supply suitable external warning lights for installation in the dashboard as well as shrouded versions that can be mounted on top of the dashboard.

! *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.*

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 as shown in the table below:

Ignition System	Connection Point
ECU	Direct to tachometer output
Coil and Points	Connect to the coil negative (low tension) terminal
HT coil lead	Use HT pick-up (ST697)

The following connections are shown in greater detail:
- Electronic ignition or ECU connection
- Standard contact breaker system
- Contact breaker series resistor connection

Electronic Ignition or ECU Connection

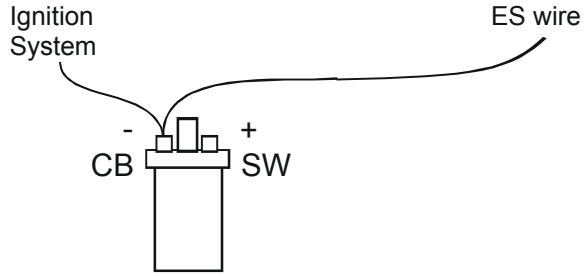
Connect the ES wire directly to the "Tacho" output of the electronic ignition or Engine Control Unit.

The signal can be either a 5 volt or 12 volt pulse.

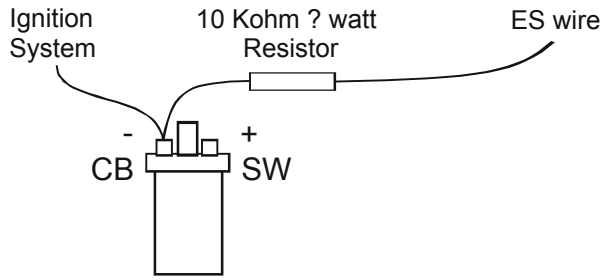
! *Some ECUs (eg, MoTeC M800) require a Pull-up resistor connected between the ES wire & +12v (battery positive). Resistor values between 470 & 4700 Ohms are recommended.*

Standard contact breaker system

Connect the ES wire directly to the negative terminal on the coil.



For systems which require a series resistor on the ES wire to limit interference from the high tension lead, a 10 KOhm _ watt resistor must be connected directly to the terminals (which must be the screened type).



Pressure Sensors

Fitting the pressure sensors

The Display System is supplied with one Stack ST747 145 psi pressure sensors to measure Oil Pressure.
In addition one ST262245 15psi Presure sensor is supplied to measure Fuel Pressure

Note: Water Pressure can be measured with an additional optional ST747

The sensors all have 1/8th NPTF threads.
If you find that you have a sensor with an incorrect thread, please contact your Stack branch or distributor for advice.

Installing the pressure sensors

- Position the sensors and their cables as far as possible from all sources of intense heat and from the ignition HT leads.
- Each sensor can be either screwed in directly to the monitoring point or fitted separately by using a suitable pressure hose to connect it to the monitoring point.