



**STACK
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Race Dash

Users Guide

Chapter 1. Introducing the Display System

The Auto Meter Race Dash 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 analog tachometer with a digital display for the following performance parameters:

- Engine speed (RPM)
- Oil pressure
- Oil temperature
- Water Temperature
- Fuel Pressure
- Battery Voltage
- Wheel speed
- 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
- 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.

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

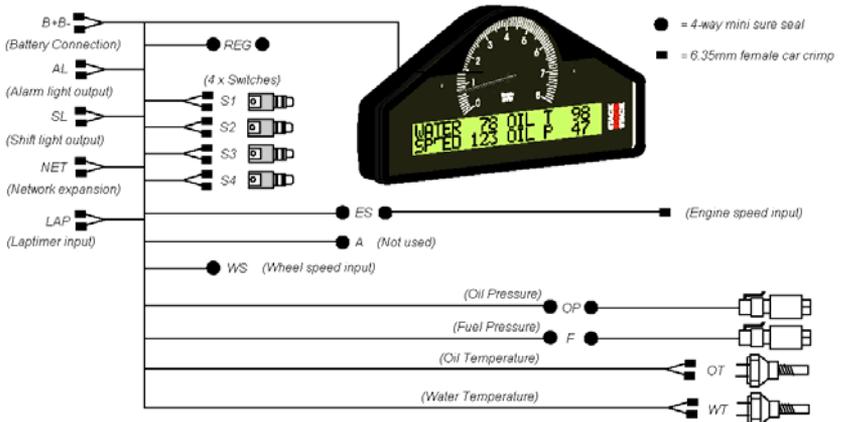
How to Use this Manual

Auto Meter recommends that you unpack and connect the components in the system **before** you install it in your vehicle. This will enable you to familiarize 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 template for the Race Dash 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 Race Dash as this is very specific to the type of vehicle in which it is installed and the type of competition in which the vehicle is engaged.



Chapter 2. Getting Started

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

Standard Race Dash Display System Items

The Race Dash Display System is supplied with the following standard components

Quantity	Description
1	Display Module with 2 mounting brackets
1	Wiring Harness
2	Pressure Sensors
2	Temperature Sensors
4	Switches (supplied with and to be connected to the wiring harness)
1	Pulse Amplifier for VSS input

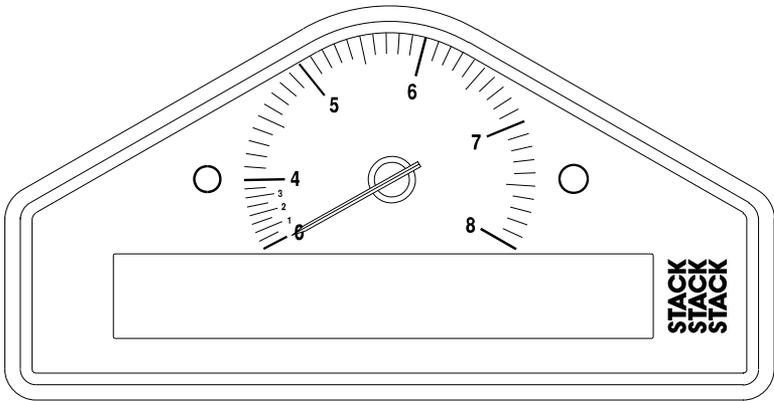
Optional Race Dash Display System Items

The Race Dash Display System can be used with the following optional components:

Quantity	Description
1	Infra-red Lap Time Receiver (model # 5266)
1	Infra-red Lap Time Beacon (model # 5267)
1	External Shift Light (model # 9580)

The Display Module

The Display Module consists of an analog 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 labeled.

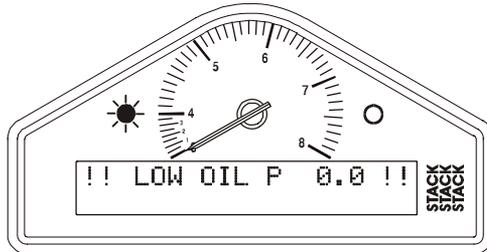
Labels on Short Cables	Connection To
REG	5 volt regulator stub
S1 to S4	Switches 1 to 4
WS	Wheel speed sensor
LAP	Lap timing sensor
SL	Shift light
AL	Alarm warning light

Labels on Long Cables	Connection To
ES	Engine speed (RPM)
OT	Oil temperature sensor
WT	Water temperature sensor
OP	Oil pressure sensor
F	Fuel pressure sensor
B +	Battery Positive
B -	Battery Negative (Ground)

Connecting the Components

1. Connect the wiring harness to the display module.
2. Connect the four switches to the cables labeled S1 to S4.
3. Connect each of the sensors that you have purchased to the appropriate wire in the wiring harness, as shown above.
4. Connect a 12v DC power supply to the power input cable.
5. Switch on the 12v DC power supply.

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



This is normal in this environment.

You can now proceed to familiarize 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 familiarize 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 analog dial face are always backlit when the system is switched on

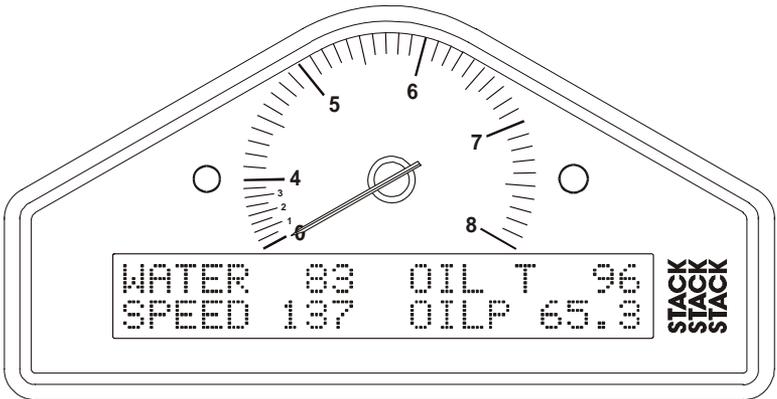
If none of these actions occurs when you switch on, switch off the power to the system and consult the section on troubleshooting in this manual.

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.

Display Layer 1



Display layer 1 shows:

- Water Temperature (WATER)
- Oil Temperature (OIL T)
- Current speed (SPEED)
- Oil Pressure (OILP)

Press Switch 3 to change the display to layer 2.

Display Layer 2

```
BATT 13.1 OIL T 96
FUELP 56.8 OILP 65.3
```

Display layer 2 shows:

- Battery voltage (BATT)
- Oil Temperature (OIL T)
- Fuel Pressure (FUELP)
- Oil Pressure (OILP)

Press Switch 3 to change the display to layer 3.

Display Layer 3

LAP No	14	1:20.96
BEST	0	1:19.83

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 change the display to layer 4.

Display Layer 4

1:19:83	18.07
---------	-------

Display layer 4 shows

- Fastest lap time
- Running time from the start of the current lap

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

Peak Values (Tell Tales)

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

Peak values are updated only when the engine speed has exceeded its "gate value" for RPM *for at least one second*. This allows the values to stabilize. 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:

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
Battery Voltage	Minimum	Yes
Wheel Speed	Maximum	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.

WATER	115	OIL T	124
SPEED	147	OIL P	45

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 values in the following table:

Parameter	New Peak Value
Engine RPM	0 RPM
Wheel speed	0 MPH
Oil Pressure	999.9 PSI
Fuel Pressure	99.99 PSI
Oil Temperature	0°F
Water Temperature	0°F
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 Auto Meter 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.

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

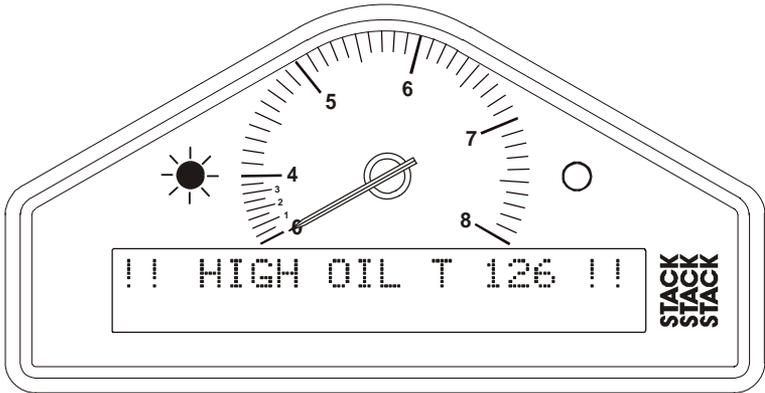
The Display System has the following built-in alarms:

Parameter	Alarm is triggered when the:	Gated to RPM
Oil 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
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 are using the 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.

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.

LAP	1:20.96
-----	---------

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.

LAP No	14	1:20.96
BEST	8	1:19.83

Resetting the Lap Time to Zero

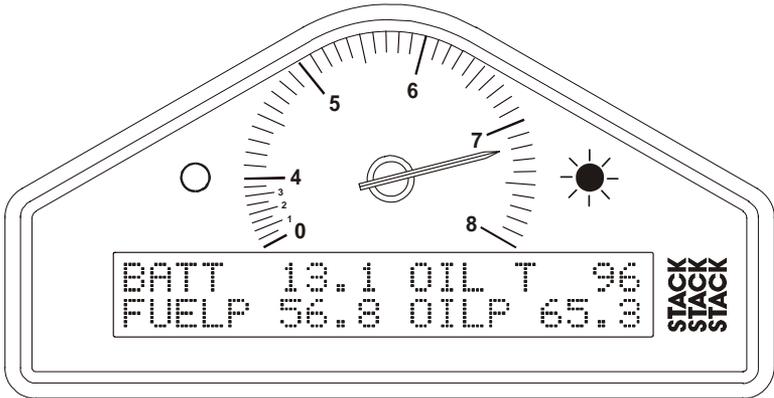
Press and hold Switch 1 and then press Switch 4 to reset the lap count and lap time to zero.

LAP No	0	0:00.00
BEST	0	0:00.00

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 Shift Light (model no. 9580) that light will illuminate at the same time.



Making a Recording

All of the displayed parameters 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* below. Recording stops when the Race Dash is switched off or after the Engine Speed has been at zero (engine not running) for more than five seconds.

The Race Dash can hold up to fifteen Runs; about two hours of data. Recorded data can be deleted from the Playback Menu (see next page).

Playback Menu

The Playback Menu is displayed by holding down Switch 3 while the dash is powered up. The most recent run will be selected, eg,

Run	5	of	5	11:53
4	Laps	B	2:03.26	

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 replay using Switches 1 and 2 to scroll through the available runs. Then press Switch 4 to start replaying.

The Playback 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 Playback 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 Note 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 Playback 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:

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.

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 set 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.

Wheel circumference:

```
EDIT SCALE  
Wheel Circ 1000 mm
```

Set the value for the wheel circumference in the units of measurement indicated.

Wheel speed pulses:

```
W.S. Pulses/Rev 10
```

Set the value to the number of ferrous targets that the wheel sensor is to count for each wheel revolution.

Engine speed cylinders:

```
E.S. Cylinders 4
```

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

Gate RPM:

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

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

Recording RPM:

```
EDIT TEST
Log RPM 3000 on
```

Set the RPM at which the recording option is started.

Shift RPM:

```
EDIT TEST
Shift RPM 7000 on
```

Set the RPM at which the shift light is to come on.

High water temperature:

```
EDIT TEST
High WaterT 105 on
```

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

High oil temperature:

```
EDIT TEST
High Oil T 130 on
```

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

Low fuel pressure:

```
EDIT TEST  
Low Fuel P 10.0 on
```

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

Low oil pressure:

```
EDIT TEST  
Low Oil P 35.0 on
```

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

Low battery voltage:

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

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

Lap time pop-up:

```
EDIT POPUP  
Lap Time 8.0 on
```

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

Recording RPM:

```
EDIT TEST  
Log RPM 3000 on
```

Set the RPM at which recording starts. Press Switches 1 and 2 together to disable and re-enable recording.

Nudge Amount:

```
EDIT VALUE  
Nudge amount 10secs
```

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 Replaying the Recorded Data below). 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.

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

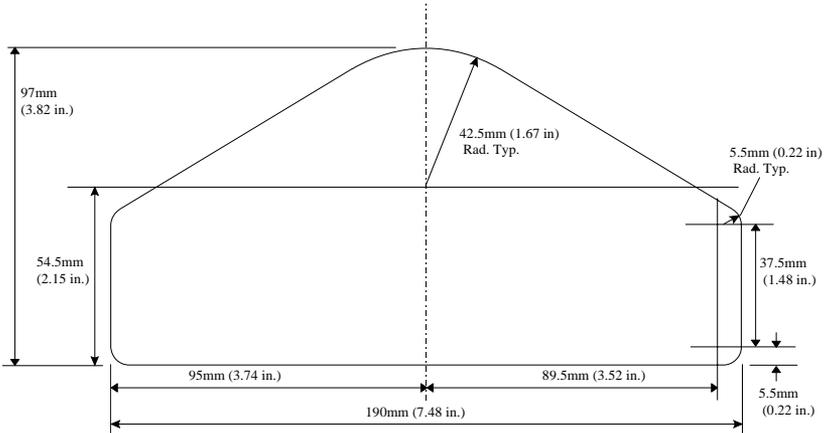
No special tools other than normal workshop tools are needed.

Preconfigured Display Systems

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

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 Race Dash.

The normal functions of the four switches are:

Switch	Functions
Switch 1	<ol style="list-style-type: none"> Show Peak Values Freeze speed on "HOLD" display (optional Corner Speed feature only)
Switch 2	<ol style="list-style-type: none"> Show Last Alarm or Enter Lap Time Memory mode (optional) Clear Alarm
Switch 3	<ol style="list-style-type: none"> Change Display Layer Clear Alarm
Switch 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 16" in length from the 19-way military connector.
- It is important that the driver is able to reach Switch 3 easily in order to change the display and clear warning messages after alarms. This switch is normally fitted on the steering wheel.
- When you configure the system, you use Switches 1 to 4 for selecting the parameters and setting their values. These switches should be installed so that you can reach them easily when you are viewing the digital display.

Warning Lights

The Race Dash has two built-in warning lights. One of these is for the 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.

Auto Meter 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.

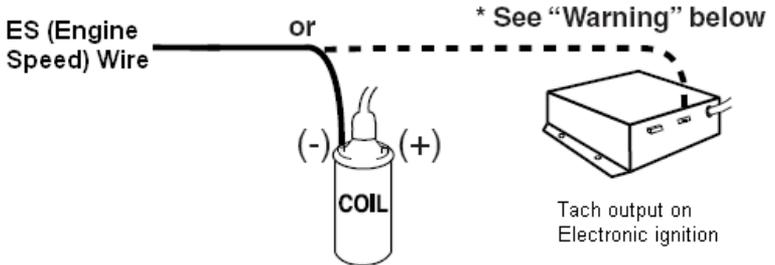
If you are using your own warning lights, ensure that the bulb rating does not exceed 2 Watts; otherwise the Race Dash will be damaged. If you need to use lamps greater than 2W, connect them to relays and use the output sockets from the Race Dash to switch these relays.

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 Race Dash to the ignition system or low-tension negative side of the coil (see warning on the next page).

Connecting the Display System to the Ignition System

The Display System can be connected to engines with a variety of ignition systems. Please see below.



* WARNING

Warranty will be void if connected to coil when using an aftermarket ignition box such as, but not limited to products from the following manufacturers: MSD, Crane, Jacobs, Mallory, Holley, Etc.. Prior to installation, check with the ignition box manufacturer for recommended tachometer signal location.

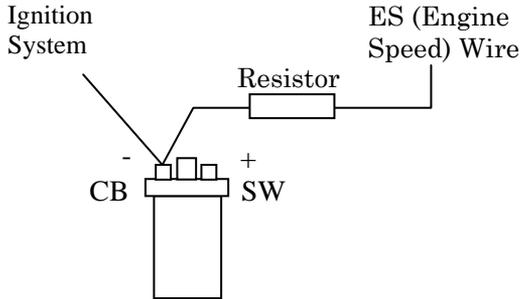
The following connections are shown in greater detail:

- Series Resistor Connection
- ECU Connection (+ Pull-up resistor)

The connection of the Display System to these types of ignition system is described on the next page:

Series Resistor Connection

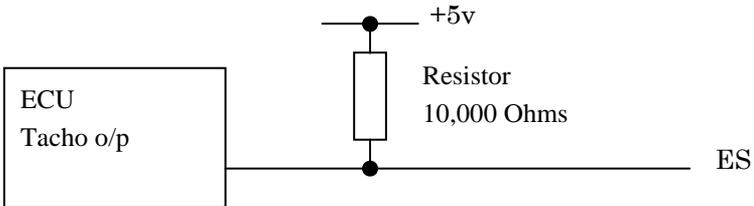
For systems which require series resistor on the ES (Engine Speed Wire) the resistor must be connected directly to the terminal to limit interference from the spark plug and coil wires (which must be the shielded type).



Electronic Ignition or ECU Connection

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

Some ECU’s (GM LS-1) require a Pull-up resistor connected between the ES wire & +5v (reference wire). Resistor value of 10,000 Ohms is required.



Pressure Sensors

Fitting the pressure sensors

The system is supplied with two 150 psi pressure sensors to measure Oil Pressure and Fuel Pressure. These sensors have a 1/8" NPTF thread.



Optional adapters may be supplied to match the pressure ports of different types of engines.

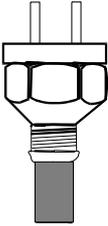
If you find that you have a sensor with an incorrect thread, please contact Auto Meter for advice.

Installing the pressure sensors

- Position each sensor and its cable as far as possible from all sources of intense heat and from the ignition HT leads.
- 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.
- 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 sensors.

Temperature Sensors

The Race Dash is supplied with two temperature sensors with 1/8" NPTF thread. Each sensor can be used for monitoring both oil temperature and water temperature.



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.

VSS Pulse Amplifier Interface

Introduction

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

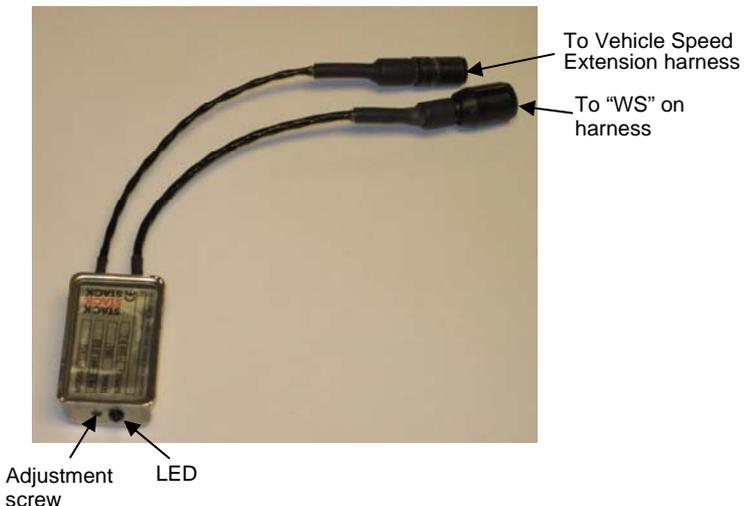
WARNING! For reasons of safety, NEVER connect the amplifier to an ABS speed sensor.

Installation

Mounting

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

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



Using the 'dual-lock' fastener with Auto Meter 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 70-100°F. Initial application to surfaces at temperatures below 50°F is not recommended because the adhesive becomes too firm to adhere readily.

To mount a sensor or housing on the vehicle

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

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

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

Do not try to separate the 2 strips of fastener immediately

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

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

Electrical

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

Use the vehicle speed extension harness with a MSS connector at one end and two wires at the other to connect the amplifier to the speed sensor.

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

For a three wire sensor, such as 5291 & 5292, connect black wire to common ground with sensor and connect the white wire to the sensor signal.

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.

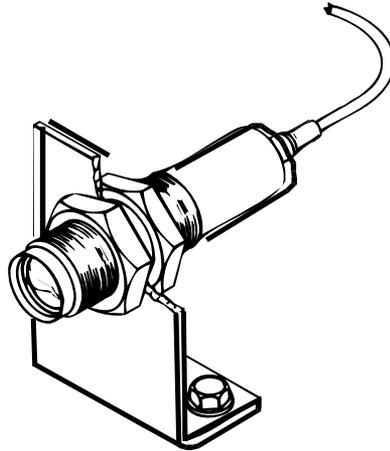
Following these adjustments, correct operation can be verified by observing the LCD speedometer at a range of speeds.

VSS Pulse Amplifier Technical Specification

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

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.



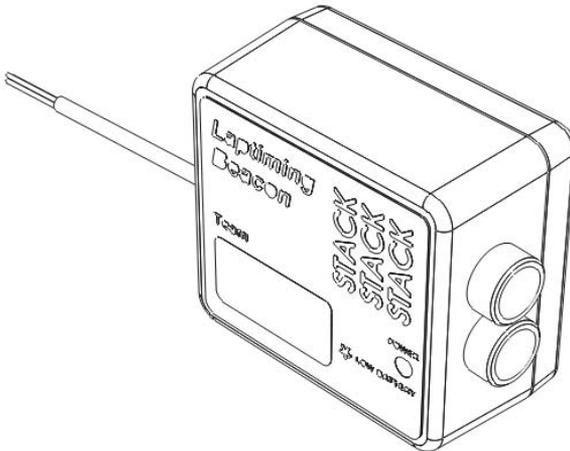
- It is secured by two nuts with M18 x 1mm threads.
- This sensor must be positioned horizontally and square to the axis of the vehicle.
- In order to detect the signals from the beacon, it must be situated outside the vehicle.
- It should, if possible, be positioned so that other vehicles that are being 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 ten seconds.

Trackside Infra-Red Lap Beacon (optional)

The 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 6 and 95 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. Do not cover the beacon, for example using a plastic bag.



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 color of the LED indicator on the front panel of the unit

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

Wiring harness

The Race Dash and 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 Race Dash and all the sensors and switches have been installed.

This harness has been designed so that the various branches are long enough for most applications. Occasionally, an individual branch may need to be extended significantly. Contact Auto Meter or your Auto Meter dealer to purchase extension cables. Do not shorten the supplied wire harness. It is recommended that additional length is coiled and secured away from moving parts and high heat sources.

Extender wires for connecting the air temperature and wheel speed sensors to the wiring harness are available in lengths of either 2', 4' or 6'.

Model No.	Length
9524	2'
9525	4'
9526	6'

Fitting the wiring harness

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

- Start by attaching the harness to the Race Dash 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 2" 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 fiber, 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 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 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 for a test drive.

Chapter 6. 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 labeled 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 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	

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.
	Faulty sensor connections	Check the continuity of sensor leads	Otherwise check harness for short circuit
Display gives a fixed temperature reading of 0°F when the engine temperature is above 55°F	A temperature sensor has failed	Replace sensor	Disconnect sensor and short its lead 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
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)

Symptom	Possible Cause	Remedy	Notes
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 Auto Meter for new battery service	Display shows "!! MEM BATT !!" warning on power up
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 (ground) greater than 1M Ohm
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 (ground) greater than 1M Ohm
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 (ground) greater than 1M Ohm

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 (ground) greater than 1M Ohm
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

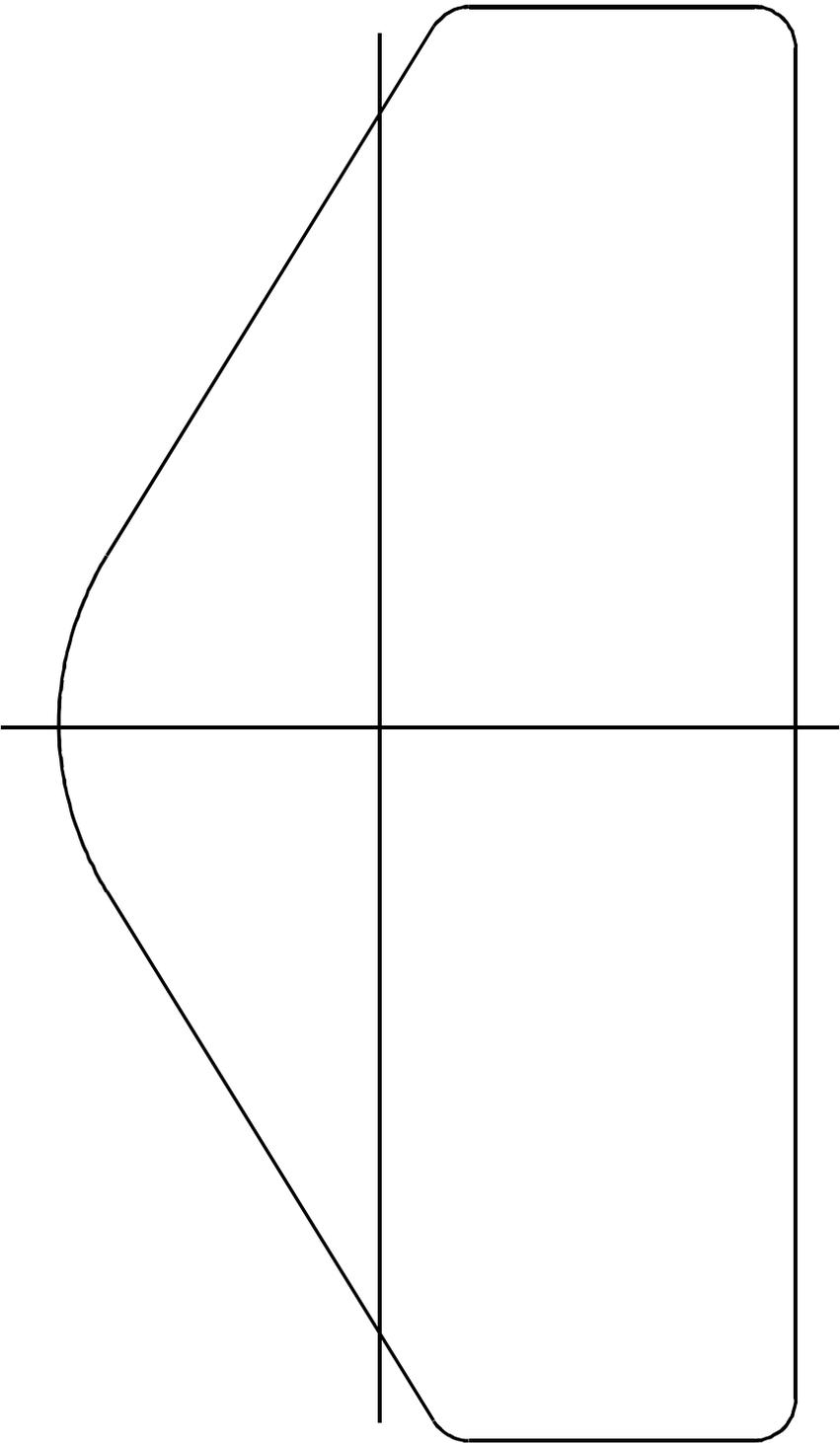
Symptom	Possible Cause	Remedy	Notes
Display values and messages unclear or unreadable (poor contrast)	Display too hot or too cold	Ensure that the display is operated within the specified temperature range	Operating temperature is +5°F to +160°F
	ECU interface shorted. Not normally fitted	Check the two 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 speed reading	Incorrect wiring	Check the connection of the engine speed wire to the ignition system (or sensor, if used)	See instructions supplied in this manual. If connected directly to the coil, check that it is to the switched low tension side (usually the negative side).
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.	
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.

Symptom	Possible Cause	Remedy	Notes
Displayed speed value too high or too low by a constant %-age amount.	System configured with wrong number of targets per wheel revolution	Reconfigure the system with correct values	Typical wheel circumference for a car is 70" or 35" for a kart
	System configured with wrong wheel circumference.		
No speed reading Speed reading erratic, value jumps high or low	Faulty sensor and/or wiring	Check sensor indicator for correct operation	Rotate the wheel by hand and check that the sensor indicator lights up as each target passes the sensor
	Incorrect sensor gap (too far apart or too close)	Check that the gap is approximately 1mm	
	Sensor and targets moving apart	Fabricate a more rigid sensor bracket	
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 175°F
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.

Symptom	Possible Cause	Remedy	Notes
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
	Dash wiring close to HT leads & or injector leads, or HT leads tied to isolated metal work to which Dash wiring is also tied.	Run Dash wiring away from HT leads & injector leads	Recommended Minimum spacing 3.0"

Appendix A. Template for the Display Module

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



Appendix C. Summary of Switch Functions

Normal Operation

Functions	Switch or Switches
Show Peak Values	Switch 1
Change Display Layer	Switch 3
Clear Alarm	Switch 2 or Switch 3
Show Last Alarm or Enter Lap Time Memory (optional)	Switch 2
Manual Lap Marker	Switch 4
Reset Peak Values	Switches 1 & 3 together
Reset lap count and lap time to zero	Switches 1 & 4 together
Enter System Configuration Mode	Switches 1 & 2 together

System Configuration Mode

Functions	Switch or Switches
Decrease the value of the parameter being displayed	Switch 1
Increase the value of the parameter being displayed	Switch 2
Enable or disable an alarm for the parameter being displayed	Switches 1 & 2 together
Display the next configurable parameter	Switch 3
Quit configuration mode and return to normal mode	Switch 4

Lap Time Memory Mode (optional)

Functions	Switch or Switches
Show Previous Lap Time	Switch 1
Show Next Lap Time	Switch 2
Quit Lap Time Memory	Switch 3