



**Delta Clubman System
and
Delta Lite System
HARDWARE REFERENCE**

Delta Lite and Delta Clubman Systems Hardware Reference

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About this manual

This manual contains information for both the Delta Lite Logger System and Delta Clubman Logger System.

Overview

What are Delta Lite and Delta Clubman?

Delta Lite and Delta Clubman are data Loggers for karting, club motorsport and motorcycle applications. Both Loggers will accept inputs from a range of sensors.

The Delta Lite and Delta Clubman loggers are not designed for use as part of a control system.

System details

The following table shows the details for both systems.

| Parameter | Delta Lite | Delta Clubman |
|---|---|---|
| Analog channels | 8 | 6 |
| Digital channels | 2 Wheelspeeds 1 RPM 1 Beacon | 1 Wheelspeed 1 RPM 1 Beacon |
| Internal channels | Lateral Acceleration Inline Acceleration Battery Voltage Box temperature | Lateral Acceleration Inline Acceleration Battery Voltage Box temperature |
| Beacon channels | 10 | 10 |
| Logging memory | 4MB | 2MB |
| Sampling rate (max) | 200Hz | 50Hz |
| Download connector | USB | USB |
| Display supplied | X Sport | X Sport |
| Display cost options (adapter looms are available) | Mini Dash C-dash System 2 | Mini Dash C-dash System 2 |
| Logger Management Software | Delta Lite | Delta Lite (Some functions limited) |
| Analysis software | Pi Analysis | Pi Club Expert Analysis |
| System loom | Terminated | Terminated |
| Analog loom | Terminated | Terminated (Some connectors not used) |
| Installation kit | Yes | Yes |

System options

The following items are available as options:

- 10-channel beacon transmitter
- Thermocouple sensor with suitable amplifier
- Throttle position sensors
- Steering position sensors
- Pressure sensors
- Temperature sensors
- Suspension sensors
- Remote gear-change light
- A second wheelspeed kit (for Delta Lite only)
- RPM pickups
- Custom made looms.

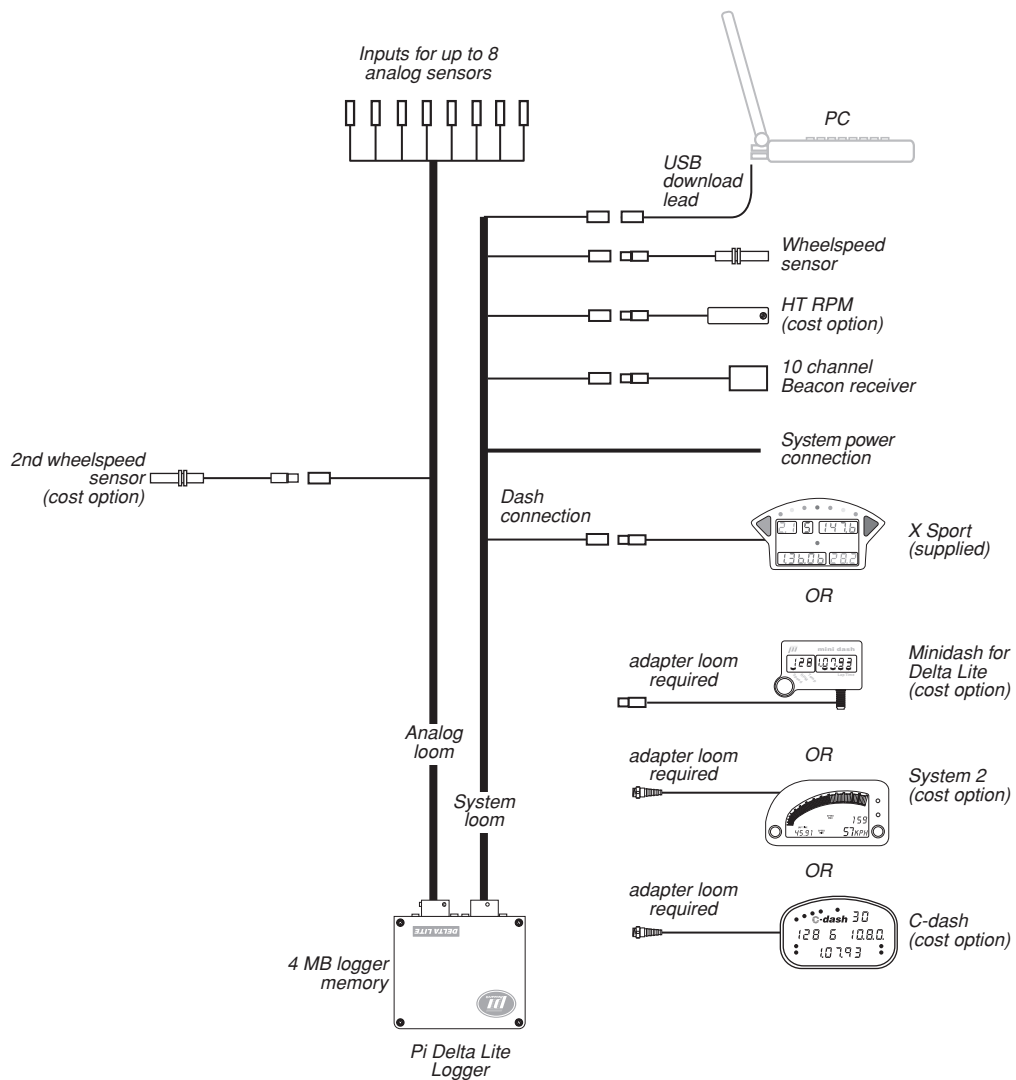
Display options

The Delta Lite and Delta Clubman loggers can display data on a number of optional dashes. These are:

- X Sport. This display is supplied as part of the System. The System loom is wired to use this dash.
- C-dash. This is a cost option. An adapter loom is required to use this dash. The C-dash must have the correct dash code installed. Also see Note below.
- System 2 dash This is a cost option. An adapter loom is required to use this dash. Also see Note below.
- Pi Minidash for Delta Lite. This is a cost option. An adapter loom is required to use this dash. Also see Note below.

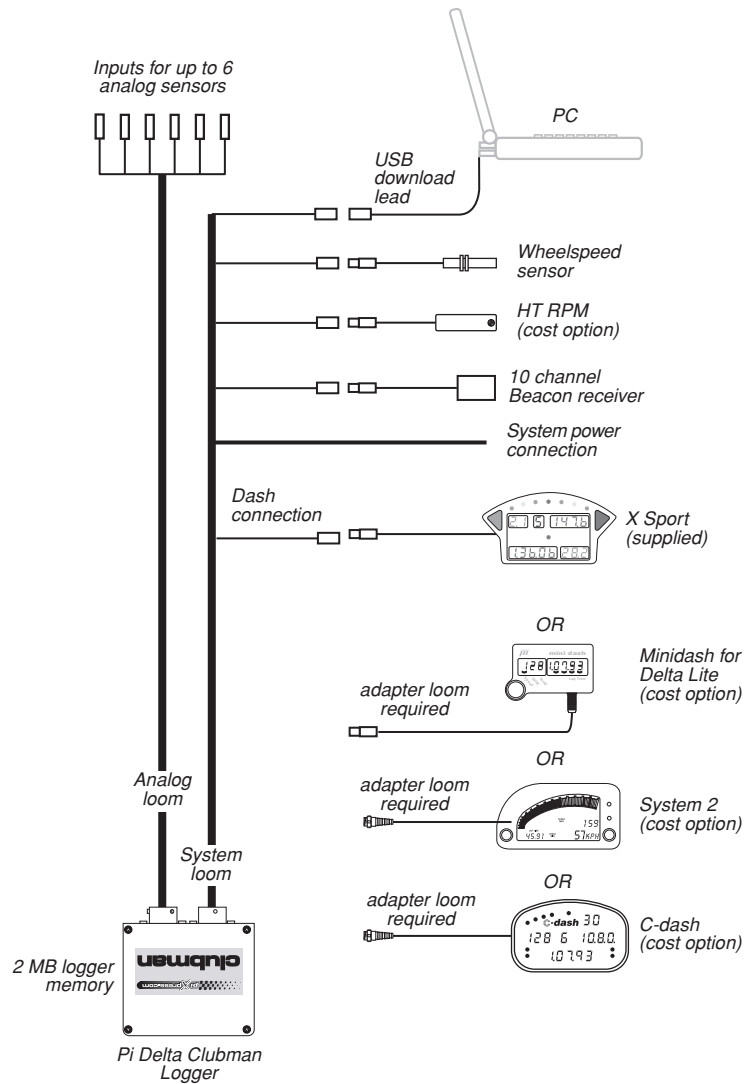
Note: To use your existing C-dash, System 2 dash or Pi Minidash you will have to return it to Pi Research for modification.

Delta Lite System overview



Typical Delta Lite system showing some cost options

Delta Clubman System overview



Typical Delta Clubman system showing some cost options

Installation

The Logger is fitted to the vehicle first, making sure that the unit is located in a friendly environment. The looms are run from the Logger along the chassis of the vehicle and connected to sensors which are positioned around the vehicle.

Logger

The Logger forms the central part of the Delta Lite and Delta Clubman systems. The Logger provides all the processing power and contains the logging memory, accelerometers for lateral acceleration measurement (used to make circuit maps) and in-line acceleration, plus power supplies and sensor interfaces for all the sensors. The Logger has two AutoSport connectors which are used to connect to sensors, displays and power.

Configuration

A Logger Profile, (supplied with the Logger) determines the capabilities of a Logger.

After installation, the Logger is configured specifically for the sensors and display being used and the measurements to be taken. This Logger 'setup' is created on the PC using the Logger Management Software and sent to the Logger via the USB download lead.

Note: When used with a Delta Clubman some features of the Logger Management Software are disabled.

Logging

When you have established that the sensors are connected and working by checking their readings in the paddock, it is time to run the vehicle. As soon as the engine starts, the Logger automatically begins recording the channels that you have chosen, e.g. RPM, temperature, pressure, etc.

You can also use the **Start Manual Logging** button on the **Card** page of the Logger Management Software to begin and end a new session without the engine running.

Downloading

Once the engine stops, the Logger stops recording. The data in the Logger must be transferred to the PC in order to view the data and analyse the performance of the vehicle and driver.

Sensors

Optional sensors are available for measuring the following:

- RPM pickups (HT RPM pickup, 2-stroke engine RPM pickup, 4-stroke engine RPM pickup)
- High pressure sensors for oil, water and fuel lines (0–5V signal)
- Low pressure sensor for measuring turbo pressure (0–5V signal)
- Temperature sensors for oil, water and air intake (0–5V signals)
- Linear potentiometers for measuring damper displacement and throttle (0–5V signal)
- Rotary potentiometers for measuring steering angle (0–5V signal).

Additionally, Delta Lite and Delta Clubman can be connected to other sensors using external signal conditioning. The choice of sensor types includes:

- Thermocouples for exhaust temperature
- Strain gauges for pushrod loads
- Tyre temperature sensor.

10-channel beacon receiver

Delta Lite and Delta Clubman systems use a 10-channel infrared beacon receiver to mark the start of each lap so that the Logger can record lap times and overlay data lap-by-lap.

The infrared beacon receiver is mounted on the vehicle and an infrared beacon transmitter is located track side. Each time the vehicle passes the transmitter, the infrared signal is picked up by the receiver on the vehicle.

The Logger then stores the lap time and information for each lap for later analysis with the appropriate analysis software.

Analysis software

Once the data has been stored in a file on the PC, you can analyse it at any time using the appropriate analysis software. You use Pi Analysis software to analyse data files produced by the Delta Lite logger. You use Club Expert Analysis software to analyse data files produced by the Delta Clubman logger.

To use these analysis software applications at the track, you need a laptop running an English language version of Microsoft Windows 2000® **OR** Microsoft Windows XP® operating system.

The analysis software offer a wide range of features, including:

- Circuit maps
- Graphs of all logged data
- Tabular lap and outing reports set up by the user
- Information about the track, driver and date
- Speed reports which compare performance with other vehicles, engines or drivers
- Full printing facilities
- System configuration
- XY plots.

The analysis software can produce graphs and lap-by-lap telltales for any of the sensor channels. In addition, the analysis software provides run time histograms, map manipulation, and split time reports.

Logger Management software

The Logger Management software is used to set up the Delta Lite and Delta Clubman loggers. The software is also used to download logged data. When used with a Delta Clubman some features of the Logger Management Software are disabled.

You can use the Watch facility of the software when setting up and checking sensors.

Logger specifications

Power supply requirements

| | |
|---------------|-----------------------------------|
| Input voltage | 7.5–18V [†] |
| Current | 300mA @ 12V (no sensors attached) |

[†] operation below 13V will degrade 12V sensor supplies. The Logger will not start if the supply voltage is below 7.5V.

Environmental

| | |
|-----------------------|---|
| Operating temperature | 0–60°C |
| Vibration | 13g @ 0–1kHz |
| Shock | 0.5m drop onto hard surface (except connector face) |
| Sealing | IP65 |

Mechanical

| | |
|---------------|---|
| Case material | Aluminium, anodised |
| Dimensions | 105 x 102 x 36.75mm (excluding connectors) |
| Weight | 364 grams |
| Connectors | Two Deutsch AutoSport Series: 37 pin Autosport AS214-35PN (Analog connector) 37 pin Autosport AS214-35PA (System connector) |

The loom connectors are Deutsch AS614-3535SN (Analog) and AS614-35SA (System) or equivalent.

Part numbers

This section gives part numbers for the Delta Lite and Delta Clubman kits. Also listed are some Display cost options and othe cost option items.

Delta Lite kit C401

| Part number | Description | Quantity |
|--------------|--|----------|
| 01D-163010-L | Delta Lite logger with 4MB logging memory | 1 |
| 01D-032405-T | X Sport dash | 1 |
| 01G-233019 | Active wheelspeed sensor | 1 |
| 01F-034110 | 10-channel beacon receiver | 1 |
| 60K-163038 | USB download lead | 1 |
| 60D-605000 | Delta Lite/Clubman System Loom, 3 metres long | 1 |
| OR | | |
| 60D-605003 | Delta Lite/Clubman System Loom, 1 metre long | 1 |
| 60D-605002 | Delta Lite/Clubman Analog loom, terminated, 3 metres long | 1 |
| OR | | |
| 60D-605004 | Delta Lite/Clubman Analog loom, terminated, 1 metre long | 1 |
| | Delta Lite/Clubman loom installation kit | 1 |
| 01P-032449 | Delta Lite CD containing: Delta Lite Logger Managment software Club Expert Analysis software Delta Lite and Delta Clubman Hardware Reference in PDF Delta Lite Logger Management Software User Guide in PDF Pi Analysis User Guide in PDF | 1 |
| 29P-071442 | Delta Lite Logger Management Software User Guide | 1 |
| 29P-071303 | Pi Analysis Software User Guide | 1 |

Delta Clubman kit C601

| Part number | Description | Quantity |
|--------------------|---|-----------------|
| 01D-163010-C | Delta Clubman logger with 2MB logger memory | 1 |
| 01D-032405-T | X Sport dash | 1 |
| 01G-233019 | Active wheelspeed sensor | 1 |
| 01F-034110 | 10-channel beacon receiver | 1 |
| 60K-163038 | USB download lead | 1 |
| 60D-605000 | Delta Lite/Clubman System Loom, 3 metres long | 1 |
| OR | | |
| 60D-605003 | Delta Lite/Clubman System Loom, 1 metre long | 1 |
| 60D-605002 | Delta Lite/Clubman Analog loom, terminated, 3 metres long | 1 |
| OR | | |
| 60D-605004 | Delta Lite/Clubman Analog loom, terminated, 1 metre long | 1 |
| | Delta Lite loom installation kit | 1 |
| 01P-032448 | Delta Clubman CD containing: Delta Lite Logger Management software Club Expert Analysis software Delta Lite and Delta Clubman Hardware Reference in PDF Delta Lite Logger Management Software User Guide in PDF Club Expert Analysis User Guide in PDF | 1 |
| 29K-071469 | Delta Lite and Delta Clubman Hardware Reference | 1 |
| 29P-071442 | Delta Lite Logger Management Software User Guide | 1 |
| 29P-071399 | Club Expert Analysis User Guide | 1 |

Display options

| Part number | Description | Comment |
|--------------|-------------------------|-------------------------------|
| 01F-152162-B | System 2 dash | Display adapter loom required |
| 01K-163058 | Delta Lite C-dash | Display adapter loom required |
| 01K-163055 | Minidash for Delta Lite | Display adapter loom required |

Display adapter looms

| Part number | Title | Description |
|-------------|------------------------------------|---|
| 60D-605001 | Autosport to System 2 Adapter Loom | Connects Delta Lite/Clubman System loom X Sport AS dash connector to a System 2 dash. |
| 60D-032436 | Autosport to C-dash Adapter Loom | Connects Delta Lite/Clubman System loom X Sport AS dash connector to a C-dash. |
| 60D-032437 | Autosport to Minidash Adapter Loom | Connects Delta Lite/Clubman System loom X Sport AS dash connector to a Minidash which has an IMS connector. |
| 60D-032434 | X Sport Coily Steering Wheel Loom | From X Sport to either X Sport or Clubman/Delta Lite loom - has bulkhead connector. |

Cost option items

Some cost items are listed below. Contact Pi Research for information on additional products.

| Part number | Description |
|--------------------|--------------------------------------|
| 01F-152033 | 10-channel beacon transmitter |
| 01K-162060 | 2-stroke engine RPM pick-up |
| 01F-152080 | 4-stroke engine RPM box |
| 01K-162169 | HT RPM pick-up |
| 01G-233020 | Temperature sensor |
| 01K-162185 | RTD temperature sensor |
| 21A-0050 | Pressure sensor (0-40psi) |
| 21A-0005 | Pressure sensor 7 bar (2.5 - 120psi) |

At the track

Initial Checks

Kit list

For a typical day using Delta Lite, you will need:

- your laptop computer with fully charged batteries, or a mains supply
- a laptop charger or a spare PC battery
- the USB download lead
- a fully charged battery for the Logger (if you are not using the vehicle battery).

If you are using a beacon transmitter, you will need:

- the beacon transmitter
- a 12V battery for the beacon transmitter
- the beacon transmitter tripod.

If you use a printer, you will need:

- the printer
- printer paper
- a power lead or battery
- a spare colour cartridge (if fitted).

In case of accidental damage, we suggest you have:

- a basic tool kit
- a spare wheelspeed sensor.

Checklists

At the start of the day

- Check that you have fitted any labels to the Delta Lite logger that are required by your race regulations.
- Run the Logger Management Software and set the download path if you have selected the Automatic Download option in the Logger Management Software.

If you are using a beacon transmitter, check that:

- the beacon transmitter is switched on, on the correct channel and working (check that the power on LED on the front of the transmitter is on)
- the beacon receiver is on the correct channel and is working by watching the lap time change on the dash as the beacon transmitter is swept past the beacon receiver
- the beacon transmitter is placed alongside the track at the same height as the beacon receiver
- the transmitter battery is fully charged.

WARNING: Lap times are stored in the Logger, not in the beacon transmitter. This means that if several 10-channel beacon transmitters are all operating on the same channel that you are using, your receiver will pick up all the signals and your lap times will not be correct. A Pi master beacon transmitter on channel 0 is available at most tracks and you are advised to use this and not your own transmitter. If a master beacon transmitter is NOT available you are advised to coordinate with anyone else at the track who is also using a 10-channel beacon transmitter.

Each time you visit a circuit, try to place the beacon transmitter at exactly the same place on the track. This will ensure that graphs produced by the PC software from different visits to the same track align.

If you use a printer, check that:

- the printer has been set up in your Windows operating system
- the printer is turned on
- paper has been loaded.

Before each outing

Check that:

- the Logger is powered up
- the Logger has been set up properly for the car
- the wheelspeed sensor is adjusted correctly (using Watch facility in the Logger Management Software) Refer to the *Logger Management Software User Guide* for information on Watch channels.
- the RPM pick-up is attached
- the other sensors are working properly (using Watch facility in the Logger Management Software). Refer to the *Logger Management Software User Guide* for information on Watch channels.
- the sensor wiring has not been damaged if you've been working on the vehicle.

After each outing

- Download the data from the Logger to the PC.

At the end of the day

- Don't forget to pick up the beacon transmitter!
- The data you collect may be valuable, so you should back up the sessions on a regular basis.

A note on sessions

Normally a session is defined as the time the engine starts until the engine stops. However you can use the **Start Manual Logging** button on the **Card** page of the Logger Management Software to begin and end a new session without the engine running.

A typical day

At the start of the day

Once you have arrived at the circuit and prepared to go out onto the track for the first time, you should check over the Logger and its sensors.

Checking the system

To check for correct settings of the Delta Lite Logger and sensors:

- 1 Have your laptop powered-up and running the Logger Management Software.
- 2 Enter the correct download path for the particular track.
- 3 Plug the USB download lead into the USB port of the laptop.
- 4 Plug the other end of the USB download lead into the download port.
- 5 Watch channels you wish to check.
- 6 To check that the wheelspeed is correctly adjusted and working, watch the wheelspeed channel and spin the wheel. The wheelspeed value should increase as the wheel spins up and decreases as the wheel slows down. The readings of all the other sensors, the battery condition and the box temperature can also be checked while watching the selected Logger channels.

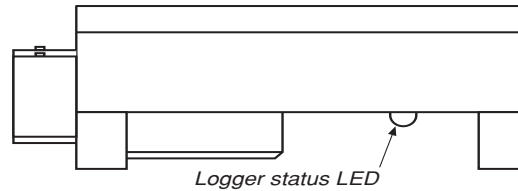
Note: You should ideally watch channels before every session during the day to check the sensors and battery condition.

Positioning the Beacon Transmitter

Only use your own beacon transmitter if a Pi 10-channel master beacon is not available at the track. Place the beacon transmitter at the side of the circuit at the same height as the receiver and turn the beacon transmitter on. When working correctly the power on LED will light up. You are now ready for your first outing.

Logger status LED

The Logger has a status LED.



Location of Logger status LED

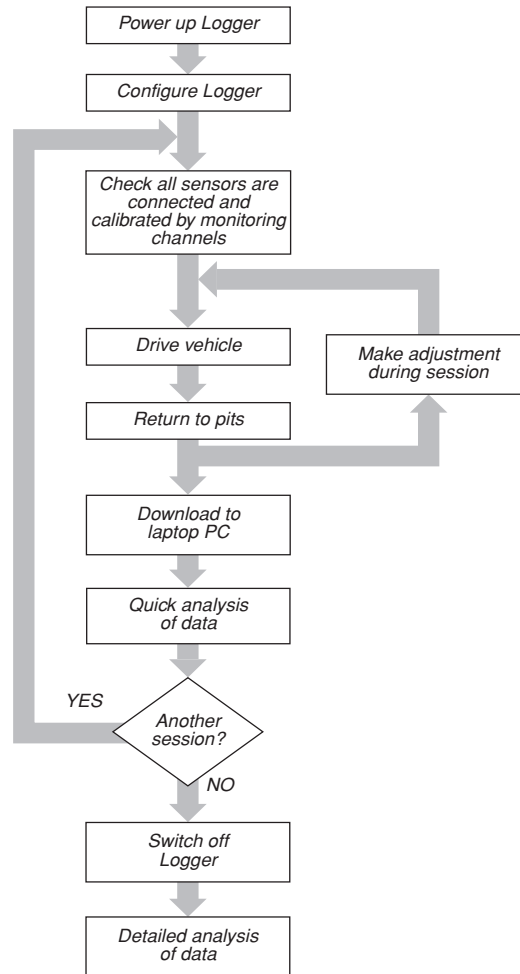
The LED flashes on and off, with the number of flashes per second indicating Logger function. These are listed in the next table.

Logger status LED function

| Flashes | Function |
|---------|--------------------------------|
| 1 | Power save (sensors off) |
| 2 | Normal (sensors on) |
| 3 | Logging |
| 4 | Memory card full |
| 5 | Memory card corrupt or missing |

A typical session

The diagram below shows the use of Delta Lite during a typical session.



Typical day

Driving the vehicle

The vehicle is now ready to drive.

Start logging

Data is automatically logged once the engine has started.

Spinning off

If you spin off the track but do not stall the engine, Delta Lite will continue to log data.

If you spin off the track **and** stall the engine, the Logger stops logging data and the session ends. When you restart the engine the Logger starts logging and a new session is started. The data already logged is not lost and will appear as two separate sessions.

Logging memory full

If the logging memory is fills up, the logger continues to log data. It does this by over-writing the oldest data on the memory card.

Battery failure

Delta Lite requires 7.5 volts minimum battery voltage in order to operate. If the battery delivers less than this, the Logger anticipates a power failure and saves the data logged so far and stops logging further data.

You can download the data already logged only when the power is restored.

Download data to a computer

To download data from the logger to a computer:

- 1 Power up the computer and run the Pi Delta Logger Management Software.
- 2 Connect the PC to the download port on the car using the USB lead.
- 3 Download starts automatically if you have chosen the **Automatic Download** option on the Card page of the Logger Management Software.

The data is saved to the location and format(s) chosen in the Automatic Download option dialog box. Refer to the *Logger Management Software User Guide*.

Manual download

If you have not chosen the Automatic Download option you must select the **Logged session** you want to download and use the **Save session** button on the Card page of the Logger Management Software. The data is saved in the format(s) chosen in the Automatic Download option dialog box. Refer to the *Logger Management Software User Guide*.

WARNING: DO NOT REMOVE the download lead until the Logger finishes the download. An on-screen message notifies you when download has finished.

The data is now stored on the PC, so you can exit the Logger Management Software and turn off the computer, or analyse the data further.

Delta Lite users should refer to the *Pi Analysis User Guide* for details of how to use that analysis software.

Delta Clubman users should refer to the *Club Expert Analysis User Guide* for details of how to use that analysis software.

Installation

Installation notes

Power supply

On racing cars, there is already a power supply available: the vehicle battery. The negative side of the battery is conventionally connected to the vehicle chassis through a master switch. This allows total disconnection of all electrical power in an emergency, and is required by motor sports regulations.

If a vehicle battery is used to supply Logger, you should connect the Logger directly to the 'safe' side of the master switch, to ensure safe installation. You should feed the positive supply to the Logger directly from the battery 'live' terminal, or optionally through a separate switch, which allows the Logger to be powered on or off as required.

To fit Logger to a kart or a motorcycle which does not have a battery fitted, you will need to provide an external power supply. This can be any type of battery supplying between 7.5 volts and 18 volts. Pi Research recommend using a rechargeable 12 volt battery which will run Logger for one day.

WARNING: Failure to disconnect the battery from the power lead before wiring the system may result in damage to both the battery and the logger. Do not connect or disconnect any of the sensors with the power on.

USB download connector

The USB download lead is terminated with a 4-pin DIN connector for the car end and a standard USB type A connector at the computer end.

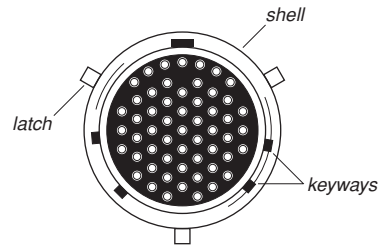
Deutsch connectors

The Logger uses Deutsch Autosport (AS) connectors.

The System loom and the Analog loom are supplied fitted with AS connectors for connection to the Logger. The System loom is also supplied fitted with an AS connector for the dash connection.

AS connector information

The Deutsch AS connector range has five keyway orientations, indicated by different coloured bands around the collars.



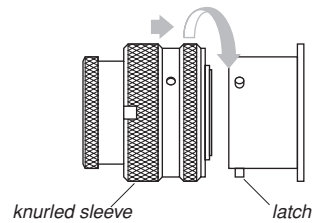
Deutsch Autosport connector detail

The Deutsch AS connectors use a rotating sleeve to lock the two halves of the connector together.

To connect Deutsch AS connectors:

- 1 Make sure that the two connectors are compatible by checking that the number of contacts and the position of the keyways is the same for both connectors.
- 2 Align the keyways, and bring the two halves of the connector together.
- 3 Apply light pressure to the connector as you slowly turn the knurled sleeve.

-
- 4 When the latches connect with the sleeve, keep turning until you hear the sleeve click.



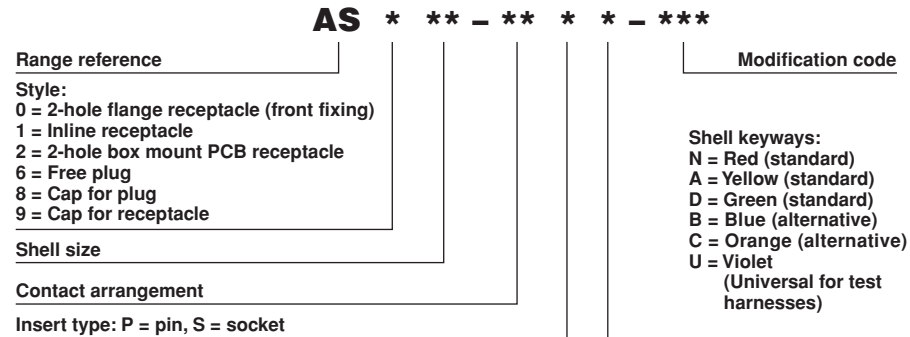
Connecting a Deutsch Autosport connector

Deutsch AS connector contacts

The contacts of a Deutsch AS connector are labelled on the connector itself. The contact numbers are given on the outside and inside of the connector.

Deutsch AS part numbering

The part number is made up using the AS range reference followed by the style, the shell size, the contact arrangement, the insert type and the shell keyway e.g. AS108-35PN. The modification code is only applicable if a special modification has been made to the connector.



Deutsch AS connector part numbering

Fitting the Logger

The main rules for installing the Logger are:

- Mount it in the right environment; and
- Orientate the Logger correctly.

Environment

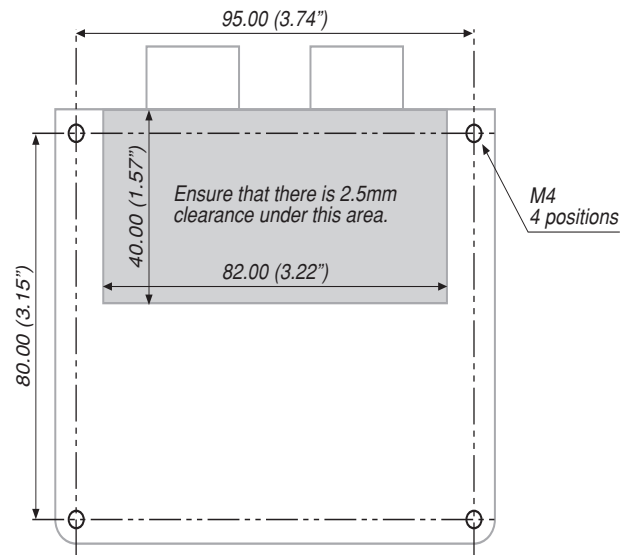
The Logger is designed to withstand a fairly harsh environment. However, some simple precautions with its mountings will improve its long-term reliability. Ideally you should mount the Logger in the driver area. This is generally a safe environment and makes the box easily accessible. You should ensure that you:

- isolate the Logger from the vehicle chassis. You **MUST** use the Anti-vibration mounts supplied.
- avoid excessive heat – make sure that the fixture position is not exposed to radiated heat from exhaust pipes or turbochargers. If in doubt, put a temperature sticker on the proposed position; after running, check that the temperature remains below 60°C. Don't forget to make an allowance for hot weather – this could add another 10°C to your measured temperature. Do not wrap the Logger in insulating material – allow air to circulate around it.
- avoid spray – the Logger is resistant to spray, but accumulated water or oil will eventually work into the box. If you cannot help the box getting sprayed (e.g. on a motorcycle or kart), then dry the area off whenever you can – do not let the Logger or any connectors remain damp for a long time.
- avoid mounting the Logger near sources of electrical interference – the performance of the system (i.e. the accuracy of signals) will be compromised if the Logger wiring looms are situated too close to HT ignition coils, plug leads, ECMs, alternators or radio antennas.

Anti-vibration (AV) mounting

The Logger is supplied with four threaded Anti Vibration (AV) rubber columns which must be screwed into the underside of the Logger. You fix these into corresponding holes drilled in a panel on the vehicle. The array of four holes should be on a rectangular grid with fixing centres 80.00mm by 95.00mm. This is shown in the next figure.

The Logger requires a clearance of 2.5mm (0.09") under the shaded area shown in the figure. Make sure that the area is free of screw heads, nuts, welds etc.



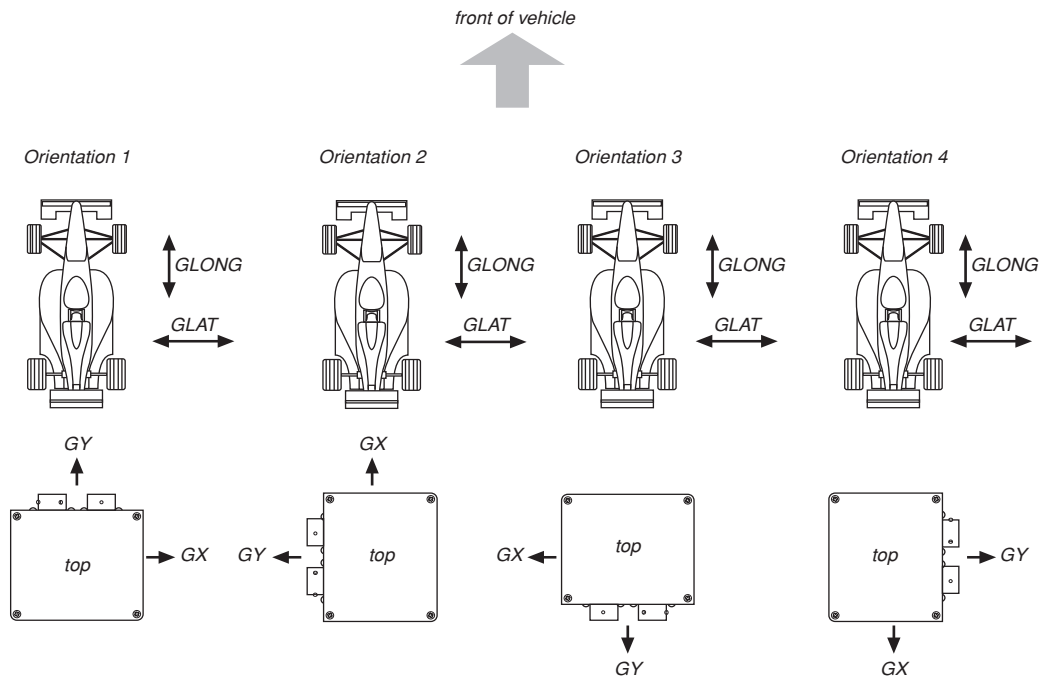
Drilling detail for Logger mounting holes. Dimensions in millimetres and (inches)

Orientation of Logger

The Logger has two internal accelerometers which measure lateral acceleration and inline acceleration. The calibrated range of the accelerometers is +6 to -6 'g'.

The orientation of the Logger determines which of the accelerometers measures which value. To allow you to make track maps you use the Logger Management Software to choose which of the accelerometers is the one that is measuring lateral acceleration. The standard mounting is such that the Logger connectors face the front of the vehicle.

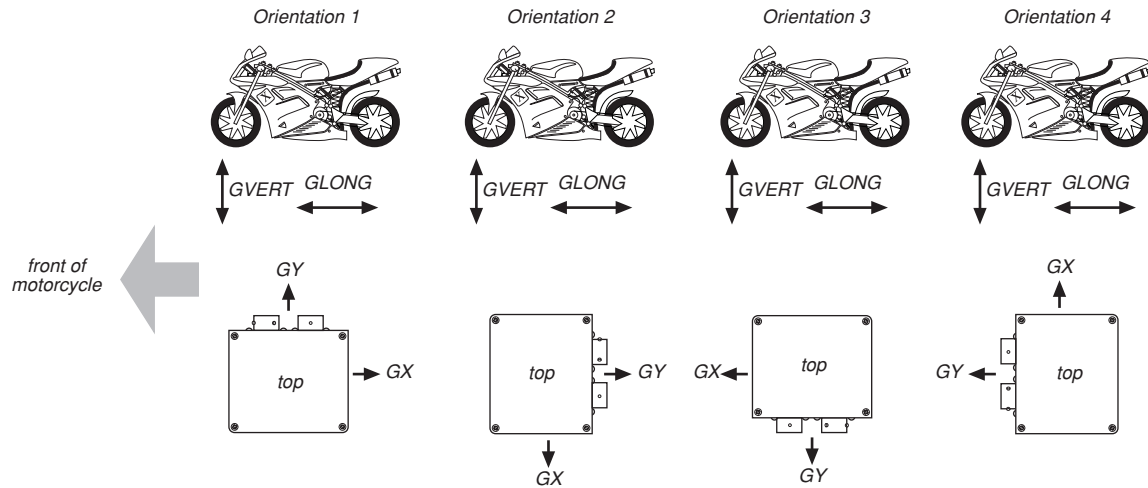
Some orientations for mounting the Logger on a car or kart are shown below.



Some mounting orientation options for a car or kart

Mounting the Logger on a motorcycle

If you are mounting the Logger on a motorcycle use one of the orientations shown below. This will allow you to measure vertical (GVERT and inline (GLONG) acceleration



Some mounting orientation options for a motorcycle

Installing the looms

This section covers the installation of the System Loom and Analog Loom for both the Delta Lite System and the Delta Clubman System.

Looms

The Delta Lite System and the Delta Clubman System both require a System loom and an Analog loom.

Both the Delta Lite System and the Delta Clubman System use the same type of looms, which are supplied pre-terminated with connectors for the sensors to be fitted. When used on a Delta Clubman System, some of connectors are not used.

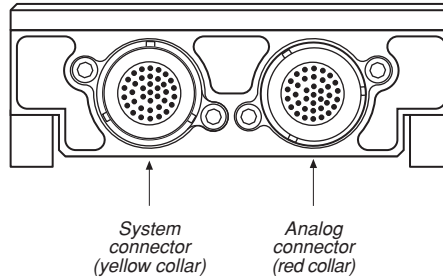
The System and Analog looms are available in two lengths, 1 metre and 3 metres. The part numbers are listed below. Also available is a coily loom which connects an X Sport dash mounted on a steering wheel to the System loom Dash connector.

Loom Part numbers

| Part number | Description |
|-------------|--|
| 60D-605000 | 2004 Delta Clubman and Delta Lite System Loom (3 metres) |
| 60D-605002 | 2004 Delta Clubman and Delta Lite Analog Loom (3 metres) |
| 60D-605003 | 2004 Delta Clubman and Delta Lite System Loom (1 metre) |
| 60D-605004 | 2004 Delta Clubman and Delta Lite Analog Loom (1 metre) |
| 60D-032434 | X Sport coily steering wheel Loom |

Connector identification

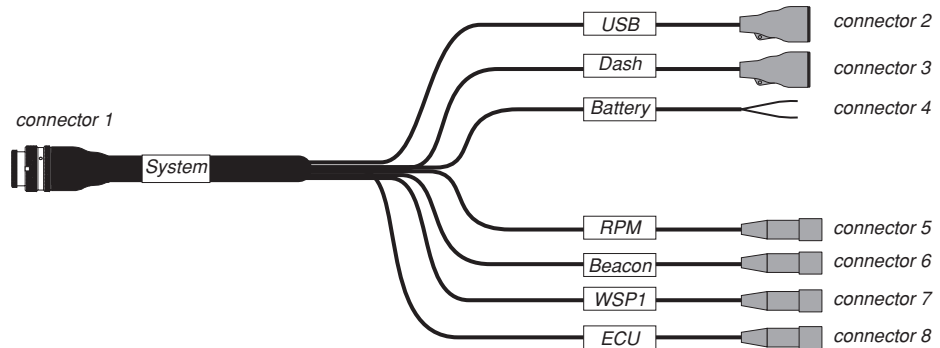
The Logger has two 37-pin Autosport connectors: the System connector and the Analog connector. The two connectors look the same but have different keyways and are identified by coloured collars. The following figure identifies the two connectors.



Logger connector identification

System looms - connector and pinout information

The Delta Lite/Delta Clubman System looms are supplied pre-terminated.



Delta Lite/Delta Clubman System loom schematic

Connector 1: System loom connector

Connector type AS6-14-35SA (yellow collar)

| Pin | To connector - pin | Function |
|-----|------------------------|--------------------|
| 1 | Connector 4 - Red wire | Battery +ve |
| 2 | Connector 3 - pin 10 | Dash Power |
| 3 | Connector 3 - pin 9 | Dash Ground |
| 4 | Connector 6 - pin 1 | Beacon Ground |
| 5 | Connector 6 - pin 3 | Beacon Power |
| 6 | Connector 5 - pin 3 | RPM Power |
| 7 | Connector 7 - pin 1 | Wheelspeed 1 Gnd |
| 8 | Connector 7 - pin 3 | Wheelspeed 1 Power |
| 9 | No connection | |
| 10 | No connection | |

table continued on the next page

Connector 1: System loom - yellow collar (continued)

| Pin | To connector - pin | Function |
|------------|---------------------------|----------------------------------|
| 11 | No connection | |
| 12 | No connection | |
| 13 | No connection | |
| 14 | No connection | |
| 15 | No connection | |
| 16 | Connector 2 - pin 1 | USB Power |
| 17 | Connector 2 - pin 4 | USB Ground |
| 18 | Connector 4 - Black wire | Battery -ve |
| 19 | Connector 3 - pin 7 | Logger Data to Dash |
| 20 | Connector 3 - pin 8 | Data from Dash |
| 21 | Connector 6 - pin 2 | Beacon Signal |
| 22 | Connector 5 - pin 2 | RPM Signal |
| 23 | Connector 7 - pin 2 | WSP1 Signal |
| 24 | No connection | |
| 25 | No connection | |
| 26 | No connection | |
| 27 | No connection | |
| 28 | No connection | |
| 29 | Connector 2 - pin 3 | USB D- |
| 30 | Connector 2 - pin 2 | USB D+ |
| 31 | No connection | |
| 32 | No connection | |
| 33 | No connection | |
| 34 | No connection | |
| 35 | No connection | |
| 36 | Connector 8 - pin 1 | ECU+ (not used by Delta Clubman) |
| 37 | Connector 8 - pin 2 | ECU- (not used by Delta Clubman) |
| Scn | Connector 5 - Scn | RPM Ground Case |
| Scn | Connector 2 - Scn | USB Screen |

Connector 2: Label USB

Connector type: Skt 4 pin DIN

| Din Pin | To connector - pin | Colour | Function |
|---------|----------------------|---------------|------------|
| 1 | Connector 1 - pin 17 | Orange/ White | USB Ground |
| 2 | Connector 1 - pin 30 | Blue | USB D+ |
| 3 | Connector 1 - pin 29 | Blue/ White | USB D- |
| 4 | Connector 1 - pin 16 | Orange | USB Power |
| Screen | Shell | | |

Connector 3: Label Dash

Connector type: AS6-12-35SN

| Pin | To connector - pin | Colour | Function |
|----------|----------------------|--------|---------------------|
| 1 | No connection | | |
| to | | | |
| 6 | No connection | | |
| 7 | Connector 1 - pin 19 | | Logger data to Dash |
| 8 | No connection | | |
| 9 | Connector 1 - pin 9 | | Dash Ground |
| 10 | Connector 1 - pin 10 | | Dash power |
| 11 to 22 | No connection | | |

Connector 4: Label Battery

Twisted Wires Length 3.00m

| Colour | To connector -pin | Function |
|--------|---|-------------|
| Red | Connector 1 - pin 1 and Connector 5 - pin 1 | Battery +ve |
| Black | Connector 1 - pin 18 | Battery -ve |

Connector 5: Label RPM

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|--------|----------------------|--------------|-------------|
| Black | Conn 4 - black wire | 1 | Main Ground |
| Purple | Conn 1 - pin 22 | 2 | RPM Signal |
| Red | Conn 1 - pin 6 | 3 | RPM Power |

Connector 6: Label Beacon

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|--------|----------------------|--------------|---------------|
| Black | Conn 1 - pin 4 | 1 | Ground |
| Green | Conn 1 - pin 21 | 2 | Beacon Signal |
| Red | Conn 1 - pin 5 | 3 | Beacon Power |

Connector 7: Label WSP1

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|--------|----------------------|--------------|---------------------|
| Black | Conn 1 - pin 7 | 1 | Ground |
| White | Conn 1 - pin 23 | 2 | Wheelspeed 1 Signal |
| Red | Conn 1 - pin 8 | 3 | Power |

Connector 8: Label ECU

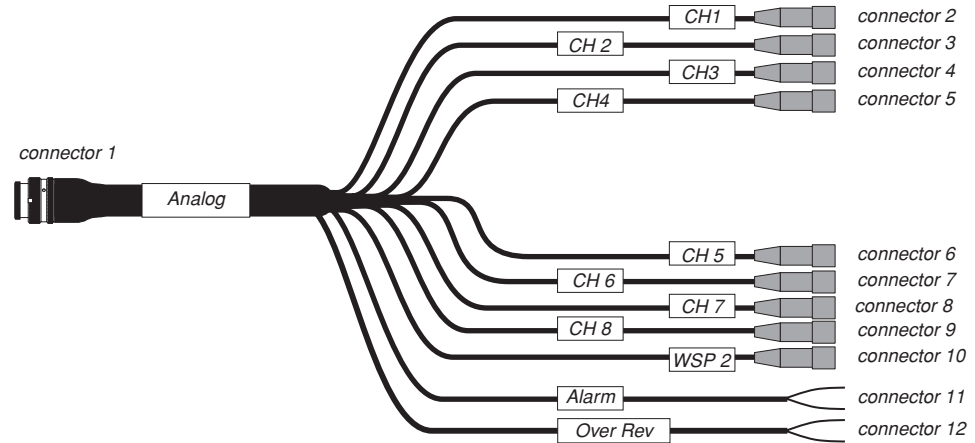
Connector type: 2 pin Sureseal socket

| Colour | From connector - pin | Function |
|--------|----------------------|----------|
| | Conn 1 - pin 36 | ECU+ |
| | Conn 1 - pin 37 | ECU- |

Analog loom connector and pinout information

The Delta Lite/Clubman Analog loom comprises an Autosport connector, with 9 sets of twisted wires, terminated with the correct types of connector for the sensors used. Each set of twisted wires has a label to show which channel they are connected to. Refer to the tables below which give the pin-out information.

Although the Delta Lite/Clubman Analog loom has connectors for eight analog sensors and a second wheelspeed sensor, the Logger Profile for a Delta Clubman System will only accept 6 analog channels and one wheelspeed sensor. Therefore when used with a Delta Clubman logger, the connectors for channels 7 and 8 and Wheelspeed 2 cannot be used, and should be taped up.



Delta Lite/Clubman Analog loom schematic

Connector 1: Delta Lite Analog loom

Connector type AS6-14-35SN (red collar)

| Pin | To connector - pin | Function |
|--|----------------------|---------------------|
| 1 | Connector 6 - pin 2 | CHANNEL 5 + |
| 2 | Connector 2 - pin 3 | CHANNEL 1 Power |
| 3 | Connector 2 - pin 1 | CHANNEL 1 Ground |
| 4 | Connector 3 - pin 1 | CHANNEL 2 Ground |
| 5 | Connector 3 - pin 2 | CHANNEL 2 Signal |
| 6 | Connector 3 - pin 3 | CHANNEL 2 Power |
| 7 | Connector 5 - pin 3 | CHANNEL 4 Power |
| 8 | Connector 5 - pin 1 | CHANNEL 4 Ground |
| 9 | Connector 7 - pin 2 | CHANNEL 6 + |
| 10 | No connection | |
| 11 | Connector 8 - pin 3 | CHANNEL 7 Power |
| 12 | Connector 8 - pin 1 | CHANNEL 7 Ground |
| 13 | Connector 9 - pin 1 | CHANNEL 8 Ground |
| 14 | Connector 9 - pin 2 | CHANNEL 8 Signal |
| 15 | Connector 9 - pin 3 | CHANNEL 8 Power |
| 16 | Connector 10 - pin 3 | Wheelspeed 2 Power |
| 17 | Connector 10 - pin 1 | Wheelspeed 2 Ground |
| 18 | No connection | |
| 19 | Connector 6 - pin 3 | CHANNEL 5 Power |
| 20 | Connector 2 - pin 2 | CHANNEL 1 Signal |
| 21 | Connector 4 - pin 1 | CHANNEL 3 Ground |
| 22 | Connector 4 - pin 3 | CHANNEL 3 Power |
| 23 | Connector 5 - pin 2 | CHANNEL 4 Signal |
| 24 | Connector 7 - pin 1 | CHANNEL 6 Ground |
| 25 | Connector 7 - pin 3 | CHANNEL 6 Power |
| 26 | Connector 8 - pin 2 | CHANNEL 7 Signal |
| 27 | No connection | |
| 28 | No connection | |
| 29 | Connector 10 - pin 2 | Wheelspeed 2 Signal |
| 30 | Connector 6 - pin 1 | CHANNEL 5 Ground |
| Pins 11 to 17, 26 and 29 for use with Delta Lite only. No connection for Delta Clubman. | | |

table continued on the next page

Connector 1: Analog loom - red collar (continued)

| Pin | To connector - pin | Function |
|--------|---------------------|--|
| 31 | No connection | |
| 32 | Connector 4 - pin 2 | CHANNEL 3 Signal |
| 33 | Alarm LED | Goes to ground (via internal 120R) when alarm is triggered |
| 34 | Over Rev Alarm | Goes to ground (via internal 120R) when alarm is triggered |
| 35 | No connection | |
| 36 | No connection | |
| 37 | No connection | |
| Screen | No connection | |

Connector 2: Label CH 1

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|--------|----------------------|--------------|-------------|
| Black | 1-3 | 1 | Ground |
| Blue | 1-20 | 2 | CH 1 Signal |
| Red | 1-2 | 3 | Power |

Connector 3: Label CH 2

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|--------|----------------------|--------------|-------------|
| Black | 1-4 | 1 | Ground |
| Blue | 1-5 | 2 | CH 2 Signal |
| Red | 1-6 | 3 | Power |

Connector 4: Label CH 3

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|---------------|-----------------------------|---------------------|-----------------|
| Black | 1-21 | 1 | Ground |
| Blue | 1-32 | 2 | CH 3 Signal |
| Red | 1-22 | 3 | Power |

Connector 5: Label CH 4

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|---------------|-----------------------------|---------------------|-----------------|
| Black | 1-8 | 1 | Ground |
| Blue | 1-23 | 2 | CH 4 Signal |
| Red | 1-7 | 3 | Power |

Connector 6: Label CH 5

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|---------------|-----------------------------|---------------------|-----------------|
| Black | 1-30 | 1 | Ground |
| Blue | 1-1 | 2 | CH 5 Signal |
| Red | 1-19 | 3 | Power |

Connector 7: Label CH 6

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|---------------|-----------------------------|---------------------|-----------------|
| Black | 1-24 | 1 | Ground |
| Blue | 1-9 | 2 | CH 6 Signal |
| Red | 1-25 | 3 | Power |

Connector 8: Label CH 7

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|---------------|-----------------------------|---------------------|-----------------|
| Black | 1-12 | 1 | Ground |
| Blue | 1-26 | 2 | CH 7 Signal |
| Red | 1-11 | 3 | Power |

Connector 9: Label CH 8

Connector type: 3 pin Sureseal socket

| Colour | From connector - pin | Sureseal Pin | Function |
|---------------|-----------------------------|---------------------|-----------------|
| Black | 1-13 | 1 | Ground |
| Blue | 1-14 | 2 | CH 8 Signal |
| Red | 1-15 | 3 | Power |

Connector 10: Label WSP2

Connector type: 3 pin Sureseal socket (signal input can be used with Delta Lite only).

| Colour | From connector - pin | Sureseal Pin | Function |
|---------------|-----------------------------|---------------------|---------------------|
| Black | 1-17 | 1 | Ground |
| White | 1-29 | 2 | Wheelspeed 2 Signal |
| Red | 1-16 | 3 | Power |

Connector 11: Alarm

Connector type: Single wires

| Colour | From connector - pin | Function |
|---------------|-----------------------------|--|
| Purple | 1-33 | Alarm light |
| Red | 1-16 | Alarm light power (use Wheelspeed 2 power) |

Connector 12: Over Rev

Connector type: Single wires

| Colour | From connector - pin | Function |
|---------------|-----------------------------|---|
| Yellow | 1-34 | Over Rev light |
| Red | 1-16 | Over Rev light power (use Wheelspeed 2 power) |

Wiring notes

The wire used in the looms is abrasion resistant and rated to 150°C.

When a wire bundle passes through a sheet metal bulkhead, make sure that there is no risk of the edge cutting into the bundle. Cables should not be run next to sources of electrical interference, i.e. ignition coils, plug leads, alternators, fuel pumps, radios and ECUs. If it is absolutely necessary to run the cables near any of these, avoid parallel runs if at all possible. Care should be taken in the routing of the cables around the engine or brake areas, as localised heating when the car is stationary can cause damage to the wiring.

All cars should be wired for the Beacon receiver even if you do not intend to use it immediately.

If the Logger is being used on a car, it should only be connected at the battery and Master switch. It should not share its wiring with other systems or items on the car.

If the Logger is being used on a motorcycle it should be connected across the battery.

Notes

- Run the cabling neatly along the chassis to the loom.
- Do not pull the cable taut either along the chassis or at joints and corners; instead, let the cable follow its natural path without excess tension.
- Use clamps at regular intervals to hold the cable to the frame. This will avoid kinking or cable damage.

Taping connectors

Where SureSeal connectors run along the chassis, tape around the outside of the sensor lead socket rather than each side of the plug and socket so that the connector pins are not pulled apart.



The correct and incorrect way to tape connections

Note: Make sure that there is enough room to make and break each connector.

Fitting the looms

Lay the looms in the vehicle

The wires for each of the sensors are grouped together, colour coded and tagged with their identity. They are also terminated with the correct type of connector for the sensor to be connected. Run the wires to each of the sensors on the vehicle. Take care to avoid sharp metal edges and cables carrying high voltages (e.g. ignition circuits).

Beacon receiver

Run the Beacon connections to a suitable position (e.g. by the roll hoop, tail fairing on a motorcycle or the Nassau panel on a kart).

Secure unwanted sensor wires

The Delta Lite/Clubman Analog loom has connectors for eight analog sensors and a second wheelspeed sensor, but the Logger Profile for a Delta Clubman System will only accept 6 analog channels and one wheelspeed sensor. Isolate any wires you are not using and tape them up.

Dash Installation

The Delta Lite and Delta Clubman loggers can display data on a number of optional dashes. These are:

- X Sport. This display is supplied as part of the System. The System loom is supplied fitted with a connector to use this dash.
- C-dash. This is a cost option. An adapter loom is required to use this dash. The C-dash must have the correct dash code installed. Also see Note below.
- System 2 dash. This is a cost option. An adapter loom is required to use this dash. Also see Note below.
- Pi Minidash for Delta Lite. This is a cost option. An adapter loom is required to use this dash. Also see Note below.

Note: To use your existing C-dash, System 2 dash or Pi Minidash you will have to return it to Pi Research for modification.

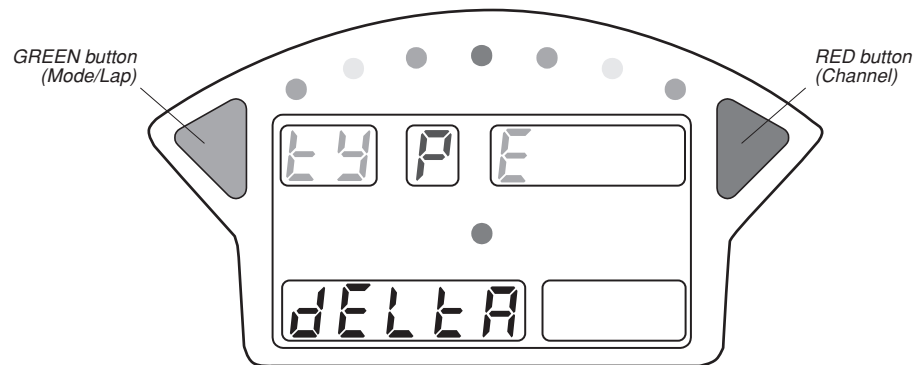
Installing and setting up an X Sport

The X Sport can be used as a standalone dash or with a Logger. To allow it to be used with a Delta Lite or a Delta Clubman logger the X Sport **Type** must be set to **delta**.

To set the X Sport Type to delta:

- 1 Press and hold the **RED** and **GREEN** buttons and power up the Logger. The dash shows **Setup**, followed by the **Units** page.
- 2 Click the **RED** button to cycle through the groups. Stop at the **Options** page.
- 3 Press and hold the **RED** button for two seconds.
- 4 Click the **RED** button to cycle through the options until you reach the **Type** page.
- 5 Click the **GREEN** button until **delta** appears in the options field.

The X Sport Type page with the **delta** option displayed is shown in the next figure.



X Sport Type page with the delta option displayed.

- 6 Press and hold the **RED** button for two seconds.
- 7 Press and hold the **RED** and **GREEN** buttons for two seconds. The X Sport is now setup to work with the Logger.

Preventive maintenance

The Delta Lite Logger is treated with a contact cleaning and lubricating spray to ensure resistance to moisture.

In addition, we recommend that a contact cleaning and lubricating spray is also applied to the contacts of the connectors used on the wheelspeed, RPM and analog channel sensors. The use of the correct contact cleaner and lubricant is recommended (e.g. Super Servisol 10). Do **NOT** use WD40 or similar products.

Type A and B sensors

Delta Lite is supplied with sensors for wheelspeed and RPM as standard. The Logger can also log information from a selection of other sensors.

Type A sensors

Type A sensors require a 5 volt regulated power supply which is provided by the Logger via the AutoSport connectors, to connectors on the Analog loom. Type A sensors are connected to the Analog loom by Type A sensor leads. Type A sensors and sensor leads mate via Cannon Mini SureSeal connectors.

Type B sensors

Type B sensors require a 12 volt power supply which is provided by the Logger via the AutoSport connectors, to connectors on the System loom. Type B sensors and sensor leads mate via standard Cannon SureSeal connectors. Type B sensors include the active wheelspeed sensor, the 4-stroke RPM pick-up and the ten channel beacon detector.

Fitting the standard sensors

This section covers the fitting of the standard Delta Lite and Delta Clubman kit sensors. Information on fitting optional sensors is given in the section *Optional Sensors*.

Using Velcro®

Both interlocking halves of the Industrial Velcro® are identical. Therefore, when using Velcro® to mount components, cut both mating halves from the strip provided.

System connection information

Battery connections

| Connection | Connector | Pin |
|-------------|-----------|-----|
| Battery +ve | System | 1 |
| Battery -ve | System | 18 |

Dash connections

| Connection | Connector | Pin |
|----------------|-----------|-----|
| Dash power | System | 2 |
| Dash ground | System | 3 |
| Data to dash | System | 19 |
| Data from dash | System | 20 |

Beacon connections

| Connection | Connector | Pin |
|-------------------|------------------|------------|
| Beacon ground | System | 4 |
| Beacon signal | System | 21 |
| Beacon power | System | 5 |

Wheelspeed 1 connections

| Connection | Connector | Pin |
|---------------------|------------------|------------|
| Wheelspeed 1 ground | System | 7 |
| Wheelspeed 1 signal | System | 23 |
| Wheelspeed 1 power | System | 8 |

RPM connections

| Connection | Connector | Pin |
|-------------------|------------------|------------|
| RPM ground | System | screen |
| RPM signal | System | 22 |
| RPM power | System | 6 |

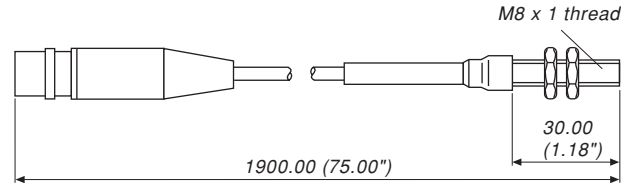
USB connections

| Connection | Connector | Pin |
|-------------------|------------------|------------|
| USB ground | System | 17 |
| USB power | System | 16 |
| USB data- | System | 29 |
| USB data+ | System | 30 |

The wheelspeed sensor

Wheelspeed sensor 01G-233019

Wheelspeed is measured by a fixed active wheelspeed sensor and a rotating trigger.



Wheelspeed sensor. Dimensions in millimetres and (inches).

The active wheelspeed sensor is triggered by a piece of ferrous metal passing the sensor head. Generally use the outside of undriven wheels i.e. for a clockwise track use the left front wheel for rear-wheel drive and left rear for front-wheel drive.

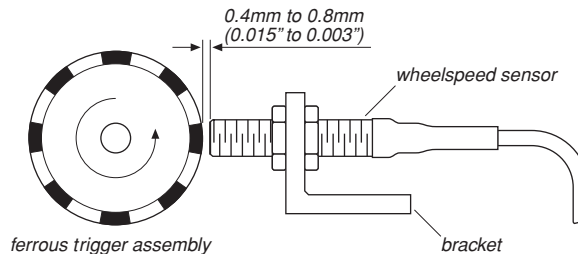
Wheelspeed sensor details (Type 'B' sensor)

| | |
|--------------------|--|
| Sensing Distance | 0.4mm to 0.8mm |
| Clearance Distance | 8mm from any steel object |
| Mounting | 30mm of M8 x 1 thread |
| Connector | 3-pin Cannon SureSeal |
| Sensor connections | Pin 1 ground (Blue) Pin 2 signal (Black) Pin 3 power (Brown) (12V) |

WARNING: The sensor should only be tightened with a small spanner. Over-tightening the sensor will cause it to fracture. Use the locknuts provide and torque to 10Nm.

Failure to have the minimum clearance from other steel objects causes the sensor to register a rotation even though the trigger target has moved out of range. On the other hand, if the working distance is too great, the sensor will miss triggers, especially at high speeds.

Wheelspeed trigger



A typical wheelspeed trigger and wheelspeed sensor installation

Wheelspeed trigger details

| | |
|--------|---|
| Type | ferrous metal object |
| Number | 2 to 30 per wheel (typically 2 or 4. Maximum is 64) |

Mounting the wheelspeed sensor

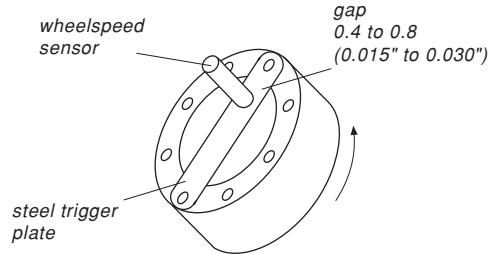
- 1 Make a bracket for the wheelspeed sensor and mount the sensor on the vehicle (the sensor is normally mounted on an undriven wheel, since this will not experience wheel spin, which can give you inaccurate speed readings). Do not over-tighten the wheelspeed sensor, and avoid mounting the sensor too close to the brake disc (to avoid superheating). Use the locknuts provide and torque to 10Nm.
- 2 Secure the cable of the sensor on the wishbone and into the front nose cone on a formula car.

Make sure the cable is not tight when the wheel moves or the wishbone is lowered.

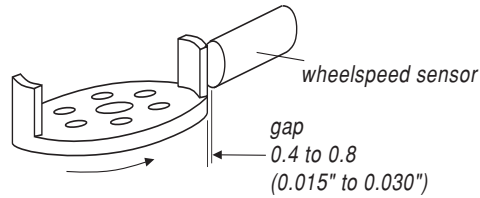
- 3 Mount the wheelspeed trigger on the wheel. Make sure that the sensor head does not touch any of the triggers. Set up the sensor with an approximate gap of 0.7mm.

The trigger used to activate the wheelspeed sensor should have a surface approximately the same size as the head of the sensor, and be at least 4mm away from other metal objects. On saloon cars, tolerances of 0.5mm can be hard to achieve so we suggest you use only one trigger.

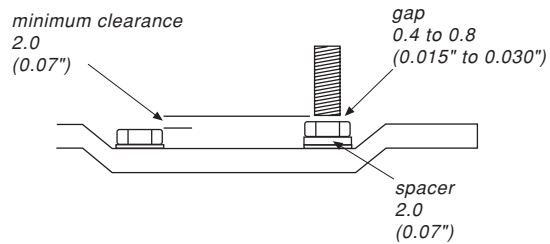
The sensor can either be mounted in a threaded block, or with a sheet metal bracket. Make sure the sensor does not vibrate or touch the trigger when the car is driven. This type of sensor can be used with a wide variety of cars, so the details of mounting the sensor will vary. Three examples of mounting configurations are shown below.



Top mounted configuration. Dimensions in millimetres and (inches).



Side mounted configuration. Dimensions in millimetres and (inches).



Wheel stud mounted configuration. Dimensions in millimetres and (inches).

Fitting the wheelspeed sensor on a motorcycle

Wheelspeed sensor 01G-233019

The wheelspeed sensor is triggered by a piece of ferrous metal passing the sensor head.

The sensor can either be mounted in a threaded block, or with a sheet metal bracket. Make sure the sensor does not vibrate or touch the trigger when the motorcycle is driven. This type of sensor can be used with a wide variety of motorcycles, so the details of mounting the sensor will vary.

Wheelspeed sensor details (Type 'B' sensor)

| | |
|--------------------|--|
| Sensing Distance | 0.4mm to 0.8mm |
| Clearance Distance | 8mm from any steel object |
| Mounting | 30mm of M8 x 1 thread |
| Connector | 3-pin Cannon SureSeal |
| Sensor connections | Pin 1 ground (Blue) Pin 2 signal (Black) Pin 3 power (Brown) (12V) |

WARNING: The sensor should only be tightened with a small spanner. Over-tightening the sensor will cause it to fracture. Use the locknuts provide and torque to 10Nm.

Failure to have the minimum clearance from other steel objects causes the sensor to register a rotation even though the trigger target has moved out of range. On the other hand, if the working distance is too great, the sensor will miss triggers, especially at low speeds.

Motorcycle wheelspeed trigger

Motorcycle wheelspeed trigger

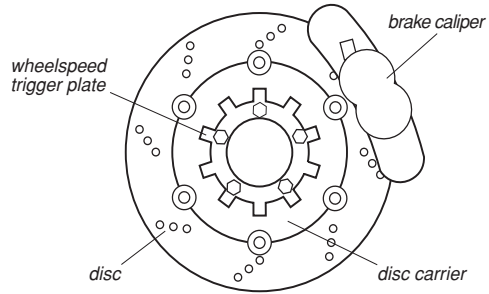
| | |
|--------|----------------------------------|
| Type | ferrous metal object |
| Number | 2 to 30 per wheel (typically 10) |

Mounting the wheelspeed sensor on a motorcycle

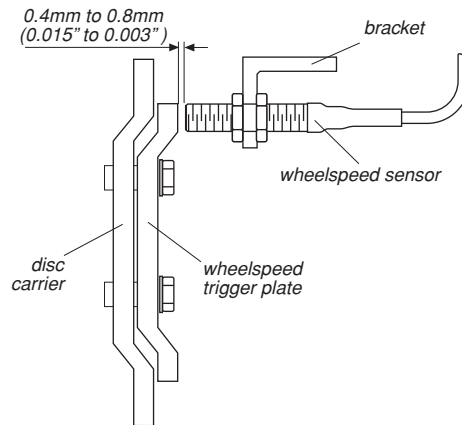
- 1 Make a bracket for the wheelspeed sensor to clamp the sensor onto the front fork. Do not over-tighten the wheelspeed sensor. Use the locknuts provided and tighten to 10Nm torque.
- 2 Secure the cable of the sensor to run along the brake line. Use tie wraps, but do not restrict the brake line. (This allows the cable to flex as the forks compress and extend.)
- 4 Mount the wheelspeed sensor so that it triggers from the bolts holding the disc carrier. Make sure that the sensor head does not touch any of the triggers. Set up the sensor with an approximate gap of 0.7mm.

The trigger used to activate the wheelspeed sensor should have a surface approximately the same size as the head of the sensor, and be at least 4mm away from other metal objects.

If you use the disc carrier bolts as wheelspeed triggers, variations in bolt head length and surface finish can reduce the quality of the wheelspeed data obtained. A method of improving the quality of wheelspeed data is to manufacture a trigger plate which is fitted to the disc carrier. An example of a wheelspeed trigger plate is shown on the next page.



Example of a motorcycle wheelspeed trigger plate fitted to a disc carrier

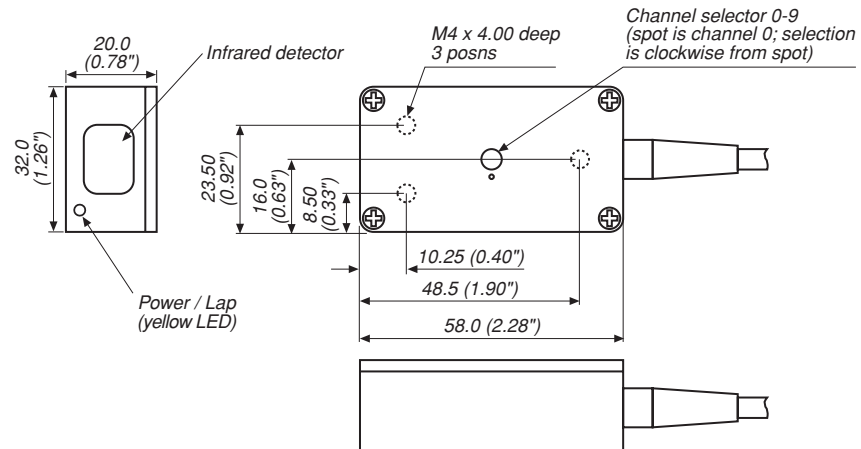


Side view of motorcycle wheelspeed sensor and trigger plate

Fitting the beacon receiver

10-channel beacon receiver (01F-034110)

Delta Lite uses the 10-channel beacon system to record the end of a lap. A 10-channel beacon receiver is mounted on the vehicle and a 10-channel beacon transmitter is mounted at the side of the track.



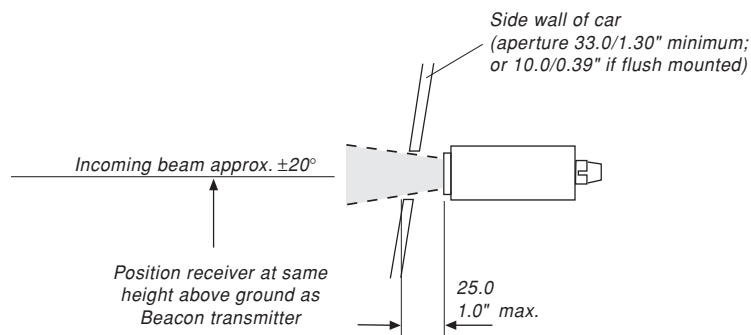
10-channel beacon receiver. Dimensions in millimetres and inches.

10-channel beacon receiver details

| | | |
|-------------|-------------------------------------|-------------|
| Mounting | Industrial Velcro or 3 off M4 holes | |
| Channels | 0 to 9 | |
| Connector | 3-pin Cannon SureSeal | |
| Connections | Pin 1 (black) | Ground |
| | Pin 2 (brown) | Signal |
| | Pin 3 (red) | Power (12V) |

Mounting the 10-channel beacon receiver

- Mount the beacon receiver at right angles to the ground and at right angles to the direction of the car in motion
- Where possible, the receiver should be mounted flush to the skin of the car, or recessed less than 25mm
- The receiving head should not face directly into the sun while detecting
- The beacon receiver should be mounted so that it can point at either side of the track. It is often placed by the roll hoop or above the driver's headrest
- Fit the receiver to the car with Industrial Velcro® (supplied by Pi Research) or use A/V mounts screwed into the three M4 x 4.00 deep holes in the base of the receiver.



10-channel Beacon receiver placement. Dimensions in millimetres and (inches).

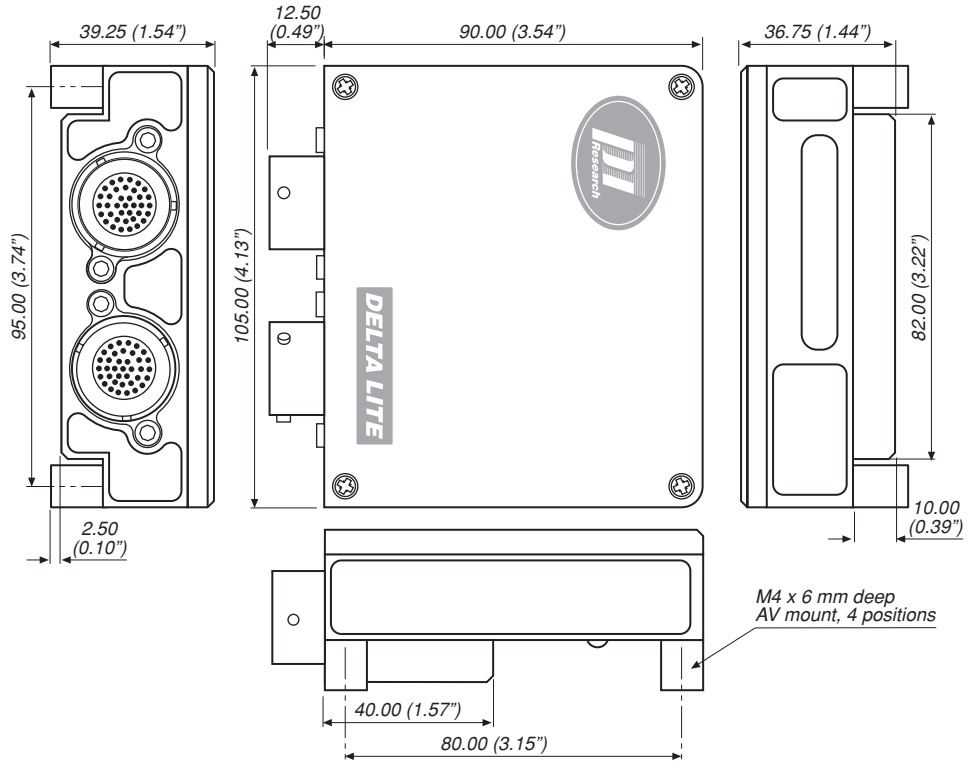
10-channel master beacons

Pi 10-channel master beacons are located at many UK race tracks and are available as an end-of-lap beacon for lap timing. The master beacon is a larger version of a standard 10-channel beacon transmitter and is more suited to a crowded race track. When a master beacon is present at a track, it will be set to channel 0.

When there is a master beacon at a race event you should not place other 10-channel beacon transmitters around the track that are transmitting channel 0. Two or more 10-channel beacons transmitting on the same channel will invalidate data for you and other teams.

Logger dimensions

The Delta Lite logger and the Delta Clubman logger dimensions are the same.



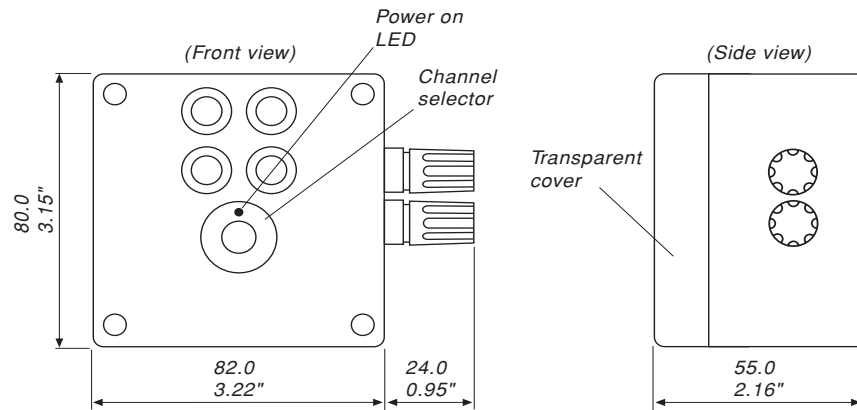
Logger dimensions in millimetres and (inches)

Options

Optional equipment

This section covers optional equipment and optional sensors that can be used with Delta Lite System and Delta Clubman System.

10-channel beacon transmitter



10-channel Beacon transmitter. Dimensions in millimetres and (inches).

Beacon transmitter (10-channel) details

| | |
|-------------|------------------------------|
| Mounting | Industrial Velcro® or tape |
| Channels | 0 to 9 |
| Connector | 2 screw posts |
| Connections | Red post +12V; Black post 0V |

Notes

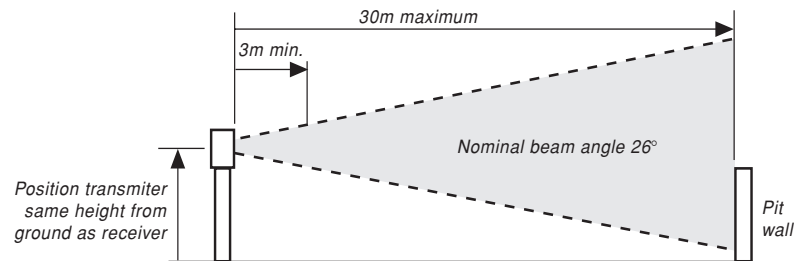
- You can use a fully charged 12V car battery or rechargeable dry cell battery to run the beacon transmitter
- Make sure that the channels selected on the receiver and transmitter are the same
- Mount the transmitter at the same height as the receiver on the car, with the transmitter beam pointing horizontally and aimed straight across the track
- Make sure the receiver is not pointing into the sun when it passes the transmitter.

Siting beacon transmitters

Place the beacon transmitter at the side of the circuit to allow Delta Lite (or Delta Clubman) to record lap times. You should mount the transmitter at the same height as the receiver on the vehicle, with the transmitter beam pointing horizontally across the track, at right angles to the path of the vehicle. This is not necessarily straight across the track. Switch the unit ON to transmit.

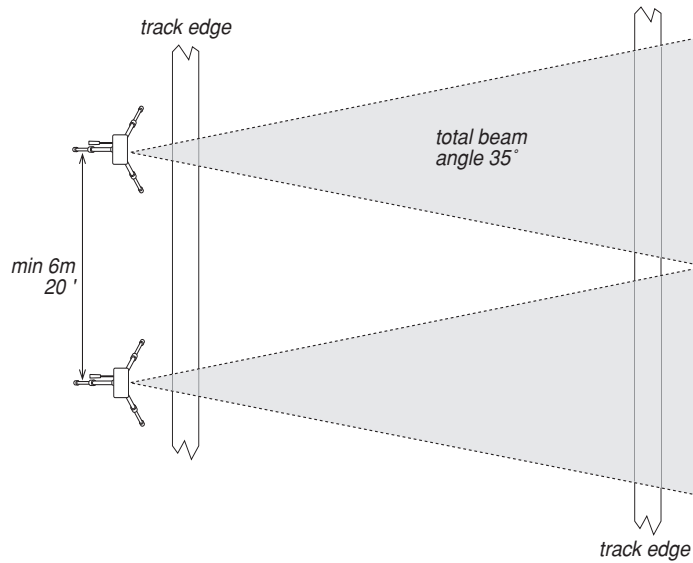
Notes

- Make sure there is only one beacon transmitter on the circuit at a time.
- If possible, make sure the receiver is not pointing into the sun when it passes the transmitter.



Siting a beacon transmitter

If other beacon transmitters are being used (e.g. System 2 or System 4 beacons), do not place them so close together that their beams interfere with one another, as this could give rise to incorrect lap times. The following diagram shows the minimum separation distances to be observed.



Siting several beacon transmitters (plan view)

Optional sensors

The standard kit includes an active wheelspeed sensor, and a 10-channel beacon receiver. A range of optional sensors that will work with Delta Lite (or Delta Clubman) are available e.g. high pressure sensors and low pressure sensors, rotary and linear potentiometers, RTD and thermocouple temperature sensors.

This section covers some of these optional items and optional sensors.

Sensor +5V power supply

When connecting sensors to the analog channels remember that the logger +5V output for sensor power has a maximum of 80mA of current available.

Club pressure sensors take 15mA each, Suspension, throttle and steering potentiometer take 3mA each. For example 2 pressure sensors, 2 temperature sensors, 4 suspension potentiometers, a throttle potentiometer and a steering potentiometer would take a total of 48mA from the +5V.

Temperature sensors take nothing from the +5V because they are fed from the 12V supply in the logger and take 0.3mA each.

Special channels

The first six analog channels have some special functions which allow the connection of the club range of sensors. Refer to the section *Special Channels* in *Logger Management User Guide* for information on how to configure these channels.

The special channels are:

- Channel 1 and Channel 2 which can be either voltage sensor or pressure
- Channel 3 and Channel 4 which can be either voltage or temperature

All other analog channels can only accept voltage inputs.

The Delta Lite and Delta Clubman loggers can have thermocouple sensors connected using a thermocouple amplifier box. Refer to section *Thermocouple sensor* for more information.

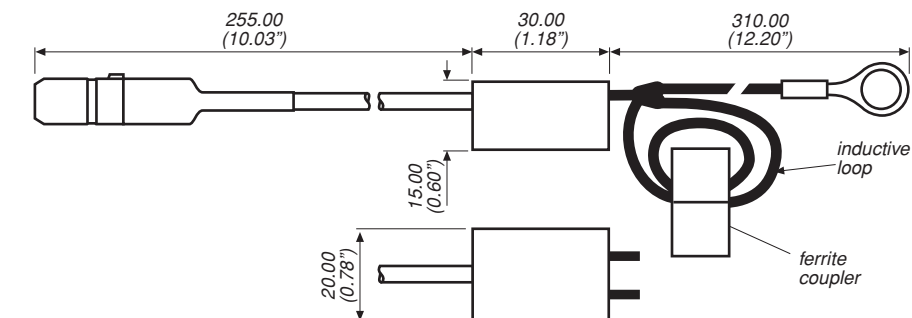
RPM sensors

Delta Lite and Delta Clubman can measure the engine RPM in different ways:

- a tacho input from an ECU;
- a 2-stroke engine type RPM pick-up
- a 4-stroke engine type RPM pick-up
- the HT RPM pick-up.

2-stroke engine RPM pick-up (01K-162060)

This RPM pick-up is ideal for use on karts.



2-stroke RPM pick-up. Dimensions in millimetres and (inches).

2-stroke RPM pick-up

| | | |
|--------------------|----------------------------|-------------------|
| Type | Type A sensor | |
| Mounting | Industrial Velcro® | |
| Connector | 3-pin Cannon Mini SureSeal | |
| Sensor connections | Plug pin 1 (green/yellow) | RPM ground |
| | Plug pin 2 (blue) | RPM signal |
| | Plug pin 3 (brown) | RPM power 5V |
| | 8.0mm Ring | System ground |
| | Blue Wire loop | RPM pulse pick-up |

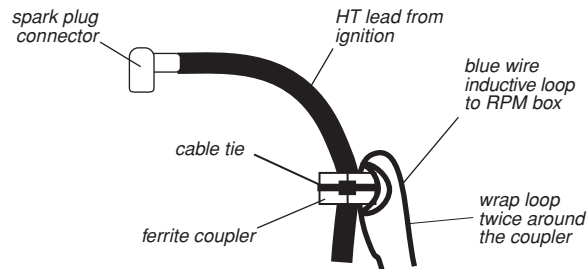
This RPM pick-up uses a wire loop and a ferrite coupler fixed around the spark plug HT lead to sense spark pulses from a 2-stroke engine. The wire loop is connected to the RPM pick-up.

Mount the 2-stroke RPM pick-up in a convenient position using industrial Velcro®.

Place the inductive loop (blue wire) along side the spark plug lead. Wrap the loop twice around the ferrite coupler. If the pickup is too sensitive, only wrap the the loop through the ferrite coupler once. Clip the ferrite coupler around the spark plug lead and enclose the inductive loop. Use a cable tie around the ferrite coupler to keep it closed.

The green wire from the sensor is the earthing lead and is fitted with an 8mm (0.31") ring tag. Bolt the ring tag to the vehicle chassis.

Note: To ensure a good earth connection, you must clear any paint from around the hole in the chassis where the earth connection is made.



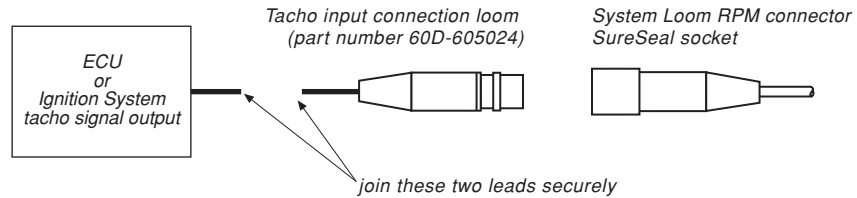
2-stroke RPM pick-up loop attachment

Note: If there is spiralwrap protection on the HT lead, manoeuvre the wrap where the loop and ferrite coupler go onto the lead so that the loop and bead are directly connected to the cable insulation. This ensures a good RPM signal.

Tachometer Signals

The Delta Lite (or Delta Clubman) unit can accept a tacho feed from most ECUs. The Delta Lite (or Delta Clubman) ECU loom includes a connection for an ECU.

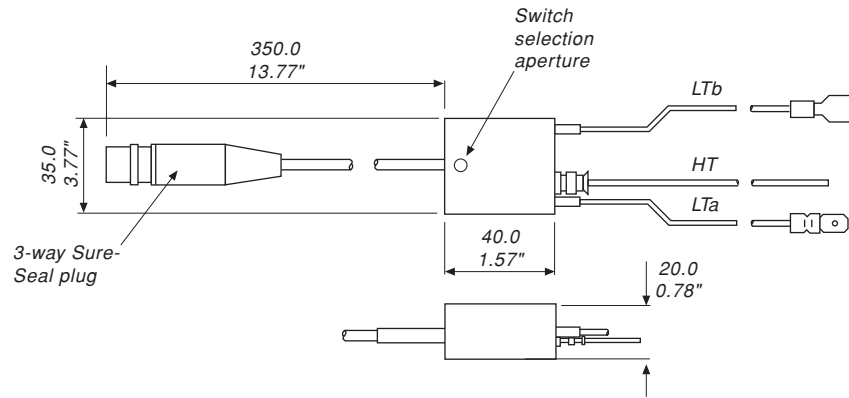
If you have a low voltage digital tacho signal on your vehicle (from the ignition system or ECU), locate the wire and join it securely to the flying lead of the Tacho input connection loom. After joining the two leads, connect the plug into the RPM connector on the Delta Lite (or Delta Clubman) System Loom.



Tachometer connections

If the tacho signal is noisy (indicated by an unstable RPM at steady revs) then you will need to use a Pi Research 4-stroke RPM box (part number 01F-152080) to clean up the tacho signal. This RPM box has the correct type of connector to plug into the RPM connector on the Delta Lite (or Delta Clubman) loom. See section Using an RPM box to clean up a noisy tacho input.

The 4-stroke engine RPM box (part number 01F-152080)



RPM box

| | | |
|-------------|-----------------------|--------|
| Mounting | Industrial Velcro® | |
| Connector | 3-pin Cannon SureSeal | |
| Connections | Pin 1 (Green) | Ground |
| | Pin 2 (Blue) | Signal |
| | Pin 3 (Red) | Power |

The RPM box either picks up current pulses from the LT side of the coil, or voltage pulses from the master HT lead or tacho signal input.

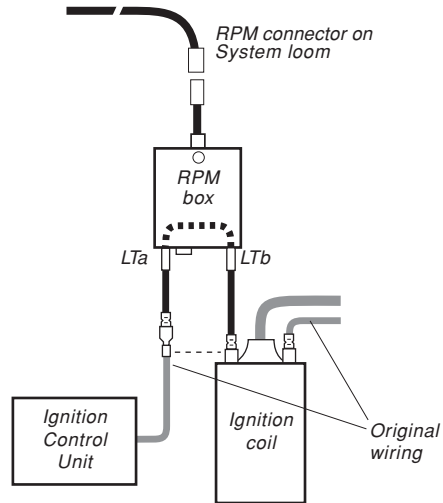
WARNING: To prevent damage, the LT or HT sources should not be directly connected to the Delta Lite (or Delta Clubman).

The RPM box should be fixed using Industrial Velcro®, near the ignition coil but not mounted to it. A suitable mounting position can usually be found which allows the LT connection to be made without extending the wiring provided.

RPM box LT connection

The LT (Low Tension voltage) connection on the RPM box has two flying leads.

- 1 Remove the connection from the coil to the ignition unit and connect one of the flying leads on RPM box to the free end of this wire.
- 2 Connect the other lead from the RPM box to the coil.



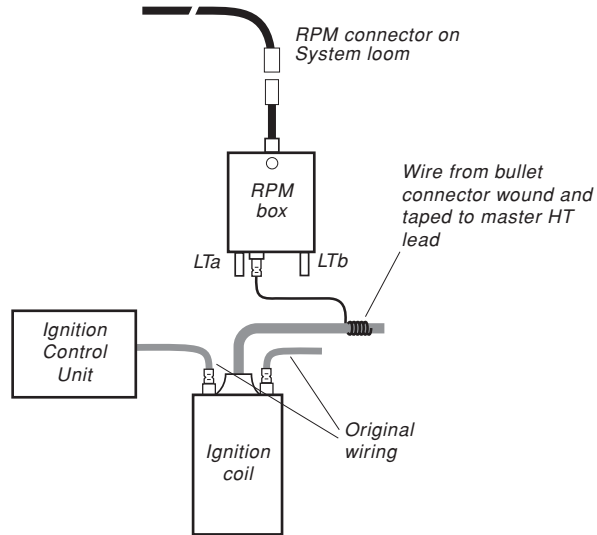
The RPM box connected using LT leads

Notes

- The wires coming from the RPM box are two ends of a piece of wire; there are no electrical connections inside the box. The ignition signal is unchanged, as long as the connections are good.
- The RPM box can be sensitive to the direction of the current pulse it receives. If this causes a problem, try connecting it into the other terminal of the ignition coil. This reverses the direction of the current flowing in the wire and should resolve the problem.
- If the spade connectors on the RPM box do not fit the terminals on your vehicle, we suggest you replace the connectors on *our* box. You can then remove the RPM box at a later date, if you wish.

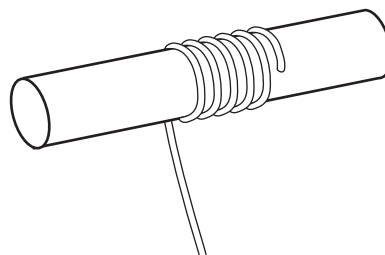
RPM box HT connection

The HT (High Tension voltage) connection consists of a single wire running from the bullet connector in the RPM box and wrapped around the HT lead of the vehicle. A piece of wire (high temperature rated) with a bullet connector has been included with the RPM box for this purpose.



The RPM box connected to HT lead

The wire should be wrapped around the master HT lead about five times: any excess can be clipped off and then secured with tape. The RPM box LT connections are not used and can be joined together and taped up.

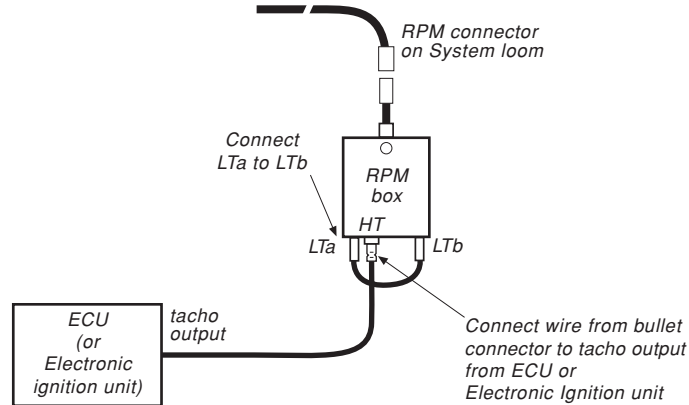


HT pickup – detail

Note: The RPM box is sensitive to the polarity of the HT pulse it receives. If this causes a problem, try using the LT pickup method.

Using a 4-stroke RPM box to clean up a noisy tachometer input

You can use a tachometer signal to provide RPM input for the Delta Lite (or Delta Clubman). If the tachometer signal proves to be noisy (this is indicated by an unstable RPM reading at steady revs) you can use a Pi Research 4-stroke RPM box, part number 01F-152080, to clean up the tachometer signal to the Delta Lite (or Delta Clubman).



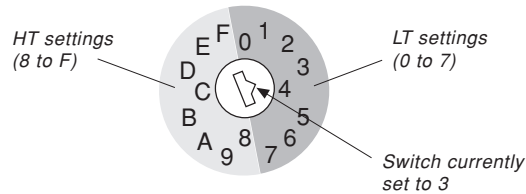
RPM box connection to clean up a noisy tachometer input

To clean up the tachometer signal you connect the tachometer output to the HT connector on the RPM box. The HT connection consists of a single wire running from the bullet connector in the RPM box. A piece of high temperature rated wire, with a bullet connector fitted, has been included with the RPM box.

- 1 Connect the LTa and LTb terminals together.
- 2 Securely connect the tachometer signal lead to the HT input lead on the RPM box.
- 3 Set up the RPM box as described on the following pages.

Setting up the 4-stroke RPM box

The RPM box has a small 16-position switch which needs to be set to match the signal received. Legends for positions 0, 4, 8 and C (=12) are printed on the box, but the intermediate settings are available. Settings 0 to 7 should be used with LT (ignition coil) connections. Settings 8 to F should be selected if using the HT connection.



RPM box switch settings

The settings are related to the number of sparks per minute the engine needs at maximum RPM, as in the following table:

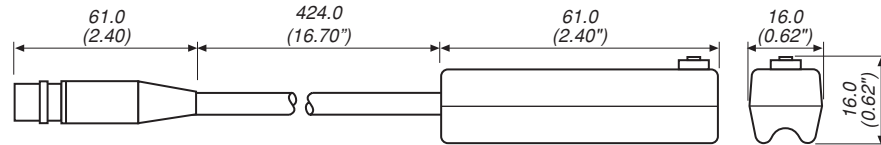
| Max. sparks/min. | LT | HT | Typical example |
|------------------|----|----|--|
| 11,000 | 0 | 8 | 11,000 RPM 2-stroke (11,000 sparks/min.) |
| 19,000 | 1 | 9 | 7,500 RPM 4-stroke (15,000 sparks/min.) |
| 36,000 | 2 | A | V8 single coil 4-stroke (30,000 sparks/min.) |
| 45,000 | 3 | B | |
| 54,000 | 4 | C | |
| 64,000 | 5 | D | |
| 85,000 | 6 | E | |
| 95,000 | 7 | F | |

Notes

- RPM measurement is more reliable when unwanted signals are filtered out. Setting the RPM box sets the frequency at which signals are filtered out, e.g. Setting 1 filters out signals higher than 19,000Hz.
- If the RPM reading on the dash starts to flash at high RPM, try increasing the setting by one or two positions.
- Do not be afraid of experimenting until you find the correct setting for your vehicle, as an incorrect setting will not damage the unit.

HT RPM pick-up (01K-162169)

The HT RPM pick-up senses pulses from an HT lead on 2-stroke and 4-stroke engines. The sensitivity of the pick-up can be adjusted to give a good output, which can be fed to a data logger.

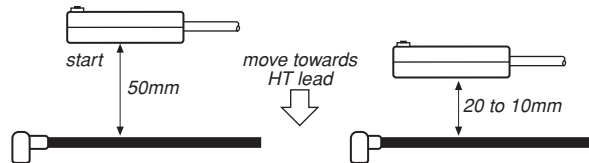


HT RPM pick-up. Dimensions in millimetres and (inches)

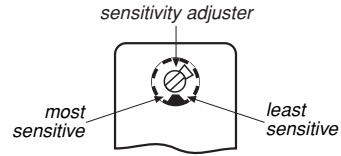
HT RPM pick-up details

| | |
|-------------|--|
| Mounting | Cable ties |
| Connector | 3-pin Cannon SureSeal |
| Connections | Pin 1 (green/yellow) Ground (0V) |
| | Pin 2 (blue) Signal |
| | Pin 3 (brown) Power (4.5V to 15.0V) |

With the engine running display RPM on your dash, or watch the RPM channel on your computer. Hold the sensor from the HT lead. Slowly move the sensor head towards the HT lead making sure that all other HT leads are at least 30mm away. Check for a response when the sensor is within 20 to 10mm of the seated position on the HT lead.

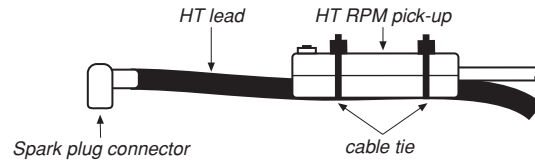


If the first RPM signal response is seen at a distance greater than 20mm, turn the adjuster clockwise to decrease sensitivity. If the first response is seen at a distance less than 10mm, turn the adjuster anti-clockwise to increase sensitivity. A zero response with the sensor held between 10 and 20mm from the HT lead means that when the sensor is fitted to the HT lead you will get a good response across the speed range of the engine.



HT RPM pick-up sensitivity adjustment

After adjustment use cable ties to fix the pick-up to the HT lead. Do not over-tighten.



Typical fitting to an HT lead

Adjustments after installation

Missing pulses

To cure missing pulses move the sensitivity adjuster anti-clockwise.

Spurious pulses

To remove spurious pulses move the sensitivity adjuster clockwise.

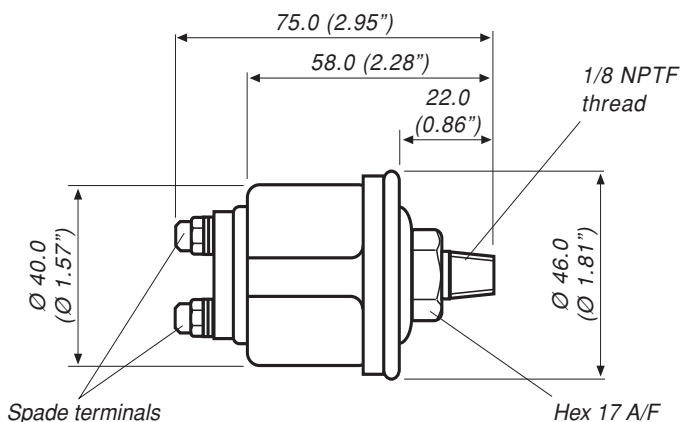
Pressure sensors

The Pi range of Club and Professional pressure sensors can be used to measure pressure. The pressure sensors are connected to analog Channels 1 and 2, with appropriate settings made using the Logger Management Software.

Pressure sensors

The pressure sensors which can be used with Delta Lite (or Delta Clubman) are:

- 21A-0050 (0–40 psi, 0–2 bar)
- 21A-0005 (5–120 psi, 0–7 bar)
- 21A-0091 (0–200 psi, 0–10 bar)



Club pressure sensor. Dimensions in millimetres and (inches)

| Pressure sensors | 21A-0050 | 21A-0005 | 21A-0091 |
|------------------|--|----------------------|-----------------------|
| Operating range | 0–40 psi 0–2 bar | 5–120 psi 0–7 bar | 0–200 psi 0–10 bar |
| Burst rating | 35 bar | 35 bar | 35 bar |
| Mounting | 7.0mm 1/8 NPTF thread | | |
| Connector | 2 off 1/4–inch female blade/or ring tags | | |
| Connections | non-polarized (they can be connected either way round) | | |

Turbo/carburettor pressure measurement

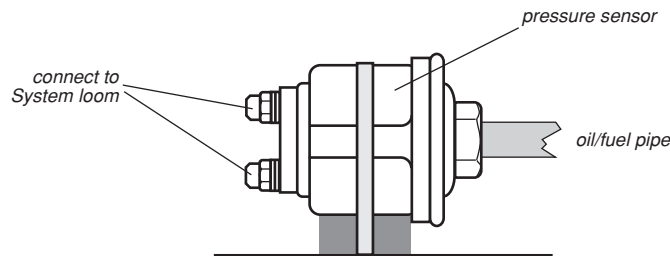
The low range pressure sensor (21A-0050) can be used to measure turbocharger pressure or carburettor fuel pressure. The sensor reads down to 0 psi. Care must be taken when interpreting carburettor pressure measurements: lateral or longitudinal **g** may generate pressure readings of the same magnitude as those caused by the draw of the carburettor.

Mounting the pressure sensors

Pi Research recommend that you do NOT fit the sensor directly to the engine block. Vibration will damage the sensor. Use the indirect fitting method as shown below.

Indirect fitting

Mount the pressure sensors on a side pod near to the fuel/oil pumps using tie-wraps and rubber pads.



Indirect fitting of pressure sensors

Fitting spade connectors on pressure sensors

Some of the pressure sensors use unpolarised spade connectors.

- 1 Once cut to length, strip about 5.0mm of insulation off each wire. DO NOT LOOP the wire.
- 2 Take a spade connector and grip it gently in the crimp tool. Slide the wire into the connector until it hits the small stop.
- 3 Squeeze the tool to crimp the connector, making sure that the bare wire is crimped securely.
- 4 Repeat this process for the remaining wire.

Fitting 8.0mm ing tags on pressure sensors

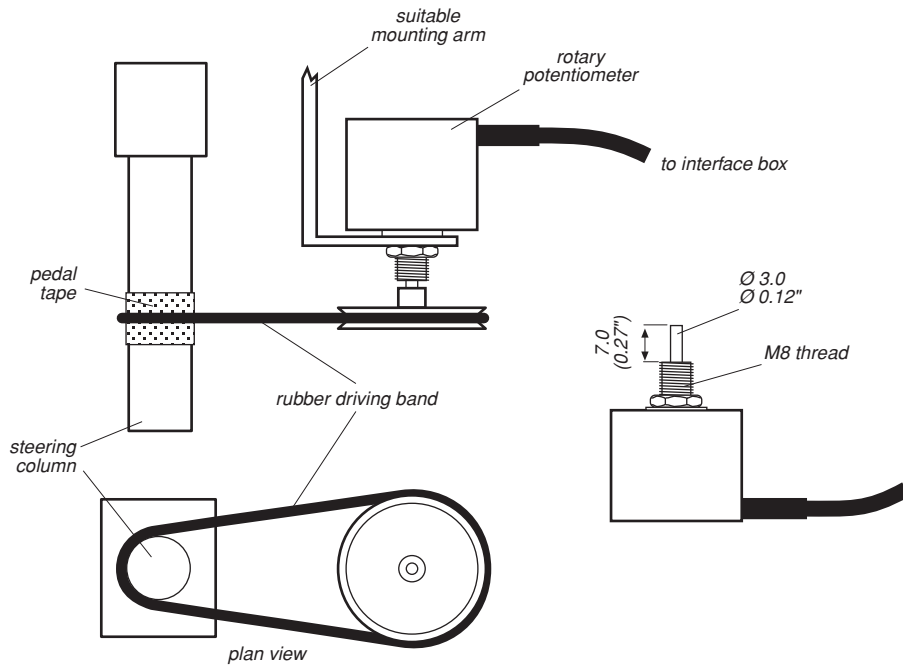
Some versions of the pressure sensors are connected using ring tags instead of spade connectors. These sensors are also non-polarised and can be connected either way.

Repeat the procedure for the spade connectors detailed above using ring tags instead of spade connectors.

Rotary Potentiometer

Rotary potentiometer

The rotary potentiometer can be used to measure steering position. The rotary potentiometer can be connected to analog channels, with appropriate settings made using the Logger Management Software.



Steering Sensor using rotary potentiometer. Dimensions in millimetres and (inches).

Rotary Potentiometer 30K-162085

| | | |
|-------------------|-----------------------------|-------------|
| Mechanical travel | 360° rotary | |
| Electrical travel | 338° rotary | |
| Mounting | mount with a custom bracket | |
| Connector | 3-pin Cannon SureSeal | |
| Connections | Pin 1 (green) | Ground (0V) |
| | Pin 2 (blue) | Signal |
| | Pin 3 (brown) | Power (5V) |

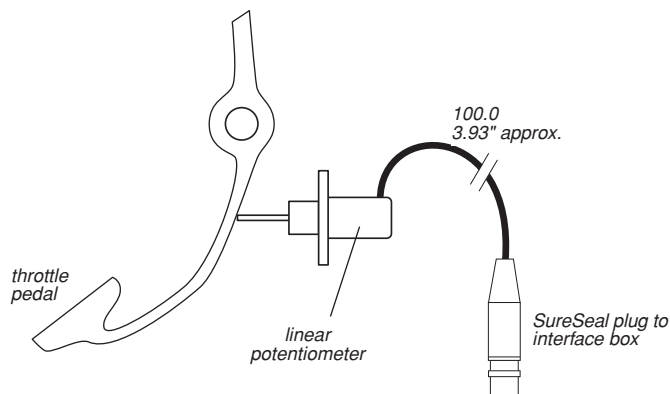
The rotary potentiometer can be used to measure steering position on a car, or other mechanical movements such as with throttle or suspension components.

Throttle sensor

Short stroke linear potentiometer

This sensor is a short stroke linear potentiometer which is typically used to measure throttle pedal movement, though it may be difficult to monitor full pedal movement. You should mount the sensor in such a way as to monitor the latter part of the throttle movement so that you can detect when the driver lifts from full power.

The linear potentiometer can be connected to analog channels, with appropriate settings made using the Logger Management Software.



Throttle sensor, using linear potentiometer. Dimensions in millimetres and (inches).

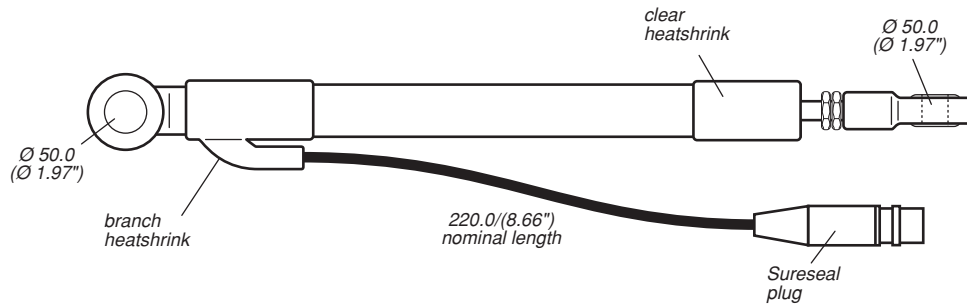
Throttle sensor 30K-162087

| | |
|-------------------|---|
| Mechanical travel | 12.0mm linear |
| Electrical travel | 10mm |
| Mounting | mount with a custom bracket |
| Connector | 3-pin Cannon SureSeal |
| Connections | Pin 1 (yellow) Ground (0V) |
| | Pin 2 (red) Signal |
| | Pin 3 (green) Power (5V) |

Linear potentiometers

A range of linear potentiometers are available which are typically used for measuring suspension travel on cars or motorcycles.

The linear potentiometer can be connected to analog channels, with appropriate settings made using the Logger Management Software.



Linear potentiometer. Dimensions in millimetres and (inches).

Linear potentiometers

| | |
|-------------------|--|
| Mechanical travel | 50, 75, 100, or 150mm |
| Electrical travel | 50, 75, 100, or 150mm |
| Mounting | Rose joints |
| Connector | 3-pin Cannon SureSeal |
| Connections | Pin 1 (black) Ground (0V) |
| | Pin 2 (yellow) Signal |
| | Pin 3 (red) Power (5V) |

Temperature sensors

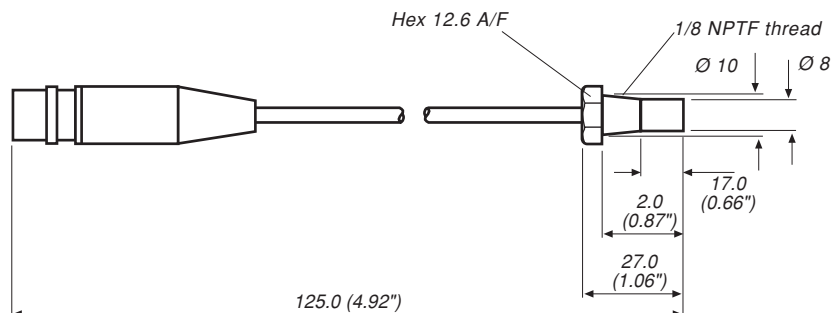
Temperature sensor 01G-233020

These temperature sensors can be used to measure oil and water temperature. The temperature sensors can be connected to analog channels 3 or 4, with appropriate settings made using the Logger Management Software.

Mounting the temperature sensors

The oil and water temperature sensors are mounted in the piping of the engine. The water temperature sensor is normally mounted in the piping of the cooling system, either in an existing mounting point or by brazing and threading an extra one. The oil temperature sensor is normally mounted either in the sump area or in the piping of the oil pump.

Note: The sensor has its own earth, so earthing the body of the sensor or isolating it from the car will have no adverse effect.



Imperial thread temperature sensor. Dimensions in millimetres and (inches).

Temperature sensor (Type 'B' sensor)

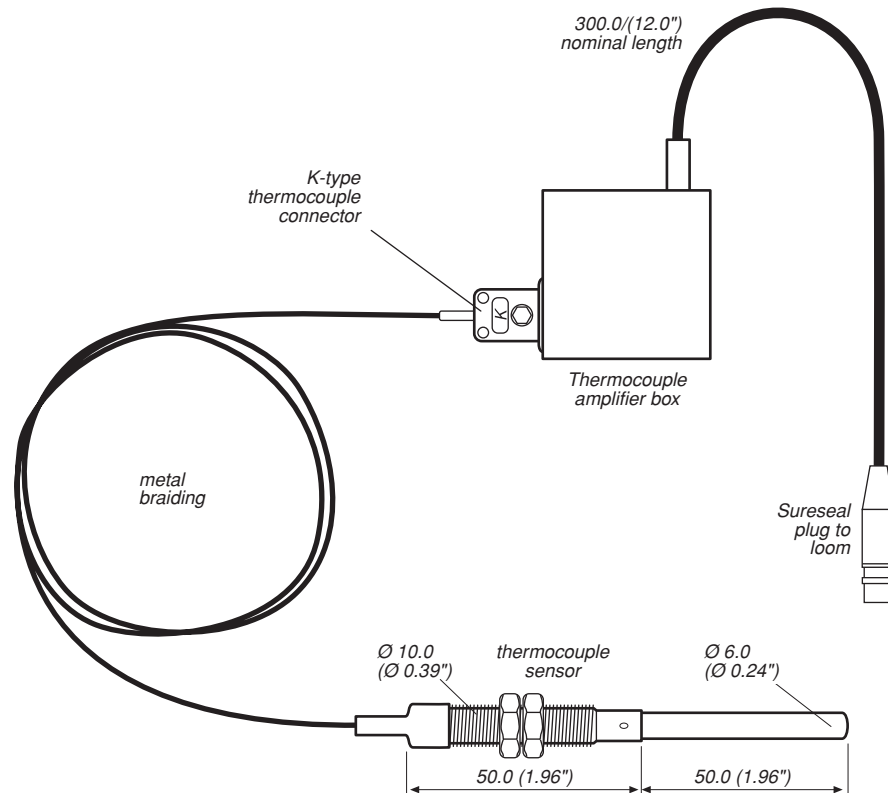
| | | |
|-----------------|------------------------------|-------------|
| Operating Range | 0–150°C (32–302°F) | |
| Accuracy | ±2.5°C (±4.5°F) | |
| Mounting | 7.0mm 1/8 NPTF thread | |
| | 17.0mm extending past thread | |
| Connector | 2-pin Cannon SureSeal | |
| Connections | Pin 1 (blue) | Signal |
| | Pin 2 (brown) | Power (12V) |

If water penetrates the connector, dry it out, reconnect, then seal using a silicone sealant. The sensors for water and oil temperature are exactly the same. The colour coded wiring on the loom determines how they should be connected.

Thermocouple sensor

Thermocouple sensors can be used to measure exhaust gas temperature (EGT) on vehicles with 2-stroke or 4-stroke engines. On 2-stroke karts, EGT is a good indicator of fuel mixture.

The thermocouple probe can be connected directly using a thermocouple amplifier box. Extension leads can be used in conjunction with the sensor, but they must be of the same composition (i.e. types of metal), and polarity.



Thermocouple Sensor. Dimensions in millimetres and (inches).

Thermocouple probe 21A-0045

Details

| | | |
|-----------------|-------------|----------|
| Operating range | 100°C–999°C | |
| Mounting | Lock nuts | |
| Connector | K-type | |
| Connections | blue | negative |
| | white | positive |

Thermocouple amplifier bo01F-152093

Details

| | | |
|--------------------|-----------------------|-------------|
| Mounting | Velcro® | |
| Sensor connector | K-type | |
| System 2 connector | 3-pin Cannon SureSeal | |
| Connections | Pin 1 (green) | Ground (0V) |
| | Pin 2 (blue) | Signal |
| | Pin 3 (red) | Power (12V) |

Kart type wheelspeed sensor

Wheelspeed on a kart is measured by a fixed wheelspeed sensor and a rotating trigger.

Kart type Wheelspeed sensor (11A-00005)

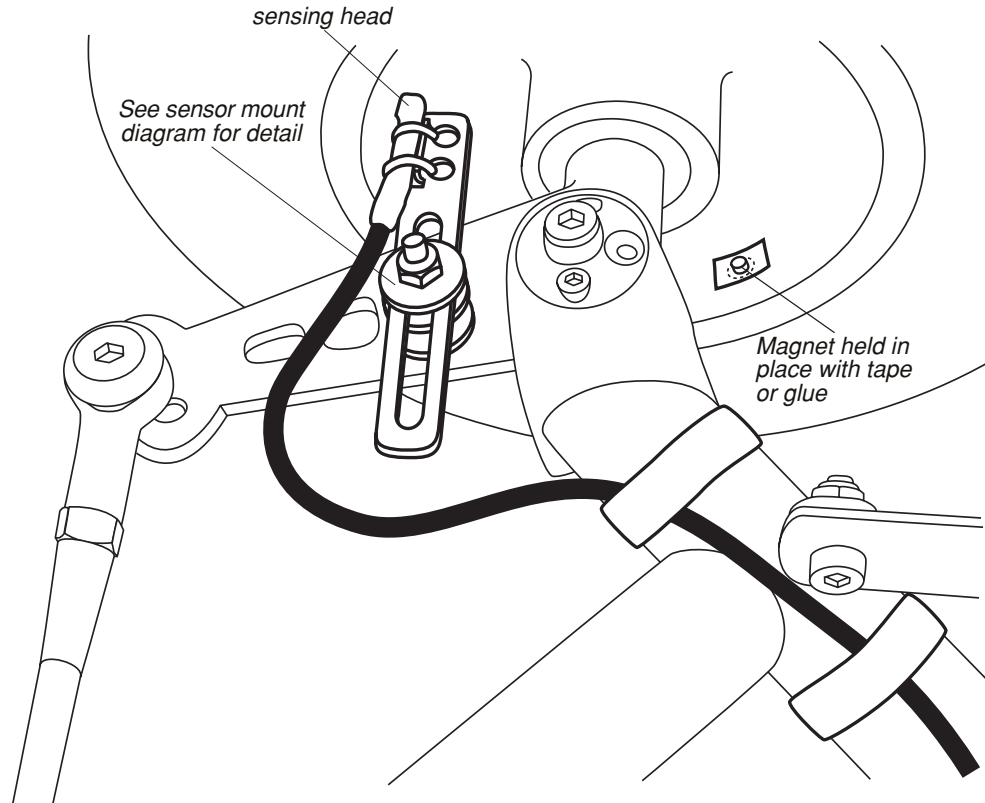
| | | |
|--------------------|--|---------------------|
| Type | Hall effect – Type A sensor | |
| Sensing distance | 0.5 to 1.5mm | |
| Mounting | Slotted steel bracket (6.0mm slot width) | |
| Connector | 3-pin Cannon Mini SureSeal | |
| Sensor connections | Plug pin 1 (green/yellow) | Wheelspeed ground |
| | Plug pin 2 (blue) | Wheelspeed signal |
| | Plug pin 3 (brown) | Wheelspeed power 5V |

Wheelspeed trigger (Kart type)

| | |
|--------|--------------------------------|
| Type | Magnet |
| Number | 1 to 40 per wheel (normally 1) |
| Size | 0.5 x 3.0mm deep |

Kart type wheelspeed sensor installation

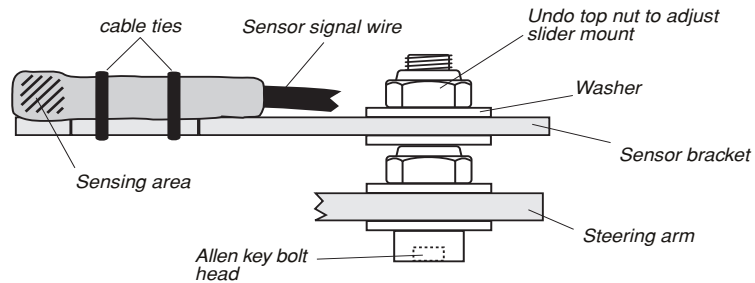
The kart wheelspeed sensor is triggered by a passing magnet. A single magnet is attached to the kart's front wheel, using tape or glue. (The magnet is usually fixed to the front wheel which is on the outside of the turn for the majority of the lap.)



Kart type wheelspeed sensor mounting

Pi Research provide the wheelspeed sensor with a bracket which is suitable for most karts. The bracket is bolted to the stub axle steering arm, as illustrated below. If no hole already exists in the arm, you must drill a 6.0mm hole. If the bracket is not suitable for your kart (i.e. there is not enough adjustment), then remove the sensor from the bracket by cutting the cable ties and make a similar bracket which is suitable for your installation.

The sensor should always be mounted at the back or front of the wheel (i.e. not at the top or bottom of the wheel).



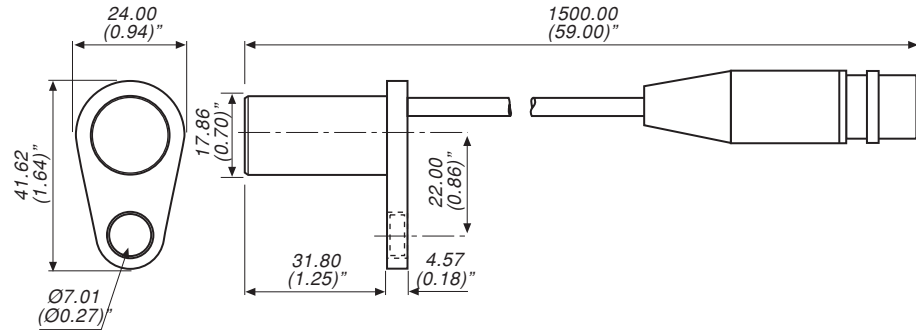
Detail showing arrangement of sensor mount

- 1 Tighten the 6.0mm bolt onto the steering arm using two of the washers and one of the nuts provided. Use the other nut and washers to clamp the sensor bracket, but do not clamp it fully.
- 2 Clean the wheel rim with solvent. Using glue or tape, stick the magnet to the rim – with the marked surface of the magnet facing the wheelspeed sensor.
- 3 Adjust the position of the bracket so that the sensing area of the wheelspeed sensor aligns with the magnet. Then adjust the gap between the magnet and the sensing head, using a piece of plastic as a gauge. The gap between the sensor and the magnet should be between 0.5mm and 1.5mm.
If the gap is greater than this, the sensor will not trigger. If it is less, you risk contact between the sensor and magnet, which could damage the sensor.
- 4 Tighten the upper nut fully.
- 5 Plug one of the wheelspeed sensor leads into the wheelspeed sensor.
- 6 Run the sensor cable and sensor lead back along the stub axle to the chassis and on to the connector on the System loom.

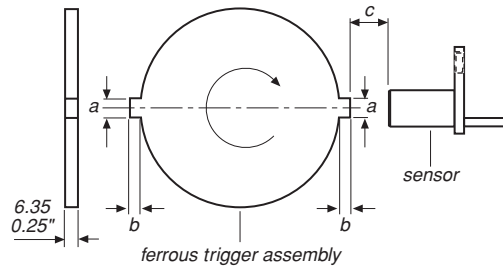
Note: Make sure there is enough cable at the stub axle/chassis joint to accommodate the full range of steering movement and front track adjustment.

Hall effect wheelspeed sensor

This compact wheelspeed sensor is intended for restricted space applications requiring a sensing distance up to 2.0mm. The sensor is a non-contact device, but needs a ferrous metal trigger to pass the sensor face. The sensor housing has a tab and a 7.0mm boss for mounting and a 1.5 metre loom terminated with a 3-pin SureSeal connector.



Hall effect wheelspeed sensor trigger design



For maximum output, try to achieve the following conditions:

- A trigger wheel made of a good magnetic material thicker than 6.35mm.
- Dimension 'a' equal to, or greater than 8.89mm.
- Dimension 'b' equal to, or greater than 5.08mm.
- Dimension 'c' is between 0.2mm and 2.0mm.
- A trigger wheel with an even number of triggers, (maximum of 64 triggers).

Hall effect wheelspeed sensor (01K-162187)

| | | |
|--------------------|------------------------------------|---------------|
| Type | Hall effect – Type A sensor | |
| Sensing distance | 0.13 to 2.03mm (1.0mm recommended) | |
| Mounting | Tab and boss (Ø7.0mm) | |
| Connector | 3-pin Cannon SureSeal | |
| Sensor connections | Plug pin 1 (black) | ground |
| | Plug pin 2 (white) | signal |
| | Plug pin 3 (red) | power 4.5—24V |

Hall effect wheelspeed sensor trigger

| | |
|--------|----------------------------------|
| Type | Ferrous trigger assembly |
| Number | Maximum of 64 triggers per wheel |
| Size | 22.00 x 41.62mm deep |

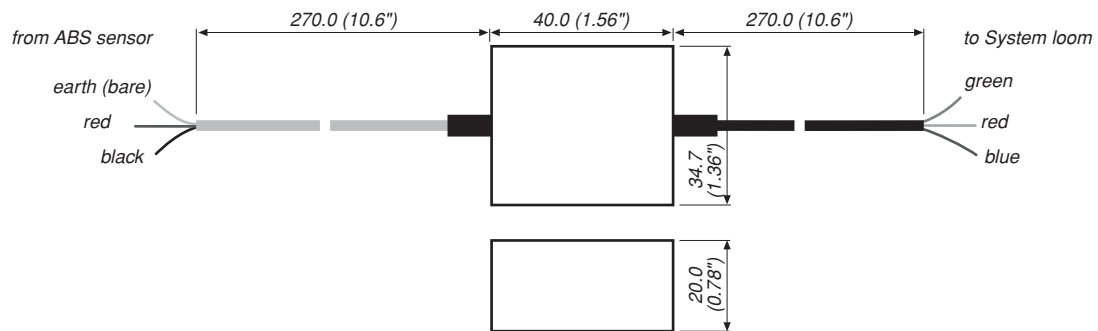
ABS sensor interface box

The ABS sensor interface box enables Delta Lite (or Delta Clubman) to take wheelspeed information from an existing ABS (Anti-lock Braking System) speed sensor. ABS speed sensors provide a robust wheelspeed measurement on touring and rally cars where mounting of the standard wheelspeed sensor might prove difficult. The interface box has been designed for use with two wire ABS speed sensors (passive type).

WARNING: If the ABS speed sensor is also used by the ABS system on the car, the two wires from the ABS interface box should be connected to the sensor connections via 100 μ F 16V capacitors, with the negative side of the capacitor going to the sensor. If in doubt please contact your Pi representative. Do not connect any wires directly to the chassis of the car.

ABS sensor interface box (01F-152084)

Mounting Industrial Velcro[®]



ABS sensor interface box. Dimensions in millimetres and (inches).

ABS sensor connections

| | | |
|----------------------|------------------------|-------------------------|
| Max. input frequency | 1500 pulses per second | |
| Connector | Unterminated | |
| Connections | bare wire | Screen (do NOT connect) |
| | red | Signal |
| | black | Reference |

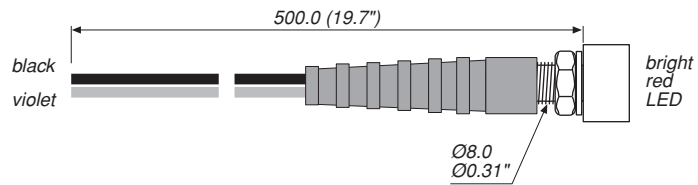
System connections

| | | |
|-------------|-----------------------|-------------|
| Connector | 3-pin Cannon SureSeal | |
| Connections | Pin 1 (green) | Ground (0V) |
| | Pin 2 (blue) | Signal |
| | Pin 3 (red) | Power (12V) |

Remote alarm light LED

Remote alarm light LED (01F-152094)

The Remote alarm light LED should be fitted in a position where it can be seen easily by the driver. Connection is from the Analog Loom.

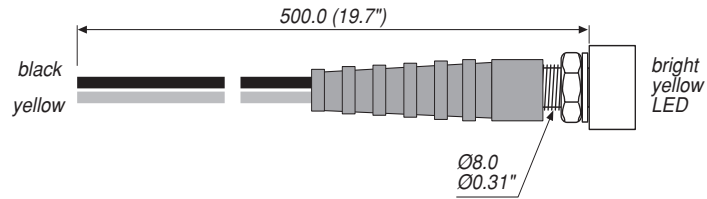


Remote alarm light LED. Dimensions in millimetres and (inches)

| Wire colour | Function | Comment |
|-------------|-----------------------|------------------------|
| Black | Alarm light -ve drive | Connect to Analog loom |
| Violet | Alarm light +ve drive | Connect to +12V supply |

Remote over rev light LED

Remote gearchange/over-rev light LED (01F-152095)



Remote gearchange/over-rev light LED .Dimensions in millimetres and (inches)

| Wire colour | Function | Comment |
|-------------|---------------------------------|------------------------|
| Black | Remote over-rev light -ve drive | Connect to Analog loom |
| Yellow | Remote over-rev light +ve drive | Connect to +12V supply |

Troubleshooting

Troubleshooting

Until you are completely familiar with your Delta Lite or Delta Clubman, you may encounter certain difficulties. This section lists the most common sources of problems and how to correct them. If the remedies suggested have no effect, please contact Pi Research or your local Pi representative.

WARNING: Do not attempt to repair Pi Research equipment yourself. All units must be opened and reassembled in clean conditions by trained personnel. The Warranty will be invalidated if any parts of the system have been tampered with.

Logger

| | |
|----------------|--|
| Problem | The Logger doesn't start up. |
| Cause | No supply voltage. |
| Action | Check the vehicle's master switch and ignition switch. |
| Cause | Flat battery. |
| Action | Make sure the vehicle battery is charged up and connected. |
| Cause | The Autosport connectors on the Logger are not secure. |
| Action | Make sure that the connectors on the front of the Logger are properly located and secured. |
| Cause | Faulty wiring. |
| Action | Check that the supply voltage wiring is not damaged or shorted out. (Refer to the Pin connection table in the 'Installation' section). |
| Problem | The Logger is logging half the correct RPM value. |
| Cause | The Pulse setting in the Logger is wrong. |
| Action | Check and adjust the value in the Logger Management Software. |
| Problem | The Logger does not log |
| Cause | The RPM signal is missing. |
| Action | Check that the wiring to the RPM unit has not become detached during engine maintenance. |

Engine speed (RPM)

RPM Box (HT or LT mode)

Problem **The RPM reading is occasionally spiky and the PC Software shows small spikes.**

Cause The wiring is picking up noise from other sources on the vehicle.

Action Check whether the RPM wiring runs close to other ignition circuits and re-route it.

RPM Box HT (High Tension) connection

Problem **The RPM bar graph cuts out or flashes at high RPM.**

Cause The RPM Box is not set up correctly.

Action Check that the RPM Box is set for HT (positions 8 to F), and for the maximum sparks per minute that can be emitted by the ignition system.

Problem **The RPM bar graph is unstable.**

Cause The HT connection on the RPM Box may be faulty.

Action Inspect the wiring on the HT lead and repair, if necessary.

Problem **The RPM reading is obviously too low.**

Cause The HT pick-up has been wrapped around an HT lead to an individual cylinder instead of the main HT lead and is not picking up the sparks for the other cylinders.

Action Wrap the HT pick-up around the main HT lead.

NOTE: Some engines now have multi-coil systems, where each cylinder has its own coil. In these cases, you can use the HT lead from one coil if the PULSE value on the Logger Management Software is adjusted accordingly; alternatively, you could use the LT signal from the ignition box and drive the RPM Box in LT mode.

Wheelspeed

| | |
|----------------|---|
| Problem | The speed reading doesn't work at all. |
| Cause | If it has never worked, the wheel speed sensor may need adjusting. |
| Action | The sensor must be set within 0.4 to 0.8 mm from the triggers on the wheel. |

WARNING: DO NOT OVER-TIGHTEN THE WHEELSPEED SENSOR – it will break. Tighten the lock nuts with a small spanner. You are advised not to use a socket set.

IMPORTANT: Although the wheelspeed sensor may appear to work at low speeds, unless the sensor is set within 0.4 and 0.8 mm from the trigger, it may stop working at high speed.

| | |
|----------------|--|
| Problem | The sensor has been adjusted but it won't work. |
| Cause | Faulty sensor. |
| Action | Visually inspect the wheelspeed sensor for any damage to the head (too close to trigger) or body (over-tightened). Replace if necessary. |
| Cause | Faulty wiring. |
| Action | Check the wiring for damage. |

| | |
|----------------|---|
| Problem | The wheelspeed is wrong (e.g. by a factor of 2 or 4). |
| Cause | The sensor is not picking up all the triggers on the wheel. |
| Action | Check that all the triggers are set within 0.4 and 0.8mm from the sensor. |

NOTE: Because of the tolerance on the suspension of some saloon cars, it is very hard to set up multiple targets within 0.5 mm. In this case, it is best to use a single trigger.

| | |
|--------|--|
| Cause | The wheelspeed Pulse setting is wrong. |
| Action | Check and adjust the value in Logger Management Software: 1 Lift the wheel with the sensor on it so that it can spin. 2 Spin the wheel and see if the respective Wheel speed channel increments whilst watching the channel value. |

Problem **The wheelspeed reading seems inaccurate (e.g. by 5 percent).**

Cause The tyre diameter setting is wrong.

Action Check and adjust the value in the Logger Management Software This should be the actual rolling diameter of the tyre when it is under load.

Problem **Speed and RPM graphs on the PC software don't line up with those from previous data.**

Cause This is actually a beacon problem – the data logged by the Logger is synchronised by the beacon position.

Action Put the beacon transmitter at the same place on the pit wall each time you race at a track: use a name marker or sticky tape.

Action Use the 'Move beacon' function of the Club Expert Analysis software to adjust the beacon position from the earlier data.

Using an ABS speed sensor

Problem **The wheelspeed appears incorrect when using an ABS sensor interface box.**

Cause The number of triggers and/or the tyre diameter set in the Logger may be wrong.

Action Check the number of triggers on the ABS sensor wheel and adjust the values in the Logger Management Software.

Problem **The wheelspeed trace shown by the software contains spikes or dropouts.**

Cause The interface box is earthing to the chassis.

Action Do not connect any of the wires from the interface box directly to the chassis.

Cause The ABS sensor is also trying to drive the vehicle's ABS system.

Action Isolate the interface box wiring from the ABS system with 100 μ F capacitors as described in the 'Installation' section.

Lap times

If you do not use the beacon system the Logger cannot show lap times on the screen when analysing the data. To test the beacon system, turn on the dash and transmitter and wave the transmitter in front of the detector on the vehicle. Watch the Lap time on the dash.

Problem **Lap times aren't working.**

Cause The beacon transmitter isn't being powered; the LED on the beacon transmitter isn't on.

Action Make sure the battery wiring is secure, and that the battery is fully charged (12V).

NOTE: Although a lit LED on the transmitter indicates a good connection to the battery, only a fully charged battery will supply a strong signal to the vehicle. Make sure you charge the battery before a day at the track.

Cause The channels are not correctly set.

Action Make sure that the beacon transmitter (on the pit wall) and beacon receiver (on the vehicle) are set to the same channel. They both have a switch with positions 0 to 9.

Cause The beacon transmitter and beacon receiver are not lined up correctly.

Action As the vehicle passes the beacon transmitter, make sure that there is a clear line-of-sight between the two. On a motorcycle check that the motor cycle is upright as it passes the beacon transmitter.

Note: At some tracks which have camber on the straights or where the vehicle passes close to the pit wall, the beacon transmitter position may be too high.

Cause Sunlight is dazzling the beacon receiver.

Action The sun (a large infrared beacon transmitter!) should not shine into the beacon receiver as it passes the pits. Place the beacon receiver on the other side of the vehicle and move the transmitter to the other side of the track.

| | |
|----------------|--|
| Problem | The lap times seem wrong. |
| Cause | The vehicle may be picking up more than one beacon signal. |
| Action | Check if any other teams are running with a beacon transmitter on the same channel and agree to use different channels, or only one transmitter. |

Sensor readings – General

Temperatures

Problem **The temperature readings are wrong.**

Cause Sensor is not calibrated correctly.

Action Re-calibrate the sensor and send the new set up to the Logger.

Cause Water in the sensor, connector or dash connector.

Action Inspect and dry, where necessary. Seal temperature connectors with Silicone sealant.

Cause The temperatures are correct, but different from previous readings.

Action Check where temperature sensors were previously mounted: for example, oil sumps may be hotter than filler pipes. If possible, confirm temperature readings at the sensor location with a thermocouple probe.

When measuring temperatures with a thermocouple

Problem **The thermocouple readings are noisy.**

Cause The amplifier is picking up electrical noise from the chassis.

Action Make sure the thermocouple amplifier box is not electrically connected to the chassis.

Cause The amplifier is picking up electrical noise from the chassis.

Action Make sure the leads for the thermocouple probe and amplifier do not pass close to high voltage sources such as the ignition coil or magneto.

Pressures

Problem **The pressure readings are wrong.**

Cause The sensor is faulty.

Action Check that the connectors on the pressure sensors are correctly fitted, and going to the right sensor. If necessary, change the pressure sensor.

Cause The sensor is has been mounted directly onto the engine block.

Action Replace the sensor and use indirect mounting for the new sensor.

Cause The pressure sensor wiring is damaged.

Action Check the wiring on the vehicle for visible damage and repair where necessary.

NOTE: If one pressure sensor seems wrong, try putting its connector onto the other sensor. If the fault moves with the connector, then the wiring or Logger is faulty. If the fault does not move with the connector, the pressure sensor needs replacing.

Steering position

Problem **The steering trace is erratic and switches from very high to very low.**

Cause The rotary steering sensor may not have been set up correctly or may have gone out of alignment, and is going off-scale during use.

Action While viewing the potentiometer reading on the relevant channel, align the steering pot so that it reads 2.5 volts when the steering is dead centre.

Throttle position

| | |
|----------------|---|
| Problem | The throttle trace does not show full throttle, or subtle movements of the throttle. |
| Cause | The 10.0mm throttle sensor is not aligned properly with the throttle pedal and as a result is not picking up certain parts of the pedal movement. |
| Action | Ensure that the stroke of the throttle sensor picks up the final (on-power) 10.0mm of movement of the pedal. |

Battery

| | |
|----------------|--|
| Problem | The Logger does not log. |
| Cause | The battery power supply is delivering less than 7.5V. |
| Action | Charge the battery before running again. |

NOTE: When the voltage drops below 7.5V, the Logger stops logging data. To make sure the Logger logs data again, switch it off and on again with a charged battery, before driving the vehicle.

Accelerometer

| | |
|----------------|---|
| Problem | The lateral acceleration trace on the Club Expert Analysis software does not show zero along the straight. |
| Cause | The Logger is not mounted horizontally, which distorts the g-force measured by the Logger. |
| Action | Check and adjust the mounting of the Logger. |

Data loss or data corruption

Problem **The Logger does not appear to have logged any data.**

Cause The Logger did not have time to shut down before it was switched off.

Action Make sure the vehicle stops for three seconds before turning the Logger off.

Cause The wheelspeed signal was not working (data loss or data corruption).

Action Refer to wheelspeed troubleshooting. Also in Club Expert Analysis use a Time Plot rather than a Distance Plot to confirm that the other channels logged correctly.

Appendices

Appendix A – Accelerometer calibration

Introduction

Delta Lite and Delta Clubman loggers have built in accelerometers. The accelerometer calibration supplied with the Delta Lite and Delta Clubman software is the default calibration for the sensor used in the logger. Due to manufacturing tolerances this may not exactly match the actual sensor fitted to your logger. There are two methods which you can use to improve the calibration.

Method 1

This is a simple method which involves zeroing sensors using the Watch channels feature of the Delta Lite Logger Management Software with the vehicle on a level surface. This method will enable a track map to be drawn, and unless you need to use the absolute value of 'g' obtained from the sensor, this method should be sufficient to run the logger.

Refer to the relevant *Logger Management Software User Guide* for information on zeroing channels and watching channels.

Method 2

Method 2 involves tipping the logger onto its four edges when using a **Raw Volts** calibration on channels **GX** and **GY** in Watch channels of the Delta Lite Logger Management Software.

Enter the values obtained at these +1g and -1g calibration points to create new custom calibrations for the sensors in your logger. Associate the new sensor calibrations to the **GX** and **GY** channels in the Inputs section of the Delta Lite Logger Management Software Configuration page. To obtain the best accuracy it may be worth using Method 1 above to counteract any temperature and long term drift.

Refer to the relevant *Logger Management Software User Guide* for information on configuring a Raw Volts channel, and setting up sensors.

Appendix B – Making changes to the looms

Introduction

The Delta Lite and Delta Clubman System and Analog looms are supplied pre-terminated with the correct connectors.

This appendix gives information on making changes to the pre-terminated looms.

Cut the Looms to size

When a loom is lying in the car, you can determine how long each group needs to be. Before cutting the wires, the loom should be consolidated by grouping sensor wires together and taking branches where particular sensors require it.

The final loom will look like a tree. You should use tape at each branch point to hold the loom in shape.

The individual sensor groups are now ready to be cut to length. Use tape to mark the length required, untwist the wires and slide the ident sleeve **AND** individual wire idents to the marked point. Be sure to leave enough length so that connections are not under stress. Make sure that there is enough room to plug in and unplug the connectors.

Each sensor ground wire **MUST** be connected to the Logger and not to the chassis. To avoid any electrical interference problems, the Logger unit should be treated as a separate system and only connected to the chassis at a single point.

Cut the branches to length and tie the loose ends to prevent the idents sliding off. Cut all the wires to the same length for each sensor. Fit the connectors. In most cases, you can do this more easily if you remove the loom from the car.

Fit the SureSeal connectors

Oil temperature, Water temperature, RPM, Wheelspeed, and Beacon receivers are connected to the loom via 2- or 3-pin Cannon SureSeal connectors.

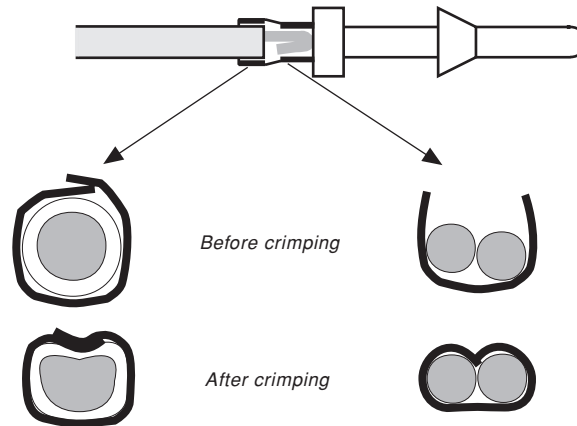
Note that on the connector, pin 1 is always a socket; pins 2 and 3 are always pin contacts.

Crimping a contact onto each wire

Take one wire:

- 1 Strip approximately 8mm of insulation off the wire, taking care not to cut the wire itself.
- 2 Twist the strands of wire together.
- 3 Fold the stripped portion of the wire in half to form a tight loop.
- 4 Take a contact and place it in aperture 3 of the crimp tool provided.

The two smaller clamping prongs should be facing the 'W' shaped part of the tool.



Waterproof connector crimp connections

- 5 Push the looped end of the wire right into the contact and crimp it by squeezing the handles all the way together.
- 6 Fold in the cable grip wings one at a time.

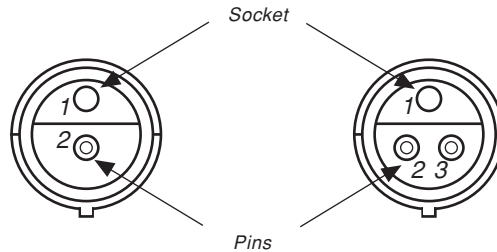
Use the flat front end section of the crimp tool (or a small pair of pliers) to fold in the cable grip wings one at a time, to hold the cable insulation.

7 Crimp the cable grip wings.

Finally, using aperture 3 of the crimp tool, crimp the cable grip wings so that they actually grip the insulation on the wire.

8 Repeat this process to crimp a pin contact onto the remaining connectors.

Insert the contact into the connector



Cannon SureSeal connectors viewed from rear

- 1 Take one of the rubber 2-way connectors from the bag, and locate the contact insertion tool provided.
- 2 Slide the slot in the tool over the a wire and push the tool up to the neck on the contact.
- 3 Pick up the connector and push the contact firmly into hole 1 in the body until it is flush with the mating face on the inside of the connector.
- 4 Check that the contact is correctly located in the body then withdraw the tool.
- 5 Repeat this process for the red wire, pushing it into hole 2 on the connector.

Repeat the process for each sensor.

WARNING: Failure to terminate any of the wires could lead to a short circuit of the Logger.

Reinstalling the loom

- 1 Connect the display, sensors and the power connections to the looms.
- 2 Check that the polarity of the power connections are correct.

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Contact information

For more information about Pi products and details of worldwide authorised agents, please contact:

Pi Research

Brookfield Motorsports Centre
Twentyence Road
Cottenham
CAMBRIDGE
UK
CB4 8PS

Customer Support Tel +44 (0) 1954 253600
Fax +44 (0) 1954 253601

Pi Research, Inc.

8250 Haverstick
Suite #275
Indianapolis
IN 46240
USA

Tel +1 (317) 259-8900
Fax +1 (317) 259-0137



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