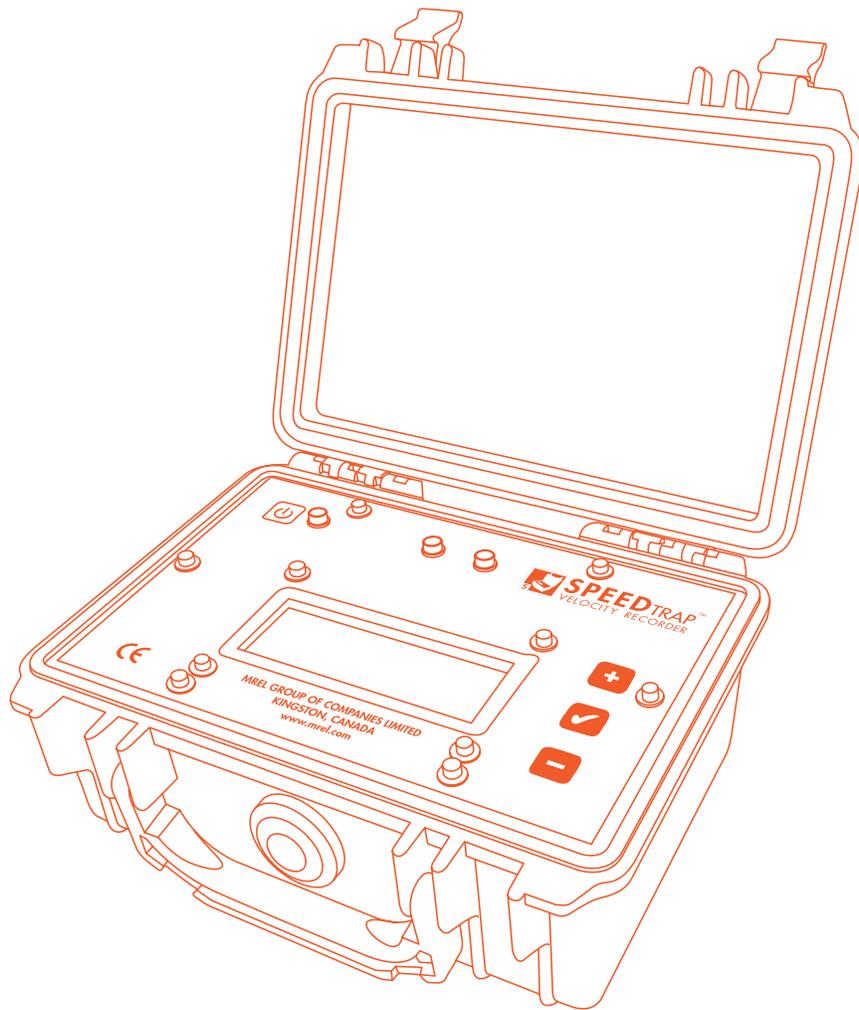




SPEEDTRAPTM
VELOCITY RECORDER

Operations Manual

Edition 3.2



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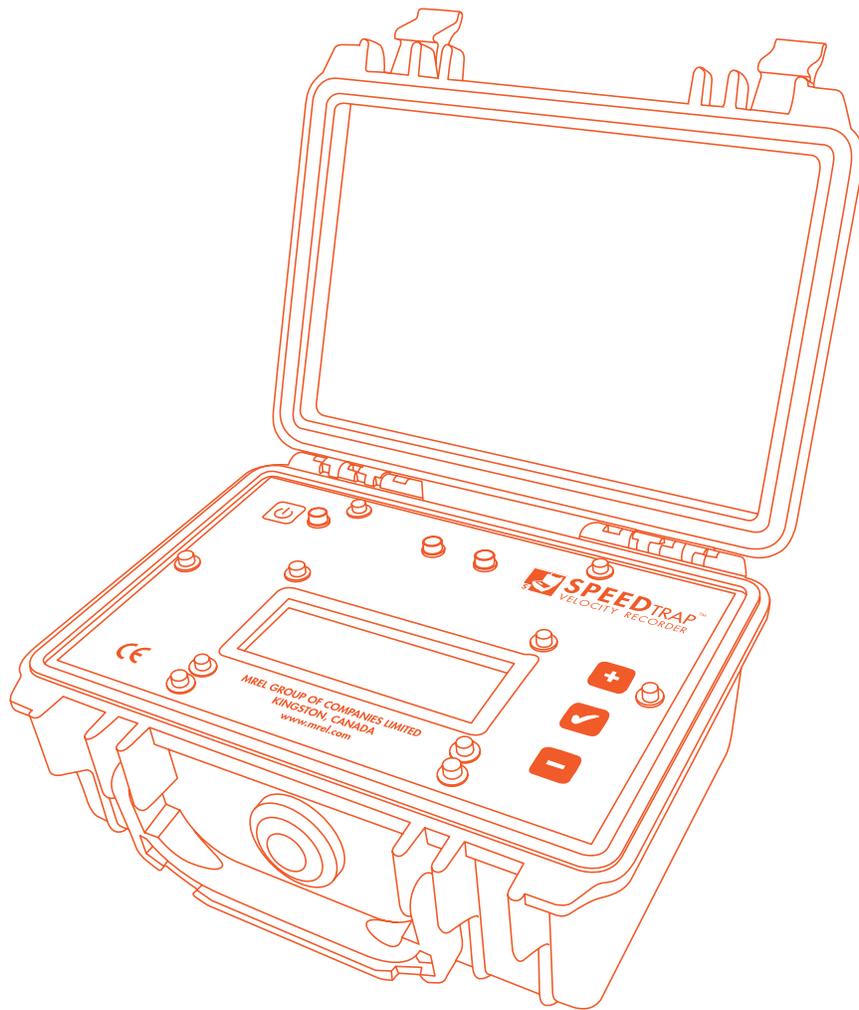
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Chapter 1

Getting Started



1.1 Ensuring That All SpeedTrap™ Hardware Has Been Received

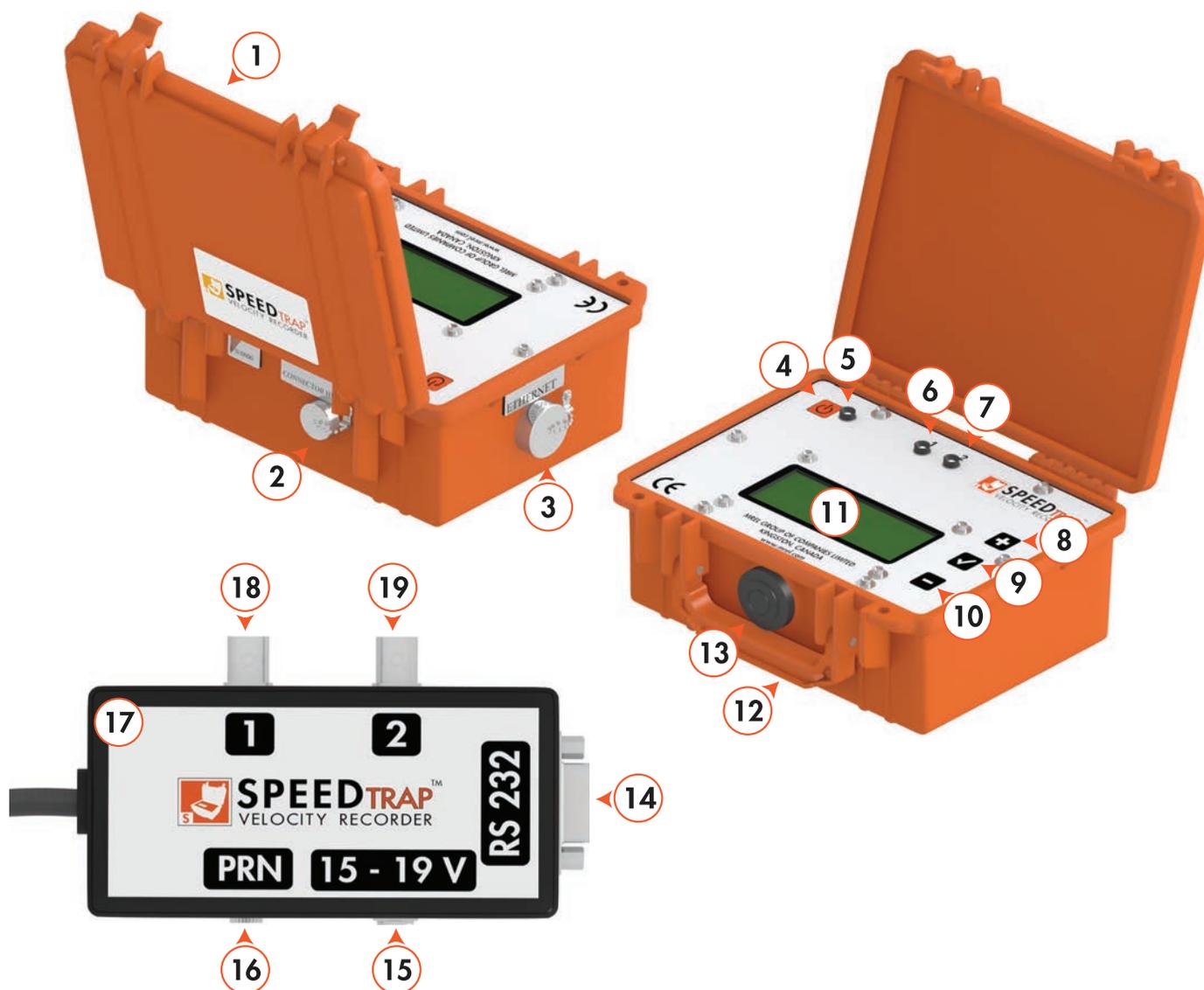
Below is a list of equipment included with the purchase of **SpeedTrap™ Velocity Recorder**. Photographs of the equipment can be found in **Chapter 3**. There are multiple models of the **SpeedTrap™ Velocity Recorder**. There is the **Fibre Optic Model**, the **Break Wire Model**, the **Adjustable Distance Model** and any combination of these together. Please refer to the model ordered and the model delivered from the **Pre-Delivery Packing Report**.

The items included in the **SpeedTrap™ Velocity Recorder** are as follows:

1. **SpeedTrap™ Velocity Recorder**
2. **SpeedTrap™ Connection Hub**
3. **USB-RS 232 Adapter**
4. **Universal Sensor Cable** - 30 metres long x 2
5. **SpeedTrap™ Battery Charger**
6. **SpeedTrap™ Padded Case**
7. **SpeedTrap™ Calibration Certificate**
8. **Customer 1 year Warranty Certificate**
9. **SpeedTrap™ Velocity Recorder Software for Windows**
10. **Fibre Optic Transducer** x 2 (Optional **Fibre Optic Model**)
11. **Break Wire Connectors** x 2 (Optional **Break Wire Model**)
12. **SpeedTrap™ Compatible Portable Printer** (Optional)
13. **Fibre Optic Sensor** - 100 metres (Optional)
14. **Break Wire Sensor** - 768 metres (Optional)

1.2 SpeedTrap™ Velocity Recorder Overview

- | | | |
|------------------------|------------------------------|------------------------------|
| 1. Case Lid | 8. Plus Button | 14. RS 232 Connection Port |
| 2. Connection Hub Port | 9. Affirmative Check Button | 15. Power Connection Port |
| 3. Ethernet Port | 10. Minus Button | 16. Printer Connection Port |
| 4. Power Button | 11. Information Screen | 17. Connection Hub |
| 5. Power Light | 12. Case Handle | 18. Sensor 1 Connection Port |
| 6. Sensor 1 Light | 13. Automatic Pressure Valve | 19. Sensor 2 Connection Port |
| 7. Sensor 2 Light | | |



1.3 Attaching the battery

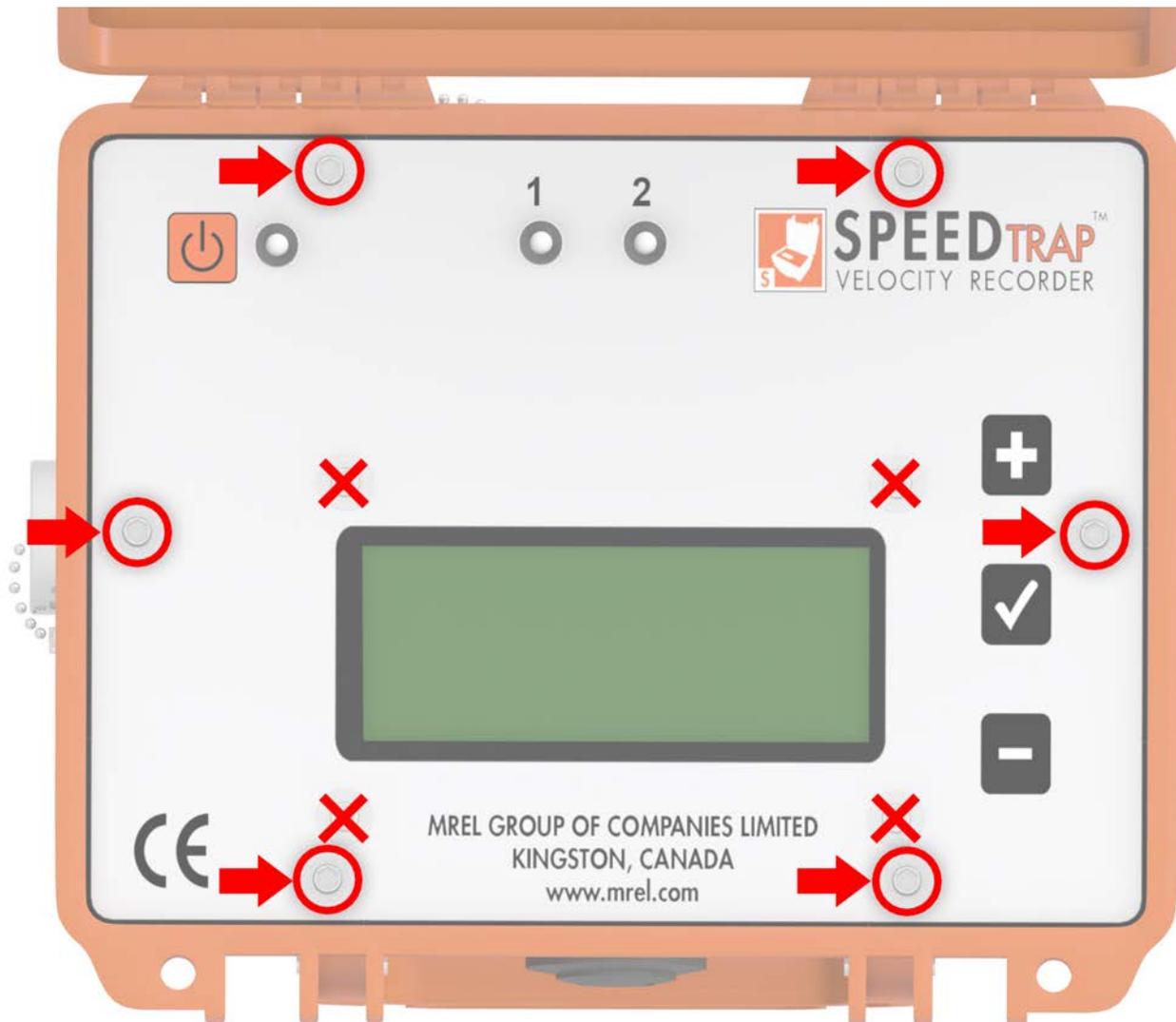
Due to airline restrictions (IATA), the battery **MUST** be disconnected prior to transport by air. Therefore the user must reconnect the battery upon receipt.

1.3.1 Front Plate Removal and Reattachment

Remove the 6 screws indicated with red circles and arrows on the image below using a 2.5 mm Allen screwdriver.

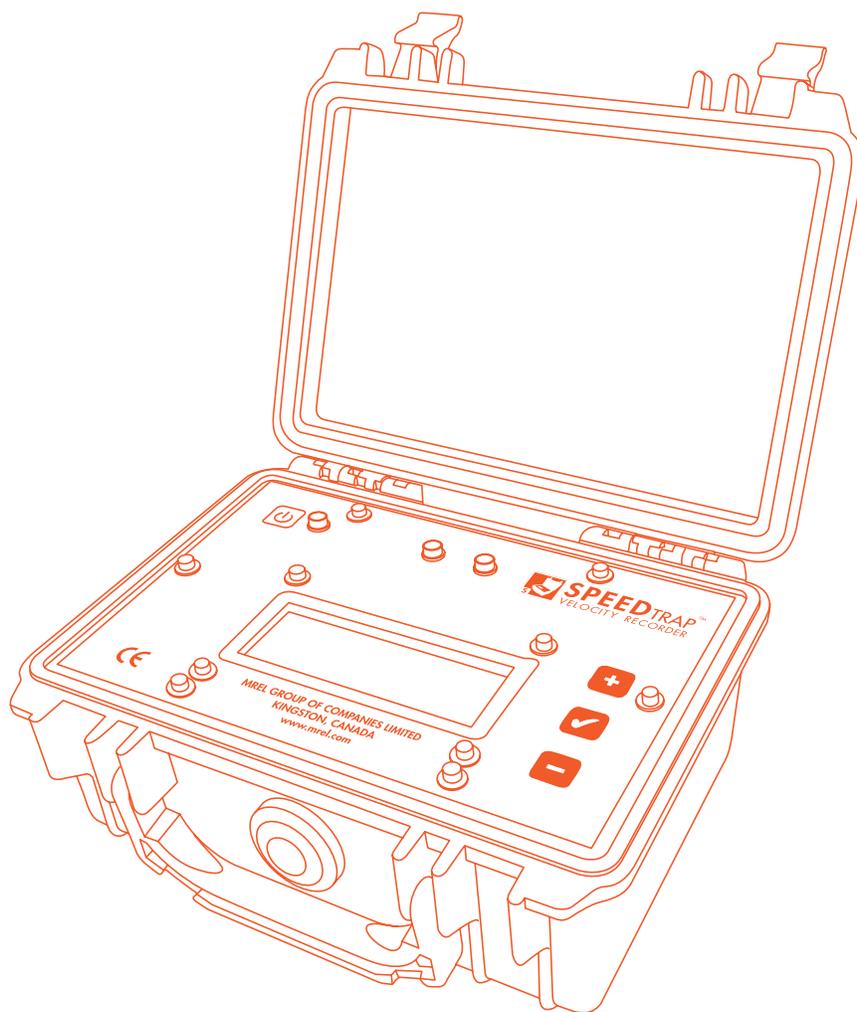
Do not remove the 4 screws around the LCD Screen each marked with a red X in the image below.

Lift the cover and attach the power leads from the battery to the circuit board near the battery. Replace the front plate in reverse order.



Chapter 2

Introduction



2.1 Background

The **SpeedTrap™ Velocity Recorder** is another recorder in the **MREL Group of Companies Limited** family to measure short sample velocity of detonation or deflagration using a two point start/stop method.

2.2 Safety Considerations

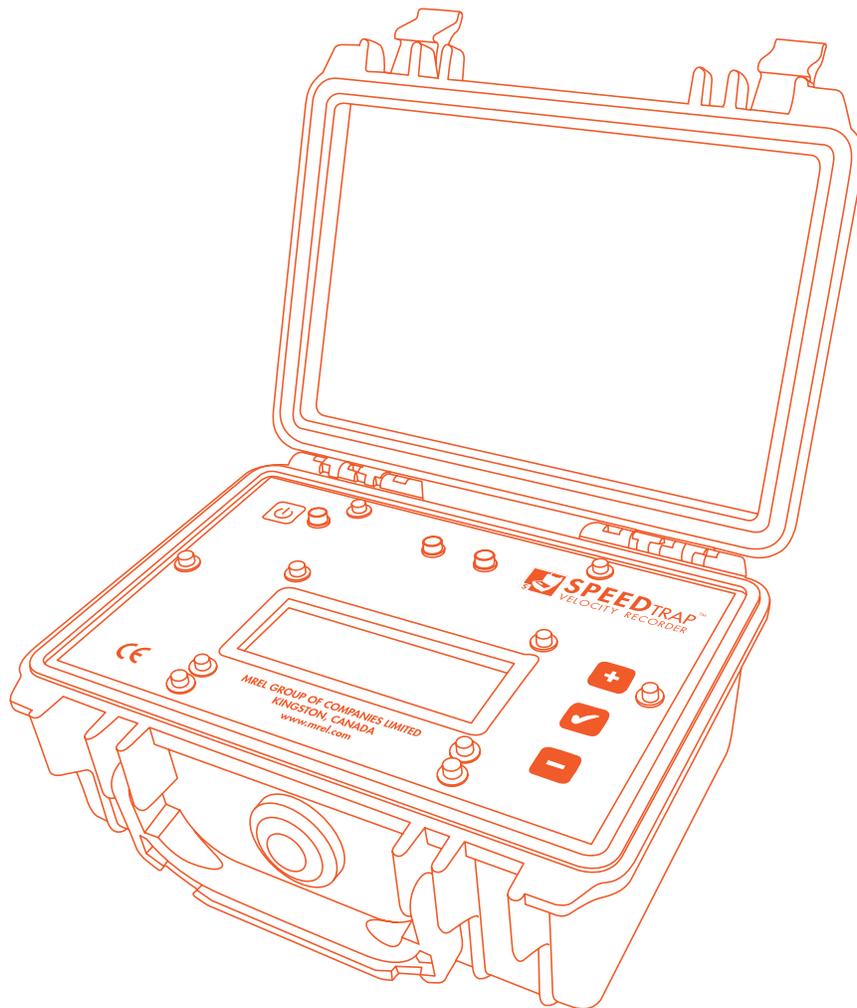
STOP

Persons not trained and/or authorized to handle explosives should not attempt to utilize the **SpeedTrap™ Velocity Recorder** for monitoring explosive properties.

The **SpeedTrap™ Velocity Recorder** is an easy and safe instrument to operate. However, one should be aware of the inherent risk associated with explosive's handling and familiar with working in blasting environments. For this reason, it is always recommended that knowledgeable personnel, experienced in handling explosives and familiar with blasting procedures, operate the **SpeedTrap™ Velocity Recorder** when testing explosives. The standard rules of safety used with explosives should apply when monitoring **VODs** or other explosive parameters.

Chapter 3

Hardware



3.1 Hardware Components

The hardware components of the **SpeedTrap™ Velocity Recorder** are shown below.

1. **SpeedTrap™ Velocity Recorder**
2. **SpeedTrap™ Connection Hub**
3. **USB-RS 232 Adapter**
4. **SpeedTrap™ Universal Sensor Cable** – 30 metres long x 2
5. **SpeedTrap™ Battery Charger** – European or North American specific plug
6. **SpeedTrap™ Calibration Certificate**
7. **SpeedTrap™ Operations Manual**
8. **SpeedTrap™ Padded Case**
9. **USB Drive with SpeedTrap™ Software**
10. **Fibre Optic Transducers** x 2 (Optional **Fibre Optic Model**)
11. **Break Wire Connectors** x 2 (Optional **Break Wire Model**)



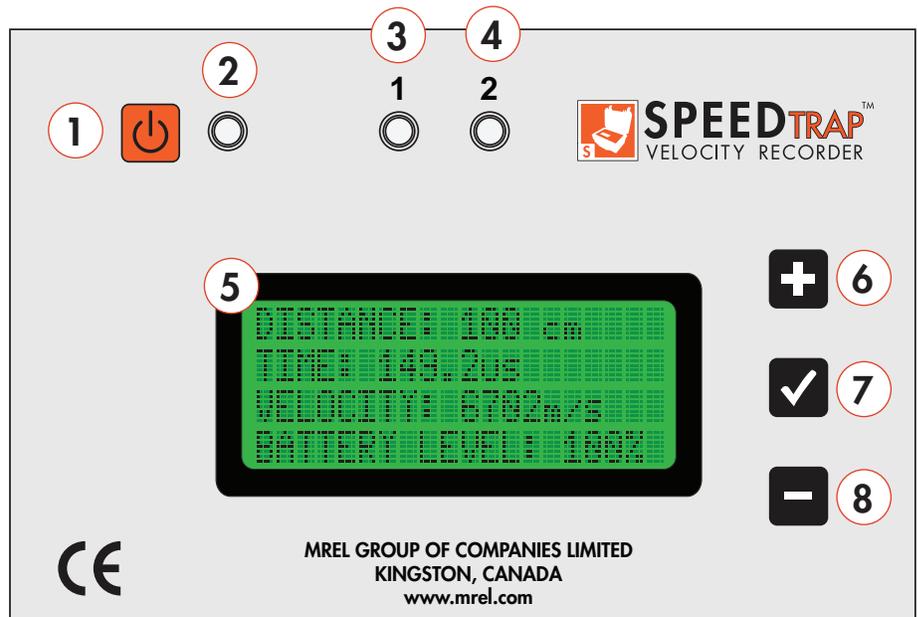
3.2 The SpeedTrap™ Velocity Recorder

The **SpeedTrap™ Velocity Recorder** is a digital chronometric device designed for measuring the velocity of detonating and deflagrating explosives. It is a small and portable unit suitable for field use.

MAIN CONTROL PANEL

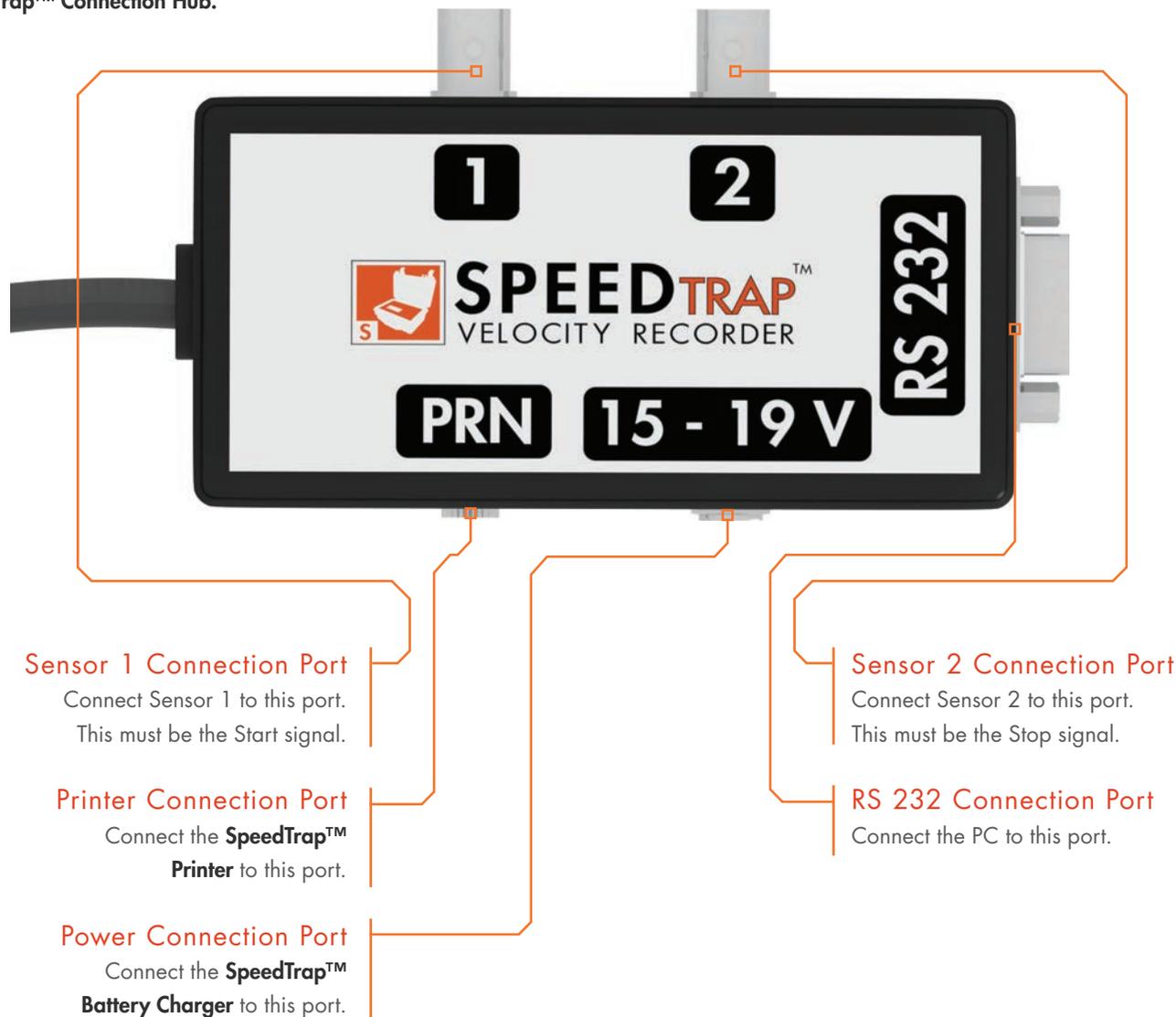
Displayed to the right is an image of the main control panel.

1. **Power On/Off** button
2. **Power** light
3. **Sensor 1** light
4. **Sensor 2** light
5. **Digital display** that shows the device settings and measurement results.
(4 lines x 20 characters)
6. **Plus** button
7. **Affirmative Check** button
8. **Minus** button



3.3 SpeedTrap™ Connection Hub

The **SpeedTrap™ Connection Hub** is where all of the connections to the **SpeedTrap™** and sensors are made. Below is a diagram of the **SpeedTrap™ Connection Hub**.



IMPORTANT

Sensor 1 **MUST** be the Start signal and
Sensor 2 **MUST** be the Stop signal.

3.4 USB-RS 232 Adapter

The **USB-RS 232 adapter** used to connect the **SpeedTrap™ Connection Hub** to a computer.

3.5 Universal Sensor Cables

There are the two sensor cables. Every sensor and the **SpeedTrap™ Velocity Recorder Connection Hub** has a **BNC connector**.



3.6 Battery Charger

This cable is used to connect the sensor to the **SpeedTrap™ Velocity Recorder**. Local power plugs can be purchased locally. The plug is an IEC-60320-1 standard C5 connector.



3.7 Padded Case

The **Padded Case** is supplied to carry all of the pieces in one case.



3.8 Operations Manual

This manual that is currently being read.

3.9 USB Drive

The USB Drive with the **SpeedTrap™ Velocity Recorder** Software.



3.10 Fibre Optic Transducers (Optional)

Two **Fibre Optic Sensors** are included in the **Fibre Optic** version of the **SpeedTrap™ Velocity Recorder**.



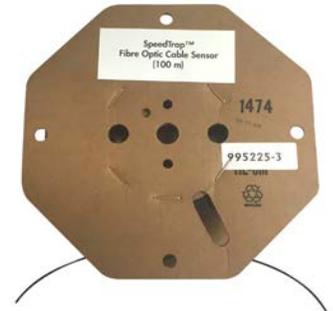
3.11 Break Wire Connectors (Optional)

There will be two **Break Wire connectors** included in the **Break Wire** version of the **SpeedTrap™ Velocity Recorder**.



3.12 Fibre Optic Sensor (Optional)

A reel of **Fibre Optic Sensor** of 100 metres can be purchased with the **SpeedTrap™ Velocity Recorder**.



3.13 Break Wire Sensor (Optional)

A spool of **Break Wire Sensor** of 768 metres can be purchased with the **SpeedTrap™ Velocity Recorder**.



3.14 SpeedTrap™ Velocity Recorder Printer (Optional)

The optional printer that can print the results in the field from the **SpeedTrap™ Velocity Recorder**.

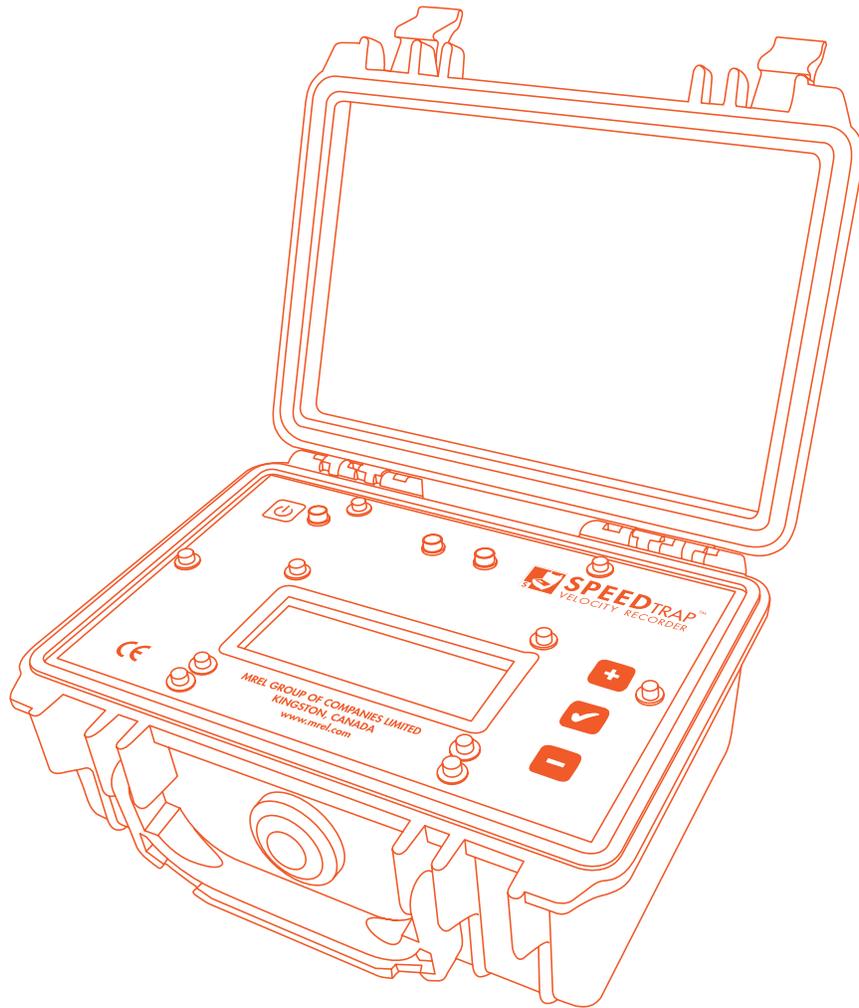


3.15 SpeedTrap™ Velocity Recorder Technical Specifications

Power supply	100 to 240 Volts AC with European or North American specific plug
Sensor Inputs	Wire Break (start and stop) (optional) Optical Fibre (start and stop) (optional)
Output to PC	RS 232 Serial port, Ethernet port
Time Accuracy	10 MS/s
Fixed Sensor Separation Distance	10 cm
Distance Adjustable Sensor Separation (Optional)	5 - 100 cm, Increments of 1 cm 1 - 10 m, Increments of 0.1m
Output to Printer	Prints multitude of information including time, date, sensor type, sensor separation, velocity (optional)
Display	Monochromatic, 4 x 20 characters

Chapter 4

Using the SpeedTrap™ Velocity Recorder



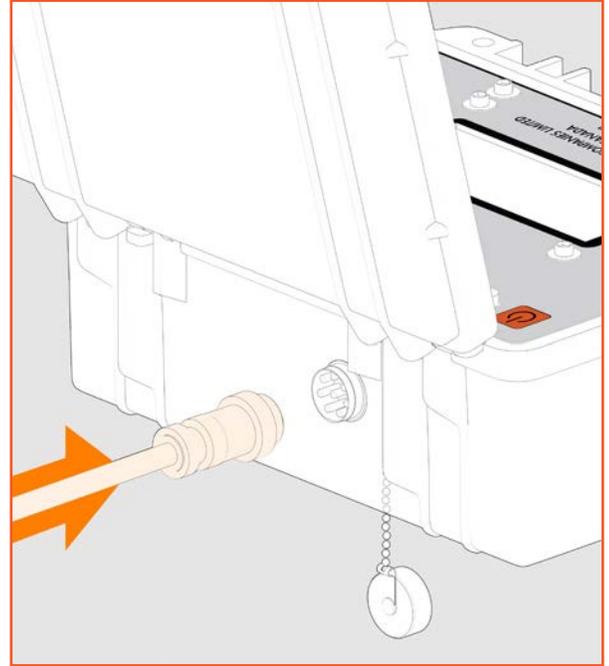
4.1 Getting the SpeedTrap™ ready for use

Connect the **SpeedTrap™ Connection Hub** to the **SpeedTrap™ Velocity Recorder** as shown to the right. If the **SpeedTrap™ Velocity Recorder** has not been charged, plug in the **SpeedTrap™ Battery Charger** into the 15-19 V DC Power port on the **SpeedTrap™ Connection Hub**.

When recharging the **SpeedTrap™ Velocity Recorder**, the screen below will be shown.



Once fully charged, the display will change to ***CHARGED***. The **SpeedTrap™ Velocity Recorder** is ready to be used.

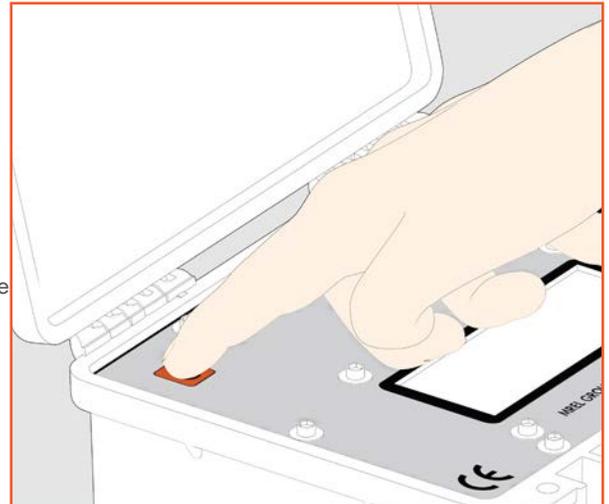


4.2 Powering on the SpeedTrap™ Velocity Recorder

Press the **Power** button shown to the right. Hold for 3 seconds and the unit will turn on.

4.3 Setting up the SpeedTrap™ Velocity Recorder

To setup the **SpeedTrap™ Velocity Recorder**, review the **Section 4.5** and press the buttons outlined to go into the **Change Settings** part of the menu structure. Once there setup the **SpeedTrap™ Velocity Recorder** as needed.



4.4 SpeedTrap™ Velocity Recorder Button Usage

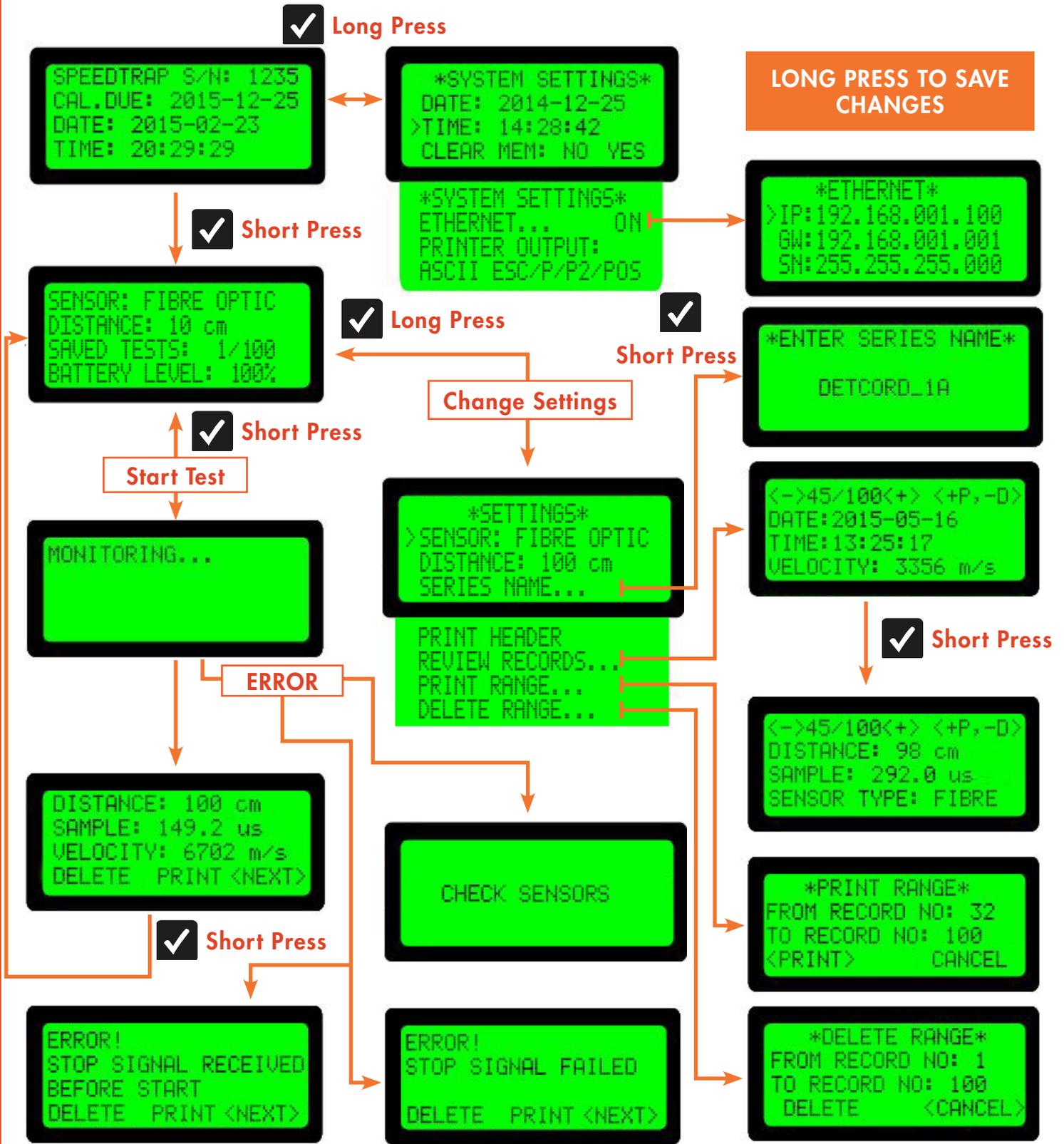
To move around the **SpeedTrap™ Velocity Recorder** Menu structure there are 3 buttons as shown to the right.

- The **+** and **-** buttons scrolls through the menu items.
- The **Affirmative Check** button chooses the selected menu item.
- Pressing the **Affirmative Check** button and the **+** button together will print the displayed record, if the optional printer is connected to the **SpeedTrap™ Connection Hub**.
- Pressing the **Affirmative Check** button and the **-** button together will delete the displayed record.



4.5 SpeedTrap™ Velocity Recorder Menu Structure

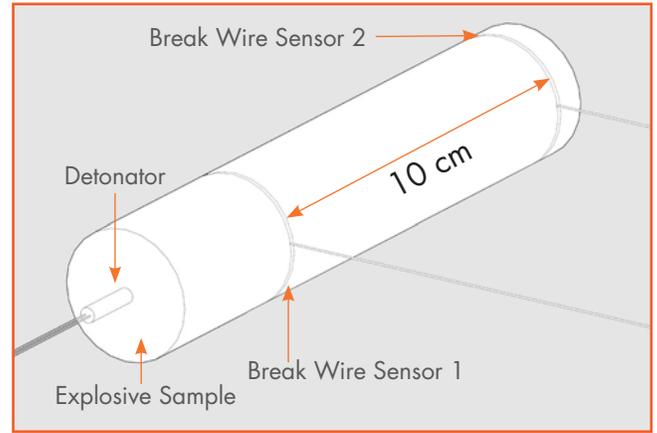
The SpeedTrap™ Velocity Recorder menu structure is as follows, starting from the powering on the SpeedTrap™ Velocity Recorder.



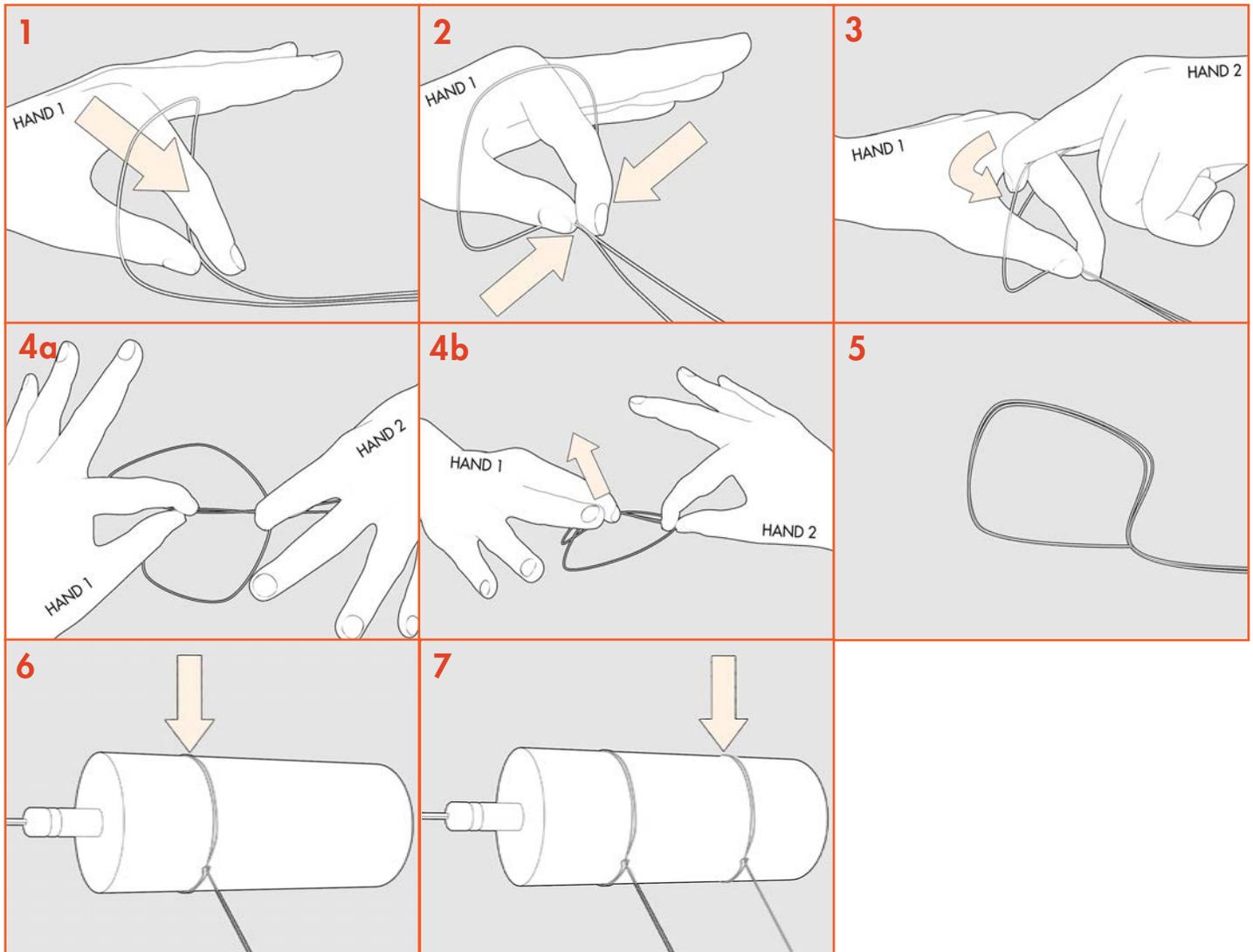
4.6 Break Wire Sensor Usage

4.6.1 Preparing the Explosive Sample

Start by preparing the explosive sample with the **Break Wire Sensors**. Be sure to position the **Break Wire Sensors** 10 cm apart from each other. If you have purchased the **Adjustable Distance Firmware**, the distance can be set on the **SpeedTrap™ Velocity Recorder** so instead measure the distance between the sensors and remember this distance for entering into the **SpeedTrap™ Velocity Recorder** between 5 and 100 cm in 1 cm increments.



The explosive sample using the **Break Wire Sensor** should look like the image in this section. Be sure to note where each sensor is on the explosive. Secure the **Break Wire Sensors** to the explosive. The sensor closest to the Detonator will be **Break Wire Sensor 1 (Start signal)** and the one furthest from the Detonator will be **Break Wire Sensor 2 (Stop signal)**. Secure the **Break Wire Sensors** to the sample using tape.



There is many ways to attach the **Break Wire Sensors** to the explosive sample. It is required to have the narrowest wire on the sample to ensure that the **SpeedTrap™ Velocity Recorder** has a well-defined separation distance between the two sensors. One of the easiest methods to attach the **Break Wire Sensor** to the sample is to use a **Prusik knot**. This knot can be easily used to make a loop in the end even if the two ends are attached to the **Break Wire Connectors**. This will allow for the wire to be held in place without the use of tape.

The **Prusik knot** is shown in images on the previous page with the description below.

- Image 1:** Place thumb and index finger from **HAND 1** through the loop.
- Image 2:** Pinch the two leads between the thumb and finger with **HAND 1**.
- Image 3:** Using **HAND 2**, pull the wire shown down to the 2 wires.
- Image 4a and 4b:** Using **HAND 1**, pull up on the pinched wires and continue to make the loop larger.
- Image 5:** This is the final loop shape. This loop can now be slid over the explosive sample and pulled tightly.
- Image 6:** Place **Break Wire Sensor 1** nearest to the detonator. Ensure that the wires lead away from the detonator side.
- Image 7:** Place **Break Wire Sensor 2** furthest from the detonator. Ensure that the wires lead away from the detonator side.

Next attach the **Break Wire Sensors** to the supplied **Break Wire Connectors** and then the **Connectors** to the supplied **Universal Sensor Cables**. Also, ensure that the **Break Wire Sensor** has been fully inserted through the small hole and the thumb screws have been tightened on the **Connectors**. Otherwise there may be error messages generated by either a **Start** or **Stop** signal not received.

Be sure to note that the correct wire is connected to the correct cable and the correct cable is connected to the correct channel. Mark each cable as you see fit.



4.6.2 Preparing the SpeedTrap™ Velocity Recorder

Connect the **SpeedTrap™ Connection Hub** to the **SpeedTrap™ Velocity Recorder**. Now connect the cable from **Break Wire Sensor 1** into the port marked **1** on the **SpeedTrap™ Connection Hub**. Next connect the cable from **Break Wire Sensor 2** into the port marked **2** on the **SpeedTrap™ Connection Hub**. Be sure to connect the Sensor 1 to port **1** and Sensor 2 to port **2**. If done incorrectly, the test will fail.

Power on the **SpeedTrap™ Velocity Recorder**. If the **Break Wire Sensors** are correctly positioned and connected, the **1** and **2** lights on the **SpeedTrap™ Velocity Recorder** will light up. If there is a problem with one of the sensors, the corresponding light will **NOT** be illuminated. The user will not be able to start the monitoring process and the **SpeedTrap™ Velocity Recorder** will display **CHECK SENSORS**. This is an active system and will monitor the status of the **Break Wire**.

If you need to update the date and time shown on the **SpeedTrap™ Velocity Recorder**, long press the **Affirmative Check button** to update system settings.

Short press the **Affirmative Check button** to view the test settings as shown to the right. If the **SpeedTrap™ Velocity Recorder** is displaying the incorrect sensor type (available if the optional **Fibre Optic firmware** has been purchased), short press the **Affirmative Check button** and then the **+** or **-** button to change to **Break Wire**. Press the **+** and **-** buttons to move through the menu. While on the Distance setting, press the **Affirmative Check button** to edit and then press the **+** and **-** buttons to increase and decrease the distance value (available if the optional **Adjustable Distance firmware** has been purchased). Press the **Affirmative Check button** to go back to editing the settings. To save all of the changes, long press the **Affirmative Check button**.

When ready to start the test, short press the **Affirmative Check** button. The **SpeedTrap™ Velocity Recorder** should now show the screen to the right.



4.6.3 Performing a Measurement Using the Break Wire Sensors

The explosive sample is now ready to be measured. Once the explosion is finished and cleared, proceed to the **SpeedTrap™ Velocity Recorder** and review the screen. The screen should look similar to the image to the right. The velocity of the explosives will be shown in metres per second. Be sure to save the test by pressing the **Affirmative Check** button.



If there is an error message shown like the ones shown to the right, there was a problem with the sensors.

The error screen to the right means that the signal reached **Sensor 2** before **Sensor 1**. This could mean a few different problems could exist:



1. The sensor cables were reversed during the test.
2. The continuity of the **Break Wire Sensor** was twisted around the sample and the detonation did not break the start wire sensor.

The error screen to the right means that the signal did not reach **Sensor 2** and a stop signal was not received from the stop wire sensor. This could mean the following problems:



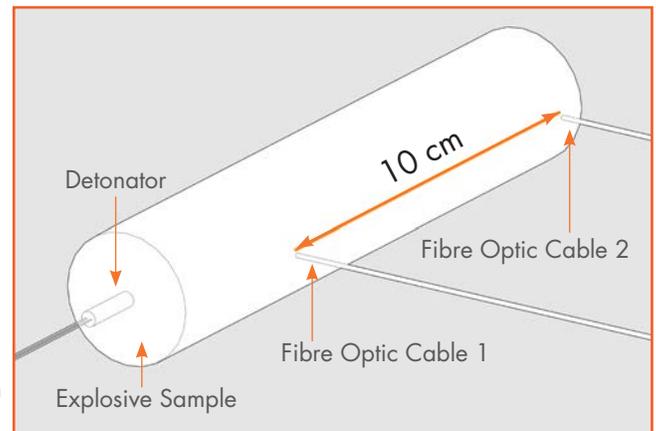
1. The continuity of the **Break Wire Sensor** was twisted around the sample and the detonation did not break the stop wire sensor.

You will need to restart the test process.

4.7 Fibre Optic Sensor Usage

4.7.1 Preparing the Explosive Sample

Start by preparing the explosive sample with the **Fibre Optic Sensors**. Be sure to position the **Fibre Optic Sensors** 10 cm apart from each other. If you have purchased the optional **Adjustable Distance Firmware**, the distance can be set on the **SpeedTrap™ Velocity Recorder** so instead measure the distance between the sensors and remember this distance for entering into the **SpeedTrap™ Velocity Recorder** between 5 and 100 cm in 1 cm increments.



The explosive sample using the **Fibre Optic Sensor** should look like the image in this section. Be sure to note where each cable is on the explosive. Secure the **Fibre Optic Sensors** to the explosive. The cable closest to the Detonator will be **Fibre Optic Sensor 1 (Start signal)** and the one furthest from the Detonator will be **Fibre Optic Sensor 2 (Stop signal)**. Secure the **Fibre Optic Sensors** to the sample using tape and be sure that no light is able to reach the **Fibre Optic Sensor** as this will interfere with the results.

CAUTION

The length of the Fibre Optic Cable is dependent on explosive type. Standard emulsion explosives should use no more than 5 m in length per channel. With light weight detonating cord, the length of Fibre Optic Cable should be no more than 2 m in length per channel.

Next attach the **Fibre Optic Sensor** to the supplied **Fibre Optic Transducers** and then the **Transducers** to the supplied **Universal Sensor Cables**. When inserting the **Fibre Optic Sensor** in the **Transducers** be sure that the **Fibre Optic Sensor** has been cut square to optimize the light transmission onto the **Transducer**. Also, ensure that the **Fibre Optic Sensor** has been fully inserted through the small hole in the sensor as shown in the picture to the right. Otherwise there may be error messages generated by either a **Start** or **Stop** signal not received.

Be sure to note that the correct sensor is connected to the correct cable and the correct cable is connected to the correct channel. Mark each cable as you see fit.

4.7.2 Preparing the SpeedTrap™ Velocity Recorder

Connect the **SpeedTrap™ Connection Hub** to the **SpeedTrap™ Velocity Recorder**.

Now connect the cable from **Fibre Optic Sensor 1** into the port marked **1** on the **SpeedTrap™ Connection Hub**. Next connect the cable from **Fibre Optic Sensor 2** into the port marked **2** on the **SpeedTrap™ Connection Hub**. Be sure to connect the Sensor 1 to port **1** and Sensor 2 to port **2**. If done incorrectly, the test will fail.

Power on the **SpeedTrap™ Velocity Recorder**. Ensure the **Fibre Optic Sensors** are correctly positioned and connected with the **Fibre Optic Sensors**. They are on a passive system. When the light from the explosives travels down the **Fibre Optic Cable** to the sensor a voltage signal is then sent to the **SpeedTrap™ Velocity Recorder**. The lights will flash off when the signal is received.

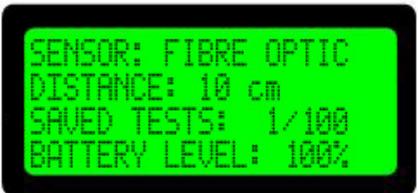
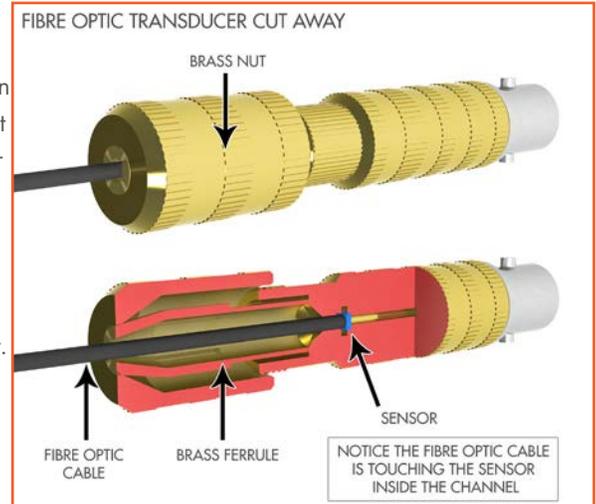
If you need to update the date and time shown on the **SpeedTrap™ Velocity Recorder**, long press the **Affirmative Check button** to update system settings.

Short press the **Affirmative Check button** to view the test settings as shown to the right. If the **SpeedTrap™ Velocity Recorder** is displaying the incorrect sensor type (available if the optional **Break Wire firmware** has been purchased), short press the **Affirmative Check button** and then the **+** or **-** button to change to **Fibre Optics**. Press the **+** and **-** buttons to move through the menu. While on the **Distance** setting, press the **Affirmative Check button** to edit and then press the **+** and **-** buttons to increase and decrease the distance value (available if the optional **Adjustable Distance firmware** has been purchased). Press the **Affirmative Check button** to go back to editing the settings. To save all of the changes, long press the **Affirmative Check button**.

When ready to start the test, short press the **Affirmative Check button**. The **SpeedTrap™ Velocity Recorder** should now show the screen to the right.

4.7.3 Performing a Measurement Using the Fibre Optic Sensors

The explosive sample is now ready to be measured. Once the explosion is finished and cleared, proceed to the **SpeedTrap™ Velocity**



Recorder and review the screen. The screen should look similar to the image to the right. The velocity of the explosives will be shown in metres per second. Be sure to save the test by pressing the **Affirmative Check** button.

If there is an error message shown like the ones shown to the right, there was a problem with the sensors.

The error screen to the right means that the signal reached Sensor 2 before Sensor 1. This could mean a few different problems could exist:

1. The sensor cables were reversed during the test.
2. The **Fibre Optic Sensor** was not cut clean and square to allow the sample light to be transmitted to the **Transducer**.
3. The **Fibre Optic Sensor** was not placed square to the explosive sample.
4. The **Fibre Optic Sensor** was not fully inserted into the **Transducer**.

The error screen to the right means that the signal did not reach **Sensor 2** and a stop signal was not received. This could mean the following problems:

1. The **Fibre Optic Sensor** was not cut clean and square to allow the sample light to be transmitted to the **Transducer**.
2. The **Fibre Optic Sensor** was not placed square to the explosive sample.
3. The **Fibre Optic Sensor** was not fully inserted into the **Transducer**.

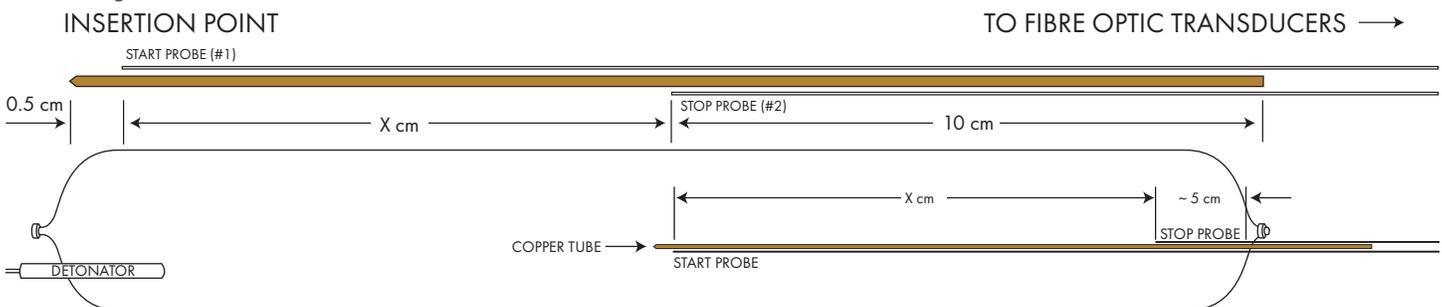
You will need to restart the test process.

4.8 Measuring Packaged Emulsion Explosive with Fibre Optic Sensor

If the use of the two previous sections did not produce reliable and repeatable results with the emulsion explosive cartridge, then this method should be tried.

4.8.1 Preparing the Fibre Optic Sensors

In the image below, the two **Fibre Optic Sensors** are attached to a rigid, narrow tube to allow for the end insertion of the assembly into the cartridge.



The distance shown as **X** in the above graphic has a default distance of 10 cm. If the **Adjustable Distance Firmware** has been purchased, then the distance of **X** is selectable by the user. For greater accuracy, the distance **X** should be as large as possible. Ensure that steady state Velocity of Detonation has been achieved by the time that the detonation front reaches the **Start Probe**.

Using a thin, rigid piece of metal (generally a thin copper tube) that is strong enough to be pushed into the end of the cartridge and will not allow the probe assembly to bend. Ensure that the overall length of the metal tube is long enough to allow for a hand hold.

The assembly of the system will have the end of the metal tube protrude a small distance in front of the **Start** probe. Place the **Start** probe 5 mm (3/16") from the end of the metal tube. Tape the probe to the metal tube. It is recommended that electrical tape be used. Make sure that during the taping of the system that the **Fibre Optic Probe** remains on the same side as it is started on and does not spiral around the metal tube. Continue taping up the metal tube until the desired separation of the two sensors is reached. Place the second **Fibre Optic Sensor** (the **Stop** signal) on the opposite side of the metal tube. Hold it in place with one wrap of tape and re-measure the distance to ensure that it is in the exact proper place. With only one wrap of tape, the **Fibre Optic Probe** can still be adjusted before complete taping occurs. Once the tips of the probes are located, continue taping up the metal tube ensuring that the two **Fibre Optic Cables** do not spiral on the metal tube. Label each of the probes to ensure that they are connected properly.

Upon completion of the assembly, perform the following checks to confirm that the assembly is ready to be used.

1. The desired distance between to the two tips of the fibre is exact.
2. The ends of the **Fibre Optic Cable** is not covered with tape.
3. The tape is securely holding the **Fibre Optic Cable** in place.
4. They are aligned with the metal tube (parallel with the tube axis).
5. There is enough of the metal tube to properly support the **Stop Fibre Optic Cable** and to be used as a handle.
6. Label each of the probes to ensure that the **Start Cable** is at the **Insertion Point** end and the **Stop Cable** is at the other end.

4.8.2 Properly Inserting the Fibre Optic Sensor Assembly into the Sample

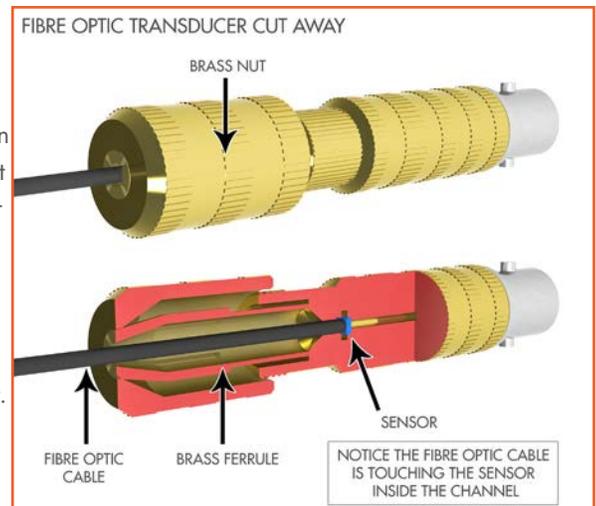
With the assembly completed from above, this product will need to be inserted from the opposite end to where the detonator will be placed as shown in the image on the previous page. Make a small slit in the package near the centre line of the product. Push the assembly into the cartridge ensuring that the assembly is near the centre line. Support the end of the assembly on the outside of the cartridge if required.

CAUTION

The length of the Fibre Optic Cable is dependent on explosive type. Standard emulsion explosives should use no more than 5 m in length per channel. With light weight detonating cord, the length of Fibre Optic Cable should be no more than 2 m in length per channel.

Next attach the **Fibre Optic Sensor** to the supplied **Fibre Optic Transducers** and then the **Transducers** to the supplied **Universal Sensor Cables**. When inserting the **Fibre Optic Sensor** in the **Transducers** be sure that the **Fibre Optic Sensor** has been cut square to optimize the light transmission onto the **Transducer**. Also, ensure that the **Fibre Optic Sensor** has been fully inserted through the small hole in the sensor as shown in the picture to the right. Otherwise there may be error messages generated by either a **Start** or **Stop** signal not received.

Be sure to note that the correct sensor is connected to the correct cable and the correct cable is connected to the correct channel. Mark each cable as you see fit.



4.8.3 Preparing the SpeedTrap™ Velocity Recorder

Connect the **SpeedTrap™ Connection Hub** to the **SpeedTrap™ Velocity Recorder**.

Now connect the cable from **Fibre Optic Sensor 1** into the port marked **1** on the **SpeedTrap™ Connection Hub**. Next connect the cable from **Fibre Optic Sensor 2** into the port marked **2** on the **SpeedTrap™ Connection Hub**. Be sure to connect the Sensor 1 to port **1** and Sensor 2 to port **2**. If done incorrectly, the test will fail.

Power on the **SpeedTrap™ Velocity Recorder**. Ensure the **Fibre Optic Sensors** are correctly positioned and connected with the **Fibre Optic Sensors**. They are on a passive system. When the light from the explosives travels down the **Fibre Optic Cable** to the sensor a voltage signal is then sent to the **SpeedTrap™ Velocity Recorder**. The lights will flash off when the signal is received.

If you need to update the date and time shown on the **SpeedTrap™ Velocity Recorder**, long press the **Affirmative Check button** to update system settings.

Short press the **Affirmative Check button** to view the test settings as shown to the right. If the **SpeedTrap™ Velocity Recorder** is displaying the incorrect sensor type (available if the optional **Break Wire firmware** has been purchased), short press the **Affirmative Check button** and then the **+** or **-** button to change to **Fibre Optics**. Press the **+** and **-** buttons to move through the menu. While on the **Distance** setting, press the **Affirmative Check button** to edit and then press the **+** and **-** buttons to increase and decrease the distance value (available if the optional **Adjustable Distance firmware** has been purchased). Press the **Affirmative Check button** to go back to editing the settings. To save all of the changes, long press the **Affirmative Check button**.

When ready to start the test, short press the **Affirmative Check button**. The **SpeedTrap™ Velocity Recorder** should now show the screen to the right.

4.8.4 Performing a Measurement Using the Fibre Optic Sensors

The explosive sample is now ready to be measured. Once the explosion is finished and cleared, proceed to the **SpeedTrap™ Velocity Recorder** and review the screen. The screen should look similar to the image to the right. The velocity of the explosives will be shown in metres per second. Be sure to save the test by pressing the **Affirmative Check button**.

If there is an error message shown like the ones shown to the right, there was a problem with the sensors.

The error screen to the right means that the signal reached Sensor 2 before Sensor 1. This could mean a few different problems could exist:

1. The sensor cables were reversed during the test.
2. The **Fibre Optic Sensor** was not cut clean and square to allow the sample light to be transmitted to the **Transducer**.
3. The **Fibre Optic Sensor** was not placed square to the explosive sample.
4. The **Fibre Optic Sensor** was not fully inserted into the **Transducer**.

The error screen to the right means that the signal did not reach **Sensor 2** and a stop signal was not received. This could mean the following problems:

1. The **Fibre Optic Sensor** was not cut clean and square to allow the sample light to be transmitted to the **Transducer**.
2. The **Fibre Optic Sensor** was not placed square to the explosive sample.
3. The **Fibre Optic Sensor** was not fully inserted into the **Transducer**.

You will need to restart the test process.



IMPORTANT

If unreliable triggering of the **Fibre Optic Channel** is experienced, reduce the overall length of the **Fibre Optic Cable** to ensure adequate light transmission.

4.9 Measuring Single Borehole VOD using Fibre Optic Sensor

Optional Equipment Required: Fibre Optic Firmware and Adjustable Distance Firmware

4.9.1 Preparing the Fibre Optic Cable for Borehole Usage

Prepare 2 lengths of **Fibre Optic Cable** each with a length of no more than 10 m. As shown in the illustration, the distance separation between the two ends is the distance that is required to be measured accurately. For borehole measurements the distance can be between 1 m and 10 m, in increments of 0.1 m. The value entered into the **SpeedTrap™ Velocity Recorder** is the linear distance between the two ends of the **Fibre Optic Cable**. The suggested distance is 3 m.

Using the illustrations shown in **Section 4.7.1**, the **Fibre Optic Cable** needs to be fully inserted into the **Fibre Optic Transducer**.

Note: The longer (closer to the bottom of the hole) **Fibre Optic Cable** must be connected to **Sensor 1 (Start)** and the shorter (closer to the collar of the hole) **Fibre Optic Cable** must be connected to **Sensor 2 (Stop)**. Also, in order for this method to measure a valid VOD, the hole must be bottom primed.

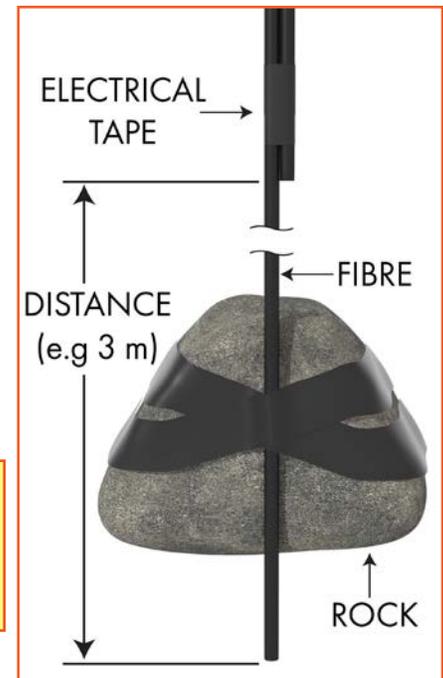
With this setup, the **Fibre Optic Transducers** are reusable and will need to be placed in a safe location. Connect the 30 m of coax cable to the **Fibre Optic Transducer** to place the **SpeedTrap™ Velocity Recorder** with the **Connection Hub** at another safe location. Ensure that strain relief is used in the cable as there is a possibility that the complete system can be pulled over the face of the shot.

4.9.2 Preparing the SpeedTrap™ Velocity Recorder

Connect the **SpeedTrap™ Connection Hub** to the **SpeedTrap™ Velocity Recorder**. Now connect the cable from **Fibre Optic Sensor 1** (the **Fibre Optic Cable** closer to the bottom of the hole) into port marked 1 on the **SpeedTrap™ Connection Hub**. Next connect the cable from **Fibre Optic Sensor 2** (the **Fibre Optic Cable** closer to the collar of the hole) into the port marked 2 on the **SpeedTrap™ Connection Hub**. Be sure to connect the Sensor 1 to port 1 and Sensor 2 to port 2. If done incorrectly, the test will fail.

Power on the **SpeedTrap™ Velocity Recorder**. Ensure the **Fibre Optic Sensors** are correctly positioned and connected with the **Fibre Optic Sensors**. They are on a passive system. When the light from the explosives travels down the **Fibre Optic Cable** to the sensor a voltage signal is then sent to the **SpeedTrap™ Velocity Recorder**. The lights will flash off when the signal is received. Ensure that the distance between the two ends of the **Fibre Optic Cable** has been entered properly into the **SpeedTrap™ Velocity Recorder**. When adjusting the separation distance, the value can be changed in increments of 10 cm between the length of 1 and 10 m. The closer that the actual distance is to the entered value, the more accurate the VOD measurement will be.

With the unit set, place the unit into monitoring mode by short pressing the **Affirmative Check** button. Review **Section 4.7.3** on the displayed information after the test.



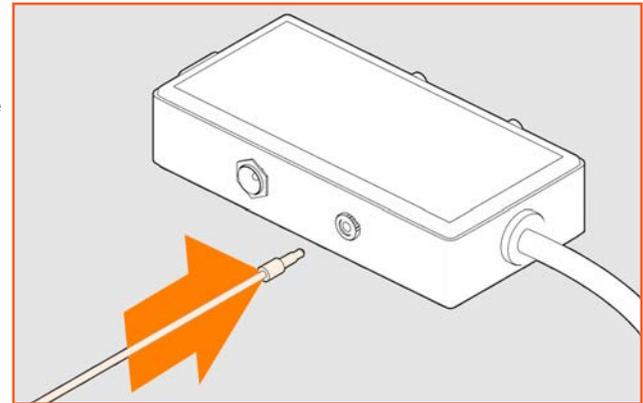
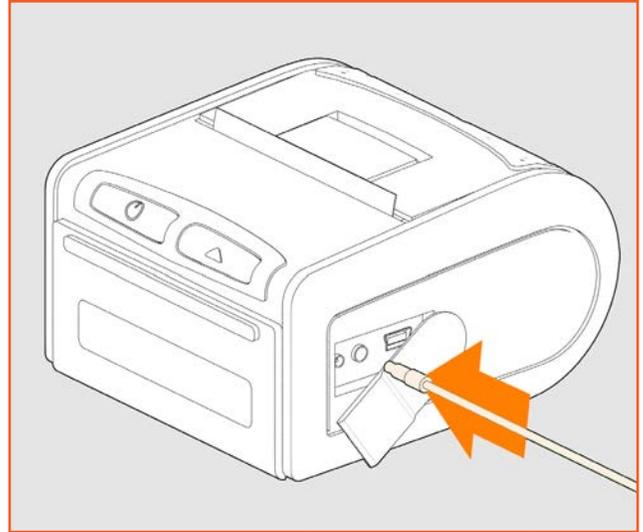
4.10 Printing the SpeedTrap™ Velocity Recorder Results

If you have purchased the optional **SpeedTrap™ Velocity Recorder Printer** you can print the **SpeedTrap™ Velocity Recorder** results in the field without the need of a computer.

Connect the **SpeedTrap™ Velocity Recorder Printer Connection Cable** from the **SpeedTrap™ Velocity Recorder Printer**, as shown in the image on the right.

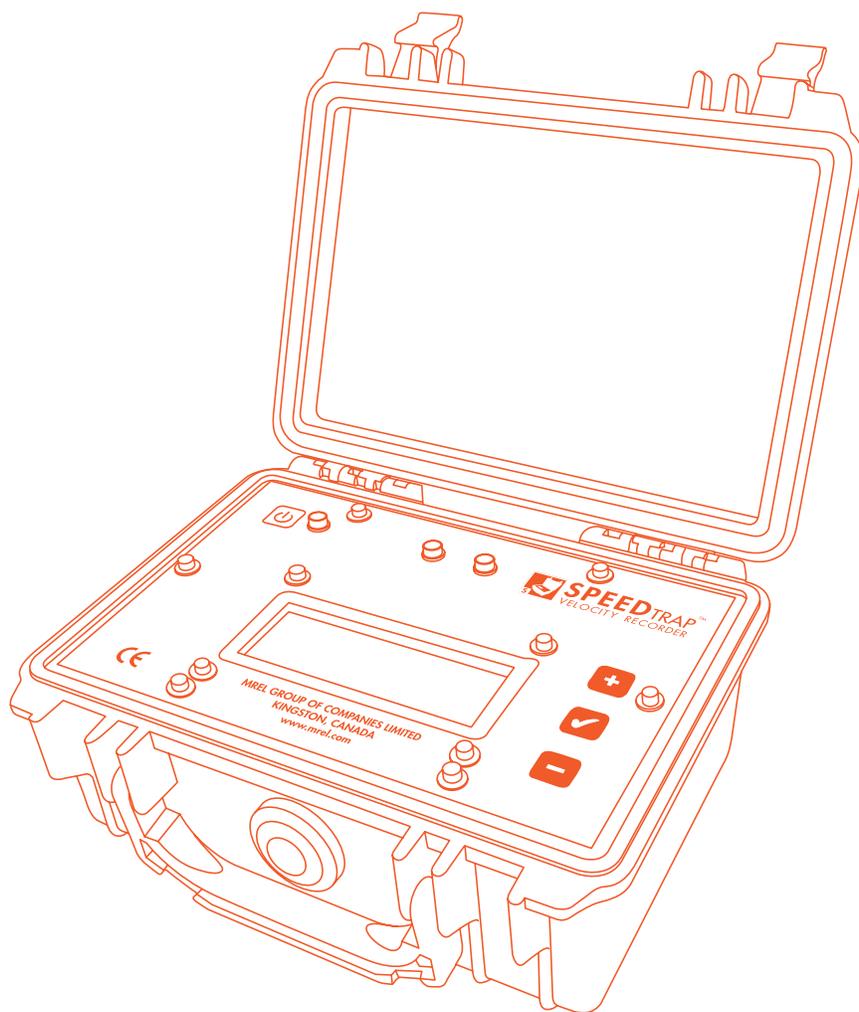
Next connect the other end of the **SpeedTrap™ Velocity Recorder Printer Connection Cable** to the **SpeedTrap™ Velocity Recorder Connection Hub**, as shown in the image to the right.

During the saving period after the test has been completed, there is an option to send the test results to the printer before the next test is conducted. If the tests results are desired to be printed all at once, within the menu there is an option to print a range of tests.



Chapter 5

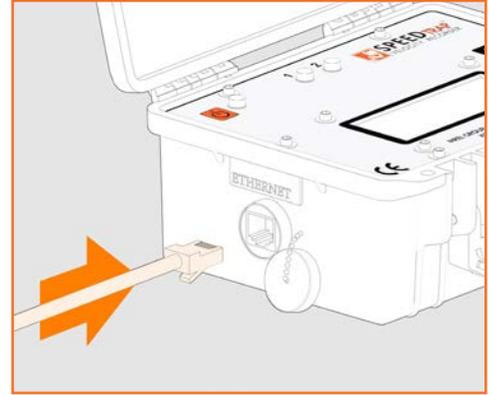
Ethernet Port



5.1 Location of the Ethernet Port

On the **SpeedTrap™ Velocity Recorder**, the **Ethernet** port can be found under the metal cap on the left side of the unit as shown in the image to the right.

The **Ethernet** port is a standard 10/100 port in an 8P8C connector commonly referred to as RJ45. This port is a standard straight connection, therefore the **SpeedTrap™ Velocity Recorder** will need to be plugged into a network (either a switch or router).



5.2 Default IP Settings

The **SpeedTrap™ Velocity Recorder** leaves the factory with the following default network settings:

IP address (IPv4): 192.168.1.100
Default Gateway (IPv4): 192.168.1.1
Subnet Mask (IPv4): 255.255.255.0

5.3 Adjusting IP Settings of the SpeedTrap™ Velocity Recorder

To adjust the IP address of the **SpeedTrap™ Velocity Recorder**, power the unit on. From the first screen, long press the **check mark**. Press the **minus** button four times (top of the next screen) to the line that is labelled "ETHERNET... ON". Short press the **check mark** and the screen will change to three rows of numbers. The first line is the IP address of the **SpeedTrap™ Velocity Recorder**. The second line is the default gateway and the third line is the subnet mask. Use the **plus** and **minus** buttons to move between the rows and a short press of the **check mark** to enter the line. Use the **plus** and **minus** to change the values of each group. A short press of the **check mark** will move between the groups of numbers. To save the changes, long press the **check mark**. This will bring the menu back to the system settings menu. Long press of the **check mark** will save all of the changes and return the starting menu.

The IP and Default Gateway only has the ability to have the first set of numbers to have the following option: 192 (default), 172 and 10. If your IP address of the network starts with any other digits, please contact **MREL**. Details are in **Chapter 7**. The remaining three sets of values have the ability to be changed to any value between 0 and 255. If you are unsure of which IP address to set the unit to, please contact your system administrator.

5.4 Accessing the SpeedTrap™ Velocity Recorder via a Browser

5.4.1 Results Tab

With the **SpeedTrap™ Velocity Recorder** connected to the local network, open your favorite browser and enter the IP address of the **SpeedTrap™ Velocity Recorder** in the address bar (for example 192.168.1.100, the default address). The screen that should appear will resemble the image to the right.

As shown in the image, the page will display the **Serial Number** of the unit as well as all of the results of the tests that have been stored in memory.

#	Name	Date	Time	Sensor	Status	Distance	Sample	VOD	Select
1		2015-09-08	11:03:19	FIBRE	OK	10 cm	99.0 µs	1010.1 m/s	■
2		2015-09-08	11:03:23	FIBRE	OK	10 cm	499.0 µs	200.4 m/s	■
3		2015-09-08	11:03:25	FIBRE	OK	10 cm	999.1 µs	100.1 m/s	■
4		2015-09-08	11:03:26	FIBRE	OK	10 cm	9999.6 µs	10.0 m/s	■
5		2015-09-08	11:03:27	FIBRE	OK	10 cm	50002.2 µs	2.0 m/s	■
6		2015-09-08	11:03:29	FIBRE	OK	10 cm	100.0 ms	1.0 m/s	■
7		2015-09-08	11:03:31	FIBRE	OK	10 cm	500.0 ms	0.2 m/s	■
8		2015-09-08	11:04:39	WIRE	OK	10 cm	99.0 µs	1010.1 m/s	■
9		2015-09-08	11:04:41	WIRE	OK	10 cm	499.0 µs	200.4 m/s	■
10		2015-09-08	11:04:42	WIRE	OK	10 cm	999.1 µs	100.1 m/s	■
11		2015-09-08	11:04:43	WIRE	OK	10 cm	9999.6 µs	10.0 m/s	■
12		2015-09-08	11:04:44	WIRE	OK	10 cm	50002.1 µs	2.0 m/s	■
13		2015-09-08	11:04:45	WIRE	OK	10 cm	100.0 ms	1.0 m/s	■
14		2015-09-08	11:04:48	WIRE	OK	10 cm	500.0 ms	0.2 m/s	■
15		2015-09-16	22:22:55	FIBRE	ERROR	10 cm	n/a	n/a	■

Each test result includes the test number, User Entered test name, the date of the test, the time of the test, the sensor type used, the status of the result of the test (either **OK** or **ERROR**), the Distance that the sensors have been separated, the time between the start and stop signal, the VOD of the resulting distance divided by the time and a selectable box.

Near the top of the screen are different operations for the manipulation of the stored data. The **Delete All Records** button will allow the memory of the unit to be cleared. When the button is selected, a pop up screen requires the user to confirm the deletion operation or will allow for the cancelling of the operation. In the middle part of the screen allows for the selected tests to be outputted into a **CSV** (comma separated values) format or an **XML** (Extensible Markup Language) format. This will allow the user to quickly extract the information from the unit to a usable format. The next section is a tick box that will allow the user to quickly select all of the tests in order for their export in either **CSV** or **XML** format. The user can either select the individual line tests for export or the quick check for all tests.

This is the main screen of the menu of the **SpeedTrap™ Velocity Recorder**. Along the top of the screen are three tabs. The current tab is the **Results tab**. When the **Options tab** is selected, the following screen will resemble the image to the right.

5.4.2 Options Tab

In the **Options tab**, the user can change the internal settings of the **SpeedTrap™ Velocity Recorder**. If there is a particular **Test Series Name** for the explosive testing that is being performed, the user can input that name and it will appear in the test line on the results page under **Name** and will be part of the test result when the data is downloaded. If the user would like to enter their **Company Name** to be stored with the data in the file output. The **Current Time** button will set the **SpeedTrap™ Velocity Recorder** to the local time on your computer in one click. The sensor type can be changed (if the optional choice has been purchased) by selecting the desired radio button for the sensor type. The User **MUST** then click the **Change Sensor** button to confirm the change.



The **Adjustable Distance** (if purchased) can be changed between 5 and 100 cm in 1 cm increments and 1 and 10 m in 10 cm increments. There is two ways that the value can be changed. The slider can be moved until the desired value is shown in the box or the number can be directly typed in. The value can only be integers from 5 to 100 cm and single decimal from 1 to 10 m. The Change Distance button **MUST** be selected to confirm the change.

The next line will allow the user to change the IP address of the **SpeedTrap™ Velocity Recorder** unit. The unit has 3 selections available for the network address. The only selections that are available are: 192, 172 and 10. The next 3 sets of values can be manually typed in between 0 and 255. The Subnet is fully selectable to the user. The **Gateway** is fully selectable to the user. With the changes made, the **Change Network Settings MUST** be selected to confirm the change. This will immediately change the local IP address of the **SpeedTrap™ Velocity Recorder** and the user **MUST** then type in the new IP address into the browser that is being used.

Note: The Adjustable Distance on this screen is displayed in centimeters. Therefore 1000 cm is 10 m. Also, on this screen, the accuracy of the probe separation can be set to 1 cm unlike from the onboard menu, which uses 1 cm accuracy between 5 and 100 cm and 10 cm between 1 m and 10 m.

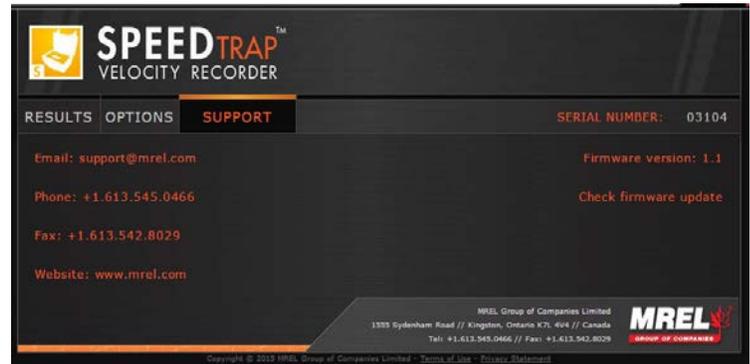
5.4.3 Support Tab

The final tab is the **Support Tab**. When the **Support Tab** is selected, the following screen will resemble the image to the right. The **Support Tab** will allow the user to quickly find the contact details for us.

If the user clicks on the email of support@mrel.com, the default mail program will open with an email addressed to the address.

If the web site address is clicked on, the default browser will open with the website started. The user also has the ability to

check for any firmware updates on the server. If the user clicks on **Check Firmware Update**, the page will contact our server to confirm that the **SpeedTrap™ Velocity Recorder** has the latest firmware in the unit. This page is also displaying the local firmware value.



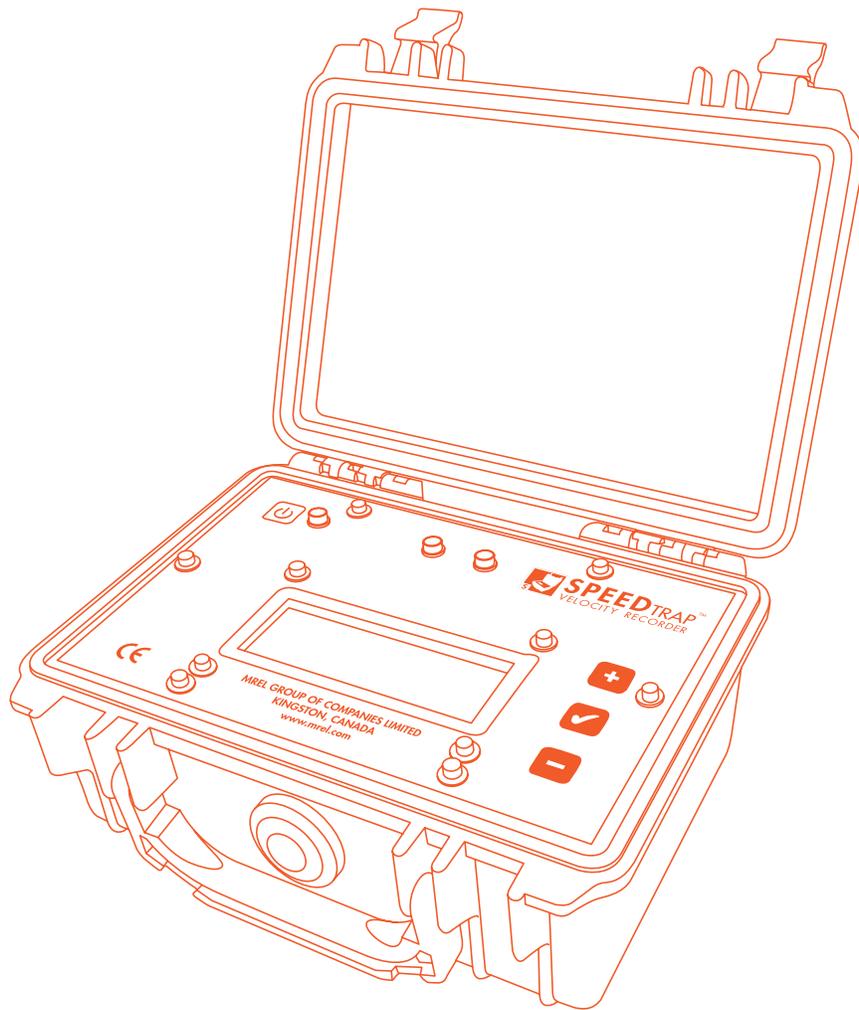
5.5 Networking Problems

If the networking port of the **SpeedTrap™ Velocity Recorder** is used with a network switch and not connected to a router on an isolated network, ensure that the network port on the computer is using same subnet address (for example: 192.168.1.xxx where xxx is any number between 0 and 255 and just not the same as the **SpeedTrap™ Velocity Recorder** which is 100 by default). Ensure that the computer is using a static IP address in the above range and not using DHCP. Without a router in the network to assign DHCP IP addresses, the computer will not be able to view the **SpeedTrap™ Velocity Recorder** on the network.

If a router or switch is not available, an **Ethernet Crossover Cable** can be used in place of the switch and/or router.

Chapter 6

Using the SpeedTrap™ Velocity Recorder Software for Windows



6.1 Install the SpeedTrap™ Velocity Recorder Software

To install the **SpeedTrap™ Velocity Recorder** software, insert the USB stick that was received with the **SpeedTrap™ Velocity Recorder**. This software will only work with the RS-232 port for downloading. This software is not compatible with the Ethernet port.

Double-click on “**Setup.exe**” (which may appear as “**Setup**”).

In the screen to the left, click ‘**Install**’.

Choose **I Agree**, then click **Next**, then **Next** again.



6.1.1 Uninstalling the SpeedTrap™ Velocity Recorder Software

To uninstall the **SpeedTrap™ Velocity Recorder** software, go to Control Panel – Programs and Features, then right-click on **SpeedTrap** and choose **Uninstall/Change**. With the Remove the application from this computer radio button selected, click **OK**.

6.2 USB Serial Port

If your computer does not have a serial port, use the included USB adapter. The installation procedure will vary with the version of Windows that is installed on the computer. Please refer to the packaging for your version requirements.

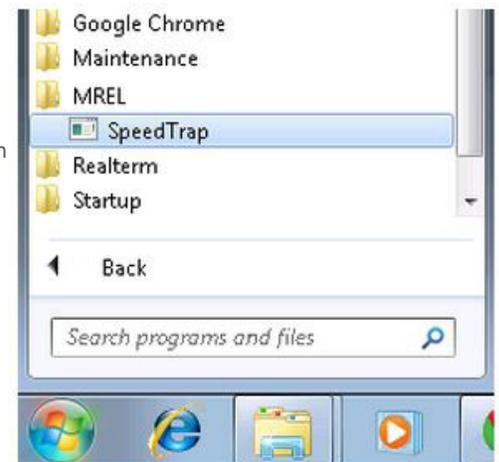
Note: A restart of the computer may be required after the USB adapter has been inserted into the USB port for proper operation. Using Device Manager, ensure that the port is operating properly if there is any problems.

6.3 Starting the SpeedTrap™ Velocity Recorder Software

With the serial port operational, connect it to the Connection Hub of the **SpeedTrap™ Velocity Recorder**. Turn on the **SpeedTrap™ Velocity Recorder**.

The software is started by clicking on **Start – All – Programs – MREL – SpeedTrap** as shown to the right.

A desktop shortcut icon will also be created for the user’s convenience.



6.3.1 The Download Tab

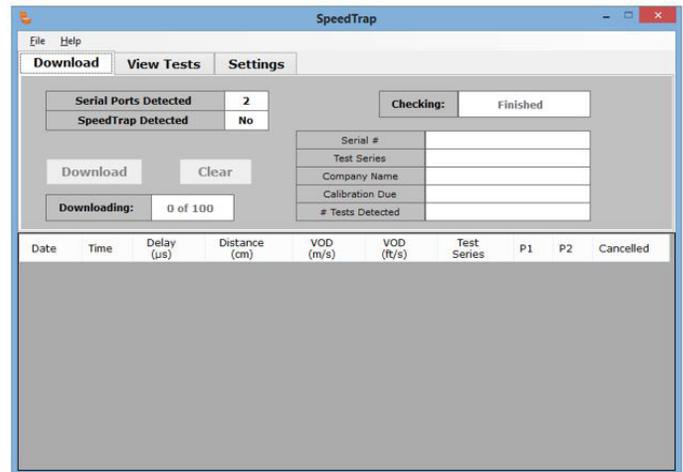
When the software starts with the **SpeedTrap™ Velocity Recorder** connected and powered on, the following screen will be displayed.

With the **SpeedTrap™ Velocity Recorder** connected and detected as shown, the **Download** and **Clear** buttons are available.



If the **SpeedTrap™ Velocity Recorder** is **NOT** detected, the following screen will be displayed.

If the **SpeedTrap™ Velocity Recorder** is not detected, ensure that the serial port is operating correctly and the unit is powered on.



The **Download Tab** provides the information in the unit including **Serial Number**, the user entered **Test Series Name**, the user entered **Company Name**, the **Calibration Due Date** as well as the number of tests detected in the unit.

The user will click on **Download** to download the test information from within the unit. The **Clear** button will erase the memory of the unit.

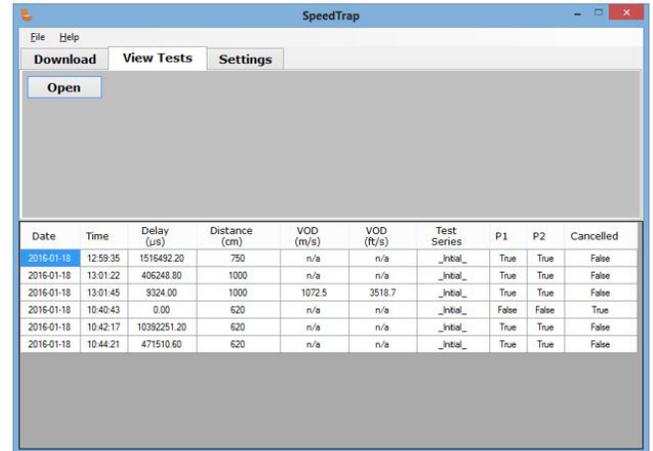
With the **Download** button selected, the following screen will be displayed.



Please notice that below the **Download** button, the **Downloading** window shows the progression of the data streaming through the serial port. The two numbers will be equal when the downloading is complete.

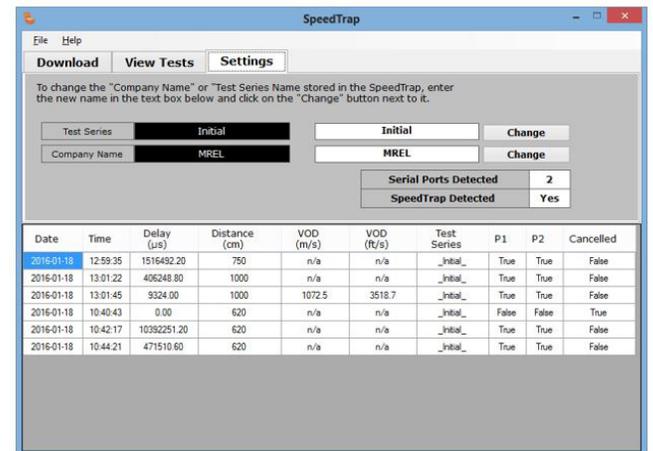
6.3.2 View Tab

The **View** tab is used to view all of the data that has been downloaded to the local computer. The **Open** button will open all of the local records.



6.3.3 Settings Tab

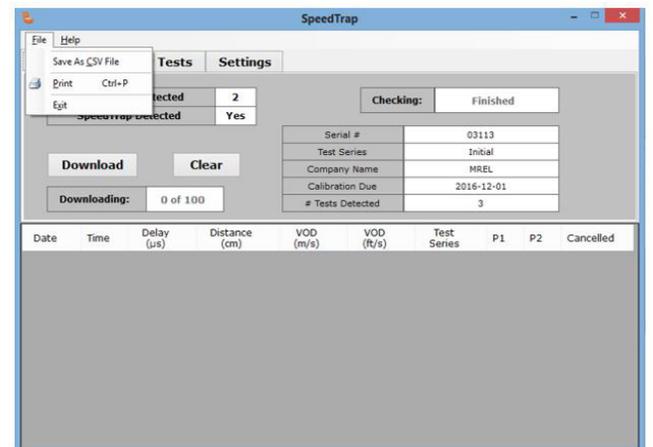
The **Settings** tab will allow for the changing of the **Test Series** and **Company Name**. The user will change the information in the white box on the right side and then click the **Change** button. Once the **Change** button has been clicked, the text to the left will not change immediately. The data has been stored in the unit and can easily be confirmed by closing the program and re-opening it.



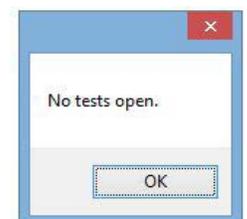
6.4 Menu Structure

6.4.1 File Tab

In the **File** tab, there is a selection of options. In order to use the options, a file must be opened. Refer to **6.3.2** to open files.

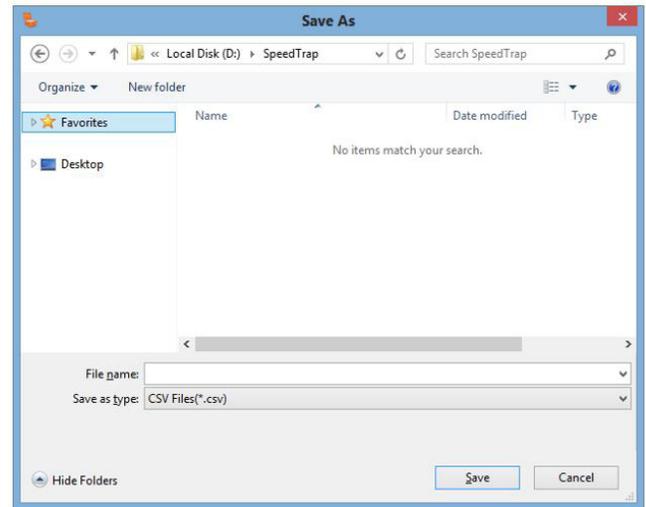


If no files have been opened, the following window will appear.



With the files opened, the following window will appear when **Save As CSV File** is selected.

Within file name, enter the desired name and navigate to the desired location to save the file.

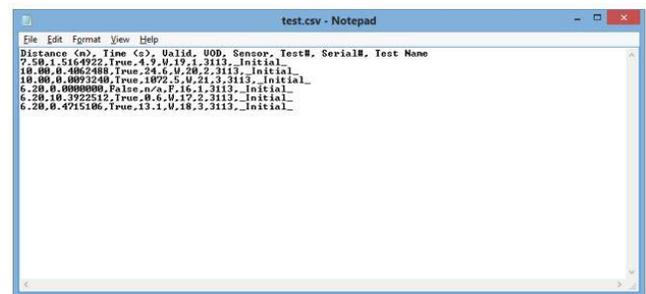


Upon entering the file name and location, the following window will appear when the save button is selected.



The CSV (comma separated values) file will save the following information: Distance (m), Time (s), Valid, VOD, Sensor, Test#, Serial#, Test Name

This is shown in the image of the CSV file.



6.4.2 Print

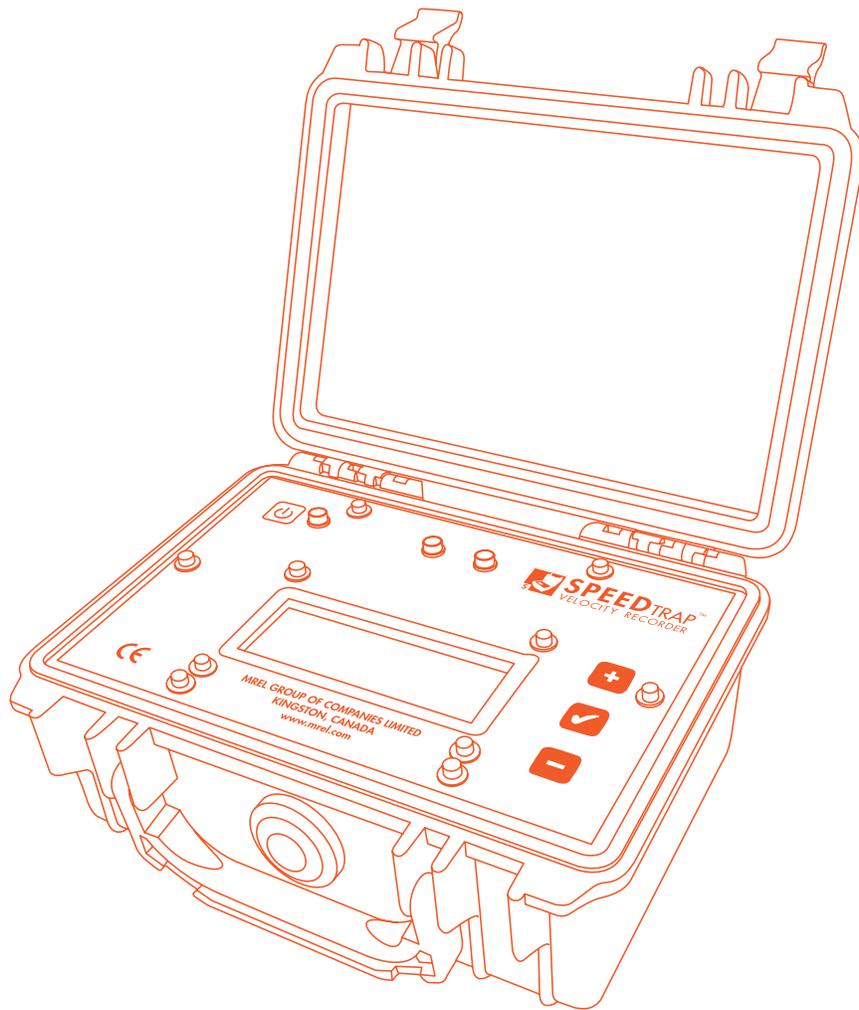
The print function will send the test data that has been opened to the desired printer. It will include the header of the current time and date that the data has been printed. Below is the information as shown in the **View** tab.

6.4.3 Exit

This will close the **SpeedTrap™ Velocity Recorder** Software.

Chapter 7

Contacting MREL for Technical Support



7.1 Contacting MREL

MREL Group of Companies Limited

Blasting Instrumentation Team

1555 Sydenham Road
Kingston, Ontario K7L 4V4
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Email: support@mrel.com

Website: www.mrel.com

MREL looks forward to providing you with assistance.



MREL is committed to product innovation; accordingly product may undergo specification improvements without notice.

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