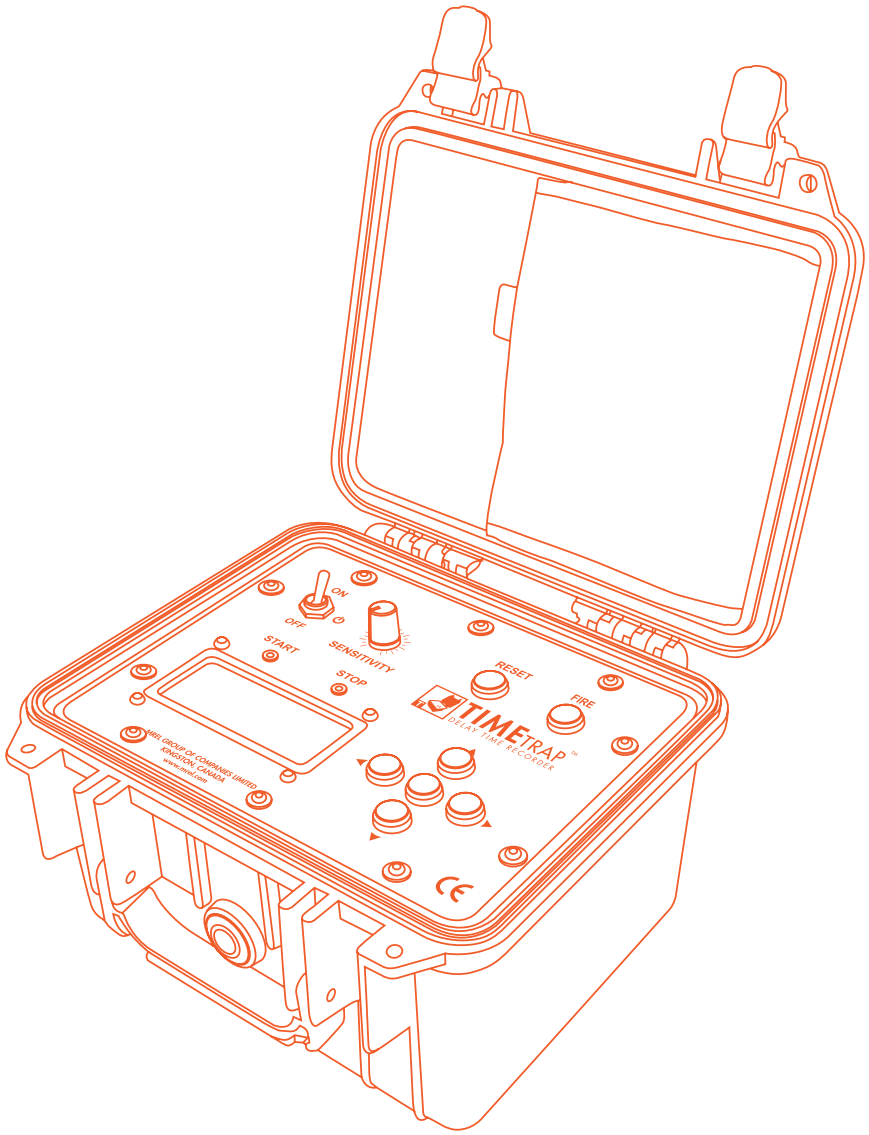
TIMETRAP™
DELAY TIME RECORDER

Operations Manual
Edition 2.0



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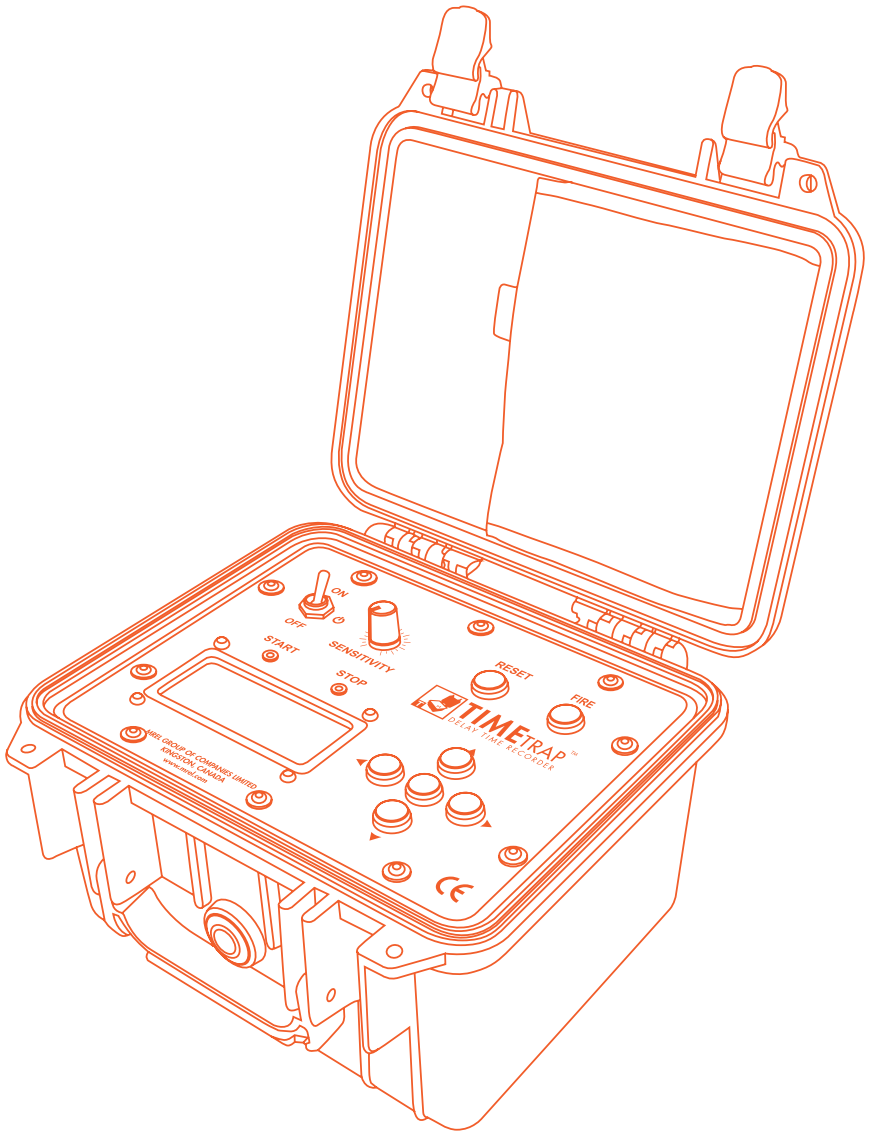
Chapter 1
Getting Started



1.1 Ensuring That All TimeTrap™ Hardware Has Been Received

Below is a list of equipment included with the purchase of **TimeTrap™ Delay Time Recorder**. Photographs of the equipment can be found in **Chapter 3**. There are two different models of the **TimeTrap™ Delay Time Recorder**. There is a **Delay Time Recorder System**, **Full Edition** and a **TimeTrap™ Delay Time Recorder**, **EBC Only Edition**. Please refer to the model ordered and the model delivered from the **Pre-Delivery Packing Report**.

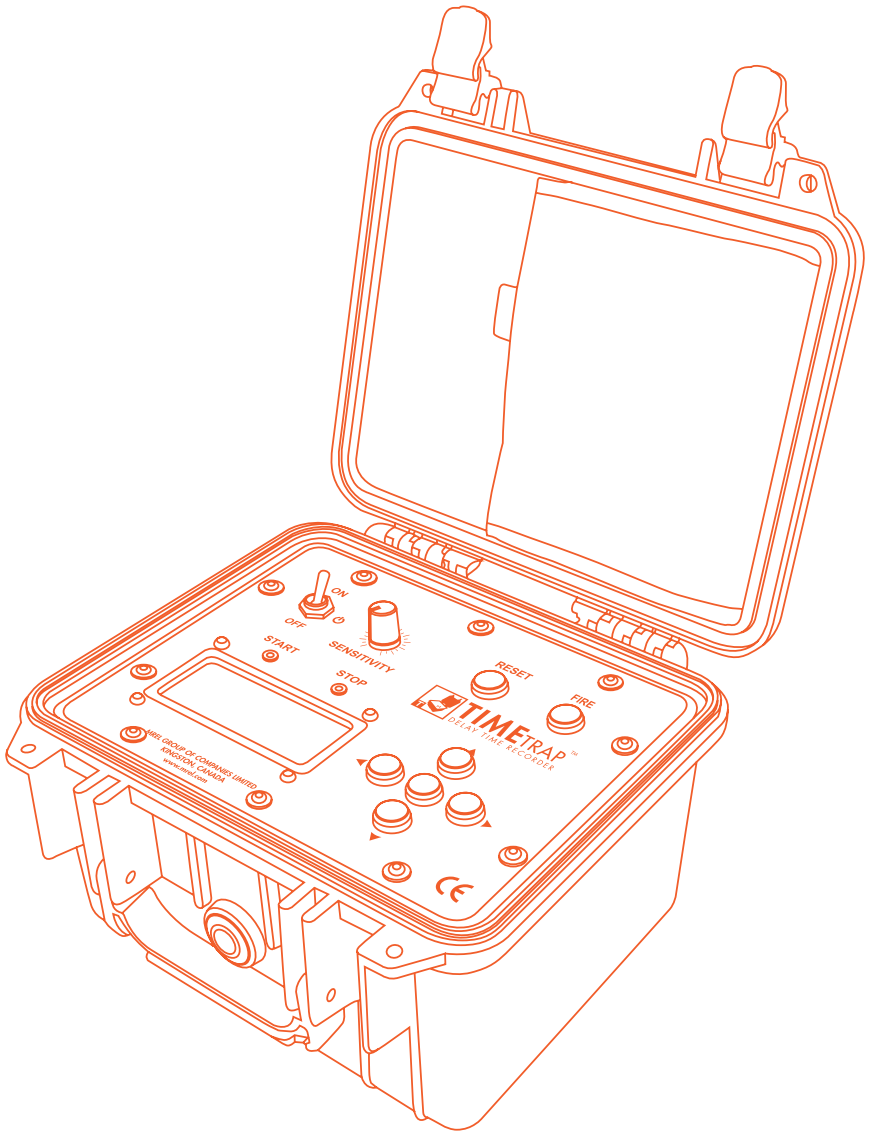
The items included in the **TimeTrap™ Delay Time Recorder System**, **Full Edition** is as follows:

1. **TimeTrap™ Delay Time Recorder**
2. **Sensor Pack** including:
    a. **Piezo-Electric Pressure Sensor**
    b. **Optical Fibre Sensor** x 2
    c. **Shocktube Adaptor** x 2
    d. **Photo Sensor** x 2
    e. **Wire Burst Sensor** x 2
3. **Signal Cable BNC to SMA-Male** – 30 metres long x 2
4. **TimeTrap™ Power Cable** – Country Specific
5. **TimeTrap™ Operations Manual**
6. **TimeTrap™ Calibration Certificate**
7. **Customer 1 year Warranty Certificate**

The items included in the **TimeTrap™ Delay Time Recorder System, EBC Only Edition** is as follows:

1. **TimeTrap™ Delay Time Recorder**
2. **Sensor Pack** including:
    a. **Piezo-Electric Pressure Sensor**
    b. **Photo Sensor**
3. **Signal Cable BNC to SMA-Male** – 30 metres long x 2
4. **TimeTrap™ Power Cable** – Country Specific
5. **TimeTrap™ Operation Manual**
6. **TimeTrap™ Calibration Certificate**
7. **Customer 1 year Warranty Certificate**

Chapter 2
Introduction



2.1 Background

The **TimeTrap™ Delay Time Recorder** is another recorder in the **MREL Group of Companies Limited** family to measure detonator and detonator accessories delay time and short sample velocity of detonation or deflagration.

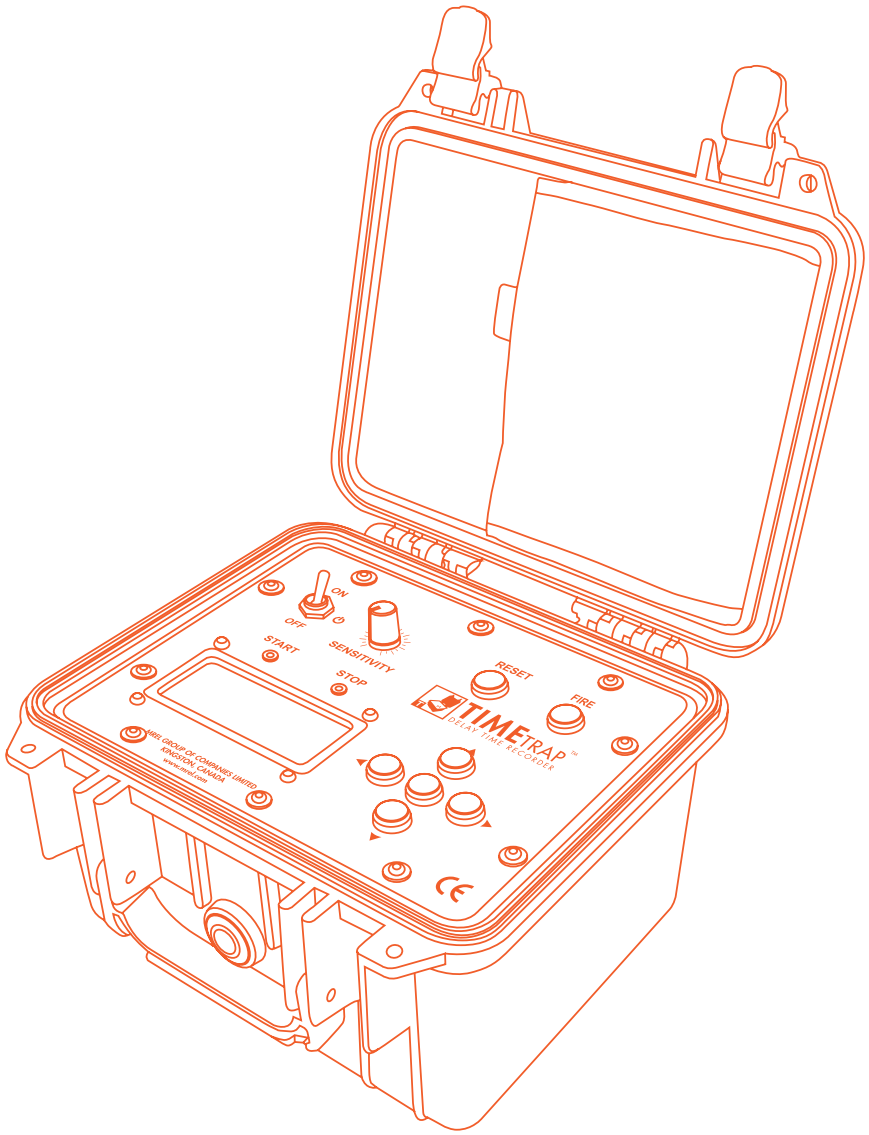
2.2 Safety Considerations

STOP

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

The **TimeTrap™ Delay Time 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 **TimeTrap™ Delay Time 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 **TimeTrap™ Delay Time Recorder System, Full Edition** are shown below.

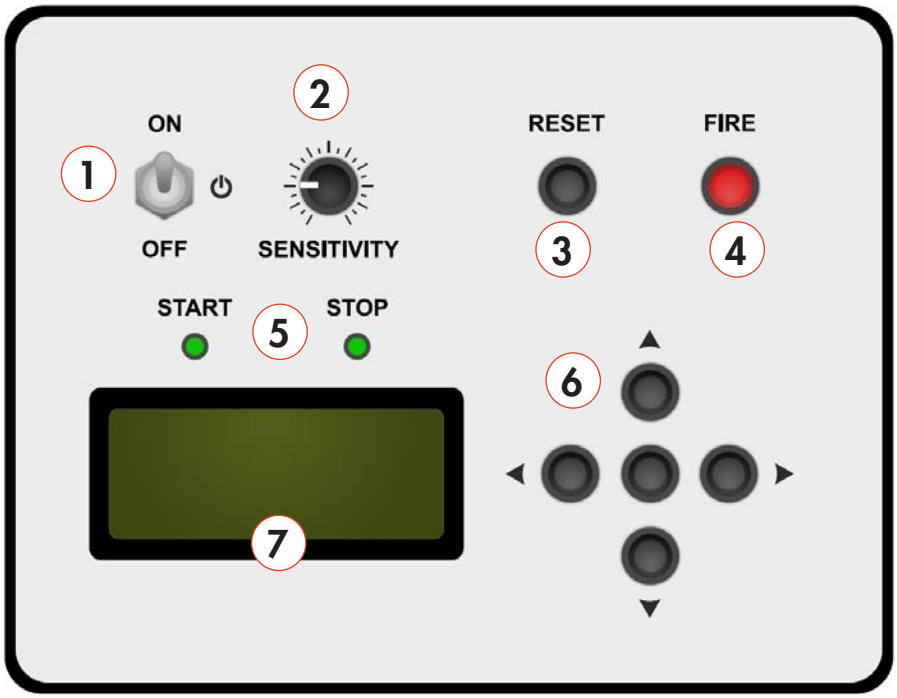
1. **TimeTrap™ Delay Time Recorder**
2. **Removable Sensor Pack** including:
   a. **Piezo-Electric Pressure Sensor**
   b. **Optical Fibre Sensor** x 2
   c. **Shocktube Adaptor** x 2
   d. **Photo Sensor** x 2
   e. **Wire Burst Sensor** x 2
3. **Signal Cable BNC to SMA** – 30 metres long x 2
4. **TimeTrap™ Power Cable** – Country Specific
5. **TimeTrap™ Calibration Certificate**
6. **TimeTrap™ Operations Manual**

3.2 The TimeTrap™ Delay Time Recorder

The **TimeTrap™ Delay Time Recorder** is a digital chronometric device designed for measuring time delay of detonating and deflagrating explosives and delay time of electric and nonelectric detonators and accessories. It is a small and portable unit suitable for field use.

MAIN CONTROL PANEL

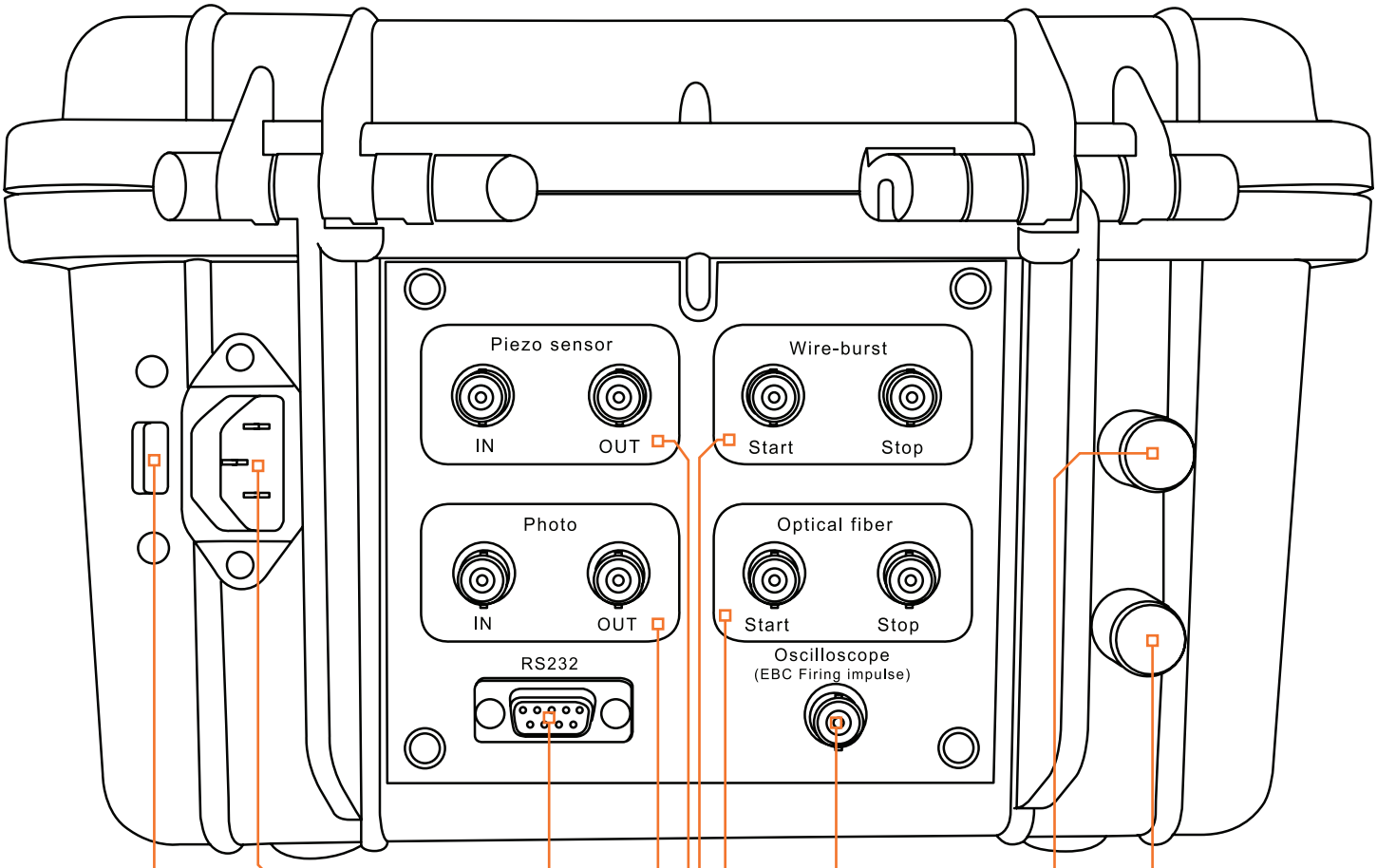
Displayed to the right is an image of the main control panel.



1. **On/Off** switch
2. **Sensitivity dial** for setting the sensitivity of **Piezo-Electric pressure sensor**.
3. **Reset** button
4. **Fire** button
5. **LED diodes** for indication of wire continuity (**Start** and **Stop**).
6. 5 circular buttons for:
   a. Choosing parameters (marked with arrows ◀ and ▶).
   b. Setting parameters (marked with arrows ▲ and ▼).
   c. Confirming parameters (no markings) **centre button**.
7. **Digital display** that shows device settings and measuring results.

BACK PANEL

The back panel of the unit is where all of the connections to the sensors are made. Below is a diagram of the back panel.



Power Voltage Selection Switch (User selectable 115/230V)

Power Port

RS232 PC interface DB9 connector

Photo input and output (BNC Connectors)

Piezo-Electric Pressure Sensor input and output (BNC Connectors)

Firing Current Output (connectors for firing electric detonators)

Firing Impulse Output Signal for oscilloscope readout (BNC connector)

Start and Stop inputs for Optical fibre signal (BNC connectors)

Start and Stop inputs for Wire–burst signal (BNC connectors)

STOP

Before plugging the TimeTrap™ Delay Time Recorder into the mains, ensure the Power Voltage Selection Switch is set to your local mains voltage. Serious damage to the TimeTrap™ Delay Time Recorder unit will occur if the Power Voltage Selection Switch is set to the improper value if the unit is plugged in.

Piezo-Electric Sensor

In – Connection of the **Piezo-Electric Pressure Sensor** to the instrument
Out – Connection to external equipment (*not commonly used*)

Wire-Burst

Start – Connection of the break wire closest to the initiating detonator
Stop – Connection of the break wire farthest from the initiating detonator

Photo

In – Connection of the **Photo Sensor**
Out – Connection to external equipment (*not commonly used*)

Optical Fiber

Start – Connection to the fibre optic cable closest to the initiating detonator
Stop – Connection to the fibre optic cable farthest from the initiating detonator

RS232 PC Interface

This is a port that will stream text data of the settings and results for each test to a serial communication device. Refer to **Chapter 5** for details on the use of this port.

Oscilloscope (EBC Firing Impulse)

This port will generate an output signal for triggering other equipment in the shape of a square wave pulse with a duration selected to function the **Electric Blasting Circuit** (**EBC**) (*not commonly used*).

Power Port

This port uses the standard IEC 60320 C13 port common on most desktop computers.

Power Voltage Selection Switch

This switch can be manually adjusted between **115 Volts AC** to **230 Volts AC**. This switch needs to be adjusted to match local voltage.

Firing Current Output

This connection point is for the connection of **Electric Detonators** to the **TimeTrap™ Delay Time Recorder**.

3.3 Removable Sensor Pack

The items that are included with the **Full Edition** in the **Removable Sensor Pack** are:

1. **Piezo-Electric Pressure Sensor** x 1
2. **Optical Fibre Sensor** x 2
3. **Photo Sensor** x 2
4. **Shocktube Adaptor** x 2
5. **Wire Burst Adaptor** x 2

3.3.1 Piezo-Electric Pressure Sensor

This sensor is designed to be used to measure a variety of parameters. This includes fuse head initiation and total delay time. This sensor has a magnetic base for attachment to a metal housing.

3.3.2 Optical Fibre Sensors

This sensors will allow the use of fibre optic cable to transmit light from the explosive and will turn the light into an electric signal for the instrument to use and measure.

3.3.3 Photo Sensors

Used to measure light from the explosive directly and turn the light energy into an electrical signal.

3.3.4 Shocktube Adaptors

Will allow the fitting of the **Photo Sensor** directly to the shocktube by unscrewing the connector on the end of the **Photo Sensor** and attaching the **Shocktube Adaptor**.

3.3.5 Wire Burst Adaptors

Will allow the use of a wire to be placed on the explosive that will send a signal when the circuit is broken.

3.4 BNC to SMA Coax Cable

This cable is used to connect the sensor to the **TimeTrap™ Delay Time Recorder**. Every sensor has an **SMA connector** and the **TimeTrap™ Delay Time Recorder** has **BNC connectors**.

3.5 Power Cable

The power cable will be supplied match the country of sale.

3.6 Calibration Certificate

The unit will be provided with a Calibration Certificate

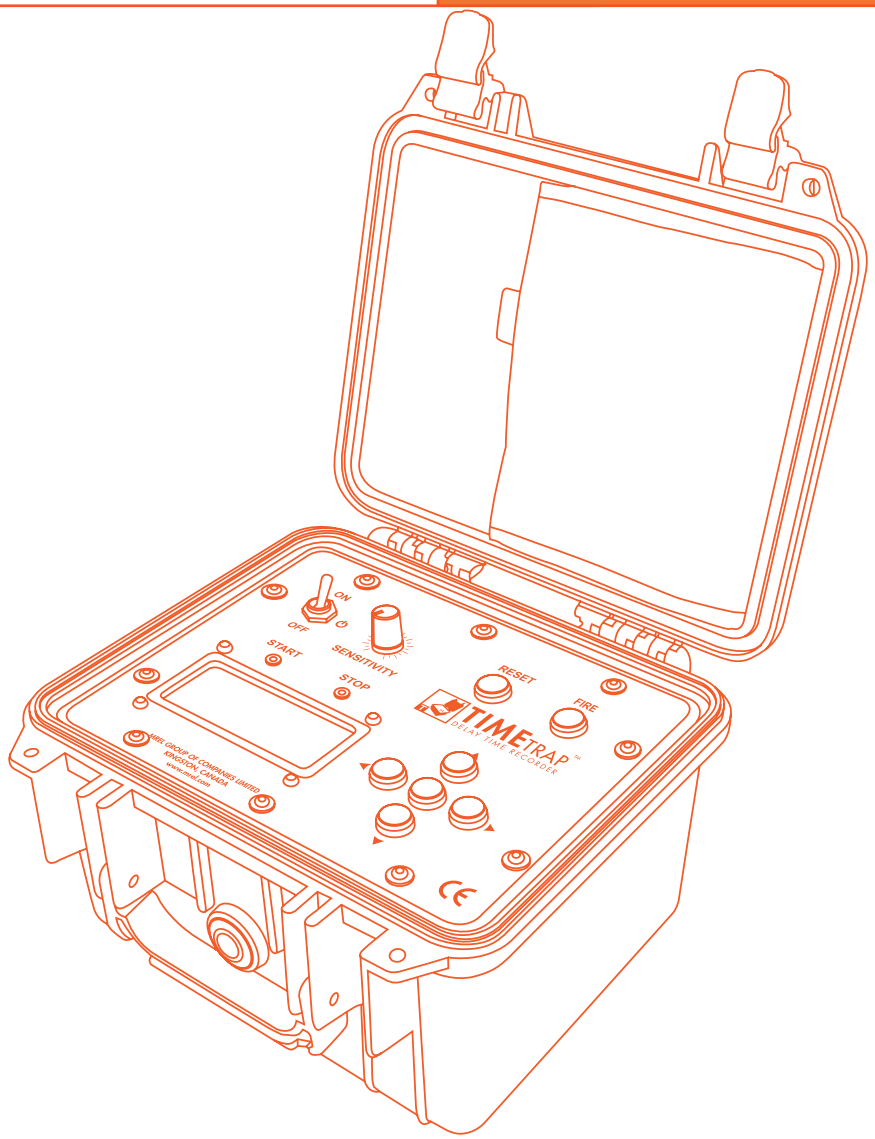
3.7 Operations Manual

This manual that is currently being read.

3.8 TimeTrap™ Delay Time Recorder Technical Specifications

Power supply	115 or 230 Volts AC User Selectable
Sensor Inputs	Piezo–Electric Pressure Sensor Photo Sensor Wire Burst (start and stop) Optical Fibres (start and stop)
Outputs for oscilloscope	Firing impulse signal from the Electric Blasting Circuit Signal from Piezo–Electric Sensor (amplified) Signal from Photo Sensor (forwarded)
Output to PC	RS232 Serial port
Firing impulse	
Amperage	0.5 mA — 6 A (selectable)
Accuracy	Better than 1 %
Lasting period	0.5 — 20 ms (selectable)
Voltage	Up to 40 V
Ohmmeter	
Measuring range	0.0 — 20.0 Ω
Measuring accuracy	0.1 Ω
Functions	Grounding, resetting
Display	Monochromatic, 4 x 20 characters

Chapter 4
Using the TimeTrap™ Delay Time Recorder



The **TimeTrap™ Delay Time Recorder** supports four methods of measuring listed below:

1. **Electric System Method**
2. **Nonelectric System Method**
3. **Impact Fuse Method**
4. **Wire Burst and Optical Sensor Method**

4.1 Electric System Method

The **Electric System Method** measures the time and sets the amperage of the bridge wire burst, the time of the fuse-head initiation and the overall delay accuracy of the electric detonators.

To use the **Electric System Method**, the following equipment is required:

- **TimeTrap™ Delay Time Recorder**
- **Photo** or **Piezo-Electric Pressure Sensor** with included cables
- Steel housing for protection from the blast of the detonator and the ability to mount the sensor(s) – not supplied

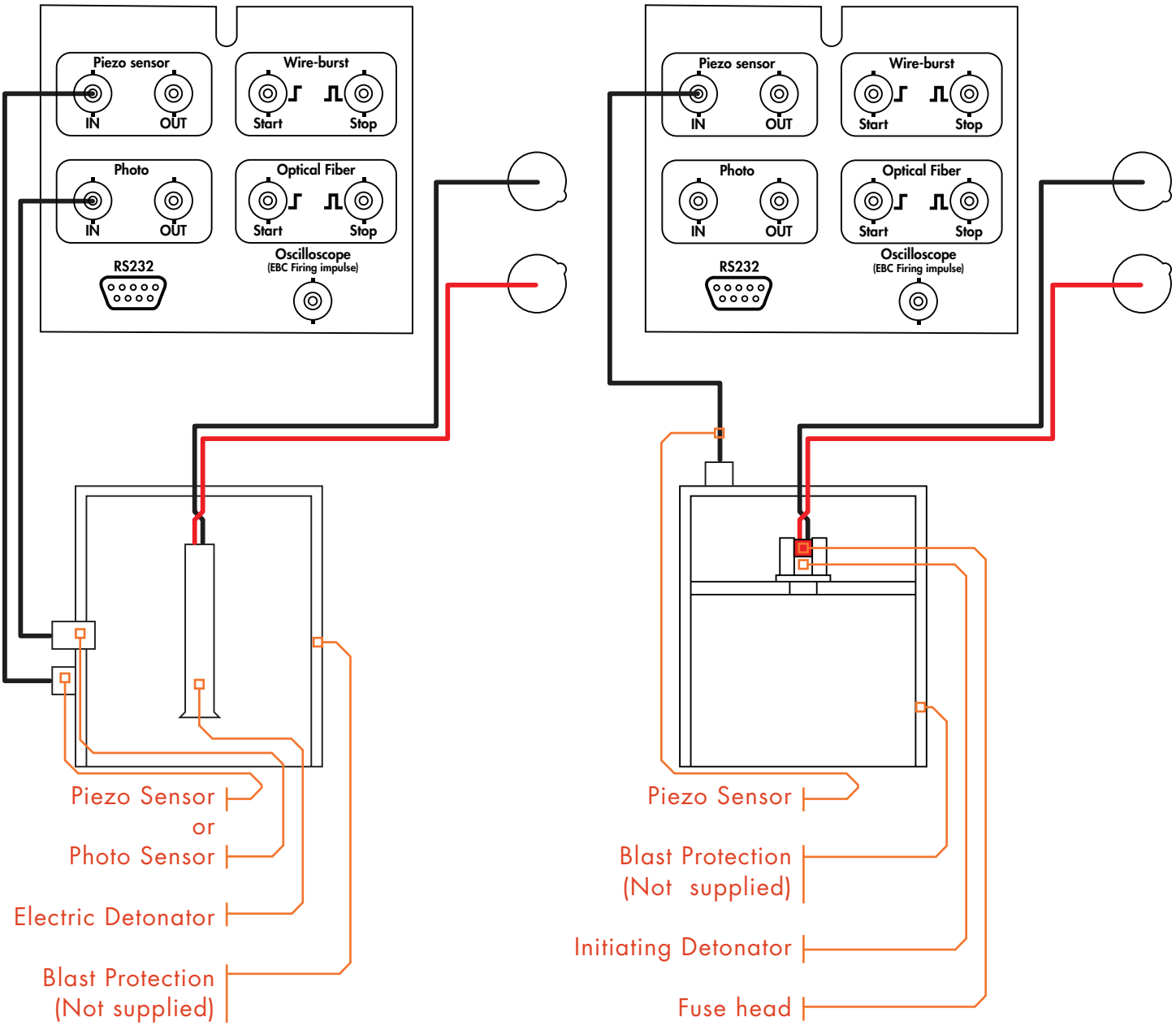
4.1.1 Test Setup Procedure

1. Demarcate the charge detonation area.
2. Place the **TimeTrap™ Delay Time Recorder** in a safe location relative to the detonation area.
   a. If a safe location cannot be found within 30 metres, barricades will be required.
3. Place the steel housing in the demarcated area.
4. Run the signal line from the steel housing to the **TimeTrap™ Delay Time Recorder**.
5. Attach the **Piezo-Electric Pressure Sensor** to the outside of the steel housing using the integrated magnet or insert the **Photo Sensor** into a pre drilled and tapped hole in the steel housing.
6. Use the **SMA connector** on the cable to attach the sensor.
   a. Ensure the cable is connected properly otherwise damage will occur to the cable.
7. Attach the **BNC terminal** to the correct port on the **TimeTrap™ Delay Time Recorder**.
   a. If using the **Piezo-Electric Pressure Sensor**, connect the cable to **Piezo Sensor In**.
   b. If using the **Photo Sensor**, connect the cable to **Photo In**.
8. Run the firing line from the **TimeTrap™ Delay Time Recorder** to the steel housing.
   a. Ensure that the firing line is shunted to eliminate the build up of stray power.
   b. Ensure proper separation of the firing line from the signal line of at least 1 metre.
9. Connect the firing line to the detonator.
   a. Wait to connect the detonator to the **TimeTrap™ Delay Time Recorder.**
10. Switch on the **TimeTrap™ Delay Time Recorder**.
11. Press the **central button** to enter the main menu.
12. Using buttons ◀ and ▶ choose **Electric system**.
13. Confirm the choice by pressing the **central button**.
14. Adjust the amperage of **Activating current** within the range 0.5 mA — 6 A.
    a. Buttons ◀ and ▶ are used for positioning the cursor onto the digit that will be changed.
    b. Buttons ▲ and ▼ are used for changing the values of that digit.
15. Confirm set value by pressing the **central button**.
    a. Recommended amperage should be within the range $i_s \leq i \leq 2\ i_s$ where (i_s is declared current for serial firing of the defender).
16. Set **firing impulse duration** within the range 0.5 ms to 20 ms.

a. Buttons ◀ and ▶ are used for positioning the cursor onto the digit that will be changed.
b. Buttons ▲ and ▼ are used for changing the value. Maximum resolution is 0.1 ms.

17. Confirm set value by pressing the **central button**.
    a. Recommendation: For standard types of detonators set the value to 10 ms.
18. Set trigger delay time within the range 0.1 to 999ms.
    a. Buttons ◀ and ▶ are used for positioning the cursor onto the digit that will be changed.
    b. Buttons ▲ and ▼ are used for changing the value. Maximum resolution is 0.1 ms.
19. Confirm set value by pressing the **central button**.

Note: Trigger delay time is a period within which the input that is used for stopping the measuring will be inactive. This setting is mandatory when detonator firing time is measured by piezo–electric pressure sensor — in order to avoid activation of the fuse–head to cause stopping of detonator delay time measuring.



20. Recommended time delay should not be higher than 30 % of total nominal value of detonator delay.
21. Set sensitivity of **Piezo–Electric Pressure Sensor** using potentiometer **Sensitivity**.
    a. Recommendation: For most part of **Piezo–Electric Pressure Sensors** the value should be set on the second notch.
22. Attach detonator leads to the **Firing Current Output** on the back of the **TimeTrap™ Delay Time Recorder**. Display shows overall electric detonator resistance of detonator including cables, as an indication of continuity of the electric circuit.
    a. Recommendation: By starting of the firing cables on the side of the detonator and pressing button ▼, ohmmeter can be trimmed. This way, in this measurement as well as future measurements, only the resistance of the blasting cap will be measured, without including the resistance of the electric cables.
    b. To reset the resistance, remove the firing lines from the **TimeTrap™ Delay Time Recorder** and press the ▼ button.
23. Conduct firing of detonator by pressing the button **Reset button** followed by the **Fire button** for longer than **2 seconds**.
    a. If the time between pressing the **Reset button** and the **Fire button** is longer than 5 seconds, the system will return to **Inactive**.

CAUTION

If the **Fire button** is released prior to the detonator functioning, the system will return to **Inactive**. Press and hold the **Fire button** until the detonator functions or the status changes to "**in progress**" from **active**.

24. The display will show the following data:
    a. Current in the moment of the burst of the bridge — **Current**
    b. Time of burst of fuse–head bridge — **FHBridge**
    c. Time of fuse–head initiation — **FHead** (if piezo sensor is used)
    d. Total delay time of Electric Detonator — **Delay**
25. If another rial is to be conducted, replace the Electric Detonator and return to **step 23**. If testing is complete, pack up the unit.

4.2 Nonelectric System Method

The Nonelectric System Method measures the overall delay accuracy of the Nonelectric detonators.

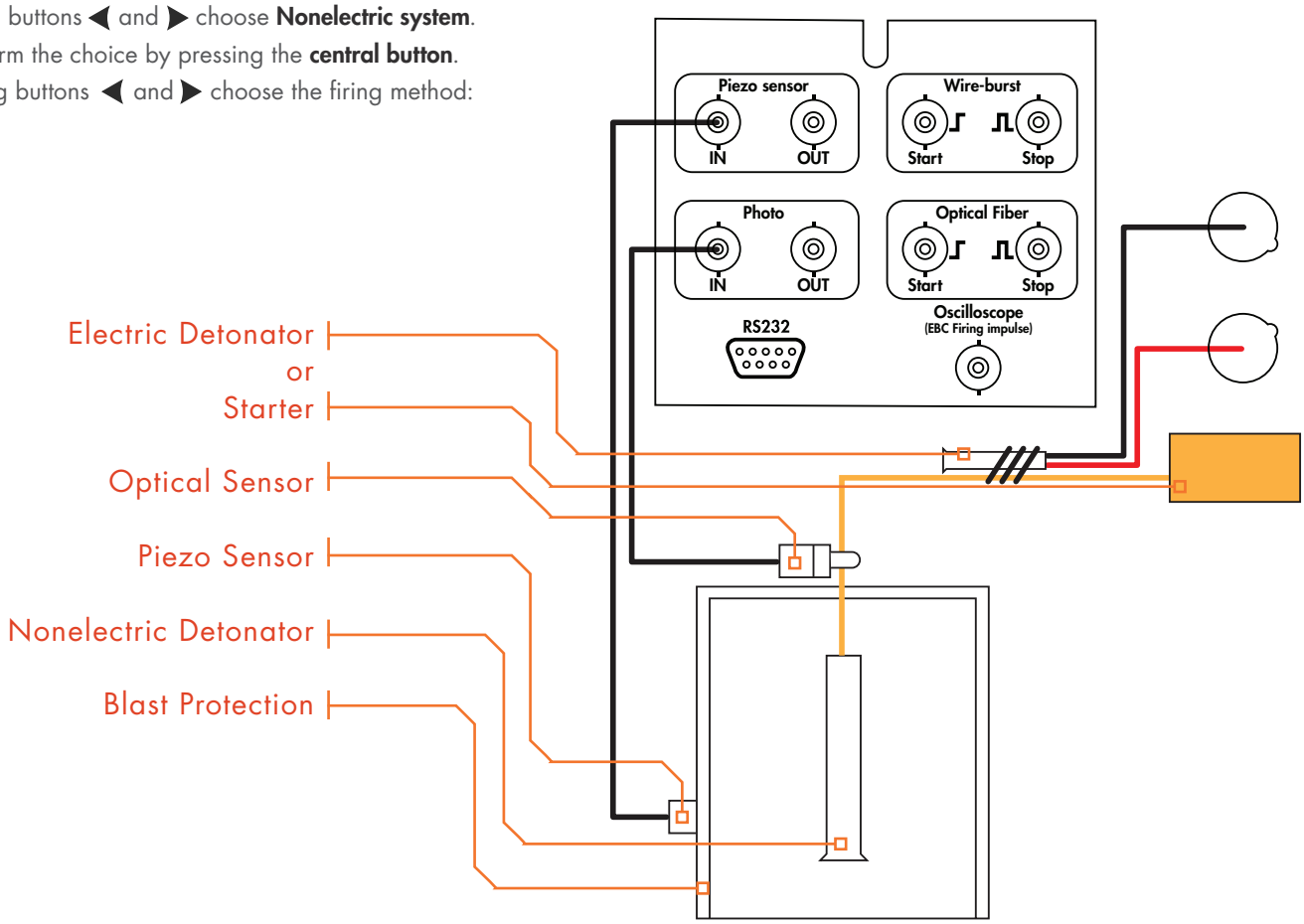
To use the Nonelectric System Method, the following equipment is required.

- **TimeTrap™ Delay Time Recorder**
- **Photo** and **Piezo-Electric Pressure Sensor** with included cables
- A nonelectric detonator shot firer or an electric detonator to be used by **TimeTrap™ Delay Time Recorder** to initiate the nonelectric detonator.
- Steel housing for protection from the blast of the detonator and the ability to mount the sensor(s) – not supplied

4.2.1 Test Setup Procedure

1. Demarcate the charge detonation area.
2. Place the **TimeTrap™ Delay Time Recorder** in a safe location relative to the detonation area.
    a. If a safe location cannot be found within 30 metres, barricades will be required.
3. Place the steel housing in the demarcated area.

4. Run two signal lines from the steel housing to the **TimeTrap™ Delay Time Recorder**.
5. Attach the **Piezo-Electric Pressure Sensor** to the outside of the steel housing using the integrated magnet.
6. Prepare the **Photo Sensor** for the shocktube adaptor by unscrewing the threaded adaptor off of the photo cell and screw on the **shock tube adaptor**.
7. Use the **SMA connector** on the cable to attach the sensor.
   a. Ensure the cable is connected properly otherwise damage will occur to the cable.
8. Attach the **BNC terminal** to the correct port on the **TimeTrap™ Delay Time Recorder**.
   a. Attach the **Piezo-Electric Pressure Sensor** cable to **Piezo Sensor In**.
   b. Attach the **Photo Sensor cable** to **Photo In**.
9. If using an electric detonator initiated by **TimeTrap™ Delay Time Recorder**, run the firing line from the **TimeTrap™ Delay Time Recorder** to the steel housing or extend the length of the shocktube back to the safe area to be initiated by the nonelectric shot firer.
   a. If using the electric detonator:
      i. Ensure that the firing line is shunted to eliminate the building of stray power.
      ii. Ensure proper separation of the firing line from the signal line with at least 1 metre.
      iii. Connect the firing line to the detonator.
      iv. Wait to connect the detonator to the **TimeTrap™ Delay Time Recorder**
10. Switch on the **TimeTrap™ Delay Time Recorder**.
11. Press the **central button** for entering the main menu.
12. Using buttons ◀ and ▶ choose **Nonelectric system**.
13. Confirm the choice by pressing the **central button**.
14. Using buttons ◀ and ▶ choose the firing method:



a. If using an Electric Detonator to initiate the shocktube, the initiating method must be set to **Internal**.
   If using this method, skip to **Step 15**.
b. If using another method other than an electric detonator to start the test, the initiating method must be set to **External**.
   If this method is being used, skip to **Step 23**.

Internal Initiation Method

15. Set the activating current within the range 500 mA to 6 A.
    a. Buttons ◀ and ▶ are used for positioning the cursor on the digit required that will be changed.
    b. Buttons ▲and ▼ are used to change the value. Confirm set value by pressing the **central button**.
       Recommendation: Current amperage should be higher than the current for single firing for the given type of detonator.
16. Confirm the set value by pressing the **central button**.
17. Set **firing impulse duration** in the range from 0.5 ms to 20 ms.
    a. Buttons ◀ and ▶ are used for positioning the cursor onto the digit required that will be changed.
    b. Buttons ▲and ▼ are used for changing the values. Maximum resolution is 0.1 ms.
18. Confirm set value by pressing the **central button**.
    a. Recommendation: For standard types of detonators set the value to 10 ms.

Attach detonator leads to the **Firing Current Output** on the back of the **TimeTrap™ Delay Time Recorder**. Display shows overall electric detonator resistance of the detonator including cables, as an indication of continuity of the electric circuit.

a. Recommendation: By short connecting of the cables on the side of the detonator and pressing button ▼, ohmmeter can be trimmed. This way, in this measurement as well as in all following measurements, only the resistance of the detonator will be measured, without including the resistance of the electric cables.
b. To reset the resistance, remove the firing lines from the **TimeTrap™ Delay Time Recorder** and press the ▼.

19. Press the **Reset button** and within five seconds: Conduct the detonator activation by holding button **Fire** in period longer than **2 seconds**

CAUTION

If the **Fire button** is released prior to the detonator functioning, the system will return to **Inactive**. Press and hold the **Fire button** until the detonator functions or the status changes to "**in progress**" from **active**.

20. Display will show the following data:
    a. Total delay time of Nonelectric Detonator – **Delay**
21. If another trial is to be conducted, replace the Nonelectric and Electric detonators and return to Step 20. If testing is complete, pack up the unit.

External Initiation Method

22. When using an external source to initiate the nonelectric detonator, the following will be applicable.
23. Press the Reset button and within 5 seconds initiate the Nonelectric Detonator.
    a. The **TimeTrap™ Delay Time Recorder** will start measuring the delay when the light of the shocktube reaches the **Photo Sensor** and will stop when the **Piezo-Electric Pressure Sensor** measures the detonator functioning.
24. Display will show the following data:
    a. Total delay time of the Nonelectric Detonator – **Delay**
25. If another trial is to be conducted, replace the Nonelectric detonator and return to **Step 23**. If testing is complete, pack up the unit.

4.3 Impact Fuse Method

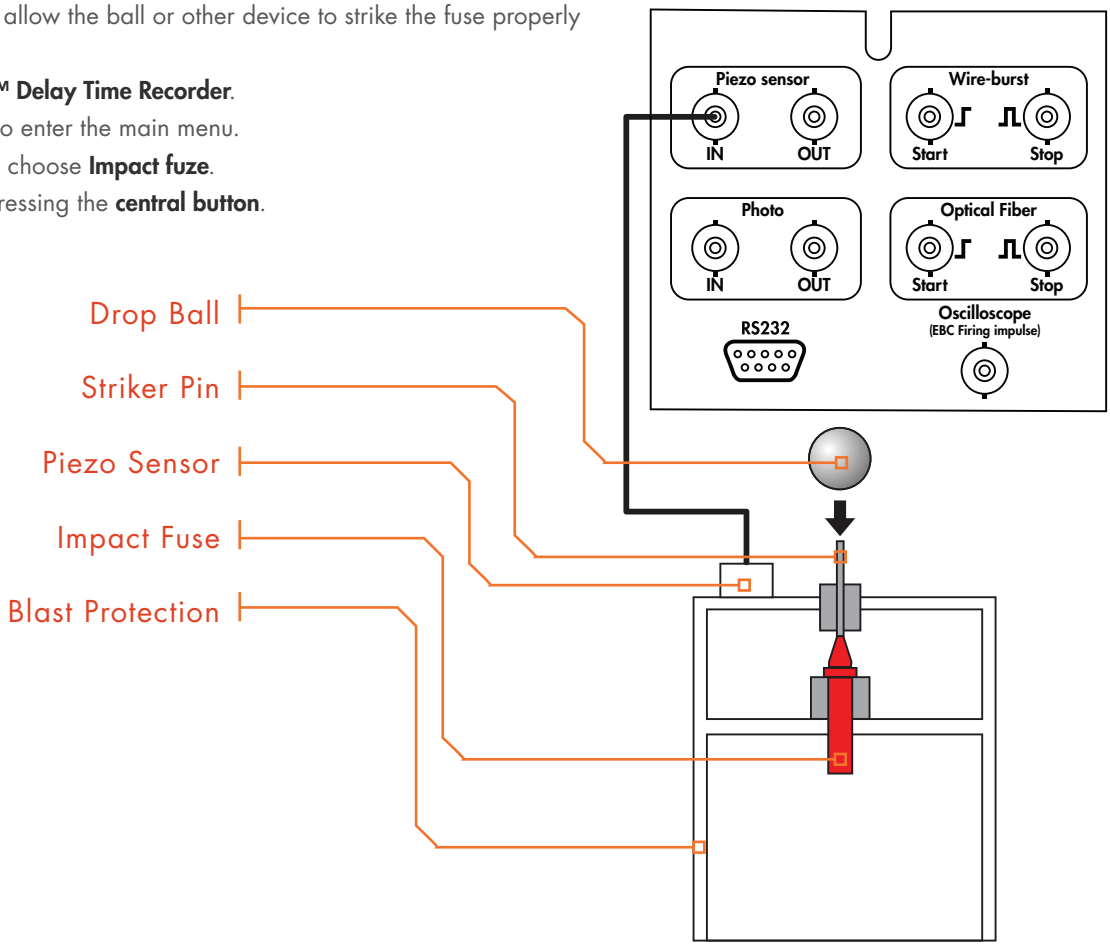
The **Impact Fuse Method** measures the overall delay accuracy of impact fuses that are used on hand grenades and projectiles.

To use the Impact Fuse Method, the following equipment is required.

- **TimeTrap™ Delay Time Recorder**
- **Piezo-Electric Pressure Sensor** with included cables
- A device for initiating the igniter by impact (a testing ball or similar) - not supplied
- Steel housing for protection from the blast of the detonator and the ability to mount the sensor – not supplied

4.3.1 Test Setup Procedure

1. Demarcate the charge detonation area.
2. Place the **TimeTrap™ Delay Time Recorder** in a safe location relative to the detonation area.
   a. If a safe location cannot be found within 30 metres, barricades will be required.
3. Place the steel housing in the demarcated area.
4. Run the signal line from the steel housing to the **TimeTrap™ Delay Time Recorder**.
5. Attach the **Piezo-Electric Pressure Sensor** to the outside of the steel housing using the integrated magnet.
6. Attach detonator leads to the **Firing Current Output** on the back of the **TimeTrap™ Delay Time Recorder**.
7. Attach the **BNC terminal** to the correct port on the **TimeTrap™ Delay Time Recorder**.
   Connect the **Piezo-Electric Pressure Sensor** cable to **Piezo Sensor In**.
8. Setup the impact fuse to allow the ball or other device to strike the fuse properly and with sufficient force.
9. Switch on the **TimeTrap™ Delay Time Recorder**.
10. Press the central button to enter the main menu.
11. Use buttons ◀ and ▶ to choose **Impact fuze**.
12. Confirm the choice by pressing the **central button**.



13. Set the Trigger delay time within range 0.1 to 999 ms.
    a. Buttons ◀ and ▶ are used for positioning the cursor onto the digit that will be changed. Buttons ▲ and ▼ are used to change values. Maximum resolution is 0.1 ms.
14. Confirm set value by pressing the **central button**. **Trigger delay time** is a period in which input will be inactive. This setting is mandatory in order to avoid activation of **piezo–electric pressure sensor** by apparatus vibration after the impact and stopping the time measuring.
    Recommendation: **Trigger delay time** should be set in accordance with the rigidity of the structure, sensitivity of the sensor and expected time delay. Initially it should be set at 50% of nominal time delay of IF, or 1 s if the nominal delay value is higher than 2 s.
15. Set the sensitivity of the **piezo–electric pressure sensor** by adjusting potentiometer **Sensitivity**.
    Recommendation: For most piezo–electric sensors, value should be set on the fifth notch. Sensitivity should be adjusted according to the trigger delay time.
16. Press the **Reset button** and within five seconds:
    Initiate the igniter by impact and read the values shown on the display
17. Display will show the following data:
    Total delay time of impact fuse — **Delay**
18. If another trial is to be conducted replace the Impact Fuse and reset the **Drop Ball** and **Striker Pin**. Return to **Step 16**. If testing is complete, pack up the unit.

4.4 Wire Burst and Optical Sensor Method

The Wire Burst and Optical Sensor Method can be used to measure the following:

- Explosive Detonation Velocity
- Detonating Cord Detonation Velocity
- Shocktube Shockwave Velocity
- Burning Time of Safety Fuse
- Detonating Relay Connector (DRC) Accuracy
- Nonelectric Trunk Line Delay (TLD) Elements Accuracy

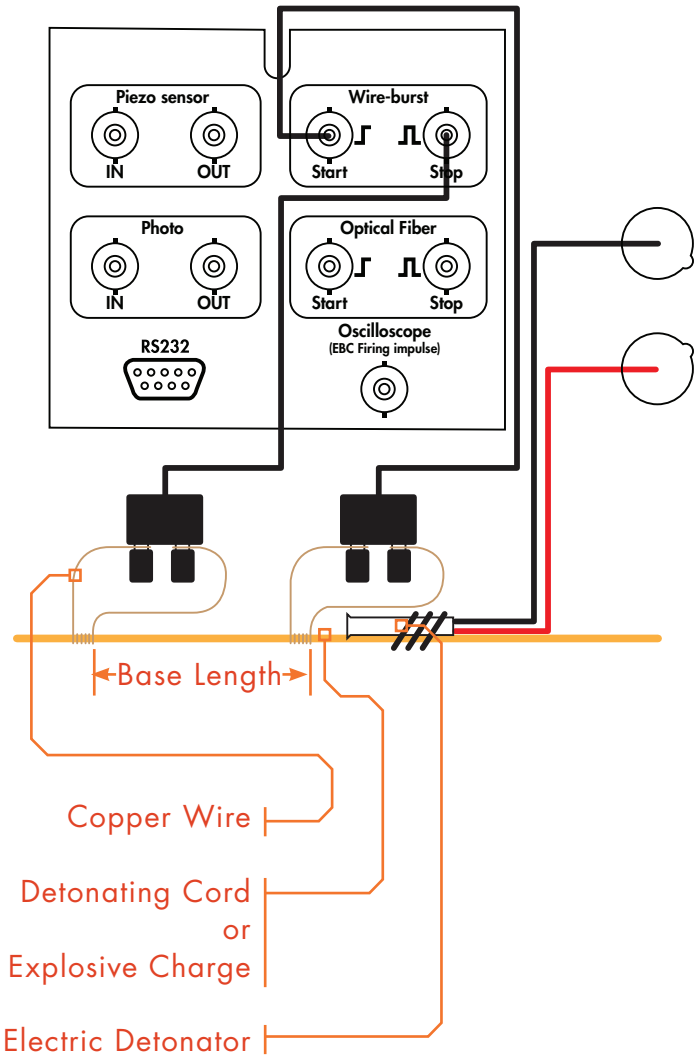
To use the **Wire Burst** or **Optical Sensor Method**, the following equipment is required.

- **TimeTrap™ Delay Time Recorder**
- **Wire Burst** x2 or **Optical Sensor** x2 plus the supplied cabling
- Enamel coated wire or fibre optic cable – not supplied

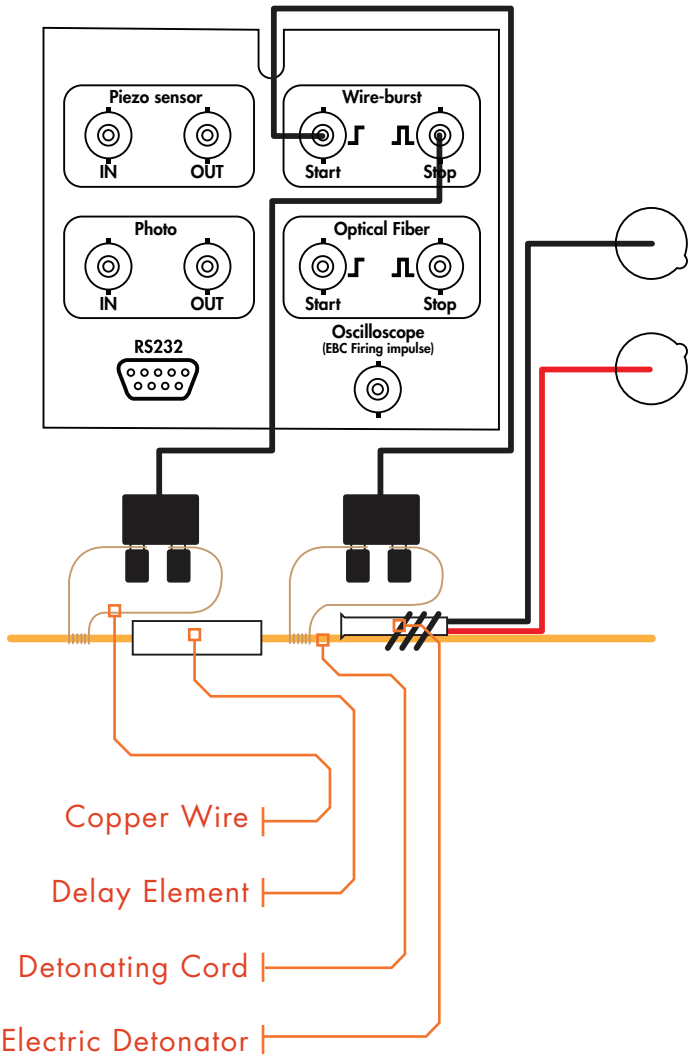
4.4.1 Test Setup Procedure

1. Demarcate the charge detonation area.
2. Place the **TimeTrap™ Delay Time Recorder** in a safe location relative to the detonation area.
   a. If a safe distance cannot be found in 30 metres, barricades will be required.
3. Run the signal line from the charge detonation area to the **TimeTrap™ Delay Time Recorder**.
4. Attach either the photo sensors or the wire burst sensors to the provided cables.

Sensor Installation for Detonating Cord Testing



Sensor Installation for Relay Element Testing



5. Attach the BNC terminal to the correct port on the **TimeTrap™ Delay Time Recorder**.
   a. Connect the Wire Burst cables to the **Wire Burst Start** and **Stop**.
      i. The start wire being closest to the initial shock front. See the illustration labelled **Sensor Installation for Detonating Cord or Relay Element Testing**.
   b. Or connect the Photo Sensor cables to the **Optical Fiber Start** and **Stop**.
      i. The start Photo Sensor being closest to the initial shock front. See the illustration labelled **Sensor Installation for Shocktube or Trunkline Delay Unit Testing**.
6. Turn the power on to the unit.
7. Press **central button** to enter the main menu
8. Use buttons ◀ and ▶ to choose **wire–burst** and **optical sensor**.
9. Confirm the choice by pressing the **central button**.

If **Velocity of Detonation (VOD) Measurement** is desired, go to **Step 10**, if a **Time Measurement** is desired, go to **Step 11**.

VOD Measurement

10. If measuring velocity, set the base length (length of explosive charge, detonating cord, burning fuse or shocktube between the two sensors) in metres to up to 10 m in a resolution of 1 mm.
    a. Buttons ◀ and ▶ are used for positioning the cursor onto the digit that will be changed.
    b. Buttons ▲ and ▼ are used to change the values.
    c. Continue to **Step 12**.

Time Measurement

11. If measuring delay element, set the base length to zero.
    a. Buttons ◀ and ▶ are used for positioning the cursor onto the digit that will be changed.
    b. Buttons ▲ and ▼ are used to change the values.

12. Confirm the selected value by pressing the **central button**.
13. If measuring delay accuracy (of DRCs and TLDs), set the **base length** to zero.
14. Use buttons ◀ and ▶ to change the activation method. Either **Internal** or **External Method**. If using an **Internal Method**, go to **Step 15**, if using an **External Method**, go to **Step 23**.

Internal Method

15. Set the **TimeTrap™ Delay Time Recorder** to **Internal Method** when an electric detonator is used to activate explosive charge, detonating cord or shocktube.
16. Device is set for initiating an electric detonator in the following way:
    a. Adjust the amperage of the Activating Current within range 500 mA to 6 A.
    b. Buttons ◀ and ▶ are used for positioning the cursor onto the digit that will be changed.
    c. Buttons ▲ and ▼ are used to change the values. Confirm the selected value by pressing the **central button**.
    Recommendation: Amperage should be higher than the minimum firing current (i) for the given detonator type.
    d. Confirm set value by pressing the **central button**.
17. Set **Firing Impulse Duration** within range 0.5 ms to 20 ms.
    a. Buttons ◀ and ▶ are used for positioning the cursor onto the digit that will be changed.
    b. Buttons ▲ and ▼ are used to change the values. Maximum resolution is 0.1 ms.
18. Confirm chosen value by pressing the **central button**.
    a. Recommendation: For standard detonator types set value to 10 ms.
19. Connect the **Electric Detonator** to the **TimeTrap™ Delay Time Recorder** ensuring the minimum separation of the firing lines and signal lines are 1 metre.
20. When ready, press the **Reset button** followed within 5 seconds by the **Fire** button. If the **Fire** button is not pressed within 5 seconds, the system will revert back to a safe mode with the screen displaying **Inactive**.

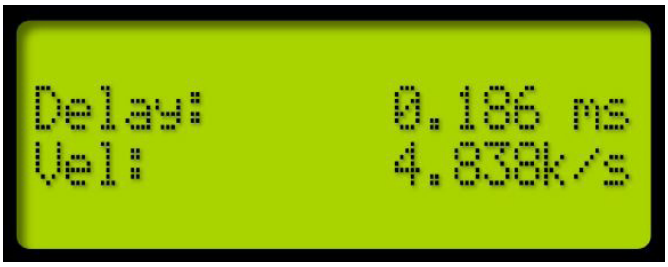
CAUTION

If the **Fire button** is released prior to the detonator functioning, the system will return to **Inactive**. Press and hold the **Fire button** until the detonator functions or the status changes to "**in progress**" from **active**.

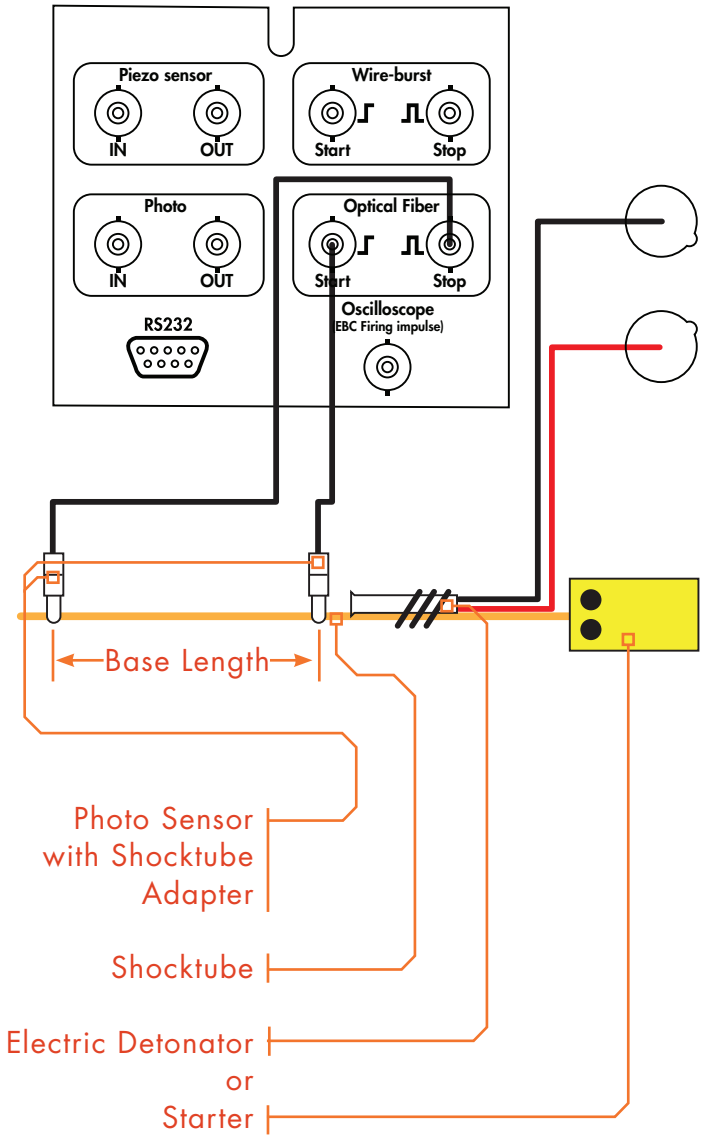
21. Display will show the following data:
    a. Total time delay — **Delay**
    b. Detonation velocity (if applicable) — **Velocity**
22. To repeat the test, replace the test article and return to **Step 19**. If the testing is complete, pack up the unit.

External Method

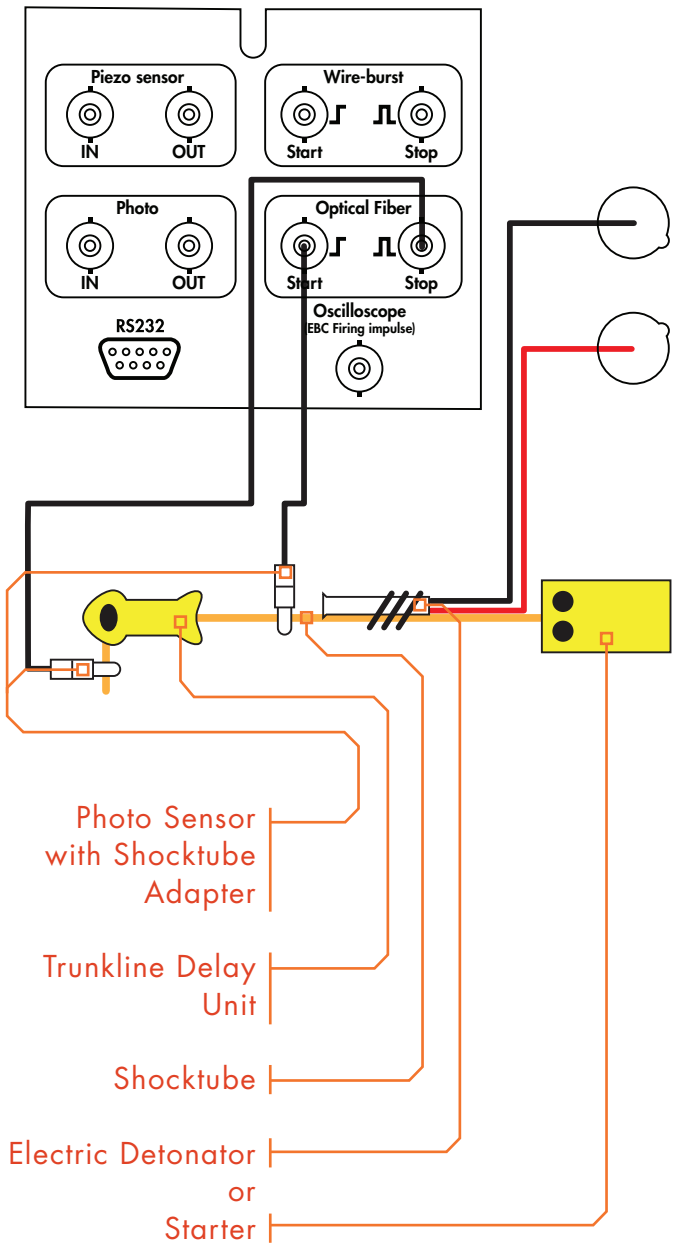
23. **External Method** should be used when the **TimeTrap™ Delay Time Recorder** is not initiating the **Electric Detonator** or a **Nonelectric Detonator** is being used to start the test.
24. Press the **Reset** button and within five seconds initiate the external detonator.
25. Display will show the following data:
    a. Total time delay — **Delay**
    b. Detonation velocity (if applicable) — **Velocity**
26. To repeat the test, replace the test article and return to **Step 23.** If the testing is complete, pack up the unit.



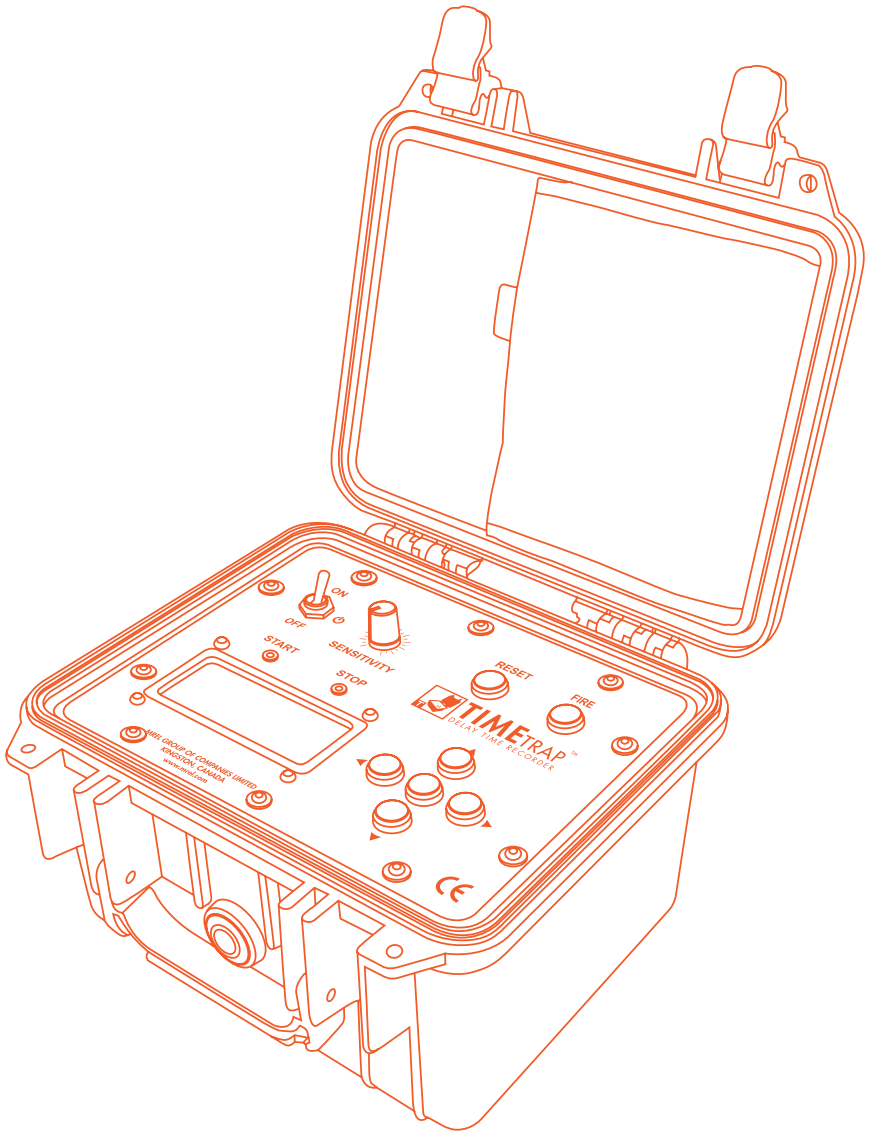
Sensor Installation for Shocktube Testing



Sensor Installation for Trunkline Delay Unit Testing



Chapter 5
Electronic Information Transfer



5.1 PC Interface

The **TimeTrap™ Delay Time Recorder** is equipped with a PC interface that enables storing the data obtained by connecting to a computer. This makes testing of large batches considerably easier. The requirements are a serial port using a DB9 connector. Often a USB-Serial adapter maybe required. The port is using the RS232 protocol to transfer the information from the unit the computer. The protocol is 9600 bits per second, 8 data bits, no parity, 1 stop bit and no flow control (9600/8/N/1). Software is required on the computer to read the information from the serial port. A common program that can be used is HyperTerminal. Data is sent from the device automatically after every test in plain ASCII format. Every line of data is followed by line feed signal, thus allowing a direct connection to a serial printer in addition. The file can be saved and imported into many different programs by the user.

5.2 Data Format

Data is sent as follows:

ELECTRIC SYSTEM METHOD:

```
t:1¦o:--.- Ohm¦c:-.--- A¦m:---.--- ms¦g:---.--- ms¦l:---,--- ms
```

NONELECTRIC SYSTEM:

```
t:1¦l:---,--- ms
```

IMPACT FUSE METHOD:

```
t:2¦l:---,--- ms
```

WIRE BURST AND OPTICAL SENSOR METHOD:

```
t:3¦b:---.--- m¦v:---.--- m/s¦l:---,--- ms
```

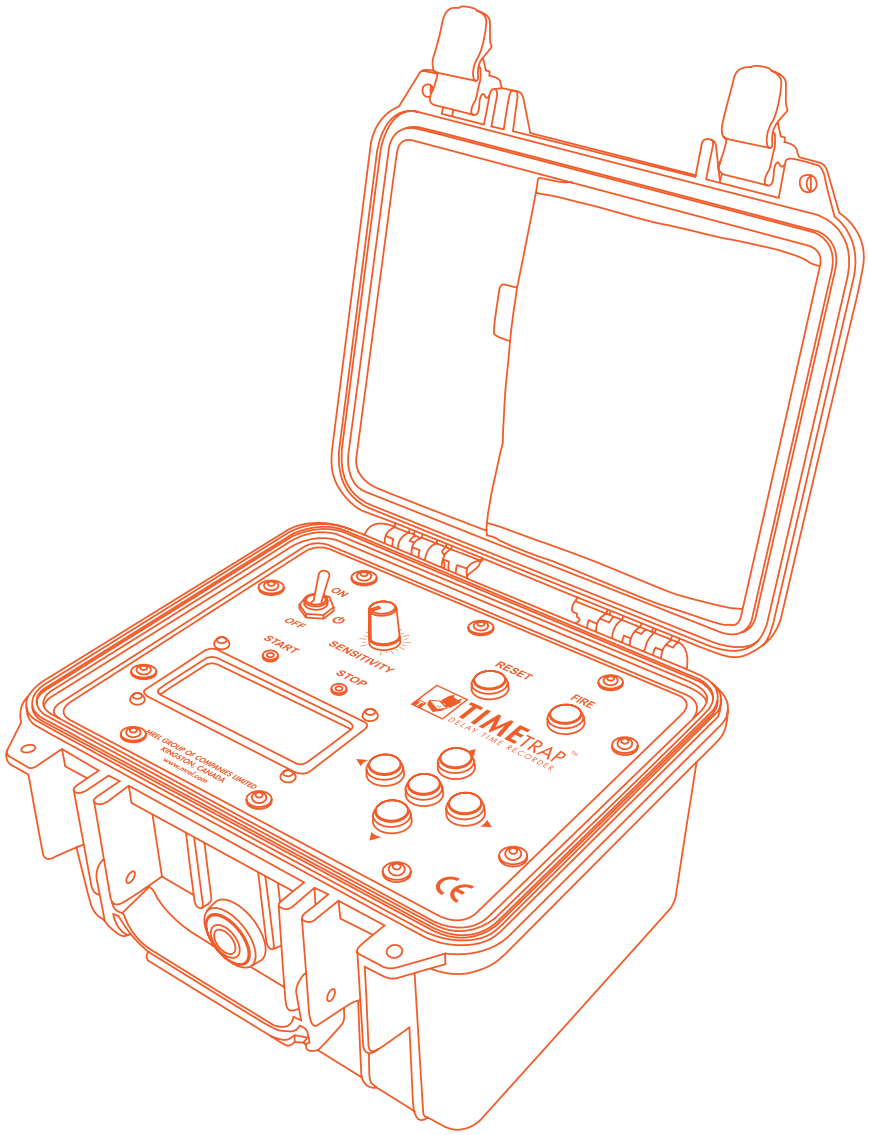
IMPORTANT

This unit shows the Overall Delay Time with a comma between ones and tenths. For example: 243,120.9 ms in the output file is 0.2431209 seconds.

Where the following descriptors are used:

- **- Place holder for a number**
- **t - Type of Test, 1 = Electric or Nonelectric, 2 = Impact Fuse and 3 = Wire burst and Optical Sensor**
- **o - Resistance**
- **c - Firing Current**
- **m - Fuse-Head Bridge Cut Time**
- **g - Burning (burst) time of the Fuse Head**
- **l - Overall Delay (lower case L, not i)**
- **b - Length of Base**
- **v - Velocity (m/s)**

Chapter 6
Contacting MREL for Technical Support



6.1 Contacting MREL

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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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