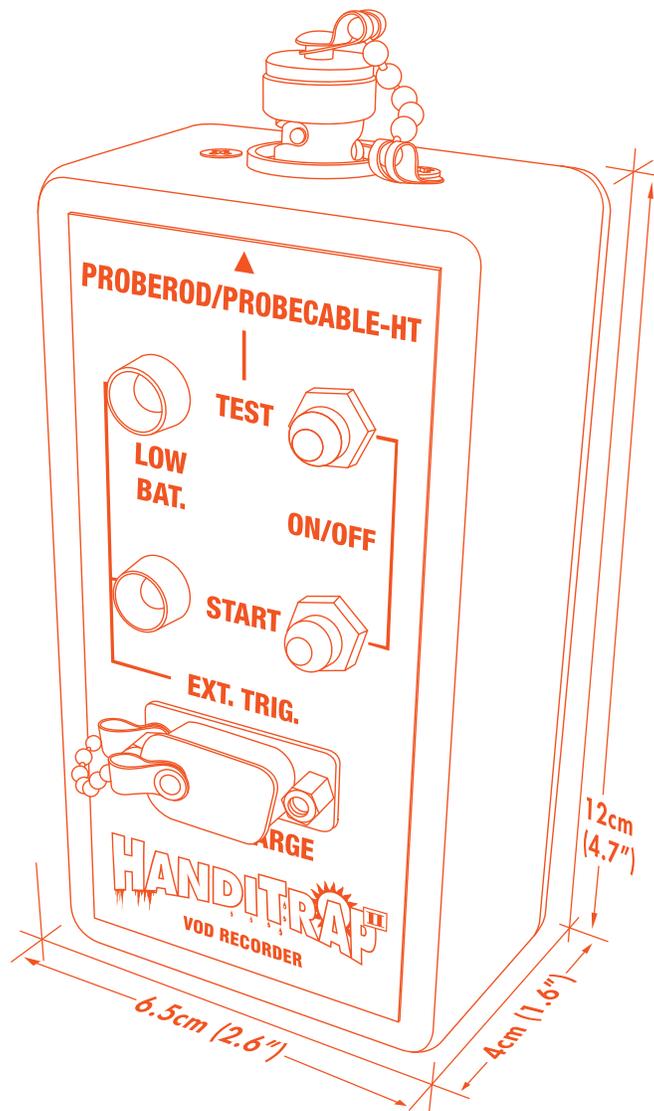




HANDITRAP^{II}
VOD RECORDER

Operations Manual

Edition 4.0



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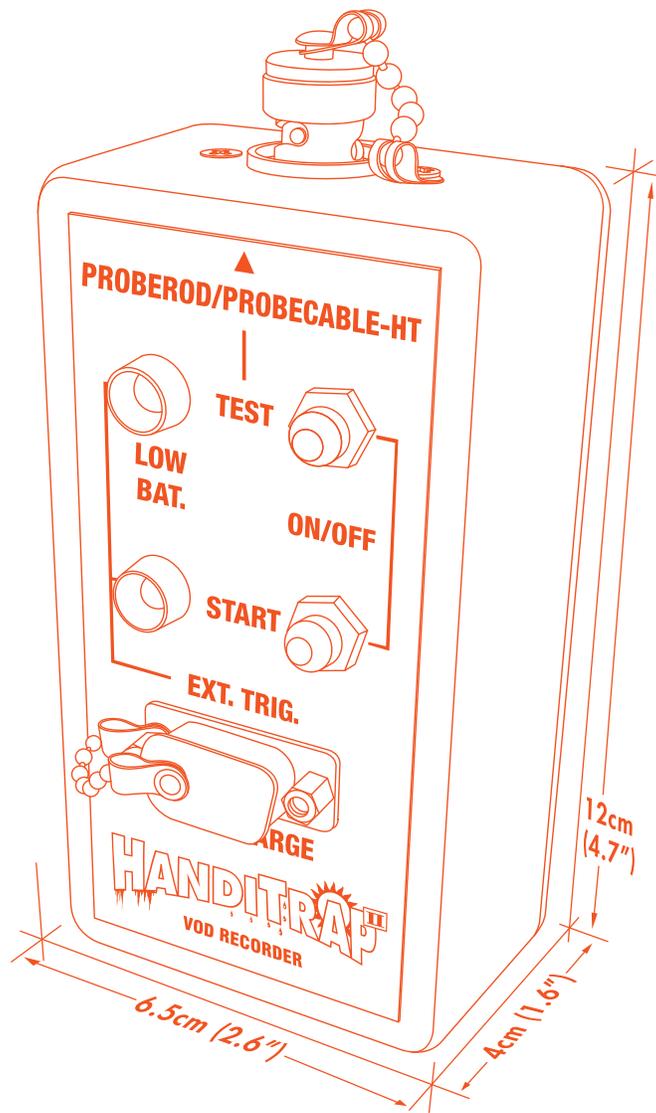
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Chapter 1

Getting Started



Overview

This Chapter provides a quick start guide to the HandiTrap II™ VOD Recorder.

All of the steps detailed in this Chapter should be completed before the Operator goes into the field to conduct a **VOD** test:

1. Ensure that all **HandiTrap II™ VOD Recorder** components have been received and are available.
2. Install the **HandiTrap II™ VOD Recorder** Software on the Operator's computer.
3. Ensure that the Operator's computer and **HandiTrap II™ VOD Recorder** are able to communicate with each other (**Section 1.3**).

1.1 Ensuring That All HandiTrap II™ VOD Recorder Hardware Has Been Received

Details of these hardware components are contained in **Chapter 3**.

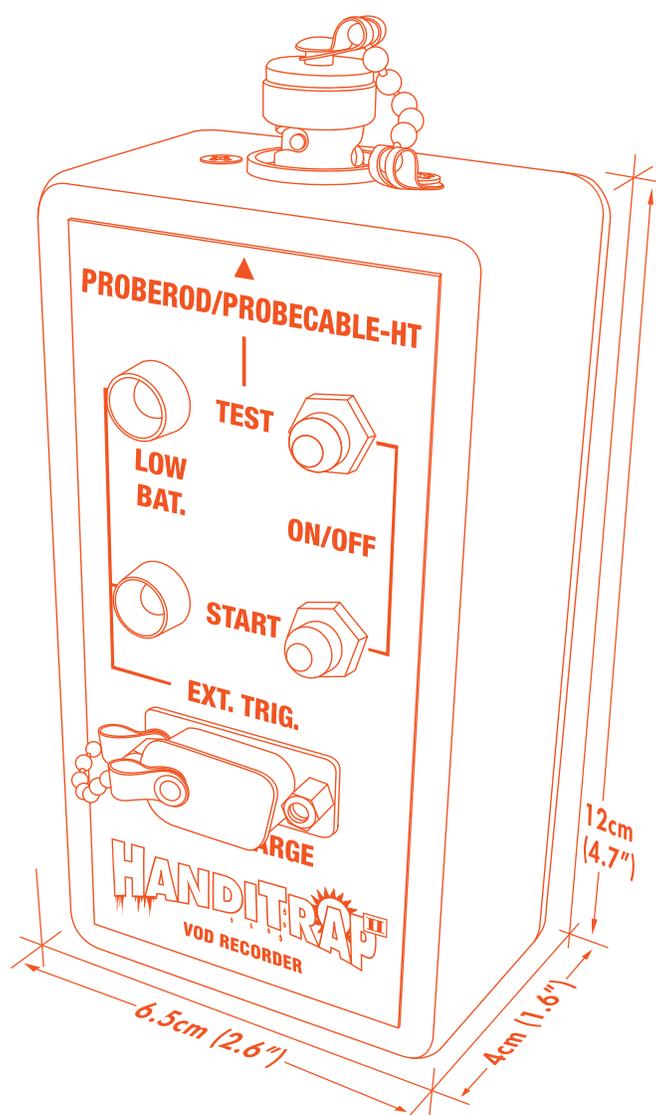
1. **HandiTrap II™ VOD Recorder.**
2. **HandiTrap II™ VOD Recorder Battery Charger** that is labeled 120 VAC or 230 VAC depending on your Country's mains power.
3. **Communications Cable – USB cable.**
4. **BNC Adapter.**
5. **External Trigger Adapter.**
6. **DAS™ Data Acquisition Suite Software** on USB.
7. **HandiTrap II™ VOD Recorder Operations Manual.**
8. (Optional) **VOD** resistance probes: **VOD PROBERODs** or **VOD PROBECABLE-HT.**
9. (Optional) **Coaxial Cable** on cable reel.

1.2 Installing the DAS™ Data Acquisition Suite Software

Refer to the **DAS™ Data Acquisition Suite Software** manual for installation procedures.

Chapter 2

Introduction



Overview

This Chapter provides an introduction to the HandiTrap II™ VOD Recorder.

2.1 Background

The **HandiTrap II™ VOD Recorder** is a portable, 1 channel, high resolution, explosives continuous **VOD** recorder that has proven its reliability under the extreme temperature, weather, dust and rugged conditions that characterize blasting environments around the world.

The **HandiTrap II™ VOD Recorder** is also the simplest and most affordable high-resolution recorder available for testing either samples of explosives, or explosives in a blasthole.

The **DAS™ Data Acquisition Suite Software** allows the User to analyze **VOD** traces recorded by the **HandiTrap II™ VOD Recorder**. This software is used to retrieve, display, analyze, print and export **VOD** data.

2.2 Safety Considerations

STOP

Persons not trained and/or authorized to handle explosives should not attempt to utilise the **HandiTrap II™ VOD Recorder** for monitoring explosive properties.

The **HandiTrap II™ VOD 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 **HandiTrap II™ VOD Recorder** when testing explosives. The standard rules of safety used with explosives should apply when monitoring VODs or other explosive parameters.

When recording VODs, the **HandiTrap II™ VOD Recorder** outputs a low voltage (less than 5 VDC) and an extremely low current (less than 50 mA) to the **VOD PROBEROD** or **VOD PROBECABLE-HT** within the explosives from the **VOD PROBEROD/VOD PROBECABLE-HT** connector on the **HandiTrap II™ VOD Recorder**. This low excitation signal ensures that the **HandiTrap II™ VOD Recorder** will not and can not prematurely initiate explosives and/or detonators.

Standard (and common sense) rules apply when it comes to the presence of electrical storms near the testing area. Due to the inherent hazards associated with blasting during these storms, in addition to the possibility of electrical interference causing false trigger signals to the **HandiTrap II™ VOD Recorder**, it is recommended to immediately suspend all blasting activities and evacuate the area. This is standard policy at most blasting operations.

2.3 Applications for the HandiTrap II™ VOD Recorder

2.3.1 The main applications of the HandiTrap II™ VOD Recorder when testing explosive samples include:

- Test the performance of explosives against the quality control standards set by the manufacturers.
- Measure the continuous **VOD** in any charge under confined or unconfined conditions.
- Determine the critical diameter and critical density of an explosive charge.
- Determine the gap sensitivity of explosives.
- Measure the timing accuracy of detonators.
- Measure the continuous **VOD** of primers/boosters.
- Determine the minimum booster size for any explosive by measuring run-up velocities.

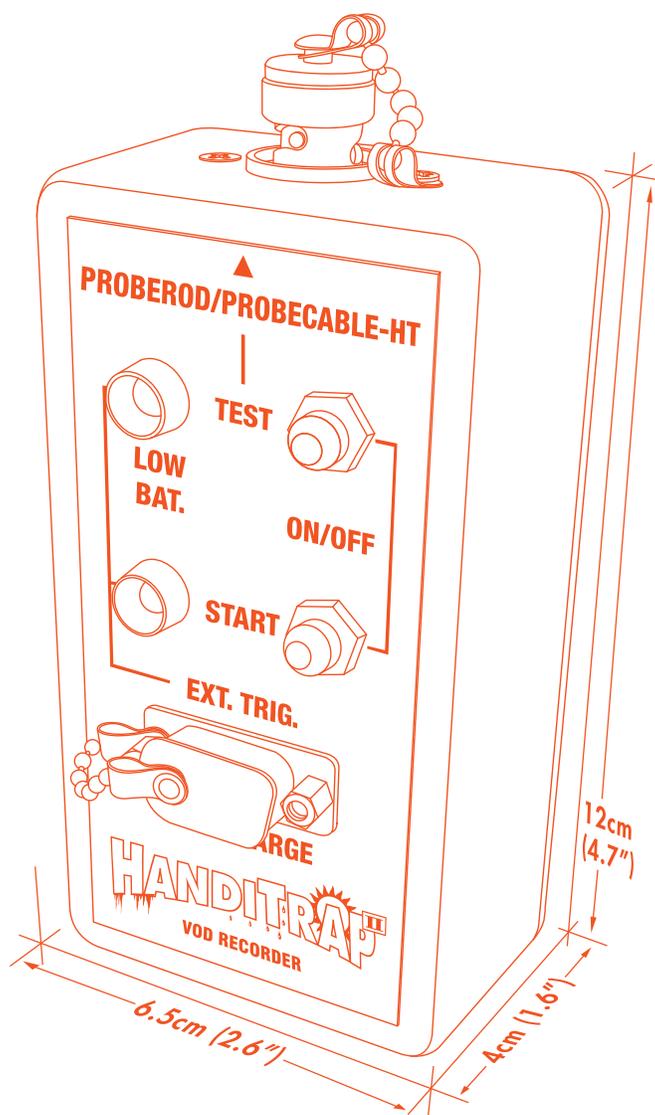
2.3.2 The main applications of the HandiTrap II™ when testing explosives in a blasthole include:

- Measure the continuous **VOD** hole diameter that is wet or dry and in any type of rock.
- Determine whether full detonation, low order detonation or failure occurred and where in the explosive column it happened.
- Check **VODs** against manufacturers' specifications in full scale blasting environments.
- Determine the minimum booster size for any explosive by measuring run-up velocities in full scale blasting environments.
- Measure the timing accuracy of detonators in a decked hole in full scale blasting environments.
- Measure the effects of water, drill cuttings, rocks, etc. trapped within the explosive mass.
- Determine the length of explosive column to use in decking operations to evaluate the effect of stemming and drill cutting dilution, water pick-up, etc. on the explosive run-up requirements.
- Determine the correct length and type of stemming material to be used between decks of explosives to prevent sympathetic detonation or explosive desensitization from occurring.
- Using multiple **HandiTrap II™ VOD Recorder's**, determine the delay time between blastholes.

Contact **MREL** for information on other **MREL VOD** recorders that are able to test the **VOD** of explosives in multiple blastholes and determine the delay time between holes.

Chapter 3

HandiTrap II™ VOD Recorder Hardware



Overview

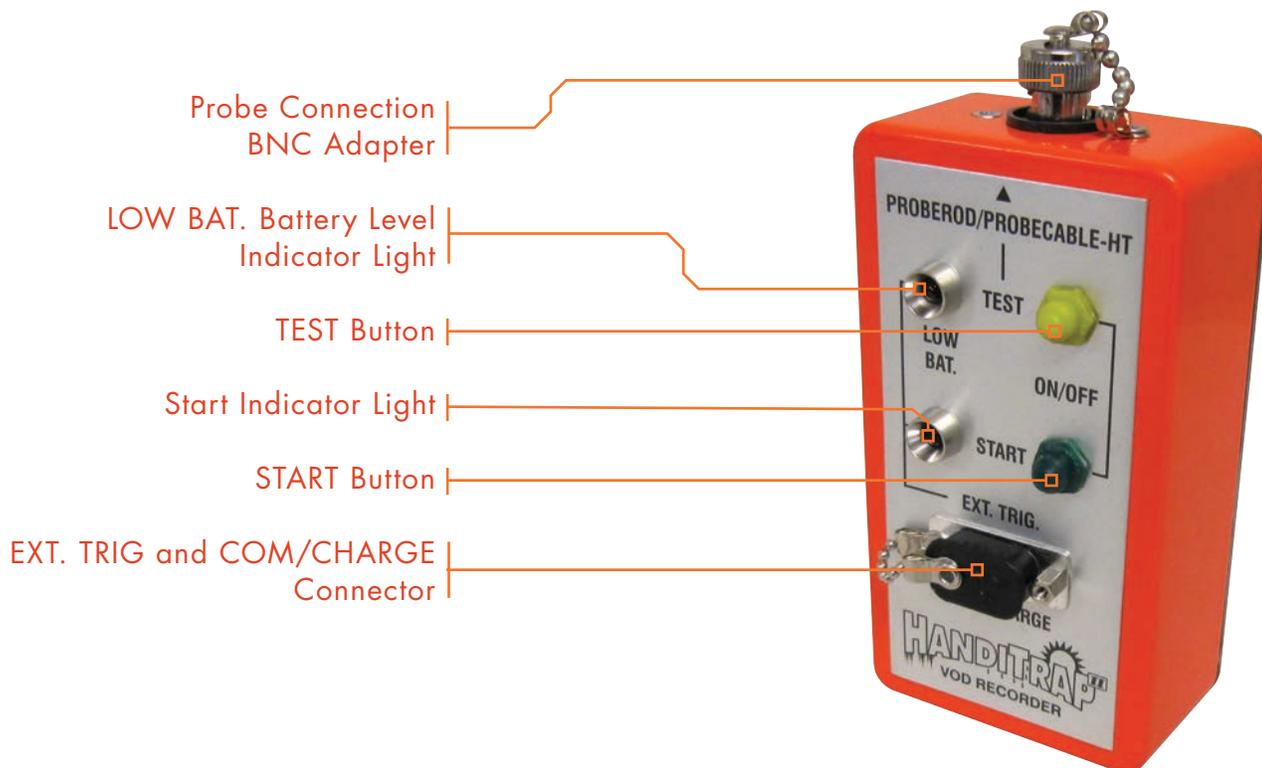
This Chapter describes all of the hardware components provided with the **HandiTrap II™ VOD Recorder**.

3.1 Hardware Components

The hardware components of the **HandiTrap II™ VOD Recorder** System include the **HandiTrap II™ VOD Recorder**, a **Battery Charger**, a **Communications Cable**, **BNC Adapter** and an **External Trigger Adapter**. Also included with the **HandiTrap II™ VOD Recorder** System are the **Operations Manual** and the **DAS™ Data Acquisition Suite Software**. A brief description of each of the hardware components is in the following Sections.

3.1.1 HandiTrap II™ VOD Recorder

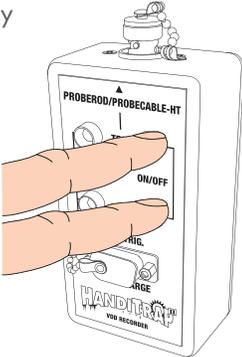
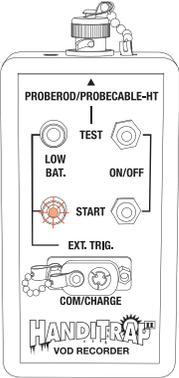
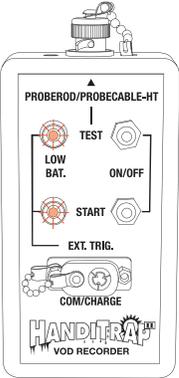
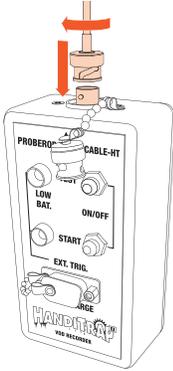
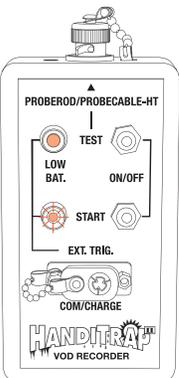
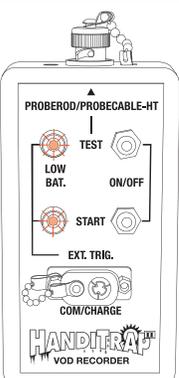
The **HandiTrap II™ VOD Recorder** contains electronic circuitry and an internal rechargeable battery within a protective steel case measuring approximately 12 x 6.5 x 4 cm (4.75 x 2.5 x 1.5 in.) and weighing 0.3 kg (0.7 lbs.). The protective steel case prevents damage from water, sand, snow, dust and similar harsh weather conditions. As well, the case offers resistance to high temperatures, shocks and vibrations. The front of the **HandiTrap II™ VOD Recorder** is shown to the right.

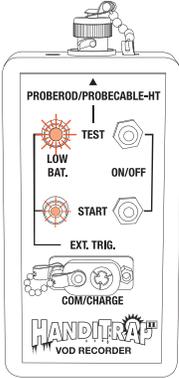
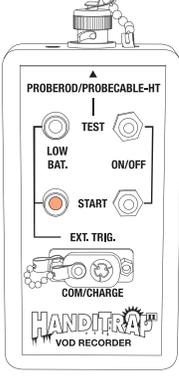


IMPORTANT

When the **External Trigger Adapter** is connected to the port, the **HandiTrap II™ VOD Recorder** will only trigger with the trigger wire breaks.

The main features on the front panel of the HandiTrap II™ VOD Recorder are outlined below:

Function	Description	Visual Representation
Power	<p>The TEST and START buttons pressed simultaneously for one second are used to turn the HandiTrap II™ VOD Recorder ON and OFF. When the HandiTrap II™ VOD Recorder is ON, the START indicator light flashes indicating that the HandiTrap II™ VOD Recorder is in Active mode.</p> 	
Battery Level	<p>The LOW BAT. indicator light flashes when the HandiTrap II™ VOD Recorder internal batteries need recharging.</p>	
Probe Connection and Testing Probes	<p>PROBEROD/PROBECABLE-HT: BNC connector for connecting RG-58/U Coaxial Cable between the VOD PROBEROD resistance probe or VOD PROBECABLE-HT resistance wire and the HandiTrap II™ VOD Recorder.</p> <p>If the TEST button is pressed when a VOD PROBEROD or VOD PROBECABLE-HT is connected to the HandiTrap II™ VOD Recorder, a steady TEST indicator light indicates that the electrical circuit of the PROBEROD or PROBECABLE-HT is OK.</p> 	
VOD PROBEROD or VOD PROBECABLE-HT resistance too low	<p>With the TEST button pressed and if the light flashes slowly, the resistance in the VOD PROBEROD or VOD PROBECABLE-HT is too low (such as a short circuit).</p>	

Function	Description	Visual Representation						
<p>VOD PROBEROD or VOD PROBECABLE-HT resistance too high</p>	<p>With the TEST button pressed and if the light flashes quickly, the resistance in the VOD PROBEROD or VOD PROBECABLE-HT is too high (such as an open circuit).</p>							
<p>Begin Monitoring</p>	<p>If a VOD PROBEROD or VOD PROBECABLE-HT is connected to the HandiTrap II™ VOD Recorder and the circuit is testing OK, pressing the START button turns the START indicator light on and puts the HandiTrap II™ VOD Recorder in Monitoring mode - waiting to record the blast.</p> <p>After the blast, the START indicator light will be flashing indicating that there is VOD data ready to download to a computer.</p>	 <table border="1"> <tr> <td>Light steady</td> <td></td> </tr> <tr> <td>Light blinking slowly</td> <td></td> </tr> <tr> <td>Light blinking fast</td> <td></td> </tr> </table>	Light steady		Light blinking slowly		Light blinking fast	
Light steady								
Light blinking slowly								
Light blinking fast								

The **COM/CHARGE** and **EXT. TRIG.** port is a multi-purpose port. It is used to connect the **Communications Cable** to the **HandiTrap II™ VOD Recorder**. The other end of the **Communications Cable** is connected to the computer for retrieval of the recorded data (**Chapter 5.1**). The **COM/CHARGE** port is also used to connect the **Battery Charger** to the **HandiTrap II™ VOD Recorder**. The **COM/CHARGE** port double as an **EXT. TRIG. (External Trigger)** port that is used to connect the **External Trigger Adapter** to a normally closed trigger wire. When the **External Trigger Adapter** is connected to the port, the **HandiTrap II™ VOD Recorder** will only trigger when the trigger wire breaks. If using the external trigger option, it is important to connect the **External Trigger Adapter** to the **HandiTrap II™ VOD Recorder** before pressing **START** or immediate triggering will occur when making the connection.

3.1.2 Battery Charger

Please note that the **Battery Charger** has a specification printed on it, regarding whether it is designed for 120 VAC or 230 VAC mains power.



STOP

Contact MREL if the **Battery Charger** that has been supplied is incorrect for the mains voltage in your country.

3.1.3 HandiTrap II™ VOD Recorder USB Cable

This **USB cable** has been designed to download data from the **HandiTrap II™ VOD Recorder**. The drivers can be found on the **HandiTrap II™ VOD Recorder** Installation disk.



3.1.4 BNC Adapter

The **BNC Adapter** is provided to facilitate easy connection between the **VOD PROBEROD/VOD PROBECABLE-HT** connector on the **HandiTrap II™ VOD Recorder** to the coaxial cable (preferably **RG-58/U**) leading to the **VOD PROBEROD** or **VOD PROBECABLE-HT**.



3.1.5 External Trigger Adapter

The **External Trigger Adapter** is provided to facilitate easy connection between the **EXT. TRIG.** connector on the **HandiTrap II™ VOD Recorder** to an external normally closed trigger wire. When the **External Trigger Adapter** is connected to the port, the **HANDITRAP II™ VOD RECORDER** **WILL ONLY TRIGGER WHEN THE TRIGGER WIRE BREAKS**.



3.2 HandiTrap II™ VOD Recorder Internal Rechargeable Battery

The **HandiTrap II™ VOD Recorder** has an internal NiCd rechargeable battery pack. The **HandiTrap II™ VOD Recorder** is supplied with an approved 120 VAC or approved 230 VAC Battery Charger, depending on the country of use. When the internal battery is fully charged, the **HandiTrap II™ VOD Recorder** can operate for 8 hours (at maximum **HandiTrap II™ VOD Recorder** power consumption) before battery recharging is required. The **HandiTrap II™ VOD Recorder** is shipped from **MREL** fully charged. Since some time may elapse before the **HandiTrap II™ VOD Recorder** is actually put to use, the **HandiTrap II™ VOD Recorder** may not be charged fully the first time it is used. Full operating time will be obtained when the **HandiTrap II™ VOD Recorder** is recharged. Normal charging time for the batteries is 14 to 16 hours. Leaving the **HandiTrap II™ VOD Recorder** connected to the charger for longer periods than this can reduce the "charge lifetime" of the batteries (the number of full charges it can take). It is helpful to completely discharge and recharge the batteries every 1 to 3 months.. When doing this, recharge the batteries immediately after they have been discharged.

IMPORTANT

Do not operate the **HandiTrap II™ VOD Recorder** when the charger is connected.

3.3 Recharging the HandiTrap II™ VOD Recorder

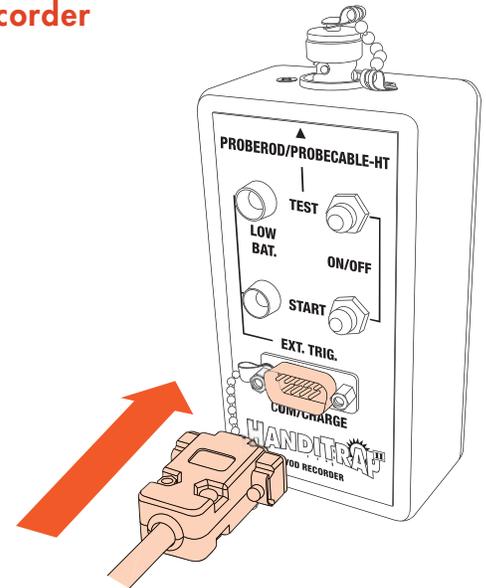
The procedure to recharge the **HandiTrap II™ VOD Recorder** is as follows:

1. With the **HandiTrap II™ VOD Recorder** switched **OFF**, connect the **Battery Charger** between the **COM/CHARGE** port on the **HandiTrap II™ VOD Recorder** and the wall outlet.
2. Full recharging is obtained after 14 to 16 hours of charging.
3. Unplug the **Battery Charger** from the wall outlet and then from the **HandiTrap II™ VOD Recorder**.

CAUTION

The **HandiTrap II™ VOD Recorder** internal battery can not be overcharged. According to the battery Manufacturer's specifications, full battery pack recharging will take 14 to 16 hours. Charging for extended periods of time can lower the lifetime of batteries, but not damage the **HandiTrap II™ VOD Recorder** in any way.

Connecting the Battery Charger cable to the HandiTrap II™ VOD Recorder



3.4 Long Term Storage Considerations

No special procedures, other than those pertaining to the internal batteries, should be taken for long term storage of the **HandiTrap II™ VOD Recorder**. In the eventuality that the **HandiTrap II™ VOD Recorder** remains idle for long periods, it is recommended to recharge the **HandiTrap II™ VOD Recorder** once per month per the procedure in **Section 3.3**. This will maintain the conditioning of the internal batteries. If the batteries lose their ability to hold a charge, discharge them completely, then recharge them for 14-16 hours

3.5 VOD Resistance Probes Used by the HandiTrap II™ VOD Recorder

The following types of VOD resistance probes are available from **MREL** and are uniquely suitable for use with the **HandiTrap II™ VOD Recorder**:

3.5.1 VOD PROBEROD

The **VOD PROBEROD**, shown below, is a rigid probe consisting of a high resistance insulated wire placed within a small diameter metal tube, which acts as the return lead of the circuit. **VOD PROBERODs** are specifically designed to measure **VODs** of explosive cartridges and/or of short sample tubes of explosives, under confined or unconfined conditions. They are available from **MREL** in a standard length of 1 m(3.3 ft.) and are supplied with two leads, ready to be connected to the inner and outer leads of the **RG-58 coaxial cable**. The other end of the **RG-58 Coaxial cable** is fitted with a **BNC connector** for attachment to the **VOD PROBEROD-VOD PROBECABLE-HT** connector on the **HandiTrap II™ VOD Recorder**. Contact **MREL** for additional **VOD PROBEROD** or **VOD PROBECABLE-HT** information and ordering details.



3.5.2 VOD PROBECABLE-HT

A spool of **VOD PROBECABLE-HT** is shown. **VOD PROBECABLE-HT** is a flexible resistance wire consisting of a high resistance wire as a solid centre conductor insulated from braided shielding which acts as the return lead of the circuit. **VOD PROBECABLE-HT** is specifically designed to measure **VODs** of explosives loaded into a blasthole and to determine the delay time between explosives decks in a blasthole. **VOD PROBECABLE-HT** is available from **MREL** in a standard length of 100 ft. (30 m) per spool and is supplied with one end prepared for lowering into the blasthole and the other end ready to be connected to the **RG-58/U** coaxial cable, which in turn connects to the **VOD PROBEROD/VOD PROBECABLE-HT** connector on the **HandiTrap II™ VOD Recorder**. Contact **MREL** for additional **PROBECABLE-HT** information and ordering details.



3.6 RG-58/U Coaxial Cable and Portable Cable Reel

3.6.1 Light-Duty Cable Reel

MREL Product # 1-06-01

As an optional accessory, **MREL** offers a portable cable reel with 101 m (333 ft.) of **RG-58/U coaxial cable** to connect between the **VOD PROBEROD** or **VOD PROBECABLE-HT** and the **PROBEROD/PROBECABLE-HT** connector on the **HandiTrap II™ VOD Recorder**. The coaxial cable has the correct **BNC connector** installed for connecting to the **HandiTrap II™ VOD Recorder**.



3.6.2 Heavy-Duty Cable Reel

MREL Product # 1-06-02

As an optional accessory, **MREL** offers a portable cable reel with 305 m (1000 ft.) of **RG-58/U coaxial cable** to connect between the **VOD PROBEROD** or **VOD PROBECABLE-HT** and the **PROBEROD/PROBECABLE-HT** connector on the **HandiTrap II™ VOD Recorder**. The coaxial cable has the correct BNC connector installed for connecting to the **HandiTrap II™ VOD Recorder**.

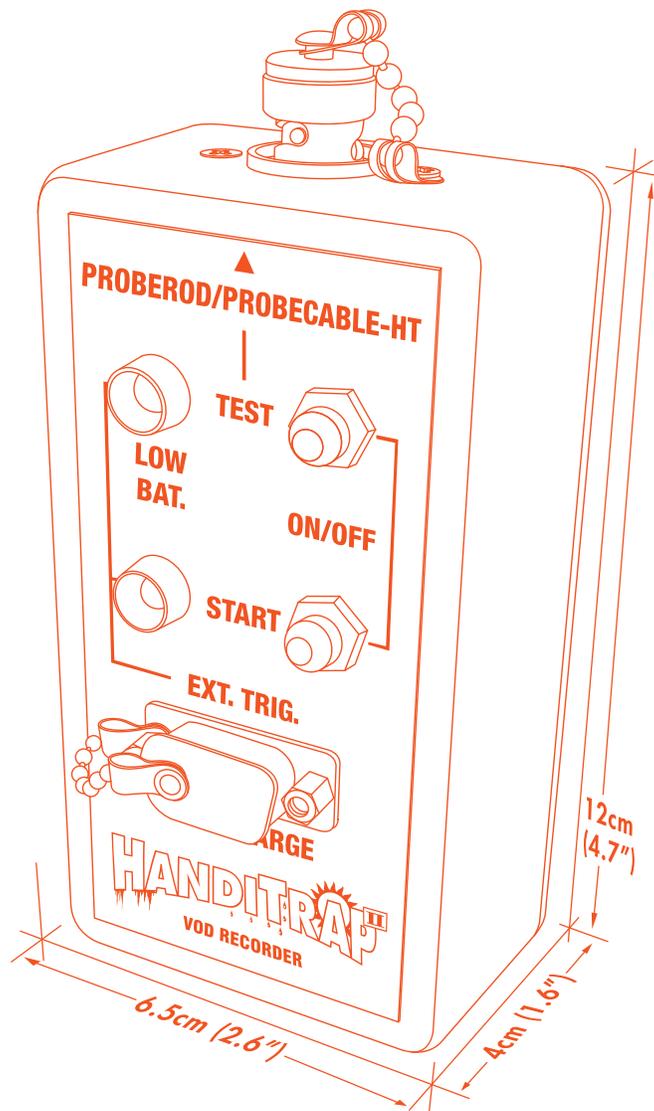


3.7 HandiTrap II™ VOD Recorder Technical Specifications

Number of Channels	1 channel for VOD.
Vertical Resolution	12 bits, 1 part in 4,096.
Recording Rate	1 MHz
Total Recording Time	131 milliseconds (131,072 data points).
Pre-Trigger Time	32.8 milliseconds (32,768 data points).
Trigger Modes	Can be triggered internally, automatically on the VOD signal from the blast. Can be triggered externally from a break-wire, which also allows multiple HandiTrap II™ VOD Recorders to be time-synchronized for determining delay times between holes.
Power	Internal rechargeable NiCd battery pack, which provides 8 hours of active operation on a full charge. Full battery recharging is obtained overnight.
Components Provided	HandiTrap II™ VOD Recorder , 120 or 230 VAC Battery Charger, USB Cable, colour Operations Manual, HandiTrap II™ VOD Recorder Advanced Analytical Software for Windows®.
Size and Weight	12 x 6.5 x 4 cm (4.7 x 2.6 x 1.6 in.) 0.3 kg (0.7 lbs.).
Environmental	Operates at -40 to +80 C (-40 to +185 F). Snow, rain, dust and sand proof. Drop proof from at least a 1 m (3 ft) height.
PC Connection	At any time after recording, the Operator can connect the HandiTrap II™ VOD Recorder to a computer's USB to download and view the VOD data on a computer within 50-75 seconds.
VOD Excitation/Safety	The HandiTrap II™ VOD Recorder's excitation voltage is pre-set for the maximum 12 bit resolution across the VOD PROBEROD or VOD PROBECABLE-HT in the explosives. All VOD operating parameters are automatically recorded by the HandiTrap II™ VOD Recorder with no requirement for additional instruments. The HandiTrap II™ VOD Recorder is physically unable to output as much as 50 mA of current to a VOD PROBEROD or VOD PROBECABLE-HT . The HandiTrap II™ VOD Recorder does not rely on "current limiting automatic fault checking systems" which may potentially fail.
VOD PROBERODS	1 m (3.3 ft.) long rigid resistance probes for use in explosive samples with the HandiTrap II™ VOD Recorder .
VOD PROBECABLE-HT	30 m (100 ft.) long spool of ready-to-use resistance wire for use with the HandiTrap II™ VOD Recorder to determine the VOD of explosives loaded into a blasthole and the delay time between decks of explosives in a blasthole.

Chapter 4

Recording VODs and Deck Delays



Overview

This Chapter provides detailed instructions on selecting a suitable site for testing sample explosives, loading VOD PROBEROD and VOD PROBECABLE-HT and connecting the HandiTrap II™ VOD Recorder to record VODs and deck delay times.

STOP

Test the **HandiTrap II™ VOD Recorder** communications with your computer BEFORE first use in the field. Ensure that Chapter 1 has been successfully completed. Most issues can be avoided by consulting the manual and/or contacting MREL BEFORE recording valuable data with the **HandiTrap II™ VOD Recorder**.

4.1 Safety Considerations for Selecting an Explosive Testing Site

STOP

Contact MREL for site specific recommendations for testing samples of explosives.

Care must be taken to select a good site for detonation and recording **VOD** of explosive samples. If possible, a permanent test site may be constructed. A pit surrounded by an earth wall is typically sufficient for smaller detonations. Additionally, a protected shelter for the **HandiTrap II™ VOD Recorder** and personnel can be constructed at an appropriate distance from the explosive. The distance will depend on the amount of explosive being detonated at one time, and how the explosives are confined (be aware of steel shrapnel from confined shots). Ensure that the area is well demarcated with the appropriate signage and that access is restricted.

If samples of explosives are to be detonated at an unprepared site, then the Operator must be careful when deciding upon what type of ground the charges are to be placed. Avoid placement on ground with stones, rubble or anything that is likely to turn into a projectile. The best surfaces are fines, sand or tailings.

It is always good practice to have maximum control over the time of firing of the test, therefore safety fuse initiation is not recommended. Electric or shock tube initiation is best with the detonator either initiating the sample of explosives or the primer/booster in the explosive sample.

4.2 The Resistance Wire Technique for Measuring VOD

The **HandiTrap II™ VOD Recorder** is capable of monitoring the continuous **VOD** profile along the entire length of an explosives column. The **HandiTrap II™ VOD Recorder** can measure the **VOD** of short explosive samples such as cast boosters or explosive cartridges. The **HandiTrap II™ VOD Recorder** can also measure the **VOD** of explosives in surface or underground blastholes. The **HandiTrap II™ VOD Recorder** provides a regulated constant excitation signal to the **VOD PROBEROD** or **VOD PROBECABLE-HT** and monitors the drop in voltage as the **VOD PROBEROD** or **VOD PROBECABLE-HT** is consumed in by the detonation front.

The **HandiTrap II™ VOD Recorder** uses the proven continuous resistance wire technique for monitoring **VODs**. An MREL-manufactured **VOD PROBEROD** or **VOD PROBECABLE-HT** of known linear resistance (i.e. ohm/m or ohm/ft) is placed axially in the explosive sample or explosive column. As the detonation front of the explosive consumes the **VOD PROBEROD** or **VOD PROBECABLE-HT**, the resistance of the circuit will decrease in proportion to the reduction in length of the **VOD PROBEROD** or **VOD PROBECABLE-HT**. The **HandiTrap II™ VOD Recorder** records the resulting decrease in voltage across the **VOD PROBEROD** or **VOD PROBECABLE-HT** versus time.

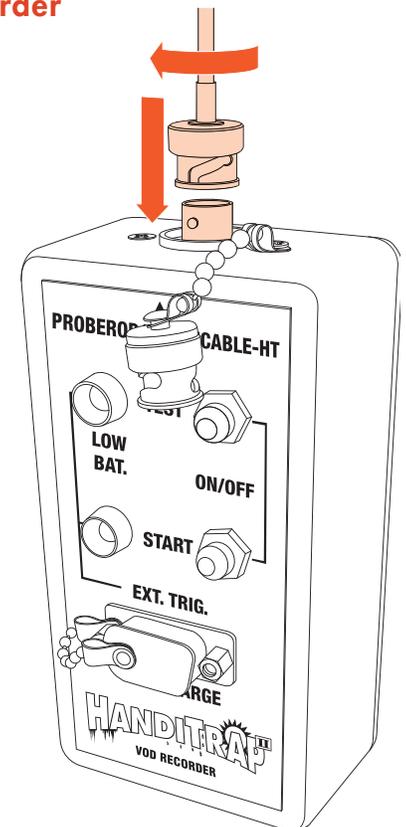
The **HandiTrap II™ VOD Recorder's** Advanced Analytical Software automatically converts the recorded data into a graph of distance versus time. The slope of this graph at any position is the **VOD** of the explosive at that particular position. The Software includes menu functions that will automatically calculate and display the **VOD** of an explosive at any selected location in the graph. Other functions allow the Operator to calculate and display the delay time between selected explosive decks within a blasthole.

4.3 Installing the VOD PROBEROD for Testing a Sample of Explosives

The equipment and supplies that are required to conduct **VOD** tests on samples of explosives or on explosive cartridges are:

- The **HandiTrap II™ VOD Recorder** System.
- **VOD PROBEROD** - one (1) per explosive sample (available from **MREL**).
- Coaxial cable (type RG-58/U is recommended and available from **MREL**) - sufficient length to run between the **HandiTrap II™ VOD Recorder** location and the explosives.
- Wire cutters and electrical tape.
- Explosives, detonators and blasting machine.

Connecting the BNC Cable to the HandiTrap II™ VOD Recorder



See Figure 1

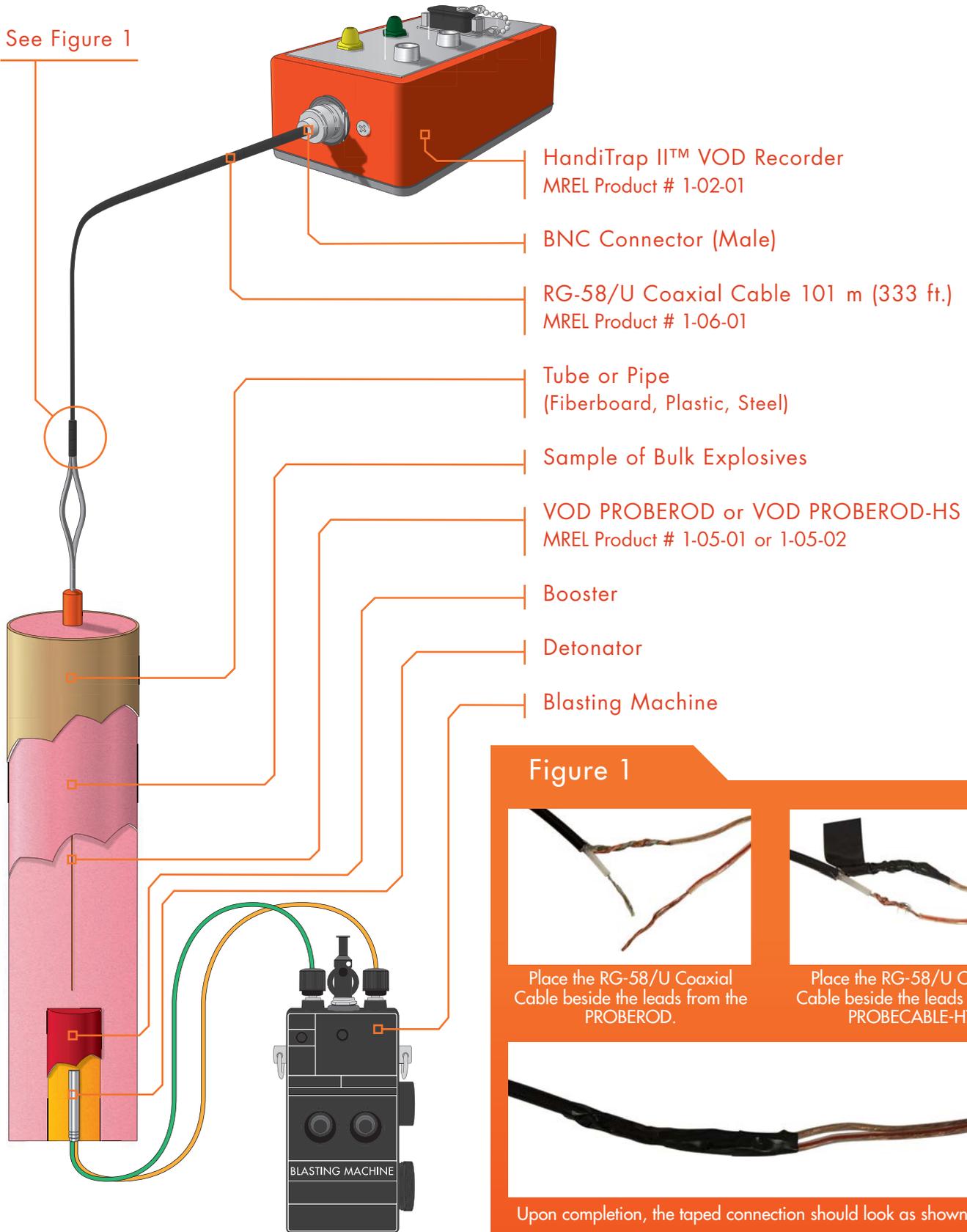


Figure 1



Place the RG-58/U Coaxial Cable beside the leads from the PROBEROD.



Place the RG-58/U Coaxial Cable beside the leads from the PROBECABLE-HT.



Upon completion, the taped connection should look as shown above.

The procedure for preparing a VOD test is as follows:

1. Demarcate the charge detonation area.
2. Place the **HandiTrap II™ VOD Recorder** in a protective shelter (a short piece of steel pipe is a good shelter) and/or a safe distance away from the detonation area. This distance may be closer than what is considered safe for the User. Once the setup is completed, the **HandiTrap II™ VOD Recorder** does not require the User to record the data; it does so automatically without assistance.
3. Run a length of coaxial cable from the **HandiTrap II™ VOD Recorder** to the detonation area with enough excess length to compensate for cable movement produced by the products of detonation. A male BNC connector should be attached to the end of the coaxial cable that is to be attached to the **VOD PROBEROD/VOD PROBECABLE-HT** input on the **HandiTrap II™ VOD Recorder**. If your reel of RG-58 coaxial cable is not equipped with a BNC male connector, A convenient **BNC Adapter** has been supplied with the **HandiTrap II™ VOD Recorder** for the purpose of connecting to the **HandiTrap II™ VOD Recorder VOD PROBEROD/VOD PROBECABLE-HT** input. The **BNC Adapter** is a short length of coaxial cable with a male BNC connector attached to one end, and two bare leads on the other. The **BNC Adapter** can be connected to the coaxial cable using wire cutters and electrical tape. The connection should be “shielding to shielding” and “center to center”. Ensure that the center conductor and the shielding conductor do not touch each other across the connection.
4. Insert a **VOD PROBEROD** axially in the sample of explosives. Start at the opposite end from where the detonator will be placed as shown. If bulk explosives are being tested in a tube that has been sealed at both ends, make a small hole in the centre of each end to allow the **VOD PROBEROD** to pass through. The **VOD PROBEROD** should be inserted all the way to the orange junction where the **VOD PROBEROD** meets the two lead wires. This will ensure that the **HandiTrap II™ VOD Recorder** triggers most dependably. If a measurement of run-up to detonation is required, ensure that the **VOD PROBEROD** is pushed well into the explosives so that it reaches the position of the detonator or booster. If the **VOD PROBEROD** reaches the booster or protrudes past it, the effect of the booster will be recorded by the **HandiTrap II™ VOD Recorder**. The same holds true for cartridges of explosives. To test the **VOD** of detonation cord, tape the detonation cord along the entire length of the **VOD PROBEROD**.
5. Connect the coaxial cable to the **VOD PROBEROD/VOD PROBECABLE-HT** connector on the **HandiTrap II™ VOD Recorder**.
6. The **VOD PROBEROD** installation aspects of the test are complete. The User can now place the detonator and connect it to the shot exploder as per standard procedures. The **HandiTrap II™ VOD Recorder** is now ready to be prepared to record the test as detailed in **Chapter 4.6**.

IMPORTANT

It is VERY important to have the coaxial cable traveling in a straight line from the sample in line with the **VOD PROBEROD** for a minimum of 16ft (5m) to acquire clean VOD traces.

4.4 Installing VOD PROBECABLE-HT for Testing Explosives in a Blasthole

The equipment and supplies that are required to conduct **VOD** tests on explosives in a blasthole are:

1. The **HandiTrap II™ VOD Recorder** System.
2. A spool of **VOD PROBECABLE-HT** (available from **MREL**).
3. Coaxial cable (type **RG-58/U** is recommended, and available from **MREL**) - sufficient length to run between the **HandiTrap II™ VOD Recorder** location and the top of the blasthole.
4. Wire cutters and electrical tape.
5. Explosives, detonators and shot exploder.

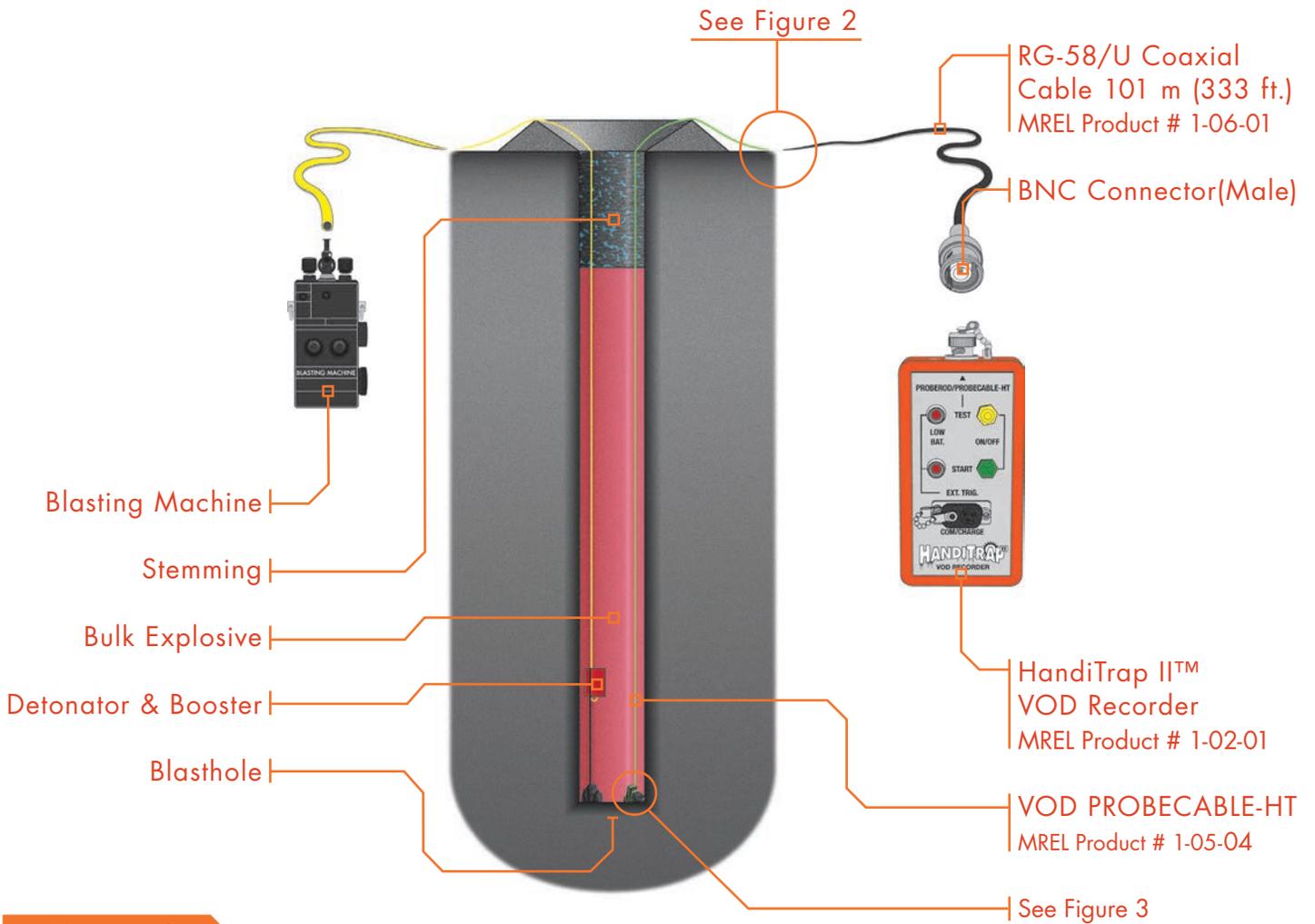
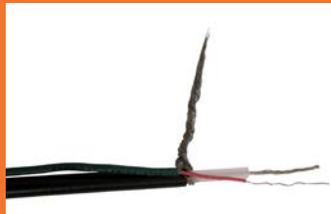


Figure 2



Place the RG-58/U Coaxial Cable beside the leads from the PROBECABLE-HT.



Twist the shielding of the coax and the PROBECABLE-HT together.



Twist the center conductors together.



Pull the shielding wires back along the cables and start taping from the cable to the end.



Making sure that there is now loose wires from the shielding touching the center conductors, continue to tape past the end.



Upon completion, the taped connection should look as shown above.

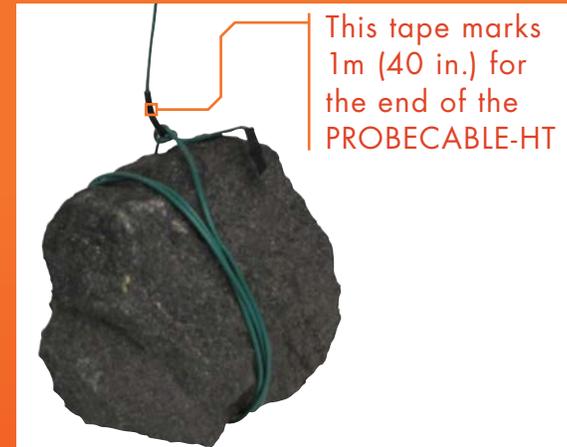


For strain relief, tie a loose knot down the cables from the connection as shown above.

4.4.1 Preparation of VOD PROBECABLE-HT for Single Blasthole Recording

- Using the wire cutters, remove the plastic cable ties from the spool of **VOD PROBECABLE-HT**. This will allow the **VOD PROBECABLE-HT** to come off freely. The **VOD PROBECABLE-HT** is 30 m (100 ft.) long and shorted at one end.
- Using tape or wire, attach the short circuit end of the **VOD PROBECABLE-HT** to a rock and lower the **VOD PROBECABLE-HT** into the hole as shown to left. Detonation cord downlines may damage the **VOD PROBECABLE-HT** or cause side initiation of the bulk explosive. When initiating with detonation cord, attach the **VOD PROBECABLE-HT** to a rock and lower it on the side of the hole opposite to the detonation cord downline.
- Ensure that at least 20 ft. (6 m) length of **VOD PROBECABLE-HT** will be in the explosive column when the hole is loaded with explosives. If the explosive column is shorter than 20 ft. then spool up enough **VOD PROBECABLE-HT** at the bottom of the borehole to allow for at least 20 ft. to be consumed by the event. Remember that this measurement excludes the stemming distance above the explosives column, as this portion of the **VOD PROBECABLE-HT** will likely not be consumed. Please note that this 20 ft. length requirement represents the minimum condition for triggering the **HandiTrap II™ VOD Recorder** and thus with only the minimum 20ft. in the explosive column, the entire event will be recorded in the pre-trigger domain of the resulting graph. Since the spool of **VOD PROBECABLE-HT** is only useful for one event, it is highly advisable to place as much length as possible inside the borehole to ensure dependable triggering.
- If the blasthole is longer than 100 ft. (30 m) then feel free to lower the connection (as per Step 7 below) between the coaxial cable and the **VOD PROBECABLE-HT** into the borehole in order to record **VOD** at the bottom of the borehole. Remember that only that portion of the column that contains the **VOD PROBECABLE-HT** will be observed by the **HandiTrap II™ VOD Recorder**. If you intend to record more than 100 ft. (30 m) of continuous **VOD** in a single trial, please contact **MREL** to learn more about the **MREL MicroTrap™ VOD/DATA Recorder** and **MREL DataTrap II™ DATA/VOD Recorder** that are capable of using much longer lengths of **VOD PROBECABLE**.
- The hole can now be loaded with explosives and stemming per usual procedure. Hold the **VOD PROBECABLE-HT** taut during the loading of the explosive to avoid slack in the hole. If you will not be present during loading, tie the **VOD PROBECABLE-HT** taut around a hole marker stake, or around a rock at the top of the borehole. After loading, you may wish to check the Probe Resistance with a digital **Blaster's Galvanometer** to ensure that no damage has occurred to the **VOD PROBECABLE-HT**. Damage is unlikely, as the **VOD PROBECABLE-HT** is well protected with PVC coating. The resistance of the **VOD PROBECABLE-HT** should be approximately **326 Ohms +/- 6 Ohms**.
- Connect the **VOD PROBECABLE-HT** to the coaxial cable using the wire cutters and electrical tape. The connection should be shielding to shielding and center conductor to center conductor. Ensure that the center conductor and the shielding connections do not touch each other.
- Place the **HandiTrap II™ VOD Recorder** in a protective shelter (a short piece of steel pipe is a good shelter) and/or a safe distance away from the blast area as dictated by flyrock. This distance may be closer than what is considered safe for the User. When set, the **HandiTrap II™ VOD Recorder** does not require an User to collect the data; the **HandiTrap II™ VOD Recorder** records the data automatically.
- Run the coaxial cable from the **VOD PROBECABLE-HT** to the **HandiTrap II™ VOD Recorder**. Shorter lengths of coaxial cable may be connected together using the wire cutters and electrical tape. Somewhere along the length of the coaxial cable, loop the coaxial cable around a large rock. When the blast is fired, and the ground moves, looping the coaxial cable around a large rock will stop the blast from pulling the coaxial cable, and the **HandiTrap II™ VOD Recorder**, with the blast. Alternatively, leave sufficient slack in the coaxial cable to allow for ground movement.

Figure 3



This tape marks 1m (40 in.) for the end of the PROBECABLE-HT

9. A male BNC connector should be attached to the end of the coaxial cable that is to be attached to the **VOD PROBEROD/VOD PROBECABLE-HT** input on the **HandiTrap II™ VOD Recorder**. If your reel of **RG-58 coaxial cable** is not equipped with a BNC male connector, a convenient BNC Adapter has been supplied with the **HandiTrap II™ VOD Recorder** for the purpose of connecting to the **HandiTrap II™ VOD Recorder VOD PROBEROD/VOD PROBECABLE-HT** input. The BNC Adapter is a short length of coaxial cable with a male BNC connector attached to one end, and two bare leads on the other. The BNC Adapter can be connected to the coaxial cable using wire cutters and electrical tape. The connection should be “shielding to shielding” and “center to center”. Ensure that the center conductor and the shielding conductor do not touch each other across the connection.
10. The **VOD PROBECABLE-HT** installation is complete. The **HandiTrap II™ VOD Recorder** is now ready to be switched into **RECORD** mode, as explained in **Chapter 4.6**.

4.5 Coaxial Cable Protection

It is important to protect the **VOD PROBECABLE-HT** and the coaxial cable from damage caused by personnel and machinery operating on the blast. It is also important to protect the **VOD PROBECABLE-HT** from damage caused by detonation of other holes and/or surface accessories such as detonating cord, detonating relays, and shock tube bunch blocks.

The cables may be protected in many ways. Experience has shown that it is best to lead the **VOD PROBECABLE-HT** and coaxial cable under the detonating cord and leave a barrier of sand or drill cuttings between the cables and the detonating cord. A danger point is the collar area of the holes as the detonating cord or shock tube bunch blocks that initiate the downlines may cross directly over the **VOD PROBECABLE-HT** or coaxial cable. A good procedure is to protect the area where there is a cross over for about 1.5 m (5 ft) along the length of cable. Experience has shown that a sand or stemming barrier thickness of 15-30 cm (0.5-1 ft) is sufficient to protect the cables.

When testing samples of explosives, it is best to lay the sample flat on the ground. This will prevent the products or detonation, or shrapnel, from damaging the **VOD** cable. If you are using an electric detonator to initiate the explosive, it is good practice to place the sample so that the **VOD** information cable is heading off in a different direction from the shot initiation cable, as this will reduce the chance of electromagnetic interference from the initiation cable affecting the **VOD** cable. Please feel free to contact **MREL** for site and product specific recommendations.

4.6 HandiTrap II™ VOD Recorder Setup Procedure for VOD Measurement

Once the **VOD PROBEROD** or **VOD PROBECABLE-HT** has been placed in the explosive and connected to the **RG-58 coaxial cable** running to the **OD PROBEROD/VOD PROBECABLE-HT** connector on the **HandiTrap II™ VOD Recorder**, the User may now prepare the **HandiTrap II™ VOD Recorder** for recording.

The procedure to record a new VOD test consists of the following steps:

1. Ensure that the coaxial cable coming from the **VOD PROBEROD** or **VOD PROBECABLE-HT** is connected to the **HandiTrap II™ VOD Recorder** input connector labeled **VOD PROBEROD/VOD PROBECABLE-HT**.
2. Turn the **HandiTrap II™ VOD Recorder** power **ON** by simultaneously pressing the **TEST** and **START** buttons for 1 second. The **START** light will illuminate and begin to flash slowly indicating that the **HandiTrap II™ VOD Recorder** is in Stand-by mode.
3. If the **TEST** light flashes when no buttons are pressed, the battery needs to be recharged.
4. Press the **TEST** button; the **TEST** light will illuminate steady red if the **VOD PROBEROD** or **VOD PROBECABLE-HT** electrical circuit is found to be within the correct resistance range. If the **TEST** light flashes slowly, the circuit exhibits a low resistance, or short circuit. If the **TEST** light



flashes quickly, the circuit exhibits a high resistance, or open circuit. Please refer to **Chapter 4.7** for possible solutions. Please note that the **START** button will be inactive so long as the resistance is not within the appropriate range. This fail-safe feature ensures that the User is notified of a faulty circuit before the test begins.

5. Press the **START** button. If the **START** light will illuminates steady red, The **HandiTrap II™ VOD Recorder** is in **RECORD** mode. The **HandiTrap II™ VOD Recorder** will wait for its trigger to record the event automatically. Personnel can now vacate the **HandiTrap II™ VOD Recorder** location. When the triggering condition is met (i.e. a sufficient length of **VOD PROBEROD** or **VOD PROBECABLE-HT** has been consumed by the detonation), the **HandiTrap II™ VOD Recorder** will trigger and start collecting **VOD** information.
6. Once data collection has been completed, the **START** light flashes slowly at the same rate as when the **HandiTrap II™ VOD Recorder** was first turned on, but pressing the **START** or **TEST** buttons by themselves will have no effect. The **BNC Adapter** can be disconnected from the **HandiTrap II™ VOD Recorder**.
7. The **VOD** data is ready to be transferred to a computer using the **Software**, as described in **Chapter 5.1**. Do not switch **OFF** the **HandiTrap II™ VOD Recorder** until the data has been transferred. The **HandiTrap II™ VOD Recorder** has a volatile memory, so switching **OFF** the **HandiTrap II™ VOD Recorder** will erase all data.

CAUTION

Do not switch the **HandiTrap II™ VOD Recorder OFF** at this point. All test data that has not been downloaded to a PC or Palm will be lost when the **HandiTrap II™ VOD Recorder** is turned off.

8. Once data transfer is complete then the **HandiTrap II™ VOD Recorder** can be switched **OFF** by simultaneously pressing the **TEST** and **START** buttons for 1 second.

4.7 VOD PROBEROD or VOD PROBECABLE-HT Circuit Resistance Out of Range

With a **VOD PROBEROD** or **VOD PROBECABLE-HT** connected to the **HandiTrap II™ VOD Recorder** and the **TEST** button is pressed, a steady **TEST** indicator light indicates that the **VOD PROBEROD** or **VOD PROBECABLE-HT** electrical circuit is within range. With a **VOD PROBEROD** or **VOD PROBECABLE-HT** connected to the **HandiTrap II™ VOD Recorder** and the **TEST** button is pressed, a slowly flashing **TEST** indicator light indicates that the resistance in the **VOD PROBEROD** or **VOD PROBECABLE-HT** electrical circuit is too low (such as a short circuit). With a **VOD PROBEROD** or **VOD PROBECABLE-HT** connected to the **HandiTrap II™ VOD Recorder** and the **TEST** button is pressed, a rapidly flashing **TEST** indicator light indicates that the resistance in the **VOD PROBEROD** or **VOD PROBECABLE-HT** electrical circuit is too high (such as an open circuit). If you are unsure which light the **HandiTrap II™ VOD Recorder** is presenting, remove the BNC connector and press the test button again. This flashing light is the rapidly flashing light from the electrical circuit having a resistance to high.

The **HandiTrap II™ VOD Recorder** is calibrated to perform **VOD** tests between the two initial resistance values of 310 - 340 ohms.

There are two common reasons for total resistance to be LOW:

1. A short circuit somewhere in the coaxial cable and probe assembly, including any BNC connector(s) or BNC Adapter;
2. Damage may have occurred to the **VOD PROBEROD** or **VOD PROBECABLE-HT**.

Items 1 and 2 above can be tested using a blaster's galvanometer to test the resistance/continuity of the coaxial cable and **VOD PROBEROD** or **VOD PROBECABLE-HT** assembly and solved by remaking the connections and/or replacing the damaged **VOD PROBEROD** or **VOD PROBECABLE-HT**.

There are two common reasons for total resistance to be HIGH:

1. An open circuit somewhere in the coaxial cable and probe assembly, including any BNC connector(s) or BNC Adapter;

2. A damaged **VOD PROBEROD** or **VOD PROBECABLE-HT**.

Items 1 and 2 above can be tested using a blaster's galvanometer to test the resistance/continuity of the coaxial cable and probe assembly and solved by remaking the connections and/or replacing the damaged **VOD PROBEROD** or **VOD PROBECABLE-HT**.

IMPORTANT

If using a **VOD PROBEROD** and the resistance is too high as per the label, one possible fix to make the **VOD PROBEROD** usable is to re-crush the one end of the **VOD PROBEROD**. Over time, that connection can corrode and increase the resistance of this connection.

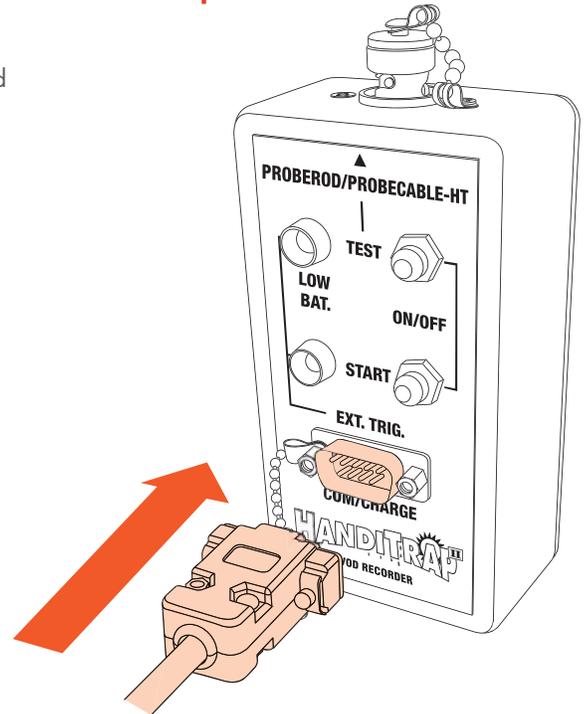
4.8 Utilizing the External Trigger

In some **VOD** recording applications, it may be desirable to have one or several **HandiTrap II™ VOD Recorders** begin to record exactly when a specific event occurs. In the case of several **HandiTrap II™ VOD Recorders**, this technique would allow the determination of the delay time between blastholes. For the specific event to start at time - 0 on the graph, the **EXT. TRIG.** connector, on the front of the **HandiTrap II™ VOD Recorder**, is used.

Connect the External Trigger Adapter to the **EXT. TRIG.** connector on the front of the **HandiTrap II™ VOD Recorder**. Connect a length of coaxial cable to the External Trigger Adapter and extend the coaxial cable to the location of the trigger event. Attach a thin wire such as an electrical blasting wire lead to the other end of the coaxial cable (center conductor of the coaxial cable to one end of the thin wire and shielding of the coaxial cable to the other end of the thin wire) using cutters and electrical tape so there is a closed circuit across the end of the coaxial cable. The polarity of the connection does not matter. The assembly consisting of the External Trigger Adapter and coaxial cable and thin wire is called the "Thin Trigger Wire".

The **HandiTrap II™ VOD Recorder** will mark time-zero when the **Trigger Wire** becomes open circuit (normally closed, **BREAK** Circuit trigger). Upon the thin wire becoming broken, the **HandiTrap II™ VOD Recorder** will begin recording data. Any explosive event such as a detonator firing, detonating cord firing or a booster firing will break such a circuit and cause the **HandiTrap II™ VOD Recorder** to collect data. Pre-trigger points will still be collected, but time=0 on the graph will be the precise time when the Trigger Wire became broken.

Connecting the EXT. TRIG. connector to the HandiTrap II™ VOD Recorder



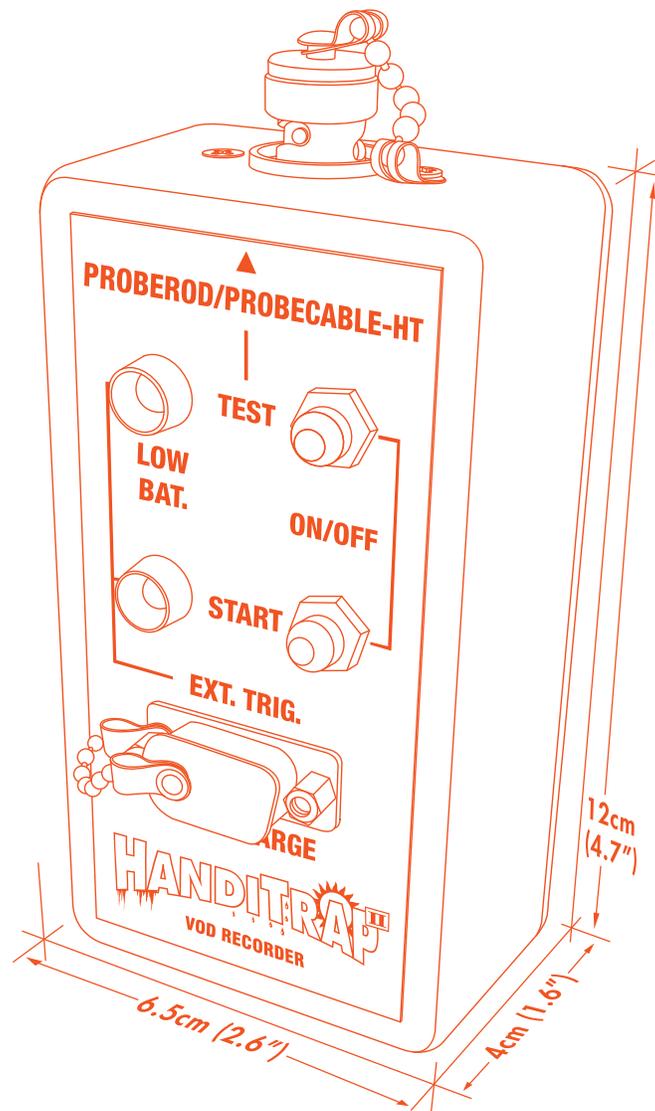
CAUTION

It is important to connect the **External Trigger Adapter** to the **HandiTrap II™ VOD Recorder** before pressing the **START** button. Otherwise, if the **START** button has already been pressed, the **HandiTrap II™ VOD Recorder** will trigger upon connecting the **External Trigger Adapter**.

To connect multiple **HandiTrap II™ VOD Recorder's** to one Trigger Wire to time synchronize the **HandiTrap II™ VOD Recorder's**, connect coaxial cable BNC "T" connectors on the ends of the External Trigger Adapters and connect the External Trigger Adapters together and to one **Trigger Wire** as shown in the example detailed in **Appendix A**.

Chapter 5

The DAS™ Data Acquisition Suite Software for Windows®



Overview

This Chapter provides detailed instructions on how to retrieve data from the HandiTrap II™ VOD recorder and how to analysis the data obtained.

STOP

Ensure that Chapter 1 has been successfully completed prior to beginning Chapter 5.

5.1 Retrieving Data From The HandiTrap II™ VOD Recorder

Refer to the **DAS™ Data Acquisition Suite Software** manual.

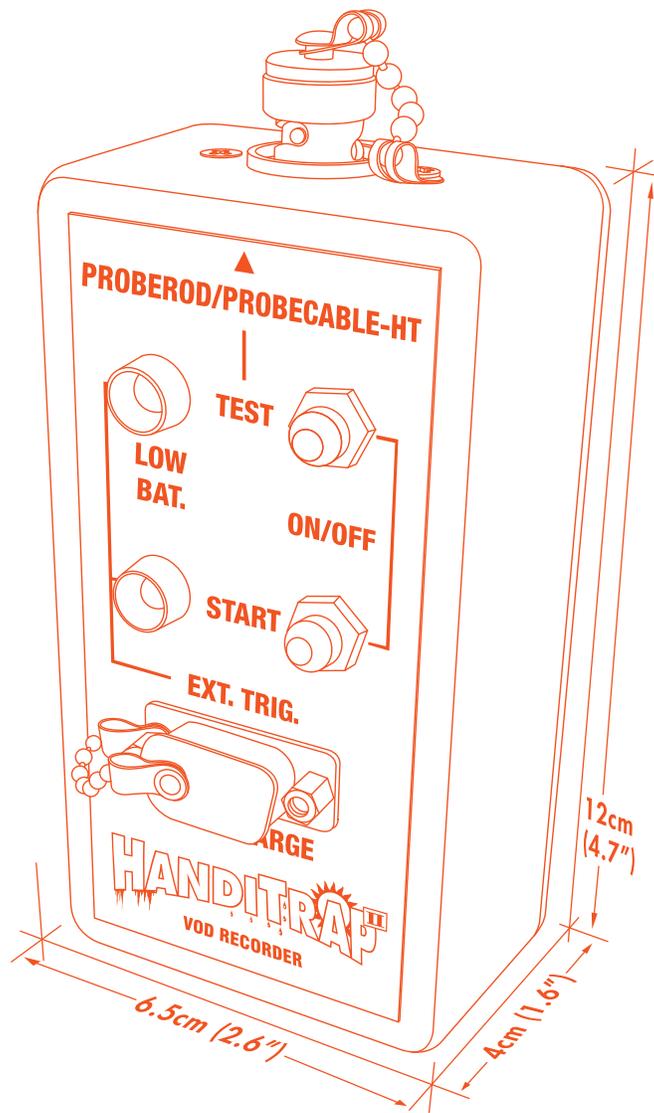
5.2 Selecting Data Files For Analysis

Refer to the **DAS™ Data Acquisition Suite Software** manual.

5.3 Introduction To Analysis

Refer to the **DAS™ Data Acquisition Suite Software** manual.

Chapter 6 Battery Maintenance



Overview

This Chapter provides detailed instructions on how to maintain the battery inside the HandiTrap II™ VOD recorder.

The internal Nickel Cadmium (NiCad) rechargeable battery of the **HandiTrap II™ VOD Recorder** is rated for 8 hours of use given the wide range of possible conditions of their use and their inevitable change of condition over years of use. With more active monitoring and conditioning of the batteries, they can be counted on to run a long test of up to 24 hours.

The NiCad battery can have its normal operating abilities reduced by various causes, but it also has the ability to be brought back to full capability from most states if it undergoes 1 to 3 complete discharge-recharge cycles. To get dependable long test use from the battery, the operator needs to:

- A. Monitor the battery regularly to confirm that it has sufficient capacity for long test use.
- B. If it has lost capacity, restore it with one or more discharge/recharge cycles.
- C. Replace the battery if discharge/recharge does not restore it.

Also, NiCad battery capacity (which comes from a chemical reaction) slowly decreases as temperature rises above 45 C (113 F). The **HandiTrap II™ VOD Recorder** battery has not been tested for extended periods of time above this temperature, so the operator may need to conduct his own testing to confirm that the **HandiTrap II™ VOD Recorder** will run for a particular amount of time beyond the stated 8 hours.

NOTE: If unexpected priorities cause the **HandiTrap II™ VOD Recorder** to be left on until it powers itself off, ensure that it is fully recharged within 7 days. If not, charge it for 16-24 hours, then run it through a discharge/recharge cycle. If unexpected priorities prevent the charger from being disconnected and it charges for 48 hours or more, a discharge/recharge cycle should be carried out as described below, since the overcharge may have reduced the battery capacity.

6.1 Monitoring the Battery

To confirm that the battery has necessary capacity, conduct the following test every 3 months, or when the battery capacity is in doubt:

1. Connect a resistor supplied by **MREL** (or a **PROBEROD** or a spool of **PROBECABLE-HT**) to the **HandiTrap II™ VOD Recorder**.
2. Press the **Test** button to confirm that the resistance is in range.
3. Press the **Start** button to place the **HandiTrap II™ VOD Recorder** in **Active Mode**.
4. Wait for 24 hours and then confirm that the low battery light has not come on.
5. Turn the **HandiTrap II™ VOD Recorder** power off.
6. Connect the charger.
7. Charge for 16-24 hours (16 is ideal), then disconnect the charger.

NOTE: This would typically be done at the same time of day on 3 consecutive days.

6.2. Discharge/Recharge Cycle

1. Connect a resistor to **HandiTrap II™ VOD Recorder** (or a **PROBEROD** or spool of **PROBECABLE-HT**). It can be discharged with nothing connected in **Standby Mode**, but that takes 50% longer.
2. Press the **Test** button to confirm that the resistance is within range (if a resistor is attached).
3. Press the **Start** button to place the **HandiTrap II™ VOD Recorder** in **Active Mode** (if a resistor is attached).
4. Wait for it to discharge completely.

NOTE: This may take up to 35 hours in Active Mode, or 50 hours in Standby Mode. Typically, this would be set up and then checked at the same time 2 days later. If it is done after a long test, it may take less than a day to discharge.

5. Connect the charger and charge for 16-24 hours (16 is ideal).

6.3. When to Replace the Battery

If the battery cannot last for 24 hours after 3 discharge/recharge cycles, then it should be replaced before conducting another long test.

The most common reason for replacing a battery is that it has left in a discharged state for too long.

NOTE: NiCad batteries will self-discharge to a discharged state if left for 6 months without charging. NiCad batteries can be charged/discharged over 1000 times.

6.3.1 Maintenance Schedule for Battery

This discharge/recharge cycle is one of the practices of ideal battery maintenance, which also includes:

Ensure that the battery has been fully charged at least every 3 months. If the **HandiTrap II™ VOD Recorder** is regularly used, this is not a problem.

Run the battery through a discharge/recharge cycle at least once every 6 months.

Ensure that the battery is not stored above 45 C for extended periods of time (eg: more than a week in a car in the summer). If this is done unintentionally, the battery should be run through a discharge/recharge cycle.

Ensure that the battery is not overcharged. If it is left attached to the charger for an extended period of time (over 48 hours) then it should be run through a discharge/recharge cycle.

6.3.2 Alternate Maintenance Schedule for Battery

If it fits the operator's schedule better, the **HandiTrap II™ VOD Recorder** can be tested and recharged as follows:

After conducting a long test, download the data, then turn off the **HandiTrap II™ VOD Recorder**.

First thing in the morning the next day, turn on the **HandiTrap II™ VOD Recorder** with a resistor attached and press Start.

At the end of the day, confirm that the low battery light has not come on. This confirms that the battery still has 8 hours more capacity (at full charge) than is needed for the long test.

Leave the **HandiTrap II™ VOD Recorder** in the condition above on overnight. It should be discharged and turned itself off by the next day.

Once it has discharged, charge for 16 to 24 hours (16 is ideal).

Store the **HandiTrap II™ VOD Recorder** until the next test.

6.3.3 Estimating Battery Run Time

The **HandiTrap II™ VOD Recorder** consumes 30 mA when in **Active Mode** and 20 mA in **Standby Mode**. The battery has a capacity of 1000 mAh when fully charged and in a full capacity state. To calculate an estimated test times with the equation below:

N = estimated hours before triggering (**Active Mode**)

M = estimated hours after triggering (**Standby Mode**)

$$\text{capacity used} = (30 * N + 20 * M) \text{ mAh}$$

So, for example, if it is expected to run for 2 hours before triggering in **Active Mode** and 14 hours after triggering in **Standby Mode**, it will consume $(30*2 + 20*14) = (60 + 280) = 340$ mAh of capacity. This gives a comfortable safety margin.

As temperature goes above 45 C (113 F), the capacity of NiCad batteries goes down, so predictions from the above formula should be reduced and tested by the operator.

6.3.4 Charging Time

Ideally, if a percentage of the battery is used, it should be charged for the same percentage of 16 hours, so from the example above, it should be recharged for $(340/1000) \Rightarrow 34\%$ of 16 hours which is 5.4 or about 6 hours. It definitely needs at least this much time to regain full capacity. Charging for an exact time is not necessary, but in this case it would be better to charge it for 8 hours rather than for 16 or 24.

6.3.5 Charging for a Precise Amount of Time

The operator can precisely control the amount of time the **HandiTrap II™ VOD Recorder** is charged by using a commonly available **Timer Plug**. Normally these are used to turn power on and off at specific times, but if the “**On**” component is removed, it will allow power for a precise amount of time, then turn power off until the operator actively turns it back on. This allows the **HandiTrap II™ VOD Recorder** to be left to charge without needing to go back to unplug it. The brand recommended is a **Heavy Duty Grounded Intermatic Appliance Timer Model TN311C**. This will allow the user to plug a power bar into the timer and charge multiple units at once. Also, the brand shown is recommended because with some brands, the “**Off**” key can function as the “**On**” key if it is put in backwards, whereas with the brand shown, the “**Off**” key will only turn the timer off, no matter how it is put in.

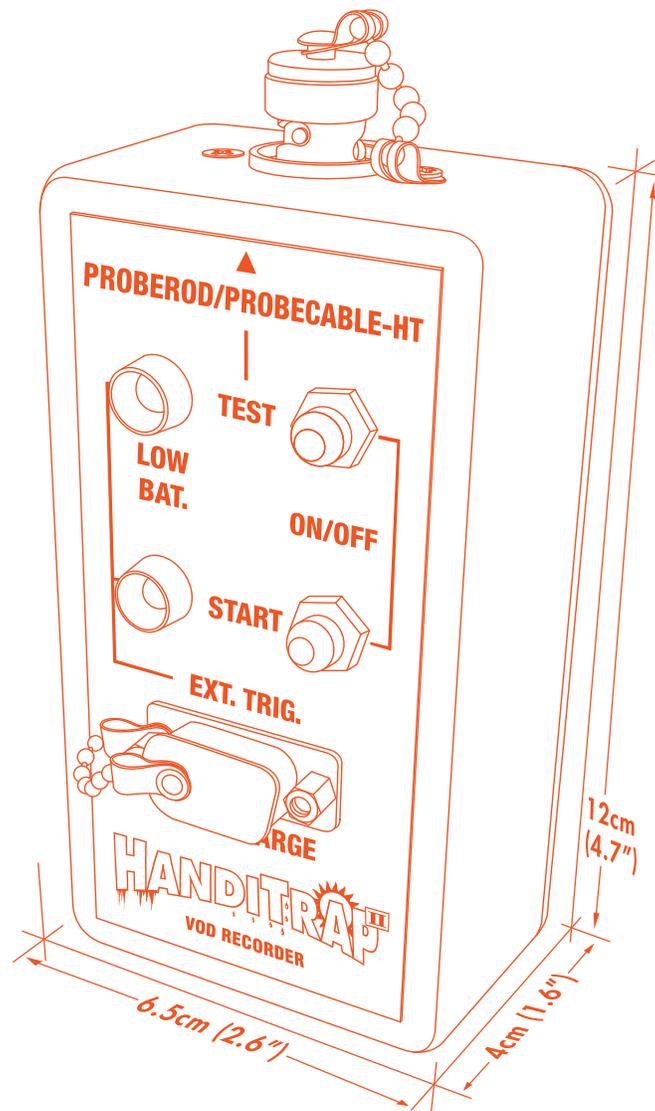


6.3.6 Using Timed Charging with the HandiTrap II™ VOD Recorder

The easiest operation of the timer is to set time on the timer to 12:00am (midnight). Insert the red plastic tab (the **OFF** tab) at 4:00 pm (1600). This will have the timer in the **ON** position for 16 hours. If less time is required (because of less power used from the battery), the user can move the OFF tab to the desired amount of time required as described in the **Charging Time** section. The Operator can plug a single **HandiTrap II™ VOD Recorder** into the Timer or plug a power bar into the Timer and charge multiple **HandiTrap II™ VOD Recorder** units at once for the desired time. The next step is to turn the timer to the **ON** position and lastly plug it into the power source. This will charge whatever the user has plugged into the timer for the given amount of time.

Chapter 7

Contacting MREL for Technical Support



7.1 Contacting MREL

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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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