



**Safeguard
Seismic
Unit 3000
LC and EZ^{Plus}**



GEOSONICS INC
WARRENDALE PA
FIRMWARE VERSION 4.98xc
MANUAL VERSION 5.3.13

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INTRODUCTION

Welcome to the Safeguard Seismic Unit family of seismographs. The SSU 3000LC and the SSU 3000-EZ PLUS were designed with the user in mind. Both models have a tough, weather resistant case. The enhanced keypad has large tactile keys for easy on-site setup. Metal, quick-lock connectors ensure secure cable connections. The 3000LC's ports are conveniently located on the base unit allowing it to be removed from the case when space is limited. The 3000 EZ-PLUS is built into the case, which has external ports allowing the case lid to remain closed during monitoring operations. The low-density geophone (which complies with ISEE recommendations for "equal to or less than" densities), 2-hertz high pass microphone, microphone stand, and all other standard accessories fit easily into the storage compartment of either unit.

Both models have four recording modes – dual, triggered, histogram/continuous and sustained trigger. Events up to 70 seconds in length can be recorded. Multiple options are available to the user to customize data collection.

The four-line LCD window not only makes on-site programming easy, it also permits the user to review results in the field. A serial port allows the seismograph to be connected to a PC for easy data transfer. The included Analysis Software can be used for compliance analysis and custom printouts.

Data can be collected in either imperial (US customary) units or metric units. The non-volatile internal memory can store up to 220, 1-second events. Enabling the timer option will turn the unit on and off at pre-selected times. The timesaving template utility can be used to store often-used setup configurations.

The internal lead-acid battery is easily charged using the included AC adapter.

GeoSonics Inc. is a leader in seismograph innovation, manufacturing, and vibration consulting. When designing our equipment user-friendly interfaces, ruggedness, and reliability are not just goals - they are standards.

A NOTE TO OUR USERS:

The GeoSonics Safeguard Seismic Unit family of seismographs is continually evolving. Technological advances and changes in both client needs and regulatory requirements influence hardware and firmware enhancements.

In order to provide our clients with the most up-to-date equipment, GeoSonics has a standing policy to upgrade seismograph firmware to the latest version when we calibrate the seismograph. Please refer to any new documentation included with your seismograph for new features and changes in operating instructions.

QUICK START GUIDE

1. Securely couple geophone to surface.
2. Plug geophone cable into geophone jack. Turn the quick-lock connector clockwise to secure the connection.
3. Extend microphone stand, attach spike, and place microphone stand on the right side of the unit (EZ PLUS only) or spike the stand into the ground. Insert microphone into the clip. Plug microphone cable into the microphone jack. Turn the quick-lock connector clockwise to secure connection.



4. Press **ENTER** to turn the seismograph on.

5. When the command menu is displayed, press 1 for Recorder Setup. Make necessary changes.
6. From the command menu, press 3 for Text Setup. Make necessary changes.
7. From the command menu, press 2 for Display Data, then 3 for Calibration Test. If any channels FAIL, check connections and correct problems before proceeding.



8. Press **SCAN** to start collecting data. Allow approximately 25 seconds for the unit to start to record.



9. After recording procedures are complete, press END to exit the SCAN mode.

GETTING STARTED – SSU 3000LC

Components

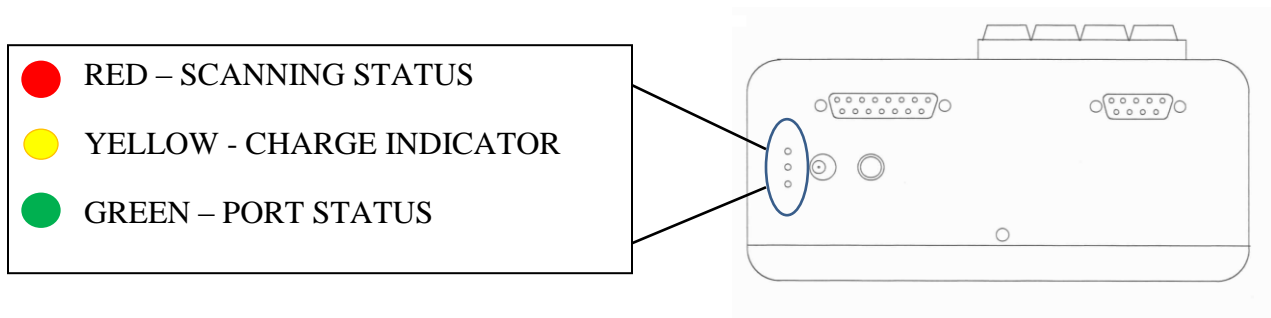
The 3000LC portable monitoring seismograph consists of the following hardware:

- seismograph base unit
- geophone
- microphone
- microphone stand
- windscreen/air ball
- three (3) 3-inch spikes with external threads (for use with geophone)
- one (1) 3-inch spike with internal threads (for use with microphone stand)
- AC adapter
- PC communication cable
- USB to serial adapter cable
- Carry case

GeoSonics' Seismic Analysis Software (version 8.1.49) is also included with your unit.

Units are typically shipped with the fuse removed. This is done to protect your unit from damage that may occur during airport or delivery tracking scans.

The fuse holder is found on the front panel of the unit, to the right of the AC charging port. The fuse is easily replaced by screwing it into place. However, date and time information will have to be re-entered into your unit once replaced. This is easily accomplished by following the instructions under the UTILITIES heading, option 1 (please see page 36.) There are three (3) LED lights on the front of the unit.



The RED LED is a status indicator light for the SCAN mode. This light will blink when the unit is in the SCAN mode. More information on this indicator light is available on page 45.

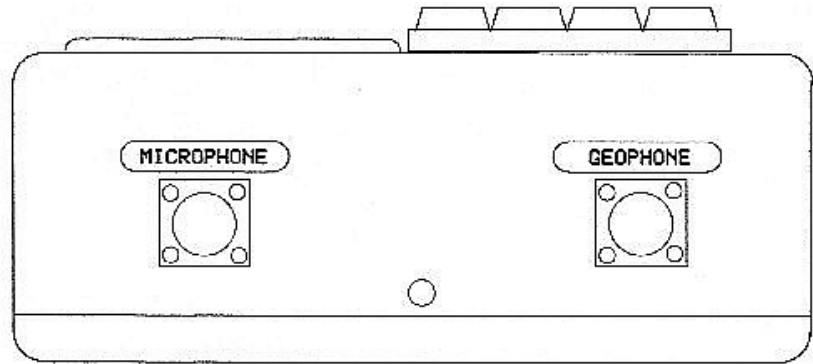
The YELLOW LED is a status indicator light for the charging circuit. This light will glow steady when the unit is charging.

The GREEN LED is the serial port status light. When the seismograph is communicating through the serial port, such as with a PC, the light will glow steady.

Basic connections

The microphone and geophone ports are located on the left side of the unit.

Note: It is recommended that the geophone and microphone be installed in their recording locations prior to connecting their cables to the main unit. See *Field Setup* (page 9) for additional instructions.



To connect the geophone to the unit locate the notch on the cable connector. This notch aligns with the top of the seismograph's port. Insert the cable's connector into the port labeled **GEOPHONE** on the left side of the unit. After inserting the connector into the port, turn the outer locking ring clockwise to complete the connection.

To connect the microphone to the unit locate the notch on the cable connector. This notch aligns with the top of the seismograph's port. Insert the cable's connector into the port labeled **MICROPHONE** on the left side of the unit. After inserting the connector into the port, turn the outer locking ring clockwise to complete the connection.

GETTING STARTED – SSU 3000EZ - PLUS

Components

The 3000EZ – PLUS portable monitoring seismograph consists of the following hardware:

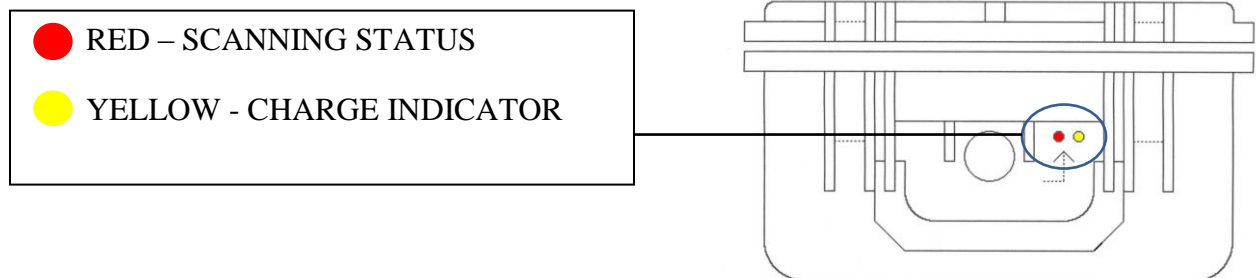
- seismograph base unit / carry case
- geophone
- microphone
- microphone stand
- windscreen/air ball
- three (3) 3-inch spikes with external threads (for use with geophone)
- one (1) 3-inch spike with internal threads (for use with microphone stand)
- AC adapter
- PC communication cable
- USB to serial adapter cable

GeoSonics' Seismic Analysis Software (version 8.1.49) is also included with your unit.

Units are typically shipped with the fuse removed. This is done to protect your unit from damage that may occur during airport or delivery tracking scans.

The fuse holder, is found on the top of the unit.. The fuse is easily replaced by screwing it into place. However, date and time information will have to be re-entered into your unit once replaced. This is easily accomplished by following the instructions under the UTILITIES heading, option 1 - page 36.

There are two (2) LED lights on the front of the unit.



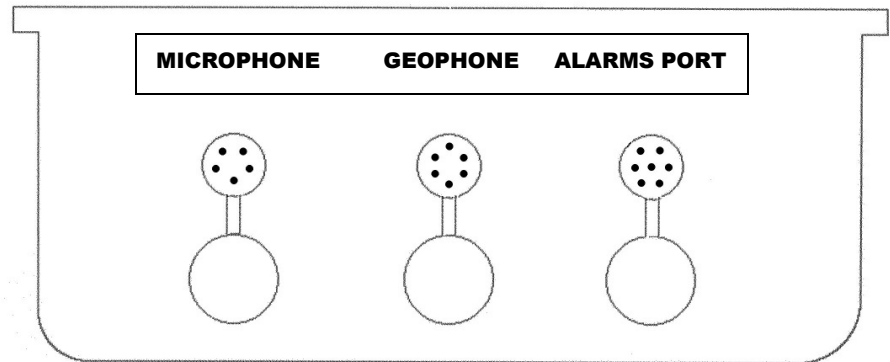
The RED LED is a status indicator light for the SCAN mode. This light will blink when the unit is in the SCAN mode. More information on this indicator light is available on page 45.

The YELLOW LED is a status indicator light for the charging circuit. This light will glow steady when the unit is charging.

Basic connections

The microphone and geophone ports are located on the right side of the unit.

Note: It is recommended that the geophone and microphone be installed in their recording locations prior to connecting their cables to the main unit. See *Field Setup* (page 9) for additional instructions.



To connect the geophone to the unit locate the notch on the cable connector. This notch aligns with the top of the seismograph's port. Insert the cable's connector into the port labeled **GEOPHONE** on the right side of the unit. After inserting the connector into the port, turn the outer locking ring clockwise to complete the connection.

To connect the microphone to the unit locate the notch on the cable connector. This notch aligns with the top of the seismograph's port. Insert the cable's connector into the port labeled **MICROPHONE** on the right side of the unit. After inserting the connector into the port, turn the outer locking ring clockwise to complete the connection.

FIELD SETUP

For additional information regarding seismograph set up, refer to the *ISEE Field Practice Guidelines for Blasting Seismographs*:

http://www.isee.org/media/pdf/FieldPracticeGuidelinesRev03_01_10.pdf

Location

When choosing the location for your seismograph, the following factors should be considered:

1. The geophone should be placed between the vibration source and the structure to be monitored/protected.
2. Avoid placing the unit under or near high-tension wires or other high voltage transmission devices. Voltage spikes may cause the unit to pre-trigger or malfunction during data collection.
3. Avoid placing the geophone within four (4) feet of a building foundation. Vibration waves may “bounce” off of a foundation and cause erroneous readings.
4. If the location is near other vibration sources, extra caution will be needed when selecting trigger levels.
5. In order to get the most accurate data, the geophone must be securely coupled to the surface. Review the *Geophone Installation* section below.
6. Choose a location where the microphone will not be placed behind a solid surface, such as a brick retaining wall. Solid surfaces block the air overpressure and may result in inaccurate data results.

Geophone Installation

The geophone contains three mutually perpendicular velocity-measuring elements that measure the vibration levels on three planes – longitudinal (back and forth), transverse (side to side) and vertical (up and down). In order for these elements to function properly, the geophone must be in a level orientation. If the geophone is mounted at an extreme angle, or upside down, one or more of the elements will be inoperable. In addition to missing data, this will also cause invalid calibration pulses. An invalid calibration pulse will render your record invalid in many states. There is a bubble level in the center of the geophone to help the operator ensure that the geophone is installed in the proper orientation.

The geophone must also be properly oriented toward the vibration source. The arrow on the top of the geophone that points away from the cable connection should be pointing toward the vibration source.



To obtain accurate data the geophone must be securely coupled to the surface. There has been much debate and discussion in recent years regarding coupling. If accelerations in excess of 0.2 g's are anticipated, some method of external coupling (burial, spikes, anchoring to bedrock, etc.) is essential. For accelerations less than 0.2 g, other forms of coupling may be acceptable. While some methods are better than others, no one method will work in all cases. Coupling methods may also be combined, such as sandbagging a spiked geophone.

Please note: Obtaining an acceleration reading in excess of 0.2 g DOES NOT mean that your geophone de-coupled and that your reading is inaccurate.

BURIAL

Most experts would agree that burying the geophone is the best way to obtain accurate data. If you plan to bury the geophone, the hole should be at least 8 inches deep. The hole should be large enough so that the cable is not pinched. The bottom of the hole should be level. After the spikes have been attached to the geophone, it should be spiked to the bottom of the hole. Soil, sand, or other loose granular material should be placed and packed tightly around and on top of the geophone until the hole is filled. If the fill material is left loose, you will not have good coupling. If gravel or a similar type of material is used to fill the hole, the ground vibrations could cause the gravel to “bounce” off the geophone causing high, inaccurate readings.

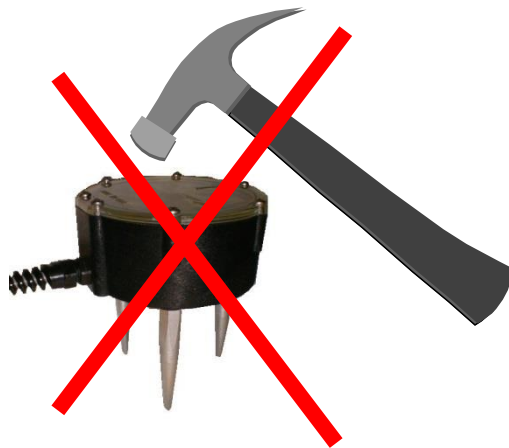
ANCHORING TO BEDROCK

The geophone may also be attached to stable bedrock using a rock bolt or an adhesive. It is best to have developed a plan for removing the geophone from the surface, before applying any type of adhesive.

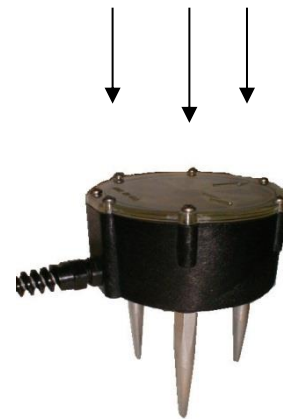
SPIKES

If monitoring is to be done on firm soil, spiking the geophone is an excellent coupling method. Three-inch spikes are included with your seismograph. These spikes can be screwed into the bottom of the geophone. After the spikes have been securely attached, use steady pressure on the geophone to push the spikes into the ground. The geophone should be flush with the ground.

DO NOT hammer the geophone as this may damage sensitive internal electronic components. DO NOT “wiggle” the geophone back and forth. This will make the spike openings larger than the spikes, preventing a secure coupling.



USE STEADY FORCE



SANDBAGGING

A LIMP, 10 pound sandbag may be draped over the geophone to prevent slippage. The sandbag should be limp enough that it conforms to the shape of the geophone and large enough so that all sides of the sandbag are in contact with the ground.

HARD SURFACE INSTALLATION

Double face (carpet) tape can be used to obtain a secure coupling on a hard surface in many cases. The surface should be flat and free of dirt or other substances that would prevent a secure attachment. Adding a sandbag will decrease the possibility of slippage.

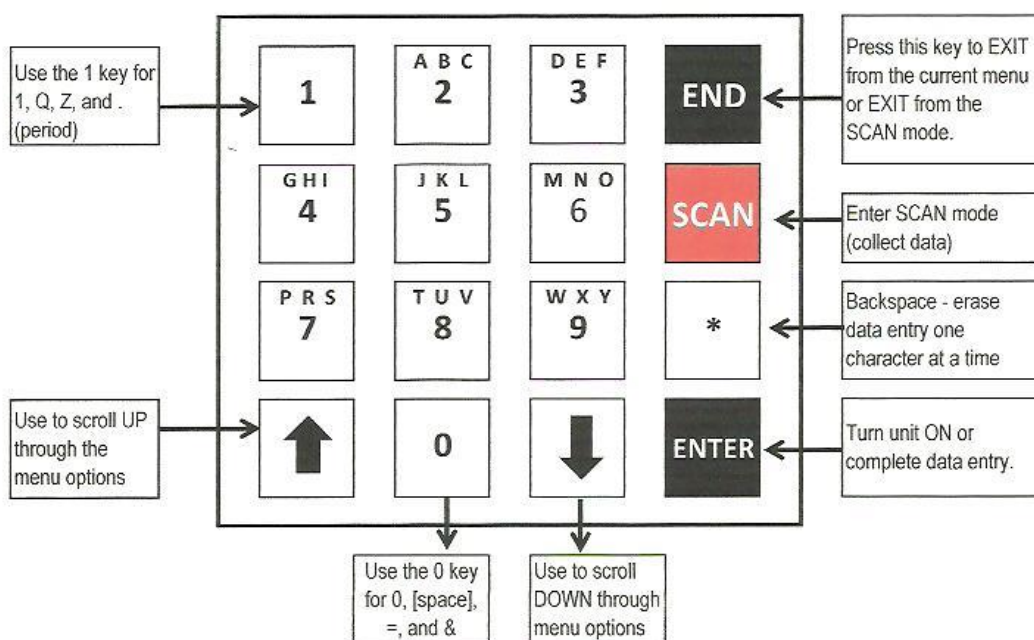
Other coupling methods have proven to be successful under specific conditions. C-clamps and epoxy have all been used to attach geophones to stable surfaces.

Both the SSU 3000LC and SSU 3000EZ PLUS contain the same firmware. The remaining information in the manual applies to both units (unless noted).

KEYPAD OVERVIEW

The seismograph is programmed using menu driven options displayed in the liquid crystal display window. The keypad allows the user to communicate with the unit. It consists of 16 keys through which all alphanumeric data can be entered.

TO ENTER TEXT: All 26 letters of the alphabet are available through this keypad. By pressing and holding the **2** key, you will scroll through the 2 – A – B – C characters. Simply release the key when the character you want is displayed in the window. The **3** key is used for 3 – D – E – F, and so on. For letters and characters not displayed on the keypad, such as Q and Z, refer to the diagram below.



Pressing the up, down, or end keys before pressing the enter key will stop a recent (i.e. NEW) entry from being saved.

Pressing the **SCAN** key will cause the unit to start collecting data in approximately five (5) to 59 seconds depending upon the mode and recording settings. Pressing **END** will end this process.

MENU OPTIONS – PROGRAMMING THE UNIT

The unit is turned on by pressing and holding the ENTER key until a small line (_) appears in the upper left corner of the display window. After a few seconds, the CHECK screen will appear. This screen provides a quick overview of basic information.

This CHECK screen provides the following information:

The seismograph's current date setting is Friday, March 8, 2013.
The time setting is 1:24:29* PM. There are 21 records
(including check events) in the unit's internal memory with 89% of the memory free and available for data recording.

| | | |
|------------|----------|----------|
| CHECK | | |
| Fr | 03/08/13 | 13:24:29 |
| 21 records | 89% free | — |

This screen will be displayed for approximately 10 seconds and will then be replaced by the BANNER screen.

| |
|---|
| SN:3779 0496xc 8.3v 03/08/13 13:25 TRIG SEI<0.050>SND< OFF> 5.0s TIMER <OFF> STD |
|---|

SN: 3779 - this unit's serial number is 3779

0496xc – the firmware version is 0.496xc

8.3 – battery voltage is 8.3 volts

03/08/13 – the internal memory date is March 8, 2013*

13:25 – the internal memory time is 1:25 PM

TRIG – the unit is programmed to record in the trigger mode

SEI<0.050> - the seismic trigger is set at 0.050 ips*

SND < OFF> - the air trigger is set to *off*

5.0 s – the unit will record a five (5) second event

TIMER<OFF> - the timer feature is turned off

STD – the unit is set to record using a standard scaling system

After the banner has been displayed, the command menu options will be displayed.

* This example, as well as the majority of examples in this manual, is in mm/dd/yy date format and imperial units. There are menu options to switch to dd.mm.yy date format (page 36) and metric units (page 27).

The first line of the command menu is <7> = OFF - i.e. pressing the



key from this

The first three command menu options are:

1. Seismic Setup
2. Display Data
3. Text Setup

Press the ↓ key to go to the next grouping.

4. Timer Setup
5. (No Printer)
6. Utilities

The ↑ and ↓ keys can be used to scroll up and down through the commands.

The next grouping is

7. Turn Off Unit
8. Display Banner
9. Templates

If you know the option that you want, simply press the appropriate number (from any command menu display) to go to that sub-menu.

Recorder Setup / Modes

Your SSU 3000 has four available recording modes: Trigger, Histogram, Dual Mode and Sustained Trigger. These modes have been designed to provide the user with multiple recording options to satisfy a wide range of vibration and airblast monitoring and recording situations. It is recommended that all users acquaint themselves with the capabilities (and limitations) of each of the recording modes.

TRIGGER MODE

Press **1** from the COMMAND screen for *Recorder Setup*.

Press **1** from the RECORDING SETUP screen for *Recording Mode*.

The *trigger mode* is designed for single event recordings of 15 seconds or less, such as blast events. (Due to changes in the sampling rate it is not recommended for events longer than 5 seconds. Please refer to the *Sustained Trigger mode*, page 21.)

In the trigger mode the seismograph measures and records peak particle velocity and air overpressures. Frequency information is calculated from this data. The information recorded in the trigger mode includes data that may be used to generate a waveform event that can be printed with, or without, the USBM/OSM or DIN compliance graph. Waveform events may be printed using the GeoSonics Analysis Software. The software can also print velocity, acceleration, and displacement graphs, perform FFT frequency analysis, as well as plot the data on expanded USBM, OSM, or DIN compliance curves.

When the seismograph is in the triggered mode, it continually scans (at a rate as high as 2,000 samples/second) for vibrations and/or airblast levels that meet or exceed preset trigger levels. Once the preset trigger level is reached or exceeded, the unit begins to collect data.

```
RECORDING MODE
0:DM 1:TRG 2:HST 3:S
SET: HISTOGRAM
NEW: TRIGGER
```

To enable the trigger mode press **1**. The unit will respond with **NEW: TRIGGER**. Press **ENTER**.

```
RECORDING MODE
0:DM 1:TRG 2:HST 3:S
SET: TRIGGER
NEW: TRIGGER
```

Press **↓** to go to the *SEISMIC TRIGGER SETUP* menu.

NOTE: You may exit the trigger mode setup menu at any time by pressing the key. You will return to the **COMMAND** menu.



```
1 TRIGGER  SETUP <1>
SEIS TRIG.0.050 - 5.000
SET:                0.050 in/sec
NEW:                0.040 in/sec
```

A seismic trigger level must be set when the unit is programmed to record in the trigger mode. Once the seismograph is placed into the scan mode, the geophone will continually *scan* for vibration levels that meet or exceed the set trigger level. If you want to keep the value displayed

under SET: simply press ↓ to go to the next setup menu. To change the value, type in the new trigger level beginning with the character to the LEFT of the decimal point, press ENTER. The new value will appear as the SET value. Press ↓ to proceed to the next setup menu.

| | | |
|---------|-------|-------|
| TRIGGER | SETUP | <2> |
| AIR TRG | 81 | – 142 |
| SET: | 0 | db |
| NEW: | 132 | db |

The seismograph can be set to trigger off airblast levels. Entering 0 will turn off the air trigger. If the air trigger is turned off and the unit is triggered by ground vibration, the airblast data will still be recorded. Because airblast data is

measured by this instrument on a linear scale, it is possible that a small gust of wind could trigger the instrument. This could cause one or more false triggers that could result in the memory filling up and the desired data (i.e. the blast event) not being recorded.

If you anticipate a high airblast level and very low ground vibrations, then the air trigger should be enabled. Use caution in setting a low-level air trigger to avoid false triggers.

If you want to keep the value displayed under SET: simply press ↓ to go to the next setup menu. To change the value, type in the new trigger level, press ENTER. The new value will appear as the SET value. Press ↓ to proceed to the next menu option.

NOTE: Menu option <3> is not applicable (and therefore not accessible) to the 3000 LCP or EZ seismograph.

| | | |
|-------------|-------|------|
| TRIGGER | SETUP | <4> |
| RECORD TIME | 1 | - 15 |
| SET: | 5.5 | SEC |
| NEW: | 5.0 | SEC |

The seismograph may be programmed in one tenth (1/10) second increments to create 1 to 15 second events. There are several factors to consider when choosing the record length.

1. The longer the record length, the more memory space it requires. The internal memory has a maximum capacity of 10,000 1-second events. Airblast travels at a much slower speed than does ground vibration. Ground vibration travels up to 10,000 feet per second, depending upon geology and other factors. It reaches the geophone almost immediately after the blast is detonated. Airblasts travel approximately 1090 feet per second under standard conditions. Because of this, allow at least one (1) second for every 900 feet between the seismograph and the blast. Additionally, each triggered event contains from 0.25 to 1.5 seconds of pre-trigger data.
2. The length of each blast event varies. Small shots with only a few delay periods may have only a few tenths of a second duration. A blast shot with tunnel delays may last several seconds. In order to record all blast associated airblast data; allow sufficient time for both the vibration and the airblast from the last delay period to reach the seismograph.
3. Weather conditions such as wind velocity and direction also effect airblast speed.

The following chart may be used as a general reference for selecting record times. This chart is based on a blast where there is no more than 0.5 second between the first delay period and the last and where there are no significant adverse wind or sky conditions.

| DISTANCE | <u>MINIMUM</u> RECOMMENDED RECORD TIME |
|----------------------|--|
| 300 ft. / 91.44 m | 1 second |
| 1,000 ft. / 304.8 m | 2 seconds |
| 2,000 ft. / 609.6 m | 3 seconds |
| 5,000 ft. / 1524 m | 6 seconds |
| 8,000 ft. / 2438.4 m | 10 seconds |

The sampling rate is determined by the record time. The frequency range of a record is affected by the sampling rate. The following sampling rates apply to events recorded in the triggered, sustained trigger, and dual modes.

| RECORD LENGTH | SAMPLING RATE | FREQUENCY RANGE |
|---------------------|------------------------|-----------------|
| 1.0 – 2.5 seconds | 2,000 samples / second | 2 – 1,000 hertz |
| 2.6 – 5.0 seconds | 1,000 samples / second | 2 – 500 hertz |
| 5.1 – 10.0 seconds | 500 samples / second | 2 – 250 hertz |
| 10.1 – 15.0 seconds | 330 samples / second | 2 – 165 hertz |

Refer to the specifications in the back of this manual for information regarding maximum number of records/recording capacity. It is also recommended that users consult local and state regulations for frequency related instrumentation requirements.

If you want to keep the value displayed under **SET**: simply press ↓ to go to the next setup menu. To change the value, type in the new record time, press **ENTER**. The new value will appear as the **SET** value. Press **END** to exit the trigger setup menu or press ↓ or ↑ to go back through the previous menu options.

To place the unit in the SCAN mode – press



The seismograph will begin scanning vibration levels within 30 - 60 seconds. The RED LED status light will blink once approximately every 10 seconds during trigger mode operation.

To end data collection press



HISTOGRAM RECORDING

Press 1 from the COMMAND screen for *Recorder Setup*.

Press **1** from the RECORDING SETUP screen for *Recording Mode*.

The histogram recording mode is used to monitor longer periods of time. It produces a record with maximum peak particle velocities and associated frequency data for set intervals of time. For instance, the seismograph may be set to record the maximum particle velocity for every 1-minute interval. (Note: the LCD screen will update a minimum of every 10 seconds.) If you record for fifteen minutes, with a 1-minute interval, there will be 15 data points, one for each one-minute interval. The Analysis Software can be used to print this data as well as produce customized histogram charts. Common applications for this mode are pile driving monitoring, dynamic compaction monitoring, and background ambient studies.

```
RECORDING MODE
0:DM 1:TRG 2:HST 3:S
SET:  TRIGGERED
NEW:  HISTOGRAM
```

To enable the histogram mode press **2**. The unit will respond with NEW: HISTOGRAM. Press ENTER.

```
RECORDING MODE
0:DM 1:TRG 2:HST 3:S
SET:  HISTOGRAM
NEW:  HISTOGRAM
```

Press ↓ to go to the *HISTOGRAM SETUP* menu.

NOTE: You may exit the histogram mode setup menu at any time by pressing the key. You will return to the command options.



HIST INTERVAL
1: sec., 2: min -
SET: seconds scale
NEW: minutes scale

There are two (2) **time interval** menu screens. The first screen (shown here) is used to set the time unit that will be employed when the interval is set on the next screen. The following table lists the available interval times.

| Screen two setting | Screen one setting set to 1 – sec. | Screen one setting set to 2 - min |
|---------------------------|---|--|
| 1 | 1 second | 1 minute |
| 2 | 2 seconds | 2 minutes |
| 3 | 5 seconds | 5 minutes |
| 4 | 10 seconds | 10 minutes |
| 5 | 15 seconds | 15 minutes |
| 6 | 30 seconds | 30 minutes |
| 7 | 1 minute | 1 hour |

Select **1** for seconds or **2** for minutes in the first screen. Press **ENTER**. After the desired setting is set, press ↓ to access the second histogram interval screen. A <s> or <m> will appear at the end of the first line to indicate whether the unit is set for a second or minute interval.

HIST INTERVAL <s>
1 – 7: 1, 2, 5, 10, 15, . .
Set: 15 sec
New: 1 min

Press 1, 2, 3, 4, 5, 6, or 7 to set the desired recording interval based upon the above table.

When recording in the histogram mode, there is a maximum of 2,500 intervals that can be saved in each event file. If the record length is set for 2,500, the data will be written to an *HIST* event after 2,500 intervals and a new *HIST* file will be begun.

The maximum record length may be changed to customize the length of the records. For instance, if the recording interval is set for 1 minute and the record length is 1440, a new file will begin every 24 hours.

NOTE: up to 59 seconds of record time will be missed every time a record is written and a new one is begun.

The following examples are provided to assist users who desire specific record (file) lengths.

| Recording Interval | Record Length | Maximum File Length |
|--------------------|---------------|---------------------|
| 1 second | 1800 | 30 minutes |
| 15 seconds | 1920 | 8 hours |
| 5 minutes | 12 | 1 hour |
| 30 minutes | 48 | 24 hours |
| 1 hour | 168 | 7 days |

To calculate the desired record length in hours:

$$(\text{\# of interval recordings per minute}) \times 60 \times (\text{desired \# of hours per event}) = \text{record length}$$

To calculate the desired record length in days:

$$(\text{\# of interval recordings per hour}) \times 24 \times (\text{desired \# of days per event}) = \text{record length}$$

HIST MAX LENGTH
RECORD LENGTH 1 – 2500
SET: 1440
NEW: 1440


Press **ENTER**. After the desired setting is set, press **↓** to cycle back to the histogram interval screen or press **END** to exit histogram setup.

NOTE: When the seismograph is writing the event data to memory, it is unable to monitor and record data. For recording intervals less than 60 seconds, data recording will resume in approximately 7 seconds. For recording intervals of 1 minute or longer, data recording will begin at the start of the next minute, i.e. when the seismograph's internal clock is HH:MM:00.



To begin to record data – press

Date collection will begin within 60 seconds. The RED LED status light will blink twice (rapidly) approximately every 10 seconds during histogram mode data collection. If the display is active, interval readings will refresh approximately every 10 seconds.

 Users of seismographs employing firmware versions prior to 4.98 should refer to Appendix D (page 47) for instructions on the proper procedures for ending histogram recording. Failure to follow the instructions in Appendix D may result in loss of data.

For seismographs with firmware version 4.98 and above*:

If the LCD has timed out, press



to 'awaken' the LCD.

Press



to end data collection.

SUSTAINED TRIGGER MODE

The sustained trigger mode is used for producing consecutive trigger events with no data loss between events. These events can then be linked to produce one long time-history event using the analysis program. Once the preset trigger level is met, the seismograph will continue to record a predetermined number of events. Unlike histogram events, these are trigger events that can be analyzed by the analysis software to produce waveform, OSM/USBM and various international compliance graph printouts; advanced frequency analysis such as FFT can also be performed on these event files.

In addition to setting both the seismic and the air trigger levels, you will need to set the record times for the individual events and the number of events that you want recorded for each trigger. For instance, if you want to record 30 seconds of data, you could choose to record six (6) 5-second events. Available record lengths and sampling rates are discussed on the following page..

Please refer to **TRIGGER SET UP** (see page 15) for information on Trigger Setup screens 1 – 2. **Do not exit the sustained trigger setup until the *records per trigger* has been set.**

| | |
|---------------------|-----|
| SUS TRIG SETUP | <3> |
| RECORDS PER TRIGGER | |
| SET: 2 | |
| NEW: 3 | |

Choose the number of consecutive events (2 - 15) that you want to be recorded every time the unit is triggered. (If the 'records per trigger' is set to 1, the unit will set itself to the *triggered mode*.) Events are recorded back to back with no loss of data between recordings. The data is then processed

after the last event is recorded.

| | |
|----------------|---------|
| SUS TRIG SETUP | <4> |
| RECORD TIME | 1 - 15 |
| SET: | 5.0 SEC |
| NEW: | 0.0 SEC |

Set the record time for EACH event beginning with the number to the left of the decimal point. Press **ENTER** to set the value; press ↓ to review current settings or **END** to exit

* If you do not know the firmware version of your unit, refer to page 44.

this menu.

The sampling rate is determined by the record time of each (individual) record. The frequency range of a record is affected by the sampling rate. The following sampling rates apply to events recorded in the triggered and sustained trigger mode.

| RECORD LENGTH | SAMPLING RATE | FREQUENCY RANGE |
|---------------------|------------------------|-----------------|
| 1.0 – 2.5 seconds | 2,000 samples / second | 2 – 1,000 hertz |
| 2.6 – 5.0 seconds | 1,000 samples / second | 2 – 500 hertz |
| 5.1 – 10.0 seconds | 500 samples / second | 2 – 250 hertz |
| 10.1 – 15.0 seconds | 330 samples / second | 2 – 165 hertz |

Refer to the specifications in the back of this manual for data regarding maximum number of records/recording capacity. It is also recommended that users consult local and state regulations for frequency related instrumentation requirements.

HOW ARE SUSTAINED TRIGGER EVENTS RECORDED?

Each sustained trigger event includes the same type of data as a trigger event. However, there are several distinctions. When a *trigger* event is recorded, the seismograph does not return to the scanning mode until the event is analyzed and the results displayed. This gap prohibits groups of consecutive, uninterrupted data from being recorded. When the seismograph is programmed to record in the *sustained trigger mode* the data is recorded as a series of events, with no time gaps between the events. The events are not processed until all the events have been recorded. The number of waveform events contained in each series is equal to the *Records per Trigger* set in SUS TRG option 3. . The summary for these files includes the same information as a triggered event. The full report is also the same with one addition. The sequence number of the event is included on the report, i.e. 2 of 6. When the events are processed, an additional file is created. The sustained summary or *SUSTAIN HEAD* file contains the maximum particle velocities, frequencies, and decibel level over the entire series. The addition of this file results in the total number of files in a series to be equal to the number of waveform events plus one. There is no waveform associated with this file; however, the calibration graph is included.

■ DUAL MONITOR MODE

The dual monitor mode utilizes both trigger and histogram style event recording. The unit continuously records in the histogram mode until ground vibrations and/or airblast levels reach or exceed preset trigger levels at which point the unit *switches* to the trigger mode and records a

trigger event. After processing the data the unit will return to the histogram mode. This mode enables the operator to continuously record low-level background data while still being able to record significant vibration events in the triggered mode. Please note that when recording in the *Dual-Mode*, no frequency data is computed or recorded with the histogram data. In order to collect histograms with the associated frequency data use the HISTOGRAM mode.

DUAL MODE SPECIFICS

- 🔥 When the unit is triggered, the data from the current interval is lost with the exception of the data that will be incorporated into the pre-trigger portion of the trigger event, (i.e., 0.5 seconds for a 5 second record).
- 🔥 Histogram records are saved in the seismograph with an HST-F extension.
- 🔥 When the seismograph is in the *Dual Monitor Mode* it only records maximum interval data for complete intervals. As an example, if you have the seismograph to record in 30-minute intervals and the scan mode is active for one hour and 22 minutes (82 minutes) your event will have two (2) interval readings covering the first hour, but no recorded data for the last 22 minutes.

Similarly, if an interval is interrupted by a trigger event, the partial interval that preceded the trigger will be written as an event, but will not contain any vibration data. For example, if you have programmed your unit to record in 1-hour intervals and a trigger event occurs 58 minutes after placing the seismograph in the scan mode, an HST-F event will be written to memory for the first 58 minutes, but will not contain any vibration data. The unit's interval timer will start over after the trigger event is processed and (if not interrupted) will produce an interval record for the next 1-hour time period.

- 🔥 **When downloading data through the analysis software, be sure to save the *check* event created when the unit exited the scan mode. It will provide verification of beginning and end times of the entire scan period as well as the number of trigger events.**

Press **1** from the COMMAND screen for *Recorder Setup*.

Press **1** from the RECORDING SETUP screen for *Recording Mode*.

RECORDING MODE
0:DM 1:TRG 2:HST 3:S
SET: HISTOGRAM
NEW: DUAL MODE

To enable the Dual Mode, press **0**. The unit will respond with NEW: DUAL MODE. Press ENTER.

HIST INTERVAL
 1: sec., 2: min
 SET: seconds scale
 NEW: minutes scale

Press ↓ to go to the *HISTOGRAM INTERVAL* screen.

There are two (2) **time interval** menu screens. The first screen (shown above) is used to set the time-unit that will be employed when the interval length is set on the next screen. The following table lists the available interval times.

| Screen two setting | Screen one setting set to 1 – sec. | Screen one setting set to 2 - min |
|---------------------------|---|--|
| 1 | 1 second | 1 minute |
| 2 | 2 seconds | 2 minutes |
| 3 | 5 seconds | 5 minutes |
| 4 | 10 seconds | 10 minutes |
| 5 | 15 seconds | 15 minutes |
| 6 | 30 seconds | 30 minutes |
| 7 | 1 minute | 1 hour |

Select **1** for seconds or **2** for minutes in the first screen. Press **ENTER**. After the desired setting is set, press ↓ to access the second histogram interval screen. An <s> or <m> will appear at the end of the first line to indicate whether the unit is set for a second or minute interval.

DUAL INTERVAL <s>
 1 – 7: 1, 2, 5, 10, 15, . . .
 Set: 15 sec
 New: 1 min

Press 1, 2, 3, 4, 5, 6, or 7 to set the desired recording interval based upon the above table. In this example the **7** was pressed which results in a 1-minute interval.

Press ↓ to go to the *DUAL MAX LENGTH* screen.

When recording in the histogram mode, there is a maximum of 2,500 intervals that can be saved in each event file. If the record length is set for 2,500, the data will be written to an HST-F event after 2,500 intervals and a new HST-F file will be begun.

The maximum record length may be changed to customize the length of the records. For instance, if the recording interval is set for 1 minute and the record length is 1440, a new file will begin every 24 hours.

NOTE: up to 59 seconds of record time may be missed every time a record is written and a new one is begun.

The following examples are provided to assist users who desire specific record lengths.

| Recording Interval | Record Length | Maximum File Length |
|--------------------|---------------|---------------------|
| 1 second | 1800 | 30 minutes |
| 15 seconds | 1920 | 8 hours |
| 5 minutes | 12 | 1 hour |
| 30 minutes | 48 | 24 hours |
| 1 hour | 168 | 7 days |

To calculate the desired record length in hours:

(# of interval recordings per minute) x 60 x (desired # of hours per event) = record length

To calculate the desired record length in days:

(# of interval recordings per hour) x 24 x (desired # of days per event) = record length

Remember that a new histogram file will begin after each seismic trigger event.

DUAL MAX LENGTH
RECORD LENGTH 1 – 2500
SET: 1440
NEW: 1440

Enter the desired maximum record length. Press **ENTER**. After the desired setting is set, press ↓ to proceed to *DUAL SEISMIC* setup.

NOTE: When the seismograph is writing the event data to memory, it is unable to monitor and record data. For recording intervals less than 60 seconds, data recording will resume in approximately 7 seconds. For recording intervals of 1 minute or longer, data recording will begin at the start of the next minute, i.e. when the seismograph's internal clock is HH:MM:00.

DUAL SEISMIC
SEIS TRIG.0.050 - 5.000
SET: 0.050 in/sec
NEW: 0.040 in/sec

A seismic trigger level must be set when the unit is programmed to record in the dual mode. Once the seismograph is placed into the scan mode, the geophone will continually *scan* and record vibration levels in the histogram mode. Once vibrations or air overpressures meet or exceed the set seismic and/or air trigger level(s) it will switch to the trigger mode. If you want to keep the value displayed under **SET**: simply press ↓ to go to the next setup menu. To change the value, type in the new trigger level beginning with the character to the LEFT of the decimal point, press **ENTER**. The new value will appear as the **SET** value. Press ↓ to proceed to the next setup menu.

DUAL AIR TRG
AIR TRG 81 – 142
SET: 132 db
NEW: 0 db

The seismograph can be set to trigger off airblast levels. Entering 00 will turn the air trigger OFF. If the air trigger is turned off and the unit is triggered by ground vibration, the airblast data will still be recorded (in both the histogram and trigger modes). Because

airblast data is measured by this instrument on a linear scale, it is possible that a small gust of wind could trigger the instrument. This could cause one or more false triggers.

If you want to keep the value displayed under **SET**: simply press ↓ to go to the next setup menu. To change the value, type in the new trigger level, press **ENTER**. The new value will appear as the **SET** value. Press ↓ to proceed to the next menu option.

| | |
|---------------|---------|
| DUAL REC TIME | |
| RECORD TIME | 1 - 15 |
| SET: | 5.5 SEC |
| NEW: | 5.0 SEC |

The seismograph may be programmed in one tenth (1/10) second increments to create 1 to 15 second events. There are several factors to consider when choosing the record length.

1. The longer the record length, the more memory space it requires. The (standard) internal memory has a maximum capacity of 220 1-second events. Airblast travels at a much slower speed does ground vibration. Ground vibration travels up to 10,000 feet per second, depending upon geology and other factors. It reaches the geophone almost immediately after the blast is detonated. Airblasts travel approximately 1090 feet per second under standard conditions. Because of this, allow at least one (1) second for every 900 feet between the seismograph and the blast. Additionally, each triggered event contains from 0.25 to 1.5 seconds of pre-trigger data. While the seismograph will return to the histogram mode following the recording and processing of the trigger event, remember that the processing time does take several seconds. An airblast from a distant event could still be missed before the unit begins to scan in the histogram mode.
2. The length of each blast event varies. Small shots with only a few delay periods may have only a few tenths of a second duration. A blast shot with tunnel delays may last several seconds. In order to record all blast and airblast associated with the trigger event, allow sufficient time for both the vibration and the airblast from the last delay period to reach the seismograph.
3. Weather conditions such as wind velocity and direction also effect airblast speed.
7. Record length also affects the frequency range of the seismograph. Please refer to page 22 for more information.

The following chart may be used as a general reference for selecting record times. This chart is based on a blast where there is no more than 0.5 second between the first delay period and the last and where there are no significant adverse wind or sky conditions.

| DISTANCE | <u>MINIMUM</u> RECOMMENDED RECORD TIME |
|----------------------|--|
| 300 ft. / 91.44 m | 1 second |
| 1,000 ft. / 304.8 m | 2 seconds |
| 2,000 ft. / 609.6 m | 3 seconds |
| 5,000 ft. / 1524 m | 6 seconds |
| 8,000 ft. / 2438.4 m | 10 seconds |

If you want to keep the value displayed under **SET**: simply press ↓ to go to the next setup menu. To change the value, type in the new record time, press **ENTER**. The new value will appear as the **SET** value. Press **END** to exit the dual mode setup menu or Press ↑ to go back through the previous menu options.

To begin to record data – press



Data collection will begin within 60 seconds. The RED LED status light will blink (rapidly) three times approximately every 10 seconds during histogram mode data collection and will glow steady when the unit is triggered and it is recording data in the trigger mode. Following a trigger event, the seismograph will process the data and will return to the histogram mode.

To end data collection press



Recording Units

Option 2 under **RECORDING SETUP**, *Recording Units*, is used to toggle between imperial units (inches/second and psi) and metric units (mm/second and Pascals)

```
SET UNITS
UNITS 1.IMP 2.METRIC
SET: IMPERIAL
NEW: METRIC
```

To keep the current (set) setup, press **END** to exit the menu and return to the command options. To toggle to the other recording unit, press the appropriate number followed by **ENTER**. Press **END** to exit and return to the **COMMAND** screen.

TEXT SETUP

The **TEXT SETUP** command option is used to program the text portion of the header information into the unit. This text information, along with the date and time of the record, and unit serial number, is saved in memory with the data portion of each record – trigger, histogram, dual mode, or sustained trigger. While not necessary for operation, this information is useful for record keeping purposes. Records printed through the Analysis Software will include this information. **THIS INFORMATION CANNOT BE CHANGED OR EDITED AFTER THE DATA IS RECORDED. THIS IS TO PROTECT USERS FROM ALLEGATIONS OF RECORD TAMPERING.**

Press **3** from the **COMMAND** menu for **TEXT SETUP**.

(See page 30 for Command Option 2: Display Data.)

Screens 1 – 6 are used to enter the basic header information that will be included with your data if you download and print your event through the Analysis Software.

```
TEXT SETUP    <1>
CLIENT NAME:
ACME CONSTRUCTION CO
—
```

Press **1** in the text setup menu to access the first entry-CLIENT NAME. To keep the current information press ↓ to go to the next menu window. To change this information, enter up to 20 characters using the keypad. Press **ENTER**. After the new information is displayed, press ↓ to continue with the text setup

or **END** to exit this option.

(To review keypad operation, see page 12.)

```
TEXT SETUP    <2>
OPERATION:
ROCK BLASTING
—
```

The next entry is **OPERATION**. To keep the current information press ↓ to go to the next menu window. To change this information, enter up to 20 characters using the keypad. Press **ENTER**. After the new information is displayed, press ↓ or ↑ to scroll to other text setup options or **END** to exit this option.

| | |
|-------------------|-----|
| TEXT SETUP | <3> |
| LOCATION: | |
| SMITH 38 MAIN ST. | |
| — | |

The next entry is LOCATION. To keep the current information press ↓ to go to the next menu window. To change this information, enter up to 20 characters using the keypad. Press ENTER. After the new information is displayed, press ↓ or ↑ to scroll to other text setup options or END to exit this option.

| | |
|------------|-----|
| TEXT SETUP | <4> |
| DISTANCE: | |
| 875 FT. | |
| — | |

The next entry is DISTANCE. To keep the current information press ↓ to go to the next menu window. To change this information, enter up to 5 numeric characters using the keypad. Press ENTER. After the new information is displayed, press ↓ or ↑ to scroll to other text setup options or END to exit this option.

| | |
|-------------------|-----|
| TEXT SETUP | <5> |
| OPERATOR: | |
| JOHN S. GEOSONICS | |

The next entry is OPERATOR. To keep the current information press ↓ to go to the next menu window. To change this information, enter up to 20 characters (including spaces) using the keypad. Press ENTER. After the new information is displayed, press ↓ or ↑ to scroll to other text setup options or END to exit this option.

| | |
|----------------|-----|
| TEXT SETUP | <6> |
| COMMENT: | |
| OVERCAST SKIES | |

The next entry is COMMENT. To keep the current information press ↓ to go to the next menu window. To change this information, enter up to 20 characters using the keypad. Press ENTER. After the new information is displayed, press ↑ to scroll to other text setup options or END to exit this option.

NOTE: *Additional Notes* and *Acquire GPS* menu options must be accessed by selecting **7** (Additional Notes) or **8** (Acquire GPS) from the *Text Menu* setup screen.

Option **7** under the Text Setup menu is ***Additional Notes***.

| |
|--------------------|
| ADDITIONAL NOTES |
| 0: DON'T USE NOTES |
| 1. USE ADD'L NOTES |
| OVERCAST SKIES |

This option allows the user to add up to three (3) lines of text or two (2) lines of text and an acquired GPS location to the record. **USE ADD'L NOTES** must be enabled in order to use the **ACQUIRE GPS** feature. **If 1** is pressed for Use Add'l Notes, the unit will prompt you for the first line of notes. Enter up to 20 characters using the keypad. Press ENTER. After the new information is displayed, press ↓ to add the second line of text. Press ↓ to scroll to the third and last line of text. If you intend to add a GPS location to your event, leave line 3 blank. Press ENTER. Press END to exit this option.

Option **8** under the Text Setup menu is ***GPS Location***.

- **USE ADD'L NOTES** (option 7 above) must be enabled in order to use the **ACQUIRE GPS** feature.

From the Text Setup menu, press **8**.

| | |
|----------------|---|
| GPS LOCATION | — |
| 1. ACQUIRE GPS | |
| 2 ERASE GPS | |

This option is for users of GPS systems with NEMA 0183 output capabilities to interface their seismograph with the GPS unit and have the location automatically entered into their record. This information will be entered into line 3 of Additional Notes.

To save the current information, press **END** to exit the menu.

To acquire a new location, connect your GPS unit to the seismograph, making sure that it is turned ON; press **1** for **ACQUIRE GPS**. If the seismograph receives a signal from the GPS device, the location data will be added to the record. If no signal is received, a **BAD** or **NO RESPONSE** message will be displayed and you will be returned to the GPS menu.

To erase the data stored in the GPS location without acquiring a new location, press **2** to erase the data.

DISPLAY DATA

Command option 2 - **DISPLAY DATA** provides the user multiple options for reviewing or verifying the internal memory of the seismograph as well as do a check to verify that the geophone and microphone have been properly connected and communicating with the unit.

Options include: a display of the directory of stored events, summaries (i.e. results) of one or more events, a calibration test, a banner display, a memory status check, a review of additional notes information and view the stored GPS location. Keep in mind that information can only be viewed through this option; you cannot change any data through the *Display Data* command option.

Display Data option **1 – Directory** will display a directory of the recorded events currently in memory.

| |
|------------------|
| DIRECTORY 102 |
| 097:TRIG 4792 |
| 3/19/13 10:18:42 |

In this example:

102: The unit's internal directory number for this event.

097: The event number (which will be incorporated into the file name if the event is processed through the Analysis Software)

TRIG: This is a triggered event

4792: The event's file size in bytes.

3/19/13: The event was recorded on March 19, 2013.

10:18:42: The event (start) time is 10:18:42.

The most recent event information is displayed first. The



and



buttons may

HOW ARE FILES NAMED

There are six (6) types of files that may appear in the directory.

A **TRIG** is a triggered event recorded in the triggered or dual monitor mode.

A **HIST** histogram event recorded in the histogram mode.

A **SUTRG** is a trigger event recorded in the sustained trigger mode.

An **HST-F** is a histogram event recorded in the dual monitor mode.

A **CHECK** event (which includes calibration check data) is a file written to memory every time the unit exits one of the recording modes. Because check events contain no vibration or airblast data, they are not assigned data collection event numbers. All check events take 992 bytes of memory.

The **TMPL** file contains the information for one or more templates.

Press



to exit this option.

Display Data option **2 – Summary** will display the summary data for individual events.

| | | |
|---------|---------|-----|
| SUMMARY | R0.435 | 034 |
| 008 105 | L0.063, | 9.4 |
| 3/20 | T0.430, | 6.4 |
| 11:10 | V0.045, | 5.8 |

For *Triggered* events, including those recorded in the Dual Mode:

034 – directory number

008 – event number

105 – peak airblast reading in dB (or Pa)

3/20 – month and date of event

11:10 – time of event

R0.435 – RPPV = 0.435 ips (or mm/sec)

L, T, V – longitudinal, transverse, vertical readings
in ips (or mm/sec) @ hertz (cycles per second)

For *Sustained Triggered* events:

| | | |
|---------|---------|-----|
| SUMMARY | SUTRG | 009 |
| 047 076 | 0.063, | 9.4 |
| 3/21 | T0.430, | 6.4 |
| 10:36 | V0.045, | 5.8 |

009 – directory number (this will be unique for each record per trigger)

047 – event number (each record per trigger event will have the same event number)

076 – peak airblast reading in dB (or Pa)

3/21 – month and date of event

10:36 – time of event

L, T, V – longitudinal, transverse, vertical readings in ips (or mm/sec) @ hertz (cycles per second)

For *Histogram* events recorded in the histogram mode:

| | |
|-----------------|-----|
| SUMMARY HIST | 005 |
| 046 076 L0.020, | 7.0 |
| 3/21 T0.103, | 7.9 |
| 10:28 V:060, | 9.4 |

005 – directory number

046 – event number

076 – peak airblast reading in dB

3/21 – month and date of event

10:28 – time of event

L, T, V – longitudinal, transverse, vertical readings in ips (or mm/sec) @ hertz (cycles per second)

Press



to exit this option.

Data Option 3 – Calibration Test:

The calibration test is used to check for proper communication between the geophone and microphone elements and the seismograph base unit. After the geophone has been installed on the surface and the geophone and microphone cables have been properly connected to the base unit, press **3**. The unit will go through a self-test. If all channels are functioning, the following window will be displayed.

| | | | |
|--------------------|-------|-------|-------|
| CALIBRATION TEST | | | |
| Last Cal. 03/15/13 | | | |
| S---- | L---- | T---- | V---- |
| PASS | PASS | PASS | PASS |

The second line of the display shows the date of the last calibration service. If any of the channels show a FAIL message, that channel is not working properly. Check the following.

1. Make sure that the cables are securely inserted into the appropriate port. Make sure that the quick-lock connectors have been tightened.

2. If any of the geophone channels, L, T, V, show FAIL, check the geophone to make sure that it has not been installed at an acute angle or upside down.
3. If the calibration test is still showing FAIL, disconnect the cables and check to make sure that the connector pins are clean and dust/mud free. Clean the pins if necessary, and reconnect.
4. If one or more channels are still showing FAIL, contact the GeoSonics Service Department.

Press



to exit this option.

Display Data Option **4** – **Banner**. This is the same information that is displayed when the unit is first turned on. It is also available by pressing **8** from the COMMAND menu.

```
SN:3779 0496xc 8.3v
03/08/13 13:25 TRIG
SEI<0.050>SND< OFF>
5.0s TIMER <OFF> STD
```

SN: 3779 - this unit's serial number is 3779
 0496xc – the firmware version is 0.496xc
 8.3 – battery voltage is 8.3 volts
 03/08/13 – the internal memory date is March 8, 2013
 13:25 – the internal memory time is 1:25 PM
 TRIG – the unit is programmed to record in the trigger mode
 SEI<0.050> - the seismic trigger is set at 0.050 ips
 SND < OFF> - the air trigger is set to *off*
 5.0 s – the unit will record a five (5) second event
 TIMER<OFF> - the timer feature is turned *off*
 STD – the unit is set to record using a standard scaling system

Press



to exit this option.

Display Data Option **5** – **Memory Status**:

```
DISPLAY MEMORY
E || _ _ _ _ _ F
Events in Memory    20
Free space          87%
```

This option shows the memory status of the seismograph in both a numeric and graphical format.

Press



to exit this option.

Display Data Option 6 - **Additional Notes:**

This option will display the information currently in the **Additional Notes** field, including the acquired GPS location (if enabled). To erase or edit these fields see page 29.

Press



to exit this option.

Display Data Option 7 – **GPS Location:**

This option will display the GPS location currently stored in the unit. Although the GPS location is stored in Line 3 of **Additional Notes**, **ONLY** GPS data will be displayed on this screen.

Press



to exit this option.

TIMER SETUP

From the **COMMAND** menu press **4 – Timer Setup**.

The **TIMER SETUP** option is used to put the seismograph in, and exit from, the scan mode at predetermined times. The timer is useful in conserving battery power during extended, unattended monitoring periods. By having the seismograph turn off during “down” times (such as overnight) memory space is not taken up by unwanted data.

It is highly recommended that the proper date and time be programmed into the unit before setting the timer options. It is also recommended that the seismic setup and text options have been entered before setting the timer options. It is suggested that the timer function be enabled at least 30 minutes prior to the desired ‘awake’ time.

* Previous seismograph versions may have referred to this feature as the *alarm option*.

TIMER SETUP

1. Timer Mode On/Off
2. One Time / Daily
3. Set Wake Up

There are four (4) menu items under **TIMER SETUP**. (The fourth option – *Set Sleep* may be accessed directly from this screen by pressing **4** or arrowing down and pressing **4**.)

1. Timer Mode ON /OFF – This option is used to turn the timer mode on or off.

TIMER SETUP <1>
TIMER 1:ON 0:OFF
Set: OFF
New: ON

This option enables or disables the timer. To change from the current setting, press the appropriate number, followed by ENTER. After the change has been entered, press END to exit the timer setup option or ↓ to proceed with additional options / setup commands.

This option allows the user to choose between two (2) on/off modes.

TIMER SETUP <2>
MODE 1:DAILY 2: ONCE
Set: DAILY
New: DAILY

1: Daily – The wake up and sleep cycles will be repeated every day until the timer is turned off.

2. Once – The unit will turn on at the pre-programmed wake up time and turn off at the pre-programmed sleep time. The cycle will not repeat.

After the timer on/off mode has been selected and the ENTER key has been pressed to set the selection, press ↓ to proceed with timer setup or END to exit the timer setup option.

TIMER SETUP <3>
WAKEUP TIME & DATE:
Set: 00/00/00 00:00
New: 03/22/13 08:00

This option sets the wake up time. The wake up time tells the unit when it is to enter the SCAN mode and start collecting data. After entering the appropriate data and pressing ENTER to set the information, press ↓ to proceed with timer setup options or END

to return to the command menu. **(If programming for a Daily cycle, enter zeroes for the date until you reach the time field.)**

Note – If you are setting the seismograph to record in either the histogram or dual mode using a *minutes* interval setting, set your wakeup time one minute prior to the desired wakeup time. This is necessary because the seismograph requires a few seconds to ‘wake up’ and *minutes* recordings always start at the beginning of a minute, i.e. when the internal clock’s time is HH:DD:00.

TIMER SETUP <4>
SLEEP TIME & DATE:
Set: 00/00/00 00:00
New: 01/22/01 16:00

This option sets the sleep time. The sleep time tells the unit when it is to exit the SCAN mode and stop collecting data. After entering the appropriate data and pressing ENTER to set the information, press END to return to the command menu or ↓ to

cycle back to the Timer ON/OFF proceed with timer setup options. **(If programming for a Daily cycle, enter zeroes for the date until you reach the time field.)**

EXAMPLE SETUPS

Desired monitoring period: Start scanning this afternoon (3/3/13) at 1:30 PM and stop scanning at 4:00 PM.

SETUP – Set the mode for ONCE

Set the WAKE UP date and time for 03/03/13 13:30

Set the SLEEP date and time for 03/03/13 16:00

Desired monitoring periods: Start recording tomorrow morning at 7:00 AM, record until 5:00 PM. Monitor during this time period every day.

SETUP – set the mode for DAILY

Set the WAKE UP date and time for 00/00/00* 07:00

Set the SLEEP date and time for 00/00/00* 17:00

*When using the **daily** setting, do not enter a wake up or sleep date.

NOTE: Every time the unit exits the scan mode, a check event will be created.

UTILITIES

MEMORY MAINTENANCE / SPECIAL SETUPS / ADVANCED SETTINGS

The *Utilities* option is used to set the seismograph's internal date and time (including time format and time zone code), erase the memory, set the event number, set special alarms, change advanced settings, and set the display default.

Press **6 – UTILITIES** from the COMMAND menu.

| |
|---|
| UTILITIES 1. Set Clock / Date 2. Erase Data Set Event Number |
|---|

Option 1 – **Set Clock / Date** is used to set the internal clock as well as select the date format.

| |
|--|
| SET CLOCK/DATE 1. Set Time 2. Set Date 3. Date Format |
|--|

To change the time, press **1**.

```
CLOCK/DATE  <1>
SET TIME:
Set:  15:37:39
New:  16:00:00
```

Time is entered using a 24-hour* format HH:MM:SS. Enter the six numeric characters for the current time, and press ENTER.

* Enter 8:00 AM as 08:00:00; enter 8:00 PM as 20:00:00.

Press



to exit this option or -

Press ↓ (or press **2** from the SET CLOCK/DATE menu) to proceed to the Set Date Option.

```
CLOCK/DATE  <2>
SET DATE:
Set:  02/22/13
New:  03/23/13
```

The default date format is mm/dd/yy. Unless you have changed the date format using option 3 of this menu, enter the 6 characters of today's date using the mm/dd/yy format. If you have switched to the other date format, enter the date using the dd.mm.yy format.

* Remember to use two numeric characters for each field, i.e. use 01, not 1, for January.

Press



to exit this option or -

Press ↓ (or press **3** from the SET CLOCK/DATE menu) to proceed to the *Date Format Option*.

```
CLOCK/DATE  <3>
FORM 1:m/d/y 2:d.m.y
Set:  M/D/Y
New:  D.M.Y
```

Select the new format by pressing **1** or **2**. Press ENTER to save the new option.

Press



to return to the command menu or -

Press ↓ (or press **4** from the SET CLOCK/DATE menu) to proceed to the *Time Zone Code* menu option.

TIME ZONE CODE

0, 1 – 51

Set: 0 unspecified

New: 11 UTC-4

The Time Zone Code feature was designed for users who employ seismographs in multiple time zones and access and transfer their data through remote communication. This setting is not required and may be left *unspecified* (setting = 0) with no effect on your recorded data.

Please see page 46 for more information on the use of this feature.

After all desired changes have been made, press
COMMAND menu.



to exit and return to the

Option **2** from the **UTILITIES** menu is **Erase Data**.

PLEASE NOTE: Erasing the memory will delete ALL event data from the seismograph. There is **NO** way to recover data that has been erased. Also, there is no way to erase select data from the memory. It is suggested that users download event data using the GeoSonics Analysis Software (supplied with your seismograph or available for download at: <http://www.geosonicsvibratech.com/seismic-analysis-software.html>) on a regular basis to avoid placing a seismograph in the field with insufficient available memory space to record the desired data.

The *Erase Data* option will erase event data only; setup data, including recorder setup, text, additional notes (including GPS location), and template information will not be erased.

ERASE MEMORY?

0. NO

1.YES, ERASE ALL

To erase ALL events in memory, press **1** for YES.

CONFIRM ERASE ALL?

0.NO

1.YES, ERASE ALL

You will be asked to confirm. Press **1** for YES, ERASE ALL

RESET EVENT NUMBER?
0. NO
1. YES

You will be asked if you want to reset the event number. To reset the event number to 01, press **1** for YES or **0** for NO.

Press **END** to return to the COMMAND menu.

Set Event Number

Utility option **3** may be used to set the next event number. Event numbers, which are assigned to all data collection events, are assigned consecutively beginning with 01. At any time, you may choose to set the event number to any number from 01 – 999.

UTILITIES
NEXT EVENT
NUMBER:
Set: 03
New: 15

Press **3** from the Utilities menu. The number currently assigned to the next data collection event is displayed. To reset the event number, enter the two-digit or three-digit number followed by **ENTER**.

Press




to exit and return to the COMMAND menu.

Special Alarms – UTILITIES option 4

Utility option **4** is used to set the Special Alarm parameters. This feature is designed for use with optional external alarm devices.

The special alarm feature allows the user to set a secondary trigger level for all recording modes – trigger, histogram, sustained trigger, and dual mode. This can be either a seismic or a sound trigger. Two (2) alarms are available should the user desire to set one for seismic and one for sound. Both alarms can be set for seismic trigger or sound trigger if desired.

 For Trigger, Sustained Trigger, and Dual Mode recording:

Once the primary trigger (as set under SEISMIC SETUP) level is reached, the unit will begin to record data. If one or both of the special alarm trigger levels are reached, a signal will be sent from the seismograph to a special external warning device connected to the seismograph. The external device will “alarm” the user that the special alarm trigger level has been reached. For additional information on alarm devices, refer to the documentation accompanying the external alarm device.

❖ DUAL MODE SPECIFICS

If the seismograph is programmed to record in the Dual Mode, histogram recording will begin as soon as the unit is placed into **SCAN**. It is important to remember that the seismic and air trigger settings which activate a triggered event are independent of the alarm triggers. If the *Special Alarm* triggers are set at lower levels than the triggers set under *Recorder Setup* the external warning device could activate without a trigger event being generated or vice versa. To program the seismograph to generate a trigger event every time the external alarm is activated, set the *Recorder Setup* trigger levels to the same value(s) as the *Special Alarm* trigger value(s).

For Histogram Recording:

The seismograph will measure and record data as programmed through the SEISMIC SETUP option. If one or both of the special alarm trigger levels are reached, a signal will be sent from the seismograph to a special external warning device connected to the seismograph. The external device will “alarm” the user that the special alarm trigger level has been reached. For additional information on alarm devices, refer to the documentation accompanying the external alarm device.

TO SET THE SPECIAL ALARMS -

Press **4** from the Utilities menu.

SPECIAL ALARMS
1. Alarm1 On/Off
2. Alarm1 Trigger
3. Alarm1 Hold Time

Press **1** to turn Alarm 1 on or off.

SPEC'L ALARM <1>
ALARM1 1:ON 0:OFF
Set: OFF
New: ON

Press **1** to set Special Alarm 1 to ON. Press **ENTER**. Press **↓** to continue with the setup process or **END** to return to the command menu.

ALARM1 SOURCE <2>
0.SEISMIC
1.SOUND

The next option is for selecting a seismic trigger or a sound trigger. Press **0** to set a seismic (ground) trigger or **1** to set a sound (air) trigger.

SPEC'L ALARM <2>
ALARM1 T 0.005 – 5.000
Set: 0.050 in/sec
New: 0.075 in/sec

The **ALARM1 T** window will be displayed. Allowable entry ranges are as follows:

SEISMIC – 0.005 – 5.000 ips (0.13 – 127.0 mm)

SOUND – 100 – 140 dB

After entering the desired trigger level, followed by **ENTER**, the **ALARM1 HOLD** window will be displayed.

```
SPEC'L ALARM <3>
ALARM1 HOLD  5-300
Set:         20 sec
New:         0 sec
```

The *alarm hold* setting tells the seismograph how long (in seconds) the signal should be sent to the external device before re-setting itself. Set the hold time followed by **ENTER**. Press ↓ to continue to the Alarm 2 setup menus or **END** to return to the command menu.

- ❖ As an example, consider the following setup. Recorder mode - histogram mode; special alarm seismic trigger - 0.50 ips; hold time – 20 seconds. If the seismograph detects a vibration level that exceeds 0.50 ips seconds, a signal will be sent to the external warning device; the alarm will reset 20 seconds after the alarm was first triggered. If the vibration lasts beyond the 20-second hold time, the alarm will re-trigger within one (1) second.

Alarm 2 is set in the same manner as Alarm 1.

Advanced Options

Option 5 of the Utilities menu accesses the *Advanced Options*.

Four features are available through the advanced setup – *Scan on Timeout*, *Configuration*, *Trigger Filter*, *Show Date/Time*, and *Always Show GPS*.

```
ADVANCED SETUP:
ENTER PASSWORD:
```

In order to access the advanced setup features, you must first enter your password. This four-digit number was supplied with the documentation included with your unit. After entering the password, press **ENTER**.

- ❖ If you have misplaced your access code, contact the GeoSonics Service Department. You will need to supply the unit's serial number as well your company name in order to obtain this information.

```
SCAN ON TIMEOUT <1>
SCAN ON TIMEOUT?
Set: No
New: Yes
```

If the *Scan on Timeout* is set to **YES** and there are no keypad entries for a period of four (4) minutes, the seismograph will enter **SCAN**.

Configuration / Alternate Scaling

CONFIGURATION <1>
0:STD 1:ALT
SET:
NEW:

The next option under the advanced menu is CONFIGURATION. The configuration feature allows the seismograph to have an alternate scaling system programmed into the unit. The alternate scaling configuration is an optional feature that must be installed by an authorized GeoSonics service technician. This alternate scaling system was designed for use with special sensor devices, such as 10X and 100X amplifiers and hydrophones. The alternate scaling system can be enabled by selecting option 1 from the Configuration menu, followed by **ENTER**. When the banner is displayed, the enabled scaling system notation (std = standard; alt = alternate) is displayed in the lower right corner of the window.

Trigger Filter

TRIGGER FILTER <2>
1...4 SAMPLES
SET:4
NEW:4

The second option under the advanced menu is TRIGGER FILTER. When the seismograph is set to record in any of the trigger modes, the unit continuously scans and measures seismic and sound levels. The sampling rate varies from 330 to 2,000 samples per second. Under the default setting of 4 samples, in order for the unit to trigger, the trigger level must be exceeded four (4) times within a 4 millisecond time frame (based on a 1,000 sample per second setting). Requiring four (4) consecutive samples above the trigger level before triggering the unit helps to prevent false triggers due to electronic interference.

Using the TRIGGER FILTER option, the seismograph can be set to trigger after only 1, 2, or 3 samples over the trigger level. Enter the desired sample limit followed by **ENTER**. Press **END** to exit the Advanced Options menu or **↑** or **↓** to move to the next option.

When the seismograph is first powered on, there are two (2) optional window displays that can be toggled on or off. These displays can be turned ON/OFF in the *Advanced Options* menu.

SHOW DATE/TIME?
0:NO 1:YES
SET: YES
NEW: YES

The SHOW DATE/TIME option allows the user to disable the DATE/TIME from being displayed every time the unit is turned on.

ALWAYS SHOW GPS?
<5>
0: NO 1:YES
SET: YES

The ALWAYS SHOW GPS? display option is for GPS users. If this option is enabled, the seismograph will query the user regarding acquiring or erasing GPS coordinates every time the unit is turned on.

Display Default

UTILITIES option **6** is *Display Default*. When your seismograph is shipped to you, the display default is set to ON. Once the unit is placed into the scan mode, the LCD will go to *sleep* (blank) after a period of 4 minutes without any keypad entries. This reduces the power drain on the battery and extends recording time. It will continue to collect data. Simply press ENTER to *wake up* the screen.

To disable this feature, press **0** to turn off the display default.

TEMPLATES

Press **9** in the COMMAND menu to access *TEMPLATES*

Six template storage locations are available to the seismograph user. The template feature is a timesaving option for saving setups. After the text and seismic setup information has been programmed into the seismograph, it can be saved as a template. The next time that set of information is needed, instead of re-entering all of the information, the template can be recalled.

USE THE FOLLOWING STEPS TO SAVE A TEMPLATE

1. Enter the seismic and text information as described under *Recorder Setup* (page 14) and *Text Setup* (page 28).
2. From the command menu, press **9** for *Templates*. The third menu window, which can be accessed by pressing ↓ twice, shows option **7** – SAVE TEMPLATE

SAVE A TEMPLATE

1. <template 1>
2. <template 2>
3. <template 3>

After choosing option 7, the names of the currently saved templates are shown. (Press ↓ to view locations 4 – 6.) If a template register is empty, or if a name was not assigned to a template, it will be listed as <template #>. Choose a template

location by pressing the appropriate number.

TEMPLATE <4>
ENTER NAME

<template 4>

Enter a name for the template using the alphanumeric keypad. Press ENTER to save; press END.

USE THE FOLLOWING STEPS TO USE (RECALL) A TEMPLATE

1. From the command menu, press **9** for *Templates*
2. The template names for locations 1 – 6 are listed.
3. Press the appropriate number for the template that you wish to use.
4. Changes to the seismic or text data can be made using the seismic setup and text setup options. The new information will not be saved to the *template* unless the template is re-saved.

EXAMPLE: A quarry operator has two main recording locations, depending upon the blast location within the pit. He saves the setup information for the Smith residence in template 1 under *SMITH*. He saves the setup information for the Jones residence in template 2 under *JONES*. Because the distance and comments change for each blast, after the operator has chosen the appropriate template, he goes into the text setup to enter these two items. After the monitoring has been completed, he does not re-save the template. The original setup data remains stored, but the distance and comment information that was edited for the last shot is not saved in the template.

EXAMPLE: An engineer at a large construction site must split his time between monitoring blasting and monitoring pile driving. He sets up one template for the trigger recording mode and another template for the histogram recording mode.

ADDITIONAL COMMANDS



Pressing 7 from the **COMMAND** menu will cause your unit to power down and shut off.



Press **8** from the **COMMAND** menu to display the current banner. This option is useful for checking the battery voltage and verifying changes to the seismic setup.

APPENDIX A

STATUS INDICATOR LIGHTS

The **RED** LED found on the front of the seismograph indicates the scanning / processing status of the seismograph.

| | |
|---|--|
| LED blinks ONCE every 10 seconds | Unit is scanning in the Trigger or Sustained Trigger Mode. |
| LED glows steady | Unit has triggered and is collecting data in the Triggered, Sustained, or Dual Mode |
| LED blinks TWICE (rapidly) every 10 seconds | Unit is collecting data in the Histogram Mode |
| LED blinks THREE times (rapidly) every 10 seconds | Unit is collecting data in the Dual – Histogram Mode. |
| LED shows no activity while the unit is in the Trigger, Sustained Trigger, or Dual Mode | The unit was triggered and is now processing data. It will return to SCAN following the processing procedure. |

The **YELLOW** LED is a status indicator light for the charging circuit. This light will glow steady when the unit is charging.

The **GREEN** LED (3000LC only) is the serial port status light. When the seismograph is communicating through the serial port, such as with a PC, the light will glow steady.

APPENDIX B

USING THE UTC TIME ZONE CODE

The Time Zone Code number is used to designate the local time zone. The Time Zone Code is set through the seismograph's Utilities → Set Clock /Date menu option. Utilizing this option ensures that reports will be printed with respect to the local time zone in which they are recorded.

When using this feature, you must set the seismograph's time to UTC time.

Example: If your seismograph is located in the Eastern Standard Time Zone, you are five (5) hours behind UTC. Therefore, you would need to ADD five hours to the local time to obtain UTC, i.e.- if local time is 1300hr, EST, set unit time to 1800 or (UTC-5). If it were Eastern Daylight Savings time (EDT), it would be set 1700 or (UTC-4).

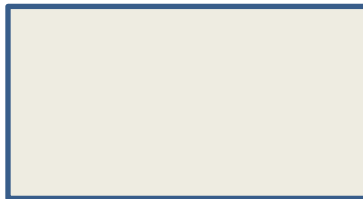
| CODE | TIME ZONE | CODE | TIME ZONE | CODE | TIME ZONE |
|------|-----------|------|-----------|------|-------------|
| 0 | undefined | 18 | UTC +1 | 36 | UTC +10 |
| 1 | UTC -12 | 19 | UTC +2 | 37 | UTC +10:30 |
| 2 | UTC -11 | 20 | UTC +3 | 38 | UTC +11 |
| 3 | UTC -10 | 21 | UTC +3:30 | 39 | UTC +11:30 |
| 4 | UTC -9:30 | 22 | UTC +4 | 40 | UTC +12 |
| 5 | UTC -9 | 23 | UTC +4:30 | 41 | UTC +12:45 |
| 6 | UTC -8 | 24 | UTC +5 | 42 | UTC +13 |
| 7 | UTC -7 | 25 | UTC +5:30 | 43 | UTC +13:45 |
| 8 | UTC -6 | 26 | UTC +5:45 | 44 | UTC +14 |
| 9 | UTC -5 | 27 | UTC +6 | 45 | US/Aleutian |
| 10 | UTC -4:30 | 28 | UTC +6:30 | 46 | US/Alaskan |
| 11 | UTC -4 | 29 | UTC +7 | 47 | US/Pacific |
| 12 | UTC -3:30 | 30 | UTC +7:30 | 48 | US/Mountain |
| 13 | UTC -3 | 31 | UTC +8 | 49 | US/Central |
| 14 | UTC -2:30 | 32 | UTC +8:30 | 50 | US/Eastern |
| 15 | UTC -2 | 33 | UTC +8:45 | 51 | US/Atlantic |

APPENDIX C

IMPORTANT NOTE REGARDING ENDING HISTOGRAM RECORDINGS FOR FIRMWARE PRIOR TO 4.98

If the LCD display has timed out, you will first need to press **ENTER** to 'awaken' the LCD. **DO NOT** end the histogram record until the seismograph displays a set of interval readings. Pressing **END** before the next set of readings is displayed will prevent the histogram event data from being written to the internal memory. This may also result in the seismograph's internal date and clock being reset to 00/00/00 and 00:00:00.

PROPER KEYSTROKE PROCEDURE TO PREVENT DATA LOSS:



LCD screen has timed out and is blank.

Press



to 'awaken' LCD.

COLLECT DATA HIST

Do NOT end the recording.

Wait until -

COLLECT DATA HIST
#58, 1 109
V0.010 L0.005 T0.016
2.8 2.8 145.2

interval data is displayed. It is now safe to

Press



to end data collection.

APPENDIX D

SPECIFICATIONS

TRIGGER MODES

| | | |
|---------|---------------------------|---|
| Seismic | Resolution: | 0.0025 in/sec (0.06 mm/sec) |
| | Range: | 5.120 in/sec (130 mm/sec) (other ranges available) |
| | Frequency Response Range: | 2 – 250 Hz (3 dB), 2 – 1000 Hz (Nyquist) |
| | Sampling Rate: | Up to 2000/sec/channel |
| | Record Time: | 1 – 15 seconds |
| | Accuracy: | 5% within one year (multi-point calibrated within 3%) |
| | Calibration: | Internal dynamic |
| Sound | Range (linear): | 78 – 138 dB (optional 154 dB and 174 dB ranges available) |
| | Frequency Range (3dB): | 2 – 250 Hz (3dB), 2 – 1000 Hz (Nyquist) |
| | Accuracy: | 5% within one year (multi-frequency calibrated) |
| | Calibration: | Internal electronic |

HISTOGRAM MODES

| | |
|----------------------|--|
| Recording intervals: | Selectable – 1,2,5,10,15,30 seconds; 1, 2, 5, 10, 15, 30, 60 minutes |
| Seismic resolution: | 0.0025 in/sec (0.06mm/sec) |
| Range: | 5.120 in/sec (130 mm/sec) (other ranges available) |
| Sound resolution: | 1 dB |

GENERAL

3000LC

- ✦ Weight: Seismograph – 4.5 lbs. (2.1)kg
Seismograph, case & components – 12.7 lbs. (5.8 kg)
- ✦ Dimensions: Seismograph – 8.7 in. x 7.0 in. x 3.6 in. (221 cm x 17.8 cm x 9,2 cm.)
Case – 12.0 in. x 14.0 in. x 6.5 in. (30.5 cm x 35.6 cm x 16.5 cm)
- ✦ Operating Temperature: 0 - 130° F (-18 - 55° C)

3000EZ PLUS

- ✦ Weight: Seismograph, case & components – 14.7 lbs. (6.67 kg)
- ✦ Dimensions: 12.25 in x 13.5 in x 5 in (31.1 cm x 34.3 cm x 12.7 cm)
- ✦ Operating Temperature: 0 - 130° F (-18 - 55° C)

APPENDIX E

TRIGGER MODE CAPACITIES

Memory capacity options: Typically, GeoSonics' 3000LC and EZ^{PLUS} seismographs are supplied with a "Standard Memory" option with a capacity of approximately 50 5-second trigger events. Two additional options are available for increased storage capacity. The *Extended Memory* option increases the event storage to approximately 100 typical events and the *Maximum Memory* option, which has a capacity of approximately 200 typical events.

Whether recorded in the triggered, sustained trigger, or dual mode, each 5 second, trigger event (uncompressed) contains 30,992 bytes. However, the total record capacity is dependent on the efficiency of the data compression that is applied during the event processing.

Compression reduces the number of bytes stored. Depending on the complexity and levels of data recorded as well as ambient noise and vibration levels. Under the worst case scenario, the compression can be as low as 2:1. Under normal recording conditions, the average data compression generally observed is 4:1. Under ideal conditions, compression levels as high as 7:1 have been observed.

The following table provides typical guidelines on event storage based on various conditions.

| COMPRESSION RATIO | MEMORY TYPE | TOTAL RECORD CAPACITY |
|-------------------------|-----------------|-----------------------|
| | | |
| Compression Ratio- 2:1 | Standard Memory | 30 events |
| (worst case scenario) | Extended Memory | 62 events |
| | Maximum Memory | 126 events |
| | | |
| Compression Ratio – 4:1 | Standard Memory | 61 events |
| (average) | Extended Memory | 124 events |
| | Maximum Memory | 253 events |
| | | |
| Compression Ratio – 7:1 | Standard Memory | 107 events |
| (best case scenario) | Extended Memory | 217 events |
| | Maximum Memory | 442 events |

APPENDIX F

HISTOGRAM MONITOR RECORDING CAPACITIES

The continuous mode (including the dual mode) records peak particle velocity data for the three (3) ground channels as well as linear air overpressure levels. There are thirteen (13) available recording intervals. The interval chosen affects the amount of total recording capacity.

Interval selection can have a dramatic effect on capacity. For example, a unit with the **standard** memory with the record interval set to 1 second, would record for only 10 hours before running out of storage space. With the interval set to 1 minute, the same unit will record for 24 days before filling the memory.

The table below lists the **histogram recording mode** recording capacity for additional intervals and available memory-type choices.

| Recording Interval | Recording Capacity |
|--------------------|--------------------|
| 1 second | 10 hours |
| 2 seconds | 20 hours |
| 5 seconds | 51 hours |
| 10 second | 4 days |
| 15 seconds | 6 days |
| 30 seconds | 12.5 days |
| 1 minute | 24 days |
| 2 minutes | 50 days |
| 5 minutes | 127 days |
| 10 minutes | 240 days |
| 15 minutes | 360 days |
| 30 minutes | 750 days |
| 1 hour | 1440 days |

Extended Memory cards have approximately two (2) times the recording capacity of a standard card. *Maximum Memory* cards have approximately four (4) times the recording capacity of a standard card.

ADDITIONAL MEMORY CONCERNS

The seismograph's firmware has a total allocation of 999 directory events. An individual histogram event contains a maximum of 2500 intervals (see page 19). Every time a completed event is written to memory, the seismograph will also write a check event to the memory. Each check event requires 992 bytes of memory space; this is generally not considered when computing available capacity but they can affect total event storage.

APPENDIX G

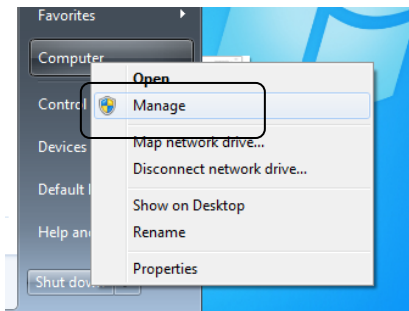
3000 USB-Serial Port Controller & USB to Serial Converter Cable

Data recorded on your 3000 model seismograph may be downloaded to a Windows-based PC for further analysis, in order to print customized reports, as well as for archival purposes. The software also provides a communication platform for programming your unit. If your PC does not have a 9-pin serial port you will need to use the USB – Serial Port Adapter supplied with your seismograph in order to access the power of the analysis software.

First, you will need to install the Cables to Go® device driver software that came with your seismograph. Insert the CD into your drive and follow the on screen instructions.

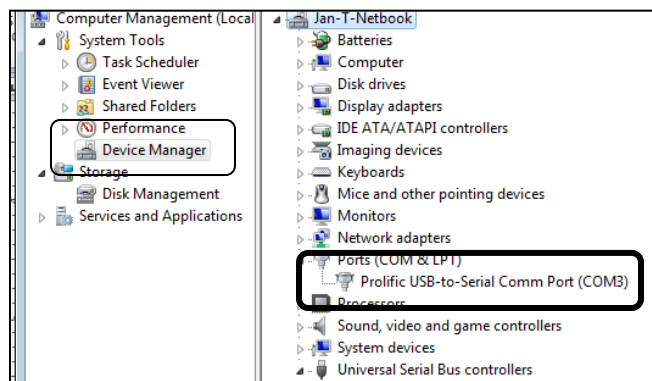
Installing the USB to Serial Converter cable and 3000 USB-Serial Port Controller:

1. Install the device drivers on the CD that is supplied with the cables.
2. Attach the USB to serial cable to the Serial Port Adapter making sure to connect it to the adapter cable identified as *USB Adapter*.
3. Connect the seismograph to your PC using the USB-Serial Port cable assembly.
4. Press and hold the Port Status button on the 3000 USB Port Adapter until the *Port Status* light comes on.
5. If you do not know the Com Port (number) associated with the software identified during installation, you can find it by the following steps. (Cable must be attached and active – *Status Port* light is illuminated.)



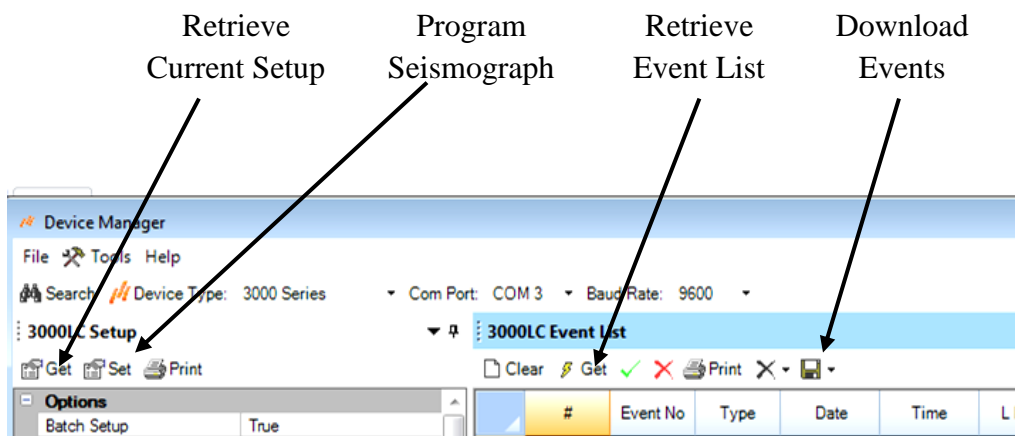
Start → Computer; right click – Manage → Device Manager

You will see *Prolific USB-to-Serial Comm Port*. The COM number next to it is the one



you will need to choose when connecting to the seismograph with Analysis.NET.

6. If you have not yet installed the Analysis.NET software, you will need to do so with the CD supplied or go to <http://www.geosonicsvibratech.com/seismic-analysis-software.html>.
7. Open Analysis.NET and click Device Manager. Set the “Com Port:” to the number found under Ports(Com & LPT).
8. Go to Tools and select “Open Port (Toggle DTR)”.
9. You may now:



SSU 3000LC and EZ^{Plus} Menu Options

1. Recorder Setup

1. RECORDING SETUP

Recording Mode

0:DM 1: TRG 2:HST 3:S

0 DM - DUAL MODE

HIST INTERVAL – 1:sec, 2 min

DUAL INTERVAL <s> - 1-7: 1, 2, 5, 10, 15 – 6= 30, 7 = 1 min

DUAL MAX LENGTH 1 – 2500

DUAL SEISMIC

DUAL AIR TRG

DUAL REC TIME

1 TRIGGER SETUP

SEIS TRG 0.005 – 5.00 <1>

AIR TRG 81 – 142 <2>

RECORD TIME 1 – 15 <3>

2 HIST SETUP

HIST INTERVAL – 1:sec, 2 min <1>

HIST INTERVAL <s / m > - 1-7: 1, 2, 5, 10, 15 – 6= 30, 7 = 1 min <2>

HIST MAX LENGTH 1 – 2500 <3>

3 S - SUSTAINED TRIGGER

SEIS TRG

AIR TRG

RECORDS PER TRIGGER

RECORD TIME 1 - 15

2. Recording Units - 1:IMP 2:METRIC

2 Display Data

Directory

Summary

Calibration Test

Banner

Memory Status

Additional Notes

GPS Location

3 Text Setup

Client Name

Operation

Location

Operator

Comment

Add'l Notes

Acquire GPS

4 Timer Setup

Timer Mode On / Off

One Time / Daily

Set Wake Up -WAKEUP TIME & DATE 00/00/00/ 00:00

Set Sleep -SLEEP TIME & DATE 00/00/00/ 00:00

6 Utilities

Set Clock / Date

Set Time

Set Date

Date Format - FORM 1: m/d/y 2: d.m.y

Time Zone Code - 0, 1 – 51 [0 = unspecified]

Erase Data

Set Event Number

Special Alarms – SPEC'L ALARM

Alarm1 On/Off

Alarm2 On/Off

Alarm2 Trigger

Advanced Options

SCAN ON TIMEOUT? y/n

CONFIGURATION - 0 STD, 1: ALT

TRIGGER FILTER 1..4 SAMPLES

SHOW DATE / TIME?

ALWAYS SHOW GPS?

Display Default - 1: ON, 0: OFF

7 Turn Off Unit

8 Display Banner

9. Templates

<template 1> . . . <template 6>

SAVE TEMPLATE

