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Consultants In Blasting Vibration Effects

MINI-SEIS DIGITAL SEISMOGRAPH

Operating Manual



*“A Full Service Company
for the Total Package”*

- Low Cost Leader in Quality Digital Seismographs
- Instrument of choice for many state and federal regulatory agencies.
- Lightweight and Easily Portable
- Optional External Printing Capabilities
- Easy to use Complimentary Data Analysis Software

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Chapter 1 - General Description

General Description

The Mini-Seis is designed for low cost blast vibration and industrial vibration monitoring. It is offered in a small package weighing approximately 3.5 pounds. There is a two line, 40 character display and six key keypad for on-site programming. An external microphone and tri-axial ground motion sensing package are included.

The Mini-Seis may be ordered with variable levels of memory for event recording. The standard memory models and approximate event storage parameters are shown in the following table:

<u>Instrument Model</u>	<u>Memory</u>	<u>Approximate Event Storage Capacity</u>
Mini-Seis 1/4M	1/4M (256K)	50-100 blast type events
Mini-Seis 1/2M	1/2M (512K)	150-250 blast type events
Mini-Seis 1.0M	1.0M (1024K)	up to 340 blast type events

Regardless of the memory size, each unit can display summary information for the last 340 events.

Data downloading and analysis software is provided. The software allows the stored data to be quickly downloaded from memory using any PC running a Windows 32 bit operating system. High communication rates, coupled with efficient data compression, allow rapid set-up and downloading of data via direct computer connection or modem.

Sample Rates And Recording Ranges

The Mini-Seis has sample rates from 32 to 2048 samples per second per channel. Numerous optional recording ranges allow both low and high level ground motions to be recorded. The standard X2 gain instrument has recording ranges of 2.5, 5.0 and 10.0 inches per second (64, 127 and 254 millimeters per second).

There are also X1, X4 and X8 gain options. Instruments with the 20.0 inch per second X1 gain option utilize accelerometers for ground motion sensors. This allows close-in monitoring where frequency or displacement values may be high. For maximum sensitivity, the Mini-Seis can be ordered with a X8 transducer. This velocity geophone configuration can record vibration levels as low as 0.0013 inch per second (0.03 millimeter per second).

The cable mounted, detachable mike, allows the monitoring of sound pressure levels up to 148 dB. There is also a 160 dB microphone option.

Recording Durations

The Mini-Seis can record events up to 12 seconds in duration at 1024 samples per second per channel. If programmed for shorter record times, the instruments may be able to record two or more events in succession.

Battery Life

The Mini-Seis instruments are power efficient. At a sample rate of 1024 samples per second, the unit will operate for approximately 7 to 10 days with a full charge. With the Timer Mode set to a seven hour monitoring day, the continuous operating time can be extended to approximately one month. The instrument can also be connected to AC power or a DC source such as an automobile battery or solar cell for extended or unlimited operating time.

Other Features

Communication with the Mini-Seis is also possible with landline, cellular or satellite modems. The data compression used by the Mini-Seis allows data to be downloaded several times faster than competing instruments. This feature saves time and reduces expense.

An external printer is available for those projects where on-site printing is needed. Each printer enabled Mini-Seis unit can have its own printer or one printer can be used with any number of units. This feature is an extra cost option and the instrument must have printer enabled firmware.

For large monitoring jobs, the programming of multiple units can be accomplished quickly using custom designed software. Multiple instruments can be charged and programmed simultaneously with an optional connecting kit. It is also possible to simply connect multiple units together and have all units trigger from a master unit. In this configuration, all units can be connected to a single external power source. Data can also be downloaded remotely with a single modem.

The Mini-Seis package contains all required accessories for operation. Once again, software is provided for setup, data downloading and analysis.

The transducer package and microphone are interchangeable between units of the same gain. Should calibration fail, it may only be necessary to send in the sensor package and not the entire unit. Some companies purchase a spare transducer and microphone package for this purpose.

Chapter 2 - Specifications

Specifications

Data Recorded	One (1) acoustic and three (3) seismic channels.
Frequency Response	2 to 500 Hz. (-3 dB. points) at 2048 samples per second. Lower sample rates reduce the high frequency response proportionately.
Seismic Sensors	Three component mounted velocity geophones or accelerometers, depending on the ordered recording ranges.
Microphone	Ceramic element rated to at least 160 dB.
Memory	Solid state with all summary, setup, and recorded data retained with power off. A lithium backup battery retains data if primary power fails.
Clock	A 24 hour clock maintains the date and time accurate to within 1 minute per month, even if primary power fails.
Timer Mode	Allows an instrument to be active only during selected hours on a daily basis.
Display	The high contrast LCD has two lines of 40 characters to facilitate the instrument's setup. It also allows the operator to view operating parameters and summary data.
Optional Keypad	Contains 6 keys for entering setup data and operating commands.
Power on Log	A log is kept in memory to indicate the active monitoring periods. If the timer is used, the log is updated each time it activates.
Battery	Internal 6 volt rechargeable.
Operating Time	With a fully charged battery all models will operate from 7 to 10 days at 1024 samples per sec. Longer times may be obtained using the timer mode or external power from a small solar cell or automobile battery.
External Battery Life	A standard automobile battery will keep the internal battery at full charge for several months at moderate temperatures. If the external battery fails, the unit will continue to operate on its internal battery.
Charging	An internal charging circuit allows charging with the supplied plug-in wall mount charger or any 10 to 15 volt DC supply. Power supplies for international use are available.
Operating Temperature	0 to 130 degrees F (-18 to 54 degrees C)

Chapter 2. Specifications

Case	Heavy gauge aluminum for effective electrical shielding and rugged protection.
Size	Approximately 7.5 in. x 4.5 in. x 2.5 in.
Weight	Approximately 3.5 lbs. (1.6 Kg.) without accessories.
Weight - Accessories	Approximately 6 lbs. (2.7 Kg.) including the storage case.
Waveform Data	1.0M: Up to 340 events. 1/2M: Approximately 150 to 250 typical blast events. 1/2M: Approximately 50 to 100 typical blast events.
Summary Data	Summarized data include the event time, date, battery voltage, peak measurements, unit serial number and frequencies. The summarized data are stored in solid state memory for the last 340 events.
Sample Rate	From 2048 to 32 samples per second per channel.
Recording Units	English (U.S.) or metric.
Seismic Recording Ranges	Standard (x2) 0.005 IPS to 2.5 IPS (0.125 to 64 MMPS) 0.01 IPS to 5.0 IPS (0.25 to 127 MMPS) 0.02 IPS to 10.0 IPS (0.50 to 254 MMPS) Optional (x1 - accelerometers) 0.01 IPS to 5.0 IPS (0.25 to 127 MMPS) 0.02 IPS to 10.0 IPS (0.50 to 254 MMPS) 0.04 IPS to 20.0 IPS (1.00 to 508 MMPS) Optional (x4) 0.0025 IPS to 1.2 IPS (0.063 to 30.5 MMPS) 0.005 IPS to 2.5 IPS (0.125 to 64 MMPS) 0.01 IPS to 5.0 IPS (0.25 to 127 MMPS) Optional (x8) 0.0013 IPS to 0.6 IPS (0.033 to 15.2 MMPS) 0.0025 IPS to 1.2 IPS (0.063 to 30.5 MMPS) 0.005 IPS to 2.5 IPS (0.125 to 64 MMPS)
Acoustic Ranges	Standard 0.02 to 2.56 millibars (100 to 142 dB) 0.04 to 5.12 millibars (106 to 148 dB) Optional 0.08 to 10.24 millibars (112 to 154 dB) 0.16 to 20.48 millibars (118 to 160 dB)

Chapter 2. Specifications

Trigger Levels	<p>Seismic</p> <p>2.5 IPS Range - 0.01 to 0.57 IPS (0.25 to 14.5 MMPS)</p> <p>5.0 IPS Range - 0.02 to 1.14 IPS (0.5 to 29 MMPS)</p> <p>10.0 IPS Range - 0.04 to 2.28 IPS (1.0 to 58 MMPS)</p> <p>Seismic trigger sensitivities are proportionally modified by optional gains.</p> <p>Acoustic - 106 to 142 dB or 112 to 148 dB.</p> <p>Acoustic trigger sensitivities are proportionally modified by optional gains.</p>
Manual Trigger	<p>Allows triggering from the keyboard or by an external input. One unit may be used to trigger additional instruments.</p>
Record Duration	<p>From 2 to 12 seconds at a sample rate of 1024 samples per second. At lower sample rates, the duration is automatically increased proportional to the amount of decrease in the sample rate.</p>
Cycle Time	<p>At 1024 samples per second, up to 12 seconds of data can be taken with only 50 milliseconds between events. After 12 seconds of data are stored, another event cannot be taken until the previous data have been processed. Processing requires about 3 seconds per second of recording time.</p>
Records Stored	<p>Up to 340 blast type events, varies depending on memory and data compression.</p>
Calibration Test (Seismic)	<p>A dynamic transducer test is performed automatically after each event or manually on command. The test is stored in the summarized data and may be downloaded as an event.</p>
Calibration Test (Acoustic)	<p>An electronic test of the microphone is performed with the seismic test and is stored in memory along with the seismic test.</p>
84 Hour Cal Test	<p>In a remote installation, an automatic calibration test occurs if no event has been recorded for 84 hours.</p>
RS232 Serial Port	<p>Data can be downloaded and setup commands can be uploaded directly by computer or remotely by modem.</p>
Baud Rate	<p>From 1200 to 38.4K.</p>
External Printer	<p>An external printer is available as an option. Printer enabled firmware is required.</p>

Chapter 3 - Setup and Operation

General

Each Mini-Seis has a keypad and display to allow setup, test, and summarized data viewing on site without a computer. Comments may be entered using the keypad or the communications software. The entered comments are stored in memory with each event. A computer may also be used for all setup functions.

Setup is accomplished by selecting fields on three primary display screens. The ENTER key accepts all values on the screen and advances the display to the next screen. Once set, the values are stored and are implemented each time power is cycled on.

Keyboard Functions

The six key keypad allows the user to accomplish all operating functions. Two-key combinations are required for some functions.

RESET

Pressing the RESET key resets the instrument. After pressing RESET, a message will appear showing the operational mode.

MODE SELECTION [WAVESHAPE]
ENTER TO ACCEPT, – KEY TO CHANGE

There are two modes, WAVESHAPE and BARGRAPH. To change the mode, press the – key while the screen is displayed. In newer firmware versions the operating mode cannot be changed unless there are no data in memory. ENTER can be pressed at any time to accept the mode and continue. If ENTER is not pressed within two minutes, the seismograph will automatically accept the displayed mode and continue.

After selecting the mode, the unit initiates a stabilization period during which it will not trigger and cannot be setup. The unit will normally recover from the reset in a few seconds.



If background vibration levels are above the trigger levels, the unit will not be able to stabilize. To minimize this possibility, we recommend connecting either the supplied activation plug or just the microphone for setup purposes.

ENTER

The ENTER key is used to accept all setup parameters as they appear on the screen. Pressing ENTER also causes the unit to cycle to the next screen.

- and +

The - and + keys are used for changing field values after a field has been selected with the Select Function (SHIFT and +). They are also used to change the summary event number on the Event Screen to allow the viewing of any event in memory. Holding down either key will cause a rapid repeat of the function to allow faster changes.

Select Function (SHIFT and +)

This two-key combination is used to select a field to be changed. The function is accessed by pressing and holding the SHIFT key, and then pressing the + key. Brackets on the display will enclose the selected field. The brackets will move to the next field each time SHIFT and + is pressed. As each field is exited, the field value will be accepted as it appears in the field. The Select Function may also be used on the Event Screen to toggle between viewing amplitude data and frequency data.

Calibration Test (SHIFT and ENTER)

Holding the SHIFT key and pressing ENTER will produce a manual calibration test. This function allows manual testing of a unit's calibration during setup or at regular intervals during long term monitoring. To pass a calibration test, both the transducer and microphone must be connected.

Clear (ENTER and RESET)

This function can be used to clear an instrument's logic in case a problem occurs. To use the Clear Function, press RESET to reset the unit. Press ENTER to continue past the Mode Selection screen and continue to hold ENTER for a few seconds thereafter. All setup parameters will be reset to default values and any data in the Comment fields will be erased. Stored events in memory will not be erased.

Clear Data (+ and RESET)

Hold down the + key and press and release the RESET key to clear all stored events in memory. The + key should be held down until you see the following message on the display:

TO ERASE MEMORY USE SELECT FUNCTION

At this point, press and release the SHIFT and + keys simultaneously to clear the memory. If successful you will see the message CLEARING MEMORY. After clearing the memory, the event number on the Event Screen will be reset and all data values will be set to zero.

If you do not respond to the above message within a few seconds, the instrument will reset and the memory will not be cleared.



Be aware that this function is irreversible. All data in memory will be erased. Also, do not hold down the + key after the Clearing Memory message is displayed. This can cause some units with older firmware to change between Waveshape and Bargraph modes.

Manual Trigger (- and RESET)

Hold down the - key and press and release the RESET key. The - key should be held down until you see the following message on the display:

MANUAL TRIGGER MODE SELECTED

The unit can now only be triggered from the keypad or by an external trigger. The keypad method is to press the SHIFT and – keys together. To trigger the unit externally, apply a trigger to pin 7 of either of the round connector on the end of the case.



Be careful not to confuse the Manual Trigger function (- and RESET) with the Clear Data function (+ and RESET). Also, when in the Manual Trigger Mode it is not possible to print events to the optional external printer.

Print (SHIFT and -)

Use of this function requires special printer firmware and that a compatible external printer be attached. If the firmware is installed, while not in the Manual Trigger Mode, pressing SHIFT and – together instructs the unit to print the current event shown on the display. For more information about using the optional external printer see the chapter on Field Printing.

Trigger Disarm (*)

The Mini-Seis is normally ready to monitor as soon as the microphone or external transducer is installed and stabilization is complete. If setup is to be done on site, accidental triggers may occur unless the trigger mode is disarmed.

To disarm triggering in the field, press the Trigger Disarm key (*) on the keypad. When the trigger disarm is activated, there will be a ■ character in the lower left corner of the display. This will allow setup to be completed without causing a trigger. The trigger disarm can be deactivated by pressing the Trigger Disarm key (*) again. When the trigger disarm is deactivated, there will not be a ■ character in the lower left corner of the display. One to two minutes after all keyboard activity has ceased, the Mini-Seis display will go blank. This action also deactivates the trigger disarm.

First Setup Screen

The first screen that appears after the unit has stabilized shows the current battery voltage, baud rate, memory configuration, status of the comments, acoustic display mode and the date and time. Each of these fields is accessible using the Select Function. To use the Select Function, hold down the SHIFT key and press + until the brackets surround a field you wish to change. Then use + or - to change the current setting.

The first setup screen will be similar to the following:

BAT 06.4	BAUD 9600	WRAP ON	AIR DB
A COMMENT OFF	CLOCK OK	04-25-06	15:34 []



Over the years there have been a number of changes to the Mini-Seis setup screens. If the first setup screen on your instrument appears significantly different than that shown above, please contact White Industrial Seismology, Inc. at 1.800.641.4538 if you should have any questions.

Battery (BAT)

This field shows the current battery voltage. In the sample shown above, the current battery voltage is 6.4 volts. The Mini-Seis should be charged if the voltage is below 6.0 volts.

Baud Rate (BAUD)

You can normally set the Baud Rate to the highest value your computer will support. All computers tested to date, including old models, have supported up to 38.4K baud with the communications software. Setting the unit to a lower baud rate may result in more reliable communication in some cases, but will slow the transmission of data and setup information. The baud rate in the above sample is set to 9600.

To change the baud rate, press SHIFT and + to bracket the field. Then press the + or - key to raise or lower the value.

Memory Wrap (WRAP)

The Mini-Seis memory can be configured to start storing events with Event 001 and automatically stop taking events either when the memory is full or Event 340 has been reached. The default configuration, WRAP ON, allows the memory to wrap around. This means that when the memory is full, a new waveform event will be stored over the oldest event in memory.

IMPORTANT: **When the memory is full in the WRAP OFF mode, the data must be manually cleared before more events can be stored.**

Since the Mini-Seis always shows summary information for the last 340 events, users may assume that the waveform for each event is in memory. This may or may not be the case. To change the wrap state, press SHIFT and + until the field is bracketed. Then press the + or - key to toggle the value to ON or OFF.

When to Use WRAP ON

WRAP ON should be used if you will be downloading data before more events are recorded than can be stored in the memory that is available.

When to Use WRAP OFF

WRAP OFF should be used if you are concerned about recording more events than can be stored in the available memory before you can download.



When events are downloaded, they are not removed from the instrument's memory. Downloading simply copies the events from memory.

Acoustic Display Units (AIR)

Acoustic measurements can be displayed in millibars (MB) or decibels (DB). To change the acoustic display units, press SHIFT and + until the field is bracketed. Then press + to toggle the value to MB or DB.

Comments (COMMENT)

Six lines of comments may be entered from the keypad or with a computer. These comments can be stored in memory with each recorded event. From the keyboard it is possible to ADD comments or turn comments ON or OFF. Turning comments OFF saves some memory, allowing perhaps one or two extra events to be stored. Selecting ADD in this field, and then pressing the ENTER key, allows the viewing and entering of comments.

To add comments, press SHIFT and + until the COMMENTS field value is bracketed. Then press + until the field value shows ADD. Next press ENTER. The first comment screen will appear as follows:

1 0123456789 ABCDEFGHIJKLMNOPQRSTUVWXYZ

The number one in the lower left corner of the screen indicates that this is comment screen #1. Pressing ENTER will change this number to 2, indicating the second comment screen. There are six of these screens.

When a screen is first displayed, a block cursor will be in the upper left corner of the display. To enter comments, you must select individual characters from the bottom half of the screen. To do this press SHIFT and +. An equal (=) sign will appear where the cursor was in the upper half of the display and the cursor will move to the space between the number 9 and the letter A. This is the space character. To enter a character, move the cursor using + or - until the cursor is over the character. Then press SHIFT and +. Do not press ENTER as this will cause the display to show the next comment screen.

The selected character will appear in the position occupied by the equal sign and the cursor will be located at the next position right. Repeat the previous process to select other characters.

The + and - keys will move the cursor without erasing characters. To erase a character, place the cursor on the character in the upper half of the screen and press SHIFT and +. The cursor will move to the space between the number 9 and the letter A. This is the space character. Press SHIFT and + again and the character will be erased.



It is much easier to enter any comments or headings using the computer software.

CLOCK

To change the date and/or time, press SHIFT and + until the OK is bracketed after the word CLOCK. Then press + to change the value to SET. Then press ENTER to access the clock setup screen. The screen will be similar to the following:

seconds = 0 after enter	M	D	Y	H	M
[EXIT]	04	-	25	-	06 15 : 32



Do not bracket [EXIT] and press enter after making changes to the date and/or time settings of the seismograph. By doing this the changes that are made will not be saved.

Chapter 3. Setup and Operation

Each item of the date and time can be accessed with the Select Function (SHIFT and +). When selected, changes to the date and time can be made by pressing the + or - keys. Holding these keys down will advance the settings at a rapid rate. When finished with any changes, simply press ENTER.

The date is displayed in the format MM-DD-YY where MM is the month from 01 to 12, DD is the day from 01 to 31 and YY is the year from 00 to 99. The time is displayed in military format as HH:MM where HH is the hour from 00 to 23 and MM is the minute from 00 to 59.

Second Setup Screen

Pressing ENTER from the first setup screen will advance the display to the second setup screen. This screen contains fields for the data units, seismic range, acoustic range, seismic trigger level and acoustic trigger level.

The second setup screen will be similar to the following:

MAX RANGES IPS	05.0	DB 142
A TRIGGERS SEIS	0.05 IPS	AIR OFF DB []



Over the years there have been a number of changes to the Mini-Seis setup screens. If the second setup screen on your instrument appears significantly different than that shown above, please contact White Industrial Seismology, Inc. at 1.800.641.4538 if you should have any questions.

Max Ranges

The Mini-Seis can display data in either U.S. (IPS inches per second) or metric (MMPS millimeters per second) units. The specified units determine how data are displayed. All data are stored in memory in U.S. units. The value in the preceding sample is presented in U.S. units, IPS. To change the displayed units, press SHIFT and + until the field is bracketed. Then press + to change.

Seismic Range

The seismic range value is shown after the IPS or MMPS designation. It indicates the highest vibration level that can be recorded. The Mini-Seis will have three ranges that can be selected. The available range values will depend on the transducer gains as shown in the following table:

Transducer Type	Available Ranges (IPS)	Available Ranges (MMPS)
X1	5.0, 10.0 and 20.0	130, 257 and 520
X2	2.5, 5.0 and 10.0	65, 130 and 257
X4	1.2, 2.5 and 5.0	32, 65 and 130
X8	0.6, 1.2 and 2.5	16, 32 and 65

It will normally be desirable to use the lowest range that will accommodate the highest particle velocity level you expect. This will give the best resolution of low level data. To change the seismic range, press SHIFT and + until the field is bracketed. Then press + to select one of the three values.

Acoustic Range (DB)

The Mini-Seis has two acoustic ranges of 142 or 148 dB. As with the seismic range, it is normally best to use the lowest range which will accommodate the highest airblast level expected. To change the acoustic range, press SHIFT and + until the field is bracketed. Then press + to toggle between the two values.



There is also a microphone option with ranges of 154 and 160 dB.

Seismic Trigger Level (TRIGGERS SEIS)

Typically, the seismic trigger level will be set as low as possible, taking into account the background vibrations in the area. Setting the level too low may allow numerous false triggers. Setting the level too high may prevent the unit from triggering to the blast event. In the sample shown above, the trigger setting is 0.05 inch per second.

To change the seismic trigger level, press SHIFT and + until the field is bracketed. Then press + or - to raise or lower the value. Holding down these keys will cause the value to change rapidly.



Whenever the seismic range is changed, the seismic trigger level changes proportionally. For example, if the current range is 5.0 ips and the trigger level is 0.06 ips, changing the range to 2.5 ips will also change the trigger level to 0.03 ips.

Acoustic Trigger Level (AIR)

The acoustic trigger may not be required for normal blast events. If the trigger is used, it should normally be set at a higher level to help prevent false triggers from wind and other non-blast sources. The above sample has the acoustic trigger set to OFF. The acoustic trigger level is in decibels (DB).

To change the acoustic trigger level, press SHIFT and + until the field is bracketed. Then press + or - to raise or lower the value. Holding down these keys will cause the value to change rapidly.



An acoustic trigger level setting below 120 decibels should only be used with caution. Always use the supplied windscreen to prevent false triggering from wind.

Third Setup Screen

Pressing the ENTER key from the second setup screen will advance the display to the third setup screen. This screen contains fields for the printer setup, timer mode, sample rate, and record duration.

The third setup screen will be similar to the following:

PRINTER RANGE 0	SPEED 1	TIMER OFF
A 1024/SEC	004 SEC RECORD	OSM NONE

Chapter 3. Setup and Operation



Once again, over the years there have been a number of changes to the Mini-Seis setup screens. If the third setup screen on your instrument appears significantly different than that shown above, please contact White Industrial Seismology, Inc. at 1.800.641.4538 if you should have any questions.

Print

An optional external printer is available for the Mini-Seis. If you have the printer firmware installed, the following printing features may be used:

Range

The range value will normally be set to 0. This value will instruct the instrument to automatically select the best range to print a record. You may however, force the range to a value of 1 to 5. This feature will allow you to print one or more records using the same amplitude scaling. The range values correspond to the following:

Largest Amplitude			Scale Factor	
Range	IPS	MMPS	IPS/DIV	MMPS/DIV
1	0.32	8.1	0.08	2.0
2	0.64	16.3	0.16	4.0
3	1.28	32.5	0.32	8.1
4	2.56	65.0	0.64	16.3
5	5.12	130.0	1.28	32.5

Speed/Chart Length

This value determines the paper length used to print the record. It can be set from 1 to 6, with 1 representing the shortest record and 6 the longest.

Timer Mode (TIMER ON, SET or OFF)

This field allows the Timer to be turned ON, OFF or SET. When the brackets are on this field, and the field value shows SET, the ENTER key can be pressed to allow the Timer operation to be programmed. It will appear similar to the following example:

HOUR TO TURN UNIT OFF 00 ON 00
arrow keys to set hour 0-23, then enter

The cursor may be moved to the OFF and ON fields where the + or - keys will allow the operator to set the hour when the unit will start and cease monitoring on a daily basis. When the ENTER key is pressed, the hours are set and the third setup screen will reappear with the TIMER field showing ON.

A typical timer setup might be to set the ON value to 08 and the OFF value to 17. This instructs the instrument to turn on at 08 (8:00 AM) and off at 17 (5:00 PM) for a recording time of nine hours per day. The primary purpose for the timer operation is to conserve power and obtain longer operating times. The Timer may also reduce the possibility of false triggers.

Chapter 3. Setup and Operation

During periods outside the set operating time, the instrument will not trigger or record events. However, the unit can be manually activated by pressing RESET. The unit will then remain activated until the next scheduled OFF time.



The Timer will not take effect until the OFF time has been reached. Also, be careful not to confuse the OFF time with the ON time as you might lose data.

Sample Rate (1024/SEC)

This field sets the number of samples each channel will acquire in a one second period. The most commonly used sample rate is 1024 samples per second. The Mini-Seis operating current gets lower as the sample rate decreases. With lower sample rates, longer operating times can be obtained. However, care should be used before reducing the sample rate below 512 samples per second.

As a minimum, at least five samples per cycle of the highest frequency to be expected should be obtained. Ideally, the sample rate should provide at least 10 samples per cycle. For example, to minimally resolve amplitudes at a frequency of 100 hertz, a sample rate of no less than 512 samples per second should be used, although a sample rate of at least 1024 samples per second would be preferable. To record amplitudes with frequencies above 100 hertz, 2048 samples per second should be used. Also, the coupling of the transducer becomes very important. The downside of using the 2048 sample rate is that the battery life will decrease by approximately 30 percent.

Record Duration (004 SEC RECORD)

The record duration field value determines the amount of recording time that will be allotted to each triggered event. For airblast considerations, the record duration should be set at a minimum time of two seconds longer than the blast duration, plus one second for each 1100 feet from a blast.



Having the record duration set shorter than the shot duration means that there may be more than one event in memory for the shot. If this occurs, the events will have consecutive numbers with the same date and possibly the same time.

OSM

If the printer firmware is installed, this field value will indicate whether or not the OSM particle velocity and frequency chart is printed. The possible values are:

NONE – no chart is printed.

COMBINED – the chart is printed with data from the three seismic channels on one chart.

SEPARATE – three charts are printed, one for each seismic channel.

Event Screen

Pressing ENTER from the third setup screen will advance the display to the Event Screen. This screen shows summary information for each of the events in memory. The + and - keys can be used to change the event number being displayed. Pressing the Select Function (SHIFT and +) will

toggle the screen to display the frequencies at the peak amplitudes. An example of an event on the Event Screen follows:

BAT 06.6 04-04-06 13:56 IPS 025 P A 0.130T 0.020V 0.340R 126 A 0.360VS

BAT 06.6

This is the instrument's battery voltage at the time the event was obtained.

Date: 04-04-06

The date the event was recorded (MM-DD-YY).

Time: 13:56

The time the event was recorded.

Units: IPS

This shows the units used to display the seismic data, IPS or MMPS.

Event: 025

This is the event number of the event. Event numbers can range from 001 to 340. The + and - keys can be used to change event numbers. For example, if - was pressed, the display would change to show summary data for event number 024.

Cal Test: P

This value indicates whether or not the unit passed (P) or failed (F) the calibration test stored with the event.

Transverse Amplitude: 0.130T

This is the peak vibration value for the transverse seismic component.

Vertical Amplitude: 0.020V

This is the peak vibration value for the vertical seismic component.

Radial Amplitude: 0.340R

This is the peak vibration value for the radial seismic component.

Acoustic: 126 A

This is the peak acoustic overpressure value. The value is in decibels since this was specified in the acoustic display units in the first setup screen.

Vector Sum: 0.360VS

This is the peak vector sum vibration value. This value is a true vector sum.

Waveform Availability: A

This value indicates whether or not the wave form data for the event are available in memory. If the value is A, the data are in memory. If the value is S, only summary data are in memory.

Field Installation

Transducer Installation

Burial of the seismic transducer package is recommended, except in super-saturated soil conditions. To bury the transducer, connect the baseplate and spikes. Then dig a hole roughly six inches deep. The bottom of the hole should be relatively flat and smooth. Orient the arrow on top of the transducer toward the shot and press the transducer assembly into the bottom of the hole. Carefully replace the soil around and over the transducer. After monitoring, care should be used when removing the soil so that the transducer cord will not be cut.

For surface spiking in good soil conditions, connect the baseplate and spikes. Orient the arrow on top of the transducer toward the shot and press the transducer assembly firmly into the earth. A sandbag may also be used.

When mounting on concrete, bolting or gluing of the seismometer is recommended. Never simply place the transducer on concrete without proper coupling.



Transducer coupling becomes a significant issue whenever ground accelerations approach or exceed 0.2 gravities. At a frequency of 30 hertz, a particle velocity of 0.40 ips yields 0.2 g acceleration. We recommend that the ISEE Seismograph User Guidelines be followed concerning proper coupling methods. To see these guidelines go to www.isee.org.

Microphone Installation

The microphone may be installed by a number of convenient methods. One suggested method is to use tape to fasten the microphone to a rod driven into the ground. It may also be set in the provided microphone stand. The supplied wind screen should always be used to prevent the acoustic readings from being influenced by wind. Use the supplied rain shield package to protect the microphone from any rain.

Preparing for Operation

As soon as either the transducer or microphone are connected to the Mini-Seis, the unit will activate. If on-site setup is required, it is suggested that only the microphone be installed. You may also use the Trigger Disarm key to disable the trigger as described previously in this manual.

REVIEWING DATA

The display can be used to view any event in memory, even while monitoring. If no event is expected, you can use the Trigger Disarm key to deactivate triggering. If the display is blank, pressing ENTER will activate the screen. The display will then be on the Main Screen. It will show the summary data of the most current event. Different events can be viewed with the + and - keys. Pressing the - key will change the screen to the next lowest event number. Press + to view the next highest event number.

Chapter 4 - Bargraph Mode

To use the BARGRAPH MODE, the operator should install the transducer and mike as described previously. If the instrument is in the WAVESHAPE MODE upon power up, the - Key can be used to change to the BARGRAPH MODE.



With current firmware, it is not possible to change modes without first clearing the memory. However, older firmware versions may allow modes to be changed accidentally which will clear the memory.

When the BARGRAPH MODE is accessed, the Stabilization Screen will appear on the display with the last calibration date on the first line. This date serves as a reminder to have the calibration certified at least once each year. The unit serial number and software version will also appear on this screen. In a few moments, this screen will disappear and Setup Screen # 1 will appear.

If previous bargraph setup data are in memory, and the data are setup as needed, it will only be necessary to press the ENTER Key to display Setup Screen #2. If this is the case, to begin a job, press ENTER to go to Setup Screen #3. Use the Select Function (SHIFT and +) to bracket the word INACTIVE and press + or - to change the value to ACTIVE. Pressing the ENTER Key at this point will activate the job. If ENTER is not pressed, the job will automatically activate after a few minutes. To end an active job, make the System Field value INACTIVE and press the ENTER Key.

Setup Screen #1

Setup Screen #1 will be similar to the following example:

BAUD 9600	COMMENTS OFF	TIMER OFF
A BAT 6.5	CLOCK OK	04-18-06 08:05

The cursor will be blinking in the lower right corner of the screen. It can be moved to any changeable field by pressing the Select Function (SHIFT and +). The + and - keys can be used to change the values of the selected fields as required. Pressing the ENTER Key will cause the seismograph to accept all displayed field values and the screen will update to the next setup screen.

The displayed battery voltage represents the current voltage. The battery should be above 6.0 volts for proper operation.

The field values that can be selected for modification are:

Baud Rate (BAUD)

You can normally set the Baud Rate to the highest value your computer will support. All computers tested to date, including old models, have supported up to 38.4K baud with the communications software. Setting the unit to a lower baud rate may result in more reliable communication in some cases, but will slow the transmission of data and setup information. The baud rate in the above sample is set to 9600.

Comments (COMMENTS)

Six lines of comments may be entered from the keypad or with a computer. These comments can be stored in memory with each recorded event. From the keyboard it is possible to ADD comments or

turn comments ON or OFF. Turning comments OFF saves some memory. Selecting ADD in this field, and then pressing the ENTER key, allows the viewing and entering of comments.

To add comments using the instrument's keypad, press SHIFT and + until the COMMENTS field value is bracketed. Then press + until the field value shows ADD. Next press ENTER. The first comment screen will appear as follows:

```
1 0123456789 ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

The number one in the lower left corner of the screen indicates that this is comment screen #1. Pressing ENTER will change this number to 2, indicating the second comment screen. There are six of these screens.

When a screen is first displayed, a block cursor will be in the upper left corner of the display. To enter comments, you must select individual characters from the bottom half of the screen. To do this press SHIFT and +. An equal (=) sign will appear where the cursor was in the upper half of the display and the cursor will move to the space between the number 9 and the letter A. This is the space character. To enter a character, move the cursor using + or - until the cursor is over the character. Then press SHIFT and +. Do not press ENTER as this will cause the display to show the next comment screen.

The selected character will appear in the position occupied by the equal sign and the cursor will be located at the next position right. Repeat the previous process to select other characters.

The + and - keys will move the cursor without erasing characters. To erase a character, place the cursor on the character in the upper half of the screen and press SHIFT and +. The cursor will move to the space between the number 9 and the letter A. This is the space character. Press SHIFT and + again and the character will be erased.



It is much easier to enter any comments or headings using the computer software. Comments can also be added to reports from the software without entering them in the instrument.

Timer Mode (TIMER ON, SET or OFF)

This field allows the Timer to be turned ON, OFF or SET. When the brackets are on this field, and the field value shows SET, the ENTER key can be pressed to allow the Timer operation to be programmed. It will appear similar to the following example:

HOUR TO TURN UNIT OFF 00 ON 00 arrow keys to set hour 0-23, then enter

The cursor may be moved to the OFF and ON fields where the + or - keys will allow the operator to set the hour when the unit will start and cease monitoring on a daily basis. When the ENTER key is pressed, the hours are set and the third setup screen will reappear with the TIMER field showing ON.

A typical timer setup might be to set the ON value to 08 and the OFF value to 17. This instructs the instrument to turn on at 08 (8:00 AM) and off at 17 (5:00 PM) for a recording time of nine hours per

Chapter 4. Bargraph Mode

day. The primary purpose for the timer operation is to conserve power and obtain longer operating times. The Timer may also reduce the possibility of false triggers.

During periods outside the set operating time, the instrument will not trigger or record events. However, the unit can be manually activated by pressing RESET. The unit will then remain activated until the next scheduled OFF time.



The Timer will not take effect until the OFF time has been reached. Also, be careful not to confuse the OFF time with the ON time as you might lose data.

CLOCK

To change the date and/or time, press SHIFT and + until the OK is bracketed after the word CLOCK. Then press + to change the value to SET. Then press ENTER to access the clock setup screen. The screen will be similar to the following:

seconds = 0 after enter	M	D	Y	H	M
[EXIT]	04	-	25	-	06 15 : 32

Each item of the date and time can be accessed with the Select Function (SHIFT and +). When selected, changes to the date and time can be made by pressing the + or - keys. Holding these keys down will advance the settings at a rapid rate. When finished with any changes, simply press ENTER.

The date is displayed in the format MM-DD-YY where MM is the month from 01 to 12, DD is the day from 01 to 31 and YY is the year from 00 to 99. The time is displayed in military format as HH:MM where HH is the hour from 00 to 23 and MM is the minute from 00 to 59.



Do not bracket [EXIT] and press enter after making changes to the date and/or time settings of the seismograph. By doing this the changes that are made will not be saved.

Setup Screen #2

Setup Screen #2 is displayed whenever the ENTER Key is pressed from Setup Screen #1. This screen will be similar to the following example:

AIR RANGE 106 - 142	SEIS RANGE IPS	1.2
DISPLAY PEAK	INTERVAL	10 SEC

Air Range Field

Two airblast recording ranges are available. The information shown in the preceding illustration covers the range from 106 dB to 142 dB. The highest airblast range is from 112 to 148 dB.

Seis Range Units Field

The IPS (inches per second) designation on the preceding Setup Screen #2 sample indicates that the

Chapter 4. Bargraph Mode

displayed seismic data units will be inches per second. This field may also be set to MMPS (millimeters per second).

Seis Range Field

Three seismic ranges are available. Each range can be displayed in IPS (inches per second) or MMPS (millimeters per second). The lowest range has an upper limit of 1.2 IPS (31 MMPS), with a resolution of 0.01 IPS (0.254 MMPS). The middle range is 2.5 IPS (64 MMPS) with a resolution of 0.02 IPS (0.508 MMPS). The highest range, 5.0 IPS (254 MMPS), has a resolution of 0.04 IPS (10.16 MMPS).

Display Field

Two display options are available. [PEAK] displays the peak particle velocity recorded. [RESULT] displays the vector sum value.

Interval Field

The Interval Field sets the time between displayed samples. However, the instrument only stores samples over six times the selected interval. In the above example, the seismograph would store in memory peak values obtained during each 60 second interval.

Setup Screen #3

Setup Screen #3 is displayed whenever the ENTER Key is pressed from Setup Screen #2. This screen will be similar to the following example:

SYSTEM INACTIVE

System Field

The value for the System Field will default to INACTIVE (not monitoring) at power on. When ACTIVE is selected for the System Field and the ENTER Key is pressed, the instrument will begin to monitor using the selected parameters. When the System Field value is ACTIVE, and the ENTER Key is pressed, the current monitoring job will end and the system will become INACTIVE.

Once the unit is placed in the ACTIVE MODE, it will remain active until power is turned off or the TIMER MODE turns it off for a selected period of time. In continuous operation, a new job will start at midnight and the unit will remain active.

Screen #4

After the ACTIVE SYSTEM MODE has been entered, Screen #4 will appear on the instrument display. This screen will be similar to the following:

BAT 6.5 04-18-06 13:21 IPS 003
4 AIR 110 DB 15:02 SEIS 00.96 15:08

Screen #4 is not a Setup Screen. Instead, this screen displays pertinent monitoring information. The number four in the lower left corner of the display identifies the screen number. The battery voltage, date and time shown on the first line are relative to the start of the current job. The IPS indicates that the peak readings are to be printed and displayed in inches per second. As was previously discussed, the printed units can be selected from Setup Screen #2. The number at the upper right corner of the display represents the current job number.

This second line displays the peak levels obtained since the start of the monitoring period. The text "AIR 110 DB 15:02" means that the largest acoustic level recorded has been 110 decibels at a time of 15:02. The text "SEIS 00.96 15:08" means that the largest seismic level recorded has been 0.96 inch per second at a time of 15:08. The type of value displayed for SEIS will depend on what was specified for the DISPLAY Field in Setup Screen #2. If the DISPLAY Field value is specified as PEAK, the SEIS value will be peak particle velocity. If the DISPLAY Field value is RESULT, the SEIS value will be the peak vector sum.

Screen #5

If the Select function (SHIFT and +) is used from Screen #4, Screen #5 will be displayed. This screen will be similar to the following:

BAT 6.5 13:40 AIR 110 DB 006
5 IPS PEAK 0.070 RESULT 0.085

Screen #5 is similar to Screen #4 except this screen shows the peak measurements for the current bar interval, not the monitoring period. Since we have an INTERVAL value of 10 seconds, this screen will update every 10 seconds. The number five in the lower left corner of the display identifies the screen number.

Chapter 5 - Charging

Charging

A Mini-Seis may be charged using two methods. One method utilizes a charger with an AC output of 9 to 15 volts. This charger may be supplied without a connector. When this is done, it is typically for use outside the U.S. The AC charging method may be used when the seismograph is not operating and AC power is available. An overnight charging time should bring the unit up to full charge. The normal operating voltage will be 6.3 to 6.5 volts. The units should not be operated below 6.0 volts. The operating time depends primarily on the sample rate and whether the timer mode is used. The worst case operating time would be based on a sample rate of 2048 samples per second. In this case, the operating time is about five days.

The second method for charging a Mini-Seis utilizes a DC charger. For this method, the applied voltage must be 9 to 15 volts DC. The power source can be an auto battery or other source such as a solar cell. This charging method may be used in the field while the unit is operating with the microphone connected. The best results will be obtained using an auto battery or solar cell. Power line spikes may cause false triggering if AC power is used.

An external charging cable is supplied with each Mini-Seis. The red clip must be connected to the positive terminal of the power source. No damage will result if the connections are reversed, however no charging will occur.

Chapter 6 - Field Printing

Field Printing

A firmware upgrade is available that supports the use of an optional external field printer. The printing is serial. In order to print, the instrument's baud rate must match the printer's baud rate. The printer comes with an instruction manual that shows how to set the DIP switches to various rates.

Next configure the Mini-Seis printing parameters by accessing Setup Screen 3 and setting the RANGE, SPEED and OSM field values. Thereafter, once the printer is connected to the Mini-Seis, all that is needed is to access the Event Screen and find the event to be printed. Then simply press the SHIFT and – keys simultaneously.

Print [YES]

[YES] enables the unit to print the current event screen/event number directly to the external printer. To use this feature simply toggle through the event screens using the - and + buttons to the desired event number. Then press the [shift] and [-] keys simultaneously. The external printer should then begin printing.



The Mini-Seis and printer baud rates must match in order for the seismograph and external printer to communicate and print records from memory. The default baud rate of the printer is initially set to [19.2].

Print [MENU]

[MENU] provides a number of printing options. These options consist of:

WAVEFORM

Waveform allows the printing of a range of event numbers with variable range and chart lengths to aid in the review of the selected events.

Range

The range value will normally be set to 0. This value will instruct the instrument to automatically select the best range to print a record. You may however, force the range to a value of 1 to 5. This feature will allow you to print one or more records using the same amplitude scaling. The range values correspond to the following:

	Largest Amplitude		Scale Factor	
Range	IPS	MMPS	IPS/DIV	MMPS/DIV
1	0.32	8.1	0.08	2.0
2	0.64	16.3	0.16	4.0
3	1.28	32.5	0.32	8.1
4	2.56	65.0	0.64	16.3
5	5.12	130.0	1.28	32.5

Speed/Chart Length

This value determines the paper length used to print the record. It can be set from 1 to 6, with 1 representing the shortest record and 6 the longest.

SUMMARY

Summary allows for the printing of summary information for a range of event numbers. (Analogous to the event screen data for each event within the specified print range.)

TIMELOG

Time log allows for the printing of the seismograph's operational time log. The latest firmware version is capable of printing up to the last 64 on/off cycles of the seismograph as well as their corresponding dates/times, acoustic/seismic triggers, and whether or not the seismograph was set on DISARM mode.



Changes made to the setup screens (Max Ranges, Seismic and/or Acoustic Trigger Levels), resetting the seismograph, establishing modem/computer communications with the seismograph, changing the date/time and other actions can result in entries being made to the timelog.

WARRANTY

White Industrial Seismology, Inc. warrants that each new instrument manufactured or sold by us is free from defects in materials and workmanship, and agrees to repair or replace any part of such instrument which under normal installation and use discloses such defect, provided the instrument is delivered intact to White Industrial Seismology, Inc. for examination with all transportation charges pre-paid within one year from the date of delivery to the purchaser, and that such examination discloses in the judgment of White Industrial Seismology, Inc. that it is defective. This warranty does not extend to any parts which have been damaged by misuse, neglect, accident or improper application, nor does it cover batteries or expendable items which may be supplied with the equipment.

This warranty is in lieu of all other warranties expressed or implied, and White Industrial Seismology, Inc. assumes no liability related to the use of its products other than that specified herein.

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