

Draka

Industry & Specialty | Elevator Products

S-Box™

Seismic Sensor

For Elevator Control Applications

Operation and Installation Manual

DO NOT DISCARD

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INTRODUCTION

Your new earthquake monitoring system has been developed with you, the customer, in mind.

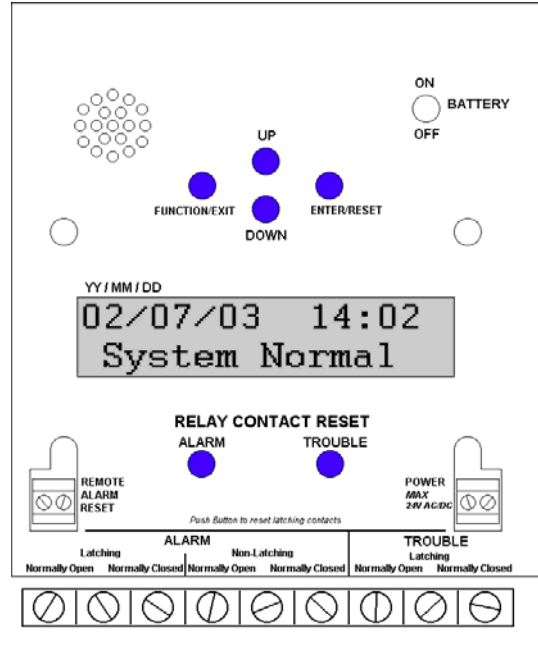
This industrial, user friendly system also requires very little maintenance when correctly installed by a qualified engineer. Because of the many features implemented in this system, it is essential to fully understand its operation.

We strongly recommend that you read this manual thoroughly and familiarize yourself with the system and its operation.

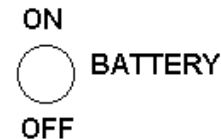
FEATURES

- 3-axis vibration sensing
- Uses patented electronic earthquake detection technology
- Liquid Crystal Display provides user friendly interface
- Meets ASCE 25-97, CSA B44.1, ASME A17.5, and UL508
- Dry contact output:
 - Max load (power factor = 1.0) 5A @ 30VDC or 250VAC
 - Normally Open or Normally Closed
 - Latching and non-latching
 - Connection for remote reset of latching alarm contact
 - Each set of contacts is configurable for the type of alarm or trouble situation that will trigger it
- Records date, time, duration and peak acceleration in each axis for every disturbance
- Meter mode allows real-time monitoring of kinetic forces (accelerations) acting on the unit

THE INSIDE PANEL

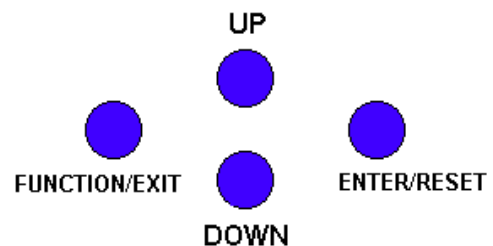


Battery Switch



The battery switch is used to switch the battery on and off. This switch should be set to the OFF position when the unit is not in use to preserve battery life. This switch affects the battery connection only. When external power is connected to the power input terminal, setting the switch to the OFF position will only disconnect the battery backup. The unit will not turn off since the external source is still supplying power. To turn the unit off, disconnect the external supply, and set the switch to OFF.

Function Buttons

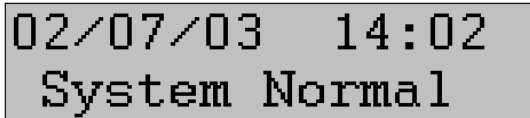


Following is a brief description of the functions of each button:

- UP** Move the cursor to the next position on the display. Scroll to the next entry on a list
- DOWN** Move the cursor back to the previous position on the display
- FUNCTION / EXIT** Toggle between Function menu and normal display. Return to Function menu from sub-menus.
- ENTER / RESET** Choose the currently selected position on the display. Reset an alarm condition.

LCD Display

YY/MM/DD

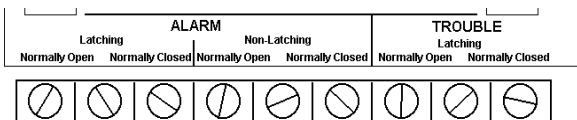


The LCD display is the primary means of visual feedback for this unit. When the unit is operating normally, the display will show the current date (in YY/MM/DD format) in the upper left corner. In the upper right corner, the time is displayed in 24-hour clock format. (e.g. 8:00pm = 20:00 and 6:00am = 06:00). The bottom line of the display shows status messages such as System Normal, Level Error, or Alarm

The display has an LED backlight to aid visibility in low-light conditions. Due to the excessive drain this light would cause on the internal battery, this backlight will only function when the system is drawing power from an external power supply. The backlight will shut off after 20 seconds to preserve power. Pressing the UP, DOWN, or FUNCTION/EXIT button will turn the backlight on again

If the unit is running off its battery backup, the display will shut off after 20 seconds to conserve power. Pressing the UP, DOWN, or FUNCTION/EXIT button will turn the display on again.

Relay Contact Terminal



The 9-position screw-type terminal block along the bottom of the unit is for relay contact connections. There are 3 relays, each using 3-positions on the terminal block. The two outside relays are latching

types. One represents an alarm condition; the other represents a "trouble" condition (e.g. level error). Once these relays are set, they will hold their position even if the power supply fails. They can be reset using the RELAY CONTACT RESET buttons.

The relay in the middle is a non-latching type that also represents an alarm condition. This relay must be set by pressing ENTER/RESET button for 2 to 3 seconds. It will hold its position until either a seismic event or a total power failure occurs. This relay will not automatically reset when power is restored and must be manually reset using the ENTER/RESET button. Each relay has 3 connections on the terminal block. The middle connection is common to both normally open and normally closed contacts. The contact on the left is for the normally open contact. The contact on the right is for the normally closed contact. For compliance with CA code (USA), use normally open non-latching contact.

Relay Contact Reset Buttons

RELAY CONTACT RESET

ALARM

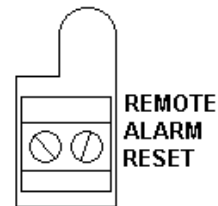


TROUBLE



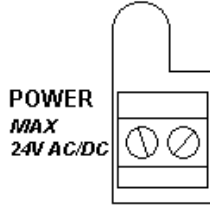
These buttons only affect the latching relay contacts. Pressing either of these buttons will not alter the display on the LCD or mute the audible alarm. Press the ALARM button to reset the latching alarm contacts. Press the TROUBLE button to reset the latching trouble contacts. If the contacts are set, they will make a clicking sound when the reset button is pressed. Pressing the reset button while the contacts are already reset will have no effect.

Remote Alarm Reset Terminal



Connecting a normally open switch or contact to this terminal will allow the latching alarm contact to be reset remotely. Activating a switch or contact connected to this terminal will have exactly the same effect as pressing the ALARM RELAY CONTACT RESET button. The switch or contact used should be rated to switch a 100mA load @ 12VDC.

Power Input Terminal



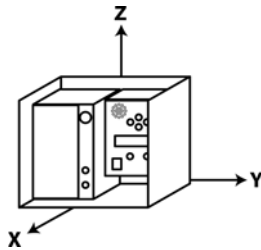
This terminal is for connecting an external power supply. AC or DC supplies are both acceptable, but *must not exceed* 24VDC or 24VAC_{PK}. The polarity is corrected internally, so the polarity of the connection is not important. This terminal is pre-connected at the factory to the AC transformer.

IMPORTANT: Disconnect the transformer wires from this terminal before connecting an external power supply. Failure to do so may damage the device or the external power supply.

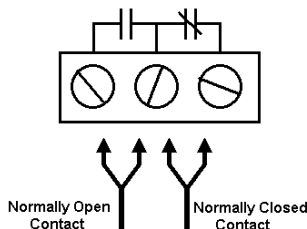
INSTALLATION

To install the product:

1. Unlock (if necessary) and remove the lid.
2. Use screws or bolts to mount the box securely to a load-bearing wall or support. It may be installed in a vertical or horizontal position as long as one primary axis (X, Y or Z as shown below) is as close to true vertical as possible. The self-calibration routine will automatically detect the vertical axis and compensate for minor deviations from level.



3. Make connections from the equipment control panel to relay contact outputs. Note that each of the 3 relays uses 3 terminal block positions according to the following pattern:



Apply tightening torque of 5.5 in-lbs. to terminal block. Use 60-degree rated copper wire.

The "Trouble" relay will activate as a warning that something is wrong with the system and that it needs to be looked at. It should be connected to a visual and/or audible indicator on the control panel. The alarm relays activate when an alarm condition occurs. The latching relay will remain active until it is reset. The non-latching relay will automatically reset when the disturbance that caused the alarm condition ends. It should be noted that the latching contacts could be in either a set (latched) or reset (unlatched) state. When power is first applied to the system, both relay contact reset buttons should be pressed to place the relays in the reset state. These relays can be reconfigured through the function menu.

4. If Remote Alarm Reset is to be used, connect a normally open switch or relay contact to the REMOTE ALARM RESET terminal. Use a switch or relay contact rated to switch a 100mA load @ 12VDC.
5. Connect the Power Supply. For AC main power (120V/60Hz or 240V/50Hz), connect the power to the transformer (See Appendix C for detailed instructions). For external power, disconnect the wires at the Power Input terminal and replace them with the output from the external power supply. The power can be either AC or DC, but it must be greater than 12V and must not exceed 24VAC or 30VDC.

WARNING: Do not connect a 120VAC or 240VAC supply directly to the power input terminal. This will damage the unit and may cause personal injury.

6. Set the battery switch to "On"
7. Press both the alarm and trouble relay contact reset buttons to ensure that the latching contacts are in their unlatched state.
8. Proceed with Initial Set Up in the next section
9. Replace and lock the lid.

INITIAL SET UP

To turn on the system either:

- Activate the battery with the battery switch
- Connect power to the power input terminal.

The following is displayed;

YY / MM / DD

MODEL : DEP2500

followed by:

Test

YY/MM/DD

Main Power ON

This display indicates that an external power supply is connected. If an external power supply is not connected, Main Power will indicate OFF.

If the enter/reset pressed within 10 seconds, the system will automatically perform a system setup and begin normal operation. Pressing the ENTER / RESET button will bring up the following display that will allow you to choose to skip the system setup.

YY/MM/DD

DO SYSTEM SETUP?
1>YES 2>NO

Performing a system setup will calibrate the seismic sensor to compensate for minor variations in tilt. If the unit is not installed in its final fixed position, the system setup step should be skipped. It can be performed later after final installation. Completing this step before the unit is fixed in position will cause alarm conditions from handling the unit.

Choosing No at this menu will skip ahead to the normal operating display. Choosing yes will bring up the following display:

YY/MM/DD

Sensing...

It is important that the sensor remain motionless during this process to ensure an accurate reading. When the calibration is done, the display will briefly state 'COMPLETED!' and change to normal operating mode.

FUNCTIONS

YY/MM/DD

1.TEST 2.CHECK
3.SETUP 4.RECORD

This section describes the various functions available by pressing the FUNCTION/EXIT button. Use the UP and DOWN buttons to move the blinking cursor to a menu item, then hit the ENTER/RESET button to choose the selection.

YY/MM/DD

Test with relay?
1>YES 2>NO

The test function performs a basic test on the system to ensure it is functioning correctly. There are two options for the test:

1. With Relays: Activates all three relays and sounds an audible alarm. Perform this test to check that the unit is working and that any equipment connected to the relay terminals functions as intended when the relays activate.
2. Without Relays: Sounds an audible alarm. Perform this test to check that the unit is working without activating the relays. This test will not affect the operation of any equipment connected to the relay terminals.

Use the UP and DOWN buttons to move the cursor to YES or NO. Press the ENTER / RESET button to proceed with the test.

Check

The following diagrams illustrate a typical sample of the information available from the check function. The first screen displays the firmware revision and the model number (in this example the firmware is Version 6.2). Pressing the UP button will proceed to the next screen

YY/MM/DD

Draka V6.2
MODEL: 2500

UP

YY/MM/DD

Main Power ON

UP

YY/MM/DD

CALIBRATE
Completed

UP

YY/MM/DD

SET DATE&TIME
Completed

UP

YY/MM/DD

Alarm Setting
ASCE25-97

This function checks the status of the unit. Pressing the UP button scrolls to the next item. Press FUNCTION/EXIT to exit back to the main function menu.

The following table displays the items that the check function monitors and explains what each means.

Main Power	Off	The external power supply is not connected or not functioning. The internal battery is providing power for the system.
	On	The external power supply is connected and functioning properly. The internal battery is not being used.
Calibrate	Completed	The calibration process has been completed.
	Not Completed	The calibration process has not been completed. See section 0 below for details on calibration. <i>Warning:</i> The unit will not sense movement (seismic or otherwise) if it has not been calibrated.
Set Date & Time	Completed	The date and time have been set.
	Not Completed	The date and time have not been set. See section 0 below for instructions on setting date and time.
Alarm Setting	ASCE 25-97	The system is set to go into alarm according to the ASCE 25-97 standard for earthquake-actuated devices. See Appendix A for more information on this standard.
	User-Define	The system is set to go into alarm above a preset threshold set by the user

Setup

YY/MM/DD

1.SET DATE&TIME
2.CALIBRATE

YY/MM/DD

3.Metering
4.Alarm Setting

YY/MM/DD

5.DEFAULT
6.MODEM

YY/MM/DD

7.WARNING
8.RELAYS

The setup function has the following options:

- Set Date & Time
- Calibrate
- Metering
- Alarm Setting
- Default
- Warning
- Relays

Set Date & Time

YY/MM/DD

02/07/03 14:02

Following are instructions for setting the date and time. Remember that the date is in YY/MM/DD format (e.g. January 25, 2002 would be 02/01/25) and the time is in 24-hour clock format (e.g. 6:00am is 06:00 and 6:00pm is 18:00).

1. Choose the *Set Date & Time* function using the UP and DOWN buttons to move the cursor to the *Set Date & Time* option. Then press the ENTER/RESET button to select it. The LCD will briefly display *Processing...* before showing the date and time with a blinking cursor.
2. Use the UP and DOWN buttons to move the cursor to the position that needs changing.
3. Use the ENTER/RESET button to scroll through values at the currently selected position.
4. Repeat steps 2 & 3 for each position that needs to be altered.

- Press the **FUNCTION/EXIT** button to store the changes into the system clock and return to the main function menu.

Calibrate

The sensor in the system is preset at the factory to operate at its best when perfectly level. Calibrating the system will compensate for minor deviations from level that may occur during installation. Calibration should only be performed when the unit is fixed in position after installation.

To calibrate the system, choose the *Calibrate* function using the **UP** and **DOWN** buttons to move the cursor to the *Calibrate* option. Then press the **ENTER/RESET** button to select it. The LCD will briefly display:

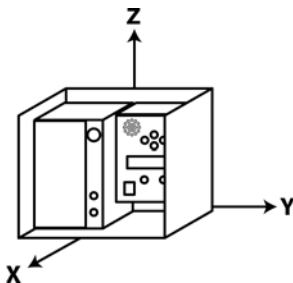
YY/MM/DD



It is very important that the system is not moved during this process. When the calibration is done, the LCD displays *Completed!* then returns to the normal operating display.

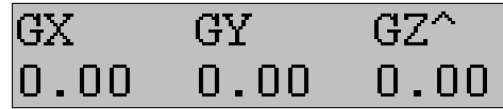
Metering

The metering function allows real time measurement of any kinetic forces aside from gravity acting on the system. The forces are displayed according to their vector components in each axis (X,Y,Z). The diagram below illustrates which direction corresponds to each axis. The vertical axis will be marked with a ^ symbol. In the example below, the Z-axis is vertical.



There are two types of displays for this function. The first display shows the force acting on the unit (in "G") in each axis. The other display displays the degree of tilt in each axis. Pushing and holding the **UP** button for 1 second while in meter mode will set the display to g-force. Pushing and holding the **DOWN** button will set the display to angles.

YY/MM/DD



In the g-force display, each force is expressed as an absolute value in g-force (1.00G is equivalent to the force of gravity acting on an object). The meter has an accuracy of $\pm 0.01G$. Since gravity is compensated for during the calibration process, each axis should read 0.00g ($\pm 0.01G$) when the system is at rest with no outside forces acting on it.

YY/MM/DD



In the angle display, the system compares the current force acting on the system to the force of gravity and calculates the angle of deflection (in degrees) that the system has moved since it was last calibrated.

Alarm Setting

This function sets the threshold at which the system will go into alarm during a seismic event. There are two options. Move the cursor with the **UP** and **DOWN** buttons to the type of alarm threshold desired and press **ENTER/RESET** to select it.

YY/MM/DD

1.ASCE25-97
2.User Define

The ASCE 25-97 standard provides a minimum and maximum acceptable acceleration for alarm over a range of frequencies of ground oscillation. See Appendix A for more information on this standard. Because of the high degree of accuracy of the sensor, the system is able to subdivide the allowable activation band within the standard into 10 sub-levels.

YY/MM/DD

ASCE-LEVEL
06

These levels are numbered 01 to 10 with 01 being the most sensitive level and 10 being the least sensitive. The default level of 06 falls in the center of the allowable actuation levels under the ASCE standard and should be suitable for most applications. Use the UP and DOWN buttons to change the ASCE level and press ENTER/RESET to save the setting and return to the main function menu.

With user-defined thresholds, the system will go into alarm whenever the acceleration in any axis exceeds a preset level. This level can be anywhere between 0.01g and 1.00g. Use the up and down buttons to move the setting in 0.01g increments to the desired threshold then push enter/reset to set it.

YY/MM/DD

X-Y
0.10 g

First set the threshold for the X-axis and Y-axis (horizontal plane).

YY/MM/DD

Z
0.10 g

Then set the threshold for the Z-axis (vertical).

Default

Choosing Default clears any user-defined thresholds and restores the alarm threshold settings to the factory default of 0.10g in the X-Y axis and 0.05g in the Z-axis. This default setting is set to B44 Elevator Safety Code.

This will also set the relay configuration to the default of Alarm only (option A) for both the alarm latching and non-latching contacts and Alarm/Early Warning/Trouble (option F) for the Trouble latching contacts.

Warning

This function is used to set the early warning level. There are 12 warning levels (01 ~ 12) to choose from. Level 01 is the most sensitive level and level 12 is the least sensitive level.

YY/MM/DD

WARNING-LEVEL
01

Relays

This function is used to configure the type of event that will activate each of the 3 sets of relays. Choosing this function brings up the following display to configure the alarm latching contacts.

YY/MM/DD

ALARM-LATCHING
OPTION: A

Use the UP and DOWN buttons to choose an option (see table), then press ENTER/RESET. Repeat this process for the Alarm non-latching contacts...

YY/MM/DD

NON-LATCHING
OPTION: A

...and the Trouble latching contacts

YY/MM/DD

TROUBLE-LATCHING
OPTION: F

Draka Elevator Products

The following table lists the different options available to choose from.

Event	Option						
	A	B	C	D	E	F	G
Alarm	●	✗	✗	●	●	●	✗
P-Wave Early Warning	✗	●	✗	●	✗	●	●
Trouble	✗	✗	●	✗	●	●	●

● Will activate relay ✗ Will not activate relay

The default values for each set of contacts are:

Relay	Option
Alarm Latching	A
Alarm Non-Latching	A
Trouble Latching	F

Record

YY/MM/DD

```
1. Accelerogram
2. Report
```

Accelerogram

Choosing accelerogram will allow you to upload any accelerograms created by the built-in accelerograph function. Each accelerogram is a record of the real-time forces that acted on the system. The force in each axis (in "g") is recorded to an accelerogram every 20ms (50 times per second) when the accelerograph function is active. A seismic event will automatically activate the accelerograph for the duration of the event. Metering will also activate the accelerograph function.

The first display on the LCD will show the record number of the accelerogram as well as the date and time it was recorded.

YY/MM/DD

```
RECORD      001
02/11/27 13:56
```

If there are no accelerograms in memory the display will read

YY/MM/DD

```
END OF DATA
```

Pressing the UP button will select the next accelerogram in memory. This may take several seconds while the system searches its memory. If no more records are found the display will show "END OF DATA"

Report

YY/MM/DD

```
1. UPLOAD
2. DISPLAY
```

The report function provides for viewing of the fifteen most recent seismic disturbances that the sensor has registered. Each record displays the:

- Date and time the disturbance occurred
- Peak acceleration (in g) registered during the disturbance in each axis
- Total duration (in seconds) of the disturbance.

Display

To display the results on the liquid crystal display, select LCD and press the ENTER/RESET button. Use the UP button to move through the records. Pressing the DOWN button will go back to the previous item within the current record. Press the FUNCTION/EXIT button to return to the main function menu.

INTERNAL BATTERY

The internal battery is a rechargeable battery that will automatically recharge whenever main power is on. It will only function if the battery switch is set to the "On" position.

ALERT MODES

Sensing

Whenever the sensor detects a seismic disturbance, the display will change to

YY/MM/DD

```
Sensing...
```

When the vibration stops, if it is not strong enough to cause an alarm condition, the display will change to

YY/MM/DD

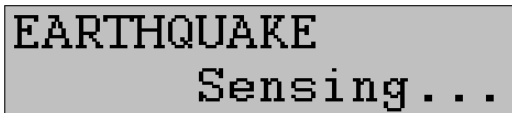


From here, the display will revert to the normal operating display.

Early Warning

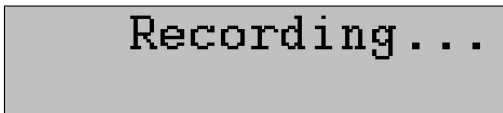
If the sensor detects a P-wave from an earthquake that exceeds a preset threshold, the system will activate any relays that have been set to trigger on P-wave early warning and sound an audible alarm. The display will show

YY/MM/DD



When the disturbance is over, the system will store a record of the data collected in its memory

YY/MM/DD



The non-latching relay will reset automatically and the audible alarm will change to an intermittent beeping. The word *EARTHQUAKE* will flash on the display as shown.

YY/MM/DD



Pressing the ENTER/RESET button will clear the warning on the display and stop the beeping. To reset the latching relay contacts, push RELAY CONTACT RESET button for the relay or close a normally open contact connected to the REMOTE ALARM RESET terminal.

Alarm

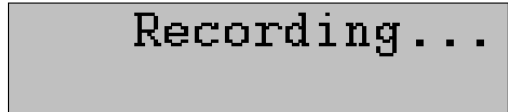
This system goes into alarm whenever the acceleration exceeds the threshold set by the setup function. If a seismic disturbance large enough to create an alarm condition, the system will activate its alarm relays and sound an audible alarm. The display will show

YY/MM/DD



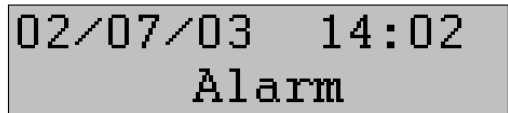
When the disturbance is over, the system will store a record of the data collected in its memory

YY/MM/DD



The non-latching relay will reset automatically and the audible alarm will change to an intermittent beeping. The word *Alarm* will flash on the display as shown below.

YY/MM/DD



Pressing the ENTER/RESET button will clear the alarm on the display and stop the beeping. To reset the latching relay contact, push THE ALARM RELAY CONTACT RESET button or close a normally open contact connected to the REMOTE ALARM RESET terminal.

Trouble

A trouble condition occurs when the system finds a fault during one of its self-checks. When this happens, the Trouble relay activates and a message flashes on the display. The following table lists the possible messages.

Draka Elevator Products

Message	Description
Not Calibrated	The sensor has not been calibrated. This error can be resolved by performing the calibration function.
Level Error	<p>The position of the unit has shifted since it was last calibrated. This could be an indication that structural damage has occurred and that the building should be inspected. Choose calibrate from the Setup menu to reset this warning.</p> <p>If after re-calibrating the sensor, this message is still present, it could indicate a malfunctioning sensor. Contact Technical Support for assistance.</p>

The display will clear automatically when the fault is no longer detected. In each case, the relay contact can only be reset by pushing the TROUBLE RELAY CONTACT RESET button near the bottom of the panel.

ROUTINE MAINTENANCE

System Check

The system should be checked periodically to ensure that everything is in good working order. To use the check function:

1. Press the FUNCTION/EXIT button
2. Press the UP and DOWN buttons until the cursor is on the *Check* function
3. Press ENTER/RESET
4. Press UP to check the status of each item (see the description of the *Check* function on page 6 for an explanation of what each item represents).

A system test using the *Test* function should also be performed at this time. To use the *Test* function:

1. Press the FUNCTION/EXIT button
2. Press the UP and DOWN buttons until the cursor is on the *Test* function
3. Press ENTER/RESET
4. Press the UP and DOWN buttons to select Yes (to test alarm and relays) or No (to test alarm only).

Perform this test using the *With Relays* option whenever possible. In this way, the system can be tested along with the equipment to which it is connected.

Sensor Analysis & Calibration

The seismic sensor does not require routine calibration. If desired, the seismic sensor can be field tested. Simply loosen the unit from the wall and shake it to be sure the alarm activates. When complete, tighten mounting screws and perform the calibration function from the set up menu.

TECHNICAL SPECIFICATIONS & APPROVALS

Technical Specifications

Sensor:	3-axis, solid state accelerometer. Detects vertical (P wave) and horizontal (S wave) accelerations
Frequency Response:	0.5 to 15Hz. Software filtered
Alarm Threshold:	User-defined* (0.01g to 1.0g) or according to ASCE 25-97 standard (e.g. 0.15g @ 1Hz, 0.30g @ 5Hz)
Diagnostics:	Self-diagnosis at startup, reset, and periodically during operation
Power:	120V AC 50/60Hz (to transformer) 12V AC or 12V~24V DC (direct to control unit input)
Battery Backup:	Provides 6 – 8 hrs backup when fully charged Recharges automatically when main power is on Charge time: 48 hrs from fully discharged Replacement recommended annually.
Dry Contact Rating:	5A @ 250VAC (General Purpose) 5A @ 30VDC (Resistive)
Operating Temperature Range:	-25°C (-13°F) to +40°C (+104°F)
Relative Humidity:	0~99%
Inputs:	2-position, screw-type terminal for remote reset of latching contact 2-position, screw-type terminal for 12V~24V DC power supply
Outputs:	3-position, screw-type barrier strip for alarm latching dry contact (NC, common, NO) 3-position, screw-type barrier strip for alarm non-latching dry contact (NC, common, NO) 3-position, screw-type barrier strip for trouble latching dry contact (NC, common, NO)
Dimensions:	8"W x 7"H x 3"D

*User-defined alarm thresholds are set for each individual axis in 0.01g increments from 0.01g to 1.0g.

Approvals

This product meets following standards:

- ASCE 25-97
- ANSI Z21.70 1981
- CAN/CSA 22.2 No. 205
- CAN/CSA B44.1 ANSI/ASME A17.1 and A17.5
- UL 508



File No. E318218



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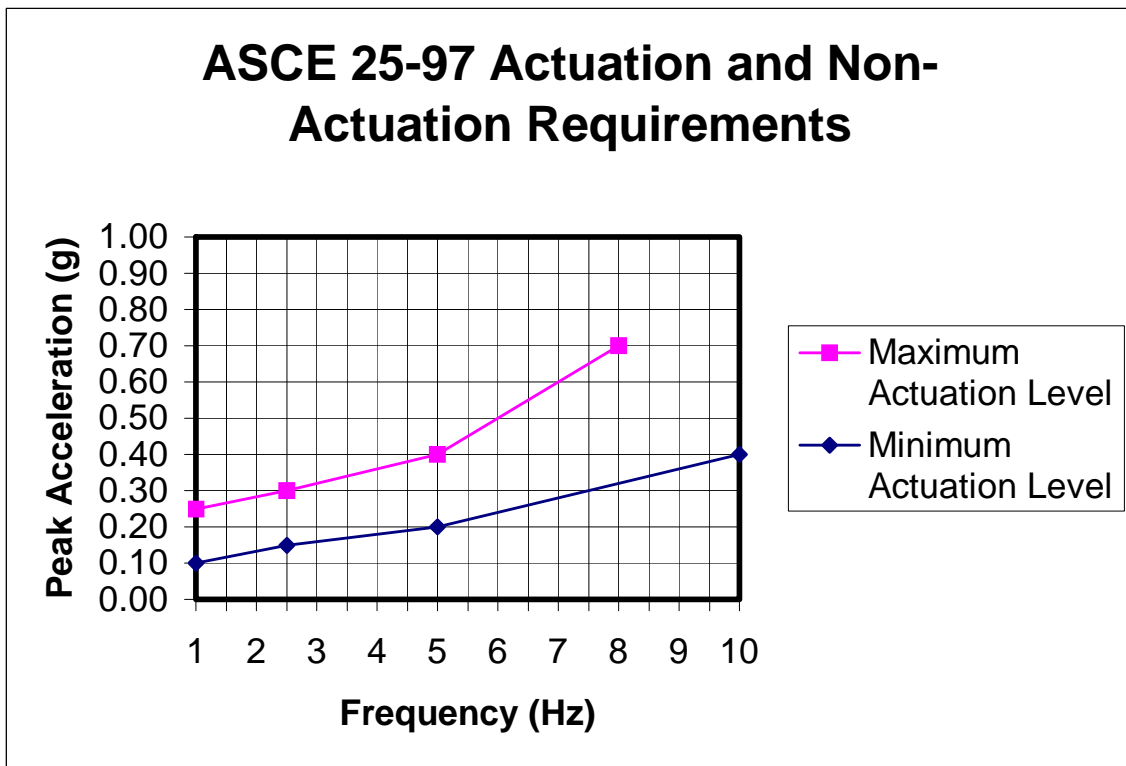
APPENDIX A: SUMMARY OF ASCE 25-97

The ASCE 25-97 standard was developed with the purpose of saving lives and property by preventing fires caused by damage during an earthquake. It is a revised version of the ANSI Z21-70 standard that was originally published in 1981. The ASCE standard is primarily based on the extensive data recovered from the January 1994 Northridge earthquake in California.

Using the data from Northridge and data previously collected for the ANSI Z21-70 standard, a series of accelerations at given frequencies by which a system covered under the standard must respond was identified. This is the Maximum Actuation Level. A Minimum Actuation Level was also defined. Vibrations below this threshold must not actuate the shutoff device. This helps prevent nuisance closures. Based on the Northridge data, the maximum threshold is considered conservative by 30% to 50%.

The chart below illustrates the relationship between acceleration and frequency. The area between the two lines indicates the band during which an earthquake shutoff device may actuate. If the device actuates below this band it is too sensitive and it could cause excessive false alarms from normal vibrations such as passing trucks. If the device actuates above this band, then it is not sensitive enough and damage could occur.

The accelerations represent the peak acceleration of the ground in the horizontal plane. These are measured with respect to the acceleration of gravity (g), which is 9.8m/s^2 . The frequency represents the frequency of the horizontal oscillation of the ground.



Note: The actuation values of the ASCE standard do not correspond to any value on the Richter scale. The Richter scale represents the magnitude of an earthquake, which is the total energy released by an earthquake at its source. Magnitude is only relevant for comparison to other earthquakes and cannot be used to determine the amount of damage caused by an earthquake. The values used for actuation levels in this standard are based on observed and tested data collected from actual and simulated earthquakes.

APPENDIX B: MEASURING EARTHQUAKES

There are two methods of expressing earthquakes as a number. These methods are magnitude (e.g. Richter scale), which is most common in North America, and intensity (e.g. Mercalli intensity level), which is more commonly used in Europe. Both methods represent different characteristics of earthquakes and they cannot be readily converted from one to another.

Magnitude and the Richter Scale

Magnitude is a measure of the energy at the source of the earthquake. It is determined mathematically using data from scientific equipment and is considered the most accurate method of representing the size of an earthquake.

The most common and most misunderstood method of measuring an earthquake is the Richter Scale. Originally developed in 1935 by Charles Richter at the California Institute of Technology, the Richter Scale used data from a seismometer to express the magnitude of an earthquake as a logarithm of the amplitude of the waves it recorded. The definition of the Richter magnitude is:

The magnitude of any shock is taken as the logarithm of the maximum trace amplitude, expressed in microns, with which the standard short-period torsion seismometer would register that shock at an epicentral distance of 100 kilometers.

As the seismometers used by Richter and his colleagues became outdated, so too did the Richter Scale. Current seismogram equipment use different and more accurate methods of measuring seismic activity. Because the methods used in the seismograms are different than those used in Richter's seismometers, the methods used to turn the data to a magnitude could no longer be identical. The earthquakes of today are therefore usually expressed as magnitude, which is similar to the Richter scale, but not identical.

Intensity and the Modified Mercalli Intensity scale

The intensity of an earthquake is a measure of the strength of the shaking at a particular location caused by an earthquake. It represents the effect the earthquake had on people, structures and the environment in a given location.

The most common representation of intensity is the Mercalli Intensity Level which is commonly represented in Roman numerals from I (one) to XII (twelve) to distinguish it from magnitude, which is commonly expressed as a 2 digit decimal (e.g. 6.7). The intensity of the earthquake depends on a number of factors such as the composition of the ground, the distance from the epicenter, and how far beneath the earth's surface the earthquake occurred. Mercalli Intensity level is not arrived at mathematically. It is given an arbitrary value based on factors such as the value of the damage caused, how frightened people were, and how much shaking was felt. This information is usually collected through surveys taken after the earthquake has occurred.

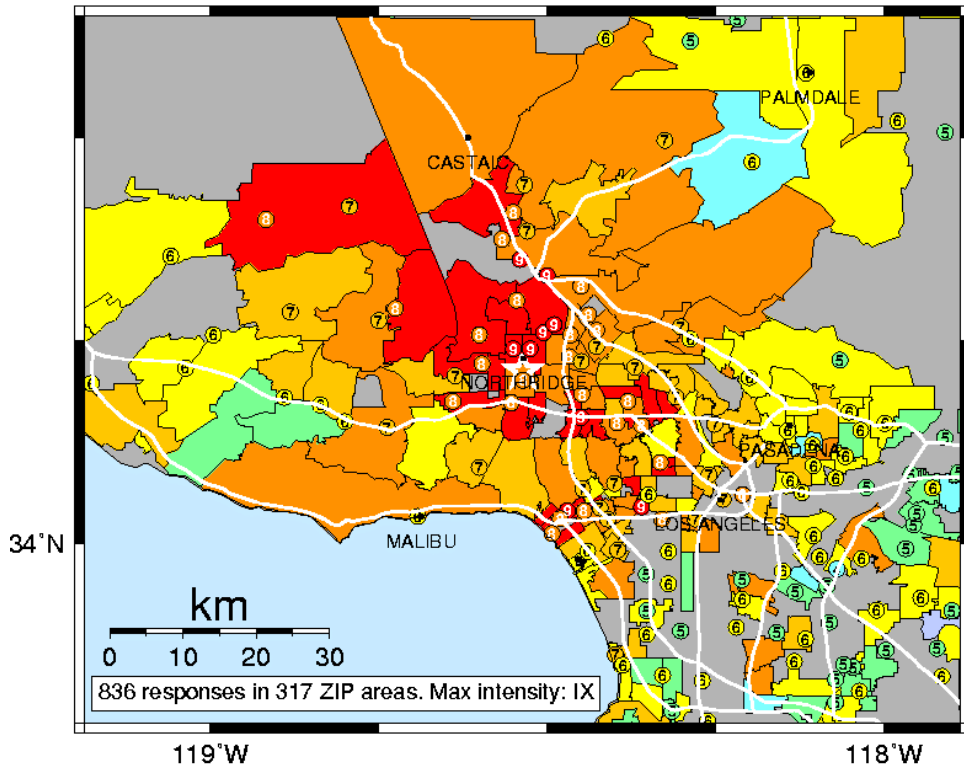
The Modified Mercalli Intensity Scale:

I	Not felt except by a very few under especially favorable conditions
II	Felt only by a few persons at rest, especially on upper floors of buildings
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown in the air.

Magnitude vs. Intensity

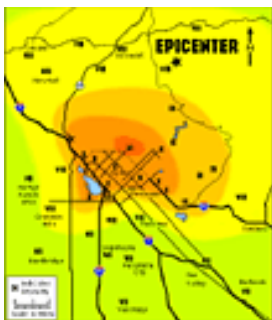
One important thing to note about magnitude is that because it is an expression of the energy released by the earthquake at its epicenter, **the value of an earthquake's magnitude never changes**. Only the intensity changes. The following map from the US Geological Survey illustrates this concept. This is from an earthquake that occurred on Jan. 17, 1994 in Northridge California. The map shows that the epicenter had an intensity of IX, but southeast in Los Angeles the intensity was in the V to VI range. The magnitude of the quake was 6.7. This value is constant. Someone 500 miles away who may have felt a slight tremble in the ground was still experiencing an earthquake of magnitude 6.7.

Community Internet Intensity Map for Northridge (Jan 17 1994)
04:30:55 PST Mag=6.7 Latitude=N34.21 Longitude=W118.54



INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy

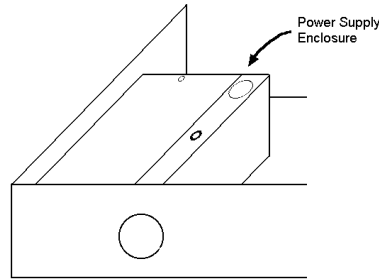
It should also be noted that the strongest shaking or highest intensity isn't always at the epicenter. The map on the left shows the intensity levels of an earthquake in the San Fernando valley in 1971. The center of the map shows where the strongest intensities were felt. The epicenter in this particular quake was actually several miles to the northeast of this location where the intensity was considerably less.



For more earthquake information on the internet, visit:

- US Geological Survey earthquakes.usgs.gov
- Southern California Earthquake Center www.scec.org

APPENDIX C: POWER SUPPLY CONNECTIONS



Models with built-in power supplies are able to draw their power directly from a main AC supply (120V 60Hz or 240V 50Hz). The power supply is internally protected from overload. The output from the power supply is pre-wired to the power input on the sensor.

Connecting the Power Supply

WARNING: Risk of electric shock. All electrical connections must be performed by a qualified electrician in accordance with all applicable codes and ordinances. Failure to follow this warning could result in property damage, personal injury, or death.

1. **DISCONNECT POWER** at breaker switch or power outlet
2. Remove the screw at the top of the power supply enclosure and remove the lid
3. Run the wires through the hole on the bottom of the box
4. Connect the Ground wire from the supply (Green) to the grounding terminal near the transformer
5. Connect the wires from the supply to the wires in the box. Connect the two black wires (live) together, and connect the white supply wire (neutral) to the red wire on the sensor.
6. Tuck the wires back into the enclosure and replace the lid.

CONTACT INFORMATION

Draka Elevator Products

Telephone: 1-877-372-5237 Toll Free - North America
1-252-984-5100 International

email:drakaep-info@draka.com

LIMITED WARRANTY

The manufacturer warrants to the original purchaser that this product will be free from defects in material and workmanship under normal use and services for a period of two (2) years from the date of purchase. The manufacturer's liability is limited to the replacement of the product provided that proof of purchase date is presented to the manufacturer. This warranty is void if the product has been damaged by accident, tampering, misuse, abuse, lack of reasonable care for the product or used in applications not in accordance with this User's Guide. This warranty is in lieu of all other express warranties, obligations or liabilities. The manufacturer shall have no liability for any personal injury, property damage or any special incidental, contingent or consequential damage of any kind.



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