E-Flex® 3i

Interior Security System

Installation & Planning Guide

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TABLE OF CONTENTS

ILLUSTRATIONS

FIGURE NUMBERS

SECTION 1
INTRODUCTION

1.1 SCOPE

This manual provides information on the application, installation & calibration, and maintenance of Stellar Systems E-Flex™3i Interior Security System.

1.2 GENERAL DESCRIPTION

The E-Flex 3i is an intrusion detection sensor for the protection of building interiors. It adapts Stellar's proven fence technology to the specialized requirements of indoor security applications. The E-Flex 3i combines Stellar's patented triboelectric cable sensor with a new processor specifically designed to function with a wide range of surfaces and materials encountered when protecting structures such as walls, ceilings, roofs, stock cages, floors and pipes.

Warehouses, banks, vaults, jewelry and precious metal dealers, ammunition bunkers, weapons storage facilities and computer facilities are vulnerable to illegal entry; and, therefore, can be protected by E-Flex 3i.

The E-Flex 3i can be easily integrated into any existing alarm system. It is intended for use in an unmanned internal security situation where an alarm can be used to deter most intruders and also alert police or security forces.

Because the E-Flex sensing element is a low-profile simple coaxial cable, it can be easily mounted on, or in, walls, ceilings, roofs and false floors. The sensor cable can be attached directly to these surfaces, or it can be installed in conduit attached to the protected surface. Care must be taken so that the cable or conduit has maximum contact with the surface at which the penetration attempt is to be detected.

Sensor cable damage can be quickly repaired with inexpensive splice kits without the need to replace the cable. Use of a splice kit to repair the wire or replace a section of cable will not affect the sensitivity of the sensor cable which is uniform along its entire length.

The E-Flex 3i Processor can monitor up to 2,000 feet (600 meters) of sensor cable with uniform sensitivity and detection, thus permitting a large surface or area to be protected by a single E-Flex Sensor. The E-Flex sensor cable is microphonic and the E-Flex 3i signal processor also provides a "listen-in" capability for alarm assessment.

The E-Flex sensor cable is fully supervised and the E-Flex 3i signal processor provides a separate supervision alarm if there is a short or cut in the sensor cable. The sensor cable carries a minute supervision current of 5 micro amps and, therefore, is intrinsically safe and can be used in hazardous environments. The intrusion (penetration) and supervision output relays (Form A and Form B selectable) are fail safe, and the signal processor is tamper protected.

Power status and relay activation are annunciated by LEDs on the processor board. Once the sensor has been calibrated, the LEDs can be disabled for power conservation.

Circuitry is protected from reverse polarity, transient and surge voltages. Since the alarm signal is generated by changes internal to the E-Flex sensor cable, the E-Flex 3i has a high resistance to external electronic noise and interference.

2.1 BASIC PRINCIPLES OF OPERATION

The E-Flex 3i is a penetration detection sensor designed for protecting an interior structure against attack or intrusion by utilizing the electrical signal produced by the flexing of a coaxial-type sensor cable attached to the structure. An alarm signal is produced indicating that a penetration attempt is occurring.

The stresses in the protected structure will result in minute movement of the sensor cable. Due to an electromechanical phenomenon known as the Triboelectric Effect, these movements will produce a transfer of charge between the conductors in the cable resulting in an input signal to the processor.

The E-Flex 3i Processor monitors either of two (2) selectable frequency bands, and produces a penetration alarm when sensor cable signals exceed the threshold for the selected band. This enables the E-Flex 3i Processor to respond to the natural characteristics of the materials and type of structure being protected.

The processor contains a built in LED BAR display which describes the amplitude of the monitored signal from the sensor cable, thus permitting the selection of the appropriate frequency band.

In addition to selecting the proper frequency band, the user can select the number of impacts required before the alarm signal is generated, the length of time within which those impacts must occur, and the minimum duration of a sustained attack necessary to generate an alarm. Since all materials have different responses to a penetration attempt, the E-Flex 3i signal processor can be calibrated to provide optimum performance for each application. Total sensitivity is adjustable to any of ten discreet levels.

The E-Flex 3i Interior Sensor consists of:

♦ the E3i Single Channel Signal Processor that requires +12 VDC power and can monitor up to 2,000 feet (600 meters) of E-Flex Sensor Cable

♦ the E-Flex Sensor Cable that generates signals in response to movement of the surface to which it is attached

♦ the SKT-7 Terminator Kit that is connected to the end of the sensor cable to permit the supervision of the cable against damage or defeat

2.2 PROCESSOR THEORY OF OPERATION

The signal from the sensor cable is applied to a high gain preamplifier which has a high input impedance. The output signal from the preamplifier is fed through a ten-position step switch which serves as the sensitivity control to regulate the amount of signal (cable flexing) required to produce a penetration alarm.

There are two (2) selectable frequency bandpass filters. The low bandpass is between 80 and 350 Hz while the high bandpass is between 330 and 2,000 Hz. The two (2) bands allow the user to select low frequency response when climbing, breaking or pressure collapse penetration are anticipated, or to select a higher frequency response for cutting, drilling or chipping penetration attempts.

After selecting a frequency band (SW3), the input signal is fed to the LED BAR display for evaluation of the signal level derived from a simulated penetration attempt.

This signal is also applied to an amplifier and Schmitt trigger threshold comparator. If the signal is of long duration, the sustained attack timer is incremented and, depending on the user selected interval, the counter will trigger a penetration alarm if the interval is exceeded. In the case where the signal is of short duration, the selectable impact counter begins to count elapsed time from the start of the signal. When the number of selected inputs (impacts) has been reached within the selected time window, a penetration alarm will be generated.

The supervision circuit utilizes a 5 VDC level to verify the integrity of the sensor cable against cuts, shorts or substitution attempts. If this DC level shifts above or below a certain tolerance, a supervision alarm is generated. A similar alarm is generated in the event of power loss or if the +12 VDC power supply drops below +10.2 VDC. This circuit also includes provisions to prevent oscillation of the supervision alarm output relay.

In the event that a sensor cable is not connected to the processor or an unterminated sensor cable is connected to the processor, the detection circuitry will not operate without the Local Supervision Switch of SW4 being placed in the active position.

2.3 SPECIFICATIONS: E-FLEX 3I

Maximum Cable Length:	2,000 Feet (600 Meters)
Operating Power:	10.5 to 15 VDC, 90mA, maximum ripple 2% 90 mA with displays disabled; 250 mA with displays enabled

2.3 SPECIFICATIONS: E-FLEX 3I (continued)

Environment:	Operating Temperature +14°F (-10°C) to +140°F (60°C) Relative Humidity to 95% non-condensing Storage Temperature -60°F (-50°C) to +160°F (+70°C)
Indicators:	RED LED BAR Display - Input Signal Level GREEN LED - Power On RED LED - Penetration Alarm RED LED - Supervision Alarm
Controls:	Frequency Band Selector SW3 Calibrated Sensitivity Selector SW2 - 10 Steps Impact (Count) Selector JP4 - 9 Steps Sustained Attack Time Selector JP3 - 9 Steps 1.0 to 5.0 seconds Impact Time Window Selector JP5 - 5 Steps 8 to 128 seconds Input Signal Display Enable SW4-1 Local Terminator SW4-2
Outputs:	Penetration Alarm Relay Contacts K1 - Form A or B Selectable 28V, 0.5A JP2 Supervision Alarm Relay Contacts K2 - Form A or B Selectable 28V, 0.5A JP1 Microphonic Sensor Cable Signal for Audio Amplifier Sonalert
Connectors:	Phoenix type A - J1 - 2 pins for sensor cable input Phoenix type A - J2 - 8 pins for power input and signal output
Tamper Switch:	1-pole, 2-position SW1
Enclosure:	Steel Enclosure, 8 inch H x 7 inch W x 1.45 inch D (20cm H x 18cm W x 2.7cm D)
Accessories:	Sensor Cable Model 2386, 1,000 feet (300 meter) per roll Terminator Kit Model SKT-7 for end-of-line terminations Cable Splice Kit Model SKJ-7

3.1 INSTALLATION PLAN

Before starting to install the E-Flex 3i Interior Protection Sensor, an installation plan should be prepared. This plan should include, but not be limited to:

a. the location of the E3i Signal Processor. The source of +12 VDC power to the processor and the wiring of the output signals to the system annunciator.

b. the deployment of the sensor cable. With an interior cable sensor, the manner in which the sensor cable is attached to the protected structure is of prime importance and is directly related to the effectiveness of the sensor. Modern construction includes many different types of material. E-Flex 3i has a range of easily adjustable controls to insure detection no matter what type of material is involved.

3.2 TYPES OF INSTALLATIONS

3.2.1 Security Cages and Grilles

Fenced security cages are often used in warehouse environments to store high value assets or enclose high security areas. In these applications, the deployment of the E-Flex 3i Sensor is similar to that on outdoor chain-link or weld mesh fences.

The security cage should be free and clear of any material stacked adjacent to it, that can be used as a defeat mechanism. The cage fabric must be tight and in good repair.

The E-Flex Sensor Cable can be attached to the fence fabric with Stellar Model 2366 Tie Wraps. The cable should be deployed in a horizontal manner with a maximum of 4 foot (1.2 meters) separation between cable passes.

Grilles over ventilation shafts, service ducts or other passageways can be protected by E-Flex 3i in a similar manner.

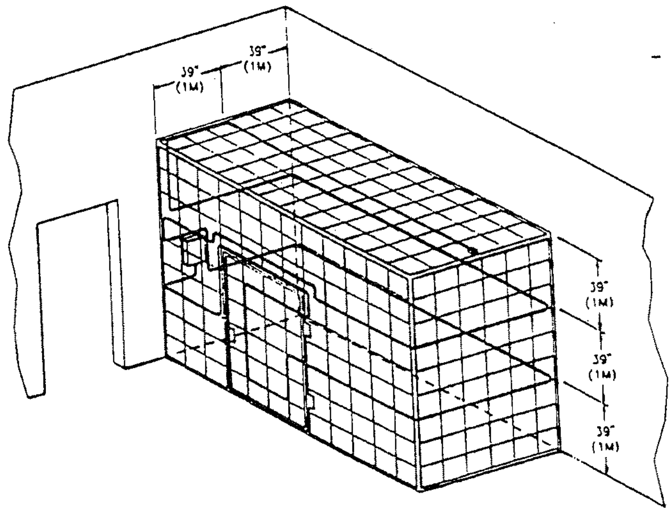


Figure 3-1
Security Cage

3.2.2 Interior Building Surface

The E-Flex Sensor Cable may be attached directly to the interior surface of a building or room to detect any attempt to break through walls, floors or roofs and bypass normal alarm systems.

In new facilities, E-Flex Sensor Cable can be embedded in a wall during construction so that the sensor is completely hidden. Since E-Flex is a passive sensor and does not radiate any signal, the sensor will be undetectable to the most sophisticated intruder.

In the event of a cable fault, directly embedded sensor cable cannot be removed. Therefore, it may be preferable to embed conduit, through which the sensor cable can be drawn at a later date.

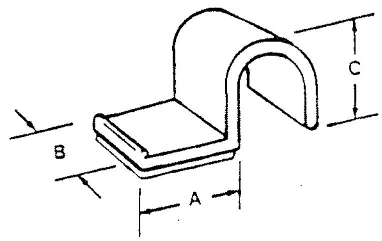
In existing buildings, the installer has the option of attaching the sensor cable directly to the surface, or placing the cable inside conduit and attaching the conduit to the surface. Metal conduit is preferable to PVC conduit for this type of installation in that the metal conduit will transfer the surface movement from a penetration attempt to the cable more readily than PVC. If PVC conduit is used, the sensitivity setting for the E3i signal processor will have to be adjusted accordingly.

Care must be taken that the conduit has maximum contact with the building surface that is being protected. In cutting conduit, care must be taken to eliminate internal

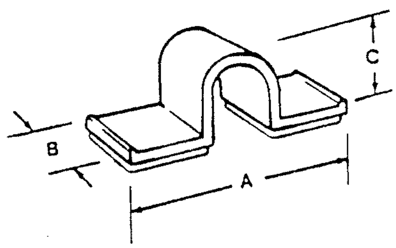
3.2.2 **Interior Building Surface (continued)**

burrs that may damage the sensor cable during installation.

Since the E-Flex sensor cable is most effective when mounted directly against the wall which it protects, adhesive backed or screw mounted cord clips are recommended with the proper diameter clip. Reference Figure 3.2.



A) .77 inch (19.6 mm)
B) .63 inch (16.0 mm)
C) .23 inch (5.8 mm)



A) 1.3 inch (33.0 mm)
B) .63 inch (16.0 mm)
C) .23 inch (5.8 mm)

Figure 3.2
Cable Attachments

The entire run of each cable should be attached to a homogeneous surface so that the sensor can be calibrated for optimum effectiveness. The transmission characteristics vary with different materials; and, therefore, a single sensor cable should not be attached to more than one type of building material. Most warehouses are constructed using at least two different types of materials. The walls are constructed of concrete slabs or cinder block which absorbs vibrations. The roof panels are often made of sheeting materials which tend to vibrate when subject to impact. Different "zones" with different calibration settings are required to react effectively to these conditions. Use separate sensor cables connected to individual signal processors with different calibration for each material and each "zone".

Surfaces such as plasterboard, cladding and insulation board have poor transmission characteristics. Therefore, more sensor cable and higher sensitivity setting will be required to protect an area of these materials than would be for the same areas of concrete or stucco.

If the walls contain windows, a separate sensor cable should be placed around the window casings. Support columns and pipes may conduct vibrations from one material surface to another.

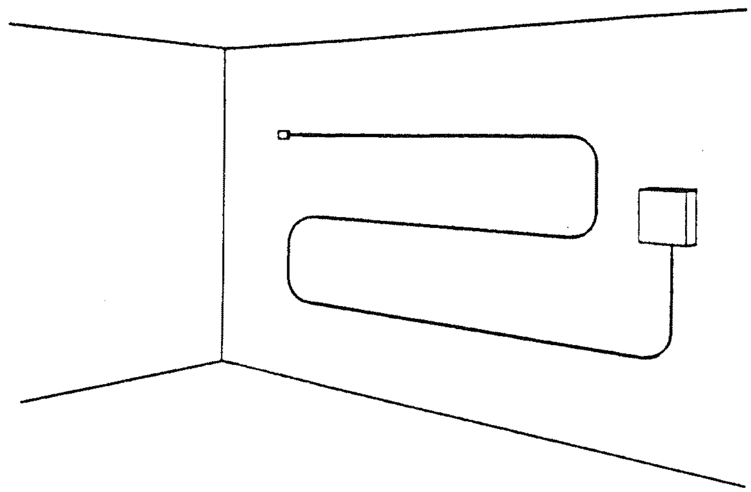


Figure 3-3
Interior Building Surface

3.2.3 Roof and Structural Beams

Where the roof is part of a protected area, it is essential that it be treated separately from any other surface and that it has its own security sensor system.

Most break-ins occur through the roof. The roof is often less rigid than the supporting walls of a building and usually unprotected by an alarm system.

The majority of industrial and commercial buildings have roofs that are supported by steel beams which are covered by various roofing materials. The E-Flex Sensor Cables may be run in conduit or attached directly to the roof fabric. The amount of cable to be used is dependent on the amount of roof area between the supports and the type of roof material.

To secure the E-Flex sensor cable on wood rafter structures, nails or screw cord clips are recommended. I-beam or metal rafter construction will require automotive style cable clips.

Single skin (layer) construction usually has better transmission qualities and will require less sensor cable per given area than will double-skin construction. Sheet metal roofs, however, typically produce thermal or "oil can" noise. Low-pitched or flat metal roofs produce temperature expansion/ contraction noise and, also, produce noise from rain. The calibration of an E-Flex type sensor is very critical in these application in order to eliminate nuisance alarms.

Intruders will usually attempt to penetrate at the lower parts of the roof and, in any case, will have to cross the lower sections to reach any higher part. Therefore, the lower section of the roof should receive the most attention in the proper deployment of the sensor cable. If the cost of total roof security is prohibitive, the protection of the lower area is, at least, mandatory. In any case, the owner should be consulted with regard to the implications of partial roof protection.

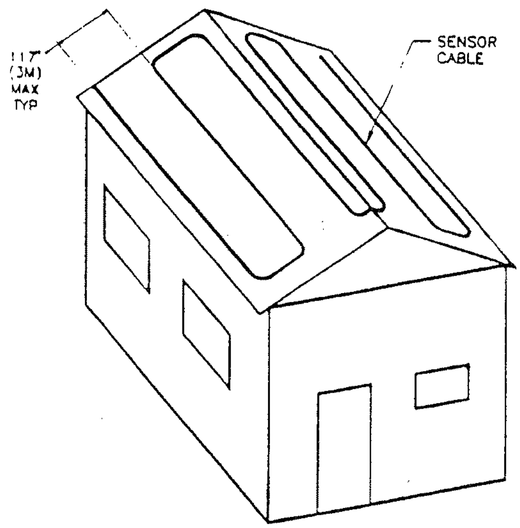


Figure 3-4
Roof Configuration

3.2.4 Pipes and Cables

Communication cables carrying classified data are often physically protected by a metal conduit. Security practices require this conduit to be either within clear view of security personnel or protected by an alarm sensing device if installed in an unmonitored area.

Damage to data communication cables can have a crippling effect on business transactions. Damage to above-ground or buried pipelines by vandals or saboteurs can have significant economic and environmental effects.

The E-Flex 3i Penetration Sensor provides an effective means of offering increased security for these applications. The E-Flex Sensor Cable can be placed inside the conduit with the data cables or can be coiled about the conduit or data cable itself. This will detect attempts to drill, cut or otherwise gain access to the data cables.

Burying E-Flex Sensor Cables with other cables and pipes can generate alarms in the event of nearby digging activity before there is damage to the equipment.

Pipelines are effective transmitters of sound and vibration over long distances. E-Flex Sensor Cable can be attached to the entire length of pipes or at specific locations in order to detect vandalism or sabotage attempts and to locate the source within a given distance.

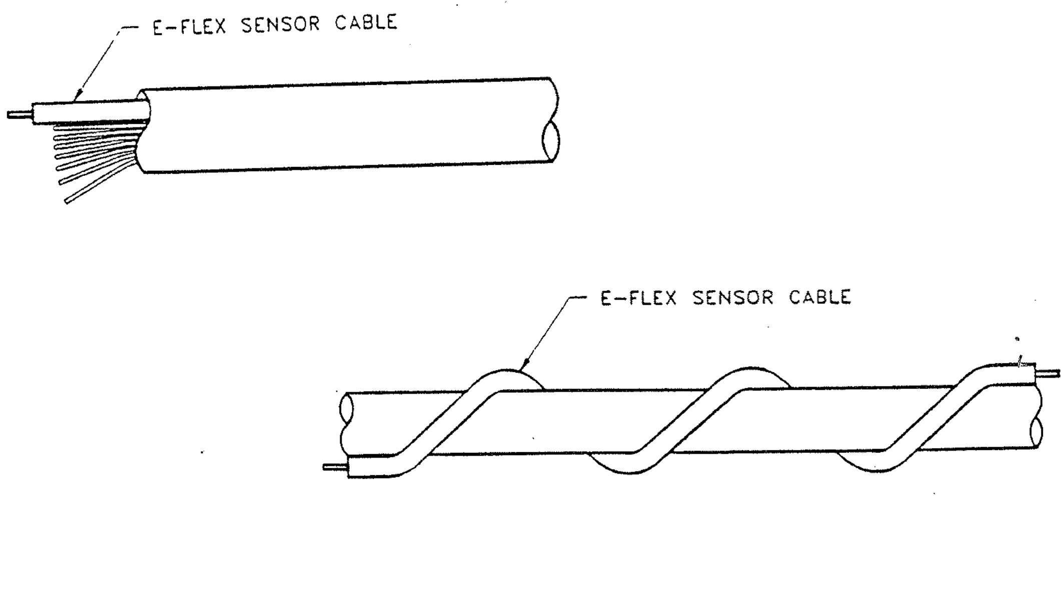


Figure 3-5
Pipes & Cables

4.1 ELECTRICAL CONNECTIONS

All input and output wires for the E-Flex 3i Processor are interfaced through Phoenix type connectors. Refer to Figure 4-1.

The E-Flex Coaxial Sensor Cable is attached to the Phoenix connector labeled J1. The center conductor is connected to J1 pin 2 (FXL-IN), and the shield is connected to J1 pin 1 (GRD). The sensor cable is routed through the cable grip in the enclosure nearest connector J1.

The E-Flex 3i is powered by +12 VDC. The power is connected to Phoenix connector J2 pin 1 (Ground) and pin 5 (+12 VDC).

Connect an earth ground wire to the Printed Circuit Board mounting screw located to the right of connector J1.

The penetration alarm output relay (K1) and the supervision alarm output relay (K2) are each supplied in dual relay packages. This provides the user with a back-up relay for each output function. These relays are Form C with either Form A contacts or Form B contacts of each relay available at the Phoenix connector J2. The user selects Form A or Form B contacts by placing a jumper on either the NO or NC contacts at JP2 for the penetration alarm relay and at JP1 for the supervision relay.

The selected contacts of the penetration alarm output relay are available at connector J2 pins 2 and 3, and the selected contacts of the supervision alarm output relay are available at connector J2 pins 6 and 7.

Pin 4 on connector J2 is not used.

The microphonic properties of the E-Flex sensor cable enables an audio signal to be wired from the Preamplifier Output to an external audio amplifier.

The enclosure tamper switch (SW1) is wired in series with the supervision circuit. SW1 is a 1 pole, 2 position switch which will open (alarm) when the enclosure cover is removed.

NOTE: **In the event that the terminated sensor cable is not wired to input connector J1 or an un-terminated sensor cable is wired to J1, the Local Supervision Switch of SW4-2 must be activated for the E-Flex 3i Processor to function.**

4.2 SENSOR CABLE DEPLOYMENT

4.2.1 General

The material on which the E-Flex™ Sensor Cable is attached determines the spatial deployment of the cable to obtain uniform detection over the entire structure.

Building materials such as metal surfaces and block or brick walls transmit vibrations from penetration attempts more readily than wood, plasterboard or sheetrock surfaces. Hence, the separation of E-Flex Sensor Cable Lines is closer on wood and sheetrock surfaces than on other denser materials.

NOTE: **Since different building materials have different responses, separate E-Flex 3i Processors should be used for each different material surface in the protected area to ensure optimum sensor performance.**

4.2.2 Cable Handling

The E-Flex sensor cable should be handled with care since it is the element that converts vibration into electrical signals. Take care in removing the sensor cable from the reel. Do not apply excessive tension to the sensor cable during installation. Internal damage will affect the detection properties and sensitivity.

Protect the E-Flex sensor cable form damage caused by persons standing on the cable, objects falling in the cable, tight bends, machine-installed cable ties or other means of deformity.

The SKT-7 terminator should only be attached after the E-Flex sensor cable has been installed.

4.2.3 Wall Protection

As a general rule, E-Flex Sensor Cable should be place in aluminum or E.M.T. conduit for any wall surface where the sensor cable could suffer physical damage from goods or equipment stacked against the wall on which the cable is mounted. Conduit is also desirable for applications where other means of attaching the sensor cable to the building surface may not be suitable. Conduit can be fastened to the building surface at 36 inch (90 cm) intervals.

Heavy metal surfaces are more "sensitive" and transmit the vibrations from penetration attempts to the E-Flex Cable more readily than do sheet metal surfaces. The sensor cable can be attached to the metal by means of simple clips or flashing adhesive tape.

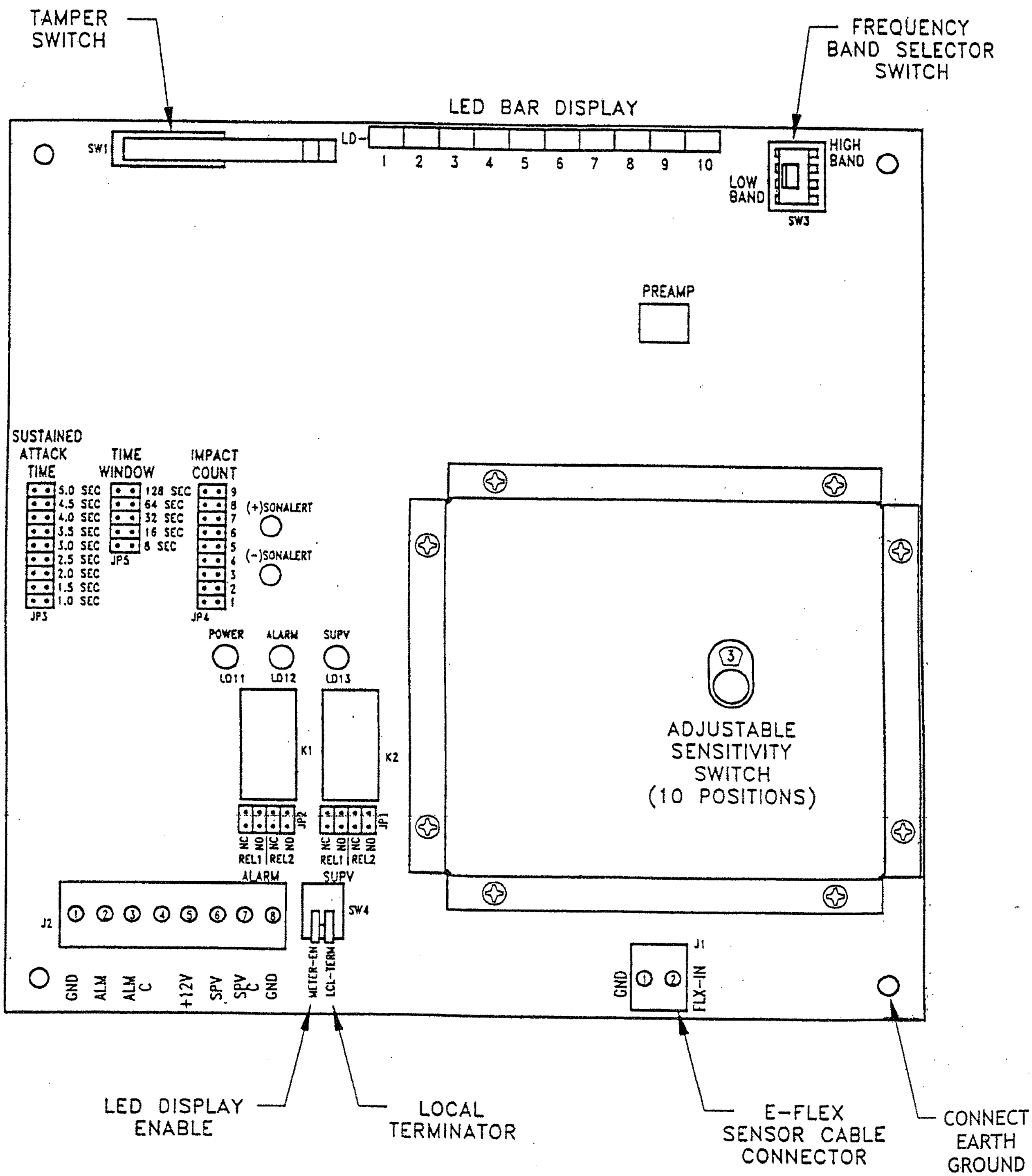


Figure 4-1
E-Flex 3i Signal Processor

4.2.3 Wall Protection (continued)

Hollow block walls are more "sensitive" than solid block or brick walls. Block or brick walls, on the other hand, are more "sensitive" than gypsum wall, plasterboard, cladding or wooden surfaces.

In general, the more "sensitive" a building surface, the less E-Flex Sensor Cable can be used per given area to provide effective detection.

Depending on the type of building surface, adequate detection can be obtained up to 3 to 5 feet (1.0 to 1.5 meters) on either side of the sensor cable in a flat uniform surface against an unsophisticated attack of smashing through the surface.

If the threat involves careful and sophisticated penetration attempts, then closer deployment of the E-Flex Sensor Cable may be required. In this case, detection may be limited to as close as one (1) foot (0.3 meters) on either side of the sensor cable.

Most break-ins through walls and vertical surfaces occur at lower levels from the ground to about a height of six (6) feet (1.8 meters). Deploy the sensor cable with closer passes at the bottom of the wall to enhance the probability of detection.

Take caution in the use of nail clips, standard cable clips or similar hardware to attach E-Flex Sensor Cable directly to the wall, as the contact between the sensor cable and wall may only occur where the clip is placed. Maximum probability of detection is achieved when there is direct contact between the wall and the sensor cable over its entire length.

NOTE: **Protection of a wall consisting of two (2) significantly different materials is best achieved by installing two (2) separate zones. Each E3i Processor can then be calibrated to the detection characteristic of each material.**

When protecting plasterboard and cladding surfaces, it is important to note the location of any support members, e.g., wooden studs or structural steel. These members will tend to reduce the detection characteristics of the sensor so additional passes of the sensor cable may be required. Without proper calibration, it may be possible to cut through plasterboard without causing sufficient vibrations that can be detected by the E3i Processor.

Single-skin structures (e.g., sheet metal buildings) are usually not suitable as a mounting surface for E-Flex Cable since they tend to produce thermal or "oil can" noise during rapid temperature changes.

4.2.4 Conduit

Certain precautions should be exercised when it is desirable to place the E-Flex Sensor Cable inside an aluminum or E.M.T. conduit for protection of the cable or for ease in attaching the cable to the building surface. Stellar does not recommend the use of plastic conduit since the plastic will tend to reduce the detection of vibrations from break-in attempts. Good mechanical coupling between the conduit and the protected surface is required.

Tight bends of the conduit, e.g., 90° or less, should be avoided as they tend to decrease the sensitivity of the sensor cable.

Cut ends of the conduit must be de-burred prior to feeding the sensor cable through the conduit. Sharp edges will tend to damage the cable or its outer jacket.

It is recommended that the conduit be divided into section lengths that will facilitate feeling the cable without damage; and, also, facilitate the deployment of the cable on the protected surface.

4.2.5 Security Cages and Grilles

Bonded storage areas and high value goods are often placed in wire cages for additional physical security in a warehouse environment. The E-Flex Strain Sensitive Cable is very effective in protecting such structures and can be easily deployed.

Attach the E-Flex Sensor Cable to the cage with plastic cable ties. The cable should be fastened at intervals not to exceed twelve (12) inches (30 cm) to ensure close contact between the sensor cable and the wire mesh. Adequate detection can be obtained up to approximately three (3.0) feet (1.0 meter) on either side of the sensor cable. The roof of this type of cage can be treated in the same manner as the walls of the cage.

NOTE: **Do not stack boxes or other material against the cage, thereby compromising the sensor's effectiveness.**

4.2.6 Windows and Roof Openings

Skylights and windows are vulnerable points in any building. To detect intruders attempting to gain entrance through these openings, attach the E-Flex Sensor Cable to the window framework.

Skylights and other roof openings are most easily protected by placing a grille over the opening and attaching the E-Flex Sensor Cable to the wire grille.

4.2.7 Roofs

Intruders will usually attempt to penetrate at the lower parts of the roof; and, in any case, will cross the lower sections to reach the higher part. Therefor, the lower section should receive the most attention in the proper deployment of the E-Flex Sensor Cable.

Industrial and commercial buildings have roofs supported by steel beams covered by various roofing materials. If the beams are not more than 6 feet (1.8 meters) apart, the E-Flex Cable can be attached to every beam. If the beam separation is greater than 6 feet, the sensor cable should be attached to the roof material itself.

On roofs that utilize wood truss construction, the E-Flex Sensor Cable can be attached along adjacent beams which normally have a 2 foot separation.

4.2.8 EMI and RFI

Although the Indoor E-Flex E3i Processor has been designed so as not to be susceptible to sources of electrical interference, certain precautions should be used in the placement of the E3i Processors and the sensor cable.

Do not route the sensor cable parallel to and in close proximity to power cables for long distances.

Avoid deployment close to motors, conductors, fluorescent lights, transformers and transmitters.

5.1 GENERAL

There are five (5) adjustments required to calibrate the E-Flex 3i Interior Protection Sensor:

Frequency Band Selector SW3	-	This selects either the low frequency band (80 Hz to 350 Hz) or high frequency band (330 Hz to 2,000 Hz) response of the processor for optimum penetration detection.
Sensitivity Switch SW2	-	This 10 step adjustment affects the sensitivity of the processor to the input signal from the sensor cable; i.e., sensor's overall performance.
Impact (Count) Selector JP4	-	Sets the number of discreet impacts (1-9) required in a given time period to initiate a penetration alarm.
Impact Time Window Selector JP5	-	Sets the time period (8 to 128 seconds) during which the selected number of impacts must occur in order to initiate a penetration alarm.
Sustained-Attack Time Selector JP3	-	Sets the minimum time of a sustained attack (1.0 to 5.0 seconds) required to initiate a penetration alarm.

5.2 PROCESSOR CALIBRATION

1. Apply +12 VDC power to the E-Flex 3i Processor. The green Power LED (LD11) should be illuminated.

2. Turn the Sensitivity Control (SW2) fully counter clockwise to obtain minimum sensitivity.

3. Place LED Display Enable Switch (SW4-1) in the "ON" position. The LED Signal Display should **not** be illuminated.

5.2 PROCESSOR CALIBRATION (CONTINUED)

4. Select the Low Band Frequency Response (SW3) by moving switch arm to the left.

5. There are 9 jumper positions on the Impact Count Selector (JP4) selecting counts from 1 to 9. Place jumper on a count of 1.

6. There are 5 jumper positions on the Impact Time Window Selector (JP5) selecting time increments of 8, 16, 32, 64, and 128 seconds. Place jumper on the 8 second time increment.

7. There are 9 jumper positions on the Sustained Attack Time Selector (JP3) selecting time increments of 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5 and 5.0 seconds. Place jumper on the 1.0 second time increment.

8. Select either NO (Form A) or NC (Form B) contacts for the alarm and supervision relays by placing the jumpers on JP1 and JP2 in the proper position.

9. If there is a sonalert monitoring device, connect the sonalert ground clip to the (-SONALERT) pin and the positive red clip to the (+SONALERT) pin. These pins are located to the right of the Impact Count Selector (JP4).

   NOTE: **Sonalert monitoring will enable you to hear the alarm indication if you cannot see the LED Display. Alarm threshold is the fourth (4th) bar on the LED Display. When the 4th bar illuminates the alarm output relay should activate.**

10. Sharply strike the surface to which the E-Flex Sensor cable has been attached, thus simulating a penetration attempt. At minimum sensitivity LED Display response should be negligible. The lower the sensitivity setting, the stronger the blow required to generate the E-Flex signals that will generate an alarm condition.

11. Continue to strike the protected surface and gradually increase sensitivity by rotating the Sensitivity Control (SW2) clockwise until the LED Display illuminates the 4th bar and/or the sonalert sounds. Note the sensitivity setting.

12. Switch the Frequency Band Response (SW3) to the High Band by moving the switch arm to the right.

13. Turn the Sensitivity Control (SW2) fully counter clockwise to minimum sensitivity and repeat steps #10 and #11.

5.2 PROCESSOR CALIBRATION (CONTINUED)

14. Select whichever Frequency Band, high or low, that provides an alarm indication at the lowest sensitivity setting.

    NOTE: **With no simulated attack or penetration attempt, the LED Display should have no bars illuminated.**

15. Set the Impact Count Selector (JP4) to the desired number of counts. If the structural material is very responsive to vibrations then a higher count selection is recommended.

16. Set the Impact Time Window Selector (JP5) to the desired time interval. Consequently, if the structural material is very responsive to vibration then a lower time window selection is recommended.

17. Set the Sustained Attack Time Selector (JP3) to the desired time interval. The thicker the structural material, the higher the setting for the Sustained Attack Time.

18. Simulate a series of sharp impacts on the protected surface to determine that an alarm occurs when the selected number occur within the selected time interval; and, that an alarm does not occur if the selected time interval is exceeded.

19. Simulate a sustained attack on the protected surface and determine if an alarm occurs once the selected time interval has been exceeded.

20. Repeat steps #18 and #19 along various sections of the protected surface to determine that the sensor cable deployment will provide uniform sensitivity and uniform probability of detection.