Perimitrax®

Buried Cable Intrusion Detection Sensor

Installation guide

A3DA0202-001, Rev P
First Edition
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SENSTAR™

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Patents

Canada no.: 1332185, 2202117, 2204485

U.S. no.: 5834688

U.K. no.: 2318689

Patents also issued or pending in other countries.

Approvals

Canada: *Sensor Module model SM100-1, SM100-2 and SMDT01* Industry Canada Certification Number: CAN 1454 102 239

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference including interference that may cause undesired operation of the device.

This class B digital apparatus meets all requirements of the Canadian Interference - Causing Equipment Regulations.
Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

This device conforms to CSA standard C22.2 no. 950.

USA: *Sensor Module model SM100-1, SM100-2 and SMDT01* FCC Identification Number: I5T-BCIDS001

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by Senstar Corporation could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation distance between the equipment and the receiver.
- Connect the equipment into a outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device conforms to UL standard 1950.

Europe: *Sensor Module models SM100-1, SM100-2 and SMDT01*

This device complies with EN50081-1, EN50130-4 and EN60950+A1+A2 standards as outlined in council directives 89/336/EEC and 73/23/EEC on the approximation of the laws of member states relating to Electromagnetic compatibility and low voltage directive, as amended by directive 93/68/EEC.

Radiocommunication Agency Certificate of type approval # 13657
Radiocommunication Agency Certificate of EC type Examination of Electromagnetic compatibility # 13658
Unit marked with CE and CEPT SRD 1dGB
Senstar Corporation's Quality Management System is ISO 9001:2000 registered.

Related publications

Perimitrax® Site planning guide (A3DA0102):

Describes Perimitrax system features, operation, components and applications. It also provides information regarding the design, planning, and ordering of Perimitrax systems.

Perimitrax® Installation guide (A3DA0202):

Provides instructions for installing the Perimitrax system and system components.

Sennet® product guide (M0DA0302):

Describes Sennet system features and provides system planning, installation and setup guidelines.

Intelli-FLEX™ product guide (multiplex version) (C6DA0402):

Describes Intelli-FLEX multiplex version features, operation, components and applications. It also provides instructions for planning, installing and setting up an Intelli-FLEX multiplex version system.

Service statement - We ensure that our products are correctly applied to achieve the maximum benefits for the end-user. We work hand-in-hand with our customers and remain accessible through all stages of a project - from concept to deployment to long-term support. We provide design assistance, site surveys, installation support, comprehensive documentation, training, post-installation annual calibration and maintenance visits, electronics and software extended warranty, rapid factory repair service and on-call/emergency service. Contact Senstar to inquire about how a package can be customized for your unique applications.

Using this guide

This guide provides the information necessary to install the components a Perimitrax security system.

Chapter 1 is a brief introduction to perimeter security as it relates to Perimitrax; chapter 2 provides an overview of the steps involved in installing a Perimitrax system; chapters 3 through 6 detail Perimitrax component installation procedures; chapter 6 also details the setup procedures for the Sensor Module; chapter 7 provides detailed instruction for checking out and completing the cable installation; chapter 8 outlines the steps involved in commissioning a standalone Perimitrax system; chapter 9 lists the criteria in assessing damaged cable. The appendices provide system component ordering information, recommended installation materials and component specifications.

Figures

The figures contained in this document are for illustration purposes only, they may differ from the actual equipment.

Throughout this guide the illustrations show the SC1 sensor cable layout, unless otherwise stated. SC2 sensor cable layouts are similar to the SC1 layouts with the exception that the SC2 systems use 2 cables instead of 1.

Abbreviations

The following abbreviations are used throughout this guide:

- NC - Sennet® Network Controller
- n.c. - normally closed
- n.o. - normally open
- Pd - probability of detection
- RF - radio-frequency
- SC - sensor cable
- SM - Perimitrax® Sensor Module
- SC1 - Perimitrax® single sensor cable
- SC2 - Perimitrax® double sensor cable
- TB - terminal block

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1 System overview

Perimitrax is a high-security perimeter intrusion detection sensor system. It is based on ported or *'leaky'* coaxial cable technology. Sensor cables buried around the perimeter of a site distribute radio-frequency (RF) signals along their path. The invisible electromagnetic detection field formed around the cables by these signals can detect the presence of an intruder crossing it. Perimitrax can use either a single sensor cable (SC1), or a separate pair of sensor cables (SC2), depending on site and performance requirements.

Sensor Modules house the necessary electronics to monitor the detection field created by the RF signals and to raise an alarm if an intruder enters the detection field. The sensor module can be powered individually, as a standalone unit or as part of a network in which power and data passes along the sensor cable between the sensor module(s).

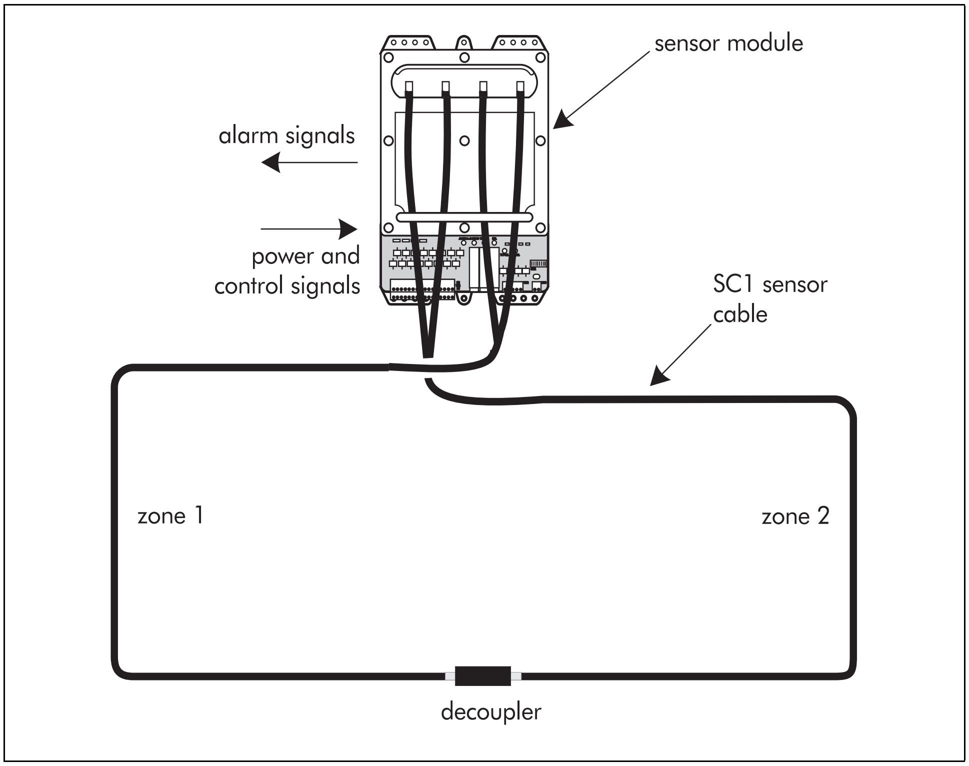
Each Sensor Module can support two Perimitrax detection zones. It can also collect alarm and tamper information from other security sensors, such as microwave sensors or fence detection systems.

A PC-based Sentient Security Management System can be used as the primary operator interface for a Perimitrax system thereby forming a complete security system. This unit monitors the performance of the entire Perimitrax system and has the capability of reporting alarms to the operator in a graphical map display format.

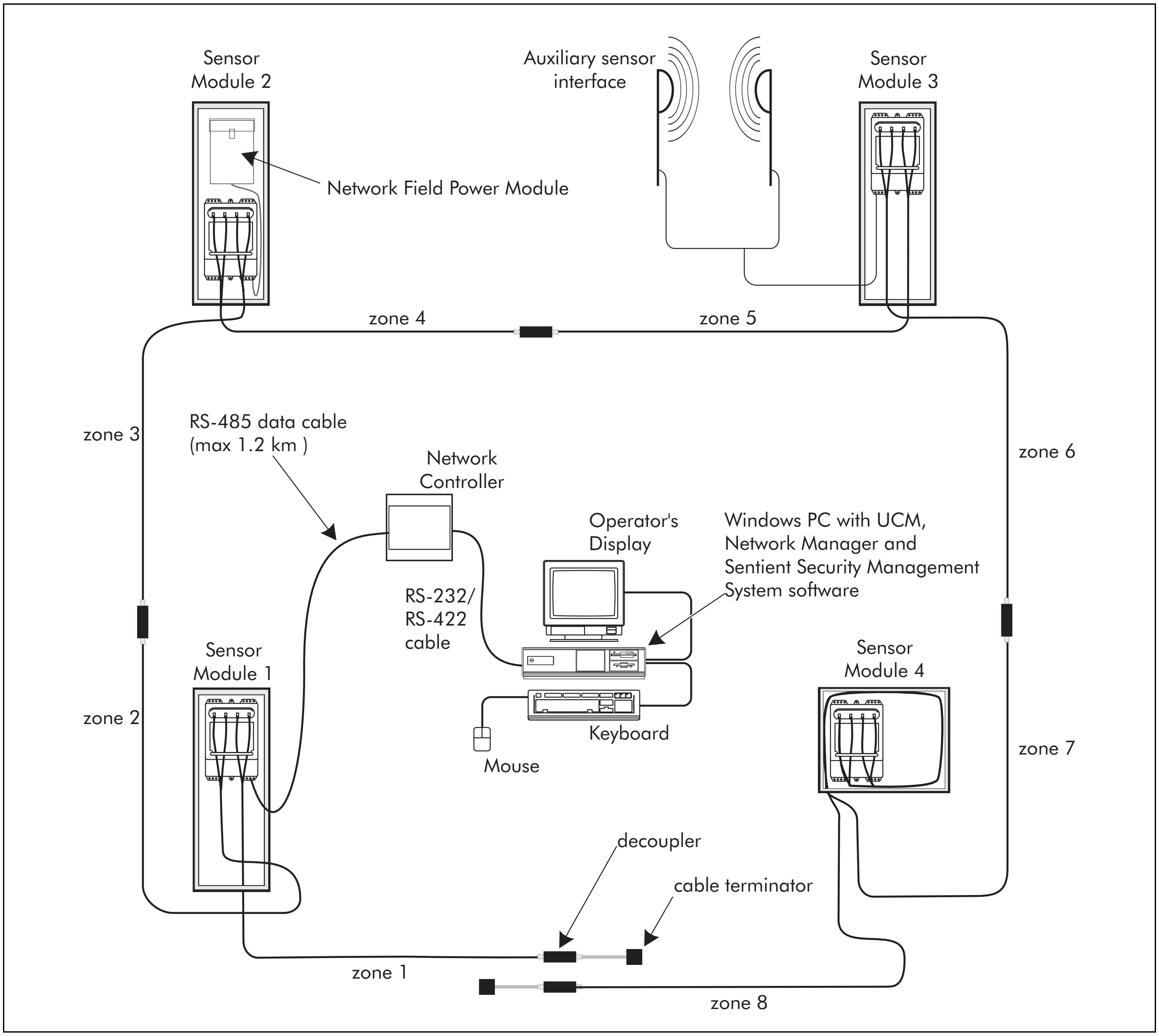
A complete Perimitrax system includes a combination of the following components:

- Sensor Modules
- enclosures
- sensor cable sets
- decouplers
- cable terminators
- power supply (including Field Power Modules)
- (optional) Local interface assembly
- (optional) Sennet®Network Controller
- (optional) Sentient Security Management System, Universal Configuration Module and Network Manager software
- (optional) printer
- (optional) repeaters
- (optional) Intelli-FLEX™ multiplex version processors

A small standalone system may use one or two cable sets and a single Sensor Module connected to external alarm annunciation equipment.



A larger network system may include all of the components and auxiliary sensors.



A spare parts list can be found in *Appendix a*.

The diagram above is for illustration purposes only. Details about Perimitrax system components and layout can be found in the *Perimitrax Site planning guide (A3DA0102)*.

2 Installation overview

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Commission network system	**Calibrate your network system**	UCM on-line help
	Power up system	
	Calibrate each zone; check operation of each Sensor Module; set Sensor Module threshold levels	
	Test entire system to ensure adequate detection and that alarms report properly	
Completion	**System is fully operational**	
	Turn over system to trained operators	

3 Installing the enclosures

If a Sensor Module is being installed outdoors or in an unsecured area it must be installed in an enclosure. Sensor Modules can be installed in a weatherproof type, Telecom style, or other suitable enclosure.

This chapter contains the general guidelines for installing the weatherproof type enclosure, the Telecom style enclosure, or your own enclosure.

All local construction and electrical codes must be followed concerning the entry and termination of “mains” electrical supply lines.

For installations in environments which include hot sunny periods, Senstar Corporation recommends that a sun shield be installed to protect the enclosure from direct sunlight.

Before you begin

- ❑ Check the site plan to determine the correct location for the enclosure.
- ❑ Gather all tools and equipment that are required to complete the installation.
- ❑ Make sure that all Sensor Modules and enclosures are grounded in accordance with local safety regulations.

Senstar Corporation recommends using a low resistance earth connection at each unit to provide maximum protection against lightning damage and undesired ground loops. More than one ground rod may be required to achieve low resistance. (Typical 5 Ω or less)

Points to remember

When installing enclosures keep the following in mind:

- follow local electrical codes as required
- a NEMA 4 rated weatherproof enclosure is recommended in areas of high humidity
- install the enclosure at eye level wherever possible
- install the enclosure above high water or snow levels
- install the enclosure close to the device power source
- install the enclosure out of direct sunlight whenever possible
- install anti-ram protection in areas of high vehicular traffic
- locate cable entry holes on the bottom surface of the enclosure

Required tools and equipment - for all types of enclosures

- site plan
- sledge hammer
- standard screwdriver
- No. 1 and No. 2 Phillips screwdrivers
- tape measure and pencil
- approved earth ground rod at least 1.2 m (4 ft.) long and 1 cm (3/8 in.) in diameter
- ground wire (minimum 10 gauge)
- hardware to connect ground wire to ground rod

Installing a weatherproof enclosure

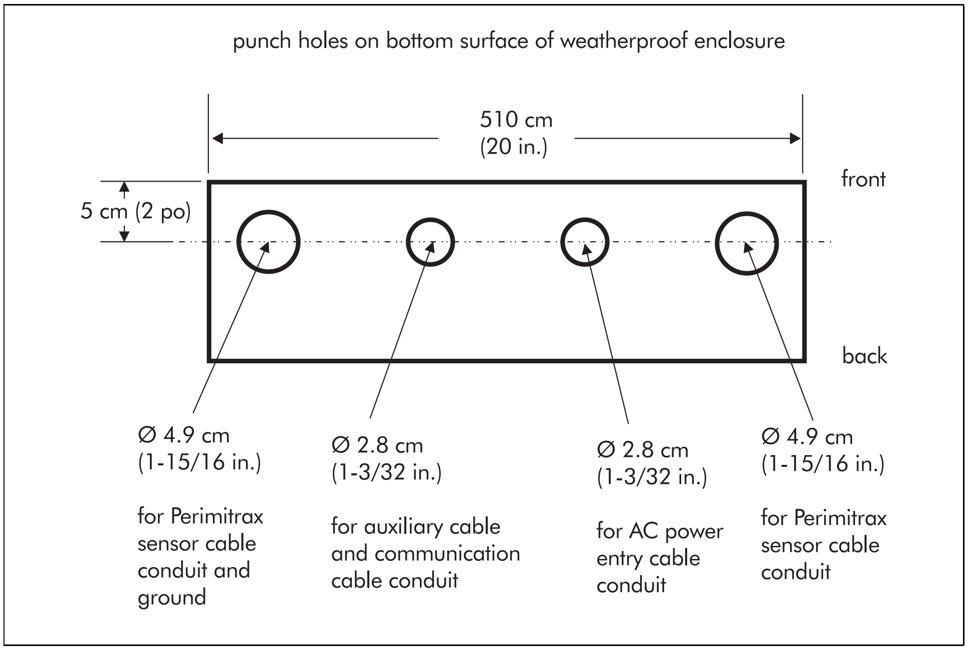
The weatherproof enclosure can be wall, fence or post mounted using specific kits available through Senstar.

Required tools and equipment

- required tools and equipment listed on page 3-2
- assorted 1/4-20 mounting hardware
- chassis punches
- sensor cable conduit - 3.8 cm (1½ in.) electrical conduit and matching bulkhead connector
- (optional) auxiliary sensor/communication cable conduit - 1.9 cm (3/4 in.) electrical conduit and matching bulkhead connector
- (optional) AC power entry cable conduit - 1.9 cm (3/4 in.) electrical conduit and matching bulkhead connector
- weatherproof enclosure (Model no. WE2-1, WE2-2, WE2-3 or WE2-4)
- (optional) pole mounting kit (Model no. PK1-1)
- (optional) mounting foot kit (Model no. FP1-1)
- (optional) padlock handle (Model no. HP1-1)

Installation procedure

locating conduit holes on the enclosure

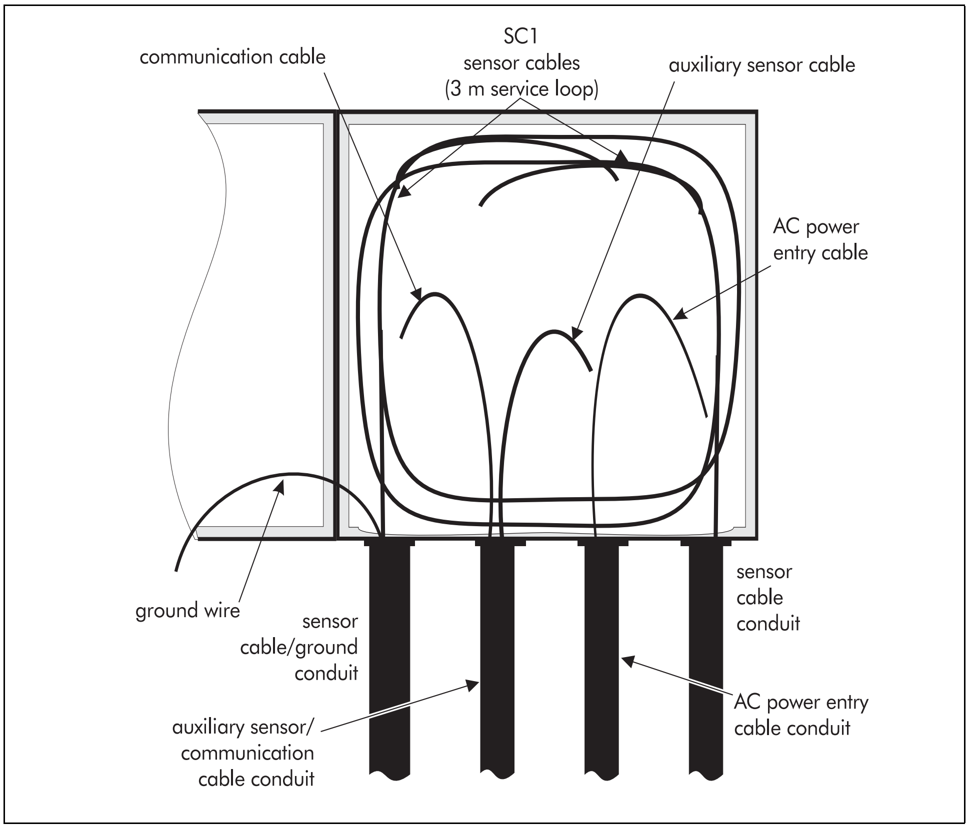


❑ Drill and punch conduit holes in the bottom of the enclosure, as required.

If the Sensor Module is being installed without a Field Power Module, the AC power entry hole will NOT be required.

If the Sensor Module is being installed without data communications (i.e., a standalone unit) or auxiliary sensors, the left-center auxiliary cable entry hole will NOT be required.

- ❑ Install the ground rod as close as possible to the Sensor Module location.
- ❑ Mount the weatherproof enclosure in accordance with the manufacturers' instructions. (supplied with enclosure)



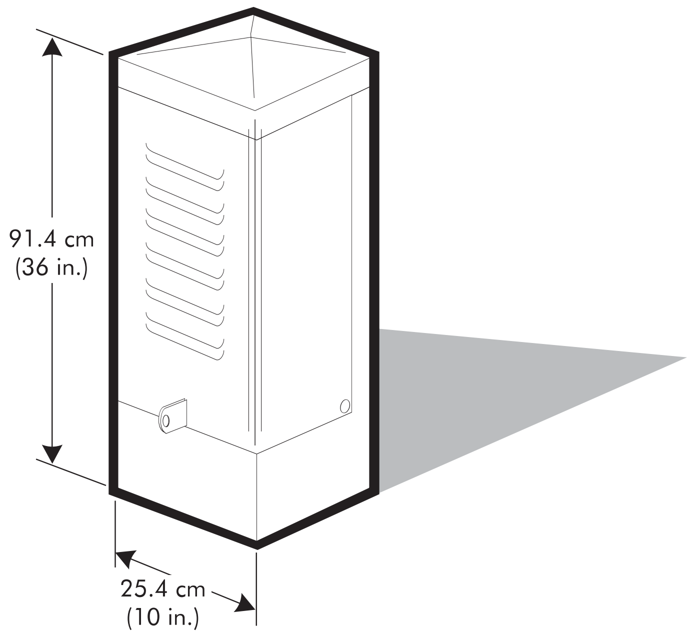
- ❑ Cut conduit to extend between the enclosure and the ground.

Metal or plastic conduit can be used.

- ❑ Temporarily label all cables and wires that are to be routed to the weatherproof enclosure.
- ❑ Secure the conduit(s) to the weatherproof enclosure using threaded connectors - 3.8 cm (1 ½ in.) or 1.9 cm (¾ in.) pipe thread depending on the conduit diameter.
- ❑ Pull cables and wires, including the ground wire, up through the conduits into the weatherproof enclosure. Be sure to pull enough material through to create a service loop for each cable (minimum 3 m or 10 ft.).

Installing a Telecom style enclosure

The Telecom style enclosure can be used for exterior installations. The enclosure is ground mounted in a concrete base. The concrete base should be set above ground level in areas prone to ice and on high ground in areas prone to flooding.



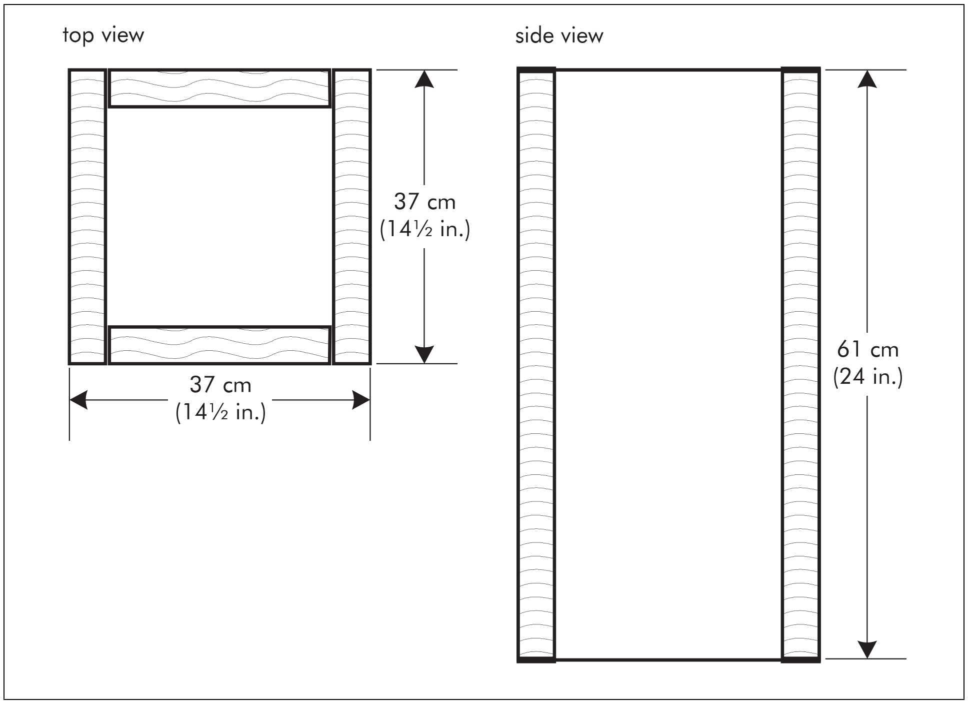
Required tools and equipment

Conduit lengths are site specific.

- tools and equipment listed on page 3-2
- plywood, hammer and nails, and hand saw; or
- sono-tube (recommended diameter 40 cm (16 in.) X 60 cm (2 ft.)) or material to construct a wooden form 37 X 37 X 60 cm (14½ X 14½ X 24 in.)
- electrical tape
- concrete mix
- trowel
- 11 mm (7/16 in.) and 15 mm (9/16 in.) wrenches
- shovel
- sensor cable entry conduit (3.8 cm (1½ in.) diameter PVC pipe and matching 90° elbows)
- (optional) auxiliary sensor/communication cable entry conduit (1.9 cm (3/4 in.) diameter PVC pipe and matching 90° elbows)
- (optional) AC power entry conduit (1.9 cm (3/4 in.) diameter PVC pipe and matching 90° elbows)
- enclosure drain pipe (1.9 cm (3/4 in.) diameter PVC pipe)
- Telecom style enclosure (Model no. PE2-1)
- (optional - site specific) Replacement mounting bracket (Model no. RB1-1)

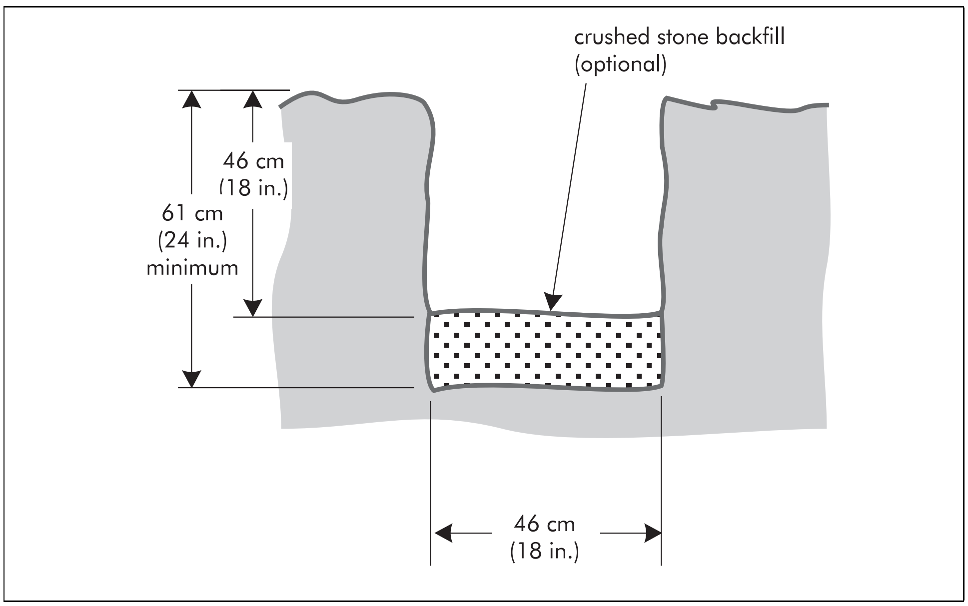
Installation procedure

dimensions for concrete form



❑ Build a concrete form with plywood or use a suitable section of sono-tube (cardboard tube) as a form.

dimensions for hole



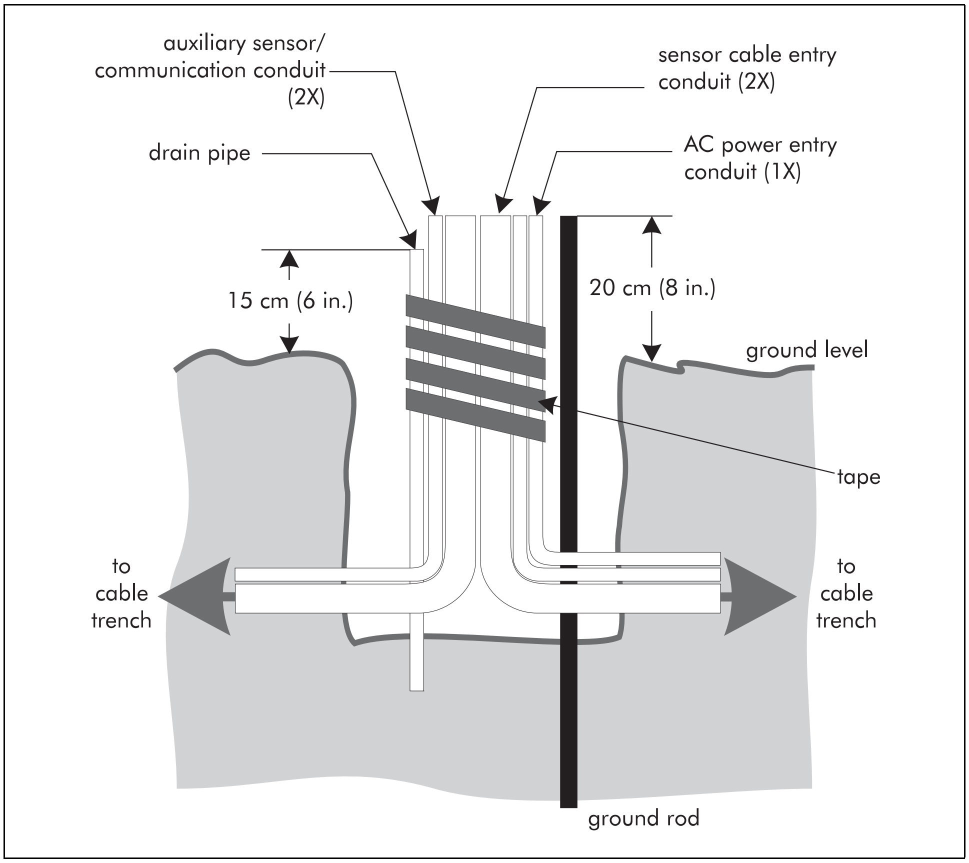
❑ From the site plan determine the location for the enclosure and dig a hole 46 X 46 X 46 cm (18 X 18 X 18 in.).

In clay soils, where the drainage is poor the hole should be a minimum of 60 cm (24 in.) deep and backfilled to 46 cm (18 in.) with crushed stone.

PVC pipe assemblies allow the sensor cables, the optional auxiliary sensor wiring and the power supply connection to run from the trenches or slots to the Sensor Modules. One conduit provides drainage for the enclosure.

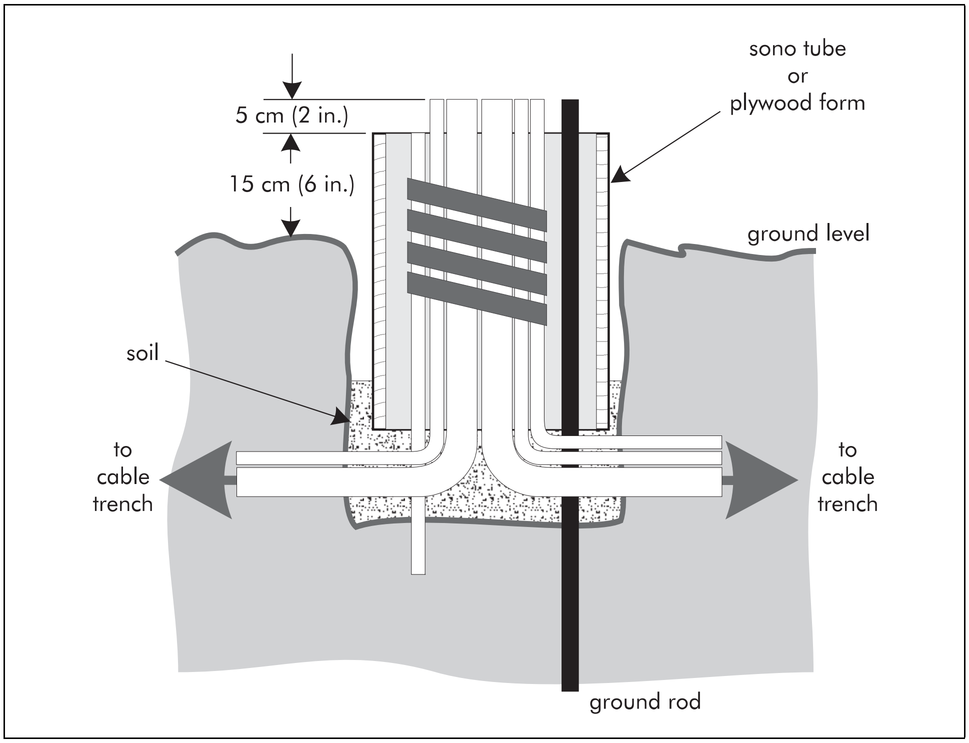
- ❑ Using the conduit and matching elbows listed in *Required tools and equipment* on page 3-3, construct assemblies as required.
- ❑ Put tape over both ends of all PVC pipe assemblies.

location of conduit assemblies in cable trench



- ❑ Drive the ground rod into the earth at the Sensor Module location.
- ❑ Following the *location of conduit assemblies in cable trench* diagram, insert the sensor cable conduit, auxiliary sensor/communication cable conduit, AC power supply wiring conduit, and drain pipe in the cable trench.
- ❑ Tape the pipes together.
- ❑ Position the sono tube or concrete form in the hole over the conduit assemblies so that the top of the form is 15 cm (6 in.) above ground level and the pipes are centered in the form (see *position of form in hole* on page 3-8).
- ❑ Fill the bottom of the hole and around the outside of the sono tube or concrete form with soil to hold the form in place.
- ❑ The Telecom enclosure is shipped with the stake inside the enclosure. Reposition the stake so that it will enter the wet concrete (see *placing the protective enclosure in concrete* on page 3-9).
- ❑ Fill, tamp and level the concrete to the top of the form.

position of form in hole

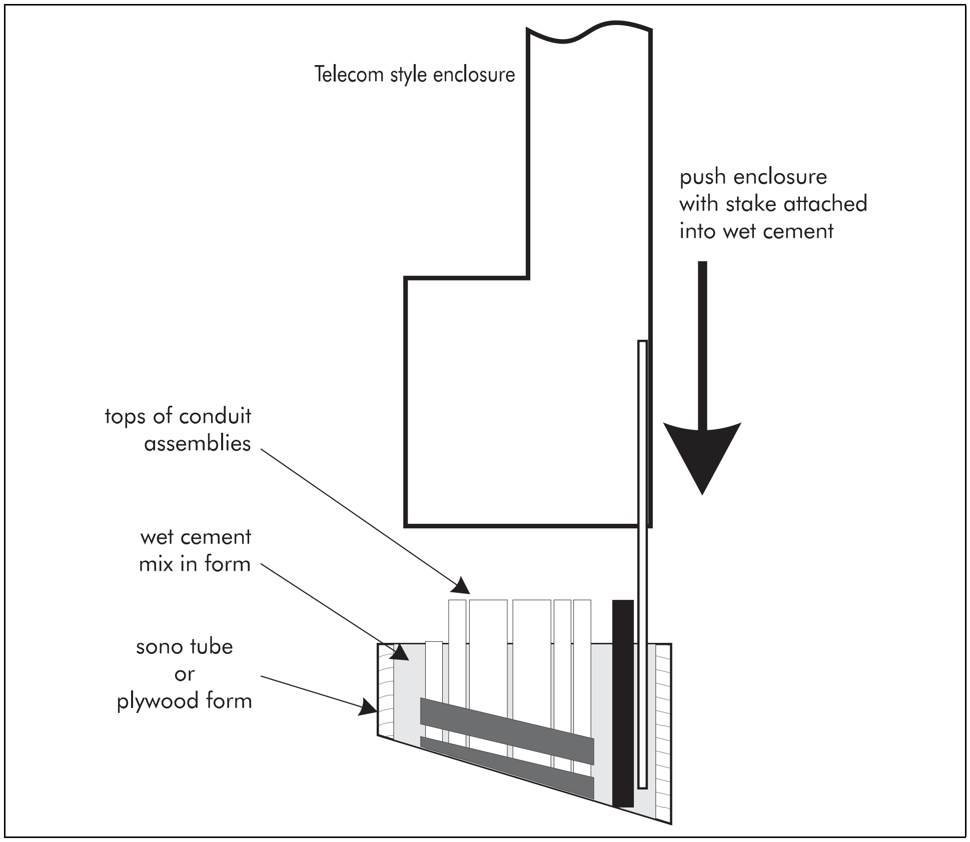


Make sure that the conduit ends are protected.

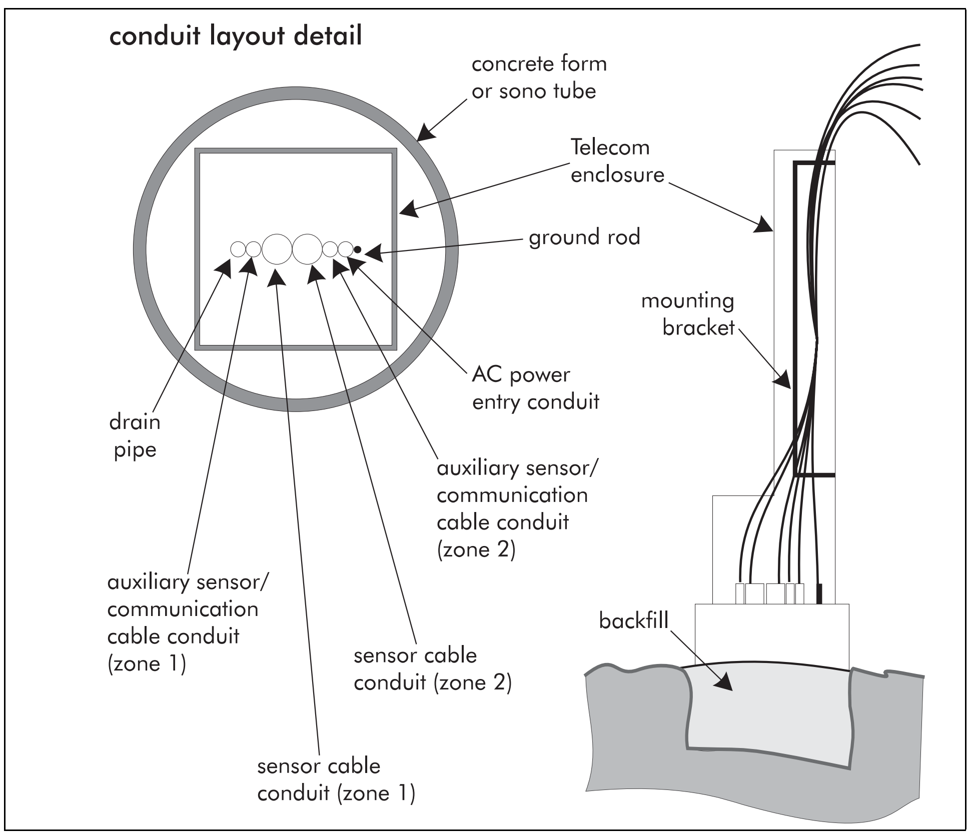
- ❑ Position the base of the enclosure over the pipes and push it down so that the bottom edge of the enclosure is approximately 2.5 cm (1 in.) deep.
- ❑ Let the concrete set for at least 24 hours before installing the Sensor Module and/or Field Power Module in the enclosure.
- ❑ After the concrete has set, trim the drain pipe so that it is flush with the concrete.
- ❑ Remove the concrete form and remove the tape from the ends of the PVC pipes. (If a sono tube has been used as the concrete form, leave it in the ground.)
- ❑ Identify and temporarily mark all of the cables and wires.
- ❑ Route the lead-in cables from the cable trenches up through the two 3.8 cm (1½ in.) diameter PVC pipes and into the protective enclosure (see *routing cables into the protective enclosure* on page 3-9).
- ❑ Route the wires from the alarm annunciation equipment, power supply and/or auxiliary sensors through the 1.9 cm (3/4 in.) diameter PVC pipes.
- ❑ Fill in the hole around the concrete base.
- ❑ Pull the cables and wires up into the back of the enclosure behind the mounting bracket until they are long enough to create a service loop (approximately 3 m (10 ft.)). Hang the wires and cables over the back of the Telecom enclosure.

❑ If a Sensor Module and a Field Power Module are both going to be installed in the Telecom style enclosure, remove the standard mounting bracket and install the (optional) replacement bracket.

placing the protective enclosure in concrete



routing cables into the protective enclosure



- [ ] If connectors and modules are NOT going to be installed immediately, coil up the cables and secure them temporarily inside the enclosure. Close the cover on the enclosure to protect the cables.

Installing your own enclosure

The Sensor Module can be installed in any weatherproof enclosure of sufficient size in any location providing the ambient temperature range (measured inside the enclosure) is -40 to 70ºC (-40 to 158ºF) and humidity is between 10% and 95% non-condensing.

For installations in environments which include hot sunny periods, Senstar Corporation recommends that a sun shield be installed to protect the enclosure from direct sunlight.

Required tools and equipment

- tools and equipment listed on page 3-2
- hardware and tools to mount the Sensor Module in your enclosure

Points to remember

- a ground rod should be installed as close as possible to the Sensor Module (The Sensor Module ground lug should be connected to the ground rod with a minimum 10 gauge wire.)
- the enclosure should be able to accommodate a Sensor Module, a field power module, and cable field service loops
- the recommended minimum enclosure dimensions are 510 X 510 X 150 mm (20 X 20 X 6 in.)
- the Sensor Module includes wire screw terminators to mount a tamper switch on the enclosure
- the same general procedure for locating conduit holes on the weatherproof enclosure is used here (See the diagram *locating conduit holes on the enclosure* on page 3-3.)

4 Installing the cables

Overview of installation procedure

System reliability depends on the proper location and installation of the sensor cables, and proper connections. Detailed procedures for installing the sensor cables are included in this chapter.

References to cables include both SC1 and SC2 sensor cables unless stated otherwise.

To properly install the cables and cable fittings, perform the following steps in order:

✓	*Description*
	Check the site plan to verify the cable route.
	Clean debris from the cable route.
	Check for any underground utilities.
	Mark the sensor cable route and the locations of decouplers, overlaps, bypasses, etc.
	Dig the trenches or cut slots.
	Dispense the cables and check for damage.
	Lay the cables in the trenches or slots.
	Install connectors, decouplers, and/or terminators.
	Partially backfill the trenches or install backer rod in the slots.
	Perform a preliminary check of the system.
	Complete backfilling the trenches or install the sealant in the slots.

Installation guidelines

To avoid problems arising from cable installations, follow the guidelines below:

- ❑ Design installation according to rules in the *Perimitrax Site planning guide (A3DA0102)*.
- ❑ Measure carefully and record cable locations on map.
- ❑ Bury in a single medium per zone (preferably soil, if possible).
- ❑ Bury at proper depth (see table).
- ❑ Make gradual turns around corners (see diagrams on page 4-4).
- ❑ Maintain minimum separation distances from obstacles (see tables on page 4-5 and page 4-6).
- ❑ Limit the change in grade of the cables to 30° or less.

Sensor cable burial depths for different mediums

Medium	Nominal burial depth
soil	23 cm (9 in.) ± 2.5 cm (± 1.0 in.)
gravel	23 cm (9 in.) ± 2.5 cm (± 1.0 in.)
asphalt - up to 10 cm (4 in.) thick	23 cm (9 in.); increase to 30 cm (12 in.) when crossing driveways in a zone buried in soil at 23 cm ± 2.5 cm (± 1.0 in.)
asphalt - more than 10 cm (4 in.) thick	slots - 6 cm (2.25 in.) ± 6 mm (± ¼ in.)
non-reinforced concrete - up to 10 cm (4 in.) thick	23 cm (9 in.) ± 2.5 cm (± 1.0 in.)
non-reinforced concrete - more than 10 cm (4 in.) thick	slots - 6 cm (2.25 in.) ± 6 mm (± ¼ in.)
reinforced concrete - any thickness	slots - 6 cm (2.25 in.) ± 6 mm (± ¼ in.)

Extremes of natural soil types such as very dry sand or moisture saturated heavy clay may require variations in installation methods and burial depths.

See application notes 7, 8 and 9 (*A3DA0709, A3DA0809* and *A3DA0909*) or contact Senstar Customer Service for information about installing Perimitrax cable in extreme soil types.

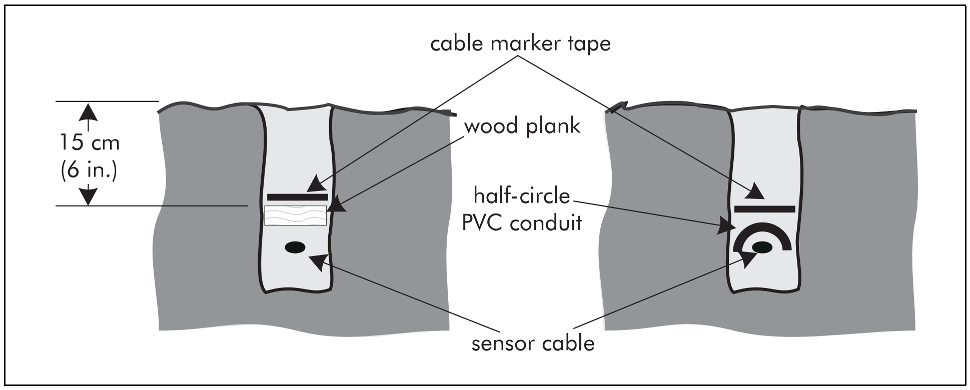
Cable burial in different mediums

A detection zone should be contained in a single installation medium whenever possible. However, a single installation medium can include several detection zones.

The zone should be tested before completion of cable burial to accommodate any changes in cable placement that may be required to achieve uniform detection properties within the zone.

Protection of buried cables

Protecting the sensor cable from surface damage



Use the marker tape, included with the sensor cable set.

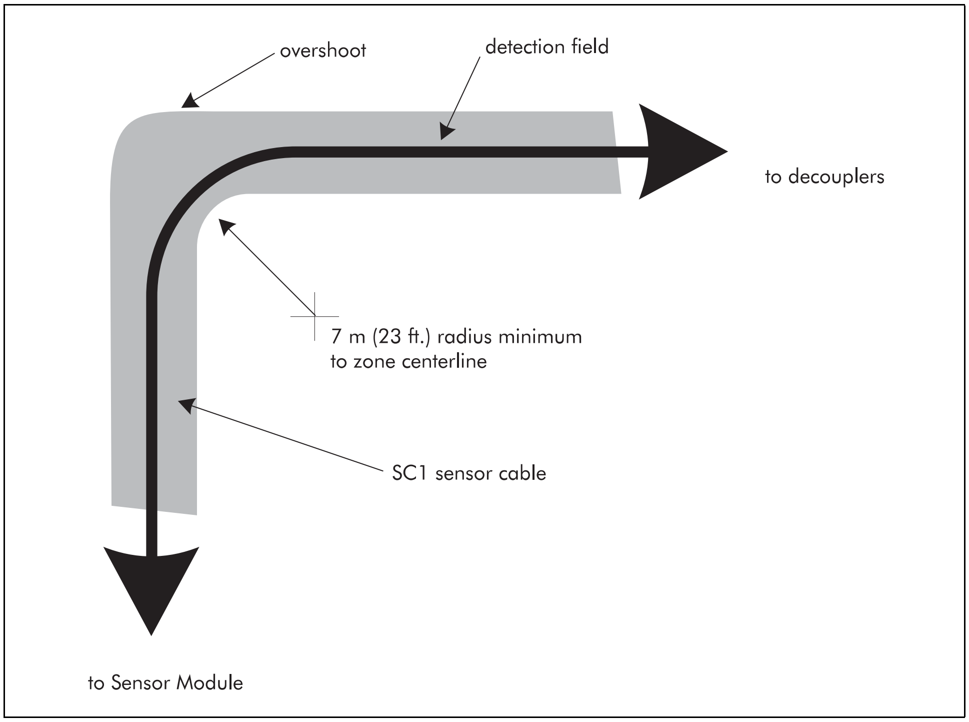
Where there will be no further landscaping activities and minimal surface maintenance, the recommended burial depth of 23 cm (9 in.) will provide adequate long term protection. However, in areas where planting will be an on-going activity, or where future irrigation changes are anticipated, the sensor cable should be protected with some form of non-metallic barrier. Pressure-treated wood planking laid over the cables, or PVC conduit cut lengthwise in a half-circle will provide the necessary protection.

Installation of the full length of a zone in a fully enclosed conduit of any kind is not recommended. However, for roadway and sidewalk crossings the sensor cable can be placed in PVC conduit as follows:

- conduit should be no longer than 7.0 m (23 ft.) and have an inside diameter of 19 mm (¾ in.)
  - **SC2 ▶** for SC2 cable the inside diameter should be 13 mm (½ in.)
- sections should be separated by 1 m (3 ft., 3 in.)
- no more than 3 sections of conduit should be placed in any one zone
- conduit should be sealed at both ends to prevent internal water flow

This conduit is normally installed during construction of the roadway or sidewalk to simplify future sensor cable installation.

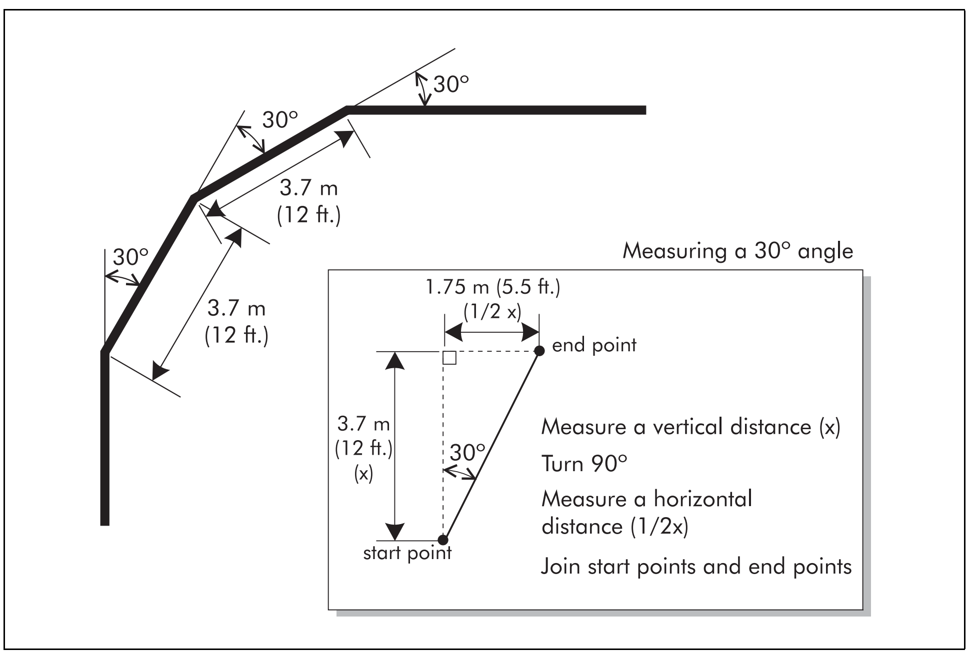
Making gradual turns in soft mediums



❑ Follow a smooth curve with a minimum bend radius of the cable centerline of 7 m (23 ft.).

Making gradual turns in hard mediums

Angles and distances are approximate.



❑ Make 90° turns using three successive turns at a maximum 30° bend, each separated by a minimum of 3.7 m (12 ft.).

SC2

❑ Keep SC2 cables parallel and the same depth around corners (sensor cable spacing is site-dependent).

For large concrete areas that are paved in slabs, place corners in the center of a single slab if possible. Turn corners in the least possible number of slabs.

Separation distances from obstacles

The detection zone centerline should be at least 1.5 m (4 ft., 5 in.) from all obstacles both above and below ground.

Obstacles	Light soil (e.g., sand, gravel)	Asphalt/concrete	Medium soil (e.g., loam)	Heavy soil (e.g., clay)
High quality fence (e.g., welded wire)	3 m (9 ft., 9 in.)	2.5 m (8 ft.)	2.5 m (8 ft.)	2 m (6 ft., 6 in.)
Medium-quality fence (e.g., chain link)	3.5 m (11 ft., 4 in.)	3.2 m (10 ft., 5 in.)	3.2 m (10 ft., 5 in.)	3 m (9 ft., 9 in.)
Low-quality fence (e.g., vinyl coated chain link, razor wire)	5.5 m (18 ft.)	4.5 m (14 ft., 8 in.)	3.5 m (11 ft., 4 in.)	3 m (9 ft., 9 in.)
Cables installed parallel to a building	3 m (9 ft., 9 in.)	2.5 m (8 ft.)	2.5 m (8 ft.)	2 m (6 ft., 6 in.)
Cables terminating perpendicular to a fence or building	7 m (23 ft.)	7 m (23 ft.)	7 m (23 ft.)	7 m (23 ft.)
Moving metallic objects (e.g., cars, bicycles, trucks)	5.5 m (18 ft.)	5.5 m (18 ft.)	5 m (16 ft., 3 in.)	4.5 m (14 ft., 8 in.)
Portable objects (e.g., lumber, cable spools, pipes)	1.5 m (4 ft., 5 in.)	1.5 m (4 ft., 5 in.)	1.5 m (4 ft., 5 in.)	1.5 m (4 ft., 5 in.)
Standing surface water	1.5 m (4 ft., 5 in.)	1.5 m (4 ft., 5 in.)	1.5 m (4 ft., 5 in.)	1.5 m (4 ft., 5 in.)

In general, Perimitrax cables must be placed to avoid obstacles. Obstacles in the detection field may pose a threat to security or may affect the sensor performance.

In all cases the separation distance between the sensor cables and the obstacle is dependent on the type of obstacle and the installation medium where the sensor cables will be installed. The separation distance is measured from the centerline of the detection zone to the object.

For specific separation distances refer to “Separation distances from obstacles” on page 4-5, and “Separation distances for pipes, conduits or electrical cables” on page 4-6. Refer to the *Perimitrax Site planning guide (A3DA0102)* for more detail.

Separation distances are measured from the centerline of the detection field.

Separation distances for pipes, conduits or electrical cables

The separation distances apply to pipes both above and below the sensor cables. The separation distances indicated are minimum requirements. If more space is available, separation distances should be increased.

Pipe/cable, orientation and size	Minimum separation distance
Metallic pipe or electrical cable up to 10 cm (4 in.) diameter parallel to the cable path	lesser of 61 cm (24 in.) from sensor cable or 1 m (3 ft., 3 in.) from detection field center line 61 cm (24 in.) below the cable burial depth for pipe or cable located between the SC2 cable pair
Metallic pipe or electrical cable up to 10 cm (4 in.) diameter perpendicular to the cable path	5 cm (2 in.) from sensor cable (above or below)
Metallic pipe more than 10 cm (4 in.) diameter parallel or perpendicular to the cable path	61 cm (24 in.)
Non-metallic pipe or conduit up to 10 cm (4 in.) diameter may contain wires or running water	61 cm (24 in.) 61 cm (24 in.) below the cable burial depth for pipe or cable located between the SC2 cable pair
Non-metallic pipe more than 10 cm (4 in.) diameter containing wires or running water	1 m (3 ft., 3 in.) (shielding recommended)
Non-metallic pipe carrying water (non-draining sprinkler pipes), parallel to cable path	30 cm (12 in.)
Non-metallic pipe carrying water (non-draining sprinkler pipes), perpendicular to cable path	5 cm (2 in.) from sensor cable (above or below) (shielding recommended)
Aerial pipes or wires suspended over detection field	2 m (6.5 ft.)
Pipes or electrical wires on the ground surface parallel to the sensor cable path	2 m (6.5 ft.)
Buried leaky sensor cables that are not being used	3 m (9.8 ft.)

For more information on obstacles and installation mediums refer to the *Perimitrax Site planning guide* (A3DA0102).

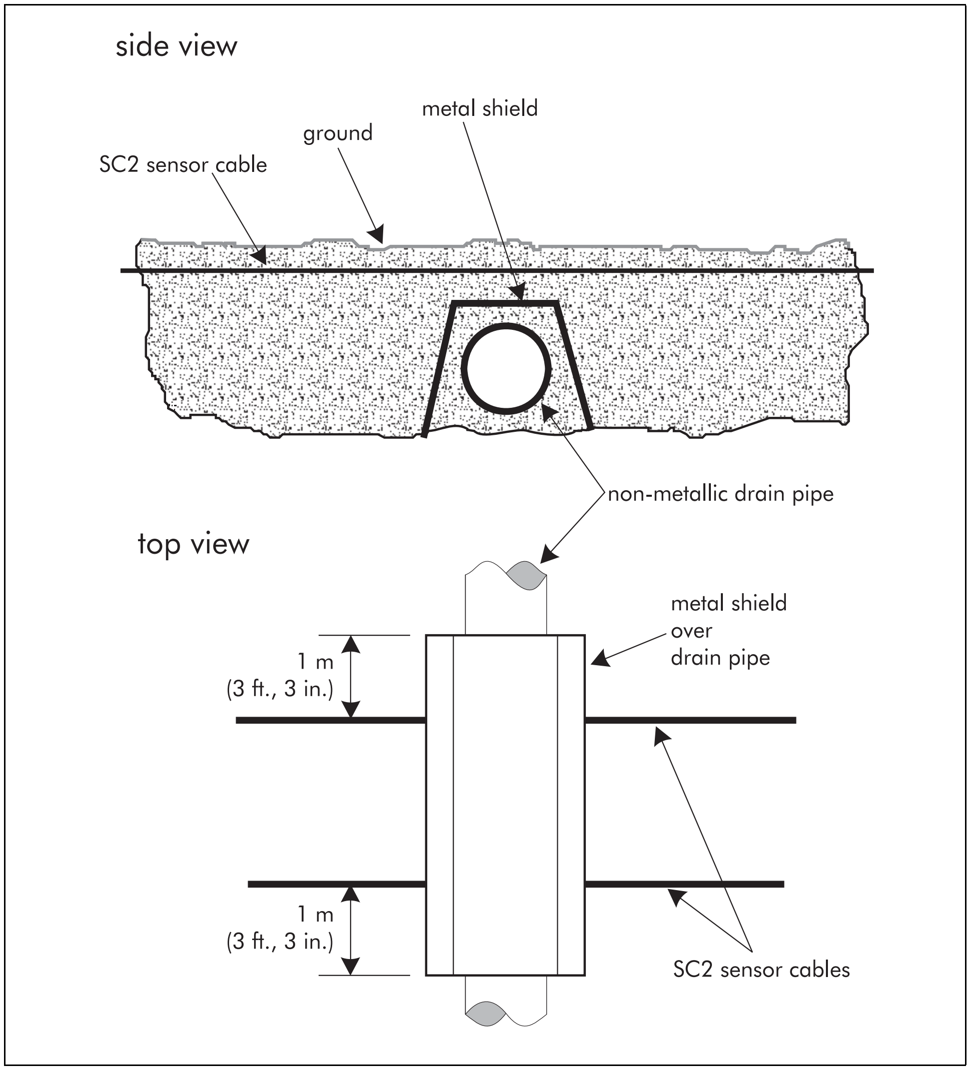
Installation near drainage culverts

❑ Cover concrete or plastic pipes that cross under the sensor cable location with a metallic shield plate or non-degrading metallic foil. Treat the pipe as a metallic pipe when determining separation distances.

Metallic shield plate or foil

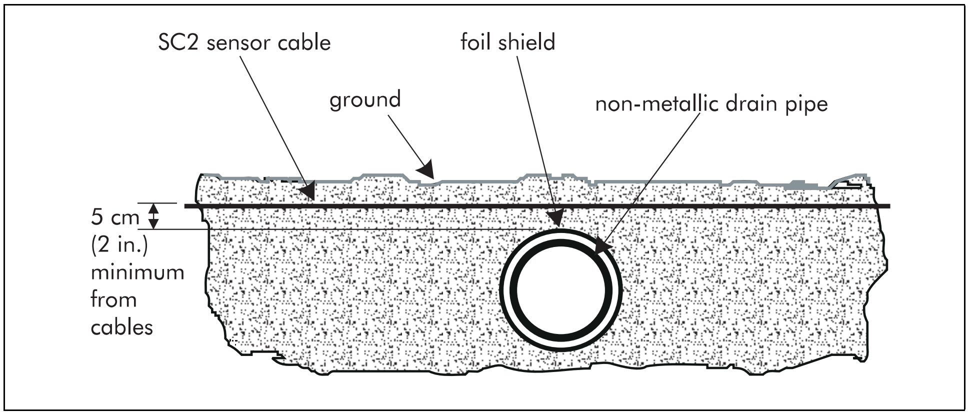
❑ For a non-metallic pipe carrying drain water or sprinkler lines and lying perpendicular to the cable path, wrap the foil around the pipe such that the foil extends for at least 1 m (3 ft., 3 in.) beyond both sides of the cable path.

- For a non-metallic pipe lying parallel to the cable path, the foil should be wrapped around the pipe for the full length of the cable path. The pipe must be at least 61 cm (24 in.) below the cable depth.
- Secure the foil in place with plastic tie wraps or electrical tape.

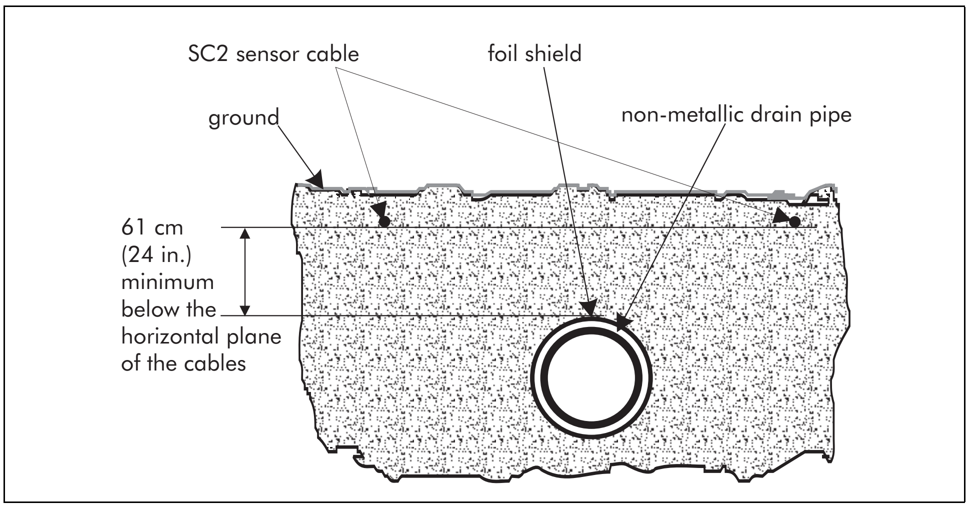


Buried cables with metallic shield

Metallic foil



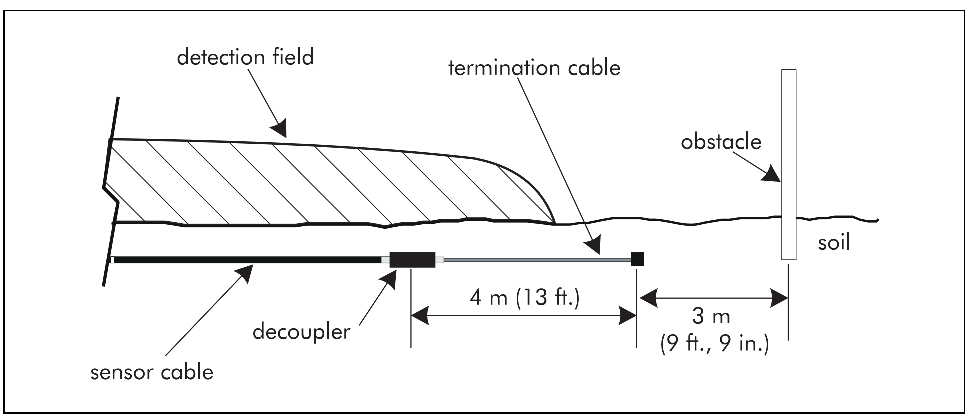
Buried pipe with foil shield



Pipe buried parallel to sensor cables

End of zone obstacles

Detection field dissipation at the decoupler



If the perimeter ends near an obstacle, the decoupler at the end of the perimeter should be located 7 m (23 ft.) from the obstacle.

Preparation of trenches

This section details the procedures required to prepare trenches for the installation of Perimitrax sensor cables in soft mediums including soil, gravel and soil under concrete/asphalt.

Using geotextile fabric in sensor cable installations

Geotextile fabric is recommended for surface or below ground soil-type sensor cable installations. It protects the installed cable from soil erosion and from damage caused by landscaping and maintenance activities.

When used in below ground applications with sensor cables in soft mediums such as soil, gravel or sand, and in areas prone to erosion, the geotextile fabric prevents the protective sand buffer that surrounds the cables from migrating, thus prolonging the installation lifetime. By maintaining a uniform environment for the cables, the geotextile fabric also helps to provide a uniform sensitivity throughout the zone. This is effective in providing a low nuisance alarm rate.

For applications where the sensor cable must run over exposed rock, or where the soil cannot be dug up due to other conditions, Senstar recommends that the cable be installed in a berm enclosed in geotextile fabric.

Required equipment

- landscape marker paint
- measuring tape or tape rule
- pick, shovels and rake
- small trenching machine
- turf cutter or turf remover (as required)
- concrete saw (for installation in trench under concrete/asphalt)
- sand backfill (for rocky soil or gravel under concrete/asphalt)
- Perimitrax sensor cable sets (as required)
- (optional) non-woven geotextile fabric

Trench dimensions

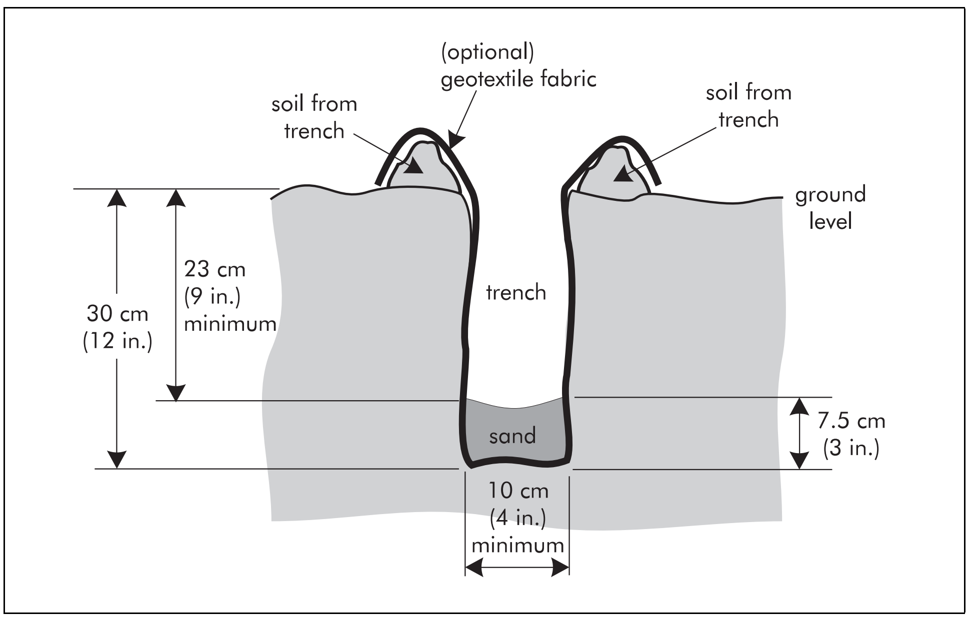
Application	W x D x L	Reference
soil, rocky soil or gravel with a sand buffer	minimum 10 x 30 cm (with 7.5 cm sand in trench) (minimum 4 x 12 in. (with 3 in. sand in trench)	page 4-10
under concrete/asphalt	30 x 38 cm (with 7.5 cm sand in trench) (12 x 15 in. (with 3 in. sand in trench)	page 4-11
transition from slot to trench	minimum 10 x 10 cm sloping to 23 cm for 61 cm from edge of slot (minimum 4 x 4 in. sloping to 9 in. for 24 in. from edge of slot)	page 4-14
soil (without sand buffer)	minimum 10 x 23 cm (minimum 4 x 9 in.)	page 4-10

Digging the trenches

Only dig as many trenches as can be backfilled in one day.

In soil

Dig trench and install Geotextile fabric



❑ If the surface is grass-covered and must be restored after installation, use a turf cutter or turf remover to peel a strip of turf from the sensor cable path.

❑ If a sand buffer is being used dig a trench 10 cm (4 in.) wide x 30 cm (12 in.) deep, otherwise, dig the trench 23 cm (9 in.) deep.

❑ (optional) Lay the geotextile fabric in the trench.

❑ Pour sand buffer in the trench so that its depth is 23 cm (9 in.) for the entire length of the route.

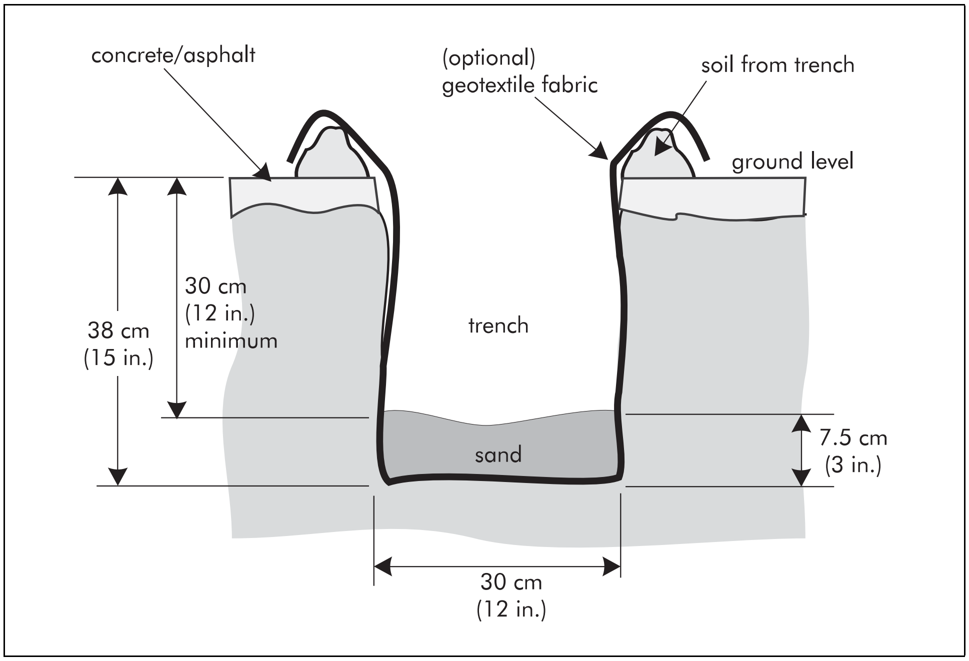
❑ Lay cable in accordance with “Installing the cables” on page 4-18.

SC2 ▶

If SC2 sensor cable is being installed, dig two parallel trenches separated by the distance indicated in the site plan. The separation distance must be kept within ±5 cm (2 in.) for the length of the route.

Under concrete/asphalt

Trench for sensor cable installation under thin, non-reinforced concrete or asphalt



❑ Make two parallel cuts 30 cm (12 in.) apart, centered on the sensor cable route.

❑ Dig up the asphalt/concrete where it has been cut and make a trench 38 cm (15 in.) deep.

❑ (optional) Lay the geotextile fabric in the trench.

❑ Pour sand buffer in the trench so that its depth is 30 cm (12 in.) for the entire length of the route.

❑ Lay cable in accordance with “Installing the cables” on page 4-18.

Boring under non-reinforced concrete

The sensor cable can also be installed under non-reinforced concrete using a boring technique to cut a path under the concrete.

- ❑ Bore a small hole through the soil just below the concrete using pressurized water or compressed air.
- ❑ Feed a PVC conduit through the hole.
- ❑ Pull the sensor cable through the conduit.

  See "Protection of buried cables" on page 4-3 for details on installing cable in conduit.

This method is used most commonly under sidewalks, and other narrow concrete surfaces, as well as under narrow asphalt paths.

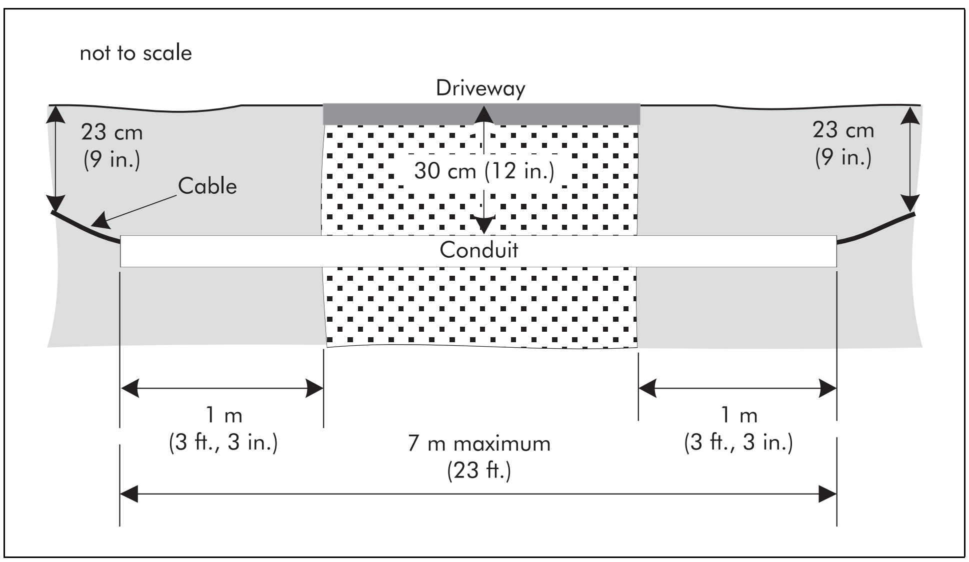
Crossing sidewalks or driveways

- ❑ If a sensor cable crosses a section of concrete or asphalt such as a driveway, it is recommended that the sensor cable(s) be installed in PVC conduit with a 19 mm (3/4 in.) internal diameter, located below the concrete or asphalt section. The maximum recommended length for this conduit is 7 m (23 ft.).

SC2 ▶

If SC2 sensor cable is being used a 13 mm (1/2 in.) internal diameter PVC conduit is recommended for each cable.

Sensor cables installed in conduit under driveway



- ❑ It is recommended that this conduit be laid during site construction to facilitate future Perimitrax sensor cable installation, otherwise refer to "Under concrete/asphalt" on page 4-11.

Preparation of hard-surface slots

This section details the procedures required to prepare slots for the installation of Perimitrax sensor cables in hard mediums including reinforced concrete, or asphalt or concrete that is more than 10 cm (4 in.) thick.

General information

Standard slots are cut around the perimeter. These slots must be modified along the perimeter to accommodate sensor cable overlaps, decouplers, terminators, ferrite beads, expansion joints, large cracks and the transition between slots and trenches. See “Slot dimensions” on page 4-15.

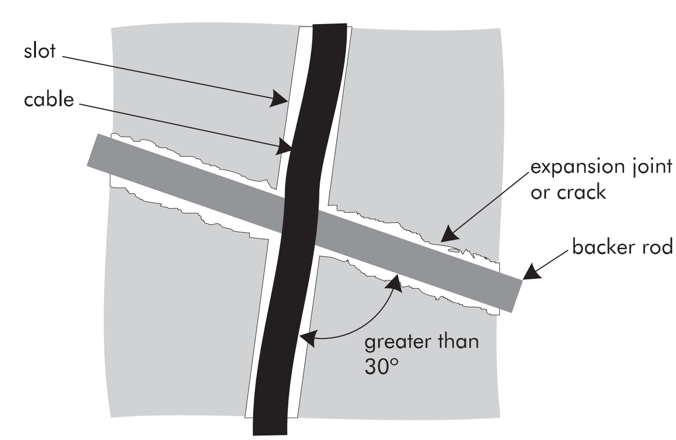
Thin asphalt

If there are areas where the asphalt is so thin that you cut through it, DO NOT continue the slot cutting technique. Install trenches as described in “Preparation of trenches” on page 4-9.

Decoupler and terminator locations

Where decouplers or terminators will be installed in asphalt/concrete, the slots must be modified to accommodate the decoupler or terminator and a slight bend in the cable to provide strain relief. See “Slot dimensions” on page 4-15.

Expansion joints and large cracks



To prevent post-installation surface damage it is recommended that the cable path must cross the crack or expansion joint at an angle greater than 30°.

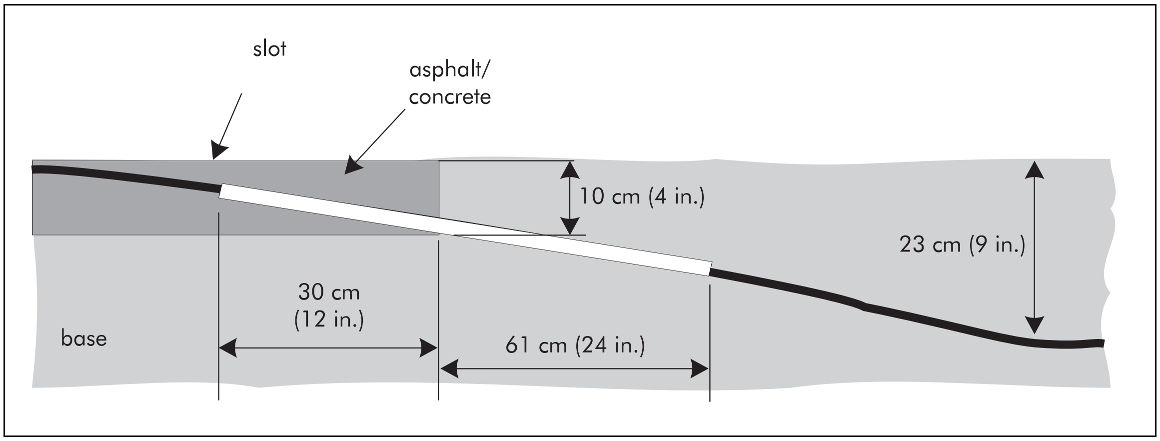
If the crack or joint is deeper than 6.4 cm (2½ in.), insert a flexible foam polyethylene backer rod for at least 30 cm (12 in.) on either side of the slot. The diameter of the backer rod should be slightly larger than the width of the crack or joint.

Use a blunt tool to install the backer rod. The backer rod should be at least 1 cm (3/8 in.) below the surface of the slot and just below the cable depth after it is installed.

Do not route the cable through existing cracks or expansion joints in the asphalt/concrete.

See “Slot dimensions” on page 4-15.

Transition from a slot to a trench



If the cables are routed from a concrete or asphalt medium to a soil medium, the last 30 cm (12 in.) of the slot and the first 61 cm (24 in.) of the trench should be sloped to meet each other. A 10 cm (4 in.) deep cut should result where the different mediums meet. The slots should be modified to accommodate a 30 cm (12 in.) section of PVC pipe. The pipe will help to protect the sensor cables from damage. See “Slot dimensions” on page 4-15.

Required equipment

- site plan
- tape measure
- spray paint, grease pen or water-resistant marker, or chalk line
- concrete saw capable of cutting a slot 1 cm (3/8 in.) wide (ganged blades are recommended for single pass cutting)

- air compressor and hose (the air compressor must have traps to remove moisture and oil from the air)
- water supply and hose
- hammer and cold chisel

Required materials

For additional information, see "Appendix b Recommended installation materials".

- closed cell foam polyethylene backer rods - 2 rows of backer rods per slot (order backer rods that are 3 mm (1/8 in.) wider than the slots into which the backer rod will be installed)
- ABS conduit 0.9 m (3 ft.) long x 7.6 cm - 9 cm (3 - 3½ in.) diameter (required only where terminators or decouplers are installed in concrete/asphalt)
- PVC pipe 30 cm (12 in.) long x 2 cm (¾ in.) inside diameter (required only at media transitions, e.g., concrete to soil)
- joint sealant (to seal the sensor cable(s) in the concrete/asphalt slot) (chemical sealant - minimum 20 liters per 100 m (5.3 US gallons per 328 ft.) of sensor cable) (tape sealant - length of slot + 5%)

Slot dimensions

Application	Slot dimensions
Standard slot	1 cm wide x 6 cm deep (3/8 x 2¼ in.)
Sensor cable crossover	9.5 cm (3¾ in.) deep
Decoupler or terminator	9 cm wide x 90 cm long x 6 cm deep (3½ in. x 3 ft. x 2¼ in.)
In heavy traffic areas	2.5 cm wide x 6 m long x 7 cm deep (1 in. x 19.7 ft. x 2¾ in.)
Expansion joints or large cracks	2.5 cm(1 in.) wide x width of crack or joint + 7.5 cm (3 in.) on each side of crack or joint, > 30º from path of crack
Transition from slot to trench	2.5 cm (1 in.) wide tapered from 6 cm (2½ in.) to 10 cm (4 in.) deep over 30 cm (12 in.)

Cutting the basic slot

- ❑ Mark the cable path using spray paint, grease pen, or a chalk line.
- ❑ Using a concrete saw, cut a basic slot along the marked cable path. To maintain an accurate slot width and depth, cut each slot using a single pass of the saw. Refer to the *Slot dimensions* table for the standard slot dimensions.
- ❑ Check that the slots are the correct depth and that the bottoms of the slots are smooth.

Several diamond-tooth blades can be mounted side-by-side with spacers to achieve the correct slot width. The slot tolerance is 10 + 1 mm - 0.7 mm (3/8 + 1/16 - 1/32 in.).

Modifying basic slots

- ❑ Use additional cuts to widen and deepen the slots where necessary. Refer to the *Slot dimensions* table for appropriate dimensions.

Preparing slots for cable installation

- ❑ At slot corners, use a hammer and cold chisel to remove any sharp edges that could cut into the cable jacket.
- ❑ Remove debris from the slots, cracks and joints, and from an area 30 cm (12 in.) on both sides of the slots. Use water under pressure and brush to remove all slurry. Clean and dry the area using compressed air. Make sure both sides of the slot are clean.

Do not allow dust or dirt to blow into the slots.

Decoupler and terminator locations

The slots need to be widened where decouplers or terminators will be installed in concrete or asphalt. The widened slots provide space to put slight bends (lazy S-pattern) in the cable near the decoupler/terminator, which provides some strain relief. Widened slots also allow space for ABS conduit to be installed over the sensor cable to provide mechanical protection.

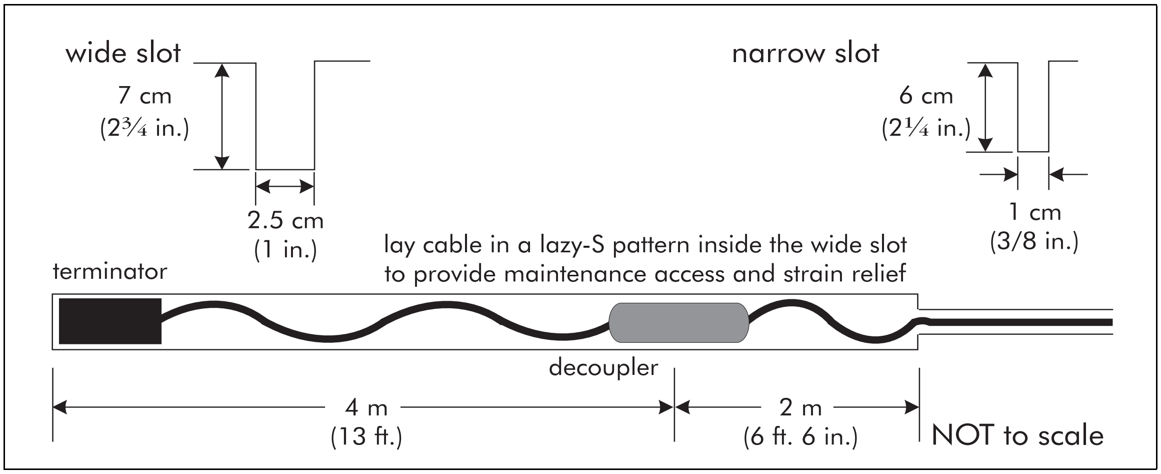
- ❑ Widen the slots to 9 cm (3½ in.) for a length of 0.9 m (3 ft.).
- ❑ Cut a 0.9 m (3 ft.) length of ABS conduit (7.6 - 9 cm (3 - 3½ in.) diameter) in half lengthwise to provide two 0.9 m half-sections.
- ❑ Cover the cable decoupler/terminator assembly with one half-section of the conduit. This protects the assembly and reduces the amount of sealant required to fill the widened slot.

Ensure that there is at least 1.3 cm (½ in.) of space between the top of the conduit and the top of the slot for the sealant.

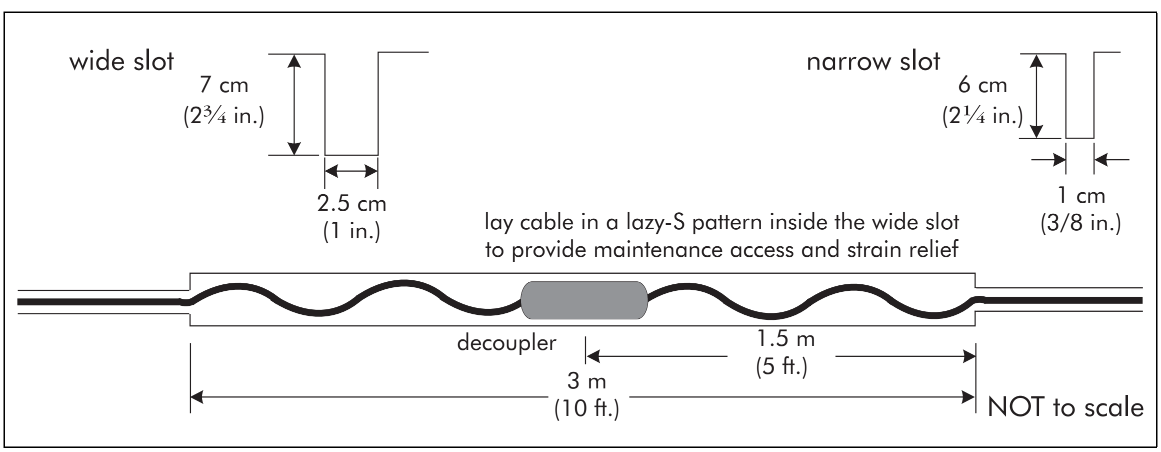
- ❑ Pack the inside and ends of the conduit tightly with backer rod to prevent the sealant from running into the conduit.

Decouplers and terminators in heavy traffic areas

When installing decouplers and terminators in heavy traffic areas such as airport runways, a long narrow slot can be used to prevent damage from the over-passing traffic.



- ❑ For decouplers and terminators, widen the slots to 2.5 cm (1 in.) for a length of 6 m (19. 7 ft.).
- ❑ For decouplers only, widen the slots to 2.5 cm (1 in.) for a length of 3 m (10 ft.).
- ❑ Lay the decoupler/terminator in the slot with a lazy-S pattern in the cable to provide maintenance access and strain relief.
- ❑ Cover the wide slot completely with backer rod. The backer rod must be large enough to compress into the slot and provide a good seal to protect the cables from the sealant.



Installing the cables

Before you begin

Inspect the open trenches and slots. Ensure that the depth is in accordance with “Sensor cable burial depths for different mediums” on page 4-2. Remove any sharp edges or debris that might damage the cables.

If you have not already done so, mark the locations for red marks, sensor cable overlaps, bypasses, etc., in accordance with the site plan.

Points to remember

- do NOT cut off the sealing cap or excess lead-in from the sensor cables until the cable fittings are ready to be installed and connected (This will prevent water from entering the cable.)
- the sensor cables must be kept at a constant depth in order to maintain uniform detection sensitivity (See “Sensor cable burial depths for different mediums” on page 4-2.)

Sensor cable bypass

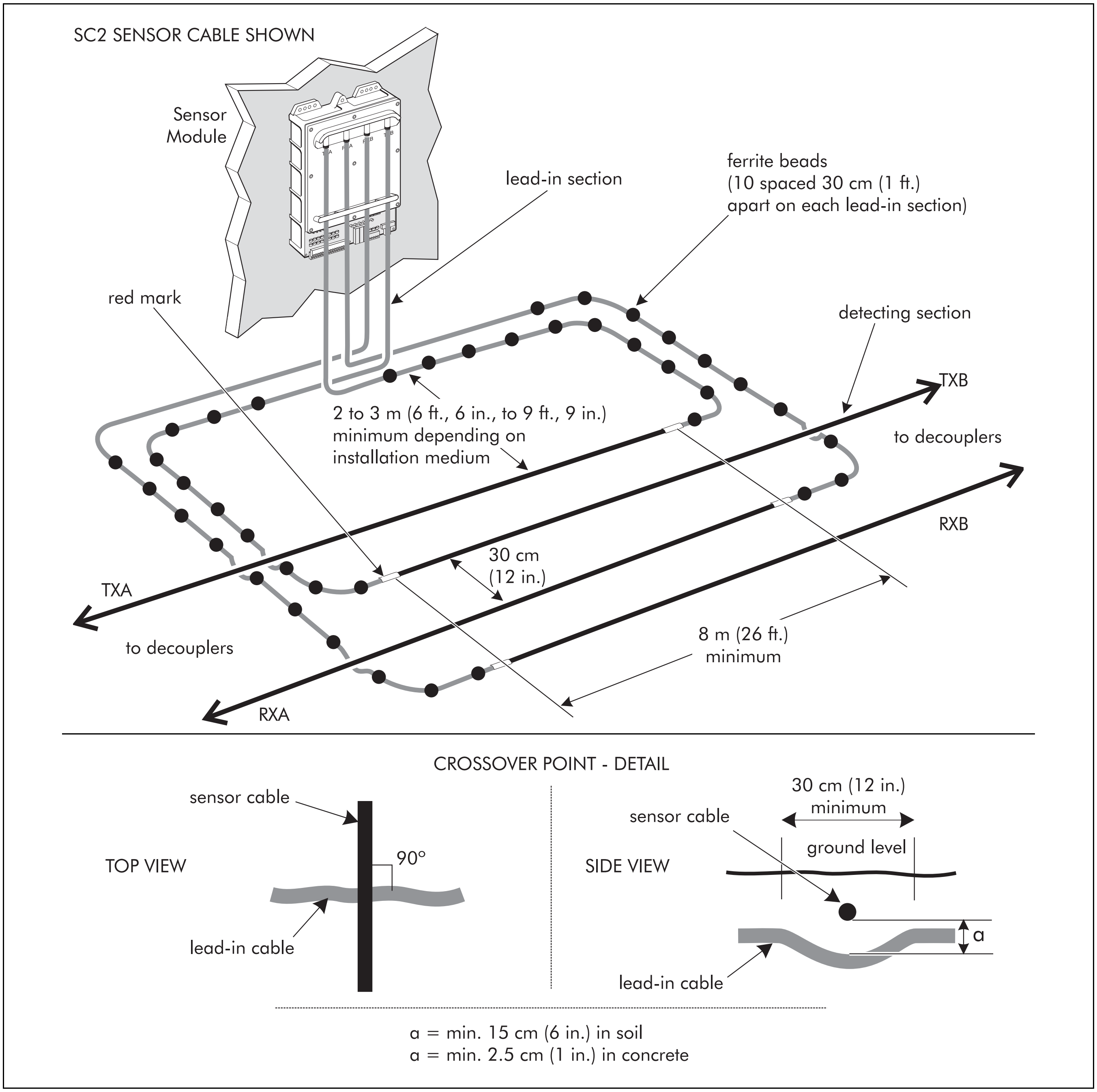
A bypass is a non-detecting section within an active zone. It is used in situations:

- where obstacles block the sensor cable route
- where an area of non-detection is desired (e.g., a gate)
- to cross a fence boundary

A bypass area can be created within an active zone by splicing in lead-in cable in place of the normal detecting cable. When installing a bypass, roll out the entire length of sensor cable required to cover the zone. The bypass or non-detecting section is created by cutting out the length of sensor cable from the area of the bypass and replacing it with non-detecting cable. Refer to Chapter 5, *Cable splice* for specific instructions.

Refer to the *Perimitrax site planning guide* (A3DA0102) for information on designing bypasses.

Sensor cable overlap

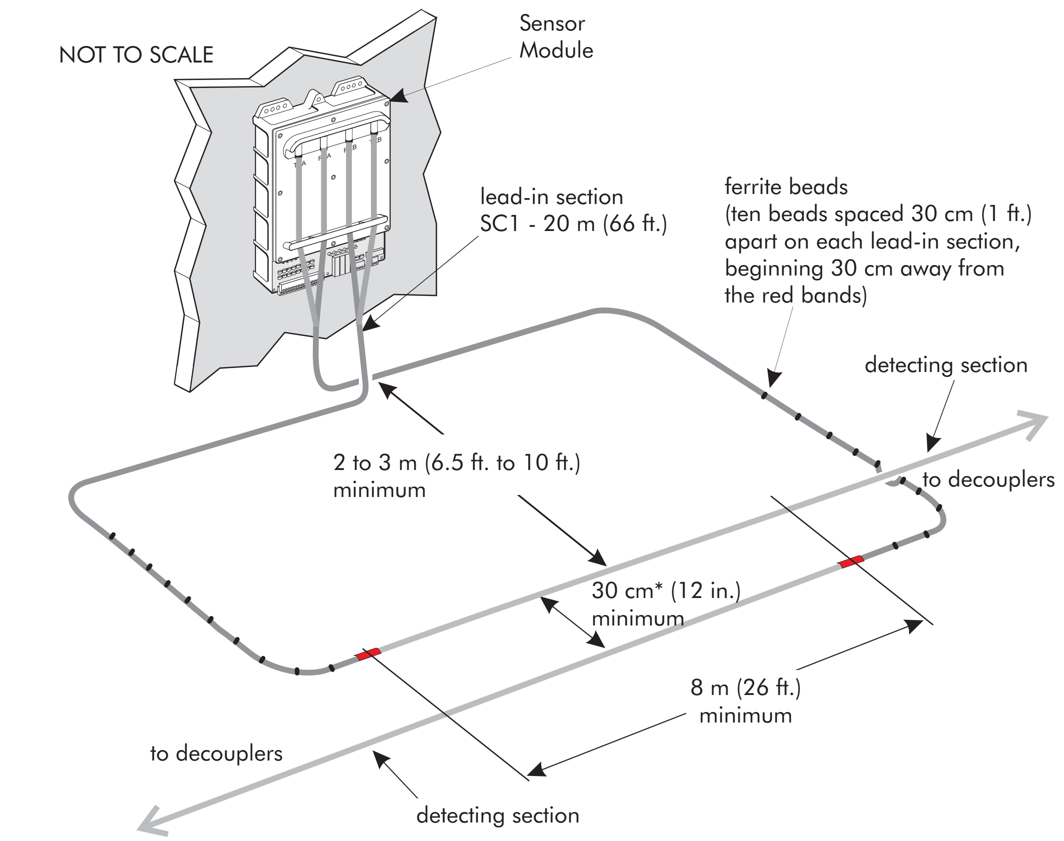


The detection field requires 4 m (13 ft.) from the red mark on the cables to build up to full strength. For configurations where there must be continuous detection between zones, the zones must overlap at the point where the detection field starts up in order to maintain full coverage.

- the cables must cross each other at a 90° angle
- top and bottom cables must **NOT** touch where they crossover
- the detecting section of the sensor cable must maintain a constant depth

- for cables buried in soil there must be a vertical separation of at least 15 cm (6 in.) over a short distance. i.e., the bottom cable (lead-in) must be buried at least 38 cm (15 in.) deep
- for cables buried in concrete there must be a vertical separation of at least 2.5 cm (1 in.) over a short distance. i.e., the bottom cable (lead-in) must be installed in a 8.5 cm (3¼ in.) deep slot

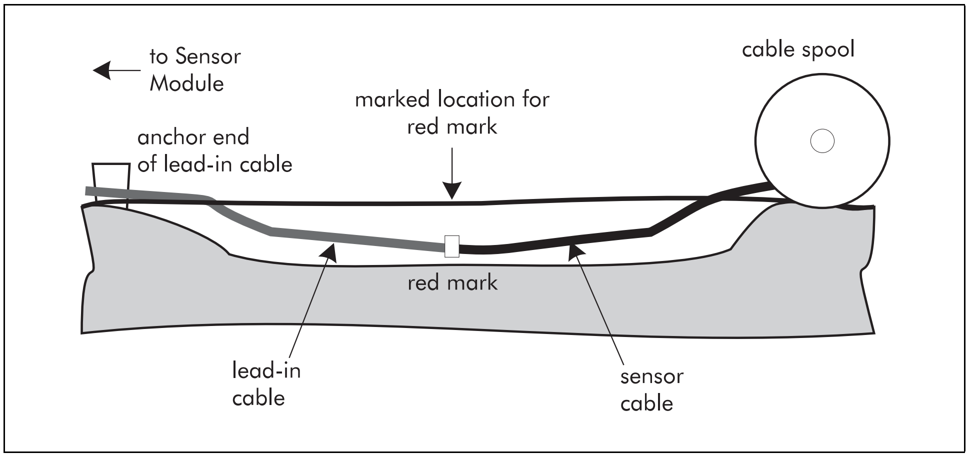
SC1 sensor cable overlap



Required equipment

- Perimitrax sensor cable sets (as required)

Basic cable installation



- ❑ The first 20 m (66 ft.) off of the cable spool is lead-in cable. Unroll the lead-in and lay it out in the trench or slot between the zone end and the Sensor Module location, so that the red mark on the cable is correctly positioned according to the site plan.

SC2 ▶

If SC2 is being installed lay out the lead-in so that the red marks on the cables are parallel to each other at the start of the zone.

- ❑ Ensure that there is enough lead-in to reach from the red mark to the Sensor Module. Keep any excess lead-in loosely coiled temporarily.

The lead-in cable will be cut back as required when the connectors are installed. DO NOT bury excess lead-in cable.

- ❑ Temporarily anchor the sensor cable in the trench at the red mark.
- ❑ Lay the cable in the trench(es) or slot(s).The recommended method of dispensing the sensor cable is as follows:
- ❑ Put a stick, such as a shovel handle, through the hole in the cable spool. With one person on each end of the handle, lift the cable spool and walk along the trench or slot. The cable will be dispensed as you walk.

If there is a coil or loop in the cable after it has been dispensed DO NOT pull it. Roll the coil or loop out to the end of the cable.

- ❑ As the cable is dispensed inspect it for damage.

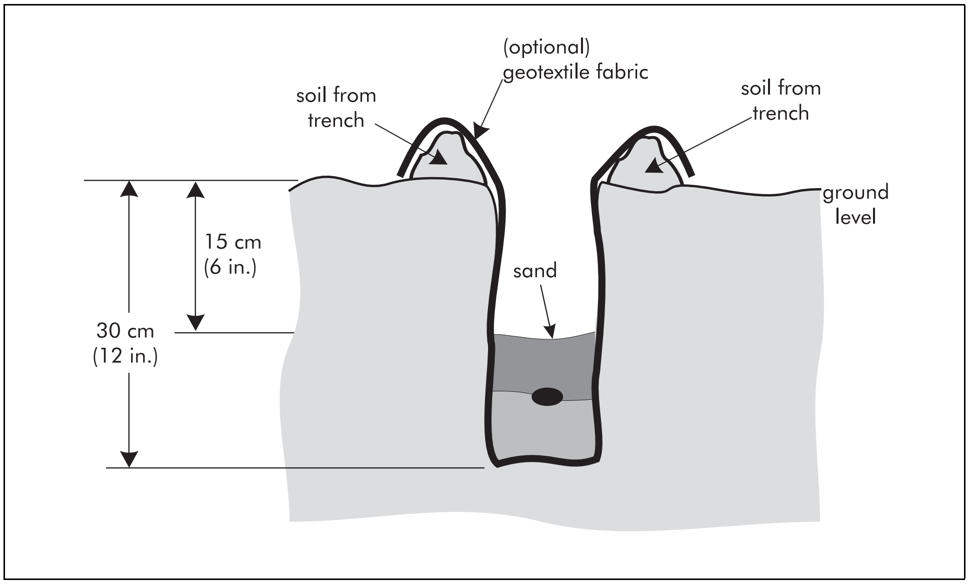
DO NOT install a cable that has a damaged outer jacket. See Chapter 10, Repairing sensor cables for repair information.

❑ Where cables from different zones will be joined with decouplers, temporarily overlap the cables by at least 1 m (3 ft., 3 in.).

❑ Install ferrite beads. See "Installing ferrite beads" on page 5-2.

Backfilling the trenches

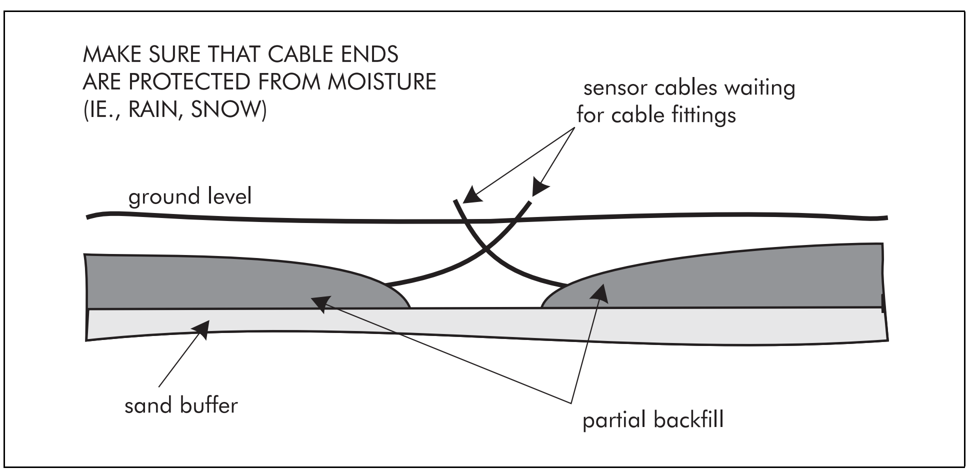
For soil installation



❑ Backfill the trenches with 7.5 cm (3 in.) of sand except at planned decoupler installation locations. Make sure that stones do not fall on or near the cables.

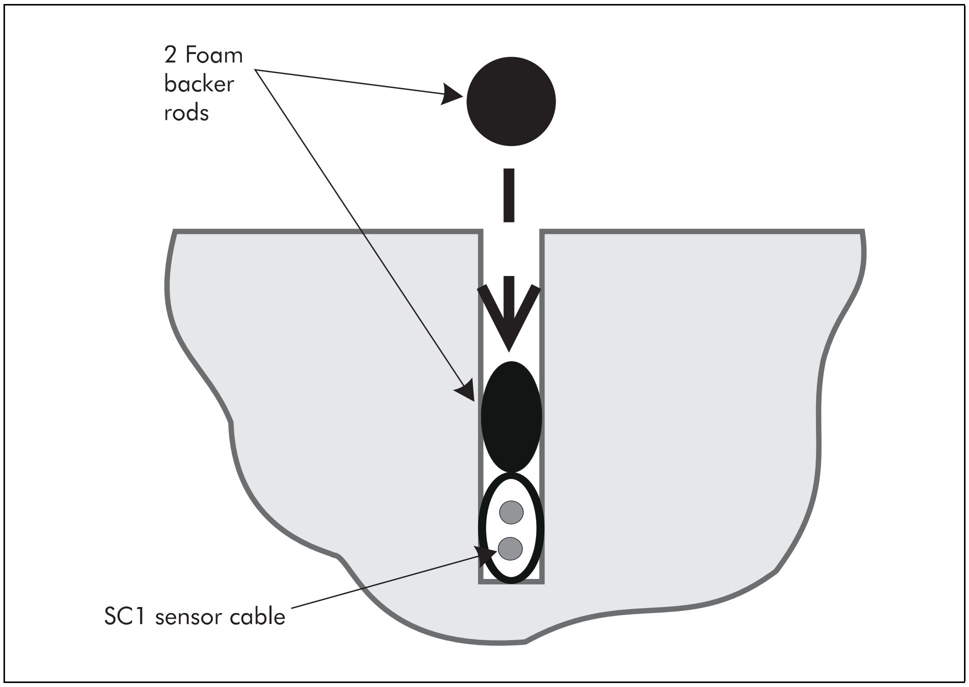
❑ Prior to replacing the soil in the trench, check to see that the cable is lying at a uniform depth of 23 cm (9 in.).

For gravel and concrete/asphalt trench installation



❑ Backfill the trenches with 7.5 cm (3 in.) of sand except at planned decoupler installation locations. Make sure that stones do not fall on or near the cables.

For slot installation



❑ Fill the slots with foam backer rods except at the planned decoupler locations.

For all installations

❑ Route the cables to the Sensor Module location.

❑ Install cable fittings as per Chapter 5, *Installing cable fittings*.

Berm installation using geotextile fabric

This method of installation is used when there is rocky soil or it is necessary to elevate the zone while providing protection from erosion. The geotextile retains the soil around and between the sensor cables.

Fabric specifications

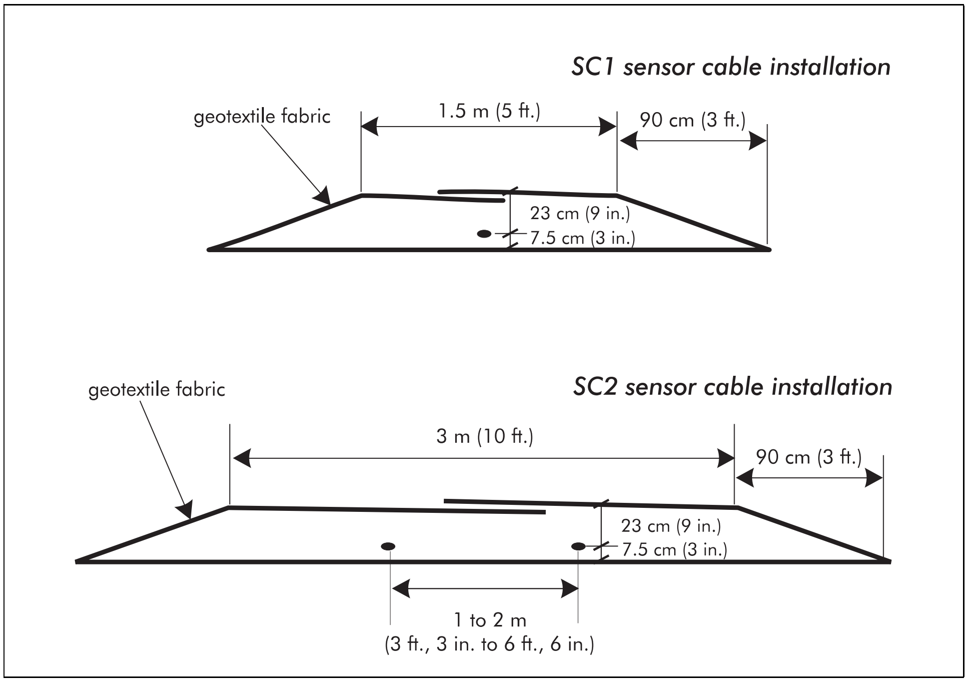
- non-woven geotextile fabric
- width is application-dependent

Installation procedure

SC1 installation

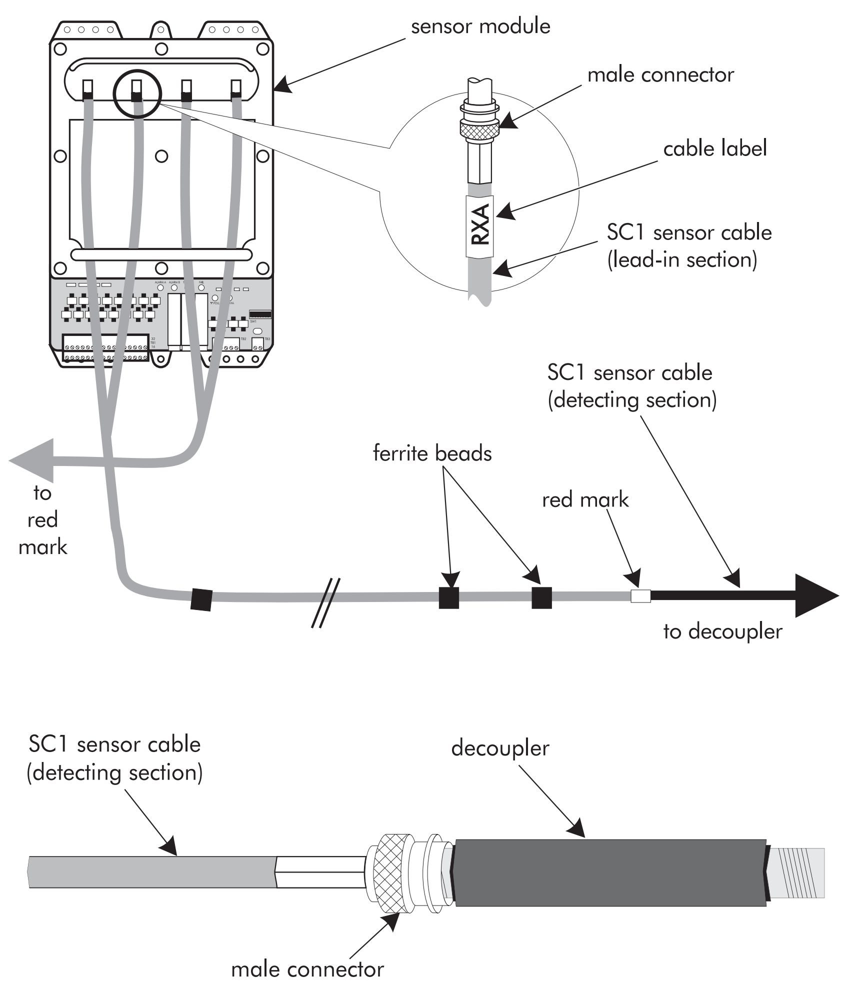
SC2 installation

SC2 ▶



- ❑ Remove any large stones from the ground surface, then roll out the geotextile fabric on the ground.
- ❑ Ensure that the geotextile fabric is large enough to encircle the planned berm.
- ❑ Cover the center portion of the fabric with a layer of sand or stone dust, 7.5 cm (3 in.) deep.
- ❑ Place the sensor cable(s) on top of the sand, then cover with another 23 cm (9 in.) of sand or stone dust.
- ❑ Slope the sides of the berm at a 1:3 ratio or less (depending on severity of erosion expected).
- ❑ Fold the geotextile fabric over the top layer of sand and cover the fabric with a layer of crushed stone. The minimum coverage should be 2.5 cm (1 in.) clear stone. More may be needed if erosion is severe. Ensure that the geotextile fabric is completely covered.

5 Installing cable fittings



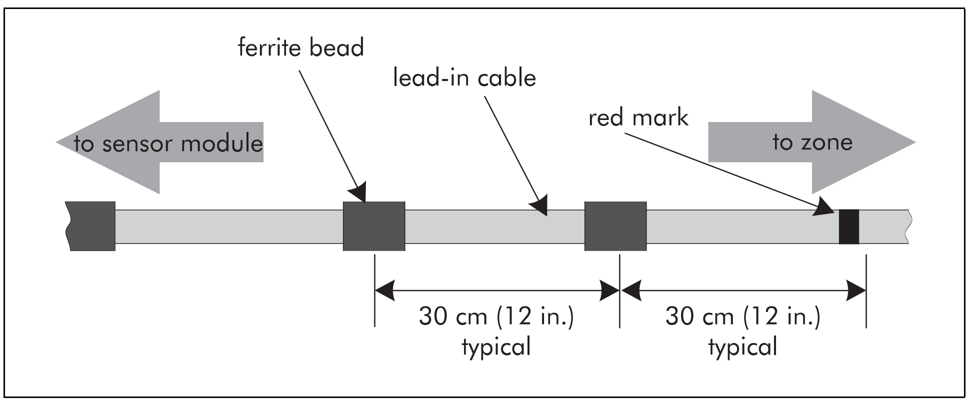
cable label • identification of sensor cables at the Sensor Module	
ferrite beads • place on lead-in cable to Sensor Module • on non-detecting cable in bypassed area • on sensor cable to dampen strong fields	page 5-2
connector • on end of sensor cable and lead-in cable to enable connection to other cable fittings	page 5-3
decoupler • to male connector to enable flow of data and power from one zone to the next	page 5-10
terminator • terminate data on sensor cable	page 5-10

Installing ferrite beads

Points to remember

- ferrite beads must be installed before the cables are buried (see *Basic cable installation* on page 4-19)
- ferrite beads must be installed on the cables before the connectors are installed
- **do NOT** allow the ferrite beads to slide freely and hit each other, they may break
- if a bead breaks at any time during the installation of cables, replace it unless the connector has already been installed
- a minimum of seven beads is required on each lead-in cable
- ferrite beads can be installed on sensor cables buried in asphalt, if the detection signal is too strong (this can be determined when calibrating the system, refer to "Adjusting sensitivity" on page 7-17 for more detail)

Installation procedure



❑ Carefully slide 10 ferrite beads onto each lead-in cable.

❑ Starting at the red mark and measuring toward the Sensor Module, position the ferrite beads. Space the beads approximately 30 cm (12 in.) apart. Secure them in place with tape.

If the lead-in cable is shorter than 3 m (9 ft., 10 in.), reduce the distance between the beads until they are distributed evenly between the red mark and the Sensor Module.

Installing connectors

The connector kits supplied with the Perimitrax system have been designed specifically for the SC1 and SC2 cables. DO NOT substitute any other connectors as this may be detrimental to system performance.

Points to remember

The installation procedure is the same for both male and female connectors.

- all connections must be dry (Trapped moisture can cause corrosion, reduced performance and system failure. Use a heat gun to remove any moisture.)
- do NOT blow on the connector to clean it
- do NOT drop or place the connectors, cable ends, terminators or decouplers on the ground or allow them to get wet or dirty
- do NOT cut the cables to length or put connectors on the cables until just before you connect them to the Sensor Modules, decouplers or terminators (Refer to "Decouplers, terminators & cable splices" on page 5-10 for more detail.)
- the ribbed surface on the outer jackets of the two sensor cables to be connected must line up together
- when connecting cables to the Sensor Module, cut off the excess lead-in, ensuring that you have enough left over to create a service loop (3 m, 10 ft.)

Read each step carefully before attempting the procedure.

Required tools

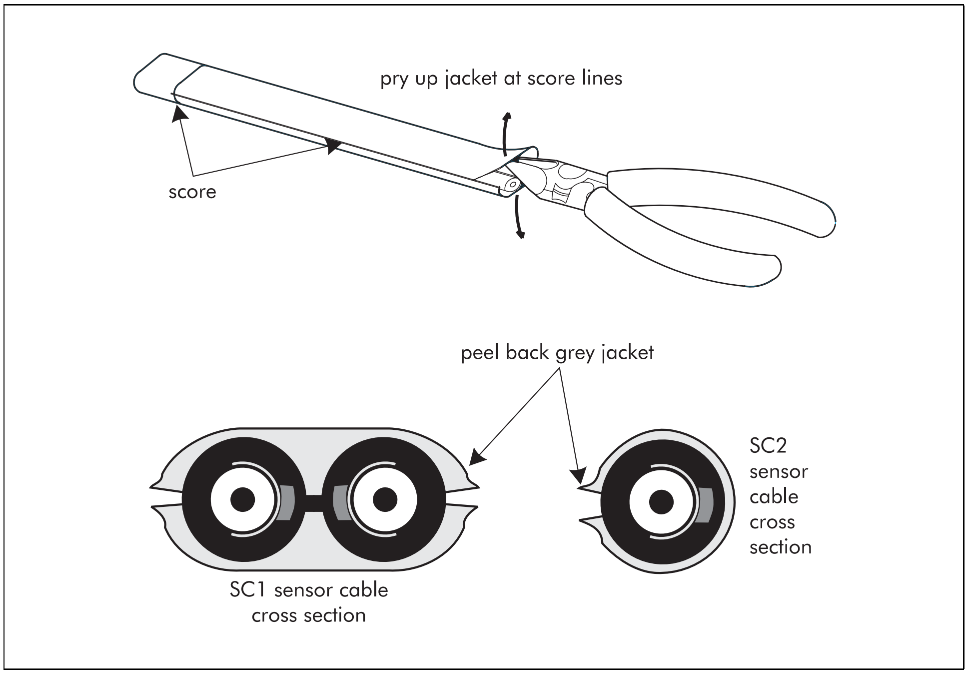
- Perimitrax cable tool kit (Model no. CT3-3) or equivalent including:
  - knife
  - side-cutting pliers
  - crimp tool
  - ruler
- ohmmeter

Preparing the cables

Remove grey outer jacket

Ensure that you do not cut into the coaxial cables underneath the grey jacket. Do not let the knife penetrate more than about 80% of the grey jacket.

Ensure that you do not overbend the cable when removing the jacket (or in any other part of the assembly procedure), as this could damage the cable.



- ❑ Cut the cables to the required length.

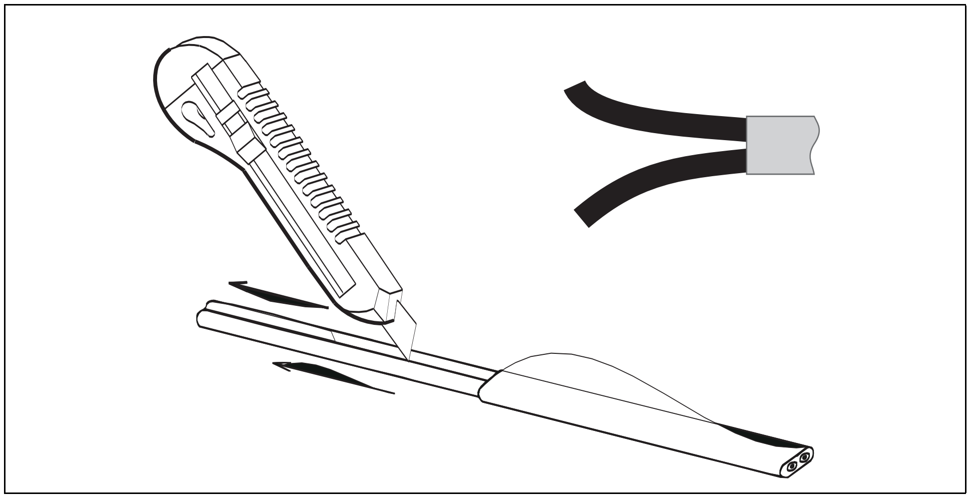
  For old style decouplers (p/n A0EM0100-001 & A0EM0300-001), or terminators (p/n A3CA0100-001) Rev C and earlier, you MUST use the measurements in a Rev M or earlier Perimitrax Installation guide (A3DA0202).

- ❑ Measure the appropriate section of cable to be stripped as follows:
  - *SC1 zone-to-zone continuous detection field* - 25 cm (10 in.)
  - *SC1 termination of data* - 25 cm (10 in.)
  - *SC1 zone bypass or cable splice* - 17 cm (6½ in.)
  - **SC2 ▶** *SC2 sensor cable applications* - 2.5 cm (1 in.)
  - *SC2 at a Sensor Module* - 12.7 cm (5 in.)
  - *SC1 at a Sensor Module* - 30.5 cm (12 in.)
- ❑ Score the outer cable jacket around its circumference and lengthwise from this mark to the end of the cable. Repeat the lengthwise score on the opposite side of the cable.
- ❑ To separate the jacket from the cable work the diagonal cutters into the end of the cable at the score mark and push them up along the score mark until the jacket starts to separate. Do this on the other side as well.
- ❑ Work the cutters into the end of the cable where the grey jacket is thickest and pry up the jacket until it lifts up. Repeat the procedure on the other side of the cable.

❑ When the jacket has lifted away from the cable on both sides, peel back and remove both pieces.

Split the two cables

Ensure that you do not strip the black jacket material from the cables.



❑ Carefully cut the web between the two coaxial cables.

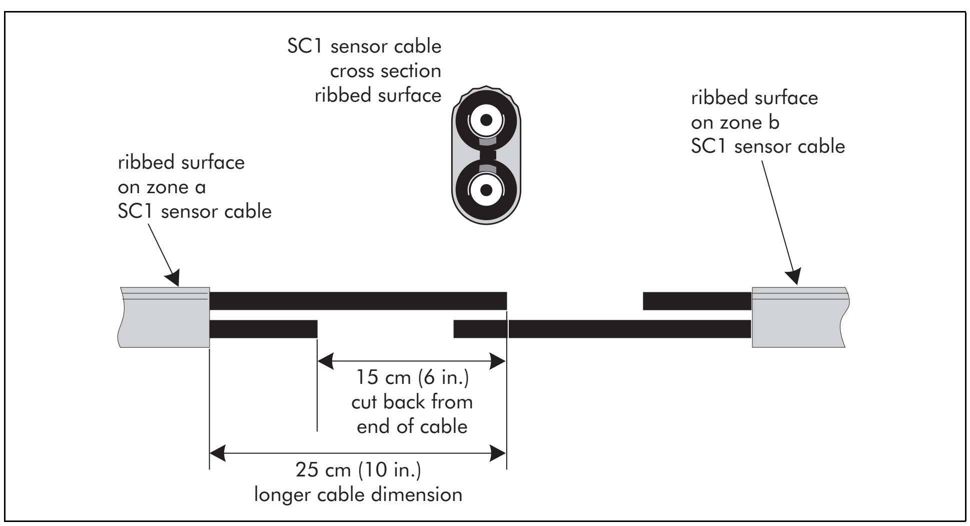
❑ If the cable will be connected to another cable, the two sides of the cable must be staggered such that the ribbing on the two cables lines up.

❑ The dimensions for the staggered cables are as follows:

For old style decouplers (p/n A0EM0100-001 & A0EM0300-001), or terminators (p/n A3CA0100-001) Rev C and earlier, you MUST use the measurements provided in a Rev M or earlier Perimitrax Installation guide.

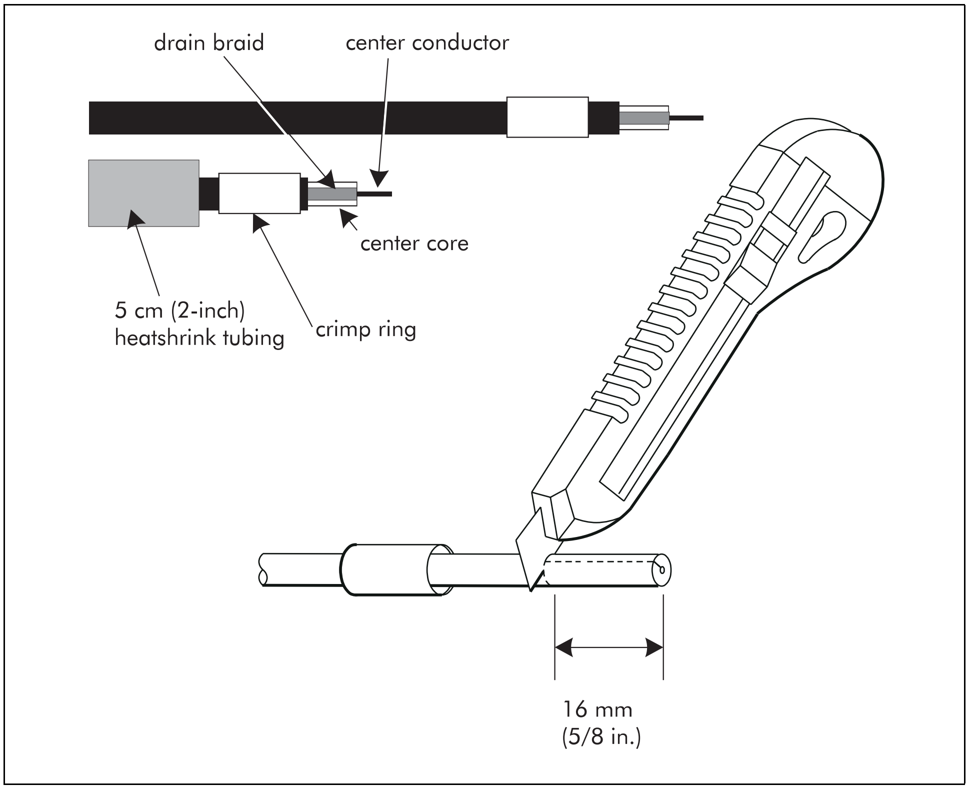
- *for zone-to-zone continuous detection field or data termination applications* - the long cable should be 25 cm (10 in.) long
  shorten the remaining cable by 15 cm (6 in.) from the end of the cable
- *for zone bypass or cable splice applications* - the long cable should be 17 cm (6½ in.) long
  shorten the remaining cable by 6 cm (2½ in.) from the end of the cable

Stagger cables for zone-to-zone connection, for zone-to-bypass connections, or for data termination applications



❑ Slide one crimp ring over each cut cable.

Remove black jacket from each cable



❑ Slide a 5 cm (2-inch) piece of heat shrink tubing over the end of the shorter cable.

SC2 ▶

The 5 cm (2-inch) heatshrink tubing is not required for the SC2 sensor cable installation.

❑ Measure back 16 mm (5/8 in.) from the end of the cable and score 80% through, around the circumference of the black jacket.

❑ Cut the black jacket from the score mark to the end of the cable making sure that you do not cut through the drain braid.

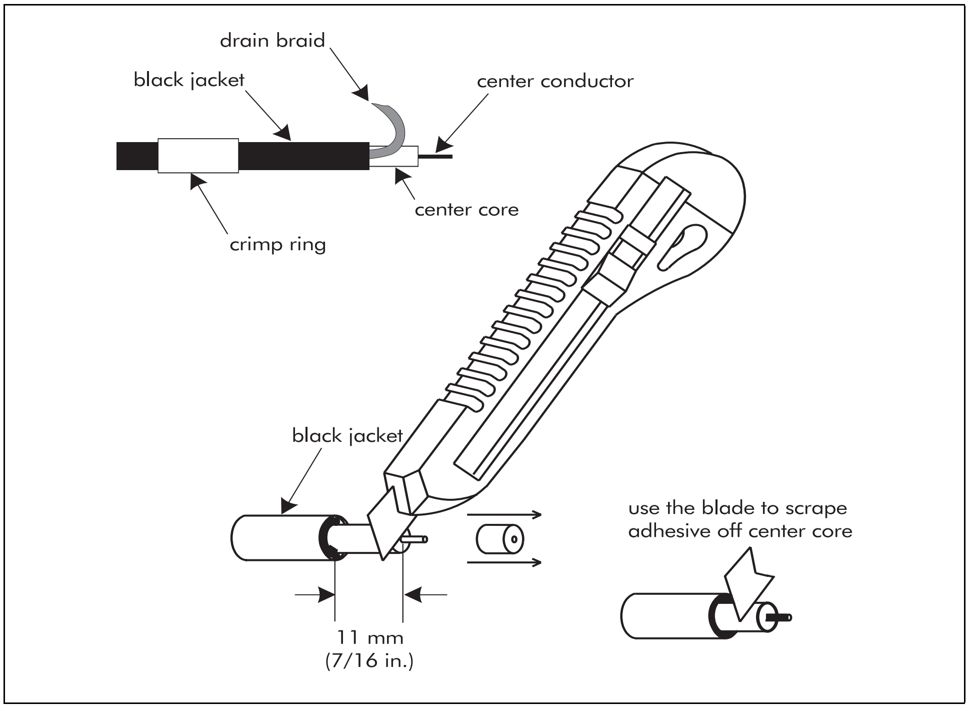
❑ Using pliers, peel the black jacket from the cable and remove it.

If you experience difficulty removing the black jacket, try warming the jacket with a few quick passes of a cigarette lighter. Heat the jacket only until it feels warm to the touch then peel the black jacket from the cable. Excessive heat will damage the cable.

❑ Peel back the drain braid.

❑ Measure 11 mm (7/16 in.) from the black jacket. Cut through the exposed aluminum foil and foam polyethylene dielectric core down to the center conductor.

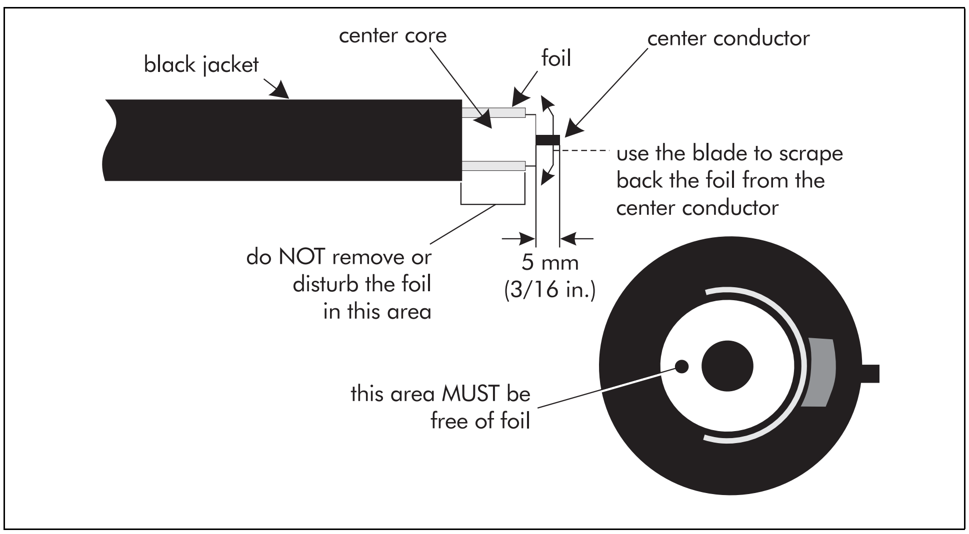
Remove the core



❑ Rotate the knife around the cable when cutting the core, then twist off the remaining section of dielectric, exposing the center conductor.

DO NOT nick the center conductor.

❑ Carefully scrape all of the residual adhesive off the dielectric center core.

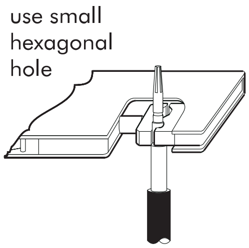


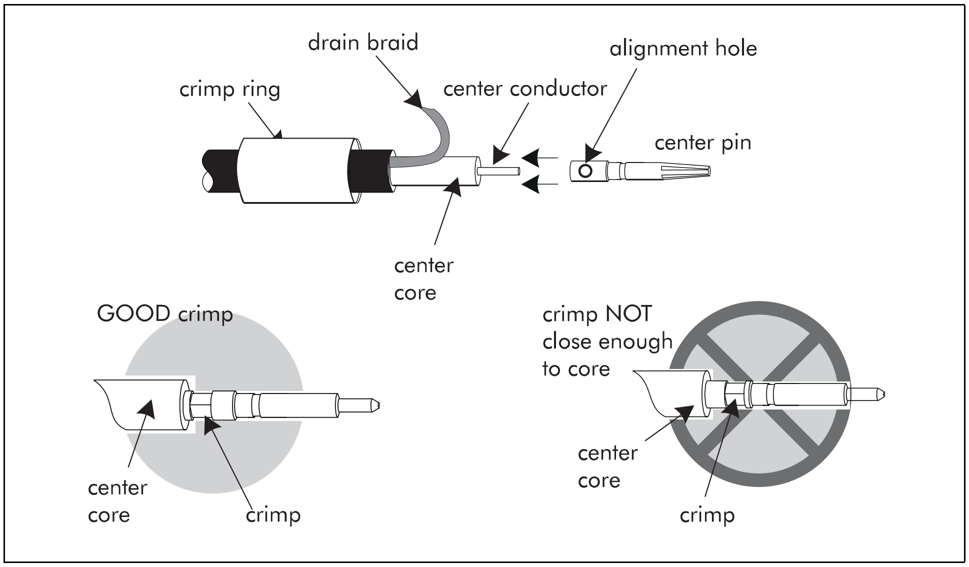
❑ Use the blade to scrape back or trim the aluminum foil from where the dielectric was cut to ensure that no foil is on the center core.

❑ Straighten the center conductor and trim it to a length of 5 mm (3/16 in.) (maximum) if necessary.

Installing the connector

Install center pin on center conductor

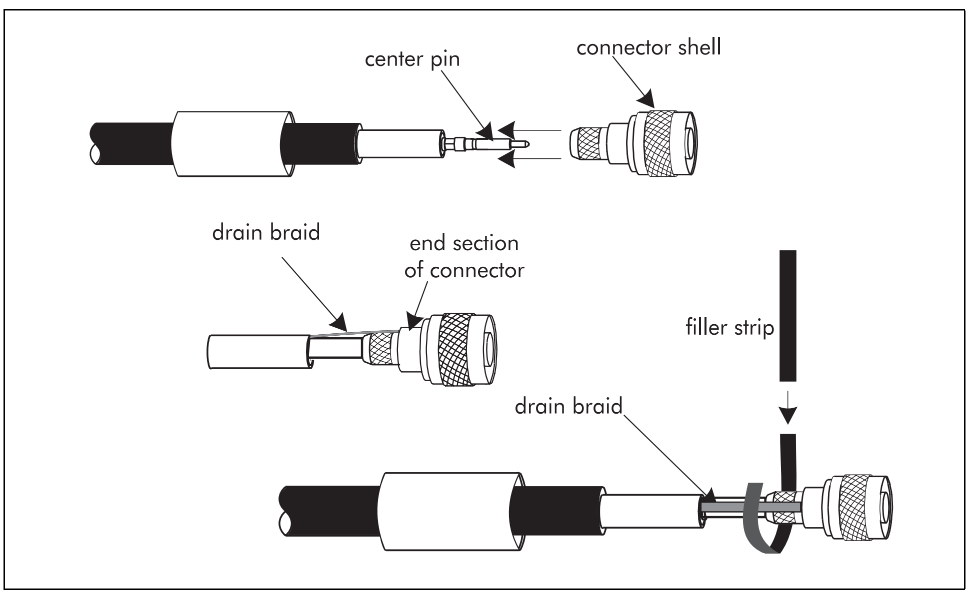




- ❑ Push the center pin over the center conductor.
- ❑ Make sure that you can see the center conductor through the hole in the center pin.
- ❑ Crimp the center pin to the center conductor, using the small hole on the crimp tool.
- ❑ Make sure that the crimp is solidly attached and butted up against the dielectric core on the cable. Check to ensure that the center pin cannot short circuit against the aluminum foil.

Install connector on center pin

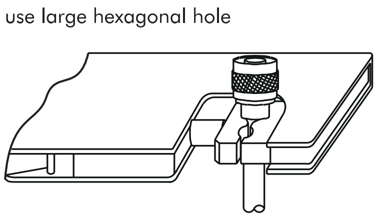
Make sure to butt the trimmed drain braid up against the end of the connector so that it does not interfere with the crimping of the ring.

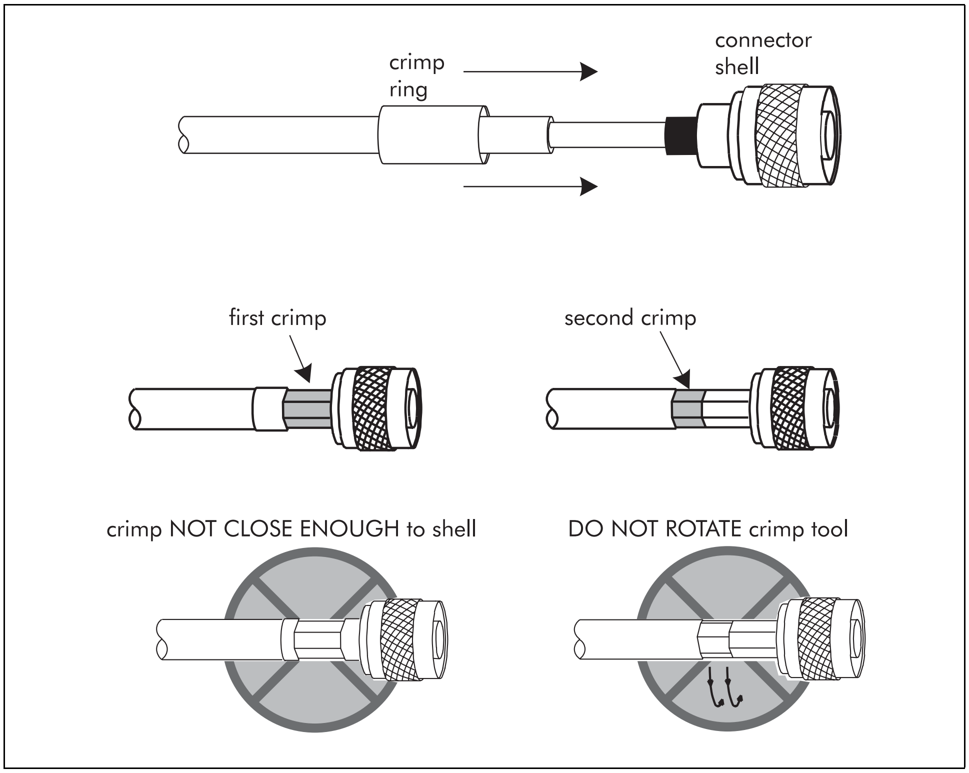


- Push the connector shell over the center pin until it locks into place. The center pin tip should be approximately flush with the end of the connector shell.
- Trim the drain braid so that it butts against the end section of the connector as illustrated.

  Make sure that you can slide the crimp ring so that it butts against the back of the connector.
- Wrap the crimp filler strip over the braid.

Secure crimp ring over connector





- Slide the crimp ring over the crimp filler strip.
- Secure the crimp ring to the shell using the large hexagonal hole on the crimp tool, making sure that you crimp it right up against the shell.
- Slide the cable back slightly and crimp again.

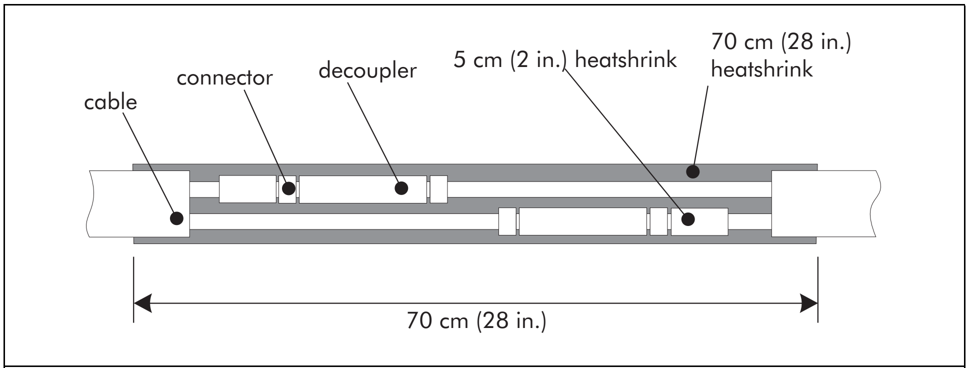
Do not rotate the connector or crimp tool when making the crimp.

- Push the 5 cm (2-inch) heatshrink up against the connector and apply heat evenly to secure the heatshrink in position.
- Test the center pin to shield and shield to ground on all connectors in accordance with the "Cable tests" on page 7-2.

Decouplers, terminators & cable splices

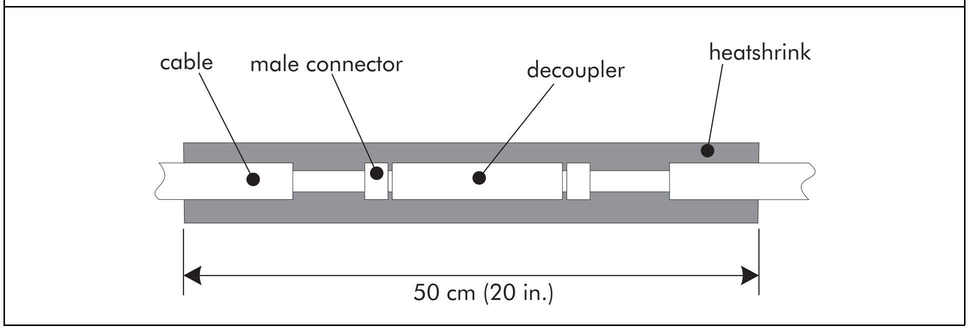
Decouplers

SC1 zone-to-zone continuous detection field



SC2 zone-to-zone continuous detection field

SC2 ▶



There are four decoupler kits available for use with the Perimitrax system. Generally, a decoupler kit includes:

- two decouplers
- heatshrink tubing

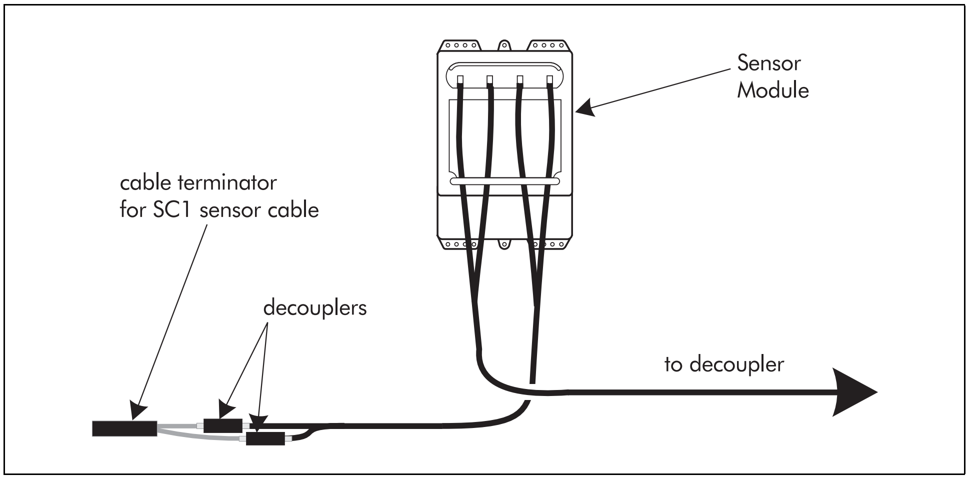
Decoupler kit	Application
Model no. DK1-1	SC1 standalone decoupler
Model no. DK2-1	SC2 standalone decoupler
Model no. DK1-2	SC1 network decoupler
Model no. DK2-2	SC2 network decoupler

Cable Terminators

Terminators must be attached to decouplers:

- at any zone end which is not connected to another, or
- at an unused zone

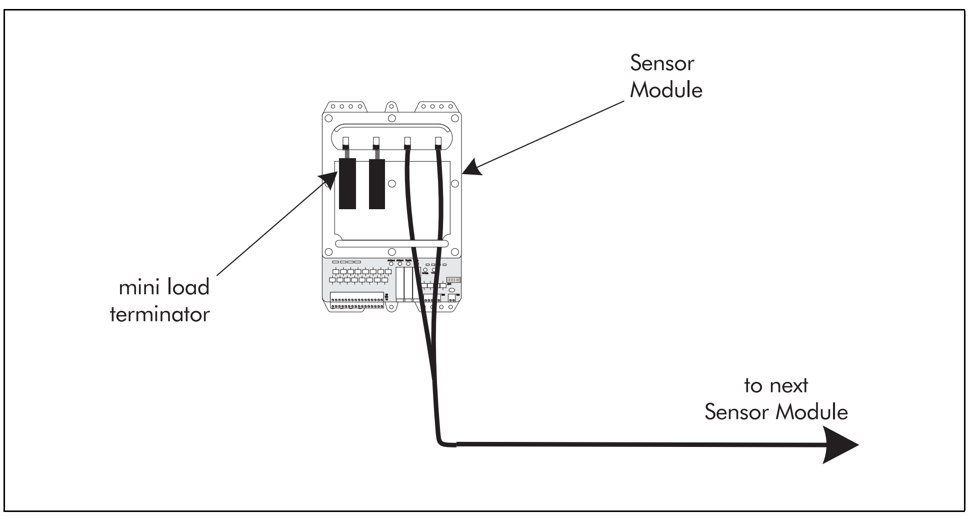
Cable terminator



Three terminator kits are available:

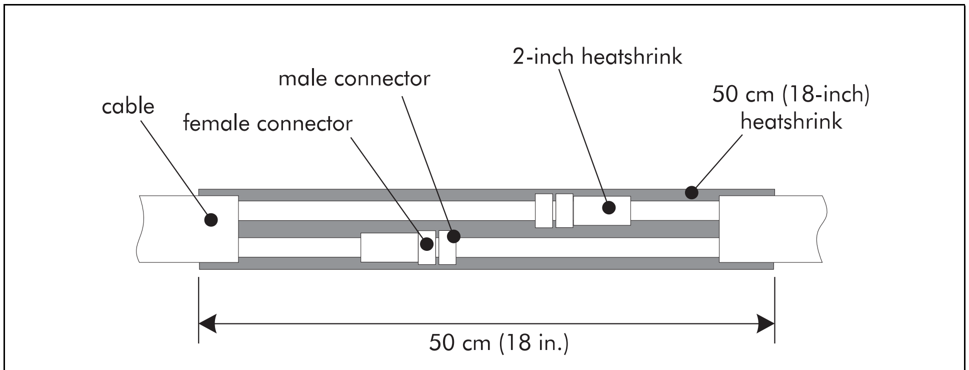
- single cable, detection zone terminator (one terminator cable) (Model no. TK1-4)
- dual cable, detection zone terminator (two terminator cables) (Model no. TK2-4)
- mini load terminator (two terminators) (Model no. ML1-1)
  The mini load terminator is attached directly to the Sensor Module to prevent false alarms from occurring on the unused zone.

Unused zone terminator



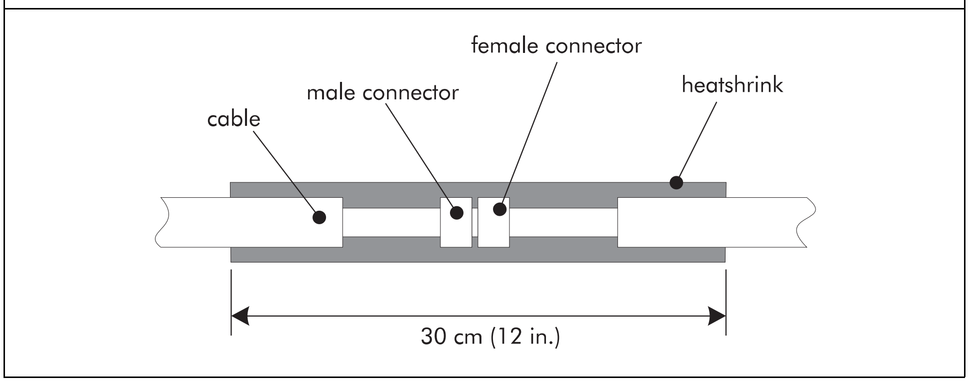
Cable splices

SC1 zone bypass or cable splice



SC2 zone bypass or cable splice

SC2 ▶



A cable splice is used either to replace a damaged section of cable with new detecting cable, to augment lead-in cable or to create an area of non-detection within a sensor zone.

Required equipment

- cable set splice kit (Model no. RK1-1 or RK2-1)
- (for a cable bypass) lead-in cable, the length of the bypass
  - one piece for SC1 sensor cable
  - two pieces for SC2 sensor cable
- cable set tool kit (Model no. CT3-3)
- heat gun or propane torch

Points to remember

- cut the replacement cable slightly longer than the length of cable that has been removed
- cut out the cable that is being replaced
  If a bypass is being installed, label and store the detecting cable.
- ferrite beads and connectors must be installed before decouplers and terminators

- decouplers, terminators and connectors that are to be buried must be covered with heatshrink tubing that contains a sealant compound
- heatshrink tubing is not required on connections that will be indoors
- decouplers should be installed within 1 m (3 ft., 3 in.) of the desired zone boundaries

Cable splice installation note

A cable splice or zone bypass does not require decouplers. If you are installing one of these two options disregard references to decouplers.

SC2 sensor cable installation note

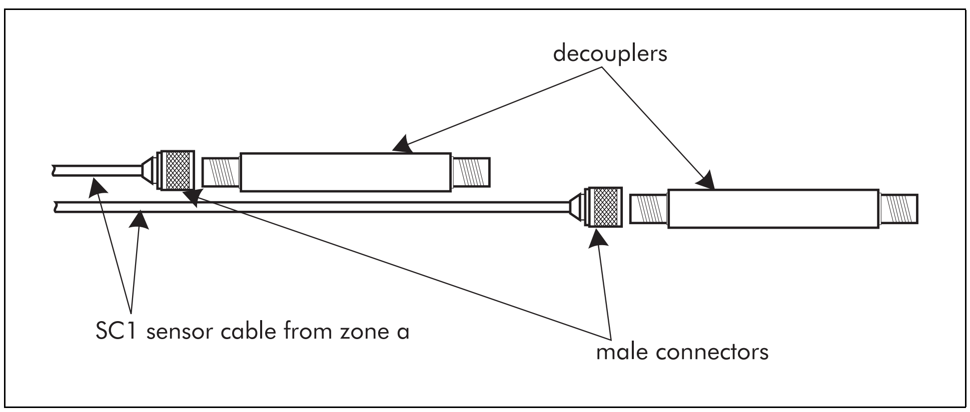
SC2 ▶

Since the SC2 sensor cables are installed in two separate trenches or slots the decouplers do not need to be staggered. If SC2 sensor cables are being installed, any reference to staggered decouplers can be disregarded unless specified otherwise.

Installation procedure

❑ Cut the sensor cable(s) from **zone a** to the required length.

❑ Install one male connector on the end of each **zone a** cable following the procedure in "Installing connectors" on page 5-3.

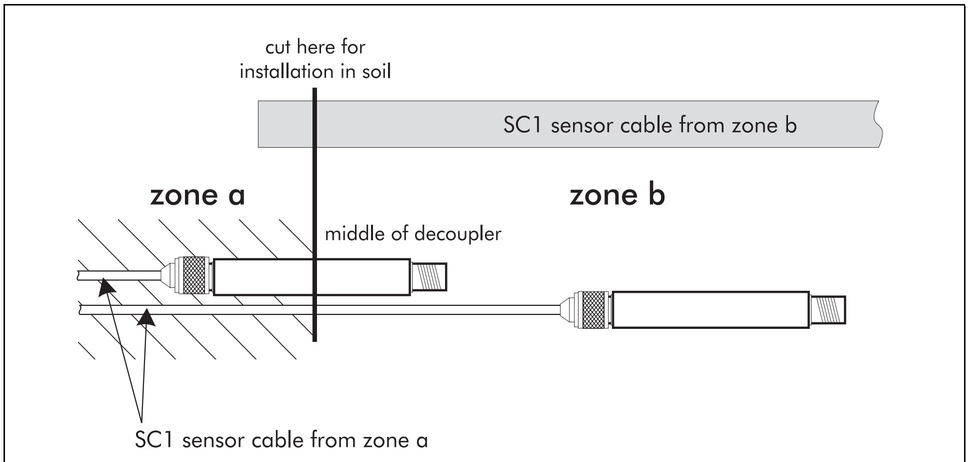


❑ Hand tighten each **zone a** male connector onto a decoupler.

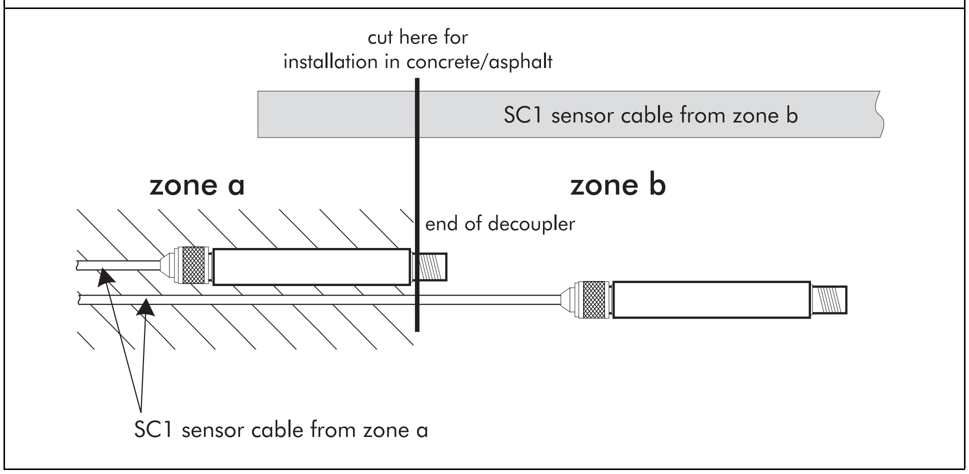
When attaching connectors turn the threaded head shell only.

DO NOT turn the decoupler.

zone b cut for installation in soil



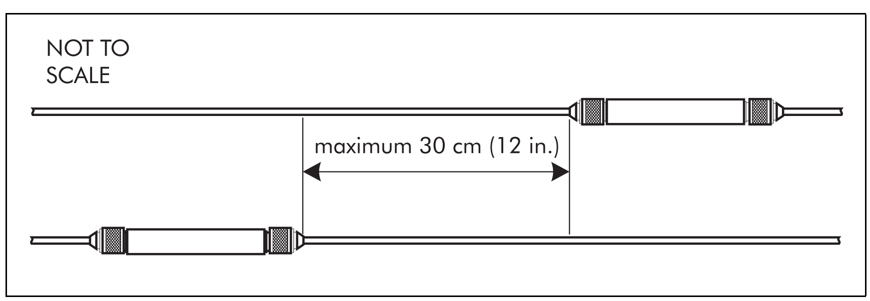
zone b cut for installation in concrete/asphalt



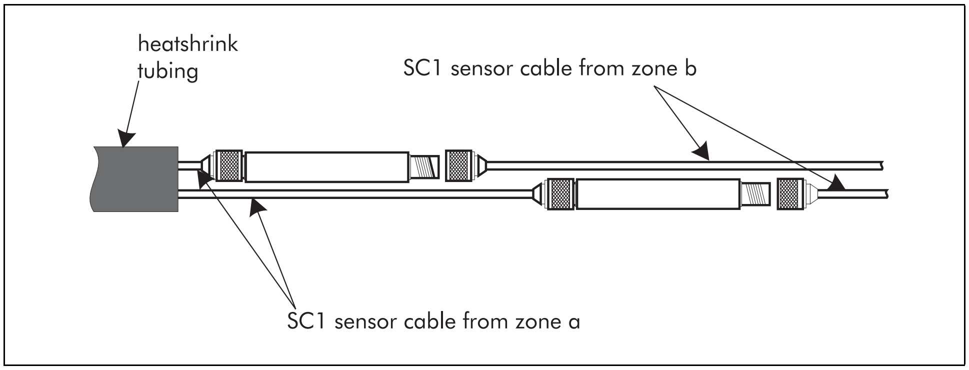
- ❑ Cut the sensor cable(s) from **zone b** to the required length as follows:
  - ❑ If the sensor cable is installed in soil, cut the cable so that the longer cable will reach to the middle of the decoupler that is attached to the shorter **zone a** cable.
  - ❑ If the sensor cable is installed in concrete/asphalt, cut the cable so that the longer cable will reach to the **zone b** end of the decoupler that is attached to the shorter **zone a** cable.

SC2

If SC2 sensor cable is being installed the decouplers on the two cables should be approximately parallel to each other with no more than 30 cm (12 in.) difference in position.



Install heatshrink tubing



❑ Slide a piece of heatshrink tubing over the **zone a** cables.

❑ Install one male connector on the end of each **zone b** cable following the procedure in "Installing connectors" on page 5-3.

*Make sure that the ribs on the **zone a** cable and the ribs on the **zone b** cable line up before staggering the **zone b** cable. See the Staggering cables figure on page 5-5.*

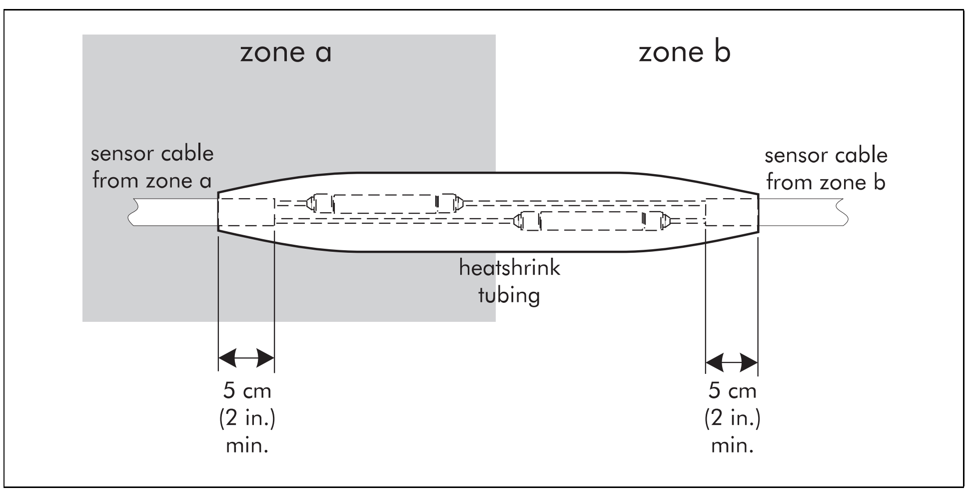
❑ Hand tighten the **zone b** connectors onto the corresponding decouplers on the **zone a** cable. (i.e. ribbed surface side to ribbed surface side, non-ribbed surface side to non-ribbed surface.)

*Ensure that the receive cable of **zone a** is connected to the receive cable of **zone b**, and the transmit cable of **zone a** to the transmit cable of **zone b**.*

❑ Cable continuity testing should be performed at this point in accordance with "Cable tests" on page 7-2.

Secure heatshrink tubing

Be careful not to burn the heatshrink or melt the cable jacket.



❑ Center the heatshrink tubing over the sensor cable connection.

At least 5 cm (2 in.) of grey jacket on each side of the connection must be covered by heatshrink material.

- ❑ Starting from the center and working towards each end, apply heat evenly all the way around the heatshrink. Use only enough heat to completely collapse the heatshrink.

Do not twist the cable while heating the heatshrink, as this could cause internal damage to the cables and connectors.

The process is complete when sealant begins to appear at the end of the heatshrink. Do not disturb the heatshrink until it has cooled down.

- ❑ Lay the decouplers and cables in a gradual, horizontal S-curve to relieve strain on the decoupler connection.

In concrete/asphalt, the cables may have to be pulled along in the slots until slack in the cable disappears. In a zone with a combination of soil and concrete/asphalt, the cables can be pulled through the slots to the soil, where the slack can be accommodated. Do not pull the cables so much that the strain-relief curve disappears.

Bury and seal the decouplers/terminators according to the procedures for each medium. Bury decouplers/terminators at the same depth as the cables. If installing in concrete/asphalt, place a metal or fiber-board plate over the slots at the decouplers to prevent them from being damaged while the sealant cures. Ensure that you remove the plate before operating the system.

6 Installing the SM and FPM

For protection from vandalism, tampering and/or weather, each Sensor Module must be installed in an enclosure. Sensor Modules can be installed in weatherproof or Telecom style enclosures, or other suitable enclosure.

Depending on the site requirements, each Sensor Module is installed in an enclosure alone, or with a Field Power Module.

Before you begin

Check the site plan for the following information:

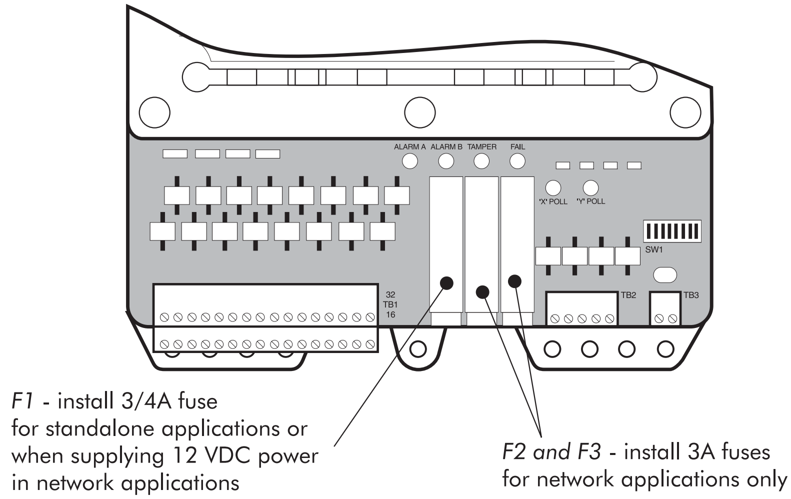
- the correct location and type of Sensor Module enclosure
- if a Field Power Module is installed in the same enclosure
- what fusing is required for the Sensor Module
- if the Sensor Module is to have a local interface assembly installed on it (not applicable for SMDT01)

Details for installing the SM and the FPM are found at these locations:

Description	Reference
Selecting the Sensor Module fuses	page 6-2
Installing the local interface assembly in the Sensor Module	page 6-6
Installation in a weatherproof enclosure	page 6-7
Installation in a Telecom style enclosure	page 6-10
Installation in a customer supplied enclosure	page 6-13
Making SM I/O wiring connections	page 6-14
Making SM settings	page 6-16

To install the Sennet Network Controller refer to the *Sennet product guide (M0DA0302)*. Once all SMs and FPMs are installed and the wiring connections have been made, proceed to checkout system.

Fuse selection guidelines



Two sets of fuse holders and fuses are shipped with the Sensor Module. North American applications use the grey fuse holders and European applications use the black ones.

The following table lists the fuse functions and values for North American and European applications.

Fuse	**Function**	**North America ¼ X 1¼ in.**	**Europe 5 mm X 20 mm**
F1	12 VDC power fuse	¾ A 250 V fast blow	800 mA 250 V fast blow
F2	Rx cable power fuse	3 A 250 V fast blow	3.15 A 250 V fast blow
F3	Tx cable power fuse	3 A 250 V fast blow	3.15 A 250 V fast blow

Fuse function and value table

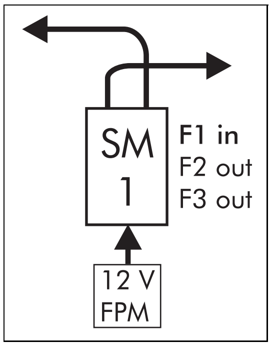
The basic configurations for power source and fuse selection are described in this section.

Power Source	Fuses	Ref.	Power Source	Fuses	Ref.
12 VDC field power module (FPM) (network and standalone)	F1	page 6-3	48 VDC redundant FPM (network power distributed — Rx cable)	F2	page 6-4
12 VDC output power to auxiliary device	F1	page 6-3	48 VDC redundant FPM (network power distributed — Tx cable)	F3	page 6-4
48 VDC FPM (connected directly to a 48 VDC FPM)	F2 & F3	page 6-4	48 VDC through the sensor cables (not connected directly to a 48 VDC FPM)	DO NOT install F2 or F3	

Power source and fuse selection table

Fuse F1

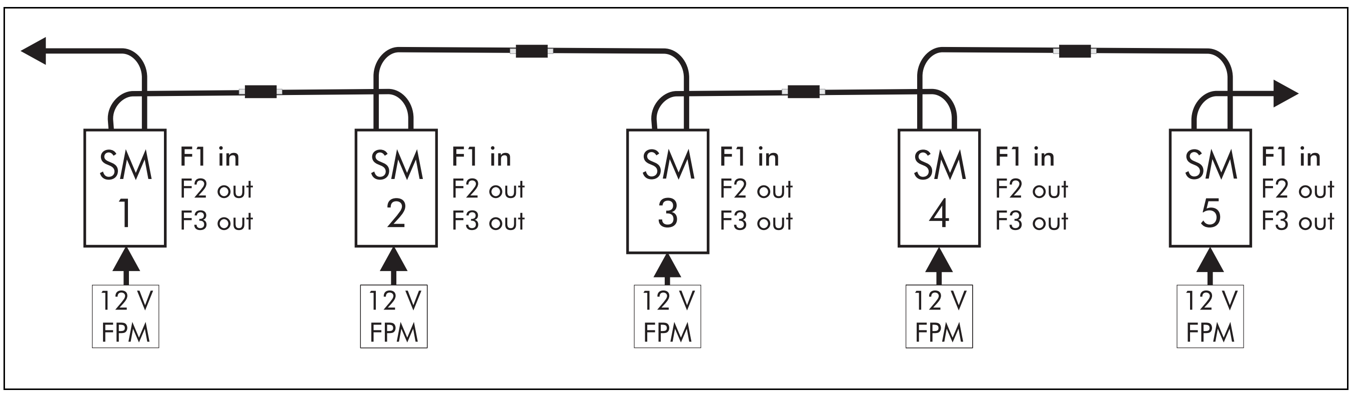
Caution	*Install F1 only in Sensor Modules that receive or supply 12 VDC power. Do not use F2 and F3 in Sensor Modules that receive 12 VDC power or some cable fault detection capabilities will be disabled.*



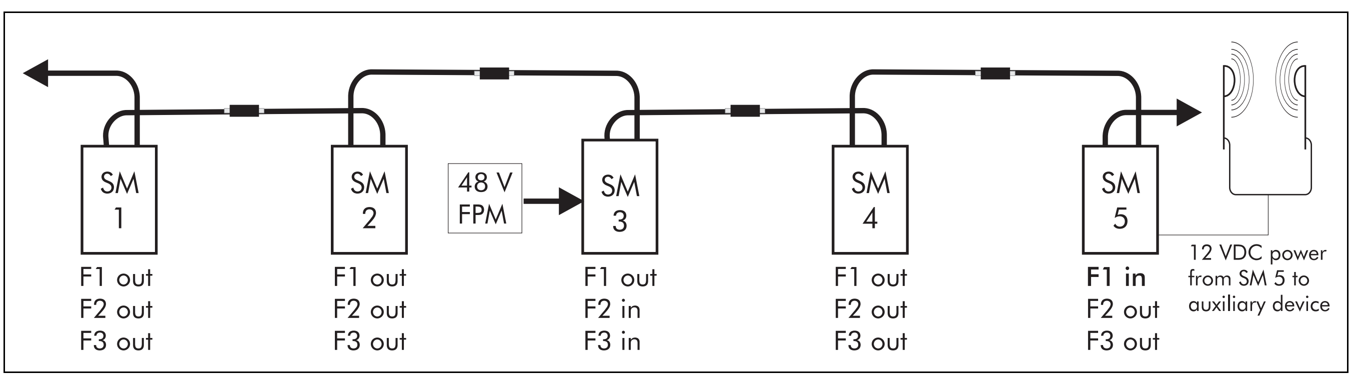
12 VDC standalone

F1 is used to fuse 12 VDC input and output power in the Sensor Module.

- ❑ Install F1 in standalone and network applications where the Sensor Module receives input power directly from a 12 VDC field power module.
- ❑ Install F1 in 48 VDC network configurations where the Sensor Module supplies 12 VDC power to an auxiliary device. In this configuration the maximum current of the output power must not exceed 150 mA.



12 VDC network



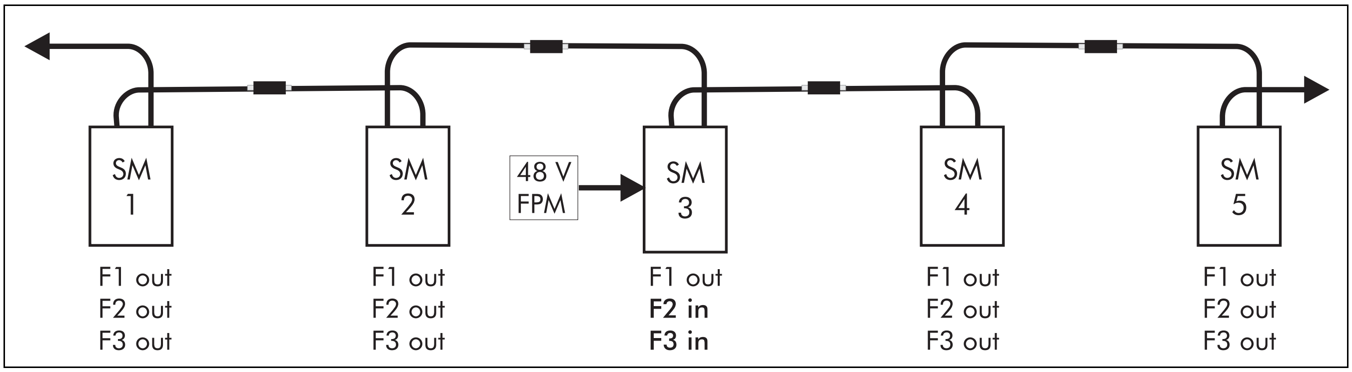
12 VDC output to auxiliary device

Fuses F2 and F3

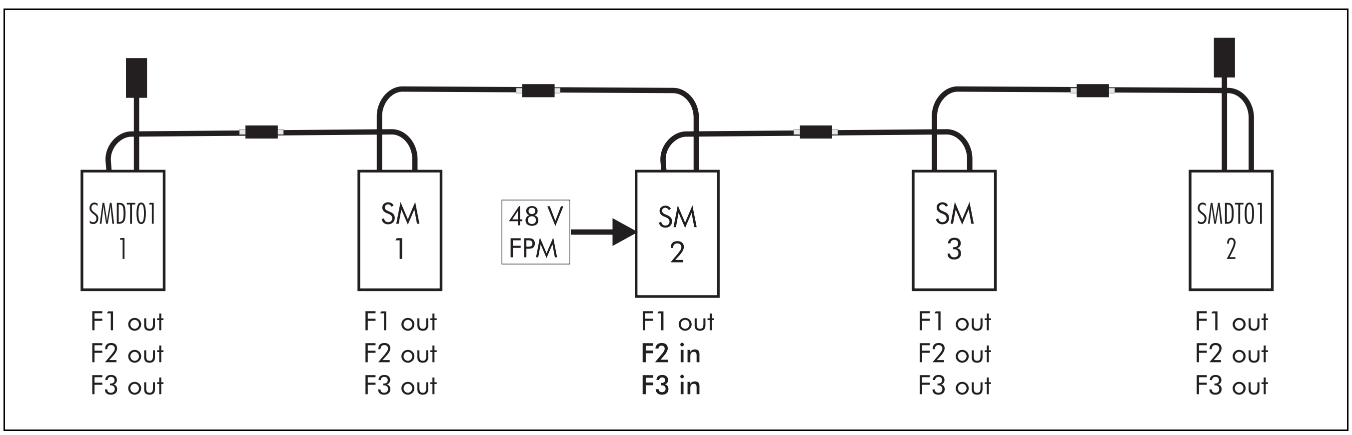
Caution *Install F2 and/or F3 only in Sensor Modules that are connected directly to a 48 VDC field power module. Do not use F2 and F3 in Sensor Modules that are powered through the sensor cables.*

Fuses F2 and F3 are used only in Sensor Modules that are connected directly to a 48 VDC field power module, to fuse the 48 VDC input power that is supplied to Sensor Modules in network configurations.

❑ Install F2 and F3 in Sensor Modules that are connected directly to a 48 VDC field power module, and distribute the power to the network through both the Rx and Tx cables.



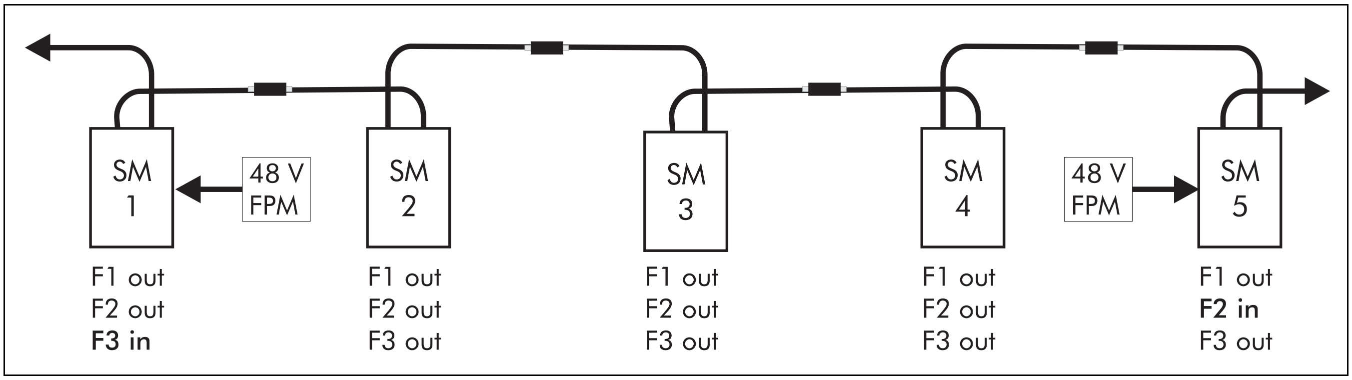
Single point 48 VDC network



Single point 48 VDC network with SMDT01 Sensor Modules

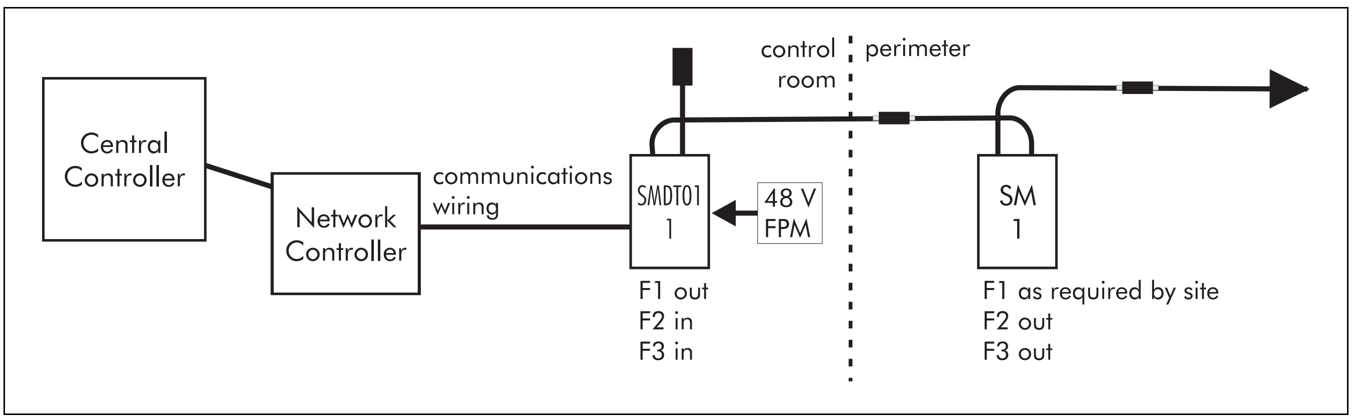
❑ Install F2 in Sensor Modules that are connected directly to a 48 VDC field power module, and distribute the network power through only the Rx cable.

❑ Install F3 in Sensor Modules that are connected directly to a 48 VDC field power module, and distribute the network power through only the Tx cable.



Redundant 48 VDC network

In a system that retrofits existing Sentrax/S∞Trax cables into a Perimitrax system:

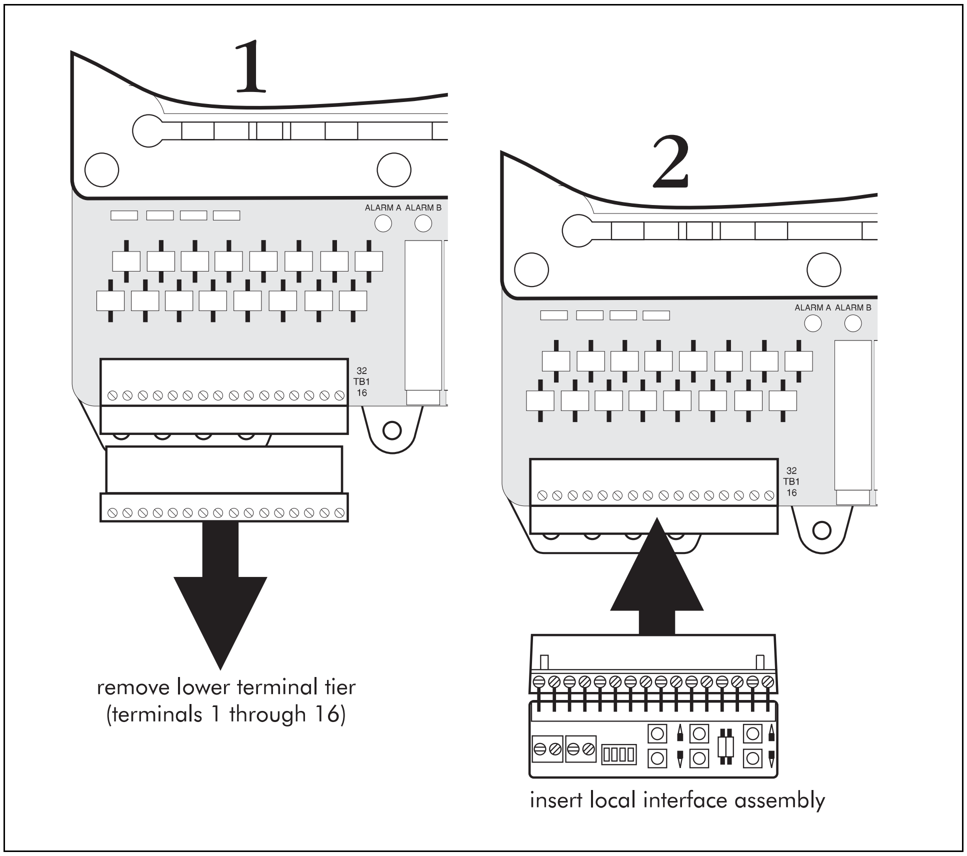


Retrofit existing Sentrax/S∞Trax cables into Perimitrax system

❑ Install F2 and F3 in the SMDT01 Sensor Module that is connected to the 48 VDC power and the Network Controller.

❑ Install F1 in the remaining Sensor Modules, as required by the site.

Installation of Local interface assembly



Standalone

The local interface assembly provides a basic user interface for the Sensor Module. This assembly is required for calibrating standalone Sensor Modules and it can be used to calibrate network Sensor Modules before the system has been connected to the Sentient Security Management System. Install the local interface assembly as follows:

- ❑ Remove terminal block 1 terminals 1-16 (lower tier) from the Sensor Module circuit board.
- ❑ Insert the local interface assembly in terminal block 1 terminals 1-16.

Installation in a weatherproof enclosure

Caution

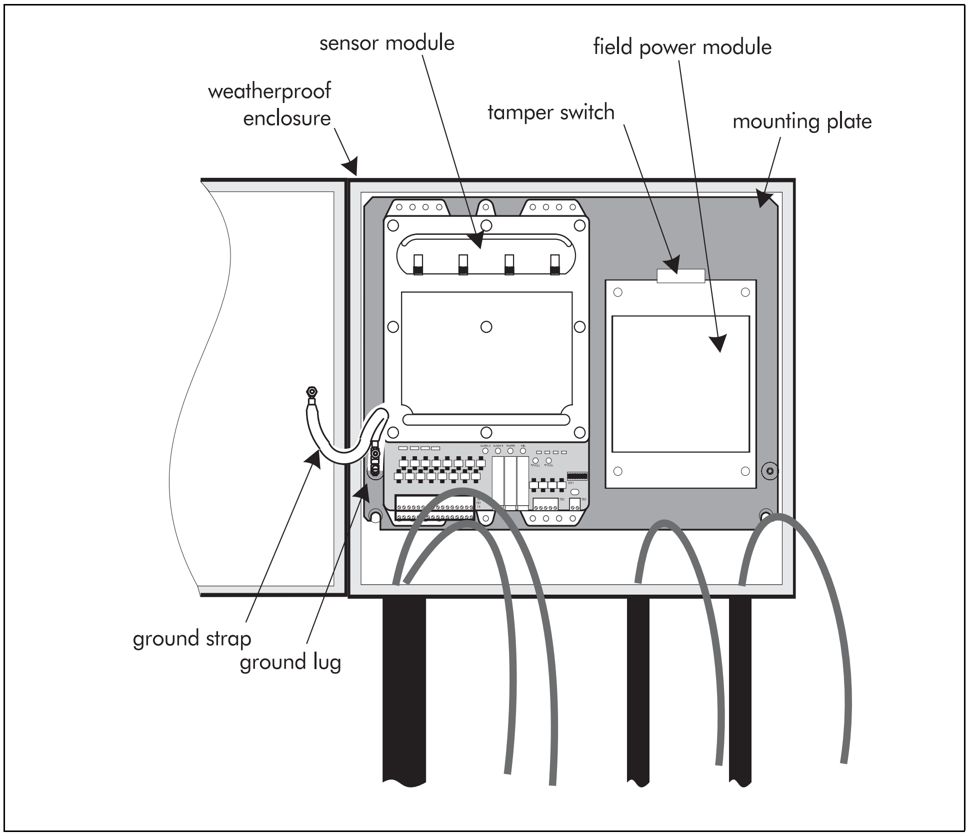
For safety reasons, these instructions must be followed carefully. Ensure that installation conforms to local wiring codes.

An appropriate two-pole disconnect device must be installed by qualified service personnel, as part of the building installation.

Always disconnect power before servicing the unit. Disassembly must be performed by qualified personnel only.

❑ Install the appropriate fuses in the Sensor Module in accordance with the site plan. See "Fuse selection guidelines" on page 6-2.

❑ Install a local interface assembly on the Sensor Module as required. See "Installation of Local interface assembly" on page 6-6.



❑ Using the 1/4-20 hardware included with the weatherproof enclosure, secure the Sensor Module to the mounting plate.

❑ If a Field Power Module is being installed, secure it to the mounting plate beside the Sensor Module using the #10 hardware provided with the Field Power Module.

❑ Label the sensor cables using the labels included in the sensor cable set.

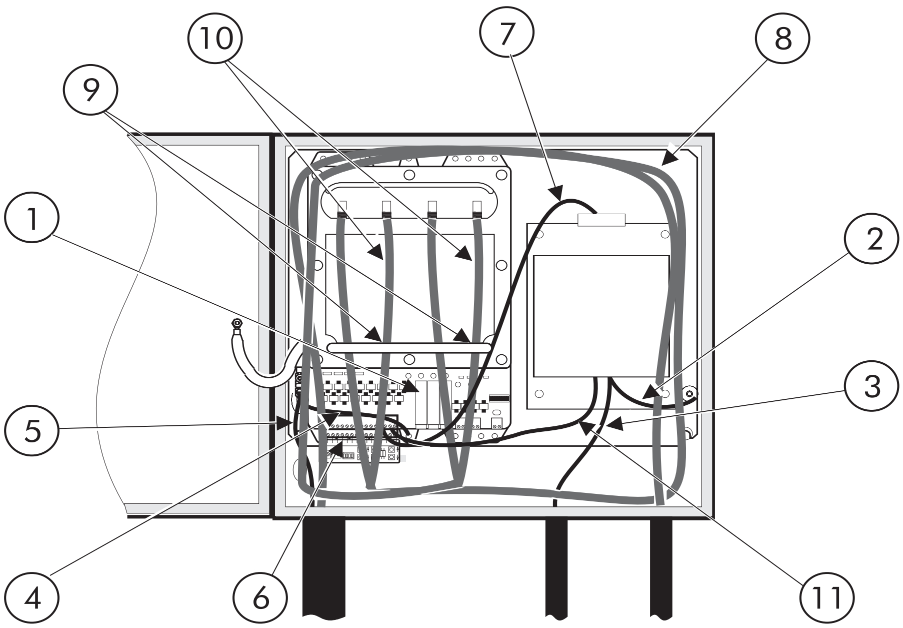
Wiring connections - standalone SM

Caution	*Make sure that the power is OFF before connecting AC power to the field power module.*

Standalone

Wiring connections are detailed at "Sensor Module input/output connections" on page 6-14.

Make sure that the power supply has the proper polarity connections.



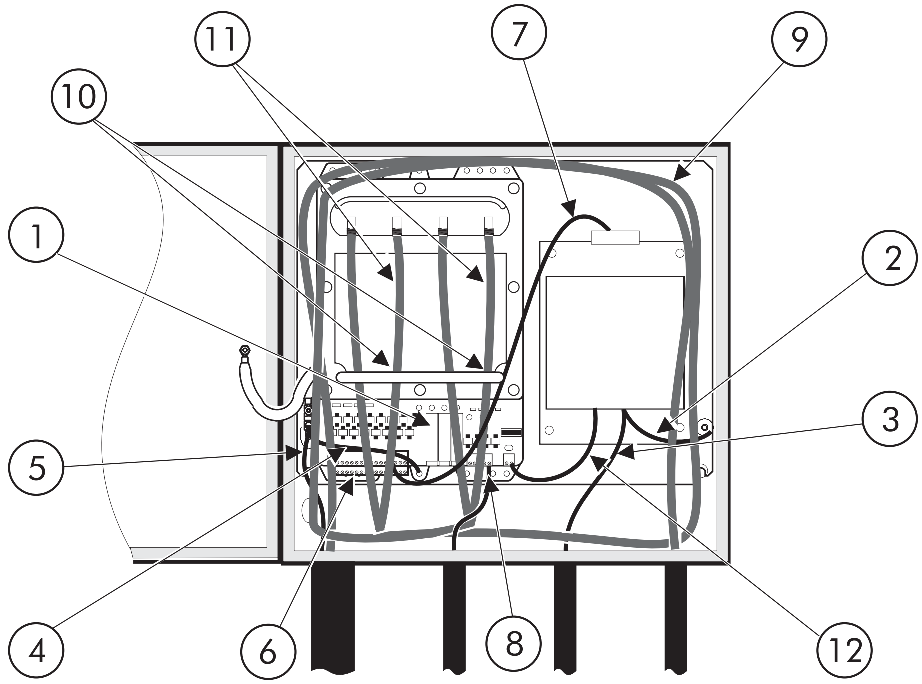
1	Install fuses as required by the site. See "Fuse selection guidelines" on page 6-2 for details.
2	Connect the AC power ground wire to the ground stud on the Field Power Module mounting plate. See Note 1.
3	Connect the AC power to the Field Power Module.
4	Connect the ground wire to the ground lug on the weatherproof enclosure and to the Sensor Module.
5	Connect the ground wire to the ground lug on the weatherproof enclosure.
6	Connect local interface assembly to Sensor Module at TB1.
7	Connect the wire pair from the tamper switch to the Sensor Module at TB1, pins 29 and 30.
8	Loop the extra length of cables and wires around the Sensor Module and Field Power Module in a field service loop (3 m, 10 ft.) as shown and secure together using tie wraps.
9	Wrap the exposed coaxial cable with electrical tape or heat-shrink tubing at the points where it passes through the restraining bar. Use enough insulating material to prevent any contact between the conductive cable and the enclosure.
10	Connect the Perimitrax sensor cables to Sensor Module at the female connectors.
11	Connect the 12V power supply to the Sensor Module at TB1, pins 31 and 32.
Note 1	The green or green/yellow conductor of the supply cord is provided with a certified/recognized ring type pressure connector (or crimp to one provided with the Power Supply Assembly), which is secured to the chassis by a star-toothed washer and nut. Another bonding wire to the same screw is secured by a separate washer and nut.

Wiring connections - network SM

Caution	*Make sure that the power is OFF before connecting AC power to the field power module.*

Wiring connections are detailed at "Sensor Module input/output connections" on page 6-14.

Make sure that the power supply has the proper polarity connections.

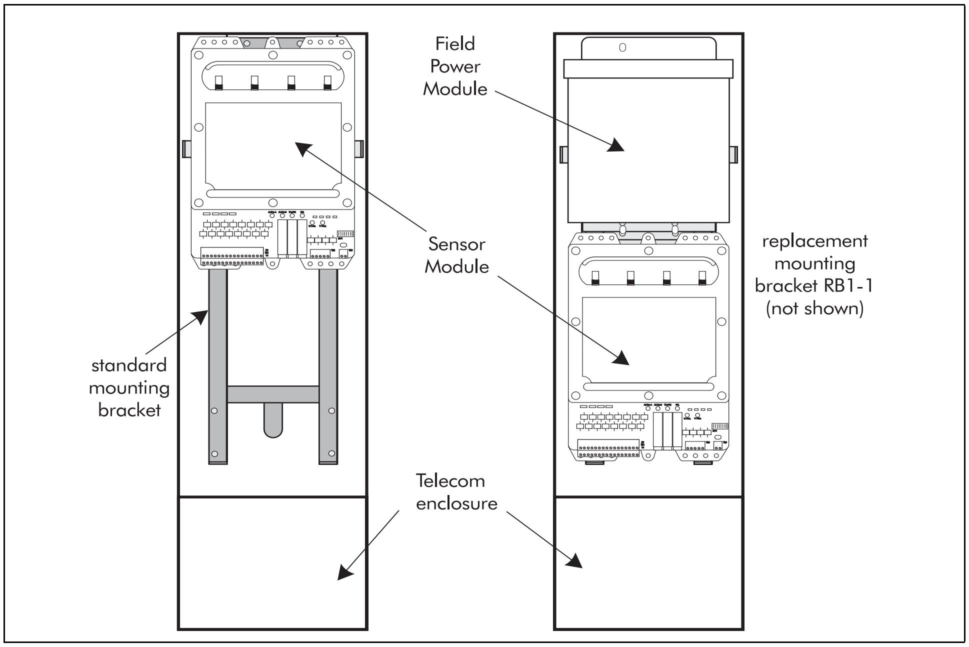


1	Install fuses as required by the site. See "Fuse selection guidelines" on page 6-2 for details.
2	Connect the AC power ground wire to the ground stud on the Field Power Module mounting plate. See Note 1.
3	Connect the AC power to the Field Power Module.
4	Connect the ground wire to the ground lug on the weatherproof enclosure and to the Sensor Module.
5	Connect the ground wire to the ground lug on the weatherproof enclosure.
6	Connect auxiliary sensor cables to Sensor Module at TB1, as required by the site.
7	Connect the wire pair from the tamper switch to the Sensor Module at TB1, pins 29 and 30.
8	Connect communication wires to Sensor Module at TB2, as required by the site.
9	Loop the extra length of cables and wires around the Sensor Module and Field Power Module in a field service loop (3 m, 10 ft.) as shown and secure together using tie wraps.
10	Wrap the exposed coaxial cable with electrical tape or heat-shrink tubing at the points where it passes through the restraining bar. Use enough insulating material to prevent any contact between the conductive cable and the enclosure.
11	Connect the Perimitrax sensor cables to Sensor Module at the female connectors.
12	Connect the 48V power supply to the Sensor Module at TB3.
Note 1	The green or green/yellow conductor of the supply cord is provided with a certified/recognized ring type pressure connector (or crimp to one provided with the Power Supply Assembly), which is secured to the chassis by a star-toothed washer and nut. Another bonding wire to the same screw is secured by a separate washer and nut.

Installation in a Telecom style enclosure

Caution	*For safety reasons, these instructions must be followed carefully. Ensure that installation conforms to local wiring codes.* *An appropriate two-pole disconnect device must be installed by qualified service personnel, as part of the building installation.* *Always disconnect power before servicing the unit. Disassembly must be performed by qualified personnel only.*

Sensor Module has two mounting configurations in the Telecom enclosure.



If the Sensor Module is alone in the Telecom style enclosure it must be installed at the top of the mounting bracket.

If the Sensor Module is installed in the Telecom style enclosure together with the Field Power Module, the standard bracket must be discarded. A replacement mounting bracket that enables you to install both the Sensor Module and a Field Power Module in a Telecom style enclosure is available from Senstar. See "*Installing a Telecom style enclosure*" on page 3-5.

Installation instructions

❑ Install the appropriate fuses in the Sensor Module in accordance with the site plan. See "Fuse selection guidelines" on page 6-2.

❑ Install a local interface assembly on the Sensor Module as required. See "Installation of Local interface assembly" on page 6-6.

❑ Secure the Sensor Module to the top of mounting bracket using the supplied hardware.

- ❑ If a Field Power Module is to be mounted in the same Telecom enclosure as the Sensor Module, secure the Sensor Module on the bottom part of the replacement mounting bracket and the Field Power Module to the top part of the mounting bracket using the supplied hardware.
- ❑ Label the sensor cables using the permanent labels included in the sensor cable set.

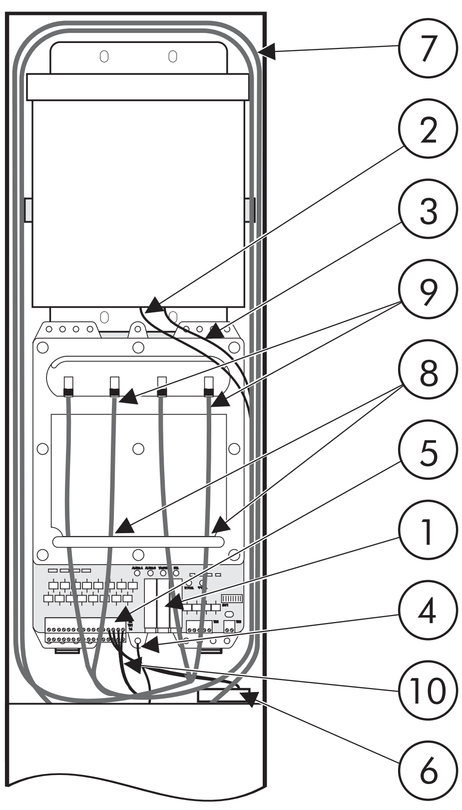
Wiring connections - standalone SM

Caution	*Make sure that the power is OFF before connecting AC power to the field power module.*

Standalone

Wiring connections are detailed at "Sensor Module input/output connections" on page 6-14.

Make sure that the power supply has the proper polarity connections.



1	Install fuses as required by the site. See "Fuse selection guidelines" on page 6-2 for details.
2	Connect the AC power ground wire to the ground stud on the Field Power Module mounting plate. See Note 1.
3	Connect the AC power to the Field Power Module.
4	Connect the ground wire to the ground lug on the Sensor Module.
5	Connect the local interface assembly to the Sensor Module at TB1.
6	Connect the wire pair from the tamper switch to the Sensor Module at TB1, pins 29 and 30.
7	Loop the extra length of cables and wires around the Sensor Module and Field Power Module in a field service loop (3 m, 10 ft.) as shown and secure together using tie wraps.
8	Wrap the exposed coaxial cable with electrical tape or heat-shrink tubing at the points where it passes through the restraining bar. Use enough insulating material to prevent any contact between the conductive cable and the enclosure.
9	Connect the Perimitrax sensor cables to Sensor Module at the female connectors.
10	Connect the 12V power supply to the Sensor Module at TB1, pins 31 and 32.

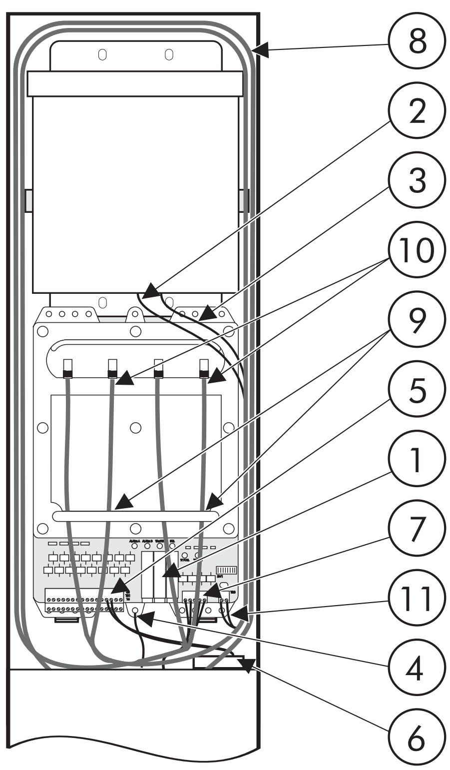
Note 1	The green or green/yellow conductor of the supply cord is provided with a certified/recognized ring type pressure connector (or crimp to one provided with the Power Supply Assembly), which is secured to the chassis by a star-toothed washer and nut. Another bonding wire to the same screw is secured by a separate washer and nut.

Wiring connections - network SM

Caution	*Make sure that the power is OFF before connecting AC power to the field power module.*

Wiring connections are detailed at "Sensor Module input/output connections" on page 6-14.

Make sure that the power supply has the proper polarity connections.



1	Install fuses as required by the site. See "Fuse selection guidelines" on page 6-2 for details.
2	Connect the AC power ground wire to the ground stud on the Field Power Module mounting plate. See Note 1.
3	Connect the AC power to the Field Power Module.
4	Connect the ground wire to the ground lug on the Sensor Module.
5	Connect auxiliary sensor cables to Sensor Module at TB1, as required by the site.
6	Connect the wire pair from the tamper switch to the Sensor Module at TB1, pins 29 and 30.
7	Connect the communication wires for to the Sensor Module at TB2, as required by the site.
8	Loop the extra length of cables and wires around the Sensor Module and Field Power Module in a field service loop (3 m, 10 ft.) as shown and secure together using tie wraps.
9	Wrap the exposed coaxial cable with electrical tape or heat-shrink tubing at the points where it passes through the restraining bar. Use enough insulating material to prevent any contact between the conductive cable and the enclosure.
10	Connect the Perimitrax sensor cables to Sensor Module at the female connectors.
11	Connect the 48V power supply to the Sensor Module at TB3.

Note 1	The green or green/yellow conductor of the supply cord is provided with a certified/recognized ring type pressure connector (or crimp to one provided with the Power Supply Assembly), which is secured to the chassis by a star-toothed washer and nut. Another bonding wire to the same screw is secured by a separate washer and nut.

Installation in your own enclosure

Caution	*For safety reasons, these instructions must be followed carefully. Ensure that installation conforms to local wiring codes.* *An appropriate two-pole disconnect device must be installed by qualified service personnel, as part of the building installation.* *Always disconnect power before servicing the unit. Disassembly must be performed by qualified personnel only.*

- ❑ Install the appropriate fuses in the Sensor Module in accordance with the site plan. See "Fuse selection guidelines" on page 6-2.
- ❑ Install a local interface assembly on the Sensor Module as required. See "Installation of Local interface assembly" on page 6-6.

Follow the same general procedure as "Installation in a weatherproof enclosure" on page 6-7 to install a Sensor Module or a Field Power Module in your own enclosure.

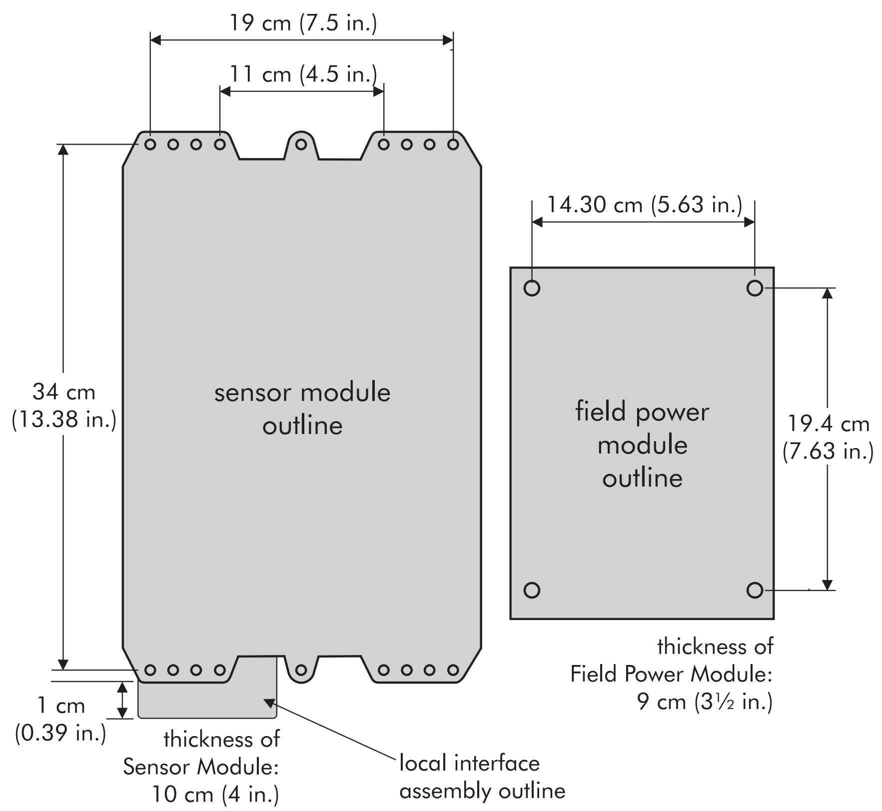
Senstar recommends using the following mounting hardware for securing the Sensor Module and the Field Power Module in your own enclosure:

- Sensor Module - four each 1/4-20 size nuts, bolts, lockwashers and washers
- Field Power Module - four each #10 size nuts, bolts, lockwashers and washers

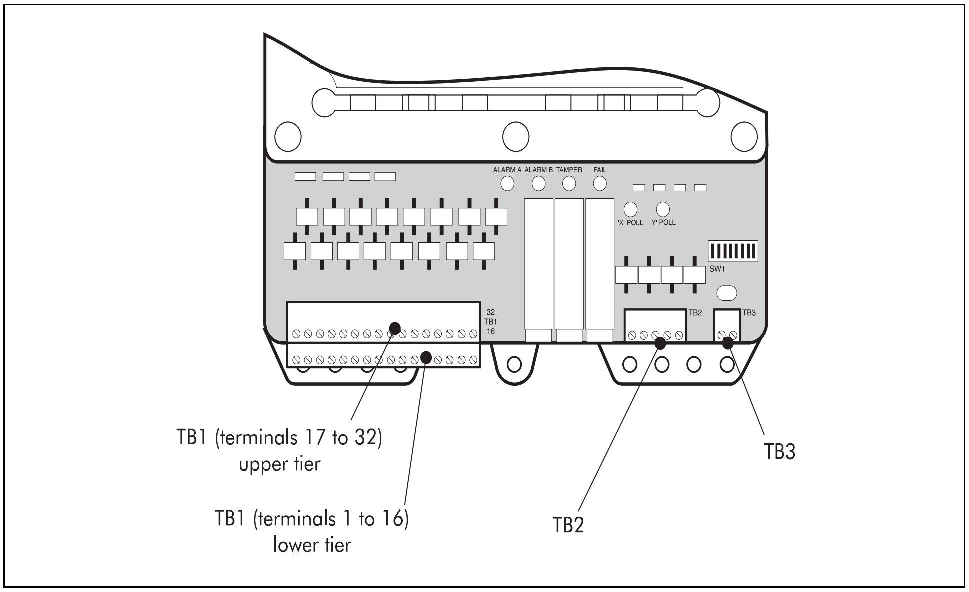
Mounting hole locations

When selecting your enclosure remember to leave appropriate space for:

- *replacing fuses*
- *the local interface assembly (in standalone systems)*



Sensor Module input/output connections



The following pin assignments are listed for reference only.

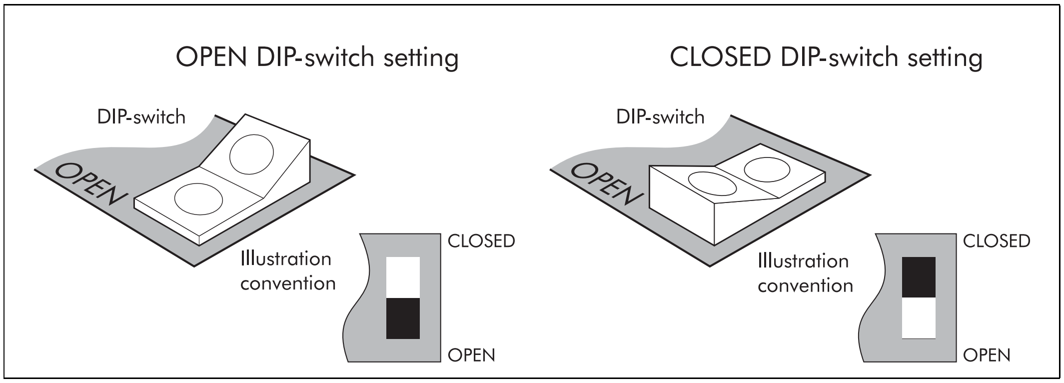
The Sensor Module has three terminal connector strips. The pin assignments are listed in the following tables:

Network data connections TB2		Network power supply connections TB3	
Function	**Pin #**	**Function**	**Pin #**
TxRx -	1	- 48 Vdc	1
TxRx +	2	+ 48 Vdc	2
Gnd	3		
TyRy -	4		
TyRy +	5		

	User interface - TB1			
	Network system		**Standalone system**	
	Function	**#**	**Function**	**#**
lower tier (terminals 1 - 16)	Input point #1	1	Local interface assembly connection (used with standalone Sensor Module setup)	1-16
	Ground	2		
	Input point #2	3		
	Ground	4		
	Input point #3	5		
	Ground	6		
	Input point #4	7		
	Ground	8		
	Input point #5	9		
	Ground	10		
	Input point #6	11		
	Ground	12		
	Input point #7	13		
	Ground	14		
	Input point #8	15		
	Ground	16		
upper tier (terminals 17 - 32)	Relay 1	17-18	A alarm relay contact output	17-18
	Relay 2	19-20	B alarm relay contact output	19-20
	Relay 3	21-22	Tamper alarm relay contact output	21-22
	Relay 4	23-24	Fail relay contact output	23-24
	Analog output A zone (+)	25	Analog output A zone (+)	25
	Analog output A zone (–)	26	Analog output A zone (–)	26
	Analog output B zone (+)	27	Analog output B zone (+)	27
	Analog output B zone (–)	28	Analog output B zone (–)	28
	Tamper alarm input	29-30	Tamper alarm input	29-30
	Auxiliary sensor power output (–) 12 Vdc	31	Standalone power input (–) 12 Vdc	31
	Auxiliary sensor power output (+) 12 Vdc	32	Standalone power input (+) 12 Vdc	32

DIP-switch settings

DIP-switch setting conventions



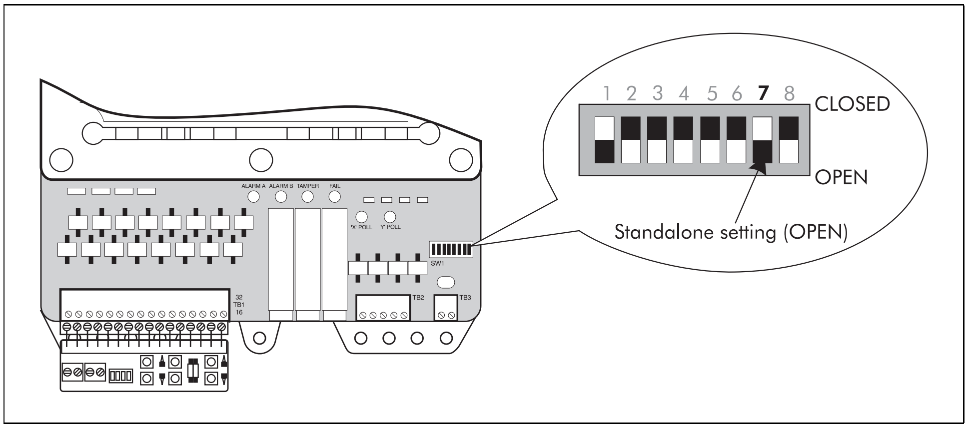
Setting the system type (standalone or network)

Standalone

System type settings

- Standalone - OPEN
- Network - CLOSED

Position 7 on the DIP-switch determines whether the Sensor Module interface functions as a standalone or a network system.



Setting the Sensor Module address

Each network system Sensor Module must be assigned a unique address number between 1 and 62 so that the Sentient System can identify it. This address must be set before the system is powered up. An address is not required for Sensor Modules configured for standalone systems. However, it is recommended.

Refer to your site plan to identify the address number for each network system Sensor Module. Set each address according to the network system Sensor Module address table.

Changing the Sensor Module address

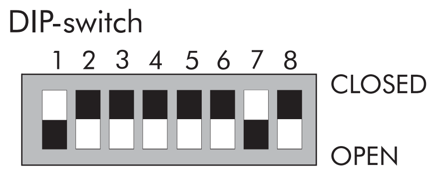
The system must be powered down before the Sensor Module address can be changed.

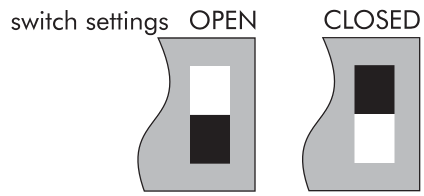
❑ Make sure the system is powered down.

❑ Change the DIP-switch to the appropriate address.

Sensor Module address DIP-switch settings

Notes:
Switch 7 must be OPEN
for standalone operation
or CLOSED for network operation
Switch 8 must be set to CLOSED.

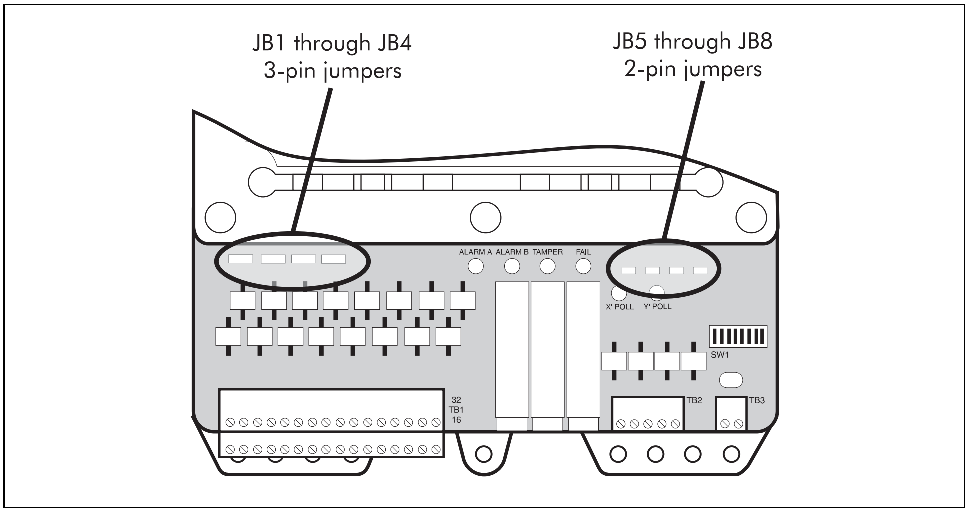




address	DIP-switch setting	address	DIP-switch setting	address	DIP-switch setting	address	DIP-switch setting
inv		16		32		48	
1		17		33		49	
2		18		34		50	
3		19		35		51	
4		20		36		52	
5		21		37		53	
6		22		38		54	
7		23		39		55	
8		24		40		56	
9		25		41		57	
10		26		42		58	
11		27		43		59	
12		28		44		60	
13		29		45		61	
14		30		46		62	
15		31		47		inv	

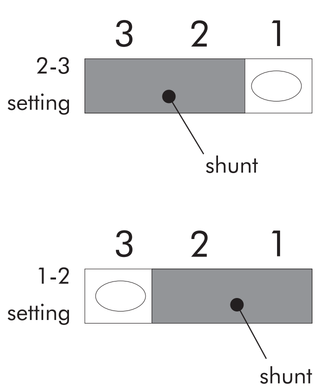
Jumper settings

Jumper locations



Relay output configuration (3-pin jumpers)

Four three-pin jumpers, JB1 through JB4, are used to configure the Sensor Module relay outputs. The assignment of normally open (n.o.) or normally closed (n.c.) operation is set here.



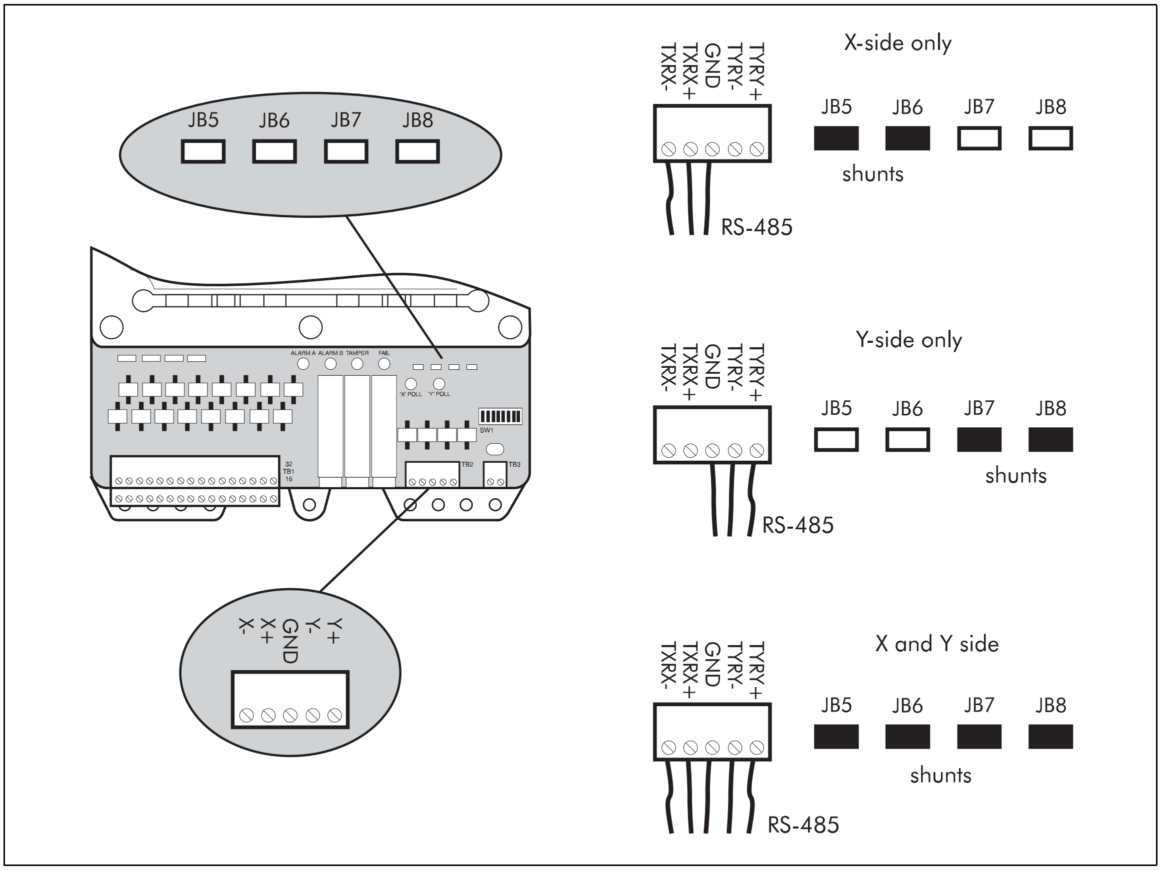
Auxiliary sensors	Local	Jumper	Shunt Pins	State
relay 1	A alarm	JB1	1-2	n.o.
			2-3	n.c.
relay 2	B alarm	JB2	1-2	n.o.
			2-3	n.c.
relay 3	Tamper	JB3	1-2	n.o.
			2-3	n.c.
relay 4	Fail	JB4	1-2	n.c.
			2-3	n.o.

Standalone

In standalone mode the fail relay (relay 4) is fail-safe (energized in the non-fail condition).

In network mode the relays are available for general purpose use and can be programmed for operation through a custom database in the Sentient Security Management System.

Data termination configuration (2-pin jumpers)



When an RS-485 cable is used to connect a Network Controller to the system, or Sensor Module blocks together, the data signals must be terminated at both ends of the network or network segment. This is to eliminate the data signal reflections that would otherwise occur.

JB5 through JB8 are two-pin jumpers. These jumpers are designated as data termination points when shunts are installed. For the RS-485 cable to be effective the connection must be X-side to X-side or Y-side to Y-side.

❑ To terminate the data signal from the RS-485 cable place the shunt over both pins of the jumper. This must be done at units located at both ends of the network or network segment.

❑ If X-side of the network is on the physical end of the network or network segment, install shunts at JB5 and JB6.

❑ If Y-side of the network is on the physical end of the network or network segment, install shunts at JB7 and JB8.

Always install network termination shunts in pairs as illustrated above.

7 Completing the cable installation

System checkout procedures

Before a system can be fully operational components must be checked out in order to verify that they are in proper working order.

This chapter details the procedures required to check out your Perimitrax installation.

Description	Reference
Check sensor cables for continuity and leakage	page 7-2
Check consistency of detection field in each zone:	page 7-6
• using the Direct test measurement method	page 7-7
• and calibration walks	page 7-14
Adjust cables to equalize detection field consistency	page 7-17
Complete cable installation	page 7-23

Do not use high-voltage cable-leakage testers (meggers) on the sensor cables unless decouplers, terminators, and Sensor Modules have first been disconnected.

Cable tests

Before applying power to the system, check the cables by performing the following tests.

- zone-pair continuity test
- insulation resistance test
- leakage resistance test

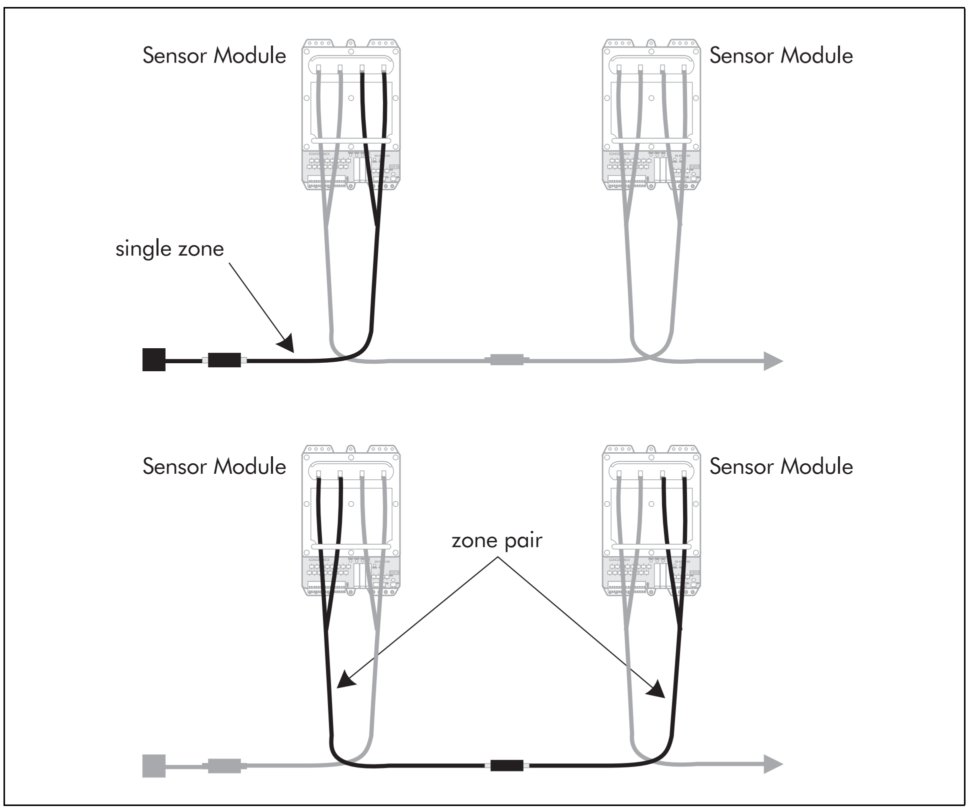
Equipment required

- digital multimeter
- wire to provide short-circuit connection

Zone-pair continuity test

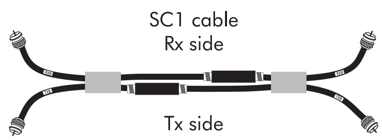
Repeat this test for all zone-pairs.

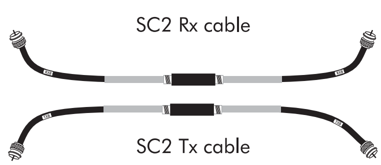
A zone-pair consists of two adjacent zones separated by a decoupler. Each zone is connected to a different Sensor Module.

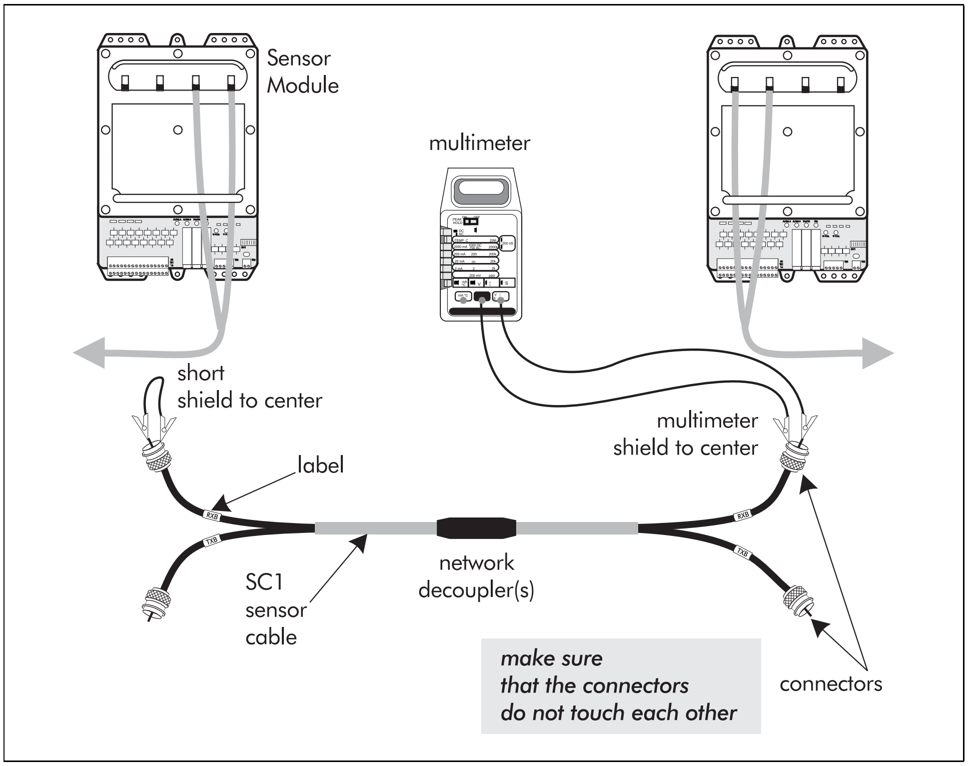


Ensure that the cables in a zone-pair are either transmit cables (Tx to Tx) or receive cables (Rx to Rx); do not connect transmit cables to receive cables in a zone-pair.

Zone-pair continuity test for SC1 or SC2 cable using a network decoupler







- [ ] Disconnect the 4 cable connectors of the zone-pair from both Sensor Modules.
- [ ] On one of the connectors, electrically connect the center conductor and the connector headshell.
- [ ] Set a digital multimeter to measure resistance and attach it to the center conductor and the headshell of the corresponding connector.

SC1 ▶

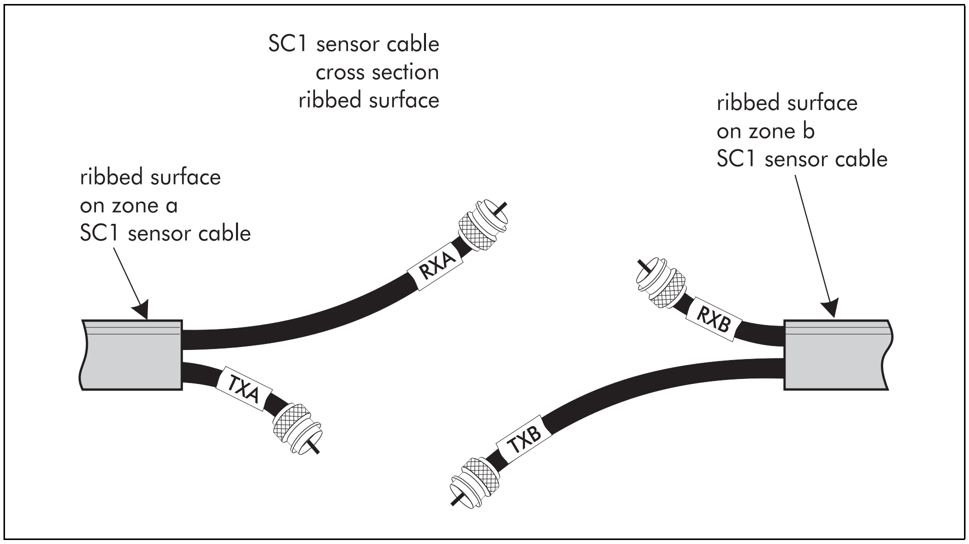
For the SC1 cable the ribbing on the cables must match up. See "Cable labelling conventions" on page 7-4.

- [ ] A resistance of approximately 3 Ω per 100 m (328 ft.) of cable confirms continuity.

Infinite resistance means the cables are not connected or are not labelled properly. Re-label or repair as required.

A zero reading means that there is a short in the zone-pair. Repair as required.

Cable labelling conventions



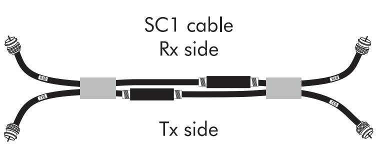
SC1 labelling convention
The cable on the side of the ribbed surface is the Rx cable.

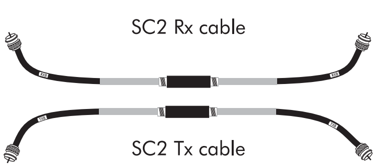
SC2 labelling convention
The inner perimeter cable is the Rx cable.

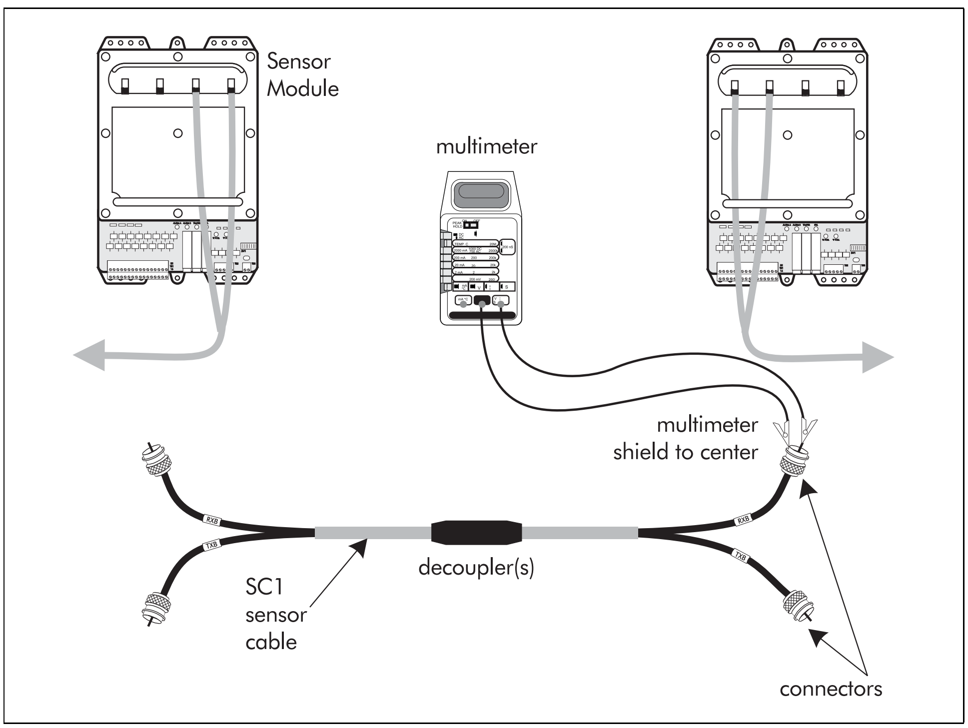
Insulation resistance test

Repeat this test for all zone-pairs.

The following test ensures that the center conductor is isolated from the outer cable conductor.







❑ Select a zone-pair to test. Disconnect all 4 connectors in the zone-pair from the Sensor Modules. Let the connectors hang in mid-air during this test.

❑ Set a digital multimeter to measure resistance and attach it to the center conductor and the headshell of one of the four connectors.

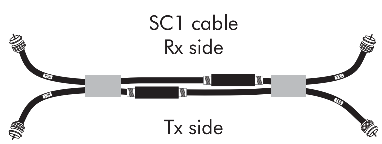
Standalone ▶

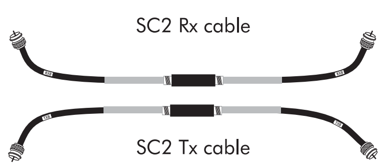
- ❑ The resistance reading for each of the four connectors should be as follows:
  - SC1 sensor cable with a network decoupler - > 20 $M\,\Omega$
  - SC2 sensor cable with a network decoupler - > 20 $M\,\Omega$
  - SC1 sensor cable with a supervised decoupler - 130 $k\,\Omega \pm 5\%$
  - SC2 sensor cable with a supervised decoupler - 130 $k\,\Omega \pm 5\%$

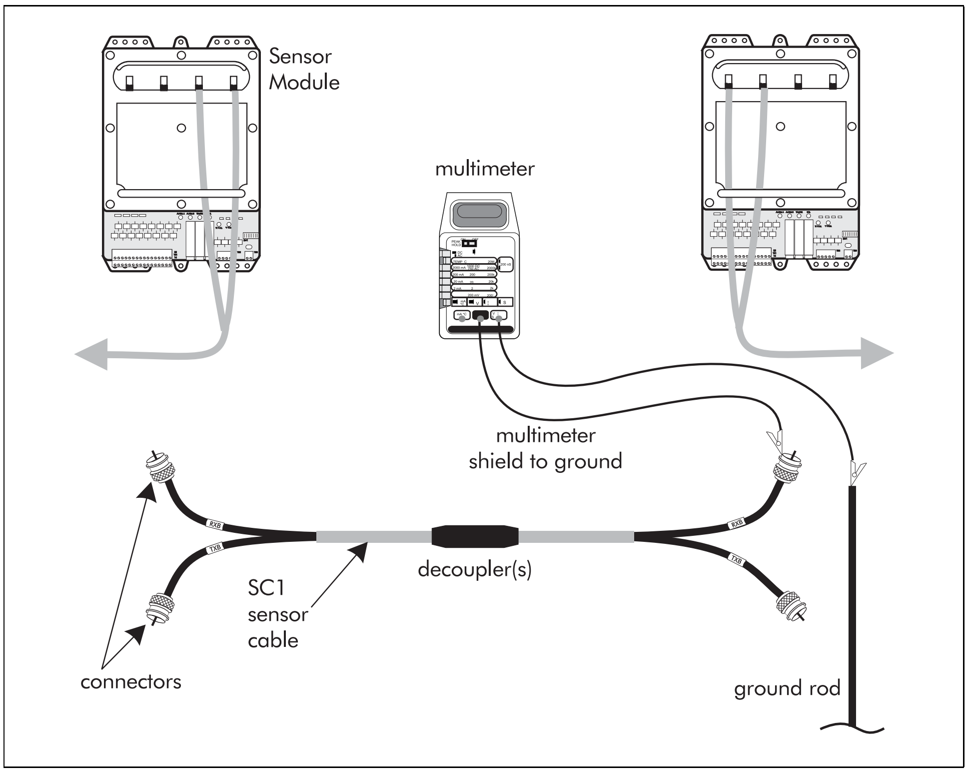
  If the readings are different from these there could be a problem with the cable, connector or the decoupler. See *Chapter 9 Repairing sensor cables*.

Leakage resistance test

To perform a leakage resistance test, follow the steps outlined below:







During the test do not let the connectors touch anything that is grounded or each other.

The black jacket material on the sensor cables is electrically conductive. To obtain accurate measurements ensure that the material does not come in contact with any grounded metal surfaces.

- ❑ Select a zone-pair to test. Disconnect all 4 connectors in the zone-pair from the Sensor Modules. Let the connectors hang in mid-air during this test.

- ❑ Set a digital multimeter to measure resistance and attach it to the headshell of one of the four connectors and to the Sensor Module ground rod.
- ❑ The resistance reading for each cable should be >20 *M*Ω.

  If the reading is different from this there could be damage to the sensor cable jacket or improperly installed heatshrink. See *Chapter 9 Repairing sensor cables.*
- ❑ Set the digital multimeter to measure Volts DC. Measure the voltage between the center pin and the head shell of the connector. The reading should be <±10 mVDC.

  If the readings are different from these, the sensor cable could have damage to the outer jacket. See *Chapter 9 Repairing sensor cables*.
- ❑ On the same connector, reverse the connections to the connector headshell and the ground rod and take a resistance reading.

  The resistance reading should once again be >20 *M*Ω A different reading from this could indicate that there is residual DC voltage on the cable. Repair as required.

Testing the system

Before a system can operate successfully the detection field within each zone must be consistent throughout the zone. Inconsistencies show up in calibration plots as high, low or saturated areas.

It is normal for the detection field to be somewhat less sensitive in soil than it is in concrete/asphalt.

The *Direct test measurement* procedure on page 7-7 is used to measure the detection field. "The walk test" on page 7-14 is the method used to perform a preliminary calibration of the system to determine if the detection field is consistent within each zone.

If inconsistencies appear along a zone, they can usually be eliminated by either raising or lowering the installed cable, or by adding loops of lead-in cable or additional ferrite beads along the cable at the point of inconsistency. See "Adjusting sensitivity" on page 7-17 for more detail.

This is a system pre-test. The detection levels that are set at this stage will not necessarily be the levels used for the final adjustments.

When the test results are satisfactory, complete the installation procedure. See "Completing the cable installation" on page 7-23.

Multiple mediums in a zone

Generally, it is not recommended to install a Perimitrax zone across multiple mediums, however this is not always avoidable.

If this situation does occur make sure to perform the precalibration procedures described in this chapter to ensure that the detection level within the zone is consistent, BEFORE completing the cable installation.

Direct test measurement

You will need a chart recorder capable of measuring a voltage in the range of 0 to +5 VDC at a speed of about 25 mm (1 in.) per minute. If possible, use a dual channel chart recorder when measuring the detection signal. This will provide a permanent record of the detection signal throughout the zone over time.

A dual-channel chart recorder has advantages over a single-channel recorder, as it allows you to:

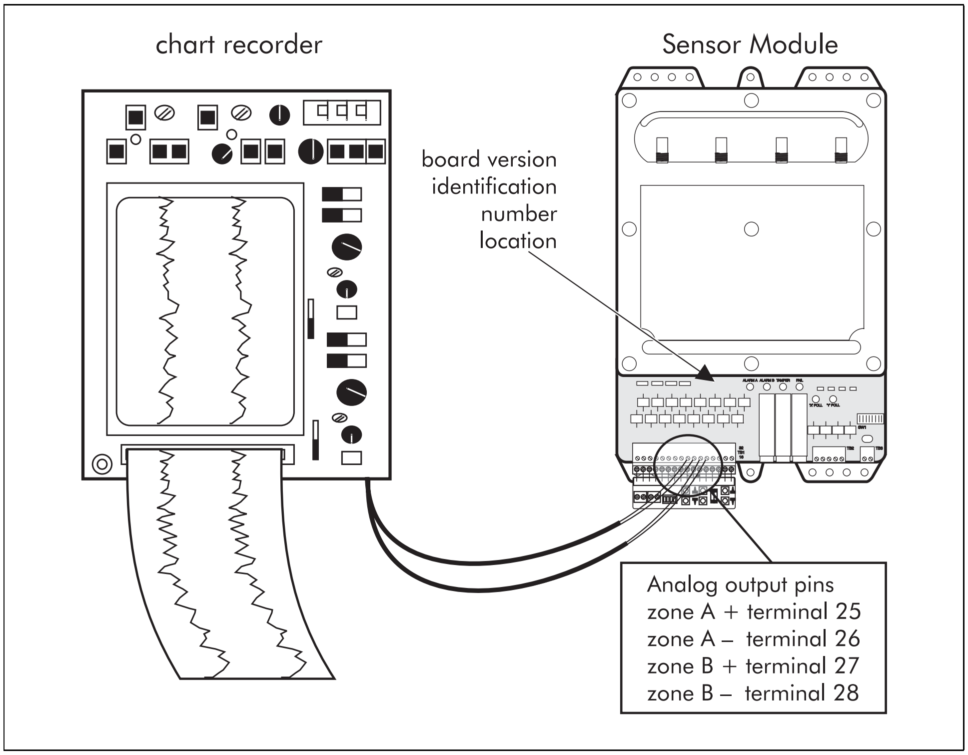
- check for overlapping detection fields in a continuous perimeter
- observe the detection signal in two zones simultaneously

The following chart recorders are recommended:

- Astro-Med Dash II dual-channel recorder
- Gould model 220 dual-channel recorder
- Graphtec model WR7500-2 dual-channel recorder
- Graphtec model WR7400 dual-channel recorder
- Linseis LM23-20-20 dual-channel recorder

Setting up a chart recorder

Chart recorder connections

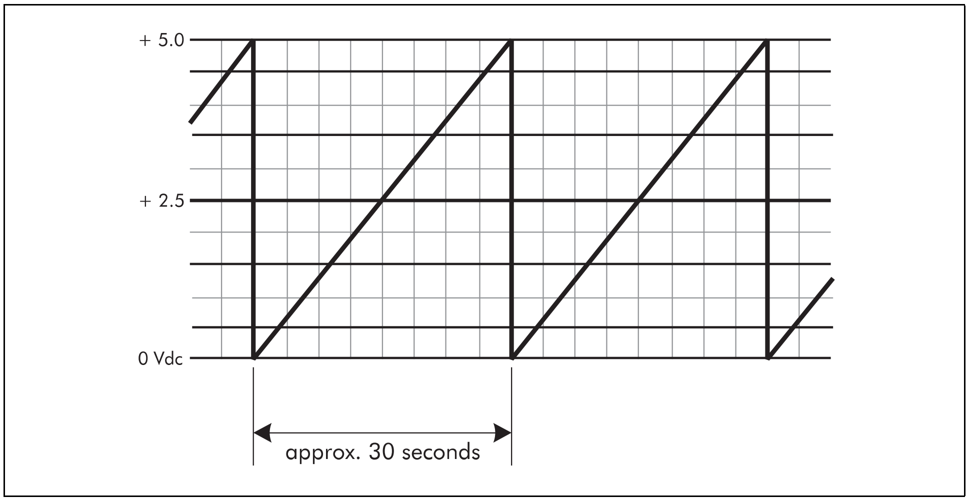


- ❑ For the zone being tested, connect the chart recorder to the Sensor Module at terminals 25 through 28 on TB1 (25(+) & 26(-) for side A, and 27(+) & 28(-) for side B).
- ❑ Power up the chart recorder.
- ❑ Set the chart speed to 25 mm/min (1 in./min.).
- ❑ Set the gain for 5V full scale.

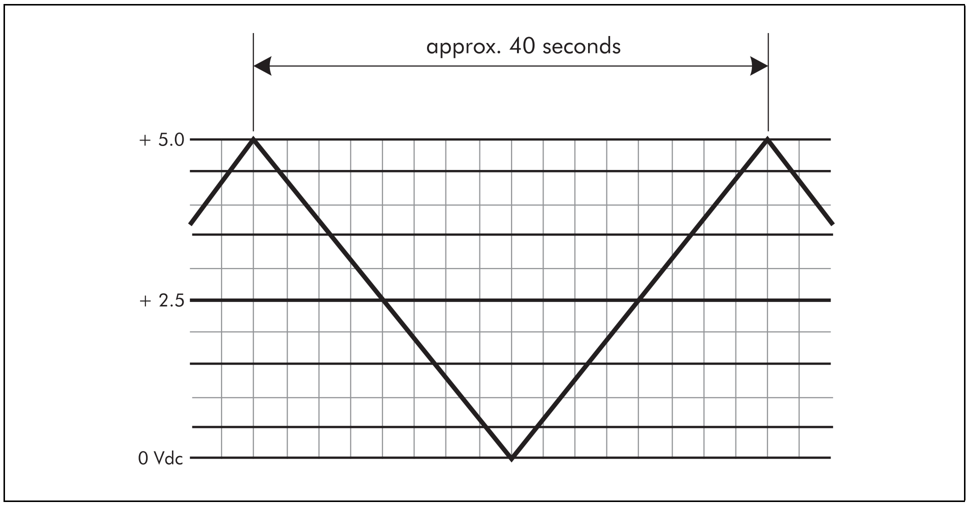
Setting scaling

Correct ramp output

Sensor Module software version 2.10 or earlier



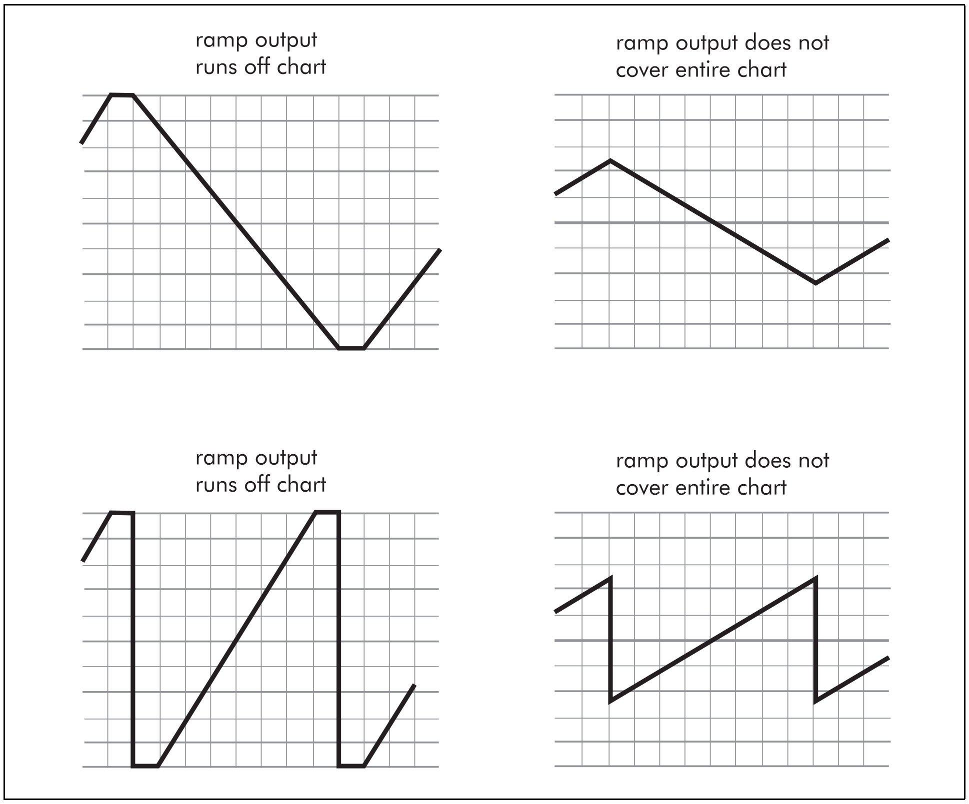
Sensor Module software version 2.20 or later



The Sensor Module can generate a ramp output to verify the chart recorder setting. To obtain the ramp output:

- ❑ Ensure that the Sensor Module is set to local mode at the Sensor Module DIP-switch (SW1-7 OPEN).
- ❑ Hold the tamper switch down, or pull it all the way out, so that the Sensor Module is not in a tamper state.
- ❑ The ramp output should appear with an approximately 30 second period.

Incorrect ramp outputs



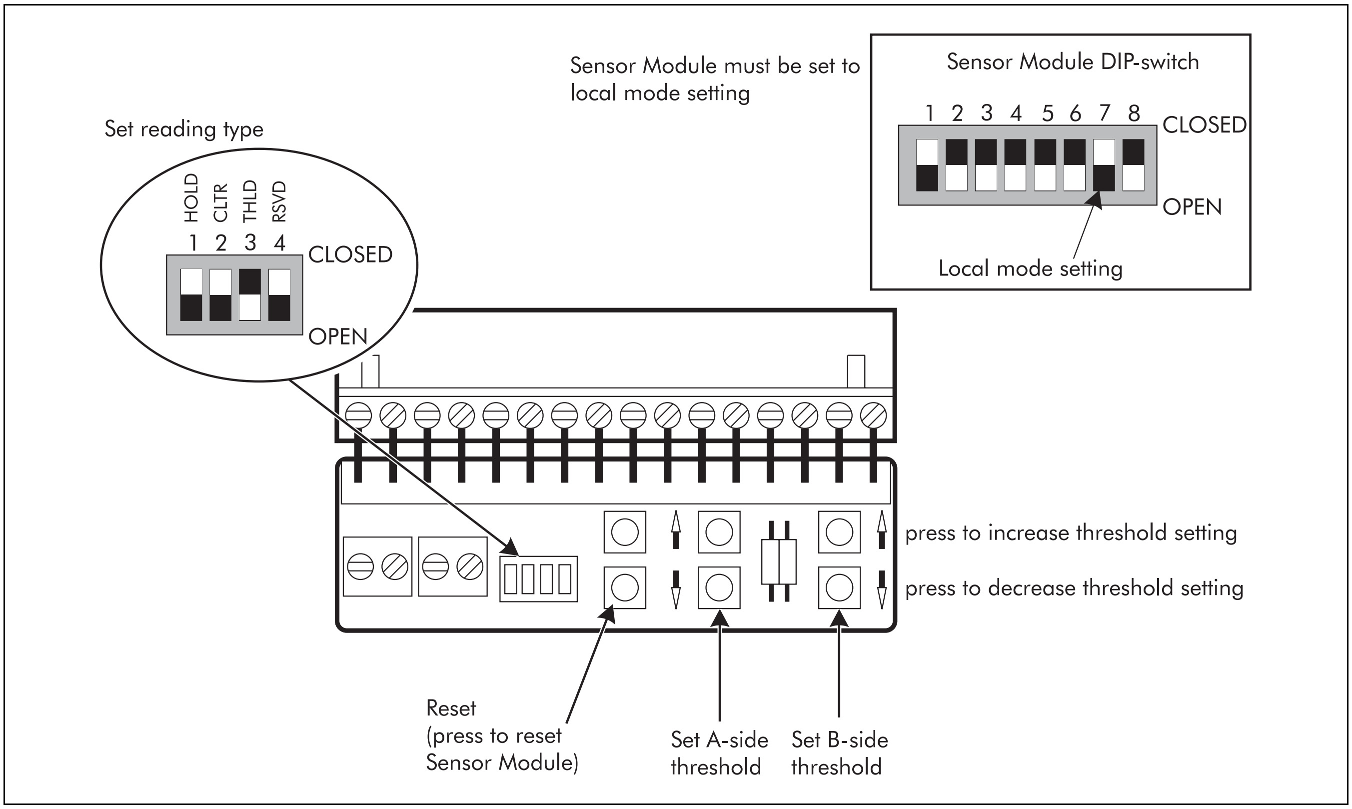
- ❑ If the ramp output is cut off at the top and bottom, or if it does not cover the entire range on the chart paper, adjust the chart recorder scaling and zero point as required.

If you are unable to achieve a proper ramp output, replace the chart recorder or the Sensor Module to determine which one is faulty.

Operating the local interface assembly

The local interface assembly is used to set the reading type (detection signal, clutter, and threshold), to change the detection signal threshold level and to reset the Sensor Module. See "Operating the local interface assembly" on page 7-10 for details.

The Sensor Module must be set to local mode in order for the local interface assembly to be functional.



Local interface assembly control panel

Measuring the detection signal

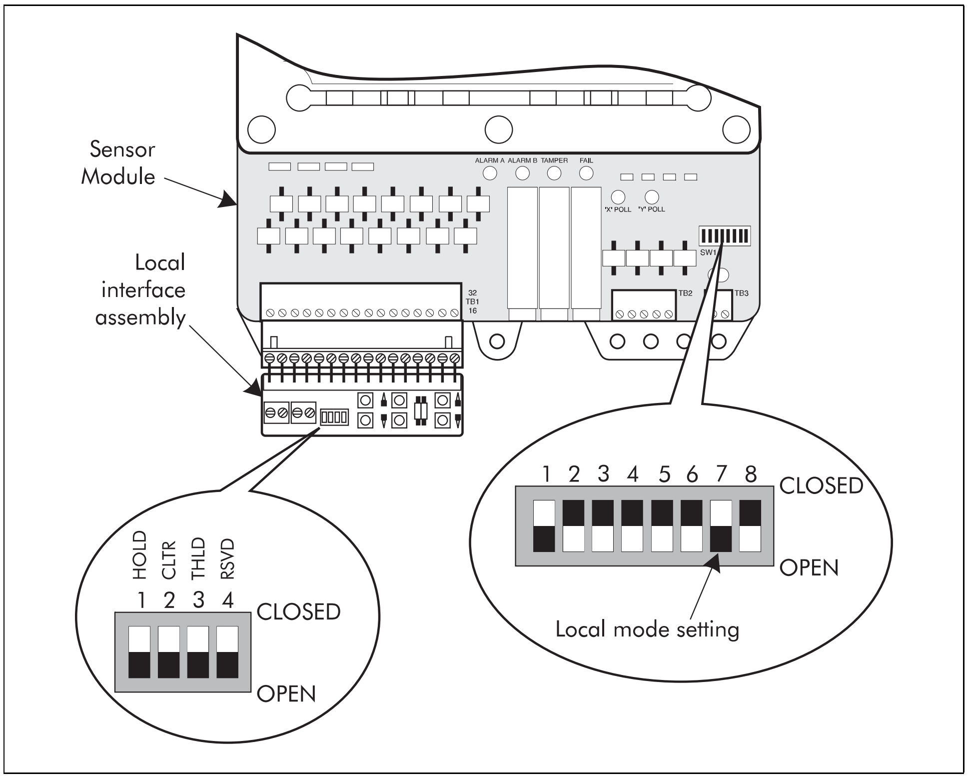
Detection signal measurements, taken from the Sensor Module analog output connectors, are converted from voltage readings into decibels (dB) using the scale factor:

$$1\ V = 20\ dB$$

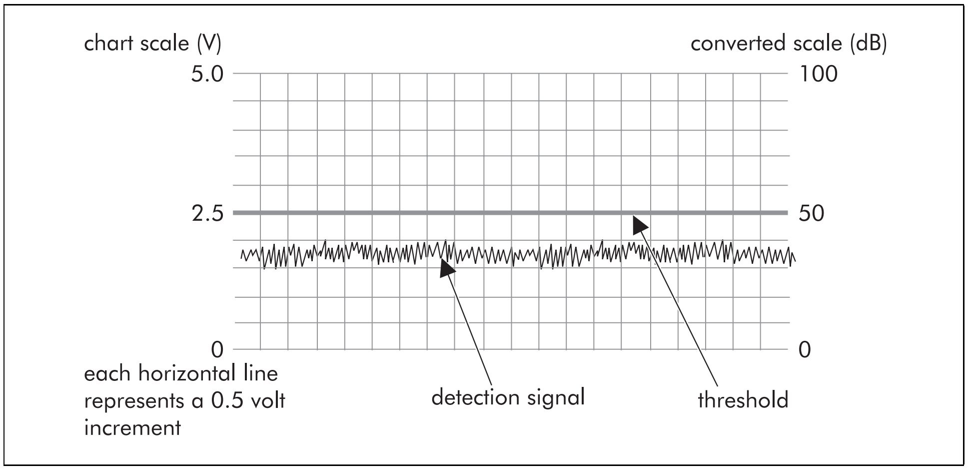
❑ Ensure that the Sensor Module is in a tamper state.

- ❑ Remove the external sensor wiring from TB1 (terminals 1 to 16) on the Sensor Module.
- ❑ Ensure that the DIP-switch on the Sensor Module is set to local mode (SW1-7 OPEN). See "DIP-switch settings" on page 6-16.
- ❑ Insert the local interface assembly in TB1. See "Installation of Local interface assembly" on page 6-6.
- ❑ Set up the chart recorder in accordance with "Setting up a chart recorder" on page 7-8.
- ❑ Set all DIP-switches on the local interface assembly to OPEN. The output at the chart recorder is the current detection signal.
- ❑ To record the peak detection signal set the local interface assembly HOLD DIP-switch to CLOSED.

Measuring the detection signal



sample chart recording



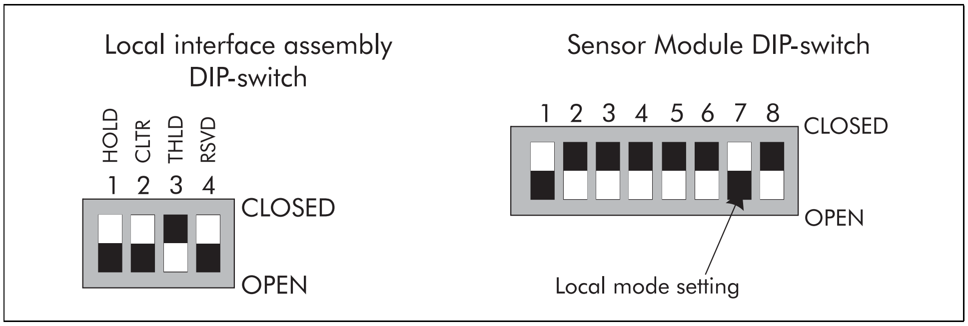
Measuring threshold values

- ❑ Set the Sensor Module and local interface assembly for measuring detection signals. See "Measuring the detection signal" on page 7-10.
- ❑ Set the DIP-switch on the local interface assembly so that THLD is CLOSED and the remaining 3 switches are OPEN.
- ❑ Convert the voltage reading into decibels using the following formula:

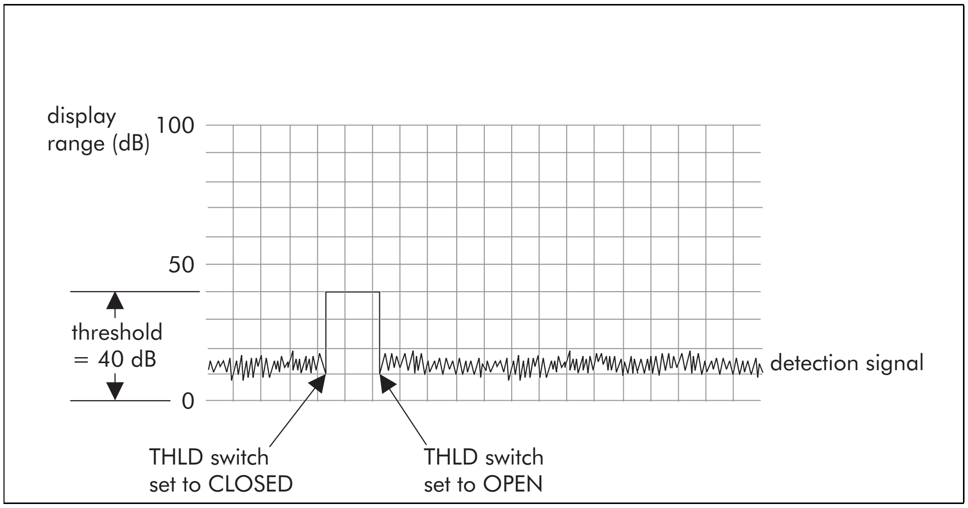
Threshold value (dB) = Voltage reading X 20 dB/V

The display range on the chart is therefore 0 to 100 dB.

Measuring threshold levels

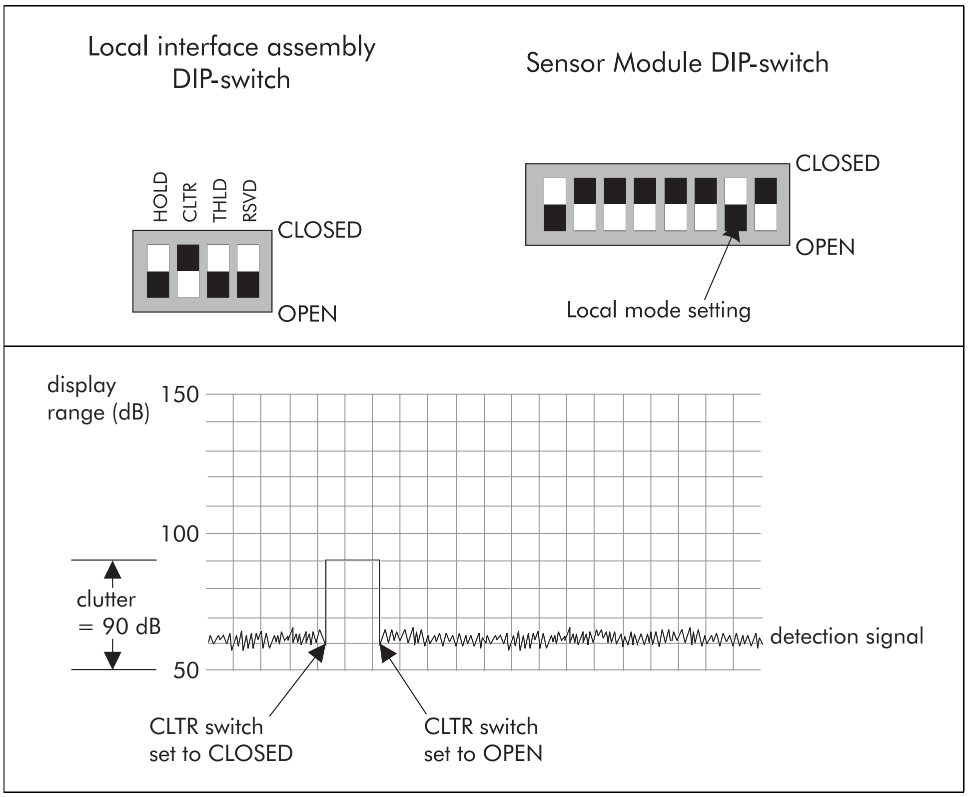


sample chart recording



Measuring clutter levels

sample chart recording



- ❑ Set the Sensor Module and local interface assembly for measuring detection signals. See "Measuring the detection signal" on page 7-10.
- ❑ Set the DIP-switch on the local interface assembly so that CLTR is CLOSED and the remaining 3 switches are OPEN.
- ❑ Convert the voltage reading into decibels using the following formula:

$$\text{Clutter (dB)} = \text{Voltage reading} \times 20\ \text{dB/V} + 50$$

The display range on the chart is therefore 50 to 150 dB.

Summary of test signals

The following table lists the Sensor Module and local interface assembly DIP-switch settings required to obtain various test output signals. Refer to the previous sections in this chapter for formulas to convert voltage readings to decibels.

Analog output	local interface assembly DIP-switch settings				SM DIP-switch settings	
Side - A or Side - B	HOLD	CLTR	THLD	RSVD	SW1-7	*Tamper
detection signal	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
detection signal peak	CLOSED	OPEN	OPEN	OPEN	OPEN	OPEN
threshold	OPEN	OPEN	CLOSED	OPEN	OPEN	OPEN
clutter	OPEN	CLOSED	OPEN	OPEN	OPEN	OPEN
ramp 0 to 5.0 V	—	—	—		OPEN	CLOSED
ramp 0 to 5.0 V	—	—	—		CLOSED	OPEN

* **tamper switch**
OPEN = box/switch open (in tamper)
CLOSED = box/switch closed (not in tamper)

The walk test

The walk test is a measurement that is used to assist in calibrating the system. This test is most easily conducted with two people (the observer and the walker). One person, the walker, walks along the cable path while the other person, the observer, notes the changes to the detection levels on the chart recording or plot while the walk test is in progress.

Since the two people conducting the walk test are generally not in the same vicinity, it is suggested that the two communicate by two-way radio (i.e., walkie-talkie).

Standalone ▶

Conduct the walk tests in zone pairs. After each walk test has been concluded in the zone, press and release the RESET button on the Sensor Module local interface assembly to prepare for a subsequent test.

Conducting the test

Walker

- ❑ Walk at a moderate pace, heel to toe, around the zones to be calibrated, while remaining along the center line of the detection zone. When you reach the end of the last zone, walk at least 10 m (33 ft.) beyond the detection field and stop. After waiting for one minute, turn around and walk back down the center of the cable path. After completing the walk, move at least 10 m (33 ft.) away from the detection field.

Observer

- ❑ As the walk test is being conducted observe the calibration plot or chart recording for the following items. Indicate where they occur on the chart recording or calibration plot:
  - pay close attention to the red mark/tape locations and decoupler location that define the zones
  - note when the walk starts and stops
  - note when the walker enters or leaves the detection field
  - note when the walker crosses from one zone to the next
  - note when the walker crosses a transition from soil to concrete, concrete to asphalt, etc.
  - note when the walker rounds a corner in the cable path
- ❑ On the printed plot or chart recorder printout, record all information relating to the walk test.
  - Sensor Module address number
  - zone being calibrated
  - threshold and receiver gain settings used during the test
  - locations of corners and changes in the burial medium
  - zero volt level, and voltage and time scales used
  - date and time
  - test participants
- ❑ Identify the minimum and maximum detection signal levels generated when the walker was in each zone.

  If a walk test produces detection signals that vary by more than 18 dB in a zone, there is a greater likelihood that either nuisance alarms or areas of no detection will occur. Adjust the sensitivity of the zone. See "Adjusting sensitivity" on page 7-17.

- ❑ Calculate (in decibels) the average value of the three lowest points on the calibration plot for each zone. Compare this average to the current threshold setting for the zone. If the average is less than 5 dB above the threshold, lower the threshold. If the average is more than 5 dB above the threshold, raise the threshold. See "Optimum threshold setting" on page 7-16.

Built in tamper resistant feature. In order to set threshold the unit must be in tamper and local mode before the threshold adjustment switches will operate.

Repeat the walk test several times. Adjust the threshold setting as necessary until an average minimum detection signal of 5 dB above the threshold is obtained in each zone.

Finishing up

- ❑ Ensure that crossings through the detection field report as sensor alarms on your alarm annunciation equipment. *Follow the troubleshooting procedures in Appendix d Troubleshooting if no alarms report, or if the system generates unexplained tamper or fail alarms.*
- ❑ **Check the containment of each zone**. Have the walker walk along one side of the zone, staying approximately 3.5 m (11 ft., 6 in.) away from the nearest cable. The calibration plot or chart recording should indicate less than 0 dB (2.5 V) and no alarms should occur. Repeat the walk, but on the other side of the cable path.
- ❑ If alarms are generated during this check, raise the threshold slightly and repeat the test. Then perform a normal walk test (down the center of the cable path) to ensure that you haven't set the threshold too high.
- ❑ **Verify your final threshold setting.** Have the walker cross the detection field at random points along the zone. The detection signal should increase above the threshold whenever the walker enters the detection field.

Standalone ▶

- ❑ For standalone Sensor Modules, measure and record the threshold value for each zone. Check that all DIP-switch and jumper settings are recorded accurately.

Optimum threshold setting

The threshold value you apply to each zone determines the probability that the system will be able to detect an intruder. Lowering the threshold increases the probability of detection, but it also increases the likelihood that nuisance alarms will occur.

Threshold margin (dB)	Probability of detection				Application
	70 kg (154 lb.) human walking	20 kg (44 lb.) human walking	10 kg (22 lb.) mammal	5 kg (11 lb.) mammal	
12	> 99%	94%	41%	< 1%	direct assessment recommended
10	> 99%	82%	29%	< 1%	direct assessment recommended
5	**> 99%**	**53%**	**< 1%**	**< 1%**	**maximum margin recommended for sites without direct assessment**
2	> 99%	35%	< 1%	< 1%	for sites without direct assessment desiring low NAR*
0	> 99%	24%	< 1%	< 1%	for sites requiring very low NAR*

* NAR = nuisance alarm rate

Direct assessment means that an operator has direct visual contact with the zone, through guards posted on the perimeter or CCTV coverage.

Performance figures in this table depend on close adherence to recommended installation procedures.

The table shows the threshold margin required to achieve a particular probability of detection. Threshold margin is the difference between the threshold value and the detection signal generated by a 70 kg (154 lb.) person crossing the detection field at the least sensitive point in a zone.

Adjusting sensitivity

Variations in the detection field sensitivity within a zone are referred to as low spots and high spots. Performing a walk test with the Sensor Module connected to a chart recorder can very quickly locate such spots along the cable path. This section describes how to identify problem areas and how to correct them.

Low spots

Occasionally, a small area of reduced sensitivity, or low spot, will occur along the cable path. Generally, these low spots occur:

- when there is a sharp contrast in adjacent installation mediums (i.e., from concrete to sand)
- when the sensor cable passes under a fence
- when the sensor cable passes under a solid polycarbonate panel

Low spots can be adjusted by creating loops in the sensor cable at the boundary between the two mediums, or by installing ferrite beads along the cable from the boundary to the beginning of the low spot. This method is most effective when the second medium is a low loss material such as asphalt or sandy soil.

Apply the low spot adjustment method to both sensor cables in an SC2 system.

In some cases it may not be possible to remove the low spot. If this is the case, a supplementary sensor such as a microwave or an infra-red motion detector can be installed to protect the area. Contact Senstar for more information.

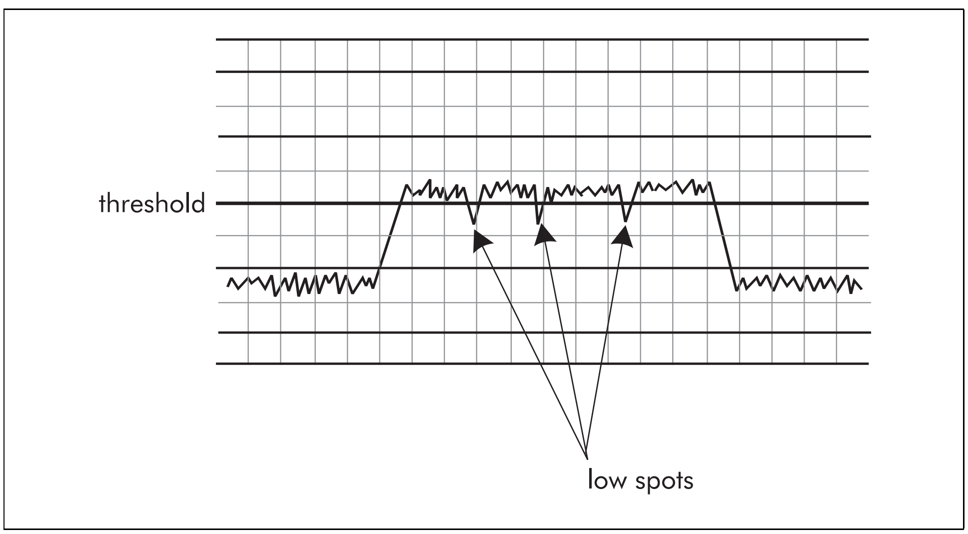
Low spots can present problems because intruders may not be detected in these areas. If you lowered the threshold for the zone so the low spot is 5 dB above the threshold, the rest of the zone would be too sensitive and the nuisance alarm rate may increase.

Examine the chart recordings from your walk tests. Places on the chart where the detection signals are lowest, are low spots in the zone. These are areas where the detection field is not as strong as it is in other areas of the zone.

If the range of the detection signal is too wide (>18 dB), one alternative is to remove the low spots from the zone. Proceed as follows:

- ❑ For this test, calibrate the zone ignoring low sensitivity areas. Perform a walk test. See "The walk test" on page 7-14. Watch for areas of low sensitivity.

Low spots



- ❑ When an area of low sensitivity is encountered drop a temporary marker on the ground.
- ❑ While the calibration plot is running have the walker cross through the detection field at the point where the low spot occurred in the walk test.

- ❑ If an alarm is generated (detection signal greater than 0 dB), the zone does not require adjustment. Have the walker make several crossings near the low spot to ensure that alarms are always generated.
- ❑ If no alarm is generated, locate and remove, if possible, any nearby buried pipes or metal objects. Buried pipes or metal objects can reduce the sensitivity of the detection field if they are too close to the cables.

  OR

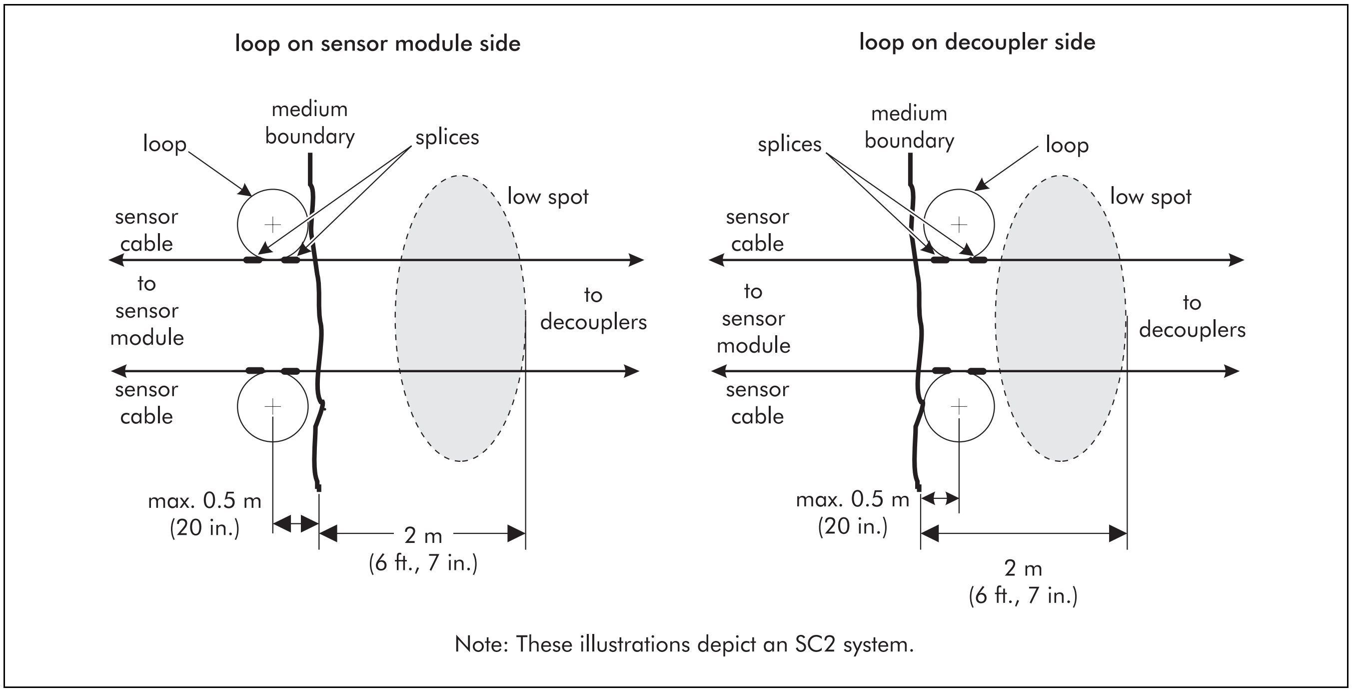
- ❑ If the cables are installed in soil or gravel, gradually raise the cables closer to the ground surface where the low spot occurs. This must be done over the full length of the low spot, starting 2 m (6 ft., 6 in.) before the low spot.

  Raising the cables will sometimes cause the low spot to move farther down the cables. After raising the cables, perform a walk test to ensure the low spot hasn't moved. If it has, repeat the procedure to eliminate all low spots.

Adjusting low spots using cable loops

The cable loops can be created on either side of the boundary between the two mediums, depending on the burial medium.

Both cable loops must be on the same side of the medium boundary when adjusting low spots along an SC2 cable installation.



Adjusting low spots using cable loops

- ❑ Create each loop by pulling 3 m (9 ft., 10 in.) of sensor cable *back toward you* at the boundary.

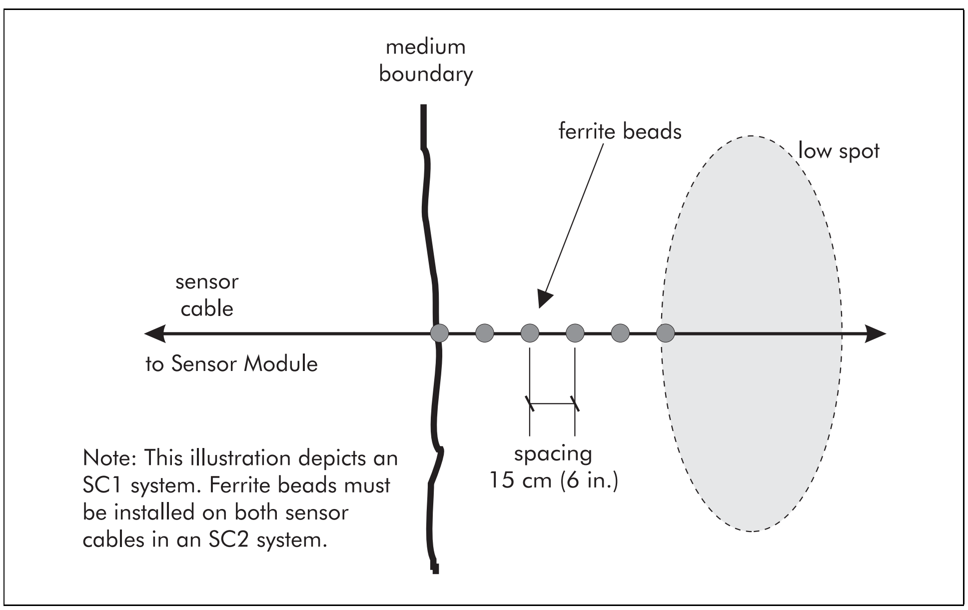
  Ensure that each loop is as close to a true circle as possible.
- ❑ Secure the crossing point of the cable with tape.
- ❑ Position each loop so that the center point of the loop is within 0.5 m (20 in.) of the boundary.
- ❑ Bury each loop at the same depth as the sensor cable in a flat horizontal plane.
- ❑ Retest the cable zone after adjusting the low spot.
- ❑ If the low spot has been removed, proceed with "Completing the cable installation" on page 7-23.

Adjusting low spots using ferrite beads

For some installations it may be impractical to install cable loops. In this case use ferrite beads to reduce the low spot:

- ❑ Slide the beads along the sensor cable so that they are spaced 15 cm (6 in.) apart from the beginning of the low spot location to the medium transition boundary.
- ❑ Secure the beads along the cable using tape.
- ❑ Retest the cable zone after adjusting the low spot.
- ❑ If the low spot has been removed, proceed with "Completing the cable installation" on page 7-23.

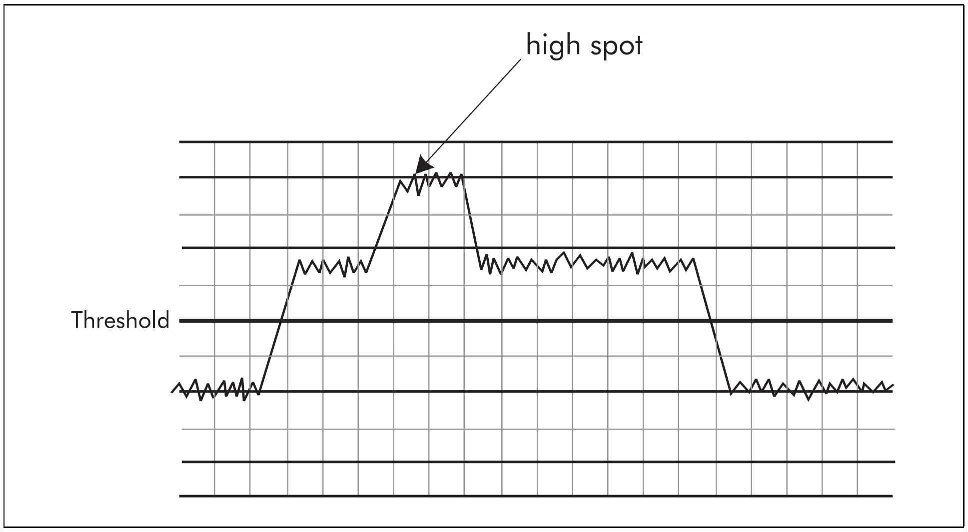
Adjusting low spots using ferrite beads



High spots

After proper calibration look for places on the chart recording where the detection signal exceeds 23 dB (18 + 5 dB) above the threshold. The increased sensitivity in these areas can result in an increased nuisance alarm rate.

High spots



High spots don't always have adverse effects on system operation. Human intruders are detected more easily in these areas, but other targets such as small animals or nearby obstacles might also be detected if they are near the high spot. A high spot can cause zone containment nuisance alarms if it is within 4 m (13 ft.) of:

- areas of high pedestrian traffic
- a frequently used road

If there is an area of high volume pedestrian traffic near the high spot, leave the chart recorder or plot running and walk along the pedestrian path near the high spot. Determine whether any alarms are generated.

If there is a road near the high spot, leave the chart recorder or plot running and monitor traffic moving down the road near the high spot. Determine whether any alarms are generated. If the resulting nuisance alarm rate is acceptable, you could simply leave the high spot alone.

Nuisance alarms arising from environmental influences such as rainfall could be the result of a high spot. The sensitivity in this area could be lowered in order to reduce the rate of nuisance alarms.

Reducing the sensitivity in a zone

The sensitivity of a detection field can be reduced in one of three ways:

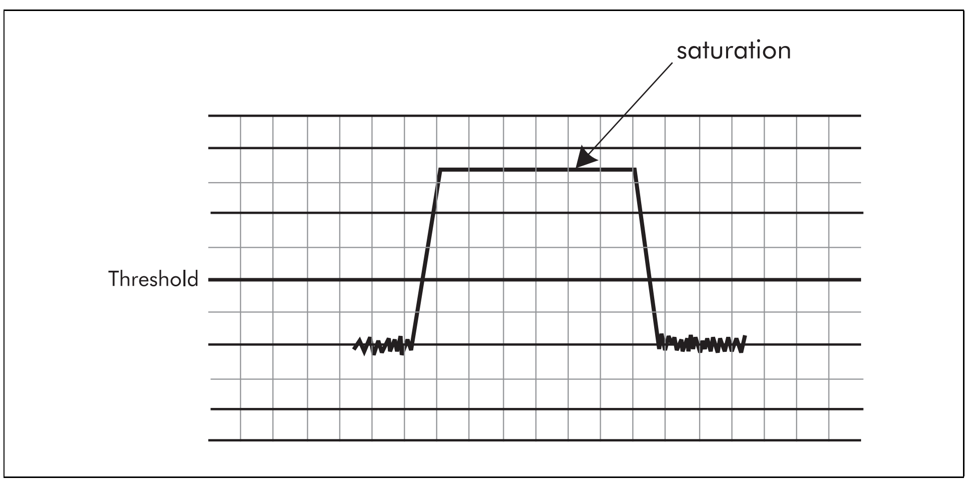
- ❑ Any cable buried in soil can be buried a few inches deeper in the area of the high spot.
- ❑ For any cable installed in asphalt, install ferrite beads 30.5 cm (12 in.) apart on the cable for the length of the high spot. If the cable end is inaccessible, you will have to cut the cable, install the beads, then splice the cables using a repair kit.
- ❑ For any cable buried in soil or gravel, a 10-gauge insulated copper wire can be buried 1.3 cm (1/2 in.) above the cables for the length of the high spot. The wire must be a uniform distance directly above the sensor cable. The wire provides an element of shielding and reduces the detection signal where it is present. Use two wires to lower sensitivity for an SC2 operation.

CAUTION *Be sure to seal the wire ends with mastic and vinyl tape prior to installation. The copper should not contact the ground.*

Saturation

A flattened peak or plateau on the chart recording in a walk test means that part or all of the zone is saturated. This means the detection field is too sensitive and proper calibration is not possible. Saturation may occur only in areas with light, sandy soil.

Saturation



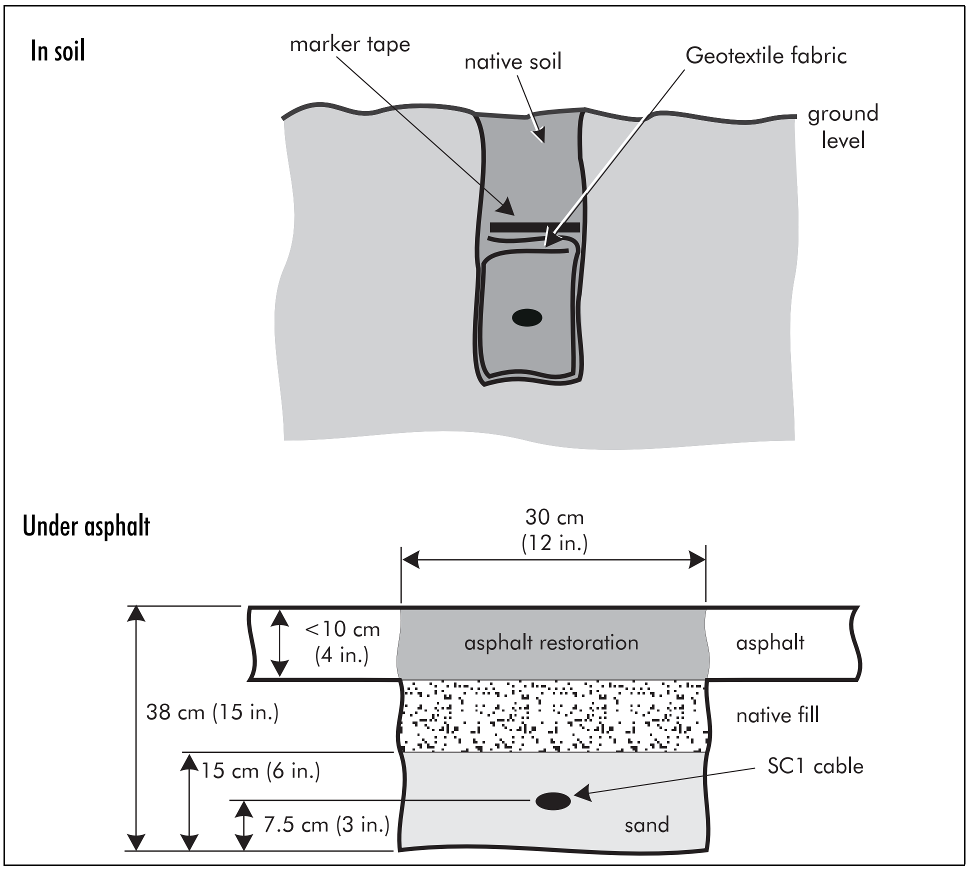
If saturation occurs over a short distance (less than 20 m [66 ft.]), you can adjust the detection field using the procedures for reducing a high spot or simply ignore it. If a large portion of the zone is saturated, you must reduce the Sensor Modules sensitivity by adjusting the Rx gain via the UCM.

Standalone ▶ For a standalone unit, you can reduce the Sensor Module receiver gain by lowering the gain setting. The highest signal level should be reduced enough to be displayed correctly.

Completing the cable installation

For trench installations

Lay cable marker tape and complete the backfilling



❑ Fold the geotextile fabric over the backfill. Lay the cable marker tape on top of this, over the length of the cables.

❑ Planking or half-round conduit can be installed in areas susceptible to damage. (See *Protection of buried cables* on page 4-3.)

❑ Complete the backfilling with the rest of the excavated soil or gravel.

❑ Restore surface treatment.

For slot installations

Required materials

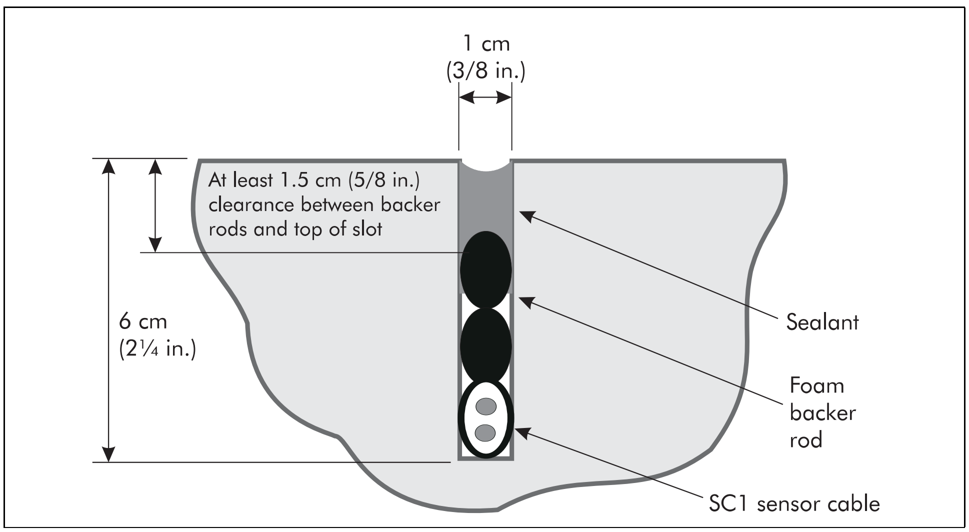
Joint sealant is required to seal the sensor cable in concrete or asphalt slots. Use a Senstar-approved sealant or pre-compressed expanding foam sealant tape. See *Appendix b Recommended installation materials*.

Chemical sealants must be installed in dry conditions. A pump may be required for large installations. Estimate 20 liters of sealant for every 100 m of cable (1.5 U.S. gallons for every 100 ft.) using the specified slot dimensions. Allow extra for spillage.

For proper bonding, sealants require a smooth clean surface. Use a diamond saw to cut the slot, wash the slot with high-pressure water and then air-dry the slot with compressed air.

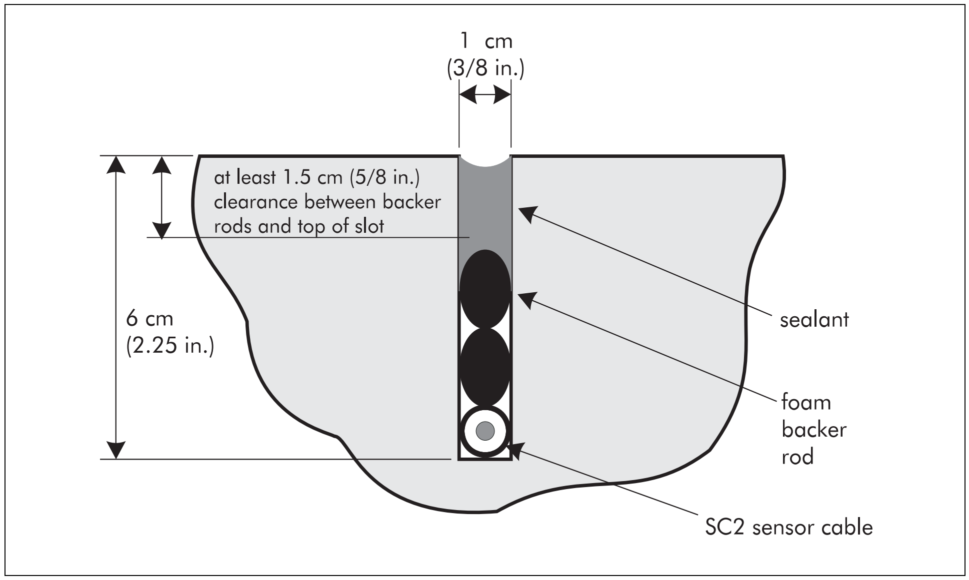
Tape sealants must be inserted manually, and the depth of installation must be carefully controlled. Allow 5% extra length for splices and decouplers.

SC1 Sealing the slot



SC2 Sealing the slot

SC2 ▶



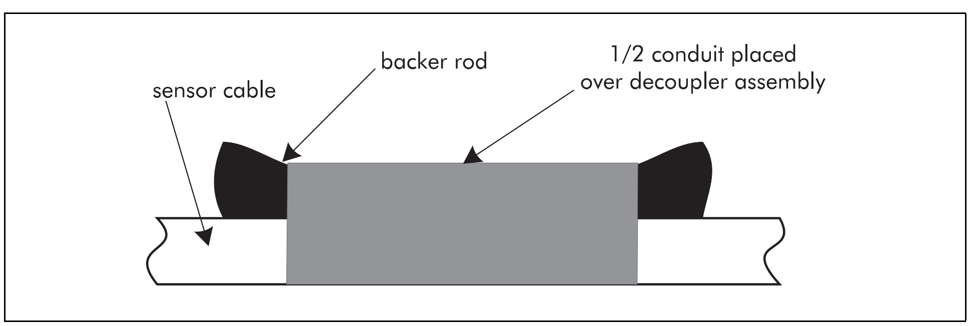
- ❑ Apply sealant as per the manufacturers instructions. Fill the slot to 3 mm (1/8 in.) below the pavement surface. If using chemical sealants, you can slide a striker plate along the slot to mold the sealant to the required depth and provide a smooth finished surface.

Ensure that the backer rod is continuous to avoid any contact between chemical sealants and the cable.

- ❑ Apply sealant to cracks and joints for at least 30 cm (12 in.) on either side of the slot. Remove excess chemical sealant from the pavement surface.
- ❑ If desired, treat the concrete along the cable path with Senstar-approved waterproofing sealer. Follow the manufacturers' instructions.

Do not use Hydrozo Clear 30 M® waterproofing compound, as it can penetrate the cable and possibly affect operation. (Refer to Appendix B for a list of recommended sealers.)

At decouplers



- ❑ Obtain a piece of ABS conduit 0.9 m (3 ft.) in length and approximately 7.6 to 9 cm (3 - 3 ½ in.) in diameter. Cut the conduit in half lengthwise.

- ❑ Cover the decoupler/cable assembly with one half-shell of the conduit.
- ❑ Pack the ends of the conduit with backer rod to prevent sealant from running into the conduit. Ensure that the backer rod is packed tightly so that the conduit does not float up when the sealant is poured.

Ensure that there is at least 1.3 cm (1/ 2 in.) of space between the top of the conduit and the top of the slot, for sealant.

Unused cable

Keep any unused cable and mark it as detecting or lead-in. If later you require a section of cable for splicing, you will need to know whether the piece is detecting cable or lead-in cable.

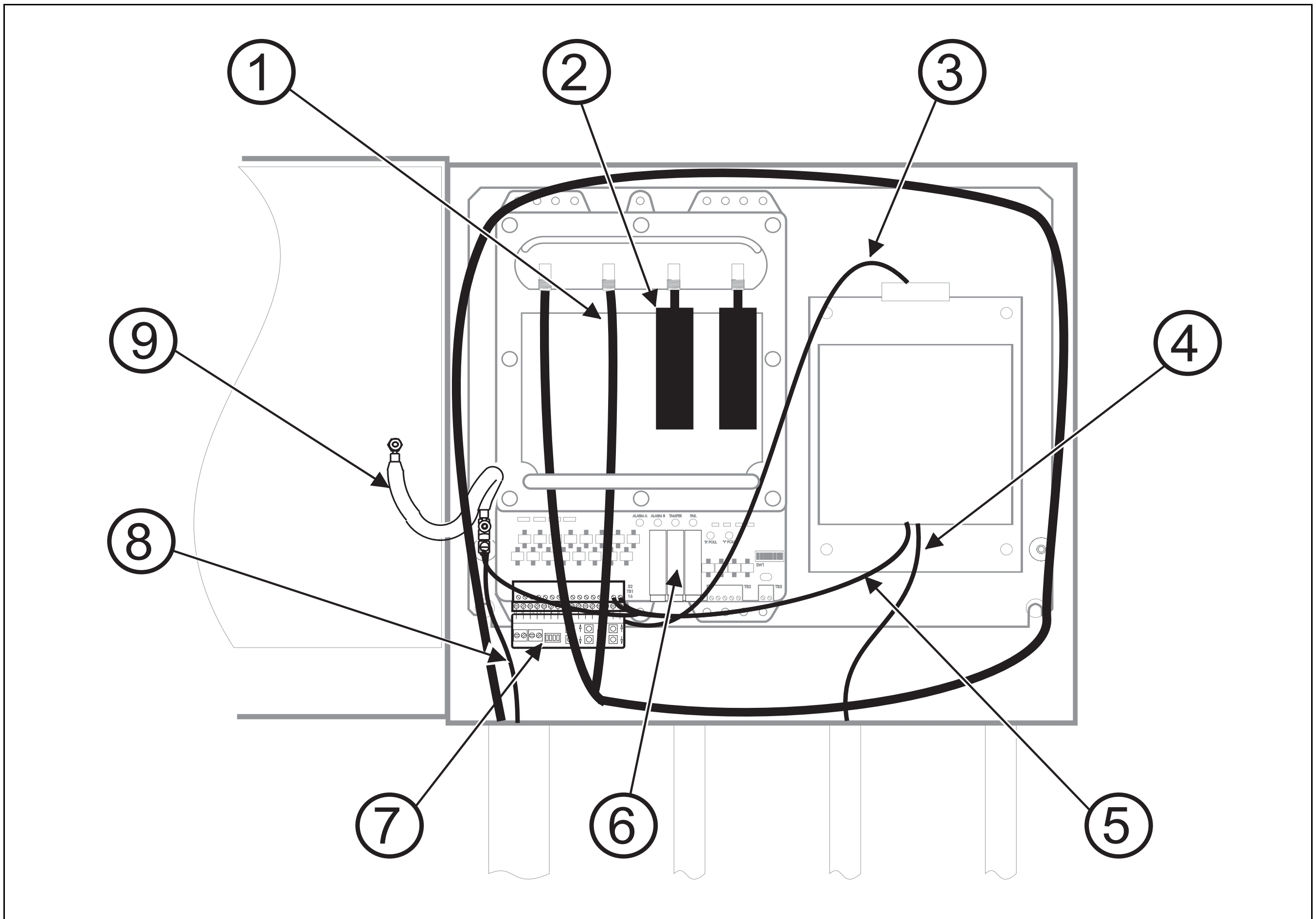
8 Standalone system setup

Once you have completed the installation procedures in chapters 2 through 7 of this guide, you can proceed to setup your system.

This chapter outlines the locations to check, and the system power up sequence. It also directs you to the location of the system calibration procedures.

Procedure/Description	Reference
Checkout cable connections - make sure that all required cable connections have been made	page 8-2
Power up system	page 8-3
Calibrate your system - Using the direct test method of signal measurement and the walk test, calibrate your system to have the detection levels that you require	page 8-4 and page 7-7 through page 7-21

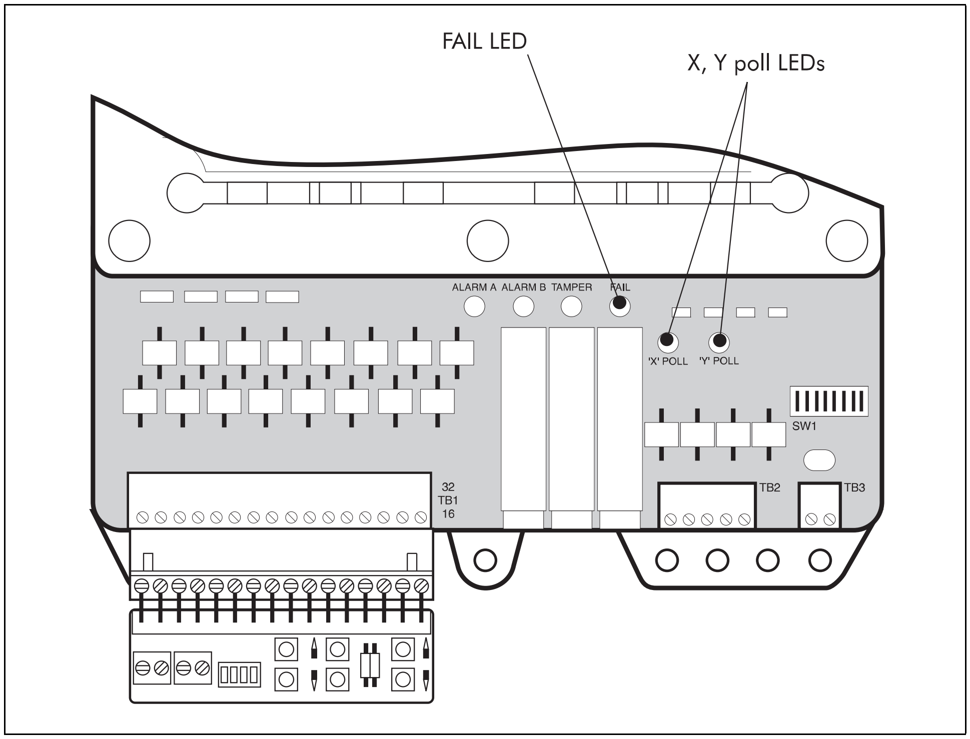
Checkout cable connections



bullet	description	bullet	description
1	sensor cables to SM	6	fusing
2	mini load terminator to SM	7	local interface assembly & I/O, auxiliary devices, etc
3	tamper wire from FPM to SM		
4	external power source to FPM	8	ground wire to ground lug
5	FPM to SM	9	ground lug to enclosure ground

Refer to *Chapter 6, Installing the SM and FPM* for general connection details. See "Sensor Module input/output connections" on page 6-14 for I/O connection details.

Power up procedures



- ❑ Disconnect the power supply from the Sensor Module.
- ❑ Using a digital multimeter set to read voltage find the positive lead from the power supply and connect it to TB1 at terminal 32. Connect the negative lead from the power supply to TB1 at terminal 31.
- ❑ Apply power to the Sensor Module. The following sequence of events should occur:
  - FAIL LED comes on
  - X, Y poll LEDs blink once
  - after 55 seconds the FAIL LED turns off, assuming there are no failures

  The Sensor Module is operational.

Repeat this sequence for each standalone Sensor Module.

Calibrating your standalone system

This section explains how to calibrate the system using a Sensor Module with a local interface assembly connected and a chart recorder.

If your Perimitrax system is a network system that is connected to a Sentient System, following the system calibration procedures in the UCM on-line help file.

Required tools and equipment

- pen or marker
- chart recorder

Points to remember

- if you are calibrating the system using a chart recorder connected to the Sensor Module, each zone must be calibrated individually
- once a threshold is adjusted at a Sensor Module, the Sensor Module must be taken out of the tamper state so that the threshold will be stored in non-volatile memory
- if a walk test does not generate alarms, lower the threshold
- if the detection signal is too high, raise the threshold

Calibration procedure

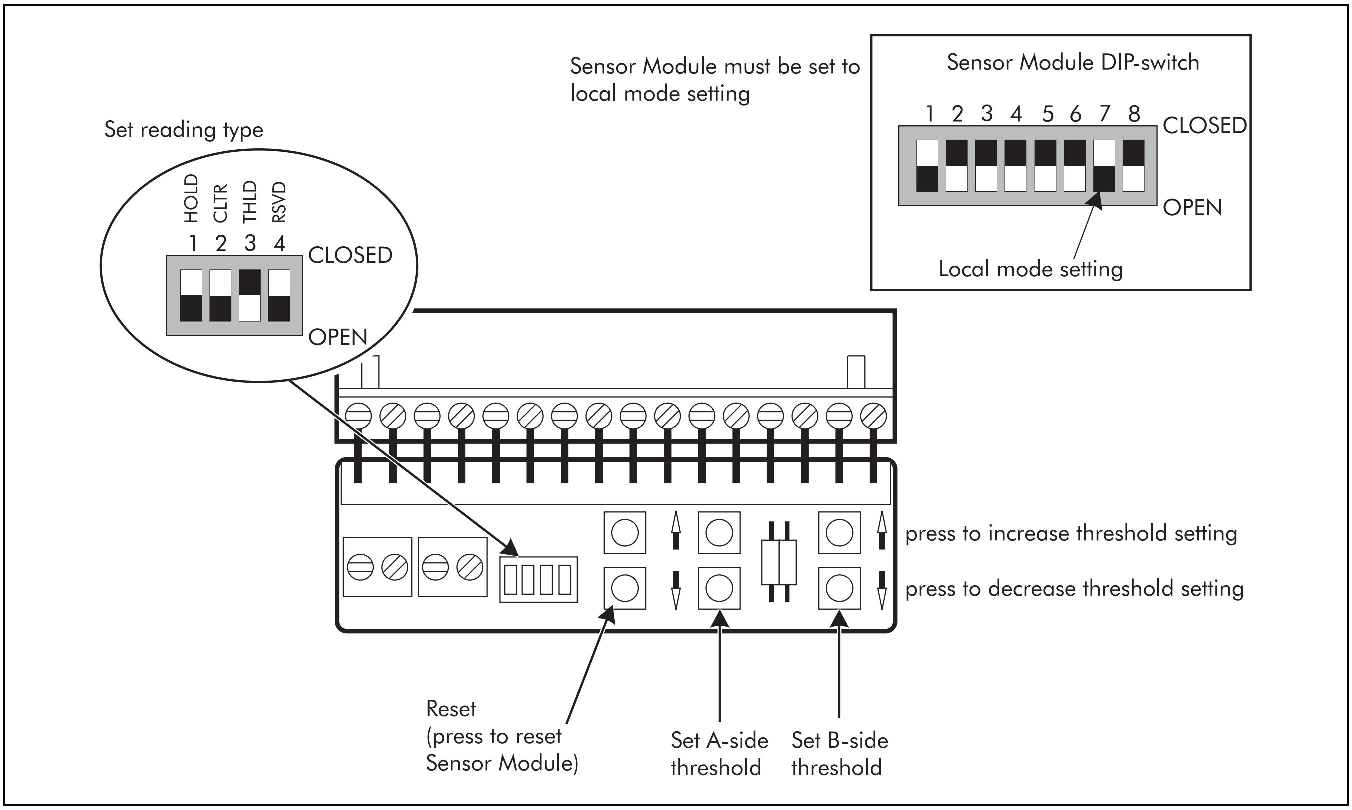
❑ Set up the Sensor Module with the transmit and receive cables of the A-side zone connected to the TXA and RXA connectors and the transmit and receive cables of the B-side zone connected to the TXB and RXB connectors. Ensure that the Sensor Module or its enclosure is grounded to earth ground.

If the Sensor Module monitors only one zone, ensure that unused zone terminators are connected to the unused transmit and receive connectors.

❑ Make sure that the local interface assembly is installed on the Sensor Module.

❑ Make sure that the Sensor Module is powered up. Wait at least one minute before taking any readings.

❑ Connect a chart recorder to the analog output connector of the zone you wish to calibrate. See "Setting up a chart recorder" on page 7-8.



Local interface assembly control panel

- ❑ Set an initial temporary threshold level at 40 dB using the A-side and B-side set buttons on the local interface assembly. See "Measuring threshold values" on page 7-12 for more information.
- ❑ Make sure that no one is in the detection field of the zone that is being calibrated. Press the RESET button and release it. Wait for one minute. The chart recorder should trace a line somewhere below 2.5 VDC. If it doesn't, check the scale and zero position setting on your chart recorder.

The plot of the detection signal should appear fairly constant with only minor fluctuations. These fluctuations are caused by background noise.

If the background noise level is very low, the plot of the detection signal will appear as large steps well below the threshold. This condition is desirable and won't affect the calibration procedure or system operation.

- ❑ Conduct a walk test. See "Conducting the test" on page 7-15. Readjust the threshold levels as necessary using the A-side and B-side set buttons on the local interface assembly.
- ❑ Repeat this process until the system is calibrated in accordance with your site requirements.
- ❑ Close the Tamper Switch (press and hold briefly) to lock-in the new sensitivity value.

9 Repairing sensor cables

Before proceeding with a repair involving the sensor cables you must determine where the fault is located (which cable), whether it is a cable or a decoupler that requires repair, or if it is the cable that requires repair, and what level of damage is present.

This chapter deals with the two most common types of faults ground faults and decoupler faults.

Ground faults

A ground fault occurs when the outer protective jacket of the cable is damaged and a path of conduction is formed from the metals in the cable to the ground. The faults can be intermittent, depending on the soils chemical properties and level of moisture.

All such cable damage must be repaired, otherwise the system might not operate properly.

Decoupler faults

Ground faults can also be caused by decouplers that haven't been properly sealed, causing water to enter the decouplers, connectors and possibly the cable.

Testing for faults

Required equipment

- multimeter
- cable ground fault locator

Test sequence

- perform the leakage resistance test to determine the presence of a ground fault (See "Leakage resistance test" on page 7-5.)
- perform the insulation resistance test to determine if cable damage is severe or if the decoupler is faulty (See "Insulation resistance test" on page 7-4.)
- If the decoupler is suspected of being the ground fault, expose the decoupler and isolate it from the ground. Measure the resistance to see if the ground fault disappears (it should if the fault exists there, as the decoupler is no longer in contact with the ground). If water has entered the decoupler assembly, replace the decoupler. See "*Replacing decouplers*" on page 9-2.
- proceed to locate any faults that could exist on the cable itself
  - use a cable ground fault locator to pinpoint the location of cable faults (A ground fault locator might not be necessary if you know where construction or landscaping work has been done close to the cable path. If this is the case, there is a good possibility that damage has been caused there by the site work.)
  - inspect the cable and assess the damage

Replacing decouplers

If the decoupler is faulty:

- remove the faulty decoupler
  (Replace decouplers in sets for SC1 sensor cables.)
- check the cables to see if water has also leaked in
  (Replace any cable sections where water has entered.)
- install a new decoupler and new heatshrink tubing in accordance with Installing decouplers (See "Decouplers" on page 5-10.)
- do NOT secure the heatshrink tubing in place until the decoupler has been tested (See "Insulation resistance test" on page 7-4.)
- secure heatshrink tubing in place (See "Secure heatshrink tubing" on page 5-15.)

Assessing cable damage

What appears to be only superficial damage may be serious if the cut or abrasion has gone through both cable jackets. Even superficial cuts or scrapes should be repaired, as water can enter a small cut and cause internal damage to the metals in the cable.

When assessing the cable for damage, if corrosion is visible, cut back the jacket until you reach an uncorroded section. Classify the cable damage based on the length of jacket that has been stripped.

Cable damage assessment table

Damage level	Description	Repair reference
superficial	a small, single-point cut or scrape through the cable jacket with no internal damage	page 9-4
minor	a cut less than 1 cm (3/8 in.) in length with internal damage i.e., damage to dielectric	page 9-4
moderate	a damaged section more than 1 cm (3/8 in.) but less than 45 cm (18 in.) in length	page 9-5
severe	a damaged section more than 45 cm (18 in.) in length	page 9-5

Required equipment (dependent on cable damage)

Tools

- knife
- side cutting pliers
- crimp tool
- ruler
- heat gun or propane torch

Perimitrax components

- mastic tape/vinyl tape
- decoupler kit
- cable repair kit
- spare sensor or lead-in cable
- replacement cable set

Repairing cable damage

Superficial damage

To repair superficial damage, seal the affected section with rubber mastic tape as described below.

- [ ] Clean the cable thoroughly on either side of the damaged section, using a cloth or paper towelling.
- [ ] Wrap overlapping layers of rubber mastic tape around the damaged section.
- [ ] DO NOT use normal electrical tape for this layer.
- [ ] Wrap electrical tape over the rubber mastic tape for extra mechanical protection.
- [ ] Mark the location of the damage on the site plan.

Minor damage

To repair minor damage, use a cable splice consisting of a male and female connector at the damaged section.

- [ ] Cut the cable at the centre of the damaged section. Clean the cable thoroughly on each side of this section, using a cloth or paper towelling.
- [ ] Examine the cut ends of the cable for any corrosion. If there is corrosion strip back the jacket until you reach uncorroded cable. Classify the cable damage based on the length of jacket you've stripped. See "Assessing cable damage" on page 9-3.
- [ ] Install connectors on the cut cable ends. See "Installing connectors" on page 5-3.
- [ ] Test the connectors for proper installation. See "Zone-pair continuity test" on page 7-2.
- [ ] Install heatshrink tubing. See "Secure heatshrink tubing" on page 5-15.
- [ ] Mark the location of the damage on the site plan.

Moderate damage

To repair moderate damage, remove the damaged cable and splice in a section of new cable. The cable repair kit includes all the necessary parts to make this repair.

- ❑ Cut out the damaged section of cable, ensuring that it is no longer than 45 cm (18 in.).

  Cut out at least 30 cm (12 in.), regardless of the actual length of the damaged section.

- ❑ Examine the cut ends of the cable for any corrosion. If there is corrosion strip back the jacket until you reach uncorroded cable. Classify the cable damage based on the length of jacket you've stripped. See "Assessing cable damage" on page 9-3.
- ❑ Install one connector each on the cut cable end and replacement piece of sensor cable. See "Installing connectors" on page 5-3.
- ❑ Test the connectors for proper installation. See "Zone-pair continuity test" on page 7-2.
- ❑ Install heatshrink tubing. See "Secure heatshrink tubing" on page 5-15.
- ❑ Mark the location of the damage on the site plan.

Severe damage

The procedure for repairing severe cable damage depends on whether the damage is done to lead-in or detecting cable.

If lead-in cable is damaged, an equivalent length of lead-in cable can be spliced in.

If detecting cable is damaged, up to 3 m (9 ft., 9 in.) of new detecting cable can be spliced in. Any section of detection cable may be used for this purpose. For sections less than 3 m in length it is not important to match the detecting cable sensitivity exactly. It is best to use an off-cut of a cable end from the original installation for this purpose, or acquire the required cable from the manufacturer.

If the damage covers more than 3 m, replace the entire cable if possible. If this is impractical, splice in a new section of cable using the procedure in "Repairing large sections of cable" on page 9-6.

Repairing large sections of cable

Be very careful when replacing a long damaged section that includes detecting cable. The gaps inside the cable, which cause it to detect, get bigger along its length. You must ensure that the new section of cable has gaps equivalent to that in the damaged section at each end.

- ❑ Measure or estimate the length from the red mark on the cable to the start of the damaged section.
- ❑ Obtain a new sensor cable that is the same original length as the damaged cable. Unroll the new cable along the path of the damaged cable (make sure that the non-detecting sections on both cables are at the same end).
- ❑ Align the red marks on the cables.
- ❑ Cut out and discard the section of damaged cable.
- ❑ Cut out the replacement section of new cable at the same location as the section removed from the damaged cable.
- ❑ Splice the new cable section into the installed cable, using the male and female connectors, and heatshrink as follows:
  - install connectors (See "Installing connectors" on page 5-3.)
  - test the connectors for proper installation (See "Zone-pair continuity test" on page 7-2.)
  - install heatshrink tubing (See "Secure heatshrink tubing" on page 5-15.)
- ❑ Label the leftover ends of the new cable, specifying the cable length and which end is which. These can be used in future repairs or in locations where you need a short cable section.
- ❑ Mark the location of the replaced section on the site plan.

a System component list

Requirements	Model Number	Part Number	Description
Sensor module	SM100-1	A3FG0101	Standard
	SM100-2	A3FG0102	Alternate RF frequency set
	SMDT01	A3EM0103	Data module
Sensor module accessories (for processor versions prior to Revision F)	SMCF-2A	A3SP1101	Crystal filter, external, for EMI suppression, for SM100-2, A-side, 40.665 MHz
	SMCF-1A	A3SP1102	Crystal filter, external, for EMI suppression, for SM100-1, A-side, 40.675 MHz
	SMCF-1B	A3SP1103	Crystal filter, external, for EMI suppression, for SM100-1, B-side, 40.685 MHz
	SMCF-2B	A3SP1104	Crystal filter, external, for EMI suppression, for SM100-2, B-side, 40.695 MHz
Field power modules and options	FPM-12	A3EM0201	Standalone DC power supply, 115/230 VAC, 50/60Hz input, 12 VDC @ 8A output (Includes hardware for mounting in Sensor Module or power supply NEMA rated enclosures.)
	FPM-12R	A3EM0202	Same as above but with Hi-Rel option, 50 W output
	FPM-48	A3EM0304	Network power supply, 115/230 VAC, 50/60Hz input, 48 VDC 150 W output (Includes hardware for mounting in Sensor Module or NEMA rated enclosures.)
	FPM-48R	A3EM0302	Same as above but with Hi-Rel option, 150 W output
	WE1-4	M0706	Power supply NEMA rated enclosure (Required for standalone or Telecom style enclosure. Includes mounting hardware. In Telecom enclosure, must be used in conjunction with A3MD0300.)

Requirements	Model Number	Part Number	Description
Field power modules and options (cont'd)	RB1-1	A3MD0300	Replacement bracket for Telecom style enclosure (Replaces the bracket shipped with the Telecom enclosure.)
Enclosure options & accessories	WE2-1	A3MA0101	Lockable outdoor NEMA 4/IP 66 rated enclosure with integral tamper switch (Internal mounting plate includes hardware to mount Sensor Module and optional standalone or network power supply. Gray enamel finish, steel construction, 410 x 510 x 150 mm (16 x 20 x 6 in.).)
	WE2-2	A3MA0102	Stainless Steel Lockable outdoor NEMA 4/IP 66 rated enclosure with integral tamper switch (Internal mounting plate includes hardware to mount Sensor Module and optional standalone or network power supply. Gray enamel finish, steel construction, 410 x 510 x 150 mm (16 x 20 x 6 in.). * special order item, not stocked)
	WE2-3	A3MA0501	Lockable outdoor NEMA 4/IP 66 rated enclosure with integral tamper switch (Internal mounting plate includes hardware to mount Sensor Module and optional standalone or network power supply. Gray enamel finish, steel construction, 510 x 510 x 150 mm (20 x 20 x 6 in.).)
	WE2-4	A3MA0502	Stainless Steel Lockable outdoor NEMA 4/IP 66 rated enclosure with integral tamper switch (Internal mounting plate includes hardware to mount Sensor Module and optional standalone or network power supply. Gray enamel finish, steel construction, 510 x 510 x 150 mm (20 x 20 x 6 in.). * special order item, not stocked)
	PE2-1	A3MA0300	Telecom style protective enclosure for above ground field mounting of Sensor Module (Includes tamper switch, mounting hardware and ground stake. Removable, lockable cover (lock not supplied), light green enamel 254 x 254 x 910 mm (10 x 10 x 36 in.).)
	PK1-1	M0703	Pole mounting kit, NEMA enclosure
	HP1-1	M0704	Handle, padlock, NEMA enclosure
	FP1-1	M0705	Composite mounting foot kit, NEMA enclosure
Cable sets (SC1)	SC1-50	A3FG0201	50 m (164 ft.) single cable set
	SC1-100	A3FG0202	100 m (328 ft.) single cable set
	SC1-150	A3FG0204	150 m (492 ft.) single cable set
	SC1-200	A3FG0211	200 m (656 ft.) single cable set

Requirements	Model Number	Part Number	Description
Cable sets (SC2)	SC2-50	A3FG0301	50 m (164 ft.), dual cable set
	SC2-100	A3FG0302	100 m (328 ft.) dual cable set
	SC2-150	A3FG0304	150 m (492 ft.) dual cable set
	SC2-200	A3FG0311	200 m (656 ft.) dual cable set
Spare Lead-in cable (SC1)	LC1-25	A3CA0601	25 m (82 ft.), single cable lead-in
	LC1-50	A3CA0602	50 m (164 ft.), single cable lead-in
	LC1-100	A3CA0603	100 m (328 ft.), single cable lead-in
Spare Lead-in cable (SC2)	LC2-25	A3CA0701	25 m (82 ft.), dual cable lead-in
	LC2-50	A3CA0702	50 m (164 ft.), dual cable lead-in
	LC2-100	A3CA0703	100 m (328 ft.), dual cable lead-in
Spare ferrite beads	FB1-2	A3KT0300	Single cable ferrite bead kit (50)
	FB2-2	A3KT0400	Dual cable ferrite bead kit (50)
Cable installation tools	CT3-3	A0KT1500	Connector tool kit
Cable splice kits	RK1-1	A3KT0500	Single cable splice kit
	RK2-1	A3KT0800	Dual cable splice kit
Cable connectors	TNC-F	A0SP0600	TNC female connector
	TNC-M	A0SP0700	TNC male connector
Adapter	TNC-NF	T0600	TNC male to N female connector
	TNC-FF	T0395	TNC female to female ended adapter
	TNC-MM	T0421	TNC male to male ended adapter

Requirements	Model Number	Part Number	Description
Heatshrink	HS1-1	W0214	Heatshrink tubing for SC1 sensor cable, 61 cm (24 in.) long
	HS2-1	W0215	Heatshrink tubing for SC2 sensor cable, 41 cm (16 in.) long
Decoupler kits	DK1-1	A3KT0601	Single cable standalone decoupler kit (use with SC1 sensor cable)
	DK1-2	A3KT0701	Single cable network decoupler kit (use with SC1 sensor cable)
	DK2-1	A3KT0602	Dual cable standalone decoupler kit (use with SC2 sensor cable)
	DK2-2	A3KT0702	Dual cable network decoupler kit (use with SC2 sensor cable)
Terminator kits	TK1-4	A3CA0100	Single cable long terminator kit
	TK2-4	A3KT0100	Dual cable long terminator kit
	ML1-1	A3KT0200	Mini load terminator for unused zones kit
Lightning protection	LA1-5	E0310	External lightning arrestor (requires LA1-R)
	LA1-R	E0311	Gas pellet replacement for lightning arrestor
Network controller options & accessories	SN-CN1	M0KT0310	Network controller circuit card assembly
	SN-PW1	M0KT0100	Line powering (Selectable 115/230 VAC, 50/60 Hz input, provides 16 VAC for use with Network Controller.)
	BA-1	00KT0100	Battery, 12 VDC, 6AH. Minimum 8 hours back-up
	SN-EN1	M0KT1000	Mounting plate, for use in OEM enclosures
	SN-EN2	M0KT0800	Indoor enclosure with tamper switch and mounting plate (lockable, padlock not included, for general indoor use)
	SN-EN3	M0KT0900	NEMA 4/IP 66 rated enclosure with tamper switch and mounting plate (lockable, padlock not included)
	SN-LN1	E0302	Lightning protection device for data lines

Requirements	Model Number	Part Number	Description
System cabling	PC-NC1	A3CA0901	3 m (10 ft.), RS-232 cable, network controller to PC
	PC-NC2	A3CA0902	7.5 m (25 ft.), RS-232 cable, network controller to PC
	PC-NC3	A3CA0903	15 m (50 ft.), RS-232 cable, network controller to PC
	NW-30	W0222	30 m (100 ft.), data grade cable for RS-485 network wiring, one pair
	NW-150	W0223	150 m (500 ft.), data grade cable for RS-485 network wiring, one pair
	NW-300	W0224	300 m (1000 ft.), data grade cable for RS-485 network wiring, one pair
Sentient Security Management System, Network Manager, Universal Configuration Module	Windows based alarm display and control system software; Windows based alarm data management software; Windows based maintenance and calibration software; Contact the factory for details		
Interface option	SA1-1	A3BA0400	Local calibration interface assembly used with Sensor Modules in standalone configurations (Allows local manual setting of alarm thresholds.)
Printers	PR2-1	OI-200056-01	80 column printer, parallel, 115V, 60 Hz version, includes 3 m (9 ft., 10 in.) parallel interface cable
	PR2-2	OI-200056-02	80 column printer, parallel, 230V, 50 Hz version, includes 3 m (9 ft., 10 in.) parallel interface cable
Power cords	PC-UK	E0321	UK, 250 VAC, 10 A, 2.5 m
	PC-EC	E0322	European, 250 VAC, 10 A, 2.5 m
	PC-AS	E0323	Australian, 250 VAC, 10 A, 2.5 m
	PC-IT	E0324	Italian, 250 VAC, 10 A, 2.5 m
	PC-XT	E0325	Extension, IEC 320, jumper, 2.5 m
Tape	RT1-1	X0217	Amalgamating tape
	MT1-1	X0191	Mastic tape
	VT1-1	X0190	Vinyl tape

Requirements	Model Number	Part Number	Description
Manuals	- - -	A3DA0102	Perimitrax Site planning guide
	- - -	A3DA0202	Perimitrax Installation guide
	- - -	M0DA0302	Sennet product guide

b Recommended installation materials

The following is a summary of sealants, sealers and other recommended materials for cable installations.

Sealant materials

Sealants may be poured from a can, caulking or sausage gun, or pumping equipment for large quantities. Consult the supplier for the appropriate format for the job and size. Materials may be self-levelling (SL) or non-sag (NS). Generally if the site is very flat, the SL materials flow most readily into the slot. However, if there is any slope, the material might run out of the slot or beneath the backer rod and periodic dams made of backer rod may be needed during curing. An NS material may be used but these materials are more viscous and hence harder to pour, and they may need tooling. Pre-formed sealants avoid many of these chemical issues.

The following describes some of the specific sealant characteristics and provides sources of supply for materials tested. Consult the manufacturer or local representative for specific equipment recommended for installation, handling instructions and material safety sheets.

Willseal 600 (Illbruck, Minneapolis, MN, 800-274-2813) is a compressed, open cell polyurethane tape impregnated with neoprene. It is furnished in 14 ft. rolls with a cross-section sized to expand to, and tightly fill, the slot dimensions above the cable. It has an adhesive on one side to retain it during the expansion. It is applied by hand via this sidewall adhesion, using a putty knife, and it expands within several hours to form a compression seal. Double layers can be used for wider slot areas at decouplers. In the preferred application it is sized to replace both the backer rod and sealant in a single step however, this is slightly more costly in materials. The advantage of using this size is that it both provides the optimal seal shape and replaces one installation step. A note when using pre-forms – since the seal depth is fixed, slot depth variations must be minimized when cutting. A tolerance of no more than +/- 3 mm (1/8 in) is recommended to ensure the sealant is recessed over its entire length. Since it arrives pre-compressed to 20% of its maximum width, width variations are more tolerable.

DOW 888, 890SL Highway Joint Sealant (Dow Corning, Midland, NJ). These are single component silicones, with 888 (grey) rated for concrete and 890 (black) rated for asphalt and concrete. They can be applied by caulking guns or pumping equipment (see below). The SL version is preferred. Curing will be slower in thick sections or at low temperatures, since air/moisture is required. It provides a very good and durable bond to materials.

MOBAY 960 (Mobay Corporation, Pittsburgh, PA, (412) 777-2000). This is a single component silicone that appears equivalent to DOW 888 with similar properties and application.

SEALEX (Meadows Sealtight Sealex Traffic Loop Sealant, W.R. Meadows, Elgin, IL, (708) 683-4500). This is a low-cost, 2-component (black) material that is easily mixed in the can and poured directly into the slots. It bonds to both asphalt and concrete but has a low bond strength. It is very fluid so care must be taken that it doesn't leak under the backer rod or out of sloping slots. Curing has typically proven variable, from 1/2 hour to 3 days. It has been used extensively in less demanding applications.

SIKA 2C (SIKA, Lindhurst, NJ, (609) 933-8800). SIKA make a variety of sealing products that may be country or regionally dependent. 2C is a 2-component polyurethane replacement for 12 SL. It is claimed to cure better than 12 SL; however, it is available only in 1.5 gallon buckets, with mixing done in the bucket with a mixer. Although not recommended, in testing it did appear to adhere well to old asphalt. The SL version is preferred.

Other sealant suppliers

U.S. Distribution Headquarters

Listed below are the U.S. Distribution Headquarters for some sealant manufacturing companies. These companies distribute products through dealers and/or distributors. If sealant is to be obtained from any other outlet than what is identified on the following sheets, you may contact the Distribution Headquarters of the selected sealant manufacturer.

Willseal-600
3800 Washington Ave. North
Minneapolis, MN 55412
Tel. (800) 274-2813

Dow Corning Technical Services
Tel. (800) 248-2481

W.R. Meadows (Sealex Traffic Loop Sealant)
East–(717) 792-2627
Central–(816) 221-6262
West–(714) 469-2606

Sika Corp.
201 Polito Avenue
Lindhurst, NJ 07071
Tel. (609) 933-8800

European Distribution

Illbruck
FranceTel. (01) 46-72-8484
BelgiumTel. (03) 658-3519
GermanyTel. (0217) 391-0

Dow Corning Europe
BelgiumTel. 32-2-6552111

Willseal-600 (Illbruck)

3800 Washington Ave., North
Minneapolis, MN 55412
Tel. (800) 274-2813

Sunshine Industries
2820K Roe Lane
Kansas City, KS 66103
Tel. (913) 362-6300

John Lattat Associates
1001 South East Division Street
Portland, OR 97202
Tel. (503) 238-1253

Sealex (W.R. Meadows)

Charles Hayes Inc.
6424 Taft Road
Scyccassi, NY 13220
Tel. (315) 452-1080

Aylwand Products
1201 Forest Street
Kansas City, MO 64106
Tel. (816) 221-6262

Concrete Tie
130 Oris Street
Compton, CA 90222
Tel. (310) 886-1000

U.S. Distribution Sika 2C/SL
D.M. Figley
10 Kelly Court
Menlo Park, CA
Tel. (415) 329-8700

Garvin Construction Products
128 Cambridge Street
Charlestown, MA 02129
Tel. (617) 242-2525

Smalley & Co.
861 South Jason Street
Denver, CO 80223
Tel. (303) 777-3010

Application equipment

Consult the sealant manufacturer or local supplier for recommendations. They may also rent equipment for application or suggest a local installer. For smaller jobs requiring only several feet, the use of caulking guns or pails may be most suitable. For intermediate sizes, for example a roadway crossing, the use of a pneumatic caulking gun using quart cartridges may be preferred. A source of supply for caulking, sausage and pneumatic guns, and a part number for the pneumatic type is:

Albion Model 702-G01
Albion Engineering
Philadelphia, PA
Tel. (215) 535-3476

This gun requires an external air supply, such as the compressor used to clean out the slots.

For very large jobs, sealant pumping equipment may be required. A source of supply is:

Graco Inc.
Minneapolis, MN
Tel. (612) 378-6000

Backer rod

This is a closed-cell polyethylene rod used as a slot filler and separator from the cable, and also as a bond breaker for the sealant. It can usually be purchased locally in long rolls from building supply companies or via the local sealant supplier.

Sources of supply if local sources are not available, include:

W.R. Meadows
Elgin, IL
Tel. (708) 683-4500

Alcot Plastics
29 Commerce Cres.
Acton, Ont.
Tel. (519) 853-3228

Other backer rod suppliers

Coastal Construction
660 North West 85th St.
Miami, FL
Tel. (305) 757-2121

Garvin Construction Products
128 Cambridge Street
Charlestown, MA 02129
Tel. (617) 242-2525

Harry Lowry & Assoc.
11176 Penrose Street
Sun Valley, CA 91352
Tel. (818) 768-4661

Smalley & Co.
861 South Jason Street
Denver, CO 80223
Tel. (303) 777-3010

Concrete sealers

In some cases the user might want to provide a moisture sealer to the asphalt or concrete in order to extend its life. If hydrocarbon-based materials (i.e., containing petroleum distillate) are employed it is possible to damage the sealant or cable. Do not use Hydrozo 30 M waterproofing compound, as it can penetrate the cable and possibly affect operation. Alcohol-based or water-based materials are preferred from this standpoint, and in any case they should not be applied in such quantities that they lie in the slot recess and allow direct cable exposure. Considerations are alcohol carrier materials dry quickly in windy conditions, and water-based materials are affected by humidity while drying. Some materials and sources of supply are:

Chemtrete BSM 40 Sealer (alcohol)
Dynamit Nobel
Rockleigh, NJ
Tel. (201) 981-5000

Hydrozo Silane 40 (alcohol) or Enviroseal 40 (water)
Hydrozo Coating Company
Tel. (402) 434-6981

Metallic foil

Any foil used must be specifically for earth burial.

For information on sources of metallic foil contact Senstar Corporation.

Terra-Tape Sentry Line 620
24 in wide x 1000 ft.
Red, no imprint, no logos

Part no. 0541456

Supplier
Reef Industries
Houston, TX
U.S. (800) 231-6074, (800) 231-2417

Canada (800) 847-5616

Chart recorders

Senstar recommends the following chart recorders:

- Astro-Med Dash II (dual-channel recorder)
- Gould Model 220 (dual-channel recorder)
- Hioki Model 8201 (compact single-channel recorder)
- Linseis LM23-20-20 (dual-channel recorder)

Geotextile fabric

Terrafix Geosynthetics,
425 Atwell Dr., Toronto, Ont., Canada
Tel. (416) 674-0363

Reemay Inc.,
70 Old Hickory Boulevard, P.O. Box 511
Old Hickory, Tennessee, U.S.A. 37138-3651
Tel. (615) 847-7000, (800) 321-6271
Fax (615) 847-7068

Ground fault locators

Supplier - Dynatel Model 2273-U3P3 - Cable/Sheath Fault Locator

Test & Measurement Systems/3M
6801 River Place Blvd.
Austin, TX 78726
Tel. (800) 426-8688
Fax (800) 626-0392

Suppliers - Radiodetection model RD 400FFL

Canadian Detection Technologies Ltd.
22 McGillivray Ave.
Toronto, Ont. M5M 2Y1
Tel. (416) 487-1999

Radiodetection Corporation
35 Whitney Road
Mahwah, NJ 07430
Tel. (800) 524-1739
Radiodetection Ltd.
Western Drive
Bristol, England B514-0A2
Tel. (02) 7283-9581

C Specifications

Sensor Module (SM100)		
	Model	• SM100-1 • SM100-2
	Dimensions (LxWxD)	• 360 x 230 x 100 mm
	Weight	• 4.5 kg (10 lbs.)
	Quantity	• one per 2 zones
	Probability of detection	• greater than 99% for walking intruder weighing more than 34 kg
	Inputs	• 8 relay inputs (supervised) 2.2 k ohm
	Outputs	• 4 relay outputs 24 VDC maximum, 350 mA DC maximum • 2 analog calibration outputs for voltmeter or chart recorder
	Number of devices	• one network controller and up to 27 devices per network without repeaters; up to 62 devices with repeaters
	Zone length	• minimum - 10 m • maximum - 200 m
	Power output	• available for external sensors - 11.5 VDC ± 5%, 150 mA maximum
	Controls	• DIP-switch for setting network address and unit configuration • jumper selectable RS-485 termination • jumper selectable relay contact configuration • adjustable detection threshold for each zone • 2.5 cm/s to 15 m/s adjustable velocity response • internal self-test - activated at CC or SM
	Connectors	• right angle TNC coaxial connectors for sensor cables • removable terminal block for network power • removable terminal block for redundant RS-485 connections • stacked removable terminal block for analog inputs, relay and analog outputs, tamper input and 12 VDC input/output
	Temperature	• -40° to +70°C (as measured inside the enclosure)
	Relative humidity	• 0 to 95%, non-condensing
	Enclosure options	• IP33 rated outdoor protective enclosure, lockable, with tamper switch • IP66/NEMA 4 rated weatherproof outdoor enclosure, lockable, with tamper switch
	Operating frequency	• SM100-1 - 40.675 MHz (zone A), 40.685 MHz (zone B) • SM100-2 - 40.665 MHz (zone A), 40.695 MHz (zone B)
	Power input options	• 12 VDC, 500 mA maximum • 48 VDC, 175 mA maximum

Sensor Module (SMDT01)		
	Model	• SMDT01
	Dimensions (LxWxD)	• 360 x 230 x 100 mm
	Weight	• 4.5 kg (10 lbs.)
	Quantity	• one per 2 zones
	Inputs	• 8 relay inputs (supervised) 2.2 k ohm
	Outputs	• 4 relay outputs 24 VDC maximum, 350 mA DC maximum
	Number of devices	• one network controller and up to 27 devices per network without repeaters; up to 62 devices with repeaters
	Power output	• available for external sensors - 11.5 VDC ± 5%, 150 mA maximum
	Controls	• DIP-switch for setting network address and unit configuration • jumper selectable RS-485 termination • jumper selectable relay contact configuration
	Connectors	• right angle TNC coaxial connectors for sensor cables • removable terminal block for network power • removable terminal block for redundant RS-485 connections • stacked removable terminal block for analog inputs, relay and analog outputs, tamper input and 12 VDC input/output
	Temperature	• -40° to +70°C (as measured inside the enclosure)
	Relative humidity	• 0 to 95%, non-condensing
	Enclosure options	• IP33 rated outdoor protective enclosure, lockable, with tamper switch • IP66/NEMA 4 rated weatherproof outdoor enclosure, lockable, with tamper switch
	Power input options	• 12 VDC, 125 mA maximum • 48 VDC, 75 mA maximum

Sensor Cable (SC1 & SC2)			
	Model	• SC1	• SC2
	Dimensions (Length)	• available in 50, 100, 150 and 200 m detection lengths (each cable includes a 20 m non-sensitive section)	
	Operational Temperature	• -40° to +70°C (-40° to +158°F)	
	Storage Temperature	• -50° to +85°C (-58° to +185°F)	
	Dimensions (outside diameter)	• 8.5 x 15 mm (0.335 x 0.590 in.)	• 8.0 mm (0.315 in.)
	Weight	• 38.6 kg (85 lbs.) maximum	• 25 kg (53.5 lbs.) maximum
	Reel diameter	• 508Ø x 330 mm wide	• 406Ø x 330 mm wide

Network controller (NC)	**Model**	• SN-CN1
	Dimensions (LxWxD)	• card only - 152.4 x 317.5 x 44.4 mm (6 x 12½ x 1¾ in.) • card in indoor enclosure - 400 x 375 x 120 mm (15¼ x 14¾ x 4¾ in.)
	Weight	• 9 kg (20 lbs.) - card in indoor enclosure with AC power option and no battery
	Quantity	• one per network
	Host	• Sentient Security Management System
	Host interface	• RS-232/RS-422 serial data link
	Speed	• up to 19,200 baud
	Controls	• DIP-switch for setting host baud rate • reset switch • diagnostic test switch
	LED indicators	• network transmit and receive • host transmit and receive • self-test status
	Connectors	• removable terminal blocks for network wiring • 2 RS-232 or RS-422 serial ports for connection to host
	Temperature	• 0°C to 55°C (32°F to 131°F) (as measured inside the enclosure)
	Relative humidity	• 5 to 95%, non-condensing
	Enclosure options	• weatherproof outdoor NEMA 4 or indoor, lockable, with tamper switch, IP66 rated
	Power input options	• 12 VDC, 500 mA maximum • 16 VAC, 20 VA • 110-120 VAC, 60 Hz/220-240 VAC, 50 Hz power module • optional backup battery (AC power module)

Protective enclosure	**Model**	• PE2-1
	Dimensions (LxWxD)	• 254 x 254 x 910 mm (10 x 10 x 36 in.)
	Weight	• 17 kg (37 lbs.)
	Quantity	• one per SM
	Rating	• IP33/NEMA 3R

Outdoor enclosure	**Model**	• WE2-1 & WE2-2
	Dimensions (LxWxD)	• 410 x 510 x 150 mm (16 x 20 x 6 in.)
	Weight	• 13 kg (29 lbs.)
	Quantity	• one per SM
	Rating	• IP66/NEMA4

Outdoor enclosure	**Model**	• WE2-3 & WE2-4
	Dimensions (LxWxD)	• 510 x 510 x 150 mm (20 x 20 x 6 in.)
	Weight	• 15 kg (33 lbs.)
	Quantity	• one per SM
	Rating	• IP66/NEMA4

Standalone power supply	**Model**	• FPM-12
	Weight	• 1.8 kg (4 lbs.)
	Quantity	• one per SM
	Power input	• 115/230 VAC, 60/50 Hz, 200W
	Power output	• 12 VDC, 8A maximum, 100W

Standalone power supply (Hi-rel option)	**Model**	• FPM-12R
	Weight	• 1.8 kg (4 lbs.)
	Quantity	• one per SM
	Power input	• 115/230 VAC, 60/50 Hz, 200W
	Power output	• 12 VDC, 4A maximum, 50W

Network power supply	**Model**	• FPM-48
	Weight	• 2.3 kg (5 lbs.)
	Quantity	• one per 9 SMs or 2800 m of perimeter
	Power input	• 115/230 VAC, 60/50 Hz, 200W
	Power output	• 48 VDC, 3A maximum, 150W

Network power supply (Hi-rel option)	**Model**	• FPM-48R
	Weight	• 2.3 kg (5 lbs.)
	Quantity	• one per 9 SMs or 2800 m of perimeter
	Power input	• 115/230 VAC, 60/50 Hz, 200W
	Power output	• 48 VDC, 3A maximum, 150W

d Troubleshooting

This appendix illustrates how to diagnose faults in Perimitrax systems and how to determine probable causes. In general, to troubleshoot nuisance alarms, collect information on the alarms, determine their sources and then eliminate the cause.

Senstar's Universal Configuration Module (UCM) software application provides calibration, maintenance and diagnostic tools for network based Perimitrax SMs.

Nuisance alarms

Nuisance alarms are alarms that are caused by objects or disturbances other than a valid intruder. Nuisance alarms can be caused by a variety of external events or conditions near the detection zones.

Possible sources of nuisance alarms

This section lists possible nuisance alarm sources and suggests ways of preventing nuisance alarms.

Incorrect threshold setting

Improper calibration is the most common problem leading to increased nuisance alarm activity. A threshold may have been set incorrectly or the site conditions may have changed due to a natural phenomenon. System sensitivity can increase by as much as 10 dB when the ground freezes, increasing the possibility of nuisance alarms.

If nuisance alarms occur during freeze or thaw periods of the year, recalibrate the system.

Wildlife, pedestrians or vehicles

False alarms can coincide with the presence of pedestrians or vehicles near the perimeter.

Detection containment tests can reveal the size of the detection field and indicate whether containment problems exist.

These problems are sometimes difficult to remedy. They may be caused by poor site planning or installation practices. In such instances changes to operating procedures may be required, or the detection zone may have to be re-located.

Rainfall

Rainfall can cause increases the detection signal due to surface running water. Nuisance alarms can result from this surface water moving through the detection field.

Puddles

Puddles more than 1 m (3 ft.) wide by 1 cm (3/8 in.) deep, stirred up by the wind, can cause nuisance alarms.

This alarm source can often be eliminated by filling the puddle with sand or soil. Another solution is to landscape the area so it will drain properly. Be careful not to change the cable burial depth if you change the surface terrain.

Subsurface water

False alarms can be caused by underground water flowing through the detection field. This problem only occurs if the sensor cables are buried in coarse gravel.

You can prevent this problem during installation by mixing sand with the coarse gravel to fill the voids.

Water filling and emptying a non-metallic pipe in the detection field can also cause alarms. You can remedy this problem by covering the pipe with a one-piece metallic shield.

Wind

Wind does not affect the detection field, but strong winds moving a metal fence or gate near the detection field can cause false alarms.

To test a fence near the detection field, shake it with a non-conductive object such as a wooden pole. If shaking the fence causes an alarm, tension the fence, move the cable, or if possible, move the fence. Verify the zone calibration and, if possible, and raise the threshold level on the Sensor Module.

Metallic objects in the zone

Metallic objects, such as pieces of wire more than 30 cm (1 ft.) in length, a measuring tape, metal conduit, etc., left on the ground surface in the zone can cause nuisance alarms.

Check for metal objects in the zone. If a metal object is discovered, remove it and verify the calibration of the zone.

Intermittent electrical contacts

Wind or ground vibrations acting on corroded or loose joints in metal structures such as fences or gates too close to the detection field can cause invalid alarms. Loose joints can cause intermittent disturbances in the detection field.

To test a zone for this problem, wait until the detection signal in the zone is low, (i.e., much less than threshold value) and proceed as follows:

- ❑ Connect a chart recorder to the Sensor Module analog output connector of the zone. Start the chart recorder.
- ❑ Keep your body outside of the detection field, or if inside the detection field, remain stationary. Use a piece of wire to create momentary shorts across various joints in the fence.
- ❑ Observe the chart recording. Intermittent electrical connections will appear as sudden sharp increases (spikes) in the detection signal.
- ❑ If spikes appear on the chart recording, weld wire conductors to electrically connect the metal parts that caused the problems.

Intermittent metallic contacts underground

In general, metallic objects located underground do not cause nuisance alarm activity. It is possible, however, that metal pipes, concrete reinforcing bars, or other metal objects buried in the detection field that are in physical contact with other such objects can create intermittent electrical connections and cause nuisance alarms.

Measure the clutter level in the problem zone. A large clutter value can indicate this nuisance alarm source. Check the zone for buried metal objects with a metal detector.

External radio frequency interference

A transmitter operating in the 40.68 MHz range near the perimeter could cause nuisance alarms. This type of interference can often be found using a programmable radio frequency scanner which can operate in the VHF Lo band.

Contact local regulatory agencies for assistance in determining if any such sources exist near the perimeter. If possible, have suspect sources turned off to see if the nuisance alarms stop. If such a source is found, collect as much information about it as possible and contact Senstar.

Faulty cable connector

A faulty cable connector can cause nuisance alarms. Perform the following procedure if you suspect a faulty connector:

- [ ] Disconnect the connectors and examine them for corrosion, moisture or mechanical damage.
- [ ] Check that the connector center pin is at the correct depth and straight for each connector.
- [ ] Look inside the barrel of the female connectors to ensure that the center pin elements are not spread or damaged.
- [ ] Perform an electrical continuity test on the cables.
- [ ] Observe the clutter level of the zone. Unusually high clutter values (more than 105 dB [Rx gain at 50 dB]) often accompany a faulty connector or a defective decoupler.

Faulty decoupler

If the RF terminating resistor in a decoupler is faulty, the RF signal will be reflected back along the cables. This can be recognized by a distinct periodic cyclic response, with distance (a rising and falling detection signal).

Damaged cable

Nicks or breaks in the jacket of the sensor cable can allow moisture to penetrate the cable, causing false alarms. The tests outlined in *Chapter 7 Completing the cable installation*, will help you identify cables that are shorted or open.

Faulty Sensor Module

False alarms can be caused by a faulty Sensor Module. Exchange the Sensor Module with a properly configured Sensor Module. If the noise remains in the zone, then it is a zone/environment problem. If the noise follows the Sensor Module, then the Sensor Module is the problem. Return the Sensor Module to Senstar with a description of the problem.

Contact Senstar to obtain a return material authorization (RMA) number before returning any items for repair.

Other causes

In the event that the source of the nuisance alarms cannot be identified, collect the information as described in *Gathering troubleshooting data* and send it to Senstar or your authorized Perimitrax dealer. Senstar, and its dealers have experienced technical staff available to perform further testing and nuisance alarm troubleshooting.

Gathering troubleshooting data

Before contacting Senstar, your dealer, or attempting any equipment replacement or repair, collect the following information:

❑ Obtain or sketch a site plan that shows:

- location of any obstacles near the perimeter, including metal fences or buried metallic objects with distances to the nearest sensor cable indicated
- variations in ground conditions
- cable spacing
- location, model number, and address number of each Sensor Module
- location of decouplers and cable splices

- [ ] Record the Sensor Module serial numbers.
- [ ] Record the location, frequency, duration, and time of occurrence of the alarms.
- [ ] Observe the affected zones to determine whether the nuisance alarms coincide with any of the following conditions:
    - wildlife entering the detection field
    - vehicles or pedestrians in the general area of the detection field
    - opening and closing of gates or other activities in or near the zone
    - extreme weather conditions such as heavy rain, wind, or lightning
    - wind moving a fence or gate located near the detection field
- [ ] Perform a walk test on the zones that are generating nuisance alarms and obtain a chart recording of each zone to verify calibration.
- [ ] Print a status summary for reference.
- [ ] Perform a containment walk test around the zone to ensure the detection field is contained within the desired boundary.

    If the detection field has increased in size or if the threshold level is too low, a Sensor Module may be detecting objects beyond what is thought to be the range of the detection field. To perform a containment walk:

    - [ ] Connect a chart recorder to Sensor Module analog output.
    - [ ] Walk along one side of the zone, staying approximately 3.5 m (11 ft., 6 in) away from the nearest cable. The chart recording should indicate less than 0 dB (2.5 V).
    - [ ] Repeat step (b), but on the other side of the cable path. Repeat the test for other problem zones.
- [ ] Test the sensor cables for leakage and integrity. Refer to *Chapter 7 Completing the cable installation*, for instructions.
- [ ] Exchange the Sensor Module with a properly configured Sensor Module. If the noise remains in the zone, then it is a zone/environment related problem. If the noise follows the Sensor Module, then the Sensor Module is the problem. Return the Sensor Module to Senstar with a description of the problem.

Contact Senstar to obtain a return material authorization (RMA) number before returning any items for repair.

Troubleshooting chart

	Problem	Possible cause	Solutions
Sensor Module	An alarm is not generated when there is a valid intrusion	Insufficient power up time	• Power up Sensor Module for at least one minute before valid operation
		No power to the unit	• Check that power supply is operating and connected to Sensor Module
		Cables may not be correctly connected to Sensor Module	• Check that all cables are correctly connected to Sensor Module
		Sensor Module may have incorrect address	• Check and correct address
		Thresholds may be too high to generate an alarm	• Calibrate zone
		Fuses may be blown	• Replace fuses
		Sensor Module may be defective	• Return unit to Senstar
	Alarms are generated for no apparent reason	Cables may not be correctly connected to Sensor Module	• Check that all cables are connected to Sensor Module
		Thresholds may be too low	• Calibrate zone
		Nuisance alarms source in detection zone	• Check the nuisance alarm checklist to determine the cause of the alarm
		Sensor Module may be defective	• Return unit to Senstar
	Tamper alarms are being generated	Sensor Module enclosure may be open	• Close Sensor Module enclosure
		Tamper switch may not be correctly connected	• Check tamper switch wiring and position
	Fail alarms are being generated - alarms clear themselves NOTE: If the Sensor Module is setup as a standalone unit, the LED labelled as FAIL on the Sensor Module will light when a fail alarm is generated. If the Sensor Module is setup as a network unit, the LED labelled as FAIL may have a different function. As a network unit connected to a Sentient Security Management System, the Sensor Module fail alarms will be annunciated at the Sentient System.	There may be an interruption in the power supply to the Sensor Module	• Check that power supply is operating and connected to Sensor Module
		There may be intermittent cable faults, such as loose or incorrect cable connections, or problems with the cable continuity	• Check that all cables are connected to Sensor Module
			• Network SM - check the continuity in each cable (SM to SM reading shows DC continuity) • Standalone SM - center to shield reading should be 130 k ohm for each cable (no continuity) • Perform cable tests (*see Cable tests pg. 7-2*)
			• If these operations do not solve the problem, contact the Customer Service Department at Senstar for further assistance

	Problem	Possible cause	Solutions
Sensor Module (Cont'd)	Fail alarms are being generated - alarms are not clearing NOTE: If the Sensor Module is setup as a standalone unit, the LED labelled as FAIL on the Sensor Module will light when a fail alarm is generated. If the Sensor Module is setup as a network unit, the LED labelled as FAIL may have a different function. As a network unit connected to a Sentient Security Management System, the Sensor Module fail alarms will be annunciated at the Sentient System.	No power to unit	• Check that power supply is operating and connected to Sensor Module
		Sensor Module fuses may be blown	• Replace fuses
		Sensor Module may not have the correct address. (The address it has been given identifies a network device other than a Sensor Module)	• Reset address • Re-power system
		There may be intermittent cable faults, such as loose or incorrect cable connections, or problems with the cable continuity	• Check that all cables are connected to Sensor Module
			• Network SM - check the continuity in each cable (SM to SM reading shows DC continuity) • Standalone SM - center to shield reading should be 130 k ohm for each cable (no continuity) • Perform cable tests (*see Cable tests pg. 7-2*)
		Internal memory fault	• Reload EEPROM memory • At the local interface assembly, change of the system parameters by one unit • Power down the system, wait a few seconds and power up the system
		Sensor Module may be defective	• Return unit to Senstar
	No tamper alarm is generated when the Sensor Module enclosure is opened	A tamper switch may not have been installed	• Check that a tamper switch exists in the enclosure
		Tamper switch wiring may not be connected properly	• Check that the tamper switch wiring and position

Glossary

ACCESS a flag on the Sentient System that shows when a sensor zone is in the Access State

Access state a condition in which alarms are not annunciated by the Sentient System

ACKNOWLEDGE an indicator that appears on the Sentient System monitor whenever an alarm occurs. Acknowledging an alarm stops audible annunciation of the alarm and lets you begin processing it

Alarm threshold see *Threshold*

A-side zone odd-numbered zones that extend to one side of the Sensor Module. The B-side zone extends from the opposite side of the Sensor Module

Auxiliary sensor another manufacturer's sensor, such as a microwave sensor or a fence disturbance sensor, that can be integrated into the SC2/SC1 power and data network via connections to Sensor Module front panel terminals

Auxiliary sensor alarm an alarm generated by an auxiliary sensor

B-side zone even-numbered zones that extend to one side of the Sensor Module. The A-side zone extends from the opposite side of the Sensor Module

Burial depth the distance between the sensor cables and the surface of the medium in which the cables are installed

Cable fault a fail alarm condition detected by the Sensor Module. Cable faults are either open circuits or short circuits

Cable path the route that the sensor cables follow along the perimeter of a site

Cable set one transmit and one receive cable used in an SC2 zone or the twin coaxial cable used in a SC1 zone. The SC2 cable set consists of two separate coaxial cables, male crimp connectors, ferrite beads and marking tape. The SC1 cable set consists of one twin coaxial cable, male crimp connectors, ferrite beads and marking tape

Cable spacing the lateral distance between the transmit and receive cables in an SC2 zone

Cable terminator a device attached to the decoupler on the last zone or zones of a perimeter, or on a sensor module at an unused zone. Terminators reduce the strength of the detection field by dissipating its power over their length, and providing a matched load for the data-link signal

Calibration plot a printout that records the peak detection signal of sensor zones at the rate of once per second. Calibration plots can be produced on printers connected to the Sentient System

Clutter the signal that is always present on the receive cable. It originates from the signal transmitted by the transmit cable, and is affected by the installation medium and stationary objects (vehicles, buildings, etc.) in the detection field and, in the case of SC2 cables, cable spacing. You can measure the clutter level at the Sensor Module. The clutter level is usually different for every zone

Containment walk a particular type of walk test performed on the perimeter to determine the extent of the detection field. See *Walk Test*

Data link communications between the Sentient System and the Sensor Modules via the sensor cables

dB decibel, a measure of signal strength

Decoupler a device installed in line with a sensor cable to define the end of a zone. A decoupler is a passive electronic device that stops radio-frequency signals, and therefore the detection field, from continuing along the cable path. The decoupler is connected between the sensor cables in two zones, or to a terminator at the end of the perimeter

Detection field the area filled by radio-frequency signals around the sensor cables in which an intruder can be detected. The detection field extends above and below the ground and has an oval-shaped cross-section

Detection signal the signal received by the Sensor Module on the receive cables. It is measured in decibels (dB) and increases when an intruder causes an electromagnetic disturbance in the detection field

Detection signal plot a printout that simultaneously records the peak detection signal of multiple sensor zones. Two types of plots are the calibration plot and the peak-magnitude plot. Plots can be produced on printers connected to the Sentient System via the UCM

Display zone information shown on the operator display terminal. The display zone may be comprised of more than one alarm, i.e., one display zone may consist of a Sensor Module detection zone, a microwave detection zone, and surveillance cameras, etc.

Dual-direction powering a Perimitrax system configuration that features redundancy of the power and data network. If both cables in a zone are cut, the detection capabilities in that zone will be lost, but the operation of other zones will be unaffected

Electromagnetic field the field created by the radio-frequency signals in the sensor cables. See *Detection field*

Enclosure any type of housing used to protect the Sensor Module or Network Controller from the weather and from tampering

Event log a printed record of system events and operator actions. The log records events automatically as they occur whenever a printer is connected to the Sentient Security Management System

External tamper switch a customer-supplied, normally-open switch. The switch can be connected to the external tamper plug on a Sensor Module. A tamper alarm is generated when the switch's electrical contacts open

Fail alarm an alarm generated when the Sensor Module senses a fail condition. Fail alarms are displayed on the Sentient Security Management System

Fail-safe condition the condition in which the fail-safe relay is energized in the non-alarm state

False alarm a sensor alarm with no observable physical cause

Ferrite beads ferrite rings that are installed at 30 cm (12 in.) intervals along the lead-in cables between the detection field and the Sensor Module. They prevent the detection field from following the lead-in cable back to the Sensor Module

Heavy soil a clay-like soil

Intrusion alarm see *Sensor alarm*

Lead-in cable the portion of the sensor cable that connects the sensor cables to the Sensor Module. Lead-in cables are completely shielded to prevent radio-frequency signals from escaping, so they prevent the detection field from forming near the Sensor Module. Lead-in cable is 20 m (66 ft.) long. See *Ferrite beads*

Leaky cable a term describing the type of sensor cable used in the Perimitrax system. Leaky cable is like ordinary coaxial cable except that the braided shield surrounding the cable conductor is incomplete. Openings in the shield allow a portion of the radio-frequency signal to escape and form the detection field around the cable. See *Sensor cable*

Light soil a sandy soil

Medium soil a normal soil such as loam, half-way between a light, sandy soil and a heavy, clay soil

Network a Perimitrax system configuration comprising a Sentient Security Management System and one or more Sensor Modules connected together by sensor cables

Nuisance alarm a sensor alarm caused by an object or disturbance other than a valid target

Operator key the keys used by operators to perform functions from the Sentient System

Peak-magnitude plot a printout that records Sensor Module detection signals at intervals between five seconds to five minutes, at ±32 dB relative to the individual zone threshold level. The peak-magnitude plot can be produced on a printer attached to the Sentient Security Management System

Physical zone term generally used when laying out a perimeter. The physical zone consists of the linear measurement zone. See also *zone*

Protective post a concrete-filled post that prevents vehicles from running into field-mounted Sensor Modules

Receive cable the sensor cable that picks up radio-frequency signals emitted by the transmit cable and returns them to the Sensor Module

Red mark a piece of red tape is affixed to the sensor cable to show where the lead-in cable stops and the sensor cable starts. Lead-in cable is 20 m (66 ft.) long; sensor cable is 50, 100, 150, or 200 m (164, 328, 492, or 656 ft.) long

RESET input an input point on the Sensor Module used to clear the Sensor Module detection filter

rip-rap broken and irregularly shaped stones used for foundations and as a protective cover for embankments, etc.

SECURE a flag on the Sentient System that shows when the zone indicated in the right-hand display is in the Secure State

Secure state a condition in which alarms will be annunciated by the Sentient System

Sensor alarm an alarm generated when an intruder enters a Sensor Module's detection field or when an intruder sets off an auxiliary sensor connected to a Sensor Module. Sensor Modules transmit sensor alarms to the Sentient System via the sensor cables

Sensor cable the buried intrusion-sensing element of the Perimitrax system. Cable is available in sets of various lengths. Each SC2 cable set contains a pair of cables. Each SC1 cable set contains a single twin coaxial cable. One SC2 cable, or one side of the SC1 cable, transmits a radio-frequency signal and the other SC2 cable, or the other side of the SC1 cable, receives it. Sensor cables are connected to the Sensor Module via lead-in cable. See also ***Leaky cable; Lead-in cable; Zone***

Sensor Module a microprocessor-controlled device that serves as the sensor unit of the Perimitrax system. Each unit is connected to one or two sets of sensor cables and provides intrusion detection for two zones. The Sensor Module contains electronic circuitry, controls, and cable connectors. When alarm conditions are detected, an alarm signal is sent to the Sentient System

Sensor test an activity in which Sensor Module test targets and auxiliary sensor test functions are activated remotely from the Sentient System

Sentient Security Management System a color-graphics alarm-processing system that can display information about the sensors on a protected perimeter. The terminal of the Sentient System can portray system status in both map and text form, and allows an operator to respond to events by entering commands from a keyboard or touchscreen

Single-direction powering a Perimitrax network system configuration in which the sensor cables operate without redundancy in the power and data network

Status report a report containing information on the current status of Sensor Modules. It is similar to the Perimitrax test report

SC1 the brand name of the twin coaxial sensor cable manufactured by Senstar Corporation for the Perimitrax perimeter intrusion detection system

SC2 the brand name of the dual coaxial sensor cable manufactured by Senstar Corporation for the Perimitrax perimeter intrusion detection system

Tamper alarm an alarm that indicates tampering with a sensor

Tamper switch a mechanical switch that, when opened will generate a tamper alarm

Telecom enclosure the Telecom protective enclosure is identical to enclosures used in many telephone and cable television installations. This enclosure provides protection against the elements and serves to camouflage the Sensor Module

Terminator a device attached to the decoupler on the last zone or zones of a perimeter. Terminators reduce the strength of the detection field by dissipating its power over their length. They also terminate data signals that are carried on the sensor cables

Threshold the level that the detection signal, received by the Sensor Module on the receive cable, must exceed to cause an alarm condition. It is measured in decibels

Threshold adjustment control controls that allow you to adjust the threshold level. There are separate controls for zones A and B. They are calibrated in decibels

Threshold margin the difference between the threshold value and the detection signal generated by a 70 kg (154 lb.) person crossing the detection field at the least sensitive point in a zone

Transmit cable the sensor cable that emits the radio-frequency signals generated by the Sensor Module. The radio-frequency signals form the detection field

Universal Configuration Module a Windows based software application used for SM calibration, maintenance and diagnostics, requires a Sennet Network Controller and Network Manager software to communicate with SMs

Walk test a procedure in which the user tests the operation of the Perimitrax system by walking along the center line of the sensor cables in a zone. The results of the test are used when setting the threshold for each zone

Weatherproof enclosure a gray, metal, weatherproof box that protects the Sensor Module

Zone a general term referring to the area in which a security sensor is desired to detect targets. Perimitrax Sensor Modules provide two zones of perimeter protection and are capable of integrating additional zones of supporting sensors. See also ***physical zone***

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