Panther® II

Buried Cable Intrusion Detection Sensor

Product Guide

A1DA0502-001, Rev B
First Edition
October 15, 2009

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: *Processor Module model PM100* 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: *Processor Module model PM100* 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: *Processor Module model PM100*

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.

Using this guide

This guide provides the information necessary to install and operate the components a Panther II security system.

Figures

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

Abbreviations

The following abbreviations are used throughout this guide:

- n.c. - normally closed
- n.o. - normally open
- Pd - probability of detection
- RF - radio-frequency
- SC - sensor cable
- PM - Panther II Processor Module
- TB - terminal block
- UCM - Universal Configuration Module

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8 Testing and adjusting the system

9 Completing the cable installation

10 Setting up the system

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1 Panther II system

This chapter provides information about:

- Panther II system overview

Panther II system overview

Panther II is a high-security perimeter intrusion detection sensor system. It is based on ported or *leaky* coaxial cable technology. Single 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.

A Processor Module (PM) houses 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. A PM can support two detection zones.

The PC-based Universal Configuration Module (UCM) allows you to set the system parameters.

Dry relay contacts perform the alarm reporting.

A complete Panther II system includes a combination of the following components:

- PM
- NEMA 4 enclosure
- sensor cable sets
- decouplers
- cable terminators
- power supply
- UCM software

Figure 1-1 shows a typical Panther II system setup.

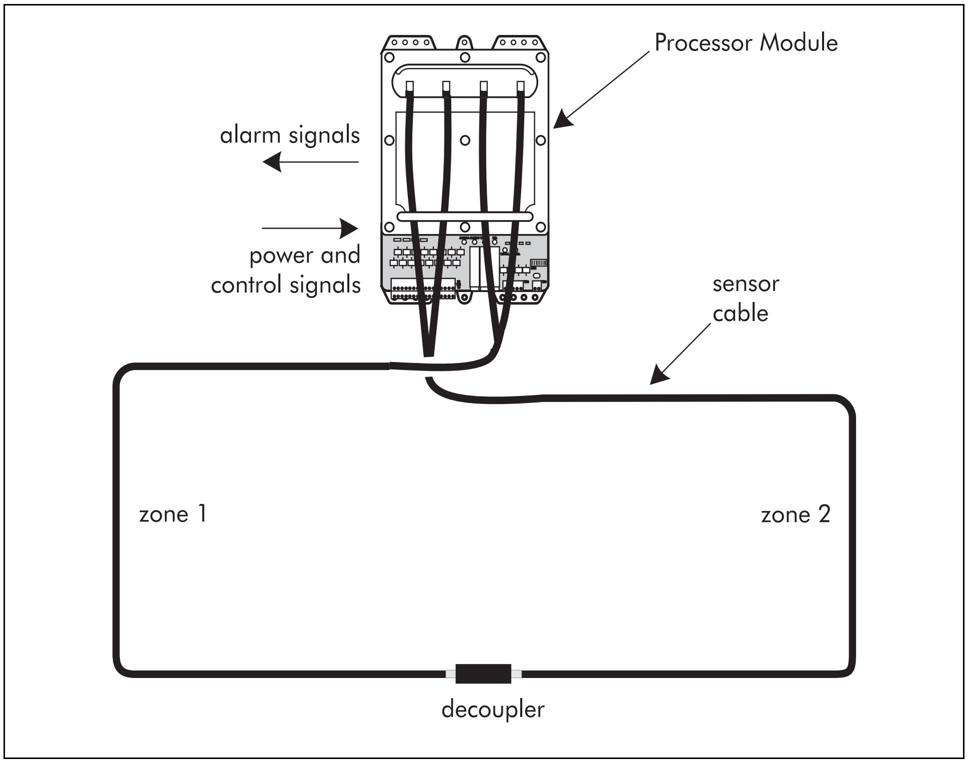


Figure 1-1: Panther II system

2 Using this guide

This chapter provides information about:

- The purpose of this guide

The purpose of this guide

This guide enables you to install the components that make up your Panther II system, make the correct wiring connections, understand the functionality of the UCM, and calibrate and maintain your system. This guide includes procedures for:

- installing PM enclosures
- installing sensor cables
- installing sensor cable fittings
- installing PMs
- working with the UCM
- testing and adjusting a system
- completing cable installations
- setting up and calibrating a system
- repairing damaged sensor cables

Contact Senstar Customer Service or your local Panther II dealer for assistance with any of the steps mentioned in this guide.

3 Installing an enclosure

This chapter provides information about:

- Enclosure installation overview
- Installing enclosures

Enclosure installation overview

This chapter contains the general guidelines to follow when installing a NEMA 4 rated enclosure or your own enclosure in which to house the PM.

Follow all local construction and electrical codes concerning the entry and termination of “mains” electrical supply lines.

Installing enclosures

This section details how to install the NEMA 4 rated enclosure or your own enclosure. Refer to the following procedures:

- *Before you begin*, page 3-2
- *Points to remember*, page 3-2
- *Required tools and equipment*, page 3-2
- *Installing NEMA 4 enclosures*, page 3-3
- *Installing your own enclosure*, page 3-5

Before you begin

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

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

Points to remember

When installing enclosures, remember the following:

- Follow local electrical codes as required.
- It is recommended that you use a NEMA 4 rated enclosure in areas of high humidity.
- Install the enclosure at eye level wherever possible.
- Install the enclosure close to the device power source.
- Locate cable entry holes on the bottom surface of the enclosure.

Required tools and equipment

The following tools and equipment are required when installing any type of enclosure.

- 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
- hardware and tools to mount the PM in the enclosure

Installing NEMA 4 enclosures

You can install the NEMA 4 enclosure by mounting it on an indoor wall.

In addition to the tools that are listed in *Required tools and equipment*, page 3-2, you require the following equipment to install the NEMA 4 rated enclosure:

- assorted 1/4-20 mounting hardware
- chassis punches
- sensor cable conduit - 3.8 cm (1½ in.) electrical conduit and matching bulkhead connector
- communication cable conduit - 1.9 cm (¾ in.) electrical conduit and matching bulkhead connector (optional)
- 40.6 X 50.8 X 15.2 cm (16 X 20 X 6 in.) NEMA 4 rated enclosure (Model no. WE2-1)
- padlock handle (Model no. HP1-1) (optional)

To install a NEMA 4 enclosure

1. Drill and punch the applicable conduit holes in the bottom of the enclosure.
2. Install the ground rod as close as possible to the PM.
3. Mount the enclosure as per the manufacturer's documentation (included with the enclosure).
4. Cut the conduit to extend between the enclosure and the ground.
5. Temporarily label all cables and wires that you are planning to route to the enclosure.
6. Secure the conduit(s) to the enclosure using thread connectors (3.8 cm (1½ in.) or 1.9 cm (¾ in.) pipe thread, depending on the diameter of the conduit).
7. Pull the cables and wires (including the ground wire) up through the conduits and into the enclosure.
8. Ensure that you pull enough material (minimum 3 m (10 ft.)) through the holes to create a service loop for each cable.

You can use metal or plastic conduit to encase the cables and wires.

Figure 3-1 illustrates where to locate the conduit holes on the enclosure.

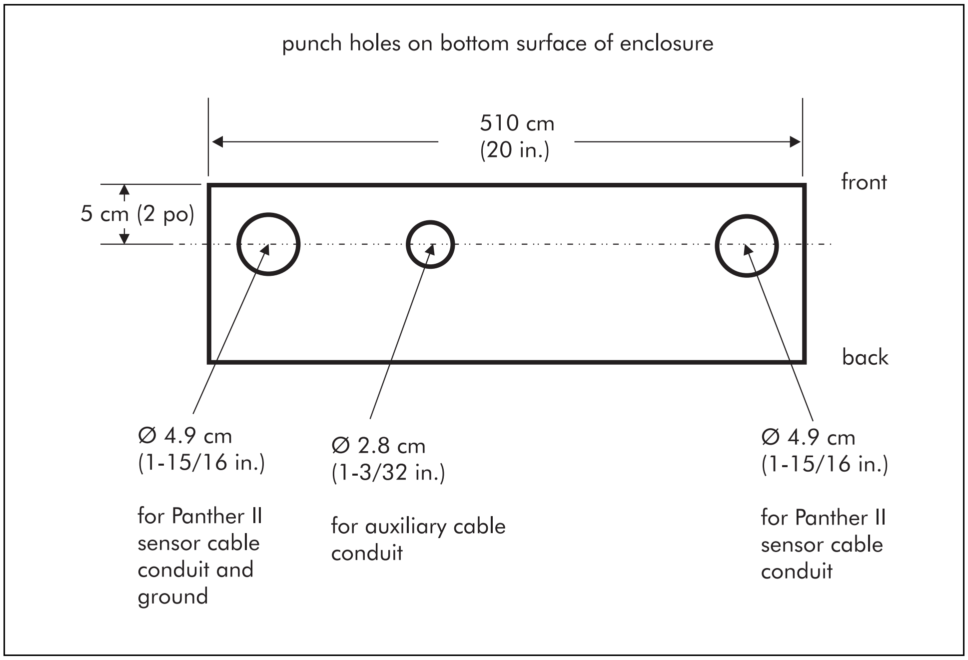


Figure 3-2: Location of conduit holes on enclosure

Figure 3-2 illustrates the cables and wires pulled through the conduit and up into the enclosure.

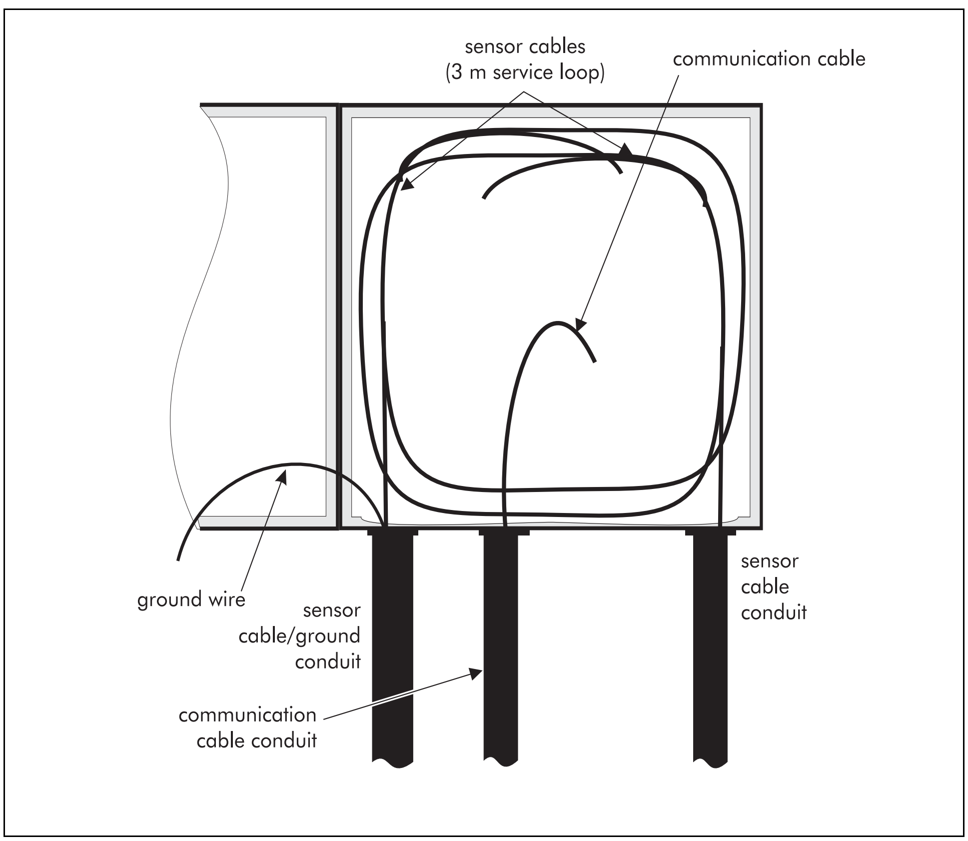


Figure 3-3: Wires and cables within conduit and enclosure

Installing your own enclosure

You can install any enclosure of sufficient size in any indoor location to house the PM, provided the ambient temperature range (measured inside the enclosure) is 0 to 70ºC (32 to 158ºF) and the humidity is between 10% and 95% non-condensing.

Points to remember

When installing your own enclosure, remember the following:

- You should install a ground rod as close as possible to the PM. (You should connect the PM ground lug to the ground rod with a minimum 10 gauge wire.)
- The enclosure should be able to accommodate a PM and cable field service loops.
- The recommended minimum enclosure dimensions are 41 X 51 X 15 cm (16 X 20 X 6 in.).
- the PM includes wire screw terminators to mount a tamper switch on the enclosure.
- Refer to *To install a NEMA 4 enclosure*, page 3-3, when locating the conduit holes on the enclosure.

4 Installing the sensor cables

This chapter provides information about:

- Cable installation overview
- Burying cables in different mediums
- Making gradual turns
- Installing cables near obstacles
- Preparing soft mediums
- Preparing hard-surface slots
- Installing the cables

Cable installation overview

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.

When installing the cables and cable fittings as per the procedures in this chapter, verify that you have performed all of the steps using the following checklist:

✓	*Description*
	Check the site plan to verify the cable route.
	Clean debris from the cable route.
	Check for any underground utilities.

✓	Description
	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.

Burying cables in different mediums

This section details how to properly bury sensor cables in varying mediums. Refer to the following procedures:

- *Sensor cable burial depths for different mediums*, page 4-2
- *Burying cables in different mediums*, page 4-3
- *Protecting buried cables*, page 4-3

Sensor cable burial depths for different mediums

The following table lists the burial depths for various mediums.

SC1 Cable	
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.

Burying cables in different mediums

You should contain a detection zone within a single installation medium whenever possible. However, you can include several detection zones in a single installation medium.

You should test the zone before you complete the cable burial to accommodate any changes in cable placement that may be required to achieve uniform detection properties within the zone.

Protecting buried cables

To properly protect the buried sensor cables, refer to the following:

- Use the marker tape that is included with the sensor cable set.
- Where there no further landscaping activities and minimal surface maintenance is required, the recommended burial depth of 23 cm (9 in.) will provide adequate long term protection. However, in areas where planting is an on-going activity or where future irrigation changes are anticipated, you should protect the sensor cable 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.
- Figure 4-1 illustrates how to protect the sensor cable from surface damage.

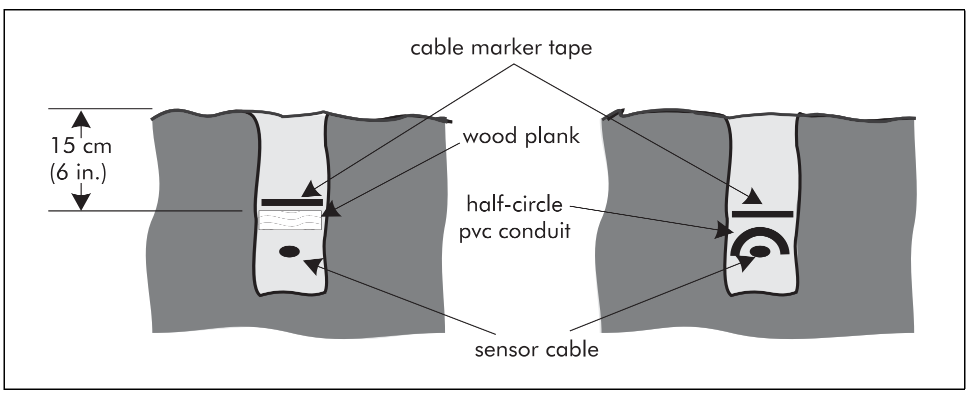


Figure 4-1: Protecting the sensor cable from surface damage

- It is not recommended that you install the full length of a zone in a fully enclosed conduit of any kind. However, under roadways and sidewalk crossings, you can place the sensor cable in PVC conduit using the following criteria:
- The conduit should be no longer than 7.0 m (23 ft.) and have an inside diameter of 19 mm (¾ in.).
- Separate sections of the conduit by 1 m (3 ft., 3 in.).
- You should place no more than three sections of conduit in any one zone.
- You should seal both ends of the conduit to prevent internal water flow.

Making gradual turns

This section details how to make gradual turns in both soft and hard mediums. Refer to the following procedures:

- *Making gradual turns in soft mediums*, page 4-4
- *Making gradual turns in hard mediums*, page 4-4

Making gradual turns in soft mediums

To make a gradual turn within a soft medium, follow a smooth curve with a minimum bend radius of the cable centerline of 7 m (23 ft.).

Figure 4-2 illustrates how to make a gradual turn in a soft medium.

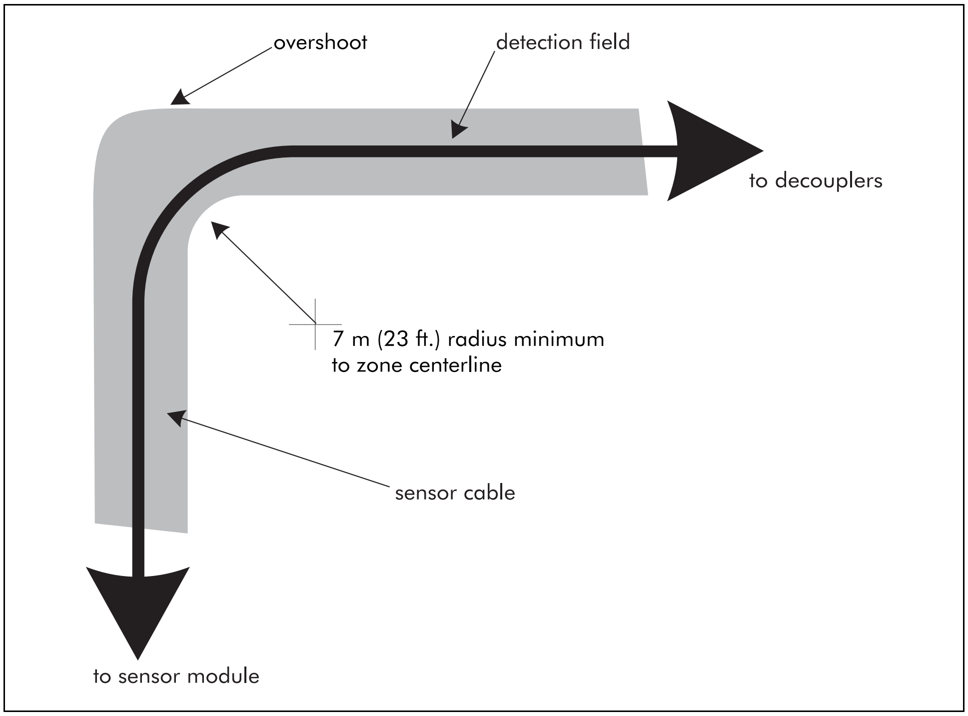


Figure 4-2: Gradual turn in a soft medium

Making gradual turns in hard mediums

To make a gradual turn in a hard medium, make a 90° turn using three successive turns at a maximum 30° bend, each separated by a minimum of 3.7 m (12 ft.).

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

Figure 4-3 illustrates how to make a gradual turn in a hard medium.

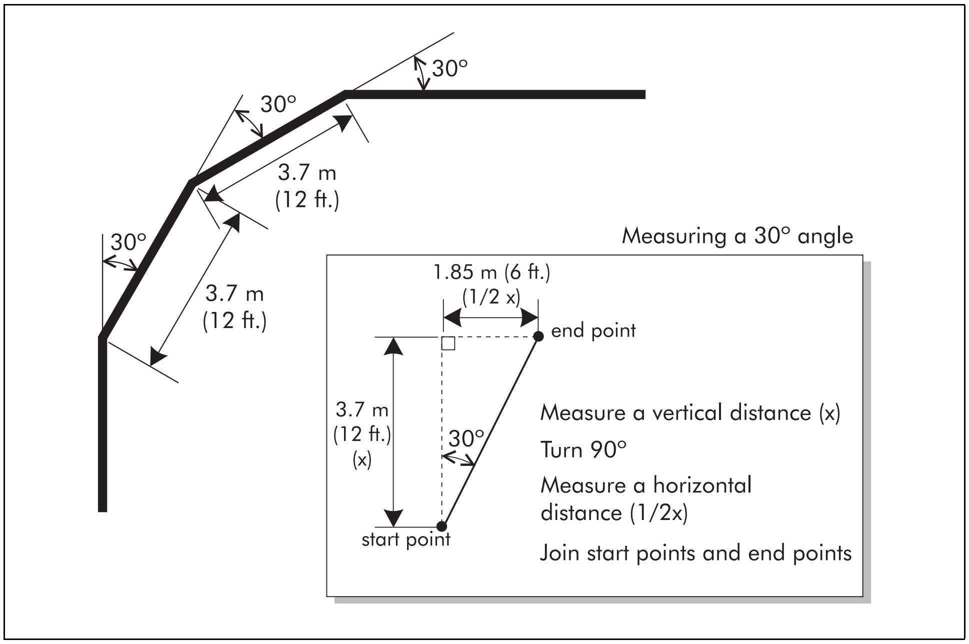


Figure 4-3: Gradual turn in a hard medium

Installing cables near obstacles

This section details the separation distances and how to install sensor cables nears obstacles such as pipes, electrical cables, and drainage culverts. Refer to the following procedures:

- *Cable set separation*, page 4-5
- *Separation distances from obstacles*, page 4-6
- *Separation distances from pipes, conduits or electrical cables*, page 4-8
- *Installing cables near drainage culverts*, page 4-8
- *End of zone obstacles*, page 4-10

Cable set separation

A minimum separation distance must be maintained between the sensor cables of two Panther II processors to prevent them from interfering with each other. Figure 4-4 illustrates this concept.

Panther II cable set separation requirements also apply when installed near other buried cable intrusion detection systems (contact Senstar Customer service for details).

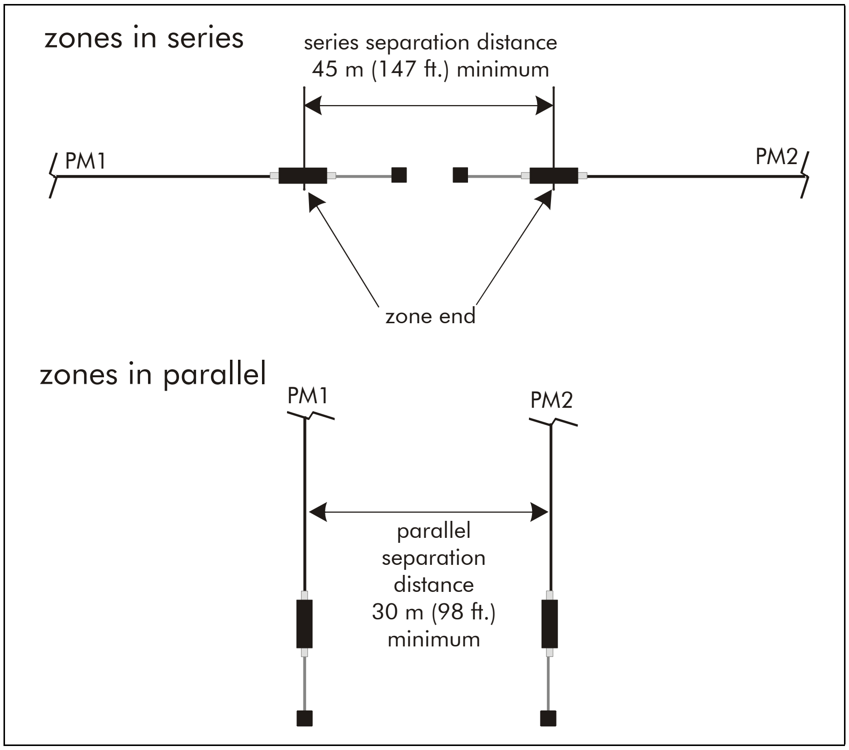


Figure 4-4: Cable set separation

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.

The following table lists various obstacles and the separation distances in different mediums.

	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, place Panther II cables 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 depends on the type of obstacle and the installation medium in which the sensor cables are being installed. The separation distance is measured from the centerline of the detection zone to the object.

For specific separation distances from pipes, conduits, and electrical cables, refer to the table in *Separation distances from pipes, conduits or electrical cables*, page 4-8.

Separation distances from pipes, conduits or electrical cables

The separation distances specified in the following table apply to pipes both above and below the sensor cables. The separation distances indicated are minimum requirements. If more space is available, you should increase the separation distances.

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
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.)
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.)

Installing cables near drainage culverts

You must protect the cables when installing them near drainage culverts.

To install cables near drainage culverts

1. 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.
2. If the non-metallic pipe carries drain water or sprinkler lines and lies perpendicular to the cable path, wrap the foil around the pipe such that the foil extends at least 1 m (3 ft., 3 in.) beyond both sides of the cable path.
3. If the non-metallic pipe lies parallel to the cable path, wrap the foil 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.
4. Secure the foil in place with plastic tie wraps or electrical tape.

Figure 4-5 illustrates the side and top views of a non-metallic drain pipe that has been covered with a metallic shield plate.

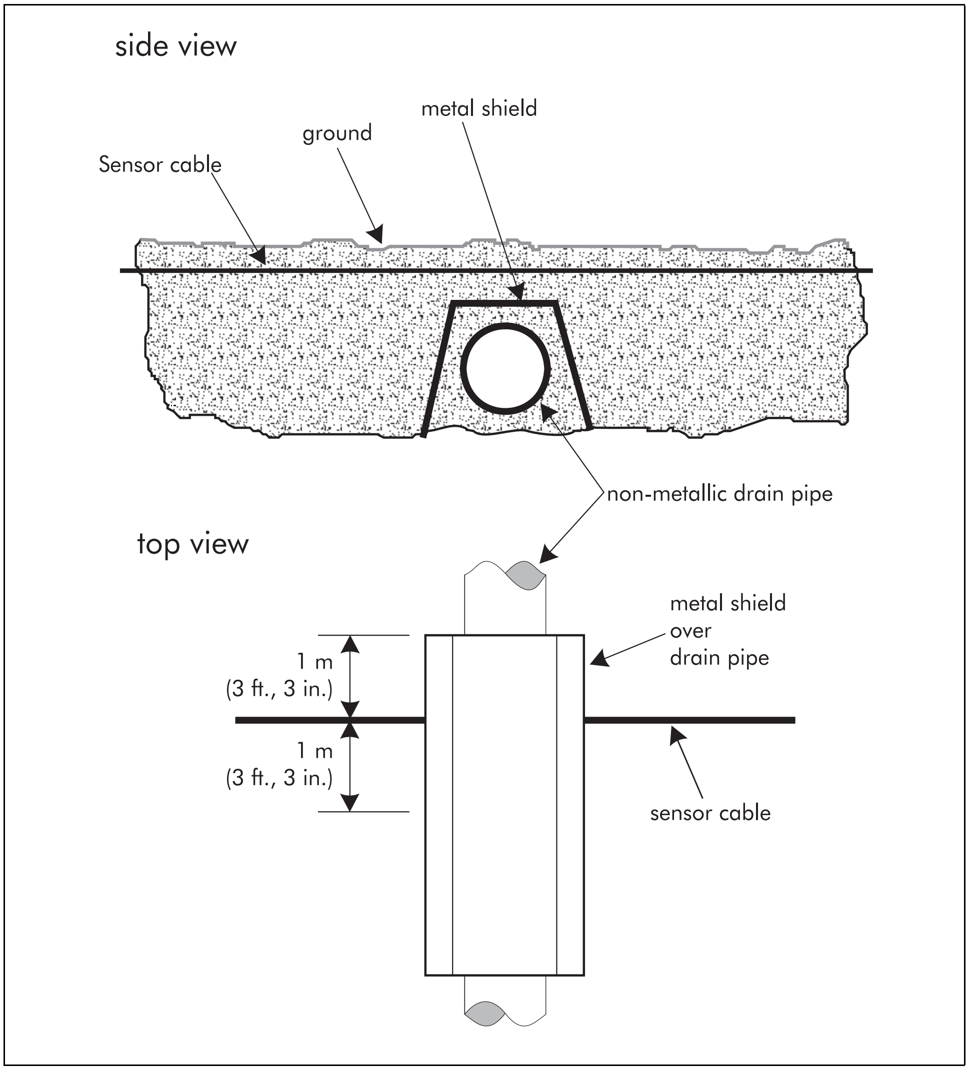


Figure 4-5: Buried cables with metallic shield

Figure 4-6 illustrates a buried non-metallic drain pipe that has been wrapped with a foil shield.

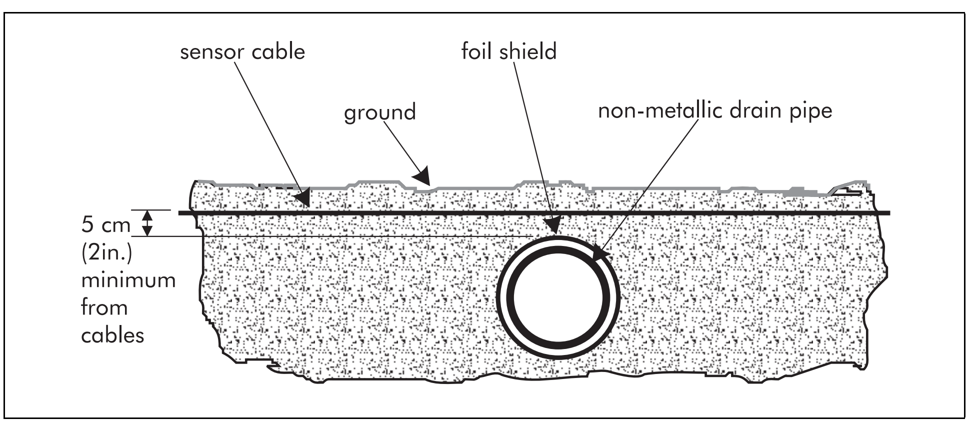


Figure 4-6: Buried pipe with foil shield

Figure 4-7 illustrates a non-metallic drain pipe, buried parallel to the sensor cables, that has been wrapped in a foil shield.

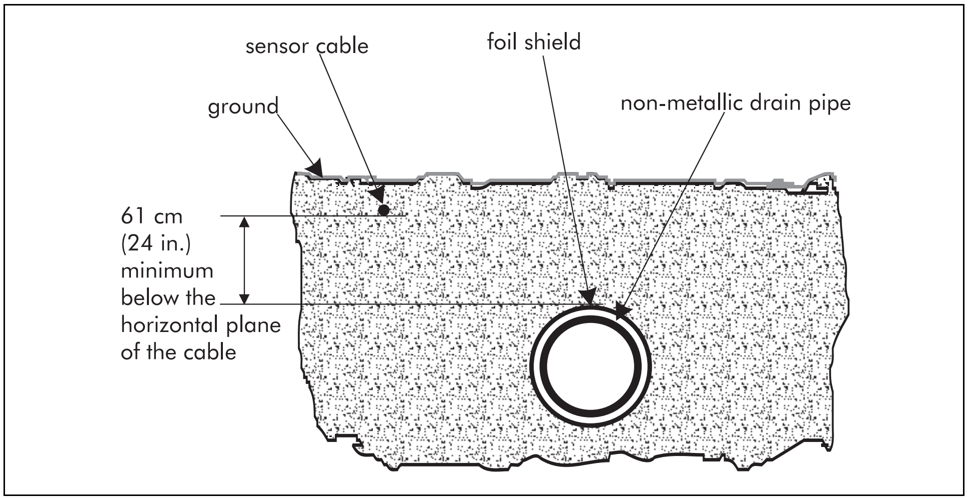


Figure 4-7: Pipe buried parallel to sensor cables

End of zone obstacles

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

Figure 4-8 illustrates where the detection field dissipates based on the distance from the decoupler to the obstacle.

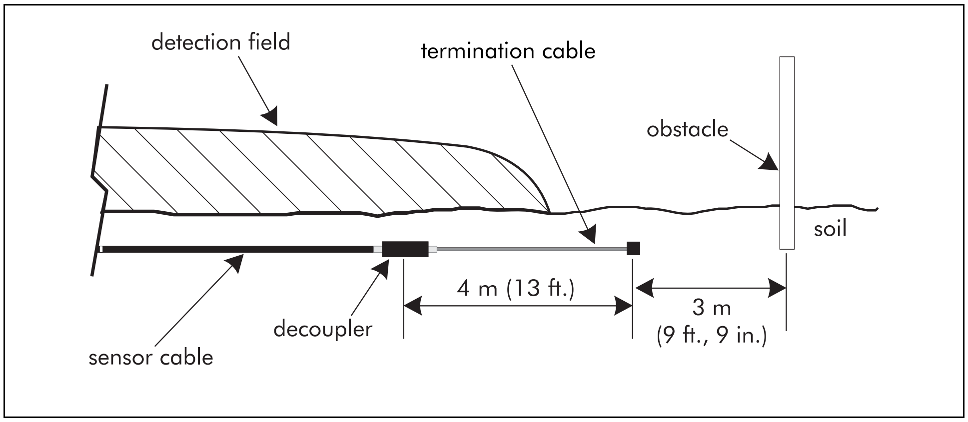


Figure 4-8: Detection field dissipation at the decoupler

Preparing soft mediums

This section details how to prepare soft mediums, including soil, gravel, and soil under concrete/asphalt, to install Panther II sensor cables. Refer to the following procedures:

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

You require the following equipment to prepare soft mediums for cable installation:

- 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)
- Panther II sensor cable sets (as required)
- non-woven geotextile fabric (optional)

Trench dimensions

The following table shows the dimensions for trenches dug in various mediums.

Application	W x D x L
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)
under concrete/asphalt	30 x 38 cm (with 7.5 cm sand in trench)+ (12 x 15 in. (with 3 in. sand in trench)
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)
soil (without sand buffer)	minimum 10 x 23 cm (minimum 4 x 9 in.)

Digging trenches

You can dig various types of trenches to install the Panther II sensor cable in soil and under non-reinforced concrete or asphalt.

Do not dig more trenches than you can backfill in one day.

To dig a trench in soil

1. If the surface is grass-covered and requires restoration after you install the cable, use a turf cutter or turf remover to peel a strip of turf from the sensor cable path.
2. If you are using a sand buffer, dig a trench 10 cm (4 in.) wide x 30 cm (12 in.) deep. If you are not using a sand buffer, dig the trench 23 cm (9 in.) deep.
3. If you are using geotextile fabric, lay the fabric in the trench.
4. If you are using a sand buffer, pour the sand into the trench so that the trench is 23 cm (9 in.) deep for the entire length of the cable route.
5. Lay the cable. To do so, refer to *Installing the cables*, page 4-20.

Figure 4-9 illustrates how to dig a trench in soil and install the Geotextile fabric.

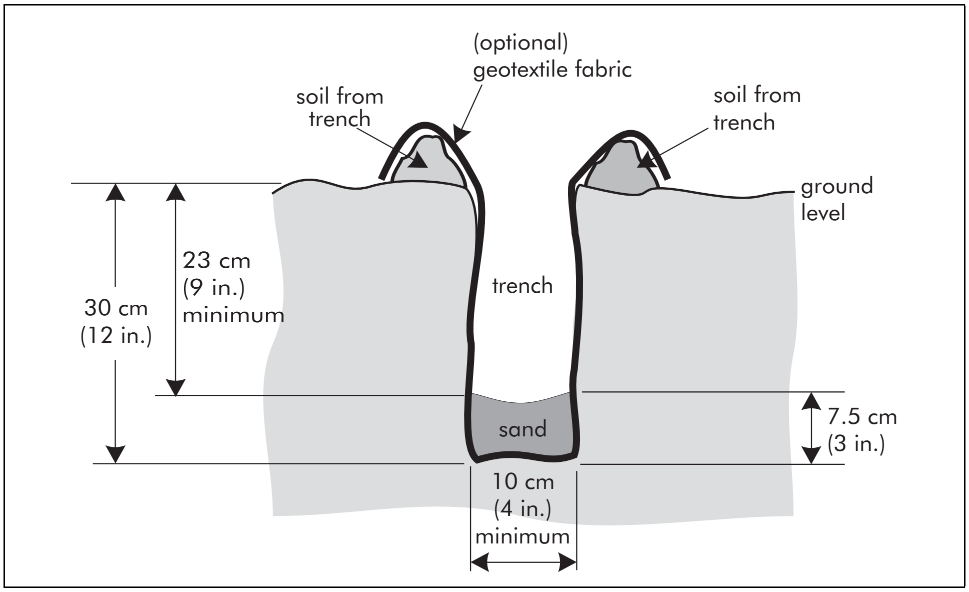


Figure 4-9: Soil trench with installed geotextile fabric

To dig a trench under concrete/asphalt

1. Make two parallel cuts, 30 cm (12 in.) apart, that are centered on the sensor cable route.
2. Remove the cut asphalt/concrete, and dig a trench 38 cm (15 in.) deep.
3. If you are using geotextile fabric, lay the fabric in the trench.
4. Pour the sand buffer into the trench so that the trench is 30 cm (12 in.) deep for the entire length of the cable route.
5. Lay the cable. To do so, refer to *Installing the cables*, page 4-20.

Figure 4-10 illustrates how to dig a trench in soil under non-reinforced concrete or asphalt and install optional geotextile fabric.

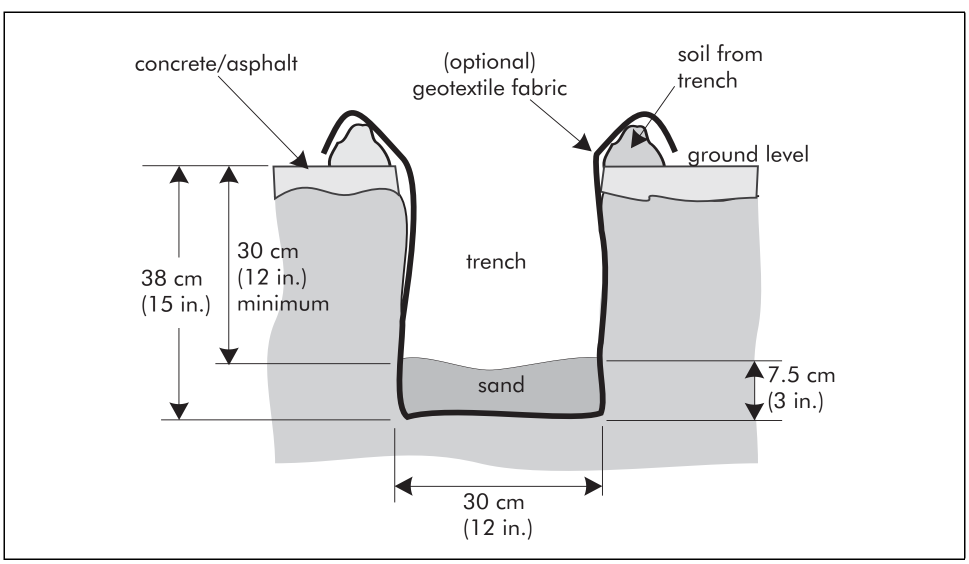


Figure 4-10: Thin, non-reinforced concrete/asphalt trench with optional geotextile fabric

Boring under concrete

You can install the sensor cable under non-reinforced concrete using a boring technique to cut a path under the concrete. This method is most commonly used when installing the cable under sidewalks and other narrow concrete surfaces, as well as under narrow asphalt paths.

To bore under non-reinforced concrete

1. Bore a small hole through the soil just below the concrete using pressurized water or compressed air.
2. Feed a PVC conduit through the hole.
3. Pull the sensor cable through the conduit. To properly install the cable in the conduit, refer to ***Protecting buried cables***, page 4-3.

Crossing sidewalks or driveways

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

It is recommended that you lay this conduit during site construction to facilitate future Panther II sensor cable installation. If this is not possible, dig a trench under the concrete/asphalt. To do so, refer to ***To dig a trench under concrete/asphalt***, page 4-13.

Figure 4-11 illustrates how to install the sensor cables in existing conduit under a driveway.

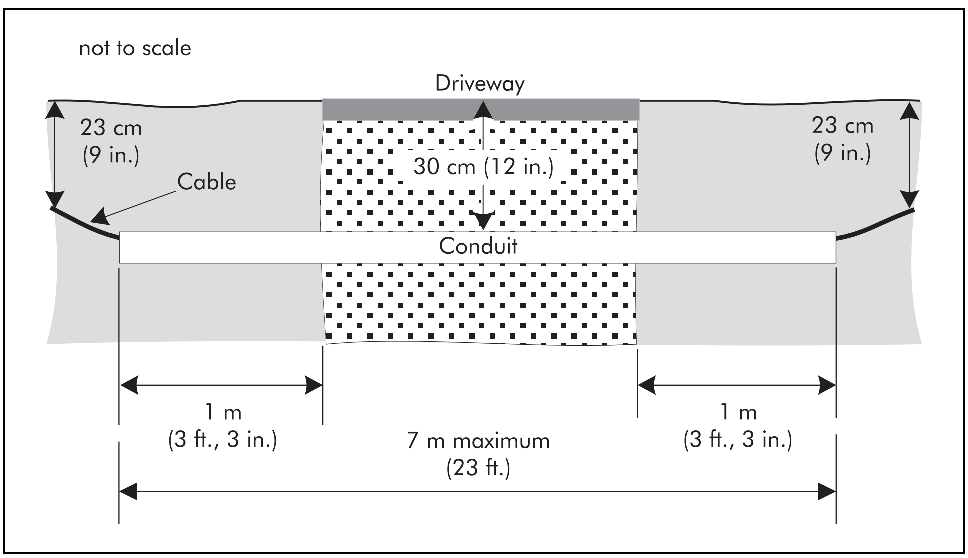


Figure 4-11: Sensor cable installed in conduit under driveway

Preparing hard-surface slots

This section details how to prepare slots in hard mediums, including reinforced concrete or asphalt/concrete that is more than 10 cm (4 in.) thick, to install Panther II sensor cables. Refer to the following procedures:

Points to remember

Before preparing the hard-surface slots for cable installation, review the following information regarding slot modification, thin asphalt, decoupler and terminator locations, expansion joints and large cracks, and transition from a slot to a trench.

Slot modification

Standard slots are cut around the perimeter. You must modify these slots along the perimeter to accommodate sensor cable overlaps, decouplers, terminators, ferrite beads, expansion joints, large cracks, and the transition between slots and trenches. For information about the dimensions of these slots, refer to the table in *Slot dimensions*, page 4-17.

Thin asphalt

If there are areas where the asphalt is so thin that you cut through it, do not continue to cut the slots. Prepare trenches instead. To do so, refer to *Digging trenches*, page 4-12.

Decoupler and terminator locations

Where you plan to install decouplers or terminators in asphalt/concrete, modify the slots to accommodate the decoupler or terminator and a slight bend (lazy S-pattern) in the cable to provide strain relief. Widening the slots also allows space to install ABS conduit over the sensor cable, which provides mechanical protection. For information about the dimensions of this slot, refer to the table in *Slot dimensions*, page 4-17.

Expansion joints and large cracks

To prevent post-installation surface damage, it is recommended that the cable path 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.), use a blunt tool to insert a flexible foam polyethylene backer rod 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. 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. For information about the dimensions of this slot, refer to the table in *Slot dimensions*, page 4-17.

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

Figure 4-12 illustrates how to cross an expansion joint or crack.

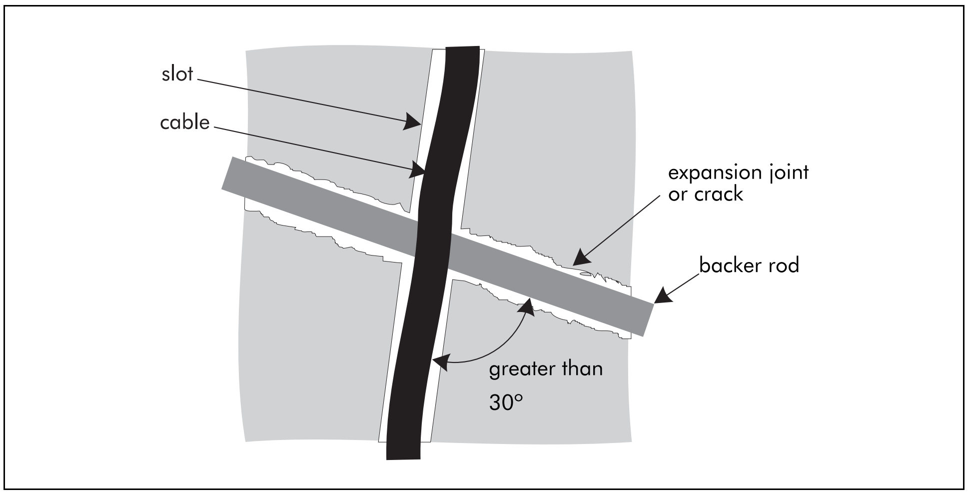


Figure 4-12: Cable crossing over an expansion joint or crack

Transition from a slot to a trench

If you are routing the cables from a concrete or asphalt medium through a soil medium, you should slope the last 30 cm (12 in.) of the slot and the first 61 cm (24 in.) of the trench to meet each other. A 10 cm (4 in.) deep cut should result where the different mediums meet. You should modify the slots to accommodate a 30 cm (12 in.) section of PVC pipe. The pipe will help to protect the sensor cables from damage. For information about the dimensions of this slot, refer to the table in *Slot dimensions*, page 4-17. Figure 4-13 illustrates how to route a cable from concrete or asphalt through soil.

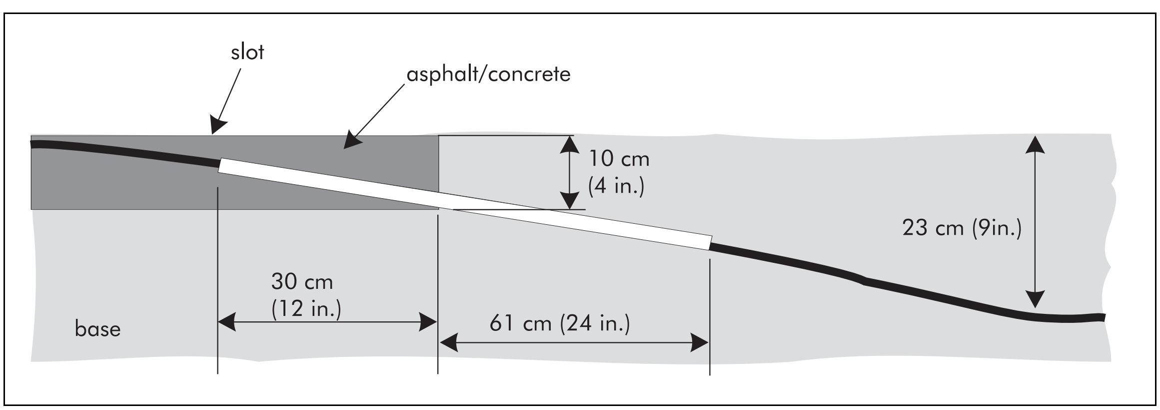


Figure 4-13: Cable route through concrete/asphalt and soil

Required equipment

To prepare hard-surface slots, you require the following 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

The following materials are required for preparing hard-surface slots:

- closed cell foam polyethylene backer rods - two 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.) 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 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%)

For more information about the materials required to prepare hard-surface slots, refer to *Recommended installation materials*, page b-1.

Slot dimensions

The following table shows the dimensions for different slot applications:

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 and modifying slots

In addition to cutting the basic slots required for installation of the Panther II sensor cables in hard mediums, you must make any necessary modifications, prepare the slots for cable installation, and widen the slots where you plan to install decouplers or terminators.

You can also cut long, narrow slots where you plan to install decouplers and terminators in heavy traffic areas (such as airport runways. These types of slots help to prevent damage from overpassing traffic.

To cut basic slots

1. Mark the cable path using spray paint, grease pen, or a chalk line.
2. 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. For slot dimensions, refer to the table in *Slot dimensions*, page 4-17.
3. Ensure that the slots are the correct depth and that the bottoms of the slots are smooth.

To achieve the correct slot width, you can mount several diamond-tooth blades side-by-side with spacers. The slot tolerance is 10 + 1 mm - 0.7 mm (3/8 + 1/16 - 1/32 in.).

To modify basic slots

- Make additional cuts to widen and deepen the slots, where necessary. For slot dimensions, refer to the table in *Slot dimensions*, page 4-17.

To prepare slots for cable installation

1. At the corners of each slot, remove any sharp edges that could cut into the cable jacket using a hammer and cold chisel.
2. Remove debris from the slots, cracks, and joints, and from the 30 cm (12 in.) area on both sides of the slots. Remove all slurry using pressurized water and a brush.
3. Clean and dry the area using compressed air.
4. Ensure that both sides of the slot are clean.

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

To widen slots at decoupler and terminator locations

1. Widen 0.9 m (3 ft.) of the slots to 9 cm (3½ in.).
2. Cut 0.9 m (3 ft.) of ABS conduit (7.6 - 9 cm (3 - 3½ in.) in diameter) in half lengthwise to provide two 0.9 m half-sections.
3. 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.
4. Pack the inside and ends of the conduit tightly with backer rod to prevent the sealant from running into the conduit.

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.

To cut slots for decouplers and terminators in heavy traffic areas

1. If you are installing decouplers and terminators, widen 6 m (19. 7 ft.) of the slots to 2.5 cm (1 in.).
2. If you are only installing decouplers, widen 3 m (10 ft.) of the slots to 2.5 cm (1 in.).
3. Lay the decoupler/terminator in the slot with a lazy-S pattern in the cable (to provide maintenance access and strain relief).
4. Cover the wide slot completely with backer rod.

   Ensure that the backer rod is large enough to compress into the slot and provide a good seal, to protect the cables from the sealant.

Figure 4-14 illustrates how to cut a narrow slot and lay the cable where you are installing decouplers and terminators in heavy traffic areas.

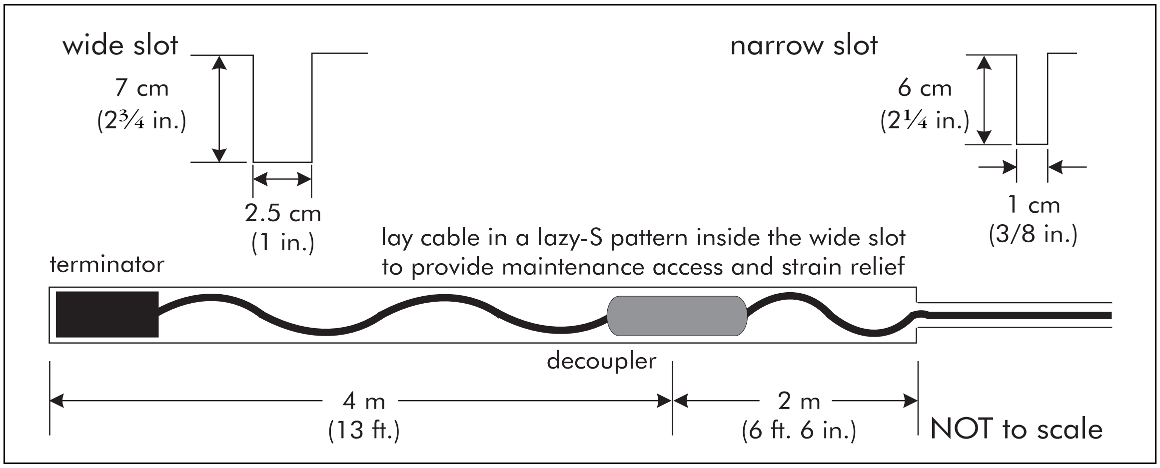


Figure 4-14: Terminator and decoupler installation in narrow slots

Figure 4-15 illustrates how to cut a narrow slot and lay the cable where you are installing only decouplers in heavy traffic areas.

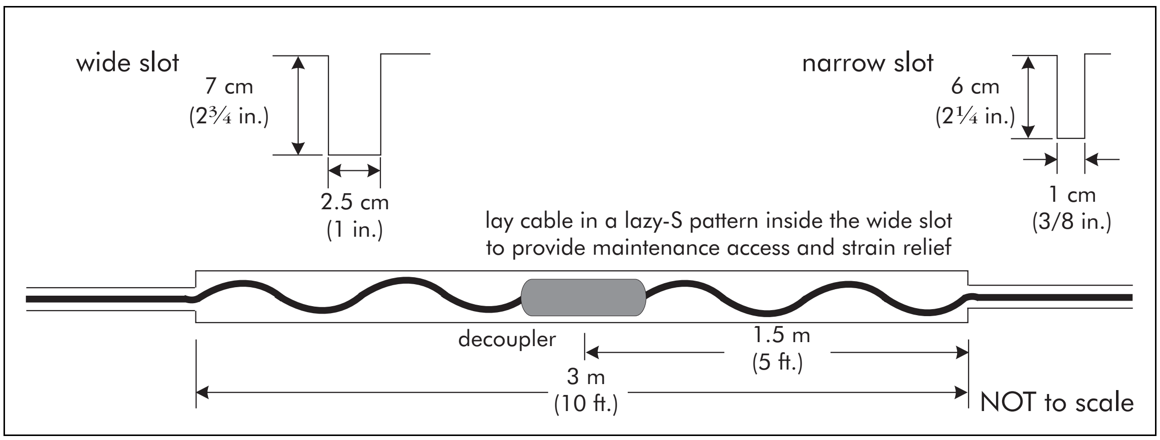


Figure 4-15: Decoupler installation in narrow slots

Installing the cables

This section details how to install the cables of your Panther II system. Refer to the following procedures:

- *Before you begin*, page 4-21
- *Points to remember*, page 4-21
- *Sensor cable bypass*, page 4-21
- *Sensor cable overlap*, page 4-21
- *Required equipment*, page 4-23
- *Installing sensor and lead-in cables*, page 4-23

- *Backfilling the trenches or slots*, page 4-24
- *Installing a berm using geotextile fabric*, page 4-26

Before you begin

Before installing the Panther II sensor cables, be sure to do the following:

- Inspect the open trenches and slots. Ensure that the depth is in accordance with the table information in *Sensor cable burial depths for different mediums*, 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 you are ready to install and connect the cable fittings. This will prevent water from entering the cable.
- You must ensure you install the cables at a constant depth to maintain uniform detection sensitivity. For information about cable burial depths, refer to *Sensor cable burial depths for different mediums*, 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 a non-detection area is required (e.g., a gate);
- where the cable route must cross a fence boundary.

You can create a bypass area within an active zone by splicing in lead-in cable to replace the normal detecting cable. When installing a bypass, roll out the entire length of sensor cable required to cover the zone. To create the bypass or non-detecting section, cut out the length of sensor cable from the area of the bypass and replace it with non-detecting cable. For more information about cable splicing, refer to *Cable splices*, page -14.

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 you require continuous detection between zones, you must overlap the zones at the point where the detection field initiates to maintain full coverage. When overlapping the cables, remember the following points:

- The cables must cross each other at a 90° angle.
- The cables must not touch where they cross each other.

- The detecting section of the sensor cable must maintain a constant depth.
- If the cables are buried in soil, you must ensure that they are vertically separated by at least 15 cm (6 in.) over a short distance. For example, you must bury the bottom (lead-in) cable at least 38 cm (15 in.) deep.
- If the cables are buried in concrete, you must ensure that they are vertically separated by at least 2.5 cm (1 in.) over a short distance. For example, you must install the bottom (lead-in) cable in a slot that is 8.5 cm (3¼ in.) deep.

Figure 4-16 illustrates how to properly overlap sensor cables.

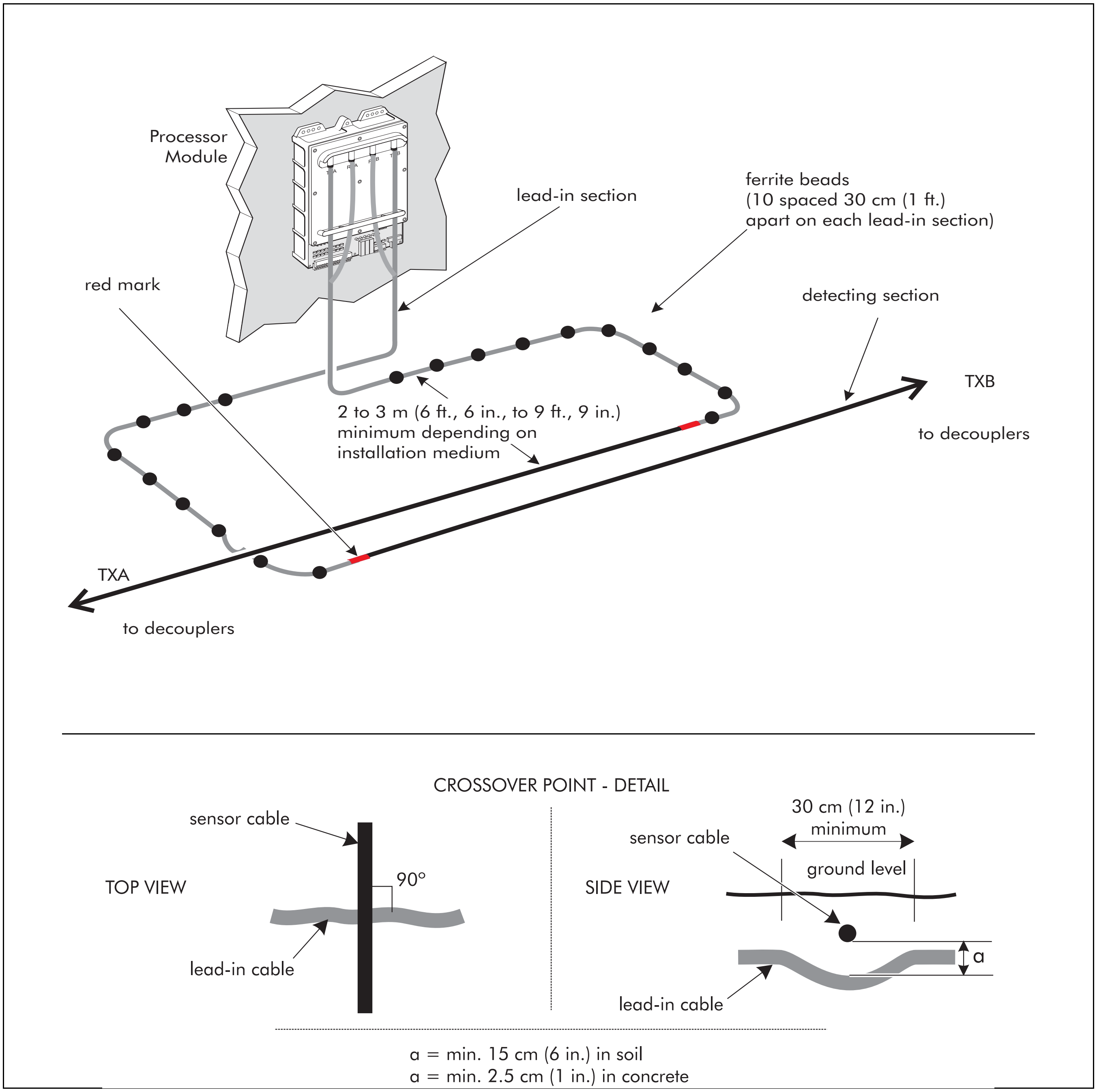


Figure 4-16: Sensor cable overlap

Required equipment

You require the number of Panther II sensor cable sets necessary to properly install your system.

Installing sensor and lead-in cables

After preparing the medium(s), you can install the sensor and lead-in cables using the required equipment. For information about the required equipment, refer to ***Required equipment***, page 4-23.

To install sensor and lead-in cables

1. Unroll the first 20 m (66 ft.) of cable, the lead-in cable, off of the spool.
2. Lay the cable out in the trench or slot between the end of the zone and the PM location, and position the red mark on the cable according to the site plan.
3. Ensure that there is enough lead-in cable to reach from the red mark to the PM.
4. Keep any excess lead-in cable loosely coiled temporarily.
5. Temporarily anchor the sensor cable in the trench at the red mark.
6. Lay the cable in the trench(es) or slot(s) by doing the following:
   - Put a stick, such as a shovel handle, through the hole in the cable spool.
   - With a person holding each end of the stick, lift the cable spool and walk along the trench or slot. The cable will dispense as you walk.
7. As you dispense the cable, inspect it for damage.
8. Where you plan to join cables from different zones with decouplers, temporarily overlap the cables by at least 1 m (3 ft., 3 in.).
9. Install ferrite beads. To do so, refer to ***Installing ferrite beads on lead-in cables***, page -3.

Once the cable connectors are installed, you will cut back the lead-in cable as required. Do no bury any excess lead-in cable.

If there is a coil or loop in the cable after you have dispensed it, Do not pull it. Roll the coil or loop out to the end of the cable.

Do not install a cable that has a damaged outer jacket. For information about repairing a cable, refer to Repairing sensor cables, page 11-1.

Figure 4-17 illustrates how to install the lead-in and sensor cable.

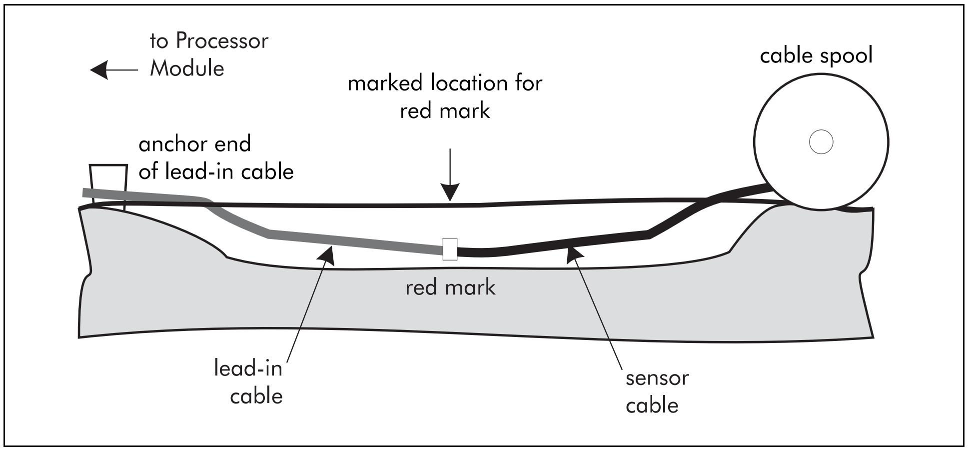


Figure 4-17: Basic cable installation

Backfilling the trenches or slots

Once you have installed the cables, you must backfill the trenches or slots depending on the type of medium used. Different backfilling techniques exist for cables installed in soil and non-reinforced concrete/asphalt (soft mediums), and in hard surfaces that require slots (such as reinforced concrete).

To backfill soil trenches

1. Backfill the trenches with 7.5 cm (3 in.) of sand except at planned decoupler installation locations.
2. Ensure that stones do not fall on or near the cables.
3. Ensure that the cable lies at a uniform depth of 23 cm (9 in.).
4. Replace the soil in the trench, except at planned decoupler installation locations.

Figure 4-18 illustrates how to backfill a soil trench after cable installation.

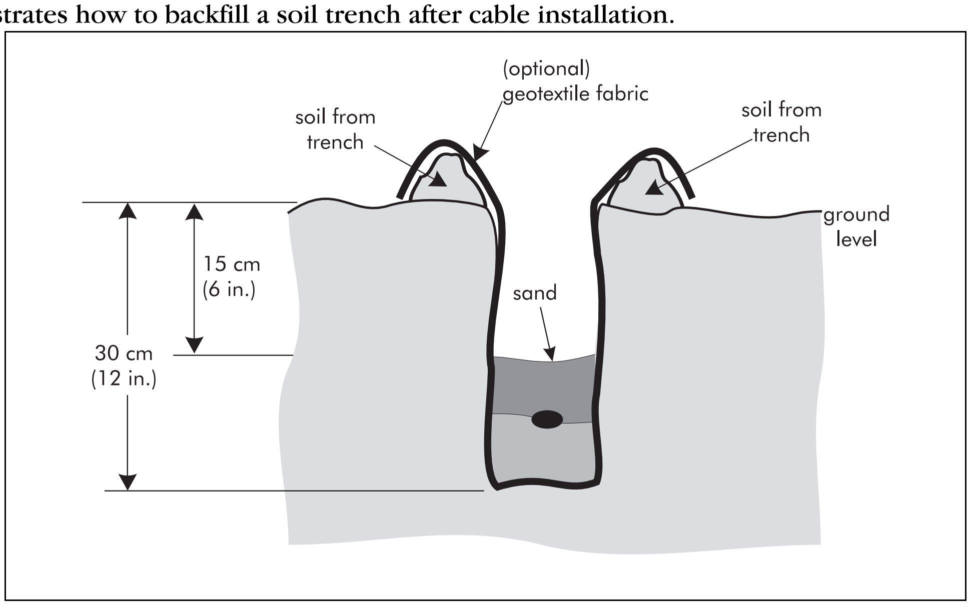


Figure 4-18: Backfilling a soil trench

To backfill non-reinforced concrete/asphalt trenches

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

Figure 4-19 illustrates how to backfill a non-reinforced concrete or asphalt trench after cable installation.

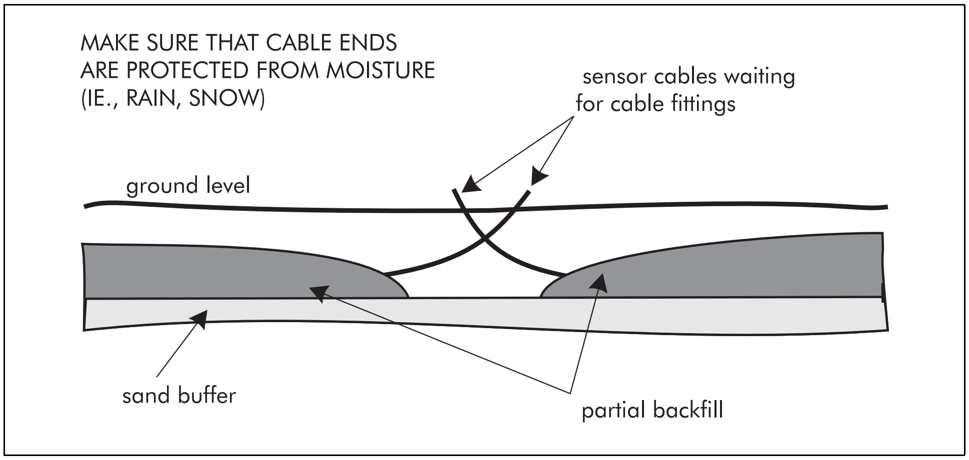


Figure 4-19: Backfilling a non-reinforced concrete/asphalt trench

To backfill hard-surface slots

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

Figure 4-20 illustrates how to backfill a hard surface slot after cable installation.

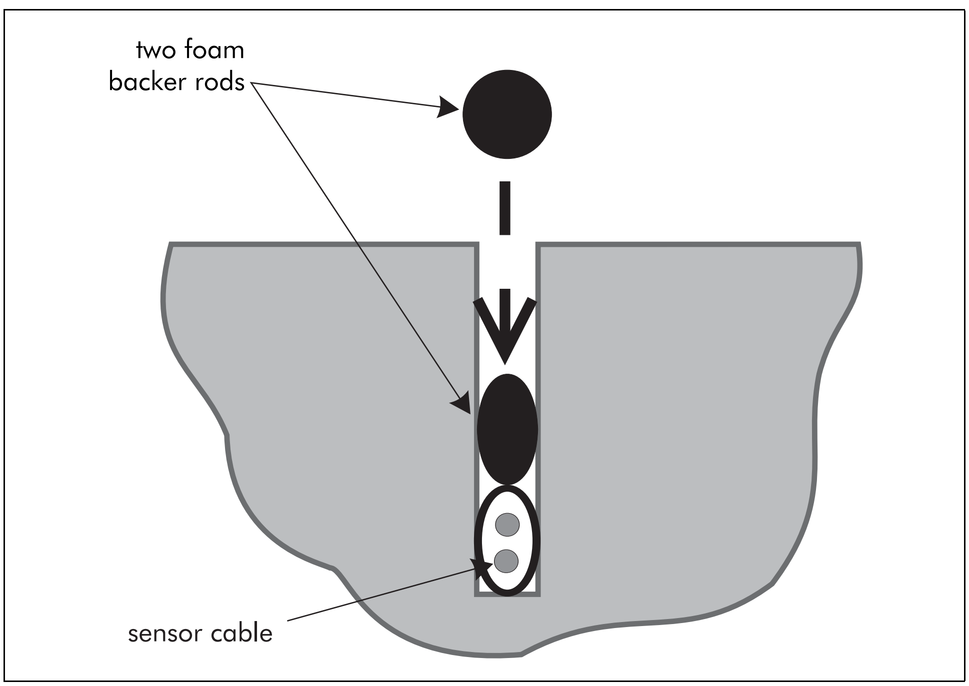


Figure 4-20: Backfilling a slot

Installing a berm using geotextile fabric

When you have installed the cables in rocky soil or it is necessary to elevate the zone while providing protection from erosion, you should install a berm. The geotextile fabric retains the soil around and between the sensor cables. The width of the geotextile fabric that you require is dependant upon the application.

To install a berm

1. Remove any large stones from the ground on which you are working.
2. Roll out the geotextile fabric on the ground.
3. Ensure that the geotextile fabric is large enough to encircle the planned berm.
4. Cover the center portion of the fabric with a 7.5 cm (3 in.) deep layer of sand or stone dust.
5. Place the sensor cable on top of the sand, and cover the cable with another 23 cm (9 in.) of sand or stone dust.
6. Slope the sides of the berm at a 1:3 ratio or less (depending on the expected erosion severity).
7. Fold the geotextile fabric over the top layer of sand.
8. Cover the fabric completely with at least a 2.5 cm (1 in.) layer of crushed stone. You may require more coverage if erosion is severe.

Figure 4-21 illustrates how to install a berm using geotextile fabric.

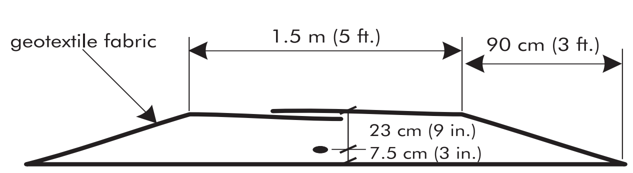


Figure 4-21: Berm installation

5 Installing cable fittings

This chapter provides information about:

- Cable fittings installation overview
- Installing ferrite beads
- Preparing the cables
- Installing connectors
- Working with decouplers, terminators, and cable splices

Cable fittings installation overview

There are various cable fittings that you must install to properly set up your Panther II system.

- Cable labels identify the sensor cable at the PM.
- Ferrite beads are located on the lead-in cable to the PM, on the non-detecting cable in the bypassed area, and on the sensor cable, to dampen strong fields. For more information about ferrite beads, refer to *Installing ferrite beads*, page 5-2.
- Connectors are installed on the end of the sensor cable and the lead-in cable, to enable other cable fittings to connect to the cable.
- Decouplers are installed on a male connector, to enable the flow of data and power from one zone to another.
- Terminators are located on sensor cables, to terminate data.

Figure 5-1 illustrates the cable fittings in a Panther II system and their various installed locations.

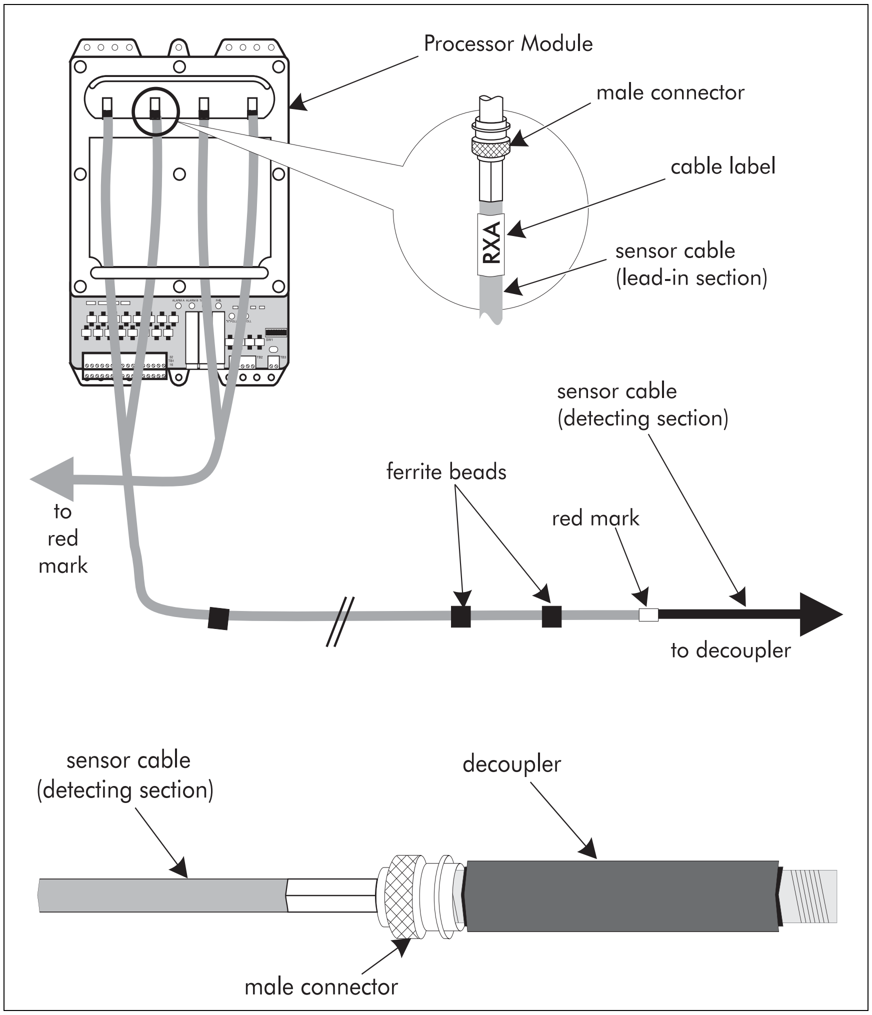


Figure 5-1: Cable fittings and their locations

Installing ferrite beads

This section details how to install ferrite beads on your Panther II cables. Refer to the following procedures:

- *Points to remember*, page 5-3
- *Installing ferrite beads on lead-in cables*, page 5-3

Points to remember

When installing ferrite beads, remember the following:

- Install the ferrite beads before you bury the cables.
- Install the ferrite beads on the cables before you install the connectors.
- Do not allow the ferrite beads to slide freely and hit each other, as they may break.
- If a ferrite bead breaks at any time while you are installing the cables, replace it, unless you have already installed the connector.
- You must install at least seven ferrite beads on each lead-in cable.
- If the detection signal of a sensor cable buried in asphalt is too strong, you can install ferrite beads on the cable. You can determine this by calibrating the system. For information about calibrating the system, refer to Chapter 8 *Adjusting sensitivity*, page 8-8.

Installing ferrite beads on lead-in cables

You must install ferrite beads on each lead-in cable of your system.

To install ferrite beads on lead-in cables

1. Carefully slide 10 ferrite beads onto each lead-in cable.
2. Starting at the red mark and measuring toward the PM, position the ferrite beads approximately 30 cm (12 in.) apart.
3. Secure the beads 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 PM.

Figure 5-2 illustrates how to install ferrite beads on the lead-in cable.

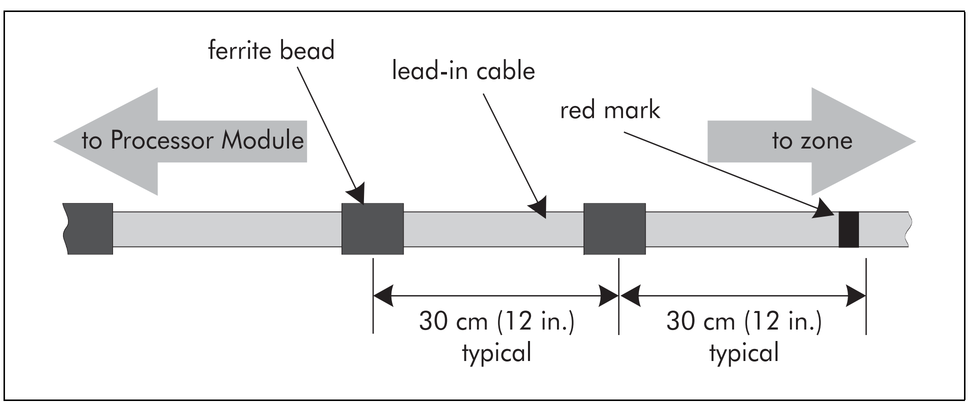


Figure 5-2: Ferrite bead installation

Preparing the cables

This section details how to prepare the cables for connector installation. Refer to the following procedures:

- *Points to remember*, page 5-4
- *Required tools*, page 5-4
- *Preparing the cables for connector installation*, page 5-5

The connector kits supplied with the Panther II system have been designed specifically for the Panther II cables. Do not substitute any other connectors, as this may be detrimental to system performance.

The installation procedure applies to both male and female connectors.

Read each step in each procedure carefully before attempting to perform them.

Points to remember

When preparing the cables, remember the following:

- Ensure that all connections are dry. Use a heat gun to remove any moisture. (Trapped moisture can cause corrosion, reduced performance, and system failure.)
- Do not blow on the connector as a means of cleaning it.
- Do not drop or place cable ends on the ground or allow them to get wet or dirty.
- Do not cut the cables to length until just before you connect them to the PM, decouplers, or terminators.
- You must line up the ribbed surface on the outer jackets of the two sensor cables that you want to connect.
- When connecting cables to the PM, cut off the excess lead-in while ensuring that you have 3 m (10 ft.) left over to create a service loop.

Required tools

You require the Panther II cable tool kit (Model no. CT3-3) or equivalent, which includes the following:

- knife
- side-cutting pliers
- crimp tool
- ruler

Preparing the cables for connector installation

To prepare the cables for proper connector installation, you must first strip the grey outer jacket from the cables. Then, if you are planning to connect two cables for zone-to-zone connection, zone-to-bypass connections, or data termination applications, you must stagger these cables. You must then remove the black jacket from each cable, and expose the center conductor.

To strip the grey outer jacket from the cable

1. Cut the cable to the required length.
2. Measure the appropriate section of cable you want to strip. Refer to the following measurements:
   - Zone-to-zone continuous detection field - 25 cm (10 in.)
   - Termination of data - 25 cm (10 in.)
   - Zone bypass or cable splice - 17 cm (6½ in.)
3. At this measurement, score the outer cable jacket around its circumference and lengthwise to the end of the cable.
4. Score the cable lengthwise on the opposite side.
5. Separate the jacket from the cable by doing the following:
   - 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 begins to separate.
   - Repeat the previous step on the opposite side of the cable.
   - Work the cutters into the end of the cable where the grey jacket is thickest, and pry the jacket until it lifts up.
   - Repeat the previous step on the opposite side of the cable.
   - Peel back the lifted jacket from the cable, and remove both pieces.
6. Carefully cut the web between the two coaxial cables.

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.

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

Do not strip the black jacket material from the cables.

Figure 5-3 illustrates how to remove the grey outer jacket from the cable.

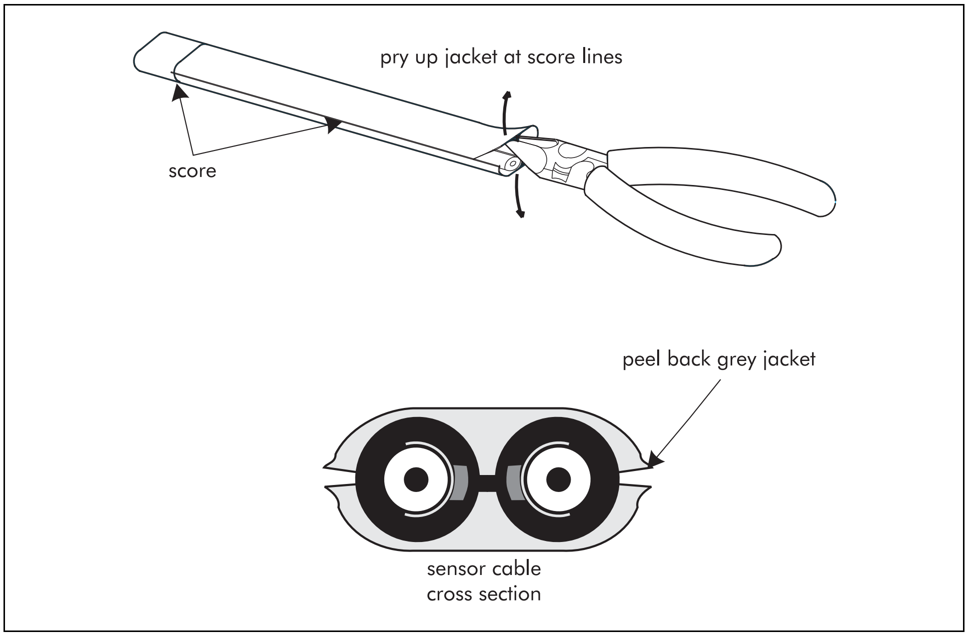


Figure 5-3: Grey outer jacket removal

Figure 5-4 illustrates how to split the two coaxial cables.

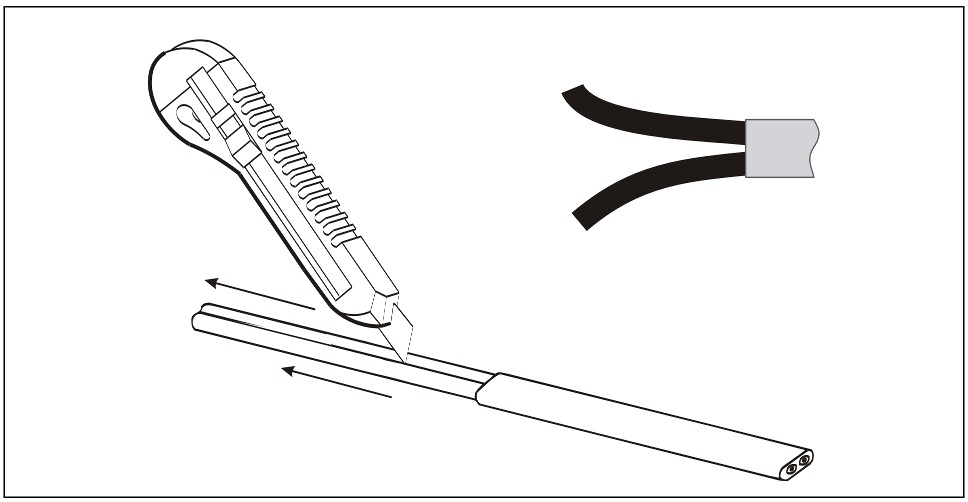


Figure 5-4: Coaxial cable split

To stagger two connecting cables

1. Stagger the two sides of the cable so that the ribbing on both cables lines up. Refer to the following dimensions:
   - Zone-to-zone continuous detection field/data termination applications - ensure the long cable is 25 cm (10 in.) long, and shorten the remaining cable by 15 cm (6 in.) from the end of the cable
   - Zone bypass/cable splice applications - ensure the long cable is 17 cm (6½ in.) long, and shorten the remaining cable by 6 cm (2½ in.) from the end of the cable
2. Slide one crimp ring over each cut cable.

3. Slide a 5 cm (2 in.) piece of heat shrink tubing over the end of the shorter cable.

Figure 5-5 illustrates how to stagger two cables that you want to connect using decouplers on the terminators.

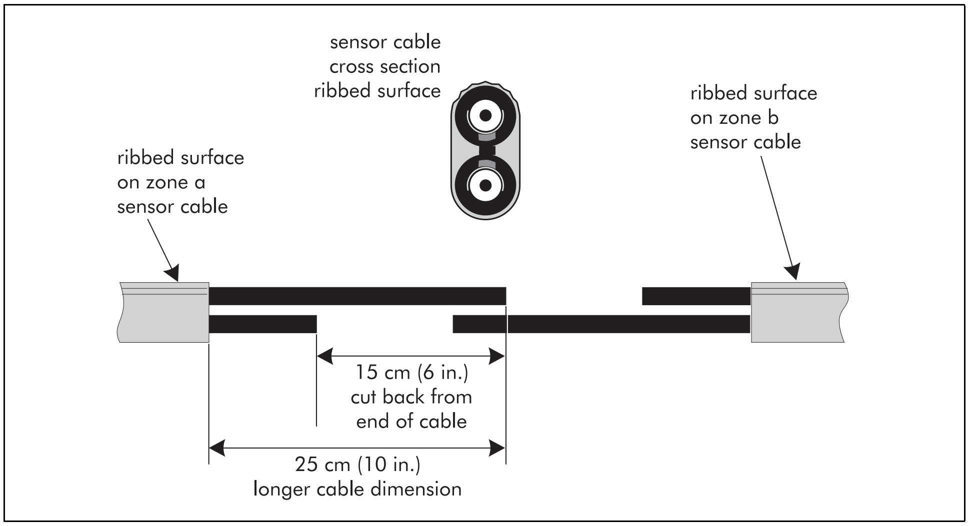


Figure 5-5: Staggered cables for zone-to-zone connection, data termination applications

To remove the black jacket from the cable

1. Measure back 16 mm (5/8 in.) from the end of the cable.
2. At this measurement, score 80% through the black jacket around the circumference of the cable.
3. Cut the black jacket from the score mark to the end of the cable. Do not cut through the drain braid.
4. Using pliers, peel back the black jacket from the cable, and remove it.
5. Peel back the drain braid.

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.

Figure 5-6 illustrates how to remove the black jacket from the cable.

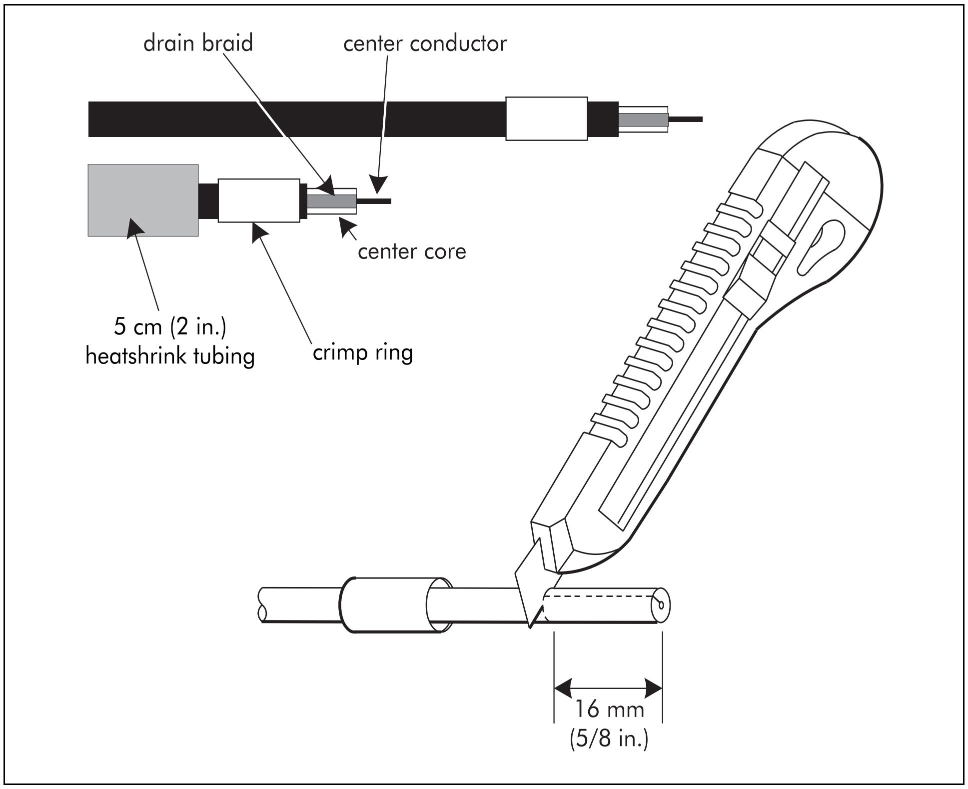


Figure 5-6: Black jacket removal

To expose the center conductors of the cable

1. Measure 11 mm (7/16 in.) from the black jacket towards the end of the cable.
2. At this measurement, cut through the exposed aluminum foil and foam polyethylene dielectric core to the center conductor, rotating around the circumference of the cable.
3. Twist off the remaining section of the dielectric to expose the center conductor.
4. Carefully scrape off all of the residual adhesive from the dielectric center core.
5. Use the knife blade to scrape back or trim any excess aluminum foil from the center core.
6. Straighten the center conductor, and trim it to a maximum length of 5mm (3/16 in.).

Do not nick the center conductor.

Figures 5-7 and 5-8 illustrate how to expose the center conductor of the cable.

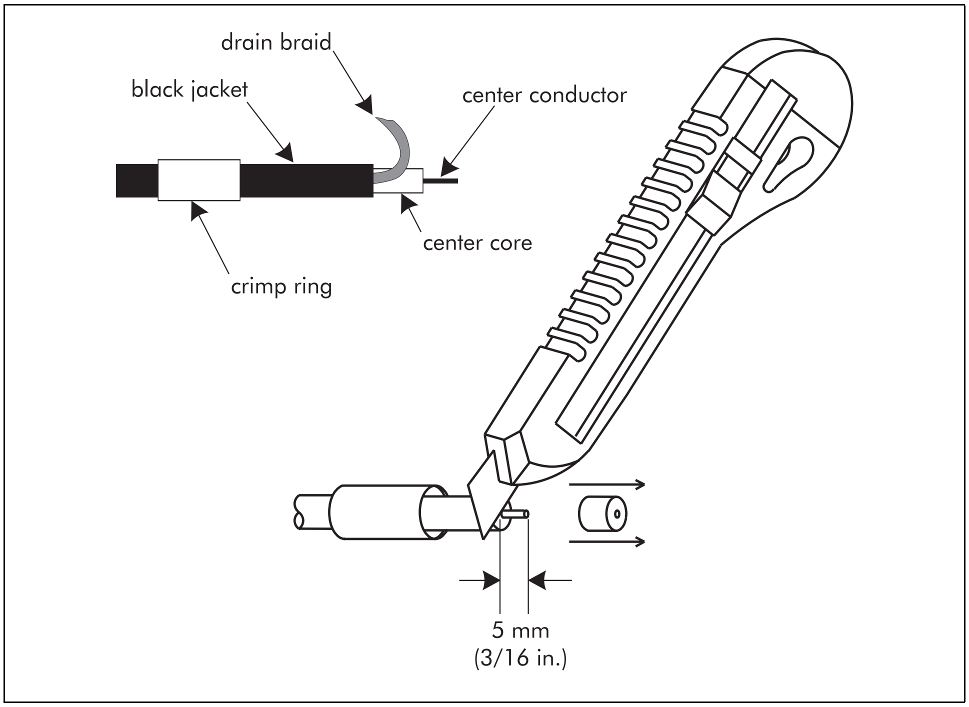


Figure 5-7: Center conductor exposure

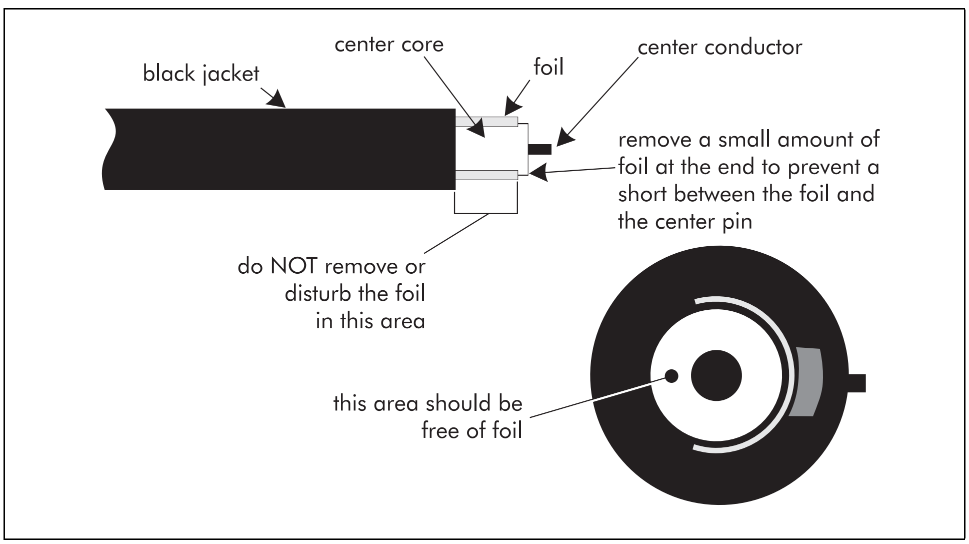


Figure 5-8: Center conductor exposure

Installing connectors

This section details how to install the connectors onto the cables. Refer to the following procedures:

- *Points to remember*, page 5-10
- *Required tools*, page 5-10
- *Installing the connectors*, page 5-10

Points to remember

When installing the connectors, remember the following:

- Ensure that all connections are dry. Use a heat gun to remove any moisture. (Trapped moisture can cause corrosion, reduced performance, and system failure.)
- Do not blow on the connector as a means of cleaning it.
- Do not drop or place the connectors on the ground or allow them to get wet or dirty.
- Do not put connectors on the cables until just before you connect them to the PM, decouplers, or terminators.

Required tools

When installing the connectors, you require the following tools:

- Panther II cable tool kit (Model no. CT3-3) or equivalent, which includes the following:
    - knife
    - side-cutting pliers
    - crimp tool
    - ruler
- ohmmeter

Installing the connectors

Once you have prepared the cables, you can install the connectors.

To install a connector

1. Push the center pin over the cable's center conductor.
2. Ensure that you can see the center conductor through the hole in the center pin.
3. Crimp the center pin to the center conductor using the small hole on the crimp tool.

4. Ensure that the crimp is solidly attached and butted up against the dielectric core on the cable. Check to be sure that the center pin cannot short-circuit against the aluminum foil.
5. Push the connector shell over the center pin until it locks into place. Check to be sure that the center pin tip is approximately flush with the end of the connector shell.
6. Trim the drain braid so that it butts up against the end of the connector.
7. Ensure that you can slide the crimp ring so that it butts up against the back of the connector.
8. Affix the crimp ring by doing the following:
   - Wrap the crimp filler strip over the braid.
   - 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. Ensure that you crimp it right up against the shell.
   - Slide the cable back slightly, and crimp again.
9. Push the 5 cm (2-inch) heatshrink up against the connector, and apply heat evenly to secure the heatshrink in position.
10. Test the center pin to shield and shield to ground on the connector. To do so, refer to Chapter 8 *Testing cables*, page 8-1.

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

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.

Figure 5-9 illustrates how to install the center pin on the center conductor of the cable.

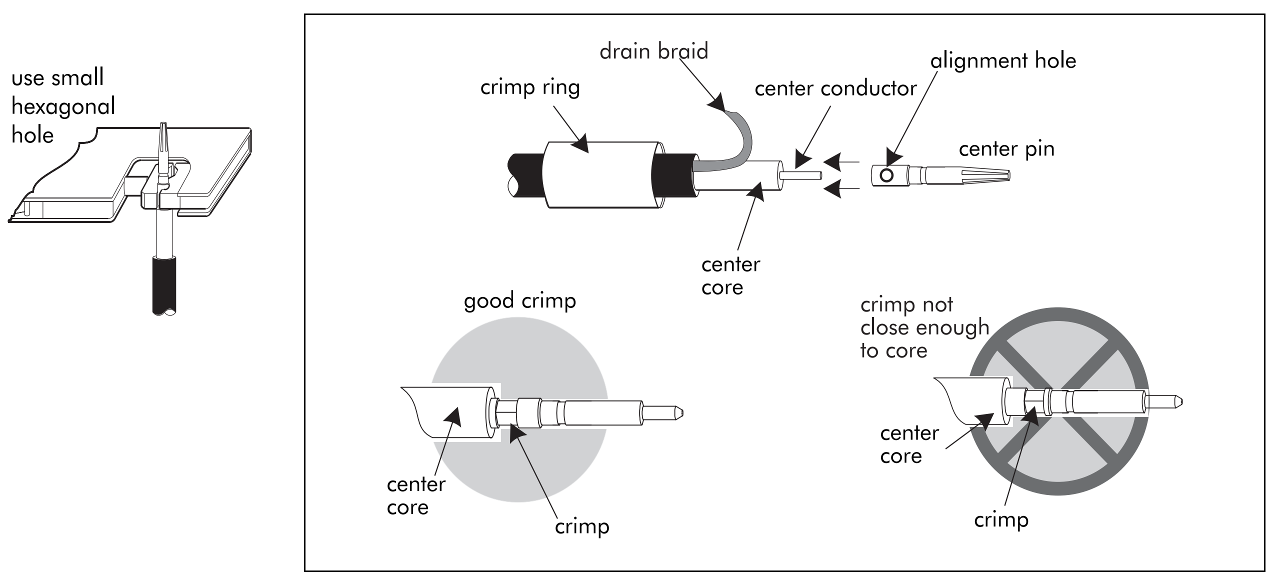


Figure 5-9: Center pin installation on center conductor

Figure 5-10 illustrates how to install the connector shell on the center pin.

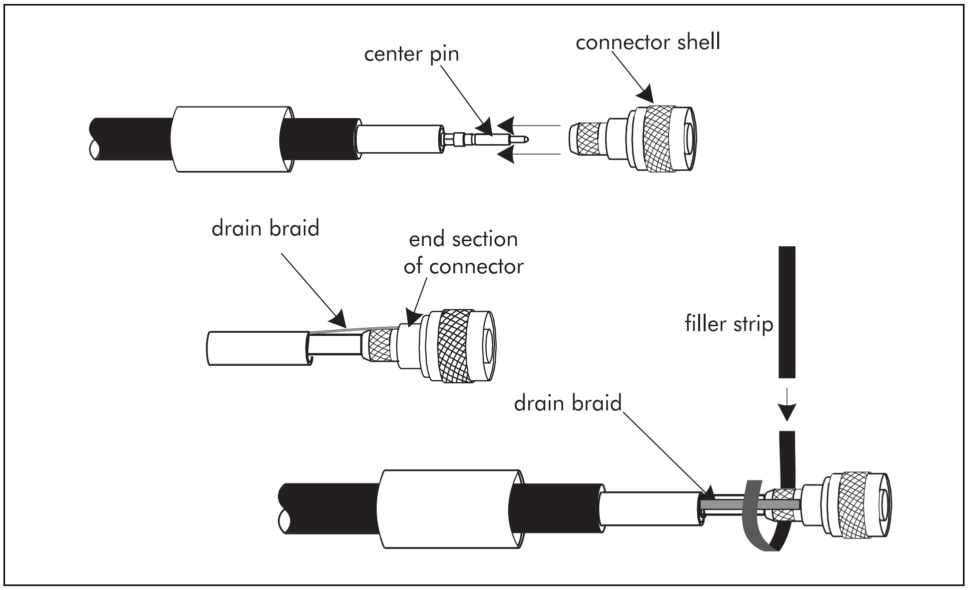


Figure 5-10: Connector shell installation on center pin

Figure 5-11 illustrates how to affix the crimp ring over the connector.

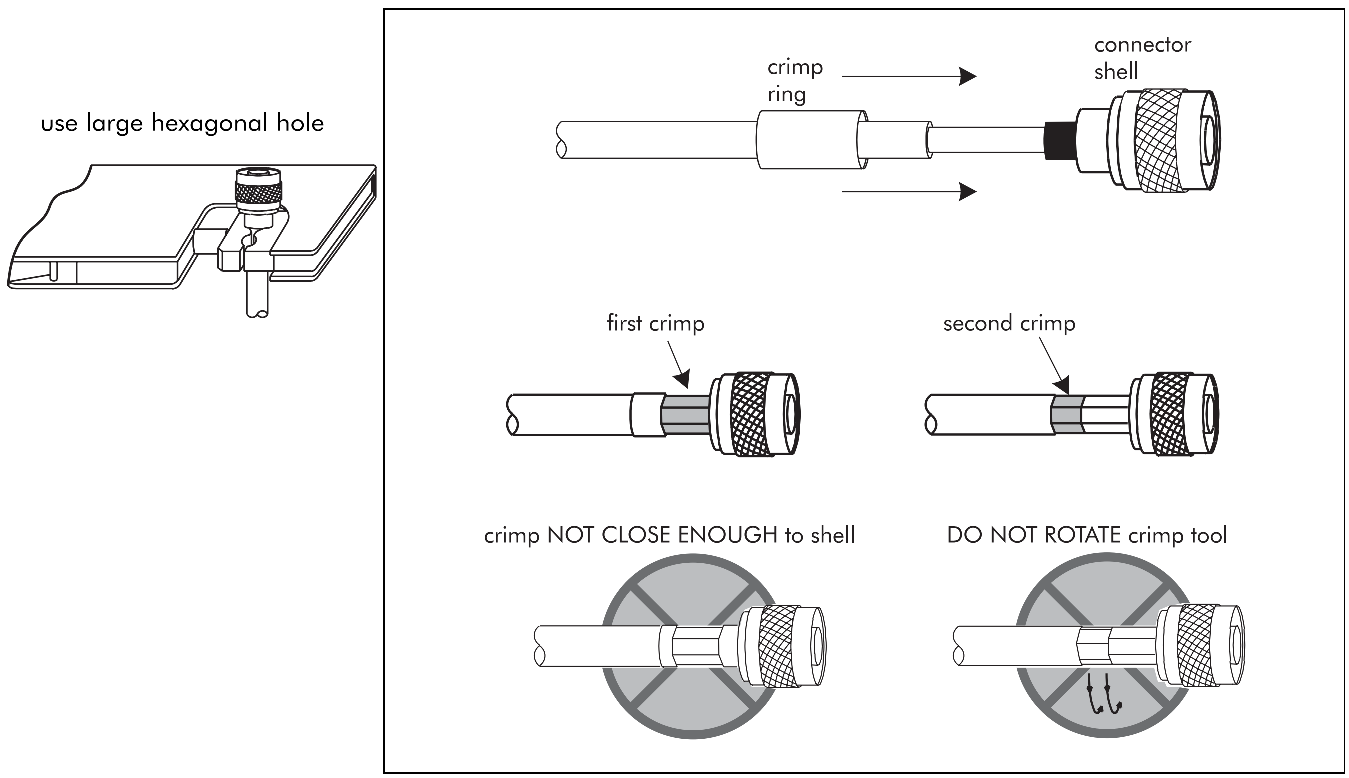


Figure 5-11: Crimp ring installation over connector

Working with decouplers, terminators, and cable splices

This section details information about decouplers, terminators, and cable splices. Refer to the following procedures:

- *Decouplers*, page 5-13
- *Cable terminators*, page 5-13
- *Cable splices*, page 5-14
- *Installing cable splices or zone bypasses*, page 5-15
- *Installing decouplers*, page 5-16

Decouplers

The standalone decoupler kit is available for use with the Panther II system. The decoupler kit includes:

- two decouplers
- heatshrink tubing

Figure 5.12 illustrates a zone-to-zone continuos detection field using decouplers.

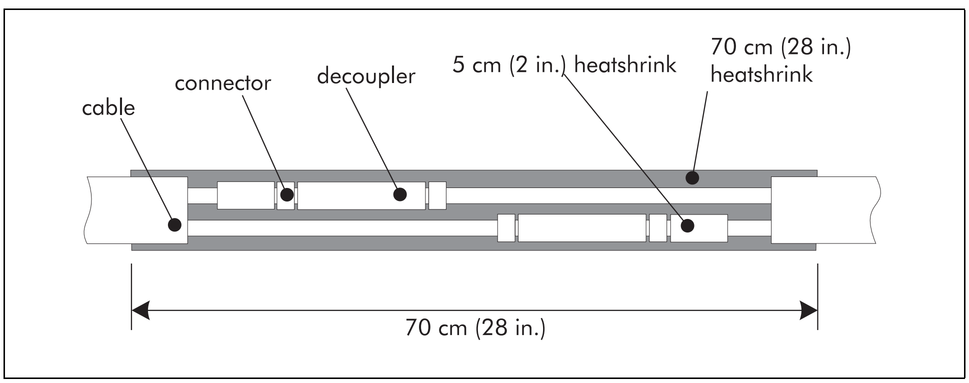


Figure 5-12: Zone-to-zone continuous detection field

Cable terminators

You must attach terminators to decouplers at

- any zone end which is not connected to another;
- an unused zone.

Figure 5-13 illustrates a cable terminator attached to decouplers.

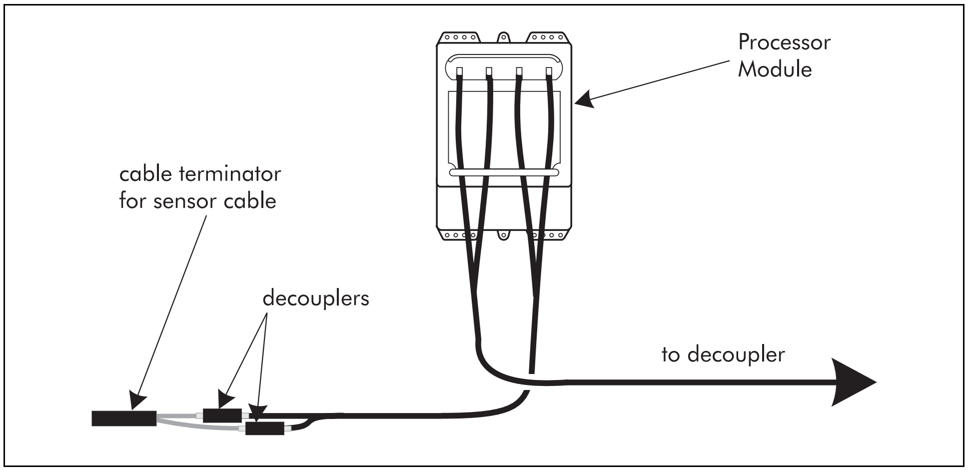


Figure 5-13: Cable terminator

The following terminator kits are available:

- detection zone terminator (one terminator cable) (Model no. TK1-4)
- mini load terminator (two terminators) (Model no. ML1-1)

The mini load terminator is attached directly to the PM to prevent false alarms from occurring on the unused zone.

Figure 5-14 illustrates the mini load terminator as it is attached to the PM.

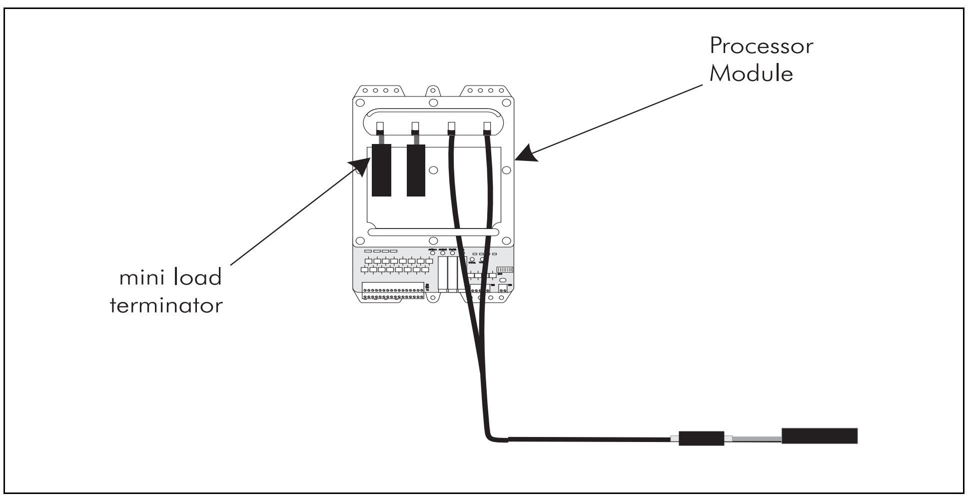


Figure 5-14: Unused zone terminator

Cable splices

A cable splice replaces a damaged section of cable with new detecting cable, augments lead-in cable, or creates an area of non-detection within a sensor zone.

Figure 5-15 illustrates a zone bypass or cable splice.

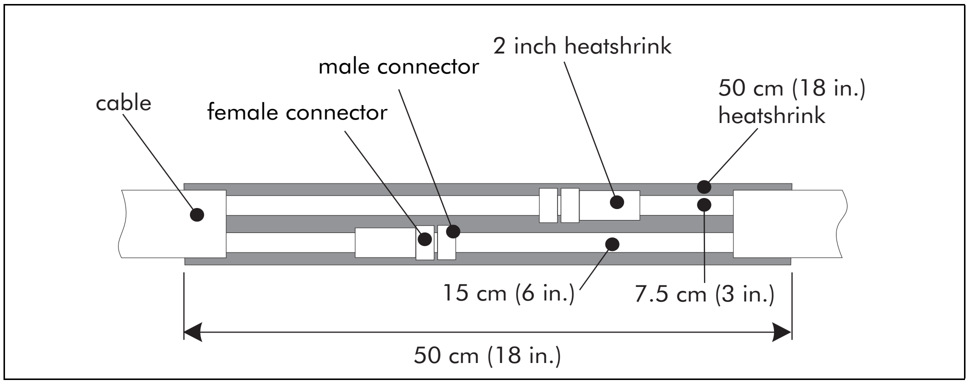


Figure 5-15: Zone bypass or cable splice

Installing cable splices or zone bypasses

You can splice a cable or create a zone bypass.

Required equipment

When installing cable splices or zone bypasses, you require the following equipment:

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

Points to remember

When installing a cable splice or zone bypass, remember the following:

- Cut the replacement cable slightly longer than the length of cable that has been removed.
- Cut out the cable that is being replaced.
- If you are installing a bypass, label and store the detecting cable.

To install a cable splice or zone bypass

1. Cut the sensor cable(s) from zone ‘a’ to the required length.
2. Install a male connector on the end of each zone ‘a’ cable. To do so, refer to *To install a connector*, page 5-10.
3. Cut the sensor cable(s) from zone ‘b’ to the required length.

4. Slide a piece of heatshrink tubing over the zone ‘a’ cables.
5. Install a male connector on the end of each zone ‘b’ cable. To do so, refer to *To install a connector*, page 5-10.

Installing decouplers

You can install decouplers on your Panther II cables.

Points to remember

When installing decouplers, remember the following:

- You must install ferrite beads and connectors before installing any decouplers.
- You must cover decouplers that you are planning to bury with heatshrink tubing that contains a sealant compound.
- It is not necessary to cover indoor connections with heatshrink tubing.
- You should install decouplers within 1 m (3 ft., 3 in.) of the desired zone boundaries.

To install decouplers

1. Cut the sensor cable(s) from zone ‘a’ to the required length.
2. Install a male connector on the end of each zone ‘a’ cable. To do so, refer to *To install a connector*, page 5-10.
3. Hand-tighten each zone ‘a’ male connector onto a decoupler.
4. Cut the sensor cable from zone ‘b’ to the required length.
5. If the sensor cable is installed in soil, cut the cable so that it reaches the middle of the decoupler that is attached to the shorter zone ‘a’ cable.
6. If the sensor cable is installed in concrete/asphalt, cut the cable so that it reaches the open end of the decoupler that is attached to the shorter zone ‘a’ cable.
7. Slide a piece of heatshrink tubing over the zone ‘a’ cables.
8. Install a male connector on the end of each zone ‘b’ cable. To do so, refer to *To install a connector*, page 5-10.
9. Hand-tighten the zone ‘b’ connectors onto the corresponding decouplers that are attached to the zone ‘a’ cable (i.e., ribbed surface side to ribbed surface side, non-ribbed surface side to non-ribbed surface).
10. Perform cable continuity testing. To do so, refer to Chapter 8 *Testing cables*, page 8-1.
11. Center the heatshrink tubing over the sensor cable connection.
12. Starting from the center and working towards each end, apply heat evenly around the heatshrink. Use only enough heat to completely collapse the heatshrink.
13. Lay the decouplers and cables in a gradual, horizontal S-curve to relieve strain on the decoupler connection.

When attaching connectors, turn the threaded head shell only. Do not turn the decoupler.

Ensure that the ribs on the zone 'a' cable and the ribs on the zone 'b' cable line up before staggering the zone 'b' cable. For information about staggering cables, refer to To stagger two connecting cables, page 5-6.

Ensure that the receive cable of zone 'a' connects to the receive cable of zone 'b' and the transmit cable of zone 'a' connects to the transmit cable of zone 'b'.

You must cover at least 5 cm (2 in.) of grey jacket on each side of the connection with heatshrink material.

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

Do not burn the heatshrink or melt the cable jacket.

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

In concrete/asphalt, you may have to pull the cables along within the slots until slack in the cable disappears. In a zone with a combination of soil and concrete/asphalt, you can pull the cables through the slots to the soil, which can accommodate the slack. Do not pull the cables so much that the strain relief S-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.

Figure 5-16 illustrates how to install decouplers on zone 'a' male connectors.

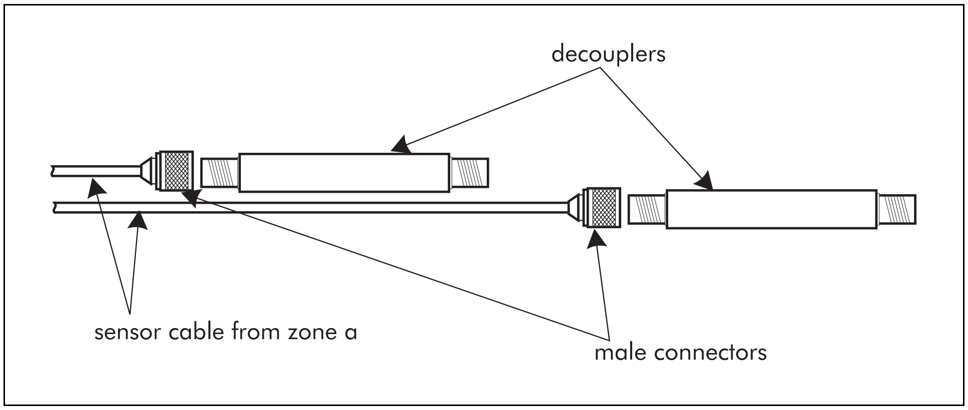


Figure 5-16: Decoupler installation on zone 'a' male connectors

Figure 5-17 illustrates how to cut the zone 'b' cable for installation in both soil and concrete/asphalt.

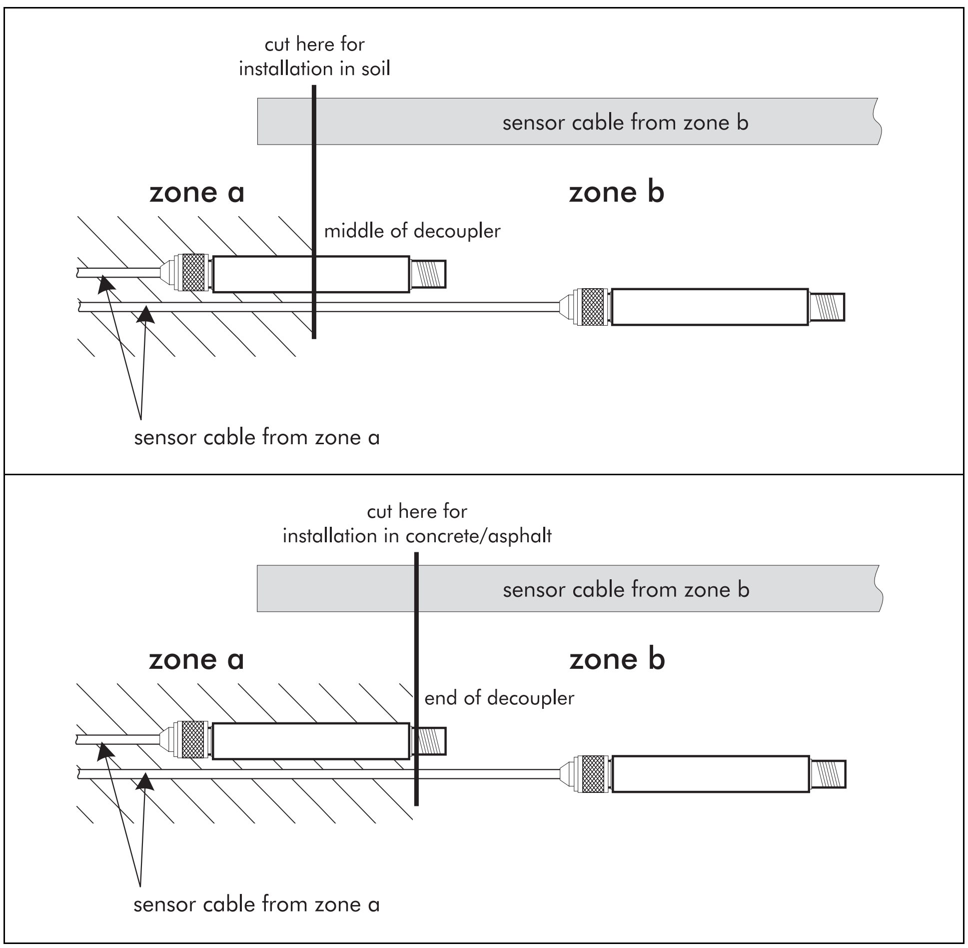


Figure 5-17: Zone 'b' cable cut for soil installation and concrete/asphalt installation

Figure 5-18 illustrates how to install the heatshrink tubing over zone 'b' cables.

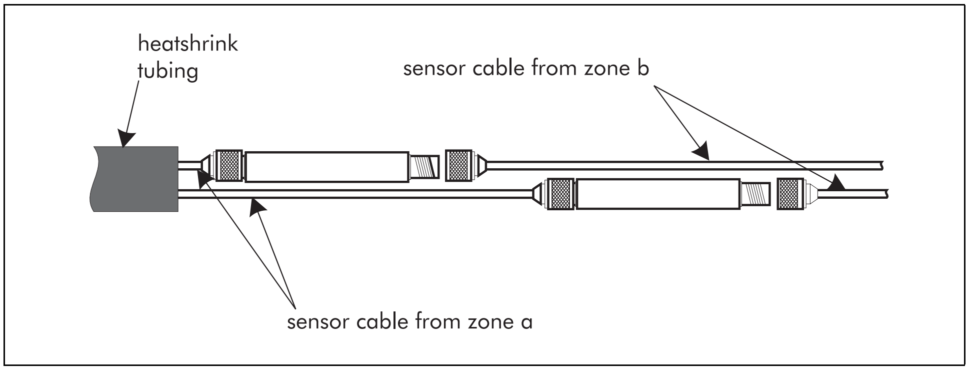


Figure 5-18: heatshrink tubing installation

Figure 5-19 illustrates how to secure the heatshrink tubing.

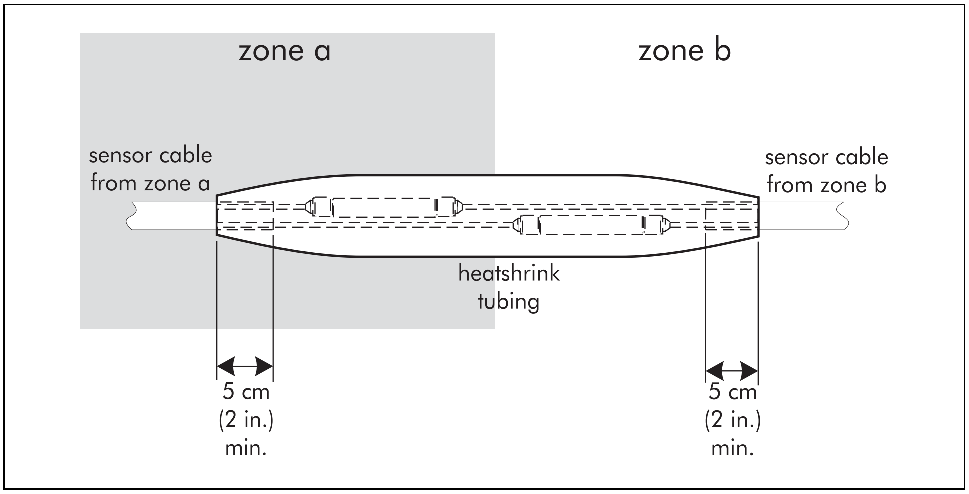


Figure 5-19: Securing heatshrink tubing

6 Installing the PM

This chapter provides information about:

- PM installation overview
- Fuse selection guidelines
- Installing the PM in a NEMA 4 enclosure
- Installing the PM in your own enclosure
- PM input/output connections
- Jumper settings

PM installation overview

For protection from vandalism and tampering, you must install the PM in an enclosure. This chapter details how to properly install your PM in the enclosure you have erected. Refer to the following procedure:

- *Before you begin*, page 6-1

For information about installing an enclosure, refer to Installing enclosures, page 3-1.

Before you begin

Check the site plan for the following information:

- the correct location and type of PM enclosure
- what fusing you require for the PM

Fuse selection guidelines

Fuse F1 is used to fuse 12 VCD input to the PM. Two sets of fuse holders and fuses are shipped with the PM. North American applications use the grey fuse holders and European applications use the black ones.

Figure 6-1 illustrates the location of the FI fuse and the type of fuse to install.

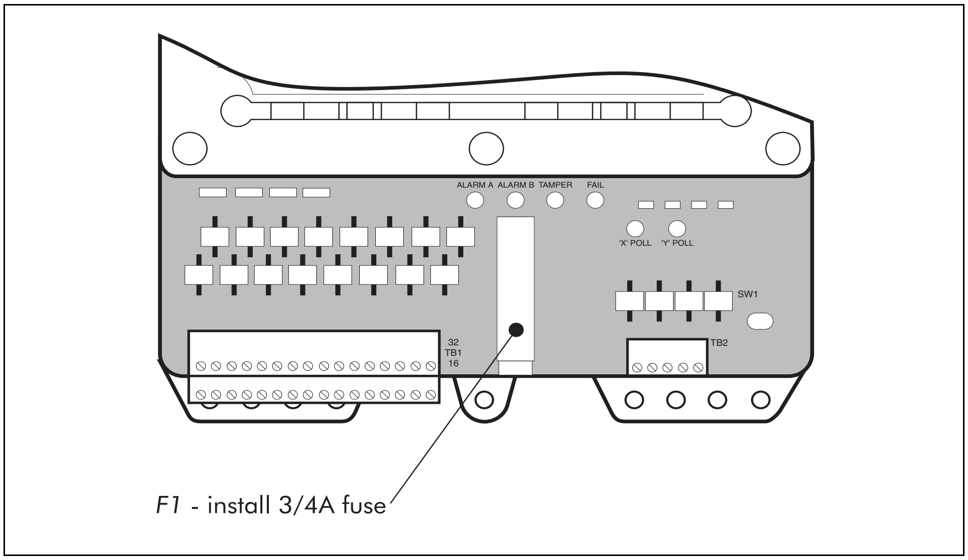


Figure 6-1 F1 fuse installation

The following table lists the F1 fuse function its 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

Installing the PM in a NEMA 4 enclosure

This section details how to properly install the Panther II PM in a NEMA 4 enclosure. Refer to the following procedure:

- *Making PM wiring connections*, page 6-3

Making PM wiring connections

For more information about wiring connections, refer to PM input/output connections, page 6-6.

Ensure that the power supply has the proper polarity connections.

To make the PM wiring connections within the enclosure

1. Install the FI fuse as required by the site.
2. Connect the ground wire to the ground lug on the enclosure and to the PM.
3. Connect the ground wire to the ground lug on the enclosure.
4. Connect the wire pair from the tamper switch to the PM at TB1, pins 29 and 30.
5. Loop the extra length of cables and wires around the PM in a field service loop (3 m (10 ft.)), and secure the cables and wires together using tie wraps.
6. 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.
7. Connect the sensor cables to the PM at the female connectors.
8. Connect the 12V power supply to the PM at TB1, pins (31-) and (32+).

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 is secured to the same screw by a separate washer and nut.

Figure 6-2 illustrates how to connect the wires to the PM as per the steps in *To make the PM wiring connections within the enclosure*, page 6-3.

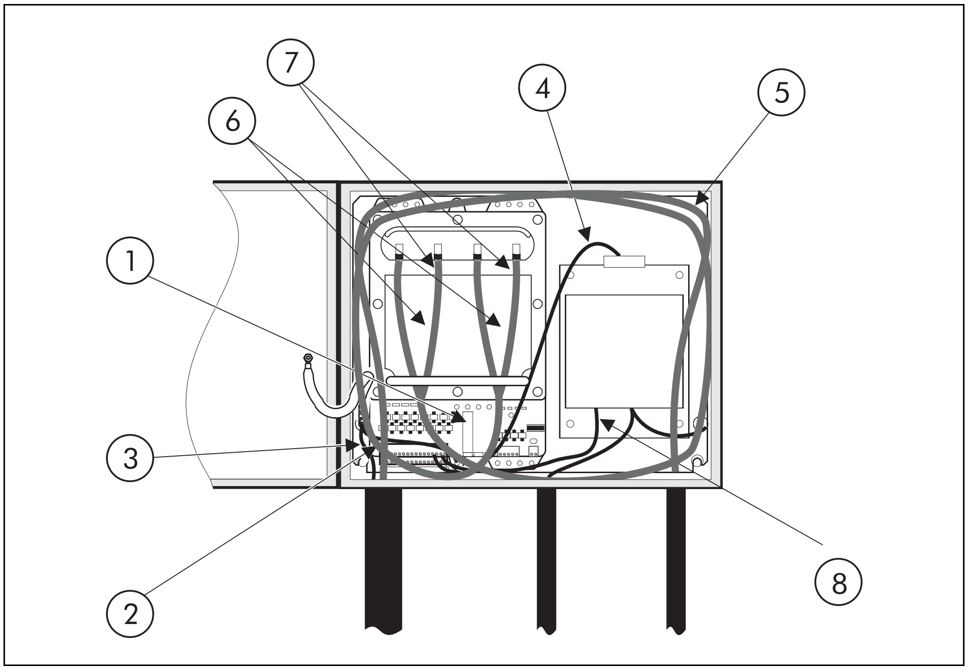


Figure 6-2 PM wire connections

Installing the PM in your own enclosure

This section details how to properly install the Panther II PM in your own enclosure. Refer to the following procedure:

- *Installing the PM within your own enclosure*, page 6-5

Caution	*For safety reasons, follow these instructions carefully. Ensure that the installation conforms to local wiring codes.* *Qualified service personnel must install an appropriate two-pole disconnect device as part of the building installation.* *Always disconnect power before servicing the unit. Only qualified personnel should perform disassembly.*

Installing the PM within your own enclosure

Senstar recommends using four 1/4-20 size nuts, bolts, lockwashers, and washers to secure the PM in your own enclosure.

Figure 6-3 illustrates the mounting hole locations on the PM.

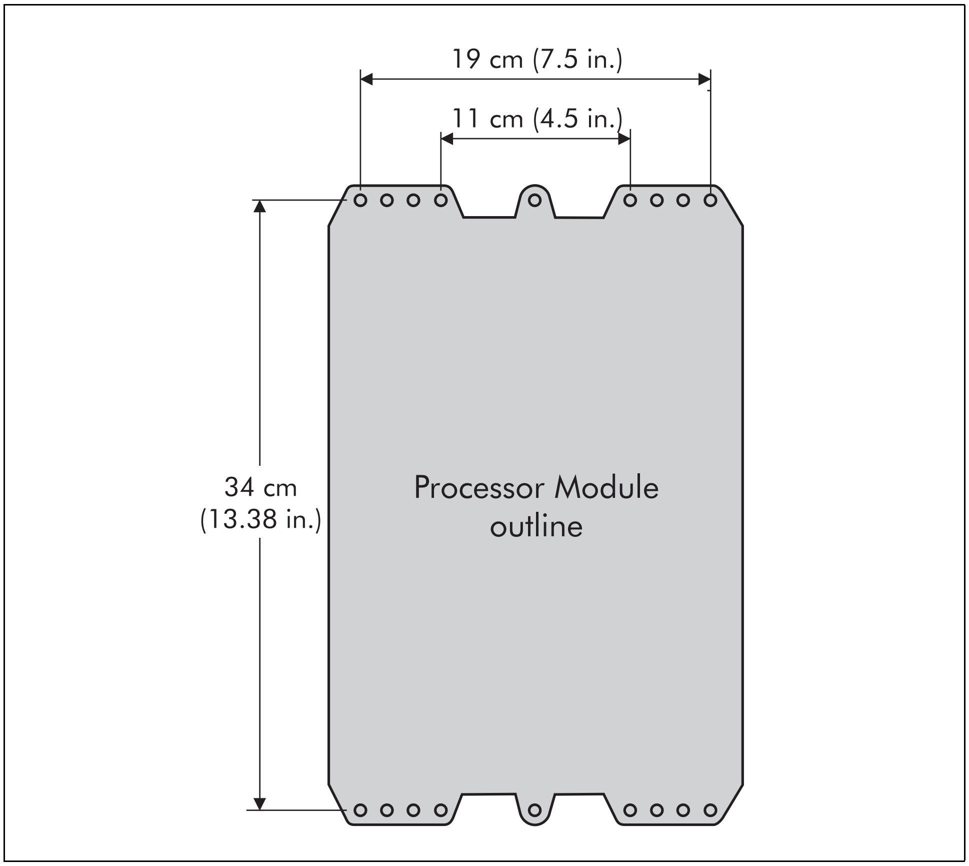


Figure 6-3 Mounting hole locations on PM

To make the PM wiring connections within your own enclosure

1. Install the appropriate fuses in the PM in accordance with the site plan. To do so, refer to *Fuse selection guidelines*, page 6-2.
2. Connect all wires and cables to the PM within the enclosure. To do so, refer to *To make the PM wiring connections within the enclosure*, page 6-3.

PM input/output connections

Figure 6-4 illustrates the input and output connections of the PM.

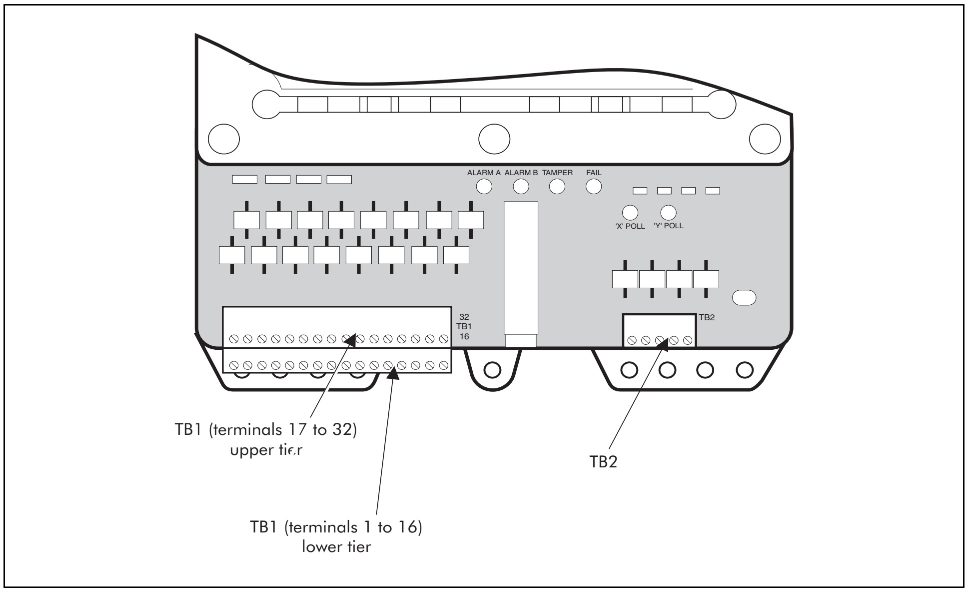


Figure 6-4 PM input/output connections

The PM has three terminal connector strips. The following tables list the pin assignments.

Configuration TB2	
Function	**Pin #**
TxRx -	1
TxRx +	2
Gnd	3
TyRy -	4
TyRy +	5

User interface - TB1	
Upper tier (terminals 17-32)	
Function	**#**
A alarm relay contact output	17-18
B alarm relay contact output	19-20
Tamper alarm relay contact output	21-22

User interface - TB1	
Upper tier (terminals 17-32)	
Function	**#**
Fail relay contact output	23-24
Analog output A zone (+)	25
Analog output A zone (–)	26
Analog output B zone (+)	27
Analog output B zone (–)	28
Tamper alarm input	29-30
Standalone power input (–) 12 Vdc	31
Standalone power input (+) 12 Vdc	32

These pin assignments are for reference purposes only.

Jumper settings

The following section details the jumper settings that are used to configure the PM. Refer to the following procedure:

- *Relay output configuration (three-pin jumpers)*, page 6-7

Relay output configuration (three-pin jumpers)

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

The following table lists the relay outputs and the relay configuration jumpers:

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.

The fail relay (relay 4) is fail-safe (energized in the non-fail condition).

Figure 6-5 illustrates the location of the three-pin jumpers.

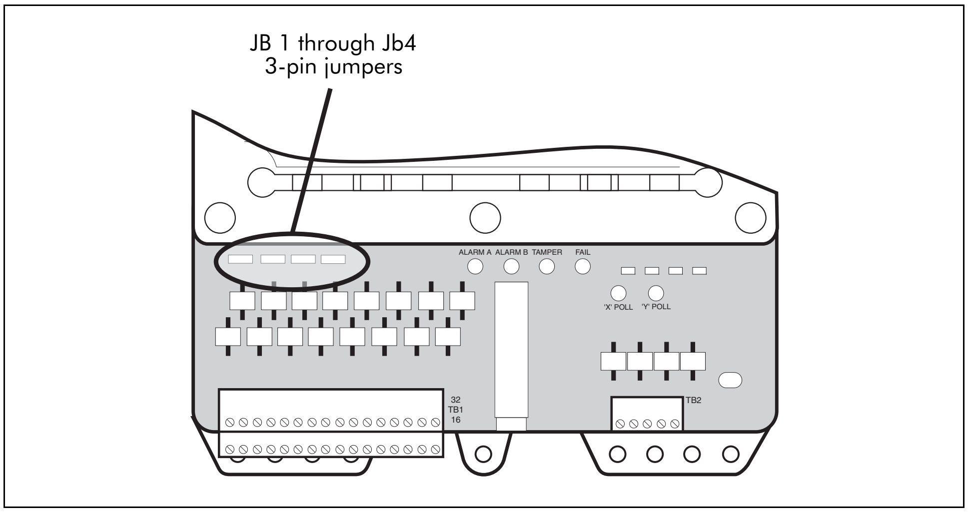


Figure 6-5 Jumper locations

7 Working with the UCM

This chapter provides information about:

- UCM overview
- Starting the UCM
- Managing UCM files
- Downloading and uploading data
- Resetting default values
- Printing UCM data
- Managing cable status
- Configuring cables
- Working with plots

UCM overview

The UCM is an application that allows you to calibrate the Panther II PM. This chapter details the functionality of the UCM.

The UCM application displays the following data and information:

- Comm status
- Diagnostic data
- Cable status
- Cable configuration

Comm status

An LED displays at the top of the UCM window that indicates the communication status between the UCM and the PM. If the UCM is communicating with the PM, the LED is green; if the two components have not been properly connected, the LED is red and when working off line, the LED is grey.

Diagnostic data

The **Diagnostic Status** section of the UCM displays various LEDs that indicate the status of the PM and its components. If any of the following LEDs are illuminated, the corresponding error has occurred.

- **Enclosure** - indicates the tamper input is open or shorted with the tamper switch
- **ROM Error** - upon internal testing (which initiates when the PM boots up), a ROM error was discovered
- **RAM Error** - upon internal testing (which initiates when the PM boots up), a RAM error was discovered
- **EEPROM** - upon internal testing (which initiates when the PM boots up), an EEPROM error was discovered
- **RX Fault** - indicates a short or a break in an RX sensor cable
- **TX Fault** - indicates a short or a break in a TX sensor cable
- **12V Fault** - indicates the 12V input is below 10.5 VDC or above 13.5 VDC
- **Temp. Fault** - indicates the PMs internal temperature is below -46°C (-50.8°F) or above +84°C (183.2°F)

The following information also displays in the **Diagnostic Status** section:

- **12V Rail (V)** - the current input voltage
- **Temp (°C)** - the current internal temperature of the PM

Figure 7-1 shows the **Diagnostic Status** section of the UCM.

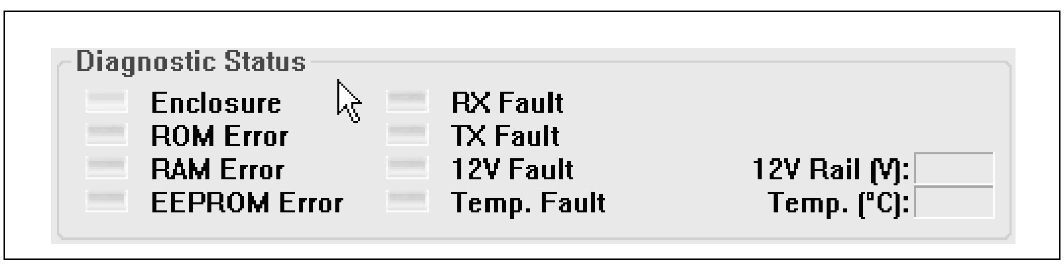


Figure 7-1: Diagnostic Status section

Cable status

The **Cable Status** section of the UCM displays the following information:

- **Walk Alarm** - a red LED in the A or B column indicates a walk alarm within that channel of the PM

- **Peak Walk Magn (dB)** - the highest peak value for channels A and B in dB from the walk filter relative to the threshold
- **Peak Clutter (dB)** - peak clutter value for channels A and B in dB
- **Test Pass** - green LEDs indicate that, after clicking the Test button, channels A and B of the PM passed the self test
- **Test Magn (dB)** - how many dB over the threshold the test response was for channels A and B

Figure 7-2 shows the **Cable Status** section of the UCM.

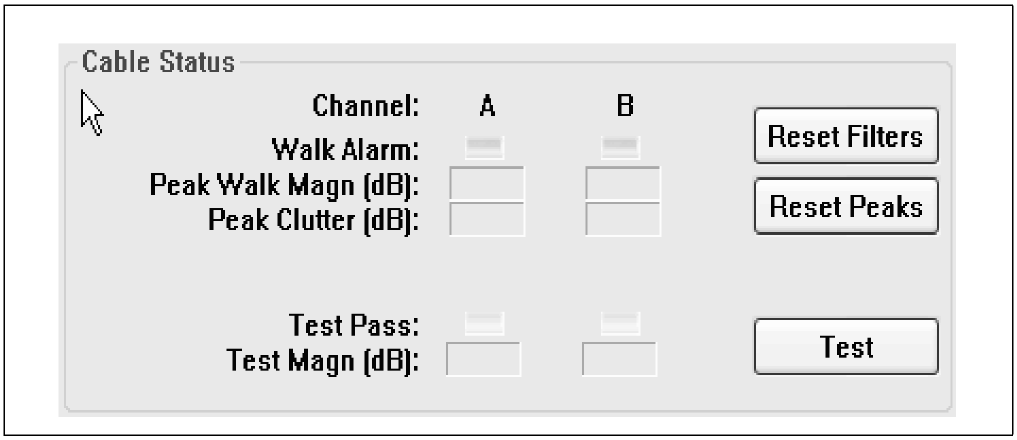


Figure 7-2: Cable Status section

Cable configuration

The **Cable Configuration** section of the UCM displays the following information:

- **Walk Threshold** - the threshold for the walk alarm for channels A and B. To trigger a walk alarm, the output of the walk filter must exceed this value.
- **Receiver Gain** - the gain of the sensor front end for channels A and B.
- **Slow Walk Cutoff (cm/sec)** - for channels A and B, the slowest speed, in centimeters per second, at which a walking target would be detected.

You can select the following options from the drop-down menu in the Cable Configuration section of the UCM:

- **Sensor** - displays the values in PM.
- **File** - displays the values stored in file.
- **Edit** - edits the PM or file values.

Figure 7-3 shows the **Cable Configuration** section of the UCM.

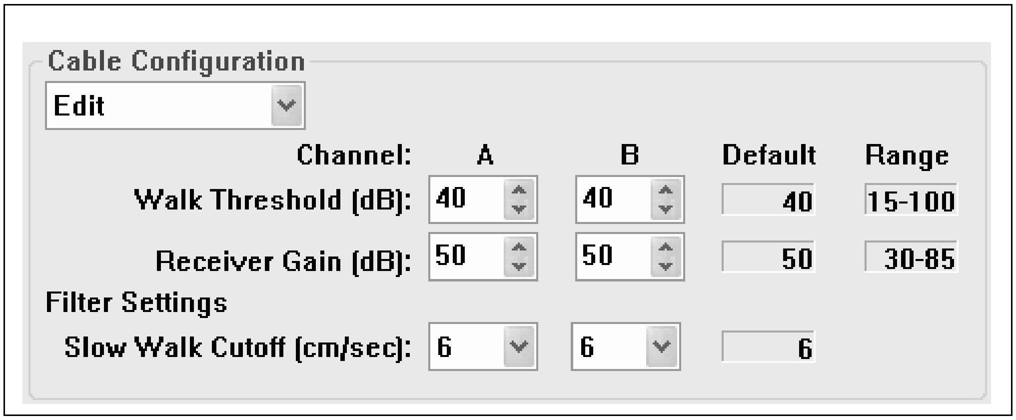


Figure 7-3: Cable Configuration section

Starting the UCM

This section details how to connect to and start the UCM. Refer to the following procedures:

- *Connecting the UCM*, page 7-4
- *Starting the UCM*, page 7-6

Connecting the UCM

With a serial link, you must connect the PC or laptop on which the UCM application is installed to the PM. You can then use an EIA-232 to EIA-485 converter to convert the EIA-232 signal from your PC or laptop to an EIA-485 signal and connect it to the PM.

Figure 7-4 illustrates how to properly connect the Panther II PM to the UCM on a PC or laptop.

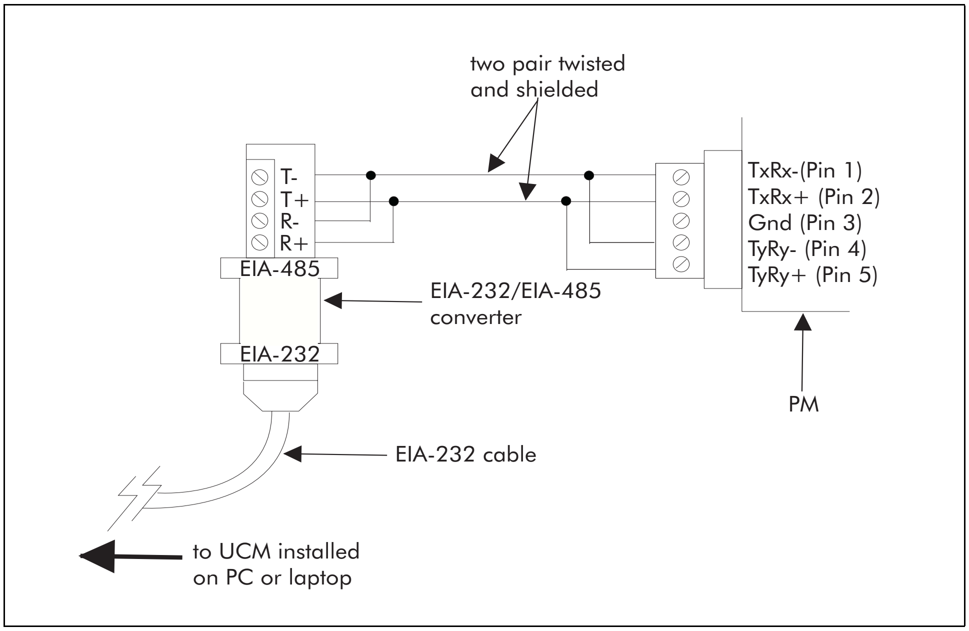


Figure 7-4: PM/UCM connection

You can also use an USB to an EIA-485 converter, for example the USOTL4 (00UT0500-001). The DIP-switch settings for the USOTL4 are shown below.

DIP-Switch

1	TD 485
2	ECHO ON
3	2 Wire
4	2 Wire

Figure 7-5 shows the wiring detail.

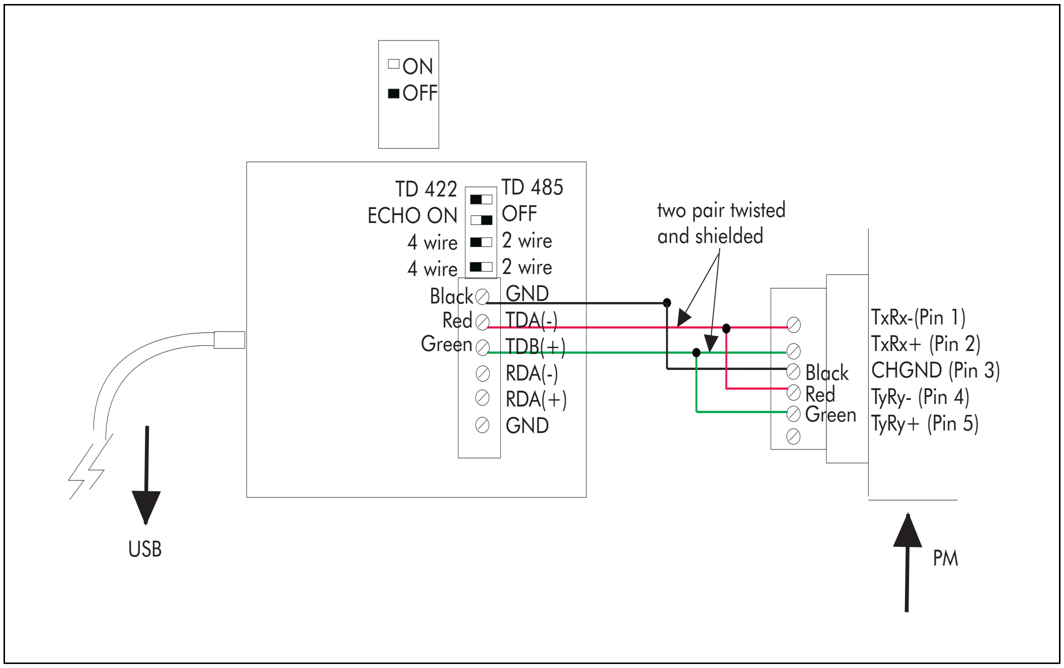


Figure 7-5: Connections for USB - EIA-422/485

Starting the UCM

Once you have connected your PC or laptop to the PM, you can start the UCM application. You can choose to connect to the PM to do such things as performing walk tests, calibrating the PM, etc. You can also choose to work offline. This may be useful when you do not require communication with the PM (i.e., reviewing a recorded plot).

To start a connection to the PM

1. Click **Start**, **Programs**, **Senstar**, **UCM**.
2. In the **Connect** dialog box, choose **Panther** from the **Connection Type** list box.
3. Click **Connect**.

   The X and Y poll LEDs on the PM should begin flashing to indicate that it is communicating with the UCM.

*You can also start the UCM by double-clicking the **UCM** icon on your desktop.*

To work offline

1. Click **Start**, **Programs**, **Senstar**, **UCM**.
2. In the **Connect** dialog box, choose **Panther** from the **Connection Type** list box.
3. Click **Work Offline**.

*You can also start the UCM by double-clicking the **UCM** icon on your desktop.*

Managing UCM files

When you first start the UCM, provided it is connected to the PM, a new file opens containing the values and parameters of the PM. This section details how to create new and open existing UCM files. Refer to the following procedures:

- *Creating and opening UCM files*, page 7-7
- *Saving UCM files*, page 7-8

Creating and opening UCM files

You can create a new UCM file that contains the current information (diagnostics, cable status, parameters) as uploaded from the PM.

To create a new configuration file

1. In the **Universal Configuration Module** window, click **File**, **New**.
2. Click **Yes**.
3. In the **Connect** dialog box, click **Connect**.

   A new UCM file opens.

A new configuration file automatically opens when you start the UCM

*You can also create a new configuration file by clicking the **New** button*  .

To open an existing configuration file

1. In the **Universal Configuration Module** window, click **File**, **Open**.
2. In the **Open** dialog box, choose the drive and folder where the UCM file is located.
3. Choose a file.
4. Click **Open**.

*You can also open an existing configuration file by clicking the **Open** button*  .

Saving UCM files

You can save the information/data uploaded from the PM as a **.ucm** file. You can also save an existing UCM file with a new name.

To save a configuration file

- In the **Universal Configuration Module** window, click **File**, **Save**.

*You can also save the file by clicking the **Save** button*  .

To save a configuration file with a new name

1. In the **Universal Configuration Module** window, click **File**, **Save As**.
2. In the **Save As** dialog box, choose the drive and folder where you want to save the file.
3. Type a filename in **File Name** box.
4. Click **Save**.

Downloading and uploading data

This section details how to write and retrieve values to and from the PM. Refer to the following procedures:

- *Downloading data to the PM*, page 7-8
- *Uploading data from the PM*, page 7-9

Downloading data to the PM

You can download changes that you have made to parameters and default values in the UCM to the PM.

To download data to the PM

1. In the **Universal Configuration Module**, click **File**, **Download**.

If you have edited the data in the UCM and downloaded the information to the PM, the edited data overwrites the existing default values. For information about default values, refer to Setting default values, page 7-9.

*You can also download data to the PM by clicking the **Download** button*  .

Uploading data from the PM

Although data automatically uploads from the PM when the UCM connects to it, you can force data to upload at any time.

To upload data from the PM

- In the **Universal Configuration Module** window, click **File**, **Upload**.

*You can also upload data from the PM by clicking the **Upload** button*  .

Resetting default values

If you have edited any of the configurable data in the UCM, you can choose to reset the factory default values. This section details how to reset the default values. Refer to the following procedures:

- *Setting default values*, page 7-9

Setting default values

You can set the original factory default values in the UCM.

To set default values

- In the **Universal Configuration Module** window, click **File**, **Set Defaults**.

To set the PM with the default values, you must download the data to the PM. To do so, refer to Downloading data to the PM, page 7-8.

*You can also set the default values by clicking the **Set Defaults** button*  .

Printing UCM data

This section details how to print the data and information that displays in the UCM. Refer to the following procedures:

- *Printing UCM display data*, page 7-10

Printing UCM display data

You can print the data that displays in the **Universal Configuration Module** window.

To print UCM data

1. In the **Universal Configuration Module** window, click **File**, **Print**.
2. In the **Print** dialog box, click **OK**.

*You can also print UCM data by clicking the **Print** button*  .

Managing cable status

This section details how to reset the filters and peaks of the cables, and how to initiate a PM self test. Refer to the following procedures:

- *Resetting filters*, page 7-10
- *Resetting peaks*, page 7-11
- *Initiating a PM self test*, page 7-11

Resetting filters

You can reset the walk filters of channels A and B.

To reset filters

- In the **Cable Status** section of the **Universal Configuration Module** window, click **Reset Filters**.

Resetting peaks

You can reset the peak values held in the UCM.

To reset peaks

- In the **Cable Status** section of the **Universal Configuration Module** window, click **Reset Peaks**.

Initiating a PM self test

You can initiate an internal self test of the PM.

To test the PM

- In the **Cable Status** section of the **Universal Configuration Module** window, click **Test**.

Configuring cables

This section details how to adjust the parameters of the walk threshold, receiver gain, slow walk cutoff, and how to enable or disable the adaptive filter and the transient filter settings. Refer to the following procedures:

- *Editing parameters*, page 7-11

Editing parameters

You can adjust the parameters of the PM to alter the performance. You can change the values for walk threshold, receiver gain, and slow walk cutoff for channels A and B.

To edit walk threshold, receiver gain, or slow walk cutoff values

1. In the **Cable Configuration** section of the **Universal Configuration Module** window, type a new value in any of the following boxes within the **A** and/or **B** column:
   - **Walk Threshold (dB)**
   - **Receiver Gain (dB)**
   - **Slow Walk Cutoff (cm/sec)**
2. Download the new data to the PM. To do so, refer to *To download data to the PM*, page 7-8.

You can also edit a value by clicking the up and down arrows beside each box.

Working with plots

When you want to view a plot of the A and B walk filters (for example, when you are observing a walk test), you can do so using the magnitude plot in the UCM. The UCM plot allows you to plot the output from the A and B walk filters. You can take plot samples at various intervals, ranging from 0.25 to 15 seconds. The solid horizontal line on the plot represents the threshold for channel A or B of the PM. Therefore, if the detected signal registers 20 dB above the threshold value, it will display on the plot at the 20 dB mark. The plot displays signals up to +90 dB above and -90 dB below the threshold.

This section details how to open and work with this plot. Refer to the following procedures:

- *Opening plots*, page 7-12
- *Working with UCM plots*, page 7-12

Opening plots

You can open a new plot to view detection signals. You can also open an archived plot.

To open a new plot

- In the **Universal Configuration Module** window, click **File**, **Magnitude Plot**.

*You can also open a new plot by clicking the **Magnitude Plot** button*  .

To open an existing plot

1. In the **Universal Configuration Module** window, click **File**, **Magnitude Plot**.
2. In the **Sensor Response Plot** dialog box, click **Open**.
3. In the **Open** dialog box, choose the drive and folder where the plot file is located.
4. Choose a file.
5. Click **Open**.

Working with UCM plots

You can choose to record a live plot, and you can print the portion of the plot that displays. As well, you can export a specified portion of plot data as a **.csv** file to edit in another program (for example, you can export the plot data to Microsoft Excel, so that you can manipulate the data as you choose). You can also determine the exact time at which any data in an archived plot was recorded, and you can scroll vertically and horizontally through the data in an archived plot. As well, you can change the displaying PM channels on the plot and change the magnification of the plot.

Figure 7-6 shows a UCM plot.

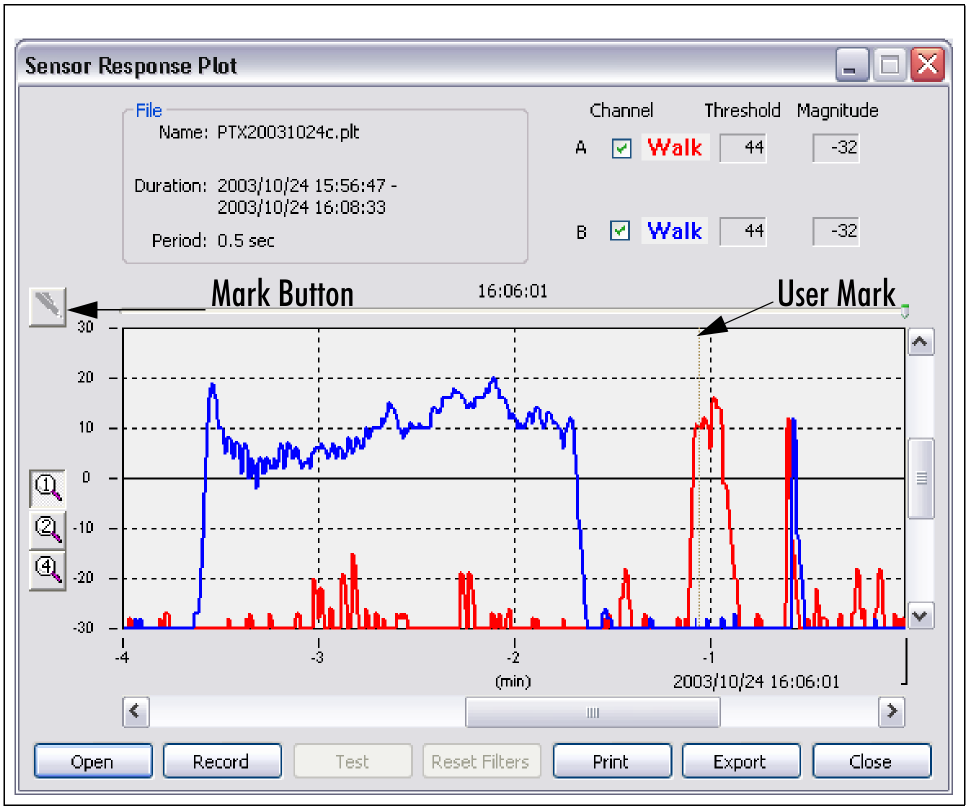
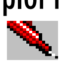


Figure 7-6: Sensor Response Plot dialog box with Mark button

To record a plot

1. In the **Sensor Response Plot** dialog box, click **Record**.
2. In the **Select Plot Parameters** dialog box, choose a sample period from the **Sample Period (sec)** list box.
3. Specify a recording duration by doing one of the following:
   - Type a number (from 1 to 72) in the **Duration (hrs)** box.
   - Use the up and down arrow buttons beside the **Duration (hrs)** box to enter a number.
4. In the file Save Dialog box, specify the file to which you want to save the plot data. Default filename is PTX yyymmdd.plt.

To place a user mark on the plot for later reference

1. Press the **Mark** button . on the **Sensor Response Plot** for later reference. See *Sensor Response Plot dialog box with Mark button*, Figure 7-6: page 7-13.

   For example, you might want to place a mark when the installer tells someone to start a cable crossing.

To print the displayed section of a plot

1. In the **Sensor Response Plot** dialog box, click **Print**.
2. In the **Print** dialog box, click **OK**.

To export plot data

1. In the **Sensor Response Plot** dialog box, click **Export**.
2. In the **Export Plot Data** dialog box, specify the export threshold by doing one of the following:
   - Type a number in the **Export Threshold** box.
   - Use the up and down arrow buttons beside the **Export Threshold** box to enter a number.
3. In the **Start Time** box, use the up and down arrows to specify the start time of the portion of the plot you want to export.
4. In the **End Time** box, use the up and down arrows to specify the end time of the portion of the plot you want to export.
5. Specify the export channel(s) by doing one of the following:
   - Choose **All** from the **Export Channels** list.
   - Choose one of the following from the **Export Channels** list:
     - **Side A Walk**
     - **Side B Walk**
6. Click **OK**.
7. In the **Save As** dialog box, specify a path and folder where you want to save the file.
8. Click **Save**.

The export threshold allows you to specify that only data exceeding the threshold you entered be exported.

*The default value (-100) in the **Export Threshold** box exports all data from the plot.*

To determine the specific recording time of plot data

- In the Sensor Response Plot dialog box, click and drag the slider above the plot to any spot on the recorded plot.

  The time at which that particular data was recorded displays above the slider.

To scroll vertically through a recorded plot

- In the **Sensor Response Plot** dialog box, click and drag the vertical scroll bar.

You can scroll vertically within a range of -90dB to +90dB.

To scroll horizontally through a recorded plot

In the **Sensor Response Plot** dialog box, click and drag the horizontal scroll bar.

To change the display channels on a plot

- In the **Channel** section of the **Sensor Response Plot** dialog box, enable or disable any of the following check boxes:
  - **A Walk**
  - **B Walk**

Each channel displays on the plot in a different color.

To adjust the horizontal magnification of a plot

- In the **Sensor Response Plot** dialog box, click one of the following buttons:
  -  - displays the plot in a normal view
  -  - displays the plot magnified twice
  -  - displays the plot magnified four times

To close a plot

- In the **Sensor Response Plot** dialog box, click **Close**.

8 Testing and adjusting the system

This chapter provides information about:

- System testing/adjustment overview
- Testing cables
- Testing the system
- Adjusting sensitivity

System testing/adjustment overview

Before your system is fully operational, you must check certain components to verify that they are in proper working order.

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

Do not use any high-voltage cable-leakage testers (meggers) on the sensor cables unless you have first disconnected all decouplers, terminators, and the PM.

Testing cables

Before applying power to the system, you must check the cables by performing the following tests:

- insulation resistance
- leakage resistance

This section details how to perform these tests. Refer to the following procedures:

- *Required equipment*, page 8-2
- *Testing insulation resistance*, page 8-2
- *Testing leakage resistance*, page 8-3

Required equipment

To properly test the cables, you require the following equipment:

- digital multimeter
- wire (to provide short-circuit connection)

Testing insulation resistance

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

To test insulation resistance

1. Disconnect all four connectors from the PMs.

   Let the connectors hang in mid-air during this test.

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

   The resistance for each of the four connectors should read 130 *k* Ω ± 5%. If the readings are different, there may be a problem with the cable, connector or decoupler. For information about repairing these components, refer to *Repairing sensor cables*, page 7-1.

Figure 8-1 illustrates how to perform an insulation resistance test.

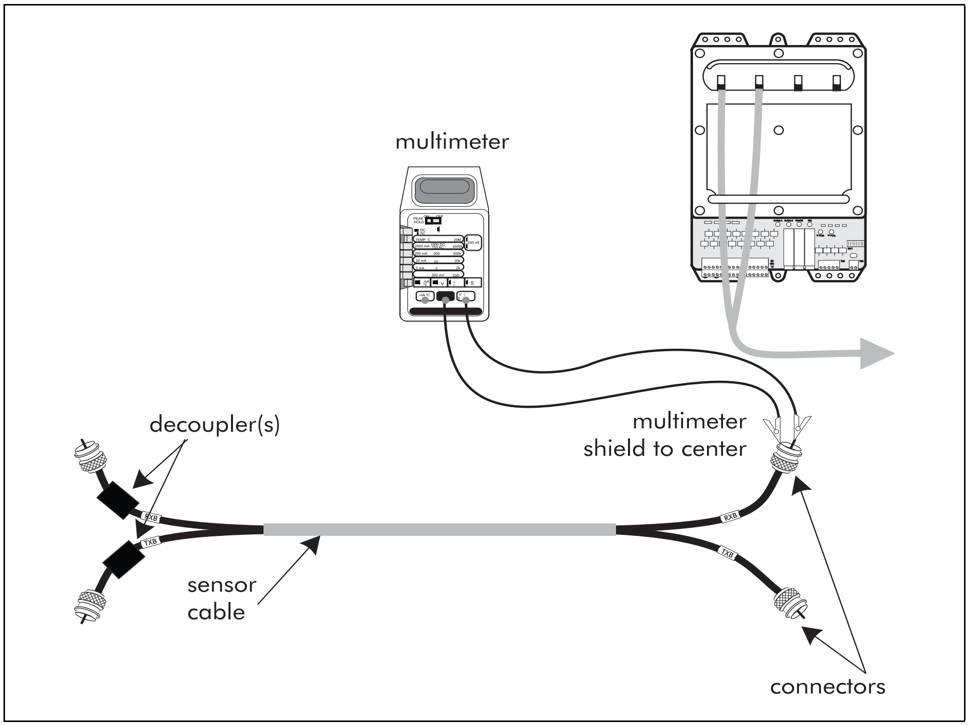


Figure 8-1: Insulation resistance test

Testing leakage resistance

When performing the leakage resistance 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.

To test leakage resistance

1. Disconnect all four connectors from the PMs.

   Let the connectors hang in mid-air during this test.

2. Set a digital multimeter to measure resistance, and attach it to the headshell of one of the four connectors and to the PM ground rod.

   The resistance for each cable should read $>20\ M\Omega$. If the reading is different, the sensor cable jacket could be damaged or the heatshrink may be improperly installed. For information about repairing these components, refer to *Repairing sensor cables*, page 7-1.

3. Set the digital multimeter to measure Volts DC. Measure the voltage between the center pin and the head shell of the connector.

The voltage should read <±10 mVDC. If the readings are different, the outer jacket of the sensor cable may be damaged. Refer to *Repairing sensor cables*, page 7-1, to repair the cable.

4. On the same connector, reverse the connections to the connector headshell and the ground rod, and take a resistance reading.

   The resistance should once again read >20 *M*Ω If the reading is different, it may indicate that there is residual DC voltage on the cable. Repair as required.

Figure 8-2 illustrates how to perform the leakage resistance test.

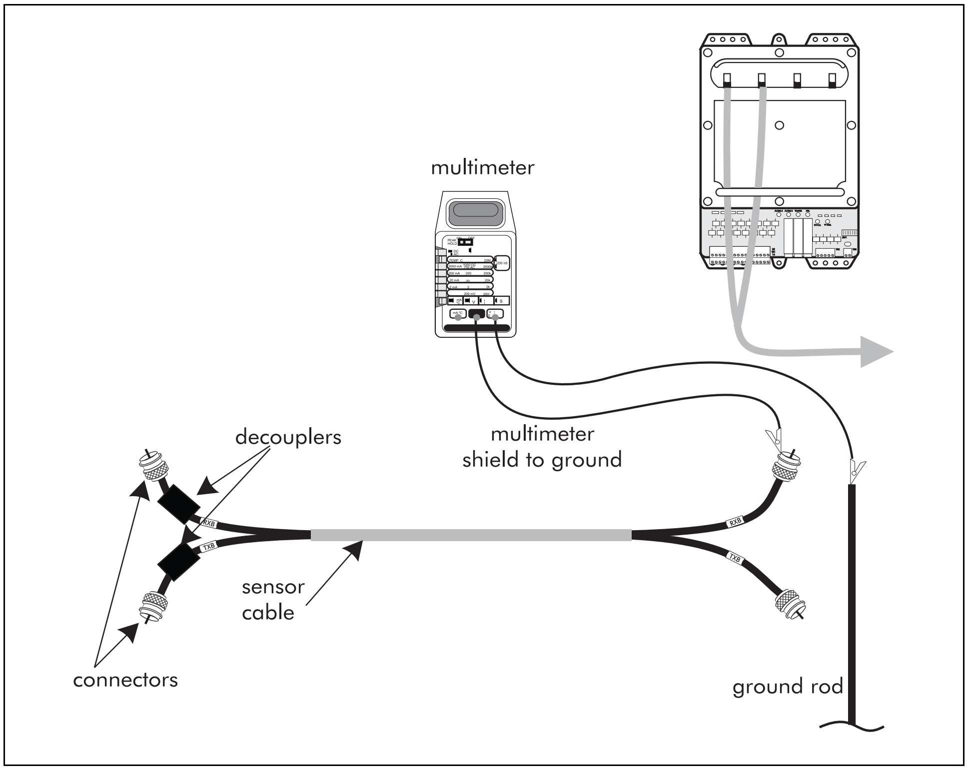


Figure 8-2: Leakage resistance test

Testing the system

Before you can operate the Panther II system successfully, you must ensure that the detection field within each zone is consistent throughout the zone. Inconsistencies show up in calibration plots as high, low, or saturated areas.

You must use the UCM to complete a walk test, in order to perform a preliminary calibration of the system. This test will determine whether the detection field is consistent within each zone. For information about the UCM, refer to *Working with the UCM*, page 7-1.

If inconsistencies appear along a zone, you can usually eliminate them either by 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. For more information about correcting inconsistencies, refer to *Adjusting sensitivity*, page 8-8.

When the walk test results are satisfactory, you can then complete the installation procedure. For information about completing the installation procedure, refer to *Completing the cable installation*, page 7-1.

This section details how to properly test your Panther II system. Refer to the following procedures:

- *Conducting the walk test*, page 8-5
- *Optimum threshold settings*, page 8-7

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

This test is part of a system pre-test. The detection levels you set at this stage are not necessarily the levels you will use for the final adjustments.

Generally, it is not recommended that you install a Panther II zone across multiple mediums; however, sometimes this is unavoidable. If you must do so, be sure to perform all precalibration tests to ensure that the detection level within the zone is consistent before you complete the cable installation.

Conducting the walk test

The walk test is a measurement that is used to assist in calibrating your Panther II system. It is recommended that two people, the walker and the observer, conduct the test. The walker walks along the cable path while the observer notes the changes to the detection levels on the UCM chart while the walk test is in progress.

Since the walker and the observer are generally not in the same vicinity while performing the walk test, it is recommended that they communicate by two-way radio (i.e., walkie-talkie).

The walker must perform the walk test around the zones being calibrated. The observer must observe the walk test being conducted on the magnitude plot, and record, identify, and calculate information about the walk.

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

*After conducting each walk test within a zone, click the **Reset Filters** button in the **Cable Status** section of the **Universal Configuration Module** window to prepare for a subsequent test.*

To perform the walk test

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

To observe the walk test

1. Start the UCM. To do so, refer to *Starting the UCM*, page 7-4.
2. Click **File**, **Magnitude Plot**.
3. In the **Sensor Response Plot** dialog box, click **Record**.
4. As the walk test is performed, observe the plot for the following items:
   - 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.
5. Ensure that you document the following information:
   - zone being calibrated
   - threshold and receiver gain settings used during the walk test
   - corner locations and any changes in the burial medium
   - date and time of the test
   - test participants
6. 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, it is probable that nuisance alarms or areas of no detection will occur. Adjust the sensitivity of the zone. To do so, refer to *Adjusting sensitivity*, page 8-8.
7. Calculate (in decibels) the average value of the three lowest points on the calibration plot for each zone.
8. Compare this average to the current threshold setting for the zone.
9. If the average is less than 5 dB above the threshold, lower the threshold for that zone. To do so:
   - In the **Cable Configuration** section of the **Universal Configuration Module** window, type a new value in the **Walk Threshold (dB)** box within the **A** or **B** column.

- Download the data to the PM. To do so, refer to *To download data to the PM*, page 7-8.

10. If the average is more than 5 dB above the threshold, raise the threshold for that zone. To do so:
    - In the **Cable Configuration** section of the **Universal Configuration Module** window, type a new value in the **Walk Threshold (dB)** box within the **A** or **B** column.
    - Download the data to the PM. To do so, refer to *To download data to the PM*, page 7-8.

For information about optimum threshold settings, refer to Optimum threshold settings, page 8-7.

*You can also enter new values in the **Walk Threshold (dB)** boxes by clicking the up and down arrow buttons beside each box.*

To check the containment of a zone

1. Walk along one side of the zone, staying approximately 3.5 m (11 ft., 6 in.) away from the nearest cable.
2. Verify that the calibration plot shows no detection.
3. Repeat the walk on the other side of the cable path.
4. If alarms are generated during this check, raise the threshold slightly. To do so:
    - In the **Cable Configuration** section of the **Universal Configuration Module** window, type a new value in the **Walk Threshold (dB)** box within the **A** or **B** column.
    - Download the data to the PM. To do so, refer to *To download data to the PM*, page 7-8.

    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. To perform the walk test, refer to *To perform the walk test*, page 8-6.

To verify the final threshold setting

- 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.

Ensure that crossings through the detection field report as sensor alarms on your alarm annunciation equipment.

Optimum threshold settings

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

The following table lists various threshold margins that are required to achieve a particular probability of detection.

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 - an operator has direct visual contact with the zone, through guards posted on the perimeter or CCTV coverage.

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

Adjusting sensitivity

Variations in the detection field sensitivity within a zone are referred to as low spots and high spots. Performing a walk test and observing it on the calibration plot of the UCM can very quickly locate such spots along the cable path. For information about conducting a walk test, refer to *Conducting the walk test*, page 8-5.

This section describes how to identify problem areas in the detection field sensitivity and how to correct them. Refer to the following procedures:

- *Low spots*, page 8-9
- *High spots*, page 8-11
- *Saturation*, page 8-13

Low spots

Occasionally, a small area of reduced sensitivity, or a low spot, occurs 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.

You can adjust low spots 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. Installing ferrite beads is most effective method when the second medium is a low-loss material such as asphalt or sandy soil.

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

Low spots can present problems because the Panther II system may not detect intruders in these areas. If you lower the threshold for the zone so the low spot is 5 dB above the threshold, the rest of the zone becomes too sensitive and the nuisance alarm rate may increase.

Examine the plot recordings from your walk tests. Points on the plot 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), you can remove the low spots from the zone.

To remove low spots from a zone

1. Calibrate the zone, ignoring low sensitivity areas.
2. Perform a walk test. To do so, refer to *Conducting the walk test*, page 8-5.
3. When you encounter an area of low sensitivity, drop a temporary marker on the ground.
4. While the calibration plot records, request that the walker cross through the detection field at the point where the low spot occurred in the walk test.
5. If an alarm generates (a detection signal greater than 0 dB), you do not need to adjust the zone. Request that the walker make several crossings near the low spot to ensure that the alarm always generates.
6. If no alarm generates, do one of the following:
    - Locate and remove, if possible, any buried pipes or metal objects (as they can reduce the sensitivity of the detection field if they are too close to the cables).
    - If the cables are installed in soil or gravel, gradually raise the cables closer to the ground’s surface, where the low spot occurs. You must raise the cables over the full length of the low spot, starting 2 m (6 ft., 6 in.) before the low spot.

Raising the cables can sometimes cause the low spot to move farther down the cables. After raising the cables, perform another walk test to ensure the low spot hasn't moved. If it has moved, raise the cables again, until you have eliminated all low spots.

Figure 8-3 illustrates low spots on a plot.

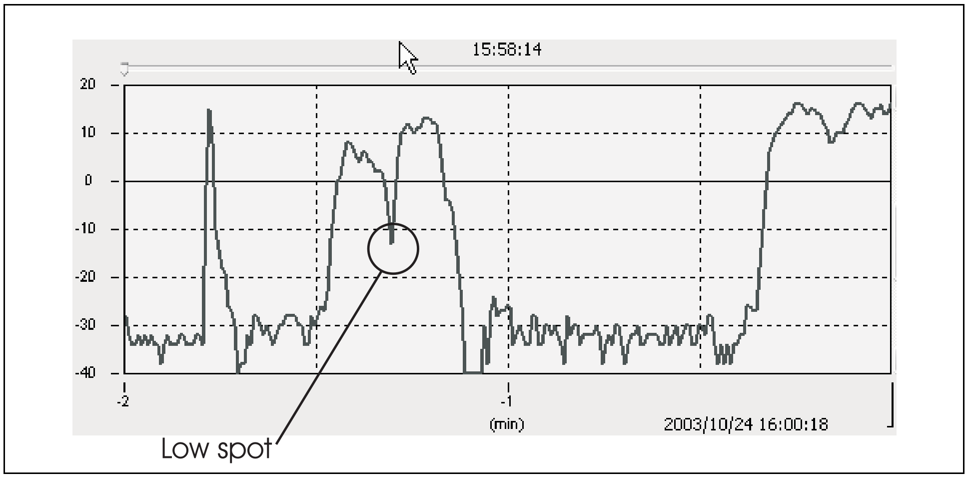


Figure 8-3: Low spots

To adjust low spots using cable loops

1. 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.

2. Secure the crossing point of the cable with tape.
3. Position each loop so that the center point of the loop is within 0.5 m (20 in.) of the boundary.
4. Bury each loop at the same depth as the sensor cable in a flat horizontal plane.
5. Retest the cable zone after adjusting the low spot.

To adjust low spots using ferrite beads

1. Slide ferrite 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.
2. Secure the beads along the cable using tape.
3. Retest the cable zone after adjusting the low spot.

Figure 8-4 illustrates how to adjust low spots using ferrite beads.

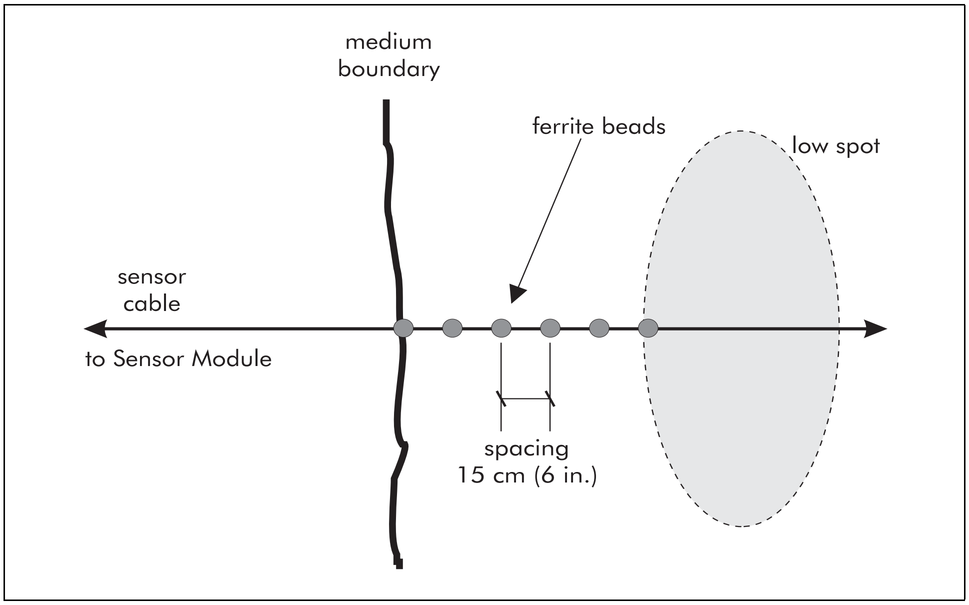


Figure 8-4: Low spot adjustment with ferrite beads

High spots

After proper calibration of your Panther II system, look for places on the plot recording where the detection signal exceeds 23 dB (18 + 5 dB) above the threshold. The increased sensitivity in these areas can cause an increased nuisance alarm rate.

Figure 8-5 illustrates high spots on a plot.

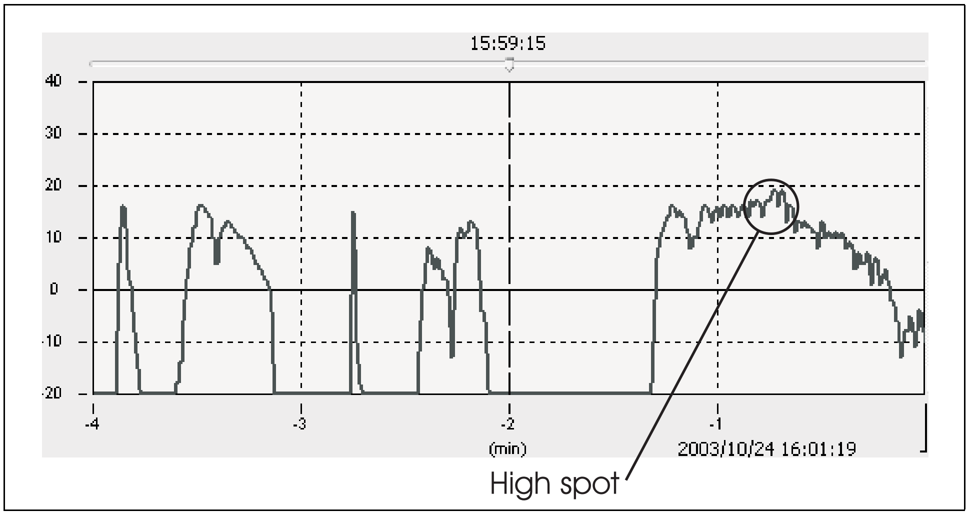


Figure 8-5: High spots

High spots don't always have adverse effects on system operation. The Panther II can detect human intruders more easily in these areas, but it might also detect other targets, such as small animals or nearby obstacles, 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 plot recording 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 plot recording and monitor traffic moving in the vicinity of the high spot. Determine whether any alarms are generated. If the resulting nuisance alarm rate is acceptable, you may choose to leave the high spot alone.

Nuisance alarms arising from environmental influences such as rainfall may result from a high spot. You can lower the sensitivity in this area to reduce the rate of nuisance alarms.

You can reduce the sensitivity of a detection field by burying the cable deeper (if the cable is buried in soil), installing ferrite beads (if the cable is installed in asphalt), or burying insulated copper wire above the cables (if the cable is buried in soil or gravel), which provides an element of shielding and reduces the detection signal where it is present.

To reduce sensitivity in soil

- Bury the cable a few inches deeper in the area of the high spot.

To reduce sensitivity in asphalt

1. Install ferrite beads 30.5 cm (12 in.) apart on the cable for the length of the high spot.
2. If you cannot access the cable end, cut the cable, install the ferrite beads, and splice the cables using a repair kit.

To reduce sensitivity in soil or gravel

- Bury a 10-gauge, insulated copper wire 1.3 cm (1/2 in.) above the cable for the length of the high spot.

  Ensure that the wire is at a uniform distance directly above the cable.

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 indicates that part or all of the zone is saturated, which means that the detection field is too sensitive and you cannot properly calibrate the system. Saturation may only occur in areas with light, sandy soil.

If saturation occurs over a short distance (less than 20 m [66 ft.]), you can choose to ignore it, or you can adjust the detection field by reducing the sensitivity in the zone. For information about reducing the sensitivity, refer to *High spots*, page 8-11.

If a large portion of the zone is saturated, you must reduce the sensitivity of the PM by adjusting the receiver gain using the UCM. For information about adjusting the receiver gain, refer to *Editing parameters*, page 7-11.

9 Completing the cable installation

This chapter provides information about

- Finishing the cable installation

Finishing the cable installation

This section describes how to complete a cable installation for both trenches and slots. It also details what to do with unused cable. Refer to the following procedures:

- *Completing trench and slot installations*, page 9-1
- *Handling unused cable*, page 9-4

Completing trench and slot installations

You must follow different procedures to complete the cable installation for a trench installation and for a slot installation. You must also follow special instructions when you reach decouplers in a slot installation.

Required materials (slot installations)

You must use joint sealant to seal the sensor cable in concrete or asphalt slots. Use a Senstar-approved sealant or pre-compressed expanding foam sealant tape. For information about recommended sealants, refer to *Recommended installation materials*, page b-1.

You must install any chemical sealants in dry conditions. You may require a pump for large installations. Estimate 20 liters (1.5 U.S. gallons) of sealant for every 100 m (100 ft.) of cable using the specified slot dimensions. Allow extra sealant in case of spillage.

You must insert tape sealants manually, and you must carefully control the depth of installation. Allow 5% extra sealant to compensate for splices and decouplers.

To complete the cable installation in a trench

1. Fold the geotextile fabric over the backfill.
2. Lay the cable marker tape on top of the fabric, over the length of the cables.
3. Install planking or half-round conduit in areas susceptible to damage. To do so, refer to *Protecting buried cables*, page 4-3.
4. Complete the backfilling with the remaining excavated soil or gravel.
5. Restore the surface treatment.

Figure 9-1 illustrates how to complete the cable installation for trenches.

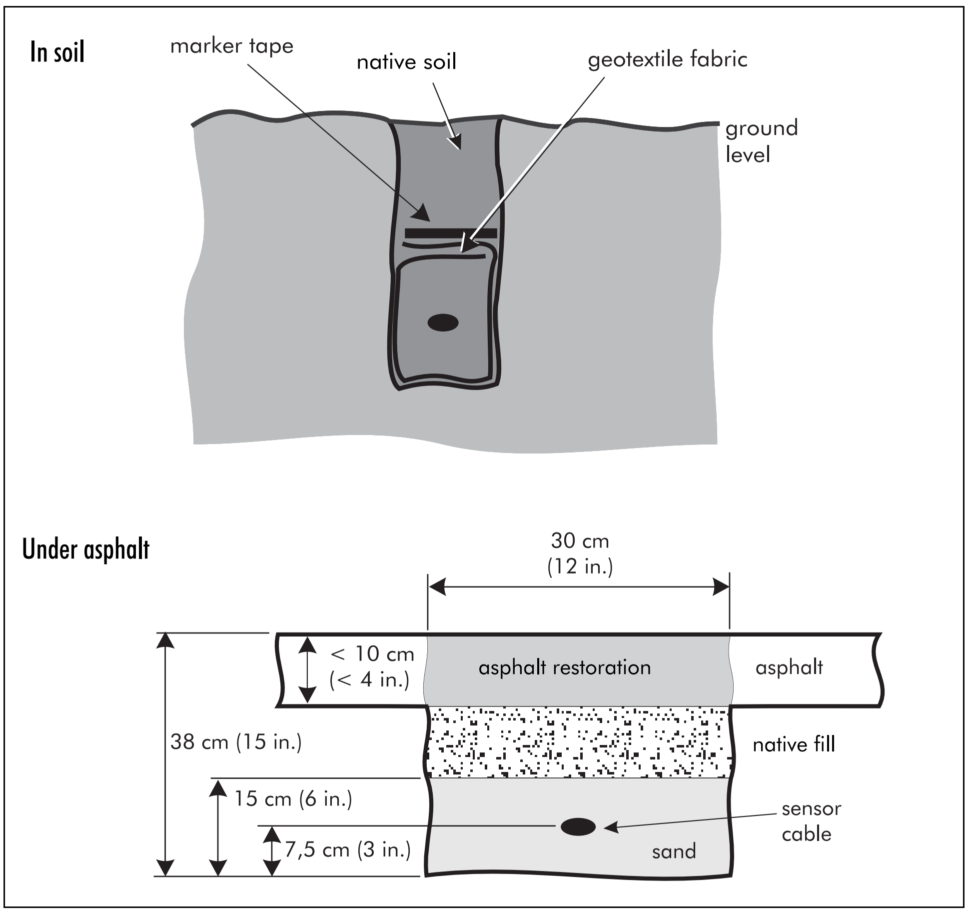


Figure 9-1 Completing cable installation for trench installations

To complete the cable installation in a slot

1. Apply sealant as per the manufacturers instructions. Fill the slot to 3 mm (1/8 in.) below the pavement surface.

   If you are 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.

2. Apply sealant to cracks and joints at least 30 cm (12 in.) along either side of the slot.
3. If you are using chemical sealants, remove any excess sealant from the pavement surface.
4. If desired, treat the concrete along the cable path with Senstar-approved waterproofing sealer. Follow the manufacturers' instructions.

If you are using chemical sealants, ensure that the backer rod is continuous to avoid any contact between sealants and the cable.

Do not use Hydrozo Clear 30 M® waterproofing compound, as it can penetrate the cable and possibly affect operation. For information about recommended sealers, refer to Recommended installation materials, page b-1.

Figure 9-2 illustrates how to properly seal the slot.

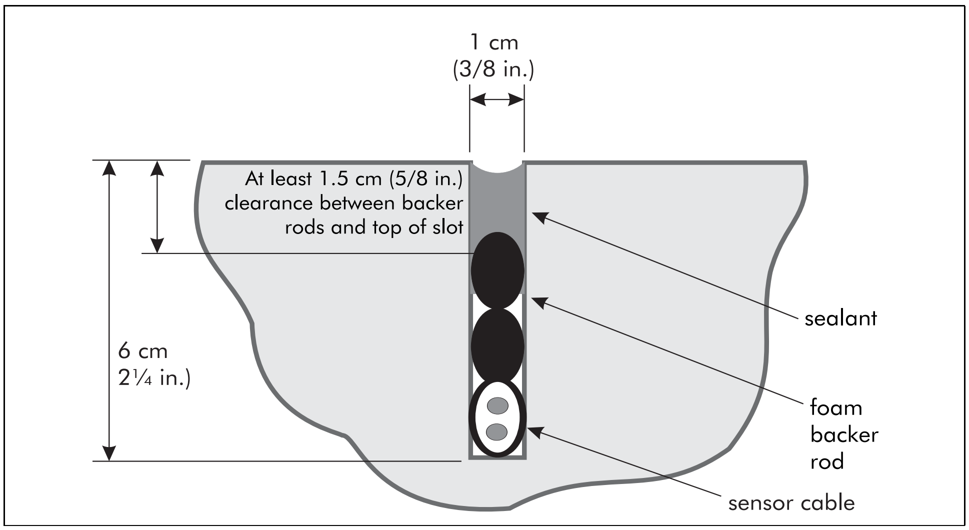


Figure 9-2 Sealing the slot

To cover decouplers in a slot

1. Cut a piece of ABS conduit 0.9 m (3 ft.) long and approximately 7.6 to 9 cm (3 to 3 ½ in.) in diameter in half lengthwise.
2. Cover the decoupler/cable assembly with one half of the conduit.
3. 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 you pour the sealant.

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

Figure 9-3 illustrates how to properly cover a decoupler in a slot installation.

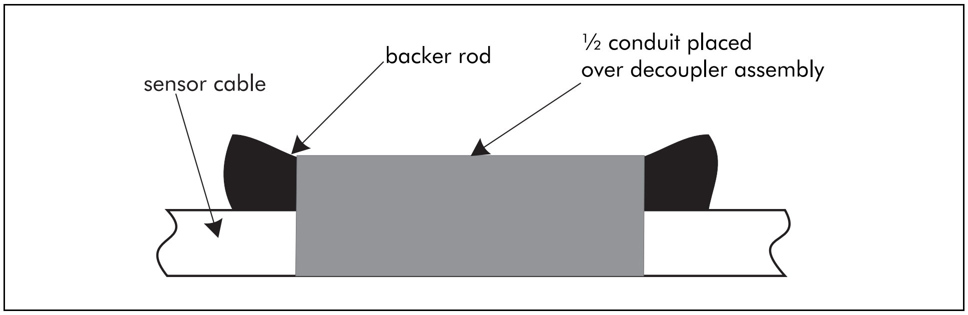


Figure 9-3 Decoupler coverage in a slot installation

Handling unused cable

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

10 Setting up the system

This chapter provides information about:

- System setup overview
- Verifying cable connections
- Powering up the system
- Calibrating the system

System setup overview

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.

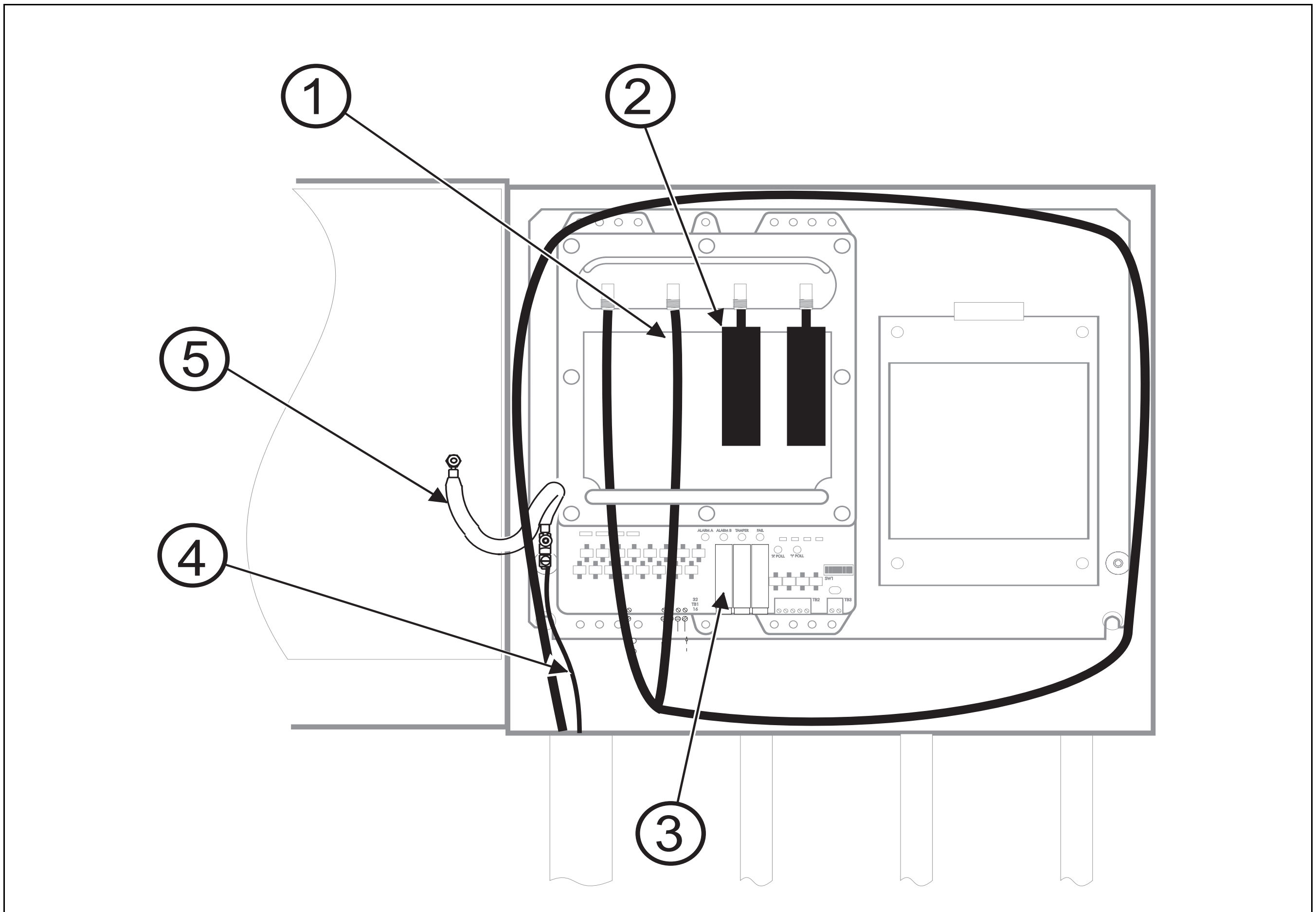
Verifying cable connections

This section details how to verify the cable connections of your Panther II system. Refer to the following procedure:

- *Panther II cable connections*, page 10-2

Panther II cable connections

Figure 10-1 illustrates the various cable connections of the Panther II system.



1	sensor cables to PM	4	ground wire to ground lug
2	mini load terminator to PM	5	ground lug to enclosure ground
3	fusing		

Figure 10-1 Panther II cable connections

For more information about connections, refer to Installing the PM in a NEMA 4 enclosure, page 6-2. For I/O connection information, refer to PM input/output connections, page 6-6.

Powering up the system

This section details how to power up your Panther II system. Refer to the following procedure:

• *Powering up your system*, page 10-3

Powering up your system

To render your Panther II system operational, you must power up the PM.

Required equipment

To power up the PM, you require a digital multimeter set.

To power up your PM

1. Disconnect the power supply from the PM.
2. Using a digital multimeter set to read voltage, find the positive lead from the power supply and connect it to TB1 at terminal 32.
3. Connect the negative lead from the power supply to TB1 at terminal 31.
4. Apply power to the PM.

   The following sequence of events should occur:

   - The FAIL LED lights.
   - The X and Y poll LEDs blink once.
   - After 55 seconds, the FAIL LED turns off (assuming there are no failures).

Figure 10-2 illustrates how the PM powers up.

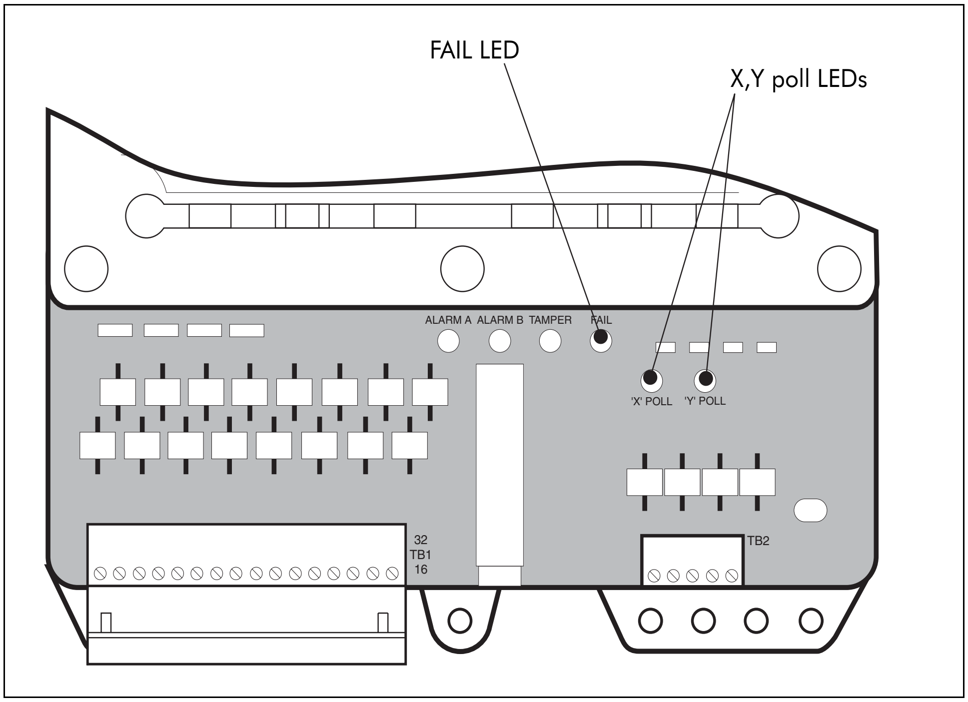


Figure 10-2 Power up PM

Calibrating the system

This section explains how to calibrate the Panther II system using the PM and the UCM. Refer to the following procedures:

- *Points to remember*, page 10-4
- *Calibrating your system*, page 10-5

Points to remember

When calibrating your system, remember the following:

- You must calibrate each zone individually.
- If a walk test does not generate alarms, you should lower the threshold.
- If the detection signal is too high, you should raise the threshold.

Calibrating your system

You must calibrate your system by connecting it to the UCM application.

To calibrate your system

1. Set up the PM by connecting the transmit and receive cables of the A-side zone to the TXA and RXA connectors and the transmit and receive cables of the B-side zone to the TXB and RXB connectors.
2. Ensure that the PM or its enclosure is grounded to earth ground.
3. If the PM monitors only one zone, ensure that unused zone terminators are connected to the unused transmit and receive connectors.
4. Connect the PM to the UCM application. To do so, refer to *To download data to the PM*, page 7-8.
5. Ensure that the PM is powered up. To power up the PM, refer to *To power up your PM*, page 10-3.

   Wait at least one minute after powering up the PM before you take any readings.
6. Ensure that no one is in the detection field of the zone that you are calibrating.
7. Set an initial temporary threshold level by doing the following:
   - In the **Cable Configuration** section of the **Universal Configuration Module** window, type **40** in the **Walk Threshold (dB)** box within the **A** column.
   - Type **40** in the box within the **B** column.
   - Download the data to the PM. To do so, refer to *To download data to the PM*, page 7-8.
8. Set up the plot by doing the following:
   - Click **File**, **Magnitude Plot**.
   - In the **PM plot** dialog box, click **Record**.
9. In the **Universal Configuration Module** window, click **Reset Peaks**, and wait for one minute.

   The plot of the detection signal should appear fairly constant with only minor fluctuations. These fluctuations are caused by background noise.
10. Conduct a walk test. To do so, refer to *Conducting the walk test*, page 8-5.
11. In the **Cable Configuration** section within the **Universal Configuration Module** window, readjust the threshold levels as necessary by clicking the up and down arrows next to the **Walk Threshold (dB)** boxes within the **A** and **B** columns.
12. Perform steps 10 and 11 until you have calibrated the system in accordance with your site requirements.
13. Download the values to the PM. To do so, refer to *To download data to the PM*, page 7-8.

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.

11 Repairing sensor cables

This chapter provides information about:

- Sensor cable repair overview
- Testing for faults
- Replacing decouplers
- Assessing cable damage
- Repairing cable damage

Sensor cable repair overview

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, and what level of damage is present.

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

A ground fault occurs when damage occurs to the outer protective jacket and a path of conduction forms from the metals in the cable to the ground. The faults can be intermittent, depending upon the soil's chemical properties and the level of moisture. You must repair all such cable damage, otherwise the system may not operate properly.

Ground faults can also occur when decouplers aren't properly sealed and water enters the decouplers, connectors, and potentially the cable.

Testing for faults

This section details how to properly test for faults in damaged cables. Refer to the following procedures:

Required equipment

When testing cables for faults, you require the following equipment:

- multimeter
- cable ground fault locator

Testing cables for faults

You must perform various tests to detect faults in the cables.

To test a cable for faults

1. Perform the leakage resistance test to determine the presence of a ground fault. To do so, refer to *To test leakage resistance*, page 8-3.
2. Perform the insulation resistance test to determine if cable damage is severe or if the decoupler is faulty. To do so, refer to *To test insulation resistance*, page 8-2.
3. If the decoupler is suspected of being the ground fault, expose the decoupler and isolate it from the ground.
4. Measure the resistance to determine if the ground fault disappears (it should if the fault exists there, as the decoupler is no longer in contact with the ground).
5. If water has entered the decoupler assembly, replace the decoupler. To do so, refer to *Replacing decouplers*, page 11-3.
6. Locate any faults that could exist on the cable itself using a cable ground fault locator to pinpoint the location of cable faults.
7. Inspect the cable and assess the damage.

You may not require a ground fault locator if you know where construction or landscaping work has been done close to the cable path. If this is the case, there is a possibility that damage resulted from site work.

Replacing decouplers

This section details how to replace faulty decouplers. Refer to the following procedure:

- *Replacing faulty decouplers*, page 11-3

Replacing faulty decouplers

If a decoupler is found faulty or water has entered the assembly, you can replace it.

To replace a decoupler

1. Remove the faulty decoupler.
2. Check the cables to see if water has also leaked in. Replace any cable sections where water has entered. To do so, refer to *Installing cable splices or zone bypasses*, page 5-15.
3. Install a new decoupler and new heatshrink tubing. To do so, refer to *Installing decouplers*, page 5-16.
4. Prior to securing the heatshrink tubing on the decoupler, perform the insulation resistance test. To do so, refer to *To test insulation resistance*, page 8-2.
5. Secure the heatshrink tubing on the decoupler. To do so, refer to *Installing decouplers*, page 5-16.

Replace decouplers in sets.

Assessing cable damage

What appears to be only superficial damage to a cable may actually 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.

The following table lists the damage levels and descriptions to refer to when assessing the damage to a cable.

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

Repairing cable damage

This section details how to repair damaged cables, based on the severity of the damage. Refer to the following procedures:

- *Required equipment*, page 11-4
- *Repairing superficial cable damage*, page 11-5
- *Repairing minor cable damage*, page 11-5
- *Repairing moderate cable damage*, page 11-6
- *Repairing severe cable damage*, page 11-6

Required equipment

When repairing damaged cables, you require the following tools and Panther II components (depending upon the level of damage):

Tools

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

Panther II components

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

Repairing superficial cable damage

If the damage to the cable is superficial (a small, single-point cut or scrape through the cable jacket with no internal damage), you can repair the affected section with rubber mastic tape.

To repair superficial cable damage

1. Using a cloth or paper towel, clean the cable thoroughly on either side of the damaged section.
2. Wrap overlapping layers of rubber mastic tape around the damaged section.
3. Wrap electrical tape over the rubber mastic tape for extra mechanical protection.
4. Mark the location of the cable damage on the site plan.

Do not use normal electrical tape instead of rubber mastic tape. Use electrical tape only as an additional layer over the rubber mastic tape for extra protection.

Repairing minor cable damage

If the damage to the cable is minor (a cut less than 1 cm (3/8 in.) in length with internal damage, i.e., damage to dielectric), you can install a cable splice, consisting of a male and female connector, at the damaged section.

To repair minor cable damage

1. Cut the cable at the centre of the damaged section.
2. Clean the cable thoroughly on each side of this section, using a cloth or paper towelling.
3. Examine the cut ends of the cable for any corrosion.
4. If there is corrosion, strip back the jacket until you reach uncorroded cable.
5. Install connectors on the cut cable ends. To do so, refer to *Installing the connectors*, page 5-10.
6. Test the connectors for proper installation. To do so, refer to *Testing cables*, page 8-1.
7. Install and secure heatshrink tubing. To do so, refer to Figure 5-18:, page 5-19, and Figure 5-19:, page 5-19.
8. Mark the location of the cable damage on the site plan.

Repairing moderate cable damage

If the damage to the cable is moderate (a damaged section more than 1 cm (3/8 in.) but less than 45 cm (18 in.) in length), you can remove the damaged cable and splice in a new section of cable. The cable repair kit includes all of the necessary parts to facilitate this repair.

To repair moderate cable damage

1. 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.

2. Examine the cut ends of the cable for any corrosion.
3. If there is corrosion, strip back the jacket until you reach uncorroded cable.
4. Install one connector on the cut end of the cable and on the replacement piece of sensor cable. To do so, refer to *Installing the connectors*, page 5-10.
5. Test the connectors for proper installation. To do so, refer to *Testing cables*, page 8-1.
6. Install and secure heatshrink tubing. To do so, refer to Figure 5-18:, page 5-19, and Figure 5-19:, page 5-19.
7. Mark the location of the cable damage on the site plan.

Repairing severe cable damage

If the damage to the cable is severe (a damaged section more than 45 cm (18 in.) in length), there are different methods of repair, depending upon whether the damage has been done to lead-in or detecting cable.

If the lead-in cable is damaged, you can splice in an equivalent length of replacement lead-in cable. To do so, refer to *Installing cable splices or zone bypasses*, page 5-15.

If up to 3 m (9 ft., 9 in.) of detecting cable has been damaged, you can splice in new detecting cable. You can use any section of detection cable when splicing in sections less than 3 m long, as it is not important to match the sensitivity exactly. It is recommended that you use an off-cut of a cable end from the original installation or acquire the required cable from the manufacturer.

If the damaged section of cable is longer than 3 m, it is recommended that you replace the entire cable. If this is not possible, you can splice in a new large section of cable.

To repair large sections of cable

1. Measure or estimate the length from the red mark on the cable to the start of the damaged section.
2. Obtain a new sensor cable that is the same original length as the damaged cable.
3. Unroll the new cable along the path of the damaged cable (making sure that the non-detecting sections on both cables are at the same end).
4. Align the red marks on the cables.

5. Cut out and discard the section of damaged cable.
6. Cut out the replacement section of new cable at the same location as the section removed from the damaged cable.
7. Splice the new cable section into the installed cable using male and female connectors. To do so, refer to *Installing cable splices or zone bypasses*, page 5-15.
8. Test the connectors for proper installation. To do so, refer to *Testing cables*, page 8-1.
9. Install and secure heatshrink. To do so, refer to Figure 5-18:, page 5-19, and Figure 5-19:, page 5-19.
10. Label the leftover ends of the new cable, specifying the cable length and which end is which.

    You can use these leftover ends in future repairs or in locations where you require a short cable section.
11. Mark the location of the replaced cable section on the site plan.

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.

a System component list

Requirements	Part Number	Description
Processor module	A1FG0300	Panther II
Field power modules and options	A3EM0201	Standalone DC power supply, 115/230 VAC, 50/60Hz input, 12 VDC @ 8A output (Includes hardware for mounting in Processor Module or power supply NEMA rated enclosures.)
Universal Configuration Module	00SW0100	Universal Configuration Module software application (Version 1.xx)
Enclosure options & accessories	A3MA0101	Lockable outdoor NEMA 4/IP 66 rated enclosure with integral tamper switch (Internal mounting plate includes hardware to mount PM and optional standalone or network power supply. Gray enamel finish, steel construction, 410 x 510 x 150 mm (16 x 20 x 6 in.).)
	M0704	Handle, padlock, NEMA enclosure
Cable sets (SC1)	A3FG0201	50 m (164 ft.) single cable set
	A3FG0202	100 m (328 ft.) single cable set
	A3FG0204	150 m (492 ft.) single cable set
	A3FG0211	200 m (656 ft.) single cable set
Spare Lead-in cable (SC1)	A3CA0601	25 m (82 ft.), single cable lead-in
	A3CA0602	50 m (164 ft.), single cable lead-in
	A3CA0603	100 m (328 ft.), single cable lead-in

Requirements	Part Number	Description
Spare ferrite beads	A3KT0300	SC1 single cable ferrite bead kit (50)
Cable installation tools	A0KT1500	Connector tool kit
Cable splice kits	A3KT0500	SC1 single cable splice kit
Cable connectors	A0SP0600	TNC female connector
	A0SP0700	TNC male connector
Heatshrink	W0214	Heatshrink tubing for SC1 sensor cable, 61 cm (24 in.) long
Decoupler kits	A3KT0601	SC1 single cable standalone decoupler kit
Terminator kits	A3CA0100	SC1 single cable long terminator kit
Lightning protection	E0310	External lightning arrestor (requires E0311 gas pellet)
	E0311	Gas pellet replacement for lightning arrestor
Tape	X0217	Amalgamating tape
	X0191	Mastic tape
	X0190	Vinyl tape
Manuals	A1DA0102	Panther II Product Guide

b Recommended installation materials

This appendix provides information about:

- Installation materials overview
- Sealant materials

Installation materials overview

This chapter provides a summary of sealants, sealers and other recommended materials for cable installations.

Sealant materials

You can pour sealants from a can, use a caulking or sausage gun, or, for large quantities, use pumping equipment. Consult the supplier to determine the appropriate format based on the job and size. Materials may be self-leveling (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 you may need to use periodic dams made of backer rod during curing. You can use an NS material, but they are more viscous and, therefore, harder to pour. They may also require tooling. Pre-formed sealants avoid many of these chemical issues.

This section details information about various sealant suppliers, application materials, backer rods, concrete sealers, metallic foil, geotextile fabric, and ground fault locators. Refer to the following procedures:

- *Sealant suppliers*, page b-2
- *Application equipment*, page b-5
- *Backer rods*, page b-5

- *Concrete sealers*, page b-6
- *Metallic foil*, page b-6
- *Geotextile fabric*, page b-7
- *Ground fault locators*, page b-7

Sealant suppliers

Listed below are some of the specific sealant characteristics and 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 150 (Illbruck, Minneapolis, MN, 800-274-2813)

This is a compressed, opened 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. You can use double layers 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. This, however, is slightly more costly in materials. The advantages of using this size are that it provides the optimal seal shape and it replaces one installation step.

Because the seal depth of pre-formed sealant is fixed, you must minimize slot depth variations when cutting. It is recommended that you follow a tolerance of no more than +/- 3 mm (1/8 in.), to ensure that the sealant is recessed over the entire length of the slot.

Since pre-formed sealant arrives pre-compressed to 20% of its maximum width, width variations are more tolerable.

DOW 888, 890, and 91224 Highway Joint Sealant (Dow Corning, Midland, NJ)

These are single component silicones: 888 (grey) is rated for concrete and 890 (black) is rated for asphalt and concrete. You can apply them using caulking guns or pumping equipment. For more information about application equipment, refer to *Application equipment*, page b-5. 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. DOW 91224 is a newer, lower-cost version.

MOBAY 960 (Mobay Corporation, Pittsburgh, PA, (412) 777-2000)

This is a single component silicone that shares similar properties and application methods with the DOW 888.

SEALEX (Meadows Sealtight Sealex Traffic Loop Sealant, W.R. Meadows, Elgin, IL, (708) 683-4500)

This is a low cost, two component (black) material that you can easily mix in the can and pour directly into the slots. It bonds to both asphalt and concrete but has a low bond strength. It is very fluid, so you must ensure that it does not leak under the backer rod or out of sloping slots. Curing time varies, from 1/2 an hour to three 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 two component polyurethane replacement for 12 SL. It claims to cure better than 12 SL; however, it is only available in 1.5 gallon buckets, and you must perform the mixing in the bucket with a mixer. Although this product is not recommended, it appeared to adhere well to old asphalt during testing. The SL version is preferred.

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.

Illbruck Inc. (Willseal-150)

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-150 (Illbruck)

Illbruck Inc.
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 regarding application equipment. They may rent equipment for application or suggest a local installer. For smaller jobs requiring only several feet, you may find using caulking guns or pails works best. For intermediate-sized jobs, for example, a roadway crossing, you may prefer to use a pneumatic caulking gun with quart cartridges. A supply source for caulking, sausage, and pneumatic guns is Albion Engineering. The part number for their pneumatic gun is *Albion Model 702-G01*. Their address is listed below.

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

The pneumatic gun requires an external air supply (i.e., a compressor).

For very large jobs, you may require sealant pumping equipment. A supply source for pumping equipment is Graco Inc. Their address is listed below.

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

Backer rods

Backer rods are closed cell, polyethylene rods that are used as slot fillers, separators from cables, and bond breakers for sealant. You can usually purchase it in long rolls, locally 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 include:

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 certain cases, you may want to apply a moisture sealer to the asphalt or concrete to extend its life. Hydrocarbon-based materials (i.e., containing petroleum distillate) may 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 recommended; however, you should not apply them in such quantities that they lie in the slot recess and allow direct cable exposure. Alcohol carrier materials dry quickly in windy conditions and water-based materials are affected by humidity while drying. The following two sources supply alcohol and/or water-based materials.

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

For information about sources that supply metallic foil, contact Senstar Corporation. Listed below is a recommended metallic foil, the part number, and the source that supplies it.

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

Part no. 0541456

Reef Industries
Houston, TX

U.S. (800) 231-6074, (800) 231-2417
Canada (800) 847-5616

You must use a foil that is designed for earth burial.

Geotextile fabric

Listed below are two sources that are recommended for geotextile fabric supply.

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

The information provided below lists the supplier(s) for two ground fault locators, *Dynatel Model 2273-U3P3 - Cable/Sheath Fault Locator* and *Radiodetection Model RD 400FFL*.

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

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

This appendix provides information about:

- Panther II specifications

Panther II specifications

Panther Module	
Specification	**Description**
Dimensions (LxWxD)	• 360 x 230 x 100 mm
Weight	• 4.5 kg (10 lbs.)
Quantity	• one per two zones
Probability of detection	• greater than 99% for walking intruder weighing more than 34 kg
Outputs	• 4 relay outputs 24 VDC maximum, 350 mA DC maximum • 2 analog calibration outputs for voltmeter or chart recorder
Zone length	• two zones per PM • minimum - 10 m (33 ft.) • maximum - 200 m (492 ft.)
Controls	• jumper selectable EIA-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 VCM or SM
Connectors	• 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
Operating temperature	• 0° to +70°C (32°F to +158°F) (as measured inside the enclosure)
Relative humidity	• 0 to 95%, non-condensing
Operating frequency	• (two frequencies per processor) - 40.675 MHz, 40.685 MHz
Power input options	• 12 VDC, 500 mA maximum
Enclosure options	• IP66/NEMA 4 rated weatherproof outdoor enclosure, lockable, with tamper switch Size = (410 X 510 X 150mm) (16 X 20 X 6 in.)

SC1 Cable	
Specification	**Description**
Required	• one roll of SC1 cable
Length	• 100 or 150 m (328,492 ft.) detection length, each cable with 50 m (164 ft.) integral non-sensitive lead-in cable
Size	• 8.5 X 15 mm (0.335 X 0.590 in.)
Reel diameter	• 508 mm (20 in.) dia. X 330 mm (13 in.) wide
Weight	• 38.6 kg (85 lbs.) max.
Operational temperature	• —40°C to +70°C (—40°F to 158°F)
Storage temperature	• —50°C to +85°C (—58°F to 185°F)

SC1 Cable	
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.)

d Troubleshooting

This appendix provides information about:

- Troubleshooting overview
- Nuisance alarms
- Gathering troubleshooting data
- Troubleshooting chart

Troubleshooting overview

This appendix illustrates how to diagnose faults in Panther II systems and determine probable causes.

Nuisance alarms

Nuisance alarms are alarms 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. This section lists possible nuisance alarm sources and suggests ways of preventing nuisance alarms. Refer to the following procedure:

- *Possible sources of nuisance alarms*, page d-2

Possible sources of nuisance alarms

There are various causes of nuisance alarms, including incorrect threshold setting, wildlife, pedestrians, or vehicles, rainfall, puddles, subsurface water, wind, metallic objects in the zone, intermittent electrical contacts, intermittent metallic contacts underground, external radio frequency interference, a faulty cable connector, a faulty decoupler, cable damage, a faulty PM, etc.

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. For information about calibrating your system, refer to *Calibrating the system*, page 10-4.

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, you may have to make changes to operating procedures or relocate the detection zone.

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.

You can often eliminate this alarm source 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

Underground water flowing through the detection field can cause false alarms. 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, raise the threshold level on the PM.

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). Then, do the following:

1. Connect the PM to the UCM. To do so, refer to *Connecting the UCM*, page 7-4.
2. Start the UCM. To do so, refer to *Starting the UCM*, page 7-6.
3. Open a magnitude plot. To do so, refer to *Opening plots*, page 7-12.
4. In the **Sensor Response Plot** dialog box, click **Record**.
5. Keep your body outside of the detection field, or if you are inside the detection field, remain stationary.
6. Use a piece of wire to create momentary shorts across various joints in the fence.
7. Observe the plot recording. Intermittent electrical connections will appear as sudden sharp increases (spikes) in the detection signal.
8. If spikes appear on the chart recording, weld wire conductors to electrically connect the metal parts that are causing 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. If you suspect a faulty connector, do the following:

1. Disconnect the connectors and examine them for corrosion, moisture or mechanical damage.
2. Check that the connector center pin is at the correct depth and straight for each connector.
3. Look inside the barrel of the female connectors to ensure that the center pin elements are not spread or damaged.
4. 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 reflect back along the cables. You can recognize this 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 in *Testing and adjusting the system*, page d-1, will help you identify cables that are shorted or open.

Faulty PM

False alarms can be caused by a faulty PM. Exchange the PM with a properly configured PM. If the noise remains in the zone, then it is a zone/environment problem. If the noise follows the PM, then the PM is faulty. Return the PM 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 you cannot identify the source of the nuisance alarms, collect the information as described in *Gathering troubleshooting data*, page d-5, and send it to Senstar or your authorized Panther II 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:
    - the 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
    - the location, model number, and address number of the PM
    - the location of all decouplers and cable splices
- Record the PM serial number.
- 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 plot recording of each zone to verify calibration. To do so, refer to *Conducting the walk test*, page 8-5.
- Perform a containment walk test around the zone to ensure the detection field is contained within the desired boundary. To do so, refer to *To check the containment of a zone*, page 8-7.

  If the detection field has increased in size or if the threshold level is too low, a PM may be detecting objects beyond what is thought to be the range of the detection field.

Test the sensor cables for leakage and integrity. To do so, refer to *Testing cables*, page 8-1.

Exchange the PM with a properly configured PM. If the noise remains in the zone, then it is a zone/environment related problem. If the noise follows the PM, then the PM is faulty. Return the PM 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
PM	An alarm is not generated when there is a valid intrusion	Insufficient power up time	• Power up PM for at least one minute before valid operation
		No power to the unit	• Check that power supply is operating and connected to PM
		Cables may not be correctly connected to PM	• Check that all cables are correctly connected to PM
		Thresholds may be too high to generate an alarm	• Calibrate zone
		Fuses may be blown	• Replace fuses
		PM may be defective	• Return unit to Senstar
	Alarms are generated for no apparent reason	Cables may not be correctly connected to PM	• Check that all cables are connected to PM
		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
		PM may be defective	• Return unit to Senstar
	Tamper alarms are being generated	PM enclosure may be open	• Close PM enclosure
		Tamper switch may not be correctly connected	• Check tamper switch wiring and position
	Fail alarms are being generated - alarms clear themselves NOTE: The LED labelled as FAIL on the PM will light when a fail alarm is generated.	There may be an interruption in the power supply to the PM	• Check that power supply is operating and connected to PM
		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 PM
			• 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
PM (Cont'd)	Fail alarms are being generated - alarms are not clearing NOTE: The LED labelled as FAIL on the PM will light when a fail alarm is generated.	No power to unit	• Check that power supply is operating and connected to PM
		PM fuses may be blown	• Replace fuses
		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 PM
			• 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 using UCM • Power down the system, wait a few seconds and power up the system
		PM may be defective	• Return unit to Senstar
	No tamper alarm is generated when the PM 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

Alarm threshold see *Threshold*

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

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

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 PM. 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 the twin coaxial cable used in a zone. The cable set consists of one twin coaxial cable, male crimp connectors, ferrite beads, and marking tape

Cable terminator a device attached to the decoupler on the last zone or zones of a perimeter, or on a PM 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

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. You can measure the clutter level at the PM. 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*

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 PM on the receive cables. It is measured in decibels (dB) and increases when an intruder causes an electromagnetic disturbance in the detection field

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 PM from vandalism and tampering

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

Fail alarm an alarm generated when the PM senses a fail condition. Fail alarms display in the UCM

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 PM. They prevent the detection field from following the lead-in cable back to the PM

Heavy soil a clay-like soil

Lead-in cable the portion of the sensor cable that connects the sensor cables to the PM. Lead-in cables are completely shielded to prevent radio-frequency signals from escaping, so they prevent the detection field from forming near the PM. 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 Panther II 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

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

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

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

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 PM used to clear the PM detection filter

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

Sensor cable the buried intrusion-sensing element of the Panther II system. Cable is available in sets of various lengths. Each cable set contains a single twin coaxial cable. One side of the cable transmits a radio-frequency signal and the other side of the cable receives it. Sensor cables are connected to the PM via lead-in cable. See also *Leaky cable; lead-in cable; Zone*

Processor Module a microprocessor-controlled device that serves as the sensor unit of the Panther II system. Each unit is connected to two sets of sensor cables and provides intrusion detection for two zones. The PM contains electronic circuitry, controls, and cable connectors.

Sensor test an activity in which PM test targets and auxiliary sensor test functions are activated remotely from the UCM

SC1 the brand name of the twin coaxial sensor cable manufactured by Senstar Corporation for the Panther II 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

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 PM on the receive cable, must exceed to cause an alarm condition. It is measured 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 PM. The radio-frequency signals form the detection field

Walk test a procedure in which the user tests the operation of the Panther II 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

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

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