# OmniTrax®

Ranging Buried Cable Intrusion Detection Sensor

# Product Guide

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December 3, 2019

SENSTAR®

Senstar Corporation

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## Equipment certifications and approvals:

Canada:

Industry Canada has authorized this equipment for operation in Canada as a license exempt device under the following conditions:
The OmniTrax system requires professional installation, which must ensure that the General Field Strength Limits listed in Tables 2 and 3 of RSS-210 are not exceeded.
This device may not cause radio interference, and this device must accept any interference received.

USA:

FCC identifier: I5T-A4EM0101
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.
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 to the software or equipment that are not expressly approved by Senstar Corporation void the manufacturer’s warranty, and could void the user’s authority to operate the equipment.
The OmniTrax system requires professional installation.

Europe:

This device conforms to EN 61000-6-4: 2001 relating to Electromagnetic compatibility for emission standards for industrial environments.
This device conforms to EN 50130-4: 1995 + amendments A1: 1998 & A2: 2003 relating to Electromagnetic compatibility for immunity requirements for components of fire, intruder, and social alarm systems.
The use of shielded cables is required for compliance.

CE

Senstar Corporation’s Quality Management System is ISO 9001:2008 registered.

Senstar Corporation’s intellectual property is protected by the following patents:

Canada - 2204485

USA - 7576648

Europe - U.K. 2318689

Patents issued and pending in other Countries.

# OmniTrax terminology

- **cable set** - Two sensor cables (TX and RX) connected to one side of a processor. For SC1 sensor cable, the cable set is encased in a single outer jacket.
- **cable pair** - Two sensor cable sets connected through decouplers (TXA to TXB and RXA to RXB). A cable pair can be comprised of either the two sides of a single processor, or the A-side of one processor and the B-side of another processor.
- **lead-in cable** - Each sensor cable is comprised of a specified length of detecting sensor cable, plus an extra 4 m of detecting cable in which the detection field builds to full strength, plus 20 m of integral lead-in cable. The lead-in cable is fully shielded and does not allow the detection signal to "leak" out of the cable and form the detection field. The lead-in cable is connected to the processor and runs to the detection start point, without forming a detection field. The junction between the lead-in cable and the detecting cable is marked with red bands.
- **meter** - The meter is the basic unit of measure for OmniTrax cable. On a 400 m cable set, the processor analyzes 424 m of cable, which includes the lead-in cable. The meter is used to define cable segments and alarm zones. The sensitivity profile records the cable sensitivity for each meter of detecting sensor cable.
- **range bin** - Range bin is a term common to radar technology, and is used for precise target location. With OmniTrax, there are up to 40 range bins per sensor cable (including lead-in). The processor analyzes the received signals from the sensor cables and locates targets to within one meter by processing the range bin response for signal strength and timing.
- **cable segment** - A cable segment is made up of a contiguous group of meters, and is used for display and control purposes. Cable segments are software-defined during setup. The cable segment is the finest granularity unit that is defined by the end-user. Each cable set can be divided into up to 50 cable segments. Cable segments are used to create alarm zones, and therefore, must begin and end where alarm zone boundaries are required. A cable segment can be a part of one zone, and a cable segment can have one relay associated with it (up to 10 relays are available for reporting sensor alarms when using the optional relay output card). In addition to the cable margin (alarm threshold) that is set for the full length of detecting cable, a second cable margin can be set for each cable segment. Cable segments can also be defined as inactive, whereby detecting cable will not report valid targets (by assigning a cable segment to zone 0).
- **alarm zone** - An alarm zone is made up of one or more cable segments, and is used for the control and annunciation of sensor alarms (access/secure, graphic map display with precise target location). There can be up to 50 alarm zones per Silver Network based processor (over two cable sets). Alarm zones are defined in software to match the site-specific zone layout details (e.g., CCTV, fence sections, gates, buildings, etc.). Any grouping of segments can be assigned to an alarm zone. The cable segments do not have to be contiguous, and can come from both cable sets on one processor (not two processors). There can be a zone within another zone, and a zone can bridge inactive cable segments. Zone 0 does not report targets, and is used to identify lead-in cable, cable bypasses, and to set detecting cable to inactive. Zone 0 does not count in the 50 zone total.
- **location accuracy -** OmniTrax location accuracy for a single valid target is to within one meter. However, phase ambiguities can result in a location deviation of up to 4 m for a valid target.
- **target resolution** - OmniTrax target resolution is in reference to two valid targets simultaneously crossing the cables. In this case, two targets that are crossing within 24 m of each other inside a period of three seconds or less, can merge and be reported as one target. The single reported target can be located anywhere within the 24 m span of cable.

# Using this guide

This guide provides the information necessary to design, install, setup and calibrate an OmniTrax system. Chapter 1 is an introduction to OmniTrax perimeter security; chapter 2 provides site planning information; chapter 3 covers enclosure installation details; chapter 4 describes sensor cable installation, cable fittings, cable splices, cable repair, and cable tests; chapter 5 details system powering and data communications, and the processor wiring connections; chapter 6 describes system setup and calibration; and chapter 7 covers the Silver Network. The appendices provide system component ordering information, recommended installation materials, component specifications, and details about using the UltraLink I/O system in Network Manager mode for reporting OmniTrax alarm conditions.

## Figures

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

## Abbreviations

The following abbreviations are used throughout this guide:

- I/O - input/output
- I/P - input
- NAR - nuisance alarm rate
- NC - normally closed
- NIC - Network Interface Card
- NIU - Network Interface Unit
- NM - Network Manager
- NO - normally open
- OC2 - OmniTrax® dual sensor cables (300 m / 400 m lengths)
- O/P - output
- Pd - probability of detection
- RF - radio-frequency
- ROC - Relay Output Card
- RX - receive
- SC1 - single cable OmniTrax cable set (max. 200 m length cable sets)
- SC2 - dual cable OmniTrax cable set (max. 200 m length cable sets)
- TX - transmit
- UCM - Universal Configuration Module
- UIC - Universal Input Card

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

# Table of contents

# 1 System description

## OmniTrax sensor system details

OmniTrax is a covert perimeter intrusion detection sensor system, that locates intruders with pinpoint accuracy using ported coaxial cable technology. A set of sensor cables are buried around the perimeter of a site. The transmit (TX) cable distributes radio-frequency (RF) signals along the cable path and the Receive (RX) cable picks up the signals and carries them back to the processor. An electromagnetic detection field forms around the cables, and the processor triggers an alarm when an intruder disturbs the field.

The OmniTrax sensor can operate as a standalone sensor, which receives 12 VDC local power and communicates alarm conditions via relay outputs. Optionally, OmniTrax processors can be part of a Silver Network in which 48 VDC power and alarm data are carried from processor to processor over the sensor cables. The alarm data can also be carried over EIA-422 copper wire, or fiber optic cable. The alarm data is sent to a Network Interface Unit, which translates the data and passes it to a Windows-based Network Manager. The Network Manager interprets the data and passes it to a security management system (SMS) for presentation to an operator. Silver Network based OmniTrax processors can collect and report alarm data from other security devices, such as microwave sensors or fence detection systems via two Aux (auxiliary) inputs. Network based processors can also use the output relays to activate and control auxiliary security equipment in response to commands from the host SMS.

A PC-based security management system, such as Senstar's Alarm Integration Module, StarNeT 1000, or StarNet 2 can serve as the primary operator interface for an OmniTrax system. The security management system monitors the OmniTrax sensor, and can report alarms to an operator on a graphical site-map.

Senstar's Windows-based Universal Configuration Module (UCM) is the calibration and diagnostic support tool for OmniTrax. The UCM connects directly to the processor via USB or remotely through the Silver Network Manager. The UCM enables sensor calibration, detection parameter adjustments and system configuration settings. The UCM also provides real time diagnostics and sensor plot modes.

- volumetric, terrain following, covert, outdoor perimeter intrusion detection system
- lockable NEMA 4 rated aluminum enclosure with integral tamper switch
- telecom style pedestal enclosure with integral tamper switch
- typical above ground detection field - 1 m high X 3 m wide (3.3 ft. X 10 ft.)
  detection field also extends below ground

- a processor monitors one, or two, cable sets each up to 400 m (1312 ft.) long (max. 800 m)
  - OC2 sensor cable includes 300 m (984 ft.) or 400 m of detecting cable, plus 20 m (65 ft.) of lead-in (non-detecting) cable
  - processor supports SC2 sensor cables for installations where shorter lengths of cable (max. 200 m, 656 ft.) are required
  - OmniTrax supports retrofit applications for Perimitrax installations, however, a preliminary site visit is strongly recommended due to the age of the sensor cables
- lightning protection on sensor cables and all I/O, additional lightning protection available and recommended for sensor cables and copper data lines
- alarm communication options
  - relay output (standalone/Silver Network)
  - via the sensor cables (Silver Network)
  - EIA-422 (Silver Network)
  - fiber optic - single mode and multi-mode (Silver Network)
  - combinations of the different alarm communication options can be used

# Sensor cable layout details

- minimum 16 m (52 ft.) sensor cable length for standalone processors (including 6 m, 20 ft. of lead-in cable)
- minimum 75 m (246 ft.) sensor cable length, per processor, for cables that are connected through decouplers (including 6 m, 20 ft. of lead-in cable per processor) 150 m (492 ft.) sensor cable separation between connected processors
- up to 50 unique software defined segments per cable set, 100 per processor, segments are used for display and control purposes
- up to 50 distinct software defined alarm zones per processor, each zone includes one or more cable segments
- a zone can include multiple segments; zones can go around corners; skip over inactive segments; include zones within zones; include segments from both the A-side and B-side cable sets
- segments of detecting cable can be defined as inactive in software (will not report alarms)
- splice kits available for cable repair and bypasses
- standard burial depth in soil - 23 cm (9 in.)
- cable spacing ranges from 10 cm to 2.0 m (4 in. to 6.5 ft.)
- power and data communications carried over sensor cables (Silver Network)

# System calibration

- UCM software simplifies calibration, and provides powerful maintenance and diagnostic tools
- UCM computer can connect directly to processor through the USB port, or remotely through the Silver Network Manager
- a calibration walk down the centerline of the cable set creates a sensitivity profile for the entire sensor cable (the sensitivity profile is stored in the processor)
  the sensitivity profile tracks and records any variations in detection sensitivity resulting from cable burial depth, cable spacing and soil conductivity
- the calibration walk determines the recommended transmitter power level for the selected cable side
- the sensitivity profile enables a uniform cable margin (alarm threshold) for each meter of cable

- an additional cable margin can be defined for each cable segment to increase or decrease the detection sensitivity within the segment
- processor synchronization is used to prevent mutual interference between nearby processors

**OmniTrax calibration parameters:**

- sensitivity profile - the recorded signal response magnitude for each meter of cable based on the calibration walk
- cable margin - the nominal number of dB that the alarm threshold is below the recorded sensitivity profile for a sensor cable
- segment margin - an additional cable margin can be set for each defined cable segment
- detection threshold - the cable sensitivity profile minus the cable margin and segment margin
- target speed settings (low speed) - the time constant associated with low speed targets is set on a per cable basis
- target speed settings (high speed) - the time constant associated with high speed targets is set on a per cable basis

**Universal Configuration Module (UCM) features**

The UCM is a Windows based software application, which serves as the configuration, maintenance and support tool for the OmniTrax processor. The UCM connects directly to the processor via USB cable, or remotely through the Silver Network Manager. When connected, the UCM recognizes the OmniTrax processor and displays OmniTrax specific configuration screens. System integrators use the UCM to calibrate and setup the OmniTrax system. The UCM defines cable segments, alarm zones, cable margins, input/output configuration and control parameters.

# Security management systems

Standalone OmniTrax sensors can be incorporated into any system, which accepts contact closure alarm data. However, contact closure alarm notification does not provide precise target location. Silver Network based OmniTrax systems are compatible with Senstar's Security Management Systems including StarNeT 1000, StarNet 2 and the Alarm Integration Module. Network based processors can communicate with third party security management systems through the Network Manager Interface (NMI). The OmniTrax security perimeter can be displayed on a graphic site map as a series of alarm zones (e.g., when a sensor alarm occurs, the zone line flashes, an alarm star flashes to identify the alarm's exact location, and an audible alarm sounds). An operator acknowledges the alarm, assesses the cause of the alarm, then either alerts security and resets the alarm (intruder), or accesses the zone (authorized personnel).

# Benefit summary

Advantages of the OmniTrax sensor system include:

- calibrated sensitivity profile, automated transmitter power level and individual cable margin for each meter of sensor cable provide uniform detection sensitivity for the full cable length, enhanced sensor performance with an increased Pd and decreased NAR/FAR
- software defined cable segments and alarm zones enable the redistribution of alarm zones, zone lengths, and cable margin settings to accommodate changes in security equipment and requirements
- precise display of an alarm's location to within 1 m (3.3 ft.)
- 1.0 second or less alarm response time per network loop (from target crossing cables to Network Manager receiving notification)
- user-configurable alarm zone display (typically, as colored lines on a scale site map; alarm zones can also remain invisible until an alarm occurs)

- alarm zone length is not dependent on cable length
- a maximum of 50 distinct alarm zones spread over up to 800 m of detecting cable per processor dramatically reduces the overall sensor cost by eliminating the need for one processor per two zones (1 processor = up to 50 zones over 800 m)
- the UCM facilitates locating nuisance alarm sources and cable faults
- digital recording of alarm history
- power and data can be passed over the sensor cables
- OC2 sensor cable can be installed by a cable plow
- backwards compatible with Perimitrax sensor cables for retrofit applications

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| **Note** | Senstar does not recommend using Sentrax sensor cables with OmniTrax processors due to the age of the Sentrax cables. |

# OmniTrax components

## Processor

The OmniTrax processor supports two separate sensor cable sets, and can monitor 50 distinct alarm zones over up to 800 m of detecting cables. The alarm zones are defined in software, and are not dependent on cable length, or cable side. The processor operates on 12 to 48 VDC power and can annunicate alarm conditions with contact closure outputs or via the Silver Network.

Figure 1: OmniTrax processor

The processor is mounted on an aluminum backplate and is shipped inside a lockable, weatherproof enclosure. Non-detecting lead-in cables connect to the external bulkhead connectors on the bottom of the OmniTrax enclosure. Mini-coax cables inside the enclosure connect the bulkhead connectors to the processor circuit card. Four cable glands on the enclosure's bottom provide access for the power cable, ground wire, alarm communication wiring and the self-test or auxiliary device wiring.

The OmniTrax processor includes four output relays and two self-test/auxiliary inputs. A relay output card (ROC) is available to provide eight additional outputs. For Silver Network based processors, a universal input card (UIC) is available to increase the processor's input capacity by eight. A processor can use either an ROC or a UIC, but not both.

Each network based processor requires a Network Interface Card (NIC) which serves as the communications interface to the Silver Network. There are five variants of the NIC, with each being specific to the network media. EIA-422 copper wire connections are made on removable terminal blocks, and ST connectors are used for single-mode and multi-mode fiber optic cable.

There are two selectable control modes for the OmniTrax processor's relay outputs and AUX (auxiliary) inputs. The control mode is set in software via the UCM. The default setting is local control mode, in which the OmniTrax processor controls the relays to signal alarm and supervision conditions, and the AUX inputs are self-test inputs. Using the optional ROC, you can configure up to ten distinct alarm zones per processor for relay output alarm communications. For Silver Network based processors, remote control mode enables the host SMS to operate the processor's relays, as output control points, and the AUX inputs function as auxiliary device inputs.

## Enclosure

The weatherproof OmniTrax enclosure (IP66/NEMA 4) is painted aluminum and includes two latches on the top for locking the door (locks not included) and hinges on the bottom to allow the door to hang freely for easy access. There are two sets of mounting studs on the enclosure door, one for the optional 6 VDC local backup battery and the other for the optional 12 VDC auxiliary device power supply. The enclosure includes a vent to prevent gas build-up from battery charging. An enclosure tamper switch is included with a harness that connects directly to the processor. For outdoor installation, the OmniTrax enclosure must be installed inside a second enclosure to protect the lead-in cables and the sensor cable connections. The two options for the second enclosure are a telecom style enclosure, which is available from Senstar, or a Customer supplied enclosure. The processor can also be mounted indoors in a secure area on a stable fixed surface.

Figure 2: OmniTrax weatherproof and telecom style enclosures

**The telecom enclosure**

The telecom style enclosure is used for outdoor installations, to provide additional security and protection from the elements. The telecom enclosure is ground mounted in a concrete base. The concrete base must be set above ground level in areas prone to ice and on high ground in areas prone to flooding. Once the telecom enclosure is installed in the concrete base, a custom bracket is installed inside, and an OmniTrax enclosure is mounted on the bracket. The telecom style enclosure comes with a tamper switch that connects to the OmniTrax processor to indicate when the telecom enclosure is opened.

**Customer supplied enclosure**

Figure 3: Customer-supplied enclosure

A Customer supplied enclosure must be large enough to accommodate the OmniTrax enclosure with a service loop for the sensor cables, power cables and I/O wiring. If the OmniTrax processor will use the local battery option, the enclosure must be properly ventilated. It is also possible to mount a power supply beside the processor if the enclosure is large enough. The recommended size for a Customer supplied enclosure without a power supply and using lightning arrestors is 69 cm W X 58 cm H X 20 cm D (27 in. W X 23 in. H X 8 in. D). For a Customer supplied enclosure that includes space for a 48 VDC network power supply and lightning arrestors the recommended dimensions are 69 cm W X 69 cm H X 20 cm D (27 in. W X 27 in. H X 8 in. D). If lightning arrestors are not being used the height of the enclosure can be reduced by 10 cm (4 in.). A Customer supplied enclosure should include an internal mounting plate for the OmniTrax enclosure.

# Sensor cables

There are three types of sensor cables available with the OmniTrax system. The type of cable you choose depends on the length of your perimeter, the installation media, the installation space, the type and number of obstacles, and the cable path. When designing your site, you should plan on using approximately 5% more sensor cable than the total length of the perimeter.

- OC2 sensor cable - requires one or two trenches, or two slots, available in lengths of 300 and 400 m of detecting cable + 20 m lead-in
- SC2 sensor cable - requires one or two trenches, or two slots, available in lengths of 50, 100, 150 and 200 m of detecting cable + 20 m of lead-in
- SC1 sensor cable - requires one trench, available in lengths of 50, 100, 150 and 200 m of detecting cable + 20 m of lead-in

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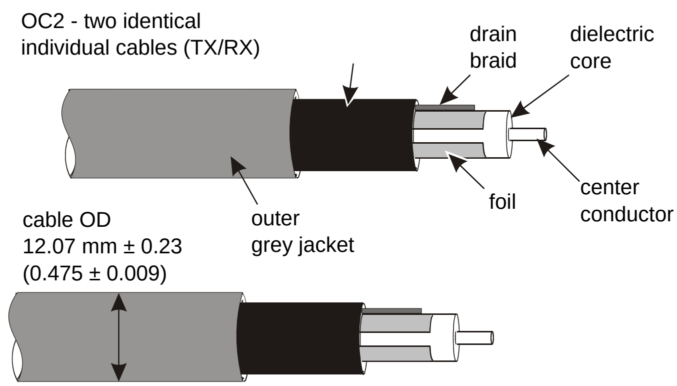
| **Note** | Contact Senstar Customer Service BEFORE using SC1 sensor cable. |

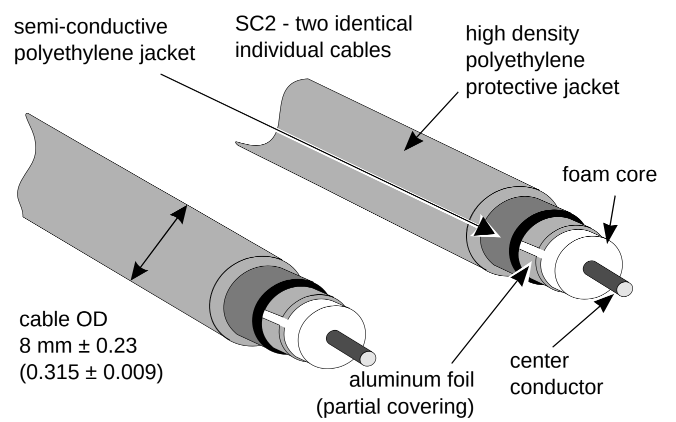
OC2 sensor cable (dual cable system):

- 300 m or 400 m lengths with 20 m of integral lead-in cable
- ferrite beads and TNC connectors field-installed
- graded foil opening for uniform detection
- requires one or two trenches, or two slots
- extremely durable
- power and data over sensor cables
- recommended for long perimeters




SC2 sensor cable (dual cable system):

- 50 m, 100 m, 150 m, 200 m lengths with 20 m of integral lead-in cable
- ferrite beads and TNC connectors field-installed
- graded foil opening for uniform detection
- requires one or two trenches, or two slots
- durable
- power and data over sensor cables
- use for shorter perimeters




SC1 sensor cable (single cable system):

- 50 m, 100 m, 150 m, 200 m lengths with 20 m of integral lead-in cable
- ferrite beads and TNC connectors field-installed
- graded foil opening for uniform detection
- requires one trench or slot
- durable
- power and data over sensor cables
- use in sites with hard surface slots or numerous installation limitations

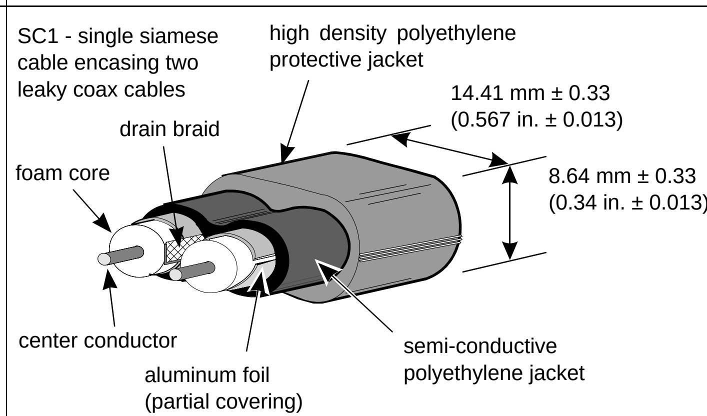



Figure 4: Available cable types

### OC2 sensor cable

OC2 cable is supplied on a 61 cm w X 41 cm (24 in. X 16 in.) center-diameter reel. The 300 m cable reel weighs approximately 39.5 kg (87 lb), and the 400 m reel weighs approximately 51.5 kg (113.5 lb). Each sensor cable includes an additional 4 m (13 ft.) of detecting cable, which allows the detection field to build up to full strength at the start point, plus 20 m (66 ft.) of non-detecting lead-in cable for the connection to the processor. The OC2 cables are shipped with TNC connectors and ferrite beads. Each side of the processor requires two sensor cables (one TX cable and one RX cable).

- 2 OmniTrax sensor cable reels (300 or 400 m cable sets)
- 20 m lead-in cable (marked by red band)
- 6 TNC male connector kits
- 42 ferrite beads
- cable marking tape
- cable identification labels
- arbor hole in reel 4 cm (1.5 in.)

Figure 5: OmniTrax OC2 sensor cable set

**SC2 sensor cable sets**

In an SC2 sensor cable system two sensor cables are buried in parallel around the site. One cable serves as the transmit cable and the other serves as the receive cable. Each sensor cable includes an additional 4 m (13 ft.) of detecting cable, which allows the detection field to build up to full strength at the start point, plus 20 m (66 ft.) of non-detecting lead-in cable for the connection to the processor. The SC2 cables are shipped with TNC connectors and ferrite beads.

- 2 SC2 sensor cable reels (50, 100, 150, 200 m cable sets)
- 20 m lead-in cable (marked by red band)
- 4 TNC male connector kits
- 20 ferrite beads
- cable marking tape
- cable identification labels

Figure 6: OmniTrax SC2 sensor cable set

**SC1 sensor cable sets**

The SC1 sensor cable consists of two ported coaxial cables in a single outer jacket with one transmit cable and one receive cable. SC1 sensor cable should be used at sites where installation space is extremely limited, there are numerous obstacles, or where the cable path meanders. Each sensor cable includes an additional 4 m (13 ft.) of detecting cable, which allows the detection field to build up to full strength at the start point, plus 20 m (66 ft.) of non-detecting lead-in cable for the connection to the processor. The SC1 cables are shipped with TNC connectors and ferrite beads. SC1 cable is ridged on one side and smooth on the other. By convention, the ridged side should be used as the receive cable (Ridged = Receive). There is no physical difference between the internal transmit and receive cables, but for cable installation and fault-finding it is important to know which side is performing each function.

- 1 SC1 sensor cable reel (50, 100, 150, 200 m cable sets)
- 20 m lead-in cable (marked by red band)
- 4 TNC male connector kits
- 10 ferrite beads
- cable marking tape
- cable identification labels

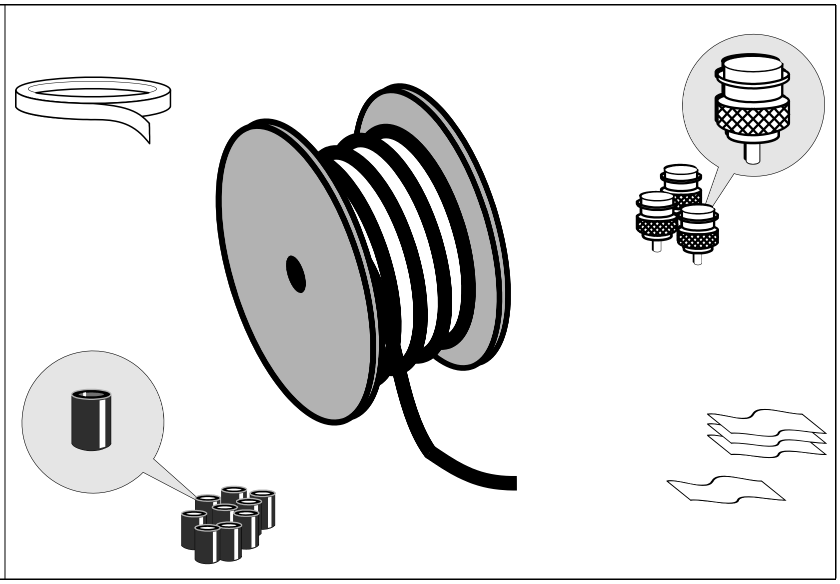


Figure 7: OmniTrax SC1 sensor cable set

# Using mixed cable types on a perimeter

It is possible to mix the different cable types on an OmniTrax perimeter. However, SC1 cable cannot be connected to OC2 or SC2 cable through decouplers. SC1 cable can be connected to the same processor as OC2 or SC2 cable. OC2 and SC2 cable can be connected to the same processor, and can be connected through decouplers.

# OmniTrax components

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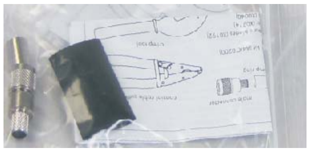
|  | • GT0967 - connector parts kit, male TNC connector for terminating OC2 cable<br>• equivalent parts for SC1/SC2 cable - A0SP0700 male TNC |
|  | • GT0395 - TNC F - F adapter used for cable splices, cable repairs, decoupler connections |
|  | • A4KT0200 - OC connector installation tool kit required for terminating OC2 cable<br>• equivalent part for SC1/SC2 connectors - A0KT1500 |
|  | • A4KT1101 - OC2 network decoupler kit<br>• equivalent part for SC2 - A4KT1201<br>• equivalent part for SC1 - A3KT0701<br>network decouplers pass data and DC power; used to connect separate cable sets where DC power is supplied over the sensor cables |
|  | • A4KT1102 - OC2 standalone decoupler kit<br>• equivalent part for SC2 - A4KT1202<br>• equivalent part for SC1 - A3KT0601<br>standalone decouplers pass data and block DC power; used to connect separate cable sets where DC power is not supplied over the cables |
|  | • A4KT1302 - SC2 long terminator kit<br>• equivalent part for OC2 - A4KT1304<br>• equivalent part for SC1 - A4KT1301<br>used at the ends of cable sets that are not connected to other cable sets; includes standalone decouplers and heatshrink |
|  | • A4KT0604 - OC2 cable splice kit includes the components required to make a cable splice<br>• equivalent part for SC1 - A4KT0601<br>• equivalent part for SC2 - A4KT0602<br>splice kits do not include cable |

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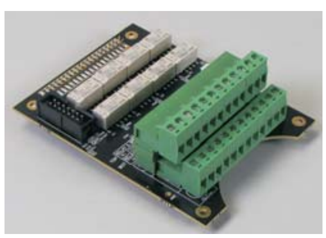
|  | • A4KT0301 - OC2 short cable repair kit<br>• equivalent part for SC1 - A3KT0500<br>• equivalent part for SC2 - A3KT0800<br>used to repair damaged sensor cables where the damaged section is less than 48 cm long<br>• A4KT0302 (not shown) - OC2 long cable repair kit<br>used to repair damaged sensor cables where the damaged section is less than 3 m long<br>no equivalent part for SC1/SC2 |
|  | • A4CA0302 - 50 m OC2 non-detecting cable<br>used for decoupler overlaps, bypasses, extending lead-in cable length<br>(also available in lengths of 25 m - A4CA0301 and 100 m - A4CA0303)<br>• equivalent part for SC1 25 m - A3CA0601, 50 m A3CA0602, 100 m A3CA0603)<br>• equivalent part for SC2 25 m - A3CA0701, 50 m A3CA0702, 100 m A3CA0703) |
|  | • A4KT0100 - spare ferrite beads (50)<br>used on non-detecting lead-in cable and cable bypasses to dampen and contain the detection field<br>• equivalent part for SC1 - A3KT0300<br>• equivalent part for SC2 - A3KT0400 |
|   | • A4KT1000 - lightning arrestor kit for all sensor cable types; includes 4 arrestors<br>used to protect the processor from lightning strikes, transients and power surges conducted by the sensor cables<br>• A4KT1001 - lightning arrestor kit for all sensor cable types; includes 2 arrestors |
|  | • 00BA0400 - relay output card<br>used to increase the processor’s relay output capacity from 4 to 12; 8 additional outputs for signaling alarm conditions when used with local control mode; provides 8 additional outputs for controlling auxiliary devices when used by a Silver Network based remote control processor |
|  | • 00EM0400 - 12 VDC @ 125 mA (max.) auxiliary device power supply, mounts on OmniTrax enclosure door<br>for use with processors receiving 18 to 48 VDC power |

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|  | • C7EM0503 (not shown) - 12 VDC, 80 W, standalone, single processor power supply on a steel plate, no enclosure<br>• A4EM0200 - 48 VDC, 100 W, network power supply in NEMA 4 rated outdoor enclosure for up to 5 processors with power distributed over the cables |
|  | • 00SW0100 - UCM software Windows based application serves as the calibration, diagnostic and maintenance tool for the OmniTrax sensor<br>• GE0444 (not shown) - 3 m USB interface cable connects UCM computer to processor |

## Silver Network components

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|  | network interface card (5 variants) - required on all Silver Network based processors<br>• 00BA0302 - EIA-422 copper wire<br>• 00BA0301 - multi-mode fiber optic<br>• 00BA0304 - EIA-422 copper wire + multi-mode fiber optic<br>• 00BA0303 (not shown) - single-mode fiber optic<br>• 00BA0305 (not shown) - EIA-422 copper wire + single-mode fiber optic |
|  | network interface unit (NIU) - data translator used between the Silver Network based devices (i.e., OmniTrax processor) and the PC based Network Manager software<br>• 00EM0200 - EIA-422 copper wire + multi-mode fiber optic<br>• 00EM0201 (not shown) - EIA-422 copper wire + single-mode fiber optic |
|  | • 00EM1301 - mini-NIU<br>single channel USB to EIA-422 and multi-mode fiber optic data converter DIN-rail mount<br>• 00EM1302 - mini-NIU (not shown)<br>single channel USB to EIA-422 and single-mode fiber optic data converter DIN-rail mount |

<table>
<tr>
<td></td>
<td>
• 00BA1200 - universal input card<br>
provides 8 supervised inputs to the security management system, used on Silver Network based processors, 1 UIC per processor, cannot be used in conjunction with relay output card
</td>
</tr>
<tr>
<td>
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<td>
• 00FG0200 - Network Manager software (Windows application) includes Sensor Management tools<br>
• 00FG0220 - Network Manager Suite (Windows service) includes Sensor Management tools the network managers function as data servers which collect and distribute alarm point data and control point status for security management systems
</td>
</tr>
</table>

The following table lists the OmniTrax system components and provides links to relevant sections in the Product Guide.

| Component | Page reference | Component | Page reference |
|---|---|---|---|
| processor | page 171 | ferrite beads (SC1) | page 121 |
| OmniTrax enclosure | page 86 | ferrite beads (SC2) | page 121 |
| telecom enclosure | page 86 | cable splice (OC2) | page 141 |
| OC2 sensor cable | page 19 | cable splice (SC1) | page 141 |
| SC1 sensor cable | page 20 | cable splice (SC2) | page 141 |
| SC2 sensor cable | page 20 | power supply (12 VDC) | page 163 |
| connectors (OC2) | page 121 | power supply (48 VDC) | page 163 |
| connectors (SC1) | page 126 | auxiliary device power supply module | page 165 |
| connectors (SC2) | page 126 | back-up battery | page 167 |
| standalone decoupler | page 56 | Relay Output card | page 185 |
| network decoupler | page 56 | Universal Input card | page 186 |
| long terminator (OC2) | page 139 | Network Interface card | page 183 |
| long terminator (SC1) | page 138 | Silver Network Manager | page 220 |
| long terminator (SC2) | page 139 | Network Interface Unit | page 220 |
| sensor cable lightning protection | page 179 | Silver repeater | page 224 |
| ferrite beads (OC2) | page 121 | | |

# Installation overview

Installing an OmniTrax system is a five step process:

1. Install the processor and enclosure.
    - power supply
    - earth ground
    - alarm communication wiring
2. Install the sensor cables.
    - mark the cable path
    - dig trenches, cut slots
    - lay cables
    - verify installation
3. Complete the cable burial and restore surfaces.
4. Setup and calibrate the system.
5. Perform verification testing over the length of the sensor cables.

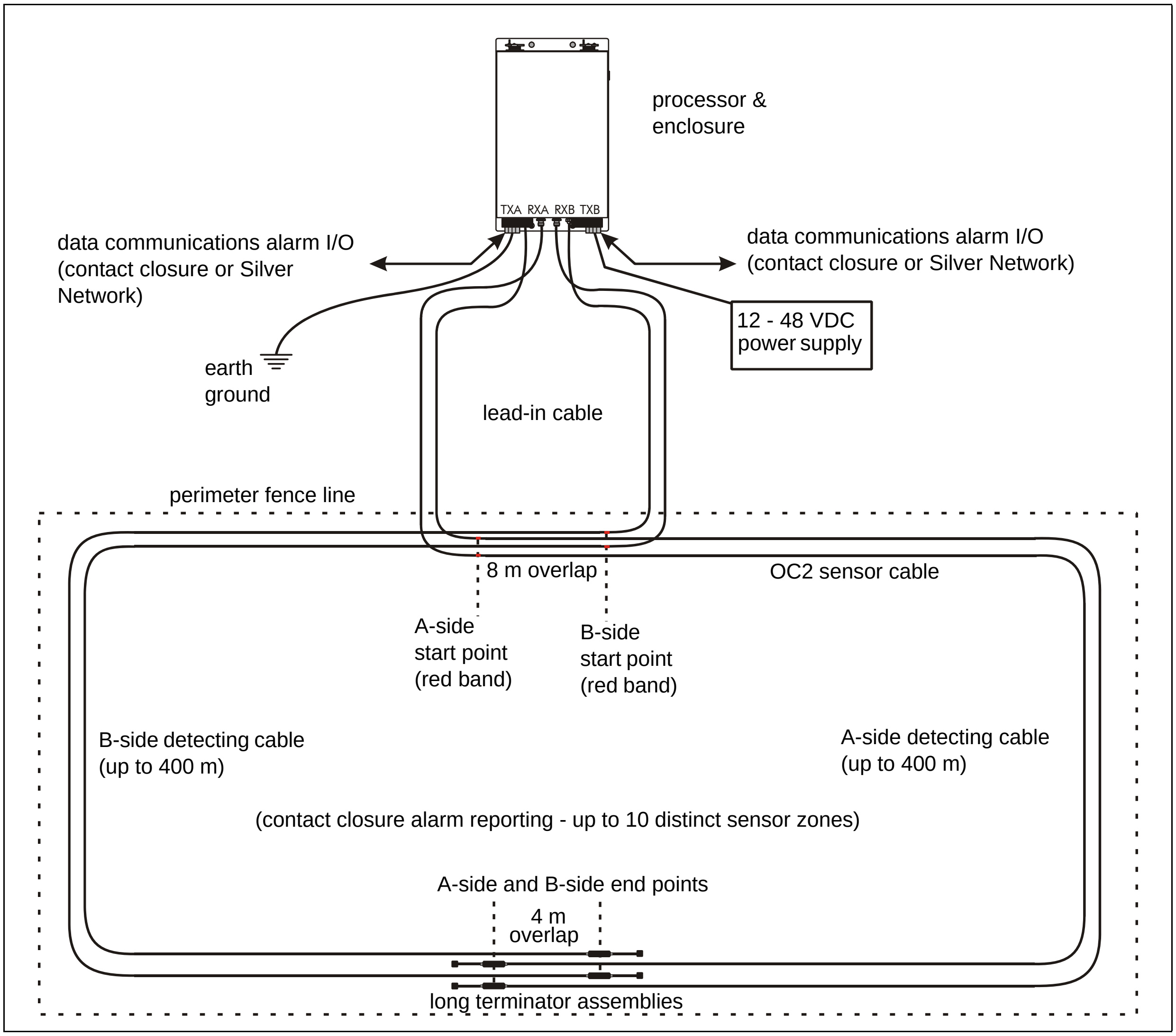


Figure 8: Standalone processor

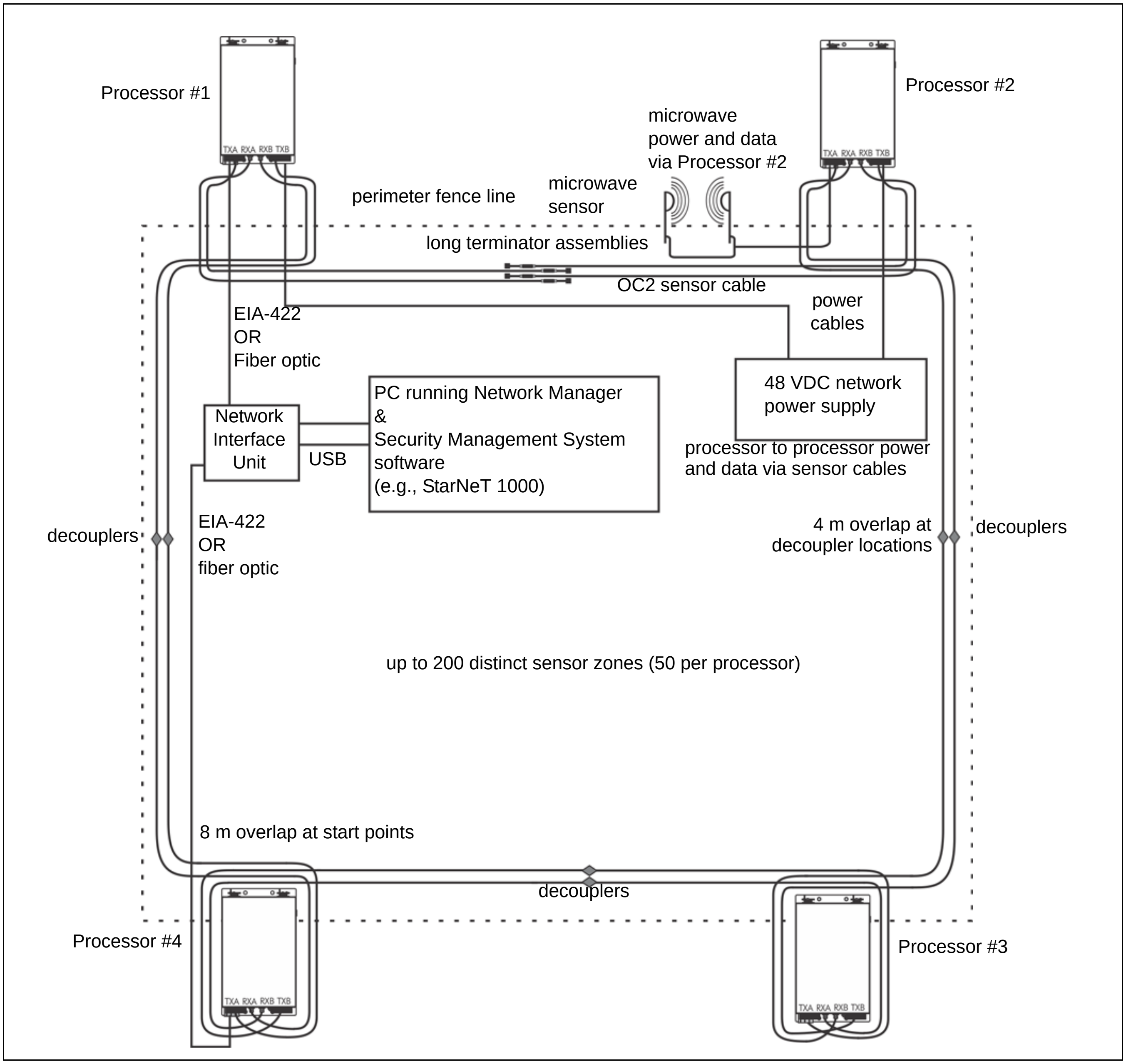


Figure 9: 4-processor Silver Network based system

# 2 Site planning

## Site survey

Every site has particular conditions that affect the configuration and placement of the intrusion detection system components. This chapter outlines some of the conditions that can affect the installation and application of the OmniTrax sensor. It also serves as a guideline for analyzing the features that commonly appear in a buried cable system site. Each section includes links to more detailed sections throughout the guide.

The first step in installing an OmniTrax system is to conduct a detailed site survey. The survey assesses the site conditions to determine the specific installation requirements including the perimeter length, zone layouts, sensor cable route, cable spacing, type of sensor cable, and the locations for the system’s components.

Create a scale drawing of the site (i.e., CAD drawings, photos), which indicates the locations of:

- buildings and other structures
- roads, driveways, sidewalks, paths, parking areas, storage compounds
- fences (include type and condition)
- underground pipes (water, sewage and drainage)
- above ground pipes
- electrical conduits, buried cables
- bodies of water (pools, ponds, drainage ditches, culverts, areas where puddles form etc.)
- trees, bushes, dense vegetation
- cable path (include cable spacing and burial depth)

### Site photographs/video

If possible, take photographs of the proposed sensor cable path. Make note of any irregularities, obstacles, or limitations along the route. These features may affect system design and installation. Provide complete coverage of the cable route, by taking sequential photographs with overlapping views. Include a measuring stick in the photographs to provide scale. Number the photographs so they can be kept in the correct sequence.

A video record of the sensor cable path provides both a visual and audio recording of the features along the perimeter. This is particularly useful for making comments on obstacles, challenging features and other site-specific details that must be taken into consideration on the detailed site plan.

# Measurements

The site survey should include a reference scale. Take accurate measurements along the perimeter. Include the type, size, spacing, and location of fences, buildings, roads, paths and any other obstructions on the proposed cable route. Measure the full length of both cable paths (TX and RX) around the perimeter. Record these measurements on the site survey.

# Weather conditions

Major seasonal changes in weather can affect system performance. You should be aware of the seasonal patterns in the region. Note such details as temperature range, hot sunny periods, periods when the ground is frozen and thaws, and average monthly precipitation.

| | |
|---|---|
| **Note** | Always perform sensor verification tests following major seasonal changes in the weather, and recalibrate the processor if required. |

### Snow coverage

Snow coverage does not affect the detection field. However, deep well-compacted snow with an icy crust may provide an opportunity for an intruder to bridge the detection zone. Deep and drifting snow can also obscure visual assessment.

### Lightning protection

The OmniTrax processor includes built-in lightning protection on its inputs and outputs as well as on the sensor cable inputs. Additional external lightning protection is available for both copper data lines and the sensor cable inputs. Senstar recommends using additional lightning protection devices on copper data lines and the sensor cable inputs for sites that experience thunderstorms and lightning.

### Water table

OmniTrax sensor cable must be installed above the water table. If the soil at the cable burial depth is consistently waterlogged, reduce the burial depth of the sensor cable accordingly. If the ground is regularly saturated up to the surface, follow the directions for Above ground berm installation using geotextile fabric.

# Completing the site survey

Review the site drawings and tour the site to verify the accuracy of the site survey and measurements. Walk along the proposed cable path, adding any relevant information about the installation mediums, obstacles, and surface grading. Use the site analysis checklist as a guide to ensure that all applicable areas have been reviewed.

| | |
|---|---|
| **Note** | Contact Senstar Customer Service for assistance when planning an OmniTrax installation. |

## Site analysis checklist

| ✓ | **Description** |
|---|---|
| | **Obtain a site plan** |
| | CAD drawings, photographs, video recording |
| | precise, detailed measurements |
| | description of local weather conditions |
| | indicate proposed cable path on site drawing |
| | **Indicate all installation mediums** |
| | locations where installation mediums change |
| | soil type (include general description of the soil, e.g., sandy soil, dry granular, loam, clay, heavy clay, etc.) |
| | concrete or asphalt (thickness, reinforced) |
| | crushed stone or rock (approximate stone size) |
| | landfill (buried metal objects) |
| | grade changes (slopes greater than 30º require levelling) |
| | **locate all obstacles on site survey** |
| | fences (type and condition) |
| | sidewalks, paths, roads, driveways |
| | buildings, gateways and other structures |
| | moving objects |
| | water, ditches, depressions (where puddles can form) |
| | utilities (sewers, pipes, conduits and electrical cables, etc.) |

# Planning the cable path

## Installation mediums

The OmniTrax sensor cables can be installed in most natural soil environments and man-made surfaces. The OmniTrax nominal working limits are defined by soil conductivity at the cable location being within the range of 10 mS/m to 200 mS/m. For optimum system performance it is best to install a cable set in a single burial medium. However, a cable set can be installed in more than one type of soil media providing the variance in signal strength does not exceed 20 dB over the length of the cable.

The size and strength of the detection field varies in different installation mediums. In general, the detection field is stronger and wider in light sandy soils, crushed stone, concrete and asphalt. The detection field is more compact in heavy soils like rich black earth or clay. As a result, in some instances the sensor cable is buried deeper in light soils, and shallower in heavy soils. Heavy soils typically provide the most uniform installed system performance.

Make notes about all installation mediums (concrete, reinforced concrete, asphalt, gravel, different types of soil, etc.) located along the proposed cable route. Include the locations of the boundaries between the different mediums. The composition of the soil (conductivity) and the location of any vegetation should also be recorded. If a sensor cable set will be installed in more than one burial medium, try to avoid situations where one cable set is buried in both heavy soil and light soil.

If clear crushed stone is used as a topping, Senstar recommends stone with a maximum size of 19 mm (3/4 in.). Stone dust used to surround and protect the sensor cable should be fine aggregate (passes 4.75 mm No. 4 sieve).

| | |
|---|---|
| **Note** | Micro-trenching is a valid installation option for soil and asphalt, and can be used provided that the trench depths and backfill requirements are maintained. Micro-trenching cannot be used in heavy clay soil. |

# Soil types

Soil types can vary from dry, sandy soil to heavy clay. Sand is considered a light soil because it has low conductivity and a low dielectric constant. Clay is considered a heavy soil as it has opposite characteristics to sand. For extremely light soil, detection field containment can be an issue. For heavy or “lossy” soil, detection sensitivity can be an issue.

| | |
|---|---|
| **Note** | Extreme soil types such as very dry sand and moderate to heavy clay require variations in installation methods and burial depths. Contact Senstar Customer Service for additional information. |

## Light soil extreme

The light soil extreme can be assessed visually where the site is loose sand or dry granular material, without moisture, extending to the approximate burial depth of the cable. A further indicator is that the installation area is devoid of vegetation, as few plants grow under such conditions. If any vegetation is present, it is sparse and loosely rooted. In some cases, the soil is stratified with a sandy layer around the cable, and a more dense soil layer below. If the cables burial depth is more than 5 cm (2 in.) above the dense layer, it is considered light soil. However, if the cables are less than 5 cm above the dense layer, then this type of stratified media behaves more like a heavy soil.

## Heavy soil extreme

| | |
|---|---|
| **Note** | Installation in clay soils, requires the use of a dual cable system (OC2 or SC2, not SC1). See application note 5 (A4DA0509) for details. |

Heavy clay soil is a layer of pure clay with an extremely high conductivity (> 200 mS/m). When dry, the surface of a heavy clay soil will be very hard and cracked, and any dried excavated lumps will be very hard. When wet, this soil will be workable like modeling clay. A sample can be rolled into a cylinder between your palms, about 1 cm (0.4 in.) in diameter and the length of your palm, without falling apart. Included in this class of soils are naturally wet soils, such as those found in saturated, or coastal marsh areas. Heavy clay soil requires variations in the installation techniques.

Moderate clay soil is a mixture of standard organic soil types with a higher than normal clay content. The surface of a moderate clay soil type will be very hard when it is dry. Excavation with a shovel is quite difficult. When moderate clay soil is wet, it will be workable. A sample can be squeezed between the palms without breaking up. Moderate clay soil also requires variations in the installation techniques.

# Man-made mediums (concrete, asphalt, crushed stone)

Most of these mediums have light soil characteristics except for new concrete, and concrete that is regularly exposed to high humidity and significant precipitation.

| | |
|---|---|
| **CAUTION** | Long straight runs of OC2 cables in slots are NOT recommended due to the possibility that thermal expansion can force the sensor cables to pop out of the slots in places. |

| | |
|---|---|
| **Note** | For installations where the sensor cables are buried in both hard surfaces and soil, a surface test is strongly recommended to estimate the variance in sensitivity between the hard surface and the soil (see The surface test on page 185). |

You must determine the thickness of the hard surface, as installation methods vary according to thickness. When surveying the site, watch for slab joints and cracks. Mark the location of joints and cracks on the site survey. Also, you must determine the presence and depth of any metal reinforcement or screening that may be present in concrete.

### New concrete

As newly poured concrete cures, the electrical properties can change dramatically for months before stabilizing. It is possible that there will be no detection in “green” concrete. Therefore, Senstar recommends the use of a supplemental sensor during the curing process. In addition, the OmniTrax sensor’s response must be monitored closely, as the response will change as the concrete cures.

### Concrete > 13 cm (5 in.) thick (no metal reinforcement)

| | |
|---|---|
| **CAUTION** | Before cutting slots, consider the structural integrity of the concrete surface given the remaining thickness after the slots are cut, and the load it must bear. |

In concrete that is more than 13 cm (5 in.) thick, slots are cut around the perimeter. The sensor cables are installed in the slots, two backer rods are installed above the cable, and then the slot is filled with sealant. Avoid routing the sensor cables through existing cracks and expansion joints. The slots must be modified, as required, to accommodate sensor cable overlaps, ferrite beads, decouplers, terminators, expansion joints, large cracks and any transitions between hard surface slots and soil trenches. See Slot dimensions on page 111.

### Concrete < 13 cm thick (no metal reinforcement)

In concrete that is less than 13 cm thick, the cables are buried in trenches similar to asphalt (see Burial under a narrow strip of asphalt on page 103). The concrete strip that was removed, is then restored. The sensor cables are protected by a stone dust bedding.

### Concrete (with metal reinforcement)

Cables can be installed in slots in metal reinforced concrete, provided the cable is installed above the metal according to Sensor cable burial depths on page 36. Sensor cable cannot be installed too close to the metal reinforcement, or below the metal reinforcement, as there will be virtually no detection sensitivity. As a general rule, do not install cables in concrete where the metal reinforcement is less than 10 cm (4 in.) deep.

### Asphalt

| | |
|---|---|
| **Note** | Slot installation is no longer recommended for asphalt surfaces. |

| | |
|---|---|
| **Note** | Always test the sensor cable installation for sensitivity and containment BEFORE restoring the asphalt surface. |

| | |
|---|---|
| **Note** | In some instances, ferrite beads may be required to prevent over-sensitivity in asphalt. Contact Senstar Customer Service if you are installing OmniTrax sensor cable in asphalt. |

Asphalt has an extremely low conductivity, which must be taken into account when installing sensor cables in asphalt. If the sensor cables pass through asphalt and native soil, the detection field above the asphalt can be significantly stronger and wider than the detection field over the surrounding soil.

For short length driveway or road crossings under asphalt where the sensor cable is buried in soil on both sides of the asphalt surface, increase the burial depth beneath the asphalt to maintain uniform sensitivity. One or two 7 m sections of conduit can be used to protect the sensor cables where they pass beneath the asphalt surface (see Road and sidewalk crossings on page 38).

Sensor cables that are installed in a large asphalt surface such as a runway or parking lot are buried in trenches at the standard depth.

A stone dust bedding is recommended to protect the cables from being damaged by the larger stones in the substrate. At least 7.5 cm (3 in.) of stone dust is required above and below the sensor cables to protect the cables from the heat when the asphalt surface is restored. The stone dust used as a protective bedding must be fine aggregate, which passes a 4.75 mm No. 4 sieve. The remaining 15 cm (6 in.) to the surface level is comprised of compacted crushed stone, or native soil, and repaved asphalt.

### Crushed stone

Crushed stone as a topping or surface treatment is acceptable provided its depth is less than one-half of the sensor cable burial depth (see Burial with a crushed stone topping on page 102). Clear crushed stone or natural rock larger than 1 cm (3/8 in.) can damage installed cables, especially in locations where vehicles or heavy equipment pass over the buried cables. Coarse gravel can also cause nuisance alarms during heavy rain, as rainwater drains rapidly through the rocks.

If site conditions require that sensor cables be buried in coarse gravel or crushed stone, use a stone dust bedding in the trench to surround and protect the cables. At least 7.5 cm (3 in.) of stone dust is required above and below the sensor cables to keep the coarse gravel away from the cables. The stone dust used as a protective bedding must be fine aggregate, which passes a 4.75 mm No. 4 sieve. In addition, add a sand or stone dust topping over the surface of the gravel to help fill the voids between the stones. This will further improve detection performance and help to prevent nuisance alarms during rain.

# Using geotextile fabric in sensor cable installations

Senstar recommends using geotextile fabric and a stone dust (or sand) bedding for installations in coarse rock and heavy clay. A stone dust or sand bedding wrapped in geotextile fabric protects the sensor cables from rocks and helps protect against potential damage due to landscaping and maintenance activities. The geotextile fabric prevents the protective bedding from erosion, thus prolonging the installation lifetime. By maintaining a uniform installation environment around the cables, the sand and geotextile fabric helps to maintain consistent detection sensitivity along the full cable length.

# Above ground berm installation using geotextile fabric

Berm installation is used when it is necessary to elevate the zone while providing protection from erosion, for example, when sensor cables must pass over exposed bedrock or water saturated soil. The geotextile fabric retains the sand around and between the sensor cables. There are three methods for berm installations:

- Enclosing both sensor cables in a wide, sloped sand bedding, which is wrapped in geotextile fabric and then covered with clear crushed stone.
- Enclosing both sensor cables in a narrow, rounded sand bedding, which is wrapped in geotextile fabric and then covered with clear crushed stone.
- Enclosing each sensor cable in a narrow, rounded sand bedding, which is wrapped in geotextile fabric and then covered with clear crushed stone.

# Landfill

Avoid laying the cables in areas that are filled with debris containing large metal objects. Large metal objects usually have electrical properties that can affect the detection field. Decaying metal objects can cause nuisance alarms, because their electrical properties can alter sporadically as ground conditions change. The metal objects can also cause variations in sensitivity and detection field size. If the installation area appears to have been filled with debris, use a metal detector to check for metal material. Locate and remove any significant findings where possible. If it is suspected that the soil has been contaminated by chemicals, a soil analysis for electrical and chemical properties should be done. If the installation area is filled with slag, or processed metal ores, take some soil samples and examine them for metal material content. Check the samples with a magnet to determine if magnetic properties exist. Other objects located below the ground and near the surface may cause nuisance alarms. These objects should be identified and located on the site survey.

| | |
|---|---|
| **Note** | If significant metal content is suspected or found, or if there are chemical contaminants in the soil, contact Senstar Customer Service for applications advice. |

# Grade changes

The surface grade along the proposed cable path must not change by more than 30° within a 4 m (13 ft.) span. If there are any areas along the cable path where the slope exceeds 30° within 4 m, fill or level the terrain to meet the maximum allowable slope specification.

# Sensor cable burial depths

OmniTrax sensor cables are typically buried in soil at a depth of 23 cm (9 in.). The soil in the trench should be clean and free of debris and stones, which could damage the sensor cables (see Digging the trenches on page 99). Although minor variations in the burial depth can be compensated for by adjusting the configuration settings, for optimum detection consistency and cable protection, a uniform burial depth is recommended.

**Note** Extremes of natural soil types such as very dry sand or heavy clay may require variations in installation methods and burial depths. Contact Senstar Customer Service for additional information.

| Medium | Nominal burial depth |
|---|---|
| soil, sand & soil mixture, or gravel | 23 cm (9 in.) ± 2.5 cm (± 1.0 in.) |
| moderate to heavy clay | 15 cm (6 in.) ± 1.3 cm (± 0.5 in.) |
| narrow strip of asphalt (e.g., a driveway) | 30 cm ± 2.5 cm (12 in. ± 1 in.) for asphalt installations where the cables are also buried at 23 cm in the surrounding soil |
| asphalt (large surface) (e.g., runway or parking lot) | 23 cm ± 2.5 cm (9 in. ± 1 in.) for asphalt installations in large paved surfaces |
| non-reinforced concrete < 13 cm (5 in.) thick | 23 cm (9 in.) ± 2.5 cm (± 1.0 in.) |
| non-reinforced concrete > 13 cm (5 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.) (cable must be at least 2.5 cm (1 in.) above the metal reinforcement) |

# Sensor cable spacing (OC2, SC2)

OC2 and SC2 transmit and receive cables are installed parallel to each other around the site perimeter. The distance between the transmit and receive cables must remain constant over the length of a cable set. The recommended cable spacing between OmniTrax TX and RX sensor cables is 1.5 m (5 ft.). The absolute minimum cable spacing is 10 cm (4 in.). The maximum cable spacing is 2 m (6.5 ft.). Anything closer than 10 cm will result in high clutter and a poor signal to noise ratio (i.e., potentially high NAR). Anything wider than 2 m can prevent the effective signal coupling between the transmit and receive cables (i.e., potentially low Pd). Use the recommended cable spacing (1.5 m) whenever possible.

**Note** Keep the cable spacing uniform ± 5 cm (2 in.) for the full length of the cable route. For minimum cable spacing the tolerance is + 2.5 cm (1 in.) (no minus tolerance).

**Note** Narrow cable spacing with a dual cable system (OC2, SC2) provides superior performance over a single cable system (SC1).

**Note** Contact Senstar Customer Service if you have difficulty meeting the required cable separation as there are mitigating installation techniques.

| | |
|---|---|
| Standard cable spacing<br>1.5 m (5 ft.) | Use standard cable spacing wherever possible as it provides the best signal to noise ratio and a wide, consistent detection field. |
| Narrow cable spacing<br>10 cm (4 in.) | Narrow cable spacing allows OC2 and SC2 sensor cable to be installed in a single 15 cm (6 in.) wide trench. Use narrow cable spacing when the required separation distance between sensor cables and obstacles cannot be accommodated using 1.5 m spacing. Also use narrow cable spacing for installations in heavy soil types. |
| Maximum cable spacing<br>2 m (6.5 ft.) | Use wide cable spacing to protect open spaces where the motions of an intruder are not restricted by a physical barrier.<br>Not recommended for use in heavy soil. |

# Protection of buried cables

## Overview

Bury the marker tape, included with the sensor cable set, approximately 7.5 cm (3 in.) above the sensor cable. If no further landscaping activity is planned along the cable route, the standard burial depth should provide adequate long term cable protection. However, in areas where digging, planting, gardening and other landscaping activities including future irrigation changes may occur, protect the sensor cable with a non-metal barrier. Pressure-treated wood, or PVC conduit cut in half lengthwise, can be laid over the sensor cables, and will provide additional protection, without affecting the detection field. Whichever method is used to protect the cables, ensure here is a minimum of 2.5 cm (1 in.) of native soil, stone dust, or sand between the sensor cable and the protective barrier.

For sites that have a significant number of burrowing rodents, the entire sensor cable can be protected by using PVC conduit, provided the conduit is filled with sand. Never put the full length of a sensor cable inside conduit that is not filled with sand or soil. Cut a slot in the conduit that will allow the sensor cable to be inserted into the conduit. Place the sensor cable into the conduit, and fill the conduit with sand. Do not join the adjacent sections of conduit.

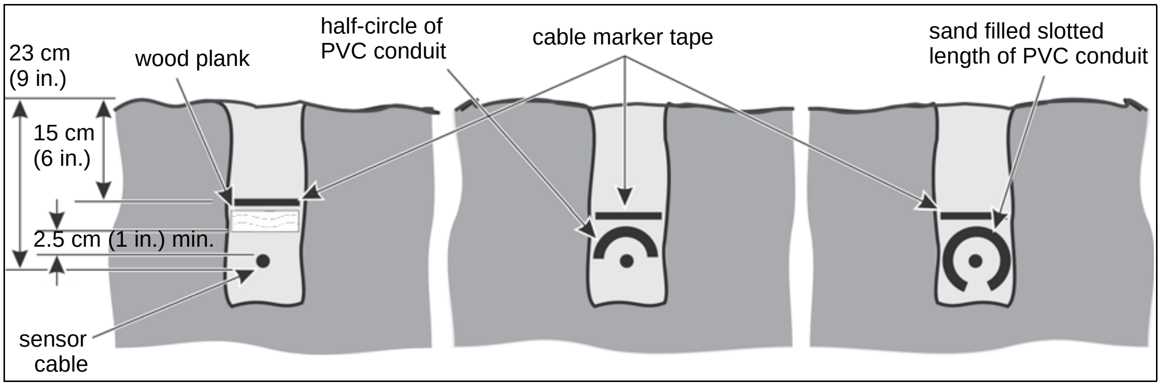


Figure 10: Protecting the sensor cable

## Road and sidewalk crossings

Sensor cables crossing roads must be protected from potential damaged caused by overhead traffic driving stones into the cable jacket. For installation under existing roads, you dig trenches and use a stone dust bedding. Ideally, you can install a section of conduit beneath the road during its construction. The cable is then pulled through the conduit after the road construction is complete. The conduit is then sealed at both ends. The same techniques are applied for cable installation under sidewalks. For an existing sidewalk, the trenches are dug to the edge of the sidewalk and a hole is bored from side to side at the burial depth. The cable is either pulled through the hole, or conduit is pulled through the hole and the cable is then pulled through the conduit. The conduit must be sealed at both ends.

| **Note** | In some cases, road crossings require a cable splice to bypass the roadway (see Mid-cable obstacles (cable bypasses) on page 46). |
|---|---|

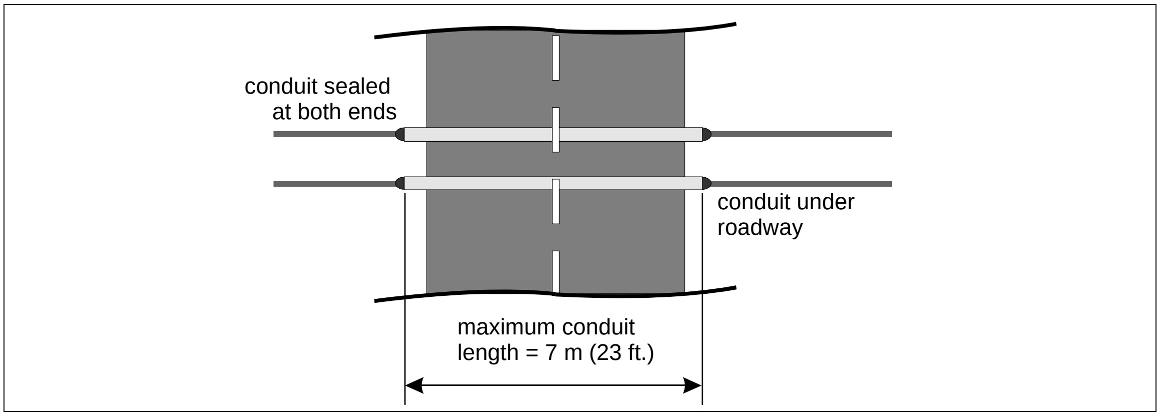


Figure 11: Cable protection for road crossings

For roadway and sidewalk crossings you can install the sensor cable in PVC conduit as follows:

- PVC conduit, maximum length 7.0 m (23 ft.)
- inside diameter OC2 and SC1 - 19 mm (¾ in.), SC2 - 13 mm (0.5 in.)
- maximum 3 sections of conduit per sensor cable (unless slotted and sand filled)
- conduit sections separated by 1 m (3.3 ft.) minimum
- conduit sealed at both ends to prevent internal water flow

# Turning corners

As OmniTrax sensor cables proceed around a corner, there is a slight overshoot in the detection field in the area of the turn. To prevent a significant detection field overshoot in the area of the turn, the smallest allowable turn radius for OmniTrax cable is 7 m (23 ft.). A smaller turn radius can cause a large overshoot which can detect targets outside the prescribed area and thereby result in nuisance alarms.

## Making gradual turns in soft mediums

- Follow a smooth curve around corners with a minimum 7 m (23 ft.) radius to the cable set centerline.

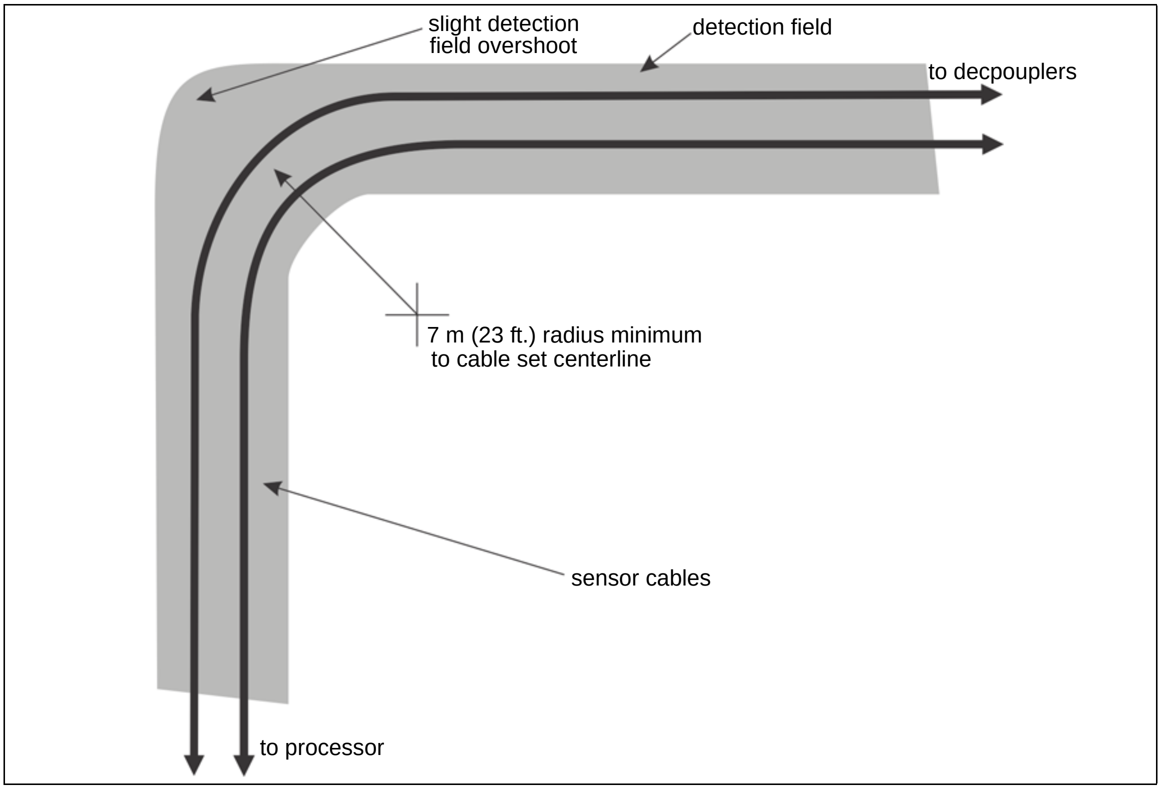


Figure 12: Minimum turn radius

# Making gradual turns in concrete

Use three 30º turns to make a 90º turn through slots cut in concrete (see Figure 13:).

- Make 90° turns by using three successive turns of 30°.
- Each 30° corner must be separated by at least 3.6 m (12 ft.).
- Keep the sensor cables parallel and properly spaced.
- Maintain the same uniform burial depth around corners.
- For large concrete areas that are paved in slabs, place corners in the center of a single slab if possible. Turn corners in the fewest possible number of slabs.

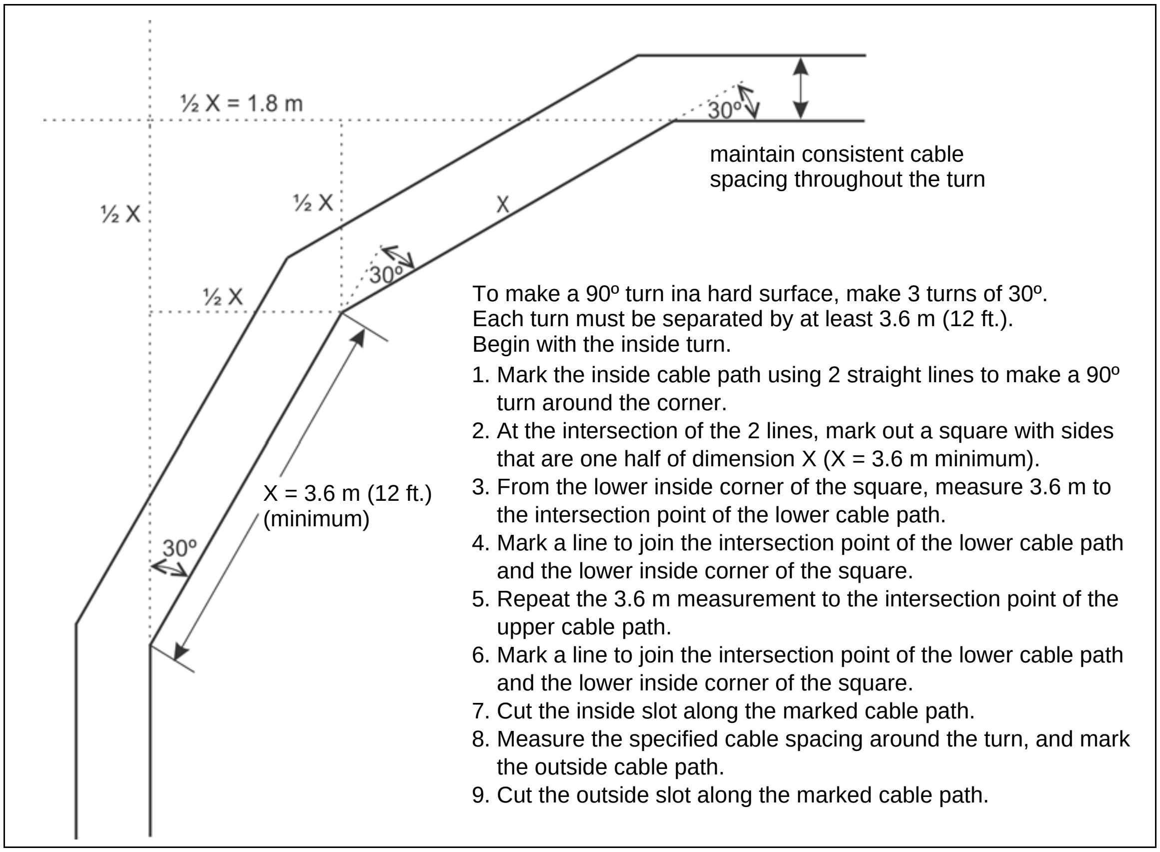


Figure 13: Gradual turns in concrete (slots)

# OmniTrax cable set separation

There are two distinct cases in which the cable separation rules are different:

- **Synchronized processors** are connected through decouplers, or through data cables. Processor synchronization prevents closely located OmniTrax systems from interfering with each other. Synchronized processors require 30 cm (1 ft.) side by side separation, and no separation for end to end cables.
- **Unsynchronized processors** are independent (standalone) OmniTrax systems and must follow minimum separation distances between the two cable sets to prevent mutual interference. Figure 14: illustrates this concept.

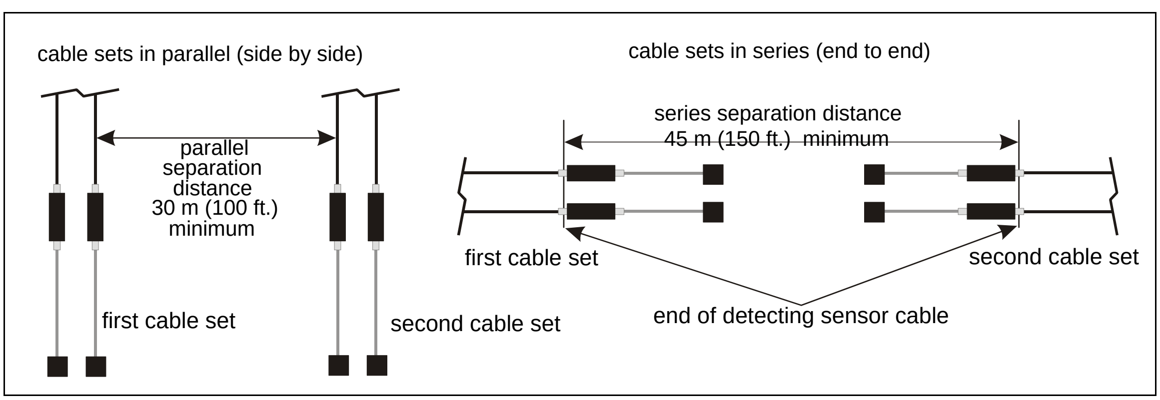


Figure 14: Cable set separation distances for unsynchronized processors

## Single/dual cable set separation, one processor

A single cable set cannot cross over itself to create a fully closed perimeter. If the active cable from a cable set crosses over active cable from the same cable set both location accuracy and target resolution are severely compromised. Figure 15: illustrates this concept. Both cable sets from a single processor are usually overlapped at the start point of the detecting cable. The minimum separation between any A-side and any B-side detecting cables is 30 cm (1 ft.) for a maximum length of 12 m (40 ft.).

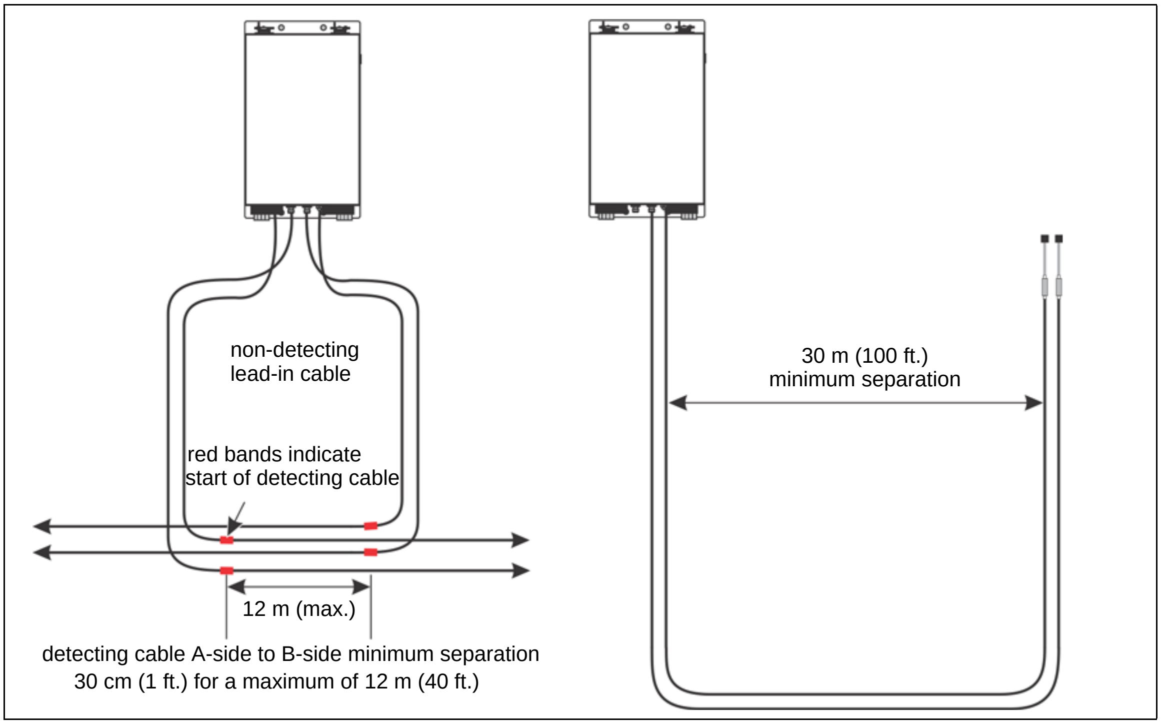


Figure 15: Single/dual cable set separation

# Obstacles

Obstacles located on or near the proposed cable path can affect the detection field and can cause security problems. For example, a tall obstacle may be used to bridge the security system and a metal obstacle can affect the detection field. There are specific rules, which outline the minimum separation distances between obstacles and the OmniTrax sensor cables. Any obstacles must be noted on the site plan and the sensor cable path or spacing may have to be adjusted to keep the separation distances within tolerance. Uniform detection sensitivity and reliable system performance depend on correct cable spacing and separation distances from obstacles.

| | |
|---|---|
| **Note** | If your site includes obstacles that are not covered in this manual, or you are having difficulty meeting the separation requirements, contact Senstar Customer Service as there are mitigating installation techniques. |

Keep the sensor cables as far away from above and below ground obstacles as possible. The minimum recommended separation distance between the cable route and any obstacle is 1.5 m (5 ft.). The separation distance is measured from the detection field centerline to the object (see Separation distances from obstacles on page 42).

Commonly encountered obstacles include:

- fences
- buildings and other structures
- roads, walkways, storage areas, parking areas
- surface water (including water that collects after a rainfall)
- underground pipes, conduits or electrical cables
- large metal objects
- large rocks, trees, bushes, dense vegetation

# Separation distances from obstacles

The required separation distance between the sensor cables and an obstacle depends on the type of obstacle and the burial medium. The separation distance is measured from the centerline of the detection zone to the object.

OmniTrax cables should be placed to avoid obstacles. Obstacles in the detection field may pose a threat to security and can affect system performance. The detection zone centerline should be at least 1.5 m (5 ft.) from all obstacles both above and below ground.

| **Note** | Avoid burying sensor cables close to young trees. As the roots grow, they can displace and damage the sensor cables. |
|---|---|

| **Obstacles** | **Light soil (e.g., sand, gravel)** | **Asphalt/ concrete** | **Medium soil (e.g., loam)** | **Heavy soil (e.g., clay)** |
|---|---|---|---|---|
| High quality fence (e.g., welded wire) | 3 m (10 ft.) | 2.5 m (8 ft.) | 2.5 m (8 ft.) | 2 m (6.5 ft.) |
| Medium-quality fence (e.g., chain link) | 3.5 m (11.5 ft.) | 3.2 m (10.5 ft.) | 3.2 m (10.5 ft.) | 3 m (10 ft.) |
| Low-quality fence (e.g., vinyl coated chain link, razor wire) | 5.5 m (18 ft.) | 4.5 m (15 ft.) | 3.5 m (11.5 ft.) | 3 m (10 ft.) |
| Cables installed parallel to a building | 3 m (10 ft.) | 2.5 m (8 ft.) | 2.5 m (8 ft.) | 2 m (6.5 ft.) |
| 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 metal objects (e.g., cars, bicycles, trucks) | 5.5 m (18 ft.) | 5.5 m (18 ft.) | 5 m (16.5 ft.) | 4.5 m (15 ft.) |
| Portable objects (e.g., lumber, cable spools, pipes) | 1.5 m (5 ft.) | 1.5 m (5 ft.) | 1.5 m (5 ft.) | 1.5 m (5 ft.) |
| Standing surface water | 1.5 m (5 ft.) | 1.5 m (5 ft.) | 1.5 m (5 ft.) | 1.5 m (5 ft.) |

### Separation distances from pipes, conduits and cables

The following separation distances apply both above and below the sensor cables. The separation distances indicated are minimum requirements. If more space is available, increase the separation distance.

| Pipe/cable, orientation and size | Minimum separation distance |
|---|---|
| Metal pipe or electrical cable up to 10 cm (4 in.) diameter parallel to the cable path | 60 cm (24 in.) from sensor cable or 60 cm (24 in.) below the cable burial depth for pipe or cable located between the cable pair |
| Metal 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) |
| Metal pipe more than 10 cm (4 in.) diameter parallel or perpendicular to the cable path | 60 cm (24 in.) from sensor cable (above or below) |
| Non-metal pipe or conduit up to 10 cm (4 in.) diameter may contain wires or running water | 60 cm (24 in.) from sensor cable (above or below)<br>60 cm (24 in.) below the cable burial depth for pipe or cable located between the cable pair |
| Non-metal pipe more than 10 cm (4 in.) diameter containing wires or running water | 1 m (3.3 ft.)<br>(shielding recommended) |
| Non-metal pipe carrying water (non-draining sprinkler pipes) parallel to cable path | 30 cm (12 in.) |
| Non-metal pipe carrying water (non-draining sprinkler pipes), perpendicular to cable path | 5 cm (2 in.) from sensor cable (above or below)<br>(shielding recommended) |
| Aerial pipes or wires suspended over detection field | 2 m (6.5 ft.) from sensor cable |
| Pipes or electrical wires on the ground surface parallel to the sensor cable path | 2 m (6.5 ft.) from sensor cable |
| Buried leaky sensor cables that are not being used (Sentrax, Perimitrax) | 3 m (10 ft.) from sensor cable |
| Buried leaky sensor cables that are being used (Sentrax, Perimitrax) | 10 m (33 ft.) from sensor cable |

### Separation distances from existing buried leaky sensor cable systems

If you are installing OmniTrax cables near an existing buried cable system (i.e., Sentrax or Perimitrax) you must keep the OmniTrax cables a minimum of 10 m (33 ft.) from the installed sensor cables. Otherwise, the OmniTrax RF signals can interfere with the existing buried cable system. If you are installing an OmniTrax system near an existing OmniTrax system, there are also minimum separation distances between cable sets (see OmniTrax cable set separation on page 40).

**Note** Contact Senstar Customer Service for details on required separation distances for buried cable systems from other manufacturers.

### Installation near drainage culverts

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

**Using a metal shield plate or foil**:

- For a non-metal pipe lying parallel to the cable path, the foil should be wrapped around the pipe for the full length of the cable path. The pipe must be at least 60 cm (24 in.) away from the cable location.
- For a non-metal pipe carrying drain water or sprinkler lines and lying perpendicular to the cable path, wrap the foil around the pipe such that the foil extends for at least 1 m (3.3 ft.) beyond the cable path, on both sides.

- Secure the foil in place with plastic tie wraps or electrical tape.

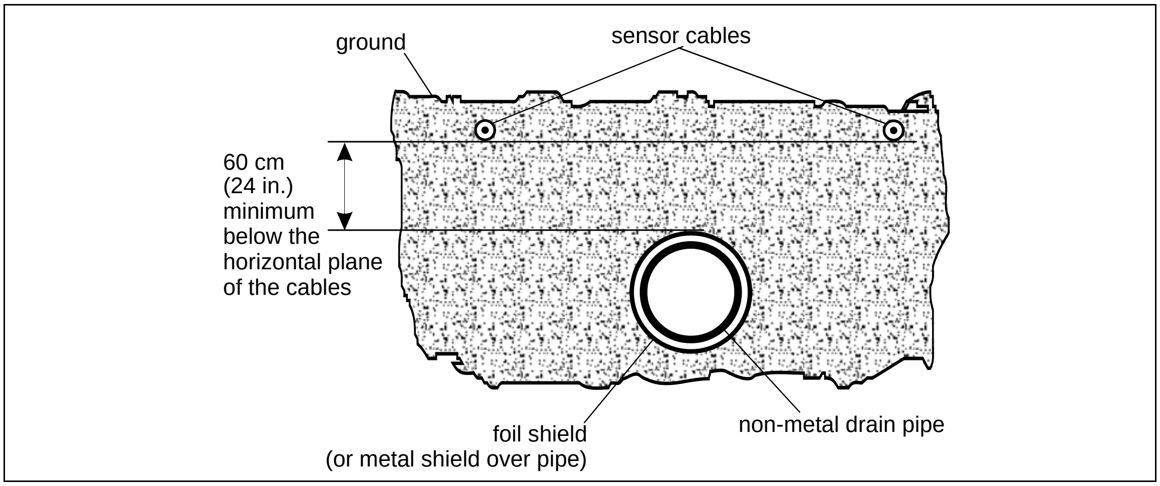


Figure 16: Pipe buried parallel to sensor cables

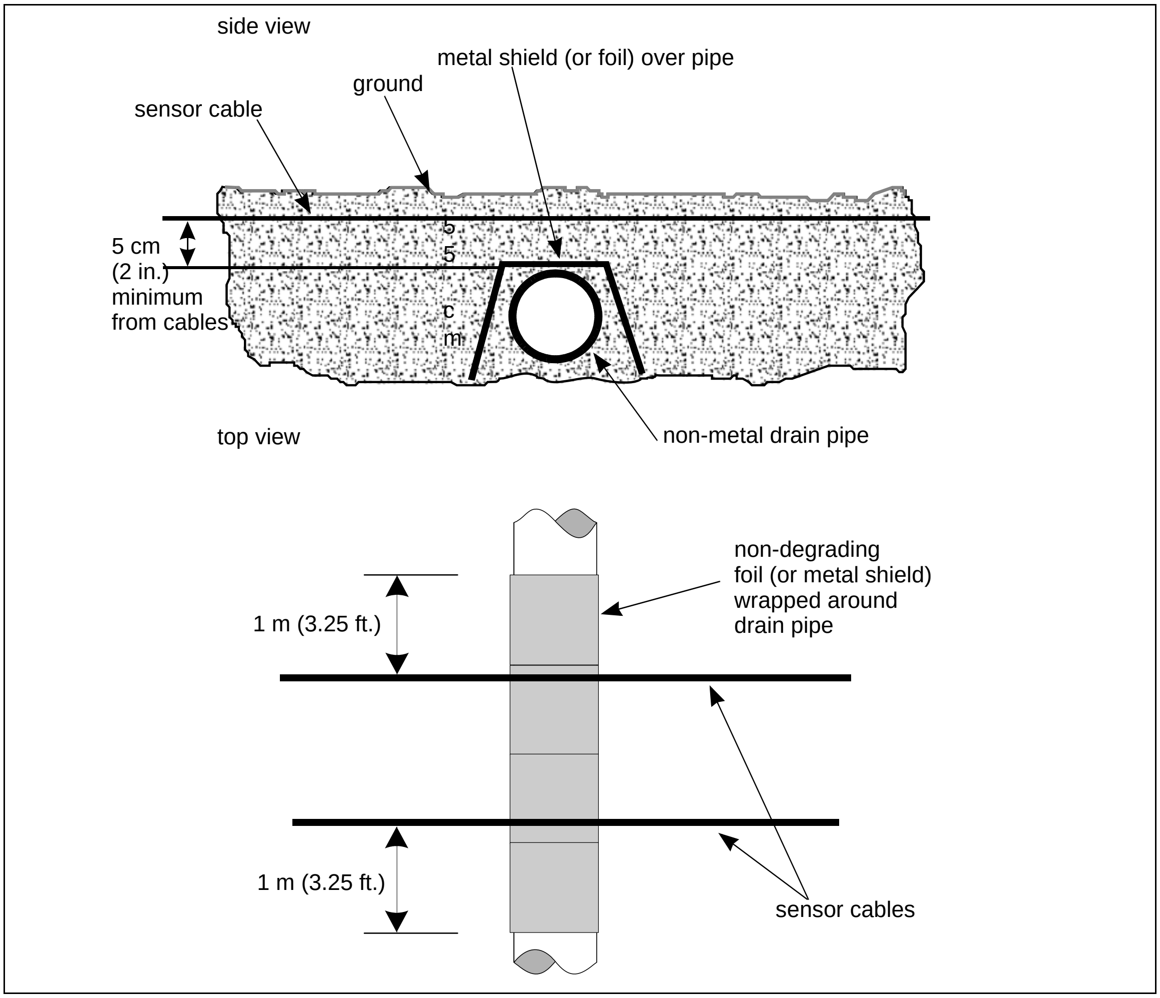


Figure 17: Buried cables with metal shield

# End of cable set obstacles

| **Note** | If detection is required right up to the obstacle, an alternate sensor must be installed to provide the coverage. |
|---|---|

If an OmniTrax perimeter ends perpendicular to a fence or building, the end of the detecting cable must be at least 7 m (23 ft.) away from the obstacle. Cut the sensor cable 7 m (23 ft.) away from the obstacle, and install terminators on the ends of the cable (see Figure 18: and Figure 19:).

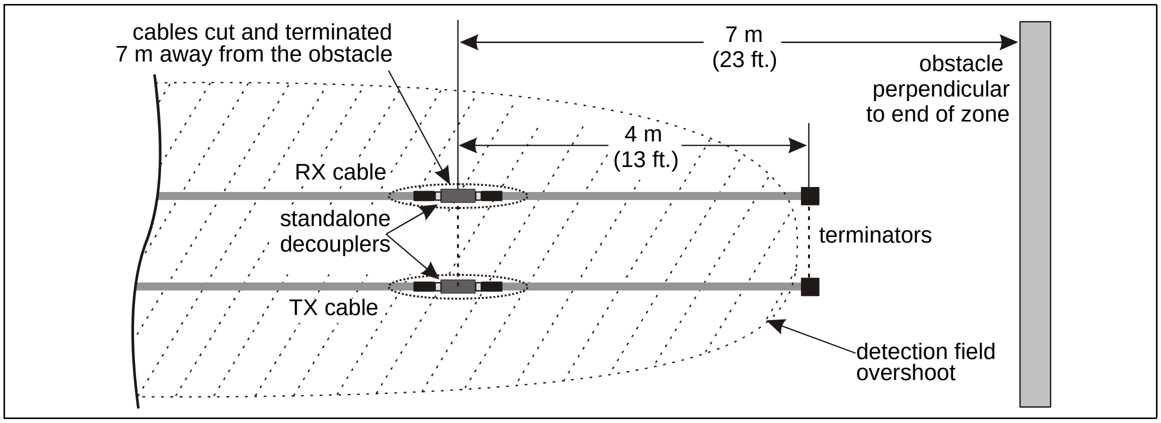


Figure 18: OC2/SC2 end of cable set obstacle

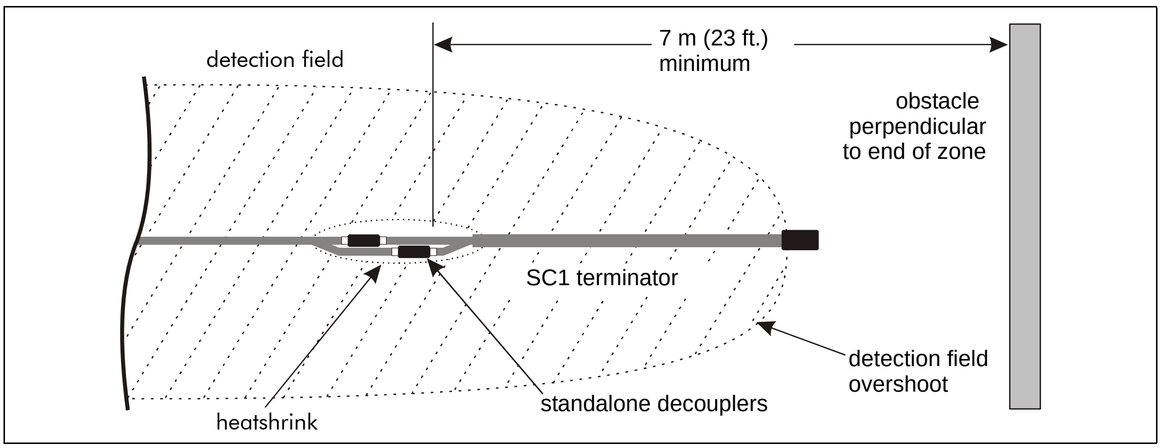


Figure 19: SC1 end of cable set obstacle

If two OmniTrax cable sets from two different processors end at an obstacle, and data and power are being carried over the sensor cables, you can use decouplers and non-detecting cable to bypass the obstacle.

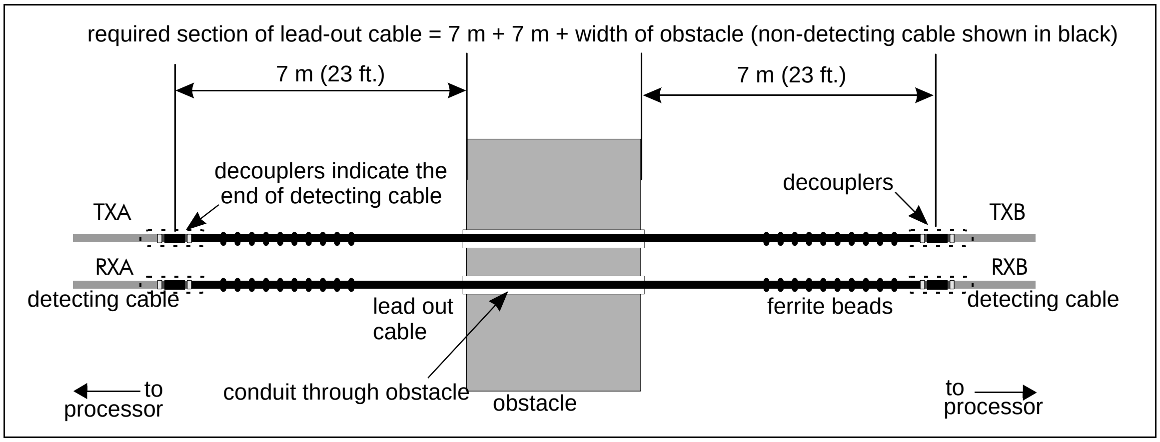


Figure 20: Obstacle bypass at the end of two OC2 cable sets

# Mid-cable obstacles (cable bypasses)

If there is an obstacle in the cable path along the length of the active cable, you can splice in a section of non-detecting cable to bypass the obstacle. PVC conduit should be used to protect the non-detecting cables, if they pass through the obstacle. Some obstacles that may be encountered include roadways, trees, fences, storage buildings, culverts, streams, ponds, etc.

If it is not possible to go through an obstacle, it may be possible to go around the obstacle. If you go around the obstacle, be sure to follow the recommended separation distances from obstacles. Otherwise, cut and terminate the cables 7 m away from the obstacle.

| | |
|---|---|
| **Note** | The full length of an OmniTrax cable bypass must be defined as a cable segment and set to Zone 0 via the UCM software. |

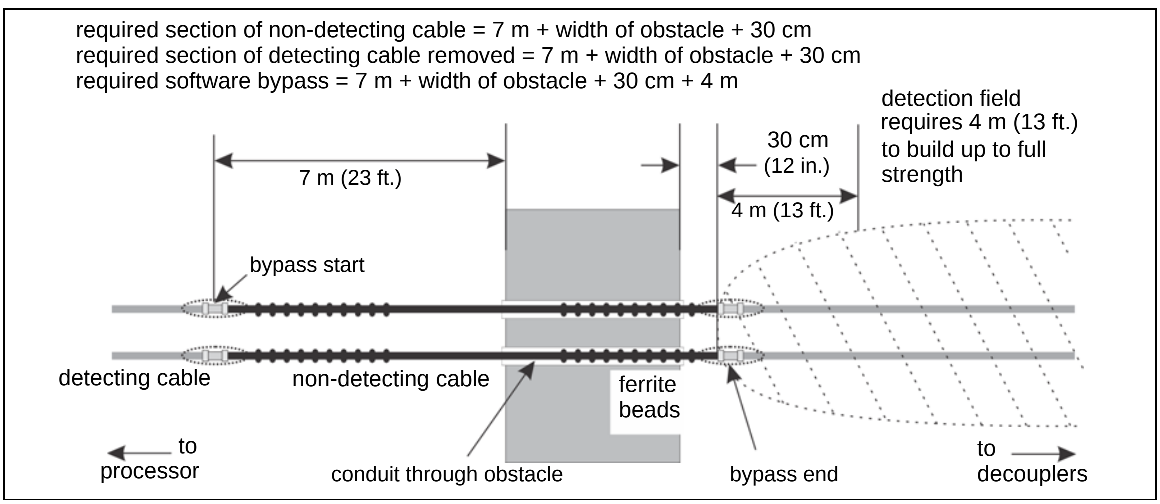


Figure 21: Mid-cable obstacle bypass (OC2 example)

# Beginning of zone obstacles

Ideally, when planning an OmniTrax installation in which there are obstacles along the cable path, a processor can be located at the obstacle. In this case lead-in (non-detecting) cable is used to bypass the obstacle. An auxiliary sensor, such as a microwave can be used to provide coverage up to the obstacle, if required. For Silver Network based processors, the auxiliary sensor can receive power from, and report alarms through, the OmniTrax processor.

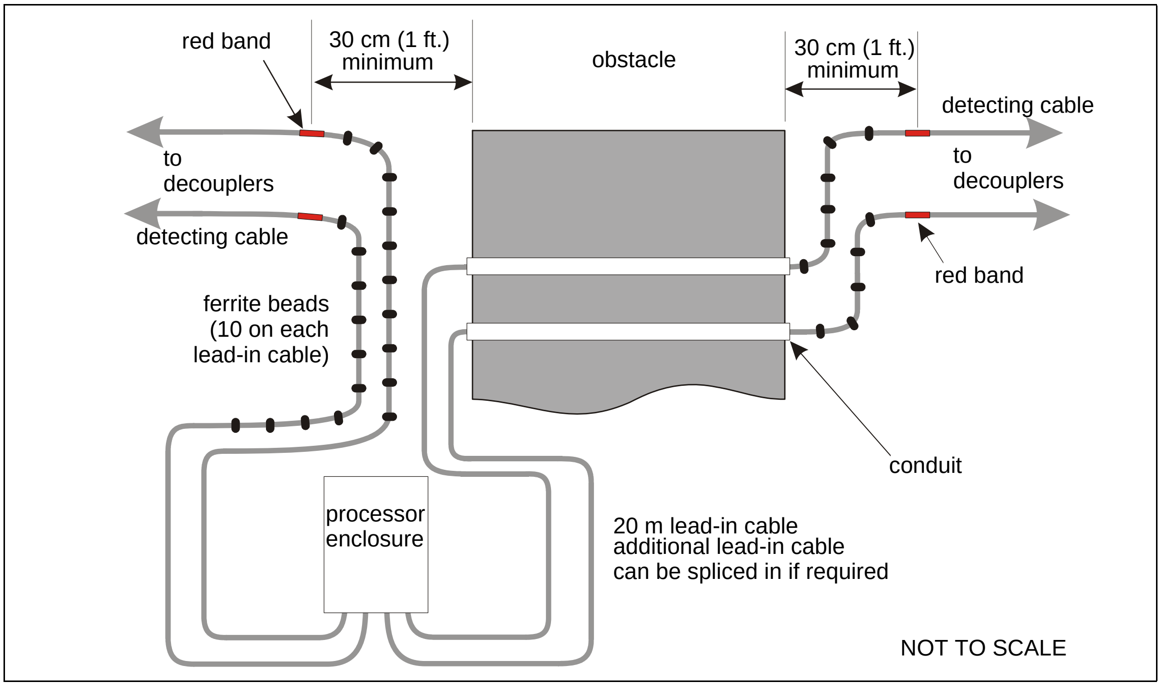


Figure 22: Beginning of zone obstacle

# Fences

The type of fence as well as its distance from the cable path are important factors. OmniTrax sensor cables must be kept specific distances away from fences (see Separation distances from obstacles on page 42). Intermittent electrical contacts and fence motion caused by wind can result in nuisance alarms. Active detecting sensor cables cannot pass under chain-link fences. The fence disrupts the detection field, resulting in an area of low sensitivity before and after the fence line. Fences can also be a source of nuisance alarms, with fence noise reflecting back along the sensor cables and causing ghost alarms. To maintain an active section of sensor cable where the sensor cables cross a metal fence line, you can replace the section of fence above the sensor cables with a non-metal material (e.g., a plastic or fiberglass panel, a polycarbonate sheet, etc.). If a section of the fence cannot be replaced, you can plan your site so a processor is located near the fence (use lead-in cable to bypass the fence). Otherwise, you can splice in a section of non-detecting cable to pass under the fence. Sensor cables are often installed between parallel security fences. However, you must follow the cable spacing and separation distance rules.

# Buildings, gateways and other structures

If the detection field encroaches upon a wall, the system may detect moving occupants or objects inside the building, resulting in nuisance alarms. If sensor coverage is required to close upon a wall, an auxiliary sensor such as a microwave, or an infrared system can be used to supplement the OmniTrax system at that location (see Separation distances from obstacles on page 42).

There are three options for when the cable path approaches a building or obstacle straight-on (perpendicular).

- bypass the obstacle by routing the sensor cable around the obstacle
- splice in a section of non-detecting cable to pass through the obstacle (see Mid-cable obstacles (cable bypasses) on page 46)
- cut and terminate the cables 7 m (23 ft.) away from the obstacle

It is also possible to install a processor near an obstacle and use lead-in cable to start the detection zones on either side of the obstruction (see Beginning of zone obstacles on page 47). I

# Road crossings

In most instances where the sensor cables must cross under a roadway, non-detecting cable is spliced in at the crossing (see Mid-cable obstacles (cable bypasses) on page 46). Ideally, a section of conduit is installed when the road is built, and the sensor cable is pulled through the conduit when the cables are installed (see Protection of buried cables on page 37).

There are instances where a road crossing through a zone in soil does not need to be permanently bypassed. For example, a road that is used occasionally during the day time, but is unused at night. In this case you can dig the trenches across the road and bury the sensor cables 30 cm (12 in.) below the road surface. The installation depth in this case is greater than normal, because of an expected higher sensitivity above the cable caused by the asphalt and gravel road bed. The segment of cable below and adjacent to the roadway is then set as an independent zone via the UCM software. The road zone can be accessed in the daytime, while the road is in use, and secured at night when the road is unused (Silver Network based systems).

# Decouplers and obstacles

At decoupler locations, make sure there is both sufficient detection and enough distance for the detection field to dissipate, especially if the perimeter ends near an obstacle. In medium and heavy soils, the detection field dissipates 2 to 3 m (6.5 ft. to 10 ft.) past the decouplers. In light soils, the detection field can continue for greater distances past the decouplers. The minimum separation distance for sensor cables ending perpendicular to an obstacle for all burial mediums is 7 m (23 ft.). Terminators are used at the end of OmniTrax perimeters.

# Moving objects

If a detection field is located too close to an area where there are moving objects such as vehicles, equipment, medium or large animals, nuisance alarms could result (see Separation distances from obstacles on page 42). This includes areas such as roads, walkways, parking areas, exercise yards, livestock pens or grazing areas, and wooded areas.

When OmniTrax is calibrated and set up, small animals weighing 5 kg (11 lb.) or less are unlikely to be detected. Avoid areas where medium or large animals (over 5 kg) are not controlled. Animals in this size category have some probability of being detected. The detection probability generally increases with size.

# Metal objects or obstructions

Metal objects located near the sensor cables can distort the detection field, causing uneven sensitivity (see Separation distances from obstacles on page 42). Differences in soil composition make it difficult to predict the exact effect at a particular site. If there are metal objects near the cable route that cannot be removed, mark the location along with a detailed description on the site survey. This information can be useful during the calibration process. Some of the potential problems arising from metal objects include:

- intermittent electrical contacts
- detection field containment (redirection of the detection field)
- variations in detection sensitivity

Use the following guidelines to assist in planning for and overcoming the effects of metal objects.

### Pipes, conduits, and electrical cables

If a pipe, conduit, or electrical cable is buried near the cable path, it may have an affect on the system (see Separation distances from pipes, conduits and cables on page 42). To be assured of trouble-free operation objects should be separated from the sensor cables by the distances listed in the separation table. The separation distances indicated are minimum requirements. If more space is available, increase the separation distance. Non-metal pipes or conduit that are shielded or wrapped with foil are equivalent to metal pipes or conduit.

| | |
|---|---|
| **Note** | If replacing an older buried cable system, the old cables should be removed. If this is not possible, the new cable must have a minimum separation distance of 3 m (10 ft.) from the old cable. |

Metal pipes crossing the sensor cable path should not have any joints or breaks. Check that the pipe has no loose fittings. If a pipe is no longer in use, it is recommended that it be removed from the zone.

### Drainage culverts

Culverts or pipes buried 1 m (3.3 ft.) or more below the surface should not cause any problems (see Installation near drainage culverts on page 43). Pipes less than 1 m below the surface should be of metal construction, to reduce the potential for nuisance alarms from water flowing in the pipe. Metal culverts must be of continuous construction where they cross the sensor cables to avoid intermittent electrical contacts. Shallow buried pipes made of concrete or plastic can be covered with a metal shield or metal foil in the vicinity of the sensor cables. Use foil that is designed for direct burial to ensure that it won’t degrade in the soil. The pipe can then be treated as a metal pipe, and the separation distances for metal pipes apply. The shield or foil will reduce the potential for nuisance alarms that can occur from water flow in the pipe.

# Water

Water that accumulates in puddles (standing water), ditches, or water flowing through underground, non-metal pipes can cause nuisance alarms (see Separation distances from obstacles on page 42). Ensure that there is adequate drainage around the perimeter and that water does not accumulate on, or near, the proposed cable path. If the local climate includes a rainy season, check with local authorities to determine the effects of heavy rainfall on the site surface.

Do not route the sensor cables where rainwater collects near a building.

- avoid areas where standing water/puddles accumulate, near the detection field
- final grade after installation should prevent the accumulation of standing water near the sensor cables
- avoid areas with running water from ground surface drainage or building down spouts

# Sensor cable bypasses

A bypass is a non-detecting section of sensor cable within an active section. With OmniTrax, there are two methods for creating sensor cable bypasses. In situations where the requirement is to have no detection along a length of active sensor cable, you can set the required length of cable to inactive via the UCM software. In this case the cable will continue to operate, but will not report alarms. Software bypasses are typically used for pedestrian crossings, and for passing through exercise yards, or other areas where people can move freely and detection is not required. This method cannot be used under metal fences, through obstacles, or for frequently used vehicle crossings. If the sensor cable must pass under a metal fence, you should replace the fence panel above the cable with a non-metal panel or a polycarbonate sheet. For most areas with vehicle crossings, or to pass through, or under obstacles, OmniTrax bypasses use spliced-in sections of non-detecting cable to prevent the formation of the detection field. In this case, an equal length of detecting cable must be removed at the bypass.

| | |
|---|---|
| **Note** | If the sensor cable must pass through an object in the cable path, try to plan your site so that the object is at a processor or decoupler location. |

| | |
|---|---|
| **Note** | OmniTrax target resolution is approximately 24 m (79 ft.). If there are two valid targets crossing within a 24 m section of cable in a period of 3 seconds or less, the two targets can merge and be reported as one target. As a result, if one of the targets is within a software bypass, it can mask the valid target outside the bypassed area. Therefore, precautions must be taken to ensure adequate detection for 24 m on both sides of a software bypass. Contact Senstar Customer Service for assistance, before implementing a software bypass. |

## Sensor cable bypasses (software bypass)

Use a software sensor cable bypass in areas where people can move freely and detection is not required such as pedestrian crossings or exercise yards.

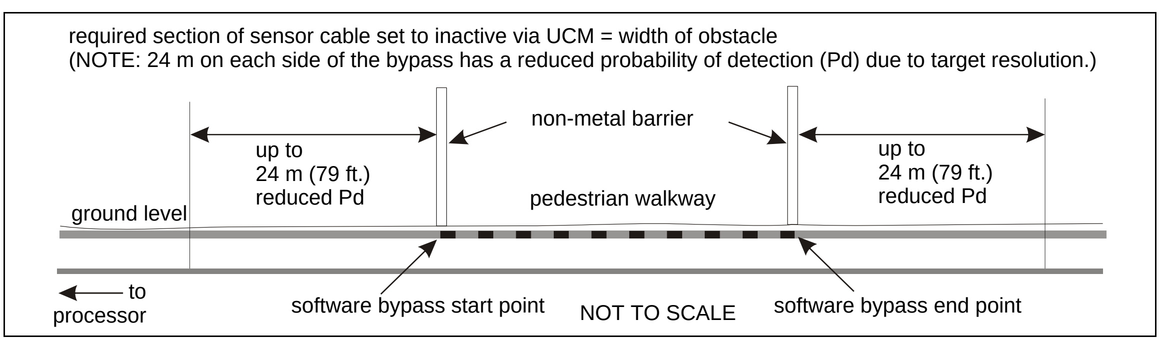


Figure 23: Sensor cable software bypass

# Sensor cable bypasses (hardware bypass)

Use a spliced-in sensor cable bypass:

- where obstacles (e.g., buildings, streams or ponds, driveway, roadway, walkway, sallyport, culvert, tree, large rocks, etc.) block the sensor cable route away from a processor or decoupler/terminator location
- where an area of non-detection, which does not meet the criteria for a software bypass, is desired (e.g., a gate, or roadway)
- to cross a metal fence boundary, which cannot be replaced by a non-metal panel

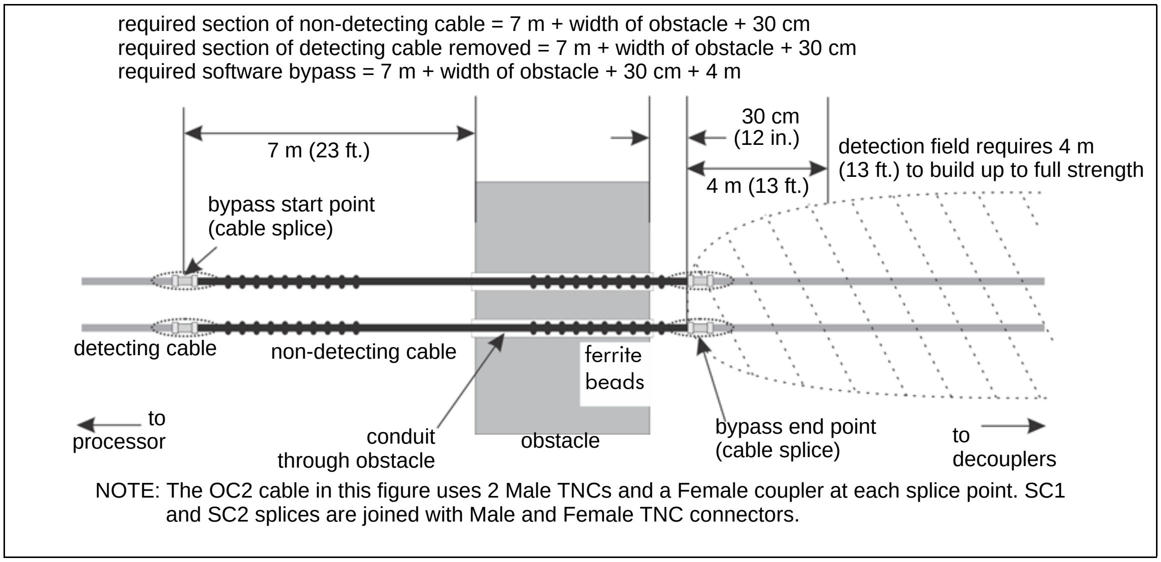


Figure 24: Sensor cable hardware bypass

# Lead-in cable splices

A cable splice is used to:

- to increase the 20 m (65 ft.) length of the lead-in (non-detecting) cable
- replace a damaged section of cable with new cable (see Repairing sensor cables on page 154)
- to create an area of non-detection within an active cable set

### Adding lead-in cable (OC2)

You can add 10 m or less of OC2 lead-in cable, without making any other changes. In this case, you use the 20 m of integral lead-in cable plus up to 10 m of additional non-detecting cable to augment the lead-in cable (max. length of lead-in cable = 30 m). You also require an OC2 cable splice kit.

To add more than 10 m of OC2 lead-in cable, you must remove an equal length of detecting cable from the **beginning** of the detecting cable (marked by the red band). You will require an OC2 cable splice kit and the full length of lead-in cable required (two pieces, RX and TX). For example, if site conditions require 75 m of lead-in cable, you must cut out 55 m of detecting cable, measured from the red band. You then splice in a 75 m section of lead-in cable to replace the 55 m of detecting cable and the 20 m of integral lead-in cable that was cut out. You should label and retain the cut out section of lead-in and detecting cable for future repairs.

### Adding lead-in cable (SC1/SC2 sensor cable)

You can add lead-in cable to increase the length of the 20 m of integral lead-in cable supplied with each SC1/SC2 sensor cable. However, there are rules that must be followed:

- To add 15 m, or less, of lead-in cable, you can splice the additional lead-in to the end of the existing lead-in cable. No other changes are required.
- To add more than 15 m of lead-in cable, you must remove an equal amount of detecting cable from the start-up section of cable, which is marked by the red band. For example, an installation requires 50 m of lead-in cable. Therefore, the first 30 m of detecting cable from the startup section (past the red band) and the existing 20 m of lead-in cable must be cut out. A 50 m section of replacement lead-in cable is then spliced in at the 30 m point, where the detecting cable was cut.

### Splice kits

Cable bypass splice kits are available for each of the three types of OmniTrax sensor cables. Each of the kits includes the hardware components required to make the splice. You must order the required amount of non-detecting lead-in cable separately. Conduit, if required, is customer supplied.

| | |
|---|---|
| **Note** | SC1 lead-in cable includes two sensor cables in one outer jacket (a 25 m splice requires 25 m of lead-in cable). OC2 and SC2 lead-in cable is a dual cable system (a 25 m splice requires 50 m of lead-in cable). |

- SC1 - A4KT0601, + lead-in cable 25 m (82 ft.) A3CA0601, 50 m (164 ft.) A3CA0602, 100 m (328 ft.) A3CA0603
- SC2 - A4KT0602, + lead-in cable 25 m A3CA0701, 50 m A3CA0702, 100 m A3CA0703
- OC2 - A4KT0604, + lead-in cable 25 m A4CA0301, 50 m A4CA0302, 100 m A4CA0303

# Perimeter layout

The information obtained in the site survey is used to determine the perimeter layout. Start by creating a comprehensive site plan that shows the layout of the OmniTrax system equipment (processors, sensor cables, decouplers, power supplies, etc.).

| | |
|---|---|
| **Note** | When digging trenches where the surface is grass-covered and must be restored after installation, use a turf cutter or turf remover to peel a strip of turf from the sensor cable path. |

## Starting the perimeter

To begin the site design, indicate the location of each alarm zone on your site plan. Allocate the alarm zones to match the site’s physical characteristics and to accommodate any additional security systems (e.g., CCTV coverage).

# Minimum sensor cable lengths

For standalone OmniTrax processors (i.e., processors that are not connected to other processors through decouplers) the absolute minimum length of sensor cable is 16 m (52 ft.). This includes the required minimum 6 m (20 ft.) of lead-in cable and the 4 m (13 ft.) start-up section of cable in which the detection field builds up to full strength.

For OmniTrax processors that are connected to other OmniTrax processors through decouplers, the minimum sensor cable length is 75 m (246 ft.) per processor; i.e., total cable length separation between two processors is 150 m (492 ft.) including 6 m of lead-in cable per processor and the 4 m (13 ft.) start-up section of cable in which the detection field builds up to full strength. Figure 25: illustrates the absolute minimum cable lengths for lead-in cable and detecting sensor cable (connected through decouplers and terminated).

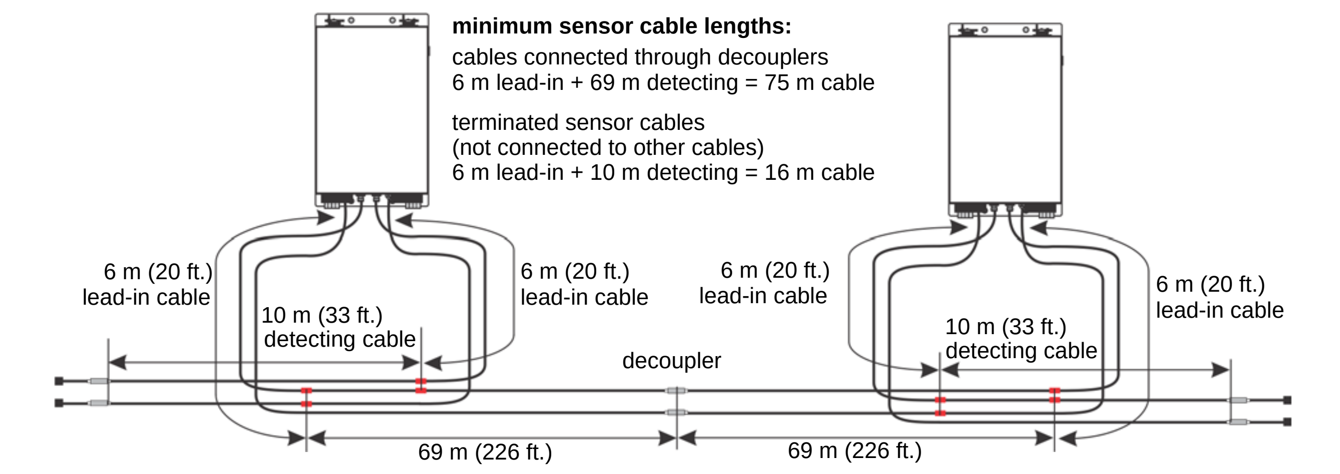


Figure 25: Minimum required sensor cable lengths

These minimum sensor cable length rules apply to all sensor cable types used with OmniTrax, including retrofit applications to Perimitrax or Sentrax sensor cables.

# Cable selection guidelines

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|---|---|
| **Note** | Typically, the maximum usage from an OmniTrax cable set is 95% of the total cable length (e.g., a 400 m OmniTrax cable set will cover approximately 380 m of perimeter). This is due to environmental factors like uneven terrain, and to compensate for minor installation variances when laying the cable. Therefore, when designing an OmniTrax perimeter, you should plan on using approximately 5% more sensor cable than the total length of the perimeter. |

| | |
|---|---|
| **Note** | If site conditions require you to shorten the lead-in cable, the absolute minimum length of lead-in cable is 6 m (20 ft.). As a precaution, Senstar recommends retaining at least 10 m of lead-in cable on each OmniTrax sensor cable. |

| | |
|---|---|
| **Note** | Each sensor cable includes at least 4 additional meters of detecting cable, which allows the detection field to build to full strength. |

| | |
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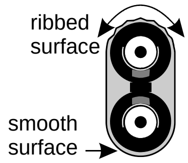
| **Note - OC2, SC2** | Install the TX cable on the outside of the perimeter, and the RX cable on the inside. |

**Note - SC1**




Use the cable side with the ribbed surface as the receive cable and the cable side with the smooth surface as the transmit cable (by convention - ribbed = RX).

There are three types of sensor cables available with the OmniTrax system (see Cable installation overview on page 97). The type of cable to choose depends on the length of the perimeter, the selected cable path, and the installation space that is available. Figure 4: provides comparisons between the three available cable types.

- OC2 sensor cable is available in lengths of 300 and 400 m of detecting cable + 20 m lead-in. OC2 cable was designed specifically for use with the OmniTrax sensor, and is recommended for use in most instances. It is ideally suited for long perimeters with each processor capable of monitoring up to 800 m of sensor cable.
- SC2 sensor cable is available in lengths of up to 200 m of detecting cable + 20 m lead-in. SC2 was originally developed for the Perimitrax sensor and works very well with OmniTrax. SC2 cable is typically used at sites with shorter perimeters. One OmniTrax processor can monitor 400 m of SC2 sensor cable.
- SC1 sensor cable is available in lengths of up to 200 m of detecting cable + 20 m lead-in. SC1 cable combines both the transmit cable and the receive cable in a single outer jacket. SC1 cable is typically used at sites where the cable path meanders and turns due to numerous obstacles.

### Sensor cable burial depth

Sensor cable burial depth depends on the burial medium and may depend on perimeter obstacles (see Sensor cable burial depths on page 36). Cables should be buried at a uniform depth throughout each medium. The better the consistency of the burial depth, the better the system will perform. Typically, a tolerance of 10% of the burial depth or better is desirable. If the burial depth must be changed, do so gradually. If the surface grade changes by more than 30° in a distance of 4 m (13 ft.), even it out.

### Sensor cable spacing (OC2, SC2)

OC2 and SC2 transmit and receive cables are installed parallel to each other. The distance between the transmit and receive cables must remain constant over the length of a cable set. The detection field's size depends on both soil type and cable spacing. The minimum separation between the TX and RX cables is 10 cm (4 in.). The maximum separation is 2 m (6.5 ft.). The recommended cable spacing, which should be used whenever possible, is 1.5 m (5 ft.).

# Cable layout at processors

To ensure full continuous detection at a processor location the sensor cables are overlapped by 8 m (26 ft.) (see Sensor cable start points on page 115). The detection field requires approximately 4 m (13 ft.) from the red band on the cables to build up to full strength. Therefore, each cable comes with an additional 4 meters of detecting cable (e.g., 400 m OC2 cable includes 404 m of detecting cable). To provide continuous detection between both cable sets on one processor (A-side, B-side) the sensor cables must overlap at the point where the two detection fields reach full strength (4 m beyond the red bands). An 8 m overlap ensures continuous detection between the two cable sets, where the active cables begin.

**Note** An intruder who crosses the two cable sets where they overlap can be detected by both cable sets.

| | |
|---|---|
| **Note** | Use flags, stakes, or paint to mark the location of the red bands on the ground's surface. The red band's positions are required for sensor calibration. |

# Placement of decouplers

Decouplers are installed at the ends of sensor cable sets (see Installing decouplers and terminators on page 132) to terminate the radio frequency (RF) signals, which form the detection field. There are two types of decouplers. Network decouplers allow DC power and alarm data to pass from processor to processor over the cables. Standalone decouplers allow data to pass but block DC power. Typically, the detection field continues a short distance past the decouplers. However, different soil composition and cable spacing makes the length of the extended detection field vary from site to site.

A combination of site-specific factors occasionally results in a high clutter signal at decoupler locations, especially in SC1 single cable systems and narrow cable spacing applications. To screen out high clutter and prevent potential detection shadows at decoupler locations, Senstar recommends that decouplers be overlapped by 4 m (13 ft.) by forming active cable loops. The 4 m of overlapping detecting cable is defined as non-detecting in software, which prevents the high clutter and the resulting detection shadows. Install the decouplers side by side and at the same burial depth as the cables. The transmit cables from two adjacent cable sets are connected using decouplers and a cable loop, as are the corresponding receive cables (i.e., TXA to TXB and RXA to RXB).

| | |
|---|---|
| **Note** | Bury and seal decouplers according to the procedures for each medium (see (Installing decouplers and terminators on page 132). Bury decouplers at the same depth as the cables. If installing in concrete, place a metal or fiber-board plate over the slots to protect the decouplers until the sealant cures.<br>The active cable loops at decoupler locations DO NOT have to follow the minimum turn radius for detecting cable. Much tighter turns can be used providing that the smallest allowable bend radius of 15 cm (6 in.) is not violated.<br>Use flags, stakes, or paint to mark the location of the decouplers on the ground's surface. The decoupler's positions are required for sensor calibration. |

| | |
|---|---|
| **Note** | Maintain the separation between the TXA and TXB, and the RXA and RXB cables. |

For OC2 and SC2 cable, the decouplers must be lined up and parallel. The maximum distance from parallel alignment for OC2/SC2 decouplers is 30 cm (12 in.).

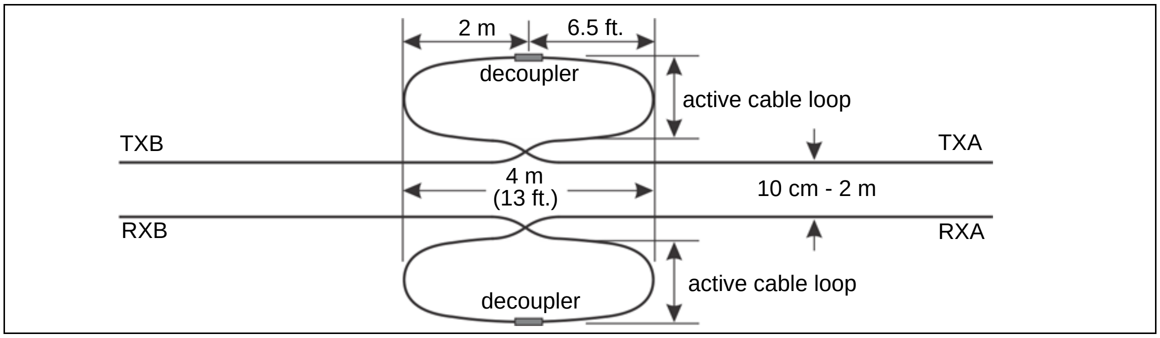



Figure 26: Decoupler overlap

### Decoupler options

There are four decoupler kits available for use with SC1, OC2 and SC2 sensor cables. Each decoupler kit includes:

- two decouplers
- heatshrink tubing

| Decoupler kit | Application |
|---|---|
| A3KT0601 | SC1 standalone decoupler (power blocking) |
| A3KT0701 | SC1 network decoupler (power passing) |
| A4KT1101 | OC2 network decoupler (power passing) |
| A4KT1102 | OC2 standalone decoupler (power blocking) |
| A4KT1201 | SC2 network decoupler (power passing) |
| A4KT1202 | SC2 standalone decoupler (power blocking) |

Use the network decoupler:

- to connect contiguous sensor cable sets from two processors where DC power and/or data is passing over the sensor cables

Use the standalone decoupler:

- to connect contiguous sensor cable sets where only data is passing over the sensor cables (no power)
- to connect contiguous sensor cable sets using local 12 VDC power supplies
- to connect the A-side cables and the B-side cables of a single processor to form a closed loop
- to terminate a single cable set at the end of a perimeter using terminators

# Perimeter termination

At each end of an OmniTrax perimeter, terminators are connected to the TX and RX cables through standalone decouplers. The terminator terminates the detection field and the data flow. Using the terminator provides increased flexibility for positioning the end points of the perimeter. Terminator kits are available for use with OC2, SC2 and SC1 sensor cable (see Installing terminators - OC2/SC2 sensor cable on page 139). For an OmniTrax system that forms a closed loop and uses terminators, the decouplers should be overlapped by 4 m.

# Connected blocks of processors

To provide optical isolation and to prevent the formation of a conductive path around the perimeter, Senstar recommends that each block of processors with sensor cables that are connected through decouplers, be limited to a maximum of five processors. Overlapping terminators should be used at the end of each block of five and the two adjacent processors at each end (e.g., processors 5 and 6) should be connected by a multi-mode fiber optic data link to enable processor synchronization and data communications. The fiber optic cable can be buried in a trench with the sensor cable. A block of five processors can cover up to 4 km (2.5 mi.) of perimeter length with OC2 sensor cable. Figure 35: illustrates a multi-block example of two optically isolated processor blocks with five processors in each block.

# Sensor cable supervision

The OmniTrax processor supervises the sensor cables. For new installations, cable pair supervision or clutter supervision are recommended. For retrofit applications using SC1 or SC2 sensor cable and terminators, clutter supervision is recommended. There are three methods for cable supervision available with the OmniTrax system:

- Clutter Supervision - the current level of clutter on the sensor cables is compared to a historical clutter level. When a change in the current clutter level exceeds the user-selectable Historic Variance parameter, a supervision alarm is declared on the cable side.
  Clutter supervision is intended for use primarily in OmniTrax retrofit perimeters, (Perimitrax upgrade - SC1 or SC2 single cable set using standalone decouplers and terminators). It is also the recommended supervision setting for an unused cable side.
- Cable Pair Supervision - standalone or network decouplers joining two cable sets from two processors (A-side and B-side). Standalone decouplers join the A-side and B-side sensor cables on a single processor. With cable pair supervision, the processor transmits error checking data bits over the connected cables (i.e., TXA to TXB and RXA to RXB). The processor also monitors and compares the clutter level as described in Clutter Supervision.
- Cable Set Supervision - for legacy installations using standalone decouplers and loopback cable assemblies at an open ended OmniTrax perimeter (single cable set, TX and RX). With cable set supervision, the processor transmits error checking data bits over the connected cables (i.e., TXA to RXA and TXB to RXB). The processor also monitors and compares the clutter level as described in Clutter Supervision. New installations should use terminators and Clutter supervision in place of loopback cable assemblies and cable set supervision.

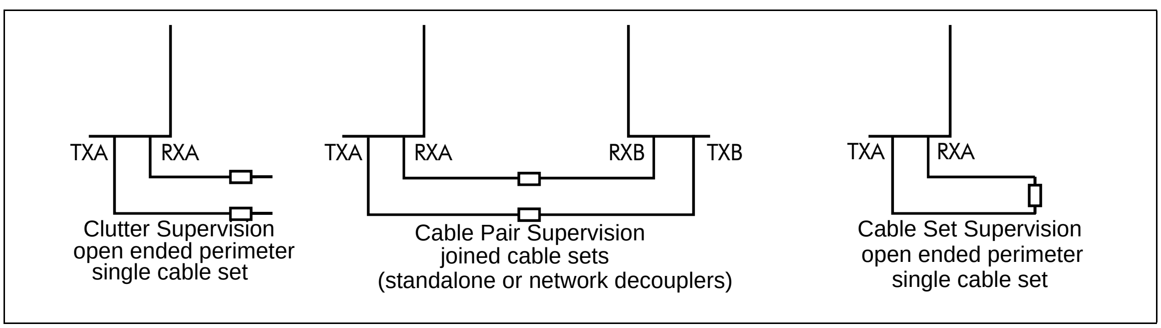



Figure 27: Sensor cable supervision options

# Alarm zone selection

Alarm zone selection depends on your method of alarm communication. A processor using relay output alarm communications can report two distinct alarm zones in the standard setup, and up to ten distinct alarm zones using the optional Relay Output Card (ROC). A processor using Silver Network communications can report up to 50 distinct alarm zones. OmniTrax alarm zones are defined in software and do not depend on cable length, or cable side. Each processor can monitor up to 50 distinct alarm zones spread over its two cable sets. OmniTrax alarm zones are made up of software defined cable segments. Each cable set can be divided into a maximum of 50 cable segments (100 per processor). The cable segments are defined by the UCM. The minimum length of a cable segment is 1 m, the maximum length of a cable segment is the full length of detecting cable (up to 400 m). A zone can be made up of one or more segments, and the segments making up the zone can be selected from anywhere along the processor's two cable sets.

### Alarm zone boundaries

Alarm zone boundaries are based on the unique physical aspects and security requirements of each site. Boundaries are defined in software, and can be changed in software if the security requirements change.

### Corners

Corners can be located anywhere along a cable set. However, the detection field tends to shift outward as the sensor cable turns around a corner. There can be a significant detection field overshoot if the turn radius is too small. To prevent a detection field overshoot, the smallest allowable turn radius is 7 m (23 ft.) (see Making gradual turns in soft mediums on page 38). Always measure the turn radius from the centerline of the detection field. This is located halfway between the cables for OC2 and SC2, and on the cable for SC1. Sensor cables must be routed in smooth gentle curves. If they are turned at sharp angles, the detection field can be disrupted. If a fence or other obstacle is near the corner, the field may detect the obstacle's motion and cause nuisance alarms. If cables are routed between two fences, the cable must be a minimum of 1 m (3 ft., 3 in.) from the inside fence at the closest point (see Figure 28:). To prevent nuisance alarms from fence noise, the turn radius should be increased to keep the inside cable farther away from the fence. The potential problems with fence noise can be overcome by maintaining the minimum separation distances or by installing a processor or decouplers at the corner.

When installing cables in concrete, make turns by cutting the slots in a series of three short lengths with 30º turn angles (for a 90º turn). The changes of direction should be separated by at least 3.6 m (12 ft.) (see Making gradual turns in concrete on page 39). Keep the turn in as smooth an arc as possible.

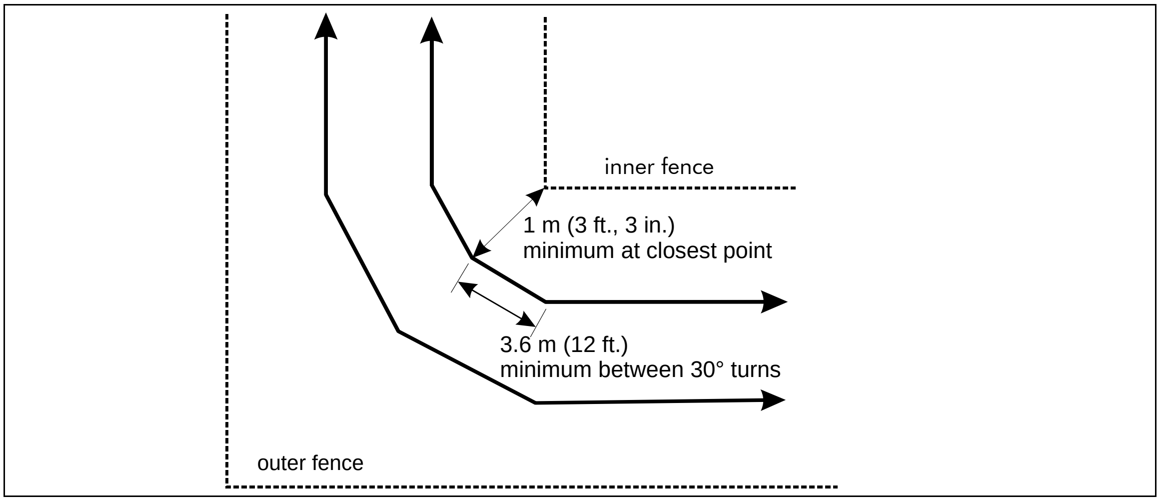



Figure 28: Sensor cable installed around corners in concrete slots

# Equipment location

## Processor

Consider the following guidelines when determining the processor locations:

- Always locate processors on the secure side of the perimeter.
- Each sensor cable starts with 20 m of lead-in cable. The processor should be installed away from the detection field. If your site requires that the processor be farther away, extra lead-in cable can be spliced onto the cable.
- Processors require a nearby connection to a low resistance earth ground.
- Processors can operate in temperatures (measured inside the enclosure) ranging from -40° to 70° C (-40° to 158° F) and humidity levels between 0% and 95%.

| | |
|---|---|
| **Note** | To protect processors from overheating due to exposure to direct sunlight, sun shields are recommended in areas with extended periods of hot sunny weather (or locate the processor in shade). |

- The processor location should be easily accessible for maintenance purposes.
- Processors are supplied inside weatherproof enclosures to protect the internal electronic components from environmental conditions. However, to protect the sensor cables and the sensor cable connections in outdoor installations, a telecom style protective enclosure is required (or a suitable customer-supplied enclosure).
- Position a local 12 VDC power supply close to the processor's location.
- The network power supply powers up to five processors. It connects to the middle processor with two on each side.

## Protective posts

Use protective bollards to protect the processor if it is located in an area that includes vehicle traffic. Install heavy gauge galvanized steel posts in a deep concrete base, and then fill the posts with concrete (see Figure 29:).

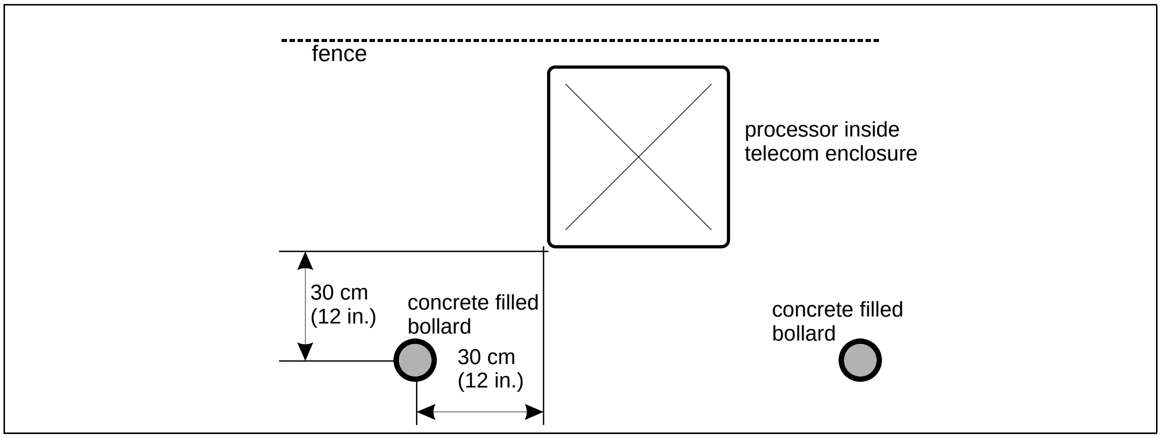



Figure 29: Installing protective bollards

# System power and data communication

The OmniTrax processor operates on 12 to 48 VDC and consumes 9 W (nominal). Senstar offers 12 VDC local power supplies, and a 48 VDC network power supply for use with the OmniTrax system.

| **Note** | In locations where the AC power may not be stable or reliable, Senstar recommends using an uninterruptible power supply (UPS) as the primary power source. |
|---|---|

OmniTrax alarm communication can be via relay contact outputs, or Senstar's Silver Network (see System power and data configurations on page 66 for examples). For relay communications, you make hard-wired connections between the processor and your annunciation equipment. The processor includes 4 on-board relays for signaling alarm, supervision and fail conditions. The optional Relay Output card (ROC) adds 8 additional relays for reporting alarm conditions.

Silver Network communications are via EIA-422 wiring, fiber optic cable, or over the OmniTrax sensor cables (between processors). Each processor communicating on the Silver Network requires a network interface card. The optional ROC adds 8 relay outputs, which are operated by the host security management system. The optional Universal Input Card can be installed to provide 8 additional inputs to the host system. With network communications, one or more processors connect to a Network Interface Unit (NIU) via EIA-422 or fiber optic cable. The NIU translates the alarm data and passes it on to the Windows-based Silver Network Manager (NM). The NM interprets the alarm data and passes it on to a PC-based security management system (e.g., Senstar's Alarm Integration Module, or StarNeT 1000). Network communications enables precise target location and software controlled alarm zone configuration.

Network data traffic passing between processors is retimed and retransmitted at full strength at each node. The Silver Network communicates at a fixed baud rate of 57.6 k. With EIA-422 communications, the processors can be separated by a maximum distance of 1.2 km (0.75 miles). Data-grade individually shielded twisted pair cable (2 pairs) should be used for EIA-422 data paths. Using 62.5/125 multi-mode fiber optic cable, the separation distance can be increased to a maximum of 2.2 km (1.35 miles). For the maximum separation distance of 10 km (6.3 miles), use 9/125 single mode fiber optic cable. For sensor cable communication, the sensor cables from one processor are connected to the sensor cables from the next processor though decouplers, for a maximum separation between processors of 800 m (0.5 miles). There are two types of decouplers available. Network decouplers allow the data signals and power to flow from processor to processor, while terminating the RF detection field. Standalone decouplers pass the data while blocking the flow of DC power over the sensor cables. Standalone decouplers also terminate the detection field.

## System power

| **Note** | DO NOT bring AC mains power into the OmniTrax enclosure. If a local power supply is being used outdoors, it must be installed in its own weatherproof enclosure. Consult the local electrical code for information about the connection of AC mains to your power supply. |
|---|---|

| **Note** | Senstar strongly recommends the use of a shielded power cable with the shield connected to ground at only one end of the power cable. |
|---|---|

# Powering options

- power (and data) via the sensor cables
  48 VDC power is connected to one or more processors, and distributed to the other processors via the sensor cables (requires network decouplers)
  (Power can be sent over the TX cables, the RX cables, or over both cables, to provide powering redundancy.)
- local power - individual power supply at each processor
  typically, a 12 VDC power supply installed at each processor location

| | |
|---|---|
| **Note** | The 48 VDC power supply can be used as a local power supply. |

- network power - separate power cables daisy-chained to each processor around the perimeter
  (A centrally located 48 VDC network power supply provides a direct power connection to each processor.)

| | |
|---|---|
| **Note** | Follow the recommended separation distances between the sensor cables and power cables. |

### Power and data via the sensor cables

With OmniTrax, both power and data communications can be carried from processor to processor over the sensor cables. This is the preferred method for powering and data communications as it greatly reduces the amount and cost of both power and data cable installation. In this case, a network power supply is connected to one processor, and that processor passes the power over the sensor cables to the other processors. The data connection between the Network Interface Unit (NIU) and the OmniTrax system can also be made at one processor with the remaining processors communicating over the sensor cables. However, data connections between the NIU and two processors provides data redundancy. The power and data connections do not have to be made at the same processor. An added benefit is that the power and data distribution is protected from tampering by being carried by the inherently secure sensor cables.

| | |
|---|---|
| **CAUTION** | When using a 48 VDC supply to power multiple processors over the sensor cables there is a limit of 5 OmniTrax processors per power supply. The power supply must be connected to the central processor with the power distributed to the remaining processors in both directions with 2 on each side. |

### Local power

For a single processor system, or for a system with widely distributed or remotely located processors, individual 12 VDC power supplies are a good choice.

- **local power** - a standalone 12 VDC power supply is installed at each processor location (for outdoor installation, the local power supply requires its own weatherproof enclosure)
  (The optional 6 VDC local backup battery can provide approximately 2 hours of emergency backup power.)

**General system powering rules (local power)**

| | |
|---|---|
| **Note** | Processors, which receive 12 VDC local power must use standalone decouplers. |

For the local power option, each processor requires its own 12 VDC power supply. When using a local power supply, keep the power cable run between the power supply and the processor as short as possible.

### Network power

An OmniTrax system with multiple processors distributed around a perimeter can be powered by one or more 48 VDC network power supplies. Network power can be routed around the perimeter in a single direction, or redundantly, depending on the site requirements.

| | |
|---|---|
| **Note** | Processors being powered over the sensor cables must use network decouplers. |

- **network power** - a centrally located 48 VDC network power supply provides power for each processor
  - a 48 VDC power supply can be connected to one or two processors, and the power can be carried around the perimeter to the other processors via the sensor cables
  - power cables can be daisy-chained from a 48 VDC power supply to each processor
  - the 48 VDC power supply can be powered from a large capacity UPS to provide back-up power for all processors
  - each processor supports the addition of an optional 6 VDC, 5 Ah (nominal) battery for local backup power
  - a processor receiving 48 VDC network power can supply 12 VDC @ 150 mA power to an auxiliary device by installing an optional auxiliary power module

**General system powering rules (network power)**

A single 48 VDC network power supply can power up to five OmniTrax processors.

- the network power supply must be connected to the middle processor with two processors on each side
- the sensor cables must be connected using network decouplers, which pass power and data
- if more than five processors are required for the system, a second block of up to five processors can be connected to the first block using standalone decouplers, which block power while passing data

## Power supply options

There are two power supply options available from Senstar for the OmniTrax system:

- C7EM0503 - 12 VDC power supply mounted on a steel baseplate with no enclosure for a standalone, single processor application
  The power supply provides a regulated 12 VDC, 80 W output. It operates on 115/230 VAC, 60/50 Hz input.
- A4EM0200 - a 48 VDC network power supply (for up to 5 processors)
  The network power supply provides a regulated 48 VDC, 100 W maximum output. It operates on 115/230 VAC, 60/50 Hz input. The 48 VDC supply comes in a lockable CSA type 4 weatherproof enclosure (see Figure 143:).

## Battery power

Each OmniTrax processor supports the addition of an optional 6 VDC gel-cell battery, which mounts inside a bracket on the enclosure door. The processor includes an intelligent charging circuit, that when enabled, keeps the battery fully charged. If the optional battery is installed and enabled, the processor automatically switches to battery power on the loss of the DC power input.

| **Note** | The optional local battery is not intended for use as a primary power source. It provides approximately 2 hours of emergency backup power in the event of an AC power failure. |
|---|---|

There are two optional batteries available for applications requiring extended run time in the event of AC power failure. The 6 Ah battery (00KT0100) will provide a minimum of 4 hours of battery operation. The 2.9 Ah battery will provide approximately 2 hours of battery operation. The power supply is capable of charging a customer supplied battery of up to 20 Ah capacity.

# Alarm data communications

There are two selectable control modes for the OmniTrax processor's inputs and outputs (I/O) local control mode and remote control mode. You set the control mode in software, via the Universal Configuration Module (UCM) which is a Windows-based software application. The default setting is local control mode, in which the OmniTrax processor controls the on-board relays to signal alarm and supervision conditions. In local control mode, the two Aux (auxiliary) inputs are self-test inputs to the processor. In remote control mode, the alarm data is carried over the Silver Network to a host security management system. Remote control mode enables the security management system to control the processor's relays as output points to operate other security equipment. The two Aux inputs provide inputs to the host security system for reporting the status of auxiliary devices. In both communication modes, you can configure the processor's input/output response according to your site-specific requirements.

- **local control mode** - hard-wired contact closure alarm data connections and self-test input wiring connections are made between the processor and the annunciation equipment (4 output relays, 2 self-test inputs) (the optional Relay Output card provides 8 additional outputs for reporting alarm conditions)
- **remote control mode** - the alarm data communications are via the Silver Network - EIA-422 copper wire data paths or fiber optic cables connect one or two processors to the Network Interface Unit (NIU), the remaining processors can be connected via EIA-422 wiring, fiber optic cable, or data can be carried between processors via the sensor cables
  the 4 output relays are available as output control points from the host system (the optional Relay Output card provides 8 additional relays, which are also available as output control points), the 2 auxiliary device inputs are available for reporting the status of auxiliary equipment to the host system (the optional Universal Input Card provides 8 additional inputs, which are also available for connecting auxiliary equipment to the host system)

| **Note** | All processors communicating over the Silver Network require a network interface card (NIC).<br>A processor can use either an ROC or a UIC, but not both. |
|---|---|

## Alarm communication options

- contact closure alarm communications (local control mode) up to 10 distinct alarm zones per processor (requires optional ROC) + supervision and fail
- built-in data communication network, secure data passes between processors over the sensor cables
  (One or two processors have a Silver Network connection to the NIU.)
- Silver Network data communications are daisy-chained to each processor around the perimeter using either EIA-422 copper wire data paths or fiber optic cable

| **Note** | You can use a combination of the above methods for powering and data communications. |
|---|---|

| | |
|---|---|
| **Note** | A Silver Network based processor can use local control mode to operate its output relays and Aux inputs. |

| | |
|---|---|
| **Note** | Each processor communicating on the Silver Network, or via the sensor cables, requires a Network Interface Card (NIC). |

# Local control mode

### Local control mode default relay functions

The following table lists the relays and the self-test inputs, along with their default functions for local control mode.

| | |
|---|---|
| **Relay K1 - Fail** | internal processor hardware faults<br>internal processor software faults<br>internal communication failure<br>DC input power fail (regardless of battery state)<br>ADC input signal exceeds range<br>**NOTE**: The Fail relay activates for 5 seconds to indicate that the processor has been powered up or reset. |
| **Relay K2 - Supervision** | sensor cable supervision<br>enclosure tamper<br>Aux 1 or Aux 2 supervision<br>DC input power fail (battery is not installed or is not charged) |
| **Relay K3 - Alarm A** | Sensor alarm (user configurable) |
| **Relay K4 - Alarm B** | Sensor alarm (user configurable) |
| **Aux 1 - Self-test 1** | closed = self-test A-side |
| **Aux 2 - Self-test 2** | closed = self-test B-side |

#### Fail-safe relay operation

In the default configuration, relays K1 (Fail) and K2 (Supervision) operate in fail-safe mode. During normal operation, both relays latch in the non-alarm state. In the event of a DC input power failure, the Fail relay changes to the alarm state. In the event of a DC input power failure, and there is no battery installed, or the battery is not charged, or the battery discharges to a level below the minimum threshold, the Supervision relay changes to the alarm state. Fail-safe operation is user-selectable for each of the processor’s four relays.

#### Local control mode functions (self-test inputs)

In local control mode, the two AUX I/Ps on the OmniTrax processor are self-test inputs. When there is a momentary switch input to an AUX input, the processor compares the current clutter level to the recorded historic clutter level on the respective cable side (AUX1 = A side cable, AUX2 = B side cable). If the current clutter level is within the Historic variance parameter (default = 12 dB) of the historic clutter level, the processor activates all relays that are assigned to the cable side. AUX1 activates all relays that are assigned to Side A. AUX2 activates all relays that are assigned to Side B. If the current clutter level deviates from the historic clutter level by more than the Historic variance parameter, the relays do not activate (self-test fails).

For local control mode, the input wiring configuration must be unsupervised with NO contacts (a momentary switch input). The Filter Window parameter (via the UCM) allows you to set the time period for which an input must be active, before a self-test occurs.

# Remote control mode

You can select Remote control mode for Silver Network based processors via the UCM software. Remote control mode enables the host security management system to operate the processor's relays as output control points, and to use the Aux inputs as auxiliary device inputs to the host system. The optional ROC provides 8 additional relays, which are also controlled by the host system. The optional UIC provides 8 additional inputs to the host system. A processor can use either a ROC or a UIC, but not both. In remote control mode, you configure the processor's input/output response according to your site-specific requirements.

| | |
|---|---|
| **Note** | Silver Network based processors can use local control mode to operate their inputs and outputs. |

### Remote control mode functions

In remote control mode, the host security management system controls the output relays. The relays function as output control points, generally to activate other security equipment (e.g., lights, doors, sirens, CCTV equipment, etc.). The AUX inputs serve as auxiliary device inputs to the host system, for example, to report the status of a microwave, magnetic contact, or other security device. Figure 156: illustrates the relay output and auxiliary input wiring connections for remote control mode. Figure 157:, Figure 158:, and Figure 159: are sample circuit diagrams of OmniTrax auxiliary inputs using the recommended input wiring configurations.

The relay output card (ROC) (P/N 00BA0400) includes eight output relays to supplement the four output relays available on the OmniTrax processor. In local control mode, you configure the ROC's relays to respond to sensor alarm conditions. With an ROC installed, a Processor can report 10 distinct alarm zones via contact closure outputs. The alarm zones and corresponding relays are configured via the UCM. In remote control mode, the host security management system operates the ROC's eight relays, as output control points, (e.g., to activate lights, doors, sirens, CCTV equipment, etc.). You can configure the relays as latching (ON by command, OFF by command), in flash mode (ON-OFF-ON-OFF, etc. by command, then OFF by command), or pulse mode (ON for a period, then OFF). For flash and pulse modes, the Active/Inactive times are selectable.

The universal input card (UIC) (P/N 00BA1200) includes eight inputs to supplement the two inputs available on the OmniTrax processor. You can use the UIC in local control mode. However, you would have 8 inputs and two cable sets reporting alarm conditions over only two relays (not recommended). In remote control mode, the UIC's 8 inputs connect auxiliary devices to the host security management system (e.g., to report the status of other security equipment such as a microwave or magnetic contact). The Filter Window parameter allows you to set the time period for which an input must be active, before an event is reported.

# Processor address

Each OmniTrax processor using network communications requires a unique network address (the default address is 1; the valid address range is from 1 to 60). For Silver Network based systems, the Network Manager uses the processor address to identify each processor for communications. Assign address number 1 to the processor at the beginning of the perimeter. Assign other processors sequential address numbers around the perimeter. Record the address numbers on the site plan. Standalone systems, which use relay output alarm communications, can use the default address of 1.

## Using a maintenance network for standalone processors

| | |
|---|---|
| **Note** | Senstar strongly recommends setting up a maintenance network for use with the OmniTrax sensor. |

Although a network interface card (NIC) is not required for standalone processors using relay output alarm communication, an NIC enables a Silver Network for maintenance purposes. Installing an NIC and communication wiring between the processor and the central control facility enables the use of a maintenance computer running Senstar's Network Manager and Universal Configuration software. This allows a technician to connect to the OmniTrax processor remotely to perform maintenance, diagnostic and calibration activities. If an NIC is not installed, the connection to the UCM must be made at the processor's location, through the USB port.

## NM Mode

The OmniTrax processor can be configured to report alarm and supervision conditions through the UltraLink modular I/O system. In NM Mode, the UltraLink I/O processor acts as the Network Manager, providing alarm outputs for a connected network of up to eight Silver devices. In NM Mode, the Silver devices do not require a connection to a PC running Silver Network Manager software. Sensor alarms and supervision conditions are assigned to UltraLink I/O outputs (relay or open collector). When an alarm occurs on a connected sensor, the corresponding UltraLink I/O output is activated (see NM Mode on page 249 for additional details).

# System power and data configurations

The following methods are available for OmniTrax alarm data communications:

- contact closure alarm output - 4 on-board relays + 8 optional relays via ROC = 10 distinct alarm zones per processor + tamper and fail (local control mode)
- Network Manager mode - up to 128 outputs available via the UltraLink modular I/O system for reporting alarm and supervision conditions (plus on-board relays and option card relays)
- Silver Network data - EIA-422 or fiber optic data paths (up to 50 distinct software defined alarm zones per processor and precise target location)
- Silver Network data - alarm data between processors via the sensor cables, at least one processor requires a data connection to the NIU (up to 50 distinct software defined alarm zones per processor and precise target location)

| | |
|---|---|
| **Note** | Connecting two processors to the NIU will provide data redundancy. |

## Standalone power/contact closure alarm

A standalone system using local power supplies and contact closure alarm reporting can include a single processor, or many independent processors. Figure 30: illustrates three OmniTrax processors using local power supplies and reporting alarms via contact closure interface.

| | |
|---|---|
| **Note** | It is possible to use relay output alarm communications and setup a Silver Network for maintenance purposes. This enables calibration, maintenance and diagnostic access to your OmniTrax processors from a central control facility. |

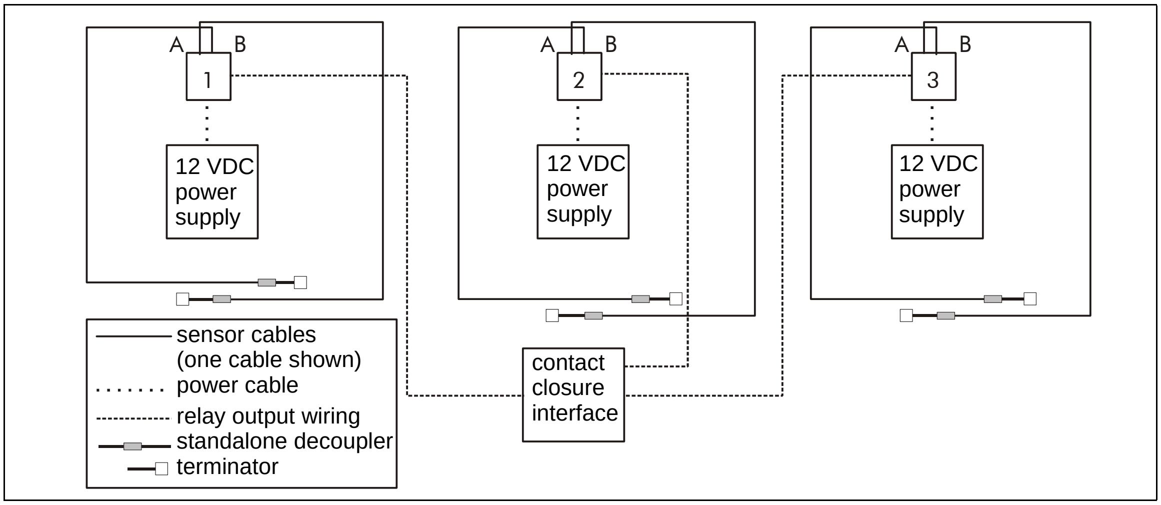



Figure 30: Standalone OmniTrax processors

A group of processors can receive local 12 VDC power, and communicate over the Silver Network.

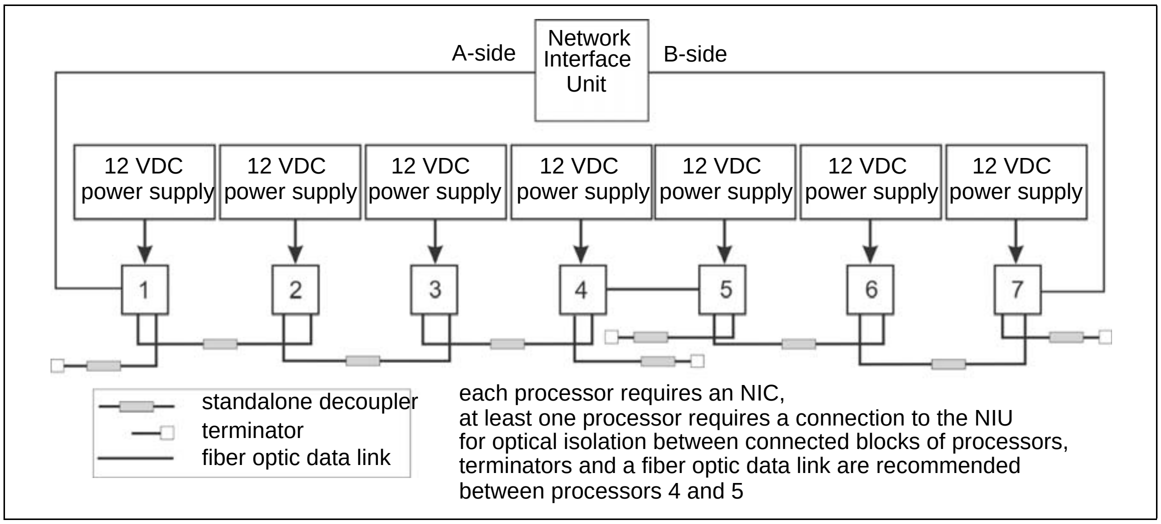



Figure 31: Local power and network data

# Network power

One 48 VDC network power supply can provide power for up to five processors.

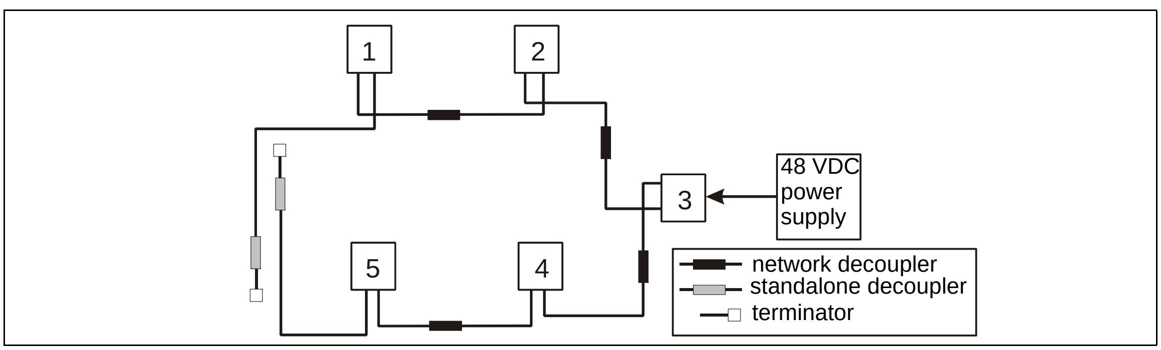



Figure 32: Closed perimeter, single block configuration

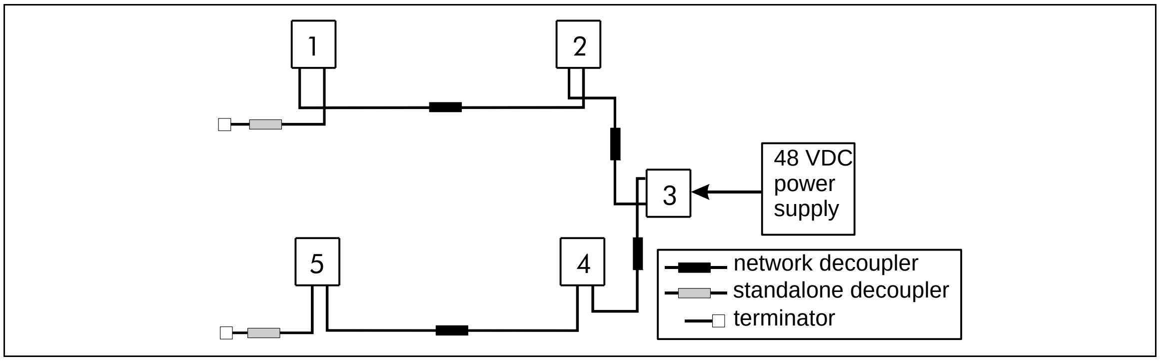



Figure 33: Open perimeter, single block configuration

The one network power supply, single block configuration can be laid out as a closed perimeter, an open perimeter, or in a linear configuration.

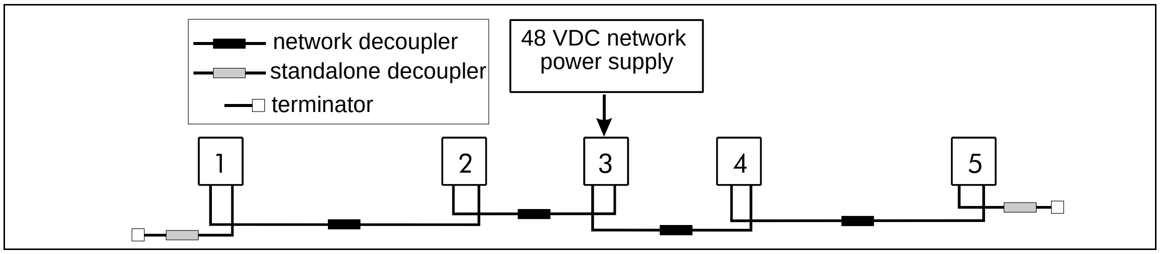



Figure 34: Linear configuration

A multi-block configuration is used whenever there is a requirement to supply network power to more than five processors via the sensor cables. One 48 VDC network power supply is used to power each block of processors. The data connection between the blocks can be made between any two processors, which maintain the loop configuration. For multi-block configurations, Senstar recommends sensor cable connected blocks be limited to 5 processors per block. Overlapped terminators ensure a closed perimeter, and a fiber optic data link provides optical isolation.

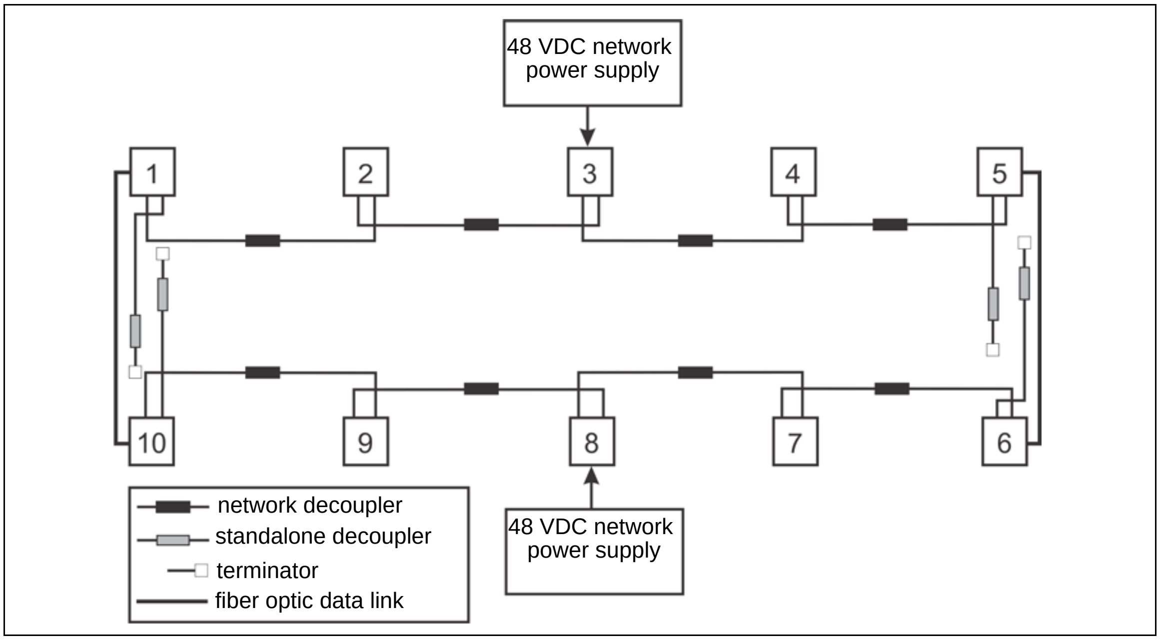



Figure 35: Closed perimeter, multi-block configuration

In a configuration that is set up for dual direction data redundancy the Silver Network A-side data path is connected to one processor and the B-side data path is connected to a second processor. This enables the data to flow in two directions. Because of this, two cut cables will not disable the entire system.

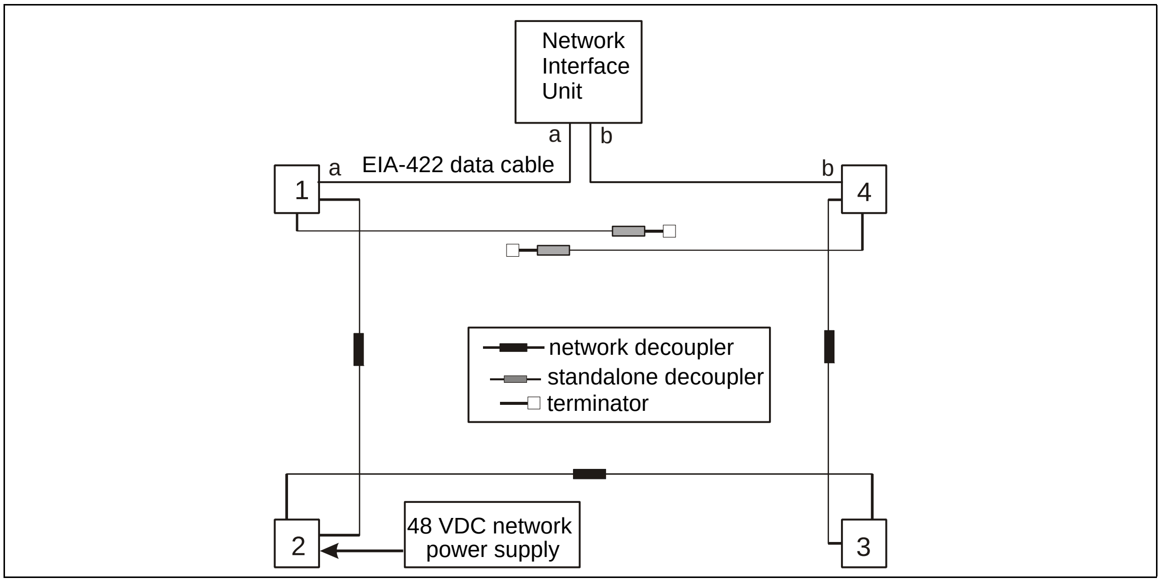



Figure 36: Dual direction data redundancy

You can use network power and relay output alarm communications. Appendix c provides details on using UltraLink I/O system relays and outputs to report OmniTrax alarm and supervision conditions by running the UltraLink system in Network Manager mode.

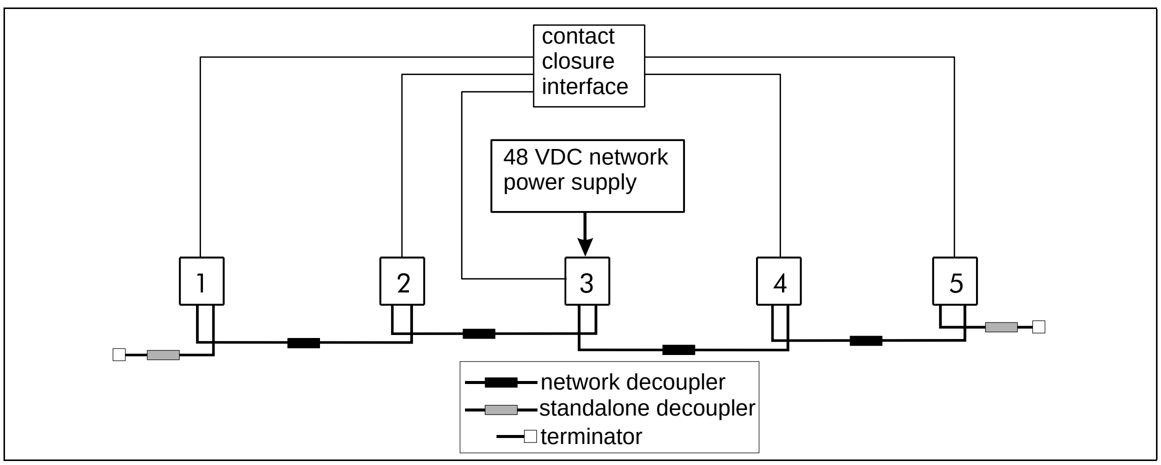



Figure 37: Network power and relay output alarm data

# Additional lightning protection

All power and data circuits on the OmniTrax processor and the Network Interface Unit include lightning and transient protection. Senstar recommends the use of additional lightning protection devices for the sensor cables (see Sensor cable lightning protection on page 179) and at points where EIA-422 copper wires exit or enter a building in areas that experience lightning and thunder storms. Figure 38: illustrates the use of additional lightning protection on the data lines between an OmniTrax processor and a Network Interface Unit.

| | |
|---|---|
| **Note** | Senstar strongly recommends the use of lightning protection devices anywhere copper wires enter, or exit, a building. |

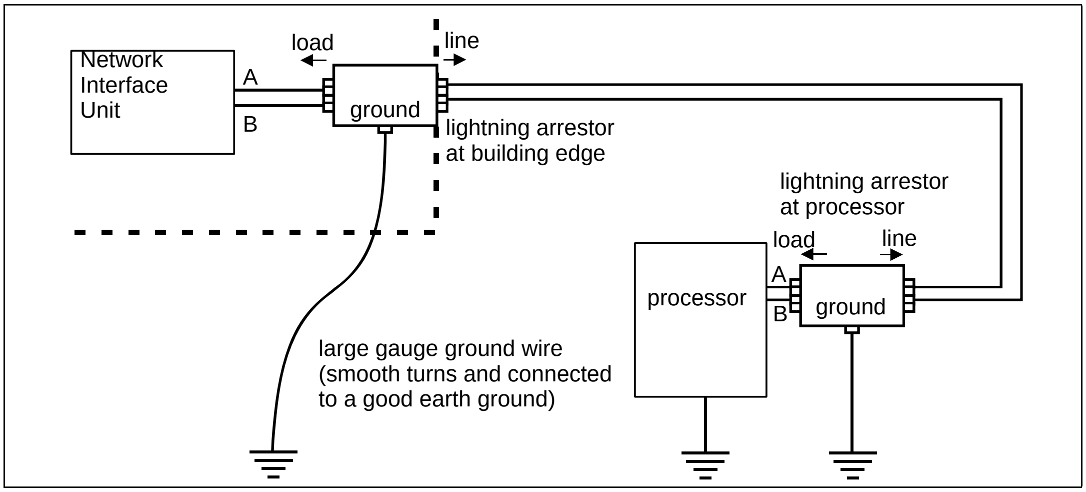



Figure 38: Data link lightning protection

# System design

The next step is designing the OmniTrax system. The information gathered in the site survey, is used to select the cable path, the system components, and the components locations. A checklist has been provided to assist in system design.

| ✓ | **Description** |
|---|---|
| | **Adjust the proposed cable path to accommodate:** |
| | Locations of obstacles |
| | **Zone layout details** |
| | Indicate total perimeter length, and the beginning and end of the perimeter |
| | Indicate individual cable segments and the length of each segment |
| | Indicate alarm zone boundaries and the length of each zone |
| | Indicate burial mediums along the cable route |
| | Indicate locations, sizes and turn angles of corners |
| | Indicate sensor cable bypasses (hardware/software bypasses) |
| | Indicate burial depth of cables in each zone |
| | Indicate cable spacing in each zone (OC2, SC2) |
| | Indicate start point overlaps |
| | Indicate lead-in cable path to processor |
| | Indicate decoupler/terminator overlap |
| | **Equipment locations** |
| | Indicate location of processors, decouplers, loopback cables, power supplies, power distribution, network interface unit, security management system, type and location of data communication wiring, etc. |
| | **Prepare interconnect diagram** |
| | **List equipment requirements** |
| | **Prepare revised site drawings** |

# System drawings

Prepare a large-scale site plan that shows the location of all OmniTrax equipment, the exact routing and length of the sensor cables (including lead-in cable) and the locations of the red marks, which indicate the beginning of the detecting cable. Label the transmit and receive cables in each cable set and indicate the cable segments, alarm zone boundaries, alarm zone numbers, processor addresses, decouplers, terminators, and any other site specific system features.

Prepare separate drawings that show the installation details at each processor, at corners, at decouplers/terminators, and at other section of the perimeter where the installers will require specific details. Prepare an interconnection diagram that shows the connections between the system components.

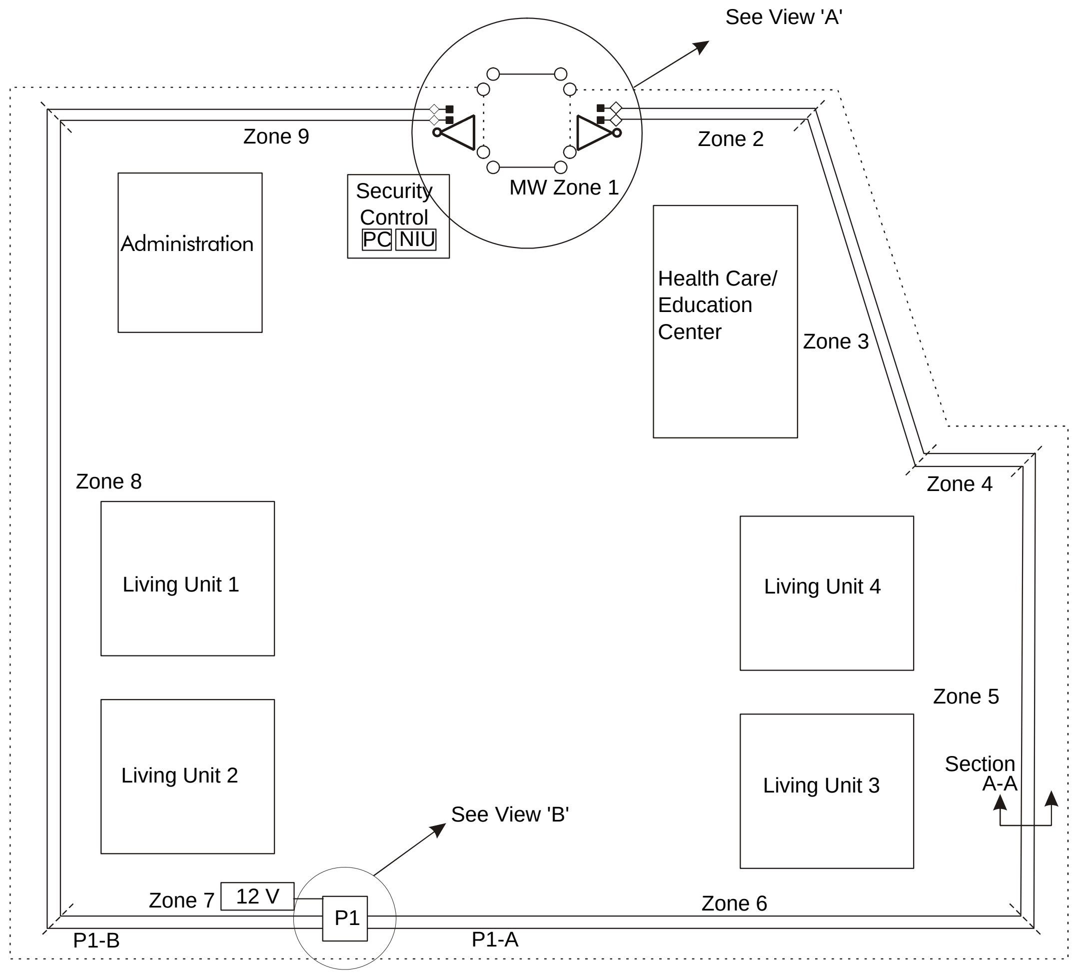
## Sample site drawings

The following drawings include sample site plans of standalone and network based OmniTrax systems. The standalone system is comprised of a single OmniTrax processor with two OC2 cable sets using relay output alarm communications. It also includes an UltraWave microwave sensor and a Silver Network for maintenance purposes. The maintenance network enables remote configuration, diagnostics and maintenance activity for the OmniTrax sensor.

| | |
|---|---|
| **Note** | Senstar recommends a maintenance network be setup for OmniTrax processor’s, which use relay output alarm communications. A maintenance network enables remote configuration, diagnostic and maintenance activities (from a central control station). Otherwise, you require a direct USB connection at the processor to perform these functions. |

The network system includes four OmniTrax processors, one UltraWave microwave and a Silver Network for alarm data communications.

| LTR | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| | CONFIGURATION BASELINE | | |




NOTE:

1. Fences are 8 m apart; cables are buried 1.5 m apart (inside perimeter fence not shown).
2. Refer to site survey for distance measurements.
3. See table on Page 3 for Processor configurations.
4. Zone layout sequential clockwise.
5. Relay output alarm communication cable and EIA-422 data cables bundled along fence top between processor and NIU.

| LEGEND | |
|---|---|
| SYMBOL | MEANING |
| P1 | OmniTrax PROCESSOR |
| Zone # | ALARM ZONE LABEL |
| - - - - | ALARM ZONE BOUNDARY |
| NIU | NETWORK INTERFACE UNIT |
| PC | NM & UCM COMPUTER |
| ◁ | UltraWave MICROWAVE |
| 12 V | POWER SUPPLY |
| ◇■ | TERMINATOR |
| ............. | OUTSIDE PERIMETER FENCE |
| P1-A | PROCESSOR CABLE ID |

Sample OmniTrax OC2 Site Plan
1 Standalone processor, 1 Microwave
(Relay Output Alarm Communications
NM & UCM Computer for Remote
Maintenance and Diagnostic Activity)

| SIZE | FSCM No. | PART NUMBER | |
|---|---|---|---|
| B | | DRAWING NUMBER | VAR. |
| SCALE | | SHEET 1 OF 3 | |

Figure 39: Sample site drawing (standalone system - block diagram)

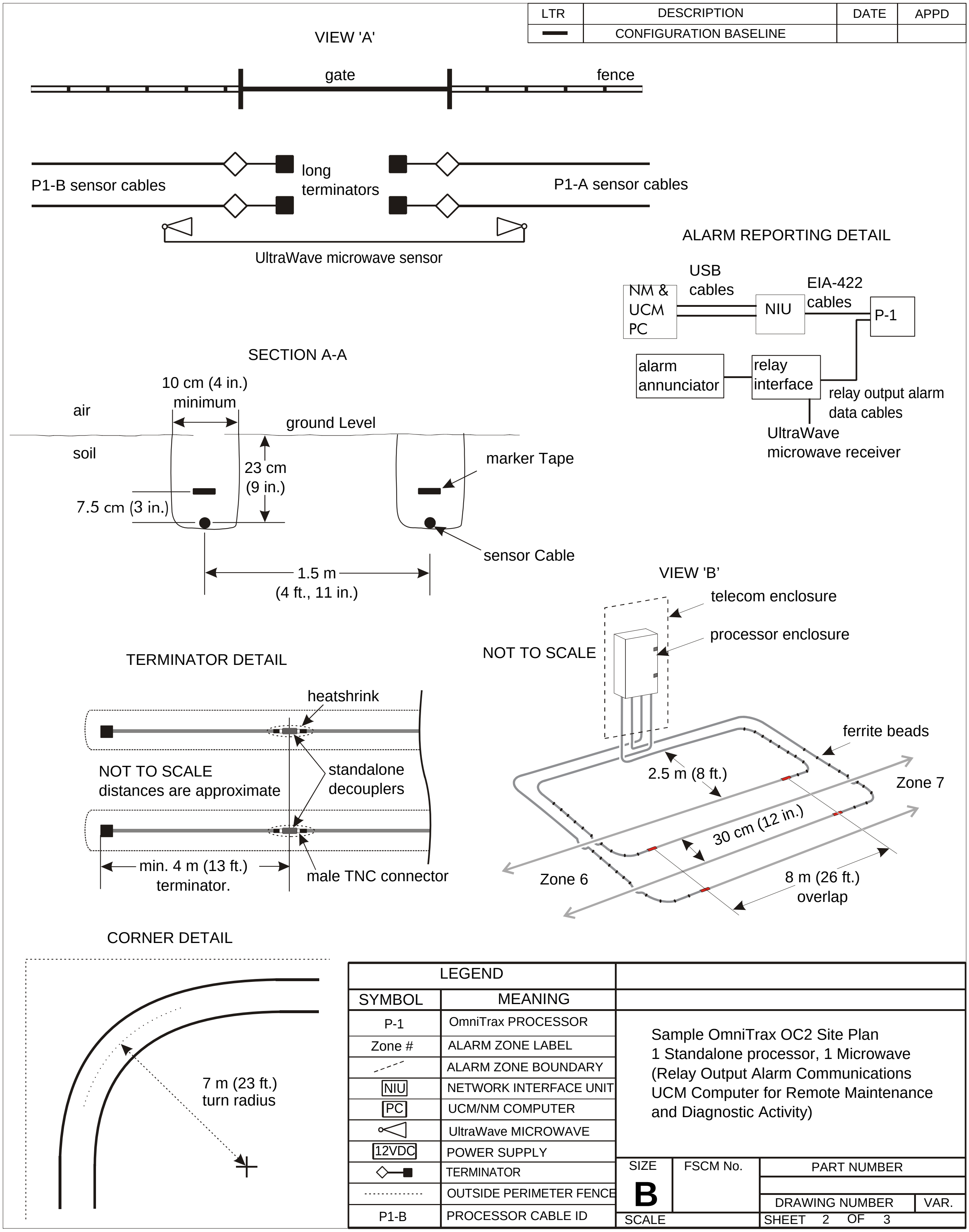



Figure 40: Sample site drawing (standalone system - details)

| LTR | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| — | CONFIGURATION BASELINE | | |

## PROCESSOR #1 CONFIGURATION

| EQUIPMENT | PART NUMBER |
|---|---|
| PROCESSOR & ENCLOSURE | A4EM0101 |
| TELECOM STYLE ENCLOSURE | A4MA0200 |
| RELAY OUTPUT CARD | 00BA0400 |
| NETWORK INTERFACE CARD * | 00BA0302 |
| OC2 CABLE SET 300M | A4FG0121 |
| OC2 CABLE SET 400M | A4FG0120 |
| OC2 TERMINATOR | A4KT01300 |
| SENSOR CABLE LIGHTNING ARRESTORS | A4KT1000 |
| DATA LINE LIGHTNING ARRESTORS | E0302 |

## PROCESSOR SETTINGS

| | |
|---|---|
| SUPERVISION | = CLUTTER |
| CABLE TYPE | OC2 |
| AUX CONTROL | LOCAL |
| AUX CARD | RELAY |
| RELAY ACTIVATION | LATCHING |
| RELAY HOLD TIME | 2 seconds |
| ALARM ZONES | 7 |
| FUSES | F3 & F4 IN |

## UltraWave MICROWAVE CONFIGURATION

| EQUIPMENT | PART NUMBER |
|---|---|
| TRANSMITTER AND RECEIVER | E4FG0101 |
| 12 VDC POWER SUPPLY | E6FG0300 |
| DATA LINE LIGHTNING ARRESTORS | E0302 |

## MISCELLANEOUS EQUIPMENT

| EQUIPMENT | PART NUMBER |
|---|---|
| OC2 CABLE INSTALLATION TOOL KIT | A4KT0200 |
| 12 VDC POWER SUPPLY | C7EM0501 |
| UCM USB CABLE | GE0444 |

## SECURITY CONTROL CONFIGURATION

| EQUIPMENT | PART NUMBER |
|---|---|
| NETWORK INTERFACE UNIT * | 00EM0200 |
| NETWORK MANAGER SOFTWARE * | 00FG0200 |
| UNIVERSAL CONFIGURATION MODULE SOFTWARE | 00SW0100 |
| DATA LINE LIGHTNING ARRESTORS | E0302 |

* Equipment indicated by an asterisk is optional and is required only for Standalone systems which employ a Maintenance Network. The Network Interface Unit can be replaced with a compatible media converter in this configuration.

LEGEND

| SYMBOL | MEANING |
|---|---|
| P1 | OmniTrax PROCESSOR |
| Zone # | ALARM ZONE LABEL |
| - - - - | ALARM ZONE BOUNDARY |
| NIU | NETWORK INTERFACE UNIT |
| PC | NM/UCM COMPUTER |
| | MPS-4100 MICROWAVE |
| 12VDC | POWER SUPPLY |
| | TERMINATOR |
| ............... | OUTSIDE PERIMETER FENCE |
| P1-A | PROCESSOR CABLE ID |

Sample OmniTrax OC2 Site Plan
1 Standalaone processor, 1 Microwave
(Relay Output Alarm Communications
UCM Computer for Remote Maintenance
and Diagnostic Activity)

| SIZE | FSCM No. | PART NUMBER | |
|---|---|---|---|
| B | | DRAWING NUMBER | VAR. |
| SCALE | | SHEET 3 OF 3 | |

Figure 41: Sample site drawing (standalone system - equipment configuration)

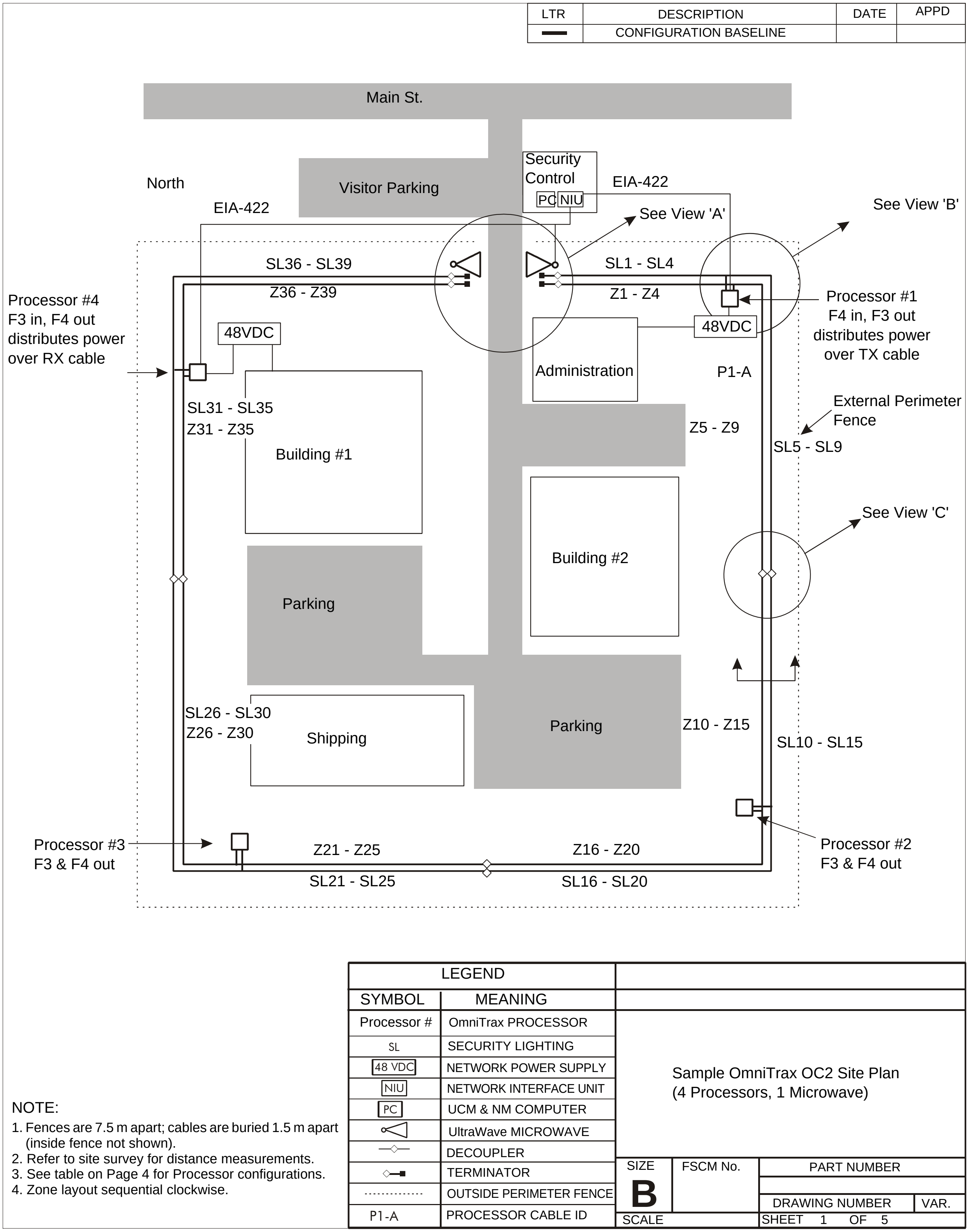



Figure 42: Sample site drawing (network system - block diagram)

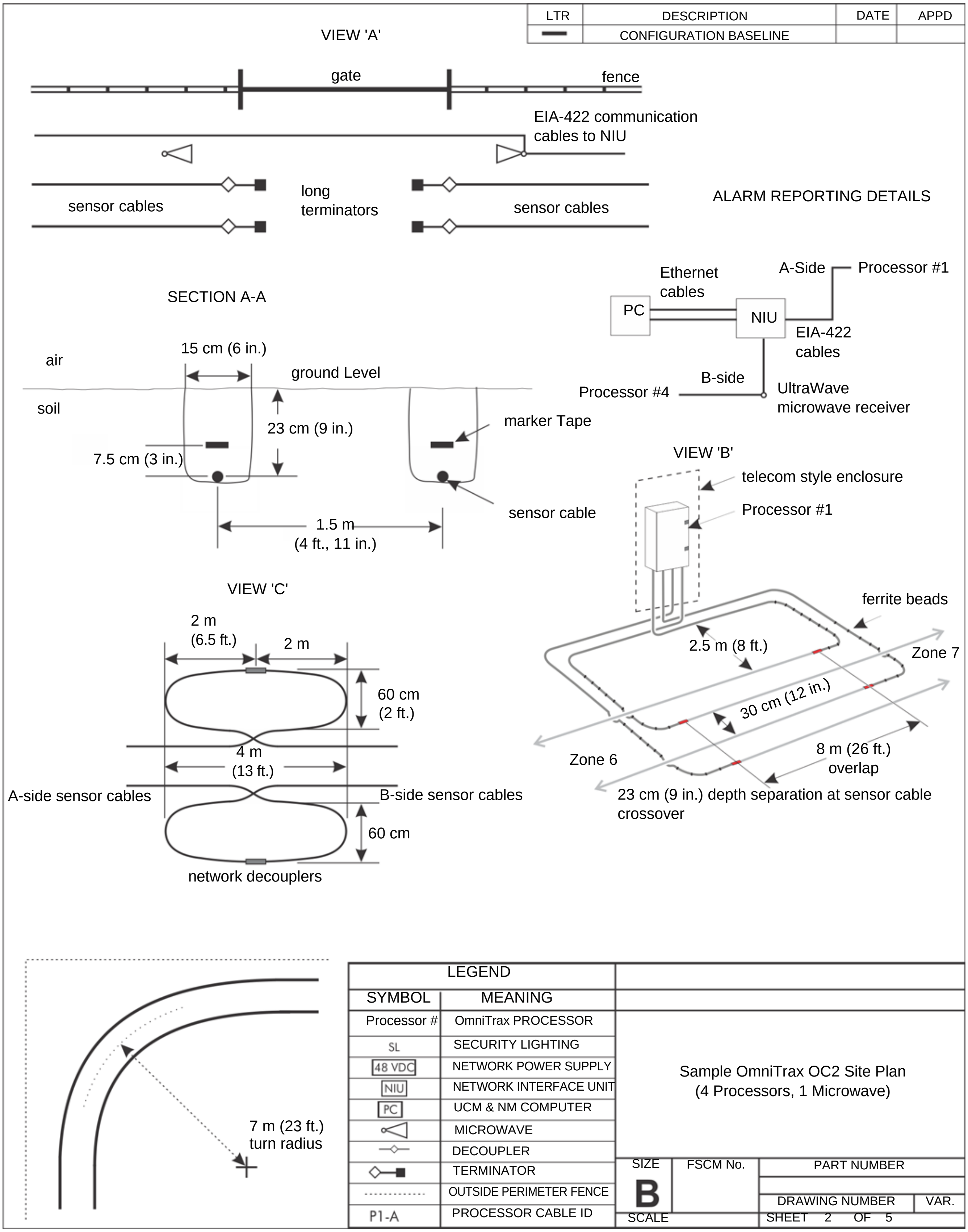



Figure 43: Sample site drawing (network system - details)

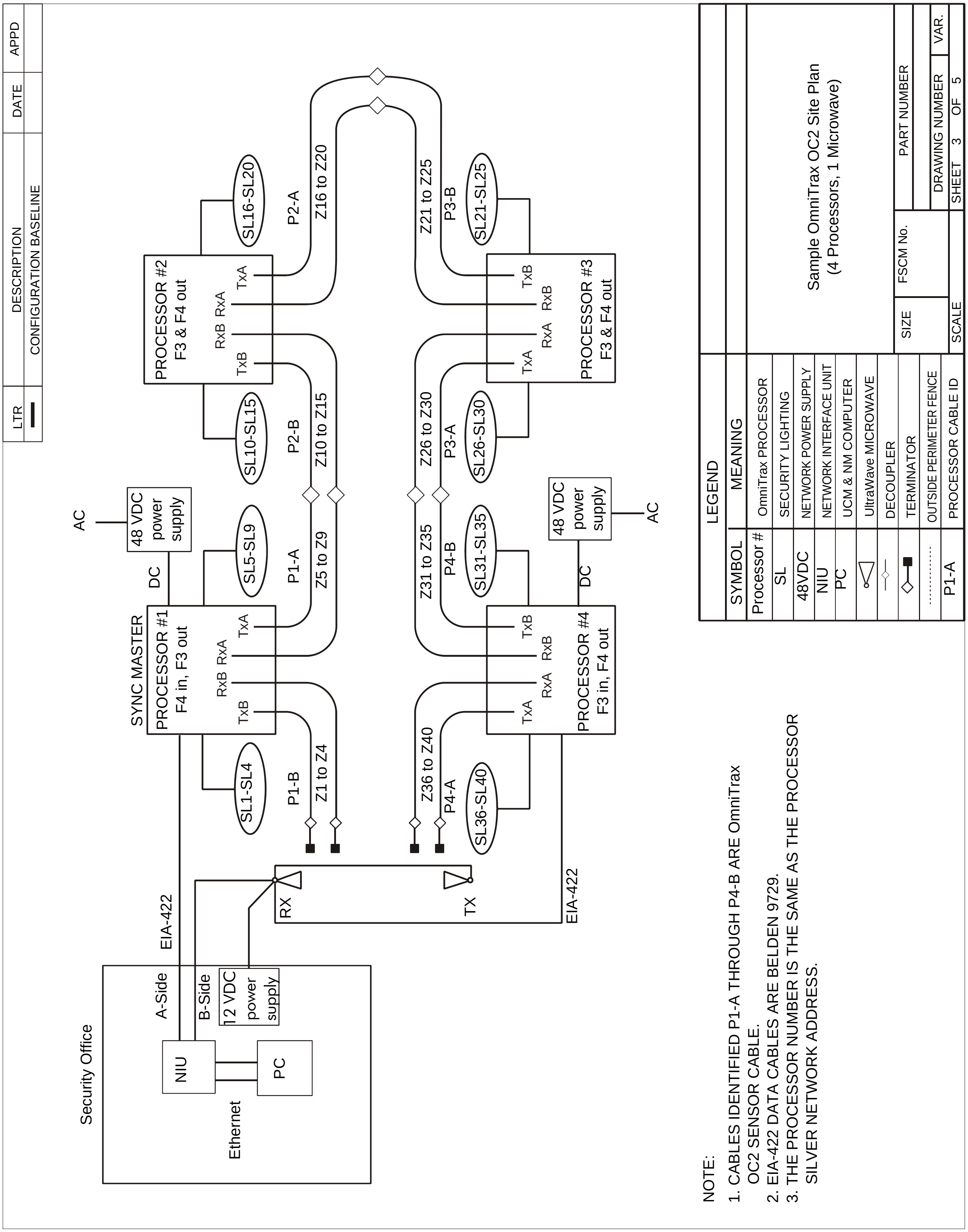



Figure 44: Sample site drawing (network system - connection diagram)

| LTR | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| — | CONFIGURATION BASELINE | | |

| PROCESSOR #1 CONFIGURATION | |
|---|---|
| **EQUIPMENT** | **PART NUMBER** |
| PROCESSOR & ENCLOSURE | A4EM0101 |
| TELECOM STYLE ENCLOSURE | A4MA0200 |
| RELAY OUTPUT CARD | 00BA0400 |
| NETWORK INTERFACE CARD | 00BA0302 |
| OC2 CABLE SET 300M | A4FG0121 |
| OC2 CABLE SET 400M | A4FG0120 |
| OC2 TERMINATOR | A4KT01300 |
| SENSOR CABLE LIGHTNING ARRESTORS | A4KT1000 |
| DATA LINE LIGHTNING ARRESTORS | E0302 |
| **PROCESSOR SETTINGS** | |
| SYNCHRONIZATION | SYNC MASTER |
| SUPERVISION | A-SIDE = CABLE PAIR<br>B-SIDE = CLUTTER |
| NETWORK COMMUNICATION | CoaxA > 422/FOB |
| CABLE TYPE | OC2 |
| NETWORK ADDRESS | 1 |
| AUX CONTROL | REMOTE |
| AUX CARD | RELAY |
| RELAY ACTIVATION | LATCHING |
| FUSES | F3 IN, F4 OUT |

| PROCESSOR #2 CONFIGURATION | |
|---|---|
| **EQUIPMENT** | **PART NUMBER** |
| PROCESSOR & ENCLOSURE | A4EM0101 |
| TELECOM STYLE ENCLOSURE | A4MA0200 |
| RELAY OUTPUT CARD | 00BA0400 |
| NETWORK INTERFACE CARD | 00BA0302 |
| OC2 CABLE SET 300M | A4FG0121 |
| OC2 CABLE SET 400M | A4FG0120 |
| SENSOR CABLE LIGHTNING ARRESTORS | A4KT1000 |
| **PROCESSOR SETTINGS** | |
| SYNCHRONIZATION | ACCEPT SYNC |
| SUPERVISION | = CABLE PAIR |
| NETWORK COMMUNICATION | Coax |
| CABLE TYPE | OC2 |
| NETWORK ADDRESS | 2 |
| AUX CONTROL | REMOTE |
| AUX CARD | RELAY |
| RELAY ACTIVATION | LATCHING |
| FUSES | F3 & F4 OUT |

| PROCESSOR #3 CONFIGURATION | |
|---|---|
| **EQUIPMENT** | **PART NUMBER** |
| PROCESSOR & ENCLOSURE | A4EM0101 |
| TELECOM STYLE ENCLOSURE | A4MA0200 |
| RELAY OUTPUT CARD | 00BA0400 |
| NETWORK INTERFACE CARD | 00BA0302 |
| OC2 CABLE SET 300M | A4FG0121 |
| OC2 CABLE SET 300M | A4FG0121 |
| SENSOR CABLE LIGHTNING ARRESTORS | A4KT1000 |
| **PROCESSOR SETTINGS** | |
| SYNCHRONIZATION | ACCEPT SYNC |
| SUPERVISION | = CABLE PAIR |
| NETWORK COMMUNICATION | Coax |
| CABLE TYPE | OC2 |
| NETWORK ADDRESS | 3 |
| AUX CONTROL | REMOTE |
| AUX CARD | RELAY |
| RELAY ACTIVATION | LATCHING |
| FUSES | F3 & F4 OUT |

| PROCESSOR #4 CONFIGURATION | |
|---|---|
| **EQUIPMENT** | **PART NUMBER** |
| PROCESSOR & ENCLOSURE | A4EM0101 |
| TELECOM STYLE ENCLOSURE | A4MA0200 |
| RELAY OUTPUT CARD | 00BA0400 |
| NETWORK INTERFACE CARD | 00BA0302 |
| OC2 CABLE SET 300M | A4FG0121 |
| OC2 CABLE SET 400M | A4FG0120 |
| OC2 TERMINATOR | A4KT01300 |
| SENSOR CABLE LIGHTNING ARRESTORS | A4KT1000 |
| DATA LINE LIGHTNING ARRESTORS | E0302 |
| **PROCESSOR SETTINGS** | |
| SYNCHRONIZATION | ACCEPT SYNC |
| SUPERVISION | A-SIDE = CLUTTER<br>B-SIDE = CABLE PAIR |
| NETWORK COMMUNICATION | 422/FOA > CoaxB |
| CABLE TYPE | OC2 |
| NETWORK ADDRESS | 4 |
| AUX CONTROL | REMOTE |
| AUX CARD | RELAY |
| RELAY ACTIVATION | LATCHING |
| FUSES | F4 IN, F3 OUT |

| Sample OmniTrax OC2 Site Plan (4 Processors, 1 Microwave) | | | |
|---|---|---|---|
| SIZE B | FSCM No. | PART NUMBER | |
| | | DRAWING NUMBER | VAR. |
| SCALE | | SHEET 4 OF 5 | |

Figure 45: Sample site drawing (network system - processor configuration)

| LTR | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| — | CONFIGURATION BASELINE | | |

| UltraWave MICROWAVE CONFIGURATION | |
|---|---|
| **EQUIPMENT** | **PART NUMBER** |
| TRANSMITTER AND RECEIVER | E4FG0101 |
| SILVER COMM CARD | 00BA2000 |
| 12 VDC POWER SUPPLY | E6FG0300 |
| DATA LINE LIGHTNING ARRESTORS | E0302 |
| NETWORK ADDRESS | 5 |

| SECURITY CONTROL CONFIGURATION | |
|---|---|
| **EQUIPMENT** | **PART NUMBER** |
| NETWORK INTERFACE UNIT | 00EM0200 |
| NETWORK MANAGER SOFTWARE | 00FG0200 |
| UNIVERSAL CONFIGURATION MODULE SOFTWARE | 00SW0100 |
| DATA LINE LIGHTNING ARRESTORS | E0302 |

| MISCELLANEOUS EQUIPMENT | |
|---|---|
| **EQUIPMENT** | **PART NUMBER** |
| OC2 CABLE INSTALLATION TOOL KIT | A4KT0200 |
| 48 VDC POWER SUPPLY | 00BA0400 |
| UCM USB CABLE | GE0444 |

| Sample OmniTrax OC2 Site Plan (4 Processors, 1 Microwave) | | | |
|---|---|---|---|
| SIZE B | FSCM No. | PART NUMBER | |
| | | DRAWING NUMBER | VAR. |
| SCALE | | SHEET 5 OF 5 | |

Figure 46: Sample site drawing (network system - equipment configuration)

# Residential & commercial applications

The installation recommendations described in this section are intended for sites that do not have a sterile zone, and where the space available for the sensor cable is often at the limit of the minimum separation distances. For non-sterile zone applications the following points must be carefully examined with respect to the site conditions:

- sensor cable selection
- sensor cable spacing
- sensor cable burial depth
- sensor cable path selection
- buried water pipes and electrical cable avoidance
- protection against gardening and landscaping damage

## Single vs. dual trench selection

Senstar recommends using dual trench installation with 1.5 m (5 ft.) cable spacing, whenever possible. However, for applications where the available installation space is limited and the required separation distances from obstacles cannot be met using dual trench installation, it is recommended that narrow cable spacing be used. Both OC2 and SC2 sensor cable can be installed in a single trench, using 10 cm (4 in.) cable spacing.

| | |
|---|---|
| **Note** | Contact Senstar Customer Service if you are considering using SC1 sensor cable. |

## Sensor cable burial depth

For most natural soil areas, including lawns a burial depth of 23 cm (9 in.) is recommended (see Sensor cable burial depths on page 36). A shallower burial depth of 15 cm (6 in.) is recommended for installation in heavy soil types. For installations where the cable burial depth has to be raised slightly to avoid a pipe or cable, the change in depth should be made gradually over a distance of 1 m (3 ft., 3 in.).

| | |
|---|---|
| **Note** | Monitor the accuracy of the burial depth closely during the sensor cable installation. |

## Sensor cable path selection

A compromise must sometimes be made between the need for a detection zone which affords the maximum advanced warning, and the avoidance of obstacles which can impair the system's performance.

| | |
|---|---|
| **Note** | Avoid burying sensor cables close to young trees. As the roots grow, they can displace and damage the sensor cables. |

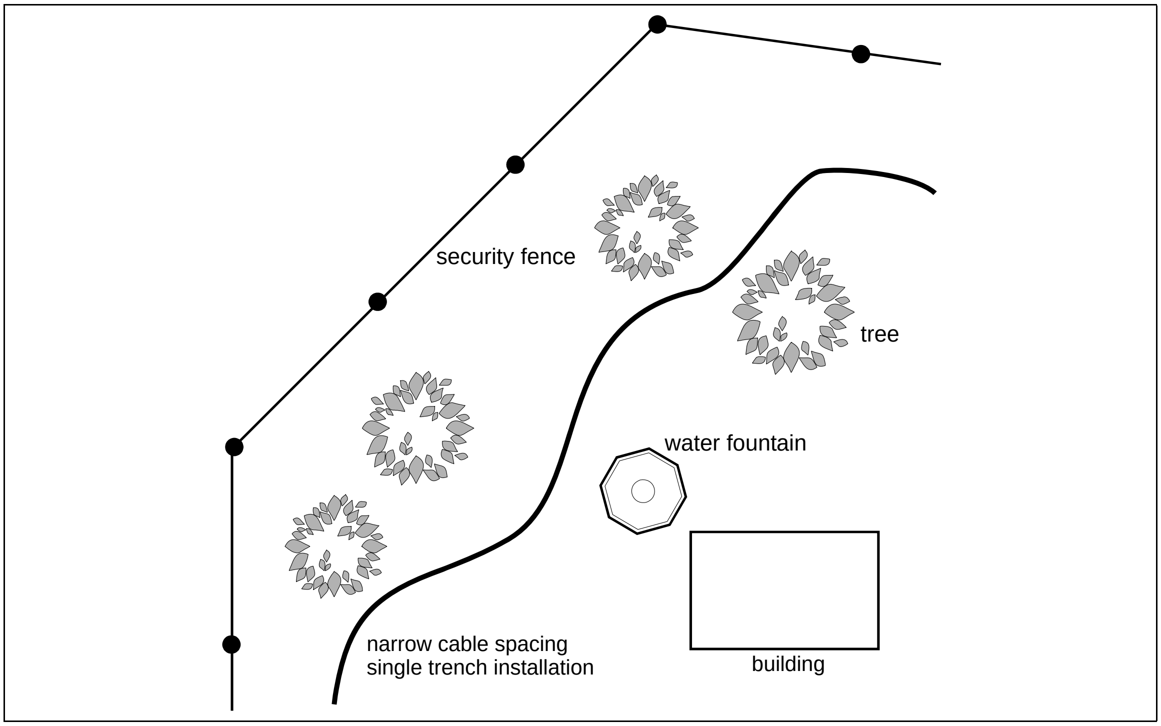



Figure 47: Adapting the sensor cable path to the environment

The OmniTrax sensor cable can be adapted easily to corners and grade changes allowing the system to be installed around bushes, full-sized trees, and man-made obstacles. The covert nature of the system hides the location of the detection zone. A meandering cable path can be regarded as an advantage, as even an informed intruder cannot predict the exact location of the detection field.

# Buried water pipe and electrical cable avoidance

Where possible, the sensor cable path should avoid irrigation pipes or electrical cables (see Separation distances from pipes, conduits and cables on page 42). By working with the landscape planner prior to the layout of the irrigation pipes and control cables, the OmniTrax sensor cable can be afforded a reasonably clear path without compromising the irrigation coverage. Avoid running sensor cables parallel to irrigation pipes and across sprinkler pipes as much as possible. If this is not possible, the pipes must be shielded to prevent the detection field from “sensing” the moving water. When the pipe crosses above or below the cable, it must be wrapped, in metal foil specified for direct burial, for a distance of approximately 1 m (3 ft., 3 in.) on both sides of the sensor cable. Parallel running pipes which are within 30 cm (12 in.) of the sensor cables should also be shielded.

# Protection against gardening and landscaping damage

Protection of the sensor cable against damage from landscaping activities throughout the life-span of the system is an important factor in maintaining proper performance (see Protection of buried cables on page 37). Where there will be no further landscaping activities and minimal surface maintenance the recommended burial depth of 23 cm (9 in.) will provide adequate long term protection. However, in areas where planting will be an on-going activity, or where future irrigation changes are anticipated, the sensor cable should be protected with some form of non-metal barrier such as pressure treated wood or PVC conduit cut lengthwise in a half-circle.

## Protection for roadway and sidewalk crossings

For roadway and sidewalk crossings the sensor cable can be protected with PVC conduit as follows. The full length of a sensor cable must not be installed in conduit.

- The maximum length for conduit sections is 7.0 m (23 ft.).
- A maximum of 3 sections of conduit can be used on a single cable set.
- Conduit sections must be separated by at least 1 m (3 ft., 3 in.).
- Conduit must be sealed at both ends to prevent internal water flow.
- Conduit must be the minimum diameter that allows passage of the sensor cable.

# Installation tips

- Use a trenching machine to dig the trenches around the perimeter (15 cm, 6 in. for single trench installation; 10 cm, 4 in. for dual trench installation).
- Use a trenching machine or a backhoe with a 30 cm (1 ft.) bucket to dig the lead-in cable trenches at the processor location.
- If the processor is being installed in a telecom style enclosure, dig the lead-in cable trenches to a depth of 60 cm (2 ft.).
- Line up the red bands at the start of the detecting cable, and secure the cable so the red bands cannot move.
- Run the cable back to the processor, ensuring that there is enough cable to make the connections to the processor (min. 2 m 6.5 ft.).
- Carefully, follow the directions for sensor cable crossover at the start point.
- Begin at the processor location and work toward the end of the sensor cables.
- At the end of the sensor cable dig out the decoupler pattern (should be marked on ground).
- Ensure that there is enough cable at the end to make the decoupler connections. If there is extra cable at the end point, leave it on the reel until you are ready to make the connections.
- Use a shovel or garden rake to clear the soil at depth measuring points along the trenches.
- Make a measuring stick by attaching a small board (e.g., 1 X 2) perpendicular to a larger board (e.g., 1 X 3 or 2 X 4) at the 23 cm (9 in.) point (a right angle cross). Use the board to verify that the trench has a uniform depth of 23 cm.
- When burying the cables, have one person hold the cable in place (e.g., stand on cable) have a second person pull the cable straight, and have a third person backfill the trenches.
- When backfilling the trenches, shovel the soil lengthwise into the trench so that it will spread out and fill any gaps around the sensor cable.
- For narrow cable spacing, build a tool that can be pulled along and will keep the cable spacing at 10 cm (see Figure 60:).
- For long perimeters, a cable dispenser on wheels will facilitate the cable installation.
- When using geotextile fabric and a sand bedding:
  - Make a second measuring stick for a depth of 30 cm (12 in.).
  - Ensure that the trench is a uniform depth of 30 cm (12 in.) before laying the geotextile fabric.
  - Cut or fold the fabric to make it fit as the cable path goes around turns.
  - Stake down the fabric to hold it in place while pouring sand.
- Do the recommended cable tests and a cable profile before sealing the heatshrink on the connectors and decouplers.
- Seal the heatshrink and finish the backfilling.

# 3 Installing enclosures

## The OmniTrax enclosure

The OmniTrax enclosure is painted aluminum and includes two lockable latches on the top and two hinges on the bottom to allow the door to hang freely. There are two sets of mounting studs on the enclosure door, one for the optional 6 VDC local backup battery and the other for the optional 12 VDC auxiliary device power supply. The enclosure includes a vent to prevent gas build-up from battery charging. It can be mounted outdoors inside a telecom style enclosure or a customer supplied enclosure, and indoors on a fixed surface.

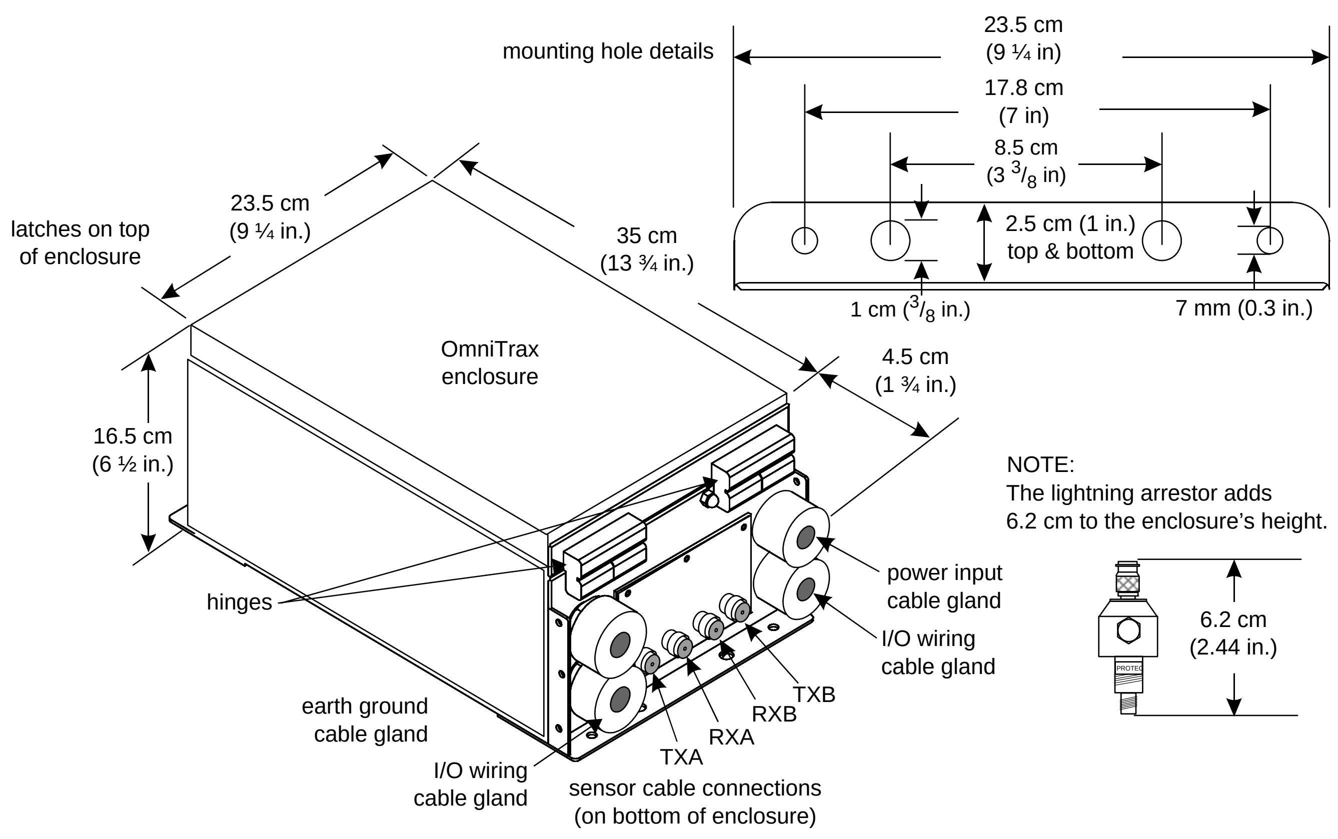



Figure 48: OmniTrax enclosure

| | |
|---|---|
| **Note** | The OmniTrax enclosure includes four 22 mm (0.875 in.) cable ports, which are fitted with cable glands. The four cable glands each provide a single hole with a 4.75 to 6.35 mm cable range (0.187 to 0.250 in.). Two additional cable sealing grommets are included in a plastic bag, which provide an 11 to 12.7 mm cable range (0.437 to 0.500 in.). |

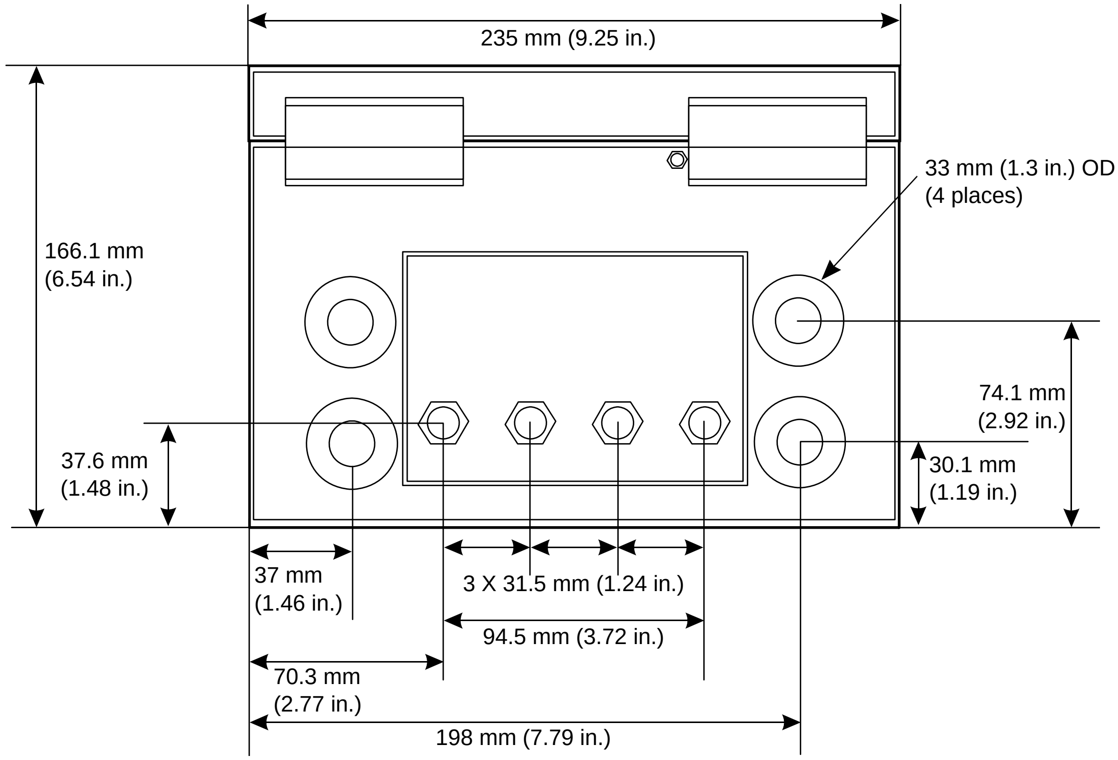



Figure 49: Enclosure bottom cable entry port dimensions

| | |
|---|---|
| **Note** | DO NOT bring AC mains power into the OmniTrax enclosure. If a local power supply is being used, it must be installed in its own weatherproof enclosure. Consult the local electrical code for information about the connection of AC mains to your power supply. |

| | |
|---|---|
| **Note** | For outdoor installation the OmniTrax enclosure must be mounted inside a telecom style pedestal enclosure or a suitable customer-supplied enclosure. |

| | |
|---|---|
| **Note** | For installations in environments which include hot sunny periods, Senstar recommends that a sun shield be installed to protect the enclosure from direct sunlight, or that the enclosure be installed in a shady area.<br>The maximum operating temperature, as measured inside the enclosure, is 70º C (158º F). |

# System grounding

The OmniTrax processor requires a connection to a low resistance earth ground (Senstar recommends 5 Ω or less). Install an approved ground rod or ground plate as close to the processor as possible. Use an approved ground wire to connect the ground rod to the ground lug on the processor enclosure. Figure 50: Ground connection details illustrates the OmniTrax earth ground connection.

| | |
|---|---|
| **Note** | Consult the local electrical code for information about installing a low resistance earth ground. |

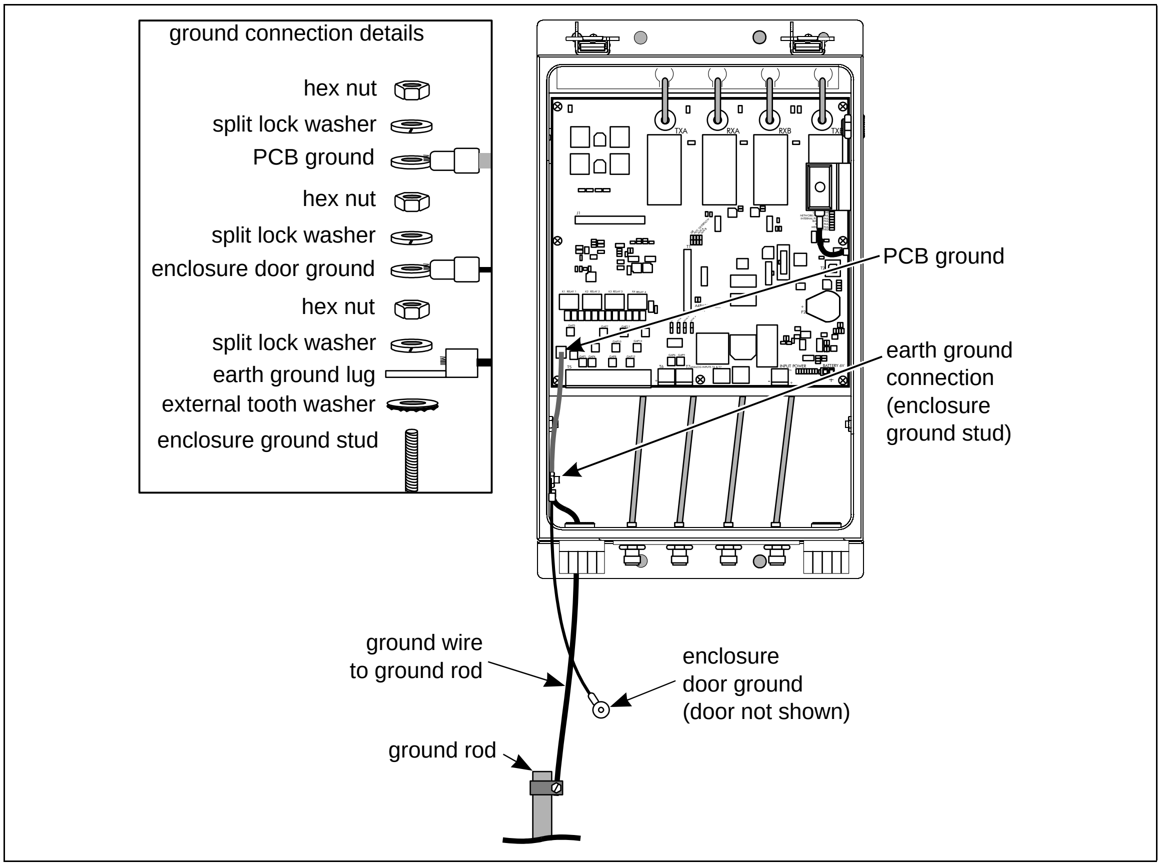



Figure 50: Ground connection details

# Points to remember

- follow all local construction and electrical codes
- install the enclosure above the high water and high snow levels
- install anti-ram bollards in areas with vehicle traffic
- ensure the cable glands and TNC connectors on the bottom of the enclosure are oriented toward the ground

# Installing a telecom style enclosure

The telecom enclosure is ground mounted in a concrete base. The concrete base must be set above ground level in areas prone to freezing and on high ground in areas prone to flooding. Once the telecom enclosure is installed on the concrete base, a custom bracket is installed inside, and an OmniTrax enclosure is mounted on the bracket.

## Required tools and equipment

- concrete base

| Note | Consult the local building code for information about the installation of a concrete base. The concrete base must provide adequate support for the 42.5 cm X 27.3 cm enclosure. |
|---|---|

- electrical tape
- 11 mm (7/16 in.) and 15 mm (9/16 in.) wrenches
- shovel
- approved ground rod/plate (plus approved hardware and ground wire)
- sensor cable entry conduit (3.8 cm (1½ in.) diameter PVC pipe and matching 90º elbows)
- (optional) auxiliary sensor/communication cable entry conduit and power cable entry conduit (1.9 cm (3/4 in.) diameter PVC pipe and matching 90º elbows)
- enclosure drain pipe (1.9 cm (3/4 in.) diameter PVC pipe)
- telecom style enclosure and mounting bracket (P/N A4MA0200 + bracket A4HA0100)
- OmniTrax enclosure

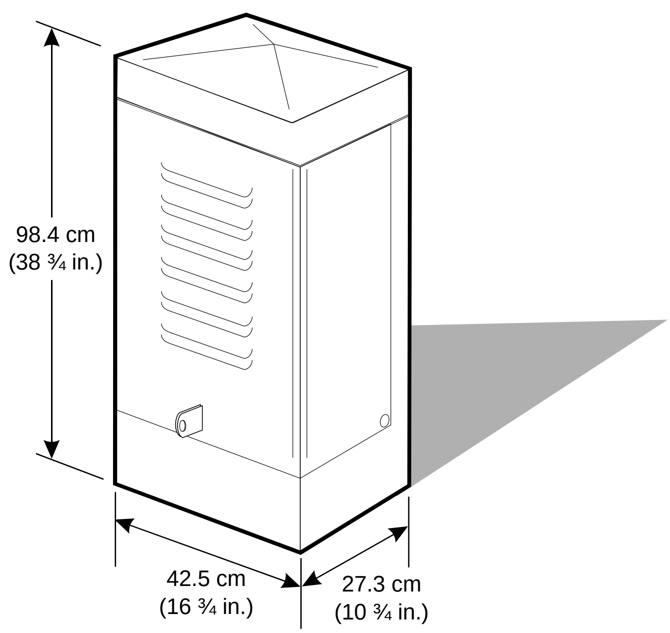



Figure 51: Telecom style enclosure

# Installation procedure for telecom enclosures

**Preparation**

1. Use the site plan to determine the location for the enclosure and dig a hole for the concrete base.

| | |
|---|---|
| **Note** | In clay soils with poor drainage, dig the hole about 25% deeper than specified in the local building code. Fill the additional 25% with clear crushed stone to aid drainage. |

2. Identify and label all of the lead-in cables and wires.

| | |
|---|---|
| **Note** | PVC pipe assemblies allow the lead-in cables, the optional auxiliary sensor wiring and data cables, and the power supply connection to run below ground to the processor. One pipe provides drainage for the enclosure. |

3. Using the conduit and matching elbows, construct assemblies as required.
4. Protect the conduit by completely covering the openings at both ends of each assembly with tape.
5. Refer to Figure 52: Location of conduit assemblies, and install the sensor cable conduit, auxiliary sensor/data cable conduit, power wiring conduit, and drain pipe.
6. Secure the conduit assemblies by taping the pipes together.
7. Install the ground rod/plate at the processor location.

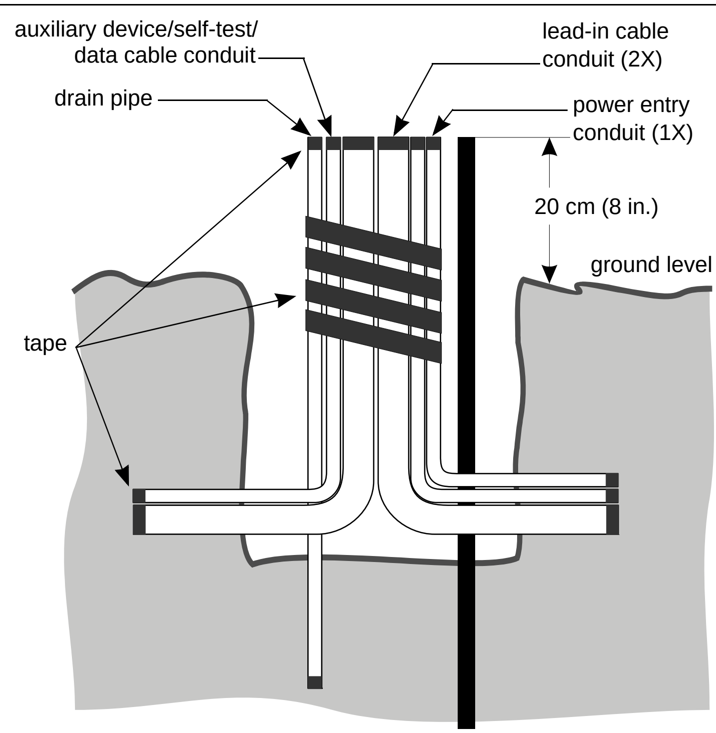



Figure 52: Location of conduit assemblies

### Building the foundation

1. Position the concrete form in the hole, over the conduit assemblies, so that the top of the form is 15 cm (6 in.) above ground level with the pipes centered (see Figure 53: Positioning the concrete form). i

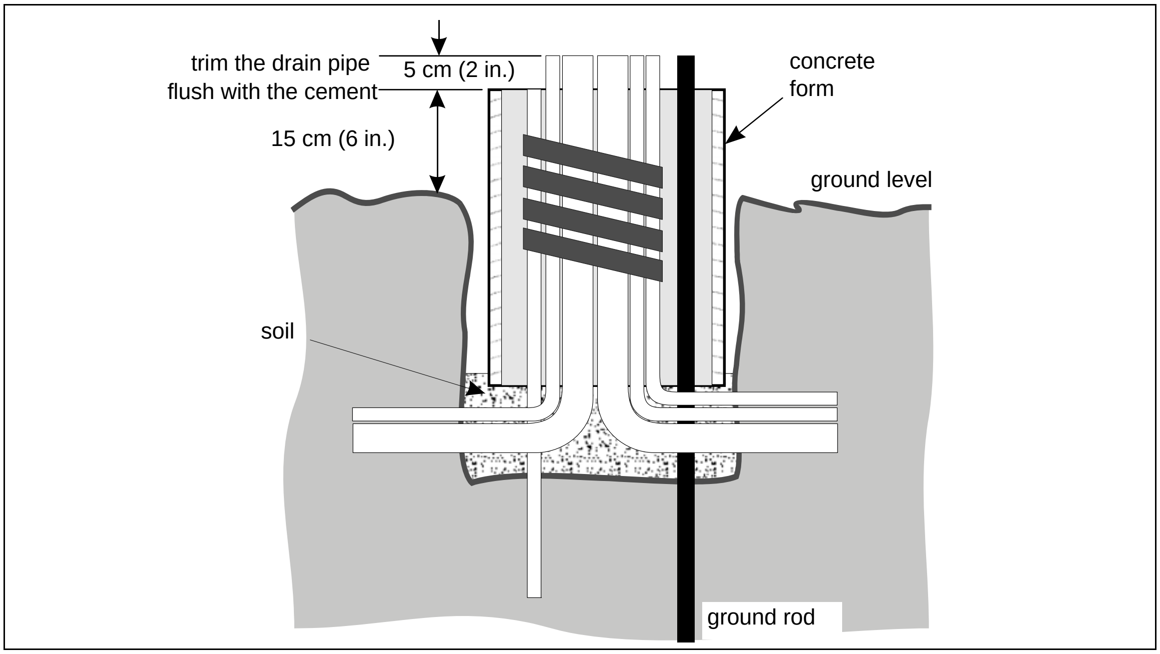



Figure 53: Positioning the concrete form

| **Note** | Make sure that the conduit ends are protected. |
|---|---|

2. Pour the concrete to fill the form.

### Installing the telecom enclosure

| **Note** | The telecom enclosure is shipped with two stakes inside. Remove the stakes from the enclosure and re-attach the stakes to the enclosure so they enter the wet concrete to anchor the enclosure. |
|---|---|

1. Position the base of the enclosure over the pipes and push it into the wet concrete so that the bottom edge of the enclosure is approximately 2.5 cm (1 in.) deep (see Figure 54: Placing the telecom enclosure in concrete).
2. Build a frame to support the enclosure while the concrete dries.
3. Let the concrete set for at least 24 hours before installing the processor and enclosure.
4. After the concrete has set, trim the drain pipe so that it is flush with the concrete surface (all other conduits remain 5 cm above the surface).
5. Remove the tape from the ends of the PVC pipes.
6. Pull the alarm communication wiring, power cables, and auxiliary sensor/self-test wires up through the 1.9 cm (3/4 in.) diameter PVC pipes, into the enclosure.
7. Fill in the hole around the concrete base.

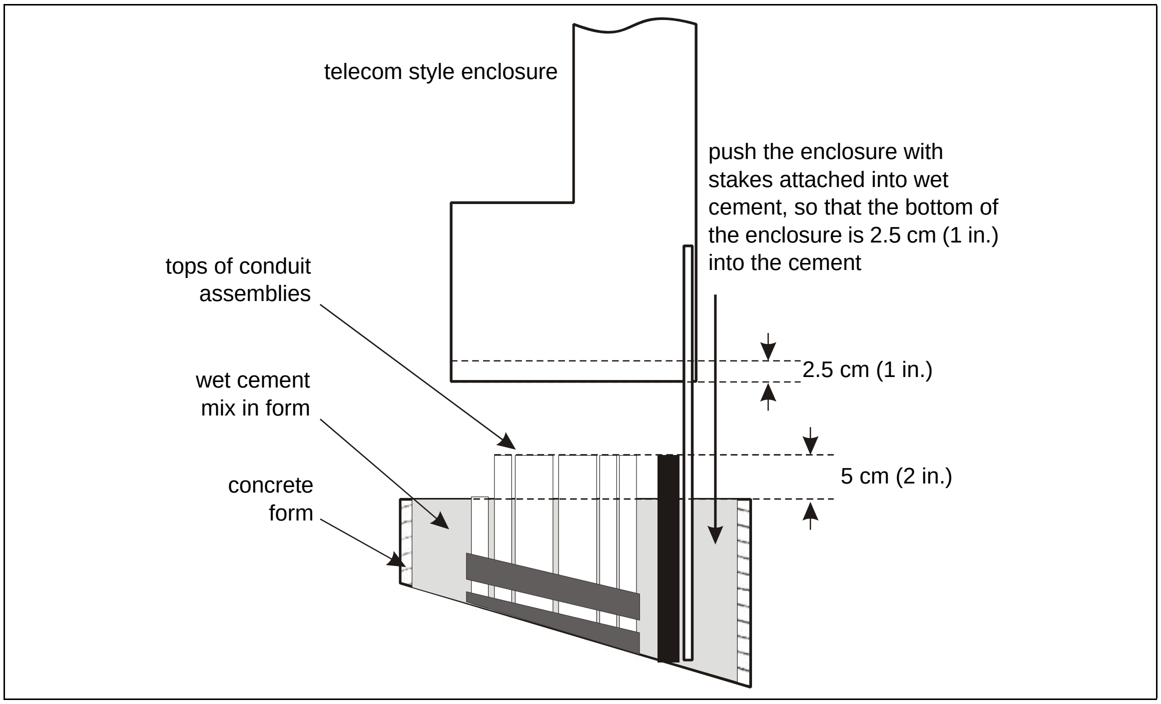



Figure 54: Placing the telecom enclosure in concrete

### Installing the OmniTrax enclosure

| **Note** | The Telecom enclosure is shipped with all of the hardware that is required to install the mounting bracket and the OmniTrax enclosure. There are also four grommets provided, which are used to protect the sensor cables where they pass through the holes in the bottom of the bracket. |
|---|---|

1. Mount the OmniTrax bracket inside the telecom enclosure (see Figure 55: Mounting the bracket and OmniTrax enclosure - rear view and Figure 56: Mounting the bracket and OmniTrax enclosure - front view).
2. Mount the enclosure on the bracket inside the telecom style enclosure.

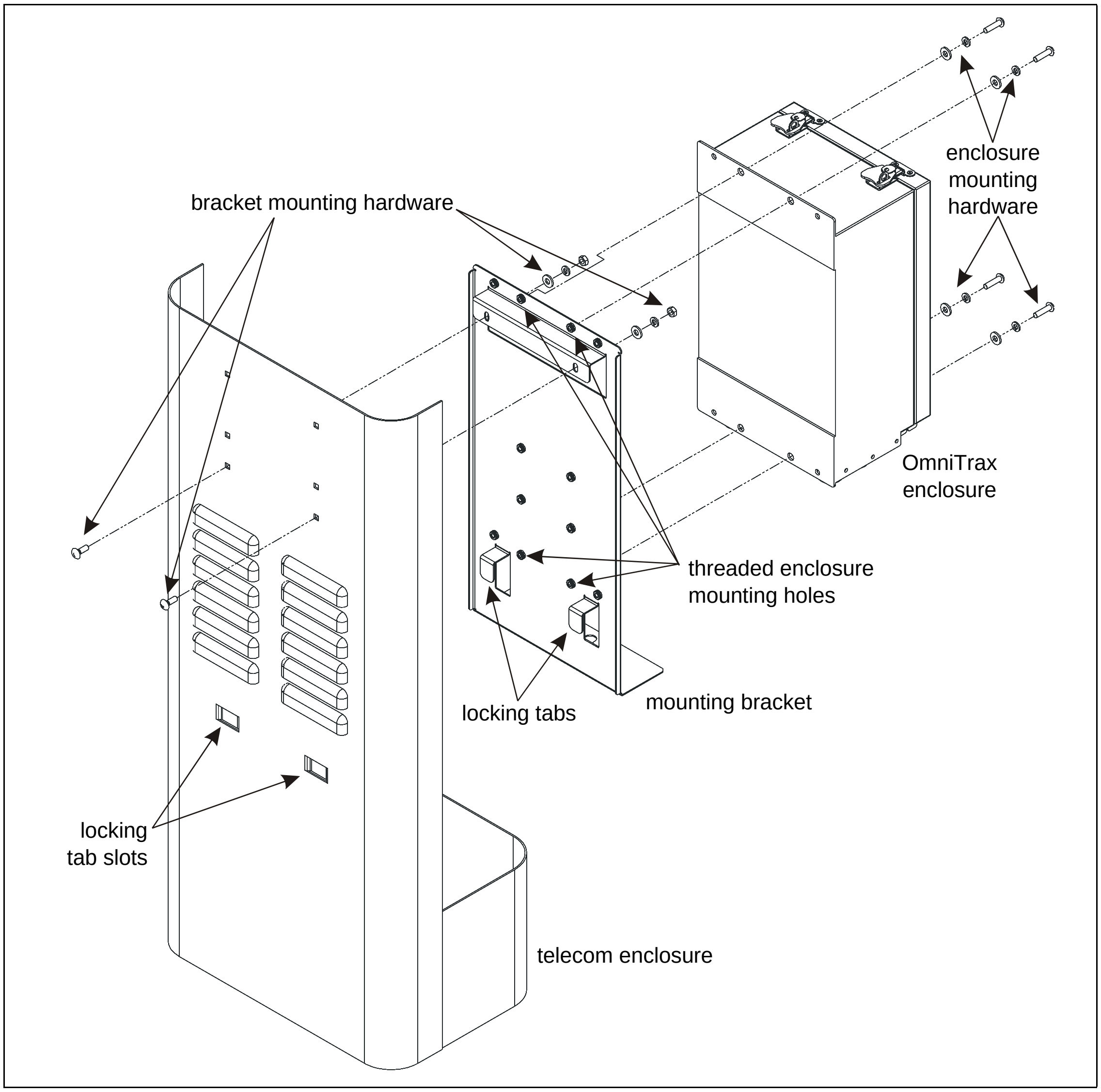



Figure 55: Mounting the bracket and OmniTrax enclosure - rear view

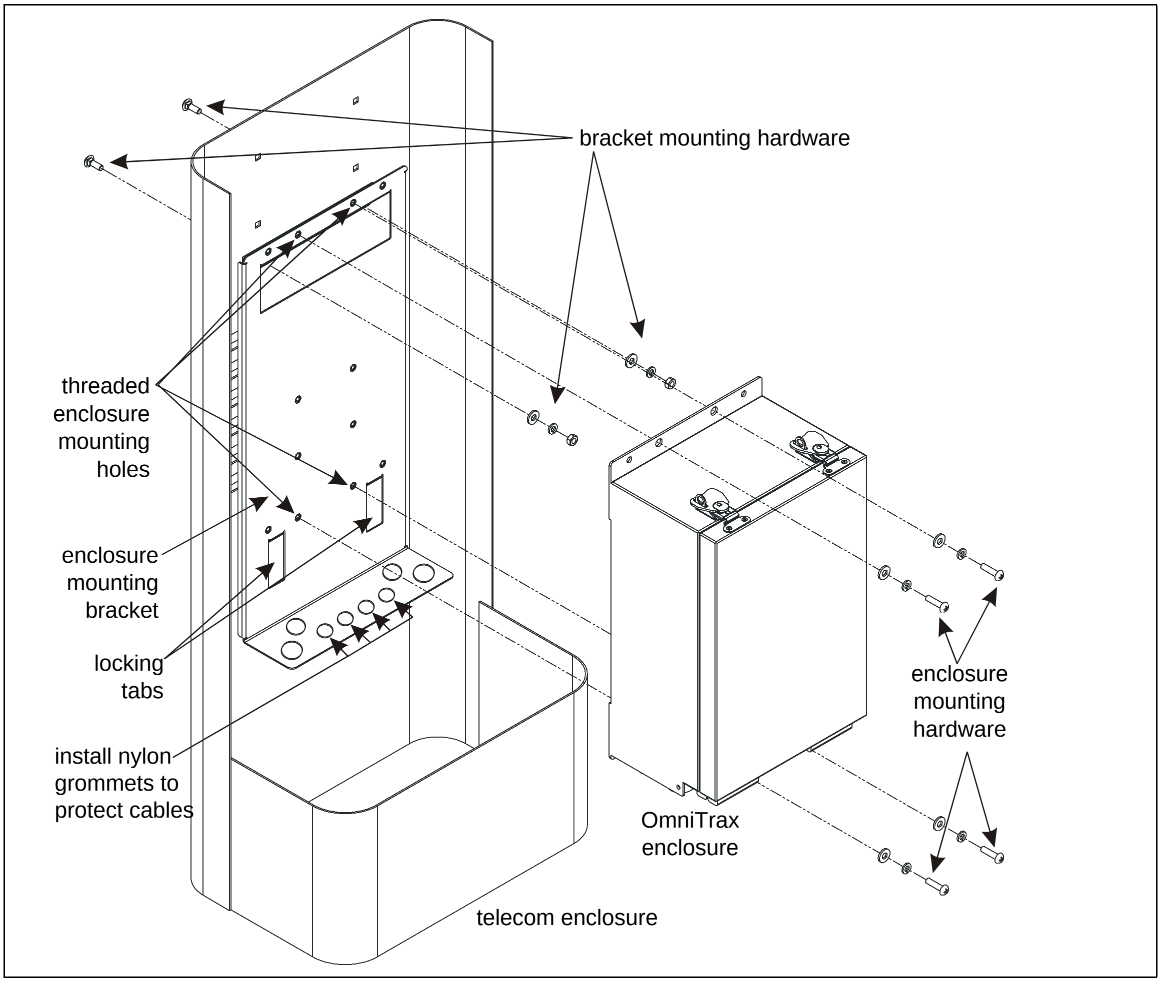



Figure 56: Mounting the bracket and OmniTrax enclosure - front view

# Indoor wall-mounting

For indoor wall-mounting, install the processor in a secure area. Four 7 mm (0.3 in.) holes are provided on the enclosure flanges for mounting the enclosure to a stable, fixed structure. The type of enclosure mounting hardware required depends on the mounting surface, and is supplied by the installer.

**Wall-mount procedure**

1. Install a low resistance earth ground as close as possible to the processor location.

| **Note** | Consult the local electrical code for information about installing a low resistance earth ground. |
|---|---|

2. Using appropriate hardware, mount the enclosure on a stable, fixed surface (see Figure 57: Indoor wall-mounting the OmniTrax enclosure).
3. Cut conduit for the power ground and data cables, if required (conduit is required to protect the lead-in cables where they exit the building).
4. Label all cables and wires that are being routed into the enclosure.
5. Pull the sensor cables through the conduit, to the OmniTrax enclosure.
6. Connect the ground wire to the ground stud inside the enclosure.

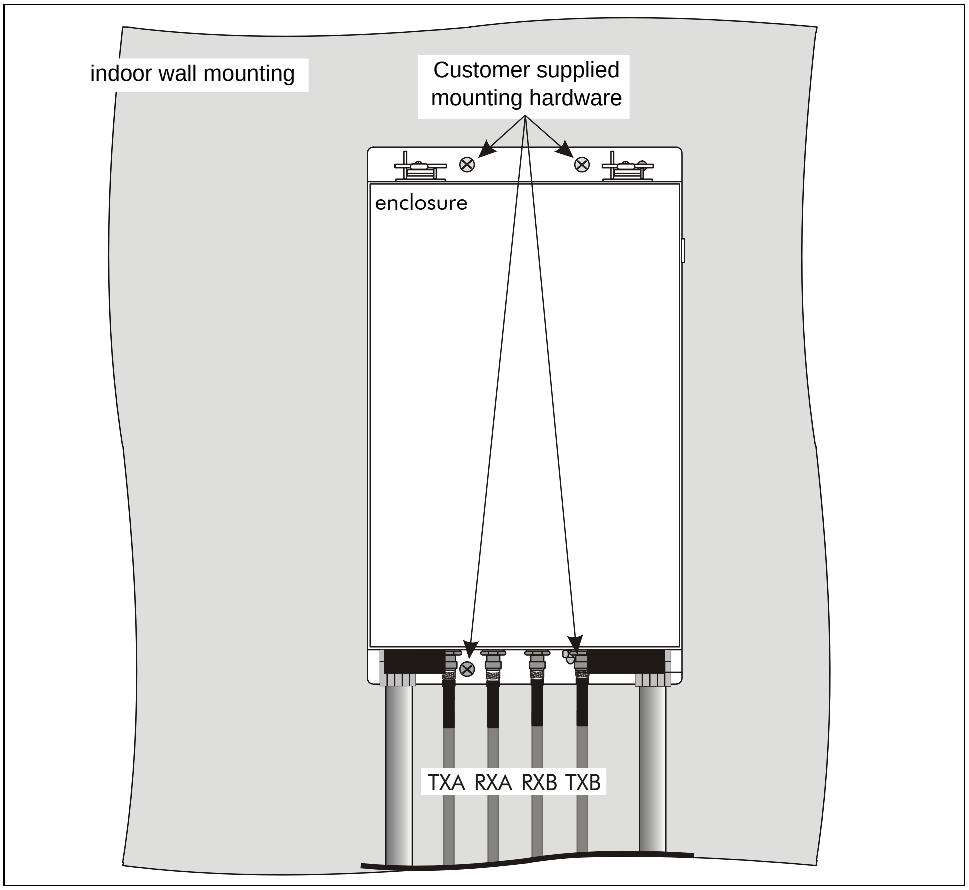



Figure 57: Indoor wall-mounting the OmniTrax enclosure

# Using a customer-supplied enclosure

It is possible to mount the OmniTrax enclosure inside a customer-supplied enclosure, providing the enclosure is large enough to accommodate the OmniTrax enclosure and a service loop for the sensor cables, power cables and I/O wiring. (See Figure 48: OmniTrax enclosure and Figure 49: Enclosure bottom cable entry port dimensions for OmniTrax enclosure dimensions). It is also possible to mount a power supply beside the processor if the enclosure is both large enough and well ventilated. The customer-supplied enclosure should include a mounting plate that can be drilled to fit the OmniTrax weatherproof enclosure. A customer-supplied enclosure should be at least 69 cm h X 58 cm w X 20 cm d (27 in. h X 23 in. w X 8 in. d) to accommodate the OmniTrax enclosure and cable service loops. For the weatherproof enclosure and a local power supply, the customer-supplied enclosure should be 69 cm h X 69 cm w X 20 cm d (27 in. h X 27 in. w X 8 in. d).

| | |
|---|---|
| **Note** | The OmniTrax earth grounding requirements and operating temperature ratings apply to customer-supplied enclosures. |

| | |
|---|---|
| **Note** | The recommended height of 69 cm will accommodate external sensor cable lightning arrestors. |

| | |
|---|---|
| **Note** | Consult the local electrical code for information about installing a power supply inside the customer-supplied enclosure. |

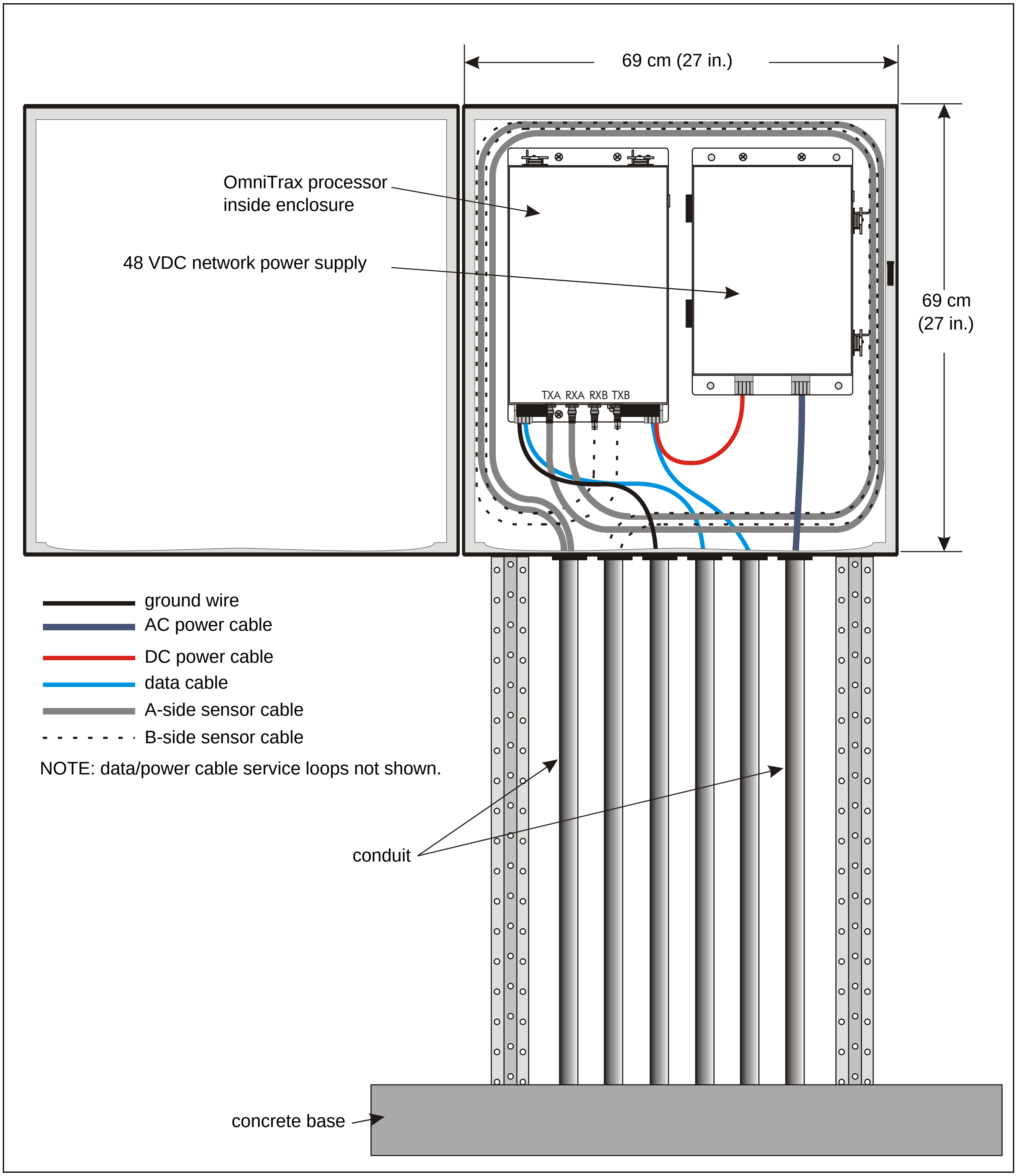



Figure 58: Using a customer-supplied enclosure

# Replacing the processor

The processor is mounted on a metal backplate, which in turn mounts inside the OmniTrax enclosure. The metal backplate fits onto four studs on the side bulkheads of the enclosure (see Figure 59: Installing the mounting plate in the enclosure). The processor's I/O connectors are oriented toward the cable glands on the bottom of the enclosure. The TNC connectors are located near the top. To install the mounting plate inside the OmniTrax enclosure:

| | |
|---|---|
| **Note** | The processor and auxiliary cards include static sensitive components. Follow proper ESD procedures when working on the cards. |

| | |
|---|---|
| **Note** | The processor and backplate form a single assembly. Do NOT attempt to remove the processor circuit card from the metal backplate. |

### Removing the processor and backplate

1. Label and disconnect all processor wiring and cables.
2. If required, remove any auxiliary cards from the 40 pin header (J1).
3. Loosen the mounting hardware on the two studs near the bottom of the enclosure (one on each side).
4. Disconnect the PCB ground strap from the enclosure ground stud.
5. Lift the backplate out of the enclosure.

### Replacing the processor and backplate

1. Fit the backplate onto the four studs on the side bulkheads.
2. Tighten the backplate mounting hardware on the two studs near the bottom of the enclosure.
3. Connect the PCB ground strap.
4. Install the auxiliary cards on J1.
5. Connect the wiring and cables.
6. Calibrate and test the processor before putting it into service.

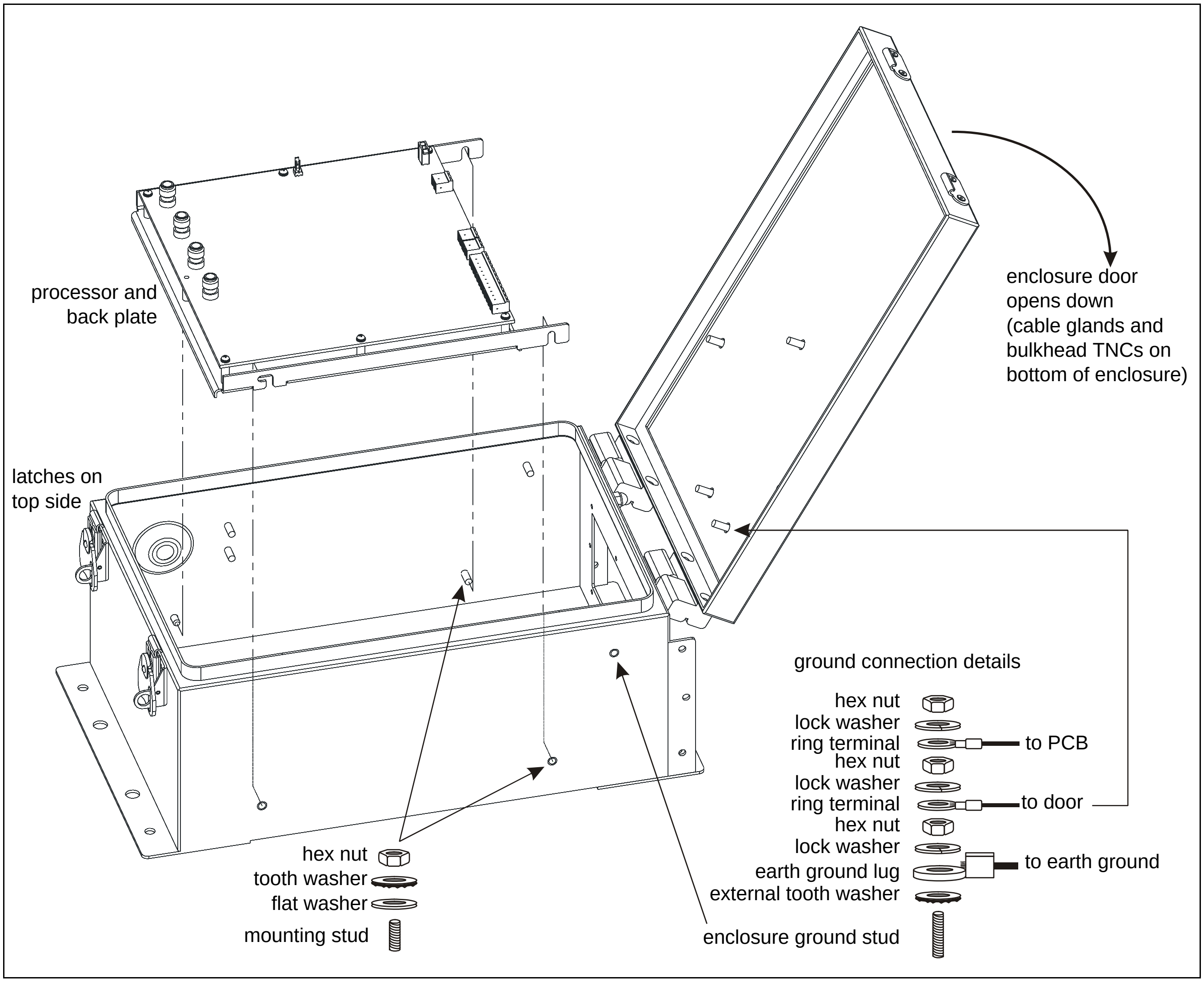



Figure 59: Installing the mounting plate in the enclosure

# 4 Installing the sensor cables

# Cable installation overview

Optimum system performance depends on the installation of the sensor cable, and the sensor cable connections. To install the cables and cable fittings, perform the following steps in order.

- Check the site plan and verify the cable route.
- Mark the sensor cable route on the ground and on a detailed site plan including lead-in cable, start point overlaps, cable bypasses, decouplers, terminator overlaps.
- Check for underground utilities near the cable route.
- Dig the trenches or cut slots.
- Prepare the trenches or slots for cable installation.
- Lay the cables in the trenches or slots, inspecting the sensor cables as you proceed.
- For trench installation, partially backfill the trenches as you proceed to hold the cables in place.
- Install connectors, decouplers and terminators.
- Test the sensor cables and connections.
- Backfill the trenches or seal the slots.

## Installation guidelines

The following guidelines apply to all cable types. Information pertaining to only one cable type will be indicated by a side heading.

| | |
|---|---|
| **Note** | For OC2 and SC2 cables, install the TX cable on the outside of the perimeter, and the RX cable on the inside. For SC1 cable, by convention, use the ribbed side of the cable as the receive cable. |

| | |
|---|---|
| **CAUTION** | The smallest allowable bend radius for all types of OmniTrax sensor cable is 15 cm (6 in.). Any tighter bend can damage the internal foil and compromise operation. |

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

- Follow the rules for burial depth, cable spacing, and cable separation from obstacles.

- Mark the locations for the red bands, the sensor cable overlaps, ferrite beads, decouplers and terminators in accordance with the site plan.
- Limit any change in the grade of the cable path to 30° or less.
- Make gradual turns around corners.
- Remove any stones or debris from inside or close to the trenches/slots.
- Ensure there are no sharp edges inside the slots.
- Make sure the red bands line up side by side at the designated start point.
- Make sure the decouplers line up side by side at the designated end point.

# Preparation of trenches

This section details the procedures for preparing trenches in soft mediums including soil and gravel, as well as soft mediums under thin layers of concrete or asphalt.

| | |
|---|---|
| **Note** | Cable marker tape is included with the sensor cables as a precaution, and should be used in situations where future gardening or landscaping activities may occur near the sensor cable route. The use of marker tape is optional for other types of installations. |

| | |
|---|---|
| **Note** | Dig only as many trenches as can be backfilled in one day. |

| | |
|---|---|
| **Note** | Senstar recommends using a sand bedding and geotextile fabric for installations in coarse gravel. |

Micro-trenching is a valid installation option for soil and asphalt, and can be used provided that the trench depths and backfill requirements are maintained (e.g., the 7.5 cm stone dust layers above and below the cable). Micro-trenching cannot be used in heavy clay soil, as installation in heavy clay requires significant soil replacement around the cables.

## Required equipment

- landscape marker paint
- measuring tape
- pick, shovels and rakes
- trenching machine
- concrete saw (for installation in trench under concrete/asphalt)
- OmniTrax sensor cable sets (as required)
- non-woven geotextile fabric and stone dust or sand (required for rocky soil, or heavy clay installations)

## Trench dimensions

| Application | Width x Depth |
|---|---|
| **Burial in soil (dual trench)** | 10 cm W x 23 cm D (4 in. x 9 in.) |
| **Narrow cable spacing (single trench)** | 15 cm W x 23 cm D (6 in. x 9 in.) |
| **Burial in moderate clay soil (dual trench)** | 10 cm W x 15 cm D (4 in. x 6 in.) |
| **Burial in moderate clay soil (single trench)** | 15 cm W x 15 cm D (6 in. x 6 in.) |
| **Burial in heavy clay soil (narrow cable spacing)** | 1 m W x 60 cm D* (3.3 ft. x 2 ft.)<br>* The trench depth depends on the depth of the gravel layer required to provide adequate drainage. |
| **Burial in heavy clay soil (wide cable spacing)** | 2 m W x 60 cm D* (6.6 ft. x 2 ft.)<br>* The trench depth depends on the depth of the gravel layer required to provide adequate drainage. |
| **Burial with stone dust or sand and geotextile fabric in rocks or crushed stone** | 10 cm W x 30 cm D with 7.5 cm sand in trench<br>(4 in. x 12 in. with 3 in. sand in trench) |
| **Burial under a narrow strip of asphalt (e.g., road or driveway)** | 30 cm W x 38 cm D with 7.5 cm stone dust in trench (12 in. x 15 in.) |
| **Transition from deep trench under asphalt to trench in soil** | 30 cm W x 38 cm D with 7.5 cm stone dust in trench under asphalt sloping to (for standard cable spacing - 10 cm W x 23 cm D {4 in. x 9 in.}) or (for narrow cable spacing - 15 cm W x 23 cm D {6 in. x 9 in.}) app. 1 m from the end of the asphalt |
| **Burial under a large asphalt paved area (with stone dust)** | 30 cm W x 30 cm D with 7.5 cm stone dust in trench<br>(12 in. x 12 in. with 3 in. stone dust in trench) |
| | micro-trenching<br>2.5 to 7.5 cm W x 30 cm D with 7.5 cm stone dust |
| **Transition from concrete slot to trench** | 10 to 14 mm W x 6 cm D sloping to 23 cm D app. 3 m from the end of the slot (0.4 to 0.6 in. W x 2.25 in. D sloping to 9 in. app. 10 ft. from end of slot) |

# Digging the trenches

Clear the excavated soil away from the trench to facilitate measuring the trench depth. Adjust any portions of the trench that are outside the limits specified for the medium. For dual trench installation, keep the cable spacing (± 5 cm, 2 in.) and burial depth ± 2.5 cm (1 in.) consistent. For single trench narrow cable spacing, keep the cable spacing to within + 2.5 cm (1 in.) for the full length of the cable route. There is no minus tolerance for narrow cable spacing (10 cm minimum). Senstar recommends that the installer build a tool or use a 10 cm wide device (e.g., a work boot) to ensure that the narrow cable spacing is consistent for the full length of the sensor cables.

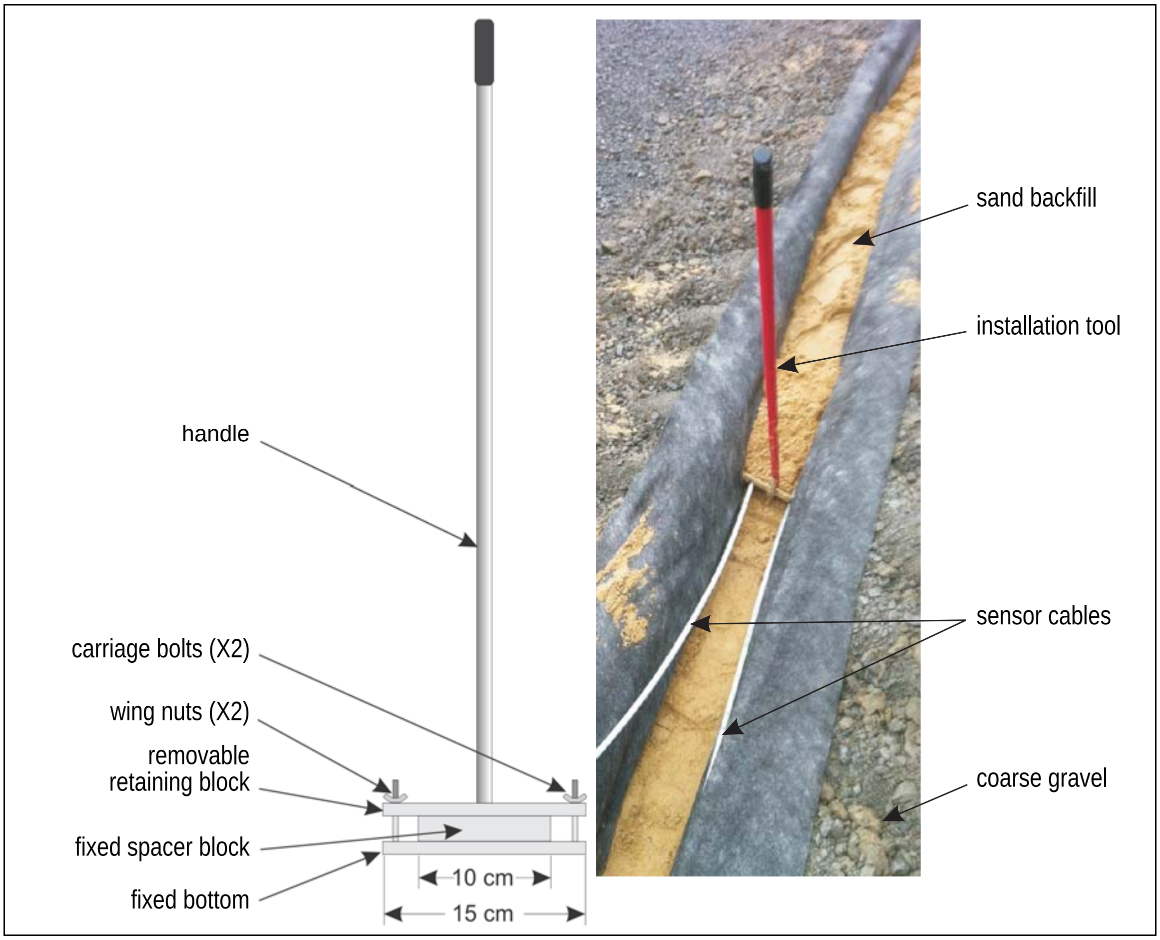



Figure 60: Narrow cable spacing installation tool

# Narrow cable spacing (single trench)

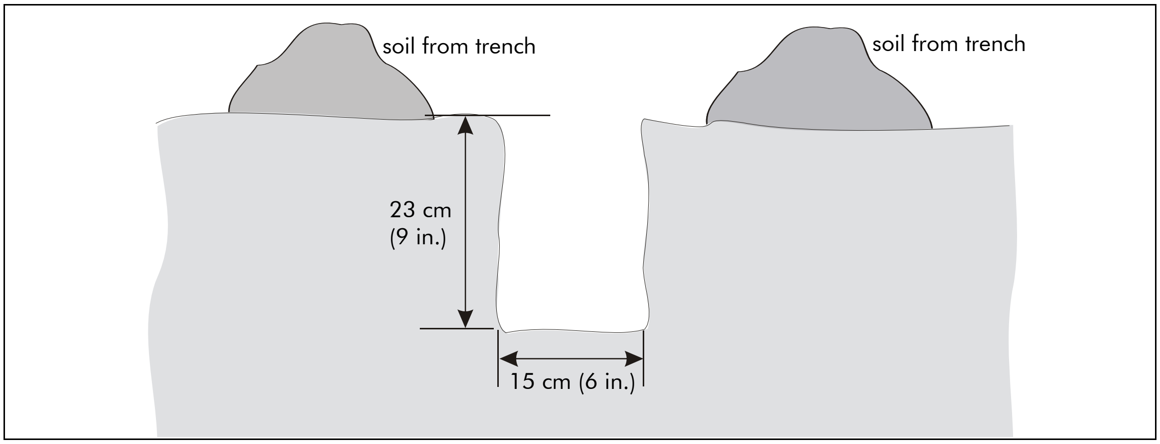



Figure 61: Trench dimensions for narrow spacing (single trench)

1. For narrow cable spacing (10 to 15 cm) dig one trench 15 cm (6 in.) wide X 23 cm (9 in.) deep.
2. Carefully lay the sensor cables in the trench at the specified cable spacing.
3. Pull the cables taut and partially backfill the trench with 7.5 cm (3 in.) of soil as you go to hold the sensor cables in place and ensure the cable spacing remains consistent.

| **Note** | Do not cover the ends of the sensor cables with soil, as ferrite beads, connectors, and decouplers must be installed. |
|---|---|

4. Place cable marker tape in the trench 7.5 cm (3 in.) above the sensor cable (optional).

| **Note** | Before backfilling the trench to ground level, install the ferrite beads and connectors, but do not seal the heatshrink at this time (see Installing cable fittings on page 121). Next, do the cable tests (see Cable tests on page 146) and then do a sensitivity profile to verify the installation (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197). |
|---|---|

5. Finish backfilling the trench.

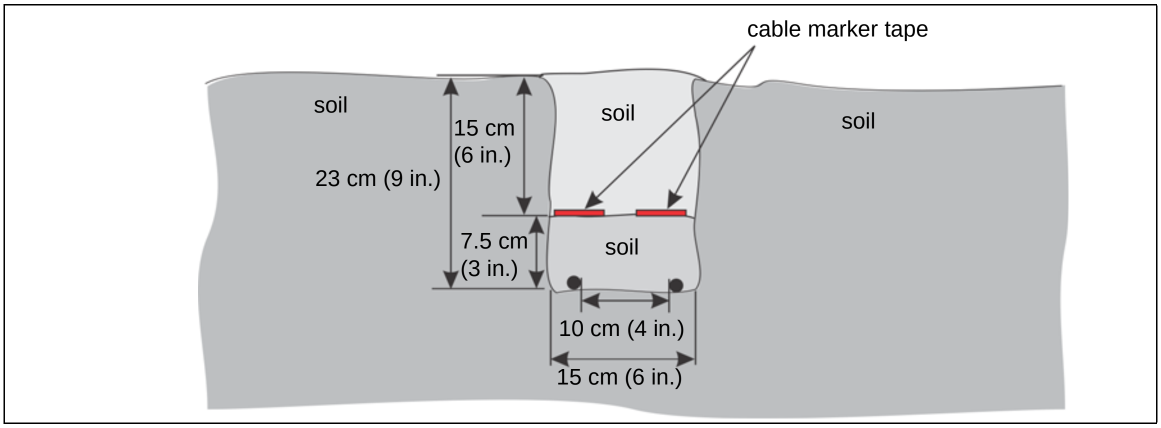



Figure 62: Completed trench for narrow spacing (single trench)

# Standard cable spacing (dual trench)

For dual trench installation, bury the sensor cable directly in native soil. Before burying the cables, ensure that there are no rocks or debris mixed in with the soil that could potentially damage the sensor cables.

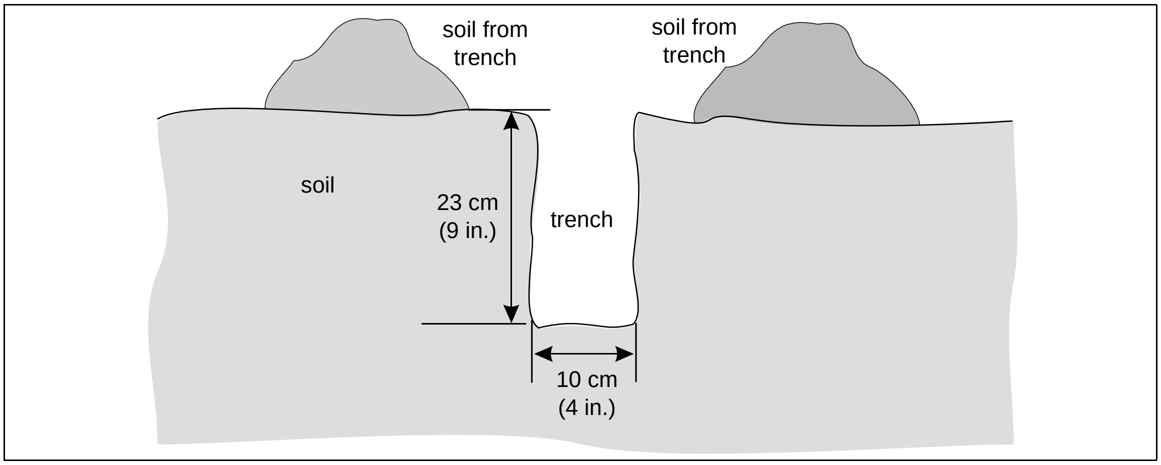



Figure 63: Trench dimensions for burial in soil (dual trench)

1. Dig two parallel trenches 10 cm wide by 23 cm deep at the specified cable spacing.

| Note | Keep the cable spacing (± 5 cm, 2 in.) and burial depth ± 2.5 cm (1 in.) consistent. |
|---|---|

2. Lay the sensor cables in the trenches.
3. Verify that the cable is lying at a uniform depth of 23 cm (9 in.).
4. Mark the locations of the red bands on the ground.
5. Pull the cable taut and partially backfill the trench with 7.5 cm (3 in.) of soil as you go to hold the sensor cable in place.

| Note | Do not cover the ends of the sensor cables as ferrite beads, connectors, and decouplers must be installed first. |
|---|---|

6. Place cable marker tape in the trench 7.5 cm (3 in.) above the sensor cable (optional).

| Note | Before backfilling the trench to ground level, install the ferrite beads and connectors, but do not seal the heatshrink at this time (see Installing cable fittings on page 121). Next, do the cable tests (see Cable tests on page 146) and then do a sensitivity profile to verify the installation (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197). |
|---|---|

7. Finish backfilling the trenches.

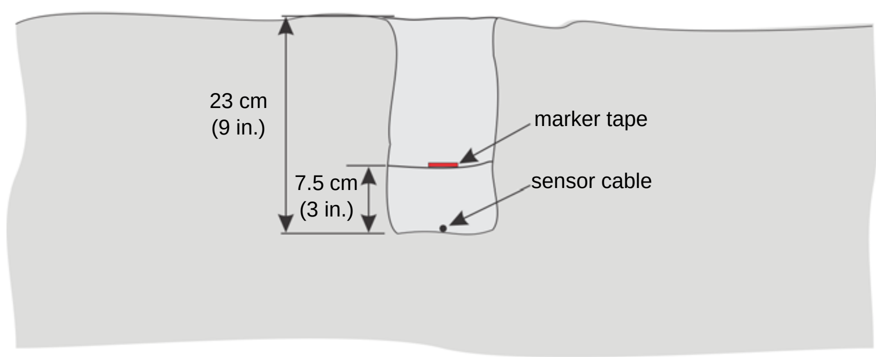



Figure 64: Completed soil installation

# Burial with a crushed stone topping

Use the following guidelines when installing cable with crushed stone:

- The maximum size for the crushed stone is 19 mm (0.75 in.).
- For a topping that is 5 cm (2 in.) or less, use the standard burial depth and add the crushed stone on top.
- For a topping that is between 5 and 15 cm (2 to 6 in.) adjust the burial depth to 15 cm (6 in.) in the soil.
- Spread a stone dust or sand layer on top of the crushed stone to help fill the voids in the crushed stone.
- For narrow cable spacing (single trench installation) increase the width of the trench from 10 cm to 15 cm (4 in. to 6 in.).

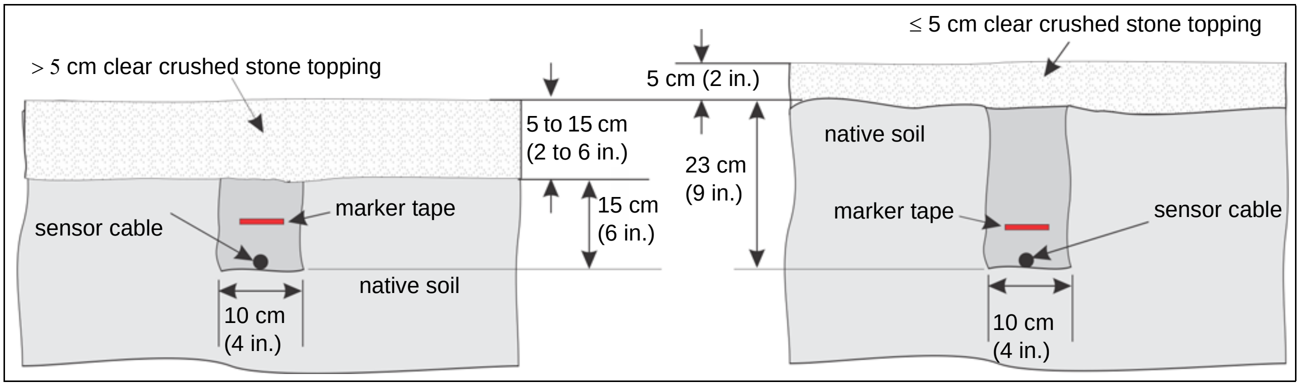



Figure 65: Crushed stone toppings

# Burial in crushed stone

Burial in clear crushed stone that extends from the surface to the sensor cable burial depth, requires the use of a stone dust, or a sand bedding, wrapped in geotextile fabric. The bedding protects the sensor cables from the crushed stone, and the geotextile fabric protects the bedding from erosion. In addition, add a sand or stone dust topping over the crushed stone to help fill the voids between the stones.

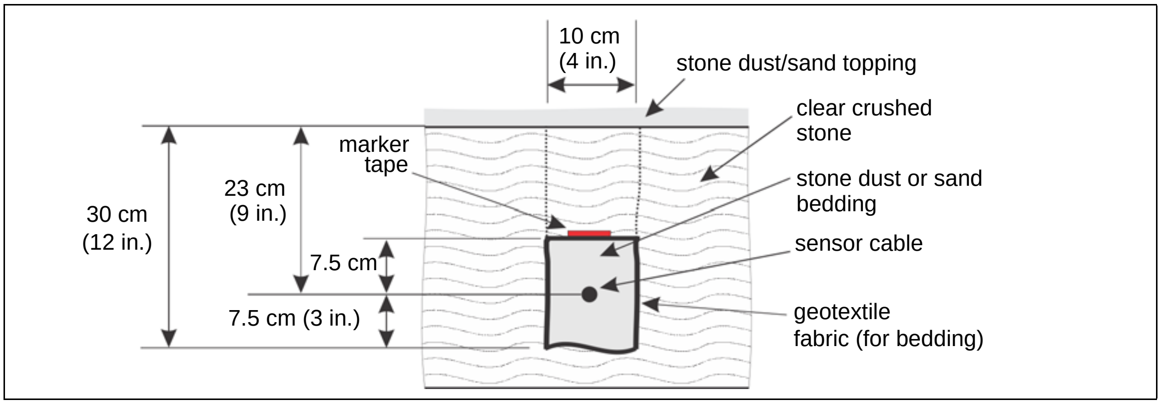



Figure 66: Crushed stone burial

# Burial under asphalt

## Burial under a narrow strip of asphalt

Micro-trenching cannot be used for narrow cable spacing installation under asphalt. Instead, for a thin strip of asphalt remove a 30 cm wide strip of the hard surface over the sensor cable's path, and then dig the trench. The burial depth under these narrow asphalt strips is slightly deeper than the burial depth in the adjacent soil to better match the detection sensitivity of the different media. If there is a crushed stone layer that extends to, or close to, the sensor cable burial depth, dig the trench deeper and use a stone dust or sand buffer to protect the sensor cables from the stones. After cable installation, restore the asphalt surface.

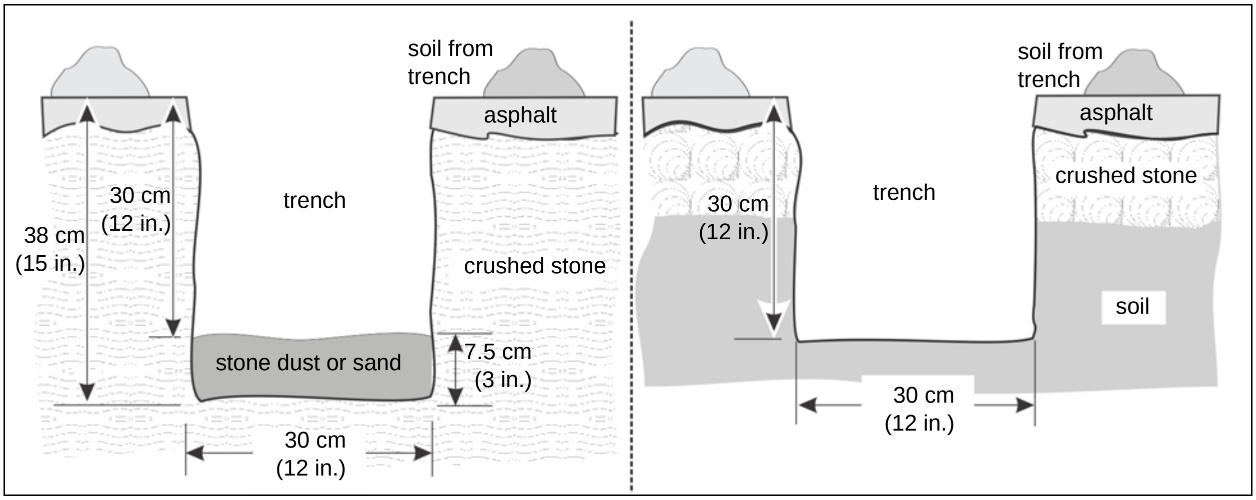



Figure 67: Trench dimensions under a thin strip of asphalt

1. For each trench, make two parallel cuts through the hard surface, 15 cm (6 in.) away from the cable path (i.e., two cuts 30 cm (12 in.) apart, centered on the sensor cable route).
2. Remove the cut sections of asphalt and dig two 30 cm (12 in.) wide by 30 cm deep trenches.

OR for hard surfaces with a crushed stone layer extending to the depth of the sensor cables:

2. Dig the trenches 30 cm wide by 38 cm (15 in.) deep to accommodate a protective stone dust or sand buffer.
3. Pour a 7.5 cm (3 in.) stone dust or sand layer in the trench so that the trench is 30 cm (12 in.) deep (from surface level).
4. Lay the cable in the trenches.

| | |
|---|---|
| **Note** | For dual trench installation keep the cable spacing to within ±5 cm (2 in.).<br>For single trench installation with narrow cable spacing, keep the cable spacing to within +2.5 cm (1 in.) (no minus tolerance). |

5. Pull the cable taut and partially backfill the trench with 7.5 cm (3 in.) of stone dust, sand, or soil as you go to hold the sensor cable in place.

| | |
|---|---|
| **Note** | Do not cover the ends of the sensor cables as ferrite beads, connectors, and decouplers must be installed first. |

6. Place cable marker tape on the stone dust, sand, or soil 7.5 cm (3 in.) above the sensor cable (optional).

| | |
|---|---|
| **Note** | Before backfilling the trench to ground level, install the ferrite beads and connectors, but do not seal the heatshrink at this time (see Installing cable fittings on page 121). Next, do the cable tests (see Cable tests on page 146) and then do a sensitivity profile to verify the installation (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197). |

7. Backfill the trench with native soil and compact the soil.
8. Restore the cut section of asphalt.

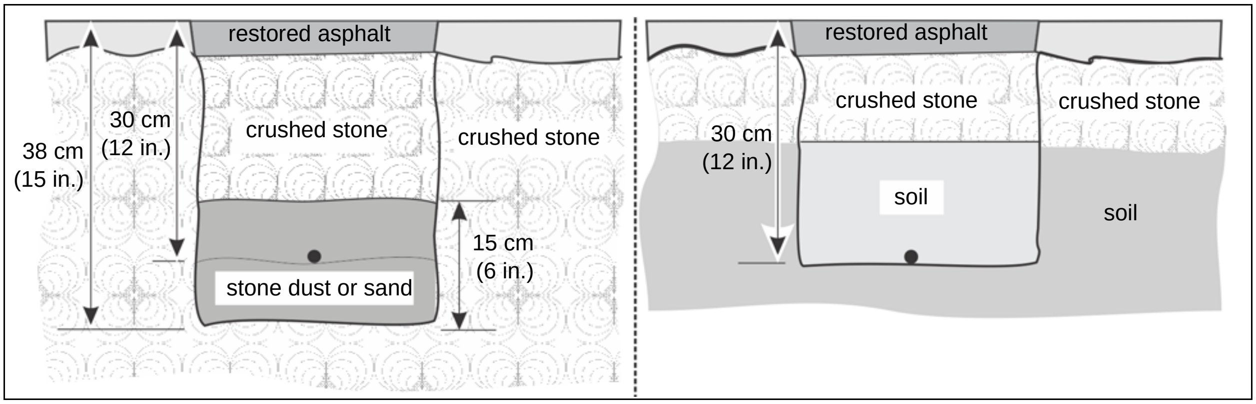



Figure 68: Trench dimensions under a thin strip of asphalt

### Micro-trenching or boring under a narrow paved strip

If the sensor cable route crosses a narrow section of asphalt or concrete such as a sidewalk or driveway, Senstar recommends installing the sensor cables below the hard surface in a buried section of PVC conduit. The conduit requires a 19 mm (3/4 in.) internal diameter and can be a maximum 7 m (23 ft.) long. You can install the sensor cable under asphalt or non-reinforced concrete either by micro-trenching, or using a boring technique to cut a path under the concrete. Before micro-trenching, consider the structural integrity of the asphalt surface given the remaining thickness after the trenches are dug and the load it must bear.

1. Bore a 2.5 cm (1 in.) hole 30 cm below the surface, through the soil under the hard surface using pressurized water or compressed air.
2. Feed a PVC conduit through the hole.
3. Pull the sensor cable through the conduit.

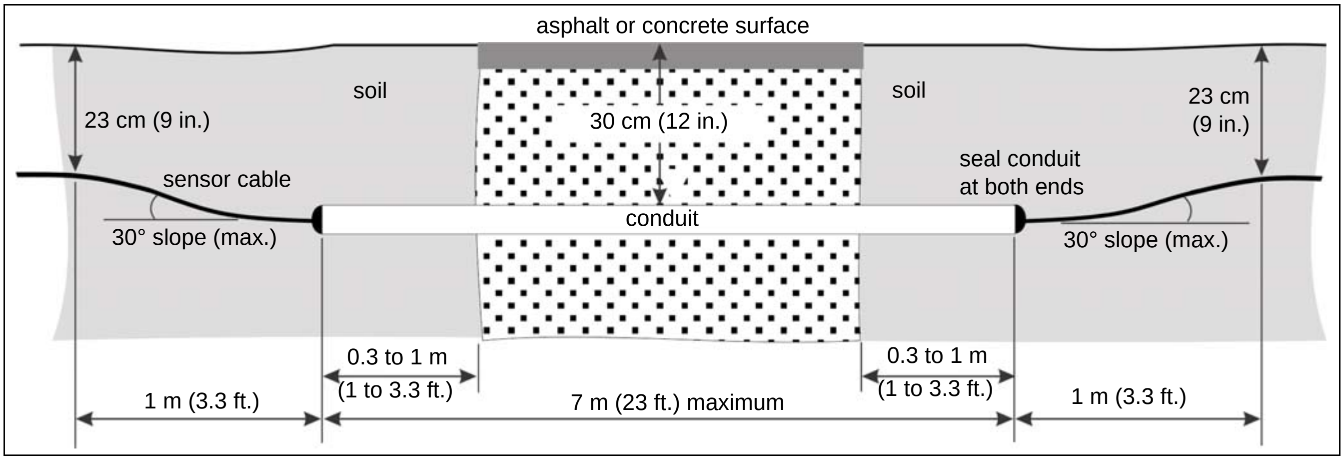



Figure 69: Using conduit under paved surfaces

4. Continue laying the cable in the trench.

### Burial under a large asphalt paved surface

For a large paved asphalt surface, remove a 30 cm wide strip of the hard surface over the sensor cable’s path, and then dig the trench. After cable installation, the asphalt surface is restored.

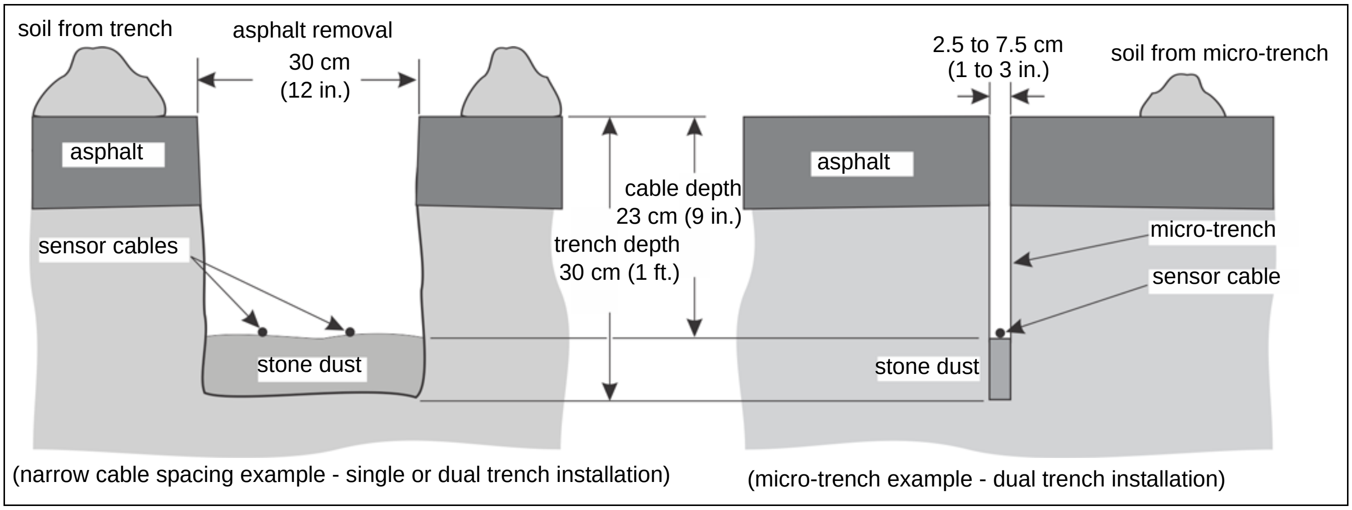



Figure 70: Trench dimensions under a large asphalt surface (narrow spacing/micro-trench)

1. For each trench, make two parallel cuts through the hard surface, 15 cm (6 in.) away from the cable path (i.e., two cuts 30 cm (12 in.) apart, centered on the sensor cable route).

OR if micro-trenching equipment is being used:

1. Dig two parallel 2.5 to 7.5 cm (1 to 3 in.) wide trenches to a depth of 30 cm beneath the top of the paved surface at the specified separation (micro-trenching cannot be used for narrow cable spacing installation).
2. Remove the cut sections of asphalt and dig two 30 cm (12 in.) wide trenches to a depth of 30 cm beneath the top of the paved surface.
3. Pour a 7.5 cm stone dust layer on the bottom of the trench.
4. Lay the cable in the trench.

| | |
|---|---|
| **Note** | For dual trench installation keep the cable spacing to ±5 cm (2 in.). For single trench installation with narrow cable spacing, keep the cable spacing to +2.5 cm (1 in.) (no minus tolerance). |

5. Pull the cable taut and partially backfill the trench with 7.5 cm (3 in.) of stone dust, or sand, as you go to hold the sensor cable in place.

| | |
|---|---|
| **Note** | Do not cover the ends of the sensor cables as ferrite beads, connectors, and decouplers must be installed first. |

6. Compact the stone dust in the trench.
7. Place cable marker tape on the stone dust above the sensor cable (optional).

| | |
|---|---|
| **Note** | Before backfilling the trench to ground level, install the ferrite beads and connectors, but do not seal the heatshrink at this time (see Installing cable fittings on page 121). Next, do the cable tests (see Cable tests on page 146) and then do a sensitivity profile to verify the installation (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197). |

8. Backfill the trench with native soil and compact the soil.
9. Restore the cut section of asphalt.

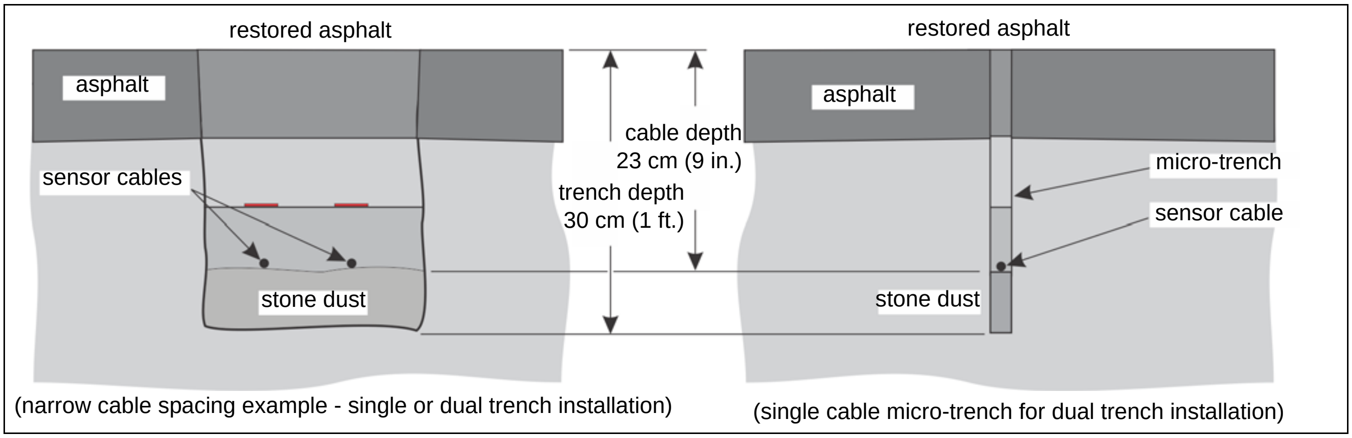



Figure 71: Trench dimensions under a large asphalt surface (completed narrow spacing/micro-trench)

# Burial in clay

Installing sensor cables in moderate or heavy clay requires modified installation techniques. When using modified techniques, install and test one sensor cable set at a time.

## Burial in moderate clay soil (OC2/SC2 cables only)

This technique includes moderate clay soil with, or without, a vegetation topping.

- reduced burial depth of 15 cm (6 in.)
- dual trench installation requires two trenches 15 cm deep and 10 cm wide
- single trench installation requires one trench 15 cm deep and 15 cm wide
- do not use a sand buffer or geotextile fabric
- clay chunks must be broken up before backfilling to prevent damaging the cables
- a dual cable system must be used (OC2, SC2)
- maximum cable spacing is 1 m (3.3 ft.)

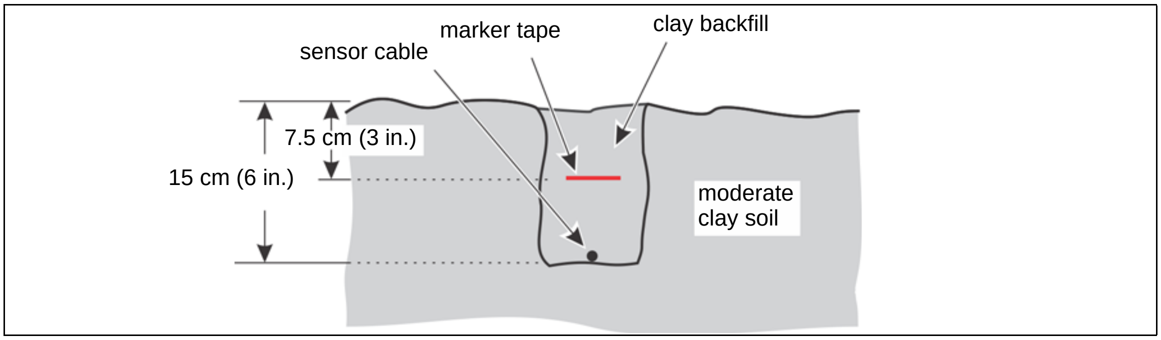



Figure 72: Installation in moderate clay soil

## Burial in heavy clay soil

| | |
|---|---|
| **Note** | If your site includes heavy clay soil, Senstar recommends engaging a Geotechnical Engineering firm to assess the soil and drainage conditions. |

| | |
|---|---|
| **Note** | Install and test one cable set, before proceeding with the full installation. The test must include the saturation of the soil to the moisture content extremes that typically occur in the area. |

- reduced burial depth of 15 cm (6 in.)
- soil replacement is required
- expanded stone dust or sand buffer and geotextile fabric required
- gravel bed strongly recommended for drainage
- the surface above the trench must be graded to allow runoff
- a dual cable system must be used (OC2, SC2)
- maximum cable spacing is 1 m (3.3 ft.)
- narrow cable spacing (10 cm) may be used

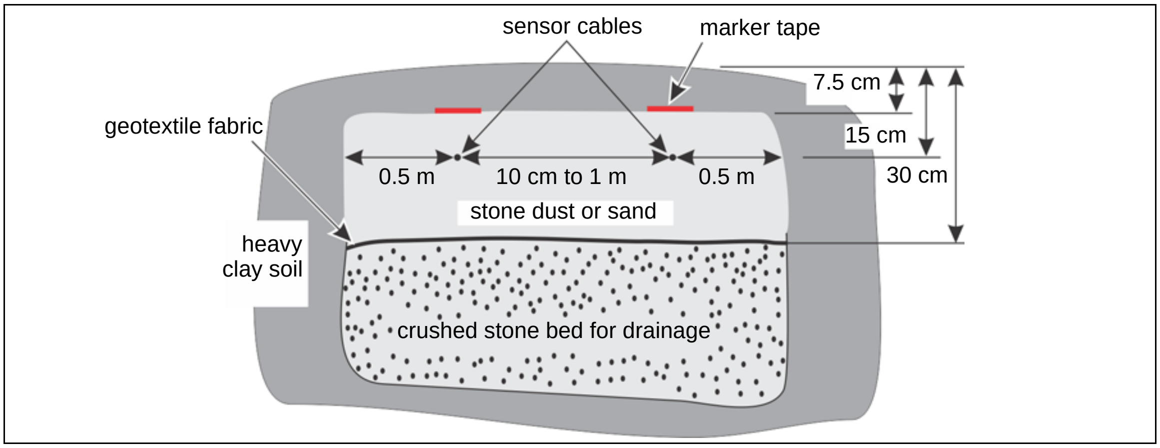



Figure 73: Installation in heavy clay soil

1. Dig one trench 1.1 m to 2 m wide (depending on cable spacing) and 30 cm to 1 m deep (depending on the size of the crushed stone bed that is required for adequate drainage.
2. Fill the bottom of the trench with clear crushed stone to a depth of 30 cm from ground level.
3. Lay the geotextile fabric in the trench above the crushed stone layer to the width of the trench.
4. Pour a 15 cm layer of stone dust or sand on the geotextile fabric in the trench.
5. Lay the sensor cables in the trench at the specified cable spacing (10 cm to 1 m).
6. Pull the cable taut and partially backfill the trench with 7.5 cm (3 in.) of stone dust, or sand, as you go to hold the sensor cable in place.

| | |
|---|---|
| **Note** | Do not cover the ends of the sensor cables as ferrite beads, connectors, and decouplers must be installed first. |

7. Place cable marker tape on the stone dust or sand above the sensor cables (optional).

| | |
|---|---|
| **Note** | Before backfilling the trench to ground level, install the ferrite beads and connectors, but do not seal the heatshrink at this time (see Installing cable fittings on page 121). Next, do the cable tests (see Cable tests on page 146) and then do a sensitivity profile to verify the installation (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197). |

8. Complete the backfilling of the trench with 7.5 cm (3 in.) of the heavy clay soil. Ensure that the native soil layer is graded to allow rainfall to run off the cable path.

# Preparation of slots in concrete

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| **Note** | Do not cut slots if there are areas where the concrete is so thin that you may cut through it; dig trenches. The concrete must be greater than 13 cm (5 in.) thick to cut slots. |

| | |
|---|---|
| **CAUTION** | Long straight runs of OC2 cables in slots are NOT recommended due to the possibility that thermal expansion can force the sensor cables to pop out of the slots in places. |

**CAUTION**

For instances in which the sensor cables are buried in soil and pass through concrete surface slots, the detection sensitivity over the concrete must be tested to determine if installation adjustments are required:

- Install the connectors on the sensor cable, but do not put on or seal the heatshrink at this time.
- Connect the sensor cables to the processor and decouplers, and lay the sensor cables in the trenches and slots. Do not bury the sensor cable or seal the slots.
- Power up the processor, establish a UCM connection to the processor, and conduct a centerline cable walk while running a UCM response plot.
- Review the plot to determine the sensitivity over the slots.
  If the average detection signal above the slots is more than 10 dB higher than the average detection signal above the soil, then install ferrite beads along the concrete surface at 30 cm (1 ft.) intervals.
- Once the ferrite beads are installed repeat the centerline cable walk to verify that the adjustment is effective (the average detection signal above the slots is less than 10 dB higher than the average detection signal above the soil).

## Crossing surface cracks and expansion joints

| | |
|---|---|
| **Note** | Do not route the sensor cable through existing cracks or expansion joints in the concrete. |

To prevent post-installation surface damage, the cable path must cross any cracks or expansion joints at an angle greater than 30°. If the crack or joint is deeper than 6.5 cm (2½ in.) insert a closed foam polyethylene backer rod into the slot. Use a blunt tool to install the backer rod so the backer rod is at least 1 cm (3/8 in.) below the bottom of the slot (just below the cable's installation depth). The backer rod must extend at least 30 cm (12 in.) beyond both sides of the slot, and the backer rod must be thicker than the width of the crack or joint. See Slot dimensions on page 111.

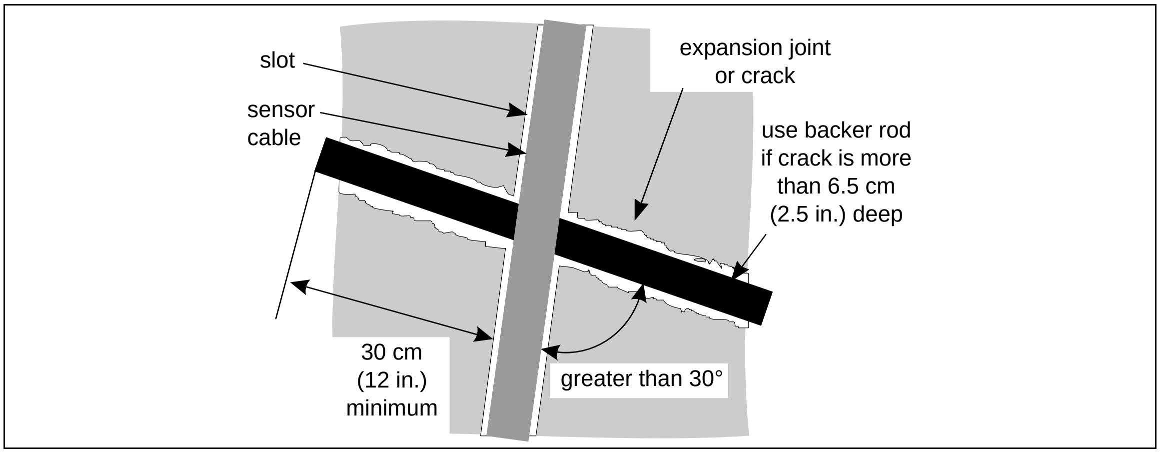


Figure 74: Crossing cracks or expansion joints

## Transition from a slot to a trench

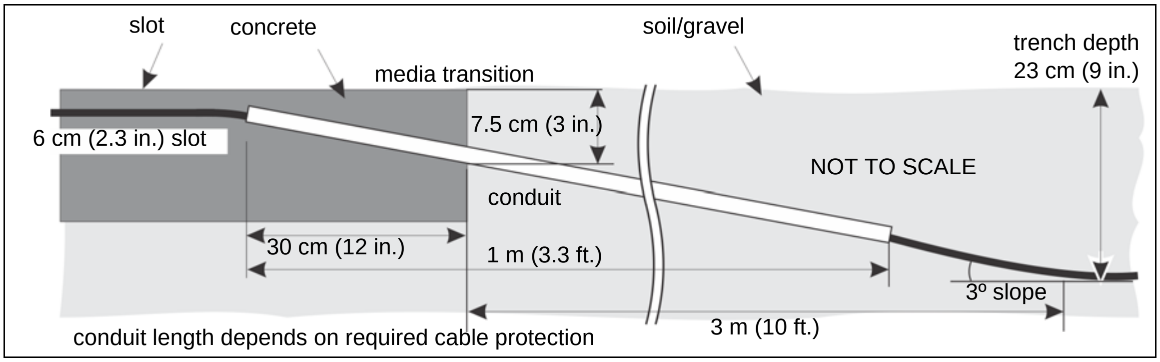


Figure 75: Slot to trench transition

| | |
|---|---|
| **CAUTION** | Additional cable protection may be required in the soil or gravel past the media transition where the cables are close to the surface. |

If the cables are routed from concrete to soil or gravel, the last 30 cm (12 in.) of the slot and the first 3 m (10 ft.) of the trench must be sloped to meet each other. The slope angle of less than 3º should be gradual and consistent until the trench is at the correct depth for the burial medium. At the media transition, the junction of the slot and trench should be approximately 7.5 cm (3 in.). A 1 m section of 2 cm (¾ in.) PVC conduit should be installed to protect the sensor cables at the media transition and where the trench is close to the ground's surface. Additional cable protection should be used if the cable may be subject to damage near the hard surface (e.g., longer section of conduit or pressure treated wood) due to the shallow burial depth. The last 30 cm of the slots must be widened to accommodate the conduit.

### Required equipment and materials

- site plan
- tape measure
- spray paint, grease pen, water-resistant marker, chalk line
- OC2 - concrete saw capable of cutting a slot 14 mm (9/16 in.) wide by 6 cm 2 1/4 in. deep (ganged blades are recommended for single pass cutting)
- SC2 - concrete saw capable of cutting a slot 1 cm (3/8 in.) wide by 6 cm 2 1/4 in. deep (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
- closed cell foam polyethylene backer rods - 2 rows of backer rods per slot
(use backer rods that are app. 3 mm (1/8 in.) wider than the slots)
- PVC pipe 1 - 7 m (3.3 - 23 ft.) long x 2 cm (¾ in.) inside diameter (required only at media transitions, e.g., concrete to soil)
- joint sealant (to seal the sensor cables in the 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 additional information, see Supplier's information on page 240.

### Slot dimensions

| Application | Slot dimensions |
|---|---|
| Standard slot (OC2) | 14 mm wide x 6 cm deep (9/16 in. x 2¼ in.) + 2 mm, - 1 mm (+ 1/8 in., - 1/16 in.) |
| Standard slot (SC2) | 1 cm wide x 6 cm deep (3/8 in. x 2¼ in.) + 1 mm, - 0.7 mm (+ 1/16 in., - 1/32 in.) |
| Sensor cable crossover | 14 cm (5.5 in.) deep at 90º angle |
| Decoupler | 2.5 cm wide x 10 m long x 7 cm deep (1 in. x 33 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 sloped from 6 cm (2½ in.) to 10 cm (4 in.) deep over 30 cm (12 in.) |
| Ferrite beads | use a drill to widen slots for ferrite bead installation<br>OC2 cable the beads O.D. = 2.54 cm (1 in.)<br>SC2 cable the beads O.D. = 2 cm (3/4 in.) |

# Cutting the basic slot

**Note** Mount several diamond-tooth blades side-by-side with spacers to achieve the recommended slot width.

1. Mark the cable path on the ground.
2. Using a concrete saw, cut the slots along the marked cable path.

**Note** To maintain a consistent and accurate slot width and depth, cut each slot using a single pass of the saw (see Slot dimensions on page 111).

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

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

6. Use additional cuts or additional ganged blades to widen and deepen the slots where necessary for decouplers, sensor cable crossovers at the start point, and for overlaps.
7. Use a drill to widen the slots for the ferrite bead's. For OC2 cable, the beads are 2.5 cm (1 in.) in diameter. For SC2 cable the ferrite beads are 2 cm (3/4 in.) in diameter.

8. Verify that the slots are the correct depth and that the bottoms and sides of the slots are smooth.
9. Lay the sensor cable in the slots.

| | |
|---|---|
| **Note** | Before completing the slot installation, install the ferrite beads and connectors, but do not seal the heatshrink at this time (see Installing cable fittings on page 121). Next, do the cable tests (see Cable tests on page 146) and then do a sensitivity profile to verify the installation (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197). A surface test is also recommended for slot installations (see The surface test on page 152). |

# Completing the slot installation

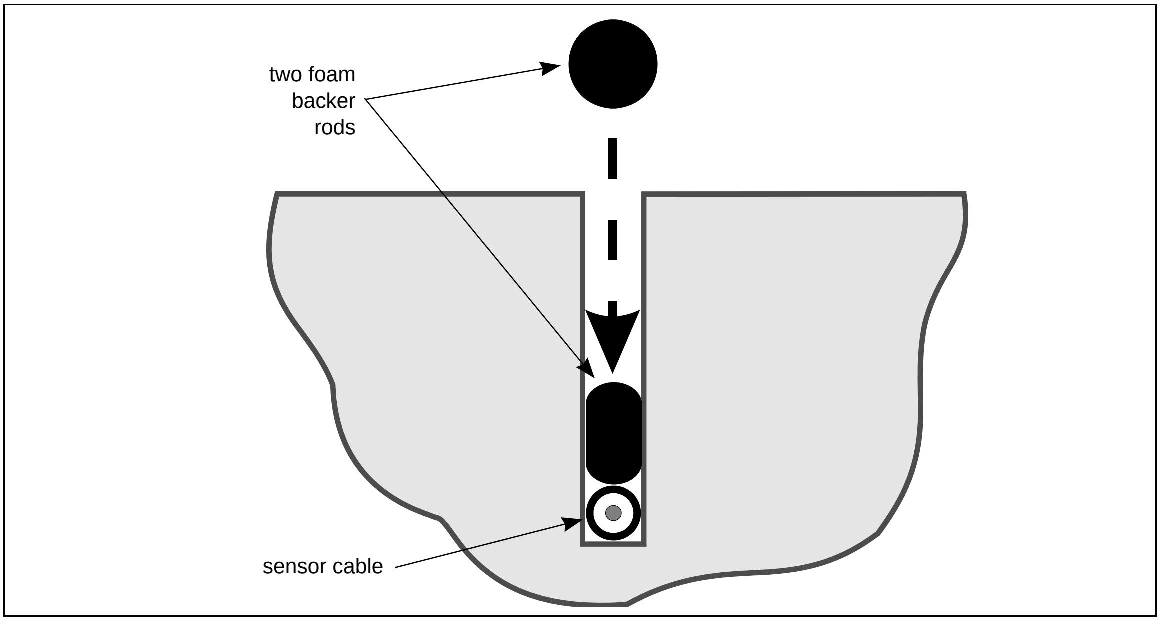


Figure 76: Slot installation using backer rods

1. Pack the slots with two rows of foam backer rods.
   Ensure that the backer rods are slightly wider than the slot, so that they compress as they are forced into the slot.
2. Mark the red band and decoupler locations.

| | |
|---|---|
| **Note** | Before sealing the slots, install the ferrite beads and connectors, but do not seal the heatshrink at this time (see Installing cable fittings on page 121). Next, do the cable tests (see Cable tests on page 146) and then do a sensitivity profile to verify the installation (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197). |

**Joint sealant** is required to seal the sensor cable in slots. Use a Senstar approved sealant or expanding foam sealant tape.

**Chemical sealants** must be installed in dry conditions. A pump may be required for large installations. At the specified slot dimensions, estimate 28 liters of sealant for every 100 m of OC2 sensor cable (2.1 U.S. gallons for every 100 ft.) and 20 liters of sealant for every 100 m of SC1/SC2 sensor cable (1.5 U.S. gallons for every 100 ft.). Allow extra for spillage, and for widened slots (decouplers, terminators, ferrite beads).

**Tape sealants** must be inserted manually, and the depth of installation must be carefully controlled. As a precaution, order 5% extra tape sealant.

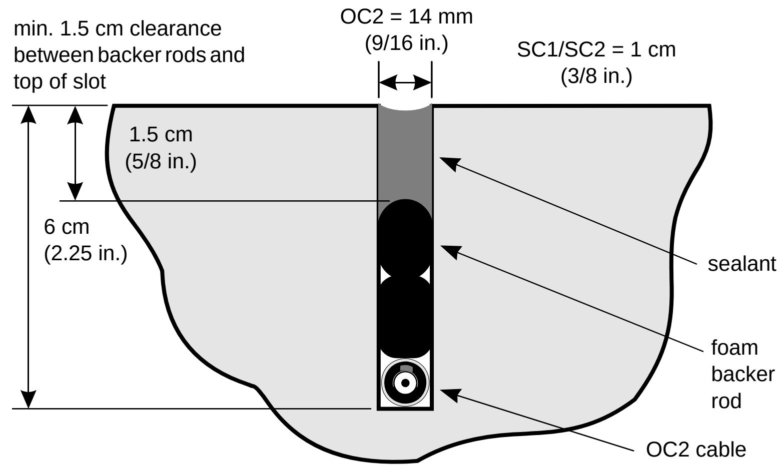


Figure 77: Sealing the slot

| | |
|---|---|
| **Note** | The slots must be clean and dry BEFORE the sealant is applied. |

| | |
|---|---|
| **Note** | Ensure that there is at least 1.5 cm (0.6 in.) of space between the top of the backer rod and the top of the slot, for the sealant. |

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

| | |
|---|---|
| **Note** | Ensure the backer rod is continuous to avoid any contact between chemical sealants and the cable. |

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

| | |
|---|---|
| **CAUTION** | Do not use a petroleum based waterproofing compound, as it can penetrate the cable and affect operation. |

# Above ground berm installation

There are three methods for above ground berm installations:

- Enclose both sensor cables in a wide, sloped sand bedding, which is wrapped in geotextile fabric and then covered with clear crushed stone.
- Enclose both sensor cables in a narrow, rounded sand bedding, which is wrapped in geotextile fabric and then covered with clear crushed stone.
- Enclosing each sensor cable in a narrow, rounded sand bedding, which is wrapped in geotextile fabric and then covered with clear crushed stone.

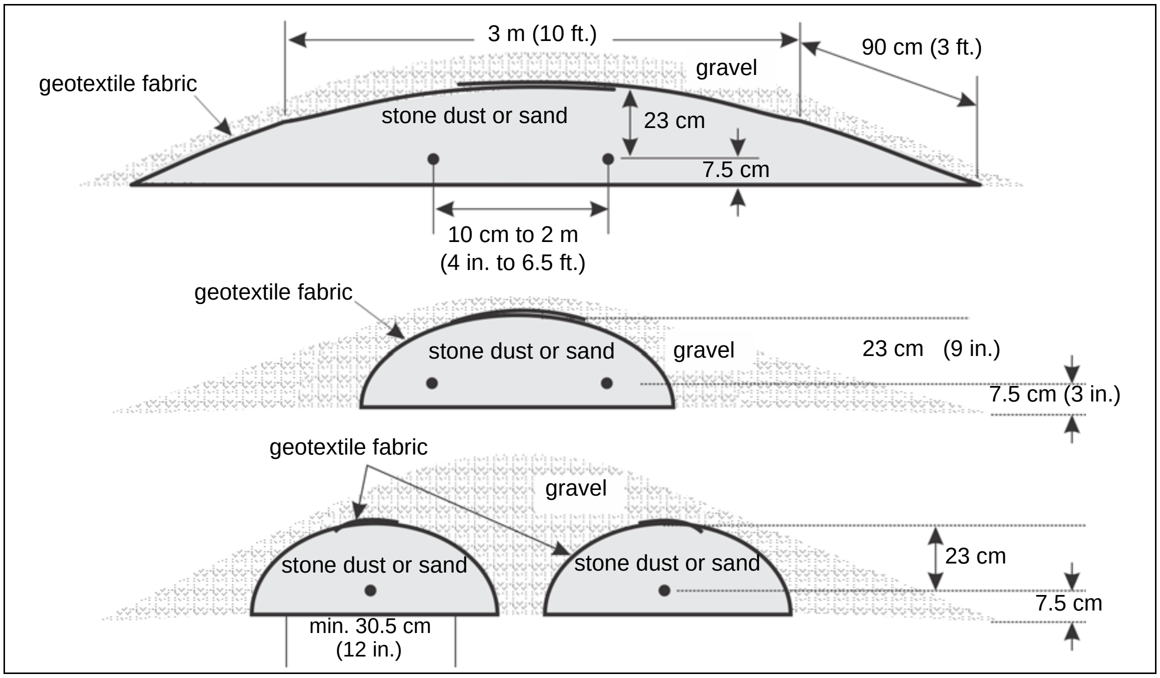


Figure 78: Above ground installation in a berm

1. Remove any debris and stones from the ground's surface, then roll out the geotextile fabric on the ground.
2. Cover the portion of the fabric where the sensor cables will lay with a 7.5 cm (3 in.) deep layer of stone dust or sand.
3. Lay the sensor cables on top of the 7.5 cm stone dust or sand layer.

| | |
|---|---|
| **Note** | Before covering the cables, install the Ferrite beads and connectors, but do not seal the heatshrink at this time (see Installing cable fittings on page 121). Next, do the cable tests (see Cable tests on page 146) and then do a sensitivity profile to verify the installation (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197). |

4. Pull the cables taut and cover the sensor cables with an additional 23 cm (9 in.) layer of stone dust or sand.
5. Slope the sides of the berm with a minimum 1:3 ratio (depending on the severity of erosion expected).
6. Fold the geotextile fabric over the stone dust or sand and cover the fabric with a layer of crushed stone that is at least 2.5 cm (1 in.) deep. Additional crushed stone may be needed if erosion is severe.
7. Ensure that the geotextile fabric is completely covered with crushed stone.

# Sensor cable start points

At sensor cable start points:

- the lead-in and detecting cables must cross each other at a 90° angle
- the detecting cable is installed above the lead-in cable, and the detecting and lead-in cables must NOT touch at the crossover
- for cables buried in soil there must be a vertical separation of at least 23 cm (9 in.) over a short distance, i.e., the bottom cable (lead-in) must be buried at least 46 cm (18 in.) deep, with the detecting cable buried at 23 cm (9 in.)
- for cables in hard surface slots there must be a vertical separation of at least 2.5 cm (1 in.) over a short distance, i.e., the bottom cable (lead-in) must be installed in a 9.5 cm (3¾ in.) deep slot, with the detecting cable installed above it at 6 cm (2¼ in.)

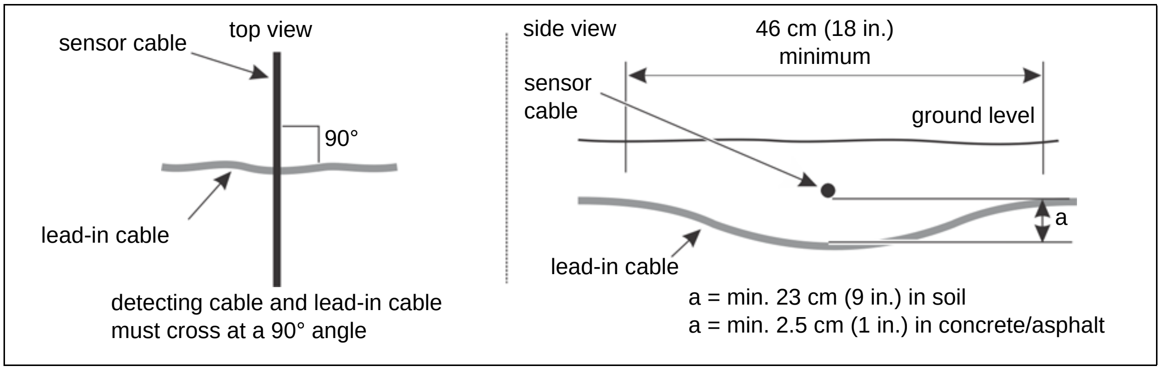


Figure 79: Detecting cable / lead-in cable crossover

## Detecting cable crossover

If two detecting sensor cables cross, you must raise one cable and lower the other. Change the burial depths over approximately 1 m (3.3 ft.) using a very gentle slope. For burial in soil, the required separation between detecting sensor cables is 23 cm (9 in.). For slot installation the required separation is 4 cm (1.5 in.). The two detecting cables must cross at a 90º angle.

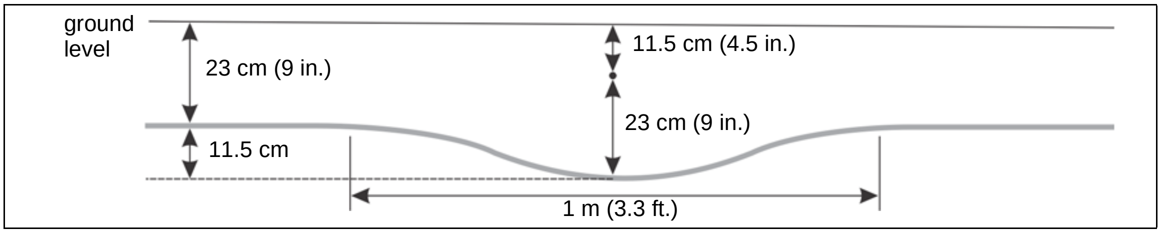


Figure 80: Detecting sensor cable crossover in soil

## Aligning the lead-in cables

1. Unroll the lead-in cable and lay it in the trench or slot between the start point and the processor location.
2. Line up the two red bands on the sensor cables side-by-side at the designated start point.
3. Temporarily anchor the sensor cable at the red mark.

| | |
|---|---|
| **Note** | Use a stake or a flag to mark the location of the red bands on the ground's surface. |

4. Lay the sensor cable in the trench(es) or slots one cable at a time.

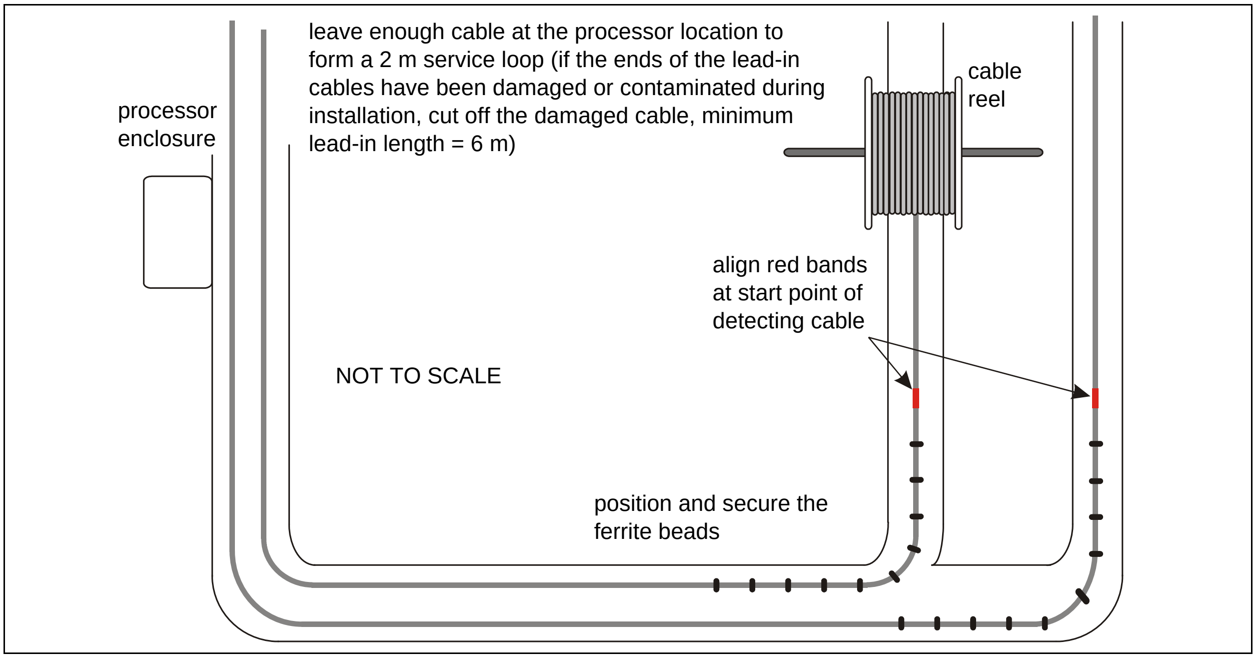


Figure 81: Laying lead-in cable

# Start point configurations

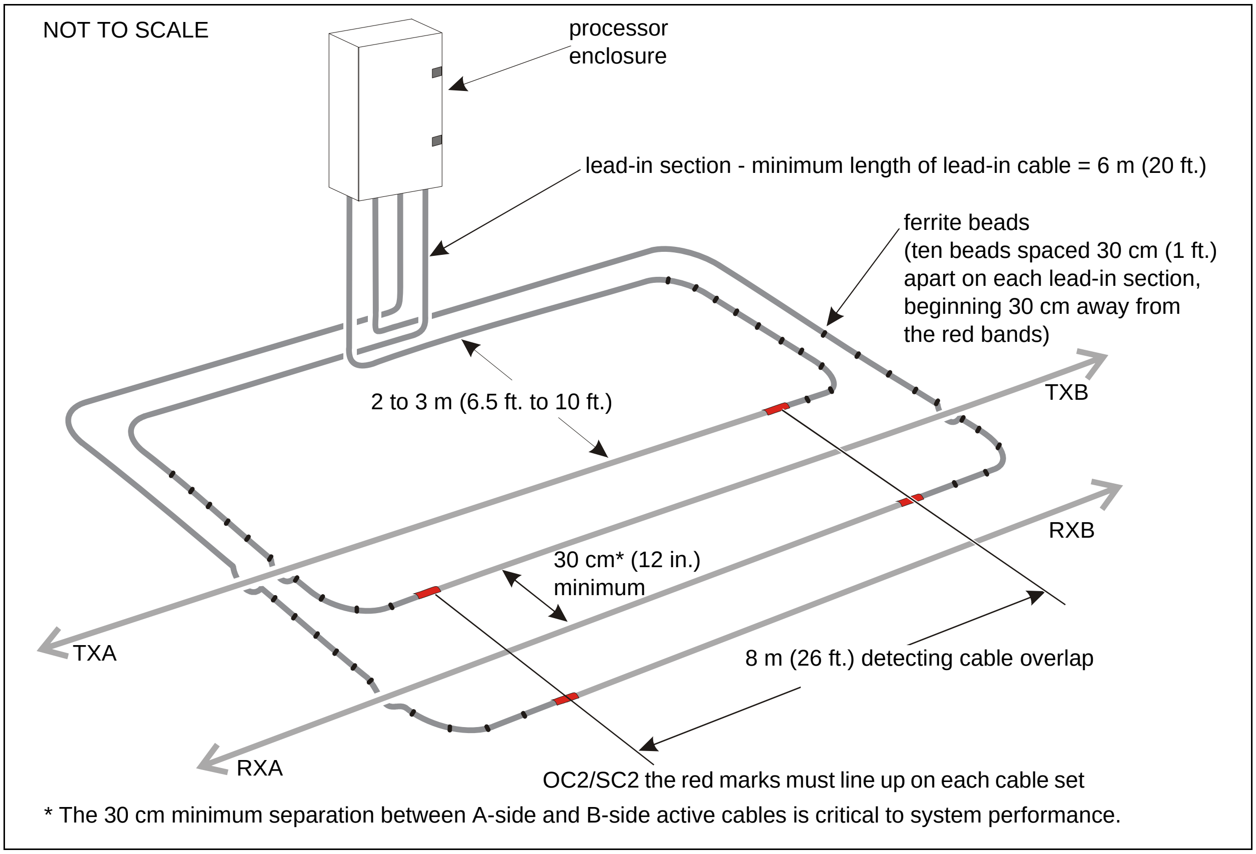


Figure 82: OC2/SC2 sensor cable start point overlap (standard cable spacing)

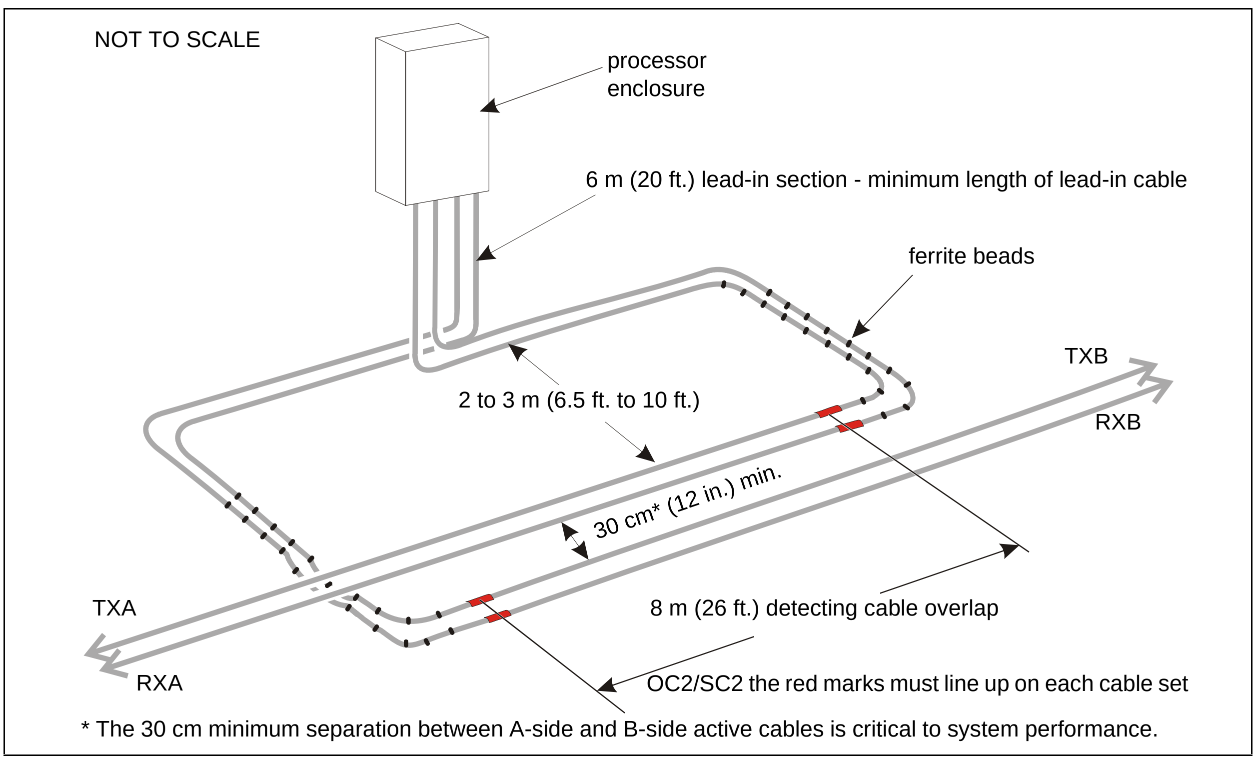


Figure 83: OC2/SC2 sensor cable start point overlap (narrow cable spacing)

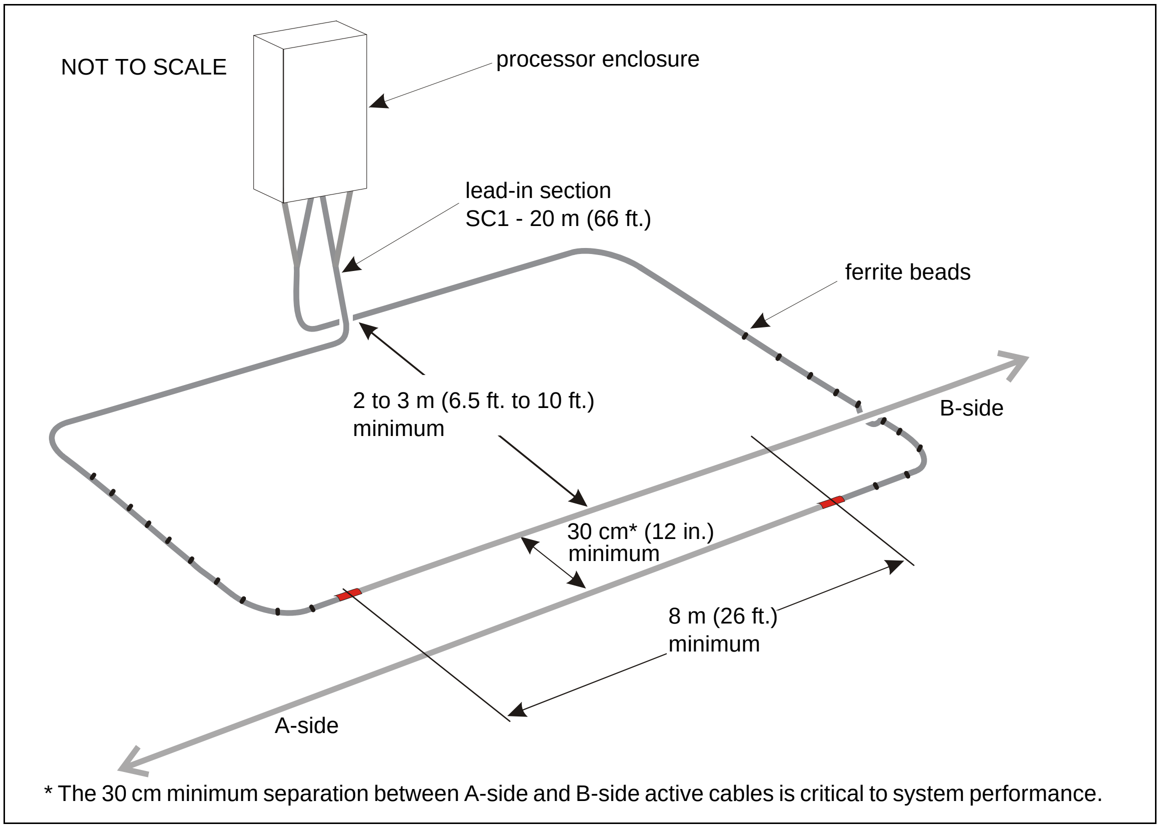


Figure 84: SC1 sensor cable lead-in overlap

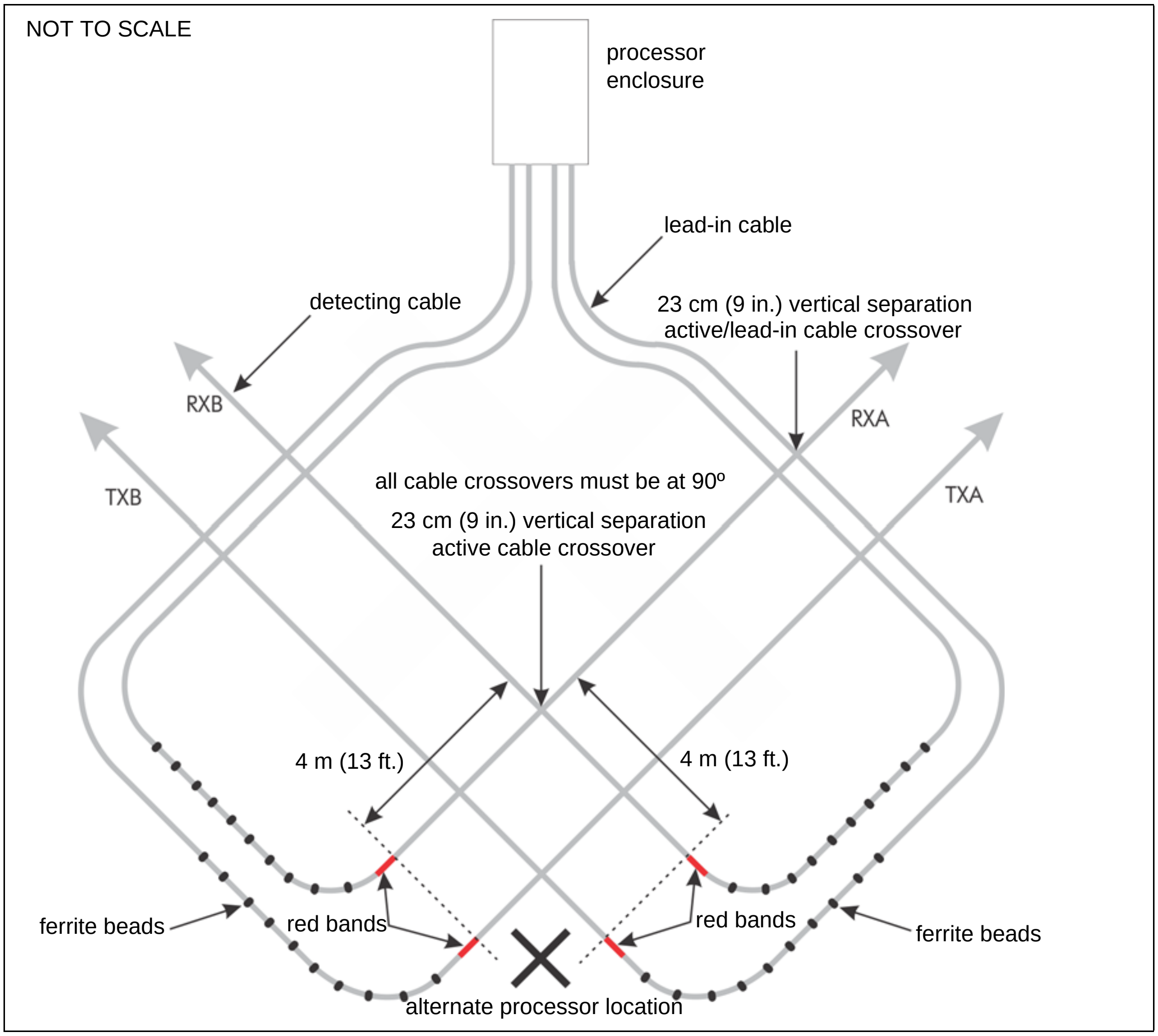


Figure 85: OC2/SC2 sensor cable start point overlap (processor corner installation)

# Digging the lead-in cable trench

You can dig a single trench for the two lead-in cables in a cable set.

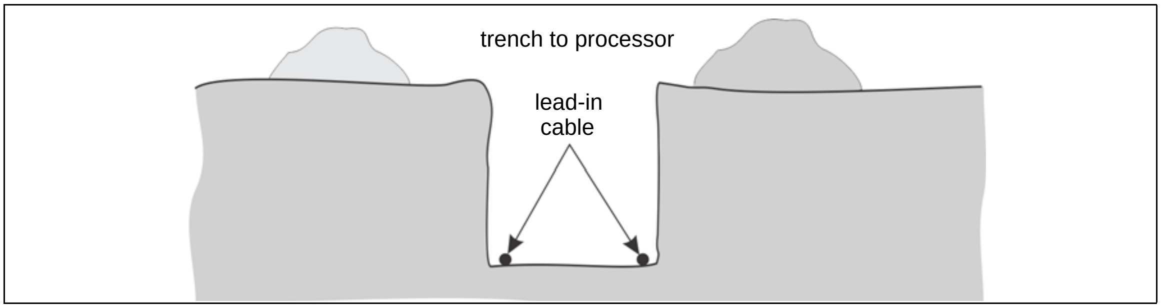


Figure 86: OC2/SC2 lead-in cable using a single trench

# Laying the sensor cables

For OmniTrax sensor cables, the first 20 m (66 ft.) of cable on the reel is lead-in cable. The beginning of the detecting section is marked by red bands. Dispense the cable into the slot(s) or trench(es). Ensure that the two red bands on the sensor cables line up side-by-side at the designated start point, and there is enough lead-in cable to create a 2 m (6.5 ft.) service loop at the processor location.

| | |
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| **Note** | If you are shortening the lead-in cable, OmniTrax requires a minimum of 6 m (20 ft.) of lead-in cable. As a precaution, Senstar recommends retaining at least 10 m of lead-in cable. |

## Required equipment

- OmniTrax sensor cable sets (SC1, SC2, OC2)
- wooden or metal shaft (for dispensing cable)

## Dispensing sensor cable

1. Put a stick (e.g., a shovel handle) through the hole in the cable reel. With one person on each end of the stick, lift the cable reel and walk along the trench or slot. The cable will dispense as you walk.

| | |
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| **Note** | If there is a coil or loop in the cable after it has been dispensed, roll the coil out to the end of the cable. DO NOT attempt to straighten it by twisting or pulling the sensor cable. |

2. Inspect the cable for damage, as it is dispensed.

| | |
|---|---|
| **Note** | DO NOT bury a cable that has a damaged outer jacket. See Repairing sensor cables on page 154 for repair information. |

3. Position and secure the ferrite beads on the lead-in cable (see Installing ferrite beads on page 121).

# Installing cable fittings

OmniTrax sensor cables require field-installed TNC connectors and the addition of 10 ferrite beads on the lead-in section of cable. Field-installed connectors are also required for cable splices and to repair damaged cable.

## Installing ferrite beads

### Points to remember

- ferrite beads must be installed before the connectors
- ferrite beads are fragile, do NOT allow them to slide freely and hit each other
- if a bead breaks at any time during the installation, remove it
- a minimum of seven beads are required on each lead-in cable
- hardware bypasses (OC2, SC2) require 20 ferrite beads, 10 on each end
- ferrite beads can be installed in slots, by using a drill to widen the slots at the location of each bead
  - SC2 - 23 mm (7/8 in.)
  - OC2 - 3 cm (1 1/8 in.)

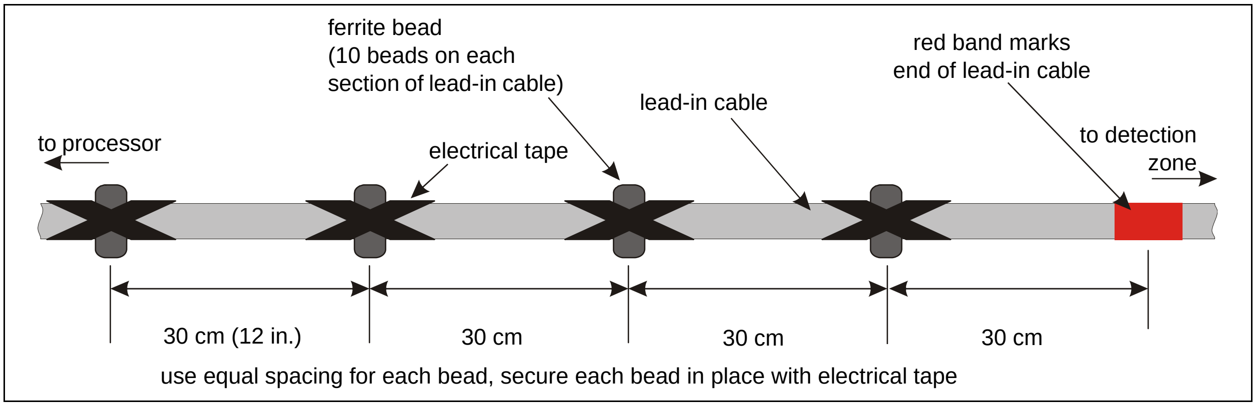


Figure 87: Positioning the ferrite beads

1. Starting at the red band that marks the end of the lead-in cable, and measuring away from the detecting cable, carefully slide the 10 ferrite bead into the correct positions on the lead-in cable. The first bead is located on the lead-in cable, 30 cm (12 in.) away from the red band.
2. Space the remaining beads 30 cm (12 in.) apart on the non-detecting cable, and secure the beads with electrical tape.

## Installing connectors on OC2 sensor cable

To install connectors on OC2 sensor cables, you require an OmniTrax connector kit (GT0967) an OmniTrax cable tool kit (A4KT0200) and a portable heat gun.

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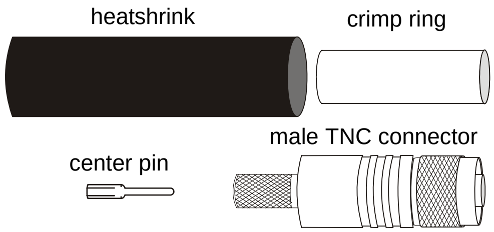
| **Note** | The OmniTrax connector kits are matched to the OC2 cables. Use ONLY the supplied connectors and the specified crimp tool when installing connectors on OC2 sensor cable. |

| **Note** | Do NOT bend or twist the sensor cable while removing the jacket or installing connectors. Bending the cable can damage the internal foil shield and compromise operation. The smallest allowable bend radius is 15 cm (6 in.). |
|---|---|

- the cables and connectors must be clean and dry
- do NOT blow on a connector to clean it
- do NOT place the connectors, cable ends, terminators or decouplers on the ground or allow them to get wet or dirty

OmniTrax connector kit (A4SP0900):

- heatshrink
- crimp ring
- center pin
- male TNC connector




OmniTrax cable tool kit (P/N A4KT0200):

- knife and spare blades
- coaxial cable cutter
- side-cutting pliers
- deburring tool
- crimp tool
- ruler

additional required tools (not included in kit):

- heat gun
- digital multi-meter (for cable tests)

## OC2 connector installation procedure

| **Note** | DO NOT cut the sensor cable until you are ready to install the connector. OmniTrax requires a minimum of 6 m of lead-in cable. |
|---|---|

### Part 1: Preparing OC2 sensor cable

Figure 88: is a scale diagram which provides the stripping dimensions for preparing OC2 sensor cable for connector installation.

| **Note** | Ensure that the actual strip dimensions match the cable preparation dimensions exactly.<br>DO NOT cut into the underlying layer when preparing the cable. |
|---|---|

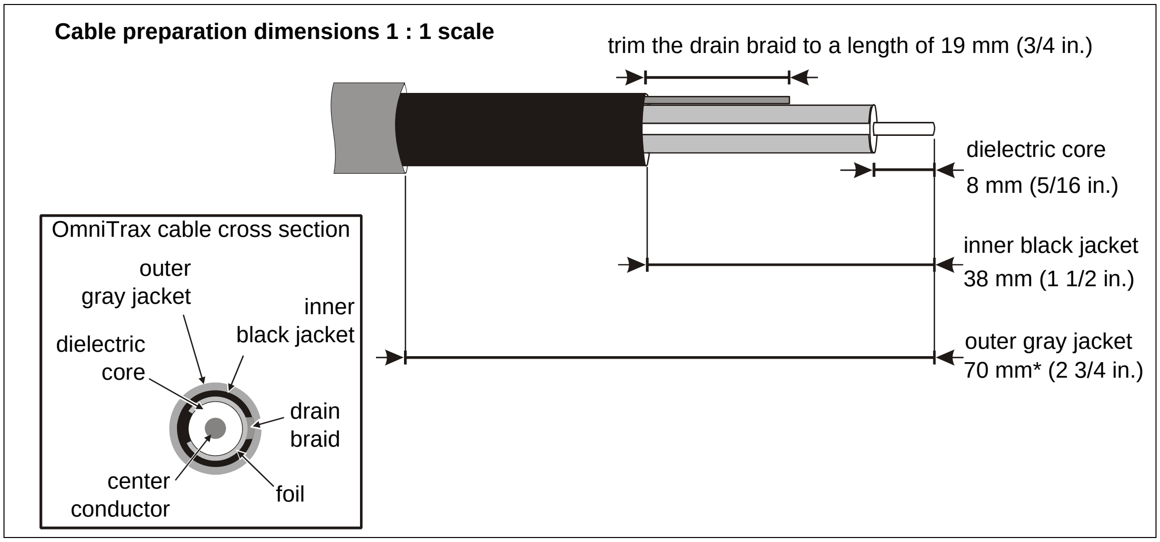



Figure 88: OC2 cable preparation

| | |
|---|---|
| **Note** | When making cuts with the knife, allow the blade to penetrate only 80% of the surface, then pry the sections apart with cutting pliers. |

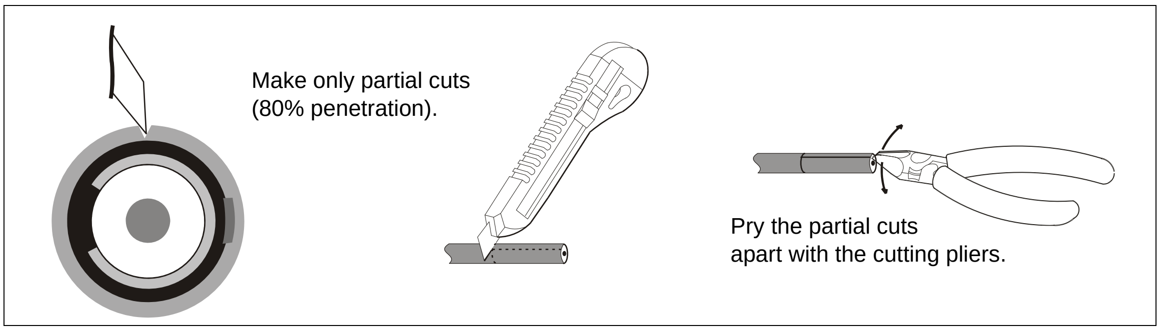



Figure 89: Stripping the cable

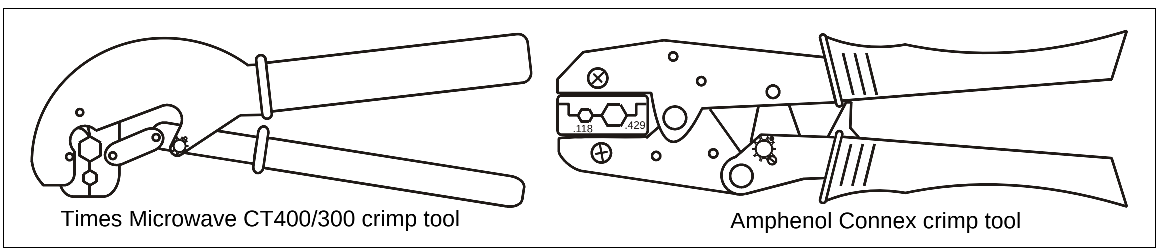
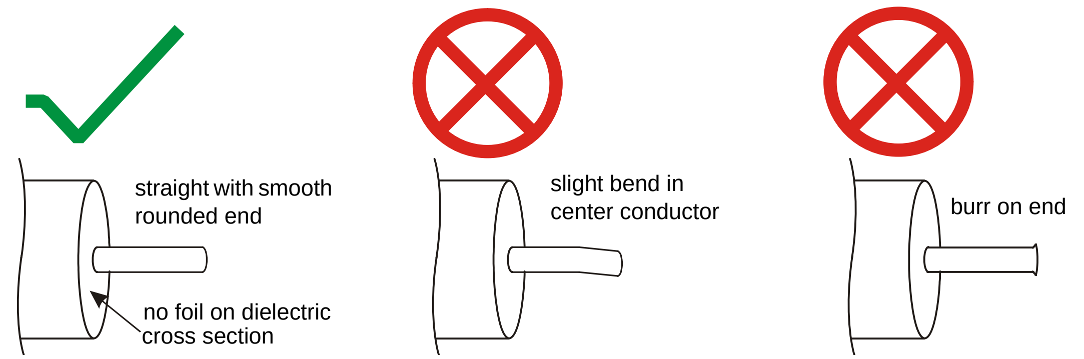



Figure 90: OC2 crimp tools

1. Using the coaxial cable cutter, cut the sensor cable to the correct length.
2. Using the knife and the cutting pliers, remove 70 mm (2 3/4 in.) of the outer gray jacket.
3. Using the knife and the cutting pliers, remove 38 mm (1 1/2 in.) of the inner black jacket. Do NOT cut into the foil, drain braid, or dielectric core when removing the black jacket.
4. Peel back and trim the drain braid to a length of 19 mm (3/4 in.) (trim off approximately 19 mm of drain braid).
5. Using the knife, carefully remove 8 mm (5/16 in.) of the dielectric core (and foil covering). Do NOT nick the center conductor.
6. Ensure that there is no foil on the dielectric core cross section.

7. Ensure that the exposed center conductor is straight.
8. If necessary, remove any residue from the center conductor.
9. Using the deburring tool, deburr the end of the center conductor so that it is smooth and rounded.




**CAUTION** The center conductor MUST be straight and its end MUST be smooth and rounded. If the end is bent or there is ANY lip or burr on the center conductor, it will NOT fit correctly into the center pir

Figure 91: Preparing the center conductor

## Part 2: Installing the connector

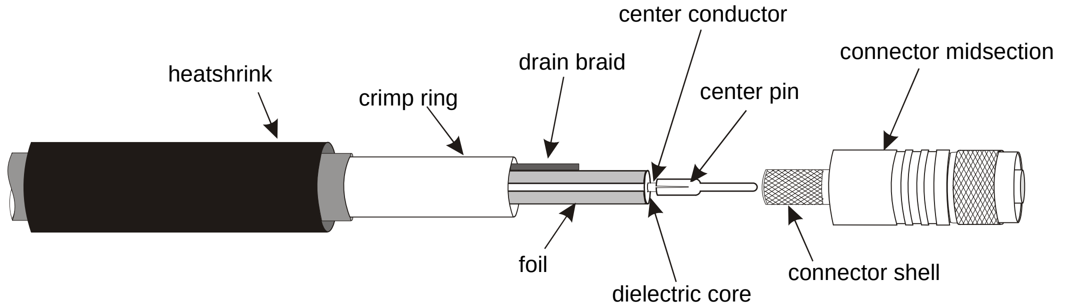



Figure 92: OC2 connector installation

1. Press the center pin firmly onto the center conductor. There should be approximately 2 mm of exposed center conductor showing between the center pin and dielectric core.
2. Slide the heatshrink over the sensor cable’s gray jacket.
3. Slide the crimp ring over the stripped sensor cable and drain braid until it butts up against the gray jacket.
4. Lift the drain braid slightly, and then fit the connector shell onto the sensor cable, so the center pin, foil and dielectric core fit smoothly into the connector shell, while the drain braid remains outside.

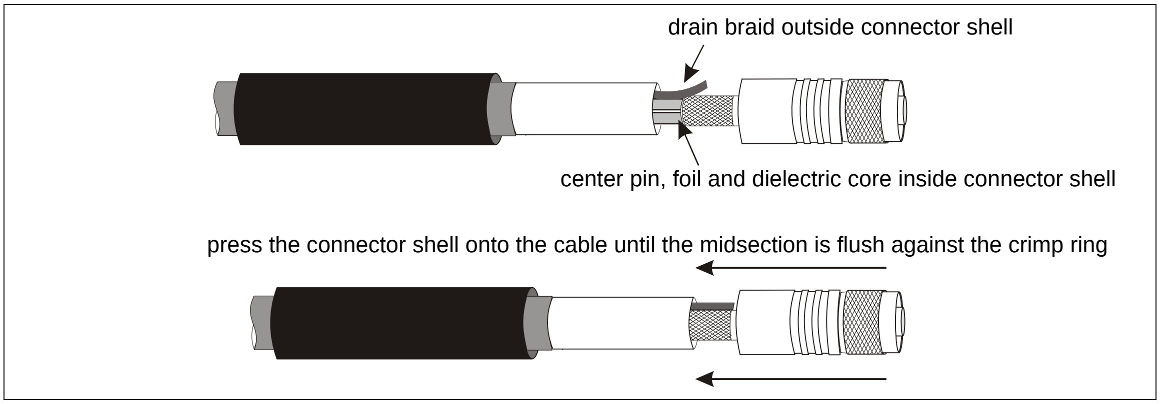



Figure 93: OC2 connector installation

5. Firmly, press the connector shell onto the sensor cable until the midsection is flush with the outside end of the crimp ring.
6. Using the larger hexagonal hole (.429) position the crimp tool over the crimp ring so that the edge of the crimp tool is right against the smooth midsection of the connector, and a flat crimping surface is directly above the drain braid. Make the first crimp.

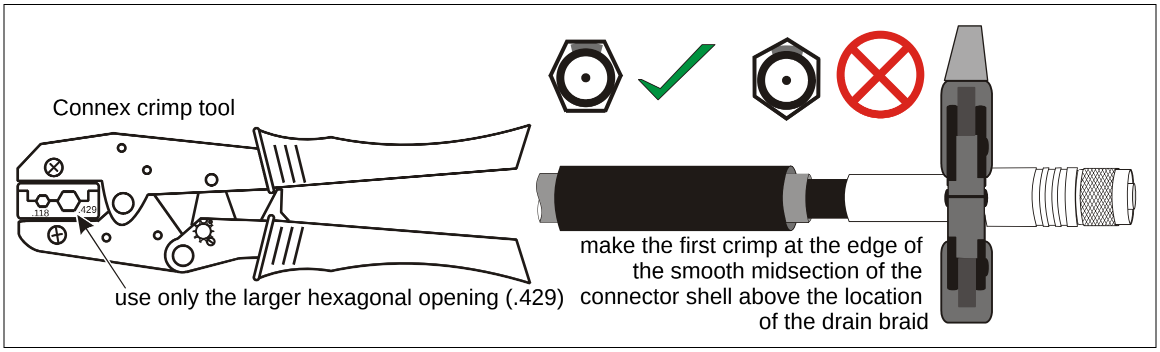



Figure 94: Making the first crimp

7. Open the crimp tool, and without rotating the crimp tool, connector, or sensor cable, move the crimp tool over the uncrimped area beside the first crimp and make a second crimp.

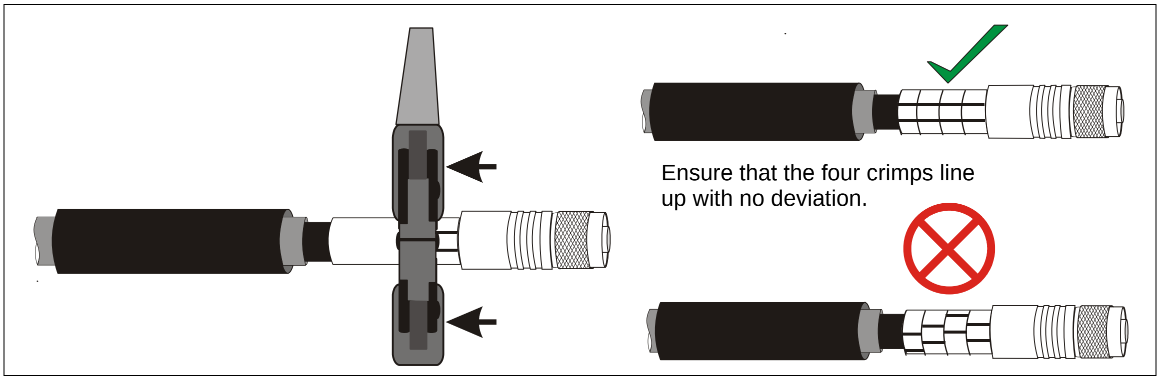



Figure 95: Making the second crimp

8. Make two more crimps so that the full length of the crimp ring is crimped, and the four crimps are lined up straight.
9. Slide the heatshrink over the crimp until it covers the smooth portion of the connector's midsection. DO NOT allow the heatshrink to cover any portion of the rotating end of the connector.

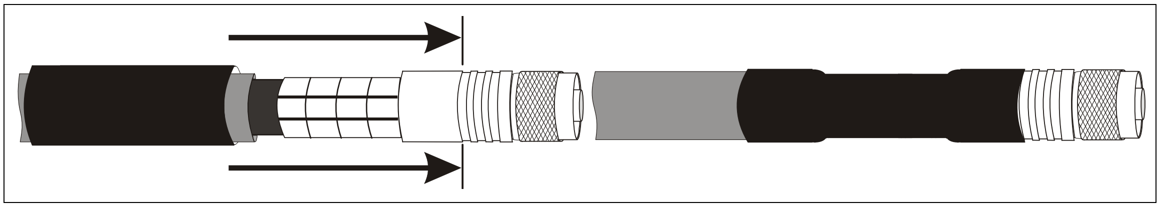


Figure 96: Completing the connector installation

10. Using a heatgun, apply heat evenly across the heatshrink until it fits tightly over the assembly. The rotating end of the connector MUST turn freely.
11. Verify the connector installation (see Cable tests on page 146).

# Installing connectors on SC1 and SC2 sensor cable

| | |
|---|---|
| **Note** | The following procedure applies to SC1/SC2 connector parts kit A0SP0700-003. For SC1/SC2 connector parts kit A0SP0700-002, follow the instructions (A3DA0403-001) that are included in the kit. |

| | |
|---|---|
| **Note** | Use ONLY the supplied connector kits, and the specified crimp tool with the SC1 and SC2 cables. |

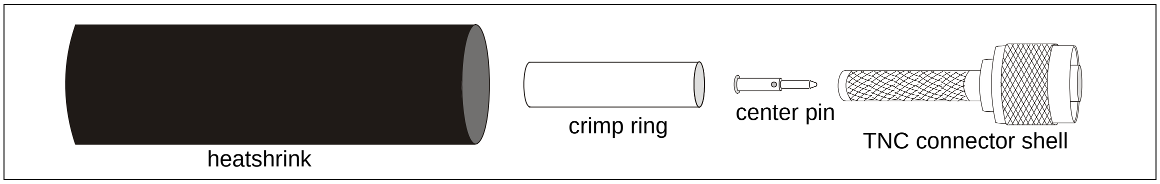



Figure 97: Connector parts kit A0SP0700-003

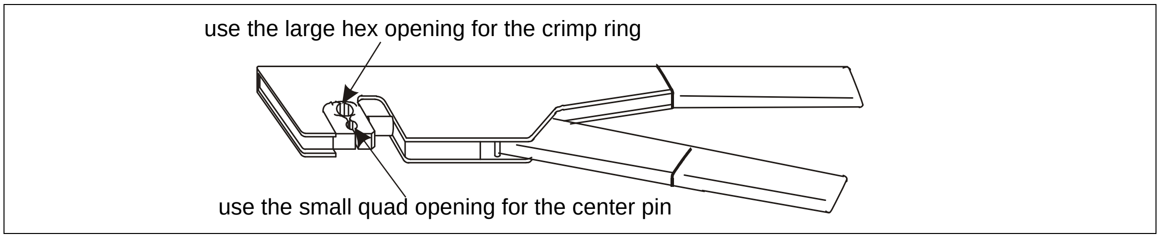



Figure 98: SC1/SC2 crimp tool

- all connections must be clean and dry - use a heat gun to remove moisture
- do NOT blow on a connector to clean it
- do NOT drop or place the connectors, cable ends, terminators or decouplers on the ground or allow them to get wet or dirty
- before installing connectors and connecting cables to the processor, cut off the excess lead-in, ensuring that there is a minimum of 6 m (20 ft.) of lead-in cable and there is enough lead-in cable to create a 2 m (6.5 ft.) service loop at the processor

## Required tools

- SC1/SC2 connector tool kit (P/N A0KT1500) including:
  - knife
  - large cutting pliers
  - small cutting pliers

  - crimp tool
  - ruler
- additional required tools (not included in kit)
  - multi-meter (for cable tests)
  - portable heat gun

### SC1 and SC2 cable strip dimensions

**Note** The dimensions provided in the following table refer to the amount of outer gray jacket that must be removed.

| sensor cable | application |
|---|---|
| SC1 | zone-to-zone continuous detection field - 25 cm (10 in.) |
| SC1 | zone bypass or cable splice - 17 cm (6.5 in.) |
| SC1 | termination - 25 cm (10 in.) |
| SC1 | for indoor wall mount applications - 30.5 cm (12 in.) |
| SC1 | for installation in a telecom enclosure - 61 cm (24 in.) |
| SC2 | all sensor cable applications - 5.8 cm (2 9/32 in.) |

**CAUTION**

- Do NOT bend or twist the sensor cable while removing the jacket or installing connectors. The smallest allowable bend radius is 15 cm (6 in.). Tightly bending the cable can damage the internal foil covering and compromise operation.
- When using the knife to make cuts, allow it to penetrate only 80%, then pry the sections apart with the cutting pliers.
- Do NOT cut into the coaxial cable inner black jacket when removing the outer gray jacket.
- Do NOT cut into the foil, drain braid, or dielectric core when removing the black inner jacket.
- Do NOT nick the center conductor when removing the dielectric core.
- Carefully remove any residue from the center conductor, foil and dielectric core, and ensure the cable jacket is clean.
- Ensure the connector's heatshrink has completely cooled before performing any other procedures with the cable.

1. Cut the cables to the required length.
2. Use the SC1 and SC2 cable strip dimensions on page 127 and Figure 102: to prepare the sensor cables for connector installation.

**Note** To remove the outer gray jacket, score the jacket (80% penetration) around its circumference and lengthwise along both sides to the end of the cable (see Figure 99:).
Work the small cutters into the end of the cable at the score mark and push them up along the score until the jacket separates.

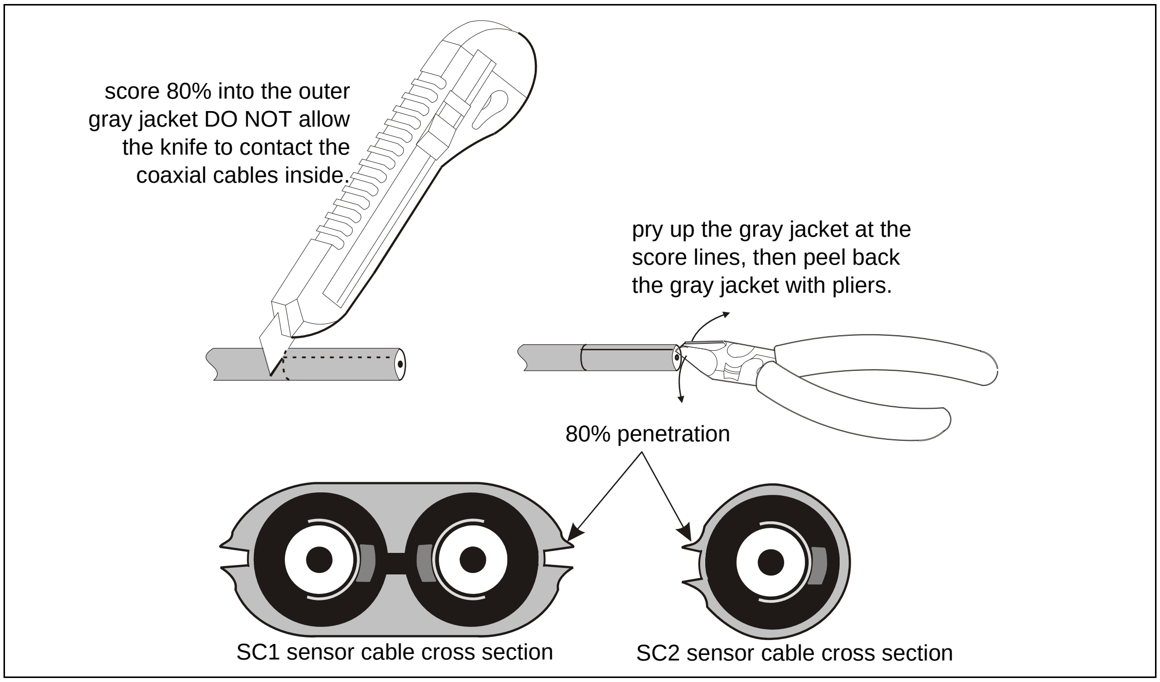



Figure 99: Stripping the gray outer jacket

3. For SC1 cable, split the two internal coaxial cables by carefully cutting the web between them.

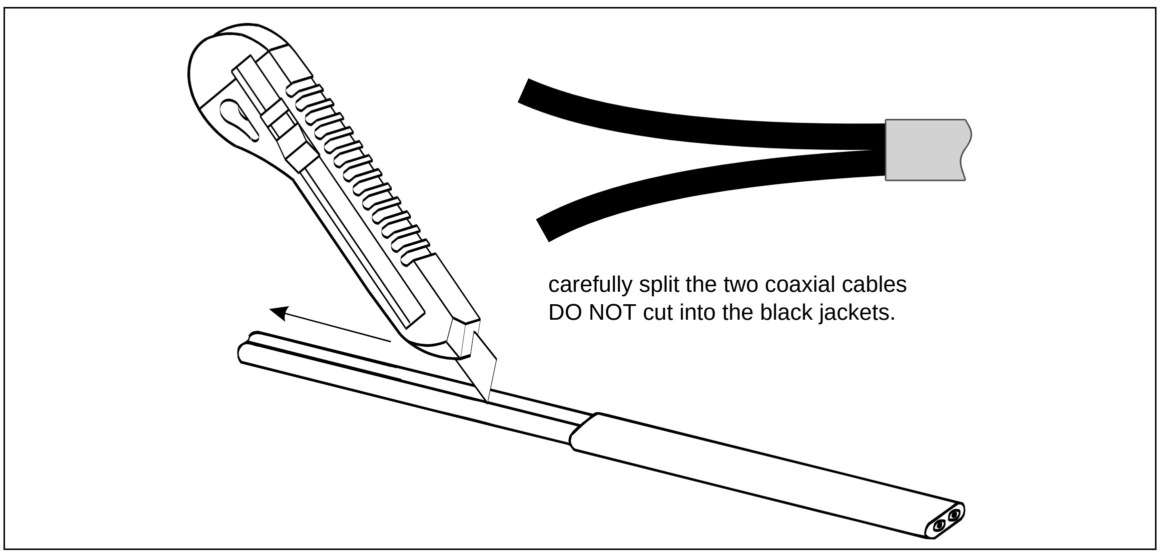



Figure 100: Separate the coax cables - SC1

| | |
|---|---|
| **Note** | If an SC1 cable will be connected to another SC1 cable, the ridged sides of the two cables must be offset and lined up (see Figure 101:). |

4. For SC1 cables, make the offset cuts as follows:
   - for cable-to-cable connections or terminators - the longer cable should be 25 cm (10 in.) long; shorten the remaining cable by 15 cm (6 in.) from the end of the cable
   - for zone bypass or cable splice applications - the longer cable should be 17 cm (6.7 in.) long; shorten the remaining cable by 6 cm (2.5 in.) from the end of the cable

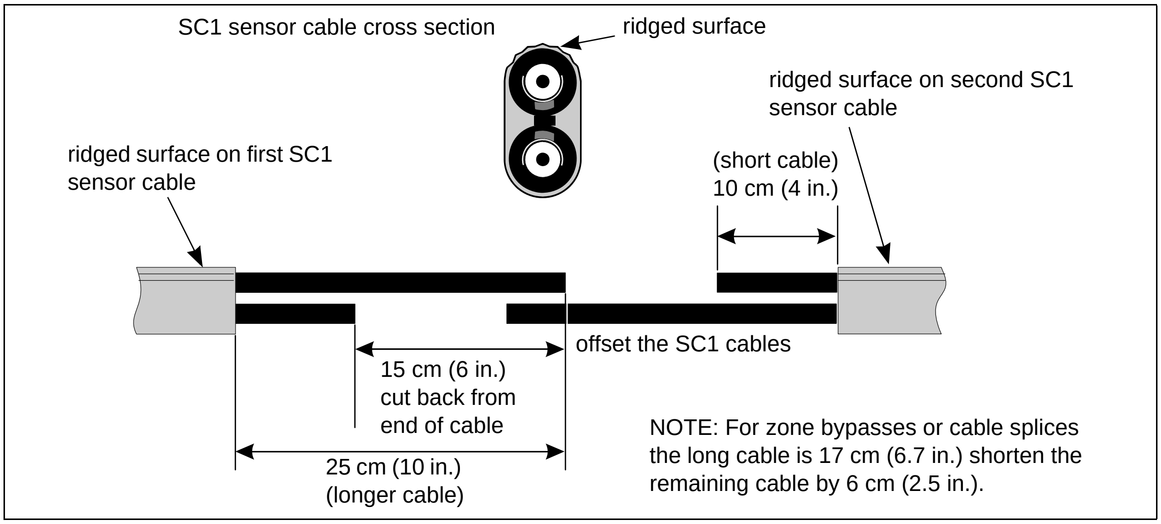



Figure 101: Offsetting SC1 cables

5. Refer to Figure 102: to prepare the sensor cables for connector installation.

| | |
|---|---|
| **Note** | Figure 102: provides a 1:1 scale for stripping the sensor cables. Follow the cable strip dimensions exactly, as the dimensions are critical to connector installation. |

| | |
|---|---|
| **Note** | When removing the black jacket, make the lengthwise score above the drain braid. Do NOT cut into or through the drain braid.<br>Use pliers to peel back and remove the black jacket.<br>If you have difficulty removing the black jacket, try warming the jacket with a few quick passes of a 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. |

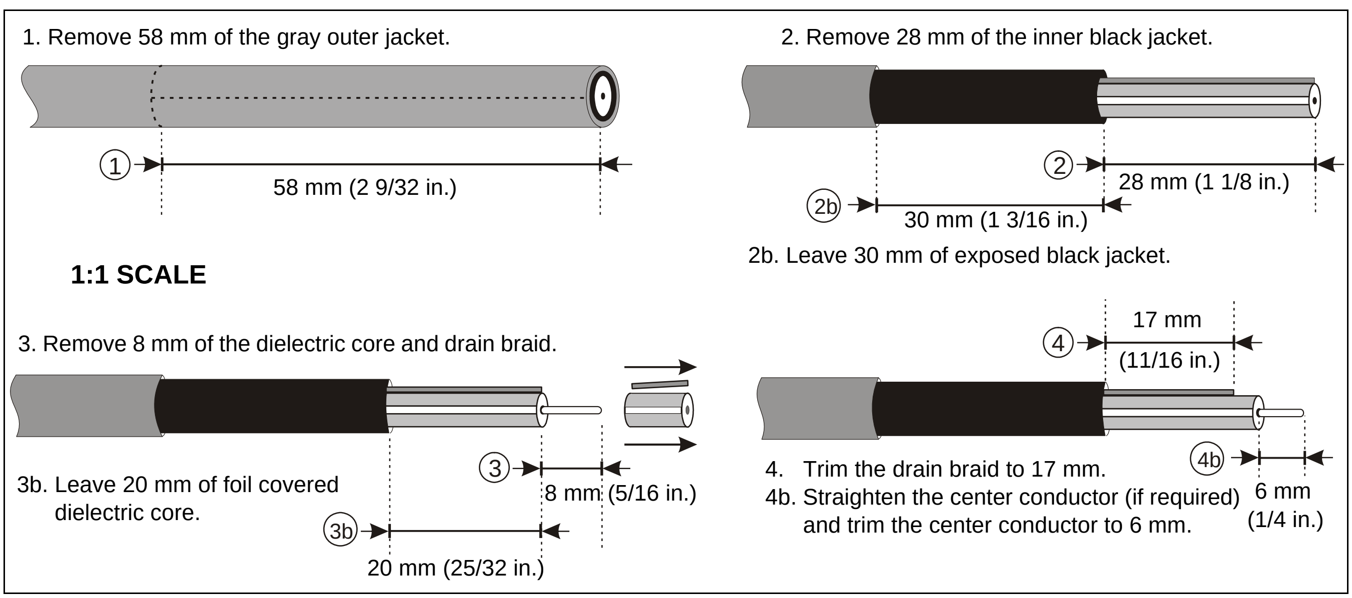



Figure 102: SC1/SC2 cable strip dimensions

| **Note** | Ensure that the center conductor is smooth (no lip or burr from cutting), straight and 6 mm long.<br>There must be no foil on the flat cross section of the dielectric core. |
|---|---|

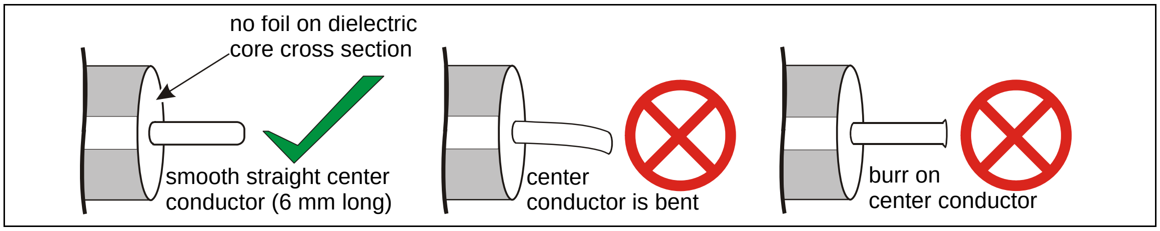



Figure 103: Trimming the center conductor

6. Push the center pin fully onto the center conductor. The center conductor must be visible through the center pin's inspection hole.
   Using the smaller quad opening in the crimp tool, crimp the center pin once, as close to the dielectric as possible. Do NOT crimp the shoulder of the center pin.

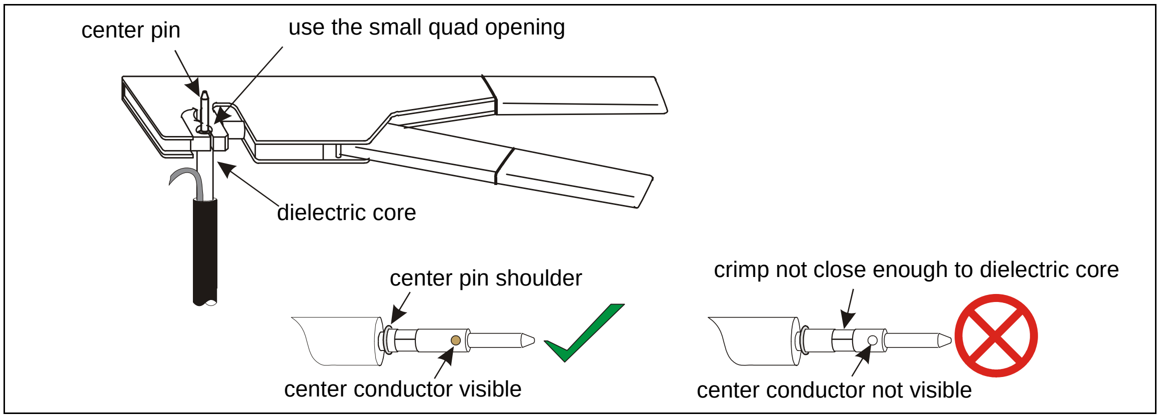



Figure 104: Crimping the center pin

7. Slide the heatshrink over the end of the cable. Slide the crimp ring over the end of the cable until it butts up against the gray jacket.
8. Lift the drain braid slightly and then fit the connector onto the sensor cable so the center pin, dielectric core and foil covering fit smoothly inside the connector shell, and the drain braid remains outside the connector shell.
   Press the connector onto the cable until it clicks into place.

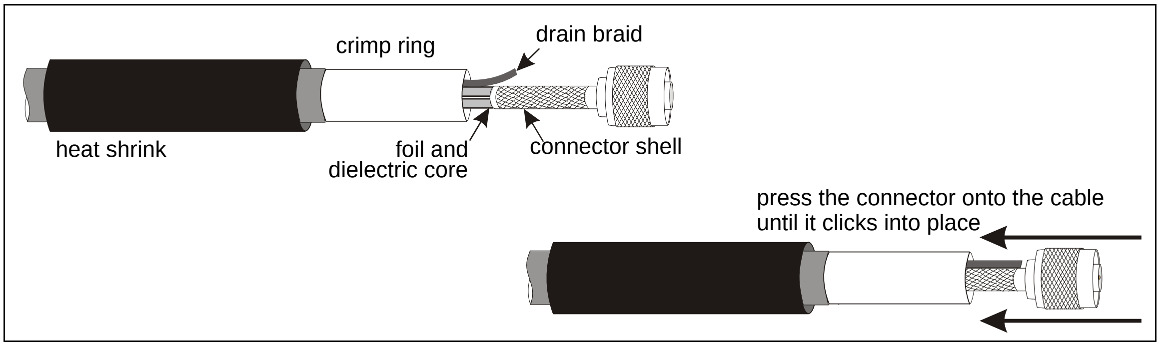



Figure 105: Fitting the connector

9. Slide the crimp ring over the connector shell and drain braid until it is flush against the head of the connector.
   Mark the location of the drain braid on the crimp ring.

10. Using the large hexagonal hole in the crimp tool, position the crimp tool over the crimp ring so that the edge of the tool is above the edge of the crimp ring, and a flat surface of the crimp tool is directly over the drain braid.
    Make the first crimp.

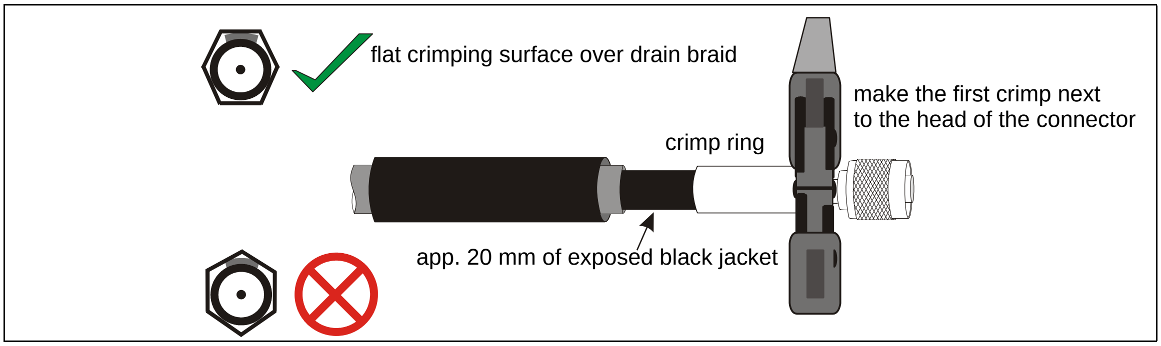



Figure 106: Making the first crimp

11. Slide the crimp tool along the crimp ring and make a second crimp beside the first.
    Do NOT rotate the crimp tool, connector, or cable. Do NOT overlap the crimps.
12. Make a third crimp so that the crimp ring is fully crimped and the three crimps are lined up straight.

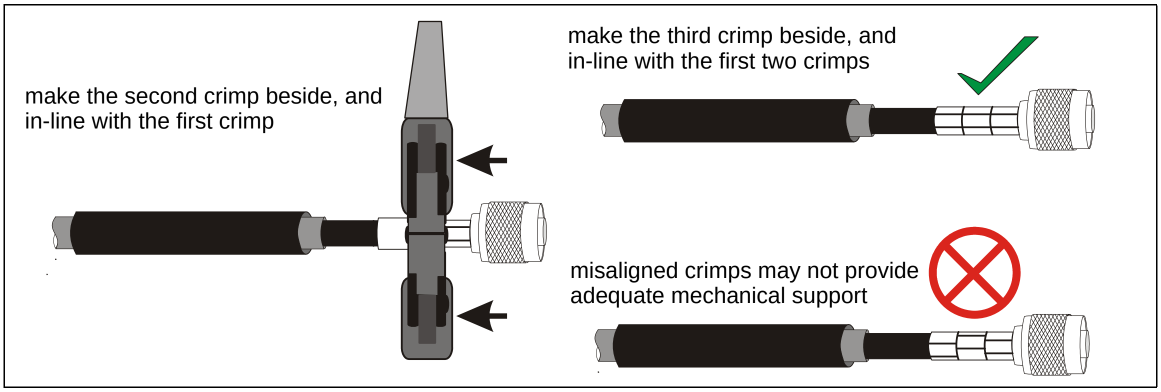



Figure 107: Completing the crimps

13. Slide the heatshrink over the crimp until it butts up against the rotating portion of the connector.
    Using a heat gun, apply heat evenly across the length of the heatshrink until it fits tightly over the assembly and the weather sealant is visible at both ends.

| | |
|---|---|
| **Note** | Do NOT cover any portion of the rotating head of the connector. The rotating end must turn freely.<br>Hold the cable steady until the heatshrink has completely cooled. |

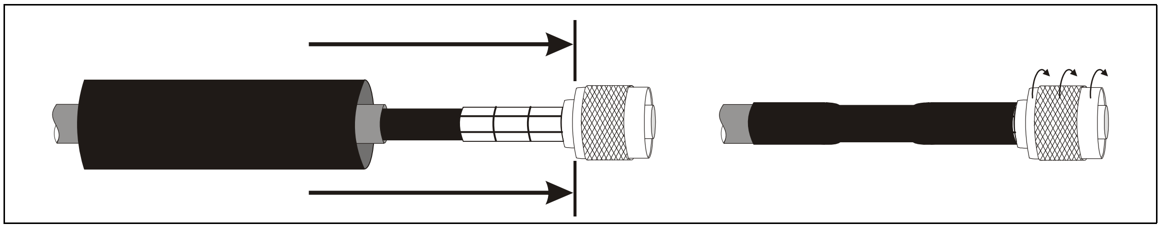


Figure 108: Sealing the heatshrink

14. Verify the connector installation (see Cable tests on page 146).

# Installing decouplers and terminators

## Terminating an unused cable side

For a processor, which uses only one of the two cable sides, you must disable the transmitter and select clutter supervision for the unused side (via the UCM) and install the supplied dust caps on the cable inputs.

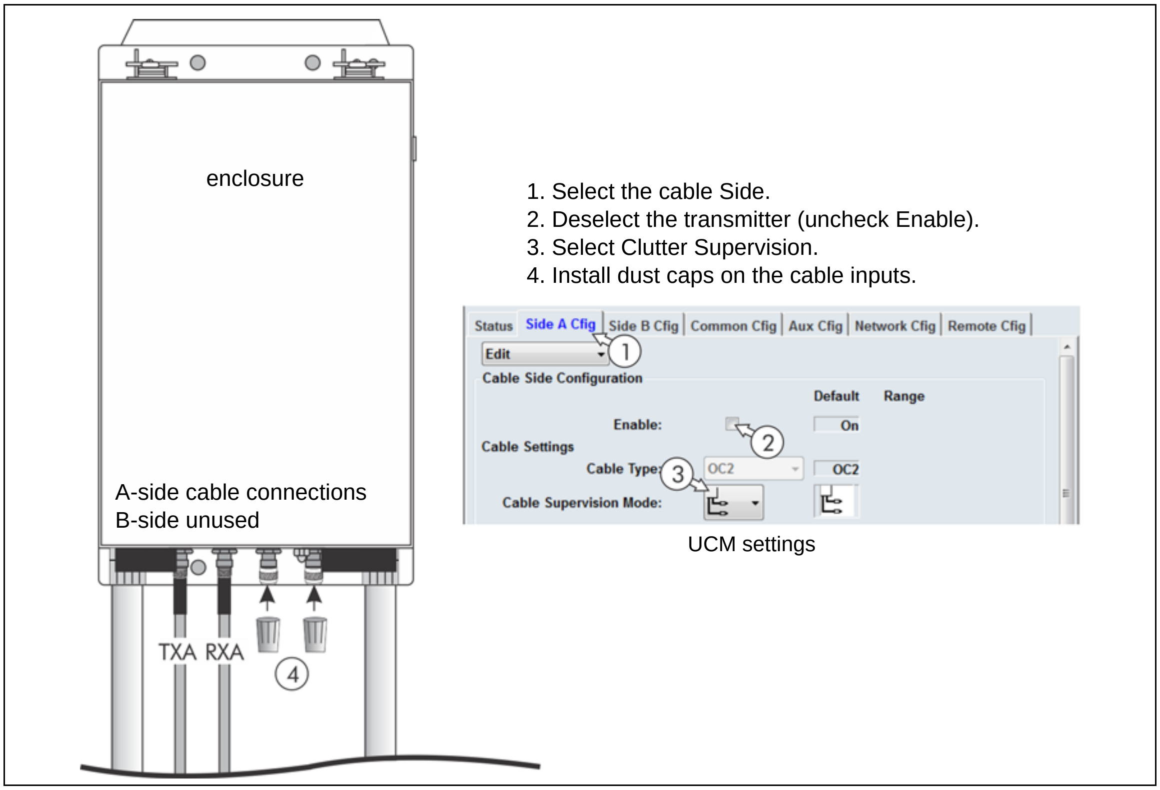



Figure 109: Terminating an unused cable side

### Unused cable side termination procedure

1. Start the UCM application and connect to the OmniTrax processor.
2. On the Cable Side Cfig tab, Select the unused Side (A or B).
3. Disable the unused Cable Side by deselecting the Enable check box (see Setting the initial configuration parameters on page 195).
4. Select Clutter Supervision for the unused Cable Side.
5. Save the changes and download the configuration settings to the processor.
6. Fit the supplied dust caps on the unused cable inputs.

# Sealing the heatshrink over decouplers/splices

| | |
|---|---|
| **CAUTION** | Use care when sealing the heatshrink. Excessive heat can burn the heatshrink and damage the sensor cable. Ensure that the heatshrink used when installing the connectors has completely cooled BEFORE applying heat to the decoupler/splice heatshrink. |

1. Position the heatshrink so that it is centered over the decoupler/splice.
2. Support the sensor cables on both sides of the heatshrink, and use a heat gun to apply heat evenly across the heatshrink, moving from the center to the outside edges.
3. Continue applying heat evenly until the heatshrink is tightly collapsed and the sealant begins to ooze outside both ends.
4. Verify that there are no bubbles or air pockets in the heatshrink.
5. Continue to support the sensor cables until the heatshrink has completely cooled.

# OC2/SC2 decoupler installation procedure

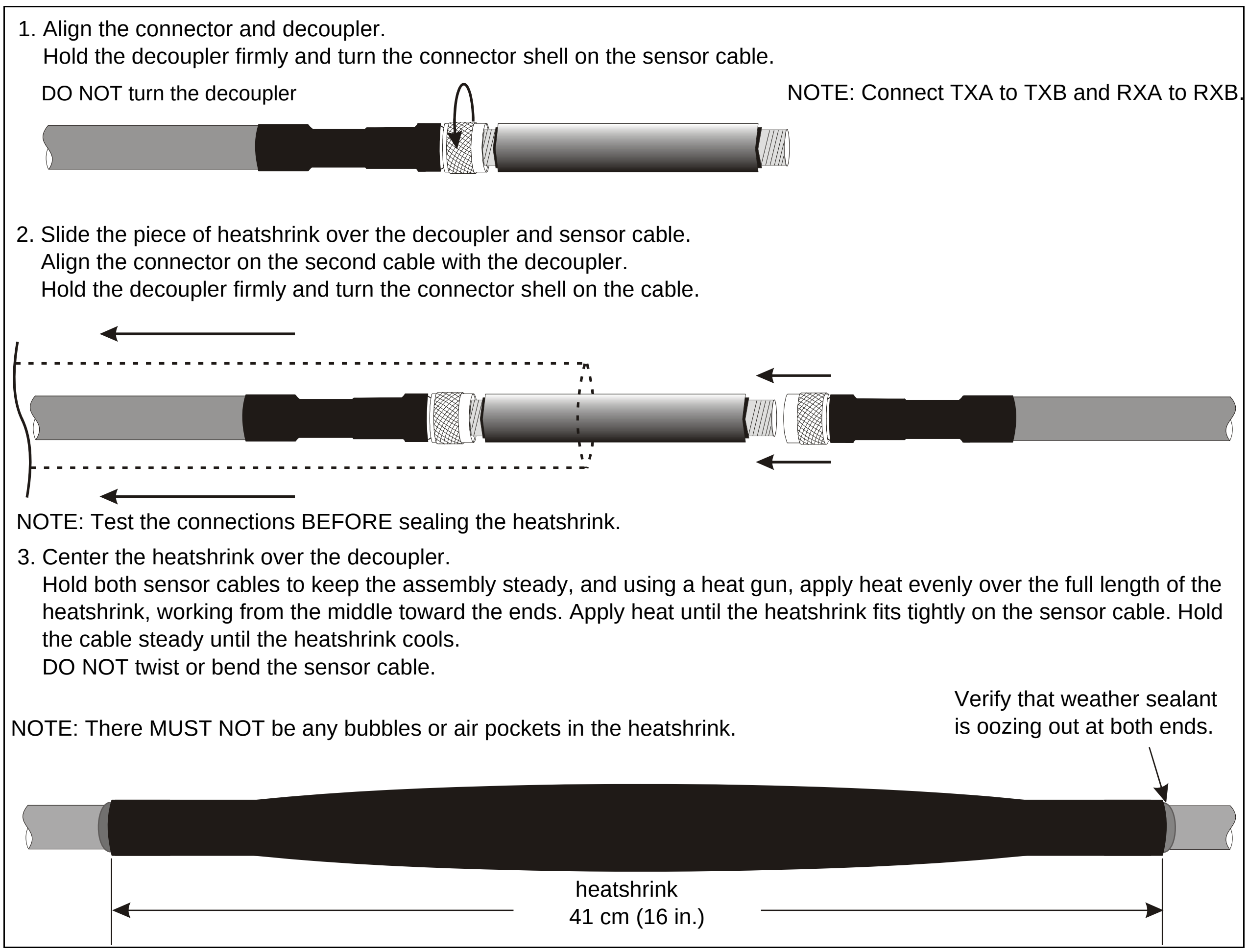



Figure 110: Installing decouplers

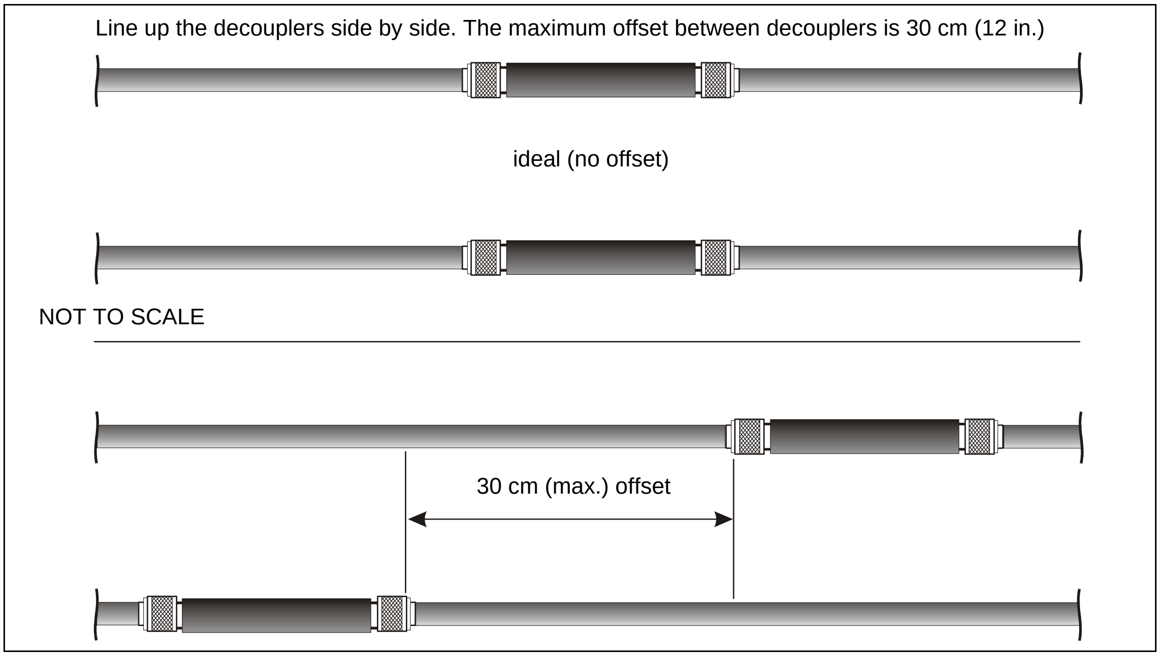



Figure 111: OC2/SC decoupler installation

# OC2/SC2 decoupler installation (method 1 - active loops)

Method 1 is the recommended decoupler installation technique, as it provides superior detection at decouplers while enabling the screening out of the high clutter signal that sometimes occurs near decoupler locations.

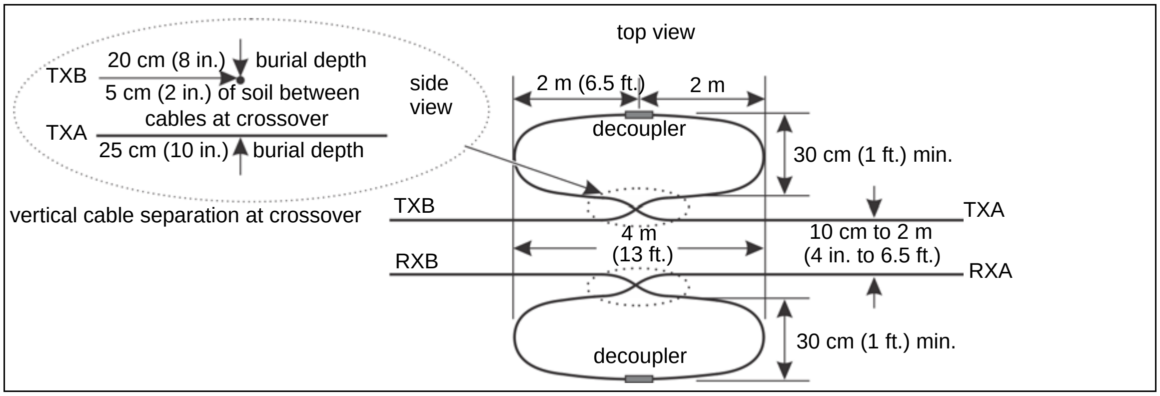



Figure 112: Active-loop overlapped decoupler installation

OmniTrax decouplers connect two contiguous sensor cable sets (TXA to TXB and RXA to RXB). To install decouplers using method 1:

1. Dig the trenches for the A-side cables and B-side cables and join the trenches at the specified decoupler location.
2. Either dig trenches for the two active cable loops or excavate the area for the active loops to the specified burial depth (min. excavated area 4 m 10 cm (13.5 ft.) long X 35 cm (14 in.) wide X 23 cm deep) (25 cm deep at cable crossover points).
3. Form the two sensor cable sets into loops, with the loops crossing each other at the decouplers' specified installation locations (TXA and TXB, RXA and RXB).

4. Over the 2 m (6.5 ft.) cable length at the crossover point, increase the burial depth of one of the sensor cables 2.5 cm (1 in.) to 25.5 cm (10 in.). Cover the sensor cable with 5 cm (2 in.) of soil to raise the second sensor cable’s burial depth to 20 cm (8 in.). This will create a separation of 5 cm (2 in.) between the two sensor cables at the crossover point.
5. Cut one of the sensor cables at the decoupler location and install a connector and decoupler on the cut end of the cable (see OC2/SC2 decoupler installation procedure on page 133).
6. Cut the adjoining cable to match and install a connector on the cut end.
7. Connect the second cable to the decoupler on the first cable.
8. Complete the decoupler installation on the first cable set, and then repeat this procedure on the second cable set ensuring that the two decouplers line up side by side.
9. Test the connections (see Cable tests on page 146).
10. Seal the four connections with heatshrink.
11. Partially backfill the trench/excavation to hold the cables in place.

## OC2/SC2 decoupler installation (method 2 - adjoining trenches)

OmniTrax decouplers connect two contiguous sensor cable sets (TXA to TXB and RXA to RXB). To install decouplers using method 2 the trenches for the cables from one processor meet the trenches from the second processor.

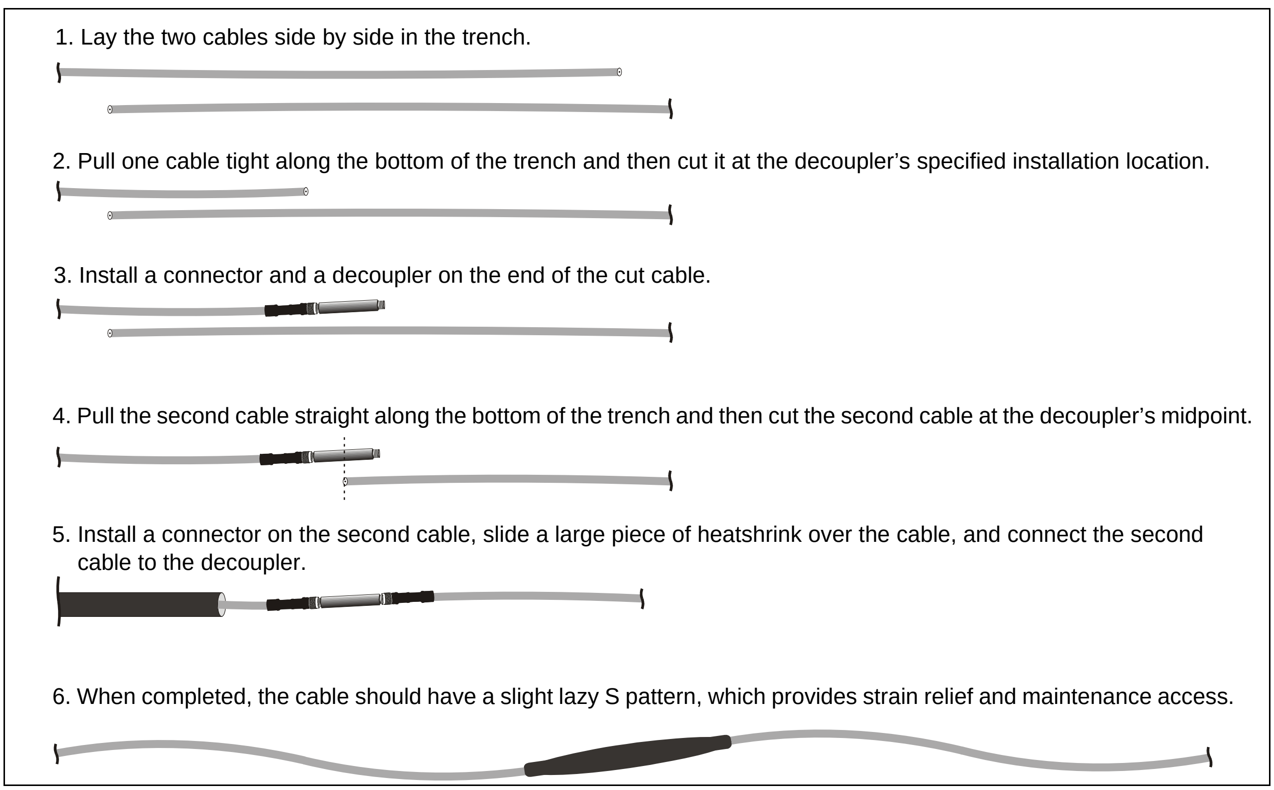



Figure 113: Preparing cables for decouplers

1. Join the trenches from two contiguous sensor cable sets.
2. Cut the sensor cables to meet end to end.
3. Install connectors on each sensor cable.
4. Install decouplers to connect the sensor cables so that the TXA cable from one processor meets the TXB cable from the second processor, and the RXA cable joins the RXB cable.

5. Ensure the two decouplers line up side by side.
6. Test the connections (see Cable tests on page 146).
7. Seal the connections with heatshrink.
8. Partially backfill the trench(es) to hold the cables in place.

# Installing decouplers in hard surface slots

For applications where decouplers are being installed in concrete or asphalt slots, a long slightly wider slot is used to accommodate the decoupler and a lazy-S pattern which provides maintenance access and strain relief.

1. For decoupler installation, widen the slots to 2.5 cm (1 in.) for a length of 10 m (33 ft.).
2. Lay the decoupler in the slot with a lazy-S pattern in the cable.
3. Cover the wide slot completely with backer rod. The backer rod must be large enough to compress into the slot and provide a good seal to protect the cables from the sealant.

| | |
|---|---|
| **Note** | Ensure that there is at least 13 mm (0.5 in.) of space between the top of the backer rod and the top of the slot for the sealant. |

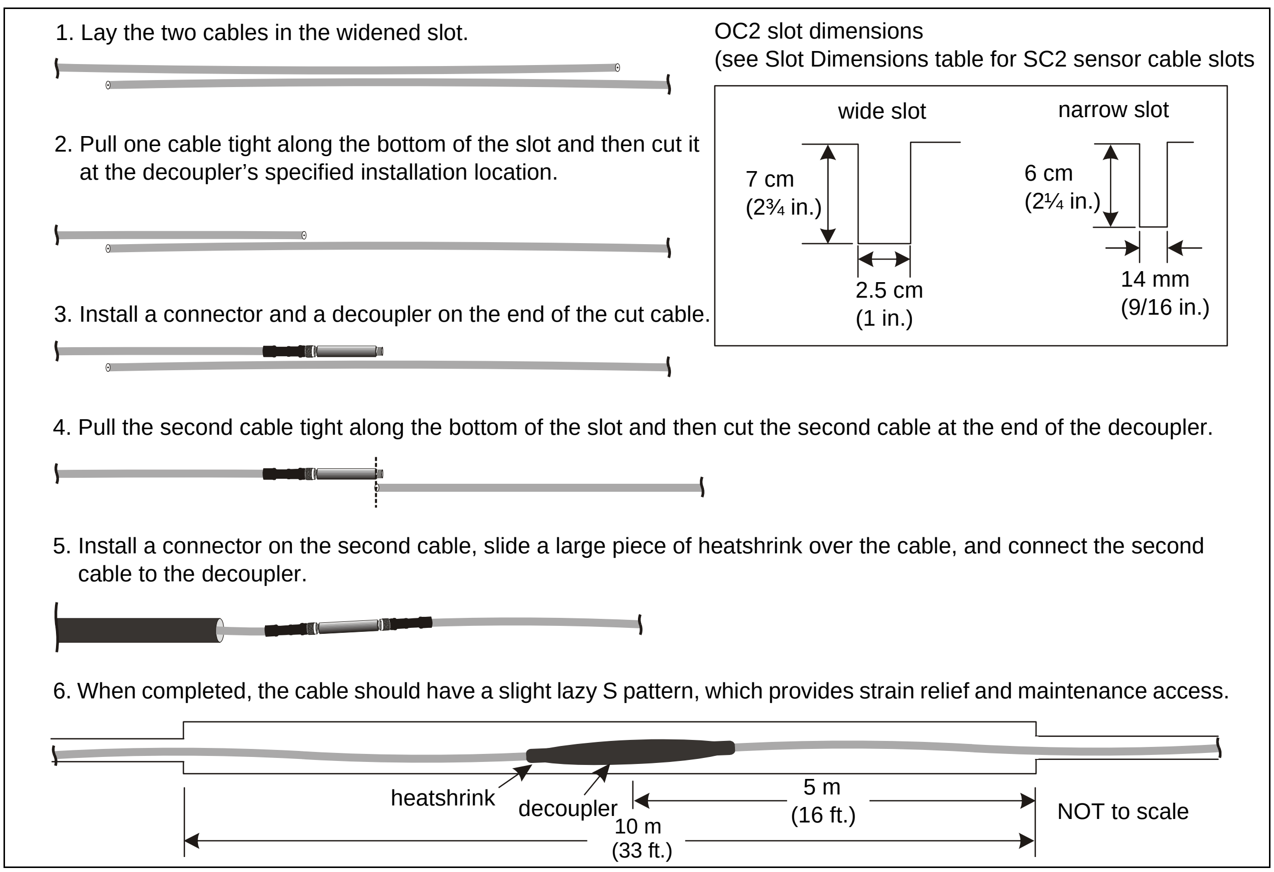



Figure 114: Preparing cables for decouplers

# Installing decouplers on SC1 sensor cable

It is no longer a recommended practice to connect detecting SC1 sensor cables end to end through decouplers to provide continuous detection between two cable sets. There are two revised installation techniques: method 1 - use active loops to connect two cable sets and create a 4 m overlap, and method 2 - use two terminators and create a 4 m overlap at the decoupler's location. The two revised methods provide superior detection at decoupler locations while enabling the screening out of the high clutter signal that can sometimes occur near decouplers.

Method 1 enables power, data and processor synchronization via the sensor cables. Method 2 is best suited for a closed perimeter with a single OmniTrax processor. If method 2 is used with 2 or more processors, power and data cables are required for each processor, and synchronization must be done over the network wiring via the NIC.

| **Note** | Ensure the burial depth of the decouplers is at the same depth as the remainder of the cables. |
|---|---|

| **Note** | The two internal sensor cables in SC1 cable must be offset when installing decouplers. (See SC1 and SC2 cable strip dimensions on page 127.) |
|---|---|

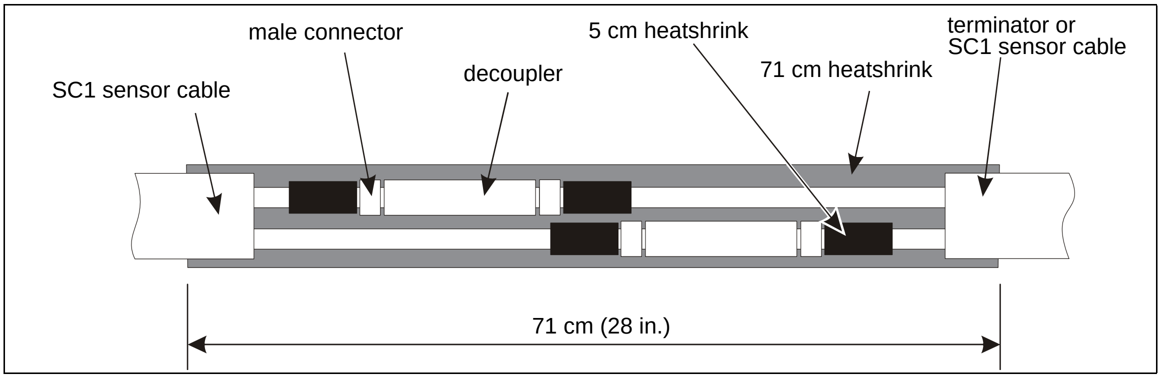



Figure 115: SC1 decoupler installation

## SC1 decoupler installation procedure (method 1 - active cable loop)

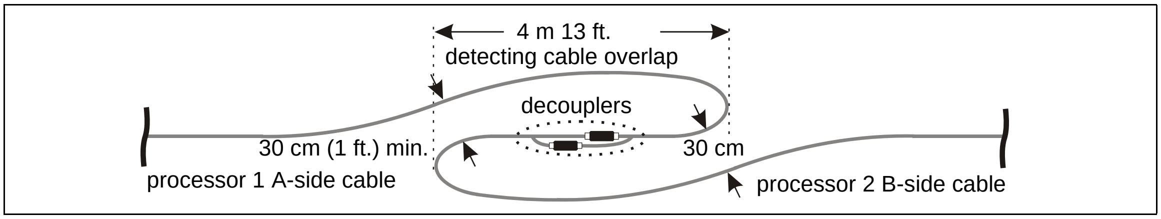



Figure 116: Connecting two SC1 sensor cables through decouplers (method 1, active loop)

1. Refer to Figure 116: and the site plan to dig trenches or excavate the installation location for the decouplers.
2. Form the two sensor cables into overlapping loops (see Figure 116:).
3. Cut the first sensor cable at the specified location, and prepare the internal cables (see SC1 and SC2 cable strip dimensions on page 127).
4. Install one connector on the end of each internal coaxial cable (see Installing connectors on SC1 and SC2 sensor cable on page 126).

5. Hand tighten each male TNC connector onto a decoupler.

| | |
|---|---|
| **Note** | When attaching connectors to decouplers, turn only the connector's rotating head shell. DO NOT turn the decoupler. |

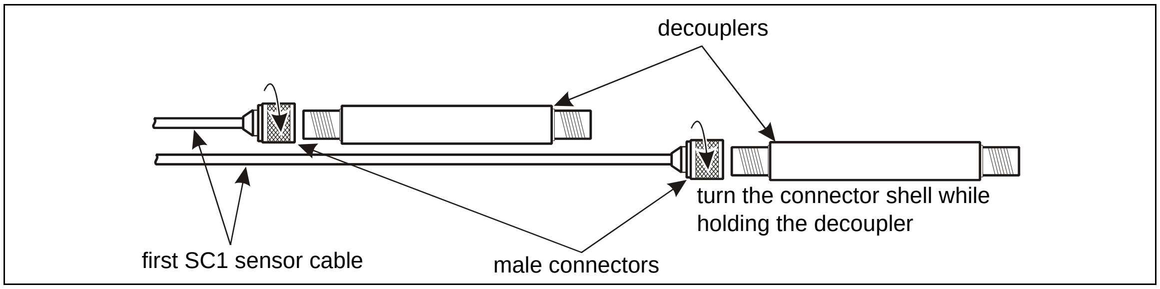
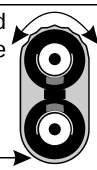



Figure 117: Install decouplers on the first SC1 sensor cable

6. Prepare and install connectors on the end of the second sensor cable to match the first sensor cable.

| | | |
|---|---|---|
| **Note - SC1** |  | Make sure that the ridged surface on the two sensor cables line up on the same side. |

7. Slide the 71 cm piece of heatshrink over the first cable.
8. Hand tighten the connectors on the second sensor cable to the corresponding decouplers on the first cable.
9. Test the connections (see Cable tests on page 146).
10. Apply heat to seal the heatshrink (see Sealing the heatshrink over decouplers/splices on page 133).

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

| | |
|---|---|
| **Note** | Ensure that the small sections of heatshrink on the connectors are completely cooled, before applying heat to the large section of heatshrink over the decoupler. |

## SC1 decoupler installation procedure (method 2 - terminators)

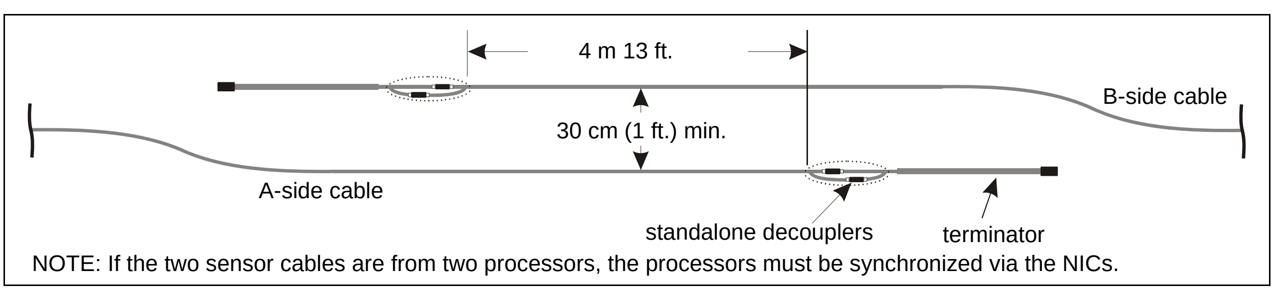



Figure 118: Overlapping SC1 cable sets (method 2)

1. Refer to Figure 118: and the site plan to dig trenches or excavate the installation location for the decouplers.

2. Hand tighten the 2 connectors on the terminator to the standalone decouplers.

| | |
|---|---|
| **Note** | When attaching connectors to decouplers, turn only the connector's rotating head shell. DO NOT turn the decoupler. |

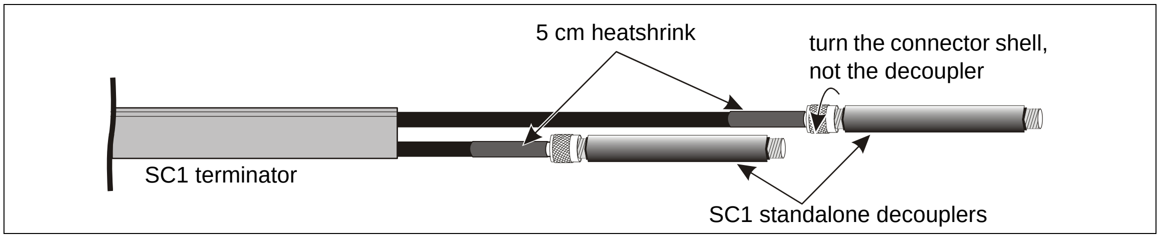



Figure 119: Installing SC1 decouplers

3. Cut the first sensor cable at the specified location, and prepare the internal cables to match the decouplers on the end of the terminator (see SC1 and SC2 cable strip dimensions on page 127).
4. Install one connector on the end of each internal coaxial cable (see Installing connectors on SC1 and SC2 sensor cable on page 126).
5. Slide the 71 cm piece of heatshrink over the sensor cable.
6. Hand tighten the sensor cable connectors onto the decouplers on the terminator.

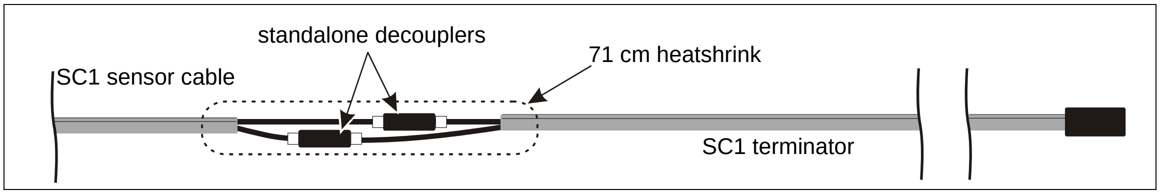



Figure 120: Positioning the ferrite beads on SC1 loopback cables

7. Center the heatshrink over the connection and apply heat to seal the heatshrink (see Sealing the heatshrink over decouplers/splices on page 133).

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

| | |
|---|---|
| **Note** | Ensure that the small sections of heatshrink on the sensor cable connectors are completely cooled, before applying heat to the large section of heatshrink over the decoupler. |

8. Repeat this procedure for the second sensor cable.

# Installing terminators - OC2/SC2 sensor cable

This procedure requires the following equipment:

- OC2 connector tool kit (A4KT0200)
- OC2 termination kit (A4KT1304)
  OR
- SC2 connector tool kit (A0KT1500)
- SC2 termination kit (A4KT1302)
- heat gun

| Note | Ensure that you follow the correct cable spacing and burial depth for the terminators. |
|---|---|

1. Refer to the site plan and cut both sensor cables side by side at the specified location.

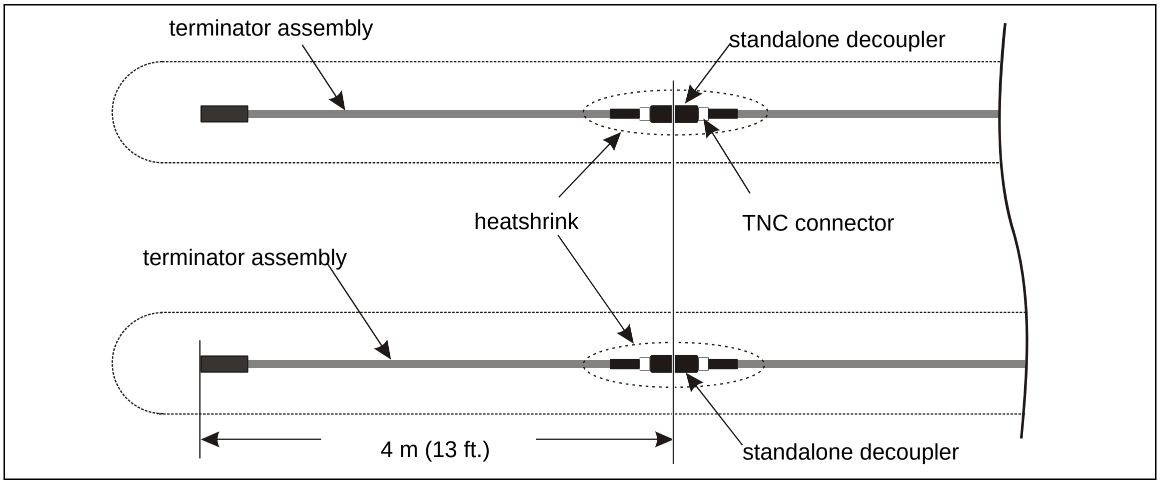
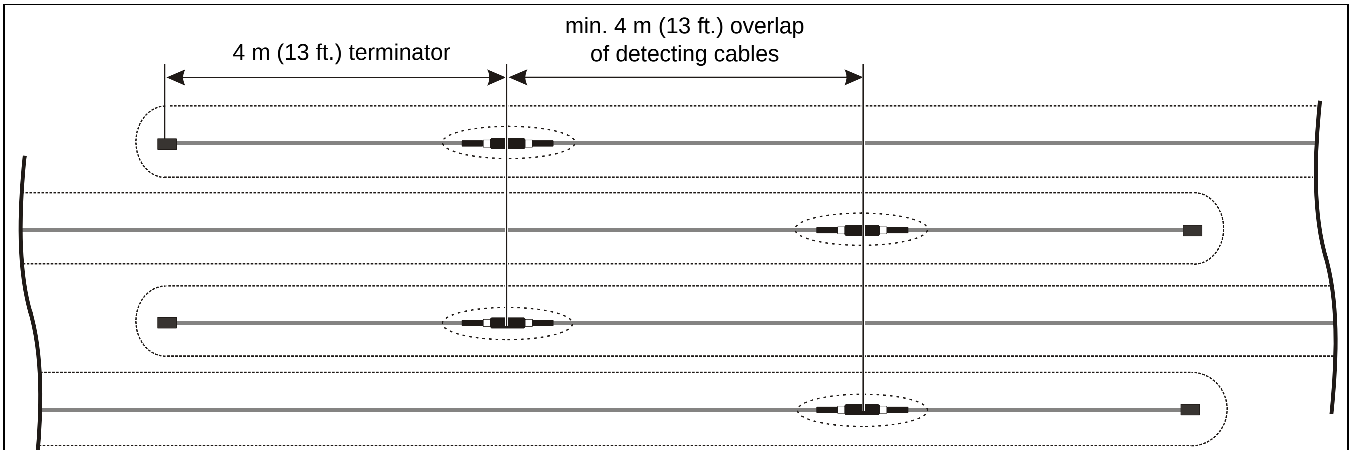



Figure 121: OC2/SC2 cable termination (terminators)

2. Install TNC connectors on the cut cables (see Installing connectors on OC2 sensor cable on page 121, OR Installing connectors on SC1 and SC2 sensor cable on page 126).
3. Slide a piece of heatshrink over each sensor cable.
4. Install standalone decouplers on each of the sensor cables (see OC2/SC2 decoupler installation (method 1 - active loops) on page 134).
5. Connect a terminator to one of the decouplers.
6. Connect the second terminator to the other decoupler.
7. Test the connections (see Cable-set continuity test (open ended perimeter) on page 152).
8. Center a piece of heatshrink over each decoupler and use a heat gun to apply heat to seal the heatshrink (see Sealing the heatshrink over decouplers/splices on page 133).




**NOTE:** Do not interleave the two sensor cable sets for narrow cable spacing single trench installations.

Figure 122: Overlapping OC2/SC2 terminators

## Terminators in slots

To terminate the ends of an OmniTrax perimeter in concrete slots, you must widen the slots for approximately 6 m (19.5 ft.) to provide maintenance access and accommodate the decouplers and terminator assemblies. To make a closed perimeter in slots you overlap the two cable sets by 4 m (13 ft.) at the decouplers as indicated in Figure 122:.

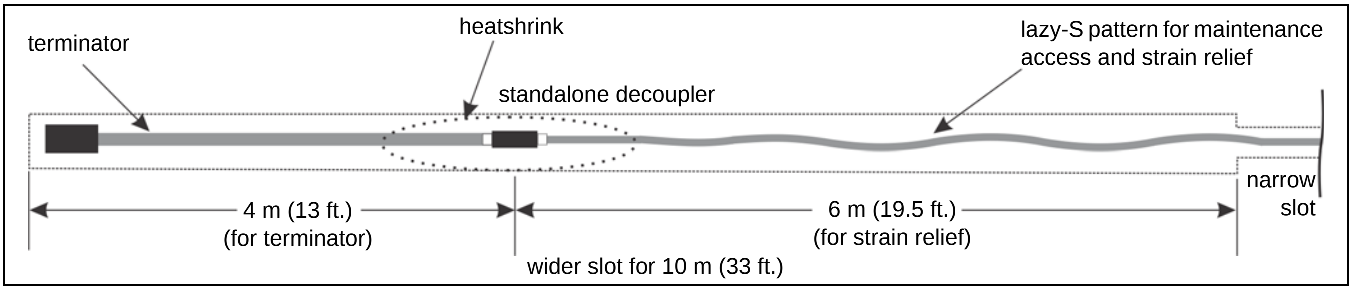



Figure 123: Terminator in a slot

# Cable splices

### Required equipment

- cable set splice kit
  - OC2 - A4KT0604
  - SC1 - A4KT0601
  - SC2 - A4KT0602
- (for a cable bypass) non-detecting cable, the length of the bypass non-detecting cable is available in lengths of 25 m (82 ft.), 50 m (164 ft.), 100 m (328 ft.)
  - one section for SC1 sensor cable
  - two sections for SC2 sensor cable
  - two sections for OC2 sensor cable
- cable set tool kit (SC1, SC2 - A0KT1500, OC2 - A4KT0200)
- heat gun

### Points to remember

- cut out the section of cable that is being replaced (if a 20 m bypass is being installed, you must remove 20 m of detecting cable)
- label and store the removed cable (e.g., detecting OC2 - 150 m to 165 m)
- cut the replacement cable slightly longer than the length of cable that has been removed

| | |
|---|---|
| **Note** | Connect the replacement cable to one side of the splice, and then cut to fit where it meets the second side of the splice. Extra cable can be laid in a lazy-S pattern to provide strain relief for the splice connections. |

- for a cable bypass install the ferrite beads on the non-detecting cable before you install the connectors
- buried connections must be covered with heatshrink that contains a sealant compound

| Note | A cable splice or bypass does not require decouplers. A cable splice requires 2 male TNCs and a female coupler. |
|---|---|

The following figures illustrate OmniTrax cable splice techniques. Figure 124: shows an OC2/SC2 cable splice and Figure 125: shows an SC1 cable splice.

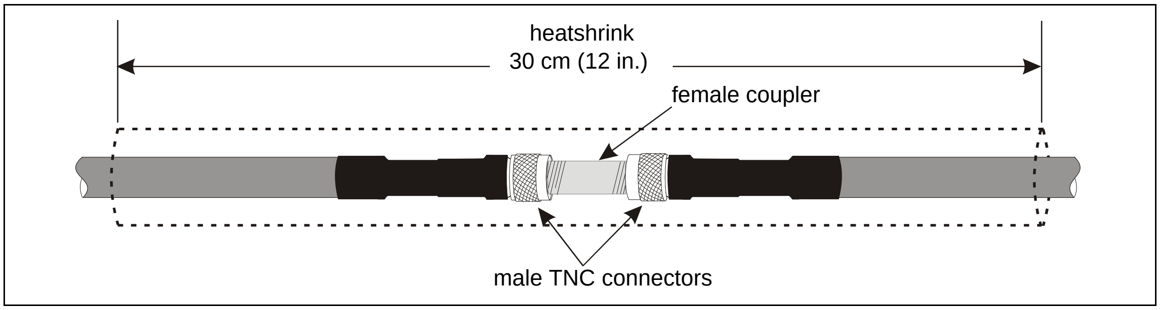



Figure 124: OC2/SC2 cable splice

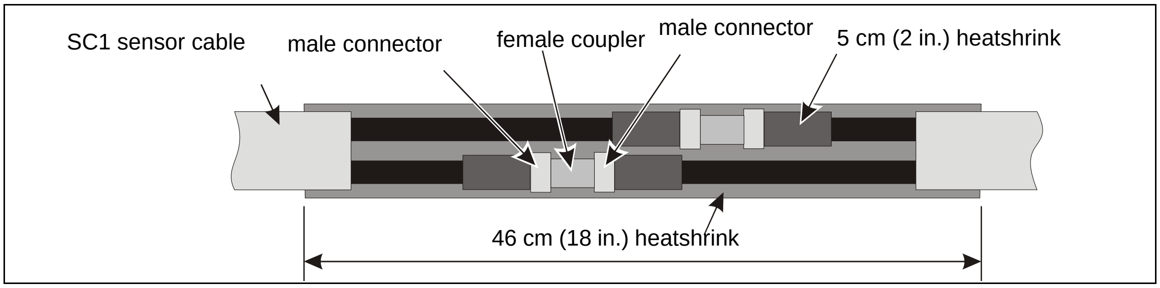



Figure 125: SC1 cable splice

## Cable splice procedure

1. Cut out the section of cable being replaced (prepare for the splice).
2. Install male TNC connectors on the sensor cables on both sides of the splice. For an SC1 cable splice, strip 17 cm (6.5 in.) of the outer jacket and cut back one cable 6 cm (2.5 in.) before installing the connectors.
3. If required, cut the replacement section of cable, ensuring that it is at least 1 m (3.3 ft.) longer than the removed section.
   For SC1 cable, repeat the strip and offset dimensions from step 2 on both ends of the replacement cable (cut the replacement cable so it matches the offset of the sensor cable).
4. For a non-detecting cable bypass, slide 20 ferrite beads onto the replacement section of cable (10 at each end).
5. Install connectors on one end of the replacement cable.
6. Slide the heatshrink over the sensor cable on both sides of the splice.
7. Connect the 2 male TNCs (sensor cable and replacement cable) through a female coupler.
8. Run the replacement cable to the other side of the splice, using a lazy-S pattern to provide strain relief.
9. Carefully cut the end of the replacement section of cable so it meets the connectors on the other section of sensor cable.
10. Install a connector(s) on the cut end of the replacement cable.
11. Connect the 2 male TNCs (sensor cable and replacement cable) through a female coupler.
12. Test the sensor cables.

13. Slide the heatshrink over each cable splice and apply heat to seal the heatshrink (see Sealing the heatshrink over decouplers/splices on page 133).
14. Partially backfill the trenches to hold the cables in place.

### Lead-in cable splices (OC2 sensor cable)

You can add lead-in cable to increase the length of the 20 m of integral lead-in cable supplied with each OC2 sensor cable. However, there are rules that must be followed.

#### Splicing in additional OC2 lead-in cable (10 m or less)

Repeat this procedure for both the TX and RX cables.

1. Determine the additional length of lead-in cable that you require (maximum 10 m).
2. Measure and cut the required lengths of non-detecting cable.
3. Install male TNC connectors on the cut ends of the additional lead-in cables.
4. Splice the non-detecting cable to the integral lead-in cable using a female TNC coupler and 30 cm of heatshrink.

#### Splicing in additional OC2 lead-in cable (greater than 10 m)

Repeat this procedure for both the TX and RX cables.

1. Determine and obtain the additional length of lead-in cable that you require.
2. Lay out the OC2 sensor cable.
3. Measure and cut off a length of detecting cable at the start section, indicated by the red band, that is equal to the full length of lead-in cable that you require minus 20 m (the length of the integral lead-in cable). Label and retain the cut off section of cable.
4. Install a male TNC connector on the cut end of the detecting cable.
5. Measure and cut a length of lead-in cable (the full length of lead-in you require).
6. Install 10 ferrite beads and two male TNC connectors on the replacement section of lead-in cable.
7. Splice the lead-in cable to the detecting cable with a female TNC coupler and 30 cm of heatshrink.

### Lead-in cable splices (SC1/SC2 sensor cable)

You can add lead-in cable to increase the length of the 20 m of integral lead-in cable supplied with each SC1/SC2 sensor cable. However, there are rules that must be followed.

#### Splicing in additional SC1/SC2 lead-in cable (15 m or less)

To add 15 m, or less, of lead-in cable, you can splice the additional lead-in to the end of the existing lead-in cable. No other changes are required.

## Splicing in additional SC1/SC2 lead-in cable (greater than 15 m)

To add more than 15 m of lead-in cable, you must remove an equal amount of detecting cable from the start-up section of cable, which is marked by the red band. The following figure illustrates an example where site conditions require 50 m of lead-in cable. Therefore, the first 30 m of detecting cable from the startup section (past the red band) and the existing 20 m of lead-in cable must be cut out. A 50 m section of replacement lead-in cable is then spliced in at the 30 m point, where the detecting cable was cut.

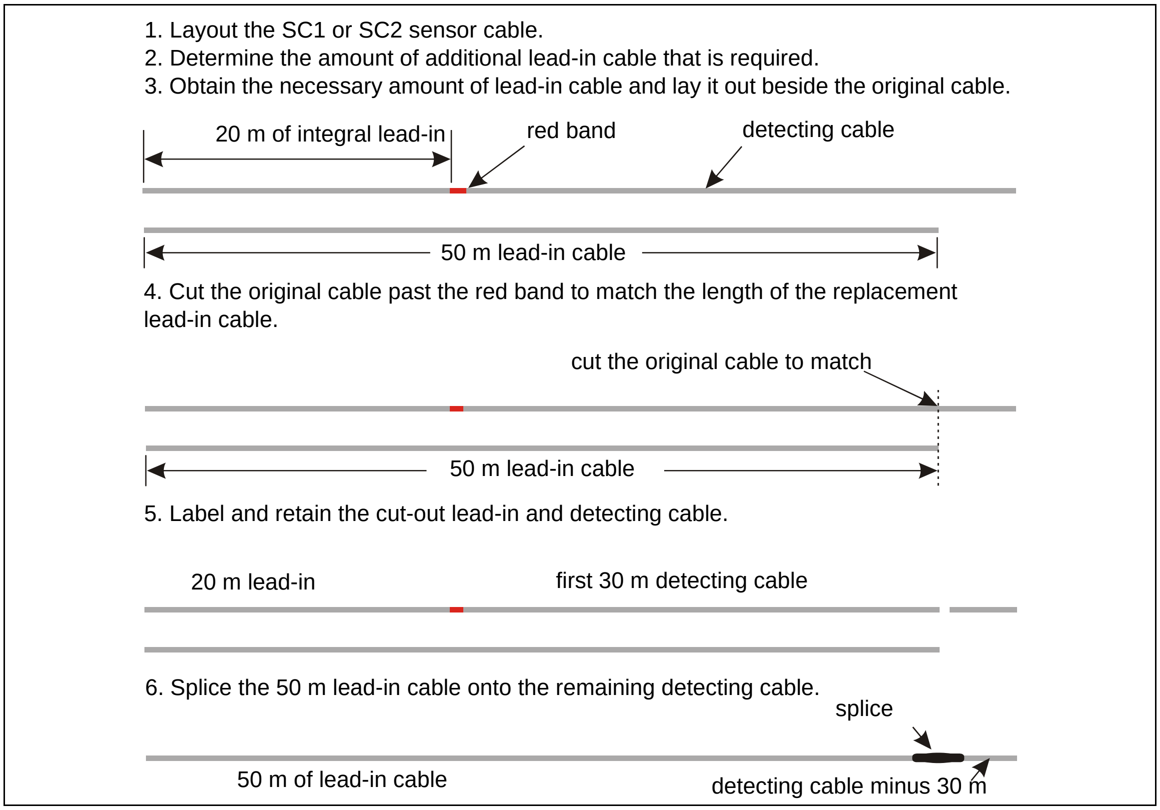



Figure 126: SC1/SC2 lead-in splice

## Sensor cable bypasses - hardware bypass

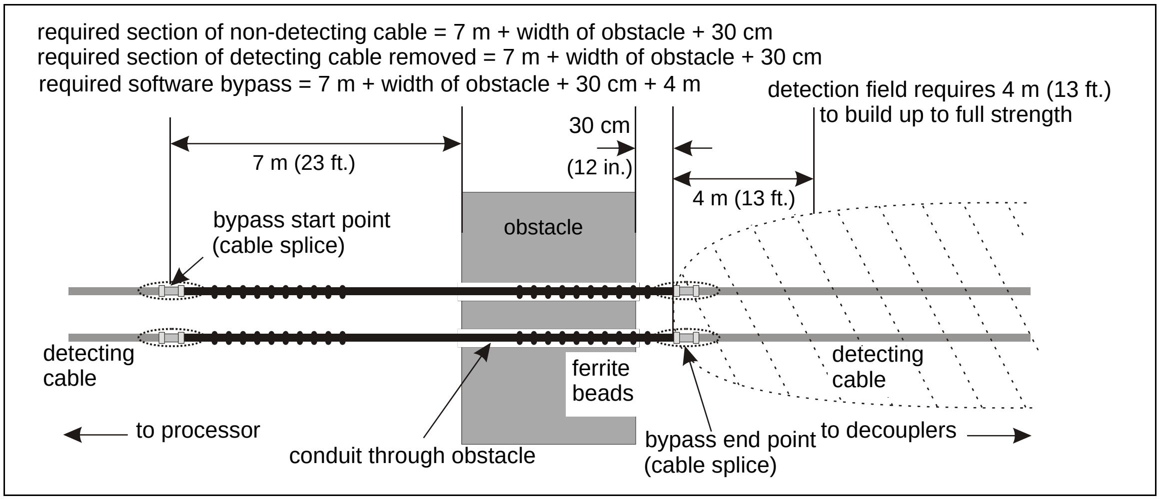



Figure 127: Sensor cable hardware bypass

1. Dispense the cable until you reach the obstacle in the cable path.
2. On the processor side of the obstacle, measure back 7 m (23 ft.) from the obstacle toward the processor.
3. Cut the sensor cable at the 7 m measurement.
4. Measure and cut two lengths of non-detecting cable (7 m + obstacle width + 30 cm). (For SC1 cable you cut a single length of SC1 lead-in).
5. Remove an equal length of detecting cable.
6. Slide 20 ferrite beads over each section of lead-in cable. At each end of the lead-in cable, place the first bead 30 cm (12 in.) past/before the splice with subsequent beads spaced 30 cm apart (going away from the detecting cable).
7. Follow the directions for making cable repairs to splice in the lead-in cable.
8. Use the UCM to set the bypassed sensor cable as non-detecting (zone 0).

### Software bypass

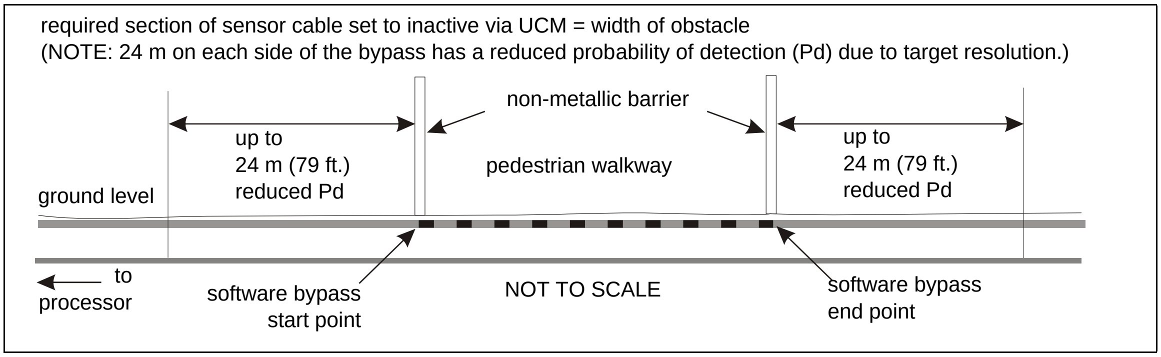



Figure 128: Sensor cable software bypass

1. Complete the cable installation and perform a preliminary system calibration.
2. With the OmniTrax processor running and connected to the UCM, have a person stand on the detection field centerline at the beginning of the bypass.
   Note the position recorded on the UCM plot.
3. Repeat step 2 at the end of the bypass.
4. Using the peak location readings obtained in steps 2 and 3, set the required length of detecting cable to inactive (see Defining the cable segments and alarm zones on page 205).
5. Measure 24 m on each side of the software bypass and note them as areas with a reduced Pd.
6. Perform crossings to test the bypassed section to ensure that alarms are not reported.
7. Perform crossings to test the adjacent sections of detecting cable to ensure that alarms are reported.

If alarms are reported in the bypassed section, repeat the procedure increasing the separation distance between the obstacle and the bypass start and end points.

# Cable tests

After installing the sensor cables, verify each cable's integrity by performing the single cable continuity test, the insulation resistance test, the leakage resistance test, the cable-pair continuity test and the cable-set continuity test before burying the cables.

### Equipment required

- digital multimeter
- jumper wire with clips (to make short-circuit connection)

| | |
|---|---|
| **Note** | DO NOT use high voltage cable leakage testers (meggers) on OmniTrax sensor cables, which are connected to processors, decouplers, or loopback cables. |

### Cable pair

A cable-pair consists of two separate sensor cables (TXA and TXB or RXA and RXB) connected by a decoupler.

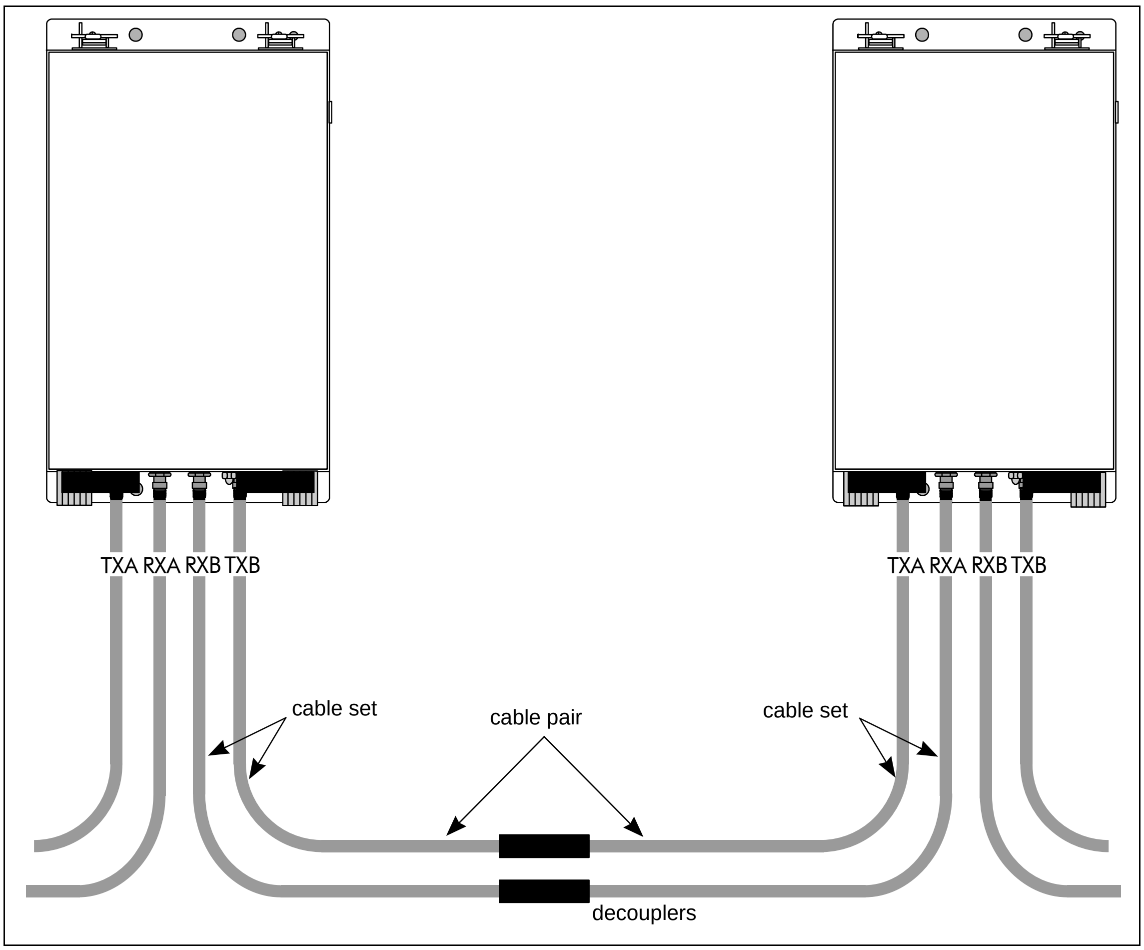



Figure 129: Cable pair

## Cable set

A cable-set consists of the two sensor cables (a single cable for SC1) connected to one side of a processor (A-side or B-side, TX and RX). A cable set can be connected to another cable set through decouplers. At the end of a perimeter, OmniTrax sensor cables are connected to terminators.

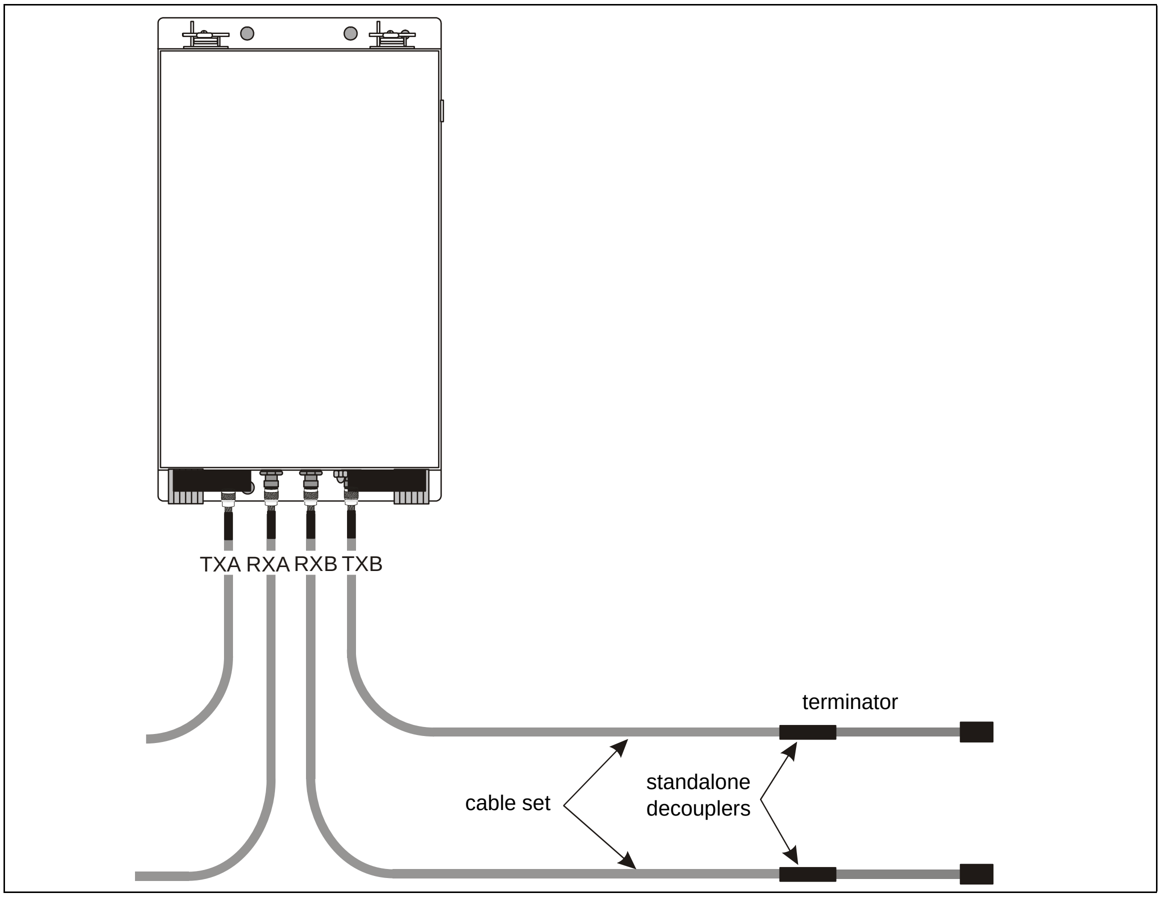



Figure 130: OC2/SC2 end of perimeter cable termination

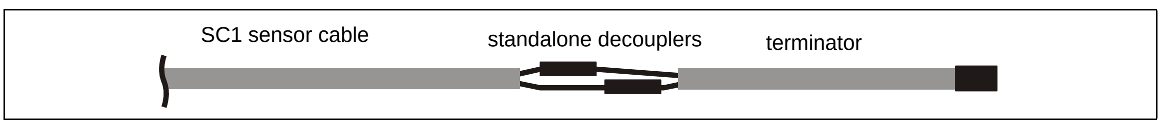



Figure 131: SC1 end of perimeter cable termination

# Sensor cable tests

| | |
|---|---|
| **Note** | Perform the single cable continuity test, the insulation resistance test, and the leakage resistance test before conducting the cable-pair continuity test.<br>Repeat each test for all sensor cables. |

## Single cable continuity test

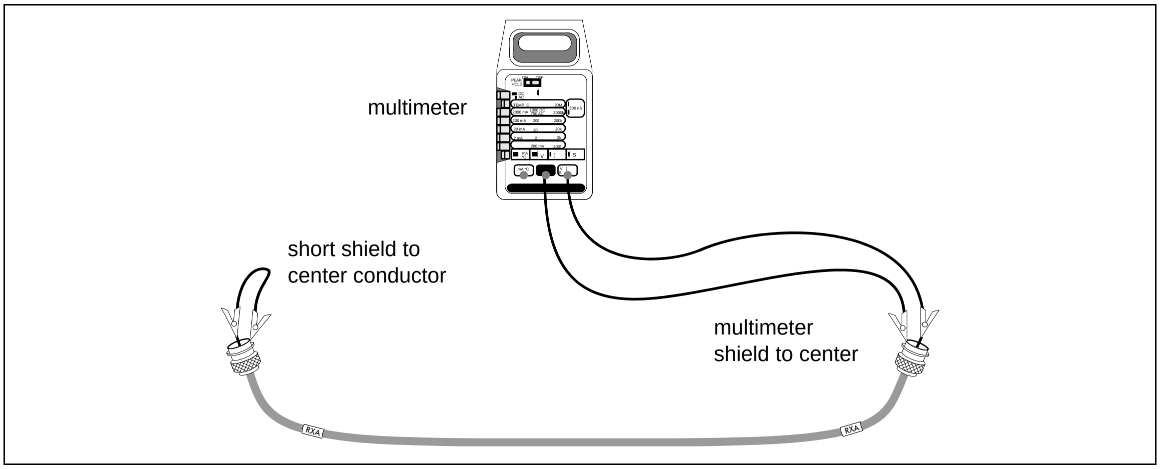



Figure 132: Single cable continuity test

1. At one end of the cable, short the center conductor to the connector shell.
2. At the other end of the cable, measure the resistance between the connector's center conductor and shell.
   - resistance = 10 Ω or less

| | |
|---|---|
| **Note** | For SC1/SC2 sensor cable the resistance should be approximately 3 Ω per 100 m of cable. |

## Insulation resistance test

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

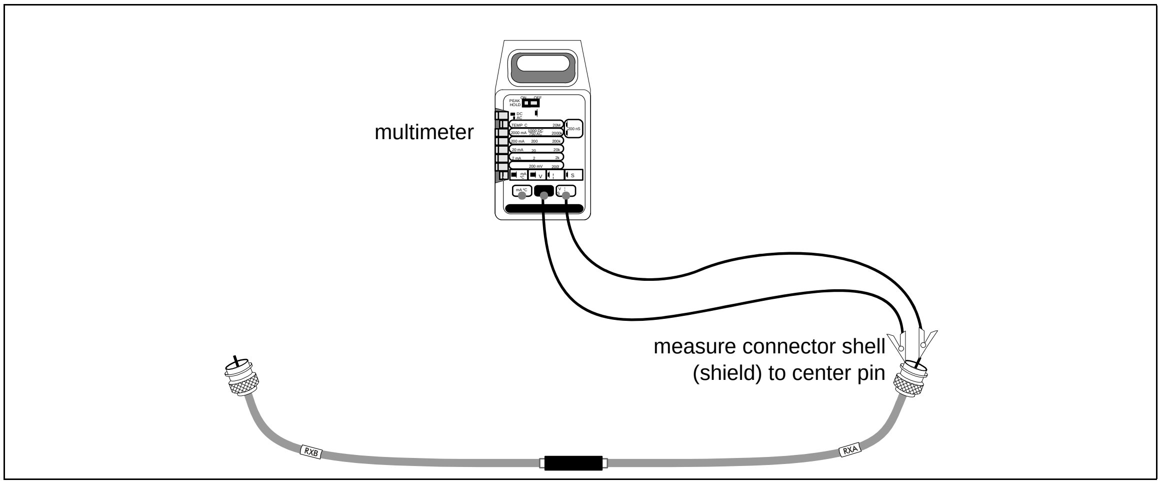



Figure 133: Insulation resistance test

1. Select a sensor cable pair to test. Disconnect both connectors, allowing the connectors to hang in mid-air during this test.
2. Set a digital multimeter to measure resistance, and attach it to the connector's center conductor and shell.
    - For cable pairs with network decouplers the resistance should be > 20 $M\Omega$
    - For cable pairs with standalone decouplers the resistance should be 130 k $\Omega \pm$ 5%

    If the resistance is different, there could be a problem with the connector installation or the decoupler.
3. Reverse the leads and repeat the measurement.

## Leakage resistance test (all cable pairs)

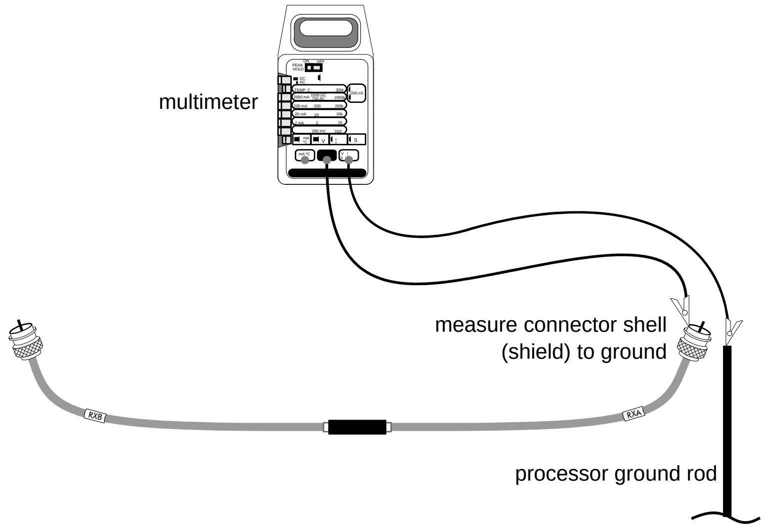



Figure 134: Leakage resistance test

| | |
|---|---|
| **Note** | During the test do not let the connectors or for SC1 cable, the conductive black jacket, touch anything that is grounded or each other. |

1. Select a sensor cable pair to test. Disconnect both connectors, allowing the connectors to hang in mid-air during this test.
2. Set a digital multimeter to measure resistance, and attach it to the connector's shell and the processor ground rod.
   - The resistance should be > 20 *M* Ω

   If the reading is different, there could be a problem with the sensor cable's jacket or with heatshrink installation.
3. Reverse the multimeter's leads (connector's shell and the processor ground rod) and repeat the resistance measurement.
   - The resistance should be > 20 *M* Ω

   If the resistance is different, there could be a problem with the connector installation.
4. 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 be < 10 mVDC (plus or minus).

   If the reading is different, the sensor cable could have damage to the outer jacket.

## Cable-pair continuity test (network decouplers)

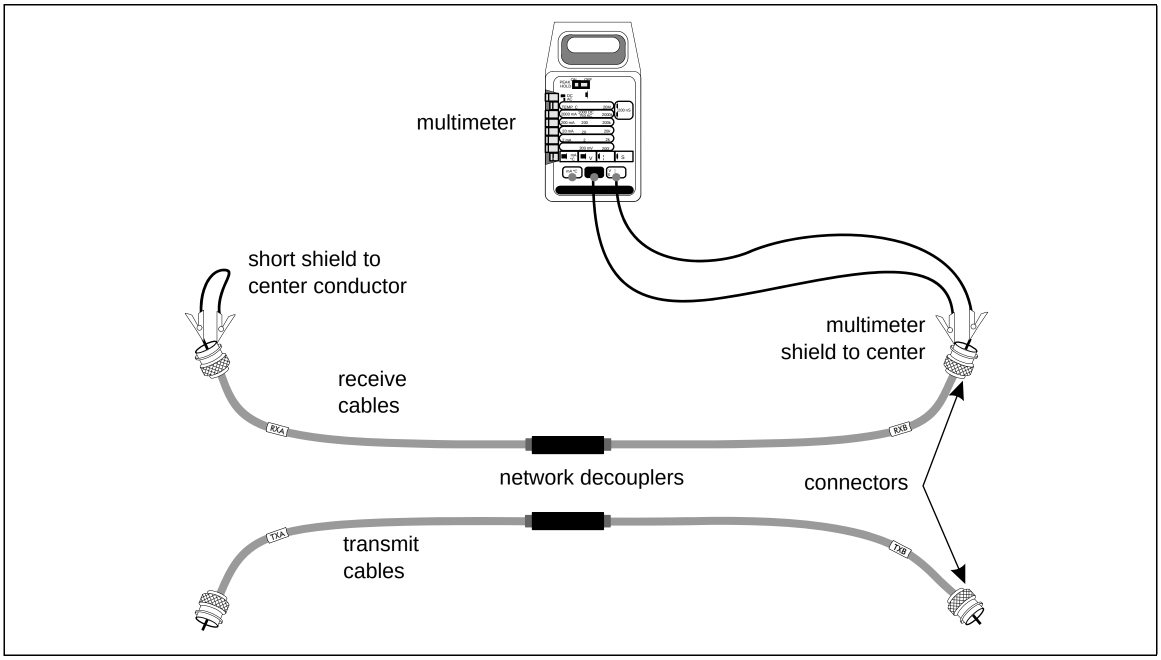



Figure 135: Cable-pair continuity test

1. At each processor, disconnect the sensor cables that are being tested (TX and TX OR RX and RX).
2. At one end of the cable-pair, short the center conductor to the connector shell.
3. At the other end of the cable-pair, set a digital multimeter to measure resistance and attach it to the center conductor and shell of the corresponding connector.
   - For OC2 cable, a resistance of between 5 and 20 Ω confirms continuity.

| | |
|---|---|
| **Note** | For SC1/SC2 sensor cable the resistance should be approximately 3 Ω per 100 m of cable. |

   - Infinite resistance means the cables are not connected or are incorrectly labelled. Re-label or repair as required.
   - A zero reading indicates a short. Check the jumper and meter clips and repair as required.

| | |
|---|---|
| **Note** | For standalone decouplers in a cable pair, do not short the center-pin to the shield at one end of the cable. Measure the resistance between the center-pin and the shield at both ends of the cable. The resistance reading should be 130 k Ω ±5% at each end. |

### Cable-set continuity test (open ended perimeter)

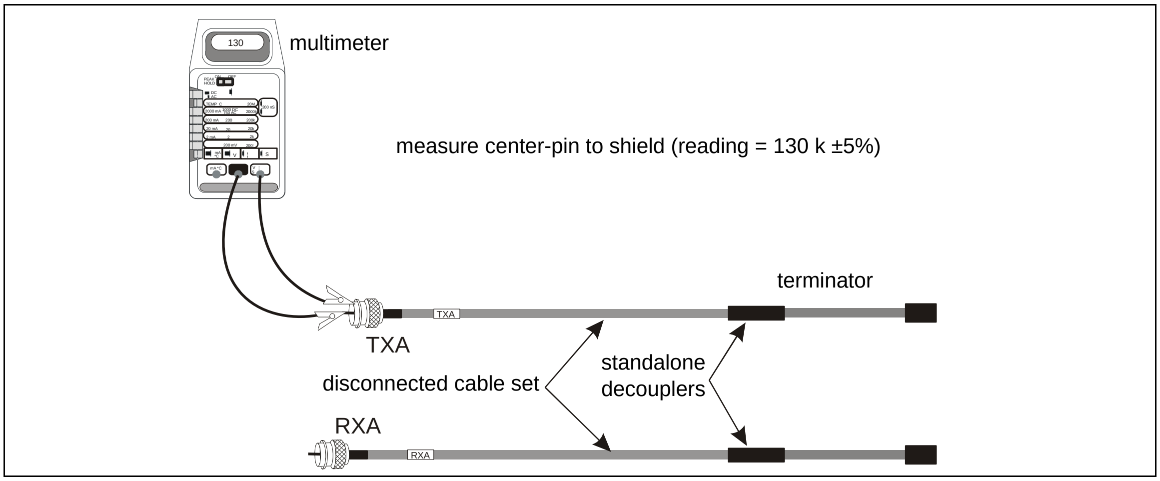



Figure 136: OC2 cable-set continuity test

1. At the processor, disconnect the sensor cables that are being tested (TXA and RXA OR TXB and RXB).
2. Using a digital multimeter, measure the resistance between the center pin and shield on each connector.
   - A resistance of 130 k Ω ± 5% confirms the connection.
   - Infinite resistance means the cables are not properly connected, terminated, or are incorrectly labeled. Re-label or repair as required.
   - A zero reading indicates a short. Check the meter clips and repair as required.

# The surface test

A surface test can identify potential system problems while the cables and connections are readily accessible. A surface test should be conducted for all installations, but is particularly important for installations in which the cables pass through more than one burial media. Once the connections are sealed and the cables are buried, detection problems are much more difficult to resolve.

Before applying power, verify the sensor cable connections and the wiring connections to the processor. Once the connections are verified, power up and test the system before burying the sensor cables, or sealing the slots.

| | |
|---|---|
| **Note** | Refer to the UCM help file, and Chapter 7 for additional details about the following procedure.<br>The surface test does not require the alarm data wiring (network or local) and the power source can be a 12 VDC battery. |

1. Apply power to the processor.
2. Connect the UCM to the processor.
3. Perform a centerline cable walk, while running a plot file in the UCM.

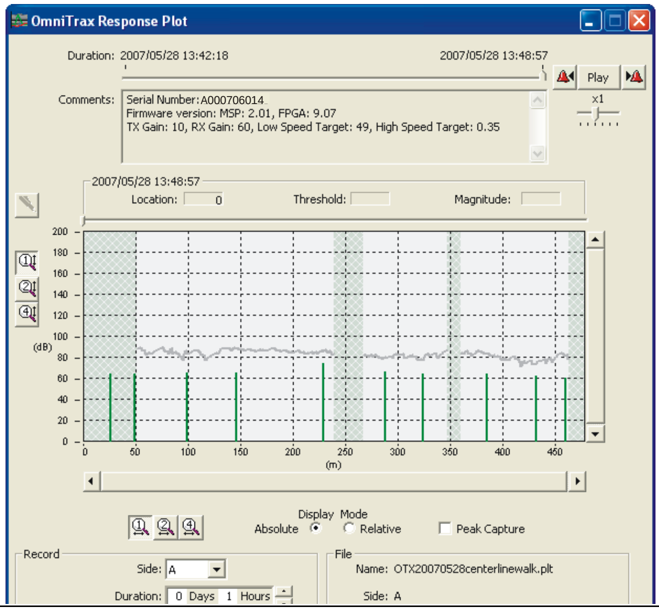



Figure 137: Typical OmniTrax plot (400 m OC2 cable)

4. Observe the recorded plot for uniform cable response.

| **Note** | The maximum dynamic range over the full cable length is 20 dB. If any section of cable has a dynamic range greater than 10 dB over 10 m, adjustments must be made to the installation (e.g., add ferrite beads). |
|---|---|

5. Check the clutter display to ensure that there is no indication of excessive clutter.

Figure 138: illustrates a clutter display and magnitude response plot, both of which indicate an excessive level of clutter near the end of the cable. In this case you must investigate the area, determine the source of the excessive clutter, and correct the problem before burying the cable.

| **Note** | Contact Senstar Customer Service for additional information. |
|---|---|

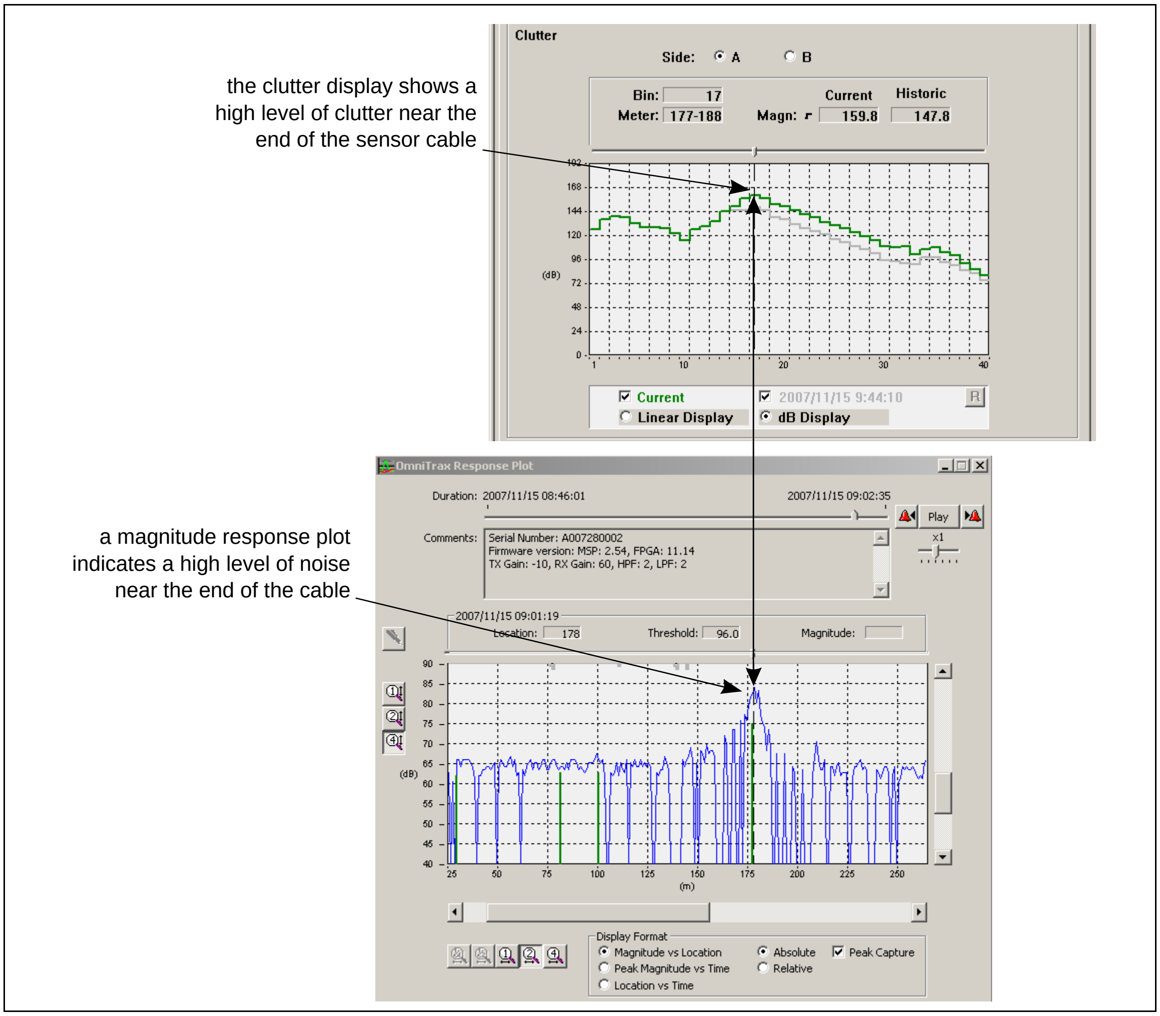



Figure 138: Excessive clutter display (200 m sensor cable)

# Repairing sensor cables

The two most common types of cable faults are ground faults resulting from cable damage, and decoupler faults resulting from buried decouplers that were not completely sealed. Cable faults can occur anywhere along the length of the cable, and can be identified and located via the UCM software. Cable faults are usually indicated by nuisance alarms during wet weather conditions and excessive levels of clutter or sharp increases in clutter in a particular cable segment.

Before proceeding with a sensor cable repair, you must determine the fault's location, and which cable is damaged (TX or RX or both). You also must identify whether a sensor cable or a decoupler requires repair. If the sensor cable is damaged, you must also determine the level of damage. Cable damage often results from digging, landscaping or other below ground construction activity. Most decoupler problems arise from moisture getting into the assembly through improperly sealed connections.

| | |
|---|---|
| **Note** | Always retest the full length of a cable set after cable repairs are made. |

### Ground faults

A ground fault occurs when the cable's outer protective jacket is damaged, creating a path between the conductive material in the cable and the ground. Ground faults can be intermittent, often depending on the soil's electrical properties and level of moisture. This kind of cable damage must be repaired promptly. If not, the problem will become worse over time as moisture penetrates and corrodes the sensor cable. Even minor cable damage can have a negative effect on system performance.

### Decoupler faults

If decouplers are not sealed correctly, water can enter the decouplers, connectors and possibly the sensor cable. This will result in ground faults as a conductive path is created between the decoupler/sensor cable and the ground.

### Testing for faults (Required equipment)

- PC running UCM software and USB cable
- multimeter
- cable ground fault locator (optional)

### Test sequence

- connect the processor to a computer running the UCM software
- observe the clutter display from the suspect cable set
- locate the ground fault (cable damage) by noting the position of the excessive clutter

### Additional tests

(see Cable tests on page 146)

- perform a leakage resistance test to determine which cable is damaged
- perform an insulation resistance test to determine if severe cable damage is present, or if the decoupler is faulty
- if required, use a cable ground fault locator to determine the location of the cable damage

### Decouplers

If a decoupler is suspected of causing the ground fault, expose the decoupler and isolate it from the ground. Perform a leakage resistance test to see if the ground fault disappears when the decoupler is isolated from the ground. If the ground fault is still present when the decoupler is isolated from the ground, it is not the source of the problem. If the ground fault is gone, replace the decoupler.

### Cable damage

If the sensor cable is the source of the ground fault, you must locate the cable damage. If recent construction or landscaping work has been done close to the cable path, the cable damage will most likely be located there.

- use the UCM software to identify the location of cable damage
- use a cable ground fault locator to determine the location of cable damage
- carefully dig up the cables in the suspect location, inspect the cable and assess the level of damage

# Replacing decouplers

If the decoupler is faulty:

1. Remove the faulty decoupler and the TNC connectors.
2. Examine the cut ends of the cables for any signs of corrosion on the center conductor.
   If any corrosion is present, strip back the cable until you reach uncorroded center conductor.
3. Install new TNC connectors and decouplers, as required.
4. Test the replacement connector and decoupler to ensure proper installation. See Cable tests on page 146.

| **Note** | Do NOT shrink the heatshrink until after the new connectors and decouplers are tested. |
|---|---|

5. Reinstall the decoupler and retest the cable set.
6. Apply heat to seal the heatshrink (see Sealing the heatshrink over decouplers/splices on page 133).

# Assessing cable damage

A minor cut in the outer jacket, which appears to be only superficial damage may actually be serious if the cut penetrates both cable jackets. Repair any visible cable damage. Even superficial cuts or scrapes can allow water to enter the cable and cause internal damage.

When you are assessing damaged cable, and there are signs of corrosion, cut back and remove the jacket until you reach an uncorroded section. Using the cable damage assessment table, classify the damage based on the length of sensor cable that must be replaced.

| Damage level | Description |
|---|---|
| **Superficial damage on page 157** | a small, single-point cut or scrape through the outer cable jacket resulting in no internal damage |
| **Minor damage on page 157** | a cut less than 1 cm (0.4 in.) long through the outer cable jacket, resulting in internal damage, (i.e., damage to inside black jacket, foil, dielectric, center conductor) |
| **Moderate damage (1 to 45 cm) on page 158** | a damaged section more than 1 cm (0.4 in.) but less than 45 cm (18 in.) long |
| **Severe damage on page 159** | a damaged section more than 45 cm (18 in.) long |

Cable damage assessment table

### Required equipment

- heat gun
- measuring tape
- shovel
- garden rake
- cleaning supplies - water with mild detergent, cloth, paper towels

### OmniTrax OC2 components

- OmniTrax cable tool kit - required to replace connectors (A4KT0200)
- mastic tape & vinyl or electrical tape - for superficial cable repair
- decoupler kit - to replace damaged decouplers
- detecting sensor cable repair kit
  - A4KT0301 - for repairs less than 45 cm (18 in.) long
  - A4KT0302 - for repairs more than 45 cm (18 in.) and less than 3 m 10 ft. long
- replacement sensor cable set (for damaged sections of detecting cable greater than 3 m long)
- replacement sections of non-detecting cable and a cable splice kit - for damaged sections of lead-in cable

### OmniTrax SC1/SC2 components

- OmniTrax SC1/SC2 cable tool kit - required to replace connectors (A0KT1500)
- mastic tape & vinyl or electrical tape - for superficial cable repair
- decoupler kit - to replace damaged decouplers
  SC1 standalone - A3KT0601, SC1 network - A3KT0701
  SC2 standalone - A4KT1202, SC2 network - A4KT1201
- detecting sensor cable repair kit
  - A3KT0500 - for SC1 cable repairs less than 45 cm (18 in.) long
  - A3KT0800 - for SC2 cable repairs less than 45 cm (18 in.) long
  - for detecting cable repairs more than 45 cm (18 in.) and less than 3 m (10 ft.) long, you need an equal length of detecting cable from anywhere along the length of a cable, plus a splice kit
- replacement sensor cable set of the same original length as the damaged cable (for damaged sections of detecting cable greater than 3 m long), plus a splice kit
- replacement sections of lead-in cable, plus a splice kit for damaged sections of lead-in cable

## Repairing detecting sensor cable damage

### Superficial damage

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

1. Using a damp cloth and mild detergent, clean the cable thoroughly in the area of the cable damage (ensure the cable is completely dry before proceeding to step 2).
2. Tightly wrap overlapping layers of mastic tape around the damaged section.
3. Wrap vinyl or electrical tape over the mastic tape for additional protection.
4. Note the location and a brief description of the cable damage on the site plan.

### Minor damage

#### OC2 (< 1 cm)

To repair minor damage, make a cable splice consisting of two male TNC connectors and a female to female coupler at the damaged section. Use heatshrink to seal the splice.

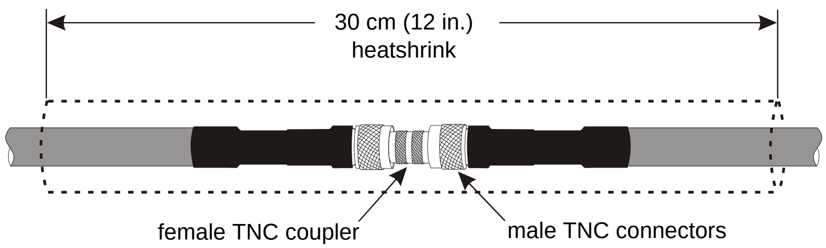



Figure 139: Repairing minor damage - OC2 cable

### SC1 (< 1 cm)

Refer to Moderate damage (1 to 45 cm) on page 158, to repair minor damage to SC1 sensor cable.

### SC2 (< 1 cm)

To repair minor damage, make a cable splice consisting of two male TNC connectors and one female coupler at the damaged section. Use heatshrink to seal the splice.

| | |
|---|---|
| **Note** | The following procedure applies to OC2/SC2 sensor cable. Use this procedure and refer to figure Figure 125: to repair minor damage to SC1 sensor cable. |

1. Cut the cable at the centre of the damaged section.
2. Using a damp cloth and mild detergent, clean and dry the two cable sections thoroughly in the area of the cable damage.
3. Examine the cut ends of the cable for any signs of corrosion on the center conductor. If any corrosion is present, strip back the cable until you reach uncorroded center conductor.
4. Classify the cable damage based on the length of removed cable. If removing corroded cable resulted in an increase in the level of cable damage (to moderate or severe) refer to the appropriate section for details. See Cable damage assessment table on page 156.
5. Install TNC connectors on the two cut cable ends. See Installing connectors on OC2 sensor cable on page 121.
6. Test the connectors to ensure proper installation. See Cable tests on page 146.
7. Slide on the 30 cm section of heatshrink tubing, and join the male connectors with a female to female coupler.
8. Position the heatshrink tubing over the connectors and apply heat to seal the heatshrink (see Sealing the heatshrink over decouplers/splices on page 133).
9. Note the location and a brief description of the cable damage on the site plan.

### Moderate damage (1 to 45 cm)

To repair moderate damage, cut out the damaged section of cable and splice in new cable. The short OmniTrax OC2 cable repair kit (A4KT0301) includes the components required to make this repair. The following procedure applies to OC2/SC2 sensor cable. Use this procedure and refer to figure Figure 125: to repair minor damage to SC1 sensor cable. The components for this repair for SC1 sensor cable are included in kit no. A3KT0500. The components for this repair for SC2 sensor cable are included in kit no. A3KT0800.

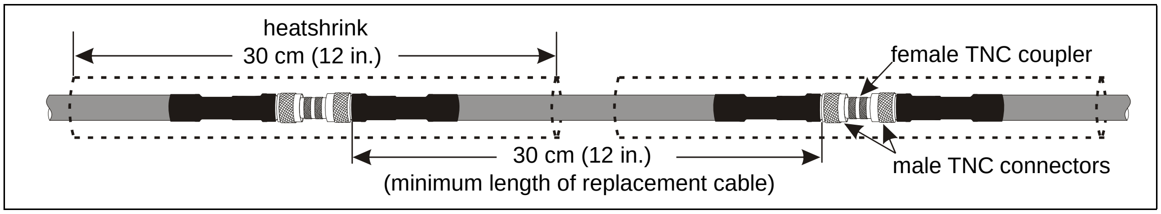



Figure 140: Repairing moderate damage - OC2 cable

1. Cut out the damaged section of cable, ensuring that at least 30 cm (12 in.) of cable is removed.
2. Using a damp cloth and mild detergent, clean and dry the two cable sections thoroughly in the area where the damaged section was removed.
3. Examine the cut ends of the cable for any signs of corrosion on the center conductor. If any corrosion is present, strip back the cable until you reach uncorroded center conductor.
4. Classify the cable damage based on the length of removed cable. If removing corroded cable resulted in an increase in the level of cable damage to severe, refer to the severe damage section for additional information. See Cable damage assessment table on page 156.
5. Install one male TNC connector each on the two cut cable ends and on both ends of the replacement cable. See Installing connectors on OC2 sensor cable on page 121.
6. Test the connectors for proper installation. See Cable tests on page 146.
7. Slide on the two 30 cm sections of heatshrink tubing, and join the male connectors with female couplers.
8. Position the two pieces of heatshrink tubing over the connectors and apply heat to seal the heatshrink (see Sealing the heatshrink over decouplers/splices on page 133).
9. Note the location and a brief description of the cable damage on the site plan.

### Severe damage

The procedure for repairing detecting sensor cable with severe damage depends on the length of the damaged section. For damaged sections up to 3 m (10 ft.) long, a replacement section of detecting cable can be spliced in. For sections less than 3 m in length, it is not critical to match the replacement cable's graded foil opening with the damaged cable's graded foil opening. Therefore, any section of detecting cable may be used for this purpose. The OmniTrax long cable splice kit (A4KT0302) includes two 3 m lengths of detecting sensor cable, for replacing damaged sensor cable.

If the damaged section of detecting cable is longer than 3 m, Senstar recommends replacing the entire sensor cable. If site conditions make this impractical, you must splice in a replacement section of detecting cable in which the graded foil opening matches the graded foil opening of the section of cable that is being replaced.

### Severe damage (< 3m)

To repair severe cable damage that is less than 3 m (10 ft.) long, cut out the damaged section of cable and splice in new cable. The long OmniTrax OC2 cable repair kit (A4KT0302) includes the components required to make this repair.

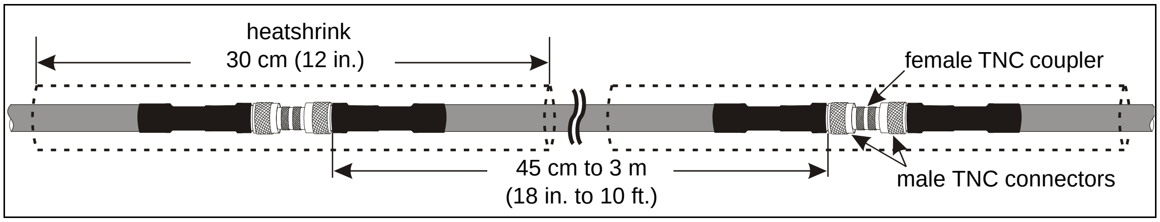



Figure 141: Repairing severe damage (< 3 m) - OC2 cable

The following procedure applies to OC2/SC2 sensor cable. Use this procedure and refer to figures Figure 125: to repair severe damage that is less than 3 m in length for SC1 and sensor cable. There are no kits available for SC1 and SC2 sensor cable. You require an equal length of detecting cable from anywhere along the length of a cable, plus male TNC connectors, female couplers and heatshrink (46 cm for SC1, - 30 cm for SC2).

1. Cut out the damaged section of cable.
2. Examine the cut ends of the cable for any signs of corrosion on the center conductor. If any corrosion is present, strip back the cable until you reach uncorroded center conductor.
3. Classify the cable damage based on the length of removed cable. If removing corroded cable resulted in an increase in the length of the damaged cable to more than 3 m, refer to the severe damage > 3 m section for additional information. See Cable damage assessment table on page 156.
4. Cut the replacement section of sensor cable to the correct length (add approximately 5 cm, 2 in. to the cut length, as a precaution).
5. Using a damp cloth and mild detergent, clean and dry the two cable sections thoroughly where the damaged section was removed.
6. Install one male TNC connector each on the two cut cable ends and on both ends of the replacement cable. See Installing connectors on OC2 sensor cable on page 121.
7. Test the connectors for proper installation. See Cable tests on page 146.
8. Slide on the two pieces of heatshrink tubing, and connect the replacement section of cable by joining the male connectors with two female to female couplers.
9. Retest the cable set and install the repaired cable.
10. Apply heat to seal the heatshrink (see Sealing the heatshrink over decouplers/splices on page 133).
11. Note the location and a brief description of the cable damage on the site plan.

## Severe damage (> 3m)

The foil opening in the detecting sensor cable is graded over the length of the cable to compensate for signal attenuation, and to provide uniform detection. When replacing a damaged section of detecting cable longer than 3 m, you must match the replacement section's graded foil opening with the graded foil opening in the damaged section. To accomplish this, you require a new sensor cable of the same length as the damaged cable. To match the graded foil openings, align the red bands, roll out the replacement cable and cut out the replacement section at the same relative location as the damaged section of cable.

| | |
|---|---|
| **Note** | If you are using 400 m OC2 cable, and the damage is before the 300 m point, you can use a 300 m replacement cable for the repair. |

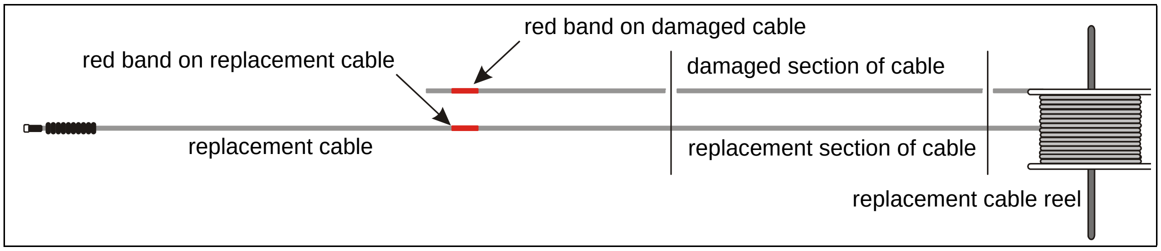



Figure 142: Repairing severe damage (> 3 m) - OC2 cable

The following procedure applies to OC2/SC2 sensor cable. Use this procedure and refer to figure Figure 125: to repair severe damage that is greater than 3 m in length for SC1 sensor cable. For SC1 and SC2 sensor cable, you require a full length detecting cable of the same original length as the damaged cable. You also need male TNC connectors, female couplers and heatshrink (46 cm for SC1, - 30 cm for SC2).

| | |
|---|---|
| **Note** | Contact Senstar Customer Service before attempting to repair severely damaged OmniTrax sensor cable. |

1. Carefully expose the damaged sensor cable's red band at the start point.
2. Dig up the full length of the damaged section.
3. Obtain a new sensor cable that is the same original length as the damaged cable. Unroll the new cable along the path of the damaged cable, until you are completely beyond the damaged section.
4. Align the red bands on the two cables at the start point.
5. Cut out and discard the section of damaged cable.
6. Using a damp cloth and mild detergent, clean and dry the two cable sections thoroughly where the damaged section was removed.
7. Examine the cut ends of the cable for any signs of corrosion on the center conductor. If any corrosion is present, strip back the cable until you reach uncorroded center conductor.
8. Ensure that the replacement cable closely follows the path of the damaged cable. Cut out the replacement section of new cable at the same location as the damaged section that was removed (add at least 5 cm {2 in.} to the cut length, as a precaution).
9. Install one male TNC connector each on the two cut cable ends and on both ends of the replacement cable. See Installing connectors on OC2 sensor cable on page 121.
10. Test the connectors for proper installation. See Cable tests on page 146.
11. Slide on the two pieces of heatshrink tubing, and join the male connectors with female couplers.
12. Position the heatshrink over the connectors and apply heat to seal the splices (see Sealing the heatshrink over decouplers/splices on page 133).
13. Label the leftover sections of the new cable, specifying the cable length to the cut, and which end is which (i.e., lead-in to cut, cut to lead-out).
14. Note the location and a brief description of the cable damage on the site plan.
15. Reinstall the sensor cable and retest the cable set.

# Repairing non-detecting sensor cable damage

If lead-in cable is damaged there are two options for repair, depending on the cable layout. If there is excess non-detecting cable buried, you can dig it up and reposition it so that it reaches the processor or decoupler enclosure. The second option is to splice in a replacement section of non-detecting cable.

| | |
|---|---|
| **Note** | The OmniTrax system requires a minimum of 6 m (20 ft.) of lead-in cable. |

The following procedures apply to OC2/SC2 sensor cable. Use these procedures and refer to figure Figure 125: to repair lead-in cable damage for SC1 sensor cable. For SC1 and SC2 sensor cable, you require non-detecting cable of the same length as the damaged cable. You also need male TNC connectors, female couplers and heatshrink (46 cm for SC1, 30 cm for SC2).

## Repositioning non-detecting cable

| | |
|---|---|
| **Note** | The 10 ferrite beads must remain in the specified positions on the non-detecting cable. |

1. Carefully dig up the full length of the non-detecting section (to the red band).
2. Route the non-detecting section of cable to the enclosure's location to determine if there is enough undamaged cable to reach the enclosure.
3. If the length of undamaged cable is adequate, cut the non-detecting cable at the point of the damage.
4. Using a damp cloth and mild detergent, clean and dry the cut section thoroughly at the point where the damaged section was cut.
5. Examine the cut end of the cable for any signs of corrosion on the center conductor. If any corrosion is present, strip back the cable until you reach uncorroded center conductor.
6. Install a male TNC connector on the cut end of the non-detecting cable. See Installing connectors on OC2 sensor cable on page 121.
7. Test the connector for proper installation. See Cable tests on page 146.
8. Dig a new trench to the enclosure's location, bury the cable, and re-connect the cable to the appropriate connector on the enclosure.

## Replacing non-detecting cable

If non-detecting cable is damaged, an equivalent length of non-detecting cable can be spliced in as a replacement. Follow the directions for repairing longer sections of detecting cable to replace damaged sections of non-detecting cable. Non-detecting cable must be replaced with non-detecting cable.

| | |
|---|---|
| **Note** | Do NOT use detecting cable to replace lead-in cable. |

# 5 Power and data connections

Senstar provides two options for powering the OmniTrax sensor:

- C7EM0503 - a 12 VDC power supply on a steel baseplate with no enclosure for standalone, single processor applications
- A4EM0200 - a 48 VDC network power supply in a weatherproof enclosure for powering up to 5 processors

## 48 VDC network power supply

The network power supply terminals accept 14 to 22 AWG insulated wire with a 9.5 mm (3/8 in.) strip length for the power connections.

| | |
|---|---|
| **Note** | The power supply includes two 3.15 A, ceramic fuses (5 X 20 mm). The fuses are located inside the main terminal block. Lift the tabs to access the power fuses.<br>Always replace a fuse with one of the same type and rating. |

1. Pull the AC power cable into the enclosure through the right side cable gland, and route the cable around the inside of the enclosure as indicated.
2. Pull the DC power cable into the enclosure through the left side cable gland.
3. Follow the connection diagram below the terminal block to make the wiring connections.
4. Connect the AC power cable ground wire (green/yellow) to the ground lug.
   From left to right connect:
   AC line (black/brown) to the first terminal
   AC neutral (white/blue) to the second terminal
   -48 VDC (black) to the third terminal
   + 48 VDC (red) to the fourth terminal

| | |
|---|---|
| **CAUTION** | Consult the Local and National Electrical Codes concerning the connection of AC mains power to the power supply.<br>For outdoor installation, the power supply must be installed in a NEMA4/IP66 rated weatherproof enclosure.<br>Consult the local electrical/building safety codes to determine if the weatherproof enclosure must be vented. |

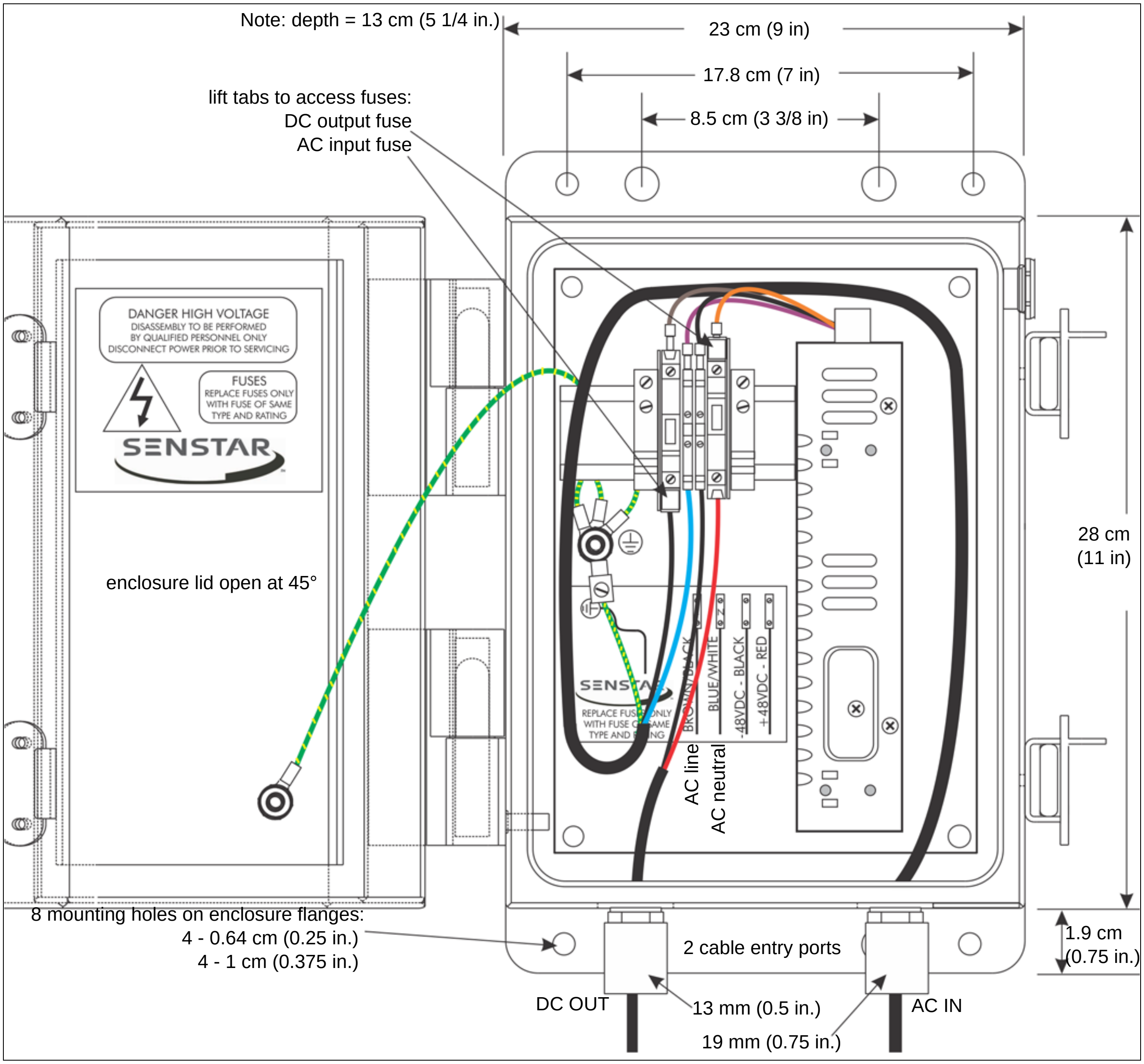



Figure 143: 48 VDC network power supply wiring

# Sensor cable power fuse installation rules

| | |
|---|---|
| **CAUTION** | Replace fuses ONLY with a fuse of the same type, and rating. |

The OmniTrax processor includes two 5 X 20 mm 1.25 A, 250 V fast acting fuses which connect the power input connector (T3) to the sensor cables. F3 connects the input power to the RX cable, and F4 connects the input power to the TX cable (see Figure 150:). The following table lists the sensor cable power fuse installation requirements.

| | |
|---|---|
| **Note** | Processors receiving power over the sensor cables, and processors receiving 12 VDC local power do not require fuses F3 and F4. |

| Note | For older OmniTrax installations (before 2010) Rev E and earlier processors receiving 12 VDC local power require both F3 & F4. |
|---|---|

| Fuse | Usage |
|---|---|
| F3 | processor connected to a 48 VDC power supply (T3) and distributing power over the RX sensor cable<br>processor receiving power over the RX cable and supplying power to an auxiliary power module |
| F4 | processor connected to a 48 VDC power supply (T3) and distributing power over the TX sensor cable<br>processor receiving power over the TX cable and supplying power to an auxiliary power module |
| F3 & F4 | processor connected to a 48 VDC power supply (T3) and distributing power over both sensor cables |
| Either F3 OR F4 | processor receiving power over both sensor cables and supplying power to an auxiliary power module |

# Auxiliary power supply module

The auxiliary power supply module mounts on the enclosure door.

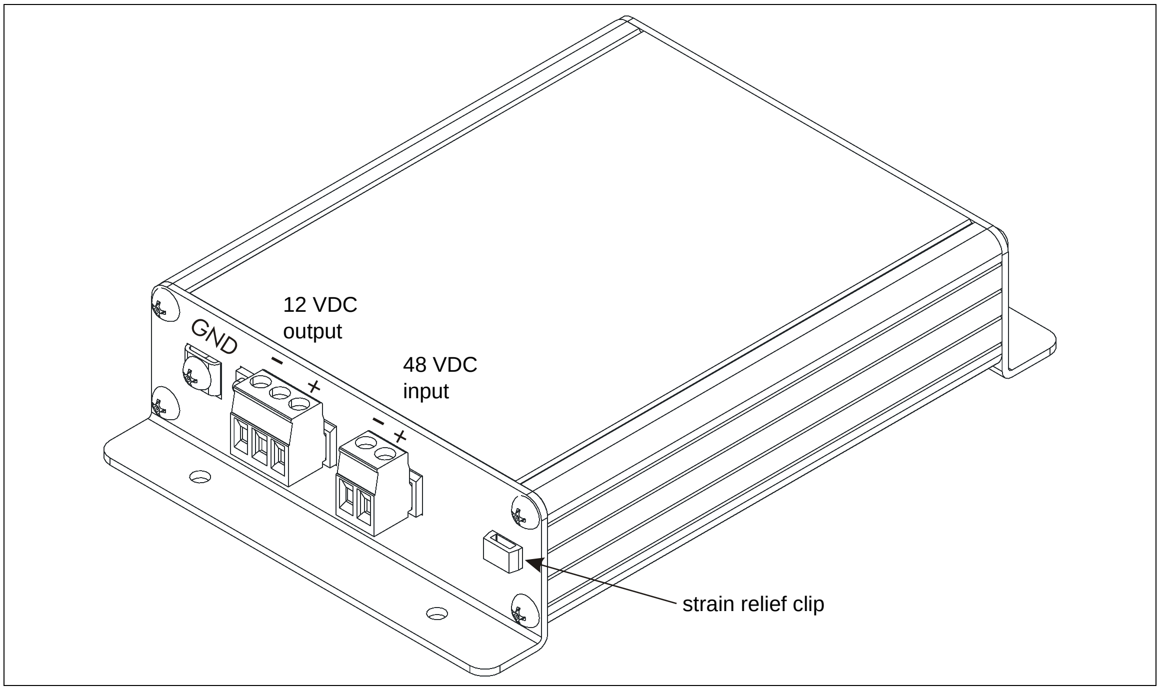



Figure 144: Auxiliary power supply module

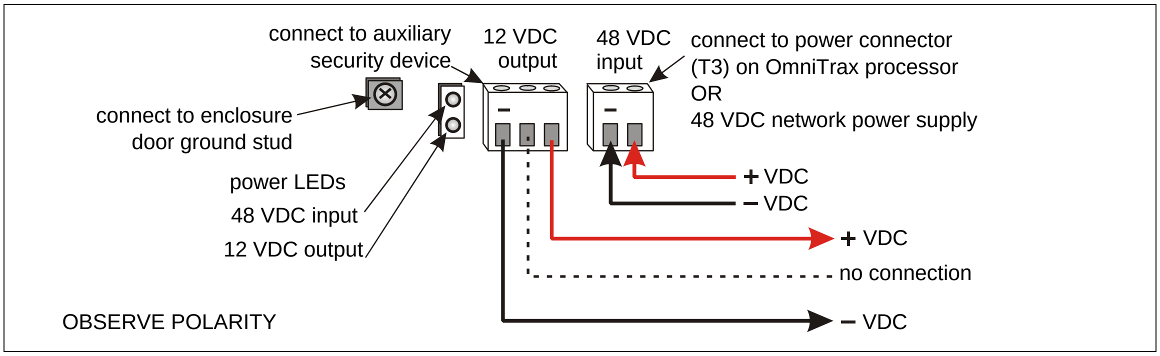



Figure 145: Auxiliary power supply wiring

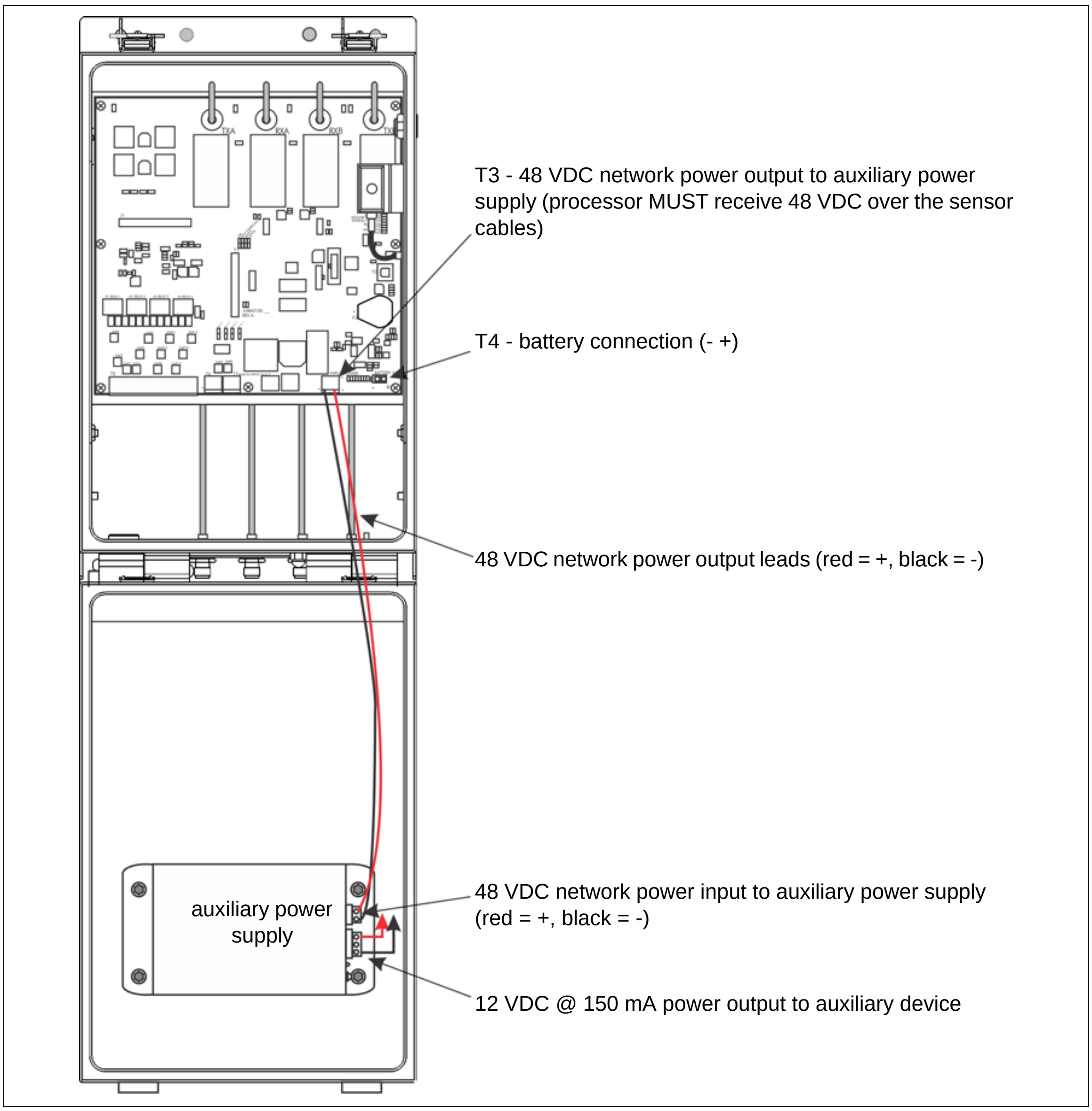



Figure 146: Auxiliary power supply module

1. Press fit the auxiliary power supply onto the enclosure door.
2. Make the wiring connections as indicated above.

# Installing the backup battery kit

The OmniTrax sensor supports the addition of an optional rechargeable 6 VDC backup battery, that can be installed on the enclosure door. The battery kit includes a 6 VDC battery, a mounting bracket and hardware, a battery harness and a fuse. The processor includes an intelligent charging circuit, that when enabled, keeps the battery fully charged (see Using the optional local backup battery on page 196).

| | |
|---|---|
| **CAUTION** | Use ONLY the battery specified for Silver Network devices (GE0487). DO NOT substitute any other batteries. |

## Battery installation procedure

Check the battery fuse BEFORE replacing the battery.

1. Disconnect the power to the processor.
2. Fit the mounting bracket over the 4 studs on the enclosure door so that the open end of the bracket is oriented toward the door's locking brackets.
3. Use 3 sets of the supplied hardware to attach the mounting bracket to 3 of the 4 studs (2 outside ends and the stud on the processor side of the door).
4. Lift the hinged lid and install the battery in the compartment.
5. Close the hinged lid and install the 4th set of mounting hardware.
6. Connect the battery leads to T4 on the processor.
7. Connect the battery leads to the battery terminals (observe polarity).
8. Use 3 cable ties to secure the battery harness to the bracket.
9. Reapply power to the processor.

CAUTION If you are replacing a battery, refer to the local hazardous waste regulations for information about battery disposal.

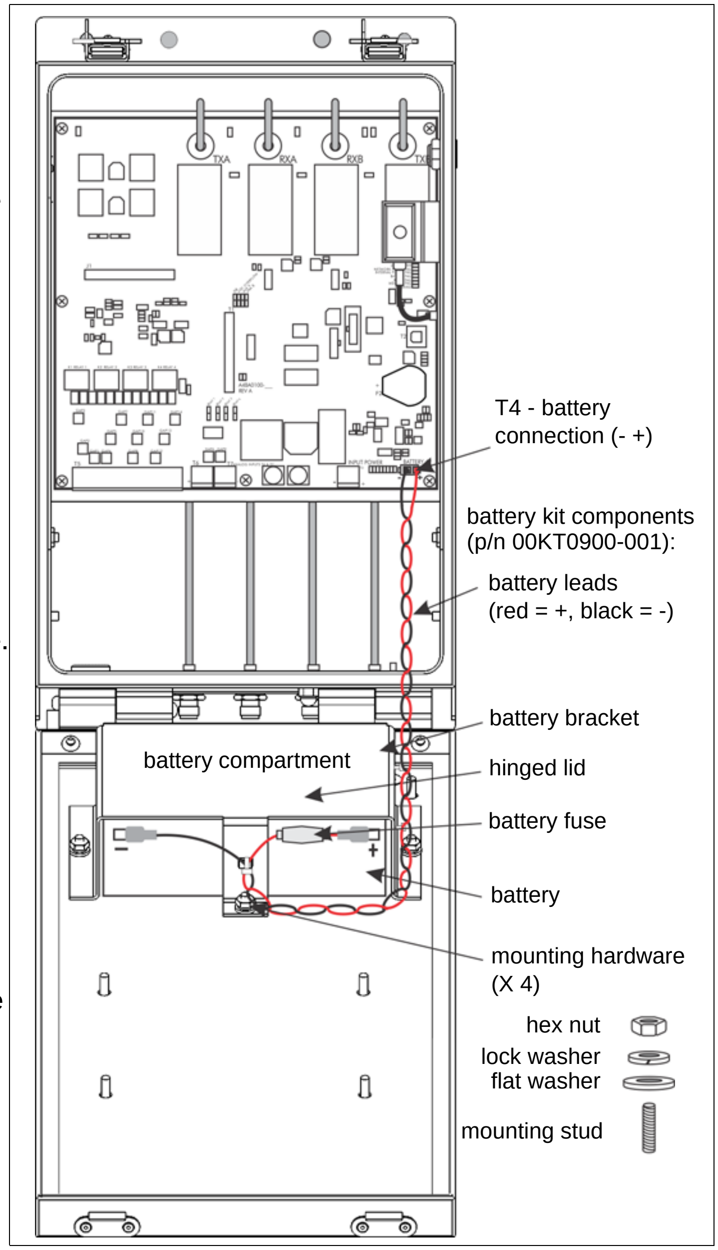



Figure 147: Battery replacement

# Telecom enclosure wiring

If you are using a telecom style enclosure, pull enough wiring and lead-in cable into the enclosure to form a 2 m service loop. Form the loop by wrapping the cables one full turn around the inside of the telecom enclosure (see Figure 148: and Figure 149:).

1. Label the lead-in cables and I/O wiring.
2. Pull the lead-in cables and I/O wiring into the telecom enclosure.
3. Create a service loop by running the lead-in cables and I/O wiring one full turn around the inside of the telecom enclosure.
4. Remove the cable glands and route the I/O wiring through the appropriate cable gland, into the OmniTrax enclosure (Figure 152:).
5. Fit the 4 protective grommets onto the 4 sensor cable holes in the mounting bracket.

| | |
|---|---|
| **Note** | For SC1 sensor cable, you must strip at least 61 cm (24 in.) of the outer gray jacket and separate the two internal coaxial cables.<br>Tape the semi-conductive inner black jackets with electrical tape anywhere that they can make contact with metal surfaces. |

| | |
|---|---|
| **Note** | Route the cable to the appropriate connector on the enclosure, trim the cable if necessary, then install a TNC connector on each cable. |

6. Connect the lead-in cables to the bulkhead connectors on the bottom of the enclosure (left to right TXA, RXA, RXB, TXB).
7. Secure the cables to one of the holes on each side of the mounting bracket.

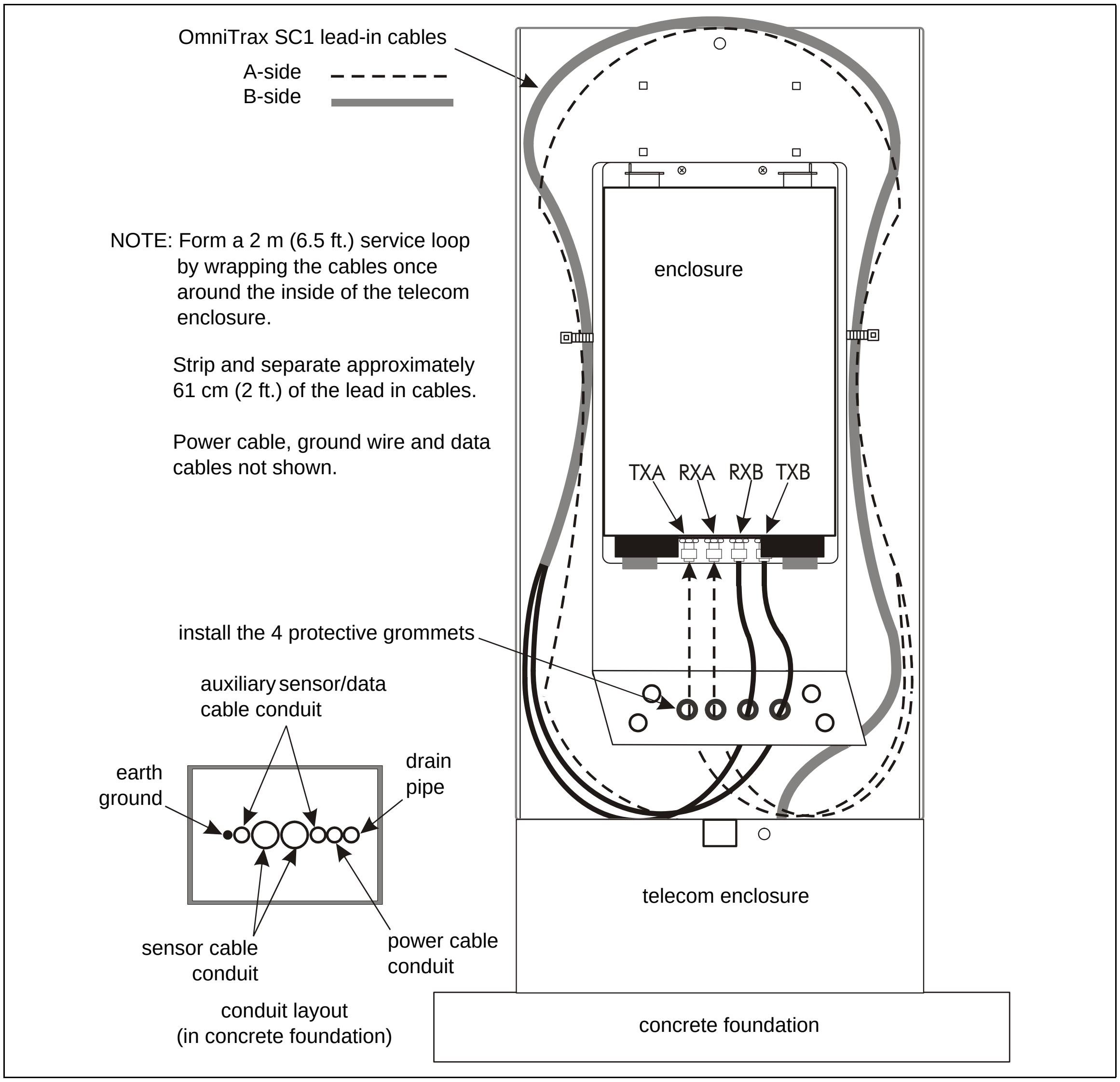



Figure 148: Routing SC1 sensor cables into the telecom enclosure

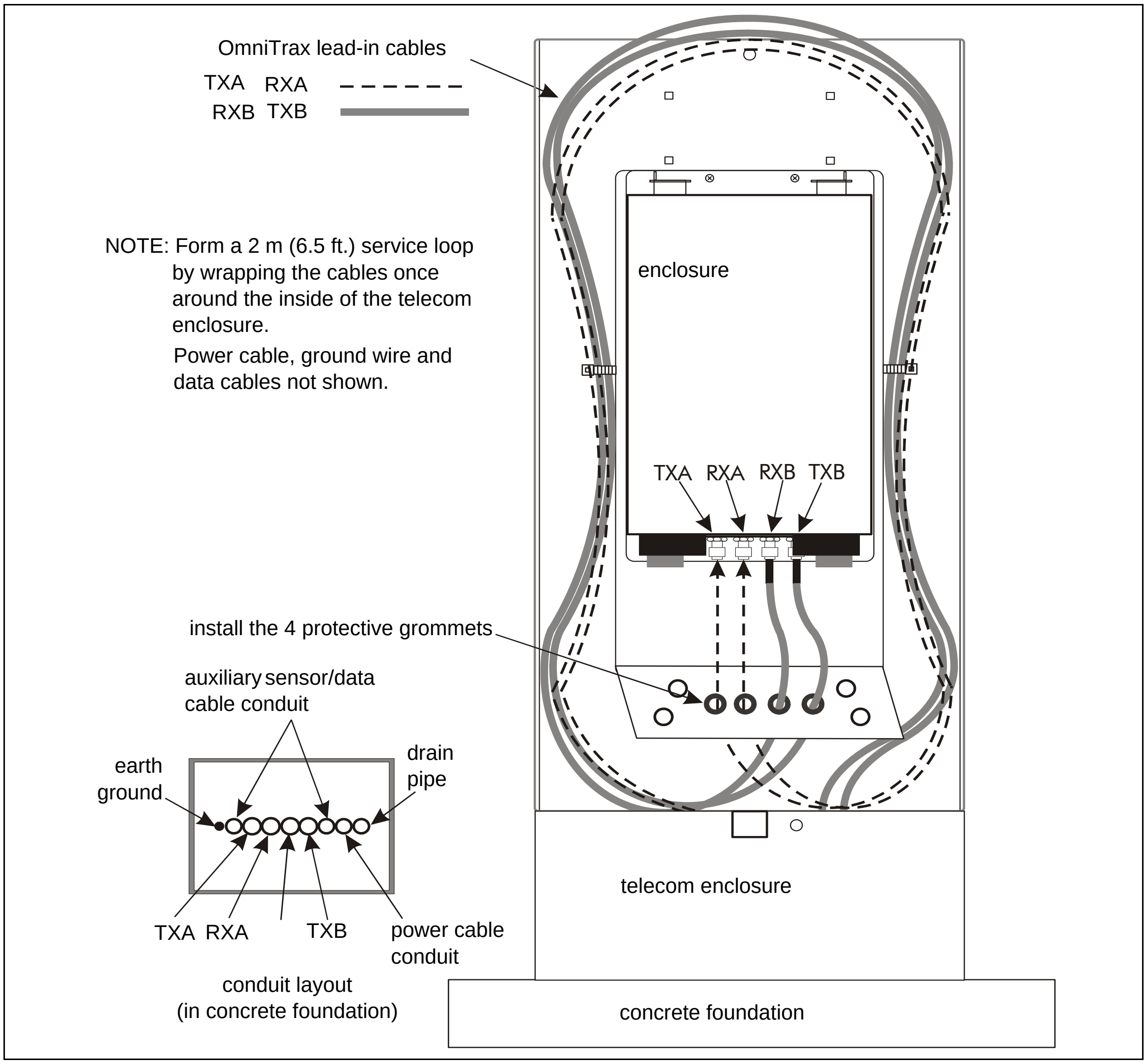



Figure 149: Routing OC2/SC2 sensor cables into the telecom enclosure

## Connecting the telecom enclosure tamper switch

The telecom style enclosure includes a tamper switch and a wiring harness to connect the switch to the OmniTrax processor. The wiring harness enables a series connection so that the OmniTrax weatherproof enclosure’s tamper switch also remains connected.

1. Open the OmniTrax enclosure and disconnect the tamper switch from T8 on the processor circuit card.
2. Plug the OmniTrax enclosure’s tamper switch connector into the two pin locking header on the supplied wiring harness.
3. Plug the other connector on the supplied wiring harness into T8, the two pin locking header, on the processor.
4. Run the two leads on the wiring harness out of the OmniTrax enclosure through the right side data cable port.
5. Press fit the tamper switch bracket onto the front edge of the telecom enclosure near the bottom.
6. Splice the two wires from the telecom enclosure tamper switch to the two wires on the wiring harness (polarity does not matter).

# Processor features

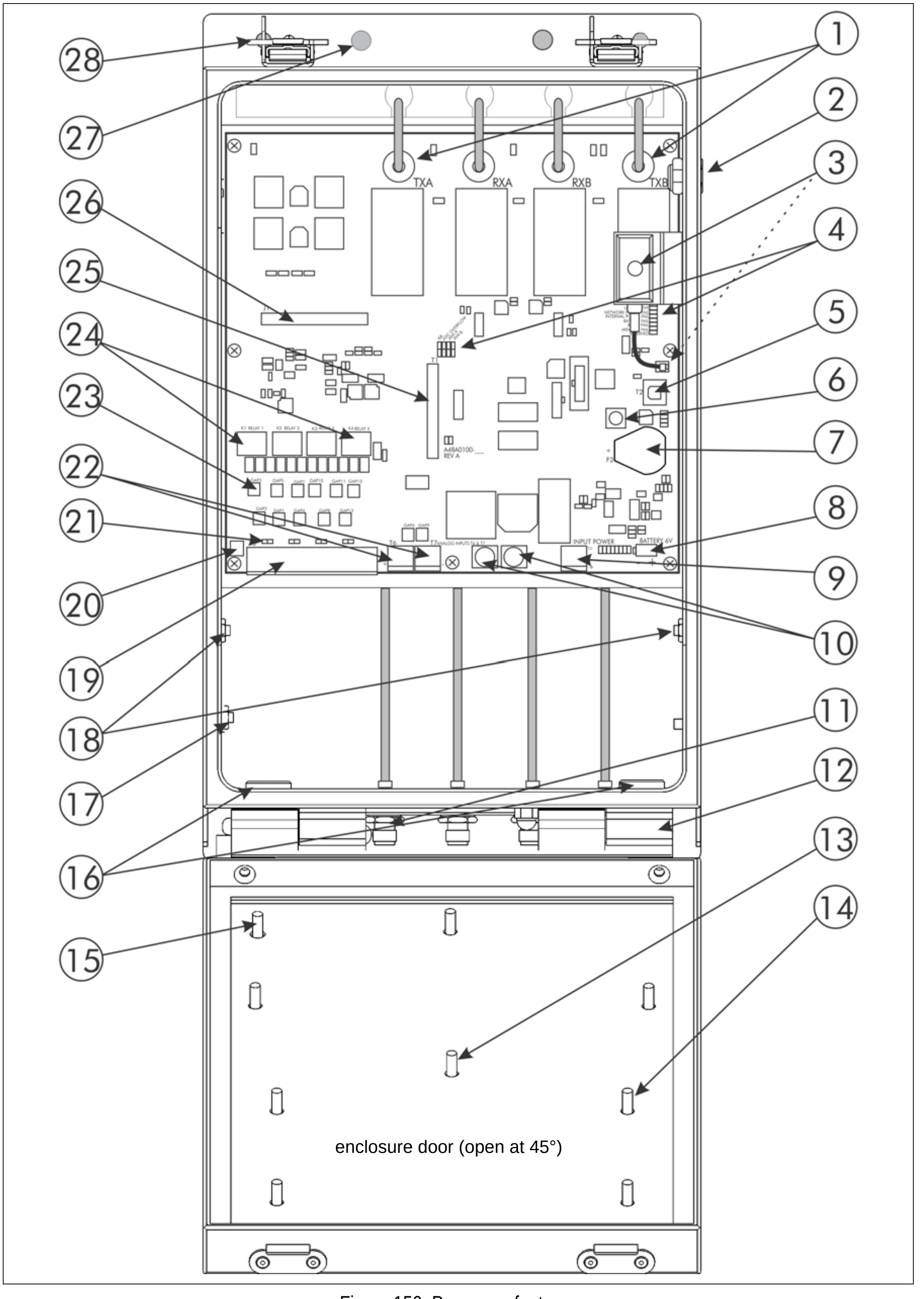



Figure 150: Processor features

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Processor on-board internal coaxial cable connectors: (TNC-F) TXA, RXA, RXB, TXB | 2 | enclosure vent |
| | | 3 | enclosure tamper switch (connects to T8) |
| 4 | diagnostic LEDs: D6 door open (enclosure door open), D42 UCM active (UCM connected to processor), D43 network power fail (no input voltage at T4), D44 internal power fail (internal power supply out of spec.), D48 battery fail (no battery power available), D47 boot fail (problem encountered on startup routine), D46 memory fail (flash checksum failure on boot), D45 (reserved for future use), D4 ISR (flashes at polling rate), D3 plot, D2 CF, D1 JAM | | |
| 5 | T2 - USB port (for connecting UCM)<br>USB com LEDs: D53 RX, D52 TX | 6 | reset switch (reboot processor) |
| 7 | clock battery | 8 | T4 - back-up battery connector |
| 9 | T3 - power input connector (12 to 48 VDC) (optional output power to auxiliary power module for processors powered over sensor cables) | 10 | sensor cable power fuses<br>(1.25 A, 250 V, fast blow) |
| 11 | enclosure bulkhead connectors, lead-in cable connections (TNC-F - TXA, RXA, RXB, TXB) | 12 | enclosure door hinges (X 2) |
| 13 | mounting studs for optional 6 VDC local battery kit (00KT0900-001) | 14 | auxiliary power supply module mounting studs (X 4) |
| 15 | enclosure door ground connection<br>(optional auxiliary power supply module ground connection) | 16 | cable gland (X 4) cable entry ports for power cables, earth ground wire, alarm data cables, self-test/auxiliary device input wiring |
| 17 | enclosure ground stud: earth ground, enclosure door ground, PCB ground | 18 | mounting studs for processor mounting plate |
| 19 | T5 - relay output connector: left to right, fail, supervision, alarm B, alarm A<br>(3 pins per relay - NO, COM, NC) | 20 | PCB ground connection (soldered) |
| 21 | relay activity LEDs: D26 - K1, D29 - K2, D33 - K3, D37 - K4 | 22 | AUX1, AUX2 - auxiliary device/self-test input connectors |
| 23 | lightning protections devices | 24 | Form C output relays: K1 fail, K2 supervision, K3 B-side alarm, K4 A-side alarm |
| 25 | T1 - connector for removable flash memory card (factory use only) | 26 | J1 - expansion header for auxiliary cards (NIC, ROC, UIC) |
| 27 | enclosure mounting holes - 1 cm (3/8 in.) X 4 and 7 mm (1/4 in.) X 4 | 28 | lockable door latch (X 2) |

# Relay output alarm communication

Local control mode is the default setting for the OmniTrax processor. In local control mode the inputs and outputs are controlled by the processor. The two inputs are self-test inputs. The four relays report sensor alarms, supervision alarms and processor status. The inputs and outputs are configured via the UCM.

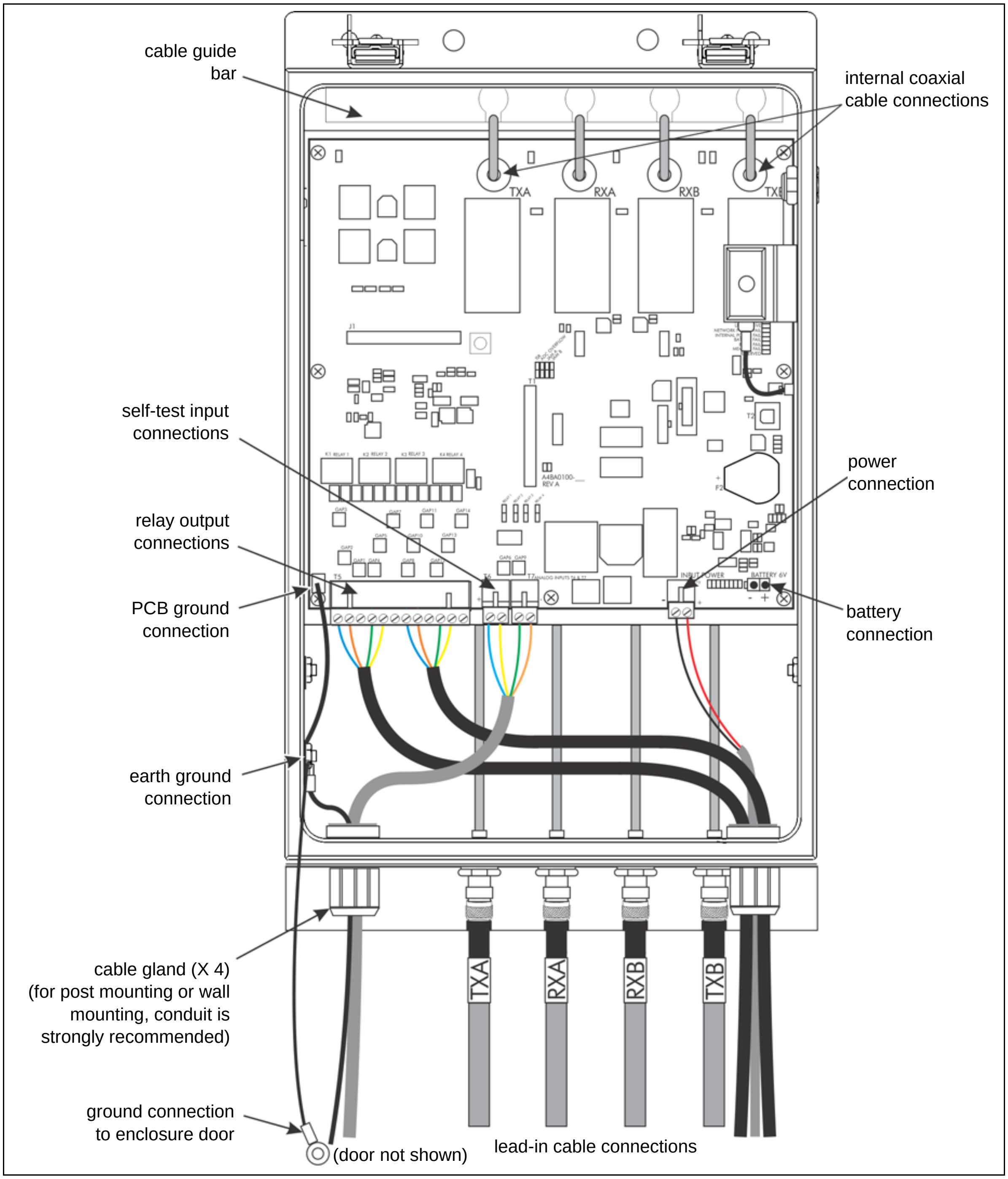



Figure 151: Local control mode wiring connections

| | |
|---|---|
| **Note** | The type and gauge of I/O wiring required depends on the length of the cable runs and the installation environment. |

| | |
|---|---|
| **CAUTION** | All I/O connections on the OmniTrax processor include lightning protection (additional protection is available, and recommended). You must provide lightning protection for the alarm annunciation equipment. |

| | |
|---|---|
| **Note** | It is possible to use relay output alarm communications and setup a Silver Network for maintenance purposes. This enables calibration, maintenance and diagnostic access to your OmniTrax processors from a central control facility. |

## Relay ratings and settings

The dry contact relays are form C and are rated for 30 V @ 1 A max. In local control mode, the relays remain active for an event's duration or for the user-selectable relay Active Time, whichever is longer.

The two coil mechanical latching relay operates like a two position toggle switch. Applying a pulse to the appropriate coil changes the position of the relay's actuator. Applying a pulse to the second coil returns the actuator to its original position. When a relay changes state, it remains in that state until a pulse on the second coil changes it back. Because the relay is latching, there is no energized state, which conserves power. The relay contacts are labelled according to the non-activated state. If you want a relay to open to signal an alarm condition, you connect to the normally closed contact. If you want a relay to close to signal an alarm condition, you connect to the normally open contact. Both relay contacts and the common are brought out to terminal block T5.

## AUX I/P (self-test) connections

AUX 1 and AUX 2 are voltage sensing inputs. The processor determines an input's status via an internal reference voltage. The contact closure inputs MUST be voltage-free. In local control mode, you connect normally open (NO) momentary switch inputs to the Aux inputs. Figure 153: illustrates the relay output configuration and the self-test input wiring for the OmniTrax processor in local control mode.

## Local control mode wiring connections

| | |
|---|---|
| **CAUTION** | Disconnect the power before making the wiring connections.<br>The OmniTrax processor includes static sensitive components.<br>Follow proper ESD procedures when working on the card.<br>Install OmniTrax wiring inside conduit for added security. |

You make the I/O wiring connections on removable terminal blocks. The terminals accept wire sizes from 12 to 24 AWG, with a 6 mm (¼ in.) strip length.

## Connection procedure

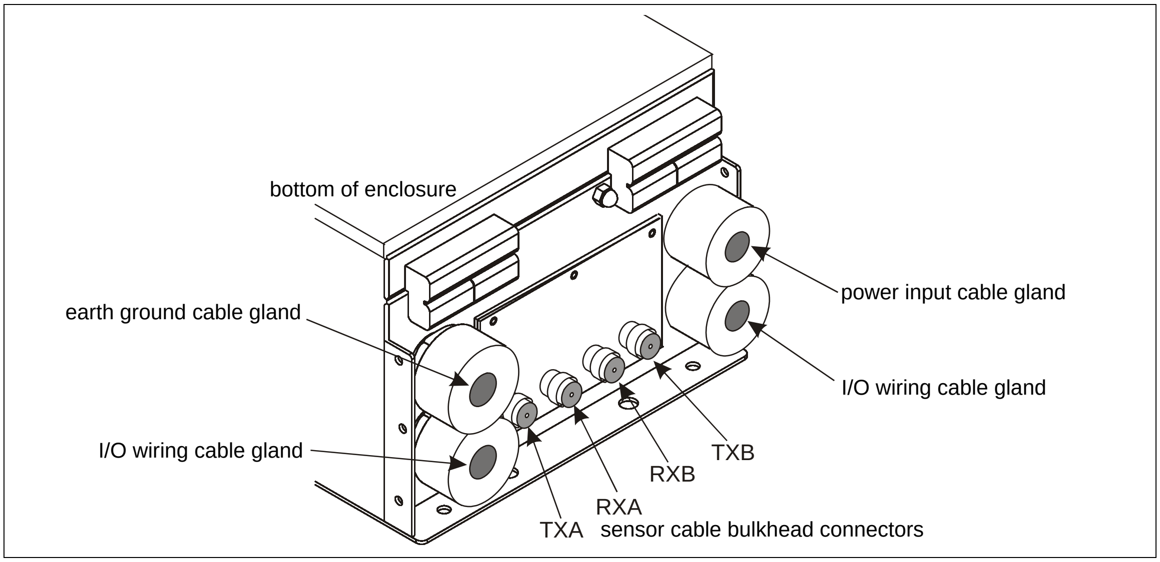



Figure 152: Sensor cable connections

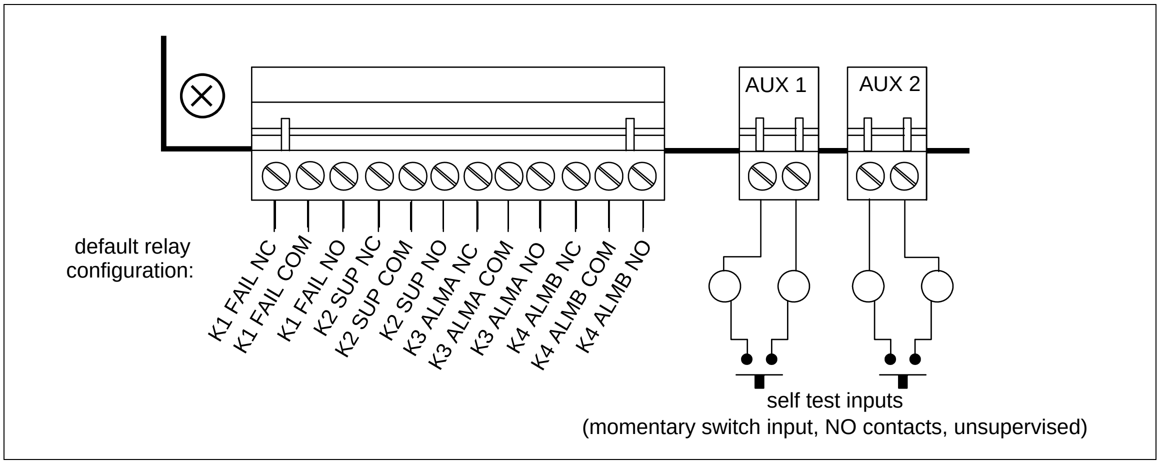



Figure 153: Local control mode input/output wiring

1. Connect the lead-in cables to the bulkhead TNC connectors in this order (from left to right) TXA, RXA, RXB, TXB.

| **Note** | Remove the cable glands to pull the I/O wiring into the enclosure. |
|---|---|

2. Pull the I/O wiring into the enclosure.
3. Pull the power cable (if required) and ground wire into the enclosure.
4. Refer to Figure 151: and Figure 153: to make the I/O wiring connections.

| **Note** | Senstar recommends the use of data link lightning arrestors at any point where copper wires enter or exit a building. |
|---|---|

# Network communication

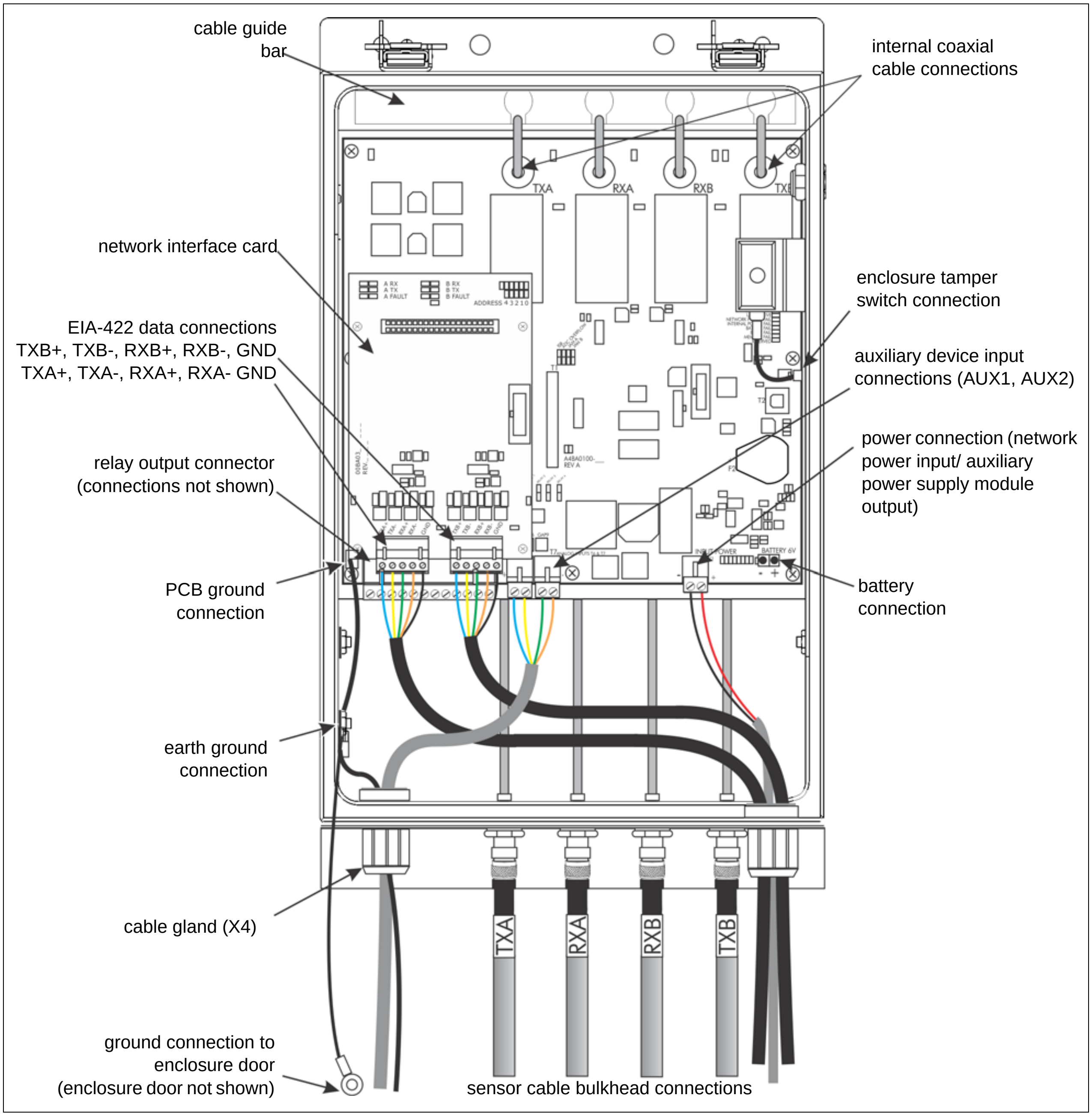



Figure 154: Network communication processor wiring

Transmission media/maximum separation distances between processors:

- Sensor cables - 800 m (2,625 ft.)
- EIA-422 copper wire - 1.2 km (0.75 mi.) - 2 pairs per Channel
- Multimode fiber optic cable (820 nm) - 2.2 km (1.4 mi.) - 2 fibers per Channel - optical power budget 8 dB
- Singlemode fiber optic cable (1310 nm) - 10 km (6.2 mi.) - 2 fibers per Channel - optical power budget 8 dB

| | |
|---|---|
| **Note** | Senstar strongly recommends the use of low capacitance shielded twisted pair data cable for EIA-422 (e.g., Belden 9729), 62.5/125 multimode fiber optic cable, and 9/125 singlemode fiber optic cable. The maximum separation distances require high quality transmission media and sound installation practices. |

| | |
|---|---|
| **Note** | To communicate over the Silver Network (and over the sensor cables) a network interface card (NIC) must be installed on the expansion header. |

## Relay ratings/settings

The dry contact relays are form C and are rated for 30 V @ 1 A max. In network control mode, you can configure the relays as latching (steady ON), in flash mode (ON-OFF-ON-OFF, etc.), or pulse mode (ON, then OFF). For flash and pulse modes, the Active/Inactive times are selectable.

## AUX I/P specifications

AUX 1 and AUX 2 are voltage sensing inputs (see Figure 155:). The processor determines an input's status via an internal reference voltage, and the configuration of the contact closures and supervision resistors. In remote control mode, the AUX inputs (and UIC inputs) serve as auxiliary device inputs to the host system. You define the inputs via the UCM, as NO or NC with single resistor supervision, dual resistor supervision, or unsupervised (see Input wiring configurations on page 212). The Filter Window parameter (via UCM) allows you to set the time period for which an input must be active, before an event is reported.

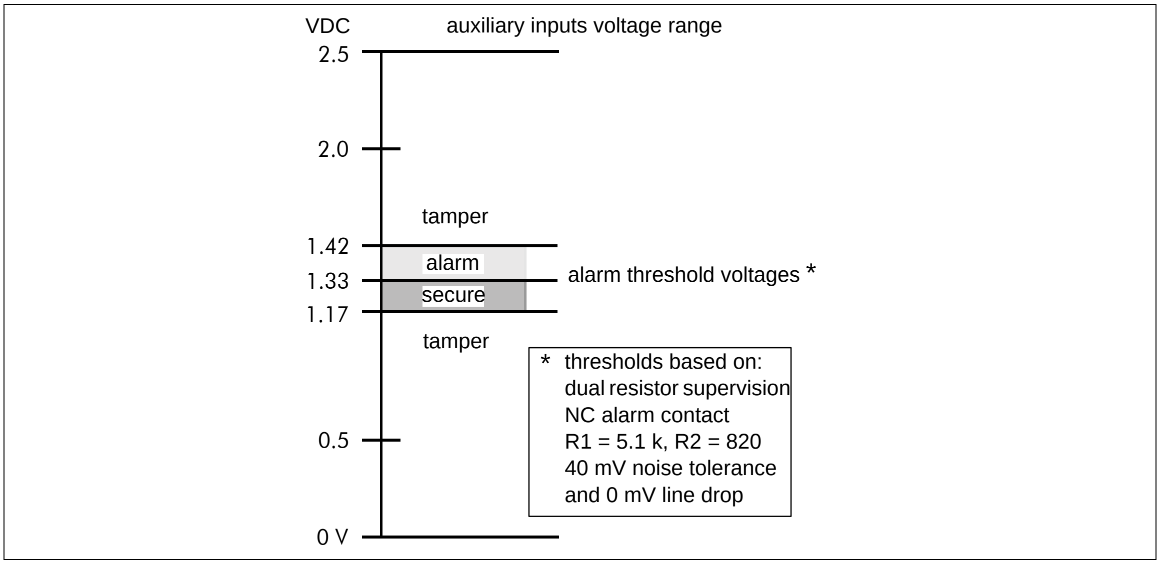



Figure 155: Voltage sensing inputs

| | |
|---|---|
| **CAUTION** | Use 1%, 1/4 W supervision resistors for OmniTrax inputs. Contact closure inputs MUST be voltage-free. |

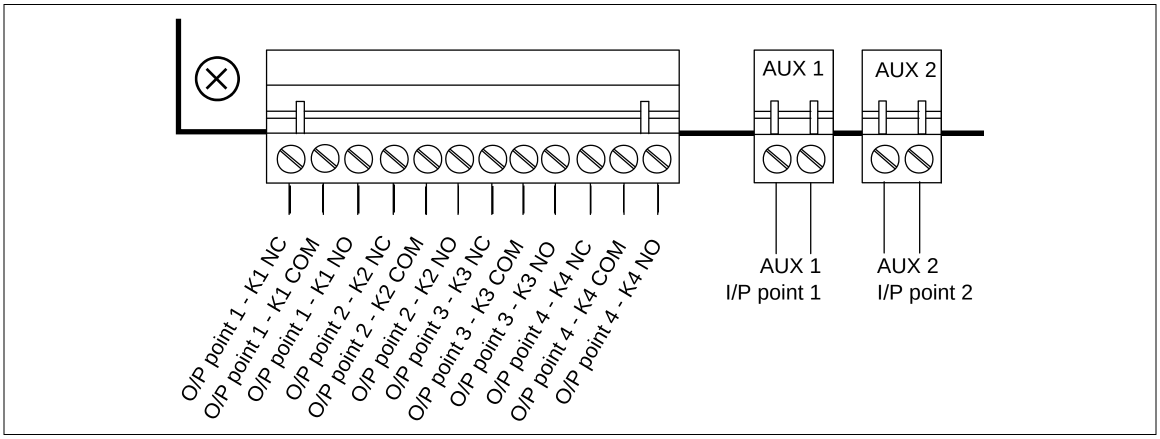



Figure 156: Remote control mode output relay and auxiliary input wiring

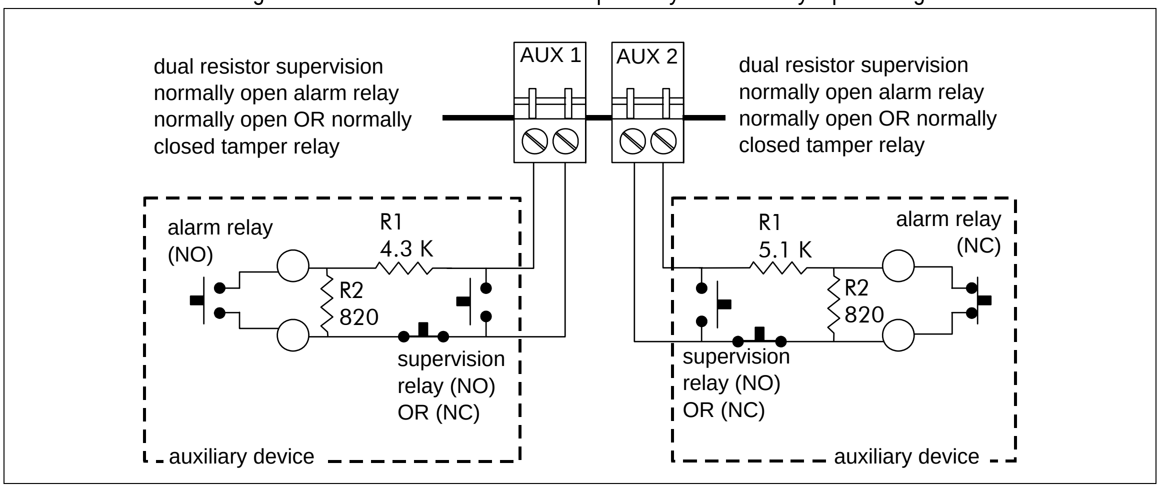



Figure 157: Auxiliary device inputs (dual resistor supervision)

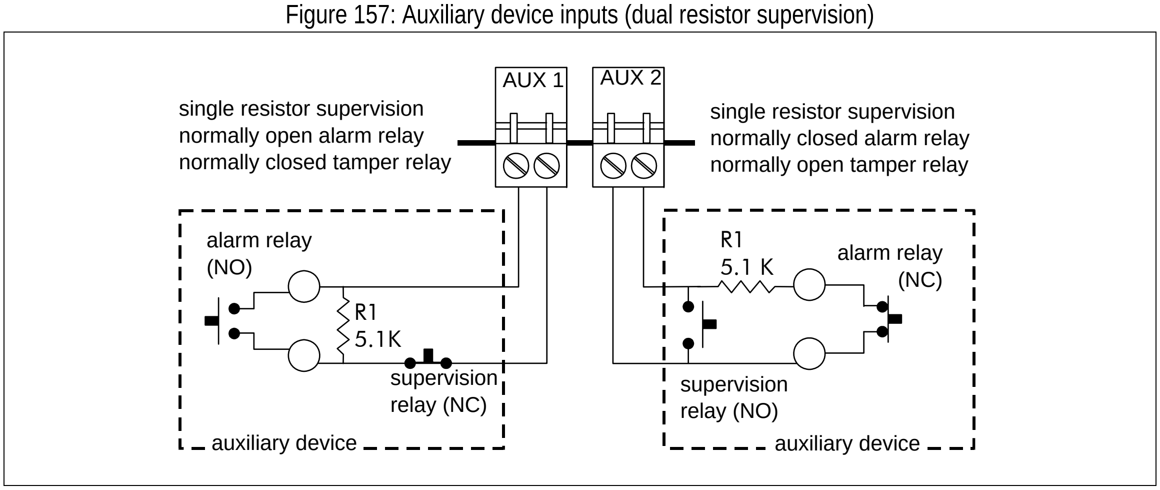



Figure 158: Auxiliary device inputs (single resistor supervision)

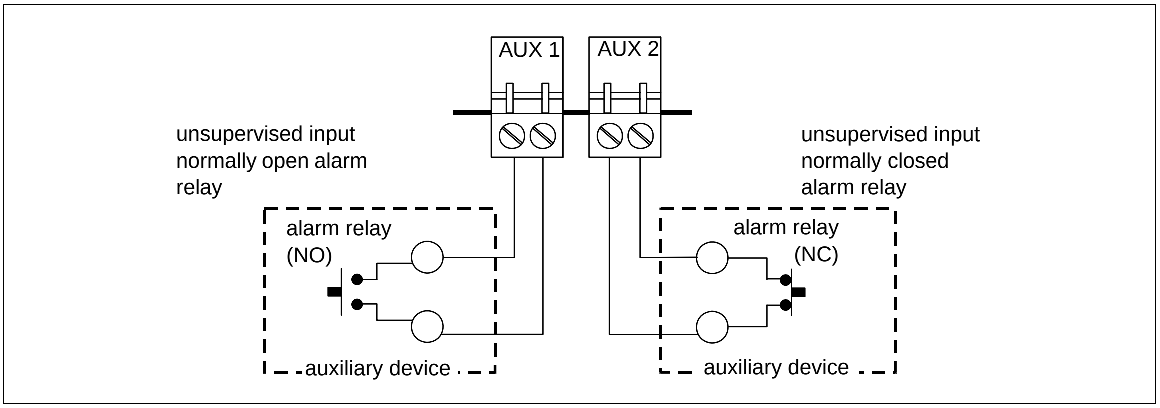



Figure 159: Auxiliary device inputs (unsupervised)

# Sensor cable lightning protection

For increased lightning protection, Senstar recommends the installation of sensor cable lightning arrestors (A4KT1000 - includes 4 arrestors, A4KT1001 - includes 2 arrestors) which connect to the bulkhead TNCs on the enclosure. The sensor cables are then connected to the lightning arrestors.

| | |
|---|---|
| **WARNING** | Do NOT perform maintenance on the processor or lightning arrestors during an electrical storm. |

## Installation procedure

1. Connect the ground lug to the lightning arrestor mounting bracket with the supplied bolt and lock washer (see Figure 160:).
2. Connect the ground strap to the ground lug.
3. Install the lightning arrestors in the lightning arrestor mounting bracket.

| | |
|---|---|
| **Note** | DO NOT tighten the lightning arrestor mounting hardware at this time. |

4. Connect the lightning arrestors to the processor (see Figure 161:).

| | |
|---|---|
| **Note** | Ensure that the seating planes remain level and straight throughout the tightening process. |

5. Connect the ground strap to a low resistance earth ground (5 Ω or less recommended).

| | |
|---|---|
| **Note** | If you are not using a telecom enclosure, the 1 m length of ground strap may be insufficient to make the connection. In this case, Senstar recommends using a minimum 6 AWG bare copper wire for making the ground connection. |

6. Connect the sensor cables to the lightning arrestors (finger tight).

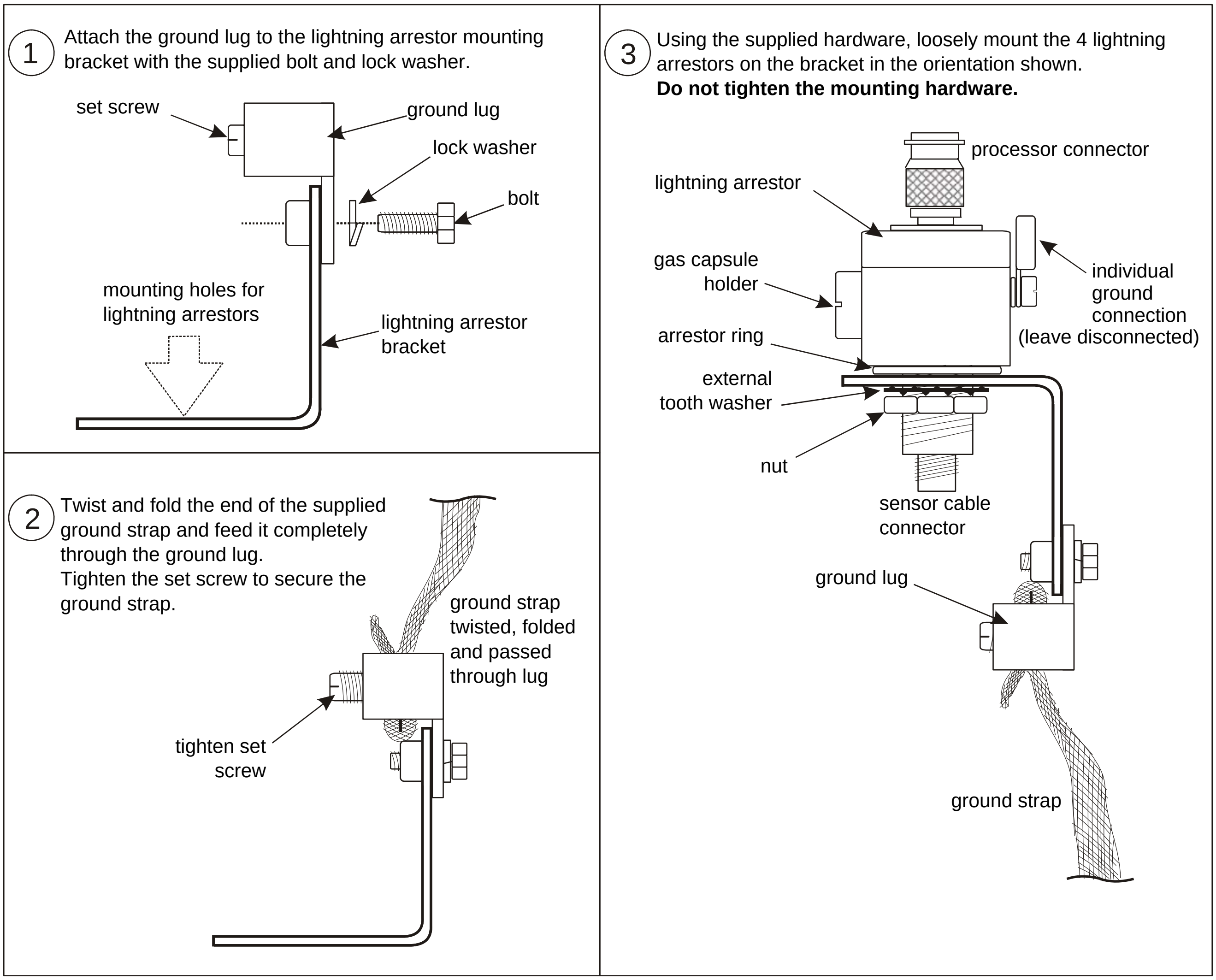



Figure 160: Preparing the lightning arrestors for installation

**CAUTION: The cable inputs on the bottom of the enclosure are pressure fitted. If you attempt to connect the lightning arrestors to the processor completely, one piece at a time, the cable inputs on the enclosure will likely be damaged.**

With the lightning arrestors installed loosely in the mounting bracket, connect the male TNCs on the cable inputs on the bottom of the enclosure as follows:

a) Begin with the two outside arrestors, tightening each only a few turns at a time until they are both loosely connected to the outside cable inputs.

b) Next, loosely connect the two inside arrestors, also tightening each only a few turns at a time.

c) When all four arrestors are loosely connected to the cable inputs, continue tightening each one sequentially, a few turns at a time, until all four are finger tight.

d) Finger tighten the hardware securing the lightning arrestors to the mounting bracket, a few turns at a time, in the same order as above outside, outside, inside, inside, outside, outside, etc.) until all four lightning arrestors are finger tight on the bracket. Use a 16 mm (5/8 in.) open-ended wrench, to fully tighten the mounting hardware in the same manner as indicated above (tighten each a few turns at a time). Tighten the mounting hardware securely.

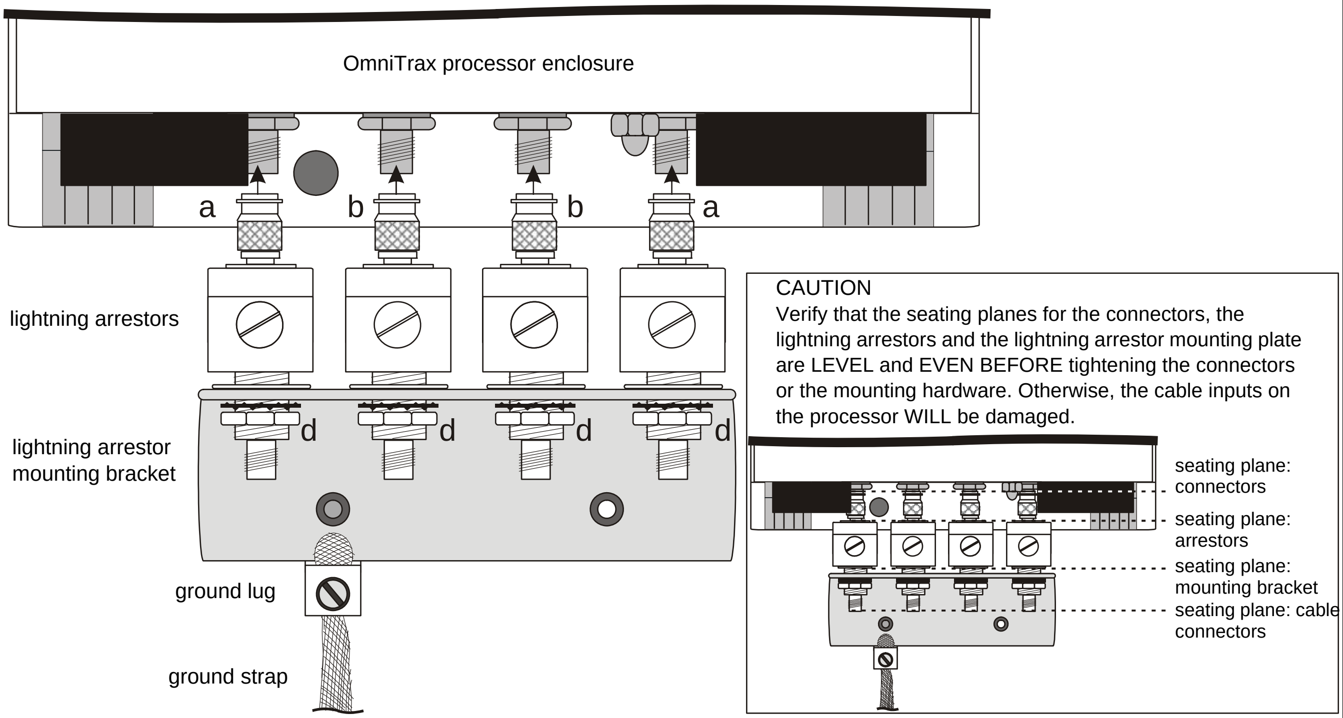



Figure 161: Connecting the lightning arrestors to the processor

## Replacing the gas capsule

Lightning strikes will break down and destroy the gas capsules over time. There is no general rule of thumb, or obvious way to determine if the gas capsules in your lightning arrestors need to be replaced. If your site frequently experiences active weather including electrical/thunder storms, you should replace the capsules on a regular basis. If your local climatic conditions rarely include electrical/thunder storms, you may never have to change the gas capsules. One factor to consider when setting up a gas capsule replacement schedule is the value of the protected equipment, as compared to the low cost of the gas capsules.

| | |
|---|---|
| **CAUTION** | Use only Senstar P/N GE0507 - GDT/90V replacement gas capsules and holders. |

1. Label and disconnect the sensor cables.
2. Refer to Figure 161: to disconnect the lightning arrestors from the processor (turn each lightning arrestor connector a few turns in sequence).

3. Hold the lightning arrestor assembly horizontally with the gas capsule holders facing upwards. Using a large bladed slot screwdriver, remove the gas capsule holder from the lightning arrestor (see Figure 160:).
4. Remove and retain the pressure ring. Remove and discard the used gas capsule.
5. Insert the replacement gas capsule into the lightning arrestor.
6. Carefully fit the pressure ring onto the capsule and tighten the gas capsule holder securely.
7. Repeat for each lightning arrestor.
8. Refer to Figure 161: to reconnect the lightning arrestors to the processor.
9. Reconnect the sensor cables to the lightning arrestors.

# Installing auxiliary cards

There are three auxiliary cards available for the OmniTrax system. The Network Interface card is required for all processors that communicate via the Silver Network. The Relay Output card (ROC) provides an additional 8 relay outputs to the processor. The Universal Input card (UIC) provides an additional 8 inputs to the processor. A processor can use two auxiliary cards, the NIC and either an ROC or a UIC. A processor cannot use an ROC and a UIC. The auxiliary cards piggyback onto J1, the 40 pin socket on the processor card.

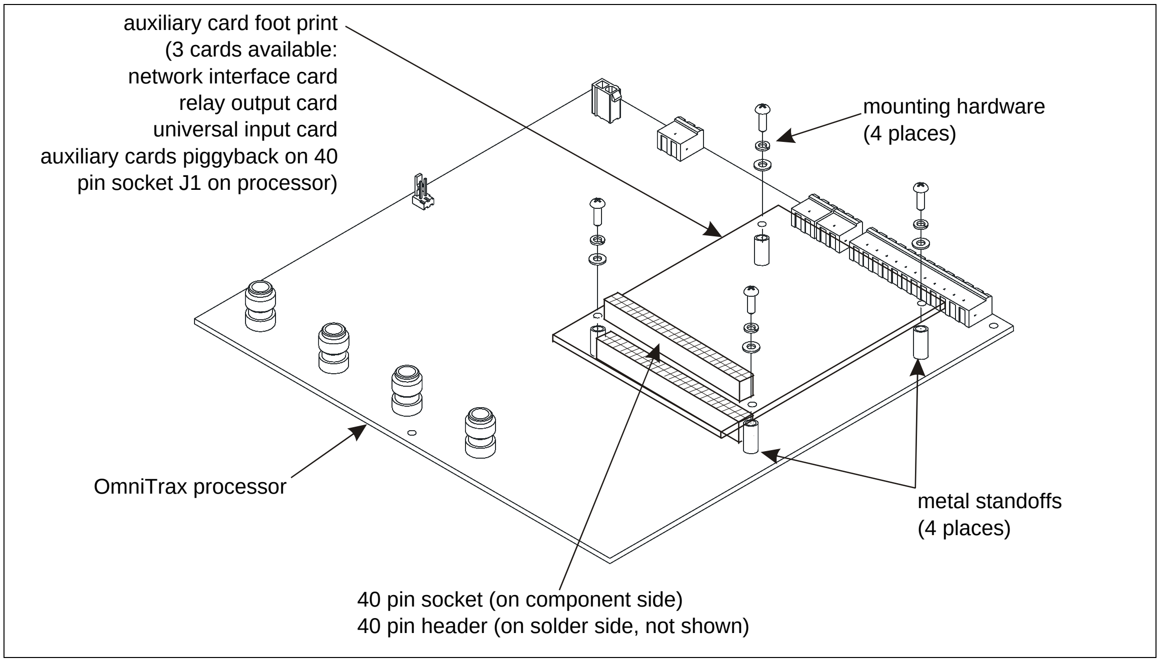



Figure 162: Auxiliary card installation

### Auxiliary card installation procedure

| | |
|---|---|
| **CAUTION** | Both the processor and auxiliary cards include static sensitive components. Follow proper ESD procedures when handling the cards. Disconnect all power sources before installing an auxiliary card. |

1. Insert the 40 pin header on the solder side of the expansion card into J1, the 40 pin socket, on the processor. Ensure that all pins are properly inserted and the four mounting holes on the auxiliary card align with the four standoffs on the processor.
2. Using the supplied hardware, secure the auxiliary card to the four standoffs.

| | |
|---|---|
| **Note** | If two auxiliary cards are being installed on this processor, install the NIC first, with the ROC or UIC piggybacked on top.<br>Use the supplied standoffs to secure the NIC, then use the standard mounting hardware to secure the second auxiliary card. |

3. Piggyback the second auxiliary card onto the first auxiliary card by inserting the 40 pin header on the solder side of the second card into the 40 pin socket on the first auxiliary card. Ensure that all pins are properly inserted and the four mounting holes on the upper auxiliary card align with the four standoffs on the lower auxiliary card.
4. Secure the upper auxiliary card with the supplied hardware.
5. Make the wiring connections as indicated in Figure 163: and Figure 164:.

## Network Interface card

You require a network interface card (NIC) if your OmniTrax processor will communicate on Senstar's Silver Network. There are five variants of the NIC, each specific to the network transmission media (P/N 00BA03xx):

- 00BA0301 multi-mode fiber optic cable
- 00BA0302 EIA-422 copper wire
- 00BA0303 single-mode fiber optic cable
- 00BA0304 combined EIA-422 copper wire and multi-mode fiber optic cable
- 00BA0305 combined EIA-422 copper wire and single-mode fiber optic cable

The -01, -02, and -03 variants are based on a single network transmission media. The -04 and -05 variants enable an EIA-422 copper wire/fiber optic cable mix (see Figure 163:). You make the EIA-422 wiring connections on removable terminal blocks. The screw terminals accept wire sizes from 12 to 24 AWG, with a 6 mm (1/4 in.) strip length. The fiber optic variants use ST connectors.

| | |
|---|---|
| **Note** | Do not use a mixed media NIC to connect a Network Interface Unit to an OmniTrax processor, which will communicate with the other processors over the sensor cables. |

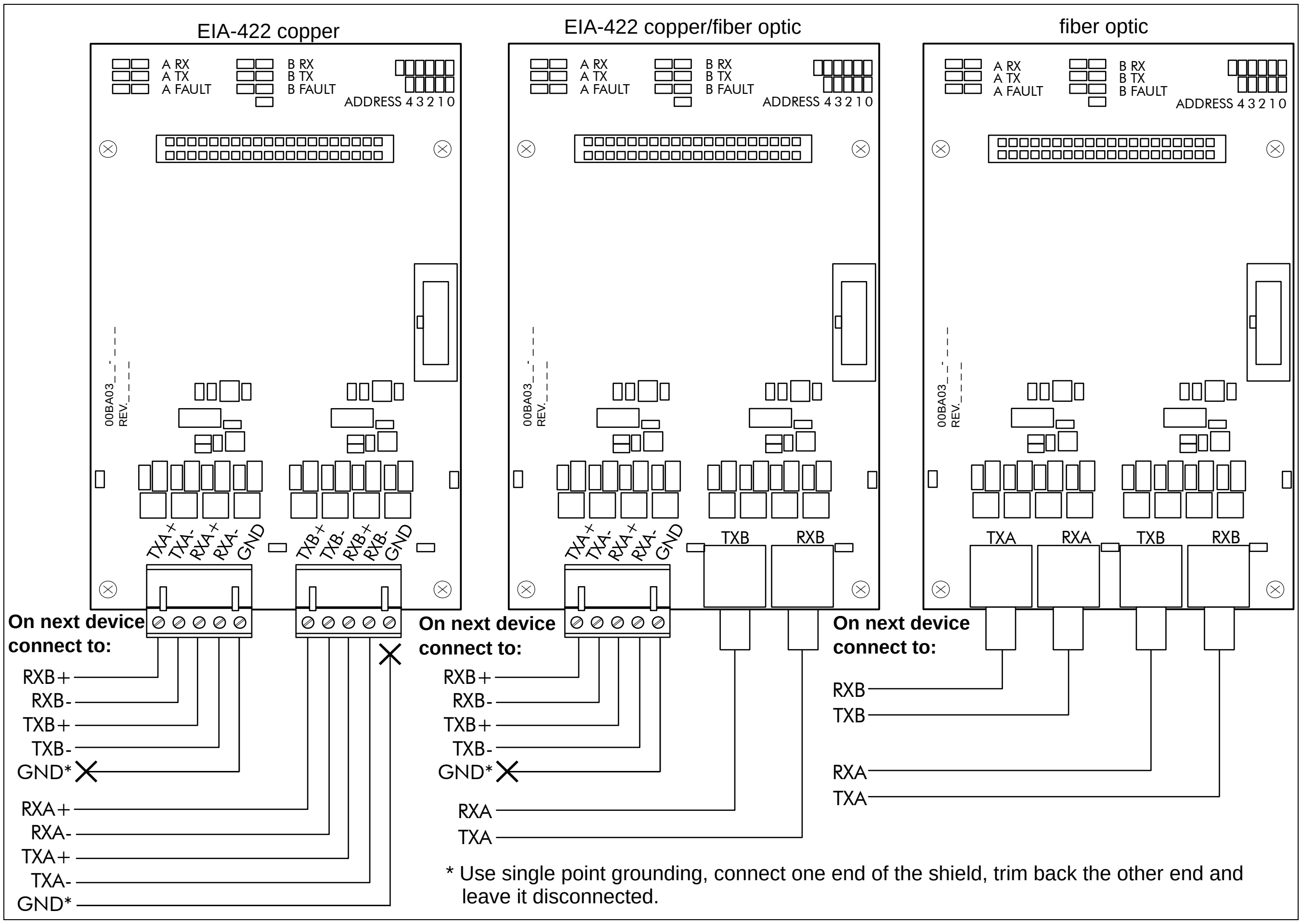



Figure 163: Network Interface card variants

# Relay output card

## Relay ratings/settings

The dry contact relays are form C and are rated for 30 V @ 1 A max.

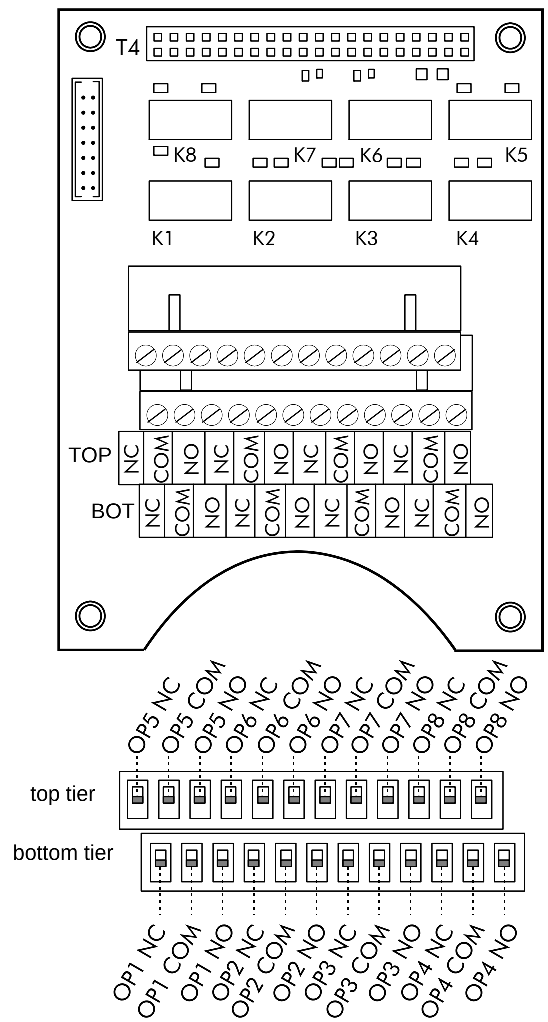



Figure 164: Relay output card connection details

| | |
|---|---|
| **Note** | You make OmniTrax I/O wiring connections on removable terminal blocks. The screw terminals accept wire sizes from 12 to 24 AWG, with a 6 mm (1/4 in.) strip length. Remove the terminal blocks from the auxiliary cards before connecting the wiring. |

# Universal Input card

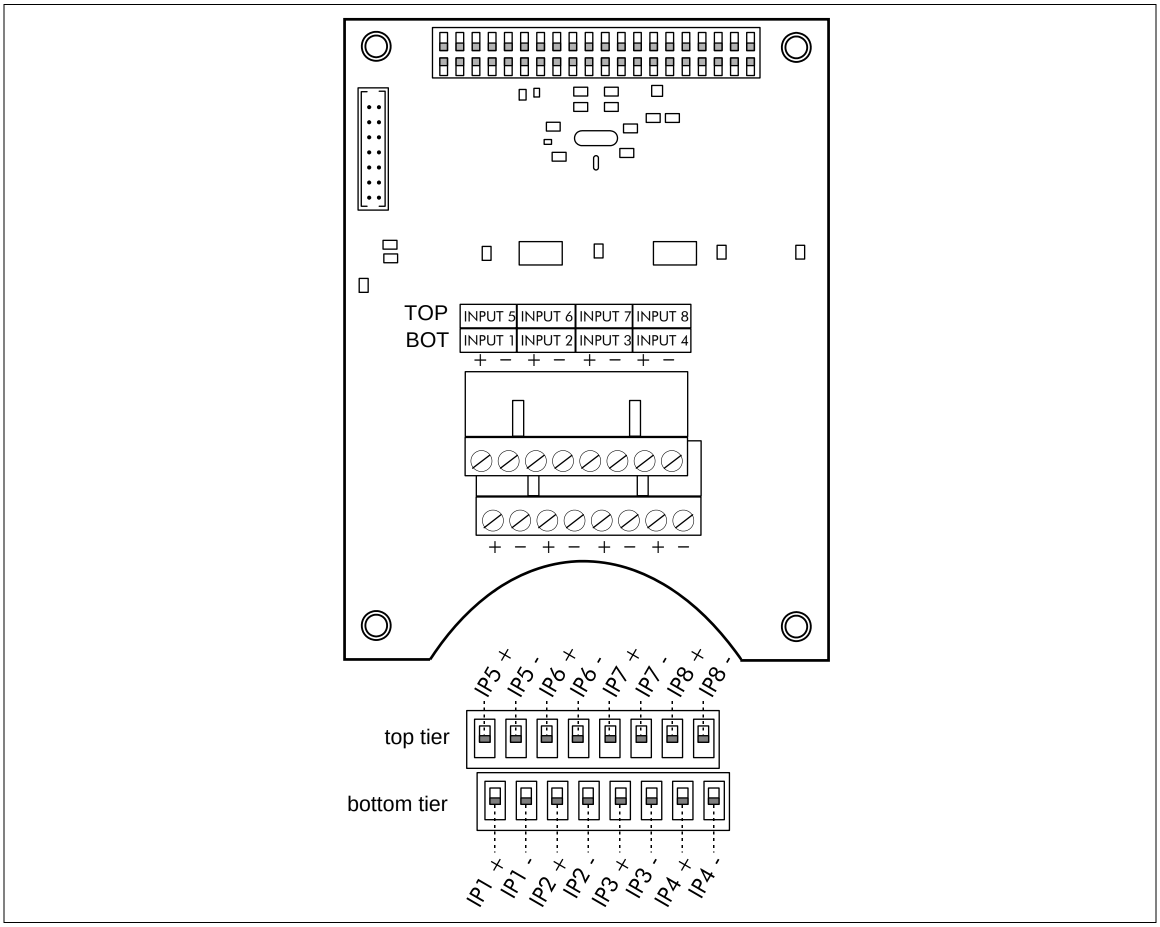



Figure 165: Universal input card connection details

# 6 Calibration & setup

# Calibration overview

To calibrate the OmniTrax sensor, setup the initial configuration parameters and then run a sensitivity profile. You can also fine tune the OmniTrax sensor for your site conditions by adjusting the processor's configuration parameters. The following table includes the OmniTrax configuration parameters along with a short description and page reference.

| **Configuration parameter** | **Descriptions** |
|---|---|
| Processor Address | Silver Network based processors require a unique network address (see Assigning the processor address (Silver Network processors) on page 192) |
| Cable Side Configuration | |
| Side A Cfig/Side B Cfig | Select the Side configuration tab to enable configuration changes to the selected cable side (A or B) |
| Enable | Select the check box to enable the RF transmitter for the selected cable side<br>Deselect the check box to disable the RF transmitter for the selected cable side (see Setting the initial configuration parameters on page 195) |
| Cable Type | Select the type of sensor cable used on the selected side (see Setting the initial configuration parameters on page 195) |
| Cable Supervision Mode | Select the sensor cable supervision method used on the selected cable side (see Setting the initial configuration parameters on page 195) |
| Margin | Set the cable margin for the full length of detecting cable on the selected side (see Setting the full-length cable margin on page 204) |
| Transmitter Duty Cycle | Set the duty cycle for the RF transmitter for the selected cable side (Do NOT adjust the Duty Cycle without direct engineering support from Senstar) see Transmitter Duty Cycle: on page 194 |
| Transmitter Power | Set the transmitter power level for the selected cable side (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197) |
| Calculate button | Select the Calculate button to determine the recommended transmitter power setting, based on the current profile and Duty Cycle |

| Configuration parameter | Descriptions |
|---|---|
| Transmitter Coding | Used in conjunction with the Duty Cycle to set the time slot in which the Transmitter for the selected cable side is ON (Do NOT adjust the Coding without direct engineering support from Senstar) see Transmitter Coding on page 194 |
| Target Speed Settings | Adjust the detection frequency filters to better detect fast and slow moving targets on the selected cable side (see Target speed settings on page 208) |
| STC Filter Enable | Select the check box to enable the switched time constant (STC) filter for the selected cable side (see STC filter settings on page 209) |
| STC LPF Enable | Select the STC LPF (low pass filter) check box to provide enhanced detection of targets moving erratically at very low speeds (default = ON) |
| STC Ratio (factory setting) | Sets the rate of change for the switched time constant (default = 8) (Do NOT adjust the STC Ratio without direct engineering support from Senstar) |
| Bounce Back Suppression (factory setting) | Reduces the potential incidence of "ghost alarms" caused by slowly resetting signal filters (Do NOT adjust the Bounce Back Suppression without direct engineering support from Senstar) |
| Segment Settings (see Defining the cable segments and alarm zones on page 205) | |
| Segment | Identifies which cable segment is currently selected, the segment number increments each time you select the Split button, the segment number decrements each time you select the Delete button |
| Range (m) | Set or display the start point in meters of the selected segment |
| Margin | Set the segment cable margin as a delta to the full length cable margin for the selected cable segment |
| Zone | Select the zone to which this cable segment is assigned |
| Relay (Local Control mode) | Select the Relay which will activate in response to an alarm condition in this cable segment |
| Split button | Select the Split button to divide the currently selected segment into two equal segments |
| Delete button | Select the Delete button to merge the currently selected segment with the preceding segment |
| Profile button | The OmniTrax Sensitivity Profile records the response magnitude for each meter of sensor cable based on a valid target moving lengthwise at the center of the detection field (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197), The Sensitivity Profile is used as a baseline for the cable margin settings |
| Common Configuration | |
| Accept Sync Signal | Select the Accept Sync Signal check box for processors, which are connected to other processors through decouplers (see Specifying the processor synchronization on page 193), deselect for the Sync master, deselect for processors which are not connected to other processors through decouplers |

| Configuration parameter | Descriptions |
|---|---|
| RXA <-> RXB | Software switching of the internal electronic connections for the RXA and RXB sensor cable connections<br>Requires a physical change of the external RXA and RXB sensor cable connections<br>For use only in installations which experience a high clutter signal originating at the processor location<br>(Do NOT adjust the RXA <-> RXB without direct engineering support from Senstar) |
| Minimum Threshold | Set the Minimum Threshold to prevent the cable margin from entering the noise floor<br>(Do NOT adjust the Minimum Threshold without direct engineering support from Senstar) |
| Est. Phase Multiplier | A variable that is applied to both cable sides to compensate for location accuracy errors resulting from environmental and processing effects<br>(Do NOT adjust the Estimated Phase Multiplier without direct engineering support from Senstar) |
| Historic variance | The historic variance parameter defines the change in the level of clutter (in dB) that will trigger a supervision alarm (see Historic clutter on page 217) |
| Interference Detection | When enabled, a signal, which causes an alarm in 20 range bins simultaneously will trigger an interference alarm |
| Peak Variance<br>(factory setting) | Define the maximum difference between local peaks in the specified number of range bins<br>The processor will declare an interference alarm if the difference between the local peaks is less than the Peak Variance parameter |
| Bins<br>(factory setting) | Specify the number of range bins that must be simultaneously in alarm for the processor to declare an interference alarm |
| Compact Flash | Reserved for Senstar Field Service Technicians |
| Auxiliary I/O configuration (see Auxiliary I/O configuration on page 209) | |
| Aux Control | Select Local to have the I/O controlled by the OmniTrax Processor; Select Remote to have the I/O controlled by the host security management system |
| Aux Option Card | Select Input if the processor includes an optional input card; Select Output if the processor includes an optional output card |
| Input Configuration | Setup the two Aux inputs and the optional input card's 8 inputs |
| Output Configuration | Setup the four relay outputs and the optional output card's 8 outputs |
| Network Configuration | Select the Silver Network and processor synchronization communication scheme for this processor (see Specify the network connection and synchronization scheme on page 215) |
| Remote Configuration | Use the Remote configuration parameters to specify UltraLink outputs that will activate in response to alarm and supervision conditions for processor that are operating in Network Manager mode. |

The following procedure is an overview of the OmniTrax calibration routine. Each step is covered in detail further in this chapter.

1. Connect a computer running the UCM to T2 on the processor.
2. Verify the processor's Serial Number, the Comm Status and review the Diagnostic Status LEDs.

3. Set the Address for the processor.
4. Set the initial configuration parameters.
5. Save the UCM file and download the configuration changes to the processor.
6. Record the sensitivity profile.
7. Set the transmitter power level.
8. Save the file and download the configuration changes to the processor.

# The Universal Configuration Module

| | |
|---|---|
| **Note** | Refer to the UCM online help for details on the operation of the UCM, and the calibration and setup of the OmniTrax processor. |

The Universal Configuration Module (UCM) is a Windows based software application, which serves as the calibration, setup and maintenance tool for the OmniTrax system. The UCM communicates with the OmniTrax processor directly through a local USB connection to T2 on the processor, or remotely via the Silver Network Manager. When you start the UCM, a window displays that enables you to specify the device to which you are connecting.

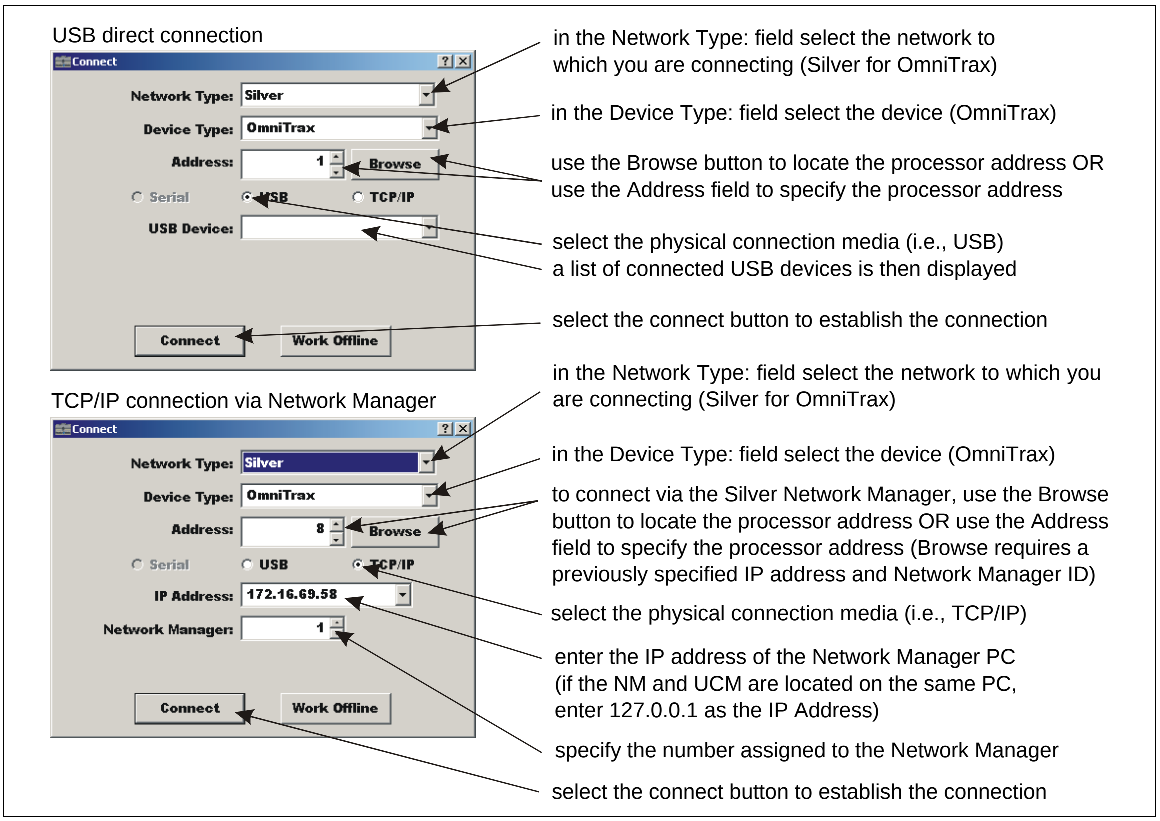



Figure 166: Connecting the UCM

| | |
|---|---|
| **Tip** | Save UCM files with a meaningful name, which includes the time and date. The files can then be reopened at a later time (Work Offline). |

When you select the Connect button, the main UCM screen for the OmniTrax processor displays.

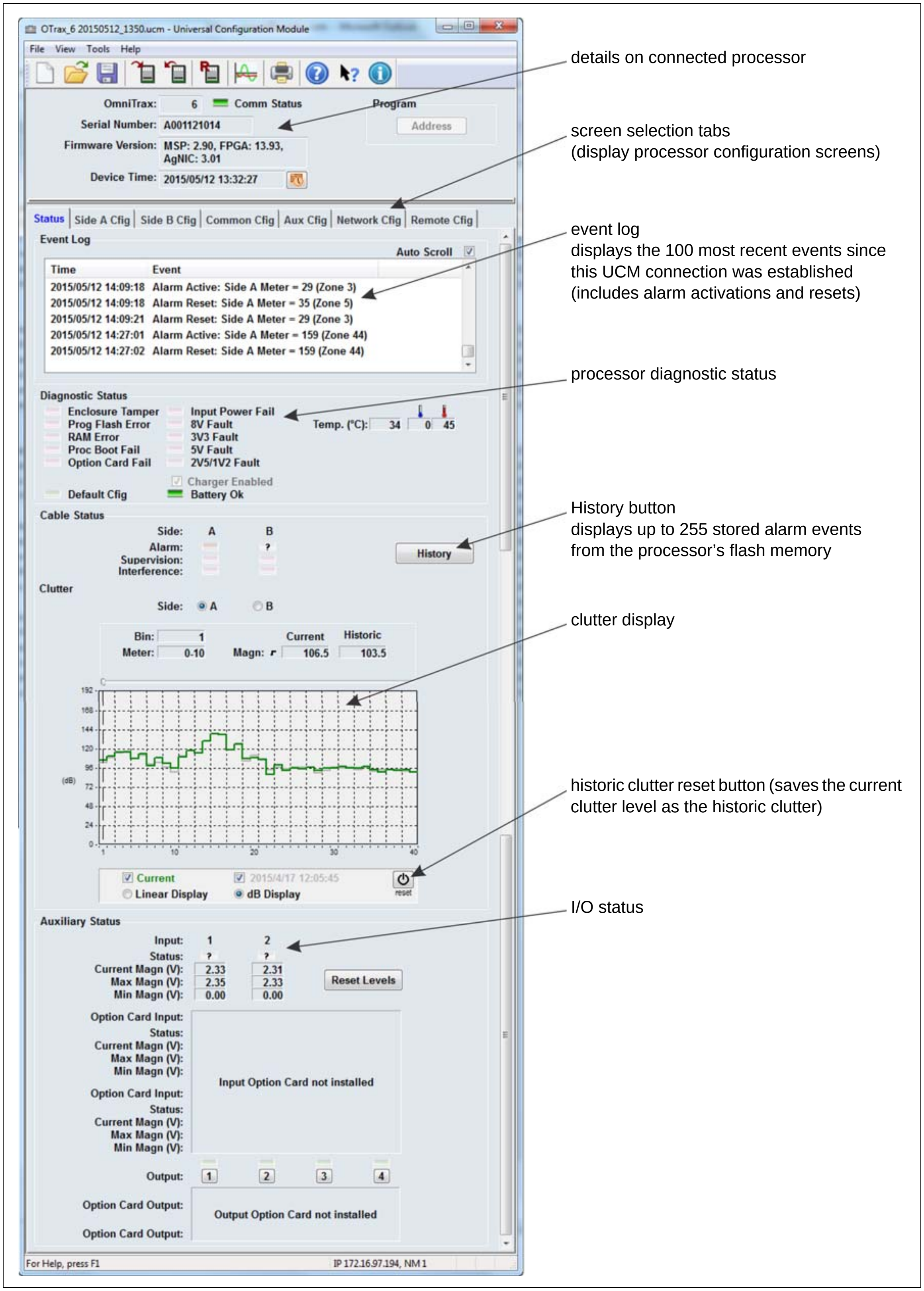



Figure 167: UCM Status screen

# Calibration

Calibrate the OmniTrax sensor to meet the site-specific detection requirements.

| | |
|---|---|
| **Note** | Senstar recommends that the initial calibration of the OmniTrax processor be performed using a direct USB connection between the processor and the UCM computer.<br>An enclosure tamper condition must be active to establish a direct USB connection to the OmniTrax processor (i.e., enclosure door opened). |

| | |
|---|---|
| **Note** | You can setup passwords to enable changing the advanced parameter settings as well as to enable the ability to download configuration changes to the processor (Tools > Password Maintenance). |

| | |
|---|---|
| **CAUTION** | Always test your OmniTrax detection system after calibration and setup, and any time detection parameters are adjusted. |

## Assigning the processor address (Silver Network processors)

| | |
|---|---|
| **Note** | Silver Network based OmniTrax processors require a unique address for network communications. The valid address range is from 1 to 60. Standalone processors can use the default address of 1. You must have a direct USB connection to the processor to set the address. |

1. On the main UCM screen, select the **Address** button in the **Program** field.
   A popup displays, which lists the processor's serial number and address.
2. In the **New Address** field, assign the processor address, according to the site plan.
3. Select the **Program** button to save the assigned address.
4. Select the **Download** button to change the processor address.

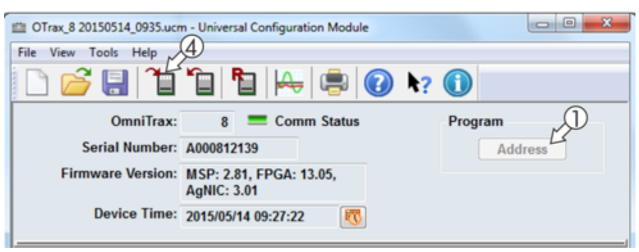



Figure 168: Assigning the processor address

# Specifying the processor synchronization

Processor synchronization prevents mutual interference between processors that are connected through decouplers. All OmniTrax processors generate a sync message. However, when multiple processors are connected through decouplers, only one of the processors may initiate the synchronization cycle. This processor is referred to as the sync master. The other processors receive the sync message, re-sync accordingly, and then send their sync message on to the next processor. This process continues until the sync message reaches the last processor. The sync master will not accept the sync message from another processor, and continues to initiate the sync cycle. This synchronization pattern applies to both open and closed OmniTrax perimeters.

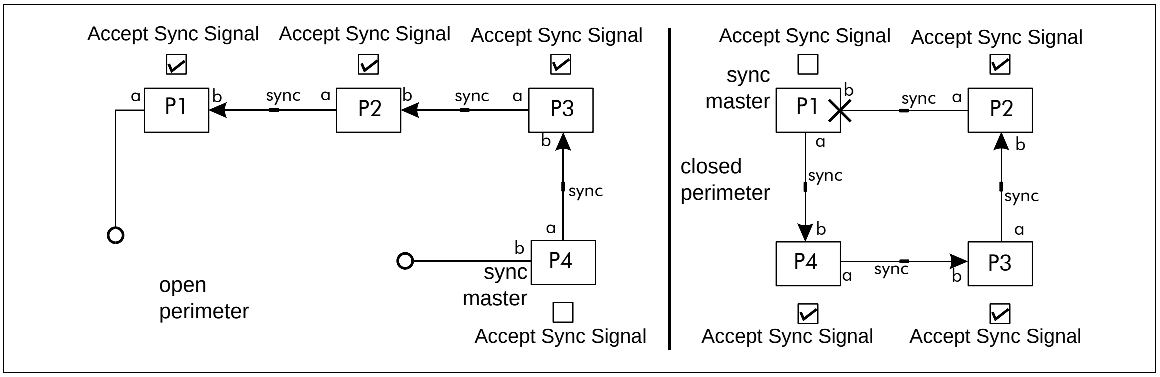



Figure 169: Processor synchronization

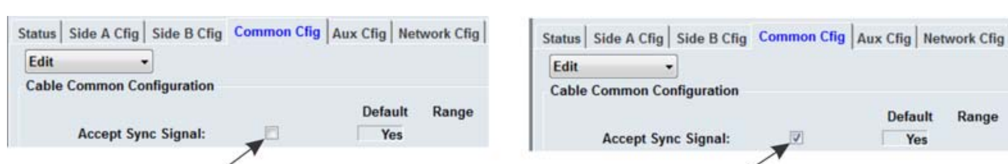
## Synchronization setup

| | |
|---|---|
| **CAUTION** | If more than one processor in a decoupler connected OmniTrax system is selected as the sync master, oscillation will occur and the system can lock up. |

| | |
|---|---|
| **Note** | If one processor in a synchronized OmniTrax system fails or goes off-line, interference may occur further down the line. |

To setup processor synchronization, you must determine which processor will be the sync master for the system. For an open perimeter the sync master must be on the end of the perimeter, and must be connected to the other processors through its A-side sensor cable. For a fully closed and connected perimeter, any processor can be selected as the sync master (see Figure 169:).

1. Uncheck the Accept Sync Signal check box (leave it blank) to select the processor that will serve as the sync. master (see Figure 170:).
   (Default setting = Accept Sync Signal check box checked)
2. Select the Accept Sync Signal check box (leave it checked) for each other processor that is connected through decouplers.




Uncheck the **Accept Sync Signal:** check box to select this processor as the sync. master. Only **ONE** processor can operate as the sync master.

Check the **Accept Sync Signal:** check box for all other processors that are connected through decouplers. (default setting = unchecked)

Figure 170: Defining the Sync Master

## Mutual interference

Mutual interference is the term used to describe the RF interference that is inherent when two transmitter receiver pairs operate in close proximity at the same time and frequency. In most cases, mutual interference is not a problem for the OmniTrax system. Following the recommended installation procedures and setting up the processor synchronization prevents mutual interference from disrupting operation. However, there are a number of environmental factors including the installation medium (e.g., light sandy soil types, concrete and asphalt) as well as variances in cable depth and spacing, that can lead to an increased effect from mutual interference. In a worst case scenario, mutual interference can cause false alarms, thereby affecting the overall confidence in the system.

To prevent mutual interference from affecting operation, there are two UCM settings for the RF transmitter on each cable side (A-side and B-side) - Duty Cycle and Coding.

### Transmitter Duty Cycle:

Duty Cycle refers to the time period that the OmniTrax RF transmitter is ON and OFF. There are two Duty Cycle settings, 100% in which the transmitter is always ON, and 50% in which the transmitter is ON for 25 ms then OFF for 25 ms in a repeating pattern. All single processor systems should use the 100% Duty Cycle setting. Network systems should use the 50% Duty Cycle setting.

Mutual interference can be recognized on a UCM plot as noise spikes moving along the range axis. If the amplitude of the noise spikes exceeds the cable margin, false alarms will occur. To prevent mutual interference between OmniTrax processors set the Duty Cycle for the affected processors to 50%. The Duty Cycle must be set independently for each cable side (A-side and B-side). In addition, specify the Coding as outlined in the following section.

The Duty Cycle can also be used to determine if there is an outside source of RF interference that is affecting system operation. If a site is experiencing false alarms that appear to result from RF interference, and changing the Duty Cycle and Coding settings do not correct the problem, then there is most likely an outside source of RF interference. In this case you must locate and correct the source of the interference.

### Transmitter Coding

Coding is used with the Duty Cycle setting to prevent mutual interference between OmniTrax processors. Coding sets the time slot for the 50% Duty Cycle transmission. For the A-side $\alpha 1$ is the first transmission time slot and $\alpha 2$ is the second. For the B-side $\beta 1$ is the first transmission time slot and $\beta 2$ is the second. At 100% Duty Cycle, Coding defaults to $\alpha 1 + \alpha 2$ for the A-side and $\beta 1 + \beta 2$ for the B-side (transmitter is always ON).

When selecting a 50% Duty Cycle you use the Coding to set the time slots for the connected cable sets so that the two transmitters are not ON at the same time. For example, the A-side cable for processor 1 is set to $\alpha 1$. The B-side cable from processor 2, which is connected to the A-side cable from processor 1, is set to $\beta 2$. Therefore, when the A-side transmitter for processor 1 is ON, the B-side transmitter for processor 2 is OFF, and vice-versa.

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|---|---|
| **Note** | Sensor cable sets that have less than 30 m (98 ft.) of parallel separation or 45 m (148 ft.) of perpendicular separation (end to end) must use a 50% duty cycle and alternate coding (e.g., $\alpha 1$ and $\beta 2$). |

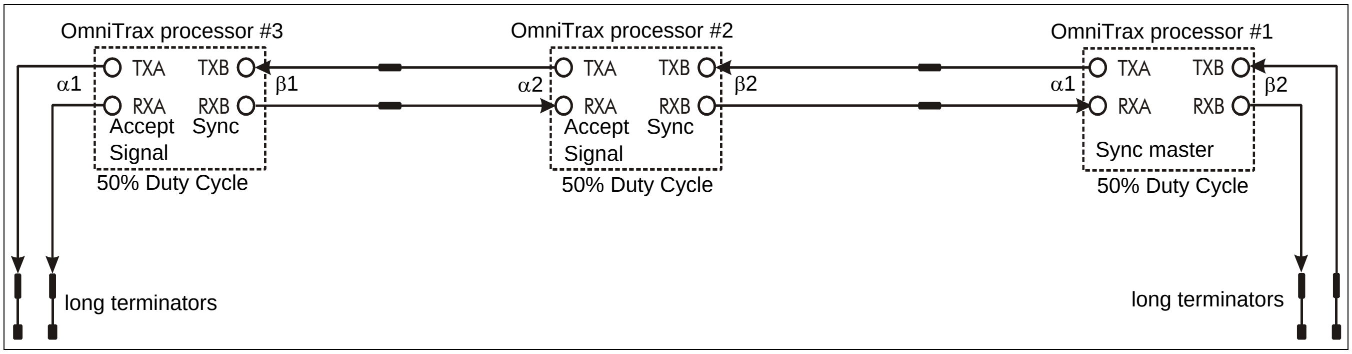


Figure 171: Transmitter coding

Following the Duty Cycle and Coding adjustment, select the Calculate button to determine the recommended Transmitter Power setting.

| | |
|---|---|
| **Note** | Senstar strongly recommends repeating the profile procedure if you make changes to the Duty Cycle and Coding settings. |

# Setting the initial configuration parameters

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|---|---|
| **Note** | You must set the initial configuration parameters before calibrating the OmniTrax sensor. If you make changes to these parameters after the calibration is complete, you must repeat the calibration procedure. |

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| **Note** | If there is an unused cable side on a processor, you must deselect (uncheck) the **Enable** check box for the unused cable side. |

| | |
|---|---|
| **Note** | The initial configuration includes advanced parameter settings. You may require a password to adjust the settings. |

1. Under the **View** menu, select **Advanced Parameters**.
2. Select the **Cable Common Cfig** tab on the main UCM window.
3. Deselect (uncheck) the **Accept Sync Signal** check box (leave it blank) if this processor will be the sync master; OR verify that the **Accept Sync Signal** check box is selected (checked) if another connected processor will be the sync master and this processor will receive the synchronization signal. (see Specifying the processor synchronization on page 193).
4. Select the **Side A Cfig** tab.

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| **Note** | Each of the following steps must be repeated for Side B. |

5. Set the **Cable Type** - OC2, SC1/SC2, Sentrax (default = OC2)
6. Select the **Cable Supervision Mode** - clutter supervision, cable pair supervision, cable set supervision (default = clutter supervision, see Sensor cable supervision on page 57).

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| **Note** | See Historic clutter on page 217 for additional details on clutter supervision. |

| | |
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| **Note** | For an unused cable side you must select clutter supervision. |

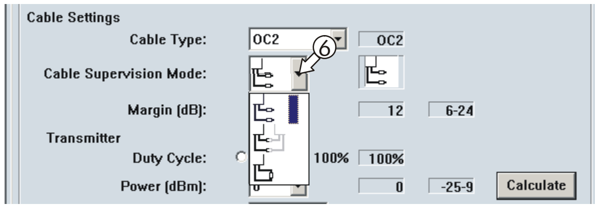


Figure 172: Cable supervision mode

7. Verify that the **STC Filter Enable** and **STC LPF Enable** check boxes are selected (default = enabled).

| | |
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| **Note** | You do not have to recalibrate the processor if you disable the STC Filters after the calibration. |

8. Verify the **Transmitter Duty Cycle** and **Coding** settings (see Mutual interference on page 194).
9. Save the UCM file and download the configuration changes to the processor.

# Using the optional local backup battery

If this processor includes the optional 6 VDC local backup battery you must enable the battery charging circuit on the UCM Status tab (see Installing the backup battery kit on page 167 for information about installing the local backup battery):

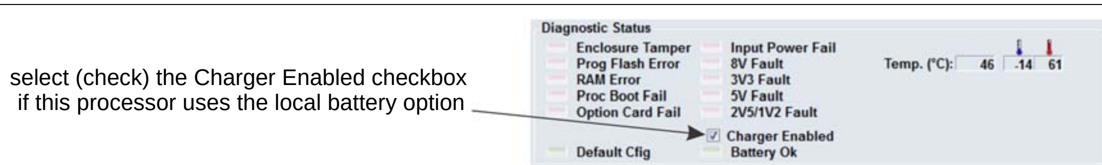


Figure 173: Enabling the battery charging circuit

# Setting the input/output control mode and adding an option card

The default setting is local control mode, in which the processor controls the inputs and outputs. Processors that communicate on the Silver Network are usually set to remote control mode to enable the host system to operate the inputs and outputs.

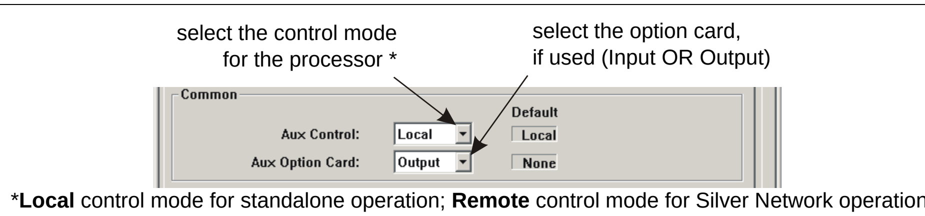


Figure 174: Setting the I/O control mode and adding an option card

1. Use the **Aux Control** selection arrow to specify the processor's control mode (**Local** OR **Remote**).
2. If this processor includes an auxiliary option card, use the **Aux Option Card** selection arrow to specify the type of card (**Input** OR **Output**).
3. Save the UCM file and download the configuration changes to the processor.

# OmniTrax calibration - Sensitivity Profile and Transmitter Power

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| **Note** | OmniTrax calibration is an automated procedure, which requires a centerline cable walk over the full length of the detecting sensor cable while running an OmniTrax Sensitivity Profile on the UCM. |

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| **Note** | To locate the cable centerline for OmniTrax systems in which the ground is fully restored, perform crossings while running a Magnitude response plot (see Locating the detection field centerline on page 218). |

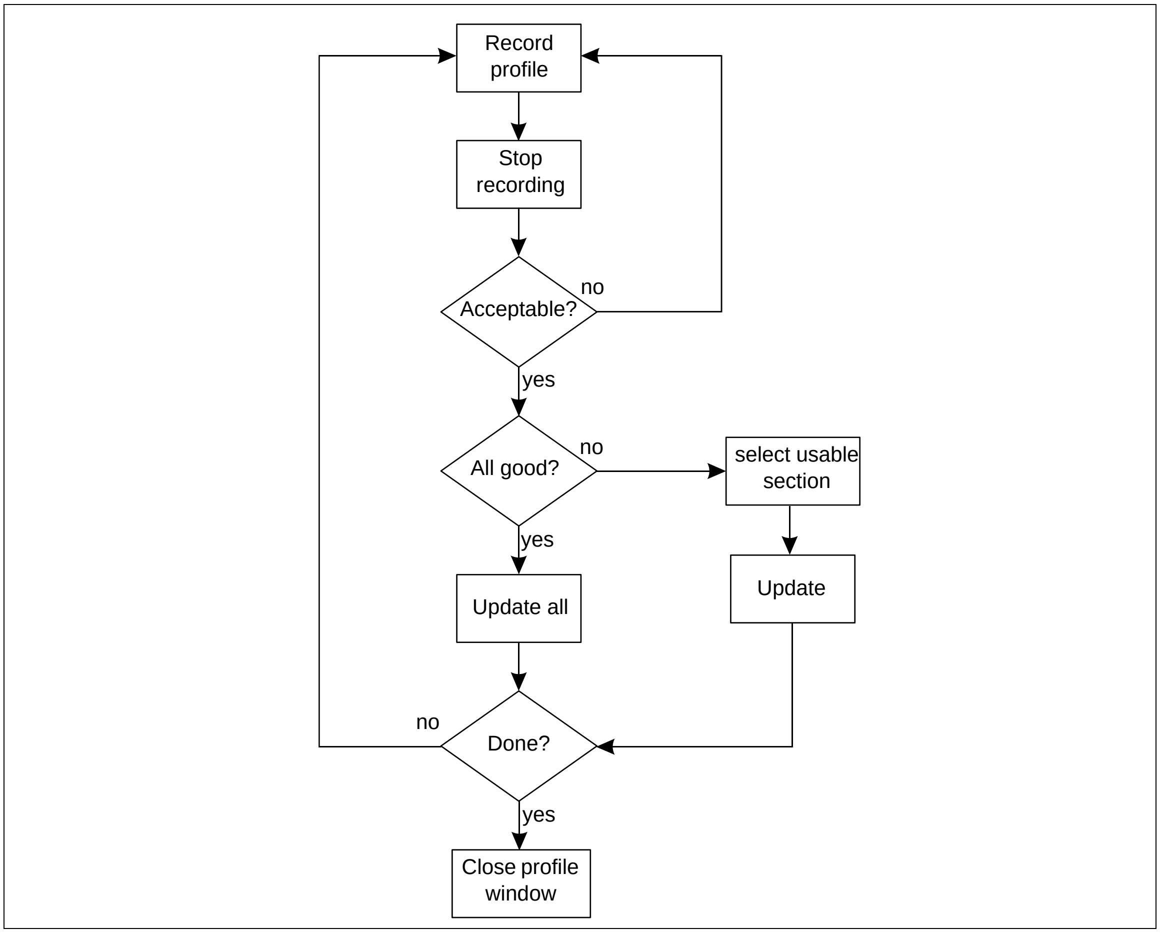


Figure 175: Calibration flow chart

The OmniTrax Sensitivity Profile provides a peak response for each meter of detecting sensor cable, based on a valid target moving along the centerline of the detection field. The Sensitivity Profile created during this procedure becomes the baseline for setting the cable margin for the full length of detecting cable.

The OmniTrax processor's recommended Transmitter Power level is determined by the UCM when it analyzes the recorded sensitivity profile. When you close the Sensitivity Profile window, a popup displays informing you of the recommended Transmitter Power level setting for the selected cable side (based on CE, FCC, or NTIA radiated power limits). You then set the Transmitter Power to the recommended level.

| | |
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| **Note** | During the calibration procedure, use only one test target (person). Prevent any other individuals and vehicles from approaching the sensor cables during this procedure. If you cannot calibrate the full length of a cable without interruption, you can select and calibrate smaller sections of the cable. |

### Recording the Sensitivity Profile

| | |
|---|---|
| **Note** | The technician running the UCM and the test walker must be in voice contact during this procedure. |

1. Select the **Side A Cfig** tab, and then select the **Profile** button.

Have the walker ready on the lead-in cable centerline, 3 to 5 m from the start point of the detecting cable (indicated by red bands on the cable). Ensure the walker is on the lead-in section of cable (not over detecting cable).

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| **Note** | To perform a centerline cable walk:<br>Walk along the cable path, midway between the TX and RX cables. (For SC1 sensor cable, walk directly above the cable.) Move slowly at a uniform pace (app. 0.5 m/s, 1 mph) taking half steps. Begin about 3 to 5 m before the start point of the detecting cable (marked by red bands) and continue until you are approximately 10 m past the decouplers. |

2. Select the **Record** button and have the walker perform the centerline cable walk over the full length of the detecting sensor cable.

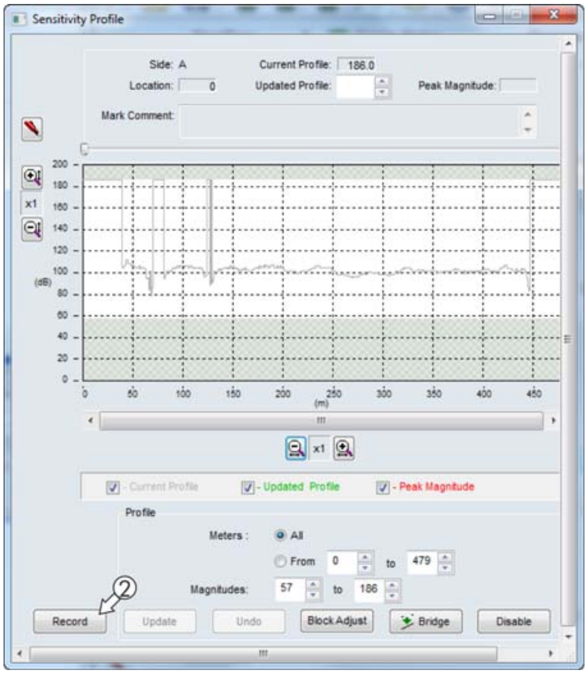


Figure 176: Starting the profile

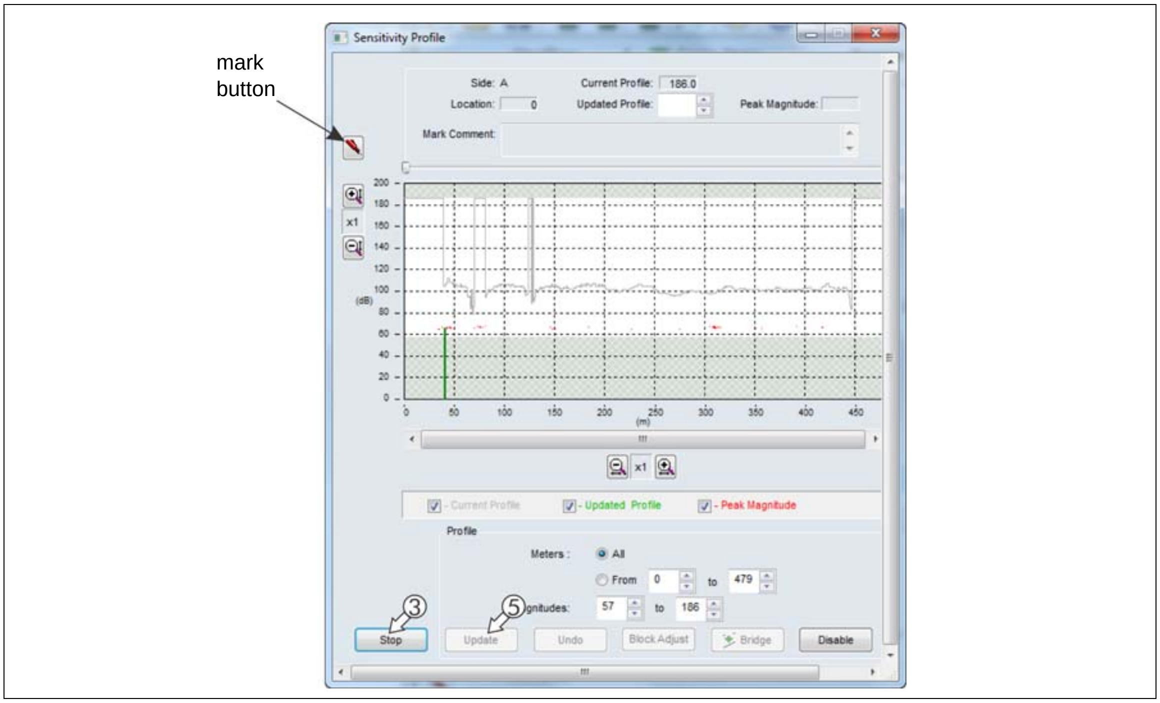


Figure 177: Stopping the profile

3. Once the walker is about 10 m past the decouplers select the **Stop** button.
4. Review the Sensitivity Profile to verify the centerline cable walk.
   Look for a reasonably flat response with no major peaks or valleys.

| **Note** | You can make a note of any points of interest on the Profile using the **Mark** button. |
|---|---|

5. If the Sensitivity Profile is acceptable, select the **Update** button to load the Sensitivity Profile data. Otherwise, select the **Undo** button to delete the recorded Sensitivity Profile and repeat the centerline cable walk.

| **CAUTION** | DO NOT download the Sensitivity Profile to the processor at this time. The Profile must be edited to exclude the first few meters of detecting cable in which the signal builds up to full strength. The end of the detecting cable near the decouplers may also have to be trimmed from the profile if the clutter signal is high. Save the recorded Sensitivity Profile with a meaningful name (e.g., RawProfile.UCM). You can then edit the Profile to exclude the first few meters of cable with the weaker detection signal, and the last few meters with a high clutter signal. If you do not exclude these sections of cable, they can become a significant source of nuisance alarms. |
|---|---|

### Editing the Sensitivity Profile

At the start point of the detecting cable (indicated by red bands) the signal is too weak to provide reliable detection. The detection signal slowly builds up to full strength over the first 2 to 4 m of active cable. As a result, the recorded Sensitivity Profile includes a low spot (weak detection signal) near the startup section. The standard installation practice of overlapping the A-side and B-side sensor cables by 8 m (4 m from each cable) enables this section of the Sensitivity Profile to be edited to exclude the low spot. Figure 178: illustrates a raw Sensitivity Profile and the same Profile after editing.

At the end of the detecting cable (indicated by the decouplers) the detection field begins to decay. There can also be a higher than normal level of clutter near the decouplers. You must edit the profile to trim out the unusable signal around the decouplers.

| | |
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| **Note** | Save the UCM file with the original Sensitivity Profile. Whenever editing the original file, always use the Save As function to rename the file. This practice enables you to reopen the original Sensitivity Profile if the changes are unacceptable. Otherwise, you will have to repeat the centerline cable walk to create a new Sensitivity Profile. |

| | |
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| **CAUTION** | Contact Senstar Customer Service for application advice if the profile editing results in any areas of the perimeter that lack the required detection sensitivity. |

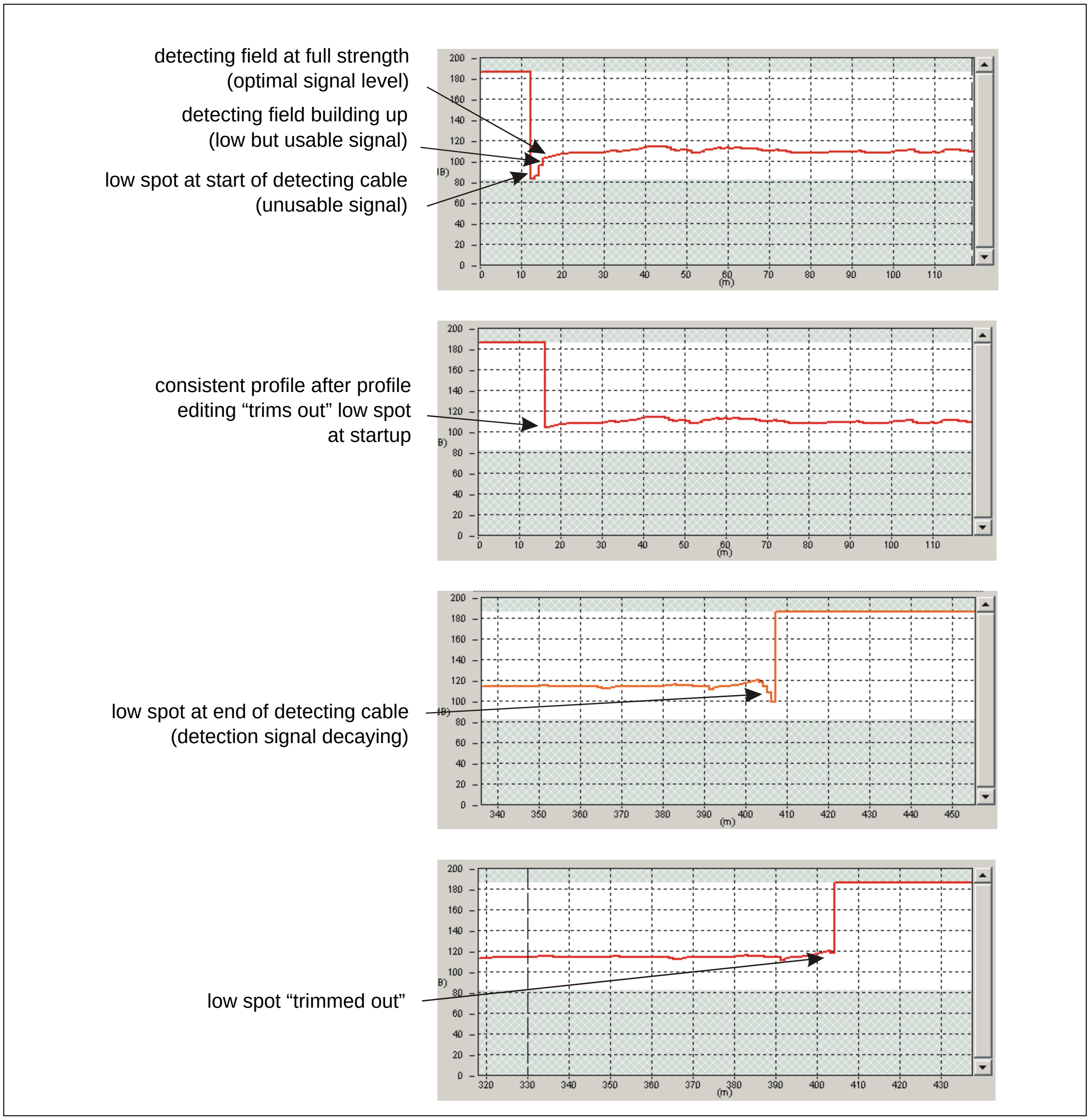


Figure 178: Editing the Sensitivity Profile

Selecting the ideal point to trim the profile would seem to be an easy choice (optimal signal level). However, there is another critical factor that must be considered. The Profile MUST NOT be trimmed to a point which results in either a low spot (with weak detection) or a dead spot (with no detection) in an area where detection is required. The 8 m overlap between the red bands at the start point provides enough room for both detection signals (A-side and B-side) to reach optimum levels. You must determine the location where both detection signals are at full strength, and trim out the sections in which the fields are building up. Figure 179: illustrates the detection field build up concept and indicates the overlap where full detection exists on both cable sides.

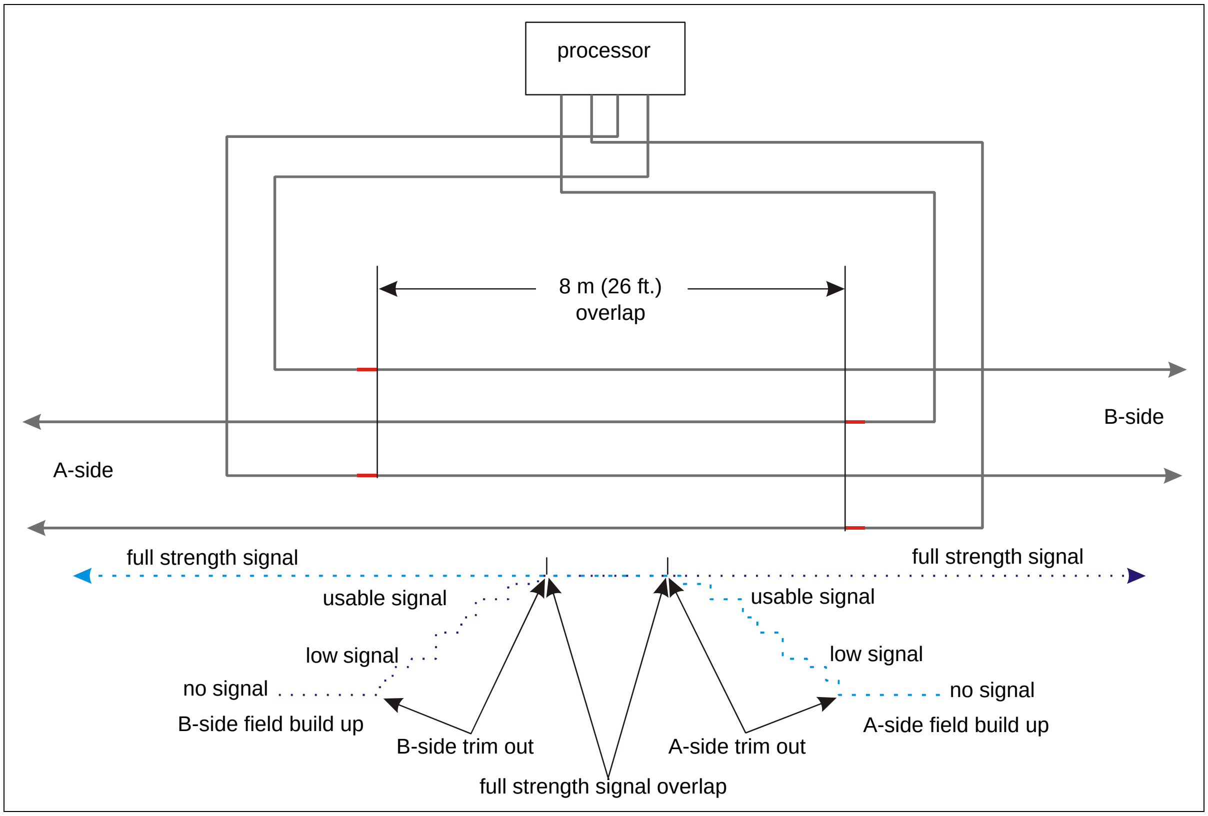


Figure 179: Detection field overlap

Locating the exact point on the sensor cables where an adequate detection signal begins presents some additional challenges. Ideally, the location of the red bands, where the detection signal begins is clearly marked. In this case, you make perpendicular crossings at one meter intervals, beginning at the red bands and moving toward the detection zone (the test subject should be the same person who did the centerline cable walk). While making the crossings, record an OmniTrax response plot on the UCM. You then review the recorded response plot to determine a safe location for profile editing.

1. Set up the response plot for Side A, with Magnitude vs Location, Absolute, and Peak capture selected. Expand both the vertical and horizontal magnifications to 4X.
2. Select the **Record** button to begin recording the response plot.
3. Have the test subject make the first crossing at the location of the A-side cables red bands (start point of detecting cable).
4. The test subject then moves one meter down the cable, marks the location and make a second perpendicular crossing.
5. The test subject continues making crossings at one meter intervals until the first 5 m of detecting cable are covered (6 crossings total).

6. Select the **Stop** button to stop the recording.
7. Review the plot to determine the exact location where an adequate detection signal begins (within 3 dB of the cable side's average signal magnitude).
8. Determine the exact location where optimum detection begins (the signal is approximately equal to the cable side's average signal magnitude that was recorded in the sensitivity profile).
9. Repeat this process on the B-side cable.
10. Compare the locations on the two cable sides where both adequate signals and optimum signals begin.
    Ideally, you can use the two optimum signal points and have at least 1 m of overlap with full detection.
11. Reopen the RawProfile UCM file and use the Save As function to rename the file.
12. Select the **Profile** button and either use the inclusion window, or enter the exact meters in the Meters: field (e.g., from 20 to 23) to trim out the unusable sections of cable where the field is too low to provide adequate detection.
13. Select the **Update** button to load the profile data.
14. Close the **OmniTrax Sensitivity Profile** window.

| | |
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| **Note** | When you close the Profile window, a dialog box displays indicating the recommended Transmitter Power level for this cable side (CE level, FCC level or NTIA level). Record the value that is appropriate for your location and application. |

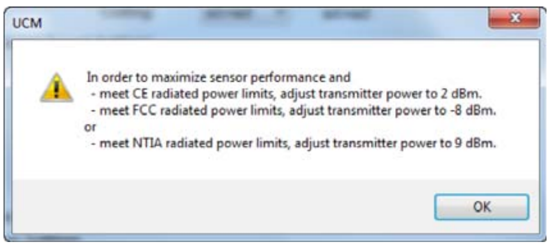


Figure 180: Transmitter power setting recommendation

Repeat the profile editing procedure to trim out the unusable signal at the end of the detecting cable (near the decouplers location).

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| **Note** | If there were any anomalous readings, or problems caused by external factors such as the walker straying from the cable path, vehicle, or pedestrian traffic during the Profile, you can repeat sections of the walk. |

1. Select the range of **Meters** that you want to re-profile (e.g., **Meters: From** 125 to 150).
2. Expand the **Magnitudes** envelope (indicated by white box) to include the current Profile reading for the area.
3. Have the walker ready at the 125 m point (outside the cable path).
4. Select **Record** and rewalk the problem area.
5. Once the walker passes the 150 m point select the **Stop** button.
6. Select the **Update** button to add the new Profile data to the existing Profile.

| | |
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| **CAUTION** | Contact Senstar Customer Service before using the Block Adjust, Bridge or Updated Profile functions. |

**Note** Sections of the Profile can be adjusted by using the **Block Adjust** function to raise or lower the profile over a selected block of meters by ± 30 dBm, or by using the **Bridge** function to interpolate across areas with unacceptably high or low sensitivity. To accomplish this, select the portion of the Profile being adjusted or bridged by dragging the gray borders in the Profile window to encompass the specific area. Use the bottom border to select the magnitude. Select the **Block Adjust** or **Bridge** button. Use the **Update** button to load the updated Profile. If the adjustment does not provide the desired result, use the **Undo** button to revert to the original Profile.

**Note** You can use the **Updated Profile** field to specify the value of the Sensitivity Profile on a meter per meter basis. This function allows you to correct small sections of cable with unacceptably high or low sensitivity. Move the slider over the meter of cable that you are adjusting. Specify the dB value for the area in the Updated Profile field (the specified value appears as a green line). Use the **Update** button to load the Updated Profile. If the adjustment does not provide the desired result, use the **Undo** button to revert to the original Profile.

### Setting the Transmitter Power level

1. Set the Transmitter Power level to the value indicated in the UCM dialog box at the conclusion of the Sensitivity Profile procedure.

**CAUTION** Selecting a higher Transmitter Power setting may improve the signal to noise ratio and potentially improve the system's performance. However, a higher Transmitter Power setting may cause interference to nearby RF receivers.

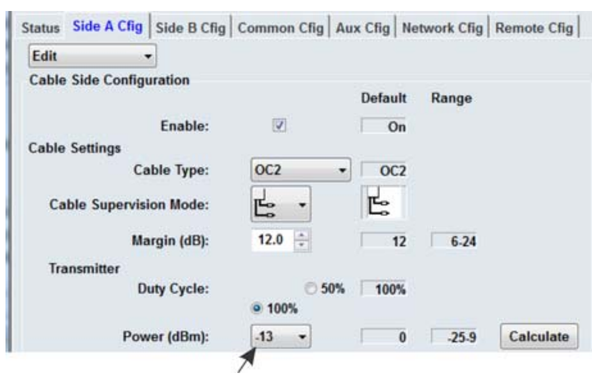


Figure 181: Setting the Transmitter Power level

2. Save the UCM file and download the Sensitivity Profile data to the processor.

**Note** If you are recalibrating a section of the cable use the Transmitter Power level that was indicated during the full calibration. Do not change the Transmitter Power level unless you are recalibrating the full length of detecting cable.

# Setup

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| **Note** | The default settings for cable margin and target speeds provide good detection for most installations. However, variations in cable spacing, burial depth and soil conductivity affect the system's performance from site to site. After initial calibration, perform multiple crossing tests to verify that the system meets your detection requirements. |

Once your OmniTrax processor is calibrated, you can setup the system for:

- cable margin (alarm threshold)
- cable segments and alarm zones
- individual segment cable margins (zone specific alarm threshold)
- target speed (velocity response)
- input/output response
- network communication (for Silver Network based processors)

| | |
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| **Note** | The following procedures assume that the processor and sensor cables are installed, the processor is powered up and calibrated, and the UCM computer is in communication with the processor. Each procedure references the A-side cable set. You must repeat each procedure for the B-side cable set. |

## Setting the full-length cable margin

You can set the cable margin, thereby adjusting the alarm threshold for the full length of detecting cable. The cable margin defines the number of decibels below the recorded sensitivity profile's peak response, that will trigger a sensor alarm. The sensitivity profile serves as the baseline for the cable margin, enabling a consistent alarm threshold for each meter of detecting cable. The cable margin follows the peaks and valleys of the sensitivity profile. By setting the cable margin below the recorded sensitivity profile, your alarm threshold is always lower than the known sensitivity of the cable. For example, if you use the default setting of 12 dB for the cable margin, your alarm threshold is 12 dB below the cable's peak reading. Whenever the processor detects a target with a signal that is within 12 dB of the recorded sensitivity profile, an alarm is declared. A cable margin of 12 will provide a high probability of detection (Pd) and a low nuisance alarm rate (NAR).

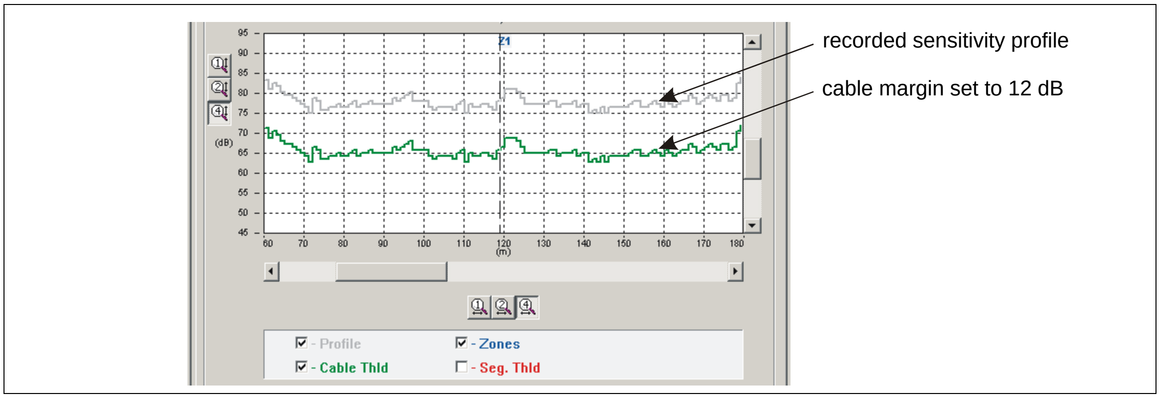



Figure 182: Cable margin

### Cable margin procedure

1. Use the spin control to set the cable margin for the full length of detecting cable.
2. Save the UCM file and download the configuration data to the processor.

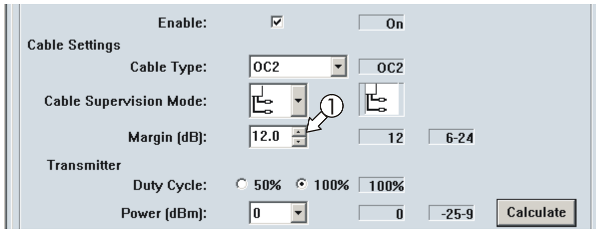



Figure 183: Setting the full length Cable Margin

**Note** At the minimum cable margin of 6 dB, the OmniTrax sensor will have a reduced Pd, and an extremely low NAR/FAR. At the maximum setting of 24 dB, the system will have an extremely high Pd, but will be prone to nuisance and false alarms from small animals, environmental effects and background noise. The default setting of 12 dB provides a high Pd and a low NAR/FAR. Senstar recommends the 12 dB default setting, which can be adjusted, if required, as historical data is accumulated.

## Defining the cable segments and alarm zones

Each OmniTrax cable set can be divided into as many as 50 cable segments (100 per processor). The defined cable segments can then be assigned to as many as 50 distinct alarm zones per processor. In addition, there is Zone 0, which does not report alarms, and does not count in the 50 zone total. You define the detecting sensor cable as cable segments, according to your site-specific requirements for alarm zone layouts. You can also adjust the cable margin independently for each cable segment to raise, or lower, the alarm threshold in that area.

**Note** Senstar recommends that the lead-in cable be defined as segment 1. The lead-in cable, and any detecting cable from which alarm reporting is not desired, must be assigned to Zone 0.

**Tip** You can accurately locate cable segment boundaries by doing sensor cable crossings.
Select **File** > **Magnitude plot** and set the **OmniTrax response plot** to **Absolute Display Mode** and **Peak Capture**. Have the test subject walk completely across the cable path at the desired cable segment boundary. Note the position of the cursor for the first peak recorded. Continue the crossings to mark all necessary segments (e.g., start point of detecting cable, end of detecting cable, site specific alarm zones - start and end of each zone). Refer to the response plot to define your cable segments and alarm zones on the Cable configuration screen.

**Note** After calibrating your OmniTrax processor you will have one alarm zone for the full length of detecting cable.

The following procedure is performed in the **Segment Settings** field of the **Cable Cfig** tab.

**Note** To precisely locate the segment boundaries, you can use the UCM's Range (m) spin control to enter the meter where a segment begins. You can adjust only the start point of each segment using the Range control.

## Defining the lead-in cable segment as non-detecting

| **Note** | You can use the magnification buttons to expand the plot. |
|---|---|

1. Open the sensitivity profile recorded during calibration.
2. Left-click on the **Segment Setting** window to select the existing Zone.
3. Select the **Split** button to divide the zone.
   The window is divided into two equal portions, one gray and one white.
4. Drag the zone boundary to the start point of the detecting cable.
5. Left-click on the lead-in cable section of the profile.
6. Use the spin controls to select **Segment 1** and **Zone 0**.
7. Save the UCM file and download the configuration data to the processor.

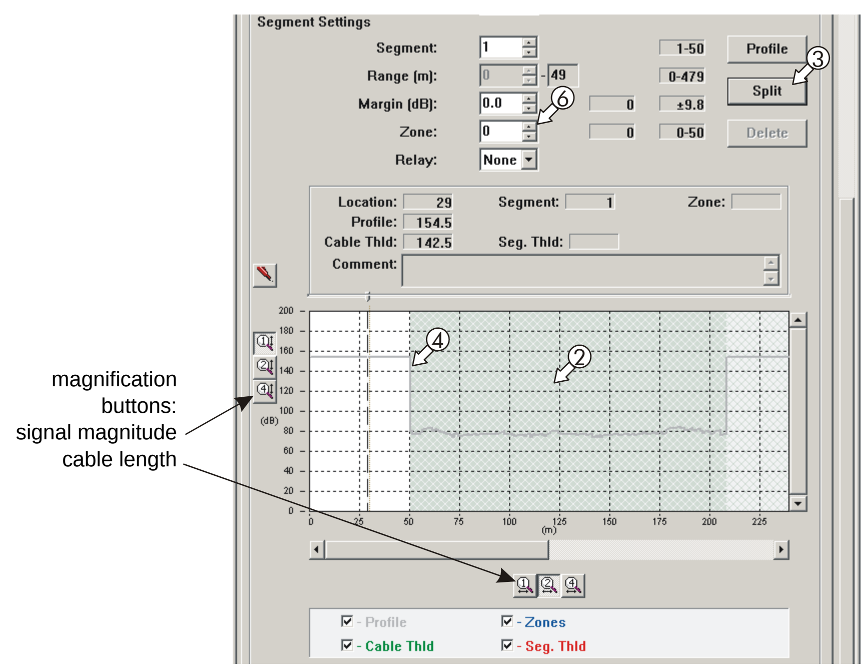



Figure 184: Defining cable segments

## Defining the detecting cable segments

Once you have defined the lead-in cable section as Zone 0 (non-reporting) you can define the detecting cable according to your site plan. Each time you select the split button, you divide the selected segment in half. You then adjust the length of the selected segment and assign the segment's zone number for alarm reporting. Each processor can include up to 100 cable segments (50 per cable side) and up to 50 distinct alarm zones (plus zone 0).

1. Left-click on the gray portion of the **Segment Setting** window (between the lead-in and lead-out cable sections) to select the detecting cable segment.
2. Select the **Split** button to divide the segment.
   The detecting cable segment is divided into two equal portions, one gray and one white.
3. Drag the zone boundary to the appropriate point of the detecting cable (refer to the site plan).
4. Left-click on the gray detecting cable section of the profile.

5. Use the spin controls to select **Segment 2** and **Zone #** (label the zone according to the site plan; more than one cable segment can be assigned to each zone).
6. Repeat this procedure to define each cable segment and zone, as specified in the site plan.

| **Note** | Any sections of detecting cable that should NOT report alarms must be assigned to Zone 0. |
|---|---|

7. Save the UCM file and download the configuration data to the processor.

# Setting the cable segment margins

In addition to the cable margin for the full length of cable, you can also set different cable margins for each defined cable segment. The cable segment margin is applied as a delta to the full length cable margin for the selected segment. This can be useful if your site includes any high risk, or low threat, areas. A wider cable margin in high risk areas will increase the Pd in that area. However, a wider cable margin can also lead to an increased nuisance alarm rate. For an area where the threat is considered low, you can decrease the cable segment margin, which will reduce the chances of nuisance alarms occurring, while still providing an acceptable Pd.

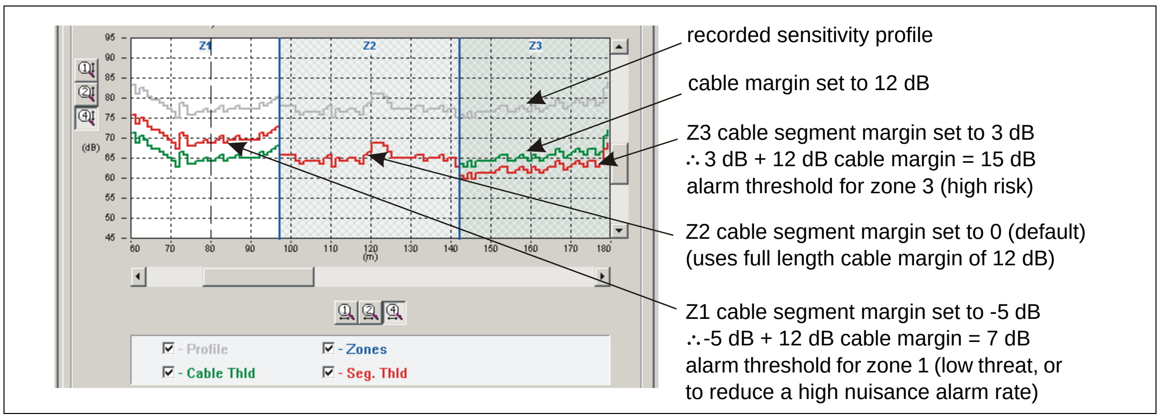



Figure 185: Cable segment margins

The range of cable margin values for each defined segment is ± 9.8 dB. When you apply a positive value to a cable segment, you increase the sensor's sensitivity in that segment. When you apply a negative value to a cable segment, you decrease the sensor's sensitivity in that segment. The following figure illustrates a cable, which has been split into 5 detecting segments plus the non-detecting lead-in. Zones 1, 4 and 5 use the default cable margin of 12 dB. Zone 2 has a segment margin of + 3.8 dB, which is added to the cable margin of 12 dB. This gives Zone 2 a margin of 15.8 dB, making Zone 2 more sensitive to intruders than the other defined zones. Zone 3 has a segment margin of - 4.5 dB, which is subtracted from the cable margin of 12 dB. This gives Zone 3 a margin of 7.5 dB, making Zone 3 less sensitive to intruders than the other defined zones.

## Cable segment margin procedure

1. Select the defined zone to which you will apply a cable segment margin.
2. Use the **Margin (dB)** spin control to set the cable margin for the selected segment.
3. Save the UCM file and download the configuration data to the processor.

Repeat this procedure to set a cable segment margin for other segments (or Zones) as specified in the site plan.

| **Note** | Cable segment margins should be set only for zones which require a higher, or lower, level of sensitivity. |
|---|---|

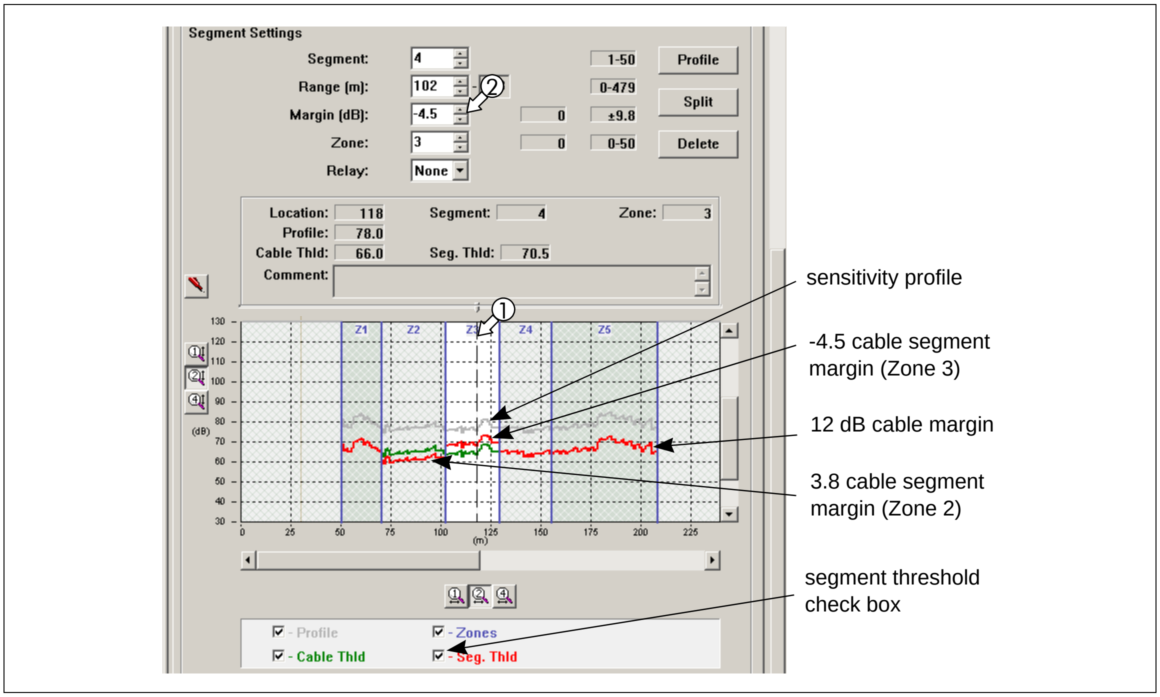



Figure 186: Cable segment margin procedure

# Target speed settings

Once the system is installed and calibrated, you can test to ensure that the default target speed settings meet your detection requirements. To verify the target speed settings for your site, perform a series of intrusion tests at different locations along the cable path at the slowest, and the fastest speeds, which must be detected. If each test results in a sensor alarm, the default settings are adequate. If any test does not cause a sensor alarm, you can adjust the appropriate target speed setting, and redo the tests. There are two independent target speed sliders, one for low speed detection and one for high speed detection. Each slider has five settings, which range from slowest on the left to fastest on the right.

| **Note** | Raising the high speed target setting or lowering the low speed setting can lead to an increased NAR/FAR from environmental effects. |
|---|---|

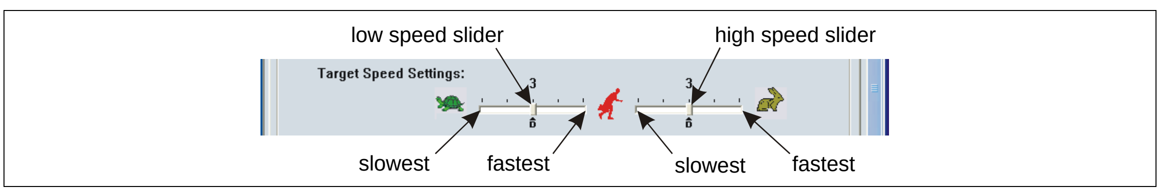



Figure 187: Adjusting the Target Speed Settings

1. Under the **Cable Cfig** tab in **Target Speed Settings** use the slider control to adjust the intrusion detection speed range.
   The low speed slider increases or decreases the system's response to a slow moving target.
   The high speed slider increases or decreases the system's response to a fast moving target.

| **Note** | If you adjust the target speed sliders, move the slider one level at a time and retest the cable. |
|---|---|

2. Save the UCM file and download the configuration data to the processor.

# STC filter settings

| | |
|---|---|
| **Note** | The STC filter helps the processor differentiate between valid targets and environmental effects. It also reduces the possibility of multiple alarms caused by a single target. When enabled, the STC filter can result in a slightly reduced Pd for extremely slow intrusion threats. |

The STC filter is used to prevent spurious signals from environmental effects and sharp increases in the clutter signal from causing nuisance alarms. The STC filter is enabled as the default setting, and should be disabled only if you cannot meet your low speed target detection requirements by adjusting the target speed settings. The STC filter should always be used in applications where the cables are installed at a shallow burial depth, such as slots in concrete or asphalt. It should also be used for cables buried in light sandy soil or gravel, and for cables with a shallower burial depth than recommended.

The STC LPF is used to enhance the detection of targets moving erratically at very low speeds. Using the STC LPF in conjunction with the STC Filter can reduce environmental nuisance alarms, while providing a high Pd for slow moving targets.

| | |
|---|---|
| **Note** | The STC Ratio and Bounce Back Suppression are factory parameters that help prevent nuisance alarms caused by environmental effects. |

1. Select the **Cable Common Cfig** tab.
2. Select the check box to enable the STC filter (default = STC Filter enabled).
3. Select the check box to enable the STC LPF (default = STC LPF enabled).
4. Save the UCM file and download the configuration data to the processor.

# Auxiliary I/O configuration

You configure the processor’s inputs and outputs (I/O) via the UCM, under the Aux Cfig tab. You must specify the Aux Control mode and whether you have an Aux Option Card installed before you configure the I/O. Figure 188: illustrates the Aux Cfig tab on the OmniTrax UCM window.

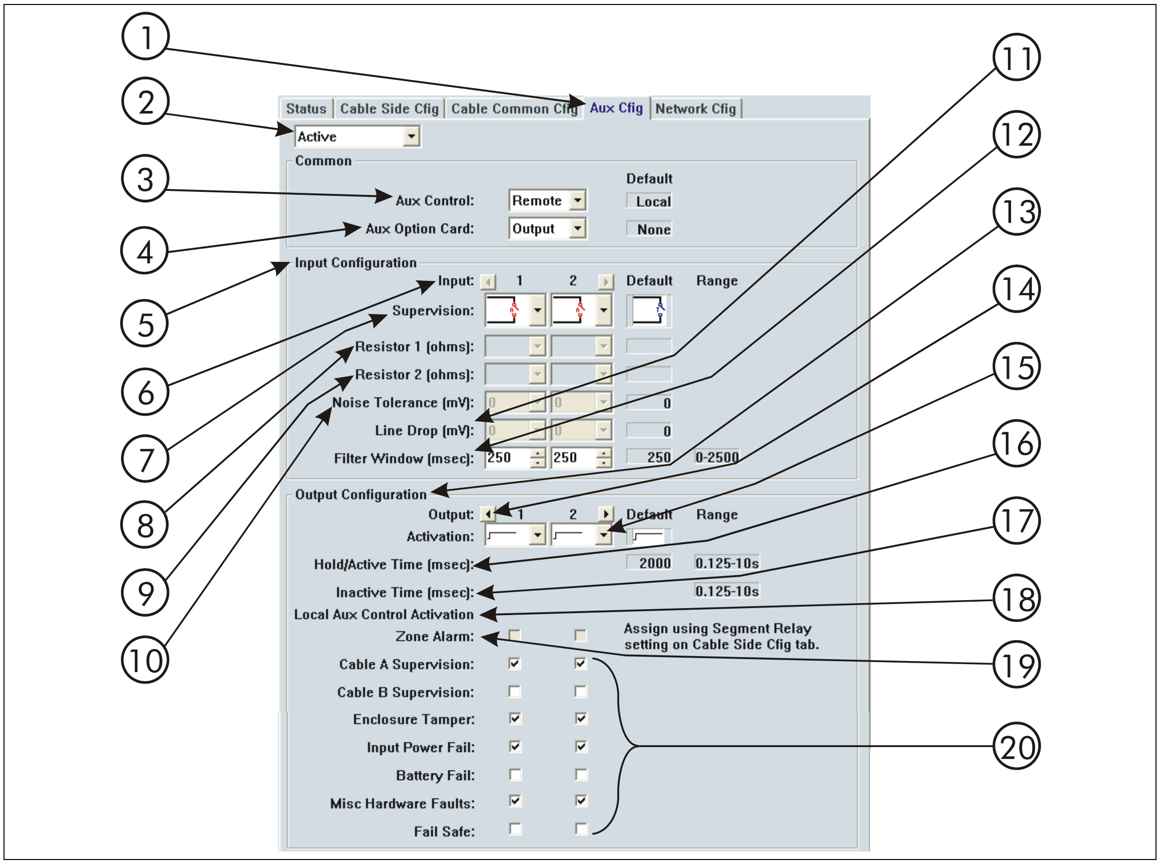



Figure 188: Auxiliary Configuration (Aux Cfig) window

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | **Aux Cfig** tab - select to display the Auxiliary Input/Output configuration screen | 2 | Activity display drop down:<br>**Edit** - displays modified configuration<br>**Active** - displays processor's current settings<br>**File** - displays saved/loaded UCM configuration |
| 3 | **Aux Control** (default = local control mode)<br>**Local** control mode - auxiliary I/O is controlled by the OmniTrax processor, relays signal alarm and supervision conditions (user configurable response) inputs activate Side A and B self-test<br>**Remote** control mode - auxiliary I/O is controlled by the host security management system, relays are output control points and inputs report alarm and supervision conditions for auxiliary devices | 4 | **Aux Option Card** (default = none)<br>Each OmniTrax processor can use one auxiliary option card, either an input card or an output card.<br>**Input** card - provides 8 additional inputs<br>**Output** card - provides 8 additional outputs |
| 5 | **Input Configuration** section<br>The input configuration parameters listed below each selected input apply only to the selected input. First you select an input, then you configure the selected input's parameters.<br>inputs **1** and **2** on the OmniTrax processor<br>inputs **Opt1** to **Opt8** on the auxiliary input card | 6 | **Input** selection arrows - click on the arrows to scroll through and select the available inputs<br>The **default** setting for each parameter is indicated beside the parameter selection drop down<br>Applicable **Range** is displayed beside the parameter selection drop down |
| 7 | **Supervision** drop down - select the input relay and supervision resistor wiring configuration | 8 | **Resistor 1** - available when single or dual resistor supervision is selected |

I/O configuration parameters

| Item | Description | Item | Description |
|---|---|---|---|
| 9 | **Resistor 2** - available when dual resistor supervision is selected | 10 | **Noise Tolerance** (default = 40 mV) - set this parameter to compensate for noisy input wiring (0, 20, 40, 60, 80, 100 mV)<br>available with single/dual resistor supervision |
| 11 | **Line Drop** (default = 0) - set this parameter to compensate for the voltage drop on long or high resistance input wiring (0, 20, 40, 60 mV)<br>available with single/dual resistor supervision | 12 | **Filter Window** (default = 250 ms) - time for which an input must remain active before an event is declared (0 to 2.5 seconds in 125 ms increments) |
| 13 | **Output Configuration** section<br>The output configuration parameters listed below each selected output apply only to the selected output. First you select an output, then you configure that output's parameters (outputs **1**, **2**, **3**, **4** on OmniTrax processor; outputs **Opt1** to **Opt8** on ROC card). | 14 | **Output** selection arrows - click on the arrows to scroll through and select the available outputs<br>The **default** setting for each parameter is indicated beside the parameter selection drop down<br>Applicable **Range** is displayed beside the parameter selection drop down |
| 15 | Relay **Activation** (selectable for remote control mode) default = latching (steady ON)<br>latching - relay is activated and deactivated by commands from the host computer<br>flash mode - relay activates ON/OFF/ON/OFF... continuously in response to a command from the host computer; relay deactivates in response to a command from the host computer<br>pulse - relay activates for a period, then deactivates, in response to a command from the host computer | 16 | **Hold/Active Time** (default = 2 sec.) - selectable for local control mode (relay remains active for the duration of an event or for the specified Hold/ Active Time, whichever is longer)<br>selectable for flash or pulse type relay activation in remote control mode (relay remains active for the specified time)<br>(from 0 to 2.5 seconds in 125 ms increments) |
| 17 | **Inactive Time** - selectable for flash type relay activation in remote control mode (relay remains inactive for the specified time)<br>(from 0 to 2.5 seconds in 125 ms increments) | 18 | **Local Aux Control Activation** - user configurable relay activation conditions for local control mode<br>select the check box beside a parameter to have that relay activate when the condition occurs |
| 19 | **Zone Alarm** - specify a relay which will activate in response to a sensor alarm condition in a configured zone (the Zone Alarm is configured in the Segment Settings section of the Cable Side Cfig tab) | | |
| 20 | user selectable **Local Aux Control Activation** conditions<br>**Zone Alarm** - response is configured in the Segment Settings under the Cable Side Cfig tab<br>**Cable A Supervision** - specified relay activates to signal a Cable A Supervision alarm<br>**Cable B Supervision** - specified relay activates to signal a Cable B Supervision alarm<br>**Enclosure Tamper** - specified relay activates to signal an Enclosure Tamper condition (door opened)<br>**Input Power Fail** - specified relay activates to signal the DC input power has failed<br>**Battery Fail** - specified relay activates to signal the battery voltage is below the operational level<br>**Misc Hardware Faults** - - specified relay activates to signal an internal hardware fault has been detected<br>**Fail Safe** - specified relay activates to signal all input power has failed and the processor is not operational | | |

I/O configuration parameters

# Auxiliary (AUX) inputs

The two AUX inputs on the OmniTrax processor are voltage sensing inputs (see Figure 155:). The processor determines an input's status by comparing the input's voltage with the defined state's voltage ranges (based on an internal reference voltage, and the configuration of the connected contact closures and supervision resistors). Input contact closures MUST be voltage-free. You define the inputs as normally open (NO) or normally closed (NC) with single resistor supervision, dual resistor supervision, or unsupervised. A Filter Window parameter allows you to set the time period for which an input must be active, before the processor reports an event.

### Local control mode

In local control mode, the two AUX I/Ps on the OmniTrax processor are self-test inputs. When there is a momentary switch input to an AUX input, the processor compares the current clutter level to the recorded historic clutter level on the respective cable side (AUX1 = A side cable, AUX2 = B side cable). If the current clutter level is within the Historic variance parameter (default = 12 dB**)** of the historic clutter level, the processor activates all relays that are assigned to the cable side. AUX1 activates all relays that are assigned to Side A. AUX2 activates all relays that are assigned to Side B. If the current clutter level deviates from the historic clutter level by more than the Historic variance parameter, the relays do not activate (self-test fails).

| | |
|---|---|
| **Note** | The momentary switch input must be held for the period specified in the Filter Window parameter (default = 250 ms). |

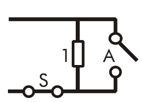
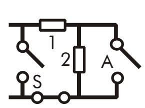
### Remote control mode

In remote control mode, the two AUX I/Ps on the OmniTrax processor, and the eight inputs on the UIC (if installed) serve as auxiliary device inputs to the host security management system. The inputs are available for reporting the status of other security devices. The processor reports any change of an input's state to the host system, via the Silver Network.

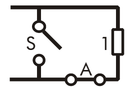
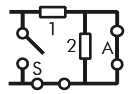
## Input wiring configurations

| | |
|---|---|
| **CAUTION** | Use **1%, ¼ W** supervision resistors for OmniTrax inputs. When selecting resistor values, there must be sufficient voltage threshold margins for the processor to discriminate between alarm and tamper conditions. |

| | |
|---|---|
| **Note** | Senstar recommends the standard UCM selectable resistor configurations, which provide optimum alarm and tamper thresholds. Contact Senstar Customer Service if you require a supervision resistor configuration that is not available through the UCM menus. |

| **Input option** | **UCM selection** | **Alarm relay** | **Supervision relay** | **R1** | **R2** |
|---|---|---|---|---|---|
| unsupervised |  | NO | --- | --- | --- |
| single resistor supervision |  | NO | NC | 5.1 k | --- |
| dual resistor supervision |  | NO | NO/NC | 4.3 k | 820 |

UCM selectable input configurations (with standard resistor values)

| Input option | UCM selection | Alarm relay | Supervision relay | R1 | R2 |
|---|---|---|---|---|---|
| unsupervised |   | NC | --- | --- | --- |
| single resistor supervision |   | NC | NO | 5.1 k | --- |
| dual resistor supervision |   | NC | NO/NC | 5.1 k | 820 |

UCM selectable input configurations (with standard resistor values)

The following table includes the UCM selectable supervision resistor values.

| R1 values (single resistor supervision) | R1 values (dual resistor supervision) | R2 values (dual resistor supervision) |
|---|---|---|
| 820 | 1.1 k | 820 |
| 1 k | 2.2 k | 1.1 k |
| 1.1 k | 4.3 k | 2.2 k |
| 1.2 k | 4.7 k | 3.3 k |
| 1.5 k | 5.1 k | 5.6 k |
| 2.2 k | 5.6 k | |
| 3.3 k | | |
| 4.7 k | | |
| 5.1 k | | |
| 5.6 k | | |

Selectable resistor values

## Input configuration procedure

**Note** Refer to the UCM help file and Figure 188: for additional information on the input configuration procedure.

1. Select the **Aux Cfig** tab on the UCM window.
2. Use the **Input** selection arrows to select an input.
3. From the **Supervision** drop down, select the desired supervision scheme for the selected input.
4. Select the **Resistor 1** value, if applicable.
5. Select the **Resistor 2** value, if applicable.
6. Set the **Noise Tolerance**, if applicable.
7. Set the **Line Drop**, if applicable.
8. Set the **Filter Window**.
9. Repeat this procedure if there is a second connected input (Aux2).
10. Save the UCM configuration file and download the configuration changes to the processor.

# Output relay setup

### Local control mode

In local control mode, the four on-board relays are controlled by the OmniTrax processor to report alarm and supervision conditions. The relays remain active for an event's duration or for the selectable relay Active Time, whichever is longer. The conditions under which each relay will activate can be configured by the user via the UCM. The eight ROC card relays can be configured to activate in response to zone alarms.

Each relay can be configured to operate in fail-safe mode. In fail-safe mode, the relay changes to the alarm state in the event of a total input power failure (DC input power failure, and there is no battery installed, or the battery is not charged, or the battery discharges to a level below the minimum threshold).

### Remote control mode

In remote control mode, all relays are controlled by the host security management system to operate auxiliary equipment as output control points (e.g., to activate lights, doors, sirens, CCTV equipment, etc.). You configure the relays response to commands from the host system via the UCM. You can configure the relays as latching (ON by command, OFF by command) or in flash mode (ON-OFF-ON-OFF etc. by command, OFF by command) or in pulse mode (ON for a period, then OFF). For flash and pulse modes, the ON-OFF time duration is configurable.

### Relay configuration

1. Use the **Output** selection arrows to select a relay.
2. Select the type of relay **Activation**.
   (local control mode activation is steady ON for a specified period, then OFF)
   (network control mode is selectable as latching, flash mode, or pulse mode).
3. Select the **Active Time** parameter, if applicable.
4. Select the **Inactive Time** parameter, if applicable.
5. Repeat this procedure for the other relays.
6. Save the UCM configuration file and download the configuration changes to the processor.

# Linking relays to cable segments (local control mode)

You can link the defined cable segments to relays 3 and 4 on the processor and to the 8 relays on the ROC. This provides 10 relays per processor, for signalling sensor alarm conditions.

1. Under the **Cable Cfig** tab, on the **Segment Settings** chart, select the cable segment to which you will associate a relay.
2. Select the relay from the pull down menu, which will be associated with the segment (the selected relay activates to annunciate a sensor alarm in the cable segment).
3. Repeat steps 1 and 2 until you have associated the available relays to the defined cable segments (up to 10 relays with ROC).
4. Save the UCM configuration file and download the configuration changes to the processor.

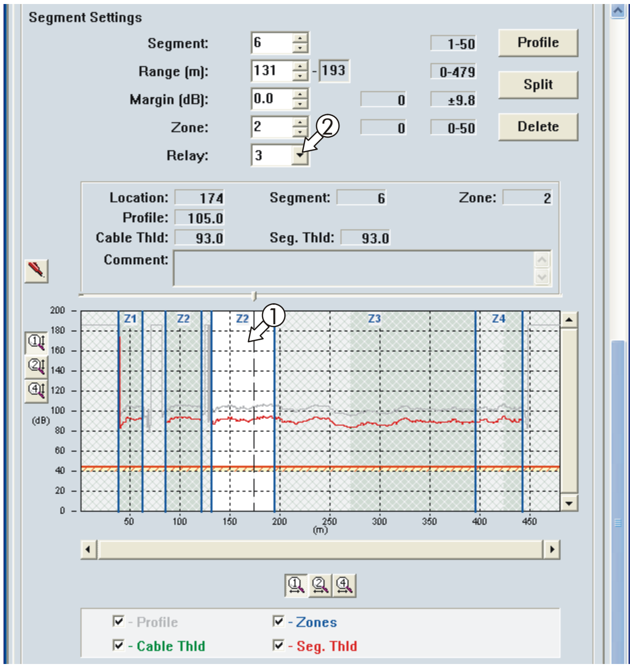



Figure 189: Linking relays to cable segments

# Specify the network connection and synchronization scheme

Use the UCM to select your network connection type from the **Network Configuration/ Connection** drop down menu (see OmniTrax network communication and synchronization options on page 225).

1. Select the **Network Cfig** tab on the main UCM window.
2. Select the **Connection** type for this processor from the drop down menu.
3. Save the UCM configuration file and download the configuration changes to the processor.

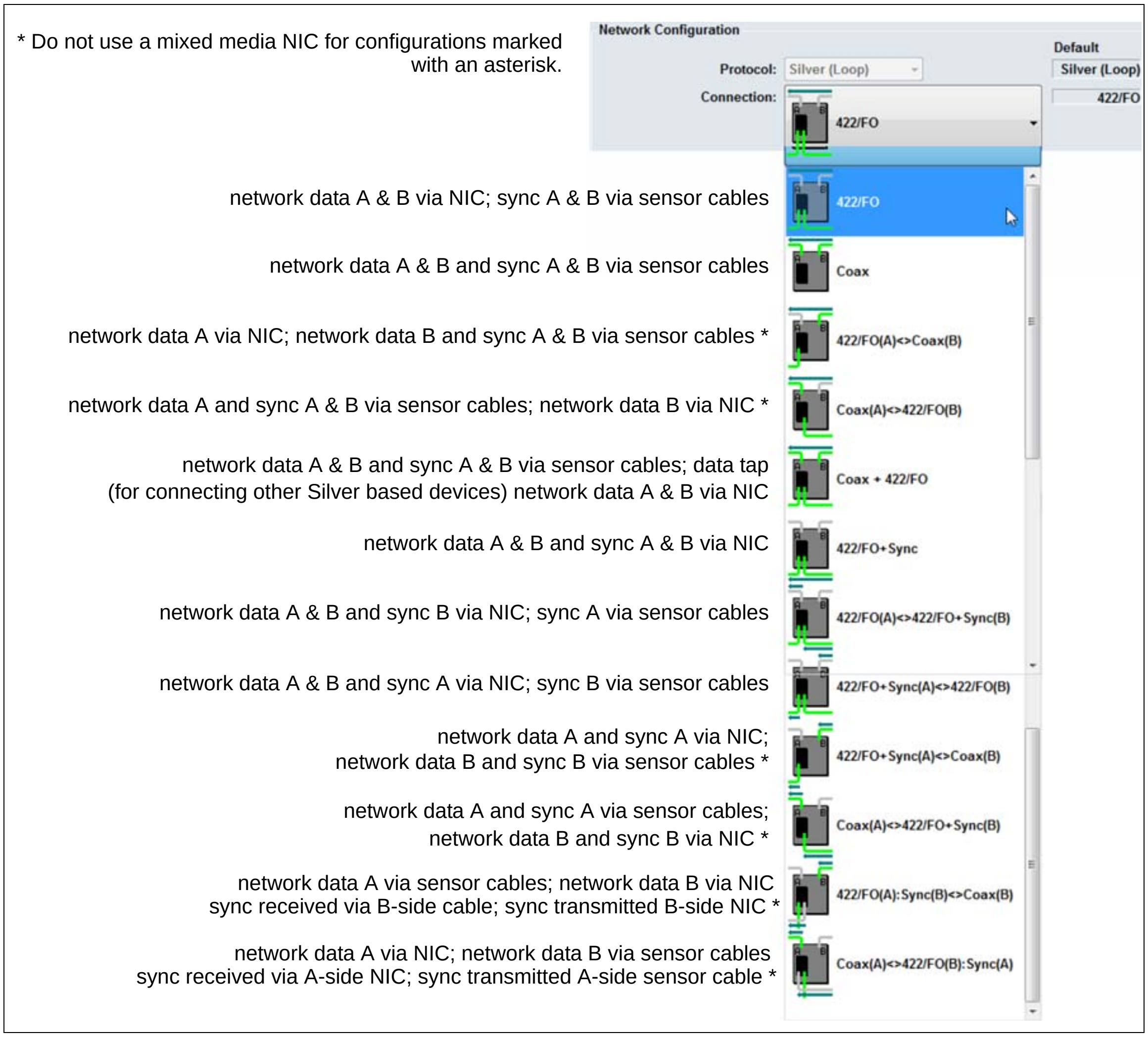



Figure 190: Data and Synchronization connections

# Clutter display

Clutter is the term used to describe the sensor cable’s response in the absence of a valid target. Clutter is a product of the installation, including burial depth, burial mediums, cable spacing and connections. The clutter level will generally remain consistent over time. Changes will occur with ground freezing and thawing, and during periods of heavy rain and dry ground. These changes typically affect the whole cable length. A significant increase in the clutter level in only a portion of the cable generally indicates a cable fault. You can use the clutter display to locate potential problem areas along the sensor cables by moving the slider to the appropriate point on the display.

The level of clutter will change slowly over time as ground conditions change due to seasonal effects. You should review the current clutter level regularly, and reset the historic clutter level. This will prevent supervision alarms resulting from changing ground conditions over time, rather than cable faults. For clutter supervision, an alarm should be triggered only by a sudden sharp increase in the clutter level.

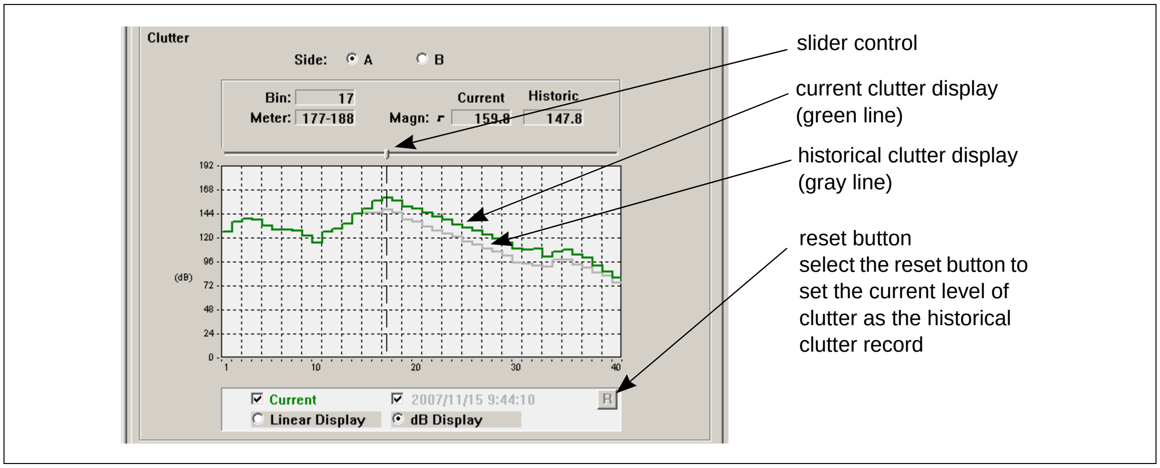



Figure 191: OmniTrax clutter display

## Historic clutter

| | |
|---|---|
| **Note** | The Historic clutter level is used by all types of OmniTrax cable supervision. When you first setup and calibrate the OmniTrax processor, save a UCM file, which includes the original level of clutter. In addition, use the Reset button regularly to reset the historic clutter level to prevent cable supervision alarms from being caused by slowly changing ground conditions. |

The processor compares the current clutter level to the historic clutter to help determine a supervision alarm (cable fault). If the difference between the current clutter level and the historic clutter exceeds the Historic variance parameter, a cable supervision alarm is declared. You can adjust the Historic variance parameter on the Cable Common Cfig screen to set the level of change in the clutter signal that will trigger a cable supervision alarm. If you are experiencing cable supervision alarms caused by changing clutter levels, you can raise the Historic variance parameter to prevent the supervision alarms from occurring.

When you initiate a self-test in local control mode, the processor compares the current clutter to the historic clutter to verify the condition of the cable, and to ensure the transmitter is operating properly.

| | |
|---|---|
| **Note** | Senstar recommends using the default historic variance parameter of 12 dB. Change the historic variance parameter only if cable supervision alarms are being caused by large objects such as vehicles crossing, or parking near, the sensor cables or environmental effects. |

1. To save the current clutter level as the historic clutter level select the reset 

 button located below the clutter display.
   The historic clutter is then displayed as a gray line in the clutter window.
2. Save the UCM configuration file and download the configuration changes to the processor.

# Sensor verification testing

Once the system is calibrated and setup, test the settings by performing multiple crossings over the full length of detecting cable. If possible, use both large and small test subjects, moving at different speeds. Connect a computer running the UCM during the tests and record magnitude response plots. Pay careful attention to any cable bypasses. Test the cable segments and zone settings to ensure alarms are reported in the correct zones. In addition, verify that the inputs and outputs function as intended. Depending on the test results, either put the system into service, or adjust the detection parameters and zone layouts.

| | |
|---|---|
| **CAUTION** | OmniTrax sites which experience significant seasonal variations in climate require additional sensor verification testing. Seasonal variations that can affect system performance include ground freezing, ground thawing, and major changes in the moisture content of the soil (i.e., periods of heavy rain and periods of hot dry weather). Heavy rain can also cause significant soil erosion. Always retest the OmniTrax system following major seasonal changes in the weather, and recalibrate the sensor if required. |

## Locating the detection field centerline

Once the ground surface is fully restored, it can be difficult to precisely locate the detection field centerline. However, precise location is critical should you need to recalibrate the processor by updating the sensitivity profile. The best method for locating the detection field centerline is to obtain a good quality cable locater. Use the cable locater to mark the cable path of both (OC2, SC2) cables or the single cable (SC1). Mark the centerline between the cables (directly above SC1) and follow the marks to recalibrate the processor.

If a cable locater is not available, you can locate the detection field centerline by doing crossings. For this procedure, you will require an accurate site plan, two way radios, marker paint, a walker and a maintenance technician running an OmniTrax magnitude response plot on the UCM.

1. Use the site plan to determine the start point of the detection zone.
2. Have the walker stand well outside the detection field and start the Magnitude plot.
3. Have the walker do a very slow crossing at the start point. The walker must cross the detection field perpendicular to the cable path.
4. Stop the walker when the signal reaches the peak.

| | |
|---|---|
| **Note** | There is always a delay between the actual UCM reading and when the walker is informed to stop. Have the walker recross the detection field very slowly to confirm the location of the peak response. |

5. After the second crossing have the walker mark the centerline with the paint.
6. Have the walker move outside the detection field and proceed down the cable.
7. Repeat the crossings at 10 m intervals over straight cable sections and at 2 m intervals around corners, marking the ground at each crossing point.
8. Once you have marked the ground over the full length of cable, return to the start point and conduct a sensitivity profile (see OmniTrax calibration - Sensitivity Profile and Transmitter Power on page 197).

# 7 The Silver Network

## Silver Network overview

The Silver Network provides the communication backbone for Senstar's line of perimeter intrusion detection sensors and I/O devices. The Silver Network implements a point-to-point communication system using a ring topology.

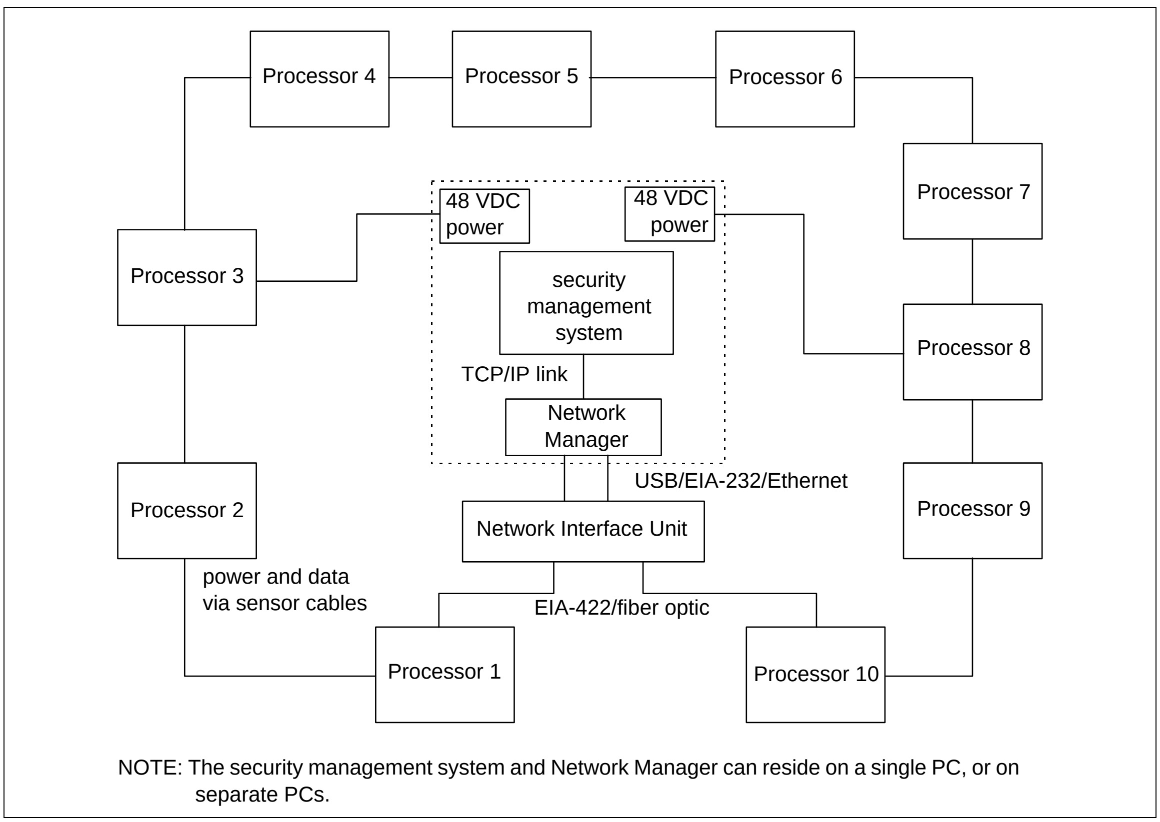



Figure 192: Silver Network block diagram

The Silver Network supports up to 60 security devices (network nodes). Each device integrates a regenerative repeater, which retimes the data before passing it on to the next node. This enables a widely distributed security network using full duplex communication over EIA-422 twisted-pair copper wire, multi-mode fiber optic cable, single-mode fiber optic cable, or mixed media (copper/

fiber). In addition, the OmniTrax processor can use its sensor cables to carry both Silver Network data and 48 VDC network power between processors. Repeaters are available for the supported transmission media (excluding OmniTrax sensor cables) to double the maximum separation distance between network devices. Silver Network repeaters do not count as network nodes. The Silver Network uses a fixed data rate of 57.6 k bps, providing a fast alarm response time.

# Network components

## Silver Network Manager

The Network Managers (NM) handle the alarm data management for Senstar's proprietary security networks. The Network Manager is available either as a Windows Application on the Network Manager CD (kit # 00FG0200) or as a Windows Service on the Network Manager Suite CD (kit # 00FG0220). The Network Manager Service handles the alarm data management for the Silver, FiberPatrol, CCC, Crossfire, Sennet, and Starcom networks. Up to ten NMs can reside on one PC, with each controlling a Silver Network of up to 60 security devices.

The NM communicates with Security Management Systems via a TCP/IP link using the Network Manager Interface (NMI). For third party Security Management Systems, the third party organization is responsible for writing the software, which establishes communication to the Network Manager and implements the NMI. The Network Manager can reside on the same PC as the security management application to which it reports, or on another PC.

For redundant applications, two identical Network Managers are setup on two separate computers. The only difference in the setups is that one is configured as the primary and the other is configured as the standby. The two computers must be connected via Ethernet to work out the primary, standby arrangement. The primary NM communicates with the network devices and the security management application. If the primary NM goes off-line, the standby NM becomes the primary and takes over. When the original primary NM goes back on-line, it functions in standby mode.

## Network Interface Unit

The Network Interface Unit (NIU) is a gateway device, which translates the alarm data messages passing between the NM and the network devices. The connection between the NIU and the NM can be via Ethernet link, or EIA-232, or USB (combinations cannot be used). The connection between the NIU and the Silver Network based devices can be via EIA-422 copper wire and fiber optic cable. There are two versions of the NIU, 00EM0200 provides multi-mode fiber optic communication and 00EM0201 provides single mode. The NIU includes two communication channels, Side A and Side B. Messages from the NM are sent over both channels by the NM, switching channels between polls. Both communication channels should be connected to the Silver Network based devices. Ideally, the network devices are laid out in a closed loop, with each end of the loop connected to one NIU channel. Using this layout means a single break in the com-link, or the failure of one processor, will not affect communications with the remaining processors.

| | |
|---|---|
| **Note** | The second generation single-mode fiber optic NIU (00EM0200-002) is not compatible with the first generation single-mode NIU (00EM0200-001) or the first generation single-mode NICs (00BA0303-001, 00BA0305-001). |

The NIU operates on 12 to 48 VDC. The enclosure occupies 1 RU in an EIA-19 in. equipment rack. Desk-top mounting is also possible. The front panel includes a removable terminal block for a Form C relay output, which is used to report equipment/communication failure. There are LEDs for power, and communications (all modes) and a USB port is provided for the connection of the UCM (to configure the device). The rear panel includes a two-pin power input (removable terminal block) and a ground screw terminal (the NIU requires a low resistance earth ground connection). There are two mirrored communication channels (Side A and Side B). Each communication channel includes the following:

- for the NM - Ethernet (RJ45), EIA-232 (DB9-F), USB
- for the Silver Network - EIA-422 removable terminal block, ST connectors for fiber optic cable

There is also a DB37-F connector on the rear panel (reserved for future use).

| | |
|---|---|
| **Note** | You can use only one of the communication options between the NIU and the NM for both channels (Ethernet OR EIA-232 OR USB) - no combinations.<br>You can use either one of the communication options for each channel between the NIU and the Silver Network devices (e.g., EIA-422 on Side A and fiber optic on Side B) - combinations can be used.<br>The NIU cannot communicate with OmniTrax processors via the sensor cables. An EIA-422, or fiber optic link must be established between the NIU and one or more processors. |

## Network Interface Card

Each processor communicating on the Silver Network requires a Network Interface Card (NIC), which piggybacks onto the processor card via a 40-pin header. The NIC manages all network communications for the processor and includes a regenerative repeater, which reshapes and retimes the network data. There are five variants of the NIC available. Each performs the same functions for the processor, but is specific to the transmission media.

| | |
|---|---|
| **Note** | OmniTrax processors, which communicate over the sensor cables require an NIC.<br>Do not use a mixed media NIC to connect an NIU to an OmniTrax processor, which will communicate with other processors over the sensor cables. In this case, use an 01, 02 or 03 variant (single media NIC). |

The network interface card supports the following network media:

- 00BA0301 - Multi-mode fiber optic cable
- 00BA0302 - EIA-422 copper wire
- 00BA0303 - Single-mode fiber optic cable
- 00BA0304 - Mixed media, EIA-422 and multi-mode fiber
- 00BA0305 - Mixed media, EIA-422 and single-mode fiber

| | |
|---|---|
| **Note** | The second generation single-mode fiber optic NICs (00BA0303-002, 00BA0305-002) are not compatible with first generation single-mode NICs (00BA0303-001, 00BA0305-001) or the first generation single-mode NIU (00EM0200-001). |

# OmniTrax sensor

The OmniTrax sensor is a covert, high-security system, that uses a set of buried cables to create a volumetric detection field around a perimeter. Each processor can monitor two independent sensor cable sets, each with up to 400 m of detecting cable. OmniTrax provides precise target location, and each processor supports up to 50 distinct software-defined sensor zones. In addition to the standard network communication media, the OmniTrax processor can use its sensor cables to carry the Silver Network data.

# XField sensor

The XField sensor system is a terrain following, volumetric perimeter intrusion detection system. XField creates an electrostatic detection field around parallel transmit and receive wires, which are mounted on fences or free-standing posts. Each processor monitors two independent 4-wire, or 5-wire, sensor zones up to 150 m in length. The two zones can be stacked to create a single 8, 9, or 10-wire, sensor zone.

# FlexZone sensor

The FlexZone fence protection system uses loose-tube coaxial sensor cables mounted on a fence to detect vibrations caused by climbing, cutting, lifting, or otherwise disturbing the fence fabric. Each FlexZone processor can monitor the activity from one or two sensor cables, each up to 300 m (984 ft.) long, and will report the alarm status of up to 60 software defined sensor zones. FlexZone will locate the source of a disturbance to within ± 3 m (10 ft.). A single pass of sensor cable can protect a high quality chain-link fence up to 4.3 m (14 ft.) high. There are two models of the FlexZone processor available. The FlexZone-4 processor supports up to 4 software defined alarm zones, but does not report target location. The FlexZone-60 processor supports up to 60 distinct alarm zones and accurately locates targets.

# FlexPS sensor

The FlexPS fence protection system uses microphonic sensor cable mounted on a fence, to detect attempts to cut, climb, lift, or otherwise disturb the fence fabric. FlexPS provides two independent sensor zones, with each zone up to 300 m (984 ft.) in length. A single pass of sensor cable will protect fences up to 2.5 m (8 ft.) high. Additional passes of sensor cable are recommended for fences that are higher than 2.5 m. FlexPS includes 4 output relays and 2 auxiliary device inputs which are available to the host security management system.

# Senstar LM100 sensor

The Senstar LM100 intelligent perimeter lighting and sensing solution combines LED lighting with a vibration detection sensor. The system is comprised of a distributed set of LM100 luminaires, which include the high-intensity LED lights and the accelerometer-based vibration detecting sensor, a gateway device that processes the signals from the luminaires, and a luminaire AP (access point) that provides an RS-485 half-duplex connection between the RF-based luminaires and the gateway. The Senstar LM100 luminaires are typically mounted on the perimeter fence, but can also be mounted on walls or other surfaces. They communicate over a proprietary wireless mesh network transmitting status information and receiving control point commands from the gateway via the hard-wired connection to the AP. The gateway provides the user interface to the distributed luminaires as well as the interface between the sensors and a security management system. The Senstar LM100 gateway supports up to 100 luminaires including the luminaire AP.

# FiberPatrol FP400 sensor

The FiberPatrol FP400 is a fence-mounted perimeter intrusion detection system that detects intruders using a fiber optic sensor cable that is attached to the fence. The FP400 processor uses interferometry technology to measure the strain in the sensor cable caused by climbing, cutting, lifting, or otherwise disturbing the fence fabric. The processor monitors four independent sensor zones, each with up to 300 m (984 ft.) of sensor cable. Up to 20 km of non-detecting lead-in cable carries the signals between the processor and the alarm zones.

# 16 I/16 O processor

The 16I/16O processor provides 16 analog inputs and 16 relay outputs, which are available to the host security management system through the Silver Network. A network interface card (NIC) must be installed on J1, the 40 pin socket on the 16I/16O card. The 16I/16O processor collects and distributes alarm status information and control point data for auxiliary security devices via the Silver Network. The 16 inputs collect status information from auxiliary security devices. The processor reports the devices' status to the Silver Network Manager, which in turn reports to the host security management system. The host system presents the alarm data to an operator. The security management system operates the 16 relays, as output control points (e.g., to activate lights, doors, sirens, CCTV equipment, etc.). The 16I/O processor operates on 12 to 48 VDC, and comes in an outdoor rated weatherproof enclosure.

# UltraWave microwave sensor

The UltraWave microwave detection sensor is designed for exterior perimeter intrusion detection applications. UltraWave consists of a microwave transmitter and receiver, which detect motion in a defined area. The transmitter emits microwave energy, which the receiver constantly monitors and measures. Any motion in the detection zone causes a variation in the received signal. The signal variations are detected and processed by the receiver, which declares a sensor alarm when the received signal meets the criteria for a valid target.

# UltraLink scalable I/O system

The UltraLink I/O system provides up to 272 I/O points for the host security management system (SMS) through the Silver Network™ Manager (NM). The UltraLink processor module includes 8 voltage sensing inputs and 8 relay outputs. Up to 8 expansion modules can be connected to the processor in any combination, to provide an additional 256 I/O points. There are three UltraLink expansion modules available. The UltraLink input module provides 32 voltage sensing inputs, the relay module provides 32 relay outputs, and the output module provides 32 open collector outputs. Each UltraLink module is comprised of a circuit card assembly (card) and a DIN rail mountable card holder.

The UltraLink I/O processor can be configured to operate in Network Manager Mode (NM Mode). In NM Mode, the UltraLink I/O processor acts as the Network Manager, providing alarm outputs for a connected network of up to eight Silver devices. In NM Mode, the Silver devices do not require a connection to a PC running Silver Network Manager software. The supported Silver devices include OmniTrax, FlexZone, FlexPS, UltraWave, XField and XField LT. Sensor alarms and supervision conditions are assigned to UltraLink I/O outputs (relay or open collector). When an alarm occurs on a connected sensor, the corresponding UltraLink I/O output is activated. If Multiple alarm conditions are assigned to a single UltraLink I/O output, the conditions are OR'd. A maximum of four output expansion modules can be used in NM Mode enabling up to 136 distinct output points (for additional details see NM Mode on page 249).

# Universal Configuration Module

The Universal Configuration Module (UCM) is a Windows-based software application that performs the configuration and calibration functions for OmniTrax and all other Silver Network compatible devices. The UCM also provides diagnostic, monitoring and maintenance functions for each device. The UCM can reside on the same PC as the NM, or can be located on a separate computer. The UCM connects to the NM using TCP/IP, and through the NM, can communicate with any device on the Silver Network without interrupting other network functions. It can also connect directly to each Silver-based device via USB.

# Silver Network repeater

The repeater amplifies, reshapes and retimes the data signals on the Silver Network. There are three variants of the repeater, each is specific to a type of transmission media. The repeater doubles the maximum separation distance between network devices. The three variants include EIA-422 copper wire, multi-mode fiber optic cable, and mixed media EIA-422 + multi-mode fiber. The repeater is housed in an aluminum enclosure and includes removable terminal blocks for copper wire connections. The fiber optic variants include ST connectors. The device accepts 12 to 48 VDC, consumes 2 W maximum, and includes an intelligent charging circuit for the backup battery. Indicator LEDs are provided for DC power, battery power, and network communications.

# Network configuration

The recommended configuration for a Silver Network is a closed-loop with each end of the loop connected to a communication channel on the NIU. There should also be two connections between the NIU and the NM. This closed-loop arrangement takes advantage of Silver's redundant communication capabilities. However, it is possible to use a linear configuration with a single processor connected to the NIU. The main drawback to this configuration is that a single break in the com-link, or a failed processor, will interrupt communication to all processors further down the line.

| | |
|---|---|
| **Note** | The NM supports up to four independent network loops. Each loop requires an NIU, and additional ports are required in the host PC. A Silver Network using additional network loops is limited to 60 network devices. |

**Silver Network specifications**

- Data rate - fixed 57.6 k bps
- Maximum 60 devices spread over up to 4 independent network loops
- Two communication channels (Side A, Side B)
- Response time - 1.0 second, or less from alarm source to Network Manager (per loop)
- Transmission media/maximum separation distances between processors:
  - OmniTrax OC2 sensor cable - approximately 800 m (2625 ft.) for continuous detection
  - OmniTrax SC1/SC2 sensor cable - approximately 400 m (1312 ft.) for continuous detection
  - EIA-422 copper wire - 1.2 km (0.75 mi.)
  - Multi-mode fiber optic cable - 2.2 km (1.4 mi.) - 2 fibers per channel
  - Single-mode fiber optic cable - 10 km (6.2 mi.) - 2 fibers per channel

| | |
|---|---|
| **Note** | The maximum separation distances require sound installation practices and high quality communication cables.<br>Senstar recommends the use of Belden 9729 or equivalent data cable for EIA-422, 62.5/125 multi-mode fiber optic cable and 9/125 single mode fiber optic cable. |

**OmniTrax network communication and synchronization options**

Silver Network based OmniTrax processors have twelve options available for network communications and processor synchronization. You select the communication/sync mode via the UCM, under the Network Cfig tab. When you select an option, a corresponding diagram is displayed below the selection. Figure 193: includes the UCM selectable communication/sync options along with the diagrams and descriptions.

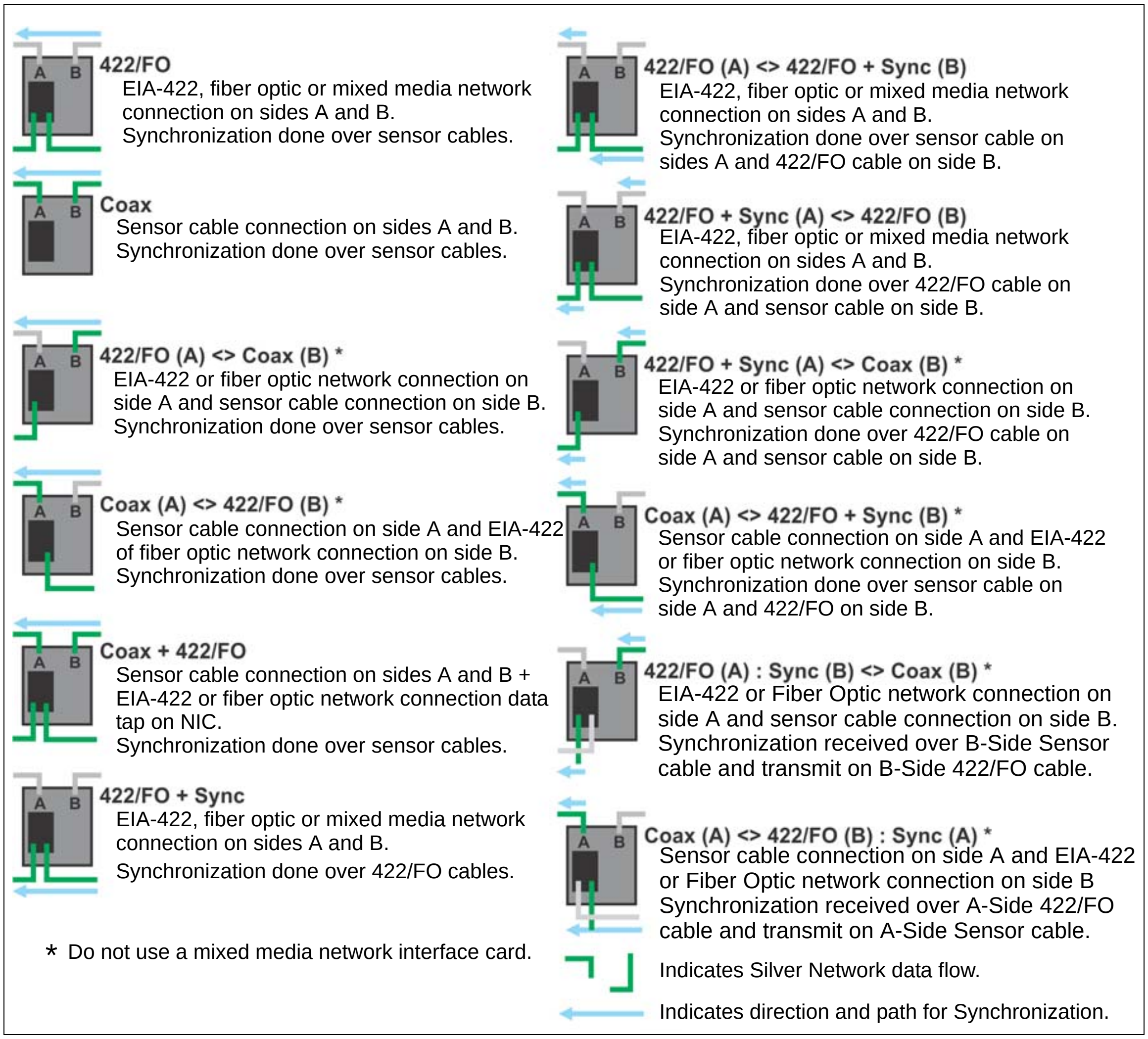



Figure 193: Network configuration and synchronization settings

| **Note** | The sensor cable + 422/FO data tap does not create a network branch. A ring topology is used as illustrated in Figure 195:. |
|---|---|

Figure 194: shows the processor to processor network connections for the EIA-422, sensor cable and fiber optic communication options. The arrows indicate the direction of data flow:

| EIA-422 | Sensor Cable | Fiber Optic |
|---|---|---|
| TXA+ → RXB+ | TXA → TXB | TXA → RXB |
| TXA- → RXB- | RXA ← RXB | RXA ← TXB |
| RXA+ ← TXB+ | | |
| RXA- ← TXB- | | |
| GND (use single point grounding, connect only one side of shield) | | |

Figure 194: Silver Network data flow diagrams

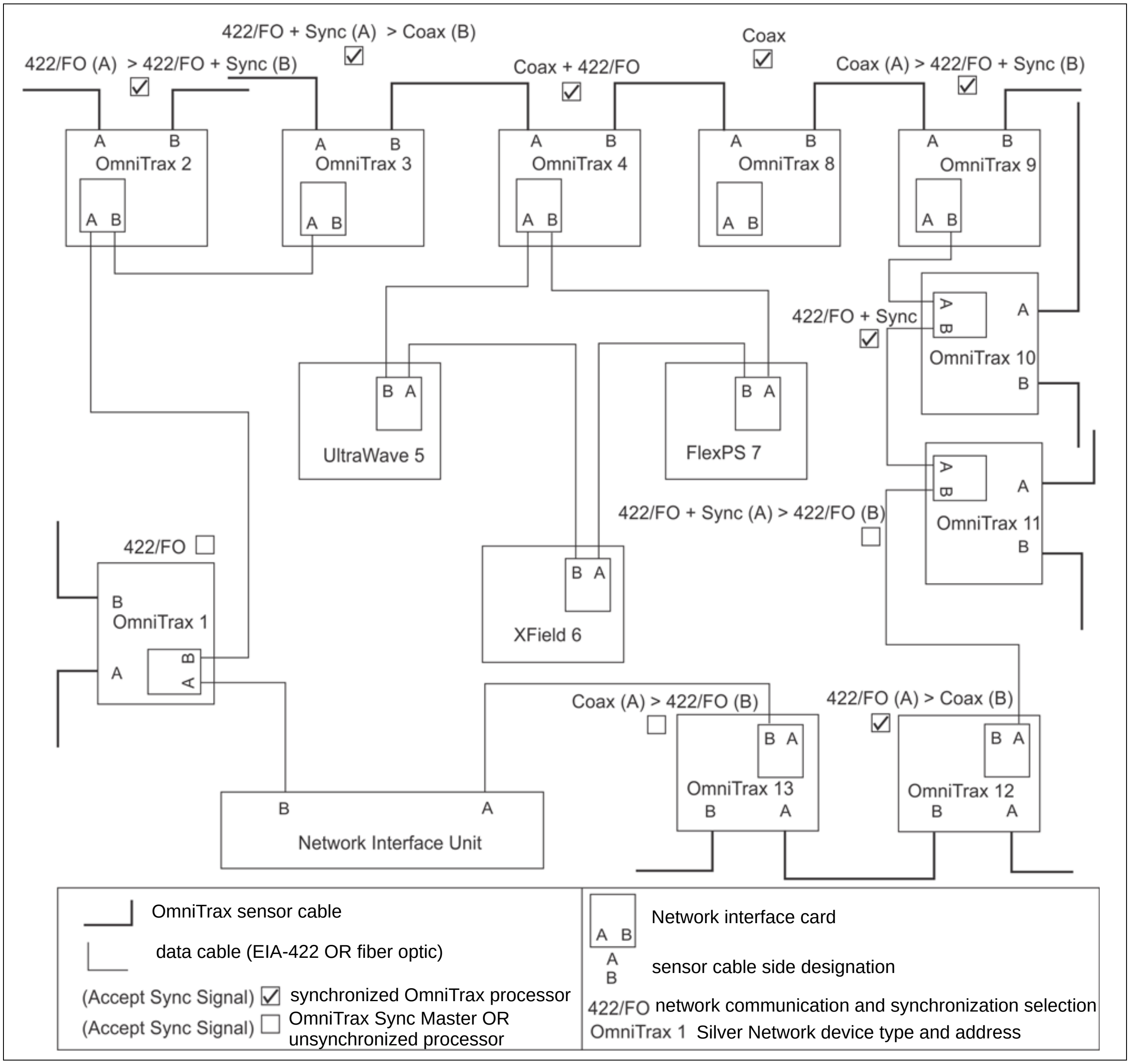



Figure 195: Silver Network data communication and processor synchronization example

Figure 195: illustrates a Silver Network comprised of 10 OmniTrax processors, an UltraWave microwave sensor, an XField electrostatic field sensor and a FlexPS fence disturbance sensor. Each OmniTrax processor uses a different communication/sync setting, based on their location and connection details.

OmniTrax 1 is isolated and does not require synchronization with the other processors. OmniTrax 11 is the sync master for OmniTrax processors 2, 3, 4, 8, 9 and 10. OmniTrax 12 and 13 are also isolated from the other processors and need only be synchronized as a pair with OmniTrax 13 serving as the sync master for OmniTrax 12. The UltraWave, XField and FlexPS processors join the network loop through an NIC data tap at OmniTrax 4.

### Connection diagrams

The following connection diagrams illustrate EIA-422, sensor cable (coax), and fiber optic based Silver Networks.

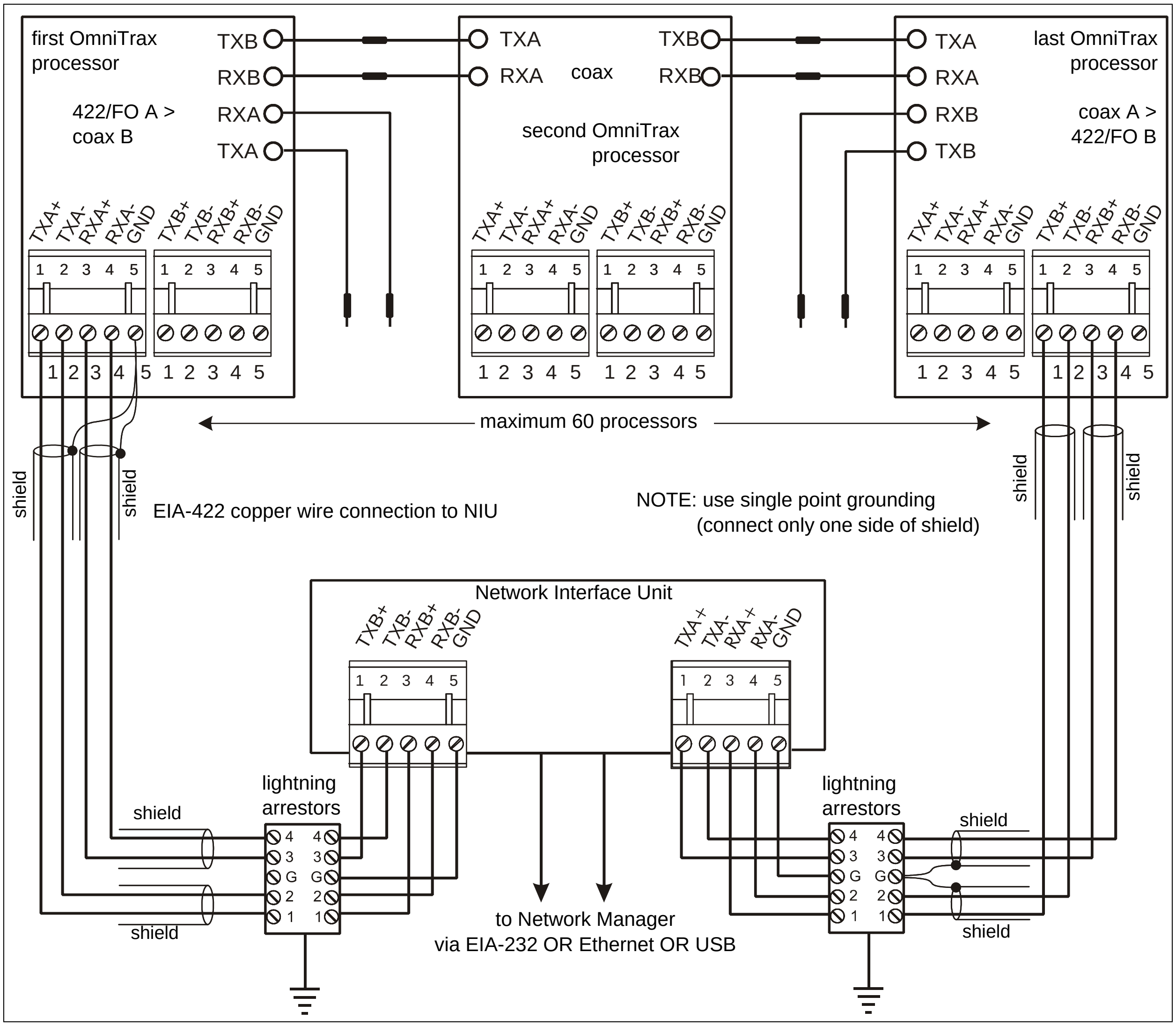



Figure 196: OmniTrax Silver Network wiring - EIA-422 & sensor cables

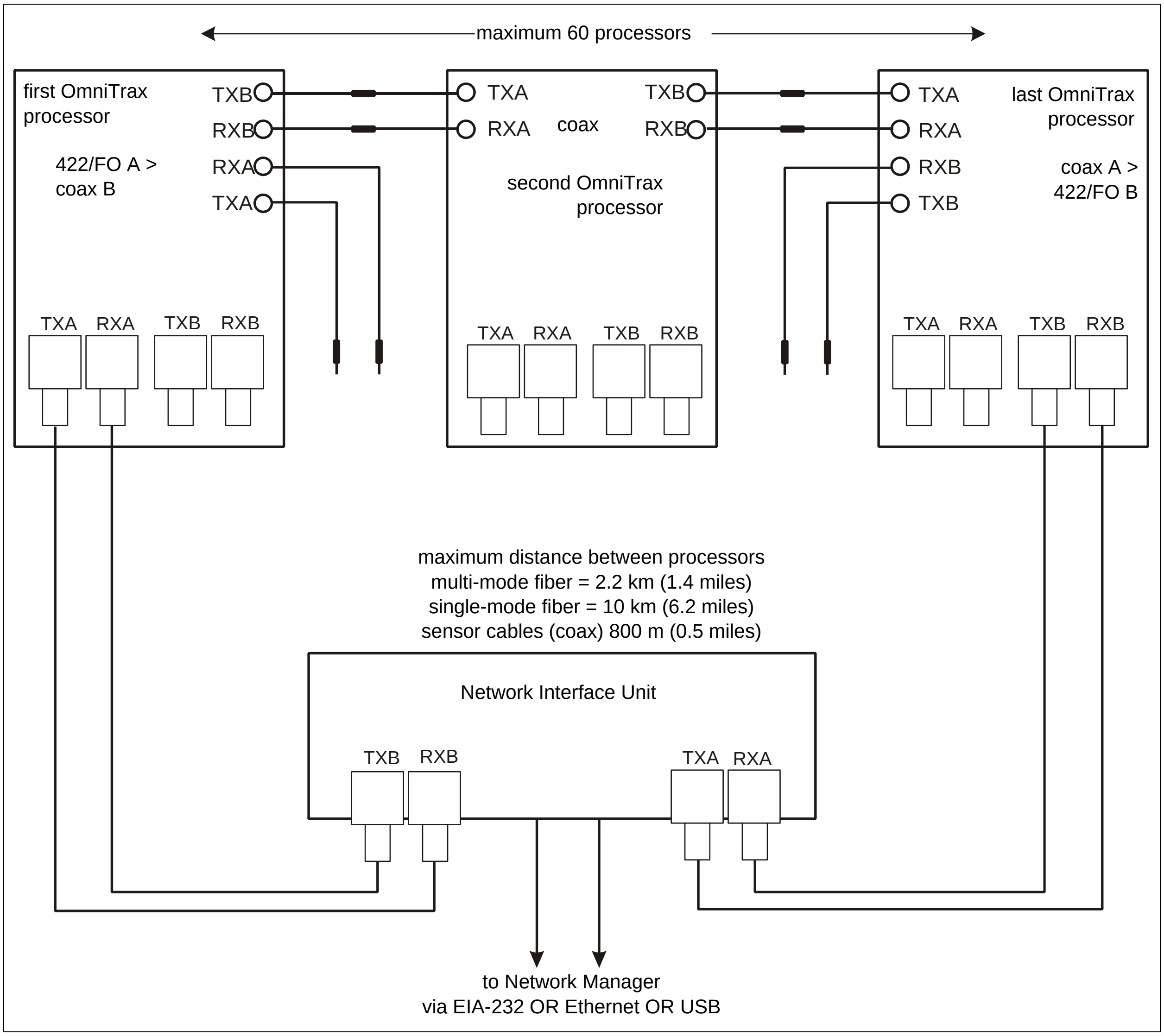



Figure 197: OmniTrax Silver Network wiring - fiber optic & sensor cables

The following figures illustrate Silver Networks using the recommended closed loop configurations.

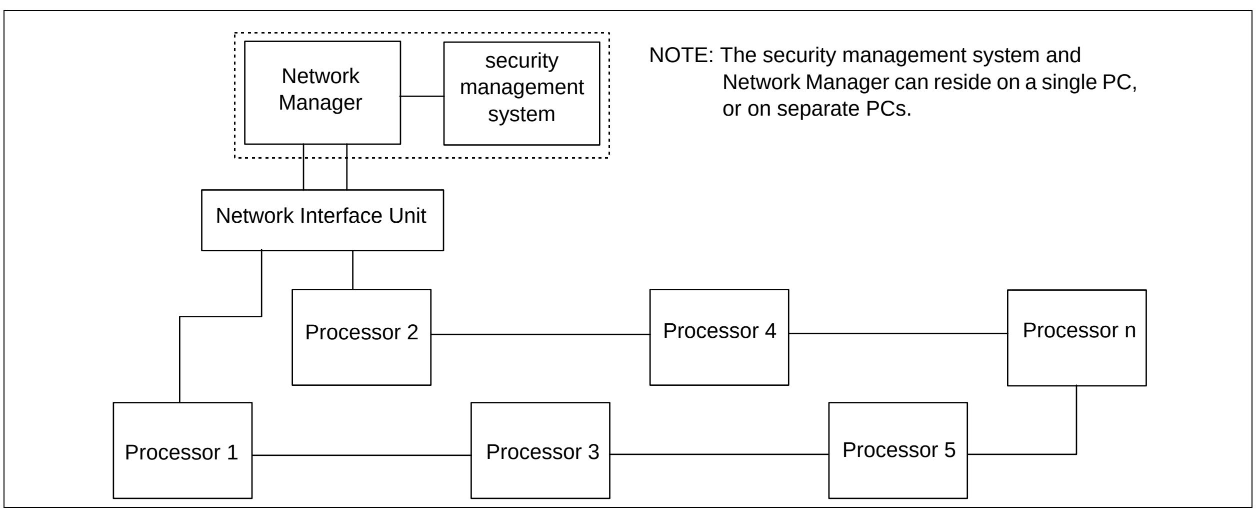



Figure 198: Closed loop configuration (leap frog)

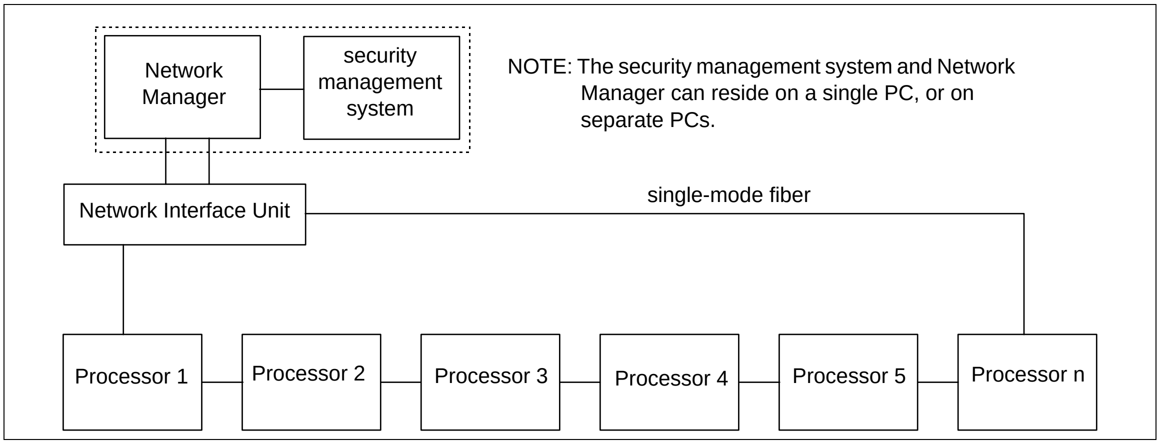



Figure 199: Closed loop configuration (home run)

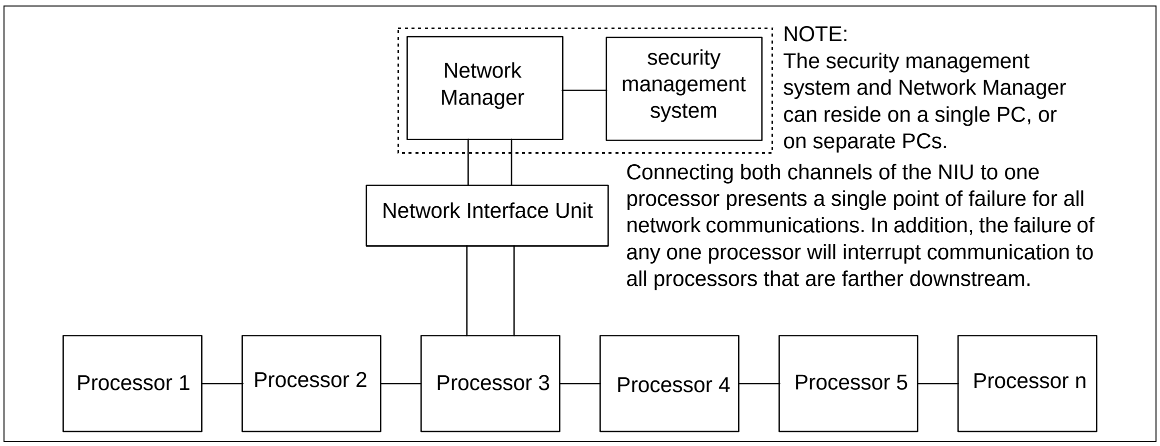



Figure 200: Linear configuration

A Silver Network can include up to four independent network loops with a maximum of 60 processors. Each loop requires its own NIU and the Network Manager PC must support the connection of four NIUs. Each NIU must use the same communication option to connect to the NM PC. Figure 201: illustrates a Silver Network using four independent communication loops.

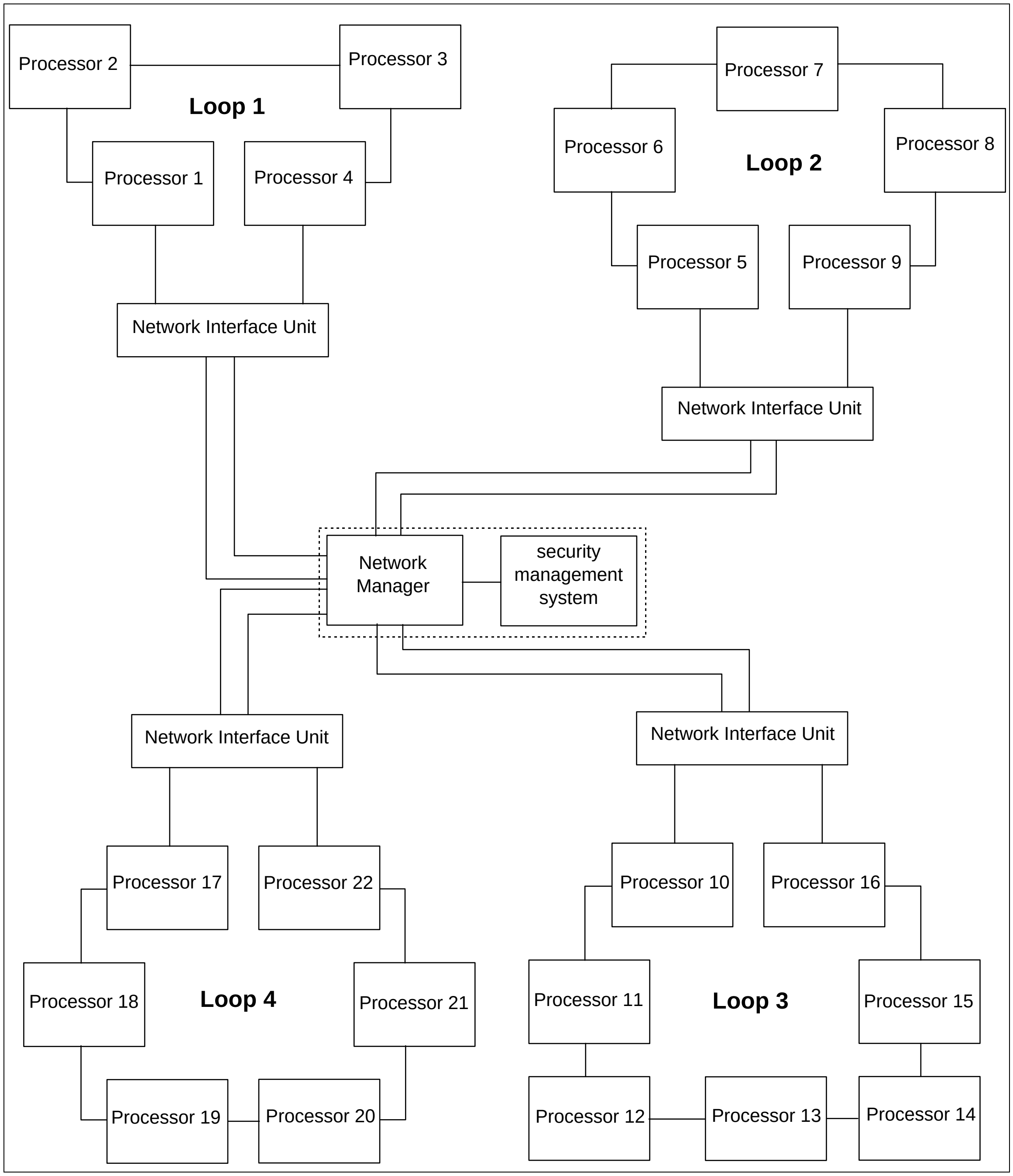



Figure 201: Four loop configuration

# Redundant configuration

For full redundancy, you require two NMs on two PCs connected to two NIUs. Each NIU is connected to a Silver Network of security devices, which are setup in a closed loop (see Figure 202:). The NMs are identical and use the same ID, with one NM specified as the primary. The two NMs are connected to two redundant security management applications, which are on separate PCs. In this setup, the failure of any single device (excluding processors) will result in the redundant device taking over, without the loss of data. The failure of any one processor will not affect the remaining processors in the network.

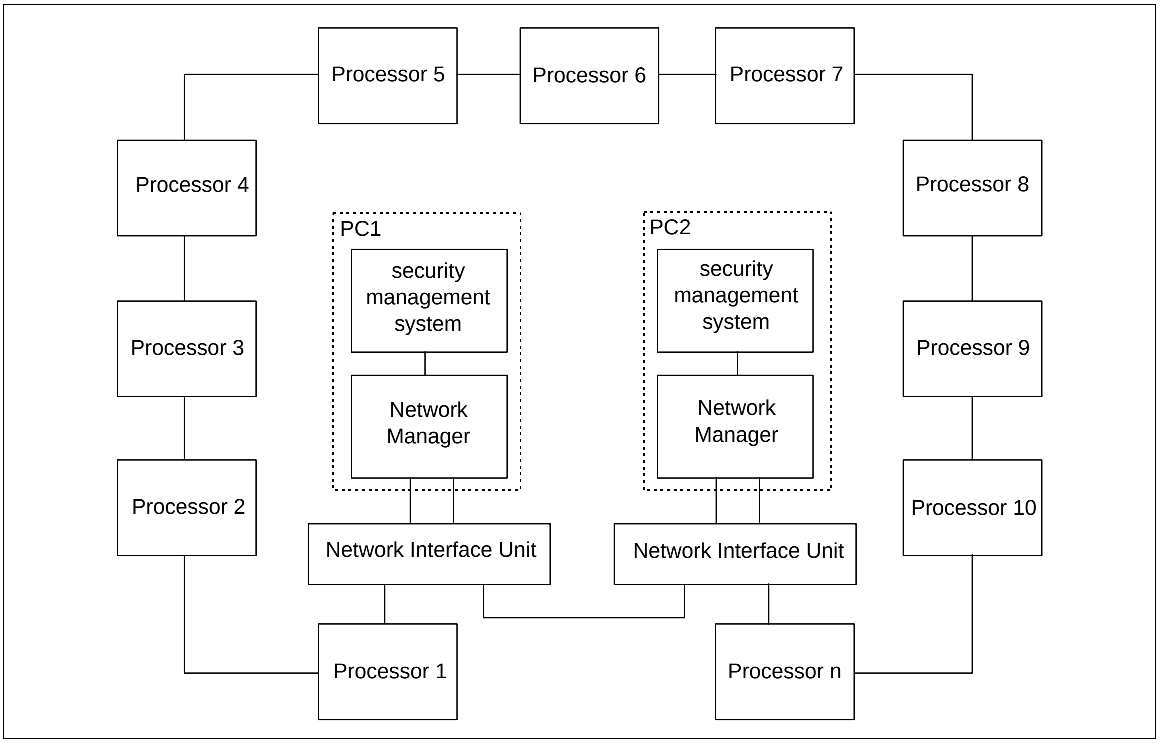



Figure 202: Redundant network setup

# Silver Network point assignments

| OmniTrax input point mapping | | | |
|---|---|---|---|
| **Point** | **Description** | **Point** | **Description** |
| **Diagnostic alarms** | | | |
| 1 | Enclosure tamper | 9 | 2 V 5 / 1 V 2 rail fault |
| 2 | Program flash error | 10 | Battery fault |
| 3 | RAM error | 11 | Input power fail |
| 4 | Processor boot fail | **Cable faults** | |
| 5 | Option card fail | 12 | Side A cable supervision |
| 6 | 8 V rail fault | 13 | Side B cable supervision |
| 7 | 3 V 3 rail fault | 14 | Side A interference (jam) |
| 8 | +5 V / - 5 V rail fault | 15 | Side B interference (jam) |
| **Point** | **Description** | **Point** | **Description** |
| **Sensor alarms** | | | |
| 1 | AUX input 1 (bit 0 alarm, bit 1 supervision) | 7 | Option card input Opt5 (bit 0 alarm, bit 1 supervision) |
| 2 | AUX input 2 (bit 0 alarm, bit 1 supervision) | 8 | Option card input Opt6 (bit 0 alarm, bit 1 supervision) |
| 3 | Option card input Opt1 (bit 0 alarm, bit 1 supervision) | 9 | Option card input Opt7 (bit 0 alarm, bit 1 supervision) |
| 4 | Option card input Opt2 (bit 0 alarm, bit 1 supervision) | 10 | Option card input Opt8 (bit 0 alarm, bit 1 supervision) |
| 5 | Option card input Opt3 (bit 0 alarm, bit 1 supervision) | 11 to 60 | Cable zone #n (bit 0 alarm, bit 1 unused) |
| 6 | Option card input Opt4 (bit 0 alarm, bit 1 supervision) | | |

| OmniTrax output point mapping (controls) | | | |
|---|---|---|---|
| **Point** | **Description** | **Point** | **Description** |
| 1 | Processor relay 1 | 7 | Option card relay Opt3 |
| 2 | Processor relay 2 | 8 | Option card relay Opt4 |
| 3 | Processor relay 3 | 9 | Option card relay Opt5 |
| 4 | Processor relay 4 | 10 | Option card relay Opt6 |
| 5 | Option card relay Opt1 | 11 | Option card relay Opt7 |
| 6 | Option card relay Opt2 | 12 | Option card relay Opt8 |

# StarNeT 1000 point assignments

| **OmniTrax input point mapping** | | | |
|---|---|---|---|
| **Point** | **Description** | **Point** | **Description** |
| **Auxiliary input alarms** | | | |
| 0 | Aux alarm 1 (processor 1) | 5 | Aux alarm 6 (input card 4) |
| 1 | Aux alarm 2 (processor 2) | 6 | Aux alarm 7 (input card 5) |
| 2 | Aux alarm 3 (input card 1) | 7 | Aux alarm 8 (input card 6) |
| 3 | Aux alarm 4 (input card 2) | 8 | Aux alarm 9 (input card 7) |
| 4 | Aux alarm 5 (input card 3) | 9 | Aux alarm 10 (input card 8) |
| **Auxiliary input tamper alarms** | | | |
| 16 | Aux tamper 1 (processor 1) | 21 | Aux tamper 6 (input card 4) |
| 17 | Aux tamper 2 (processor 2) | 22 | Aux tamper 7 (input card 5) |
| 18 | Aux tamper 3 (input card 1) | 23 | Aux tamper 8 (input card 6) |
| 19 | Aux tamper 4 (input card 2) | 24 | Aux tamper 9 (input card 7) |
| 20 | Aux tamper 5 (input card 3) | 25 | Aux tamper 10 (input card 8) |
| **Point** | **Description** | **Point** | **Description** |
| **Diagnostic alarms** | | | |
| 14 | processor fail (OR of bits 33 to 40) | 15 | processor warn (OR of bits 41 to 46) |
| 32 | enclosure tamper | 40 | 2V5/1V2 rail fault |
| 33 | program flash error | 41 | battery fault |
| 34 | RAM error | 42 | input power fault |
| 35 | processor boot fail | 43 | Side A supervision fault |
| 36 | option card fault | 44 | Side B supervision fault |
| 37 | 8V rail fault | 45 | Side A interference fault |
| 38 | 3V3 rail fault | 46 | Side B interference fault |
| 39 | +5V/-5V rail fault | | |
| **Point** | **Description** | | |
| **Sensor alarms** | | | |
| 51 to 100 | Zone 1 to Zone 50 sensor alarms | | |

| **OmniTrax 0utput point mapping (controls)** | | | |
|---|---|---|---|
| **Point** | **Description** | **Point** | **Description** |
| 0 | Aux control 1 (Processor relay 1) | 6 | Aux control 7 (Output card relay 3) |
| 1 | Aux control 2 (Processor relay 2) | 7 | Aux control 8 (Output card relay 4) |
| 2 | Aux control 3 (Processor relay 3) | 8 | Aux control 9 (Output card relay 5) |
| 3 | Aux control 4 (Processor relay 4) | 9 | Aux control 10 (Output card relay 6) |
| 4 | Aux control 5 (Output card relay 1) | 10 | Aux control 11 (Output card relay 7) |
| 5 | Aux control 6 (Output card relay 2) | 11 | Aux control 12 (Output card relay 8) |

# a System component list

| Component | Part Number | Description |
|---|---|---|
| processor and enclosure | A4EM0101 | OmniTrax processor mounted in an aluminum CSA Type 4 (NEMA 4/IP 66 equivalent) enclosure, provides electronic processing for two sensor cable sets each with up to 400 m (1312 ft.) detecting cable, includes no option cards |
| processor card on mounting plate | A4EM0301 | replacement OmniTrax processor on metal backplate |
| **OmniTrax processor auxiliary cards** (an NIC is required for each processor using network communications) | | |
| Network Interface Card (multi-mode fiber optic) | 00BA0301 | Fiber optic NIC, mounts on processor, supports two multi-mode 62.5/125 fiber optic data paths (4 fibers), mounting hardware included |
| Network Interface Card (EIA-422 copper wire) | 00BA0302 | EIA-422 copper wire NIC, mounts on processor, supports two EIA-422 (4-wire) data lines, mounting hardware included |
| Network Interface Card (single mode fiber optic) | 00BA0303 | Fiber optic NIC, mounts on processor, supports two single mode fiber optic data paths (4 fibers), mounting hardware included |
| Network Interface Card (EIA-422/ multi- mode F.O.) | 00BA0304 | Side A EIA-422 copper wire, Side B multi-mode fiber optic, NIC, mounts on processor, supports one EIA-422 (4-wire) data line and one multi-mode fiber optic data line, mounting hardware included |
| Network Interface Card (EIA-422/single mode fiber optic) | 00BA0305 | Side A EIA-422 copper wire, Side B single mode fiber optic, NIC, mounts on processor, supports one EIA-422 (4-wire) data line and one single mode fiber optic data line, mounting hardware included |
| Relay Output Card | 00BA0400 | Relay output card, mounts on processor, 8 Form C relay outputs rated 30 VAC/VDC @ 1.0 A max, non-inductive load, mounting hardware included, maximum one ROC per processor (cannot be used with UIC) |
| Universal Input Card | 00BA1200 | Auxiliary input card, mounts on processor, 8 inputs, mounting hardware included, maximum one UIC per processor (cannot be used with ROC) |
| **OmniTrax processor enclosures** | | |
| Enclosure | A4MA0101 | OmniTrax processor replacement enclosure, aluminum, CSA Type 4 (equivalent to NEMA 4/IP 66), includes all internal interconnecting cables |
| Telecom style enclosure | A4MA0200 | Telecom style protective enclosure for above ground field mounting of processor enclosure, includes tamper switch and wiring harness (A4HA0100), mounting brackets, mounting hardware and ground stakes, removable, lockable cover (lock not included), light green enamel, 42.5 x 27.3 x 98.4 cm (16 ¾ x 10 ¾ x 38 ¾ in) |

| Component | Part Number | Description |
|---|---|---|
| Enclosure mounting clamp | C7SP0500 | Enclosure mounting clamp, for post-mounting the 48 VDC network power supply (P/N A4EM0200) post size 5 to 12 cm (2 to 4 ¾ in.) O.D., (order 2 clamps per power supply) |
| Mounting bracket for Perimitrax telecom enclosure | A4KT0400 | Replacement bracket and hardware for installing an OmniTrax processor in an existing Perimitrax telecom style enclosure |
| Telecom enclosure tamper harness | A4HA0100 | Wiring harness to connect the telecom enclosure tamper switch to the OmniTrax processor |
| **OmniTrax power supply options** | | |
| 12 VDC standalone power supply, no enclosure | C7EM0503 | Standalone single processor DC power supply, 115/230 VAC, 50/60 Hz input, 12 VDC 80 W output, without enclosure |
| 48 VDC Network power supply in weatherproof enclosure | A4EM0200 | Network power supply, 115/230 VAC, 50/60 Hz input, 48 VDC 100 W output, mounted in a CSA Type 4 (Equivalent to NEMA 4/IP 66) painted aluminum enclosure 26 x 23 x 13 cm (11 x 9 x 5 in.) |
| replacement core for Network power supply | GP0141 | Power supply core for 48 VDC 100 W output, network power supply |
| 12 VDC auxiliary device power supply module | 00EM0400 | Auxiliary device power supply module, 12 VDC @ 150 mA max. regulated output power, mounts on door inside OmniTrax enclosure, for use with processors receiving 48 VDC network power |
| optional 6 VDC local battery kit | 00KT0900 | 6 VDC rechargeable battery, mounting bracket and hardware, battery harness and fuse, mounts inside the enclosure on the door |
| 6 VDC battery | GE0487 | 6 VDC 5 Ah (nominal) replacement backup battery for kit 00KT0900 |
| optional extended run-time battery | 00KT0100<br>E0414 | 6 Ah gel-cell battery (minimum 4 hours operation)<br>2.9 Ah gel-cell battery |
| **OmniTrax sensor cable sets/decouplers/terminators** | | |
| SC1 sensor cable | A3FG0201 | 50 m (164 ft.) SC1 single cable with 20 m (66 ft.) integrated lead-in, 4 TNC connectors, 10 ferrite beads, heatshrink |
| SC1 sensor cable | A3FG0202 | 100 m (328 ft.) SC1 single cable with 20 m (66 ft.) integrated lead-in, 4 TNC connectors, 10 ferrite beads, heatshrink |
| SC1 sensor cable | A3FG0204 | 150 m (492 ft.) SC1 single cable with 20 m (66 ft.) integrated lead-in, 4 TNC connectors, 10 ferrite beads, heatshrink |
| SC1 sensor cable | A3FG0211 | 200 m (656 ft.) SC1 single cable with 20 m (66 ft.) integrated lead-in, 4 TNC connectors, 10 ferrite beads, heatshrink |
| SC1 standalone decoupler kit | A3KT0601 | SC1 cable standalone decoupler includes 2 standalone decouplers and heatshrink, passes data, blocks DC power |
| SC1 network decoupler kit | A3KT0701 | SC1 cable network decoupler includes 2 network decouplers and heatshrink, passes data and DC power |
| SC1 loopback termination kit (legacy component) | A4KT0501 | SC1 loopback termination kit includes 4 m loopback cable, 2 standalone decouplers, 2 TNC connectors, 10 ferrite beads and heatshrink, terminates detection field and enables processor supervision of sensor cable at the end of an open SC1 perimeter |
| SC1 terminator kit | A4KT1301 | SC1 terminator cable assy. terminates detection field and enables sensor cable supervision (includes power blocking decouplers and heatshrink) |
| bulkhead connector dust caps | GT0944-MNC | Screw-on dust cap to protect unused cable connectors on processor enclosure (2 required per cable set) |
| SC2 sensor cable | A3FG0301 | 50 m (164 ft.) SC2 two cable set with 20 m (66 ft.) integrated lead-in, 4 TNC connectors, 20 ferrite beads, heatshrink |

| Component | Part Number | Description |
|---|---|---|
| SC2 sensor cable | A3FG0302 | 100 m (328 ft.) SC2 two cable set with 20 m (66 ft.) integrated lead-in, 4 TNC connectors, 20 ferrite beads, heatshrink |
| SC2 sensor cable | A3FG0304 | 150 m (492 ft.) SC2 two cable set with 20 m (66 ft.) integrated lead-in, 4 TNC connectors, 20 ferrite beads, heatshrink |
| SC2 sensor cable | A3FG0311 | 200 m (656 ft.) SC2 two cable set with 20 m (66 ft.) integrated lead-in, 4 TNC connectors, 20 ferrite beads, heatshrink |
| OC2 network decoupler kit | A4KT1101 | OC2 cable network decoupler kit includes 2 decouplers and heatshrink, passes data and DC power |
| OC2 standalone decoupler kit | A4KT1102 | OC2 cable standalone decoupler kit includes 2 decouplers and heatshrink, passes data, blocks DC power |
| SC2 network decoupler kit | A4KT1201 | SC2 cable network decoupler kit includes 2 decouplers and heatshrink, passes data and DC power |
| SC2 standalone decoupler kit | A4KT1202 | SC2 cable standalone decoupler kit includes 2 decouplers and heatshrink, passes data, blocks DC power |
| OC2/SC2 standalone decoupler kit (legacy component) | A3KT0602 | OC2/SC2 cable standalone decoupler kit includes 2 decouplers and heatshrink, passes data, blocks DC power |
| OC2/SC2 network decoupler kit (legacy component) | A3KT0702 | OC2/SC2 cable network decoupler kit includes 2 decouplers and heatshrink, passes data and DC power |
| SC2 loopback termination kit (legacy component) | A4KT0502 | SC2 loopback termination kit, includes loopback cable assembly, 2 standalone decouplers, 2 TNC connectors, 20 ferrite beads, terminates detection field and enables processor supervision of sensor cable at the end of an open SC2 perimeter |
| SC2 terminator kit | A4KT1302 | SC2 terminator cable assy. terminates detection field and enables sensor cable supervision (includes power blocking decouplers and heatshrink) |
| OC2 sensor cable (300 m) | A4FG0121 | 300 m (984 ft.) dual OC2 sensor cable set with 20 m integral lead-in, includes ferrite beads and connectors (+2 spare connector kits) |
| OC2 sensor cable (400 m) | A4FG0120 | 400 m (1312 ft.) dual OC2 sensor cable set with 20 m integral lead-in, includes ferrite beads and connectors (+2 spare connector kits) |
| OC2 loopback termination kit (legacy component) | A4KT0505 | OC2 loopback cable termination kit, includes loopback cable assembly and heatshrink, terminates the detection field and enables processor supervision of sensor cable at the end of an open OC2 perimeter |
| OC2 terminator kit | A4KT1304 | OC2 terminator cable assy. terminates detection field and enables sensor cable supervision (includes power blocking decouplers and heatshrink) |
| SC1 Lead-in cable | A3CA0601 | 25 m (82 ft.) SC1 non-detecting lead-in cable |
| SC1 Lead-in cable | A3CA0602 | 50 m (164 ft.) SC1 non-detecting lead-in cable |
| SC1 Lead-in cable | A3CA0603 | 100 m (328 ft.) SC1 non-detecting lead-in cable |
| SC2 Lead-in cable | A3CA0701 | 25 m (82 ft.) SC2 non-detecting lead-in cable |
| SC2 Lead-in cable | A3CA0702 | 50 m (164 ft.) SC2 non-detecting lead-in cable |
| SC2 Lead-in cable | A3CA0703 | 100 m (328 ft.) SC2 non-detecting lead-in cable |
| OC2 non-detecting cable | A4CA0301 | 25 m (82 ft.) OC2 non-detecting cable (lead-in) |
| OC2 non-detecting cable | A4CA0302 | 50 m (164 ft.) OC2 non-detecting cable (lead-in) |
| OC2 non-detecting cable | A4CA0303 | 100 m (328 ft.) OC2 non-detecting cable (lead-in) |
| Ferrite beads (SC1) | A3KT0300 | Single cable ferrite bead kit (50) for SC1 sensor cable |

| Component | Part Number | Description |
|---|---|---|
| Ferrite beads (SC2) | A3KT0400 | Dual cable ferrite bead kit (50) for SC2 sensor cable |
| Ferrite beads (OC2) | A4KT0100 | Dual cable ferrite bead kit (50) for OC2 sensor cable |
| Cable installation tool kit (SC1, SC2) | A0KT1500 | Connector tool kit for SC1 and SC2 sensor cable connectors |
| Cable installation tool kit (OC2) | A4KT0200 | Connector tool kit for OC2 sensor cable connectors |
| Cable repair kit (SC1 cable) | A3KT0500 | SC1 cable repair kit - 48 cm (18 in.) lead-in cable, TNC connectors and heatshrink |
| Cable repair kit (SC2 cable) | A3KT0800 | SC2 cable repair kit - 2 X 48 cm (18 in.) lead-in cable, TNC connectors and heatshrink |
| Cable repair kit (OC2 cable, short) | A4KT0301 | OC2 short cable repair kit - 1 m (39 in.) lead-in cable, 8 TNC connectors, 4 F-F TNC adapters and heatshrink |
| Cable repair kit (OC2 cable, long) | A4KT0302 | OC2 long cable repair kit - 2 X 3 m (10 ft.) sensor cable, 8 TNC connectors, 4 F-F TNC adapters and heatshrink |
| SC1 splice kit | A4KT0601 | SC1 splice kit for splicing in a length of non-detecting cable, includes male and female connectors, ferrite beads, and heatshrink (cable sold separately) |
| SC2 splice kit | A4KT0602 | SC2 splice kit for splicing in non-detecting cable, includes male and female connectors, ferrite beads, and heatshrink (cable sold separately) |
| OC2 splice kit | A4KT0604 | OC2 splice kit for splicing in non-detecting cable, includes connectors, female TNC couplers, ferrite beads, and heatshrink (cable sold separately) |
| Cable connectors (SC1, SC2) | A0SP0700 | TNC male connector for SC1, SC2 cables |
| Cable connectors (OC2) | A4SP0900 | TNC male connector for OC 2 cables |
| Cable connectors | GT0395 | TNC F-F adapter |
| Cable connectors Sentrax adapter | GT0600 | TNC male to female ended adapter for Sentrax cables |
| Cable connectors adapter | GT0421 | TNC male to male ended adapter |
| Heatshrink | GW0214 | Heatshrink for SC1 sensor cable, 71 cm (28 in.) |
| Heatshrink | GW0215 | Heatshrink for SC2, OC2 sensor cable, 51 cm (20 in.) |
| Lightning arrestor kit | A4KT1000 | External lightning arrestor kit includes four lightning arrestors, four gas pellets, mounting bracket, ground lug and ground strap |
| Lightning arrestor kit | A4KT1001 | External lightning arrestor kit includes two lightning arrestors, two gas pellets, mounting bracket, ground lug and ground strap |
| Gas pellet | GE0311 | Gas pellet replacement for lightning arrestor (GE0310) |
| Gas pellet | GE0507-GDT/ 90V | Gas pellet replacement for lightning arrestor (GE0507-T/MF) |
| UCM cable | GE0444 | UCM interface cable, 3 m, USB (connects PC running UCM to processor) |
| UCM | 00SW0100 | Universal Configuration Module software, Windows-based application, setup, calibration and diagnostic tool |
| Network Interface Unit - multi-mode | 00EM0200 | NIU interfaces between Silver Network based security transponders and Windows based head end |
| Network Interface Unit - single-mode | 00EM0201 | NIU interfaces between Silver Network based security transponders and Windows based head end |
| Network Manager Software | 00FG0200 | Silver Network manager software *application*, controls and communicates with Silver Network based security transponders, communicates with Windows based display and control system |

| Component | Part Number | Description |
|---|---|---|
| Network Manager Software (UltraLink) | 00FG0220 | Silver Network manager software *service*, controls and communicates with Silver Network based security transponders, communicates with Windows based display and control system |
| Alarm Integration Module | 00SW0230 | USB security key - required to enable Alarm Integration Module software functionality, Alarm Integration Module available on UltraLink CD |
| Mini-NIU | 00EM1301 | Single channel mini-NIU - USB to EIA-422 and multi-mode F.O. |
| Mini-NIU | 00EM1302 | Single channel mini-NIU - USB to EIA-422 and single-mode F.O. |
| Ethernet converter | GB0-360-ST | Ethernet to dual EIA-422 converter 0 - 60º C (32 - 140º F) operating temp. |
| Ethernet converter | GB0-360-ET | Ethernet to dual EIA-422 converter -40 - 75º C (-40 - 167º F) operating temp. |
| Mounting kit | GB0-360-MK | 35 mm DIN rail mounting kit for Ethernet to dual EIA-422 converter |
| Silver Network repeater | 00EM0301 | Silver Network repeater multi-mode fiber to multi-mode fiber |
| Silver Network repeater | 00EM0302 | Silver Network repeater EIA-422 to EIA-422 |
| Silver Network repeater | 00EM0303 | Silver Network repeater multi-mode fiber to EIA-422 |
| Tape | X0191 | Mastic tape |
| Tape | X0190 | Vinyl tape |
| Tape | A4SP0100 | Underground warning tape |
| Manuals | A4DA0120 | OmniTrax documentation CD |

# Supplier's information

## Sealant materials

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

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

Willseal 150 (Illbruck, Minneapolis, MN, 800-274-2813) is a compressed, open cell polyurethane tape impregnated with neoprene. It is furnished in 14 ft. rolls with a cross-section sized to expand to, and tightly fill, the slot dimensions above the cable. It has an adhesive on one side to retain it during the expansion. It is applied by hand via this sidewall adhesion, using a putty knife, and it expands within several hours to form a compression seal. Double layers can be used for wider slot areas at decouplers. In the preferred application it is sized to replace both the backer rod and sealant in a single step however, this is slightly more costly in materials. The advantage of using this size is that it both provides the optimal seal shape and replaces one installation step. A note when using pre-forms – since the seal depth is fixed, slot depth variations must be minimized when cutting. A tolerance of no more than +/- 3 mm (1/8 in) is recommended to ensure the sealant is recessed over its entire length. Since it arrives pre-compressed to 20% of its maximum width, width variations are more tolerable.

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

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

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

3M 5000 traffic loop detector sealant, comes in 1 liter sausages, 12 per case, requires pumping equipment

# Other sealant suppliers

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

Illbruck Inc. (Willseal-150)
3800 Washington Ave. North
Minneapolis, MN 55412
Tel. (800) 274-2813

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

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

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

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

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

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

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

Willseal-150 (Illbruck)
Illbruck Inc.
3800 Washington Ave., North
Minneapolis, MN 55412
Tel. (800) 274-2813

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

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

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

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

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

Dow Corning Europe
BelgiumTel. 32-2-6552111

# Application equipment

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

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

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

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

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

# Backer rod

This is a closed-cell polyethylene rod used as a slot filler and separator from the cable, and also as a bond breaker for the sealant. It can usually be purchased locally in long rolls from building supply companies or via the local sealant supplier. Select backer rod with a slightly greater OD than the width of the slots i.e., 3 to 6 mm (1/8 to 1/4 in.) wider than the slots.

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|---|---|
| **Note** | Consult the manufacturer for detailed information before ordering the backer rod. |

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

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

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

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

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

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

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

# Concrete sealers

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

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

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

# Metal foil

| **Note** | Any foil used must be rated for direct burial. |
|---|---|

For information on sources of metal foil contact Senstar Corporation.

Terra-Tape Sentry Line 620
24 in wide x 1000 ft.
Red, no imprint, no logos
Part no. 0541456

Supplier
Reef Industries
Houston, TX
U.S. (800) 231-6074, (800) 231-2417
Canada (800) 847-5616

# Geotextile fabric

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

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

# b Specifications

| | | |
|---|---|---|
| **Processor** | **Part Number** | • A4EM0101 - processor card, mounting plate and painted aluminum enclosure (weight 6.6 kg (packed) 5.5 kg (unpacked)<br>• A4EM0301 - processor card with mounting plate |
| | **Dimensions - PCB (L x W)<br>- Enclosure (H x W x D)** | • 21 x 21 cm (8 ¼ x 8 ¼ in.)<br>• 40 + 2.5 (cable glands) x 23.5 x 16.5 cm (15.75 + 1 x 9.25 x 6.5 in.) |
| | **Quantity** | • one processor per two sensor cable sets (50 software defined alarm zones per processor) |
| | **Probability of detection** | • greater than 99% Pd with 95% confidence factor for a walking intruder weighing more than 35 kg (77 lb) when installed and calibrated according to the manufacturer's directions |
| | **Detecting sensor cable lengths** | • up to 400 m per cable set (1312 ft.) |
| | **Maximum perimeter length** | • unlimited using multiple processors |
| | **Power consumption** | • 9 W nominal |
| | **Voltage input** | • 12 to 48 VDC |
| | **Backup battery (optional)** | • 6 VDC, 5 Ah (nominal) mounts inside enclosure, processor includes intelligent charging circuit |
| | **Zone height (nominal)** | • 1 m (3.3 ft.) also extends below ground |
| | **Zone width (nominal)** | • 2 - 3 m (3.3 - 6.5 ft.) depending on cable spacing and burial medium |
| | **Location accuracy** | • 1 m (occasionally, it is possible for a phase ambiguity to result in a location deviation of up to 4 m) |
| | **Target resolution** | • 24 m for simultaneous crossings (when two valid targets cross the sensor cables within 24 m of each other over a period of 3 seconds or less, the two targets can merge and be reported as one, the single reported target can be located anywhere within the 24 m section) |
| | **Soil conductivity/dynamic range** | • soil conductivity nominal working range of 10 to 200 mS/m,<br>• maximum dynamic signal range of 20 dB per cable set |
| | **Enclosure options** | • CSA type 4 (equivalent to NEMA-4/IP66) painted aluminum enclosure, lockable, with tamper switch<br>• Telecom style pedestal enclosure (IP33), light green enamel on steel |
| | **Operating frequency** | • 32.125 MHz |

| | | |
|---|---|---|
| Processor | **Controls** | • all control adjustments are made via the Universal Configuration Module (software application)<br>• automated sensitivity profile for each cable set<br>• automated transmission power level for each cable set<br>• up to 50 defined cable segments per cable set (100 per processor)<br>• up to 50 software defined sensor zones  per processor<br>• calibrated alarm threshold for each defined cable segment<br>• calibrated alarm threshold for each meter of sensor cable<br>• adjustable target speed settings<br>• remote self-test inputs (local control mode) |
| | **Connectors** | • board-mounted TNC connectors for internal mini-coaxial cables<br>• external bulkhead connectors for lead-in cables<br>• removable terminal block for power input<br>• removable terminal block for relay output connections<br>• removable terminal block for auxiliary device/self-test inputs<br>• USB port for UCM connection<br>• 40-pin socket for auxiliary cards (NIC, ROC)<br>• Compact Flash memory plug-in connector<br>• locking 2-pin header for battery connection<br>• locking 2-pin header for enclosure tamper connection |
| | **Outputs** | • 4 form C relay outputs 30 VDC @ 1.0 A maximum, non-inductive load<br>  • one sensor alarm relay for each cable set (A-side and B-side)<br>  • one supervision relay, and one fail relay per processor |
| | **LED indicators** | • one each per output relay, eight diagnostic, four internal function, one each for TX and RX |
| | **Supervision** | • mechanical enclosure tamper switch<br>• sensor cables<br>• lead-in cable<br>• processor operation<br>• power fail<br>• auxiliary inputs |
| | **Lightning protection** | • transorbs and gas discharge pellets on all I/O - relay outputs, communication lines, auxiliary device/self-test inputs, power inputs<br>• additional protection available for sensor cables and data lines |
| | **Grounding requirements** | • earth ground connection at each processor (5 Ω max. recommended) |
| | **Temperature** | • -40º to +70º C (-40º to +158º F) as measured inside enclosure |
| | **Relative humidity** | • 0 to 95%, non-condensing |
| | **Auxiliary cards** | • Network Interface Card (one NIC is required by each processor using Silver Network communication)<br>• EIA-422 copper wire<br>• multi-mode fiber optic cable<br>• single-mode fiber optic cable<br>• EIA-422/multi-mode fiber<br>• EIA-422/single-mode fiber<br>• Relay Output Card (ROC) - provides 8 additional relay outputs (one ROC per processor, cannot be used with UIC)<br>• Universal Input Card (UIC) - provides 8 additional inputs (one ROC per processor, cannot be used with UIC)<br>• NOTE - auxiliary card power consumption is included in the processor’s rating |

| | | |
|---|---|---|
| **Sensor Cable** | **Description** | • OC2 - 300 or 400 m with 20 m integral lead-in, includes connectors and ferrite beads<br>• SC1 - 50 to 200 m lengths in 50 m increments, TX and RX cables encased in a single outer jacket, 20 m integral lead-in, field installed connectors and ferrite beads<br>• SC2 - 50 to 200 m lengths in 50 m increments, separate TX and RX cables, 20 m integral lead-in, field installed connectors and ferrite beads |
| | **Minimum length (lead-in)** | • a minimum length of 6 m (20 ft.) of lead-in cable is required |
| | **Minimum length (sensor cable including lead-in)** | • for sensor cable that is connected to another sensor cable through decouplers (two processors) the minimum length of sensor cable is 75 m (246 ft.) per processor (150 m between two processors)<br>• for sensor cable that is terminated (not connected to another sensor cable through decouplers) the minimum length of sensor cable is 16 m (52 ft.) |
| | **Operational temperature** | • -40º to +70ºC (-40º to +158ºF) |
| | **Storage temperature** | • -50º to +85ºC (-58º to +185ºF) |

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|---|---|---|
| **48 VDC Network power supply** | **Part number** | • A4EM0200 |
| | **Enclosure** | • mounted in a painted aluminum CSA type 4 enclosure (equivalent to NEMA 4 IP66) 26 x 23 x 13 cm (11 x 9 x 5 in.) |
| | **Quantity** | • maximum 5 processors from one 48 VDC supply, with the middle processor connected to the supply, and power distributed to the other processors over the sensor cables |
| | **Power input** | • 115/230 VAC, 47 - 63 Hz |
| | **Power output** | • 48 VDC, 3A maximum, 100 W |

| | | |
|---|---|---|
| **12 VDC power supply** | **Part number** | • C7EM0503 |
| | **Enclosure** | • no enclosure |
| | **Quantity** | • one per processor |
| | **Power input** | • 115/230 VAC, 60/50 Hz |
| | **Power output** | • 12 VDC, 80 W |

| | | |
|---|---|---|
| **Auxiliary power supply module** | **Part number** | • 00EM0400 |
| | **Power input** | • 48 VDC |
| | **Power consumption** | • 2 W |
| | **Power output** | • 12 VDC @ 150 mA maximum |

| | | |
|---|---|---|
| Silver Network | **Network control** | • Network Manager (Windows-based software) - 1 required per Silver Network, max. 10 NMs on one PC, communicates with and controls Silver Network based sensors, reports status to Windows-based security management systems via TCP/IP communications |
| | **Number of devices** | • up to 60 sensors per Silver Network |
| | **Network transmission media/ Device separation distance** | • EIA-422 - 1.2 km (1300 yd.)<br>• multi-mode fiber - 2.2 km (2400 yd.)<br>• single-mode fiber - 10 km (10900 yd.)<br>• OC2 sensor cable - 800 m (875 yd.)<br>• SC1/SC2 sensor cable - 400 m (437 yd.) |
| | **NIU to NM communication** | • USB<br>• EIA-232<br>• Ethernet |
| | **Network communication** | • point-to-point<br>• 57.6 k bps (fixed)<br>• two channels (A-side, B-side) |
| | **Response time** | • 1.0 second or less from alarm source to Network Manager (for each network loop, not using Ethernet communications) |
| | **Network Interface Unit** | • two variants - multi-mode fiber, single-mode fiber<br>• NIU - 1 required per Silver Network, 2 required for full redundancy, dual channel (A-side, B-side),<br>• two communication ports to NW devices - EIA-422, fiber optic<br>• three communication ports to NM - EIA-232, USB, Ethernet<br>• USB port for UCM connection<br>• 12 to 48 VDC power input<br>• power LED, communication LEDs for all modes<br>• does not count against the total number of network devices |
| | **Network data terminations** | • on sensor cable at end of perimeter |
| | **Network repeaters** | • three variants - EIA-422, multi-mode fiber, EIA-422 and multi-mode fiber<br>• double the maximum separation distance between devices<br>• 12 to 48 VDC power input, 2 W max. consumption |

# C NM Mode

The UltraLink I/O processor can be configured to operate in Network Manager Mode (NM Mode). In NM Mode, the UltraLink I/O processor acts as the Network Manager, providing alarm outputs for a connected network of up to eight Silver devices. In NM Mode, the Silver devices do not require a connection to a PC running Silver Network Manager software. The supported Silver devices include OmniTrax, FlexZone, Senstar LM100, UltraWave, FlexPS, XField and XField LT. Sensor alarms and supervision conditions are assigned to UltraLink I/O outputs (relay or open collector). When an alarm occurs on a connected sensor, the corresponding UltraLink I/O output is activated. If Multiple alarm conditions are assigned to a single UltraLink I/O output, the conditions are OR'd. A maximum of four output expansion modules can be used in NM Mode enabling up to 136 distinct output points.

| | |
|---|---|
| **Note** | NM Mode supports only the Silver Loop configuration. The Silver Star configuration (PoE NIC) cannot be used with NM Mode. |

Use NM Mode to setup a network of up to eight Silver Network based sensors that will report alarm, supervision and diagnostic conditions via UltraLink I/O outputs. The 4 onboard relays on each sensor are also available for use in NM Mode. UltraLink I/O inputs are not used in NM Mode. Figure 203: illustrates an UltraLink I/O system operating in NM Mode with eight connected sensors and a temporary connection to a Silver Network Manager to enable remote maintenance access.

| | |
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| **Note** | The UltraLink I/O output point assignments for each node are made at the sensor level through a direct UCM (USB) connection to the sensor (or via a temporary remote connection to the Silver Network Manager). Each sensor allows the user to specify the alarm, supervision and diagnostic fault conditions, and the UltraLink I/O outputs they activate.<br>The Aux Control for each sensor must be set to Remote control mode. |

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| **Note** | The UltraLink processor's Silver Network address is not used in NM Mode, and does not count against the NM Mode address limit of 8 nodes. By convention, set the UltraLink I/O processor's Silver Network address to 9. |

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| **Note** | The output activation buttons located below the outputs on the UCM status screen do not function in NM Mode. |

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| **Note** | Each sensor connected to the UltraLink I/O system (operating in NM Mode) requires a Network Interface card with the exception of a connected block of FlexZone processors. For a connected block of FlexZone sensors, one FlexZone requires an NIC to connect to the UltraLink I/O processor and the other FlexZone processors can communicate over their connected sensor cables. |

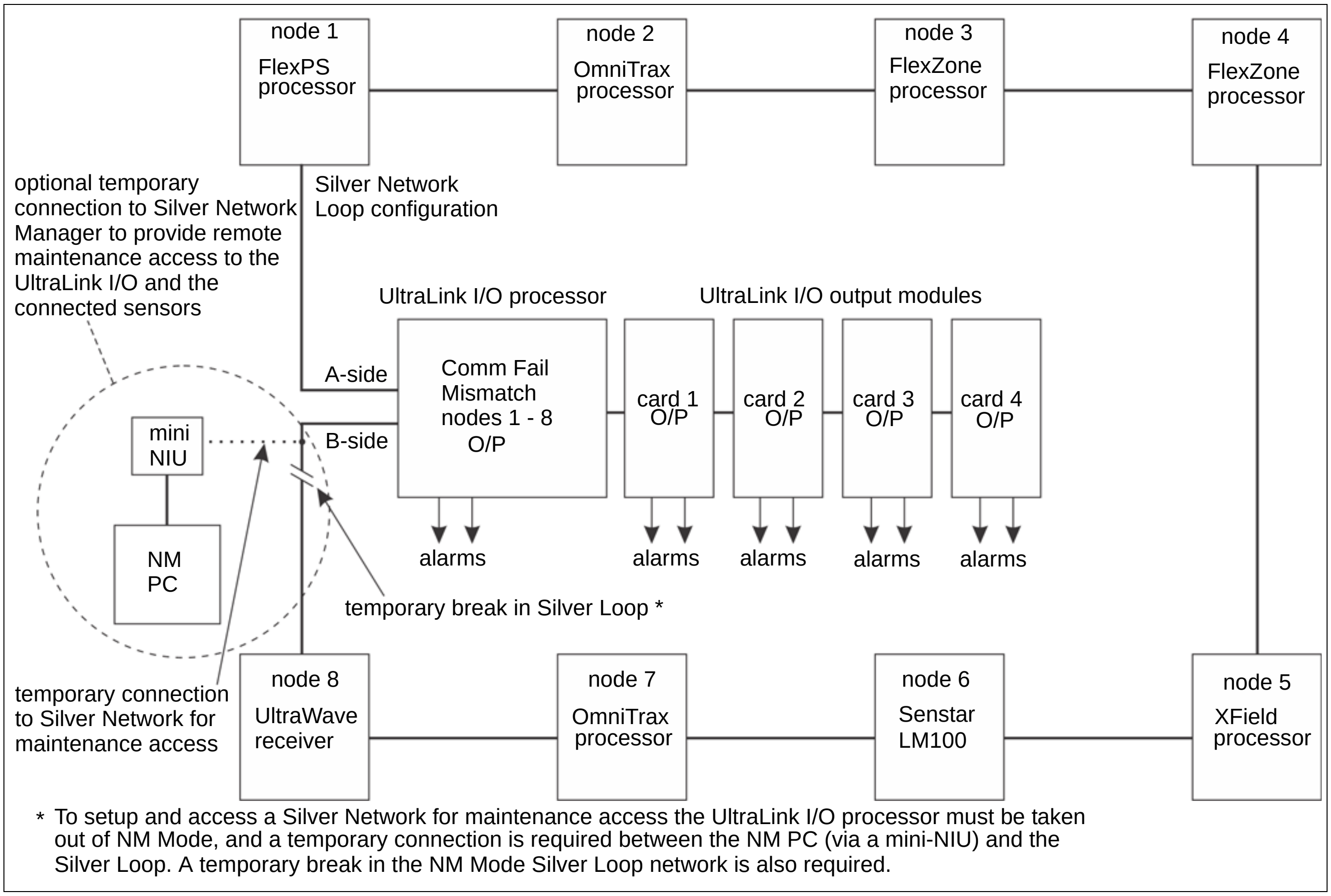


Figure 203: NM Mode block diagram

# UCM configuration

To use UltraLink modular I/O system outputs to report OmniTrax alarm and supervision conditions establish a UCM connection to the OmniTrax processor.

| | |
|---|---|
| **Note** | Refer to the UltraLink Modular I/O system instruction sheet and the UCM help file for additional details on NM Mode operation. |

Select the Remote Cfig tab and specify the outputs that will activate to annunciate the required alarm and supervision conditions (see Figure 203: ).

| | |
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| **Note** | Output assignments for Comm Fail and device mismatch for each connected device are made via a UCM connection to the UltraLink processor (see 00DA1003). |

Select the Side A Cfig or Side B Cfig tabs to assign outputs to Cable segments for reporting Zone alarms (Figure 205: ).

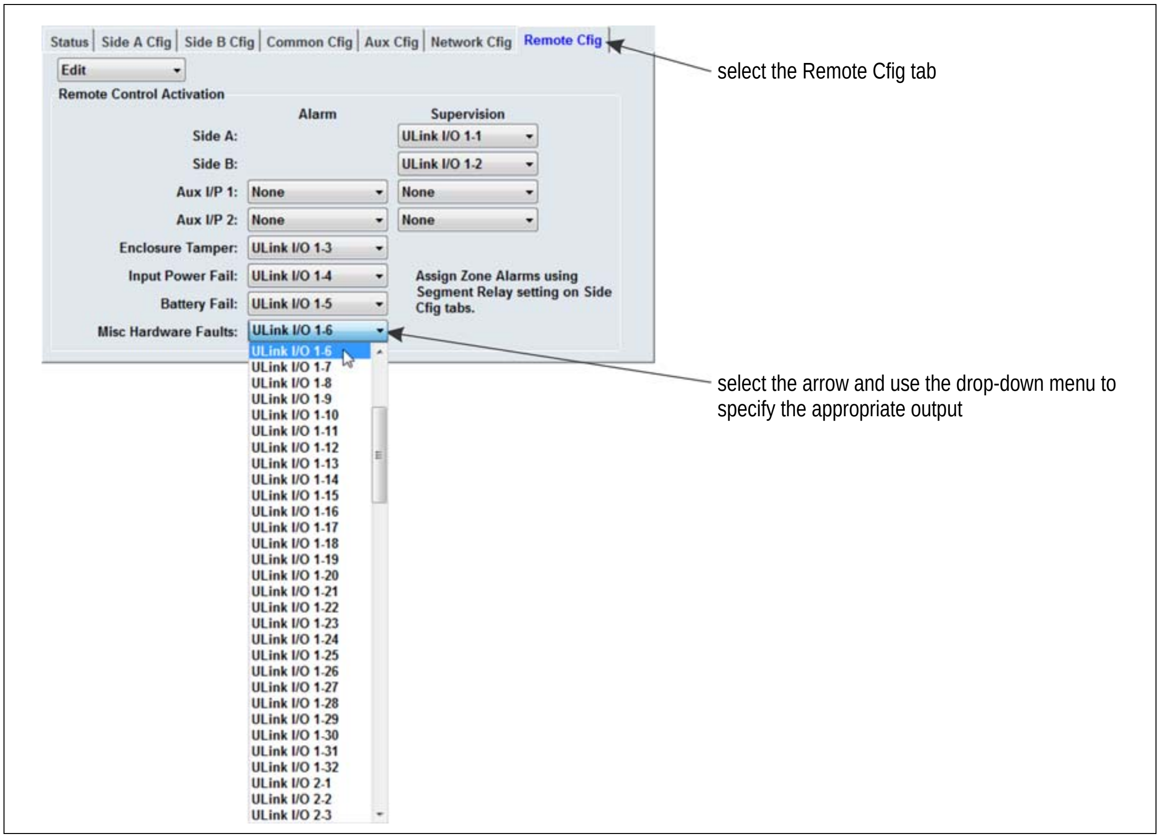


Figure 204: Setting up the Remote Configuration outputs

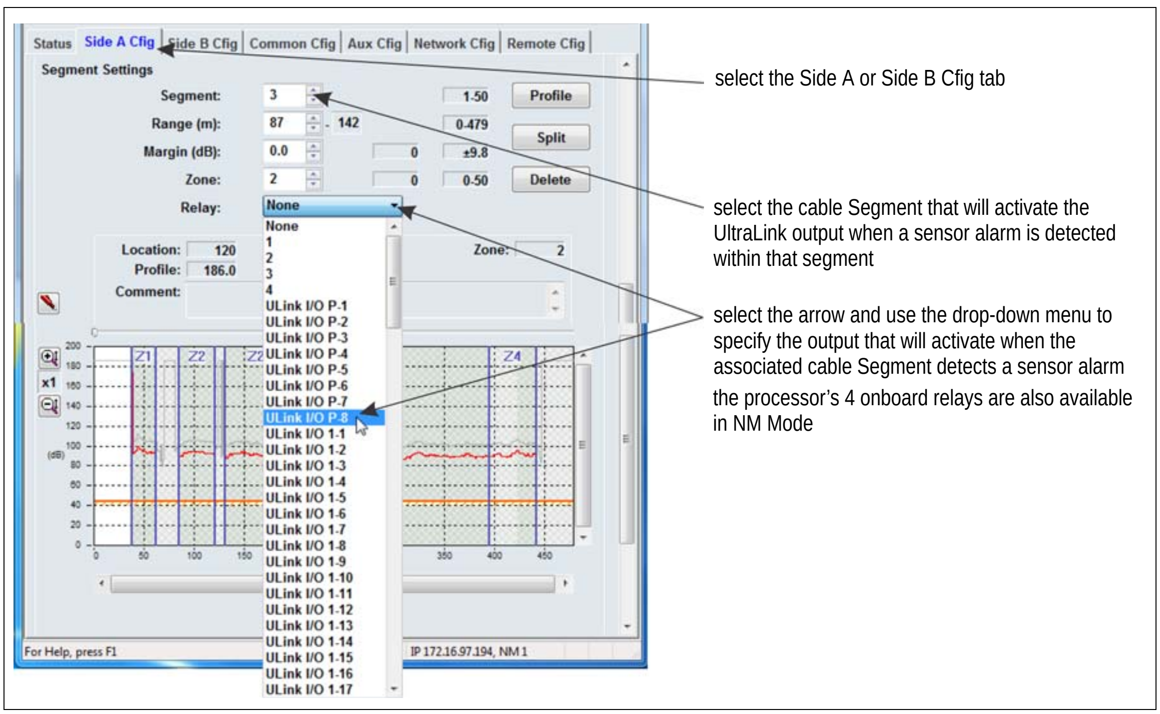


Figure 205: Selecting the UltraLink I/O outputs for Zone alarms