FlexPS®

Fence-mounted Perimeter Intrusion Detection Sensor

Product Guide

G5DA0102-001 Rev G
July 8, 2015

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

Approvals

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 equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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.

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

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1 System planning

Introduction

The FlexPS fence protection system uses microphonic sensor cable mounted on a fence, to detect vibrations caused by climbing, cutting, lifting, or otherwise disturbing the fence fabric. Each FlexPS processor can monitor the activity from one or two sensor zones up to 300 m (984 ft.) long, and will report the alarm and supervision status of each zone. 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 can also be used on many other types of building material (e.g., brick, stone, concrete, cinder-block, stucco, wood, drywall, ceramic). However, due to the different vibration transmission characteristics of each type of fence or building material, one zone of a processor should be used on only one type of surface. Contact Senstar Customer service for additional details on non-standard FlexPS applications.

Installation overview

Installing a FlexPS system is a four step process:

1. Plan and design the system.
2. Prepare the mounting surface, and install the sensor cable and terminator.
3. Install the processor and enclosure.
    - ground rod
    - power supply
    - alarm communication wiring
    - lead-in cable if the processor will be located away from the protected surface
4. Setup and calibrate the system.

Note	When using FlexPS to protect a surface other than chain-link or weld-mesh fencing, Senstar strongly recommends installing and testing a single short-length sensor zone before installing a complete system.

Security factors

There are many important factors to consider when planning a fence-mounted perimeter security system:

- Fence height - The fence must be high enough to present an effective barrier to climb-over intrusions. It should also include climb-over deterrent hardware such as barbed wire or razor ribbon. Senstar recommends that the minimum fence height for a FlexPS installation be 2.5 m (8 ft.). A lower fence can be quickly and easily breached with a climbing aid such as a ladder.
- Fence condition - FlexPS detects intrusions by picking up the minute vibrations or fence noise caused by an intrusion attempt. Therefore, the fence must be in good condition to prevent any metal on metal contact or vibrations caused by environmental effects. It may be necessary to upgrade the perimeter fences to ensure they present sufficient barriers against climb over and crawl under intrusions. If you are not sure of the suitability of your fence for a FlexPS sensor, Senstar recommends hiring a local fencing contractor to inspect, and if required, repair the fence.
- Alarm assessment/response - What happens when the system triggers an alarm? Can the alarm be assessed visually? Does the site include CCTV coverage to verify the event? Does an operator monitor the system? Does the system contact a remote monitoring service? How long does it take the alarm response to arrive at the zone? Does the system activate sirens and lights to deter an intruder?
- Probability of detection (Pd) vs. nuisance alarm rate (NAR) - With a fence-mounted intrusion detection system there is always a trade-off between the probability of detection and the nuisance alarm rate. A properly calibrated system will provide a high Pd by matching the sensor’s sensitivity (cable gain) to the fence and cable type.

Fence structures

All fence panels in a sensor zone should be similar in type, size and condition. Ensure that there are no loose panels, fittings or metal parts that can move and cause nuisance alarms. A shake test in which you grip the fence fabric in the middle of a panel and gently shake it back and forth with an increasing motion will help identify any loose pieces. Listen for metal-on-metal contact and correct any problems found. Verify that there are no washouts or depressions under the fence that could allow an intruder access. Ensure that there is no vegetation or other objects that can make contact with the fence in windy conditions.

Standard fence types

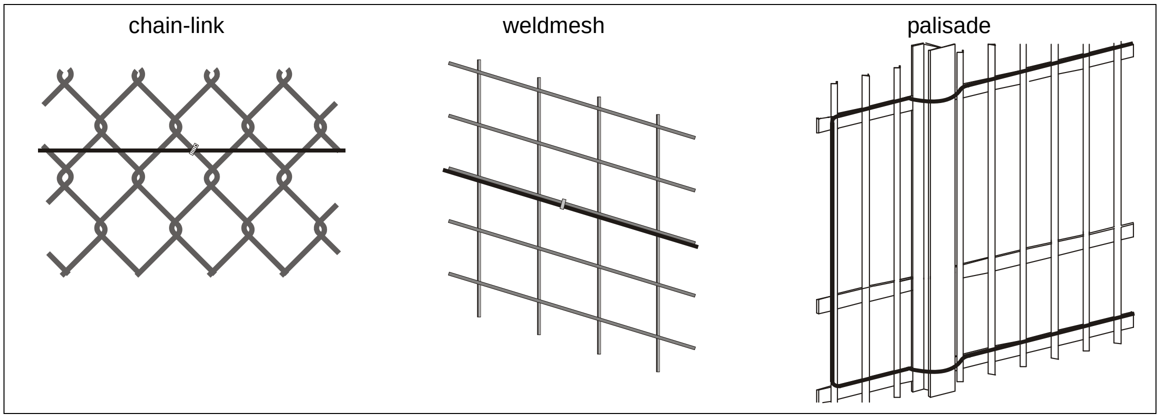


Figure 1: Fence types

Chain-link fence

Chain-link fence is comprised of steel wires that are bent lengthwise into zig-zag patterns. The zig-zag wires are vertically woven to form the characteristic diamond pattern. The fence fabric is attached to fence posts approximately 3 m (10 ft.) apart. Tension wires are often used to stiffen the fence fabric at the top, bottom and middle of the fence. Chain-link fences are available in different heights and are sometimes vinyl coated.

Weld-mesh fences

A typical weld-mesh fence section consists of steel wire welded into a grid, with horizontal spacing differing from vertical spacing. These fence sections are secured to fence posts and to top and bottom rails.

Palisade fences

Palisade fences usually consist of vertical metal stakes that are attached to horizontal support members, which are supported by metal posts. The effectiveness of FlexPS on a palisade fence depends on the characteristics and construction of the particular fence. Palisade fences conduct vibrations well and any attempt to cut into the fence will be detected. However, because the fence is rigid, climb-over intrusion attempts are more difficult to detect on a palisade fence than on than chain-link or weld-mesh fences. A trial on a section of the palisade fence is recommended before an entire system is installed to determine if the climb-over detection meets the site requirements.

Note	Ornamental palisade fences, which use non-metallic support pillars (e.g., concrete or brick) may not be suitable for use with the FlexPS system. The non-metallic pillars can make the fence vulnerable to climb-over intrusions.

Climb-over deterrent hardware

Barbed wire outriggers must be secure to prevent movement due to environmental conditions. Install bracing wires between the outrigger supports to prevent the barbed wires from spreading apart. Each barbed wire strand should be taut and tightly secured at each support. Any extension arms or outriggers attached to post tops should have a tight press-fit or be spot-welded. Remove or fasten any loose or rattling equipment.

Senstar recommends using Armour-FLEX cable when protecting barbed wire. To protect both the fence and the barbed wire, use one zone of Armour-FLEX cable installed in a saw tooth pattern on the barbed wire, and use sensor cable on the fence fabric for the second zone (see Figure 2:). This configuration allows both zones to be properly calibrated for the specific mounting surface.

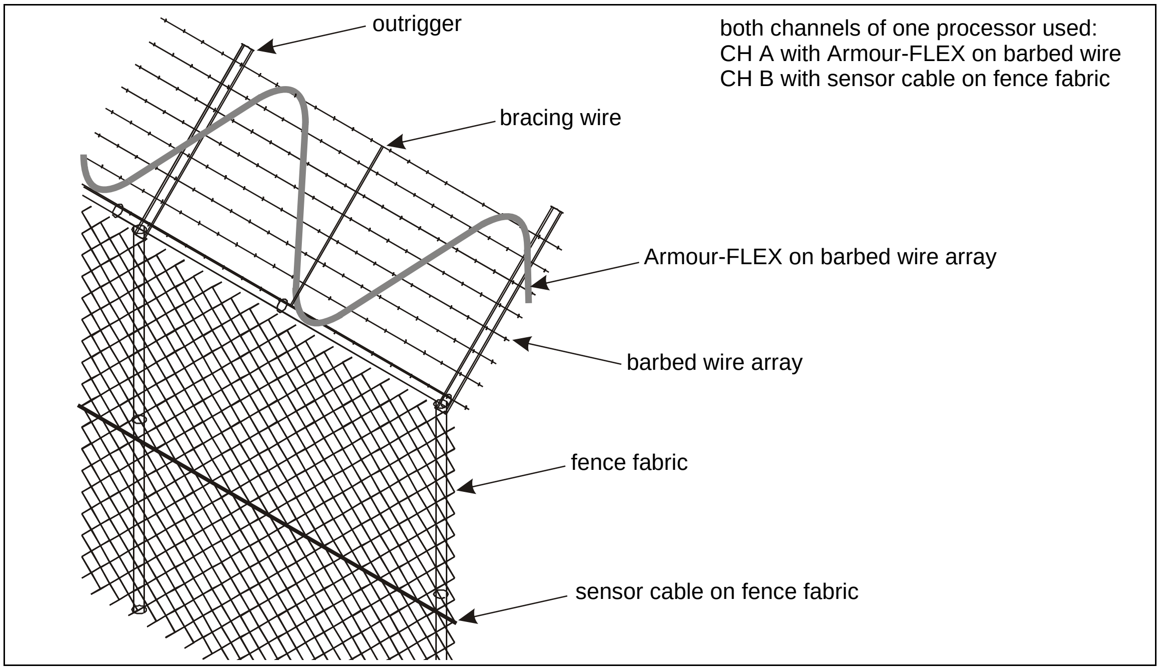


Figure 2: Recommended cable installation on barbed wire fence

Razor ribbon

FlexPS sensor cable can be installed on razor ribbon. However, due to the likelihood of the sensor cable being damaged, Armour-FLEX cable is recommended. The razor ribbon must be secured so that it does not move in the wind. Use tensioning wires to secure the coil and to prevent the razor ribbon from separating if it is cut.

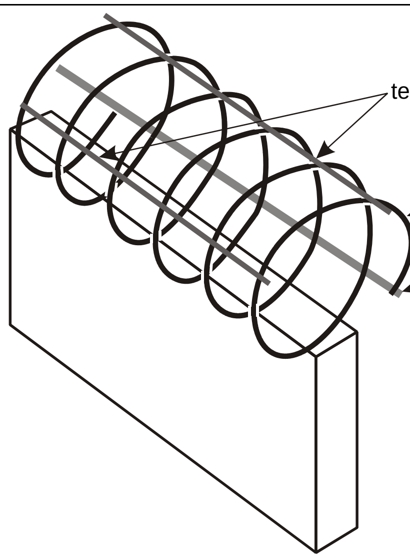


Figure 3: Razor ribbon

Gates

Gates should consist of fence fabric on a rigid frame that includes horizontal and vertical bracing.

- Firmly attach all gate hardware accessories (minimum free-play).
- Make sure that double gates have travel stops (rigid anchors).
- Prevent locking hardware from moving in the wind.
- Prevent sliding gate track hardware, supports, guides, etc., from rattling in the wind.

There are generally two types of gates used with fences, swinging gates and sliding gates. The type of gate protection required is determined by:

- the type of gate
- the frequency of gate use
- when the sensor is active
- the type of ground beneath the gate
- the overall protection plan (the number of zones and their location relative to the gate in question)

Gates in a FlexPS zone that are not protected by the sensor are bypassed using non-sensitive lead-in cable (see Figure 36:). The lead-in cable is installed inside conduit, underground, from one side of the gate to the other. The sensor zone continues beyond the gate, and another technology is used to provide protection in the area of the gate (e.g., a microwave sensor).

Occasionally, it is not possible to dig underground to continue the active zone coverage on the other side of a gate. There are three standard solutions for this situation:

- Install the cable on the ground surface, under a secured, protective cable mat.
- End the zone at the gate.
- Connect the cable across the gate using quick-disconnect connectors.

Other structures

The FlexPS sensor can be used on other types of fences and structures. It can be deployed on wooden fences, walls, along the top of concrete or brick walls to detect climb-overs, inside conduits to protect sensitive data cables, on pipes to prevent sabotage, etc. For installation information on walls, buildings, wrought iron, or other fence types contact Senstar Customer Service.

Note	Always install and test a short FlexPS zone (< 100 m) before installing a full system on a non-standard mounting surface.

Environment

Ensure that the ambient temperature, as measured inside the enclosure, is within the range of -40 to +70º C (-40 to +158º F). For installations in environments which include hot sunny periods, install a sun shield to protect the enclosure from direct sunlight, or install the enclosure in a shady area. Extra care must be taken at sites that experience strong winds on a regular basis. The fence must be maintained in excellent condition to prevent any metal to metal contact caused by the wind. All vegetation (weeds, brush, trees, etc.) must be cleared from around the fence area. Vegetation must not touch or hang over the fence fabric. Any objects that may contact the fence must also be removed from the perimeter.

Site Survey

Conduct a site survey to ensure that site conditions are suitable for a FlexPS sensor system. The primary concern is the condition of the fences and gates.

Note	Sites that include a fence line that abuts the primary perimeter fence can be vulnerable to climb over intrusions where the two fences meet. To increase security in this situation, extend the FlexPS zone for at least 2 m onto the abutting fence.

Indicate the following on the site plan:

- The locations of existing structures (include fences, gates, buildings, roads, etc.). Verify that mounting surfaces comply with established standards for installation and stability.
- The locations of obstacles such as vegetation and trees.

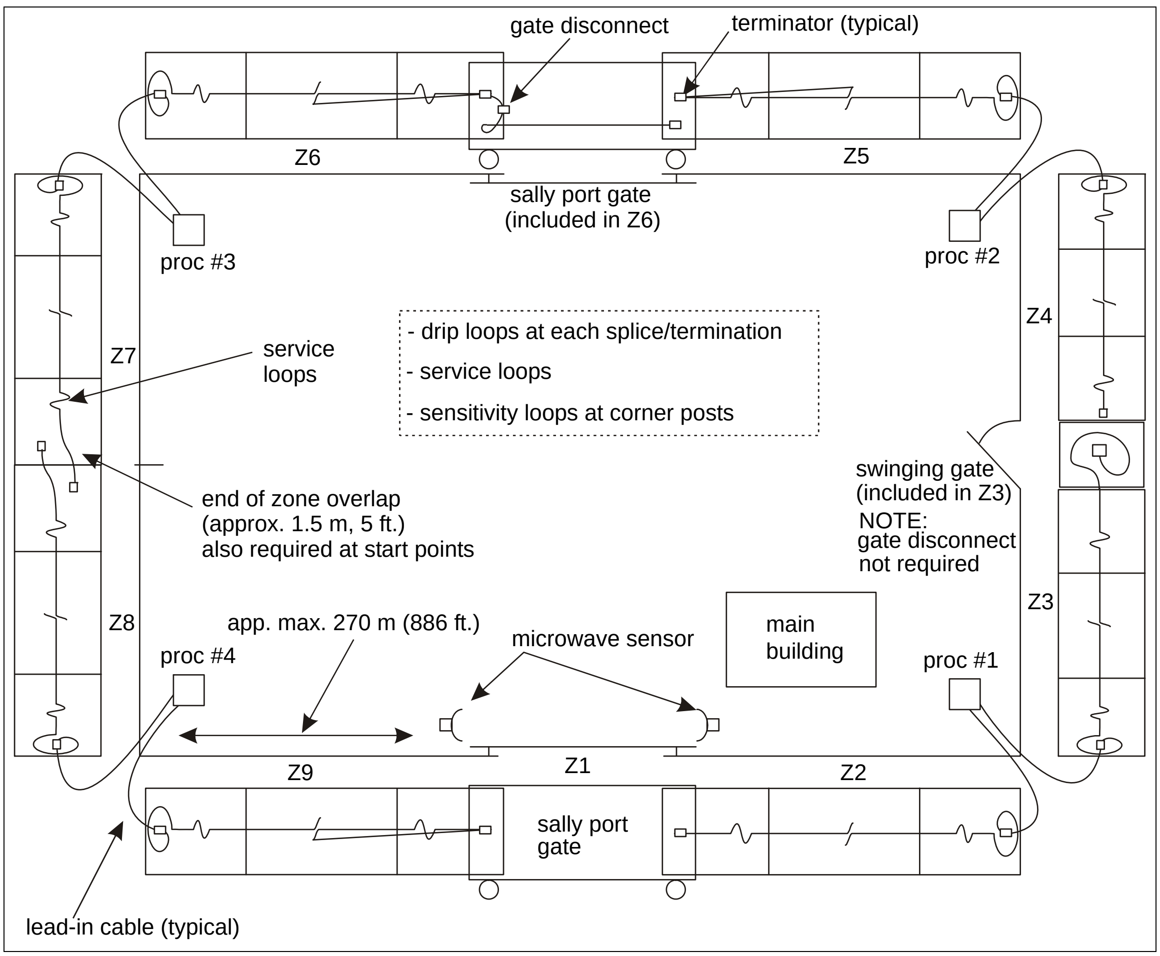


Figure 4: Sample site plan

Perimeter layout guidelines

Use a site plan to mark the locations for the FlexPS components:

- Sensor cable - indicate the cable layout for each zone.
- Lead-in cable - Indicate the layout if lead-in cable is being used (at the processor, for a bypass).
- Cable connectors - indicate the type of connection (splice, terminator).
- FlexPS processors (note the addresses for network based processors).
- Power supply - indicate the type of power supply and the power distribution plan.
- Alarm communication wiring (relay output or network alarm communications).

Sensor cable selection rules

There are two types of sensor cable available for use with the FlexPS system, MEX cable and Mark 2 cable. MEX cable uses a fixed center conductor and contains a permanent electrical charge. Mark 2 cable uses a loose center conductor inside a clear tube and generates an electrical signal through the triboelectric effect.

Figure 5: Mark 2 and MEX sensor cable reels

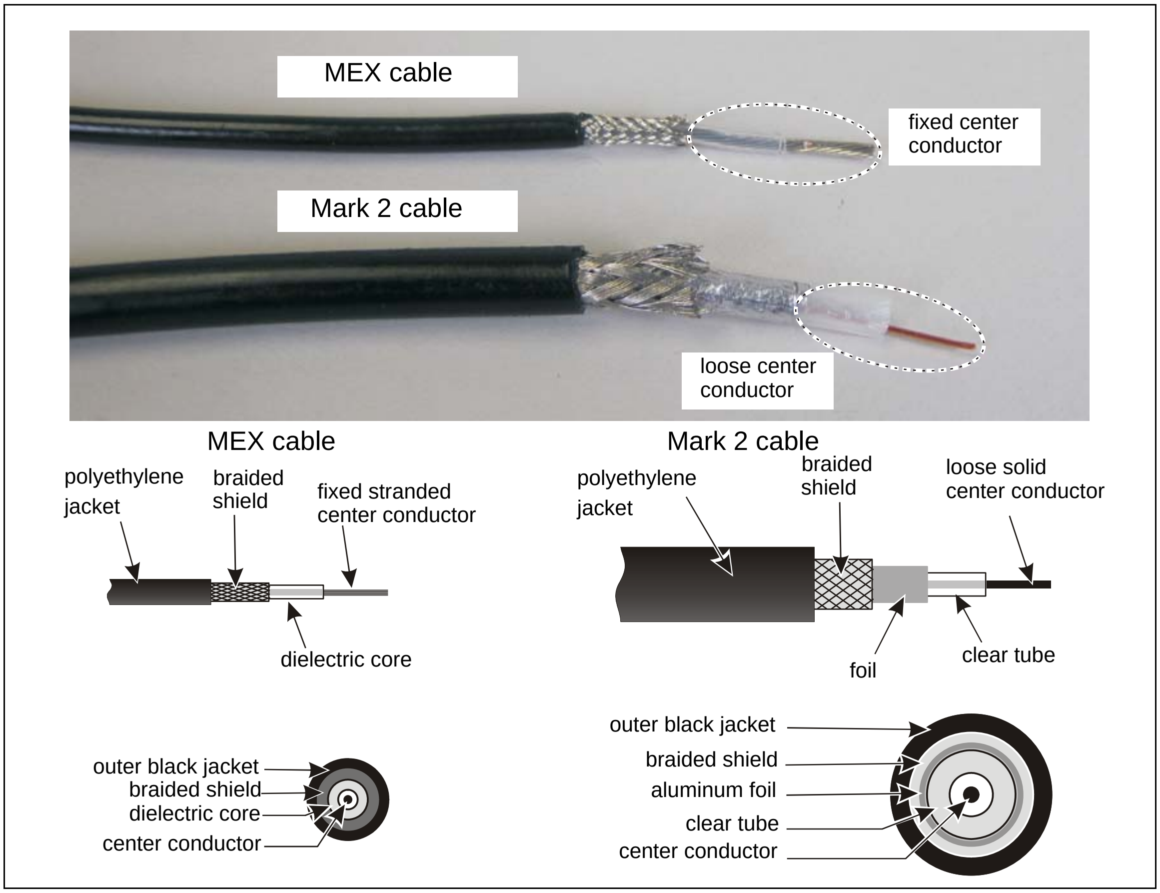


Figure 6: MEX and Mark 2 cable comparison

Use **MEX sensor cable** on standard chain-link, weldmesh and expanded metal fences. MEX cable is thinner and lighter than Mark 2 sensor cable and does not require conditioning. MEX sensor cable comes in 100 m (328 ft.) 200 m (656 ft.) and 300 m (984 ft.) lengths.

Use **Mark 2 sensor cable** on vinyl coated chain-link fences, on palisade fences, and on fences that are used around sites with a high level of EMI such as electrical and solar power generating stations. Mark 2 sensor cable has a higher sensitivity than MEX sensor cable, and requires cable conditioning before it can be installed. Mark 2 sensor cable comes in 150 m (492 ft.) lengths. Two lengths of Mark 2 can be spliced together to provide a 300 m (984 ft.) sensor cable.

Note	Contact Senstar Customer Service for applications advice when ordering FlexPS sensor cable.

Cable layout guidelines

- The sensor cable must be mounted on the same or similar type of surface for each zone.
- The maximum length of sensor cable is 300 meters (984 ft.) per zone.
- The smallest allowable bend radius for MEX sensor cable is 4 cm (1.6 in.).
- The smallest allowable bend radius for Mark 2 sensor cable is 7.5 cm (3 in.).
- The smallest allowable bend radius for Armour-FLEX sensor cable is 15 cm (6 in.).
- The sensor cable should follow the ground contour to maintain a constant height above the ground.

Note	Senstar strongly recommends installing the sensor cables on the secure side of the perimeter (the side of the fence opposite the threat).

Cable length calculator

Typically, a zone requires approximately 10% more cable than the linear zone length. The following table provides a guideline for calculating the amount of sensor cable required for a zone (in meters):

zone element	required cable length
start point	+ 1 m
service loops	+ 0.75 m X (linear zone length / 15)
corner and heavy gauge posts	+ 3.5 m X number of posts
cable terminations and splices	+ 0.5 m each
linear zone length	+ _ _ _ _ _ (zone length in meters)
required length of cable per pass	= _ _ _ _ _ (total length in meters)
total length X number of passes	= _ _ _ _ _ cable length (max. 300 m)

Fence height recommendations

The following cable spacing recommendations provide good security on well maintained fences. However, depending on the security requirements and the fence condition, it is possible to use alternate cable spacing. For example, on a high quality fence, in excellent condition, you could use a single pass of cable to cover a 3 m (10 ft.) fence. However, to ensure the highest Pd, Senstar recommends the following cable spacing (see Figure 7:):

Note	The term standard refers to uncoated chain link, weld mesh, and expanded metal fences. Painted fences are included in the standard fence type, but the fence must be painted before the sensor cable is attached. If a fence will be painted after the sensor cable is installed, the cable must be removed while the fence is being painted, and then reinstalled after the paint has completely dried.

- For standard fences up to 2.5 meters (8 ft.) tall - a single pass of MEX sensor cable at 1/2 the fence height.
- For standard fences greater than 2.5 m and less than 4.5 m (15 ft.) tall - a double pass of MEX sensor cable at 1/3 and 2/3 the fence height.
- For standard fences exceeding 4.5 m - three or more equally spaced passes of MEX sensor cable. This depends on the fence fabric and structure, and on the site's security requirements.
- For vinyl coated fences up to 2.5 meters (8 ft.) tall - a double pass of Mark 2 sensor cable at 1/3 and 2/3 the fence height.
  For higher vinyl coated fences, use double the recommended cable passes of Mark 2 cable for standard chain-link of similar height.
- For palisade fences that are less than 1.8 m (6 ft.) high, a single pass of Mark 2 cable along the top rail.
- For palisade fences that are greater than 1.8 m (6 ft.) high, use a dual pass of Mark 2 cable along the top and middle rails.

Note	If the lower edge of the fence fabric is embedded in a concrete footing, or below ground, use an additional cable pass on the lower section of fence to increase the sensitivity.

Note	If the fence framework includes an intermediate (middle) rail, then there must be at least one cable pass above the rail and one cable pass below the rail.

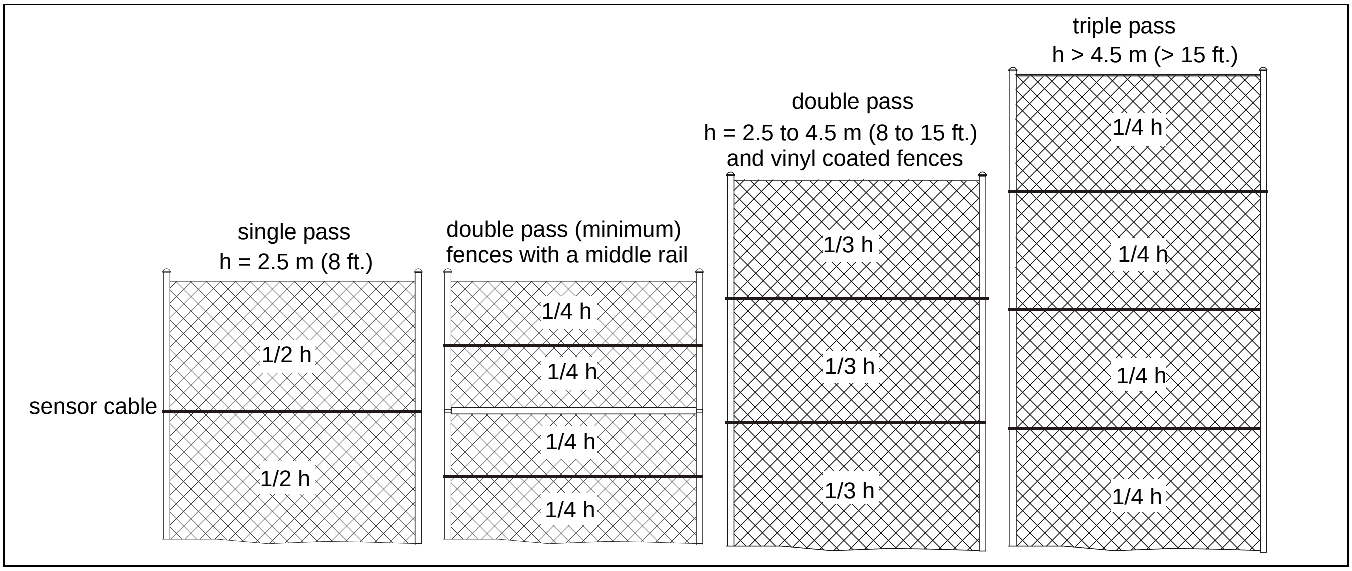


Figure 7: Cable pass recommendations

Note	Fences that use vinyl privacy slats may not be suitable for use with a FlexPS sensor system, as the privacy slats have a tendency to dampen vibrations.

Fence corners and heavier gauge posts

Corner posts and heavier gauge support posts tend to dampen the fence’s vibration transmission characteristics. Therefore, use cable loops at corner posts and heavy gauge support posts, to increase the sensitivity. Each sensitivity loop requires approximately 3.5 m (11.5 ft.) of sensor cable.

Service loops

Service loops provide extra sensor cable along the fence to make cable repairs. Allot 75 cm (30 in.) of cable each 15 m (50 ft.) for a service loop. Locate the U-shaped service loops at fence posts.

Drip loops

Drip loops raise the connector above the sensor cable to prevent water from running along the cable and accumulating in the enclosure. Drip loops also relieve strain resulting from temperature changes that cause the cable to expand and contract. Form the drip loop by raising the connector 15 cm (6 in.) above the level of the cable run. Allot 50 cm (20 in.) of cable for each splice or termination.

Non-sensitive lead-in cable (MEX sensor cable)

Non-sensitive lead-in cable is almost identical to MEX sensor cable, but does not detect vibrations. Lead-in cable is available in lengths of 30 m (98 ft.), 150 m (492 ft.) and 300 m (984 ft.). It allows you to install the processor away from the start of the sensor zone, and is also used to bypass gates, buildings, and other structures (see Figure 10:). The recommended maximum length of lead-in cable for a zone with 300 m of sensor cable is 150 m (492 ft.). This length can be extended for zones that use shorter lengths of sensor cable (e.g., a zone with 200 m of sensor cable can use up to 250 m of lead-in cable).

Non-sensitive lead-in cable (Mark 2 sensor cable)

For Mark 2 sensor cable, standard coaxial cable is used for lead-in cable and bypasses. The length of non-detecting cable that can be used with Mark 2 is determined by the coaxial cable's capacitance. The following table includes the approved coaxial cable types that may be used as lead-in cable with Mark 2 sensor cable, and the maximum lead-in lengths.

Non-sensitive cable type	Maximum length
RG-59/U, 69 pf/m (21 pf/ft.)	116 m (380 ft.)
RG-62/U, 43 pf/m (13 pf/ft.)	186 m (610 ft.)

The maximum length of non-sensitive cable is based on a zone with 300 m of Mark 2 sensor cable. The length of non-detecting cable may be extended, provided the length of the Mark 2 sensor cable is reduced accordingly.

Gate bypass

If there is a gate within a FlexPS sensor zone, you require a sufficient amount of lead-in cable to bypass the gate, even if the gate is protected by sensor cable. Bury the bypass cable in PVC conduit. See Figure 36: for an example of a bypassed gate, which uses a microwave system to provide security across the gate.

Gate bypass modules

The gate bypass module is used to bypass a protected gate without triggering an intrusion alarm. Refer to instruction sheet G5DA0103 for detailed installation instructions for the gate bypass modules. See Figure 8: and Figure 9: for illustrations of gate bypass modules.

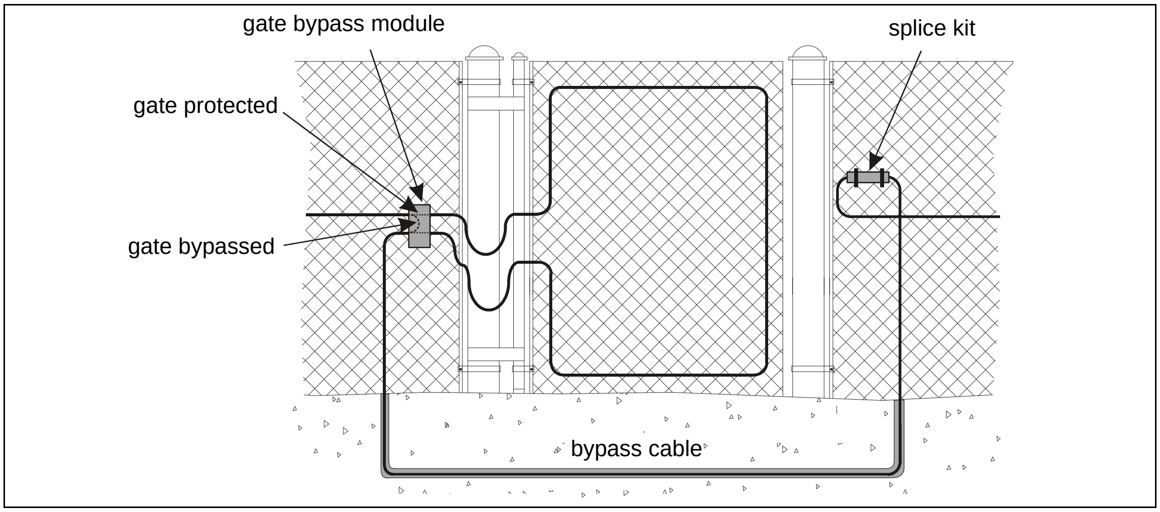


Figure 8: Gate bypass module example

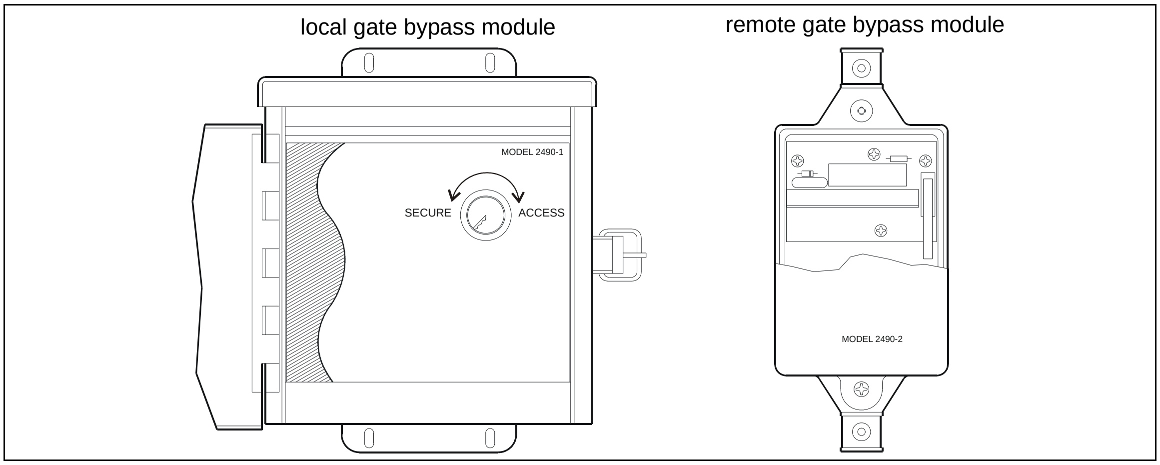


Figure 9: Gate bypass modules

There are two types of gate bypass modules available:

- Local bypass module for manual activation (key switch)

  When the key is in the access position:

  The sensor cable is shunted around the gate or terminated at the gate, depending on the configuration.

  The status contacts close giving a signal to the annunciator device.

  Removing the faceplate opens the tamper switch.

- Remote bypass module for remote activation

  Remote operation from the display and control system requires a voltage input to the gate bypass module to energize the bypass relay.

  When the relay is energized, the sensor cable is either shunted around the gate or terminated at the gate, and the bypass module's status contacts close to signal the annunciator.

  If the cover is removed from the bypass housing, the tamper switch opens to signal the annunciator.

Armour-FLEX

Armour-FLEX is FlexPS sensor cable encased in a flexible metallic conduit. There are two types of Armour-FLEX cable, MEX and Mark 2. Armour-FLEX protects the sensor cable from damage and vandalism, as well as from the sun and weather. Steel cable ties or wire ties are the recommended fasteners for Armour-FLEX, although UV resistant cable ties can also be used. Armour-FLEX is available in lengths of 100 meters (328 ft.). Up to three lengths can be spliced together to create a 300 meter (984 ft.) cable. Armour-FLEX splices must be enclosed inside outdoor rated electrical junction boxes (condulets). Refer to the Sensor cable selection rules on page 13 to select the correct type of Armour-FLEX cable for your application.

Processor location guidelines

The FlexPS processor can be mounted outdoors on a post, either on, or separate from, the fence on which the sensor cables are installed (see Figure 10:). A rigid fixed post is recommended for outdoor applications. The maximum distance away from the fence that the processor can be installed is determined by the non-sensitive lead-in cable length (see Non-sensitive lead-in cable (MEX sensor cable) on page 17). The FlexPS processor can also be installed indoors or outdoors on a flat stable surface. A post-mount kit is available for post sizes from 4.5 cm to 12.7 cm (1.75 in. to 5 in.). The hardware required for mounting the processor on a flat surface is customer-supplied. For installations in which the enclosure must be locked, there is a lockable mounting kit available. The lockable kit can be used to post-mount or surface mount the FlexPS enclosure.

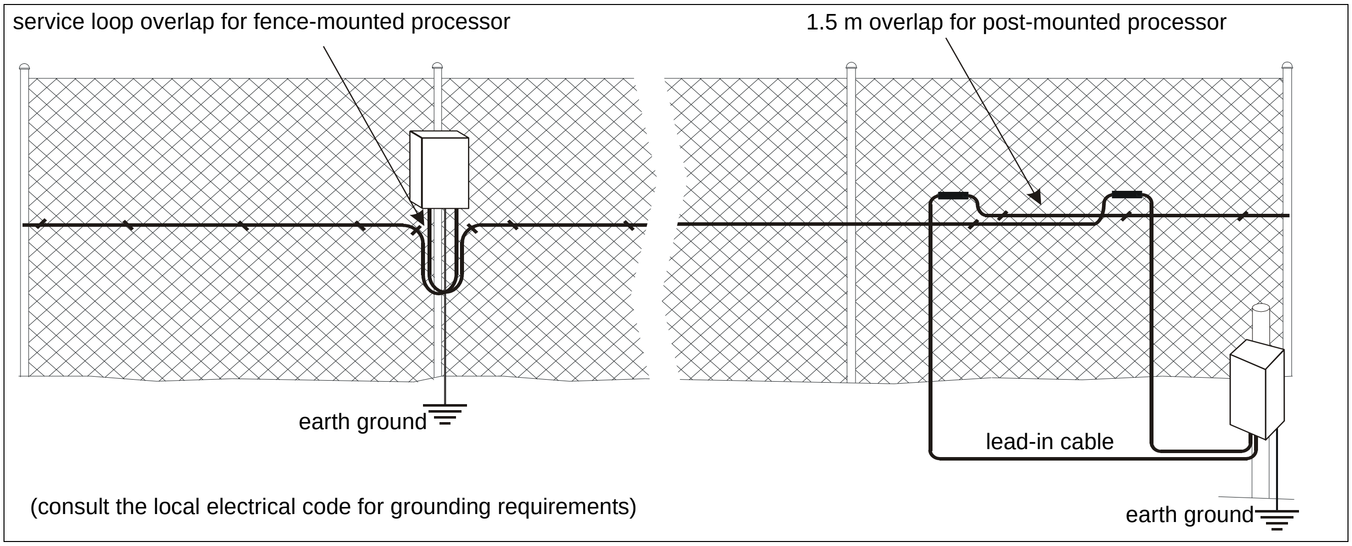


Figure 10: Processor location/ start point overlaps

AC/DC Power source and wiring

The FlexPS processor operates on a wide range of input voltages (12 to 48 VDC). The power supply, the number of processors, and the lengths of the power cable runs will determine the gauge of the power cable wiring. In locations where AC power may not be stable or reliable, an uninterruptable power supply (UPS) should be used for primary power. The following tables include power cable/load recommendations for 24 VDC and 48 VDC power supplies. The table assumes a maximum power consumption of 2 W per processor (with NIC and backup battery).

zone length	processor separation	wire gauge	power supply output voltage	number of processors	power supply connected to processor #
300 m (984 ft.)	600 m (1968 ft.)	18 AWG (1.02 - 1.27 mm)	24 VDC	5	3
			48 VDC	9	5
250 m (820 ft.)	500 m (1640 ft.)	18 AWG (1.02 - 1.27 mm)	24 VDC	5	3
			48 VDC	11	6
200 m (656 ft.)	400 m (1312 ft.)	18 AWG (1.02 - 1.27 mm)	24 VDC	5	3
			48 VDC	11	6
150 m (492 ft.)	300 m (984 ft.)	18 AWG (1.02 - 1.27 mm)	24 VDC	7	4
			48 VDC	13	7
100 m (328 ft.)	200 m (656 ft.)	18 AWG (1.02 - 1.27 mm)	24 VDC	7	4
			48 VDC	17	9
50 m (164 ft.)	100 m (328 ft.)	18 AWG (1.02 - 1.27 mm)	24 VDC	11	6
			48 VDC	25	13

Table 1 Power supply/power cable loads (18 AWG power cable)

zone length	processor separation	wire gauge	power supply output voltage	number of processors	power supply connected to processor #
300 m (984 ft.)	600 m (1968 ft.)	16 AWG (1.29 - 1.53 mm)	24 VDC	5	3
			48 VDC	13	7
250 m (820 ft.)	500 m (1640 ft.)	16 AWG (1.29 - 1.53 mm)	24 VDC	7	4
			48 VDC	13	7
200 m (656 ft.)	400 m (1312 ft.)	16 AWG (1.29 - 1.53 mm)	24 VDC	7	4
			48 VDC	15	8
150 m (492 ft.)	300 m (984 ft.)	16 AWG (1.29 - 1.53 mm)	24 VDC	9	5
			48 VDC	15	8
100 m (328 ft.)	200 m (656 ft.)	16 AWG (1.29 - 1.53 mm)	24 VDC	11	6
			48 VDC	21	11
50 m (164 ft.)	100 m (328 ft.)	16 AWG (1.29 - 1.53 mm)	24 VDC	15	8
			48 VDC	31	16

Table 2 Power supply/power cable loads (16 AWG power cable)

Power over Ethernet

Silver Network based processors using Ethernet communications have the option of using Power over Ethernet technology to power the FlexPS processor. To use this powering option requires a PoE standard class 3 switch that is located a maximum of 100 m (328 ft.) from the processor, and Category 5 network cable. Power over Ethernet is supplied to the processor's Network Interface card (NIC) and the power output on the NIC is connected to the power input on the processor.

CAUTION The PoE NIC is intended to supply power only to the processor on which it is mounted. Do not attempt to power an auxiliary device with the PoE NIC.

Note Senstar strongly recommends the use of a fully managed PoE switch to connect and power IP based FlexPS processors.

Grounding considerations

The FlexPS sensor system requires a single ground reference. A stable low resistance earth ground is required at each processor mounting location, and the entire system is referenced to this ground. Consult the local electrical code for grounding requirements.

Alarm monitoring

Alarm monitoring is site specific and depends on whether you are using relay output alarm communications (Local control mode) or network based alarm communications (Remote control mode). Each processor has four user-configurable Form C relay outputs. In Local control mode, the processor uses the four relays to signal alarm and supervision conditions. For network based processors, alarm data is carried over the network cables and the four relays are available as output control points from the head end system.

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

Auxiliary inputs

The processor includes two auxiliary/self-test inputs. In Local control mode the inputs are used to activate electronic self-tests and to activate the audio listen-in function. In Remote control mode the auxiliary inputs are used to report the status of two auxiliary security devices to the head end.

NM Mode

The FlexPS 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 91 for additional details).

Audio listen-in

The FlexPS sensor cable is microphonic and picks up acoustic fence noise along the zone. The processor can place the audio from its two monitored zones on an audio bus. The audio system requires a single twisted shielded pair, with 35 pf/ft. or less capacitance. (Belden 8761 has a single shielded twisted pair of 22 AWG wire.) An amplifier with a 600 Ohm impedance input and a good quality speaker can be used with FlexPS to provide audio assessment at the control center. In Local control mode, the audio output is activated through the processors AUX inputs. In Remote control mode the audio output is activated by a command from the host computer.

Cable connectors

The splice kit is used to join two cables together within a zone, either sensor cable to sensor cable or sensor cable to lead-in cable. The termination kit is connected to the end of the sensor cable to enable processor supervision of the cable. The connectors are mounted horizontally on the fence using two cable ties.

Equipment requirements

After completing the layout, compile a list of equipment requirements for your site.

	Single zone	Dual zone
FlexPS dual zone Processor	1 each	1 each
Terminator/cable splice kit	2 each for processors using lead-in cable; 1 each for processors that are connected directly to sensor cable	4 each for processors using lead-in cable; 2 each for processors that are connected directly to sensor cable
Sensor cable	max. 300 m (984 ft.)	max. 300 m (984 ft.) X 2
Lead-in cable	if required - max. 150 m (492 ft.)	if required - max. 150 m (492 ft.) X 2
Tie wraps	1 bag of 1,000 pieces	2 bags of 1000 pieces

Table 3 System component quantities for single and dual sensor zones

2 Installation

Installing the sensor cable

Note	The number of cable passes required on a fence depends on the height of the fence, the type of fence, and the required level of security (see Fence height recommendations on page 15).

Cable handling rules

The FlexPS sensor cable converts minute vibrations in the fence fabric into electrical signals. Any damage to the cable from mishandling or poor installation practices will have a negative effect on the system's performance.

- DO NOT allow the cable to fall off the cable reel during installation.
- DO NOT bend, twist, jerk, knot, or kink the sensor cable. Sensor cable MUST NOT be nicked, or scraped.
- Avoid tight turns in the sensor cable, the smallest allowable bend radius for MEX sensor cable is 4 cm (1.5 in.) for Mark 2 sensor cable is 7.5 cm (3 in.) and for Armour-FLEX cable is 15 cm (6 in.).
- DO NOT place objects on the sensor cable or allow anyone to stand or walk on the cable.
- DO NOT apply excessive tension to the sensor cable at any time.
- When using cable ties to attach the sensor cable to a fence, install the ties by hand and pull them hand-tight until snug.
- DO NOT use mechanical tighteners to attach cable ties to a fence.
- DO NOT allow the sensor cable to be pinched between the fence and a fence post, or any other object.
- When attaching the sensor cable to a flat mounting surface, use fasteners that hold the cable firmly against the surface without squeezing, crimping or distorting the cable in any way.
- DO NOT use a staple gun to attach sensor cable to a wall.
- Keep the ends of the sensor cable clean and dry. For Mark 2 cable, if water enters the loose tube it can cause corrosion and potentially freeze in the winter, thereby having a negative effect on detection sensitivity.

Note	Mark 2 sensor cable must be conditioned before it is attached to the fence.

Mark 2 cable conditioning

Note	MEX sensor cable does not require conditioning.

Before installing Mark 2 sensor cable, the cable must be conditioned. Prior to conditioning, there may be excess center conductor in the cable, or the center conductor may be adhered to the cable side walls after the manufacturing process. Conditioning frees the center conductor and maximizes its movement, thereby providing the greatest sensitivity. Cable conditioning requires two people to complete and typically takes less than 10 minutes for a 150 m sensor cable.

Cable **conditioning** procedure (part 1 - loosening the center conductor)

Note	Cable conditioning is required for both standard Mark 2 sensor cable and Mark 2 Armour-FLEX sensor cable. For Armour-FLEX cable, see Mark 2 Armour-FLEX cable conditioning procedure on page 41.

1. Dispense the sensor cable alongside the fence in a long straight line.
2. Carefully remove 30 cm (12 in.) of the outer jacket, shield and clear tube to expose 30 cm of the center conductor at both ends of the cable.
3. Check the ends of the cable to verify that the center conductor is free to retract or extend (i.e., the cable end is not pinched, flattened, twisted, bent, or distorted). If an end is damaged enough to prevent the free movement of the center conductor, cut off the damaged section.

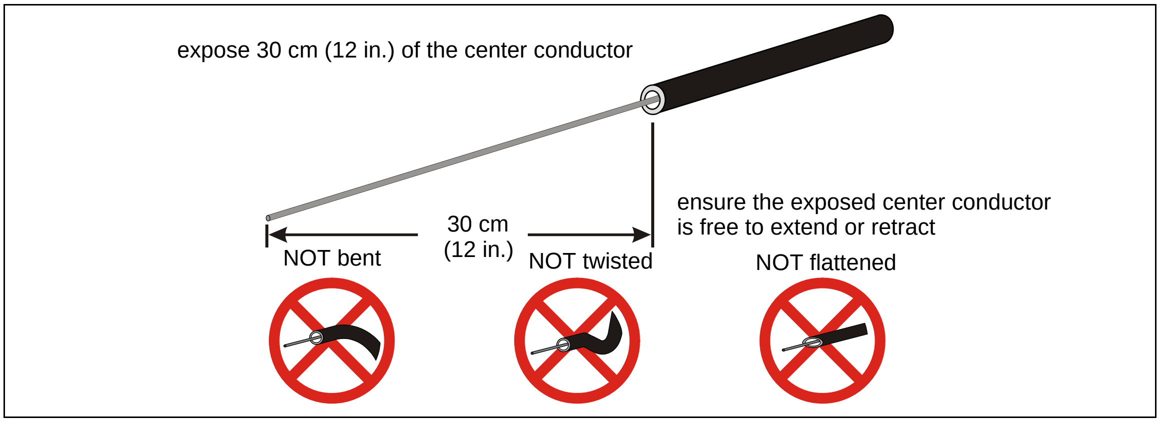


Figure 11: Exposing the center conductor

4. At both ends of the cable, use a cable tie, or a 2.5 cm (1 in.) piece of the outer jacket, to secure the center conductor to prevent it from retracting into the cable during the conditioning procedure.

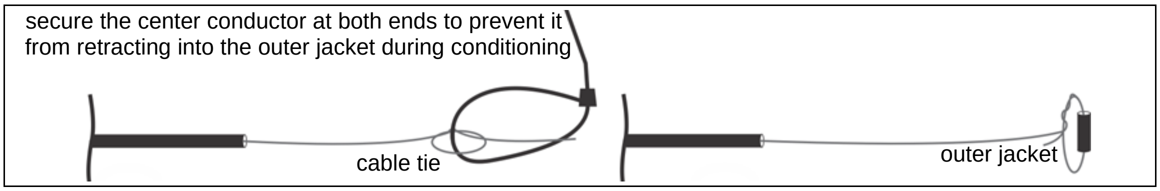


Figure 12: Securing the center conductor

5. At one end of the sensor cable, the first person firmly holds the sensor cable by the black jacket with one hand, while using the other hand to grip the center conductor with a pair of pliers (see Figure 13:).
6. Apply 2 kg (4.5 lb) of pulling tension to the center conductor with the pliers while maintaining a firm grip on the cable's black jacket.

Note	Maintain a firm grip and consistent pulling tension, and keep the sensor cable taut and in-line with the second person during the center conductor loosening procedure.

7. The second person picks up the sensor cable near the first, and waves it up and down a few times creating small waves, which travel approximately 3 to 5 m (10 to 15 ft.) in both directions along the cable.

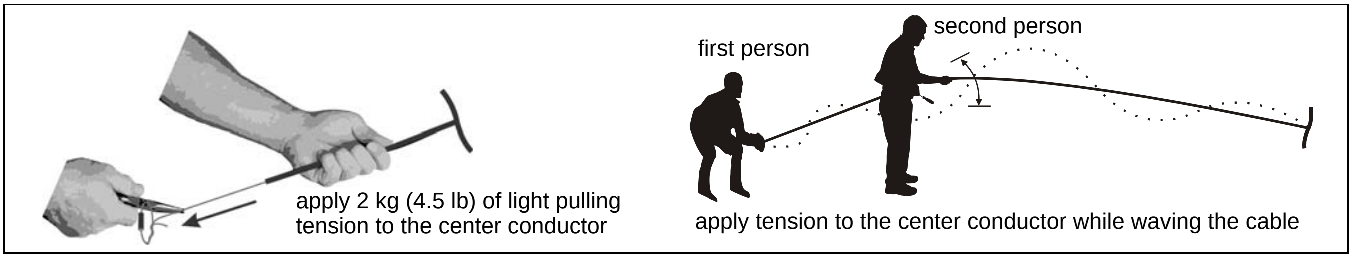


Figure 13: Applying tension to the center conductor / Waving the sensor cable

8. At the same location, the second person taps the cable with the handle of a screwdriver a few times, and then repeats the waving. (As you tap the cable, you will hear the center conductor rattle inside.)

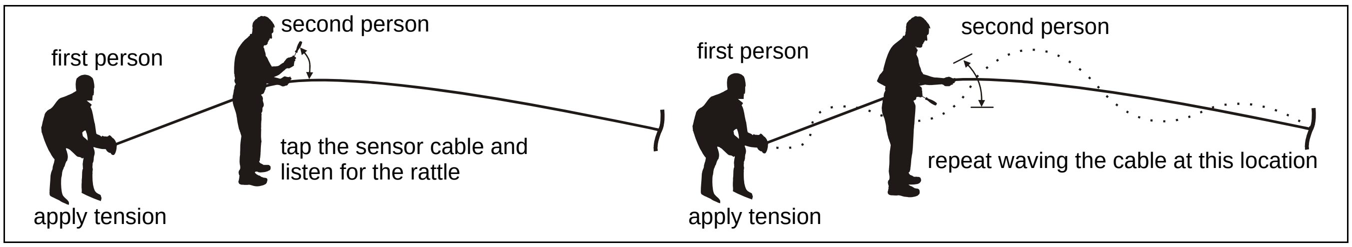


Figure 14: Tapping the sensor cable / Waving the sensor cable

9. Move along the sensor cable, waving, tapping, and waving the cable at one meter intervals. Listen for the rattle, with each tap of the cable. Continue waving and tapping until you reach the end of the cable.
10. When the second person reaches the end of the sensor cable, the first person releases the tension on the center conductor at the other end.

Cable conditioning procedure (part 2 - cable flossing)

Pull the cable by the outer jacket to remove any slack and then use a “flossing” motion to pull the center conductor back and forth to ensure the center conductor is floating freely over the full length of the sensor cable.

Note	Initially, there may be resistance as well as some “stretching” as the center conductor is freed inside the cable (i.e., the center conductor pulls out at one end but remains the same length at the other). Once the center conductor moves back and forth so that pulling it out 15 cm (6 in.) at one end causes it to retract 15 cm at the other end, the conditioning is complete.

Note	If the center conductor does not move back and forth easily (or at all) during the flossing process, it is likely bound somewhere inside the cable. In this case, repeat waving and tapping and flossing until the center conductor moves freely and easily.

1. The second person begins by using pliers to apply 2.3 to 4.5 kg (5 to 10 lb) of pulling tension to the center conductor while maintaining a firm grip on the cable's black jacket (see Figure 15:). The first person holds the cable firmly by the black jacket and tells the second person to stop pulling when the knot reaches the black jacket.

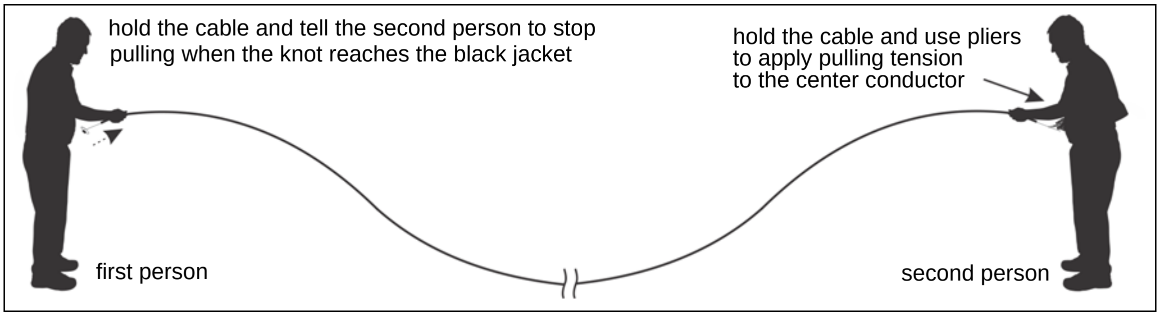


Figure 15: Mark 2 cable conditioning (part 2 cable flossing)

2. The first person then uses pliers to apply 2.3 to 4.5 kg (5 to 10 lb) of pulling tension to the center conductor while maintaining a firm grip on the cable's black jacket (see Figure 16:). The second person holds the cable firmly by the black jacket and tells the first person to stop pulling when the knot reaches the black jacket.

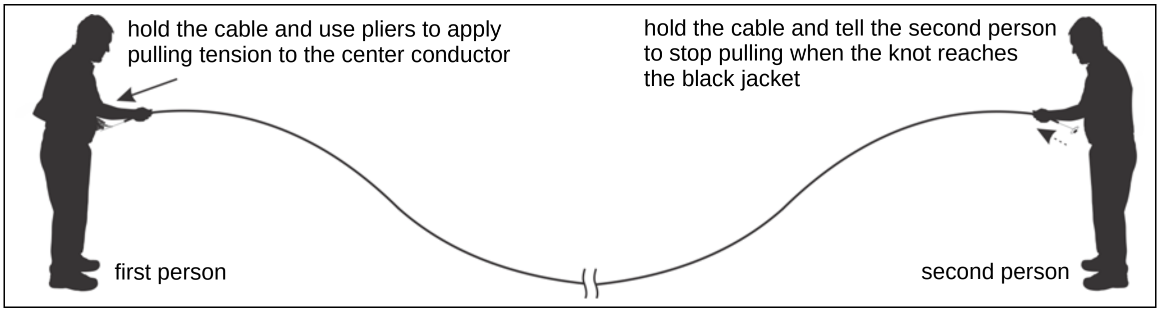


Figure 16: Mark 2 cable conditioning (part 2 cable flossing)

3. Continue this back and forth flossing motion until the center conductor moves easily with very little resistance.
4. When the conditioning procedure is complete, release the tension on the center conductor, and cut off any center conductor that was damaged during conditioning.

Note	When conditioning is complete, the center conductor usually extends an additional 15 to 30 cm out of the cable jacket at both ends, and it slides easily in both directions.

Installing cable on chain-link fences

- Attach the sensor cable to the secure side of the fence (the side opposite the threat).
- Secure the cable to the fence so that it maintains a constant height above ground (i.e., if the fence steps up a hill, the cable should also step up the hill).
- Use UV resistant polypropylene cable ties spaced 25 to 30 cm (10 to 12 in.) apart to attach the sensor cable to the fence.
- Pull the cable ties until they are hand tight and the cable is snug to the fence.
- Attach the cable ties to either the center of each link (one wire), or at the junctions of two wires.
- DO NOT attach the sensor cable to tension wires.

- Attach the sensor cable at least 30 cm (1 ft.) away from horizontal support bars and other cables.
- For added security use one or two steel cable ties or pieces of steel wire per fence panel.
- For a single cable pass, attach the sensor wire to the middle of the fence.
- Use Armour-FLEX if the cable is being installed in an area where it may be prone to damage from vandalism, equipment, or materials.

Note	During installation at sub-zero temperatures (0º C, 32º F), the plastic cable ties may become brittle and subject to failure.

- Using UV resistant polypropylene cable ties, secure the cable to the fence fabric at the midpoint of the chain-link. Install the cable ties by hand, tightening them enough to hold the cable securely against the fence.

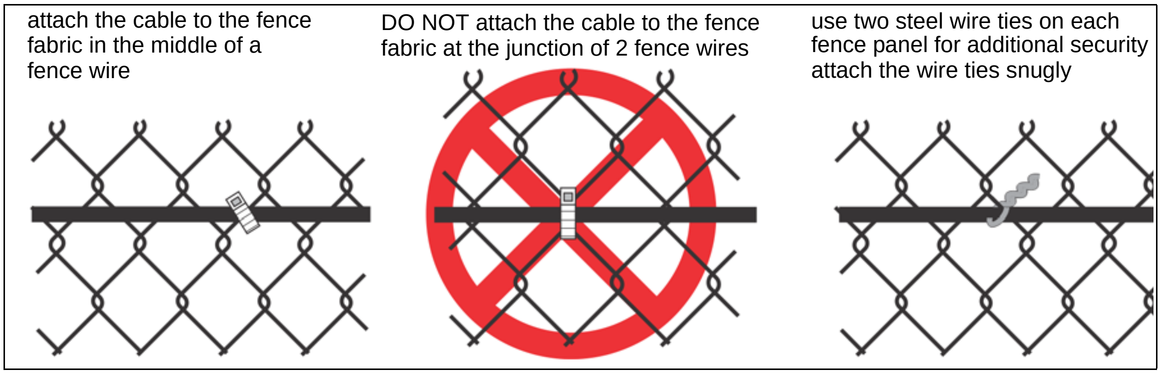


Figure 17: Securing cable to a chain-link fence

Bend radius

- The smallest allowable bend radius for MEX sensor cable is 4 cm (1.5 in.).
- The smallest allowable bend radius for Mark 2 sensor cable is 7.5 cm (3 in.).
- The smallest allowable bend radius for Armour-FLEX sensor cable is 15 cm (6 in.).

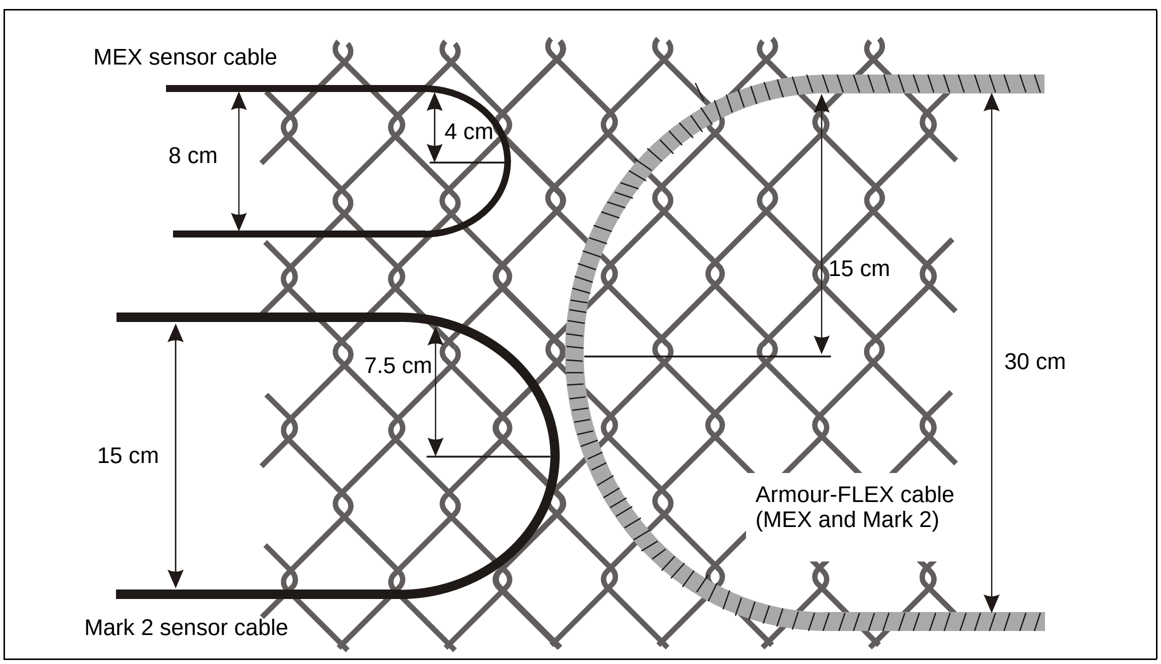


Figure 18: Smallest allowable bend radius

At fence posts

- Secure the cable at both sides of each fence post so the cable is in contact with the post. The cable should have enough slack so that it is not stressed, but be tight enough so that it can not easily move.

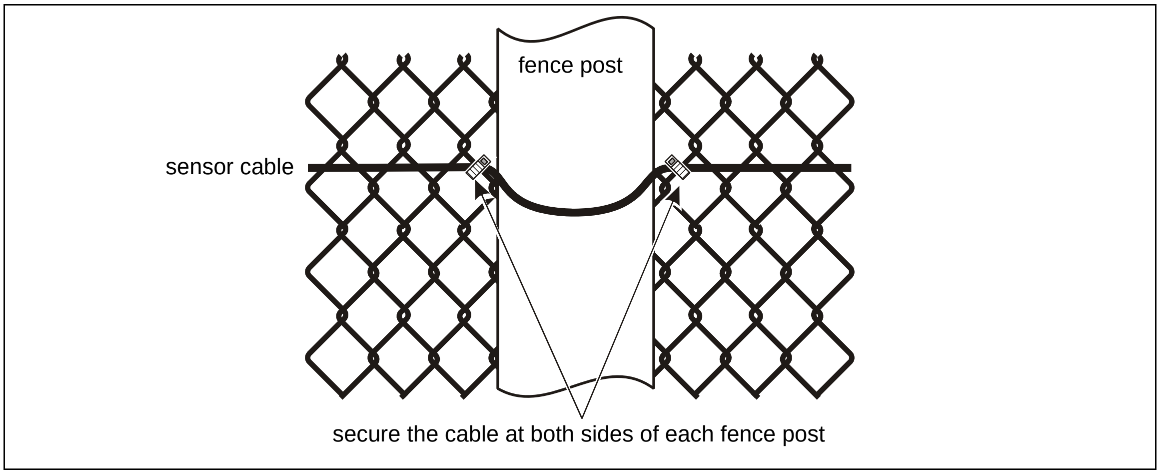


Figure 19: Cable at fence posts

At corners or heavier gauge posts

Install a sensitivity loop at all fence corners and at any heavier gauge fence posts.

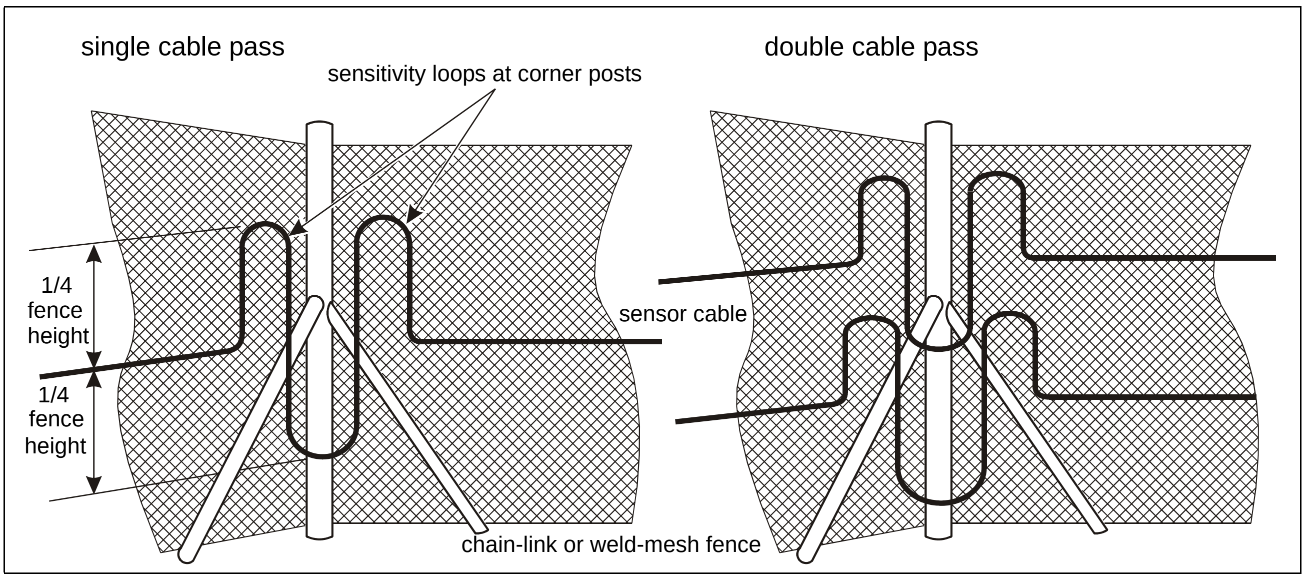


Figure 20: Sensor cable at corner and at heavier gauge posts

Service loops

- Install U-shaped service loops approximately 15 m (50 ft.) apart along the sensor cable run. The loop should measure 30 to 45 cm from top to bottom. Install service loops at fence posts.
- For a double cable pass create two equally spaced service loops in the same manner as for a single cable pass.

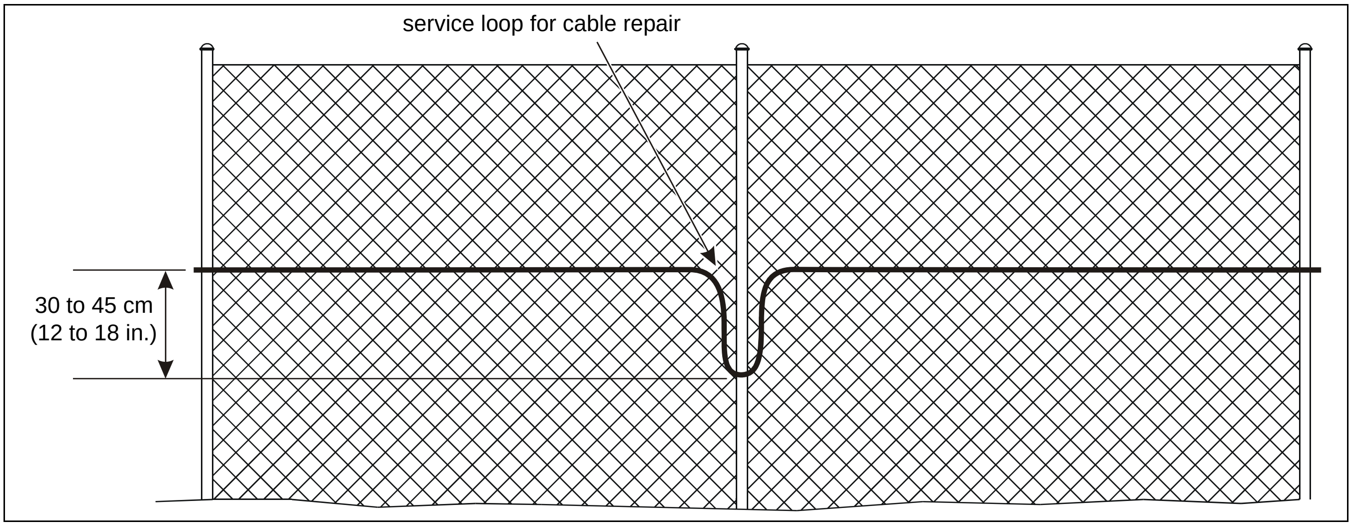


Figure 21: Single cable pass service loop

Sensor cable overlaps

Senstar recommends creating an overlap where adjacent FlexPS zones meet (see Figure 10: for start point overlaps, and Figure 22: for end point overlaps).

Note	An alarm originating in an overlap can be reported in both zones.

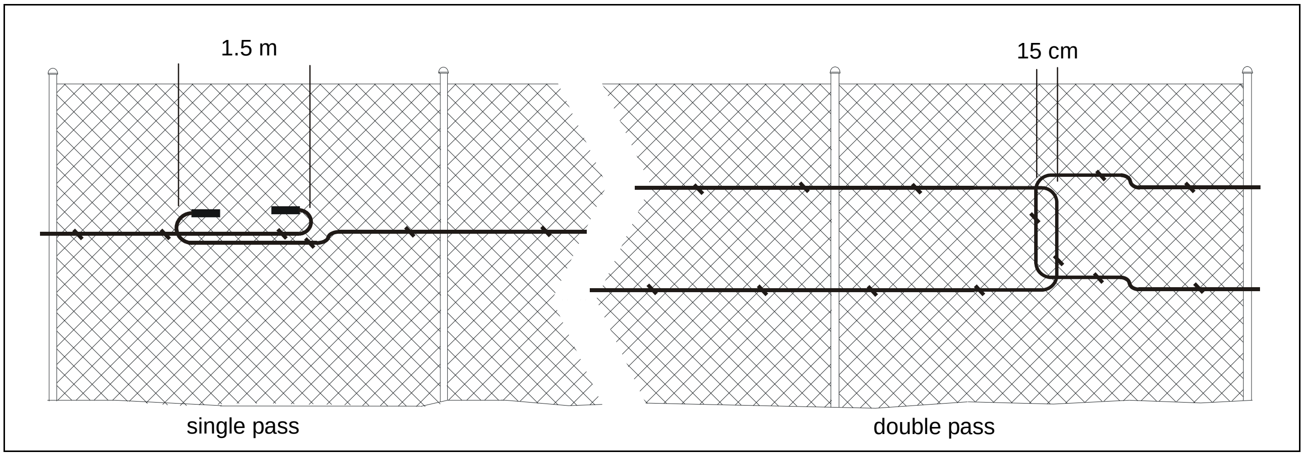


Figure 22: End point overlaps - adjacent zones

Installing cable on chain-link

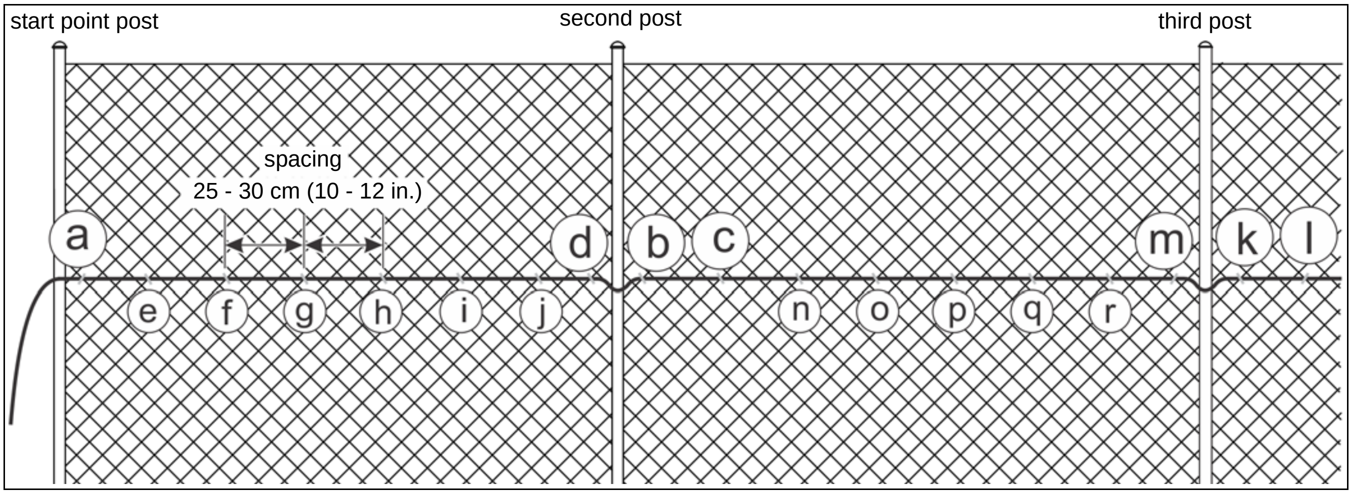


Figure 23: Installation procedure diagram

1. Dispense the sensor cable alongside the installation location on the secure side of the fence. Do not allow the sensor cable to fall off the spool, as it may twist and kink.
2. Beginning at the start point of the zone, attach the sensor cable to the fence fabric (point a). Leave enough extra sensor cable at this point to install a splice kit, or form a service loop and connect the sensor cable to the processor (app. 1 m, 3.3 ft.).
3. Hold the sensor cable straight and level along the fence while you attach the cable to the fence fabric beside the second post at point b. Ensure that there is no slack in the sensor cable.
4. Attach the cable to the fence at point c.
5. Attach the cable to the fence beside the second post at point d.
6. Return to the start point and install cable ties every 25 to 30 cm (10 to 12 in.) along the first fence panel at points e to j.
7. Hold the sensor cable straight and level along the fence while you attach the cable to the fence fabric beside the third post at point k.
8. Attach the cable to the fence at point l.
9. Attach the cable to the fence beside the third post at point m.
10. Return to the second post and install cable ties every 25 to 30 cm (10 to 12 in.) along the second fence panel at points n to r.
11. Repeat this procedure, one fence panel at a time, until the cable is fully installed.
12. Verify that there are no slack or loose sections of cable, and that the cable ties are properly tightened. Trim and properly discard the ends of the cable ties.

Drip loops

- Install drip loops at every cable connector. Form the drip loop by raising the connector 15 cm (6 in.) above the level of the cable run before securing it, horizontally, to the fence fabric.

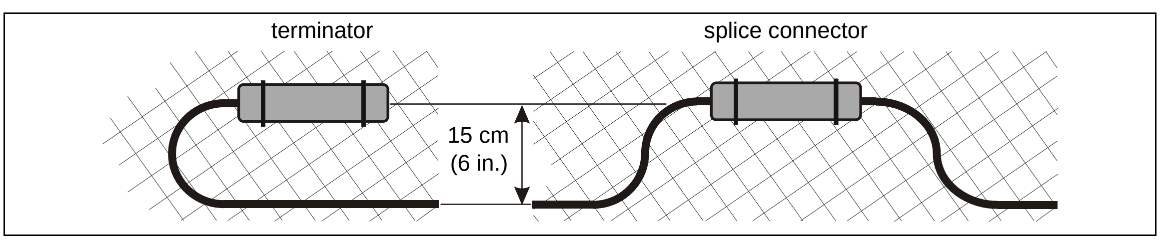


Figure 24: Drip loops

Installing terminators

Note	If there is excess sensor cable at the terminator’s location, do not coil the cable and attach it to the fence. Either cut the cable to the proper length, or loop the cable back along the fence. The sensor cable and enclosure must remain dry during installation.

FlexPS sensor cable must be properly terminated to enable processor supervision of the cable. To terminate the sensor cable, a terminal block is used to install a 1 MΩ resistor between the center conductor and the shield at the end of the cable (away from the processor). Begin by cutting the cable approximately 0.5 m (20 in.) past the specified termination point.

Installing terminators on MEX cable

1. At the cut end of the sensor cable, carefully, remove 2.5 cm (1 in.) of the outer jacket.
   DO NOT nick the braided shield.
2. Separate and peel back the exposed braided shield.

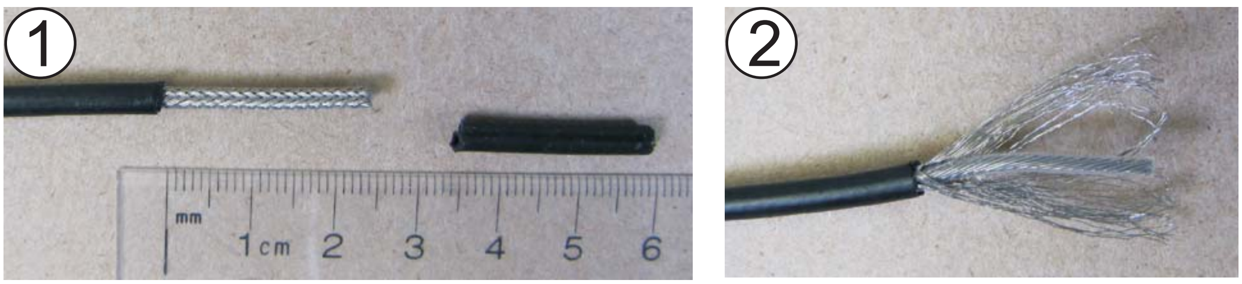


Figure 25: Preparing MEX sensor cable

3. Tightly twist the separated strands of shield into a single conductor, and then carefully remove 6 mm (0.25 in.) of the insulator from the center conductor.
   DO NOT nick the center conductor.
4. Insert the twisted shield into one of the terminals of the terminal block and tighten the screw.
   Insert the center conductor into the adjacent terminal and tighten the screw.
   Insert the termination resistor into the opposing two terminals and tighten the screws.

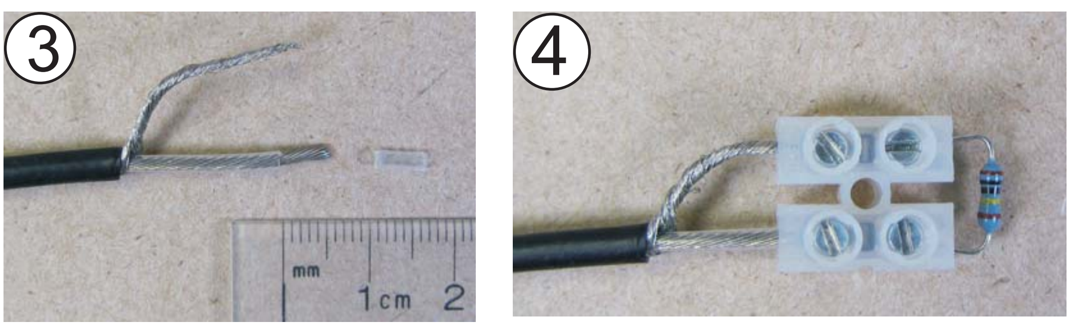


Figure 26: Preparing the terminal block

5. Line up the terminal block with the center of the enclosure and tightly install two cable ties where the sensor cable fits into the cable guide bars. The cable ties provide strain relief for the termination.
6. Align the cable ties to fit beside the guide bars, line up the terminal block with the center of the enclosure, and press the assembly firmly into the enclosure.

DO NOT remove the protective gel inside the enclosure.

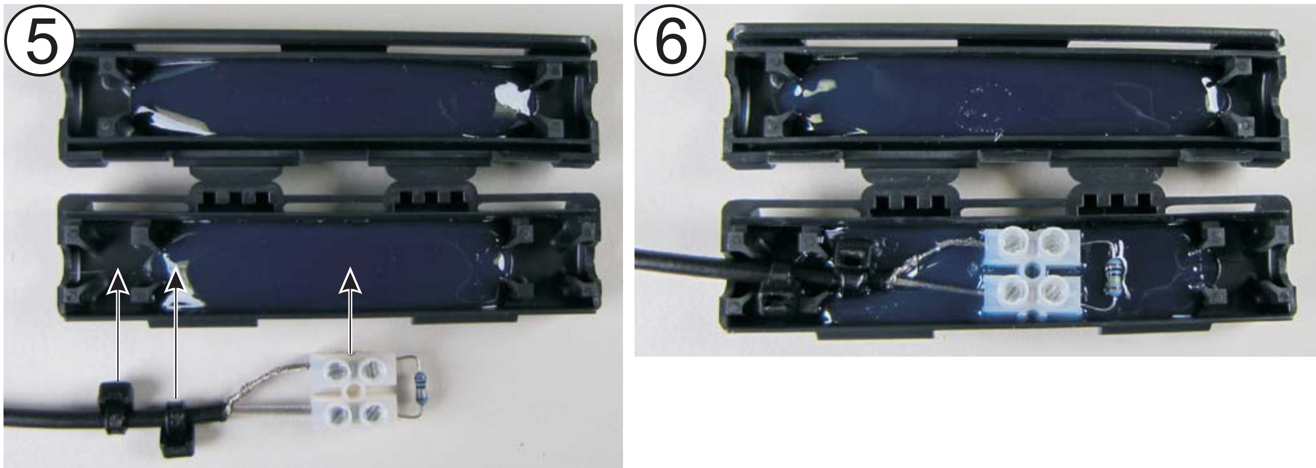


Figure 27: Preparing the termination enclosure

7. Snap the enclosure shut ensuring that both tabs are securely locked in the slots.
8. Attach the enclosure to the fence.

Note	Form a 15 cm drip loop and install the enclosure horizontally to protect the cable entry points from rain and run off.

Figure 28: Mounting the termination enclosure

Installing terminators on Mark 2 cable

1. At the cut end of the sensor cable, carefully, remove 2.5 cm (1 in.) of the outer jacket.
   DO NOT nick the braided shield.
2. Separate and peel back the exposed braided shield.

Figure 29: Preparing Mark 2 sensor cable step 1 & 2

3. Tightly twist the separated strands of shield into a single conductor, and then carefully remove 6 mm (0.25 in.) of the insulator from the center conductor.
   DO NOT nick the center conductor.

4. Slide the plastic ferrule over the center conductor and into the clear tube.
   OR
   Remove 5 mm (¼ in.) of the foil covering from the clear tube.

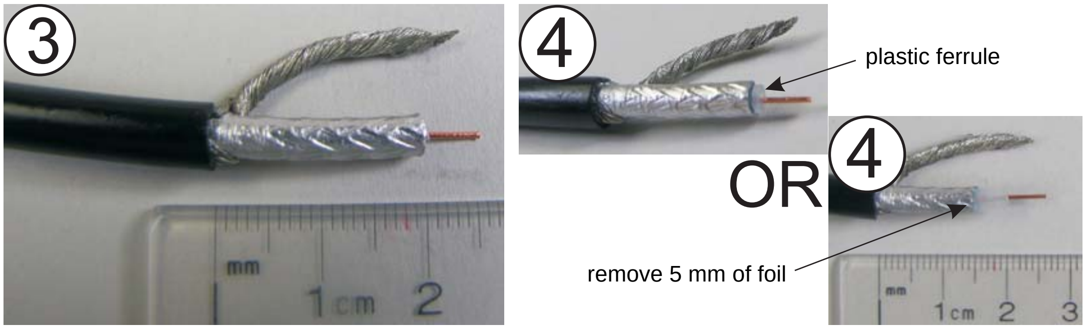


Figure 30: Preparing Mark 2 sensor cable step 3 & 4

5. Insert the twisted shield into one of the terminals of the terminal block and tighten the screw.
   Insert the center conductor into the adjacent terminal and tighten the screw.
   Insert the termination resistor into the opposing two terminals and tighten the screws.
6. Line up the terminal block with the center of the enclosure, and press the assembly firmly into the enclosure.
   DO NOT remove the protective gel inside the enclosure.

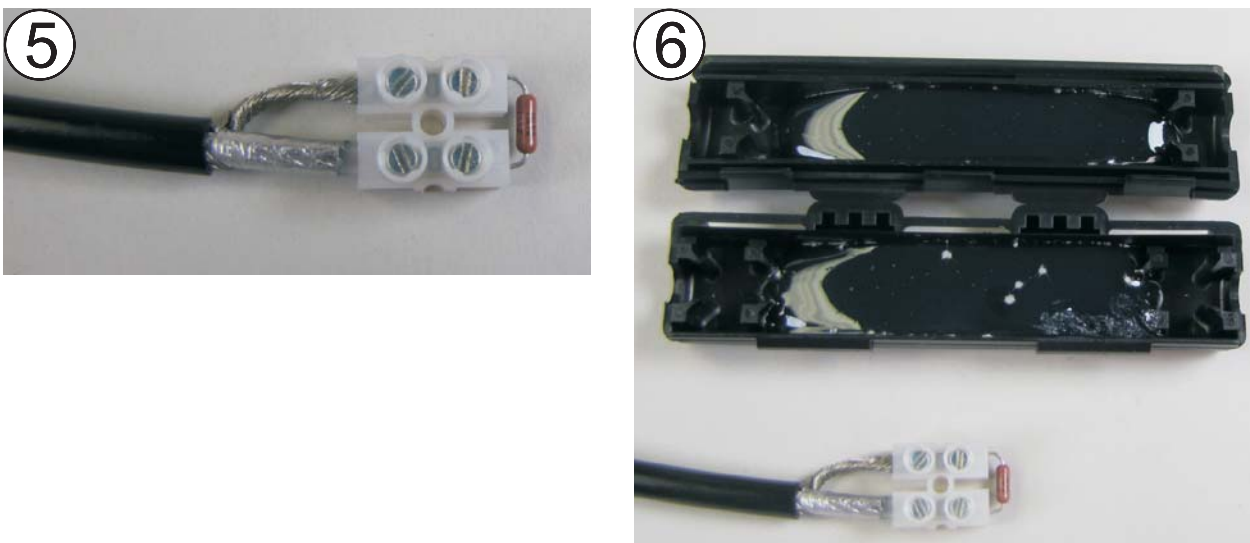


Figure 31: Preparing the terminal block

7. Snap the enclosure shut ensuring that both tabs are securely locked in the slots.
8. Attach the enclosure to the fence (see Figure 28:).

Note	Form a 15 cm drip loop and install the enclosure horizontally to protect the cable entry points from rain and run off.

Splicing cable

Note	The sensor cable and enclosure must remain dry during installation.

Note	Senstar recommends that the number of cable splices in a sensor zone be kept to the minimum requirement. Splices are required to connect lead-in cable to detecting cable, for gates and other bypasses, and to connect two 150 m lengths of Mark 2 sensor cable. Splices that are used for cable repair should be limited to two per cable length.

Cable splices are made the same way for sensor cable to sensor cable splices and for lead-in cable to sensor cable splices. Leave enough extra cable to form a drip loop by elevating the splice enclosure 15 cm above the sensor cable.

Splicing MEX sensor cable

Follow steps 1, 2 and 3 from Installing terminators on MEX cable on page 31 to prepare the cables for splicing.

4. Insert the two twisted shields into opposing terminals of the terminal block and tighten the screws.
   Insert the two center conductors into the two adjacent terminals and tighten the screws.
   Ensure that shield meets shield and center conductor meets center conductor.
5. Line up the terminal block with the center of the enclosure and tightly install two cable ties on each cable where the cables fit into the cable guide bars. The cable ties provide strain relief for the splice.

Connect shield to shield and center conductor to center conductor.

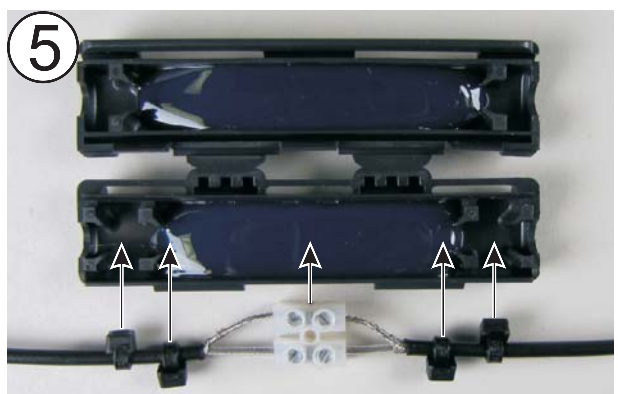


Figure 32: Splicing MEX sensor cable

6. Align the cable ties to fit beside the guide bars, line up the terminal block with the center of the enclosure, and press the assembly firmly into the enclosure.
   DO NOT remove or disturb the protective gel inside the enclosure.

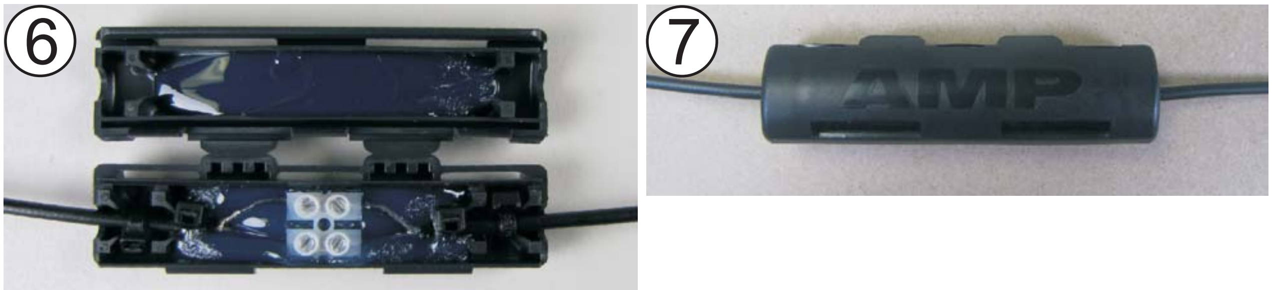


Figure 33: Preparing the splice enclosure

7. Snap the enclosure shut ensuring that both tabs are securely locked in the slots.
8. Attach the enclosure to the fence.

Note	Form drip loops and install the enclosure horizontally to protect the cable entry points from rain and run off.

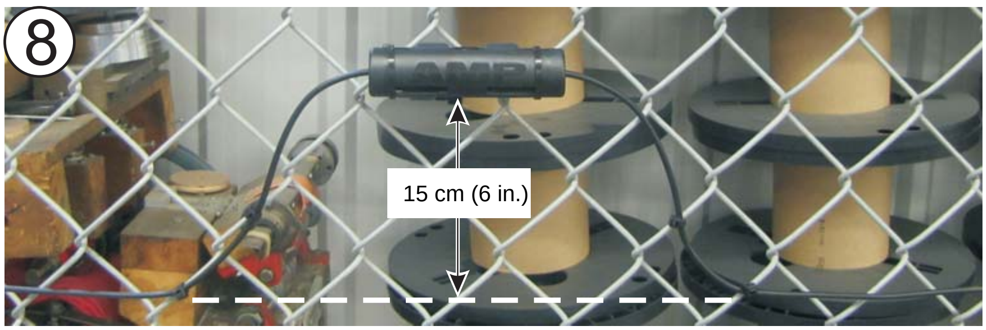


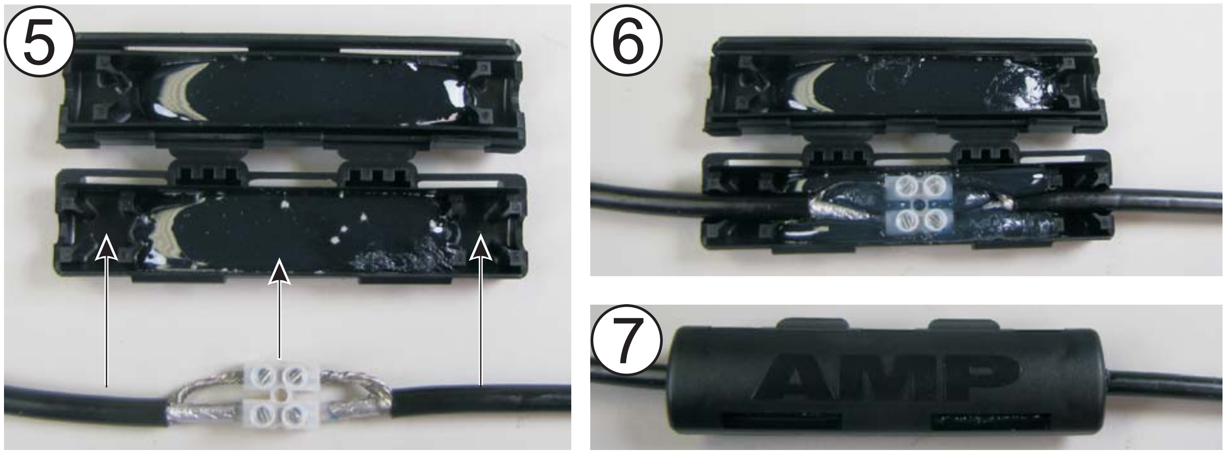
Figure 34: Mounting the splice enclosure

Splicing Mark 2 sensor cable

Follow steps 1, 2, 3 and 4 from Installing terminators on Mark 2 cable on page 32 to prepare the cables for splicing.

5. Insert the two twisted shields into opposing terminals of the terminal block and tighten the screws.
   Insert the two center conductors into the two adjacent terminals and tighten the screws.
   Ensure that shield meets shield and center conductor meets center conductor.
6. Line up the terminal block with the center of the enclosure and line up the sensor cable with the cable guide bars in the enclosure. Press the assembly firmly into the enclosure.
   DO NOT remove or disturb the protective gel inside the enclosure (see Figure 35:).
7. Snap the enclosure shut ensuring that both tabs are securely locked in the slots.
8. Attach the enclosure to the fence (see Figure 34:).

Note	Form drip loops and install the enclosure horizontally to protect the cable entry points from rain and run off.



Connect shield to shield and center conductor to center conductor.

Figure 35: Splicing Mark 2 sensor cable (steps 5, 6 & 7)

Installing cable on gates

Gates usually require the same level of protection as the fence.

- Install the sensor cable on the side of the fence into which the gate panel opens.
- If the gate panel opens in the opposite direction, or both directions, leave enough slack in the sensor cable so that the gate can be fully opened in either direction.
- Make sure that there is no loose sensor cable when the gate is closed.
- On swinging gates, run the cable from the fence to the gate at the hinged side of the gate, and then back to the fence on the same side.
- Ensure that the cable cannot be caught and pinched when the gate opens and closes.
- Run the cable once completely around the gate approximately 30 cm from the edge.
- Install a bypass cable below ground inside conduit.
- Continue installing the cable on the remainder of the fence.

Gate bypass cable

To bypass a gate in a FlexPS zone, splice in a length of non-sensitive lead-in cable, and run it from one side of the gate to the other, underground. The gate can be protected with another technology, such as a microwave system (see Figure 36:).

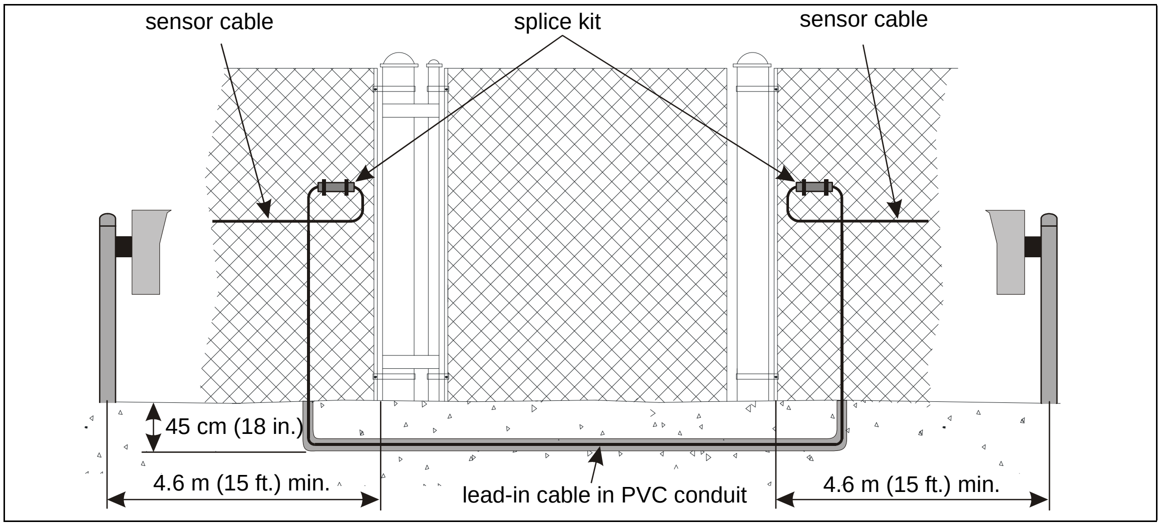


Figure 36: Figure 36: Gate bypass (using microwave protection)

Bypass cable installation instructions

1. Install the sensor cable on the fence in the usual manner.
2. Cut a piece of PVC conduit to the required length, and bury the conduit at a depth of 45 cm (18 in.).
3. Pull the bypass cable through the buried conduit, and then cut the bypass cable.
4. Splice-connect the bypass cable to the sensor cable.
5. Seal the ends of the conduit.

Installing sensor cable on swinging gates

1. Run sensor cable to the hinged side of the gate.
2. Make a service loop that reaches the gate without binding the cable when the gate is fully opened in either direction.
3. Run the sensor cable around the perimeter of the gate panel, 30 cm (12 in.) in from the edges. (For a double panel swinging gate install the sensor cable on both gate panels.)
4. Run a bypass cable from one side of the gate to the other.

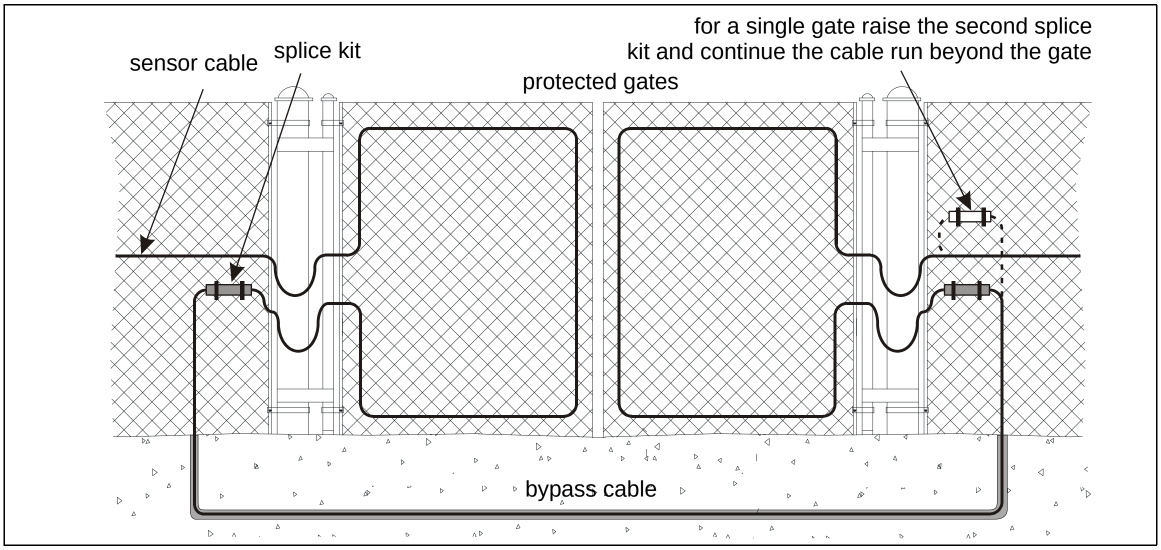
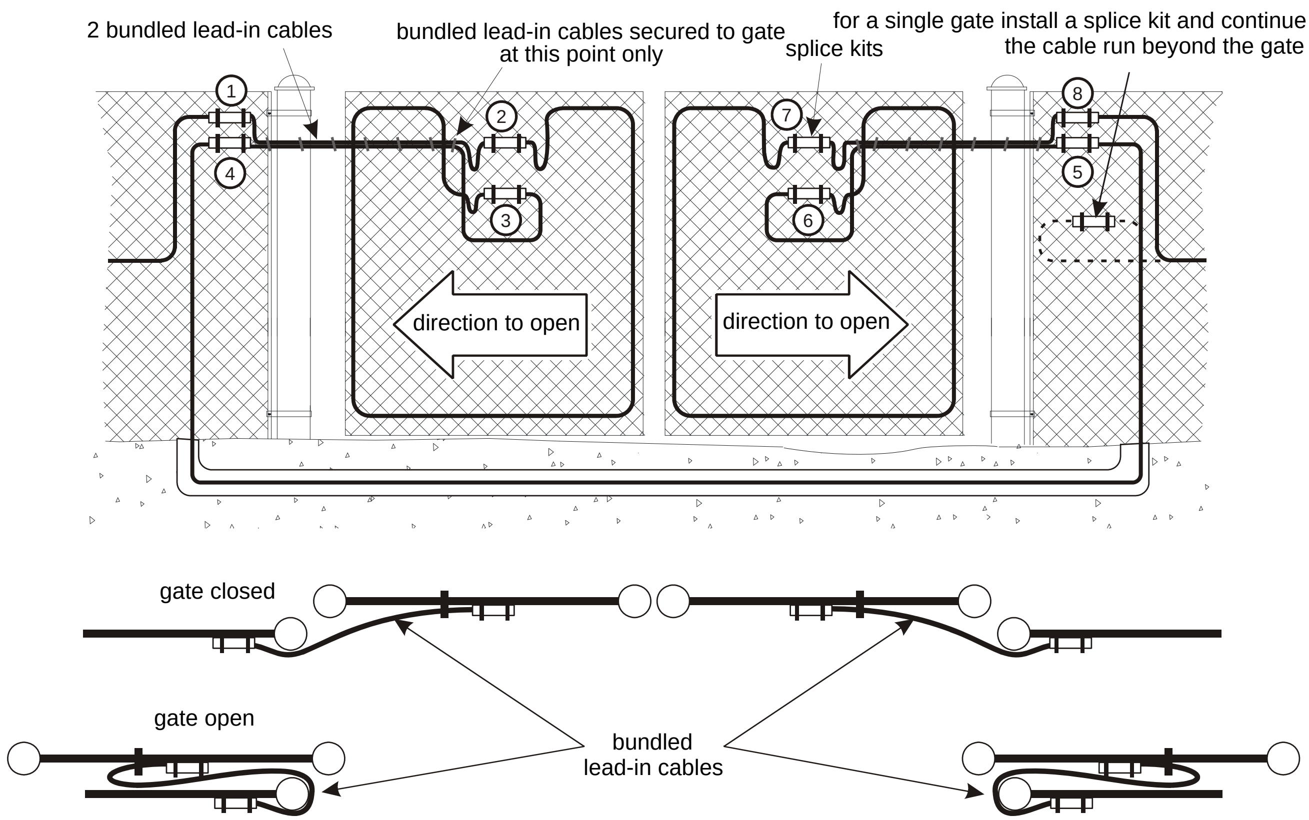


Figure 37: Installing sensor cable on swinging gates

Sliding gates with cable protection

Protect sliding gates by installing sensor cable on the gate panel, and connecting it to the sensor cable on the fence with lead-in cable.

1. Run the sensor cable around the perimeter of each gate panel from top center to top center, with a 20 cm (8 in.) overlap.
2. Determine the length requirements for the lead-in cable.
3. Using cable ties, bundle two lead-in cables together and secure the bundle to one gate at the location indicated.
   For a double sliding gate, repeat for the second gate.
4. Run a bypass cable from one side of the gate to the other.
5. Join the lead-in cables to the sensor cables and bypass cable using splice kits.



Connection details

1. Sensor cable on fence to lead-in cable to gate.
2. Lead-in cable to gate to sensor cable on gate.
3. Sensor cable on gate to lead-in cable to fence.
4. Lead-in cable from gate to bypass cable to other side of gate.
5. Bypass cable to lead-in cable to second gate.
OR Bypass cable to sensor cable beyond gate (for a single panel sliding gate).
6. Lead-in cable to sensor cable on second gate.
7. Sensor cable on second gate to lead-in cable to fence.
8. Lead-in cable from gate to sensor cable on fence.

Figure 38: Sliding gate on inside of perimeter

Installation at a sliding gate on the outside of the perimeter

Note	It may be necessary to install an L-bracket as a cable guide bar, to prevent the cable from being jammed between the gate and the fence panel.

Secure the lead-in cables to the cable guide bar (L-bracket) to prevent the cables from becoming jammed between the gate and the fence when the gate is opened.

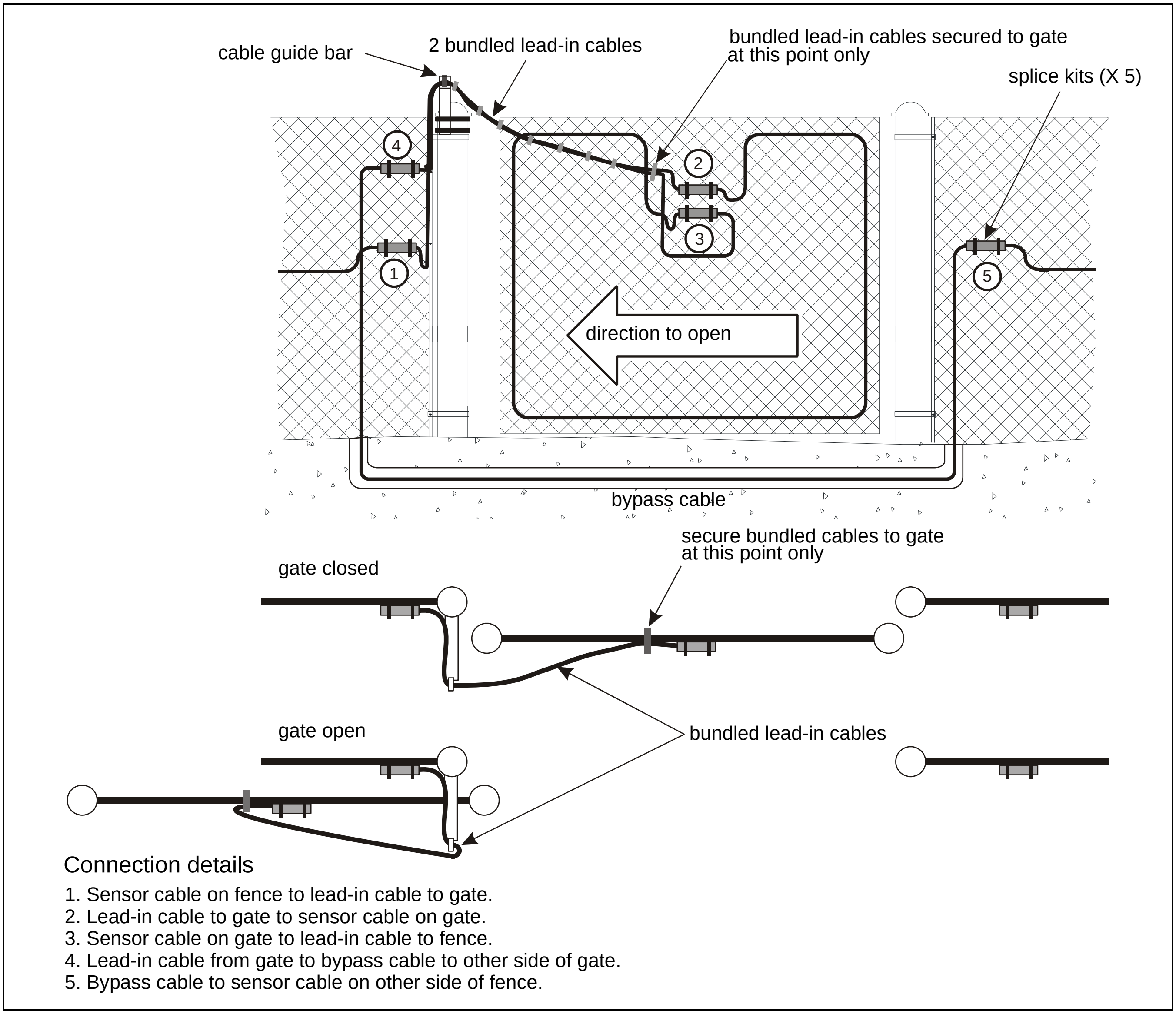


Figure 39: Sliding gate on outside of perimeter

Gate disconnect assembly

The gate disconnect assembly protects gates that are infrequently used. The gate can be opened and closed by manually separating the connection. When the assembly is opened, a supervision alarm is generated. When the assembly is closed the gate is protected and secure.

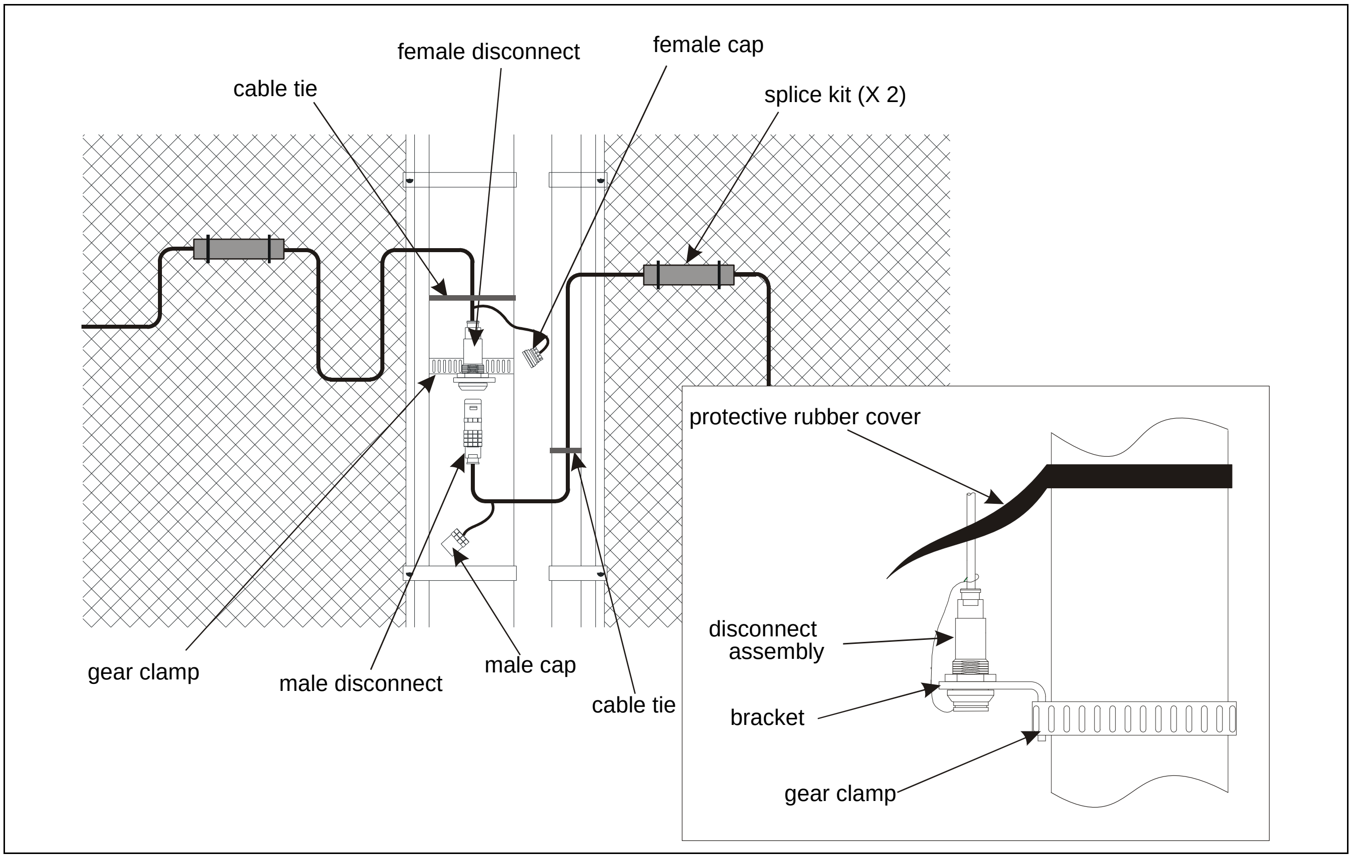


Figure 40: Gate disconnect assembly

Installation instructions

1. Place the male cap stay wire over the open end of the lead-in cable on the male connector. Put the cap in place on the connector during installation.
2. Wrap a gear clamp (customer supplied) around the fixed post on the opening side of the fence on which the gate disconnect will be mounted.
3. Before tightening the clamp, position the L-bracket against the post under the clamp.
4. Tighten the clamp until the assembly is firmly attached to the post.
5. Dress the lead-in cables to the splice kits with cable ties.
6. Follow the directions for a standard splice.
7. Attach the rubber cover over the disconnect assembly.

Note	When caps are not in use, they fit into one another for protection and storage. Cap the connectors when the gate will be open for extended periods.

Installing Armour-FLEX sensor cable

Note	Mark 2 Armour-FLEX sensor cable must be conditioned before it is attached to the fence. MEX Armour-FLEX sensor cable does not require conditioning.

- Handle Armour-FLEX cable carefully to prevent twisting, bending, kinking, jerking, or stretching the cable. Take extra care when deploying Armour-FLEX around curves and corners. Mishandling the cable can damage the jacket, and adversely affect the sensor cable.

- The smallest allowable bend radius for Armour-FLEX sensor cable is 15 cm (6 in.).
- DO NOT subject Armour-FLEX cable to excessive tension (max. 3.4 kg, 7.5 lb).
- Armour-FLEX cable comes in 100 m (328 ft.) lengths. You can splice up to three sections of Armour-FLEX together to create a 300 m (985 ft.) zone (see Figure 50:).
- Use Armour-FLEX condulet fittings to protect cable splices and terminations (see Figure 51:).
- If you must move Armour-FLEX after dispensing the cable on the ground, carefully move it in 5 m (16 ft.) lengths, to prevent cable damage.
- Use UV resistant polypropylene cable ties, stainless steel straps, or wire ties to secure the Armour-FLEX to the fence fabric.
- Secure Armour-FLEX tightly to the fence fabric at either the midpoint of the chain-link or at the junction of two fence links.
- Keep the ends of the Armour-FLEX cable dry.

Mark 2 Armour-FLEX cable **conditioning** procedure

Before installing Mark 2 Armour-FLEX sensor cable, the cable must be conditioned. Prior to conditioning, there may be excess center conductor in the cable, or the center conductor may be adhered to the cable side walls after the manufacturing process. Conditioning frees the center conductor and maximizes its movement, thereby providing the greatest sensitivity. Cable conditioning requires two people to complete and typically takes less than 10 minutes for a 150 m sensor cable.

Cable **conditioning** procedure (part 1 - loosening the center conductor)

1. Dispense the sensor cable alongside the fence in a long straight line.
2. At both ends of the sensor cable, carefully remove 45 cm (18 in.) of the armoured jacket, then remove 30 cm (12 in.) of the black jacket, shield and clear tube to expose 30 cm of the center conductor.
3. Check the ends of the cable to verify that the center conductor is free to retract or extend
   If an end is damaged enough to prevent the free movement of the center conductor, cut off the damaged section and restrip the cable.

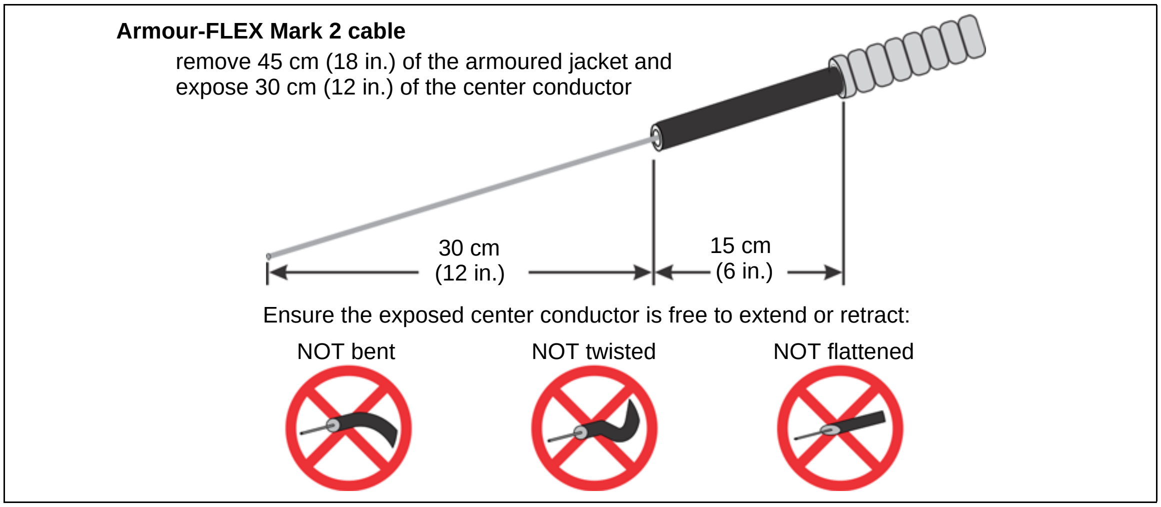


Figure 41: Exposing the center conductor

4. At both ends of the cable, use a cable tie, or a 2.5 cm (1 in.) piece of the outer jacket, to secure the center conductor to prevent it from retracting into the cable during the conditioning procedure.

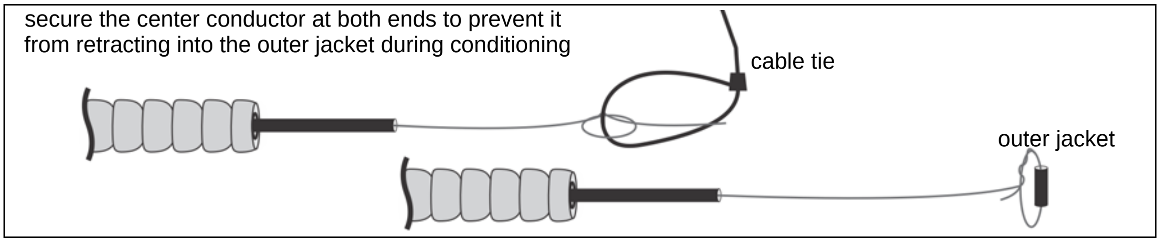


Figure 42: Securing the center conductor

5. At one end of the sensor cable, the first person firmly holds the sensor cable by the black jacket with one hand, while using the other hand to grip the center conductor with a pair of pliers (see Figure 43:).
6. Apply 2 kg (4.5 lb) of pulling tension to the center conductor with the pliers while maintaining a firm grip on the cable's black jacket.

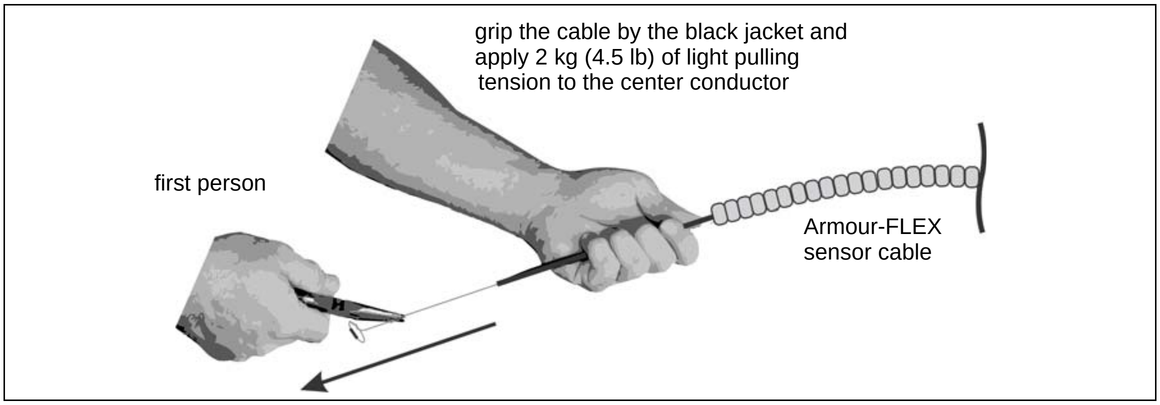


Figure 43: Conditioning Armour-FLEX cable (part 1)

Note	Maintain a firm grip and consistent pulling tension, and keep the sensor cable taut and in-line with the second person during the center conductor loosening procedure.

7. The second person picks up the sensor cable near the first, and waves it back and forth a few times creating small waves, which travel approximately 1 to 3 m (3 to 10 ft.) in both directions along the cable.

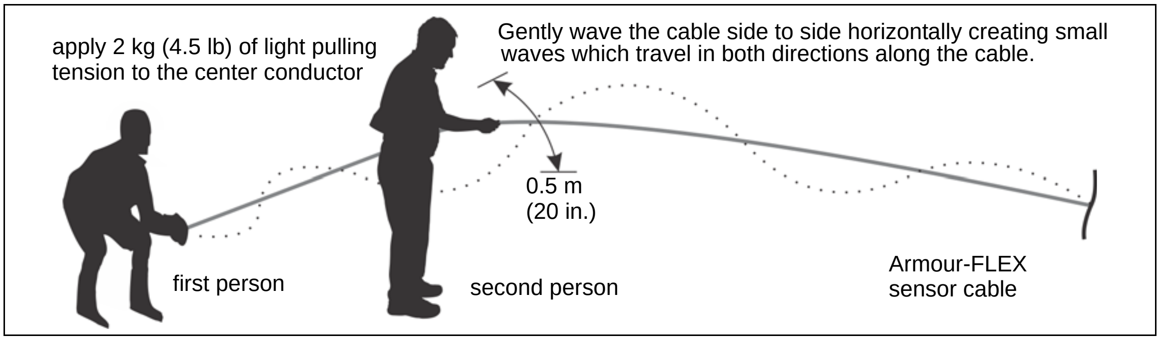


Figure 44: Conditioning Armour-FLEX cable (part 1)

8. The second person moves along the sensor cable, waving the cable back and forth at one meter intervals while the first person maintains a firm grip on the cable, and consistent tension on the center conductor.
9. When the second person reaches the end of the sensor cable, the first person releases the tension on the center conductor at the other end.

Cable conditioning procedure (part 2 - cable flossing)

Pull the cable by the armoured jacket to remove any slack and then use a “flossing” motion to pull the center conductor back and forth to ensure the center conductor is floating freely over the full length of the sensor cable.

Note	Initially, there may be resistance as well as some “stretching” as the center conductor is freed inside the cable (i.e., the center conductor pulls out at one end but remains the same length at the other). Once the center conductor moves back and forth so that pulling it out 15 cm (6 in.) at one end causes it to retract 15 cm at the other end, the conditioning is complete.

Note	If the center conductor does not move back and forth easily (or at all) during the flossing process, it is likely bound somewhere inside the cable. In this case, repeat waving and tapping and flossing until the center conductor moves freely and easily.

1. The second person begins by using pliers to apply 2.3 to 4.5 kg (5 to 10 lb) of pulling tension to the center conductor while maintaining a firm grip on the cable’s black jacket (see Figure 45:). The first person holds the cable firmly by the black jacket and tells the second person to stop pulling when the knot reaches the black jacket.

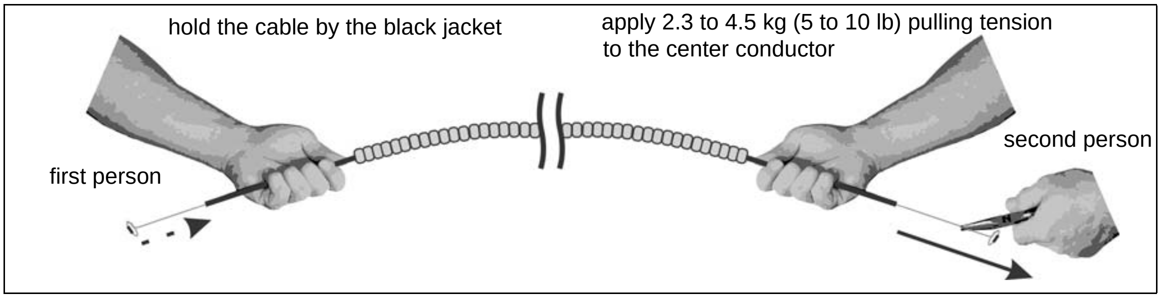


Figure 45: Mark 2 Armour-FLEX cable conditioning (part 2 cable flossing)

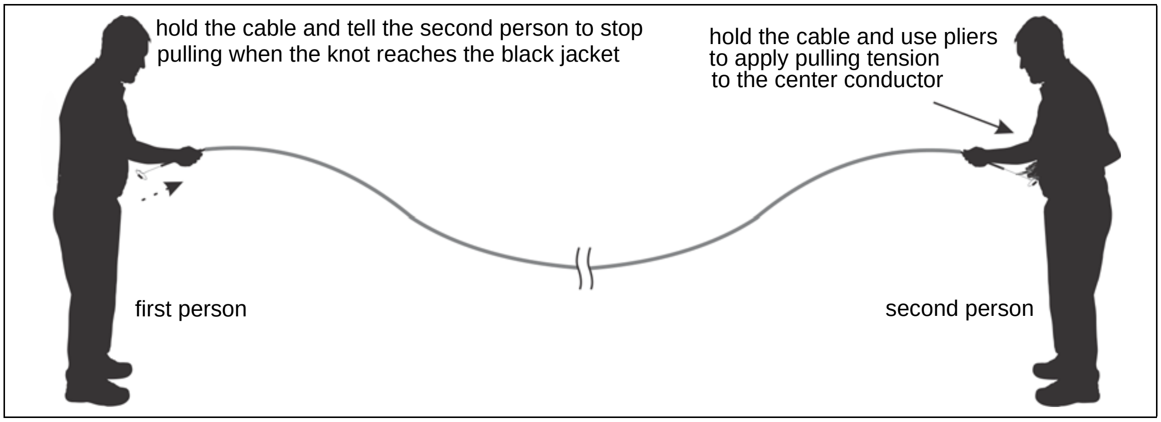


Figure 46: Mark 2 Armour-FLEX cable conditioning (part 2 cable flossing)

2. The first person then uses pliers to apply 2.3 to 4.5 kg (5 to 10 lb) of pulling tension to the center conductor while maintaining a firm grip on the cable’s black jacket (see Figure 16:). The second person holds the cable firmly by the black jacket and tells the first person to stop pulling when the knot reaches the black jacket.

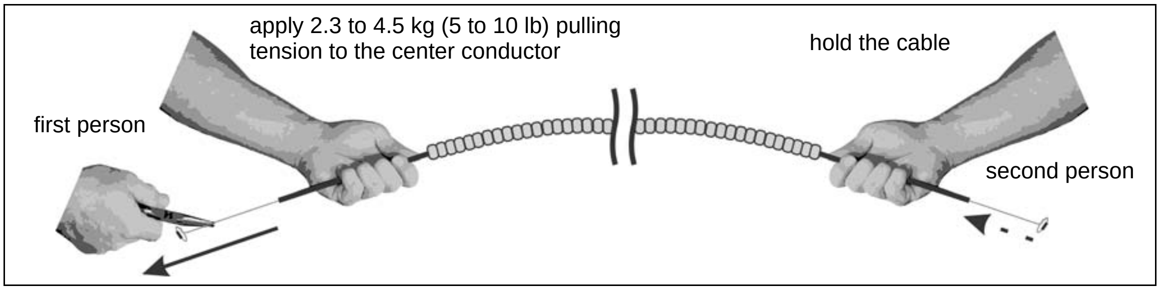


Figure 47: Mark 2 Armour-FLEX cable conditioning (part 2 cable flossing)

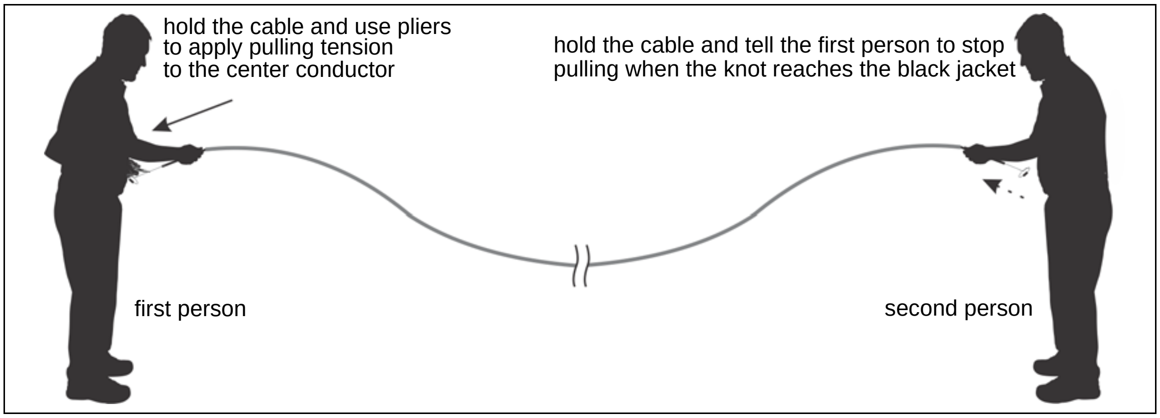


Figure 48: Mark 2 Armour-FLEX cable conditioning (part 2 cable flossing)

3. Continue this back and forth flossing motion until the center conductor moves easily with very little resistance.
4. When the conditioning procedure is complete, release the tension on the center conductor, and cut off any center conductor that was damaged during conditioning.

Note	When conditioning is complete, the center conductor usually extends an additional 15 to 30 cm out of the cable jacket at both ends, and it slides easily in both directions.

Once the Armour-FLEX cable is conditioned, it can be attached to the fence.

Installation instructions

Note	Refer to Installing cable on chain-link on page 30 for additional details.

1. Carefully deploy the entire roll of Armour-FLEX sensor cable on the ground beside the installation location. (The cable should be in place following the conditioning procedure.)
2. Secure the Armour-FLEX to the fence using cable ties, stainless steel straps or wire ties.

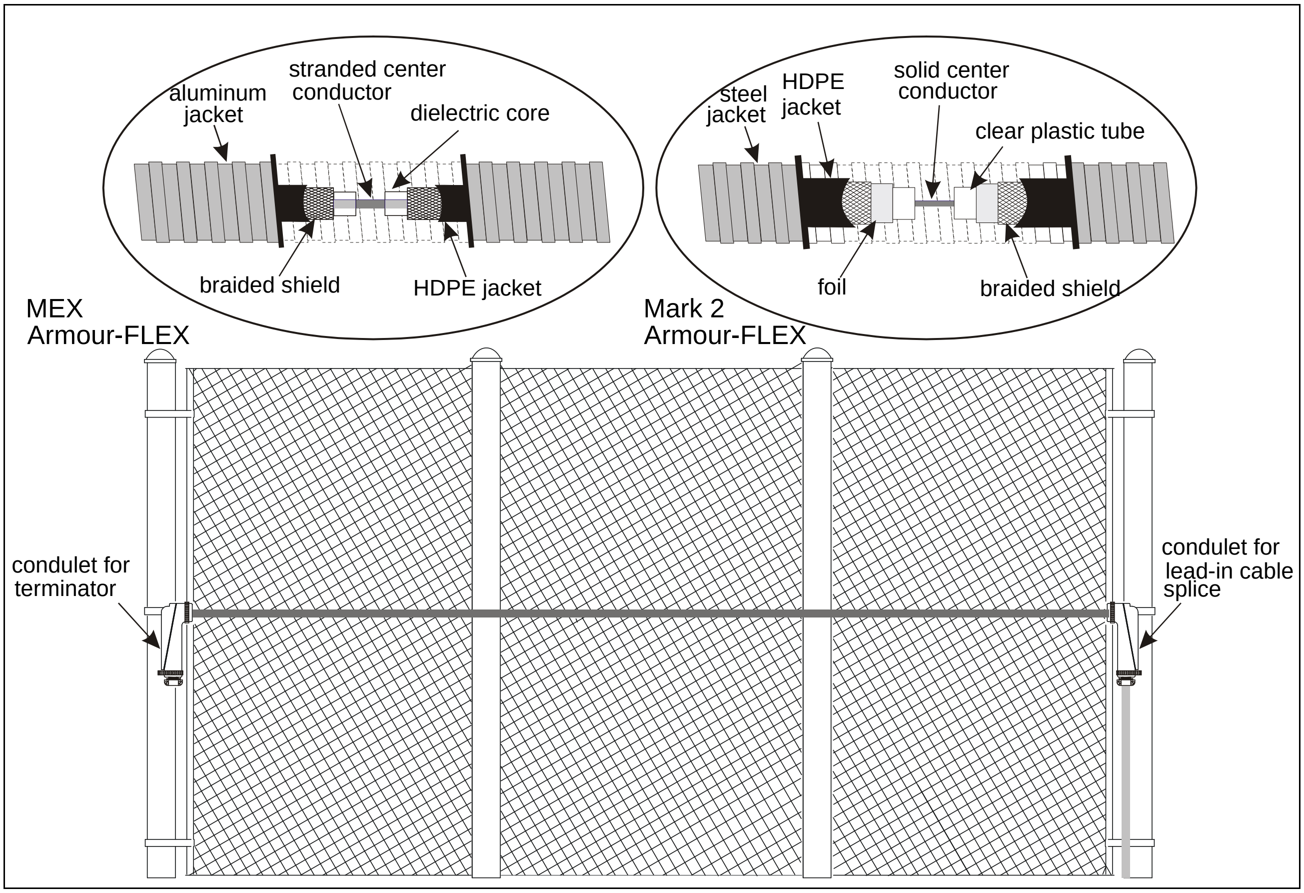


Figure 49: Armour-FLEX break-away comparison view (MEX & Mark 2)

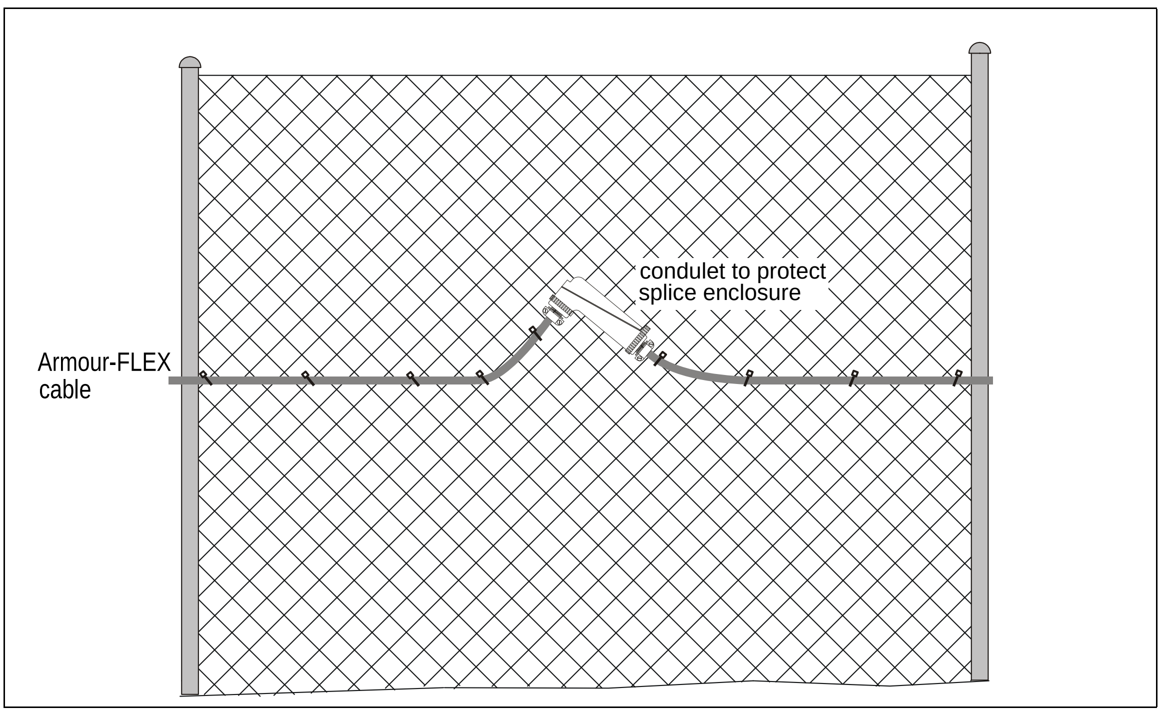


Figure 50: Armour-FLEX cable splice mounting

Figure 51: Armour-FLEX terminator installation

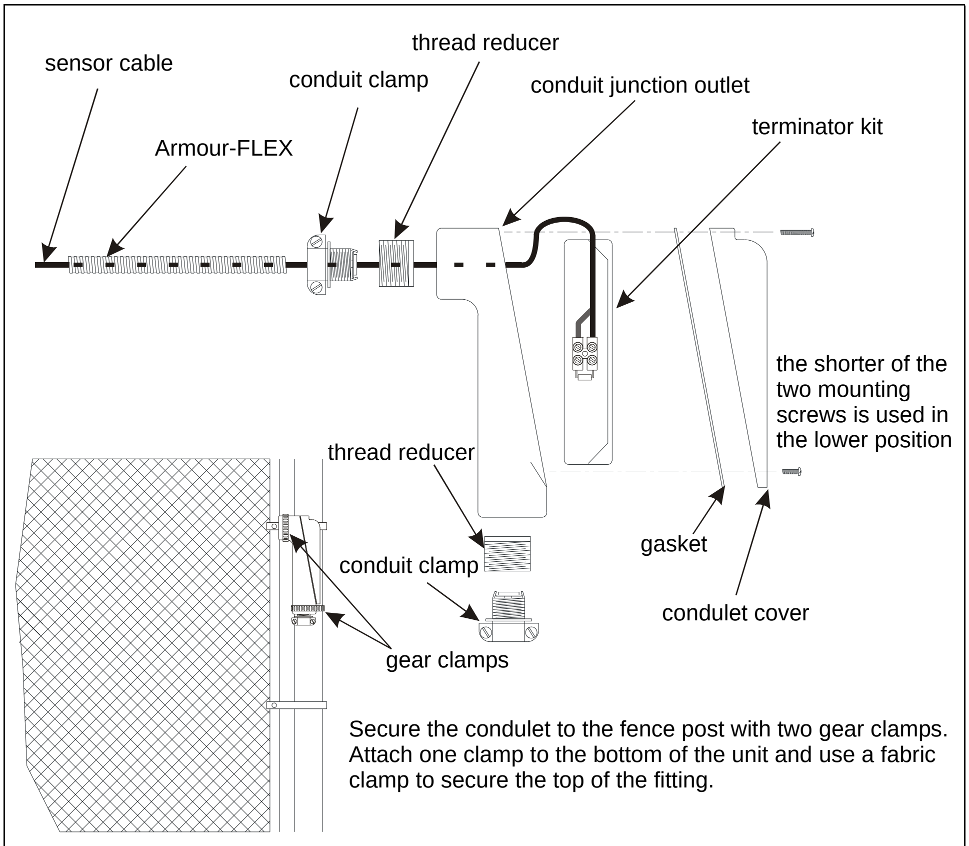
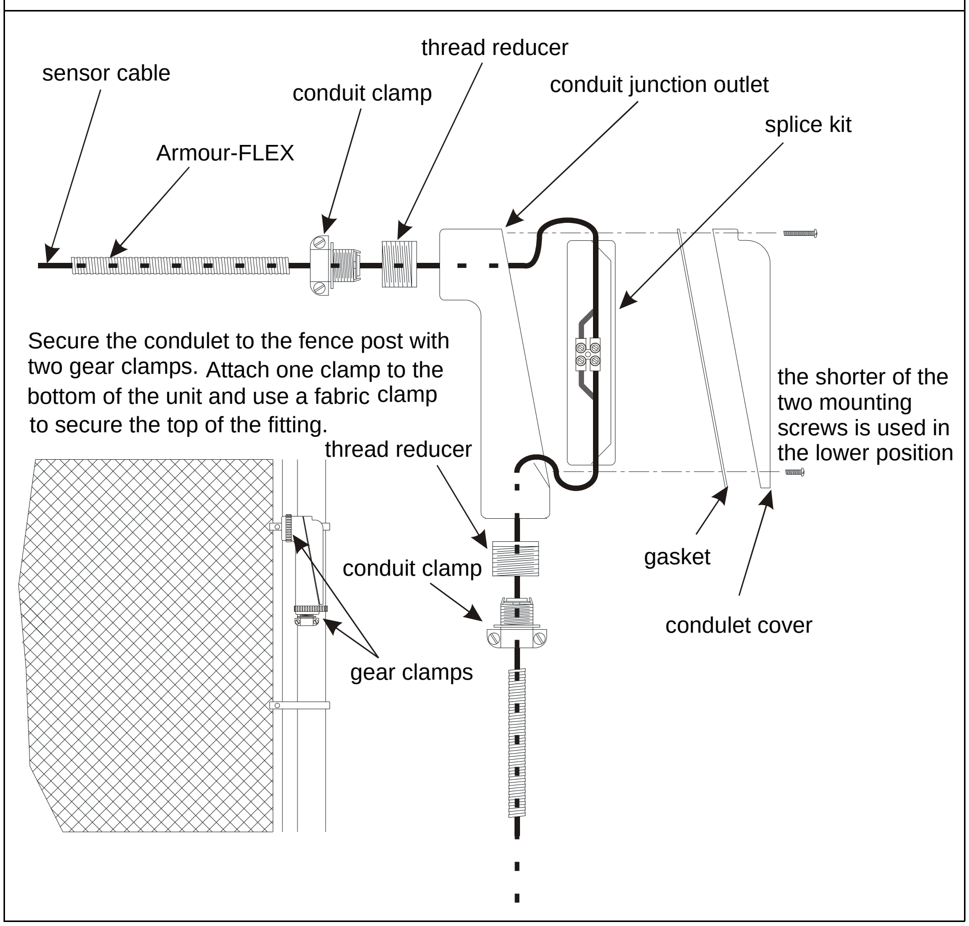


Figure 52: Armour-FLEX splice installation



Installing cable on barbed wire

Note	Senstar recommends the use of Armour-FLEX sensor cable for instances where the cable is attached to barbed wire or razor ribbon.

Refer to Climb-over deterrent hardware on page 9.

- Take care not to damage the sensor cable on the barbs during installation.
- Ensure that there is no possibility of subsequent damage from the barbs.
- Attach the sensor cable to the barbed wire using UV-resistant cable ties.
- If the barbed wire array contains three or more wires, attach the sensor cable to the top wire.
- If the wires in the array are less than 10 cm (4 in.) apart, use a saw-tooth pattern.

On razor ribbon

- Attach the sensor wire to the outer perimeter of the coil (see Figure 3:).
- Use stiffening wires to prevent the concertina from moving.

Installing cable on weld-mesh fence

Note	Follow the installation instructions and use the height recommendations for chain-link fences when installing sensor cable on weld-mesh fence.

- Install the sensor cable on the secure side of the fence (the side opposite the threat).
- Sensor cable being installed on the same side of the fence as the horizontal wires should be placed directly below the horizontal wire and attached every 25 cm (10 in.).
- Sensor cable being installed on the opposite side of the fence as the horizontal wires should be attached at the intersection points of the two wires every 25 cm (10 in.).

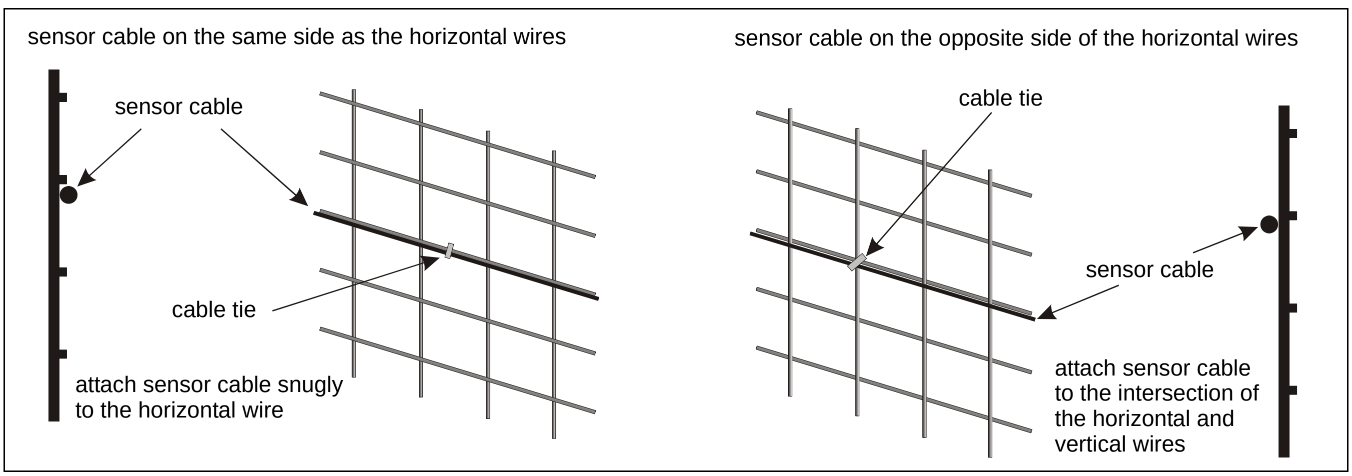


Figure 53: Weld-mesh fence

Installing cable on palisade fence

Note	Senstar recommends Mark 2 sensor cable for palisade fences. Install and test a single, short-length zone on a section of a palisade fence before installing a complete system.

- Install the sensor cable on the secure side of the fence (the side opposite the threat).
- Curve the sensor cable smoothly around the pillars to maintain maximum contact with the fence.
- Deploy the sensor cable in a double pass along the top and bottom horizontal rails.
- No special sensor cable deployment is required at corners.
- Do not use service loops on a palisade fence.
- If possible, position the cable ties behind the vertical stakes along the horizontal rail.

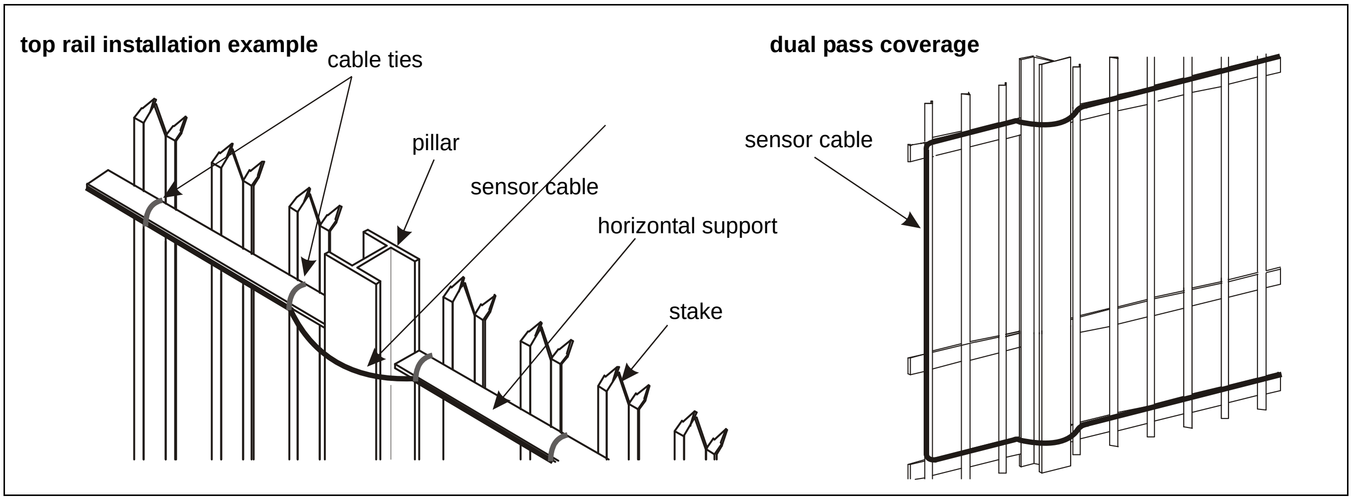


Figure 54: Palisade fence

Installing the FlexPS processor

Do not remove the processor circuit card when installing the enclosure. There is a post mounting kit available for securing the enclosure to a post. There is also a lockable mounting kit available for applications in which the enclosure must be locked. The hardware required to mount the enclosure on another type of surface is customer supplied. Figure 56: shows a fence-mounted dual zone processor with a single pass of sensor cable. The data and power cables are attached to the top of the fence. Figure 55: illustrates the FlexPS processor features and Table 4 includes feature descriptions.

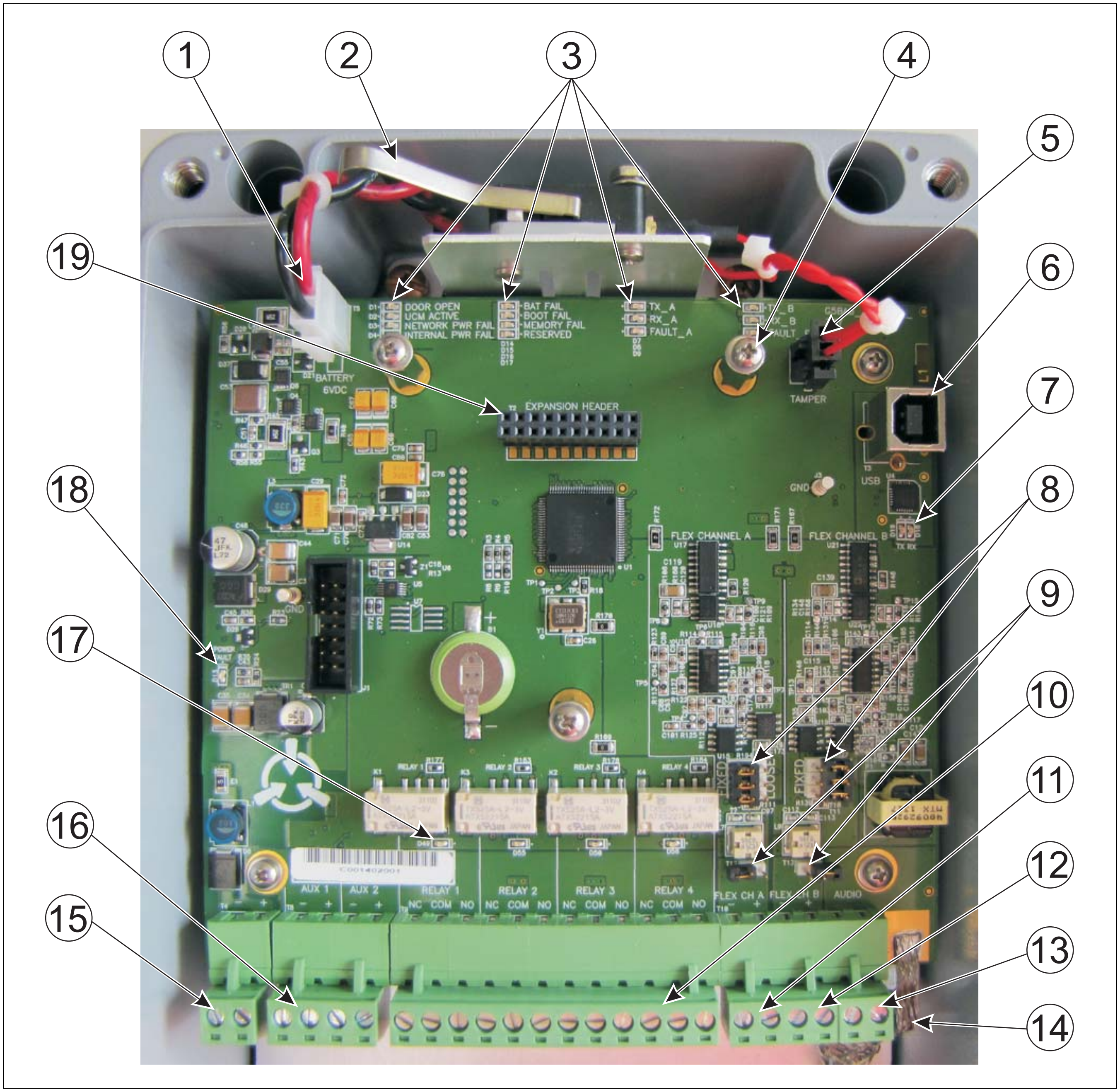


Figure 55: FlexPS processor features

Item	Description	Item	Description
1	T5 - 6 VDC rechargeable battery connector	11	T10 (terminals 1 & 2) - Flex Channel A sensor cable input (- = shield, + = center conductor)
2	Tamper switch - open = tamper alarm	12	T10 (terminals 3 & 4) - Flex Channel B sensor cable input (- = shield, + = center conductor)
3	Activity LEDs - door open, UCM active, network power fail, internal power fail, battery fail, boot fail, memory fail, TXA, RXA, fault A, TXB, RXB, fault B (LED ON = condition active)	13	T10 (terminals 5 & 6) - Flex audio output Connect an amplified speaker to use the audio listen-in feature
4	Network interface card mounting hardware (X 2)	14	PCB ground strap
5	T1 - tamper input	15	T4 - power input (- +) 12 to 48 VDC
6	T3 - USB connection to UCM PC	16	Auxiliary inputs (self-test/audio activation/ auxiliary device inputs) AUX 1 - +, AUX 2 - +
7	UCM activity LEDs (TX, RX)	17	Relay activity LEDs (X4) - LED ON = relay active
8	T6, T15, T7 - Channel A cable selection jumper T14, T16, T11 - Channel B cable selection jumper Place shunt on LOOSE for Mark 2 sensor cable Place shunt on FIXED for MEX sensor cable	18	Input power LED - LED ON indicates an input power problem (voltage/current too high/low)
9	T12 - Channel A cable termination bypass jumper T13 - Channel B cable termination bypass jumper Remove the shunt if a properly terminated sensor cable is connected to the corresponding input	19	T2 - Expansion header for network interface card
10	T9 - Form C relay output connections (X4) Normally Closed, Common, Normally Open		

Table 4 Processor features

Free-standing or fence post mounting the enclosure

- Install the processor near eye-level on the secure side of the perimeter.
- Mount the enclosure with the cable entry holes on the bottom toward the ground.
- Install an approved earth ground at the processor location.
- Mounting the enclosure away from the protected fence on the secure side of the perimeter can prevent tampering.
- If razor ribbon is installed along the bottom of the fence, mount the processor on the secure side of the perimeter, away from the fence and razor ribbon.

CAUTION 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. The maximum operating temperature, as measured inside the enclosure, is 70º C (158º F).

Tip A 5/16 in. nut driver and a cordless drill will facilitate post mounting the processor.

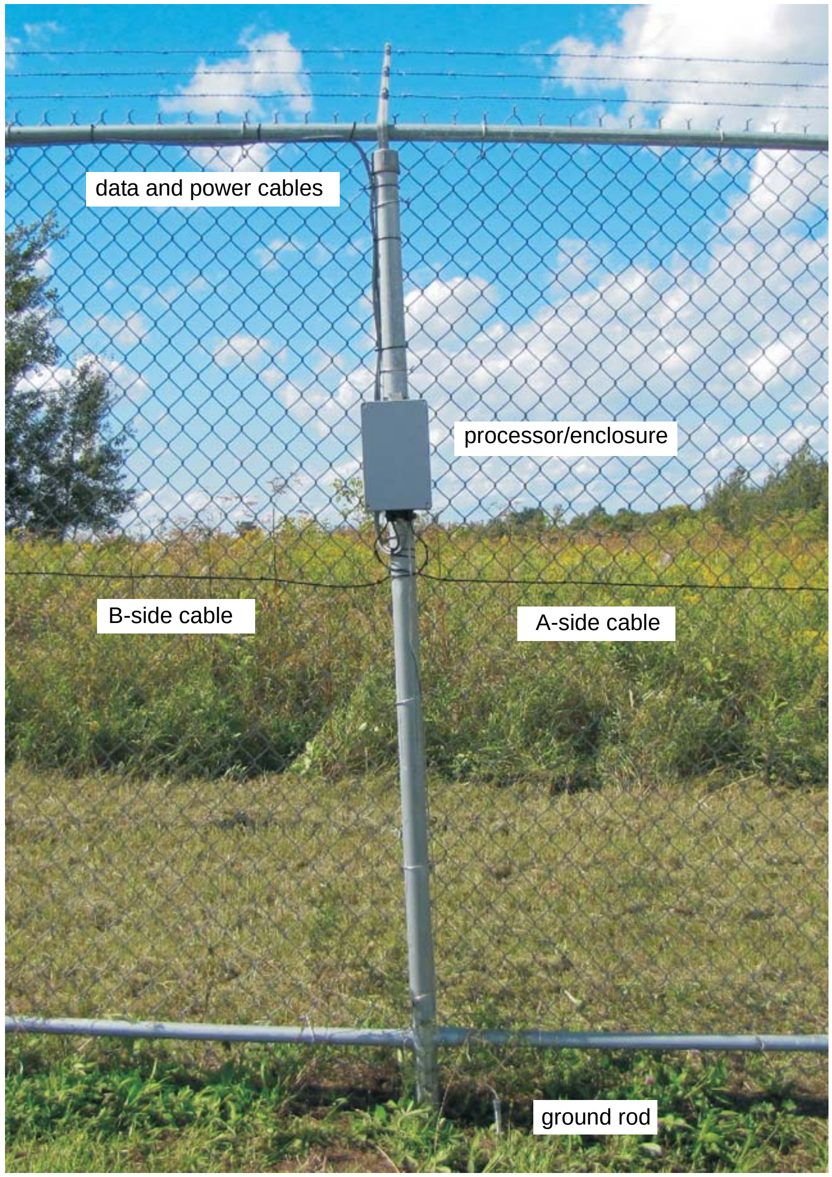


Figure 56: FlexPS single pass dual zone fence-mounted processor

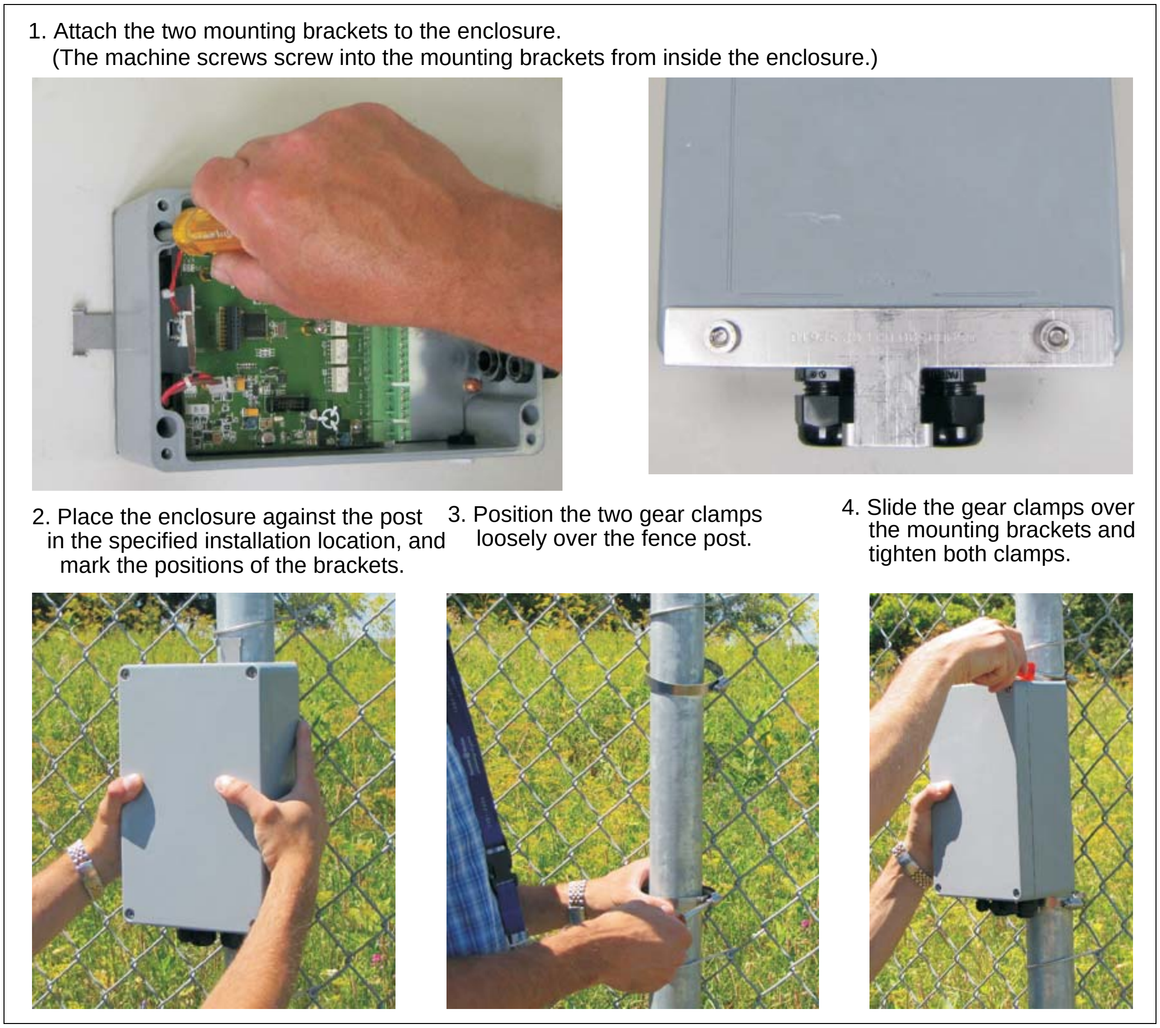


Figure 57: Post-mounting the enclosure (on the fence)

Figure 58: Post-mounting the enclosure (away from the fence)

Surface mounting

1. Remove the cover from the enclosure.
2. Hold the enclosure against the mounting surface, and mark the positions of the 4 mounting holes.
3. Drill 4 holes in the mounting surface.
4. Using appropriate hardware, mount the enclosure.

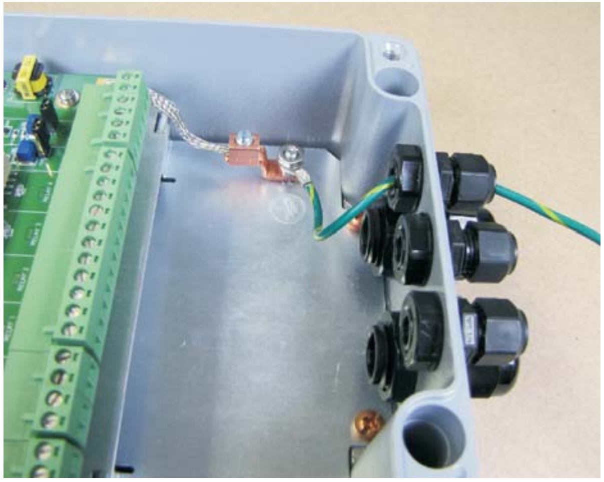
Figure 59: Surface-mounting the enclosure

Grounding

The earth ground connection must be stable and noise free. An improper or unstable earth ground can induce noise in the FlexPS sensor. Do not use the fence structure as an earth ground connection. Consult the local electrical code for grounding requirements. Avoid sharp bends in the ground wire.

WARNING!	DO NOT bring AC mains power into the FlexPS 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.

1. Refer to the local electrical code, to install a low resistance ground rod at the processor location.
2. Using an approved ground wire, connect the ground rod to the ground stud on the FlexPS mounting plate.



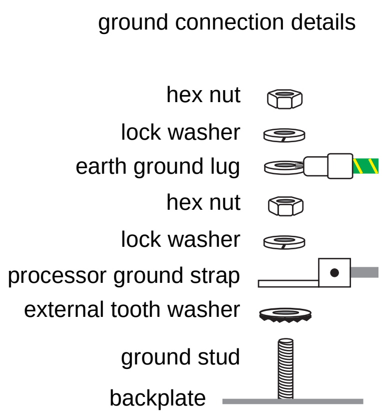
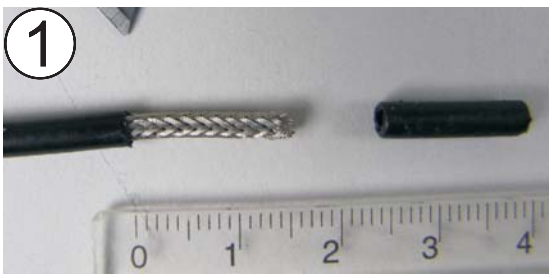


Figure 60: Processor ground connection

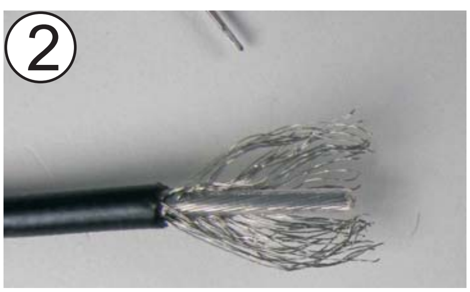
If excessive noise is present, or becomes evident after installation, check the integrity of the sensor cable installation. In particular, ensure that there is no inadvertent ground connection to the coaxial cable shield at either end of a splice connection or terminator. Verify that the center conductor and shield have not been swapped at the terminal block.

Sensor cable/lead-in cable connections

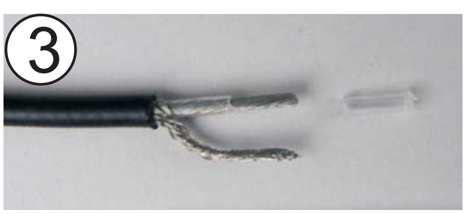
An enclosure that is installed on a post on the protected fence can use a direct connection to the sensor cable. If the enclosure is installed away from the protected fence, or away from the start of the sensor zone, then the connection to the processor must be made with lead-in cable. The lead-in cable is spliced to the sensor cable at the start point of the zone. The sensor cable to processor connections are made on removable terminal blocks. First, prepare the cables. Then install the cables in the terminal block and connect the terminal block to the sensor cable inputs (Flex Channel A, Flex Channel B). Sensor cable and lead-in cable connections are made exactly the same way. Figure 61: illustrates the sensor cable connection procedure for MEX sensor cable. Figure 62: illustrates the sensor cable connection procedure for Mark 2 sensor cable.



Pass the sensor cable through one of the enclosure's small cable glands. Carefully, remove 1.5 cm of the outer black jacket.

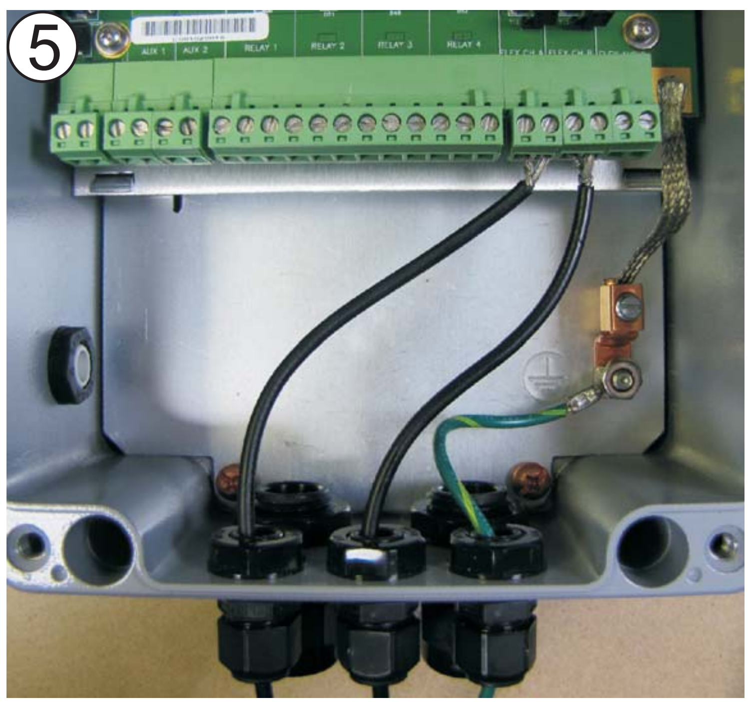


Separate the exposed braided shield.



Twist the shield into a single conductor, and remove 6.4 mm (0.25 in.) of the insulator from the center conductor.

Insert the center conductor into the + terminal and the shield into the - terminal, and tighten the screws.
Repeat steps 1, 2, 3 and 4 for the second cable.

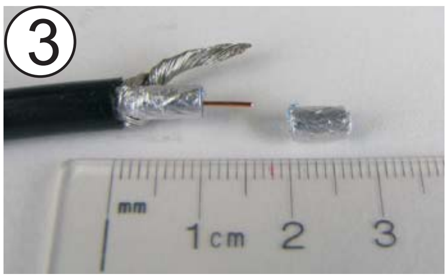


Insert the terminal blocks into T10 (FLEX CH A / FLEX CH B) and tighten the cable glands. Verify that the center conductors go to the + terminals and the shields go to the - terminals.

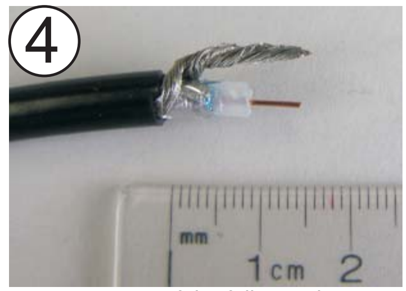
Figure 61: Connecting MEX sensor cable to the processor

Pass the sensor cable through one of the enclosure's small cable glands. Carefully, remove 1.5 cm of the outer black jacket.

Separate the exposed braided shield.



Twist the shield into a single conductor, and remove 6.4 mm (0.25 in.) of the foil covered insulator from the center conductor.



Remove 5 mm of the foil covering from the clear tube insulator.

Insert the center conductor into the right side terminal (+) and the shield into the left side terminal (-) and tighten the screws.
Repeat steps 1, 2, 3, 4, and 5 for the second cable.

Insert the terminal block into T10 (FLEX CH A / FLEX CH B) and tighten the cable gland. Verify that the center conductor goes to the + terminal and the shield goes to the - terminal.

Figure 62: Connecting Mark 2 sensor cable to the processor

Jumper settings

The processor includes two sets of jumpers, the cable selection jumpers and the terminator bypass jumpers (see Figure 63:):

The cable selection jumpers (T6, T15, T7 - Channel A; T14, T16, T11 - Channel B) are used to specify the type of sensor cable that is connected to Channel A and Channel B. Each of the jumpers provides two selections, FIXED and LOOSE.

- Place the shunt on the FIXED side if MEX sensor cable is used for the corresponding channel.
- Place the shunt on the LOOSE side if Mark 2 sensor cable is used for the corresponding channel.

The two terminator bypass jumpers (T12 and T13) are used on processors that employ a single channel (A or B), and for troubleshooting purposes to help identify cable faults.

- Install the shunt at T12 if a properly terminated sensor cable is NOT connected to Channel A.
- Install the shunt at T13 if a properly terminated sensor cable is NOT connected to Channel B.
- Remove the shunt at T12 if a properly terminated sensor cable is connected to Channel A.
- Remove the shunt at T13 if a properly terminated sensor cable is connected to Channel B.

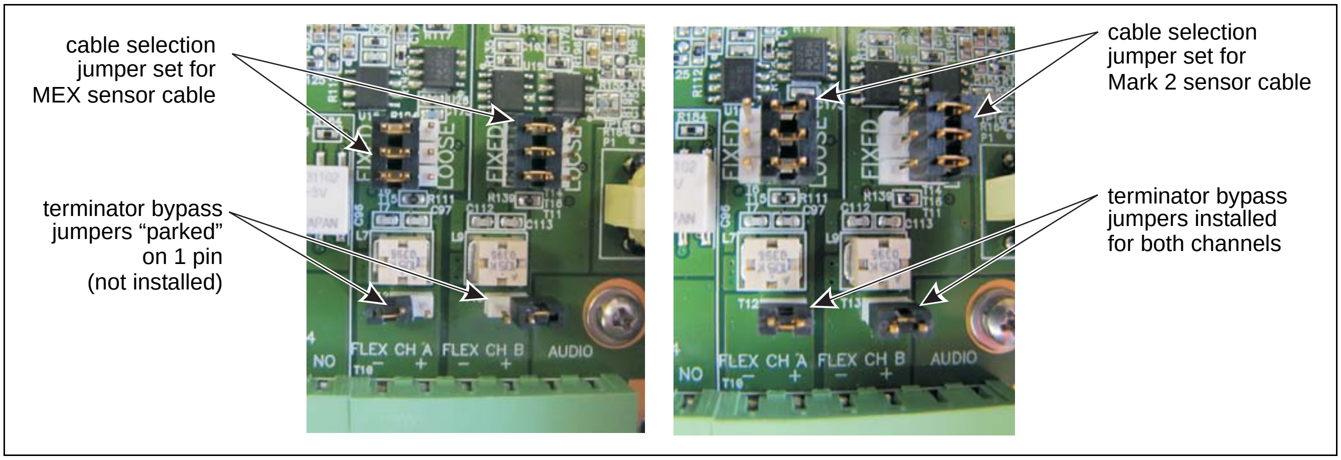


Figure 63: FlexPS jumper settings

If a properly terminated sensor cable is not connected to a cable input, and the appropriate jumper is not installed, the processor will report a constant supervision alarm on that channel.

Relay outputs

The FlexPS processor includes four Form C relays. Each relay has an associated LED, which indicates when the relay is active. Each relay has a common connection to either a Normally Open (NO) or Normally Closed (NC) relay contact.

Relay contact ratings

The dry contact relays are single pole, double throw, Form C, latching, rated for 30 V @ 1 A max. In Remote control mode, 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 relay Active/Inactive times are selectable. In Local control mode the relays remain active for the event’s duration or for the selectable Hold Time, whichever is longer.

Auxiliary inputs

CAUTION	The contact closure inputs to AUX 1 and AUX 2 MUST be voltage-free.

AUX 1 and AUX 2 are voltage sensing inputs. The processor determines an input’s status via an internal reference voltage, and the configuration of the contact closures and supervision resistors. Figure 64: provides wiring diagrams for self-test, audio activation, and auxiliary device inputs.

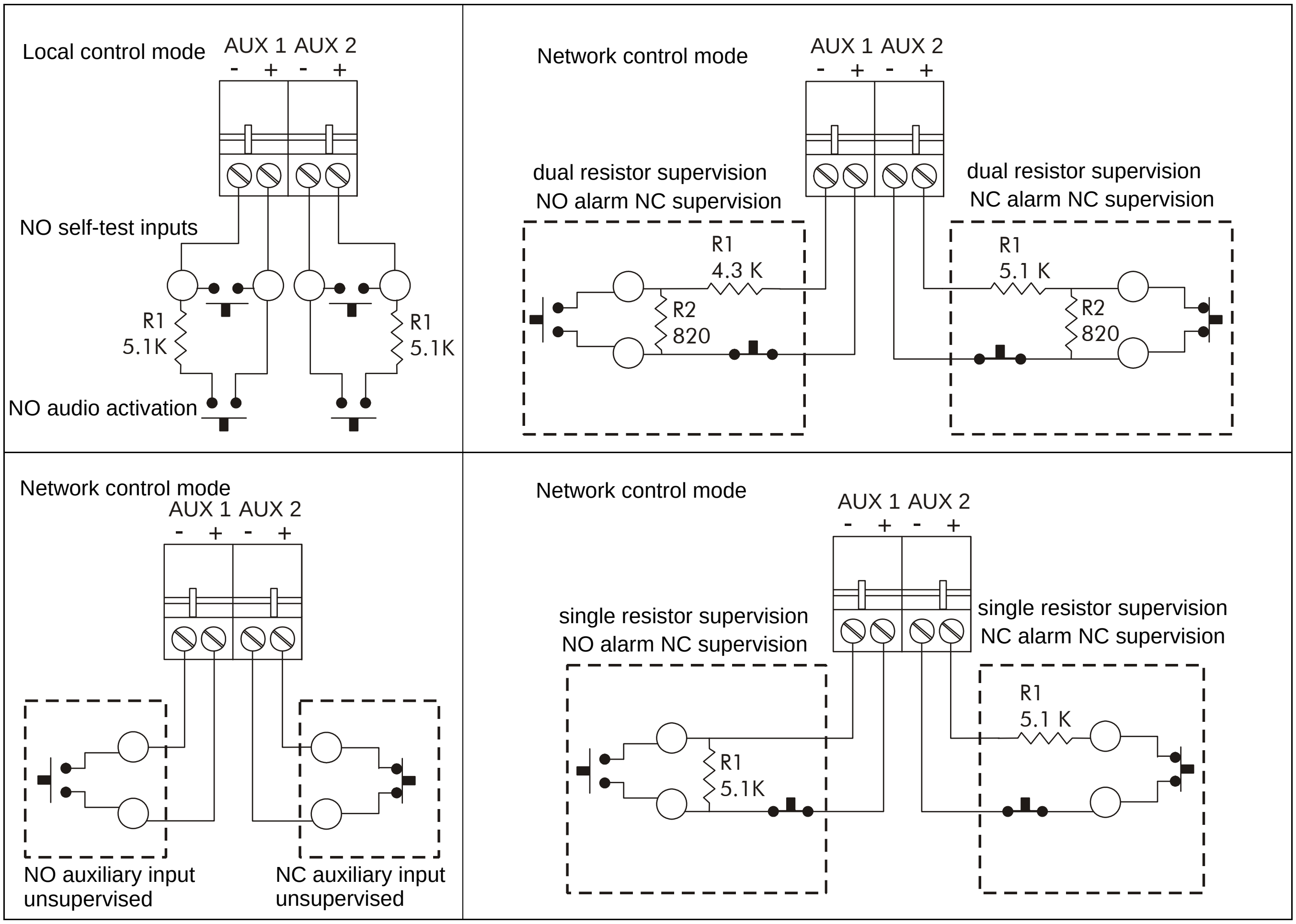


Figure 64: Self-test/Audio/Auxiliary device input wiring examples

Flex audio

The microphonic sensor cable picks up and carries audio signals from each zone to the processor. The audio signals originate with the fence noise in the monitored zone. When an audio zone is selected, the processor amplifies the signal from the selected zone and places it on the audio bus. Senstar recommends that the audio bus be connected to a 600 Ω input impedance amplifier. A speaker should be located in the control room to listen to the fence noise.

Senstar recommends 22 AWG shielded twisted pair for audio cable. The audio outputs are daisy chained from processor to processor and are connected to an amplified speaker in the control room. In-line amplification may be required for any wire runs longer than 1800 m (5900 ft.) based on 22 AWG shielded audio cables. The audio gain for each processor should be adjusted via the UCM to ensure that the audio volume is consistent from processor to processor.

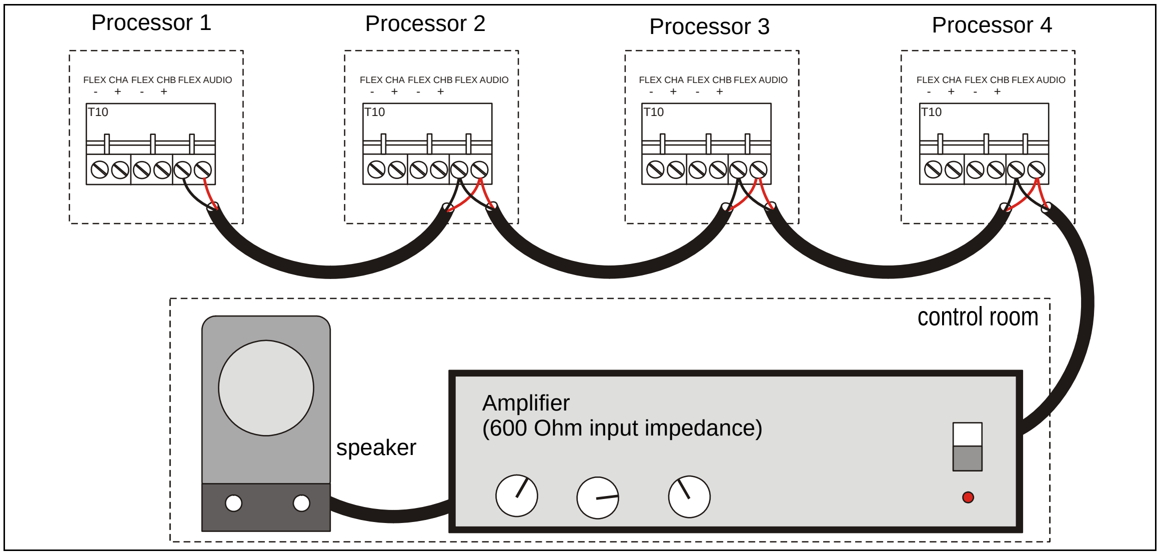


Figure 65: Audio bus connection diagram

For Silver Network based processors using Remote control mode, a processor's audio output is placed on the audio bus in response to commands from the security management system. For processors using Local control mode, closing a contact across the Aux inputs activates the audio output (Aux 1 = A-side, Aux 2 = B-side, see Figure 64:).

Input/output wiring connections

You make FlexPS processor wiring connections on removable terminal blocks. The screw terminals accept wire sizes from 12 to 24 AWG, with a 6.4 mm (0.25 in.) strip length. Remove the terminal blocks to make the wiring connections. Reinstall the blocks after the connections are complete, and verified. Figure 61: shows the MEX sensor cable to processor connection procedure. Figure 64: shows the input/output wiring connections to the FlexPS processor. Figure 68: to Figure 74: show the Silver Network wiring options.

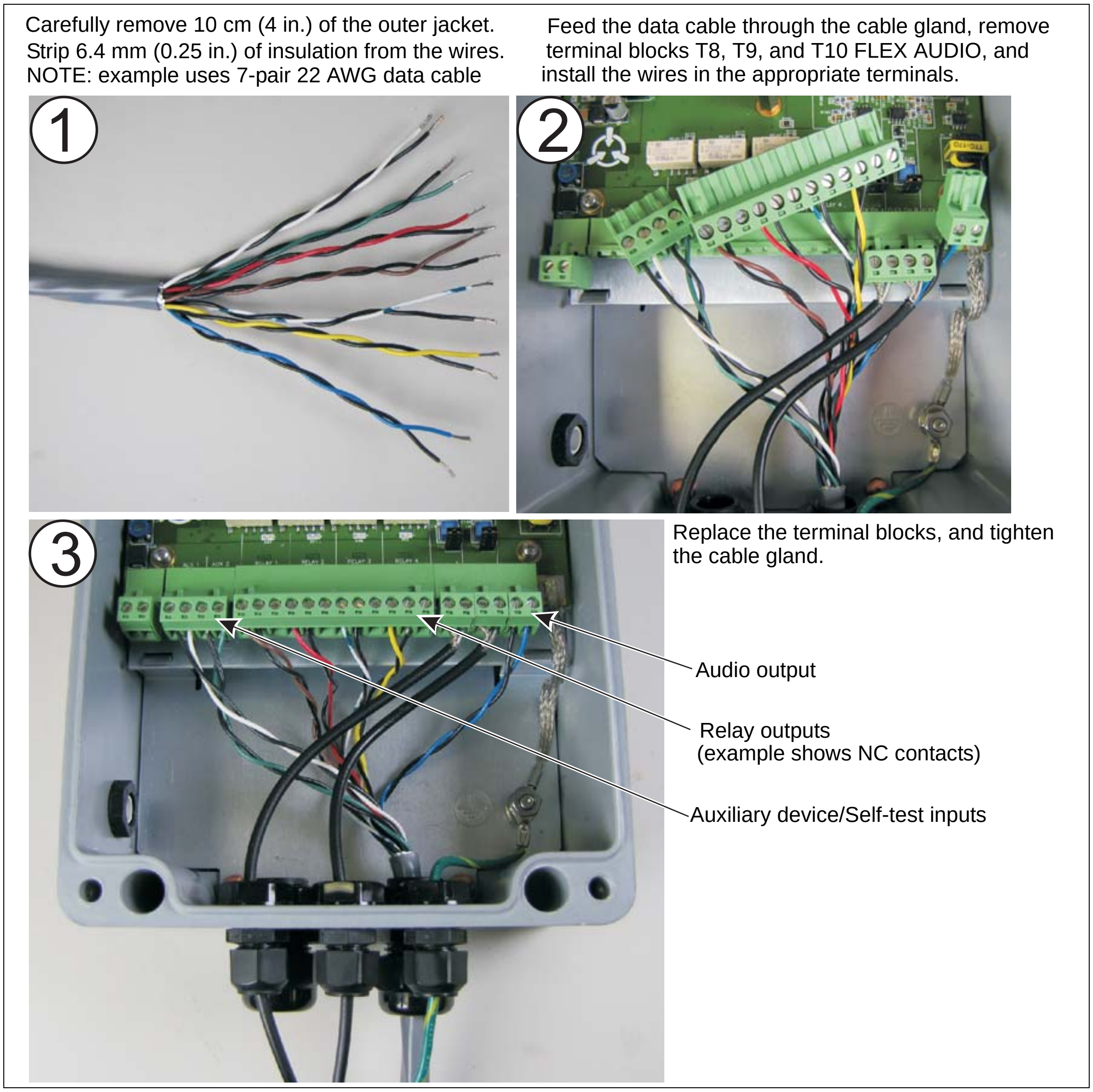


Figure 66: Connecting the data cable

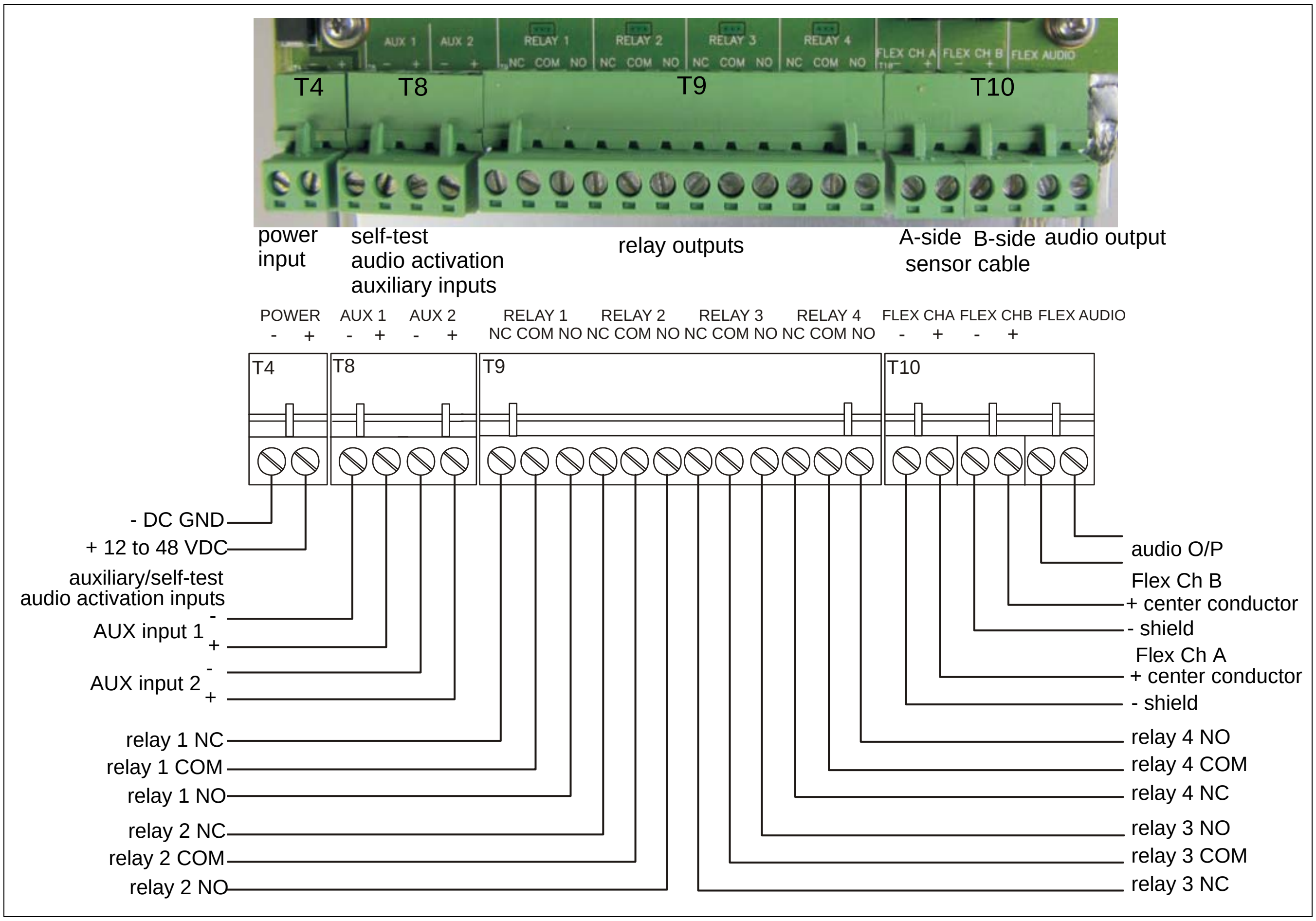


Figure 67: FlexPS processor wiring diagram

Silver Network wiring connections

Note	A network interface card must be installed on the FlexPS processor for the processor to use network communications.

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 - 0.5 seconds, or less from alarm source to Network Manager (per loop)
- Network termination - not required
- Transmission media/maximum separation distances between processors:
  - 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
  - Ethernet - Category 5 cable, 100 m between PoE switch and processor location

Note	Senstar strongly recommends the use of low capacitance shielded twisted pair data cable for EIA-422, 62.5/125 multimode fiber optic cable, 9/125 singlemode fiber optic cable, and Category 5 Ethernet cable. The maximum separation distances listed require high quality transmission media and sound installation practices.

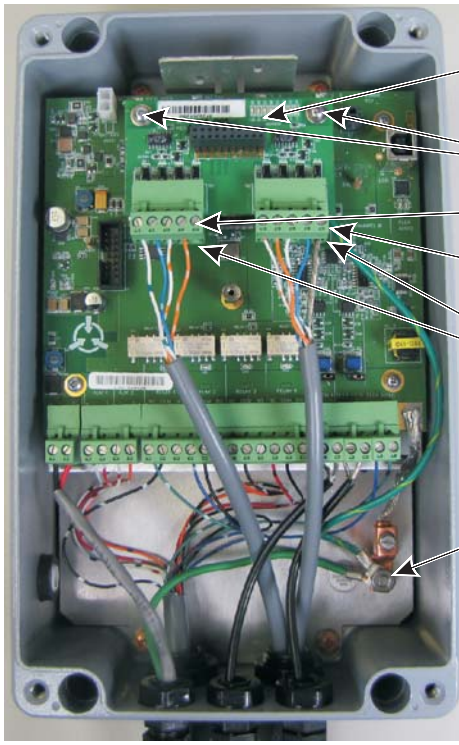


Figure 68: Silver Network EIA-422 network interface card

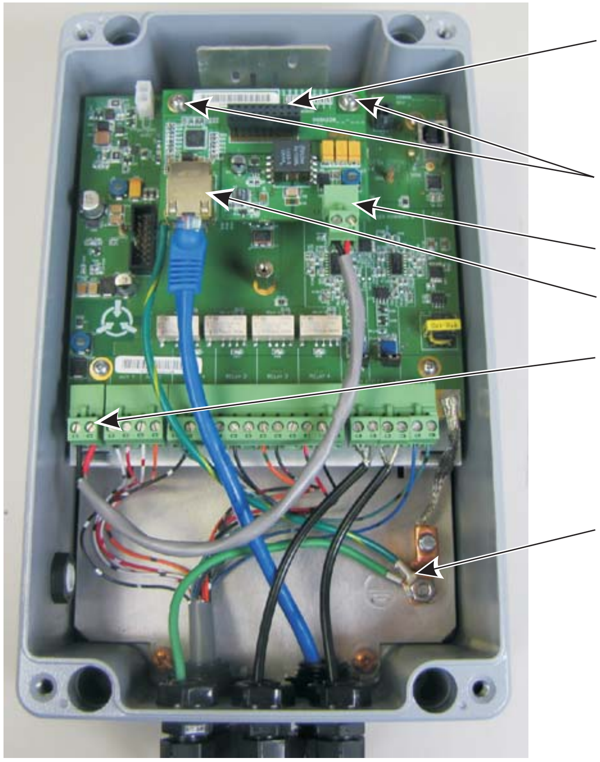


Figure 69: Silver Network Ethernet PoE NIC

CAUTION The PoE NIC is intended to supply power only to the processor on which it is mounted. Do not attempt to power an auxiliary device with the PoE NIC.

Silver Network data path connections

In the standard Silver Network setup, a point to point loop configuration is used for network communications. Figure 70: shows the processor to processor network connections for the EIA-422 and fiber optic communication options. Silver Network's using Ethernet communications use a star configuration. Figure 71: illustrates an EIA-422 based Silver Network, Figure 72: shows a fiber optic based Silver Network and Figure 73: shows a mixed media Silver Network. Figure 74: illustrates an Ethernet based Silver Network.

EIA-422			Fiber Optic		
TXA+	→	RXB+	TXA	→	RXB
TXA-	→	RXB-	RXA	←	TXB
RXA+	←	TXB+			
RXA-	←	TXB-			
GND (use single point grounding, connect only one side of shield)					

Figure 70: Silver Network data connections (loop configurations)

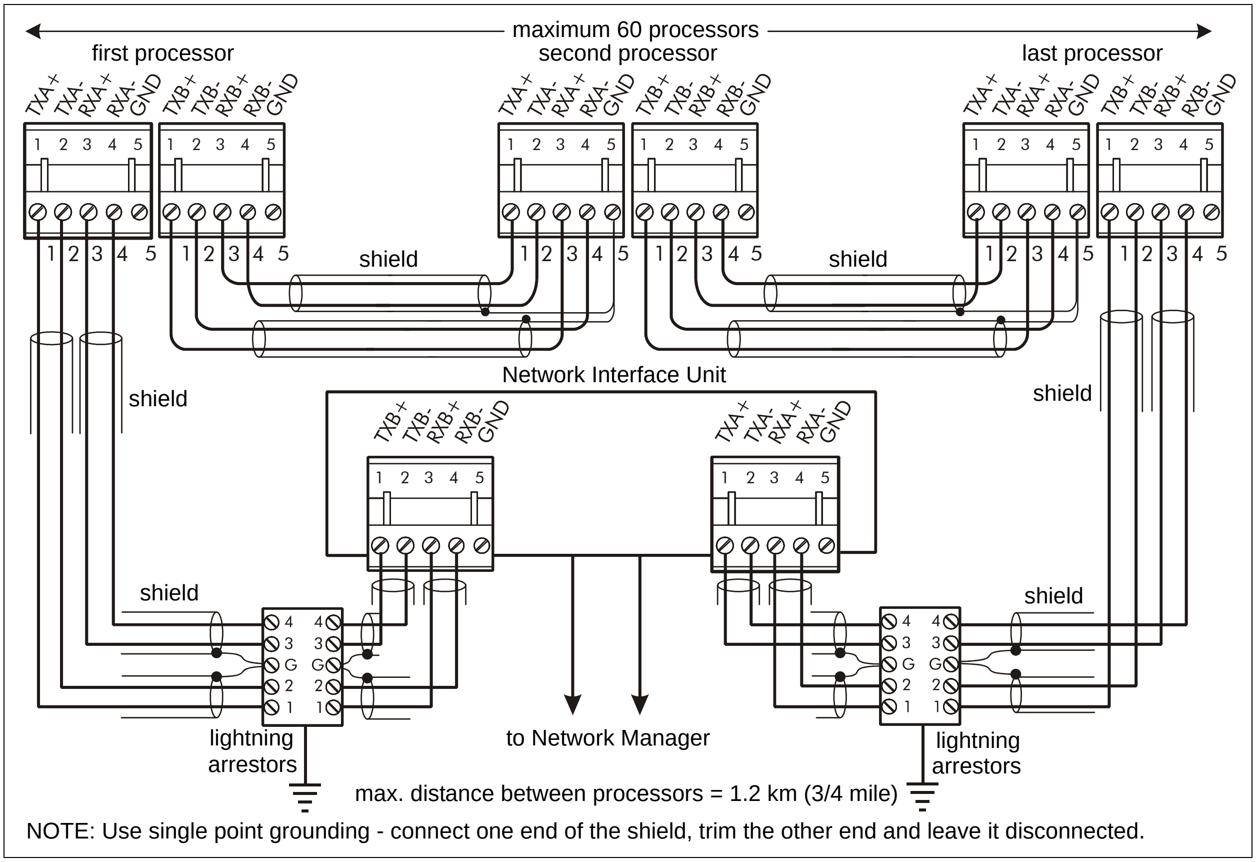


Figure 71: Silver Network EIA-422 wiring diagram

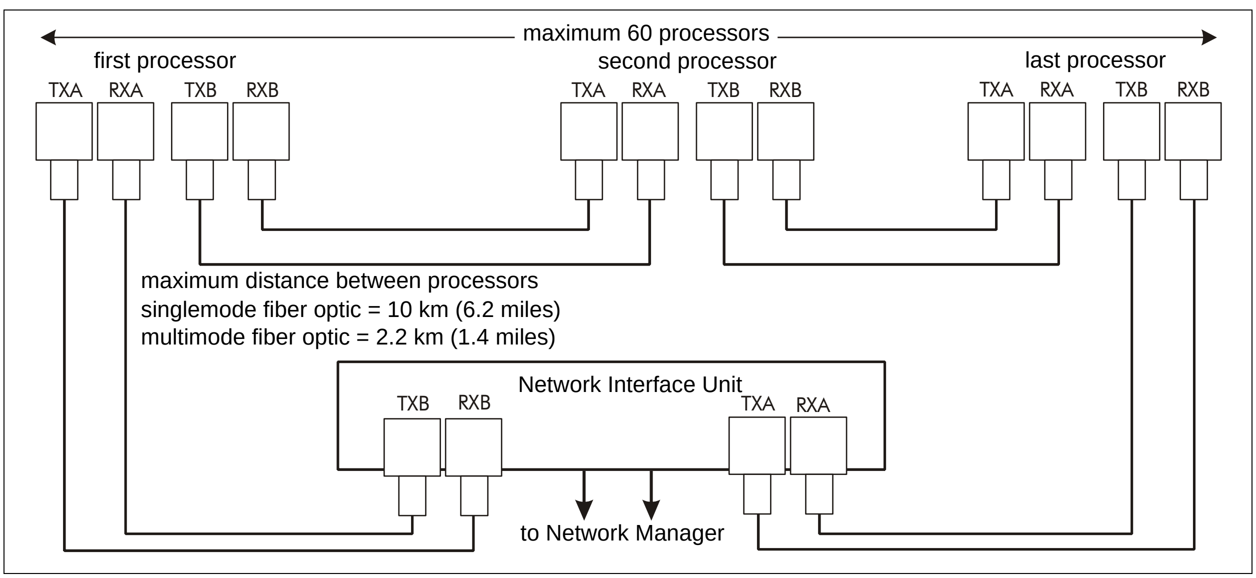


Figure 72: Silver Network fiber optic wiring diagram

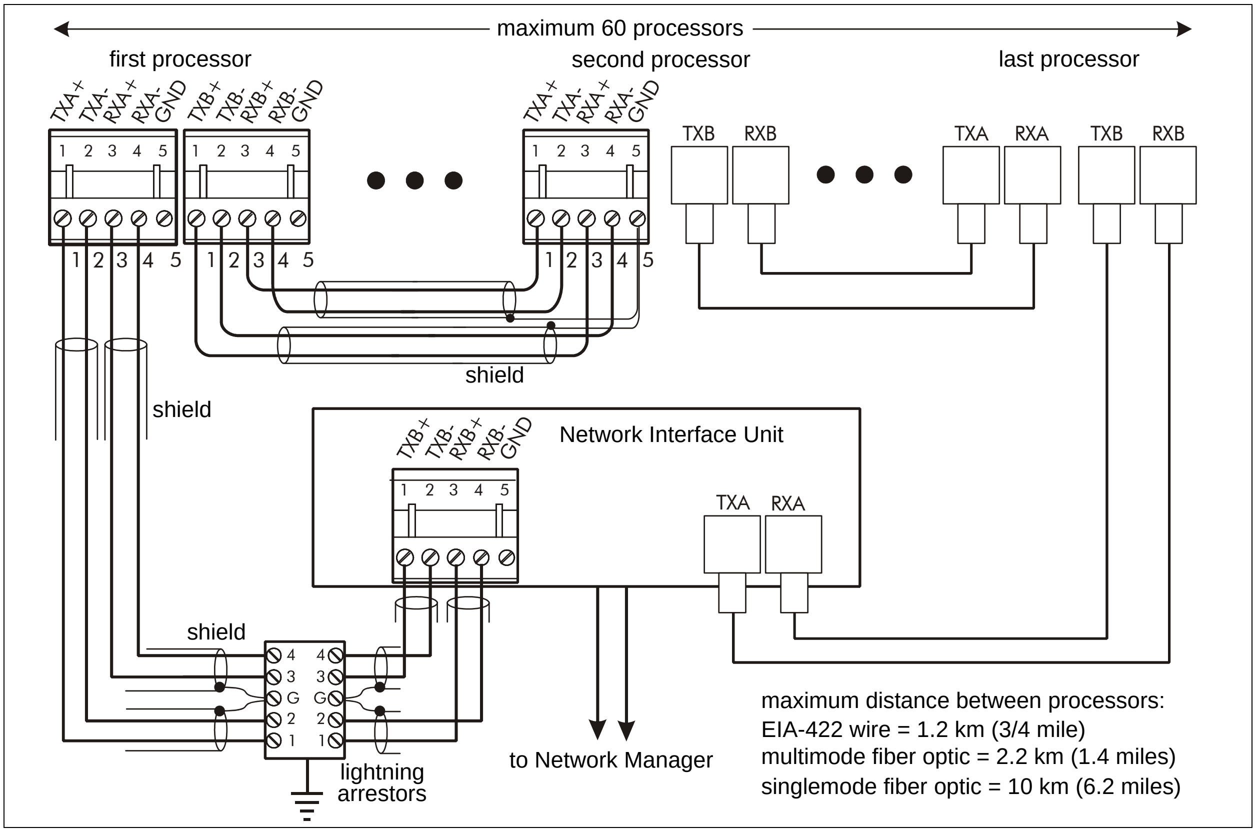


Figure 73: Silver Network mixed media

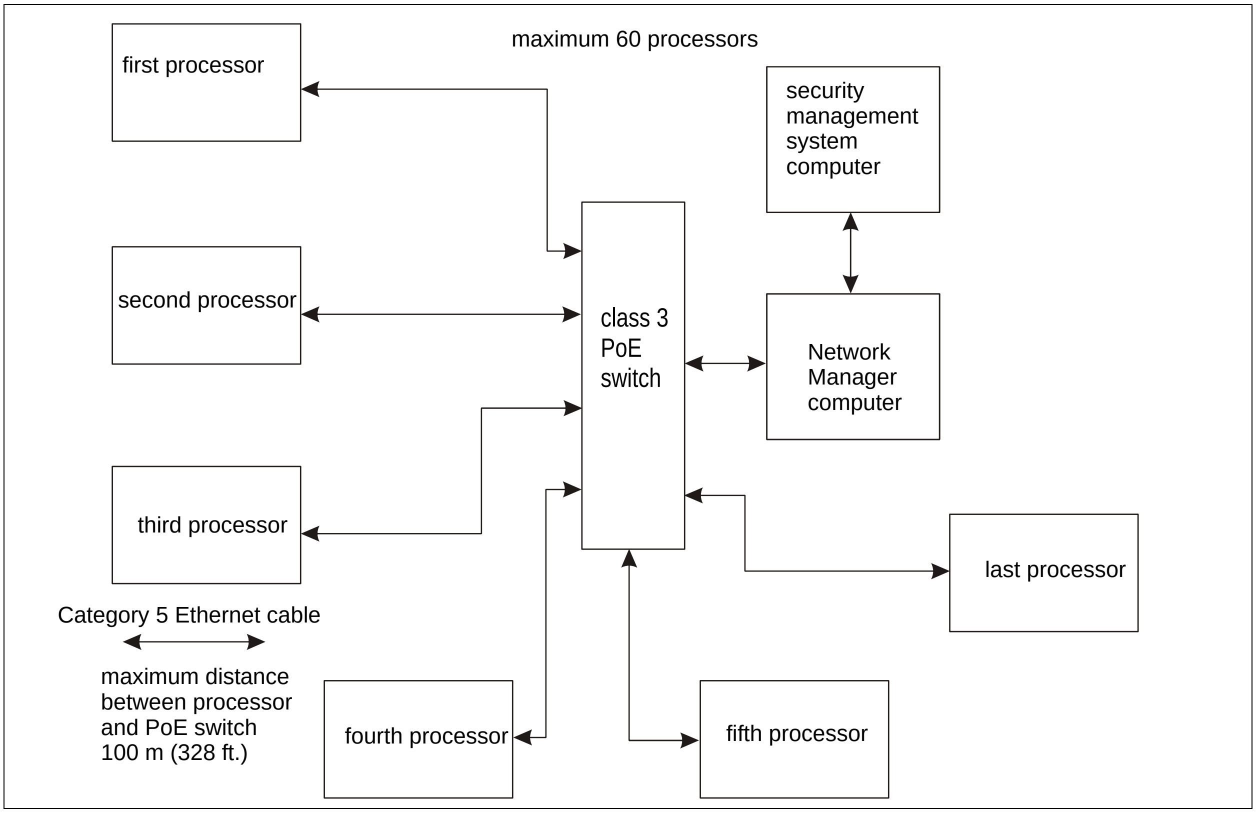


Figure 74: Silver Network Ethernet wiring diagram

Power connections

WARNING!	DO NOT bring AC mains power into the FlexPS 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.

When a central low voltage power supply is being used for primary power, it should be powered from an uninterruptible AC power source. In a typical DC power distribution system the power cable can be installed in conduit above or below ground. The power cable may also be installed on the fence.

- To power the system from a central source, run the power distribution cable around the perimeter and tap off to each processor. Use a minimum 18 AWG wire for power runs up to 1.2 km (4000 ft.). For longer runs use 16 AWG gauge wire.
- At each processor, splice the power cable to a lighter gauge pigtail that is approximately 30 cm (12 in.) long. Connect the + - pigtail wires to T4 + and T4 -.

Local power supply

It is possible to use a local DC power supply when a source of AC power is readily available near the processor. The DC power supply must be installed in its own weatherproof enclosure. The local supply can be mounted on the same post as the processor to keep the wire runs to a minimum.

Power over Ethernet

For power over Ethernet, a standard 48 VDC class 3 PoE switch is required. In this configuration, minimum Category 5 cable is also required and the maximum distance between the FlexPS processor and the PoE switch is 100 m (328 ft.). Use Cat-5 cable to connect the PoE switch to T1 (RJ45 jack) on the NIC. Then use the supplied power cable to connect T2 on the NIC to T4 on the processor (observe polarity). See Figure 69: .

CAUTION	The PoE NIC is intended to supply power only to the processor on which it is mounted. Do not attempt to power an auxiliary device with the PoE NIC.

Note	Senstar strongly recommends the use of a fully managed PoE switch to connect and power IP based FlexPS processors.

Battery power

Each FlexPS processor includes an intelligent charging circuit for an optional 6 VDC rechargeable battery. The backup battery will provide approximately 8 hours of emergency power when fully charged (the age and condition of the battery, and environmental factors such as temperature have a direct effect on battery run-time).

3 Calibration & setup

Introduction

FlexPS calibration is done, using Senstar's Universal Configuration Module (UCM). The UCM is a window-based software application that performs the calibration, setup, maintenance and diagnostic functions for Senstar's line of intrusion detection sensors. The UCM connects directly to the FlexPS processor via USB. Network based processors can also connect remotely via the Network Manager.

Senstar recommends that the initial calibration be done at the processor location using a direct USB connection to the UCM. An enclosure tamper condition must exist to enable UCM communication via a USB connection.

Note	Consult the online help for detailed information on UCM operation.

FlexPS calibration is a four stage process that requires:

- Adjusting the processor's Gain Settings
- Adjusting the processor's Cut Alarm Settings
- Adjusting the processor's Climb Alarm Settings
- Testing the installation

Begin by using the Calibrate tool to observe the sensor's response over the full length of the zone. Once the sensor's response is consistent along the length of the zone, you setup the processor's Cut Alarm Settings and Climb Alarm Settings. Finally, test the system to ensure that the detection meets the site requirements.

Note	For network based systems, after completing the initial calibration Senstar recommends running a magnitude response plot through the Network Manager during the first periods of inclement weather. If the weather causes an unacceptable number of nuisance alarms, you can increase the Threshold setting to exclude the effects of the weather. For standalone systems that encounter an unacceptable number of nuisance alarms during inclement weather, increase the Threshold setting to exclude the effects of the weather. After increasing the Threshold, retest the system to ensure that the sensor's detection meets your security requirements.

Calibration terminology

UCM Parameter	Parameter description	Default
Cut Alarm Settings	Detection parameters used to detect a cut intrusion.	
Window (sec)	The time period in which the specified number of cuts (Count) must occur to trigger an alarm.	30
Threshold	The received signal strength at which a cut is added to the Count total.	10
Count	The number of cuts that must occur within the specified Window to trigger an alarm. Counts the cuts that have signal magnitudes above the Threshold setting.	4
Cut Profile (%)	A percentage of the Window setting that is added to the time remaining in the Window each time a cut is recorded.	20%
Climb Alarm Settings	Detection parameters used to detect a climb or crawl-under intrusion.	
Window	Sets the time period in which the specified Time of a climb or crawl-under attempt must accumulate to trigger an intrusion alarm.	30 sec.
Threshold	The received signal strength at which a climb or crawl-under attempt is added to the total Time.	10
Time	Sets the total Time, that the received signal must exceed the climb Threshold before a climb or crawl-under attempt will trigger an intrusion alarm. The Time must be accumulated within the climb alarm Window setting.	3 sec.
Filter Settings	The filter settings are used to customize the sensor’s frequency response to the type and condition of the fence on which it is mounted. Correct adjustment of the Filters increases the signal to noise ratio and helps to screen out the ambient background noise that is always present. There are two slider controls, which enable you to set the processor’s frequency response band between 100 Hz and 900 Hz. **NOTE**: The filter settings are covered in Chapter 4 Maintenance on page 79, and should be adjusted only if problems are encountered at specific frequencies.	lower corner 300 Hz upper corner 700 Hz
Power Grid	Enables onboard filters to screen out high levels of EMI common to solar farms, electrical generation stations and transformer stations, and to other high EMI installations. Select 50 Hz if the local power grid uses 50 Hz power; select 60 Hz if the local power grid uses 60 Hz power; use the default setting of OFF if the site is not a high EMI location. **NOTE**: The Power Grid setting is covered in Chapter 4 Maintenance on page 79, and should be adjusted only if problems are encountered at the 50 Hz or 60 Hz frequencies.	OFF
Gain Settings	Two settings that boost/attenuate the received signal from the sensor cable (detection and audio).	
Cable	Sets the processor’s input signal gain (8 distinct settings - 1 to 8).	2
Audio	Sets the amplification level for the audio signal received from the sensor cable (0 to 7).	4
Misc Settings	A setting used to screen out ambient noise from environmental effects.	
Ambient Compensation	When Ambient Compensation is enabled, the processor evaluates the signals from the sensor cable to obtain data on environmental activity that is typically gradual and of long duration. This ambient signal can effectively be ignored and only the signals which are outside this ambient, consistent region, are evaluated for Cut and Climb Alarm significance.	ON

Understanding FlexPS alarm detection

The FlexPS processor constantly evaluates the input signals from the sensor cables to discriminate between Cut events, Climb events, and environmental activity. The characteristic response of a Cut event is a sharp spike with a fast rising and fast falling edge. For a climb event, the response includes the fast rising edge, which is followed by a series of peaks and valleys caused by the continued presence and changing stresses on the fence. Environmental activity is generally of longer duration, lower magnitude, and has more gradual increases and decreases. Figure 75: illustrates typical response signals for cut, climb, and environmental activity.

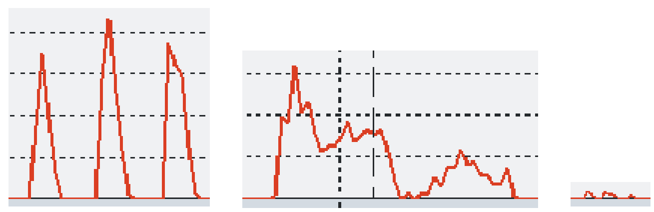


Figure 75: FlexPS detection response

The processor examines the signal magnitude of each sample in sequence, and compares these magnitudes to preceding and subsequent samples. In this way, the processor increments the Cut Count, or the Climb Time, based on typical expected results. When the processor interprets activity to be the result of environmental stimulus, it removes the “Noise” value from the displayed signal magnitude. As a result, the processor discriminates between Cut and Climb events, and environmental activity. However, with all of the variables such as fence type and condition, attack type and tools used during an attack, it is possible that the processor may report a Climb event as a Cut event or vice versa. Regardless of how the processor interprets an actual event (as a cut or a climb) the processor will record the event and report an intrusion alarm when the user-specified detection parameters are satisfied.

Note	It is possible that strong gusting wind or the sudden onset of heavy precipitation can be interpreted as intrusion activity.

Intruder detection

There are three intrusion attempt scenarios:

- Cut scenario - An intruder attempts to cut through the fence fabric.
- Climb scenario 1 (climb-over) - An intruder attempts to climb over the fence.
- Climb scenario 2 (crawl-under) - An intruder attempts to crawl under the fence by lifting the fence fabric.

An intrusion alarm resets automatically when the event is over or when the Alarm Hold Time lapses. The Alarm Hold Time is a factory setting which is used to prevent subsequent alarms from being declared for a single event. The Alarm Hold Time is 2 seconds, and cannot be adjusted. Once the processor declares an alarm, another alarm will not be triggered for 2 seconds.

Cut detection

Cutting the fence fabric produces a high amplitude signal that exceeds the cut alarm Threshold. Each time the cut Threshold is exceeded a Count (cut event) is recorded. When a specified number of cuts occur within a preset time Window, the system generates a cut alarm. If the cut Count is not exceeded within the time Window, the cut Count resets.

The processor reports a cut alarm when:

- the signal from the sensor cable exceeds the cut alarm Threshold,
- the number of times that the cut alarm Threshold is exceeded is greater than the cut Count,

and

- the cut Count is exceeded within the cut alarm time Window.

Climb/crawl-under detection

When an intruder attempts to climb over the fence, a large number of energy pulses rapidly occur. Lifting the fabric to crawl under the fence has a similar effect. Climbing or lifting the fence fabric causes the signal from the sensor cable to exceed the climb alarm Threshold. The initial contact activates the climb Time counter. If the climb alarm Time is exceeded within the specified time Window, the system generates a climb alarm. If the climb alarm Time setting is not exceeded within the Window, the counter resets.

The processor reports a climb alarm when:

- the signal from the sensor cable exceeds the climb alarm Threshold,
- the climb alarm Threshold is exceeded for the climb alarm Time,

and

- the climb alarm Time is accumulated within the climb alarm Window.

FlexPS initial calibration

When calibrating the FlexPS processor for the first time, begin with all parameters in the default settings.

Intrusion simulations

To setup and test the FlexPS sensor you must perform intrusion simulations for both cut and climb intrusions. The easiest method for simulating a cut intrusion is to tap the fence with the blade of a medium sized screwdriver. Hold the screwdriver lightly by the handle, and flip your wrist to bring the blade into contact with the fence. The metal on metal contact generates an impulse that is similar to the cutting of a fence wire.

To determine the amount of force to apply with each fence tap, Senstar recommends weaving a scrap piece of fence wire into the fence fabric, and then cutting the scrap wire several times while running a magnitude response plot on the UCM. Continue running the magnitude response plot while tapping the fence with a screwdriver. Look for a response from the taps with a similar magnitude as the response from the scrap wire cuts. When you achieve a similar response, practice the fence taps to develop a consistent motion. Use the same amount of force for each tap.

Rather than tapping the fence, you can simulate a cut intrusion by weaving a length of fence wire into each fence panel and then cutting the wires. Both methods generate a signal that is similar to the response of an actual cut intrusion. An actual fence cut also creates a significant amount of secondary noise as the cut section of fence pulls apart.

For a simulated climb intrusion, the best method is to actually climb the fence. It is not necessary to climb over the fence. The tester simply needs to climb on the fence for a period that exceeds the climb alarm Time setting.

Testing the fence condition

To determine if there are any loose fittings or parts of the fence that can cause nuisance alarms in windy weather, grip a fence panel in the middle and gently push and pull on the fence with an increasing motion. Run a UCM magnitude response plot and listen for any metal on metal contact while conducting the shake test. When you review the plot, look for any response spikes that are over the threshold. If the shake test causes metal on metal contact, or generates response spikes over the threshold, locate and correct the problems on the fence. This will help to prevent nuisance alarms during inclement weather.

Connecting the UCM via USB

1. Remove the enclosure cover and connect the UCM computer to the processor via USB (T3).
2. Start the UCM software (the UCM Connect dialog displays).
3. Select Connect to establish a connection to the processor.
   (e.g., Network Type: = Silver Network; Device Type = FlexPS; Address = 1 {default address}; select USB radio button; USB Device = processor ID).
   The FlexPS Status window opens.

Sensor calibration

FlexPS calibration is done under the Config tab. Select the Config tab and the Cable Configuration window displays.

The Calibrate tool

The Calibrate tool is provided to assist you in adjusting the processor's Gain and Filter Settings. Use the Calibrate tool to see the effects of Cable gain, Audio gain, and Filter adjustments before changing the processor's settings. First, make the configuration changes using the calibrate tool. You can then view a magnitude or frequency response plot of the new settings while testing the installation. If the configuration changes do not result in the required level of detection, you can continue making and reviewing adjustments. When you are satisfied with the results, you can download the new parameters to the processor.

Adjusting the Cable setting

The Cable setting amplifies the signal received from the sensor cable before it is processed. There are 8 distinct cable gain settings ranging from 1, the lowest gain, to 8, the maximum. Begin with the default Cable setting of 2. Next, open the Calibrate tool and test the processor's response. Finally, adjust the Cable setting, if required, and then retest the response.

Note	Ensure that the correct Cable Type is selected for each cable side, before adjusting the Gain.

Note	Although the Cable setting amplifies the received signal it also amplifies the ambient fence noise. Use care when adjusting the processor's Cable setting.

Note	The sensor cable response is affected for approximately 4 seconds after each alarm while the filters clear.

1. Under the Cable Cfig tab, verify that the Cable setting is at the default value of 2.
2. Open the Calibrate tool, and setup the tool by selecting the Cable side (A or B) and Magnitude.

3. Select the Record button to start the plot.
4. Beginning in the middle of the first fence panel, at least 30 cm (1 ft.) away from the cable, tap the fence 4 times with the blade of a medium screwdriver. Wait approximately 2 seconds between taps.
   Each tap should be at the same location and should use the same amount of force.
5. Move along the fence tapping each panel 4 times. Wait at least 4 seconds between panels.
6. After tapping the last fence panel in the zone, stop the recording and review the plot.
7. Take the average of the 4 readings for each fence panel.
   Look for an average reading that is between 50 and 125.
8. If the average readings are below 50, increase the Cable setting by 1, apply the changes, and repeat the tapping procedure while recording a plot.
   If the average readings are above 125, decrease the Cable setting by 1, apply the changes, and repeat the tapping procedure.
   When the average reading of each fence panel is consistently between 50 and 125, the Cable setting is correct for this zone.

Note	If the average readings for one or two fence panels are above 125 or below 50, repeat the tap test on those panels. If the secondary test also results in a high or low response, carefully inspect the particular panels and correct any problems. If another tap test does not provide an adequate response, you may have to adjust the processor's Filter Settings (see Adjusting the Filter Settings on page 80). DO NOT change the Cable setting to compensate for one or two fence panels that fall outside the recommended range.

Setting up the Cut Alarm parameters

At the default Cut Alarm settings, the Window is 30 seconds, the Threshold is 10, and the Count is 4. This means that for an alarm to occur, the processor must record 4 distinct Cuts with a signal magnitude above 10, within a 30 second period. The Cut Profile is an Advanced Parameter and should be adjusted only by a factory trained maintenance technician. At the default setting, 20% of the Window setting is added to the Time remaining with each subsequent Count (i.e., Count 1 starts the time Window counter, Count 2 adds 6 seconds to the Window, Count 3 adds 6 seconds, Count 4 causes an alarm and resets the Window to 0.)

The default settings for the Cut Alarm parameters are based on extensive field experience with Senstar's previous generation of fence protection systems. You can increase, or decrease, the number of fence cuts required to trigger an alarm, raise the cut alarm Threshold, and increase, or decrease, the period of time in which the specified number of cuts must occur. You can also increase, or decrease, the amount of time added to the Window with each recorded cut Count. The cut Count and Window can be changed to meet a specification or site requirements. The Threshold can be adjusted to help prevent nuisance alarms from environmental effects. If your site does not specify values for the Count and Window parameters, Senstar recommends using the default values and changing the values only if you experience a problem with nuisance alarms.

Setting up the Climb Alarm parameters

The best method for setting up the Climb Alarm Settings is to actually climb the protected fence. You do not have to climb over the fence as long as the climbing activity exceeds the climb Time setting.

Conduct the initial climb testing at the processor's default settings. The Window is set at 30 seconds, the climb alarm Threshold is 10 and the Time is set at 3 seconds. This means that for an alarm to occur, the processor must record 3 seconds of climbing activity with a signal magnitude above 10, within a 30 second period.

1. Open the Calibrate tool, and setup the tool by selecting the Cable side (A or B) and Magnitude.
2. Select the Record button to start the plot.
3. Beginning on the first fence panel, have the tester begin climbing on the fence. Watch the Climb indicator to verify that the climbing activity is accumulating.
4. Watch the signal magnitude as the climber moves on the fence. The resulting signal magnitude must exceed the climb alarm Threshold.
5. If the climbing activity does not cause the Climb indicator to accumulate climb time, lower the Threshold and repeat the test.

Preventing weather related nuisance alarms

If your FlexPS system is having a problem with nuisance alarms during inclement weather, inspect the fence to ensure it is in good condition and there are no loose fittings that can cause metal on metal contact. Next, connect the UCM to the processor and review the alarm history. If the nuisance alarms are listed as cut alarms, raise the cut alarm Threshold. If the alarms are listed as climb alarms, raise the climb alarm Threshold. Continue with this process until the nuisance alarm rate reaches an acceptable level. Retest the appropriate detection (cut or climb) after raising an alarm threshold.

Adjusting the Audio Gain

If your system is setup to use the audio listen-in feature, you should adjust the Audio Gain. If your system includes multiple processors using the audio listen-in capability, you should adjust the Audio Gain on each processor to provide a consistent audio response in the control room.

1. Start the UCM and establish a connection to the processor.
2. Select the Cable Cfig tab and start the Calibrate tool.
3. Activate the Audio Monitor for Side A.
4. Have a tester create fence noise in the A side zone.
5. Listen to the noise over the amplified speaker to determine if the volume is adequate.
6. Adjust the Audio Gain, if required, and repeat the fence noise test.
7. When the volume is acceptable on the A side, repeat the process on the B side.
8. Once you are satisfied with the audio level, close the Calibrate tool and download the new settings to the processor.

Setup

Processor setup requires configuring the inputs and outputs (I/O) and for network based processors, specifying the network configuration.

Specify the Auxiliary I/O control mode

This section details the procedures for configuring the processor's I/O for Local control and Remote control operation.

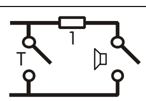
1. On the Aux Cfig tab select the Arrow beside the Aux Control: field.
2. Specify the control mode for this processor (Local or Remote).
3. Select the Download button to save the configuration changes to the processor.

Auxiliary (Aux) inputs

The two Aux inputs on the FlexPS processor are voltage sensing inputs. The processor determines an input's status via an internal reference voltage, and the configuration of the 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. The 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 inputs are dual purpose inputs for self-test and audio activation (AUX1 = A-side, AUX2 = B-side). You can setup the Aux inputs to perform both functions, either function, or no function. To activate the self-test function, close a momentary switch across the input. You must close the momentary switch for the time specified in the Filter Window. To activate the audio function, close a switch with a 5.1 kΩ series resistor across the input. Leave the AUX inputs open if you do not want to use the self-test or audio functions. Figure 76: shows the input wiring configuration for Local control mode:



T = self-test switch
speaker = audio switch
1 = 5.1 k series resistor

Figure 76: Local Control Mode input wiring

Remote control mode

In Remote control mode, the two Aux inputs serve as auxiliary device inputs to the host computer. The inputs are available for reporting the status of other security devices. The processor reports any change of an input's state to the head end system. Table 5: includes the selectable Remote Control input wiring configurations, and Table 6: includes the selectable supervision resistor values.

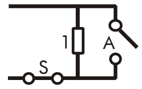
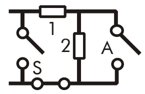
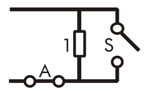
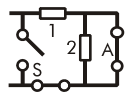
Input option	UCM selection	Alarm relay	Supervision relay	R1	R2
unsupervised		NO	---	---	---
single resistor supervision		NO	NC	5.1 k	---
dual resistor supervision		NO	NO/NC	4.3 k	820
unsupervised		NC	---	---	---
single resistor supervision		NC	NO	5.1 k	---
dual resistor supervision		NC	NO/NC	5.1 k	820

Table 5: Selectable input configurations

R1 values (single resistor supervision)	R1 values (double resistor supervision)	R2 values (double 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	5.1 k	5.6 k
1.5 k	5.6 k	
2.2 k		
3.3 k		
4.7 k		
5.1 k		
5.6 k		

Table 6: Selectable resistor values

Input configuration procedure (Remote control mode)

1. Select the Aux Cfig tab on the UCM window.
2. From the Supervision drop down, select the desired supervision scheme for the input.
3. Select the Resistor 1 value, if applicable.
4. Select the Resistor 2 value, if applicable.
5. Set the Noise Tolerance, if required.
6. Set the Line Drop, if required.
7. Set the Filter Window.
8. Repeat this procedure if there is a second connected input.
9. Save the UCM configuration file.
10. Select the Download button to save the configuration changes to the processor.

Output relays

Output relay setup (Local control mode)

In Local control mode, the four relays are setup via the Local Aux Control Activation check boxes to report alarm conditions. The relays are then controlled by the processor to activate on the user-specified conditions. The relays remain active for an event's duration or for the selectable relay Active Time, whichever is longer.

1. Use the Output selection arrows to select a relay.
2. Specify the Hold/Active Time parameter.
3. Specify the conditions from the Local Aux Control Activation field under which this relay will activate.
4. Repeat this procedure for the other relays.
5. Save the UCM configuration file.
6. Select the Download button to save the configuration changes to the processor.

Output relay setup (Remote control mode)

In Remote control mode, the relays are controlled by the host computer 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 computer. 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.

1. Use the Output selection arrows to select a relay.
2. Select the type of relay Activation (latching, or flash mode, or pulse mode).
3. Select the Hold/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.
7. Select the Download button to save the configuration changes to the processor.

Setting the processor address

The processor address can be set only by using a direct USB connection between the UCM computer and T3, the USB port on the processor. Processors that do not use network communications can use the default address of 1.

1. In the Program field select the Address button.
   The change Device Address dialog displays.
2. In the Change Device Address dialog, specify the New Address for the connected processor.
3. Select the Program button.
   The new address takes effect when communications are reestablished.

Network configuration

For FlexPS processors that use network alarm data communications, you must define the network type under the Network Cfig tab. The network configuration can be set only by using a direct USB connection between the UCM computer and T3, the USB port on the processor.

Note	For Silver Network based processors, there are two selectable configurations based on media type. For EIA-422 and fiber optic cable, select Silver Loop and for Ethernet communications select Silver Star.

1. Specify the type of alarm data network (Silver, Crossfire, or MX).
2. For the Silver Star configuration, you must specify the IP address and the subnet mask and if required, the gateway IP address for each processor.
3. For the Crossfire network you must specify the baud rate (all devices on a Crossfire network must communicate at the same baud rate).
4. Save and download the configuration changes to the processor.

System test procedure

Once the system is calibrated and setup, you should conduct a series of tests to verify detection. Run a UCM Response plot during the testing. Network based processors can be tested over the network to verify network operation.

Note	The following tests can be used to verify FlexPS system operation. The tests are described in a generic manner, which does not take into account site specific details (e.g., you can test the Audio output, only if the Audio listen-in feature is setup at your site).

- **Cut detection** - Use the tap test, or weave a piece of scrap fence wire into the fabric of the fence and cut the scrap wire. Test each zone in at least three separate locations.
  At each location, tap the fence fabric, or cut the scrap wire, the number of times specified by the cut Count parameter (default = 4). (Pass = alarm after Count setting is reached)

  PASS ____ FAIL____
- **Climb detection** - Have a tester climb on the fence fabric for at least as long as the climb Time parameter. Repeat the climb test in at least three locations. Use both a fast climb and a stealthy climb to ensure detection (default = 2 seconds). (Pass = alarm after Time setting is exceeded)

  PASS ____ FAIL____
- **Fence lift detection** (Use care to ensure that the fence is not damaged during this test) - Have a tester lift or pry up the bottom the fence fabric for a minimum of the time specified by the Time parameter (depending on the amount of fence noise being generated, the test may have to exceed the Time setting by several seconds). Repeat the lift test in at least three locations (default = 2 seconds). (Pass = alarm after Time setting is exceeded)

  PASS ____ FAIL____
- **Enclosure tamper** - Remove the cover from the enclosure. The DOOR OPEN LED (D1) turns on, and the UCM Event log reports an Enclosure Tamper alarm. If a relay is configured to activate for an enclosure tamper, the specified Relay should activate.

  PASS ____ FAIL____
- **Cable supervision** - Use jumpers T12 (A-side) and T13 (B-side) to test for cable faults. If a properly terminated sensor cable is connected to the A-side, place a shunt on T12. An A-side supervision alarm should be declared. Remove the shunt from T12 and the A-side supervision alarm should clear.

If the A-side of the processor is not used, remove the shunt from T12. An A-side supervision alarm should be declared. Replace the shunt on T12 and the A-side supervision alarm should clear.
If a properly terminated sensor cable is connected to the B-side, place a shunt on T13. A B-side supervision alarm should be declared. Remove the shunt from T13 and the B-side supervision alarm should clear.
If the B-side of the processor is not used, remove the shunt from T13. A B-side supervision alarm should be declared. Replace the shunt on T13 and the B-side supervision alarm should clear.

PASS ____ FAIL____

- **Audio** - On the UCM Status window, activate the Audio Monitor for the A-side. Have a tester create some fence noise in the selected zone while listening to the connected speaker. Activate the Audio Monitor for the B-side. Have a tester make some fence noise in the selected zone while listening to the connected speaker.

  PASS ____ FAIL____

- **Self-test** - Activate the self-test for the A-side. The processor performs electronic self-tests of the A-side detection (cut and climb). The first test causes a cut alarm, and the second test causes a climb alarm. The test can take up to a minute, depending on the Time settings. Activate the self-test for the B-side. The processor performs electronic self-tests of the B-side detection (cut and climb). The first test causes a cut alarm, and the second test causes a climb alarm. The test can take up to a minute, depending on the Time settings.

  PASS ____ FAIL____

- **Auxiliary device inputs** - For Local control mode the Aux inputs activate the system self-test and the Audio listen-in feature. In this case, activate the appropriate switch, and verify that the specified event occurs (self-test or Audio ON/OFF). Repeat for both cable sides.
  For Remote control mode, the Aux inputs serve as auxiliary device inputs to the host system. In this case, activate the connected device, and verify the status change is reported by the host system. Repeat for Aux 2.

  PASS ____ FAIL____

- **Relay outputs** - For Local control mode the relay outputs are used to report events. Cause an event, and verify that the specified relay activates for a minimum of the relay hold time. Repeat this procedure for each specified event (in the Output Configuration field).
  For Remote control mode, the relays serve as output control points for the host system. Send an activation command from the host system to one of the relays and verify that the relay activates. Repeat this procedure for each relay.

  PASS ____ FAIL____

The Zone profile

Senstar strongly recommends creating a zone profile for each FlexPS sensor zone at your site. To create a zone profile, connect the UCM to the processor. Open a magnitude response plot, and select the Disable Filter Reset After Alarms check box. Have a tester move along the zone, tapping each fence panel three times, while recording the plot. After tapping the final fence panel in the zone, stop the recording and save the UCM plot. This plot file provides a record of the sensor’s response immediately after calibration. This can be compared to future response plots for maintenance or troubleshooting activities.

4 Maintenance

The FlexPS sensor requires minimal maintenance to ensure proper operation. However, setting up and following a maintenance schedule based on your site-specific requirements can ensure proper detection performance, prevent nuisance alarms and extend the operational lifetime of the system. The frequency at which the maintenance should be scheduled depends on your security requirements and on the installation environment. This section includes the recommended maintenance activities along with suggested intervals.

1. Perform a visual inspection of the installation (once per month). Check for the following:
   - fence condition - ensure the fence is in good condition and that there are no loose panels, loose fittings or metal bits that can move with the wind and cause nuisance alarms (a shake test in which you grip the fence fabric in the middle of a panel and gently shake it with an increasing motion can help identify any loose pieces)
   - there are no washouts or depressions under the fence
   - vegetation beside and above the fence is cut back and cannot make contact with the fence
   - the sensor cables are held snugly against the fence fabric and the cable ties are holding the cable securely in place
   - there is no loose sensor cable
   - connectors and terminator enclosures are properly mounted according to the installation instructions
   - there is no corrosion or moisture inside the processor enclosure
2. Physically test the system (once per week).
   - use a screwdriver to simulate a series of cut intrusions and verify that cut alarms are declared each time
   - climb the fence at several locations and verify that climb alarms are declared each time
3. Record a UCM sensor response plot (quarterly).
   Connect the UCM to the processor and record a sensor response plot. Note the environmental conditions at the time of the recording. Review the plot to examine the ambient noise level, and compare the plot to any previously recorded plots. Depending on the weather conditions, the recorded plots should be quite similar. During inclement weather the noise level will be higher, and during good weather with very little wind, the noise level should be extremely low. If there is a significant amount of noise indicated during good weather, examine the cable and cable connections for possible problems.
4. Battery test (once per year)
   If your processor(s) includes battery back-up, disconnect the power to the processor and allow it to run on battery power until the battery runs down and the system shuts down. Note the duration of the battery run-time, and replace the battery when the run-time no longer meets the specification (minimum battery runtime = 8 hrs for a fully charged battery).

5. Snow removal (as required)
   If the weather conditions at your site include snow falls, the fence should be kept clear of accumulating snow. If snow accumulates against and around the fence, it will absorb and dampen the vibrations caused by an intrusion attempt. In addition, if there is significant snow accumulation, the snow can serve as a bridging or tunneling aid to defeat the sensor.

Adjusting the Filter Settings

The FlexPS processor’s frequency response range is from 100 Hz to 900 Hz. In most installations, the default setting of 300 Hz and 700 Hz should be used. However, in some instances, nearby equipment that generates noise at a specific frequency, can affect the sensor’s detection. It is also possible that fence conditions can result in an area that has a significantly higher, or lower, signal magnitude at certain frequencies. To prevent detection problems caused by either circumstance, the processor’s Filter Settings can be adjusted to exclude the suspect frequencies.

Note	A direct USB connection is required to use the Frequency Plot mode on the Calibrate tool.

To verify the sensor’s frequency response, open the Calibrate tool and start a Frequency plot. Use Auto Scale to fit the frequency response in the plot window. With the system in a quiescent state with minimal fence noise, the response should be minimal. Any frequency spikes on a quiet system indicate a problem (interference or fence condition).

1. Start the Calibrate tool and select Frequency.
2. Look at the frequency response while the system is quiet (light wind, no precipitation, no disturbance of the fence). The frequency response should be very low and flat.
3. Perform the tap test as described in the Cable setting procedure.
4. Review the frequency response looking for any frequencies at which the results were significantly higher or lower than the average response.

Note	The response should be similar throughout the zone for impacts of similar force. If the response increases dramatically in an area even though the force used is consistent and the fence conditions are unchanged, there may be a “sweet spot” that amplifies the signal. If this occurs, use the filters to exclude the affected frequencies.

5. Adjust the Filter Settings sliders to exclude any frequencies that are well outside the average.
6. Apply the changes and repeat the tap test while viewing the frequency response.
7. If the Frequency response is adequate close the Calibrate tool and download the new settings to the processor.
8. Retest the zone to verify cut and climb detection.

To set the Filters to screen out background noise you can use the Calibrate tool during inclement weather that can cause noisy fence conditions, such as strong winds. (You can also simulate strong winds by gripping the center of a fence panel and shaking the panel back and forth.)

1. Open the Calibrate tool, setup the tool for Frequency response and begin recording.
2. Observe the response caused by the elements (or the simulation).
3. Look for frequencies at which the response is unusually high.
4. Adjust the Filters to eliminate those frequencies and apply the changes.
5. Select the Reset Peaks button and observe the response. If the resulting frequency response is adequate close the Calibrate tool and download the new settings to the processor.
6. Retest the zone to verify cut and climb detection.

Using the Power Grid filters

Some sites have an extremely high level of EMI at certain frequencies, which can lead to an increase in the FlexPS false alarm rate (FAR). This has been known to occur at electrical generating stations, electrical transformer stations and solar power farms. To counter the effects of high EMI, FlexPS includes two selectable low frequency filters that can be used to screen out 50 Hz and 60 Hz noise. The following procedure can be used to determine if such a condition exists at your site and to correct the situation if it does exist. The main symptom of this problem is false alarms for which the source of the alarms cannot be identified.

1. Connect the UCM computer directly to the suspect processor and establish a connection.

Note	A direct USB connection is required to use the Frequency Plot mode on the Calibrate tool.

2. Open the Config window and select the Calibrate button.
3. Start recording a Frequency Response plot and look for noise spikes at the 50 or 60 Hz frequencies.
4. If noise spies are present at either frequency, select the corresponding Power Grid filter (50 Hz or 60 Hz).
5. Continue monitoring the processor the verify that false alarms are not being caused by noise spikes.

Replacing the processor/battery

The processor PCB is mounted on a backplate. It is secured inside the enclosure by two tabs that fit into the slots on the bottom of the backplate and by the locking tab that latches over the top of the backplate. The battery fits into a compartment below the PCB assembly (see Figure 77:).

CAUTION	The processor PCB includes static sensitive components. Follow proper ESD handling procedures when working on the PCB.

Note	Do not remove the processor PCB from the backplate.

Removing the processor assembly

1. Label and disconnect the removable terminal blocks.
2. Disconnect the PCB ground strap, the tamper switch connector, and if required, the battery harness connector.
3. Push the tamper switch mounting bracket away from the PCB until the locking tab is clear of the backplate.
4. Hold the tamper switch mounting bracket away from the PCB and lift the backplate/PCB assembly off the two tabs and out of the enclosure.

Replacing the battery

5. Remove the battery from its compartment.
6. Disconnect the battery harness from the battery.
7. Connect the battery harness to the replacement battery (observe polarity).
8. Replace the battery in the compartment.

Replacing the processor assembly

9. Fit the two slots in the backplate over the tabs on the mounting plate inside the enclosure.
10. Press the backplate down until the locking tab latches.
11. Reconnect the PCB ground-strap, the tamper switch connector, and if required, the battery harness connector.
12. Reinstall the removable terminal blocks.

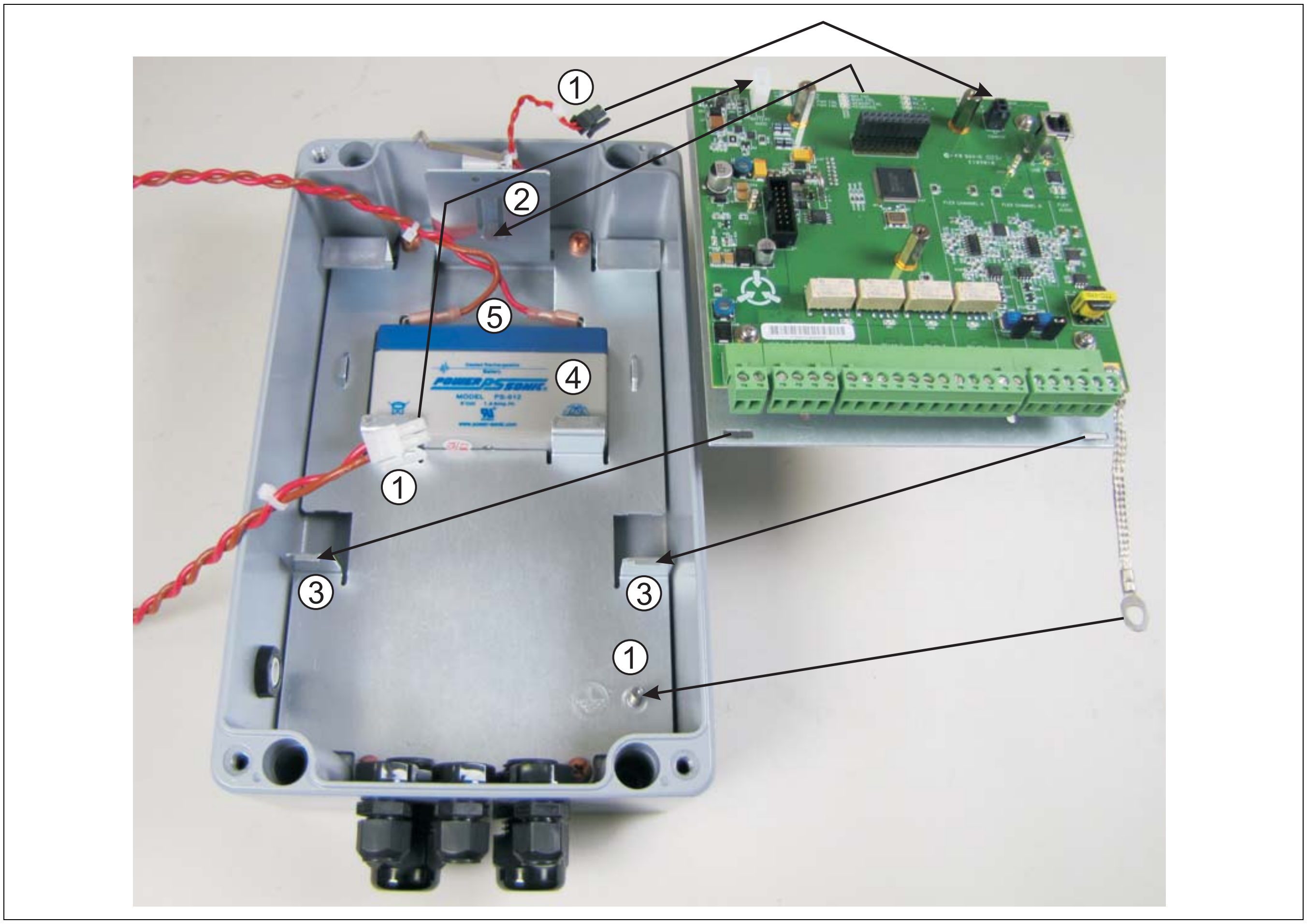


Figure 77: Replacing the processor/battery

Updating the firmware

To update the processor's firmware, begin by establishing a UCM connection.

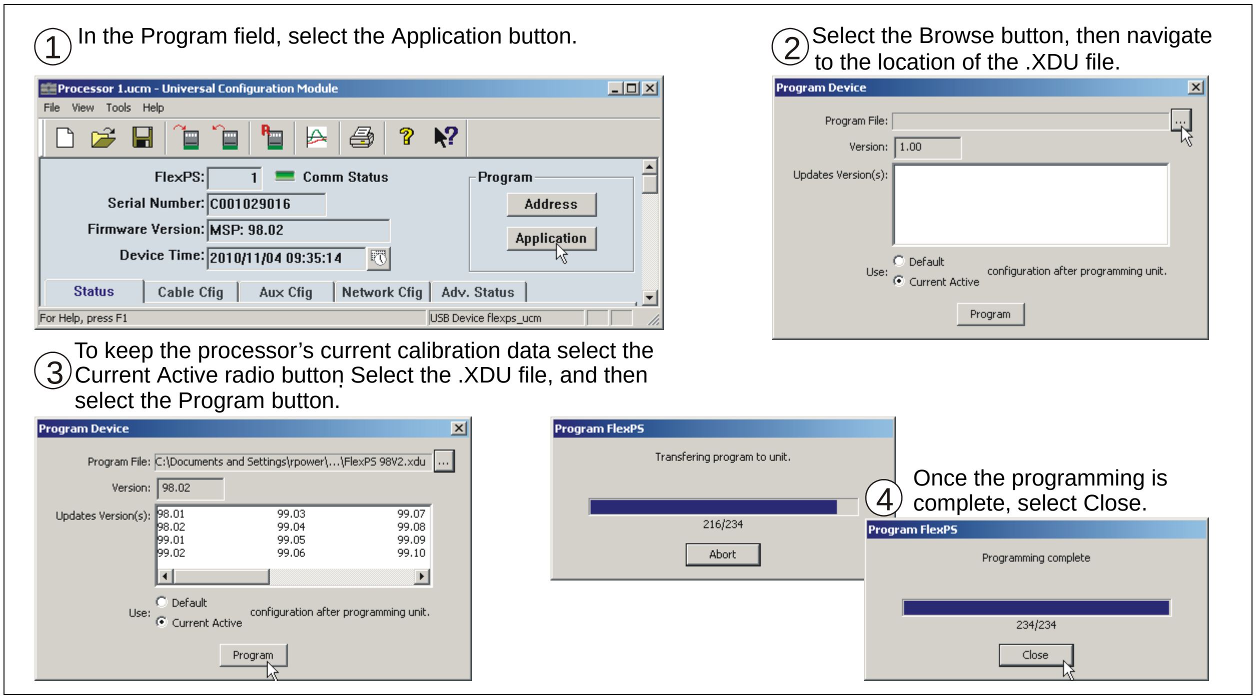


Figure 78: Updating the FlexPS firmware

Adjusting low sensitivity cable

Occasionally, low detection sensitivity sections can occur along the installed sensor cable. Low spots can result from incorrect or incomplete cable stabilization, installation problems, loose fence fabric, or from mishandling the cable.

Note	Mishandling Mark 2 sensor cable can cause a kink in the center conductor, which may require a splice to repair.

- Verify that the cable is correctly installed, and is not slack around the low spot. If there are any visible installation problems, remove the cable and re-install it correctly.
- Ensure that the fence fabric is not loose, and that the cable is not installed too close to tension wires, tension bars, or other cables.

If the above steps do not correct the low detection spot, make the following adjustment:

Low spot near the end of the cable

1. Beginning at the end of the sensor cable, remove the cable from the fence to a point several meters beyond the low spot's location. Lay the cable carefully on the ground in a straight line.
2. Remove and discard the connector shell and terminal block from the end of the cable.
3. Have someone grip the sensor cable's black jacket near the end, while applying 2.2 kg (5 lb) of pulling tension to the center conductor with a pair of pliers.
4. Pick up the sensor cable near the end, and wave and lightly tap the cable at 1 m intervals, back to a point beyond the low detection spot.
   As you tap the cable, listen for the rattle, which indicates that the center conductor is stabilized.
5. Cut off any excess center conductor.
   OR, If the center conductor is retracted, tap back from the end until you locate the center conductor (by listening for the rattle).
6. Cut back the cable so that the center conductor and dielectric are the same length.
7. Reinstall and reterminate the cable, test the sensor zone and recalibrate as required.

Low spot near the middle of a sensor cable

1. Remove the cable from the fence over the length of the low spot, removing enough cable to reach a service loop.
2. Cut the cable at the mid-point of the low spot.
3. Expose 15 cm (6 in.) of center conductor on each section of cable at the cut.
4. On one section, have someone grip the sensor cable's black jacket near the end, while applying 2.2 kg (5 lb) of pulling tension to the center conductor with a pair of pliers.
5. Pick up the sensor cable near the gripper, and wave and lightly tap the cable at 1 m intervals, back to a point beyond the low detection spot.
   As you tap the cable, listen for the rattle, which indicates that the center conductor is stabilized.
6. Cut off any excess center conductor.
   OR, If the center conductor is retracted, tap back from the end until you locate the center conductor (by listening for the rattle).
7. Repeat steps 4, 5, and 6 on the second section of cable.
8. Cut back the cable so that the center conductor and dielectric are the same length.
9. Splice the two sections of cable together using the standard splice kit and re-install the cable.
10. Test the sensor zone and recalibrate as required.

Note	If these methods do not correct the low spot, replace the low sensitivity cable section with a new length of sensor cable.

a Parts list

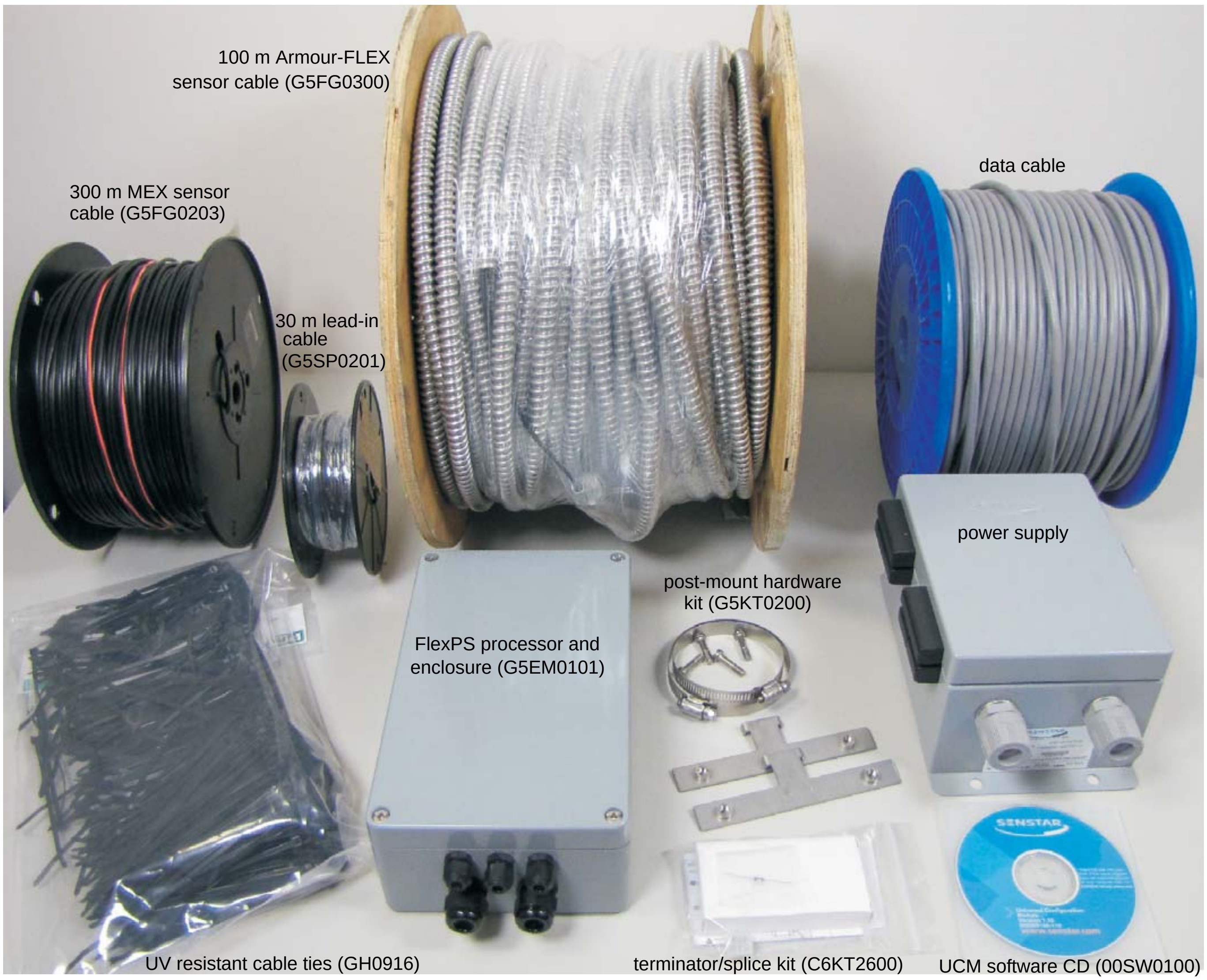


Figure 79 FlexPS general system components

Component	Part Number	Description
FlexPS processor		
Processor and enclosure	G5EM0101	FlexPS processor mounted in an outdoor rated painted aluminum enclosure, provides electronic processing for one or two sensor zones with up to up to 300 m (984 ft.) of sensor cable per zone
Processor	G5BA0100	FlexPS processor printed circuit board assembly mounted on backplate
FlexPS sensor cable		
MEX sensor cable	G5FG0201	FlexPS MEX sensor cable, 100 m (328 ft.) reel
MEX sensor cable	G5FG0501	FlexPS MEX sensor cable, 100 m (328 ft.) reel + 333 UV resistant cable ties
MEX sensor cable	G5FG0202	FlexPS MEX sensor cable, 200 m (656 ft.) reel
MEX sensor cable	G5FG0502	FlexPS MEX sensor cable, 200 m (656 ft.) reel + 667 UV resistant cable ties
MEX sensor cable	G5FG0203	FlexPS MEX sensor cable, 300 m (984 ft.) reel
MEX sensor cable	G5FG0503	FlexPS MEX sensor cable, 300 m (984 ft.) reel + 1000 UV resistant cable ties
Armour-FLEX MEX sensor cable, 100 m	G5FG0300	FlexPS MEX sensor cable inside flexible aluminum jacket, 100 m (328 ft.) reel
MEX lead-in cable 30 m	G5SP0201	Non-sensitive MEX lead-in cable with black jacket, 30 m (98 ft.) reel
MEX lead-in cable 150 m	G5SP0202	Non-sensitive MEX lead-in cable with black jacket, 30 m (98 ft.) reel
MEX lead-in cable 300 m	G5SP0203	Non-sensitive MEX lead-in cable with black jacket, 30 m (98 ft.) reel
Mark 2 sensor cable	C6FG0902	FlexPS Mark 2 sensor cable, 150 m (492 ft.) reel
Armour-FLEX Mark 2 cable, 100 m	C6SP1300	FlexPS Mark 2 sensor cable inside flexible steel jacket, 100 m (328 ft.) reel
FlexPS accessories		
termination/splice kit	C6KT2600	single zone termination/splice kit
post mounting kit	G5KT0200	hardware for mounting enclosure on a post with OD range from 4.5 cm to 12.7 cm (1.75 in. to 5 in.)
lockable mounting kit	G5KT0400	enclosure locking mounting kit for post-mount and surface-mount applications (lock not included)
cable ties	GH0916	UV resistant polypropylene cable ties, 1000 piece bag
stainless steel cable ties	H0845	stainless steel cable ties for Armour-FLEX sensor cable, 25 piece bag
stainless steel cable tie tool	X0240	installation tool for stainless steel cable ties
double loop steel bar ties	82-130020	steel bar ties, 15 cm (6 in.) 18 AWG, 1000 piece bundle
condulet fitting	C6KT0900	weatherproof junction box for Armour-FLEX cable splices and terminations
battery	GE0499	6 VDC 1.4 Ah rechargeable sealed lead-acid battery with G5HA0100 wiring harness

Component	Part Number	Description
Gate accessories		
gate disconnect assembly	C6KT0101	Sensor cable disconnect assembly for swinging and sliding gates
local control gate bypass module	C6EM0301	key switch activated gate bypass module
remote control gate bypass module	C6EM0400	remotely activated gate bypass module
Retrofit applications		
mounting plate	G5MD0301	FPS retrofit adaptor for installing FlexPS in FPS enclosure
mounting plate	G5MD0302	Intelli-FLEX retrofit adaptor for installing FlexPS in Intelli-FLEX enclosure
UCM software		
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 accessories		
Silver Network Interface Unit	00EM0200	Silver Network data converter for EIA-422 and multimode fiber optic applications
Silver Network Interface Unit	00EM0201	Silver Network data converter for EIA-422 and singlemode fiber optic applications
Network Manager software	00FG0200	Network Manager software CD for Silver, Crossfire, MX, VoE, Sennet, plus USB security key
Network Interface Card (multimode fiber)	00BA1901	Network interface card for multimode fiber optic communications
Network Interface Card (EIA-422)	00BA2000	Network interface card for copper wire communications
Network Interface Card (singlemode fiber)	00BA2101	Network interface card for singlemode fiber optic communications
Network Interface Card (EIA-422 & multimode fiber)	00BA1902	Mixed media network interface card for copper wire and multimode fiber optic communications
Network Interface Card (EIA-422 & singlemode fiber)	00BA2102	Mixed media network interface card for copper wire and singlemode fiber optic communications
Network Interface Card (Ethernet PoE)	00BA2200	Power over Ethernet network interface card for Ethernet communications

b Specifications

Processor	**Model**	• processor card and enclosure
	PCB dimensions (L x W)	• 13.2 x 14.5 cm (5.2 x 5.7 in.)
	Quantity	• one per two sensor zones
	Enclosure	• IP66/NEMA 4 painted aluminum, outdoor rated • L x W x D 26 cm (+2.5 for cable glands) x 16 cm x 9 cm 10.25 in. (+1 for cable glands) x 6.3 in. x 3.5 in.
	Cable entry ports	• 3 small cable ports fitted with cable glands - 13.71 mm (0.54 in.) compression gland range - 2.92 - 6.35 mm (0.115 to 0.25 in.) • 2 large cable ports fitted with cable glands - 22.23 mm (0.875 in.) compression gland range - 4.32 - 11.94 mm (0.17 to 0.47 in.)
	Probability of detection	• 95% with a 95% confidence factor for cutting the fence, lifting the fence fabric, or climbing over the fence unaided (based on a high quality chain link fence, and following manufacturers' installation recommendations)
	Maximum sensor cable length	• 300 m (984 ft.) max; zone length app. 10% less @ 270 m (886 ft.)
	Maximum lead-in cable length	• 150 m (492 ft.) max. based on 300 m of sensor cable; lead-in cable length can be increased by decreasing the sensor cable length the same amount
	Power consumption	• 0.5 W nominal; 1 W nominal with network interface card
	Power input	• 12 to 48 VDC
	Connectors	• removable terminal block for power input • removable terminal block for relay output connections • removable terminal block for auxiliary input/self-test connections • removable terminal block for sensor cable input • USB port for UCM connection • 20-pin socket for network interface card

Processor	**Controls**	• calibration adjustments via the Universal Configuration Module (Windows-based software application)
	Inputs	• 2 sensor cable inputs (1 per zone) • 2 voltage sensing auxiliary device/self-test/audio activation inputs
	Outputs	• 4 form C relay outputs 30 VDC @ 1 A maximum, non-inductive load user-configurable relay response • 600 Ω impedance audio output
	LED indicators	• power • one per relay • UCM connected • Enclosure door open • diagnostic activity
	Supervision	• mechanical enclosure tamper switch • sensor wires • lead-in cable • processor operation
	Temperature	• -40º to +70ºC (-40º to +158º F)
	Relative humidity	• 0 to 95%, non-condensing
	Frequency response	• selectable frequency response band • 100 - 900 Hz

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 FlexPS, FlexZone, OmniTrax, 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 80: 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.

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. The Aux Control for each sensor must be set to Remote control mode.

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.

Note	The output activation buttons located below the outputs on the UCM status screen do not function in NM Mode.

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.

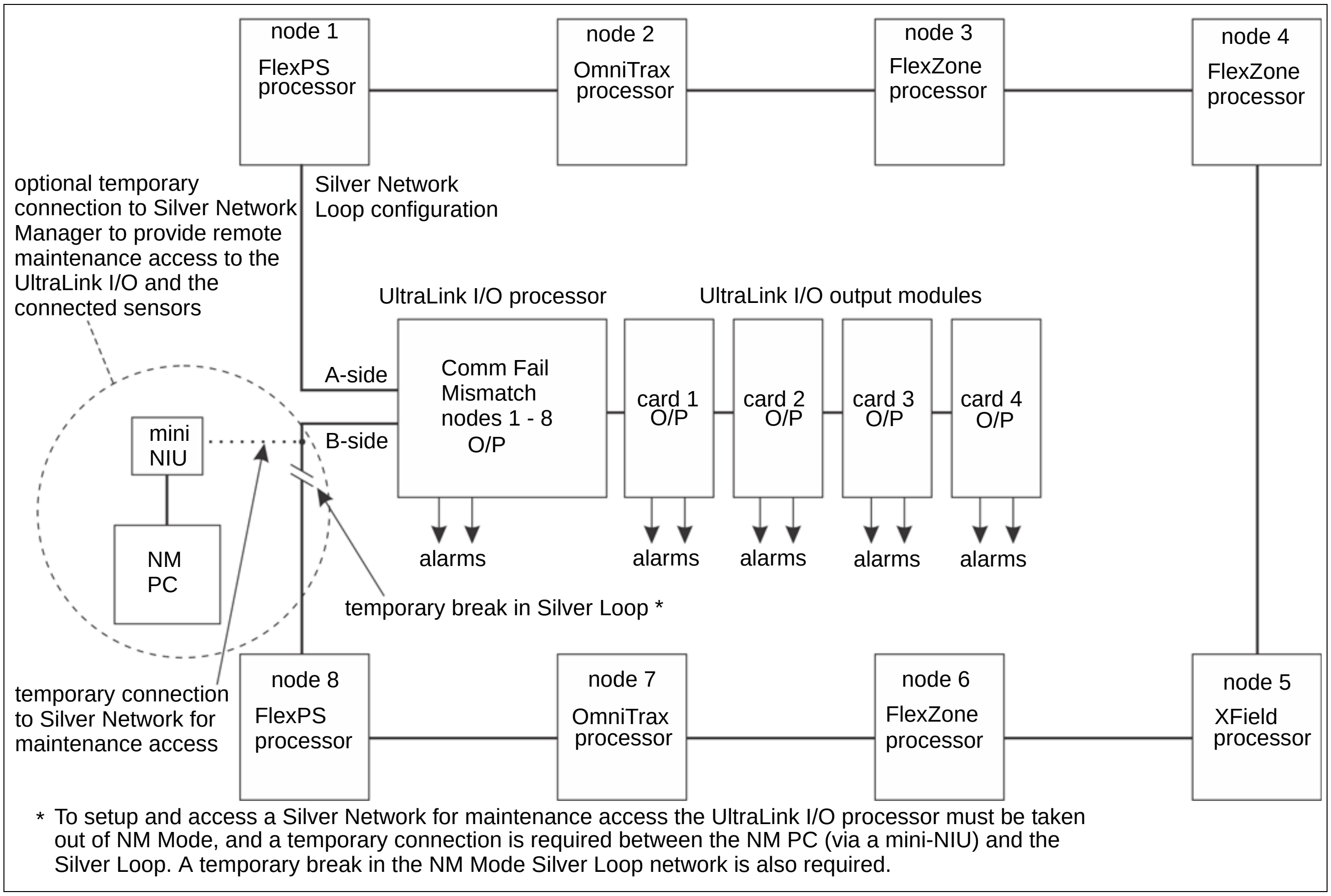


Figure 80: NM Mode block diagram

UCM configuration

To use UltraLink modular I/O system outputs to report FlexPS alarm and supervision conditions establish a UCM connection to the FlexPS 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 80:).

Note	Output assignments for Comm Fail and device mismatch for each connected device are made via a UCM connection to the UltraLink processor (see 00DA1003-002).

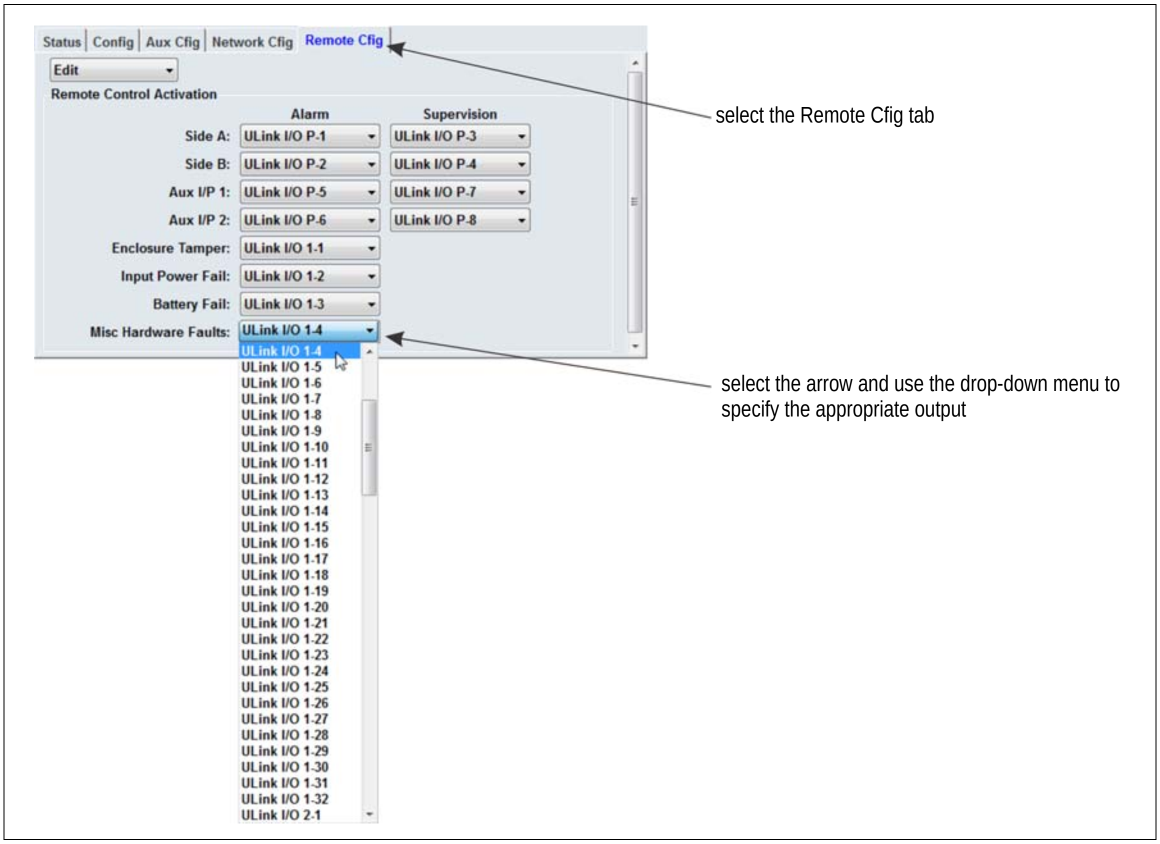


Figure 81: Setting up the Remote Configuration outputs