FiberPatrol®

Fiber Optic Fence Protection Sensor

Product Guide

FP400 Sensor

F4DA0102-001, Rev C
September 1, 2021

SENSTAR®

F4DA0102-001, Rev C
September 1, 2021
website: www.senstar.com
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Approvals:

Canada: This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations. Industry Canada ICES-003, issue 4 requirements for Class A devices.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

USA: This device complies with part 15, subpart B 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 any interference that may cause undesired operation.

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 in a residential installation.This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

Europe: This device conforms to the protection requirement of council directives 89/336/EEC on the approximation of the laws of member states relating to Electromagnetic compatibility, amended by directive 93/68/EEC.

EN50130-4:2011+A1:2014, EN61000-6-3:2007/A1:2011, RoHS3, REACH

CE

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

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1 System description

The FiberPatrol FP400 is a fence-mounted perimeter intrusion detection system that detects intruders using a fiber optic sensor cable that is attached to the fence. The FP400 processor uses interferometry technology to measure the strain in the sensor cable caused by climbing, cutting, lifting, or otherwise disturbing the fence fabric. The processor monitors four independent sensor zones, each with up to 300 m (984 ft.) of sensor cable.

The sensor cable is communication-grade single-mode fiber optic cable intended for outdoor installation. The cable includes 12 fibers and each detection zone requires 2 dedicated fibers. The number of unused (dark) fibers available for other perimeter applications depends on the configuration of the zones. The sensor cable is easily attached to the fence with UV resistant cable ties. All fiber splices require fusion splicing and the fiber optic connections to the processor use SC/APC type connectors.

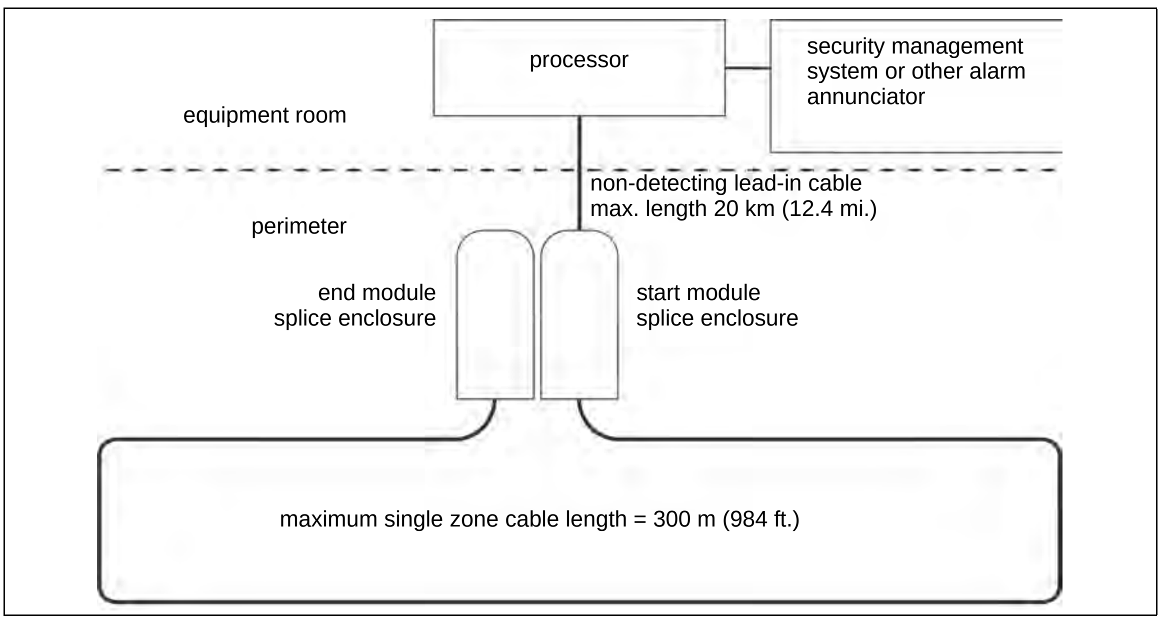


Figure 1 Senstar block diagram - single zone closed perimeter example

For each sensor zone, the processor transmits laser light through an optical output channel (TX) into a fiber in the lead-in cable. Up to 20 km (12.4 mi) of non-detecting lead-in cable carries the light to the start module where it is sent down the two sensing fibers. At the end of the zone, the end module reflects the light back to the start module, which in turn sends it to the processor through an optical input channel (RX). The processor analyzes the detection signals from each zone and triggers an alarm when a fence disturbance meets the user-defined criteria for a valid intrusion.

There are two methods of controlling the processors inputs and outputs (I/O) Local control mode and Remote control mode. In Local control mode, the FP400 operates as a standalone sensor which communicates alarm and supervision conditions via 6 onboard relays. Alternatively, in Remote control mode, the FP400 communicates with a security management system (SMS) via the Silver Network Manager. The SMS uses the outputs as control points, and the inputs to report the status of auxiliary security equipment.

Silver Network based processors can use Ethernet, EIA-422 copper wire, multi-mode or single-mode fiber optic cable for alarm data communications. A PC-based SMS, such as Senstar's Alarm Integration Module, StarNet 2, or Symphony, can serve as the primary operator interface for an FP400 system. The FP400 can also communicate with a third party SMS via the Network Manager Interface. The security management system monitors the sensor, and can report alarms to an operator on a graphic site-map. The FP400 sensor's user interface is the Windows-based Universal Configuration Module (UCM) software, which is used to setup and calibrate the system. The UCM enables sensor calibration, detection parameter adjustments, system configuration settings, and real time signal monitoring and recording.

System details

- fiber optic, fence-mounted outdoor perimeter intrusion detection system
- uses standard outdoor rated telecommunication grade single-mode fiber optic cable
- 4 independent sensor alarm zones, each with up to 300 m (984 ft.) of sensor cable

Note	The length of each FP400 sensor zone is based on the length of the detecting sensor cable, not the physical length of the fence.

- up to 20 km (12.4 miles) of non-detecting lead-in cable to each sensor zone
- processor supervision of lead-in cable and detecting cable
- 2 dedicated sensor fibers required for each detection zone
- additional dark fibers available for other perimeter applications
- single pass coverage for chain-link and welded mesh fences up to 3 m (10 ft.) high
- dual pass coverage for higher fences
- no power required for outdoor sensing components (excluding processor)
- sensor cable unaffected by lightning, EMI, or electrical transients
- compact, outdoor rated splice enclosures for start modules, end modules and fiber drop points
- panel-mount processor (outdoor mounting requires a customer supplied weatherproof field distribution box)
    - can be mounted on any stable flat surface (vertical or horizontal)
    - rack-mounted on a custom EIA-19 in. equipment rack shelf (p/n F4KT0500)
    - DIN rail mounted (requires DIN rail mounting kit p/n F4KT0600)
    - post-mounted outdoors on, or separate from, the protected fence

FP400 components

FP400 Processor

The FP400 processor operates on 12 to 48 VDC input power, or can be powered by PoE, and consumes 2 W (nominal).

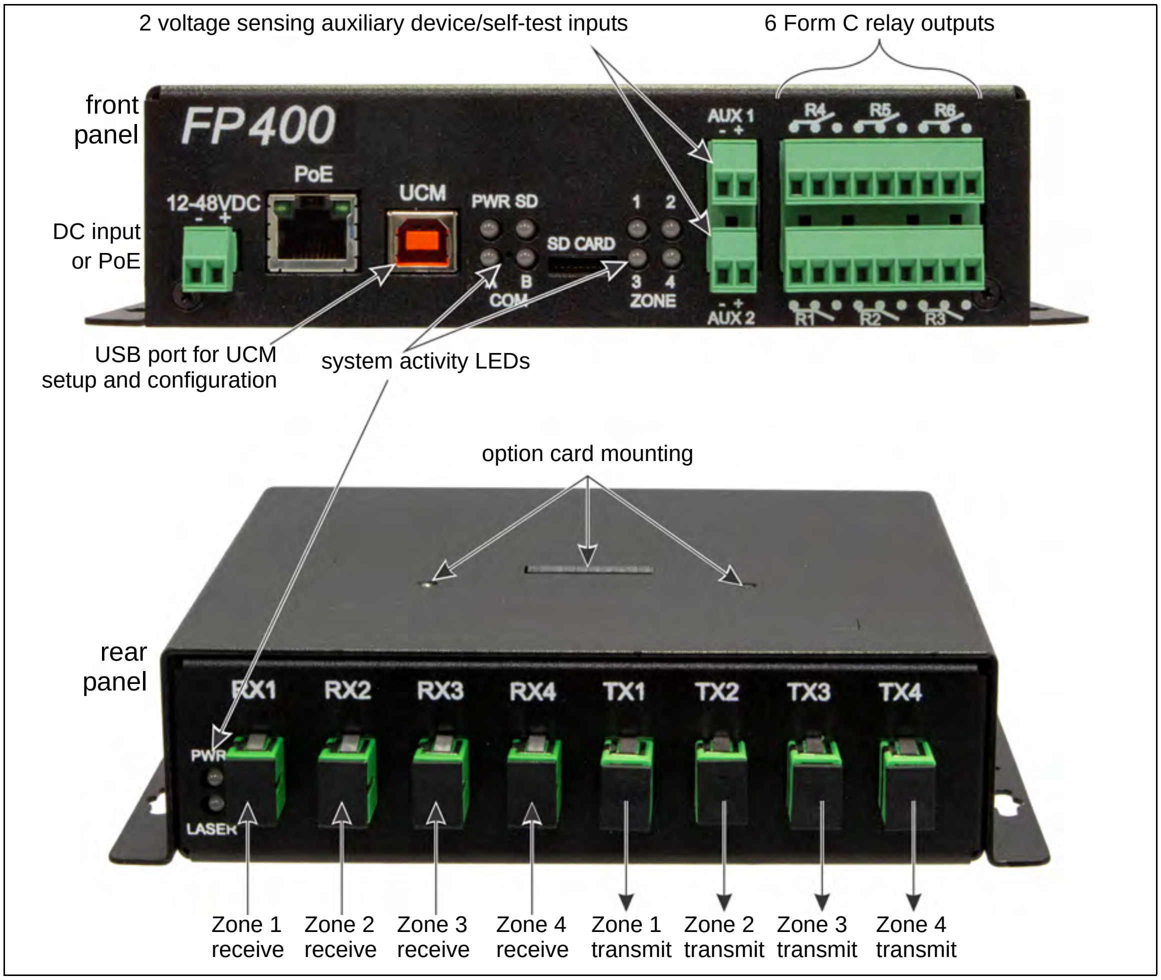


Figure 2 FP400 processor connections

Relay outputs

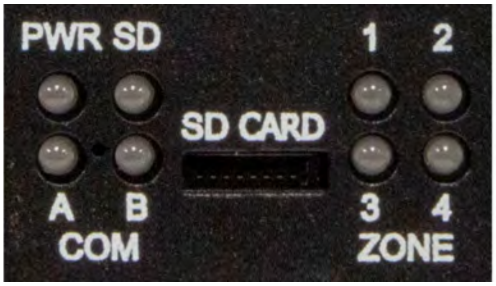
The FP400 processor has 6 user-configurable Form C relay outputs rated for 30 V @ 1 A max. When the processor is set to Local control mode, the relays are used to signal alarm and supervision conditions. For network based processors (set to Remote control mode) alarm data is carried over the network cables and the six relays are available as output control points from the security management system.

Auxiliary inputs

The processor includes 2 voltage sensing self-test/auxiliary device inputs. In Local control mode the inputs are used to activate electronic self-tests. In Remote control mode the inputs are used to report the status of 1 or 2 auxiliary security devices to the host SMS.

LED indicators

The processor includes 10 LED indicators to visually display its current status. Figure 3 shows the front and rear panel LEDs and Table 1 provides the display state details.



front panel LEDs

rear panel LEDs

Figure 3 FP400 LED indicators

LED Name	LED OFF	LED Green	LED Red	LED Amber
PWR (2)	power OFF	power ON	power fault	N/A
LASER	Laser OFF	Laser ON	Laser fault	N/A
SD	no SD card	card in (steady) / writing (blinks)	SD card fault	N/A
COM A	no activity side A	A side receive (blinks)	A side fault	N/A
COM B	no activity side B	B side receive (blinks)	B side fault	N/A
ZONE 1	disabled	enabled and secure	zone alarm	supervision
ZONE 2	disabled	enabled and secure	zone alarm	supervision
ZONE 3	disabled	enabled and secure	zone alarm	supervision
ZONE 4	disabled	enabled and secure	zone alarm	supervision

Table 1 LED indications

Network communications

The FP400 processor includes an Ethernet port for network communications and power (PoE). Alternatively, a network interface card (NIC) can be plugged into the processor to enable Silver Network communications via EIA-422 copper wire, or fiber optic cable. Network communications are managed by the Silver Network Manager (NM) and communication to a third-party SMS can be made via the Network Manager Interface.

Note Network communications can use either the onboard Ethernet, or an optional NIC, not both.

Zone kit

Note Each sensor zone requires one, or two, splice enclosures. Splice enclosures are ordered separately.

The zone kit (p/n F4KT0200) includes a start module, an end module, 10 splice sleeves, and labels for the SC/APC connections to the processor. For each sensor zone, 2 SC/APC connectors with 1 m (3.3 ft.) fiber leads are harvested from the start module. The 2 connectors are spliced to 2 fibers in the lead-in cable for the connection between the processor and the lead-in cable. The SC/APC connectors are labeled to ensure they are connected to the appropriate TX and RX ports on the processor. The non-detecting lead-in cable runs between the processor and the start module located at the beginning of the sensor zone. At the start point of the zone, the two fibers in the lead-in cable are spliced to one side of the start module. The two fibers on the other side of the start module are spliced to two fibers in the detecting section of sensor cable. The detection zone begins at this point, and runs for up to 300 m (984 ft.) of sensor cable. At the end of the detection zone the two sensor fibers are spliced to the end module which terminates the zone. The start module and end module are protected inside weatherproof splice enclosures. Depending on the sensor zone configuration, a start module or a second end module can be co-located in the end module's splice enclosure. Figure 4 shows the zone connection kit contents.

Note	The 2 leads on each side of the start module are interchangeable. Connect the 2 leads on one side of the start module to the lead-in cable and connect the 2 leads on the other side of the start module to the detecting cable.

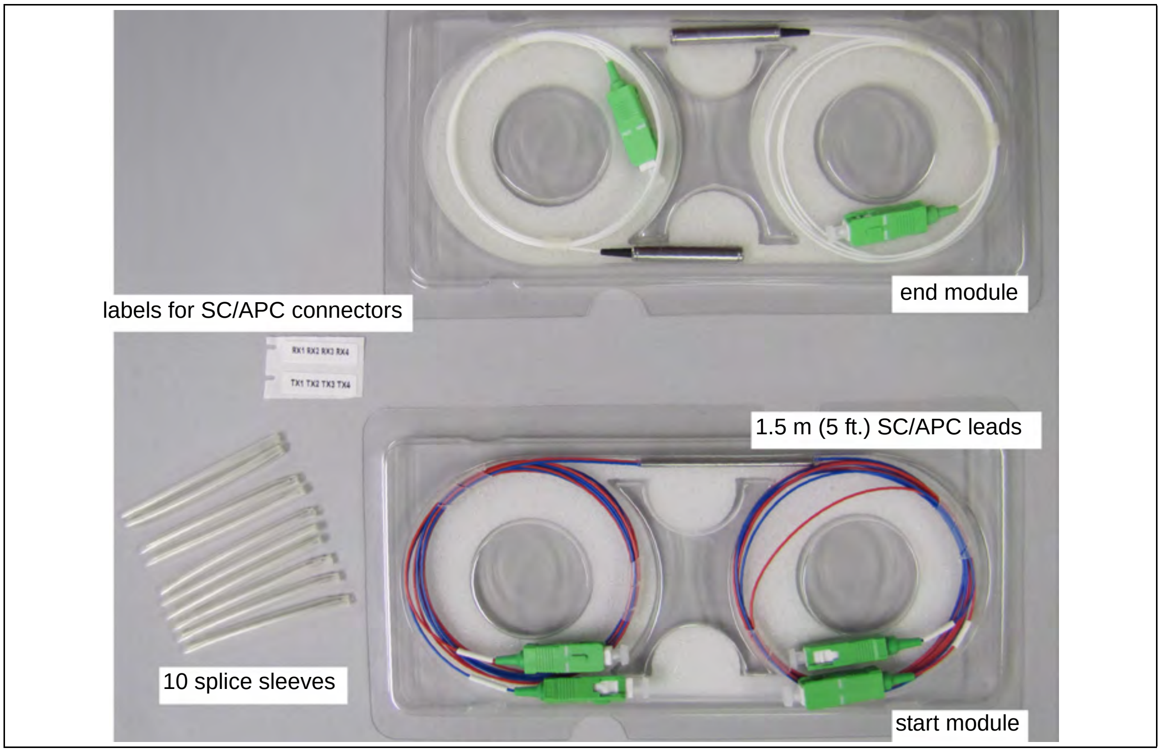


Figure 4 FP400 zone kit

Start Module

The detection for each sensor zone begins at the start module. One side of the start module is connected to the TX and RX ports of the processor through the lead-in cable. The other side is connected to the two sensing fibers in the detecting cable. The start module includes 4 SC/APC connectors, which are cut off with 1 m fiber leads. Two of the connectors are labeled and used for the connection between the lead-in cable and the processor. The start module is fence-mounted inside a weatherproof enclosure at the beginning of the detection zone.

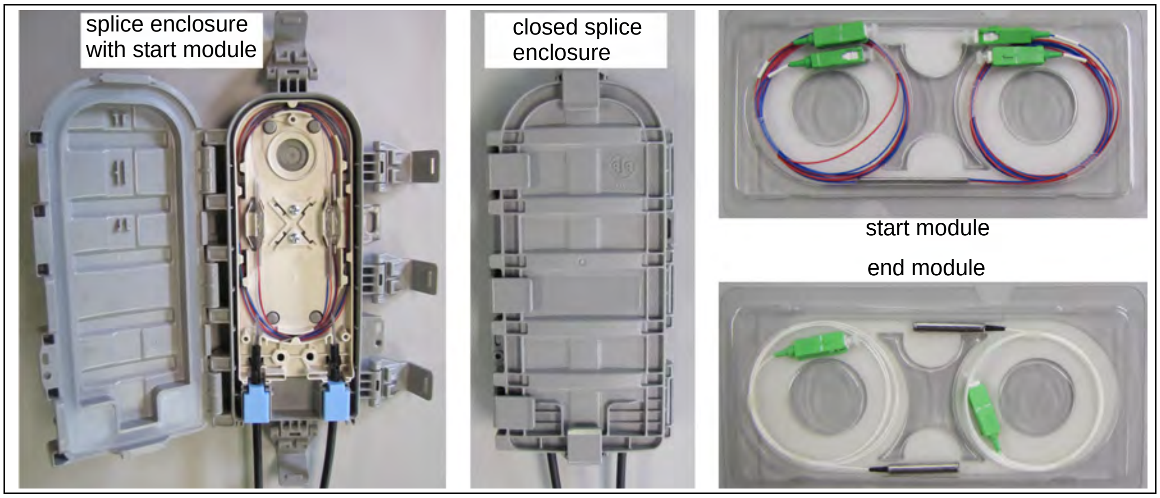


Figure 5 FP400 outdoor splice components

End Module

The detection for each sensor zone is terminated by the end module. The two sensor fibers in the detecting cable are spliced to two end module fibers. The end module includes 2 SC/APC connectors, which are cut off with 1 m fiber leads. The end module is fence-mounted inside a weatherproof enclosure at the end of the detection zone.

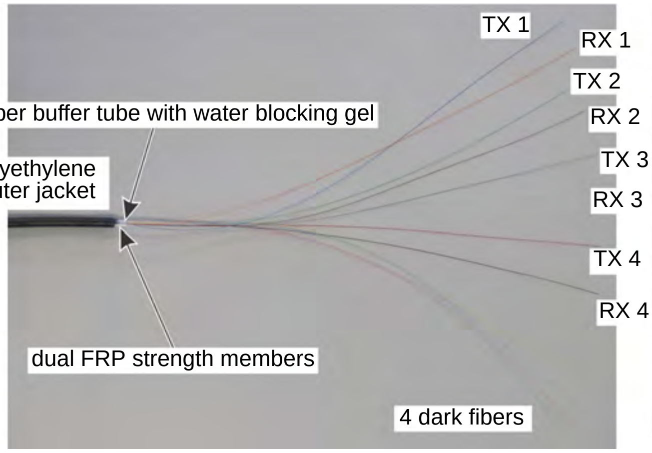
Weatherproof splice enclosure

The outdoor-rated weatherproof splice enclosure (p/n F4KT0100) protects the optical components and field splices for the FP400 sensor system. The enclosure includes two cable ports and sealing grommets sized for the sensor cable. The splice enclosure can contain up to 12 splices including a start module, an end module, a start module and end module, or two end modules. It can also be used to protect the lead-in cable splices at the processor location.

Sensor cable/non-detecting lead-in cable

The sensor cable is telecommunication grade outdoor-rated central loose tube single-mode fiber optic cable with a polyethylene outer jacket and a waterblock system. The non-armored loose tube cable is comprised of a central 12-fiber buffer tube and 2 fiberglass reinforced plastic (FRP) strength members. The sensor cable is also used as the non-detecting lead-in cable for the connection between the processor and the start module. Sensor detection begins at the start module of each zone. Figure 6 illustrates the sensor cable with a fiber designation table indicating the recommended use of the individual fibers. Sensor cable can be ordered in lengths of 250 m (820 ft. p/n F4SP0100) and 1000 m (3,280 ft. p/n F4SP0101).

Note	Contact Senstar Customer Service if the installation requires additional dark fibers. Higher capacity sensor cable is available from the factory. However, the higher capacity cable requires larger splice enclosures to accommodate the larger cable.



fiber usage recommendations		
fiber #	color	designation
1	blue	TX1
2	orange	RX 1
3	green	TX 2
4	brown	RX 2
5	gray	TX 3
6	white	RX 3
7	red	TX 4
8	black	RX 4
9	yellow	dark
10	purple	dark
11	rose	dark
12	aqua	dark

Figure 6 Sensor cable details

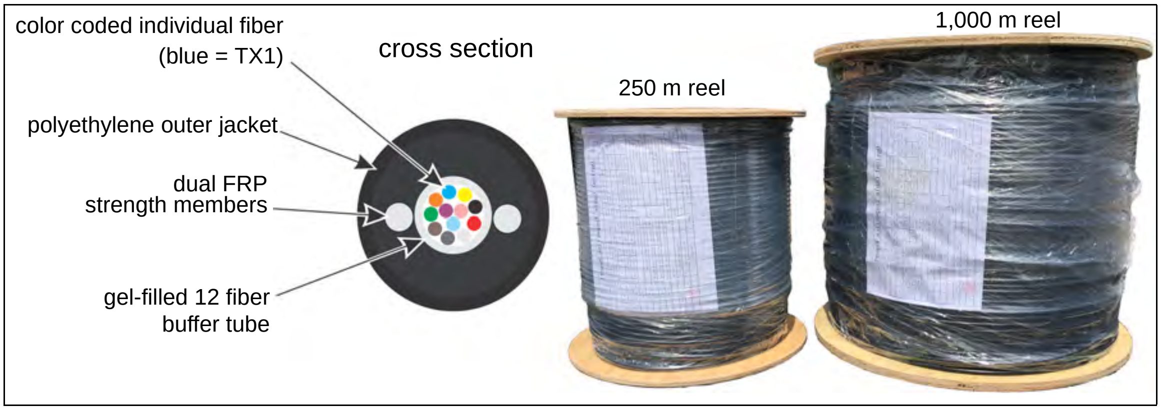


Figure 7 Sensor cable cross section

Cable ties

FiberPatrol sensor cable is attached to the fence with durable plastic UV-resistant cable ties (p/n GH1210-1000). The cable ties come in bags of 1000 pieces and one bag can attach approximately 300 m of sensor cable to a fence. The recommended spacing is 30 cm (1 ft.) and the cable ties are hand tightened to hold the sensor cable snuggly against the fence. Mechanical tightening devices cannot be used as over-tightening the cable ties will have an adverse effect on the sensor’s detection.

2 Site planning

FP400 configurations

The recommended method for installing the sensor cable is to use the minimum number of splices possible for each sensor zone. This includes 2 splices for the lead-in cable connections to the processor, 4 splices for the start module, and 2 splices for the end module. Midspan access techniques are recommended for non-spliced (expressed) fibers passing through an enclosure. Figure 8 illustrates an FP400 sensor zone with the minimum 8 fusion splices.

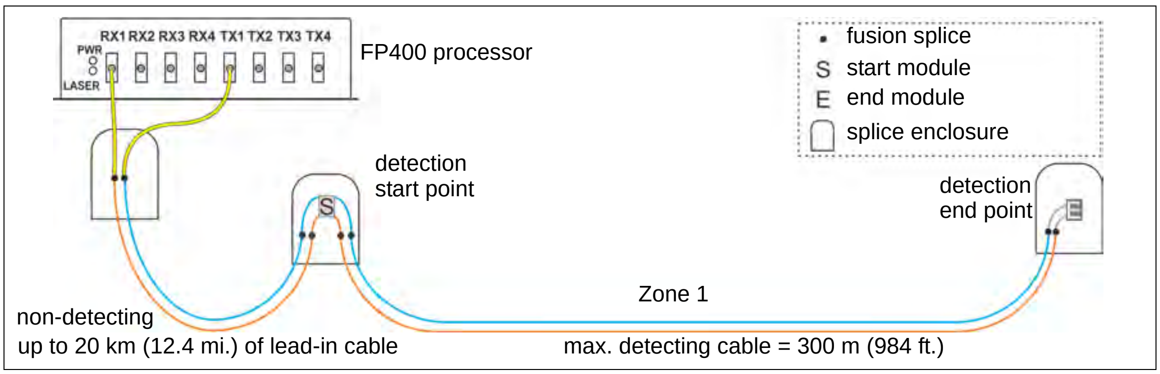


Figure 8 Single zone linear configuration (minimum splices)

The FP400 detection zone runs between the start module and end module, and can include up to 300 m of sensor cable. For planning purposes approximately 15% extra cable should be budgeted for splice point service loops and installation variations. The 15% overage allows one sensor zone to protect approximately 255 m (840 ft.) of perimeter fence. For longer perimeters, the 4 zones can be installed back to back thereby extending coverage to a maximum length of 1.2 km (0.75 mi.) of sensor cable. Four contiguous zones of sensor cable can cover approximately 1 km (0.62 mi.) of fence. The coverage length can be extended indefinitely by networking multiple FP400 sensors back to back.

Some FP400 zone configurations require only 2 dedicated fibers. For those configurations there is no need to express the 10 unused fibers through the enclosure. In this situation, it is acceptable to cut the sensor cable and splice only the required fibers. In the example drawings in Figure 9, a and b require expressed fibers but c does not. In the example drawings in Figure 11, a requires expressed fibers but b and c do not.

Note	Expressing fibers through splice enclosures reduces the number of fusion splices required in the field, and helps to keep the signal loss to a minimum.

Linear zone configuration

The linear zone configuration is used when the start point and end point of the detection zone are separated by some distance. In this case, the processor module is connected to the start module by lead-in cable at the beginning of the sensor zone. The sensor zone runs for up to 300 m to an end module. Figure 9 illustrates three block diagrams of FP400 linear configurations, and Figure 10 shows a back-to-back 8 zone configuration.

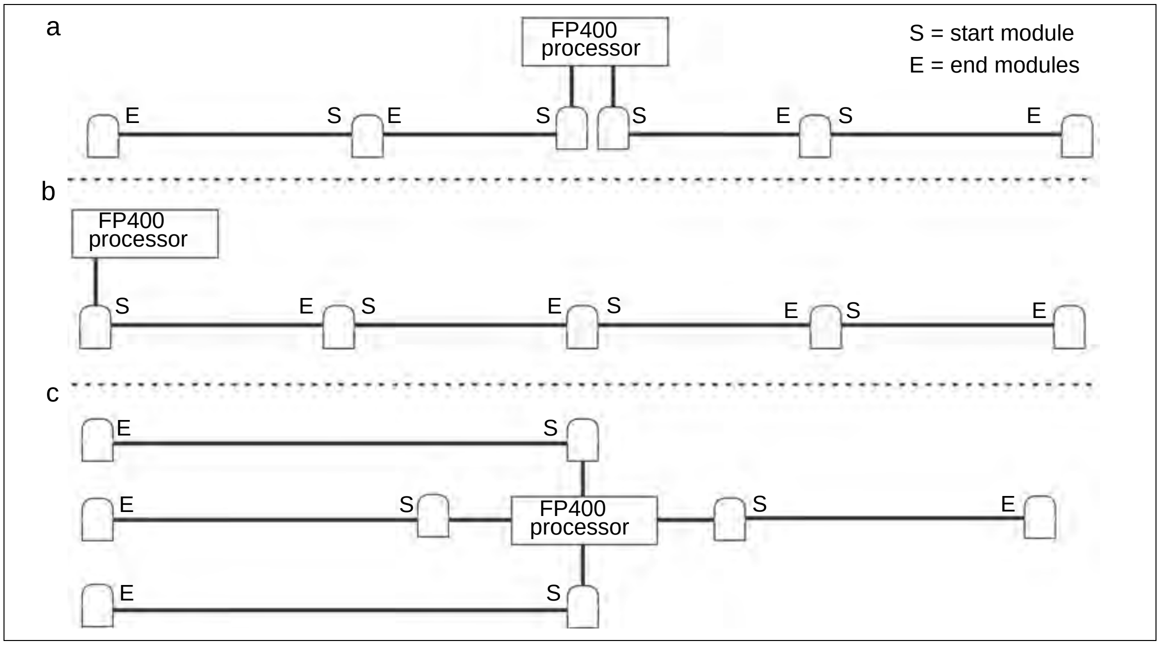


Figure 9 Single processor linear zone configurations

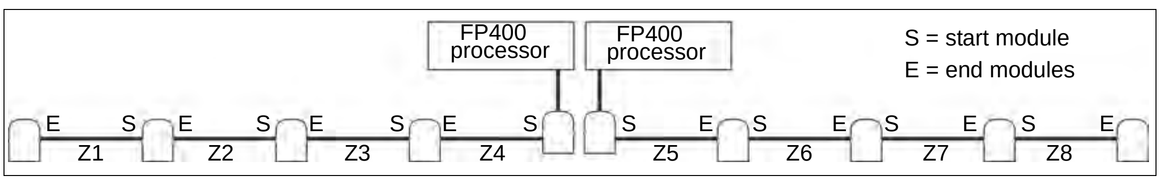


Figure 10 Two processor linear zone configuration (8 zones)

Closed loop configuration

The loop configuration provides a closed perimeter. The processor is located within 20 km of the perimeter fence with two splice enclosures housing the start and end points of the detecting sensor cable. Non-detecting lead-in cable carries the laser light signals between the processor and the start module at the beginning of the detection zone. The sensor zone runs for up to 300 m of detecting cable to the end module. Figure 11 illustrates three block diagrams of FP400 closed loop configurations.

The closed loop configuration can be used as a single zone with up to 300 m of detecting cable (see Figure 13). It can also be used with two, three, or four zones providing up to 1.2 km of detecting sensor cable per processor. With careful planning, the start module and end module splice enclosures can be located on either side of a gate, with the gate protected by another sensor technology (e.g., a wireless gate sensor, or a microwave).

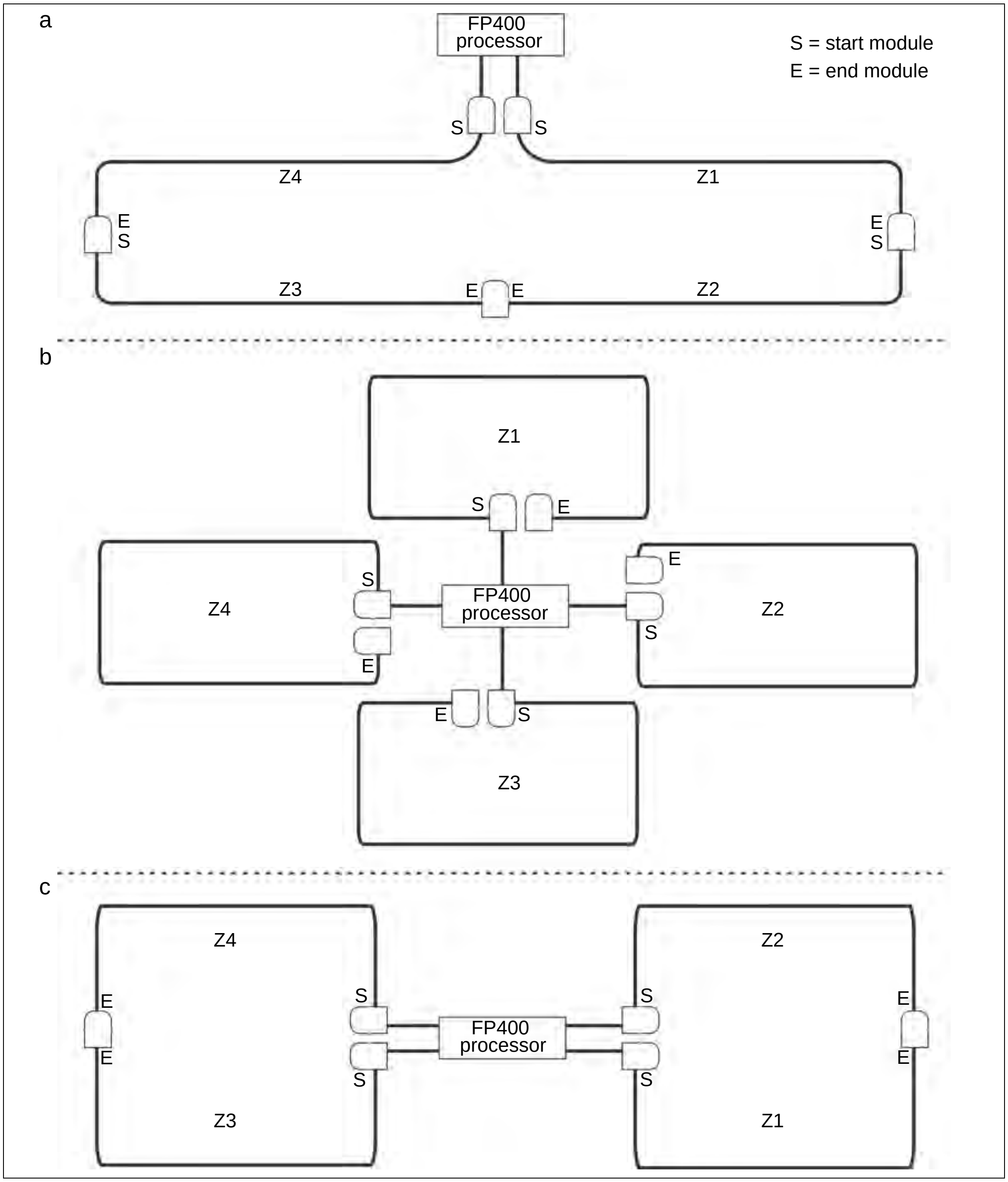


Figure 11 Closed loop configurations

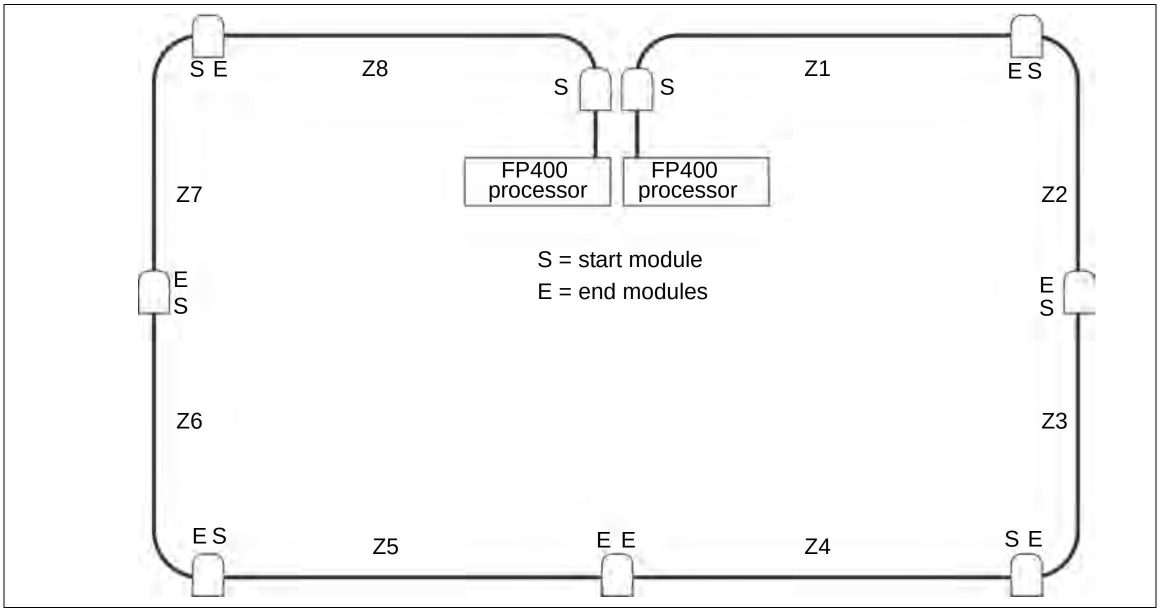


Figure 12 Two processor closed loop configuration (8 zones)

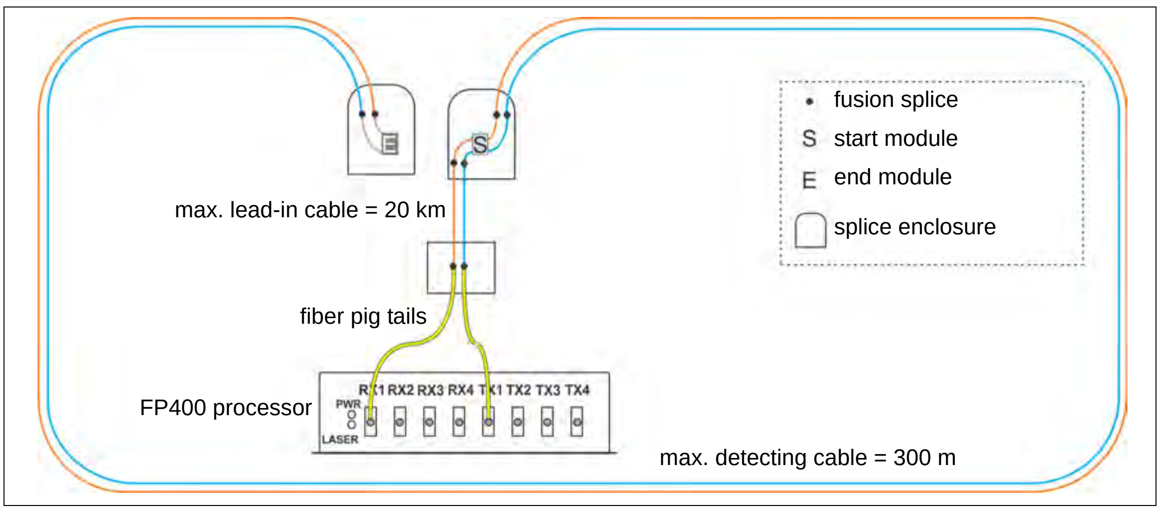


Figure 13 Single zone closed loop configuration (minimum splices)

FP400 fiber drop points

In the standard configurations, fiber drop points to access dark fibers for other perimeter applications are possible at end module enclosures which include a single end module. The enclosure's second cable port can be used to connect an auxiliary device such as a CCTV camera. The dark fibers that will be accessed should be expressed through the start module enclosure. Figure 14 illustrates this concept. For sites which require additional dark fibers or additional drop locations, Senstar can supply multi-tube fiber cable. To use these larger diameter cables also requires the use of larger splice enclosures and some additional components. Contact Senstar for information about using multi-tube fiber cable with the FP400 system.

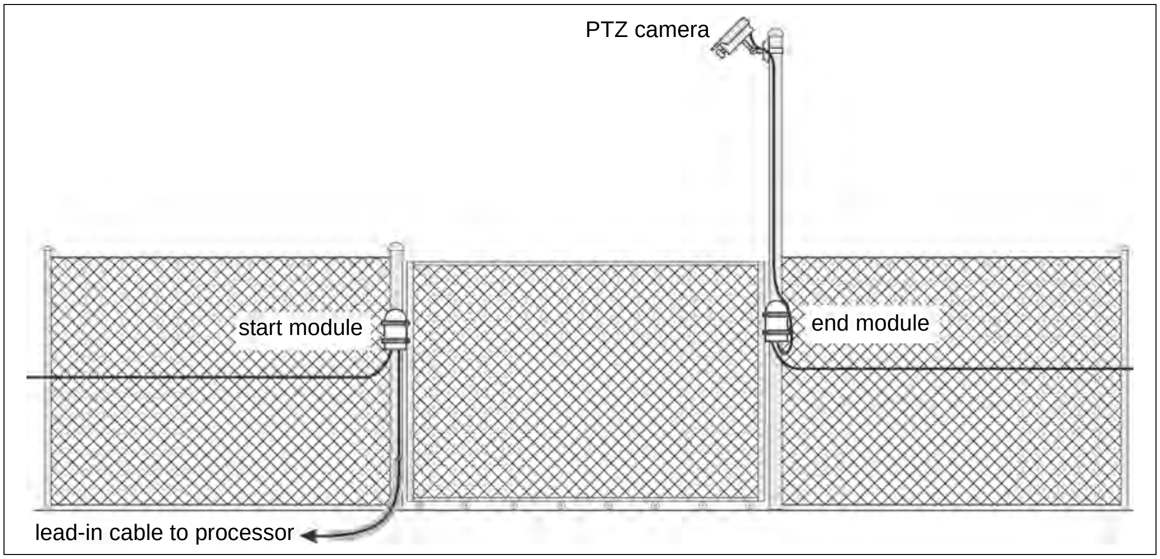


Figure 14 Fiber drop point

Lightning protection

Silver Network based FP400 sensors using IP-based communications sometimes include outdoor runs of Ethernet cable. In some cases, it is desirable to add external surge protectors to the comm link for lightning protection. The following surge protectors have been tested and approved for use with Senstar IP-based sensors. Figure 51: illustrates the connection details.

- L-Com HGLN-CAT6-HP
- L-Com AL-CAT6HPJW (weather resistant)
- Laird ESP-100-POE

Site survey

The first step in installing a Senstar FP400 fence protection system is to conduct a detailed site survey. The survey assesses the site conditions to determine the specific installation requirements including the fence type, fence condition, fence length, zone layouts, sensor cable route, non-detecting lead-in cable length, length of sensor cable required to cover the perimeter, and the location for the processor.

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

- head end equipment - FP400 processor, power supply and SMS
- fences (include type, length and condition)
- gates (include type and size)
- buildings and other structures
- roads, driveways, sidewalks, paths, parking areas
- trees, bushes, dense vegetation (near perimeter)
- non-detecting lead-in cable
- detecting sensor cable
- other existing or planned security equipment (e.g., CCTV cameras, security lighting, etc.)

Fence condition

The fence must be properly installed, tensioned, and maintained to provide effective intrusion detection with the FP400 sensor. The fence should be uniform in height and quality, and should be high enough to present an effective barrier against climb-over intrusions. It is also recommended that a climb-over barrier, such as barbed wire or concertina, be installed along the top of the fence. The condition of the fence is critical to the efficient operation of the FP400. Breaks in the fence structure, or slack portions of fence fabric, will inhibit the transmission of fence vibrations to the sensor cable. Poor fence conditions can also cause metal on metal contact noise during inclement weather that will result in nuisance alarms.

Supported fence types

- chain-link
- welded-mesh
- expanded metal
- palisade

Note	Fences used in conjunction with the FP400 sensor must meet industry standards for security fences. To prevent nuisance alarms, remove or secure any signs, loose fittings, locks, gate hardware, nearby vegetation, and anything else that can move and make contact with the fence.

It is possible to use the FP400 sensor to protect other fence types, as well as buildings and walls. However, revised installation techniques are required.

Note	Senstar recommends installing the sensor cable on a representative section of the building or wall to test and verify that the detection sensitivity meets the security requirements, before installing a complete system.

Site analysis checklist

✓	**Description**
	create a site plan
	accurate CAD drawings with precise measurements
	detailed description of fences (type, condition, height, fence rails, climb over deterrent hardware, other cables, conduit, or signs attached to fence)
	detailed description of gates (type, condition, location, size)
	locate all obstacles on site survey
	spur fences or fences abutting the perimeter fence
	sidewalks, paths, roads, driveways
	buildings, walls and other structures
	utilities (sewers, pipes, conduits and electrical cables, etc.)

3 Installing the FP400

FP400 installation overview

CAUTION	Fusion splicing the sensor cable must be done by qualified personnel who are trained and certified in fiber optic cable installation to telecom industry standards. Dispensing the sensor cable and attaching the cable to the fence requires minimal training.

There are ten steps to completing an FP400 installation:

1. Create a detailed site plan.
2. Deploy the sensor cable alongside the fence according to the site plan.
3. Attach the sensor cable to the fence.
   Pull the cable through bypass conduit, if required.
   Attach cable to protected gates, if required.
4. Make the fusion splices.
5. Create splice point service loops, and attach the loops to the fence.
6. Use a visual fault locater (VFL) to verify the continuity of each spliced fiber (recommended).
7. Install and connect the FP400 processor.
8. Setup and configure the system software.
9. Calibrate the sensor.
10. Test the system to ensure it meets the site’s detection requirements.

Laser light safety

WARNING	The FP400 processor contains a Class I laser light source. NEVER look directly into the end of a fiber connector. Ensure that the fiber optic light source is off, BEFORE using a scope to check a fiber optic connector.

Optical fiber safety

WARNING	Use care when working with exposed optical fibers. The bare fibers are 125 microns in diameter and can easily penetrate skin. Always wear safety glasses when working with optical fibers. Always dispose of bare fibers in a sealed and labeled container that is specifically designed to contain fiber optic waste. NEVER dispose of bare fibers in a standard waste receptacle.

Fiber optic cable handling

Note	The sensor cable (p/n F4SP0101) includes 12 optical fibers inside a gel filled buffer tube. Custom sized cables are also available with additional fibers (contact Senstar for details).

Sensor cable performance specifications

The following manufacturer's performance specifications apply to the sensor cable:

- Fiber count 12 fibers 1 tube
- Fiber type 9/125 single-mode
- Manufacturer's maximum cable attenuation 0.24 dB/km @ 1550 nm
- Minimum allowable bend radius (dynamic) 12 cm (5 in.) (20 X OD)
- Minimum allowable bend radius (static) 6 cm (2.5 in.) (10 X OD)
- Maximum allowable tensile rating during installation 800 N (180 lbf)
- Maximum allowable tensile rating installed 400 N (90 lbf)
- Crush resistance (short term) 1000 N (740 lbf)
- Temperature ratings (operational/storage) -40 to 70ºC (-40 to 158º F)
- Temperature ratings (installation) -10 to 60ºC (14 to 140º F)
- Typical outside diameter 6 mm (0.25 in.)

Additional cable requirements

- FRP strength members
- water blocking tube
- gel filled buffer tube
- cable OD 6.0 mm
- HDPE outer jacket

Cable handling recommendations

- Bend management systems should be used to restrict cable bend during installation so that the minimum bend radius is not violated. (Cable pulleys of a suitable diameter should be used at points where the cable changes directions during installation.)
- Fused swivels and tension controlled hauling winches should be used to ensure the cable is installed at a tension that does not exceed the specified limits.
- Cable spools should be positioned to limit cable bending and minimize the angle of cable pay-off during unwinding/hauling.
- Cable spools should be held firmly in the pay-off stands to ensure smooth rotation and prevent vibrations that may damage the drum and/or the sensor cable.

Installation requirements

Cable loss limits (maximum attenuation)

- Average loss over the full length of installed cable < 0.3 dB/km (< 0.48 dB/mi.)
- Individual event loss limit < 0.1 dB

Note	Fusion splice performance typically results in a loss of between 0.01 and 0.03 dB.

Sensor fiber length matching requirement

It is critical that the two sensor fibers for each zone are exactly the same length. To meet this length matching requirement, when the lead-in cable and sensor cable are stripped for splicing to the start module and end module, ensure that the two sensor fibers are exactly the same length (i.e., measure carefully and trim if necessary, to match the two fiber's lengths). In addition, ensure that the two fiber leads from the start module that are used for the processor connections are also exactly the same length.

CAUTION	The two fibers used for each zone must be exactly the same length from the start module to the end module (± 5 mm; ± 0.2 in.). If the fibers are not the same length, optimum detection cannot be achieved.

Fence height considerations

The FP400 will provide excellent detection for fences up to 3 m (10 ft.) high with a single pass of cable. The single cable pass is installed at one-half the fence height unless the fence includes a middle rail. For fences with a middle rail, the sensor cable should be installed 30 cm (1 ft.) above the middle rail. For fences greater than 3 m high, use two passes of sensor cable to protect the fence. Install one pass at 1/3 the fence height and the second pass at 2/3 the fence height.

Note	For instances in which a portion of the fence is covered by a climb-over deterrent (i.e., razor ribbon/concertina) the fence height should be based on the uncovered portion of the fence. For example, a 3.7 m (12 ft.) fence with a 90 cm (3 ft.) coil of concertina wire covering the top section of the fence should be considered a 2.75 m (9 ft.) fence. The concertina wire must be securely attached to the fence to prevent any metal on metal contact resulting from environmental conditions.

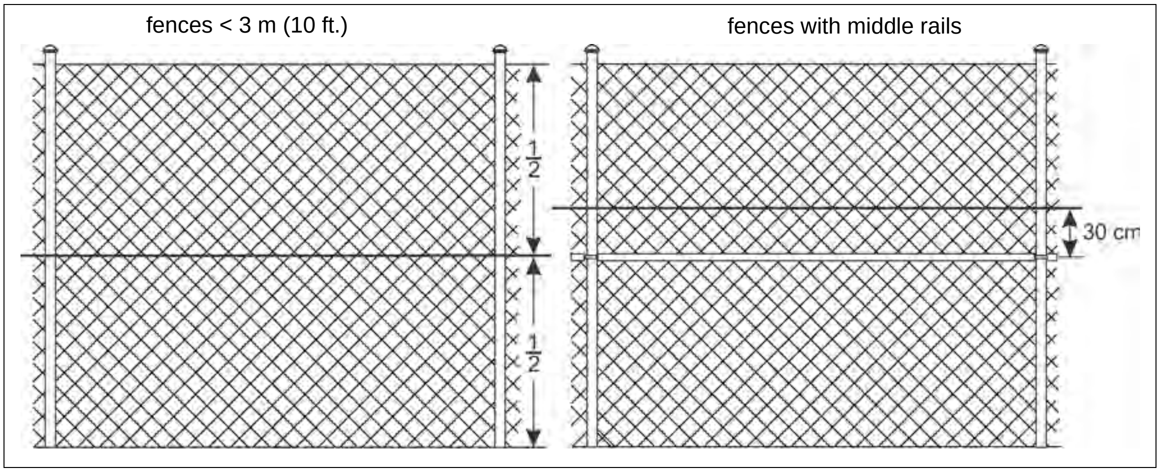


Figure 15 Recommended fence height/cable pass configurations

Double pass coverage

The FP400 will provide excellent detection on fences that are greater than 3 m when used in the double pass configuration. For double pass coverage, two zones from one processor are installed on a single section of fence. The two sensor cables function independently to provide overlapping detection on higher fences. Install the first pass at 1/3 of the fence height and the second pass at 2/3 fence height. Each zone is setup and calibrated independently. Use the same directions as for the regular cable installation. Alternatively, a single zone can be looped back to provide double pass coverage (see Figure 17:)

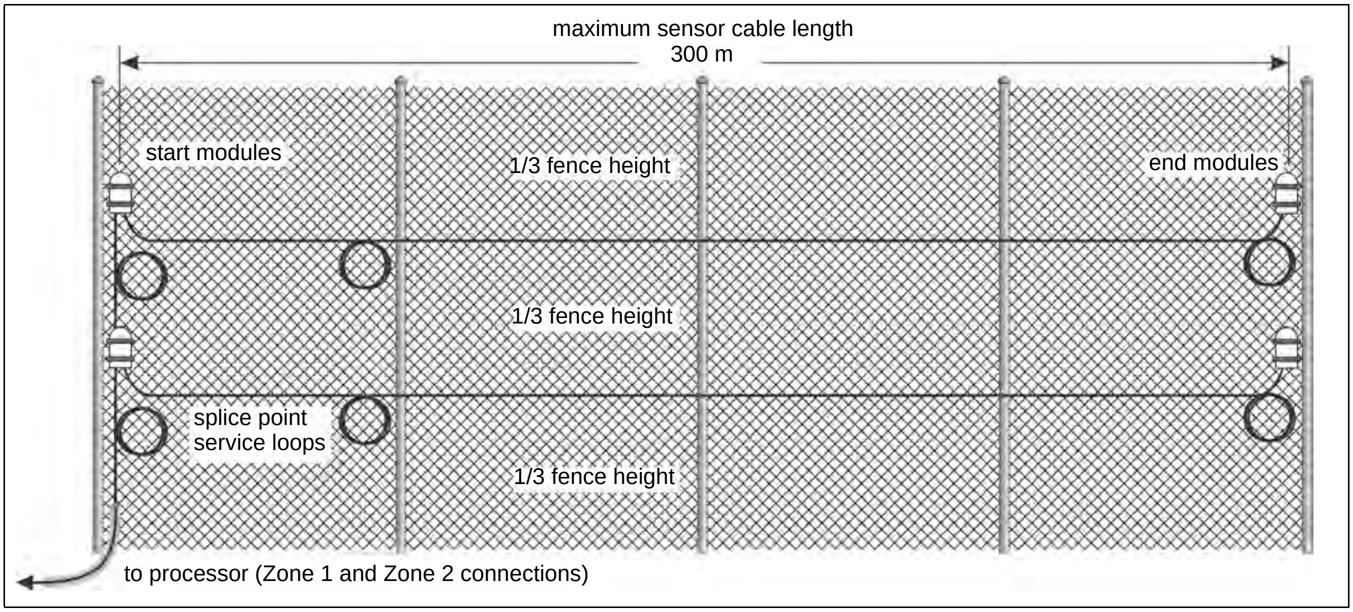


Figure 16: Dual zone, double cable pass configuration

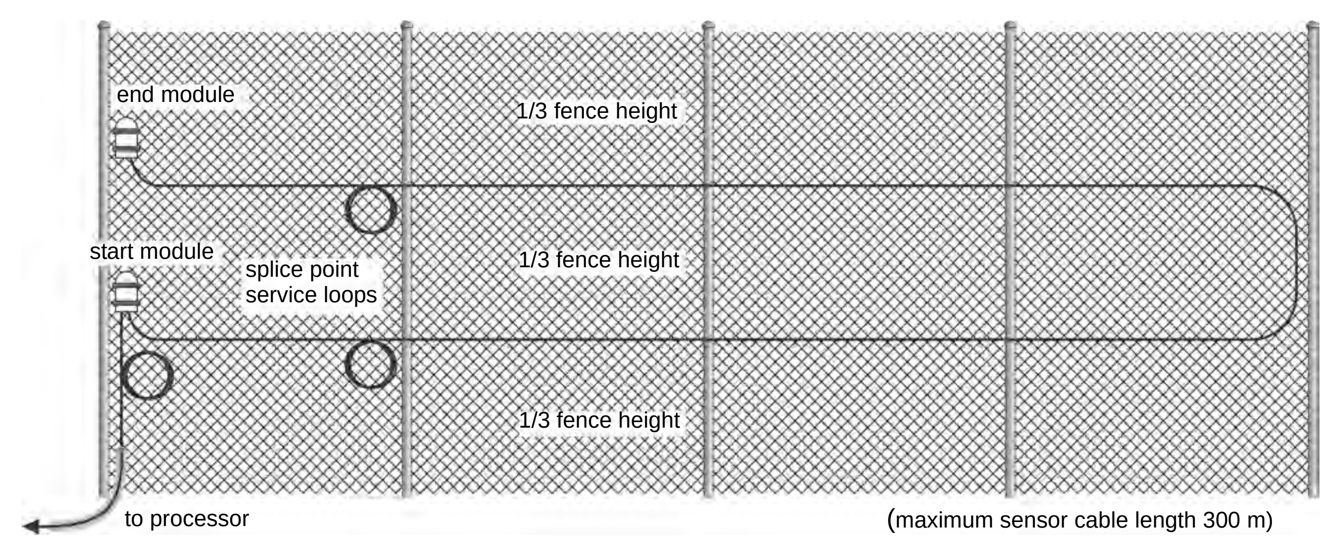


Figure 17: Single zone, double cable pass configuration

Climb-over deterrent hardware

Climb-over deterrent hardware is strongly recommended on perimeter fences under the following conditions. 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/set-screw or be spot-welded. Remove or fasten any loose or rattling material. Sensor cable can also be installed on a fence that is protected with razor ribbon, providing the razor ribbon is secured so that it cannot move due to the wind, or other environmental factors. Use tensioning wires to secure the coil and to prevent the razor ribbon from pulling apart if it is cut.

Barbed wire

It is possible to install sensor cable on barbed wire, but extra precautions must be taken to avoid damage to the sensor cable. Run the sensor cable along the fence and loop the cable up beside the fence posts. Secure the sensor cable to each strand of barbed wire so that the cable avoids contact with the barbs. Secure the cable where it crosses each outrigger. Run the cable past the outrigger and then back down to the half way height of the fence. Alternatively, two zones can be used to provide coverage for the fence and for the barbed wire. Figure 18 and Figure 19 show the recommended methods for installing sensor cable on barbed wire.

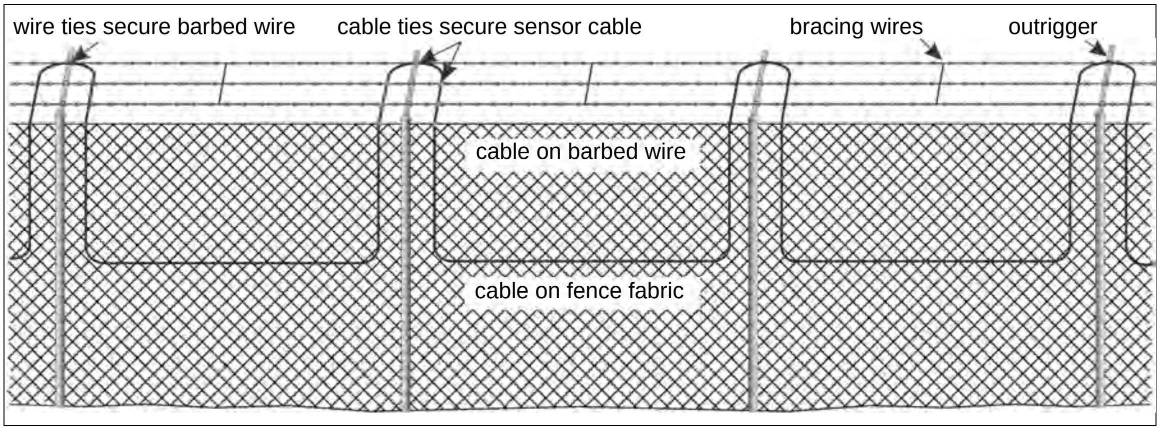


Figure 18 Sensor cable installation on barbed wire fence

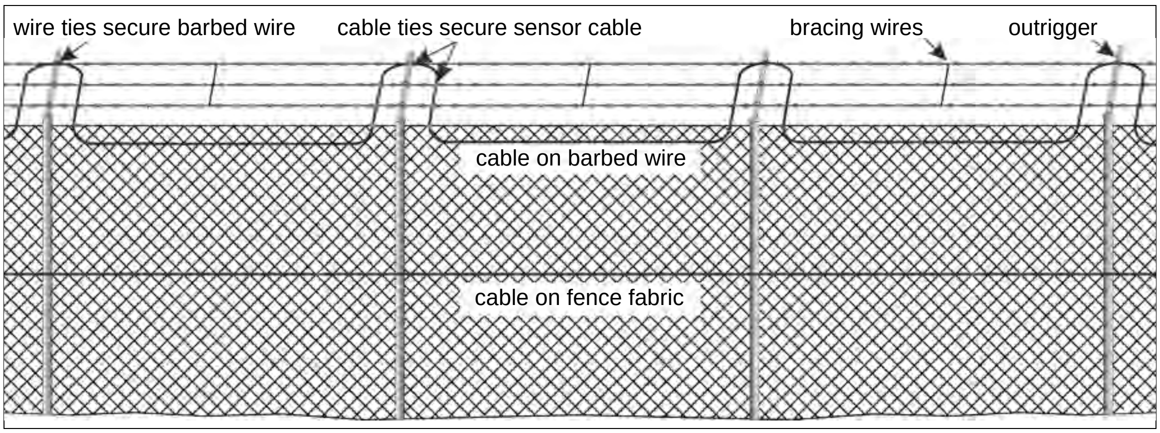


Figure 19 Double pass coverage on barbed wire fence

Gates

There are generally two types of gates used with fences, sliding gates and swinging gates. Sliding gates must be bypassed, and should be protected by another type of sensor (e.g., a wireless gate sensor, a microwave sensor, an IR beam). Swinging gates can be protected by the FP400 sensor. Protected gates should consist of fence fabric attached to a rigid frame that includes horizontal and vertical bracing. There are a number of factors that must be considered when planning for gates, including whether it's a single panel or double panel gate and the type of ground beneath the gate (for cable bypass). Other gate requirements and concerns include:

- 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
- the direction that the protected gate opens (to the inside, to the outside, or both directions)
- the frequency of gate use
- authorized gate use when the sensor is active

Note	Senstar recommends creating a service loop on the hinged side of protected gates.

Gate bypasses

Note	Bypassed gates should be protected with another sensor technology.

To get the sensor cable from one side of a gate to the other, the sensor cable is usually buried below ground inside conduit (see Figure 20). The sensor cable continues the fence coverage beyond the gate. If site conditions make it impossible to dig underground to continue the coverage on the other side of a gate, it may be possible to install the cable above the gate, inside protective conduit. Otherwise, plan the installation so there is a start module on one side of the gate and an end module on the other side (see Figure 21).

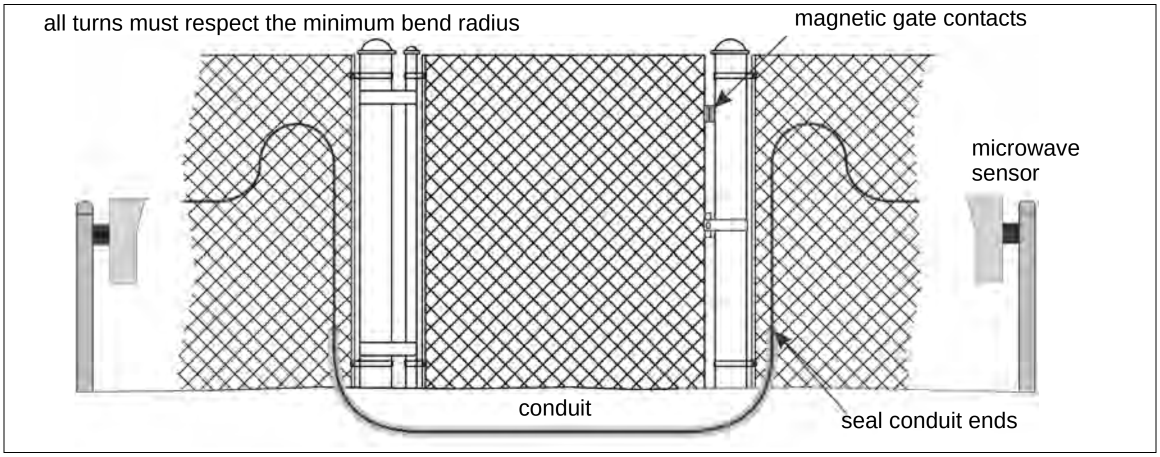


Figure 20 Gate bypass

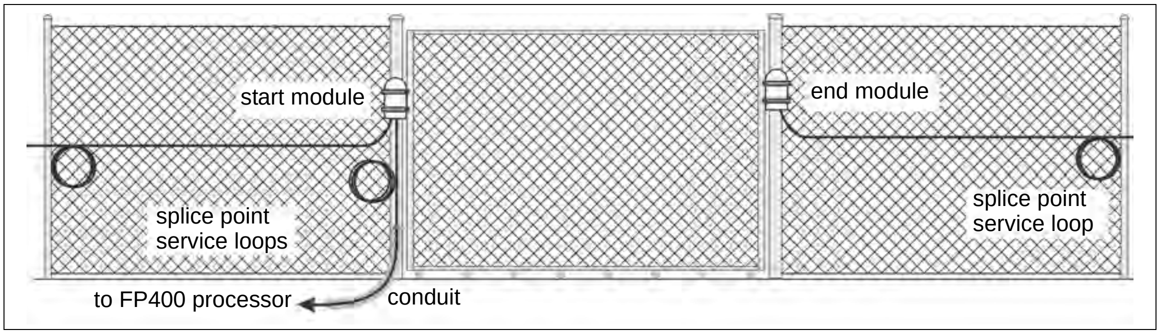


Figure 21 Start and end modules at sliding gate

Protecting swinging gates with sensor cable

A cable management kit (p/n FPKT0500) is available to protect sensor cable that is attached to a swinging gate. To cover a swinging gate with sensor cable, the cable is passed through a section of split conduit that is attached to the fence post with the gate's hinges. The sensor cable is attached to the gate panel at ¼ and ¾ of the gate height and 30 cm in from the edge (see Figure 22). The cable then passes through the split conduit a second time. The sensor cable is routed below ground through conduit, to the other side of the fence, where the fence protection continues. All hardware on the gate must be well secured to prevent any metal on metal contact while the gate is not in use. If there is excess sensor cable at a gate location it should be coiled into a service loop on the hinged side of the gate.

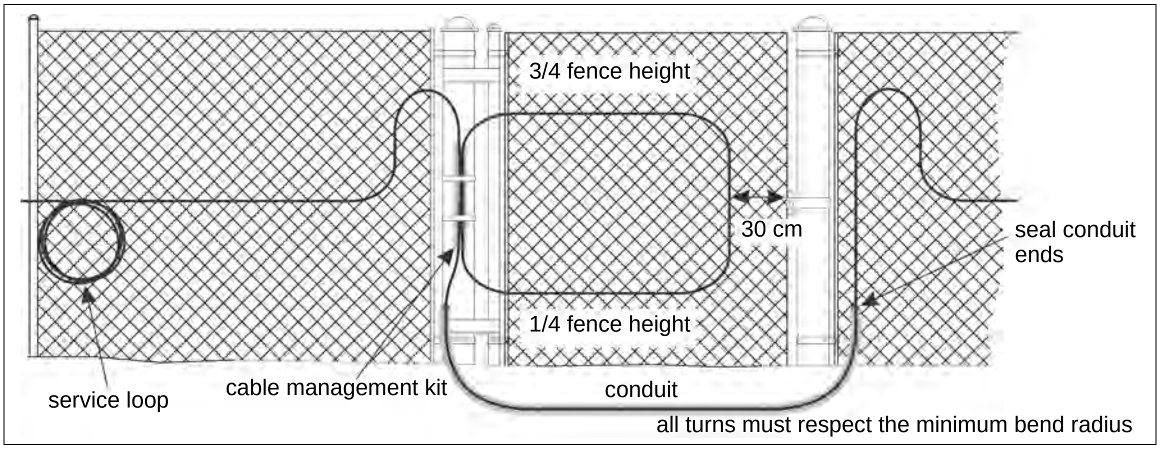


Figure 22 Cable layout on a single panel swinging gate

For a double swinging gate, both gate panels are protected by sensor cable.

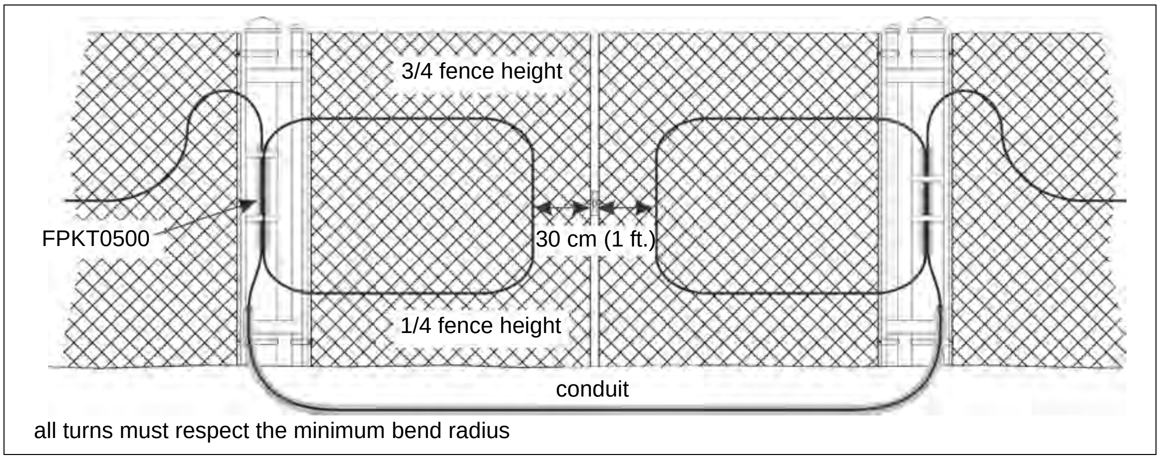


Figure 23 Double panel swinging gate

Determining cable length requirements for gates

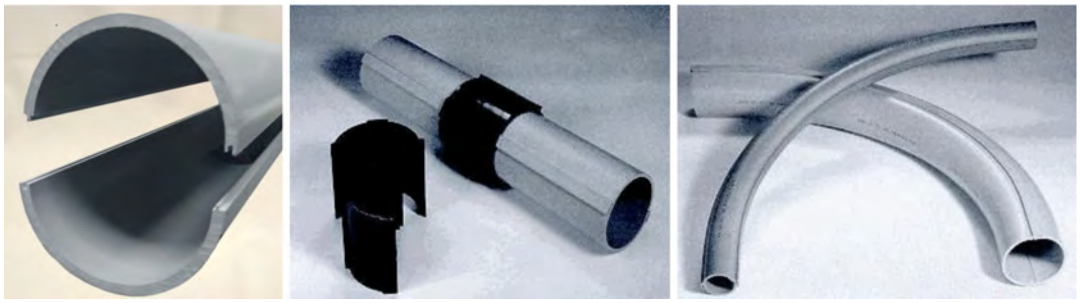
1. For each gate panel:
   - The sensor cable passes around the circumference of each gate panel at ¼ the gate height, 30 cm in from the outside edge, and ¾ the gate height.
     length of cable to protect a gate = 2 X (gate length - 30 cm) + gate height + 2 X (distance from inside edge of gate to fence post) + (60 cm for sensitivity loop) + optional service loop
2. To reach the other side of a gate:
   - Create a sensitivity loop beside the fence post adjacent to the gate. Run the sensitivity loop up 30 cm and back down the post to pass through the split conduit. Loop the cable around the gate as described in step 1. Pull the cable through the conduit to the other side of the gate. The conduit should be buried at least 30 cm deep, and the conduit ends should be at least 30 cm above ground level. Seal both ends of the conduit (water tight).

Using the cable management kit at the hinged side of protected gates

The cable management is used at gate locations to protect the sensor cable from binding or being pinched by the gate while allowing the cable to rotate freely when the gate is opening and closing. The split conduit is fitted against the fence post on the hinged side of the gate so that it is perpendicular to the fence line. Two gear clamps are used to secure the conduit to the fence post. The conduit must have notches cut at points where gate hardware is attached to the post, so the conduit can fit snugly and flush against the fence post.

Selecting conduit for below ground bypasses

When the sensor cable must go below ground to reach the other side of a gate, or go through or below a building or object, the cable must be protected by using conduit. For sites that include periods of freezing weather, solid wall conduit is required. For sites in temperate climates that do not experience freezing weather, split conduit can be used.



split wall conduit — split wall conduit couplers — split wall conduit sweeps (not elbows)

Figure 24 Split wall conduit

flexible solid wall conduit is required for areas with freezing temperatures

Figure 25 Solid wall conduit

water tight rain plugs are required for conduit

use cement at joints for solid wall conduit

Figure 26 Conduit fittings

Solid wall conduit

- Both ends of the conduit must be sealed.
- Flexible conduit can be bent and formed into the required shape for a cable bypass.
- The minimum bend radius for flexible solid wall conduit is 46 cm (18 in.). (If the conduit is kinked during bending it must be replaced.)
- If conduit sections are used, the sections must be glued together (water tight).
- Use conduit sweeps. Do not use 90º elbows. (Cable bend radius rules must be followed.)
- Bury the conduit at least 30 cm (1 ft.) below ground.

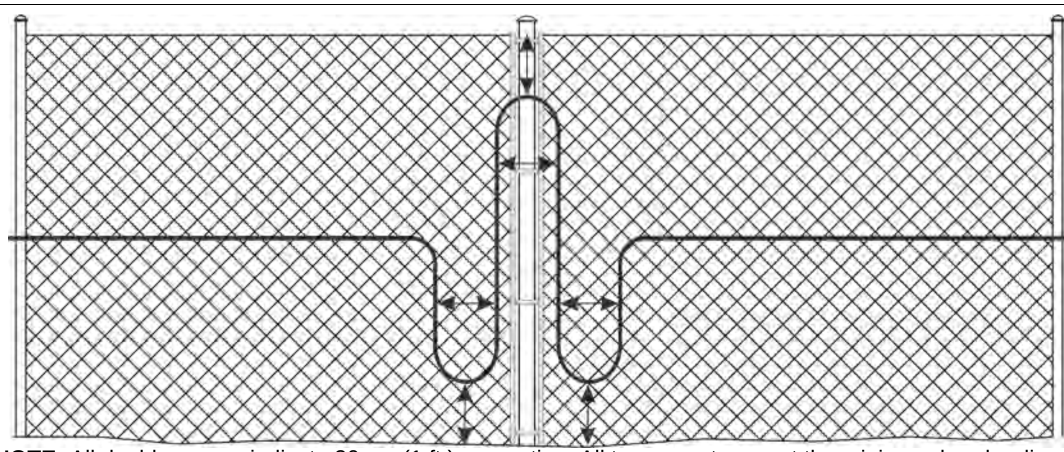
Split wall conduit

- Use conduit sweeps. Do not use 90º elbows.
- Bury the conduit at least 30 cm (1 ft.) below ground.
- Both ends of the conduit must be sealed.

Sensitivity loops for tension posts and corner posts

Corner posts, terminal posts and tension posts are made of heavier gauge steel than ordinary fence posts and can have a dampening effect on nearby fence vibrations. To compensate for this, Senstar recommends using sensitivity loops at all corner posts, terminal posts and heavy gauge tension posts on the fence. The sensitivity loops provide additional sensor cable for areas that typically produce lower levels of fence noise. The length of cable required for a sensitivity loop can be calculated using this formula:

3 X (fence height - 60 cm) + 90 cm = sensitivity loop cable length requirement.
For example, on a 2.4 m (8 ft.) fence, the service loop would go down 90 cm, then up 1.8 m, then down 1.8 m, and up 90 cm over a horizontal length of 90 cm.



NOTE: All double arrows indicate 30 cm (1 ft.) separation. All turns must respect the minimum bend radius.

Figure 27 Sensitivity loop (heavy gauge post)

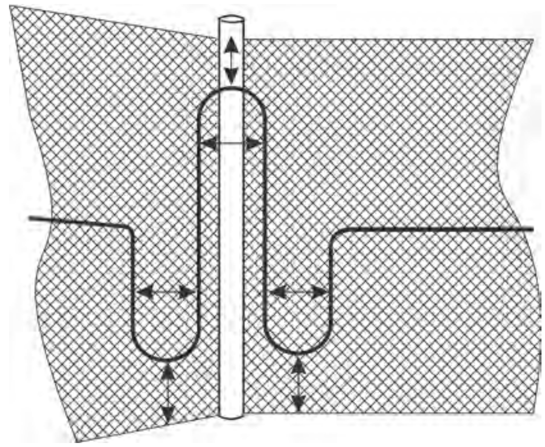


Figure 28 Sensitivity loop (corner post)

Service loops

Service loops provide the sensor cable required for making fusion splices, and for making future repairs. The length of cable required depends on how much cable the installer needs to make the splices inside the splice truck. A splice point service loop is required for each section of sensor cable at all splice enclosure locations. In addition, a service loop is recommended on the hinged side of each gate that is protected by sensor cable. To create a 6 m (20 ft.) service loop, form 3 circular loops of cable with a 60 cm (2 ft.) diameter. Service loops should be securely attached to the lower section of the fence beside a fence post. Attach service loops directly to the fence fabric using one cable tie at each 30º point of the loop (12 cable ties).

Note	Each 60 cm diameter coil uses about 2 m of cable. For service loops comprised of detecting cable use the minimum length of cable that is required to make the fusion splices. For non-detecting lead-in cable use up to 10 m (33 ft.) of cable (5 coils) for each splice point.

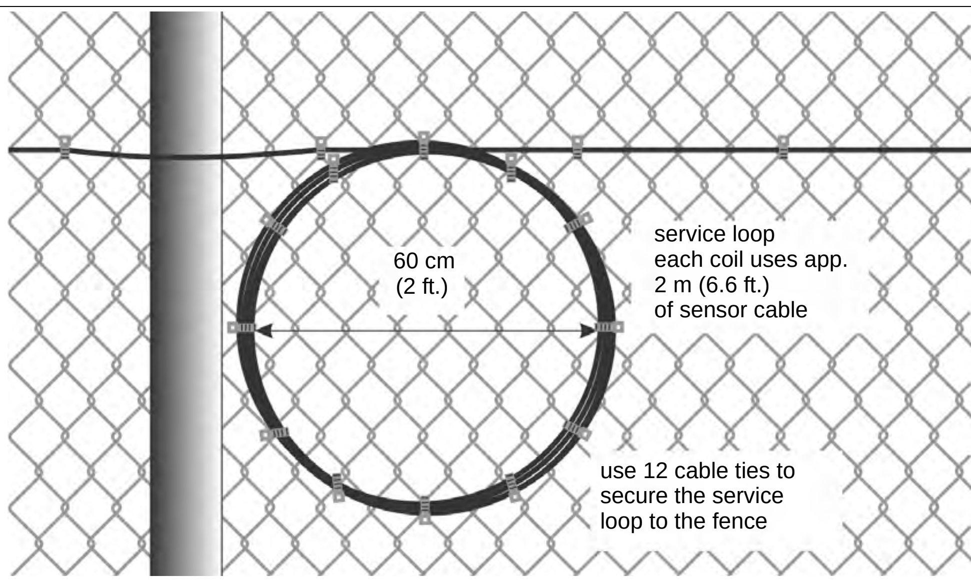


Figure 29 Service loop

Deploying the sensor cable

Note	Install the sensor cable on the secure side of the perimeter (the opposite side of the fence to the threat).

The sensor cable is light weight at 34 kg (75 lb) per km so it can easily be deployed by running a round shaft through the arbor holes in the cable reel and having 2 people walk along the fence line laying cable as they go.

Once the cable is deployed, refer to the site plan and pull back and lay out sufficient sensor cable to cover the site specific features (gates, bypasses, service loops, sensitivity loops).

The following factors must be considered when deploying sensor cable alongside the perimeter fence:

- the length of the section of sensor cable being deployed (lead-in cable, detecting cable)
- clearance and access beside the fence
- service loops, sensitivity loops, and gate coverage
- site-specific features such as cable bypasses for gates and other structures on the perimeter
- the location of start modules and end modules

Sensor cable splices

At all designated splice points, each section of sensor cable requires a service loop. The splice point service loops allow the sensor cable and splice enclosure to be attached and removed from the fence to make the splices. Splice point service loops also provide extra sensor cable for making future repairs (if required). Inside the enclosure, the 2 sensor fibers must be fusion spliced. Other fibers passing through the enclosure can be left intact (expressed fibers). Midspan access techniques can be used at most splice points, depending on the configuration of the sensor zones. When dressing the bare fibers, ensure that the bend radius is kept above a minimum bend radius of 32 mm (1.25 in.) at all times. Any tighter bend radius may lead to optical fiber damage and increased loss. Once the splices are complete and the sensor cable is attached to the fence, a visual fault locater (VFL) should be used to verify the continuity of each spliced fiber.

Note	The two sensor fibers between the start module and end module for each zone must be exactly the same length (± 5 mm; ± 0.2 in.).

Illustrated installation requirements

Using UV-resistant cable ties, attach the cable to the fence fabric either on a single wire at the midpoint of the chain-link; or at the junction of two fence wires. Both methods work well, however only one method should be used at an installation. Install the cable ties by hand, tightening them enough to hold the cable snuggly against the fence fabric. The recommended cable tie spacing is 30 cm (1 ft.). The maximum recommended spacing is 45 cm (1.5 ft.). Once the cable is fully installed, cut off and dispose of the cable tie tails.

CAUTION	Do not use a mechanical device to tighten the cable ties. Over tightening cable ties can compromise detection and operation.

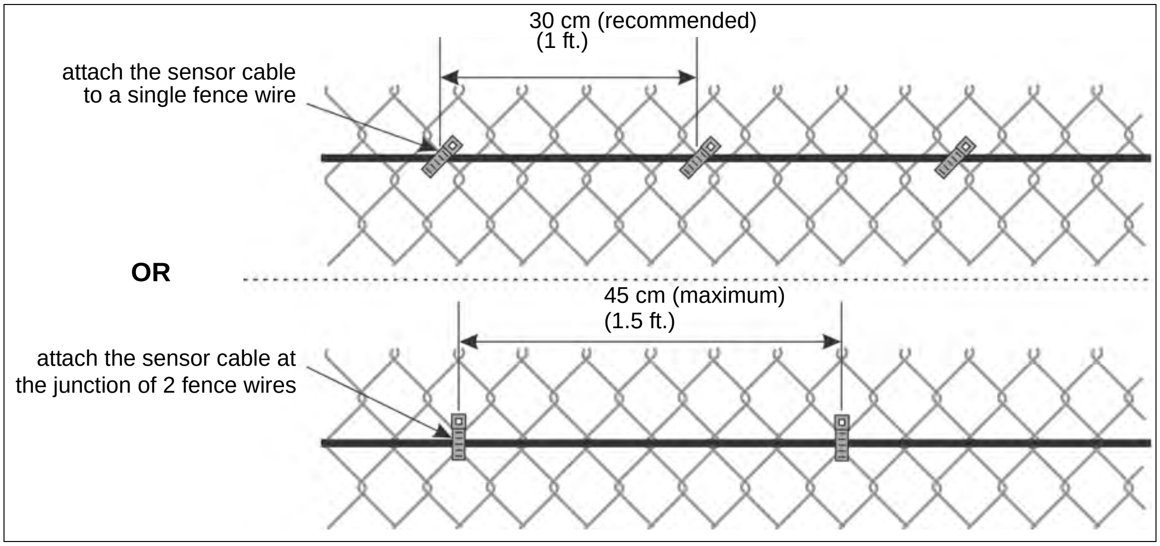


Figure 30 Cable tie spacing on fence fabric

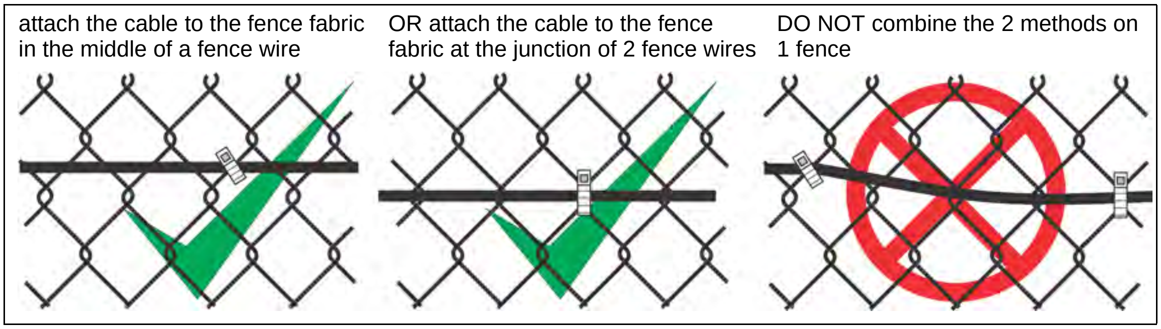


Figure 31: Securing cable to a chain-link fence

Attach the sensor cable to the fence fabric with cable ties 15 to 20 cm (6 to 8 in.) away from the post at both sides of each post. Keep the cable attachment consistent. Ensure the cable is snug against the fence post, but is not pulled tightly or stressed.

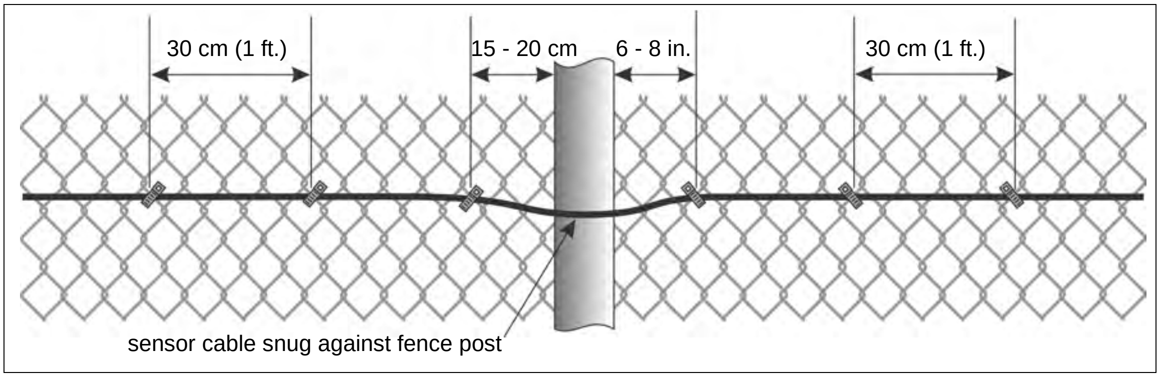


Figure 32 Cable tie spacing at fence posts

For all cable turns attach the cable to the fence fabric at each 45º point of the curve.

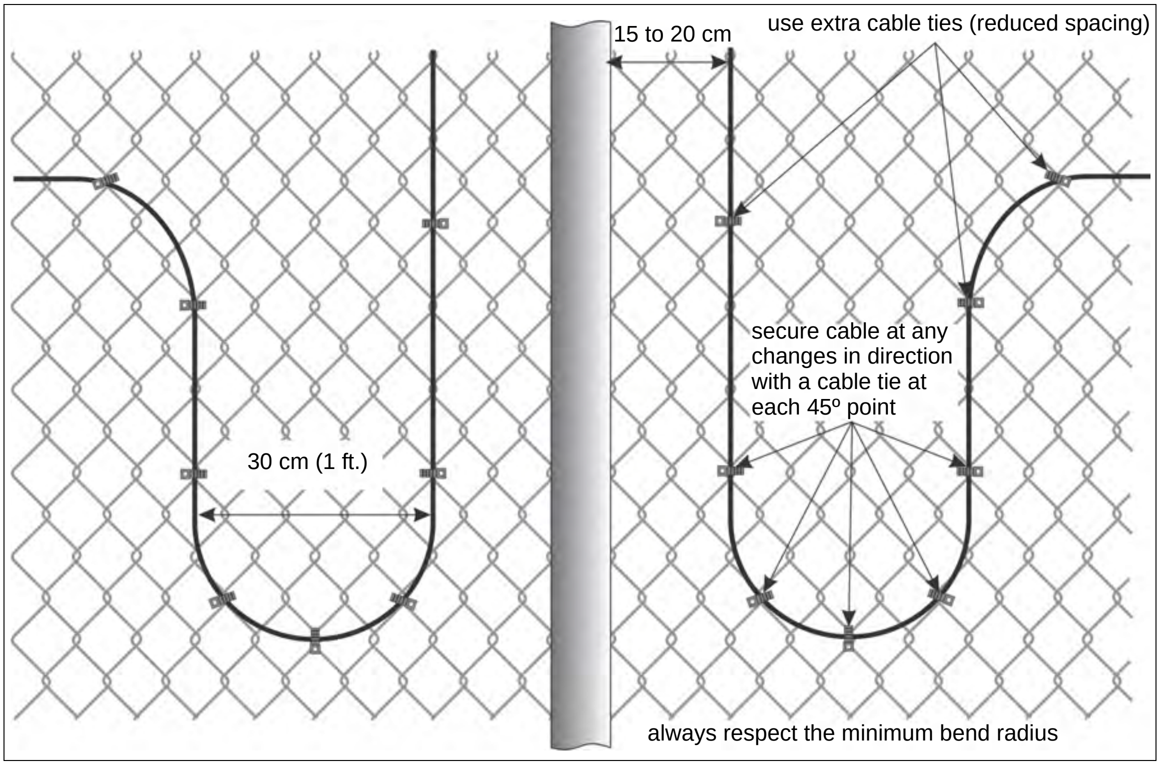
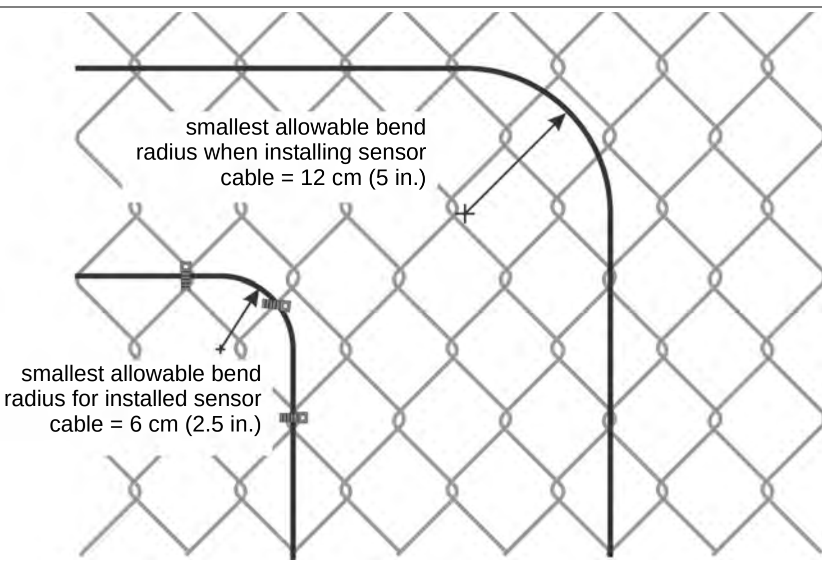


Figure 33 Cable tie spacing at cable turns (sensitivity loop example)

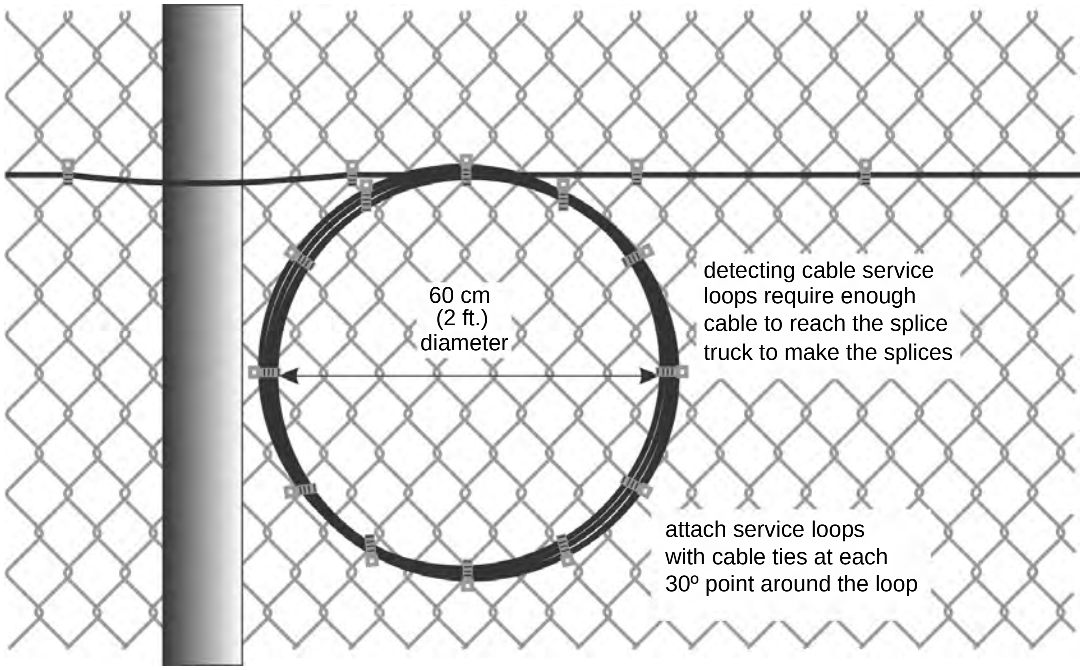
Ensure that the minimum bend radius (dynamic and static) is not exceeded during or after installation.



NOTE: At sensor cable turns, it is okay to attach the sensor cable at junctions and on single wires.

Figure 34 Static and dynamic bend radius limits

Attach service loops beside a fence post on the lower section of the fence using cable ties at each 30º point of the loop



NOTE: For service loops, it is okay to attach the sensor cable at junctions and on single wires.

Figure 35 Service loops

For instances where the cable must be unreeled and pulled back to accommodate site-specific installation requirements (e.g., gates, bypasses) lay the cable on the ground in a large figure-8 pattern to prevent twisting or kinking. Never lay the cable in a circular roll.

Figure 36 Laying cable in a figure-8 pattern

Sensor cable and below ground bypasses

Sensor cable typically passes through conduit that is buried below ground to get from one side of a gate to the other. There are several techniques that can be used to pull the cable through conduit. The best method to use depends on a number of site specific factors:

- the local climate, if the site has a temperate climate and the ground never freezes, split conduit can be used to protect the sensor cable
- in areas where ground freezing occurs, solid wall conduit must be used
    - the solid wall conduit must be sealed water tight, at both ends
- if the cable is being deployed from a cable stand, the cable can be pulled through the conduit as it is dispensed
- if the cable is being deployed from a trailer, or truck, or is being walked around the perimeter, it will have to be pulled back to pass through the conduit
- a sufficient amount of cable must be pulled back and laid out in a figure 8 pattern for service loops, and gate coverage, as required

Installing the sensor cable

1. Ensure that there is enough lead-in cable at the processor location to reach the processor connections and to create a splice point service loop.
2. Run the lead-in cable to the designated start point of the first zone. Ensure that there is enough cable to reach the start module enclosure, add 1 m (3.3 ft.) for the splice and enough extra cable to create a splice point service loop.
3. Depending on the zone configuration:
    - For expressed fibers (midspan access used to pass fibers through the enclosure without cutting the cable) run the sensor cable back to the start point of the zone and leave enough cable to create a second splice point service loop. Continue deploying the cable.

OR

    - Cut the sensor cable at the start module plus 1 m for the splice, and then add 1 m for the splice and run the sensor cable back to the start point of the zone and leave enough cable to create a second splice point service loop. Continue deploying the cable.
4. At each point in the installation where extra cable is required, lay out a sufficient amount of cable in a figure 8 pattern to cover the feature.
   If you are pulling the cable around the perimeter, you must pull back a sufficient amount of cable after the cable is dispensed to cover the cable length requirement for each feature.
5. Once you have reached the designated end of the zone, leave enough cable to create a splice point service loop for the fiber termination. Add 1 m (3.3 ft.) for the end module splice.
6. If the installation ends at this zone’s end module, cut the sensor cable.

OR

   If the installation continues past the end of this sensor zone, express the required fibers through the enclosure and leave enough cable to make a splice and create a splice point service loop. Then continue deploying the sensor cable.

Attaching sensor cable to the fence

The sensor cable is typically attached to the fence fabric with UV-resistant cable ties. Figure 37 illustrates the recommended cable attachment procedure.

- Install the sensor cable on the secure side of the fence (the side opposite the threat).
- Keep the sensor cable straight and taut while attaching it to the fence fabric.
- Attach the cable to the fence fabric either:
  - on a single fence wire,

OR

  - at the junction of two fence wires.

Note	Be consistent with the attachment points; single wire OR junction.

- The recommended cable tie spacing is 30 cm (1 ft.). The maximum recommended cable tie spacing is 45 cm (1.5 ft.).
- Attach the sensor cable at both sides of each fence post 15 to 20 cm (6 to 8 in.) away from the post.

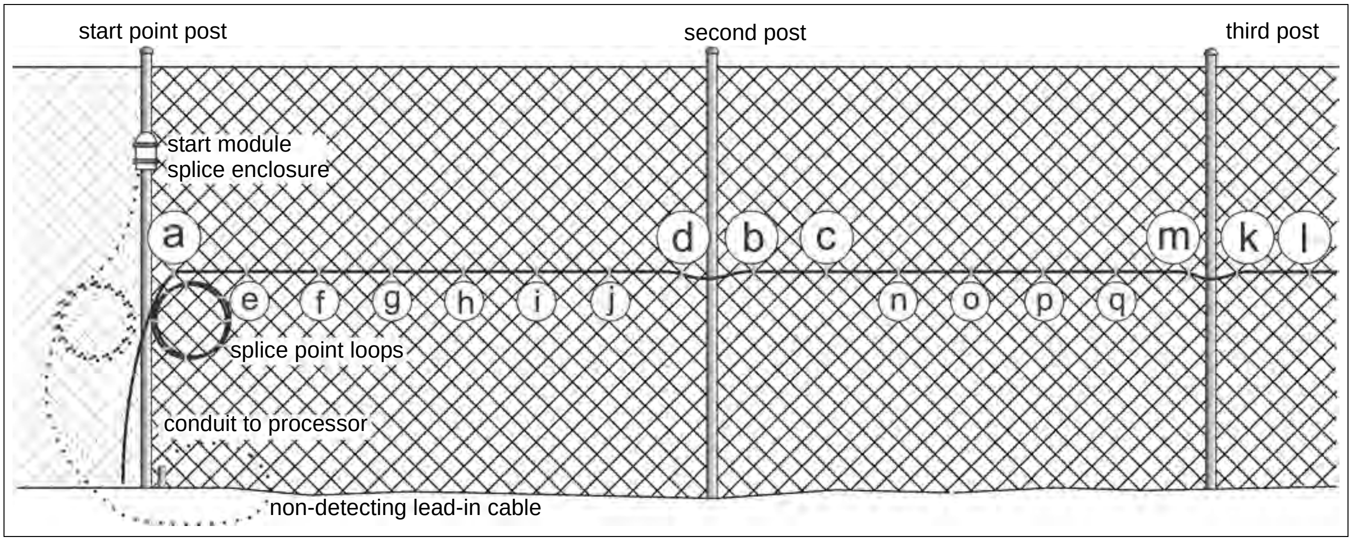


Figure 37 Cable installation procedure

1. Beginning 15 to 20 cm away from the start point post, layout enough cable to form a splice point service loop and attach the sensor cable to the fence at the specified height above ground (point **a**).

Note	Be consistent. Attach each cable tie at the same point on the fence.

2. Hold the cable straight and level just past the second post and attach the cable to the fence 15 to 20 cm away from the second post (point **b**).
3. Attach the sensor cable to the fence 30 cm past point **b** (point **c**).
4. Attach the sensor cable to the fence 15 to 20 cm before the second post (point **d**).
5. Return to the start point and attach the sensor cable at 30 cm intervals on the first fence panel (points **e**, **f**, **g**, **h**, **i**, **j**).

6. Hold the cable straight and level just past the third post and attach the cable to the fence 15 to 20 cm away from the third post (point **k**).
7. Attach the sensor cable to the fence 30 cm past point **k** (point **l**).
8. Attach the sensor cable to the fence 15 to 20 cm before the third post (point **m**).
9. Attach the sensor cable at 30 cm intervals on the second fence panel (points **n**, **o**, **p**, **q**).
10. Proceed along the perimeter, attaching the cable to the fence one panel at a time.

Attaching the sensor cable at protected gates

Before attaching the sensor cable to a gate, ensure that there is a sufficient amount of sensor cable laid out to:

- cover the gate
- form the sensitivity loops
- (optional) make a service loop on hinged side(s) of gate

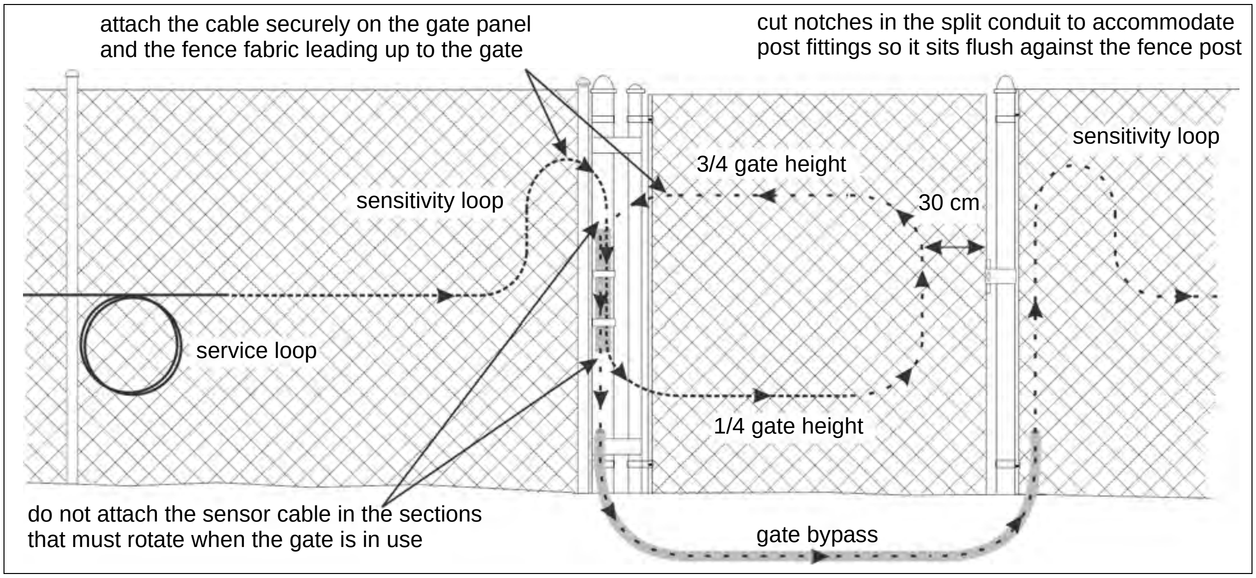


Figure 38 Cable installation on gates

Note	The following procedure assumes that the cable has been pulled through the conduit from one side of the gate to the other.

1. Refer to the site plan and lay out a sufficient amount of sensor cable in a figure 8 pattern.
2. Form a sensitivity loop and attach the sensor cable to the fence panel leading up to the gate.
3. Loosely attach the sensor cable to the post on which the gate is hinged above and below the intended position of the cable management kit (split conduit).
4. Attach the sensor cable to the gate at ¼ the fence height, 30 cm away from the outside edge, and ¾ of the fence height.
5. Hold the bottom half of the split conduit against the fence post and on the conduit, mark the positions of any hardware on the fence that will require notches in the conduit.
6. Make any required notches in the conduit.
7. Place the notched half of the conduit under the cable against the fence post and hold it in place.

8. Fit the sensor cable into the split loom so the split loom extends 7.5 cm (3 in.) beyond the top and bottom of the split conduit.
9. Place the other half of the conduit over the split loom and cable and secure the conduit to the fence post with the supplied gear clamps. Ensure the split loom covers the sensor cable, and protects it from chafing against the top and bottom edges of the conduit as it rotates.
10. Form a sensitivity loop and attach the sensor cable to the fence panel leading away from the gate.

Installing the FP400 processor

The FP400 processor includes four 7 mm (1/4 in.) screw holes for direct panel mounting. It also includes two sets of 3 screw holes for attaching DIN rail clips to the base of the processor. The processor operates on 12 to 48 VDC and consumes 2 W (nominal).

Note	Senstar recommends that the FP400 processor be powered through a UPS system.

Mounting options:

There are 4 recommended methods of installing the FP400 processor:

- rack-mount on a custom 1RU shelf in an EIA-19 in. equipment rack, or
- surface-mount (indoors, typically wall-mount),
- outdoors inside a Customer-supplied weatherproof field distribution box,
- on a 35 mm DIN rail.

CAUTION	Outdoor mounting requires a Customer-supplied weatherproof field distribution box.

The hardware required to surface-mount the enclosure depends on the type of surface and is customer supplied. To rack-mount the FP400 processor order a rack-mount installation kit (p/n F4KT0500). For DIN rail mounting obtain a DIN rail mounting kit (p/n F4KT0600).

Rack-mounting

For rack-mounting, Senstar offers a custom 1 RU shelf designed specifically for the FP400 (p/n F4KT0500). The shelf will hold 1 or 2 FP400 processors and 1 or 2 splice trays, each with a 12 splice capacity to accommodate the lead-in cable to processor splice connections.The sensor cable connections and splice trays are on the back side of the shelf and the I/O and PoE power connections are on the front. The back corners of the shelf have large chamfers to accommodate the sensor cables and the rear panel and both sides include holes to facilitate cable management. Figure 39 shows a custom rack shelf with two processors and 2 splice trays.

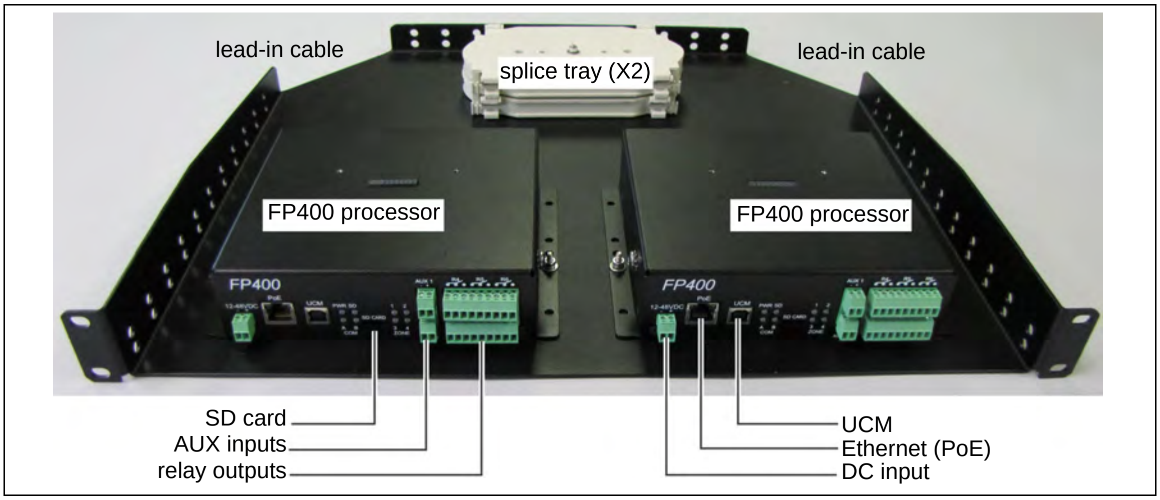


Figure 39 1 RU rack-mount shelf (p/n F4MD0500)

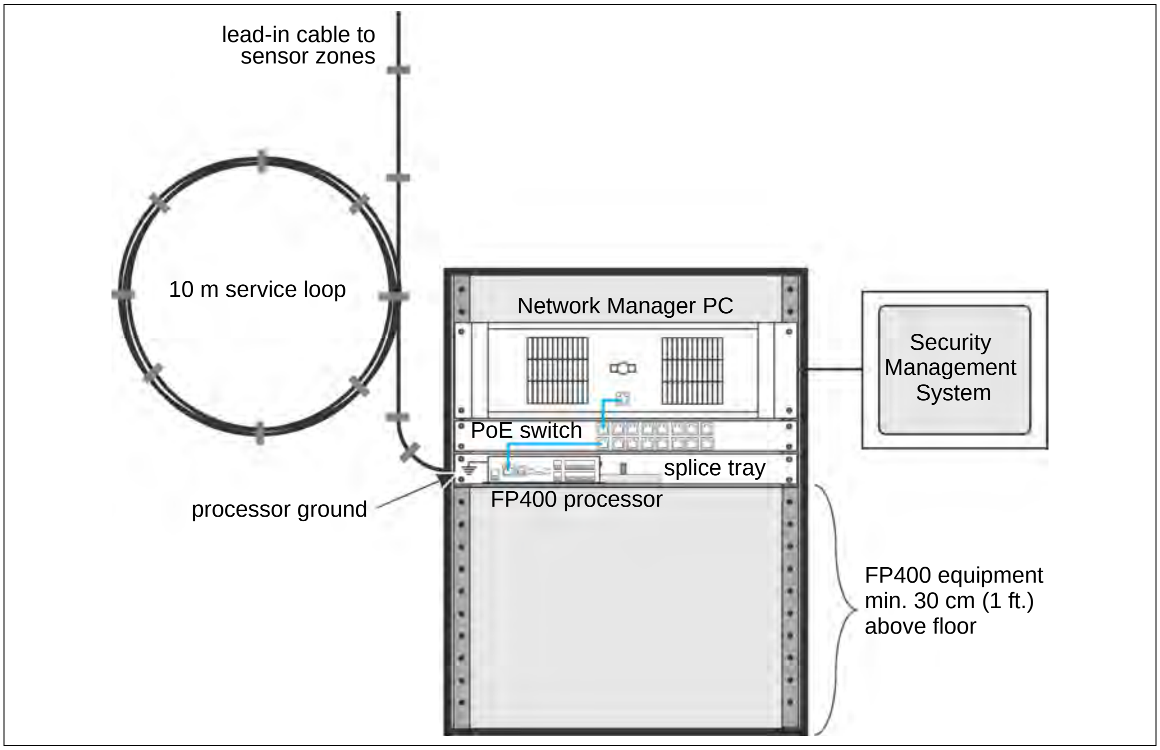


Figure 40 FP400 rack-mount installation example

DIN Rail mounting

To mount the processor on a DIN rail, obtain a DIN rail mounting kit (p/n F4KT0600). The kit includes 2 clips for a 35 mm DIN rail, and 6 thread cutting screws for plastic. Just screw the DIN rail clips onto the processor and snap the processor onto a DIN rail.

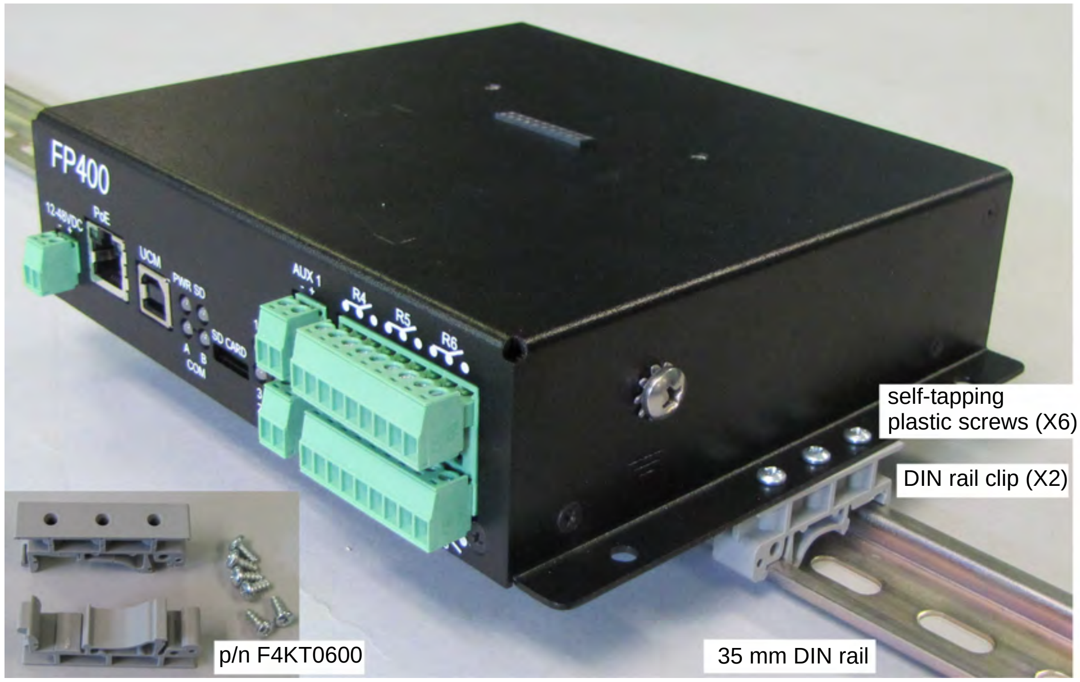


Figure 41 DIN rail mounting

Surface mounting

The mounting surface must be flat, stable and capable of supporting the processor. To prevent tampering, the mounting surface should be located in a secure area (see Figure 42). Ensure that all fibers, cables, and wires are adequately protected. Use # 6 screws, suitable for the mounting surface, in the 4 corner holes.

1. Hold the enclosure against the mounting surface and mark the locations of the 4 corner mounting holes on the surface.
2. Using an appropriate bit, drill the 4 mounting holes in the surface.
3. Using hardware appropriate for the mounting surface, attach the processor to the surface. (Use # 6 screws.)

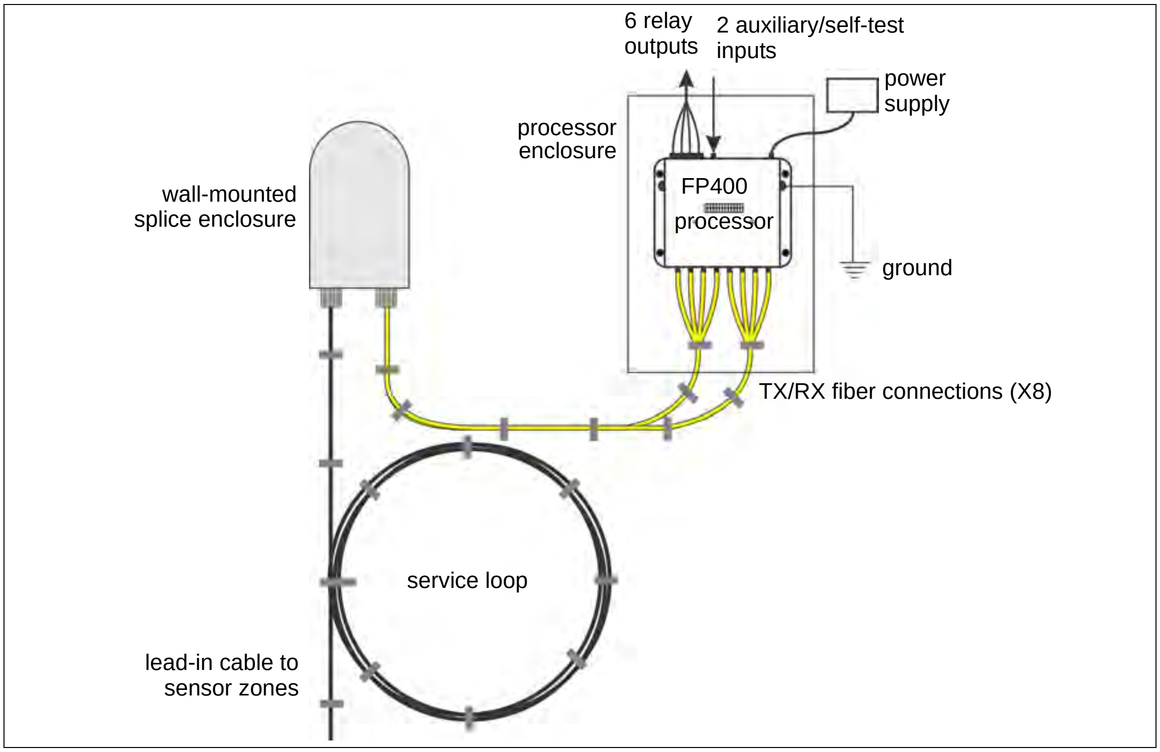


Figure 42 FP400 indoor wall-mount installation example

Free-standing or fence post mounting the enclosure

To post mount the processor, install it inside a weatherproof field distribution box.

- Install the processor near eye-level on the secure side of the perimeter.
- 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 help 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.

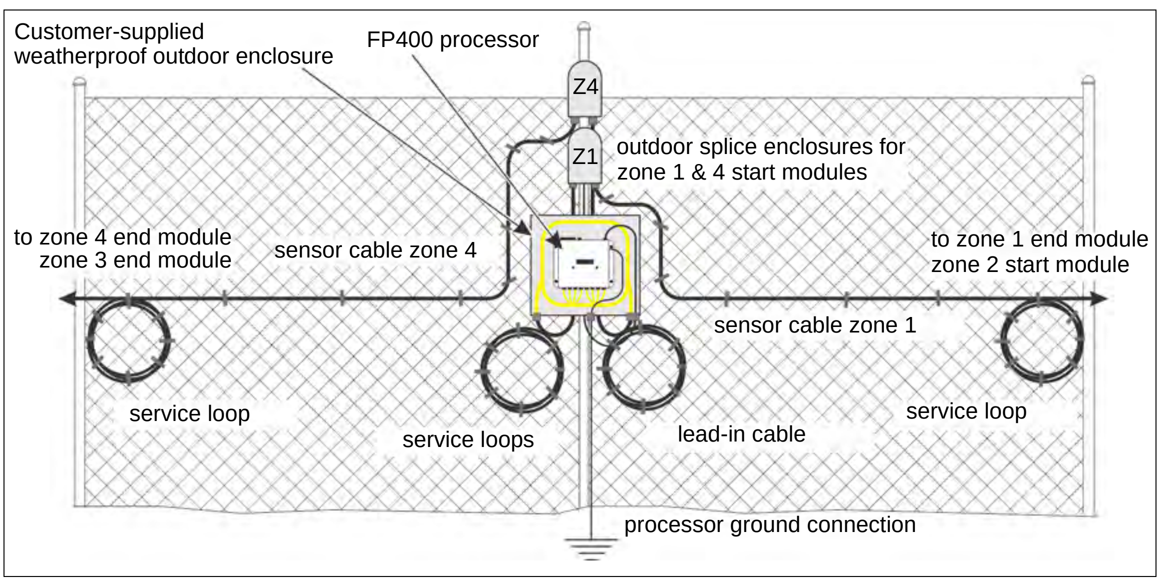


Figure 43 FP400 outdoor post-mount installation example

Processor connections

CAUTION	The two sensor fibers between the start module and end module for each zone must be exactly the same length (± 5 mm; ± 0.2 in.). Ensure that the two fiber leads are the same length when splicing the lead-in cable, the start module, and the end module (i.e., measure carefully and trim if necessary, to match the length of the two sensor fibers).

Sensor cable connections

The lead-in cable connections to the processor for each zone use 2 SC/APC connectors with 1 m leads that are harvested from the zone's start module. Carefully measure and cut 1 m leads off of the start module and end module. Retain 2 of the leads for the processor connections. The remaining leads can be discarded following the installation. To make the connections remove the plastic cover from the processor connector and plug in the SC/APC connector. Retain the plastic covers in case the processor has to be disconnected for any reason.

Wiring connections

You make the FP400 wiring connections on removable terminal blocks. The screw terminals accept wire sizes from 12 to 24 AWG, with a 6 mm (¼ in.) strip length. Remove the terminal blocks to make the wiring connections. Reinstall the blocks after the connections are complete, and verified. Figure 44 shows the sensor cable to processor connections and the input/output (I/O) wiring connections. Figure 46 to Figure 50 show the Silver Network wiring options.

Power connection

There are two methods for powering the FP400 processor, screw terminals for a 12 to 48 VDC power connection or an RJ-45 PoE connection. The PoE connection also serves as a network interface for Silver Network communications.

Note	Outdoor runs of PoE cable and EIA-422 cable can use lightning arrestors to protect the communication lines. Figure 48 and Figure 51: illustrate the use of lightning arrestors on the FP400 comm links.

Ground connection

The FP400 sensor requires a single ground reference. For surface-mount and post-mount processors, connect the enclosure ground screw to an approved earth ground. For rack-mount processors, connect the ground screw on the processor to the rack ground. The earth ground connection should be stable and noise free. An improper or unstable earth ground can induce noise in the FP400 sensor.

CAUTION	Consult the local electrical code for grounding information and requirements. Do not use the fence structure as an earth ground. Keep the ground wire as short, straight and direct as possible.

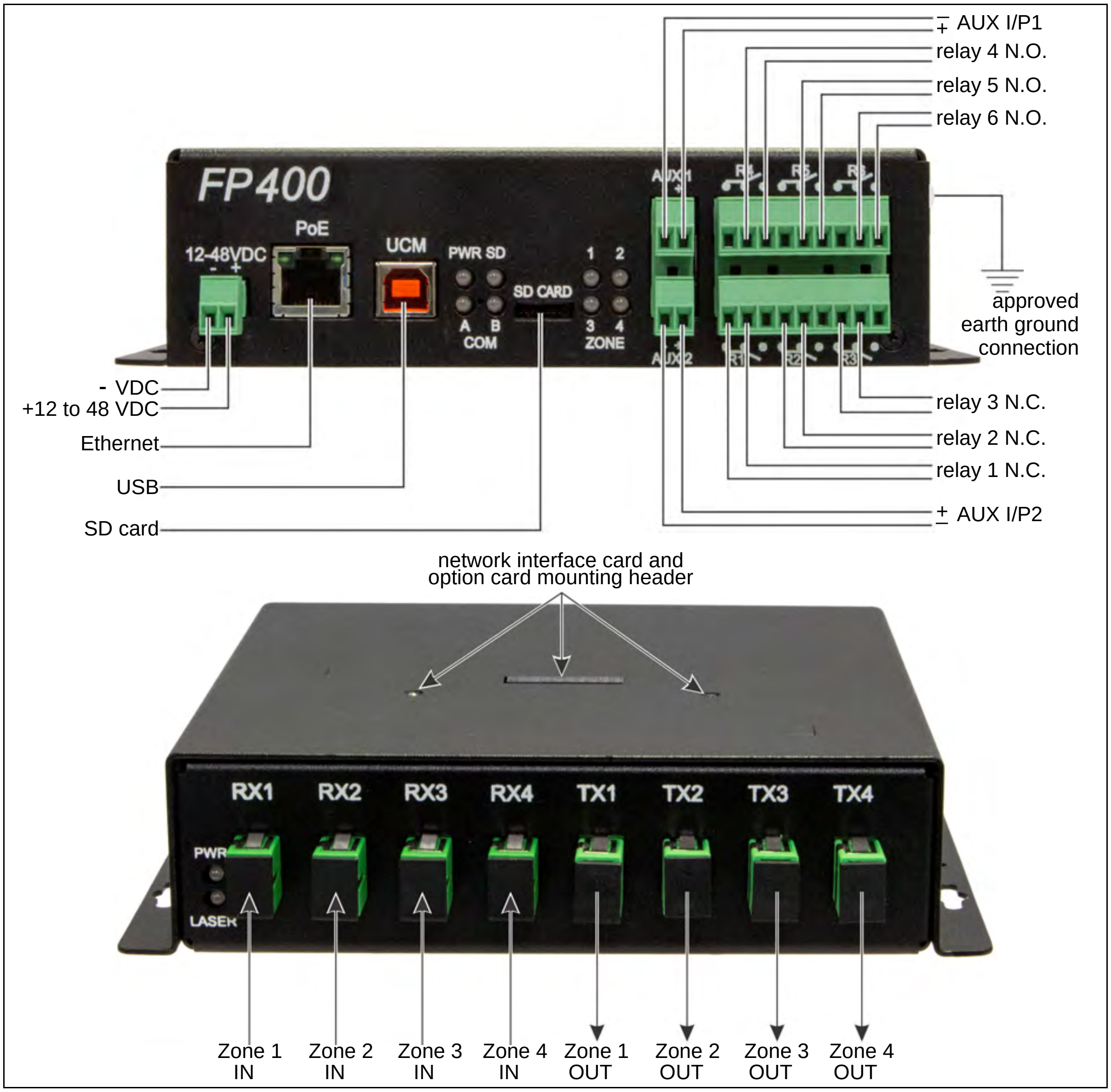


Figure 44 FP400 processor connections (front and back)

Relay outputs

The FP400 processor includes six Form C relay outputs available through two removable terminal blocks. Each relay has a common connection to either a Normally Open (NO) or Normally Closed (NC) contact. When the processor is set to Local control mode, the relays are used to signal alarm and supervision conditions. For network based processors set to Remote control mode, alarm data is carried over the network cables and the six relays are available as output control points from the security management system.

Relay contact ratings

The dry contact relays are 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... 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/Self-test 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 FP400 processor determines an input's status via an internal reference voltage, and the configuration of the contact closures and supervision resistors. Figure 45 provides wiring diagrams for self-test and auxiliary device inputs. In Local control mode the inputs activate internal self-tests. In Remote control mode the AUX inputs serve as auxiliary device inputs for reporting the status of auxiliary security equipment to the SMS.

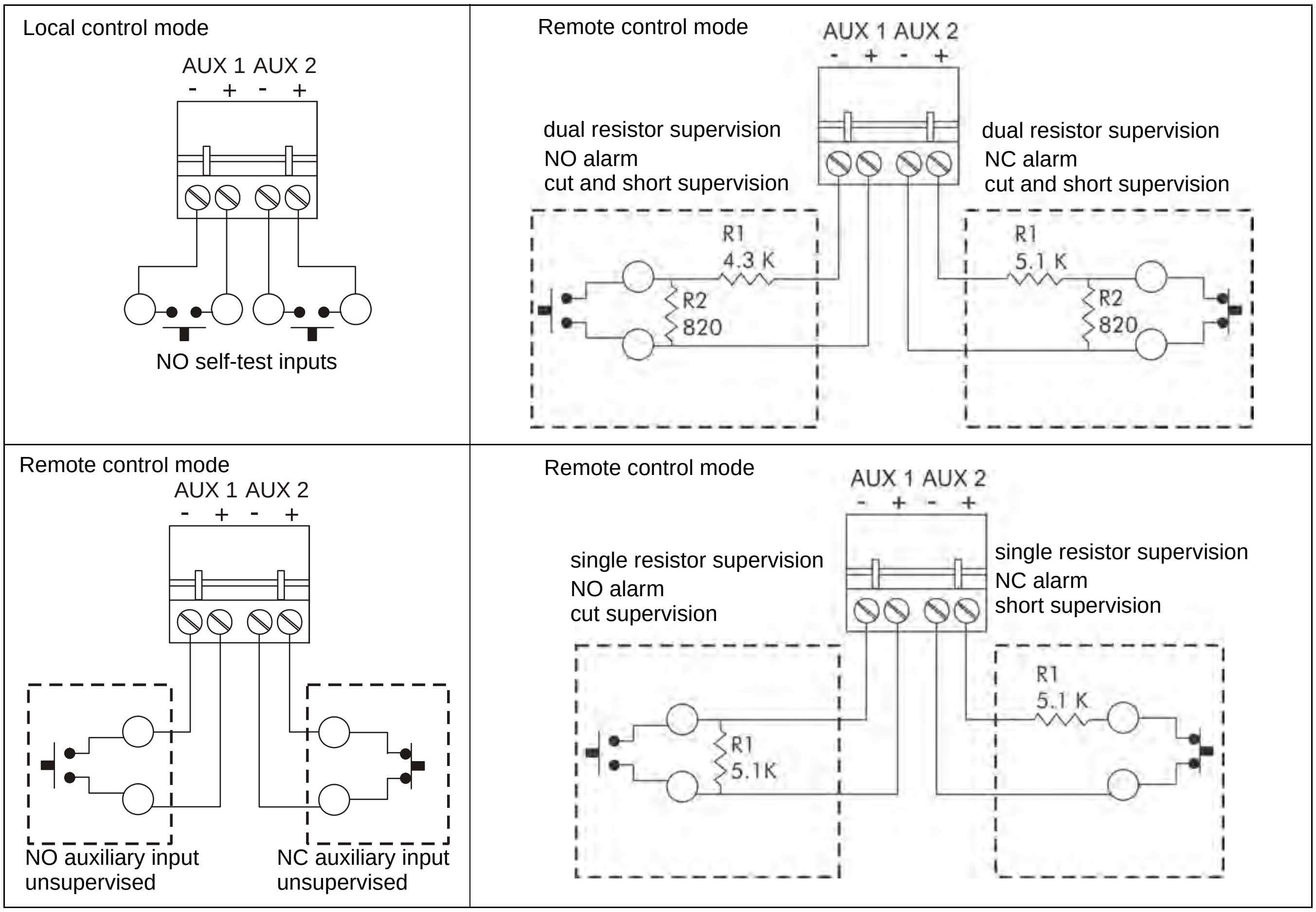


Figure 45 Self-test/Auxiliary device input wiring examples

Silver Network alarm data communication

Note	A network interface card is required to enable EIA-422 copper wire, Multi-mode fiber optic, and Single-mode fiber optic communications between a FP400 processor and the Silver Network Manager. Ethernet communications are built-in via the processor's PoE port.

To use a network interface card with the FP400 processor requires an expansion header hardware kit (p/n F4KT0300). The kit includes an expansion header extender and 2 sets of mounting hardware (2 each - standoffs, screws, flat washers, lock washers).

Silver Network specifications

- Data rate - fixed 57.6 kbps
- Maximum 60 devices spread over up to 4 independent network loops
- Two communication Channels (Side A, Side B)
- Response time - 1 second, 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
  - Multi-mode fiber optic cable (820 nm) - 2.2 km (1.4 mi.) - 2 fibers per Channel - optical power budget 8 dB
  - Single-mode fiber optic cable (1310 nm) - 10 km (6.2 mi.) - 2 fibers per Channel - optical power budget 8 dB
  - Ethernet - min. Category 5 cable, 100 m between PoE switch and processor location

Note	Use low capacitance shielded twisted pair data cable for EIA-422, 62.5/125 multi-mode fiber optic cable, 9/125 single-mode fiber optic cable, and Category 5 Ethernet cable (minimum). The maximum separation distances require high quality transmission media and sound installation practices.

CAUTION	The network interface cards contain static sensitive components. Follow proper ESD handling procedures when handling the cards. Ensure the expansion header on the NIC is properly lined up and fully seated on the processor.

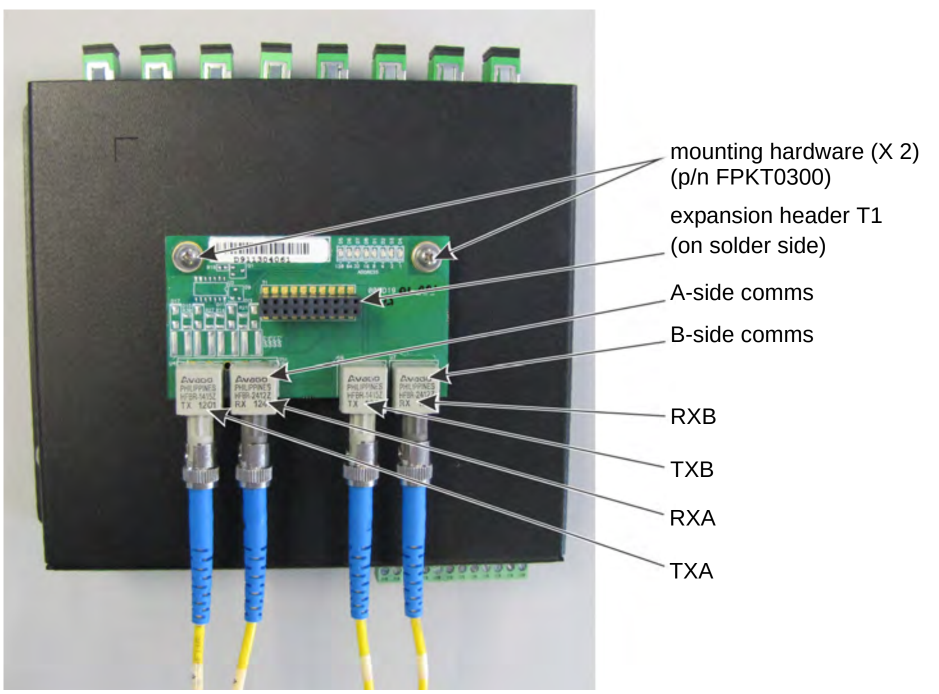
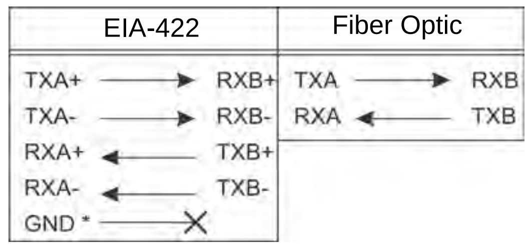


Figure 46 Silver Network multi-mode fiber optic network interface card connections

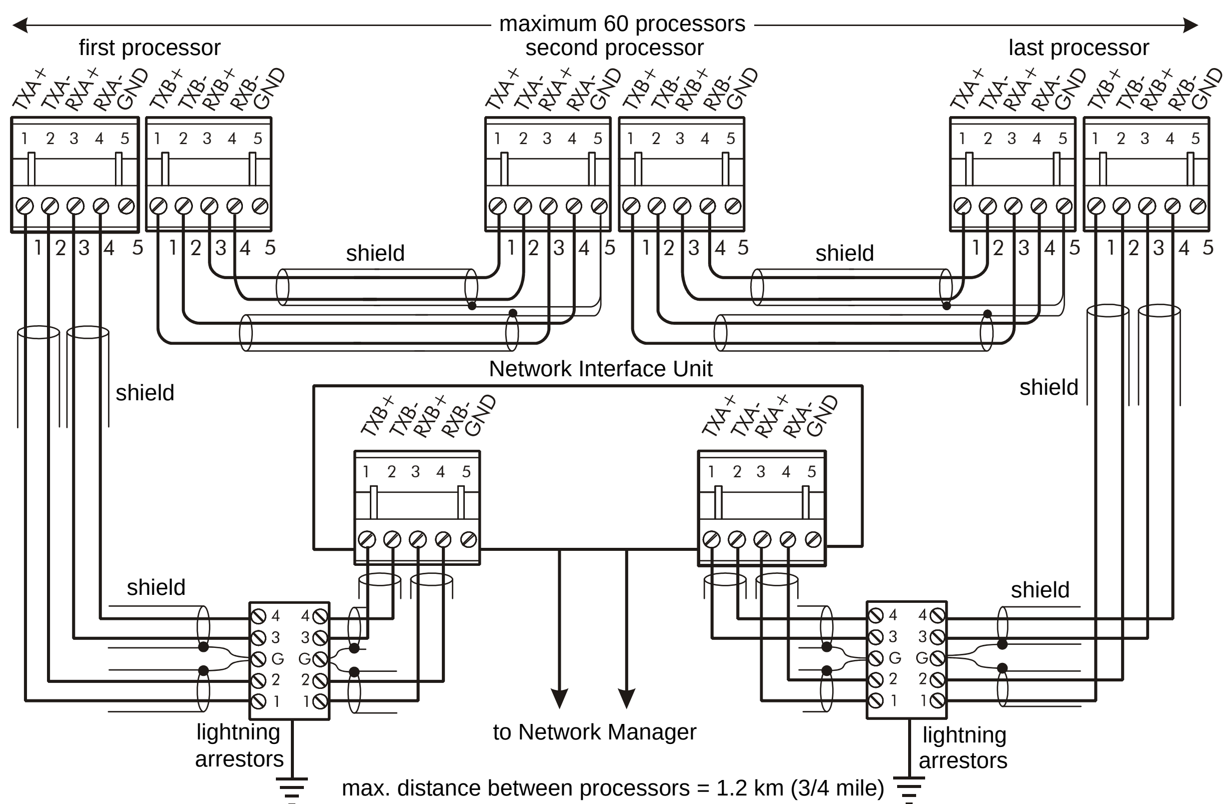
Silver Network data path connections

In the standard Silver Network setup, a point to point loop configuration is used for network communications. Figure 47 shows the processor to processor network connections for the RS-422 and fiber optic communication options. Figure 48 illustrates an RS-422 based Silver Network and Figure 49 shows a fiber optic based Silver Network. Silver Network's using Ethernet communications use a star configuration. Figure 50 illustrates an Ethernet based Silver Network (Star configuration).



* Use single point grounding. Connect one end of the cable shield to ground, trim back the other end and leave it disconnected.

Figure 47 Silver Network data connections (loop configurations)



NOTE: Use single point grounding. Connect one end of the cable shield to ground. At the other end of the cable, trim back the shield and leave it disconnected.

Figure 48 Silver Network RS-422 wiring diagram

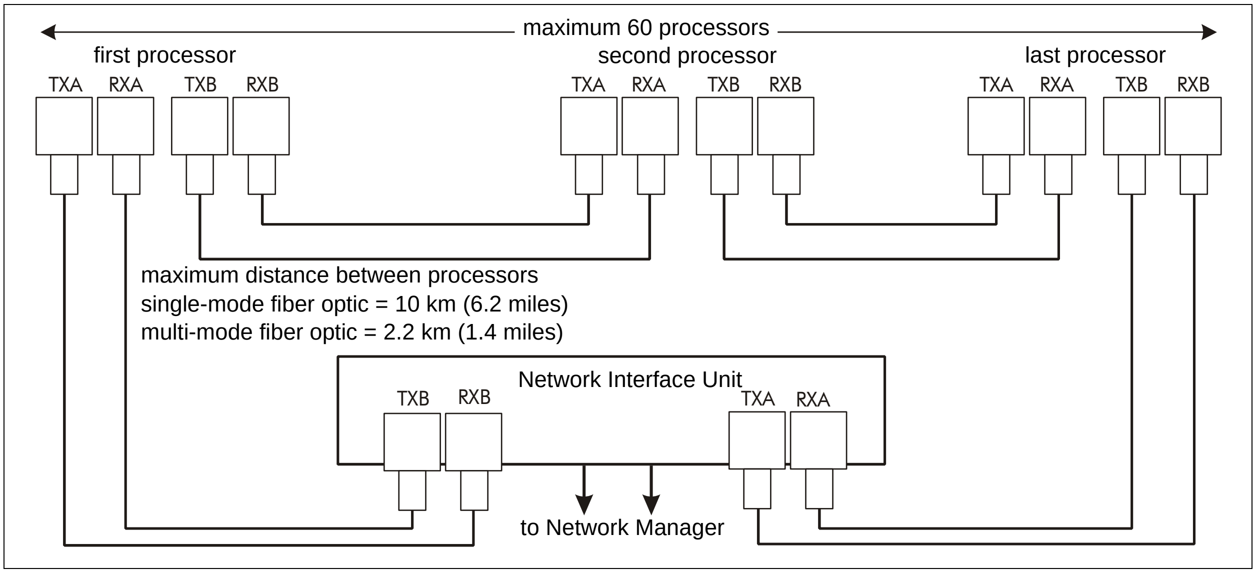


Figure 49 Silver Network fiber optic wiring diagram

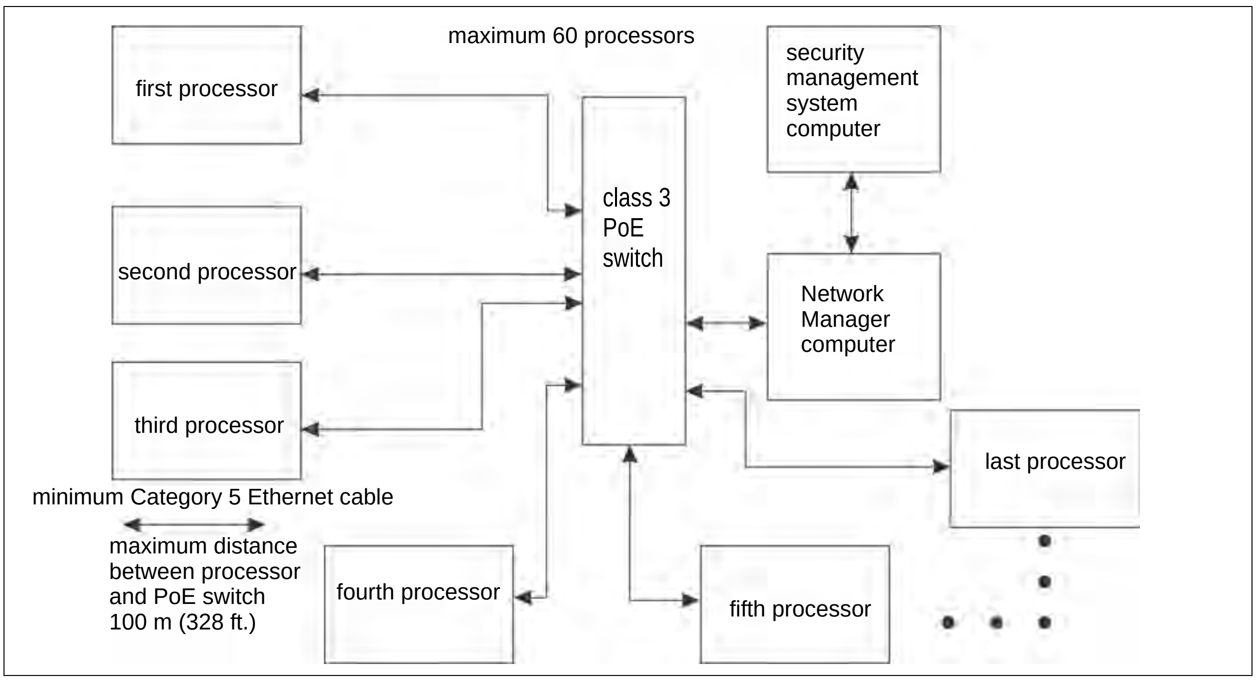


Figure 50 Silver Network Ethernet wiring diagram

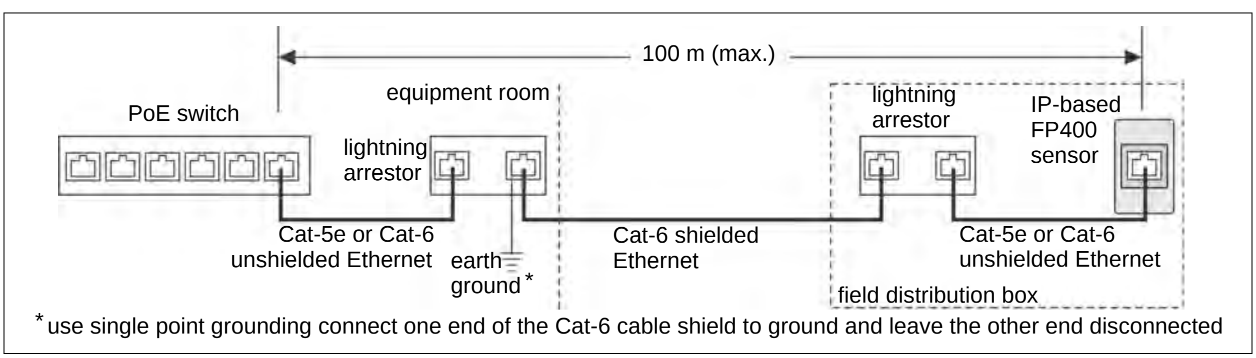


Figure 51: IP-based Silver Network block diagram (with lightning protection)

FP400 fusion splices

WARNING	Use care when working with exposed optical fibers. The fibers are 125 microns in diameter and can easily penetrate skin. Always wear safety glasses when working with optical fibers. Always dispose of bare fibers in a sealed and labeled container that is specifically designed to contain fiber optic waste. NEVER dispose of bare fibers in a standard waste receptacle.

CAUTION	The following procedures require specialized training and specific tools. The person making the FP400 fusion splices must be trained and certified to telecom industry standards.

CAUTION	The two sensor fibers between the start module and end module for each zone must be exactly the same length (± 5 mm; ± 0.2 in.). When stripping the sensor cable, carefully measure the 2 sensor fibers and ensure they are the same length. When preparing the fiber leads for the start module, end module and processor splices, carefully measure the 2 fibers and ensure they are the same length. When dressing the bare fibers, ensure that the turn radius is kept above a minimum bend radius of 32 mm (1.25 in.).

CAUTION	The loss at splices must not cause the average loss of the sensor cable to exceed 0.3 dB/km. Maximum loss for a single event = 0.1 dB, typical fusion splice loss 0.01 dB to 0.03 dB

The sensor cable requires high quality fusion splices for the processor connection, and at all outdoor splice locations including the start modules and end modules. Indoor splices are made in either a rack-mounted splice tray or in the weatherproof splice enclosure. Outdoor splices are protected inside the weatherproof outdoor splice enclosure. Each zone requires a minimum of 8 splices (4 per sensor fiber). Additional splices are required for contiguous sensor zones and fiber drop points. Figure 53 lists the fiber color usage recommendations.

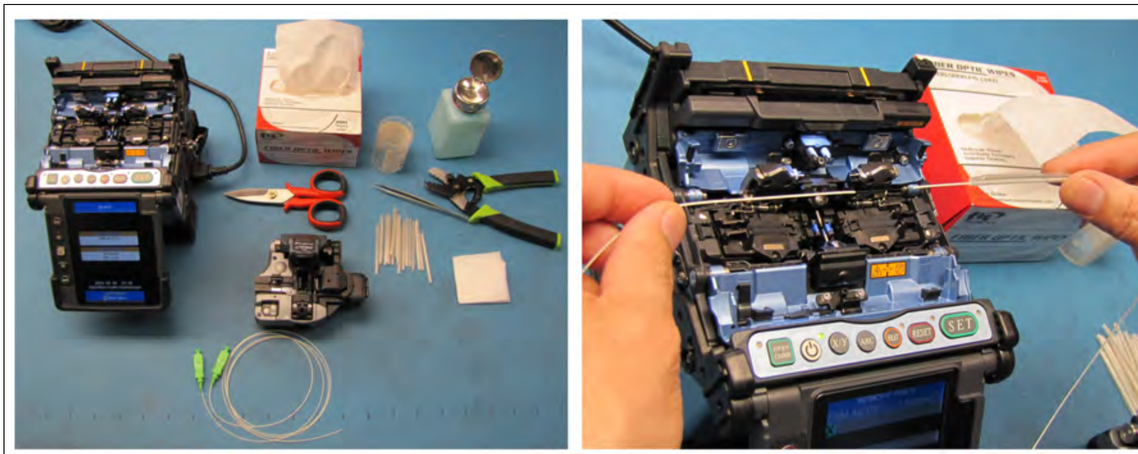
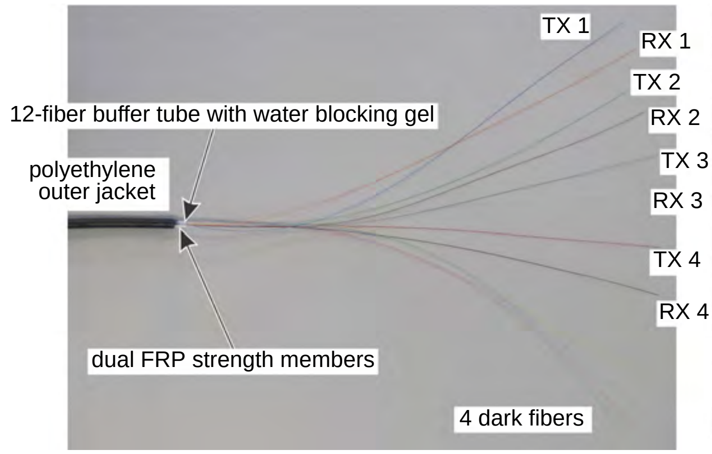


Figure 52 Fusion splicing tools



fiber usage recommendations		
fiber #	color	designation
1	blue	TX1
2	orange	RX 1
3	green	TX 2
4	brown	RX 2
5	gray	TX 3
6	white	RX 3
7	red	TX 4
8	black	RX 4
9	yellow	dark
10	purple	dark
11	rose	dark
12	aqua	dark

Figure 53 Recommended fiber assignments

Preparing the start and end modules for splicing

Before any of the fusion splices can be made, the start module and end module must be prepared for splicing. Both components include 1.5 m (5 ft.) leads terminated with SC/APC connectors. Cut off the 6 connectors with 1 m (3.3 ft.) leads, leaving the start module and the end module with unterminated leads that are 0.5 m (20 in.) long. Reserve 2 of the 1 m leads with the connectors for the connections between the processor and the lead-in cable. The remainder can be discarded following the installation. Measure and trim the leads and sensor fibers, if necessary, to ensure that the full length of fibers used for each zone are exactly the same length (± 5 mm; ± 0.2 in.). Figure 54 illustrates the minimum number of fusion splices required for one sensor zone.

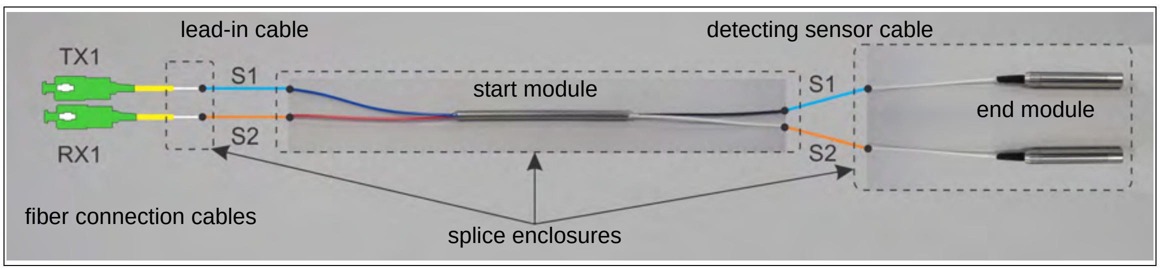


Figure 54 FP400 splice connection details

Start module splices

Note	The 2 leads on each side of the start module are interchangeable. Connect the 2 leads on one side of the start module to the lead-in cable and connect the 2 leads on the other side of the start module to the detecting cable.

Follow the appropriate directions in Fusion splicing on page 51 to make the start module splices. Follow the directions in Protecting splices inside STP enclosures on page 53 to complete the procedure.

End module splices

Follow the appropriate directions in Fusion splicing on page 51 to make the end module splices. Follow the directions in Protecting splices inside STP enclosures on page 53 to complete the procedure.

Fusion splicing

The following procedures assume that the sensor cable is correctly deployed with sufficient cable laid out at the splice location. There are 2 recommended methods for making the field splices. Depending on the zone configurations at the site, follow either the cut cable applications or the expressed cable applications.

Recommended tools

The following tools have been tested and are recommended for use with the standard FP400 sensor cable:

- Miller ACS-2 or equivalent (e.g., CATVSCOPE 4 - 10 mm transverse armored stripping tool) for outer jacket removal (midspan access ring cut and slitting)
- Jonard MS-8 midspan slitter
- RTV sealant
- isopropyl alcohol and lint free cloth or wipes (e.g., Kim wipes)
- fiber technicians splicing tools

Cut cable applications

In cut cable applications the sensor cable is cut at the point of the splices and only the fibers required for the particular configuration are spliced. This method works for single zone configurations or for two contiguous linear zones.

1. Determine the location of the splice on the sensor cable and cut the cable at that point.
2. Pass 50 cm (20 in.) of cable from each cut section through the supplied grommets.
3. Remove 40 cm (16 in.) of the outer black jacket and FRP strength members to expose the fiber buffer tube on both cables.
4. Remove 39.4 cm (15 3/4 in.) of the buffer tube leaving 6 mm (1/4 in.) of tube on each cable.

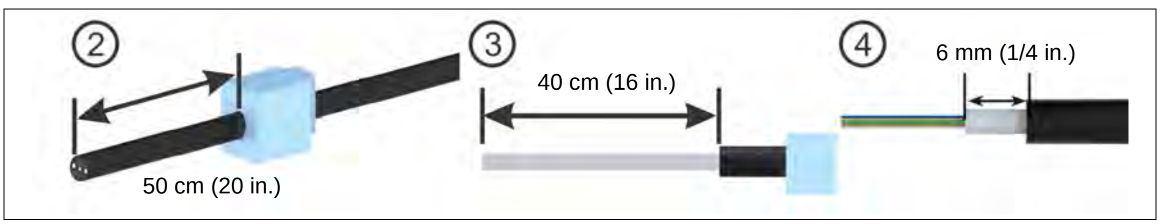


Figure 55 FP400 cut splice connection details

5. Trim off the unused fibers (i.e., all fibers except the ones required for the splice).
6. Thoroughly clean the remaining exposed fibers, the buffer tube and the end of the outer jacket with alcohol and lint free wipes to remove all of the protective gel and any other contamination.
7. Make the required fusion splices (2 for processor, 4 for start module, 2 for end module).
8. Carefully, dress the fibers and fit the module/splice sleeves into the slots in the STP enclosure.
9. Use RTV sealant to seal the ends of the buffer tubes and to secure the modules and splice sleeves in the spice tray’s slots.

Expressed cable applications

In expressed cable applications midspan access techniques are used to expose the 12 fibers around the splice location. Only the fibers required for the particular connection are spliced. The remaining fibers are left intact and continue beyond the splice. This method works for multi-zone contiguous configurations.

1. Determine the location of the splice on the sensor cable and mark the cable at the splice point.
2. Slit the 2 grommets and fit them over the cable with each grommet 50 cm (20 in.) away from the splice mark.

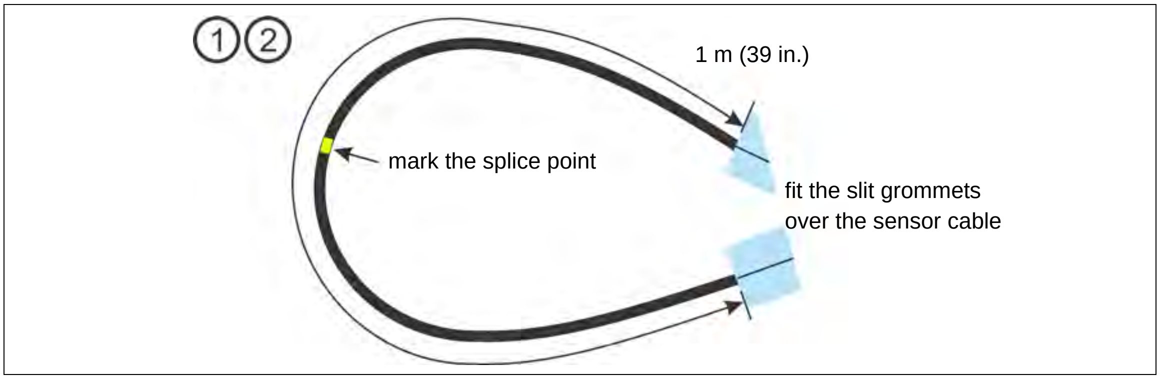


Figure 56 FP400 cut splice connection details

3. Remove 78.5 cm of outer black jacket centered on the splice mark cables.
   - Measure 78.5 cm (31 in.) of cable centered on the splice mark (i.e., 39.25 cm on both sides of mark).
   - Mark the top of the cable between the ring cuts and slit the cable lengthwise along the mark.
   - Ring cut through the black jacket at both ends of the measured section.
   - Invert the cable (180º) and make a second slit between the ring cuts.
   - Peel off the black jacket.

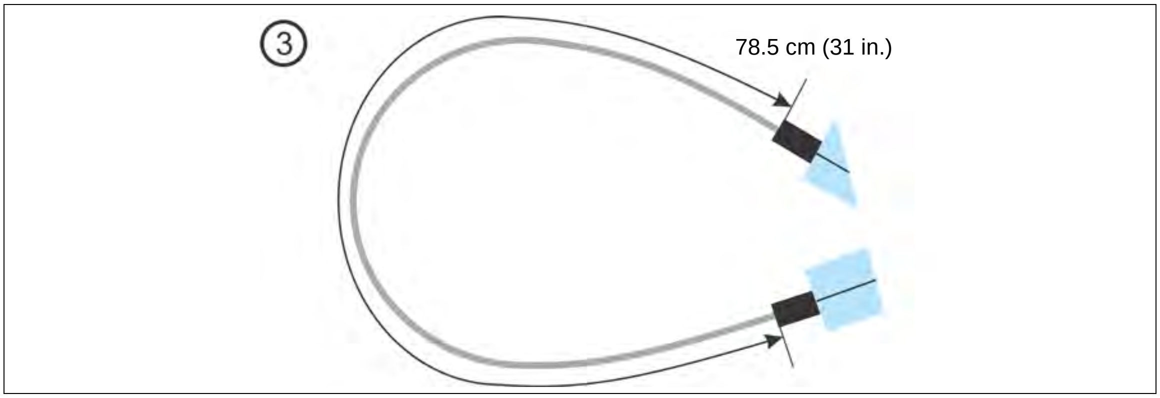


Figure 57 FP400 cut splice connection details

4. Remove the buffer tube to expose the fibers leaving 6 mm (1/4 in.) of exposed buffer tube at each end of the stripped cable section.
5. Thoroughly clean the exposed fibers, the buffer tubes and cable ends with alcohol and lint free wipes.
6. Cut only the fibers required for the splice and leave the others intact.
7. Make the required fusion splices (2 for processor, 4 for start module, 2 for end module).
8. Carefully, dress the fibers and fit the module/splice sleeves into the slots in the STP enclosure.
9. Use RTV sealant to seal the ends of the buffer tubes and to secure the modules and splice sleeves.

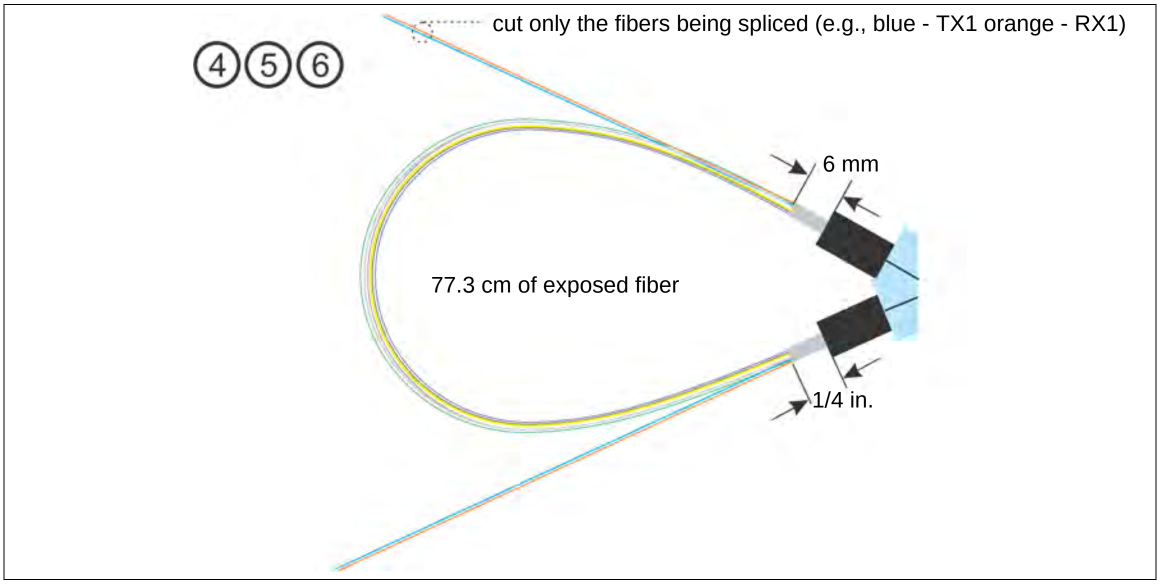


Figure 58 FP400 cut splice connection details

Protecting splices inside STP enclosures

Once the splices are made they are protected inside outdoor-rated enclosures which are usually attached to the protected fence. The STP enclosure includes a security screw to secure the latched enclosure. A T-10 security bit is required to use the security screw.

1. Wrap the supplied felt tape three times around the ends of both sensor cables so the tape is flush with the end of each black jacket and slide the grommet so it is 6 mm away from the tape.

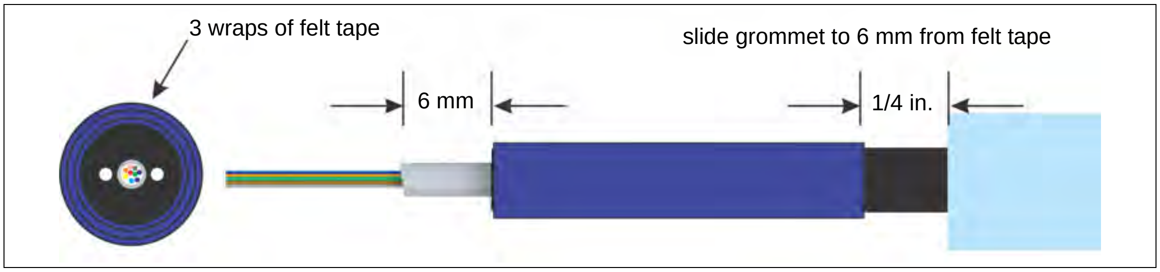


Figure 59 Taping the sensor cable

2. Slide the supplied cable ties into the slots in the splice tray.
3. Place the sensor cable into the cable guides so the end of the buffer tube is flush with the inside of the tray then tighten the cable tie over the tape and cut off the end of the tie.
4. Slide the grommet to within 6 mm of the felt tape.

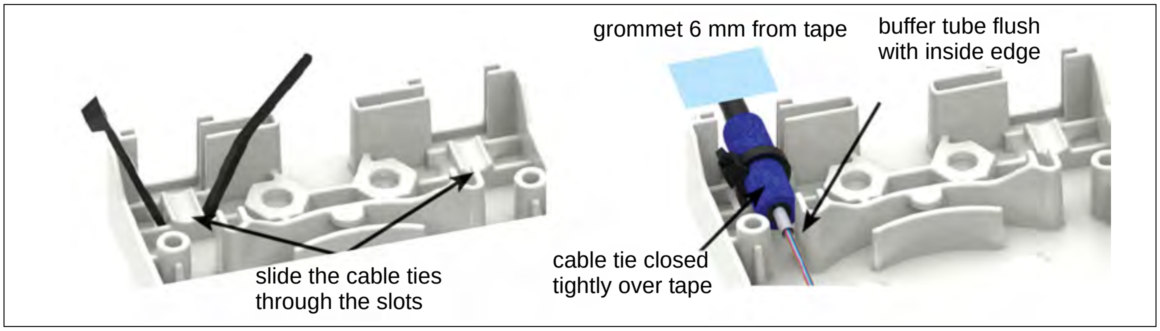


Figure 60 Securing the sensor cable in the splice tray

5. Use the fiber pick to neatly dress the fibers inside the tray.

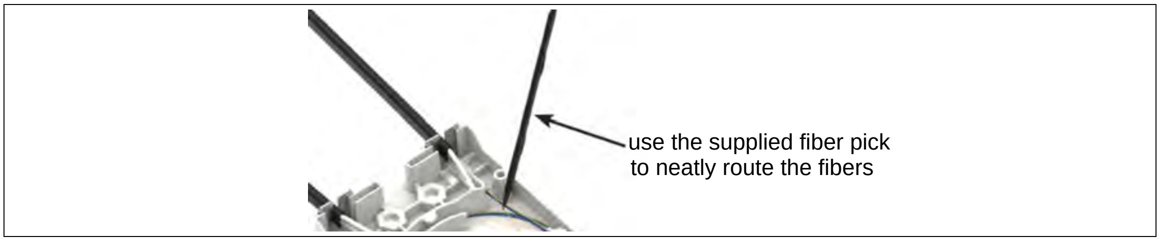


Figure 61 Dressing the fibers in the splice tray

6. Fit the splice tray into the bottom of the enclosure and latch the enclosure.
7. Refer to Figure 62 to route the fibers inside the splice tray.

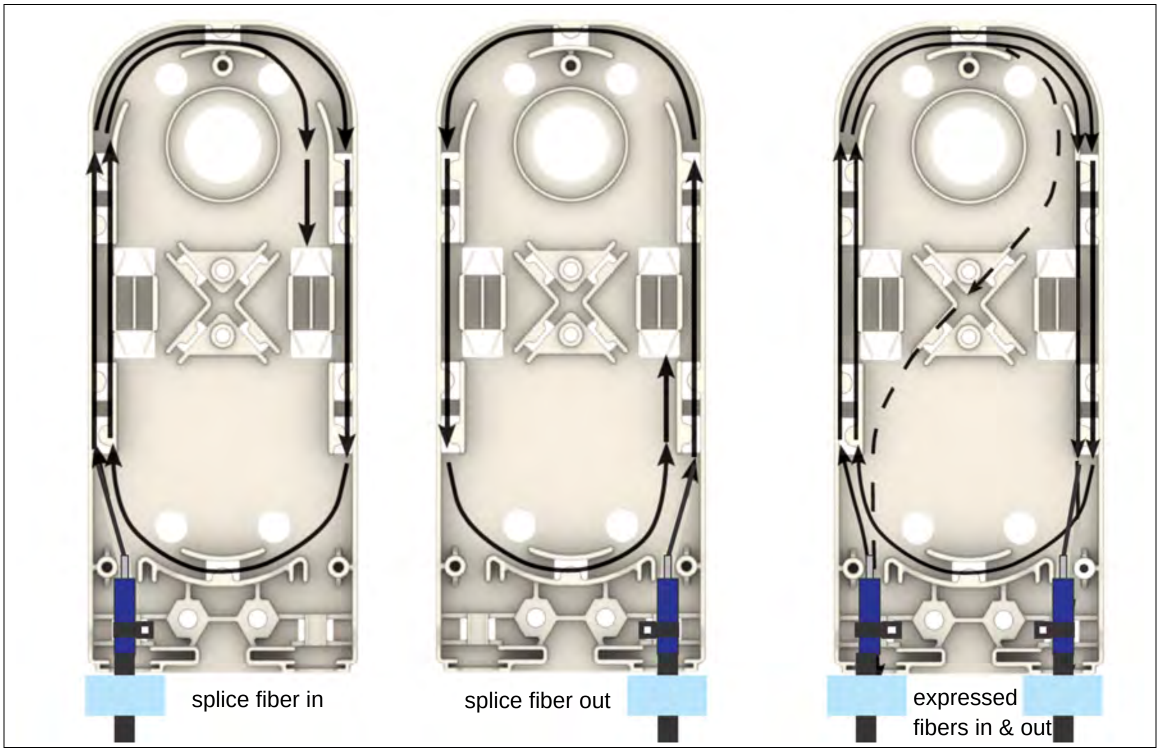


Figure 62 Fiber routing in the splice tray

8. Seal the ends of the buffer tubes and secure the modules and splice sleeves in the splice tray's slots with RTV sealant.
9. Use the supplied silicone lubricant to thinly coat the four sealing sides of both grommets.
10. Fit the splice tray into the enclosure so it sits on the four mounting posts, and secure the tray with 2 of the supplied screws.

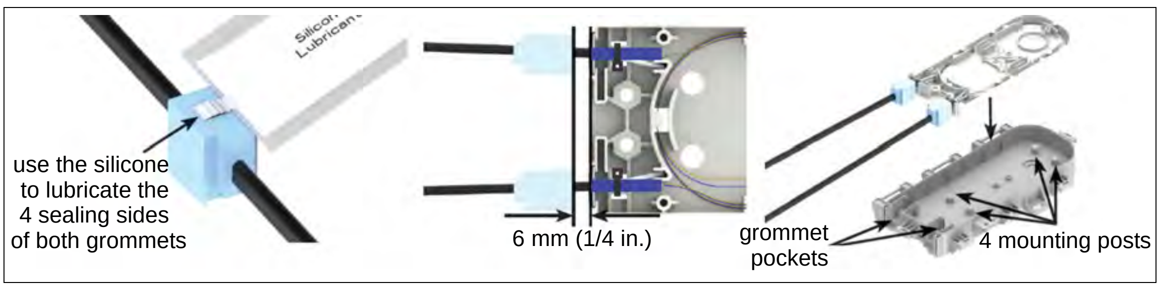


Figure 63 Fitting the splice tray into the enclosure

11. Fit the top of the enclosure onto the bottom.
12. Close and latch the enclosure.

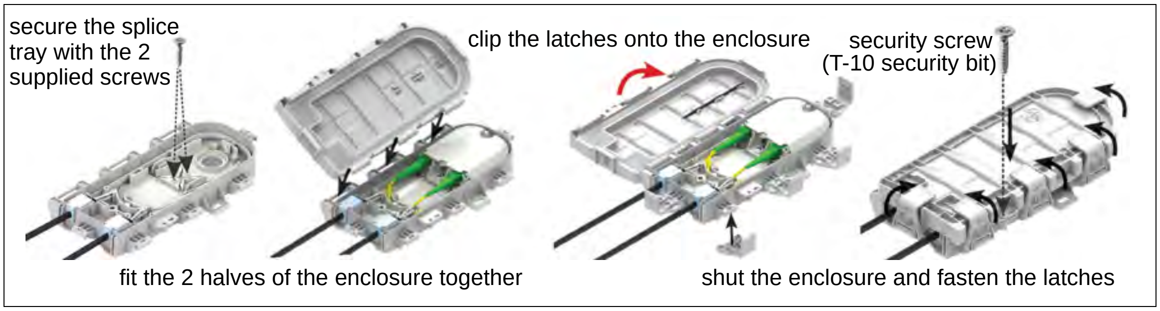


Figure 64 Dressing the fibers in the enclosure tray

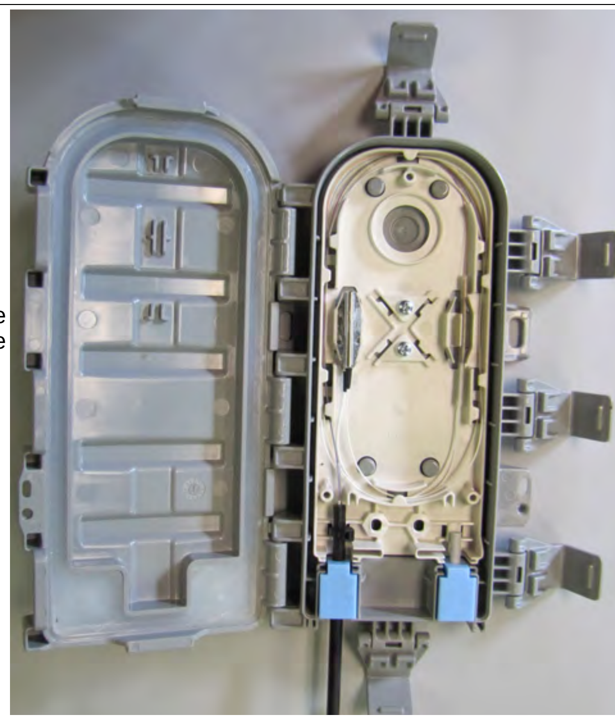


Figure 65 Outdoor splice enclosure example (single end module)

13. Use the supplied security screw to secure the latched enclosure (requires T-10 security bit).
14. Attach the enclosure to the fence beside a post and form the service loops.

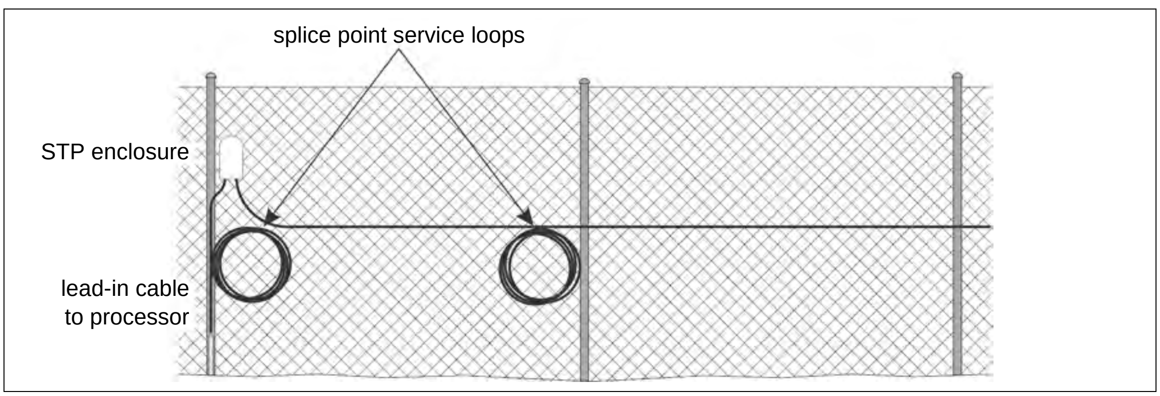


Figure 66 Attaching the splice enclosure and service loops to the fence

4 Calibration & setup

FP400 alarm detection

The FP400 processor evaluates the input signals from the sensor cables to discriminate between fence disturbance events and environmental activity. The characteristic response caused by cutting a fence wire is a sharp spike with a fast rising and fast falling edge. For a disturbance caused by climbing on the fence, 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 67 illustrates typical response signals for cut wires, a fence climb, and environmental activity.

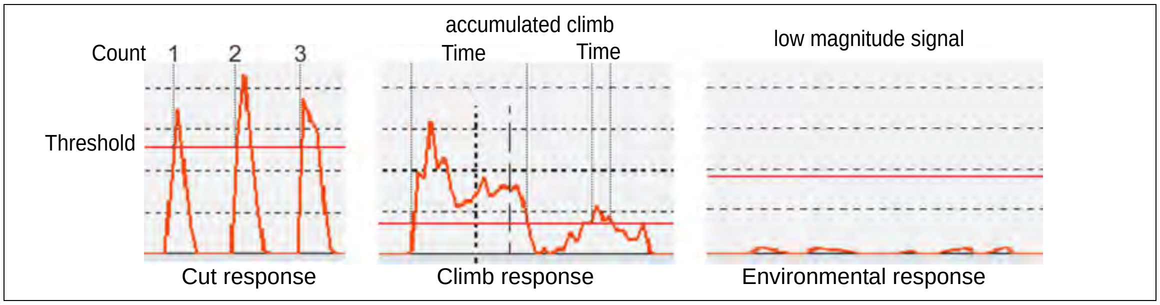


Figure 67 FP400 detection response

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 Event Count, or adds to the Event Duration, 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 actual fence disturbances and environmental activity. The FP400 processor’s detection parameters are setup independently for each zone, and it reports an intrusion alarm when the user-specified detection parameters are met.

Note	The detection parameters are configured independently for each sensor zone.

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

Intruder detection

The FP400 protects against 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.

Cut intrusion detection

Cutting the fence fabric produces a high amplitude signal that exceeds the Event Threshold setting. Each time the Event Threshold is exceeded the Event Count (disturbance event) is incremented. When a specified number of Events occur within a preset Alarm Window time, the FP400 processor generates an alarm. If the Event Count is not reached within the Alarm Window setting, the Event Count and Alarm Window reset to 0.

The processor reports an alarm when:

- the signal from the sensor cable exceeds the Event Threshold,
- the number of times that the Event Threshold is exceeded reaches the Event Count setting,

and

- the Event Count setting is met within the Alarm Window time period.

Climb intrusion 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 onto the fence causes the signal from the sensor cable to exceed the Event Threshold setting, which increments the Event Count. The initial contact also activates the Event Duration counter. Each time the detection signal rises above the Event Threshold, the Event Count increments and the Event Duration accumulates the time the signal remains above the Threshold. If the Event Count is reached or the Event Duration time is exceeded within the Alarm Window time, the system generates an alarm. If the Alarm Window time lapses before the Event Count is reached or the Event Duration time is exceeded, the Event count, the Event Duration, and the Alarm Window all reset to 0.

The processor reports an alarm when:

- the signal from the sensor cable exceeds the Event Threshold,
- the Event Threshold is exceeded for the Event Duration time,
OR
the number of times that the Event Threshold is exceeded reaches the Event Count setting

and

- the Event Duration time is accumulated within the Alarm Window time setting,
OR
the Event Count setting is met within the Alarm Window time setting.

Detection parameters

UCM Parameter	Parameter description	Default	Range
Zone Enable	Select (check) the Zone Enable checkbox to make the corresponding Zone operational. Deselect the Zone Enable checkbox only for an unused Zone (i.e., no fiber optic cable connected).	unchecked zone OFF	
RX Cable Gain	Amplifier setting that boosts the detection signal received from the sensor cable. Use the RX gain to optimize the amplitude of the detection signal.	1	1 - 3
Extended Lead In	When checked, the Extended Lead In checkbox enables a fixed gain pre-amplifier to compensate for attenuation due to a long run of lead-in cable. Use in conjunction with the RX Gain setting to optimize the detection signal amplitude. Select (check) the Extended Lead In checkbox if there is more than 5km (3.1 mi.) of lead-in cable to a zone's start module.	unchecked lead-in cable length less than 5 km	
Detection Settings	Detection parameters used to detect an intrusion attempt.		
Low Frequency Filter Settings	Sets the low frequency cut-off of the target detection filter. Signals below this frequency are ignored.	8 kHz	1 kHz - 40 kHz
High Frequency Filter Settings	Sets the high frequency cut-off of the target detection filter. Signals above this frequency are ignored.	32 kHz	1 kHz - 40 kHz
Event Threshold	The Event Threshold is the signal level at which a cable stimulus is considered to be a fence disturbance event. Each time the Event Threshold is crossed, the Event Count is incremented and the Event Duration accumulates the time that the signal remains above the Threshold. Using a lower Event Threshold setting typically increases the probability of detection (Pd). However, a lower Event Threshold may also increase the nuisance alarm rate (NAR). A higher Event Threshold typically decreases the Pd and may also reduce the NAR.	50	1 - 255
Alarm Window (Sec)	Sets the time period following an event in which the Event Count setting or the Event Duration must be reached to cause an alarm. If neither parameter is met within the Alarm Window time setting the three parameters are cleared and reset to 0.	30	10 - 120 Seconds
Event Count	Sets the number of events that must occur within the Alarm Window to trigger an alarm. Counts the disturbance events that have signal magnitudes above the Event Threshold.	4	1 - 32
Event Duration	An advanced parameter that sets the cumulative time period that the signal remains above the Event Threshold within the specified Alarm Window time to trigger an alarm.	3	1 - 30 Seconds
Event Profile (%)	An advanced parameter that specifies a percentage of the Alarm Window time setting that is added to the time remaining in the Alarm Window each time the Event Count is incremented.	20%	10 - 100

Event Mask (Sec)	An advanced parameter that specifies the time period following an Event that must lapse before the next Event can be recorded. Used to prevent reverberations caused by a single event from being recorded as subsequent events.	0.3	0.1 - 20
Supervision Threshold	The signal level at which the received signal adds or subtracts time to, or from, the accumulating supervision time. If the maximum signal strength minus the minimum signal strength is below the Supervision Threshold 100 ms is added to the supervision time total. If the maximum signal strength minus the minimum signal strength is above the Supervision Threshold 100 ms is subtracted from the supervision time total.	50	0 - 4095
Supervision Duration	The period of time that the calculated detection signal must remain below the Supervision Threshold to declare a cable supervision alarm in a zone. If the calculated detection signal goes above the Supervision Threshold for the Supervision Duration time the supervision alarm is cleared.	5	1 - 240
Misc Settings	Miscellaneous processor settings		
Configuration Type	Selects the type of sensor configuration deployed.	Single tube	Single tube or Cross-Cable
ADC Offset	Used to bring the Optical Power to within the observable window. Disabled when the RX Gain setting is 1. When the Optical Power Max - Min difference is less than 1000 (see Figure 69) the RX Gain needs to be increased for optimal sensor performance. After increasing the RX Gain and uploading the new configuration, check the new Optical Power Max - Min. If the new Max value is 4094 then the ADC Offset must be increased. If the new Min value is 1 then the ADC Offset must be decreased. These values represent the limit of the observable window of the optical signal (1 - 4094). Increasing the RX Gain can force the Optical Power signal outside the observable window, in which case the ADC Offset must be tweaked. When tweaking the ADC Offset, ensure that neither the Max or the Min display their limit. ADC Offset tweaking is complete when the Optical Power Min is > 1 and the Optical Power Max is < 4094.	512	0 - 1023
Auto-Scale Enable	Selects whether the signal magnitude is scaled automatically to fit the range of 0 - 255. The Auto-Scale factor is stored internally in the processor and is not indicated by the UCM. The Auto-Scale factor can become too high if there is an extreme response in the sensor (e.g. a hail storm). An FP400 with an Auto-Scale factor that is too high appears to be lacking sensitivity when viewing a sensor plot taken during tests on the fence (i.e. very low signal magnitude). To reset the Auto-Scale factor, uncheck Auto Scale Enable and upload the new configuration to the FP400. Then, power cycle the FP400. Re-check Auto-Scale Enable and upload the configuration to the FP400. The internal Auto-Scale factor starts at the default value of 5 and is functionally identical to the Manual Scale Factor.	Enabled Checked	
Manual Scale Factor	Selects the factor by which the signal magnitude will be scaled down by, if Auto-Scale is disabled. If Auto-Scale is disabled, the Manual Scale Factor selects the factor by which the signal magnitude will be scaled down.	5	0 - 255

FP400 initial calibration

When first calibrating the FP400 processor, begin with the detection parameters at the default settings.

Note	The parameters listed below each Zone apply only to that Zone. Each zone is setup independently.

Before beginning calibration, verify that the sensor fiber pairs for each zone are length matched:

1. Establish a UCM connection to the processor.
2. Have someone repeatedly strike the fence in the zone in which you are verifying the sensor fiber lengths.
3. Select the Fringe button on the Status panel.
4. Select the Zone in which you are verifying the lengths of the 2 sensor fibers.
5. Review the Fringe plot to verify the sensor fibers lengths are matched.

See Fiber length matching on page 75 for details on length match verification. The following three fringe plots illustrate increasing levels of high frequency noise caused by the length differences on the sensor fibers. The first plot shows near perfect length matching with no visible high frequency noise affecting the fringe. The second plot shows what should be seen in a regular installation. The final plot has very visible high frequency noise affecting the fringe. This noise will reduce the sensor's effectiveness in that zone. See Fiber length matching on page 75 for recommended corrective measures.

Intrusion simulations

To setup and test the FP400 sensor you must perform intrusion simulations for both cut and climb events.

Cut simulation (tap test)

The easiest method for simulating a cut intrusion is to strike the fence with the blade of a medium sized screwdriver. Hold the screwdriver by the handle, and flip your wrist to bring the blade into contact with the fence. Use moderate force and try to keep the amount of force consistent for each tap. The metal on metal contact generates an impulse that is similar to the cutting of a fence wire.

Rather than striking the fence, you can simulate a cut intrusion by weaving a length of fence wire tightly into a fence panel and then cutting the wire in several places. 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.

Climb simulation

For a simulated climb intrusion, the best method is to actually climb on 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 Event Duration setting, or until the number of disturbance events exceeds the Event Count setting. If climbing on the fence is not allowed, simulate a climb intrusion by lightly dragging a screwdriver across the fence panel for a period that exceeds the Event Duration setting.

Note	In most cases, the Event Count is reached before the Event Duration is exceeded.

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 and force. Listen for any metal on metal contact noise and run a UCM magnitude response plot 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.

The Universal Configuration Module

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

The Universal Configuration Module (UCM) is a Windows based software application, which serves as the calibration, setup and maintenance tool for the FP400 sensor system. The UCM communicates with the FP400 processor locally through a USB connection, or remotely via the Silver Network Manager. When you start the UCM, a window displays that enables you to specify the device to which you are connecting (see Figure 68).

Tip	Save UCM files with a meaningful name including the time and date. The files can then be reopened for editing or review (Work Offline).

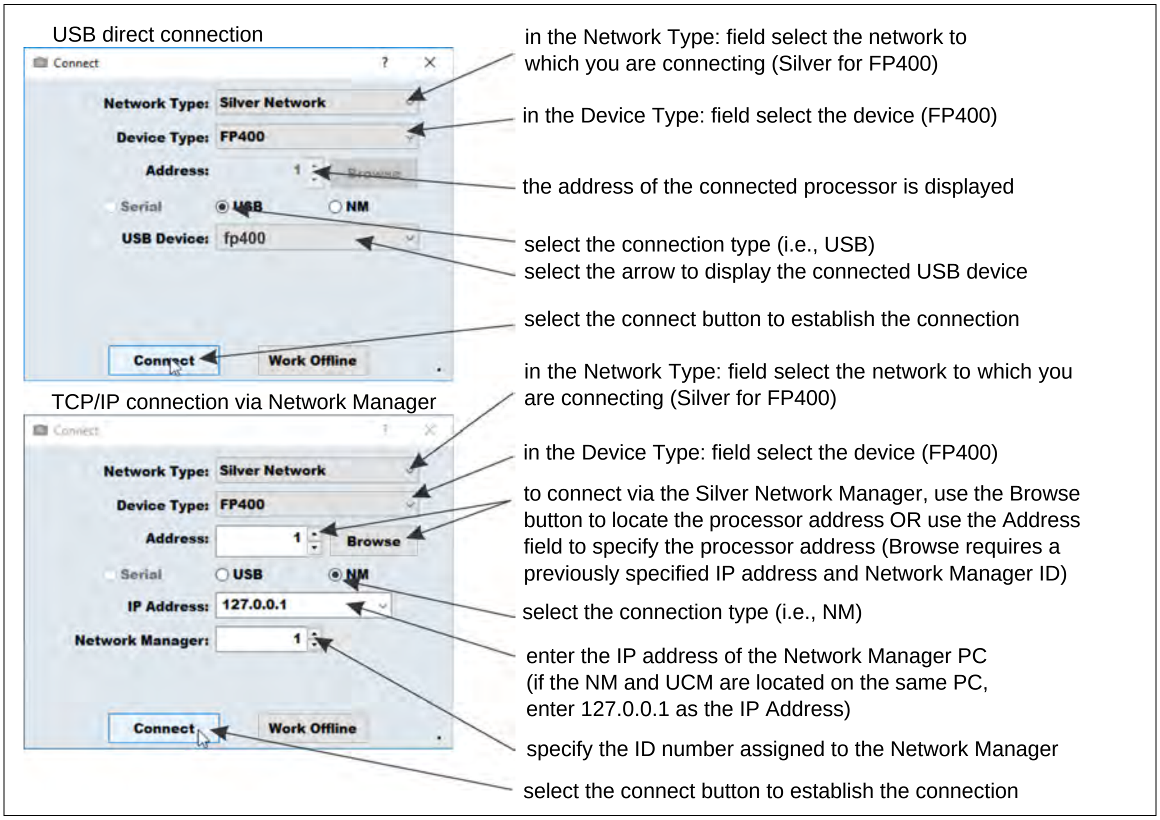


Figure 68 Connecting the UCM

Senstar recommends that the initial calibration be done at the processor location using a direct USB connection to the UCM.

Note	The processor's Address and Network Configuration settings can be adjusted only through a direct USB connection.

FP400 calibration is a five step process that involves:

- Adjusting the processor's RX Cable gain settings (if required)
- Tuning the processor's detection settings (if required)
- Adjusting the processor's supervision settings (if required)
- Adjusting the processor's Filter settings (if required)
- Testing the installation

Connecting the UCM via USB

Note	The FP400 processor must be powered by either PoE or a direct DC input (12 - 48 VDC) to connect to the UCM.

1. Connect the UCM computer to the processor via USB (to the UCM port).
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 = FP400; Address = 1 {default address}; select the USB radio button; USB Device = fp400). The FP400 Status window opens (see Figure 69):

Note	For FP400 systems that encounter an unacceptable NAR during inclement weather, raise the Event Threshold to reduce the NAR. After adjusting the Event Threshold, retest the system to ensure that the detection meets the site's security requirements.

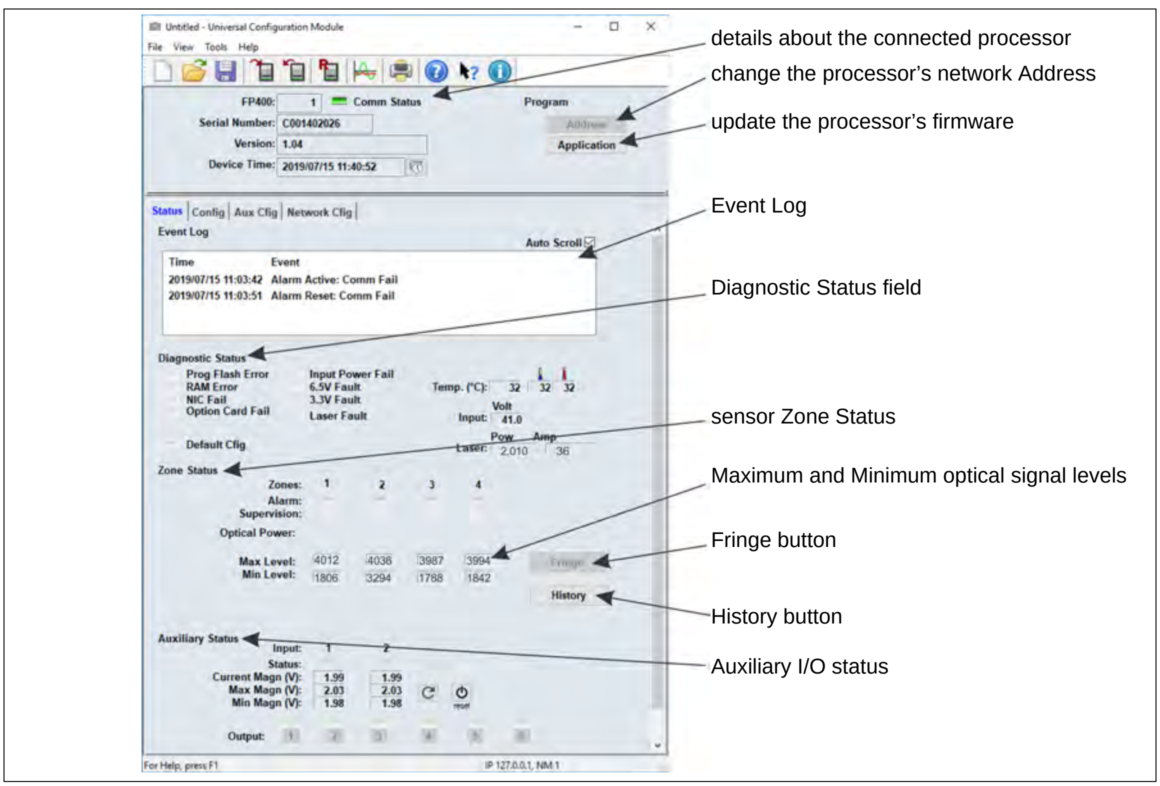


Figure 69 UCM Status screen

Adjusting the RX Cable (Gain) settings

FP400 calibration is done under the Config tab. Select the Config tab and the Cable Configuration window displays.

The RX Cable Gain amplifies the signal received from the sensor cable before it is processed. There are 3 cable RX Cable settings: 1, 2, 3. Begin with the default setting of 1. Next, open the Status window and check the Max. (maximum optical signal) and the Min. (minimum optical signal) levels for each enabled and connected zone. Depending on the measured signals, either adjust the RX Gain or keep the default values.

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

To find the proper Gain setting for each zone you subtract the value of the minimum optical signal from the value of the maximum optical signal to determine the difference between the two.

1. Connect the UCM and verify that the RX Gain is at the default value of 1 (on the Cfig tab).
2. Create a large disturbance in each zone being setup (the best way to ensure a broad range of signals is to shake the start module enclosure).
3. Open the Status window and check the Max. Level and Min. Level for each zone.
4. For each enabled and connected zone, subtract the value of the minimum optical signal (Min. Level) from the value of the maximum optical signal (Max. Level).
   For a Gain setting of 1: 4096 > (Max. - Min.) > 1000.
   For a Gain setting of 2 or 3: 3000 > (Max. - Min.) > 1000.

   The following example uses the Max. Min. values shown in Figure 69:

   For Zone 1: the Max. = 4012 and the Min. = 1806 therefore 4012 - 1806 = 2206; therefore, the correct RX Cable gain for Zone 1 is 1.

   For Zone 2: the Max. = 4036 and the Min. = 3294 therefore 4036 - 3294 = 742. Set the RX Cable gain for Zone 2 to 2 and retest the zone.
5. Test the RX Cable Gain setting by conducting intrusion tests for both cut intrusions and climb intrusions. Record the tests on a UCM magnitude response plot. Begin 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.
6. Move along the fence tapping each panel in the zone 4 times. Wait approximately 5 seconds between panels to allow the alarm from the previous test to reset.
7. After tapping the last fence panel in the zone, stop the recording and review the plot.
8. If each tap test caused an alarm then the RX Cable Gain is correct for the zone.
9. Start another magnitude response plot and conduct a number of climb tests to verify the RX Cable Gain setting for climb detection.
10. If each climb test causes an alarm then the RX Cable Gain is correct for the zone.

Setting the detection parameters

At the default settings, the Alarm Window is 30 seconds, the Event Threshold is 50, and the Event Count is 4. This means that for an alarm to occur, the processor must record 4 Events with a signal magnitude above 50, within a 30 second period. At the default Event Profile setting, 20% of the Alarm Window setting is added to the time remaining in the Alarm Window with each subsequent Event (i.e., Event 1 starts the time Window counter, Event 2 adds 6 seconds to the Alarm Window, Event 3 adds 6 seconds, Event 4 causes an alarm and resets the Alarm Window.)

The default settings for intrusion detection are based on extensive field experience with other fence protection systems. You can increase, or decrease, the number of fence cuts (Events) required to trigger an alarm, and adjust the Event Threshold to increase, or decrease, the signal strength at which a fence disturbance becomes an Event. You can also increase, or decrease, the amount of time added to the Alarm Window each time the Event Count is incremented. The Event Count and Alarm Window can be changed to meet a specification or site requirements. If your site does not specify values for the Event Count and Alarm Window parameters, Senstar recommends using the default values and changing the values if you encounter a problem with detection sensitivity or nuisance alarms.

Setting the cut detection parameters

1. Open a UCM magnitude response plot, and select the Zone number and Magnitude.
2. Select the Record button to start the plot.
3. Beginning on the first fence panel, have the tester conduct cut simulations by striking the fence with a medium size screwdriver.
4. Strike the fence 4 times, waiting about 2 seconds between strikes.
5. Proceed along the fence testing each panel with 4 strikes. Wait about 45 seconds between panels for the alarm to reset. Conduct some of the tests in the middle of a fence panel and some of the tests near the fence posts.
6. When you reach the end of the zone stop the plot and review the recording.
7. Verify that each series of 4 fence strikes caused an alarm. If any of the tests did not cause an alarm, investigate the fence panel, repair if necessary, and then repeat the test on that panel.
8. If the recorded responses were on the high side, you can raise the Event Threshold to help prevent nuisance alarms. If the recorded responses were on the low side, verify that the RX cable gain was calibrated and then you can lower the Event Threshold to help ensure adequate detection. If you adjust any detection parameters, retest the zone.

Setting the climb detection parameters

For climb intrusion detection, the best method for setting up the detection parameters is to actually climb on the protected fence. You do not have to climb over the fence as long as the climbing activity is representative of an actual climb intrusion and exceeds the Event Duration time setting.

Conduct the initial climb testing at the processor’s default settings. The Alarm Window is set at 30 seconds, the Event Threshold is 50 and the Event Duration 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 50, within a 30 second period.

Note	The Count parameter also applies to climb intrusions and will often cause an alarm before the Event Duration can accumulate enough time to cause an alarm.

1. Open a UCM magnitude response plot and select the Zone number 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. Monitor the response plot to verify that the climbing activity is accumulating (Event Duration) and the Event Count is increasing.
4. Watch the signal magnitude as the climber moves on the fence. The resulting signal magnitude must exceed the Event Threshold for the Event Duration, or reach the Event Count setting.
5. If the climbing activity does not result in a detection signal above the Event Threshold, lower the Event Threshold and repeat the test.

Setting the cable supervision parameters

The FP400 processor supervises the sensor cables (lead-in and detecting) independently for each zone. There are two settings that are used to fine tune cable supervision: Supervision Duration and Supervision Threshold. The Supervision Duration sets the period of time the processor uses to declare a supervision alarm. The Supervision Threshold subtracts the minimum signal from the maximum signal to determine if there is a supervision event in progress. When the difference between min. and max. is below the Supervision Threshold setting, 100 ms of supervision time is accumulated. When the difference between min. and max. is above the Supervision Threshold setting, the accumulated supervision time is reduced by 100 ms. If the accumulated supervision time reaches the Supervision Duration setting, a supervision alarm is declared in that zone.

Note	Senstar recommends using the default supervision settings. Adjust the supervision settings only if you encounter an unacceptable nuisance alarm rate (NAR). To increase the processor’s sensitivity to supervision events lower the Supervision Duration and/or raise the Supervision Threshold. To decrease the processor’s sensitivity to supervision events raise the Supervision Duration and/or lower the Supervision Threshold.

Setting the Supervision Duration

Use the Supervision Duration to set the period of time that must accumulate before a supervision alarm is recorded in the selected zone (default value = 5 seconds, range from 0 to 240 seconds).

Setting the Supervision Threshold

The Supervision Threshold sets the signal level that determines whether a supervision event is in progress. The processor subtracts the minimum signal level from the maximum signal level recorded during a 100 ms period to determine the value of the supervision signal. When the value of the supervision signal is below the Supervision Threshold, 100 ms of supervision time is accumulated. When the value of the supervision signal is above the Supervision Threshold, the accumulated supervision time is reduced by 100 ms (default value = 50, range from 0 to 4095).

Mitigating weather related nuisance alarms

If your FP400 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 or other objects that can cause metal on metal contact or bang against the fence. Check to make sure that no vegetation is growing against or through the fence and that there are no overhanging tree branches that can contact the fence or the barbed wire/razor ribbon topping. Next, connect the UCM to the processor and review the alarm history. Adjust the detection parameters to try to exclude the signals that are causing the nuisance alarms. Continue with this process until the nuisance alarm rate reaches an acceptable level. Retest the detection response after adjusting the detection parameters.

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

There are 2 methods of operation for the processor's inputs and outputs, Local control and Remote control. When set to Local control mode, the processor uses its relays to signal alarm and supervision conditions, and the inputs are used to activate electronic self-tests. For network based processors set to Remote control mode, alarm data is carried over the network cables and the six relays are available as output control points from the security management system. In Remote control mode the inputs are used to report the status of one, or two, auxiliary security devices to the host SMS. 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 FP400 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 initiate processor self-tests. To activate the self-test function, close a momentary switch across an input. The switch must close for the time specified in the Filter Window. Leave the AUX inputs open if you do not want to use the self-test function. Table 2: shows the input wiring configuration for a self-test switch (unsupervised N.O.).

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 2: includes the selectable Remote Control input wiring configurations and Table 3: lists the selectable supervision resistor values.

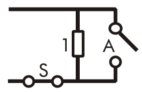
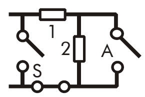
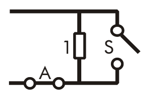
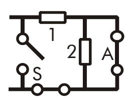
Input option	UCM selection	Alarm relay	Supervision relay	R1	R2
unsupervised		NO	---	---	---
single resistor supervision		NO	NC	5.1 k	---
dual resistor supervision		NO	NO/NC	4.3 k	820
unsupervised		NC	---	---	---
single resistor supervision		NC	NO	5.1 k	---
dual resistor supervision		NC	NO/NC	5.1 k	820

Table 2: 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	4.7 k	3.3 k
1.5 k	5.1 k	5.6 k
2.2 k	5.6 k	
3.3 k		
4.7 k		
5.1 k		
5.6 k		

Table 3: 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

Tip	Use the activate buttons below the outputs on the UCM status panel to activate the corresponding relays (configured as Remote control mode).

Output relay setup (Local control mode)

In Local control mode, the six relays are setup via the Local Aux Control Activation check boxes to report alarm and supervision 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 network address

Note	The processor address can be set only through a direct USB connection between the UCM computer and the processor's USB port. Processors that do not use network communications (standalone) 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

Note	The Network configuration can be set only through a direct USB connection between the UCM computer and the processor's USB port.

For FP400 processors that use network alarm data communications, you must setup the network communication parameters under the Network Cfig tab.

Note	There are two selectable configurations for Silver Network based processors. For EIA-422 and fiber optic cable, select Silver Loop (see Figure 48 and Figure 49) and for Ethernet communications select Silver Star (see Figure 50).

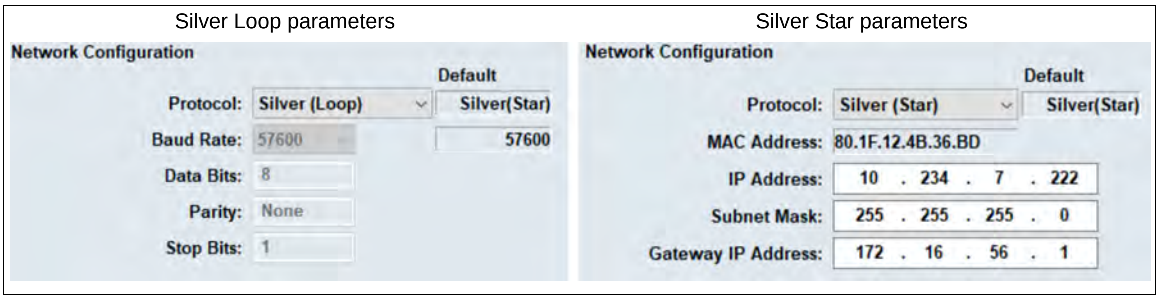


Figure 70 UCM Network Configuration example screen

1. Specify the network Protocol: (Silver Loop or Silver Star).
2. For the Silver Loop configuration, the network parameters are preset to default values.
   For the Silver Star configuration, you must specify the IP Address, the Subnet Mask and the Gateway IP Address for each processor.
3. 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.

- **Cut detection** - Use the tap test, or weave a piece of scrap fence wire tightly 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 Event Count parameter (default = 4). (Pass = alarm after Event Count setting is reached)

  PASS ____ FAIL____

- **Climb detection** - Have a tester climb on the fence fabric for at least as long as the Event Duration setting plus one second. Repeat the climb test in at least three locations using both a fast climb and a stealthy climb (default = 3 seconds). (Pass = alarm after Event Duration time or Event Count setting is reached)

  PASS ____ FAIL____

- **Fence lift detection** (This test may not be possible at all sites or on all fence types. 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 Event Duration parameter (depending on the amount of fence noise being generated, the test may have to exceed the Event Duration setting by several seconds). Repeat the lift test in at least three locations (default = 3 seconds). (Pass = alarm after Event Duration or Event Count setting is reached)

  PASS ____ FAIL____

- **Zone supervision** - Temporarily disconnect the TX connector from each sensor zone and verify that a supervision alarm is declared in that zone. Replace the TX connector and verify that the supervision alarm is cleared.

  PASS ____ FAIL____

- **Auxiliary device inputs (Self-test)** - For Local control mode, activate the self-test for AUX 1. The processor performs electronic self-tests. The self-test causes an alarm. The test can take up to a minute, depending on the Time settings.
  Activate the self-test for AUX 2. The processor performs electronic self-tests. The self-test causes an alarm. The test can take up to a minute, depending on the Time settings.

  PASS ____ FAIL____

- **Auxiliary device inputs -** 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____

5 Maintenance

Recommended maintenance

The FP400 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.

Note	Senstar strongly recommends that the fence be kept clear of accumulating snow and ice. Both snow and ice have a dampening effect on the transmission of vibrations and will lead to a reduced probability of detection. Significant snow accumulation can also provide concealment or a bridging aid for defeating the sensor.

1. Perform a visual inspection of the installation (quarterly). 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 shake it back and forth with an increasing amount of force can help identify any loose pieces)
   - gates - ensure that all gate hardware is tight and secure and cannot move in the wind
   - 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 frequency at which vegetation must be cut back depends on the local growing conditions)
   - the sensor cable is fastened firmly against the fence fabric and the cable ties are holding the cable securely in place
   - there is no loose or sagging sensor cable
   - service loops are securely attached to the fence fabric
   - splice enclosures are properly mounted and secured according to the installation instructions
2. Physically test the system (once per week at randomly selected locations; once per year at all locations).
   High security sites should increase the frequency of testing (daily at randomly selected locations; quarterly at all locations).

- use a hard, blunt tool (e.g., a screwdriver) to simulate a series of cut intrusions by tapping the fence and verify that alarms are declared each time
- climb on the fence (do not climb over the fence) at several locations and verify that alarms are declared each time

3. Check the system status via the UCM software (see The Universal Configuration Module on page 62).
4. Check the electronic equipment and connections (quarterly).
   Verify that all system connections are properly seated and secure. Ensure that all cables are properly organized and are not exposed to potential damage. Verify that there is adequate clearance for ventilation.

CAUTION	DO NOT disconnect the SC/APC connectors after they are installed. Any dust or contamination will compromise system operation.

5. Battery test (once per year)
   If your FP400 system includes battery back-up, disconnect the power to the components and allow the system 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.

Updating the firmware

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

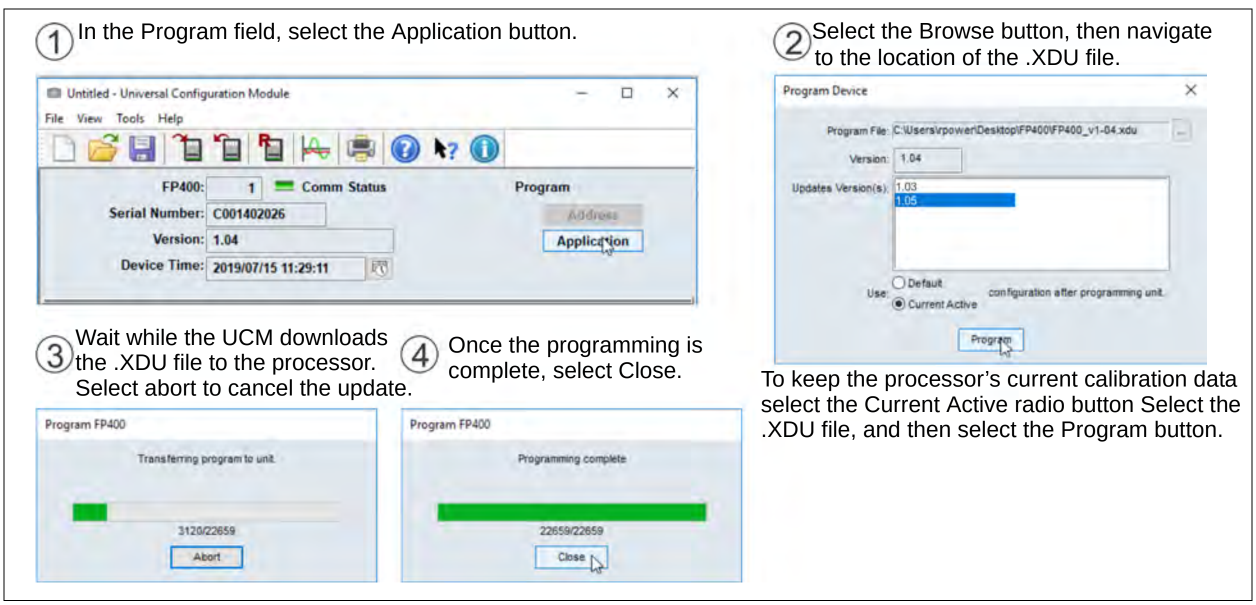


Figure 71: Updating the FP400 firmware

Troubleshooting the sensor cable

Note	There are no user-serviceable components in the FP400 processor. If you have processor problems that cannot be solved by adjusting the detection settings, contact Senstar for a return merchandise authorization (RMA) number.

Fiber length matching

Ideally using the length markers on the cable and taking care during splicing will ensure that the fibers are length matched. However, if there is a length mismatch between the two sensor fibers, you must use an OTDR to troubleshoot the cable installation.

Note	The FP400 end modules have mirrors, therefore, additional care must be taken during troubleshooting with an OTDR.

UCM Fringe plot

The UCM Fringe plot provides a visual display of the high frequency noise caused by mismatched fiber lengths. To use the Fringe plot to determine if a fiber length mismatch is causing excessive noise, have someone repeatedly strike the fence in the zone in which you are verifying the sensor fiber lengths. Select the Fringe button on the UCM Status panel. On the Fringe plot, select the Zone in which you are verifying the lengths of the 2 sensor fibers. Select the Refresh Fringe button to view a current Fringe plot.

The three fringe plots below show increasing levels of high frequency noise caused by the length differences on the sensor fibers during an installation. The first plot immediately below is near perfect length matching with no visible high frequency noise affecting the fringe. The second plot in the middle is a what is expected to be seen in a regular installation. The last one has very visible high frequency noise affecting the fringe, reducing the sensor's effectiveness.

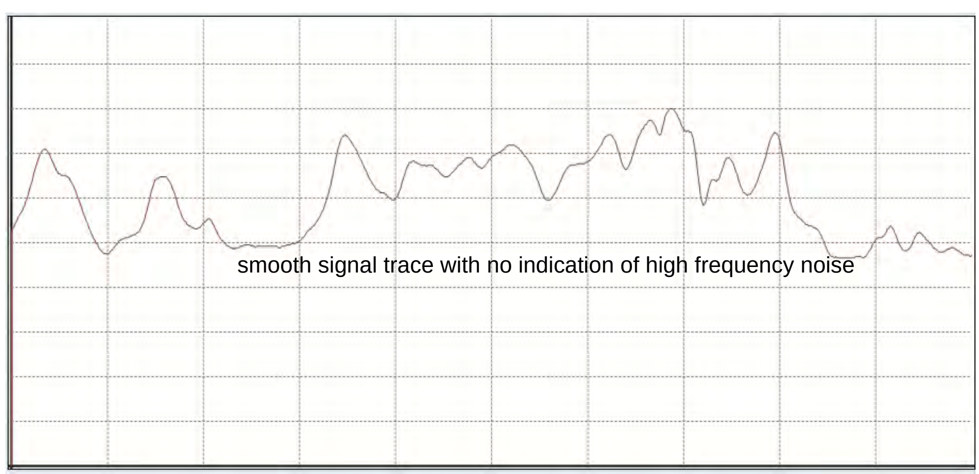


Figure 72: FP400 Exceptional length matching

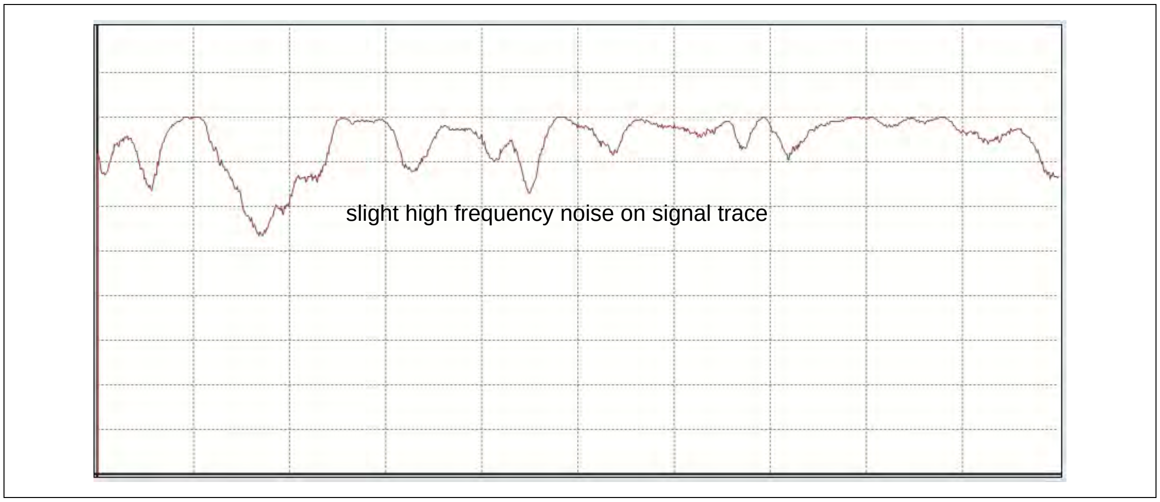


Figure 73: FP400 Typical length matching

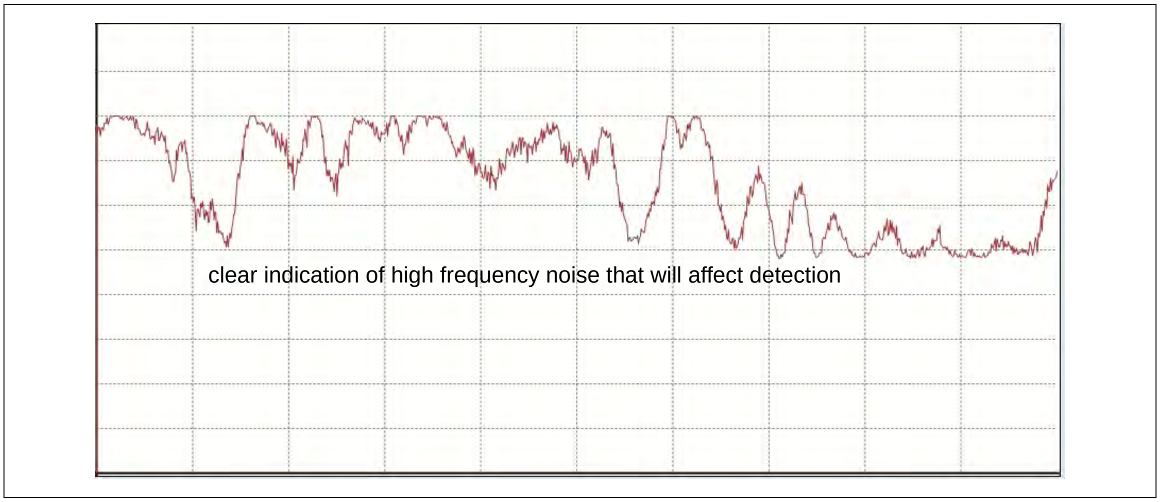


Figure 74: FP400 length mismatch

Fiber Isolation

To determine if there is a problem with a detecting fiber you must use an OTDR to examine the fiber while isolating the second detecting fiber. To isolate a detecting fiber open the start module to expose both fibers. Carefully wrap six tight loops of one of the detecting fibers around a pen (don't break it). This will attenuate the fiber which will have a negligible impact on the OTDR results. This enables you to look down the length of a single detecting fiber from the other side of the start module.

Cable troubleshooting

To troubleshoot the cable, the cable's installation on the fence, and the splices, you need to determine whether there is a break in the fiber, or if there is severe attenuation that is dampening the signal.

The first step is to ensure there is a broad range of signals from the fibers. You can do this easily by shaking the enclosure that contains the start module. After stimulating the fibers, open the UCM status tab and look at the maximum and minimum signal levels for that zone. If the difference between them is greater than 100 then the issue in the cable is attenuation, either due to splice quality or tight bends along the fiber. If the difference between the zone’s maximum and minimum signal is less than 100 you probably have a break in the fiber. A zone with a difference of greater than 1000 indicates no severe attenuation or breaks in the fiber.

You can use the OTDR to determine at what point along the fiber the problem occurs, using the fiber isolation technique. This allows you to use the OTDR on the connectorized (processor) end of the lead-in cable, avoiding extra splices. When troubleshooting, use the OTDR with three different fiber configurations to ensure full coverage of the fibers in use. Both the RX and TX connectors need to be removed from the processor before beginning:

1. Use the OTDR with the TX connector and detecting fiber #1 isolated (attenuate detecting fiber #2). Which detecting fiber you choose as #1 is arbitrary. Purpose: Verify the integrity of the TX lead-in fiber and detecting fiber #1.
2. Use the OTDR with the TX connector and detecting fiber #2 isolated (attenuate detecting fiber #1). Purpose: Verify the integrity of detecting fiber #2.
3. Use the OTDR with the RX connector and don’t isolate any detecting fibers. Purpose: Verify the integrity of the RX lead-in fiber.

Each time you get results from the OTDR, look for signs of attenuation or breakages in the fiber. A fully intact fiber will have no large drops along the length (the presence of such indicates attenuation) and will show the large reflection of the mirror at the end (the lack of such indicates a break in the fiber). Using this technique it is possible to get the fiber length.

If a fiber problem is found you must correct the problem and retest the sensor.

a System component list

Component	Part Number	Description
FP400 processor	F4EM0100	Senstar FP400 panel mount processor in painted aluminum shell for fence protection applications with 4 independent alarm zones
EIA-19 in. rack-mount kit	F4KT0500	Components required to rack-mount the Senstar FP400 in an EIA-19 in. equipment rack (1 RU)
DIN rail mount kit	F4KT0600	Components required to mount the Senstar FP400 on a 35 mm DIN rail
Zone connection kit	F4KT0200	Includes the components to connect one sensor zone (start module, end module) (splice enclosure’s ordered separately)
splice enclosure	F4KT0100	compact outdoor rated STP 2-port splice enclosure can accommodate 12 fusion splices
high capacity splice enclosure	GM0749-24	3-port splice enclosure can accommodate up to 24 fusion splices
single-mode fiber optic cable	F4SP0100	250 m (820 ft) single-mode fiber optic lead-in cable/sensor cable for fence applications (12 fibers) 8.6 kg (19.0 lb) 29 cm h x 29 cm diameter (11.5 in. h x 11.5 in. diameter)
single-mode fiber optic cable	F4SP0101	1000 m (3280 ft) single-mode fiber optic lead-in cable/sensor cable for fence applications (12 fibers) 30.8 kg (67.8 lb) 42 cm h x 37 cm diameter (16.5 in. h x 14.75 in. diameter)
bypass conduit	GW0328-ORN	orange solid wall conduit for buried cable bypasses
bypass conduit	GW0328-BLK	black solid wall conduit for buried cable bypasses
conduit coupler	GW0328-COU	coupler for joining 2 lengths of solid wall conduit
cable ties, nylon-12	GH1210-1000	Bag of 1,000 long lasting UV resistant cable ties
Senstar connector cleaning tool kit	GX0313	fiber technician connector cleaning kit for Senstar applications
Senstar installation tool kit	GX0314-04	fiber technician tool kit customized for Senstar applications
splice consumables kit	FPKT0200	components required to make up to 24 fusion splices
Option card installation kit	F4KT0300	hardware kit required to mount any optional add-on card on the FP400 processor
Gate accessories		
wireless gate sensor processor (GSP) and enclosure	E7EM0300	wireless gate sensor processor mounted in an outdoor rated painted aluminum enclosure, provides electronic processing for up to 4 GSMs
wireless gate sensor module (GSM)	E7EM0201	battery powered wireless gate sensor module mounts on gate and communicates via RF with plug-in module on FP400 processor

Component	Part Number	Description
wireless gate sensor module (GSM)	E7EM0202	solar powered wireless gate sensor module mounts on gate and communicates via RF with plug-in module on FP400 processor
gate sensor receiver card for WGS	E7FG0301	plug-in module for FP400 processor, communicates via RF with GSM
cable management kit for swinging gates	FPKT0500	Split conduit 1 m (3.3 ft.) section and two gear clamps for sensor cable installation at protected swinging gates
Power supplies		
DIN rail mount	GP0154-050	50 W, 48 VDC, DIN rail mount indoor power supply (-10 to 70º C)
DIN rail mount	GP0154-480	480 W, 48 VDC, DIN rail mount indoor power supply (-25 to 70º C)
Indoor/outdoor	GP0160-185	185 W, 48 VDC, indoor/outdoor power supply (IP65)
Indoor/outdoor	GP0160-480	480 W, 48 VDC, indoor/outdoor power supply (IP65)
Outdoor power supply	A4EM0200	100 W, 48 VDC network power supply in a painted aluminum enclosure (CSA type 4 / NEMA 4/IP 66)
Network accessories		
Silver Network Interface Unit	00EM0200	Silver Network data converter for EIA-422 and multi-mode fiber optic applications
Silver Network Interface Unit	00EM0201	Silver Network data converter for EIA-422 and single-mode fiber optic applications
Mini Silver Network Interface Unit	00EM1301	Silver Network data converter for USB to EIA-422 and multi-mode fiber optic applications DIN rail mount
Mini Silver Network Interface Unit	00EM1302	Silver Network data converter for USB to EIA-422 and single-mode fiber optic applications DIN rail mount
Data converter	GB0360-ST	Ethernet to dual EIA-422 data converter (0 to 60º C operating temp)
Data converter	GB0360-ET	Ethernet to dual EIA-422 data converter (-40 to +75º C operating temp)
Data converter mounting kit	GB0360-MK	35 mm DIN rail mounting kit for Ethernet to dual EIA-422 data converters
Network Interface Card (multi-mode fiber)	00BA1901	Network interface card for multi-mode fiber optic communications
Network Interface Card (EIA-422)	00BA2000	Network interface card for copper wire communications
Network Interface Card (single-mode fiber)	00BA2101	Network interface card for single-mode fiber optic communications
Network Manager service software	00FG0220	Network Manager service software CD for Silver Network plus Alarm Integration Module software (AIM requires hardware key for operation)
AIM hardware key	00SW0230	USB security dongle for AIM software operation
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

b Specifications

Processor	**Model**	• processor card and clam shell enclosure
	weight/dimensions	• 0.46 kg (1 lb) • 160 L x 178 W x 43 H (mm) 6.3 L x 7 W x 1.7 H (in.)
	Quantity	• one per 4 sensor zones
	Enclosure	• painted aluminum
	Cable entry ports	• 6 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.)
	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)
	Mounting	• surface-mount on a flat stable surface • rack-mount • DIN rail mount • post-mount (requires Customer supplied weatherproof enclosure)
	Alarm zones	• 4 independent sensor zones each with up to 300 m (984 ft.) of cable
	Cable cut	• reported and located to specific alarm zone
	Power consumption	• 2 W nominal
	Power input	• 12 to 48 VDC OR PoE
	Connectors	• removable terminal block for power input • RJ45 PoE port for Ethernet communications and power input • removable terminal blocks for relay output connections • removable terminal blocks for auxiliary input/self-test connections • 8 X SC/APC connectors for fiber optic lead-in cable input/output • USB port for UCM connection • 20-pin socket for network interface card • micro SD card slot

Processor	**Controls**	• calibration adjustments via the Universal Configuration Module (Windows-based software application)
	Inputs	• 4 lead-in cable receive signal inputs (1 per zone) • 2 auxiliary device/self-test inputs
	Outputs	• 4 lead-in cable transmit laser outputs (1 per zone) • 6 form C relay outputs rated 30 VDC @ 1 A maximum, non-inductive load user-configurable relay response • onboard lightning protection for inputs and outputs
	LED indicators	• power • laser • zone activity • SD card connected • network communication channels A/B
	Supervision	• sensor cable • lead-in cable • processor operation • network communications
	Temperature	• -40º to +70ºC (-40º to +158º F)
	Relative humidity	• 0 to 100%
	Frequency response	• selectable frequency response band 1 kHz - 40 kHz
Senstar sensor cable	**Sensor cable/lead-in cable part numbers**	• F4SP0100 12 fibers, 250 m (820 ft) 8.6 kg (19.0 lb) 29 cm h x 29 cm diameter (11.5 in. h x 11.5 in. diameter) • F4SP0101 12 fibers, 1000 m (3280 ft) 30.8 kg (67.8 lb) 42 cm h x 37 cm diameter (16.5 in. h x 14.75 in. diameter) • contact the factory if you require greater lengths of cable
	Max. sensor cable length per zone	• 300 m (984 ft.)
	Max. lead-in cable length to start of each zone	• 20 km (12.4 mi)
	Dark fiber count	• 4 to 10 depending on configuration (contact factory for additional dark fibers available for perimeter applications; requires alternate splice enclosure)
	Fiber type/wavelength	• single-mode / 1550 nm
	Bend radius (smallest allowable)	• dynamic (during installation) - 20 x OD 12 cm (4.8 in.) • static (during operation) - 10 x OD 6 cm (2.4 in.)
	Tensile rating	• during installation - 800 N (600 lbf)
	Outside diameter/weight	• 6 mm (0.25 in.); 25 kg/km (55 lb/3280 ft)
	Sensor fiber length matching	• max. allowable difference in length of the two sensor fibers between the start module and end module for each zone is ± 5 mm (0.2 in.)
	Optical power loss	• max. allowable loss 0.3 dB/km (averaged over length of cable) • max. cable attenuation 0.25 dB/km @ 1550 nm • max. loss per event (e.g., fusion splice) 0.1 dB