Optellios

Section 28 16 43
Perimeter Security Systems

FiberPatrol FP6100-X
Location-Sensing Fiber-Optic Intrusion Detection System
Buried Pipeline Applications

Architectural and Engineering Specifications

TECHNICAL SPECIFICATIONS
DIVISION 28 - SPECIAL CONSTRUCTION
SECTION 281643 - PERIMETER INTRUSION DETECTION SYSTEM

PART 2 – PRODUCTS

2.01 GENERAL

A. All equipment and materials used shall be standard components, regularly manufactured, and regularly utilized in the manufacturer's system.

B. All systems and components shall have been thoroughly tested and proven in actual use.

C. All systems and components shall be provided with the availability of a technical support phone number from the manufacturer. The phone number shall allow for immediate technical assistance for either the dealer/installer or the end user.

D. All systems and components shall be provided with an explicit manufacturer warranty.

2.02 SYSTEM DESCRIPTION

A. The system shall be a fiber-optic intrusion detection system for promoting pipeline security.
B. The system shall incorporate a buried fiber-optic vibration sensor cable.
C. The system shall incorporate rack-mounted instrumentation (head end) located at an indoor equipment room.
D. The system shall incorporate a fiber-optic lead cable connecting the sensor to the head end.
E. The system shall support mixed sensor installation modes including above and below ground within a single system.
F. The system shall require no mechanical, electrical or electronic components in the field.
G. The system shall require no electrical power in the field.
H. The sensor cable shall incorporate optional dark fibers for video and data communication.
I. The system shall be capable of monitoring changes in the optical signal resulting from the vibration of the sensor.
J. The system shall be capable of detecting ground vibrations associated with third-party intrusion.
K. The system shall be capable of locating the point of intrusion.
L. The system shall be capable of detecting and locating multiple simultaneous intrusions.
M. The system shall be capable of detecting and locating a sensor cable cut.
N. In the event of sensor cable cut, the system shall retain detection and location ability in the contiguous portion of the sensor cable.
O. The system shall provide a PC-based operator interface with graphical alarm annunciation at the head end.
P. The system shall be capable of communicating alarm information to local or remote recipients via computer network.
Q. The system shall meet or exceed performance criteria provided by Fiber Patrol FP6100-X as manufactured by Optellios, Inc., 11 Penns Trail, STE 300, Newtown, PA 18940, U.S.A.

2.03 SYSTEM COMPONENTS

A. Field components shall include

1. Fiber-optic sensor cable
2. Fiber-optic lead cable
3. Sensor termination module(s)
4. Fiber-drop module(s) (optional)
5. Installation hardware

B. Head end components shall include

1. Sensor controller module

2. Alarm processor module
3. LCD / keyboard / touchpad module (optional)
4. Uninterrupted power supply (optional)
5. Equipment rack (optional)
6. Power and data cables
7. Fiber-optic patch panel
8. Fiber-optic patch cords
9. System interface software
10. Software drivers and components

2.04 SUBMITTALS

A. System data sheet
B. System shop drawings
C. System installation plan (after site survey)

2.05 SYSTEM PERFORMANCE

A. Detection Principles

1. The system shall sense the changes in the optical signal resulting from the minute motion of the fiber strand(s) within the fiber-optic sensor cable.
2. By burying the sensor cable in-ground, the motion and/or vibration of the ground shall be monitored.
3. The sensitivity of the sensor to the ground vibrations shall depend on the ground type and condition and on the sensor configuration.
4. Location of a disturbance along the sensor length shall be determined from the time of arrival of the changed optical signal.

B. Factors Affecting System Performance

1. System performance benchmarks are not fixed and may be influenced by factors related to the ground type and condition, vegetation, environment, as well as on configuration and depth of the buried sensor.
2. The system shall have variable detection parameters that shall enable adjustments to the tradeoff between the system sensitivity and the confidence of detection.
3. System performance with respect to specific types of intrusion attempts shall depend on the exact nature, intensity, and duration of the intrusion, as well as the system detection settings.

C. Probability of Detection

1. The system shall generate and report an alarm with greater than 95% probability for an isolated non-stealthy excavation attempt in the area directly above the sensor cable, before such excavation reaches the cable.
2. Such attempts shall include
    a. Digging using excavation equipment
    b. Digging using manual tools

D. Time to Detection

1. The system shall be capable of generating an alarm within one second from the onset of an intrusion attempt that involves a substantial disturbance of the sensor cable.
2. Other detected intrusion attempts shall be reported no later than one second after the event is completed.
3. The time-to-detection shall generally depend on the type and intensity of the intrusion activity and the specific timing and sensitivity settings of the system.

E. Accuracy of Intrusion Location

The location along the fiber-optic sensor cable of an isolated intrusion attempt in quiet environment shall be determined and reported with an absolute accuracy better than 100 feet (30 meters) in 95% of detected intrusion attempts for a standard installation.

F. False Alarms

The false intrusion alarms generated due to occurrences other than sensor cable motion / vibration shall be limited to less than one such alarm per month of continuous operation.

G. Nuisance Alarms

1. The system shall be immune to nuisance alarms and performance degradation originating from electromagnetic and radio-frequency interference in the field.
2. The system shall be intrinsically capable of rejecting nuisance alarms due to moderate non-localized environmental disturbances.
3. The system shall be capable of rejecting low-level localized or semi-localized disturbances such as those created by small animals or nearby vehicle traffic.
4. The system shall employ adaptive filtering algorithms to minimize the rate of environmental alarms.

H. Cable Cut

1. The system shall be capable of detecting and locating a sensor cable cut.
2. The cut location shall be determined and reported with an absolute accuracy of better than 100 feet (30 meters).
3. In the event of a sensor cable cut, the system shall retain detection and location ability in the portion(s) of the sensor cable that remain connected to the system head end.
4. The system shall support self-healing sensor ring architecture.

2.06 FIBER-OPTIC SENSOR

A. Fiber-Optic Sensor Cable

1. The sensing element of the system shall be an outdoor-grade fiber-optic cable.
2. The sensor cable shall be rated for aerial and duct installations according to the accepted industry standards.
3. The outer jacket of the cable shall be made of black UV-resistant medium-density polyethylene.
4. The outer jacket of the cable shall carry length identification markings as well as Optellios proprietary labels.
5. Internal cable construction shall include water-blocking materials and re-enforcement structures such as a strength member.
6. The outside diameter of the standard sensor cable shall be approximately 0.45”.
7. Cable shall be shipped to the installation site in one or several segments, subject to availability, unless otherwise specified at the time of ordering.
8. The sensor cable shall have a nominal lifetime of 20 years.
9. The standard sensor cable shall include no mechanical, electrically powered, conducting or emitting parts.

B. Optical Fibers

1. The fiber-optic sensor cable shall include communication-grade single-mode optical fiber strands.
2. General fiber-optic cable construction.
    a. Fiber strands shall be contained in gel-filled loose buffer tubes.
    b. The fiber-optic sensor cable shall be capable of housing up to 6 such tubes.
    c. Each buffer tube shall house 6 or 12 fiber strands.
3. Standard sensor cable construction.
    a. The sensor cable shall include 3 buffer tubes housing 6 fiber strands each.
    b. The sensor cable shall include 18 fiber strands total.
    c. Two (2) tubes with 12 fibers shall be reserved for system operation.

d. One (1) tube with 6 fibers shall be spare.

C. Optional Data and Video Links

1. The fiber-optic sensor cable may optionally include communication-grade single-mode and/or multi-mode fiber strands to be used for data and video communication.
2. Up to 54 dark fibers may be optionally added to the standard sensor cable.
3. The access to optional fibers shall be provided at
    a. Fiber drop-off enclosures at customer-specified perimeter locations.
    b. Fiber patch panel at the head end location.

D. Fiber-Optic Sensor Length

1. The system shall be capable of monitoring fiber-optic sensor cable with total length of up to 25 miles (40 km).
2. Shorter sensor length may be recommended based upon the considerations of the type and condition of the carrying structure (e.g., fence), the prevailing weather conditions, and the amount of human, animal, and vehicle traffic.
3. Installations that require zigzagging of the sensor cable will have the maximum effective length of the protected perimeter reduced accordingly.

E. Fiber-Optic Sensor Layout

1. The system shall be capable of monitoring a single continuous fiber-optic sensor cable deployed in an open-loop or closed-loop configurations.
2. Special recommendations for more complex perimeter layouts shall be made following a site survey.

F. Environmental Specifications

1. The fiber-optic cables shall withstand operation temperatures between -40°F and +158°F (-40°C and +70°C).
2. The fiber-optic sensor cable shall operate within said temperature range without performance degradation.
3. The fiber-optic cables shall be shipped and stored within temperature range between -40°F and +167°F (-40°C and +75°C).

G. Additional Fiber-Optic Cable Specifications

1.	Outside Diameter, 5 Tubes	0.44” (11.2 mm)
2.	Outside Diameter, 6 Tubes	0.47” (12.0 mm)
3.	Weight, 5 Tubes	52 lbs/kft (78 kg/km)
4.	Weight, 6 Tubes	62 lbs/kft (93 kg/km)
5.	Minimum Bend Radius, Static	10 x OD
6.	Minimum Bend Radius, Dynamic	20 x OD
7.	Tensile Rating, Installation	600 lbf (2700 N)
8.	Tensile Rating, Residual	180 lbf (800 N)
9.	Crush Resistance, Short Term	125 lbf/in (220 N/cm)
10.	Crush Resistance, Long Term	63 lbf/in (110 N/cm)
11.	Optical Loss @ 1550 nm	0.30 dB/km

2.07 SENSOR CABLE INSTALLATION

A. Ground Type and Condition Requirements

1. The ground shall be of the type conducive to propagating surface disturbance to the buried sensor cable.
2. A clearance area at least 10’ wide on each side of the sensor area shall be free of vegetation taller than 12”.
3. The clearance area shall be free of running water and ground erosion.

B. Fiber-Optic Sensor Cable Installation

1. Sensor cable installation requirements shall be determined based on the details of the ground type and prevailing conditions, as well as on construction and security considerations.
2. Unless otherwise specified, sensor cable shall be buried 3' (1m) deep in a single straight line.
3. Sensor cable shall be installed inside a standard 1.25" diameter HDPE utility conduit.

C. Fiber-Optic Sensor Termination

1. Both ends of the fiber-optic sensor shall be terminated with special termination modules.
2. The termination modules shall utilize passive fiber-optic components only.
3. The termination modules shall require no electrical power.
4. All fiber connections shall be permanent fusion splice connections.
5. The termination components shall be sealed inside outdoor-rated fiber-optic splice enclosure(s).
6. The termination enclosure(s) shall be directly buried or installed inside a buried vault filled with sand bags.
7. The termination enclosures shall only be opened by factory-trained and certified personnel. Unauthorized opening of the termination enclosures shall void any and all product warranties.
8. Termination enclosure specifications:
    a. Dimensions — 14.75"x8.5"x3" (375x216x76mm)
    b. Weight, unloaded — 4.0 lbs (1.8 kg)
    c. Maximum splice count — 24

D. Fiber-Optic Lead Cable

1. The fiber-optic lead cable shall connect the fiber-optic sensor to the head-end equipment.
2. The lead cable shall be insensitive.
3. The lead cable may consist of an outdoor and an indoor sections as necessary.
4. The outdoor lead cable shall be of the same type as the sensor cable unless otherwise specified.
5. The length of the lead cable shall be less than 25 miles (40 km).
6. The combined length of the sensor and lead fiber-optic cables shall be less than 25 miles (40 km).
7. The lead cable shall be installed inside existing or specially added duct path.
8. Generally accepted or site-specific requirements pertaining to communication infrastructure shall apply to lead cable installation.
9. The outdoor end of the lead cable shall be connected to the sensor cable inside the near-end termination enclosure or a separate fiberoptic splice enclosure.
10. The indoor end of the lead cable shall be terminated inside the fiber patch panel installed in proximity to the head end equipment.

2.08 SYSTEM HEAD END

A. Head End Components and Installation

1. The head end components shall include
    a. Sensor controller module
    b. Data processor module
    c. Slide-out LCD / keyboard / touchpad drawer (console)
    d. Fiber-optic patch panel
2. The head end components shall be designed for standard 19"-wide rack.
3. The rack shall not be included unless specially ordered.
4. The rack shall have at least 22" depth clearance with rear access for module interconnects and unimpeded air circulation.
5. The rack shall have at least 2" of clearance in front of the mounting rails.
6. The head end equipment shall require
    a. 7RU contiguous rack space for modules only

   b. 9RU contiguous rack space for modules with patch panel and console
7. The head end equipment shall be mounted at least 12” above floor level.

B. Head End Mechanical Specifications

1.	Width	19” (482 mm)
2.	Depth w/o cables	19” (482 mm)
3.	Depth w/ cables	22” (559 mm)
4.	Height, Processor Module	4 RU – 7” (178 mm)
5.	Height, Controller Module	3 RU – 5.25” (134 mm)
6.	Height, Console	1 RU – 1.75” (45 mm)
7.	Height, Patch Panel	1 RU – 1.75” (45 mm)
8.	Weight, Processor	43 lbs (19.5 kg)
9.	Weight, Controller	26 lbs (11.8 kg)
10.	Weight, Console	23 lbs (10.5 kg)
11.	Weight, Patch Panel	11 lbs (5 kg)

C. Head End Fiber Connections

1. Fiber-optic lead cable shall be connected to the sensor controller module via a fiber patch panel and a set of fiber patch cords.
2. Standard fiber patch panel shall have the following characteristics:
   a. compatible with standard 19”-wide rack, 1RU high
   b. designed to hold up to 12 fiber-optic splices
   c. splice access via front-end slide-out tray
   d. front- and rear-end patch cord access
   e. rear-end lead cable access
3. Fiber patch panel shall be mounted in the rack space adjacent to the head end equipment.
4. Optionally, fiber patch panel can be wall-mounted in an accessible location within 6’ from the cabinet containing the head end equipment.

D. Data Processor Module

1. The system shall be controlled by the software running on the data processor module.
2. The data processor module shall be PC-based.
3. The data processor module shall include the following or similar:
   a. 1.86 GHz Intel Nehalem CPU
   b. 3.0 GB DDR3-1333 ECC RAM
   c. Two 500 GB 7,200 RPM SATA HDD – Raid 1
   d. DVDRW drive
   e. 550 W redundant universal power supply
4. The data processor module shall operate under Microsoft Windows XP Professional 2002 SP3 operating system or similar.
5. The data processor module shall provide a network connection with the following features:
   a. Built-in dual 10/100/1000base-T Ethernet interface
   b. Two RJ45 connectors
   c. Connection via standard CAT5 cable

E. Optical Characteristics

1. Active optical components shall be contained in transmitter and receiver modules.
2. The fiber-optic inputs and outputs shall be of the FC/APC type.
3. All optical components shall be either fiber-based or sealed fiber-pigtailed devices.
4. Sensor controller module shall incorporate a Class IIIb infra-red laser.
   a. The laser shall operate in the 1550 nm wavelength band.
5. No free-space laser beams shall be present during normal operation.
6. System optical power margin shall be no less than 6 dB.

F. Head End Power Requirements

1. Head end equipment shall require
   a. 100 to 240 Volts AC, 50 / 60 Hz electrical power line.
   b. Four (4) power outlets.

c. Maximum of 325 W of electrical power.

2. An uninterrupted power supply (UPS) and/or a stand-by power generator is recommended for continuous system operation.
3. The UPS shall not be included unless specially ordered.

G. Optional Console Specifications (Typical, Subject to Availability)

1.	LCD dimension	15”
2.	Resolution	up to 1024 × 768 (XGA)
3.	Brightness	250 cd/m^2
4.	Contrast	400:1
5.	Video input	VGA
6.	Keyboard	PS/2
7.	Touch Pad	PS/2

H. Head End Environmental Specifications

1. The head end equipment shall operate between +50°F and +95°F (+10°C and +35°C).
2. The head end equipment shall operate in relative humidity of 20% to 80%, non-condensing.
3. The head end equipment shall be shipped and stored within temperature range between -4°F and +158°F (-20°C and +70°C).
4. The head end equipment shall be shipped and stored in relative humidity of 5% to 85%, non-condensing.

2.09 SYSTEM SOFTWARE

A. Modes of Operation.

The system software interface (Fiber Patrol Software Interface or FPSI) shall support the following general modes of operation:

1. Standalone
2. Interfaced to Fiber Patrol Remote Alarm Management System (FPRAMS)
3. Interfaced to third-party alarm management system (subject to separate software development terms and conditions).

B. Functionality.

FPSI shall support the following functions:

1. Hardware monitoring and control
2. Sensor signal processing and analysis
3. Event detection and alarm generation
4. Basic alarm management
5. Event and alarm logging
6. Detection zone definition and configuration
7. Adjustment of detection parameters
8. Local operator interface
9. Remote interface

C. Secure System Access

1. FPSI shall require a valid password at start-up and shutdown time.
2. FPSI shall provide at least three access levels:
    a. Operator level for routine operation
    b. Supervisor level for advanced system monitoring, configuration, and troubleshooting
    c. Installer level for advanced configuration and troubleshooting

D. Hardware Monitoring and Control

1. FPSI shall monitor the operating status of system components.
2. FPSI shall alert local and remote operators of any detected system component failure.

E. Graphical Alarm Display

1. FPSI shall incorporate an image depicting the protected site with a schematic perimeter overlay.
2. Each new alarm shall be annunciated by
    a. flashing notification message
    b. location marker displayed on the site image
3. The site image and alarm location marker shall be provided for visual reference only.
4. Subject to availability, the site image shall be one of the following:
    a. satellite photo
    b. aerial photo
    c. map
    d. schematic
5. The quality and fidelity of the image shall be subject to availability.
6. Integration of a site image shall require detailed mapping of the perimeter, performed at the time of system installation and calibration.

F. Alarm Management

1. FPSI shall maintain complete information on all alarms for 24 hours or until the alarm is cleared.
2. Alarms shall be cleared by local or remote operator or automatically in 24 hours after alarm generation.
3. Until cleared, the alarm information shall be compiled in a scrollable multi-column table.
4. The maintained information shall include
    a. unique alarm ID number
    b. time label
    c. event duration
    d. event status
    e. event strength
    f. event location
5. Operator shall be able to
    a. select any of the alarms from the list
    b. enter text notes regarding the cause of the alarm and the mitigation measures
    c. clear the alarm
6. Operator notes as well as the alarm clearing event shall be recorded in the event log.

G. Alarm Location Formats

1. The primary format of the alarm location
    a. shall be the linear position along the sensor cable
    b. may optionally match the length marks printed on the cable
    c. shall be expressed in feet, unless otherwise specified at the time of ordering
2. Secondary location formats shall be derived from the primary measure using appropriate calibration tables.
3. Secondary location formats shall require corresponding mapping of the perimeter fence line.
4. Optionally available secondary alarm location formats shall include
    a. latitude and longitude (GPS) coordinates
    b. software-defined zones

H. Event Logging

1. FPSI shall maintain and display an event log, including alarms, system notifications, and user actions.
2. The logs shall be periodically saved to the hard drive.
3. A new set of log files shall be generated every 24 hours at midnight.

I. Standard Remote Interface

1. FPSI shall incorporate ASCII text-based input/output interface for integration with FP RAMS and third party alarm management software products.
2. The interface shall utilize custom XML formatting.
3. Standard communication modes shall include
    a. TCP/IP server
    b. TCP/IP client
4. The maximum connection bandwidth requirement shall be 100 kBytes/sec.
5. FPSI remote interface shall support broadcast and query modes.
6. In the broadcast mode, the alarm information shall be continuously sent to the recipient.
7. In the query mode, the recipient shall request the alarm information strings.
8. The remote recipient shall be able to clear alarms and query/set select system parameters.

J. Custom Remote Interface Capabilities

1. The alarm data format and communication mode may optionally be customized to fit the requirements of third-party monitoring products.
2. Custom interface development shall be subject to separately defined terms and conditions.
3. A limited list of custom interface capabilities includes
    a. Hardware input/output
        i. RS-232
        ii. Relays
    b. Network-based input/output
        i. E-mail (SMTP, SOAP) messages
        ii. Instant messaging (SMS)

2.10 PRODUCT AVAILABILITY

A. The system as described herein is manufactured by

Optellios, Inc.
11 Penns Trail
STE 300
Newtown, PA 18940
U.S.A.
phone: 1.267.364.5298
fax: 1. 267.364.5357
email: info@optellios.com

2.11 WARRANTY AND SERVICE

A. The system shall be free of defects in workmanship and material under normal operating conditions for a period of one year from the date of shipping.

B. Any parts shown defective in workmanship or material during the warranty period shall be repaired, replaced or adjusted free of charge.

C. The system shall be supported with service and replacement parts available for a period of 5 years from the date of shipping.

D. Warranty and general service shall be provided by

Optellios, Inc.
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