



Section 28 16 43

Perimeter Security Systems

FiberPatrol FP3200

Multi-Zone Fiber-Optic Intrusion Detection System
Masonry Wall Application

Architectural and Engineering Specifications

TECHNICAL SPECIFICATIONS
DIVISION 28 – ELECTRONIC SAFETY AND SECURITY
SECTION 28 16 43 - PERIMETER SECURITY SYSTEMS

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 perimeter security.
- B. The system shall incorporate a wall-mounted fiber-optic vibration sensor.
- C. The sensor shall be divided into detection zones connected by zone termination modules.
- D. The sensor cable shall incorporate optional dark fibers for video and data communication.
- E. The system shall incorporate rack-mounted instrumentation (head end) located at an indoor equipment room.
- F. The system shall incorporate a fiber-optic lead cable connecting the sensor to the head end.
- G. The system shall require no electrical power in the field.
- H. The system shall be capable of monitoring changes in the optical signal resulting from the vibration of the sensor.
- I. The system shall be capable of detecting cable vibrations induced by attempts to scale or breach the wall.
- J. The system shall be capable of identifying the detection zone in which the breach is attempted.
- K. The system shall be expandable to support multiple sensors each comprising multiple intrusion detection zones.
- L. The system shall provide a PC-based operator interface with graphical alarm annunciation at the head end.
- M. The system shall be capable of communicating alarm information to local or remote recipients via computer network.
- N. The system shall meet or exceed performance criteria provided by Fiber Patrol FP3200 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. Zone termination modules
 - 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 relative motion of the fiber strands within the fiber-optic sensor cable.
 2. The system shall monitor the optical signal continuously.
 3. The sensitivity of the fiber-optic sensor shall be continuous and uniform across its entire length.
 4. The sensor cable shall be installed in a manner maximizing the probability of contact between the cable and an intruder.
- B. Factors Affecting System Performance
 1. System performance benchmarks are not fixed and may be influenced by factors related to the wall construction, integrity, environment, and the type of sensor installation.
 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 scaling attempt in quiet environment that involves direct and prolonged contact with the sensor cable, or cable supporting hardware, and results in the intruder's crossing of the wall line.
 2. Such attempts shall include
 - a. Unassisted scaling
 - b. Ladder-assisted scaling, with ladder leaned against the top edge of the wall
 - c. Rope-assisted scaling, with rope thrown across the top of the wall
- 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 an aggressive contact with 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. Intrusion Location
 1. The system shall be capable of identifying the detection zone in which the intrusion attempt occurs.
 2. Intrusion attempts occurring in the immediate proximity to an in-line zone termination module may be reported in either or both of the adjacent detection zones.

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. When installed according to the specifications, the system shall be capable of rejecting environmentally induced disturbances.
3. The system shall provide a set of variable detection parameters for each detection zone that shall enable adjustments to the tradeoff between the zone sensitivity and the confidence of detection.
4. The system shall employ adaptive filtering algorithms to minimize the rate of environmental alarms induced by stormy weather.

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. The nearest zone termination modules or fiber drop-off enclosures at customer-specified perimeter locations.
 - b. Fiber patch panel at the head end location.

D. Intrusion Detection Zones

1. The standard sensor cable shall support up to four detection zones.
2. Sensor cable shall optionally support up to 64 detection zones.

E. Detection Zone Length and Overall Sensor Length

1. The system shall be capable of monitoring intrusion detection zones with length of up to 100 km (62 miles).
2. Detection zone length shall be recommended based upon the considerations of the type and condition of the perimeter barrier, the prevailing weather conditions, and the amount of human, animal, and vehicle traffic, etc.
3. The system shall be capable of monitoring fiber-optic sensor cable with combined length of up to 100 km (62 miles).
4. Installations that require zigzagging of the sensor cable will have the maximum effective length of the protected perimeter reduced accordingly.

F. Fiber-Optic Sensor Layout

1. The system shall be capable of monitoring a single multi-zone fiber-optic sensor cable deployed in an open-loop or closed-loop configurations.
2. The system shall be capable of monitoring custom sensor layouts including multi-cable and branching structures.
3. Special recommendations for complex perimeter layouts shall be made following a site survey.

G. 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).

H. 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. Masonry Wall Requirements

1. Wall construction shall conform to industry standards for security walls.
2. Wall shall be maintained and repaired in accordance with the industry standards.
3. Clearance area shall be at least 10' wide on each side of the wall.

B. Fiber-Optic Sensor Cable Mounting

The contents of this document are subject to change without notice.

1. Sensor cable mounting shall be selected based on the details of the wall shape and structure, wall materials, related construction and security requirements, and aesthetic preferences.
2. Standard sensor cable mounting options shall include
 - a. Single cable run along the outer top edge of the wall
 - b. Dual cable run along the outer and the inner edges of the wall
 - c. Single or dual run of cable attached to wire-mesh copping
 - d. Single or dual run of cable under the top stone
 - e. Special cable patterns shall be used around wall corners, steps, etc.
3. Sensor cable attachment for edge mounting
 - a. The sensor cable shall be mounted parallel to the wall edge, 0.5" to 1.5" outside from the vertical face of the wall.
 - b. The sensor cable shall be mounted above the top surface of the wall.
 - c. Cable shall be attached to the wall using P-type cable clamps.
 - d. Unless otherwise specified, the cable shall be attached
 - i. At least every 24".
 - ii. At least 6" away from wall corners, steps, etc.
 - e. Cable clamps shall be anchored to the wall at least 1" from the edge
 - f. Cable clamps shall be anchored at least 0.5" deep with 8-gauge masonry nails or similar.
 - g. The cable shall be attached under manual tension.

C. Gate Bypass

1. The sensor cable shall be buried across gates and other openings in the perimeter barrier.
2. Overhead structures shall be alternatively used if present and factory approved.
3. The sensor cable shall be buried in conduit at least 12" deep.
4. Deeper burial shall be recommended for high-traffic or fast-traffic roadways and railroad tracks.
5. The ground entry points shall be protected by conduit extending at least 12" above ground.
6. The conduit path shall be offset to the inside of the perimeter barrier. The offset distance shall be determined by the following considerations:
 - a. Extent of underground utilities
 - b. Extent of gate post foundation
 - c. Access space requirements for trenching equipment
7. Split conduit specifications:

a. Material	Schedule 40 PVC
b. OD	2.375"
c. Section length	10'
d. Weight	8.1 lbs
e. 90° elbow dimensions	11.5" x 11.5"
f. 90° elbow bend radius	9.5"
g. Coupling sleeve length	6"

D. Building Bypass

In the situations where the perimeter barrier is interrupted by a building or other such structure, the sensor cable shall be routed around or through the obstacle in one of the following ways:

1. Buried at the foot of the structure. Subject to the requirements of §2.07.C.
2. Securely attached to and around the side or over the top of the structure. Subject to factory approval.
3. Routed through the structure and securely attached inside. Subject to factory approval.

E. Detection Zone Termination

1. Both ends of each intrusion detection zone shall be terminated with special termination modules.

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2. A termination module shall include termination components for all detection zones terminated at the location.
3. Optical fibers not terminated at the location shall pass in and out of the termination module.
4. The termination modules shall utilize passive fiber-optic components only.
5. The termination modules shall require no electrical power.
6. All fiber connections shall be permanent fusion splice connections.
7. The termination components shall be sealed inside outdoor-rated fiber-optic splice enclosure(s).
8. The termination enclosure(s) shall be mounted in a safe location inside the protected area
 - a. The termination enclosure(s) shall be secured to the face of the wall.
 - b. The bottom of termination enclosure shall be at least 12" above ground.
9. 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.
10. 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

F. 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 100 km (62 miles).
6. The combined length of the sensor and lead fiber-optic cables shall be less than 100 km (62 miles).
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 nearest zone 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. Alarm processor module
 - c. Optional slide-out LCD / keyboard / touchpad drawer (console)
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 24" 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. 5RU continuous rack space (without console)
 - b. 7RU continuous rack space (with console)
7. The head end equipment shall be mounted at least 12" above floor level.

B. Head End Scalability

1. The standard head end shall comprise one Sensor Controller module and one Alarm Processor module.
2. The standard head end shall support up to 4 detection zones.

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3. The system head end shall be optionally expandable to support up to 8 detection zones per controller and up to 5 controllers (40 detection zones) per processor.
4. The system head end shall be optionally expandable to support multiple Alarm Processors linked to a common operator interface.

C. Head End Mechanical Specifications

1. Width	19" (482 mm)
2. Depth w/o Cables, w/o Console	19" (482 mm)
3. Depth w/o Cables, w/ Console	22" (559 mm)
4. Depth w/ Cables	24" (610 mm)
5. Height, Combined	6 RU – 10.5" (267 mm)
6. Weight, Processor	30 lbs (13.6 kg)
7. Weight, Controller	17 lbs (7.7 kg)
8. Weight, Console	28 lbs (12.7 kg)
9. Weight, Combined	75 lbs (34 kg)
10. Weight, Shipping	150 lbs (68 kg)

D. 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 shall be wall-mounted in an accessible location within 6' from the cabinet containing the head end equipment.

E. Alarm Processor Module

1. The system shall be controlled by the software running on the alarm processor module.
2. The alarm processor module shall be PC-based.
3. The alarm processor module shall include the following or similar:
 - a. 2.2 GHz AMD 64 Dual Core CPU
 - b. 1.0 GHz system bus, 1 Mb cache
 - c. 1 GB DDR2 RAM
 - d. 74 GB 10,000 RPM SATA 150 HDD
4. The alarm processor module shall operate under Microsoft Windows XP Professional version 2002 SP2 operating system or similar.
5. The alarm processor module shall provide a network connection with the following features:
 - a. Built-in 10/100/1000base-T Ethernet card
 - b. One RJ45 connector
 - c. Connection via standard CAT5 cable

F. Optical Characteristics

1. Active optical components shall be contained in sensor controller module.
2. The fiber-optic inputs of the sensor controller module 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.
 - b. The laser output power shall not exceed 10mW.
5. No free-space laser beams shall be present during normal operation.
6. System optical power budget shall be less than the sum of
 - a. 11 dB fixed overhead
 - b. 0.3 dB per kilometer of cable
7. System optical power margin shall be no less than 5 dB.

G. Head End Power Requirements

1. Head end equipment shall require
 - a. 100 to 240 Volts AC, 50 / 60 Hz electrical power line.
 - b. Three (3) power outlets.
 - c. Minimum of 300W of electrical power.
2. An uninterrupted power supply (UPS) and/or a stand-by power generator are recommended for continuous system operation.
3. The UPS shall not be included unless specially ordered.

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

- | | |
|------------------|-----------------------|
| 1. LCD dimension | 15" |
| 2. Resolution | 1024 × 768 |
| 3. Brightness | 250 cd/m ² |
| 4. Contrast | 300:1 |
| 5. Video input | VGA |
| 6. Keyboard | PS/2 |
| 7. Touch Pad | PS/2 |

I. 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. Alarm generation
4. Basic alarm management
5. Event logging
6. Local operator interface
7. 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 two access levels:
 - a. Operator level for routine operation
 - b. Supervisor level for advanced system monitoring, configuration, and troubleshooting.

D. Hardware Monitoring and Control

1. FPSI shall alert local and remote operators of any detected system component failure.
2. FPSI shall enable the operator to adjust the sensitivity of each detection zone individually.
3. FPSI shall allow the operator to enable/disable individual detection zones.

E. Graphical Alarm Display

1. FPSI shall incorporate an image depicting the protected site with a schematic perimeter line overlay.
2. Each new alarm shall be annunciated by
 - a. flashing notification message
 - b. highlighted zone marker displayed on the site image
3. The site image and zone 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 mapping of the perimeter line, 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. detection zone
 - d. event duration
 - e. event status
 - f. event strength
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. 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.

H. 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.

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8. The remote recipient shall be able to clear alarms and query/set select system parameters.

I. 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. HTTP upload
 - ii. SNMP traps
 - iii. E-mail (SMTP, SOAP) messages
 - iv. 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: 267.364.5298
fax: 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. Local or locally represented service organization shall maintain trained and certified manpower adequate for the service needs of the installed system.
- D. Warranty and general service shall be provided locally by

Optellios Inc.
11 Penns Trail
STE 300
Newtown, PA 18940
U.S.A.
phone: 267.364.5298
fax: 267.364.5357
email: info@optellios.com

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