Architectural & Engineering Specification for

Fiber Optic Cable Fence Disturbance Sensor

Purpose of document

This document is intended to provide performance specifications and operational requirements for the IntelliFIBER™ fiber optic cable fence disturbance sensor. It is written in a generic format without referring to the IntelliFIBER system by name or by specific identifiers. These specifications may be copied verbatim to form a generic procurement specification for a fiber optic cable fence disturbance sensor.

Distribution of document

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Classification of equipment

The IntelliFIBER system is a fiber optic cable fence disturbance sensor, used in conjunction with fences, for outdoor perimeter intrusion detection. The IntelliFIBER system functions as a standalone system or as an integral component of a centralized control and maintenance facility.

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Contents

1.0 General performance specifications

1.1 System description

The fiber optic cable fence disturbance sensor shall function as an electronic perimeter intrusion detector. The system shall be used in conjunction with fences to protect the perimeter of a site. The system shall consist of an ultraviolet resistant fiber optic transducer cable, and a microprocessor based dual zone signal processor. The system shall be capable of monitoring different styles of metal fabric fencing such as chain-link, expanded-metal or welded-mesh fence. The sensor shall detect intruders by utilizing signals generated by the minute flexing of the fiber optic transducer cable, caused by attempting to cut, climb, or raise the fence fabric. The system shall be capable of functioning as either a standalone system (relay version processor) or as an integral part of a centralized control and maintenance facility (multiplex version processor).

1.2 System technology

The signal processor shall analyze the signals from the fiber optic transducer cable and shall detect minute vibrations in the fabric of the fence. The processor shall utilize adaptive algorithms, ambient signal compensation and selectable common-mode rejection, to discriminate between valid, false and nuisance alarms, without lowering the probability of detection. The processor shall identify, by type, a cut intrusion and a climb intrusion. The sensor shall have independent adjustments and thresholds for each type of intrusion and shall have the capability to completely mask climb or cut alarms.

1.2.1 Fiber optic cable

The cable transducer shall be an ultraviolet resistant fiber optic sensor cable and shall be attached to the fence by means of ultraviolet resistant cable ties. The cable shall generate signals when an attempt is made to cut, climb, or lift the fence fabric.

1.2.2 Signal processing algorithms

The system shall utilize digital signal processing techniques that employ adaptive algorithms, capable of adapting to specific fence types and environmental conditions.

1.2.3 Zone Optical Power Sensing

The detector module shall have a bar graph meter that displays the received power level for the selected zone in order to simplify field setup and to set the optimum power level independent of zone length.

1.3 Detection properties

1.3.1 Detection sensitivity

The system shall detect intruders climbing, lifting or cutting the fence while rejecting other environmental stimuli. The sensitivity level shall be adjustable for each zone's specific conditions.

1.3.2 Probability of detection

The probability of detection (PD) of an intruder cutting the fence, and for unaided climbing attempts shall be 95% with a 95% confidence factor.

1.3.3 False and nuisance alarms

1.3.3.1 System-generated alarms (False alarms)

The maximum rate for alarms generated by internal electronic processes (cables excluded) shall be less than one per zone per year, averaged over the total number of zones in the system.

1.3.3.2 Environmental alarms (Nuisance alarms)

The system shall operate within specification in typical outdoor environments. The system shall be installed in accordance with the manufacturer's recommendations to minimize the probability of alarms from the following factors while maintaining the full PD for valid intruders:

- precipitation including rain, snow, hail and fog
- sunrise/sunset
- wind
- temperature changes
- sandstorms
- motion of nearby objects (vehicles, etc.)
- motion of surface or underground water
- nearby vegetation up to 30 cm (1 ft.) high
- nearby sources of radio-frequencies and electro-magnetic interference
- seismic vibration
- acoustic or magnetic effects

1.3.3.3 Notification of environmental concerns

Before installation begins, the installer shall alert the customer, in writing, as to all site-specific conditions that may contribute to a higher environmental alarm rate. The customer shall decide whether to remedy the situation or to accept the

nuisance alarm sources without any further responsibility on the part of the installer or the manufacturer.

1.4 Sensor characteristics

1.4.1 Sensor Cable

The sensor cable shall consist of fiber optic cable jacketed in an ultraviolet resistant material so that the cable can be installed directly on the fence with ultraviolet resistant cable ties, without the need of installation in conduit.

The sensor cable shall be available in three configurations:

- Dual (2) fiber optic core for single pass applications with the second fiber being used for the return signal, or for double pass applications with the second fiber being spare.
- Quad (4) fiber optic core, two cores for detection (transmit and return), two cores for data collection and transmission in a networked application.
- Quad (4) fiber optic core, plus two jacketed 16 GA copper wires for networked power distribution.

All configurations shall be available in rolls of 100 m (328 ft.), 200 m (656 ft.) and 305 m (1000 ft.). Further, the dual configuration and the quad configuration without power distribution shall each be available in rolls of 1000 m (3281 ft.).

1.4.2 Zone length

The maximum length of each zone shall contain 2000 m (6562 ft.) of sensing fiber optic cable. Individual zone lengths shall be determined by the physical boundaries of each zone.

1.4.3 Fence height

For regular chain-link (i.e. not vinyl-coated), welded-mesh, palisade, barbwire, and concertina fences the following requirements shall apply:

- For fence heights up to 2.5 m (8 ft.) high, a single cable, attached at the midpoint of the fence, shall be adequate for intruder detection.
- For fence heights between 2.5 m (8 ft.) and 4.0 m (15 ft.), the cable shall be deployed in a double pass, with the cables spaced evenly from each other and the top and bottom of the fence.
- For fence heights greater than 4.0 m (15 ft.), the cable shall be deployed in a triple pass with the cables spaced evenly from each other and the top and bottom of the fence.

Depending on the height and type of fence, and the level of security required, it may be necessary to increase the number of cable passes.

1.4.4 Conduit

It shall not be necessary to install the fiber optic sensor cable in conduit in order to reduce the false/nuisance alarm rate from environmental causes to an acceptable level.

2.0 Signal processor specifications

2.1 Signal processor description

Each signal processor shall be capable of monitoring two detection zones. The processor shall operate either as a standalone unit with local alarm relays, or as an integral component of a centralized control and maintenance facility. The processor shall include internal circuitry to protect against lightning and voltage transients.

The multiplex version processor shall be used in conjunction with a PC based alarm display and control system, and shall be capable of providing multiplexed communications via twisted pair copper wire or via fiber-optic cable.

2.2 Signal processor operation

2.2.1 Distributed processing

The signal processors distributed along the perimeter shall receive and process the signals from the sensor cables while providing fail-safe operation. The failure of one processor shall not affect the signal processing of the other processors along the perimeter.

2.2.2 Total sensor cable length

Total sensor cable length shall be expandable from the 2000 m (6562 ft.) maximum using one dual-zone signal processor to an unlimited length using multiple processors. The detection zone shall be continuous and uniform, and there shall be no gap between the individual zones, when installed in accordance with the manufacturer's recommendations.

2.2.3 Alarm outputs

The relay version processor shall identify intrusion, fail, and tamper alarms locally by relay contacts. The multiplex version processor shall identify intrusion, fail, and tamper alarms to an alarm display and control system via multiplexed communications.

Alarms caused by climbing, cutting, or otherwise disturbing the fence fabric shall be identified as intrusion alarms. Intrusion alarms shall be distinguished from supervisory alarms.

Alarms caused by power failure, low input voltage, cable fault (cable cut or high loss due to physical stress), or internal electronic fault shall be identified as

supervisory alarms. Supervisory alarms shall be distinguished from intrusion alarms.

Alarms caused by opening the outer enclosure shall be identified as tamper alarms. Tamper alarms shall be identified as supervisory alarms.

The local alarm outputs shall be form C relays with n.o./n.c. contacts rated at 0.5 A, 30 VDC.

2.2.4 Auxiliary inputs/outputs, self-test inputs

Each relay version processor shall include two self-test inputs, that when activated, shall perform electronic self-tests of each alarm zone. Each multiplex version processor shall be capable of collecting and transmitting a minimum of two contact-closure events to the alarm display and control system through an internal interface. The interface shall provide a minimum of two supervised input points and two relay output points to report and control the activity of auxiliary devices.

2.2.5 Continuous Light Level Monitoring

The signal processor shall continuously monitor the light intensity of the received signal. The processor shall declare a supervisory alarm whenever the light intensity drops below the set limit.

2.3 Environmental operating range

The system shall operate within specifications under the following environmental conditions:

- temperatures between -40° C (-40° F) and 70° C (158° F)
- relative humidity between 0 and 95%, non-condensing

2.4 Powering requirements

The processor shall operate at 12 VDC, and shall accept input power from DC power supplies at:

- 12 to 15 VDC, for individual unit powering
- 18 VDC to 56 VDC, for multiple unit powering

2.5 Physical installation criteria

When installed outdoors, the signal processor shall be installed in a weatherproof, painted aluminum NEMA 4 enclosure, which meets standard IP 66. The enclosure shall include a hinged cover, stainless steel hardware and a Hall Effect tamper device. The enclosure shall be mounted on a pole, separate from the fence on which the sensor cables are mounted, on the secure side of the perimeter. Each processor shall include a suitable ground rod, to provide an earth ground connection.

2.6 Sensor calibration

Each sensor zone shall be capable of being calibrated from its respective signal processor. Sensor calibration shall be made using a configuration module, which shall allow the technician to adjust and monitor the response of each zone. The configuration module shall be detachable via a snap-in connector and shall be capable of calibrating each of the processors in the system. The configuration module shall receive power from the processor and shall not require batteries, calibration or maintenance. Accessing the snap-in connector shall require the opening of the processor's enclosure. This action shall cause a tamper alarm to be generated.

For the multiplex version processor, each sensor zone shall be capable of being calibrated remotely, over the security network, via the Universal Configuration Module (a Windows-based software application).

2.6.1 Calibration parameters

The following system parameters shall be adjustable by the user:

- **Cut detection**: independent threshold, count and time per zone
- **Climb detection**: independent threshold, duration and time per zone
- **Preamp gain**: to match the fence to the sensor
- **Laser Output Power**: optimize the laser output level for each zone independently using the on-board Received Power meter

2.6.2 Restricted calibration parameters

The following system parameters shall be adjustable by the user, through the use of a restricted pass-code. These parameters shall only require adjustment for highly specialized applications:

- **Ambient compensation**: enable/disable, level (for background effects)
- **Common mode rejection**: enable/disable (for environmental effects)
- **Peak trigger value**: (to identify intrusion over background)
- **Cut profile value**: (to better define a cut event over environmental effects)
- **Alarm output relay activation time**: between 0.5 s and 5.0 s

2.7 Audio Module

An optional audio module shall be available to allow an operator to listen to fence noise to assess possible intrusions. The system shall allow audio monitoring of each zone separately or any combination of zones over a twisted-pair audio cable.

2.8 Weather station

An optional weather station shall be available to monitor weather conditions at the site and to supply the data to the signal processor. The processor shall utilize the data to increase the level of discrimination between environmental effects and actual intrusion attempts.

3.0 System installation and commissioning

The system shall be installed and commissioned in accordance with the manufacturer's recommended procedures as defined in the product's installation and setup guides.

Prior to installation, the installer shall have completed a manufacturer's training program and be certified by the manufacturer. Alternatively, the installer shall be required to have the manufacturer, or their designate, provide qualified technical support for installation and commissioning.

Acceptance tests shall be performed in accordance with standard procedures available from the manufacturer.

The multiplex version fiber optic cable fence disturbance sensor shall be capable of being integrated into a centralized control and maintenance facility.

4.0 System maintenance and repair

4.1 Recalibration requirements

There shall be no need to recalibrate the system after initial calibration except as the fence condition deteriorates (loose fence elements or wires).

4.2 Sensor cable repair

If the sensor cable is cut or damaged, it shall be capable of being repaired using additional cable, if required, and an appropriate splice kit.

4.3 Product support

The product shall carry a minimum one-year warranty from the date of purchase.

The supplier shall warrant that the product shall be supported by spare parts and assemblies for a minimum of 10 years.

5.0 Product certifications

The manufacturer's management system shall have ISO 9001:2008 certification.

The product shall comply as a Class B digital device pursuant to both Part 15 of the FCC Rules, and the regulations of Industry Canada (IC).

For European installations, the product shall bear the CE mark.

6.0 System availability

A product that meets or exceeds this specification is the IntelliFIBER™ fiber optic cable fence disturbance sensor, available from:

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