SECTION 28 16 43

perimeter INTRUSION DETECTION SYSTEM

Fiber optic – rack mount

1. GENERAL
   * + 1. SCOPE OF WORK
          1. It is the intent of the Owner to purchase all the necessary components for a complete, installed and operable fiber-optic fence mounted intrusion sensor.
          2. The perimeter intrusion detection system shall be as described herein specified and indicated on any attached drawings, which define the general scope of the required services.
       2. GENERAL PERFORMANCE REQUIREMENTS
          1. System Description

The system shall be based on a multimode fiber optic sensor with single-channel rack-mounted DSP-based Processing Unit (PU) designed and configured for fence line, or wall. The system shall also incorporate the use of insensitive lead-in cables.

The fiber optic intrusion detection system shall function as a perimeter intrusion detector. The multimode fiber optic sensor cable shall be designed for encasement in flexible conduit and mounted on a perimeter fence or wall. The basic system shall consist of the fiber optic sensor cable, insensitive lead-in cables, flexible conduit, a single rack-mounted alarm processing unit, and a rack-mount enclosure.

The system shall provide intruder detection on various types of fencing such as chain link, expanded-metal, or welded-mesh fabric.

The system shall detect intruders and generate an alarm based on changes created in the sensor cable’s optical signal by any intruder action that causes vibration, motion or pressure. These actions are characteristic of an egression of a fence barrier in any of the following manners: fence climbing, post climbing, cutting, digging at the base of a fence, lifting of fence fabric, ladder assisted vaulting, or other fence contact bridging methods.

The system shall be capable of stand-alone operation. The system shall also be capable of integrating itself into a central control system by providing alarm relay contact outputs, XML output via TCP/IP, and/or an RS-232 interface, depending on requirements of the alarm monitoring system.

The performance criteria required for this project shall meet or exceed that of a perimeter intrusion detection system as provided by the original equipment manufacturer.

* + - 1. SUBMITTALS

The Contractor shall submit the following documents for review and approval prior to any shipment of components:

* + - * 1. Installation/operation manuals and instructions for all equipment furnished under this system.
        2. An overall perimeter site plan showing the detection zone layout.
        3. Site-specific layouts shall be provided showing major components and interconnections located on the perimeter.
        4. Standard system and sensor cable layout drawings shall be provided to the installer.
      1. SYSTEM TECHNOLOGY
         1. Alarm Processor

The Processing Unit (PU) shall analyze the signals from the fiber optic sensor cable and shall detect vibration, motion, or pressure acting on the fence. The processor shall use an advanced algorithm to determine actual alarms versus false or nuisance alarms.

The light source shall be a LASER or equivalent optical source providing sufficient coherent light to meet the system’s performance requirements.

The Processing Unit shall support a total sensor cable length of up to 800 meters (2625 feet).

The Processing Unit shall support sensing cable + insensitive lead-in cable lengths of up to 5 kilometers (3.1 miles).

Signal Processing Algorithms

The system shall use digital signal processing and an advanced algorithms capable of adjusting the performance to specific fence types and environmental conditions. Each Zone shall have two parallel internal processor channels - Processor 1 (“Climb”) and Processor 2 (“Cut”) - where a separate calibration is allowed for either processor providing detection for two distinctly different intrusion scenarios. Either processor may be turned ON or OFF. If they are both on, they are logically OR gated so that an ALARM will occur if the conditions for either Processor 1 or Processor 2 are satisfied.

* + - * 1. Fiber Optic Cable

The fiber optic sensor shall be made of glass and not plastic. The fiber shall be compatible with LASER light sources and shall be an outdoor rated fiber cable design

* + - * 1. Laser Monitoring

Each processor shall monitor the returning laser power and generate a “Fault” alarm if power falls below a pre-determined value.

* + - 1. SYSTEM PARAMETERS
         1. Processor Adjustments

Both internal processors shall have the following adjustments, menus, or entries available for tuning and setting up the system.

System:

Gain (overall system sensitivity)

Sensitivity

Prefilter

Processor 1: (Climb detection)

Enable/Disable

Signal

Lo frequency

Hi frequency

Duration

Tolerance

Event count

Event win

Event mask

Processor 2: (Cut detection)

Enable/Disable

Signal

Lo frequency

Hi frequency

Duration

Tolerance

Event count

Event win

Event mask

Software-based Wind Dependent Processing

Wind Reject (Enable / Disable)

Reject

* + - * 1. Perimeter Maximum Sensor Cable Length

Each Processing Unit alone will be capable of supporting 800 m of sensing cable for each zone. The maximum combination of lead-in and sensing cable length for each zone is 5km. Multiple Processing Units shall be capable of protecting a perimeter of any length when used in tandem.

* + - 1. DETECTION PROPERTIES
         1. Detection Sensitivity

Sensitivity shall be linear across the entire zone and shall be adjustable for each zone’s specific requirement.

* + - * 1. Probability of Detection

A properly installed system shall be capable of achieving a Probability of Detection (PoD) of not less than 0.95 at the 90 percent level of confidence.

The PoD and error rate is not fixed, and is a function of the parameter settings of the Processing Unit and sensor cable configuration.

PoD for an installed system cannot be stated without site and zone specific configuration testing to determine the PoD.

The more areas tested and the stricter the written test procedure used, the better the confidence level and more accurate the PoD result will be.

Testing procedures shall match the security level of the installation, which shall match the facility’s security level requirements. Stealthy or mechanically assisted climbing on low security installations would be inappropriate.

Inappropriate testing for the security level or procedures, and test results not documented or approved by the manufacturer for the installation, shall be given no credence.

* + - * 1. False and Nuisance Alarms

The system shall be set up to minimize both false and nuisance alarms by use of all the adjustments available. See section 1.05A. The fence shall be subsequently tested and inspected to determine if any problems exist that may cause these types of alarms.

System Internally-Generated Alarms (False Alarms)

False alarms are those alarms for which no cause can be immediately determined but later prove to be caused by something other than intrusion. In this case it will refer to those alarms generated by a properly functioning processor and attached sensor due to an internal processing error.

The maximum allowable False Alarm Rate (FAR) for a processor due to internally generated alarms shall be less than one per zone per year, averaged over the total number of zones in the system.

Environmental Alarm (Nuisance Alarms)

Nuisance alarms are defined as those alarms generated by a properly functioning APU and attached sensor cable, where the cause is known or suspected, and is not an intentional intrusion attempt (e.g. animals, wind-blown debris, etc.).

The system shall operate as specified when installed properly to the manufacturer’s recommendations in outdoor environments. The system shall be installed and the site and fence prepared before installation in such a manner as to minimize the Nuisance Alarm Rate (NAR) from the following possible causes and corrections:

Precipitation

Seismic activity acting on the fence

Ground vibration from nearby trains or heavy vehicle traffic near the fence line may cause nuisance alarms. These causes shall be filtered out through calibration of the system.

Wind-blown objects

Vegetation, including trees, shrubs, or extremely long ground cover striking the fence at intermittent intervals as the result of wind may cause nuisance alarms. These potential sources shall be trimmed, cut, or otherwise prevented from contacting the fence.

Fence Vibration

Fence-mounted signs and other loose materials or fence hardware shall be secured in place or removed as needed to prevent banging against the fabric or moving it. The fence fabric shall be consistently taut throughout the perimeter.

Other Potential Alarm Causing Factors

Any site specific concern, or any unusual application or condition that may lead to unacceptable false or nuisance alarm rates or other system problems, shall be communicated to the factory for analysis before ordering or installing any system.

Such concerns are best resolved by submitting photos and detailed synopses to the factory. Solutions to potential problems can usually be found through subsequent site work recommendations and selection of equipment designed to address concerns.

* + - 1. SENSOR CABLE

The sensor cable shall have a polyurethane outer jacket that is resistant to cuts, abrasions, UV radiation, and chemicals. The sensor cable shall be installed in non-metallic flexible conduit along its entire run on the fence. This sensor/conduit combination shall be attached to the fence by stainless steel wire ties, spaced approximately 12 to 14 inches (30 centimeters) apart.

* + - * 1. Sensor Cable Types

The sensor cable shall be available in the following configurations:

Single-fiber sensor cable in a 3-millimeter (OD) cable used for applications such as fences, walls, or roofs.

* + - * 1. Cable Lengths

Sensor cable is available in any length up to 800 meters (2625 feet).

* + - * 1. Zone Lengths

Zone lengths shall be determined by the physical shape of the perimeter and the security level required by the facility.

* + - * 1. Fence Material

The factory shall be consulted if fence materials other than chain link, expanded metal, welded-mesh fabric, or wrought iron decorative fence are to be used.

* + - * 1. Fence Height

The following configurations are for comparison only. The factory shall be consulted for actual layout configurations for any fence in excess of 12 feet (3.5 meters) in height. Layout of the sensor cable is strongly influenced by the security level desired, and should be designed accordingly. Contact the factory for assistance with high-level security design layouts.

A chain link fence comprised of hot-dipped galvanized steel, or steel with an electroplated applied coating, shall be 7 feet (2 meters) tall for a minimum single run of sensor cable mounted at the mid-point of the fence.

For the same fence material of 8 to 15 feet (2.5 to 4.5 meters) in height, a double run, or “loopback” configuration, shall be used, with mounting heights spaced from the top and bottom equal to one-fourth of the total fence height.

For the same fence material in excess of 15feet (4.5 meters) in height, a triple run or double loop configuration shall be used, with mounting heights equally spaced from top, center, and bottom equal to one-third of the total height.

* + - * 1. Conduit

Conduit protection has proven to extend the useful life of all sensor cables, and shall be used for both physical protection and facilitation of quick and easy sensor cable maintenance.

The conduit shall be supplied in a split or solid construction of UV-resistant, linear low density polyethylene (LLDPE).

Each 3-millimeter sensor cable shall be physically protected by conduit along its entire path on the fence.

All sensor cable and wiring running between the Processing Unit and the fence shall be protected by conduit. Special attention to protection shall also be given to the point at which the cable(s) enter and exit the ground, regardless of sensor type or application.

1. PRODUCT
   * + 1. SCOPE
          1. This document describes best-in-class specifications for a fence-mounted perimeter security system consisting of the following:

A linear sensor that is attached to a fence.

A processing unit consisting of electronic components used to interrogate the sensor.

Software running on a computer that allows the operator to control and tune the Processing Unit.

* + - * 1. This document does not include specifications for the complete perimeter security system, which would be expected to integrate one or more Processing Units with other security sensors as part of a total solution.
      1. GENERAL PERFORMANCE SPECIFICATIONS
         1. Lead-in Cable

The system shall be designed to allow the option of installing the Processing Unit in a safe location and remotely connecting the Processing Unit to the sensor via non-sensing lead-in fiber/cable.

The non-sensing lead-in fiber/cable + the sensing fiber/cable shall be capable of being at least 5km long.

The lead-in shall not increase the susceptibility of the system to nuisance alarms, damage from lightning strikes, or susceptibility to electromagnetic interference.

* + - * 1. Zones

The sensor system shall divide the perimeter into zones and identify the locations of intruders by zone.

The system shall be capable of addressing zones of variable length (measured along the perimeter), from 1meter (3.3 feet) in length to 800 meters (2625 feet).

All zones shall be fully independent of each other. Each zone must be independently tunable and the condition of any particular zone (presence of an intruder, signal saturation or even cutting) shall have no effect on any of the other zones.

Each Processing Unit shall support up to 8 fully independent zones.

* + - * 1. Time Coverage

The manufacturer shall certify that the perimeter sensor is designed to be effective one hundred percent (100%) of the time over the course of a year, with no “dead” time (either inadvertently or designed into the system) lasting more than ten milliseconds (10ms).

* + - * 1. Uniformity

The sensor shall be designed and installed in such a manner that it has uniform sensitivity along the perimeter, braced corners and posts. For braced corners and posts, the use of additional sensing cable is recommended to ensure a consistent sensitivity level. Doing so will allow for an intrusion to be signaled at any of these points.

* + - * 1. Durability

Neither the sensing fiber/cable nor the Processing Unit shall be damaged by repeated lightning strikes at the perimeter or by manmade electromagnetic interference.

The sensor and the materials used to attach it to the fence shall not be damaged by rain, hail, ultraviolet radiation, high humidity, mist, or salt spray.

The sensor shall have a mean time between failure (MTBF) of 15 years when properly installed on the fence (does not include acts of vandalism, accidental cutting from lawn maintenance equipment, etc.).

* + - * 1. Susceptibility to Electromagnetic Interference & Lightning

The sensor shall not produce nuisance alarms as a consequence of electromagnetic interference from common manmade devices or meteorological phenomena.

* + - * 1. Power

|  |
| --- |
| Sensor |
| Parameter | Min | Max | Units | Notes |
| Electrical power |  | 0 | Watts | Sensor shall be passive, requiring no electrical power |

|  |
| --- |
| APU |
| Parameter | Min | Max | Units | Notes |
| Electrical  power |  | 19 | Watts | Maximum power draw |
| Electrical voltage | 12 | 24 | VDC | Minimum supply voltage range |

* + - * 1. Environmental

|  |
| --- |
| Sensor |
| Parameter | Min | Max | Units | Notes |
| Operating temp | -40° | 85° | °C |  |
| Humidity |  | 100% | RH | Condensing |
| Precipitation | Sensing element not damaged by long-term exposure to environmental factors such as rain, hail, snow or salt spray. | | | |
| EMI | Sensing element not affected by exposure to electromagnetic interference | | | |
| Lightning | Sensing element not damaged by lightning strikes to the fence | | | |
| Volatility | The sensor shall be inherently safe in the volatile/explosive environments and incapable of initiating an explosion or fire. | | | |

In anticipation of failures in air conditioning and heating, the Processing Unit shall be able to operate over a wide range of temperatures.

|  |
| --- |
| Processing Unit |
| Parameter | Min | Max | Units | Notes |
| Operating Temp | 0° | 55° | °C |  |
| Relative Humidity |  | 95% | Percent | Non-condensing |

* + - * 1. Concurrent PoD and NAR specifications

The specifications for probability of detection (PoD) and nuisance alarm rate (NAR) shall be met concurrently for every zone in the system.

The system shall be designed to block attempts to defeat or bypass the sensors. If a given zone is adversely affected (intruded upon, cut, saturated with noise, etc.) the rest of the system shall be unaffected and continue operating effectively, meeting all requirements for PoD and NAR.

* + - * 1. Tuning

The system shall have the ability to be tuned (or calibrated) to ensure compliance with specifications for PoD and NAR. The tuning capability shall include both manual and automatic options.

When tuned manually, the user shall be presented with a real-time visual display of the time/frequency components of signals detected by the sensor, and be given the option of manipulating various parameters for use in filtering the signals so as to maximize PoD and minimize NAR.

When tuned automatically the system shall choose the optimum tuning parameters to maximize PoD and minimize NAR. The system shall do this without requiring the operator to know anything about the time/frequency nature of the signal or the parametric values required for optimum system performance.

* + - * 1. Probability of detection (PoD)

The system shall simultaneously provide high PoD and low NAR when installed per the manufacturer’s recommendations. Recommendations may include such things as cutting vegetation away from the fence and making improvements to the fence fabric and structure such as stretching/tightening the fabric, securing fence-mounted signs against wind-driven vibrations, etc.

The Probability of Detection is measured by making twenty (20) simulated intrusions and recording the number of times that the system correctly detects the intruder and properly identifies the zone of intrusion.

The system should be capable of meeting the PoD requirements for the following simulated intrusions (the intruder is a person weighing at least one hundred and twenty pounds (120 lbs).

Cutting

Stretch four strands of a wire (of the same or nearly the same gauge as the fence) tightly across the fence and then cut all four wires.

Climbing

Intruder places both hands on the fence and takes three steps up the fence.

* + - * 1. Nuisance Alarm Rate (NAR)

Alarms that occur for reasons other than actual intrusion attempts constitute nuisance alarms. Typically NAR is caused by environmental effects (wind, rain, hail, etc.) or animals.

The specification for the nuisance alarm rate (NAR) shall be met concurrently with the specification for probability of detection (POD).

Though susceptibility to nuisance alarms can sometimes be tested by simulating environmental factors, in general this is not possible. Rather, NAR should be tested by installing the system per manufacturer’s instructions, in an environment similar to the deployed site, and monitoring all alarms via video capture (where a camera system captures an image of the zone when the zone goes into alarm).

Such tests are often impractical at the installation site. In lieu of such tests, third-party verification may be requested and/or documented and verifiable test results from the manufacturer provided.

The perimeter security system shall generate less than one (1) nuisance alarm per month per zone.

* + - * 1. False Alarms

False alarms result from system noise arising from poor design and/or fabrication. The system shall produce less than one (1) false alarm per year.

* + - * 1. Gates

The system shall be configurable so that gates (either swinging or sliding) can be covered with one or more zones.

* + - * 1. Communications, Interface, Alarms

The system shall use open architecture gateways for data exchange with other security systems and applications.

The Processing Unit shall provide alarm, event and fault information. This information shall be available either through dry contact relays or through TCP/IP communication.

An event occurs when the sensor detects sufficient disturbance to signal the likely presence of an intruder.

An alarm is generated after detecting a certain number of events within a user-defined window (the number of events is also user definable).

A fault occurs when a zone is cut or damaged.

The Processing Unit shall provide an independent alert for every zone that is cut or damaged.

* + - 1. AUTHORIZED INSTALLERS, TECHNICIANS AND TRAINERS
         1. Manufacturer shall provide a list of local installers that are trained and qualified to install the system.
         2. In the event there are no local, trained installers, manufacturer shall (at the discretion of the installer) provide either on-site training or training at the manufacturer’s facility.
      2. RELIABILITY AND MAINTENANCE
         1. There shall be no required scheduled hardware maintenance for the equipment, and no consumable supplies for its proper operation (beyond electrical energy).
         2. When installed in fence applications the sensing fiber/cable shall be attached to the fence using stainless steel wire ties.
         3. The equipment manufacturer shall provide an extended warranty, if desired, at additional cost.

END OF SECTION