FIBER SECURITY

Optical Fiber Perimeter Intrusion Detection System

AFL

The Need for Fiber Security

Sensitive, high value sites are targets for both theft and terrorism and are usually protected with perimeter fencing. While fences are an effective deterrent, determined intruders have learned how to breach these defenses.

Patrolling and traditional methods for monitoring the perimeter fence with sensors or instruments are often unreliable, expensive or inefficient in keeping away intruders. Some methods have a high rate of false positive alarms caused by non-intruder events. Others have a high rate of false negatives because the system's sensitivity cannot detect actual intrusions. High rates of false positives lead to operator fatigue, and the system is eventually ignored. High rates of false negatives lead to distrust of the system and the addition of secondary systems or personnel to cover observed shortcomings.

Fiber Security™

Fiber Security, AFL's optical fiber perimeter intrusion detection system, enhances a security team's ability to detect and respond to intrusion events while reducing existing system and new construction costs. The system employs a fence-mounted fiber optic sensing cable for vibration detection and a central sensing device analyzes both the magnitude and pattern of the vibration signatures, resulting in a system that is:

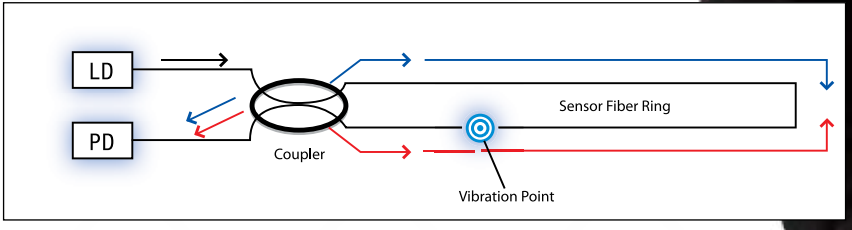
- ***Responsive:*** Low false positive rate due to noise generated by environmental factors
- ***Reliable:*** High reliability for detection of intrusion events (extremely low frequency of false negative)
- ***Accurate:*** +/-2.5% accuracy of intrusion event locations over continuous fence line lengths of up to 5 kilometers
- ***Flexible:*** Stand alone system or integrated with pan-tilt cameras and other technologies like infrared systems

Comparison of Perimeter Security Methods

	System Functionalities					System Costs		
Detection Method	**Multiple Intrusion Detection**	**Low False Positives**	**Long Distance Capabilities**	**Continuous Monitoring**	**System Integration**	**Low Maintenance /Repair Costs**	**Low Operating Costs**	**Low Start Up Costs**
AFL's Fiber Security	●	●	●	●	●	●	●	●
Break Tension Wire			●	●				●
Infrared/ Line of Sight	●			●	●		●	●
Motion Detection	●	●		●	●		●	●
Microwave Detection	●	●		●	●		●	
Electrical Fence			●		●	●	●	●
Scheduled Patrols		●	●		●	●		
Unscheduled Patrols		●	●		●	●		

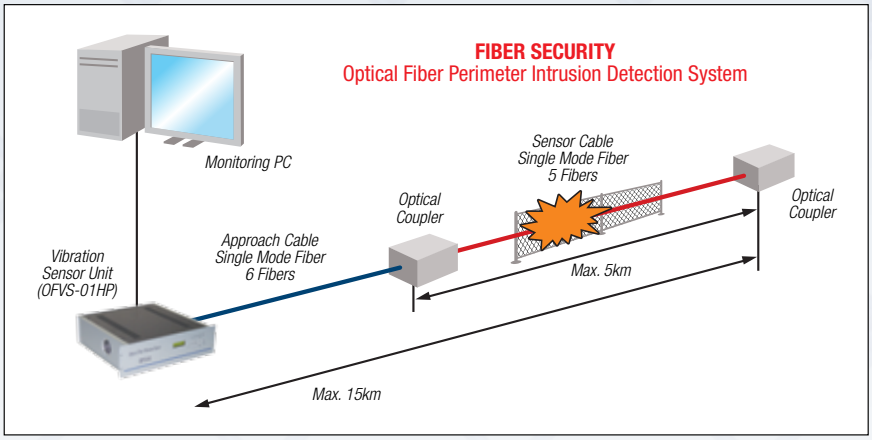
How Fiber Security Works

Optical power from a laser diode (LD in diagram) is split by the optical coupler and is diffused through an optical fiber ring in two counter directional paths. When vibration is applied to the fiber, the strength of the interference light fluctuates due to the change of refractive index in the region of the cable vibration. The emitted light arrives at a vibration point with some difference in time of flight. After passing the vibration point, the two counter directional light packets are combined to cause interference. The light interference is detected by a photo diode (PD). Under static conditions (no vibration) the interference light strength is stable.



Fiber Security System Architecture

The diagram below depicts the key components of Fiber Security, AFL's optical fiber vibration system. The system is comprised of the sensor and approach cables, optical couplers, a Vibration Sensing Unit (VSU) and outputs connected to either a monitoring PC or the master security system for the site.



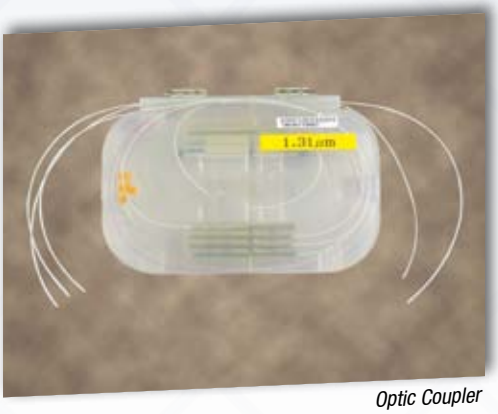

Vibration Sensor Unit


Buried Cable Installation Prior to Backfill

Vibration Sensor Unit

The Vibration Sensor Unit (VSU) indicates the presence and location of possible intrusions by observing and analyzing interference signals in laser light due to the vibration of the sensor optic fiber. The VSU features the following:

- Vibration magnitude and location are detected in real time
- Many options for vibration pattern analysis are provided to enable differentiation of real and false alarms
- Connections for Ethernet, dry contactors and RS-232 provide many possible avenues for integration
- Minimal maintenance during long periods of operation (no moving parts)


Optic Coupler

Approach and Sensor Cables

The approach cable connects the VSU to the sensing cable that hangs on the fence. This cable can be deployed at distances of up to 10 kilometers for remote sensing and is typically a standard design that is most suitable for the installation method intended. The sensing cable translates vibration from the fence to the optical fiber and is the heart of the intrusion detection system. The sensing cable can be armored to prevent easy cut-through.

Splice Closure and Optical Coupler

AFL's Fiber Security system incorporates water-tight splice closures suitable for above ground or buried applications. A proprietary 3 x 2 optical coupler is housed within each closure and splits the light path to form an optical ring to detect intrusions.


Splice Closure

Proven Detection Performance

Fiber Security is proven to be highly successful in detecting intrusion events. The Japanese Defense Force conducted a mock attack using multiple, trained paramilitary intruders to attempt a coordinated break of a sensitive installation from all approaches of the perimeter. The test resulted in no false positives even with a high level of ambient noise that was caused by 36 mph winds. All intruders were detected and intercepted by the security team.

Fiber Security has also been field proven in the following situations:

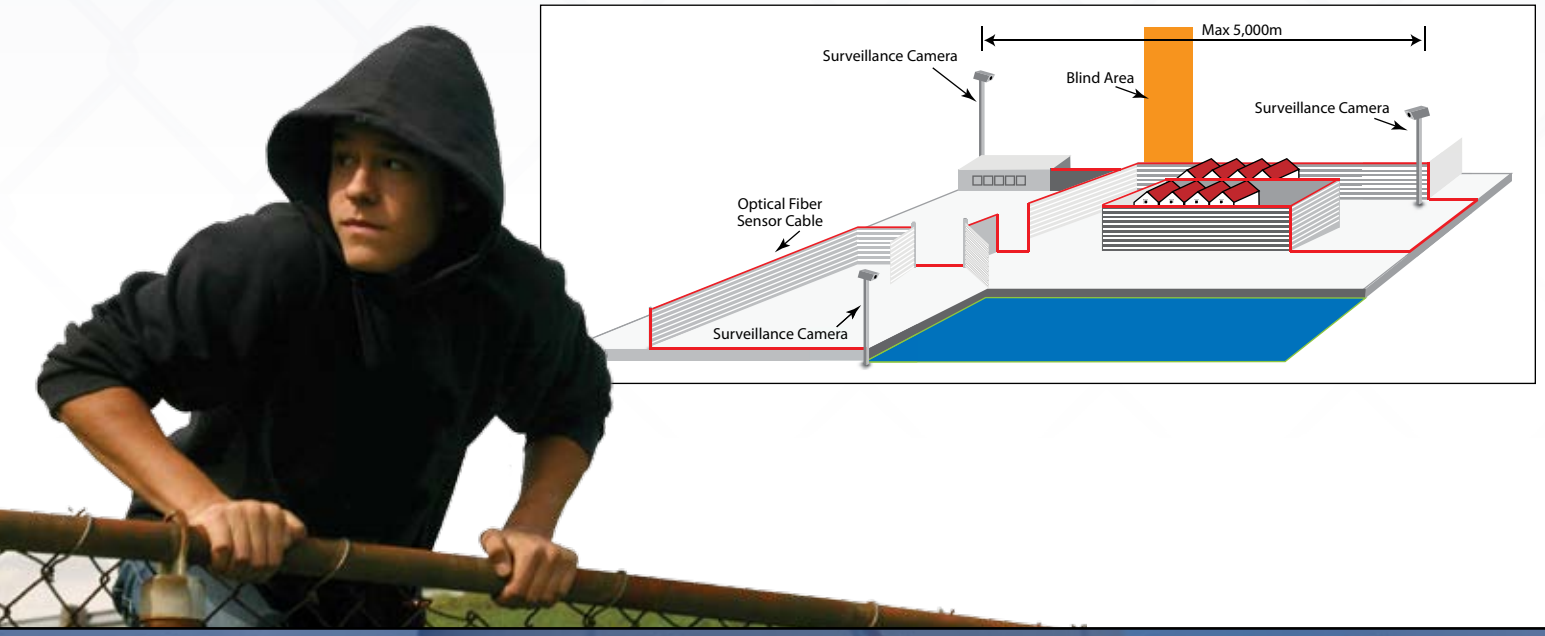
- Intruders attempting to climb or cut the fence
- Materials placed atop fences (such as carpeting to protect from barbed/razor wire)
- Items thrown at fence (intruders testing system prior to attempting a breach)
- Multiple intruders (discretely logs multiple intrusions separated by > 0.1 seconds)
- Intruders using a ladder positioned against a vertical support
- Objects placed against the fence (such as pallets, scrap wood, barrels, etc.)
- Intrusions by digging under the fence (when sensing cable is buried to specification)

Gravel dumped against fence - impact triggered alarm

Debris placed against fence - vibration triggered alarm

Typical Installation

The figure below depicts the configuration for a seaport and how cabling can be routed along fence lines, swing gates and fence lines within other fence lines. For a single 5,000 meter sensing cable, 100 individual zones can be created with their own unique warning and alarm threshold. Blind areas that are not visible by surveillance cameras can still be monitored for intrusion events and since these locations are not associated with a camera, the alarm thresholds may be set to a greater or lesser sensitivity, as the threat assessment dictates.



Typical Project Work Flow

A typical Fiber Security design plan includes:

Threat Assessment
This step is conducted by the client, with the help of the integrator and is a required input for satisfactory system design and installation. Other complementary security technologies that the client wishes to use should be identified at this time for incorporation with Fiber Security.

Site Survey
The integrator conducts a site survey to confirm issues with the site for consideration in installation of cables and parameter tuning. The survey includes analysis of engineering drawings, photographs and video. It also takes into consideration road, rail and air traffic; vibration transmitted through soil type, seismic activity, fence type, the number of gates and gate type, etc.

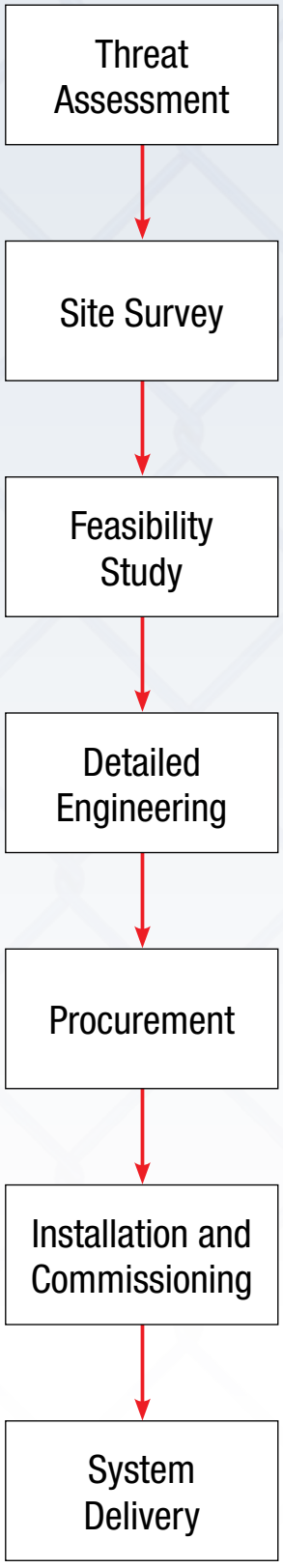
Feasibility Study
The integrator provides a budgetary proposal for the site. The client makes a decision based on the proposal.

Detailed Engineering
AFL and the integrator proceeds with the project based on an order negotiated with the client.

Procurement
Materials are procured upon client's acceptance of engineering drawings.

Installation and Commissioning
The phases of the installation include installation of VSU, installation of approach and sensor cables, splicing approach cable to sensor cable, IP cameras (optional) and programming of the VSU.

System Delivery
The system is turned over to the end user. The integrator and AFL will provide agreed to follow-up support for any questions or issues regarding the system.



The Right Choice: AFL's Fiber Security

Fiber Security offers a wide variety of features and benefits to customers. From its relatively low cost to easy system integration, Fiber Security is proven to be a superior method for large perimeter intrusion detection.

Cost Effective

AFL's Fiber Security operation and maintenance costs are lower than other security methods which have shorter sensing lengths or require multiple transmitters and receivers. The sensing cable is very simple to deploy and affix to the fencing. For a single length of sensing cable, Fiber Security assigns individual zones to each camera using software parameters in the VSU, while competitors require separately wired and powered zones for each camera. Each zone can be programmed with its own warning and alarm thresholds with a total of 100 zones per sensing system, making AFL's system the lowest installed cost option available.

Some security requirements are temporary. In these situations the ability to re-use equipment helps lower the operating costs of an organization. Fiber Security components can easily be moved for temporary needs or completely relocated. Reusable hardware and cabling make this transition easy and cost effective.

Low False Positives/Negatives

Fiber Security automatically adjusts to changing environmental conditions to reduce the amount of false positives and negatives. The self-tuning function and tuning performed during installation optimize detection capabilities while reducing the occurrence of false readings. Low rates of false alarms help ensure operator trust in the system and remove the sensory load on operators compared with constant scanning of CCTV monitors. Lowering the amount of alarms and inputs during a threat condition improves decision making during the security team's response.

Robust and Flexible System Architecture

Fiber Security uses standard racking for VSU mounts. Cables and components are industry-proven through use by telecommunications providers world-wide. The system also significantly reduces the number of inputs to the master security system when compared to line of sight systems. Fiber Security offers an additional layer of real-time intrusion detection to enhance existing technologies and communicates with master security systems via dry contact outputs, RS232C or Ethernet.

Sabotage and Tamper Resistant

Optional armoring of cables makes them resistant to cutting. Optical couplers are environmentally protected inside industry proven splice closures, and the VSU is password protected to prevent unauthorized changing of parameters.

Real Time Intrusion Detection

The system provides a warning alarm which can be used as an initiating signal to direct a PTZ camera towards an event while the algorithm analyzes the signal. If the algorithm determines that the signals constitute an actual intrusion, the camera system is already focused on the event area for the security team to review and take action.

Easy Maintenance

Fiber Security is easy to repair and maintain. Damaged cables can be repaired by arc fusion splicers. Repair loops are designed into the initial layout to allow for field repairs with minimal splices.

Parameters can be safely stored on backup media and can be loaded onto a replacement VSU in the event of a system failure. The system will return to its fully operational state without the time and expense of reprogramming.

Defeats Intruder Expectations

Fiber Security can be installed in ways that cannot be seen and anticipated by intruders. Properly installed in buried applications, Fiber Security detects intruders walking over cable or can detect efforts to breach the perimeter by digging under fencing.

Backed by Fujikura Technology

Fujikura extrudes 30% of the world's optical fiber and 15% of the world's multi-fiber cable. With a 120-year history of producing quality products and services, Fujikura is a trusted supplier to leading telecommunications providers around the globe.

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CABLE SPECIFICATIONS	
Sensing Cable Type	Proprietary, Single Mode Construction
Min. Sensing Cable Length	200 meters
Max. Sensing Cable Length	5 km (3.1 miles)
Overall Optical Loss	<14 dB for combined wavelengths
Max. Approach Cable Length	10 km (6.2 miles)
DETECTION SYSTEM SPECIFICATIONS	
Sensing Cable Configuration	Straight Run, Optical Fiber Ring
Detection Method	Auto Tuning, Interferometic Signal Processing
Minimum Zone Length	50 meters
Maximum Zone Count	100 (serial data or Ethernet)
Location Accuracy	± 2.5% of total sensing cable length
Laser Classification	Class 1 Laser Diodes (safe at any exposure level)
Laser Wavelengths	1310 and 1550 nm
Connector Type	SC/UPC
CONTROLLER / OPERATING SYSTEM SPECIFICATIONS	
OFVS-01HP Vibration Sensing Unit	
Dimensions	19" W x 17" D x 5.25" H (3U)
Output Specifications	1 x RS-232 Serial Data 1 x TCP/IP Port 128 x Dry Contacts
Power Supply	100 - 240 VAC, 50 - 60 Hz
Power Consumption	≤100 W (typical)
Vibration Frequency Range	100 Hz - 10 kHz
VSU Operating Conditions	0 to 40°C (32 to 104°F) at 20-80% Relative Humidity
Cable Operating Conditions	-20 to 60°C (-4 to 140°F)
Operator PC	
Operating System	Windows XP Pro
Processor	Intel Pentium Dual Core (2MB L2, 2.5 GHz, 800 FSB)
RAM	2GB Dual Channel DDR2 SDRAM at 800MHz
Hard Drive	7200rpm 320GB Serial ATA Drive (w/ DataBurst Cache)
Optical Drive	16X DVD +/-RW Drive
Additional Software	Visual Basic 2005, Excel, Word
MISCELLANEOUS SPECIFICATIONS	
Fence Types	Chain Link, Welded Mesh, or Other Flexible Fencing
Seasonal Calibration	Not Necessary

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