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FiberPatrol® FP1150 for Pipeline Protection Applications

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Fiber optic third-party interference (TPI) detection

Third-party interference (TPI), including unauthorized excavation in a pipeline's right-of-way, is a leading cause of pipeline accidents and loss. A single pipeline incident can have devastating effects, causing property destruction, service interruptions, environmental damage and risks to human life – all of which can cost pipeline operators millions of dollars in financial losses. Further, incidents involving oil theft can have a significant economic impact by going unnoticed for long periods of time.

The FiberPatrol FP1150 uses fiber optic cable buried along the pipeline to detect and locate ground vibrations and acoustic signatures associated with TPI activity.

No powered or conductive items are required in the field. The sensor cable is intrinsically safe within explosive atmospheres and completely immune to all forms of electromagnetic energy from radio communications, radar, electrical power transmission equipment and lightning.

EARLY WARNING OF THREATS TO PIPELINES

The FP1150 is designed specifically to detect activities that threaten pipelines: machine or manual digging, heavy machinery operating in the nearby vicinity–even people walking within the protected area if so configured.

PIPELINE TPI DETECTION

When TPI events such as manual digging, machine digging, or vehicle movements occur in the vicinity of a pipeline, characteristic vibrations are created. The FP1150 is able to detect these minute vibrations and using its advanced algorithms distinguish them from background vibrations and declare an alarm.

VEHICLE DETECTION AND OPTIONAL REJECTION

The FP1150 is capable of detecting vehicles in the vicinity of the sensor cable due to the vibrations created by their motion or by the engine. In the case of a road parallel to the protected asset the FP1150 can be configured to reject normal vehicle traffic and only raise an alarm if a vehicle drops below a configurable speed setting or stops altogether.

Features and Benefits

- Detect and locate pipeline third-party interference (TPI) events over a distance of up to 100 km (62.1 mi) per sensor unit
- Combine fence detection with TPI for distances up to 80 km (49.7 mi) per sensor unit
- Pinpoint interference locations with a ±4 m (±13 ft) accuracy
- Accurate locating of multiple simultaneous intrusions
- Sensor cable continues to operate up to the point of a cut
- Dual sensor channels
- 100% operational after a cable cut in cut-immune configuration
- High Probability of Detection (PD) and low Nuisance Alarm Rate (NAR)
- Software-configurable detection zones
- No outdoor power or communication infrastructure required
- EMI and lightning immune
- No electronics or grounding points required in the field
- Accurate locating for directing surveillance cameras and/or response forces
- Field components intrinsically safe
- Alarms reported by zone number, cable distance, and/or GPS coordinates
- Multiple options for integration with SMS, VMS and PSIM platforms
- Easy to install and maintain
- Per-meter licensing

TPI DETECTION - TYPICAL DETECTION RANGES

Typical detection ranges are shown in the table below. It is important to note that actual performance will depend on specific site conditions and can increase or decrease considerably from these typical values. Factors that can affect achievable detection ranges include:

- Nearby incidental sources of vibration
- Burial medium type (clay, gravel, sand, etc.), moisture content, and compaction level
- Presence of distinct layers within the burial medium
- Amount of vegetation

Typical detection ranges can vary from location to location at a given site and can vary over time depending on the moisture content and the depth of frost penetration.

INTRUSION TYPE	TYPICAL DISTANCE FROM CABLE FOR DETECTION*
Human - Normal Walking	1 to 5 m (3 to 16 ft)**
Human - Running	5 to 10 m (16 to 33 ft)**
Light Vehicle - Moving	3 to 10 m (10 to 33 ft)
Heavy Vehicle - Moving	10 to 20 m (33 to 66 ft)
Heavy Vehicle - Engine Running	5 to 10 m (16 to 33 ft)
Manual Digging (pickaxe)	10 to 20 m (33 to 66 ft)
Machine digging (backhoe)	10 to 30 m (33 to 100 ft)

* At the maximum sensor length of 50 km the typical lateral detection distances are halved

** Requires quiet background environment

TRANSITIONING BETWEEN PIPELINE TPI AND FENCE DETECTION SECTIONS

At the transition point between pipeline TPI sections and fence detection sections a 30-meter (100 ft) buffer coil of sensor cable is recommended.

KEY SPECIFICATIONS

- Up to 100 km (62.1 mi) of sensing cable for fiber attenuation (installed) of 0.24 dB/km or less @1550 nm
- Sensor Unit MTBF: greater than 87,000 hours
- Detection accuracy: ±4 m (13 ft) typical
- Up to 1,440 software-definable detection zones
- Pd: 95% typical
- FAR: less than 1/km/month typical NAR: site dependent
- Detection resolution (minimum separation for two disturbances to be reported separately):
  - 15 m (50 ft) in non cut-immune configuration
  - 30 m (100 ft) in cut-immune configuration
- Cut cable response
  - Cable cut detected and location reported to +/- 30 m (100 ft)
  - Operation continues up to the point of the cut

PART	DESCRIPTION
FP115005U	FP1150 unlicensed Sensor Unit capable of providing up to 5 km (3.10 mi) of detection processing on each of its two sensor channels, up to 10 km (6.21 mi) in total. Requires separately-purchased per-meter activation licenses, FP-PML-05, to enable detection processing.
FP115040U	FP1150 unlicensed Sensor Unit capable of providing up to 40 km (24.8 mi) of detection processing on each of its two sensor channels, up to 80 km (49.7 mi) in total for perimeter protection applications. Up to 100 km total for pipeline or conduit TPI applications. Requires separately-purchased per-meter activation licenses, FP-PML-40, to enable detection processing.
FP-PML-05	Per-meter activation license applicable to FP115005U Sensor Unit. The number of meters licensed needs to cover all cable beyond the initial lead-in section (max 500 m) including all service loops, isolation loops, gate bypasses, etc. Initial lead-in in excess of 500 m needs to be added to the licensed section. Each meter licensed activates both sensor channels.
FP-PML-40	Per-meter activation license applicable to FP115040U Sensor Unit. The number of meters licensed needs to cover all cable beyond the initial lead-in section (max 500 m) including all service loops, isolation loops, gate bypasses, etc. Initial lead-in in excess of 500 m needs to be added to the licensed section. Each meter licensed activates both sensor channels.
FP115005H	Equivalent to FP115005U but with fiber connections compatible with FP1100X/FP1400/FP6100X systems.
FP115040H	Equivalent to FP115040U but with fiber connections compatible with FP1100X/FP1400/FP6100X systems.
FPMA0922	FiberPatrol fiber connection module for FP1150 systems. Includes two patch cords, two end modules, associated splice trays, and 1U rack-mount splice enclosure.
GB0296-17	17 in 1U rack mount KVM (KB/LCD/Mouse)
FPKT0400	8 port KVM switch with 2 sets of cables
FPMA0222	Dual End module for FiberPatrol FP1150
GM0749-24	Field splice enclosure (24 splice capacity, 3 cable ports)
FPKT0200	Splice consumables kit
GH1080-08	3/16” x 08” (4.8 x 20.3 cm) stainless steel cable ties (100 each)
GX0310	Tool – manual tension and cut-off tool for stainless steel cable ties
GM0748	Buried vault for buried cable splices and service loops, 100 x 75 x 45 cm
FPKT0500	Sensor cable management kit for swinging gates. One (1) section of 5 cm (2 in) diameter split conduit 1 m (3 ft) long and two (2) hose clamps
FPSP0424	Unarmored fiber optic sensor/lead cable, 24 fibers, recommended for fence or wall-top applications
FPSP0624	Single-armor, double-jacket fiber optic sensor/lead cable, 24 fibers, recommended for buried applications
00FG0220	Network Manager service version on USB drive