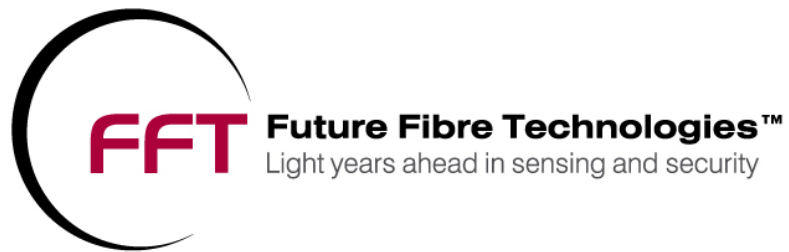


FFT Secure Fence™

Installation Overview



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Secure Fence Overview

A major issue for Security Service providers is confidence in the integrity of the monitoring systems at their disposal. Security service providers require systems that are able to operate easily and reliably under a wide variety of operational and environmental conditions and that are not prone to false alarms and nuisance alarms.

In response to this, Future Fibre Technologies has developed FFT Secure Fence™ - a significant and highly cost-effective intrusion detection technology for fences, employing advanced distributed fibre optic sensors. FFT Secure Fence™ is a monitoring system that detects the **first signs** of intrusion at the fence line, performing easily and reliably under a wide variety of operational and environmental conditions with an extremely low false alarm and nuisance alarm rates. The FFT Secure Fence™ system has been primarily designed to work on Chain Link fences - these fences have an inherent flex and movement in their construction that provides optimal sensitivity, performance and intrusion detection for the Sensing Controller. Application to other fence fabrics, such as weld mesh and palisade, is also possible.

This technology provides a new dimension in detecting and locating fence line and perimeter intrusions, employing 3 Singlemode fibres within the sensor cable attached to the fence fabric as the sensing element. This sensing cable continuously monitors in real-time, any physical disturbances or activity on the fence. It also locates where the disturbance is along perimeter fences up to 80km long – quickly, reliably and accurately – to within 25 meters. This unique feature allows end users to pinpoint an intrusion on long perimeter sites, such as airports and military bases.

While the technology behind FFT Secure Fence™ is sophisticated, its application in a system context is very simple. The basic system operates over spans of 80km of perimeter fencing with an industrial hardware platform (sensing controller) and Start Sensor at one end, and a passive termination device (or End Sensor) at the remote end. The only system component between these two ends is the fibre optic sensing cable itself. There is no electronics, power or maintenance required in the field.

By employing multiple FFT Secure Fence™ systems networked together, you can monitor and protect hundreds, if not thousands of kilometres of fence line.

The information contained in this document relates to installing FFT Secure Fence™ onto Chain Link fences. FFT Secure Fence™ can be installed onto other types of fence constructions, but physical cable attachment and installation would be dependant on the physical characteristics such as fence flexibility, rigidity etc. in order to deliver a comparable detection performance to chainmesh. Contact FFT for further information and specific recommendations.

How it Works

FFT Secure Fence™ is effectively a fibre optic ‘microphone’, combining the characteristics of a piezo-electric transducer and strain gauge sensor, designed to detect disturbances generated by intrusions and attempted intrusions on a chainmesh fence, while discriminating between normal ambient conditions.

The Secure Fence system is very sensitive to minute movements of the cable and the fence fabric the cable is attached to. Through the use of intelligent signal processing, these movements can be isolated from other environmental signals for clear identification, with minimal false alarm and nuisance rates. Secure Fence is already installed in numerous commercial, military and industrial applications.

As you can see in Fig 1, the system comprises an optical fibre cable attached to the fence fabric and a Secure Fence Sensing Controller containing the opto-electronics, data acquisition hardware and signal processing software, installed at one end of the fence line (section) to be monitored. The system can operate in a stand-alone mode, or FFT can supply FFT CAMS (Central Alarm Monitoring System) and integrate a number of these Secure Fence systems into the one central monitoring unit for ease of operation.

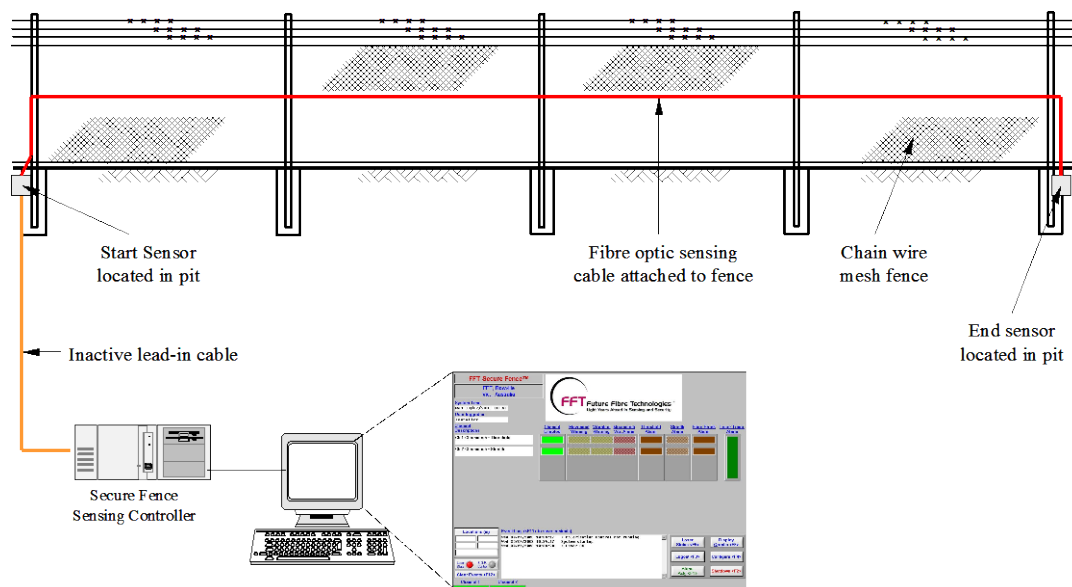


Fig 1: Basic Secure Fence Layout

FFT Secure Fence™ uses singlemode optical fibres as its sensor, detecting movement, vibration and sound acting on the cable and the fence it is attached to. Contact FFT for further information and specific recommendations for fence constructions other than chain link.

Referring to Fig 2, the Secure Fence Microstrain Locator sensor is based on interferometry where two of the fibres within the sensing cable form the arms of an interferometer. Using a coherent laser, CW light is propagated through the arms of the sensor. When there is an external interference on the sensing fibres (motion, sound or vibrations) an interference pattern will be generated. The Sensing Controller will detect this change and the FOSS software will interpret the effect as either an intrusion event, or reject it as ambient conditions.

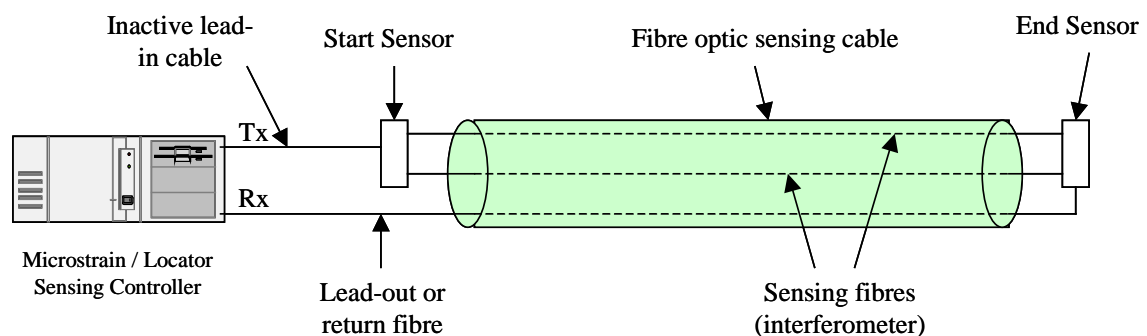


Fig 2: Secure Fence System

The Sensing Controller identifies the event and can, through the FOSS software, determine the type of event. Using the unique recognition features in FOSS, we can limit nuisance alarms created by ambient noise and nuisance events to minimal levels while ensuring >95% detection of intrusion events.

FFT Secure Fence™ provides an unlimited amount of zones using 3 optic fibres within the one cable, and is able to detect and locate multiple tampering or intrusions events in real time.

The Locator portion of the system will locate any intrusion attempt to within 25 meters. This unique feature allows you to pinpoint the intrusion location on perimeters and fence lines of hundreds of kilometres. It also reduces the number of systems required, since multiple fixed zones and the associated hardware are not required. It should be noted that the return or Lead-out fibre can follow a completely different path in a different cable – it does not need to follow the same path as the interferometer at all.

Power is not required along the fence line for FFT Secure Fence™ (other than at the monitoring posts), nor is the sensing cable at risk of damage from electrical interference, lightning strikes, EMI, or RFI.

Sensing Distances

A major advantage of using FFT Secure Fence™ is the consistency of the detection response over long perimeter distances. The sensing controller will protect perimeters of up to 80 kilometres or 50 miles (total optical path length) without the need for any external hardware other than the fibre optic sensing cable itself. In a straight line, this distance is 40km (40km out plus 40km return = 80km light path).

The actual distance achievable is limited by optical an power budget of 25dB, which translates into an optical path length of 80km depending on the quality of the fibre optic cable and the number and quality of the splices and general installation. The optical path length compromises the "lead-in", sensing cable length, return path (if not a loop or closed perimeter) and "lead-out" cable. Multiple systems can be cascaded together to protect longer fence lines.

Zoning

Via FFT CAMS, the Secure Fence system has the flexibility to be configured either as a large single zone sensor or as multiple smaller zones. These zone lengths are software configurable, so you can break down the one sensor cable into multiple zones of varying lengths to correspond with the positions of CCTV's, lights etc. A matrix switcher interface is optionally available within FFT CAMS to interface and control Pelco P series switchers using ASCII Protocol.

If these zones are kept short and manageable, then it is much simpler to locate with greater accuracy where a breach has occurred.

Interference Immunity

One specific benefit of fibre optic based systems is their immunity to electromagnetic interference, particularly important for installations near high voltage electrical equipment, or in areas subject to lightning strikes, electromagnetic pulses, strong magnetic fields, or RFI.

Intrinsically safe

Another important aspect of FFT Secure Fence™ is that no power, external electronics, or control hardware is required in the field other than for the sensing controller located at the start of fence. There is no power applied to or near the fence itself, and the start and end sensors are passive optical devices also requiring no power.

Interfacing

FFT Secure Fence™ systems have the flexibility to interface to a wide variety of local or remote security management systems so that it can integrate with supporting security technologies such as display systems, cameras, lights and audible alarms.

Fibre Optic Cable Installation

Planning

Detailed site and installation planning is essential for a smooth and successful installation, and the following points are critical to ensure a complete understanding of the capabilities of the system and avoid costly pitfalls.

A proper site layout is required to determine where best to place the controller(s), the fibre optic sensing cables, lead in / lead out cables, the fibre enclosures, and the start and end sensors. Various site configurations are possible and will vary with regards to the type of system employed, the site terrain, as well and the number of zones required.

Optical power budgets also need to be addressed on long or multi-zoned sites, and OTDR fibre testing at the completion of each stage of the installation must be carried out.

Distance that can be protected with a single Secure Fence system

The FFT Secure Fence™ sensing controller is typically capable of driving a total optical path length of up to 80km or 50 miles. The actual distance is limited by an optical power budget of 25dB @1550nm, which translates into an optical path length of 80 km or 50 miles depending on the quality of the fibre optic cable, the number and quality of the splices, number of connectors and general installation.

The optical path length comprises the "lead-in", sensing cable length, return path (if not a loop or closed perimeter) and "lead-out" cable. Referring to Fig 3, this total light path is the distance from the sensing controller to the end sensor and **back to** the sensing controller via the Lead-out fibre.

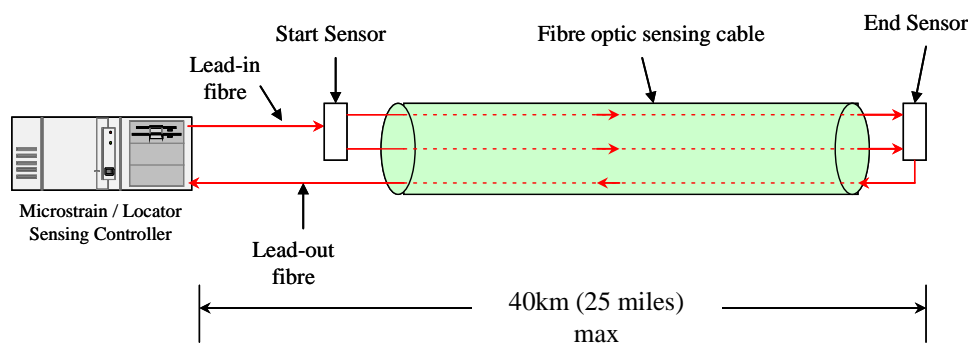


Fig 3: Single Ended configuration showing light path

If you have a perimeter fence configuration where the start and end sensors are in the same location, then the total optical path length of 80km equates to a “perimeter” length of 80km or 50 miles as the return path on the Lead-out fibre is very short.

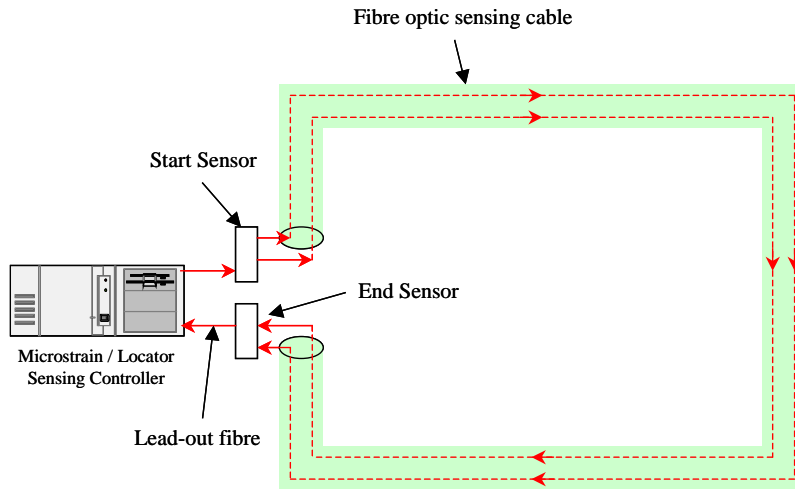


Fig 4: Perimeter configuration showing light path

Covering Longer Distances

Multiple FFT Secure Fence™ systems can be easily installed for fence lines longer than 40km or 25 miles. The outputs from each of these sensing controllers can feed back into one centralized alarm monitoring system such as FFT’s FFT CAMS. A typical long distance multi-system configuration using FFT sensor cable would look as follows:

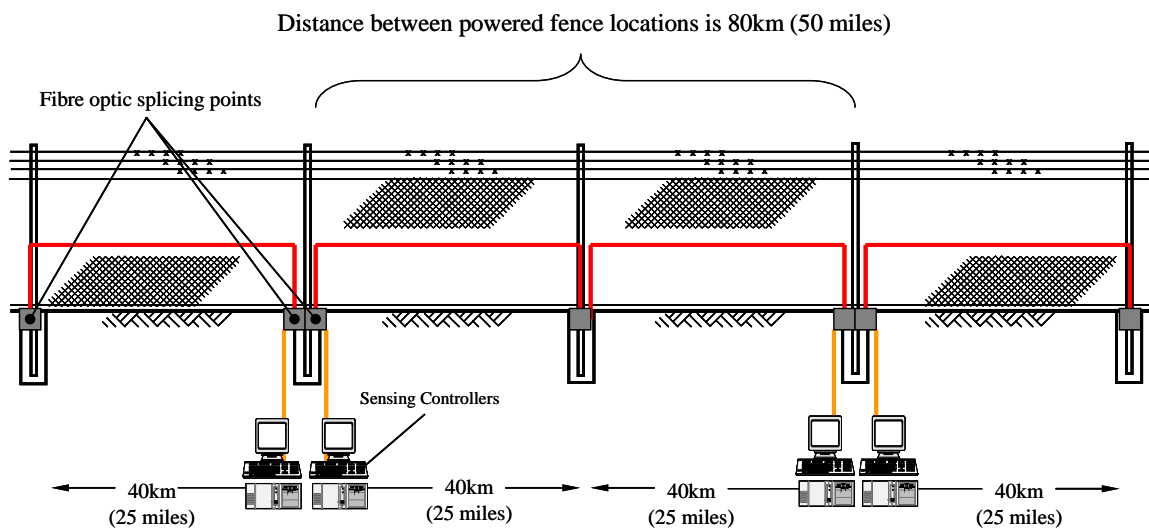


Fig 5: Multi-system configuration

Attaching the Sensing Cable – Chain link example



The sensor cable is attached to the chainmesh fence using the supplied UV protected cable ties (Panduit Pan-Ty Cable Tie, 7.4", WR Nylon 6.6, 3/16" wide, **Panduit Part No: PLT2S-M0**) every 300mm or 12 inches. When tightening the cable tie, the cable should be held snugly, to prevent sideways movement, but not tightly. You must avoid sharp bends or pressure points on the cable as they will cause losses and become potential fracture points in the future.

You will note in this picture that the fibre sits in the “grooves” or indents formed in the weaving of the mesh fabric – 300mm or 1 ft is about every 5 of these indents.

It is important that the fence posts are securely mounted in the ground, and the fence and fence fabric is in good, taut condition in order to minimize nuisance alarms.

Depending on the client installation requirements, the fibre optic sensing cable may be installed on either side of the chainmesh fence. As shown in Fig 6, the easiest installation by far is to have the sensor cable on the side of the fence without the posts, as there are no posts or poles to interfere with attaching of the cable. However, it depends on the specific site requirements, and how accessible that side of the fence is. Note that the sensor cable is always attached to the fence fabric itself and never to the centre strainer wire.

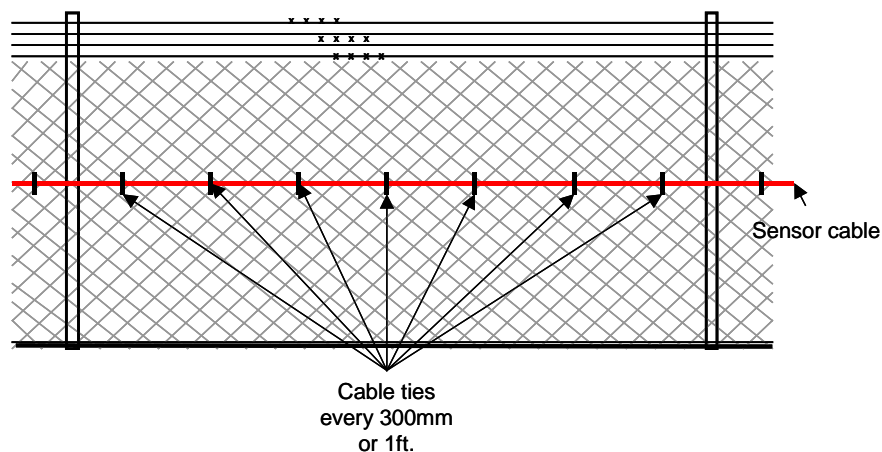


Fig 6: Cable attached to outside of the fence

If the cable must be installed on the pole of the chain mesh fence (the side of the fabric the posts or poles are on), then as you loop the cable around the vertical support poles, you need to allow enough slack so that if an intruder pulls on the fence fabric, the fibre optic sensing cable is not stretched and/or damaged. The loops shown in Fig 7 are normally only 75-100mm (3-4"). If you don't put these loops in and instead draw the cable tight around the post, you *will* get *many* nuisance alarms.

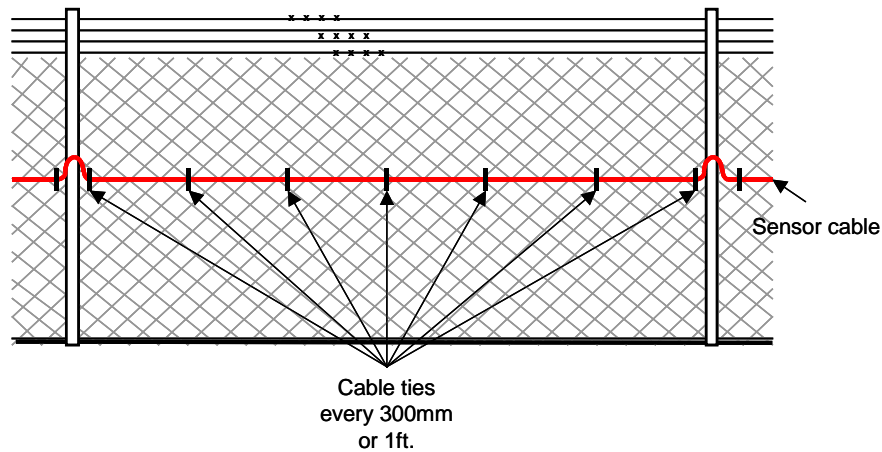


Fig 7: Cable attached to inside of the fence

If these cable loops are so long as to flap around with the potential to cause nuisance alarms, you can secure them directly to the vertical posts using a 9mm (3/8") half-saddle clamp, a cable tie or a fabricated clamp as indicated in Fig 8.

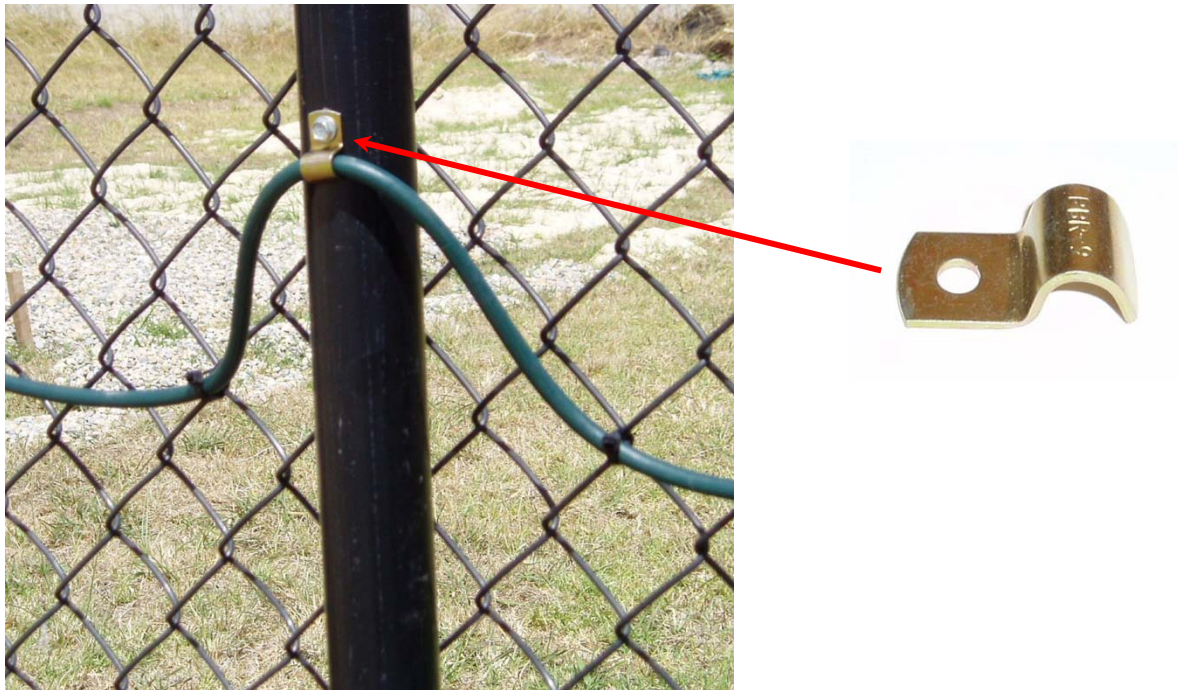


Fig 8: Attachment of Loop to Vertical Post with Half-Saddle Clamp

At each fence corner post, fence bracing point, or rigid post, the fibre must be looped up to provide additional detection at the post, since this is the most ridged part of the fence. These loops should be approximately 600 mm high (24”) and the radius of the bends should not exceed 10 times the diameter of the cable, i.e. 60 mm (2.4”) on a 6 mm diameter cable. Again use cable ties to attach the loop.

Important Note:

The distance markings on the sensor cable jacket are to be used as a guide only. Typically the actual fibre length will be longer than indicated on the jacket as the fibres are twisted during cable manufacture. As we are often dealing with long cable lengths, even an OTDR will not give a sufficiently accurate distance.

The most accurate distance measurement is achieved by calibrating the sensor against FOSS. Firstly enter the OTDR readings in the locator section, and then verify the locations at the beginning, end and mid point of the sensor. You may have to make a small adjustment to the lead in, sensor or lead out length. Once you do this, the system location accuracy will be optimum.

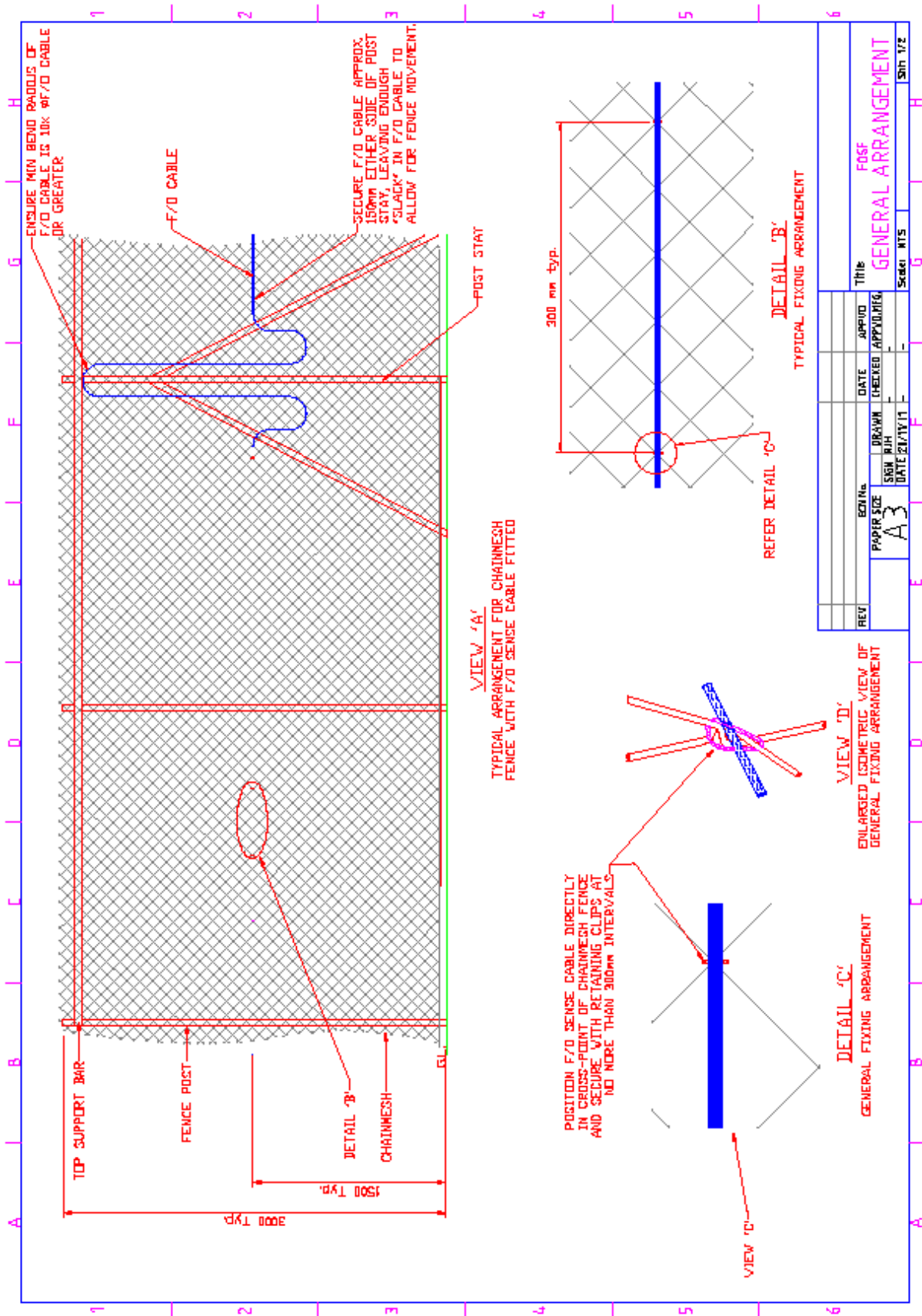


Fig 9: Attaching Microstrain Sensing Cable to a Chain link Fence

For more information on FFT Secure Fence installation procedures, please contact your nearest Future Fibre Technologies office.

Contact Details:

Americas

Future Fibre Technologies (US) Inc.
800 West El Camino Real, Suite 180
Mountain View, CA 94040 USA

Toll Free: +1-877-650-8900
Outside the USA: +1 650 903 2222
Fax: +1 (435) 417-6671

Email: info@fft-usa.com

Asia Pacific

Future Fibre Technologies Pty. Ltd.,
10 Hartnett Close,
Mulgrave, Vic., 3170
Australia

Phone: +61 3 9590 3100
Fax: +61 3 9560 8000

Email: info@fft.com.au

Europe

Future Fibre Technologies Pty Ltd
3000 Hillswood Drive,
Hillswood Business Park
Chertsey, Surrey KT16 0RS
England

Phone: +44 (0)1932 895 317
Fax: +44 (0)1932 895 318

Email: info@fft-emea.com

Middle East

Future Fibre Technologies MENA FZ-
LLC
Building 11, Office G08
Dubai Internet City
United Arab Emirates

Phone: +971 4 434 5361
Fax: +971 4 439 3406

Email: info@fft-mena.com

Web: www.fftsecurity.com