

# Smart Fusion Fence

for the highest perimeter protection costing low



- Fence itself having sensing capability
- Invisible to intruder
- Success Rate of detection : 95% or over
- Locate intruder presence within  $\pm 25$  meters or less
- No nuisance alarm, no malfunctioning
- Easy to install & maintain



Fiber Optic Mesh Fence



Sensing Wire Net



Security Matt



Sensing Concertina



Alarm Control Unit



Sensing Wire Fence



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## Development Background



**Fiber Optic Mesh Fence on a Military Site Wall**



**Fiber Optic Mesh Fence for demonstration**

A fence is to prevent an unauthorized person's trespassing into the facility under protection but is vulnerable either to cutting through or climbing over. Most of important facilities such as nuclear power plant, missile site, airbase etc require intrusion sensors separately in addition to the fence for protection from intrusion. Having both a fence and intrusion sensor separately require higher for installation cost and extra material cost compared to install both simultaneously.

Our human body was created with nerve everywhere muscle is. Likewise 'Smart Fusion Fence' was invented to have the fence fused with intrusion sensor so as to reduce fence material cost but drastically increase the security effect.

Recently employing three patented technologies (KOR Patents # 10-1698834, #10-1698837, #10-2016-0117259), we jointly developed to present '**Smart Fusion Fence**' in various type such as **Sensing Concertina, Security Matt, Sensing Wire Net, Sensing Wire Fence** etc. in addition to the original **Fiber Optic Mesh Fence** which was developed by Fibertron in 1990's based on the unique Optical Radar principle and has been reputed as the unique foolproof accurate intrusion detection system being free from nuisance alarm throughout its worldwide installations over 15 years.

### FOM (Fiber Optic Mesh) Description

The FOM is woven of a twisted Fiber Optic Sensor Cable (FOSC) in rhombic shape to stretch or shrink to be suited slight fence height /length variation and to remain in the twisted cell structure even after removing a cell fastener.

Highly flexible insulation (high grade polyurethane) is used to make the cable to allow a bending radius of less than 10mm (typically single core tight buffered fiber offers a bending radius of about 30mm) enabling it to be extra flexible and easy to manage on site.

The flexible nature shall cater to make it hardier for rough handling and less prone to internal fiber breakage, which occurs in other fiber system.

FOM bottom can be fixed to Concrete Fixtures and/or Grooved Rods so as to prevent or sense intruder by underneath crawling or shallow digging.

Climbing over the fence can be detected by Taut Wire coupled with FOSC at either TT (Top Transducer) on FOM top or FOT(Fiber Optic Transducer) inside concertina coil.

### Model : FOM- HM

- The cable diameter/color : 3mm/black
- Optical Fiber grade : 125 $\mu$ m multimode
- FOM width (height) : H meter (3 meter typically)
- Cell size : 90-120cm in woven rhombic shape
- Operating temperature : -40°C + 75°C
- Cell fastener : SUS304/Prevent opening using commercial hand-powered tools
- Environmental characteristic: Immune to all kind of environment effects such as water (rain, snow, haze etc)/electricity ( lightning, electrostatic, ground loop, power line, EMI, RF etc)/ sound & vibration (wind, storm, sound, vehicle vibration etc)
- Weight < 40kg / 3m x 100m

## Control Equipments

The ACS is the intelligent main unit which receives the presence of the abnormal Optical echoes from OSU and processes it to identify and pinpoint on monitor with visible and audible alarms. There are two different models. ACS-nP houses an OSU-nP in the same rack. ACS-kT is to control k OSUs at separate remote location. ACS also provides OTDR service function and operation data storage. ACS provides input ports for other sensors such as IR Sensor, Shock Sensor, Door Locks etc and communication ports with other PC, CCTV Control, Server PC, LAN, Internet etc

### ACS(Alarm Control Station)

#### ◆ ACS-nP/kT (Alarm Control Station)

- Operation mode : Normal, Test, Emergency, Setting, Stop
- Sensing mode : cutting and/or excess force
- Location Accuracy :  $\pm 1m$  ,  $\pm 15m$  ,  $\pm 25m$ , Optional
- No of Optical ports : n (upto 8)
- No of terminals : k OSUs (upto 64 typical)
- External connection port : PC interface
- Fiber Optic test function : semi-OTDR
- Auto-logging : alarm, action, status, setting value etc
- Monitor : 17" color
- Interface : dry contacts, serial or LAN
- Acceptable output devices : warning light, signal phone
- Acceptable input devices : IR/MW sensor, shock sensor
- O/S : Window XP
- Dimension : 195 x 60 x 75cm or 150 x 60 x 75cm
- Operating condition : indoors
- Power : AC220V $\pm$ 10% 50/60Hz, 400Watt approx



ACS - nP



ACS - kT

The OSU injects infrared Laser Pulses into the FOM and measures any optical echoes to pick up any external disturbances. The OSU transmit abnormal symptom data to the Alarm Control Station to process and trigger an alarm. The OSU is either housed within ACS-nP or remotely at the site.

### OSU (Optical Sensing Unit)

#### ◆ OSU-nP (Optical Sensing Unit)

- No of Optical Ports : n (upto 8)
- Sensing coverage per Optical port : 3m x 250m for break, 3m x 200m for excess force stronger than 20kg
- Fiber Optic connector type : FC multi-mode
- Dimension : 177 $\times$ 483 $\times$ 300 mm
- Weight : 10 kg, typical
- Operating condition : indoors, inside shelter for outdoors
- Power : AC220V $\pm$ 10% 50/60Hz, 250Watt



OIA-nP is a PC body size desktop version of ACS-nP. OIA injects Infrared Laser Pulses to the FOSC (Fiber Optic Sensor Cable) periodically and shall identify & accurately locate the presence of intrusion from the abnormal Optical Echoes to trigger an alarm visibly & audibly operators. OIA also provides OTDR service function and operation data storage. ACS provides input ports for other sensors such as IR Sensor, Shock Sensor, Door Locks etc and communication ports with other PC, CCTV Control, Server PC, LAN, Internet etc.

### OIA (Optical Intrusion Alarm)

#### ◆ OIA-nP (Optical Sensing Unit)

- Operation mode : Normal, Test, Emergency, Setting, Stop
- Sensing mode : cutting and/or excess force
- Location Accuracy :  $\pm 1m$  ,  $\pm 15m$  ,  $\pm 25m$ , Optional
- No of Optical Ports : n (maximum 8)
- Sensing mode : cutting , excess force , selectable
- External connection port : PC interface
- Fiber Optic test function : semi-OTDR
- Auto-logging : event data (alarm, action, status, setting value etc)
- Monitor : 8.4" LCD color built in or 17" LCD external
- Interface : dry contacts, serial or LAN
- Acceptable output devices : warning light, signal phone
- O/S : Window XP
- Dimension : 19" 4U (177 $\times$ 483 $\times$ 300 mm)
- Operating condition : indoors
- Power : AC220V $\pm$ 10% 50/60Hz, 100Watt approx



## Security Matt



**Security Matt between two military fences**



**Security Matt, Top**



**Buried FOSS under Lawn**



**Buried Carpet, Red**



**Buried FOSS near by Rails**



**Security Matt, Bottom**



**Buried FOSS under Grasses**



**Buried Carpet, Green**

Security Matt consists with a Matt and FOSS (Fiber Optic Sensor Cable) attached in zig-zag pattern to the Matt bottom with fixture. Either one or both ends of FOSS shall be connected to OIA (Alarm Control Station) which periodically pumps Infrared pulses in to FOSS and trigger alarm and locate intrusion accurately from the abnormal Optical echoes related to the stress by intruder presence on the Matt.

The Coconut Matt is in widespread use to provide soft & pleasant way for walkers & pedestrians preventing the road surface from flood, grasses etc. In addition to this, the Security Matt having sensing capability itself shall protect the client facility/area from intrusion with following advantages;

- Hidden to intruder
- Easy to install
- Wide application unlimited by terrain surface condition
- Free from nuisance alarm
- Locate accurately within  $\pm 15$  m
- No field equipment up to 10KM
- Minimum maintenance
- Long life time use

For other than Coconut Matt, a FOSS can be buried under carpet or grasses or gravel near by rails to alarm at intruder presence and locate accurately.

## Specification of Security Matt

- Coconut Matt Thickness : 40mm, typical
- Matt Width : 1 to 2 meters, typical
- Matt Weight : 8kg / square meter
- Material : Coconut
- Detection Coverage per Control Unit : 1.5M x 10KM
- Location Accuracy :  $\pm 15$  m,  $\pm 25$  m,  $\pm 50$  m,  $\pm 100$  m, Optional
- FOSS diameter: 3 mm
- Fiber Grade : MMF
- Immune to weather, free from nuisance alarm
- Power requirement for Control Unit: AC220V  $\pm 10\%$  50/60Hz, 100Watt approx

## Sensing Concertina – FOSS detecting Intruder Climbing Concertina Coils



### Concertina

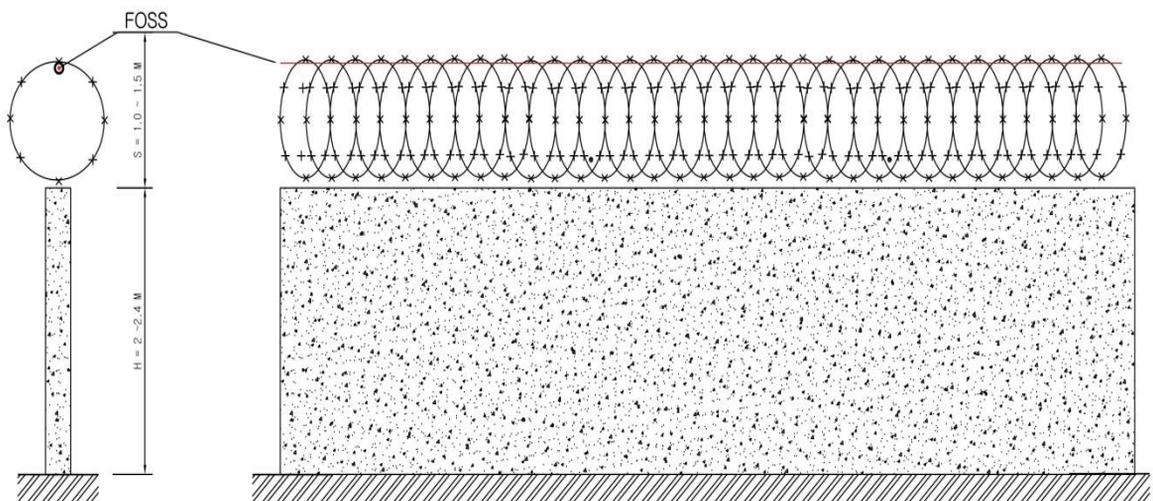


### Sensing Concertina

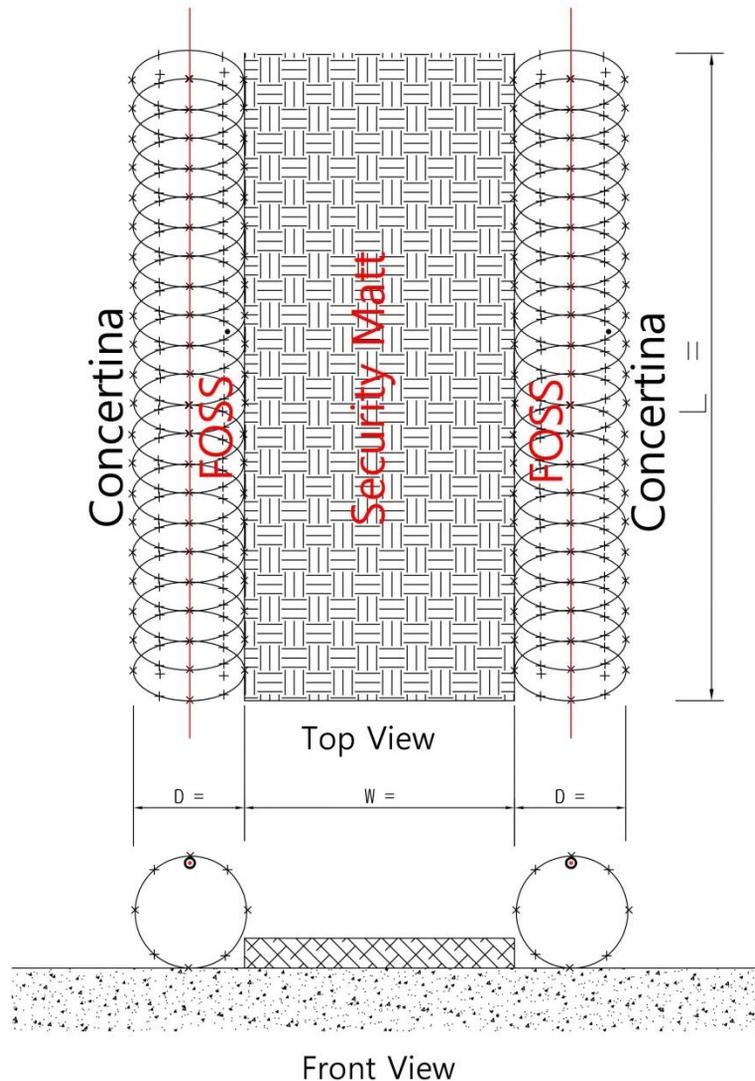
Concertina coil(s) can be put either on the fence/wall top or wall top or laid on the ground for the purpose of prohibiting intruder trespassing. Cutting through concertina coil(s) is much more difficult compared to cutting fence mesh. Usually concertina coil(s) are placed high on the fence/wall. Thus mounting FOSS to concertina top to trigger alarm when an intruder steps on the concertina while climbing over can be good enough to secure the perimeter costing very low.

The FOSS was invented in the unique design comprising a number of passive elements such as Sensing Bar, Tension Wire, Support and FOSSC (Fiber Optic Sensor Cable) so as to sense intruder presence in the unit of 1.5M segment. Its functioning can be easily illustrated by the Spine Analogy. The Human Spine is formed of 26 small segments. Each segment is only a few centimeters. All 26 spine segments share the same internal nerve which is connected to the brain. Tiny transverse impact to any spine segment by injury or disease will exert stress to the internal nerve and the nerve will send a pain signal to the brain for recognizing the stress.

The FOSS is composed of 1.5M long segments. All the segments share the same FOSSC connecting to OSU (Optical Sensing Unit). Intruder stepping on the Concertina with FOSS shall cause to strongly push any one of FOSS segments and apply stress to the FOSSC to generate abnormal Optical backscatter and trigger alarm.



## Smart Fusion Fence



Instead to have a conventional fence or concrete wall along a perimeter, it is strongly recommended to have a Smart Fence which consists with Security Matt and Concertina with FOSS for much higher security as well for much less cost. One or two Concertina coils equipped with FOSS shall be put along both sides of Security Matt.

An intruder crossing the Smart Fence must step on and disturb the concertina top and security matt to trigger alarm. The Security Matt shall provide a soft & pleasant way for patrol (security guard) preventing the road surface from flood, grasses etc.

The Smart Fence having sensing capability itself shall protect the client facility/area from intrusion with following advantages;

- Maximum obstacle to intruder
- Hidden to intruder
- Easy to install
- Wide application unlimited by terrain surface condition
- Free from nuisance alarm
- Locate accurately within  $\pm 15$  m
- No field equipment up to 10KM
- Minimum maintenance
- Long life time use

### Concertina /Matt combined Smart Fence

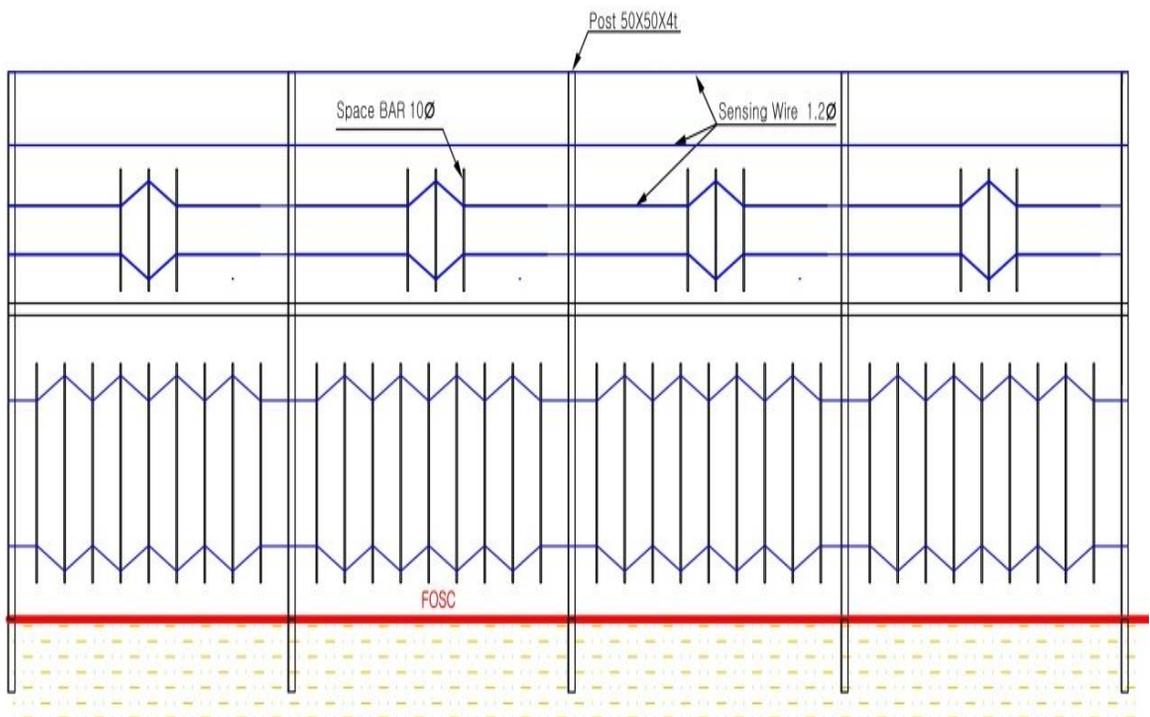
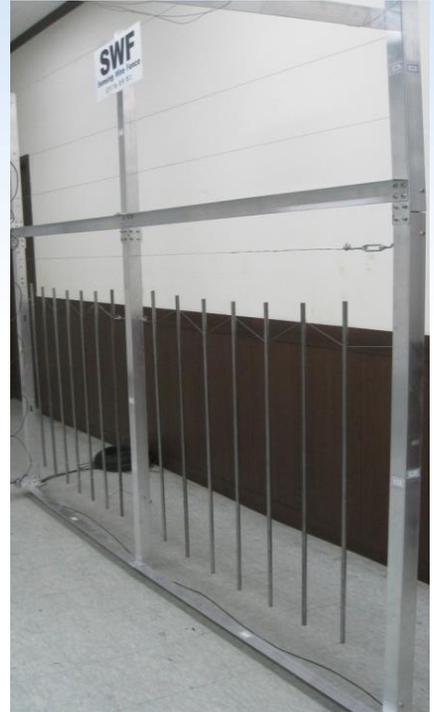
- Matt Thickness : 40mm, typical
- Matt Width = 1.5 to 2 meters, typical
- Matt Weight : 8kg / square meter
- Matt Material : Walnut
- Coverage per Control Equipment : 1.5M x 10KM
- Location Accuracy :  $\pm 15$  m,  $\pm 25$  m, Optional
- FO Sensor Cable Diameter : 3 mm
- FO Sensor Grade : MMF
- Concertina Diameter  $D = 90$ cm, typical
- Environmental Characteristic : all weather

## Sensing Wire Fence

Sensing Wire Fence consists of metal Posts, thin Space Bars, Sensing Wires and a FOSC (Fiber Optic Sensor Cable). Install 2meter high Posts at 3 meter intervals along the perimeter. Mount two Sensing Wires with Space Bars up to 1.2meter height from the ground. Mount three Sensing Wires along with a FOSC (FO Sensor Cable) up to 3 meters height. Mount FOT (Fiber Optic Transducer) at about 25 meter spacing in a hidden place so the FOSC can detect wire cutting or pulling by an intruder.

The FOSC is connected to the OIA (Optical Intrusion Alarm) at SCR (Security Control Room) to receive Infrared Laser Pulses periodically. At reception of abnormal Optical echoes along FOSC, the OIA will signal an alarm & locate the intrusion spot within  $\pm 25m$  error visibly and audibly to operators.

The system will need no field equipment (Electrical Power, Communication Port, and Processor) along the fence and thus will minimize maintenance requirements during the expected 15 year life time. The Sensing Wire System will be intrinsically free from nuisance alarm and immune to environmental effects or outside influences such as aircraft/truck vibrations, high temperature, sunshine, rain, snow, haze, dirt, storm, lightening, surge, power lines, Electric ground loop, Electric cross talk etc.



## Sensing Wire Net



To stop and alarm at death-leap from a bridge

- For suicide fall prevention and alarm
- Rare nuisance alarm
- Nearly invisible
- Accurate locate
- No filed equipment
- Compatible with CCTV camera and server



To stop/trap and alarm at intruder scaling over a fence

