Application Note AN-3
AURATEK for Fenced Compound Applications

Revision 1: January 2003

Introduction

In the past, a fence acted as a physical barrier to delay intrusion. In today's security requirements, this role has changed. Now, a fence must both deter and detect intrusion to protect a compound. This detection requirement is accomplished by adding an electronic sensing capability to the fenced compound. Adding this capability is not easily accomplished because of the noise and vibration present in a fence environment. As well, the sensor must be capable of detecting intruders who enter a compound by climbing over, cutting through or tunneling under the fence.

Requirements for Fenced Compounds

ENCLO**SURE** meets today's requirements as a sensor for protecting a compound. The difficult environment that a fenced compound presents to a detection sensor are easily addressed by ENCLO**SURE**'s application flexibility.

Reduced Nuisance Alarms - The sensor can provide better detection and greatly reduced nuisance alarms once the intruder is actually inside the compound. This can be accomplished by installing the sensor on the inside of the fence or buried inside the perimeter of the fence.

Protect Gate Areas - To handle the presence of a gate, some sensors have to leave an unprotected zone across the gate area. It also means that a zone has to be broken and a new zone started once past the gate area. ENCLO**SURE** can protect the gate area by being buried across the mouth of the gate and continue past it without incurring the additional expenses of starting another zone, as many other sensors would.

No interference with compound traffic - The sensor can be placed so that it does not physically interfere with compound traffic. Also, it can be located so that it does not detect the movement of vehicles in the compound. These two requirements can be addressed by either mounting the sensor on the inside of the fence or by properly burying it inside the compound.

Snow and snow removal equipment - Snow can be a problem for some sensors because it interferes with their ability to detect intruders. Also, there is a concern that snow removal equipment can damage a sensor by hitting it or by tearing it up.

ENCLO**SURE** can address these requirements through the proper placement of the sensors. They can be placed on the inside of the fence or buried to a safe depth.

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Typical Fenced Compound Installation

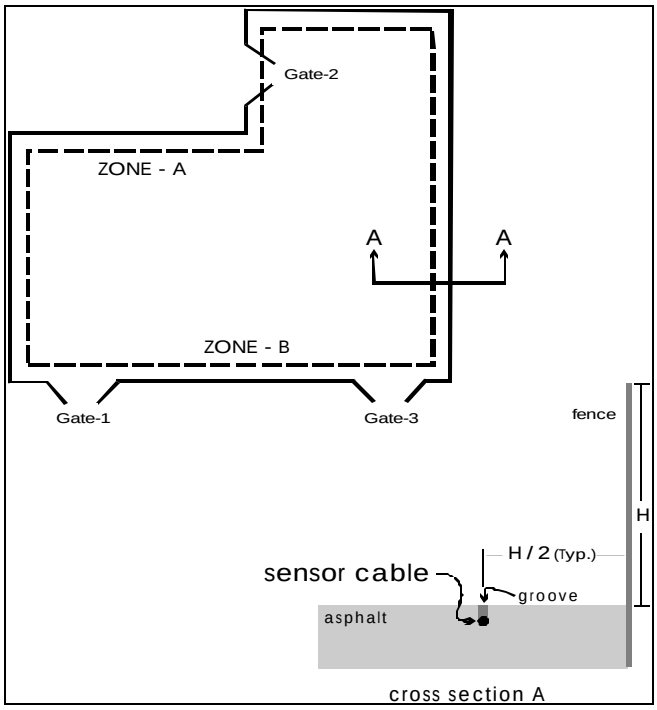

Fig. 1

Typical installation where the sensor cable is just laid on surface (or buried) inside the fenced compound. Note the facility to maintain protection across the gate access area.

ENCLO**SURE** should be utilized in a fenced compound application so that it provides sufficient protection while addressing the requirements described in the introduction. Specially, the system should :

- Reduce nuisance alarms by only detecting intruders once they are inside the compound.

- Reduce nuisance alarms caused by acoustic vibrations on the fence and vibrations caused by activities outside the compound.

The maximum zone length for a compound application is 50 m (165 feet) per zone when the sensor cable is buried or placed on the surface inside the compound. This can be achieved if the cable is buried or placed on the surface in an "open field" within the compound. An "open field" can be defined as an area that is a minimum distance equal to the height of any "volumetric" metal object or fence away from the cable. Volumetric can be defined as an object that has approximately the same height and width (e.g. a metal fence or a large spool of electrical wire. On the other hand a metal light pole would not be considered to be a "volumetric" metal object.

If the cable is kept a minimum distance of half the height of the fence or the metal object, the system will work effectively, however, the usable length of the zone will be reduced by half. This is site dependent. If a maximum zone length is desired, the cable should be kept a minimum distance equal to the height of the fence or the height of a metal object for full zone length detection.

The width of the detection zone is typically 2.0 m (6.6 feet) in diameter.

If the sensor is mounted on the fence, 20 cm (8 inches), stand-offs should be used.

Typical Compound Installations

a) Sensor cable Buried or Surface

A buried or surface application of the sensor provides detection against jumping over or tunneling under the fence.

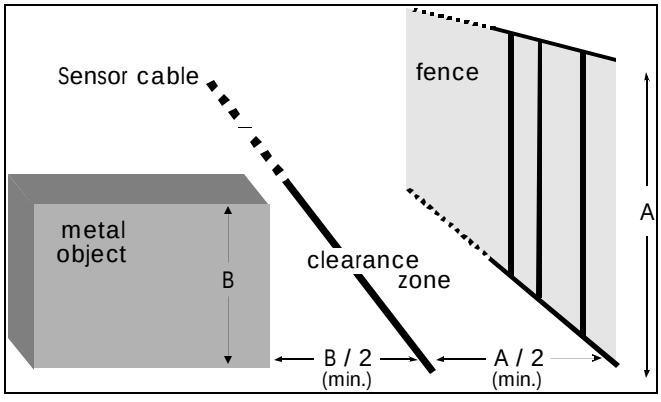

Fig. 2

A zone free of metallic articles is needed in order to maintain a uniform detection zone. Note that the clearance zone contributes to deter the intruder.

When the sensor is placed inside a fenced compound, the cable should be placed a minimum distance from

the fence equal to half the height of the fence. (e.g. for a 2.0 m (6.6 feet) high fence it should be placed 1.0 m (3.3 feet) from the fence.) The clearance zone created by the placement of the cable away from the fence acts as an additional security deterrent to an intruder. The same clearance distance should be applied to any large metal objects.

There are several advantages to placing the assets which need protecting in the middle of the compound and burying the ENCLO**SURE** detection cable in the compound roadway which goes around the assets. These benefits include :

- Intruders will cross the detection zone several times as they move toward and away from the protected assets.
- Intruders cannot use a physical bridge to climb over the fence and over the detection cable as they could if the detection zone was placed just inside the fence.
- Since the roadway will always be kept clear, there is no fear of materials being piled on top of the detection cable.
- The roadway will always be plowed to allow access to the stored materials, therefore, there is no fear of snow piling on top of the cable and being used as a bridge over the detection zone.
- There is less chance of nuisance alarms being caused by activities outside the compound (e.g. large vehicles passing close to the detection cable or people touching the fence).

The disadvantages to protecting assets in this manner are:

- Intruders are well inside the compound before they are detected.
- Not all the compound is protected.
- It may take considerable effort to organize the compound in this manner.

When the sensor cable is buried or placed on the surface, the detection zone does not have to be interrupted at a gate area. ENCLO**SURE** addresses this by having the sensor cable routed across the mouth of the gate entrance.

b) Sensor cable Mounted on Fence

A fence mounted application of ENCLO**SURE** protects against intruders jumping over but not tunneling under.

For this application the cable is mounted on the inside of the fence using non-metallic spacers (stand-offs) 20 cm (8 inches) from the fence. (see Figure 3)

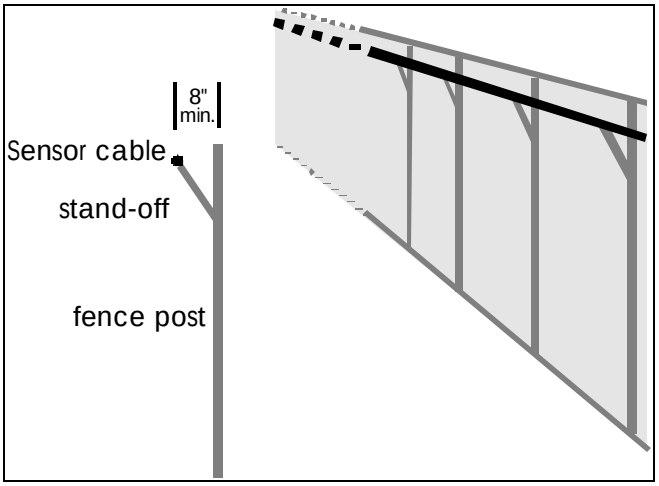

Fig. 3

This figure shows a fence mounted installation which provides protection against a wide range of intrusion, (e.g. by cutting through or by passing over the fence).

The detection zone could be bridged across gated entrances using a section of non-detection cable to avoid having to add an unnecessary zone for every gate.

c) Sensor cable located at close proximity or under protected articles.

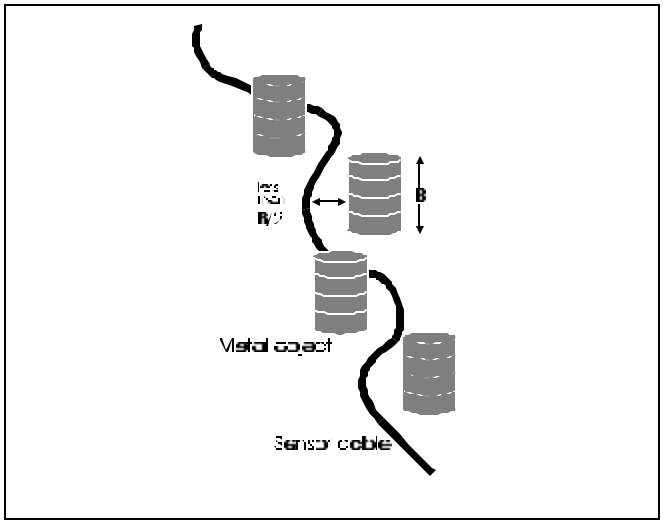

Fig. 4

When placed at proximity to the sensor cable (distance less than B/2), the detection field surrounds the metal articles, such that an alarm is triggered when an intruder approaches these articles or when they are moved.

When one (or more) metallic article(s) (e.g. a tractor, trailer, spool of electrical wire, toxic waste container, etc.) is placed within the clearance zone (located at a distance shorter than half the height of the article), any displacement will automatically generate an alarm.

When a new article is added, an alarm is generated and the Processor Unit adjust itself to the presence of that new article such that a second alarm is generated if that new added article or any other article is displaced. (see Figure 4)

d) Dual Mode Application for Gate Areas

Gate areas provide a unique challenge to protecting fenced-in compounds. The challenge lies in how to handle the gate areas during the day with heavy traffic moving in and out of the compound and when the rest of the perimeter requires protection during the day. (see Figure 5)

This is achieved by using two kinds of cables; a detection (sensor) cable and a non-detection (doubled shielded) cable.

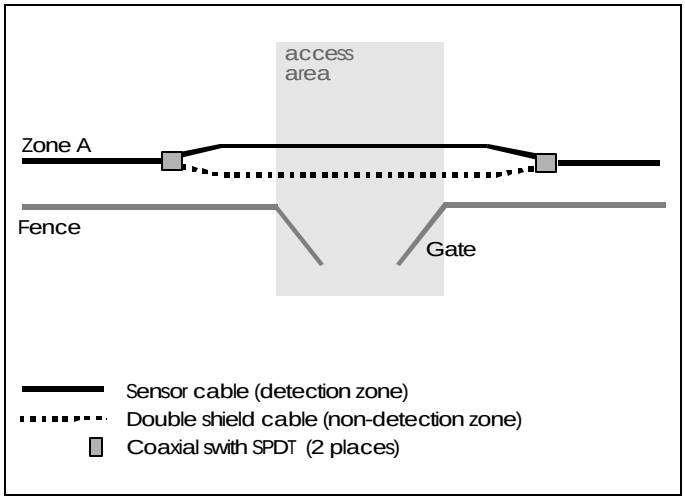

Fig. 5

A combination of two cables, one for detection (sensor cable) and the other for non-detection (lead-in cable) are used to create a temporary "breach section" among the zone to allow the traffic to freely cross the zone without de-activating the entire zone length.

Day operation - The detection is maintained along the fence compound, excluding the gate area. The segment of non-detection cable is selected to allow the traffic to flow without causing alarms.

Night operation - For a full perimeter coverage (including the gate area), a segment of the detection cable is selected, hence forming a continuous detection zone among a single zone.

All required switching control signals are sent via a card access or gate access controller.

In compounds where there is traffic from heavy equipment, the cables crossing the gate area should be protected by a non-metallic conduit that is buried in the ground.

e) Sensor Cable Located in Between Two Fences

Because of the amount of metal present (typical installation is between two fences of 3-4 m (10-12 feet) in height) the reference antenna is replaced with a series of flat antennas. The flat antenna is mounted on the fence while the second (transmitting) cable is buried between the two fences. A field is then created around both the cable and the flat antenna providing a wide area of detection.

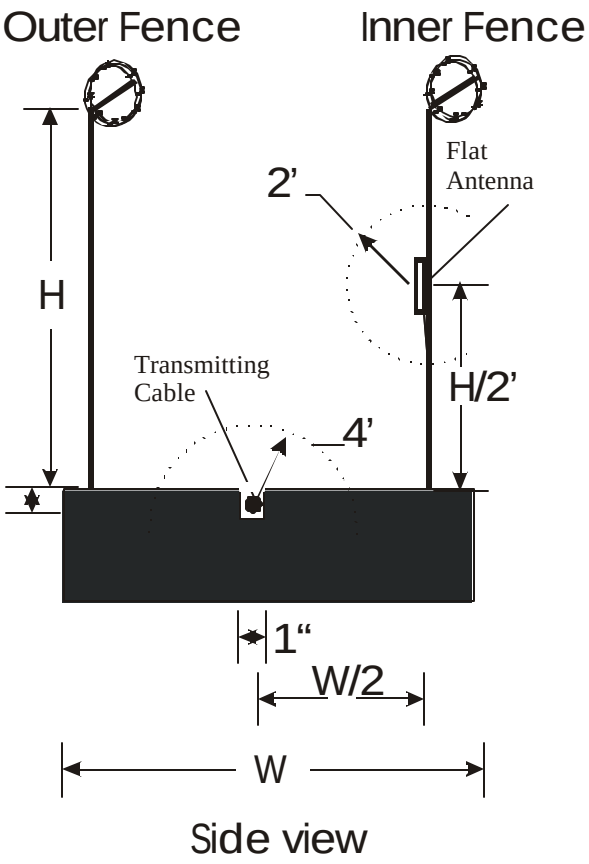

Fig. 6
The flat antenna is mounted on the inner fence. The transmitting cable is buried between the two fences in a 1.5" deep by 1" wide groove.

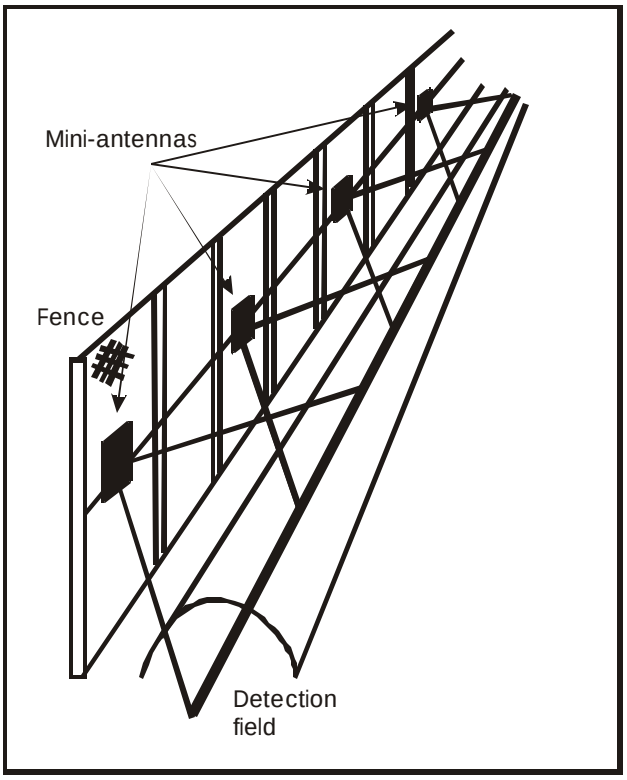

Fig. 7
Fence mounted flat antenna transmitting to buried sensor cable.

f) Sensor Cable Used as a Pre-Warning

Many end users require detection of intruders before they enter their compounds. On fence compounds, where the surrounding property is owned by the end user, the sensor cable can be installed on the outside perimeter of the fence where it would act as an early warning system.

Two sensor cables (zone A , zone B) are used in this configuration, since the area outside of a fence is usually uncontrolled regarding human or animal activities. Zone A is installed on the outside of the fence, acting as the early detection zone. Zone B is mounted on the fence, it acts as the true alarm zone. Depending on the height of the antenna, Zone A must be far enough from the fence in order to properly receive the signals from the antenna. (see Figure 7)

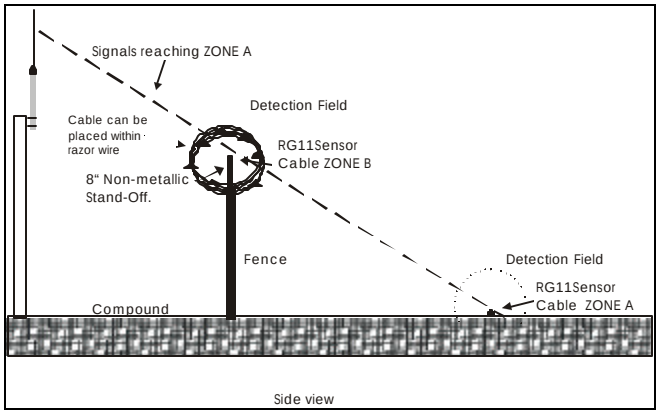

Fig. 8

To detect intruders before they penetrate the compound, a zone is placed outside the fenced perimeter, it serves as a pre-warning. The actual alarm is generated by the zone mounted on the fence.

Interconnections

a) Processor Unit

The processor unit can be located either inside a building adjacent to the compound or it can be placed outside in a weatherproof NEMA-4 rated box.

b) Lead-in Cable

For fenced compounds, the lead-in cable (non detection cable) between the Processor Unit and the detection zone can be mounted directly on the fence or buried. The minimum distances shown in Figure 2 do not apply for the lead-in cable with the exception of the 3.0 m (10 feet) section meeting the sensor cable.

c) Antenna

Passive mode - The (reference) antenna can be placed on any high elevation adjacent to the compound (e.g. on a high post, or on an adjacent building). NOTE: Passive mode must be designed by the manufacturer.

Active mode - The (receiving/transmitting) antenna must have line of sight with the sensor cables. If the antenna is transmitting to the sensor cables, it should be located in the middle of the zone. If the sensor cable is transmitting to the antenna, the antenna must be located at ¾the length of the zone. In either case, a minimum setback distance of 15 m (50 feet) from the sensor cable is required. The minimum height of the antenna should be 5.0 m (17 feet).

d) Alarm annunciating

As an option, the alarms can be reported by the following: Vocal annunciator, wireless alarm annunciator or via the RS-232 port. For buried applications, the alarm wires (if used) can be run in the same trench as the sensor cable as long as the alarm wires are a minimum of 15 cm (6 inches) below (underneath) the sensor cable.

Conclusion

This application note attempts to demonstrate the flexibility of the ENCLO**SURE** , in addressing specific difficulties encountered in large fenced compounds.

This flexibility offers a cost efficient solution for complex sites.

Finally, ENCLO**SURE**'s covertness contributes considerably to increasing the capture rate in addition to its detection capabilities.