STEALTH
LABORATORIES

STEALTHFLEX
Perimeter Protection System

Installation Manual

Stealth Laboratories, 600 Highland Avenue SE, Hickory, NC 28601.

Tel. 800 360 4146 Fax. 828 328 1105 www.stealthlabs.com

STEALTHFLEX Perimeter Protection System

Installation Manual

Contents

Section

1

STEALTHFLEX Perimeter Protection System

Installation Manual

An Introduction to the STEALTHFLEX Perimeter Security System.

STEALTHFLEX is a highly efficient perimeter intruder detection system, designed for use on virtually all types of fence. It has been successfully deployed on chain link (both galvanized and plastic coated), all types of welded mesh, expanded mesh and most types of palisade fences. In addition, it can be used to protect the walls and roofing of buildings.

There are two key components to the STEALTHFLEX perimeter intrusion detection system. The first is a special microphonic sensor cable, which is attached to the fabric being protected. The cable has the effect of converting the fence or roof etc into a giant high fidelity microphone, which will "listen" for any intrusion attempts. The electrical output of the cable is a faithful reproduction of all of the noises generated by the fence. The cable is tough, long lasting, easy to install and unobtrusive. The sensor cable may be attached directly to the fence with standard black plastic cable ties, using a tie wrap gun to minimize installation time. Alternatively, if additional mechanical protection is required for the cable, it can be installed in a plastic or metal conduit. The sensor cable is totally passive and is available in a range of sensitivities to suit the specific application. The second key component of the STEALTHFLEX system is the electronic Analyzer, a signal processor which continuously monitors the output of the sensor cable. It is designed to ignore the signals generated by environmental effects, such as wind, rain, birds etc, but detect any attempt at breaching the perimeter fence by, for example, climb over, cut through or jacking. The Analyzer uses the latest microprocessor technology and is housed in a robust, fully weatherproof diecast metal box. The Analyzer continuously checks the integrity of the sensor cable by monitoring a termination resistor which is attached to the outer end of the sensor cable. If the cable is cut, damaged or in any way interfered with, the Analyzer detects this and signals it as a tamper alarm condition.

STEALTHFLEX is rapidly installed and is easy to set up. It can be used for both permanent and temporary installations and is designed to interface to a conventional intruder alarm panel. However, it has the added operational advantage of an audio output. If an alarm is generated, the person responding to the alarm can "listen in" to the fence and confirm that an intrusion is taking place. This facility is available on every STEALTHFLEX installation, provided the necessary (two wire) connection is installed between the Analyzer and central monitoring station.

For installing the STEALTHFLEX system on gates, a bypass switch unit is available. This enables a section of sensor cable, installed on an entrance gate in the fence, to be switched out. The gate can then be opened and closed without the need to disable the STEALTHFLEX system on the remainder of the zone. The bypass switch can either be operated at the gate location with a key, or it can be supplied with a relay to enable remote operation from the control center.

Properly installed, STEALTHFLEX provides a cost effective and highly reliable fence protection system, with a high probability of detecting an intruder combined with a low nuisance or false alarm rate.

Figure 1
A STEALTHFLEX system installed on a chain link fence.

The Components of a STEALTHFLEX Installation.

This section provides a list of the components required for the installation of a STEALTHFLEX perimeter security system. As might be anticipated, some of these items are specific to STEALTHFLEX and can only be obtained from vendors of the system. Others are of a more general specification and are available from a number of suppliers.

Items specific to the STEALTHFLEX System:

AN-1000 **Single Zone Analyzer in Metal Can for Indoor Installation**

AN-1001 **Single Zone Analyzer in NEMA 4 Outdoor Housing**

For monitoring one zone of up to 1,000 feet (305 meters) of Sensor Cable.

AN-2000 **Dual Zone Analyzer in Metal Can for Indoor Installation**

AN-2001 **Single Zone Analyzer in NEMA 4 Outdoor Housing**

For monitoring two zones of up to 1,000 feet (305 meters) each.

A means of attaching each Analyzer to a fence post is required. A suitable mount can usually be manufactured from aluminum sheet, of about $^1/_8$" thick and fixed to the fence post with stainless steel banding. Further information is given in Section 3, Installation Procedure.

SC-1000 **Sensor Cable.**

Supplied on 1,000 ft reels.

SC-500 Sensor Cable.

Supplied on 500 ft reels.

NC-100 Non Sensitive Coaxial Cable.

Supplied on 100 ft reels.

EOL-1 Weatherproof End of Zone Termination Box.

With terminals to enable the Analyzer to monitor automatically the integrity of the Sensor Cable.

JB-1 Weatherproof Junction Box.

With terminals for joining Sensor Cable to itself or to Non Sensitive Coaxial Cable.

BPS-1 Manually Operated Gate Bypass Switch.

BPS-2 Gate Bypass Switch with Remote Operating Relay.

KITS

SF-500	**500 ft. SC-1000 Cable, Indoor Analyzer, Termination Box**
SF-501	**As SF-500, with Outdoor Analyzer.**
SF-1000	**1000 ft. SC-1000 Cable, Indoor Analyzer, Termination Box**
SF-1001	**As SF-1000, with Outdoor Analyzer.**
SF-2000	**2000 ft. SC-1000 Cable, Indoor Analyzer, 2 Termination Boxes**
SF-2001	**As SF-2000, with Outdoor Analyzer.**

Items not specific to STEALTHFLEX, available from local electrical suppliers:

Cable Ties

Cable ties are used for attaching the sensor cable to the fence. One is required every 6" (150mm) to 8" (200mm). These must be UV stabilized and designed for outdoor use. A suitable type is, for example, Thomas and Betts TY525 MXR. For some high security installations, one or two stainless steel tie wraps per fence panel may also be required.

Interconnect Cable

The specification of the interconnecting cable between the Analyzer and alarm control panel varies with the requirements of the system. For example, a single zone Analyzer, using alarm and tamper circuits, with audio monitoring, requires 4 individually shielded twisted pairs . The gauge of wire varies with the distance between the Analyzer and alarm control panel. Typically, 22 awg will be suitable for runs of up to 1 mile. 20 awg conductors should be used if the distance is greater than this. Before specifying the interconnecting cable, the connection diagrams for the Analyzer (Figures 23 & 23) should be studied; these will enable the correct number of twisted pairs to be specified. If this cable is to run below ground, it clearly needs either to be installed in a duct, or be armored and suitable for direct burial.

Grounding Rods

It is most important that each Analyzer is grounded to a copper or zinc coated steel rod, of ~3 feet length, driven into the soil adjacent to it. A short length of heavy gauge insulated copper wire will also be required, to connect the Analyzer to the grounding rod.

Alarm Control Panel & Power Supply

STEALTHFLEX will work with most types of alarm control panels. The panel is required to supply the power to each of the Analyzers, so it clearly must have an adequate internal power supply. The requirement is for between 10.5 to 28 volts DC; at 12V DC an Analyzer draws a maximum current of 100 mA and the normal operating current is ~30mA. A separate power supply, such as the Stealth PS-1224 can also be used. This is often more convenient when the distance between the alarm panel and the analyzer is sufficient to cause concerns of voltage drop – a problem that can be eliminated by placing the power supply close to the analyzer and running AC voltage to it.

Audio Monitoring

If the audio monitoring facility is to be used, a headset or a small amplifier and loudspeaker is required. A walkman type headset will work.

Figure 2
The STEALTHFLEX Analyzer.

Section
2

STEALTHFLEX Perimeter Protection System

Installation Manual

The Site Survey.

The key to the successful installation of any security system is planning, and STEALTHFLEX is no exception. Time spent on the site survey will pay dividends during the installation and commissioning phases of the system. It will also help to eliminate the need to return to the site after the hand-over to track down the cause of problems such as false alarms.

The condition of the fence

First of all, examine the fence itself and decide whether the site security will actually be improved by the installation of an intrusion detection system. If the fence will not physically prevent an average person climbing over it, or the fabric and/or the support posts are worn or damaged, a security system attached to the fence is unlikely to increase the security of the site. STEALTHFLEX should only be attached to fences of sound construction and adequate height, say a minimum of 7 feet. The installation of STEALTHFLEX should never be used as a substitute for the replacement of an inadequate or worn out fence.

Walk around the entire perimeter, taking a careful look at the fence and noting any places which require repair or maintenance. This inspection is to identify sources of extraneous noise, which will cause false alarms once STEALTHFLEX is installed. If in doubt, give the fence a vigorous shake and listen to the noises made by the fence fabric. It is important that no “bangs and rattles” are heard. Some potential problem areas are listed below:

- Slack or missing strainer wires, which will allow excessive movement of the mesh.
- Missing or badly corroded fixing nuts and bolts or screws.
- Loose or damaged fence posts and bracing stays.
- Areas where the fence fabric is not securely fixed to its supports.
- An area adjacent to the fence to which the public has access.
- A highway near to the fence that carries heavy traffic during protected hours.
- Large animals, i.e. cattle, that may come into contact with the fence.
- Signs not securely attached to the fence, Figure 3.
- Trees and bushes growing against the fence, Figure 4.
- Areas where rubbish can accumulate against the fence and flap in the wind.

- Gaps at the bottom of the fence where an intruder could gain access without coming into contact with the fence itself.

- Access gates that can rattle excessively in either the open or closed positions.

- Flag poles, CCTV camera mounting posts etc that can move in the wind and transfer vibrations to the fence.

Figure 3
A loose sign on a fence - a sure cause of false alarms.

Figure 4
Bushes growing against the fence should be removed before starting to install STEALTHFLEX.

It is important that repairs to the fence are made before the installation commences. It will also be necessary to clear the fence of all vegetation; this can often entail a significant amount of work, and will require regular inspections after installation to ensure that bushes etc are not regrowing. If the fence is new, it is worth checking that the client has no intention of “landscaping” the site by planting trees and shrubs around the perimeter fence. In the short term this will not be a problem, but after the bushes have grown large, with many branches able to be blown against the fence, the number of nuisance alarms will rise significantly.

If there is any doubt as to the suitability of a fence for the installation of a STEALTHFLEX system, it can often be resolved by temporarily installing a short test/demonstration zone.

The Site Installation Plan

The next step is to draw up a Site Installation Plan. This will be used to produce a Bill of Materials and provide a guide for the installation engineers.

The Site Installation Plan should be commenced by showing the following information:

- The line of the fence and its dimensions.
- The shape and dimensions of the fence posts (if the Analyzers are to be post mounted).
- Locations of gates, with type and dimensions.
- The location of the building where the alarm panel will be located.
- The locations of the other buildings, plant and machinery etc on the site.
- Locations of any existing security systems, such as CCTV cameras, outdoor infra-red systems etc.
- Routes where the interconnecting cables can be run from the Analyzers to the alarm panel.

Draw the Plan to scale, on a conveniently sized sheet (or sheets) of paper. Squared (graph) paper or a computer drawing package may be useful for this exercise.

With this information drawn up and annotated, the zone planning can be carried out. When doing this, a number of factors must be taken into consideration.

1) A mandatory requirement of the STEALTHFLEX system is that zones should not contain more than 1000 feet (305 meters) of sensor cable. The system will work with longer zones, but its performance will be degraded, possibly seriously. Short zones are not a problem; many installations, for operational reasons, use zones of only 150 feet (50 meters).

2) When planning zones, it is necessary to provide an additional 10% sensor cable to allow for service loops at fence posts, additional cable at braced corners etc.

3) On a standard height fence, around 7 feet 6 inches (2.3 meters), a single length of sensor cable will be required. If the fence is higher than this, or the system is to be installed on a high security site, then a double trace of sensor cable must be used.

This will obviously double the amount of sensor cable required per zone. The 1000 feet maximum sensor length must still be adhered to in such cases.

4) If the perimeter is under CCTV surveillance it is advisable to match the camera zones to the STEALTHFLEX zones. A similar consideration applies if there is a complementary perimeter security system present, such as microwave or infra red.

5) The location of the Analyzers relative to the control panel is also important; it is advisable to locate Analyzers so as to minimize the length of interface cable required.

6) Do not mix different types of fence in the same zone. For example, a STEALTHFLEX zone that has chain link fencing combined with another fence fabric, such as welded mesh, will be difficult to set up and its operating efficiency will invariably be compromised. These considerations also apply if the fence changes height along its length; for example do not combine high fence with outriggers and medium height fence without outriggers in the same zone.

7) For operational reasons, the user may have his own requirements for the number and placement of zones.

8) There is obviously an economic advantage to having longer zones, since each zone, regardless of its length, requires an Analyzer.

9) Gates should, whenever possible, be located at the ends of zones. If required, a Gate Bypass unit is available to remove gates that are being opened or closed from the detection circuit, whilst leaving the remainder of the zone protected. The Gate Bypass unit can be remotely operated by applying 12 volts DC.

10) Both single and dual zone Analyzers are available; a dual zone Analyzer will monitor two adjacent zones with up to 1000 feet (305 meters) of sensor cable in each. A dual zone Analyzer is more economical to install than two single zone Analyzers, since two electronic assemblies are mounted in one box and only one interconnecting cable has to be installed between the Analyzers and the alarm control panel.

11) Analyzers can either be mounted directly on fence posts or located some distance away from the fence. If the latter option is chosen, a length of non microphonic cable is required to connect the end of the sensor cable to the Analyzer. The length of the non microphonic cable should not exceed about half the length of the sensor cable on the fence. However, it should be remembered that setting up the system becomes a two person operation if the Analyzer is not mounted on or close to a fence post. In order to optimize the Analyzer settings it is necessary to monitor the Analyzer response when the fence is tapped sharply with a screwdriver handle; this is clearly impossible for one person to do if Analyzer and fence are not collocated.

12) In areas where there may be a high risk of the sensor cable incurring physical damage it can be protected by a conduit attached the fence. The conduit can be conventional rigid steel or the type that is flexible. Clearly the conduit must be fabricated from a material that is suitable for outdoor use. The sensor cable is available pre-installed in 9/32" (7 mm) diameter flexible stainless steel conduit, in lengths up to 400 feet (122 meters). This is conveniently supplied on reels ready for installation using cable ties or screw fixed clips.

13) The interconnecting cable may require to be run in conduit or be steel wire armored for direct burial. The number of pairs in the cable also needs to be decided at this point; consult Section 3 on Installation and Figures 22 & 23 to decide which functions are required. If a dual Analyzer is being used, the power supply for each zone can be run on a single pair of wires.

The Installation Plan, when complete, should be a detailed drawing of how the system will be installed. It should clearly show all of the salient features of the installation, including zone divisions, zone lengths, Analyzer locations, interconnecting cable runs and lengths and any special items such as gate bypass switches. The Installation Plan should enable an installation engineer who has not had the benefit of a site visit to envision exactly how the installation is to be carried out.

The Bill of Materials

The final stage in the installation planning is to draw up a comprehensive Bill of Materials (BOM); this should list all of the hardware required on site for the successful completion of the job. If the installation planning has been carried out carefully, drawing up the BOM should be easy. A sample Bill of Materials form is provided in Figure 5. An accurate BOM will also enable a precise costing of the hardware required for the installation to be produced.

Figure 5
Sample Bill of Materials.

Site Reference:

Total Number of Zones:

Zone Number	Measured length of zone (feet)	Length of sensor cable (feet)
1		
2		
3		
4		
5		
6		

Item	Description	Part Number	Unit	Quantity
1	Single Zone Analyzer	AN-1000	each	
2	Dual Zone Analyzer	AN-2000	each	
3	Mountings for Analyzer		each	
4	Standard Sensitivity Sensor Cable	SC-1000	foot	
5	High Sensitivity Sensor Cable	SSC-1000	foot	
6	Non Sensitive Coaxial Cable	NC-100	foot	
7	End of zone termination box	EOL-1	each	
8	Weatherproof junction box	JB-1	each	
9	Manual gate bypass switch	BPS-1	each	
10	Remote operating gate bypass switch	BPS-2	each	
11	Cable ties (black plastic)		each	
12	Cable ties (stainless steel)		each	
13	Grounding rods		each	
14	Interconnecting cables:			
	Type 1		foot	
	Type 2		foot	
	Type 3		foot	
15	Alarm control panel		each	
18	Audio monitoring:			
16	Headset (e.g. walkman style) OR computer speakers OR 8 Ohm, 1W speaker		each	
	Amplifier + speaker		each	
17	Additional items:			

Section
3

STEALTHFLEX Perimeter Protection System

Installation Manual

Carrying out the installation.

Having completed the planning, and with all of the hardware available, the installation can commence.

Remedial Work and Clearance

Before starting the installation, it is important that any repairs or remedial work are carried out on the fence and its surroundings. The fence should be cleared of any overhanging branches, shrubbery etc and, if necessary, the fenceline sprayed with a suitable herbicide to prevent regrowth of vegetation.

Analyzer Installation

If the Analyzers are to be mounted on the fence posts, suitable mounting hardware will need to be constructed. This can consist of an aluminum plate, of between $^{1}/_{8}$" and $^{1}/_{4}$" thickness, fixed to the fence post by stainless steel worm drive bands. Figure 6. illustrates a mounting plate suitable for most types of fence post, Figure 7 shows an Analyzer mounting plate fixed to a concrete fence post. The Analyzer should be slightly over half way up the fence. Only use the holes that already exist in the Analyzer case for mounting, drilling further holes will compromise the water resistance of the case. Alternatively, the Analyzer can be located away from the fence, mounted on a post or wall, or within a weatherproof housing. Under no circumstances attach the Analyzer directly to the fence mesh, this will give rise to false alarms. The Analyzer should always be mounted upright, with the cable glands at the bottom.

Having attached the Analyzers to the fence posts, ground the case of each one to a local ground using, for example, a 3 feet long copper plated or galvanized steel rod driven into the ground beneath the Analyzer (Figure 8). Connect the Analyzer case to the grounding rod using a heavy gauge copper conductor. It is important that each Analyzer is connected to an effective ground, to eliminate false alarms from the pick up of electrical noise. When this operation has been completed, it is wise to check, using a DVM on its ohms range, that there is a low resistance electrical connection between the printed circuit board mounting plate inside the Analyzer case and the connection to the grounding rod.

Figure 6
A plate suitable for attaching an Analyzer to a fence post, using stainless steel worm drive banding.

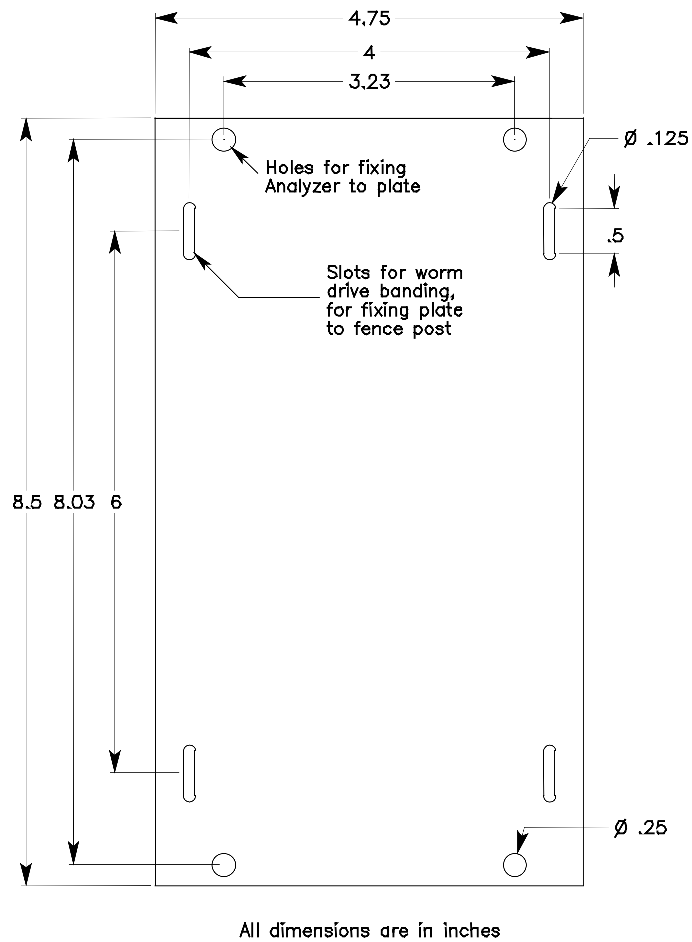


Figure 7
An Analyzer mounting plate fixed to a concrete fence post.

Figure 8
Driving in a grounding rod adjacent to the Analyzer.

Sensor Cable Installation

Installing the sensor cable is best carried out as a two person operation. One person unreels the cable (Figure 9) whilst the second person attaches it to the fence. On a standard height (~7 feet) fence a single strand of sensor cable will be used; it should be fixed at a height of between 3' 0" and 3' 6" from the ground, with cable ties every 6" to 8" (Figure 10). For high security installations, or where the fence is higher than 7', a double trace of sensor cable should be used, fitted at one third and two thirds fence height. In this configuration, installation of the sensor cable will start at the Analyzer and be attached to the fence, one third of the way up, until the end of the zone is reached. At the end of the zone the sensor cable goes vertically up the fence to the two thirds position, from where it is led back to the Analyzer.

Figure 9
Unreeling the sensor cable.

Figure 10
Sensor cable attached to the fence with cable ties.

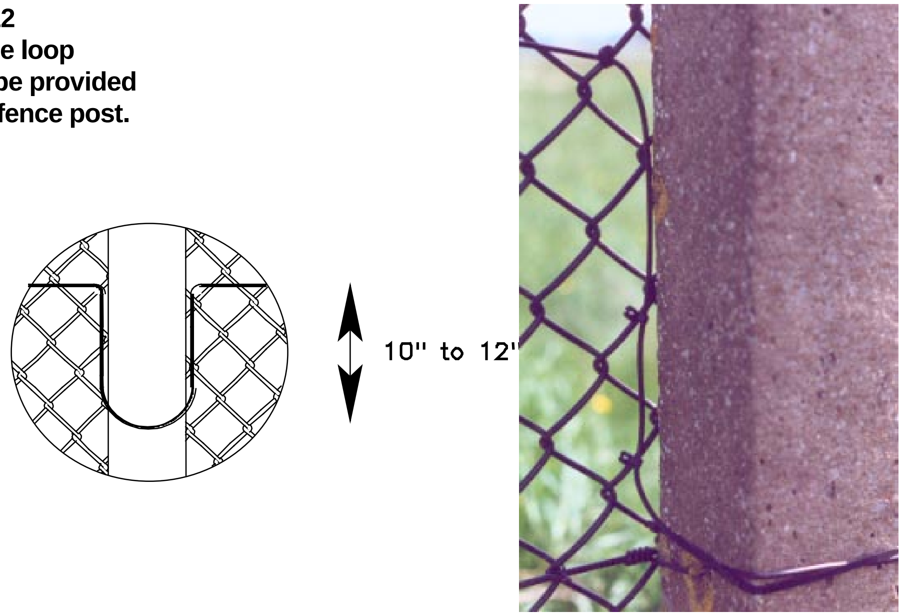
The sensor cable should exit the Analyzer housing vertically, to provide a water drip leg, before being lead along the fence at the correct height. Attaching the cable to the fence with a loose tie wrap either side of each fence post is a convenient way of keeping the cable off the ground whilst it is being installed. After unreeling and loosely attaching cable to 3 or 4 sections of fence, its length can be adjusted by sliding it through the loose cable ties, after which it is attached to the fence using further cable ties positioned at the correct intervals.

A cable tie wrap gun, which tensions the cable tie and trims it to length in one operation, will greatly speed up installation (Figure 11). Set the tie wrap tool to give a low to medium tension to the tie wraps, the sensor cable only needs to be held snug against the fence. When installing on galvanized fence material, beware of tightening the sensor cable onto "spikes" of galvanizing, which may damage the cable jacket. Any spikes should be removed from the fence fabric with a file before the sensor cable is attached.

Figure 11
Using a tie wrap gun to tighten and trim cable ties.

At each fence post a "service loop" should be provided, by looping the cable vertically downwards by about a foot as it goes around the post, Figure 12. These loops of cable should be attached to the fence and care taken to avoid leaving any loose cable which could rattle in strong winds. Also avoid leaving cable in such a position that it could chafe against the posts. The cable can either be left slightly loose around the post, or it may be necessary to use a cable tie around the post itself to prevent chafing movement. The service loops should not constrain the movement of the cable relative to the fence posts. These loops serve a dual purpose. They firstly provide sufficient spare cable for a repair to be made if the sensor is cut or damaged and secondly they give an increase in sensitivity at points where the fence fabric is being held more rigidly.

Figure 12
A service loop should be provided at each fence post.



At other points where the fence is held more stiffly, i.e. where there is diagonal cross bracing, such as is usually found at corners, it is necessary to increase the amount of sensor cable used to insure that climb over protection is maintained. First of all check whether the fence material can flap against the bracing strut or post in a strong wind. If it can, use cable ties to firmly attach the fence mesh to the post to prevent the flapping, Figure 13. The sensor cable should then be looped either side of the bracing post, as illustrated in Figure 14. It is particularly important that the sensor is taken into the triangular section below the diagonal bracing post, otherwise an area of low sensitivity will be left in the fence, which may be susceptible to cut through. After taking the sensor cable around the vertical fence post, repeat this operation with the other corner brace. The cable layout should be symmetrical about the vertical post at reinforced corners.

Figure 13
Using a cable tie to attach the fence fabric to a stiffening brace.

Figure 14
Cable layout at a cross-bracing post.

When the end of the zone is reached and the cable is attached to the fence, the end of line termination resistor should be fitted. This is to enable the Analyzer to monitor the continuity of the cable throughout its length; if the cable is cut the system will give a non resettable tamper alarm. If the box mounted termination resistor is being used, simple screw terminals are used to fix the sensor cable into the box - please note that the connections are polarity conscious. (Figure 15a) Having made the connections, mount the box vertically with the cable gland at the bottom. These boxes can be mounted either on the fence adjacent to a fence post, or on a post itself. The cable should be vertical when it enters the box, to provide a water drip leg. Finally, the cable gland should be tightened and the tamper protected box cover replaced. Do not attempt to ground the metallization inside the end termination box to the fence, it will be grounded via the sensor cable at the Analyzer end. Grounding both ends of any of the cables used in the STEALTHFLEX system will cause problems with “ground loops” when the system is commissioned.

If there is any surplus cable at the end of a zone, cut it off before joining on the end of zone termination. Do not be tempted to coil surplus cable and attach it to the fence, this will have the effect of making the fence panel excessively sensitive.

Figure 15
End of zone termination.

EOL-1

Gates

There are no hard and fast rules for installing STEALTHFLEX on gates. Wherever possible, gates should be located at the end of a zone. With a single gate at a zone end, the sensor cable should be attached to the fence close to the fence post, then run across to the swinging panel of the gate, allowing sufficient strain relief for the gate to open fully. The cable is then looped around the gate panel, where it stops in an end of zone termination, as illustrated in Figure 16. For double gates situated at a zone end, the layout shown in Figure 17 is suggested. Joint boxes or heat shrink joint kits should be used where shown to splice in a length of non-sensitive coaxial cable to go across the roadway. This cable should be protected by a conduit, or be installed in a duct to avoid damage to the jacket. Care should be taken at the points where the sensor cable goes from the stationary fence to the swinging gate section. A strain relief loop will be required and it will be necessary to avoid this loop being able to flap against the fence in high winds. Depending on the construction of the gate, it may be necessary to protect the cable at this point by passing it through a short piece of flexible conduit fixed between two small boxes attached to the fixed and swinging parts of the gate, as sketched in Figure 18. Nylon spiral wrap can also be used to provide reinforcement for the sensor cable between the fixed and moving parts of the gate.

If the gate is required to be in use whilst the remainder of the system is protected by STEALTHFLEX, it will be necessary to use a Gate Bypass Switch to isolate the gate. The Bypass Switch should be mounted on one side of the gate and 15 to 20 feet away from it, either on a fence post or some other vertical post, and connected as shown in Figure 19. It is important that the Bypass Switch is not mounted too close to the gate itself, otherwise vibration will be transmitted mechanically from the operating gate into the protected section, leading to nuisance alarms.

If the Bypass Switch is to be operated remotely, it will be necessary to provide an additional pair of wires between the control room and Bypass Switch to carry the 12 volts operating supply.

Figure 16
Arrangement for single gate at end of zone.

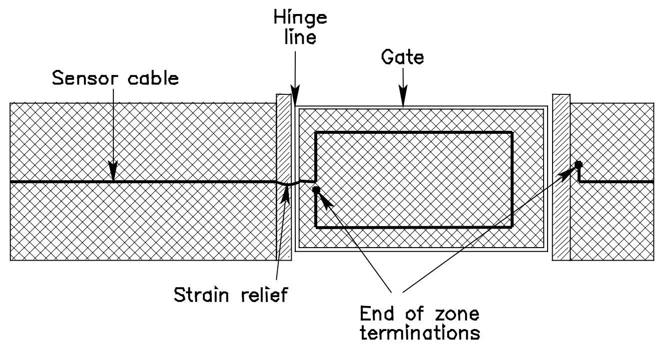


Figure 17
Arrangement for double gates at end of zone.

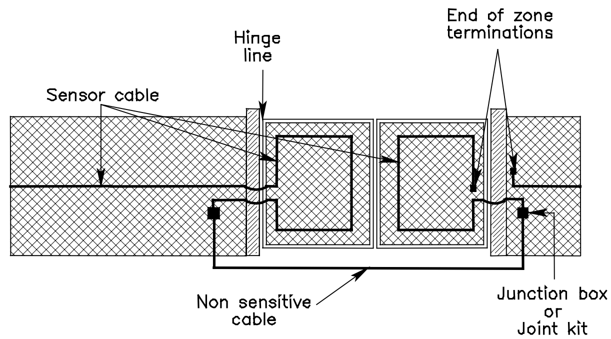


Figure 18
Use of flexible conduit to provide protection for cable across gate hinge.

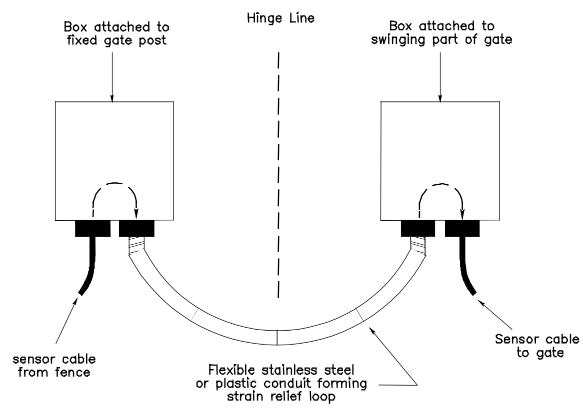
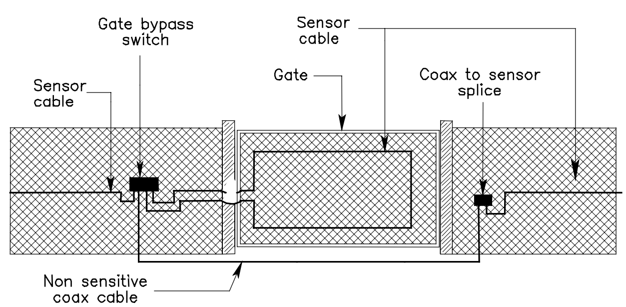


Figure 19
Single gate isolated in center of zone using Gate Bypass Switch.



The use of the Gate Bypass Switch is, of course, not restricted to gates. The Switch may be used for the temporary isolation of any short section of fence within an active zone.

Connecting the Analyzers to the Alarm Control Panel

The interconnecting cable between the each Analyzer and the central alarm control panel should either be armored and directly buried in the ground, or be installed into ducts between the Analyzers and the control room. The interconnecting cables will consist of the correct number (according to the functions required, and whether the Analyzer is a single or dual zone) of individually shielded twisted pairs. 22 awg stranded copper conductors will be adequate for installations where the maximum distance between Analyzers and alarm control panel is less than 1 mile.

The interconnecting cable should be fed through the central gland of the Analyzer case and attached to the fence post with cable ties. If the cable is non armored it will need to be protected by conduit between the exit from the duct and the Analyzer entry point.

Connections are made to the Analyzer printed board assembly (pba) via board mounted plugs and sockets, 14 ways for the interface cable and 2 ways for the sensor cable, Figure 20. The free parts of both connectors have screw terminals for making easy connection to the interface and sensor cables. Wire the incoming cables according to Figures 21 and 22. The control room end of the interface cables should be wired into the alarm control panel. If the audio monitoring facility is being used, the twisted pairs carrying the audio signals from each zone will need to be connected to an array of headphone jack sockets, or switched to a single socket using a rotary switch, to enable a zone to be selected for "listening in."

The screens on all cables, including the sensor cable itself, should only be grounded at one end, to avoid setting up "ground loops" which will introduce excessive electrical noise into the system. If in doubt use a DVM on its ohms range to check for correct grounding. It is particularly important that the sensor cable is not grounded at both ends.

Once all of the electrical connections have been made, and the cables tidily attached to the fence or other supports, commissioning can begin, following the procedures given in the next section.

Figure 20
Connecting sockets
on Analyzer board.

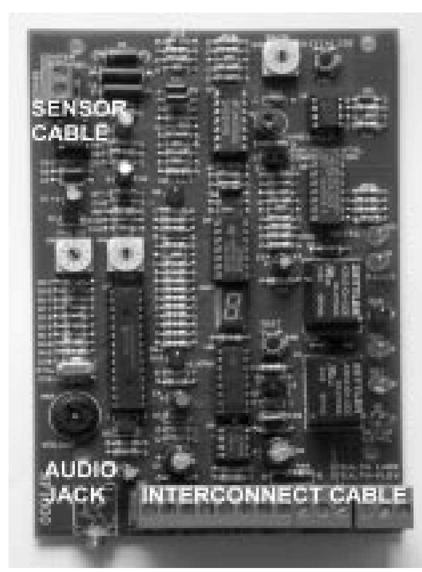


Figure 22
Analyzer Connections & Functions.

Sensor Cable Input

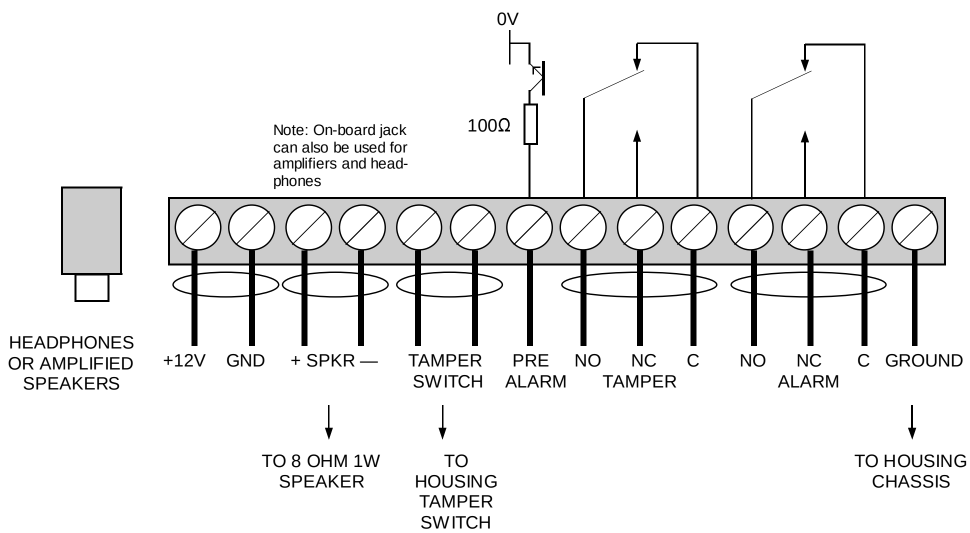
Pin 1	Sensor Cable core.
Pin 2	Sensor Cable screen (braid).

Interconnect Cable

Pin 1	Power supply positive 10.5 to 28 V DC (maximum 100mA @ 12 V per Analyzer board).
Pin 2	Power supply negative.
Pin 3	Speaker output, capable of driving an 8 Ohm, 1W speaker directly.
Pin 4	Speaker output, capable of driving an 8 Ohm, 1W speaker directly.
Pin 5	Tamper switch – connect to housing tamper switch, if used.
Pin 6	Tamper switch – connect to housing tamper switch, if used.
Pin 7	Pre-alarm output, open collector switching to 0 V on activation via 1K2 resistor. May be used to drive remote indicator, transistor relay etc.
Pin 8	Tamper Relay Normally Open contact.
Pin 9	Tamper Relay Normally Closed contact.
Pin 10	Tamper Relay Common contact, voltage free rated at 0.5 A 50 V DC maximum, 1 mA minimum.
Pin 11	Alarm Relay Normally Open contact.
Pin 12	Alarm Relay Normally Closed contact.
Pin 13	Alarm Relay Common contact, voltage free rated at 0.5 A 50 V DC maximum, 1 mA minimum.
Pin 14	Ground. Connect to a good local ground

Note: The relays are energized during normal operation. Therefore the contacts, Normally Open & Normally Closed, are reversed.

Figure 23
Analyzer connector drawing.



Note. Further explanation of the functions provided by the Analyzer is given in Section 4.

Section
4

STEALTHFLEX Perimeter Protection System

Installation Manual

Commissioning the STEALTHFLEX system

Preliminary Checks

Each Analyzer is set up individually, by switches on the Analyzer itself. However, before commencing the set up it is good practice to visually inspect the entire installation, to check that the sensor cable is correctly attached to the fence and the end of line terminations have been fitted properly. It is useful to unplug the two pin sensor connector from the board and check, using a DVM on ohms range, firstly that there is no connection between the cable screen and the fence fabric and secondly that the resistance across the two pins of the connector is 1 megohm ± 5%. If any problems are found during this check, the faults need to be put right before proceeding further. The most likely causes of such faults are an incorrectly fitted or a wrong value end of line resistor or the cable jacket being damaged during installation

Set Up Switches, Display LEDs and Output Circuits (See Figure 24)

On the Analyzer board there are 4 controls, which are used to set up the Analyzer's detection circuitry, and a number of LEDs with related output circuits which are used to indicate various conditions. Referring to Figure 24, these function are as follows:

Control Switch (1) – Gain The gain control switch sets the amplification of the analogue signal from the sensor cable before it is digitized for processing. It has 16 positions, with Position 1 corresponding to the lowest gain.

Control Potentiometer (2) – Threshold
The threshold potentiometer sets the level below which signals are ignored. Signals exceeding the threshold setting will generate a pulse for counting. Turning the potentiometer clockwise raises the threshold and lowers the sensitivity.

Control Switch (3) - Pulse Count.
Switch 3 has 10 positions to select the number of pulses required to trigger an alarm output. The default setting is position 5. Do not use the 0 setting, which is reserved for factory test.

Control Switch (4) - Time Decay.
Switch 4 is a 16 position switch which sets the time decay of the pulse counter. An input signal which is above the threshold level preset by Switch 2 generates a pulse, which is stored in the pulse counter. When the pulse count exceeds the number selected by Switch 3, the alarm output is triggered.
The time decay switch determines the time before a pulse is removed from the pulse count memeory. For example, if the pulse counter contains 3 counts, with Switch 3 set to position 0 and in the absence of any more above threshold input signals, after 8 seconds

the count will be reduced to 2, after a further 8 seconds to 1 and will be reset to 0 after another 8 seconds. The count then remains at zero until further above threshold signals are detected.

Each switch setting increase adds 8 seconds to the time a pulse remains in memory. The default setting is position 2. The decay time provided by each switch position is as follows:

Position 0	8 seconds
Position 1	16 seconds
Position 2	24 seconds
Position 3	32 seconds
Position 4	40 seconds
Position 5	48 seconds
Position 6	56 seconds
Position 7	64 seconds
Position 8	72 seconds
Position 9	80 seconds
Position A	88 seconds
Position B	96 seconds
Position C	104 seconds
Position D	112 seconds
Position E	120 seconds
Position F	128 seconds

Numeric Pulse Count LED
This seven segment LED displays the current number of pulses stored by the processor.

Test Button.
The pulse count setting can be confirmed by pushing the test button. The counts will be displayed on the numeric pulse count LED and if audio monitoring is being used the pulses will be heard in the headphones.

Speaker Jumper
This jumper. Located just below the TEST switch, allows you to disable the speaker/headphone outputs by removing the cap from the two left pins.

Initialize Button & Environmental Compensation Jumper
These are for factory testing. Do not use.

Alarm LED & Alarm Relay Outputs
An alarm condition is indicated by the red Alarm LED lighting and the alarm Form C (changeover) relay operating for 2 seconds. The alarm circuit is activated when the signal threshold is exceeded the number of times set on the pulse count switch.

Flashing Alarm LED (Pre-Alarm Indication) & Pre-Alarm Output
In the pre-alarm condition the red alarm LED flashes and the pre-alarm open collector output switches to “0” volts. This state occurs prior to the activation of the alarm relay. The pre-alarm output becomes active when the pulse count has reached 2 pulses below the setting of the pulse count switch, so it is only functional when 3 or more pulses are required for an alarm. A pre-alarm output will also occur if the analog signal exceeds the set threshold for a period of 10 seconds. The pre-alarm output is non latching.

Pre-alarm is a useful feature on manned sites where the audio outputs are being used. The security officer can be alerted to activity in a particular zone before the system signals an alarm condition. He can then monitor this activity using the audio feature, and will therefore be better informed as to the nature of the intrusion, if it is an intrusion.

Noise Level LEDs
The signal strength LEDs graphically show the strength of the analog signals being processed. These LEDs can be used to view the level of background noise. The LEDs are numbered 1, 2, 4 and 8. The higher the value, the greater the noise level.
Stealth-Flex includes environmental noise compensation circuitry to help suppress false alarms in noisy environments. As the noise level rises, as indicated by more of the noise level LEDs being lit, this circuitry will become operational.

Tamper LED & Relay Outputs
Stealth-Flex provides several indications of fault or tamper conditions. All of these conditions will cause the the Form C (changeover) relay to operate. In addition, the nature of the condition will be signaled by one or both of the two yellow LEDs at the center right of the board, as described below.

<u>YELLOW TAMPER (UPPER) LED ON</u>

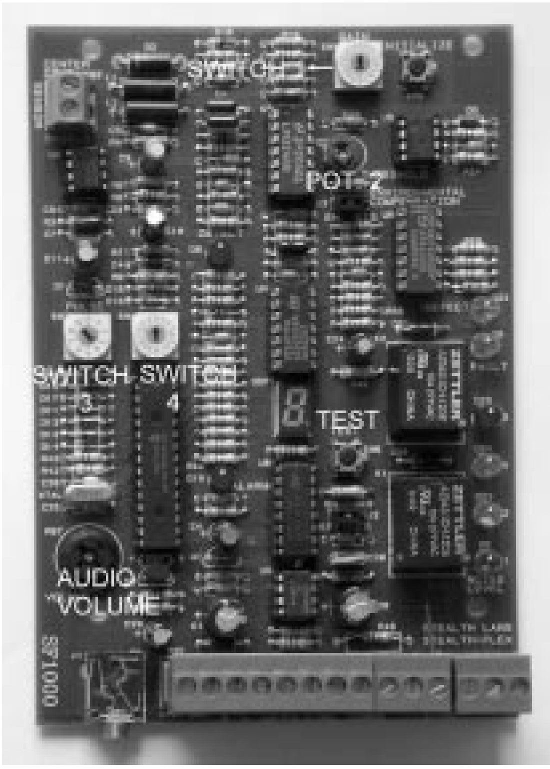
- A tamper condition caused by the opening of the Stealth-Flex box.
- A failure of circuitry on the board itself (e.g. through lightning damage).
- “Jamming” of the circuitry by causing the unit to be constantly in alarm. The “DETECT” LED will come on solid. After it has been lit for ten seconds, the fault will be signaled.

<u>BOTH YELLOW LEDS (TAMPER & FAULT) ON</u>

- A tamper or fault condition on the Stealth-Flex cable (e.g. cutting of the cable, shorting of the end-of-line resistor, opening of the end-of-line resistor box).

The StealthFlex analyzer board is shipped with a zero Ohm resistor/jumper installed in the Tamper Switch terminals. Remove this jumper to make the LEDs operational to assist in system set-up. If detection of opening of the housing is required, a normally cosed tamper switch must be installed in the TAMPER SWITCH terminals. A switch of this type, TP-100, is provided with analyzer boards mounted in outdoor (NEMA 4) housings. If a housing tamper switch is not used, replace the jumper after system set-up to disable the LEDs (thus reducing power consumption) and to enable the tamper circuit for detection of cutting of the sensitive cable.

Note that closing the tamper switch on the analyzer case, as when the lid is fitted, disables the 7 segment display and the ALARM LED, to reduce the power consumption in the normal operating mode.



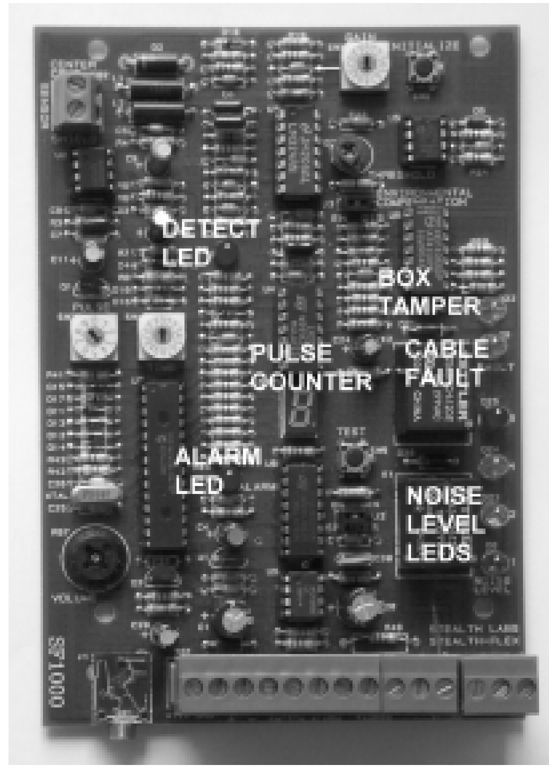


Figure 24A
Analyzer Switches

Figure 24B
Analyzer Indicators

Setting up a STEALTHFLEX System

Each Analyzer in the installation should be set up individually, following the procedure given below:

WIRING

1) Connect +12V to the terminal marked +12V

2) Connect ground to the terminal marked GND

3) Connect the center conductor of the microphonic cable to the terminal marked CENTER COND on the small 2 position terminal strip

4) Connect the braid shield of the microphonic cable to the terminal marked SHIELD on the small 2 position terminal strip

5) Connect the control panel tamper zone to the appropriate TAMPER terminals. For a normally closed tamper zone, connect to the terminals marked TAMPER NC and

TAMPER C. For a normally open tamper zone, connect to the terminals marked TAMPER NO and TAMPER C.

6) Connect the control panel alarm zone to the appropriate ALARM terminals. For a normally closed tamper zone, connect to the terminals marked ALARM NC and ALARM C. For a normally open tamper zone, connect to the terminals marked ALARM NO and ALARM C.

7) Connect the housing tamper switch (if required) to the TAMPER SWITCH terminals. Note that the LED pulse count display DSP1 will be off when the tamper switch terminals are shorted. This is to reduce current consumption when the unit is in its normal operational condition (enclosure lid closed, no tamper or alarm conditions).

8) If a pre-alarm indication is desired, connect a low current sounder's – lead to the PRE-ALARM terminal. Connect the + lead of the sounder to +12V (or recommended voltage of the sounder). Note: the PRE-ALARM terminal is an open collector output and does not supply any voltage output. It switches low when active, thereby connecting the switched device's negative terminal to ground. This output is only capable of sinking 200mA.

9) When all connections have been made, apply power to the system. **Make sure that the jumper between the TAMPER SWITCH terminals is removed to enable the LEDs on the analyzer board.**

MONITORING AND REDUCING BACKGROUND NOISE

10) Allow 1 minute of set-up time for noise levels to stabilize. Use headphones or low power speakers connected to the audio jack to monitor the background noise. If feedback (a high pitched whistle) is heard, reduce the GAIN setting at SWITCH 1. If excessive hum/hiss is present follow the steps outlined below to reduce electrical noise. As an alternative, the SPEAKER terminals may be connected to an 8 Ohm, 1W speaker.

11) Listen for excessive hum or other electrical noise while jiggling the microphonic cable. Any sudden presence of hum could indicate an intermittent connection and should be remedied befor proceeding. Check connectioins at all terminals and junction boxes.

12) A certain amount of constant hum or hiss is to be expected, but every effort should be made to minimize this background noise:

- Do not mount the Stealth-Flex analyzer board in the same housing as a power transformer
- Avoid installing the analyzer near sources of electrical noise, such as computers, monitors, printers, fax machines, etc.
- Use only the Stealth-Flex microphonic cable, and high quality shielded braid cable for non-sensitive runs.
- Use only the JB-1 shielded junction boxes.

- IMPORTANT – Seal all exposed junction boxes and conduit with silicon to prevent water ingress. Rain water getting into buried conduit can be a major source of background noise.

- Do not use a switching power supply for powering Stealth-Flex. Stealth Labs PS-1224 is the recommended linear 12V DC power supply.

- Do not connect cable runs loner than 1000 feet. If excessive noise is present at this maximum length, it might be reduced by reducing the cable length and dividing the system into shorter zones.

SETTING THE THRESHOLD AND GAIN SWITCHES

13) Observe the red DETECT LED, D8. If it is illuminated, turn the THRESHOLD potentiometer R22 clockwise until the LED goes off. This is the threshold point for the pulse detector circuit. Now turn it further clockwise to a position halfway between this threshold point and the furthest clockwise (maximum) setting. Calibrating the settings of the GAIN and THRESHOLD switches may require some trial and error. **Note:** If the DETECT LED remains illuminated with the THRESHOLD potentiometer at its maximum setting, the GAIN is set too high. Decrease the the setting of the GAIN switch SW1 until the DETECT LED, D8 goes out. A second person should help in this process by performing “climb-over” tests, while the installer makes adjustments to the switches.

SETTING THE PULSE SWITCH

14) The setting of the PULSE switch SW3 determines how many pulses must be detected to trigger the alarm relay. When the detected pulses reach within 2 counts of the value set by the PULSE switch, the PRE-ALARM output is triggered and the red ALARM LED D18 flashes. If the PULSE switch is set at less than 3, the PRE-ALARM output will not function. If the PULSE switch is set at 3, the PRE-ALARM output will be triggered by the first pulse detected, since it is within 2 pulses of the maximum setting.

The setting of PULSE switch SW3 should only be reduced if the factory default setting of 5 is insufficient to trigger an alarm during a “climb-over” test. Similarly, the setting can be increased if the protected fence is in a high wind area and prone to false detections.

SETTING THE TIME SWITCH

15) The setting of the TIME switch SW4 determines how long a pulse, once registered, remains in memory. This feature provides an important safeguard against false alarms. A detected pulse remains in memory for 8 seconds, when the switch is set to 0. Each increase in the switch setting increases this time by 8 seconds (see page 23). The factory setting of this switch is 2 (24 seconds). This time should be increased only if 24 seconds is insufficient to trigger an alarm by generating the programmed number of pulses or if increased security is desired. The time setting should be decreased only if false alarms are a problem.

FINAL CHECK

16) Finally, check the uniformity of detection by drawing a stick along the fence whilst listening to the signal on headphones plugged into the Analyzer. The signal should sound uniform along the entire length of the sensor. (Obviously it requires two people to carry out this check.)

17) When the Analyzer set up has been completed (or both Analyzers set up if the unit is an AN-2000) replace the cover making sure the fixing screws are tight. Note: If you are not using a tamper switch for the housing, make sure that the jumper between the TAMPER SWITCH terminals is reconnected to disable the LEDs, thus reducing the current consumption. If you have a housing tamper switch connected to these terminals, this will happen automatically when you close the housing.

18) Set up the other Analyzers in the system, following steps 1) to 17).

19) Walk test the whole system, checking that an alarm is generated at the control panel for each zone. If the acoustic monitoring is installed, check that the audio signals are arriving at the alarm panel.

Section

5

STEALTHFLEX Perimeter Protection System

Installation Manual

Problem Solving and Fault Location

This section will be of assistance if difficulties are experienced during the commissioning of a STEALTHFLEX system, or if problems develop in a system that has been installed for some time.

Self Test Button

Pressing the test button on the analyzer momentarily causes a test signal to be generated at the analog input, to simulate an intrusion signal. The pulses seen on the numeric LED confirm the pulse count setting and the operation of the alarm circuit. These test pulses can also be monitored with a headset or speaker plugged into the socket on the analyzer board or an 8 Ohm, 1W speaker connected tot he SPEAKER terminals.

Lack of Detection and Poor Sensitivity

If the system suffers from a lack of detection and the sensitivity seems low, the set up for the threshold and gain switches should be repeated, following the procedure in the previous section. The sensor cable should also be checked, to see that it is securely attached to the fence, with cable ties at the correct intervals, approximately every 6 to 8 inches. In general, the more fixings and the more cable used the greater the sensitivity will be. The audio signal should be monitored while a stick is drawn along the fence; the signal should sound consistent from panel to panel of the fence throughout the zone. If it is not, there is likely to be a problem with the way the cable is fixed to the fence panel in question.

Unwanted Alarm Activation

First of all, the threshold and gain settings should be checked. The fence itself should be inspected, to see whether there are any loose items, such as signs, that are causing bangs and rattles in the wind. Particular attention should be paid to trees or shrubs that are close to the fence line; branches hitting the fence fabric in the wind will almost invariably cause false alarms. The audio signal can be very helpful for diagnosing these types of problem, the background noise should be free of any bumps, bangs and rattles. The Trouble-Shooting Guide at the end of this manual should be helpful in locating and solving any unwanted alarm problems that may arise.

Slow Response.

If the detection is good, i.e. events are causing the Analyzer to “count”, but the alarm needs to be activated more quickly, the pulse count can be reduced. However, if the pulse count is reduced too low, say to below a setting of 3 pulses, there may be more nuisance alarms.

Tamper Alarm - Yellow LED & Tamper Relay Operated

There are a number of reasons why the tamper detection circuit operates. Check whether one or both of the TAMPER and FAULT LEDs are illuminated.
If only the TAMPER LED is illuminated, check that the cover on the analyzer housing is in place and tightened down.
If both the TAMPER and FAULT LEDs are lit, the problem is on the cable or in the end-of-line resistor box. The integrity of the sensor cable should be checked by unplugging it from the analyzer and measuring the resistance between the core and screen, with a digital volt meter on the "Ohms" range; it should be 1 megohm. A high or low reading indicates a fault; in particular an open circuit is usually an indication that the sensor cable has been cut somewhere along its length. The connections to the termination box should also be checked, and the box inspected for damage which may have resulted in the ingress of moisture. If the resistance between the core and braid is low, there may have been water ingress at a joint or termination box. If the tamper is intermittent or momentary, and the alarm relay also activates, the sensor cable may be damaged or the end termination faulty. A useful test for sensor cable damage is to unplug the sensor from the analyzer and measure the resistance between the cable screen and the fence fabric, it should be open circuit. If any connection at all is seen, no matter how high the resistance, there is likely to be a point somewhere along the sensor where the jacket has been damaged.

Supply Voltage

The supply voltage should be checked at the analyzer terminal block, using a digital voltmeter between pins 1 and 2 on the main connector. It should lie between 10.5 and 14 volts DC, with the lid of the analyzer off and the LEDs illuminated. In this condition the current consumed by the analyzer is at its highest.

Excessive Signal Level Noise

If the background signal level appears excessively high, the GAIN switch should be lowered and the front end gain recalibrated. The grounding of the Analyzer should be checked, as should the polarity of the sensor cable connector. (The shield of the sensor cable should be connected to the terminal marked SHIELD on the two position connector).

It is possible that the noise is being picked up by the sensor cable; this can be checked by unplugging the sensor cable terminals. If the noise goes away, it may be from a mechanical source, such as motors or transformers that are located close enough to the fence to be inducing vibration in it. Listening carefully to the audio signal may provide clues to locating this type of problem.

Ground loops can be a problem; the screens of all cables should only be grounded at one end. The sensor cable should be checked for ground loops. To do this, unplug the sensor cable from the analyzer and meter between the chassis of the analyzer and the outer braid of the sensor cable. There should be no connection, even a high resistance one. If there is, the unwanted connection(s) should be located and removed. The most likely cause is damage to the jacket of the sensor cable.

The power supply should be carefully checked. It can be eliminated by replacing the power supply with a directly connected battery (a 12 volt sealed lead acid battery is ideal for this). If the problem goes away, the power supply needs to be investigated. There may, for example, be interference from other equipment connected to the system power supply.

The system should never be mounted close to sources of high power radio frequency emissions. Although the equipment is shielded, there is still a possibility that high energy fields may penetrate the shielding of the interconnecting cables. Efficient grounding is critical if there is any RF energy present. Analyzers are more susceptible to RFI when the covers are off and the electronics are not fully shielded.

Stealth-Flex Troubleshooting Guide

Symptom	Cause
Tamper Alarm Yellow LED is on	Tamper switch is open or cabinet door is open Need to jumper Tamper terminals
High noise (more than 2 "Noise Level" LEDs lit)	Excessive noise on power supply; Poor Earth Ground Unshielded wiring runs near noise source Wiring runs near Hi-voltage AC source Poor splicing in sensitive loop Wires not under screw terminals securely
Low noise, but false pulses	Excessive noise on power supply; Poor Earth Ground Unshielded wiring runs near noise source Wiring runs near Hi-voltage AC source Poor splicing in sensitive loop Wires not under screw terminals securely

Trouble-Shooting Procedure:

A headset or speaker is recommended for trouble-shooting. When connected to the analyzer board this will allow you to hear any noise and judge the effectiveness of your trouble-shooting measures by changes in the noise level.

1) Pick a length of cable without cuts or splices for testing. If you do not have such a length, pick your longest segment of uncut cable and place an End-of-Line Resistor box at the end of this length.

2) Temporarily isolate the analyzer cabinet from any metal object or earth ground connection.

3) Remove all wiring other than the sensitive cable and power leads from the Analyzer board. Power the system with ONLY a 12V Lead-Acid battery.

4) The system should easily work with these minimum conditions. At this point, make sure your board is setup for factory default settings.

5) Your next step should be re-mounting the cabinet. Test the system again. If it fails at this point, you have an earth-grounding fault that must be remedied by either isolating the unit entirely, or finding an alternative ground. In extremely dry soil conditions, a longer grounding rod of up to 8 feet may be required.

6) Once you have eliminated any grounding problems, connect your power supply leads. A clean supply like the Stealth Labs PS1224 is absolutely crucial to the operation of the unit.

7) Re-connect all of your wiring to the panel and analyzer. Ensure correct operation is continuing.

8) Once your analyzer is setup and stable, you may begin working on the sensitive cable portion of your installation. Again, working step by step, segment by segment, you can easily find your problems. With cable problems, the number one cause of faults is wires not under screw terminals in junction boxes, or nicked cables that allow metal braid to touch the fence.

9) Occasionally, a problem may arise from the fence itself acting as an antenna, causing a build-up of noise. This may be solved by grounding the fence itself, using a grounding rod. Remember that if the earth is extremely dry, you may need a longer grounding rod (see 5).

WARRANTY

Stealth Laboratories warrants this product to be free of defects in manufacture. If the product should fail, due to a defect in manufacture within one year of purchase, Stealth Laboratories will repair it or replace it with the same or equivalent product. Please contact Stealth Laboratories to obtain a Return Authorization Number before returning any product.

Lightning constitutes a danger to the Stealth-Flex equipment, which is not covered by warranty. It is recommended that a surge suppressor be installed to protect the power terminals of the AN-1000 board.

Detection systems deployed in outdoor applications are subject to many environmental influences, which can affect their performance. In the event of such situations arising, Stealth Laboratories will attempt to resolve them by means of technical support. Several courses of action are available depending on the specific circumstances. These may involve the execution of additional measures and/or the use of additional equipment, which Stealth will make available at cost or, at their discretion, at no charge. Such equipment is not supplied as standard, as it is not appropriate in the majority of situations. The precise extra measures to be taken will vary according to environmental factors.