GEOQUIP

WORLDWIDE

The Leader in Perimeter Protection Solutions

# GW500 ANALYSER OPERATION MANUAL

**PROVEN PERIMETER PROTECTION**

**GEOQUIP LIMITED**
Kingsfield Industrial Estate, Derby Road
Wirksworth, Matlock, Derbyshire, DE4 4BG
Tel : +44 1629 824891 Fax : +44 1629 824896
Web : www.geoquip.com E-mail : info@geoquip.com

| | | | |
|---|---|---|---|
| Document Number: | QA392 | Prepared by: | P Cook |
| Revision Number: | 1 | | |
| Date of Issue: | 3/1/06 | Approved by: | M Scott |

**All illustrations and sizes shown in this manual are intended as a guide only and do not form any part of any contract between Geoquip Limited and its customers.**

**All specifications and designs shown in this manual are subject to alteration by Geoquip Limited without notice at any time.**

## CONTENTS

**CONTENTS**

## 1.1 GENERAL

This manual covers the installation, connection, commissioning and testing of the GW500 analyser designed by Geoquip Ltd for building protection.

It is designed as a stand alone detection device which provides alarm, tamper and audio outputs as standard. A basic detection system consists of three standard components.

1. The GW500 Analyser.

2. GDALPHA Sensor Cable.

3. GDELT End-of-line Termination Box.

On manned sites the audio, alarm and tamper outputs can be connected to a multi-zone annunciator (Part Nos GQ6ZA, GQ12ZA and GQ24ZA). These provide audio monitoring, a zone disable facility and LED indication of alarm status. See QA137 Multi-zone Annunciator Operation Manual for details of the annunciators.

There are various additional accessories that are available for use in conjunction with the basic system to assist in complying with the particular site requirements and include junction boxes, gate loops, physical cable protection etc. For details of these accessories see the Sensor Cable Installation Manual QA189.

## 2.1 GENERAL

The analysers are usually mounted directly onto the protected surface. It is important to place the analysers where they can be easily accessed for the purposes of commissioning and adjustment of the system.

The analysers are provided with two PG9 glands, one for the incoming GDALPHA sensor cable and one for the outgoing alarm signal cable. This cable should be screened and have sufficient twisted pairs to carry the alarm, tamper and audio signals from the analyser to the control station and an additional pair if power is being supplied from the same point.

## 2.2 POWER REQUIREMENTS

Each individual analyser PCB requires a nominal 12V dc supply and consumes a 90mA current. The analysers will however operate correctly over a supply voltage range of 7V to 24V.

## 2.3 POWER SUPPLY CABLE

When choosing a cable to feed power to the analyser, the maximum **loop** resistance value should not exceed 55Ω for the dc analyser supply to remain above the lower supply voltage limit of 10V assuming the power supply emits 12V dc. The maximum loop resistance should not exceed 190Ω if the power supply emits 24V. Characteristics of some commonly used cables are given below.

Alarm Signalling Cable

Four twisted pair alarm signalling cable has a conductor size of 7 x 0.2mm per core giving a loop resistance value of 160Ω/km. Using the figures above, the maximum length run from the power supply to the analyser would be given by the formula

$$\frac{\textit{Max loop resistance}}{\textit{Loop resistance of cable per km}}\ x\,1000$$

$$= \textit{Max distance between supply}\ \text{and}\ \textit{analyser}$$

i.e. $\frac{55}{160}\ x\,1000 = 344\ m$

assuming a 12V dc output from the supply.

or $\frac{190}{160}\ x\,1000 = 1187\ m$

assuming a 24V dc output from the supply.

Telephone Type Cable

Telephone type cable uses a single strand conductor of 0.5mm diameter giving a loop resistance value of 195.6Ω/km. Using the figures and equation above, the maximum length of this type of cable between the analyser and the power supply would be

$$\frac{55}{195.6}\ x\,1000 = 280\ m$$

assuming a 12V dc output from the supply.

or $$\frac{190}{195.6}\ x\,1000 = 970\ m$$

assuming a 24V dc output from the supply.

It is important to remember that the current consumption of the analyser will drop by approximately 20% if both alarm and tamper relays are de-energised i.e. when in an alarm condition. This will cause a rise in the terminal voltage of the analyser if there is a significant loop resistance in the supply cable to the analyser. The amount of rise is governed by the loop resistance of the interconnecting cable so it is important to check the analyser terminal voltage when the system is in alarm as well as when it is quiescent.

*To avoid deterioration of the service cable, ensure that the cable selected is suitable for exposure to the environment in which it is to be installed.*

## 3.1 GENERAL CONNECTIONS

All connections to the analyser are made via the terminal blocks mounted directly on the printed circuit board (PCB) with the exception of the ground connection which is made to the stud on the outside of the box.

## 3.2 GDALPHA SENSOR CABLE CONNECTIONS

The GDALPHA sensor cable is connected to the two way terminal block. See Figure 1.

## 3.3 DC POWER SUPPLY

The positive side of the supply must be connected to the left terminal of the two way terminal block and the 0V or grounded side of the supply to the other terminal. See Figure 1.

The system includes reverse polarity protection and overvoltage protection although it should be noted that neither of these conditions can be sustained for long periods of time.

The current consumption of the analyser is 90mA at 12V dc but the supply to the analyser can be in the range 7V to 24V and still function correctly. However, for optimum performance the power supply voltage should be set to 12V whenever possible.

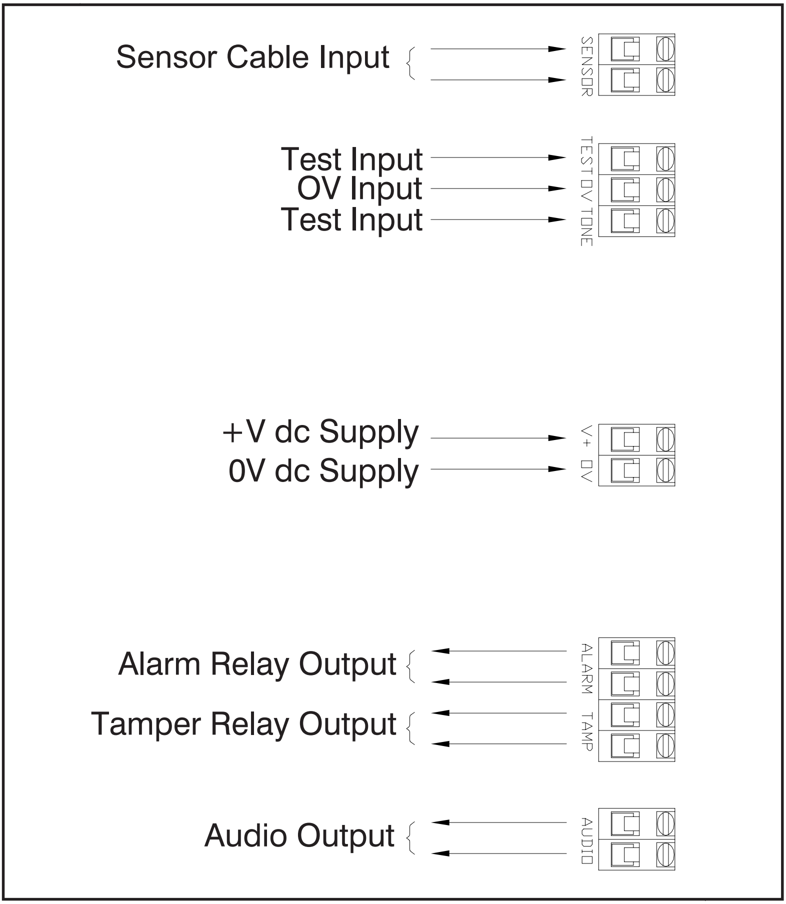


Figure 1

## 3.4 SELF-TEST FACILITY

The analyser has both a local and remote self test facility. The local self test and remote self are initiated by pressing the button above the terminals whilst the remote self test is initiated by connecting the either of tthe Test terminals to the 0V terminal. When a self test is initiated the analyser sets itself to four Events (regardless of any of the switch positions) and then fires four audio pulses to generate an alarm. The analyser then resets itself to the number of Events set by the Events rotary switch.

## 3.5 AUDIO OUTPUT FACILITY

The analyser includes a facility to monitor the audio signal picked up by the sensor cable. This output is available on the two terminals of the audio terminal block. See Figure 1. The output signal level is nominally 0dBm (0.772V RMS) and the output impedance is 600Ω. These terminals are not polarity sensitive.

The audio output level can be monitored by directly connecting to these terminals either a high impedance earphone or a small amplifier to drive a loudspeaker. Geoquip Ltd supply a battery powered amplifier (Part No. GWAMP-1) to provide audio to an integral loudspeaker.

If it is required to send the audio signal over more than 100m to the control station, it is recommended that a twisted pair (preferably shielded) cable is used to overcome any interference which may degrade the audio quality.

## 3.6 ALARM/TAMPER CONTACTS

The alarm contact outputs are connected via the left two terminals of the four way terminal block and the tamper contact outputs via the right two terminals of the same block. The above description assumes the PCB is being viewed with the terminal blocks at the bottom of the board. See Figure 1.

The alarm and tamper relay outputs are a Single Pole Change Over (SPCO) type, referred to as Form C contacts. A link option is supplied on these boards to enable the commissioning engineer to select ***either*** an opening ***or*** a closing contact configuration for each relay output. The links which determine the form type are Lk5 for the alarm relay and Lk6 for the tamper relay located above the relay output terminal block. The factory setting for these links is position A which is the NO (Normally Open) position whereby the contact will open on an alarm or a power fail condition.

The relays provide two individual outputs for alarm and tamper, if it is required to have only one output in the event of either an alarm or a tamper then the middle two terminals need to be linked together and then the output collected on the outer two terminals.

See Figure 2 on page 13 for the location of the above links on the PCB.

Both the alarm and tamper contacts are rated as follows:

| | ac | dc |
|---|---|---|
| Max. Voltage: | 350V | 350V |
| Max. Current: | 100mA | 100mA |
| Max. Power: | 600mW | 600mW |

## 3.7 GROUND STUD CONNECTIONS

A 6mm ground stud is provided on the outside of the box to allow the connection of a low impedance ground terminal to the system. It is imperative that a ground is always fitted to comply with safety regulations, to improve the rejection of electrical interference which may be induced into the sensor cable and to prevent damage from lightening strikes. For GW500 analysers this should be to a ground spike.

## 4.1 CONTROL SWITCHES

Four rotary control switches are placed along the top edge of the PCB and can be adjusted to any value between 0 and 9. See Figure 2.

The two rotary switches on the left-hand side of the PCB are sensitivity controls used to set the levels at which the analyser will respond to disturbances. These controls are marked Gain A and Gain B and, as described above, on most types of biulding, control the sensitivity to the attack modes listed below.

| | Gain A | Gain B |
|---|---|---|
| Attack mode | Sustained attack | Impact attack |

The two switches on the right-hand side of the PCB are concerned with the number of cut through (Gain B) disturbances and the time in which they must occur before the alarm relay is operated. These switches are referred to as the Timer control and the Events control.

## 4.2 GAIN A SENSITIVITY CONTROL

The left-hand control, marked Gain A, sets the sensitivity of the system to intrusions where, on most types of building, a sustained attack is being attempted ,e.g. drilling through a wall.

Correct setting of Gain A causes the alarm relay to operate, regardless of the Events and Timer settings, provided that the disturbance lasts long enough for the analyser to class the disturbance as a genuine attack i.e. more than 4 seconds. For the purpose of commissioning and testing there is an LED to the left of the switch which will flash when a sufficient level of disturbance is being generated. This LED flashing does not necessarily imply that an alarm will be generated since this is dependent on the sensitivity setting of Gain A.

## 4.3 GAIN B SENSITIVITY CONTROL

The right-hand control, marked Gain B, sets the sensitivity of the system to intrusions where short, sharp impacts are generated as the intrusion occurs. Each cut detected by the system is referred to as an *Event*. For the purpose of commissioning and testing there is an LED to the right of the switch which will flash once for every *Event*.

## 4.4 DIL CONTROL SWITCHES

The GW500 analyser also has a dual control (DIL) switch mounted between the two left hand rotary sensitivity controls providing a high and low sensitivity range selection for each rotary control. If either half of the DIL switch is placed in the HI position, the corresponding rotary switch operates over a higher range of sensitivity.

For example, if the LO position is selected and there is still insufficient sensitivity when the rotary switch is set to position 9, the next higher sensitivity setting can be achieved when the DIL switch is set to the HI position and the rotary switch is set to position 0. Further increases can be obtained by increasing the rotary switch setting.

## 4.5 EVENTS CONTROL

This control is located on the top right-hand side of the board and is used to set the system to respond to a particular number of *Events* before the alarm relay is operated, e.g. if the Events switch is set to 3, then three separate *Events* must occur before the alarm relay operates.

**IMPORTANT**
**If the Events control switch is set to 0, a permanent alarm condition will occur.**

The Events control should be set in conjunction with the Timer control as described below.

## 4.6 TIMER CONTROL

Each *Event* that occurs starts an individual time window during which the required number of *Events* must occur before the alarm relay operates. The Timer control is used to select the required length of this time window.

Each step on the Timer control switch represents a 30 second interval e.g. position 1 = 30 seconds, position 2 = 60 seconds etc. The maximum time window is 270 seconds at position 9.

If position 1, i.e. one *Event*, is selected on the Events control, setting the Timer control can be disregarded.

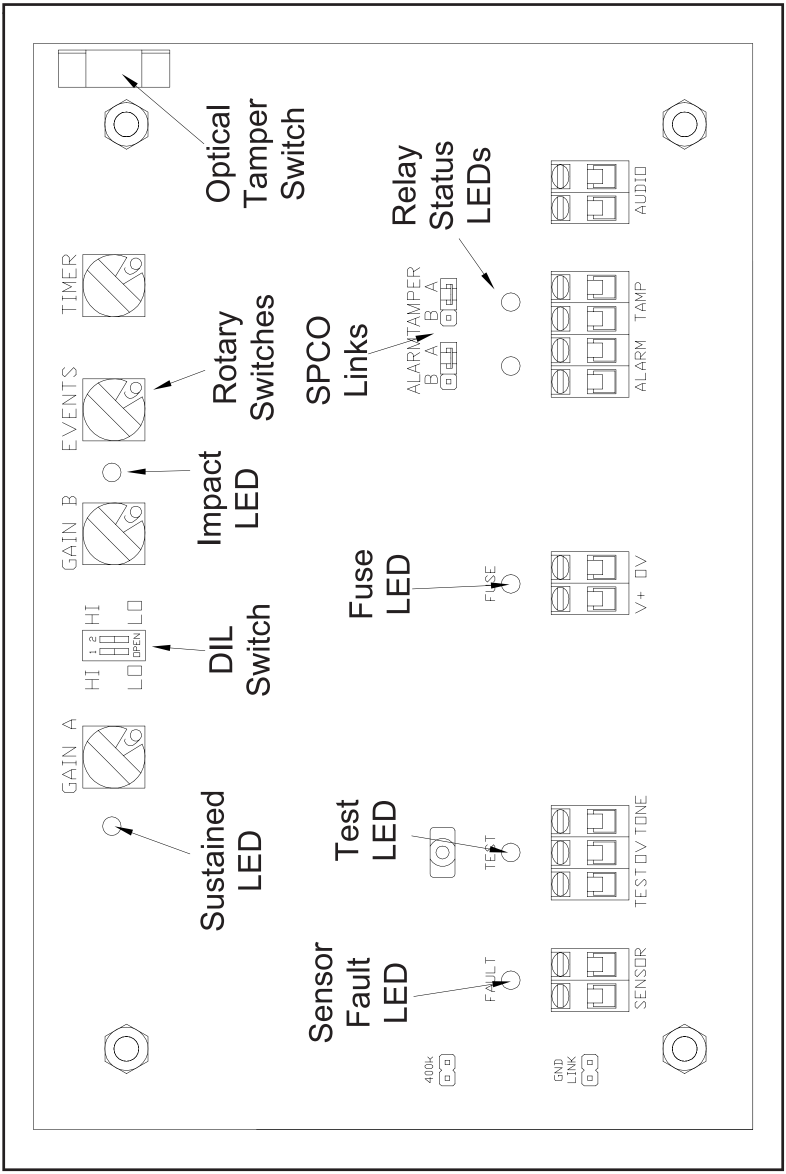
Optical Tamper Switch
Relay Status LEDs
Rotary Switches
SPCO Links
Impact LED
Fuse LED
DIL Switch
Sustained LED
Test LED
Sensor Fault LED

Figure 2

To illustrate the operation of the Timer and Events control, the following example is given.

It is required that the alarm relay is to operate only if three impacts occur within a one minute period starting from the time when the first cut occurred.

The Events control is set to position 3 and the Timer control is set to position 2. The occurrence of an *Event* starts the first time window, which in this example lasts for one minute. If two more *Events* occur within this window then the alarm relay will operate.

If after the first time window has elapsed only one further *Event* (which itself started a second time window) has occurred, the first *Event* and its time window are discarded from the memory, leaving the second event and its time window in the memory. For the alarm relay to now operate two more *Events* must occur within this second window.

While *Events* remain in the system memory, the separate time windows will continue to run and when each one elapses, the window and its associated *Event* are discarded. When there are no more *Events* left in the memory, the Timer will be cancelled until another impact is detected.

Note that the Events and Timer control settings have no effect on the operation of the system when responding to Gain A (sustained) attacks.

## 4.7 LED INDICATORS

The analysers are fitted with seven LEDs which indicate the status of the analyser.

Climb Indicator

This LED indicates the occurrence of a sustained attack by flashing whilst a disturbance of a sufficient level is being generated. This is used when setting the system up to indicate that sufficient sensitivity is available to detect a sustained attack. It also becomes constantly illuminated when the Gain A setting is too high.

Event Indicator

The Event LED indicates the occurrence of a cut *Event* by briefly flashing. This is used when setting the system up to indicate that sufficient sensitivity is available to detect an impact.

The above two LEDs can also be used to determine which channel of the analyser is responding to a particular disturbance, for example, if when observing the LED indicators, the Event LED flashes and then an alarm occurs, it can be assumed that Gain B has responded to that particular type of disturbance. If, on the other hand, the Sustained LED flashes and then an alarm occurs, it can be assumed that Gain A has responded to that particular type of disturbance.

## Relay Status Indicators

Two LEDs indicate the status of the relays on the analyser. When the system is switched on, both of these LEDs should be illuminated. This indicates that both relays have power applied and are in the energised condition. The relay status LEDs will be illuminated in normal operation regardless of the settings of links Lk5 and Lk6.

When an alarm or tamper condition occurs, the appropriate LED will turn off, showing that the power has been removed and that the relay is now de-energised.

When the alarm relay operates, the LED under the alarm link, marked ALARM, will turn off for about two seconds and then turn on again, showing that the alarm relay has switched to signal an alarm.

When a tamper condition is detected, the LED under the tamper link, marked TAMP, will turn off and stay off until the fault is cleared.

## Sensor Cable Fault Indicator

This LED indicates that there is a fault in the sensor cable. If this condition occurs then this LED will turn on and the tamper LED will turn off. These LEDs will remain in this condition until the fault is cleared.

Fuse Blown Indicator

The analyser PCB is fitted with a 750mA resetable fuse to protect it from power surges. If the fuse activates then the fuse LED will be illuminated showing that the PCB is still powered but the fuse has been activated. The fuse is reset by removing the power for a short while and then reapplying the power again ensuring it is in the range of 7V to 24V dc.

Test Indicator

This indicates that the analyser is in self-test mode. It will illuminate when either the test push-button is pressed or the a remote self test is initiated and will remain lit until the four test pulses have gone through and an Alarm condition has been generated. At the end of the two second alarm activation, the LED will go turn off and the analyser will return to normal operation.

## 5.1 INSPECTING THE SYSTEM

An important aspect of the commissioning operation is inspection of the sensor cable installation to ensure adherence to the recommendations outlined in the installation manual QA189. Satisfactory adjustment of the analyser will be difficult to achieve with a poor installation. It is important to ensure that any problem areas are fixed before moving on to the next stage.

## 5.2 ANALYSER TESTING

Once all the connections to the analyser are made, the analyser can be powered up and tested.

1. Before switching the power supply on, remove the positive side of the power connection from the terminal block on the PCB and tie it back so that it cannot accidentally come into contact with any metalwork. Ensure that the tamper optical switch is covered using a piece of paper or card.

2. Switch on the power supply and, using a multimeter, verify that the voltage appearing between the disconnected wire and 0V power terminal is between 7V and 24V dc and that the polarity is correct i.e. disconnected lead =+V.

3. Reconnect the positive wire to the terminal block and verify that the dc voltage between the two power terminals is still between 7V and 24V dc.

   If the voltage changes significantly when the supply wire is reconnected to the analyser, this indicates a problem with either the power source and/or supply cable or possibly with the analyser board.

If the analyser is remote from the 12V power source, the voltage drop in the supply cable can be compensated for by increasing the power supply output voltage, although it must be remembered that the terminal voltage to the analyser will rise significantly when the relays in the unit turn off under alarm conditions.

4. Verify that the alarm and tamper LEDs are both illuminated. Refer to Figure 2 for the position of these LEDs.

   If either of the LEDs is not illuminated, a fault condition exists. Refer to Section 6 for guidance.

5. Monitor the audio signal by connecting a high impedance earpiece or a GWAMP-1 audio amplifier to the audio terminals. Verify that the audio output is quiet and that no continuous tones or other signals are present. Verify that, by tapping the surface to which the sensor cable is attached, a clear audio signal is detected. Refer to Section 6 for guidance if audio interference in the form of continuous tones or hum is detected.

## 5.3 ADJUSTING THE ANALYSER

Follow the instructions below to ensure that the system is set up correctly. Prior to carrying out the following procedures, ensure that the analyser has been successfully tested in accordance with the recommendations in the previous section.

1. Remove the lid and cover the tamper optical switch and verify that both alarm and tamper LEDs are on. Set the Events and Timer controls to position 1.

## 5.4 ADJUSTING FOR IMPACT DETECTION (GAIN B)

1. Set the Gain A Sensitivity control to position 0, the DIL switch to HI and the Gain B Sensitivity control to position 5.

2. Simulate a repeatable level of impact intrusion approximately 1.2m from the line of the sensor cable to mimic the actions of an intruder. Observe the Event LED whilst this is being done.

3. If the Event LED flashes, decrease the Gain B Sensitivity control by one position. If the Event LED does not flash, increase the Gain B Sensitivity control by one position. Increasing the control setting will make the system more sensitive while decreasing the control setting will make the system less sensitive.

4. Repeat steps 2 and 3 using the same repeatable level of impact until an optimum setting is reached i.e. it gives reliable detection at the lowest possible setting whilst still causing the Event LED to flash. Ensure that an optimum has been reached by decreasing the setting by one, and checking that

the alarm LED does not turn off in response to an impact.

If the Event LED flashes when the Gain B Sensitivity control setting is at 0, the next lowest sensitivity setting is achieved by changing the DIL switch to LO and the Sensitivity control to 9.

5. The Events control can now be set to decide on the number of *Events* necessary to operate the alarm relay. Setting the Events control to 3, for example, means that three impacts of sufficient strength to trigger the Event LED must occur within the time interval set by the Timer control before the alarm operates.

6. The Timer control should now be set to decide on the time interval in which the *Events* must occur before the alarm operates. With the Timer control set to position 1, all three *Events* described in the previous step must occur within 30 seconds for the alarm to operate. This 30 second interval starts from the time of detection of the first *Event*. Each step on the Timer control switch corresponds to a 30 second change in the length of the interval so that position 1 = 30 seconds, position 2 = 60 seconds and so on up to a maximum interval of 270 seconds at position 9.

7. Note the setting established in step 4 for the Gain B Sensitivity control and then reset this control to position 0. The Events and Timer controls can be left since their settings have no effect when adjusting the sustained attack channel

## 5.5 ADJUSTING FOR SUSTAINED ATTACK DETECTION (GAIN A)

1. Set the Gain A Sensitivity control to position 5 and the DIL switch to HI.

2. Simulate a sustained attack similar to that of an intruder gaining access to the building. The attack simulation is at an adequate level when the Sustained LED is flashing. If the Sustained LED is constantly illuminated then the Channel A setting is too high.

**IMPORTANT**
**To obtain a realistic adjustment of the Channel A setting a full sustained attack should be attempted and it should last for at least four seconds to cause the alarm relay to operate.**

3. If the Alarm LED momentarily turns off, decrease the Gain A Sensitivity control by one position. If the Alarm LED does not turn off, increase the Gain A Sensitivity control by one position. Increasing the control setting will make the system more sensitive while decreasing the control setting will make the system less sensitive.

4. Repeat steps 2 and 3 using the same level of sustained attack until an optimum setting is reached i.e. it gives reliable detection at the lowest possible setting whilst still causing the Alarm LED to turn off. Ensure that an optimum has been reached by decreasing the setting by one, and checking that

the Alarm LED does not turn off in response to an attack.

If the Alarm LED turns off when the Gain A Sensitivity control setting is at 0 the next lowest sensitivity setting is achieved by changing the DIL switch to LO and the Sensitivity control to 9.

5. Reset the Gain B Sensitivity control to the original setting noted above.

The system is now set to detect both impact and sustained modes of attack as simulated and/or performed by the commissioning engineer.

**IMPORTANT**
**It is advisable that the site owner verifies the settings and performance levels to ensure they are consistent with their view of the potential attack style and intrusion attempts**

## 5.6 TESTING THE SYSTEM

Additional testing should be carried out to verify that the response at different points is adequate, particularly at points where intrusions might be more likely to occur.

It is recommended that for ongoing maintenance purposes all tests and settings are recorded on the label provided on the inside of the lid of the analyser.

If the Defensor GW500 Analyser should malfunction the following gives a list of faults, causes and suggested remedial actions.

| Symptom | Possible Cause | Remedy |
|---|---|---|
| Analyser drawing excessive current from power supply. | Excessive power supply voltage applied to analyser. | Reduce power supply voltage to within specified range of the analyser. |
| Analyser apparently not functioning at all, although dc power is applied. | Power supply polarity incorrect. | Ensure polarity of applied voltage matches the analyser requirements. |
| | Power input fuse has been activated, indicated by the Fuse LED on the PCB being illuminated. | Reset fuse by removing and then reapplying the power. If fuse LED illuminatres again then return analyser to Geoquip Ltd. for repair. |
| Relay output(s) apparently not operational. | Relay contacts welded shut by excessive current load on contacts. | Return analyser to Geoquip Ltd. for repair. |

| Sympton | Possible Cause | Remedy |
|---|---|---|
| Analyser indicates continuous tamper condition. | Damaged tamper optical switch or associated wiring. | Return analyser to Geoquip Ltd. for repair. |
| Analyser indicates tamper condition and a sensor cable fault. | Sensor cable fault. | Test the sensor cable as detailed in the sensor cable installation manual QA189. |
| Analyser indicates continuous alarm and tamper conditions. | dc supply voltage to analyser too low. | Ensure dc supply voltage is within specified range. i.e. 7V - 24V dc. |
| Excessive interference detected when monitoring audio output. | dc power supply common connected to ground as well as ground stud on analyser housing. | Disconnect one of the grounding points to break ground loop. |

| Sympton | Possible Cause | Remedy |
|---|---|---|
| Less than 7V available at the analyser terminals. | Excessive volt-drop in power supply cable. | Increase power supply output or increase wire size of power cable. Refer to Section 2.3. |
| Analyser indicates continuous alarm condition. | Events control switch set to 0. | Increase setting on Event control switch to 1 or above. |

The analyser's technical specifications are as follows

| | |
|---|---|
| Dimensions | Height 220mm<br>Width 140mm<br>Depth 70mm<br>Weight 1.2kg |
| Construction | Diecast aluminium enclosure finished with agate grey polyester finish RAL7038. |
| Fixing Method | Steel mounting bars with concealed screws. |
| Sealing | Housing sealed to IP66 standard. |
| Power Requirements | 7V - 24V dc Current consumption 90mA per PCB at 12V<br>Reverse polarity and overvoltage protected. |
| Operating Temperature | -40°C to + 80°C |
| Outputs | Audio monitoring output: 0dBm at 600Ω<br>Alarm Relay: SPCO (Form C)<br>Tamper Relay: SPCO (Form C)<br>Contact Rating: ac dc<br>Max. Voltage 350V 350V<br>Max. Current 100mA 100mA<br>Max. Power 600mW 600mW |
| Internal Controls | Independent Sensitivity controls for Cut and Climb attack modes (Rotary Switches)<br>Events (Rotary Switch)<br>Timer (Rotary Switch) |
| Internal Indicators | Alarm and tamper relay status indicators.<br>Events and Climb indicator.<br>Self test indicator |
| Electro Magnetic Compatibility | Complies with the requirements of BS EN50081-1 and EN50082-1. |