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The Leader in Perimeter Protection Solutions

GW475 ANALYSER
OPERATION MANUAL

PROVEN PERIMETER PROTECTION

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guardwire

Document Number:	QA95	Prepared by:	P Cook
Revision Number:	5		
Date of Issue:	28/9/99	Approved by:	P Elliott

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

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1.1 GENERAL

This manual covers the installation, connection, commissioning and testing of the GW475 analyser designed by Geoquip Ltd for perimeter fence protection.

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

1. The GW475 Analyser.
2. GW400k Sensor.
3. GWELT-4 End-of-line Termination Box.

There are various additional accessories that are available for use in conjunction with the basic device to assist in complying with site requirements ie junction boxes, door loops, physical protection etc. For details of these accessories see the Sensor Installation Manual QA162.

IMPORTANT
This manual relates to analysers with a PCB revision number of 8 or above. For analysers with earlier PCB revisions contact Geoquip Limited for the correct manual. The PCB revision number is located on the lower left corner of the PCB

1.2 STATEMENT OF COMPLIANCE

The equipment described in this manual complies with all relevant sections of EMC Directive 89/336/EEC introduced in January 1996.

Specifically, the equipment has been tested to the following standards:

BS EN 50082-1 1992 - Generic Immunity Standard

and

BS EN 50081-1 1992 - Generic Emission Standard

While the system complies with the standards listed above, it is still possible that certain high level interference sources can have an adverse effect on the system performance. The guidelines detailed later in this manual should be followed to minimise such problems.

A technical report detailing these tests and procedures is available from Geoquip Ltd. on request.

Additionally, to satisfy the requirements for CE marking of the product, the equipment complies with all other relevant standards for this type of equipment.

2.1 GENERAL

The analysers are usually mounted directly onto the protected surface using the mounting bar kit supplied. 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 PG11 glands to accept the cable entries. The signal cable provided should have sufficient cores to carry the alarm, tamper and audio signals to the central control point. This cable usually comprises of three twisted pair screened cable for the single zone analysers and six twisted pair screened cable for the dual zone analysers.

2.2 POWER REQUIREMENTS

The individual analyser PCBs require a 12V dc supply and consume 100mA of current. The analysers will, however, operate correctly over a supply voltage range of 10.2V to 13.8V (12V dc $\pm$ 15%)

2.3 POWER SUPPLY CABLE

When choosing a cable to feed power to the analyser, the maximum **loop** resistance value should not exceed 22.5Ω for the dc analyser supply to remain above the lower supply voltage limit of 10.2V given that the power supply emits 12V dc. The maximum loop resistance should not exceed 45Ω if the power supply emits 13.8V. 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 160 Ω/km. Using the figures given above, the maximum length run from the power supply to the analyser would be given by the formula

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

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

ie

$$\frac{22.5}{160} \text{ x } 1000 = 140 \text{ m}$$

assuming a 12V 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 195.6 Ω/km. Using the figures given above, the maximum length of this type of cable between the analyser and the power supply would be

$$\frac{22.5}{195.6} \text{ x } 1000 = 115 \text{ m}$$

assuming a 12V 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 ie 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 removable terminal blocks mounted directly on the printed circuit board (PCB). The exception being the ground connection which is made to the stud on the casing.

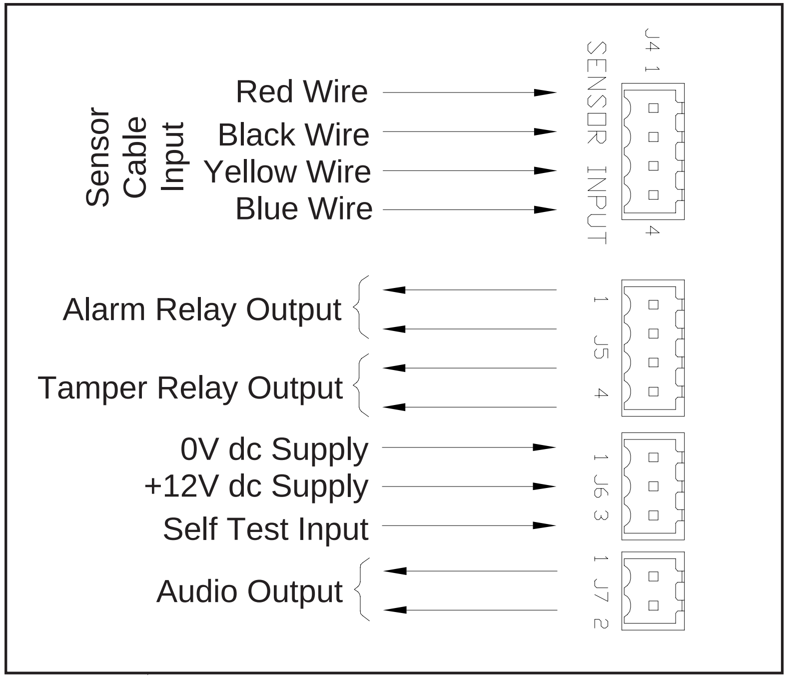

Figure 1

3.2 GW400k SENSOR CONNECTIONS

The GW400k sensor is connected to terminals 1 to 4 of the sensor input terminal block (J4). The colours indicated in Figure 1 and on the PCB match the colours of the sensor wires following termination (using the termination kit supplied with the analyser.)

3.3 ALARM/TAMPER CONTACTS

The alarm contact outputs are connected via terminals 1 and 2 and the tamper contact outputs via terminals 3 and 4 of the output terminal block (J5).

On the GW475 analyser the relays fitted for both alarm and tamper outputs are of the Single Pole Change Over (SPCO) type, referred to as Form C contacts. A link option is supplied on these boards to enable the engineer to select ***either*** an opening ***or*** a closing contact configuration for each relay output. The links are referred to as LK3 for the Alarm relay and LK4 for the Tamper relay. See Figure 2 page 12 for the location of these links on the PCB. The factory setting for these links is the NO (Normally Open) position where the contact will OPEN on an alarm or a power fail condition.

When a Tamper condition is detected, the Alarm relay is also forced into a Alarm condition. If the Tamper condition is required to be totally separate to the alarm condition link LK1 can be changed as shown in Figure 3 on page 17.

3.4 CONTACT RATINGS

Both the alarm and tamper contacts are rated as follows:

	ac	dc
Max. Voltage:	110V	30V
Max. Current:	0.3A	1A
Max. Power:	30VA	20W

3.5 DC POWER SUPPLY

The analyser requires a nominal 12V dc supply. The grounded or 0V side of the supply must be connected to terminal 1 and the positive side of the supply must be connected to terminal 2 of the power supply terminal block (J6).

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 100mA at 12V dc but the supply to the analyser can vary from 10.2V to 13.8V and still function correctly. For optimum reliability the power supply voltage should, however, be set to 12V whenever possible.

3.6 SELF-TEST FACILITY

The analysers are provided with a self-test feature which verifies the operation of the electronics in the signal analyser.

The self test will operate if terminal 3 of the power supply terminal block is connected to the incoming 0V side of the power supply, ie terminal 1 on the same terminal block.

Each time this connection is made a short audio pulse is induced into the analyser circuit which passes through the system and causes the Event counter to trigger and the Event LED to illuminate. If this counter is set to 1, the first pulse received will cause the Alarm relay to operate. If the audio monitoring facility is used, a short “beep” of audio will sound, after which the Alarm relay will trigger.

If more than one Event is selected, then the number of pulses indicated by the Event switch must occur within the time period set by the Timer switch before the Alarm relay operates.

For more details on the Events and Timer switches see Sections 4.5 and 4.6.

3.7 AUDIO OUTPUT FACILITY

The analyser includes a facility to monitor the audio signal picked up by the sensor. This output is available on terminals 1 and 2 of the audio terminal block (J7). The output signal level is nominally 0dBm (0.772V RMS) and the output impedance is 600Ω.

The audio output level can be monitored by either connection of a high impedance earphone directly to the above terminals or the signal can be connected to a small amplifier to drive a loudspeaker. Geoquip Ltd supply a battery powered amplifier (Part No. GQAMP-1) to provide audio on an integral loudspeaker.

On manned sites the audio, alarm and tamper outputs can be connected to 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.

If it is required to send the audio signal over more than 100m to the monitoring point, a twisted pair cable is recommended to overcome any stray interference which may degrade the audio quality.

3.8 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. The ground wire of the GW400k sensor must be connected to this ground stud on the inside of the case.

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 and to prevent damage from lightening strikes. For GW475 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 CH. A and CH. B and, on most types of fence, control the sensitivity to the attack modes listed below.

	CH. A	CH. B
Attack mode	Climb over	Cut through

The two switches on the right-hand side of the PCB are concerned with the number of cut through (channel 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 CH.A SENSITIVITY CONTROL

The left-hand control marked CH.A (channel A) sets the sensitivity of the system to intrusions where a climbover attack is being attempted.

Correct setting of channel 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.

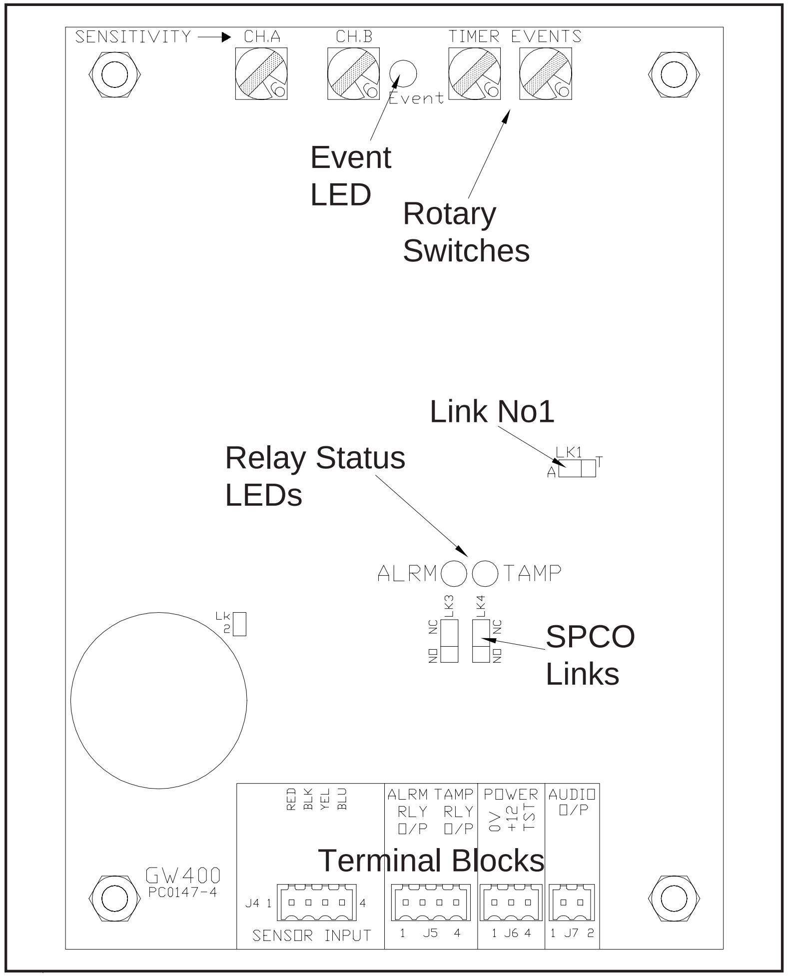

Figure 2

4.3 CH.B SENSITIVITY CONTROL

The right-hand control marked CH.B (channel B) sets the sensitivity of the system to intrusions where short, sharp impacts, ie cuts, are generated as the intrusion occurs. Each impact detected by the system is referred to as an Event.

4.4 SENSITIVITY ADJUSTMENTS

On the range and style of fences that Guardwire sensor has been applied to, experience has shown that the Dual Channel Signal Processing developed by Geoquip Ltd yields adequate detection on the majority of fence designs.

In recent years, therefore, it has been appropriate to associate Ch A with climbover detection and Ch B with cut detection.

With the increase of newer fence design and construction, primarily heavy gauge weldmesh types, this designation is no longer necessarily appropriate and as such **should not be considered as definitive.**

Therefore all system adjustments should be arrived at taking into account the variable factors influenced by fence construction.

For example, **on rigid fences**, if reliable climb-over detection can be achieved by increasing CH.B setting one or two steps above the nominal setting required for cut detection, CH.A should be set at a maximum of 3. This will assist in the climb-over detection whilst maintaining a minimum level of nuisance alarms.

For details of dealing with non standard fence construction refer to the Sensor Installation Manual QA162.

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 will have to occur before the alarm relay operates.

If the Events control is set to 1, then only one Event will be necessary to operate the alarm relay.

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.

Note that the Events control has no effect on the operation of the system when responding to climbover attacks (Channel A).

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 interval is 270 seconds at position 9.

If only one Event is selected on the Events control, the Timer control can be disregarded.

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 impact occurred.

The Events control must be set to position 3 and the Timer control must be 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 operate two more Events must now 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 associated Event are discarded. When there are no more Events left in the memory, the Timer will reset until another cut is detected.

4.7 LED INDICATORS

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

Relay Status Indicators

Two LED's indicate the status of the relays on the analyser. When the system is switched on, both of the LED's should be illuminated. This indicates that both relays have power applied to the relay coils and are in the energised condition.

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

When the Alarm relay operates, the LED on the left, marked ALRM, will turn off for about two seconds and then turn on again, showing that the Alarm relay has switched for two seconds to signal an Alarm.

When a Tamper condition is detected, the LED on the right, marked TAMP, will turn off and stay off until the fault is cleared. When a Tamper condition is detected, the Alarm relay is also forced into a Alarm condition.

If it is required to create a tamper condition independent to the alarm condition, eg where separate alarm and tamper circuits are monitored, link LK1 can be changed to the position shown in Figure 3 below.

Refer to Figure 2 for the location of this link on the analyser PCB.

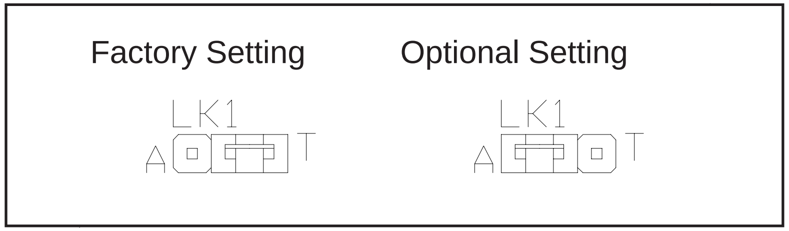

Figure 3

<u>Event LED Indicator</u>

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

The Event LED can also be used to determine which channel of the analyser is responding to a particular disturbance, e.g. if when observing the LED indicators, the Event LED flashes and then an Alarm occurs, it can be assumed that channel B has responded to that particular type of disturbance. If, however, the Alarm relay operates and no indication is given on the Event LED, then channel A has responded to the disturbance.

5.1 ANALYSER TESTING

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

Before switching the power supply on, remove the connection to terminal 2 on the power supply terminal block (+ 12V input) and tie it back so that it cannot accidentally come into contact with any metalwork. Ensure that the tamper microswitch is held down using a tiewrap or other fixing.

1. Switch on the power supply and, using a multimeter set to the 20V range, verify that the voltage appearing between the disconnected wire and terminal 1 power supply terminal block is 12V dc ±15% and that the polarity is correct i.e. disconnected lead = +12V.

2. Reconnect the wire to terminal 2 and verify that the dc voltage between terminals 1 and 2 is still 12V dc ±15%.

3. 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 card.

   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 in the ON condition.

   Refer to Figure 2 for details of the position of these LEDs. If either of the LED's is off, a fault condition exists. Refer to Section 6 for guidance.

5. Monitor the audio signal by connecting a high impedance earpiece or a GQAMP-1 audio amplifier to terminals 1 and 2 on the audio terminal block of the analyser. 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 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.

5.2 INSPECTING THE SYSTEM

An important aspect of the commissioning operation is inspection of the installation to ensure adherence to the recommendations outlined in the appropriate Sensor Installation Manual QA162. Satisfactory adjustment of the system will be difficult to achieve with a poor installation. It is important to ensure that any problem areas are corrected before moving on to the next stage.

5.3 ADJUSTING THE ANALYSER

Follow the instructions below to ensure that the system is set up correctly.

Prior to carrying out the following procedure, ensure that the analyser has been successfully tested in accordance with the recommendations in the previous section. Also ensure that the sensor has been tested in accordance with the recommendations described in the Sensor Installation Manual QA162 and acceptable results have been obtained.

1. Remove the lid and fasten down the tamper 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 (CH.B)

1. Set the CH.A Sensitivity control to position 0 and the CH.B Sensitivity control to position 5.

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

3. If the Event LED flashes, decrease the CH.B Sensitivity control by one position and repeat. When the Event LED does not flash, increase the CH.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.

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 cuts 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 CH.B Sensitivity control and then reset this control to position 0. The Events and Timer controls can be left as set.

5.5 ADJUSTING FOR SUSTAINED ATTACK DETECTION (CH.A)

1. Set CH.A sensitivity control to position 5. Simulate a sustained attack similar to that of an intruder climbing the fence. Note that to obtain a realistic adjustment of the control, a full sustained attack should be attempted. Observe the Alarm LED as when this goes off the alarm relay is simultaneously triggered. Depending on the system response, adjust the control sensitivity up or down, as per step 3, until an optimum is reached. The optimum adjustment is that which gives reliable detection at the lowest possible control setting whilst still causing the Alarm LED to extinguish. Note that the disturbance must last for at least four seconds to cause the alarm to operate. The Event and Timer settings have no effect when adjusting the sustained attack channel.

2. Reset the CH.B Sensitivity control to the original setting noted in step 7.

The system is now set to detect both cut and climbover modes of attack.

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.

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 12V applied.	Power supply polarity incorrect.	Ensure polarity of applied voltage matches the analyser requirements.
Relay output(s) apparently not operational.	Relay contacts welded shut by excessive current load on contacts.	Return analyser to Geoquip Ltd. for repair.
Analyser indicates continuous tamper condition.	Damaged tamper microswitch or associated wiring.	Return analyser to Geoquip Ltd. for repair.

SYMPTOM	POSSIBLE CAUSE	REMEDY
Analyser indicates continuous alarm conditions on both relay outputs.	dc supply voltage to analyser too low to pull in relay coils.	Ensure dc supply voltage is within specified range. ie 12V ±15%.
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.
Less than 12V 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.

Dimensions		Single zone	Dual zone
	Height Width Depth Weight	260mm 160mm 90mm 2.4 kg	232mm 332mm 110mm 5.0 kg
Construction	Diecast aluminium enclosure finished in two part grey polyester finish to RAL7001.		
Fixing Method	Steel mounting bars with concealed screws.		
Sealing	Housing sealed to IP65 standard.		
Power Requirements	10.2V - 13.8V dc (12V ± 15%) Current consumption 100mA per PCB at 12V Reverse polarity and overvoltage protected.		
Operating Temperature	-40°C to + 80°C		
Outputs	Audio monitoring output: 0dBm at 600Ω Alarm Relay: SPCO (Form C) Tamper Relay: SPCO (Form C) Contact Rating: ac dc Max. Voltage 110V 30V Max. Current 0.3A 1A Max. Power 30VA 20W		
Internal Controls	Independent Sensitivity controls for Cut and Climb attack modes (Rotary Switches) Events (Rotary Switch) Timer (Rotary Switch)		
Internal Indicators	Alarm and Tamper relay status indicators. Events indicator.		
R.F. Immunity	Complies with the requirements of BS6667 Part 3 Level 3 1985.		
Electro Magnetic Compatibility	Complies with the requirements of BS EN50081-1 and EN50082-1.		