GUTERMANN

AQUASCOPE 3

Operating Manual

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Contents

1. Introduction

Welcome to the AQUASCOPE 3 leak detection system. The AQUASCOPE 3 is a digital acoustic leak locator with superior crystal clear sound with simple to use operation. It's light weight with a waist strap for user comfort. The on board digital leak noise analysis displays the real leak noise level without effect from ambient sounds. To aid pin pointing while sounding the leak noise is automatically memorised and the last 8 reads are available for comparison.

The AQUSCOPE 3 has a filter system which allows the operator to finely tune the narrow band-pass filter to suppress unwanted interference and background noise while focusing on the leak noise. The system has a versatile hand probe for direct sounding and leak location on soft ground. For the ground microphone or combined locator system a shielded robust ground microphone (Geophone) with its high performance sensor is available for pin pointing through hard surfaces.

1.1. System Components

Depending on which AQUASCOPE 3 system was purchased, the following configuration is supplied:

All Configuration Types include

- Amplifier control unit with waist belt
- Stereo Headphones
- Connection Cable

Hand probe Locator (see chapter 4)

- Hand probe microphone
- 3 x Probe rods including 1 with a tip
- 1 x Tripod and magnet

Ground Mic Locator (see chapter 5)

- Geophone
- T bar handle and rod

Combined Locator

- All of the above components.

Pmic Kit

- Pocket microphone
- 3 Probe rods including 1 with tip
- Ground plate and magnet (optional)

2. How to Switch on the Amplifier

The amplifier does not have an on/off switch, the cable performs that task. Once the connecting cable is plugged into the amplifier (control unit), the amplifier switches on and will remain on until the cable is unplugged. When switched on, the display will show the battery charge, filter setting, volume setting and the signal strength.

Fig. 1 Plug in Cable

Fig. 2 Display is On (Stand-by)

Note: In order to save battery consumption, please ensure that the cable is disconnected from the amplifier after using the AQUASCOPE 3.

3. Connecting the Headphones

The headphone is connected to the AQUASCOPE 3 control unit via the 3.5mm stereo socket on the right side of the display. There is a volume control on the headphone cable for adjustment for your comfort of sound level. Coil any excess cable so to avoid rubbing against the microphone which can create unwanted noise.

Fig. 3 Neatly Coiled Cable

Fig. 4 Poorly Coiled Cable

4. The Hand probe Microphone

Screw the desired amount of probe rods together as required, generally an extension together with the Tip rod is recommended. Next, attach the rod assembly to the hand probe microphone. The longer the rod assembly the more background noise is introduced especially on windy days. Some people lag the rod with pipe insulation to reduce wind noise. The hand probe is used for direct sounding on pipes and fittings. For direct sounding we recommend to use the “filter off” mode.

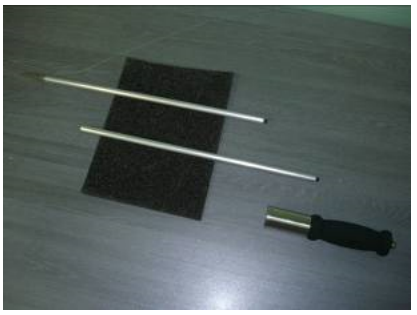

Fig.5 Hand probe Component Parts

Fig.6 Hand probe Assembly using 2 x rod sections

Fig.7 Hand probe Assembly with Cable Attached

4.2 Techniques using the hand probe Microphone with Rods

The following photos show example methods of using the AQUASCOPE 3 hand probe:

Fig.8 Listening directly on a Water Meter

Fig.9 listening directly on a Valve or Hydrant

Fig.10 listening directly on a pipe with the rod inserted through soft soil

Fig.11 listening to the pipe via an insulated toughened probe

Caution: when probing through the soil it's highly recommended that a certified insulated probe such as a punch bar is used. This helps prevent the possibility of electrical shock or damaging the aluminium rods while probing through the ground.

4.3 How to find leaks with the AQUASCOPE 3 listening stick

An electronic listening stick is usually used to perform a leakage survey by walking the street listening on every valve, hydrant and accessible service connection. Each sounding is usually for 10 to 30 seconds. It takes longer to assess the noise when there is more background noise. It is not unusual to perform this work at night in busy cities when the pressure is highest and the background noise is lowest. It is important to hold the stick still and firmly pressed against the pipe, valve or hydrant. Ensure there is no long grass or cables making contact with the stick.

The electronic listening stick is usually a localization tool used to localize the leak position; however when the leak is suspected to be in a pipe under soft ground, the electronic listening stick can be used to pinpoint the leak. It is preferable to make the hole with an electrically insulated punch bar or another probe and then insert the stick into the hole made. Extreme Care should be taken to ensure there is no contact with other underground services. Check with your company Health and Safety Officer before proceeding with this method.

1. Listen on all fittings in an area making note of the noise level, frequency and characteristics. It is usual to listen at each location for a period of 10 to 30 seconds, waiting for background noise to stop. If

there is noise generated from consumption, pumps, road works or heavy traffic you will need to return when the noise stops.

2. Note the minimum noise detected on each reading on a map.

3. Analyse the minimum noise levels on the map to identify the area of interest.

4. Use a pipe locator to trace and mark the pipe location in the area of interest and check to see if there are any other services in the same trench as your pipe.

5. If it is safe to do so, make a series of holes at 3 meter intervals in the ground with an insulated punch bar and insert the probe from the electronic listening stick into the ground as deep as it is safe.

6. Continue this process along the section of pipe work until the leak is found. Holes will need to be made at 1 meter intervals when the leak has been located to a 6 meter span.

7. Determine which point has the loudest minimum noise.

8. Perform a “star check” moving about 30 cm from this point to all 8 points of a star. Each point should have a lower noise than the pin-pointed leak position. If a point has a louder noise than the centre, this could be the correct position, repeat the star check to verify.

4.4 Techniques using the hand probe Microphone with Tripod

The hand-probe tripod attachment is used to find leaks buried in concrete slab, walls and shallow ground. This microphone has less sensitivity than the ground microphone which makes it possible to pin point leaks in such conditions. Too much amplification can be confusing to the operator. Screw the magnet into the sensor and attach to the tripod foot. Lift or move the hand-probe to each point and then listen.

Fig.12 Tripod & magnet

Fig.13 magnet

The following photos show example methods of using the AQUASCOPE 3 hand probe with Tripod:

Fig.14 using the tripod attached to the hand probe microphone

Fig.15 listening to a leaking pipe through the wall

4.5 How to find Leaks with the AQUASCOPE 3 Tripod foot

The tripod foot is a pinpointing tool that attaches to the electronic listening stick in place of the probe bars. It is used to find leaks in concrete slab, shallow underground pipes and in walls. It should always be placed or held in a still position during operation.

1. Localise the leak position with noise loggers or an electronic listening stick. If a Correlator is available this can be used to narrow down the location to a much smaller area.

2. It is best practice to locate the pipe position with a pipe locator.

3. Follow the path of the pipe listening for the leak at 1 meter intervals. Each sample should last long enough to capture a minimum noise value, typically 20 to 30 seconds.

4. When the location with the highest minimum noise has been identified use your leakage experience to confirm this is a leak noise.

5. Perform a “star check” moving about 30 cm from this point to all 8 points of a star. Each point should have a lower noise than the pin-pointed leak position. If a point is louder this could be the correct position, repeat the star check to verify.

5. The Ground Microphone/Geophone

To assemble the Geophone, take the T-bar handle and screw into the stainless steel plate of the Geophone base in a clockwise direction. There should be no thread visible once complete. When attaching the cable ensure the notch lines up between the 4 way plug on the cable and the socket of the T-Bar.

Fig.16 T-Bar handle for Geophone

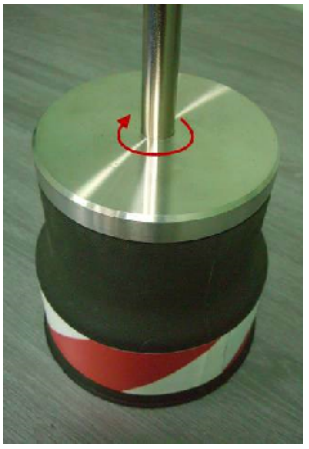

Fig.17 Threading the T-bar handle into the Geophone base

Fig.18 Screw the 4 way plug of the connection cable into the handle

5.2 Techniques using the Geophone

Use the Geophone to surface sound and pin point on compact earth, concrete and tarmac. When sounding on grass use a hand-probe or a piece of plywood to act as a sounding board, this will help to reduce the tickling sound caused by the blades of grass on the Geophone sensor.

Fig.19 sounding using the Geophone concrete

Fig.20 sounding using the Geophone on grass with a wooden board

Fig.21 sounding using the Geophone on compact earth

Fig.22 sounding using the Geophone on Tarmac

When using the Geophone to pin point the leak move along the path of the pipe in regular (1ft or 300mm) intervals taking a reading at each point, this is depicted by the diagram fig 23 (PTO) which shows a buried pipe and the Geophone taking readings at regular intervals. Use the memory button (see section 8.2) to analysis the results and return to the loudest point to confirm the leak.

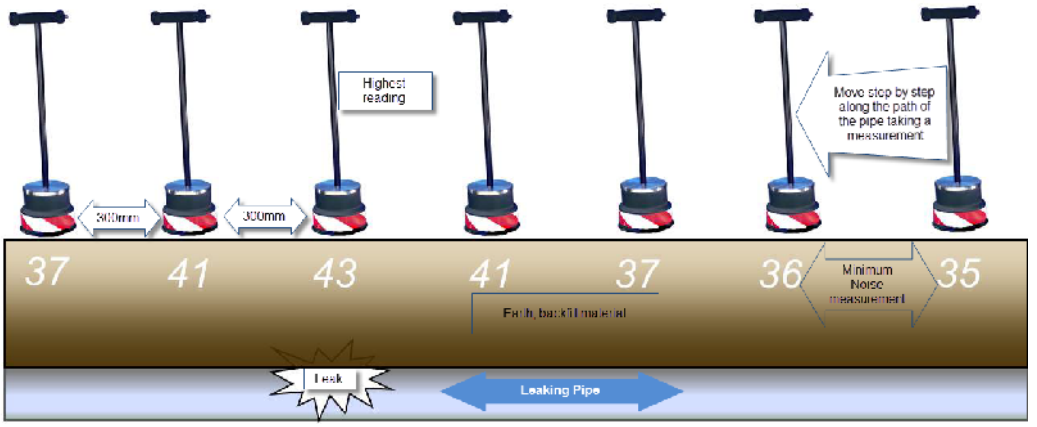

Fig.23 Method of Pin Pointing with a Geophone

In clay soils there maybe 2 high readings with a lower reading in between due to the water leak created a cavity and the water hitting the walls of the cavity.

6. How to find leaks with the AQUASCOPE 3 Geophone

The ground microphone is a pinpointing tool that is used to find leaks under sealed surfaces. It has more sensitivity than the tripod foot which is an advantage in finding leaks in deeper pipes but a disadvantage finding leaks in good noise conductors like concrete slab. It should always be placed or held in a still position during operation.

1. Localise the leak position with noise loggers or an electronic listening stick. If a Correlator is available this can be used to narrow down the location to a much smaller area.

2. It is best practice to locate the pipe position with a pipe locator.

3. Follow the path of the pipe listening for the leak at 1 meter intervals. Each sample should last long enough to capture a minimum noise value, typically 20 to 30 seconds.

4. When the location with the highest minimum noise has been identified use your leakage experience to confirm this is a leak noise.

5. Perform a “star check” moving about 30 cm from this point to all 8 points of a star. Each point should have a lower noise than the pin-pointed leak position. If a point is louder this could be the correct position, repeat the star check to verify.

7. Aquascope Pocket Microphone

Fig.24 Pocket Mic

The Pocket Microphone (Pmic) is a versatile microphone that comprises of a trigger handle attached to a rubberised microphone via a flexible cable. The Pmic can take various attachments including the ground plate, magnet or rods. The Pmic connects to the control unit by pushing and screwing the binder plug into the Aquascope socket.

Fig.25 Pocket Mic Handle Trigger

There are 2 methods of activating the sound by either pushing the trigger on the handle or the button on the Aquascope 3 control unit.

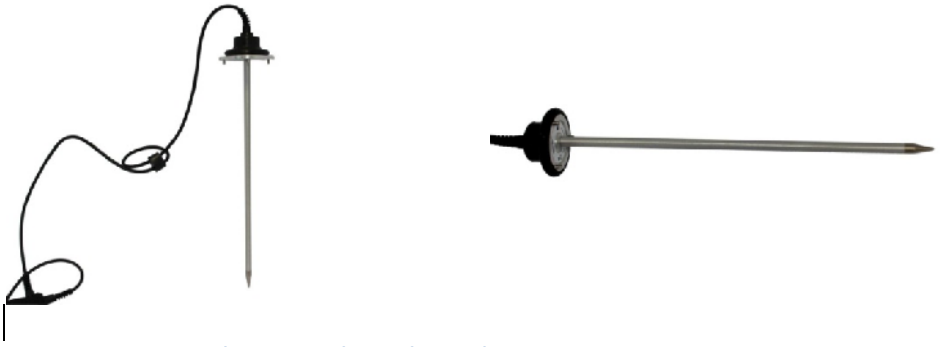

Fig.26 Pocket Mic Rods

Screw the rods directly onto the Pmic or onto the ground plate to create a listening stick used to sound on valves, taps, hydrants, pipes and meters. See Handprobe section 4.2 for further detail.

Fig.27 the Magnet Attachment

Screw the magnet to the ground plate or directly to the Pmic as shown above. The magnet is perfect for listening directly on fittings where the leak is quite and difficult to distinguish if you use a rod and are having problems holding the microphone completely still.

Fig.28 Pocket Mic as a Ground Microphone

With or without the ground plate attached the pocket mic can be used to pin point a leak under hard surfaces such as concrete and asphalt. Move the Pmic along the path of the pipe step by step to find the loudest point, use your leak values and memory recall as a reference. See Aquascope 3 Geophone section 5.2 for further detail on technique.

8. Wearing the Control Unit

Fig.29 Waisted Mounted Control Unit

Attach the Aquascope3 control unit around the waist using the webbing strap and quick release clips provided. The waist band can be adjusted to suit. An alternative method of holding the control unit is around the neck using the waist band.

9. Operation of the AQUASCOPE 3

9.1 The display and the button function.

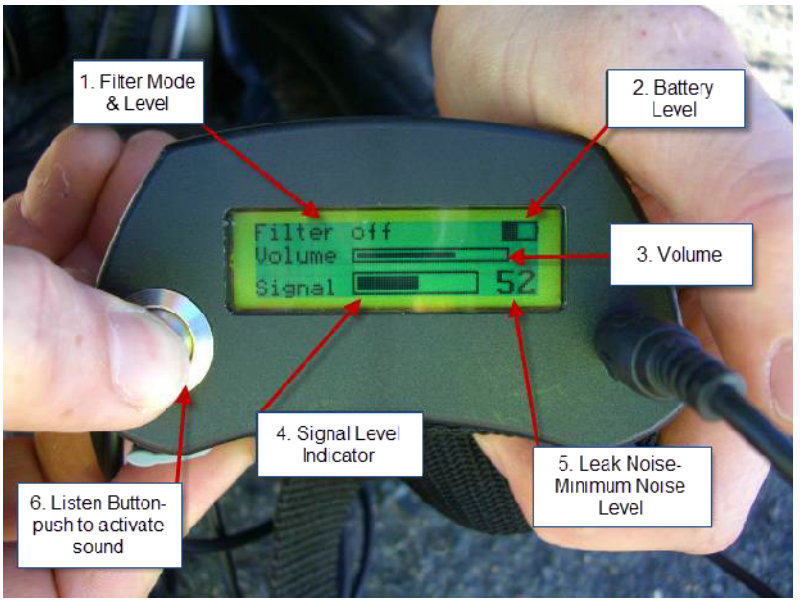

Fig.30 AQUASCOPE 3 Display

1. Filter setting - On the upper left-hand corner the filter setting is shown. Either "**Filter off"** or "**Filter on**" plus the centre frequency of the selected narrow-band band-pass filter (e.g. 700 Hz).

2. Battery charge - On the upper right-hand corner is a battery symbol indicating the actual battery charge.

3. Volume - In the upper part of the display from left to right is a bar showing the selected volume level.

4. Signal strength - In the lower part of the display, starting from the left-hand side, the actual signal strength is indicated in the signal strength bar.

5. Minimum noise level - On the lower right-hand corner, the minimum noise level (value between 00 and 99) is indicated during a listening session. From the moment the "listen" button is pressed (until released), the AQUASCOPE-3 automatically samples and records the lowest noise level, indicating the true leak noise without ambient interference. When the "listen" button is released, this value will automatically be saved in the memory. The last 8 leak values can be recalled on your display.

On the upper side of the amplifier, on the left-hand side of the display, is the "listen" button. When pressing this button the operator can listen

to the leak noise at each sounding point. Press and hold the button until you are confident the background noise has gone. When releasing the button, the amplifier will return to the mute mode. This will automatically store the leak noise value in the memory.

9.2 Keyboard functions

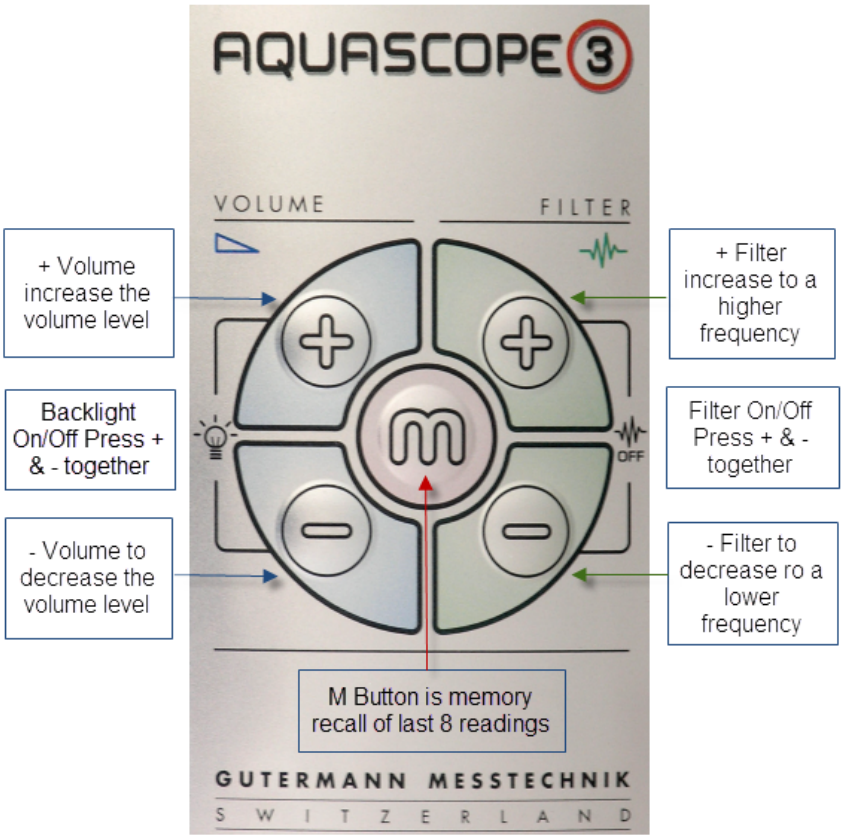

Fig.31 AQUASCOPE 3 Keyboard

On the front label panel is 5 keys which allow selection and change of the settings at any given moment.

1. Volume – the 2 blue buttons on the left hand side are for volume control + to increase and – to decrease.

2. Filters – the 2 green buttons on the right hand side are to adjust the filters + to increase the frequency and – to reduce the frequency.

3. Memory – the red M button is to activate the memory recall of the latest 8 Noise Levels

Fig.32 M button pressed and the last 8 readings displayed

4. Back light – to activate the display backlight press both blue buttons together simultaneously.

Note: When the backlight is switched on, the battery consumption will triple and thus reduce the battery life!!

In order to save battery consumption: If for a period exceeding 10 seconds none of the keys including the “listen” button is pressed, the backlight will automatically be switched off. As soon as any of the keys are pressed, the backlight will automatically switch on again.

5. Activate Filters - to turn the filter on or off press the 2 green buttons together simultaneously. When ambient noises and background interference disturb the leak sounding survey, the operator can switch to the “filter on” mode. This will activate a narrow band pass filter. It can be adjusted by using the upper key to increase or the lower key to reduce the centre frequency in order to suppress any unwanted interference and background noise, and to adjust the audible range to the exact leak noise frequency. The centre frequency can be adjusted between 200Hz and 5000Hz. On the display the selected setting is indicated by “filter on” plus the centre value of the actual band pass currently being used.

Fig. 33 Activating the Filter

10. Battery replacement

At the back of the amplifier is the battery compartment. Please lift the battery compartment cover. There are 4 LR6 (AA) size alkaline batteries. When the battery charge indicator on the display suggests replacing the batteries, please make sure that all 4 batteries are replaced at the same time. When inserting the batteries please observe the correct direction (+ and – according to the indicated position).

11. Technical Specifications

1.	The control unit should be manufactured from a high strength PVC material that is resistant to exposure from high levels of UV exposure.
2.	Power supply comprises of 4 x standard LR6" or "AA" Alkaline batteries.
3.	The System has a Frequency range of 1 – 5000Hz
4.	The control unit has amplification of 60DB or more.
5.	The Sensitivity in the hand probe is 15v/g or more.
6.	The Sensitivity in the ground microphone is 20 v/g or more.
7.	The Aquascope 3 has a display showing battery status, noise level, volume setting and signal strength.
8.	The center frequency of a band-pass filters shown as a numeric value. The operator tunes into the exact filter setting required in increments of 40Hz.
9.	Activating the filters only takes one simple button press.
10.	The filter settings have a narrow bandwidth to allow for optimal acoustic tuning of the leak noise.
11.	The ground microphone to cable connector is at a height greater than 400mm from the floor so it cannot be accidentally kicked by the operator.
12.	The ground microphone to controller cable runs within the ground microphone handle, this reduces exposure to increased background noise from wind.

12. Trouble Shooting

Fault	Cause	Solution
No Sound	A Damaged cable or Headphones. Headphone Volume control is too low	Replace connection cable or headphones. Increase headphone volume control.
No Display	Dead batteries	Replace batteries
No Display	Cable fault	Replace connection cable
Noise Level 25,no sound	Cable fault	Replace connection cable
Corrupt Display	Circuit Board	Return to Gutermann
Sound in 1 earpiece	Headphone	Replace Headphone
Cannot plug in hand probe or Geophone	Damaged connection socket	Return to Gutermann

13. Appendix

The AQUASCOPE 3 connection cable has change overtime, the main difference between each cable variant is the plug and socket on the control unit. The various types of connector are shown below:

Fig. 29 Type 1; Oldest version

Fig. 30 Type 2; 3way connector

Fig. 31 Type 3; Latest version (Binder)

Fig. 32 Type 4; Australia only