

**Xmic  
Acoustic Listening System  
Operating Manual**



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## Xmic Introduction

The Xmic (pronounced ex-mike) is an advanced, electronic ground microphone designed to amplify the noise generated by water escaping from buried supply pipes under pressure. Identifying the position of the loudest leak noise indicates the below ground position of the actual leak itself.

The Xmic system comprises a lightweight portable amplifier module complete with battery charger, a pair of aviation-quality headphones and an acoustically shielded ground microphone foot. As an optional extra, a hand-held listening probe is available. This comes with a tripod foot and two probe rods for sounding in soft ground.

The portable amplifier module has an LCD display. The advanced, easy-to-use features of the Xmic enable the operator to pinpoint leaks faster and with more confidence than ever before.

Although the system is rugged and shower-proof (to IP65), it contains electronic circuitry and should be handled with care. The equipment should be kept dry and clean. Where necessary it should be cleaned with a damp cloth; abrasive materials must not be used.

**Note:** The headphones supplied with the Xmic cannot be interchanged. The impedance of the headphones is matched to the Xmic control unit during manufacture.

### Key features

- Sliding scale filter selection
- Backlit multi-function LCD display showing ...
  - ⇒ Noise level graphically and digitally
  - ⇒ Dynamic sensitivity (signal strength)
  - ⇒ Settings and operation mode
- Levels of leak noise can be recorded for comparison in a histogram profile (MLP)
- IP65 enclosure
- Aviation-quality headphones with volume control
- Lightweight, easily portable system
- Membrane keypad
- Versatile – ground microphone and hand probe configurations
- Military specification connectors
- Robust construction for field use
- Rechargeable batteries (up to 25 hours use)

## Warnings

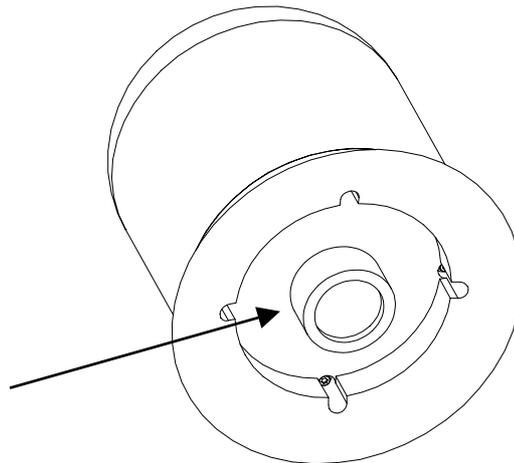
### Lithium ion batteries

The batteries supplied and fitted to the Xmic units are rechargeable lithium ion. Do not short circuit or overcharge these batteries. Any misuse of these batteries may result in explosion or fire. They must not be used in any other application or used with any other equipment.

### Microphone foot warning

The Microphone foot has a sensor attached that can be seen from the bottom of the unit. **Users must not attempt to unscrew this sensor as this will break internal components of the microphone resulting in irreparable internal damage.** Sensor replacement is then the only option.

Any necessary repair or dismantling of the foot must be carried out by Hydreka



**Sensor:**

**Do NOT attempt to unscrew**

If the sensor does become loose it should be tightened manually so that it is "finger tight". Excessive force will cause damage.

## System Description

### Control unit – robust for field conditions

The control unit is the operator interface. It is very easily portable, and can be carried with either hand- or shoulder-strap. Its injection-moulded housing is purpose-designed to provide long-term field durability and effective protection under realistic site conditions. It is environmentally rated to IP65.

The control unit has a membrane keypad, with push-key operation, and a backlit, multifunction LCD display. It interfaces to the headphones, charger and microphone via military-specification connectors.

### Versatile leak noise sensing

The acoustically shielded ground microphone foot provides isolation from airborne noise interference and can therefore be used in wet and windy conditions.



Xmic  
standard  
equipment

### Standard equipment list:-

1. Control/amplifier module with adjustable carry strap.
2. Acoustically shielded ground microphone foot.
3. Aviation quality headphones.
4. Lithium ion battery pack and battery charger.
5. Carry case.
6. Cables.
7. Manual.

## Optional Additional Equipment

A handheld sensor unit can be added to the system as an option, providing the operator with the facility to use this as a smaller ground microphone with its tripod; or to use it with probe rods to sound fittings in deep chambers or to use in soft ground.



Xmic with optional handprobe, tripod and probe rods

### Equipment list including optional extras:-

1. Control/amplifier module with adjustable carry strap.
2. Combined hand probe and ground microphone with integral cable.
3. Two 400mm stainless steel rods.
4. One short legged tripod.
5. Aviation quality headphones.
6. Lithium ion battery pack and charger.
7. Carry case.
8. Cables.
9. Manual.

# Xmic Controls

Headphone  
mute

Dynamic acoustic  
signal level meter

Battery  
status

Gain  
level

Power On/Off  
and  
back light



Mode  
select

Contrast  
adjustment

Gain  
increase /  
decrease

Battery  
charging  
LED

Context sensitive buttons

**Xmic (back of unit)**

Sensor socket

Headphone and combined charger socket



Three retaining screws  
for battery compartment

## **Preparing the Xmic for Use**

The battery pack for the Xmic is supplied as a separate item in the carry case. The batteries within this pack are supplied quarter charged. To insert the battery pack into the Xmic unscrew the three screws underneath the unit, remove the cover and packing foam and connect the battery pack, place in the battery compartment, refit the packing foam, and then replace the cover with the three screws.

### **Battery charging**

To charge the batteries, connect the charge lead from the charger to the Headphones / Battery charge connector on the back of the Xmic. Plug the charger unit into the mains supply.

While the batteries are charging, the charging LED will be illuminated. This only goes out when the batteries are fully charged. The Xmic unit cannot be used while the batteries are charging. However, it can be turned on, a sensor can be plugged in and a meter reading will be given, but there will be no sound as the headphones are not connected during battery charging. The time required to charge the batteries from flat is approximately 7 hours, which can be easily achieved overnight.

The On/Off switch can be pressed while the unit is on charge to see how much charge is in the batteries at any time. However, the Xmic **MUST** be switched back off again in order to resume charging.

When the unit is switched on the battery power available is indicated by the battery icon. When fully charged the battery icon will appear dark.

### **Battery replacement**

Although the batteries are rechargeable, they may eventually need to be replaced. Only batteries configured to the correct specification and type must be used. These are available from Hydreka.

To replace the batteries, first switch the unit off. Unscrew the three screws underneath the unit, remove the packing foam, then unplug the battery pack connector releasing the batteries. Connect a new battery pack, place in the battery compartment, refit the packing foam, and then replace the cover with the three screws. The batteries will need charging.

## **Using the Xmic**

Select the sensor attachment required, either the acoustically shielded ground microphone foot, or the optional microphone unit with probe rods or tripod which must be screwed into the bottom of the microphone housing. Plug the headphones into the Xmic control unit .

### **Xmic Switch On/Off.**

Switch the unit on by momentarily pressing the On/Off switch. The unit will switch on and remain switched on until this same button is pressed again unless it is left unused.

To switch the unit off, the On/off switch must be pressed and held down for a few seconds.

### **Headphones mute**

To switch the headphones on press the headphones button. To switch them off press the same button again. The headphones mute icon will be displayed. Note there is a rotary control on the headphones to adjust the volume.

To momentarily mute the headphones, press and hold the button.

## **Back Light**

To view the LCD display in bad light, illuminate the backlight by pressing the combined On/Off Backlight switch briefly. This then latches the backlight in an on-position.

To switch it off, press this same button momentarily.

## Filter Selection

To clarify the leak noise, background or unwanted noise frequencies can be filtered out using a combination of the controls on the Xmic. Unwanted frequencies can be filtered out by varying the bandpass, bandwidth and filter position buttons on the Xmic unit.

**There are two modes of operation – survey mode and minimum level profiling mode (MLP)**

In survey mode, the gain level can be adjusted for the optimum volume and then the filters can be adjusted to reduce unwanted ambient noise. To locate the position of an underground leak the microphone foot can be placed on the ground above the line of the suspect pipe and the readings observed.

## Survey Mode



## MLP Mode

MLP stands for Minimum Level Profiling. This is performed, by stepping along the line of the suspect pipe and recording sound levels. The ground microphone is placed on the ground and the sample button pressed momentarily. The Xmic then records the minimum noise over the previous three seconds. This is the leak noise. As each recording is made the histogram graph is built up showing the difference between each reading visually and numerically making noise level comparison a simple task.

For each sample taken a number appears on the top right of the screen. This noise level value is a relative indicator for each sample. Once several readings have been taken the operator can select a sample by pressing the + or - button on the right of the Xmic. The numerical noise level value is then shown for each sample.

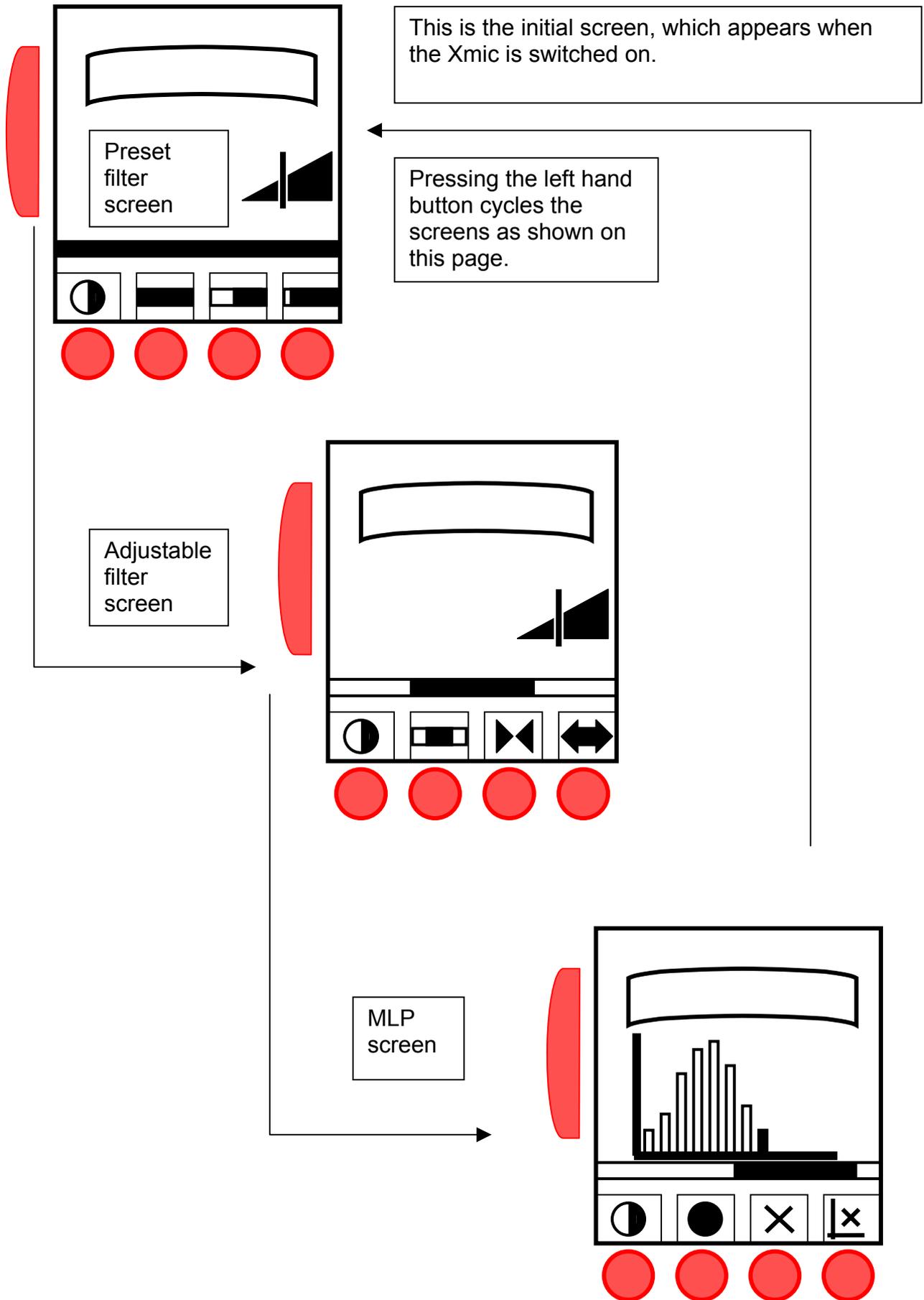


**Sample button**

**Delete last sample**

**Delete all samples/graph**

# Xmic screens



# Xmic screens explained

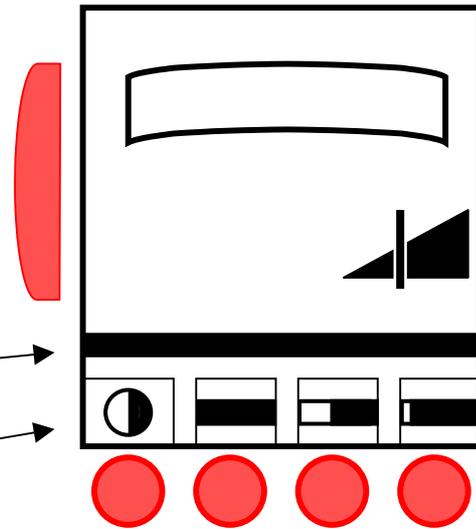
## Unfiltered noise

This is the initial screen when Xmic is switched on.

Press here to cycle through all three main screens. (Preset filters, adjustable filters and MLP).

Frequency spectrum indicator bar shows that all frequencies are available.

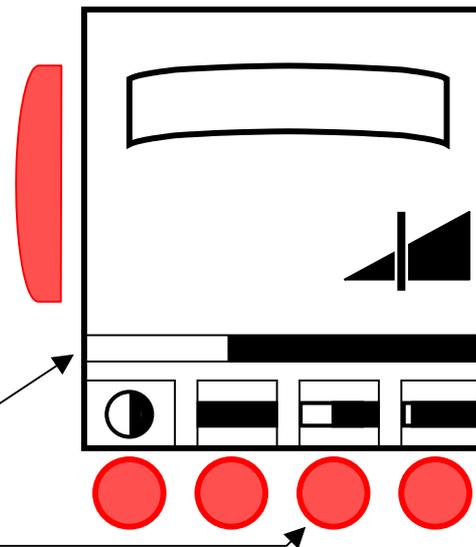
Contrast



## Preset filter for high frequencies only

Use on metal pipes.

The frequency spectrum indicator bar shows only the higher frequencies are allowed through when the high pass filter button is pressed.

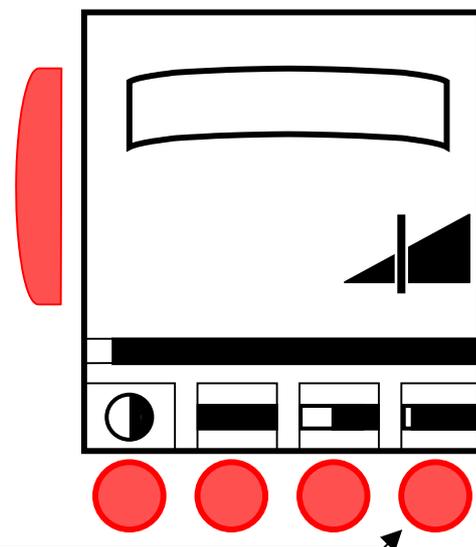


## Preset filter for high and medium frequencies

Use on plastic (MDPE) pipes.

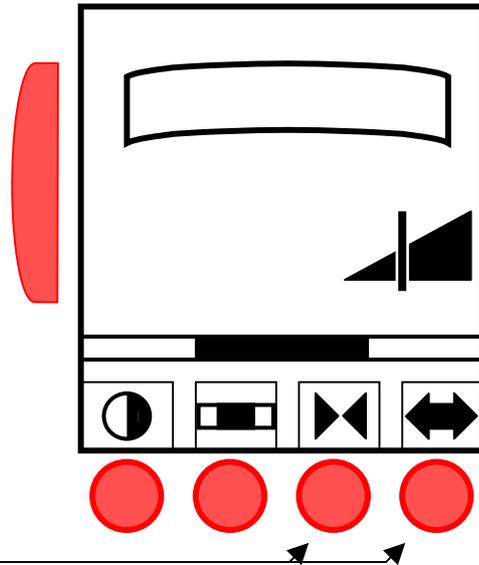
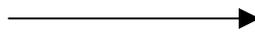
When the far right hand button is pressed medium and high frequencies are allowed through. Low frequencies are filtered out (blocked).

Press here for this screen.



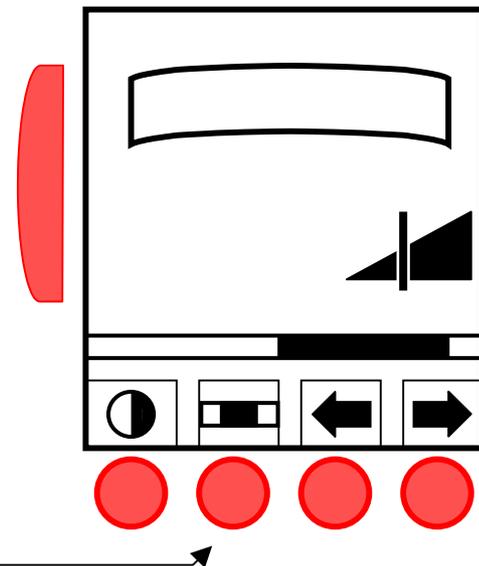
## To adjust filters

Press here for this screen



The bandwidth of the frequencies allowed through can be adjusted using the double-headed arrow buttons shown here.

The position of the bandpass frequencies can be adjusted up or down the spectrum using the left and right arrows.



Press here for this screen and press again to revert to the previous screen above.



Alternatively press the left hand large button to cycle through the Preset filter screen, the Adjustable filter screen and the MLP screen.

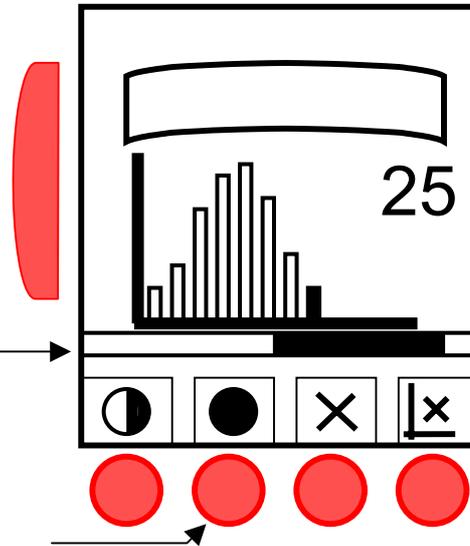
## MLP screen

Once filters have been selected go to the MLP (Minimum Level Profiling) screen to carry out a leak noise comparison.

Press here to go to the MLP screen

This shows the filter bandwidth setting  
(See previous screen).

To record the leak noise sound  
(graphically) at different positions press here.

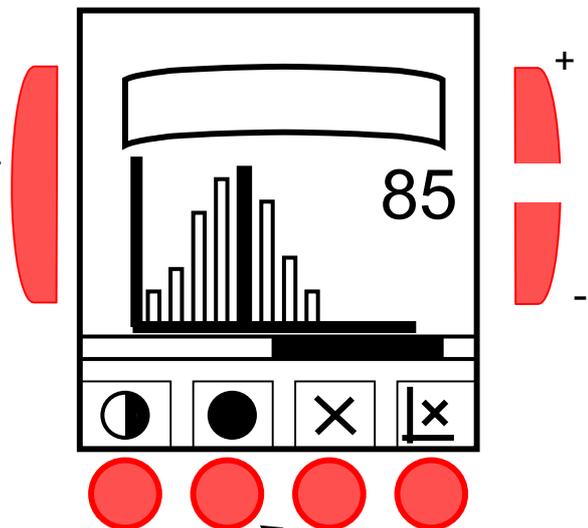


Each time this button is pressed momentarily the leak noise acquired in the previous three seconds is recorded and displayed as a vertical bar on a histogram. In the example above, eight consecutive readings have been taken by stepping the ground microphone along the length of the pipe and pressing the sample button at each position.

Each time a sample is taken, a relative number appears on the right of the screen.

Each sample can be subsequently selected to check the relative number by pressing the + or - button on the right.

This indicates the greatest leak noise acquired and the probable position of the leak.



Press here to delete the last sample taken.

Press here to delete the graph and all samples taken.

## **Guidance to Effective Acoustic Leak Detection**

All acoustic leak detection methods are based on the premise that normal water passage through pipelines takes place noiselessly. When the water passage is disturbed a noise is created. Causes can include partial pipe blockages, sudden changes in pipe diameter, abrupt changes in pipe direction, pumps or meters installed in the pipeline, consumer usage or pipeline damage. Pipeline damage can include holes, cracks or splits, complete pipeline rupture, leaking joints or leaking valves.

Careful application of leak detection techniques will enable the operator to eliminate detected noises generated by poor pipeline design or consumer usage and to identify leakage due to pipe system damage.

The strength and clarity of noise generated by leaks will be affected by the water pressure, the size and shape of the orifice allowing leakage, the type of ground material around the pipeline, the type of ground cover over the pipe, the diameter, wall thickness and material of the pipeline and the quantity of water leaking.

A small orifice or hole and high water pressure generally produces a higher frequency noise. Often the noise level increases around valves, pipe elbows, T connections, pipe ends, etc. since the partial obstruction increases pressure and creates some further disturbance in the water path.

Leak noise is transmitted along the pipeline both through the water and the pipe wall as well as into the ground around the pipe. The noise travels much better through "hard" materials: further along metallic pipes than asbestos cement pipes which themselves are better than plastic pipes. Ground material generally provides a poorer travel path than the pipeline itself. Soft sandy ground provides a worse travel path than well compacted ground with a hard paved surface covering.

The leak noise can change in strength and pitch as it travels along the pipe or through the ground. The deeper the pipe is buried and the softer the ground the more the noise will be dampened.

When a leak is produced in a metallic pipe the leak noise will transmit well through the pipe. It does not travel so well through a plastic pipe. This means that a leak noise can be heard further away on metal than on plastic. Also bear in mind that the further you go from a leak noise source the more difficult it is to pinpoint that leak noise accurately.

Background noise can interfere with leak detection. Traffic and machinery noises can travel for considerable distances through both air and ground material and often occur in the same frequency bands as leak noise. Sometimes it is necessary to use leak detection techniques at night when interfering noises are less.

It is very important to adopt a methodical approach when using any instrument for acoustic leak detection. It is necessary to practice the technique in order to distinguish between different sounds, recognising background or interfering noises,

so that they can be eliminated. It is also essential that other (non-leakage) system noise sources such as consumer draw-off or partially closed valves are eliminated by logical site inspection practices prior to any excavation taking place.

### **Hand probe**

For normal soft ground surfaces the single pointed extension rod should be connected - do not overtighten the screw thread. For direct contact with underground fittings via access covers it may be necessary to use the second extension rod. To do this remove the single rod and connect the extension rod - replacing the pointed rod again. If the rods have been overtightened, spanner slots allow easy removal.

### **Surveying**

The leak location can be narrowed down by listening at accessible contact points such as meters, hydrants, valves and stop-taps, which provide points of good sound pick-up particularly if the pipe is metallic. Use the hand-probe/extension rod to listen at these points.

If there are no accessible contact points or if the pipe is of non-metallic material, use the microphone foot for listening, placing the foot over the pipe route in the area of the suspected leak. Move along the pipe route listening at each accessible pipe-fitting or at regular positions on the ground until you have identified the area of maximum noise level.

*Note:* When you are listening on pipe-fittings the location of the point of maximum noise will probably not indicate the leak position, only the fitting closest to the leak. The noise level will also appear stronger where there is less thickness of ground or other material for it to pass through. The leak noise will follow the path of least resistance.

### **Pinpointing the leak position**

Pinpointing the leak position involves a process of comparing a number of leak noises. Select the most suitable sensor device; the microphone foot for hard ground surfaces or the hand probe for soft ground.

Operate the ground microphone and adjust the headphone volume control to a comfortable listening level. Once you have listened to the noise through the headphones, mute the headphones and move the microphone foot or hand probe to the next test position.

Repeat the sequence to listen to each of the test locations moving along the pipe route in the direction where signal strength is increasing. If the leak noise level falls you have passed the leak and should go back and reduce the distance that you move between measurements. The loudest leak noise will then indicate the location of the leak bearing in mind the ground conditions already mentioned.

# **Xmic Technical Specification**

## **Control Unit**

Low power analogue design with active digitally switched filters  
LCD display with backlight control

### **LCD numerical display of:**

- Signal level display 0 – 99
- Volume/sensitivity setting
- Filter settings
- Battery level
- Recorded measurements

## **Filter Options**

Variable filter system using three button controls

Two preset filters

## **Power supply**

2 x Lithium ion 1.8Ah rechargeable batteries giving up to 25 hours operation without backlight (20 hours with backlight)

**Amphenol connectors** for microphone and headphone/charger connections

**Environmental rating** IP65

**Membrane keypad** with push-button control

**Dimensions** 206mm x 167mm x 86mm

**Weight** 1kg

**Charging** Universal 110-240V AC mains charger with 12V DC output

**Charge time** 7 hours

### **Microphone Housing**

High sensitivity piezo-electric sensor mounted in windproof, nitrile rubber housing.  
Low noise 1.5m cable (detachable)  
Weight 2.9kg

### **Hand Probe Attachment (Optional Upgrade)**

The hand probe option includes the tripod and two stainless steel probe rods (each 400mm in length)  
Combined weight of rods 162g

### **Headphones**

Aviation quality headphones are supplied as standard with the Xmic

## **Warranty**

All equipment is warranted by Hydreka to be free from defects in materials and workmanship for a period of one year (unless otherwise stated) from the date of shipment to the original customer. This warranty is only valid if the equipment has been installed and used in the correct manner as described in this manual.

Repair or replacement (at Hydreka's option) will be made without charge provided the above conditions have been met.

If any problems occur, notify Hydreka giving full details of the problem, and the model and serial number of the equipment. You will receive technical advice and/or shipping instructions depending upon the nature of the problem.