HWM User Guide – Hydrophones

User Guide for Hydrophones

Record of Amendments

Keep this record in the front of the User Guide. When the document has been amended write the amendment number, the date, the paragraph numbers affected by the amendment and your initials in the table below.

Amendment Number	Amendment Date	Reason for Re-Issue (Paragraph Number (s) Amended)	Amended by
1.0	17th Sept 10	First Draft	AJB
1.1	6th Oct 10	Second Draft – Images updated	AJB
1.2	3rd Nov 10	1st Release	AJB

Contents

Introduction.

Hydrophone sensors are used to improve performance on traditionally difficult leak detection situations such as on plastic and larger diameter pipelines. They can be used with HWM Digital correlators including MicroCorr Digital DX, DigiCall, MicroCall+ and MicroCorr Touch. The sensor unit connects to 'wet' fittings that allow access through into the water column; for example, hydrants, washouts, or meter points. The hydrophone sensor itself is an extremely sensitive marine sensor, which listens in the water column. Typically leak noise travels greater distances through the water inside the pipe, than through the pipe wall and fittings. Low frequency noise also travels best; hydrophone sensors are particularly sensitive to this low frequency noise. The hydrophone sensor kit includes a range of adapters to easily connect to many fittings. There are specific adapters for connection to hydrants and 'Atplas' type meter box access.
The hydrophone is designed for deployment on site, a locking ring locks the adapter in place, and a bleed valve is operated to remove air from the sensor chamber to ensure the best quality sound. The unit is tightened in place with a standard valve key.

Safety procedures

Working with water and other fluids under pressure can be hazardous. Recommended safety procedures for working conditions must be followed at all times, and operational procedures described in this manual should not take precedence over local safe working practices or company procedures. If in doubt ask your local safety officer.

Use of correlation equipment with the water supply is subject to the hygiene procedures applicable to any objects coming into contact with drinking water supplies. Hydrophone sensors and adaptors should be appropriately sterilised prior to use and applicable procedures should be followed during their installation.

The Hydrophone kit

The basic Hydrophone kit is supplied with a range of adaptors to suit a variety of fittings.
The Hydrophones can be connected to hydrants using either standard London thread fittings or, alternatively, by use of the other adaptors provided, they can be connected to air valves or flow meter fittings.

The kit comprises of the following (see photograph on page 5) :-

2 x Hydrophones
2 x Hydrophone adaptors
1 x Tommy Bar
2 x 1½" BSP Nipple
2 x 1½" to ½" reducer (fitted with O ring seal)
1 x Carry case
2 x ½" BSP nipple
1 x Tube silicone grease
1 x reel of PTFE tape
2 x Digital interface boxes
2 x Connecting cables

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London round thread adaptor

Hydrophone

1½" to ½" BSP Reducer

½" BSP Nipple

1½" BSP Nipple

Connection to a Hydrant

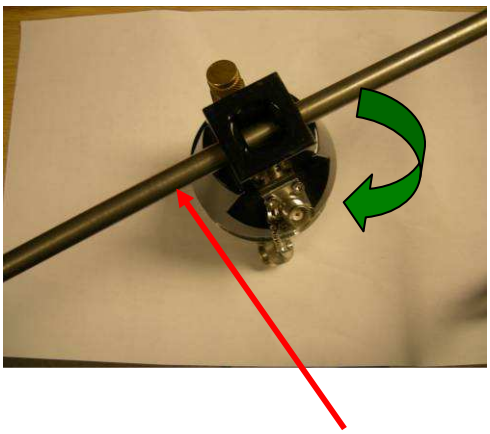
1) Remove the Hydrant cap and gently open the hydrant valve to flush out dirt and debris. Close the hydrant valve and inspect for cleanliness.

2) If using the London Round Thread adaptor, first lightly coat the internal rubber seal with silicone grease.

Apply a light coat of silicone grease to lubricate the adaptor and hydrophone sensor screw threads.

DO NOT seal the threads between the Hydrophone sensor and the London round thread adaptor (or meter box) with PTFE tape or any other sealing material, as this could irreversibly lock the threads together.

Fit the London round thread adaptor to the Hydrophone sensor taking care not to damage or cross the threads. Tighten the adaptor ➡ until the castellations fitted to the top of the adaptor are secured by the quick release mechanism ⟺ fitted to the Hydrophone sensor.



The Hydrophone may then be fitted to the Hydrant and tightened using a 'Tommy bar' Valve key, or ½" square drive tool. Note – overtightening, or continual use without lubricant will damage the sealing washer.

3) Unscrew the waterproof connector cover and connect the Hydrophone to Digital interface box lead. Note – should the hydrant location be flooded ensure the lead is connected prior to immersion . The sensor connector is only water proof after connection

4) Open Hydrant valve fully to allow water into the hydrophone. A fully open hydrant valve will give the best noise transmission to the Hydrophone.
Remove trapped air by opening the bleed valve and closing it once a steady stream of water indicates the air is completely expelled.

5) Ensure the Hydrophone does not leak from the main thread and tighten as necessary. Ensure that the Hydrant gland is not leaking. If the hydrant frost plug is ‘blown’ ensure it is re-inserted in order to eliminate another possible leak noise.

6) Having connected the Hyrophone lead to the Digital interface box, now connect the digital interface box to the Transmitter (Outstation) using the existing magnetic sensor lead. Repeat for the second Hydrophone installation. Your Hydrophone kit is now ready for correlation testing to commence.

7) After use dismantle via the reverse process.

Connection to air Valves and Flowmeter fittings

1) Connect the appropriate nipple and/or reducer to the Hydrophone sensor. Use PTFE tape on all threads (except the London round thread adaptor or the Meter box)

2) Screw the assembly onto the pipe fitting. Fully open the valve (for best sound transmission) and bleed air from the system. Check for leaks and tighten as necessary.

Correlation

The current range of HWM Correlators require no additional setting when using Hydrophones. The Correlators will detect the alternative sensor and automatically adjust filter settings to suit.

At the Correlator base station the pipe characteristics should be entered as normal and the correlation should be undertaken as if normal magnetic accelerometer sensors were fitted.

Please note that the velocity of sound and the frequency of leak noise will be different to those observed using the normal magnetic accelerometer sensors because of the more direct contact with the water column. If no result is initially achieved, the operator should try an alternative filter setting – reducing by one step each time from the automatically selected filter. The Correlators frequency visualisation features will help to determine filter selection.

As with normal correlation, an accurate velocity should be ascertained on site using a fitting to create noise or by an out of bracket velocity measurement using the leak itself as the noise source.

If this is not possible, try to position the sensors so that the leak is as close to the centre of the pipe run under test as this will minimise error due to velocity inaccuracy.

For additional general guidance on Correlation refer to your Correlator Product Manual or Users Guide.

Appendix 1 - Supplementary information

Because accelerometers are attached to the external surfaces of pipe systems, weak noise may sometimes be degraded by mechanical filtering or high background interference effects. In these instances, and if suitable pipe fittings are available, Hydrophone sensors can be used instead of accelerometers. Hydrophones, which are available as optional equipment, generally provide better leak noise signals in difficult operating conditions.

Replacing standard accelerometer sensors with hydrophones enables the operator to locate leaks over greater distances. These sensors also provide better leak noise signals under difficult background noise conditions.

If two suitable pipe fittings are not available operators may use one hydrophone and one accelerometer. It should be noted, however, that this technique is not generally recommended because the hydrophone sensitivity and working range is restricted by the accelerometer sensor performance.

Hydrophone sensors are mounted for direct contact with the water at hydrant, air valve or flowmeter points. A selection of pipe fitting adapters are supplied in the hydrophone kit. It is important that the connection instructions given above are followed. These should be referred to before using the hydrophones.

Leak noise propagates very efficiently along the water core which gives hydrophones a greater working range than accelerometers. Hydrophones are also far more sensitive to low pressure waves (signals) and they are particularly effective in locating leaks in large diameter trunk lines.

Hydrophones give good results in all types of plastic pipe systems and the signal information from hydrophones increases operator confidence where any soft or non-metallic pipe materials are encountered.

Appendix 2 - Typical operating ranges

Using hydrophones, the operating range between outstations can be very high particularly during a quiet period of the day. For example, distances over 4Km of 4" iron can be achieved from leak to sensor.

Increasing the operating distance always decreases the chance of correlating successfully.

Actual operating ranges are influenced by a number of variables. The results will vary dependent, for example on pipe wall thickness, ground conditions, size and shape of the leak, background noise and other noises in the pipe system. Successful correlation distances in excess of 2,000 meters have been achieved on 8" PVC pipe using hydrophones.

The following tables gives a general indication of maximum working distances. **It is stressed that the actual range achieved may be better or worse than indicated depending on the site conditions.**

General reliable maximum Pipe Materials working distances for pressures above 2 bar

Urban Network

Pipe Material	Accelerometers	Hydrophones
Iron, Steel, Copper	400 metres	800 - 1200 metres
Lead, A/C, Concrete	300 metres	600 - 800 metres
Plastic	50 - 100 metres	400 - 500 metres

Trunk Mains

Pipe Material	Accelerometers	Hydrophones
Iron, Steel	500 - 800 metres	2000 - 3000 + metres
A/C, Concrete	400 - 600 metres	1000 - 2500 + metres
Plastic	100 - 200 metres	500 - 1500 + metres