

SoundSens™ Leak Noise Correlator

A unique leak location system combining sound logging and correlation in one simple to use, cost effective process.



- Ⓡ The first ever Multi-point correlation system
- Ⓡ Accurate pinpointing of leaks
- Ⓡ Uses self-contained CP loggers no radio link or direct wire connection for operation
- Ⓡ Total flexibility for day or night working
- Ⓡ Cost effective and versatile solution

Designed using the latest advances in sound technology, the RADCOM *SoundSens™* system offers complete leak localization and/or correlating package. Three possible methods of deployment give a cost effective and versatile solution to the problem of exact leak location in the distribution system.

***SoundSens™* Methodology:**

The system is based around the RADCOM CP (Correlating Pod) Datalogger, which can be deployed in units of two, three or more depending on the strategy being adopted by the user. These CP loggers are self-contained lithium battery powered units requiring no radio or hardwire connection for on-site operation. The CP Loggers do not require any battery recharging and can left unattended, below ground with valve covers replaced, to avoid risk of tampering or damage.

Three general methods of deployment have been found in practice to give a cost effective and versatile solution to the problem of accurate leak location in a pipeline distribution system. The three methods are described in more detail on preceding pages but comprise of datalogging regimes based on precise 'time slices' of leak noise being recorded and analyzed - which in turn gives the user total flexibility for either day or night working and successful leak location, even in the most difficult distribution networks.

SoundSens™ Leak Noise Correlator

SoundSens™ Applications:

- Ⓢ Conventional leak noise correlation - day and night.
- Ⓢ Advanced leak location in congested, complicated networks - day and night work.
- Ⓢ Combined sound logging and correlation investigations where rapid deployment and location is required without costly (and possibly disruptive) valve operations (sectioning / step testing, etc.)
- Ⓢ Effective low cost investigations overseas in large rural or urban networks where little or no infrastructure information is available or is currently operational.

SoundSens™ Benefits:

- Ⓢ Correlator Pod (CP) Loggers are easy and quick to install below ground - reducing deployment costs.
- Ⓢ No trailing cables or radio equipment required with CP Loggers - ensuring security of equipment during day or night operation with reduced risk of damage or theft.
- Ⓢ No minimum distance restriction when deploying CP Loggers.
- Ⓢ Flexible deployment methods available when two, three or more CP Loggers are used – allowing efficient use of operational staff and generally avoiding costly night work.
- Ⓢ Multiple time slots can be selected to allow for particular noisy networks and with pre-selected logging start times programmed into the units during the day - allows multi-point correlation at night.
- Ⓢ Combines the two operations of sound logging (or sectioning / step testing) followed by leak noise correlation, into one efficient operation. Saves at least 75% of time previously spent on traditional operations - significantly reducing labor and equipment costs.

Method 1: 2-Pod Correlation Technique

Two Correlator Pods (CPs) are deployed either side of a suspected leak and recordings taken. Logged sound data is downloaded into the software, generally a Laptop PC in an adjoining vehicle. Having reviewed the initial data to establish that there is a leak noise, actual topographical details and pipe material can be entered into the software. Accordingly the software correlates this data and gives an accurate positioning of the leak (or leaks.)

Method 2: 3-Pod Correlation Technique

Three Correlator Pods (CPs) are deployed around a suspected leak with a recording strategy comprising, say, two time slices. Logged sound data is downloaded into the software. The advantage of using three CPs is that it eliminates the need to know the exact diameter and pipe material. (The actual velocity of sound is calculated and utilized in the subsequent correlation sequence.) Accordingly the software correlates and gives an accurate leak position.

Method 3: Multi-Pod Correlation Technique

Six or more Correlator Pods (CPs) are deployed in a district where there is a suspected leakage problem , usually indicated by a rise in nightline on a logged district meter. The CPs are set up to record a number of time slices, retrieved after the required logging period (sometimes overnight) and downloaded into the software. After downloading data from all deployed loggers, the software will survey the data to give an approximate location of any number of leaks in the distribution system. GIS or measured site information is then inputted into the topography module. The correlation software is then re-run to determine accurate leak position(s).

The procedure can be repeated on different pipe connections until the whole of the district meter area has been surveyed and appropriate correlations carried out.

In all three methods, the collected sound data is saved to disk to permit repeat correlations or comparisons after repair work has been carried out on site.

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5 Easy Steps

🌀 Stage 1 - Deployment of Correlation Pod Loggers:

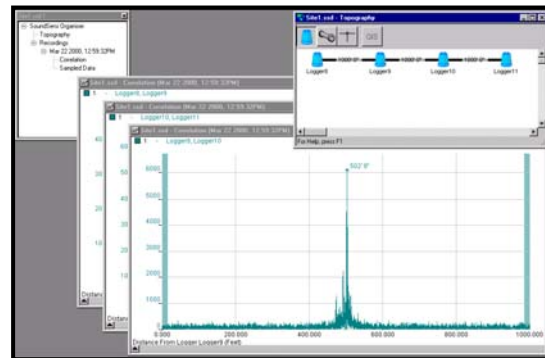
Operational users may not be able, and do not have to confirm pipe diameter or material prior to deployment of Correlator Pods. Users may adopt different logging strategies depending on day or nighttime working. Typically a small number, two to three short recordings of 10 seconds duration, will normally be sufficient for metal pipes with the CP's placed on the 4" port of hydrants, for more difficult materials, the recording length can be increased. Where ambient noise is too high during the day, pre-selected start times at night can be adopted, using shorter recordings of up to 32 in number and the CP's can be placed directly on the valves with the covers replaced so as they are out of sight.



🌀 Stage 2 - Survey Sweep Mode:

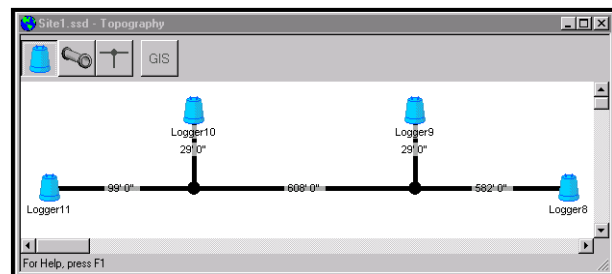
Following the retrieval of two or more CP Loggers, the operator has the option to use the *SoundSens*™ Software to carry out an initial review of sound logging results in the survey sweep mode. The software package will:-

- * Set a default pipe length and material, carry out a correlation exercise and display an initial set of results.
- * Allow the user to change default pipe lengths and material and then re-correlate.



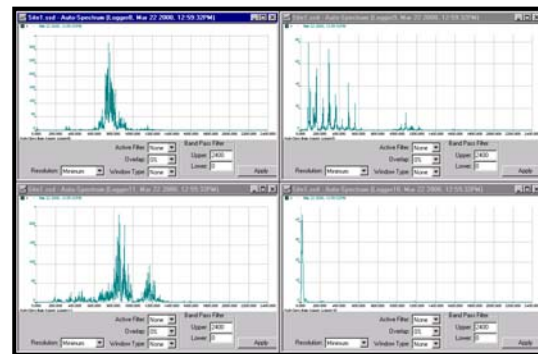
🌀 Stage 3 - Topography Input Mode:

Having established from the results of Stage 2 that a significant leak(s) is present, the user is required to input accurate information i.e. on pipe material and lengths between appropriate pipeline access points. This information can be obtained from either direct site measurements or GIS plans. An example of how the *SoundSens*™ Software allows the user to draw the pipework topography is shown below.



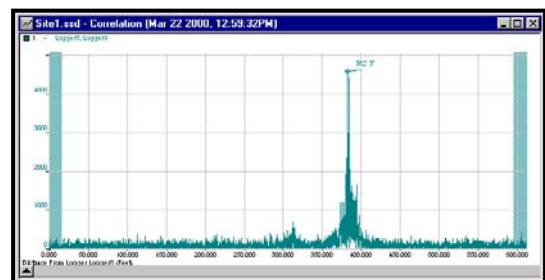
🌀 Stage 4 - Evaluation of Energy Graphs (Optional Use):

In some circumstances the user may require to investigate in more detail the frequency values obtained from the CP Loggers, rather than rely on the default values, prior to final correlation. The *SoundSens*™ Software allows the user to display individual graphs of energy levels against sound frequency spectrum, and from these results, the user can choose to filter out certain frequencies and correlate on sound suspected to be generated by a leak. Examples of graphs from different pipe materials and site conditions are also shown.



🌀 Stage 5 - Correlation Mode:

The final stage of the *SoundSens*™ procedure is the correlation of the selected leak data, which gives the accurate position of a leak (or leaks) between two or more deployed CP loggers.



SoundSens™ TECHNICAL SPECIFICATION

Correlator Pods (SoundSens™ Loggers)

PHYSICAL CHARACTERISTICS:

Enclosure: Die-cast aluminum, polyester powder paint finish
Protection: IP68, fully submersible and pressure tested to at least 3.0 metres (10 feet) of water
Weight: 0.7 kg (1.54 lbs)
Dimensions: 170mm (6.7") high x 75mm (2.95") max. diameter
Operating Temp: -10°C (14°F) to 50°C (122°F)
Data Comms: Infra- Red Communication

SENSOR:

Type: Internal piezo compression accelerometer

DATA ACQUISITION:

Memory: 650,000 readings (expandable to 1.35 million)
Sampling: Individual measurements can be pre-programmed into 32 separate recordings (650,000 readings)
Time Clock: Real time clock, 24 hour, Y2k compatible
Delayed Start: At nominated time or after pre-set delay period
Frequency Range: From 1 - 2,750 HZ
Signal Resolution: 12Bit A to D converter
Diagnostics: On-board diagnostics provide logger operational audit

POWER SUPPLY

Battery: Internal lithium thionyl chloride battery pack, non-rechargeable, greater than 5 years life under normal operating conditions, factory replaceable.

ACCELERATOR

Frequency Range: 5Hz to 5KHz
Min' Sensitivity: 58 V/g

ELECTRICAL

50/60 Hz Notch filter
Low pass Filter Maximum frequency limit 2.5KHz
Acceleration range: 10ug to 50 mg.
Resolution: 0.066ug.

CP Logger Interface and Carry Case

PHYSICAL CHARACTERISTICS:

Enclosure: Aluminum carry case with two handles
Protection: Rugged construction
Weight: 6.0 kg (13.2 lbs) without CP loggers
Total Weight: 10.2 kg (22.4 lbs) with 6 CP loggers included
Dimensions: 405mm (15.9") w x 310mm (12.2") d x 310mm (12.2") h
Operating Temp: -10°C (14°F) to 50°C (122°F)
Loggers per case: Up to 8 CP loggers per case
Interlinked cases: From 2 to 16 cases can be linked, resulting in up to 192 CP loggers being deployed in one session

POWER SUPPLY / ELECTRICAL / COMMUNICATIONS:

Battery: Internal rechargeable Ni-Cad battery with 12vdc charger socket
PC Link: RS232 Serial communication to Laptop / Office PC, from multiple CP Logger Pods via Interface Case
Baud Rate: 115 K Baud with data compression

Software (MS Windows™)

The SoundSens™ software package comprises a number of modules linked to specialist applications, designed and supported by RADCOM Technologies.

The following detailed list of features incorporate the main elements of the software package which is used to set-up, interrogate and view the process of "multi-point" correlation.

- Ⓟ Easy to use Windows™ icon driven comms, data storage and graphing
- Ⓟ Multiple correlations detect leak(s) among all CP loggers
- Ⓟ Advanced signal processing with suppression of spurious noise events
- Ⓟ Full color high resolution graphical presentations including:
 - a) Deployment topography
 - b) Sound pattern display of raw data
 - c) Frequency spectra display
 - d) Correlation function / location
 - e) Time delay graph
- Ⓟ Different types of pipe materials, including sections of mixed pipe materials
- Ⓟ Choice of digital filters
- Ⓟ Full data storage (any number of studies) on PC or Network File Server for later analysis
- Ⓟ Capable of re-analyzing stored data with different pipe material and length information
- Ⓟ Display of multiple leak positions
- Ⓟ Sound velocity measurements to avoid uncertainties of unknown pipeline construction

Recommended minimum specification for Laptop or Office PC is:

300 MHz Processor, 64MB RAM, 6.0GB Hard Drive, Floppy Drive Ext. 3.5" 1.44MB or CD ROM Ext. 24 x Speed, Serial Port x 1, 115 K Baud, Parallel x 1.



Heavy-duty aluminum, Interface Box and Carry Case for CP Loggers

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