Asel-Tech
Leak Detection Solutions

RLDS - REMOTE LEAK DETECTION SYSTEM

Asel-Tech has spent a considerable amount of time and resources over the past 10 years to improve our technology to the point where it is has become unparalleled in reliability and performance in the realm of leak detection. Asel-Tech's RLDS system is the only leak detection system available that offers virtually 100% pipeline coverage without any dead zones. The RLDS combines an Artificial Neural Network, specially designed algorithms coupled by signal processing techniques to ensure a very high degree of accuracy plus very low false alarm rates.
Asel-Tech's RLDS is the most reliable and sensitive leak detection system available on the market today with proven commercial success. The system is capable of reliably detecting and locating leak incidents in a matter of seconds. Some advantages of our acoustic leak detection and location system can be summarized as follows:

- Very fast – detects leaks at the speed of sound and it is not dependent on the size of the leak.

- Detection is not dependent on flow parameters, so steady state/no-flow is not an issue.

- It does not require third person instrumentation.

- The system works with liquids, gases, and multiphase products.

- Easily interfaced with SCADA systems.

- Calibration is not required.

- No proprietary software required.

- No mute/dead zones - 100% of the pipeline is monitored.

- It utilizes specially developed algorithms and processes for leak sensors.

- User-friendly interface.

- GPS time stamping.

- Option of data acquisition with the use of Data Loggers.

- Reprogramming of leak masks.

- Field test – Real time tests upon commissioning without using rupture disks - To prove performance specs.

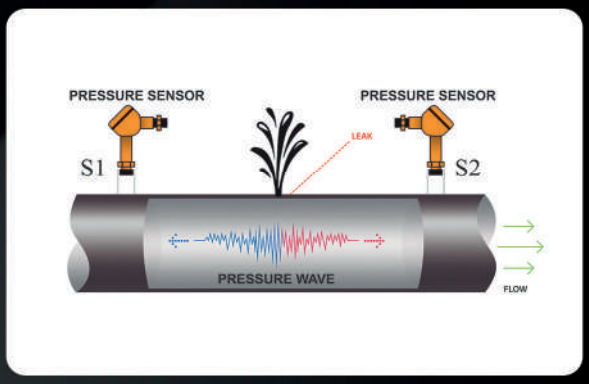
- **Asel-Tech**'s system integrates various advanced technologies including artificial intelligence and neural networks.

ASEL-TECH'S NEGATIVE PRESSURE WAVE LEAK DETECTION SYSTEM TECHNOLOGY

The RLDS technology can effectively be employed to detect leaks in pipelines that transport various types of products - liquids, gases, or multiphase. Suitable for above - ground, below - ground or subsea pipelines.

The RLDS operating principle is based on the detection of pressure transient waves caused by an onset of a pipeline leak. Unlike "Acoustic Emission" technology, Asel-Tech's system is not designed to detect the audible noise produced by a leak, it does not detect sound in the pipeline material whether it is steel, stainless or HDPE etc.

The pressure transient waves our system detects are caused by the sudden drop in pressure and the immediate line re-pressurization at the location of a leak onset. This onset causes pressure oscillations in the fluid pressure and propagates as a wave signal at the speed of sound through the fluid or gas, away from the leak location in opposite directions, guided by the pipeline wall.



Pressure sensors installed at opposite ends of the pipeline segment will intercept and transmit the leak signal to its corresponding Asel-Tech SRU-504 remote unit. The SRU-504 is responsible for the acquisition and signal conditioning from the pressure sensors and sending the signals to a CMS. Sophisticated algorithms, Artificial Neural Networks (ANN) and other specific components of the leak detection module, process.

When all the aspects that define a leak signal are confirmed-including the neural network, an alarm will be declared by the Central Monitoring Station computer (CMS).

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SYSTEM COMPONENTS

The RLDS hardware system is made up of the following subsystems:

- FSS Pressure Sensors.

- SRU-504 Sonic Remote Unit.

- CMS Central Monitoring Station.

FSS PRESSURE SENSORS

The intrinsically safe pressure sensors are the components responsible for signal acquisition and transmission. The sensor elements are mechanically mounted inside all-weather casing and are connected to the pipeline using 1" taps.

The sensors require 10-30 volt supply provided by the SRU-504 remote units and they output a 4-20mA current signal. The connection between the sensor and the SRU-504 remote unit is done using a two-wire instrumentation cable.

Sensors are strategically installed at various locations along the pipeline. The distances between sensors vary and it depends on many factors including: the particular characteristics of the pipeline, the fluid, the overall RLDS system performance requirements, and the calculated signal attenuation in the fluid. The use of a pair of sensors at the two ends of the pipeline segment allows for the identification and rejection of external operational noises generated outside the monitored segment that otherwise would cause false alarms.

Sensors are generally installed on the pipeline while it is pressurized using Hot-Tapping procedures thus eliminating costly shutdowns.

SRU-504 REMOTE UNIT

The SRU-504 remote units are installed in the field and in close proximity to the sensors. They are normally placed in a standard rack mount cabinet located in the equipment shelter. Each unit supports one pair of sensors (FSS). Its function is to pre-filter the data acquired by the sensors and send them over digital communication systems to the central monitoring station.

The SRUs can be connected to the Central Monitoring Station via a single or a combination of methods, such as optical fiber, GPRS, radio, satellite, etc.

CMS CENTRAL MONITORING STATION

System configuration and operation are performed on a dedicated computer running non-proprietary supervisory software. It acts as a Human-Machine Interface (HMI) and features customized pictographic screens illustrating pipeline aerial views and highlighting the monitored points and many other vital system details.

Configuration parameters and operating conditions are entered in the supervisory software through user friendly Engineered screens. The screenshot above demonstrates the layout of a pipeline segment and the monitoring stations where normal operational conditions are represented in green whereas alarm conditions are displayed in red. When a leak is detected and confirmed, an alarm will sound and the screen will change to show the exact location of the leak with date and time. The HMI screen can be customized in many ways to the client's choice.
The main functions and characteristics of the CMS leak detection module are:

- Carry out complex multi-layer signal filtering and data processing.

- Utilize filters (band pass filters, differential filters, phase filters, floating average filters, correlative filters, mask filters, neural filters, and adaptive gain blocks).

- Compare acquired signals with embedded masks.

- Analyze and evaluate data received from sensors to validate and confirm an event (Leak).

- Clock synchronized by satellite between all SRU-504 in use.

- Utilizes reprogrammable leak masks.

- Perform internal diagnostic tests and report faults.

The supervisory computer system is responsible for various informational, communication, security, and diagnostic functions. In addition, it manages and maintains an intricate database and reports as well as historical event logs.

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SYSTEM PERFORMANCE METRICS

In comparison with other leak detection and location methodologies, Asel-Tech's RLDS boasts unparalleled performance and reliability. This is attributed to its speed, simplicity, and straightforwardness in obtaining data without having to depend on third party instruments or proprietary software. Of particular importance in evaluating leak detection systems are the following criteria:

- SENSITIVITY

API 1130 defines sensitivity as follows:

"A composite measure of the size of a leak that a system is capable of detecting and the time required for the system to issue an alarm in the event that a leak of that size should occur".

Unlike other leak detection systems, the leak size Asel-Tech's RLDS system is able to detect and the time required to declare the leak are unrelated. Our system can detect leaks of any size in a few minutes (max) from the time a leak occurs.

The RLDS systems sensitivity is a variable value, and differs according to pipeline arrangement. The maximum sensitivity permitted by any system depends on several factors and is unique to every segment of a pipeline. The main factors that determine system sensitivity are:

- Pipeline length and diameter.

- Operational conditions such as pressure, temperature, and flow.

- Type of fluid being transported (liquid, gas or multiphase flow).

- Number and location of the installed pressure sensors.

- General arrangements of pumps, valves, separators among others.

- Background noise and operational events produced under normal operational conditions.

The system has varying degrees of sensitivity along the pipeline. The middle section (equal- distant from the sensors on either end of the pipeline segment) tends to have the best sensitivity because the signal has less distance to travel, than say a signal generated from a leak close to one of the sensors – in this case the signal has a longer distance to travel to the other sensor and may encounter additional attenuation.

- RESPONSE TIME

Negative Pressure Wave Leak Detection Systems is absolutely the fastest available today. The time it takes to declare an alarm is measured in seconds or minutes rather than hours or days as in some other detection methods. Asel-Tech's system detects a specific and unique pressure wave-which travels from the source of the leak's onset to strategically placed pressure sensors.

- LEAK LOCATION ACCURACY

Asel-Tech's RLDS system boasts unprecedented accuracy in determining location of a leak. Theoretical leak location accuracy is 2% of the protected pipeline section length. Depending on local pipeline conditions, we have at times experienced better results.

Leak Location is computed at the supervisory computer level using wave travel time, which is calculated via the difference between wave arrival times at the two opposing sensors and length of the pipeline segment.

For added leak location accuracy, the **Asel- Tech** system features:

- Time synchronization from a Global Positioning System (GPS).

- Actual wave propagation speed measurements are taken in the field and fed to the Central Monitoring Station computer for added leak location accuracy.

- ROBUSTNESS

API 1130 defines system robustness as "a measure of the CPM'S ability to continue to function and provide useful information even under changing conditions of the pipeline (i.e. transients) or in conditions where data are lost or suspect. A system is considered robust if it continues to function under less than ideal conditions".

Asek-Tech's systems have undergone extensive field test to withstand extreme environmental conditions.