

Real-time erosion and  
corrosion monitoring

# PipeMonit<sup>®</sup> Swarm<sup>®</sup>

PipeMonit<sup>®</sup> Swarm<sup>®</sup> is a high resolution ultrasonic erosion and corrosion monitoring tool which provides quick response to wall thickness changes in pipelines and vessels. It is non-invasive, installed and operated without interfering with production.

The Swarm<sup>®</sup>'s ability to provide fast and accurate wall thickness loss measurements makes it a cost effective tool for real-time feedback of corrosion inhibitor programs. The Swarm<sup>®</sup> is rated for Atex Zone 1, C1 Zone 1 and InMetro. The Swarm<sup>®</sup> sensor matrix is retrofittable and installed simply by strapping the Swarm<sup>®</sup> to the pipe. No gluing, no welding and no hot workpermits required. Swarm<sup>®</sup> wall thickness monitoring is based on the well-established ultrasonic pulse-echo method.

#### SOME KEY ADVANTAGES ARE:

- Accurate erosion/corrosion feedback increases the service life of pipelines
- Real-time feedback on the effectiveness of corrosion inhibitors makes a significant OPEX saving
- Accurate wall loss history enables reduced inspection and intelligent pigging activity
- Accurate and direct sand erosion monitoring
- Monitoring of selective weld corrosion and heat-affected zone (HAZ) corrosion
- Fast and maintenance free installation
- Being retrofittable, the Swarm<sup>®</sup> can be relocated without expert support

#### How does it work?

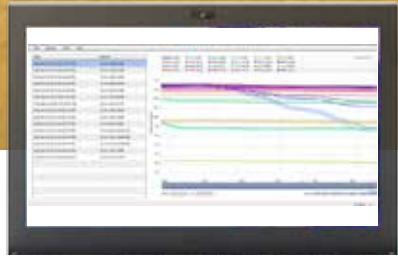
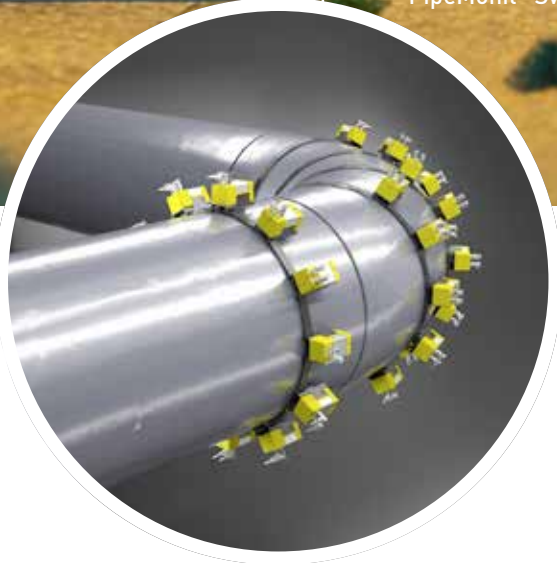
The Swarm<sup>®</sup> S1 ultrasonic sensor measures wall thickness as a function of time providing marketleading resolution on wall thickness loss. A Swarm<sup>®</sup> consists of multiple daisy chained S1 sensors organized in a customized matrix to cover a bend, straight pipe, a weld, a T-piece or a vessel or a tank. The Swarm<sup>®</sup> is hooked up to a USB Junction box for manual capture of data, or to a FDL - Field Data Logger - for autonomous operation. Swarm<sup>®</sup> operates with cable lengths up to 500 meters without loss in performance and wall thickness resolution.

The FDL operates and stores data locally providing online real-time wall thickness monitoring when connected to a PipeView<sup>®</sup> PC or Server, it be via GSM, Wi-Fi, Ethernet or RS485. Alternatively, the stored data can be collected using a PDL - Portable Data Logger. The PDL communicates with the FDL via Bluetooth, Wi-Fi or USB and it provides the operator with graphical presentations of wall thickness data and corrosion rates.

SENSORLINK AS, Nedre Ila 39, 7018 Trondheim, Norway



Sensorlink



monitoring is important for verification of the assets integrity, optimised corrosion and erosion mitigation and control.

Swarm®'s unique design allows for installation on critical areas such as top of welds, heated weld zones, elbows and T-pieces to monitor and detect:

- Selective weld corrosion
- Heat-affected zone (HAZ) corrosion
- Erosion and corrosion on elbows and T-joints

## Installation and Maintenance

Swarm® offers simpler, faster and safer installation than any competing systems:

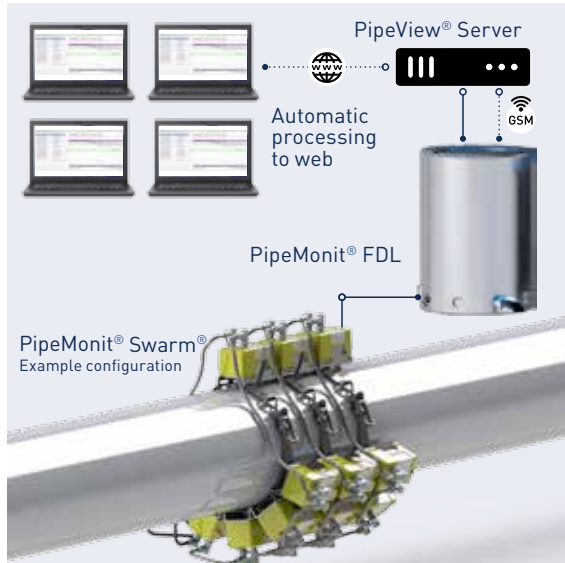
- Clean the pipe surface.  
No need to remove solid coatings
- Position the Swarm® and engage the locking mechanism, no gluing or welding required
- Connect the Swarm® to the Junction Box or the Field Data Logger
- Connect the Portable Data Logger and verify successful installation
- Fit a Swarm® protection cover

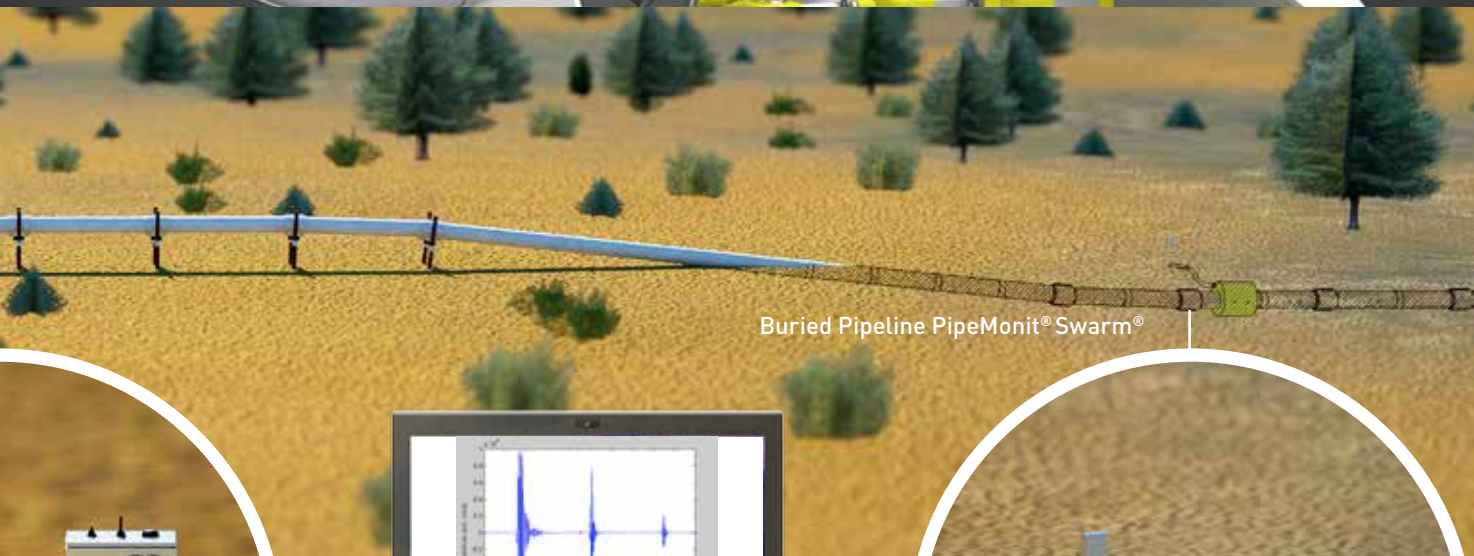
Single sensors are replaceable. The entire Swarm® unit can be adjusted or relocated by the operator. Install Swarm®, monitor your pipeline and improve your asset integrity management.

## Applications

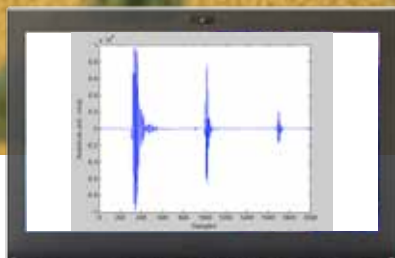
Corrosion and erosion is a major cost in the oil and gas and associated industries, and recurrently the reason for accidents and unplanned interruptions. Wall loss

## Online monitoring



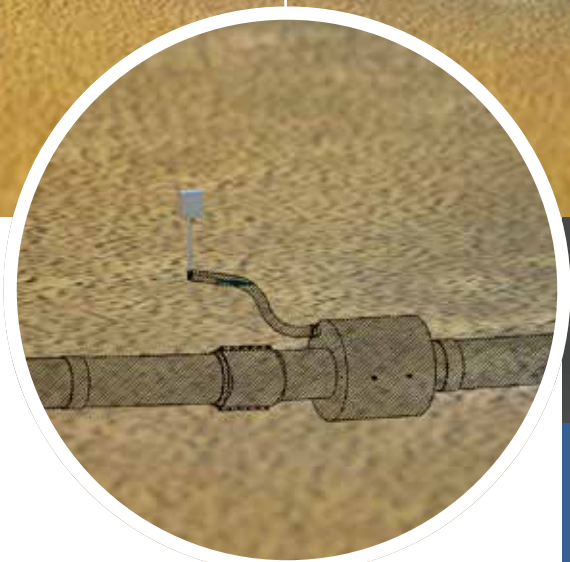


Buried Pipeline PipeMonit® Swarm®

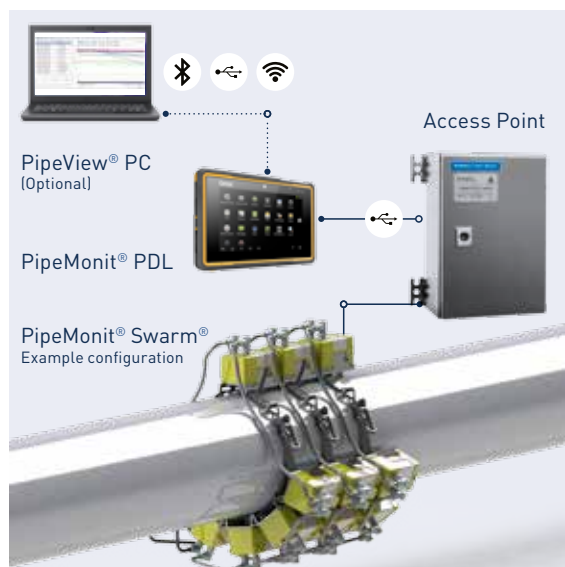


Swarm® substitutes probes and coupons in sour operations.

It is designed to be used in the Oil & Gas, Petrochemical, Process, Mining and any other Industries with pipe wall erosion or corrosion problems.



## Manual data capture



## Key Advantages

Swarm® is the market leading non-intrusive corrosion and erosion monitoring system providing wall loss resolution better than 0,1 mills or 2,5µm. The high resolution gives swift detection of corrosion and erosion rate changes.

A world class corrosion monitoring system is an investment in improved economy, prolonged asset life and safer operations resulting in customer feedback:

“Prolonged pipeline lifetime up to 2-3 times”

“Reduced chemical inhibitor use with 20%”

The PipeView® Software offers OPC and Modbus interface for easy integration with the Clients Control System.

Swarm® is built to endure challenging conditions and harsh environment throughout its field life. No moving parts means Swarm® is practically maintenance free and there is no need for calibration after installation.

## PRODUCT SPECIFICATIONS

### TECHNICAL DATA

PipeMonit® Output Data:	Wall thickness, corrosion/erosion rate, temperature, raw signals
S1 Transducers:	Pulse/Echo 10 mm diameter, 5 MHz, 25 MHz sampling rate, IP67
S1 Power Consumption	<1 W Active, <0.1 W Idle
Transducer quantity and matrix:	Flexible and configurable, non-intrusive snap on installation
Pipe size:	>= 4 inch OD (100 mm)
Wall thickness:	>3 mm (0.12 inches)
Wall material:	Steel or solid homogenous materials
Coating materials:	Works through external FBE and homogenous PU/PE/PP coatings
Temperature sensor:	-40 °C – +125 °C, ± 0.1°C/ -40 - +257 °F, +- 0.06 °F (One for each Swarm® S1 Sensor)
Repeatability:	<2.5 µm (0.1 mils)
Absolute wall thickness accuracy:	0.1 mm (4 mils)
Wall Loss Rate Resolution:	0.04 mm (1.7 mils)/year in 30 days or 0.002 mm (0.08 mils)/year in 365 days assuming 1 daily reading, 95% confidence, 10 mm wall thickness and a temperature error of +-1 °C
Ex rating:	UL USA: Class 1 Zone 1 AEx ib IIB T4 cUL Canada: Ex ib IIB T4 Europe: ATEX Ex ib IIB T4 Gb IECEX: IEC Ex ib IIB T4 Gb Brasil: InMetro
PipeView® Software:	Runs on Windows operated PDAs and Computers. Used for commissioning and operation of PipeMonit® stations. Provides the end user with corrosion and erosion data, trends, wall thickness, temperature and raw signals
PipeView® Computer requirements:	Core i5 Processor, 4 GB of RAM, 512 MB of VRAM and at least 250 GB of storage space
PipeView® PAD requirements:	Microsoft Surface 3 or similar, 64 GB or more of storage space, Windows 8 OS
PipeView® Server:	Runs on Microsoft operated servers. Communicates with PipeMonit® stations over internet, Ethernet, WiFi or GSM. Provides secure Web access for end users/operators
PipeView® Server output:	Modbus RTU, Modbus TCP, OPC, CSV (Comma Separated values). Web interface
PDL (Portable Data Logger):	Windows based PDA with full PipeView® software. Powers and operates PipeMonit® stations over USB or communicates with Field Data Loggers over BlueTooth or USB
Junction Box:	Weatherproof IP 65 Stainless Steel Field Junction Box (USB connection for PDL or FDL)
FDL (Field Data Logger):	Autonomous operation of PipeMonit® Swarm® stations. Mounted in a weatherproof IP 65 Stainless Steel Housing
FDL Power supply:	9-36 VDC, 110-240 VAC, battery
FDL Power consumption:	<6 W
FDL Communication options:	Wifi, Bluetooth, GSM, Ethernet, Modbus TCP/IP, OPC, RS485
Pipeline Operating temperature:	-40 to +125 °C/ -40 °F to 257 °F
Ambient Operating temperature:	-40 to +60 °C/ -40 °F to 140 °F

### SWARM OPERATIONAL MODES

Manual Mode:	The Swarm® is hardwired to a Field Junction Box. Swarm® is activated when a PDL is connected to the Junction Box. Back in the office the operator downloads the data to a PC or Server running our PipeView® application
Semi Automated Mode:	The Swarm® is hardwired to a FDL. The FDL operates, collects and stores data from the Swarm® locally. The operator periodically downloads the wall thickness data from the FDL using a PDL. Back in the office the operator downloads the data to a PC or Server running the PipeView® application
Fully Automated Mode:	The Swarm® is hardwired to a FDL - Field Data Logger via RS485 ( 2 pair cable). The FDL operates the Swarm® and communicates online (Ethernet, Wi-Fi, GSM) with a Windows server or PC running the PipeView® software.