PipeMonit® Swarm®

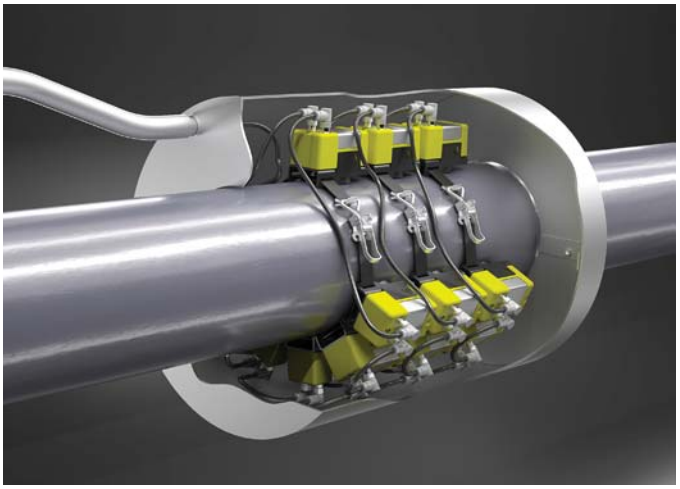
Non-Intrusive Wall Thickness Monitor

Real-time corrosion and erosion monitoring system

Swarm® is a high resolution ultrasonic corrosion and erosion monitoring system which provides rapid response to wall thickness changes in pipelines, topsides and vessels. It is non-intrusive, installed and operated without interfering with asset production.

Swarm® provides fast, accurate and repeatable wall thickness measurements which makes it a cost effective tool for real-time monitoring of corrosion and erosion concerns throughout the operators asset. When integrated with our Microcor® high resolution ER technology it can also be a highly effective tool to monitor the effectiveness of chemical inhibitor programs.

The Swarm® multi array sensor matrix is retrofittable and installed simply by strapping Swarm® sensors to the pipe. There is no requirement to remove coatings, no gluing, no welding or no hot work permits required. Swarm® wall thickness monitoring is based on the well-established ultrasonic pulse-echo method.



Non-intrusive Corrosion/Erosion Data

- Market leading performance with wall resolution better than 0.1 mils, or 2.5 μm
- Accurate, repeatable wall loss history enables reduced inspection and intelligent pigging activities
- Swarm® and Microcor® provide real-time feedback on the effectiveness of corrosion inhibitors makes a significant OPEX saving
- Accurate and direct erosion monitoring
- Non-intrusive, installed and operated without interfering with asset production

Easy Installation and Maintenance

- Sensors are retrofittable for easy relocation
- Fast, maintenance free installation
- No requirement to remove coatings
- No need for maintenance or calibration after installation

Communication

- Modbus TCP or 4-20mA interface for easy integration to client control systems
- Online or data logging
- Bluetooth or USB communication between the Portable and Field Data Loggers
- Cable Lengths up to 200 meters (656 ft)

Hazardous Area Certifications

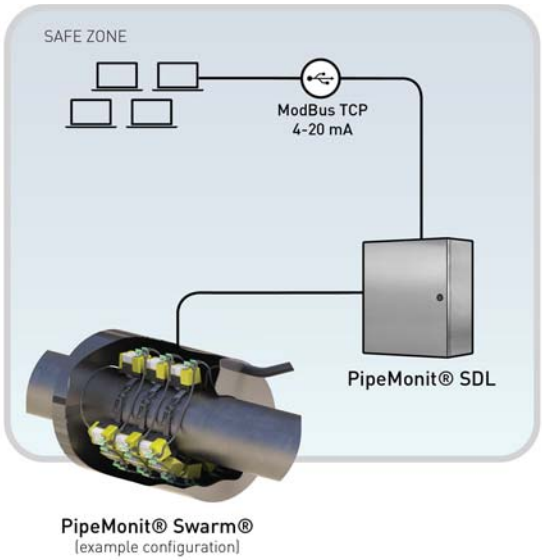
- Intrinsically safe (IECEx/ATEX)
- Certified for use in Class 1, Zone 1 areas
- IP67 rated enclosure for S1 Transducers
- IP65 rated enclosure for FDL/SDL/Junction Box

COSASCO® Sensorlink

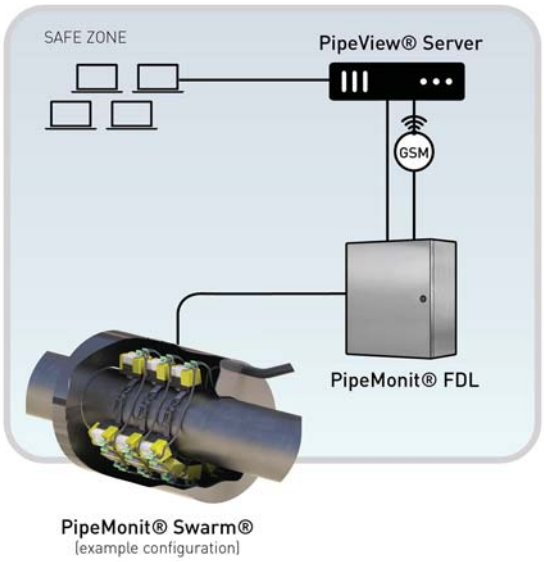
How the Swarm® Wall Thickness Monitoring System Works

Swarm® S1 ultrasonic sensors measure absolute wall thickness providing market leading resolution for wall thickness loss. Swarm® consists of multiple daisy chained S1 sensors organized in a customized matrix to cover a bend, straight pipe, a weld, a T-piece, a vessel or a tank. The Swarm® is connected to to a USB Junction box for manual capture of data, a FDL (Field Data Logger) or SDL (Safe Data Logger) for autonomous operation. Swarm® operates with cable lengths up to 200 meters without loss in performance and wall thickness resolution.

The SDL operates and stores data locally, in addition to providing the data via Modbus interface or 4-20 mA. The FDL operates and stores data locally providing online real-time wall thickness monitoring when connected to a PipeView® PC or Server, it be via GSM or Ethernet. Alternatively, the stored data can be collected using a PDL - Portable Data Logger. The PDL communicates with the FDL via Bluetooth and it provides the operator with graphical presentations of wall thickness data and corrosion rates.



Online Monitoring using an SDL via Modbus TCP or 4-20mA

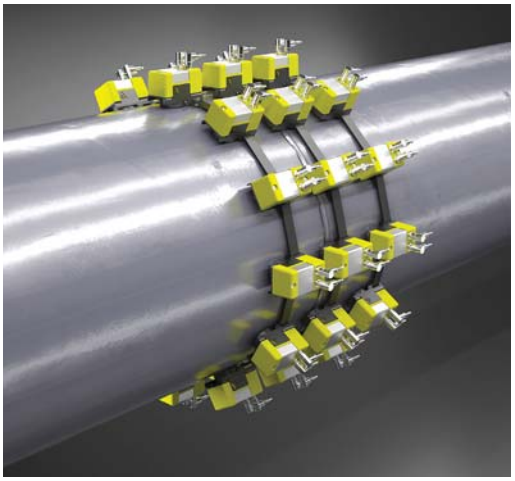


Online Monitoring using an FDL via GSM or Ethernet

Installation and Maintenance

Swarm® offers a simpler, faster and safer installation than any competing systems in the market:

- 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, configure the system, 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.

*It is recommended that initial commissioning and installation are done by a certified Cosasco Care Technician.

PipeMonit® Swarm®

Applications

Corrosion and erosion is a major cost in the oil and gas and associated industries, and recurrently the reason for accidents, unplanned interruptions and shut downs. Wall loss monitoring is critically important for the verification of the assets integrity and the effectiveness of the 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

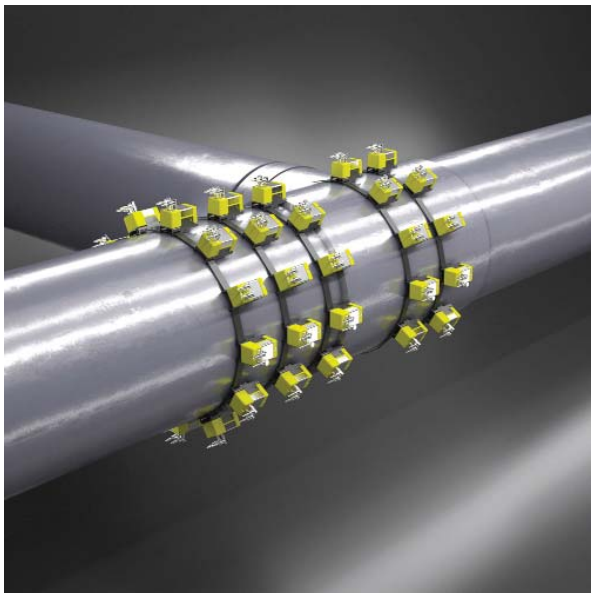
Swarm® is designed to be used in the Oil & Gas, Petrochemical, Utilities, Process, Mining and any other Industries with pipe wall erosion or corrosion problems.

Key Advantages

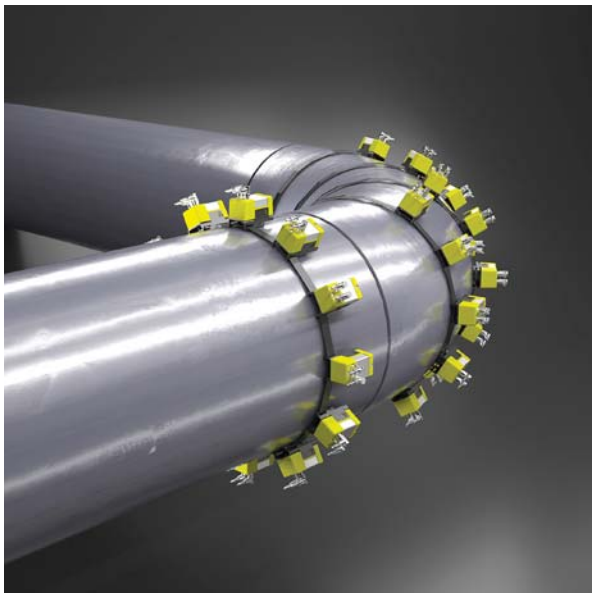
Swarm® is the market leading non-intrusive corrosion and erosion monitoring system providing wall loss resolution better than 0.1 mills or 2.5µm. The high resolution gives swift detection of corrosion and erosion rate changes allowing asset owners to manage process upsets quickly and effectively.

A world class corrosion monitoring system is an investment in improved economy, prolonged asset life and safer operations and has been proven to prolong pipeline lifetime by up to 2-3 times and reduced chemical inhibitor use by 20% or more.

Swarm® is built to endure the most challenging conditions and harsh environments throughout its life in the field. No moving parts means the Swarm® is practically maintenance free after installation.



Swarm Matrix of Sensors Installed on T-Piece



Swarm Matrix of Sensors Installed on Bend

Specifications

Swarm® 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 inches OD (100 mm)
Wall thickness	>3 mm (0.12 inches)
Pipe material	Steel
Coating materials	Works through external FBE and homogenous PU/PE/PP coatings
Repeatability	< 2.5 µm (0.1 mils)*
Temperature sensor	-40 °C to +125 °C, ± 0.1 °C /-40 to +257 °F, ± 0.6 °F (One for each Swarm S1 Sensor)
Temperature compensation	±20 °C between 2 measurements
Max temperature compensation	Max temp. Comp. Speed: ±2 °C/hour
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	Europe: ATEX Ex ib IIB T4 Gb IECEx: IEC Ex ib IIB T4 Gb
PipeView Software	PipeView® Software: Runs on Windows operated PDLs and Computers. Used for commissioning and operation of Swarm® 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 Tablet requirements	Minimum Microsoft Surface 3 or similar, 64 GB or more of storage space, Windows 8 OS
PipeView Server	Runs on Microsoft operated servers. Communicates with Swarm stations over internet, Ethernet, or GSM. Provides secure Web access for end users/operators
PDL (Portable Data Logger)	Windows based tablet with full PipeView® software. Powers and operates Swarm 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 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	Bluetooth, GSM
SDL Communication options	Modbus TCP, 4-20 mA
Pipeline Operating temperature	-40 to +125 °C/-40 °F to 257 °F
Ambient Operating temperature	-40°C to ≤ Ta ≤ 80°C (-40°F to ≤ Ta ≤ 176°F) @ Pi 1.7 W -40°C to ≤ Ta ≤ 55°C (-40°F to ≤ Ta ≤ 131°F) @ Pi 2.5 W

Specifications

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 or FDL-EX. The FDL operates, collects, and stores data from the Swarm® locally. The operator periodically downloads the wall thickness data from the FDL or FDL-EX 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 SDL (Safe Data Logger) or FDL - Field Data Logger via RS485 (2 pair cable). The SDL operates the Swarm® and communicates with the control system via Modbus TCP or 4-20 mA. The FDL operates the Swarm® and communicates online (Ethernet, GSM) with a Windows server or PC running the PipeView® software.

***Repeatability is defined as one standard deviation for repeated measurements on an object with no corrosion and at constant temperature over the measurements.**

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FM 10694

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