Cosasco Non-Intrusive Corrosion Monitoring

Non-Intrusive Wall Thickness Monitor

Real-time corrosion and erosion monitoring system

Cosasco Non-Intrusive solutions offer high resolution ultrasonic corrosion and erosion monitoring providing rapid response to wall thickness changes in pipelines, topside equipment and vessels. Non-intrusive sensors are installed and operated without interfering with asset production.

Our non-intrusive systems provide fast, accurate and repeatable wall thickness measurements making them 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 Non-Intrusive multi array sensor matrix is retrofittable and installed simply by strapping our non-intrusive sensors to the pipe. There is no requirement to remove coatings, no gluing, no welding or hot work permits required. Non-Intrusive wall thickness monitoring is based on the well-established ultrasonic pulse-echo NDT method.

Non-intrusive Corrosion/Erosion Data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market leading performance</td>
<td>with wall resolution better than 0.1 mils, or 2.5 μm</td>
</tr>
<tr>
<td>Accurate, repeatable wall loss history</td>
<td>enables reduced inspection and intelligent pigging activities</td>
</tr>
<tr>
<td>Temperature Rating</td>
<td>-40 to +257 °F (-40 to +125 °C)</td>
</tr>
<tr>
<td>Non-Intrusive sensors and Microcor® intrusive</td>
<td>provide real-time feedback on the effectiveness of corrosion inhibitors makes a significant OPEX saving</td>
</tr>
<tr>
<td>Accurate and direct erosion monitoring</td>
<td></td>
</tr>
<tr>
<td>Non-intrusive, installed and operated without interfering with asset production</td>
<td></td>
</tr>
</tbody>
</table>

Communication

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modbus TCP or OPC</td>
<td>for easy integration to client control systems</td>
</tr>
<tr>
<td>Online or data logging</td>
<td></td>
</tr>
<tr>
<td>Bluetooth or USB communication</td>
<td>between the Portable and Field Data Loggers</td>
</tr>
</tbody>
</table>

Hazardous Area Certifications

- Intrinsically safe (IECEx/ATEX/CSA) |
- Certified for use in Class 1, Zone 1 areas |
- IP67 rated enclosure for Transducers |
- IP66 rated enclosure for FDL |

Easy Installation and Maintenance

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensors are retrofittable</td>
<td>for easy relocation</td>
</tr>
<tr>
<td>Fast, maintenance free installation</td>
<td></td>
</tr>
<tr>
<td>No requirement to remove coatings</td>
<td></td>
</tr>
<tr>
<td>No need for maintenance or calibration after installation</td>
<td></td>
</tr>
</tbody>
</table>

All specifications and content are subject to change.
How Cosasco Non-Intrusive Wall Thickness Monitoring Systems Work

Non-intrusive ultrasonic sensors measure absolute wall thickness with market leading resolution for wall thickness loss. The non-intrusive system consists of multiple daisy chained sensors organized in a customized matrix to cover a bend, straight pipe, weld, T-piece, vessel or tank. Non-Intrusive sensors are connected to an FDL (Field Data Logger) or SDL (Safe Data Logger) for autonomous operation.

The SDL operates and stores data locally, in addition to providing the data via Modbus/OPC interface. The FDL operates and stores data locally providing online real-time wall thickness monitoring when connected to a Cosasco PC or Server via GSM. The PDL communicates with the FDL via Bluetooth and provides the operator with graphical representation of wall thickness data and corrosion rates.
Installation and Maintenance

Cosasco non-intrusive monitoring offers a simpler, faster and safer installation than competing systems in the market:

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

Single sensors are replaceable. The entire non-intrusive unit can be adjusted or relocated by the operator*. Install the non-intrusive sensors, 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.

Key Advantages

Market leading high resolution non-intrusive corrosion and erosion monitoring system 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.

Non-Intrusive sensors are built to endure the most challenging conditions and harsh environments throughout their life in the field. No moving parts means the systems are practically maintenance free after installation.

Application

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.

Cosasco non-intrusive system’s unique design allows for installation on critical areas such as top of welds, heat affected 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

Solutions are designed to be used in the Oil & Gas, Petrochemical, Utilities, Process, Mining and any other Industries with pipe wall erosion or corrosion problems.
Safe Data Logger (SDL)

The SDL is hard wired (RS 485) to the non-intrusive sensors using a two pair IS instrumentation cable. Utilizing one or more extension kits the number of sensor channels connected increase with 16 per kit. The SDL performs daily readings (configurable) of the sensors and communicates with the control system via Modbus TCP.

Specifications

<table>
<thead>
<tr>
<th>Technical Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-intrusive sensor channels</td>
<td>16</td>
</tr>
<tr>
<td>Extension kit available for additional 16 non-intrusive Sensor channels</td>
<td>Yes</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20 to +50 °C (-4 to +122 °F)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>12-24 VDC or 110/240 VAC</td>
</tr>
<tr>
<td>Typical power consumption</td>
<td>&lt;20 W</td>
</tr>
<tr>
<td>Non-intrusive system interface</td>
<td>RS485</td>
</tr>
<tr>
<td>Main communication interface</td>
<td>Modbus TCP</td>
</tr>
<tr>
<td>Data download</td>
<td>USB</td>
</tr>
</tbody>
</table>

Dimensions

- 2.6” (67 mm)
- 5.7” (145 mm)
- 7.7” (195 mm)
Ultrasonic Sensors

Cosasco ultrasonic sensors measure absolute wall thickness providing market leading resolution for wall thickness loss. The non-intrusive system consists of multiple daisy chained sensors organized in a customized matrix to cover a bend, straight pipe, a weld, a T-piece, a vessel or a tank. The system is connected to a USB Junction box for manual capture of data, a FDL (Field Data Logger) or SDL (Safe Data Logger) for autonomous operation.

Specifications

<table>
<thead>
<tr>
<th>Technical Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasound channels</td>
<td>1</td>
</tr>
<tr>
<td>Ultrasound frequency</td>
<td>~5 MHz</td>
</tr>
<tr>
<td>Pipeline operating temperature</td>
<td>-40 to +125 °C (-40 to +257 °Fahrenheit)</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>-40 to +125 °C ± 0.1 °C (-40 to +257 °Fahrenheit)</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>-40°C to ≤ Ta ≤ 80°C (-40°F to ≤ Ta ≤ 176°F) @ Pi 1.7 W (Limited barrier for up to 8 sensors)  -40°C to ≤ Ta ≤ 55°C (-40°F to ≤ Ta ≤ 131°F) @ Pi 2.5 W (Standard)</td>
</tr>
<tr>
<td>Pipe size</td>
<td>≥ 4 inches</td>
</tr>
<tr>
<td>Wall thickness</td>
<td>&gt; 3 mm (0.12 inches)</td>
</tr>
<tr>
<td>Coating materials</td>
<td>Works through external FBE and homogeneous PE/PP coatings</td>
</tr>
<tr>
<td>Repeatability</td>
<td>&lt;2.5 µm (0.1 mils)*</td>
</tr>
<tr>
<td>Temperature compensation</td>
<td>±20 °C between 2 measurements</td>
</tr>
<tr>
<td>Wall Loss Rate Resolution</td>
<td>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</td>
</tr>
<tr>
<td>Retrofittable</td>
<td>Yes</td>
</tr>
<tr>
<td>Non-intrusive</td>
<td>Yes</td>
</tr>
<tr>
<td>Dimensions</td>
<td>80 x 45 x 50 mm (3.15 x 1.77 x 1.97 in)</td>
</tr>
<tr>
<td>Weight</td>
<td>0.3 kg (0.66 lb)</td>
</tr>
<tr>
<td>Ingress protection</td>
<td>IP67</td>
</tr>
<tr>
<td>Ex rating</td>
<td>Europe: ATEX: Ex ib IIB T4 Gb  IECEx: IEC Ex ib IIB T4 Gb  CSA: Class 1, Zone 1 AEx ib Iib T4</td>
</tr>
</tbody>
</table>

Electrical Data

| Supply Voltage          | 12 to 24 VDC |
| Power consumption (typical) | < 1 W (Active), < 0.1 W (Idle) |
| Communication interface | RS-485 (2 connectors) |
| Connector type          | 4 pin, Sealed |

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

Dimensions

Non-Intrusive Topology

Identification of sensor positions in software
Portable Data Logger

The PDL and PDL Ex are Windows based rugged tablets with corrosion monitoring application software. The software application includes everything needed for installation, commissioning and operation.

During installation, simply connect the PDL (Ex) and configure the system utilizing the installation tool application.

Specifications

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>Portable Data Logger (PDL)</th>
<th>Portable Data Logger Ex (PDL Ex)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output data</td>
<td>Wall thickness data, corrosion/erosion rates, raw signals, temperature</td>
<td>Wall thickness data, corrosion/erosion rates, raw signals, temperature</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-21°C to 50°C/-5.8°F to 122°F</td>
<td>-10°C to 50°C/14°F to 122°F</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40°C to 71°C/-40°F to -160°F</td>
<td>-10°C to 50°C/14°F to 122°F</td>
</tr>
<tr>
<td>Screen</td>
<td>12” TFT LCD HD</td>
<td>10.1” AHVA Full HD Plus</td>
</tr>
<tr>
<td>RAM</td>
<td>4 Gigabyte</td>
<td>4 Gigabyte</td>
</tr>
<tr>
<td>Storage</td>
<td>128 Gigabyte</td>
<td>64 - 128 Gigabyte</td>
</tr>
<tr>
<td>Ex rating</td>
<td>NA</td>
<td>ATEX Zone 1, IECEx Zone 1 and UL C1D1</td>
</tr>
</tbody>
</table>

Electrical Data

| Power supply         | Rechargeable Li-Ion battery (up to 8 hours battery time, up to 2 hours in sub-zero temperature) | Rechargeable Li-Ion battery (up to 12 hours battery time, up to 1 hours in sub-zero temperature) |

Dimensions

10.7” (273 mm)
Field Data Logger Ex

The non-intrusive Field Data Logger Ex (FDL Ex) is hard wired (RS 485) to the non-intrusive sensors using two pair IS instrumentation cable. In semi-automated mode the FDL Ex performs daily logging of the system and stores the data locally. With one reading a day the storage capacity will be 9 months for a 16 sensor system unit.

In fully automated mode the FDL Ex performs daily readings of the system and communicates the data online and real-time over Ethernet or GSM. The FDL Ex is powered by battery or via hard wire 12/24 VDC or 110/230 VAC.

Specifications

<table>
<thead>
<tr>
<th>Technical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Intrusive sensor channels</td>
</tr>
<tr>
<td>Operating temperature</td>
</tr>
<tr>
<td>Dimensions</td>
</tr>
<tr>
<td>Weight</td>
</tr>
<tr>
<td>Cable length (RS485) standard 10 m (33ft)</td>
</tr>
<tr>
<td>Material</td>
</tr>
<tr>
<td>Ingress protection</td>
</tr>
<tr>
<td>Ex rating</td>
</tr>
</tbody>
</table>

Electrical Data

<table>
<thead>
<tr>
<th>Power supply</th>
<th>12-24 VDC or 110/240 VAC or internal alkaline battery pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical power consumption</td>
<td>&lt;9 W</td>
</tr>
<tr>
<td>Communication options</td>
<td>RS485, Bluetooth, GSM, Ethernet</td>
</tr>
</tbody>
</table>

Dimensions

- Ø 7.7" (195 mm)
- 14.7" (373 mm)
- 7.1" (181 mm)
- 10.3" (260 mm)
# Ordering Information

## Cosasco Non-Intrusive Safe Area Datalogger

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1037163</td>
<td>SDL System 16 Channel Modbus, w/Std Modbus Map</td>
</tr>
<tr>
<td>1037206</td>
<td>SDL Extension Kit 16 Channel IS barriers and Power Supply</td>
</tr>
</tbody>
</table>

## Cosasco Non-Intrusive Field Data Logger Ex

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1037160</td>
<td>Field Data Logger Ex Mains Power, Battery and Bluetooth.</td>
</tr>
</tbody>
</table>

## Cosasco Non-Intrusive Portable Data Logger Ex

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1037164</td>
<td>Portable Data Logger Ex</td>
</tr>
</tbody>
</table>

## Cosasco Non-Intrusive Ultrasonic Sensors

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1037227</td>
<td>Non-Intrusive Ultrasonic Sensor IECEx/ATEX</td>
</tr>
<tr>
<td>1037230</td>
<td>Non-Intrusive Ultrasonic Sensor CSAUS/IECEx/ATEX</td>
</tr>
</tbody>
</table>

## Accessories/Spare Parts

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1037152</td>
<td>Standard Bracket Low</td>
</tr>
<tr>
<td>1037150</td>
<td>Standard Bracket High</td>
</tr>
<tr>
<td>1037219</td>
<td>Protective Cover</td>
</tr>
<tr>
<td>1037216</td>
<td>Gasket Protection Gasket for Transducer</td>
</tr>
<tr>
<td>1037214</td>
<td>Cosasco Non-Intrusive Positioning Tool to Adjust Sensor Location.</td>
</tr>
<tr>
<td>1037726</td>
<td>Non-Intrusive - USB to Serial Converter Cable</td>
</tr>
<tr>
<td>1037169</td>
<td>0.3m Jumper Cable</td>
</tr>
<tr>
<td>1037170</td>
<td>0.5m Jumper Cable Jumper</td>
</tr>
<tr>
<td>1037171</td>
<td>1.0m Jumper Cable Jumper</td>
</tr>
<tr>
<td>1037172</td>
<td>10m Connection Cable From 1st sensor to FDL/JB</td>
</tr>
<tr>
<td>1037173</td>
<td>Band Buckle</td>
</tr>
<tr>
<td>1037212</td>
<td>FDL Battery Pack Ex</td>
</tr>
<tr>
<td>1037208</td>
<td>Metal Mounting Strap</td>
</tr>
<tr>
<td>1037209</td>
<td>Protective Galvanic Isolation Tape</td>
</tr>
<tr>
<td>1037210</td>
<td>Echo 8 Couplant</td>
</tr>
</tbody>
</table>

*Individual installation kit parts are based upon number of sensors, locations, and pipe size. Contact Cosasco sales representative for quantities.*