



smart
PIMSTM

Permanently installed monitoring system



Remote Asset- Integrity Monitoring

Measuring Metal Loss with
Installed Ultrasonic Sensors & IoT



SENSORTM
NETWORKS, INC

Installed ultrasonic sensors for asset-integrity monitoring

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Sensor Networks, Inc. is a US-based IoT technology company specializing in networked installed ultrasonic sensor systems engineered for precision, scalability and versatility in safety-critical, energy-sector assets. Our unique, patent-pending product and service offering helps customers cost-effectively manage their corrosion and erosion measurement challenges with plant piping, vessels and other components—both for regulatory compliance and improved asset management.

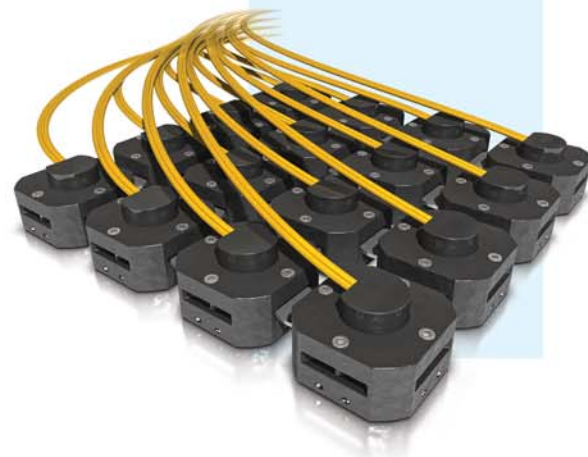
Productivity advantage

Metal loss due to corrosion & erosion is a major issue and cost for:

- **Refineries:** overhead crude lines and naphthenic acid corrosion
- **Chemical plants:** hydrofluoric acid corrosion
- **Oil production facilities:** sand erosion
- **Mid-stream assets:** general ID corrosion
- **Electric power generators:** FAC and MIC
- **Any PSM-regulated sites:** compliance and loss prevention

A fundamental tenet of any asset-integrity strategy is to accurately measure metal loss so it can be properly managed. Sensor Networks' smartPIMS provides that as a safe and cost-effective solution.

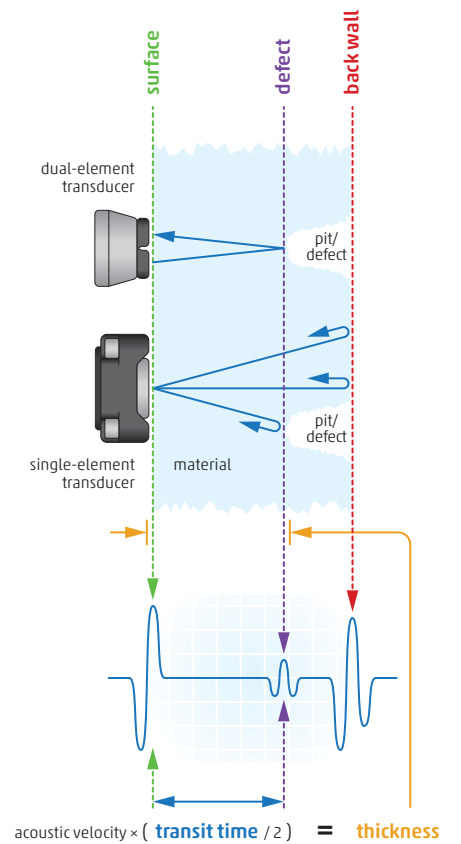
"Measure It, Manage It."



Ultrasound

Ultrasonic nondestructive testing (NDT) is a 70-year-old, proven, established and refined technology. Recent advances with microelectronics, software, wireless communications and the "internet of things" have made "installed ultrasound" an extremely attractive and cost-effective solution for corrosion & erosion monitoring.

- **Safe.** Non-invasive to the asset's pressure boundary.
- **Absolute** in its ability to directly measure remaining wall thickness. (Not a proxy for wall loss.)
- **Extremely accurate** to 0.001" (0.025 mm), with ability to measure down to 0.040" (1 mm) in carbon steel, especially for fixed-location probes.
- **Rugged, reliable and portable.** Low recurring maintenance costs.
- **Versatile and cost-effective.**



For long-term installations, including underground or harsh environments, the transducer is encapsulated for extended protection.



Flexible matPIMS linear or area arrays, with 16 ultrasonic elements can be wrapped around pipes and elbow extrados, with up to 1,000' (305 m) of cable.

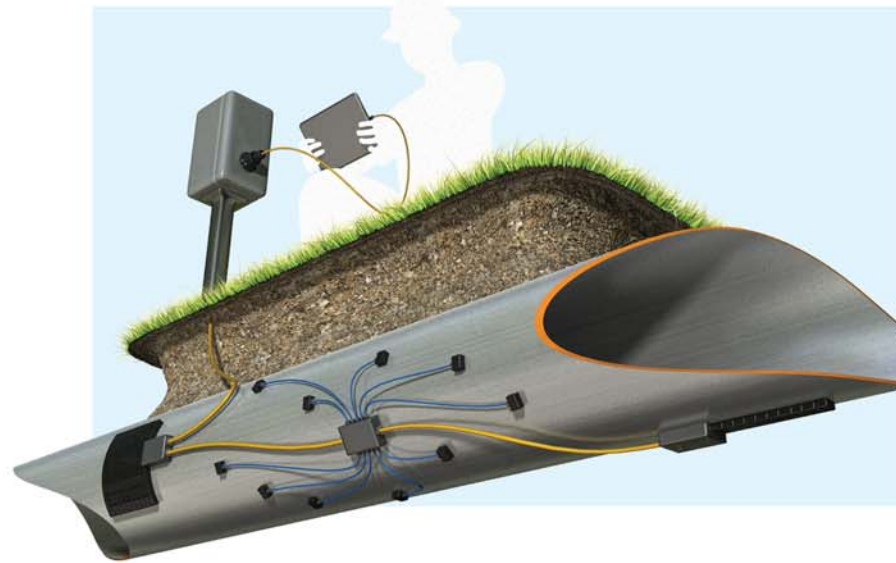


smartPIMS™ components, software and systems are highly configurable, from just a few sensors to thousands of TMLs per network—and available for purchase, rent or as a service. Leveraging the low-cost and ubiquitous aspects of the Internet and wireless networks—including cellular—systems can be more easily and cost-effectively installed and maintained at most industrial facilities.

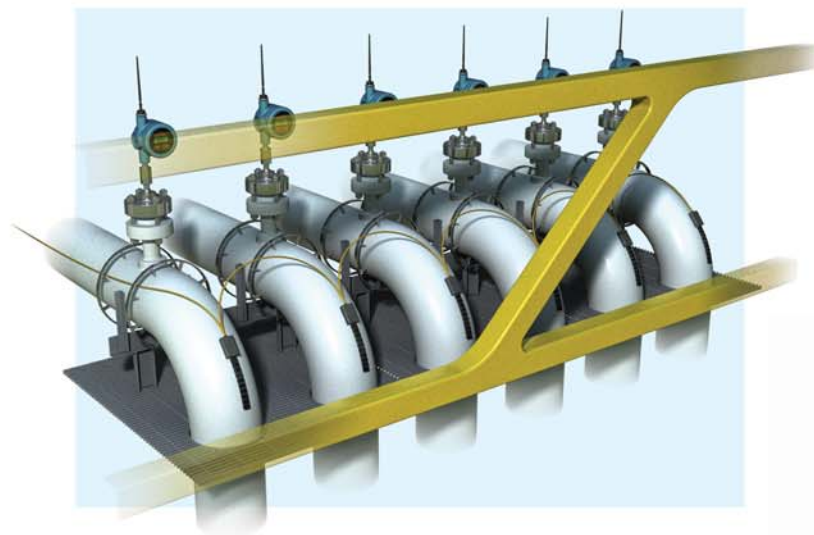
Wired solutions

Best suited for:

- Buried installations
- Integration with plant control systems via Modbus/RS485
- Lowest hardware cost per TML/CML
- Manual, automated and integrated data collection options
- High data-collection frequency (>2X/day) incl. control room
- No battery replacement required
- Resistance to RF interference



- ▶ **Modbus tablet systems** are ideally suited for buried pipe and mobile assets, such as rail and highway chemical tank cars, that require accurate and repeatable measurements on an infrequent basis such as two times per year.
- ▶ **Modbus control room systems** are ideal for offshore platforms when wired directly into the asset's plant control system or DCS. The installed sensors can provide automatic closed-loop to the production process.



Our new matPIMS™ 3×5 array transducer is a 16-element device that can wrap radially or axially on a pipe as small as 4" diameter. matPIMS plugs directly into the Modbus Tablet with up to 1,000' (305 m) of cable for signal/data capture.

Wireless solutions

Best suited for:

- Wiring cost is prohibitive or impractical
- Fully-automated and integrated data collection solutions are required
- Measurement frequencies typically less than two per day
- Transmitter and transducers need to be periodically repositioned



- ▶ **Cellular systems** are battery powered, environmentally sealed, self-contained, CI, D2 safety rated and 100% autonomous. Programmed to turn-on at any desired periodic time interval and powering up to 8 dual-element or 16 single element probes, the smartPIMS device transmits all data and measured values to the cloud / web portal. These units transmit the data using secure HTTPS -SSL encryption protocols.



smartPIMS™ is available with a wide variety of sensors that can be arranged to suit the application. Due to the system's high channel count, linear or area arrays can be created allowing more coverage and more data.



Transducer model XD-301 is an ultra-high temp probe which can operate in 900° F (500°C) continuous-duty service. These probes and their temperature-measuring RTDs are mechanically clamped onto the plant asset.

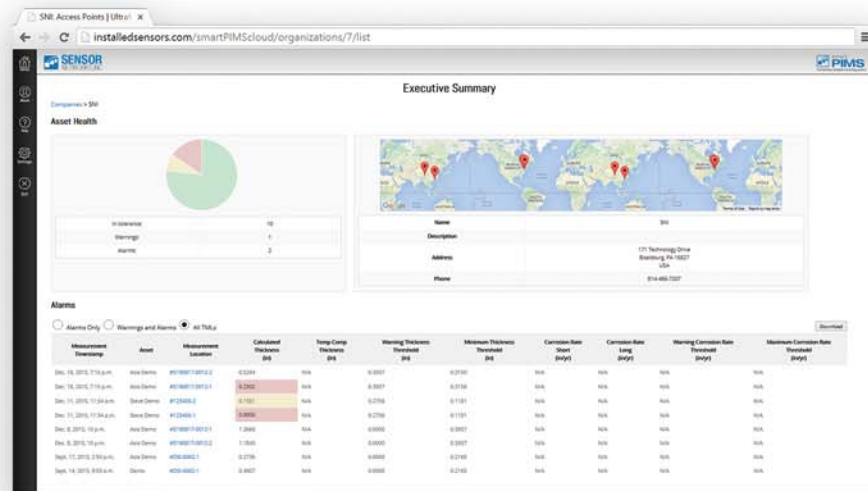
Data Flow & Management

with webPIMS™

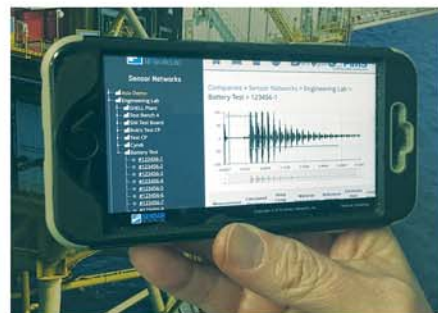
AWS-hosted cloud-based data management system for ultrasonic thickness measurements from installed UT sensors.

webPIMS can automatically or manually receive data from ultrasonic sensors for web-based display, storage, trending and analysis. Users can access this data from anywhere with an internet-enabled device such as a PC, tablet or smart phone.

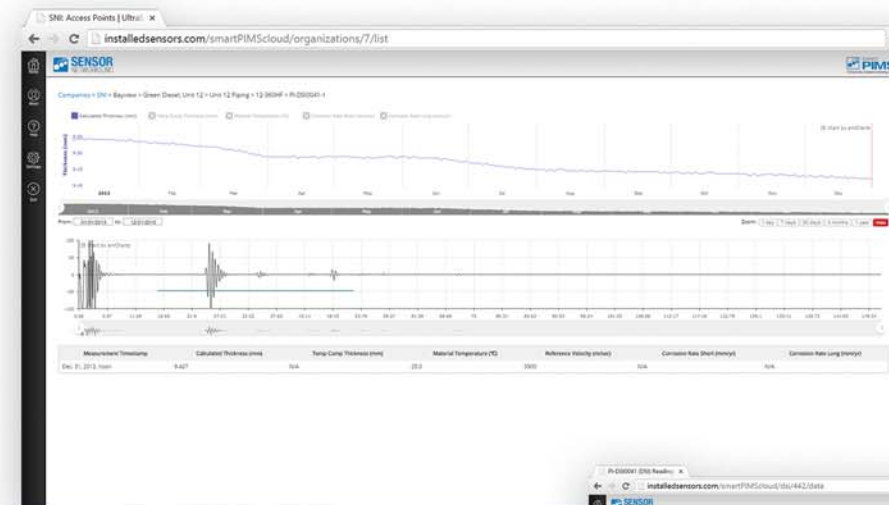
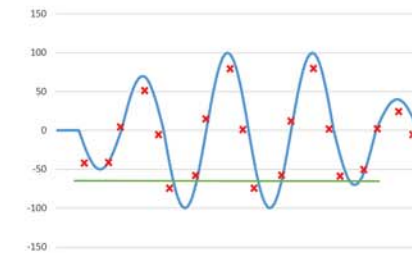
An intuitive user's interface allows easy access to stored images or pdf drawings of the actual installed set-up. Temperature sensors at the TMLs record the asset's temperature while software automatically compensates for thermal changes.



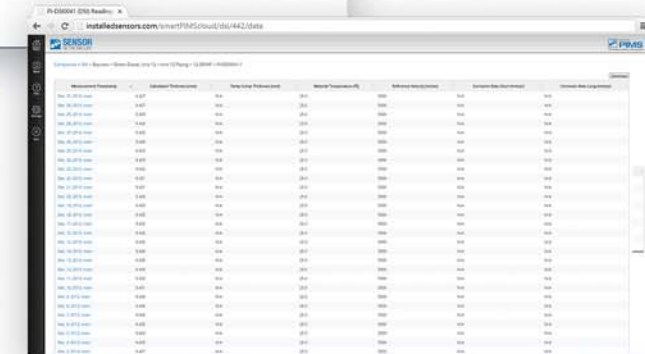
webPIMS data can be easily accessed from any mobile device or smartphone.



Executive Summary view shows the GPS location of your assets, the in-or-out-of-spec status and an exportable tabular summary with time / date stamp and temperature status. Ultrasonic test data can be automatically uploaded to this cloud app via SNI's cellular smartPIMS device, at any periodic time interval or manually via the tablet-based Modbus system.



The smartPIMS & webPIMS products store the digitized RF waveform from every thickness reading. Changes in wall thickness, due to corrosion and/or erosion, can be accurately trended while metal-loss rates are precisely calculated using statistical noise-reduction algorithms. Per-TML alarms can be set for either minimum thickness or a maximum metal-loss rate.



All thickness data is archived for easy future access and analysis. These files can be down-loaded from the web for further analysis or imported into other RBI software platforms. Auto reporting via e-mail is easily set-up.

6 tiers of user-defined hierarchy are possible:

- Company
- Region
- Plant
- Unit
- Pipe Rack
- TML #

Digital images and/or piping schematic drawings can be archived at each tier.

cellular

transmitter

type cellular (3G)
model no. C-PIMS 100
battery type Li-Ion C-cell, 3.6 VDC, qty. 2
battery life 5 years (typical, based on 1 reading/day)
ultrasonic system
channels 16 ultrasonic, 1 temperature
pulser voltage ±5V bipolar square wave
analog frequency 1–10 MHz (-3dB)
gain -10dB to +70dB
digitizer frequency 40 Msps
certification Class 1, Div. 2
enclosure
type instrumentation housing
material aluminum
rating NEMA 4X, IP66
dimensions 5" × 5¼" × 4¼"
weight 4 lbs.

Modbus

transmitter

model no. C-PIMS 100 Modbus
protocol Modbus
communication RS-485, 2-wire, max. 1000'
power 10-20 VDC
ultrasonic system
channels 16 ultrasonic, 1 temperature
pulser voltage ±5V bipolar square wave
receiver 1–10 MHz (-3dB)
gain -10dB to +70dB
digitizer frequency 40 Msps
certification Class 1, Div. 2
enclosure
type instrumentation housing
material aluminum
rating NEMA 4X, IP66
dimensions/weight 5" × 5¼" × 4¼" / 4 lbs.

tablet datalogger

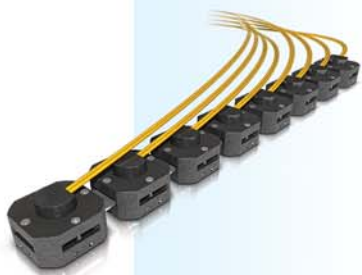
performance
processor Intel i5-4200U 1.6GHz w/ 3MB L3 cache (dual-core)
memory 8 GB RAM
storage M2-SATA SSD, 64 GB
operating system Windows 10
connections network power, data via RS-485-to-USB adapter
physical
drop/shock resistance MIL-STD-810G
environmental IP65, 14–131°F (-10 to +55 °C)
dimensions/weight 11.4" × 7.48" × 0.78" / 2.73 lbs.

transducers

transducer cable

type armored, ¾" dia.
maximum length to transducer standard 10' (3.0m), custom to 25' (7.6m)

transducers



	single-element contact	dual-element	delay-line contact	matPIMS
<i>model</i>	XD-101	XD-201	XD-301	XD-401
<i>application</i>	general purpose	severe pitting	ultra-high temp	general wall loss
<i>frequency</i>	5 MHz	5 MHz	7 MHz	7.5 MHz
<i>active area (dia.)</i>	0.25"/6.35mm	0.375"/10mm	0.375"/10mm	0.25"/6.35mm
<i>overall (dia. x h)</i>	1.0 × 1.0" 25.4 × 25.4 mm	0.75 × 0.75" 19 × 19 mm	0.8 × 2.25" 20.3 × 57.2 mm	1.0 × 9.12" 25.4 × 231.6 mm
<i>no. transducers</i>	1–16	1–8	1–16	16 (1 reference, 15 active)
<i>resolution</i>	0.001"/0.025mm	0.001"/0.025mm	0.001"/0.025mm	0.001"/0.025mm
<i>thickness range</i>	application-dependent	0.040–6.0" 1.0–150.0mm	0.125–1.0" 3.0–25.0mm	0.125–6.0" 3.0–150.0mm
<i>temp range</i>	application-dependent	-5 to +300 °F -20 to +150 °C	-5 to +932 °F -20 to +500 °C	-5 to +150 °F -20 to +80 °C
<i>attachment</i>	magnet/adhesive	magnet/adhesive	mechanical clamp	adhesive