The ET310 is a permanently mounted wall thickness monitoring sensor which forms part of the Permasense WirelessHART corrosion monitoring system. The ET310 sensor provides measurements through external coatings on pipes and vessels with a continuous service temperature of up to 160°C.

**Features**
- May be used on metal with continuous service temperatures up to 160 °C (320 °F) with a maximum short-term temperature excursion up to 200 °C (392 °F)
- WirelessHART data transmission
- Intrinsically safe
- Measures through external coatings

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Safety notices

Installation of this sensor in an explosive environment must be in accordance with the standards and practices appropriate to the site.

Review the Regulatory compliance section for restrictions for safe installation.

Only fit approved Permasense BP10E or BP20E power modules.

Use supplied lanyard to prevent sensor falling from heights, potentially causing injury.

The sensor contains magnets which can be harmful to pacemaker wearers and can be suddenly attracted to other objects such as tools. This can cause injury as well as damage to the sensor and to other objects. Only remove the protective cap when necessary and then take great care.

Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Ensure the device is installed to provide a separation distance of at least 20cm (8”) from all persons.

Potential electrostatic charging hazard – do not rub or clean with a dry cloth.

Introduction

Permasense systems use ultrasonic wall thickness measurement sensors such as the ET310 (see Figure 1) for corrosion and erosion monitoring and are proven to provide robust measurements in oil and gas environments. The sensors are easy to install and intrinsically safe so they can be deployed anywhere, including inaccessible locations and hazardous environments.

The sensors communicate using the WirelessHART protocol, creating a self-forming and self-managing wireless mesh, which delivers continuous wall thickness measurements of the highest integrity and accuracy directly to the end user.

Figure 1. ET310 sensor
A built-in thermocouple probe is used to monitor the pipe surface temperature. This allows the wall thickness measurement to be temperature-compensated.

**Specification**

**Method of mounting**

The ET310 sensor can be mounted over, and without damaging, a coating of up to 1.0mm (40mils) thick, including zinc coatings. The sensor is mounted magnetically. For permanent secure mounting, a strap is fitted tightly around the pipe and through the sensor. Multiple sensors can be attached in a ring around the pipe using a single strap. A lanyard provides additional security against the sensor falling.

Suitable magnetic fixtures, straps, lanyards, buckles and fixing tools are supplied by Permasense.

The Magnetic fixture for ET310 sensors may only be used with an ET310 sensor which has been fitted with magnetic fixture brackets. The ET310 magnetic fixture brackets are ordered with the magnetic fixture and are fitted to the sensor by a trained installation technician.

The sensor installation procedure can be found in *Installation guide – ET310 WiHART sensor*. For magnetic mounting also use *Installation guide - Magnetic fixture for ET310 sensor*.

**Dimensions**

ET310 sensor dimensions are shown in Figure 2.

![Figure 2. Dimensions of the ET310 sensor, shown with a BP10E power module](image_url)

Note: for a BP20E power module, dimension A is 58mm [2.3"] and dimension B is 140mm [5.51"]
## Weight

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor excluding power module</td>
<td>600g (1.32 lbs)</td>
</tr>
</tbody>
</table>

## Measurement location

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe diameter</td>
<td>Minimum 100mm (4 inches)</td>
</tr>
<tr>
<td></td>
<td>Maximum 1000mm (40 inches)</td>
</tr>
</tbody>
</table>

- Where the diameter is 50 – 100mm (2- 4 inches) an alternative mounting system can be supplied. Please contact Permasense.
- Where the diameter is greater than 1000mm (40 inches). Please contact Permasense.

Note: The strap can be installed over cladding up to a maximum cladding diameter of 1000mm (40 inches)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe material</td>
<td>Carbon steels, Duplex and Super Duplex stainless steels, martensitic steels which have not been hardened. For austenitic stainless steels use WT210 marine sensors.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>External coating layer</td>
<td>Measures through all commonly used coatings, typically up to 1 mm (40 mils). For thicker or specialist coatings please contact Permasense.</td>
</tr>
</tbody>
</table>

## Thickness measurement

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transduction</td>
<td>Single electro-magnetic acoustic transducer</td>
</tr>
<tr>
<td>Couplant</td>
<td>No couplant required</td>
</tr>
<tr>
<td>Minimum measurable wall thickness *</td>
<td>4mm (5/32inch)</td>
</tr>
<tr>
<td>Maximum measurable wall thickness **</td>
<td>100mm (2 inches)</td>
</tr>
</tbody>
</table>

- Reference thickness accuracy *** ±0.3mm
- Reference thickness repeatability *** ±0.1mm

* Where the inner surface of the measured pipe/vessel wall is non-uniform or rough, the minimum measurable metal thickness is 6mm (1/4 inch).

** For wall thicknesses above 50mm, parameter adjustment at installation is required – contact Permasense.

*** Reference accuracy is stated across the range of measurable wall thicknesses on calibrated test blocks with ultrasonic velocity within 2% actual velocity, measured at room temperature. Meeting reference thickness accuracy across the operating temperature range requires velocity is known across the temperature range to within 2%.

## Environmental

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum continuous service temperature</td>
<td>up to +160 °C (+320 °F)</td>
</tr>
<tr>
<td>(See Regulatory Compliance)</td>
<td></td>
</tr>
<tr>
<td>Maximum short-term temperature excursion</td>
<td>up to +200 °C (+392 °F)</td>
</tr>
<tr>
<td>Sensor head temperature range</td>
<td></td>
</tr>
<tr>
<td>For safety compliance</td>
<td>-50 °C to +75 °C (-58 °F to +167 °F)</td>
</tr>
<tr>
<td>For operation</td>
<td>-40 °C to +75 °C (-40 °F to +167 °F)</td>
</tr>
<tr>
<td>IP rating (when mated to power module)</td>
<td>IP67</td>
</tr>
</tbody>
</table>
Temperature measurement

| Temperature at pipe surface | Absolute accuracy: within 10°C (18°F) Repeatability: within 2°C (4°F) |

WirelessHART

<table>
<thead>
<tr>
<th>Standard</th>
<th>Based on IEEE 802.15.4, WirelessHART</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network type</td>
<td>Self-forming, self-managing, self-healing mesh</td>
</tr>
<tr>
<td>Operating band</td>
<td>2.4 GHz worldwide unlicensed band</td>
</tr>
<tr>
<td>Channel use / frequency</td>
<td>Channels 11-25, 2.405 GHz to 2.475 GHz</td>
</tr>
<tr>
<td>RF power output (maximum)</td>
<td>&lt;10dBm EIRP</td>
</tr>
<tr>
<td>Range</td>
<td>Up to 50m (160ft) line of sight between devices</td>
</tr>
<tr>
<td>Maximum ET310 series sensors per gateway</td>
<td>Gateway dependant - typically 100</td>
</tr>
<tr>
<td>Maximum data hops from gateway to furthest sensor</td>
<td>Gateway dependant - typically 8 hops</td>
</tr>
<tr>
<td>Compatible gateways</td>
<td>Emerson Smart Wireless Gateways</td>
</tr>
</tbody>
</table>

When sensors are installed, they form a robust, self-managing mesh network over which data will flow from the sensor via the most reliable route, as shown in Figure 3. Permasense recommends a minimum network size of 25 sensors to ensure adequate redundancy in the network.

Figure 3. Mesh networking in Permasense WiHART sensors
Handling, storage and transit

Sensors must be stored within the operating ambient temperature range in a dry place.

ET310 sensor shipping box information

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number in box</td>
<td>20</td>
</tr>
<tr>
<td>Full box weight</td>
<td>22 kg (49 lbs)</td>
</tr>
<tr>
<td>Dimensions (w x d x h)</td>
<td>67cm x 55cm x 45cm (26” x 21” x 18”)</td>
</tr>
</tbody>
</table>

CAUTION: take care when lifting full boxes of sensors. Handles are provided to allow lifting by two persons.

For power module handling and storage, consult the relevant power module datasheet.

Disposal of equipment

The European Union Directive 2012/19/EU on waste electrical and electronic equipment mandates recycling of electrical and electronic equipment throughout the EU. Unless otherwise noted, all products manufactured by Permasense are compliant with this directive and any subsequent revisions or amendments. This product carries the WEEE symbol to demonstrate compliance. Dispose of this product in accordance with local regulations.

Accessories

Power modules

ET310 sensors may be powered from Permasense, intrinsically safe, approved BP20E power modules.

<table>
<thead>
<tr>
<th>Power module service life</th>
<th>BP20E</th>
<th>9 years*</th>
</tr>
</thead>
</table>

* Figures assume an acquisition is taken every 12 hours at an average sensor head and power module temperature of 20°C (68°F). Acquisitions taken more frequently or at higher ambient temperatures will reduce the service life of the power module.

Alternatively, an appropriately certified intrinsically safe power source may be used.

Sensor input parameters

<table>
<thead>
<tr>
<th>$U_i$ = 7.9V</th>
<th>$C_i$ = 0</th>
<th>$C_o$ = 8.8µF</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_i$ = 850mA</td>
<td>$L_i$ = 0</td>
<td>$L_o$ = 40µH</td>
</tr>
</tbody>
</table>
Regulatory compliance

Note: Certifications are being regularly updated. For current information please contact permasense.support@emerson.com

Generic certifications

IECEx Intrinsic Safety
Certificate number: IECEx BAS 17.0047X
Markings: Ex ia IIC T4…T2 Ga, T_{amb} = -50°C to +75°C, IP67

WARNING:
- POTENTIAL ELECTROSTATIC CHARGING HAZARD
- USE ONLY WITH APPROVED POWER SOURCE
- CONTAINS MAGNETS
- SEE INSTRUCTIONS

Specific conditions of use:
1. The plastic enclosure and mounting foot may present a potential electrostatic ignition risk and must not be rubbed or cleaned with a dry cloth
2. The equipment may be attached to process pipework at a temperature of up to 200°C as follows:
   a) up to +120 °C (+248 °F) for T4
   b) up to +190 °C (+374 °F) for T3
   c) up to +200 °C (+392 °F) for T2

ATEX Intrinsic Safety
Certificate number: Baseefa17ATEX0062X
Markings: Ex II 1 G, Ex ia IIC T4…T2 Ga, T_{amb} = -50°C to +75°C, IP67

WARNING:
- POTENTIAL ELECTROSTATIC CHARGING HAZARD
- USE ONLY WITH APPROVED POWER SOURCE
- CONTAINS MAGNETS
- SEE INSTRUCTIONS

Specific conditions of use:
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   b) up to +190 °C (+374 °F) for T3
   c) up to +200 °C (+392 °F) for T2

Radio
IEEE 802.15.4 compliant, operating in the 2.4GHz worldwide ISM band
Compliant with EN 300 328 v2.1.1
EMC
Compliance to the following standards:
- EN 301 489-1 v1.9.2: 2011 in accordance with EN 301 489-17 v2.2.1: 2012
- EN 61326-1: 2013, including radiated emissions to CISPR 11:2009 + A1:2010, Class B
  With reference to:
    - EN 61000-4-2:2009

Dangerous goods regulations
The magnets in the sensor are shielded for transportation and meet the IATA Dangerous Goods Regulations for magnetic fields. The sensors are therefore safe for air transportation.

Regional/country specific certifications
Canada
SGS North America - Intrinsically Safe
  Certificate number: SGSNA/17/SUW/00281
  Applicable standards: CAN/CSA C22.2 No. 157-92 (R2012) +Upd1 +Upd2
  Marking: CLASS I, DIV 1, GP ABCD, T4, $T_{amb} = -50˚C to +75˚C$, IP67
Ordinary Location Certification
  Certificate number: SGSNA/17/SUW/00259
  Applicable standards: CAN/CSA C22.2 No. 61010-1-12, 3rd Edition

WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD
  USE ONLY WITH APPROVED POWER SOURCE
  SEE INSTRUCTIONS

Radio
Important notes:
- The antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.
- This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Notes importantes:
- L’antenne utilisée pour ce transmetteur doit être installée en considérant une distance de séparation à toute personne d’au moins 20 cm.
- Cet appareil est conforme à la norme RSS Industrie Canada exempt de licence. Son fonctionnement est soumis aux deux conditions suivantes : (1) cet appareil ne peut pas provoquer d’interférences ; et, (2) Cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement du dispositif.

Marking: Contains IC: 5853A-ETERNA2

EMC - Compliant with RSS-Gen: Issue 4 with reference to ANSI C63.4:2014, Class A
China

NEPSI intrinsically safe
Certificate number: GYJ18.1090X
Conforms to: GB 3836.1-2010, GB 3836.4-2010, GB 3836.20-2010

Radio – Under SRRC No.423 this product is classified as low power technical (class F). The People’s Republic of China radio regulations article 44, states the product does not require type approval.

China RoHS 2: 中国《电器电子产品有害物质限制使用管理办法》，2016年第32号令

China RoHS 2: Chinese order No. 32, 2016; administrative measures for the restriction of hazardous substances in electrical and electronic equipment

Emerson understands there are numerous requirements with the regulation regarding, among others, marking of product and communications for purpose of the Phase I implementation of China RoHS 2. As a supplier of electrical and electronic equipment, Emerson has determined that the captioned product supplied to your company is within scope of China RoHS 2.

To date, based on information provided by suppliers and to Emerson’s best knowledge, the following China RoHS substances are present at a concentration above the Maximum Concentration Values (“MCVs”), have been identified in the following parts, and the product is marked to reflect this.

<table>
<thead>
<tr>
<th>部件名称</th>
<th>Part Name</th>
<th>有害物质 / Hazardous Substances</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>铅 Lead (Pb)</td>
<td>汞 Mercury (Hg)</td>
</tr>
<tr>
<td></td>
<td>锗 Cadmium (Cd)</td>
<td>六价铬 Hexavalent Chromium (Cr +6)</td>
</tr>
<tr>
<td></td>
<td>多溴联苯 Polybrominated biphenyls (PBB)</td>
<td>多溴联苯醚 Polybrominated diphenyl ethers (PBDE)</td>
</tr>
<tr>
<td>传感器组件 Sensor assembly</td>
<td>X</td>
<td>O</td>
</tr>
</tbody>
</table>

This table is proposed in accordance with the provision of SJ/T11364

本表格系依据 SJ/T11364 的规定而制作。
O: 意为该部件的所有均质材料中该有害物质的含量均低于 GB/T 26572 所规定的限量要求。
O: Indicate that said hazardous substance in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

X: 意为在该部件所使用的所有均质材料里，至少有一类均质材料中该有害物质的含量高于 GB/T 26572 所规定的限量要求。
X: Indicate that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.

Eurasian Economic Union - Armenia, Belarus, Russia, Kazakhstan, Kyrgyzstan
EMC - Declaration of Conformity, number: ЕАЭС № RU Д-GB, МЮ62, В.03417
Safety - Certificate of Conformity, number: ТС RU C-GB, МЮ62, В.05220
Metrology - (pattern approval) Kazakhstan only
- Registration number KZ.02.02.05735-2017
- Certificate number 14317

European Union
Meets the intent of the following directives:
2014/34/EU - ATEX
2014/30/EU - EMC
2014/53/EU - RED
Marking: ◆
[See EU Declaration of Conformity below]

Malaysia
Radio – SIRIM approval number: RAOS/29A/0218/S(18-0340)

Singapore
Radio – IMDA
- Registration number: N3930-17
  Marking: Complies with IMDA standards DA105282

Trinidad and Tobago
Radio – TATT reference 2/2/1/1948/6

USA certification
SGS North America - Intrinsically Safe
- Certificate number: SGSNA/17/SUW/00281
  Marking: CLASS I, DIV 1, GP ABCD, T4, Tamb = -50°C to +75°C, IP67
- Ordinary Location Certification
  Certificate number: SGSNA/17/SUW/00259
  Applicable standards: UL 61010-1

WARNING:
POTENTIAL ELECTROSTATIC CHARGING HAZARD
USE ONLY WITH APPROVED POWER SOURCE
CONTAINS MAGNETS
SEE INSTRUCTIONS

Radio - The antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Marking: Contains FCC IC: SJC-ETERNA2

EMC - Compliant with FCC/CFR 47 Part 15: 2016 with reference to ANSI C63.4:2014, Class A
EU Declaration of Conformity

We,
Permasense Ltd
Alexandra House
Newton Road
Manor Royal
Crawley
RH10 9TT, UK

declare under our sole responsibility that the product,
ET310 WiHART wireless mesh, corrosion monitoring sensor

is in conformity with the relevant Union harmonisation legislation:
- Electromagnetic compatibility directive (EMC) 2014/30/EU
- Radio equipment directive (RED) 2014/53/EU
- Equipment for explosive atmospheres directive (ATEX) 2014/34/EU

The following harmonised standards and reference standards have been applied:
EMC: EN 61326-1:2013, including radiated emissions to CISPR 11:2009 + A1:2010 Class B

RED: EN 300 328 v2.1.1
EN 301 489-1 v1.9.2: 2011 in accordance with EN 301 489-17 v2.2.1:2012 with reference to:
   - EN 61000-4-2:2009
   - EN 61010-1:2010

ATEX: EN IEC 60079-0:2018
EN 60079-11:2012

ATEX notified body:
SGS Baseefa Ltd (notified body number 1180) performed a EU-type examination and issued certificate number Baseefa17ATEX0062X with coding 2 II 1 G, Ex ia IIC T4…T2 Ga

Signed for and on behalf of Permasense Ltd.

Dr Jonathan Allin – Chief Technical Officer
Crawley, UK – 1st May 2019