This guide details the installation process for ET410 WiHART sensors. It assumes the user is familiar with the operation of the IK220 installation kit.

Refer to User guide – IK220 installation kit for more detailed usage instructions.

Refer to Overview – ET410 WiHART system deployment for the full list of system documentation.

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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 in the relevant datasheet for restrictions on safe installation.

Only fit approved Permasense BP10, BP10E, BP20 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 with an antenna separation distance of at least 20cm (8”) from all persons.

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

Compatibility

ET410 WiHART sensors can be used in networks with other WirelessHART devices, including Permasense ET210, ET310 and WT210 sensors.

Technical background

Permasense systems are corrosion monitoring solutions for use in oil and gas and other industrial facilities using permanently installed ultrasonic wall thickness measurement sensors.

An ET410 sensor requires no couplant and is held against the surface of the pipe using a low force produced by its internal magnet and the securing strap. Multiple sensors can be attached to a pipe using a single strap. The ET410 sensor is not intended for use on painted pipes.

Once correctly installed the sensor creates ultrasonic waves in the surface of the pipe which travel through and reverberate in the pipe wall. One or more echoes are seen in the received signal. The thickness is calculated from this signal.
Once a sensor is installed, it will communicate with the gateway specified during installation, and any other sensors already installed that are assigned to the same gateway. These sensors form a wireless mesh network. The gateway manages this mesh, selecting the best path to transmit data from each sensor to the gateway. The gateway then delivers this data to the Permasense database. Data from all sensors can be viewed by the end user via the Permasense Data Manager browser interface.

Installation requirements

Before sensor installation:

- Emerson Smart Wireless gateway must be installed.
- Network ID and provisioning information (join keys) for the gateway must be known.
- Access to the sensor locations must be in place.
- If lines are insulated, all insulation must be removed at sensor locations to allow suitable access for sensor installation.

Required hardware

(supplied with Permasense ET410 sensors and power modules)

- Permasense ET410 sensor, complete with protective cap
- Lanyard kit, comprising 2m of 316 stainless steel lanyard with looped end and cable lock
- Strap kit, comprising strap, strap tensioner and buckle
- Permasense BP20E power module, one per sensor
Required tooling
(supplied in the Permasense IK220 Installation Kit)

- Rugged tablet PC, preloaded with Permasense installation software
- CC21 USB powered commissioning communicator
- Strap tensioning tool
- Ratcheting wrench with 17mm socket
- 17mm spanner
- Pliers
- Tin snips
- Hammer, ball-pein, anti-spark
- Hex key, 2.5mm, for power module retaining bolts

Optional tooling
(not supplied by Permasense)

- Permanent marker
- Adjustable slip joint pliers

Task 1. Mounting the sensor

Note: Two people are required for this operation. PPE of gloves and safety goggles or full face mask are recommended.

1. Identify the location where the sensor is to be fixed. The securing strap can be installed over the cladding or around the pipe. Remove a suitable section of cladding and the underlying insulation. If the strap is to be placed over the cladding, remove a circular section of the cladding with a diameter of 100mm ±10mm and core the insulation to expose the pipe.

2. Cut a length of strap by wrapping it around the pipe and adding 50cm [20”]. As a rough guide, if the diameter is D cm / inches, the length can be approximated by \((3 \times D + 50)\) cm or \((3 \times D + 20)\) inches.

3. Clean the area of the pipe where the sensor will make contact, mainly to remove any particles which might keep the transducer away from the pipe surface or damage the face of the transducer. A permanent marker may be used to show exactly where each sensor is to be placed on the pipe.

4. Remove the protective cap from the sensor. **Note:** Ensure tools and fastenings are kept away from the sensor when the cap is removed as a strong magnetic field is unleashed.

5. Carefully place the sensor in the required location on the pipe. One person will need to hold the sensor until the strap is in place and under tension. Note that the magnets used in the sensors have a high pull force. To avoid damage, and to get the precise location for each sensor, initially place the sensor at an angle to the pipe…
... and then gently lower onto the pipe.

6. Taking the strap tensioner, loop one end of the strap under the spring and through the slot in the ‘L’ shaped bracket, leaving a tail of about 15cm [6”]. The tail must be on the side away from the spring.

7. At the ‘L’ shaped bracket, pinch the ends of the strap together with pliers.

   **Note:** The nut should be at the end of the thread of the bolt in the strap tensioner before looping the strap through the tensioner.

8. While one person is holding the sensor in the desired location, the other person should loop the free end of the strap around the pipe and through the strap slot in the sensor. Feed the strap end through the buckle, with the buckle ‘ears’ facing towards the strap tensioner, and then through the other slot in the tensioner.

9. Position the tensioner so that it is as close as possible to the sensor while both ‘L’ shaped brackets are still in contact with the pipe and pull the end of the strap away from the pipe, until it’s tight.

10. Feed the strap through the tensioning tool and hold the tool perpendicular to the pipe. Ensuring the strap is flat and in-line around the pipe, remove the slack by turning the handle on the tool to tension the strap until the spring is nearly fully compressed.
11. Push the tensioning tool towards the sensor folding it against the pipe. Release the strap using the black handle on the tool while keeping the strap towards the pipe.

12. Hammer the loose end of the strap flat against the pipe.

13. Cut the loose end of the strap just short of the sensor and thread it through the buckle.

14. Move the buckle up the strap until it’s 2cm from the strap tensioner or until it’s touching the pipe, then fold the loose end of the strap back across the buckle towards the tensioner.

15. Hammer the strap flat against the buckle,
… and then while supporting the strap, hammer the buckle ‘ears’ flat against the strap.

**Note** that pre-bending the buckle ears with adjustable slip joint pliers can reduce the strike force required to then hammer the ears flat against the strap.

16. Crop the loose end of the strap to about 2 cms, then turn the end inwards with pliers to conceal the sharp end of the strap.

17. Ensure the strap is still flat and in-line around the pipe, and the sensor is perpendicular to the pipe. Then, using a ratcheting wrench and spanner at each end of the tensioner bolt, tighten the tensioner until the spring is fully compressed. A gap of at least 1 cm should remain between the two ‘L’ shaped brackets.

**Note:** It can be easier to tighten the bolt head than the nut.

18. Ensure the sensor is firmly fixed and sitting perpendicular to the pipe.

**Task 2. Fitting the lanyard**

1. Wrap the lanyard around the circumference of the pipe, on top of any cladding. The 2m (7ft) length will accommodate a maximum diameter of 20”. When it is not possible to wrap the lanyard around a pipe, find an alternative attachment point for the lanyard.

   - For pipes exceeding 20” in diameter, lanyards may be linked together.
   - For sensors in close proximity to each other, a single lanyard may be used.

2. Thread the bare end of the wire through the loop in the lanyard to secure it to the pipe.

3. Feed the end of the lanyard into the cable lock and push the lock up the lanyard.
4. Feed the end of the lanyard through one of the slots in the strap tensioner …

5. … then through the strap slot of each sensor and into the return hole of the cable lock.

6. If the heatshield is to be installed later, secure it to the lanyard or sensor strap with a Nylon cable tie.

   **Note:** The lanyard wire can be released from the ‘lock’ using the release key.

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**Task 3. Provisioning the sensor on the radio network**

1. Provision the sensor to join the gateway using the 200 series installation tool

   Refer to User guide – IK220 installation kit for detailed instructions. A summary of the steps is given below.

   ![Provisioning Screen](image)

   1. Enter network ID and Join Key
   2. Click Provision
   3. Check sensor can hear the network

2. Record the installation location, sensor ID, MAC address of the sensor, and power module serial number.
Task 4. Completing sensor installation

In the installation app software on the Installation tab

1. Press the Start button. Wait for an Ultrasonic waveform to download from the sensor.

   **Note.** Waveforms are automatically downloaded every 10 seconds. When a new waveform arrives, the lines briefly become thicker.

2. Check the quality of the waveform. The first one or two reflections must be well defined above the noise. Only one reflection is needed to calculate a thickness. If the signal is poor, move the sensor to a slightly different position and wait 20 seconds before assessing the waveform quality for the new location.

3. Check the measured thickness displayed is inline with expectations.

4. Press the Complete button. Verify that the Install State is Off and Installed is ticked in the footer of the application.

5. Cut off any unnecessary strap.

6. Remove the CC21 and fit the power module, tightening the two power module retaining bolts.

   When the power module is fitted, the sensor will restart and try to join the WiHART gateway. In a large network of 100 sensors this can often take 2 hours, and sometimes up to 6 hours.

   ![Image](image.png)

   Refer to *Installation guide – BP series power module*.

Sensor installation is now complete.

Task 5. Sealing the cladding

1. Re-pack the cavity around the sensor with insulation.

2. Take the heatshield and slide it around the sensor legs. Bend the heatshield to form it as closely as possible to the curvature of the cladding.

3. Drill through the holes in the heatshield and through the cladding.

4. Put a generous bead of sealant around the rim of the circular hole in the cladding push the heatshield down onto it.

5. Fix the heatshield in place with suitable pop rivets or screws.

6. Apply further sealant where necessary to ensure the sensor and cladding are well sealed.
Re-installing a sensor (if required)

If a good ultrasonic signal is not being sent by the sensor, it can be reinstalled:

1. Attach the CC21 to the tablet PC and the sensor and run the installation app.

2. On the Installation tab, press the Reset button and then follow the instructions described in Task 4. 
   **Note.** The sensor will no longer join the network until the Complete button is pressed again.

3. If the sensor has to be moved, the strap may have to be cut and replaced with a new length. Follow the instructions described in Task 1 as for a new installation. Where possible, leave the lanyard in place to prevent a hazard should the sensor fall.

Re-provisioning a sensor (if required)

A sensor can be re-provisioned, if required to assign the sensor to a different gateway, without needing to physically reinstall the sensor:

1. Remove the power module and attach the CC21 to the tablet PC and the sensor and run the installation app.

2. On the Provision tab, enter the new provisioning information.

3. Click the Provision button.

The Join Network button can be pressed to start the sensor join process and receive on-screen feedback about the join state of the sensor.

**Note.** Although the join process often takes just a few minutes, it can take several hours depending on the size and activity of the network.

See *User guide – IK220 installation kit* for more details about using the status bar to identify the join state.

Maintenance

The ET410 sensor is a sealed unit with no user serviceable parts.

See *Installation guide - BP series power module* if the power module requires changing.