



Food  
Beverage  
Dairy  
Pharma



Windridge  
Sensors

[www.WindridgeSensors.com](http://www.WindridgeSensors.com)

## Keyhole Sanitary Sensors

**Innovative RTDs and thermocouples  
for continuous in-line and batch  
sanitary processes**

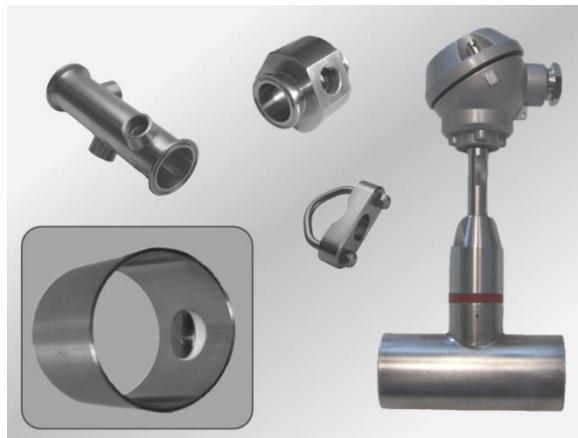
Keyhole Sensors can make measurements where traditional sensors cannot, and offer unique new measurement opportunities for demanding applications.



US Patent  
Approved

## Keyhole™ Sanitary Sensors

### Innovative RTDs and Thermocouples for Continuous In-Line and Batch Sanitary Process Temperature Measurement



#### Measuring where other sensors cannot

Keyhole sensors are unique in the way they are inserted into the process without a traditional tee or elbow. This enables them to measure temperature in places conventional RTDs or thermocouples cannot.

#### Difficult Products & Processes

High viscosity & difficult to clean & High pressure. Low obstruction

#### Difficult Locations in the Process

Long straight runs, vertical runs, bends. On top of a pipe or vessel, at the bottom or anywhere in between. Small bore pipes. All without compromising hygienic performance.

#### Difficult locations in the Flow

Measuring at the edge of the flow is very difficult with traditional

#### Superior accuracy

Isolation from the pipe wall and short immersion length means can make very low thermal mass tips which enable point measurement and fast thermal response.

#### No More Instrumentation Dead-Legs

In response to the need for ultra clean process measurement capability, Windridge Sensors has introduced a revolutionary new line of sanitary temperature sensors and fittings that can be inserted into processes without creating pockets, crevices or process "dead legs" that trap product during processing. This results in reduced CIP trouble spots and lower BioBurden risks compared to traditional RTDs.

#### Any Orientation

The lack of any process dead-leg also allows Keyhole sensors to be installed in any orientation – pointing up, down, 45°, vertical or horizontal – and in almost any location according to the space available without impacting their hygienic performance.

#### High Pressure Operation

Because of the unique way that the Keyhole seal works, the sensors are also excellent for higher pressure environments. All models operate leak-free up to 750psig (50Bar). The Small Bore units operate as far as 3,000psig (200Bar).

#### New Measurement Capabilities

The Keyhole sealing mechanism not only allows for ultra-clean insertion, it also enables further measurement capabilities not possible with other sensor designs:

#### Low Flow Obstruction:

By replacing the standard center-reach probe with a simple domed profile, the entire immersed portion of the sensor can be reduced to a protrusion of less than 1/4" (6mm). This minimizes obstruction of the product flow, reducing pumping pressures as well as damage to any larger particles in the flow.



#### Edge Measurement:

The Low Flow Obstruction tip profile also enables the sensor to measure the product temperature near the pipe wall. The thermal isolation of the Keyhole probe from the pipe wall allows a more accurate measurement of the

product than conventional sensors that mount on the exterior surface of the pipe wall.

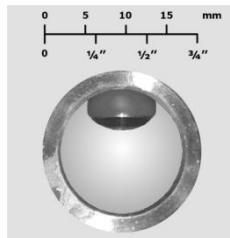
This is particularly important for products with laminar flow patterns, where there can be significant temperature differences between the edge and the center of the flow. Modern thermal processing technologies can also result in a cold zone being at the edge of the flow rather than the center, requiring the critical control point measurement to be near the pipe wall.

#### **Tank or Vessel Installation:**

The Low Flow Obstruction tip profile style of probe can also be used for measuring product temperature adjacent to the internal wall of a batch processing tank or vessel. The very short immersion depth required for the probe avoids interference with any rotating agitator blades, while remaining thermally isolated from the temperature of any heating jacket on the vessel.

#### **Small Bore Installation:**

Because traditional RTDs require a minimum insertion depth to maintain their accuracy, their size becomes a greater proportion of the pipe size the smaller the pipe becomes. Using the Low Flow Obstruction tip design, Keyhole sensors can be made to fit pipe sizes down to 0.5" ID with minimal obstruction.



#### **Multi-Point Measurement:**

Advanced thermal processing techniques such as microwave, RF and ohmic heating can produce very different product thermal profiles to traditional heat exchangers. Determining this radial temperature profile is necessary for proper process operation and validation.

Thermal profiles can be measured by Keyhole Multi-point probes. These are constructed from ultra-thin 0.060" (1.5mm) diameter stainless steel probe tips equipped with multiple

thermocouples to simultaneously measure at multiple points across the product flow. Use of an ultra-thin walled probe minimizes heat conduction between adjacent measurement points and increases the accuracy of each reading. The probe tip can be curved in the direction of the flow to reduce the risk of fouling.

Single-point probes using miniature thin-film PT100 elements are also available in this tip style.

#### **Case Studies**

Windridge Sensors has partnered with several commercial food processors, equipment manufacturers and research institutions to solve specific temperature measurement problems:

#### **Reducing Process Bioburden**

A global producer of sanitary non-woven fabrics wanted to eliminate the dead-legs created by conventional RTDs in its process. By simply replacing the old RTDs and pipework tees with Keyhole sensors, the company was able to cost-effectively remove those dead-legs and improve the overall sanitary performance of the process.

#### **Microwave Thermal Processing**

A leading equipment manufacturer wanted to understand the thermal profile of food products such as vegetable and fruit purees at different points during microwave aseptic sterilization.



The Keyhole Multi-point probes were mounted at various locations in the process to measure the difference in heating across the radial flow profile.

Keyhole sensors were able to measure the location of the critical cold spot previously only available through theoretical calculations. The company was also able to understand the radial temperature distribution of the flow with

different product types, enabling them to rapidly fine-tune their process for each food.

### Particulate food processing

A major commercial food processor wanted to test a new recipe in a small-scale pilot plant prior to finalizing the design of a full-scale plant. However the recipe called for solid particles of food the same size as the radius of the pilot plant pipe. These food particles were being destroyed by conventional RTDs extending across the flow as well as causing line blockages and high operating pressures.

By deploying Keyhole small-bore "mini" sensors with a low-profile tip, the company was not only able to process all the food particles intact, but was also able to reduce the overall pumping pressure due to the lower obstruction created by the Keyhole sensors.

### Customized Fittings & Probes

Windridge Sensors produces many custom fittings for clients, who either have restricted physical space in which to place a sensor, a need for multiple sensors in a single location, or specialized pipe dimensions.



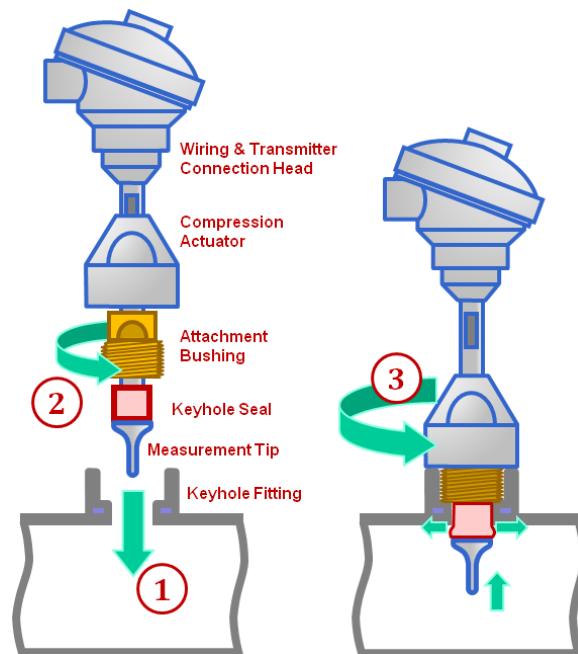
Please call us if you have any unusual needs. We are well practiced in resolving challenging applications.

### Proven Innovation

Although new to the market, the Keyhole technology has been fully proven within an international food manufacturer over many years. Windridge Sensors acquired the license to market the technology worldwide in 2007, and now holds US and International patents for the mechanism.

### How It Works

Keyhole Sanitary Sensors use a patented hygienic seal. Instead of a conventional compression-type fitting where a seal is squeezed between two opposing faces, the Keyhole seal works by having a cylindrical seal that expands radially when compressed axially. That is, when the seal is squeezed in one direction, it expands in the other to fill a hole in the pipe or vessel wall. See Below:



**Step 1:** insert the Keyhole Probe through the Fitting into the hole in the pipe wall.

**Step 2:** attach the Probe to the Fitting using the threaded Bushing.

**Step 3:** slide the Compression Actuator over the top of the Bushing and tighten it. This draws

the probe tip back towards the Bushing, compressing the seal and forcing it to expand outwards against the wall of the hole in the pipe and Fitting.

Because the Attachment Bushing is made of thermally insulating PEEK, the probe is isolated from the pipe or vessel, increasing the accuracy

with which it can measure the product temperature.

Other construction features further enhance the measurement performance by eliminating most Stem Conduction losses normally associated with RTD measurements.