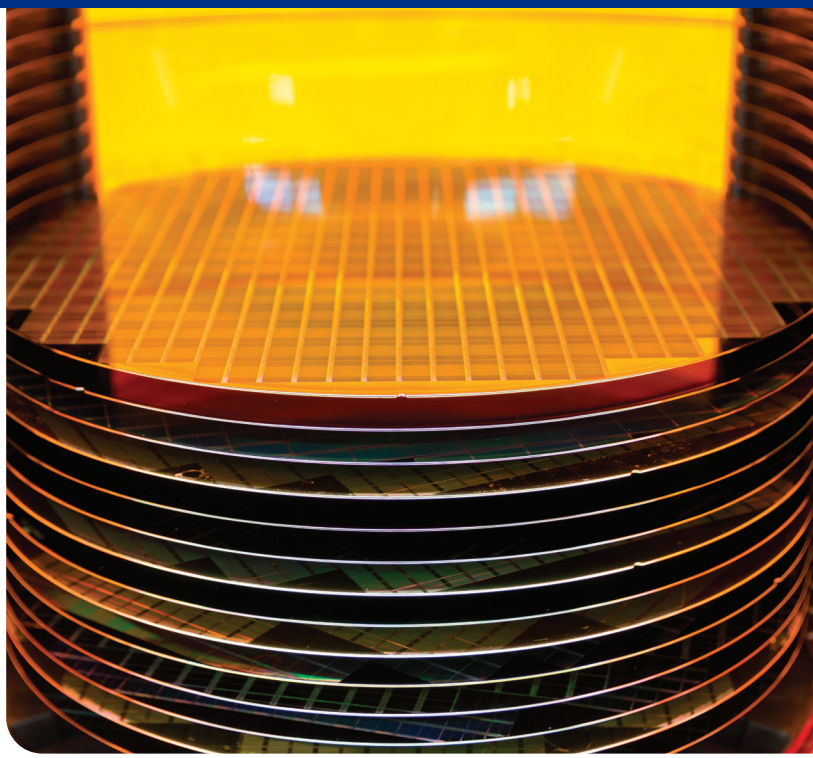
LeakDefender™ Thermocouples

for the ASM® EPSILON® Reactor



Real-time gas monitoring to minimize wafer loss and maximize thermocouple life

Hydrogen gas leaking through the quartz thermocouple sheath is an early-warning sign to stop and change a thermocouple before more costly damage occurs; or safety of personnel, equipment or product is compromised. These leaks can lead to:

- Operator safety concerns resulting from process gases leaking out and atmosphere leaking in
- Wafer yield loss due to surface defects
- Damage to the tool that can lead to premature chamber change and potential tool explosion
- Costly unscheduled tool downtime

Conax Technologies' new LeakDefender™ brand thermocouples are used to monitor the quartz sheaths for gas leaks in **real time** and allow for fast shut down of the reactor. This minimizes or completely eliminates wafer yield loss!

Typical LeakDefender™ brand thermocouples with gas sensing tubes

LeakDefender™ brand thermocouple benefits

- **Lower tool Cost of Ownership (CoO):** Real-time leak detection ensures faster leak discovery, limiting loss to a single wafer.
- **Improved yield:** Surface defects caused by leaks are reduced to minimize scrap wafers.
- **Reduced process variation:** Atmospheric leaks that cause excessive chamber coating and power disruption are prevented, reducing the need for adjustments to power offsets.
- **Reduction in unscheduled downtime**: Early detection of atmospheric leaks prevents premature chamber cleans.
- **Increased tool and cleanroom safety:** Localized leak detection occurs earlier than with cleanroom H2 detectors, preventing hydrogen chloride leaks from corroding external hardware.
- **Seamless integration with system controller:** Thermocouples connect directly to OEM-provided user digital input.
- **Proven technology:** Hydrogen gas detectors are widely used in the EPSILON® H2 monitoring system.
- **One-shift installation:** The 6-hour installation and 2-hour calibration and testing can be completed in a single day.
- **Cost-effective protection:** The cost is less than a single scrapped device wafer, and off-the-shelf components eliminate the need for special equipment.
- **Center TC monitoring:** The Center TC is most prone to premature sheath failure. The LeakDefender™ brand Center TC monitoring line leaves the rotating assembly through a special **slip ring assembly**.

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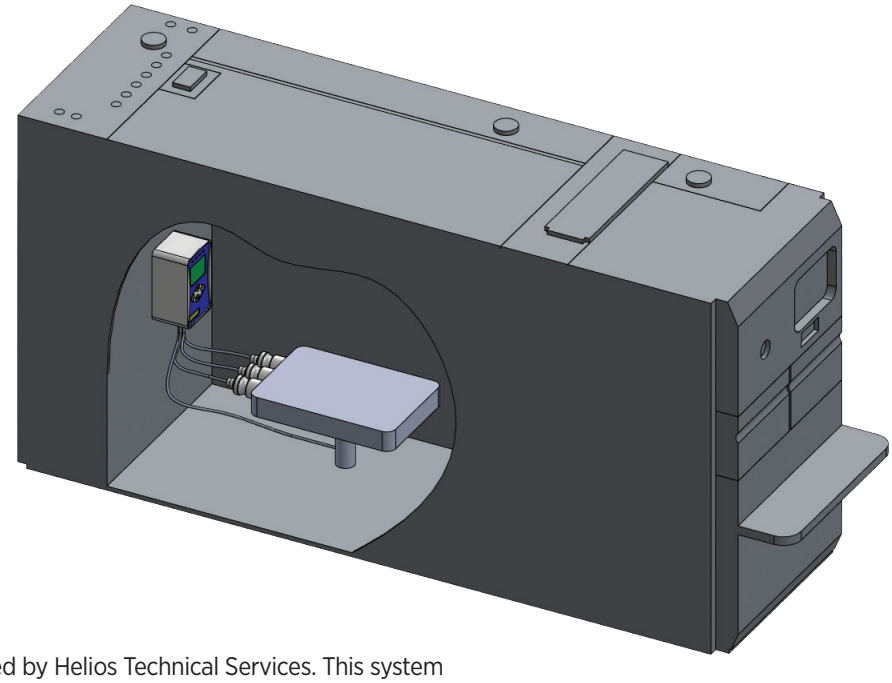
LeakDefender™ brand thermocouples for the ASM® EPSILON® Reactor

Typical reactor schematic

Depending on process chamber type, a typical reactor has two or three LeakDefender™ thermocouples installed in the horizontal orientation and one LeakDefender™ Center thermocouple installed in the vertical orientation.

Gas monitoring lines exit each of the LeakDefender™ thermocouples and are routed into the TC Sentry System™ gas monitor. If a premature thermocouple sheath breach condition occurs, this in-situ monitoring system will detect the leak and prevent product loss and major unplanned maintenance events.



LeakDefender™ control outputs

The TC Sentry System™ gas monitor is manufactured by Helios Technical Services. This system is capable of detecting minute volumes of hydrogen and triggering one or more control outputs. The ultra-fast detection and response of the system will prevent product loss and contamination of items internal to the process chamber. Detecting a single premature thermocouple sheath failure can save significant time and money.

- **Shutdown or warning:**
  - Immediately upon leak detection tied to reactor user digital input
  - After current wafer cycle upon leak detection tied to reactor user digital input
  - After current cassette cycle upon leak detection tied to reactor user digital input
- **Signal sent to reactor on-board gas monitoring system upon leak detection**
- **Signal sent to Fab detection system upon leak detection**

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