Leap Industrial Grade Wireless Wafer Temperature Sensor Wireless 9 RTD & PRT Sensor Transmitter for Silicon Wafer Processing Ovens

Wireless Temperature: Wafer Temperature Sensor

Applications

- Temperature gradient monitoring
- Silicon wafer temperature monitoring
- Precision temperature monitoring of multiple points
- Temperature chuck testing/verification
- Paint and coatings curing
- Temperature profiling over a surface

Special Features

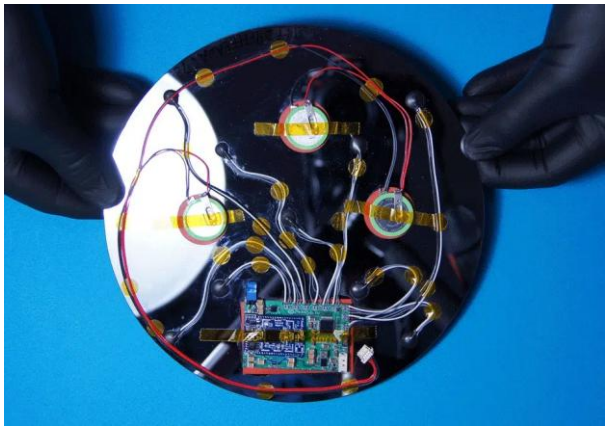
- Sensor transmission range of 1,100 ft. in open air at full power
- Configurable to power and transmit any PRT or RTD sensor type
- Edge computing for small, actionable data
- Configurable sample and transmit intervals to fit many application requirements
- Simple integration into existing Leap Sensor systems
- Transceiver nodes factory preconfigured to pair with new or existing gateway for simple integration – up and running in 5 minutes

Description & Product Highlights

This unique Leap wireless sensor attaches to the top of a silicon wafer for fabrication process monitoring. It is less than 5mm thick, so it fits in wafer processing ovens and other critical fab equipment. The sensor has 9 ultra-small, high-accuracy RTD sensors that are adhered to the surface of the wafer, giving you better accuracy than a wireless thermocouple wafer sensor.

- The entire sensor is rated to operate up to at least 125ºC (257ºF).
- Readings as fast as every 10 seconds for each of the 9 sensors.
- Field replaceable batteries.
- Data logging capability when the transceiver node is not linked to a gateway.
- 3-wire RTD connection supports long cables (if needed) while maintaining temperature accuracy during rapid heating.

The Leap Wafer Sensor RTD Temperature Transceiver Node is ideal for any remote temperature monitoring application that requires a high level of precision and accuracy with 2 to 9 high precision temperature probes. User configurable sample and transmit rates as well as event triggered rapid sampling conditions give the user powerful insight to prevent failure conditions from unevenly heated wafer material.



200 mm LEAP Wafer Sensor
For Semiconductor Processing Oven Monitoring

The Leap Sensors wireless sensor system greatly reduces the cost and complexity by eliminating the laying of cables between sensors inside ovens and data acquisition units. Wireless communication is much better suited for small, actionable data to trigger alerts. This is particularly helpful to track the temperature interaction of semi-concuctor wafers on moving hotplates. A single RTD circuit board allows for remote monitoring of up to 9 different temperature points on high-value equipment and product.

Ease of implementation
All Leap Sensors device nodes come pre-configured and paired with selected Leap Sensors gateways for quick and simple integration into an existing Leap Sensors system, or to function as a new stand-alone system.

Real-time data viewing and alerts
All Leap Sensors nodes stream data to Leap Sensors gateway devices at configurable intervals. This data is accessible and viewable in real time. In addition to real-time viewing and graphing of sensor parameters, alerts based on any sensor condition are configurable, and can be sent via phone call, email, or text for instant communication of a sensor reaching an alert condition. Data is logged as well for later viewing or downloads for analysis.

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Wireless Wafer Temperature Sensor Specifications

This highly versatile industrial sensor supports 9 miniature, low-mass precision RTD temperature sensors connected to one small, thin high-temperature transmitter.

Designed Specifically for Silicon Wafer Processing Applications

- **High-value ROI:** Especially for a wafer sensor that can be maintained and last a long time.
- **Less than 5mm thick**: Electronics, battery, and all other components are designed to fit in a standard fab oven and other wafer processing equipment. Optional silicon sheet insulator between the wafer and electronics adds 0.75mm.
- **Circuit board size:** 1.45 x 2.20 inches (37 x 56mm).
- **High temperature:** Electronics and battery operate continuously up to 125ºC (257ºF). Contact us for higher operating temperature options using our insulating enclosure option.
- **Rapid temperature sampling rate:** Each of the 9 sensors can be read every 10 seconds.
- **Real-time data:** Wireless transmitter and onboard antenna can send updates every 20 seconds – even when the wafer is in a closed oven.
- **Data logging** (when needed): If the sensor loses communication with the gateway, the sensor writes the time-stamped data to memory.
- **Splash-proof:** Electronics do not have an enclosure, but they may be conformal coated make them splash-resistant.
- **Full wafer coverage with 9 sensors:** Sensors are typically placed 4 along the edge, 4 in the middle, and 1 in the center.
    - Customized sensor placement – Let us know if you want your sensors located in different places. We will ship the wafer to you "ready to go".
    - Available on all wafer sizes. (200 mm wafer is shown If a component gets damaged, contact us for a quick repair.

RTD Specifications

- Low mass:
    - Thin-film DIN Class A.
    - Size: 2.3 x 2.1 x 0.9 (thick) mm.
    - Rated for temperatures between -50 and 500°C (-58 to 932°F). However, Class A accuracy is assured between -30 to 300°C (-22 to 572°F).
- **3-wire RTD:** the sensor utilizes a 3-wire configuration to the RTD sensors. The electronics measure and compensate for changes in wire resistance over temperature changes.
- **Long cable lengths to sensors:** The 3-wire RTD temperature sensor design facilitates long cable lengths to the sensors (if needed) while maintaining temperature accuracy.
- Temperature accuracy:
    - Contact us for application-specific estimates on accuracy.
    - Typical: +/- 0.4C from 25ºC to 120ºC.
- **Sensors connect to main circuit board** with wire soldered to the sensor and to the three through-holes on the circuit board.
- **Other RTDs** can be connected to this board. Contact us for more information.

Sensor Electronics and Battery

- **Small, thin electronics board:**
    - 2.2 X 1.5 inches (5.6 x 3.8 cm)
    - Less than 5mm thick.
- **Electronics operating temperature**:
    - Standard operating temperature: Battery and electronics can operate up to **125ºC, or higher. (H**igher operating temperatures are available using enclosure– contact us.)
- **Optional additional on-circuit-board temperature sensor**
    - 3-Wire RTD – electronics measure wire resistance to the sensor and compensate for changes in wire resistance over temperature to maintain accuracy over a wide temperature range.
- **Fast temperature sampling time interval:**
    - Fastest sampling rate for 9-RTD temperature sensors – all 9 sensors every 10 seconds.
    - Data is typically data-logged with a time stamp on the sensor processor, then transmitted every 20 to 30 seconds.
    - Sampling options as slow as one sensor reading per day.
- **Data logging:** When a gateway is not in range, sensor will act as a data logger, storing up to 10,000 time-stamped readings on board.
    - in the photo). Contact us with your needs.
- **Optional silicone backing:** The circuit board and batteries can be backed with a thin silicone sheet to reduce heat transfer into these components. This adds 0.75mm to the 5mm maximum height.
- **High accuracy RTD temperature sensors** – Class A sensors for high accuracy is our standard.
- **Miniature RTD Temperature Sensors** – low mass and fast response.
    - Adhered to wafer with epoxy. Can be replaced if needed.
- **Replaceable batteries** – long sensor life.
    - Field replaceable batteries – takes less than 1 minute.
    - Standard replacement batteries can be ordered off the internet.
- **Easily repairable** – assures your investment.

Leap Sensors® Wafer Sensor Specifications	
General Sensor Specifications	
PRT / RTD Inputs	Class A RTD standard
Sensor Range	30 to 300°C (-22 to 572°F) (calibrated, contact factory for custom cal. ranges)
Accuracy Typical:	+/- 1C. Verified at 3 points
Output units	Temperature in C, K, F
Power Specifications	
Battery Power	3 thin high temperature coin cells
Battery Life	5 years at 10 minute transmit & sample intervals
Power / Current Consumption	Low sleep current assures long life Typical Operating Current: 6mA - 30mA (depending on sensors) Typical Transmit Current: 40mA @ 10 dBm RX Current: 11 mA
Wireless Specifications	
RF Transmission Power	User configurable 0-20 dBm, factory configured to 10 dBm for wafer sensors
Wireless Transmission Range Open-Air	800 ft @ 10 dBm
Wireless Transmission Range Industrial Environments	150 ft @ 10 dBm
Range Extenders	Range extenders available to extend transmission distance
RF Communication Protocol	Internet protocol-based thread, IPV6LoWPAN, IEEE 802.15.4
RF Frequency and Modulation	2.4 GHz (16 Channels), DSSS provides higher noise and interference resistance
Data Security	AES 128-bit encryption with secure join and key exchange (J-PAKE)
Internal Electronics Features	
Operating Temp.	-40°C to 125°C for wafer electronics and batteries
Gateway Compatibility	Compatible with all Leap Sensor wireless gateways
Firmware	Over-the-air upgradeable via web interface
Certifications	FCC (USA), IC (Canada), others in progress
Gateway Communication	Send and receive (data, acknowledgements, updates, and device configuration). Data stored in node until confirmed write to database.
Power Switch	Wafer uses miniature jumper dongle
Internal Memory	110,000 time-stamped device readings stored on transceiver node if gateway does not acknowledge writing data to database.
Hardware Specs	
Weight	Electronics and batteries weigh approximately 35 grams in addition to wafer weight.
Printed Circuit Board Size	1.45 x 2.20 inches (37 x 56mm)
Node Antenna	Internal antenna built into electronics
Mounting Options	The circuit board and batteries can be backed with a thin silicone sheet to reduce heat transfer into these components. This adds 0.75mm to the 5mm maximum height. Option for higher temperature enclosure and optional heat sink for temperatures exceeding 125°C

Enclosure Option for Very High Temperature Wafer Applications

The Leap wafer sensor is rated to 125C. Going above 125C partly depends on the amount of time at a higher temperature. Short durations may be able to be tolerated, and it also depends on the source of the heat as insulators, enclosures and a heat sink can be included under our electronics to slow the transfer of heat.

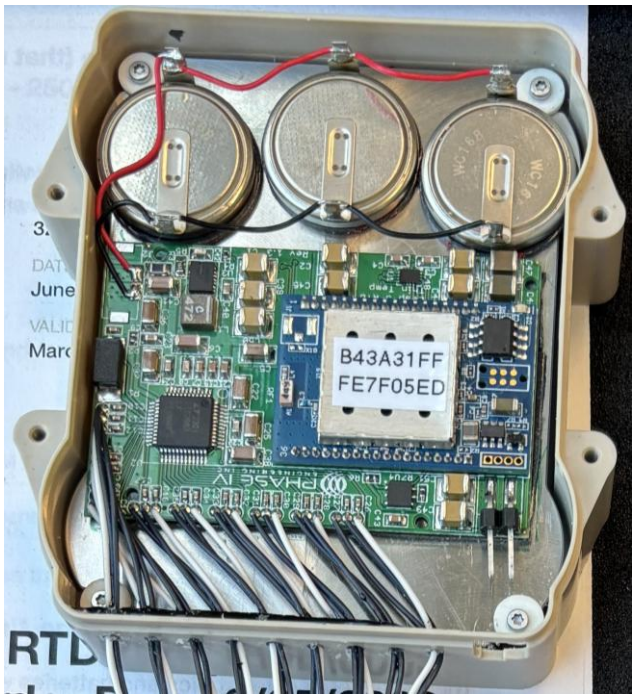
An enclosure is avaiable for the electronics to insulate the boards and batteries from heat and provide the ability to sense higher temperatures for short durations of time. However, this will significantly increase the thickness of the sensor, which may be a problem for applications where sensor height and/or weight is critical. A heat sink can be included inside the enclosure that keeps the electronics cooler for longer as well, but at the cost of additional weight. We can help with modelling this type of solution for individual application cases. Leap customers have used this type of solution for temperatures of up to 250C for as long as 10 minutes. WIKA IIoT engineers can determine the best option to meet the needs of your wafer monitoring application.

This unique Leap wireless sensor and enclosure attaches to the top of a silicon wafer for process monitoring. It is less than one inch thick, so it still fits in many wafer processing ovens and other critical fab equipment.The sensor has connections for 9 ultra-small, high-accuracy RTD sensors.

RTD connections maintain temperature accuracy during rapid heating.The sensor electronics and batteries are rated to operate up to 125C (257F). With the high temperature enclosure and heat sink, the system can withstand temperatures above 125C for several minutes, while protecting the electronics from getting above rated temperatures. Electronics, batteries, and heat sinks are sealed inside the custom-machined high temperature enclosure.

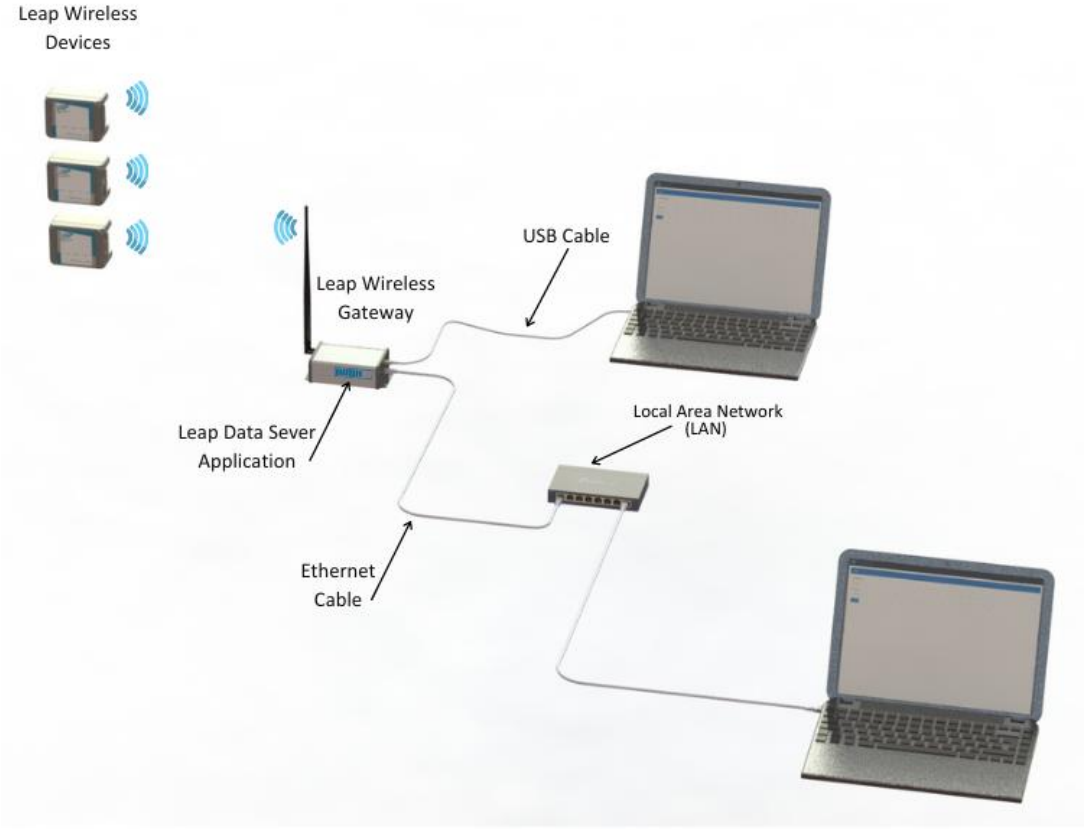
The sensor electronics can be turned off and on by a removable jumper dongle the fits snugly into the side of the enclosure. The enclosure can be opened to easily change the batteries inside when needed.

High Temperature Enclosure



Interior View of Enclosure

Typical Local Data Architecture



Software Options for the Leap Sensors® System

The Leap Sensors system is designed to easily work with multiple software options. Keep your data in your gateway, easily integrate with your existing data systems or use our cloud-based LeapSensorManager software. The choice is yours.

- Add new transceiver nodes
- Configure transceiver sensor nodes – sample and transmit intervals & other special configurations.
- Set email, text, and telephone alerts.
- Graph data.
- Download data to a csv Excel file.
- Pass data to other software via Modbus or our API
- Give permissions to others to access the software.
- Customize your data presentation with a configurable Leap Dashboard.