

Phase IV's Breakthrough Wireless Sensors: *Leap Sensors* Streamline the Development of Customized Industrial IoT Systems and Smart Products



Phase IV has nearly finished developing its most advanced, yet practical, industrial wireless sensing system ever.

With over 25 years of wireless sensor expertise through our contract engineering work, Phase IV has designed groundbreaking sensors for clients like NASA, Crane Aerospace, the US Army, as well as many Fortune 500 clients. Our innovative designs won us “**Sensor Engineering Team of the Year**” in 2015 and “**RFID Sensor Product of the Year**” in 2016.



We've taken what we've learned on these cutting-edge projects to create the Leap Sensors system: a highly configurable platform at a low-barrier cost.

It is a major leap forward in wireless sensing.

Leading-Edge Features of the Leap Sensor System

- **Designed to be customized:** The hardware, firmware, software, enclosure, and the “back-end” of our gateways are designed modularly – so we can *quickly and efficiently customize sensors* for a specific application.
 - Leap Sensors are the only wireless sensors that target customized designs that large IoT customers nearly always require.
- **Fast, inexpensive proof of concept:** A client can start with our demonstration kit. Once the requirements are field-proven, cost-reducing for high-volume production is easy.
- **Modular code base with thorough documentation means long product life cycle:** The Leap firmware design is structured to be maintainable.
 - The system can service a wide variety of applications over many years.
 - The Leap Sensor platform supports multiple protocols, transmitters, and sensors, which can be easily changed as technology evolves. We expect it to be positioned to stay on the leading edge for a long time.
- **Pre-configured systems that don't require an engineer to install:** A non-frustrating, easy first experience is critical to successful installations. Our systems are typically pre-configured at Phase IV so all the customer needs to do is turn-on the power switch and log into the software. See our [video demonstration](#) of installing a system in less than 5 minutes.



- **Highly adaptable gateway to deliver data “any way you want it”:** The gateway utilizes an advanced on-board web server – allowing users to interface the Leap network with a web browser and a password from any type of computer. The same web user interface, which supports a variety of operating systems, can be moved to a local server (to keep the data in-house) or to a cloud server.



- Unlike most wireless sensor companies, the Leap Sensor system is available without a required data plan – no SaaS and no recurring monthly fees.
 - Leap Sensors Cloud Server is an available option if a client does need a cloud interface.
 - The Leap Gateway is designed to be highly flexible in how it delivers the data to client’s application. The gateway “back end” is programmable and supports just about every physical layer including Ethernet, cellular modem, USB, RS232, Modbus, Iridium satellite modem, and many others. This greatly simplifies the integration of the Leap Sensor System to a client’s existing infrastructure.
- **“Infinite Range” – *Sensor Anywhere* options:** available with the latest Cat-M1 cellular connectivity. We offer cellular gateways and sensor-direct-to-cellular options. Iridium satellite connections are also available customizations.

- **One sensor module for multiple sensors means low cost and easy customization:** Because of Leap sensors’ modular firmware design, we can easily develop custom designs with multiple, various sensors. For example, a motor monitoring sensor may have a temperature, vibration, and amp clamp connected to one transmitter. Plus, no need to have a separate transmitter for each individual sensor keeps the per-sensor cost low.



- **“One-stop shop” for wireless sensors:** In addition to long-life battery-powered sensors, we invented battery-free RFID wireless sensing, and we offer the most advanced wireless data loggers.
- **Intrinsically safe (ATEX) customizations available:** Phase IV has experience with getting custom Leap Sensors certified as intrinsically safe.
- **Always on the leading edge:** Decades of customer feedback and wireless design experience: The Leap Sensor System is the culmination of years of working with clients to find the right balance with their needs and wireless technology capabilities. This experience results in an ideal balance of application problem solving and the latest wireless sensing technology.

Unique High-Value Technical Features

- **Direct Sequence Spread Spectrum:** DSSS modulation allows the sensor system to operate at the international 2.4 GHz band – but make it highly immune to interference. The DSSS modulation also facilitates a highly sensitive receiver that extends the read range and reliability.
- **Miniature sensors available:** Some applications require miniature sensors. Our miniature Leap sensor option package is *one square inch* – including an on-board antenna *capable of transmitting over 300 feet*.
- **High-temperature operation up to 120C:** The Leap Sensor is *the only* wireless sensor where the electronics and battery are tested and rated to operate 120C (260F). This allows them to operate in harsh food processing environments and industrial paint curing processes at elevated temperatures.
- **Interoperability with 6LoPan - internet and network ready:** Each Leap Sensor device has its own IP address and easily integrates into a network. The user interface is website based – so any device with a web browser can connect to the password-protected Leap system.
- **Trusted, standard protocol for high data security:** Leap Sensors use 6LoPan protocol that leverages the same TLS security protocol and AES packet encryption that banks use for highly secure over-the-internet transactions.
- **Thread-based user interface:** Leap sensors use the established Thread protocol that provides a standard user interface that can support repeaters, mesh networks, and other valuable options.
- **Edge computing capabilities:**
 - **High processing power at the sensor:** Powerful on-board microprocessor and high memory enables high sampling rate applications – such as compressor vibration monitoring for predictive maintenance. The sensor microprocessor can process the vibration samples on-board and transmit a frequency vs. g-force histogram/spectrum instead of transmitting thousands of data points over the air.
 - **High data efficiency for longer battery life:** Sensors can be configured to process data at the sensor and send wireless messages only when an alert is justified. This minimizes low-value data and reduces transmissions that affect the battery life.
- **Long transmission distance & high reliability:** High RF power increases the read range and wireless link reliability. Leap sensors are available with high output power and high receive sensitivity to achieve transmission distances of thousands of feet, when needed.
- **Support for all sensor types:** Modularly-designed hardware and firmware facilitate the integration of all sensor types – temperature, humidity, pressure, strain, vibration, etc.



- **On-board high-precision four-wire bridge for strain sensing and other low-signal sensors**, such as pressure sensors. Ideal for structural health monitoring and predictive maintenance.
- **On-board thermocouple sensor input**: Measure temperature extremes from -300C to +2000C with off-the-shelf thermocouples.
- **Sensor 2-way communication for configuration and reliability**: All sensor transmissions are acknowledged by the gateway with a 2-way communication link. The two-way link also facilitates over-the-air sensor reconfiguration and firmware updates.
- **On-board time-stamped data logging for extra reliability**: If a sensor does not receive a transmission acknowledgement from the gateway, the sensor will store the sensor data, with a time-stamp, in its memory. The sensor will transmit all the readings when the connection to the gateway is restored. This assures no data loss – even if a gateway is unplugged. The data logging can also be leveraged when moving sensors enter processes where radio communication is not possible – such as ovens or pressure vessels.
- **Sensor roaming capability**: Unlike other wireless sensor systems that require the sensor be assigned to one gateway, the Leap system allows sensors to “roam” from one gateway to another and still maintain 2-way communication. This is important in applications such as forklift monitoring in large warehouses.
- **Radio Power and antenna matching on-board diagnostics**: Leap sensors have on-board radio power and antenna matching diagnostics to assure maximum radio communication reliability.
- **Ultra-long battery life**: We leverage our experience with energy-harvesting battery-free RFID sensors to design ultra-low-power circuits that result in long battery life – 3-10 years depending on other factors in the sensor design. This makes our sensors *practically battery-freetm*.

Questions?

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