ColdStream® RF
Infrastructure

Wireless Temperature Monitoring Infrastructure

Cold chain management—the process of monitoring temperature-sensitive products moving from one partner or location to another—is a complex endeavor with many variables that can adversely affect quality, freshness and safety. When a load is exposed to various methods of transportation, multiple handoffs between receivers, and time spent in staging and/or storage, quality can be compromised through excursions in time and temperature. Electronic monitoring technology gives receivers a snapshot of a delivery's cold chain history, but requires labor to retrieve, download and interpret the data. Wireless temperature monitoring automates the data collection and download process, delivering accurate and comprehensive data for every trip.

Sensitech has taken the mystery out of wireless technology. The ColdStream® RF Infrastructure operates in a mesh-networking environment. The Infrastructure integrates the data collection and communication technologies necessary to automate the process of collecting and managing comprehensive time, temperature and location information in a reliable and cost-effective manner.

Benefits of Wireless Technology

- Wireless downloads automate data collection and communication for increased operational efficiencies—no monitor retrieval or data conditioning required.

- Comprehensive time, temperature and location information deliver a broader picture of the cold chain process.

- Secure, validated, centralized data management allows information to be shared among partners.

- Automated alarming and alerting improves quality, reduces waste and enables receivers to prioritize and focus resources appropriately.

- Tailored robust reporting facilitates sound decision making.

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SUPPLY CHAIN VISIBILITY

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TTRF Specifications

Monitor specification	Single use, ambient
Read Range	up to 100 meters (328 feet) line of sight
Frequency Bands	915 or 868 MHz
Temperature Measurement Range	-22ºF to +158ºF (-30ºC to +70ºC)
Battery Life	up to one year
Temperature Accuracy	±2ºF from -22ºF to 0ºF (±1.1ºC from -30ºC to -18ºC) ±1ºF from 0ºF to +122ºF (±0.55ºC from -18ºC to +50ºC) ±2ºF from +122ºF to +158ºF (±1.1ºC from +50ºC to +70ºC)
Memory Capacity	1,920 data points (2K)
Programmable Temperature Alarms	Single and cumulative time-out-of-range events
Display Current Temperature Readings	LCD factory-programmable option
Start-Up Delay	Configurable
Water Resistant Housing	NEMA 4; IP64 rated
Start & Stop Buttons	Color-coded, finger buttons for easy execution
Dimensions	4.25" L x 2.25" W x 0.86" H (10.80 cm x 5.72 cm x 2.18 cm)
Weight	3.1 ounces (88 grams)
Programmable Measurement Interval	Selectable
Primary Sensor Resolution	0.1º (1/10º) over full operational temperature range

Infrastructure Components

HARDWARE

TempTale® RF (TTRF) temperature monitors are part of Sensitech's family of precision devices designed to track and collect time and temperature data about temperature-sensitive shipments. These highly reliable, wireless monitors collect and store temperatures for a wide array of in-transit and storage applications. TTRF is designed with configurable time and temperature limits to trigger time-out-of-range alerts, along with an easy-to-read LCD screen for immediate shipment evaluation. Use our monitors to:

- Measure and store ambient temperature data at set intervals
- Set alarm limits
- Read information via LCD display
- Start or stop data collection using the front panel buttons
- Store and record location information when other ColdStream RF Infrastructure components are detected
- Operate within the 915 MHz or 868 MHz ISM band for efficient transmission in high water content product situations
- Leverage reader-talk-first mode—monitors will never transmit until they are in the vicinity of an active ColdStream Infrastructure component (i.e., an operational TTRF Gateway and/or TTRF Repeater); this mode is required for air transit

TempTale RF Gateway is an AC powered reader that is attached to the network via an Ethernet connection. The TTRF Gateway wirelessly communicates with TTRF monitors directly or through TTRF Repeaters. When a TTRF Gateway is shipped, its operating frequency band is set by country. The TTRF Gateway automatically chooses a channel within the band based on the current signal-to-noise ratio measured in each channel. The TTRF Gateway contains a firmware-based Ethernet controller that is assigned an IP address.

TempTale RF Repeater is an AC powered unit used to extend the area that is covered by the network. TTRF Repeaters pass signals between the TTRF monitors, other TTRF Repeaters and the TTRF Gateway. When a TTRF Repeater is first installed, it searches for the presence of a TTRF Gateway and establishes communication on the same channel as the TTRF Gateway.

TempTale RF Signpost is used at locations where it is not necessary to read data from the TTRF monitors. TTRF Signposts transmit a location ID and are typically used to mark the monitor's arrival and departure times at particular locations.

SOFTWARE

Remote Site Server (RSS) is a Windows®-based software agent that manages the activity of the hardware components to ensure that new TTRF monitors are read and downloaded when they are detected in the network. RSS forwards the downloaded data files via high-speed Internet connection to Sensitech's secure central data repository—ColdStream.

ColdStream is an internet enabled software application providing comprehensive and secure data management supporting the viewing, storing, retrieving, and analysis of detailed shipment (logistic) information and critical time-and-temperature data of temperature-sensitive shipments. ColdStream is designed and built to comply with 21 CFR Part 11 guidance, Annex 11 and Good Manufacturing Practices (cGMP) guidelines for electronic record keeping. Data access is tightly controlled via user permission profiles and selective access enabling receivers to share critical data efficiently across their own organization or with selected trading partners.

| RSS Requirements	
Operating Systems	• Windows® 7 Enterprise • Windows® 2008 Server
Internet Connection	• High Speed Required
Languages	• U.S. – English
Framework	• MS .NET Framework 3.5
Communication to ColdStream	• http, https via ports 80 and 443
Communication to TTRF Gateway	• TCP/IP via ports 4900-4904

How the ColdStream Wireless Infrastructure Works

Every receiving site is unique. For optimal performance, our experienced technical field teams conduct site surveys, which include receiving site layouts and sophisticated transmission testing to ensure high-quality read rates.

Outfitting small areas would likely consist of one TTRF Gateway. Larger areas, such as a distribution center with dozens of dock doors, would also include several TTRF Repeaters. For any location that is not transmitting data, a TTRF Signpost would be used to merely mark the monitor data with its location identifier.

When a TTRF monitor detects the presence of a TTRF Gateway, TTRF Repeater, or stand alone TTRF Signpost, the monitor records the facility's location identifier associated with that network, thereby providing time, temperature and location information.

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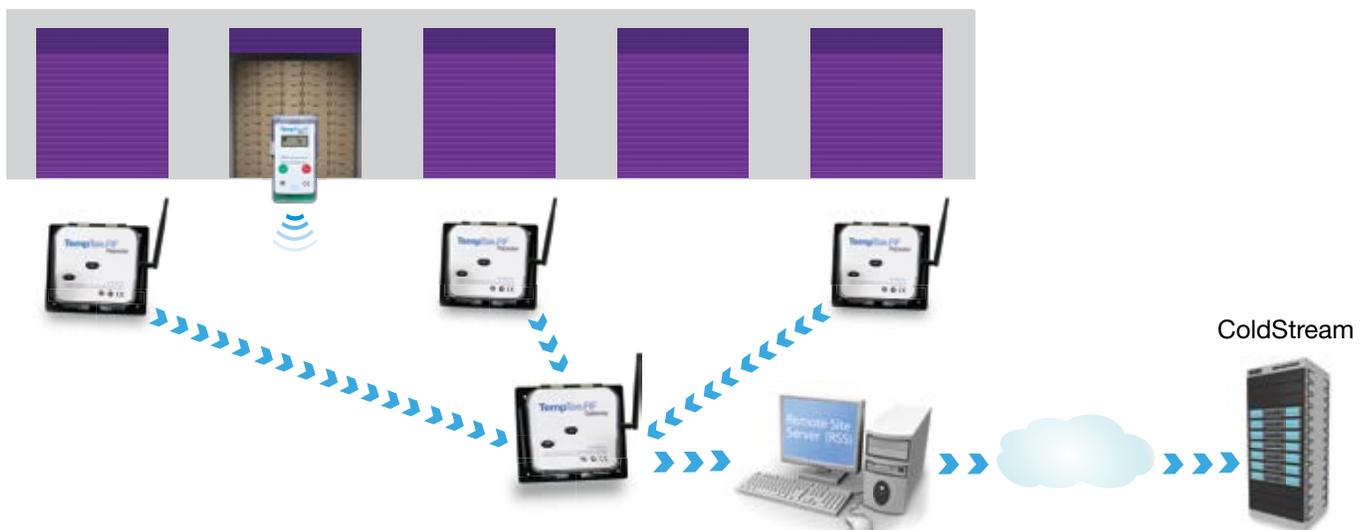
Your System Is Secure

Data is Safe from Tampering
- Data is in binary format
- Data is encrypted via TEA (Tiny Encryption Algorithm)

Infrastructure is Safe from Tampering
- ColdStream RF Infrastructure only accepts valid data packets
- TTRF monitors only communicate when asked, and only respond to a set list of ColdStream commands

Infrastructure Protects Your Systems from Interference
- Communicates only with other ColdStream components
- Can co-exist on wireless networks without interfering
- Has very low bandwidth requirements and will not overload your networks

SECURITY

Data within the ColdStream RF Infrastructure is safe from tampering. Monitor data is encrypted at the source with a TEA (Tiny Encryption Algorithm) and decrypted at the destination (on the TTRF Gateway). This algorithm provides basic protection from inadvertent viewing or hacking. In addition, the data downloaded from a TTRF monitor is in binary format which is not human readable. This provides an additional level of security from unauthorized data access.

Security has been integrated into the infrastructure level. ColdStream RF Infrastructure is designed to accept only valid packets with a known destination. In addition, TTRF monitors will only communicate with the ColdStream RF Infrastructure when asked and will only respond to a set list of commands.

The ColdStream RF Infrastructure is designed to not interfere with any of your existing systems. It cannot communicate with any devices other than ColdStream devices. The bandwidth requirement is very low and will not overload your networks. ColdStream RF Infrastructure is installed to ensure that it can co-exist with your wireless networks without causing any interference issues.