

*This Buyer's Guide is second in a series of papers designed to provide you, the perishable logistics and quality assurance professional, with information about current Cold Chain Monitoring technology. The first segment discussed the limitations of the traditional "strip chart" temperature recorders.*

Digital temperature recorders were introduced around 1990 and have evolved to eliminate many of the problems associated with old-tech strip chart recorders. Most digital recorders currently on the market utilize thermistor technology. Unlike the bi-metallic coil in strip chart recorders, a thermistor is a solid state electronic component that is sensitive to temperature. As ambient temperature drops, electrical current through the thermistor is slowed due to increased resistance. Warmer temps reduce the electrical resistance and allow more current through the thermistor. A simple integrated circuit measures resistance against a constant, and makes the temperature calculation based on that difference. Thermistor technology does not require any recalibration during its lifecycle and is accurate to 1/10<sup>th</sup> of 1 degree Fahrenheit in most applications.

Due to the wide range of temperature recorder applications, manufacturers have customized their recorders, product standards, interfaces, and desktop software packages for specific applications. While such customization is often essential, it has created a market environment in which cross-platform compatibility does not exist. Think Microsoft vs. Apple. A recorder from manufacturer "A" is NOT compatible with the desktop software from manufacturer "B" and visa-versa. Additionally, some units require use of proprietary cords, adapters, or other custom peripherals to download data from the recorders.

Some of the features available on digital recorders include LED "out of range" indicators, built-in LCD screens which display data summaries, range programming selectors, audible beepers to help locate the recorder within a shipment, and even Radio Frequency (RF) transmitters which can transmit temperature data wirelessly from the loaded trailer/container to handheld or permanently mounted receivers within a warehouse facility.

Manufacturers have developed desktop applications which allow users to download and process the data from their recorders. Once the data has been downloaded, some of the software packages can variously archive the data, create reports in graphical and tabular formats, and even share data in proprietary or common file formats via email. Cloud based data storage and retrieval is also becoming available.

When evaluating which temperature monitoring system best fits the requirements of your operation, there are a number of factors to consider. The following is a partial list of key features to consider:

**How long is your transit cycle?** Digital recorders are typically available in recording periods ranging from 10 days to 80 days. Generally, it is best to use a recorder with a recording period closest to your needs. Since digital temperature recorders have only limited memory, longer recording period units take fewer periodic temperature samples to accommodate limited data storage capacity.

**Single-Use or Reusable?** The vast majority of temperature recorders are placed in vehicles/vessels that are one-way only (from supplier to purchaser). In this case, a single use (less expensive) recorder makes the most sense, since there is no cost effective means to return the recorder to the shipping point for re-use. In some closed-loop applications, such as intercompany transfers, a reusable recorder (more expensive than single use) can be a cost saving option. An internal procedure would need to be developed to download data and reset the recorder for its next use.

**Do you require a recorder with an LCD monitor?** Some Receivers simply make their reject/accept decisions based on out-of-range LED indicators and/or summary data displayed on built-in LCDs. Recorder manufacturers have different type LED alerts and reporting available on the LCD. Make sure the recorder you are considering displays the alerts and data points you require.

**Does your application include a wet environment?** Some manufactures can provide a waterproof pouch which can protect the recorder from harmful water fouling in transit. This is important when monitoring iced product like broccoli or corn. If an unprotected recorder falls off a pallet of iced product, it may be rendered inoperative by melting ice.

**Would your Receiving/QA staff benefit from a handheld data retrieval device?** Some recorders dock to a handheld device designed to capture trip data immediately upon retrieval. Some handheld devices include on-board LCD monitors large enough to display a graph (chart) for the trip. Some handhelds simply download data for future download into a PC. Handheld data retrieval devices can greatly improve overall Receiving/QA efficiency by eliminating the need for staffers to repeatedly take retrieved recorders to a computer and/or printer for downloading and chart viewing. Time saved by such added efficiencies can do nothing but improve overall Receiving department efficiency and reduce overtime during busy periods.

**Can your operation benefit from Radio Frequency technology?** An RF enabled temperature monitoring system can eliminate labor costs associated with finding a recorder within a load. The Perishable Agricultural Commodities Act (PACA) stipulates that unloading a truck or vessel is an act of ownership. If your operations are regulated under PACA, Radio Frequency enabled recorders allow Receivers to download temperature data wirelessly while the load remains onboard the shipping container/vessel/trailer. Disputes can be minimized and settlements expedited when temperature data can be analyzed before unloading. Logistics managers should review their standard Contract of Haul and other agreements to determine if RF Technology can reduce exposure to unnecessary risks and potential legal disputes. RF technology can also provide automated temperature data archiving when fixed receivers are deployed in Receiving warehouses.

**Would a digital temperature recorder with audible locating beeper bring efficiency to the Receiving process?** Some recorders are available with an audible locating beeper. A beeper can immediately alert Receiving staff to the location of the recorder and subsequently expedite the Receiving process. This feature is generally NOT desired when shipments are sent overseas or via domestic package handlers like UPS and FedEx. Security protocols often require shipments with audible beepers to be opened and inspected. Recorders equipped with locating beepers are best suited to domestic over-the-road truckload and intermodal shipments.

**What are your data archiving and reporting requirements?** Digital temperature recorders are optimized to interface with PC based software packages. Some of the software is free with no registration required, while some manufacturers restrict access through fee structures or registration requirements. Some manufacturers offer software packages that include only limited report generating capabilities, while others offer robust reporting. Some apps can provide data in .pdf or in .csv format (which is compatible with MS Excel). Some manufacturers offer summary printed reports from a central data center for additional costs. Determine what reports you need (for internal and third party audit purposes), and confirm that the software and/or print services offered for your temperature monitoring system can support that specific reporting requirement. Obviously, avoid additional cost software and printed reports whenever possible.

**Rebates for Used Recorder Recycling:** Some recorder manufacturers have embraced and encouraged recorder recycling programs to help eliminate hazardous electronic component waste (most recorders contain lead, cadmium, mercury, and other pollutants). Some manufacturers have implemented rebate programs for Receivers who return used recorders.

**Costs:** Temperature recorder unit prices vary according to manufacturer and feature sets. Like many other infrastructure-type decisions, a “Big Picture” approach must be adopted when determining what temperature monitoring system best fits your operational structure and budget. Rebate programs for returned recorders can substantially reduce the total cost of your temperature monitoring program.

A handheld data retrieval device may add tremendous efficiency to your Receiving/QA process and result in significant cost savings. Transitioning from a fee-based reporting regime to free desktop software or a free cloud-based data archive may also bring significant administrative savings. Since the goals are shrink reduction, product safety, and freshness maximization, the value proposition is determined by comparing the effectiveness of each manufacturer’s system, its ease of integration to existing internal processes, and its total overall costs.

**Sources:** Cargo Data Corporation ([www.cargodatacorp.com](http://www.cargodatacorp.com)) of Ventura, CA offers the Automated Temperature Monitoring System designed to simplify cold chain monitoring at every level. Cargo Data provides **Select Radio Frequency** enabled transit digital temperature recorders, **Express** handheld data retrieval device, **iMAT** real-time temperature monitoring systems, **Boomerang Reusable** recorders, **KoldLink App** free full-featured desktop software, and much, much more.

As product quality, safety, and traceability programs become more sophisticated and more important, perishables logistics and quality assurance professionals will be increasingly responsible for monitoring cold chain integrity. Many such professionals are seeking an integrated and automated temperature monitoring system that provides added efficiency, full data archiving, and easy data sharing. You should too.

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