



# Wireless Temperature Monitoring Systems: **Selection, Implementation, and Quality Assurance**

**ADMITTEDLY, THE MONITORING OF TEMPERATURES IN YOUR MEDICATION storage areas is not the most exciting topic, and we all have countless other things to think about.** However, given the problems you may have experienced with your manual temperature monitoring methods – such as lost paper logs at Joint Commission survey time or expensive medications that have been wasted in out-of-limit refrigerators – it makes good sense to take a closer look at wireless temperature monitoring systems. Most hospitals need to improve their temperature monitoring processes, and these systems are an effective, automated means of doing so.

Many hospitals use small consumer-grade refrigerators to store medications on their nursing units and in other care areas, and once or twice a day, a pharmacy technician will check the temperatures in these refrigerators and record his or her findings in a paper log. More and more facilities are using medical-grade refrigerators, equipped with audible temperature alarms, chart monitors, or hard-wired monitoring systems, to store medications in the central pharmacy.

Documenting the temperatures of all of these units is a time-consuming task for pharmacy staff, and furthermore, checking the temperatures once or twice a day will not give you an accurate or comprehensive assessment of your medication storage conditions. Because nursing unit mini-fridges typically do not have fans to circulate cold air inside the box and because their doors are repeatedly opened and reopened during med passes, true refrigerator temperatures are likely more erratic than the steady 36° to 38° Fahrenheit indicated by paper logs.

## The Value of Automated Systems

Wireless systems can effectively automate your temperature monitoring activities. A typical system comprises hardware, software, and a personal computer or server. Temperatures are measured by a probe, which uses a transmitter to output radio frequency (RF) signals to a receiver. The receiver is connected to the hospital's internal computer network, which then routes the temperature data to the computer. Signal boosters or repeaters may be needed to increase the operational range of the transmitters. Once the temperature information reaches the computer, the software stores the data and determines if an alert should be triggered. Users can view temperatures, respond to alarms, document follow-up actions, and generate summary reports from the computer.

## System Selection

In selecting a system for your facility, check with your biomedical engineering, facilities, and IT departments to make sure the system is suitable for your environment; the RF signal will not interfere or be interfered with by other systems, such as telemetry or portable phones; and the software and network requirements are compatible with your current systems. Addressing these concerns up front will narrow your vendor options and facilitate a smooth installation.

There are a few product features that you should look for in a wireless refrigerator temperature monitoring system. Alert features are a must; they tell you when and

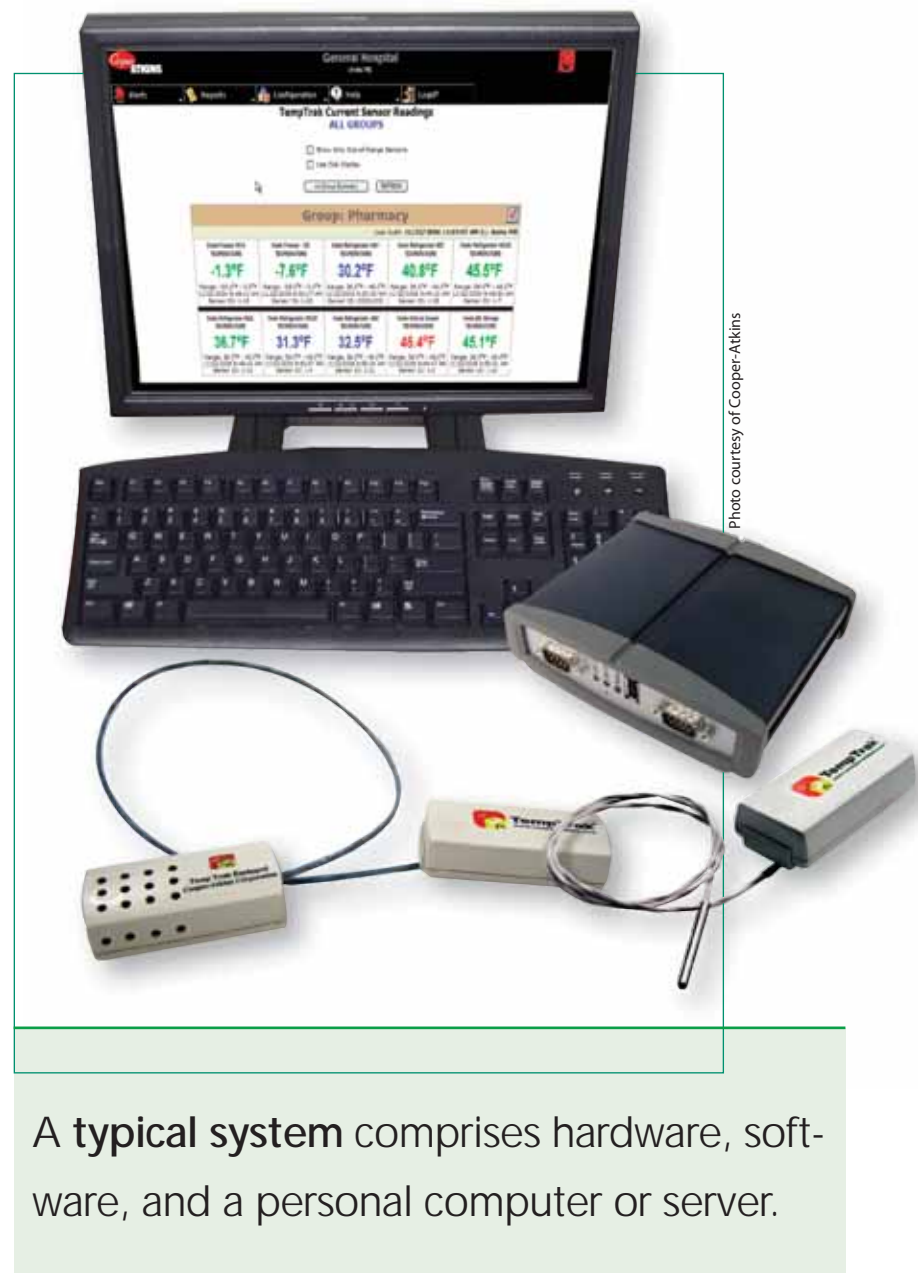


Photo courtesy of Cooper-Atkins

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where something is wrong, so you do not have to go looking for a problem. The temperature alerts in your system should be fully customizable to accommodate your facility's needs and offer several notification options, such as e-mail, alpha-pages, or computer pop-ups. Regardless of the delivery mechanism, you must be able to easily document and report the actions taken to address the alert via the system's software.

The system should also inform you if the probe transmitter, repeater, or receiver



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is not functioning properly or if it needs repair. At a minimum, any battery-operated devices, such as the temperature transmitter or back-up batteries in the repeater or receiver, should report a low battery charge. Also, if temperature data is not being received and recorded, you should be able to quickly identify the truant transmitters. If you plan on deploying your system in locations without emergency power or in off-site clinics, you may require a system with “buffering” capabilities that allow the battery-operated devices to store data in the event of power outage or network downtime.

You should also find out

department can have the equipment installed and connected in just a few days. Next, the software is loaded and the transmitters are registered with the system by naming the refrigerator or freezer, setting the alarm values, and organizing them into groups, if necessary. Finally, the signal connectivity should be verified and any outstanding issues should be addressed. For instance, if transmitter signals are not getting through to the receiver, you may want to consider installing signal-boosting equipment in those problem areas.

When installing your temperature probes, place them in neither a particularly cold nor particularly hot spot in the refrigerator. For instance, situating a probe under a refrigerator’s fan will cause your probe to collect readings that are higher than the actual location temperature. On the other hand, storing a probe in the bottom of a refrigerator may lead to temperature readings that are colder than actual storage conditions.

### Data Collection and Analysis

Once you have your system in place, you will need to designate staff members to manage its data output, depending on your interdepartmental workflow. The following are two common options:

- Pharmacy maintains the refrigerators and reviews all monitoring data.
- A facility or system monitoring department spearheads the monitoring process, and notifies pharmacy management if preventative maintenance or changes to workflow are needed.

Ultimately, however, pharmacy will be held accountable for how medications and vaccines are stored in the hospital. So you cannot just forget about your monitoring systems, even if you do not have direct oversight of them.

Familiarize yourself with your wireless temperature monitoring system’s reporting capabilities from the start. Make sure you can generate the kind of reports you need to document temperature trending in your medication storage areas, before a regulatory agency is at your door, asking to see your documentation. Understand your data and store it where it is easily retrievable when you need to reference it. In addition, be sure you are generating reports that track the specific data required by different regulatory agencies, such as your state board of pharmacy, the Joint Commission, CMS, and the CDC.

Check your system’s software interface daily for low-battery warnings or other alerts. Although your system is meant to notify you when temperatures are out of range, generating weekly graphs of

The temperature alerts in your system should be **fully customizable** to accommodate your facility’s needs and offer several notification options, such as e-mail, alpha-pages, or computer pop-ups.

what accessories are available for your system, specifically temperature probes. Air probes are standard on most systems, but a submersible probe, which is less susceptible to temperature fluctuations during med passes, may be more appropriate for high-use refrigerators. Also, for the storage of blood products and other highly sensitive items, a submersible probe may prove more effective than an air probe. Submersible probe readings more accurately represent the temperature of the products in your storage areas, whereas air probe readings more accurately represent the air temperature. As such, submersible probes may be a better option for recording the temperatures of products that require more precise monitoring. Also, special probes may be needed for refrigerators that store investigational drugs or products that require extremely cold temperatures.

### System Installation

Although it will vary by vendor, any installation should follow a similar process. The vendor should conduct a site survey to determine the number of repeaters and receivers you will need. At this point, your IT department may need to provide some network connections for the receivers. Also, if the signal repeaters are going to be hidden above the ceiling tiles, new power outlets may be required. Once these steps have been completed, the installation is rather painless. Even a large pharmacy

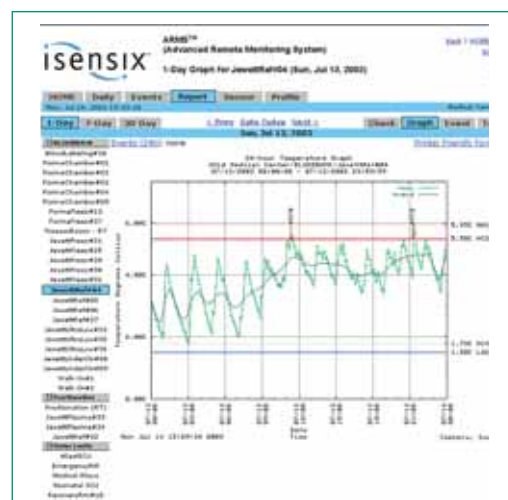


Image courtesy of Isensix

Generating **weekly graphs** of the recorded temperatures for each of your storage areas is a proactive way to prevent out-of-range conditions before they occur.



## Medication Storage

the recorded temperatures for each of your storage areas is a proactive way to prevent out-of-range conditions before they occur. For instance, a graph may illustrate that temperatures are slowly creeping up in one of your nursing unit refrigerators. Using that information, you can perform the necessary maintenance on that refrigerator before medications are wasted from being stored in out-of-range conditions.

You should be especially vigilant in your data collection and analysis following the installation of a new refrigerator, in order to ensure that the equipment is capable of maintaining the necessary temperatures for its intended use. You may find that, no matter what tweaks you make to a refrigerator, it is simply incapable of maintaining the necessary temperature range. With this in mind, think carefully before buying “dormitory” style refrigerators for medication storage. You may be able to source them at a great price, but if they are not able to maintain required temperature ranges, that bargain will hardly save your facility any money in the long run.

Keep in mind that “false alarms” will occur with temperature monitoring systems. For example, a medication freezer may maintain an appropriate average temperature, but when the compressor runs, the temperature may spike for a minute or two. That condition will trigger an alarm, but may not adversely affect the medications stored in the refrigerator. In addition, temperatures may spike during med passes, due to the frequent opening of their doors. To avoid false alarms in these instances, you can extend the alert intervals for high-traffic refrigerators, so that the system only reports longer-term out-of-limit conditions. As long as your products are still being appropriately stored, such tweaks can decrease the possibility of false alarms and simplify your temperature monitoring processes.

### Action Plans for Out-of-Range Alerts

When your monitoring system alerts you to an out-of-range temperature, you first need to physically inspect the storage area. Has the door been left open? Has someone inadvertently moved the temperature dial? Is the refrigerator malfunctioning and on its last legs? You may choose to move the drugs or vaccines to another location, until you can rectify the situation and stabilize the storage area temperature. It is a good idea to pre-determine an alternate storage area for these products in the event of a systems failure, as well as identify a staff mem-

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ber with the responsibility of relocating them. If you do not operate a 24-hour pharmacy, you may need to appoint an on-call staff member to move the products in the event of an after-hours failure. Address these logistical concerns upon implementing your monitoring system to avoid chaos should a systems failure occur.

Finally, use your monitoring system's data to determine whether the products involved are still appropriate for patient administration. Because medications and vaccines are under our jurisdiction, pharmacy will be responsible for clearing these products for use in the event of out-of-range conditions. Your system data should reveal how long the drugs were stored inappropriately, and your knowledge of the necessary storage conditions will inform you of their viability for use in patient care.

### Conclusion

A wireless temperature monitoring system can be a valuable tool for ensuring the optimal conditions of your medication storage areas and for improving pharmacy workflow and efficiency. With the proper utilization of system data and well-thought-out action plans, the use of these systems can free up technicians' time, increase the ease and accuracy of required documentation, and ensure proper storage conditions for your pharmaceutical products – an important aspect of any facility's mission to provide safe and effective care to its patients. ■

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### WHERE TO FIND IT

Vendor	Reader Service Number
Aegis Scientific <a href="http://www.aegisfridge.com">www.aegisfridge.com</a>	73
Cooper-Atkins <a href="http://www.cooper-atkins.com">www.cooper-atkins.com</a>	74
DeltaTRAK <a href="http://www.deltatrak.com">www.deltatrak.com</a>	76
Hampshire Controls <a href="http://www.hampshirecontrols.com">www.hampshirecontrols.com</a>	75
Isensix <a href="http://www.isensix.com">www.isensix.com</a>	78
Veriteq Instruments <a href="http://www.veriteq.com">www.veriteq.com</a>	79