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Addressing Comfort Complaints with Data Loggers

Using Data Loggers to Address Comfort Complaints

Employee productivity is affected by indoor environmental conditions at the workplace, and temperature is often a major factor. In fact, according to a 2009 survey by the International Facility Management Association, the most common comfort complaints expressed by office workers pertain to temperature. It seems that in any work environment – whether an industrial plant, office park, or hospital – at one point or another some employees will report being too hot and/or some will report being too cold.

Potential dollars lost in productivity due to employee discomfort can be substantial. With salaries typically making up more than 90% of the total operating cost of a commercial building, even tiny increases in employee productivity can mean a lot to the organization's bottom line. A 2004 study by the Cornell Human Factors and Ergonomics Laboratory revealed that raising office temperature to a more comfortable range can save employers approximately two dollars per worker per hour, which translates to $200,000 yearly for a company of 50 employees.

Today, many building managers and owners are looking to increase energy efficiency, often making changes to their facility that can lead to comfort complaints. Actions such as installing sun screens, moving thermostats, altering day and night set points, and overall building recommissioning can affect occupant comfort, and therefore complaints may increase after these changes are implemented.

Although it can be challenging for any facility manager to juggle the various factors to consider when evaluating worker comfort – including the season, the clothing worn by individuals, whether workers are sedentary at their desks or moving about the room, and simple variation in temperature preferences – ASHRAE Standard 55 can serve as a guide. Standard 55, Thermal Environmental Conditions for Human Occupancy, addresses the range of indoor thermal environmental conditions acceptable to a majority of occupants. It also describes and quantifies how air temperature, relative humidity, air flow, and occupant activity and clothing together create an indoor thermal environment.

Before determining the possible root cause of a comfort complaint (e.g., lack of proper zoning, poor workspace design, solar gain) and taking corrective action, facilities managers first must establish whether the subject area is in fact too hot or too cold.

Getting Answers

To validate temperature-related comfort complaints, an increasing number of facilities managers and HVAC contractors rely on battery-powered data loggers. Data loggers are low-cost compact devices that incorporate high-accuracy sensing, recording, and battery power in a self-contained package. Data loggers can employ sensors that measure temperature, relative humidity, light, and other parameters, and they monitor and record data at user-defined intervals (minutes, hours, or days) and can collect data for months at a time. Many temperature loggers are small enough to be placed in out-of-the-way locations where they can gather information in a workspace without being seen or disturbed. They can also be used over and over again, so the investment in a few data loggers can pay off big, even in a large facility.

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According to Steve Walker, an HVAC supervisor for Massachusetts-based Genzyme Corporation, data loggers have been an important tool in investigating comfort complaints at the company's 11-building campus in Framingham, Massachusetts.

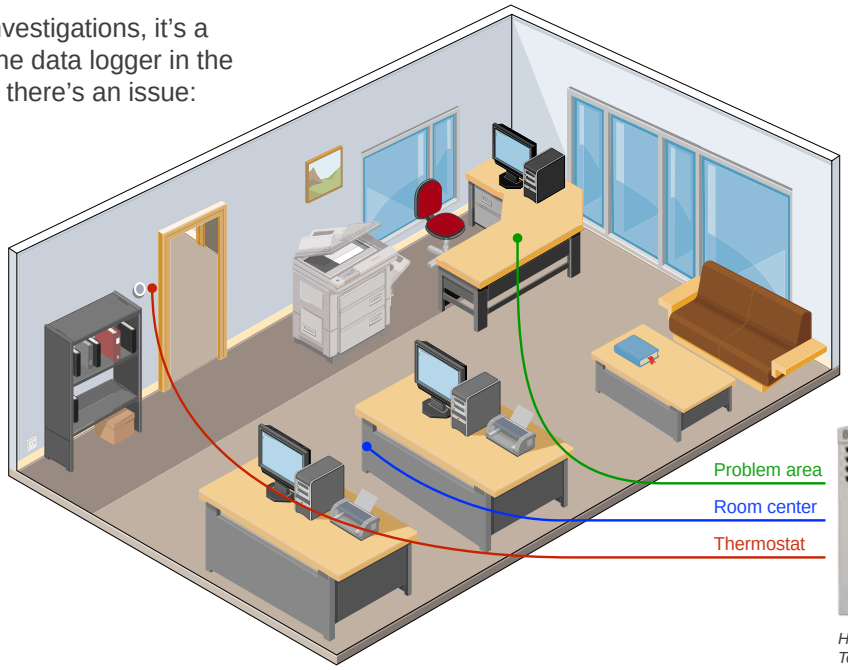
"In one of the administration buildings, employees were complaining about their feet being cold," explains Walker. "We put data loggers underneath desks in the area and actually showed that the air was four to six degrees colder than the air above the desks. From this, we were able to determine that there was not enough velocity of heat coming out of the registers to get the air to circulate under the desks, which were built into the walls. Realizing there was a problem in how the workspace was configured, we went back to the design firm and had them make modifications."

Ron Mincks, a district energy manager for the Rapid City School District in South Dakota, uses data loggers to investigate comfort complaints from teachers and other school employees.

"When a teacher complains about classroom temperature," he explains, "we are now able to monitor conditions very easily. In one building I had computerized univents, and the custodian had them coming on at seven a.m. The teacher was saying that at nine a.m. the room was cold. We couldn't figure why the room would still be cold, so we deployed a few data loggers, and from the data we were able to determine that there was a computer operation glitch that was causing the temperature to drop." Mincks adds that just the process of using data loggers itself can help with comfort issues. "We've really increased student and teacher comfort just by documenting temperature." Mincks also uses loggers on an ongoing basis to verify that classroom thermostats are working properly, and he collects a daily log of temperatures in the classrooms each day.

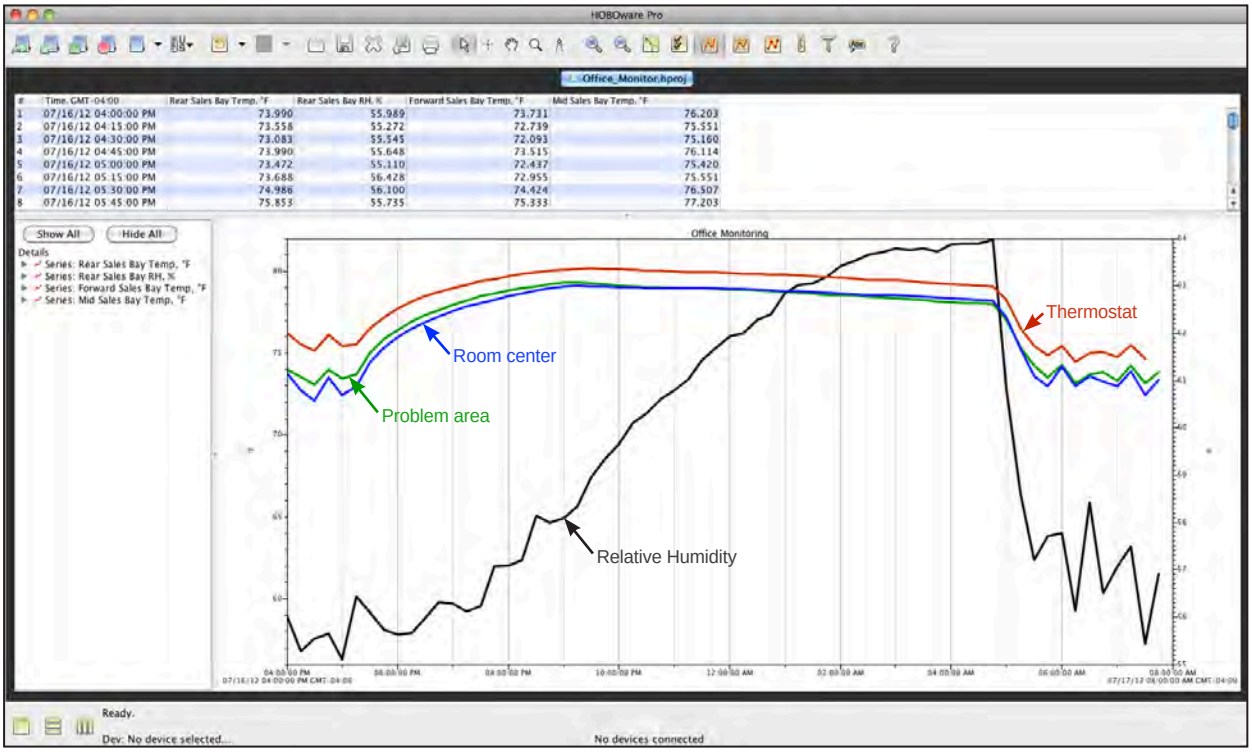
In many comfort complaint investigations, it's a good idea to place at least one data logger in the following locations to verify if there's an issue:

- Center of room/space
- Complaint/problem area
- Above area thermostat



HOBO U12
Temperature/RH data logger

It's also a good idea to keep the data loggers at least three feet from large windows and other areas expected to have high or low temperatures. In some cases, it may help to place an additional data logger with an external temperature sensor in the supply air register to measure the delivered air temperature.



When the monitoring period is complete, data can be offloaded easily to a computer by connecting the logger via USB cable. The data can then be plotted and analyzed using accompanying software, and exported to a spreadsheet for further analysis if necessary.

CASE STUDY – THE ROCKEFELLER UNIVERSITY

"I'm surrounded by scientists all day long, and they like data. Data loggers allow me to show actual numbers to people."

Alexander Kogan is responsible for plant operations and housing at The Rockefeller University in New York, NY, an institution for research and graduate education in laboratory biosciences, chemistry, and physics. The 21 buildings on campus include offices, student housing, laboratories, and a hospital, and serve 1,800 people ranging from staff to professors and graduate students.

When it comes to addressing temperature-related complaints or requests, Kogan and his HVAC team of 16 turn to battery-powered data loggers. "We use them all over the place. We have building management systems, but the loggers are great for checking that what the system says is happening is really happening. There are instances where a professor says, 'You've got this great automated system, but something just isn't right.' After deploying a logger, we can see that there is in fact a glitch in the system software, and the logger told us exactly when and where the glitch occurred."

Kogan sees plenty of situations where individuals report being too cold or too hot in their workspaces. In one lab, occupants often complained that they were too cold, "so we put in a logger to check out the situation. We confirmed that, yes, the room was too cold, and that led us to discover that someone had moved a refrigerator near the thermostat. As you know, fridges pump out heat, and it prevented the heat from going on in the room." In this case, the logger was able to confirm the temperature discrepancy and prompt an investigation into the source of the problem.

In another example, three people in a shared office space complained that they were too hot or too cold at different times of the day. A temperature data logger confirmed that while the temperature did fluctuate throughout the day, the room temperature was in fact tracking with the thermostat setting. Here, the problem was not with the equipment, but with the fact that the individuals in the room kept adjusting the thermostat. The equipment was operating correctly, but, according to Kogan, "It was that the people in the room couldn't agree."

Being able to retrieve data quickly and easily is a big plus for Kogan; it's as simple as bringing the loggers to a computer and plugging them in. That ease of use also makes it simple to deploy loggers at the drop of a hat. Kogan also appreciates that it's easy to format the presentation of the data. "The software is great, and you get a nice chart out of it." This is especially useful at an institution such as The Rockefeller University, where data rule supreme.

Using and Choosing Data Loggers

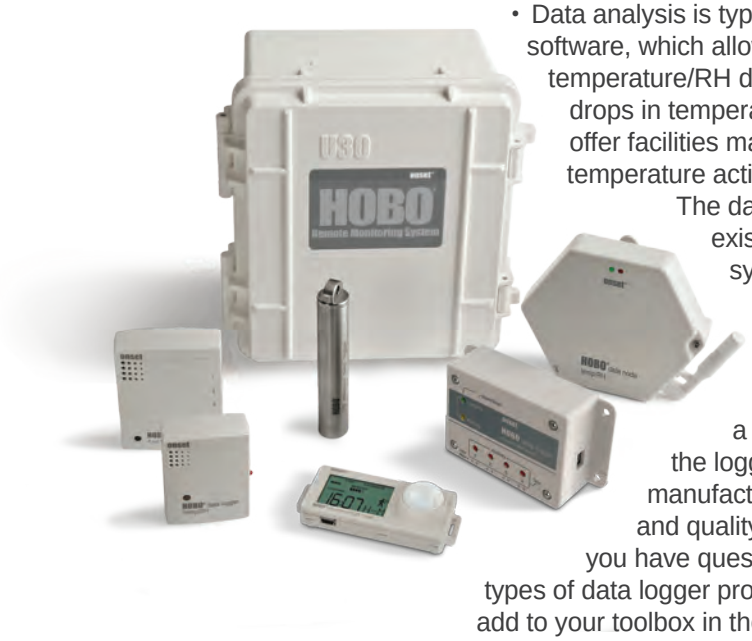
Using a data logger involves four basic steps: logger setup and configuration, logger deployment, data retrieval, and data analysis. Your job as a user will be made easier or more complicated depending on the model of data logger you choose, so here are some tips to keep in mind when shopping around:

Some logger software packages allow for batch configuration, which makes it quick and easy to set up many loggers at one time.

- Setting up and configuring a logger typically involves connecting the device to a PC and using accompanying logger software to make point-and-click selections that include how often the logger records a measurement and the time and date the logger begins recording. Some logger software packages allow for batch configuration, which makes it quick and easy to set up many loggers at one time.

- Deployment involves determining optimal placement of the logger(s) in the workspace, positioning the logger in a location that's safe, secure, and discreet, if necessary. It's important to ensure that the logger is capable of withstanding the temperature and humidity ranges in the deployment site, and that it offers flexible ways of being secured – by magnets, hanging tabs, etc.

- Data retrieval involves offloading the collected data onto a desktop computer, laptop, or data shuttle. Some manufacturers make data offload as easy as plugging in the logger to a computer via a USB cable, though a dedicated hand-held data shuttle is available if you don't want to take a laptop out to the facility or bring the logger back to the office. For long deployments requiring frequent data offloads, web-based data logging systems can be an option.



- Data analysis is typically performed using accompanying data logger software, which allows the user to quickly and easily translate the temperature/RH data into time/date-stamped graphs that show spikes and drops in temperature over the given data collection period. These data offer facilities managers an accurate and complete picture of the actual temperature activity that occurred throughout the entire monitoring period. The data, in turn, can be used to determine where problems exist. Look for software that runs on the latest operating systems, and that allows you to easily plot the data or export it to other programs, such as Microsoft Excel, for further analysis.

Additional considerations to keep in mind are whether a logger requires calibration and whether you can change the logger's batteries yourself rather than having to send it to the manufacturer. It's also a good idea to investigate the availability and quality of customer support offered by the manufacturer, should you have questions about your logger. You should also consider other types of data logger products the manufacturer offers, which you may want to add to your toolbox in the future.

Conclusion

Although facilities managers may never be able to put a stop to the age-old "too hot/too cold" battle, they do have access to compact, affordable tools that can validate the complaints. Data loggers are the instruments of choice among facilities managers and contractors due to their 24/7 operation, high accuracy, ease of use, and PC-based analysis and reporting capabilities. For more information about data loggers, please contact Onset Computer Corporation at www.onsetcomp.com or call 1-800-564-4377.

Other informational resources available from Onset:

Choosing an Occupancy & Light On/Off Data Logger – 5 Important Considerations

This paper provides guidance on features to consider when choosing an occupancy and light on/off data logger, including calibration, LCD display, logger accuracy and range, speed of deployment, and time-saving software. Learn how to select the right logger for identifying ideal locations in your building where permanent changes in lighting could result in cost savings up to 80%.

Using Data Loggers Beyond Equipment Scheduling

While data loggers are a great tool for identifying equipment-scheduling opportunities in buildings, their usefulness far exceeds just that one function. This paper discusses how the use of inexpensive data loggers and some spreadsheet analysis can provide all the evidence needed to make powerful building-specific cases for saving money by replacing failed air-handler economizers. It also describes how information from data loggers can be used to accurately calculate the energy savings that can be realized from variable frequency drives (VFDs) on pumps and fans, supply air resets, and boiler lockouts.

Analyzing Air Handling Unit Efficiency with Data Loggers

Operating a heating, ventilation and air conditioning (HVAC) system at optimum efficiency in a commercial setting is complicated, to say the least. There is a very real chance that any number of setpoints, levels, and feedbacks at boilers, chillers, pumps, fans, air delivery components and more can cause costly inefficiencies.

Finding Hidden Energy Waste with Data Loggers: 8 Cost-Saving Opportunities

The first step to reducing building energy costs is identifying energy waste. Statistics on utility bills or name plates on equipment, while useful, are not enough to identify what practices and equipment are contributing to high energy use. Portable data loggers can be used to obtain critical energy use information in a wide range of commercial building types – from manufacturing plants to office buildings.

Monitoring HVAC Performance with Data Loggers

Building operators and managers have the difficult job of providing comfortable working conditions and coaxing aging mechanical equipment to operate at peak performance while minimizing energy costs. If the mechanical equipment is old or has inadequate controls, maintaining comfort at a reasonable cost may prove difficult or impossible.

The Energy Professional's Guide to Data Loggers & Building Performance

This 30-page guide, developed in conjunction with Stetz Consulting LLC, details how portable data loggers can be applied in a number of building monitoring applications, such as HVAC systems monitoring, commissioning, Measurement & Verification, and load profiling. The guide offers practical tips and techniques on a range of topics, including data logger installation, monitoring plan development, safety, and data interpretation.

Monitoring Geothermal Heat Pump Performance

This paper discusses how portable data logging technology can be used to measure, record, and document the performance of geothermal heat pumps, and provides specific case study examples of how the technology is being applied in geothermal system monitoring applications.

Optimizing Solar Thermal Performance with Data loggers

This paper discusses how solar thermal systems, with the help of portable data loggers, can be optimized to deliver the financial benefits residential and commercial users hope to achieve through their investments. The paper shows installers and engineers how portable data logging devices can be used to measure performance of solar thermal systems, pinpoint any defects or inefficiencies, and optimize performance for greater return on investment.

Measurement & Verification: Tapping into ARRA Stimulus Funds

This paper provides guidance on identifying potential sources of ARRA stimulus funding for energy performance monitoring projects. It details new programs from the ARRA, explains the growing importance of Measurement Verification (M&V) services, and discusses specific ways ESCOs can apply portable data logging technology to document building energy savings.

Using Data Loggers to Meet LEED® Existing Building Certification Credits

This paper provides information about how data loggers can make it simple to satisfy many LEED Existing Buildings Operations & Maintenance credits. It discusses how the devices can help with the certification process and documenting performance improvements for submission to the U.S. Green Building Council.

Air Compressor Energy Savings: Finding the Low-Hanging Fruit

This paper discusses different ways to measure compressed air system performance and identify savings opportunities. It provides insight into how portable data loggers can be used to monitor compressor power, and references various compressed air upgrade funding programs throughout the United States.

Access our full resources library at: www.onsetcomp.com/resources

About Onset

Onset is the world's leading supplier of data loggers. Our HOBO data logger products are used around the world in a broad range of monitoring applications, from verifying the performance of green buildings and renewable energy systems to agricultural and coastal research.

Based on Cape Cod, Massachusetts, Onset has sold more than 2 million data loggers since the company's founding in 1981.

Contact Us

Our goal is to make your data logging project a success. Our product application specialists are available to discuss your needs and recommend the right solution for your project.

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- Speak with an application specialist by calling 1-800-564-4377
- Email your inquiry to sales@onsetcomp.com
- Go to onsetcomp.com to browse our white papers, application stories, videos, and webinars