



Choosing a Temperature Data Logger: 5 Things You Need to Know

The measurement accuracy offered by today's most advanced data loggers rivals the performance of many higher priced, computer-based data acquisition systems.

Introduction

Battery-powered temperature data loggers are widely used by performance contractors, service technicians, and engineers responsible for monitoring indoor environmental conditions, investigating occupant comfort complaints, adjusting temperature setbacks, and evaluating HVAC/R (Heating/Ventilation/Air Conditioning/Refrigeration) systems. Temperature data loggers are also used by research scientists, ecologists, and hydrologists looking to continuously monitor soil, air, and water temperature without having to be on site.

Data loggers, in most cases, are easy to deploy, and can be used as stand-alone devices without a computer. More importantly, the measurement accuracy offered by today's most advanced data loggers rivals the performance of many higher priced, computer-based data acquisition systems.

However, not all temperature data loggers are created equal, and with so many choices available today, it can be challenging to know which one is right for your application. Do you need to measure a range of conditions, or just a single parameter? Does your application require alarm notification when conditions go beyond a certain threshold? Will the data logger withstand harsh environments? Does it need to be weatherproof or waterproof? How often will you need to offload data? Will you be viewing collected data on a computer, or a mobile device?

Whether you are an experienced data logger user, or just getting started, this article can help you during the temperature logger selection process. It points out some of the most important considerations to keep in mind, and offers tips on specific features.



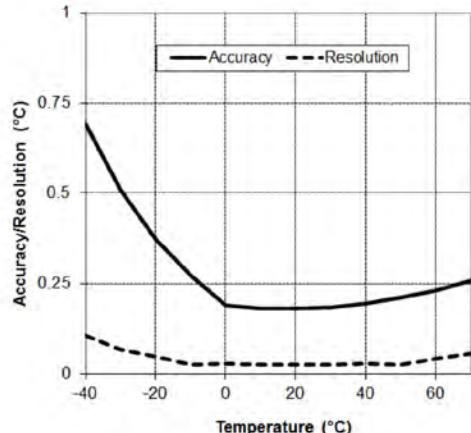
1. Know your accuracy requirements

No matter what you need to measure, understanding your measurement accuracy requirements is essential. For example, if you're monitoring air-conditioning temperature in an office space, you may only require a temperature measurement accuracy of +/- 1°C, while monitoring conditions in a research lab may require far greater accuracy. Or when monitoring streams for suitability for certain fish species, for example, accuracy on the order of 0.2°C is typically required.

Accuracy specifications vary widely among different types of data loggers, and a good understanding of specific accuracy requirements will help you avoid paying for accuracy you might not need. When looking at the accuracy specifications for a given data logger, be sure to look for charts that indicate accuracy over an entire measurement range, not just a single value. The accuracy a data logger can achieve at the high or low end of a given range may be far different from the accuracy at the middle of the range.

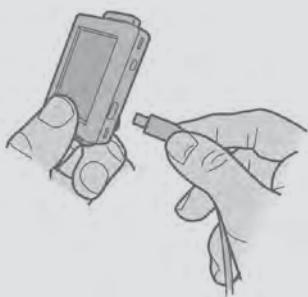
Another important factor is data logger resolution; that is, the number of increments of a value a data logger is capable of reporting. For example, a data logger with 12-bit resolution can report 4,096 values over a given temperature range. While a 16-bit data logger may offer more resolution than a 12-bit model, it's important to keep in mind that higher resolution does not necessarily mean better measurements.

If you're unsure about the data logger accuracy and resolution requirements of your application, an experienced data logger supplier should be able to help you determine which product will best meet your needs.



Plot A: Temperature Accuracy and Resolution

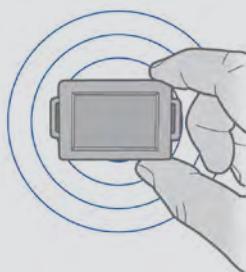
Using a Temperature Data Logger



1. Configure and launch

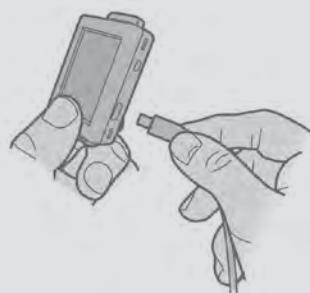
Install and start HOBOware CD in your computer.

Connect your data logger to your computer via USB and set parameters.



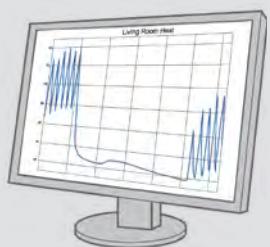
2. Secure in place

Deploy the data logger in the desired location. Securing it in place can be as simple as using a magnet, screw, or lanyard to fasten it to a wall.



3. Download or access data

After the desired monitoring period, reconnect the data logger to the computer, and launch the software to read out the data.



4. Process/analyze data

The data logger's software allows you to combine and compare data, and display the measurements in graphs that show profiles over time.

2. Anticipate your data access needs

Wireless temperature data loggers transmit highly accurate temperature/RH data from dozens of points to a central location.

With the simplest stand-alone data loggers, temperature data is directly offloaded to a computer via a USB interface. In many instances, however, it's not practical to bring a computer out to a site, nor is it always convenient to bring a data logger back to an office computer. In such cases, data retrieval from stand-alone loggers can instead be easily and quickly accomplished using a pocket-sized device called a data shuttle. With a shuttle (or waterproof shuttle), you can download and store the collected data without having to interrupt or move the logger, and later link the shuttle to a computer for downloading and analyzing the data.

Wireless temperature data loggers can transmit real-time temperature/relative humidity (RH) data from dozens of points to a central location. With a networked arrangement, the chore of manual retrieval and offloading of data from individual loggers is eliminated.

Web-based data logging systems enable real-time remote access to temperature and other types of data via cellular, Wi-Fi, or Ethernet communications, and can be configured with a wide range of plug-and-play sensors. Data can be accessed easily through a secure website or integrated into custom systems with a relatively simple-to-implement set of web services.

Bluetooth® Smart enabled data loggers measure and transmit temperature data wirelessly to mobile devices over a 100-foot range. This is particularly useful in applications where data loggers need to be deployed in hard-to-reach spaces or in limited-access areas within a facility



USB Loggers

Short or long-term trend logging with manual offload



Bluetooth Loggers

Wireless data access via mobile devices



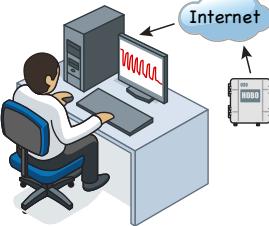
Wireless Sensors

Short-range centralized data collection



Web-Based Systems

Long-range wireless internet access



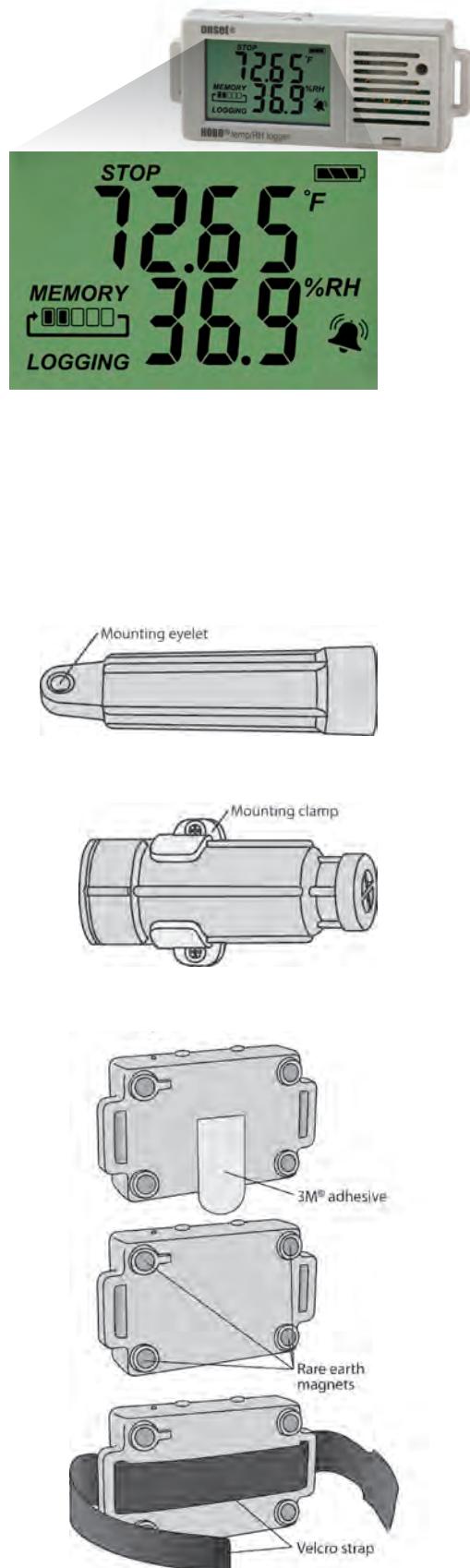
3. Look for time-saving features

Time is money, so you'll want to make sure the temperature data logger you select has a feature set that will make the process of field deployment simple and reliable. Here are some features you'll want to consider:

- Memory capacity – Make sure the logger has enough memory to allow for longer deployments with fewer site visits. Low-cost loggers can store 6,000 measurements which is enough for some applications. For longer deployments or faster logging, higher-capacity loggers are readily available with capacities of over 1 million measurements.
- Deployment flexibility – Since temperature loggers are typically deployed in a wide range of environments and spaces, they often need to be mounted in different ways. Look for options like mounting eyelets, magnets, straps, and command-strips to streamline the mounting process and help ensure reliable deployments.
- Durability – Select ruggedly-built loggers that can withstand extended deployment in harsh environments, including extreme weather conditions or submergence in fresh or salt water, if required.
- Visual display – Temperature loggers with LCD displays enable you to visually confirm logger operation and battery status in the field, eliminating the need to connect the logger to a computer to view the information.
- Start & Stop push buttons – A temperature logger you can start, stop, or resume with the simple push of a button can make life easier when at the job site.
- Firmware upgrades – A temperature logger with firmware that you can upgrade from the field offers much greater convenience than having to send the unit back to the manufacturer for upgrades.

It's also a good idea to look for features that can save time when offloading and analyzing data. Some temperature loggers, for example, can operate in a statistics logging mode where they continuously calculate and display the minimum, maximum, average, and standard deviation for measurements as they are being recorded. This eliminates the need to post-process data to generate these statistics.

Bluetooth Smart enabled data loggers require no dedicated equipment beyond a smartphone or tablet for configuring the logger and reading out data, saving both time and money.



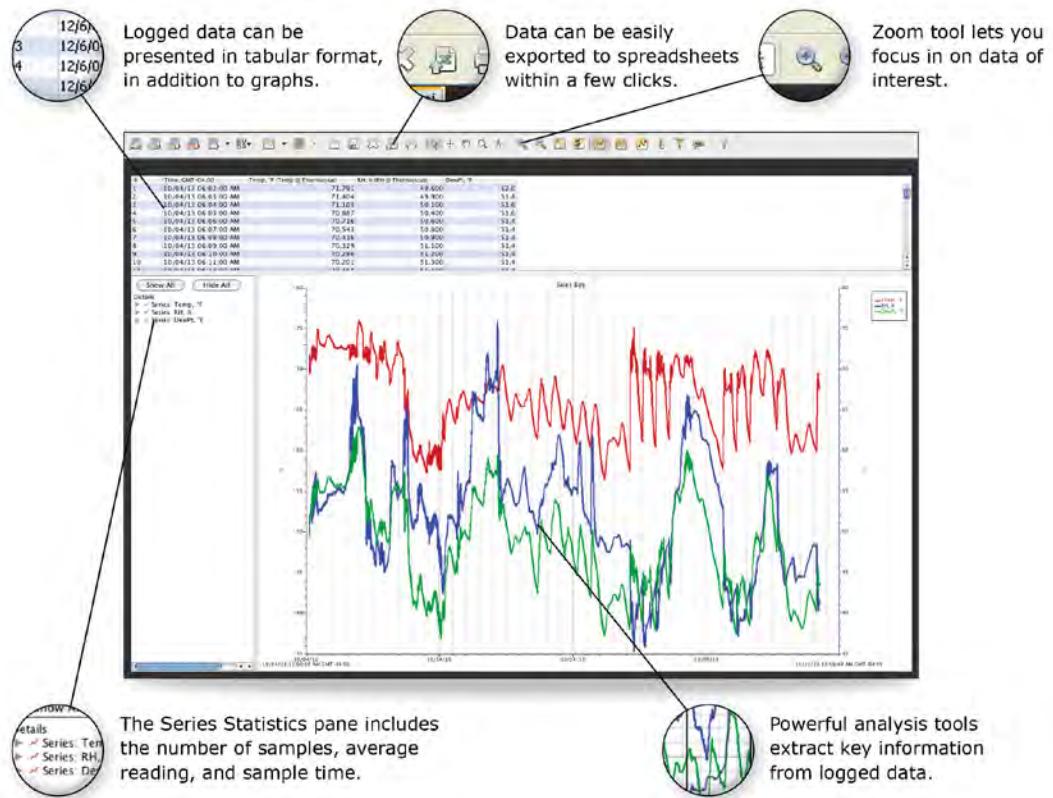
4. Don't overlook the software

The software should enable you to quickly and easily perform tasks such as configuring parameters, starting the data logger, and offloading data, with point-and-click simplicity.

Just as there are many different types of temperature loggers available, there are also many different types of data graphing and analysis software packages. In general, look for software that is Windows or Macintosh-based, depending on your requirements, and highly intuitive so the learning curve is minimal. The software should enable you to quickly and easily perform tasks such as configuring parameters, starting the data logger, and offloading data, with point-and-click simplicity. Certain packages allow you to batch-configure and read out hundreds of loggers very quickly.

The data logging software package should also offer powerful data plotting capabilities, with an ability to easily merge, append, and crop data, and enable you to easily export data to other programs, such as Microsoft Excel, for analysis.

For Bluetooth Smart enabled data loggers, you'll want an app that allows you to configure loggers, view data in graphs, share data files for analysis in Excel, Numbers, and other applications, and store data in the cloud.

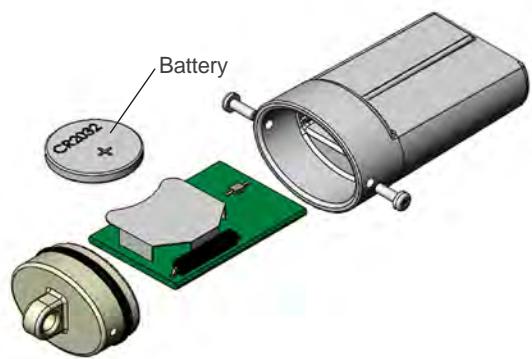


5. Consider power requirements

Overall, data loggers are extremely low-power devices. However, because they are used in a variety of environmental conditions and sample at different rates, battery life can vary widely. As a general rule of thumb, make sure the data logger you select has a battery life of at least one year at the logging rate you need. For some remote situations, you may want to investigate whether a solar-powered option is available.

You should also look at whether the logger's batteries are replaceable. User-replaceable batteries are the most convenient, as this can eliminate the time and expense of having to ship the logger back to the manufacturer for battery replacement. Data loggers that run off standard household batteries offer greater convenience than those requiring specialized batteries.

The batteries in some loggers are not replaceable; in this case the logger must be replaced when the batteries run out.



Temperature Logging Application Examples

Museum Preservation

Challenge:

- Prevent deterioration of natural history museum collection
- Comply with restrictions associated with historical landmarks
- Monitor and maintain stable temperature/RH levels throughout 420,000 square feet of museum space



Solution:

- 50 wireless data loggers with integrated temperature and RH sensors
- Discreet deployment of data nodes via non-marking 3M adhesive strips
- Real-time data, instant notification potential, and onboard buffer memory to ensure no data are lost

Results:

- Convenient offload of data from multiple locations
- Prompt identification, diagnosis, and resolution of HVAC equipment dysfunction

Climate Monitoring

Challenge:

- Manage agricultural risks related to weather and pests; minimize use of pesticides
- Fully utilize the power of weather-based models
- Provide a user-friendly decision support tool that doesn't involve additional work for growers



Solution:

- Deployment of on-site web-based weather stations
- Transmittal of live air temperature, relative humidity, wind speed, and additional weather data to the Internet via integrated Wi-Fi communication modules

Results:

- Accessible, accurate, farm-specific weather data
- Information helps growers with actionable pest management decisions

Cold Storage Temperature Monitoring

Challenge:

- Maintain high quality/safety standards at food production company
- Implement reliable backup temperature monitoring system in cold storage areas

Solution:

- Several temperature data loggers
- Temperature recorded at five-minute intervals, around the clock
- Data analyzed on an as-needed basis, with verification at least once a month



Results:

- Correlation of building automation system alarms with time-stamped readings from data loggers
- Second level of assurance that proper temperatures are being maintained
- Real-time temperature data on an easy-to-read LCD screen

Water Monitoring

Challenge:

- Restore and preserve freshwater ecosystem
- Decrease stream temperature to increase pool habitat for native fish
- Support healthier fish populations and a larger beaver population



Solution:

- Create active connections between three natural springs and the creek to provide new sources of cool water and additional stream-flow
- Install water temperature data loggers above and below each spring confluence with the creek to collect pre- and post-project stream temperature data

Results:

- Charted stream-flow and temperature information from data collected at 30-minute intervals and downloaded approximately four times per year via HOBO Waterproof Shuttle
- Data helped determine how effective the connection of the springs to the creek was in lowering stream temperature

Other informational resources available from Onset:

Choosing an Occupancy and 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 changes in lighting could result in cost savings up to 80%.

Utility Incentive Programs: How to Get More Money Quickly and Easily

"Utility Incentive Programs: How to Get More Money Quickly and Easily," is aimed at making the process of applying for and receiving energy efficiency incentives and rebates faster, easier, and more rewarding. Authored by Carbon Lighthouse, an energy firm that makes it profitable for commercial and industrial buildings to eliminate their carbon footprint, the paper discusses the two main types of incentive and rebate programs, how utility efficiency program managers think, and how to use data to get more incentive dollars for your projects.

Deploying Weather Stations: A Best Practices Guide

From the tropics to the poles, climate, agriculture and other researchers rely on unattended research-grade, data logging weather stations. For example, the US Department of Agriculture uses weather stations to study anything from molecular plant pathology to forest management. Non-government groups, such as universities, use weather stations to study a wide array of subjects including how glacial activity affects air temperature. Additionally, commercial companies depend on weather stations to conduct businesses.

Data Logger Basics

In today's data-driven world of satellite uplinks, wireless networks, and the Internet, it is common to hear the terms "data logging" and "data loggers" and not really have a firm grasp of what they are.

Most people have a vague idea that data logging involves electronically collecting information about the status of something in the environment, such as temperature, relative humidity, or energy use. They're right, but that's just a small view of what data logging is.

Addressing Comfort Complaints With Data Loggers

This paper offers facility managers, HVAC contractors, and others with valuable tips on how low-cost data loggers can be used to validate temperature-related comfort complaints.

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

Monitoring Green Roof Performance with Weather Stations

Data logging weather stations are the ideal tools for documenting green roof performance. A weather station can measure weather parameters such as rainfall, stormwater runoff, temperature, relative humidity, wind speed, solar radiation, and a host of non-weather parameters such as soil moisture on a continuous basis (say every five minutes, hourly, or an interval appropriate to the situation).

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

Monitoring Wetlands with Data Loggers: A Best Practices Guide

Wetlands act as a natural filter for polluted water and thus play an essential role in water quality protection. They serve as floodwater storage to help minimize erosion, and create a habitat for many fish and wildlife.

While a variety of factors have decreased the number of wetlands in the U.S. by half since 1950, many organizations are restoring wetlands back to their original flourishing ecosystems. To ensure success, it is necessary to monitor wetland factors such as water level, temperature, and rainfall.

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

This paper is for building operators and managers who have the difficult job of providing comfortable working conditions and coaxing aging mechanical equipment to operate at peak performance while minimizing energy costs.

About Onset

Onset is a 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 two and a half 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.



Sales (8am to 5pm ET, Monday through Friday)

- ▶ Email sales@onsetcomp.com
- ▶ Call 1-800-564-4377
- ▶ Fax 508-759-9100

Technical Support (8am to 8pm ET, Monday through Friday)

- ▶ Email loggerhelp@onsetcomp.com
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