



Conserve O Gram

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Datalogger Applications In Monitoring The Museum Environment, Part I: Comparison Of Temperature And Relative Humidity Dataloggers

A monitoring program is used to collect information on general trends and develop an environmental profile of a particular space. It also can be used to acquire data for specific projects. *Datalogger* is the general term given to the devices that depend on electronic sensors to monitor and record data (such as temperature, relative humidity [RH], and light).

Dataloggers greatly expand the possibilities for environmental monitoring with specific project goals. Loggers can be placed to collect data to support the purchase of buffered exhibition or storage cases, or the installation or repair of heating, ventilation, and air-conditioning (HVAC) systems. The ability of the building envelope to buffer the environment can be assessed by comparing the indoor environment with exterior climate data. (See *NPS Museum Handbook*, Part I, Chapter 4, for further information on monitoring the museum environment.)

Choosing a Datalogger

Determining the monitoring program goal is essential to avoid wasting money on unnecessary features when working with a tight budget. In some instances, memory capacity and battery-life are important. In other instances, such as in exhibition cases, size of the logger, type of display, or alarm capability may be more important features. The prices of loggers range widely from under \$100 to around \$1,000 not including the required software and cables. Probes, alarms,

and portable download units are additional costs. Unit price generally reflects the quality of the sensor, the longevity of the battery, the durability of the casing, the flexibility of the software, and any additional features, such as displays or alarms.

Datalogger Features

Following is a list of factors to consider when reviewing a logger's specifications. The accompanying table provides details on ten different dataloggers.

- **Memory capacity.** The product literature describing memory capacity can be confusing. Most manufacturers list the number of readings the logger will take and store, but to actually compare these figures it is essential to know if that is the total number, or if it must be divided by the number of operating channels. These loggers require at least two channels: one to record temperature and the other for RH. Some loggers allow extra channels to be enabled for additional features such as an external probe. When more channels are activated, fewer readings will be collected.
- **Battery life.** At a minimum, a logger should have enough battery life to provide one full year of monitoring. The manufacturer should be consulted to check that the calculation for battery longevity is factored when the logger is working to capacity. For example, a logger with a one-

year battery life may not last an entire year if the logger will be taking frequent readings. It is critical to know if the battery dies whether or not the logger saves the data until a new battery is installed and the data downloaded.

- **Sensor accuracy.** For monitoring the performance of environmental units such as HVAC systems, freezers, and buffered cases, both the accuracy of the sensor and the operating range may be important. Not all loggers are guaranteed to be accurate across the range of temperature and humidity that they record. A logger calibrated at three points across its range should take accurate high and low readings. A logger that is calibrated at one midpoint close to ambient temperature may not be accurate at the extremes. It is important to determine if the application requires accuracy within 0.5% or 5% RH. Some loggers allow the user to recalibrate, but most must be sent back to the manufacturer if they are not performing within their set parameters. The manufacturer should be consulted to determine if the accuracy of temperature readings listed on product data sheets is given for the entire range, or for ambient temperature.
- **Size, appearance, and construction.** For monitoring projects designed to evaluate the environment in vitrines, buffered frame enclosures, storage cases, and shipping crates, the logger size may be a determining factor. Casings are normally made of hard plastic and the colors and shapes vary. The Hobo Pro is the only weatherproof model suitable for outdoor use. The smallest loggers may be the most unobtrusive, but larger loggers generally can be screwed in place to fasten them securely. This is important when the units are installed in public spaces.
- **Display.** Some monitoring projects may require a visible display of real-time data for spot checks. While the display is an extremely useful feature, it often greatly shortens the battery life.
- **Alarms.** Some loggers have either visible or audible alarms to alert staff that set parameters have been exceeded. This feature is extremely useful in areas where a leak or other sudden change could cause severe damage. Alarms, too, may come at the cost of battery life.
- **Probes.** Optional external probes may be available that are less obtrusive than the logger itself and that can be placed into hard-to-reach locations. This leaves the logger in a more accessible location for downloading.
- **Download options.** Data can be retrieved from the loggers either by bringing the unit back to a desktop computer or by connecting in-situ to a laptop. Some loggers also can be downloaded via a small handheld device such as a portable shuttle or palm pilot. This is an alternative to visible display loggers for locations where frequent spot checks are necessary.
- **Download speed.** If numerous loggers are to be placed in a museum, and data is to be retrieved at frequent intervals, download speed is an important factor. The speed of data transmission is an important factor. The speed of data transmission will vary depending on the memory size, type of interface cable and software, as well as the speed of the computer.
- **Software capabilities.** All of the hardware considerations discussed here are important, but software is an area where differences between the loggers become even more apparent. Some programs are more intuitive to use than others. All of the models referenced here were tested on a personal computer. Individual manufacturers should be consulted to determine if Mac software is available. Logger software should provide easy

launching, data retrieval, and graph manipulation.

All of the units listed in this *Conserve O Gram* allow the user to delay the onset of logging with the exception of the Trak-R and XerlC. Almost all allow you to stop logging after a certain number of readings, stop when full, or never stop (i.e., wrap around). An essential function is the ability to back up or retrieve data from the logger without having to re-launch. This provides one long, uninterrupted graph rather than many short ones. All of these models have this feature.

There are also several key graphing features: the ability to manipulate the x and y axes to compare graphs, the ability to print the graph without having to export the data to a secondary program and the ability to label the graph. The program should clearly display the time, date, and year of the readings. It is helpful to be able to view data in tabulated form, and there may be occasions when it is useful to be able to export data to a spreadsheet program. The ability to rename and organize the download files is also convenient.

Service and Technical Support

The reputation of the company and the quality of its service and technical support should also factor into a purchasing decision. There should be a product specialist at the company who understands museum needs and can accurately answer any question about its products. Some companies allow tests of their software via the Internet, and many will send their logger for a 30-day free trial.

Reference

Daly, Gregg M., and Hugh J. Flye.
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COMPANY MODEL	Display	Alarm	Probe	Portable Download Unit	Download Speed *1 – fast to 3 – slower	Comments
ACR SmartReader 2	No	No	Yes	No	3	RH accuracy across entire range
Dickson TP-120	No	No	No	No	3	Temperature accuracy range measured above 14°F
Gemini Tinyview TV0050	Yes	Yes	No	No	3	Change of battery after two years recommended
Hanwell Humbug	Yes	Yes	Yes	No	1	\$549 without display
Langan XerIC Measurer	Yes	No	Yes	No	2	Will record RH in condensing environment. Battery life 2 years if display is not in constant activated use
Onset HOBO RH & Temp 2 x External	No	No	No	Yes	2	±5% RH accuracy not guaranteed under 25% RH
Onset HOBO Pro Series 2-channel RH & Temp	No	No	Yes	Yes	2	Will record RH in condensing environment Probe for temperature only
Trak-R TR-2000	Yes	Yes	Yes	No	1	Temperature accuracy 1°F between 40-90°F. Visual alarm with option for audible alarm
Veriteq Spectrum 2000	No	No	Yes	No	1	
Wetronics Rustrak Scout RR-1040D	Yes	No	Yes	Yes	2	

COMPANY MODEL WEBSITE	PRICE * For logger unit only as of 11/2000	SIZE	OPERATING LIMITS *RH in non-condensing environment	ACCURACY *Generally assessed around room temperature	MEMORY * # of Temp. & RH readings	POWER SOURCE/ BATTERY LIFE * Approximate life
ACR SmartReader 2 www.acrsystems.com	\$719	4.2 x 2.9 x 0.9 in. 107 x 74 x 22 mm 5 oz. / 110 g	-50°F to 160°F -45°C to 70°C 0-95% RH	±1°F ±4% RH	16,384	Lithium battery 10 year life
Dickson TP-120 www.dicksonweb.com	\$159	3.1 x 2.1 x 0.9 in. 79 x 53 x 23 mm 1.5 oz. / 42 g	-40°F to 176°F -40°C to 80°C 0-95% RH	±1.8°F ±2% RH	16,256	Lithium battery 5 year life
Gemini Tinyview TV0050 www.gemindataloggers.com	\$295	3.5 x 2.6 x 1.4 in. 88 x 65 x 35 mm 3 oz. / 85 g	-85°F to 185°F -40°C to 85°C 0-95% RH	±0.36°F ±3 %RH	14,800	Lithium battery 3 year life
Hanwell Humbug www.hanwellusa.com	\$649 with display	3.7 x 1.8 x 0.6 in. 95 x 45 x 16 mm 3 oz. / 85 g	-40°F to 176°F -40°C to 50°C 0-95% RH	±1°F ±2% RH	8,000	Lithium battery 10 year life
Langan XerIC Measurer www.langan.net	\$695	5.5 x 1.5 x 1.3 in. 139 x 38 x 33 mm 6.5 oz. / 184 g	0°F to 128°F -18°C to 53°C 0-100% RH	±0.5°F ±0.5% RH	15,360	AA batteries 6 month life
Onset HOBO RH & Temp 2 x External www.onsetcomp.com	\$95	2.4 x 1.9 x 0.8 in. 68 x 48 x 19 mm 1 oz. / 29 g	-4°C to 158°F -20°F to 70°C 0-95% RH	±1°F ±5% RH	3,971	Lithium battery 1 year life
Onset HOBOPro Series 2-channel RH & Temp www.onsetcomp.com	\$159	4 x 3.2 x 2 in. 102 x 81 x 51 mm 3.7 oz. / 104 g	-22°C to 122°F -30°F to 50°C 0-100% RH	±0.7°F ±3% RH	32,645	Lithium battery 3 year life
Trak-R TR-2000 www.trak-r-logger.com	\$498	5.3 x 3.3 x 1.2 in. 133 x 83 x 29 mm 6 oz. / 170 g	0°F to 158°F -18°C to 70°C 15-90% RH	±2.7°F ±2% RH	16,000	Lithium battery 1.5 year life
Veriteq Spectrum 2000 www.veriteq.com	\$425	2.8 x 2.1 x 0.7 in. 71 x 53 x 18 mm 2.2 oz. / 62 g	-22°F to 158°F -30°C to 70°C 0-95% RH	±0.5°F ±2% RH	10,900	Lithium battery 10 year life
1Wetronics Rustrak Scout RR-1040D www.westronics.com	\$1,095	4.6 x 7 x 2.3 in. 117 x 177 x 58 mm 1.5 lb. / 680 g	30°F to 130°F 0°C to 50°C 0-100% RH	±3.6°F ±0.5% RH	64,000	Ni-Cad C cell battery 1 week