



System Assessment and Validation for Emergency Responders (SAVER)

Temperature and Humidity Monitors/Recorders Market Survey Report

April 2012



**Homeland
Security**

Science and Technology

U.S. Department of Homeland Security



System Assessment and Validation for Emergency Responders

Prepared by National Urban Security Technology Laboratory

The *Temperature and Humidity Monitors/Recorders Market Survey Report* was prepared by the National Urban Security Technology Laboratory for the U.S. Department of Homeland Security, Science and Technology Directorate.

The views and opinions of authors expressed herein do not necessarily reflect those of the U.S. Government.

Reference herein to any specific commercial products, processes, or services by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government.

The information and statements contained herein shall not be used for the purposes of advertising, nor to imply the endorsement or recommendation of the U.S. Government.

With respect to documentation contained herein, neither the U.S. Government nor any of its employees make any warranty, express or implied, including but not limited to the warranties of merchantability and fitness for a particular purpose. Further, neither the U.S. Government nor any of its employees assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed; nor do they represent that its use would not infringe privately owned rights.

FOREWORD

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL). The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, operationally oriented assessments and validations of emergency responder equipment; and
- Providing information that enables decision-makers and responders to better select, procure, use, and maintain emergency responder equipment.

Information provided by the SAVER Program will be shared nationally with the responder community, providing a life- and cost-saving asset to DHS, as well as to Federal, state, and local responders.

The SAVER Program is supported by a network of Technical Agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: “What equipment is available?” and “How does it perform?”

As a SAVER Program Technical Agent, the National Urban Security Technology Laboratory (NUSTL), has been tasked to provide expertise for chemical, biological, radiological, nuclear, and explosive weapons (CBRNE) detection, response, remediation instruments and techniques, and related equipment and technologies. In support of this tasking, NUSTL conducted a market survey of commercially available temperature and humidity monitors/recorders that fall under AEL reference number 19GN-00-RFMN titled Monitors/Recorders, Temperature and Humidity.

Visit the SAVER website at www.dhs.gov/science-and-technology/SAVER for more information on the SAVER Program or to view additional reports on temperature and humidity monitors and recorders.

POINTS OF CONTACT

National Urban Security Technology Laboratory

U.S. Department of Homeland Security

Science and Technology Directorate

201 Varick Street

New York, NY 10014

E-mail: NUSTL@hq.dhs.gov

Website: www.dhs.gov/science-and-technology/SAVER

TABLE OF CONTENTS

Foreword.....	i
Points of Contact.....	ii
1. Introduction.....	1
2. Temperature and Humidity Monitors/Recorders Overview	1
2.1 Current Technologies.....	1
2.2 Applications	3
2.3 Standards/Regulations.....	4
2.4 Emerging Technologies	4
3. Product Data	4
3.1 Dickson FH525, FH535	9
3.2 Dickson WH445.....	9
3.3 Extech 42270	9
3.4 Extech SD500	10
3.5 Extech RH520A	10
3.6 Lascar Electronics EL-USB-2.....	10
3.7 LogTag HAXO-8 Datalogger	11
3.8 Monarch Instruments Track-It™ Logger Model 5396-0201, Model 5396-0203	11
3.9 Omega OM-73	11
3.10 Omega OM-CP-RHTEMP1000.....	11
3.11 Sensitech TempTale® 4 (TT4) and TempTale® 4 IS (TT4 IS)	12
3.12 Supco SL300TH, SL400TH.....	12
3.13 Supco THA2	12
3.14 TandD US, LLC RTR-500 Series, RTR-503	13
3.15 Temperature Guard M306.....	13
3.16 Testo 174H Mini Datalogger	14
3.17 Two Dimensional Instruments Paperless Hygrometer TDVDR-02	14
4. Vendor Contact Information	15
5. Conclusion	16
Appendix A. Request for information	A-1

LIST OF TABLES

Table 3-1 Product Comparison Matrix	6
Table 4-1 Product and Vendor List.....	15

1. INTRODUCTION

Temperature and humidity monitors/recorders are devices used to continuously monitor the temperature and/or humidity of a storage area or refrigeration device to ensure that contents do not exceed storage limits. These devices are used by public safety and first responder organizations and there are a wide variety of products available to meet their needs. To provide these organizations with information helpful in making purchasing decisions, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted this market survey on Temperature and Humidity Monitors/Recorders.

This market survey report is based on information gathered from November 2010 to October 2011 from responses to a government-issued Request for Information (RFI) posted on the Federal Business Opportunities (FedBizOpps) website (<https://www.fbo.gov>), Internet research, and correspondence with equipment manufacturers. For inclusion in this report, the product had to meet the following criteria:

- Accurately measure temperature and humidity;
- Record data; and
- Transfer the recorded data to a computer or other device for further analysis, archiving, or to meet regulatory requirements.

Due diligence was performed to develop a report that is representative of products in the marketplace. Due to the large number of products available, this report provides only a sampling of the products available for purchase.

2. TEMPERATURE AND HUMIDITY MONITORS/RECORDERS OVERVIEW

Temperature and humidity monitoring technologies range from hand recording data read from a thermometer, to a paper chart recorder, to real-time monitoring using wireless devices. All monitors consist of a sensor and a method of recording the sensor data. An additional useful function for many applications is the ability to alert personnel when temperature and humidity values fall outside acceptable ranges. This information can be conveyed through local alarms or by telephone or e-mail.

Chart recorders are self-contained, battery-operated devices which provide a paper record of past temperatures. They are not as precise or as durable as many of the electronic temperature recorders, and provide no way of transferring data to a computer. They are not reviewed in this report. Temperature indicators usually consist of dye strips that indicate when temperature has reached a certain high or low point. Although they are inexpensive and easy to use, they are relatively inaccurate and do not provide a record of the data. They are also not discussed in this report.

2.1 Current Technologies

There are a variety of sensors available for temperature monitoring which can be chosen to meet the specific needs of the user. These include thermistors, resistance temperature devices (RTDs),

thermocouples, and semiconductors. A thermistor is a temperature sensing element composed of sintered semiconductor material which exhibits a large change in resistance proportional to a small change in temperature. Thermistors are stable and extremely accurate. However, they cover a limited temperature range. RTDs depend on the change of resistance of the RTD element, usually platinum, nickel, or copper. These sensors provide good accuracy, stability, and repeatability, and are not sensitive to electrical noise. A thermocouple consists of two dissimilar metals joined together at one end. The junction produces a predictable and repeatable relationship between voltage and temperature. Thermocouples are rugged and can cover a wide temperature range. Semiconductor sensors rely on the fact that as the temperature changes, there is a change in the junction potential between two semiconductor materials such as germanium or silicon. These sensors have no moving parts, are precise, and work under many environmental conditions.

Relative humidity (RH) monitors employ polymer resistive sensors, capacitive sensors, and thermal conductivity sensors. Resistive humidity sensors measure the change in electrical impedance of a hygroscopic medium such as a conductive polymer, salt, or treated substrate. They are interchangeable and inexpensive. However, they do not function well when exposed to chemical vapors or condensation. Bulk polymer capacitive sensors consist of a substrate on which a thin film of polymer or metal oxide is deposited between two conductive electrodes. The change in the dielectric constant of the sensor is nearly directly proportional to the RH. Capacitive sensors can function at high temperatures, recover from condensation, and are reasonably resistant to chemical vapors. Thermal conductivity sensors consist of two matched negative temperature coefficient thermistor elements in a bridge circuit; one is encapsulated in dry nitrogen and the other is exposed to the environment. These sensors are durable, operate at high temperatures, and are resistant to chemical vapors by virtue of the inert materials used for their construction, such as glass, semiconductor materials, high temperature plastics, or aluminum. For some monitors, care must be taken that they are not operating in condensing conditions. The dew point temperature must be below the ambient temperature so that condensation will not damage the humidity sensor and the associated electronics.

The monitors and recorders included in this market survey can function as data loggers, and product manufacturers often use the terms “monitors,” “recorders,” and “loggers” interchangeably. Data loggers are small, portable devices that store data which can then be downloaded to a computer. They can operate independently from a computer and range from single channel fixed function loggers to programmable devices capable of handling hundreds of inputs. They record data at predetermined user set intervals and tend to be more accurate and precise than mechanical devices. The recording duration depends on the memory capacity of the logger and the desired sampling rate. Data storage capacities for instruments included in this report range from 8 thousand temperature/humidity data pairs to over 2 million total points. There are frequently two recording modes available to the user. When logging capacity has been reached the oldest data can be overwritten and recording continued; alternatively, the recording can be stopped when the logger is full. Most data loggers are battery powered with some offering an option for external power. Data loggers powered by external voltage usually have some type of battery backup. Many loggers use nonvolatile memory for data storage, ensuring the data is retained if the power or battery fails.

Data loggers can be set to alarm for a variety of conditions including exceeding temperature and/or humidity limits, an open refrigerator door, or a low battery condition. Temperatures that are too high or too low can be detrimental. For example, while the potency of a majority of vaccines can be affected by storage temperatures that are too warm, some vaccines require a storage temperature of 35-46 degrees Fahrenheit (°F) and cannot be exposed to freezing temperatures. When used in a refrigerator or freezer, setting both a temperature and an elapsed time allowance avoids false alarms from door openings or defrost cycles. When logging medicine or vaccine temperatures during storage or transport, momentary dips and rises of air temperature, which occur when the refrigerator door is opened, are not large enough to affect the actual medicine or vaccine temperature and can be safely tolerated for brief periods of time.

Locally audible and visual alarms can be used to indicate that conditions have exceeded acceptable limits. These include flashing lights, beeps, or a change of color in a light emitting diode (LED). Some loggers have relays which can be used to start phone notifications or connect to an established alarming system. Loggers connected either directly or wirelessly to a computer can send out e-mail or Short Message Service (SMS) notifications at any time to alert personnel.

Most monitors have accuracies from 1 to 2 °F for temperatures in the 20 to 120 °F range and approximately 2-3 percent for relative humidity in the 20 to 80 percent RH range. Accuracies may decline to 4 °F at either end of the temperature range and up to 5 percent at the low and high ends of the humidity range. Most monitors include National Institute of Standards (NIST) traceable certificates of calibration, which should be updated at least annually. One, two, or three point calibrations can be purchased from the vendor or directly from NIST.

Data can be transferred to a computer using hard wire or wireless technology. Data can be transferred by plugging directly into a Universal Serial Bus (USB) port, using a USB cable, an RS-232 cable, or an optical reader. An optical reader is a device found in scanners that recognizes printed characters and converts them to their corresponding digital codes. Wireless technologies, such as Wi-Fi, cellular communications, and Bluetooth allow one to connect many loggers to one computer and monitor conditions remotely and in real time, allowing users to be immediately aware of a problem and correct it. It is up to the user to determine which features are most important for their application.

2.2 Applications

One of the main uses for temperature and humidity monitors/recorders by first responders is to monitor the temperature or humidity of medical supplies during distribution and storage. Some medicines and vaccines are rendered useless if stored outside specific temperature limits. During the response to an emergency, medical personnel need to know that the pharmaceuticals being distributed are viable and at full strength to prevent the development of disease in exposed individuals. During a medical surge when care may be provided in portable or temporary structures, portable temperature monitors allow for the tracking of storage, transport, and distribution conditions of needed medicines and vaccines. Maintenance of pharmaceuticals prior to an incident can be accomplished with stationary monitors that alarm if preset limits are exceeded. These monitors should be capable of storing enough data to keep a full record of the storage period.

Another application of temperature and humidity monitors/recorders is laboratory testing to assess population exposures to biological, chemical, or radiological agents. For example, samples of blood or tissue to be tested often need to be stored under controlled temperature conditions if test results are to be valid. Some types of personal radiation monitors, including film badges worn by first responders, may be affected by storage temperature and humidity.

2.3 Standards/Regulations

ASTM F2362 covers the requirements for equipment that monitor temperatures in general applications and includes standards for temperature sensors such as thermocouples and resistance temperature element assemblies.

Manufacturers of temperature and humidity monitors generally want to comply with the following standards established by the Food and Drug Administration and the medical community. First responders can be assured that products conforming to these standards meet the relevant performance criteria.

Title 21 of the Code of Federal Regulations (CFR) defines Food and Drug Administration guidelines for electronic records and signatures. Title 21 CFR Part 11 defines the criteria under which electronic records and signatures are considered to be trustworthy, reliable, and equivalent to paper records.

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) PC.17.10 standard concerns the storage of tissues. Regulations dealing with maintaining continuous temperature monitoring for refrigerators and freezers, ensuring storage equipment has functional alarms and backups, and record retention are covered. JCAHO Standard MM.2.20 requires that medications be stored under conditions necessary to ensure stability.

2.4 Emerging Technologies

Improvements in the Global Positioning System (GPS), the Global System for Mobile Communications (GSM), and satellite communications will make it possible to report temperatures of cargo, e.g., of material being transported by truck, along with information on precise location.

3. PRODUCT DATA

This market survey identified 21 temperature and humidity monitors and recorders from 12 manufacturers.

Information in this market survey report was gathered from November 2010 to October 2011 from responses to a government-issued RFI posted on the FedBizOpps website (<https://www.fbo.gov>), Internet research, and correspondence with equipment manufacturers. The information has not been validated by the SAVER Program.

Features given in Table 3-1, are defined as follows, listed in column order:

<i>Price</i>	The price provided by the vendor or distributor who completed the questionnaire or the price found on the company's website.
<i>Base Size</i>	The size of the monitor or recorder base in inches.
<i>Probe Size</i>	The size of the external probe in inches. In some products the probe is internal to the base.
<i>Weight</i>	The weight of the monitor or recorder in ounces (oz).
<i>Temperature Measuring Range</i>	The range of temperature in °F recorded by the monitor.
<i>Relative Humidity Measuring Range</i>	The range of relative humidity in percent RH that can be recorded by the monitor.
<i>Power Supply</i>	The type of power source used by the unit. Sources of power include line voltage (120 to 240 VAC), various battery types, and car chargers. It is noted if battery backup is available.
<i>Data Display</i>	The manner in which data is displayed by the unit. Types of data display include light emitting diode (LED), liquid crystal display (LCD), and touchscreen. Some monitors require that the data be downloaded to a computer before the information can be displayed.
<i>Data Transfer</i>	The manner in which data is transferred from the monitor or recorder to a computer. Data can be transferred via USB direct (model plugs directly into a USB port without a cable), USB cables, RS-232 cables, or through an optical reader. Data can also be transferred wirelessly through Ethernet, Wi-Fi, or cellular networks.
<i>Alarm Type</i>	The manner in which the monitor conveys an alarm condition to outside personnel. Alarms can be audible, visual, or external such as phone notifications, pagers, e-mails, or Short Message Service (SMS) notifications.

Table 3-1. Product Comparison Matrix

Company /Model	Price (\$)	Base Size (l x w x h) (inches)	Probe Size (l x w) (inches)	Weight (oz)	Temperature Measuring Range (°F)	Relative Humidity Measuring Range (%)	Power Supply	Data Display	Data Transfer	Alarm Type
Dickson FH525, FH535	459.00 499.00	1.5 x 7.3 x 6.1	0.5 x 1.5	20.8	-40 to 185	0 to 95 Non Condensing ^a	120 to 240 VAC, 12 VDC; Rechargeable Battery Backup	Touchscreen	USB, Flash Card ^b	Visual, Audible on both. External ^c on the FH535 (phone)
Dickson WH445	299.00	1.7 x 4.3 x 4.3	0.5 x 1.5	48.0	-40 to 185	0 to 95 Non Condensing	120 to 240 VAC, 12 VDC; 4 AA Battery Backup	LCD	RF	Pop-Up notification on computer, External (SMS, e-mail)
Extech 42270	104.00	3.0 x 2.3 x 0.9	Integral	9.0	-40 to 185	0 to 100	3.6 V 1/2AA Lithium Battery	LED, LCD	RS-232	Visual
Extech SD500	229.99	3.1 x 1.3 x 5.2	Integral	9.9	32 to 122	10 to 90	6 AAA Batteries, 9V AC adaptor	LCD	RS-232, SD Card	Visual
Extech RH520A	269.99	7.7 x 0.9 x 5.0	0.4 x 5.0	12.6	-20 to 140	10 to 95	3 AAA Batteries, AC adaptor	LCD	RS-232	Visual, Audible, External (phone)
Lascar Electronics EL-USB-2 ^d	64.85	4.1 x 1.0 x 0.8	Integral	1.1	-31 to 176	0 to 100	3.6 V 1/2AA Lithium Battery	LED	USB Direct	Visual

Table 3-1. Product Comparison Matrix (continued)

Company /Model	Price (\$)	Base Size (l x w x h) (inches)	Probe Size (l x w) (inches)	Weight (oz)	Temperature Measuring Range (°F)	Relative Humidity Measuring Range (%)	Power Supply	Data Display	Data Transfer	Alarm Type
LogTag HAXO-8 Datalogger	46.85	3.4 x 2.1 x 0.3	Integral	1.2	-40 to 185	0 to 100	3V Lithium Battery	LED	USB	Visual
Monarch Track-It™ Logger Model 5396-0201, 5396-0203	119.00 68.85	3.7 x 0.8 x 1.2	Integral	<1.0	-4 to 185	0 to 100	3.0V CR2032	Model 0201 LED, LCD Model 0203 LED	USB Direct	Visual
Omega OM-73	149.00	6.0 x 5.7 x 1.3	Integral	3.2	-4 to 160	0 to 99 Non Condensing	3.0V CR2032	LCD	USB	Visual
Omega OM-CP-RHTEMP1000	399.00 Aluminum (Al) 499.00 Stainless Steel (SS)	1.0 x 5.4	Integral	Al 5.1 SS 10.1	-40 to 176	0 to 100 Non Condensing	3.6V Lithium Battery	None	RS-232, USB	None
Sensitech TempTale® 4 (TT4), TempTale4 IS (TT4 IS) ^c	65.00 Single use 179.00 for Multiple use	4.0 x 2.0 x 1.0	Integral	1.7	-22 to 158	10 to 100	3.0V Lithium Battery	LCD	Interface Reader Adapter	Visual
Supco SL300TH	124.00	3.0 x 1.6 x 0.6	Integral	1.0	-40 to 160	0 to 99 Non Condensing	3.0V CR2032	LED	USB	Visual on demand
Supco SL400TH	135.65	3.0 x 1.6 x 0.6	Integral	1.0	-4 to 140	0 to 99 Non Condensing	3.0V CR2032	LCD	USB	Visual
Supco THA2	268.00	5.5 x 4.5 x 1.6	3.8 x 1.1	9.5	-40 to 140	0 to 95 Non Condensing	12-24 VAC or VDC; 9V battery backup	LCD	USB, RS-232	Visual, Audible, External (phone)

Table 3-1. Product Comparison Matrix (continued)

Company /Model	Price (\$)	Base Size (l x w x h) (inches)	Probe Size (l x w) (inches)	Weight (oz)	Temperature Measuring Range (°F)	Relative Humidity Measuring Range (%)	Power Supply	Data Display	Data Transfer	Alarm Type
TandD RTR-500 Series Wireless Data Logging System RTR-503	279.00	1.9 x 0.7 x 2.4	0.5 x 1.3	2.0	32 to 130	10 to 95	120 to 240 VAC, Lithium Battery, 12VDC Vehicle Power	LCD, Computer Monitor, Smart Phone with web browser	USB, Ethernet, 802.11 g Wi-Fi, GSM Cellular	Visual, External (phone, e-mail, pager, SMS)
Temperature Guard M306	495.00	5.6 x 3.3 x 1.4	2 probes 4.3 x 2.3, 0.2 x 2.0	Not Available	-40 to 248	0 to 100	120 VAC, 12 VDC; Rechargeable Battery Backup	LCD	Wired Ethernet, 802.11 b/g Wi-Fi	Visual, Audible, External (e-mail, SMS)
Testo 174H Mini Datalogger	113.85	2.3 x 1.5 x 0.8	Integral	1.1	-4 to 158	0 to 100	3.0V CR2032	LCD	USB Desktop Docking Station	Visual
Two Dimensional Instruments Paperless Hygrometer TDVDR-02	779.00	8.3 x 6.0 x 1.0	2.0 x 2.0	48.0	-4 to 176	0 to 99	120 to 240 VAC; 9V Battery Backup	LED, LCD	RS-232	Visual, Audible, External (phone)

Notes:

Integral = No external probe
 LCD = Liquid Crystal Display
 LED = Light Emitting diode
 RF = Radio Frequency

SD Card = Nonvolatile memory card
 SMS = Short Message Service
 V = Volts
 AC = Alternating current
 DC = Direct current

a – The dew point temperature must be below the ambient temperature so that condensation will not damage the humidity sensor and the associated electronics.

b – A Flash Card is an electronic flash memory storage device.

c – External indicates monitor can make contact with an external device, such as a phone, either through a relay or wirelessly.

d – The EL-USB-2+ is a high accuracy version of the EL-USB-2 and sells for \$84.85. The EL-USB-2-LCD adds an LCD display to the base model, and sells for \$74.85. The EL-USB-2-LCD+ is the high accuracy version of the logger with LCD display and sells for \$119.

e – The price of the TempTale® 4 Intrinsically Safe (TT4-IS) depends on the number purchased.

3.1 Dickson FH525, FH535

The Dickson FH525 has a 4.1 x 5.5 inch touchscreen digital display with graphing capabilities. The touchscreen is designed to work without software. The FH525 is equipped with an external polycarbonate plastic-enclosed temperature and humidity probe with a 10-foot cable. DicksonWare software must be purchased separately to view the data on a personal computer (PC) (\$89 to \$199 depending on the level of data security desired). Logged data can be exported using a USB cable or a flash memory card. The cable is included with the purchase of the software but the flash memory card must be purchased separately. Up to 32,000 data points can be stored and the unit is set to overwrite when full. The choice to stop when full can be activated in the DicksonWare software. The Dickson FH535 is the same instrument with a relay. If an alarm threshold is reached the unit will turn on a dry contact relay which can be connected to an external alarm, an auto dialer, light, or bell. The Sensaphone dialer for use with the FH535 can be purchased for \$499 and can dial up to four numbers. The alarm will not sound and the relays will not operate under battery power.



FH525
Photo Courtesy of Dickson

3.2 Dickson WH445

The Dickson WH445 is a wireless temperature and humidity data logger with an external 1.5 x 0.5 inch sensor housed in polycarbonate plastic. The remote sensor cable length is 10 feet. Data is sent from the logger to a receiver at regular intervals. Signal strength is less than 100 milliwatt (mW) with a wireless range of 300 feet with a clear line of sight. Physical barriers and electrical equipment may significantly limit wireless range and repeaters are recommended to ensure continuous communication. DicksonWare software is needed to communicate with this logger and is sold separately (\$89 to \$199 depending on the level of data security desired). A wireless receiver and software are required and range in price from \$299 to \$499, again depending on the level of data security. Text and e-mail alerts are included at the higher price. One receiver can receive logged data from up to 60 loggers. A wireless repeater which will extend the distance of the network by forwarding the signal from out-of-range loggers to the receiver costs \$199.



WH445
Photo Courtesy of Dickson

3.3 Extech 42270

The Extech 42270 is a compact temperature and humidity data logger with a user programmable sampling rate ranging from 1 second to 2 hours. The kit, Extech 42275, includes a logger, software, an RS-232 serial cable, and a docking station, and sells for \$160. The logger will not operate without the docking station. Additional loggers can be purchased for use with the docking station. This unit has a data capacity of 16,000 readings (8,000/parameter) and has an alarm indication for out-of-range



42270
Photo Courtesy of Extech

readings. There are three start methods including scheduled, immediate, and magnetic. Data logging can be started in magnetic mode by passing a magnet by the bottom of the logger.

3.4 Extech SD500

The Extech SD500 logs data by recording to a Secure Digital (SD) card in Microsoft Excel format, allowing for transfer to a computer without the need for cables. The sampling rate is selectable by the user and ranges from 5 to 600 seconds or auto. In auto the data will be stored every time there is a value change of >1 percent RH or >1 degree. Up to 2 million date and time stamped points can be saved to a 2 gigabyte SD card. The unit comes with 6 AAA batteries, a 2 gigabyte SD card, a universal AC adaptor, and a mounting bracket. An RS-232 interface is available to connect the monitor to a PC.



SD500

Photo Courtesy of Extech

3.5 Extech RH520A

The Extech RH520A is a temperature and humidity digital chart recorder with detachable probe that extends up to 1 meter for measurements in enclosed environments. Readings are displayed on a large digital display that emulates a paper and pen chart recorder. There is an output socket for an optional external alarm module. Data can be downloaded to a computer for archiving or analysis. This recorder stores 49,152 sets of temperature and humidity data. It can be table or wall mounted and comes with LabView-based software, an RS-232 cable, a 100-240 VAC 50/60 Hz adaptor, and three AA batteries.



RH520A

Photo Courtesy of Extech

3.6 Lascar Electronics EL-USB-2

The Lascar Electronics EL-USB-2 can record and store 16,382 temperature and humidity readings. Each data point is date stamped. The logger features a user selectable sampling rate and start time and direct USB connection to a PC for downloading data. The logger software allows for data to be graphed, printed, and exported to other applications. Separate LEDs for temperature and humidity indicate if the logger is collecting data, has alarmed, or needs a new battery. The logger is supplied with Windows control software and a replaceable internal lithium battery. No cables or additional items are needed. This logger is available in several versions. The version listed in the table is the entry level version. The EL-USB-2+ is a high accuracy version and sells for \$85. The EL-USB-2-LCD adds an LCD display to the base model, is slightly longer at 4.96 inches, and a bit heavier. It sells for \$75. The EL-USB-2-LCD+ is the high accuracy version of the logger with LCD display and sells for \$119.



EL-USB-2

Photo Courtesy of Lascar Electronics

3.7 LogTag HAXO-8 Datalogger

The LogTag HAXO-8 datalogger measures and stores up to 8,000 sets of time and date stamped humidity and temperature readings. The recorder has a 2 to 3 year battery life which can be extended by using hibernation mode. The LogTag software can be programmed to start the logger at the push of a button or at a certain date and time. The ALERT indicator light will activate when pre-set temperature or RH thresholds have been exceeded. Readings are downloaded using the LogTag Analyzer, which provides charting and zooming capabilities, lists data statistics, and can export data to other applications such as Microsoft Excel. A dock (Part number LTI-USB, \$47) is required to set up and download the logger. One dock can be used with thousands of loggers per location.



HAXO-8
Photo Courtesy of Logtag

3.8 Monarch Instruments Track-It™ Logger Model 5396-0201, Model 5396-0203

The Monarch Instruments Track-It Logger is a standalone compact data logger that records up to 64,000 total readings. This compact logger has two independent triggers that allow it to be started or stopped in a variety of ways. The logger can be started when an alarm threshold has been crossed, at a specific time and date (start and stop), or via a push button start. The data logger can be set to record only when the logger is in an alarm state. The Track-It logger allows for sampling as fast as once every 2 seconds to once every 24 hours and can be ordered with or without an LCD display. Information displayed on the LCD is also user programmable and can be sequenced by pressing the logger button. Both models have a multicolored LED indicator to notify the user of alarms or general activity. The logger is configured using the included Track-It software. No additional cables, equipment, or software is required. The Track-it logger is available without an LCD display (Model 5396-0203) for \$69, or in a version (Model 5396-0201) with a display for \$109.



Track-It Model 5396-0201
Photo Courtesy of Monarch Instruments

3.9 Omega OM-73

The Omega OM-73 is a compact, portable temperature and humidity data logger whose sampling rate is user specified. Up to 21,672 data sets can be stored and the user can select to stop sampling when memory is full or write over old data for continuous recording. Software, an operator's manual on compact disc (CD), a USB interface cable, and a battery are included with the monitor. The software allows one to set up the logging conditions and download the collected data for statistical analysis.

3.10 Omega OM-CP-RHTEMP1000

The OM-CP-RHTEMP1000 data logger is a compact, battery powered, stand alone device that can store 10,920 sets of date and time stamped temperature and humidity data. The data is stored in nonvolatile solid state memory ensuring data security even if the battery becomes discharged.

The data can be displayed by downloading to a computer via an RS-232 port. Software is required to run the logger and is sold separately (\$119). The software allows selection of the sampling rate, logging duration, and high and low temperature alarm values. The logger is available with either an aluminum or stainless steel case.

3.11 Sensitech TempTale[®] 4 (TT4) and TempTale[®] 4 IS (TT4 IS)

The Sensitech TT4 is a battery powered electronic monitor used to measure temperature and humidity in a variety of transit and storage applications. The design of the alarm integrates pre-programmed time and temperature limits to trigger time-out-of-range events. Cumulative time above both the high- and low-temperature limit and the highest and lowest temperature records are provided in the trip summary data. The monitor downloads time/temperature history information to a PC by using optical communications. Up to 16,000 data points (8,000 temperature and 8,000 RH) can be stored. Both single-use and multiple-use monitors are available. Single-use monitors can be started only once, can be pre-programmed by the manufacturer, and are less expensive. Additional equipment needed includes an Interface Reader Cradle and TempTale Manager Desktop software. The Sensitech TT4 IS, the intrinsically safe version of this product, can be used in hazardous environments containing flammable and explosive substances. The price of the TT4 IS depends on the number purchased.



TempTale[®] 4 TT4
Photo Courtesy of Sensitech

3.12 Supco SL300TH, SL400TH

The Supco SL300TH is a self-contained, USB-based miniature temperature and humidity data logger with a user controlled sampling rate of 1 second to 18 hours. It alarms on high and low temperatures with visual indication on demand. Up to 21,672 data sets can be stored with the user having the option to stop counting when memory is full or having memory roll over for continuous recording. The unit comes with a battery and Windows compatible SupcoLog software. The SL300TH covers a temperature range of of -40 to 160 °F. The SL400TH is a similar data logger with a smaller temperature range of -4 to 140 °F. This logger has a LCD display showing current temperature, RH, and logging and alarm status.



SL400TH
Photo Courtesy of Supco

3.13 Supco THA2

The Supco THA2 is a multi-function data logger that monitors temperature, humidity and dew point, and alarms for out-of-range conditions. The THA2 logger consists of a base unit with display and a remote sensor probe that can support cable lengths of up to 300 feet. The unit comes with a 15-foot sensor cable. If any of the readings reach an alarm threshold, the unit generates an alarm by turning on a beeper and a dry contact relay. The relay can be connected to a telephone dialer, light, or bell. A delay feature, which ignores short duration alarm conditions, is available to reduce the number of false alarms. The auto dialer (Part AVD-45) can be purchased for \$166. The logger function records the temperature, humidity, and dew point into

internal nonvolatile memory at a user specified interval. No computer setup is necessary to start logging, and all logging settings can be viewed or changed through the front panel functions. When the internal memory becomes full, the recording rolls over, overwriting the oldest recorded data. Data can be reviewed with PC software provided with the unit. The unit will simultaneously support review of logged data on a computer while continuously recording new data.



THA2

Photo Courtesy of Supco

3.14 TandD US, LLC RTR-500 Series, RTR-503

The TandD RTR-503 is a battery operated data logger which uses an external sensor to measure temperature and humidity. It has been designed to withstand some condensation. The RTR-503L has an extended battery life of approximately 2 years. This data logger functions as a remote unit. Recorded data can be downloaded via wireless communication with a base unit. The wireless communication range between the remote unit and base is about 500 feet with an unobstructed line of sight. Data can be retrieved via a 900 MHz wireless link through data collectors that are connected via USB to a PC, through Ethernet or Wi-Fi to a LAN or the Internet, through a GSM cellular connection, or with a portable, handheld data collector that incorporates a graphing LCD display. These base stations must be purchased separately and range in price from \$399 to \$499. Each base station can handle up to 20 loggers. Functions include real-time monitoring, warning notifications if readings exceed preset limits, and automatic downloading of data. These monitors are capable of running off a vehicle battery. The units ship with software, batteries, and cables.



RTR 500 Series, RTR-503

Photo Courtesy of TandD US, LLC

3.15 Temperature Guard M306

The Temperature Guard M306 can monitor three temperature, one humidity, and two door sensors with either a wired or wireless Ethernet network. The included Data Capture Program automatically collects and maintains a log of the data obtained from all the monitors on the network. An alarm relay can be connected to existing security systems or signaling equipment. Up to 2 weeks of date/time stamped readings can be stored in nonvolatile memory. Rechargeable battery backup allows internal data logging to continue for up to 4 days. Upper and lower level limits and time delays can be set for each monitor over the network. Data Capture software will send out e-mails and SMS messages when alarm conditions are reached. The software also allows maintaining secure data log files and manipulating the data.



Photo Courtesy of Temperature Guard (Microtechnologies, Inc.)

3.16 Testo 174H Mini Datalogger

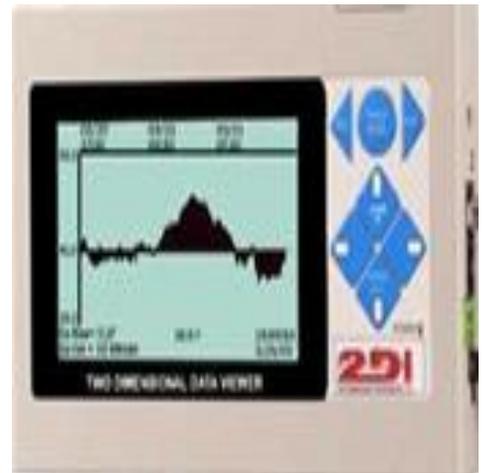
The Testo 174H Mini Datalogger is a full-featured logger for monitoring the temperature and humidity of sensitive goods in storage using internal sensors. The included software allows for programming of the data logger and analysis. The onboard memory stores up to 16,000 measured readings in nonvolatile memory. The LCD display shows current temperature and RH values, battery status, and visual alarm warnings. The logger has a user selectable sample rate as fast as once per second and a replaceable coin cell battery. A spare battery is included. A desktop docking station is required for configuring and downloading the 174H-Mini. The cost of the docking station is \$109.



174H-Mini
Photo Courtesy of Testo

3.17 Two Dimensional Instruments Paperless Hygrometer TDVDR-02

The Two Dimensional Instruments Paperless Hygrometer TDVDR-02 is a microprocessor-based monitor that logs and charts temperature and RH with two remote sensors. It stores and displays a history chart on its panel display which can be scrolled through or zoomed in and out. This instrument is a combination data logger and chart recorder. It continually samples and stores data and does not require a computer to setup or view the data. Over 80,000 data points for each of its two sensors can be stored. Over a year of temperature history can be viewed if the sampling rate is set for every 10 minutes. Each sensor comes with a 20-foot wire. A 100-foot wire for remote monitoring can be purchased. Alarm settings include a trigger point and a delay so that momentary swings of temperature or humidity do not trigger false alarms. The hygrometer is also equipped with a relay so that an external alarm, buzzer, light, or auto dialer will be triggered. An auto dialer must be purchased separately if phone notification is required. Prices for the auto dialer start at \$169.



TDVDR-02
Photo Courtesy of Two Dimensional
Instruments

All the preceding material was compiled from vendor-provided information and supplemented with information from the vendor's website.

4. VENDOR CONTACT INFORMATION

Table 4-1. Product and Vendor List

Company	Product	Point of Contact/Website	Address/Phone Number
Dickson	FH525, FH535, WH445	dicksoncsr@dicksondata.com www.dicksondata.com	930 S. Westwood Avenue Addison, IL 60101-4917 800-757-3747
Extech	42275, SD500, RH520A	sales@extech.com www.extech.com	285 Bear Hill Road Waltham, MA 02451 781-890-7440 ext. 200
Lascar Electronics	EL-USB-2	sales@lascarelectronics.com www.lascarelectronics.com www.microdaq.com	4258 W.12th Street Erie, PA 16505 814-835-0621
LogTag	LogTag HAXO-8 Datalogger	info@logtag-recorders.com www.logtag-recorders.com www.microdaq.com	P.O. Box 362-95 Northcote Auckland 0748 New Zealand
Monarch Instruments	Track-It™ logger Model 5396-0203, Model 5396-0201	sales@monarchinstruments.com www.monarchinstrument.com www.microdaq.com	15 Columbia Drive Amherst, NH 03031 603-886-3300
Omega	OM-73, OM-CP- RHTEMP1000	info@omega.com www.omega.com	One Omega Drive Stamford, CT 06907-0047 203-359-1660
Sensitech Inc.	TempTale® 4, TempTale® 4 IS	clientservices@sensitech.com www.sensitech.com	900 Cummings Center Suite 258X Beverly, MA 28027 781-367-3630
Supco	SL300TH, SL400TH, THA2	info@supco.com www.supco.com	2230 Landmark Place Allenwood, NJ 08720 732-223-6644
TandD US, LLC.	RTR-503	sales@tandd.com www.tandd.com	P.O. Box 321 Saratoga Springs, NY 12866 518-669-9227

Table 4-1. Product and Vendor List (continued)

Company	Product	Point of Contact/Website	Address/Phone Number
Temperature Guard	M306	sales@temperatureguard.com www.temperatureguard.com	123 Whiting Street Suite 1A Plainville, CT 06062 860-747-6004 ext. 201
Testo	174H Mini Data Logger	info@testo.com www.testo.com www.microdaq.com	40 White Lake Road Sparta, NJ 07871 862-354-5001
Two Dimensional Instruments	Paperless Hygrometer TDVDR-02	info@e2di.com www.e2di.com	P.O. Box 159 Crestwood, KY 40014 502-243-0042

5. CONCLUSION

This market survey identified 21 temperature and humidity monitors and recorders from 12 manufacturers.

Temperature and humidity monitors and recorders may aid first responders in handling emergency situations by ensuring the viability of needed biomedical products. Many vaccines and medicines require specific storage conditions, e.g., no exposure to freezing temperatures during storage or transport, in order to remain effective. The type of monitor that should be purchased depends on the particular needs of the user. A useful feature for all monitors is a time delay to reduce the instances of false alarms due to doors opening or a defrost cycle starting. For AC powered units battery backup will ensure that data is not lost. In some cases the ability to control sampling and alarm conditions remotely may be beneficial. Phone, e-mail, or SMS notification when temperatures exceed allowable limits may be a useful feature to ensure that blood products, medicines, and vaccines are viable when needed.

This report reviews only a sampling of the available temperature and humidity monitors. Purchasers should determine which features are useful and research the numerous manufacturers to get the best product for their individual needs.

APPENDIX A. REQUEST FOR INFORMATION

U. S. Department of Homeland Security
National Urban Security Technology Laboratory
201 Varick Street, 5th floor, New York, NY 10014-7447



Document Type: Special Notice

Title: Market Survey - Temperature and Humidity Monitors/Recorders

Posted Date: 2/23/2011

Contracting Office Address:

Office of the Chief Procurement Officer
Washington, District of Columbia 20528
United States

Description:

Request for Information (RFI) - TEMPERATURE AND HUMIDITY MONITORS/RECORDERS

DUE: 3/11/2011

The U. S. Department of Homeland Security, National Urban Security Technology Laboratory (NUSTL), formerly the Environmental Measurements Laboratory (EML), 201 Varick St. 5th Floor, New York, NY 10014, is seeking information about temperature and humidity monitors to meet the needs of emergency responders. The Department of Homeland Security (DHS) Authorized Equipment List (AEL) item number(s) for this equipment are/is 19GN-00-RFMN. The target audience for this information is law enforcement personnel, fire fighters, and emergency medical and public safety providers and their purchasing agents. All submittals should be suited to the target audience's specific needs .

Review of this information is being performed for the DHS, Science and Technology Directorates System Assessment and Validation for Emergency Responders (SAVER) Program. DHS established SAVER to conduct comparative assessments and validation activities that provide the emergency responder community with information on important products and services. For more information on the SAVER Program, visit the SAVER Website at <http://www.rkb.us.saver>.

All information received will be treated as public knowledge and may be used in SAVER Program documentation; therefore, vendors should not submit proprietary information in response to this RFI. Specific information sought includes:

1. Company information, including name, address, point of contact, URL and the number of employees.
2. Whether the company is a manufacturer or distributor.

www.dhs.gov

- 2 -

3. A point of contact for follow-up information, and the point of contacts phone number and e-mail address.
4. Product name, brief description and specifications.
5. Cost information such as purchase price and General Services Administration (GSA) schedule information.

The submitted information will be evaluated for inclusion in SAVER projects and reports. Determination as to an individual product's suitability will be made by the National Urban Security Technology Laboratory based on the objectives of this request. Therefore, requests for feedback should not be made through the Federal Business Opportunities posting agency. Vendors may be contacted following submission for more detailed product information. Vendor provided information may be reformatted for publication in SAVER Program documents.

Submittals

Respondents are required to complete a product summary questionnaire for each product.

The questionnaire may be obtained, via E-mail, by contacting the technical point of contact Karin Decker at Karin.decker@dhs.gov.

This RFI is for information gathering and planning purposes only, and should not be construed as a Request for Proposal (RFP) or solicitation of an offer. The Government does not intend to award a contract on the basis of this RFI or otherwise pay for the information solicited. Submission of vendor information constitutes consent to publication of that information in SAVER Program documentation. E-mail your non-technical questions to Sharon Flowers, DHS Contracting Officer (Sharon.flowersl@dhs.gov, 202-254-6816).