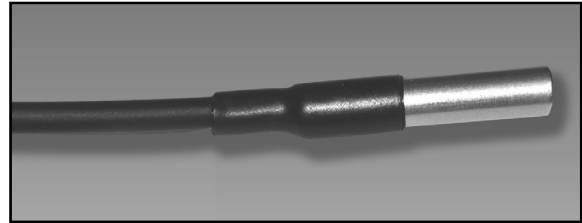# 12-Bit Temperature Smart Sensor

The 12-Bit Temperature smart sensor is designed to work with the HOBO® Weather Station. The smart sensor has a plug-in modular connector that allows it to be added easily to a HOBO Weather Station. All sensor parameters are stored inside the smart sensor, which automatically communicates configuration information to the logger without any programming or extensive user setup.

Specification	12-Bit Temperature Smart Sensor
Measurement Range	-40° to +75°C (-40° to +167°F)
Accuracy	< ±0.2°C from 0° to +50°C (< ±0.36°F from +32° to +122°F), see Figure 1
Resolution	< 0.03°C from 0° to +50°C (< 0.054°F from +32° to +122°F), see Figure 1
Drift	< 0.1°C (0.18°F) per year
Response Time	< 2 minutes typical, in 2 m/sec (4.5 mph) moving air flow < 1 minute typical in stirred water bath
Operating Temperature Range	-40° to +75°C (-40° to +167°F)
Environmental Rating	Sensor tip and cable jacket: Immersion in water up to +50°C (+122°F) for 1 year
Housings	Stainless steel waterproof sensor tip; weatherproof PVC housing for smart sensor adapter
Dimensions	Temperature probe: 7 x 38 mm (0.28 x 1.5 in.)
Weight	2 meter: .09 g (3.3 oz) 6 meter: .14 g (5.2 oz) 17 meter: .30 g (11.2 oz)
Bits per Sample	12
Number of Data Channels *	1
Measurement Averaging Option	Yes
Cable Lengths Available	2 m (6.6 ft) S-TMB-M002 6 m (19.7 ft) S-TMB-M006 17 m (55.8 ft) S-TMB-M017
Length of Smart Sensor Network Cable *	0.5 m (1.6 ft) for all models
Part Number	S-TMB-M002 (2 meter cable) S-TMB-M006 (6 meter cable) S-TMB-M017 (17 meter cable)
(€ Specification	This product meets CE specification EN61326 criterion C for ESD, criterion C for Radiated Immunity, criterion B for Fast Transient, criterion A for Conducted Immunity, and criterion A for Power Frequency Magnetic Fields. To minimize measurement errors due to ambient RF, use the shortest possible probe cable length and keep the probe cable as far as possible from other cables.

*   A single HOBO Weather Station can accommodate 15 data channels and up to 100 m (328 ft) of smart sensor cable (the digital communications portion of the sensor cables).
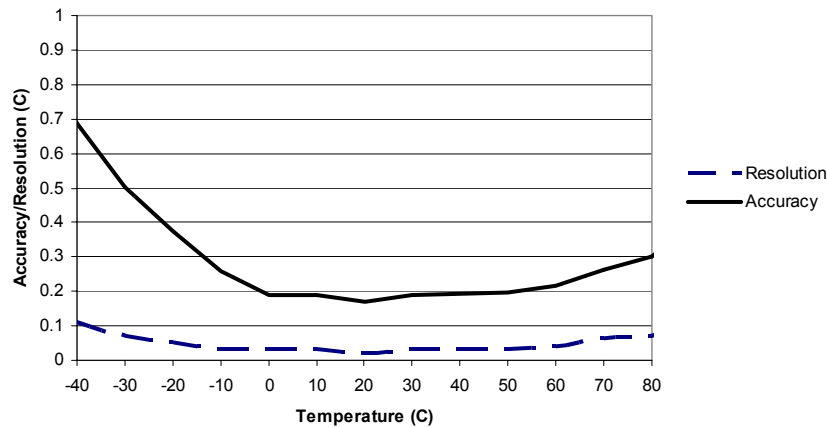
Figure 1: 12-Bit Temperature Smart Sensor Accuracy and Resolution

Inside this package
- 12-Bit Temperature Smart Sensor

Mounting

Optional Accessories
- Solar Radiation Shield (Part # M-RSA)

Typical Mounting
Use the ¼ inch cable clamp, washer, and screw (included with the solar radiation shield) to secure the sensor in the solar radiation shield as shown below.
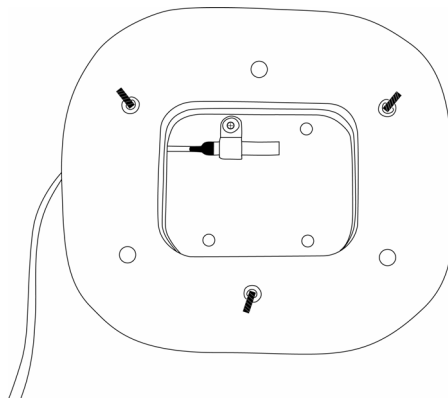

Figure 2: 12-Bit Temperature Smart Sensor Mounted in the Solar Radiation Shield

Mounting Considerations
- Mount the sensor so that at least 10 cm (4 inches) of the sensor cable is placed in the medium that is being measured. The temperature sensor is approximately 0.32 cm (1/8 inch) from the end of the stainless steel tip.

- If the sensor cable is left on the ground, it is recommended that you use conduit to protect against animals, lawn mowers, exposure to chemicals, etc.

- If you are mounting the sensor in water, place the sensor cable on the side of the mounting post facing downstream. This helps protect the sensor cable from getting damaged by floating debris.

- The Solar Radiation Shield (Part # M-RSA) is strongly recommended when measuring outdoor air temperatures. Solar radiation can significantly affect the air temperature readings.

- Refer to the *HOBO Weather Station User's Guide* for more information about setting up complete HOBO Weather Stations.

Connecting

To use the 12-Bit Temperature smart sensor, stop the HOBO Weather Station logger and insert the sensor's modular jack into an available port on the logger. If a port is not available, use a 1-to-2 adapter (Part # S-ADAPT), which allows you to plug two sensors into one port. The next time you use the HOBO Weather Station, it will automatically detect the new smart sensor. Note that the HOBO Weather Station supports a maximum of 15 data channels; this sensor uses one data channel. Launch the logger and verify that the sensor is functioning correctly. See the *HOBO Weather Station User's Guide* for more details about connecting smart sensors to the HOBO Weather Station.

Operating Environment

The 12-Bit Temperature smart sensor can be used in air, soil, or water. The sensor is designed to last at least one year in water as warm as +50°C (+122°F). If the smart sensor is continually exposed to water for more than a year, it will eventually drift. Exposure to water above +50˚C (+122°F) is not recommended and may significantly reduce the life of the sensor.

Response Time

The 12-Bit Temperature smart sensor has 90% response times of < 2 minutes in 2 m/sec (4.5 mph) moving air flow (< 1 minute typical in stirred water bath). Faster sensor response times are not always better because they are more likely to be affected by transient conditions. Ideally the response time of a sensor should be the same order of magnitude as the logging interval. For typical logging intervals of 10 to 30 minutes, this smart sensor's response time of < 2 minutes is an acceptable match, however, measurement averaging may be useful for longer logging intervals (see the *Operation* section below).

Operation

The 12-Bit Temperature smart sensor supports measurement averaging. When measurement averaging is enabled, data is sampled more frequently than it is logged. The multiple samples are then averaged together and the average value is stored for the interval. For example, if the logging interval is set at 10 minutes and the sampling interval is set at 1 minute, each recorded data point will be the average of 10 measurements. Measurement averaging is useful for reducing noise in the data and preventing aliasing, which can occur when the temperature varies more rapidly than it is being measured. It is recommended that you use measurement averaging whenever the 12-Bit Temperature smart sensor is placed in an area where the temperatures can change quickly with respect to the logging interval, for example, placed in front of a cycling air vent while using a relatively long logging interval. Note that fast sampling intervals (less than 1 minute) may significantly reduce battery life.

Maintenance

The 12-Bit Temperature smart sensor does not require any maintenance other than an occasional cleaning. If necessary, rinse the sensor and cable with mild soap and fresh water.

Verifying Sensor Accuracy

It is recommended that you check the accuracy of the 12-Bit Temperature smart sensor annually. The 12-Bit Temperature smart sensor cannot be calibrated. Onset® uses precision components to obtain accurate measurements. If the smart sensor is not providing accurate data, then it may be damaged or worn out if it has been in use for several years. If you are unsure of the smart sensor's accuracy, you can send it back to Onset for re-certification. Contact Onset or your place of purchase for a Return Merchandise Authorization (RMA) number and associated costs prior to sending it.

Warranty

Onset Computer Corporation (Onset) warrants to the original end-user purchaser for a period of **one year** from the date of original purchase that the HOBO® product(s) purchased will be free from defect in material and workmanship. During the warranty period Onset will, at its option, either repair or replace products that prove to be defective in material or workmanship. This warranty shall terminate and be of no further effect at the time the product is (1) damaged by extraneous cause such as fire, water, lightning, etc. or not maintained in accordance with the accompanying documentation; (2) modified; (3) improperly installed; (4) repaired by someone other than Onset; or (5) used in a manner or purpose for which the product was not intended.

THERE ARE NO WARRANTIES BEYOND THE EXPRESSED WARRANTY ABOVE. IN NO EVENT SHALL ONSET BE LIABLE FOR LOSS OF PROFITS OR INDIRECT, CONSEQUENTIAL, INCIDENTAL, SPECIAL OR OTHER SIMILAR DAMAGES ARISING OUT OF ANY BREACH OF THIS CONTRACT OR OBLIGATIONS UNDER THIS CONTRACT, INCLUDING BREACH OF WARRANTY, NEGLIGENCE, STRICT LIABILITY, OR ANY OTHER LEGAL THEORY.

Limitation of Liability. The Purchaser's sole remedy and the limit of Onset's liability for any loss whatsoever shall not exceed the Purchaser's price of the product(s). The determination of suitability of products to the specific needs of the Purchaser is solely the Purchaser's responsibility. **THERE ARE NO WARRANTIES BEYOND THE EXPRESSED WARRANTY OFFERED WITH THIS PRODUCT. EXCEPT AS SPECIFICALLY PROVIDED IN THIS DOCUMENT, THERE ARE NO OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTIBILITY OR FITNESS FOR A PARTICULAR PURPOSE. NO INFORMATION OR ADVICE GIVEN BY ONSET, ITS AGENTS OR EMPLOYEES SHALL CREATE A WARRANTY OR IN ANY WAY INCREASE THE SCOPE OF THE EXPRESSED WARRANTY OFFERED WITH THIS PRODUCT.**

Indemnification. Products supplied by Onset are not designed, intended, or authorized for use as components intended for surgical implant or ingestion into the body or other applications involving life-support, or for any application in which the failure of the Onset-supplied product could create or contribute to a situation where personal injury or death may occur. Products supplied by Onset are not designed, intended, or authorized for use in or with any nuclear installation or activity. Products supplied by Onset are not designed, intended, or authorized for use in any aeronautical or related application. Should any Onset-supplied product or equipment be used in any application involving surgical implant or ingestion, life-support, or where failure of the product could lead to personal injury or death, or should any Onset-supplied product or equipment be used in or with any nuclear installation or activity, or in or with any aeronautical or related application or activity, Purchaser will indemnify Onset and hold Onset harmless from any liability or damage whatsoever arising out of the use of the product and/or equipment in such manner.

Returns

Please direct all warranty claims and repair requests to place of purchase.

Before returning a failed unit directly to Onset, you must obtain a Return Merchandise Authorization (RMA) number from Onset. You must provide proof that you purchased the Onset product(s) directly from Onset (purchase order number or Onset invoice number). Onset will issue an RMA number that is valid for 30 days. You must ship the product(s), properly packaged against further damage, to Onset (at your expense) with the RMA number marked clearly on the outside of the package. Onset is not responsible for any package that is returned without a valid RMA number or for the loss of the package by any shipping company. Loggers and sensors must be clean before they are sent back to Onset or they may be returned to you.

Repair Policy

Products that are returned after the warranty period or are damaged by the customer as specified in the warranty provisions can be returned to Onset with a valid RMA number for evaluation.

ASAP Repair Policy

For an additional charge, Onset will expedite the repair of a returned product.

Tune Up Service

Onset will examine and retest any HOBO data logger or sensor.