

Thermochron iButton: Limitation of this Inexpensive and Small-Diameter Temperature Logger

by Brad D. Wolaver and John M. Sharp Jr.

Introduction

The purpose of this technical note is to inform the reader of an important limitation of the Thermochron iButton that may lead to data loss due to water leakage. Johnson et al. (2005) evaluated the performance of the Thermochron iButton, an inexpensive, small-diameter temperature logger manufactured by Dallas Semiconductor (a subsidiary of Maxim Integrated Products, Sunnyvale, California). The Thermochron iButton is traditionally used to track fresh food shipping temperature and recently used for hydrogeology applications. The Thermochron iButton is an attractive new tool for hydrogeologists because it collects high-resolution shallow water temperature data for a fraction of the cost and size of traditional temperature loggers, permitting multiple-logger deployment in tight areas like small-diameter monitoring wells. Recent field testing of the Thermochron iButton in fresh water springs at ambient temperatures and water depths less than 6 m for a period of 7 weeks resulted in the loss of data in some temperature loggers due to water leakage. Johnson et al. (2005) did not encounter this problem with earlier Thermochron iButtons.

Field Deployment: Successes and Failures

We installed eight high-resolution Thermochron iButtons at water depths of approximately 2 to 6 m in fresh water springs of the Cuatrociénegas Basin,

Coahuila, Mexico, in mid-June 2006 (temperatures 30°C to 34°C, specific conductance 2300 to 2500 μS ; Wolaver et al. 2007). When we attempted to retrieve temperature data from the loggers after 7 weeks, communication was not possible with three loggers and an error message was displayed (“Invalid CRC16 read from device”).

Our findings are contrary to those of Johnson et al. (2005), who suggest successful deployment and data retrieval from Thermochron iButton (without iButton capsules) installed at depths of up to 5 m for a time period as long as 12 months (and depths perhaps as great as 15 m) without any waterproof protection.

Thermochron iButton: Design Updates

Dallas Semiconductor recently has made available a waterproof iButton Capsule (model DS9107, ~\$30; Figure 1) that corrects for this design limitation. In addition, the waterproof iButton Capsule increases the size of the device from 17.35×6 mm (Johnson et al. 2005) to approximately 35×25 mm (Dallas Semiconductor 2006). However, the iButton Capsule has two stainless steel screws that may facilitate deployment in small-diameter monitoring wells.

Summary

While iButton Thermochron temperature loggers offer a low-cost, small-diameter solution for high-resolution temperature measurement,

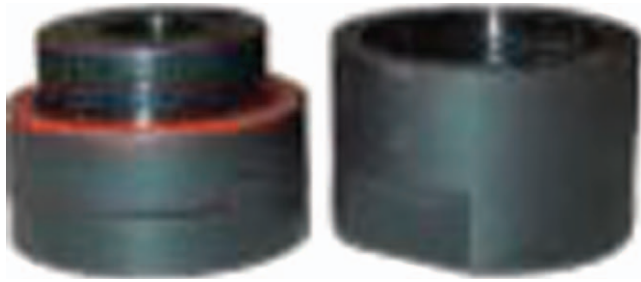


Figure 1. iButton Capsule. Diameter = 25.4 mm. Photo by Dallas Semiconductor.

a water leakage problem in current models may result in complete logger failure in installations as shallow as 2 m in fresh water at ambient temperatures. In the summer of 2006, Dallas Semiconductor began offering the previously unavailable waterproof iButton Capsule (model DS9107) that facilitates deployment of iButton Thermochron loggers for hydrogeology applications. The waterproof iButton Capsule adds approximately \$30 to the base price of an iButton Thermochron (~\$15 to \$40, depending on temperature range and resolution). In addition, the size of the iButton Thermochron is increased by

approximately eight times (from a volume standpoint) by the waterproof capsule, making it nearly the same size as other temperature loggers evaluated by Johnson et al. (2005). Ultimately, price and size requirements of individual temperature logging requirements and applications should guide the purchase of an appropriate temperature logger.

Editor's Note: The use of brand names in peer-reviewed papers is for identification purposes only and does not constitute endorsement by the authors, their employers, or the National Ground Water Association.

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