

AquaTemp Submersible Temperature Sensor



Operations & Maintenance Manual



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Manual Version Control

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1 Introduction

The AquaTemp® is a rugged, submersible digital precision temperature sensor. The sensor is compatible with the industry standard, SDI-12 protocol v1.3. The sensor consists of a precision calibrated digital sensor accurate to $\pm 0.1^{\circ}\text{C}$ (-5°C to $+45^{\circ}\text{C}$). The sensor can be ordered with variable lengths of UV resistant cable.

2 Unpacking

Remove the AquaTemp sensor from the shipping container and visually inspect the unit for signs of damage during shipment. Report any such damage to the factory immediately to ensure a prompt response and resolution. Retain one shipping container in the event a factory return is necessary.

Please note that if a return is required, a return material authorization (RMA) number is required. To get this RMA number, call the Sutron Customer Service Department at 703-406-2800.

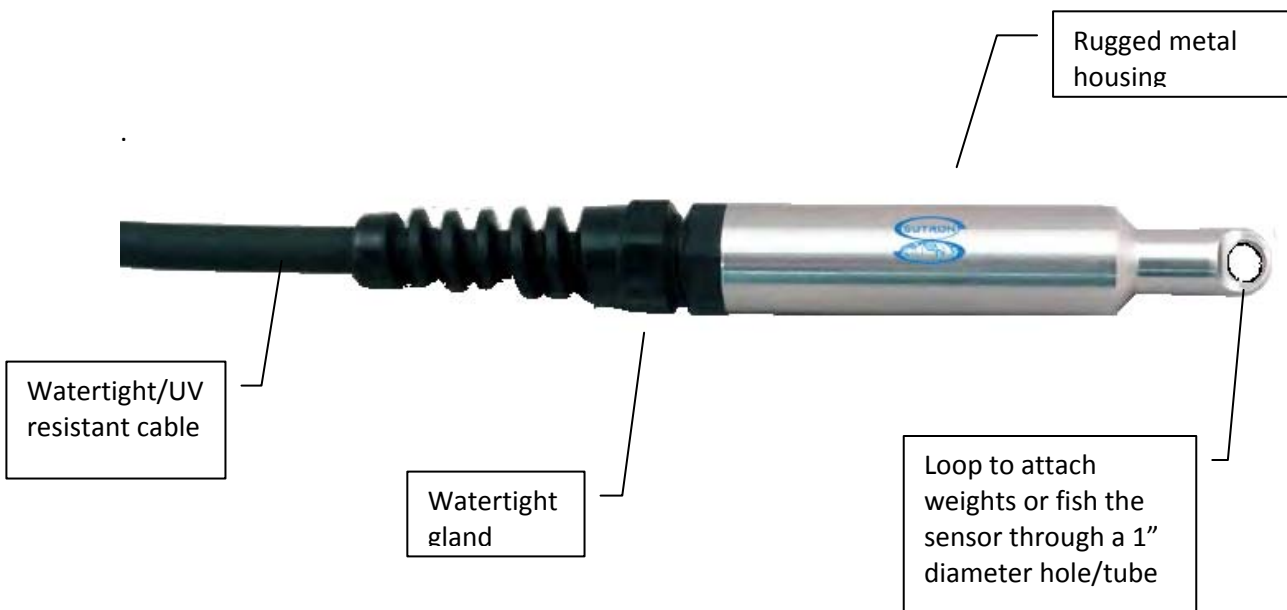


Figure: 1 AquaTemp Sensor Parts

3 Connections

The AquaTemp sensor is very simple to connect and get working. The unit has a standard three wire SDI-12 interface (i.e. power, ground, and data).

Color	Description
Black	SDI-12 Ground
Red	SDI-12 + power
White	SDI-12 Data

4 Sensor Configuration

The AquaTemp sensors are configured at the factory to the default SDI address 0. If the AquaTemp is the only SDI-12 sensor on the SDI-12 bus, no additional configuration is needed. Refer to the SDI-12 command table below for instructions on how to change the address if needed.

5 SDI-12 Command Reference

The AquaTemp sensor is SDI-12 compliant and will respond to all SDI-12 commands according to version 1.3 of the standard. To use the SDI-12 commands you must have a data logger or interface that supports the SDI-12 standard. More details on the SDI-12 interface can be found at <http://www.sdi-12.org>.

The general form of an SDI-12 command is:

aC!<CR><LF>

Where a is the sensor address 0-9,A-Z,a-z,*, ?. (Addresses * and ? will address any sensor, regardless of its address.) ,C is the command and ! is the last character of the command.

Example: 0I!<CR><LF>
 Response:013SUTRON AQUATEMP000130T1.01

Asks the sensor at address 0 to identify itself.
 Board Number: 13, serial number: 000130, SW version: 1.01

Example: 0M!<CR><LF>
 Response: 000002

Command to make a measurement
 Address 0, data ready in 0000 seconds, 2 values

Example: 0D!
 Response: 0+32.15+89.87

Request data (valid only after M, C commands
 Address 0, 32.15C, 89.97F.

The following table gives the details for the SDI-12 commands supported by Aquatemp.

Command	Name	Command	Response	Notes
?	Query SDI Address	?!	A where a= address	Only one SDI-12 device should be connected to the bus since all will respond.
	Acknowledge Active	a!	A	
I	Send Identification	a!	For a master the expected response is a13 SUTRON AQUATEMP ssssssTv.vv a = address 13 = Board Number SUTRON = manufacturer AQUATEMP = model number ssssss = serial number v.vv = software revision number	Identification string for AquaTemp sensors.
A	Change Address	aAb! Example: 0A5!	b Indicating new address Example: 5	
M MC C CC	Measure Temperature	aM! (or MC, C, CC) Ex : 8M! aD0! Ex: 8D0!	A0002 2 values available in 0 seconds. Use D0 to retrieve data. 8+32.15+89.87 32.15 = temperature in Celsius 89.97= temperature in Fahrenheit	Performs a single measurement and returns the temperature in Celsius and Fahrenheit

6 Maintenance

The sensor is designed to require minimal maintenance while deployed. Most routine maintenance will be inspecting the sensor periodically to make sure it is free of dirt or debris that might accumulate on the outside of the sensor housing. Accumulation of debris on the sensor housing will typically effect sensor response time.

Calibration of the sensor can be checked in the field with an independent reference. However, it may be difficult to get an agreement between the sensor and the reference better than 0.5 C. This will likely be due to placement of the sensor in relation to the reference, the medium being measured, the temperature uniformity in the medium, the accuracy and the response time of the reference device.

Calibration information of the sensor is available upon request for a nominal fee. Contact Sutron's Customer Service Department for further information. Have the Serial number of the sensor available. The serial number is on the label attached to the sensor housing and can also be queried by issuing the SDI command "I!" to the appropriate sensor address.

7 Ordering Information

AquaTemp-X X is custom cable length in feet (max recommended length is 300 ft/91m)

Appendix A – Specifications

Units	Celsius, Fahrenheit
High Accuracy Temperature Sensor	$\pm 0.1^{\circ}\text{C}$ (-5 to +45°C)
Temperature Resolution	0.01°C
Operating Range	-40 to +60°C
Quiescent Current	< 0.1 mA
Active Current	<5 mA
Input Voltage	7-16V DC
Sensor drift after 1 year at room temperature	0.02°C
Sensor drift after 1000 hours at 85°C	0.05°C
SDI-12 Operation	V1.3
Tough UV resistant, water blocking polyurethane cable	User specified length up to 91m (300ft) Up to 305m (1000 ft) when there are no other SDI-12 devices on the bus.
Diameter	1.6 cm (0.63 inch)
Device is capable of fitting through a standard 1 inch conduit with 8 inch factory bend corner	
<i>Specifications subject to change without notice</i>	

Appendix B – Sutron Customer Service Policy

Dear Customer:

Thank you for making the important decision to purchase Sutron equipment. All Sutron equipment is manufactured and tested to the highest quality standards as set by Sutron's Quality Assurance Department. Our Customer Service Representatives have years of experience with equipment, systems and services. We have electronic technicians with field and applications experience, not limited to technical school training.

Sutron Equipment Repairs

Sutron maintains a Repair Department at the Virginia factory (22400 Davis Drive, Sterling, VA 20164). Turn-around time normally ranges from 10-30 days after Sutron receives equipment for repair. Prior to returning any equipment for repair, please call Customer Service at (703) 406-2800 for a Return Material Authorization (RMA) number. Next send the faulty equipment back to the Virginia factory*.

Sutron Customer Service will repair Sutron-manufactured equipment sent to us for repair within 30 days of the time we receive the item or that repair is free of charge. Please provide our Customer Service Representative with your email address when receiving the RMA number so that we can email you when your equipment is received at Sutron and again when it is shipped back to you. Expedited repairs can be completed within one (1) week for an additional expedite fee of \$200.00. Repaired equipment is warranted for a period of 180 days after the repair shipment date.**

Note: The 30 day guarantee does not apply to bulk shipments of 10 or more repair items. We appreciate your cooperation in achieving a quick turn-around by promptly providing cost approval decisions, Purchase Order and credit card information once we have supplied you with a repair estimate.

Customer Phone Support - 8:00 am to 8:00 pm EST

Customer Service Representatives routinely handle a wide variety of questions every day. When equipment questions arise, please feel free to contact me or one of Sutron's Customer Service Representatives. We are available from 8:00 am to 8:00 pm EST Monday through Friday and will be happy to take your calls. The main Customer Service number is (703) 406-2800, extension #5. After 5 pm EST Monday through Friday, please use extension #6. We typically answer most sensor and interface questions on the first call. If we cannot quickly answer a question on an interface, we will work with you until we find a solution. Sometimes a problem is application related. Although we pride ourselves on handling 95% of application related questions over the phone, we maintain constant contact with our Integrated Systems Division and Engineering Division for additional assistance.

Training

Training is an important part of the Sutron Customer Service Success policy. With proper training, you will learn how to take advantage of all the benefits and tools that Sutron equipment provides. We are available for, and frequently provide, on-site introductory training at our Customers' facilities. We also hold three (3) day training seminars approximately four times per year at our Sutron headquarters in Sterling (near Washington, DC). Contact me or your Sutron Regional Sales Manager for details.

On-Site Visits

Of course not all problems can be fixed over the phone. Sometimes a customer needs an on-site technician to identify site related problems or troubleshoot a network. Sutron provides these services at a reasonable cost. Please call for details. If you would like to learn more about Sutron products, please email sales@sutron.com. Thank you again for your business.

Paul Delisi

Customer Service Manager
pdelisi@sutron.com

**Transportation charges for equipment returns are the responsibility of the Customer.*

*** See Warranty on next page. Any products repaired or replaced under Warranty will be warranted for the balance of the Warranty period or for a period of 180 days from the repair shipment date, whichever is greater.*

Appendix C – Commercial Warranty

SUTRON MANUFACTURED EQUIPMENT

SUTRON CORPORATION WARRANTS that the equipment manufactured by its Manufacturing Division shall conform to applicable specifications and shall remain free from defects in workmanship and material for a period ending two years from the date of shipment from Sutron's plant.

Sutron's obligation under this Warranty shall be limited to repair at the factory (22400 Davis Drive, Sterling, VA 20164) or, at Sutron's option, replacement of the defective product. In no event shall Sutron be responsible for incidental or consequential damages, whether or not foreseeable or whether or not Sutron has knowledge of the possibility of such damages. This Warranty shall not apply to products that have been damaged through negligence, accident, misuse or acts of nature such as floods, fires, earthquakes, lightning strikes, etc.

Sutron's liability, whether in contract or in tort, arising out of warranties or representations, instructions or defects from any cause, shall be limited exclusively to repair or replacement parts under the aforesaid conditions.

Sutron requires the return of the defective electronic products or parts to the factory to establish claim under this Warranty. The customer shall pre-pay transportation charges to the factory. Sutron shall pay transportation charges for the return of the repaired equipment to the customer when the validity of the damage claim has been established. Otherwise, Sutron will pre-pay shipment and bill the amount to the customer. All shipments shall be accomplished by best-way surface freight.

Sutron shall in no event assume any responsibility for repairs or alterations made other than by Sutron. Any products repaired or replaced under this Warranty will be warranted for the balance of the Warranty period or for a period of 180 days from the repair shipment date, whichever is greater. Products repaired at cost will be warranted for 90 days from the date of shipment.

NON-SUTRON MANUFACTURED EQUIPMENT

The above Warranty applies only to products manufactured by Sutron. Equipment provided, but not manufactured by Sutron, is warranted and will be repaired to the extent of and according to the current terms and conditions of the respective equipment manufacturers.

EXTENDED WARRANTY AND ON-SITE MAINTENANCE

Extended warranty and on-site maintenance contracts are available. Price quotations may be obtained from Sutron Customer Service Representatives.