



DigiTemp

SDI-12 Submersible Digital Temperature Sensor

User Manual



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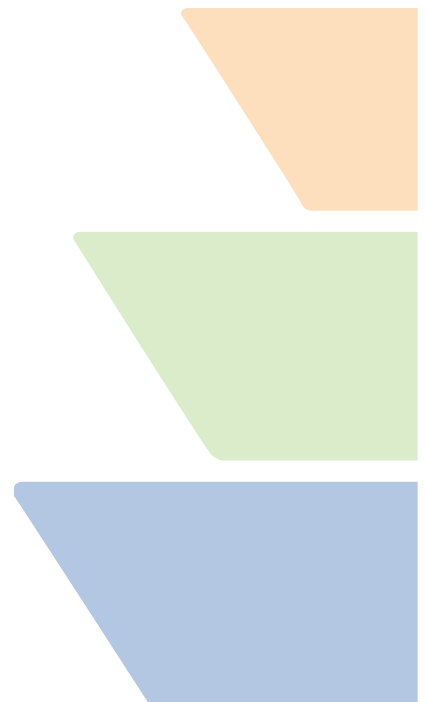
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Revision History

Date	Person	Description
24 Nov 2011	RG	First released version
28 Nov 2011	RG	Late corrections

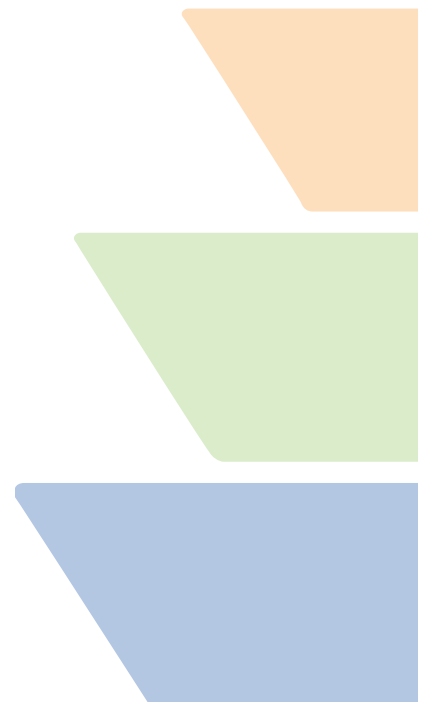
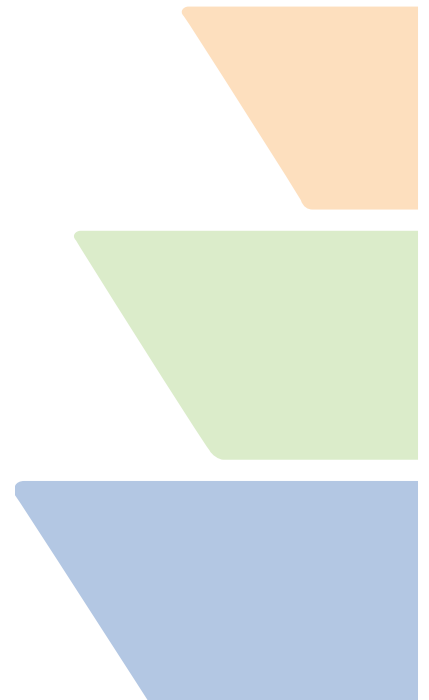




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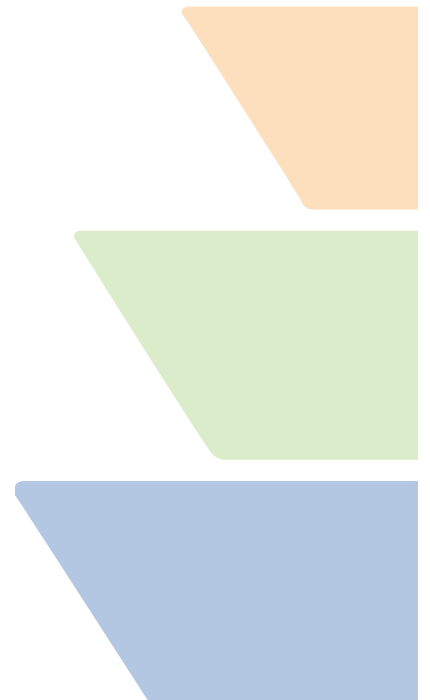




Chapter 1 Operation

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1.1 General description

The FTS DigiTemp Submersible Temperature Sensor is simple, compact, rugged SDI-12 device that measures temperature of water or soil. The DigiTemp is extremely simple to use: it needs absolutely no configuration in most applications, and it returns measured temperatures in both degrees Celsius and degrees Fahrenheit. It is accurate to 0.2 °C over a temperature range of -5 °C to +45 °C.

The FTS DigiTemp consists of a thermistor sensing element connected to a microcontroller unit that processes the thermistor resistance into a temperature value and communicates with the data collection platform using the SDI-12 protocol. The data collection platform requests measurements by sending commands to the DigiTemp.

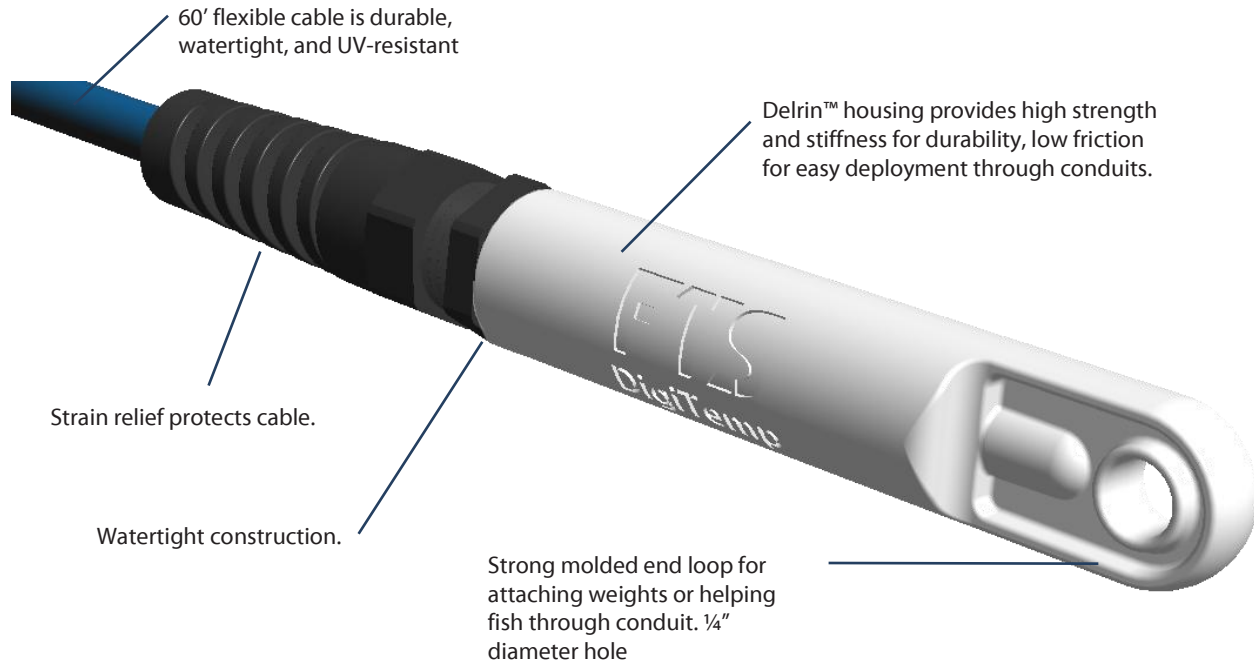


Figure 1-1: FTS DigiTemp sensor

1.2 Installation

The DigiTemp is easy to install. Follow these steps:

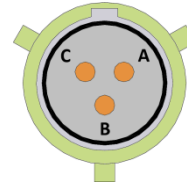
1. Place the sensor in a location where it is continuously immersed in a representative sample of the water to be monitored (usually a well-mixed locale).
2. The sensor may be mounted on an object or armature, or it may be suspended by its cable with an anchor (do not exceed a cable tension of 5 kg / 11 lb). Sensor and cable dimensions enable it to be deployed through standard 1-inch PVC conduit with 8-inch factory bends.
3. Secure the sensor cable to the mounting structure to prevent cable chafing.
4. Route the cable safely to the data collection device.
5. If a connector is used, plug the connector into the connector port on the data collection device.

If a terminal block is used, refer to section 1.3 below for wire colour and function.

1.3 Connection

The DigiTemp can be supplied with or without a connector. Cable wire colour coding and FTS standard connector¹ pinouts are shown in the table and diagram below:

Wire colour	Pin ¹	Function
Red	A	+12 V DC power supply
White	B	Data
Black	C	Ground



If the DigiTemp is supplied without a connector, the user is responsible for connecting the sensor to the data collection platform. A user can attach their own connector, or connect the cable via a terminal strip, or directly wire it to device electronics.

1.4 Operation

The FTS DigiTemp is an SDI-12 device and is powered by the +12 V DC power supply on the SDI-12 bus.

For details on the SDI commands used by the sensor, see Chapter 2 SDI Commands.

1.5 Configuration

The DigiTemp is shipped with default address 0 (unless shipped as part of an integrated FTS system). The only configuration available is to change this address if necessary in systems with more than one SDI-12 sensor on the same bus. Refer to section 2.3.3 Change Address for instructions on setting the sensor's address.

1.6 Calibration and maintenance

Calibration is never required. Maintenance consists of periodic checking for cable wear.

Please contact FTS technical support (see manual front pages) if the unit ceases to operate properly.

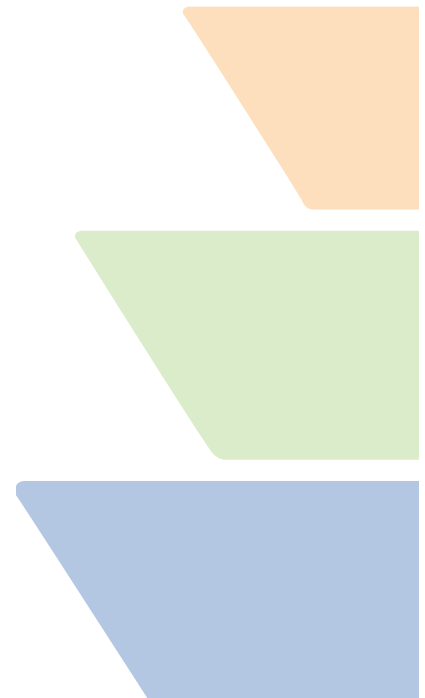
¹ Waterproof military-style bayonet connector 851-06JC8-3AP50; FTS part number 520-83AP; compatible with FTS Axiom dataloggers.



Chapter 2 SDI Commands

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2.1 Notation for SDI commands

In the end, SDI commands are strings of characters sent to the SDI device. The format of those strings is important, of course, and to specify the format of SDI commands we use different typefaces. All commands (and the replies from the device) are represented in a monospaced font, **thus**. Different parts of a command are represented with variants on this text format.

Item	Meaning	Text representation
Command literal	Part of a command that must be reproduced literally as it appears;	X
Command parameter	Part of a command that must be filled in with an appropriate value	<i>data</i>

2.2 Commands recognized by DigiTemp

The table below provides a quick reference to the commands recognized by the DigiTemp. For details on these commands, see the following sections.

Command name	Command code	Notes
Address Query	?!	
Acknowledge Active	a!	
Change Address	aAb!	
Send Identification	aI!	
Start Measurement	aM!, aMC!	C following a command requests a CRC code in the data return (D command)
Start Concurrent Measurement	aC!, aCC!	C following a command requests a CRC code in the data return (D command)
Send Data	aDb!	
Continuous Measurements (Read)	aR!, aRC!	C following a command requests a CRC code in the data return
Start Verification	aV!	

2.3 General SDI commands

General SDI commands are used for housekeeping issues such as device address configuration, device identification and confirmation of device communications. General SDI-12 version 1.3 commands are as follows.

2.3.1 Address Query

This command requests the address of the SDI sensor.

	String	Note
Cmd	?!	request the (single) device on this bus to report its address
Resp	0	the device is configured for address 0 only one SDI device should be connected to the bus when using this command; problems arise when several devices respond on the same bus

2.3.2 Acknowledge Active

This command queries whether a sensor is present on the SDI bus at the specified address.

	String	Note
Cmd	0!	request the device at address 0 to confirm it is active
Resp	0	a device is present at address 0

2.3.3 Change Address

This command changes a sensor's SDI address.

	String	Note
Cmd	0A3!	change the address of the device at SDI address 0 to 3
Resp	3	response confirms change

2.3.4 Send Identification

This command requests detailed identification information from the addressed sensor.

	String	Note
Cmd	3I!	
Resp	3 13 FTS ----- DgiTmp -v1 34567	3 device SDI address 13 compatible with SDI-12 version 1.3 FTS manufacturer's identifier DgiTmp sensor model -v1 version 1 of sensor firmware 34567 sensor serial number

2.4 SDI Data commands

SDI data commands request data from the sensor.

2.4.1 Start Measurement

This command is used to trigger a measurement on the addressed sensor. The sensor will not return data, instead the sensor will return the duration of the measurement as well as the number of data points returned by the measurement. The data is read using a subsequent Send Data command. Refer to Tables 2 and 3 for the specifics of the data returned from the sensor.

	String	Note
Cmd	3M! or 3MC!	start a measurement on sensor at address 3 (without or with CRC in data response, respectively)
Resp	30032	3 device SDI address 003 measurement delay (until data is ready; seconds) 2 number of data points returned

2.4.2 Start Concurrent Measurement

The concurrent measurement command allows a sensor to take a measurement while other SDI sensors are also taking measurements. The Start Concurrent Measurement Command operates in the same manner and returns the same information as the Start Measurement command (refer to Table 2).

	String	Note
Cmd	3C! or 3CC!	start a concurrent measurement on sensor at address 3 (without or with CRC in data response, respectively)
Resp	300302	3 device SDI address 003 measurement delay (until data is ready; seconds) 02 number of data points returned

2.4.3 Send Data

This command requests the data generated by the preceding Measurement (**M** or **C**) command. An **ad0!** command is always the first command sent to retrieve the data. If additional data needs to be read, then an **ad1!** command is sent, then and **ad2!** etc. etc., up to **ad9!**. Since the DigiTemp returns only two values (temperature in degrees C and F), only an **ad0!** command is ever required with it.

	String	Note
Cmd	3M!	start a measurement on sensor at address 3
Resp	30032	3 device SDI address 003 measurement delay (until data is ready; seconds) 2 number of data points returned
Cmd	3D0!	request data from previous measurement command
Resp	3+11.4+52.5	3 sensor SDI address +11.4 temperature in degrees Celsius +52.5 temperature in degrees Fahrenheit
Cmd	3MC!	start a measurement on sensor at address 3, with CRC in data response
Resp	30032	3 device SDI address 003 measurement delay (until data is ready; seconds) 2 number of data points returned

Cmd	3D0!	request data from previous measurement command
Resp	3+11.4+52.5DZF	3 sensor SDI address +11.4 temperature in degrees Celsius +52.5 temperature in degrees Fahrenheit DZF CRC code

2.4.4 Continuous Measurement

This command is not supported by the sensor. The response of the sensor to a Continuous Measurement command is shown below.

	String	Note
Cmd	1R!	perform a continuous measurement read on sensor at address 3
Resp	1	1 sensor SDI address DigiTemp is not a continuous measurement device. No data is returned.
Cmd	1RC!	perform a continuous measurement read on sensor at address 3, with CRC code in data response
Resp	1MSA	1 sensor SDI address MSA CRC code DigiTemp is not a continuous measurement device. No data is returned.

2.4.5 Start Verification

This command is not supported by the sensor. The response of the sensor to a Start Verification command is shown below.

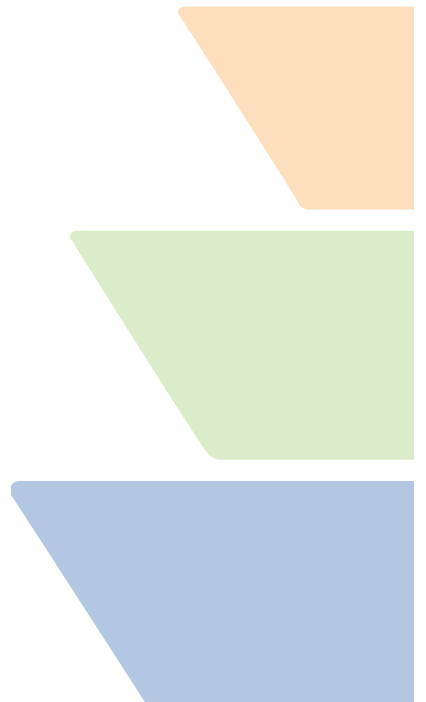
	String	Note
Cmd	3V!	start verification on sensor at address 3
Resp	30000	3 device SDI address 000 measurement delay (until data is ready; seconds) 0 no data is returned

2.5 Description of measured values

Measured value	Measurement resolution	Description
Temperature (C)	2 decimal places	Temperature in degrees Celsius
Temperature (F)	2 decimal places	Temperature in degrees Fahrenheit



Chapter 3 Technical specifications



Sensor type	Encapsulated thermistor
Interface	SDI-12 v.1.3
Nominal temperature range	-5°C to +45°C
Accuracy	±0.2°C
Resolution	0.01°C
Operating temperature range	-40°C to +60°C (temperature outside of nominal range may be less accurate)
Responsiveness	Time constant: 0.57 min (reaches 95% of final value in 1.7 min., 99% in 2.9min)
Measurement time	3 s
Power supply voltage	+12 V DC (nominal range: 9.6 V – 18.6 V)
Standby current	0.6 mA
Active current	5 mA
Dimensions	see Figure 3-1 below
Cable length	18.3 m (60 ft)
Weight (sensor without cable)	25 g (0.9 oz)
Weight (with 18.3 m cable)	0.9 kg(2 lb)
Maximum depth	30.5 m (100 ft)
Maximum suspended weight	5 kg (11 lb)

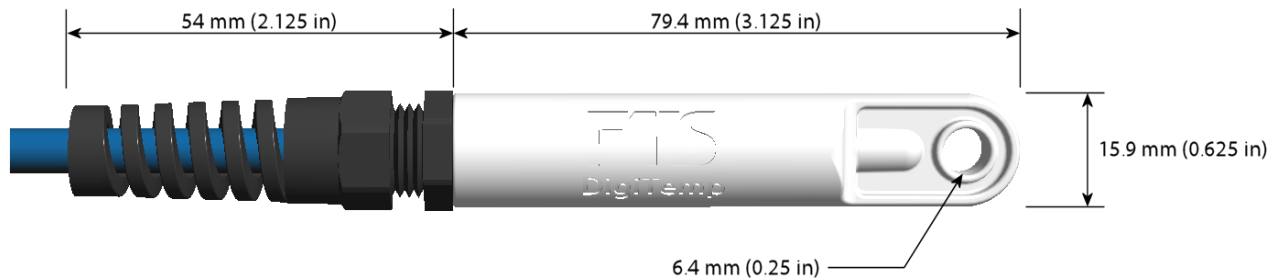


Figure 3-1: FTS DigiTemp sensor dimensions