Manual

SDI-12 Temperature Sensor

Models 6508A

Revision History

File name / Revision	Date	Authors & Change Details	Checked/ Approved
Unidata Manual - 6508A SDI-12 Temperature Sensor 30 11 2017.docx	30 11 17	RDS Initial Copy	IM
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1.0 INTRODUCTION

The 6580A SDI-12 temperature sensor is a high precision instrument for measuring environmental temperatures in soils and water. Based upon a high accuracy 24 bit digital sensing element it is accurate to less than 0.1°C over a range of -5° to 50°C.

A 10 metre waterproof polyethylene sheathed cable is fitted to the instrument as standard.

The SDI-12 interface allows the instrument to be used with modern data logging equipment.

Features:

- Submersible SDI-12 Temperature instrument
- Accuracy < 0.1°C over the range of -5°C to 50°C
- Low power
- Precision 24 bit digital temperature sensor
- Stable and factory calibrated

Applications:

- Aquaculture & egg hatcheries
- Soil temperature
- Surface water
- Streams
- Dams
- Ambient temperature
- Hydroponics
- Stilling wells
- Agriculture & soil science

SAFETY

This SDI-12 Temperature instrument is intended to be used and operated by persons with adequate electrical training. It is intended for connection only to low voltage SDI-12 signal wiring. It shall not be connected to other electrical systems or higher voltage power supplies.

2.0 INSTALLATION

Place the sensor in the desired location. If placing in flowing water, consider placing it in a location where thorough mixing occurs. If mounting to a structure take care to thermally isolate the sensor to ensure that it measures the water temperature rather than the structure temperature. Ensure that the cable is routed and supported to prevent chaffing or other damage.

2.1 Wiring Connection

The unit needs to be connected to the SDI-12 bus and power for operation. The following wiring connections are required:

Signal	Wire colour	Note
Ground	Black	Data logger / power supply signal ground
Power +12Vdc	Red	Power must be in the range of 6 to 16Vdc
SDI-12 Signal	White	SDI-12 signal bus to data logger

2.2 Configuration

The instrument is delivered with a default SDI-12 address of '0'.

In systems with more than one sensor on the SDI-12 bus the address can be changed using the aAb! Command. The address is easily changed using a tool like the Unidata 6412 SDI-12 Tester.

2.3 Reading the Sensor – Basic SDI-12 Operation

To read the sensor temperature via the SDI-12 bus you must send a command instructing the sensor to take a measurement (0M!). After 1 second the data will be ready and can be read via the get data command (0D!). The address of the sensor is set to '0' at manufacture. The address can be changed by the user via the change address (aAb!) command.

Note	Data logger → Sensor	Sensor response → Data Logger
Take Measurement command	0M!	
Sensor responds Response: atttn<CR><LF> Address = 0 Time until ready = 001 second Data to be returned = 1		00011
Sensor responds when ready Address returned = 0		0
Read data command	0D!	
Data returned from sensor Address = 0 Temperature = +30.62°C		0+30.62

Note that the above example is for a sensor with an assigned SDI-12 address of '0'.

Important: you must assign the desired address to the sensor prior to use using the aAb! change address command. The sensors have an address of '0' programmed at the time of manufacture

3.0 SUPPORTED SDI-12 COMMANDS

Command	Usage	Example	Comment
Address Query	Command: ?! Response:	Command: ?! Response: 0<CR><LF>	Used to find the sensors address, in this case it is '0'
Acknowledge	Command: a! Response: a<CR><LF>	Command: 0! Response: 0<CR><LF>	Used to confirm a sensor with address 'a' is operating ok. The sensor will respond with its address, in this case '0'
Send Identification	Command: aI! Response:	Command: 0I! Response:	Used to retrieve the sensors identification data. allccccccccmmmmmmvvvxxx…xxx<CR><LF>
Change address	Command: aAb! Response: b<CR><LF>	Command: 0A1! Response: 1<CR><LF>	'a' is the current address. 'b' is the new address. After processing the command the sensor replies with its new address.
Start Measurement	Command: aM! Response: atttn<CR><LF>	Command: 0M! Response: 0<CR><LF>	Instructs the sensor to take measurements. The sensor will reply with its address, the time until the data is ready and the number of parameters that will be returned. a: sensor address ttt: time in seconds until data will be ready n: number of values that will be returned in by a Send Data command.
Send Data	Command: aD0! Responses: a<values><CR><LF> or a<values><CRC><CR><LF>		The Send Data command aD0! is used to read the measured data values back from the sensor following a measurement command.

3.1 Examples of Command Usage

Detailed examples of command usage are shown in the table below.

Note that 'a' is the sensor address and should be in the range of 0...9, a...z, A...Z.

Commands are sent to the sensor using an SDI-12 Tester (e.g. Unidata 6412A) or your data logger in transparent mode, send the ?! command to the sensor. The sensor should immediately reply with its address followed by the carriage return and line feed characters. The carriage return and line feed characters may not be displayed by your logger communications software.

It should be noted that all sensors on an SDI-12 bus should have unique addresses. If sensors have the same address they will attempt to respond simultaneously causing a crash on the SDI-12 bus.

ADDRESS QUERY COMMAND	?!
Purpose: To determine the sensors address	

Data Logger		Sensor
!?	→	
	←	a<CR><LF>

Only one sensor should be connected to the SDI-12 bus when using the ?! command otherwise they will all attempt to reply simultaneously resulting in a crash on the SDI-12 bus.

ACKNOWLEDGE ACTIVE COMMAND	a!
Purpose: To determine if the sensor is functional.	

Data Logger		Sensor
a!	→	
	←	a<CR><LF>

When addressed with the a! command the sensor will reply with its address.

SEND IDENTIFICATION COMMAND	aI!
Purpose: To read the sensor identification string.	

Data Logger		Sensor
aI!	→	
	←	a13Unidata-6508A-1.008999<CR><LF>
		where:
		a = address
		13 = SDI-12 Version 1.3 compliant
		Unidata-6508A = Product Name/Model
		1.0 = Firmware Version
		08999 = Instrument Serial Number

In response to the Send Identification command the sensor will reply with its internally stored identification string.

CHANGE ADDRESS COMMAND	aAb!

Purpose: To change the sensor address.

Data Logger		Sensor
aAb!	→	
	←	a<CR><LF>

This command is used to change the address of a sensor.
a = current address.
b = the new address.
After the sensor receives the command it will reply with it's newly assigned address.
The sensor address is non-volatile and will be retained when the sensor is disconnected from the power supply.

START MEASUREMENT COMMAND	aM!

Purpose: Instructs the sensor to take a temperature measurement.

Data Logger		Sensor
aM! or aMC!	→	
	←	a0011<CR><LF>

After being instructed to take a measurement, the sensor will reply with 'a0011'.
atttn<CR><LF>, where:
a = the sensor address
001 = the time in seconds until the measured data will be ready (i.e. 1 second).
1 = the number of measurements that will be returned.

SEND DATA COMMAND	aD!

Purpose: Instructs the sensor to take a temperature measurement.

Data Logger		Sensor	
aD!	→		
	←	a+19.26<CR><LF>	
	or		
	←	a+19.26C→r	if a CRC was requested via the aMC! command In this case the value of the CRC was "C→r"

After being instructed to take a measurement, the sensor will reply with its address followed by the temperature value. If a CRC was requested, this will be appended to the temperature value.
This will be in the form of the sign (+/1) followed by the temperature in degrees Celsius.
The value will always be given to two decimal places.

4.0 SPECIFICATIONS

Measurement		
Temperature accuracy	±0.1°C	-5°C < T < +50°C
	±0.5°C	-20°C < T < +70°C
Resolution	0.01°C	
Response time	30 seconds	time to 63.2% of a step change in H_2O
Operating range	-20°C to 70°C	
Max. operable cable length	60m (200')	as per SDI-12 standard
Operating depth	30m (100') water	maximum
Power Supply		
Supply voltage	6Vdc - 16Vdc	
Idle current	360uA	low sleep current
Active read current	<4mA	while responding to an SDI-12 command
Physical		
Diameter	12.7mm (0.5")	
Length	145mm (5.7")	
Cable Length	10m standard	custom lengths optional
Weight	220g	with 10m cable
Materials		
Body	304 Stainless steel	
	PVC	
	Polyurethane or Silicone	
Cable	Polyethylene	water proof sheath
SDI-12 Command support		
SDI-12 version	V1.3	CRC capable
	a?	address query
	a!	acknowledge
	aI!	return identification
	aAb!	change address
	aM! aMC!	start measurement
	aD!	return measurement data

5.0 SDI-12 SENSOR FAULT FINDING AND DEBUGGING

The following notes may be useful in fault-finding and debugging SDI-12 sensor systems in general. If you are having problems with SDI-12 sensors consider the following points:

- Is your power supply present?
- Are both the ground and data wires of the instrument connected?
- Each sensor in an SDI-12 system should have a unique address. Sensors with the same address will reply simultaneously causing errors.
- A faulty sensor can disable the SDI-12 bus causing problems for all sensors on the bus. If you have multiple sensors connected to the bus and are having problems, remove all sensors from the bus and add them one at a time to isolate the problem instrument

6.0 SENSOR CALIBRATION CONFORMANCE CERTIFICATE

Product: *TSYS01 – G-NICO-018*
(e.g.: name of product, type of unit)

Supplier: *TE Connectivity Sensor Solutions Germany*

Address: *Hauert 13*
D-44227 Dortmund

The delivered product is conforming to:

Document	Description:	Date of issue:
TSYS01_datasheet_rev12_20131210	*Specification TSYS01*	*10.12.2013*
2015-08-26_MEAS_RoHS_(II)-Erklärung_en_TSYS01_G-NICO-018	*RoHS/EU*	*26.08.2015*
2015-09-28_MEAS_REACH - Erklärung_en_G-NICO-018REACH	*REACH*	*28.09.2015*

Additional Information:

Each TSYS01 under test is individually calibrated and tested. The calibration and test measurements are performed under homogeneous temperature and standard operation conditions.
The calibration parameters are derived by calibration measurements at +10°C and +40°C.
The verification measurement is performed at +20°C. The measurement data of each of the three set points is judged versus a maximum deviation of 40mK.

The calibration is performed by comparison with reference standards or reference standard measuring equipment, which is traceable to national respectively international standards.
Calibration uncertainty or reference measurement equipment: 12mK @ +0.01°C, 12mK @ +29.765°C

Document	Description:	Date of issue:
DKD_4330_TTI7_909Q_2014	*Calibration Certificate*	*25.04.2014*

Dortmund, 15.12.2015
(Town, Date)