

SDI-12 Sub-surface Soil Temperature Sensor

TBSST03 is a soil temperature sensor with SDI-12 interface that can operate over a wide temperature range. The electronic parts are mounted inside an UV resistant resin/glass fiber fabrics reinforced tube and the sensors are based on Swiss made PT1000 with 0.1 °C accuracy. The sensor is typically used to measure the temperature in situations where probing is difficult like in boreholes or soil trenches.



TBSST03

Features

- Soil temperature sensor
- Short response time
- Excellent long term stability
- SDI-12 Standard V1.3
- 6 - 16V supply voltage
- Less than 80µA idle current
- Temperature accuracy: 0.1 °C
- Temperature resolution: 3 digits

- Dimensions: 19x18x4 cm
- Weight: 400 g
- Operating Temperature Range:
- 40°C ... + 80°C

Target Applications

- Soil temperature monitoring in boreholes, trenches, etc...

UP Umweltanalytische Produkte GmbH

Bockradenerstrasse 52b

D-49477 Ibbenbueren

phone: +49 (0)5451 505 222 fax: +49 (0)5451 505 333

email: sales@upgmbh.com

upgmbh.com



SDI-12 Sub-surface Soil Temperature Sensor

Contents

1	INTRODUCTION	3
2	MEASUREMENT	3
3	PRODUCT SPECIFICATION	3
4	CALIBRATION	4
5	INSTALLATION	4
6	SDI-12	4
7	APPLICATION EXAMPLES	5
8	FUNCTIONAL DESCRIPTION	6
9	SUPPORTED SDI-12 V1.3 COMMANDS	6
10	SUPPORTED EXTENDED COMMANDS	7
11	MECHANICAL DIMENSIONS	7
12	CABLE CONNECTION	7
13	ORDERING INFORMATION	7
14	HISTORY	8

Tables

Table 1 – Standard SDI-12 v1.3 commands	7
Table 2 – Extended SDI-12 Commands	7
Table 3 – Cable Connection	7
Table 4 – Ordering Information	8
Table 5 – History	8

Figures

Figure 1 – TBSST03 and other sensors with SDI-12 interface connected to TBS03 SDI-12 to USB converter; setup for controlling / testing sensors and for PC based data recording	5
Figure 2 – TBSST03 and other sensors with SDI-12 interface connected to Remote Telemetry Unit or Data Recorder	5



SDI-12 Sub-surface Soil Temperature Sensor

1 Introduction

The TBSST03 is a rugged soil temperature probe with SDI-12 interface.

The electronic parts are mounted inside an UV resistant resin/glass fiber fabrics reinforced tubes. The interior of the tube is potted with silicon for enhanced durability.

2 Measurement

The TBSST03 outputs the soil temperature.

Supported measurement commands:

aM! aMC! aC! aCC! **Temperature**

Extended SDI-12 commands:

aXSNnnnnnn! **Set serial number**
where nnnnnn: 6 digits serial number

aXSTO,ff.ff! **Calibration at ambient temperature**
where: ff.ff the ambient temperature

aXF! **Set temperature unit to degree Fahrenheit**

aXC! **Set temperature unit to degree Celcius**

3 Product Specification

- UV resistant resin/glass fiber fabrics reinforced tube
 - 18 mm outer diameter
 - 3.5 mm wall thickness
 - Length: 150 mm
 - Potted with silicon
- SDI-12 Standard V1.3
- 6 - 16V supply voltage
- Operating Temperature Range: - 40°C ... + 80°C
- Temperature accuracy: 0.1 °C
- Temperature resolution: 3 digits
- Weight: 400 g (without cable)
- Dimensions: 19x18x4 cm
- Current consumption: active 10mA; idle 80µA

UP Umweltanalytische Produkte GmbH

Bockradenerstrasse 52b

D-49477 Ibbenbueren

phone: +49 (0)5451 505 222 fax: +49 (0)5451 505 333

email: sales@upgmbh.com



SDI-12 Sub-surface Soil Temperature Sensor

- Standard cable length: 3m; any other length upon requirement

4 Calibration

TBSST03 is factory calibrated by inserting a 1k Ω resistor in lieu of Pt1000 sensor (which is equivalent to a zero degree Celcius calibration).

However user calibration is also possible by setting the actual temperature based on a reference through aXSTO,ff.ff! SDI-12 command.

Example:

- aXSTO,+28.925! => calibrates with temperature +28.925 degrees Celcius

5 Installation

TBSST03 is compatible with any data logger or remote telemetry unit with SDI-12 interface (v1.3).

Refer to the data logger or RTU manual for further information.

6 SDI-12

SDI-12 is a standard for interfacing data recorders with microprocessor-based sensors. SDI-12 stands for serial/digital interface at 1200 baud. It can connect multiple sensors with a single data recorder on one cable. It supports up to 60 meter cable between a sensor and a data logger.

The SDI-12 standard is prepared by

**SDI-12 Support Group
(Technical Committee)
165 East 500 South
River Heights, Utah
435-752-4200
435-752-1691 (FAX)
<http://www.sdi-12.org>**

The latest standard is version V1.4 which dates from December 1st, 2017. The standard is available on the website of the SDI-12 Support Group.

UP Umweltanalytische Produkte GmbH

Bockradenerstrasse 52b

D-49477 Ibbenbueren

phone: +49 (0)5451 505 222 fax: +49 (0)5451 505 333

email: sales@upgmbh.com

upgmbh.com⁴

SDI-12 Sub-surface Soil Temperature Sensor

7 Application Examples

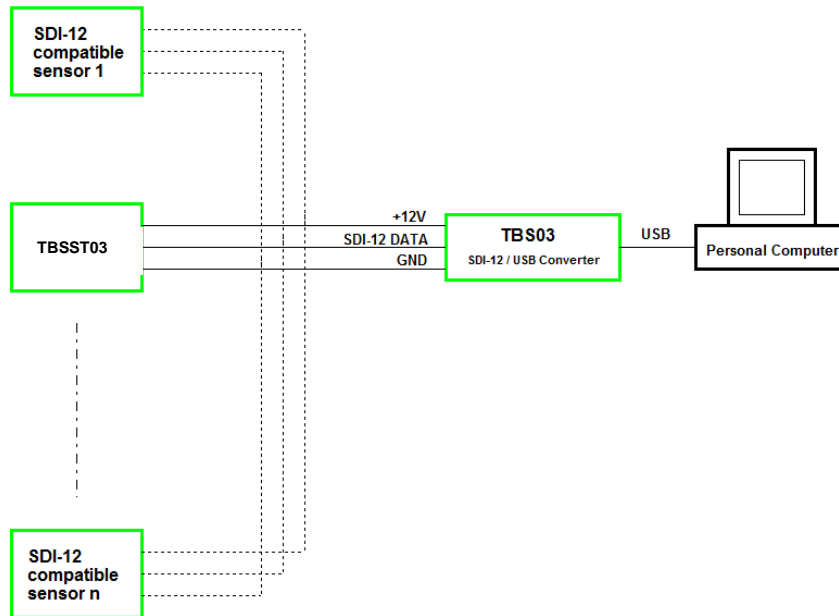


Figure 1 – TBSST03 and other sensors with SDI-12 interface connected to TBS03 SDI-12 to USB converter; setup for controlling / testing sensors and for PC based data recording

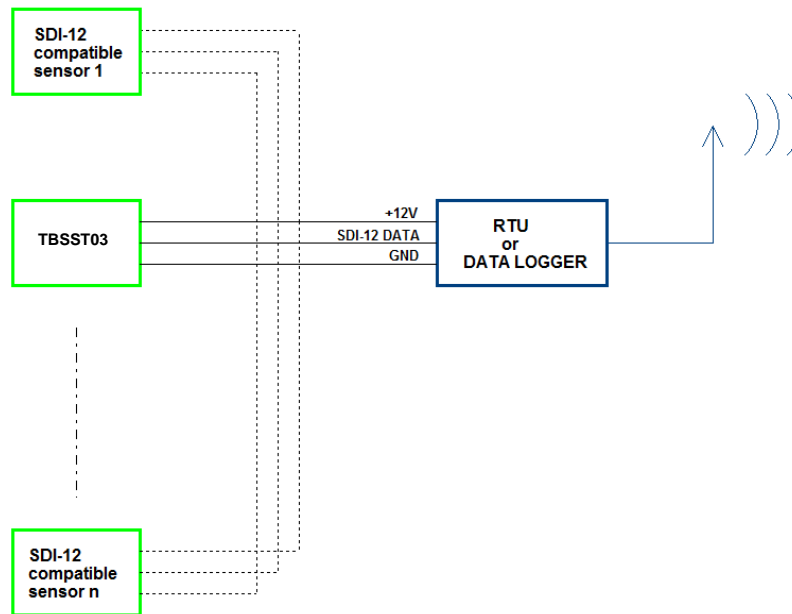


Figure 2 – TBSST03 and other sensors with SDI-12 interface connected to Remote Telemetry Unit or Data Recorder

UP Umweltanalytische Produkte GmbH

Bockradenerstrasse 52b

D-49477 Ibbenbueren

phone: +49 (0)5451 505 222 fax: +49 (0)5451 505 333

email: sales@upgmbh.com



SDI-12 Sub-surface Soil Temperature Sensor

8 Functional description

Below is an example of SDI-12 communication between a SDI-12 Recorder and TBSST03 to retrieve the measured temperature:

Measuring the temperature

SDI-12 Recorder	TBSST03
OM!	00011
OD0!	0+23.876

User can choose to report the temperature in degree Celcius or Fahrenheit by using extended SDI-12 commands aXC!/aXF!.

9 Supported SDI-12 v1.3 Commands

Following commands are supported by the TBSST03:

Command	Description	Response
a!	Acknowledge Active	a<CR><LF>
al!	Send Identification	013TEKBOXVNTBSST3v.vnnnnnn<CR><LF> With nnnnnn representing the serial number and v.v representing the firmware version
aAb!	Change Address	b<CR><LF> Changing the sensor address from a to b
?!	Address Query	a<CR><LF>
aM!	Start Measurement Measures temperature	a0011<CR><LF> Delay: (1) seconds and number of values (1)
aMC!	Start Measurement and request CRC Measures temperature and calculates CRC	a0011<CR><LF> Delay: (1) second, number of values (1)
aC!	Start Concurrent Measurement Measures temperature	a00101<CR><LF> Delay: (1) second and number of values (01)
aCC!	Start Concurrent Measurement and request CRC Measures temperature and calculate CRC	a00101<CR><LF> Delay: (1) second, number of values (1)
aD0!	Get Measurement Result(s)	Upon issuing the aD0! Command, TBSST03 will send the measurement results.
aV!	Start Verification	a0000<CR><LF> Not supported
aRn! aRCn!	Continuous Measurement Continuous Measurement + CRC	a<CR><LF> Not supported

UP Umweltanalytische Produkte GmbH

Bockradenerstrasse 52b

D-49477 Ibbenbueren

phone: +49 (0)5451 505 222 fax: +49 (0)5451 505 333

email: sales@upgmbh.com

upgmbh.com⁶



SDI-12 Sub-surface Soil Temperature Sensor

Table 1 – Standard SDI-12 v1.3 commands

10 Supported Extended Commands

Command	Description	Response
aXSNnnnnnn!	Set 6 digits serial number nnnnnn	aX_OK<CR><LF>
aXSTO,ff.fff!	Temperature calibration (user settings) where: ff.fff: is the temperature in floating format (9 digits maximum including sign and decimal point)	aX_OK<CR><LF>
aXF!	Set temperature unit to degree Fahrenheit	aX_OK<CR><LF>
aXC!	Set temperature unit to degree Celcius	aX_OK<CR><LF>

Table 2 – Extended SDI-12 Commands

11 Mechanical Dimensions

- UV resistant resin/glass fiber fabrics reinforced tube
 - 18 mm outer diameter
 - 3.5 mm wall thickness
- Length: 150 mm

12 Cable Connection

Cable Colour	Signal Assignment
Blue	SDI-12 Power
Yellow	SDI-12 Data
Brown	GND
Black	Shield (GND)

Table 3 – Cable Connection

13 Ordering Information

Part Number	Description
TBSST03	SDI-12 sub-surface soil temperature sensor

Please mention in your order, if you require a different cable length

UP Umweltanalytische Produkte GmbH

Bockradenerstrasse 52b

D-49477 Ibbenbueren

phone: +49 (0)5451 505 222 fax: +49 (0)5451 505 333

email: sales@upgmbh.com