

SDI-12 Soil Temperature Sensor 3 depth levels

TBSST04 is a soil temperature sensor with SDI-12 interface. It allows measuring the temperature on 3 different depth levels (up to 3 meters for each segment). The product is available in 3 variants, with one, two or three temperature sensors.

The sensor is used to monitor the soil temperature and for specific applications like compost temperature monitoring where this parameter is critical to prevent sudden fire.



Features

- Soil and compost temperature sensor
- Measures temperatures on 3 levels.
- Each segment length: up to 3 m
- Probe length: up to 9 m
- Customizable probe length
- SDI-12 Standard V1.4
- 6 - 16V supply voltage
- Less than 23 μ A idle current
- Operating Temperature Range:
- 40°C ... + 80°C

Target Applications

- Soil temperature monitoring
- Compost temperature monitoring

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1 Introduction

The TBSST04 is a rugged soil temperature probe with SDI-12 interface.

It is made of high grade Pt1000 sensors and 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.



Figure 1 – TBSST04 probe

2 Measurement

The TBSST04 outputs the temperature for 3 different depth levels.

Levels are numbered from 1 to 3, bottom to top:

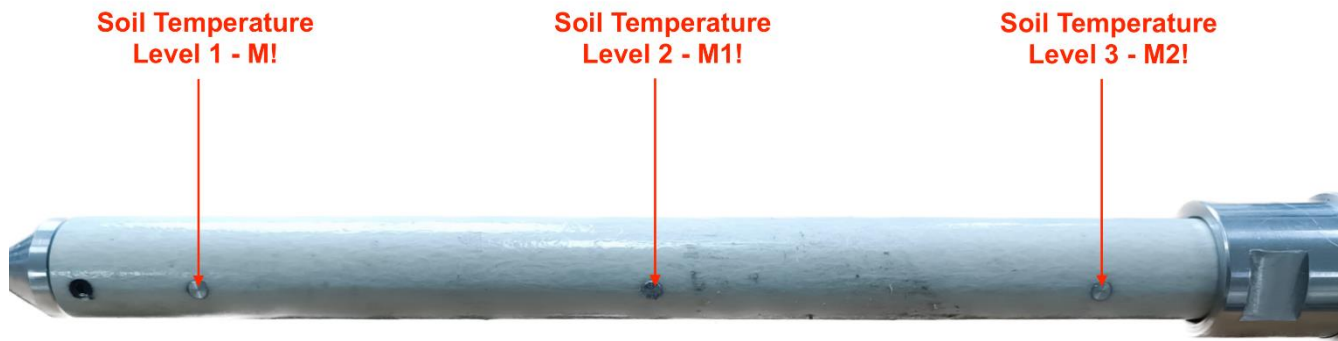


Figure 2 – TBSST04 temperature sensors levels

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Supported measurement commands:

aM!	aMC!	aC!	aCC!	Temperature first depth level
aM1!	aMC1!	aC1!	aCC1!	Temperature second depth level
aM2!	aMC2!	aC2!	aCC2!	Temperature third depth level
aM3!	aMC3!	aC3!	aCC3!	Temperature for each depth level

Supported SDI-12 v1.4 commands: metadata commands

aIM!	aIMC!	aIC!	aICC!	Identify Measurement Commands
aIM1!	aIMC1!	aIC1!	aICC1!	Identify Measurement Commands
aIM2!	aIMC2!	aIC2!	aICC2!	Identify Measurement Commands
aIM3!	aIMC3!	aIC3!	aICC3!	Identify Measurement Commands
aIM_001!	aIMC_001!	aIC_001!	aICC_001!	Identify Measurement Parameter (1st)
aIM1_001!	aIMC1_001!	aIC1_001!	aICC1_001!	Identify Measurement Parameter (1st)
aIM2_001!	aIMC2_001!	aIC2_001!	aICC2_001!	Identify Measurement Parameter (1st)
aIM3_001!	aIMC3_001!	aIC3_001!	aICC3_001!	Identify Measurement Parameter (1st)
aIM3_002!	aIMC3_002!	aIC3_002!	aICC3_002!	Identify Measurement Parameter (2nd)
aIM3_003!	aIMC3_003!	aIC3_003!	aICC3_003!	Identify Measurement Parameter (3rd)

Extended SDI-12 commands:

aXSTUF!	Set temperature unit to degree Fahrenheit
aXSTUC!	Set temperature unit to degree Celcius

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3 Product Specification

Feature	Description	Additional information
Electrical characteristics		
Power supply	6 – 16V	
Power consumption	<ul style="list-style-type: none"> • Active: 6mA • Idle: 23µA 	
Communication		
Protocol	SDI-12	V1.4
Sensor		
Sensing element	Pt000 F0.1	<ul style="list-style-type: none"> • Extremely short response time • Low heat transfer, vibration resistant • Long term stability: maximum drift=0.03% after 1000h at 600C
Operating range	-40°C to + 80°C	
Tolerance range	<ul style="list-style-type: none"> • Range [+5°C ; +60°C]: ±0.15°C • Range [-25°C ; +5°C]: <ul style="list-style-type: none"> ○ Increasing temperature: ± 0.35°C ○ Decreasing temperature: ± 0.15°C 	
Mechanical characteristics		
Materials	UV resistant resin/glass fiber fabrics reinforced tube Probe's head housing: aluminum	Potted with silicon
Dimensions	Segment length of the profile probe Tube diameterer/thickness	Can be fully customized up to a maximum segment length of 3 meters (maximum probe size is 9 meters)

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		<ul style="list-style-type: none"> 18 mm outer diameter 3.5 mm wall thickness
Weight	Variable depending on the tube length	
Cable	Standard length: 3m	Other lengths available on request

Table 1 – TBSST04 specification

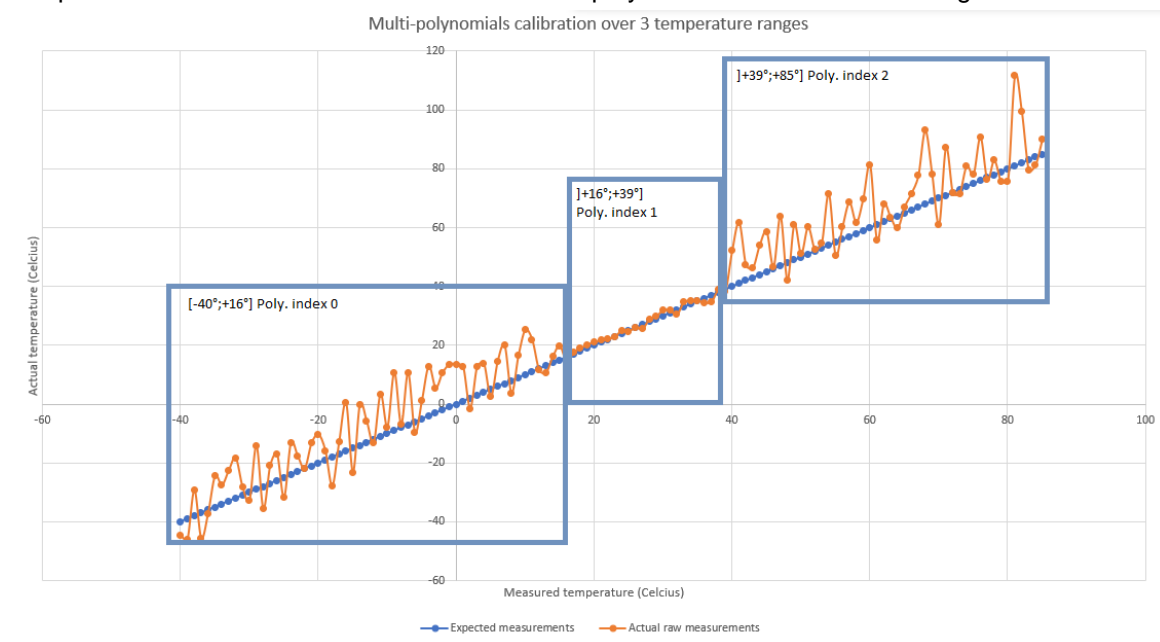
4 Temperature measurement

4.1 Calibration

TBSST04 is factory calibrated and does not require any further calibration.

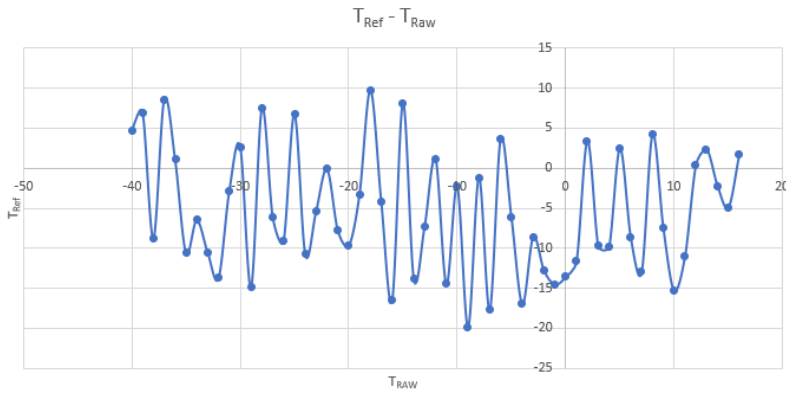
However, in case it is required to adjust the probe measurement results depending on the test environment, it is possible to proceed with a polynomial calibration over up to 3 custom temperature ranges, each having its own polynomial correction. The calibration is then applied to all TBSST04 levels and finally an additional offset can also be applied if required.

1. Perform desired temperature measurements over the whole operating temperature range with TBSST04 and compare the results with a reference so the multi-polynomials calibration can be generated.



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For each defined temperature range, a third order polynomial correction is generated (P_0 , P_1 and P_2) based on the calculation of $(T_{Ref} - T_{Raw}) = P(T_{Raw})$



2. Define temperature ranges (*XSMMRG* extended command) and corresponding polynomial corrections (*XSPOLC* extended command) for each required index. Following example shows how to set polynomial coefficients for temperature range $[-40^{\circ}\text{C}; +16^{\circ}\text{C}]$ (Note: polynomials shall be defined so the whole temperature range -40°C to $+85^{\circ}\text{C}$ is fully covered).
 - a. Set first temperature range (index 0), -40°C to $+16^{\circ}\text{C}$: *0XSMMRG0,-40,16!*
 - b. Set polynomial coefficients: $\Delta(T_{Raw}) = -0.0742 * T_{Raw} - 6.285$: *0XSPOLC0,0,0,-0.0742,-6.285!*

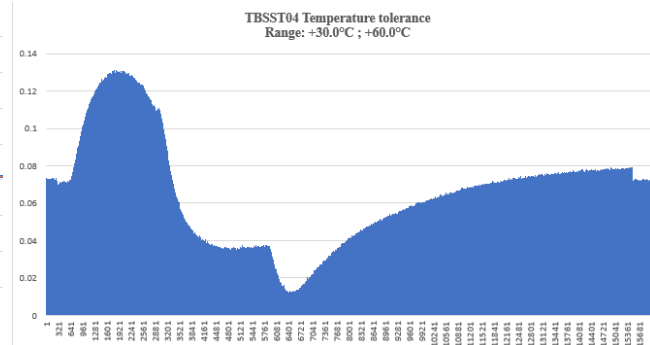
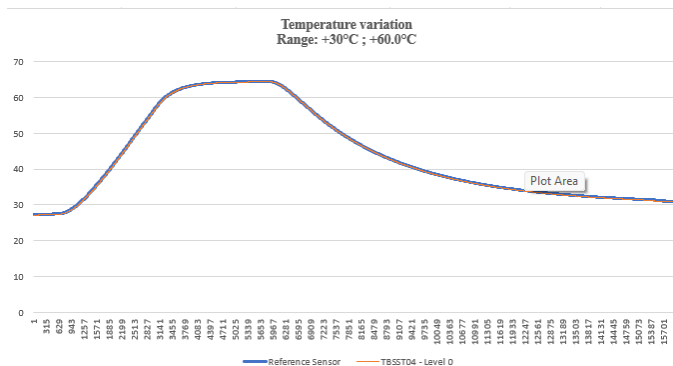
Once configured TBSST04 returns the corrected temperature $T_{Corrected} = T_{Raw} + \Delta(T_{Raw})$
3. Proceed likewise to cover the whole operating temperature range.
4. An additional offset can be then applied by measuring the ambient temperature with a reference external temperature sensor: for instance, 25.08
 - a. *0XSSTCO0,25.08!* offset is internally calculated and applied on depth level index 0

4.2 Tolerance

The measured temperature tolerance depends on the operating temperature range and whether the temperature is increasing or decreasing.

4.2.1 $[+30^{\circ}\text{C} ; +60^{\circ}\text{C}]$ temperature range (increasing/decreasing)

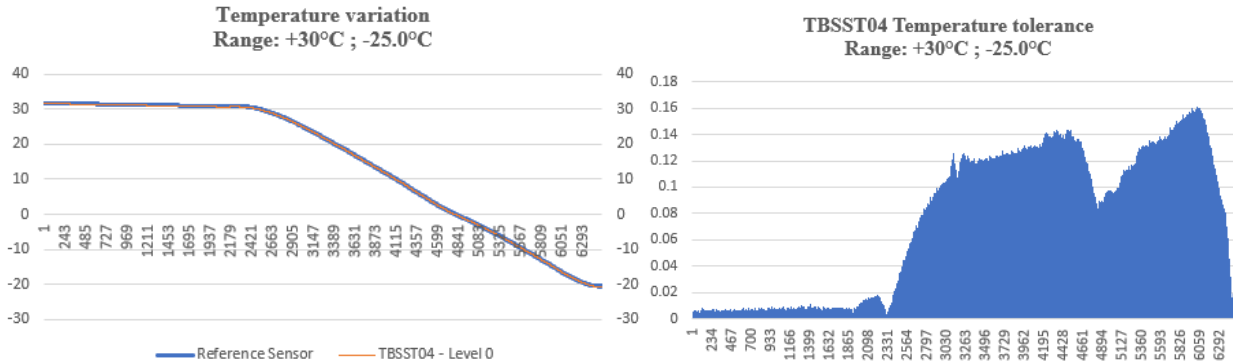
The tolerance over that range is $\pm 0.15^{\circ}\text{C}$.



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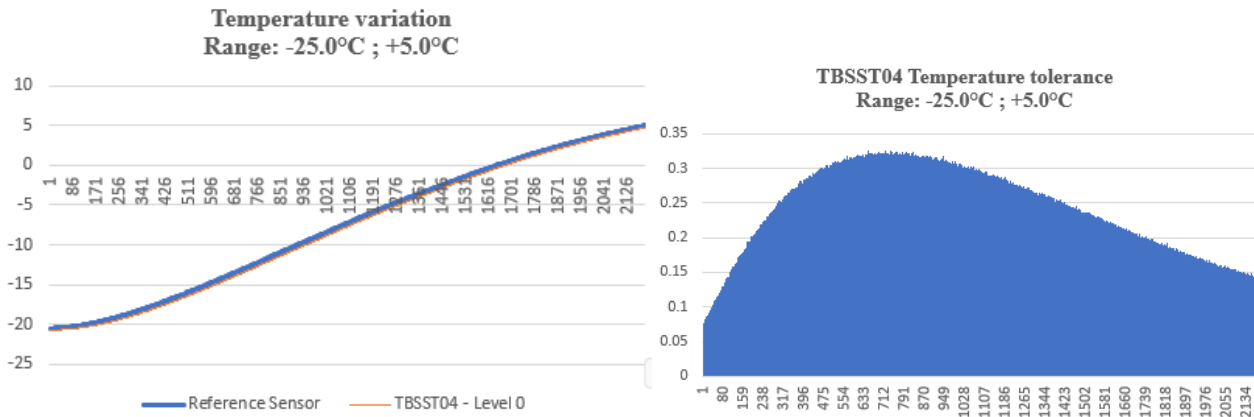
4.2.2 [+30°C ; -25°C] temperature range (decreasing)

The tolerance over that range is $\pm 0.15^\circ\text{C}$.



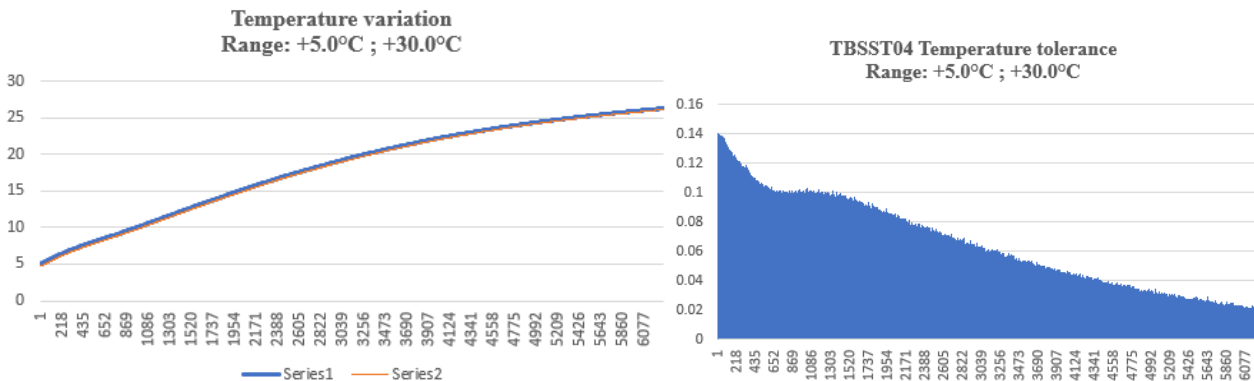
4.2.3 [-25°C ; +5°C] temperature range (increasing)

The tolerance over that range is $\pm 0.35^\circ\text{C}$.



4.2.4 [+5°C ; +30°C] temperature range (increasing)

The tolerance over that range is $\pm 0.15^\circ\text{C}$.



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5 Installation

TBSST04 is compatible with any data logger or remote telemetry unit with SDI-12 interface (v1.3 or v1.4).

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. The standard is available on the website of the SDI-12 Support Group.

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7 Application Examples

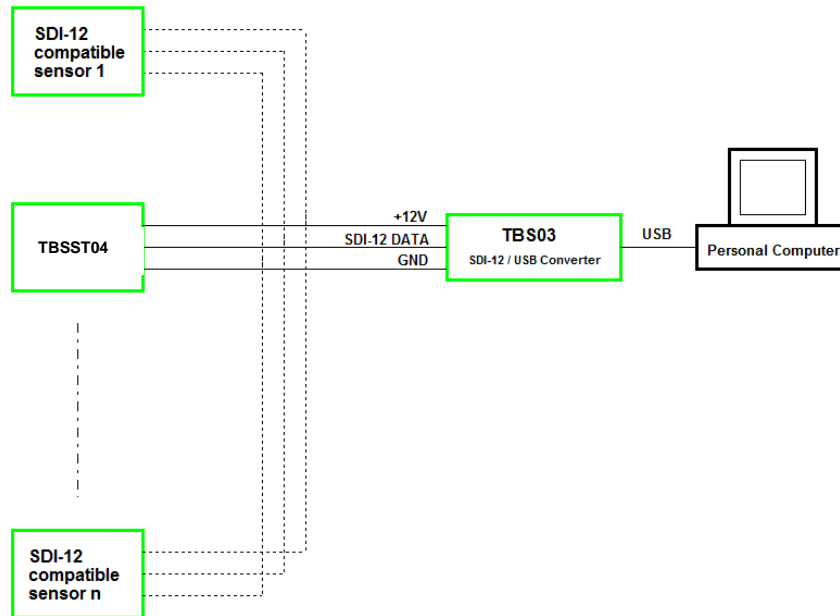


Figure 3 – TBSST04 and other sensors with SDI-12 interface connected to TBS03 SDI-12 to USB converter; setup for controlling / testing sensors and for PC based data recording

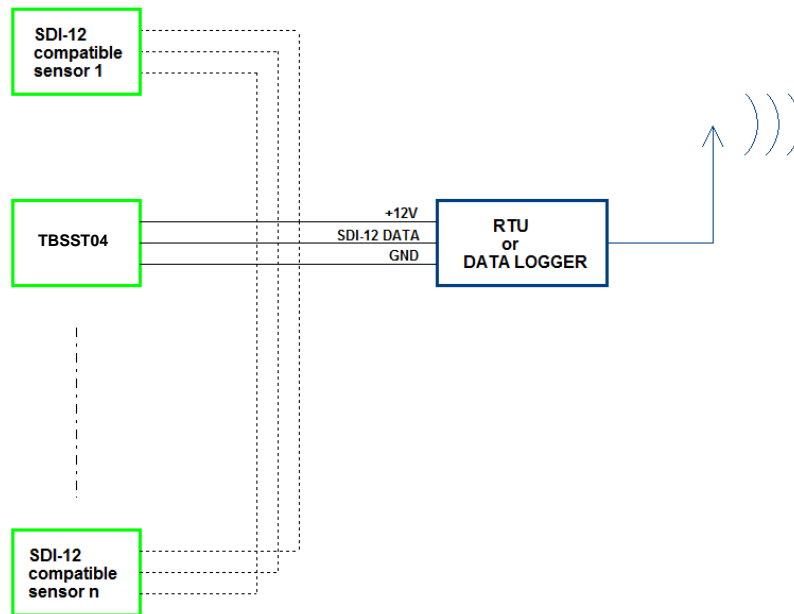


Figure 4 – TBSST04 and other sensors with SDI-12 interface connected to Remote Telemetry Unit or Data Recorder

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8 Functional description

The temperature can be measured on a specific depth level or reported for each level.

Below are examples of SDI-12 communication between a SDI-12 Recorder and TBSST04 to retrieve the measured temperature(s):

Measuring the temperature on a specific depth level

Ex. Measures temperature on the 2nd depth level:

SDI-12 Recorder	TBSST04
0M1!	00031
0D0!	0+23.876

If the depth level is unavailable, then the measurement SDI-12 command will return *ttt=000* and *n(n)=0(0)*.

Measuring the temperature on each depth level

Ex. Reports the temperature from each depth level

SDI-12 Recorder	TBSST04
0M3!	00093
0D0!	0+28.675+27.213+26.651

The number of returned measurements depends on how many depth levels are available.

Temperature unit

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

9 Supported SDI-12 v1.3 Commands

Following commands are supported by the TBSST04:

Command	Description	Response
a!	Acknowledge Active	a<CR><LF>
al!	Send Identification	a14TEKBOXVNTBSST4rv<h><nnnnnn><ffffff><CR><LF> With: <ul style="list-style-type: none"> ○ <a>: SDI-12 address ○ <h>: HW revision (one letter) ○ <nnnnnn>: serial number (6 digits) ○ <ffffff>: firmware version (7 digits) Example:

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		014TEKBOXVNTBSST4rvA1234560F00105<CR><LF>
aAb!	Change Address	b<CR><LF> Changing the sensor address from a to b
?!	Address Query	a<CR><LF>
aM!	Start Measurement Measures temperature – 1st depth level	a0031<CR><LF> Delay: (3) seconds and number of values (1)
aMC!	Start Measurement and request CRC Measures temperature – 1st depth level and calculates CRC	a0031<CR><LF> Delay: (3) seconds, number of values (1)
aC!	Start Concurrent Measurement Measures temperature – 1st depth level	a00301<CR><LF> Delay: (3) seconds and number of values (01)
aCC!	Start Concurrent Measurement and request CRC Measures temperature – 1st depth level and calculate CRC	a00301<CR><LF> Delay: (3) seconds, number of values (1)
aM1!	Start Measurement Measures temperature – 2nd depth level	a0031<CR><LF> (*) Delay: (3) seconds and number of values (1)
aMC1!	Start Measurement and request CRC Measures temperature – 2nd depth level and calculates CRC	a0031<CR><LF> (*) Delay: (3) seconds, number of values (1)
aC1!	Start Concurrent Measurement Measures temperature – 2nd depth level	a00301<CR><LF> (*) Delay: (3) seconds and number of values (01)
aCC1!	Start Concurrent Measurement and request CRC Measures temperature – 2nd depth level and calculate CRC	a00301<CR><LF> (*) Delay: (3) seconds, number of values (1)
aM2!	Start Measurement Measures temperature – 3rd depth level	a0031<CR><LF> (*) Delay: (3) seconds and number of values (1)
aMC2!	Start Measurement and request CRC Measures temperature – 3rd depth level and calculates CRC	a0031<CR><LF> (*) Delay: (3) seconds, number of values (1)
aC2!	Start Concurrent Measurement Measures temperature – 3rd depth level	a00301<CR><LF> (*) Delay: (3) seconds and number of values (01)
aCC2!	Start Concurrent Measurement and request CRC Measures temperature – 3rd depth level and calculate CRC	a00301<CR><LF> (*) Delay: (3) seconds, number of values (1)
aM3!	Start Measurement Measures temperature for all depth levels	a00mn<CR><LF> Delay: $m=(3*n)$ seconds and number of values (n) Where n is the number of TBSST04 levels (1 to 3).
aMC3!	Start Measurement and request CRC Measures temperature for all depth levels and calculates CRC	a00mn<CR><LF> Delay: $m=(3*n)$ seconds and number of values (n) Where n is the number of TBSST04 levels (1 to 3).
aC3!	Start Concurrent Measurement Measures temperature for all depth levels	a00m0n<CR><LF> Delay: $m=(3*n)$ seconds and number of values (n)

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		Where n is the number of TBSST04 levels (1 to 3).
aCC3!	Start Concurrent Measurement and request CRC Measures temperature for all depth levels and calculate CRC	a00m0n<CR><LF> Delay: m=(3*n) seconds and number of values (n) Where n is the number of TBSST04 levels (1 to 3).
aD0!	Get Measurement Result(s)	Upon issuing the aD0! Command, TBSST04 will send the measurement results.
aV!	Start Verification	a0000<CR><LF> Not supported
aRn! aRCn!	Continuous Measurement Continuous Measurement + CRC	a<CR><LF> a<CRC><CR><LF>

(*) Or a0000<CR><LF>/a00000<CR><LF> respectively for aM(C)x!/aC(C)x! if TBSST04 does not have this depth level available

Table 2 – Standard SDI-12 v1.3 commands

10 Supported SDI-12 v1.4 commands

Command	Description	Response
aIM!	aM! Identify Measurement Returns delay and number of parameters	a0031<CR><LF> Delay: (3) seconds and number of values (1)
aIMC!	aMC! Identify Measurement Returns delay and number of parameters	a0031<CR><LF> Delay: (3) seconds, number of values (1)
aIC!	aC! Identify Measurement Returns delay and number of parameters	a00301<CR><LF> Delay: (3) seconds and number of values (01)
aICC!	aCC! Identify Measurement Returns delay and number of parameters	a00301<CR><LF> Delay: (3) seconds, number of values (1)
aIM1!	aM1! Identify Measurement Returns delay and number of parameters	a0031<CR><LF> (***) Delay: (3) seconds and number of values (1)
aIMC1!	aMC1! Identify Measurement Returns delay and number of parameters	a0031<CR><LF> (***) Delay: (3) seconds, number of values (1)
aIC1!	aC1! Identify Measurement Returns delay and number of parameters	a00301<CR><LF> (***) Delay: (3) second and number of values (01)
aICC1!	aCC1! Identify Measurement Returns delay and number of parameters	a00301<CR><LF> (***) Delay: (3) seconds, number of values (1)
aIM2!	aM2! Identify Measurement Returns delay and number of parameters	a0031<CR><LF> (***) Delay: (3) seconds and number of values (1)
aIMC2!	aMC2! Identify Measurement Returns delay and number of parameters	a0031<CR><LF> (***) Delay: (3) seconds, number of values (1)
aIC2!	aC2! Identify Measurement Returns delay and number of parameters	a00301<CR><LF> (***) Delay: (3) seconds and number of values (01)
aICC2!	aCC2! Identify Measurement Returns delay and number of parameters	a00301<CR><LF> (***) Delay: (3) seconds, number of values (1)

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aIM3!	aM3! Identify Measurement Returns delay and number of parameters	a00mn<CR><LF> Delay: m=(3*n) seconds and number of values (n) Where n is the number of TBSST04 levels (1 to 3).
aIMC3!	aMC3! Identify Measurement Returns delay and number of parameters	a00mn<CR><LF> Delay: m=(3*n) seconds and number of values (n) Where n is the number of TBSST04 levels (1 to 3).
aIC3!	aC3! Identify Measurement Returns delay and number of parameters	a00m0n<CR><LF> Delay: m=(3*n) seconds and number of values (n) Where n is the number of TBSST04 levels (1 to 3).
aICC3!	aCC3! Identify Measurement Returns delay and number of parameters	a00m0n<CR><LF> Delay: m=(3*n) seconds and number of values (n) Where n is the number of TBSST04 levels (1 to 3).
aIM_001!	aM! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*)
aIMC_001!	aMC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (**)
aIC_001!	aC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*)
aICC_001!	aCC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (**)
aIM1_001!	aM1! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*) (****)
aIMC1_001!	aMC1! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (**) (****)
aIC1_001!	aC1! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*) (****)
aICC1_001!	aCC1! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (**) (****)
aIM2_001!	aM2! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*) (****)
aIMC2_001!	aMC2! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (**) (****)
aIC2_001!	aC2! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*) (****)

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aICC2_001!	aCC2! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (**) (****)
aIM3_001!	aM3! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*)
aIMC3_001!	aMC3! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (**)
aIC3_001!	aC3! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*)
aICC3_001!	aCC3! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (**)
aIM3_002!	aM3! Identify Measurement Parameters (2nd) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*) (****)
aIMC3_002!	aMC3! Identify Measurement Parameters (2nd) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (** (****)
aIC3_002!	aC3! Identify Measurement Parameters (2nd) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*) (****)
aICC3_002!	aCC3! Identify Measurement Parameters (2nd) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (** (****)
aIM3_003!	aM3! Identify Measurement Parameters (3rd) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*) (****)
aIMC3_003!	aMC3! Identify Measurement Parameters (3rd) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (** (****)
aIC3_003!	aC3! Identify Measurement Parameters (3rd) Returns parameter's identification and unit	a, Temperature, Celcius; <CR><LF> (*) (****)
aICC3_003!	aCC3! Identify Measurement Parameters (3rd) Returns parameter's identification and unit	a, Temperature, Celcius; <CRC><CR><LF> (** (****)

(*) Or a, Temperature, Fahrenheit; <CR><LF>

(**) Or a, Temperature, Fahrenheit; <CRC><CR><LF>

(***) Or a0000<CR><LF>/a00000<CR><LF> respectively for aM(C)x!/aC(C)x! if TBSST04 does not have this depth level available.

(****) Or a<CR><LF>/a<CRC><CR><LF> respectively for aMx!/aCx! and aMCx!/aCCx! if TBSST04 does not have this depth level available.

Table 3 – Standard SDI-12 v1.4 commands

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11 Supported Extended Commands

11.1 Setting temperature unit

Command	Description	Response
aXSTUn!	Set temperature unit <n>: temperature unit <ul style="list-style-type: none"> ○ C: Celcius ○ F: Fahrenheit 	aX_OK<CR><LF>
aXGTU!	Get temperature unit	an<CR><LF> <n>: <ul style="list-style-type: none"> ○ C: Celcius ○ F: Fahrenheit

Table 4 – Extended SDI-12 Commands – Engineering units

11.2 Calibration

Note: advanced commands, shall normally not be used by end user.

Command	Description	Response
aXSNnnnnnn!	Set 6 digits serial number nnnnnn	aX_OK<CR><LF>
aXSLVNBn!	Set the number of TBSST04 depth levels: <n>: 1 – 3 Warning: shall not be used unless instructed by Tekbox.	aX_OK<CR><LF>
aXGLVNB!	Get the number of TBSST04 depth levels	an<CR><LF> <n>: 1 - 3
aXRSTDC!	Reset TBSST04 configuration to default parameters: SDI-12 address: 0 Temperature unit: Celcius RTD offset on each level: 0°C Polynomial coefficients on each level: (a,b,c,d)=(0,0,1,0)	aX_OK<CR><LF>
aXGLVNB!	Get the number of TBSST04 depth levels	an<CR><LF> <n>: 1 - 3
aXSPOLCn,a,b,c,d!	Set multi-polynomial temperature calibration coefficients for depth level <i>n</i> . The polynomial shall be calculated as a compensation based on the difference between the reference temperature and the actual temperature. <ul style="list-style-type: none"> • <i>q,r,s,t</i> are the polynomial coefficients (float numbers, 6 digits maximum) • <i>n</i> (0 to 2) is the depth level index. 	aX_OK<CR><LF>

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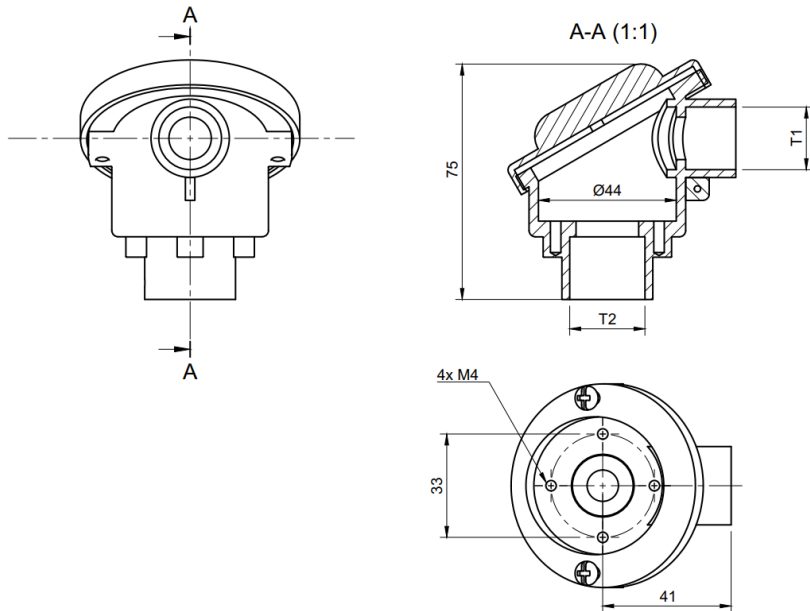
	<p>Polynomial: $\Delta(T_{Raw}) = q \cdot T_{Raw}^3 + r \cdot T_{Raw}^2 + s \cdot T_{Raw} + t$</p> <p>$\Delta(T_{Raw})$: is compensation that is then applied to the temperature measurement, $T_{Measure} = T_{Raw} + \Delta(T_{Raw})$</p> <p>$T_{Raw}$: raw temperature before compensation.</p>	
aXGPOLCn!	<p>Get multi-polynomial temperature calibration coefficients (q, r, s, t) for depth level n.</p> <ul style="list-style-type: none"> n (0 to 2) is the depth level index 	aq,r,s,t<CR><LF>
aXSMMRGt,min,max!	<p>Set temperature boundaries for temperature range t used in multi-polynomial temperature calibration.</p> <ul style="list-style-type: none"> t (0 to 2) is the index of the selected temperature range min, max are the lower and upper boundaries of the temperature range t (float, 6 digits maximum). 	aX_OK<CR><LF>
aXGMMRGt!	<p>Get temperature boundaries for temperature range t used in multi-polynomial temperature calibration.</p> <ul style="list-style-type: none"> t (0 to 2) is the index of the selected temperature range 	amin,max<CR><LF> <min>, <max>: lower and upper boundaries of the temperature range t .
aXSSTCOn,tref!	<p>Set reference temperature used for internal offset calculation for depth level n.</p> <ul style="list-style-type: none"> $tref$ is the ambient reference temperature measured with an external reference temperature sensor. n (0 to 2) is the depth level. If $n=3$ then offset is calculated and applied to all levels. <p>Note: The offset calibration is applied after multi-polynomial calibration.</p>	aX_OK<CR><LF>
aXGSTCOn!	<p>Get reference temperature used for internal offset calculation for depth level n.</p> <ul style="list-style-type: none"> n (0 to 2) is the depth level. If $n=3$ then the reference temperature used for offset calculation is returned for each level. 	af _n <CR><LF> <f _n >: reference temperature for level n af ₀ ,f ₁ ,f ₂ <CR><LF> <f ₀ >, <f ₁ >, <f ₂ >: reference temperatures for levels 0, 1 and 2.

Table 5 – Extended SDI-12 Commands: configuration and calibration

SDI-12 Soil Temperature Sensor 3 depth levels

12 Mechanical Dimensions

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



With:

$T1 = M20 * 1.5$

$T2 = M20 * 1.5$

SDI-12 Soil Temperature Sensor 3 depth levels

13 Cable Connection

Cable Color	Signal Assignment
Blue	SDI-12 Power
Yellow-green	SDI-12 Data
Brown	GND
Black	Shield

Table 6 – Cable Connection

14 Ordering Information

Part Number	Description
TBSST04_1	1 level soil temperature sensor
TBSST04_2	2 levels soil temperature sensor
TBSST04_3	3 levels soil temperature sensor
Custom (please contact Tekbox' sales)	Segment length: maximum 3m Probe length: maximum 9m

Table 7 – Ordering Information

15 History

Version	Date	Author	Changes
V2.0	15.12.2022	Philippe Hervieu	Creation – Updated probe mechanical design and FW SDI-12 commands.
V2.1	21.12.2022	Philippe Hervieu	Update M3!/C3! measurement time
V2.2	20.06.2023	Philippe Hervieu	Update SDI-12 timing, extended commands and power consumption. Temperature tolerance added.

Table 8 – History