

## SDI-12 COMPASS / INCLINATION SENSOR

The TBSCS1 is a 3D compass and inclination sensor with SDI-12 interface. It measures heading, roll angle and pitch angle.

The sensor is used in agricultural yield applications to monitor the operation of center pivot irrigation systems or the status of flood gates.



TBSCS1 SDI-12 compass / inclinometer

### Features

- 3D Compass and inclination sensor
- Measurement range: 0° to 360° heading,
- -90° to +90° roll, -90° to +90° pitch
- Measurement response: 1 sec
- SDI-12 Standard V1.3
- Plug and Play
- 6 - 16V supply voltage
- Less than 80µA idle current

- Operating Temperature Range:  
- 40°C ... + 80°C
- Weight: 80g
- Excellent price-performance ratio

### Target Applications

- Monitoring of flood gates
- Monitoring of center pivot irrigators

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# SDI-12 COMPASS / INCLINATION SENSOR

## 1 Introduction

The TBSCS1 is a rugged compass sensor/inclinometer with SDI-12 interface. It is mounted inside an IP67 housing from Fibox.



Figure 1 – TBSCS1 board

## 2 Measurement

The TBSCS1 outputs compass heading, roll angle, pitch angle and board temperature:

Supported measurement commands:

**aM! aMC! aC! aCC!** roll angle, pitch angle, compass heading

**aM1! aMC1! aC1! aCC1!** internal temperature

The measurement unit is degree.

Extended SDI-12 commands:

<b>aXSCC!</b>	compass calibration	factory calibrated
<b>aXGC!</b>	query calibration status	<b>0: uncalibrated, 1: calibrated</b>

<b>aXCT, stt. tt!</b>	temperature calibration	factory calibrated
where s:	sign (+, -)	
where tt. tt:	ambient temperature measured with a reference thermometer	

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The temperature calibration is carried out in production; in case of a re-calibration, allow the sensor half an hour to settle to room temperature

**aXSTUu!**      **set temperature unit; u= C for °C; u=F for °F**  
**aXGTU!**      **query temperature unit**

Use the above command to configure the temperature unit; [°C] is the default setting

### 3 Product Specification

- Compass heading range: 0 to 360°, ±3° accuracy
- Roll angle range: -90° to +90°, ±2° accuracy
- Pitch angle range: -90° to +90°, ±2° accuracy
- Measurement response: 1 sec
- SDI-12 Standard V1.3
- 6 - 16V supply voltage
- Operating Temperature Range: - 40°C ... + 80°C
- Weight: 0,08kg
- Current consumption: active 8mA (for 1 second); idle < 80µA
- Standard cable length: 3m; any other length upon requirement

### 4 Calibration

The TBSCS1 comes factory calibrated and normally does not need any user calibration.

In case that the compass deviation is higher than ±3°, carry out a re-calibration.

Open the cover to watch the internal LED. Place the compass on a flat surface and issue the calibration command. While the LED is on, slowly, but steadily rotate the compass around the center axis of the housing. The calibration process is done, when the LED goes off.

### 5 Installation

The TBSCS1 is compatible with any data logger or remote telemetry unit with SDI-12 interface. Refer to the data logger or RTU manual and to chapter 2 and 3 of this datasheet. Chapter 2 refers to the electrical installation; chapter 3 refers to the mechanical drawings.

The TBSCS1 shall be mounted in at least 1,5 meters distance from iron objects if the compass feature is used.

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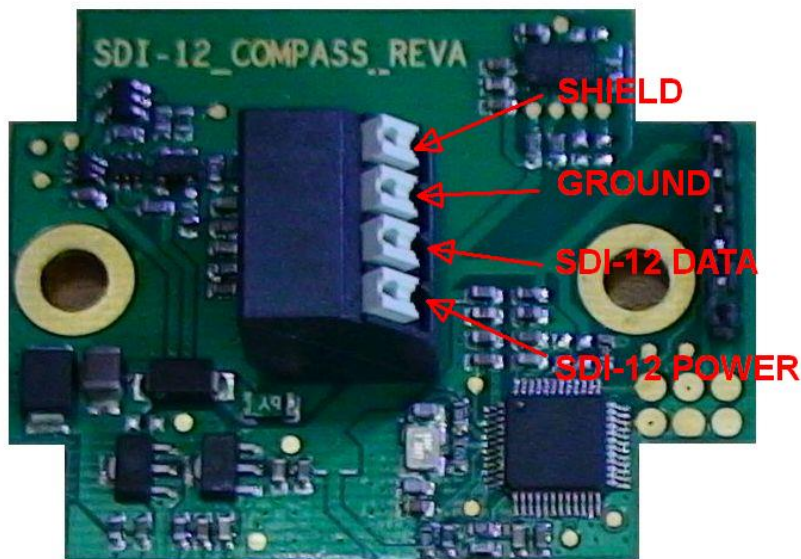


Figure 2 – terminal block pin assignment

### 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 V1.3 which dates from July 18<sup>th</sup>, 2005. The standard is available on the website of the SDI-12 Support Group.

More information on SDI-12 is presented in chapter 3.

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## 7 Application Examples

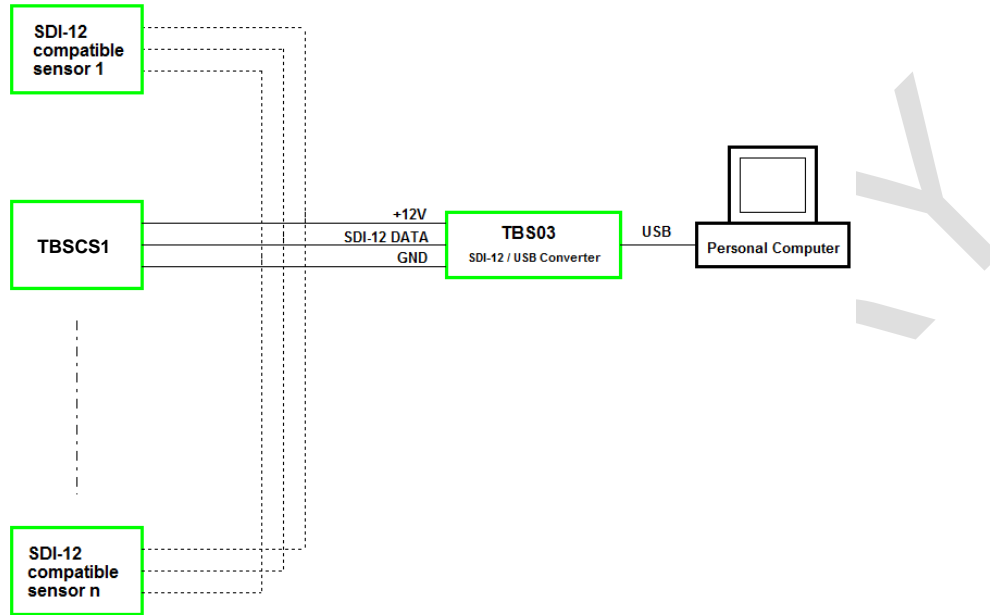


Figure 3 – TBSCS1 and other sensors with SDI-12 interface connected to TBS03 SDI-12 to USB converter; setup for controlling / testing sensors and for PC based data recording

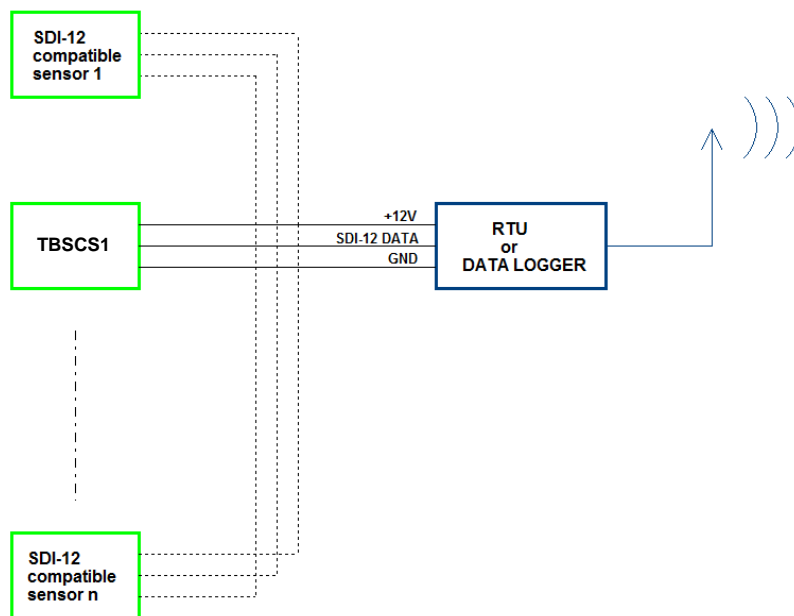


Figure 4 – TBSCS1 and other sensors with SDI-12 interface connected to Remote Telemetry Unit or Data Recorder

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## 8 Mechanical Dimensions

Refer to [http://www.fibox.com/catalog/1995/product/609/7032520\\_ENG3.html](http://www.fibox.com/catalog/1995/product/609/7032520_ENG3.html) with respect to the mounting holes of the housing.

## 9 Cable Connection

Cable Color	Signal Assignment
Red	SDI-12 Power
White	SDI-12 Data
Blue	GND
Black	Shield

Table 1 – Cable Connection

## 10 Supported SDI-12 Commands

Following commands are supported by the TBSCS1:

Command	Description	Response
<b>a!</b>	Acknowledge Active	a<CR><LF>
<b>al!</b>	Send Identification	013TEKBOXTBSCS1.0000000xxxxx<CR><LF> With xxxxx representing the serial number
<b>aAb!</b>	Change Address	b<CR><LF> Changing the sensor address from a to b
<b>?!</b>	Address Query	a<CR><LF>
<b>aM!</b>	Start Measurement Measures roll angle, pitch angle and compass heading	att1<CR><LF> Delay (ttt = 001) in seconds and number of values (1)
<b>aM1!</b>	Additional Measurement Measures board temperature	att1<CR><LF> Delay (ttt = 001) in seconds and number of values (1)
<b>aMC!</b>	Start Measurement and request CRC Measures roll angle, pitch angle, compass heading and calculates CRC	att1<CR><LF> Delay (ttt = 001) in seconds and number of values (1)
<b>aMC1!</b>	Additional Measurement and request CRC	att1<CR><LF>

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	Measures board temperature and calculates CRC	Delay (ttt = 001) in seconds and number of values (1)
<b>aC!</b>	Start Concurrent Measurement Measures roll angle, pitch angle and compass heading	att1<CR><LF> Delay (ttt) in seconds and number of values (4)
<b>aC1!</b>	Start Concurrent Measurement Measures board temperature	att1<CR><LF> Delay (ttt) in seconds and number of values (4)
<b>aCC!</b>	Start Concurrent Measurement and request CRC Measures roll angle, pitch angle, compass heading and calculates CRC	att1<CR><LF> Delay (ttt) in seconds and number of values (4)
<b>aCC1!</b>	Start Concurrent Measurement and request CRC Measures board temperature and calculates CRC	att1<CR><LF> Delay (ttt) in seconds and number of values (4)
<b>aD0!</b>	Get Measurement Result(s)	Upon issuing the aD0! Command, the TBSCS1 will send the measurement results. The response format depends on the measurement command issued before.
<b>aV!</b>	Start Verification	a0000<CR><LF> Not supported
<b>aRn!</b> <b>aRCn!</b>	Continuous Measurement Continuous Measurement + CRC	a<CR><LF> Not supported

Table 2 – Standard SDI-12 commands

### 11 Supported Extended Commands

Command	Description	Response
<b>aXSCC!</b>	Compass calibration	aX_ok<CR><LF>
<b>aXGC!</b>	Query calibration status b=0 uncalibrated b=1 calibrated	a+b <CR ><LF>
<b>aXCT, stt.tt</b>	Temperature calibration s: sign (+,-) tt.tt: ambient temperature measured with a reference thermometer	aX_ok<CR><LF>
<b>aXSTUu!</b>	Set temperature unit u = c for [°C], u = f for [°F]	aX_ok<CR><LF>
<b>aXGTU!</b>	Query temperature unit	au<CR><LF>

Table 3 – Extended SDI-12 Commands



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### 12 Ordering Information

Part Number	Description
TBSCS1	TBSCS1, SDI-12 compass sensor / inclinometer with 3m cable

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

*Table 4 – Ordering Information*

### 13 History

Version	Date	Author	Changes
V1.0	8.04.2015	Mayerhofer	Creation of the document

*Table 5 – History*

PRELIMINARY