SDI-12 Wind Vane

The TBSWV1 is a versatile wind vane with SDI-12 interface. It provides two operation modes. It can either measure momentary wind direction, or measure average wind direction over a configurable logging period.
It is based on a rugged aluminium body with polyester coating. Precision, low friction bearings and a stainless steel shaft make it a very reliable device. The use of a magnetic rotary encoder as sensor element eliminates the disadvantages associated with reed switches used in conventional wind vanes.
Optionally, the wind vane can be delivered with an integrated heating for de-icing.

TBSWV1 SDI-12 Wind vane

Features

- Measurement range: 0 to 360°, no dead zone, 0.35° resolution
- Accuracy: typ. ± 2%; max. . ± 3%
- Polyester coated aluminium body
- Precision stainless steel bearings
- Carbon fibre vane
- High resolution magnetic rotary encoder
- Measurement response: 1 sec
- SDI-12 Standard V1.3
- Plug and Play
- 6 - 16V supply voltage range
- Advanced measurement mode
- Operating Temperature Range: - 40°C … + 70°C
- Weight: 0,6kg
- Excellent price-performance ratio

Target Applications

- SDI-12 Sensor Networks

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1 Introduction

The TBSWV1 is a rugged wind vane with SDI-12 interface. For applications in low temperature environment, the wind vane can be delivered with a built in heating for de-icing.

1.1 Measurement

The TBSWV1 can output wind direction and temperature.
Wind direction can be measured as momentary value (simple mode) or as average value (advanced mode) over a configurable logging period.

Supported measurement commands:

aM! ,aMC! aC! ,aCC! wind direction [0° to 360°]
the measurement unit is angular degree with 0°/360° representing geographic North.

Simple mode:

00011
0D0!
0+18.90 momentary wind direction

Advanced mode:

00011
0D0!
0+9999999 invalid data; the measurement command was issued before the first logging period was completed
00011
0D0!
0+47.91 average wind direction of the latest completed logging period

In advanced mode, wind direction is measured every 3 seconds. The measurement values are then averaged over a configurable period which must be a multiple of 3 seconds, up to a maximum of 60 seconds. The averaged values are then collected over a configurable logging period. At the end of the logging period, the average wind direction of the logging period is calculated and stored. Upon a measurement command, the result of the latest, completed logging period will be delivered.
The wind vane must be continuously powered when it is operated in advanced mode.

aM1! ,aMC1! aC1!,aCC1! temperature [°C,F]
the default measurement unit is degree Celsius, however using an extended SDI-12 command, the result can be changed to Fahrenheit

Extended SDI-12 commands:

aXCT,sa.aa! temperature calibration
The temperature is factory calibrated. For re-calibration, measure the temperature with a reference thermometer and enter the temperature as parameter sa.aa; the temperature needs to be entered in degree Celsius.
s represents the sign.

Example: measured temperature is +23.5°C, sensor address is 0; issue the command 0XCT+23.5! to calibrate the temperature.

aXTUu! set temperature unit; u= C for °C; u=F for °F
Use the above command to configure the temperature unit; [°C] is the default setting
Example: sensor address is 0, measurement unit shall be Fahrenheit; issue the command 0XTUF! to change the measurement unit to Fahrenheit.
Default unit is Celsius

aXGU! query temperature unit
responds with a,C or a,F depending on the unit setting

aXSZP! Set zero position
Upon issuing this command the momentary angle of the vane with respect to the body will be set to zero degree (north)

aXSAMm! Set mode for wind vane
m = 0: simple mode, measurement of momentary wind direction
m = 1: advanced mode, measurement of average wind direction
simple mode is the default setting

aXSAP,+tt! Set averaging period
Default value is 9 seconds, this value must be a multiple of 3 seconds
Value: 3, 6, 9 ….60 seconds

aXGAP! Query averaging period

aXSLP,+tt! Set logging period
Default value is 900 seconds (15 minutes)
Value 60 seconds to 3600 seconds

aXSLP! Query logging period

1.2 Product Specification

- Measurement of wind direction in the range 0° to 360°; maximum wind speed rating > 70m/s
- Measurement resolution: 0.35°
- Operating temperature range: -40 to +70°C
- Relative air humidity range: 0% to 95% (no condensation)
- Internal temperature measurement: -40°C to +80°C, ± 3°C accuracy
- Optional built in heating, PTC type, 12 – 30V, ≤ 50W
- IP protection: IP65
- Body material: aluminium alloy, polyester coating
- Wind vane material: carbon fibre

- Bearing material: stainless steel 440C
- Weight: 0,6 kg
- SDI-12 interface
- Supply voltage range: 6V to 16V
- Current consumption: 20 mA for 1 second in simple mode; avg. 1 mA in advanced mode; idle < 50µA
- Standard cable length: 3m; any other length upon requirement/order

1.3 Calibration

The TBSWV1 needs to be adjusted to geographic north during installation. The TBSWV1 got an embossed arrow at its rotor and another embossed arrow at its body. The TBSWV is calibrated to show 0° when the rotor is positioned such that the tips of the two arrows are pointing to each other. Use a compass to position the wind vane.

Figure 1 – TBSWV1 North markers

Optionally you can mount the wind vane in whatever orientation you want. Then point the wind vane into the direction of the North Pole and issue the following command:

aXSZP! **Set zero position**

1.4 Installation

The TBSWV1 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 contains a mechanical drawing of the base part of the housing.

The TBSWV1 shall be mounted above any local objects that obstruct wind flow or may cause turbulences. In case of mounting the wind vane on a roof, it shall be placed at least 2 - 3 meters above the roof line.

According meteorological and aviation standards, wind vanes shall be placed 10 meters above ground, provided there are no large obstructions nearby.

Mount the wind vane on the pole and adjust/calibrate according to chapter 1.3

1.5 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 18th, 2005. The standard is available on the website of the SDI-12 Support Group.

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

SDI-12 WIND VANE

2 Application Examples

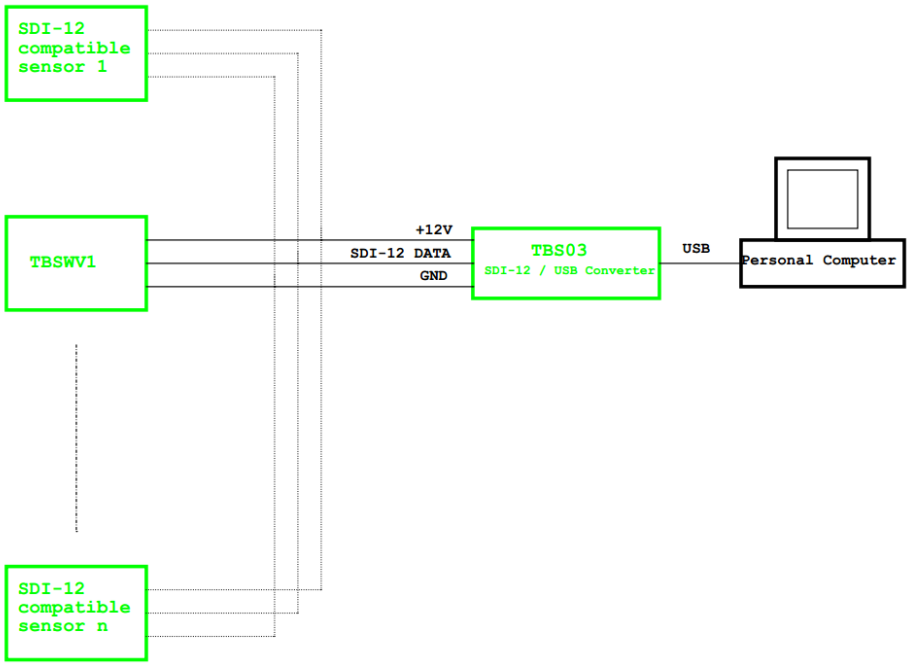


Figure 2 – TBSWV1 and other sensors with SDI-12 interface connected to TBS03 SDI-12 to USB converter; setup for controlling / testing sensors and for PC based data recording

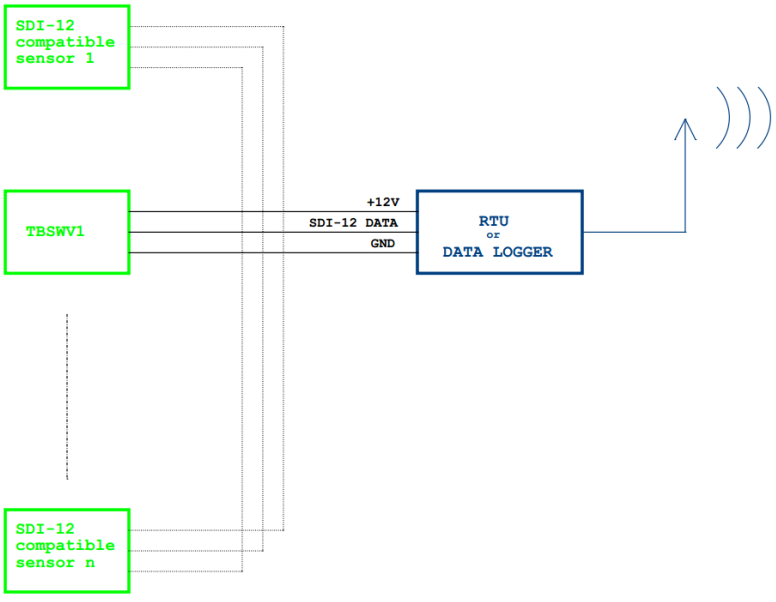
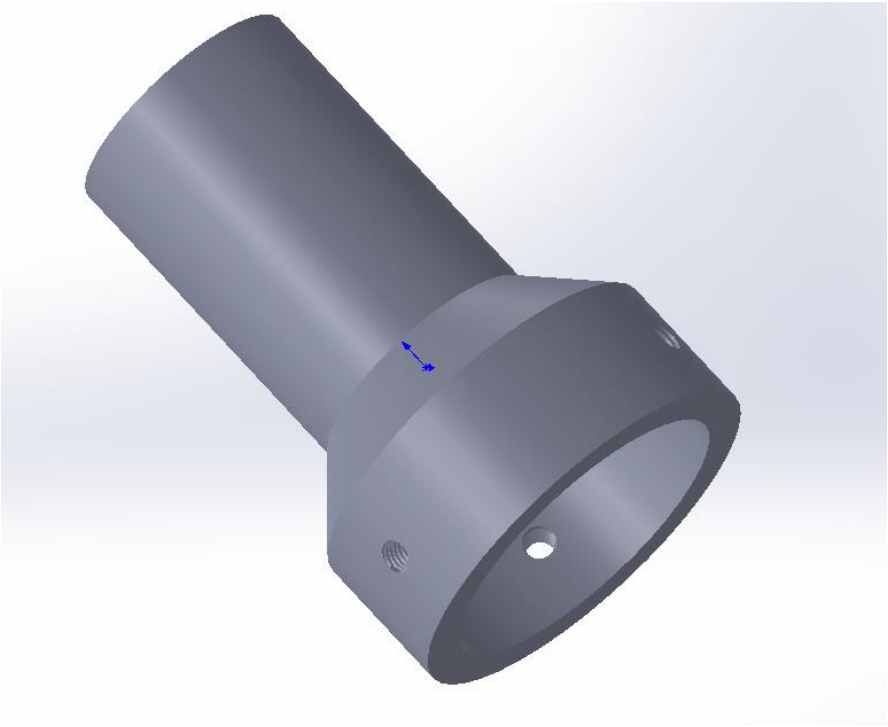
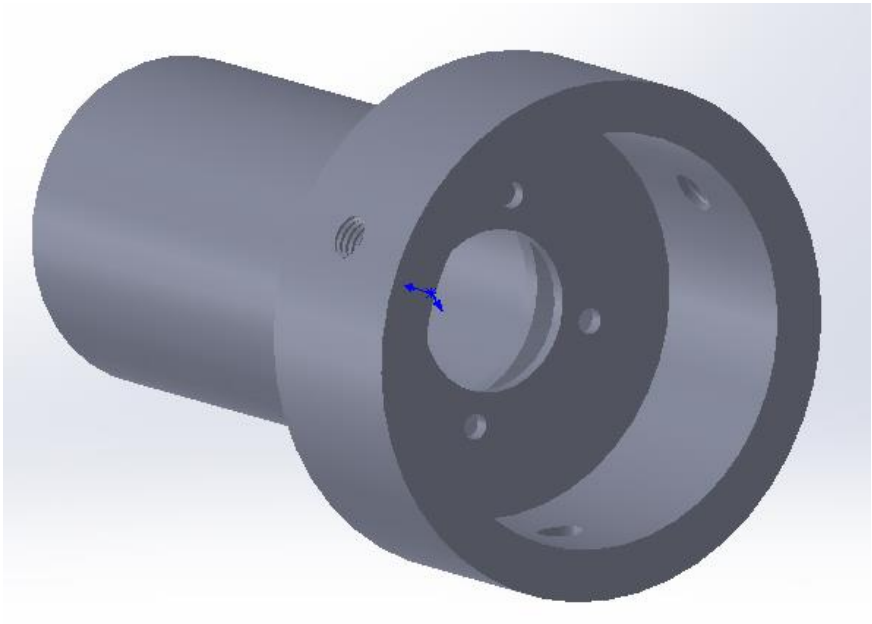


Figure 3 – TBSWV1 and other sensors with SDI-12 interface connected to Remote Telemetry Unit or Data Recorder

3 Hardware Description

3.1 Base part drawings





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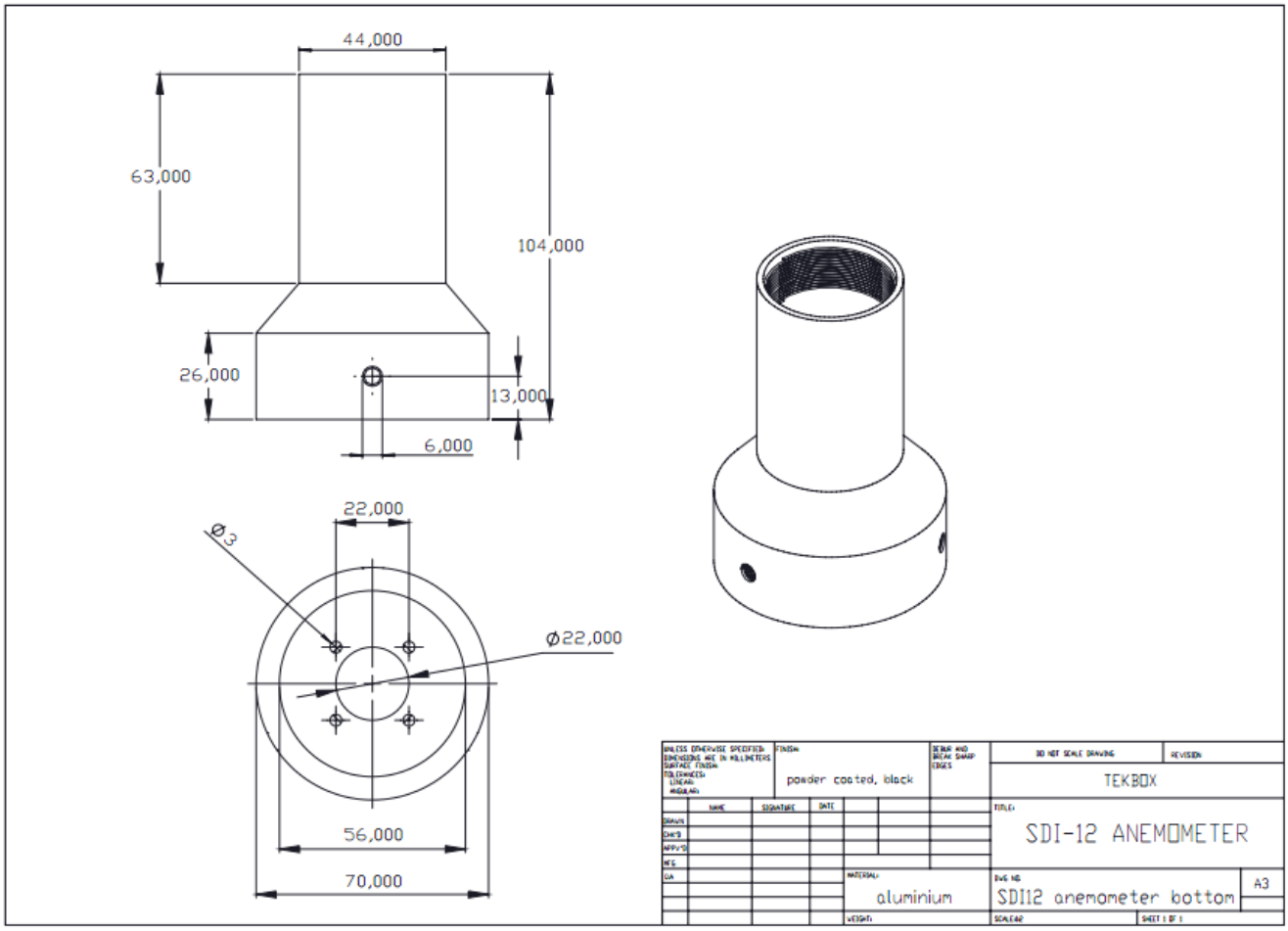

Figure 4 – Base part drawing

The TBSWV1 is designed to be mounted on top of a pole with a diameter in the range of 40 mm to 54mm. In case of diameters below 40mm, simply use longer clamping screws.

3.2 Cable Connection

Cable Color	Signal Assignment
Red	SDI-12 Power
Yellow	SDI-12 Data
Brown	GND
Black	Shield (GND)

Table 1 – Cable Connection

3.3 Cable Replacement

To replace the cable, proceed as follows:

1) Cut the cable 5 cm from the grommet
2) Remove the 4 screws of the grommet base plate
3) Open the grommet and strip it from the cable; take care not to lose the base plate gasket
4) Un-insulate the remaining cable and attach it to a suitable screw terminal block (there is sufficient space inside the housing to accommodate a screw terminal block)
5) Un-insulate the ends of the replacement cable, feed it through the grommet and attach it to the other side of the screw terminal block
6) Tighten the grommet and fasten the screws of the base plate; don´t forget to add the base plate gasket

Alternatively proceed as follows:

1) Cut the cable 5 cm from the grommet
2) Remove the 4 screws of the grommet base plate
3) Open the grommet and strip it from the cable; take care not to lose the base plate gasket
4) Hold or clamp the bottom part of the body and unscrew the top section with a wrench
5) Unsolder the cable from the PCB
6) Feed the replacement cable through the grommet, don´t forget to add the base plate gasket
7) Solder the replacement cable to the PCB
8) Apply suitable Loctite to the thread and screw the top part to the bottom part. Take care not to contaminate or damage the O-ring.
9) Tighten the grommet and fasten the screws of the base plate

4 Supported SDI-12 Commands

Following commands are supported by the TBS02PA:

Command	Description	Response
a!	Acknowledge Active	a<CR><LF>
aI!	Send Identification	013TEKBOXVNTBSAB21.0000005xxxxx<CR><LF> With xxxxx representing the serial number
aAb!	Change Address	b<CR><LF> Changing the sensor address from a to b
?!	Address Query	a<CR><LF>
aM!	Start Measurement Measures wind direction	atttn<CR><LF> Delay (ttt = 001) in seconds and number of values (n) n = 01: simple mode, measurement of momentary wind direction n = 03: advanced mode, measurement of average wind direction over the configured logging period
aM1!	Additional Measurement Measures internal temperature	attt1<CR><LF> Delay (ttt = 001) in seconds and number of values (1)

aMC!	Start Measurement and request CRC Measures wind direction and calculates CRC	atttnn<CR><LF> Delay (ttt = 001) in seconds and number of values (nn) n = 01: simple mode, measurement of momentary wind direction n = 03: advanced mode, measurement of average wind direction over the configured logging period
aMC1!	Additional Measurement and request CRC Measures internal temperature and calculates CRC	attt1<CR><LF> Delay (ttt = 001) in seconds and number of values (1)
aC!	Start Concurrent Measurement Measures wind direction	attt1<CR><LF> Delay (ttt) in seconds and number of values
aC1!	Start Concurrent Measurement Measures internal temperature	attt1<CR><LF> Delay (ttt) in seconds and number of values
aCC!	Start Concurrent Measurement and request CRC Measures wind direction and calculates CRC	attt1<CR><LF> Delay (ttt) in seconds and number of values
aCC1!	Start Concurrent Measurement and request CRC Measures internal temperature and calculates CRC	attt1<CR><LF> Delay (ttt) in seconds and number of values
aD0!	Get Measurement Result(s)	Upon issuing the aD0! Command, the TBSWV1 will send the measurement results. The response format depends on the measurement command issued before.
aV!	Start Verification	a0000<CR><LF> Not supported
aRn! **aRCn!**	Continuous Measurement Continuous Measurement + CRC	a<CR><LF> Not supported

Table 2 – Standard SDI-12 commands

4.1 Supported Extended Commands

Command	Description	Response
aXSZP!	Set zero positon	aX_OK <CR><LF>
aXCT,+a.aa!	Temperature calibration +a.aa: temperature measured with reference thermometer	aX_OK <CR><LF>
aXTUu!	Set temperature unit u = F for [°C], u = f for [°F]	aX_OK <CR><LF>
aXGU!	Query temperature unit	a,u<CR><LF>
aXSAMm!	Set the measurement mode m = 0: simple mode, measurement of momentary wind direction m = 1: advanced mode, measurement of average wind direction default value: simple mode	aX_OK <CR><LF>
aXGAM!	Query wind vane mode	a,m<CR><LF>

aXSAP,+tt!	Set averaging period Default value is 9 seconds, this value must be a multiple of 3 seconds Value: 3, 6, 9 ….60 seconds	aX_OK <CR><LF>
aXGAP!	Query averaging period	a+tt <CR><LF>
aXSLP,+tt!	Set logging period Default value is 900 seconds (15 minutes) Value 60 seconds to 3600 seconds	aX_OK <CR><LF>
aXSLP!	Query logging period	a+tt <CR><LF>

Table 3 – Extended SDI-12 Commands

5 Ordering Information

Part Number	Description
TBSWV1	TBSWV1, Wind vane with 3m cable

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

Table 4 – Ordering Information

6 History

Version	Date	Author	Changes
V1.0	18.08.2013	Mayerhofer	Creation of the document

Table 5 – History