SDI-12 ANEMOMETER

The TBSWS1 is a versatile anemometer with SDI-12 interface. It provides two operation modes. It can either measure momentary wind speed, or measure average wind speed, maximum wind speed and minimum wind speed over a configurable logging period.
It is based on a rugged aluminium body with polyester coating. Precision, low friction bearings, a stainless steel shaft, a rotating rain guard and breather vented cable grommets 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 anemometers.
Optionally, the anemometer can be delivered with an integrated heating for de-icing.

TBSWS1 SDI-12 Anemometer

Features

- Measurement range: 0,5 m/s to 55 m/s
- Accuracy: typ. ± 2%; max. . ± 3%
- Resolution: 3 decimal digits
- Polyester coated aluminium body
- Precision stainless steel bearings
- High resolution magnetic rotary encoder
- SDI-12 Standard V1.4
- 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 TBSWS1 is a rugged anemometer with SDI-12 interface. The measurement result can be set to any unit, using extended SDI-12 commands.
For applications in low temperature environment, the anemometer can be delivered with a built in heating for de-icing.

Note: this user manual is relevant to SDI-12 v1.4 TBSWS1 product only.
For SDI-12 v1.3 TBSWS1, refer to user manual v1.8.

Checking the supported SDI-12 version:

- **Send 0I!**
- **Response:**
  - **013… => SDI-12 v1.3**
  - **014… => SDI-12 v1.4**

1.1 Product Specification

- Measurement of wind speed in the range 0.5 m/s to 55 m/s; maximum rating > 70m/s
- Measurement accuracy ± 0.35 m/s (over 0.5 – 42 m/s range)
- 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 cup material: stainless steel 304
- Bearing material: stainless steel 440C
- Weight: 0,6 kg
- SDI-12 interface compliant with SDI-12 v1.4 standard.
- Supply voltage range: 6V to 16V
- Current consumption: less than 25mA for all modes mode; idle: 21µA
- Standard cable length: 3m; any other length upon requirement/order

1.2 Calibration

TBSWS1 does not need any user calibration.

The device is by default calibrated to a linear wind speed of 0.4975 m/s corresponding to one revolution/s.

All internal parameters settings can be changed through extended SDI-12 commands although this should be done only upon Tekbox request.

1.2.1 User's defined calibration

A set of extended SDI-12 commands is provided for custom calibration. This includes:

- Wind speed and temperature offset and scaling factor
- Wind speed and temperature polynomial correction

Normally these commands shall not be used as TBSWS1 is already calibrated and are provided for custom use only.

1.2.2 Default parameters

TBSWS1 is provided with following default configuration:

- Temperature unit: Celcius
- Wind speed unit: km/h
- Operating mode: simple mode
- Logging period: 900s
- Measurement period: 9s
- Number of pulses per revolution: 256
- Polynomial coefficients (temperature): (q,r,s,t) = (0,0,3.4468,-65.29)
- Temperature offset: 0 degree
- Temperature scaling factor: 1
- Polynomial coefficients (wind speed): (q,r,s,t) = (0,0,1,0)
- Wind speed offset: 0 km/h
- Wind speed scaling factor: 1
- Linear wind speed for 1 revolution/s: 0.90624 m/s

Default configuration can be restored by sending extended SDI-12 command **aXRSTDC!**.

1.3 Installation

The TBSWS1 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 TBSWS1 shall be mounted above any local objects that obstruct wind flow or may cause turbulences. In case of mounting the anemometer on a roof, it shall be placed at least 2 - 3 meters above the roof line.

For the calculation of evapotranspiration in agricultural applications, the anemometer shall be placed 2 meters above ground.

According metereological and aviation standards, anemometers shall be placed 10 meters above ground.

1.4 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

SDI-12 ANEMOMETER

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

2 Measurement

The following chapters describe the steps to follow to proceed with wind speed and air temperature measurements.

2.1 Wind speed measurement

2.1.1 Setting the wind speed unit

The TBSWS1 can output wind speed in any of the units below:

- m/s
- km/h
- mph
- knot
- ft/s

The default output of the wind speed sensor is meter/second (km/h).

This can be changed by using extended SDI-12 command **aXSSUn!** and selecting the desired unit.

2.1.2 Operating mode and wind speed measurements

TBSWS1 supports 3 different operating modes (simple/advanced 1advanced 2) to measure the wind speed.

The default operating mode is simple mode which performs instantaneous wind speed measurent.

Advanced Modes are used to deliver average wind speed over a defined or random logging period.

The mode can be selected by using the extended SDI-12 command **aXSAMn!**.

In any case, wind speed measurements is based on TBSWS1 mechanical and sensor design:

- The rotary encoder delivers 256 pulses per revolution
- The 3 cup anemometer dimensions lead to a linear speed of 0.90624 m/s corresponding to 1 revolution/s

Note: if the measured wind speed is below the 0.5 m/s threshold, TBSWS1 will report 0 m/s wind speed.

Supported measurement commands:

aM!	**aMC!**	**aC!**	**aCC!**	**Wind speed**

These commands are applicable for all 3 operating modes.

2.1.3 Simple mode (instantaneous wind speed measurement)

0M!
00031

0D0!
0+0.56 instantaneous wind speed

2.1.4 Advanced Mode 1 (averaging over a defined logging period)

Sensor setup

The anemometer must be continuously powered when it is operated in Advanced Mode 1.

Description

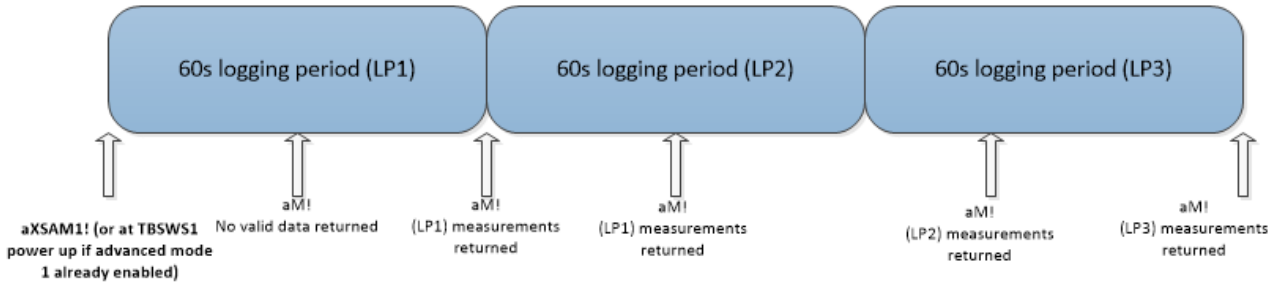
In Advanced Mode 1, wind speed is measured at least every 3 seconds (depending on the configured measurement period using **aXSMP,n!**). The measurement values are then processed by a moving average over a configurable logging period set by **aXSLP,n!**.

Notes:

- *The measurement period must be a multiple of 3s*
- *The logging period must be a multiple of the measurement period*
- *The reported wind speed values for the first logging period after power up are (average, max, min)=(0,0,0).*

At the end of the logging period, average, minimum- and maximum windspeed of the logging period are calculated and stored. Upon a measurement command, the results of the latest, completed logging period will be delivered.

The SDI-12 data logger shall operate as following:



Example

To have TBSWS1 operating in Advanced Mode 1, it is required to set up the desired measurement and logging periods first (in case the default values wouldn't be suitable) and then set the mode:

- aXSMP,n! => set measurement period (optional, otherwise 9s used by default)
- aXSLP,n! => set logging period (optional, otherwise 900s used by default)
- aXSAM1! => set Advanced Mode 1 and automatically starts wind speed sampling and averaging (or after power up if Advanced Mode 1 has been previously set)

Then take a measurement to get the average, maximum and minimum wind speed:

0M!
00013
0D0!
0+0.0+0.0+0.0 invalid data; the measurement command was issued before the first logging period was completed.

0M!
00013
0D0!
0+1.56+1.85+1.42 avg, max, min wind speed of the latest completed logging period
Average=1.56 km/h, maximum=1.85 km/h, minimum=1.42 km/h

2.1.5 0.90Advanced Mode 2 (averaging over a random logging period)

Sensor setup

Usually the anemometer must be continuously powered when it is operated in Advanced Mode 2. However it is still possible to use TBSWS1 in Advanced Mode 2 while being intermittently powered, this is explained in the next section.

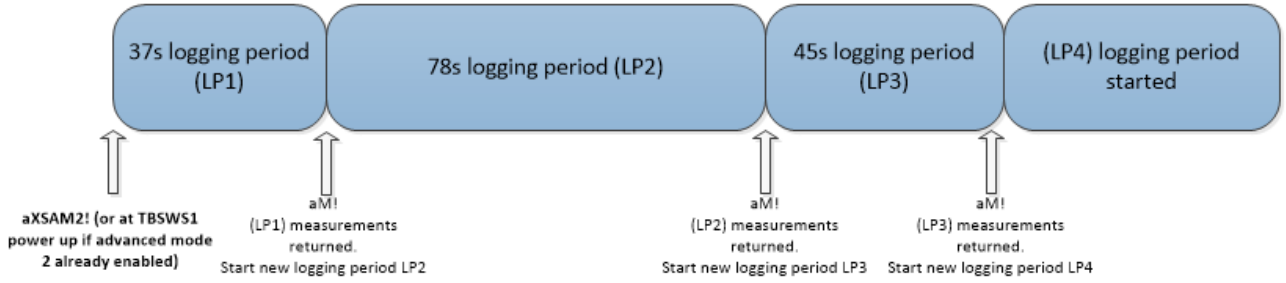
Description

In Advanced Mode 2 the logging period is the time between two consecutive SDI-12 measurements. This is like Advanced Mode 1 but logging starts after an SDI-12 measurement and stops when the next measurement is issued. At this point, average, minimum and maximum wind speed are output over SDI-12 and the logging is immediately restarted.

Notes:

- *The measurement period must be a multiple of 3s*
- *In this mode, TBSWS1 starts measuring the wind speed right after power up (unlike Advanced Mode 1). It allows for situations where TBSWS1 can't be continuously powered while keeping the ability to collect average/max/min wind speed parameters intermittently.*
- *A 3s warm up time is required for this mode.*

The SDI-12 data logger shall operate as following:



Example

To have TBSWS1 operating in Advanced Mode 2, it is required to set up the desired measurement period first (in case the default value wouldn't be suitable) and then set the mode:

- aXSMP,n! => set measurement period (optional, otherwise 9s used by default)
- aXSAM2! => set Advanced Mode 2 and automatically starts wind speed sampling and averaging (or after power up if Advanced Mode 2 has been previously set)

Then take a measurement to get the average, maximum and minimum wind speed:

0M!
00013
0D0!
0+1.56+1.85+1.42 avg, max, min wind speed over 2 consecutive SDI-12 measurements
Average=1.56 km/h, maximum=1.85 km/h, minimum=1.42 km/h

2.1.6 Invalid magnetic input field

TBSWS1 embeds a fault detection mechanism related to the magnetic field.

In case an invalid magnetic input field is detected, TBSWS1 will return +999.9999 while getting data after issuing M!/MC!/C!/CC!.

2.2 Air temperature measurement

2.2.1 Setting air temperature unit

Air temperature can be reported either in degree Celcius (default) or Fahrenheit.

This can be configured by using **aXSTUn!** extended SDI-12 command.

2.2.2 Air temperature measurements

Temperature is measured using any of the following commands:

aM1!	**,aMC1! aC1!,aCC1!**	**Temperature [°C, °F]**

3 Application Examples

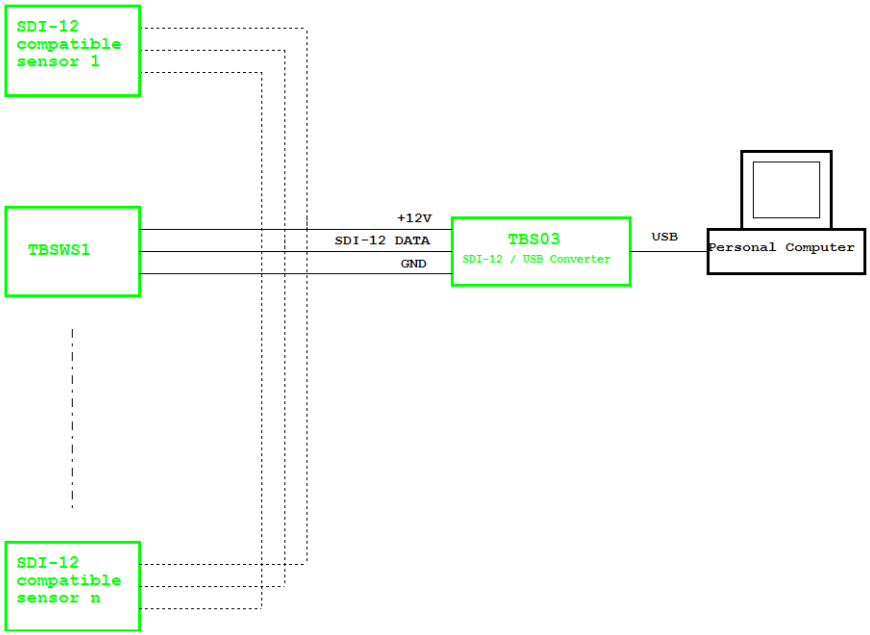


Figure 1 – TBSWS1 and other sensors with SDI-12 interface connected to TBS03 SDI-12 to USB converter; setup for controlling / testing sensors and for PC based data recording

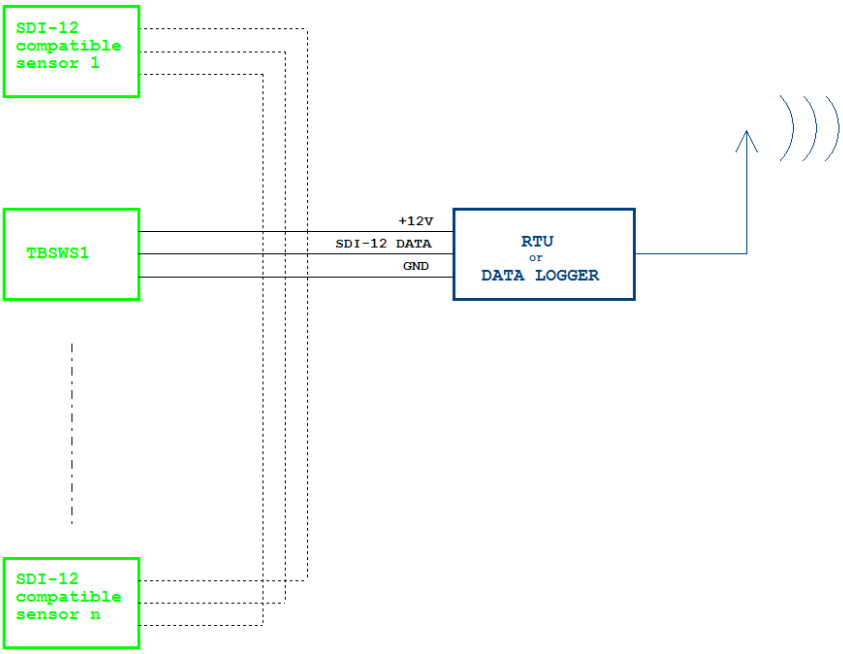
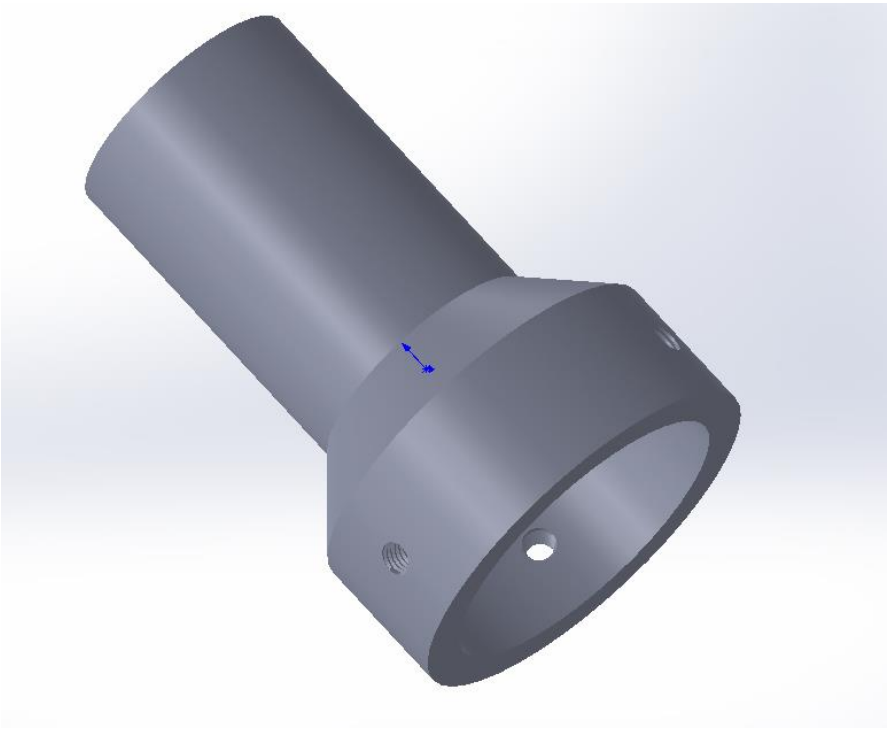


Figure 2 – TBSWS1 and other sensors with SDI-12 interface connected to Remote Telemetry Unit or Data Recorder

4 Hardware Description

4.1 Base part drawings



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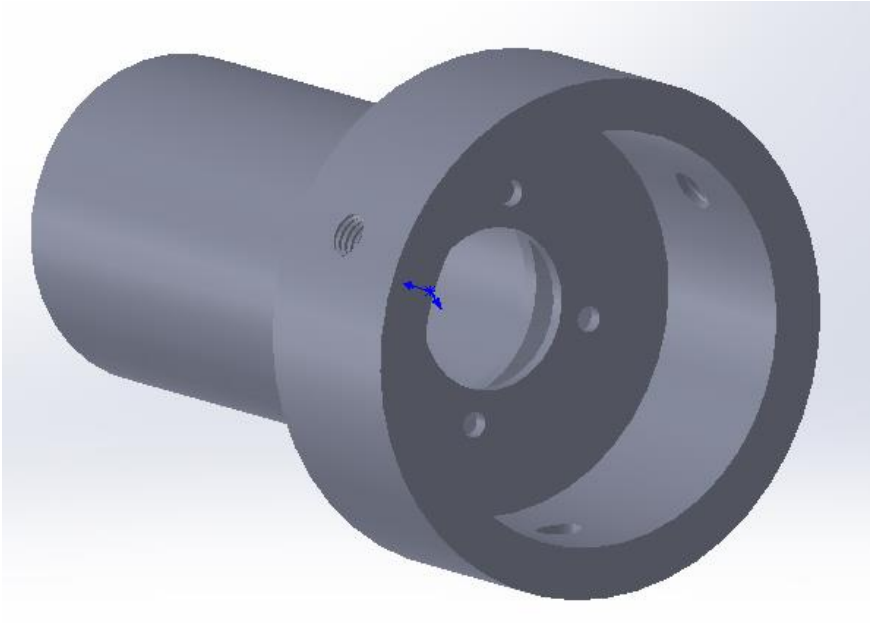

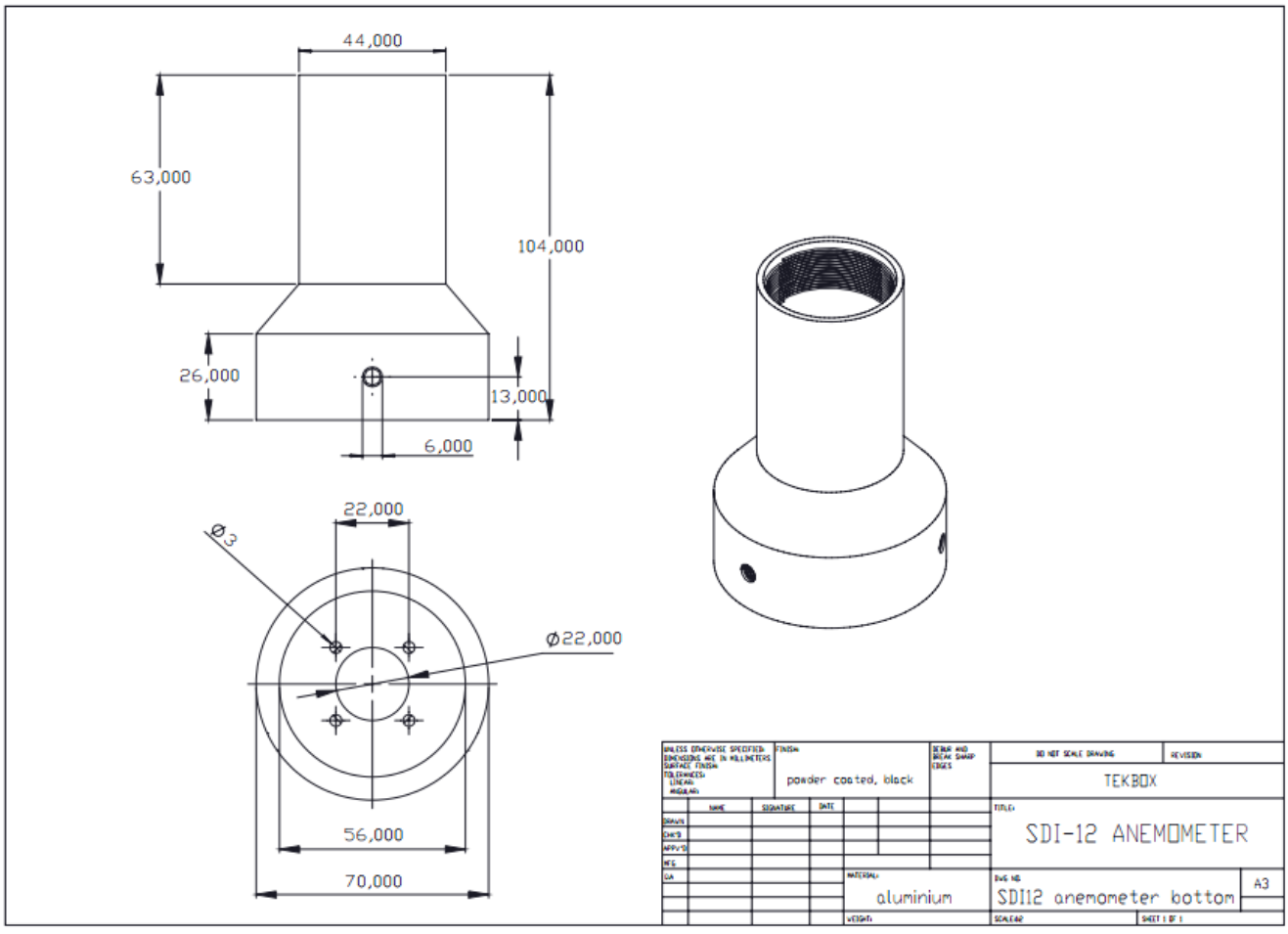

Figure 3 – Base part drawing

The TBSWS1 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.

4.2 Cable Connection

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

Table 1 – Cable Connection

4.3 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

5 Supported SDI-12 v1.3 Commands

Following commands are supported by the TBSWS1:

Command	Description	Response
a!	Acknowledge Active	a<CR><LF>
aI!	Send Identification	a14TEKBOXVNTBSWS1rv<h><nnnnnn><fffffff><CR><LF> With:

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		○ <a>: SDI-12 address ○ <h>: HW revision (one letter) ○ <nnnnnn>: serial number (6 digits) ○ <fffffff>: firmware version (7 digits) Example: 014TEKBOXVNTBSWS1rvE1234561000101<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 wind speed	Simple mode: measurement of momentary wind speed a0031<CR><LF> Delay: (3) seconds and number of values (1) Advanced Mode 1&2: measurement of average -, maximum – and minimum wind speed a0013<CR><LF> Delay: (1) seconds and number of values (3)
aM1!	Additional Measurement Measures internal temperature	a0011<CR><LF> Delay: (1) seconds and number of values (1)
aMC!	Start Measurement and request CRC Measures wind speed and calculates CRC	Simple mode: measurement of momentary wind speed a0031<CR><LF> Delay: (3) seconds and number of values (1) Advanced Mode 1&2: measurement of average -, maximum – and minimum wind speed a0013<CR><LF> Delay: (1) seconds and number of values (3)
aMC1!	Additional Measurement and request CRC Measures internal temperature and calculates CRC	a0011<CR><LF> Delay: (1) seconds and number of values (1)
aC!	Start Concurrent Measurement Measures wind speed	Simple mode: measurement of momentary wind speed a00301<CR><LF> Delay: (3) seconds and number of values (1) Advanced Mode 1&2: measurement of average -, maximum – and minimum wind speed a00103<CR><LF> Delay: (1) seconds and number of values (3)
aC1!	Start Concurrent Measurement Measures internal temperature	a00101<CR><LF> Delay: (1) seconds and number of values (1)
aCC!	Start Concurrent Measurement and request CRC Measures wind speed and calculates CRC	Simple mode: measurement of momentary wind speed a00301<CR><LF> Delay: (3) seconds and number of values (1) Advanced Mode 1&2: measurement of average -, maximum – and minimum wind speed a00103<CR><LF> Delay: (1) seconds and number of values (3)
aCC1!	Start Concurrent Measurement and request CRC	a00101<CR><LF> Delay: (1) seconds and number of values (1)

	Measures internal temperature and calculates CRC	
aD0!	Get Measurement Result(s)	Upon issuing the aD0! Command, the TBSWS1 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 v1.3 commands

6 Supported SDI-12 v1.4 Commands

Command	Description	Response
aIM!	aM! Identify Measurement Returns delay and number of parameters	Simple mode: measurement of momentary wind speed a0031<CR><LF> Delay: (3) seconds and number of values (1) Advanced Mode 1&2: measurement of average -, maximum – and minimum wind speed a0013<CR><LF> Delay: (1) seconds and number of values (3)
aIMC!	aMC! Identify Measurement Returns delay and number of parameters	Simple mode: measurement of momentary wind speed a0031<CR><LF> Delay: (3) seconds and number of values (1) Advanced Mode 1&2: measurement of average -, maximum – and minimum wind speed a0013<CR><LF> Delay: (1) seconds and number of values (3)
aIC!	aC! Identify Measurement Returns delay and number of parameters	Simple mode: measurement of momentary wind speed a00301<CR><LF> Delay: (3) seconds and number of values (1) Advanced Mode 1&2: measurement of average -, maximum – and minimum wind speed a00103<CR><LF> Delay: (1) seconds and number of values (3)
aICC!	aCC! Identify Measurement Returns delay and number of parameters	Simple mode: measurement of momentary wind speed a00301<CR><LF> Delay: (3) seconds and number of values (1) Advanced Mode 1&2: measurement of average -, maximum – and minimum wind speed a00103<CR><LF> Delay: (1) seconds and number of values (3)
aIM1!	aM1! Identify Measurement Returns delay and number of parameters	a0011<CR><LF> Delay: (1) seconds and number of values (1)
aIMC1!	aMC1! Identify Measurement Returns delay and number of parameters	a0011<CR><LF> Delay: (1) second, number of values (1)

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aIC1!	aC1! Identify Measurement Returns delay and number of parameters	a00101<CR><LF> Delay: (1) second and number of values (01)
aICC1!	aCC1! Identify Measurement Returns delay and number of parameters	a00101<CR><LF> Delay: (1) second, number of values (1)
aIM_001!	aM! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*;<CR><LF> (*)
aIMC_001!	aMC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*; <CRC><CR><LF> (*)
aIC_001!	aC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*;<CR><LF> (*)
aICC_001!	aCC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*; <CRC><CR><LF> (*)
aIM_002!	aM! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*;<CR><LF> (*)(***)
aIMC_002!	aMC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*; <CRC><CR><LF> (*)(***)
aIC_002!	aC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*;<CR><LF> (*)(***)
aICC_002!	aCC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*; <CRC><CR><LF> (*)(***)
aIM_003!	aM! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*;<CR><LF> (*)(***)
aIMC_003!	aMC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*; <CRC><CR><LF> (*)(***)
aIC_003!	aC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*;<CR><LF> (*)(***)
aICC_003!	aCC! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,WindSpeed,*ws_unit*; <CRC><CR><LF> (*)(***)
aIM1_001!	aM1! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,AirTemperature,*t_unit*;<CR><LF> (**)
aIMC1_001!	aMC1! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,AirTemperature,*t_unit*; <CRC><CR><LF> (**)
aIC1_001!	aC1! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,AirTemperature,*t_unit*;<CR><LF> (**)

aICC1_001!	aCC1! Identify Measurement Parameters (1rst) Returns parameter's identification and unit	a,AirTemperature,*t_unit*; <CRC><CR><LF> (**)

Table 3 – Standard SDI-12 v1.4 commands

(*) Where *ws_unit* depends on the unit set with aXSSUn! (m/s km/h mph knot ft/s)
(**) Where *t_unit* depends on the unit set with aXSTUn! (Celcius Fahrenheit)
(***) Advanced Mode 1 and 2 only

7 Supported Extended Commands

7.1 Setting engineering units

Command	Description	Response
aXSTUn!	Set temperature unit <n>: temperature unit ○ C: Celcius ○ F: Fahrenheit	aX_OK<CR><LF>
aXGTU!	Get temperature unit	an<CR><LF> <n>: ○ C (Celcius) ○ F (Fahrenheit)
aXSSUn!	Set wind speed unit <n>: wind speed unit ○ 0: m/s ○ 1: km/h ○ 2: mph ○ 3: knot ○ 4: ft/s	aX_OK<CR><LF>
aXGSU!	Get wind speed unit	an<CR><LF> <n>: ○ 0 (m/s) ○ 1(km/h) ○ 2 (mph) ○ 3 (knot) ○ 4 (ft/s)

Table 4 – Extended SDI-12 commands: engineering units

7.2 Operating modes

Command	Description	Response
aXSAMn!	Set operating mode	aX_OK<CR><LF>

	<n>: operating mode ○ 0: simple mode ○ 1: Advanced Mode 1 ○ 2: Advanced Mode 2	
aXGAM!	Get operating mode	an<CR><LF> <n>: ○ 0 (simple mode) ○ 1 (Advanced Mode 1) ○ 2 (Advanced Mode 2)
aXSMP,n!	Set measurement period (Advanced Mode 1 and 2 only) <n>: ○ from 3s to <logging period> ○ must be a divider of the logging period.	aX_OK<CR><LF>
aXGMP!	Get measurement period	an<CR><LF> <n>:
aXSLP,n!	Set measurement logging period (Advanced Mode 1 only) <n>: logging period, 6 to 3600 s	aX_OK<CR><LF>
aXGLP!	Get measurement logging period	an<CR><LF> <n>: 6-3600 s
aXRSTDC!	Reset to default parameters: ○ Temperature unit: Celcius ○ Wind speed unit: km/h ○ Operating mode: simple mode ○ Logging period: 900s ○ Measurement period: 9s ○ Number of pulses per revolution: 256 ○ Polynomial coefficients (temperature): (q,r,s,t) = (0,0,3.4468,-65.29) ○ Temperature offset: 0 degree ○ Temperature scaling factor: 1 ○ Polynomial coefficients (wind speed): (q,r,s,t) = (0,0,1,0) ○ Wind speed offset: 0 m/s ○ Wind speed scaling factor: 1 ○ Wind speed for 1 revolution/s: 0.90624 m/s After issuing this command, default parameters are restored and TBSWS1 is reset.	A<CR><LF>

Table 5 – Extended SDI-12 commands: operating modes

7.3 Internal parameters

These commands shall not be used and are reserved for production.

Command	Description	Response
aXSRP,n!	Set number of pulses per revolution <n>: number of pulses per revolution o Default value: 256	aX_OK<CR><LF>
aXGRP!	Get the number of pulses per revolution	an<CR><LF> <n>: number of pulses/revolution
aXSRS,n!	Set the anemometer linear speed corresponding to one revolution/s <n>: linear speed for 1 revolution/s (float) o Default value: 0.90624 m/s	aX_OK<CR><LF>
aXGRS!	Get the anemometer linear speed corresponding to one revolution/s	an<CR><LF> <n>: linear speed
aXSSN,nnnnnn!	Set 6 digits serial number nnnnnn	aX_OK<CR><LF>

Table 6 – Extended SDI-12 commands: internal parameters

7.4 Calibration

TBSWS1 does not require any calibration, however a set of commands is provided to the user would it be required to perform some adjustments depending on the environment.

Command	Description	Response
aXSTP,q,r,s,t!	Set polynomial temperature calibration coefficients: (q, r, s, t): polynomial coefficients qX^3+rX^2+sX+t o Default value: (q, r, s, t) = (0, 0, 3.4468, -65.29)	aX_OK<CR><LF>
aXGTP!	Get polynomial temperature calibration coefficients	aq,r,s,t<CR><LF> (q,r,s,t): polynomial coefficients qX^3+rX^2+sX+t
aXSTO,n!	Set temperature offset <n>: temperature offset (float) o Default value: 0°Celcius	aX_OK<CR><LF>
aXGTO!	Get temperature offset	an<CR><LF> <n>: temperature offset (float)
aXSTS,n!	Set temperature scaling factor <n>: temperature scaling factor (float) o Default value: 1	aX_OK<CR><LF>
aXGTS!	Get temperature scaling factor	an<CR><LF> <n>: temperature scaling factor (float)
aXSSP,q,r,s,t!	Set polynomial wind speed calibration coefficients: (q, r, s, t): polynomial coefficients qX^3+rX^2+sX+t o Default value: (q, r, s, t) = (0, 0, 1, 0)	aX_OK<CR><LF>

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aXGSP!	Get polynomial wind speed calibration coefficients	aq,r,s,t<CR><LF> (q,r,s,t): polynomial coefficients qX^3+rX^2+sX+t
aXSSO,n!	Set wind speed offset <n>: wind speed offset (float) ○ Default value: 0 m/s	aX_OK<CR><LF>
aXGSO!	Get wind speed offset	an<CR><LF> <n>: wind speed offset (float)
aXSSS,n!	Set wind speed scaling factor <n>: wind speed scaling factor (float) ○ Default value: 1	aX_OK<CR><LF>
aXGSS!	Get wind speed scaling factor	an<CR><LF> <n>: wind speed scaling factor (float)

Table 7 – Extended SDI-12 Commands: calibration

8 Ordering Information

Part Number	Description
TBSWS1	TBSWS1, Anemometer with 3m cable

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

Table 8 – Ordering Information

9 History

Version	Date	Author	Changes
V1.0	18.08.2013	Mayerhofer	Creation of the document
V1.1	6.03.2015	Mayerhofer	Chapter 1.1 corrected
V1.2	23.08.2016	Mayerhofer	Correction: revolution ->revolution/s
V1.3	23.08.2016	Mayerhofer	Correction: 3.2 Cable Connection
V1.4	05.11.2020	Philippe Hervieu	Advanced Mode 2 added.
V1.5	06.11.2020	Philippe Hervieu	Fix typo mistakes and errors in some SDI-12 commands format.
V1.6	03.03.2021	Philippe Hervieu	Update SDI-12 measurement commands format
V1.7	30.03.2021	Philippe Hervieu	Update some SDI-12 timing information
V1.8	26.08.2021	Mayerhofer	Updated mechanics
V1.9	27.10.2021	Philippe Hervieu	Update to SDI-12 v1.4 / Extended commands reworked.
V1.10	11.03.2022	Philippe Hervieu	Warm up time information (Advanced Modes 2) and update Advanced Modes section.
V1.11	16.03.2022	Philippe Hervieu	Update aXRSTDC! and fix some typo errors.

Table 9 – History