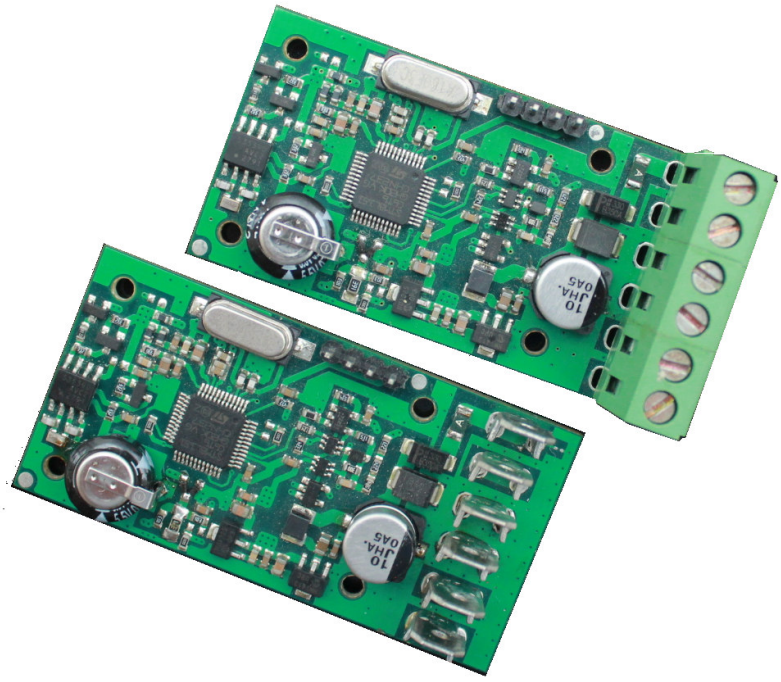
SDI-12 RAIN GAUGE INTERFACE

The TBSRGM1 is a retrofit module to equip tipping bucket rain gauges with data logging capability and SDI-12 interface.

The TBSRGM1 has been designed to work with any type of tipping bucket rain gauge with switch outputs. The TBSRGM1 has an on board real time clock with supercap buffer. It is easy to install and easy to configure. The TBSRGM1 is available with either screw terminal block interface or with blade terminals. The module is sealed with Henkel Technomelt.



Features

- SDI-12 interface
- 6V - 16V supply range
- Real time clock/calendar
- Data logging
- Low power consumption
- PCB can be customized
- Hermetically sealed
- Small size
- Rugged design
- Simple installation
- Operating Temperature Range: -40°C - +85°C

Target Applications

- Meteorology
- Agricultural monitoring

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1 Introduction

The TBSRGM1 is a SDI-12 interface for retrofitting tipping bucket rain gauges. It has an on board real time clock/calendar with supercap buffer to enable logging capability.

2 Measurement

The TBSRGM1 outputs precipitation volume

SDI-12 Measurement Commands:

aM!	Read precipitation parameters
aMC!	Read precipitation parameters – measurement with cyclic redundancy check
aC!	Read precipitation parameters
aCC!	Read precipitation parameters – measurement with cyclic redundancy check

Output format:

+A.AAA+ +B.BBB+C.CCC+D.DDD

where:

+A.AAA = accumulated rainfall since last measurement (inches or mm of rain)

+B.BBB = total rainfall accumulation today (inches of rain)

+C.CCC = total rainfall accumulation yesterday (inches of rain)

+D.DDD = total rainfall accumulation since reset. (Inches of rain)

aM1!	Read temperature
aMC1!	Read temperature – measurement with cyclic redundancy check
aC1!	Read temperature
aCC1!	Read temperature – measurement with cyclic redundancy check

Note that the temperature measurement relates to chip temperature which however is close to the ambient temperature as due to the short measurement times, chip temperature increase can be neglected.

Extended SDI-12 Commands:

aXSD,YYYY,MM,DD!	Set date
aXST,HH,MM,SS!	Set time
aXGD!	Query date
aXGT!	Query time
aXCT,saa.aa!	Temperature calibration saa.aa: enter ambient temperature in °Celsius measured with a reference thermometer; s is the sign

aXTUu!	Set temperature unit u = C for °Celsius or F for °Fahrenheit
aXGU!	Query temperature unit
aXSBV, sn.nn!	Set rain gauge bucket volume n.nn is the equivalent rainfall in mm or inch, per bucket tip
aXGBV!	Query rain gauge bucket volume n.nn is the equivalent rainfall in mm or inch, per bucket tip
aXSO,snnnn.nn!	Set start value/offset for the total accumulated rainfalls aX_ok<CR><LF>
aXGO!	Query start value/offset for the total accumulated rainfalls a+nnnn.nn<CR><LF
aXRS!	Reset total accumulated rainfall Use this command to set the accumulated rainfall value to zero.

3 Product Specification

- SDI-12 Interface
- Supply voltage: 12V nominal; woking range 6V 16V
- Supply current: 8mA during measurement (1 sec); 80µA in sleep mode
- Operating temperature range: -40 … +85°C
- Dimensions: 60 x 30 x 19 mm

4 Configuration

Use the extended SDI-12 command **aXSBV, sn.nn!** to set the rain gauge bucket volume
n.nn is the equivalent rainfall in mm or inch, per bucket tip.

5 Installation

The TBSRGM1 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 of this datasheet.

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

7 Application Examples

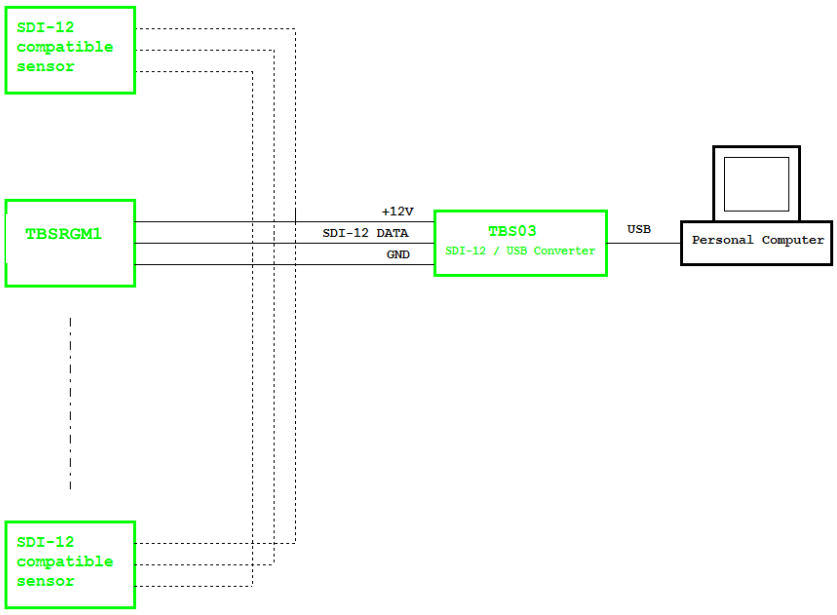

Figure 1 – TBSRGM1 sensor connected to TBS03 SDI-12 to USB converter; setup for controlling / testing sensors and for PC based data recording

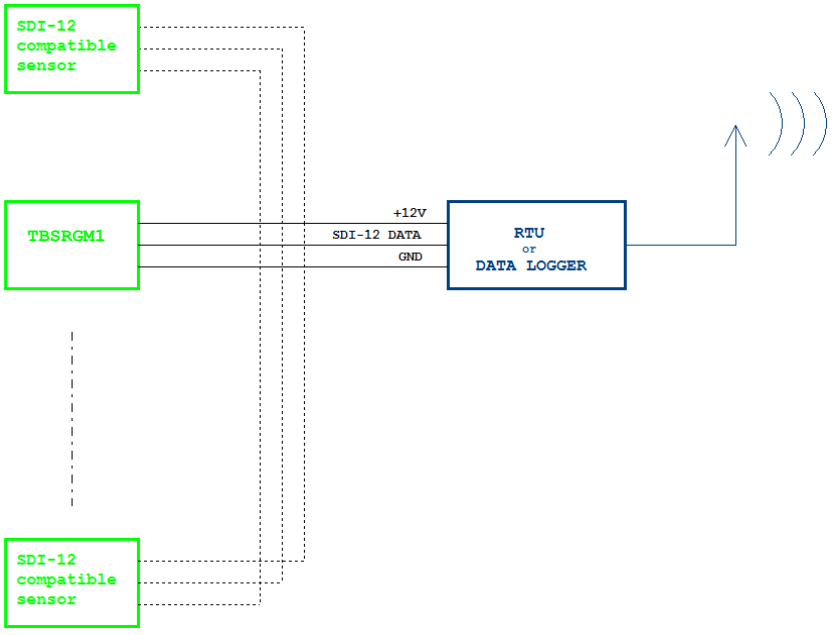

Figure 2 –TBSRGM1 sensors connected to Remote Telemetry Unit or Data Recorder

8 Supported SDI-12 Commands

Command	Description	Response
a!	Acknowledge Active	a<CR><LF>
aI!	Send Identification	013TEKBOXVN_TBSRGM1_V0.10_xxxxx <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 precipitation parameters	attt1<CR><LF> Delay (ttt = 001) in seconds and number of values (5)
aMC!	Start Measurement and request CRC Measures precipitation parameters and calculates CRC	attt1<CR><LF> Delay (ttt = 001) in seconds and number of values (5)
aC!	Start Concurrent Measurement Measures precipitation parameters	attt1<CR><LF> Delay (ttt) in seconds and number of values (5)
aCC!	Start Concurrent Measurement and request CRC Measures precipitation parameters and calculates CRC	attt1<CR><LF> Delay (ttt) in seconds and number of values (5)
aM1!	Start Measurement Measures temperature	attt1<CR><LF> Delay (ttt = 001) in seconds and number of values (5)
aMC1!	Start Measurement and request CRC Measures temperature and calculates CRC	attt1<CR><LF> Delay (ttt = 001) in seconds and number of values (5)
aC1!	Start Concurrent Measurement Measures temperature	attt1<CR><LF> Delay (ttt) in seconds and number of values (5)
aCC1!	Start Concurrent Measurement and request CRC Measures temperature CRC	attt1<CR><LF> Delay (ttt) in seconds and number of values (5)
aD0!	Get Measurement Result(s)	Upon issuing the aD0! Command, the TBSRGM1 will send the measurement results. Response on aM!, +AA.AAA+BBB+CC.CCC+DD.DDD+EE.EEE where: +AA.AAA = accumulated rainfall since last measurement (inches or mm of rain) +BB = number of raw bucket tips since last measurement (counts) +CC.CCC = total rainfall accumulation since reset. (inches/mm of rain) +DD.DDD = total rainfall accumulation today (inches of rain) +EE.EEE = total rainfall accumulation yesterday (inches of rain)
aV!	Start Verification	a0000<CR><LF> Not supported
aRn! **aRCn!**	Continuous Measurement Continuous Measurement + CRC	a<CR><LF> Not supported

Table 1 – Standard SDI-12 commands supported by the TBSRGM1

9 Supported Extended Commands

Command	Description	Response
aXSD,YYYY,MM,DD!	set date where a represents the address, YYYY the year, MM the month and DD the day	aX_ok<CR><LF>
aXST,HH,MM,SS!	set time where a represents the address, HH the hour, MM the minute and SS the second	aX_ok<CR><LF>
aXGD!	query date	a,YYYY.MM,DD<CR><LF>
aXGT!	query time	a,HH,MM,SS<CR><LF>
aXCT,saa.aa!	Calibrate temperature where a represents the address, s the sign (+ or -), aa.aa the ambient temperature in °Celsius measured with a reference thermometer	aX_ok<CR><LF>
aXTUu!	Set temperature unit where a represents the address and u the temperature unit (C for °Celsius and F for °Fahrenheit)	aX_ok<CR><LF>
aXGU!	Query temperature unit	a,C or a,F<CR><LF>
aXSBV, sn.nn!	Set the volume of the Rain Gauge bucket where a represents the address and s the sign (+ or -) n.nn is the equivalent rainfall in mm or inch, per bucket tip	aX_ok<CR><LF>
aXGBV!	Query the volume of the Rain Gauge bucket	asn.nn<CR><LF>
aXSO,snnnn.nn!	Set start value/offset for the total accumulated rainfall where a represents the address and s the sign (+ or -) nnnn.nn is the start value/offset of the accumulated rainfall in mm or inch	aX_ok<CR><LF>
aXGO!	Query the start value/offset for the total accumulated rainfall	asnnnn.nn<CR><LF>
aXRS!	Reset total accumulated rainfall (to zero)	aX_ok<CR><LF>

Table 2 – Extended SDI-12 Commands

10 Technical Specifications

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Is	Supply current	Active mode (during measurement)		8		mA
Is	Supply current	Sleep mode		80		µA
Vs	Supply voltage		6	12	17	V
tm	Measurement Time	Time in active mode upon receiving a measurement command		1		s
TR	Temperature measurement range		-40		+85	°C

Table 3 – Technical Specifications

11 Connections

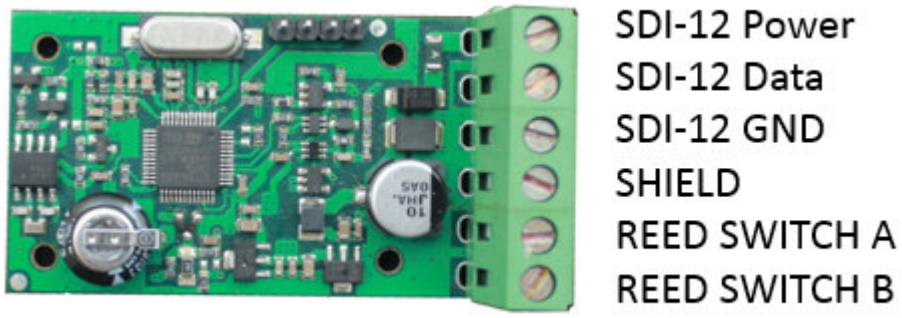

Figure 3 – Module connections

The reed switch input B is internally pulled up(connecting signal here), de-bounced and EMC/overvoltage protected. Reed switch input A is internally connected to ground.

12 Environmental Specifications

Symbol	Parameter	Conditions	Min	Max	Unit
T_A	Operating Ambient Temperature Range		-40	+85	°C
T_{STG}	Storage Temperature Range		-40	+85	°C
	Moisture level	Non condensing	-	95	%

Table 4 - Environmental Specifications

13 Ordering Information

Part Number	Description
TBSRGM1	TBSRGM1, SDI-12 Rain Gauge Interface *)

*) available with conformal coating or conformal coating + Hotmelt coating upon order

Table 5 – Ordering Information

14 History

Version	Date	Author	Changes
V1.0	11.7.2015	Mayerhofer	Creation of the document
V1.1	29.04.2016	THINH	Corect pulse input

Table 6 – History