**TEKBOX**
DIGITAL SOLUTIONS

SDI-12 RAIN GAUGE Converter

The TBSRGC1 is a 2 x 1.5V AA alkaline battery powered converter to equip tipping bucket rain gauges with data logging capability and SDI-12 interface.

The TBSRGC1 has been designed to work with any type of tipping bucket rain gauge with switch output. The TBSRGC1 has a real time clock, programmable via extended SDI-12 commands. It is easy to install and easy to configure. The TBSRGC1 is mounted in an IP67 housing from Fibox. Additional connectivity points enable distribution of SDI-12 cables to other sensors, if required. The converter is equipped with two PG grommets by default. It can be customized with additional grommets or equipped with IP67 connectors upon inquiry.
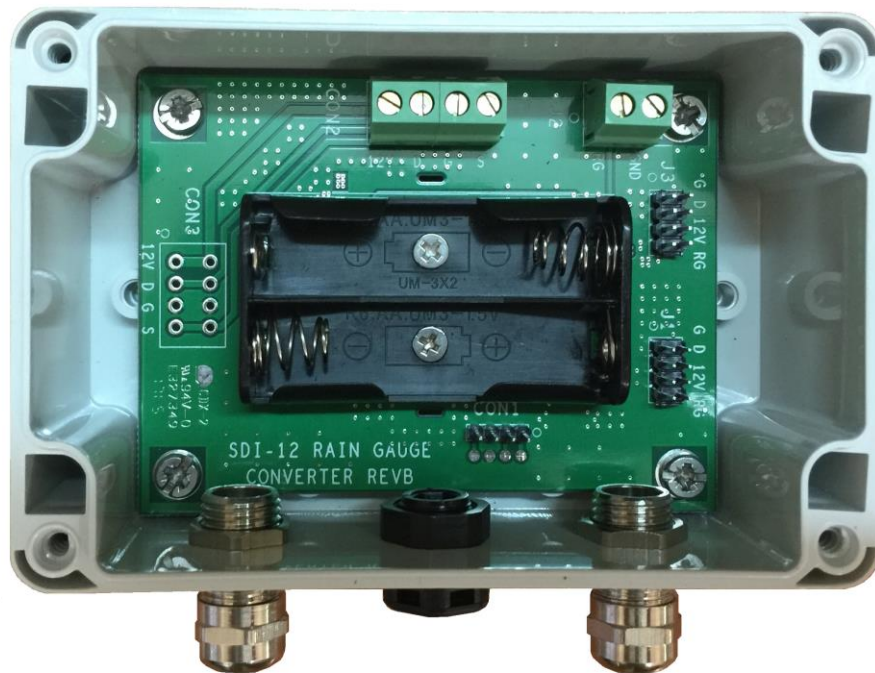
Features

- SDI-12 interface
- 2x AA battery powered
- Real time clock/calendar
- Data logging
- Ultra low power consumption
- IP67 housing - FIBOX PC081206
- IP67 air pressure balance vent
- Size 80 x 120 x 57 mm

- Rugged design
- Simple installation
- Operating Temperature Range:
  -40°C - +85°C

Target Applications

- Meteorology
- Agricultural monitoring

SDI-12 RAIN GAUGE INTERFACE

Contents

Tables

Figures

SDI-12 RAIN GAUGE INTERFACE

1   Introduction

The TBSRGC1 is a SDI-12 converter for standard tipping bucket rain gauges. It has an on board real time clock/calendar to enable precipitation logging capability.

2   Measurement

The TBSRGC1 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 or mm of rain)

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

+D.DDD = total rainfall accumulation since reset. (Inches or mm 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 inside the housing, 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

SDI-12 RAIN GAUGE INTERFACE

	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 for SDI-12 IF: 12V nominal; working range 6V ....16V. The SDI-12 voltage is used to power the SDI-12 data level shifter and only needs to be present during a SDI-12 measurement

- Supply voltage for rain gauge converter electronics: 2 x 1.5V AA alkaline battery cells

- Supply current: 4µA in sleep mode waiting for RG pulse; 8mA during SDI-12 measurement (1 sec)

- Operating temperature range: -40 … +85°C

- Dimensions: 80 x 120 x 57 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 TBSRGC1 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.

SDI-12 RAIN GAUGE INTERFACE

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.
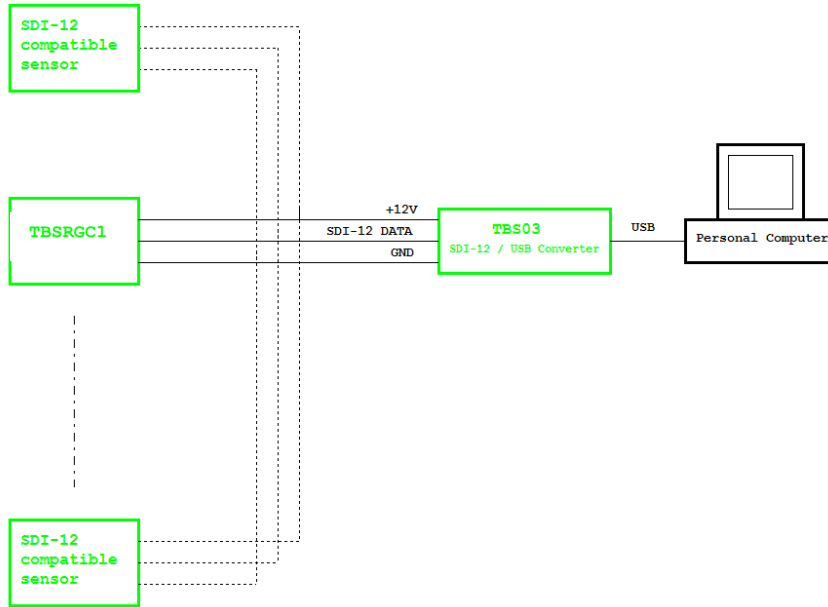
7   Application Examples

Figure 1 – TBSRGC1 sensor connected to TBS03 SDI-12 to USB converter; setup for controlling / testing sensors and for PC based data recording
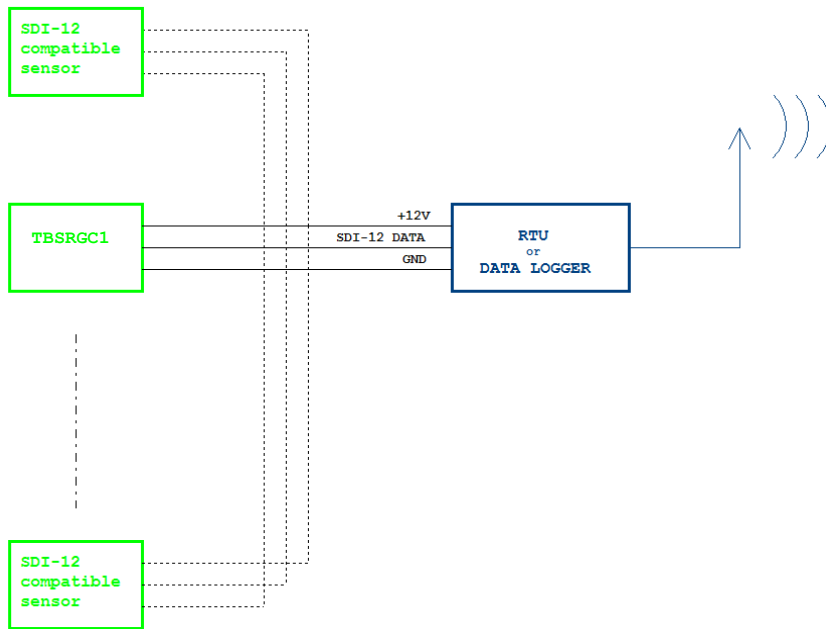

Figure 2 –TBSRGC1 sensors connected to Remote Telemetry Unit or Data Recorder

SDI-12 RAIN GAUGE INTERFACE

8   Supported SDI-12 Commands

Command	Description	Response
a!	Acknowledge Active	a<CR><LF>
aI!	Send Identification	013TEKBOXVN_TBSRGC1_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 TBSRGC1 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 TBSRGC1

SDI-12 RAIN GAUGE INTERFACE

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, waiting for pulse interrupt		4		µA
Vs	Supply voltage	2 x AA alkaline cells		3		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

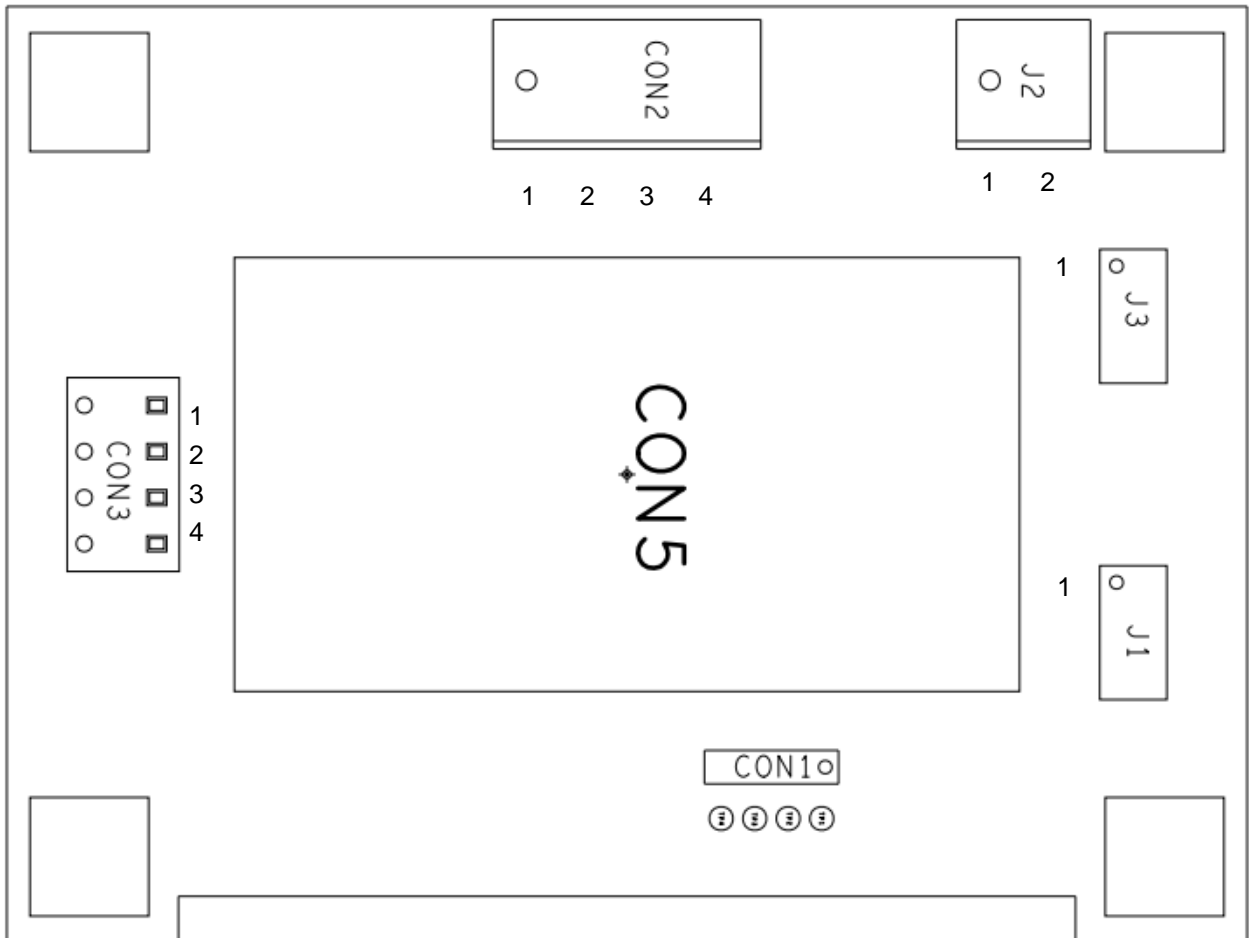# SDI-12 RAIN GAUGE INTERFACE

11 Connections

Figure 3 –connector assignment

CON 1: Production connector – do not connect

CON2: Main SDI-12 connector, screw terminal block
      Pin1 – SDI-12 power (6…12V)
      Pin2 – SDI-12 data
      Pin3 – SDI-12 ground
      Pin4 – Cable shield, decoupled to ground with 100K//100nF

CON3: Optional SDI-12 connector footprint
      Pin1 – SDI-12 power (6…12V)
      Pin2 – SDI-12 data
      Pin3 – SDI-12 ground
      Pin4 – Cable shield, decoupled to ground with 100K//100nF

SDI-12 RAIN GAUGE INTERFACE

J2:   Raingauge connector; screw terminal block

       Pin1 – Rain Gauge input; internally pulled up to 3V with 4.7K; ESD protected and debounced

       Pin2 – Rain Gauge input; internally connected to GND

J1, J3: 2 x Combined SDI-12 / Rain Gauge connectors; 2.54mm header; optional use

       Pin1 – NC

       Pin2 – Ground

       Pin3 – NC

       Pin4 – SDI-12 data

       Pin5 – Cable shield, decoupled to ground with 100K//100nF

       Pin6 – SDI-12 power (6…12V)

       Pin7 – Ground

       Pin8 – Rain Gauge input; internally pulled up to 3V with 4.7K; ESD protected and debounced

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
TBSRGC1	TBSRGC1, SDI-12 Rain Gauge Interface *)

*) available with additional grommets or IP67 connectors upon order

Table 5 – Ordering Information

14 History

Version	Date	Author	Changes
V1.0	11.05.2017	Mayerhofer	Creation of the document

Table 6 – History