

# SBS314 Lite Rain Gauge

## User Manual



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# 1. General Information

## About this Manual

This manual is intended as a general guide for installing, wiring and using the SBS LITE range of rain gauges. The information contained in this manual may not cover all aspects of SBS LITE applications. Please refer to associated equipment manuals or consult papers and technical notes on the EML website ([www.emltd.net](http://www.emltd.net)) or contact EML for more details ([sales@emltd.net](mailto:sales@emltd.net)).

## Version Information

*Table 1 - Document Revisions*

<b>EML Document Number:</b>	<b>Description:</b>
UM-P-780-3981	Version 1.0 - First Release, dated 27/01/2023
UM-780-3981	Version 2.0 - Second Release, dated 27/06/2023

## Related Manuals

*Table 2 - Related Manuals*

<b>EML Document Number:</b>	<b>Description:</b>

## 2. Introduction

The SBS LITE is an excellent solution for many hydrological or meteorological applications such as weather stations and flood warning systems. The SBS LITE is a versatile gauge suitable for climates with all types and intensities of rainfall. The injection moulded UV-stabilised material from which the base of the gauge is made, enhanced with the marine grade shot blasted aluminium funnel, means that the SBS LITE is an extremely robust and versatile instrument, ideal for applications where data precision and accuracy are critically important.

The internal tipping bucket mechanism has been designed to ensure maximum performance repeatability.

Traditional cylinder-shaped rain gauges are inaccurate due to the effect of wind blowing over the orifice. The physical presence of the gauge causes air to accelerate, carrying rainfall away from the collecting vessel. The effect of this can be up to a 20% reduction in rainfall catch. The unique aerodynamic shape of the EML range of scientific standard rain gauges reduces this effect, ensuring a high level of confidence in the accuracy of our measurements.

## 3. Site and Installation Requirements

### Choosing a site

A rain gauge site is often a compromise between exposure requirements and operational constraints. The ideal site is level ground with a uniform scattering of objects in the surrounding area thus reducing overall wind speeds. However, these objects should not be too large to cause eddying or high gusts to occur near to the gauge, or so close to prevent rain from entering the gauge. The gauge should ideally be no closer than at least twice the height of the obstruction. Extensive details on rain gauge siting best-practice can be found in Chapter 6 of the [WMO Guide to Meteorological Instruments and Methods of Observation](#). Although the SBS LITE rain gauge is designed to operate in higher wind speeds, care must still be taken to avoid over-exposing the gauge where possible. Large expanses of open flat land should be avoided. If the application is very specific, such as monitoring a building site, then the siting of the rain gauge is largely prescribed by use. Those users who wish to enquire more fully into rain gauge exposure are referred to the EML website for more technical information and papers ([www.emltd.net](http://www.emltd.net)).

**NOTES:** No two rain gauge designs are ever likely to produce identical results, and even two identical rain gauges can give slightly different catches even when sited close to each other.

If the gauge is to be operated in the area of livestock then a fence will almost always be required to prevent damage from and to the animals.

**ATTENTION! Remove packing piece and fit levelling feet!** The tipping-bucket mechanism is immobilised before shipping to prevent damage in transit. To release the mechanism for use, remove the funnel assembly from its base by loosening/removing the three screws and then lifting the funnel. Remove the piece of foam from under the bucket mechanism. This foam may be saved and used whenever the rain gauge is transported. The SBS LITE is supplied fully assembled except for the three levelling feet, which need to be fitted to the gauge. There should be a locking nut above and below the gauge base, and the feet should be positioned below, as in Figure 2.

## Unpacking the rain gauge

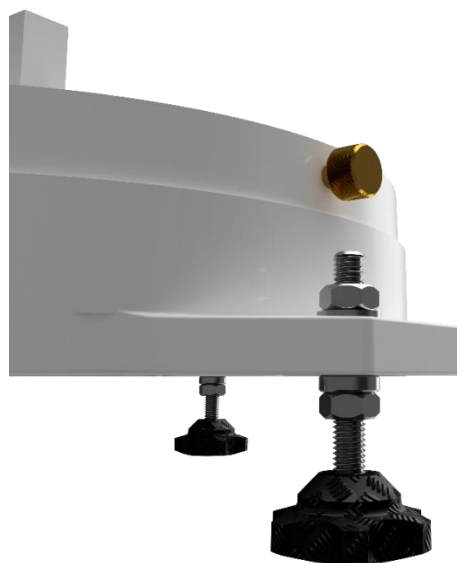
- 1) Included in the box: SBS LITE Gauge, three levelling feet plus fixings (Figure 1 right), cable gland (if not already fitted) and cable if ordered (Figure 1 left)
- 2) Fit the three levelling feet as shown in Figure 2.
- 3) Carefully remove the packing foam from underneath the tipping bucket.
- 4) Your gauge is now ready to use.



*Figure 1 - Cable gland and cable (left), levelling feet (right)*

## Levelling the rain gauge

The SBS LITE can be mounted directly onto any flat surface, and securely fastened as required. There is a small circular spirit level provided on the outside of the base of the rain gauge, which should be used to level the rain gauge. Levelling is one of the simplest means of ensuring the accuracy of rainfall measurements, failure to do this properly will result in a systematic error. Always check the level on every site visit. The gauge is levelled by slackening the locking nuts on the adjustable feet, adjust feet for level and tighten locking nuts (Figure 2). Pegs can be fitted if necessary, through the holes provided next to the adjusters.



*Figure 2 – SBS LITE Levelling Feet*

### Alternative mounting options

It is not always possible to mount a rain gauge on the ground surface. Examples of applications which make use of rain gauges mounted above the ground include; urban monitoring, areas prone to ground-flooding and areas prone to snowfall. It should be noted that regardless of which option is used to mount the gauge, it must be firmly fixed and not susceptible to vibration. Vibration may lead to 'false-tipping' of the bucket mechanism and thus contribute to erroneous or inaccurate measurements. There are options which can be used to mount the SBS LITE above the ground.

The SBS LITE can be purchased with a rain gauge pedestal and guy kit or a rain gauge pedestal only. An example of this configuration is shown in Figure 3.



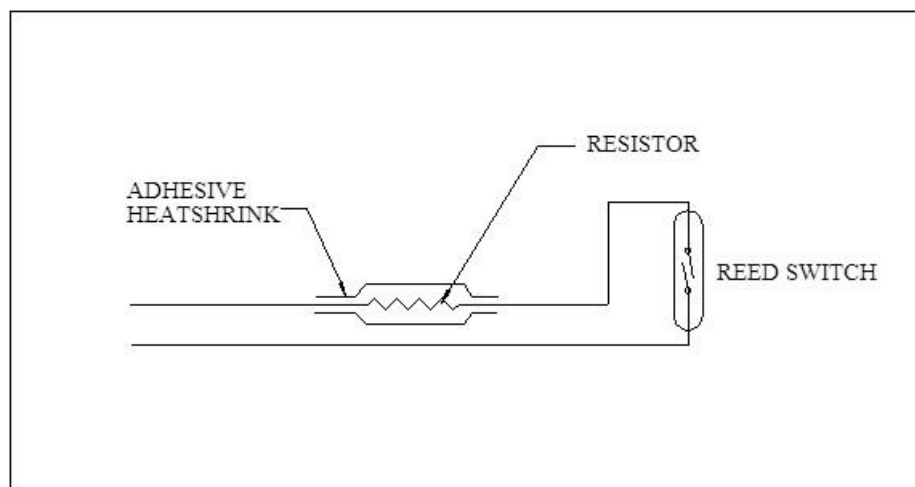
*Figure 3 – Rain gauge fitted to a pedestal as part of the EML system*



## 4. Wiring Guidelines

This section gives information on the wiring of SBS LITE rain gauge.

For most applications, the rain gauge may be connected directly to a pulse counting input (contact closure) on a data logger, but some care is needed if long cables are used. In a long cable significant capacitance can exist between the conductors, which discharges across the reed switch as it closes. As well as shortening the life of the switch, a voltage transient may be induced in any other wires which run close to the rain gauge cable each time the rain gauges tips. To help this situation, 100Ω resistors are pre-fitted to each of the reed switches (Figure 4), these will help protect the switches from arcing and help prevent transients.



*Figure 4 - Reed switch and resistor*

### Wiring for internal loggers

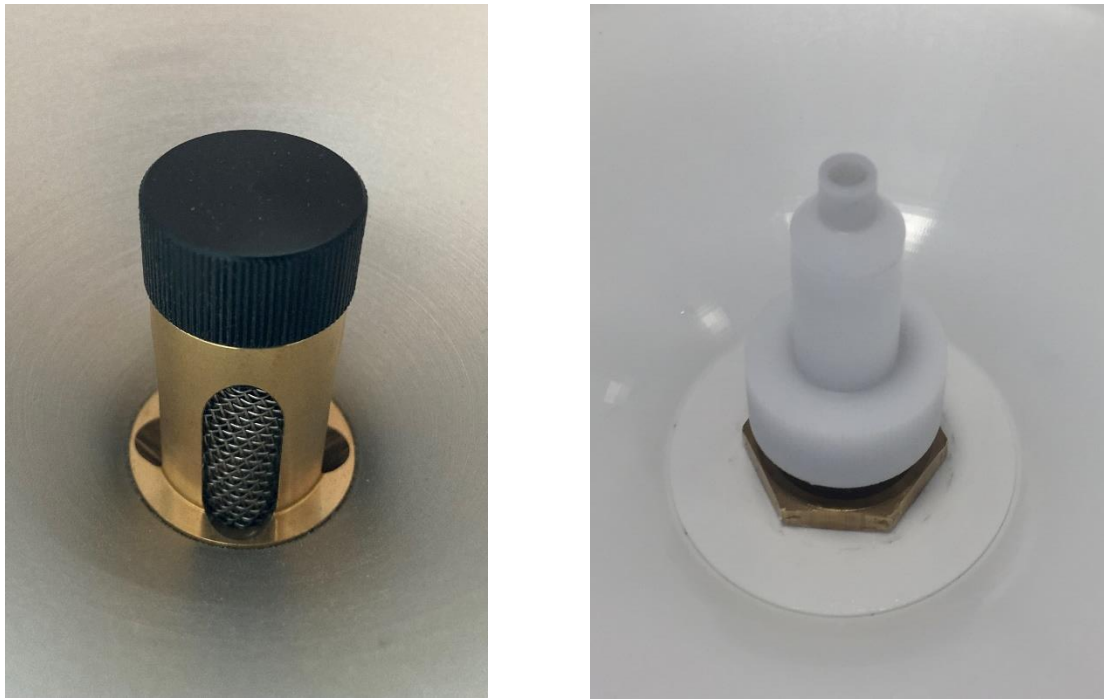
To connect an internal data logger or counter, two wires have to be connected to the green connector terminal block and taken to the contact closure input of your chosen logging device.

The SBS LITE includes a 2-way terminal for connection (the green terminal). As this is a contact closure (switch) device it does not matter which way you connect this to your logging device or counter.

## 5. Operation

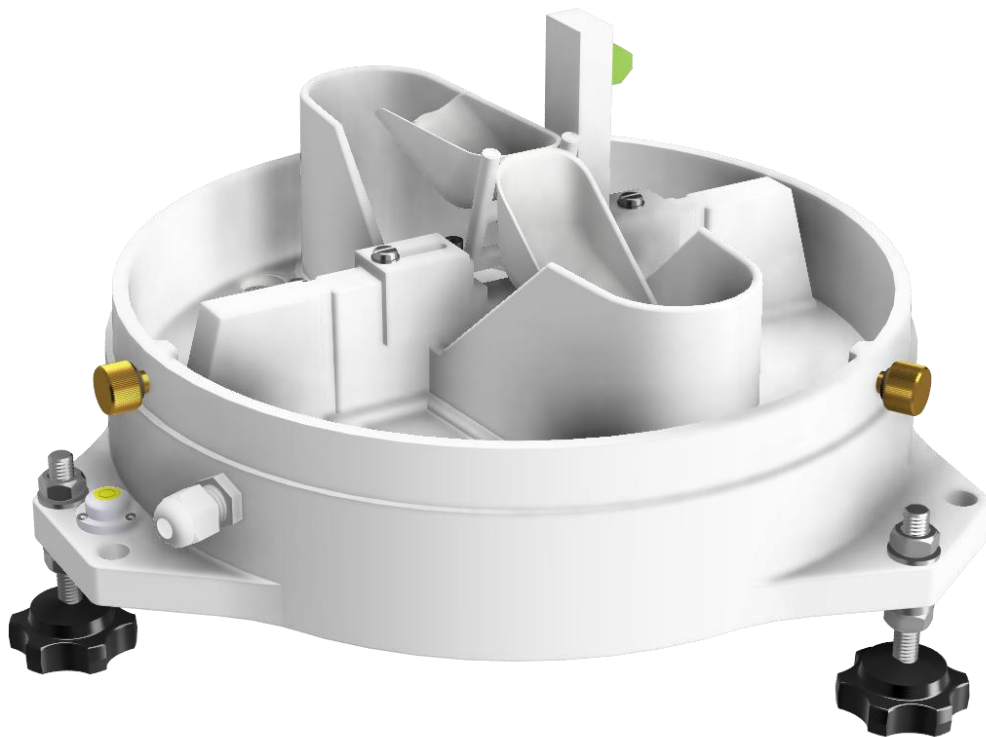
### Operation of the gauge

Rainfall is measured by the well-proven tipping bucket method. Precipitation is collected by the funnel and flows through a stainless-steel gauze filter, trapping and removing any leaves, dirt, etc. Figure 5. Water then drips from the nozzle into one of the two halves of the tipping bucket.



*Figure 5 - Filter and filter cap (left) / Nozzle delivering water into tipping bucket (right)*

The internal tipping bucket assembly rotates around precision rolling pivot bearings. The balance arm tips when the first bucket is full, emptying this rain water and positioning the second bucket under the funnel. The tipping process repeats indefinitely as long as the rain continues to fall, with each tip corresponding to a calibrated fixed quantity of rainfall. At each tip of the bucket the moving arm forces the magnet past the reed switch causing contact to be made for a few milliseconds. As each bucket side is used in turn, the outgoing water is drained away via outlets and discarded. Figure 6 shows the internal mechanism of the SBS LITE.



*Figure 6 - Internal image of the SBS LITE tipping bucket mechanism*

The exact calibration of each tip is pre-set by adjustable stops located under the tipping buckets. Do not alter these stops unless as part of a calibration exercise. A levelling bubble is provided as an aid to levelling of the rain gauge. Connections to the reed switches are made via the green connector terminal.

## 6. Maintenance and Calibration

### Basic Maintenance

To ensure reliable and accurate measurements it is recommended that the following checks are carried out at each visit to the rain gauge (if the gauge is still connected to a data logger and the logger is operating, care must be taken to avoid tipping the bucket when carrying out these checks).

1. Inspect the funnel and filter for any damage or blockage. Depending upon geographical location, at certain times of the year leaves may accumulate in the funnel, dirt and dust can also block the filter preventing or reducing the flow rate to the buckets beneath. The leaves can easily be removed from the funnel and the filter cleaned by removing the end cap from the filter tube, remove the stainless-steel filter gauze carefully, clean and re-fit the filter and cap.
2. Check that the gauge is still level. Small movements may occur over time.
3. Remove and clean any dirt from the tipping bucket, being careful not to tip the bucket should the rain gauge still be logging.
4. During any occasion when the rain gauge is disconnected from the logger, it is good practice to check the balance arm of the tipping bucket for stiffness. The easiest way to do this in the field is to try and balance the bucket in its centre position, it should be very difficult if not impossible to achieve this, if the bucket balances easily then examine the bucket closely for any dirt or wear on the pivot pin and bucket tubes.

**PLEASE NOTE:** A spares kit is available with filter, cap, and screws. Contact EML sales ([sales@emltd.net](mailto:sales@emltd.net)) for more information.

### Calibration

The sensitivity of the rain gauge is accurately calibrated during the manufacturing to a nominal 0.2mm/tip using a purpose-built calibration rig supplying an adjustable constant head of water allowing accurate calibration of the rain gauge. Each rain gauge is supplied with its own calibration figure to three decimal places. All gauges are calibrated to a tolerance of 2% of the 0.2mm tip value.

A re-calibration and overhaul service is also offered to customers; EML recommends re-calibration every 12 to 24 months depending on applications.

For information on how we calibrate the rain gauges see British Standards document BS 7843-1:2012 and the CIMO Guide to Meteorological Instruments and Methods of Observation (Chapter 6). These documents describe the processes of bucket balancing, static calibration at a fixed intensity, and dynamic calibration using variable intensities.

There is also a Rain Gauge Field Test Kit which can be deployed in the field to test the accuracy of the calibration at different rainfall intensities. Contact EML Sales ([sales@emltd.net](mailto:sales@emltd.net)) for more information.

## 7. Specifications

### Gauge Specifications

Table 3 - Gauge Specifications for SBS LITE

Technical Specifications	
Resolution	Metric: 0.1mm, 0.2mm, 0.5mm Imperial: 0.005 inch, 0.01 inch, 0.02 inch
WMO Compliant	Yes
Output	Contact Closure (Reed Switch) Dual reed switch upgrade available
Typical Accuracy	All gauges +/- 2% up to 25mm/hr (Class A) 0.1mm Gauge +/- 3% up to 50mm/hr (Class A) 0.2mm / 0.5mm Gauges +/- 3% up to 120mm/hr (Class A)
Rainfall Intensity	With mathematical correction 0.1mm +/- 3% up to 500mm/hr (Class A) 0.2mm +/- 3% up to 1000mm/hr (Class A) 0.5mm +/- 3% up to 1500mm/hr (Class A)
Operating Temperature	0°C - 70°C
Funnel Diameter	20.0cm / 7.87 Inch
Funnel Area	314cm <sup>2</sup> / 48.67 sq. Inch
Height	42.5cm to 45.5cm (with feet adjustment)
Weight	3 Kg
Colour	White

### Cable Specifications (if fitted)

The standard cable used in all extended versions (on request) of the rain gauge is a single twisted pair of 7/0.25mm (22awg) tinned copper conductors, insulated with polyethylene, wrapped in an aluminised tape with a 7/0.25mm tinned drain wire and a PVC outer sheath.

Table 4 - Cable Specifications (if fitted)

Technical Specifications	
Temperature Range	-30°C to +70°C
Overall diameter	4.6 mm
Char. impedance	85 Ω
Capacitance/metre	154 pF
Equivalentents	<b>Alpha</b> 2401 <b>Belden</b> 8761 <b>UL style</b> 2092

## Appendix A – SBS LITE products, accessories and spares

Table 5 – SBS LITE products

Product code	Description
P-780-3981	SBS314 LITE Rain gauge 0.1mm
P-780-3982	SBS314 LITE Rain gauge 0.2mm
P-780-3983	SBS314 LITE Rain gauge 0.5mm
C-102-008	Additional Cable (Per Metre)

Table 6 - Accessories and spare parts for the SBS LITE

Product code	Description
P-780-490	SBS Spares Kit
P-780-491	SBS Spares Kit Including Nozzle
P-780-320	Dual Switch Upgrade
P-780-453	SBS314 Funnel Assembly
P-780-350	Calibration
P-780-361	Base and Cross Support
P-780-363	Calibrated Base Assembly
P-780-365	Bucket & Frame Assembly
P-780-367	Reed & PCB Housing
P-780-475	SBS Filter Cap
P-780-4762	SBS LITE Filter Mesh
P-780-474	SBS LITE Funnel Nozzle
P-780-487	SBS LITE Set of 3 Brass Funnel Screws (with shoulder)