EML Environmental Measurements Limited

ARG314 Rain Gauge User Manual

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Table of Contents

List of Figures 4
List of Tables 4
1. General Information 5
About this Manual 5
Version Information 5
Related Manuals 5
2. Introduction 6
3. Site and Installation Requirements 6
Choosing a site 6
Unpacking the rain gauge 7
Levelling the rain gauge 7
Alternative mounting options 8
4. Wiring Guidelines 9
Wiring for internal loggers 10
5. Operation 10
Operation of the gauge 10
6. Maintenance and Calibration 12
Basic Maintenance 12
Calibration 12
7. Specifications 13
Gauge Specifications 13
Cable Specifications (if fitted) 14
Appendix A – ARG314 products, accessories and spares 15

List of Figures

Figure 1 - Levelling feet (and cable if ordered) 7
Figure 2 – ARG314 Levelling Feet 8
Figure 3 – Rain gauge fitted to a pedestal 9
Figure 4 - Reed switch and resistor 9
Figure 5 - Filter and filter cap (left) / Nozzle delivering water into tipping bucket (right) 10
Figure 6 - Internal image of the ARG314 tipping bucket mechanism 11

List of Tables

Table 1 - Document Revisions 5
Table 2 - Related Manuals 5
Table 3 - Gauge Specifications for ARG314 13
Table 4 - Cable Specifications (if fitted) 14
Table 5 – ARG314 products 15
Table 6 - Accessories and spare parts for the ARG314 16

1. General Information

About this Manual

This manual is intended as a general guide for installing, wiring and using the ARG314 range of rain gauges. The information contained in this manual may not cover all aspects of ARG314 applications. Please refer to associated equipment manuals or consult papers and technical notes on the EML website (www.emltd.net).

Version Information

Table 1 - Document Revisions

EML Document Number:	Description:
UM-P-780-300	Version 1.0 - First Release, dated 1st April 2019
UM-P-780-303	Version 1.1 – Release date 21st May 2019
UM-P-780-303	Version 6.0 – Release date 10th December 2022
UM-P-780-303	Version 8.0 – Release date 30th April 2024

Related Manuals

Table 2 - Related Manuals

EML Document Number:	Description:

2. Introduction

The ARG314 is EML's recommended solution for many hydrological or meteorological applications such as weather stations and flood warning systems. The ARG314 is a versatile gauge suitable for climates with all types and intensities of rainfall. The injection moulded UV-stabilised material from which the gauge is made means that the ARG314 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 ARG314 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).

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 ARG314 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: ARG314 Gauge & three levelling feet, and cable if ordered (Figure 1)

2) Fit the three levelling feet as shown in Figure 2.

3) Remove Funnel from the gauge and carefully remove the packing foam from underneath the tipping bucket.

4) Your gauge is now ready to use.

Figure 1 - Levelling feet (and cable if ordered)

Levelling the rain gauge

The ARG314 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.

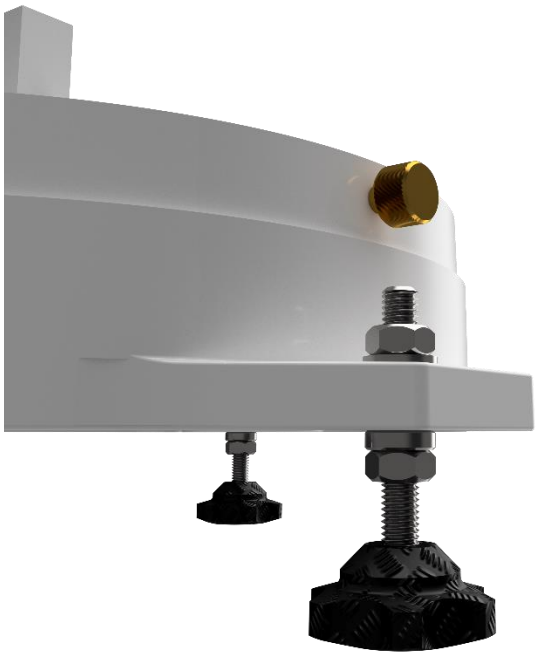

Figure 2 – ARG314 Levelling Feet

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 ARG314 above the ground.

The ARG314 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

4. Wiring Guidelines

This section gives information on the wiring of ARG314 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.

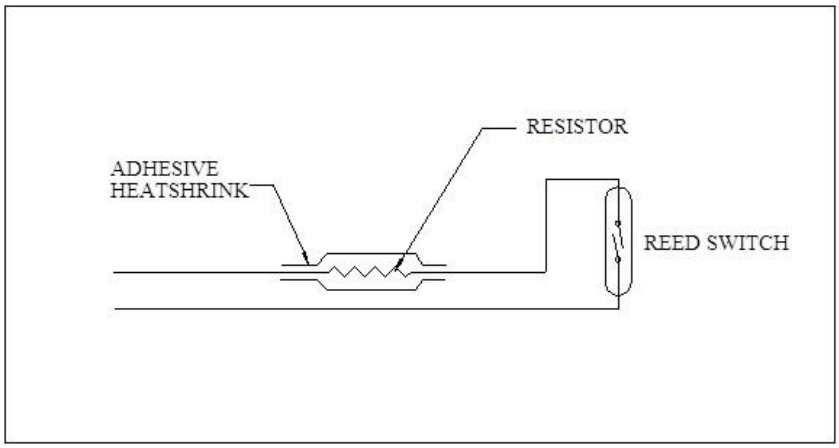

Figure 4 - Reed switch and resistor

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 ARG314 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 ARG314.

Figure 6 - Internal image of the ARG314 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) 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) for more information.

7. Specifications

Gauge Specifications

Table 3 - Gauge Specifications for ARG314

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	0.1mm Gauge +/- 3% up to 50mm/hr (Class A) 0.2/0.5mm 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	314cm2 / 48.67 sq. Inch
Height	43.5cm to 46.5cm (with feet adjustment)
Weight	2.5Kg
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
Equivalents	**Alpha** 2401 **Belden** 8761 **UL style**2092

Appendix A – ARG314 products, accessories and spares

Table 5 – ARG314 products

Product code	Description
P-780-300	ARG314/STD Rain gauge 0.1mm
P-780-301	ARG314/EC Rain gauge 0.1mm (inc. 6 metre cable)
P-780-303	ARG314/STD Rain gauge 0.2mm
P-780-304	ARG314/EC Rain gauge 0.2mm (inc. 6 metre cable)
P-780-306	ARG314/STD Rain gauge 0.5mm
P-780-307	ARG314/EC Rain gauge 0.5mm (inc. 6 metre cable)
C-102-008	Additional Cable (Fitted to EC/6m gauge) - Per Metre

Table 6 - Accessories and spare parts for the ARG314

Product code	Description
P-780-321	ARG314 Spares Kit
P-780-319	ARG314 Spares Kit Including Nozzle
P-780-320	ARG314 Dual Switch Upgrade
P-780-333	ARG314 Funnel Assembly
P-780-336	ARG314S Funnel Assembly
P-780-350	ARG314 Calibration
P-780-361	ARG314 Base and Cross Support
P-780-363	ARG314 Calibrated Base Assembly
P-780-365	ARG314 Bucket & Frame Assembly
P-780-367	ARG314 Reed & PCB Housing
P-780-475	ARG314 Filter Cap
P-780-4762	ARG314 Filter Mesh
P-780-379	ARG314 Funnel Nozzle
P-780-487	ARG314 Set of 3 Brass Funnel Screws (with shoulder)