

**Tipping Bucket, Heated Tipping
Bucket Rain Gauges & Rain Gauge
That Meets The Requirements of
The UK Environmental Agency
Operator's Handbook**
HB 3166-06

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CASELLA CEL

CASELLA CEL
Regent House
Wolseley Road
Kempston
Bedford
MK42 7JY, U.K.
Phone: +44 (0) 1234 844 100
Fax: +44 (0) 1234 841 490
E-mail: info@casellameasurement.com
Web: www.casellagmeasurement.com

CASELLA USA
17 Old Nashua Road #15
Amherst
NH 03031
U.S.A.
Toll Free: +1 800 366 2966
Fax: +1 603 672 8053
e-mail: info@casellausa.com
Web: www.casellausa.com

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1. INTRODUCTION

Casella Tipping Bucket Rain Gauges are reliable and extremely robust devices that are intended for use as stand-alone sensors operating within an existing logging system, such as the Casella Automatic or Portable Weather Stations.



Figure 1: The non-heated tipping bucket rain gauge with the outer cover removed

Three versions of tipping bucket rain gauge are available:

- ✘ Standard non-heated version.
- ✘ Standard heated version for more severe weather conditions.
- ✘ Non-heated version constructed to meet the requirements of The UK Environmental Agency.
- ✘ 200cm² versions are also available (these utilise a 0.1mm bucket mechanism which relates to 0.2mm per tip).
- ✘ The non-heated version to meet the requirements of The UK Environmental Agency has a dual output, while dual output versions of the standard rain gauges are available for those users who need independent outputs, for example to a counter and to a logger.

All versions now feature M6 bucket adjusting studs, while the version to meet UK Environmental Agency requirements has a larger drop tube diameter (5 mm), retained hexagonal headed long base-mounting screws to raise the base plate above ground level and quick-release terminal blocks with Mil Spec external connectors rated to IP67. When required, a heater can be

fitted to the base of this version (please consult the Casella CEL sales department).

2. PRINCIPLE OF OPERATION

The rain gauges comprise a light weight injection moulded plastic divided "tipping bucket" assembly with stainless steel pivot pins that rest upon stainless steel pins in the support assembly. The use of pins produces a rolling rather than pivoting motion when the bucket tips, which reduces the likelihood of friction.

Rain collects in one side of the bucket, which tips once a predetermined volume of water has been collected. The tipping action discharges the collected water and positions the other side of the bucket under the discharge nozzle ready for filling.

Each time the bucket is tipped, a magnet within the bucket moulding closes a reed switch in the support assembly. The use of a sealed reed switch, capable of indefinite operation, ensures the instrument has a long working life. Each contact closure pulse represents a discrete amount of rainfall appropriate to the instrument's calibration. These "tipping" pulses may be counted or recorded using a variety of methods, as described in Chapter 6.

The tipping bucket mechanism is mounted inside the body on a cast aluminium-alloy base, incorporating a built-in spirit level to facilitate correct

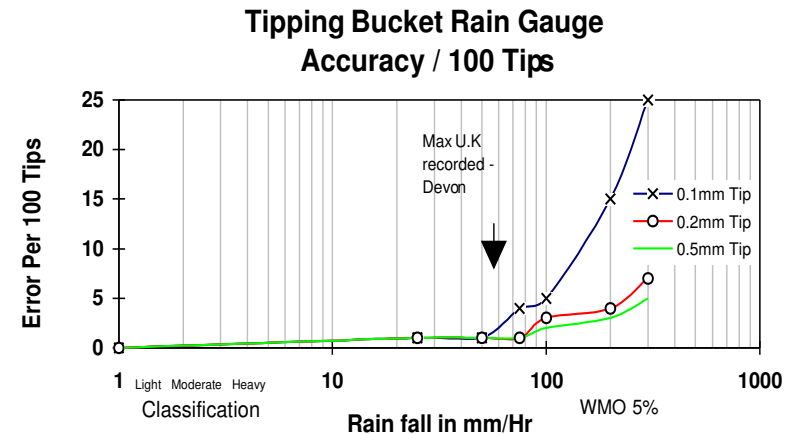


Figure 2: Accuracy of 0.1 mm, 0.2 mm and 0.5 mm tip versions

positioning. Both body and funnel are manufactured from aluminium alloy, with an accurately machined septum ring with an aperture of 400 cm².

(200cm² version is now also available)

The measurement accuracy for the various tip sizes is shown in Figure 2.

3. CONSTRUCTION

The rain gauge is manufactured entirely from non-corrosive materials. The base and septum ring are cast in Aluminium Alloy LM25, heat treated and protectively coated.

The outer ring and funnel are fabricated from aluminium alloy sheet and again protectively coated.

Stainless steel mesh is employed to protect the inlet and outlet ports from the ingress of foreign bodies.

The heater unit on heated rain gauges is operated via an adjustable thermostat which controls the supply to two power resistors. The thermostat is factory-set to switch the heater on at 3°C to ensure that the mechanism is kept above freezing point.

The heater requires a 24 V AC supply, which can be obtained from the isolated and fully protected -TR26 Mains Transformer available from Casella CEL.

A cable carries the power to the heater and returns the signal from the "tip" switch.

4. PREPARATION FOR USE

Each instrument is delivered ready calibrated to indicate either 0.1 mm, 0.2 mm or 0.5 mm of rainfall each time the bucket tips. (The Environmental Agency version is available only with 0.2 mm or 0.5 mm buckets.)

The heated versions require a 24 V AC source, which can be obtained from an isolated and fully protected -TR26 Mains Transformer that must be ordered separately. It is suggested that the transformer be installed in a hut or some other weather proof enclosure that has mains power available.

It is also recommended that the rain gauge be installed in a location or enclosed compound away from access by the general public.

Prepare a reasonably level site for the rain gauge paying due regard to the following points:

- ✗ No object should be nearer than four times its own height from the bucket.
- ✗ Do not locate the rain gauge in a hollow or on top of a hill.
- ✗ Tall buildings or belts of trees can cause turbulence and gusts which can increase or decrease the rain collected.
- ✗ The surrounding soil should be capable of allowing the discharged water to drain away freely.

Warning !

The septum ring has a sharp edge and should be treated with care whenever handling the instrument.

4.1 Non-Heated Versions

4.1.1 Standard Single Output Non-Heated Version

1. Release the two catches securing the outer cover to the base and then carefully lift off the cover.
2. Feed a suitable length of 2 A, 2-core cable, through the grommet.
3. Connect the instrument end of this cable to the terminal block provided on the underside of the base unit for the output signal.
4. Connect the free end to the counting device, see Figure 3 and Chapter 6.

- Go to Section 4.3.

4.1.2 Standard Dual Output Non-Heated Version

- Release the two catches securing the outer cover to the base and then carefully lift off the cover.
- Feed a suitable length of 2 A, 4-core cable, through the grommet.
- Connect the instrument ends of two of the cores to adjacent terminals connected to the white leads on the block provided on the underside of the base unit for the output signals.
- Connect the free ends of these cores to the first counting device (see Figure 3 and Chapter 6).
- Connect the instrument ends of the other two cores to the other adjacent terminals connected to the white leads on the block.
- Connect the free ends of these cores to the second counting device (see Figure 3 and Chapter 6).
- Go to Section 4.3.

4.1.3 Dual Output Non-Heated Version That Meets the Requirements of The UK Environmental Agency

This version is delivered with dual outputs pre-wired to the Mil Spec external connector in the underside of the base plate (Figure 3).

The user must supply a suitable cable with Mil Spec connector to couple the outputs from the rain gauge to the two counting devices.



Figure 3: Base plate of version that meets the requirements of The UK Environmental Agency

- Connect the plug on the free end of the cable from the counting device to the connector under the base plate.
- Use an Allen Key to release the three catches securing the outer cover to the base and carefully lift off the cover.
- Go to Section 4.3.

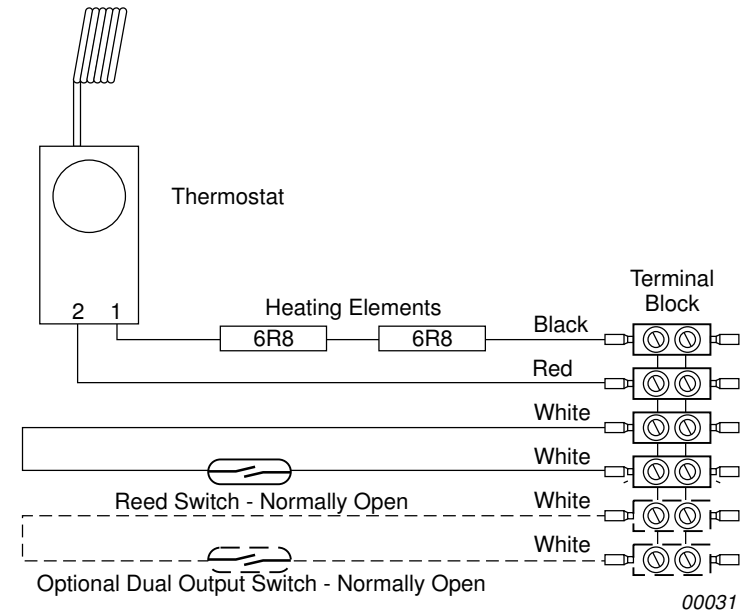


Figure 4: Reed switch and heater connections for standard versions

4.2 Heated Versions

4.2.1 Standard Single Output Heated Version

- Release the two catches securing the outer cover to the base and then carefully lift off the cover.
- Feed a suitable length of 2 A, 4-core cable, through the grommet.
- Connect the instrument ends of two of the cores to the terminals connected to the white leads on the block provided on the underside of the base unit for the output signal.
- Connect the free ends of these cores to the counting device (see Figure 4 and Chapter 6).
- Connect the instrument ends of the other two cores to the terminals on the block connected to the black and red heater leads.
- Connect the free ends of these cores to the power transformer in the hut or enclosure (see Figure 4).
- Go to Section 4.3.

4.2.2 Standard Dual Output Heated Version

1. Release the two catches securing the outer cover to the base and then carefully lift off the cover.
2. Feed a suitable length of 2 A, 6-core cable, through the grommet.
3. Connect the instrument ends of two of the cores to adjacent terminals connected to the white leads on the block provided on the underside of the base unit for the output signal.
4. Connect the free ends of these cores to the first counting device (see Figure 4 and Chapter 6).
5. Connect the instrument ends of another two cores to the other adjacent terminals connected to the white leads on the block.
6. Connect the free ends of these cores to the second counting device (see Figure 4 and Chapter 6).
7. Connect the instrument ends of the remaining two cores to the terminals with the black and red heater leads.
8. Connect the free ends of these cores to the power transformer in the hut or enclosure (see Figure 4).
9. Go to Section 4.3.

4.2.3 Dual Output Heated Version That Meets the Requirements of The UK Environmental Agency

This version is available to special order or the heater unit can be retro-fitted to an existing unit (please consult the Casella CEL sales department). It is delivered with dual outputs and heater pre-wired to the Mil Spec external connector in the underside of the base plate (see Figure 3).

The user must supply a suitable cable with Mil Spec connector to couple the dual outputs on the rain gauge to the two counting devices and the heater to the -TR26 24 V power supply (ordered separately).

1. Connect the plug on the free end of the cable from the counting device to the connector under the base plate.
2. Use an Allen Key to release the three catches securing the outer cover to the base and carefully lift off the cover.

3. Go to Section 4.3.

4.3 General

1. Seal all weather connections using a silicone rubber compound.
2. With the base plate mounted in its correct location on site, adjust the three levelling screws until the built-in spirit level indicates that the unit is level.
3. Once the unit is level secure the locknuts.
4. It is advisable to secure the base unit permanently to a firm foundation using the two holding lugs provided.

These accept either 9.5 mm or 3/8" rawl bolts.

Do not over tighten the fixings.

A restriction, such as an elastic band, may have been fitted to prevent the bucket from moving during transit.

5. Carefully remove any restriction and check that the bucket pivots freely.
6. Replace the outer cover of standard versions, with the catches engaged in the cutouts in the base plate.
7. Replace the outer cover of versions that meet the Environmental Agency Framework Directive, then use the Allen Key to lock the three catches to secure the cover to the base.

The rain gauge is now ready for operation.

5. MAINTENANCE

Warning !

The septum ring has a sharp edge and should be treated with care whenever cleaning or handling the instrument.

Periodically check for debris in the funnel and blockage of the inlet and outlet ports. Remove any debris present and clean the meshes.

The water outlet on the underside of the funnel can be unscrewed allowing the inlet mesh to be removed and cleaned.

If necessary, bucket surfaces can be cleaned using a mild detergent solution.

6. COUNTING THE BUCKET TIPS

A variety of devices may be used to count the bucket tips, these include:

- ✕ Data Loggers (with contact closure input capability),
- ✕ Event counter (a simple LCD counter to indicate bucket tips),
- ✕ Chart Recorder,
- ✕ Computer data acquisition system.

Consideration should be given to ensure that the counting/logging device used can accept a contact closure input.

For fast counter inputs, some form of capacitor-resistor filtering may be necessary to reduce "bounce" effects in the contact signal.

For details of suitable logging devices please contact the Casella CEL sales department.

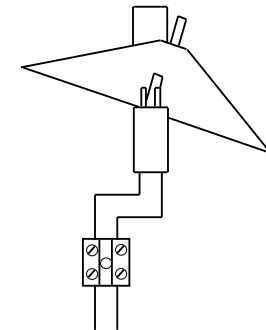


Figure 5: Connections for reed switch

6.1 Reed Switch Details

Switching contact closure time is typically less than 100 milli-seconds for 0.2 mm of rain (N.B. closure time will be faster for 0.5 mm of rain).

Maximum current rating	300 mA
Breakdown voltage	200 V D.C. minimum
Contact resistance	150 m Ω
Insulation resistance	10 ⁹ Ω
Capacitance open contacts	0.2 pF
Life	10 ⁶ operations.

Reed switch connections are made via a 2 way terminal block (see Figure 5).

7. SERVICING

To ensure its conformity with the specification, this instrument is thoroughly inspected and its accuracy verified prior to dispatch. Test information is filed under the instrument serial number, which should, therefore, be quoted in any correspondence.

Casella CEL undertake to rectify any defect in the instrument that is directly attributable to faulty design or assembly, and which becomes apparent during the warranty period. In order to take advantage of this warranty, the instrument must be returned, carriage paid, to the Casella CEL factory or accredited agent, where necessary repairs will be carried out.

The warranty period runs for 12 months from the date of receipt of goods, with exceptions on certain specialised components supplied by other manufacturers which may be warranted for shorter or longer periods by their actual manufacturers. In all such cases, the benefit of these undertakings will be passed on to the user.

Casella CEL's liability is limited to items of their own manufacture, and they do not accept liability for any loss resulting from the operation or interpretation of the results from this equipment.

To obtain repair under warranty or for servicing, the instrument should be packed and returned in its original packing or an equivalent to the Service Department at Bedford. Insure to full value and ship pre-paid.

For repair or service outside the United Kingdom, please return to our appointed distributor.

Please include a letter giving full details with your packing list. It should contain the following information:

- Instrument Type(s) and Serial Number(s),
- Customer name and address,
- Contact name and phone number,
- Details of any PC and Software involved, including Version Number(s),
- Reason for returning the equipment with a detailed description of the fault,
- List of any error messages that may have been displayed.

The necessary adjustments or repairs will be carried out, and the instrument returned as soon as possible.

8. SPECIFICATION

8.1 General Specifications

Bucket sizes	0.1 mm (not version that meets the requirements of UK Env. Agency, 0.2 mm or 0.5 mm)
Aperture	200 or 400 cm ²
Accuracy	±1% at 1 litre/hour
Capacity	Unlimited
Transducer	Magnet/Reed switch
Operating temperature range	1°C to 85°C
Output	Contact closure
Weight	2.6 kg

8.2 Heated Version - Additional Specifications

Heater supply voltage	24 V AC
Heater power consumption	42 Watts
Cable rating	2 A at 24 V AC, 4-core
Thermostat range	-20°C to 40°C
Operating temperature range	-20°C to 85°C

9. ORDERING INFORMATION

Type	Sensitivity	Output	Catalogue Reference
Standard non-heated	0.1 mm	Single	102471E
	0.2 mm	Single	100000E
	0.5 mm	Single	100573E
	0.1 mm	Double	103700D
	0.2 mm	Double	103592D
	0.5 mm	Double	103701D
Standard heated	0.1 mm	Single	103590D
	0.2 mm	Single	103589D
	0.5 mm	Single	103591D
	0.1 mm	Double	103702D
	0.2 mm	Double	103703D
	0.5 mm	Double	103704D
Versions that meets the requirements of The UK Environmental Agency	0.2 mm	Double	103755D
	0.5 mm	Double	103759D

General Notes

1. Purchasers of heated versions must order the -TR26 Mains Transformer (220/240 V A.C.) from Casella CEL separately.
2. Purchasers of versions that meet the requirements of The UK Environmental Agency may need to obtain a Mil Spec connector.

Please contact Casella CEL for advice on suitable connectors.

The manufacturer reserves the right to change these products without notice.
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