ROYAL Eijkelkamp
Meet the difference

Rain Gauge (200 cm2, 400 cm2 and 1,000 cm2)

Manual

200 cm²

400 cm²

Meet the difference

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About this manual

If the text follows a mark (as shown on the left), this means that an important instruction follows.

If the text follows a mark (as shown on the left), this means that an important warning follows relating to danger to the user or damage to the apparatus.The user is always responsible for its own personal protection.

Text **Italic indicated text indicates that the text concerned appears in writing on the display (or must be typed).**

1. Introduction

This manual describes the use and maintenance of the Rain gauge collector 200, 400 and 1,000 cm2. The Rain gauge collector is suitable for monitoring rain events.

1.1 Warranty

The Rain gauge collector is warranted for 1 year from the date of delivery subject to proper installation and application of the equipment in accordance with the provisions of this manual. Any defects or faults should be reported in writing to your supplier immediately, but no later than 30 days after discovery. Transportation costs, travel hours and travel kilometers are not covered by the warranty. Defects or faults resulting from unintended/ incompetent use, modifications not authorized by Royal Eijkelkamp, inadequate maintenance, other abuse and damage due to transport are not covered by the warranty. Royal Eijkelkamp can never be held liable for direct and/or indirect consequential damage resulting from defects or faults in the equipment supplied by Royal Eijkelkamp. During the statutory warranty period, maintenance shall only be carried out by Royal Eijkelkamp or competent persons designated by it. Any claim under the warranty can only be made if the maintenance intervals mentioned in Chapter 4 have been met.

1.2 Community regulations

The device conforms to the EU Directive No. 2014/30 / EU for electromagnetic compatibility. A copy of the declaration of conformity is kept at Royal Eijkelkamp and available upon request.

2. The Rain gauge collector

The Rain gauge collector is used to measure the quantity of water that falls on the ground in a liquid or solid aggregation state.

2.1 Functional description

The Rain gauge collector belongs to the “tipping-bucket” family. It consists of a funnel-shaped collector and two calibrated buckets. The rain passes through the funnel and is collected by one bucket. After a pre-set amount of precipitation falls (typically 0.2 mm), the bucket is full and rotates on a pivot. Each rotation causes the activation of two reed switches that send a signal to an external data acquisition system through a connection cable. In the event of solid precipitation (snow or hail), the instrument can be equipped with a heated device that melts the snow and guarantees the measuring of the water equivalent.

The instrument is composed of five main parts, namely:
- a cylindric body;
- a calibrated collector funnel;
- a support basement;
- an electromechanic measurement system (tipping-bucket);
- a heating device (optional).

The **body** consists of an aluminium cylinder that is painted white to enable the maximum reflection of the incident solar radiation and reducing the undesired evaporation. By means of screws located in its lower side, the cylinder may be locked on the support base. At its interior, the electromechanical system permits the measurement of the collected precipitation.

The **collecting funnel** is made in anodized aluminium and is fitted with a circular calibrated inlet. The shape of the collector prevents the bouncing of the rainfall from the internal wall to the external ambient, as recommended by the World Meteorological Organization.

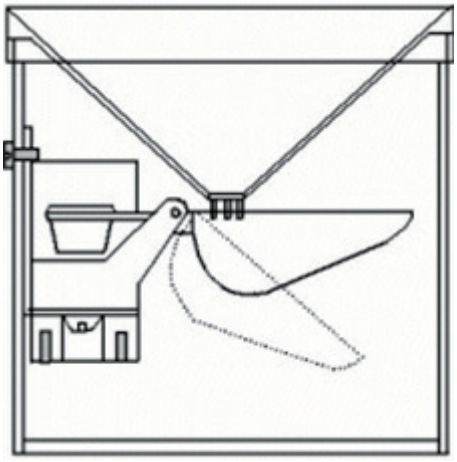
A **protection filter** (that must be periodically cleaned) is located at the end of the funnel, preventing leaves and other solid bodies from falling inside the electromechanical group. The shape and size of the filter grid have been especially designed to reduce possible clogging.

The **support basement** is made of diecast aluminium. At the bottom, facing downwards, there is a housing in which the support pole can be inserted and secured, and in which there are two holes enabling drainage of water that must flow down after the measurement. Another hole, located in the middle of the mentioned housing, allows the passing of the connection cable to reach the external acquisition system. On the upper side of the basement are the housings for the fixing screws of the electromechanic measurement system.

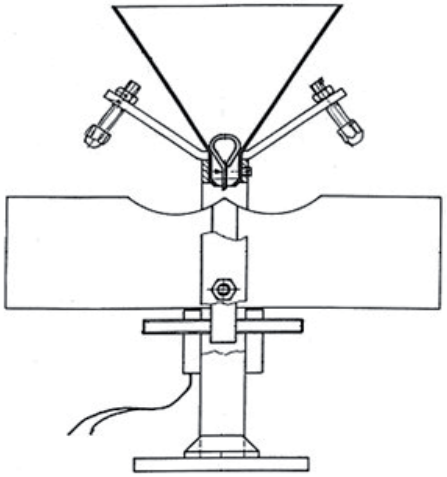
The **measurement system** consists of a tipping bucket. It is divided in two symmetrical parts by a suitable shaped central barrier. The bucket is made of a single aluminium piece (anodized at a later stage) in order to avoid mechanical subassemblies and hence water leakage from one bucket to the other.

In order to perform the measurement, the bucket is horizontally hinged to a fixed support and can therefore tilt between two static positions. The lower bucket is empty, the upper one is ready to be loaded by the falling rain; when it is completely filled, its weight causes it to tilt downwards and to empty through the mentioned hole at the same time. To minimize friction during tipping, the stainless steel fulcrum is housed inside PTFE bushes.

The tipping group is calibrated in such a way that when a bucket holds the equivalent weight of 0.2 mm of water, the equilibrium of the group becomes instable and a tipping takes place as a result. A quick emptying of each bucket is enabled by its shape. In this way, when the upper bucket starts filling, the lower one is empty and ready for this operation at the subsequent tipping.



200 cm2 model



400 and 1,000 cm2 model

The electronic part of the sensor consists of a simple transducer able to generate an ON/OFF signal after each tipping. The system consists of two magnetic switches placed on the fixed part of the bucket support and a permanent magnet attached to the moving part. In each position of the bucket, one of the switches is closed (since it is engaged with the permanent magnet) while the other is open. At each tipping, this condition reverses, causing the closure of the open switch and the opening of the closed one.

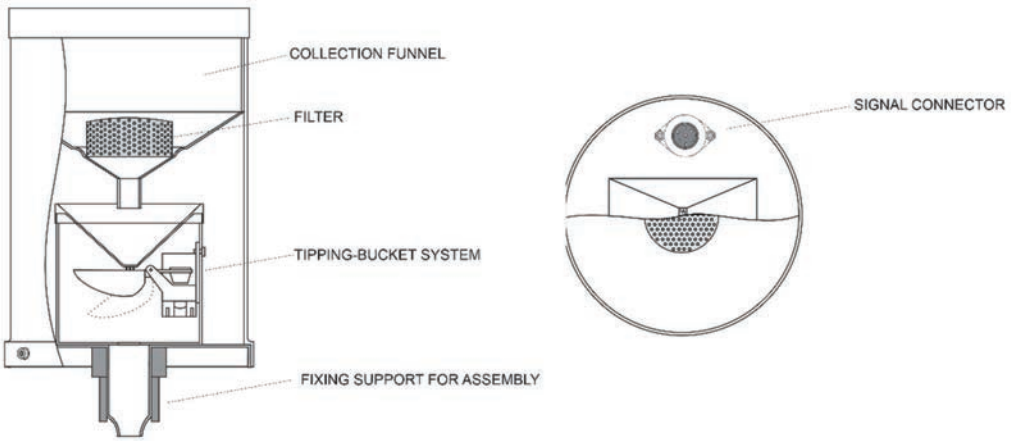
Each closure shows a tipping, meaning: the measurement of exactly 0.2 millimetres of precipitation. The double magnetic switch prevents possible bounces of the bucket from being interpreted as further tippings by the acquisition system.
A circular level is embedded in the support of the tilting system to adjust the position of the tilting group on the horizontal plane.

The heating device (optional) is suitably designed to allow a quick melting of the snow, but without releasing too much heat that could lead to a considerable evaporation. Of course, this option can work only when the mains (220/240 Vca) is present on the installation site. The combined action of a control electronics and a temperature sensor placed near the lower inlet enables activation of the system when the temperature falls below a given threshold. The funnel is standard equipped with a thermostat at a temperature of 4 to 6°C.

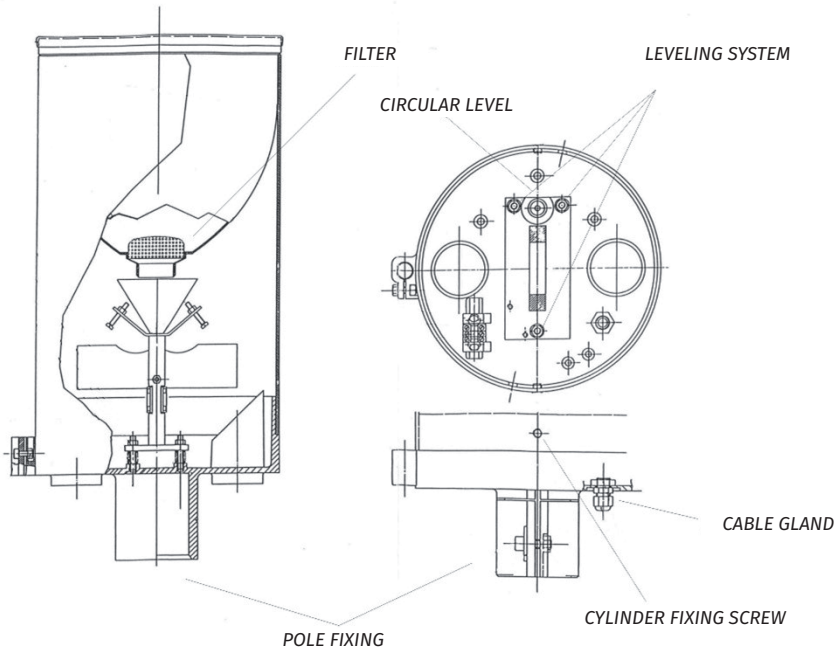
2.2 Product overview

The figures below show the mechanical layout of the three models.

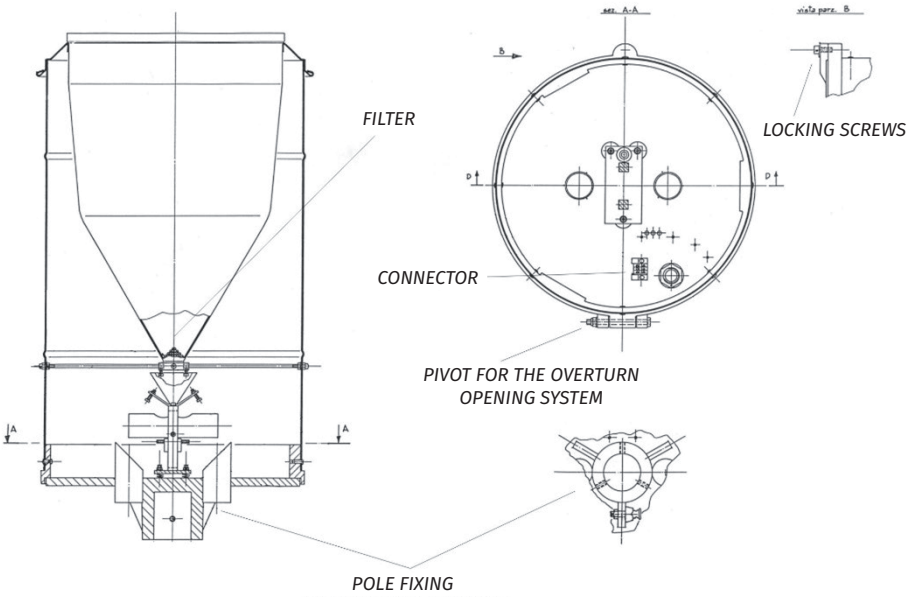
200 cm2 model



400 cm2 model



1,000 cm2 model



2.3 Technical specifications

Technical specifications of the Rain gauge

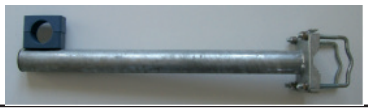
Device features	Specification
Sensor type	Anodized aluminium tipping bucket with double magnetic contacts
Collecting funnel	Circular 1000cm² Circular 400cm² Circular 200 cm2
Resolution	0.2 mm (0.1 mm on demand with 1000 cm2 models)
Accuracy	200 cm2: 1 tipping or better than 2% at an intensity of 24mm/h 400-1,000 cm2: 1 tipping or better than 1% at an intensity of 24mm/h
Range	0 - 300 mm/h
Levelling	Set of bucket with level
Electric output	200 cm2: Single contact 400/1,000cm2: Double contact (single contact on demand)
Working temperature	From -30°C to +70°C (with heater)
Recalibration	Annual check recommended
Maintenance	Periodic cleaning of the calibrated funnel and filter
Dimensions	h: 860 mm - Ø 430mm h: 480 mm - Ø 230mm h: 300 mm - Ø 160mm
Weight	15Kg (17Kg heated ver.) 3.5Kg (4,5Kg heated ver.) 0.85Kg (1,85Kg heated ver.)

Heating system (optional)

Device features	Specification
Power supply	24Vac
Power consumption	450W @ 24Vac model with 1000 cm2 collecting funnel 60 W @ 24 Vac model with 400 cm2 collecting funnel 60 W @ 24 Vac or 15 W @ 12 Vac model with 200 cm2 collecting funnel
Trigger temperature	Ranging from 4 °C e 6 °C

2.4 Accessories

The accessories below are available at Royal Eijkelkamp.

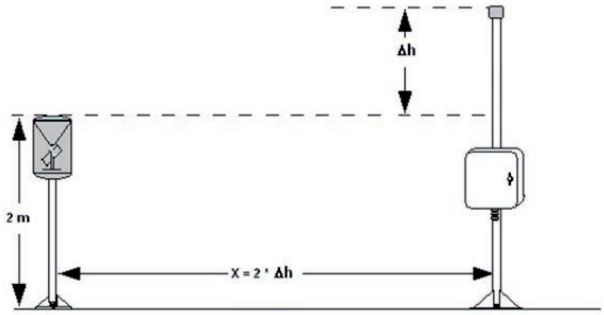
Article number	**Accessory**
16953001	Support arm for 200 cm2 rain gauge, length 500 mm, diameter 40 mm, galvanized steel, with sensor clamp 
16953002	Support arm for 200 cm2 rain gauge, length 400 mm, diameter 15 mm, anodized aluminium, with sensor clamp (inside diameter 40 mm) 

3. Installation

3.1 Setup

Before installing the precipitation gauge, make sure that the chosen site meets the recommendations of the WMO. We recommend a field visit to ensure the requirements for the measurement location.

In particular, the norms establish that the installation site is free of obstacles (buildings or vegetation) within a radius of at least two times the difference in height between the upper end of the precipitation gauge and the obstacle itself. The need to maintain this distance arises from the fact that any surrounding obstacle (plants, for example) not only have a direct effect on precipitation, but also have an indirect influence due to wind turbulences.



Additional to the above mentioned requirements, the measurement location must meet the following requirements:

- Not in a crowded environment
- Sufficient range for mobile communication

The system can be powered by batteries or a solar panel. A connection to the power grid is therefore not necessary.

3.2 Installing

3.2.1 General installation guidelines

The sensor can be mounted on every pole or support that has a vertical cylindrical shape with a diameter of 60 mm. Due to the size and weight of the instrument, you need to pay particular attention to the strength of support. The action of the wind causes vibrations that could cause structural failure or undesired measurement.

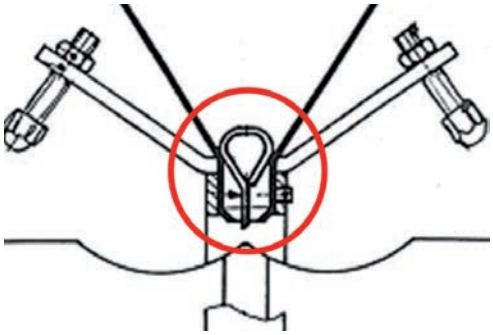
Usually the sensor is installed directly on the pole that supports the weather station. For the 200 cm2 model is a support arm (see picture) available. By using a spirit level, it should be checked that the collecting funnel of the instrument is installed level.

First of all, mount the instrument on the upper end of the pole ad lock it by tightening the proper screw, then open the rain gauge:

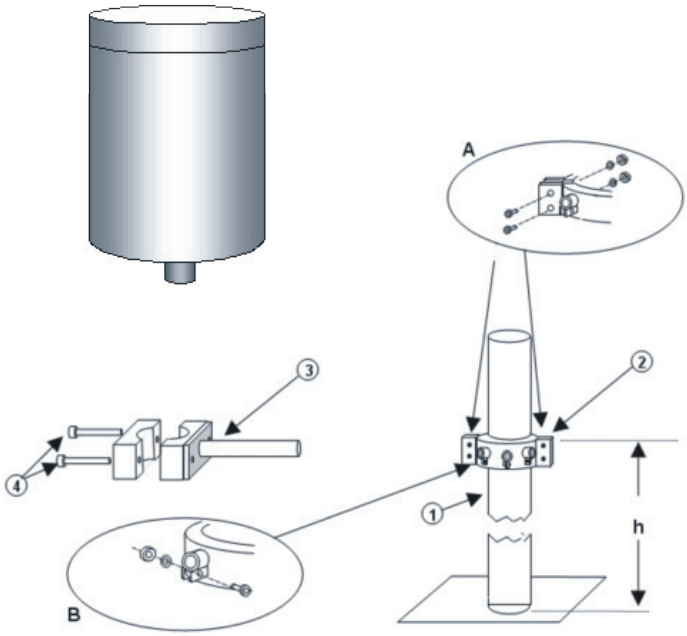
- for the 1000 cm2 model: remove the locking screw placed on the bottom side of the basement and rotate the cylinder on the pivot fixed to the side of the basement;
- for the 400 cm2 model: remove the two screws at the base of cylinder and then pull up it to remove from the basement.
- for the 200 cm2 model: remove the two screws at the base of cylinder and then pull up it to remove from the basement.

For installation, follow the steps below:

1. Fix the main support (2) on the pole (1);
2. Insert the arm support (3) in the main support (2) and fix it;
3. Insert the sensor into the clamp of the arm support and fix it using the screws (4);



200 cm2 model



400 and 1,000 cm2 model

Check that the electromechanical system is correctly positioned on the horizontal plane. Look at the level and act (if necessary) on the three self-locking nuts.

The last operation is to connect the signal cable (and the cable for the heating system if present). Pass the cable through the cable gland on the bottom of the basement, and fix the wires to the connector by the screws. Wiring diagram is described in the next chapter. Once the wires are fixed, tighten the cable gland.

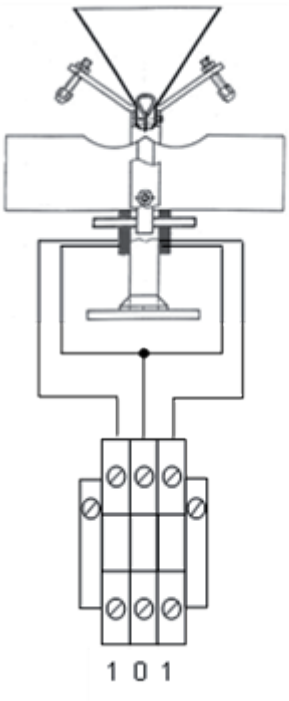
The two plastic strips that keep the tipping group locked during the transport can now be cut. Before closing the instrument, verify that the drop-guide device (necessary for the correct draining of the water) inside the funnel (see figure) is placed correctly.

3.2.2 Electrical connections

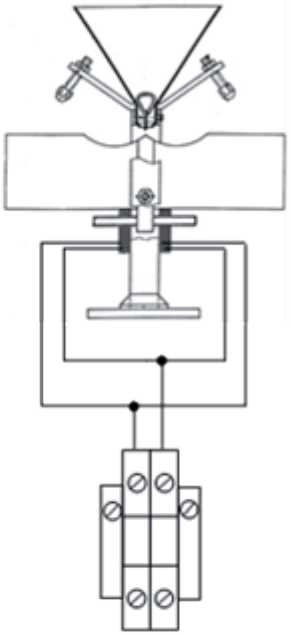
Pin	
1	Not necessary
2	Contact rain gauge
3	Contact rain gauge
4	+ Power supply - heater (opz.)
5	- Power supply - heater (opz.)
6	Not necessary
7	Not necessary

Wiring diagrams
200 cm2 model

Wiring diagrams 400 and 1,000 cm2 model

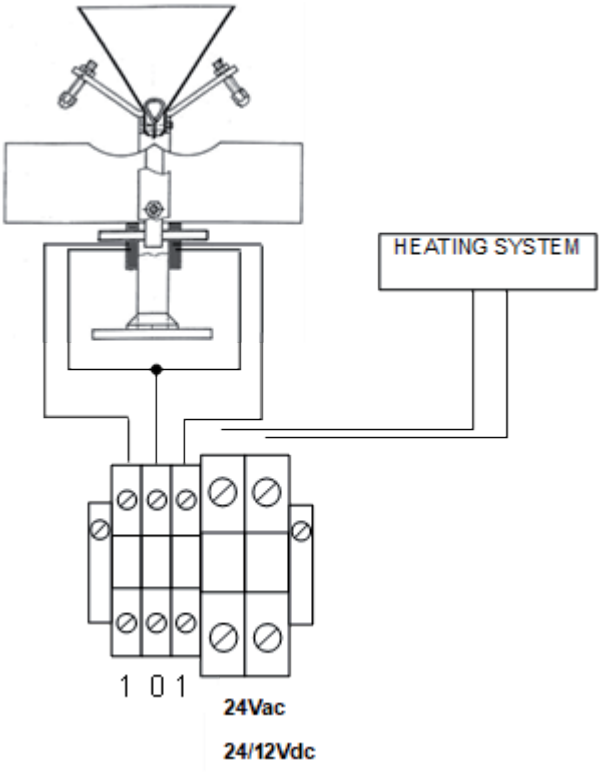


Double Contact

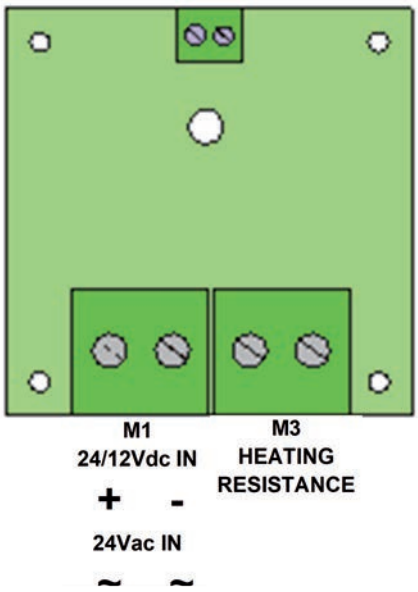


Single Contact

Wiring diagram for heated 400 and 1000 cm2 model



Wiring diagram of heated system command board



3.2.2 Use of the sensor

The sensor is equipped with a connector for connecting the contact signal and the heater (optional).

The use of this sensor is closely related to the type of data logger to which it is connected. Therefore, for all operations related to programming (in the data logger) the type of measurements to be performed and stored (e.g. averages, minimum and maximum, total, etc.), please refer to the technical manual of the data logger.

4. Maintenance

4.1 Ordinary maintenance

Some ordinary maintenance operations are necessary for this sensor due to the possible filth (leaves, pollution, insects, etc..) that could enter in the collecting funnel.

The frequency of these operations is closely related to the environmental conditions at the installation site. Usually, it is suggested to open the cylindrical body and clean the two funnels and the filter every six months. Before closing the body, make sure that the filter and the drop-guide device are placed correctly inside their housings.

It is recommended to check the calibration of the instruments with a “rain simulator” system once a year. In case of a negative test result, the tipping-bucket system must be sent to Royal Eijkelkamp for recalibration.

To test the correct operation of the heating system, use a freeze spray directly on the NTC sensor placed over the tipping-bucket system. When the temperature decrease under 5°C, a RED LED on the heating system electronic board will light up and the resistance will start to generate heat.

4.2 Checking the sensor

In case of suspected anomalies in the measurement values, the sensor can easily be checked in the field by simply simulating an artificial precipitation. To do this, just manually force a certain number of tippings and check the result on the acquisition station that must measure 0.2 mm times the number of forced tippings.

If the tipping apparatus does not work properly, (be sure that the connection cable has been properly tested) it is recommended to replace and send it back for an in-depth control.

The presence of 24 Vac at the heating input can be simply read by means of a multimeter. Verify that the green LED is always lighted. Then, the thermostatic function can be verified looking at the red LED mounted on the control circuit: usually, it should be off and light up when the air temperature falls below its activation threshold (around 5 °C). This condition can also be artificially forced by means of a suitable freezing spry, commonly used in electronic works.

4.3 Troubleshooting

In case of malfunctions, check the following items:
- bad sensor-station connection;
- problems with magnetic switches on tipping-bucket system;

First, verify that the sensor-station connection is good by accurately checking the cable. Look for some damage and check the continuity with a multimeter. Also ensure that each terminal pin (at both ends of the cable) is firmly secured to the terminal connector.

To verify the two magnetic switches, place a multimeter on the terminals connector (in case of double contact model place the multimeter between 0 and 1 terminals). Rotate the tipping-bucket manually and verify the opening/closing of the contacts.

If a problem is suspected on the heating system, act as described in chapter 4.2.

If it's necessary to check the correct temperature threshold for the heating system activation, follow the next steps:

- Get a trimmer potentiometer able to vary its resistance between 40 e 60KΩ;
- Unplug the NTC resistor from the electrical board (M2 connector), and connect the trimmer;
- Set a value greater then 51KΩ (correspond to 4°C) on the trimmer and check if the heating system starts (RED LED light up);
- Set a value lower then 51KΩ (consider that there is an hysteresis of 2°C between activation and deactivation of the heater) and check if the heating system stops (RED LED off);
- to be sure that the heater works, measure the current with a clamp meter when the heater is on (RED LED on);
- once the test is finished, reconnect the NTC sensor to the M2 connector.

If the malfunctions can't be solved with these procedures, send the sensor back to Royal Eijkelkamp for repair.

4.4 Customer service contact information

If you still have questions about maintenance or calibration after reading this manual, please feel free to contact us at:

Royal Eijkelkamp, Service Department
T: +31 313 800 200
E: service@eijkelkamp.com
I: https://www.royaleijkelkamp.com/service-rentals/

Appendix 1: 4-20 mA conversion board for rain gauges

The EAA310BA board allows to convert the electrical contact (N.O. or N.C.) into electric output 0-5V or 4-20mA. The range of electrical output is divided into number of contacts set in the calibration phase (typically 250 tippings), The electrical output at each tipping is increased by one “step”, equivalent to:

$$\frac{\text{Full range electrical output}}{\text{Number of tipping}}$$

Example for an output of 0-5000mV

$$\frac{5000\text{mV}}{250} = 20\text{mV/tipping}$$

Reached the maximum number of tippings, the electronic circuit automatically returns to start electric scale.