RS-110 / RS120 Rainfall Sensor Installation Guide

For XR5 Data Loggers
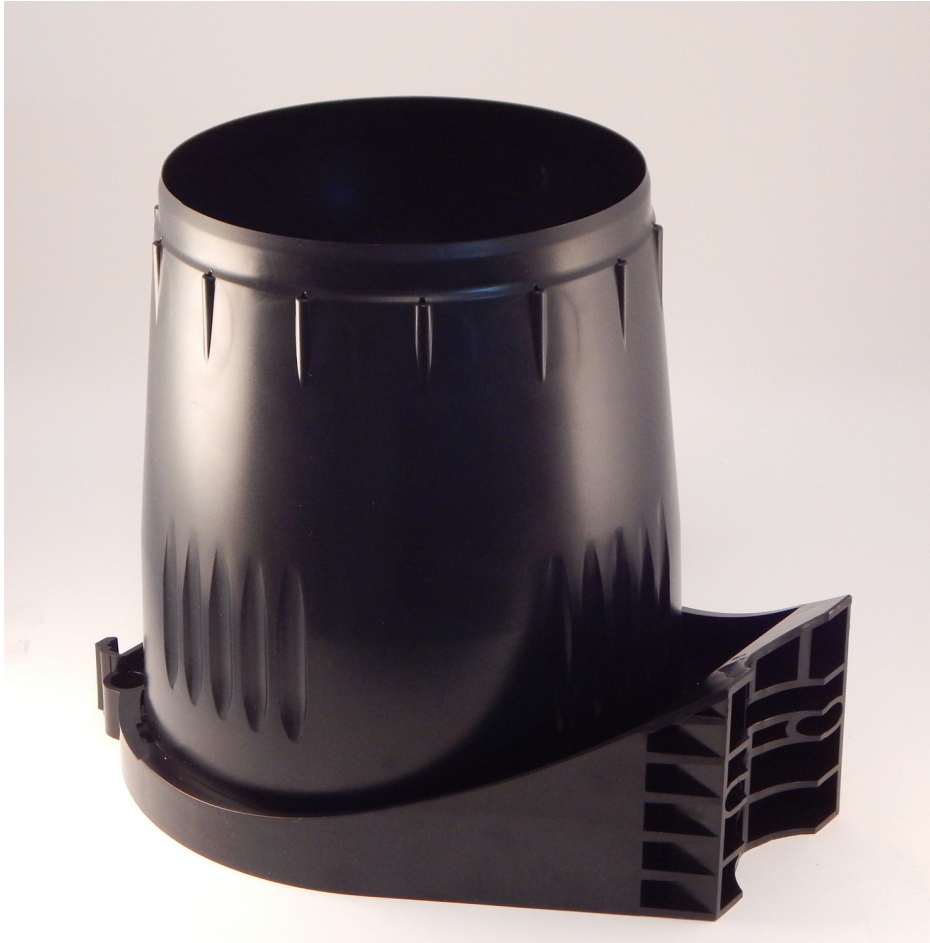
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Pace Scientific
Data Loggers and Sensors

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RS-110 / RS120 Rainfall Sensor

- High accuracy

- Forty foot (12 meter) cable

- No external power required

- Self-emptying tipping-bucket design

- Rainfall readings in inches or millimeters

- Optional (included) bird spikes (shown above)

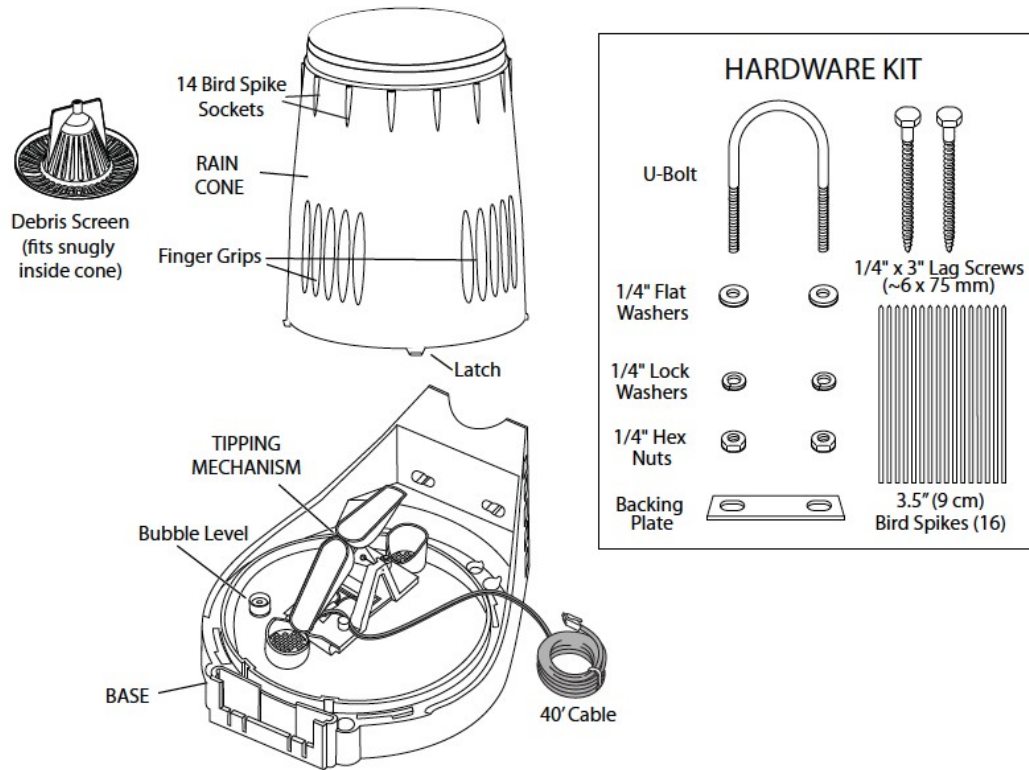- Easily mounts on a pole, post, or flat surface

Description

The RS-110 / RS-120 Rainfall Sensor is designed for years of accurate and trouble-free service. Its body and base are constructed of tough, UV resistant plastic. Tipping buckets pivot on bearings, minimizing friction and wear. Stainless steel adjustment screws under each tipping bucket allow fine-tuning the sensor's calibration. A built-in bubble level simplifies installation.

Operation
Rain enters the top of the sensor and passes through a debris-filtering screen. It then collects in one of two tipping buckets. When accumulated rainfall equals 0.2 mm (RS-110) or 0.01" (RS-120) the bucket tips, which causes a pulse output and moves the second bucket into position. Water exits the sensor through screened drains in the sensor's base.

The sensor's output connects directly to a pulse input of the XR5-SE. No external power is required.

Included Components

14 Bird Spike Sockets

RAIN CONE

Debris Screen (fits snugly inside cone)

Finger Grips

Latch

TIPPING MECHANISM

Bubble Level

BASE

40' Cable

HARDWARE KIT

U-Bolt

1/4" Flat Washers

1/4" Lock Washers

1/4" Hex Nuts

Backing Plate

1/4" x 3" Lag Screws (~6 x 75 mm)

3.5" (9 cm) Bird Spikes (16)

The RS-110 / RS-120 Rainfall Sensor includes the components listed below. Please be sure you have all components before continuing.

1. Rainfall Sensor with 40 ft (12 m) cable

2. Debris Screen

3. Plastic bag containing: U-Bolt (1)
1/4" Flat Washers (2)
1/4" Lock Washers (2)
1/4" Hex Nuts (2)
Backing Plate (1)
1/4" x 3" (~ 6 x 75 mm) Lag Screws (2)

3.5" (9 cm) Bird Spikes (16)

Tools and Materials

You may need some of the following tools and materials to install the Rainfall Sensor.

- Medium Phillips Screwdriver
- Drill with 3/32" (2 mm) drill bit
- 3/16" (5 mm) wrench
- Weather-resistant cable ties or clips for mounting cable

## Rainfall Sensor Internal Components
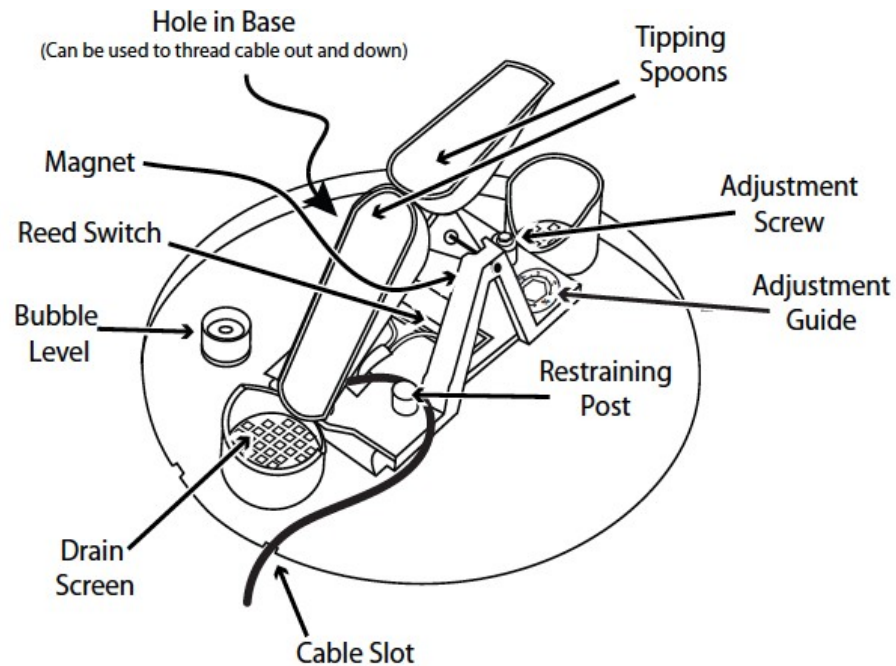
Preparing the Rainfall Sensor for operation

1. Remove the cone from the base by rotating the base until the latches on the cone line up with the latch openings in the base, then lift the cone away from the base.
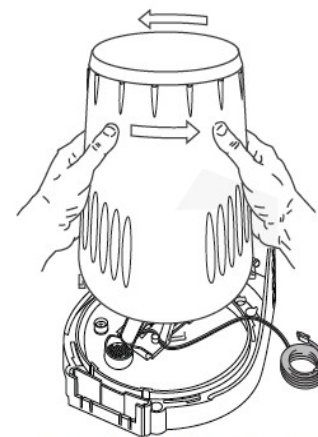
Twist off the rain collector cone

2. Carefully cut and remove the plastic tie which holds the tipping spoons in place during shipping.

Tipping Spoons

Plastic Tie
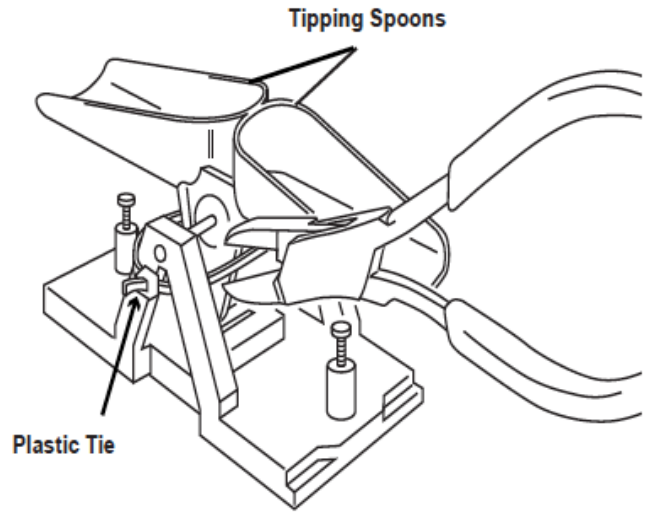
Testing the Rainfall Sensor

Using the XR5-SE Data Logger

Before installing the Rainfall Sensor, we recommended testing the unit's pulse output operation.

Wiring

Wire the Rainfall Sensor's Cable to the XR5 as follows:

Wire Color	XR5 Terminal	Function
Green	"X"	Rainfall contact closure
Red	"C"	Ground

> *Note: The Rainfall Sensor's reed switch is not polarity sensitive; reversing the above wires is OK and will give the same results.*

Software Setup

Using LogXR Software, send a setup to the XR5 with the following selections:

Log Mode:	Manual/Slow
Log Interval:	10 seconds

Channel X:	(Pulse tab)		
	Type:	Mechanical Switch	
	Slope:	1	(Note: slope value of 1 is for testing only!)
	Offset:	0	
	Frequency:	Not Checked	

Real Time readings

1. From LogXR Software's main menu click Real Time | Text.

2. While the Real Time screen is active, gently tip the bucket from side to side.

3. You should see an increasing pulse count each time the bucket is tipped to one side, and every 10 seconds (or the selected logging interval) the count will be stored and reset to 0.

4. When you are finished testing the Rainfall Sensor, terminate the Real Time screen, and disconnect the two wires from the XR5's Terminal Block.

INSTALLATION

CAUTION: Please use a qualified professional to complete a roof or elevated installation. Pace Scientific specifically disclaims any liability for injury or loss resulting in the installation or use of the Rainfall Sensor.

Choosing an installation site

Use the following guidelines to select the best location for the Rainfall Sensor.

- For highest accuracy, the Rainfall Sensor needs to be mounted so that it is level. A bubble level is built-in to the sensor's base to simplify this process.

- Choose a location that is easily accessible for normal cleaning and distant from trees or other sources of heavy pollen or debris.

- Be sure there is an unobstructed path for water runoff from the drain screen in the sensor's base.

- The magnet-operated reed switch may not operate correctly if you locate the sensor near any object that can attract a magnet. If you mount the Rainfall Sensor on a sheet metal roof, mount the base of the sensor at least 1" (4 cm) away from any steel or iron surface and make sure the reed switch is at least 1" (4 cm) away from any steel or iron objects including nails.

Installing the Rainfall Sensor on a Post or Flat Surface

Use the following illustration to install the Rainfall Sensor on a post or flat vertical surface.
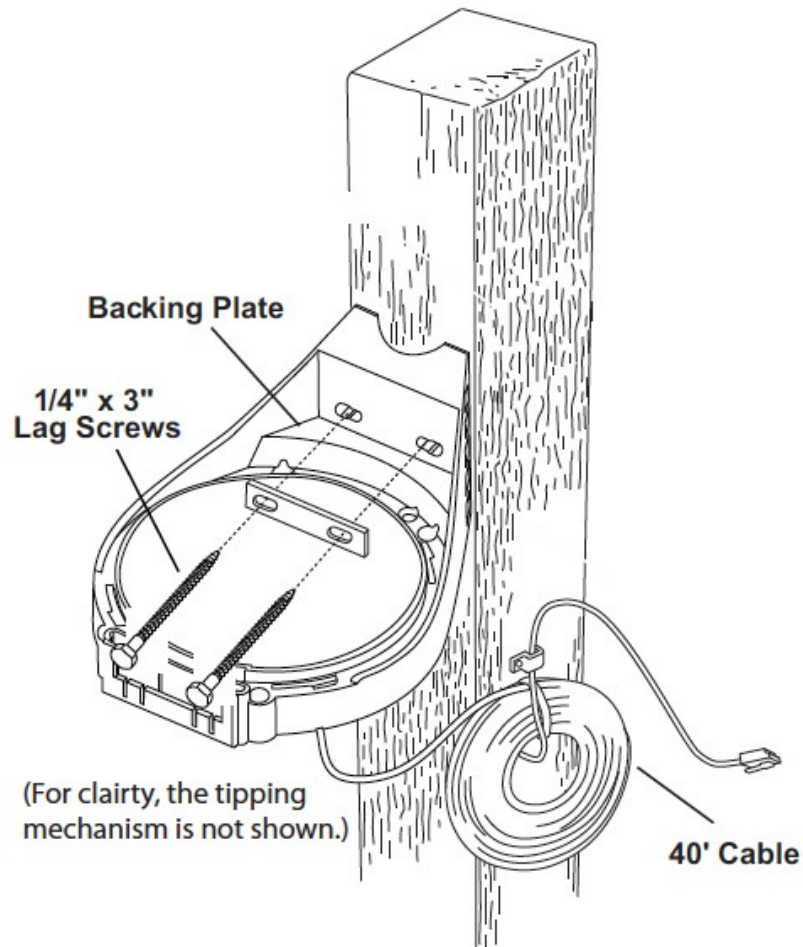

1. With a 3/16" (5 mm) drill bit, drill two holes approximately 2 $\frac{1}{8}$" (54 mm) apart. Use the metal backing plate as a guide when marking holes and a carpenter's level to ensure the holes are level.

2. Remove the Rainfall Sensor cone if it is installed.

3. Insert 1/4" x 3" lag screws through the metal backing plate and the holes in the mounting base into the post. Make sure the base is level by checking the built-in bubble level.

4. Tighten the lag screws using a 7/16" wrench or adjustable wrench.

Installing the Rainfall Sensor on a Pole

Guidelines for installing on a pole

- With the supplied U-bolt, the Rainfall Sensor can be mounted on a pole having an outside diameter ranging from $1\,^1/_4$" to $1\,^3/_4$" (32 – 44 mm).

- A larger U-bolt (not supplied) can be used to mount to a pole with a maximum outside diameter of $2\,^1/_2$".

- To mount on a smaller diameter pole, obtain a U-bolt that fits the base openings but which has a shorter thread length. If the included U-bolt is used with a smaller diameter pole, the bolt could interfere with the Rainfall Sensor's cone.

- Use the built-in bubble level to insure that the Rainfall Sensor is level.

Refer to the following illustration when installing the Rainfall Sensor on a pole.
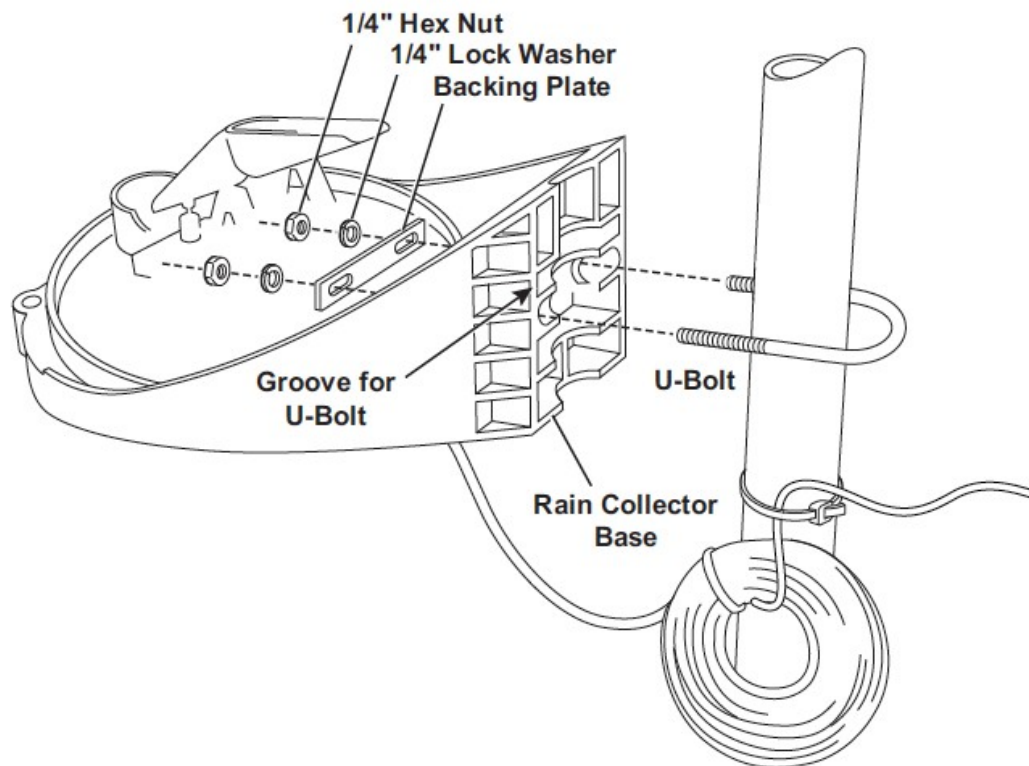
1. While holding the mounting base against the pole, place the two ends of a U-bolt around the pole and through the two holes in the base.

2. Slide the metal backing plate over the bolt ends as they stick out toward the Rainfall Sensor cone. Secure the backing plate with a flat washer, a lock washer, and a hex nut on each of the bolt ends. Adjust the height of the Rainfall Sensor, then tighten the nuts.

Finishing Steps

1. To use the bird spikes, insert one spike into each socket around the rim of the cone. The sockets are tapered: push firmly or tap lightly with a hammer for a more secure fit.

2. Place the cone back onto the base by putting the latches on the cone into the latch openings in the base and rotating the cone clockwise until the latches "lock" into place. As you reattach the cone, make sure to run the cable to the cable slot in the base, or the cone will not fit snugly against the base. (You may also run the cable down through the hole in the base.)

3. Place the debris screen, pointed end up, into the cone. The screen prevents large bits of debris from blocking the funnel hole. If bird nesting is a problem, you can place a bird spike in the hole on top of the debris screen. Note that using a bird spike in the debris screen may make the screen more likely to blown over or out in a high wind gust.
Be careful; bird spikes may be sharp.

4. To prevent fraying or cutting of the cable where it is exposed to weather, it is important to secure the cable so that it does not whip around in the wind.
Use cable clips or weather resistant cable ties to secure the cable. Place clips or ties every 3 to 5 feet (1 to 1.6 meter). Do not use metal staples or a staple gun as metal staples can cut into the cable.
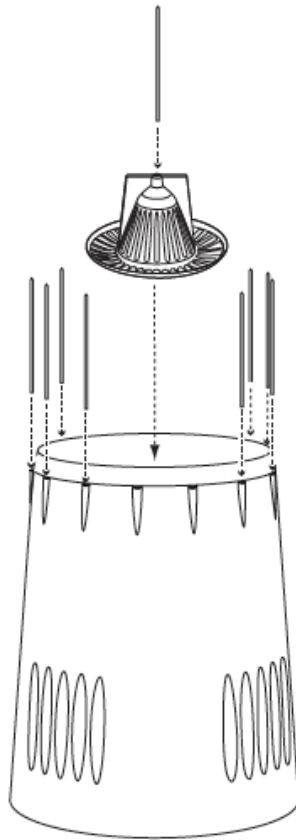
Extending the Signal Cable

If the 40 ft (12 meter) cable is not long enough for your application, it may be extended by up to 500 ft (150 meters) using 24 AWG (or thicker) two conductor cable. Pace also offers two extension kits: Pace part # WE-40 extends the cable by 40 ft (12 meter) and Pace part # WE-100 extends the cable by 100 ft (30 meters).

Adjusting the Rainfall Sensor

The Rainfall Sensor is calibrated so the spoons tip for each 0.2 mm (0.008") of rainfall for model RS-110, and 0.01" for model RS-120. To adjust the calibration slightly, use a 3/16" (or 5 mm) wrench to rotate the adjustment screws which are located underneath the tipping spoons (see illustration on page 4). The adjustment guide embossed in the base shows how far you must rotate both screws to effect a 1% and 2% change. Moving the screws in the positive (+) direction causes the spoons to tip more times (giving a larger count) for a given amount of water.
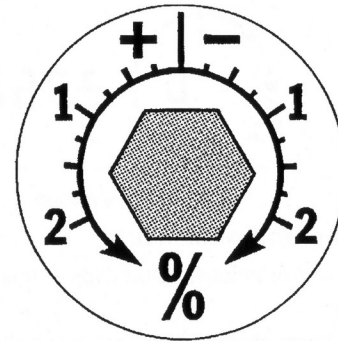
> Note: Modify both adjustment screws by the same amount.

To check the accuracy of the Rainfall Sensor, compare the sensor's results with a tube type rain gage. Use a rain gage with an aperture of at least 4 inches. Any smaller and the reading obtained may not be accurate. Place the tube type rain gage beside the Rainfall Sensor. Compare the totals on 3 storms to determine whether the Rainfall Sensor needs calibration, and by how much. Adjust the screws to fine-tune the reading for the next 3 storms if necessary.

Maintaining the Rainfall Sensor

For greatest accuracy, the Rainfall Sensor should be cleaned once or twice per year.

1. Separate the cone from the base.

2. Use a soft damp cloth to clean pollen, dirt, and other debris from the cone, debris screen, and spoons.

3. Use a pipe cleaner to clear the funnel hole in the cone and the drain screens in the base. When all parts are clean, rinse with clear water.

4. Reattach the cone and replace the debris screen.

Wiring Connections

Rainfall Sensor Cable Termination	
Wire color	**XR5 Terminal**
Green	X, Y, or Z
Red	C

Note: The Rainfall Sensor's reed switch is not polarity sensitive; reversing the Green and Red wires is OK and will give the same results.

Software Setup using the XR5 Data Logger

When creating a Setup in LogXR for the XR5 Data Logger, select the Pulse tab and the channel that the Rainfall Sensor is wired to (Green wire), and select the following:

Type:	Mechanical Switch
Slope:	(see table below)
Offset:	0
Frequency:	Not Checked

RS-110 Rainfall Sensor	
Rainfall unit of measure	**Slope value**
Millimeters	0.2
Inches	0.00787

RS-120 Rainfall Sensor	
Rainfall unit of measure	**Slope value**
Inches	0.01
Millimeters	0.254

For instructions on how to use LogXR Software and the XR5 Data Logger please refer to the XR5-SE User's Guide, a free download from the Pace website: www.pace-sci.com/XR5-SE.pdf

Troubleshooting Guide

Data shows no rainfall accumulation, or has a large error.

- Double check the cable connections at the Pace data logger. Insure that each wire is firmly gripped by the screw terminal's cage clamp.

- Make sure there is no magnetic, steel or iron object near the Rainfall Sensor.

- Make sure the funnel hole in the cone is clear so that water can empty into the spoons.

- Make sure the spoons move freely when tipping to *both sides*. If the spoons do not move at all, check that the cable tie that holds the spoons in place during shipping has been cut and removed.

- Make sure the Rainfall Sensor is mounted so that it is level.

- Double check that the correct Slope Offset scaling values have been entered into the Pulse channel that the Rain Sensor has been wired to (see previous two sections). From LogXR, select Setup | Extract, and click on the Pulse tab.

Technical Support

For questions or comments regarding the Rainfall Sensor or any Pace Scientific product, please contact Pace Technical Support:

        Phone: 704-799-0688 (9-5pm EST)

        Email: support@pace-sci.com

Rainfall Sensor Specifications

Sensor

Type	Tipping bucket with magnetic reed switch
Resolution (rainfall per pulse)	RS-110: 0.2 mm (0.00787 inches) RS-120: 0.01 inches (0.254 mm)
Accuracy	For rainfall rates up to 2"/hr (50 mm/hr): ±4% of total or ±0.008" (0.2 mm) whichever is greater. For rainfall rates from 2"/hr (50 mm/hr) to 4"/hr (100 mm/hr): ±5% of total.

Attached Cable

Length	40 ft (12 meter)
Type	2-conductor, 26 AWG, unshielded
Termination	Stripped and tinned leads
Maximum cable length (if user extended)	500 ft (150 meters)

Physical

Housing material	UV-resistant ABS plastic
Collection area	33.2 in^2 (214 cm^2)
Overall Dimensions (not including bird spikes)	9.25" wide x 10.25" high x 11" deep (23.5 x 26 x 28 cm)
Weight (including hardware and cable)	3 lbs. 3 oz. (1.45 kg)

Pulse Output

Minimum pulse width	30 ms
Pulse origin	Normally open contact closure (reed switch)