

TORRENT™ Rain Gauge

Theory of Operation and Hints for Testing

The **TORRENT™** Rain Gauge is a digital electronic rain gauge which operates on the principle of collecting rainfall in a funnel top, converting the rainfall to drops of uniform volume, and counting the drops electronically. Its ability to form uniform-volume drops is maintained until rainfall rates exceed about 12 inches/hr, at which time the high flow rate of water through the gauge exceeds its ability to form uniform drops for counting, and rainwater tends to "gush" (instead of drip) through the gauge. With regard to accuracy, the **TORRENT™** Rain Gauge requires no field calibration to achieve or maintain accuracy. Maximum accuracy is achieved first by optimum placement and level setup, and is maintained through periodic cleaning of the gauge.

For those who wish to test the operation of the **TORRENT™** Rain Gauge, several points should be considered. The first and most important is the rate at which water is introduced into the gauge – water must not be added too fast. There is a tendency to want to pour some known volume of water into the funnel of the gauge, expecting a certain rainfall indication on the weather station in response. The problem with this method is that in most cases, water is poured into the funnel faster than the rain gauge's ability to form and count discrete drops of uniform volume, resulting in incorrect rainfall indication. Remember, real rainfall introduces *very small volumes* of water, *very slowly*, into the rain gauge. Watching rain fall into the rain gauge, in all but deluge conditions, is kind of like watching grass grow - it happens, but usually too slowly for us to observe. Doubters should try drawing a 3" circle on the inside of their automobile windshield, and observing the amount of rain that falls inside the circle (with the car parked, not moving). When water poured from a spoon or cup is used to test the rain gauge, it is likely to be at a rate equivalent to 12" of rain per hour or more - even if only for a few seconds - and can run through the gauge too quickly for accurate measurement.

The best method for testing the **TORRENT™** Rain Gauge is comparison of its readings to rainfall measurements made with a conventional cylinder-type rain gauge or any straight-wall jar or glass. First, make certain that the gauge is level and clean. Place the jar or second rain gauge in a location close (within three feet or so) of the **TORRENT™** Rain Gauge, and compare the rainfall measured by each.

NOTE: The actual volume of water measured (or collected) by a rain gauge, for a given amount of rainfall, depends upon the area (or diameter) of its top opening. Rainfall, as normally expressed in "inches", describes the depth of rainfall on the surface of the ground - it's not a measure of the *volume* of water in a rain gauge. The formula for converting volume of water in a rain gauge to depth of rainfall is:

$$\text{Rainfall (inches)} = .50 \times \text{Volume of Rainwater Collected (ml)} \div [\text{Diameter of Opening (cm)}]^2$$

The larger the diameter of the opening of the rain gauge, the more rainwater that will be collected from the same rainfall. For example, two glass jars (one 2" diameter and one 3" diameter) are placed in the same thunderstorm

in which one inch of rain falls. After the storm, both jars have an inch of water depth contained in them, but the 3" diameter jar contains over twice the water *volume* of the 2" diameter jar. The importance of this concept to rain gauge testing is that we cannot collect an inch of rainfall in a jar of a different top diameter than the **TORRENT™** Rain Gauge, and then pour that water into the **TORRENT™** Rain Gauge and expect it to respond with the same rainfall measurement of one inch.

If a laboratory test simulating rainfall in the **TORRENT™** Rain Gauge is desired, we recommend the following apparatus for introducing water into the rain gauge: a 10 ml Luer-Lock Syringe (P/N 7510A653, McMaster-Carr Supply Co., Atlanta, GA 30374, (404) 346-7000) with 27-Gauge Tip (P/N 75165A688, McMaster-Carr Supply Co.), also available from Ventorum Technologies. Add a small volume of water to the **TORRENT™** Rain Gauge until you see a drop fall from the bottom of the gauge (this "primes" the drop-forming tube inside the gauge). Fill the syringe with 10 ml water. To begin measurement, feed water from the syringe slowly and steadily into the gauge (direct the water stream down the side of the funnel, not onto the screen) - it should take about 30-60 seconds to empty the syringe completely. The **TORRENT™** Rain Gauge should indicate about .070"-080" for each 10 ml of water added from the syringe.

If you have any questions, or encounter any difficulties with these procedures, please do not hesitate to contact us.