Performance Report:
Tipping Bucket Rain Gauge
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</tbody>
</table>
In the late 1980’s, Hydrological Services Pty. Ltd., in conjunction with the Australian Bureau of Meteorology began development on a new generation of tipping bucket raingauge that would:

- be far more accurate & have high accuracy regardless of rainfall intensity
- reduce field maintenance
- have stable calibration in the field for long periods of time
- be resistant to corrosion, even when installed in coastal areas exposed to salt air & spray
- resist blocking from bird droppings and blown debris such as leaves and dust

By the late 1980’s Hydrological Services had developed a tipping bucket raingauge that could meet these tight accuracy, durability and reliability requirements. This new generation of tipping bucket raingauge incorporated a siphon control mechanism that gave the TB3 a level of accuracy previously unachievable on a tipping bucket raingauge.

In 1995 Commonwealth Scientific and Industrial Research Organization (CSIRO) performed an Accelerated Corrosion Test equivalent to 5 years direct exposure to salt air, salt spray and high humidity using 4 raingauges supplied by the Bureau of Meteorology. The TB3 was the only raingauge to have passed, showing no signs of corrosion. In 2006, the TB3 underwent testing by the World Meteorological Organization (WMO) and finished ranked number 1 for tipping bucket raingauges.

Many of hours testing numerous configurations and materials, both in the laboratory and in the field, has resulted in a raingauge that is regarded as the benchmark product of its kind in the world. From then, Hydrological Services has continued to perfect their tipping bucket raingauge design and now offers a complete line raingauges including heated and 12” gauges.

The TB6 is our standard non-siphoning raingauge, which competes with most tipping bucket raingauges around the world, but with a build quality, accuracy and features that set it apart. The TB6 is specially calibrated to achieve a high level of accuracy at lower intensities.

The TB3 & TB4 incorporate the unique siphon control mechanism which allows these gauges to deliver unparalleled accuracy regardless of rainfall intensity. It is the most accurate tipping bucket raingauge on the market across all rainfall intensities up to 500mm/hour. According to a test by the WMO, tipping bucket raingauges that offer software correction are still not as accurate.

From the Siphon Control Mechanism, giving it the ability to achieve high levels of accuracy regardless of rainfall intensity, to the dual digital outputs allowing independent monitoring and logging of rainfall data by two independent devices, to the dual discharge outlets that allow rainfall to be collected for volumetric, weight, or water quality checks, Hydrological Services’ raingauges are among the highest quality and most accurate available.
**TB6 Features & Options**

- Non-siphoning with unique finger filter that resists blocking
- Spun aluminum outer enclosure with corrosion resistant powder coating
- Pressure die cast aluminum rim & funnel assembly with corrosion resistant powder coating
- Stainless steel rolling bearings that do not bind & cause calibration drift
- Dual outlet magnetic reed switch (optional triple reed switch)
- Non-hydroscopic UV stabilized ABS injection molded base
- Built in discharge outlets for collection and analysis of water
- Bulls-Eye Level
TB4 Features & Options

- Brass Siphon control with unique finger filter
- Non-hydroscopic UV stabilized ABS Injection Molded Base
- Dual outlet magnetic reed switch (optional triple reed switch)
- Pressure die cast aluminum rim & funnel assembly with corrosion resistant powder coating
- Spun aluminum outer enclosure with corrosion resistant powder coating
- Stainless steel rolling bearings that do not bind & cause calibration drift
- Bulls-Eye Level
- Built in discharge outlets for collection and analysis of water

Official Document Issued 6 February 2013
TB3 Features & Options

- Siphon control with unique finger filter that resists blocking
- Dual outlet magnetic reed switch (optional triple reed switch)
- Spun aluminum outer enclosure with corrosion resistant powder coating
- Die cast aluminum base with corrosion resistant powder coating
- Stainless Steel Insect Screens
- Built in discharge outlets for collection and analysis of water
- Pressure die cast aluminum rim & funnel assembly with corrosion resistant powder coating
- Sapphire Bearings
Tipping Bucket Rain Gauges Features & Options

1. Enclosure
   All Hydrological Services’ raingauges have a pressure die cast aluminum funnel and rim assembly and spun aluminum outer enclosure finished with a corrosion resistant powder coating. The construction of the catch, rim and funnel have proven superior in ‘catching’ the rainfall with minimal splash effect, due to the steep slope of the funnel and extended rim.

2. Base
   **TB3 Powder Coated Aluminum Construction**
   The TB3 has a powder coated die cast aluminum base, that in conjunction with the aluminum enclosure makes the TB3 is resistant to salt air and pollution. The durability of the TB3 was tested by the CSIRO for the equivalent of 5 years direct exposure to salt air and spray. The TB3 was the only rain gauge to pass the test.

   **TB4 & TB6 ABS injection molded base**
   The TB4 & TB6 have a non-hydroscopic ABS injection molded base with a field life of 15-20 years in direct sunlight and high heat.

3. Mean Time Between Failure (M.T.B.F.)
   M.T.B.F. Definition = Total operational hours in the field / number of observed failures

<table>
<thead>
<tr>
<th>Model</th>
<th>Sales per year</th>
<th>Units returned / Year</th>
<th>Calculation (units x hrs/day x days/year ÷ failures)</th>
<th>M.T.B.F. (hours)</th>
<th>M.T.B.F. (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB3</td>
<td>1000</td>
<td>5</td>
<td>1000 x 24 x 365 ÷ 5</td>
<td>1,752,000</td>
<td>200</td>
</tr>
<tr>
<td>TB4</td>
<td>900</td>
<td>5</td>
<td>900 x 24 x 365 ÷ 5</td>
<td>1,576,800</td>
<td>180</td>
</tr>
<tr>
<td>TB6</td>
<td>400</td>
<td>2</td>
<td>400 x 24 x 365 ÷ 2</td>
<td>1,752,000</td>
<td>200</td>
</tr>
</tbody>
</table>
4. Finger Filter

The Hydrological Services finger filter on all models is a stainless steel mesh with a non-
hydroscopic plastic frame. The unique design of the filter no only keeps debris out of the
rain gauge but is also resistant to clogging from things such as leaves, bird droppings, dust
and dirt among other things without effecting the accuracy of the gauge.

5. Dual Reed Switch Outputs (Optional Triple Reed Switch)

Dual Reed Switch Outputs on the rain gauges allow monitoring, logging or transmission of
data by two independent devices. E.g. One device may transmit data in real time while a
second independent device can provide a permanent on-site record; or two authorities may
share the same raingauge, each having their own separate data output. Each Reed Switch
is potted in silicon with built in ‘Varisters’ for lightning protection and is Bi-polar for a clean
contact signature.

6. Siphon vs. Non-Siphon

Siphoning TB3 & TB4
The Siphon Control Mechanism ensures that water entering the tipping bucket mechanism
always does so at a constant velocity. This guarantees an accuracy of +/- 2% from 0-
250mm/hr and +/-3% from 250-500mm/hr (0.01” and 0.2mm bucket); and +/-2% 0-
500mm/hr for the 0.5mm and 1.0mm buckets. The TB3 was tested by the WMO with 19
other rain gauges from around the world. The TB3 was the only tipping bucket rain gauge
to fall within WMO specifications:

“All uncorrected tipping bucket rain gauges show their characteristic
underestimation and do not fall within the WMO limits of ±5 %. It is also clear that
of the tipping bucket rain gauges with mechanical correction (Rimco 7499, TB-3 and
UM7525), denoted by the thin dashed line with diamond markers, only the TB-3
gives results within the WMO limits.”

Non-Siphoning TB6
The TB6 non-siphoning raingauge is actually more accurate than siphoning raingauges at
low intensities (less than 50mm/hr or 2 inches/hr).
Tipping Bucket Raingauge Features & Options

7. Bearings

**TB3 Sapphire Bearings**
The TB3 uses a "rotating" system which has two ground Sapphire bearings that fit over each end of the 316 grade hard stainless steel bucket axle. The extremely high quality sapphire bearing is a very important component of the TB3. The hard but smooth surface of the sapphire allows for very low resistance against the shaft of the bucket as it passes through its tipping cycle. The sapphire will not wear down and will not bind or grind due to dust or other contaminates that may have entered the rain gauge. It allows for extremely accurate repeatability for years upon years.

**TB4 & TB6 Stainless steel rolling bearings**
TB4 & TB6 use a "rolling" pivot system that has two stainless spring steel rods (rolling bearings) clamped onto the rain gauge base at 90 degrees to the bucket. The same material is used for the bucket axle that is positioned on top of the rolling bearings by a clamp over each end. There is sufficient clearance in the clamps to allow the axle to roll along the bearings as the bucket oscillates during the tipping cycle. The stainless steel rolling bearings are an economic alternative to the sapphire bearings of the TB3 and proven to be just as durable.

8. Built-in discharge outlets

Dual outlets are provided at the base of all Hydrological Services tipping bucket raingauges to allow precipitation to drain out. 1/2 inch id tubes can be connected to the fittings for collection of water into a storage container. Once the water is collected it can serve several purposes the first being volumetric weighing to verify amount of rainfall. The second would be for water quality analysis to check for pollutants in the rainwater that may have been collected in the atmosphere upon descent.

9. Bucket Options

Hydrological Services offers two options for bucket types: a chrome plated, injection molded ABS or a ceramic coated metal bucket. Over 90% of all tipping bucket raingauges sold by Hydrological Services are fitted with the chrome platted ABS bucket.

10. Extended Catch Option, 0.1mm Resolution

All Hydrological Services Tipping Bucket Rain Gauges are available with an “Extended Diameter Catch”. The extended catch allows the TB3, TB4 or TB6 to measure rainfall at a resolution of 0.1mm per tip.
11. Internally mounted Data Logging

By using the Hydrological Services’ MinLog ML1-FL data logger, rainfall can be directly logged within the enclosure of the raingauge without the need for an additional enclosure, solar panel or external 12V battery. The ML1-FL is capable of operating in the field for up to 10 years on its internal ‘AA’ lithium battery and can store up to 100,000 events in non-volatile memory. A new model (ML1-420) with expanded capabilities is now offered with inputs for rainfall, water level (4-20mA), battery voltage and temperature with storage for up to 400,000 events. The ML1-FL and ML1-420 can also be connected to an external 12V battery if required.

Hydrological Services also offers the ‘RainTrak’ system, a compact, low power, autonomous rainfall monitoring station for remote areas. The ‘RainTrak’ is a stand alone system with integrated data logging via the ML1-FL, and GSM or IP addressable telemetry options.

12. Calibration Devices

Hydrological Services offers two options for calibration of tipping bucket raingauges.

The first is the FCD (Field Calibration Device). The FCD is comprised of tube calibrated to hold 653mL of water which is designed to cause a specific number of tips regardless of rainfall intensity. The FCD is supplied with one 100mm/hr nozzle but can be supplied with a range of other nozzles for specific rainfall intensities.

The second option is TB340 Automatic Lab Calibration Rig. The Lab Calibrator can simultaneously check the calibration of two rain gauges. It will automatically refill the calibrated tube to 653mL, discharge completely, register the number of tips recorded and output the data to a printer that will flag the runs that did not fall within the tips allowed. Each side of the calibrator hold 3 nozzles and automatically runs the cycle 3 times at each intensity before switching to a higher intensity. This allows the calibration check of larger rain gauge networks to become automated and less labor intensive. All that is needed to do is set the number of runs and at which intensities, connect the reed switch and walk away.

Nozzle intensities range from 50mm/hr, 100mm/hr, 200mm/hr, 300mm/hr, and 500mm/hr.
It is well documented that tipping bucket rain gauges under-register when collecting rainfall. The Hydrological Services TB3 & TB4 raingauges incorporate a siphon control mechanism. The siphon control ensures that precipitation always discharges into the bucket at a constant rate, regardless of rainfall intensity. The siphon mechanism is not actually there to slow the flow. It is there to control the rate of discharge into the buckets.

By controlling the discharge rate we are able to calibrate the gauge taking account of the loss that occurs with each bucket tip. This loss occurs when precipitation continues to enter the bucket after it has begun tipping. This loss is the fundamental reason for inaccuracy in all uncorrected tipping bucket raingauges.

The problem with non siphoning rain gauges

This sequence clearly shows why tipping bucket rain gauges notoriously under register rainfall.

**Picture 1:**

The bucket begins to fill and continues until the calibrated amount of water is reached, causing the bucket to begin tipping through its arc.

**Picture 2, 3 & 4:**

Water continues to enter the bucket until the center baffle passes the midway point. Any additional precipitation that entered the bucket after the tipping cycle has begun passes through the raingauge, but is not measured.

**Picture 5:**

The tipping cycle has ended.

At low rainfall intensities (up to 20mm/hr), the ‘loss’ is relatively small and of no serious consequence. However, as rainfall intensity increases, so does the amount of loss, causing serious and unacceptable errors in the data collected. So over hours the amount of water that is lost becomes more and more substantial, especially during high intensity rainfall events.
Standard Calibration

Tipping bucket raingauges that do not incorporate a siphon control feature or some form of
correction are typically calibrated at a rainfall rate of 100mm/hr. Manufacturers may state that their
gauge is accurate to +/- 2, 3, or 4% etc., but what is omitted is that the gauge will only deliver the
stated accuracy at the 100mm/hr rate.

When calibration checks are performed on these types of rain gauges at higher intensities,
the gauges will often display errors of as much as 15-20%. This is due to the uncontrolled flow from
the funnel into the tipping bucket. Without a siphon to control flow, the rain gauge is only accurate
at the one rainfall rate at which it was originally calibrated. Given that the accuracy of a non-
siphoning rain gauge will vary substantially as rainfall intensity varies, then unless this type of
gauge is checked at several intensities the rainfall data cannot be considered accurate.

The TB3 and TB4 siphoning raingauges are therefore said to have ‘Linear Calibration’. The
discharge rate is controlled by the siphoning mechanism so water will discharge from the siphon
at the same rate whether at 25mm/hr or 500mm/hr. Therefore the calibration is linear because if it
is accurate at 100mm/hr, then it will be accurate at all intensities due to the controlled discharge of
rainfall.

An 8-inch (200mm) Tipping Bucket Rain Gauge should be expected to accurately measure
rainfall rates up to at least 250mm/hr, as experienced in heavy rainstorms, as well as accurately
measure the lower intensities of around 25mm/hr.
Hydrological Services’ Calibration

Firstly, all Hydrological Services buckets are balance to +/-0.05 gms, then each bucket is buretted so that it tips at the required volume of water.

Calibration of the TB6
The TB6 non-siphoning gauge is specially calibrated to be extremely accurate at low intensities of rainfall.

Calibration of the TB3 & TB4
The calibration of the siphoning gauges is different to the calibration of standard raingauges. First it is important to understand two major concepts: Practical Value and Theoretical Value.

**Theoretical Value:**
The theoretical volume of water that will cause a bucket to tip. This is the value that all un-corrected tipping bucket raingauges are calibrated to.

**Practical Value:**
This is the actual volume of water that Hydrological Services calibrate their siphoning raingauges to tip at. This is less than the theoretical value in order compensate for the extra rainfall that is discharged into the bucket after it has begun tipping. If the bucket is set to the Theoretical value, then the tipping bucket raingauge will under register.

<table>
<thead>
<tr>
<th>Bucket Size</th>
<th>Rainfall intensity</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1mm, 0.2mm, 0.01&quot;, 0.5mm &amp; 1.0mm</td>
<td>0-50mm/hr</td>
<td>&lt;1%</td>
</tr>
<tr>
<td></td>
<td>50-75mm/hr</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>75-100mm/hr</td>
<td>+/-3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size</th>
<th>Bucket Capacity</th>
<th>Tips per 653mL of water</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theoretical</td>
<td>Practical</td>
<td>Theoretical number of tips</td>
</tr>
<tr>
<td>0.2mm</td>
<td>6.28</td>
<td>5.2</td>
<td>103.9</td>
</tr>
<tr>
<td>0.01inch</td>
<td>7.98</td>
<td>6.8</td>
<td>81.8</td>
</tr>
<tr>
<td>0.5mm</td>
<td>15.69</td>
<td>14.4</td>
<td>41.6</td>
</tr>
<tr>
<td>1.0mm</td>
<td>31.39</td>
<td>29.5</td>
<td>20.8</td>
</tr>
</tbody>
</table>

Once the bucket is set to the practical value using a burette, it is then run through the Lab Calibration Rig multiple times at intensities of 50, 100 & 300mm/hr. If the number of tips is out of the allowed range, then the raingauge is adjusted and is run through the same process again until it is within the specified number of tips across all rainfall intensities.

<table>
<thead>
<tr>
<th>Bucket Size</th>
<th>Rainfall intensity</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1mm, 0.2mm &amp; 0.01&quot;</td>
<td>0-250mm/hr</td>
<td>+/-2%</td>
</tr>
<tr>
<td></td>
<td>250-500mm/hr</td>
<td>+/-3%</td>
</tr>
</tbody>
</table>
Customer Quotes

“To date, the agreement between the TB3 and weighing type gauges (Geonor), when subject to the same wind shield configuration, has been very good with catch ratios all falling between 0.95 and 1.0. We are very confident in the precipitation data from the TB3.”

Tilden Meyers
NOAA/ARL/ATDD

“We are particularly pleased with the strainer and siphon mechanism that has extended the time between maintenance visits.”

Steven Clark
Riverside County Flood Control and Water Conservation District

“SJRWMD has found the gauges to be extremely accurate and reliable for the collection of the long-term data from remote locations. The gauges are easy to calibrate and retain their calibration for long periods of time even in harsh climatic conditions.”

Larry Fayard
St. Johns River Water Management District

“The filtering system combined with the dual output reed switch and the repeatability of catch measurement was the prime reason for upgrading to the TB3.”

Bill Raisner
County of San Bernadino, CA
## TB3 Sales Report of Major Users

<table>
<thead>
<tr>
<th>Organization</th>
<th>Qty in Service</th>
</tr>
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<tbody>
<tr>
<td>Australian Bureau of Meteorology</td>
<td>520</td>
</tr>
<tr>
<td>Campbell Scientific (USA, Canada, Brazil, Australia)</td>
<td>1,400</td>
</tr>
<tr>
<td>Hydro-meteorological Programs, Brasil</td>
<td>147</td>
</tr>
<tr>
<td>San Bernadino, Riverside, Ventura, Santa Barbara, San Diego, San Luis Obispo, CA - USA</td>
<td>403</td>
</tr>
<tr>
<td>Department of Agriculture, Western Australia</td>
<td>80</td>
</tr>
<tr>
<td>Department of Lands, Planning &amp; Environment, Northern Territory - Australia</td>
<td>180</td>
</tr>
<tr>
<td>Department of Meteorology Thailand / Royal Irrigation Department of Thailand</td>
<td>2,000</td>
</tr>
<tr>
<td>Department of Water Resources - South Australia</td>
<td>170</td>
</tr>
<tr>
<td>Department of Irrigation &amp; Drainage - East Malaysia</td>
<td>820</td>
</tr>
<tr>
<td>Department of Water Resources - China</td>
<td>160</td>
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<tr>
<td>Central Water Commission, India</td>
<td>274</td>
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<tr>
<td>Changjiang Water Commission, China</td>
<td>125</td>
</tr>
<tr>
<td>Environment Canada</td>
<td>440</td>
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<tr>
<td>Government of Fiji</td>
<td>90</td>
</tr>
<tr>
<td>Government of Turkey</td>
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<tr>
<td>Hydro Tasmania – Australia</td>
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<tr>
<td>Government of Indonesia Public Works</td>
<td>620</td>
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<tr>
<td>Locher Environmental – Florida - USA</td>
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<tr>
<td>Malaysia Irrigation and Drainage Department (JPS) / Government of Malaysia</td>
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<tr>
<td>Manly Hydraulics Laboratory, New South Wales - Australia</td>
<td>110</td>
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<tr>
<td>Mekong River Commission - Cambodia</td>
<td>340</td>
</tr>
<tr>
<td>Mekong River Commission - Laos</td>
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<tr>
<td>New Zealand Regional Councils</td>
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<td>National Oceanic &amp; Atmospheric Administration, Climate Reference Network - USA</td>
<td>155</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>140</td>
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<tr>
<td>Queensland Department of Natural Resources - Australia</td>
<td>450</td>
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<tr>
<td>South African Weather Service</td>
<td>415</td>
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<tr>
<td>South Florida/Southwest Florida/St.Johns River Water Management Districts - USA</td>
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<tr>
<td>Stevens Water Monitoring - USA</td>
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<tr>
<td>Sydney Catchment Authority &amp; Sydney Water Board, NSW - Australia</td>
<td>300</td>
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<tr>
<td>Theiss Environmental Services, Victoria - Australia</td>
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</tr>
<tr>
<td>Tyco Environmental Services, England</td>
<td>310</td>
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</table>
A Cross Section of Raingauge Users

AUSTRALIA
- AUSTRALIAN BUREAU OF METEOROLOGY
- AWT (AUSTRALIAN WATER TECHNOLOGIES)
- BARWON REGIONAL COUNCIL
- BRISBANE CITY COUNCIL, QUEENSLAND
- BUREAU OF SUGAR EXPERIMENT STATIONS
- C.S.I.R.O. (COMMONWEALTH SCIENTIFIC INSTRUMENT RESEARCH ORG.)
- DEPARTMENT OF AGRICULTURE, WESTERN AUSTRALIA
- DEPARTMENT OF LAND, PLANNING & ENVIRONMENT, NORTHERN TERRITORY
- DEPT. OF NATURAL RESOURCES, QUEENSLAND
- DEPT. OF NATURAL RESOURCES, NSW
- DEPT. OF NATURAL RESOURCES, VICTORIA
- DEPT. OF NATURAL RESOURCES, STH AUSTRALIA
- DEPT. OF NATURAL RESOURCES, WEST AUSTRALIA
- DEPT. OF NATURAL RESOURCES, TASMANIA
- DEPT. OF NATURAL RESOURCES, NTH TERRITORY
- DEPT. OF LAND & WATER CONSERVATION
- DEPT. OF PUBLIC WORKS, NEW SOUTH WALES
- DEPARTMENT OF MINES & ENERGY
- ENVIRONMENTAL PROTECTION AGENCY, SOUTH AUSTRALIA
- ENVIRONMENTAL DATA SERVICES
- FORESTRY COMMISSION, NEW SOUTH WALES
- GOLD COAST CITY COUNCIL
- HUNTER WATER CORPORATION (HUNTER VALLEY WATER AUTHORITY)
- HYDRO ELECTRIC COMMISSION OF TASMANIA
- KEMPSEY SHIRE COUNCIL
- MANLY HYDRAULICS LABORATORY
- MOREE PLAINS SHIRE COUNCIL
- MELBOURNE WATER AUTHORITY, VICTORIA
- QUEENSLAND RAIL AUTHORITY
- STATE RAIL AUTHORITY OF NEW SOUTH WALES
- SNOWY MOUNTAINS ENGINEERING CORPORATION
- SNOWY MOUNTAINS CORE OF ENGINEERS
- SNOWY MOUNTAINS HYDRO ELECTRIC AUTH.
- SNOWY MOUNTAINS ELECTRICITY COMMISSION
- SYDNEY WATER AUTHORITY
- TAMWORTH CITY COUNCIL
- UPPER PARRAMATTA RIVER CATCHMENT TRUST
- MONASH UNIVERSITY
- NSW UNIVERSITY OF TECHNOLOGY
- UNIVERSITY OF NEW SOUTH WALES
- UNIVERSITY OF QUEENSLAND
- UNIVERSITY OF WOLLONGONG
- UNIVERSITY OF NEW ENGLAND
- UNIVERSITY OF WESTERN SYDNEY
- UNIVERSITY OF CANBERRA
- UNIVERSITY OF NORTHERN TERRITORY
- UNIVERSITY OF NEWCASTLE
- SYDNEY UNIVERSITY
- MELBOURNE UNIVERSITY
- BEP ENGINEERING
- ELPRO TECHNOLOGIES
- FUTURETECH PTY. LTD.
- GREENSPAN TECHNOLOGIES
- MEASUREMENT ENGINEERING
- TELEVISION AUSTRALIA – 600 TB3’s
- THIESS ENVIRONMENTAL
- RURAL WATER COMMISSION OF VIC.

BRAZIL
- CAMPBELL SCIENTIFIC DO BRASIL
- (SUPPLY TO A NUMBER OF GOVT. AGENCIES)
- FUNSEME
- UNIVERSIDADE FEDERAL DE ALAGOAS

COLUMBIA
- EMPRESAS PUBLICAS DE MEDELLIN

CAMBODIA
- MEKONG RIVER COMMISSION

CANADA
- ENVIRONMENT CANADA
- HOSKIN SCIENTIFIC (RESELLER)
- CAMPBELL SCIENTIFIC (RESELLER)
- UCOM (RESELLER)

CHINA
- PERFECT WATER BEIJING
- CHINA WATER
- PAK PANANG

ENGLAND
- GREENSPAN (RESELLER)
- INTEGRATED HYDRO SYSTEMS

FIJI
- DEPARTMENT OF IRRIGATION & DRAINAGE
- ELECTRICITY AUTHORITY OF FIJI

INDIA
- CENTRAL WATER COMMISSION

INDONESIA
- MINISTRY OF PUBLIC WORKS
- DEPARTMENT OF IRRIGATION & DRAINAGE
A Cross Section of Raingauge Users

THAILAND
- SAMSAHAI SUPPLY GROUP (RESELLER)
- (SUPPLY TO A NUMBER OF GOVT. AGENCIES)
- DEPARTMENT OF METEOROLOGY

MALAYSIA
- DEPARTMENT OF IRRIGATION & DRAINAGE
- JPS/DID
- JUMSAR SARAWAK (RESELLER)
- VANGUARD (RESELLER)

NEW ZEALAND
- SCOTT TECHNICAL INSTRUMENTS (RESELLER)
- (SUPPLY TO A NUMBER OF GOVT. AGENCIES)
- NEW ZEALAND WATER AUTHORITY

NEPAL
- INTERNATIONAL GLOBAL WARMING RESEARCH PROJECT

PAPUA NEW GUINEA
- DEPT. OF WATER RESOURCES
- OK TEDI MINING LTD
- PORGERA JOINT VENTURE

SINGAPORE
- PT MODULE (RESELLER)
- (SUPPLY TO A NUMBER OF GOVT. AGENCIES)

SOUTH AFRICA
- BUREAU OF METEOROLOGY
- ANALOG PRECISION (RESELLER)

U.A.E.
- MINISTRY OF JAHAD

UNITED STATES
- ADS ENVIRONMENTAL SERVICES
- AMJ EQUIPMENT CORPORATION
- CALIFORNIA STATE UNIVERSITY, NORTHRIDGE
- CAMPBELL SCIENTIFIC INC. (RESELLER)
- CENTER FOR MARINE SCIENCE, UNIVERSITY OF N.C.
- CITY OF PORTLAND, WPCL
- CITY OF PORTLAND, BUREAU OF ENV. SERVICES
- CITY OF SUPERIOR, WASTEWATER DIVISION
- CITY OF TALLAHASSEE, FL
- DESERT RESEARCH INSTITUTE, NV
- RIVERSIDE COUNTY FLOOD CONTROL DISTRICT, CA
- COUNTY OF SAN BERNARDINO, CA
- COUNTY OF SAN DIEGO, CA
- COUNTY OF SAN LUIS OBISPO, CA
- COUNTY OF VENTURA, FLOOD CONTROL, CA
- DEPARTMENT OF ECOLOGY, WASHINGTON

- DACOM TECHNOLOGIES, INC. (RESELLER)
- DUKE ENERGY CORPORATION, NC
- DUKE UNIVERSITY, NC
- ENTERPRISE ELECTRONICS CORPORATION
- EVERGLADES NATIONAL PARK, FL
- HARVARD UNIV, DIV OF ENG & APPLIED SCIENCES
- HIGH SIERRA ELECTRONICS (RESELLER)
- HOWARD UNIVERSITY, WASHINGTON DC
- INTERMOUNTAIN ENVIRONMENTAL (RESELLER)
- KANSAS STATE UNIVERSITY
- KING CTY, DEPT OF WATER & LAND RES, SEATTLE
- LOCHER ENV. TECHNOLOGY (RESELLER)
- LOUISIANA STATE UNIVERSITY
- LOUISIANA MARINE CONSORTIUM
- SM TECHNICAL CONSULTANTS (RESELLER)
- MICROCOM DESIGN (RESELLER)
- MIAMI DADE SOLID WASTE MANAGEMENT, FL
- NOAA – CLIMATE REFERENCE NETWORK
- OKLAHOMA MESONET
- PACIFIC REMS (RESELLER)
- PENNSYLVANIA STATE UNIVERSITY
- PINELLAS COUNTY SEWER SYSTEM, FL
- ST. JOHNS RIVER WATER MGMT. DISTRICT, FL
- SEATTLE PUBLIC UTILITIES
- STATE CLIMATE OFFICE OF NORTH CAROLINA
- STEVENS WATER MON. SYSTEMS (RESELLER)
- SOUTH FLORIDA WATER MGMT DISTRICT
- SOUTHWEST FLORIDA WATER MGMT DISTRICT
- SUWANNEE RIVER WATER MGMT DISTRICT, FL
- SOUTHEASTERN LOUISIANA UNIVERSITY
- UNIVERSITY OF CALIFORNIA, SANTA BARBARA
- UNIV. CORP. FOR ATMOSPHERIC RESEARCH
- UNIVERSITY OF LOUISIANA
- UNIVERSITY OF SOUTH ALABAMA
- UNIVERSITY OF WASHINGTON, SEATTLE
- UNIVERSITY OF WISCONSIN-MADISON
- NORTHEAST LOUISIANA UNIVERSITY
- U.S. DEPARTMENT OF AGRICULTURE
- U.S. DEPARTMENT OF AGRICULTURE - ARS
- U.S. BUREAU OF RECLAMATION
- U.S. GEOLOGICAL SURVEY