STARLOG

Tipping Bucket
Rainfall Gauge

Model 6506

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1. INTRODUCTION

The Tipping Bucket Rainfall Gauge (Model 6506A), which operates on the tipping bucket principle, is designed to measure rainfall autonomously and is ideal for long-term unmanned weather monitoring with a STARLOG Data Logging System.

To operate, a funnel in the Rainfall Gauge collects the rainfall which is strained by a metal gauze before being passed to the metallic tipping bucket measuring system. The bucket tips each time 0.2mm of precipitation is collected. (This can be adjusted from 0.1mm to 0.5mm.) A reed switch detects that the bucket has tipped and produces a momentary contact closure signal. This cycle continues while rainfall continues to fall.

When the Rainfall Gauge is connected to a STARLOG Data Logger, this signal is detected and recorded via a Counter Channel.

Up to four units may be connected to the Data Logger at any one time.

Model 6506A Tipping Bucket Rainfall Gauge

2. USING THE TIPPING BUCKET RAINFALL GAUGE IN A STARLOG SCHEME

UNIDATA's Tipping Bucket Rainfall Gauge is designed for automatic monitoring and collection of rainfall data in a STARLOG Data Logging System. When the Gauge is connected to a STARLOGGER or MACRO Data Logger, data sensed by the instrument is logged and stored according to a program you define using STARLOG Software.

STARLOG Software runs on a computer compatible with IBM systems (PC/XT/AT, PS/2). Using the program, you generate a data logging program – called a Scheme – then load the Scheme into a Data Logger. To discover how to use this program see the STARLOG Users Manual (6245 for Version 3 and for Version 2, 6203.)

This section provides you with information you will find helpful in creating and executing a Rainfall Monitoring Scheme.

2.1. Choosing a Data Logger

Any of the STARLOG range of Data Loggers can be used with the Rainfall Gauge to record rainfall. Each Logger offers a Counter channel with sufficient resolution to record the pulses sent by the instrument. In fact, an 8-bit channel is sufficient for most rainfall monitoring projects.

When connecting the instrument to a STARLOGGER (Model 6004) or MACRO Data Logger (Model 7000) you will want to program the Logger for *PDL compatibility mode* which will configure Counter channels for 8-bit resolution. This is automatic via Version 3 Software. When using Version 2 Software, consult the Users Manual 6203.

2.2. Notes About A Rainfall Monitoring Scheme

This section describes the transducer's attributes and suggests how you might want to use data gathered.

2.2.1. Adding an Instrument

To create a Rainfall Monitoring Scheme, select a Tipping Bucket Rainfall Gauge from the Instrument List to add it to the Scheme.

If the model you have does not appear in the instrument list, you will want to add it to the list first. (Use the **Instrument Editor** in Version 3 or **Maintain Instruments** in Version 2.)

Once you add the instrument to the Scheme, check to see which channel is allocated, scaling factors, format of data shown in reports, etc. The default settings are:

```
=[∎]==================== Transducer 1 =

  Description:  Rainfall 0.2

  Output:    Count (Hz)          |↓|      Channel:   c0            |↓|
  Min:          0
  Max:          255
                                          Title:    Rain
                                          Units:    mm
  Scale:     Scale ax + b        |↓|      Using:    ###.#          |↓|
  a:            0.2
  b:            0
  Formula:                       |↓|


                                                   OK ▪   Cancel ▪
```

Model 6506A Rainfall Gauge Transducer using Version 3 Software

Transducer Description	**Rainfall**
Input Channel C0	**counter 0 (8 bit)**
Input Channel Range bits	**0 to 255**
Transducer Range bits	**0 to 255**
Transducer Scaling/Formula	**0 gain 0.2**
Title for Reports	**Rain**
Units of Result	**mm**
Using String	**###.#**

Model 6506A Rainfall Gauge Transducer using Version 2 Software

If you choose to log using a channel other than the default as listed here, ensure that you make the connection to the correct terminal of the Field Termination Strip, if you are using that option, or the correct pin in the INPUT SIGNALS connector.

In Compatibily Mode, the STARLOGGER offers four 8-bit counters (c0, c1, c0u, c1u): each Tipping Bucket Rainfall Gauge uses one channel.

The connections described in this supplement (see Section 3 Installation) assume that you are using c0, the default channel.

2.2.2. What to Log

When logging data, readings must be totalised. Totalising to 2 bytes is usually sufficient. If you are logging less than 50 mm of rain in one log interval, then you can choose to totalise to 1 byte.

➢   Using Version 3 Software

Make the following selections in the Log Buffer window:

```
=[▮]============== Log Buffer 1 ========4=[↑]=┐
|6004B - STARLOGGER Data Logger 128K + KB          ▲
|Channel Xducer  RAW MAX MIN T1  T2  T4  AVE SD  ave▓
|c0      Rain    [ ] [ ] [ ] [X] [ ] [ ] [ ] [-] [ ]▓
|                                                   ▼
```

*Nominating to totalise readings over the log interval to 1 byte
using Version 3 Software*

➢   Using Version 2 Software

1. First, add the Counter channel to the Scheme's list of *What to*

What to Log

c0	Rain	Rainfall

Log, i.e.

Channel	c0	Rain	Rainfall 0.2
Action	Tot1		Totalise to 1 byte

2. Once you add c0 (or whatever channel you use) to the Log, you will want to choose a log action, like Total.

Plot Title	
Time Base (X Axis)	**Autoscale**
Log Entry	**Rain**
Range (Y Axis)	**0 to 255**

3. Then, in order to print or plot the resulting data, you would select the following when defining *Output Details*:

2.2.3. When To Log

For a time-based scheme, set the log interval to suit your particular application. For instance, if you are logging daily rainfall, use a long interval like 24 hours. If you are logging small changes, use a brief interval like 15 minutes.

For an event-based scheme, define the event which will trigger the logging of data and/or the transmission of an output signal to alert you. For instance, you could program the logger to log only when rain falls (when the bucket tips and sends a signal from the Rainfall Gauge on c0.) Then, logging would occur at every log interval if it is raining.

2.3. Using a MACRO Data Logger

If you use a MACRO Data Logger to log the Tipping Bucket Rainfall Gauge readings, you will want to configure the Counter channel to 8-bit.

This is automatic when you use Version 3 Software. If you use Version 2 Software, see the STARLOG Users' Manual 6203 for details on configuring a MACRO Data Logger.

When a Logger is in PDL compatibility mode, you can simply follow the procedure described in section 2.2.

3. INSTALLATION

Select an outdoor site where:-

- the ground is flat
- rainfall as measured is unaffected by air disturbances caused by tall buildings or trees.
- the measured rainfall may be regarded as representative of the surrounding area.

The bucket in this raingauge has a rubber band preventing it from tipping. This is essential during transport to prevent damage occurring to the mechanism.

To remove the rubber band undo the 3 screws near the base and lift the cover off. Remove the rubber band and replace the cover and screws.

3.1. Mounting

The rainfall gauge should be bolted to a concrete foundation (a paving slab would be suitable). Then:

1. Remove the cover which is secured by two toggle clips.

2. Level the base using the "bulls eye" spirit level and packing the hold-down fittings as necessary.

3. Connect the signal cable to the Data Logger. (See below.)

4. Remove the rubber band locking the tipping bucket.

3.2. Connections

The rainfall gauge comes complete with 5 metres of two core shielded cable. The *red* is the signal output and the *white (or other color)* cable is the ground.

The signal output is a series of digital impulses which are logged by the Data Logger via a counter channel. Of four available, the default channel is c0.

Wire Colour	STARLOGGER Pin	FTS	MACRO Pin	FTS	«SQL» Colour	Pin
Red signal	11	9	11	1	Yellow	2
Other(s) common	23	10	28	2	Grn/Brn	7
Shield (if available)	not connected				Grn/Brn	7

3.3. Contact Bounce

There is an RC filter factory-fitted to eliminate contact bounce. This ensures that there is only one pulse per bucketful of water.

Early models did not include this RC filter. If you discover errors due to contact bounce, it is recommended that you install this filter. You can verify that this error is occurring by observing the Counter channel's memory location in **Scheme Test Mode**.

470 ohms
Resistor

Reed Switch

0.1 uF
Capacitor

Counter Input

Common
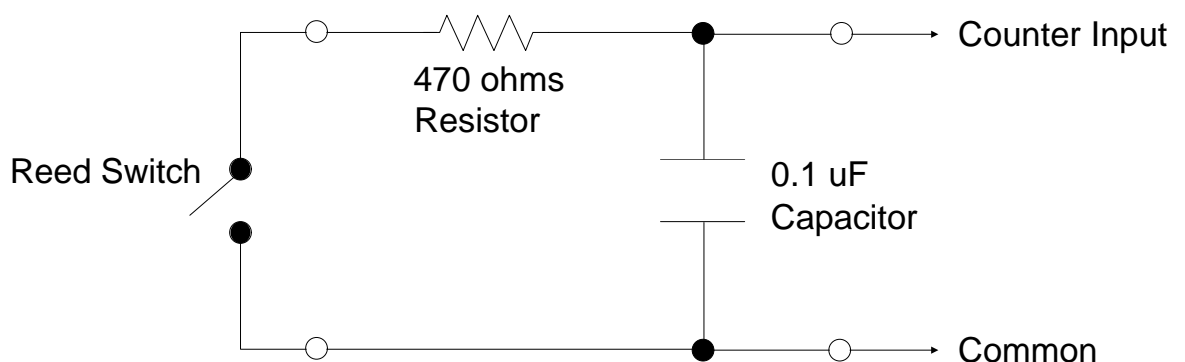
4. SPECIFICATIONS

Sensitivity:	0.2 mm preadjusted.
	Adjustable from 0.1 to 0.5mm
Range:	0 to 200mm of rain per hour
Accuracy:	4% up to 200 mm/hour
Contact Time:	40 milliseconds
Signal element:	Glass encapsulated reed switch 15VA AC or DC
	with debounce CCT fitted
Cable:	PVC 2-wire, shielded, 5m supplied
Material:	Painted funnel, polished stainless steel,
	cast alloy base
Size:	340mm height, 220mm diameter
Funnel:	203mm diam (0.3mm)
Weight:	3 kg

5. TESTING

To determine whether a Rain Gauge is calibrated properly and operating correctly you can use the test facility in STARLOG Software. This section describes how to test and calibrate the instrument.

5.1. Using Scheme Test Mode (Version 3 Software)

When connected to a STARLOG Data Logger, a computer running Version 3 for STARLOG Software can be used to interrogate a Rainfall Gauge for real time data readings and programming information.

1. Connect the Instrument to the Data Logger (see section 3). Use pin#11, Counter Channel 0, as the signal input pin.

2. Connect the STARLOG Data Logger to the computer.

3. Start STARLOG Software.

4. Select the Rainfall Monitoring Scheme (or create one, if you haven't yet).

5. If the Scheme has not been loaded, choose **Program Logger with Scheme** from the Control Panel. If the STARLOG Data Logger is loaded with the Scheme, then...

6. From the Scheme's Control Panel, select **Scheme Test Mode**.

7. View the display to determine how the scheme is operating. The Test Window (upper window) displays scheme information from the Data Logger and its content is updated every Scan. The Log Entry Window (lower window) displays what has been logged.

   You can also use Scheme Test Mode to create your own Test Screens. (See the Users Manual, 6245)

5.2. Using the Test a Logger Menu (Version 2 Software)

There are two ways to begin the **Test a Logger** process. Directly from the main menu you can select the **Test a Logger** option. Alternatively, if you have created and loaded a Rainfall Monitoring Scheme, you can select the **Test a Scheme** option from the **Maintain Schemes** menu. A test screen for this scheme will be available in the **Test a Logger** menu.

For the Tipping Bucket Rain Gauge, you will want to examine Address 25, 26 or 27 depending on which channel you use (see the table).

Channel	Address
c0	25
c0U	26
c0L	27

1. Connect the Tipping Bucket Rain Gauge to the Data Logger as outlined in section 3.2 Connections.

2. Connect the Data Logger to your computer (see the STARLOG Users Manual if you don't know how to do this).

3. Start STARLOG Software and then select **Test a Logger** from the main menu.

   The test screen which appears first shows you a few scheme details and a grid of addresses.

4. Press Alt-A or press the spacebar and select **Address Offset** from the **Test a Logger** menu.

   Offset the address to look at that portion of Logger memory used by the Counter Channel 0 (or whichever channel you are using).

5. Enter 24 in the **Address Offset** menu, then press **F2** to process this change.

6. To manually operate the tipping bucket, remove the stainless steel cover and tip the bucket up and down.

   The number which appears in the test screen should change as you tip the bucket. If the reading is erratic or nonsensical, check that the connections are sound and that the correct address is being displayed.

5.3. Calibration

The Rainfall Gauge is factory calibrated to tip at 0.2mm of rainfall. If the Rain Gauge is required to tip at a different amount of rainfall use the following calibration procedure. This procedure explains how to calibrate for 0.4 mm, this is equivalent to 12.96 ml per bucket. (Refer to the calibration table below.)

1. With a large screwdriver turn one bucket stop shaft till the bucket will hold its maximum.

2. Pipette 12.96 ml, (13.0 ml will ensure sufficient accuracy), into the bucket.

3. Turn the bucket stop shaft carefully until the bucket tips. Do this with the other bucket.

4. Replace the funnel and pour 650 ml at a slow drip rate into the funnel and expect 50 counts.

5. Make minute adjustments as necessary.

5.3.1. Calibration Table

Sensitivity Required	Bucket Capacity	Testing Volume for 10 mm Rainfall
0.2 mm	6.48 mm each	324 ml
0.4 mm	13.0 mm each	324 ml
0.5 mm	16.2 mm each	324 ml

5.3.2. Testing Calibration

Measure a volume of water corresponding to 10mm of rainfall using a rainfall gauge (or measure out 324ml of water. 1mm of rain into 200mm is approximately 32.4ml).

Very slowly (over a 15 minute period) pour the water into the 203mm funnel. When all the water has passed through the recorder, the Logger should have registered 50 counts (10 mm) for a sensitivity of 0.2mm. You can check this with STARLOG Software.

6. MAINTENANCE

Regular inspection once a month is required to:

- Clear the receiver of fallen leaves and dust
- Check that the rainwater falls into the bucket properly.
- Check that the bearing of the tipping bucket is clean.
- Check that the instrument is still level.

Appendix A
Using a Portable Data Logger

To use a Portable Data Logger with this instrument, you will want to ensure that both the scan rate switch and the counter channel switches are set correctly. For Rainfall Monitoring Schemes the default setting of 5 seconds is acceptable.

A.1. Set Scan Rate Switch

This switch is set at 5 seconds when delivered from the factory. If this scheme uses a different scan rate or you have changed the switch setting since your logger arrived from the factory, remember to set the switch.

A.2. Counter Channel Capacity

Signals from the Tipping Bucket Rainfall Gauge to the Data Logger can be detected using an 8-bit counter channel. Usually, a 4-bit channel could also be used. Ensure that the counter switches are set appropriately.

A.3. Prescale Setting

The prescale for Counter Channel 0, C0 (or any other channel you use to log rain data), should be set to 1. This is the default setting of a Portable Data Logger.

This setting ensures that there is no prescaling of data - the relationship of data measured to data logged is 1:1.

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