INSTRUCTION MANUAL

TE525 Tipping Bucket Rain Gage

Revision: 8/04

Warranty and Assistance

The **TE525 TIPPING BUCKET RAIN GAGE** is warranted by CAMPBELL SCIENTIFIC, INC. to be free from defects in materials and workmanship under normal use and service for twelve (12) months from date of shipment unless specified otherwise. Batteries have no warranty. CAMPBELL SCIENTIFIC, INC.'s obligation under this warranty is limited to repairing or replacing (at CAMPBELL SCIENTIFIC, INC.'s option) defective products. The customer shall assume all costs of removing, reinstalling, and shipping defective products to CAMPBELL SCIENTIFIC, INC. CAMPBELL SCIENTIFIC, INC. will return such products by surface carrier prepaid. This warranty shall not apply to any CAMPBELL SCIENTIFIC, INC. products which have been subjected to modification, misuse, neglect, accidents of nature, or shipping damage. This warranty is in lieu of all other warranties, expressed or implied, including warranties of merchantability or fitness for a particular purpose. CAMPBELL SCIENTIFIC, INC. is not liable for special, indirect, incidental, or consequential damages.

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CAMPBELL SCIENTIFIC, INC.
RMA#_____
815 West 1800 North
Logan, Utah 84321-1784

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Tables

TE525 Tipping Bucket Rain Gage

1. General Description

The TE525 is an adaptation of the standard Weather Bureau tipping bucket rain gage. Output is a switch closure for each bucket tip. Three models are available:

- TE525 6 in. Collector 0.01 in. tip
- TE525WS 8 in. Collector 0.01 in. tip
- TE525MM 9.6 in Collector 0.1 mm tip

A "–L" after the model number indicates that the cable length is specified when ordering.

2. Specifications

Range of Indication:

Infinite in increments of tip (least count) of rainfall.

Rainfall per Tip

TE525	0.01 in.
TE525WS	0.01 in.
TE525MM	0.1 mm

Accuracy:

Rainfall Rate	TE525	TE525WS
Up to 1 in./hr	±1%	±1%
1 to 2 in./hr	+0, –3%	+0, –2.5%
2 to 3 in./hr	+0, –5%	+0, –3.5%

Rainfall Rate	TE525MM
Up to 10 mm/hr	±1%
10 to 20 mm/hr	+0, –3%
20 to 30 mm/hr	+0, –5%

Signal Output:

Momentary switch closure activated by tipping bucket mechanism. Switch closure is approximately 135 ms.

Calibration/Cleaning Frequency:

Sensor is factory calibrated and should not require field calibration. Debris filters, funnel, and bucket reservoirs should be kept clean. Section 6 describes field calibration check and factory calibration.

Environmental Limits:

Temperature: 0° to +50°C
Humidity: 0 to 100%

Physical Data:

Diameter: 6.25 in. overall

Height

TE525	9.5 in.
TE525WS	12 in.
TE525MM	12 in.

Weight: 2.5 pounds

Funnel: Gold anodized spun aluminum knife edge collector ring and funnel assembly.

Funnel Collector Diameter:

TE525	6.064 in.
TE525WS	8 in.
TE525MM	9.664 in.

Resolution: 1 tip

Mounting: Side bracket with clamps for pole or mast mounting

Material: Aluminum

Cable: 2-conductor, shielded cable, length must be specified when ordering.

NOTE

The black outer jacket of the cable is Santoprene® rubber. This compound was chosen for its resistance to temperature extremes, moisture, and UV degradation. However, this jacket will support combustion in air. It is rated as slow burning when tested according to U.L. 94 H.B. and will pass FMVSS302. Local fire codes may preclude its use inside buildings.

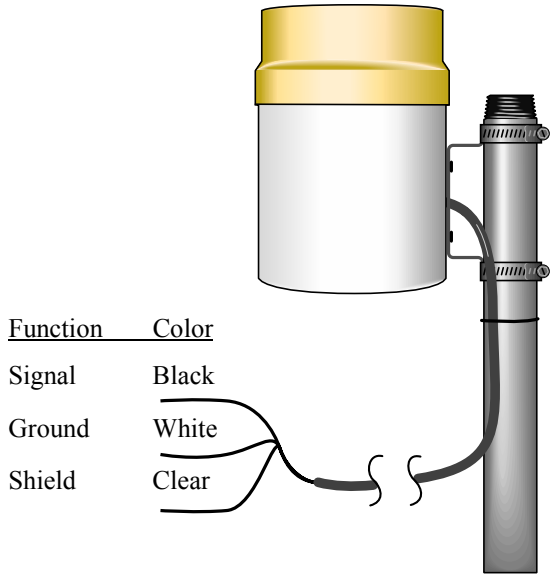

FIGURE 2-1. TE525 Tipping Bucket Rain Gage

3. Installation

3.1 Location

The rain gage should be mounted in a relatively level spot which is representative of the surrounding area. The lip of the funnel should be horizontal and at least 30 cm. above the ground. It should be high enough to be above the average snow depth. The ground surface around the rain gage should be natural vegetation or gravel. It should not be paved.

The rain gage should be placed away from objects that obstruct the wind. The distance should be 2 to 4 times the height of the obstruction.

When leveling, be sure that the funnel is properly seated in the body of the gage and that:

- the orifice is level
- the body of the sensor is vertical (plumb).

3.2 Mounting

The TE525 rain gage mounts to a 1 ½ inch post or pipe. Set the post or drive the pipe as nearly vertical as possible. Use the enclosed hose clamps to mount the gage as shown in Figure 2-1. The lip of the gage should be at least 2 inches above the post or pipe. Level the rain gage after mounting it.

NOTE Before final leveling, press either end of the bucket down against its stop to make sure the bucket is NOT hung up in the center.

4. Wiring

TABLE 4-1. Wiring for Pulse Channel Input

Color	Function	CR10(X), CR510, CR1000	21X, CR7, CR23X	CR200 Series
Black	Signal	Pulse Channel	Pulse Channel	P_SW
White	Signal Return	G	⏚	**G**
Clear	Shield	G	⏚	**G**

TABLE 4-2. Wiring for Control Port Input

Color	Function	CR10(X), CR510, CR1000	CR23X
Black	Signal	Control Port	Control Port
White	Signal Return	5 V	5 V
Clear	Shield	G	⏚

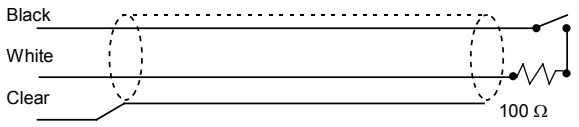

FIGURE 4-1. Rain Gage Schematic

In a long cable there is appreciable capacitance between the lines. A built up charge could cause arcing when the switch closes, shortening switch life. A 100 ohm resistor is connected in series at the switch to prevent arcing by limiting the current (Figure 4-1). This resistor is installed on all rain gages currently sold by Campbell Scientific.

5. Datalogger Programming

This section discusses the instructions used to measure the rain gage in a datalogger program. An alternative to writing a program yourself is using the Short Cut program builder. With Short Cut, the appropriate sensor model and output units are selected and Short Cut creates the program.

The rain gage is measured using Instruction 3 with the switch closure configuration code. The multiplier used in Instruction 3 determines the units in which rainfall is reported.

TABLE 5-1. Multipliers for Rain Measurement

Rain Gage	0.01 in	in	0.1 mm	mm
TE525	1.0	0.01	2.54	0.254
TE525WS	1.0	0.01	2.54	0.254
TE525MM	0.394	0.00394	1.0	0.1
TE525 or TE525MM w/8" funnel	0.57456	0.0057	1.459	0.1459

The volume of water required to cause a tip in the TE525 and the TE525MM is the same. The difference in calibration is strictly due to funnel size. If the CS705 Snowfall Adapter or other eight inch funnel is installed on these gages, use a multiplier from the last row in Table 5-1. (The CS705 will not install directly on the TE525MM; the MM funnel must first be replaced with an eight inch funnel.)

5.1 Pulse Channel Example

The following example program uses a pulse channel to read the output from the rain gage and will work with the CR510, CR10(X), 21X or CR23X. The CR7 is similar but has an additional parameter in Instruction 3 to specify the slot that the Pulse Card is in.

TABLE 5-2. Wiring for Pulse Channel Example			
Color	**Function**	**CR10(X), CR510**	**21X, CR7, CR23X**
Black	Signal	Pulse Channel 1	Pulse Channel 1
White	Signal Return	G	⏚
Clear	Shield	G	⏚

The following example measures a TE525 rain gage in mm. A different multiplier would be entered (Table 5-1) for other units.

```
01:  Pulse (P3)
   1:   1              Reps
   2:   1              Pulse Channel 1
   3:   2              Switch Closure, All Counts
   4:   1              Loc [ Rain_mm   ]
   5:   0.254          Mult                  (mm)
   6:   0              Offset
```

Output Instruction 72, Totalize, is used in the output section of the program to output the total rainfall over the output interval.

5.2 Control Port Example

The CR510, CR10, CR10X, and CR23X have the capability of counting switch closures on some of their control ports. When a control port is used, the return from the rain gage switch must be connected to + 5 volts on the datalogger.

TABLE 5-3. Wiring for Control Port Example			
Color	**Function**	**CR10(X)**	**CR23X**
Black	Signal	Control Port 8	Control Port 8
White	Signal Return	5 V	5 V
Clear	Shield	G	⏚

The following example is for the CR10X and CR23X. The CR10 does not support the use of control port inputs with Instruction 3; use Short Cut or see example 8.5 in the CR10 operator's manual.

This example measures a TE525 rain gage in inches. A different multiplier would be entered (Table 5-1) for other units.

```
01:  Pulse (P3)
   1:   1              Reps
   2:   8              Control Port 8
   3:   2              Switch Closure, All Counts
   4:   1              Loc [ Rain_in   ]
   5:   0.01           Mult                  (inches)
   6:   0              Offset
```

Output Instruction 72, Totalize, is used in the output section of the program to output the total rainfall over the output interval. This instruction should be executed every scan and not placed in a subroutine or conditional statement.

5.3 CR1000 Sample Program

```
'CR1000
'TE525/TE525WS & TE525MM sample program
Public Rain_mm
Units Rain_mm=mm
DataTable(Rain,True,-1)
    DataInterval(0,60,Min,0)
    Totalize(1,Rain_mm,FP2,0)
EndTable

BeginProg
    Scan(1,Sec,1,0)
        'For TE525MM Rain Gauge, use multiplier of 0.1 in PulseCount instruction
        PulseCount(Rain_mm,1,1,2,0,0.254,0)
        CallTable(Rain)
    NextScan
EndProg
```

5.4 CR200 Series Sample Program

```
'CR200 Series

'Declare Variables and Units
Public Rain_mm

Units Rain_mm=mm

'Define Data Tables
DataTable(Rain,True,-1)
    DataInterval(0,60,Min)
    Totalize(1,Rain_mm,0)
EndTable

'Main Program
BeginProg
    Scan(1,Sec)
        'TE525/TE525WS Rain Gauge measurement Rain_mm:
        PulseCount(Rain_mm,P_SW,2,0,0.254,0)
        'Call Data Tables and Store Data
        CallTable(Rain)
    NextScan
EndProg

'For TE525MM Rain Gauge, use multiplier of 0.1 in PulseCount instruction
```

6. Maintenance

The funnel and bucket mechanism must be kept clean. Routinely check for and remove any foreign material, dust, insects, etc. The following calibration check is advised every 12 months.

Field Calibration Check:

(1) Secure a metal can that will hold at least one quart of water.

(2) Punch a very small hole in the bottom of the can.

(3) Place the can in the top funnel of the rain gage and pour 16 fluid ounces (1 pint) of water into the can. (A 16 oz. soft drink bottle filled to within 2.5 inches of the top may be used for a rough field calibration. An exact volume will allow for a more precise calibration).

(4) If it takes less than 45 minutes for this water to run out, the hole in the can is too large.

(5) The following number of tips should occur:

TE525, TE525MM	100 ± 3
TE525WS	57 ± 2

(6) Adjusting screws are located on the bottom adjacent to the large center drain hole. Adjust both screws the same number of turns. Rotation clockwise increases the number of tips per 16 oz. of water; counter clockwise rotation decreases the number of tips per 16 oz. of water. One half turn of both screws causes a 2% to 3% change.

(7) Check and re-level the rain gage lid.

Factory Calibration:

If factory calibration is required, contact Campbell Scientific to obtain an RMA (see Warranty and Assistance at front of manual.

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