INSTRUCTION MANUAL

TE525 Tipping Bucket Rain Gage

Revision: 10/10

®
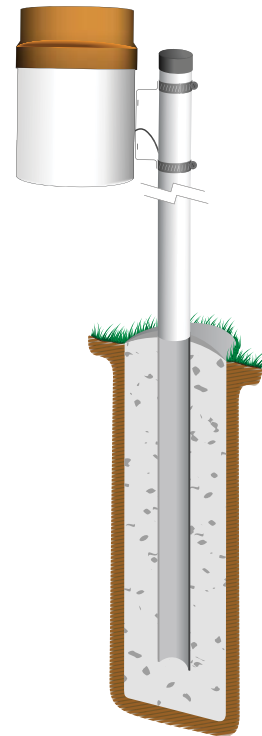
Warranty and Assistance

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.

Products may not be returned without prior authorization. The following contact information is for US and International customers residing in countries served by Campbell Scientific, Inc. directly. Affiliate companies handle repairs for customers within their territories. Please visit www.campbellsci.com to determine which Campbell Scientific company serves your country.

To obtain a Returned Materials Authorization (RMA), contact Campbell Scientific, Inc., phone (435) 753-2342. After an applications engineer determines the nature of the problem, an RMA number will be issued. Please write this number clearly on the outside of the shipping container. Campbell Scientific's shipping address is:

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

For all returns, the customer must fill out a "Declaration of Hazardous Material and Decontamination" form and comply with the requirements specified in it. The form is available from our website at www.campbellsci.com/repair. A completed form must be either emailed to repair@campbellsci.com or faxed to 435-750-9579. Campbell Scientific will not process any returns until we receive this form. If the form is not received within three days of product receipt or is incomplete, the product will be returned to the customer at the customer's expense. Campbell Scientific reserves the right to refuse service on products that were exposed to contaminants that may cause health or safety concerns for our employees.

TE525 Table of Contents

PDF viewers note: These page numbers refer to the printed version of this document. Use the Adobe Acrobat® bookmarks tab for links to specific sections.

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.

The TE525 ships with:

(1) Calibration sheet
(2) Hose clamps from original mfg
(1) Instruction manual
(3) Screws from original mfg

The 260-953 Alter-Type Wind Screen can be used with the TE525 to minimize the effects of strong winds.

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

Volume per Tip
    TE525, TE525MM: 0.16 fl. oz./tip (4.73 ml/tip)
    TE525WS: 0.28 fl. oz./tip (8.24 ml/tip)

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.

3. Installation

NOTE   The 260-953 Alter-Type Wind Screen's siting information and
installation procedure are provided in our 260-953 manual.

3.1 Siting

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 CM300 Series mounting poles provide a stainless steel 1.5 IPS vertical pole for mounting the TE525 rain gage. Pole length is 23", 47", or 56" for the CM300, CM305, and CM310 models respectively. The CM300 Series offers pedestal base options as well, as shown in Figure 3-2.

Use the enclosed hose clamps to mount the gage as shown in Figure 3-1. The lip of the gage should be at least 2 inches above the post or pole. 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.
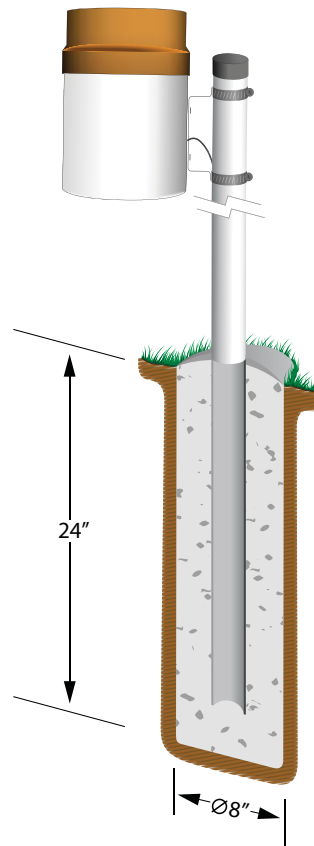

FIGURE 3-1. TE525 Tipping Bucket Rain Gage
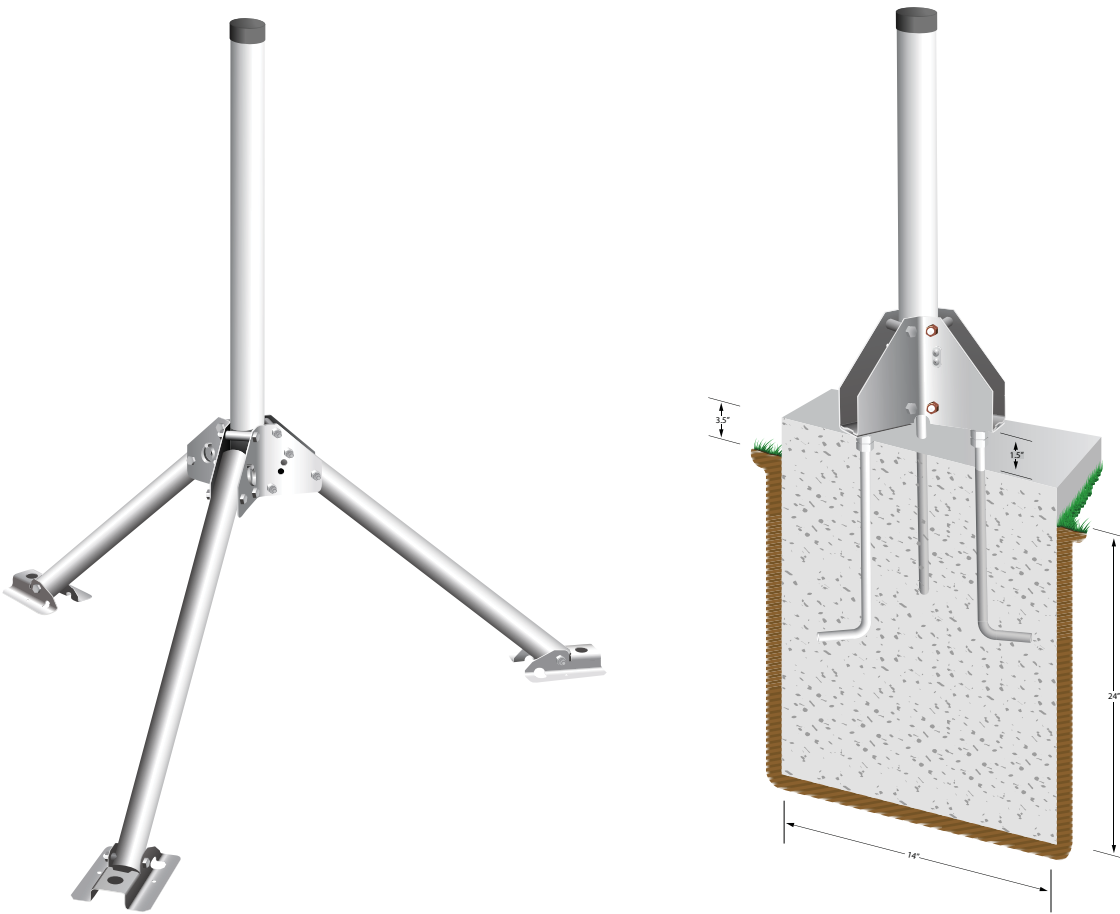
FIGURE 3-2. Pedestal Base Options

4. Wiring

When Short Cut software is used to generate the datalogger program, the sensor should be wired to the channels shown on the wiring diagram created by Short Cut.

The rain gage is typically wired to a datalogger's pulse channel (see Table 4-1).

TABLE 4-1. Wiring for Pulse Channel Input					
Color	**Description**	**CR800 CR1000 CR3000 CR5000**	**CR510 CR500 CR10(X)**	**21X CR7 CR23X**	**CR200(X) Series**
Black	Signal	Pulse Channel	Pulse Channel	Pulse Channel	P_SW
White	Signal Return	⏚	G	⏚	⏚
Clear	Shield	⏚	G	⏚	⏚

Dataloggers listed in Table 4-2 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.

Color	Description	CR800 CR1000 CR3000	CR500 CR510	CR10X	CR23X
Black	Signal	Control Port	C2/P3	Control Port	Control Port
White	Signal Return	5 V	5 V	5 V	5 V
Clear	Shield	⏚	⏚	G	⏚

TABLE 4-2. Wiring for Control Port Input

The CR10 does not support the use of control port inputs with the Pulse Count instruction.
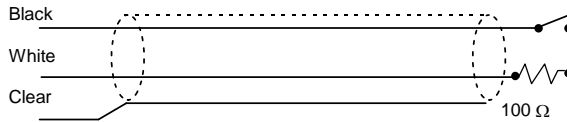

FIGURE 4-1. Rain Gage Schematic

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 is for users who write their own programs. A datalogger program to measure this sensor can be generated using our Short Cut Program Builder software. You do not need to read this section to use Short Cut.

The rain gage is measured using the Pulse Count instruction with the switch closure configuration code. The multiplier used in the Pulse Count instruction determines the units in which rainfall is reported (see Table 5-1).

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 Count Example Programs

The following example programs use a pulse channel to read the output from the rain gage. The CR1000 example will also work with the CR800, CR850, CR3000, and CR5000. CR9000(X) programming is similar to the CR1000 except it has an additional parameter in the PulseCount instruction to specify the pulse module's slot. The CR10X program will also work with the CR500, CR510, CR10, 21X or CR23X. CR7 programming is similar to the CR10X but has an additional parameter in the PulseCount instruction to specify the slot that the Pulse Card is in.

5.1.1 CR1000 Example 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 Gage, use multiplier of 0.1 in PulseCount instruction
        PulseCount(Rain_mm,1,1,2,0,0.254,0)
        CallTable(Rain)
    NextScan
EndProg
```

5.1.2 CR200(X) Series Example Program

```
'CR200(X) 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 Gage 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 Gage, use multiplier of 0.1 in PulseCount instruction
```

5.1.3 CR10X Example Program

```
;{CR10X}
*Table 1 Program
  01: 1.0000              Execution Interval (seconds)

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

2:  If time is (P92)
  1:   0                  Minutes (Seconds --) into a
  2:   60                 Interval (same units as above)
  3:   10                 Set Output Flag High (Flag 0)

3:  Set Active Storage Area (P80)
  1:   1                  Final Storage Area 1
  2:   101                Array ID

4:  Real Time (P77)
  1:   1220               Year,Day,Hour/Minute (midnight = 2400)

5:  Totalize (P72)
  1:   1                  Reps
  2:   3                  Loc [ Rain_mm   ]

*Table 2 Program
  01: 0                   Execution Interval (seconds)

*Table 3 Subroutines

End Program
```

7

5.2 Control Port Examples

These examples measure a TE525 rain gage in mm. A different multiplier would be entered (Table 5-1) for other units.

5.2.1 CR1000 Example Program

```
'CR1000
'Declare Public Variables and Units
Public Rain_mm
Units Rain_mm=mm

DataTable (Rain,True,-1)
    DataInterval (0,60,Min,0)
    Totalize (1,Rain_mm,FP2,0)
EndTable

'Main Program
BeginProg
    Scan (1,Sec,1,0)
        'For TE525MM Rain Gage use multiplier of 0.1 in PulseCount Instruction.
        PulseCount (Rain_mm,1,18,2,0,.254,0)
        CallTable (Rain)
    NextScan
EndProg
```

5.2.2 CR10X Example Program

```
;{CR10X}
;
*Table 1 Program
  01: 1                 Execution Interval (seconds)

1:  Pulse (P3)
  1:  1                 Reps
  2:  8                 Control Port 8 (switch closure only)   ;Black wire connect to C8
  3:  2                 Switch Closure, All Counts
  4:  1                 Loc [ Rain_mm   ]
  5:  .254              Multiplier
  6:  0                 Offset

2:  If time is (P92)
  1:  0                 Minutes (Seconds --) into a
  2:  60                Interval (same units as above)
  3:  10                Set Output Flag High (Flag 0)

3:  Set Active Storage Area (P80)
  1:  1                 Final Storage Area 1
  2:  101               Array ID
```

```
4: Real Time (P77)
  1:  1220                Year,Day,Hour/Minute (midnight = 2400)

5: Totalize (P72)
  1:  1                   Reps
  2:  1                   Loc [ Rain_mm   ]

*Table 2 Program
  02: 0.0000              Execution Interval (seconds)

*Table 3 Subroutines

End Program
```

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

6. Troubleshooting

6.1 Precipitation

Symptom: No Precipitation

1. Check that the sensor is wired to the Pulse Channel specified by the pulse count instruction.

2. Verify that the Configuration Code (Switch Closure), and Multiplier and Offset parameters for the Pulse Count instruction are correct for the datalogger type.

3. Disconnect the sensor from the datalogger and use an ohm meter to do a continuity check of the switch. The resistance measured at the terminal block on the inside of the bucket between the black and white leads should vary from infinite (switch open) when the bucket is tipped, to less than an ohm when the bucket is balanced.

7. 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).

Campbell Scientific Companies

Campbell Scientific, Inc. (CSI)
815 West 1800 North
Logan, Utah 84321
UNITED STATES
www.campbellsci.com • info@campbellsci.com

Campbell Scientific Africa Pty. Ltd. (CSAf)
PO Box 2450
Somerset West 7129
SOUTH AFRICA
www.csafrica.co.za • cleroux@csafrica.co.za

Campbell Scientific Australia Pty. Ltd. (CSA)
PO Box 444
Thuringowa Central
QLD 4812 AUSTRALIA
www.campbellsci.com.au • info@campbellsci.com.au

Campbell Scientific do Brazil Ltda. (CSB)
Rua Luisa Crapsi Orsi, 15 Butantã
CEP: 005543-000 São Paulo SP BRAZIL
www.campbellsci.com.br • suporte@campbellsci.com.br

Campbell Scientific Canada Corp. (CSC)
11564 - 149th Street NW
Edmonton, Alberta T5M 1W7
CANADA
www.campbellsci.ca • dataloggers@campbellsci.ca

Campbell Scientific Centro Caribe S.A. (CSCC)
300 N Cementerio, Edificio Breller
Santo Domingo, Heredia 40305
COSTA RICA
www.campbellsci.cc • info@campbellsci.cc

Campbell Scientific Ltd. (CSL)
Campbell Park
80 Hathern Road
Shepshed, Loughborough LE12 9GX
UNITED KINGDOM
www.campbellsci.co.uk • sales@campbellsci.co.uk

Campbell Scientific Ltd. (France)
Miniparc du Verger - Bat. H
1, rue de Terre Neuve - Les Ulis
91967 COURTABOEUF CEDEX
FRANCE
www.campbellsci.fr • info@campbellsci.fr

Campbell Scientific Spain, S. L.
Avda. Pompeu Fabra 7-9, local 1
08024 Barcelona
SPAIN
www.campbellsci.es • info@campbellsci.es

Please visit www.campbellsci.com to obtain contact information for your local US or International representative.