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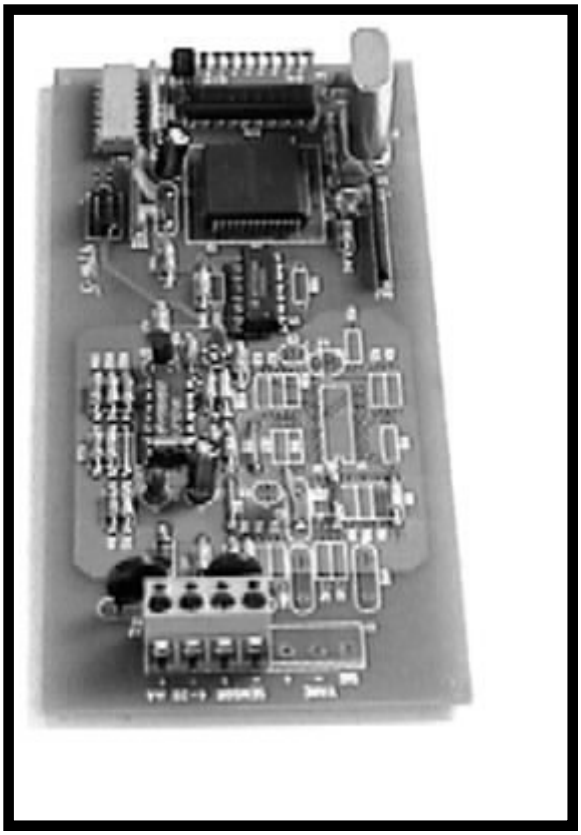

A70-R
Rainfall Transmitter
Instruction Manual

Document # 1142H

ISO 9001 Registered

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Figure 1
Ramp Mode Output Signal

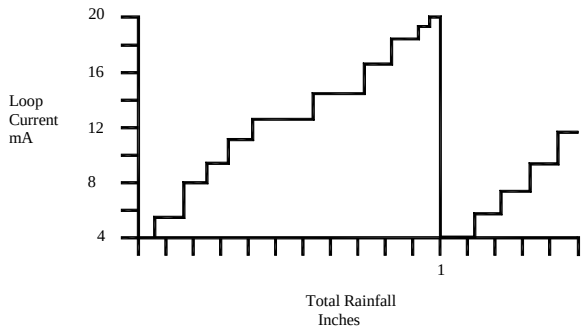
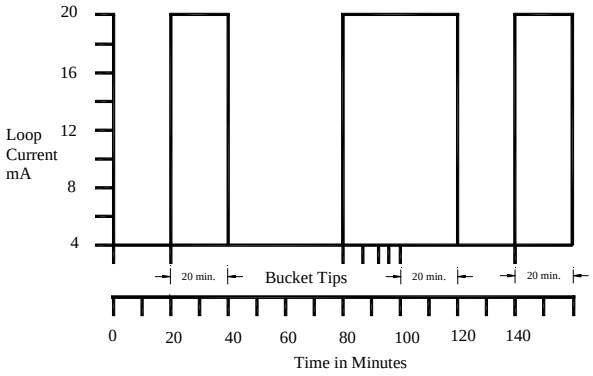


Figure 2
Rain Detector Mode Output Signal



INTRODUCTION

The A70 Rainfall Transmitter converts the signal from the tipping bucket rain gage into an electrical signal for input to a computer, meters or other instrumentation. It features reliability, low cost, low power drain, accuracy, simplicity of operation and ruggedness.

In ramp mode each tip of the bucket causes the output signal to increase 1% of full scale.

Each complete excursion of the output signal from zero to full scale represents 100 tips of the bucket. This corresponds to one inch or 100 mm of rainfall depending on the calibration of the rain gage. During periods of no rain there is no change in the output signal.

In rain detector mode each tip of the bucket causes the output to change to full scale for a user selectable time period of 1 to 80 minutes. The timer in the rainfall detector mode is retriggerable meaning that a new time period starts with each tip of the bucket. If bucket tips occur faster than the selected time period the output will remain continuously at full scale.

Running average and other signal output formats are available. Contact Comptus for additional information.

The Transmitter is protected from lightning damage with metal oxide varistors.

SPECIFICATIONS

Operating Power	12-24 Vdc
Input Device:	Tipping Bucket Rain Gage
Output:	Rainfall 4 to 20 mA 1 - 80 minute period pulse
Range:	/E - 1 inch, /M - 25 mm
Resolution:	/E 0.01 inch, /M 0.25 mm
Accuracy:	Electronics: +/- 1 % Rain Gage: See Spec. for gage supplied
Temperature Range:	Electronics - 0 to 70 Degrees C. -40 to 70 Degrees C. available
Dimensions:	PWB: 6."l X 2.75"w X 1"h
Weight:	Transmitter Track Mount - 1 lb.
Maintenance:	Recalibrate system yearly
Connectors:	Terminal Strip to accept AWG #12 to #22 Wire
Accessories:	A70-EO Power Supply A70-LPD Loop Powered Display A96 Lightning Arrestor

DESCRIPTION

The system consists of the rain gage and Transmitter. The rain gage is fabricated of heavy duty PVC, aluminum and stainless steel. It consists of an outer funnel, screen, inner funnel and tipping bucket assembly.

Precipitation entering the collection orifice fills the calibrated tipping bucket assembly. When the bucket fills to the calibrated amount, the bucket tips. Another bucket is brought into place and the precipitation sample is discharged through the dump tubes to the ground below. This produces a switch closure which is detected by the electronics in the Transmitter.

The electronics in the Transmitter count the switch closures from the rain gage. In ramp mode the counter drives a digital to analog converter which produces a current signal which increases as counts are accumulated. The current signal drives the output amplifier.

In rain detector mode each tip of the bucket causes the output to change to full scale for a user selectable time period of 1 to 80 minutes. The timer in the rainfall detector mode is retriggerable meaning that a new time period starts with each tip of the bucket. If bucket tips occur faster than the selected time period the output will remain continuously at full scale

Running average and other signal output formats are available. Contact Comptus for additional information.

The electronics are protected from damage by lightning and high voltage surges with metal oxide varistors.

Accessories

Additional lightning protection is indicated if any of the cables connected to the instrument are buried or run on top of the ground for a distance of more than 100 feet. The A96 Series of Lightning Protectors are available for this purpose.

The A70-EO is a linear power supply suitable for providing operating power for the system from the AC mains. Two models are available that will provide 10 watts at either 15 or 24 VDC. It will operate from 105 - 130 VAC or 210 - 260 Vac, 50 / 60 Hz.

The A70-LPD is a loop powered display used when displays at multiple locations are required. It is simply installed in series with the 4 -20 mA loop and derives its power from the loop. Each display in the loop introduces a 2.5 volt drop. A 24 Vdc source of excitation is recommended for applications involving the A70-LPD.

INSTALLATION

Do not install this equipment in the same enclosure with a liquid electrolyte battery unless ventilation is provided. Various gasses emitted from the battery will cause both premature and intermittent circuit failure.

SENSOR LOCATION

It is necessary to shield the gage from the wind to obtain an accurate measure of precipitation. Trees, bushes and shrubbery provide natural shields from the wind. The gage must be clear of obstructions or surfaces that could drip or splash water into the orifice. The gauge should be located in the center of a circle clear of obstructions. The radius of the circle should be at least twice the height of the surrounding vegetation. If natural protection is unavailable, a wind shield will be required. In locations where heavy snowfall occurs the gauge should be mounted on a tower, high above the average snow level.

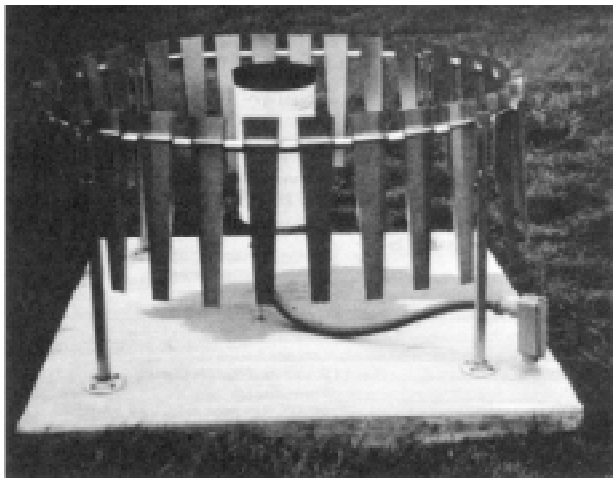
A stable, level mounting platform approximately 18 inches (0.5 meter) square is required to attach the rain gage. The platform can be fabricated of concrete, treated wood or any other suitable material.

Remove the funnel from the top of the gage and remove all packing material from it. Verify the bucket moves freely. The gage must be level to operate properly. Use a carpenter's level to check that the gage is level in all directions. Attach it to the mounting platform with 1/4" bolts. Washers can be used under the feet as shims to level the gage.

POWER SUPPLY

A 15 - 24 Vdc power supply is recommended for operation of this instrument. Voltage ripple must be less than 100 volts per second for proper operation. A 12 volt power supply can drive a current loop with a total resistance of 100 ohms. A 15 volt power supply can drive a current loop with a total resistance of 250 ohms. See Figure 4.

Before proceeding verify that the maximum resistance of the current loop including the wiring and sensing element does not exceed the maximum given by Formula 3. If this resistance is exceeded the loop current will not attain full scale. The resistance of various gages of copper wire is given in Table 1.



Wind Screen for Rain Gage

Table 1
Resistance of Copper Wire

Wire Gage AWG	Resistance in Ohms per foot
12	.0016
14	.0026
16	.0041
18	.0065
20	.0103
22	.0165
24	.0262

Figure 3
Component Layout

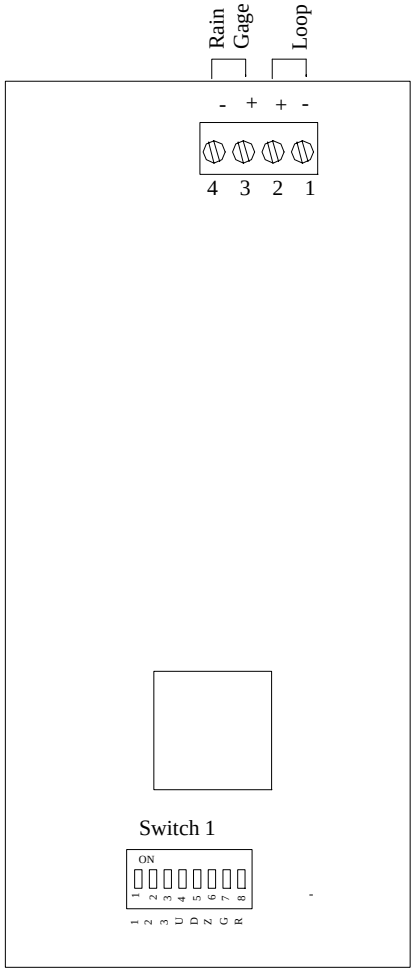


Figure 4
Graph of Maximum Loop Resistance

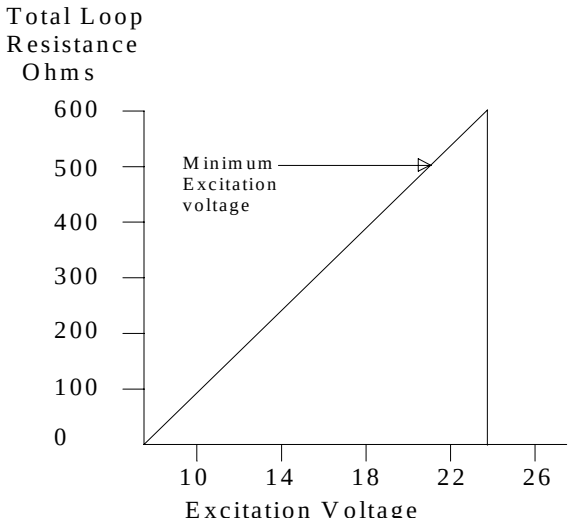


Figure 5
Transmitter Connection Diagram

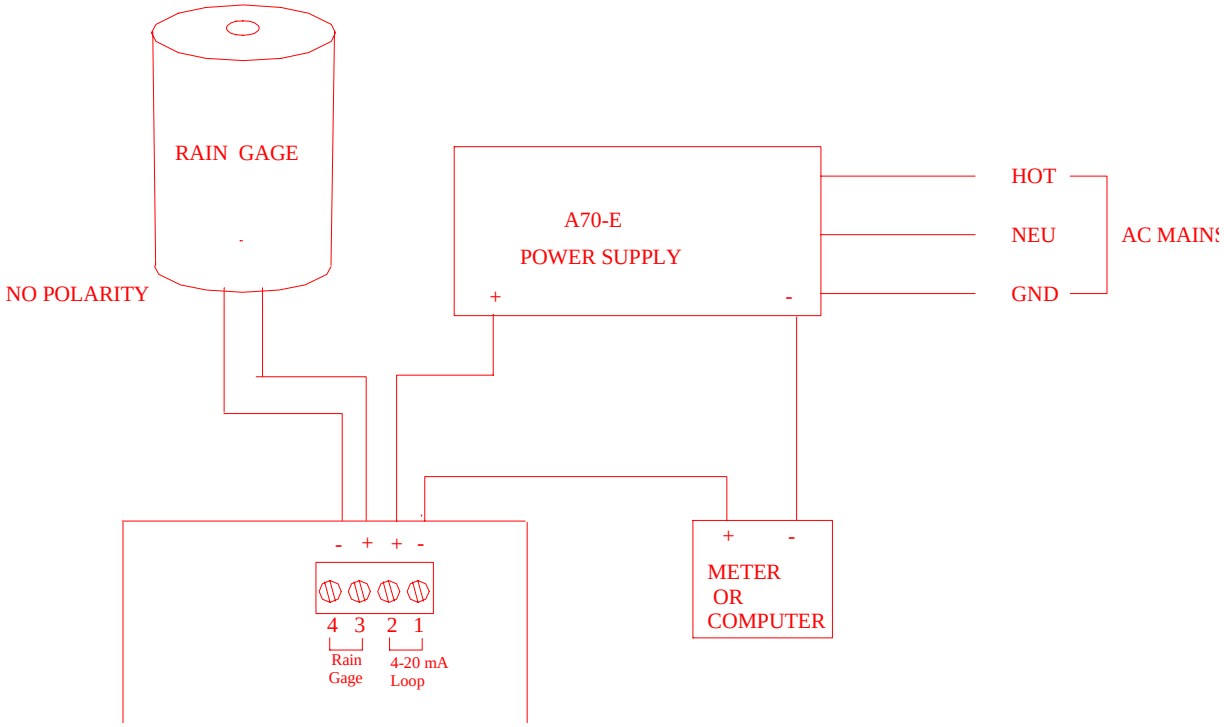


Figure 6
Multiple Transmitters Sharing One Power Supply

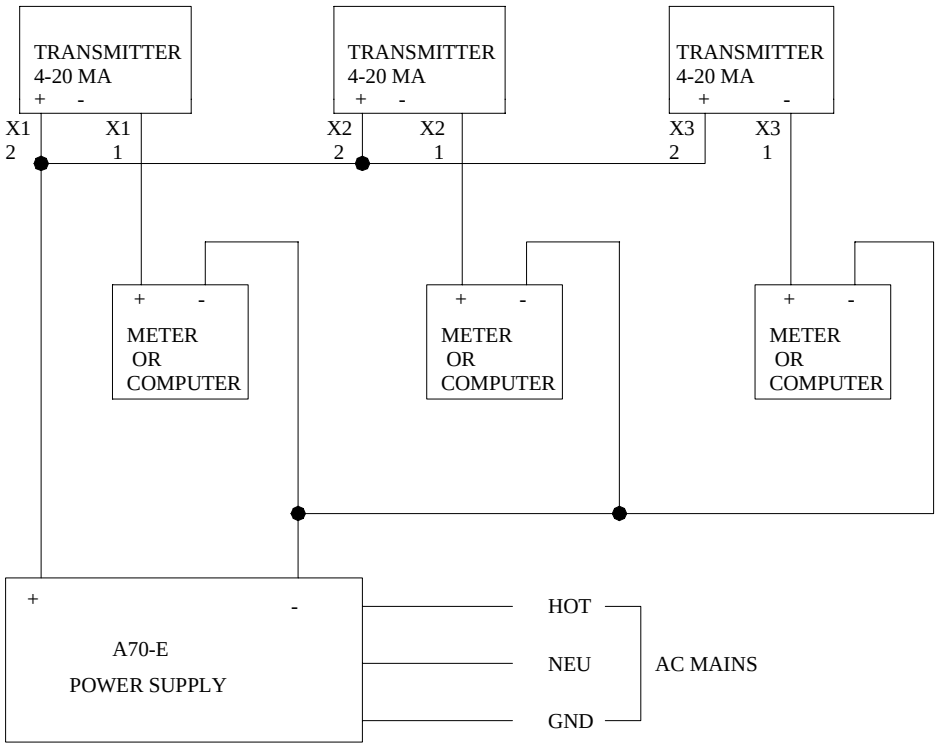
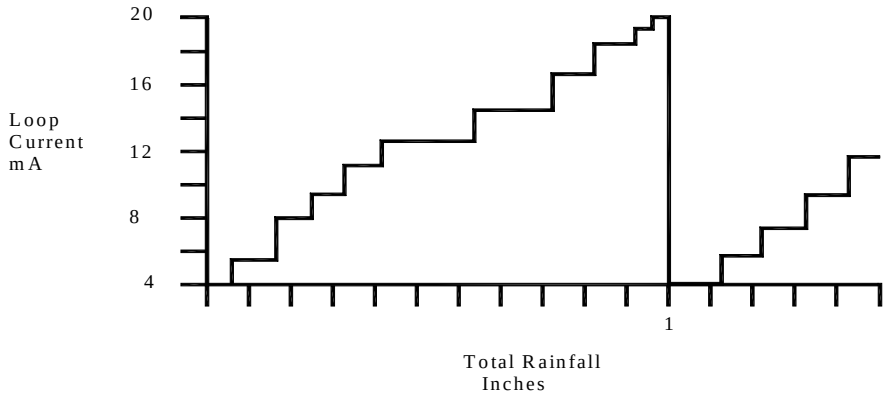


Figure7
Graph Ramp Mode Rainfall
Transfer Function



Wiring

1. Refer to Figure 3. The two wires from the gage should be attached to terminals 3 & 4 on the Transmitter circuit board. Polarity is not important.

2. Refer to Figure 3 & 5. Connect the output terminals 1(-) & 2 (+) to the desired meter on computer. Be sure to observe polarity.

OPERATION

Operation will commence when power is applied to the Transmitter. The output signal is initialized to 4 mA when operating power is applied or when the reset switch (R) on Switch 1 is moved to ON and then OFF.

Ramp Mode Transfer Function

R Rainfall in Inches
I Loop Current in Milliamperes

R = (I - 4mA) / 16 Formula 1

Ramp Mode

Select by moving switch 2 to off position. The loop current from the Transmitter in ramp mode increases in a staircase like manner, 1% for each .01 inch of rain. See Figure 7. When 1 inch of rainfall is accumulated (output signal is 20 mA), the output resets to 4 mA. Thus each step in the current represents 1/100 inch of rainfall.

Rain Detector Mode

Select by moving switch 2 to on position. This mode is intended to provide a signal to inhibit a machine or process when rain is detected. Each tip of the rain gage bucket causes the transmitter to output full scale output for a period of time from 1 to 80 minutes. The timer is retriggerable so that a new time period begins at each tip of the bucket. See Figure 8. See Figure 9. and calibration instructions for adjusting time period.

Figure 8
Rain Detector Mode Transfer Function

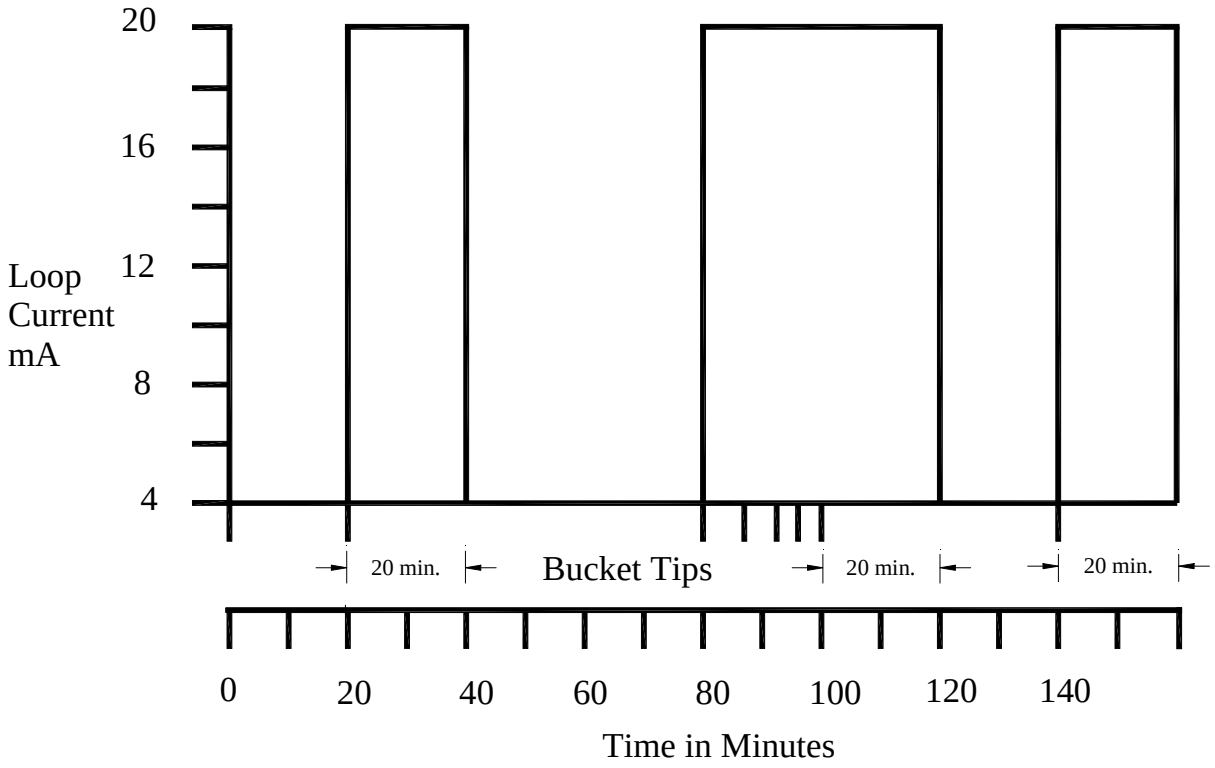
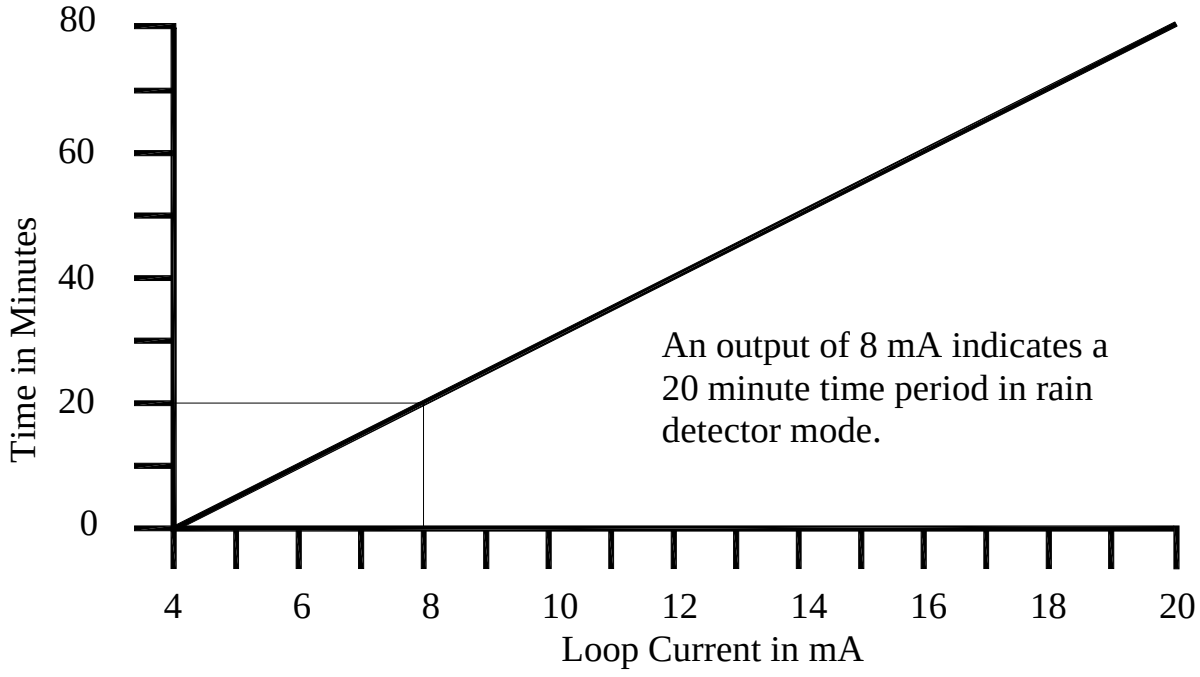


Figure 9
Rain Detector Timer Calibration



OPERATION *Continued*

Voltage Across Sensing Resistor

I Loop Current in Milliamperes
R Resistance in Ohms
V Voltage in Volts

V = I X R / 1000 Formula 2

Maximum Loop Resistance for 4 - 20 mA Output Transmitter

Rmax Maximum Loop Resistance
Vsup Supply Voltage

Rmax = (Vsup - 10 V) / 20 mA Formula 3

Gain & Zero Adjustments

Gain & Zero are set using switch 1. See Figure 3. Settings are stored in EEPROM and are retained when power is removed. Adjust Zero first to produce 4.08 mA output 0.5% of full scale). After Zero is set input 99 switch closures and adjust the Gain (Span) to produce 19.92 mA (99.5% of full scale). Follow instructions exactly or settings may not be stored permanently.

Switch 1 Controls

	1	Set Output to full scale
	2	Ramp / One Shot Mode
	3	Set One One Shot Time Period
U	4	Increase parameter
D	5	Decrease parameter
Z	6	Select Zero adjust
G	7	Select Gain adjust
R	8	Reset

Zero Adjust
1. Move R to ON
2. Move U to ON
3. Move D to ON
4. Move R to OFF
5. Move U to OFF
6. Move D to OFF
7. Move Z to ON
8. Move U or D ON & OFF as required
9. Move U or D to OFF
10. Move Z to OFF.

Gain Adjust
1. Move R to ON
2. Move U to ON
3. Move D to ON
4. Move R to OFF
5. Move U to OFF
6. Move D to OFF
7. Move SW 1 to ON
10. Move G to ON
11. Move U or D ON & OFF as required
12. Move U or D to OFF
13. Move G to OFF.
14. Move SW1 to OFF

Rain Detector Time Period Transfer Function

T Time in Minutes
I Loop Current in Milliamperes

T = (I - 4mA) / 16 X 80 minutes Formula 4

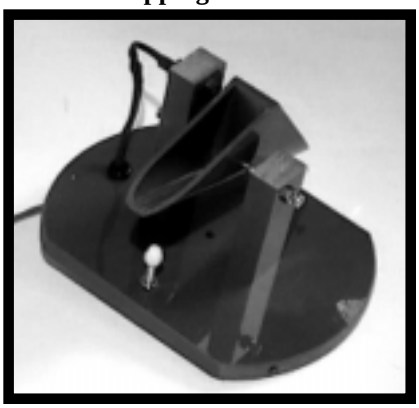
Example:
I - 8 mA
T = (8mA - 4mA) /16 X 80 minutes = 20 minutes

One Shot Time Period Adjust
1. Move R to ON
2. Move U to ON
3. Move D to ON
4. Move R to OFF
5. Move U to OFF
6. Move D to OFF
7. Move SW 3 to ON
8. Move U or D ON & OFF as required
9. Move U or D to OFF
10. Move SW3 to OFF

Note: Normal program execution is suspended while parameters are stored. Allow ten seconds for output to stabilize after final step of calibration.

Switch 1 loads the rainfall counter to assist in calibration. Closing Switch 1 loads 99 bucket tips.

Tipping Bucket



MAINTENANCE

Rain Gage

Check that the screen, bucket assembly and drainage holes are free of debris. The bucket and inner funnel should be carefully wiped clean.

Every six months the two bucket pivot points should be lubricated with a drop of light oil.

Once a year check that the gage is level and adjust if necessary.

Calibration

The rain gage has been calibrated at the factory.

Verification of Calibration

Table 2

Calibration Volume

Units of Calibration	Volume of water
0.5mm	16.215 ml
0.25mm	8.11 ml
0.2 mm	6.48 ml
0.01 inch	8.24 ml

1. Wet rain gage surfaces.

2. Refer to Table 2. Pour water into gage at rate of approximately 0.5 ml / second.

3. Check that bucket tips within $\pm$2 as averaged over 5 tips of the bucket.

Re-Calibration

1. Release the 4 locknuts on the calibration screws that the bucket rests on.

2. Wet all gage surfaces and empty excess water from bucket.

3. Refer to Table 2 and using a flow rate of 0.5 ml /second drip water through the funnel noting how much water it takes to tip the bucket.

4. If the bucket tips too soon, adjust the screws downward. If the bucket tips too late, adjust them upward.

5. When the required calibration is obtained tighten all locknuts simultaneously.

6. Verify calibration as above.

TROUBLE SHOOTING

Philosophy

Effective trouble shooting requires that problem locations be systematically eliminated until the problem is found.

There are four basic questions to answer when trouble shooting (Ref. #1):

1. Did it ever work right?

2. What are the symptoms that tell you it's not working right?

3. When did it start working badly or stop working?

4. What other symptoms showed up just before, just after, or at the same time as the failure?

It is best to write down any clues you may obtain. Be sure to write down anything unusual.

The response to question #3 should probably not be 3:04 P.M.. A useful response might be, "Just after an electrical storm." or, "Just after it fell off the shelf."

Double check all the simple solutions to the problem before searching for complex ones. If the problem occurs right after installation, it probably has a simple solution.

If an automobile engine cranks, but doesn't start, make sure there is fuel in the tank before replacing the engine. If the electronic equipment doesn't function verify that it has power and is turned on.

Systems containing parts which can be quickly inter-changed are easy to trouble shoot. Swap parts until the problem moves. The location has then been narrowed to the part that caused the problem to move.

Sometimes there are multiple problems. These reveal themselves in layers much like peeling an onion.

It often helps to explain the problem to another person, even if that person is not knowledgeable about the particular piece of equipment.

This does two things. First it requires you to organize the situation so it can be explained to another. Secondly, it may turn out that you are so familiar with the situation that you have over looked the obvious. Another person unfamiliar with the equipment may be able to help.

If you are unable to solve the problem, put it aside until the next day. Some new thoughts will probably occur while working on another project.

No Rainfall Recorded

All Switches in S1 must be in OFF position.

Debris in gage

Failed Switch in Gage -Use ohm meter to check resistance as bucket is slowly tipped by hand. Meter should indicate infinite resistance when bucket is at rest. It should indicate 1 - 10 ohms when the switch is closed.

Broken Signal Cable - Ohm meter will indicate only infinite resistance.

Failure of Electronics in Transmitter - Disconnect signal cable. Use a switch or short piece of wire to momentarily connect the two terminals on the Transmitter circuit board at two second intervals. This will simulate pulses from the rain gage. If the output of the Transmitter fails to respond, return the Transmitter to the factory for repair.

Excessive Precipitation

Check that the gage orifice is level.

General Electrical Problems

Loop Current	Failure Description
0 mA	Current loop polarity reversed Open circuit in cable Power supply failure
Less than 4 mA	Low power supply voltage Loop resistance too high
Greater than 20	Short circuit in cable
Does not reach 20 mA, otherwise operates properly	Low power supply voltage Loop resistance too high

References

1. "Troubleshooting is More Effective with the Right Philosophy", Robert A. Pease, Electronic Design News, January 5, 1989.

LIMITED WARRANTY

COMPTUS Inc. extends this warranty to the original consumer only. Any product manufactured by Comptus is warranted against defect for a period of ONE YEAR beginning on the date of purchase by the consumer or two years beginning on the date of purchase from Comptus by the authorized dealer, whichever expires sooner.

TO OBTAIN WARRANTY SERVICE, the purchaser must contact Comptus and receive return authorization. Such correspondence should be addressed to: Comptus Inc., 342 Lyndeboro Rd., New Boston, NH. 03070. All warranty service is performed at the factory. All incidental expenses, including shipment of products to Comptus by the purchaser, shall be the sole responsibility of the purchaser. WARRANTY SERVICE is at the sole discretion of Comptus and free of charge for parts and labor. Under the above terms, Comptus will repair or replace the defective component(s), provided that:

a) the product has not been subjected to abuse, neglect, accident, alteration, improper installation or servicing, or used in violation of instructions furnished by Comptus;

b) the product has not been repaired or altered by anyone except Comptus or its authorized service agencies;

c) the serial number has not been defaced, removed, or otherwise changed;

d) the damage has not been caused by acts of nature including windstorm and hail beyond those specified as within the range of operating conditions;

e) the damage has not been caused by shipping.

THIS WARRANTY IS IN PLACE OF ALL OBLIGATIONS OR LIABILITIES ON THE PART OF COMPTUS FOR DAMAGES. IT DOES NOT APPLY TO ANY COMPONENT OR EQUIPMENT RESOLD BY COMPTUS IN ITS ORIGINAL CONDITION AS RECEIVED BY COMPTUS FROM THE MANUFACTURER OR DISTRIBUTOR, AMONG THE DAMAGES EXCLUDED FROM THIS WARRANTY ARE ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE PRODUCT IN ANY WAY. Any implied warranties are limited in duration to the duration of the written warranty. No representative or person is authorized to give any other warranty or assume for Comptus any other liability in connection with the sale of its products.
THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATIONS AND/OR EXCLUSIONS MAY NOT APPLY TO YOU. This warranty complies with the Magnuson-Moss Consumer Warranty Act, and completely replaces any warranty printed on promotional material describing products of Comptus Inc.
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HOW TO RETURN EQUIPMENT TO COMPTUS

1. Contact the Comptus Service department with the model and serial number of the unit. Be prepared to provide the symptoms of the problem as many are solved without the need for returning the equipment. Have a person with firsthand experience of the trouble on hand to provide specific information.

2. Comptus will issue a Return Material Authorization Number (RMA#) if required. This will ensure the fastest response and least cost for all parties. Please reference this number in all correspondence. This number should be printed on the shipping container.

3. Include a description of the service desired with the returned equipment. If the equipment is being returned for repair, please include a description of the problem.

4. If the equipment is packaged in a plastic case, wrap it in aluminum foil, or other conductive material. This will protect it from static electricity, as well as prevent the packing material from jamming mechanical parts, such as switches. Otherwise, place the equipment in a plastic bag, again to prevent contamination by packing material.

Place the equipment in a suitable shipping container and fill with packing material. There should be at least one inch of packing material between the equipment and the shipping container on all sides.

5. Equipment will be returned C.O.D. to sender if any charges are incurred, unless other arrangements are made in advance.

SHIP THE EQUIPMENT TO:
Comptus Inc.
342 Lyndeboro Rd.
New Boston NH 03070 U.S.A.
Telephone : 603 487-5512
Telfax : 603 487-5513
e-mail : service@comptus.com

NOTE: Please be sure to include the RMA Number, as described in Item 1, on the shipping container.

A70-RL
Packing List

Qty.	Description
1	A70-RL Rain gage Transmitter
1	Rain gage
1	Instruction Manual
1	Certificate of Calibration

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IMPORTANT: Please check your order on receipt to be certain all listed accessories are included before discarding shipping container or packing material. All shortages must be reported within 10 days of receipt.