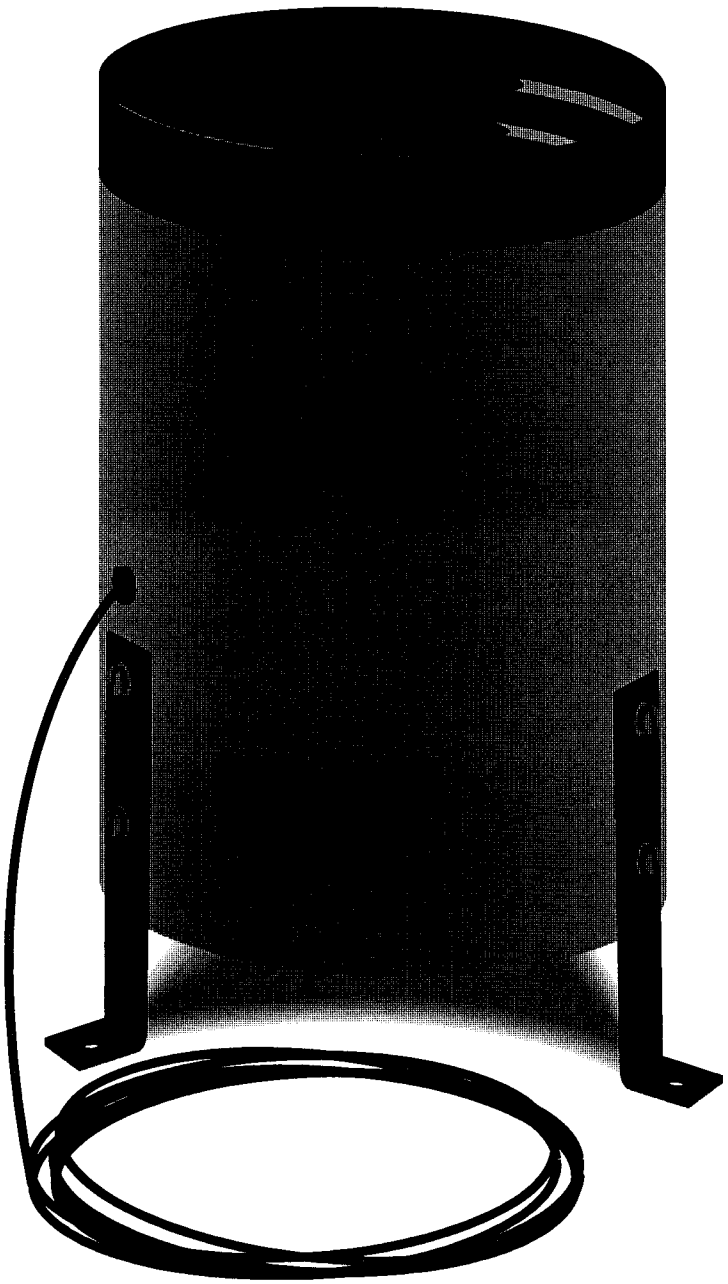
RG-2501 Series

Tipping Bucket Rain Gauge



OMEGA®

An OMEGA Technologies Company

Operator's Manual

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MSS0395FVR1B

Unpacking Instructions

Remove the Packing List and verify that you have received all equipment, including the following (quantities in parentheses):

RG-2501 Tipping Bucket Rain Gauge (1)

Operator's Manual (1)

If you have any questions about the shipment, please call the OMEGA Customer Service Department.

When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

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Chapter 1: Introduction

1.1 General Description

The OMEGA® Model RG-2501 Tipping Bucket Rain Gauge provides an inexpensive yet accurate method for measuring and recording rainfall. The tipping bucket design provides a means for operating an magnet-sensitive switch. The switch contact closure may be used with electro-mechanical counters, event recorders or electronic recording equipment to automatically obtain a record of the rainfall. The standard model of the rain gauge, Model RG-2501, produces a switch closure for each 0.01 inch of rainfall. The Model RG-2501M switch closure represents 1 millimeter of rainfall. Other calibrations of the rain gauge are available upon request. The tipping bucket design allows unlimited measurements since the tipping action dumps the water out of the bucket on alternating tips. Drain holes in the base plate allow the water to drain out of the gauge.

All OMEGA® rain gauges are made of the highest quality materials to provide long term, trouble free operation with a minimum of maintenance as long as each gauge has been properly installed and maintained. Parts of the rain gauge are made of aluminum with anodized or painted finishes. Fasteners are all stainless steel except for the aluminum pop rivets used to hold the bug screens in place. Some components are made of plastic, including the terminal block, the signal cable strain relief, the calibration screw acorn nuts, the bearing spacers, and the bearing inserts.

The basic rain gauge assembly includes a removable outer funnel, the tipping bucket assembly, the magnet and switch assemblies, and the outer housing assembly. The main sensor assembly with the tipping buckets, switch, magnet and signal terminal block is mounted onto a bracket that is fastened to the base plate. Two adjustable screws provide the calibration of the buckets by changing the position of the bucket stop point.

Three adjustable legs allow the gauge to be fastened permanently onto a platform or deck using standard fasteners. Slots in the legs provide some adjustment for leveling the gauge. A two-conductor, shielded cable with a wire size between 18 and 24 AWG should be used to connect the rain gauge output into the monitoring or recording equipment. A two position terminal block is provided for attaching the cable into the switch. Power for operating the switch originates within the monitoring/recording equipment and is typically a pulse ranging from 5 to 12 VDC.

The Model RG-2501 and RG-2501M rain gauges are not available in heated versions for use in cold climates. These two gauges are designed and sold as low cost general purpose rain gauges and are best suited for standard rainfall measurements only. Refer to the NovaLynx catalog or contact the company to obtain information regarding other types of rain gauges that are available for more specialized uses.

1.2 Specifications

Capacity: unlimited
Orifice: 8" (20 cm) diameter
Calibration: 0.01", 1 mm, 0.5 mm, 0.25 mm
Accuracy: ± 4% for rainfall rates of 1" to 6" per hour
Switch: magnetic sensitive, 3 W, 28 Vac
Construction:
Fabricated parts: anodized aluminum
Fasteners: stainless steel (except for aluminum rivets)
Mounting: 3 legs, 1/4" diameter bolt holes on a 9-1/2" diameter bolt circle
Dimensions: 8.4" D x 15" H
Shipping weight: 8 lbs

Optional Accessories:

Wind Screen, Alter Type	Model RG-952
Event Recorder, Drum Chart	Model RG-952
Calibrator Bottle	Model RG-2596
Digital Event Counter	Model RG-2596

Chapter 2: Installation

2.1 Site Requirements

Finding the best possible site for the gauge is important and careful consideration should be given to the quality of precipitation catch prior to the final installation. The most accurate rainfall measurements are made in sheltered areas that block wind and eddy currents in the vicinity of the gauge. The best exposures are often found in orchards or openings within a grove of trees, bushes, or shrubbery. Fences or other objects can act together to serve as an effective windbreak. As a general rule in such areas, the heights of the objects and the distance from the gauge should be uniform. The height of nearby objects above the gauge should not exceed about twice their distance from the gauge. Individual or small groups of isolated objects near a gauge may set up serious eddy currents. Since it is not always possible to select sites that provide adequate protection from adverse wind effects, an open site away from isolated objects may be the only location available. Wind Shields help minimize loss of precipitation catch by breaking up the air flow immediately over the gauge funnel. Wind effects on catch losses are much greater during snowfall than rainfall. Windshields are not generally installed at gauge site locations where snowfall constitutes less than 20% of the mean annual precipitation.

Good exposures are not always permanent. The growth of vegetation, trees, and shrubs can change an excellent exposure into an unsatisfactory one within a relatively short time. Sites should be inspected and groomed regularly.

In areas where heavy snowfall occurs, rain and snow gauges are mounted onto supports (tower) at a height well above the average snow level. A location with this type of exposure would be improved if the tower can be located within an area of trees of comparable height.

2.2 Installation

The RG-2501 rain gauge may be shipped from the factory with the three mounting legs attached upside down on the 1/4-20 bolts. If this is the case, detach and replace the legs into the correct position with the legs pointing downward and the leg end facing outward, away from the gauge. (Refer to the assembly drawing.) Be sure the leg mounting bolts are tightly fastened. Carefully remove all packing material and any tape, foam pieces, or rubber bands used to keep the tipping bucket from moving during shipment. Operate the tipping bucket to verify that the bucket can now move freely.

Place the funnel into the top of the gauge. The gauge housing must be mounted as level as possible on its platform. The holes in the mounting legs are sized for 1/4" diameter mounting bolts. For correct measurement of precipitation, the open end edge of the rain gauge funnel must lie in a horizontal plane. This can be tested by laying a carpenter's level across the top edge of the gauge funnel using two 90° directions: one direction crossing the other at right angles. If the top is not level in both directions, the condition should be corrected. Washers can be used as leveling shims between the mounting legs on the gauge and the platform or tower mounting plate.

Place the bug and debris screens into place inside the funnel.

Upon completion of the rain gauge mounting, route the signal cable to the monitoring/recording equipment. Use the most direct route possible, avoiding sharp or jagged objects that may rub against the cable jacket during high winds causing exposure of the wires. Attach the cable to the structure or support using plastic wire ties or other appropriate devices. When using plastic wire ties, use only black, ultraviolet resistant, wire ties, placing them at a spacing of two to three feet along the cable length. for best results, whenever possible, the signal cable should be routed through conduit.

Chapter 3: Operation

Precipitation entering the collection orifice fills the calibrated tipping bucket assembly. When the calibrated amount has been collected, the bucket tips, causing a momentary closure of the reed switch, and sending an electrical signal to the event recorder or other data collection device. The precipitation sample is discharged out of the gauge at the same time.

Chapter 4: Calibration

The rain gauge is calibrated at the factory. Recalibration should not be necessary unless damage during shipment or mishandling during installation has occurred. If the damage is extensive, the gauge may need to be repaired or replaced before it can be used properly.

Verify the calibration by using a calibration bottle, a graduated cylinder, or a calibrated burette. The calibration is verified by allowing a known volume of water to flow into the funnel at a rate of 1 to 2 inches per hour producing a specific number of bucket tips. Before putting the volume of water into the funnel run some water into the gauge to wet the funnel and the buckets. The gauge calibration test must be made while the gauge is wet. Do not wipe off any water especially from the buckets between tests and calibration screw adjustments. Add the measured amount of water at the specified flow rate (refer to Table 1). The bucket should tip within the published gauge tolerances and should give the calculated number of tips within the gauge accuracy. If the number of counts is not within the gauge accuracy, then the bucket stops must be adjusted to increase or to decrease the amount of water needed to tip the buckets.

The individual buckets can be calibrated by placing an amount of water equal to one tip into the bucket and adjusting the bucket stop on the opposite side of the gauge until the bucket tips and empties its water. To move the bucket stop screw first loosen the hex nut on the outside of the rain gauge. The nut keeps the screw locked into place. With the nut loosened, the screw can be rotated by hand or by using a screw driver set into the head of the screw. The screw should only be rotated by a small amount between each test. Use a large rotation of the screw only if the bucket is out of calibration by a large number of counts.

Note that moving the bucket stop screw upward means that less water is needed to tip the bucket and moving the screw downward increases the amount of water needed to tip the bucket.

For inches of rain, the amount of water needed for a single tip equal to 0.01 inches is 8.24 milliliters. For a 1 millimeter tip the amount of water is 32.43 milliliters. Add the amount of water needed to each of the buckets separately and adjust the corresponding stop screws as needed to obtain a single tip form each bucket. Several adjustments of each calibration screw may be necessary as there will be some influence from each of the buckets upon the other as the adjustments are changed. If there is repeatability in the tip with the calibrated amount of water, then the adjustment screw has been correctly set and can be locked into place. Use the hex nut located on the adjustment screw at the outside the rain gauge base to lock the screw into position. Take care and do not allow the screw to rotate as the nut is being tightened. In case the screw has turned slightly, retest the tip of the bucket after the nut has been tightened.

Table 1 - Standard Calibration Quantities

260-2501M @ 1 mm (std)	Cal:	32.43	milliliters
260-2501M @ .5 mm	Cal:	16.215	milliliters
260-2501 @ .01" (std)	Cal:	8.24	milliliters
260-2501 @ .05"	Cal:	41.2	milliliters

Flow rate for calibration: 1/2 ml per second.
Accuracy desired is ± 4% of volume at 1-6 inches precipitation per hour.

After making changes to the bucket stop screws, retest the rain gauge operation using the calibration bottle and a large volume of water to produce 50 to 100 tips at a rate of 1 to 2 inches per hour. Remember to thoroughly wet the funnel and buckets first!
The total number of tips generated should correspond to the volume of water run through the gauge (expressed in milliliters; 1 quart = 946.3 milliliters) divided by the calibration quantity indicated in milliliters in Table 1. A tolerance of ± 6% or better should be obtained through testing using this method. A more accurate test can be made in the lab using controlled conditions and more accurate test equipment.

Chapter 5: Maintenance

Rain gauges require regular maintenance. Gauges located in heavily forested areas or where airborne debris is a consideration should be serviced more often. The bucket assembly and drain screens should be inspected to ensure they are clean and free from debris such as leaves and insects. The tipping buckets should be carefully wiped clean to remove mud and dirt. Inspect the small tube of the main funnel and remove any obstructions inside it.

Test the gauge for correct operation and accuracy of the tipping buckets. Refer to Section 4.

Annually or after 6 months of heavy operation, put a drop of light machine oil onto each rotating part, specifically, the bucket assembly shaft at the bearings.

Should the tipping bucket fail to rotate freely about its axis, check the two small right angled brackets that hold the shaft and the bearings onto the main mounting bracket. These two brackets can become loosened or misaligned causing the shaft to bind. The brackets' edges should be at the same level.

Severe friction will create excessive wear in the plastic bushings resulting in the magnet making contact with the switch and stopping the bucket assembly from tipping. Replace worn

or damaged bushings. Too many bushings may cause the bucket shaft to bind as well. If a bushing needs to be removed, remove it from the side away from the magnet and switch allowing more room between the magnet and switch. The number of bushings will vary from gauge to gauge depending upon variations in the materials used. Typically there are four bushings on each side of the shaft.

Check the magnetic switch for proper operation. The standard switch closure is a momentary single pole, normally open (SPNO) contact. Connect an ohmmeter to the gauge at the signal cable terminal strip. With the bucket assembly at rest upon one of the calibration screws, the ohmmeter should read infinite resistance. Slowly move the bucket assembly to simulate a rain event until the bucket assembly has fully rotated. As the magnet passes over the end of the barrel switch, the resistance of the switch should change to a short (zero or less than one ohm). As the tipping bucket comes to a complete tip and rests upon the other calibration screw the ohmmeter will again read an infinite resistance.

Upon completion of all testing and maintenance, replace the funnel into the gauge housing. Confirm that the gauge is still level by checking as described in Section 2.3.

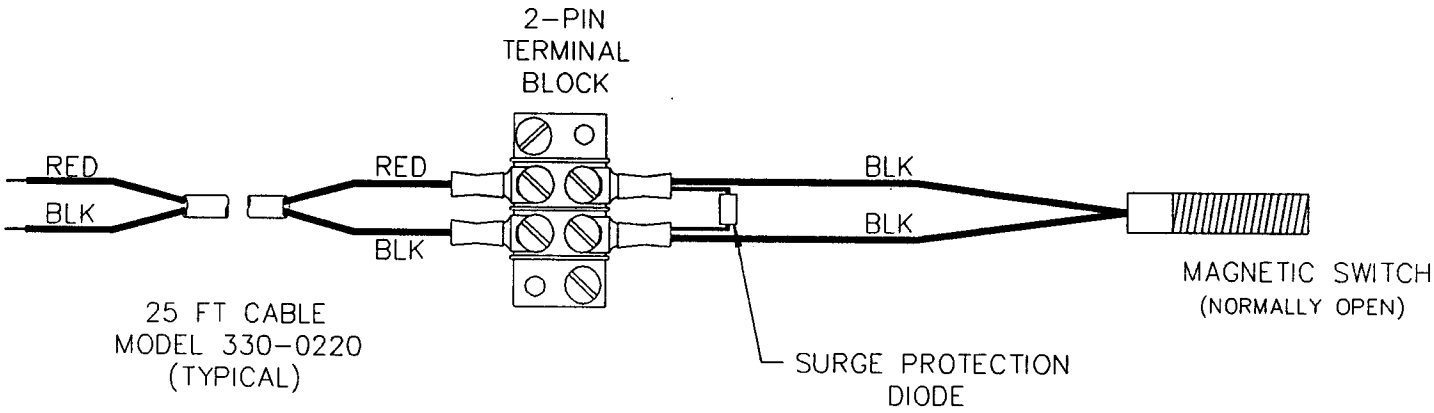
In order to maintain the accuracy of the rainfall catch, the rim of the funnel should be protected from dents or other damage that might alter its shape.

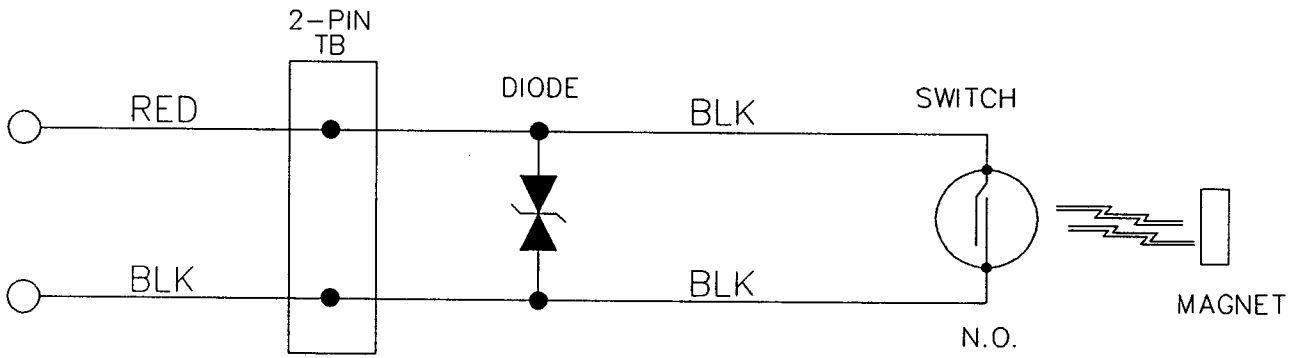
Chapter 6: Troubleshooting

If it becomes necessary to correct an operation problem always perform the following step first: Check the cable connections to ensure a solid connection. A loose or faulty cable is often the problem to missing data. Next, check to see that the bucket assembly moves freely upon its pivoting shaft. Make sure that the magnet has not become loose and is securely in place on the bucket. Check to ensure proper contact closure. Refer to Section 5.4.

If the gauge registers low or not at all during a precipitation event, check for debris in the inlet funnel and drains that might be blocking bucket movement. If the gauge registers high during precipitation, check the level bubble indicator to ensure the sensor is properly installed and leveled. Recheck calibration.

Whenever the gauge is to be used with an electro-mechanical counter or event recorder, surge protection diodes must be installed between the gauge and the equipment. Failure to install these diodes will result in a stuck magnetic switch due to electrical interference from the counter or recorder solenoids. Some gauges have been shipped with these diodes installed across the signal terminal block inside the gauge. If it appears that the diodes have not been included on your gauge and that they will be needed for your application, please contact OMEGA® and arrange to have a set of diodes sent, one set per gauge.



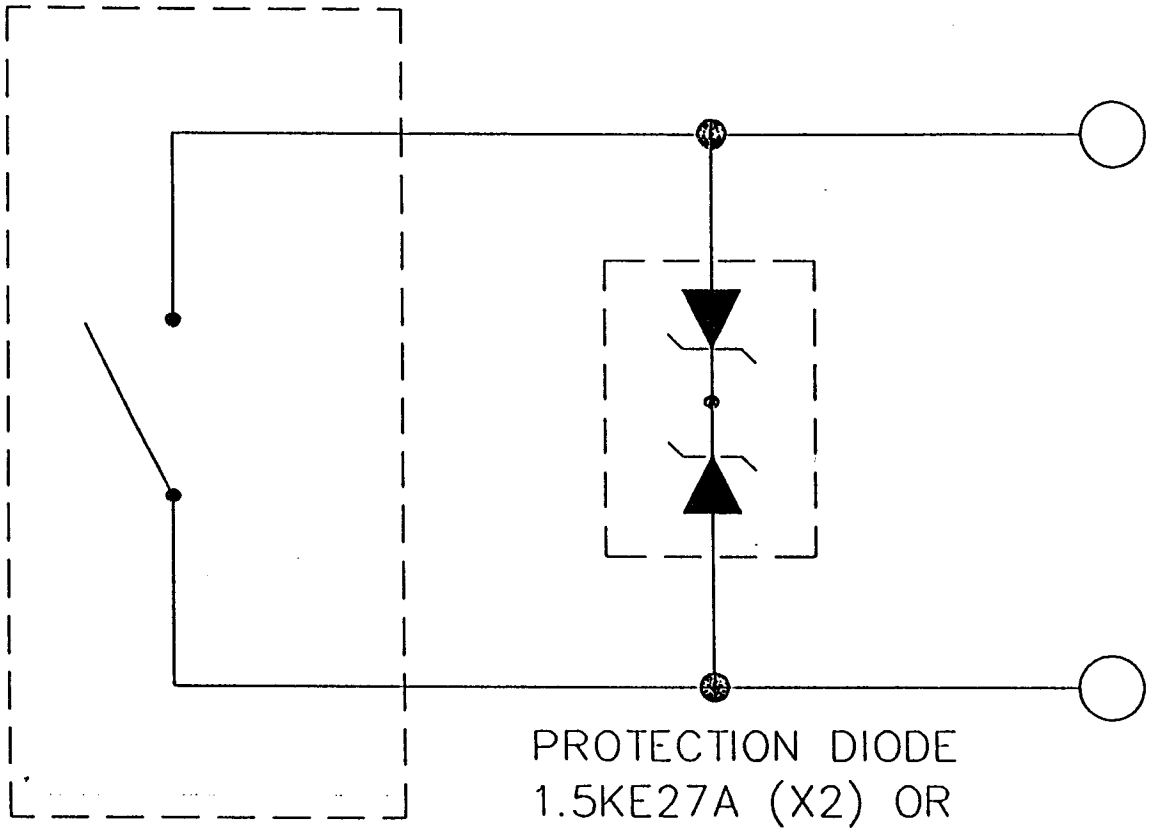


27 VDC
MAXIMUM

3 WATTS
0.25A @ 175 VDC
MAXIMUM

TYPICAL CLOSURE TIME
0.1 SECOND

	C
TITLE: SCHEMATIC, SWITCH, MAGNETIC, TIPPING BUCKET RAIN GAUGE	
MODEL USAGE	SHEET 1 OF 1
BY RGN	SCALE NONE
DATE 12-31-97	DWG. NO. 10000364



WIRE LEADS
TO EVENT RECORDER
OR COUNTER

PROTECTION DIODE
1.5KE27A (X2) OR
1.5KE27C (X1)

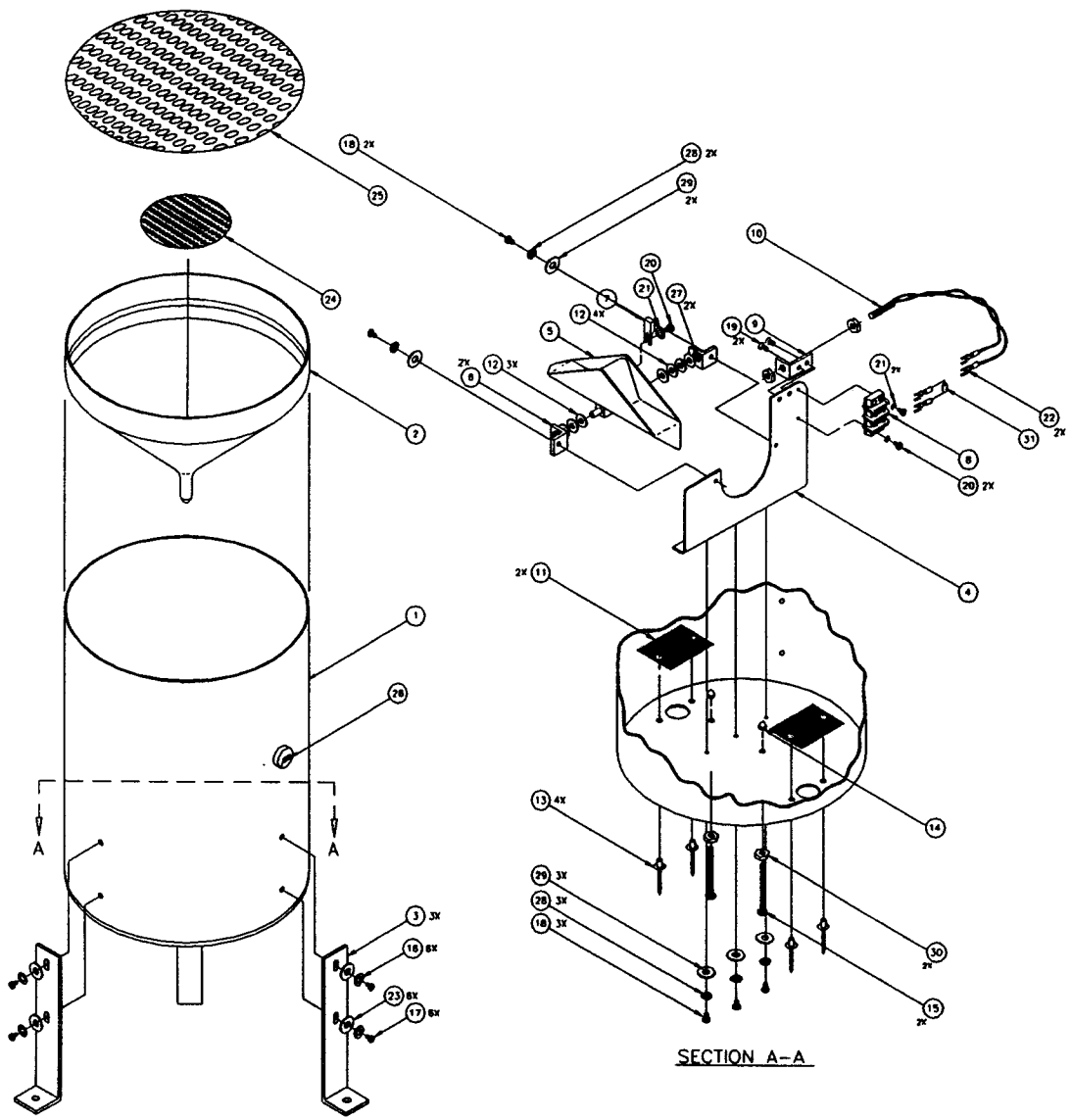
RAIN GAUGE
BARREL SWITCH

ATTACH SURGE SUPPRESSION DIODE(S) TO RAIN GAUGE SWITCH OR TO INPUT OF RECORDER OR COUNTER.

ECO#	DESCRIPTION	DATE
NL031	NEW RELEASE	10/6/94
		A

TITLE
SCHEMATIC, RAIN GAUGE SWITCH SURGE PROTECTION

MODEL USAGE 260-2501, 260-2500			SHEET 1 OF 1
BY RN		SCALE	DWG. NO.
DATE 8-30-94		FULL	940835



ITEM NO.	QTY	DESCRIPTION	PART NO.
31	1 EA.	SURGE PROTECTION DIODE, 1.5KE27C	46311501
30	2 EA.	NUT, 10-32 HEX SS	72211410
29	5 EA.	WASHER, #6 FLAT SS	72302101
28	5 EA.	WASHER, #6 LOCK SS	72341101
27	2 EA.	BEARING, NYLON INSERT	71010100
26	1 EA.	STRAIN RELIEF, CABLE	41500302
25	1 EA.	SCREEN, SMALL FUNNEL 7 5/8"	A100786
24	1 EA.	SCREEN, LOWER FUNNEL 2"	A100785
23	6 EA.	WASHER, #10 FLAT SS	72300301
22	2 EA.	SPADE LUG, #6 NYLON	41900600
21	3 EA.	WASHER, LOCK #4 SPLIT SS	72341001
20	3 EA.	SCREW, 4-40 X 3/8 PAN HD SS	72083301
19	2 EA.	SCREW, 4-40 X 1/4 FLAT HD SS	72060401
18	5 EA.	SCREW, 6-32 X 3/8 PAN HD SS	72082002
17	6 EA.	SCREW, 10-32 X 1/2 PAN HD SS	72188003
16	6 EA.	WASHER, LOCK, #10 SPLIT SS	72340210
15	2 EA.	SCREW, 10-32 X 3 PAN HD SS	72083003
14	2 EA.	ACORN NUT, 10-32 NYLON	72246310
13	4 EA.	RIVET, 1/8 DIA X 1/4 ALUM	72380000
12	8 EA.	WASHER, 0.440D X 0.21D X 0.033 TH NYLON	72310503
11	2 EA.	SCREEN, DRAIN	10000049
10	1 EA.	SWITCH, BARREL REED RELAY	51001802
9	1 EA.	BRACKET, BARREL SWITCH MOUNT	10000077
8	1 EA.	TERMINAL BLOCK, 2 POSITION	21051401
7	1 EA.	MAGNET WITH BRACKET ASSEMBLY	10000079
6	2 EA.	BRACKET, BUCKET SHAFT SUPPORT	10000069
5	1 EA.	BUCKET WITH SHAFT ASSEMBLY	10000078
4	1 EA.	BRACKET,BUCKET SUPPORT MOUNTING	10000070
3	3 EA.	LEG, RAIN GAGE SUPPORT	10000072
2	1 EA.	FUNNEL ASSEMBLY 8"	10000116
1	1 EA.	BODY ASSEMBLY,OUTER CASE 8"	10000076

ECO#	DESCRIPTION	DATE
980102	CHANGE 2-1/2" SCREW TO 3"	1/20/98

TITLE ASSEMBLY, RAIN GAUGE MODEL 260-2501

MODEL USAGE 260-2501		SHEET 1 OF 1
BY RN	SCALE	DWG. NO.
DATE 9-9-94	1:1	10000284

PARTS LIST FOR

TIPPING BUCKET RAIN GAGE
MODEL 260-2501

8 INCH ORIFICE, 0.01" PER TIP

ECO 980102

NL P/N	DESCRIPTION	QTY
10000049	SCREEN, DRAIN	2
10000069	BRACKET, BUCKET SHAFT SUPPORT	2
10000070	BRACKET, BUCKET SUPPORT MOUNTING	1
10000072	LEG, RAIN GAGE SUPPORT	3
10000076	BODY ASSEMBLY, OUTER CASE	1
10000077	BRACKET, BARREL SWITCH	1
10000078	BUCKET WITH SHAFT ASSEMBLY	1
10000079	MAGNET WITH BRACKET ASSEMBLY	1
10000116	FUNNEL ASSEMBLY, 8 INCH	1
10000224	SCREEN, LOWER FUNNEL, 2" DIA	1
10000225	SCREEN, UPPER FUNNEL, 7 5/8" DIA	1
21051401	TERMINAL BLOCK, 2 PIN	1
41500302	STRAIN RELIEF, SIGNAL CABLE	1
41900600	SPADE LUG, #6 NYLON INSULATED	4
46311501	SURGE PROTECTION DIODE 1.5KE27C	1
51001802	BARREL SWITCH	1
71010100	BEARING, NYLON INSERT, PRESS FIT	2
72310503	SPACER/WASHER, NYLON 0.44 OD X 0.2 ID X 0.033 THK	8
72060401	SCREW 4-40 X 1/4 FLAT HEAD SS	2
72083301	SCREW 4-40 X 3/8 PAN HEAD SS	3
72341001	WASHER, #4 LOCK SS	3
72082002	SCREW, 6-32 X 3/8 PAN HEAD SS	5
72302101	WASHER, #6 FLAT SS	5
72341101	WASHER, #6 LOCK SS	5
72188003	SCREW, 10-32 X 1/2 PAN HEAD SS	6
72083003	SCREW, 10-32 X 3 PAN HEAD SS	2
72211410	NUT, #10 HEX SS	2
72246310	NUT, #10 ACORN, NYLON	2
72300301	WASHER, #10 FLAT SS	6
72340210	WASHER, #10 LOCK SS	6
72380000	RIVET, 1/8 X 1/4 ALUM	4

MADE IN USA

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

OMEGA is glad to offer suggestions on the use of its various products. Nevertheless, OMEGA only warrants that the parts manufactured by it will be as specified and free of defects.

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Every precaution for accuracy has been taken in the preparation of this manual; however, OMEGA ENGINEERING, INC. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that result from the use of the products in accordance with the information contained in the manual.

SPECIAL CONDITION: Should this equipment be used in or with any nuclear installation or activity, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the equipment in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATION**, consult OMEGA for current repair/calibration charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

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M2235/0395