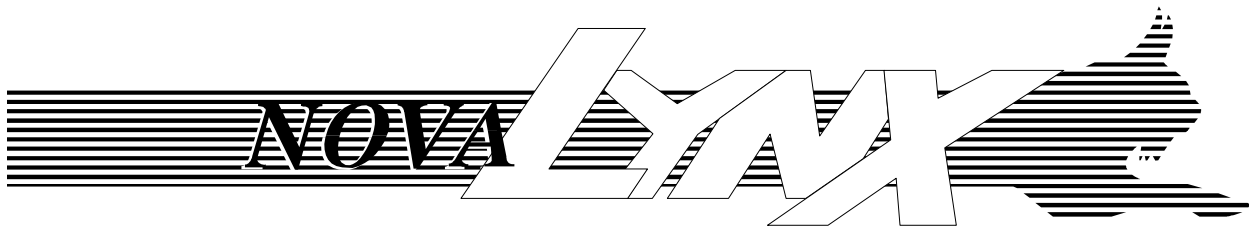


# NOVALYNX CORPORATION

MODEL 260-2501-A & 260-2501M-A  
TIPPING BUCKET RAIN GAUGE

INSTRUCTION MANUAL



REVISION DATE: SEPTEMBER 2009

## **Receiving and Unpacking**

Carefully unpack all components and compare to packing list. Notify NovaLynx Corporation immediately concerning any discrepancy. Inspect equipment to detect any damage that may have occurred during shipment. In the event of damage, any claim for loss must be filed immediately with the carrier by the consignee. Damages to equipment sent via Parcel Post or UPS require the consignee to contact NovaLynx Corporation for instructions.

## **Returns**

If equipment is to be returned to the factory for any reason, call NovaLynx between 8:00 a.m. and 4:00 p.m. Pacific Time to request a Return Authorization Number (RA#). Include with the returned equipment a description of the problem and the name, address, and daytime phone number of the sender. Carefully pack the equipment to prevent damage or additional damage during the return shipment. Call NovaLynx for packing instructions in the case of delicate or sensitive items. If packing facilities are not available take the equipment to the nearest Post Office, UPS, or other freight service and obtain assistance with the packaging. Please write the RA# on the outside of the box.

## **Warranty**

NovaLynx Corporation warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from the date of shipment from the factory. NovaLynx Corporation's obligations under this warranty are limited to, at NovaLynx's option: (i) replacing; or (ii) repairing; any product determined to be defective. In no case shall NovaLynx Corporation's liability exceed product's original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by NovaLynx Corporation, or that has been subjected to misuse, negligence, or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.

## **Address**

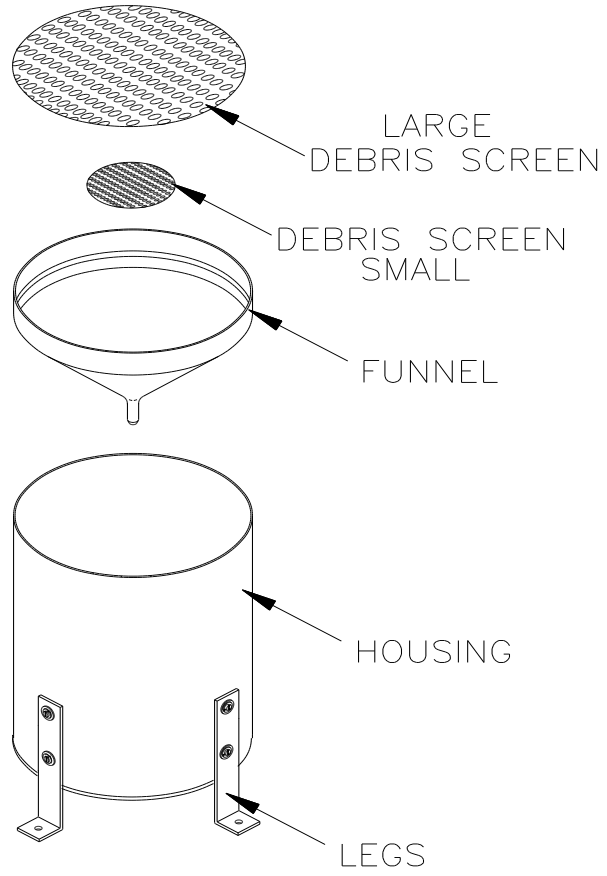
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# MODEL 260-2501-A EQUIPMENT CONFIGURATION AND IDENTIFICATION



# NovaLynx Corporation

## Model 260-2501-A & 260-2501M-A Tipping Bucket Rain Gauge Instruction Manual

### 1.0 INTRODUCTION

The NovaLynx Tipping Bucket Rain Gauge, Model 260-2501-A, 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 260-2501-A produces a switch closure for each 0.01 inch of rainfall. The 260-2501M-A 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 NovaLynx 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. Fabricated 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 two lower 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 bucket support spacers, and the shaft support nylon inserts.

The basic rain gauge assembly includes a removable outer funnel, an inner funnel, the tipping bucket assembly, 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 25-foot cable with a wire size of 20 AWG is used to connect the rain gauge output to the monitoring or recording equipment. A two-position terminal block is provided for connecting the cable to 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 voltage must not exceed 24 Vdc.

The 260-2501-A and 260-2501M-A 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.

## 1.1 Specifications

Sensor type:	Tipping bucket
Output:	Momentary SPST-NO contact switch closure, 100 millisecond duration
Switch:	Sealed reed switch, form A
Sensitivity:	1 tip per 0.01" or 1 tip per 1mm
Accuracy:	± 2% up to 2" per hour (Factory calibration at 2"/hr rate)
Switch rating:	10 Watts, 200 Vdc, 0.5 Amp (Transient suppressor clamps the max voltage to 27 Vdc)
Orifice:	8" diameter
Capacity:	Unlimited
Construction:	
Fabricated parts:	Aluminum (anodized or powdercoated)
Fasteners:	Stainless steel
Mounting:	3 legs, 1/4" diameter bolt holes on a 9-1/2" diameter bolt circle
Dimensions:	8" dia x 14-1/2" high
Weight:	4 lbs
Shipping weight:	5-1/2 lbs

## 1.2 Optional Accessories

260-2101	Rain Data Logger
260-2595	Rain Gauge Calibrator
260-2597	Pocket-Size Digital Event Counter
260-950	Rain Gauge Mounting Plate
260-2501MB	Rain Gauge Side Mounting Bracket
260-952	Rain Gauge Wind Screen, 24" legs (Alter type)

## 2.0 INSTALLATION

### 2.1 Unpacking

After carefully unpacking all components, inspect for damage that may have occurred in shipment. Do not discard any packing material until you are certain there is no damage and all items are accounted for, including accessories.

Be sure to remove any tape, foam inserts, cable ties, or rubber bands used to keep the buckets from moving during shipment.

## **2.2 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.

## **2.3 Installation**

The 260-2501-A rain gauge is shipped from the factory with the three mounting legs attached upside down on the 1/4-20 bolts. Be sure the leg mounting bolts are tightly fastened. Carefully remove all packing material and any tape, foam pieces, cable ties, 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.

Insert the inner funnel into the top of the tipping bucket assembly, then place the outer 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. Each of the three mounting legs can be adjusted, or washers can be used as leveling shims between the mounting legs on the gauge and the platform or tower mounting plate.

Place the two debris screens into place inside the funnel.

Upon completion of the rain gauge mounting, route the signal cable to the monitoring or 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 cable ties or other appropriate devices. When using plastic cable ties, use only black ultraviolet-resistant cable 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.

### **3.0 THEORY OF 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.

### **4.0 CALIBRATION**

The rain gauge is calibrated at NovaLynx facilities. 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 from 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. Retest the tip of the bucket after the nut has been tightened, in case the screw has turned slightly.

**Table 1 - Standard Calibration Quantities**

260-2501M-A @ 1 mm (std)	Cal:	32.43	milliliters
260-2501M-A @ .2 mm	Cal:	6.48	milliliters
260-2501M-A @ .5 mm	Cal:	16.215	milliliters
260-2501-A @ .01" (std)	Cal:	8.24	milliliters
260-2501-A @ .05"	Cal:	41.2	milliliters
Accuracy desired is $\pm 2\%$ of volume at 6 inches precipitation per hour.			

If a 260-2595 Rain Gauge Calibrator is available, re-test the rain gauge operation using the calibration bottle and a 1/16" orifice which gives a rate of 6 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  $\pm 2\%$  or better should be obtained through testing using this method.

## 5.0 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.

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

Severe friction will create excessive wear in the nylon shim washers resulting in the magnet making contact with the switch and stopping the bucket assembly from tipping. Replace worn or damaged washers. Too many washers may cause the bucket shaft to bind as well. If a washer 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 shim washers will vary from gauge to gauge depending upon variations in the materials used. Typically there are two to four washers 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. A transient suppressor rated at 27 Vdc is connected across the switch terminals.

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.

## **6.0 TROUBLESHOOTING**

Failure of the rain gauge to operate often is the result of loose wiring. Inspect the cable connections to ensure the connections are solid and are correctly made.

Inspect the motion of the bucket assembly to ensure that the buckets move smoothly and without any interference.

Check the magnet to see that it passes over the switch without any physical contact and that the switch closes when the magnet passes over it.

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 with a level bubble indicator to ensure the sensor is properly installed and leveled. Re-check calibration.

After a lightning storm the surge suppressor may become shorted or increase resistance. Cut the suppressor out of the circuit to verify if this is the case.

## 7.0 PARTS LIST

TIPPING BUCKET RAIN GAGE  
MODEL 260-2501-A

8 INCH FUNNEL, 0.01" PER TIP

NL P/N	DESCRIPTION	QTY
10000006	INNER FUNNEL. ....	1
10000026	LOWER SCREEN 2-INCH. ....	1
10000069	BUCKET SHAFT SUPPORT BRACKET. ....	2
10000070	BUCKET SUPPORT BRACKET. ....	1
10000072	MOUNTING FOOT. ....	3
10000076-A	RAIN GAUGE BODY WHITE. ....	1
10000077	BARREL SWITCH BRACKET. ....	1
10000078	BUCKET ASSEMBLY 0.01 INCH. ....	1
10000079	MAGNET WITH BRACKET ASSEMBLY. ....	1
10000116	FUNNEL 8-INCH. ....	1
10000160	REED SWITCH ASSY WITH DIODE. ....	1
	46311502 SURGE SUPPRESSION DIODE P6KE27CA	
	51001802 REED SWITCH HAMLIN BARREL	
10000225	UPPER SCREEN 8-INCH. ....	1
21051401	BARRIER TERMINAL BLOCK 2-POS. ....	1
330-0220	CABLE 2C 20AWG UNSHIELDED, PER FOOT. ....	25
41500305	STRAIN RELIEF FOR SIGNAL CABLE. ....	1
41900610	FLANGED SPADE TERM RED #6. ....	2
71010100	SHAFT SUPPORT, NYLON INSERT. ....	2
72082000	SCREW 6-32X5/16 PAN PH SS. ....	7
72083001	SCREW 10-32X2-1/2 PAN PH SS. ....	2
72083501	SCREW 4-40X1/4 FLAT SL SS. ....	2
72083503	SCREW 4-40X3/8 PAN PH SS. ....	2
72083506	SCREW 4-40X1/4 PAN PH SS. ....	1
72121036	SCREW 10-32X5/8 RD PH SS. ....	6
72211410	NUT 10-32 SS. ....	2
72246310	ACORN NUT 10-32 HEX NYLON. ....	2
72302106	WASHER #6 FLAT SS. ....	7
72302110	WASHER #10 FLAT SS. ....	6
72310810	WASHER #10 FLAT NYLON. ....	6
72342104	LOCK WASHER #4 SS. ....	3
72342106	LOCK WASHER #6 SS. ....	7
72342110	LOCK WASHER #10 SS. ....	6