HydroLynx Systems, Inc.

Model 3003
Evaporation Gauge

Instruction Manual

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Receiving and Unpacking

Carefully unpack all components and compare to the packing list. Notify HydroLynx Systems 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. If the equipment was shipped via Parcel Post or UPS, contact HydroLynx Systems for instructions.

Returns

If equipment is to be returned to the factory for any reason, call HydroLynx 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 during the return shipment. Call HydroLynx 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 packaging. Please write the RA# on the outside of the box.

Warranty

HydroLynx Systems 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. HydroLynx Systems' obligations under this warranty are limited to, at HydroLynx's option: (i) replacing; or (ii) repairing; any product determined to be defective. In no case shall HydroLynx Systems' liability exceed product's original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by HydroLynx Systems, 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.

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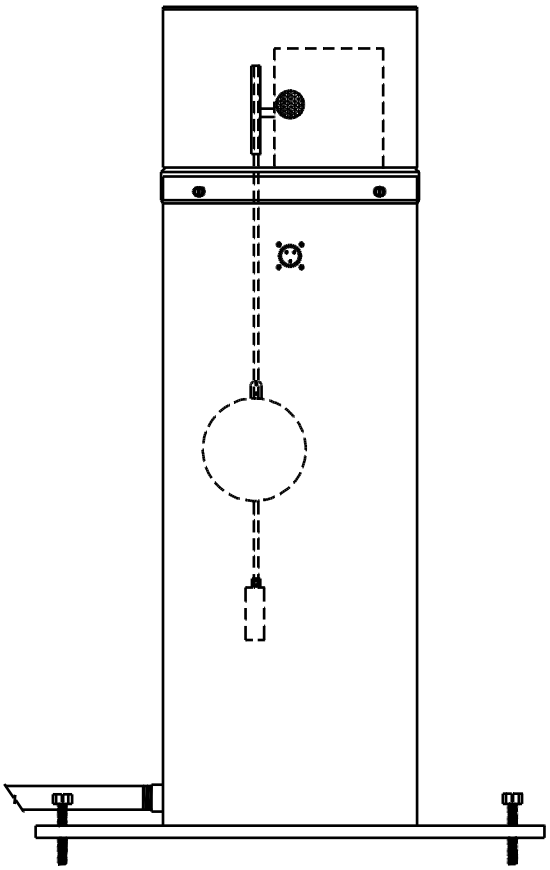
TABLE OF CONTENTS

SECTION NO. **PAGE NO.**

Equipment Configuration and Parts Identification



Sensor: Model 3003 Evaporation Gauge

1.0 INTRODUCTION

1.1 General Description

The Model 3003 Analog Output Evaporation Gauge has been designed to accurately measure the changing water level in an evaporation pan. The evaporation gauge provides an electrical signal proportional to the water level. The data can be used to determine the evaporation rate of the water. Although it may be used with a variety of evaporation measuring equipment, the evaporation gauge is normally used with a standard National Weather Service Class A Evaporation Pan (HydroLynx Model 3005).

The evaporation gauge design includes a float, a counterweight, a chain attached to both the float and counterweight, and a sprocket attached to a precision 1000 ohm potentiometer, all mounted in a protective enclosure. The housing of the evaporation gauge has been designed to act as a stilling well for the float to help eliminate rapid fluctuations in the measurements. The housing is constructed to hold the water inside it without any leakage to the outside. By using the built-in water pipe coupler, the gauge can be physically attached to the evaporation pan to remotely sense the water level while the gauge is mounted outside the evaporation pan. This design helps eliminate any influence the gauge may introduce to the evaporation measurement that occurs whenever the gauge is mounted inside the evaporation pan.

As the level of the water inside the evaporation pan changes, the water inside the evaporation gauge will change to the same level. The float moves on top of the water's surface. The float transfers its motion through the chain to the sprocket. The sprocket, in turn, causes the shaft of the potentiometer to rotate, changing the resistance of the potentiometer. Using a regulated dc power source, typically +5 Vdc, to excite the potentiometer, a voltage that varies from zero to +5.000 Vdc can be measured at the wiper of the potentiometer. The voltage from the potentiometer can be then be translated into inches of evaporated water. The output of the potentiometer is normally wired to give a decreasing voltage as the water level decreases (increasing amount of evaporated water but decreasing water height). In some situations the gauge may be employed as a water level sensor measuring both increasing as well as decreasing levels of water. The maximum amount of water level that can be measured by the gauge is ten inches.

1.2 Specifications

General

Height:	27-1/2" (700 mm)
Diameter:	8" (203 mm)
Weight:	7-1/2 lbs (3.4 kg)
Shipping weight:	15 lbs (6.8 kg)
Cable:	50' of 3-conductor, 22 AWG, shielded
Signal connector:	3-pin connector, standard (opposite end of cable terminated to meet monitoring equipment interface requirements)
Float:	4" diameter, plastic
Counterweight:	4 oz (114 g)

Water input port:	½" NPT coupling, female
Base dimensions:	16" triangle with leveling screws
Total resolution:	0.03" (0.76mm)

Potentiometer

Accuracy:	1%
Rotation:	Continuous
Resistance:	1000 ohms
Operating temperature:	-50 to +125° F (-45 to +51°C)
Linearity:	0.25%
Range:	0-10" (254 mm)

2.0 INSTALLATION

2.1 Site Selection & General Installation Considerations

The site should be level and free of nearby obstructions that can cast shadows or reflect sunlight onto the evaporation pan. The pan should be placed upon a wooden platform over soil typical of the area. Level the platform before installing the pan. Place the pan so that the water pipe fitting faces the evaporation gauge. A second platform for mounting the gauge may be needed in order to place the bottom of the gauge at the same elevation as the pan.

The water reservoir of the evaporation gauge is physically connected to the pan by using a ½" diameter pipe. Threaded couplings are provided on both the pan and the gauge. Typically, ½" rigid water pipe is used to connect the gauge to the pan. Flexible tubing may be used, provided it does not deteriorate in outdoor weather conditions.

The gauge should be placed far enough away from the pan to avoid casting any shadows or reflections inside or onto the sides of the pan, affecting the evaporation process.

Both the evaporation pan and the gauge need to be as level as possible in order to maximize the amount of water that can be poured into and measured in the pan. A level pan will provide uniform exposure of the water to the atmosphere, eliminating uneven depths of water.

2.2 Leveling the Gauge

Level the gauge by adjusting the three leveling screws located on the triangular base. With the top cover removed, place a carpenter's level across the opening and check the level. Adjust the screws until the air bubble in the level is centered. After leveling the gauge look down inside the stillwell to make certain that the float and chain hang down straight and are centered in the gauge. The float must be free to move up and down without making contact with the sides of the gauge.

2.3 Testing for Leaks

After connecting the gauge to the pan and all electrical connections are in place, fill the evaporation pan with the desired amount of water and carefully check all of the joints for leaks. Use of Teflon tape at each threaded coupling will help prevent leaks.

2.4 Wiring

Electrical wiring of the evaporation gauge as described in this manual is for use with the Model 5096 ALERT Data Transmitter. The wiring may vary if the gauge is being used with other equipment. The signal and power wires are connected into the gauge through a 3-pin circular connector. The connector receptacle is mounted on the side of the gauge. A matching cable connector is attached onto the standard 50' length of cable. The opposite end of the cable may or may not have a connector attached to it, depending upon the equipment into which it will be wired.

For the ALERT transmitter, the evaporation gauge cable will normally be terminated by a 6-pin circular connector. The 6-pin connector enables the evaporation gauge to be used with the wind direction analog input channel of the transmitter. The wind direction analog input channel is the only source of a +5 Vdc regulated power source. If the transmitter is to be used with both wind sensors and an evaporation gauge, a special system wiring configuration will be required. The 3003 can be easily used with the 5096N version of the ALERT Transmitter, whether or not there are wind sensors connected to the transmitter.

Refer to the tables presented below for wiring details.

3003 OUTPUT SIGNAL CONNECTIONS

[A]	POWER GROUND	GND	BLACK
[B]	EVAP SIGNAL	0-5 Vdc	WHITE
[C]	POWER INPUT	5 Vdc	RED

5096 CONNECTOR PIN WIRING

[A]	NO CONNECTION		
[B]	NO CONNECTION		
[C]	EVAP SIGNAL	0-5 Vdc	WHITE
[D]	POWER GROUND	GND	BLACK
[E]	POWER	+5 Vdc	RED
[F]	NO CONNECTION		

3.0 OPERATION

The evaporation gauge potentiometer exhibits a varying resistance in response to the motion of the float. Applying a voltage across the potentiometer allows monitoring of the gauge by a data logger or other electronic voltage sensing instrument. The output signal of the potentiometer can be configured to give an increasing or a decreasing voltage with regard to the changing level of the water. For most systems provided by HydroLynx, the signal is configured so that a decrease in the water level is represented by a decrease in the gauge voltage.

4.0 CALIBRATION

Proper calibration of the evaporation gauge is critical to the accuracy of the data as well as to the correct operation of the gauge. Calibration of the gauge is required upon initial installation of the gauge and whenever the gauge is removed from its platform or from inside the evaporation pan. The evaporation gauge must be calibrated in order to set the operating range of the potentiometer and to determine the zero point of the float motion. For data logging systems, the slope and intercept data will be measured or calculated from the calibration of the gauge. After the gauge has been calibrated, the operator needs only to keep track of the amount of water added back into the evaporation pan. With the gauge calibrated, the gauge may be used to measure the amount of water added into the pan each week.

The following procedure needs to be used in order to properly calibrate the evaporation gauge. Record the calibration values whenever possible in order to check the gauge calibration during the year.

4.1 Upon completion of the gauge and pan installation, fill the evaporation pan with approximately eight inches of water. The water height can be checked by using a ruler or a tape measure. Check the evaporation gauge to ensure that the water has filled the stillwell to the correct height inside the gauge.

4.2 Use a digital ohmmeter to measure the resistance of the potentiometer across the pot wiper and ground wires, white and black. Rotate the sprocket until the resistance value nears 1000 ohms. Rotate the sprocket slowly until the reading jumps to zero or a floating condition. Go back slowly until the resistance reads correctly again. Obtain the maximum resistance of the pot by slowly going back towards the deadband of the pot. Some pots may be exactly 1000 ohms but most will not and will be either a value larger than or less than 1000 ohms. Obtain this value to correctly calculate the operating line of the potentiometer. Record this maximum resistance value. Perform the same measurement for the zero resistance value of the pot. Record the zero resistance value. These two values will give the total resistance of the potentiometer. If the gauge is connected into the monitoring equipment and power has been applied, the minimum and maximum voltage may be measured using the same methods.

4.3 Check to make certain that the float is hanging down the center of the evaporation gauge. As viewed from the front of the gauge, looking toward the face of the sprocket wheel, the float should hang from the right side of the sprocket wheel with the counter-weight to the left side of the wheel.

4.4 Move the float by hand down toward the bottom of the gauge. As soon as the float contacts the bottom surface of the gauge, hold the float in position and check to see that the chain is straight and tight. The chain must not be moving nor pulled downward other than by the tension exerted by the float. Measure the resistance of the potentiometer.

4.5 The potentiometer should be at its point of least resistance for the range of motion of the pot. The resistance should be near zero ohms but may be as large as several hundred ohms. If the value appears to be floating or within the deadband of the potentiometer the sprocket wheel must be adjusted with relation to the chain. The potentiometer must not cross into or beyond the deadband as the float approaches and touches the bottom of the gauge. To adjust the sprocket, allow the float to return to the top of the water. Lift the chain off the sprocket and rotate the sprocket counter-clock-wise, one or two gear tooth positions. Replace the chain and repeat step 4.4. Repeat this step (4.5) until the chain is properly positioned on the sprocket. Observe the ohmmeter to detect any crossover of the deadband as the float is moved downward.

4.6 Record the resistance of this bottom or ZERO position of the float. If the gauge is connected into the monitoring equipment and power has been applied, measure the voltage at this position as well as the resistance. Measure the position of the center of the float with respect to the bottom of the evaporation pan for pan mounted gauges. For gauges mounted outside the pan, measure the water level inside the gauge to the center of the float. Usually, the center of the float is aligned with the center of the threaded pipe fitting on the housing when the float touches the bottom of the gauge.

4.7 Move the float back to the top of the water and let go of the float. The center of the float should now be even with the surface of the water. Measure the resistance and voltage of the potentiometer at this position. Also measure the water level at this point with respect to the bottom of the pan. The resistance of the potentiometer should be high at this point and approaching the 1000 ohm end of the pot. If the chain and sprocket have been properly set, the potentiometer should not move past the 1000 ohm end of the element and stop in the deadband. If it appears that the pot is in its deadband at the top of the water level, then either the sprocket and chain must be adjusted further or else there is too much water in the pan and some water must be drained.

4.8 At this point the slope and intercept information can be generated and the operating curve of the instrument can be calculated. The operating curve can then be verified by setting the float to several points of water level and by comparing the actual output voltage to the calculated voltage. The formulas used are:

$$Y = m*X + b$$

$$m = (Y_2 - Y_1) \div (X_2 - X_1)$$

$$b = Y_1 - mX_1$$

where **Y** is inches of water, **X** is ohms or volts, **m** is the slope of the line and **b** is the zero offset.

For a range of 10 inches and a potentiometer resistance of 1000 ohms the calculation reveals that **b** = 0, and **m** = 0.01.

For a range of 10 inches and a voltage range of 5 VDC, **b** = 0 and **m** = 2.

If the float range of motion happens to be 1.5 to 8.0 inches, then the output voltage can be calculated as 0.75 and 4.0 volts, respectively. Use the actual values measured in the preceding steps (4.2, 4.4, 4.6, and 4.7) with the above formulas to determine the operating line of the gauge. The line should be linear allowing calculation of intermediate outputs for known positions of the float.

5.0 TROUBLESHOOTING

5.1 General Inspection

Always disconnect the reporting/recording device from its power source before making any changes to the wiring connections.

If possible, troubleshoot the gauge immediately whenever any of the following conditions are observed:

- Severe weather has recently occurred
- The gauge does not appear to operate normally or exhibits a marked change in performance
- The data is missing or appears to be incorrect
- The gauge has been dropped or damaged
- Water has damaged the wiring or electronic components
- Water has been allowed to dry out totally in the evaporation pan.

5.2 Power

If the gauge does not register correctly, first check the power connections. Check the voltage with a voltmeter. Be sure the reporting/recording device has been powered up correctly. If the reporting/recording device uses batteries for it's primary source of power, check the batteries to be sure they have sufficient voltage and that they are securely in place. Check the battery terminals to ensure that they are clean and provide solid contact.

5.3 Cables

Check the sensor cable connections both at the gauge and at the control unit. Cable shorts or opens can cause loss of data. If a connection is found to be loose, reattach the wire and check to see if the problem has been corrected.

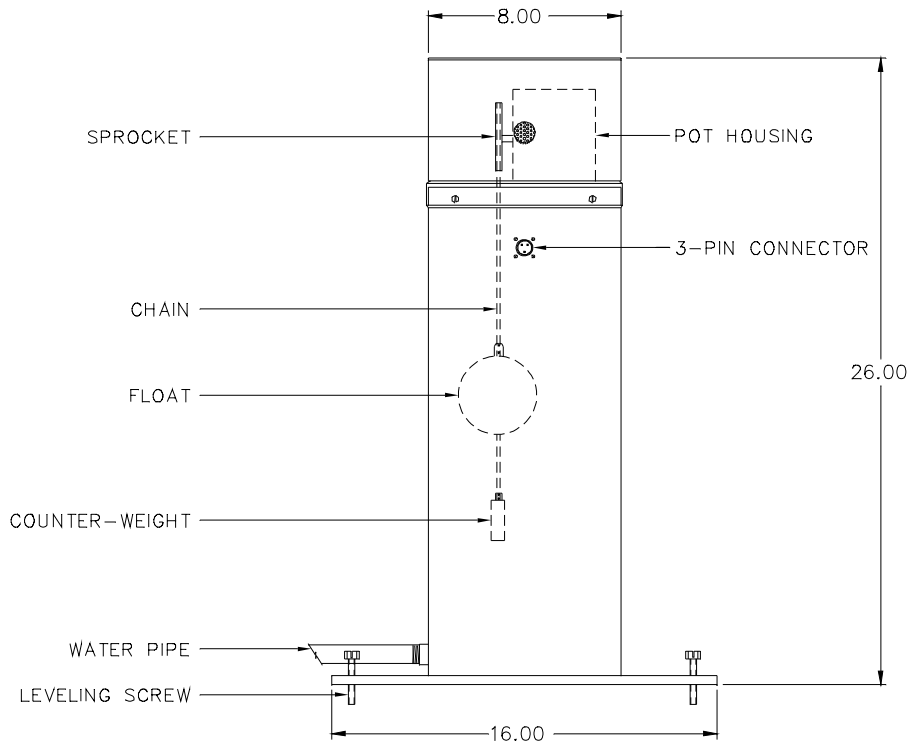
Check for damage to the cable insulation. Replace the cable if it appears that the jacket has been worn or cut open.

5.4 Float

Inspect the float and chain to make certain that they have not become entangled. Whenever the evaporation pan has been allowed to empty or dry out completely, the float may tip sideways at the bottom of the gauge stillwell and become kinked at the chain connector. Test the motion of the float to ensure that it moves smoothly and freely.

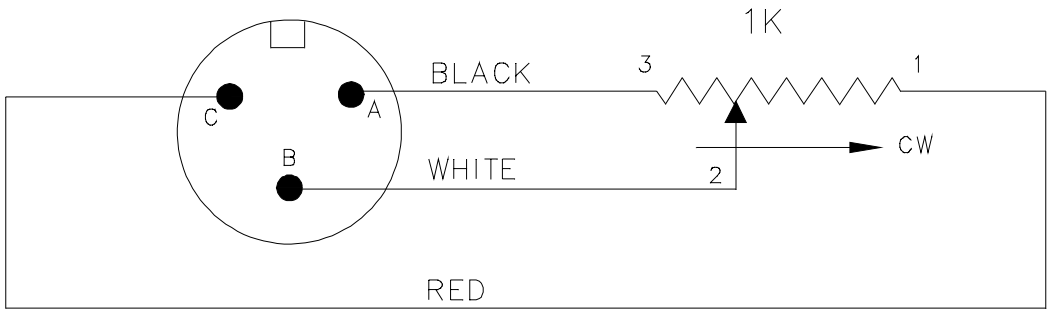
6.0 DRAWINGS

AC102352 Outline - Gauge
AC103000 Wiring Diagram - Sensor
AC103137 Cable Assembly



ECN#	DESCRIPTION	DATE
N/A	REDRAWN ON NEW BORDER	12/20/99

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES	MODEL USAGE		HydroLynx	
FRACTIONS = ± N/A				
.XX = ± .01			MODEL NO. 3003, 255 – 100	
.XXX = ± .005			TITLE EVAPORATION GAUGE	
MAT'L				
FINISH	DRAWN BY BRIAN MICHAUD	DATE 12/20/99	DWG TYPE OUTLINE	
TREATMENT	CHECKED BY	DATE	SIZE A	DWG NO. AC102352 REV B



REAR VIEW
OF CONNECTOR

NOTES: 1. CLOCK WISE DIRECTION INDICATED IS FOR GEAR BOX MOUNTED POTENTIOMETER.
2. CONNECTOR IS 3-PIN MALE RECEPTACLE MS3102A-10SL-3P.
3. CABLE IS BELDEN #9533, AT 8 INCHES.

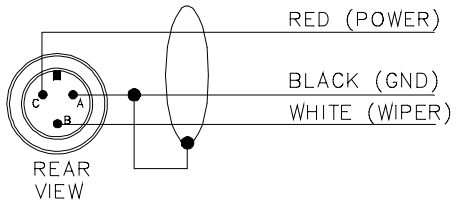
NL016	MANUAL UPDATE/ACAD REDRAW	7/12/94
ECO#	DESCRIPTION	DATE

NOVA SYSTEMS INC

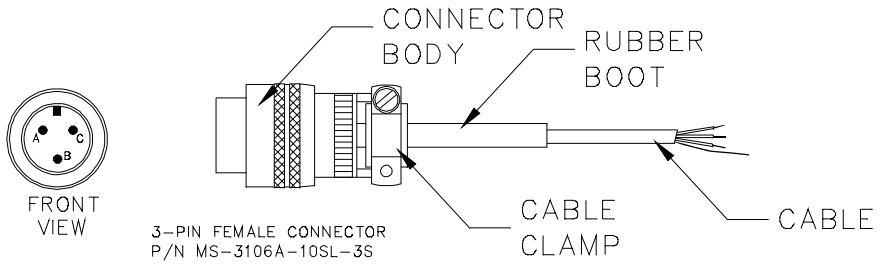
C

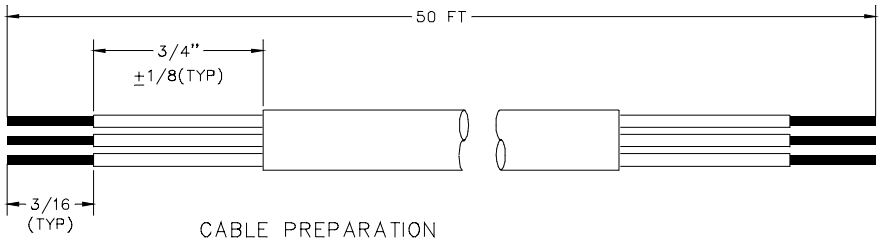
TITLE SCHEMATIC, INTERNAL WIRING
EVAP GAUGE MODEL 3003

MODEL USAGE 3003, 255-100		SHEET 1 OF 1
BY RGN	SCALE	ACAD DWG. NO.
DATE 7-12-94	NONE	AC103000



CONNECT WIRES:
BLACK TO A
RED TO C
WHITE TO B
SHIELD TO A





CABLE PREPARATION

NOTES: 1. PREPARE ENDS OF CABLE AS SHOWN.
2. SOLDER ONE END TO THREE PIN CONNECTOR.
3. CABLE IS 50 FT OF BELDEN 9533.

ECO#	DESCRIPTION	DATE
NL016	MANUAL UPDATE/ACAD REDRAW	7/12/94

NOVA LYNX SYSTEMS INC

C

TITLE: ASSEMBLY, CABLE & CONNECTOR FOR SENSOR MODEL 3003

MOD. USAGE 3003 | SHEET 1 OF 1

BY RGN | DATE 7-12-94 | SCALE NONE | ACAD DWG. NO. AC103137