255-704-B

User Manual

255-704-B Evaporation Logger

255-704-B Evaporation Logger
with
255-100 Analog Output Evaporation Gauge

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Receiving and Unpacking

Carefully unpack all components and compare to the 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.

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1 FORWARD

Thank you for purchasing NovaLynx products. NovaLynx has been designing and manufacturing weather instruments since 1988. NovaLynx represents several well-known brands of quality manufacturers, including Gill Instruments, RM Young, Kipp & Zonen, and Vaisala. It is our hope that our products will meet all your monitoring requirements.

2 INTRODUCTION

The **255-704-B Evaporation Logger** is designed to record the output of an analog evaporation gauge (NovaLynx 255-100). The logger displays the current water level in the evaporation pan, along with logging status, battery status, and memory consumption. The logger stores up to 1.9 million measurements with 16-bit resolution.

The logger is protected by a waterproof enclosure that is strapped to the outside of the evaporation gauge. The clear cover on the enclosure must be removed and a USB cable connected in order to read data out of the logger. The PC or Mac compatible software manages the logger and includes graphing and export functions.

Optional air and water temperature sensors can be connected to the logger to record temperature readings along with the pan water level. The logger calculates minimum, maximum, average, and standard deviation statistics.

3 SPECIFICATIONS

255-704-B Evaporation Logger	
Analog Channels	4 high resolution(16-bit) channels, 0 to 2.5 Volt
	1 internal battery monitor channel
Memory	4 MB (1.9 million measurements, maximum)
Logging Rate	1 second to 18 hours, 12 minutes, 15 seconds
Logging Mode	Normal, burst, or statistics
Sensor excitation	2.5 Volts, 4 mA total. Excitation 5 mS before sensor reading begins.
Battery type	Two AAA 1.5 V alkaline batteries, user replaceable
Clock	± 1 minute per month at 25°C (77°F)
Communications	USB 2.0 interface
Operating Range	Logging: -20° to 70°C (-4° to 158°F); 0 to 95% RH (non-condensing)
	Launch/Readout: 0° to 50°C (32° to 122°F) per USB specification
Size	5.12 x 5.88 x 2.95 in. (13.0 x 15.0 x 7.5 cm)
CE	The CE Marking identifies this product as complying with all relevant directives in the European Union (EU).

4   COMPUTER SYSTEM REQUIREMENTS

PC:	Windows 10, 8, 7, XP
Mac:	OSX Ver 10.11.x,10.10.x, 10.9.x
Java Runtime Environment (JRE):	1.7.0_17 and above (32-bit or 64-bit on Windows)
Software required:	195-BHW-KIT (Includes Software on CD and 6' USB Cable)

5   INSTALLATION

The **255-704-B Evaporation Logger** and **255-100 Analog Output Evaporation Gauge** are often ordered together. When ordered at the same time, the logger is mounted on the gauge and pre-wired, saving time for the installer.

Retrofitting the logger to an existing evaporation gauge is straightforward. The enclosure is fitted with a large band clamp, which must be opened and passed around the body of the evaporation gauge (photo). Adjust the height so that the logger does not interfere with the cover of the gauge, and tighten the band.

5.1   Connections

Route the cable from the evaporation gauge into the cord grip on the bottom of the logger enclosure and tighten the cord grip. Connect the wires to the terminal strip provided, matching the color of the wires to the colors painted on the terminal strip.
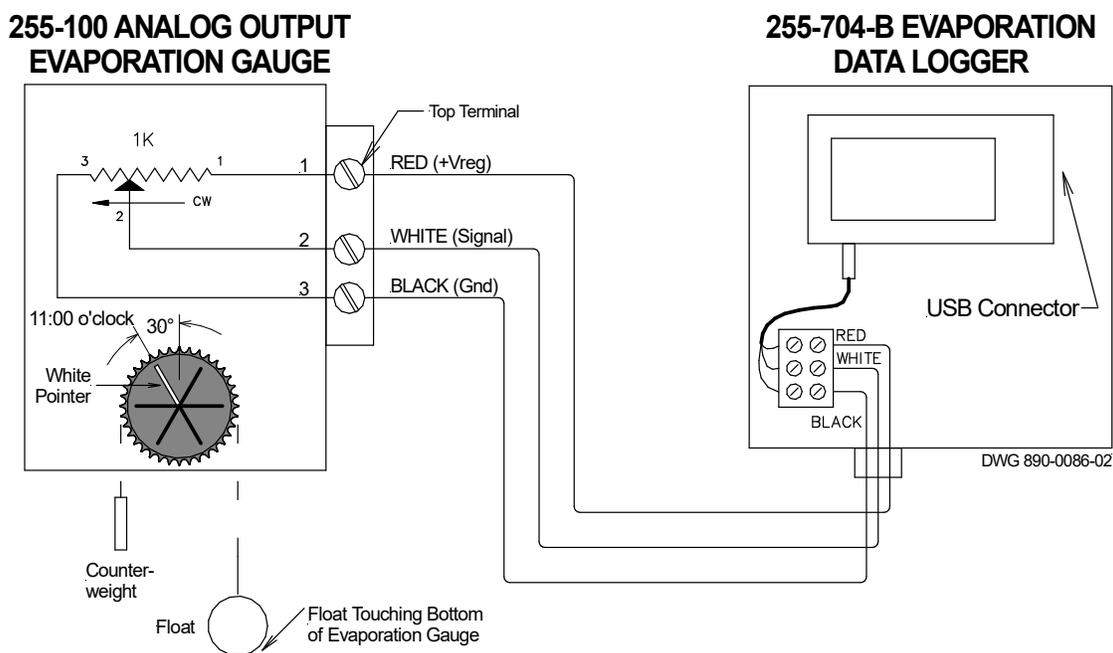
5.2   Float and Chain Installation

The 255-100 Analog Output Evaporation Gauge measures water level in the evaporation pan by means of a float and chain that turns a precision potentiometer housed at the top of the gauge. The sprocket and chain must be synchronized so that the full range of the potentiometer is utilized without entering the electrical dead band of the potentiometer.

Install the evaporation gauge according to the instructions in the user manual. Connect the gauge to the evaporation pan but do not fill the pan with water. Level the gauge. Remove the four screws that hold the evaporation gauge cover to the body and set the cover aside.

IMPORTANT: Be careful when removing the packing material not to hit the sprocket, because that might damage the potentiometer. Do not attempt to remove the float from the body of the sensor.

Chain Installation Using the Pointer

1. Make sure the gauge is empty of water.
2. Turn the sprocket until the white pointer is at the 11:00 o'clock position (30 degrees to left).
3. Lift the chain until all the slack is taken up, but the float is still resting on the bottom of the gauge. Drape the chain over the sprocket so that the float is on the right and the counterweight is on the left.

DWG 880-0002-02
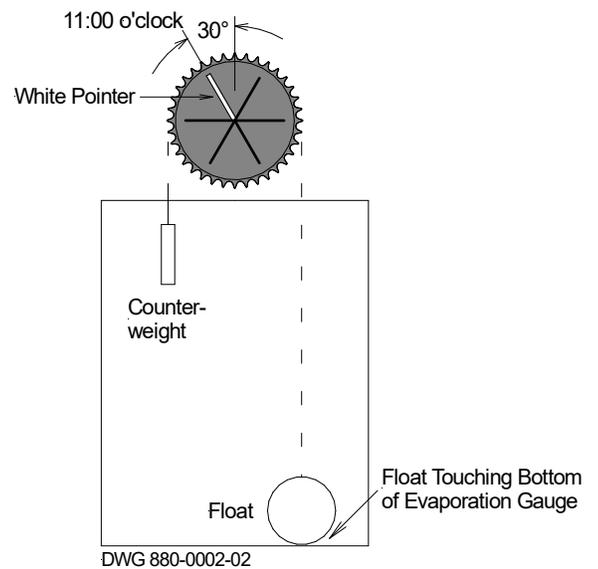
5.3   Software Installation

HOBOware software is required to operate the logger. The software and user manual are on the CD provided with NovaLynx 195-BHW-KIT. The kit includes a USB cable. If your computer does not have a CD drive, download the software and user manual here:

https://www.onsetcomp.com/products/software/hoboware/
https://www.onsetcomp.com/files/manual_pdfs/12730-AD%20HOBOware%20User%27s%20Guide.pdf

Install HOBOware_Free_Setup.exe onto the computer before connecting to the logger.

The first time HOBOware runs, the Setup Assistant feature will open to allow the following selections: (*If the Setup Assistant window does not appear, select File / Preferences / to open the HOBOware Preferences window, then click the Setup Assistant button.*)

- Device Type   ~   Select USB devices.
- Unit System   ~   Select US (inches) or SI (millimeters).
- Data Assistant   ~   Select Linear Scaling Assistant.

Connect the logger to the computer:

1. Loosen the screws at the four corners of the clear plastic cover on the enclosure and remove the cover.
2. The logger is magnetically attached to a metal plate fastened to the back of the enclosure. To access the USB connector which is on the right side of the logger, pull gently on the plastic tab protruding from the right side of the logger.
3. Connect the USB cable to the mini USB input port on the logger. Connect the other end of the cable to the computer.
4. Look at the status ribbon at the bottom of the HOBOware program window (below). At first, the status will indicate "No devices connected". Within a minute, the status should update and show "1 device connected". If the logger is not detected, make sure the logger is powered (*the battery indicator is in the upper right corner of the LCD screen*). Disconnect/reconnect the USB cable.

Status Ribbon

Software Navigation:

The commonly used functions are associated with program icons. The same functions are accessible using the drop-down menus above the icons. View the Help dropdown menu for information on using HOBOware.

Program Icons

Launch device
Readout device
Device status
Stop device
Select device
Set default unit system
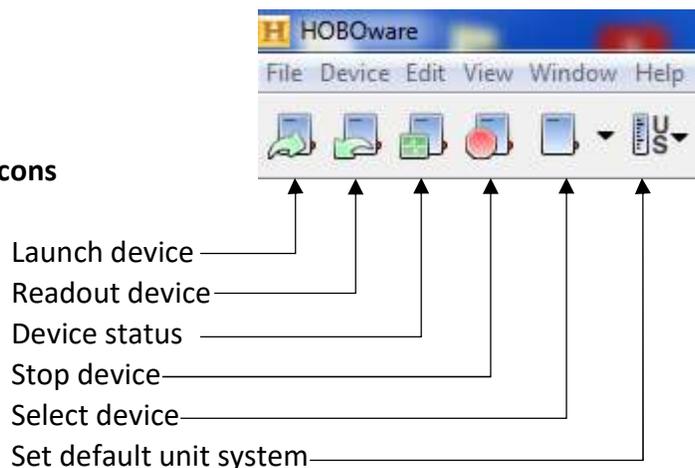
5.4   Logger Settings

Click the "Launch device" icon to retrieve the logger settings.

The **255-704-B Evaporation Logger** has been pre-programmed to read Channel #1 as water level in the evaporation pan. The logger will be programmed either in inches or millimeters, depending on the order specification. The example below is in inches.
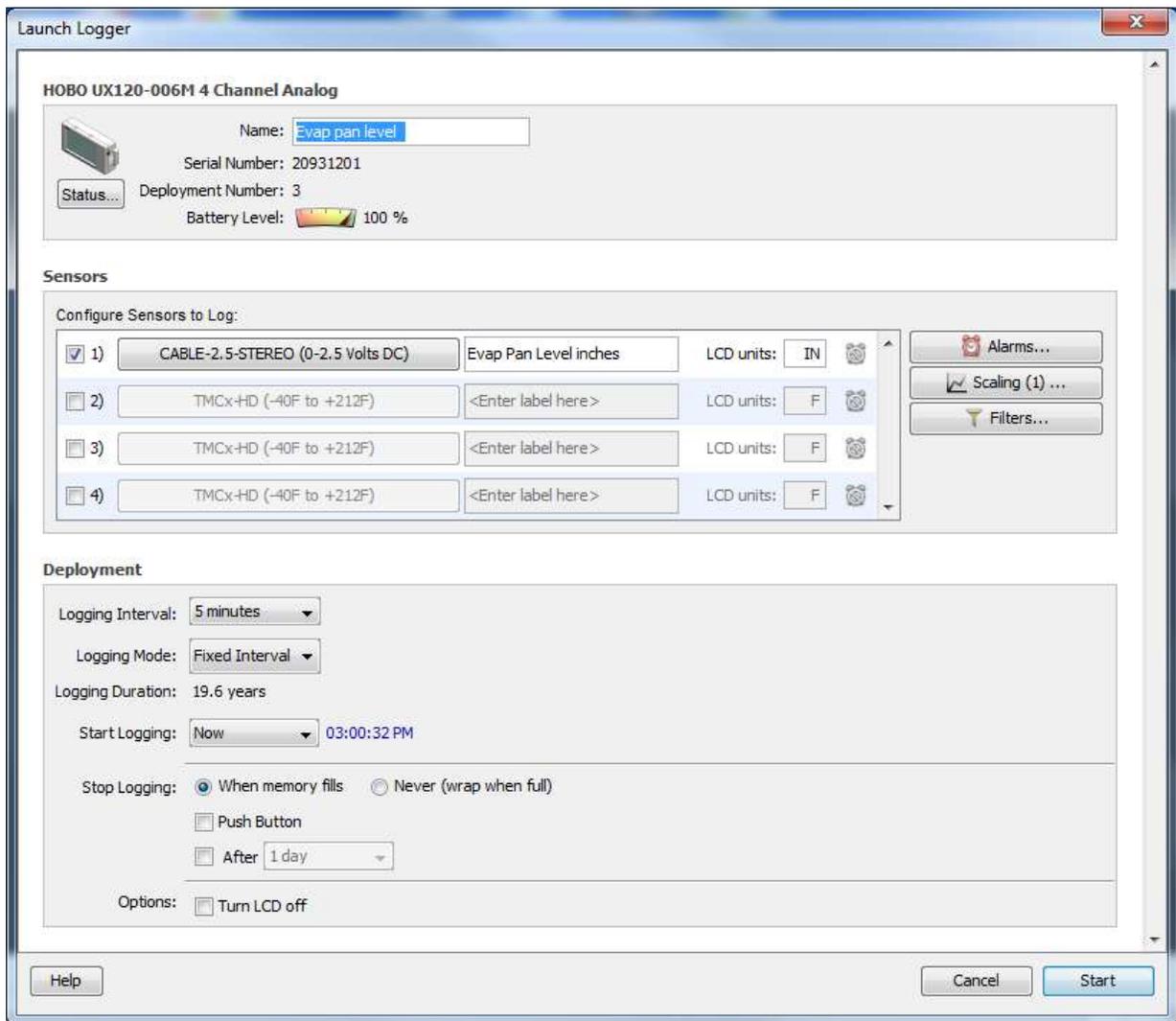
5. Please verify the settings on your logger.
6. Click the button marked "Scaling (1)…".
7. The Data Assistants window will open (screenshot, next page).
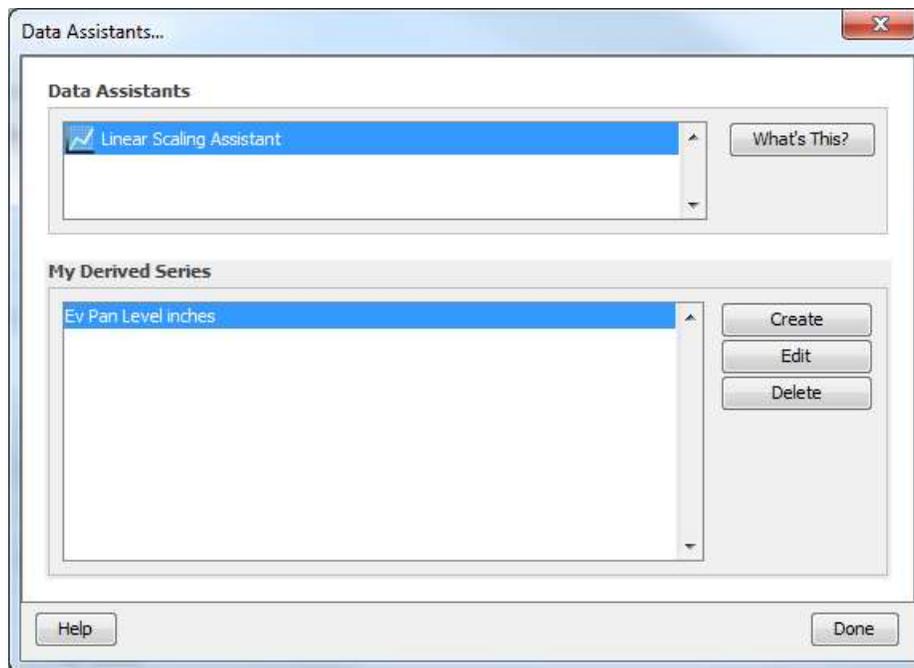
8. Make sure the "Ev Pan Level" series is highlighted, then click "Edit"
9. The Linear Scaling Assistant window will open. Please verify the settings on your logger.
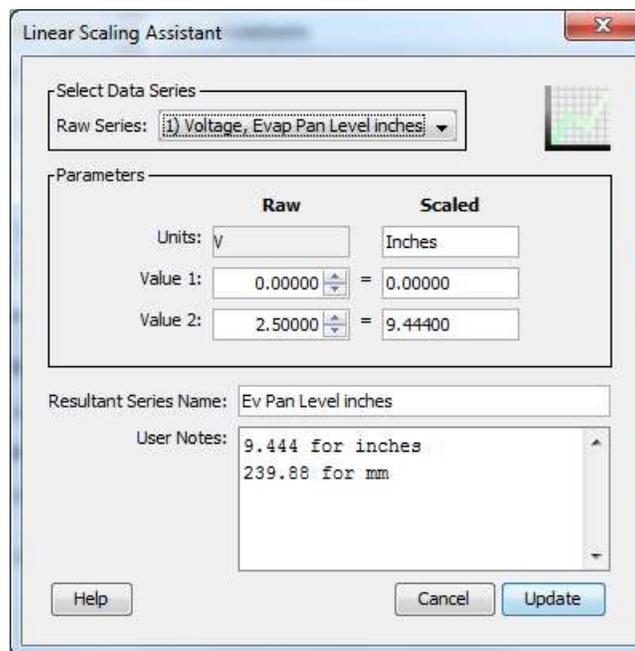
NOTE: The generic calibration shown above does not take into account the amount of water required to raise the float off the bottom of the gauge. If desired, an offset can be applied or a field calibration can be performed to scale the logger to actual water depth (Section 5.5 or 5.6).

10. After you have verified the settings, click "Cancel" (or "Update" if changes were made) to exit from the Linear Scaling Assistant window. Click "Done" on the Data Assistants page to close it. Click "Cancel" to close the "Launch Logger" window.

11. Click the "Device status" icon to open the Status window (below). Note the battery level and memory used, to ensure there is enough power and memory available for your next logging session.

12. Set the Screen Refresh Interval to one second. You will see the evaporation gauge readings presented in two ways:

- Number 1 <u>Voltage</u> is the pan level expressed in volts.
- Number 5 <u>Ev Pan Level</u> is the calibrated pan level, expressed in inches or millimeters.

Click "OK" or "X" to close the window.

5.5   Offset Calibration (optional)

The generic calibration (Section 5.4) does not take into account the amount of water required to lift the float off the bottom of the gauge. Since evaporation is the DIFFERENCE between readings (typically measured once every 24 hours), it isn't necessary to adjust the offset. However, to match the readings to the actual water level, add the offset to each scaled measurement in the Linear Scaling Assistant.

The amount of water required to lift the float is about 1.7 inches (varies from unit to unit). To find the actual offset for a particular unit, measure the water level in the evaporation pan (using a tape measure) and subtract the logger's reading at that level.

1. Measure the water depth and calculate the offset:
    Example: 8.00" Measured Depth – 6.30" Logger Reading = 1.7" Offset

2. Add the offset to the generic calibration values:
    Value 1 Scaled: 0 + 1.7" Offset = 1.70000
    Value 2 Scaled: 9.444 + 1.7" Offset = 11.14400

3. Program the new calibrations into the Linear Scaling Assistant.

	Raw	**Scaled**	
Units:	Volts	Inches	
Value 1:	0.00000	1.70000	(1.7" offset added)
Value 2:	2.50000	11.14400	(1.7" offset added)

5.6   Field Calibration (optional)

A two-point field calibration is easy to do provided there is an accurate way to measure the water depth in the evaporation pan. The depth can be measured with a tape measure, ruler, hook gauge, or by adding known amounts of water.

Connect a computer to the logger, run HOBOware, then open the Status window. In the Current Readings section, set the Screen Refresh Interval to 1 second.
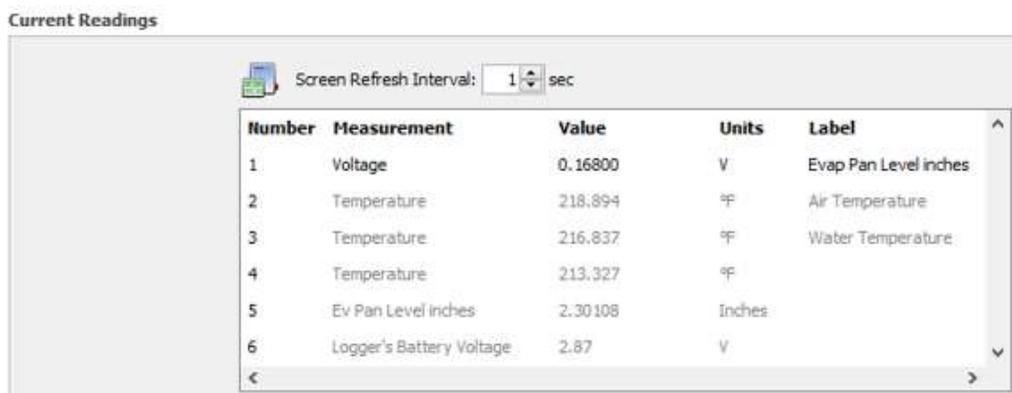
Use the calibration chart below to record your measurements:

	Raw	Scaled
Units:	Volts	inch / mm
Value 1:		
Value 2:		

1. **Value 1:**
   a. Fill the evaporation pan with approximately 5 inches of water. Allow the water to settle.
   b. Observe the Number 1 Voltage measurement shown in the Current Readings window. Record the voltage.
   c. As accurately as possible, measure the depth of water in the pan. Record the level.
2. **Value 2:**
   a. Add water to the evaporation pan until the water is approximately 8 inches deep. Allow the water to settle.
   b. Record the Number 1 Voltage measurement.
   c. As accurately as possible, measure the depth of water in the pan. Record the level.
3. Close the Status window.
4. Open the Launch Logger window and navigate to the Linear Scaling Assistant window (Section 5.4). Enter your measurements in place of the generic parameters.
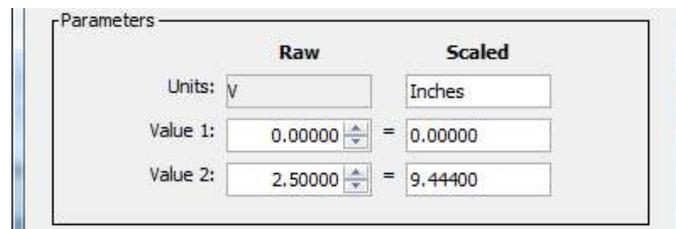
5. Click "Update" to save your measurements.
6. Return to the Status screen and compare the calibrated result (Number 5 Ev Pan Level) with the Value 2 depth measurement. They should be very close, provided the water level has not changed.

6 OPERATION

6.1 Start Logging

Connect your computer to the logger (Section 5.3). Click the "Launch device" icon to open the logger setup window. When ready, click the "Start" button (lower right) to start logging. The LCD display will now show the current position of the potentiometer expressed in inches (or millimeters). Look at the lower left corner of the LCD display and verify that the logger is "LOGGING". Disconnect the USB cable.

Replace the logger in the enclosure. Magnets on the back of the logger hold it in place. Press upward on the plug that connects the evaporation gauge signal to the logger (*occasionally the signal connector gets dislodged when the logger is moved to access the USB port*). Make a note of the time and date the logger was started, along with the initial reading.

6.2   Upload Data

Connect your computer to the logger (Section 5.3). Click the "Readout device" icon. Select a file location and filename, then click "Save". Once the file is saved the "Plot Setup" screen will open. Select the elements you want to display in graphical and tabular form, then click "Plot".
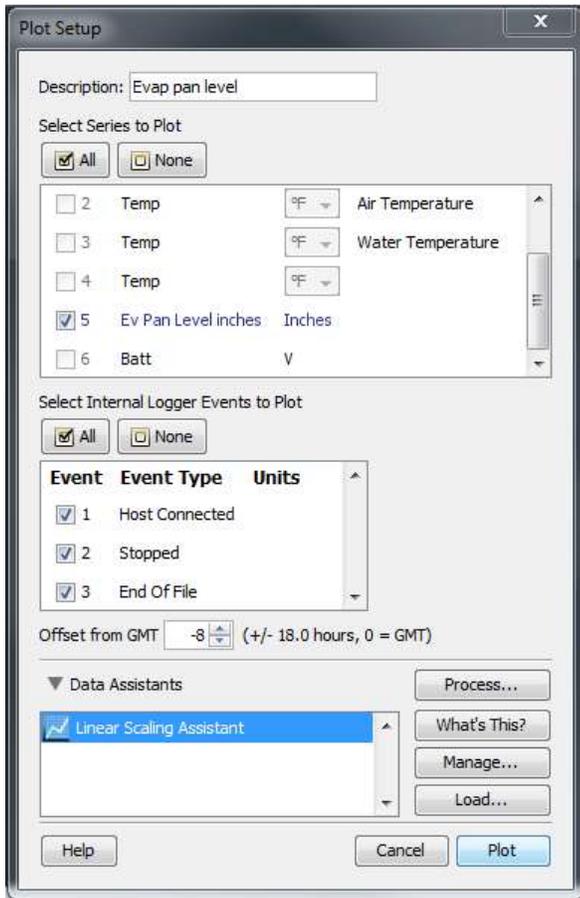
LEFT: Plot Setup screen showing the **Ev Pan Level** check box selected. The logger has three spare channels which can be used for monitoring temperature or other analog parameters. These channels can be selected to plot on the same graph as the evaporation pan level, or the file can be re-opened and selected sensors can be plotted together.

BELOW: The current log file is shown in tabular form and as a graph. The data can be exported (.csv format). Refer to the HOBOware manual for additional features, or click the Help drop-down box.
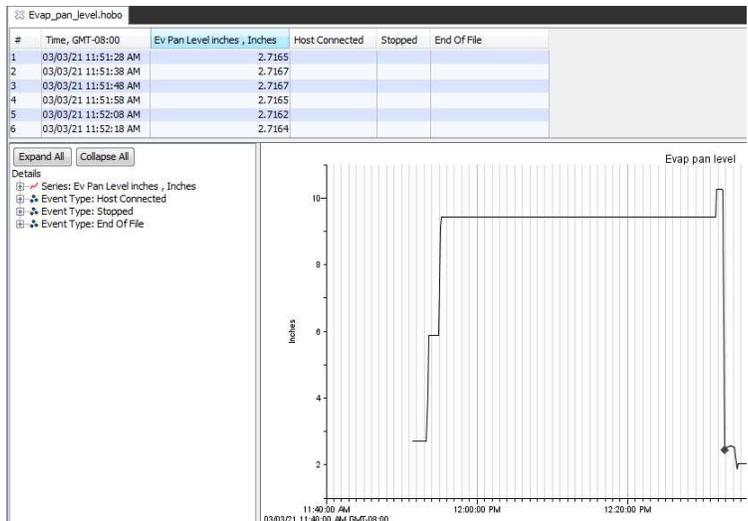
6.3   Water Level Management

The logger can operate for long periods of time un-attended due to its very large memory capacity. However, other factors must be considered to ensure the evaporation station is operating properly. A regular maintenance period should be scheduled to inspect the evaporation pan, water replacement system, and operation of the logger and evaporation gauge.

Evaporated water must be replaced. Ideally, the water level should be maintained from 7 to 8 inches deep (175 to 200 mm) in the evaporation pan. In practice, keeping the level between 5 and 8 inches deep (125 to 200 mm) is adequate. Do not overfill because the potentiometer may enter the dead band where the readings would be "floating", resulting in meaningless data.

Water replacement can be accomplished by means of a NovaLynx 255-620-A Automatic Refill System, if a water source is available. Otherwise the station will need to be visited often enough to keep the water level within acceptable limits.

Upload the data regularly and process the data. Water that is added either manally or automatically must be deducted from the evaporation totals. Water added by precipitation should also be deducted.

7   MAINTENANCE

At regular intervals, inspect the following:

- Check under the evaporation pan for leaks.
- Inspect the pipe between the pan and the analog evaporation gauge for leaks.
- Make sure the automatic refill system shuts off completely between refills.
- If the optional offset calibration (Section 5.5) was performed when the logger was installed, compare the reading on the logger with the actual water level (*use a measuring stick*).
  Note: *If the offset calibration was not done the measurements will not agree because the generic calibration does not include an offset for the amount of water required to cause the float to lift off the bottom of the pan.*
- Read the logger memory using a computer. Check the data to ensure the logger is recording data properly.
- From the HOBOware icon menu, select "Device status" and verify the battery is good and the memory is not too full. Replace the two AAA batteries if needed (Section 8).
- Be sure to "Start" the logger before disconnecting.
- Disconnect the USB cable.
- Install the logger in the enclosure.
- Make sure the sensor cable on the bottom of the logger is plugged in all the way and the display is showing the correct water level.
- Verify the logger is LOGGING and the display updates every 15 seconds.

8   BATTERY REPLACEMENT

WARNING: Keep all batteries away from small children. Dispose of used batteries properly.

IMPORTANT: When the batteries are removed all programming in the logger is lost and the display will go blank UNLESS you provide power to the logger while the batteries are being changed.

FIRST: Connect the USB cable from your logger to a computer, USB wall charger, or USB output battery pack.

1. Open the battery door on the back of the logger.

2. Remove any old batteries.

3. Insert two new batteries **observing polarity**.

4. Reinsert the battery door and snap it back into place.

The two AAA 1.5V batteries should provide you with 7 to 9 months of continuous use.
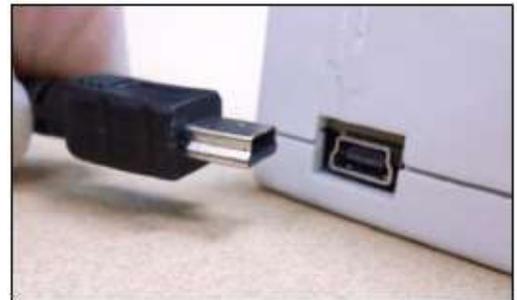
Note: A desiccant pack may be inside the logger box. It can be replaced or retreated as needed.

9   TEMPERATURE SENSORS (OPTIONAL)

The NovaLynx **210-TMC20-HD Water or Air Temperature Sensor** (sold separately) connects directly to the logger, and includes 20' (6 m) of cable. The sensor can be submerged in the evaporation pan to monitor the water temperature, or mounted in the NovaLynx **380-280 Solar Radiation Shield** for monitoring ambient air temperature.

To add sensors, connect them to available input channels and enable the channels. Open the "Launch Logger" window and select the check boxes on the left. Select the TMCx-HD sensor from a drop-down list (this step calibrates the channel). Type in a unique name for each sensor.
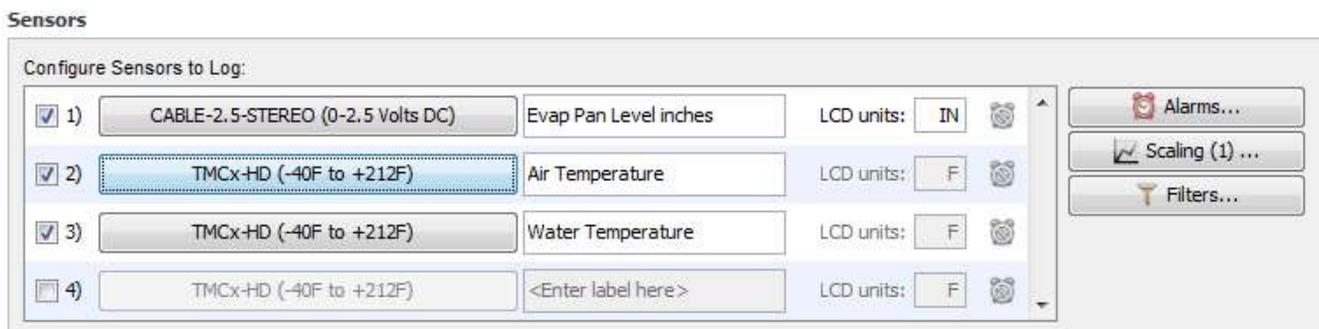
10 EVAPORATION GAUGE CALIBRATION CHECKUP

The 255-704-B Evaporation Logger can be used to check the accuracy of the potentiometer as part of a regular maintenance cycle. At a minimum, the operation of the potentiometer should be checked at the beginning of a monitoring season. **The following procedure applies to the logger when it is calibrated to the generic factory settings.**

Disassembly

1. Remove the four screws holding the evaporation gauge cover and lift the cover off.
2. Remove the chain from the sprocket by lifting the counterweight. Drape the counterweight and chain over the outside of the gauge. Do not attempt to remove the float.
3. Rotate the sprocket by hand to verify that it turns freely 360° without binding. It should spin freely when given a small push.
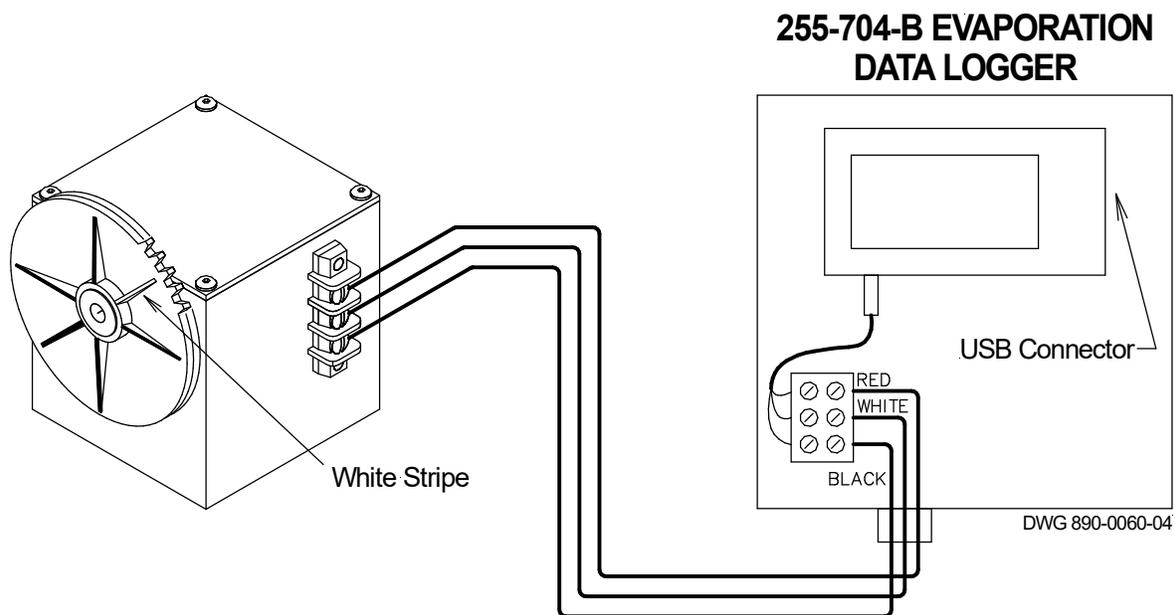
Testing with Evaporation Data Logger

Setup

1. Note that one ridge on the sprocket face has been painted with a white stripe. The other ridges are not painted and are spaced 60° around the face of the sprocket. The back side of the sprocket has similar ridges but none are painted.
2. Verify that the logger is displaying the position of the sprocket. Rotate the sprocket a little and note the change in reading. Remember, the display updates only once every 15 seconds. Be patient.

Procedure

1. Adjust the position of the sprocket until the display reads 9.00" or 228.6 mm. The white stripe on the **front** of the sprocket should be at approximately 1 o'clock position as viewed from the front.

2. While looking at the **back** of the sprocket, use a sticky-note as a pointer and apply it to the top of the evaporation gauge housing, aligning one corner to point at a rib on the back side of the sprocket.

3. Enter the measured value as the starting point in the table (next page).

4. Rotate the sprocket 60° counter-clockwise to the next ridge and record the measured value.

5. Continue recording measurements in 60° increments.

6. Compare the actual readings with the expected readings at each measured point, and determine the Pass/Fail status.

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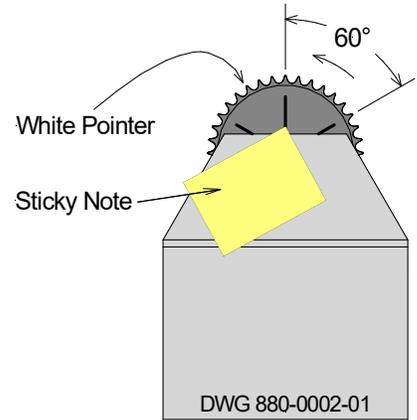
View from Back of Sprocket

Sprocket Position	Expected Value		Measured Value	Acceptable Limit		Pass	Fail
	inches	millimeters		inches	millimeters		
9.00" Starting point	9.000	228.6		±0.074	±1.9		
Rotated 60°	7.333	186.2		±0.074	±1.9		
Rotated 120°	5.666	143.9		±0.074	±1.9		
Rotated 180°	4.000	101.6		±0.074	±1.9		

Remedial Steps

- If the white stripe is not between 12:00 and 1:00 o'clock at the starting point (9.00" or 228.6 mm), the sprocket may have slipped on the shaft and be out of position.

- If the readings on the display are progressively worse the farther the sprocket is turned, the potentiometer may be out of specification, or there is added resistance in the circuit. Check all connections.

- If successive readings are non-linear then the potentiometer may need to be replaced.

- The measured depth of water and the display will not agree when calibrated to the generic settings, because the amount of water required to raise the float is not accounted for. This is acceptable since the amount of evaporation is *relative* (i.e. the difference of two readings). If desired, an offset can be applied or a field calibration can be performed to scale the logger (Section 5.5 or 5.6).

Reassembly

Replace the chain (Section 5.2). Replace the cover on the evaporation gauge.