HOBO® MicroRX Station (RX2101, RX2102, RX2103 & RX2104) Manual

HOBO ®
Data Loggers

RX2102 model shown

HOBO MicroRX Station

Models: RX2101 MicroRX Station
RX2102 MicroRX Station with Solar Panel
RX2103 MicroRX Water Level Station
RX2104 MicroRX Water Level Station with Solar Panel

Included Items:

- Grease packet
- Screws and washers
- Cable ties
- Six AA lithium batteries (RX2101 and RX2103 models)
- Rechargeable battery pack (RX2102 and RX2104 models)

Required Items:

- HOBOlink
- Smart Sensors (required for RX2101 and RX2102; optional for RX2103 and RX2104)

For RX2103 and RX2104 models:
One MX2001 water level sensor and one cable:

- MX2001-01-SS-S or MX2001-01-Ti-S (Titanium), 9-meter/30-foot depth)
- MX2001-02-SS-S, 30-meter/100-foot depth
- MX2001-03-SS-S, 76-meter/250-foot depth
- MX2001-04-SS-S or MX2001-04-Ti-S (Titanium), 4-meter/13-foot depth
- Cable (CABLE-RWL-xxx)

Optional Items:

- AC adapter (P-AC-1)
- Ground wire (CABLE-MICRO-G)
- 2-meter tripod (M-TPB)
- 3-meter tripod (M-TPA)
- 1.5 meter mast (M-MPB)
- 1-5/8 inch U-bolts (U-BOLT-KIT2)
- Guy wire kit (M-GWA)
- 1/2 inch stake kit (M-SKA)
- Well cap (WELL-CAP-02)

Smart sensors and accessories are available at www.onsetcomp.com.

The HOBO MicroRX Station provides continuous logging for a broad range of weather monitoring and microclimate applications with up to five plug-and-play smart sensor inputs. In addition, the HOBO MicroRX Water Level Station supports an easy-to-install water level sensor and integrated flow conversion for monitoring streams, lakes, wetlands, tidal areas, groundwater, and more. Logged data from the station is transferred at regular connection intervals to HOBOlink® cloud software where you can check the latest conditions, view graphs, configure sensors and alarms, set up a dashboard, and create on-demand and scheduled data exports. Inside its weatherproof enclosure, this compact station has a built-in LCD screen to check the current system configuration and status, start and stop logging, add and remove smart sensors, and connect to HOBOlink on demand. The station offers two primary power source options depending on your deployment needs: the RX2101 and RX2103 models include user-replaceable AA lithium batteries and the RX2102 and RX2104 models are designed with a built-in solar panel and rechargeable NiMH battery pack.

Specifications

Station

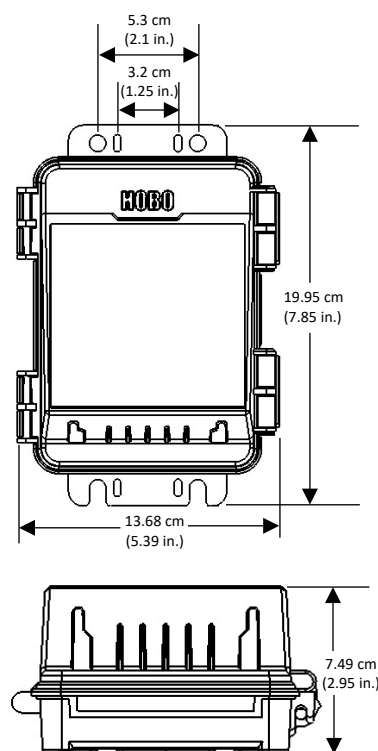|	
Operating Range	RX2101 and RX2103: -40° to 60°C (-40° to 140°F) RX2102 and RX2104: -20° to 60°C (-4° to 140°F)
Smart Sensor Connectors	5
Smart Sensor Network Cable Length	100 m (328 ft) maximum
Smart Sensor Data Channels	Maximum of 15 (some smart sensors use more than one data channel; see sensor manual for details)
Logging Rate	1 minute to 18 hours
Time Accuracy	±8 seconds per month in 0° to 40°C (32°F to 104°F) range; ±30 seconds per month in -40° to 60°C (-40° to 140°F) range
Battery Type/Power Source	RX2102 and RX2104: Integrated 1.7 watt solar panel and NiMH rechargeable battery pack; optional AC power adapter (P-AC-1) or external solar panel (SOLAR-xW) can be used in place of integrated solar panel RX2101 and RX2103: 6 AA 1.5 V lithium batteries or AC power adapter (P-AC-1)
Battery Life	**RX2102 and RX2104:** Typical 3–5 years when operated in the temperature range -20° to 40°C (-4° to 104°F); operating the station outside this range reduces the battery service life. Maximum connection rates with built-in solar panel, in full sun: • 10 minute connections year round for latitudes less than ±40° • 10 minute connections through three seasons in other regions, reduced to 30 minute connections in winter Maximum connection rates with external 5W or 15W solar panels: • 10 minute connections year round, in full sun • Connection rate with external solar panels may be less if deployed in partial sun Battery life without solar recharging, with hourly connections and 1 minute logging: • RX2102: 3 months • RX2104: 2 months **RX2101 and RX2103:** Battery life with daily connections: • RX2101: 1 year with 1 minute logging • RX2103: 1 year with 2 minute logging Battery life with hourly connections and 1 minute logging: • RX2101: 3 months • RX2103: 2 months **Note:** Deploying the station in areas with weak cell strength may reduce battery life.

Specifications (continued)

Dimensions

5.3 cm
(2.1 in.)

3.2 cm
(1.25 in.)

19.95 cm
(7.85 in.)

13.68 cm
(5.39 in.)

7.49 cm
(2.95 in.)

Memory	16 MB, 1 million measurements, continuous logging
Alarm Notification Latency	Logging interval plus 2–4 minutes, typical
Enclosure Access	Hinged door secured by two latches with eyelets for use with user-supplied padlocks
LCD	LCD is visible from 0° to 50°C (32° to 122°F); the LCD may react slowly or go blank in temperatures outside this range
Materials	Outer enclosure: Polycarbonate/PBT blend with brass inserts; Interior: Polycarbonate/PBT; Gasket: Silicone foam; Cable channel: Santoprene™ TPE; U-Bolts (not included): Steel with zinc dichromate finish
Dimensions	19.95 x 13.68 x 7.49 cm (7.85 x 5.39 x 2.95 in.); see diagrams at left
Weight	678 g (23.9 oz)
Mounting	Optional U-bolts are compatible with masts up to 4.14 cm (1.63 in.) mast diameter; can also be mounted with zip ties or mounted to a flat surface with screws
Environmental Rating	Weatherproof enclosure, NEMA 4X and IP66 (requires proper installation of cable channel system)
Wireless Radio	GSM/GPRS/EDGE: Quad band 850/900/1800/1900 MHz UMTS/HSPA+: Seven band 800/850/900/1800/1900/2100 MHz LTE: Twelve Band 700/800/850/900/1800/1900/2100/2600 MHz
Antenna	4G LTE
CE	The CE Marking identifies this product as complying with all relevant directives in the European Union (EU)
FC	See last page, FCC ID QIPPLS62-W, IC ID:7830A-PLS62W

Water Level Sensor

Water Level Sensor for RX2103 and RX2104 stations (MX2001-0x-SS-S or MX2001-0x-Ti-S)

Pressure (Absolute) and Water Level Measurements MX2001-01-SS-S and MX2001-01-Ti-S

Operation Range	0 to 207 kPa (0 to 30 psia); approximately 0 to 9 m (0 to 30 ft) of water depth at sea level, or 0 to 12 m (0 to 40 ft) of water at 3,000 m (10,000 ft) of altitude
Factory Calibrated Range	69 to 207 kPa (10 to 30 psia), 0° to 40°C (32° to 104°F)
Burst Pressure	310 kPa (45 psia) or 18 m (60 ft) depth
Water Level Accuracy*	Typical error: ±0.05% FS, 0.5 cm (0.015 ft) water Maximum error: ±0.1% FS, 1.0 cm (0.03 ft) water
Raw Pressure Accuracy**	±0.3% FS, 0.62 kPa (0.09 psi) maximum error
Resolution	<0.02 kPa (0.003 psi), 0.21 cm (0.007 ft) water
Pressure Response Time (90%)***	<1 second at a stable temperature

Pressure (Absolute) and Water Level Measurements MX2001-02-SS-S

Operation Range	0 to 400 kPa (0 to 58 psia); approximately 0 to 30.6 m (0 to 100 ft) of water depth at sea level, or 0 to 33.6 m (0 to 111 ft) of water at 3,000 m (10,000 ft) of altitude
Factory Calibrated Range	69 to 400 kPa (10 to 58 psia), 0° to 40°C (32° to 104°F)
Burst Pressure	500 kPa (72.5 psia) or 40.8 m (134 ft) depth
Water Level Accuracy*	Typical error: ±0.05% FS, 1.5 cm (0.05 ft) water Maximum error: ±0.1% FS, 3.0 cm (0.1 ft) water
Raw Pressure Accuracy**	±0.3% FS, 1.20 kPa (0.17 psi) maximum error
Resolution	<0.04 kPa (0.006 psi), 0.41 cm (0.013 ft) water
Pressure Response Time (90%)***	<1 second at a stable temperature

Specifications (continued)

Pressure (Absolute) and Water Level Measurements MX2001-03-SS-S

Operation Range	0 to 850 kPa (0 to 123.3 psia); approximately 0 to 76.5 m (0 to 251 ft.) of water depth at sea level, or 0 to 79.5 m (0 to 262 ft.) of water at 3,000 m (10,000 ft.) of altitude
Factory Calibrated Range	69 to 850 kPa (10 to 123.3 psia), 0° to 40°C (32° to 104°F)
Burst Pressure	1,200 kPa (174 psia) or 112 m (368 ft.) depth
Water Level Accuracy*	Typical error: ±0.05% FS, 3.8 cm (0.125 ft.) water Maximum error: ±0.1% FS, 7.6 cm (0.25 ft.) water
Raw Pressure Accuracy**	±0.3% FS, 2.55 kPa (0.37 psi) maximum error
Resolution	<0.085 kPa (0.012 psi), 0.87 cm (0.028 ft.) water
Pressure Response Time (90%)***	<1 second at a stable temperature

Pressure (Absolute) and Water Level Measurements MX2001-04-SS-S and MX2001-04-Ti-S

Operation Range	0 to 145 kPa (0 to 21 psia); approximately 0 to 4 m (0 to 13 ft.) of water depth at sea level, or 0 to 7 m (0 to 23 ft.) of water at 3,000 m (10,000 ft) of altitude
Factory Calibrated Range	69 to 145 kPa (10 to 21 psia), 0° to 40°C (32° to 104°F)
Burst Pressure	310 kPa (45 psia) or 18 m (60 ft.) depth
Water Level Accuracy*	Typical error: ±0.075% FS, 0.3 cm (0.01 ft.) water Maximum error: ±0.15% FS, 0.6 cm (0.02 ft.) water
Raw Pressure Accuracy**	±0.3% FS, 0.43 kPa (0.063 psi) maximum error
Resolution	<0.014 kPa (0.002 psi), 0.14 cm (0.005 ft.) water
Pressure Response Time (90%)***	<1 second at a stable temperature

Water Level Sensor and Cable

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Dimensions	Sensor (MX2001-0x-SS-S and MX2001-0x-Ti-S): 2.54 cm (1.0 inches) diameter, 9.91 cm (3.9 inches) length
	Cable (CABLE-RWL-xxx): 0.47 cm ±0.03 (0.185 inches ±0.01) diameter, 0.2 to 400 m (0.65 to 1,312 ft.) length; 5.44 x 2.46 x 1.45 cm (2.14 x 0.97 x 0.57 inches) connector station end; 5.0 x 2.5 cm (1.97 x 0.98 inches) connector sensor end
	Note: The length of the water level logger cable can vary -0% to +3% +10 cm (3.9 inches) from the length ordered.
Weight	Stainless sensor (MX2001-0x-SS-S): Approximately 141.4 g (4.99 oz) in air; approximately 93.4 g (3.3 oz) in fresh water
	Titanium sensor (MX2001-0x-Ti-S): Approximately 80 g (2.83 oz) in air; approximately 37 g (1.3 oz) in fresh water
	Cable (CABLE-RWL-XXX): 39 g (1.38 oz) per 1 meter (3.28 ft)
Materials	Stainless sensor (MX2001-0x-SS-S): Stainless steel housing, Viton and Buna-N O-rings, ceramic sensor in stainless steel end cap
	Titanium sensor (MX2001-0x-Ti-S): Acetal housing, Viton and Buna-N O-rings, ceramic sensor in Titanium end cap
	Cable (CABLE-RWL-xxx): Polycarbonate strain relief (top end connection), PVC end cap (sensor connection), nylon collar nut, Viton O-rings, polyurethane jacket
Environmental Rating	IP68; cable is waterproof for continuous immersion up to 112 m (368 ft), refer to sensor model specifications for sensor depth rating

Barometric Pressure (RX2103 and RX2104 station)

Operation Range	66 to 107 kPa (9.57 to 15.52 psia)
Temperature Calibrated Range	-20 to 50°C (-4 to 122°C)
Accuracy	±0.2 kPa (±0.029 psi) over full temperature range at fixed pressure; maximum error ±0.5% FS

Specifications (continued)
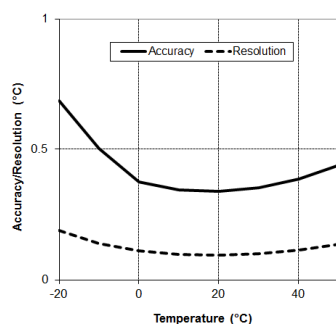
Water Level Accuracy*	Typical error: ±0.075% FS, 0.3 cm (0.01 ft.) water Maximum error: ±0.15% FS, 0.6 cm (0.02 ft.) water
Resolution	<0.01 kPa (0.0015 psi)
Response Time	<1 second at stable temperature
Stability (Drift)	<0.01 kPa (0.0015 psi) per year

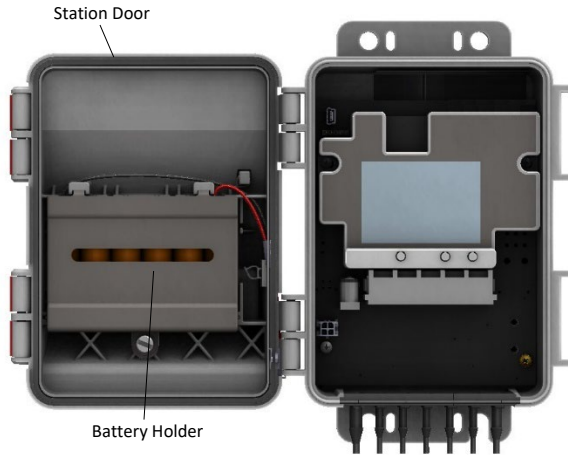**Temperature (Water Level Sensors MX2001-0x-SS-S and MX2001-0x-Ti-S)**

Operation Range	-20° to 50°C (-4° to 122°F)
Accuracy	±0.44°C from 0° to 50°C (±0.79°F from 32° to 122°F), see *Plot A*
Resolution	0.1°C at 25°C (0.18°F at 77°F), see *Plot A*
Response Time (90%)	5 minutes in water (typical)
Stability (Drift)	0.1°C (0.18°F) per year

Plot A

* Water Level Accuracy: With accurate reference water level measurement, known water density, and a stable temperature environment. System Water Level Accuracy equals the sum of the Barometric Water Level Accuracy plus the selected sensor Water Level Accuracy.

** Raw Pressure Accuracy: Absolute pressure sensor accuracy includes all sensor drift, temperature, and hysteresis-induced errors.

*** Changes in Temperature: Allow 20 minutes in water to achieve full temperature compensation of the pressure sensor. There can be up to 0.5% of additional error due to rapid temperature changes. Measurement accuracy also depends on temperature response time.
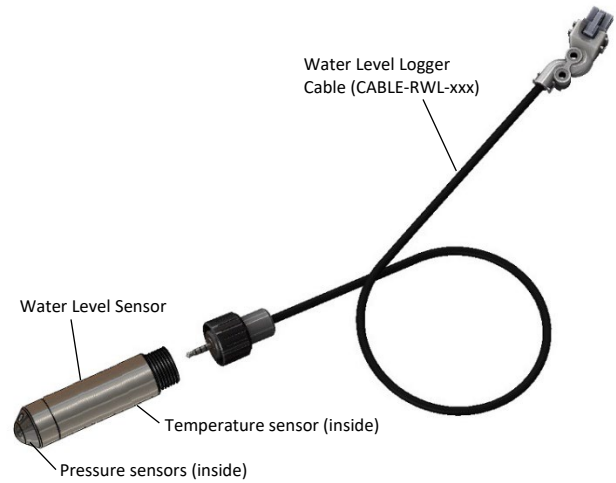
Table of Contents

Device Components and Operation

RX2101 model shown

Internal RX2104 model shown

RX2104 model shown

Station Door: The protective, hinged door covering the LCD and electronics. The station serial number and device key needed for HOBOlink registration are located on the inside of the door.

Battery Holder: The location where batteries are installed (AA 1.5 V lithium batteries in RX2101 and RX2103 models or a NiMH battery pack in RX2102 and RX2104 models (see both *Battery Information* sections).

Micro SIM Card: Enables cellular communications.

USB Port: Port that connects the station to the comsuter using a USB cable as needed for HOBOware® if you are installing your own micro SIM card or for downloading data to a CSV file.

LCD Screen: Details about system, module, and sensor operation (see *LCD Operation*).

Solar Panel Port: In RX2102 and RX2104 models, use this port to plug in the built-in solar panel or an external solar panel with a higher wattage (see *Setting up the Station*).

Battery Port: Port where you plugs in the internal battery cable (see *Setting up the Station* and both *Battery Information* sections).

AC Adapter Port: Port where you plug in an AC adapter (see both *Battery Information* sections).

Cable Channel: Allows you to route sensor cables and other wires to create a weatherproof seal. Seal any open holes with the integrated plugs (see *Setting up the Station* and *Deployment Guidelines*).

Smart Sensor Connectors: Input jacks to connect up to 5 smart sensors (see *Setting up the Station*). The station can support up to 15 smart sensor data channels; some smart sensors have more than one data channel.

Water Level Sensor Port: Allows you to connect a water level sensor in the RX2103 and RX2104 models (see *Setting up the Station*).

Connect/Search Button: Allows you to connect to HOBOlink or search for new smart sensors (see *LCD Operation)*.
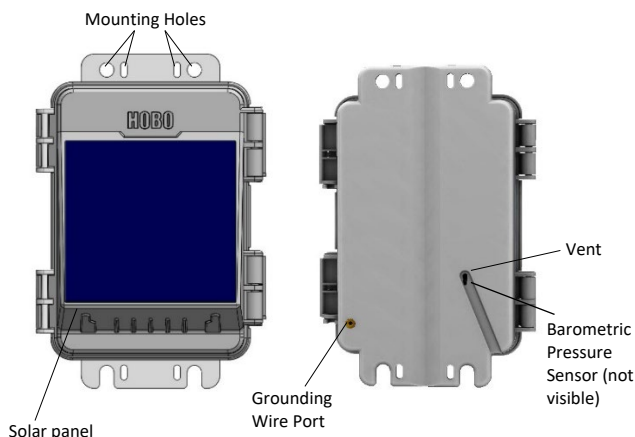
Start/Stop Button: Starts and stops logging or clears a fault code (see *LCD Operation*).

Select Button: Cycle through information about the smart sensors and water level sensor module (see *LCD Operation*).

Mounting Holes: Mount the station using the inner or outer holes at the top and bottom of the logger (see *Deployment Guidelines*).
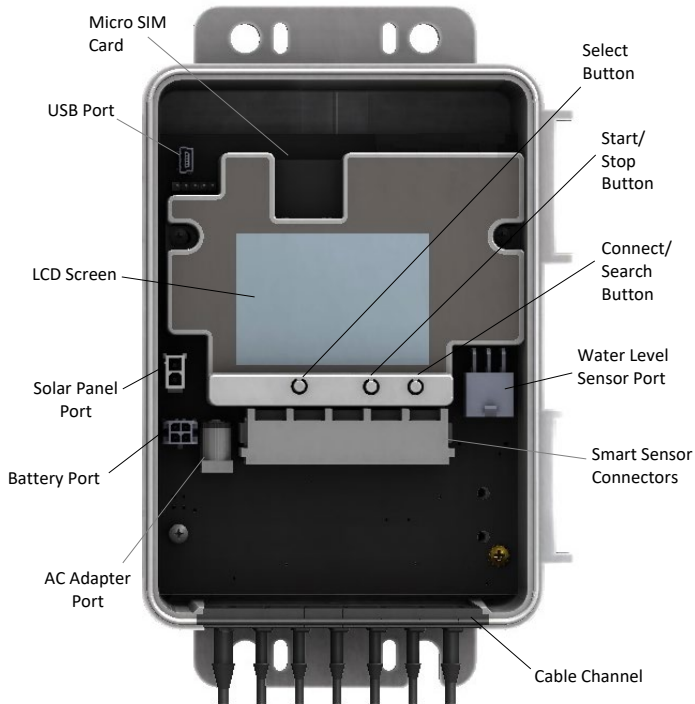
Solar Panel: 1.7 watt solar panel built into the front of the station door in RX2102 and RX2104 models.

Grounding Wire Port: Port on the back of the station that allows you to connect a grounding wire (CABLE-MICRO-G) (see *Installing the Grounding Wire*).

Vent: Allows pressure to equalize inside the station while keeping water out.
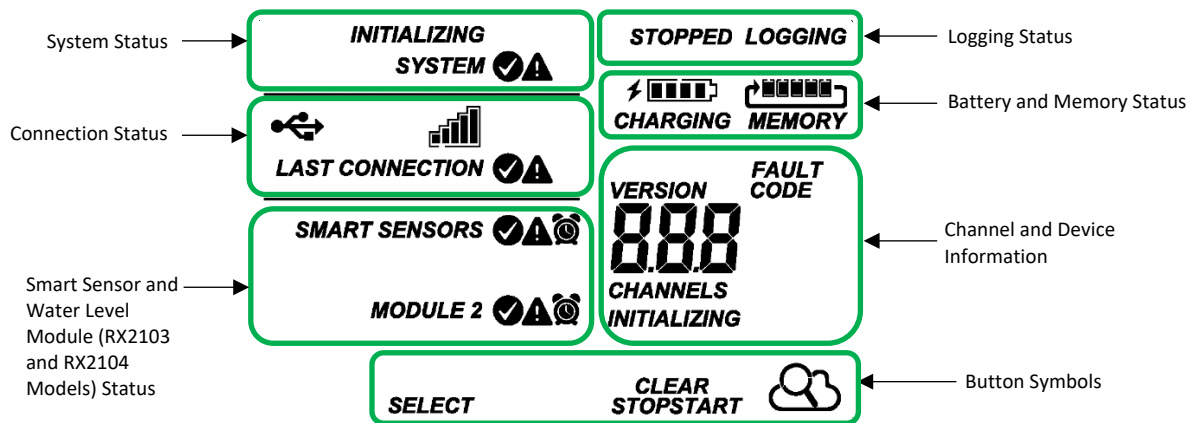
Barometric Pressure Sensor: Sensor located behind the vent in RX2103 and RX2104 models that logs barometric pressure for use with the water level sensor.

Water Level Sensor: Sensor for RX2103 and RX2104 models. The nose cone on the sensor houses the pressure sensors and the body of the sensor houses the temperature sensor.
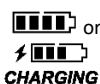
Water Level Logger Cable: Cable that connects the sensor to the station via the water level sensor port (see *Setting up the Station*).

LCD Operation

The following image shows all symbols illuminated on the LCD screen with an overview of what each section of the LCD represents. Refer to the table below for details about each section and associated symbols.

System Status	Shows the overall system status.
SYSTEM or **INITIALIZING SYSTEM**	When the station is powered up, *Initializing System* flashes in the upper left part of the LCD. After initialization is complete, *System* remains illuminated and one of these symbols appears: ✓ indicates the system is ok. ⚠ indicates there is a problem with the system; check the Device page for your station in HOBOlink.
Connection Status	Shows the status of the HOBOlink connection and other items.
⟵• (USB)	Indicates the station is connected to a USB cable.
▭▭▭ (signal)	Shows the strength of the cell signal; the more bars there are, the stronger the signal. Blinks while connecting to HOBOlink.
CONNECTION or **LAST CONNECTION**	When the station is attempting to connect or is currently connected to HOBOlink, *Connection* flashes on the LCD. After the connection is complete, *Last Connection* remains illuminated and one of these symbols appears: ✓ indicates the last connection to HOBOlink was ok. ⚠ indicates there was a problem with the last connection; check the Connections Log in HOBOlink.
Smart Sensor and Module Status **SMART SENSORS** **MODULE 2**	Shows the status of the smart sensors and the water level sensor (RX2103 and RX2104 models). One of the following symbols also appears next to smart sensors or module 2 (water level sensor) (if applicable): ✓ indicates the smart sensor or water level sensor module is ok. ⚠ indicates there is a problem with the smart sensor or water level sensor module; check the Device page for your station in HOBOlink. ⏰ indicates a sensor alarm has tripped. Flashes on the LCD until the alarm is cleared; check the Latest Alarms list in HOBOlink.
Logging Status **STOPPED** or **LOGGING**	Indicates whether the station is currently logging. *Stopped* indicates the station is not currently logging; *Logging* indicates it is currently logging. Press the Start/Stop button to start or stop logging as desired. Note that *Logging* blinks until the first data point is logged after you press the Start button. Pressing Start also initiates a connection to HOBOlink. Pressing Stop stops logging, but it does not initiate a connection to HOBOlink.
Battery and Memory Status	Shows the current battery level and memory.

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▮▮▮⁺ or **⚡▮▮▮⁺** **CHARGING**	The battery indicator shows the approximate battery power remaining. In this example, the battery is fully charged. The lightning bolt appears when an AC adapter or solar panel is plugged into the station. *Charging* flashes while the battery is being charged.
⊂▮▮▮▮▮⁺ **MEMORY**	When the station is logging, it records data indefinitely, with the newest data overwriting the oldest data until you stop the station. This continuous logging is represented by the arrow in this symbol. With normal communication, the memory used is small, and this icon shows one bar. If the station is not able to connect to HOBOlink, this icon shows the amount of memory that is filled with data waiting to be downloaded at the next connection.
Channel and Device Information	This part of the LCD shows the number of channels and other information about each module. It also shows general device information. Press the Select button to scroll through the main screen, smart sensors screen, and module 2 (water level sensor, if applicable).

Main Screen

The main LCD screen displays the total number of channels in use by the system. This is a combination of smart sensor channels and four channels for the water level sensor (if installed). In this example, the main LCD screen shows 9 channels, which is a total of 5 smart sensor channels plus 4 channels for the water level sensor parameters.
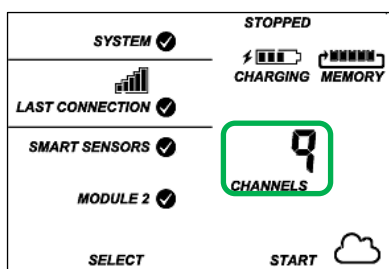
Smart Sensors Screen

The smart sensors screen displays the number of smart sensor channels. Note that some smart sensors have more than one channel associated with them so the number of channels may not match the number of physical smart sensors. In this example, there are 5 smart sensor channels.
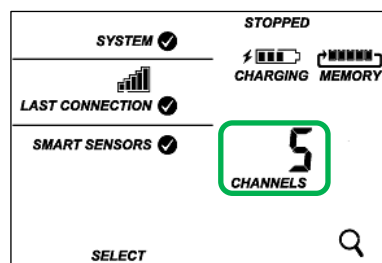
Module 2

The module 2 screen appears only if a water level sensor is installed (RX2103 and RX2104 models). The channel count is listed as 4 representing barometric pressure, water pressure, differential pressure, and water temperature. Note that water level and water flow channels are derived in HOBOlink and not included in the channel count shown on the station LCD.
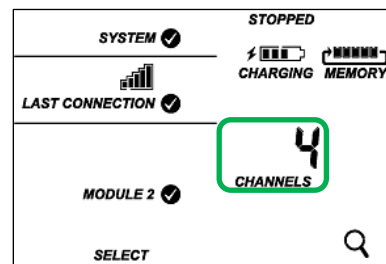
INITIALIZING	Blinks in the lower right part of the LCD when a firmware update is underway. The LCD displays which module or element is being updated.
FAULT CODE **004**	A numerical code that appears when a system fault has occurred. You may need to provide this code to Onset Technical Support. See *Troubleshooting* for details.
VERSION **108**	The version number of the station firmware. Appears only when powering up the device.
Button Symbols	Use the buttons below the following symbols to operate the station. Press any of the three buttons to turn on the LCD.
SELECT	Cycles through status information about the smart sensors and the water level sensor module (if applicable).
START	Starts logging. Not available while the station is actively connected to HOBOlink.
STOP	Stops logging. Not available while the station is actively connected to HOBOlink.
☁	Connects to HOBOlink. Available only on the main LCD screen. Not available when scrolling through smart sensor and module information with the Select button. In addition, this option is not available while a connection is underway or active.
🔍	Search button tells the station to detect all currently installed smart sensors. As you add or remove smart sensors (while the station is stopped), press the Select button and then the Search button for the system to recognize your changes. Not available for smart sensors while the station is logging.
CLEAR	Clears a fault code.

Notes on LCD Operation:

- The LCD turns off after 5 minutes of inactivity. Press any button to turn the LCD back on.

- There can be a delay before the LCD updates. For example, if you plug in an AC adapter, it may take a few seconds before the lightning bolt icon appears on the LCD. This delay is by design to preserve battery life.

Setting up the Station
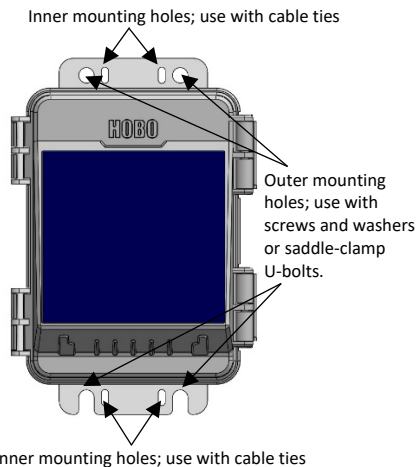
Follow these steps to set up the station.

Tools required:

- A Phillips-head screwdriver for installing the water level sensor (RX2103 and RX2104 models) or mounting the station to a flat surface with screws.
- A ½ inch box wrench if using U-bolts to mount the station to a tripod or mast.
- Other tools may be required depending on the accessories you are using for your station deployment.

1. **Mount the station.**

   There are three ways to mount the station using the built-in mounting tabs. **Note:** You can also defer mounting until the end of the process if you want to perform initial testing.

   - Use the two sets of outer holes and 1-5/8 inch saddle-clamp U-bolts to attach the logger to a tripod or mast (this is the recommended method for mounting on a mast). Do not use U-bolts without the saddle clamps as that could bend the mounting tabs and damage the housing or compromise the weatherproof seal. The flat portion of the saddle clamps should be against the mounting tabs.

Inner mounting holes; use with cable ties

Outer mounting holes; use with screws and washers or saddle-clamp U-bolts.

Inner mounting holes; use with cable ties

   - Use the included cable ties with the two sets of inner holes to affix the logger to a PVC pipe or mast.
   - Use the included screws and washers with the two sets of outer holes to adhere the logger to a wall or flat surface.

   Important: See *Deployment Guidelines* and *Installing the Grounding Wire* for installation steps and other deployment guidelines.

2. **Remove the cable channel.** Make note of how the cable channel is oriented when removing it.

Cable channel
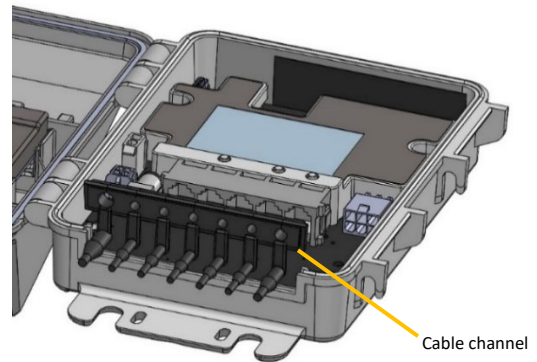
3. **Install the water level sensor if applicable (RX2103 and RX2104 models).**

   a. Insert the water level sensor cable jack into the water level sensor. Screw on locking nut (hand tight).

   Important: Make sure the O-rings on the cable jack end and the cable and sensor mating housing surfaces are clear of any debris. Contaminating these surfaces can cause leaks that may lead to sensor failure.
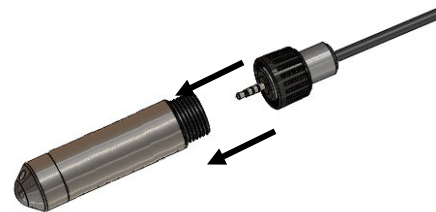
   b. Plug the other end of the water level sensor cable into the port on the right side of the board.

Plug in water level sensor cable here.
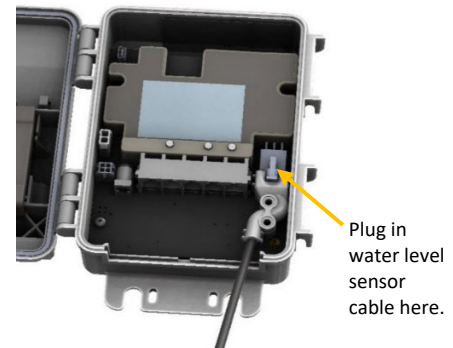
   c. Use a Phillips head screwdriver to secure the water level sensor cable in place with the two screws provided.

Secure the cable with the enclosed screws.
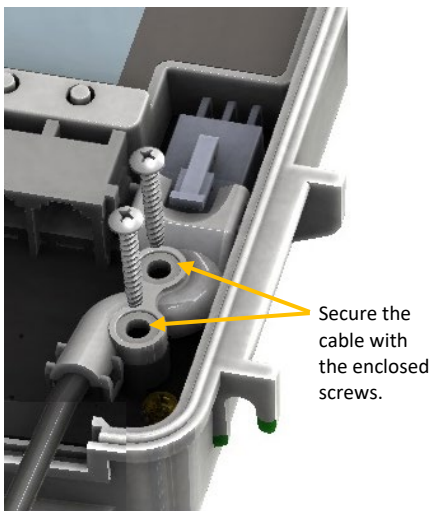
d. Route the cable through the far-right hole in the cable channel.
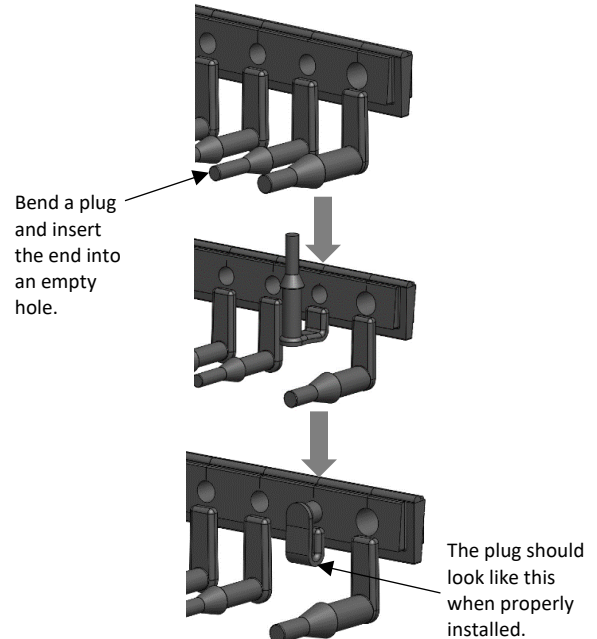
4. **Plug in smart sensors if applicable.**

   a. Plug the smart sensors into the ports below the LCD. When using multiple smart sensors, it is easiest to start by plugging one into the leftmost or rightmost connector and then working your way across the connectors in order.


Plug in smart sensors here.
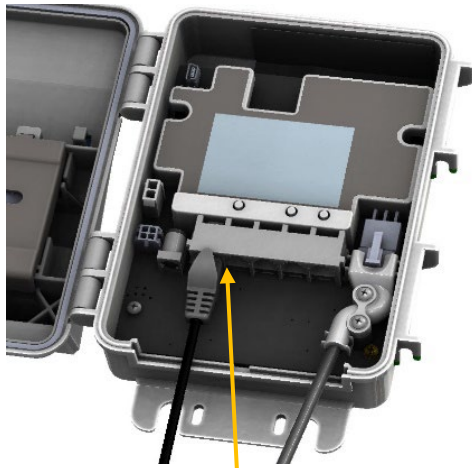
   b. Route the cables through the holes in the cable channel. There are slits in the cable channel above each hole to guide the cable into the hole. You may need to slightly bend the ends of the channel to reveal the slits and push each cable into the hole that lines up with the corresponding sensor connector.

5. **Grease and reinstall the cable channel.**

   a. Use the integrated plugs to fill any unused holes. Bend the plugs up so that you can push them into the holes. Once a plug is partially pushed through, you can pull on the part of the plug that is inside the case. You may need to bend the ends of the channel slightly to widen the holes for installing the plugs.

Bend a plug and insert the end into an empty hole.

The plug should look like this when properly installed.

   b. Lightly coat the portion of the sensor cables that will be in the cable channel with a small amount of silicone grease (about the size of a pea).

   c. Lightly coat the bottom and two sides of the cable channel with silicone grease.

   d. Reinstall the cable channel in the station making sure the key on the bottom is inserted in the notch in the station enclosure.

Use this notch as a guide to install the key in the bottom of the cable channel.

Cable channel reinstalled
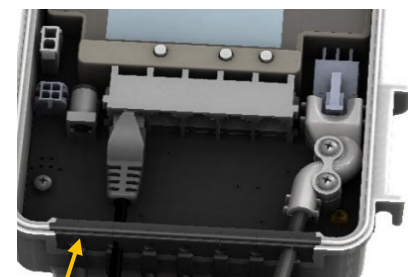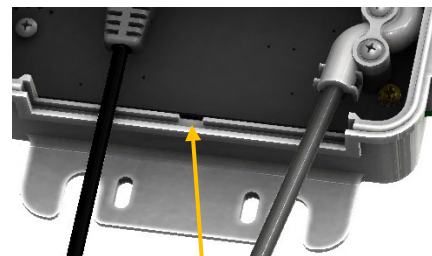
6. Plug in the battery and wait for the station to connect to HOBOlink.

> **Note for RX2103 and RX2104 models:** If you are using the water level sensor, make sure it is plugged in before powering up the station in this step. Otherwise, only barometric pressure is logged.

a. Plug in the battery cable. For RX2102 and RX2104 models, plug in the solar panel cable for the built-in solar panel. If you are using an external solar panel, tuck the built-in solar panel cable inside the station door. Plug in the external solar panel cable. Lightly coat the portion of the cable that will be placed in the rubber cable channel with a small amount of silicone grease. Route the cable through the far-left hole in the cable channel.)


Plug in solar panel cable here (RX2102 and RX2104).
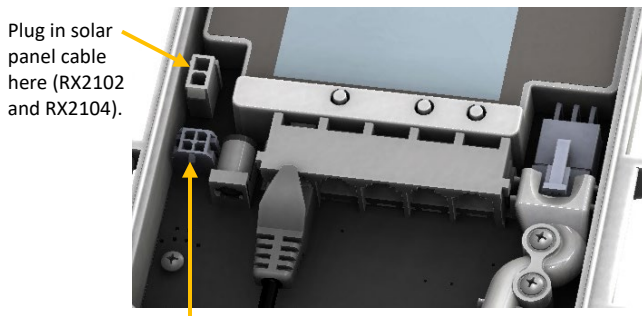
Connect the battery cable here.

b. Once the battery cable is plugged in, *Initializing System* flashes on the LCD. A checkmark appears next to *System* after the station initialization is complete.

Initializing System flashes when the battery cable is first plugged in.
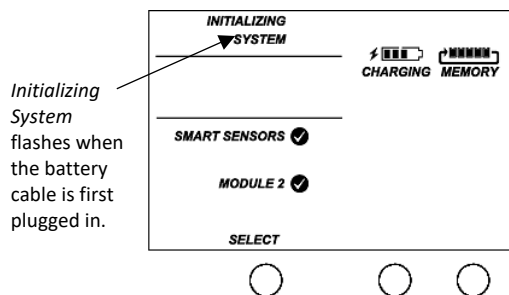
c. After the station powers up, it connects to HOBOlink automatically within two minutes. The cell icon and *Connection* flashes while the connection is underway. Once the connection is complete, a checkmark appears next to Last Connection. Note that the entire initialization process may take several minutes; wait until Last Connection and the checkmark appear before continuing to step 9.

A checkmark appears next to Last Connection after the station connects to HOBOlink.
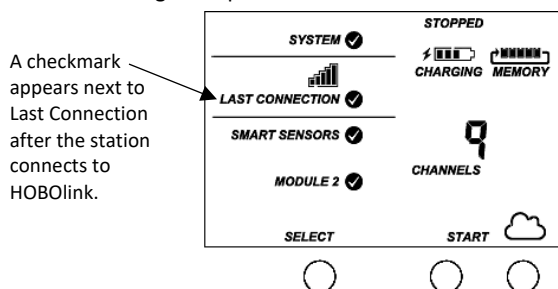
7. Log in to HOBOlink.

Go to www.hobolink.com and log in to an existing account or create a new one. You'll receive an email to activate the new account.

8. Register and Configure the RX Device.

Once your device is set up, register it in HOBOlink. During the registration process, HOBOlink walks you through adding the device to your organization, configuring the device and its sensors, and setting up any alarms and alerts you want to add. See the *HOBOlink User Guide* for detailed information.

Note: If you are using your own micro SIM card, follow the instructions at https://www.onsetcomp.com/support/manuals/23845-installing-micro-sim-rx2100-station before continuing.

9. Start logging.

Press the Start button on the station to start logging. The station connects to HOBOlink (*Connection* blinks on the LCD) and logging begins at the logging interval specified for smart sensors and the water level module (if applicable).

Press this button to start logging.
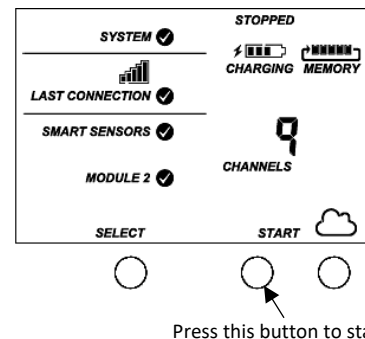
Once the station begins logging, *Logging* appears in the upper right corner of the LCD as shown in the following example. *Logging* blinks until the station records the first logging sample. At that point, it stops blinking and remains illuminated until you stop logging.

Logging appears when logging begins.
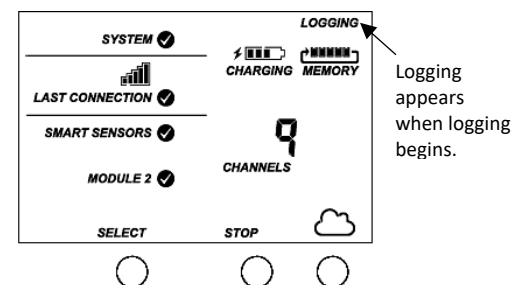
If you are not using a water level sensor, then the setup is complete. Measurements are uploaded to HOBOlink each time the station connects.

Setting up Water Level and Water Flow Channels in HOBOlink (RX2103 and RX2104 Models)

If you installed a water level sensor module (RXMOD-W1) and sensor, obtain a reference water level reading, then configure the water level and water flow channels in HOBOlink.

Make sure the water level sensor is deployed in its final location and the station is logging. Take a reference level reading, measuring the water level from your reference point.

> **Important:** Note the reference level reading as well as the date and time it was taken.

If you installed a water level sensor module and water level sensor, the station automatically logs four measurement channels:

- Barometric pressure
- Water pressure
- Differential pressure
- Water temperature

In addition, you can set up two additional channels in HOBOlink:

- Water level
- Water flow

These derived channels are available only once enabled in HOBOlink. The data for these two channels is calculated at each logging interval based on the measurements from the pressure and temperature channels and the settings and values you enter in HOBOlink.

If a water level sensor is not physically connected to the module, barometric pressure is the only channel logged related to the water level sensor. You cannot set up water level and water flow unless you install the water level sensor as described in *Setting up the Station*. Similarly, if you unplug a water level sensor while a station is logging, only barometric pressure is logged and the rest of the water level sensor channels report errors.

See the *HOBOlink User Guide* for detailed information.

Starting and Stopping Logging

You can start and stop logging with the Start/Stop button on the station or from HOBOlink.
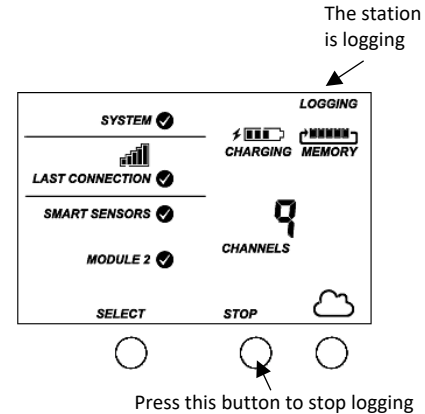
To start and stop logging with the station:

1. When the station is stopped, press the Start button to start logging. The device connects to HOBOlink (*Connection* blinks on the LCD) and then logging begins at the logging interval specified for smart sensors and water level sensor (if applicable).

The station is stopped

Press this button to start logging
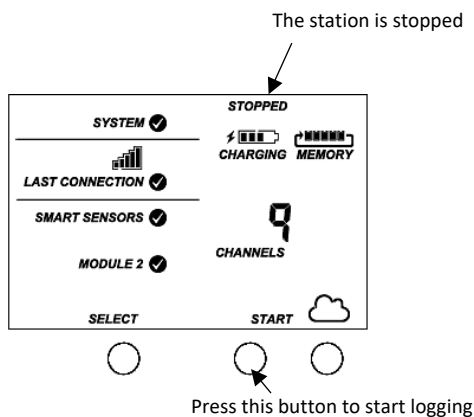
2. To stop logging, press the Stop button. Logging stops immediately. Note that the station does not immediately connect when the station is stopped, but it continues to

connect to HOBOlink at the connection interval set in HOBOlink even if it is not logging.

The station is logging

Press this button to stop logging

To start and stop the station from HOBOlink:

1. In HOBOlink, select Devices and then select your station's tile.

2. Select either Start Logging or Stop Logging. The station starts or stops logging the next time it connects to HOBOlink.

Adding or Removing Smart Sensors

To add or remove smart sensors from the station:

1. If the station is currently logging, press the Stop button to stop it.

2. Press the Connect button and wait for the station to connect to HOBOlink so that all the latest data is offloaded before changing smart sensors.

3. Unplug any smart sensors you want to remove. Plug in any new smart sensors. Lightly coat the portion of the cable(s) that will be placed in the cable channel with a small amount of silicone grease. Push each new sensor cable into the hole that lines up with the corresponding sensor connector. Use the integrated plugs in the cable channel to fill any empty holes.

4. Press the Select button to view the smart sensors on the LCD screen.

The station is stopped

Press the Select button to view the smart sensor screen

Press the Search button for the station to find all connected smart sensors
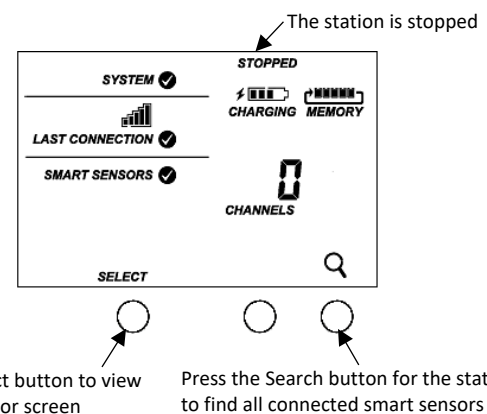
5. Press the Search button for the station to detect all the smart sensors currently connected (the magnifying glass icon should be visible as in the previous example).

6. Press the Start button to begin logging again. The station will automatically connect to HOBOlink.

7. Make sure the cable channel is securely in place and close the station door.

8. Make any configuration changes in HOBOlink as desired, such as adding sensor labels or scaling (see *Setting up the Station*).

Note that any existing alarms associated with removed sensors will still be listed in HOBOlink. See the HOBOlink Help for details on deleting alarms.

Adding or Removing a Water Level Sensor (RX2103 and RX2104 Models)

To add or remove a water level sensor from the station:

1. If the station is currently logging, press the Stop button to stop it.

2. Press the Connect button and wait for the station to connect to HOBOlink so that all the latest data is offloaded before adding or removing the water level sensor.

3. Power down the station by disconnecting the battery cable.

4. If you are removing a water level sensor, unscrew the two screws and unplug the sensor cable from the water level sensor port.

5. If you are adding a water level sensor, plug the sensor cable into the water level sensor port and secure the cable in place with two screws. Be sure the other end of the cable is plugged into the water level sensor. (See *Setting up the Station* for more details.)

6. Route the cable through the far-right hole in the cable channel.

7. Reconnect the battery cable.

8. After the station powers up, the channel count on the LCD should be updated. If you removed the sensor, the total channel count will decrease by three. If you added the sensor, the channel count will increase by three. (Barometric pressure is always included in the channel count whether the sensor is plugged in or not.)

If you added a water level sensor, be sure to obtain a reference water level reading and configure the water level and water flow channels as described in *Setting up the Station* and *Setting up Water Level and Water Flow Channels in HOBOlink*.

Managing Connections to HOBOlink

The station connects to HOBOlink at the Connection Interval you specify.

To change the connection schedule:

To change the Connection Interval:

1. In HOBOlink, select Devices and then click the wrench icon on your station's tile.

2. Select Connection Interval and edit the frequency the station connects with.

Setting Up Power Saving Mode

In low power situations, such as a solar-powered station or for a station during the winter, you may want to save power through power saving mode.

To set up a second connection interval with power saving mode:

1. In HOBOlink, select Devices and then click the wrench icon on your station's tile.

2. Select Enable Power Saving Mode.

3. Select when this mode should begin and end and then enter the Power Save Connection Interval you want to use during the time you specified.

4. Click Save. The changes to the connection interval will take place the next time the station connects to HOBOlink.

You can connect to HOBOlink from the station at any time, regardless of the connection schedule. Press the Connect button on the station to connect to HOBOlink. Unless the station is running on a power saving connection interval, the normal connection schedule then restarts after the connection is complete. For example, a station is configured to connect hourly and the last connection on its regular schedule occurred at 10:05. If you use the Connect button on the station to connect to HOBOlink at 10:15, the next connection is at about 11:15 based on the one-hour connection interval. Similarly, if a station misses a connection, the connection schedule shifts depending on the time of the next successful connection. While the station is using a second, power saving mode schedule, all connections follow that schedule only; any extra connections while the station is in power saving mode do not cause a shift in the connection schedule.

Also note that the station connects to HOBOlink when the device is powered up and when you press the Start button.

Deployment Guidelines

Follow the guidelines and steps in this section for deploying and mounting the station.

Guidelines for All Models

- Check the signal strength on the LCD in the location you want to deploy the station to make sure can reliably connect to HOBOlink. The station may have difficulty connecting if there is only one bar illuminated in the signal strength icon on the LCD. (The signal strength shown on the LCD is from the last connection.)

- The station must be mounted at least one foot from all sensors to avoid interference from the built-in radio module and antenna with the measurements made by the sensors.

- Make sure the station remains in a vertical position once it is placed in its deployment location to prevent pooling of water on the cable entries. In addition, if it is mounted horizontally, the battery could be damaged over time in RX2102 and RX2104 models as it is charged and the antenna in all models will not have optimal range.

- If possible, avoid sites immediately adjacent to radio/television/microwave towers and equipment. In rare situations, strong electromagnetic interference may result in sensor network errors.

- If you are using a wind speed/direction sensor or if the station will be installed on a roof or in a location with exposure to lightning, use a grounding wire (CABLE-MICRO-G). A grounding wire may also reduce potential sensor errors that can result from installing near other radio or electrical equipment or antennas. See *Installing the Grounding Wire*. Also, ground the tripod or mast using

appropriate grounding, such as the Grounding Kit (M-GKA).

- Take note of the mounting considerations in the sensor manuals at www.onsetcomp.com/resources for additional guidelines for the sensors you are using.

- Make sure all cables and wires are fastened securely and routed through the cable channel. Any empty holes in the cable channels need to be filled with the integrated plugs to ensure the station is weatherproof (see the diagrams in *Setting up the Station* for how to insert the plugs).

- When using the AC adapter (P-AC-1) with the cable channel installed, route the AC adapter cable through the far-left hole in the cable channel. Tuck the cable into the left side of the hole and use the integrated cable channel plug in the same hole (see the diagrams in *Setting up the Station* for how to insert the plug). The far-left hole is slightly bigger than the other holes in the cable channel and can accommodate both the AC adapter cable and the integrated plug at the same time.

- Do not store excess sensor cable wire coiled inside the station case or within one foot outside the case.

- Protect cables and wires with conduit. Exposed cables can be chewed by rodents.

- Make sure the total cable length for all installed smart sensors does not exceed 100 m (328 ft).

- Consider using a padlock to restrict access to the station. With the station door closed, hook a padlock through one of the latches on the right side of the door and lock it.

Guidelines for the RX2102 and RX2104 Models

- The RX2102 and RX2104 models have a built-in solar panel to recharge the NiMH battery pack. Connect the solar panel cable to keep the battery charged. When mounting the station, position the solar panel in the direction where it will receive the most sunlight through the day and throughout each season. It may be necessary to periodically adjust the station position as the path of sunlight changes throughout the year or if the tree and leaf growth alters the amount of sunlight reaching the solar panel.

- If the location where you want to install the station does not produce enough sunlight to charge the battery, use an external solar panel (SOLAR-xW). Disconnect the built-in solar panel cable and tuck it in the station door. Plug in an external solar panel. Lightly coat the portion of the cable that will be placed in the cable channel with a small amount of silicone grease. Route the external solar panel cable through far-left hole in the cable channel.

Guidelines for the RX2103 and RX2104 Models

- The absolute pressure sensor in the water level sensor is temperature compensated over the range of 0° to 40°C (32° to 104°F). The barometric pressure sensor is temperature compensated over the range of -20° to 50°C (-4° to 122°F). To obtain the highest level of accuracy, both the sensor and station should be allowed to come to full temperature equilibrium (approximately 20 minutes) before the reference level is entered in HOBOlink as described in *Setting up the Station*.

- Sudden temperature changes should be avoided.

- When deploying the water level sensor in a well, make sure the well is vented to the atmosphere. Typically, a small hole can be drilled in the side of the well cap to ensure that the pressure inside and outside the well is at equilibrium. Use the Onset well cap (WELL-CAP-02) if it is a 5 cm (2 inch) well. Otherwise, you will need to find another method of attaching the cable at the top of your well so that the sensor stays in position. The sensor cable includes a Kevlar® strength member so it can support the weight of the sensor and its cable. You can attach a clamp around the cable, such as a hose clamp, but be careful not to damage the cable.

- There is a vent for the barometric sensor on the back of the station. This vent must not collect water or it will block proper barometric pressure readings. The best way to avoid water collecting is to mount the station vertically.

- The sensor face located in the nose cone of the sensor end needs to be in the water to measure water level.

Make sure the sensor face (represented by dashed lines in this diagram) is in the water to measure water level

10.0 mm (0.39 in.)
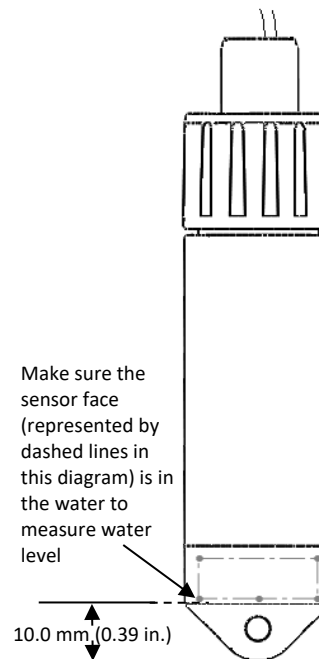
- Any change in length of the sensor cable will result in a 1-to-1 corresponding error in the depth measurement. Always pull-test a cable prior to deploying a logger in a well to make sure it does not stretch.

- If you are deploying the sensor in a lake, river, or stream, you must first build a stilling well to protect it and the cable. A simple stilling well can be constructed with PVC or ABS pipe. A properly constructed stilling well holds the sensor in position and protects the sensor from currents, wave action, and debris. Suspend the sensor in the stilling well so it is always underwater, but not on the bottom to be buried by silt.

For more information, see the Technical Application Note for Constructing a Stilling Well at: https://www.onsetcomp.com/resources/tech-notes/how-to-build-stilling-well

- To prevent the sensor from moving in currents and to ensure the support cable is kept straight during deployment, you may need to add a weight to the suspension cable just above the sensor or hang a weight below the sensor. In some cases, you may need to both add a weight and use a stilling well.

- Be very careful not to exceed the burst pressure for the sensor. The pressure sensor will burst if the maximum depth is exceeded (see *Specifications*). The sensor should be positioned at a depth where it will remain in the water for the duration of the deployment, but not exceed the rated bursting depth.

- If the cable is too long, loop the cable and secure the cable with multiple zip ties to ensure the loop does not slip. The looped cable should be tight enough that the cable can be easily pulled out of the well if necessary, but it must not bend the cable any tighter than a 1.25 cm (0.5 inch) radius to prevent damage to the cable.

Installing the Grounding Wire

If you are using a grounding wire (CABLE-MICRO-G), attach it to the grounding wire port on the back of the station. Use the screw and washer included with the grounding wire to attach it to the port.

- If you are mounting the station on a tripod or mast, use the optional U-bolts (U-BOLT-KIT2). Attach the grounding wire under one of the nuts on one end of the U-bolt.

- If you are mounting the station on a metal post, clamp the grounding wire to the metal post with a hose clamp or a U-bolt.

- If you are mounting the station to a flat surface, attach the grounding wire to a proper ground. Note that the grounding wire may prevent the logger from being flat against the surface. Be careful not to bend the case when tightening screws.

Connect the grounding wire here
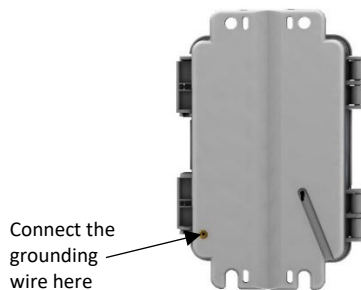
Care and Maintenance

The station is designed for outdoor use, but should be inspected periodically. When inspecting the station:

- Verify the station enclosure is free of visible damage or cracks.

- Make sure the station is clean. Wipe any dust or grime off with a damp cloth.

- For RX2102 and RX2104 models: Make sure the built-in solar panel is clean. Wipe off any debris with a damp cloth.

- Wipe any water off the station before opening it.

- Check that all cables and wires are free of damage, such as cracks, cuts, and splits.

- Make sure cables and wires are still fastened securely and any conduit is still intact.

- Grease the sides and bottom of the cable channel and the portion of the cables in the cable channel with a small amount of silicon grease.

- Verify that all cables and wires are free of corrosion. If moisture is visible inside the station, open the door to air it out. Be sure to determine the source of the moisture and fix it. Check the cable channel and cover seals for any sign of moisture entry.

- Make sure the cable channel is intact and installed properly, and the latches are fully locked when the station door is closed.

Troubleshooting

Error codes can appear on the LCD if a problem arises with the station or a sensor. This table describes common error codes that may appear. Contact Onset Technical Support for help.

Fault Code #	Description	Action to Take
001	System Failed Initialization	Power cycle the station (disconnect the battery and charging device, wait for a minute, and then plug the battery and charging device back in).
004	Sensor Error/Fault	Check the smart sensor data in HOBOlink to see which smart sensor is producing an error. You may need to remove or replace the smart sensor if the smart sensor is consistently reporting erroneous data.
129	Smart Sensor Bus Fault	There is a problem with one or more of the smart sensor connections. Check that all smart sensors are fully plugged in (follow the instructions in *Adding or Removing Smart Sensors*). Also check that the smart sensor cables are ok.

Battery Information for RX2101 and RX2103 Models

The RX2101 and RX2103 station requires 6 user-replaceable AA 1.5 V lithium batteries. You can also power the station with an AC adapter (P-AC-1) plugged into the AC adapter port. Expected battery life varies based on the ambient temperature where the station is deployed, the frequency of connections to HOBOlink, the number of sensors connected, the logging or sampling intervals selected, the number of tripped alarms, and other factors.

Battery life for the RX2101 model with a 1-minute logging interval is 1 year with daily connections to HOBOlink or 3 months with hourly connections. Battery life for the RX2103 model is 1 year with daily connections and a 2-minute logging interval or 2 months with hourly connections and a 1-minute logging interval. Deployments in areas with weak cellular

strength could reduce battery life. Deployments in extremely cold or hot temperatures, logging intervals faster than 1 minute, or a sampling interval faster than 15 seconds can impact battery life. Estimates are not guaranteed due to uncertainties in initial battery conditions and operating environment.

⚠ **WARNING:** Do not cut open, incinerate, heat above 85°C (185°F), or recharge the lithium batteries. The batteries may explode if the logger is exposed to extreme heat or conditions that could damage or destroy the battery cases. Do not mix battery types, either by chemistry or age; batteries may rupture or explode. Do not dispose of the logger or batteries in fire. Do not expose the contents of the batteries to water. Dispose of the batteries according to local regulations for lithium batteries.

To replace the batteries:

1. Open the station door.
2. Disconnect the battery cable.
3. Use a flat-head screwdriver to remove the screw below the battery cover.

Remove this screw
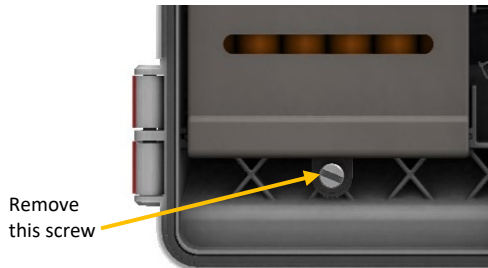
4. Pull to remove the battery cover.
5. Remove the old batteries.
6. Install six new batteries observing polarity.
7. Reinstall the battery cover.
8. Use a flat-head screwdriver to secure the cover with the screw.
9. Plug in the battery cable.

Battery Information for RX2102 and RX2104 Models

The RX2102 and RX2104 station uses one rechargeable NiMH battery pack (HRB-NiMH-6). Typical battery life is 3–5 years when operated in the temperature range -20° to 40°C (-4° to 104°F); operation outside this range will reduce the battery service life. Use the AC adapter (P-AC-1), built-in solar panel, or external solar panel (SOLAR-xW) to keep the battery charged. If using an external solar panel or built-in solar panel, the quality and quantity of solar light can affect whether the battery is sufficiently charged to last through the night and cloudy periods.

The maximum connection rates when using the built-in solar panel in full sun are:

- 10 minute connections year round for latitudes less than ±40°
- 10 minute connections through three seasons in other regions, reduced to 30 minute connections in winter

The maximum connection rate when using an external 5W or 15W solar panel is 10 minute connections year round, in full sun. The connection rate with external solar panels may be less if deployed in partial sun.

Battery life without solar recharging, with hourly connections, and a 1-minute logging interval is 3 months for the RX2102 model and 2 months for the RX2104 model.

Deployments in extremely cold or hot temperatures, a logging interval faster than 1 minute, or a sampling interval faster than 15 seconds can impact battery life. Estimates are not guaranteed due to uncertainties in initial battery conditions and operating environment. If using an external solar panel or built-in solar panel, the quality and quantity of solar light can affect whether the battery is sufficiently charged to last through the night and cloudy periods

The station will shut down once the battery voltage drops to 6 V. Plug in an AC adapter or solar panel to recharge it. Once the voltage rises to 7.5 V, the station will power up. If the charging device is not recharging a dead battery, contact Onset Technical Support.

To replace the battery pack:

1. Open the station door.
2. Disconnect the battery cable.
3. Use a flat-head screwdriver to remove the screw below the battery cover.

Remove this screw
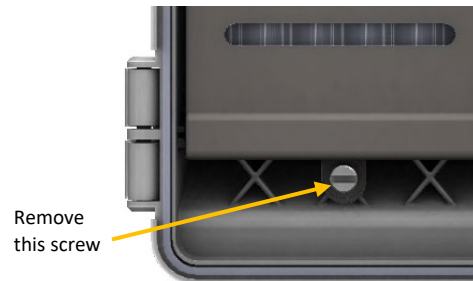
4. Pull to remove the battery cover.
5. Remove the old battery pack and install the new one from Onset.
6. Reinstall the battery cover.
7. Use a flat-head screwdriver to secure the cover with the screw.
8. Plug in the battery cable.
9. Make sure the built-in solar panel cable is plugged in. If you are using an external solar panel, make sure the built-in solar panel cable is tucked inside the station door. Plug in the external solar panel. Lightly coat the portion of the cable that will be placed in the cable channel with a small amount of silicone grease. Route the cable through the far-left hole in the cable channel.

⚠ **WARNING:** Dispose of the battery pack according to local regulations for NiMH batteries.

```
⚠     WARNING

This station contains a radio and is not approved for use on airplanes. Disconnect the
battery and all power sources before flight.
```

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Industry Canada Statements

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Avis de conformité pour l'Industrie Canada

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

To comply with FCC and Industry Canada RF radiation exposure limits for general population, the logger must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.