The HOBOnet Analog Mote can accept up to four analog inputs from third-party sensors and supports excitation power, scaling, and sampling measurements. It is designed to work with the HOBOnet (HOBO® RX) Wireless Sensor Network in which data is transmitted wirelessly from the sensor mote across the network to the station and then uploaded to LI-COR Cloud™. With LI-COR Cloud, you can monitor sensor readings, view graphs, set up alarms, download data, and more.

RXW HOBOnet Analog Mote

Models:

RXW-ANA-900 (US)
RXW-ANA-868 (Europe)
RXW-ANA-921 (Taiwan)
RXW-ANA-922 (Australia/NZ)

Included Items:

- Grease packet
- Screws and washers
- Cable ties
- 2 cable channels
- Rechargeable battery pack

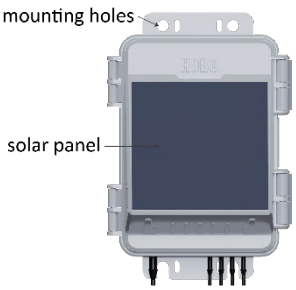
Specifications

Analog Input	
Input Channels	Four, single-ended
Accuracy	0–25.6 mA DC, ±5 µA ± 0.20% of reading 0 to 160mV, +/-2mV +/-0.25% of reading 0 to 320mV, +/-1mV +/-0.25% of reading 0 to 640mV, +/-0.5mV +/-0.25% of reading 0 to 1.28V, +/-0.25mV +/-0.25% of reading 0 to 2.56V, +/-0.25mV +/-0.25% of reading 0 to 5.12V, +/-0.25mV +/-0.25% of reading 0 to 10.24V, +/-0.25mV +/-0.25% of reading 0 to 20.48V, +/-0.25mV +/-0.25% of reading
Resolution	15 bits
Field Wiring	Two- or three-wire via screw terminals, 16–24 AWG
Minimum/Maximum Input Voltage	0/20.48 V DC
Minimum/Maximum Input Current	0/25.6 mA
Minimum Source Impedance for Current Measurement	20 KΩ
Excitation Voltage	12 V DC ±5% at 200 mA maximum
Wireless Mote	
Operating Temperature Range	-20° to 60°C (-4° to 140°F)
Radio Power	12.6 mW (+11 dBm) non-adjustable
Transmission Range	Reliable connection to 457.2 m (1,500 ft) line of sight at 1.8 m (6 ft) high Reliable connection to 609.6 m (2,000 ft) line of sight at 3 m (10 ft) high
Wireless Data Standard	IEEE 802.15.4
Radio Operating Frequencies	RXW-ANA-900: 904–924 MHz RXW-ANA-868: 866.5 MHz RXW-ANA-921: 921 MHz RXW-ANA-922: 916–924 MHz
Modulation Employed	OQPSK (Offset Quadrature Phase Shift Keying)
Data Rate	Up to 250 kbps, non-adjustable
Duty Cycle	<1%
Maximum Number of Motes	Up to 50 wireless sensors or 336 data channels per one HOBO RX station
Logging Rate	1 minute to 18 hours
Number of Data Channels	4

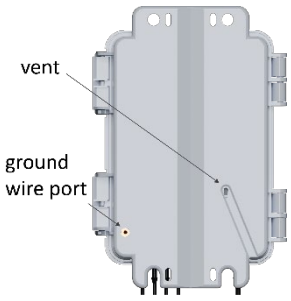
Specifications (continued)

Battery Type/ Power Source	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
Battery Life	Typical 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.
Memory	16 MB
Dimensions	19.95 x 13.68 x 7.49 cm (7.85 x 5.39 x 2.95 in.); see diagrams at left
Weight	617.5 g (21.8 oz)
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
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)
Compliance Marks	RXW-ANA-900: See last page RXW-ANA-868: The CE Marking identifies this product as complying with all relevant directives in the European Union (EU). RXW-ANA-921: See last page RXW-ANA-922: See last page

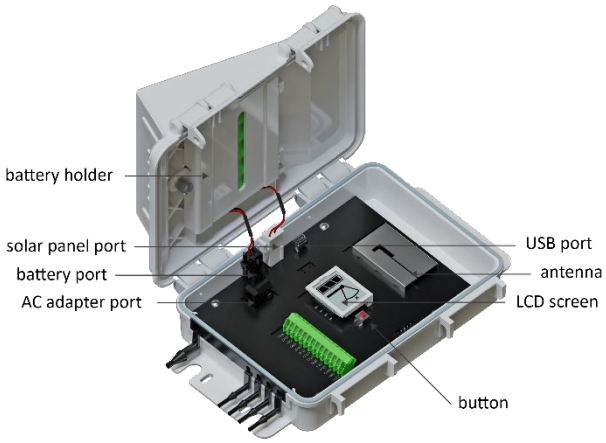
Mote Components and Operation



Mote Closed, Front



Mote Closed, Back



Mote Opened

AC Adapter Port: Use this port to plug in an AC adapter (see *Battery Information).*

Antenna: This is the built-in antenna for the radio communications across the RX Wireless Sensor Network.

Battery Holder: The location where a NiMH battery pack is installed (see *Battery Information*).

Button: Push this button for 1 second to illuminate the LCD or 3 seconds for the mote to search for a HOBOnet Wireless Sensor Network to join (see *Adding the Mote to the HOBOnet Wireless Sensor Network*).

Ground Wire Port: Use this port to connect a ground wire (see *Mounting and Positioning the Mote*).

LEDs: There are two LEDs to the left of the LCD screen. The green LED blinks during the process of joining a network, blinking quickly while the mote searches for a network and then slowly as the mote registers with the network. Once the network registration process is complete, the blue LED blinks at 4 seconds to indicate normal operation. If the mote is not currently part of a network, then the blue LED will be off. If the blue LED is on and not blinking, then there is an issue with the mote. Contact Onset Technical Support.

Mounting Holes: Use the tabs at the top and bottom of the mote to mount it (see *Mounting and Positioning the Mote*).

Solar Panel: 1.7 watt solar panel built into the front of the mote door (see *Mounting and Positioning the Mote*).

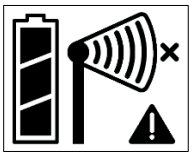
Solar Panel Cable: This cable connects the built-in solar panel to the mote circuitry.

Solar Panel Port: Use this port to plug in the built-in solar panel or an external solar panel with a higher wattage.

USB Port: Use this port to connect to the mote to a computer via USB cable if you need to update the firmware (see *Updating the Mote Firmware*).

Vent: Allows pressure to equalize inside the mote while keeping water out.

LCD Screen: The mote is equipped with an LCD screen that displays details about the current status. The following example shows all symbols illuminated on the LCD screen followed by definitions of each symbol in the table.



LCD Symbol	Description
	The battery indicator shows the approximate battery charge remaining.
	This is a signal strength indicator. The more bars, the stronger the signal between motes. If there is no x icon next to the signal strength indicator, then the mote is part of a HOBOnet Wireless Sensor Network.
	An empty signal strength icon plus the x icon indicates that the mote is not currently part of a network. See *Adding the Mote to the HOBOnet Wireless Sensor Network* for details on how to add a mote to the network.
	When the mote is in the process of joining a network, the signal strength icon will blink and then the bars in the icon will cycle from left to right. The x icon will blink during the last step in the network registration process (see *Adding the Mote to the HOBOnet Wireless Sensor Network* for details).
	This indicates a problem with the sensor itself (the mote is operational). Check the sensor and make any adjustments to it as needed. Contact Onset Technical Support if the problem persists.

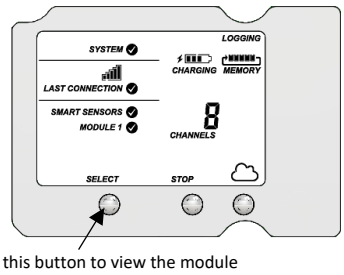
Adding the Mote to the HOBOnet Wireless Sensor Network

The mote must join a HOBOnet Wireless Sensor Network before it can begin measuring and transmitting data. This requires accessing the station and the mote at the same time, so it is recommended that you complete these steps before deploying the mote.

Important: If you are setting up a new station, follow the instructions in the station quick start before setting up this mote (go to www.onsetcomp.com/support/manuals/24380-man-rx2105-rx2106-qsg for RX2105 and RX2106 stations or go to www.onsetcomp.com/support/manuals/18254-MAN-QSG-RX3000 for RX3000 stations).

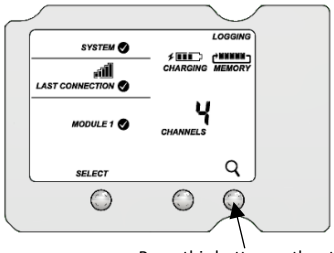
To add a mote to the network:

1. If the LCD is blank on the station, press any button to wake it up.
2. Press the Select button once (which shows the number of smart sensors installed) then press it again to switch to the module with the manager.



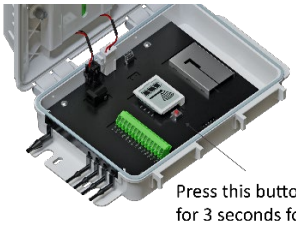
Press this button to view the module

3. Press the Search button (the magnifying glass). The magnifying glass icon will blink while the station is in search mode.



Press this button so the station is ready to have motes join the network

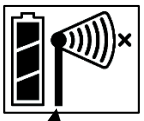
4. Open the mote door and install the batteries if you have not already done so.
5. Press the button on the mote for 3 seconds. The signal strength icon will flash then cycle.



Press this button for 3 seconds for the mote to join the network

6. Watch the mote LCD while it joins the network:

a.

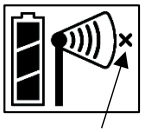


This signal strength icon blinks while the mote searches for a network.

b.

Once the mote finds a network, the icon stops blinking and the bars cycle from left to right.

c.



This network connection "x" icon blinks while the mote completes the registration process, which may take up to five minutes.

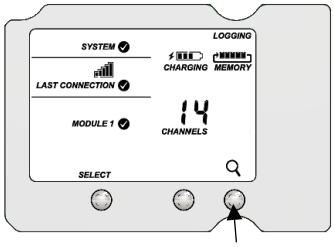
d.

Once the mote has finished joining the network, the "x" icon no longer appears. The channel count on the station LCD increases by four.

The green LED blinks quickly while the mote searches for a network to join and then blinks slowly while it completes the network registration. Once the mote has finished joining the network, the green LED turns off and the blue LED then blinks indefinitely while the mote is part of the network.

Note: If the mote fails to join the system and error code 135 is displayed on the station's LCD, log in to LI-COR Cloud (licor.cloud) and update your station with the latest firmware.

7. Press the Search button on the station again to stop searching for motes.



Press this button again to stop searching for motes

If you added more than one more mote to the network, then the total channel count on the station LCD for the manager module will represent all measurement channels plus a battery channel for each mote in the network.

Sensor measurements will be recorded at the logging interval specified in LI-COR Cloud, transmitted to the station, and uploaded to LI-COR Cloud at the next connection interval (readout).

Note that this logging interval will be applied to all wireless motes in the HOBOnet wireless network.

Use LI-COR Cloud to monitor mote status and health. If a mote is temporarily offline, any logged data is saved until it is back online. In addition, if a mote is offline for 30 minutes, the station will automatically connect to LI-COR Cloud and report the mote as missing. Once the mote is back online, any logged data will be uploaded the next time the station connects to LI-COR Cloud.

See the LI-COR Cloud Help for details on how to change the logging and connection intervals, view data, check mote status, add the mote to a map, and more.

Installing Sensors

Note: You may wait to connect these until you are at the deployment site.

Power down the station (unplug any charging device and then disconnect the battery). Connect any sensors or devices to the optional modules as described in the following sections.

To Connect Analog Sensors:

You can connect a two- or three-wire sensor or transducer to one of the four terminals.

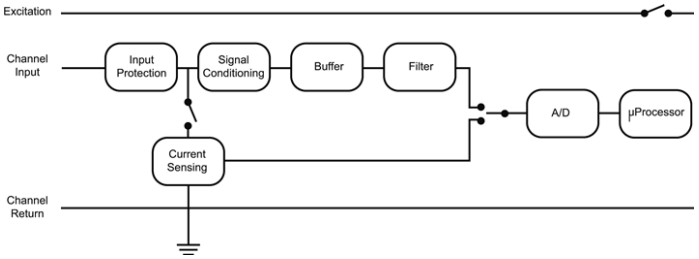
1. Loosen the screw for each pin on the screw terminal.
2. Feed the wire through the grommet.
3. Insert the correct wire into the screw terminal (see the pinout table below). Trim the wire to expose 0.25 inches ±0.04 inches of bare wire.
4. Tighten the screw.
5. Plug in the battery and then the charging device to power up the sensor if it is not already powered.

Pinout Table

Pin #	Pin Description
1	CH1 SIGNAL
2	CH1 GND
3	+12V Excitation
4	GND (EX. RTN)
5	CH2 SIGNAL
6	CH2 GND
7	SHIELD
8	CH3 SIGNAL
9	CH3 GND
10	+12V Excitation
11	GND (EX. RTN)
12	CH4 SIGNAL
13	CH4 GND
14	SHIELD

Note: All four input channels share the same common ground.

Analog Functional Diagram



Adding the Mote's Sensors to LI-COR Cloud

To add a sensor to LI-COR Cloud:

1. Go to licor.cloud.
2. Choose your organization then click Start Viewing.
3. On the Devices page, select your device.
4. Click Configure then select Wireless Sensors Logging from the lefthand menu.
5. Under Wireless Sensors Configuration, select the sensor.
6. Input the desired logging interval.
7. Configure sampling interval (optional).
   Checking the "Enable sampling interval" box averages all sampled values taken within the logging interval and logs them as a single measurement.
   Note: The sampling interval must be at least two seconds.
8. Configure excitation power (optional).

Checking the "Use excitation power" box allows the system to power the sensor. Alternatively, third party power sources can be used.

a. Select Warmup or Continuous. Warmup is ideal for sensors that require a startup time and will not remain on. Continuous is ideal for sensors that use low or DC power and can always remain on.
b. If selecting Warmup, set the time in seconds and/or milliseconds based on your sensor's startup time.

9. Under Sensor Configuration, enable the Analog Channel.
   a. Enter a label for the sensor.
   b. Select a Sensor/Input Type from the dropdown list. If selecting a voltage range, choose the closest match to the sensor's voltage.
   Note: See *Specifications* > *Accuracy* for more information.
   c. Select the "Enable scaling" box (optional). Select a standard Scaled Measurement Type from the dropdown list or click Add to define a custom measurement type and unit. Input the scaled low and high values.

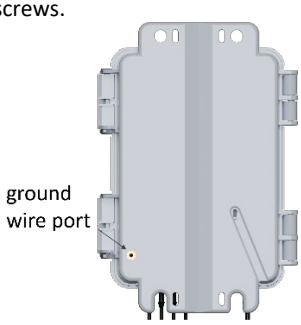
> **Important:** Scaling converts the default current or voltage output to the sensor's actual measurement type. If the "Enable scaling" box is not selected, all outputs will be reported in current or voltage.

10. Repeat the above steps for the additional channels as needed.
11. Click the Save button to apply the configuration(s).

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 mote. Use the screw and washer included with the grounding wire to attach it to the port.

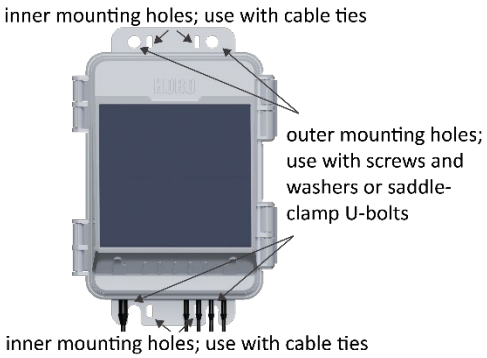
- If you are mounting the mote on a tripod or mast, use the optional U-bolts (U-BOLT-KIT2). Attach the grounding wire under one of the nuts on one end of the U-bolt.
- If you are mounting the mote on a metal post, clamp the grounding wire to the metal post with a hose clamp or a U-bolt.
- If you are mounting the mote 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.



Mounting the Mote

There are three ways to mount the mote using the built-in mounting tabs.

- Use the two sets of outer holes and 1-5/8 inch saddle-clamp U-bolts to attach the mote 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 in outdoor environments. The flat portion of the saddle clamps should be against the mounting tabs.
- 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.



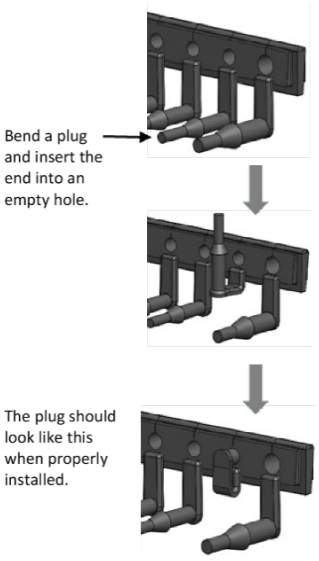
> **Important:** See *Installing the Grounding Wire* for installation steps.

Installing the Cable Channel

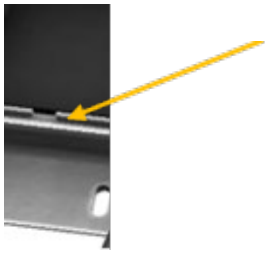
> **Important:** This is required for outdoor and weatherproof deployments and recommended for harsh indoor environments where debris could enter the mote.

1. Make sure all sensors and cables are installed, including the solar panel, AC adapter cable or external DC power cable, and the grounding wire.
2. 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.



3. 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).
4. Lightly coat the bottom and two sides of the cable channel with silicone grease.
5. Reinstall the cable channel in the mote making sure the key on the bottom is inserted in the notch in the mote enclosure.



Care and Maintenance

Periodically inspect the mote as follows:

- Verify the mote enclosure is free of visible damage or cracks.
- Make sure the mote is clean. Wipe any dust or grime off with a damp cloth.
- Make sure the built-in solar panel is clean. Wipe off any debris with a damp cloth.
- Wipe any water off the mote before opening it (if applicable).
- 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 silicone grease.
- Verify that all cables and wires are free of corrosion. If moisture is visible inside the mote, 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 mote door is closed.

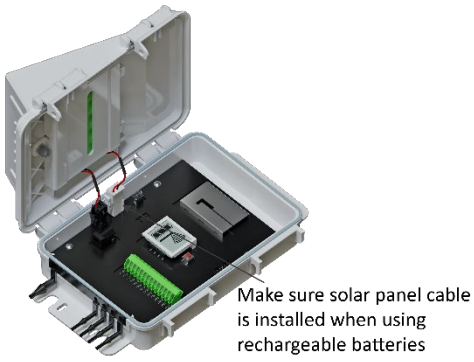
Mounting and Positioning the Mote

- Mount the mote to a mast or pipe using cable ties or affix the mote to a wooden post or flat surface with screws. Insert the cable ties or screws through the holes on the mounting tabs.
- Consider using plastic poles such as PVC to mount the mote as certain types of metal could decrease signal strength.
- Make sure the mote remains in a vertical position once it is placed in its deployment location for optimal network communications.
- Make sure the mote door is closed, with both latches fully locked to ensure a watertight seal.
- Consider using a 3/16 inch padlock to restrict access to the mote. With the mote door closed, hook a padlock through the eyelet on the right side of the door and lock it.
- Position the mote towards the sun, making sure the solar panel is oriented so that it receives optimal sunlight throughout each season. It may be necessary to periodically adjust the mote position as the path of the sunlight changes throughout the year or if tree and leaf growth alters the amount of sunlight reaching the solar panel.
- Make sure the mote is mounted a minimum of 1.8 m (6 ft) from the ground or vegetation to help maximize distance and signal strength.
- Place the mote so there is full line of sight with the next mote. If there is an obstruction between two sensor motes or between the sensor mote and the manager, then use a repeater mounted on the obstruction. For example, if there is a hill between the sensor mote and the manager, place a repeater at the top of the hill between the sensor mote and the manager.
- There should not be more than five motes in any direction at their maximum transmission range from the manager. Data logged by a wireless sensor must travel or “hop” across the wireless network from one mote to the next until it ultimately reaches the manager connected to the station. To make sure the data can successfully travel across the network, the mote should not be more than five hops away from the manager.
- The HOBOnet Wireless Sensor Network can support up to 50 wireless sensors or 336 data channels per one HOBO RX station.
- Use a #4-40 screw to attach a ground wire to the port on the back of the mote if you are deploying the mote in a location where lightning is a concern.

Updating the Mote Firmware

If a new firmware version is available for the mote, use LI-COR Cloud to download the file to your computer.

1. In LI-COR Cloud, go to Devices, then RX Devices, and click your station name.
2. Make sure the solar panel cable is plugged in.



   The mote contacts the network once the new batteries are installed. The green LED blinks quickly while the mote searches for a network to join and then blinks slowly while it completes the network registration. Once the mote has finished joining the network, the green LED turns off and the blue LED then blinks indefinitely while the mote is part of the network.
3. On the station page, click Overview and scroll down to Device Information.
4. Click the Wireless tab. This icon appears next to the mote if there is a new version of firmware available.
5. Click the firmware upgrade link. Click Download and save the firmware .bin file to your computer.
6. Connect the mote to the computer with a USB cable (open the mote door and use the USB port to the right of the LCD). The blue LED is illuminated while connected.
7. The mote appears as a new storage device in the computer's file storage manager. Copy the downloaded firmware file to the new storage device (the mote). The blue LED will blink slowly while the file is copying.
8. After the file is copied to the mote, the LED will stop blinking and remain a steady blue. Eject the storage device from the computer and disconnect the cable from the mote. The firmware installation process will begin automatically on the mote. The blue LED will blink rapidly while the firmware is installed. Once the firmware installation is complete, the LCD symbols return and the mote will automatically rejoin the network.

Notes:

- Mac® users: A message may appear indicating the disk has not ejected properly when disconnecting the mote from the computer. The mote is operational and you can ignore the message.
- If the blue LED turns off abruptly while copying the file or installing the firmware, a problem has occurred. Contact Onset Technical Support for help.

Battery Information

The mote 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. The quality and quantity of solar light can affect whether the battery is sufficiently charged to last through the night and cloudy periods. Make sure the mote is placed in a location that will receive several hours of sunlight each day. If the mote does not receive enough sunlight to recharge the batteries, the battery life is estimated at 3-4 months. Battery life varies based on the ambient temperature where the mote is deployed, the logging interval, the number of tripped alarms, and other factors. Deployments in extremely cold or hot temperatures can impact battery life. Estimates are not guaranteed due to uncertainties in initial battery conditions and operating environment. The mote 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 mote 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 mote door.
2. Disconnect the battery cable.
3. Use a flat-head screwdriver to remove the screw below the battery cover.
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.

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 the local regulations for NiMH batteries.

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.

NCC Statement

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

Translation:

Article 12

Without permission granted by the NCC, any company, enterprise, or user is not allowed to change frequency, enhance transmitting power or alter original characteristic as well as performance to an approved low power radio-frequency device.

Article 14

The low power radio-frequency devices shall not influence aircraft security and interfere with legal communications. If found, the user shall cease operating immediately until no interference is achieved. The said legal communications means radio communications is operated in compliance with the Telecommunications Act. The low power radio-frequency devices must be susceptible with the interference from legal communications or ISM radio wave radiated devices.