SENSOR MOTE USER GUIDE

MODELS:

SM1-0101
SM1-1150
SM2-0864

MODELS:
SM6
SM7

VERSION 3.2a

Updated June 2024

For questions regarding content in this guide or for any other support related items, contact **support@waites.net** or call **1-800-574-WAITES**

TABLE OF CONTENTS

1 Sensor Mote Overview

This product user guide provides information about the following Waites sensor mote models:

- SM1-0101
- SM1-1150
- SM2-0864
- SM6
- SM7

> ⚠️ The Waites sensor mote is a high-frequency, high-G, 3-axis wireless vibration sensor that helps keep your equipment running properly by alerting you before unexpected failures occur. This all-in-one condition monitoring device is made to withstand the harshest conditions.

Cap and Batteries

Polycarbonate caps are resistant to many common industrial fluids. However, the durability of the Polycarbonate sensor mote cap can be compromised by certain solvents and chemicals. Solvents such as Tetrachloroethylene, brake cleaner, and kerosene should not be used. If chemical compatibility is a concern, you have the option of ordering a Nylon-based cap for the SM7 (part number MC7-0002).

The model number determines the type of battery you will need:

- The SM1-0101 model requires the BT7-1733 battery.
- The SM1-1150, SM6, and SM2-0864 models require the BT7-0123 battery.
- The SM7 model requires the BT7-7330 battery.

Note: You must purchase all sensor mote batteries from Waites. Using non-approved batteries voids the warranty.
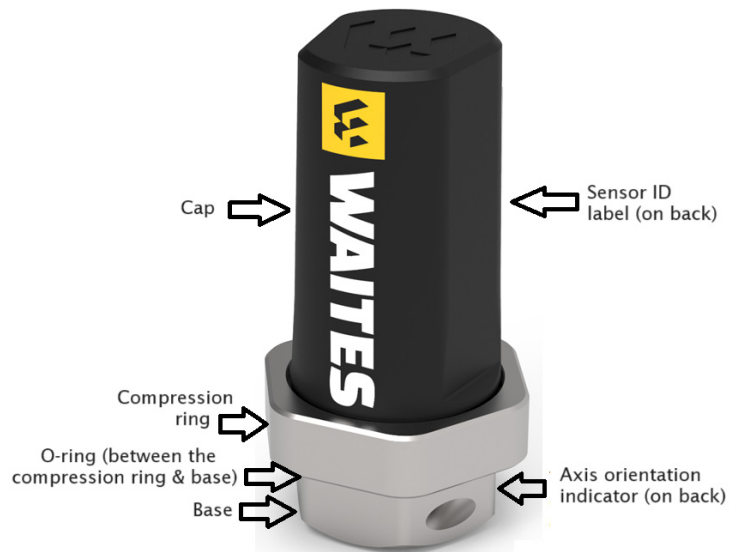
SM1-0101, SM1-1150, and SM2-0864

The following image identifies the main parts of the SM1-0101, SM1-1150, and SM2-0864 models:

SM6 and SM7

The following image identifies the main parts of the SM6 and SM7 models:

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2 Installing and Configuring Sensor Motes

All sensor motes will arrive to your facility in hibernation mode with batteries pre-installed to conserve power.

This chapter provides information on how to install and configure sensor motes.

Note the following:

- You should avoid touching the board inside the sensor mote as much as possible, and the use of gloves is highly recommended.
- There is no need for you to open the sensor mote prior to installation, unless directed by Waites personnel.
- You must bring the sensor mote out of hibernation mode before installation. See "Performing Pre-Installation Steps" on page 5 for details.

Working with Intrinsically Safe Sensor Motes

The SM1-0101 model is intrinsically safe and C1D1/IECEx certified and has the following certifications:

- NEC: Class I, II, III and Division I environments
- IECEx: Ex ia IIB Ga -40 to +85C

Note: If you need to replace an intrinsically safe sensor mote, you must confirm the replacement sensor mote meets the appropriate ratings for that area.

When installing the SM1-0101, note the following:

- Due to the intrinsic safe nature of the SM1-0101, the battery life is shorter than a normal sensor mote; therefore, the batteries may need to be replaced more often. In order to meet the required certifications, you must purchase specific batteries from Waites.
- The radio range for the SM1-0101 is less than a standard (non-C1D1) sensor mote.
- Only certified technicians should install and maintain the SM1-0101, and they must keep track of all training records.
- A mounting pad must be used instead of epoxy so they can be easily removed for service.

In order to properly maintain the SM1-0101, you are required to do the following:

- Inspect the system at regular intervals to verify there are no unapproved changes and that the system is in good shape.
- Inspect the system periodically according to the specific environment and plant conditions and look for impact damage, corrosion, seal efficiency, and mounting security.

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- Disconnect and remove the SM1-0101 whenever they require testing or service. In the meantime, replace the SM1-0101 with spare parts and complete all activities in a maintenance lab.
- Move the SM1-0101 from the classified area to a non-classified area if the battery needs to be replaced.
- Remove the SM1-0101 from service if there is any reason to doubt the intrinsic safety. If any part of the SM1-0101 is defective, it must be deemed unsafe and cannot be used.
- Follow proper maintenance and service procedures. If not followed, the IS certification can be voided instantly.
- Inspect the o-ring when replacing the battery in the SM1-0101. If there are signs of wear or damage, replacement o-rings can be obtained from Waites.
  Note: When putting in a new o-ring, it's essential to use silicone grease (of any type). This lubrication aids in creating a secure and efficient seal.

Performing Pre-Installation Steps

Note: There is no need for you to open a sensor mote prior to installation, unless directed by Waites personnel. Once you are ready to install a sensor mote, you must bring the sensor mote out of hibernation mode.

To bring the sensor mote out of hibernation mode:
- For the SM1-0101, SM1-1150, and SM2-0864 models, hold a magnet over the top of the cap of the sensor mote and do not remove it until the indicator light comes on and goes back off (usually takes about 3-5 seconds).
- For the SM6- and SM7- models, hold a magnet over the label on the sensor mote and do not remove it until the indicator light comes on and goes back off (usually takes about 3-5 seconds) and note the following:
  - If the light stays on longer than 10 seconds with the magnet nearby, then it is already out of hibernation mode and ready to connect.
  - There will be additional flashes after the magnet is removed while the sensor mote syncs with the network.

The standard boot sequence performs a power-on self-test immediately on start-up and will turn on the LED light with a long flash if the self-test passes and a short flash if the self-test fails. If the self-test fails, try again and contact Waites Support if you need additional help. Next, the device will start searching for a gateway. If a gateway is found, it rapidly flashes the LED light indicating that it is paired with a gateway.

A quick magnet swipe will invoke the standard boot sequence. If you invoke another magnet swipe prior to completing the operation, the sensor mote will restart the sequence from the beginning.

Note: Hibernation mode cannot be reactivated once the standard boot sequence has been initiated.

Locating the Sensor Installation Point

After your sensor mote has been added in the Waites Self-Service Dashboard, the next step is to determine the physical installation point.

Note: The sensor installation point should have enough space for the sensor to sit without touching any other part of the equipment other than the point being monitored. This prevents equipment from picking up additional background vibrations.

To determine an installation point for a sensor mote:

- Locate a flat area that is approximately 1 sq. in (6.45 sq. cm) that provides the most metal-to-metal contact between the equipment and the base of the sensor mote.
- Identify the sensor mote axes. (Note: The X axis is the most sensitive axis.)

Preparing the Sensor Installation Point Location

After you have located a sensor installation point, you must prepare the location.

To prepare the sensor installation point location:

1. Clean the location of the sensor installation point by removing all dirt and grease on any exposed surface of the equipment. If the equipment surface is painted, remove the paint as well.
2. If required, grind down the equipment surface to create a flat area for the sensor to be mounted. Optionally, you can use the mill attachment in the Accelerometer Installation Tool Kit to create a flat surface area of 1.25 inches in diameter.

Selecting a Mounting Technique

After you have prepared the sensor installation point location, you must select a mounting technique: stud mount, mounting pad, or direct epoxy.

Stud Mount

The stud mount technique is recommended whenever possible, since it provides the most metal surface area contact between the machine and the sensor. This technique involves screwing the sensor directly into a 1/4"-28 stud tap and drilling the tap into the equipment, but it allows you to easily remove and replace the sensor on the equipment.

Mounting Pad

The mounting pad technique is recommended when you cannot drill a tap into the equipment. This technique allows you to easily remove and replace the sensor on the mounting pad.

Direct Epoxy

The direct epoxy technique is the most common technique. This technique requires an installation point that has a large amount of flat metal-to-metal surface area contact (for example, 1 in. sq./6.45 cm sq.) between the equipment and sensor.

Mounting Sensor Motes

This section provides instructions on how to mount a sensor mote on the installation point using each mounting technique.

Note: If a sensor mote needs to be replaced, you must replace it with the same model number unless otherwise instructed by a Waites support associate.

Your sensor mote will be online if the equipment is installed properly and the sensor mote ID is correctly associated with the installation point. It is recommended that you take photos and upload them to the Waites Self-Service Dashboard for better installation point identification and analysis.

Using a Stud Mount

To mount a sensor mote using a stud mount:

1. Have a mechanical fitter install the stud mount cap and note that a 1/4"-28 UNF threaded hole is sufficient. The recommended height for the stud cap is 5 mm.
2. Associate the sensor mote ID to the installation point.
3. Screw the sensor mote onto the mounting stud after you have done the following:
    - The sensor mote ID is associated with the installation point.
    - The sensor mote is powered on.
    - The mounting stud is secure.
4. Confirm that the axes on the sensor mote line up with the equipment and that the metal base of the sensor mote is firmly pressed against the metal face of the equipment.
5. Reboot the sensor mote by holding a magnet to the top of the sensor mote cap for 3 seconds. The sensor mote should blink again after you remove the magnet.

Using a Mounting Pad

To mount a sensor mote using a mounting pad:

1. Tightly fasten the mounting pad onto the sensor mote and confirm that the metal face of the mounting pad has solid contact with the metal base of the sensor mote.

    Note: A 1-inch crescent wrench or similar is required to securely fasten or remove the sensor mote.
2. Position the mounting pad and sensor mote on the equipment in the desired installation point location and line up the monitored axes. Make note of the position and orientation of the mounting pad by marking the mounting pad.
3. Remove the sensor mote from the mounting pad.
4. Apply a small bead of Loctite AA330 epoxy on the center of the mounting pad and lightly spray the bead of epoxy with the Loctite SF 7387 activator.
5. Line up the mounting pad using the marking created in Step 2, then press the plate directly onto the equipment. Hold the mounting pad in place until the epoxy is cured enough to fully support the weight of the mounting pad, which should take approximately 1-2 minutes. Make sure the mounting pad does not shift after you release it.
6. Continue to let the epoxy cure for another 2-3 minutes before proceeding. The full cure time is 6 hours at 77° F (25° C).
7. While waiting for the mounting pad to become secure, associate the sensor mote ID with the installation point.
8. Screw the sensor mote onto the mounting pad after the following has occurred:
    - The sensor mote ID is associated with the installation point.
    - The sensor mote is powered on.
    - The mounting pad is secure.

9. Confirm that the axes on the sensor mote line up with the equipment and that the metal base of the sensor mote is firmly pressed against the metal face of the mounting pad.
10. Release the sensor mote and allow the epoxy to continue to cure. During this time, make sure the position and orientation of the sensor mote does not shift. The sensor mote should be secure after 5 minutes, and the full cure time is 6 hours at (77° F) (25° C).
11. Reboot the sensor mote by holding a magnet to the top of the sensor mote cap for 3 seconds. The sensor mote should blink again after you remove the magnet.

Using Direct Epoxy

To mount a sensor mote using direct epoxy:

1. Confirm that the sensor mote ID is associated with the installation point.
2. Apply a very thin layer of Loctite AA330 epoxy around the metal base of the sensor mote and lightly spray the bead of epoxy with the Loctite SF 7387 activator.
3. Line up the axes of the sensor mote with the prepared installation point, then press the sensor mote directly onto the installation point. Be sure the epoxy distributes across the base of the sensor mote evenly.
4. Hold the mounting sensor mote in place until the epoxy is cured enough to fully support the weight of the sensor mote, which should take approximately 2-3 minutes.
5. Release the sensor mote and allow the epoxy to continue to cure. During this time, make sure the position and orientation of the sensor mote do not shift. The sensor mote should be secure after 5 minutes, and the full cure time is 6 hours at (77° F) (25° C).
6. Reboot the sensor mote by holding a magnet to the top of the sensor mote cap for 3 seconds. The sensor mote should blink again after you remove the magnet.
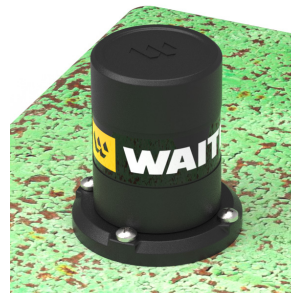
Installing Sensor Mote Guards

A sensor mote guard is an optional protective device designed to safeguard sensor motes from physical damage, resulting in enhanced data accuracy and reliability.

There are two types of sensor mote guards, half and whole. The half sensor mote guard shields the sensor mote from a specific direction and has a small footprint, whereas the whole sensor mote guard protects the sensor mote on all sides and requires a bigger installation footprint.

Sensor mote guard (half):

Sensor mote guard (whole):

Note the following:

- The sensor mote guard installation process varies slightly for each type.
- The screw width should be 4.9 mm, and the length can vary depending on your needs.
- There should be a minimum of 10 mm from the base of the sensor mote to support the surface, and the thread should be at least 15 mm high.
- The effectiveness of self-tapping screws can vary depending on your environment. Use self-tapping screws with caution.
- It is suggested that you:
    - Keep records of the installation, including the date, any modifications made, and any maintenance requirements for future reference.
    - Periodically inspect the guard to check for damage, corrosion, or contamination.
    - Clean or replace the guard as needed to ensure continued protection.

To install a sensor mote guard (whole):

1. Place the sensor mote base over the sensor mote and use the appropriate screws to secure it in place so it does not move.

2. Place the cap over the sensor mote and twist it tightly into place.

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To install a sensor mote guard (half):

1. Place the sensor mote guard (half) over the sensor mote in the correct direction and use the appropriate screws to secure it in place so it does not move. (Note: The half guard does not have a base.)

3 Replacing Sensor Mote Batteries

This chapter provides information on how to replace the battery in each sensor mote model. Each sensor mote model requires a specific battery.

Note the following about sensor mote batteries:

- Sensor mote batteries are designed to work for 3-5 years; however, there may be times when you need to replace them sooner.
- You must remove and service intrinsically safe sensor mote batteries from equipment in a safe area. Also, you must not replace intrinsically safe sensor mote batteries in an explosive (EX) environment.

Replacing the SM1-0101, SM1-1150, or SM2-0864 Battery

Note the following:

- The SM1-0101 model requires a BT7-1733 battery.
- The SM2-0846 and SM1-1150 models requires a BT7-0123 battery.

To replace the battery in the SM1-0101, SM1-1150, or SM2-0864:

1. Unscrew the black cap counter clockwise and note that an o-ring seal exists between the stainless steel base and the black polycarbonate cap.
2. Gently remove the old battery out of the battery clip and retainer.
3. Insert a new battery after confirming the following:
   - You are using a BT7-1733 battery for the SM1-0101 or a BT7-0123 battery for the SM2-0846.
   - You are inserting the battery correctly (that is, the plus (+) side is on the top and the negative (-) side is on the bottom). See the images below.
   - The indicator light flashes on the board after you insert the battery.

4. Check that the o-ring seal is clean and note the following:

- To keep the o-ring to keep it in position and prevent o-ring cracking, you can apply additional silicone grease.
- If required, you can order replacement o-rings from Waites.

5. Screw the cap back on and remember that the base threads are sharp and small.

When reinstalling the sensor mote, be careful not to cross thread the cap so the seal is not ruined.

Replacing the SM6 Battery

Note: The SM6 model requires the BT7-0123 battery. To

replace the battery in the SM6:

1. Unscrew the compression ring counter clockwise and note the following:

- You must grip the sensor mote from the metal base hexagon.
- The compression ring seal exists between the stainless steel base and cap and the compression ring. **NOTE: Do not twist the cap.**
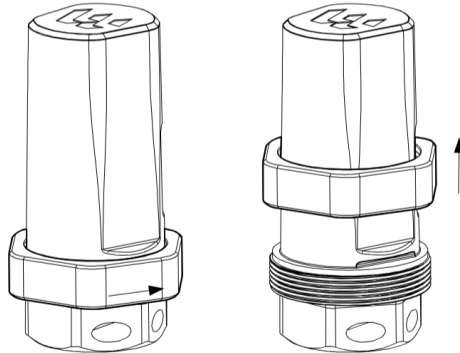
2. Gently remove the old battery out of the battery clip and retainer.
3. Insert a new battery and confirm the following:

- You are using a BT7-0123 battery.
- You are inserting the battery correctly (that is, the plus (+) side is on the top and the negative (-) side is on the bottom).
- The indicator light flashes on the board after you insert the battery.

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4. Check that the compression ring seal is clean and note the following:
    *   To keep the compression ring in position and prevent it from cracking, you can apply additional Super Lube Silicone O-Ring Lubricant (93003) or equivalent from the factory.
    *   If required, you can order replacement compression rings from Waites.
5. Insert the cover and observe the correct orientation.

6. Insert the compression ring and manually rotate clockwise until it's no longer possible.


7. Tighten the compression ring to a torque between 5 and 20 lbs-ft.

Replacing the SM7 Battery

Note: The SM7 model requires the BT7-7330 battery.

To replace the battery in the SM7-:

1. Unscrew the compression ring counter clockwise and note the following:
   - You must grip the sensor mote from the metal base hexagon.
   - The compression ring seal exists between the stainless steel base and cap and the compression ring. **NOTE: Do not twist the cap.**
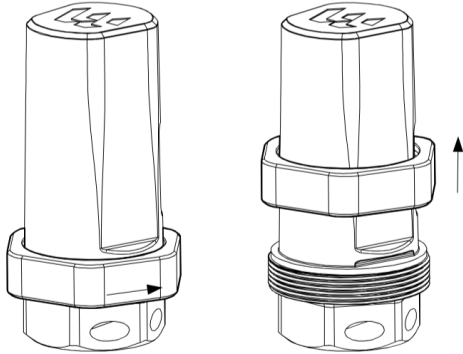

2. Gently remove the old battery out of the battery clip and retainer.
3. Place a magnet near the back of the circuit board reed switch. The LED will briefly flash. Once it stops flashing, that will indicate that the SM7 is fully powered down.
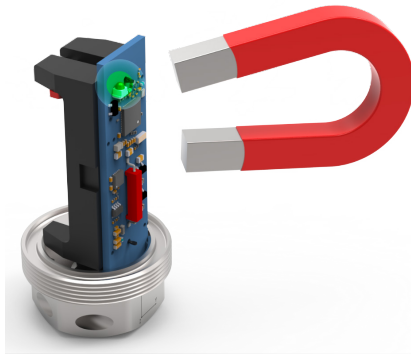
4. Insert a new battery and confirm the following:
   - You are using the BT7-7330 from Waites.
   - You are inserting the battery correctly (that is, the plus (+) side is on the bottom and the negative (-) side is on the top).
   - The indicator light flashes on the board after you insert the battery.

5. Check that the compression ring seal is clean and note the following:

   • To keep the compression ring in position and prevent it from cracking, you can apply additional Super Lube Silicone O-Ring Lubricant (93003) or equivalent from the factory.

   • If required, you can order replacement compression rings from Waites.

6. Insert the cover and observe the correct orientation.
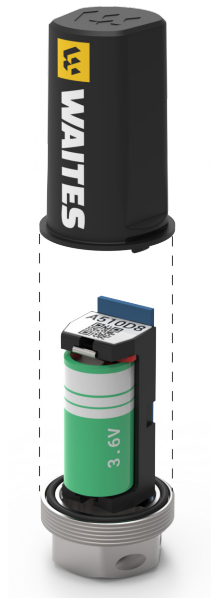
7. Insert the compression ring and manually rotate clockwise until it's no longer possible.

8. Tighten the compression ring to a torque between 5 and 20 lbs-ft.

4 Removing and Reinstalling Sensor Motes

This chapter provides information on how to remove and reinstall sensor motes.

Safety Requirements:
- Proper PPE must be worn
- Identify potential hazards
- Perform all necessary LOTO
- Verify the equipment has been properly locked out
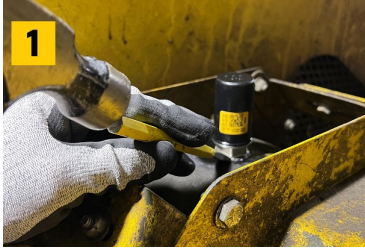
Required PPE:
- Gloves
- Safety goggles

Required Tools:
- Hammer
- Scraper
- Screwdriver
- Machinist file
- Emery cloth
- Loctite AA 330 adhesive
- Loctite SF 7387 activator

Note: Before you remove a sensor mote, take a picture of it so you can refer to the photo during reinstallation for proper placement and orientation.

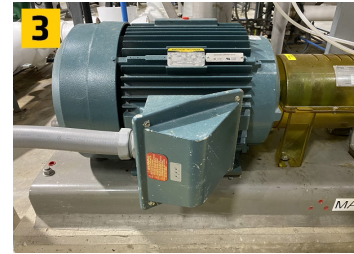support@waites.net | 1-800-574-WAITES

Place the scraper between the sensor mote and equipment. Tap the scraper with a hammer until the sensor mote is freed from the equipment.

Remove any remaining adhesive from the sensor mote using an emery cloth.

Identify the proper location on the equipment (and avoid the cover) and then prepare the location for paint removal by wiping it down with a rag. Note: The motor location acceptable for the drive and non-drive side is green. In rare cases, you will need to modify the cover if there isn't a flat surface.

Remove all remaining paint from the equipment. If desired, use a wire brush attachment with the drill.

If the replacement component is a different shape, you should do the following to obtain better data:
- Attach the sensor mote where there is a direct connection to the bearing being monitored.
- Attach the sensor mote to the flattest surface possible.

If the replacement component is the same shape, you should attach the sensor mote to the exact location it was removed from, in the same orientation.

Clean the surface of the equipment where the sensor mote is to be mounted using alcohol wipes and allow the surface to fully dry.

Apply a small amount of adhesive to the sensor mote base and evenly spread it on the face of the sensor mote. Coat the epoxy with the activator spray to begin cohesion.
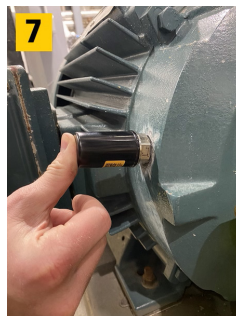
Apply the sensor mote to the proper location using medium pressure until it is secure (3-5 minutes). Verify the sensor mote is properly mounted and secure. Ensure the Z-axis is running directly along the shaft. In this example, the Z-axis is facing the camera; therefore, it is running along the shaft.

5 Troubleshooting Sensor Motes

Note: To prevent future problems, it is crucial to minimize contact with the board inside the sensor mote. Waites strongly advises the use of gloves whenever working with sensor motes.

If you encounter any issues during the installation or configuration of sensor motes, Waites suggests initiating a reboot sequence to synchronize it to the gateway. This should be your initial troubleshooting step if the sensor mote is malfunctioning.

For the SM1-0101, SM1-1150, SM2-0864, and SM6 models, tap/swipe a magnet on the top of the sensor mote. For the SM7 model, follow the multi-step reboot sequence that is described in "Replacing the SM7 Battery" on page 15.

If you observe intermittent flashes after the resynchronization, it is likely that the battery is low and needs to be replaced.

For information on how to replace sensor mote batteries, see "Replacing Sensor Mote Batteries" on page 12. For information on how to remove and replace sensor motes, see "Removing and Reinstalling Sensor Motes" on page 17.

If you are still encountering issues after performing these tasks, contact Waites technical support at support@waites.net.

A C1D1 and IECEx Hazardous Location Requirements for the SM1-0101

This appendix provides information about C1D1 and IECEx hazardous location requirements (in both English and French) for the SM1-0101 model with the following specifications:

> Class I, II, III Division 1, Groups C-G, T4, T165°C
> Ex ia IIB T4 Ga
> -40°C to +85°C
> IECEx ETL 21.0010X

WARNING - Use only battery pack Tenergy CR17335.
AVERTISSEMENT - Utiliser uniquement la pile Tenergy CR17335.

WARNING - Do not replace battery when an explosive gas atmosphere may be present.
AVERTISSEMENT - Ne pas remplacer la pile dans une atmosphère explosive gazeuse.

WARNING - Substitution of components may impair intrinsic safety.
AVERTISSEMENT - Substituer un composant peut compromettre la sécurité intrinsèque.

WARNING - Potential electrostatic charging hazard - see instructions.
AVERTISSEMENT - Risque potentiel de charge électrostatique - voir les instructions.

WARNING - Use of any battery other than the Tenergy CR17335 will impair the protection provided by the equipment.
AVERTISSEMENT - Utiliser une autre pile que la Tenergy CR17335 compromettra la protection fournie par l'équipement.

WARNING - Battery powered fixed installation. Battery details: Tenergy CR17335.
AVERTISSEMENT - Installation fixe alimentée par pile. Information sur la pile: Tenergy CR17335.

WARNING - Electrostatic hazard warning. Refer to the equipment instruction manual for techniques to mitigate risk of electrostatic discharge.
AVERTISSEMENT - Avertissement sur les risques électrostatiques. Reportez-vous au manuel d'instructions de l'équipement pour connaître les techniques afin de réduire le risque de décharge électrostatique.

B FCC Compliance Statement

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.

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

Note: 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 or more 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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.

C ISED Canada Compliance Statement

The device complies with ISED 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.

Exposure to radio frequency energy. The radiated output power of this device meets the limits of FCC/ISED Canada radio frequency exposure limits. This device should be operated with a minimum separation distance of 20 cm (8 inches) between the equipment and a person's body.

French:

Le présent appareil est conforme aux CNR d'ISDE 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.

L'exposition à l'énergie radiofréquence. La puissance de sortie rayonnée de cet appareil est conforme aux limites de la FCC/ISDE Canada limites d'exposition aux fréquences radio. Cet appareil doit être utilisé avec une distance minimale de séparation de 20 cm entre l'appareil et le corps d'une personne.

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