Installation, operation, and maintenance

Wireless Zone Sensor

Model WZS

June 2006  BAS-SVX04A-EN
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Warnings and Cautions

**Warnings and Cautions.** Notice that warnings and cautions appear at appropriate intervals throughout this manual. Warnings are provided to alert installing contractors to potential hazards that could result in personal injury or death, while cautions are designed to alert personnel to conditions that could result in equipment damage.

Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

<table>
<thead>
<tr>
<th>NOTICE: Warnings and Cautions appear at appropriate sections throughout this literature. Read these carefully.</th>
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<tbody>
<tr>
<td><strong>WARNING:</strong> Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.</td>
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<tr>
<td><strong>CAUTION:</strong> Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.</td>
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<tr>
<td><strong>CAUTION:</strong> Indicates a situation that may result in equipment or property-damage only accidents.</td>
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Product Description

This manual contains information about installing, operating, and maintaining the Trane® Wireless Zone Sensor system.

Overview

The Trane Wireless Zone Sensor set includes a sensor and a receiver that work together to provide the same functions as the equivalent Trane wired sensor (#4190-1090), such as the standard 10 kΩ temperature input (with the exception of the communication jack). No further software or hardware is necessary for site evaluation, installation, or maintenance.

The sensor transmits the zone temperature, all zone temperature setpoint functions, timed override Occupied (On) and timed override Unoccupied (Cancel) information to the receiver. The receiver electrically reproduces the zone temperature resistance, all zone temperature setpoint function resistances, and timed override On and timed override Cancel information as sent by the sensor.

Factory or Field Installed

The information in this manual is applicable to Wireless Zone Sensor sets that are either factory or field installed.

Part Numbers

Table 1. Part numbers

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X13790496</td>
<td>Wireless Zone Sensor set, North America (100 mW, 16 channel), Fahrenheit, analog</td>
</tr>
<tr>
<td>X13790498</td>
<td>Wireless Zone Sensor set, North America (100 mW, 16 channel), Celsius, analog</td>
</tr>
<tr>
<td>X13790492</td>
<td>Sensor only, Fahrenheit</td>
</tr>
<tr>
<td>X13790494</td>
<td>Sensor only, Celsius</td>
</tr>
<tr>
<td>X13790488</td>
<td>Receiver only, North America (100 mW, 16 channels), analog</td>
</tr>
<tr>
<td>X13790489</td>
<td>Receiver only, Europe (10 mW, 16 channels), analog (Not advised for North America.)</td>
</tr>
<tr>
<td>X19051672</td>
<td>Wire harness, five-conductor, for wireless receiver (all locations)</td>
</tr>
</tbody>
</table>

Dimensional Diagrams

See Figure 1, p. 10 and Figure 2, p. 11 for dimensions of the Wireless Zone Sensor set. The dimensions are the same for both the sensor and the receiver.
Figure 1. Outside dimensions for sensor and receiver

Note: The dimensions are the same for both the sensor and the receiver.
Figure 2. Mounting hole dimensions for sensor and receiver

Note: The dimensions are the same for both the sensor and the receiver.
Setting the Address, Mounting, Wiring, and Associating the Receiver and Sensor

The following procedure list shows the recommended order for installation:

- Choosing a location for mounting the receiver and sensor
- Setting the rotary switches on the receiver and the sensor
- Mounting the base plate of the receiver
- Wiring the receiver to the unit controller
- Replacing and securing the receiver cover
- Applying power to the receiver
- Powering the sensor and associating the sensor to the receiver
- Testing signal and battery strength
- Automatic association
- Manual association
- Mounting the base plate of the sensor
- Replacing and securing the sensor cover

Choosing a Location for Mounting the Receiver and Sensor

Placement of the receiver and the sensor set is critical to proper operation. In most installations, distance is not the limiting factor for proper radio signal quality. It is more greatly affected by walls, barriers, and general clutter. For best radio transmission range and reliability, wherever possible, mount the receiver and sensor in line of sight. Try to minimize the number of barriers between the pair of devices. In general, sheetrock walls and ceiling tiles offer little restriction to the propagation of the radio signal throughout the building; concrete or metal barriers offer the most restriction.

The transmission range for the sensor is as follows:

- Open range: 2,500 ft (762 m) (packet error rate = 2%)
- Usable range: 200 ft (61 m)
- Typical range: 75 ft (23 m)

Location Considerations for the Receiver

When selecting a location for the receiver, consider both ambient and radio transmission characteristics of the location.

Ambient considerations

- Avoid locations that are outside the operating temperature and humidity range (refer to Table 11, p. 45).
Radio transmission considerations

- Avoid metal barriers between the receiver and the sensor; they decrease radio signal quality significantly (for example, plastered walls with metal lathe or metal roof decks).
- Avoid placing the receiver inside metal enclosures.
- Avoid radio transmissions through thick, solid concrete walls.
- Conduct rooftop mounting and operation of the receiver only after careful site evaluation and confirmation.

Location Considerations for the Sensor

When selecting a location for the sensor, consider both thermal and radio transmission characteristics of the location.

Thermal considerations

- Avoid areas of direct sunlight.
- Avoid areas in the direct airstream of air diffusers.
- Avoid exterior walls and other walls that have a temperature differential between their two sides.
- Avoid areas close to sources of heat such as sunlight, appliances, or other equipment.
- Avoid drafty areas.
- Avoid dead spots behind doors, projection screens, or corners.

Radio transmission considerations

- Avoid metal barriers between the sensor and receiver, such as plastered walls with metal lathe. They will decrease radio signal quality.
- Avoid placing the sensor inside metal enclosures.
- Avoid radio transmissions through thick, solid concrete walls.
Setting the Rotary Address Switches on the Receiver and the Sensor

*Note:* To expedite the installation and association process, set the addresses before applying power to the receiver.

The process of establishing communication between the receiver and sensor is referred to as *association*. The receiver and the sensor must have their rotary switches set to the same address in order to enable communication between the two devices (see Figure 3). Important limitations are as follows:

- Only one associated receiver/sensor set can communicate within the reception range of the wireless system.
- It is not possible to associate more than one sensor to a receiver, nor is it possible to associate more than one receiver to a sensor.

![Figure 3. Setting the rotary address switches on the receiver and the sensor](image)

Each pair of devices must have a unique address. Range 001 - 999
Setting the Receiver Address

1. Using a small screwdriver, set the three rotary address switches (locations S1, S2, S3) on the receiver (Figure 3, p. 15) to an address between 001 and 999.

   **Note:**
   - Do not use 000 as an address for installation. If you set the receiver address to 000, it will:
     - Returns the receiver outputs to their factory defaults indefinitely (zone temperature and setpoint outputs: 72.5°F [22.5°C])
     - Remove all association knowledge
     - Make the receiver unable to associate with a sensor
   - Read the switches from left to right in the order in which they are numbered (S1, S2, S3).
   - Zero is at the 9 o’clock position.

2. Make a notation of the address and location of the receiver.

Setting the Sensor Address

1. Using a small screwdriver, set the three rotary address switches (locations S1, S2, S3) on the sensor (Figure 3, p. 15) to the same address used for the receiver it is to be associated with.

2. Make a notation of the address and location where this sensor is to be mounted.

   **Note:**
   - Do not use 000 as an address for installation. If you set the address to 000, it will:
     - Remove all association knowledge
     - Revert to a low-power hibernation mode.
     - Send a disassociation request to the receiver. If the sensor and receiver are associated and communicating at the time the sensor is set to 000 and the Test button is pressed, the receiver will also become unassociated and will be available for re-association.
   - Read the switches from left to right in the order in which they are numbered (S1, S2, S3).
   - Zero is at the 9 o’clock position.

3. Make a notation of the address and location of the sensor.
Mounting the Base Plate of the Receiver

The receiver consists of two parts: the base plate and the cover (which includes the electronics).

1. Remove the cover: While grasping the top and bottom of the base plate, firmly depress the thumb tab at the bottom of the cover. Pull the bottom of the receiver cover away from the base plate (Figure 4, p. 17).

2. Mount the base plate of the receiver. Mounting hardware is included with the receiver.
   The receiver can be mounted to any flat surface including sheet metal or a standard 2 in. x 4 in. electrical box. The appropriate location for mounting the receiver is job dependent.

Figure 4. Removing the cover
Setting the Address, Mounting, Wiring, and Associating the Receiver and Sensor

Wiring the Receiver to the Unit Controller

Power Requirements

The required power for the receiver is 24 Vac or 24 Vdc and is less than 1 VA. The receiver is designed to be powered by the host unit controller.

*Note:* A dedicated transformer is not necessary or advised. However, if a dedicated transformer is used, the two grounds (commons) of the multiple transformers are electrically connected to one another ([Figure 9, p. 23](#)).

Wiring Procedures

**WARNING**

Hazardous voltage!

Shut off power to the unit controller. Failure to disconnect the high voltage at the unit controller may result in personal injury or death.

**CAUTION**

Equipment damage!

Applying excessive voltage to the receiver module will permanently damage it.

1. Shut off power to the unit controller that you are wiring the receiver to.
2. Wire the receiver to the controller using the supplied five-conductor wiring harness ([Figure 5, p. 19](#)) that is included with the product. Refer to [Table 2, p. 19](#) to determine where to terminate each wire at the unit controller.

There are two ways to route the wires from the receiver to the termination points. The wires can be run through either:

- The hole in the bottom of the cover (see [Figure 6, p. 20](#) for an example).
- The opening at the back of the base plate (see [Figure 7, p. 21](#) for an example).

*Note:* • The harness comes terminated with ¼ in. (6.4 mm) fully insulated spade connectors. Snip these ends off if necessary.
• The length of wires on the wiring harness can be extended to a maximum of 3 m.
• Adaptors are provided, which allow connecting multiple wires to the power terminals of the host unit controller.
• An anti-short bushing is provided; use it to prevent the wire from shorting out if the steel penetrates the wiring harness.
Setting the Address, Mounting, Wiring, and Associating the Receiver and Sensor

Table 2. Wiring harness: Wire identification

<table>
<thead>
<tr>
<th>Wire label</th>
<th>Color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEATING SET</td>
<td>N/A</td>
<td>Not used. For future use.</td>
</tr>
<tr>
<td>FAN/SYSTEM</td>
<td>N/A</td>
<td>Not used. For future use.</td>
</tr>
<tr>
<td>SETPOINT</td>
<td>Red</td>
<td>Space temperature setpoint</td>
</tr>
<tr>
<td>ZONE</td>
<td>White</td>
<td>Zone temperature</td>
</tr>
<tr>
<td>GND-SIGNAL</td>
<td>Black</td>
<td>Ground for setpoint and zone signal</td>
</tr>
<tr>
<td>24VAC/DC</td>
<td>Blue</td>
<td>24 Vac/Vdc power</td>
</tr>
<tr>
<td>GND-POWER a</td>
<td>Yellow</td>
<td>Ground for 24 Vac/dc</td>
</tr>
<tr>
<td>COMM +</td>
<td>N/A</td>
<td>Not used. For future use.</td>
</tr>
<tr>
<td>COMM –</td>
<td>N/A</td>
<td>Not used. For future use.</td>
</tr>
</tbody>
</table>

\(^{a}\) Both GND-SIGNAL and GND-POWER must be wired for the receiver to operate (see Figure 8, p. 22 or Figure 9, p. 23).

Figure 5. Wiring harness

Connect wiring harness to receiver
Figure 6. Example of wiring a receiver to a unit controller with wires routed through the slot in the bottom of the cover.
Figure 7. Example of wiring a receiver to a unit controller with wires routed through the opening in the back of the base plate
Transformer Wiring

Figure 8 shows a wiring diagram using a single transformer to power the unit controller and the receiver. This is the recommended method of installation.

Figure 8. Single transformer wiring (recommended)
Using a dedicated transformer to power the receiver is seldom necessary and is not advised. (See Figure 8, p. 22 for the recommended single transformer wiring method.) A dedicated transformer should be used only when the host transformer does not have enough volt-ampere (VA) capacity to power the receiver (see Table 11, p. 45 for receiver power consumption).

If you are using a dedicated transformer, make sure the grounds (commons) of the multiple transformers are electrically connected to one another (see Figure 9 for an example).

Figure 9. Multiple transformer wiring (not recommended)
Replacing and Securing the Receiver Cover

1. To replace the receiver cover on the base plate, hook the cover over the top of the base plate. Apply light pressure to the bottom of the cover until it snaps in place.

2. If necessary to keep the cover securely attached, install the security screw into the bottom of the receiver (Figure 10).

Figure 10. Snap receiver cover on base plate and attach security screw
Applying Power to the Receiver

1. Restore power to the UCM. Observe LED5 on the receiver (Figure 11). It will light and stay constantly On when 24 V power is normal.

Figure 11. LED5 stays On after applying power to the receiver

LED5 stays constantly On

Receiver Indicates Readiness to Associate

After initial power up, the receiver conducts a channel scan for 10 seconds. During this time, the receiver selects from 16 available channels the clearest channel on which to operate. LED1, LED2, and LED3 flash rapidly in succession (round-robin style) while the channel scan is in progress.

*Note:* *Do not attempt association until the channel scan is finished.*

After the channel scan is finished, LED3 will begin blinking (one-blink pattern) to show that the receiver is ready to be associated with a sensor. LED3 will stop blinking when association has been established (Figure 12).

Figure 12. LED3 blinks when the receiver is ready to be associated with a sensor
Powering the Sensor and Associating the Sensor to the Receiver

1. Verify that the sensor is set to the same address as the receiver it is to be associated with.

2. Remove the insulation barrier, which is a plastic strip located between the two batteries (Figure 13).

3. Association will automatically occur between the sensor and the receiver (see "Automatic Association," p. 28).

**Note:** LED3 on the receiver stops blinking to indicate that association has been established.
Testing Signal and Battery Strength

The following recommended test indicates signal and battery strength. It verifies that the association process was successful and that the batteries have adequate charge. (For more information on LEDs, see “Operation, Maintenance, and Troubleshooting” on page 31.)

1. Firmly press and release the Test button (S5) on the bottom of the sensor (Figure 14).

2. View LED1, LED2, and LED3 to determine the strength of the signal. View LED5 to determine the strength of the battery.

   **Note:** The LEDs will turn Off after 5 seconds to conserve battery strength.

3. Record the results in your commissioning statement.

Figure 14. Testing signal and battery strength
Setting the Address, Mounting, Wiring, and Associating the Receiver and Sensor

Automatic Association

When the sensor powers up for the first time, (when the insulation barrier is removed), association between the receiver and the sensor is automatically attempted.

If the first association attempt is unsuccessful, the sensor will automatically reattempt association with the receiver every 10 minutes. You can also manually initiate an association process (see “Manual Association”).

Note: A disassociated sensor will transmit an association request every 10 minutes. An associated sensor that has lost communication with the receiver will transmit an association request every 50 minutes.

Manual Association

At any time, the manual association method can be used to associate the receiver with the sensor. If an association was previously established between a receiver and a sensor and needs to be re-established, the manual association process may be used. If an association has not yet been established, the automatic association process is recommended (refer to “Automatic Association,” p. 28).

1. Set the rotary switches (Figure 3, p. 15, locations S1, S2, S3) on the receiver to an address between 001 and 999.

   Note: 1) An address can be changed without powering down the receiver or sensor.

          2) An address can be changed at any time after initial association has been established.

2. Make a notation of the address and location of this receiver.

3. Set the rotary switches (Figure 3, p. 15, locations S1, S2, S3) on the sensor to the same address used for the receiver it is to be associated with.

4. Make a notation of the address and location of this sensor.

5. After making sure that both the receiver and sensor are powered up, press the Test button (S5) on the sensor (see Figure 14, p. 27). LED1, LED2, and LED3 will respond, by indicating the quality of the signal. (For detailed information about interpreting signal quality from the LEDs, see “Signal Quality Test,” p. 32.)

Disassociation

The receiver removes all stored association information, conducts a channel scan, and restarts itself, if any of the following are true:

- The receiver address is changed from its current setting (001–999)
- The receiver receives a disassociation notification from its associated sensor
- The receiver does not receive a communication from its associated sensor within 35 minutes
Mounting the Base Plate of the Sensor

Mount the base plate of the sensor directly to any flat surface, including sheet rock or a standard 2 in. x 4 in. electrical box, at a maximum height of 54 in. above the floor. Mounting hardware is included with the sensor.

Note: When only parallel approach by a person in a wheelchair is possible, mount the sensor at a maximum height of 48 inches above the floor. Consult section 4.27.3 of the 2002 ADA (Americans with Disability Act) guideline, and local building codes, for further details.

To Mount Sensor Directly to Drywall or Plaster

1. Position the base plate over the wall and mark the centers of the two oblong mounting holes.

   Note: The sensor must be mounted plumb (vertically level) to ensure proper air movement through the sensor and to ensure accurate temperature control.

2. Use the plastic anchors that are included with the sensor. Screw the anchors into the wall until they are flush (Figure 15). Pre-drilling holes is not usually necessary.

   Figure 15. Mounting the base plate of the sensor into drywall or plaster

3. Fasten the base plate to the wall using the two supplied M3.5 x 35 mm mounting screws.

   Or, as an alternative, attach the sensor to the wall with any Velcro™ fastening system.
To Mount Sensor Directly to an Electrical Junction Box

1. Fasten the base plate to the vertically mounted electrical junction box using the two supplied 6-32 x 3/4 in. mounting screws.

   Note: The sensor must be mounted plumb (vertically level) to ensure proper air movement through the sensor and to ensure accurate temperature control.

Replacing and Securing the Sensor Cover

1. If the sensor cover has been removed from the base plate, replace it by hooking the cover over the top of the base plate. Apply light pressure to the bottom of the cover until it snaps in place (Figure 16).

2. If necessary to keep the cover securely attached, install the security screw into the bottom of the sensor (Figure 16).

Figure 16. Snap cover on and attach security screw
LED Operation

The sensor and receiver each have four LEDs (LED1, LED2, LED3, and LED5). The sensor also has a Test button (S5). See Figure 17 for their locations.

Figure 17. Wireless zone sensor set components with base plates removed
Signal Quality Test

Pressing the Test button (S5) on the sensor initiates a signal quality test. LED1, LED2, and LED3 respond by indicating excellent, marginal, or poor signal quality. The LEDs can be observed on both the sensor (Table 3) and the receiver (Table 4).

Table 3. Signal quality: LED1, LED2, LED3 on the sensor

<table>
<thead>
<tr>
<th>User action</th>
<th>LED display</th>
<th>Indicates...</th>
</tr>
</thead>
</table>
| None                         | LED1: Off                                | Normal state  
|                              | LED2: Off                                | • No Test button press.                                                      |
|                              | LED3: Off                                |                                                                              |
| Press Test button (S5)       | LED1: Off                                | Associated; no communication with receiver  
|                              | LED2: Off                                | • Associated, but no signal from the receiver after pressing Test button.    |
|                              | LED3: Off                                |                                                                              |
|                              | Displays for 5 seconds, then constantly Off |                                                                              |
|                              |                                          | Excellent signal quality  
|                              |                                          | • Adequate signal margin for reliable communication.                        |
| LED1: Off                    |                                          | Marginal signal quality  
| LED2: On                     |                                          | • Reduced battery life is likely.                                            |
| LED3: On                     |                                          | • Consider moving the sensor or receiver to a better location.               |
| Displays for 5 seconds, then and constantly Off |                                          | Poor signal quality  
|                              |                                          | • Unreliable communication.                                                 |
|                              |                                          | • Strongly recommend moving the sensor or receiver to a better location.     |

Table 4. Signal quality: LED1, LED2, LED3 on the receiver

<table>
<thead>
<tr>
<th>User action</th>
<th>LED display</th>
<th>Indicates...</th>
</tr>
</thead>
</table>
| None                         | LED1: Off                                | Normal state  
|                              | LED2: Off                                | • No Test button press.                                                      |
|                              | LED3: Off                                |                                                                              |
| Press Test button (S5) on the sensor | LED1: On                                | Excellent signal quality  
|                              | LED2: On                                | • Adequate signal margin for reliable communication.                        |
|                              | LED3: On                                |                                                                              |
| Displays for 5 seconds, then and constantly Off |                                          | Marginal signal quality  
|                              |                                          | • Reduced battery life is likely.                                            |
|                              |                                          | • Consider moving the sensor or receiver to a better location.               |
| LED1: Off                    |                                          | Poor signal quality  
| LED2: On                     |                                          | • Unreliable communication.                                                 |
| LED3: On                     |                                          | • Strongly recommend moving the sensor or receiver to a better location.     |
| Displays for 5 seconds, then and constantly Off |                                          |                                                                              |
Diagnostics

LED1, LED2, and LED3 will respond to diagnostics by exhibiting specific blinking patterns. They will occur on the sensor as a result of pressing the Test button (S5) (Table 5). They will occur on the receiver independently of any user action (Table 6).

Table 5. Diagnostics: LED1, LED2, LED3 on the sensor

<table>
<thead>
<tr>
<th>User action</th>
<th>LED display</th>
<th>Indicates...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press Test button (S5)</td>
<td>LED1: Off</td>
<td>Disassociated</td>
</tr>
<tr>
<td></td>
<td>LED2: Off</td>
<td>• Sensor is not associated with a receiver.</td>
</tr>
<tr>
<td></td>
<td>LED3: 1-blink pattern repeated 3 times</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LED1: Off</td>
<td>Address set to 000</td>
</tr>
<tr>
<td></td>
<td>LED2: Off</td>
<td>• Address not set to between 001–999.</td>
</tr>
<tr>
<td></td>
<td>LED3: 2-blink pattern repeated 3 times</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LED1: Off</td>
<td>Not configured</td>
</tr>
<tr>
<td></td>
<td>LED2: Off</td>
<td>• Sensor configuration properties not properly set (defective sensor).</td>
</tr>
<tr>
<td></td>
<td>LED3: 3-blink pattern repeated 3 times</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LED1: Off</td>
<td>Input voltage too high</td>
</tr>
<tr>
<td></td>
<td>LED2: Off</td>
<td>• No RF transmission is permitted with an input battery voltage greater than 3.9 V.</td>
</tr>
<tr>
<td></td>
<td>LED3: 4-blink pattern repeated 3 times</td>
<td></td>
</tr>
</tbody>
</table>

1 Blink pattern is On for 1/4 s, Off for 1/4 s, with 2 s Off between repetitions.

Table 6. Diagnostics: LED1, LED2, LED3 on the receiver

<table>
<thead>
<tr>
<th>User action</th>
<th>LED display</th>
<th>Indicates...</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>LED1: Off</td>
<td>Disassociated</td>
</tr>
<tr>
<td></td>
<td>LED2: Off</td>
<td>• Receiver is not associated, waiting for a sensor.</td>
</tr>
<tr>
<td></td>
<td>LED3: 3-blink pattern repeated 3 times</td>
<td>• Receiver lost communication with sensor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Receiver has no devices on its wireless personal area network.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Association with a device has been manually removed.</td>
</tr>
<tr>
<td></td>
<td>LED1: Off</td>
<td>Address set to 000</td>
</tr>
<tr>
<td></td>
<td>LED2: Off</td>
<td>• Address not set to between 001–999.</td>
</tr>
<tr>
<td></td>
<td>LED3: 2-blink pattern repeated continuously</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LED1: Off</td>
<td>Not configured</td>
</tr>
<tr>
<td></td>
<td>LED2: Off</td>
<td>• Receiver configuration properties not properly set (defective receiver).</td>
</tr>
<tr>
<td></td>
<td>LED3: 3-blink pattern repeated 3 times</td>
<td></td>
</tr>
</tbody>
</table>

1 Blink pattern is On for 1/4 s, Off for 1/4 s, with 2 s Off between repetitions.
Sensor Battery Status Test and Low Battery Power Notification

LED5 indicates battery status. LED5 is:

- Located on the sensor
- Bi-color (green/red)
- Normally Off

Testing is initiated by pressing the Test button (S5). When the battery power goes below a certain threshold, LED5 is automatically activated.

Table 7 explains how to interpret LED5 on the sensor.

<table>
<thead>
<tr>
<th>User action</th>
<th>LED display</th>
<th>Indicates...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press Test button (S5)</td>
<td>Solid green for 5 seconds</td>
<td>Battery condition is adequate for proper operation.</td>
</tr>
<tr>
<td></td>
<td>Solid red for 5 seconds</td>
<td>Battery condition is low. Batteries should be replaced.</td>
</tr>
<tr>
<td></td>
<td>No light</td>
<td>Batteries are totally dead or not installed properly, or sensor is defective.</td>
</tr>
<tr>
<td>None</td>
<td>Blinking red: 1-blink pattern(^1) repeated 5 times. Cycle repeats every 15 minutes.</td>
<td>Battery condition is low. Approximately 14 days of operation remain before the battery is too weak to power the sensor.</td>
</tr>
</tbody>
</table>

\(^1\) Blink pattern is On for 1/4 s, Off for 3/4 s, with 2 s Off between repetitions. [Bryan: please verify about the 2 s Off. Thank you PK].

24 V Power Status

On the receiver (Figure 11, p. 25), LED5 will light and stay constantly On when 24 V power is normal.
Sensor Batteries

Sensor battery type, length of life, and installation are covered in this section.

**Battery Type**

**CAUTION**

Equipment Damage!

The batteries are manufactured in a ready-to-use state. They are not designed for recharging. Recharging can cause battery leakage or, in some cases, can cause the safety release vent to open.

**CAUTION**

Equipment Damage!

Do not attempt to hook up the WZS to a power supply. Equipment damage may result.

Use non-rechargeable 1.5 volt AA lithium batteries in the sensor. Two batteries are required. To maintain UL rating, only UL-listed lithium batteries should be used. The sensor ships with Energizer™ L91 batteries already installed.

*Note: The sensor is shipped with an insulation barrier between the batteries (Figure 18) to prevent discharging of the batteries during shipment and storage. Remove this barrier when installing the sensor (see “Powering the Sensor and Associating the Sensor to the Receiver,” p. 26).*

**Figure 18. Battery insulation barrier**
Battery Life

Battery life is five years under normal conditions. If the battery is not used for an extended period of time, either remove the batteries or set the sensor address to 000 and press the Test button (S5). This will place the sensor into a low-power hibernation mode.

**Note:** If lithium batteries are temporarily unavailable, alkaline batteries can be used. However, alkaline battery life is very short by comparison.

Battery Installation

**WARNING**

Prevent Injury!

Batteries can explode or leak and cause burns if installed backwards, disassembled, charged, or exposed to water, fire, or high temperature.

**WARNING**

Prevent Injury!

Keep away from small children. If swallowed, promptly see doctor. Have doctor telephone your poison control center.

Install two AA lithium batteries in the battery-holding slot that is molded into the sensor cover. Observe the “+” and “−” polarity indicators that are molded into the cover.

The sensor has been designed to prevent damage if the batteries are installed backwards, thereby reducing the potential for injury.
Occupied (On)/Unoccupied (Cancel) Button Operation

The Wireless Zone Sensor set supports Occupied (On) and Unoccupied (Cancel) buttons for timed override request and Service pin request (see Table 8). See Figure 19 for button locations.

Note: Not all systems support the timed override Occupied and Unoccupied functions.

Table 8. Occupied and Unoccupied button functions

<table>
<thead>
<tr>
<th>User input at sensor</th>
<th>User pushes button for...</th>
<th>Output generated at receiver</th>
<th>Output will generate for...</th>
</tr>
</thead>
<tbody>
<tr>
<td>User presses Occupied button (occupancy request)</td>
<td>0.2 to 6 seconds</td>
<td>Space temperature output is driven to 10 Ω (nominal)</td>
<td>4 seconds</td>
</tr>
<tr>
<td>User presses Unoccupied button (cancels occupancy request)</td>
<td>0.2 to 6 seconds</td>
<td>Space temperature output is driven to 1330 Ω (nominal)</td>
<td>4 seconds</td>
</tr>
<tr>
<td>User presses Unoccupied button (Comm5 Service pin request)</td>
<td>10 to 25 seconds</td>
<td>Space temperature output is driven to 10 Ω (nominal)</td>
<td>15 seconds</td>
</tr>
</tbody>
</table>

i Consult the appropriate unit control module literature for information about this function.
ii Comm5 is Trane’s implementation of LonTalk®.

Figure 19. Sensor: Location of Occupied button, Unoccupied button, and star (*) and double star (**) on thumb wheel
Special Thumbwheel Operation

The Wireless Zone Sensor set supports star (*) and double star (**) on the sensor thumb wheel (Figure 19, p. 37).

Note: Consult the appropriate unit control module for information about this function.

Using the Wireless Zone Sensor System as a Site Survey Tool to Check Signal Quality

Follow these steps to check the signal quality on a site:

1. Power up a receiver with a 24 V transformer (user supplied)
2. Associate the sensor to a receiver of the same model intended for the job
3. Place the receiver at the desired location
4. Place or hold the sensor at the desired location
5. Press the Test button (S5) on the sensor and observe the signal quality as indicated by LED1, LED2, and LED3 (Figure 17, p. 31).

For more information on interpreting the LEDs that indicate signal quality, see “Signal Quality Test,” p. 32.

Output Power Level

The maximum output power level of a Wireless Zone Sensor set is controlled by software and restricted by channel of operation and agency requirements per country or region. The sensor has a default maximum power level of 10 mW, but the receiver determines the ultimate output power level of the sensor.

The Wireless Zone Sensor set has two receiver models available:

- X13790488: 100 mW for North American use
- X13790489: 10 mW for international use

If receiver model X13790488 is used, the system power level for the sensor will be increased from 10 mW to 100 mW after it has been associated with the receiver. If receiver model X13790489 is used, the system power level for the sensor will be limited to 10 mW.

Note: If initial association of a sensor with receiver model X13790488 is unsuccessful, try re-attempting association after moving the sensor closer to the receiver. After association, the system power level will increase to 100 mW and the sensor can be relocated farther away.
Output Failure Modes of Operation

Table 9. Output failure modes of operation

<table>
<thead>
<tr>
<th>Situation</th>
<th>Zone temperature output</th>
<th>Zone setpoint output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver address = 000</td>
<td>11.17 kΩ, 72.5°F (22.5°C), indefinitely</td>
<td>451 Ω, 72.5°F (22.5°C), indefinitely</td>
</tr>
<tr>
<td>Receiver address = 001 to 999</td>
<td>11.17 kΩ, 72.5°F (22.5°C)</td>
<td>451 Ω, 72.5°F (22.5°C)</td>
</tr>
<tr>
<td>Receiver has powered up, but has not received a communication from sensor.</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>Receiver address = 001 to 999</td>
<td>Open</td>
<td>Normal value</td>
</tr>
<tr>
<td>Receiver has no power.</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>Thermistor in sensor has failed to either open or close.</td>
<td>Normal value</td>
<td>Open</td>
</tr>
<tr>
<td>Setpoint potentiometer has failed to either open or close.</td>
<td>Normal value</td>
<td>Open</td>
</tr>
</tbody>
</table>

Output Default Mode

When power is applied to the receiver and its address is set to between 001 and 999, the zone temperature and zone setpoint outputs default to 72.5°F (22.5°C) for 35 minutes or until the receiver receives a communicated value from the sensor. If the receiver address is set to 000, the zone temperature and zone setpoint outputs default to 72.5°F (22.5°C) indefinitely.
Measuring Output Resistance

To measure the resistance of the receiver outputs:

1. Make sure the black wire (GNS-SIGNAL) and the yellow wire (GND-POWER) are grounded (see Figure 8, p. 22 or Figure 9, p. 23 for wiring diagrams).

2. Make sure the receiver is powered up.

3. Disconnect the SETPOINT wire (red) and the ZONE wire (white) from the host unit controller.

4. Measure resistance between the grounded GND-SIGNAL wire and either the SETPOINT or ZONE wire. Compare resistance measurements to those presented in Table 10.

Table 10. Receiver resistance table

<table>
<thead>
<tr>
<th>Zone or Setpoint Temperature</th>
<th>Nominal Zone Temperature output resistance</th>
<th>Nominal Space Temperature Setpoint output resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>55°F (12.8°C)</td>
<td>17.47 kΩ</td>
<td>812 Ω</td>
</tr>
<tr>
<td>60°F (15.6°C)</td>
<td>15.3 kΩ</td>
<td>695 Ω</td>
</tr>
<tr>
<td>65°F (18.3°C)</td>
<td>13.49 kΩ</td>
<td>597 Ω</td>
</tr>
<tr>
<td>70°F (21.1°C)</td>
<td>11.9 kΩ</td>
<td>500 Ω</td>
</tr>
<tr>
<td>75°F (23.9°C)</td>
<td>10.5 kΩ</td>
<td>403 Ω</td>
</tr>
<tr>
<td>80°F (26.7°C)</td>
<td>9.3 kΩ</td>
<td>305 Ω</td>
</tr>
<tr>
<td>85°F (29.4°C)</td>
<td>8.25 kΩ</td>
<td>208 Ω</td>
</tr>
</tbody>
</table>

End-of-Range Temperature Values

The end-of-range temperature limits of the receiver are 32°F to 122°F (0°C to 50°C). The receiver cannot replicate temperature values outside this range. If the sensor transmits a temperature value to the receiver that is out of the receiver’s replication range, the receiver will “freeze” the output at the end-of-range values. This value will remain frozen until the transmitted temperature moves to between the end-of-range temperature limits.
Receiver Power-up Sequence

When power is applied to the receiver, the following sequences occur. They are dependent on the rotary switch address setting and on the association status of the receiver.

**Address set to 000 and receiver is not associated with a sensor**
- LED5 is constantly On, indicating power is applied and the receiver is functional.
- Zone temperature and setpoint outputs default to 72.5°F (22.5°C) indefinitely (Table 9, p. 39).
- Status LED3 will display a 2-blink pattern diagnostic (Table 6, p. 33).

**Address set from 001 to 999 and receiver is not associated with a sensor**
- LED5 is constantly On, indicating power is applied and the receiver is functional.
- Zone temperature and setpoint outputs default to 72.5°F (22.5°C).
- The receiver conducts an energy scan for 10 seconds to determine the clearest channel on which to operate.
- LED3 flashes On every 2 seconds when it is ready to accept a sensor association request. When an association request is made by a sensor, the receiver instructs the sensor on which power level to operate. Then the receiver and sensor begin operation at the appropriate channel and power level ("Receiver Indicates Readiness to Associate," p. 25).

**Address set from 001 to 999 (and not changed since most recent power-up) and receiver is associated with a sensor**
- LED5 is constantly On, indicating power is applied and the receiver is functional.
- Zone temperature and setpoint outputs default to 72.5°F (22.5°C).
- The receiver waits for a broadcast transmission from its associated sensor. When a transmission is received, the receiver positions its zone temperature and setpoint outputs appropriately.
- If the receiver does not receive a communicated signal from its associated sensor within 35 minutes, zone temperature and setpoint outputs fail, generating a unit controller alarm (Table 9, p. 39).
Sensor Transmission Time and Temperature Variables

Time Variables

- The maximum time between sensor temperature transmissions is 15 minutes.
- The minimum time between sensor temperature transmissions is 30 seconds.
- The minimum time for transmitting temperature setpoint changes is 10 seconds.

Note: If a sensor transmits a message to the receiver and the receiver does not reply, the sensor will retransmit the message to the receiver every 30 seconds until communication to the receiver is re-established. This feature makes re-establishing communication efficient. For example, if an HVAC unit is powered down (and, consequently, the receiver) for servicing, the sensor will rebroadcast the transmission every 30 seconds until the HVAC unit (and, consequently, the receiver) is powered back up. It will take no longer than 30 seconds for communication to be re-established.

Temperature Variables

- The minimum change in temperature required to force a sensor transmission is:
  - 0.2°F (0.11°C) when the temperature range is between 60°F (15.6°C) and 80°F (26.7°C)
  - 0.5°F (0.28°C) when the temperature range is between 0 °F (–17.8°C) and 60°F (15.6°C) or between 80°F (26.7°C) and 122°F (50°C)
- The minimum change in temperature setpoint required to force a sensor transmission is 1°F (0.56°C).
Servicing and Testing

If the wireless zone sensor system is not working as expected, use the tools and procedure described in this section.

Servicing and Testing Tools

No special tools or software are necessary to service and test the wireless zone sensor system. The system can be testing by using the following:

- LEDs 1, 2, 3, and 5 on the sensor and on the receiver
- The Test button (S5) on the sensor
- The address test mode on the receiver
- A common volt-ohm meter

Procedure for the Testing the Wireless Zone Sensor System

If the wireless zone sensor system is not working as expected, perform the following steps:

1. Observe LED5 on the receiver. LED5 will be On solid green whenever the receiver is powered.
2. Make sure the receiver is properly grounded. Both the black wire (GND-SIGNAL) and the yellow wire (GND-POWER) must be grounded (see Figure 8, p. 22 or Figure 9, p. 23 for wiring diagrams).
3. Press the Test button (S5) on the sensor.
   LED5 should turn On solid green, indicating proper battery strength. LED1, LED2, and LED3 will indicate signal strength.

   Note: When checking signal strength, both LED1 and LED3 on the receiver and sensor should illuminate in unison if the sensor and receiver are associated. Use this feature to confirm association.

Procedure for Testing the Receiver

If the receiver is not working as expected, perform the following steps:

1. Make sure the receiver is powered.
2. Set the receiver address to 000 to force the zone temperature output and zone temperature setpoint output to their test mode values (see Table 9, p. 39).
3. Measure the receiver output resistance by following the procedures for “Measuring Output Resistance,” p. 40.
4. When the test is complete, reset the receiver address to its previous setting.
5. Press the Test button (S5) on the sensor to force re-association.
6. Confirm association and communication by noting LED1, LED2, and LED3 as described in “Signal Quality Test,” p. 32.
Returning a Sensor to its Factory Defaults

1. To return a sensor to its factory defaults, set the device address to 000. (For more information about setting the address to 000, see “Setting the Sensor Address,” p. 16.)

   1. Press the Test button (S5) on the sensor to force the sensor to read the address switches.
   2. Confirm LED operation (see Table 5, p. 33).

Returning a Receiver to its Factory Defaults

1. To return a receiver to its factory defaults, set the device address to 000. (For more information about setting the address to 000, see “Setting the Receiver Address,” p. 16.)

   The sensor reads the address as the switches are set.

   2. Confirm LED operation (see Table 6, p. 33).

Replacing a Defective Sensor or Receiver

If either the sensor or receiver need to be replaced, follow this procedure:

1. Return the device that is still operational (either the sensor or the receiver) to its factory defaults (see “Returning a Receiver to its Factory Defaults”).

2. Replace the malfunctioning or missing device by following the installation procedures given in “Setting the Address, Mounting, Wiring, and Associating the Receiver and Sensor,” p. 13.

3. Associate the two devices to one another following the association procedures given in either “Automatic Association,” p. 28” or “Manual Association,” p. 28).

Forcing a Sensor to Transmit

It may be desirable to force a wireless zone sensor to transmit, for example, during servicing an HVAC unit that is fitted with a wireless zone sensor system.

1. To force a transmission, press Test button (S5) on the sensor.
# Specifications and Agency Compliance

## Specifications

Table 11. Wireless Zone Sensor system specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor operating temperature</td>
<td>32 to 122°F (0 to 50°C)</td>
</tr>
<tr>
<td>Receiver operating temperature</td>
<td>-40 to 158°F (-40 to 70°C)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 to 185°F (-40 to 85°C)</td>
</tr>
<tr>
<td>Storage and operating humidity range</td>
<td>5% to 95%, non-condensing</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.5 °F over a range of 55 to 85°F (12.8 to 29.4°C)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.125°F over a range of 60 to 80°F (15.56 to 26.67°C)</td>
</tr>
<tr>
<td></td>
<td>0.25°F when outside this range</td>
</tr>
<tr>
<td>Setpoint functional range</td>
<td>45 to 95°F (7.22 to 35°C)</td>
</tr>
<tr>
<td>Setpoint thumb wheel markings</td>
<td>50 to 85°F (stamped every 5°F) and *, **</td>
</tr>
<tr>
<td></td>
<td>11 to 29°C (stamped every 3°C) and *, **</td>
</tr>
<tr>
<td>Receiver voltage</td>
<td>24 V nominal ac/dc ± 10%</td>
</tr>
<tr>
<td>Receiver power consumption</td>
<td>&lt;1 VA</td>
</tr>
<tr>
<td>Housing</td>
<td>Polycarbonate/ABS blend, UV protected, UL 94-5VA flammability rating, suitable for application in a plenum</td>
</tr>
<tr>
<td>Mounting</td>
<td>3.24 in (8.26 cm) for 2 mounting screws (supplied)</td>
</tr>
<tr>
<td>Sensor battery</td>
<td>(2) AA, 1.5 V, 2800 mAh, lithium, 5-year life</td>
</tr>
<tr>
<td>Range</td>
<td>Open range: 2,500 ft (762 m)</td>
</tr>
<tr>
<td></td>
<td>(packet error rate = 2%)</td>
</tr>
<tr>
<td></td>
<td>Usable: 200 ft (61 m)</td>
</tr>
<tr>
<td></td>
<td>Typical: 75 ft (23 m)</td>
</tr>
<tr>
<td>Output power</td>
<td>100 mW: North America</td>
</tr>
<tr>
<td></td>
<td>10 mW: Outside North America</td>
</tr>
<tr>
<td>Radio frequency</td>
<td>2.4 GHz (IEEE Std 802.15.4-2003 compliant)</td>
</tr>
<tr>
<td></td>
<td>(2405–2480 MHz, 5 MHz spacing)</td>
</tr>
<tr>
<td>Radio channels</td>
<td>16</td>
</tr>
<tr>
<td>Address range</td>
<td>000–999</td>
</tr>
<tr>
<td>Minimum time between transmissions</td>
<td>30 seconds</td>
</tr>
<tr>
<td>Maximum time between transmissions</td>
<td>15 minutes</td>
</tr>
</tbody>
</table>

1. Range values are estimated transmission distances for satisfactory operation of the 100 mW version. Estimated transmission distance for the 10 mW version will be less. Actual distance is job specific and must be determined during site evaluation.

Placement of the receiver and the sensor is critical to proper system operation. In most general office space installations, distance is not the limiting factor for proper radio signal quality. It is more greatly affected by walls, barriers, and general clutter. In general, sheetrock walls and ceiling tiles offer little restriction to the propagation of the radio signal throughout the building as opposed to concrete or metal barriers.
## Agency Compliance

### Table 12. Agency compliance for the Wireless Zone Sensor system

| United States compliance | UL listed: UL 94-5VA Flammability rating  
| | UL 916: Energy management equipment  
| | FCC CFR47, Section 15.247 & Subpart E Digital Modulation Transmission with no SAR (FCC Identification TFP-13651127)  
| | 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.  
| | Warning:  
| | Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.  
| | 20 cm separation distance:  
| | To comply with FCC’s RF exposure limits for general population/uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.  
| Canada compliance | CSA22.2 No. 205-M1983 Signal Equipment  
| | Industry Canada (Certification no: IC: 6178A-13651127)  
| | Industry Canada statement:  
| | the term “IC” before the certification/registration number signifies only that the Industry Canada technical specifications were met.  
| | Section 14 of RSS-210:  
| | The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population.  
| | ETSO EM 300 328-1 ISM Spread Spectrum 2.4 GHz  
| IEEE compliance for radio frequency range | IEEE 802.15.4-2003, IEEE Standard for Information Technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements, Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low Rate Wireless Personal Area Networks (LR-WPANs) |
Declaration of CE Conformity
for the Trane Wireless Zone Sensor system, sensor module

Manufacturer name: Trane, a division of American Standard, Inc.
Manufacturer address: 3600 Pammel Creek Road
La Crosse, WI 54601 USA

The manufacturer hereby declares that the product:

Product name: Sensor, Temp, Wireless Zone Sensor
Model numbers: X13790492, X13790439, X13790494

Conforms to the following standards or other normative documents:

R&TTE Directive: EN 300 328
Radiated Emissions (Note: Norway and Romania have restrictions as per Annex 1 Band H of ERC/REC 70-03)

EMC Directive:
EN61000-4-2 ESD: ± 4 kV by contact ±8 kV by air. Criterion B.
EN61000-4-3 Radiated RF Immunity: 10 V/m, 80% AM @ 1 kHz, 1% step of previous frequency 80–1000 MHz, 1400–2000 MHz. Criterion A.
EN61000-4-8 Magnetic Field Immunity: 30 A/m Criterion A

When and Where Issued:
EMC: 3/8/2006

Mark of compliance

Chris VanderKoy
Design/Compliance Engineer

European contact
Societe Trane (Epinal, France)
1, rue des Ameriques, B.P. 6
F-88191 Golbey Cedex, France
Phone: (33) 329.31.73.00
Fax: (33) 329.81.24.98

This document validates CE conformity of the Trane Wireless Zone Sensor system, sensor module.
Declaration of CE Conformity
for the Trane Wireless Zone Sensor system, receiver module

Manufacturer name: Trane, a division of American Standard, Inc.
Manufacturer address: 3600 Pammel Creek Road
La Crosse, WI 54601 USA

The manufacturer hereby declares that the product:

Product name: Sensor, Temp, Wireless Receiver, 10 mW, 16 Channels, Analog, Europe
Model numbers: X13790489

Conforms to the following standards or other normative documents:

R&TTE Directive:
EN 300 328 Radiated Emissions (Note: Norway and Romania have restrictions as per Annex 1 Band H of ERC/REC 70-03)

EMC Directive:
EN 301 489-1 Conducted Emissions: Clause 8.2, 8.3, 8.4, 8.7
EN 61000-4-2 ESD: ± 4 kV by contact +/- 8 kV by air. Criterion B.
EN 61000-4-3 Radiated RF Immunity: 10 V/m, 80% AM @ 1 kHz, 1% step of previous frequency
80–1000 MHz, 1400–2000 MHz. Criterion A.
EN 61000-4-4 EFT Burst: ± 0.5 kV & ± 1 kV Power Ports. Criterion B.
EN 61000-4-5 Surge: ± 0.5 kV Differential, ± 1 kV Common Mode Power Ports. Criterion A.
EN 61000-4-6 Conducted Immunity: 3 V 80% AM @ 1 kHz 0.15 MHz to 80 MHz Power Ports.
Criterion A.
EN 61000-4-8 Magnetic Field Immunity: 30 A/m. Criterion A.
EN 61000-4-11 Voltage Dips and Interruptions: 70%, 40%, and 5% nominal for 10 mS, 100 mS,
and 5 s (50 Hz). Criterion B.

When and Where Issued:
EMC: 3/8/2006

The mark of compliance:

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Design/Compliance Engineer

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This document validates CE conformity of the Trane Wireless Zone Sensor system, receiver module.