Resonate Wireless Temperature Sensor
INSTALLATION GUIDE

This guide covers all Resonate Temperature Sensor models.

The Resonate temperature sensor product family includes:

RTS-1T-nW   Temperature sensor
RTS-1H-nW   Temperature and relative humidity sensor
RTS-1TS-nW,   Temperature sensor with temperature set point
RTS-2HS-nW   Temperature and humidity sensor with temperature set point, fan speed and occupancy button

The character n is replaced with U for 902MHz, Y for 868MHz and J for 928 MHz radios.

The package includes the temperature sensor and installation guide.

NOTE: The RTS is a solar powered device that absorbs solar energy storing it for use during low light periods. Before assigning the RTS device to a receiver/ controller, the device should be exposed to a good light source for a minimum of 2 hours.

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Temperature Sensor Description

The temperature sensor (also referred to as the sensor in this guide) is a wireless, energy harvesting sensor that monitors room temperature in the range of 0-40°C (32° - 104°F) and relative humidity in the range of 0-100% . The sensor is intended for indoor use only.

Some models have a temperature set point knob and/or a fan speed slide switch. These options provide the user an interface to manually adjust how the temperature control operates.

A button on the lower right edge of the sensor body can be used to invoke an occupancy event (for RTS-2HS models) or to go into test mode (when the button is held down, see "Test Operating Modes").

The temperature sensor transmits to a receiver which is typically a device that is programmed to provide temperature control in the space that the sensor is monitoring for closed loop temperature control. The sensor and receiver must be within range, preferably in the same room and installed within 50' (15.2 m) of each other. For applications exceeding 50' (15.2 m) range, greater care must be taken to insure proper reception of the sensors transmissions at the receiver, refer to sections "Test Operating Modes" and 'Installing Wireless Devices".

Even with a brief exposure to light the sensor will operate; however for best results the sensor should be mounted in a location with exposure of 4 hours of natural or artificial light on a daily basis.

The temperature sensor transmits status telegrams that contain the information defined within a equipment profile.

The temperature sensor supports the following profiles:

- A5-02-05: Temperature Sensor
- A5-04-01: Temperature Sensor + Humidity Sensor
- A5-10-03: Temperature Sensor + Temperature Set Point Control
- A5-10-19: Temperature + Humidity + Set Point + Fan Speed + Occupancy Button.

The valid ranges for each data element:

- Temperature: 0 - 40°C, (32° - 104°F)
- Temperature Set Point: offset scale 0-250
- Humidity Sensor: 0 -100% RH
- Fan Speed Switch: Auto, OFF, Low (1) Med (2), High (3)
- Occupancy Button: Occupied

Temperature Sensing Operation

Temperature and Humidity Monitoring - The temperature sensor will record the temperature, temperature set point and humidity values* every 10 seconds (sample period) when there is approximately 100 lux (10 foot-candles) available. If there is less than 100 lux (10 fc), the sample period will increase to 100 seconds. After 24 hours at < 15 lux (1.5 fc) the sample period will increase to 200 seconds. *Assuming sufficient storage charge to operate.

Temperature Set Point - Users can adjust the temperature set point by rotating the knob counterclockwise to lower the set point value; clockwise to increase the set point value.

The receiving temperature control equipment must scale the set point range to values that are applicable for the application.

Fan Speed Switch - Users can adjust the fan speed switch by sliding the switch to a setting: Auto, OFF, Low (1) Med (2), High (3).

Occupancy Button - (RTS-2HS models only) Users can override a room occupancy state by pressing the occupancy button on the lower right edge of the sensor.

LED Operation - LEDs are on the right side of the solar panel. The red LED will flash when the Link or Occupancy button is pressed. See Test Operating Modes for further LED information.

Transmitting Values - The temperature sensor will transmit a telegram when:

- 10 sample periods have been completed or
- when the fan switch or occupancy button are used or
- when the temperature value difference from the last transmitted value is greater than 0.3°C, (0.5°F) or the humidity value difference from the last transmitted value is greater than 3%.

Installing the Temperature Sensor

The temperature sensor can be mounted on any surface; glass, stone, concrete, wallboard, cubicle partitions, etc. The sensor can be mounted using screws (not supplied) through the removable back plate (2 keyholes or using double sided tape or Velcro™ (not supplied).

The mounting location of the wireless transmitter is important as this will directly affect the receivers reception of the telegrams. Before installing, refer to the sections in the guide detailing the installation of wireless devices, layout tips and the test operation modes.

1. The sensor has a removable back plate. The back plate has a security feature which requires a tool for the removal of the device from the backplate. To remove the sensor, insert a flat head screw driver, into the slot and exert torque on the key tab to separate the backplate from the housing body as shown in the photos. Once the tab is free, pull the body away from the back plate.
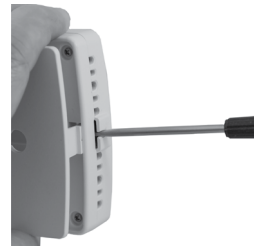
2. Mount the back plate to a bracket or the wall surface in a vertical orientation with the plastic key on the bottom. There are keyholes in the back plate that mate with standard electrical box screw patterns. Alternatively, you can mount the sensor using double sided tape or Velcro® (not supplied).

3. Once the back plate has been secured to the wall or mounting bracket, align the two top alignment tabs on the back plate with the temperature sensor body and press the lower edge over the plastic key until it clicks in place.

Linking the Temperature Sensor to a Receiver

This process requires the controller or receiver to be mounted and powered and

within range of the temperature sensor to be linked.

The sensor is a solar powered device that absorbs energy through a solar panel storing it for use during low light periods. Before assigning the sensor to a receiver/controller, the device must be exposed to a good light source for a minimum of 2 hours, or install the optional start assist battery (not supplied).

1. Remove the sensor from the back plate by pressing in on the tab on the lower edge and pulling away from the back plate.
2. Activate LEARN or LINK mode at the receiver, if necessary refer to the manufacturers documentation.
3. Press the temperature sensors Link (Teach) button.
4. Deactivate LEARN mode at the receiver.

Installing or Replacing the Battery

The battery is not required for normal operation when the RTS receives adequate natural or artificial light. The battery can be used during installation (start assist).

1. Remove the sensor from the back plate by pressing the key on the lower edge of the sensor body and pull the body away from the back plate.
2. To remove old battery: Using a small flat head screwdriver or pen as a lever, insert pointed end under the clear plastic battery retaining clip's edge and pop the clip off.
3. Install or replace the battery in the clip with a new CR2032 coin cell battery insuring the positive side (+) will be facing up.
4. Align the two straight edges of the retaining clip with the battery holder and press the clip in with your finger.

Test Operating Modes

Ensure the RTS is fully charged before entering test modes. Inserting a battery during test modes is also recommended. The following tests can be selected when in test mode.

Light Level Test: provides visual feedback of the immediate energy produced by the solar panel.

1. To enter Light Level Test mode, press and hold the occupancy/ test button for 6 seconds. The green LED will begin to blink.
2. Press the test button again for 6 seconds to select Light Level Test. The green LED will blink in accordance to the light level it is detecting. This will change (2 second lag time) as you move the sensor to areas with different light levels. See following blink indicator table.

Note: Entering test mode section: If the red LED blinks (no green LED) after you have

released the test mode button, place the sensor under a lamp with at least 100 foot-candles (1000 lux) for 1 hour before retrying.

LIGHT LEVEL TEST TABLE

The green LED will blink according to the energy produced by the solar cell

Blinks	Lux	Foot Candles	Time to Fully Charge	Discharge time
0,1	< 15	< 1.4	below operating level	n/a
2	15-50	1.4 - 4.6	min operating level	n/a
3	50-100	4.6 - 9.3	24 hours to full charge	100 hours
4	100-200	9.3 - 18.6	12 hours to full charge	150 hours
5	200-400	18.6 - 37.2	6 hours to full charge	200 hours

The time to fully charge is based on the storage capacitor charging from a non-operational condition. Discharge time indicates how long a fully charged sensor will operate in the dark. The test will repeat every 2 seconds and run for a duration of 100 seconds. You may quit the test at any time by pressing the test button for 6 seconds.

Range Confirmation Test: provides visual feedback of the sensors signal strength by a linked receiver with range confirmation capability (only "F series" controllers have range confirmation ability). One and only one receiver can be linked to the sensor for proper operation of the test. (disable repeaters in range for proper test operation).

1. To enter Range Confirmation Test mode, press and hold the occupancy/ test button for 6 seconds. The green led will begin to blink.
2. A quick press and release of the button at this point will allow you to select between light level test (green LED) and range confirmation test (amber). When the amber LED is blinking, go to step 3. (If the 3 LEDs fail to blink during this test, place under a lamp with at least 100 fc (1000 lux) for 1 hour before retrying.)
3. Press and hold the test button again for 6 seconds to select Range Confirmation Test.

All three LED's can blink in this test mode when the sensor transmits or receives a Range Confirmation Telegram. The sensor will display the signal strength status for 5 seconds, see table below.

RANGE CONFIRMATION TEST TABLE

LED	Signal Strength
Green	> -70 dbm
Amber	> -80 dbm
Red	< -80 dbm

The test will repeat every 10 seconds and run for a duration of 3 minutes. You may quit the test at any time by pressing the occupancy/test button for 6 seconds.

Installing Wireless Devices

Careful planning is needed when locating the receivers and transmitters based on the construction materials in the space and possibility of tenant's furniture disrupting the transmissions.

The temperature sensor should be installed in the space where the receiver is mounted and connected to the temperature control equipment however the signal will travel through material barriers.

Refer to the tables below for range considerations with building materials that reduce the radio signal power.

Material	Attenuation
Wood	0 - 10%
Plaster	0 - 10%
Glass	0 - 10%
Brick	5 - 35%
MDF	5 - 35%
Ferro concrete	10 - 90%
Metal	90 - 100%
Aluminum	90 - 100%

Material	Radio Range-typical
Line of sight:	80' (24m) corridors
Line of sight:	150' (46m)open halls
Plasterboard:	80' (24m) through 3 walls
Brick	33' (10m) through 1 wall
Ferro concrete	33' (10m) through 1 wall
Ceiling:	Not Recommended

Wireless System Layout Hints

- Avoid locating transmitters and receivers on the same wall.
- Avoid locating transmitters and receivers where the telegrams must penetrate walls at acute angles. This increases the material the telegram must pass through reducing the signal power.
- Avoid large metal obstructions as they create radio shadows. Place receivers in alternate locations to avoid the shadow or use repeaters to go around the obstacle.
- Do not locate receivers close to other high frequency transmitters. Leave at least 3' (1 m) between the receiver and any other source of interference including, ballasts, LED drivers, computers, video equipment, Wi-Fi/LAN routers, GSM modems and monitors. Transmitters are not affected by these sources of interference.

Agency Listings and Compliance

Built in an ISO9001 certified facility

FCC Part 15.231 (902 MHz models only)

Contains FCC ID: TCM300U

The enclosed device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

> (I.) this device may not cause harmful interference and
>
> (ii.) this device must accept any interference received, including interference that may cause undesired operation.

IC RSS-210 (902 MHz models only)
Contains IC: 5713A-STM300U

CE (868 MHz models only)
CE Marking

ARIB STDT108 (928MHz models only)

Complies with the Japanese radio law and is certified according to ARIB STDT108. This device should not be modified (otherwise the granted designation number will become invalid)

R 206-000372

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