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# R9 Technology SN400 Sensor Node Installation Guide

This guide provides information regarding installation of R9 Technology's SN400 Sensor Node.

Release 1.8



Refer to the [R9 Technology installation video located online:](http://www.r9technology.com/resources-videos)  
[www.r9technology.com/resources-videos](http://www.r9technology.com/resources-videos)

## **SN400 Background:**

The SN400 sensor node has four external ports, each port can support one cabled sensor type (for example, temperature, humidity, door closure, tank liquid level, light level). The node is typically mounted to equipment, and then cabled sensors are applied to specific areas for sensing. For example, a node device is attached externally to a refrigerator, and then a cabled temperature sensor is routed inside the refrigerator.

**For simple installations, the SN400 node can be installed inside a room, or refrigerator/freezer, without cabling for the measurement of temperature.** If installed inside a refrigerator/freezer, wireless range may be diminished (typically by one third to one half), but should be adequate for connection to a nearby gateway device. For this simple type of installation, the cabled sensor installation description towards the end of this document is not applicable.

## **Required Items:**

### **Items included in the SN400 Sensor Node kit:**

- Qty 01, SN400 Sensor Node
- Miscellaneous cabled sensor probes as ordered
- Probe mounting tape or cable tie bracket

### **Additional items required but not included in the kit:**

Qty 02, AAA alkaline batteries (use two AAA Lithium Chemistry batteries if node is to be placed in a freezer with a temperature of less than 0F or -18C)

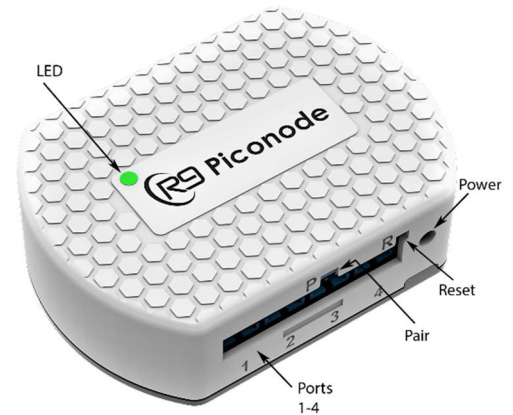
### **Additional items required, per node, depending on the mounting option:**

- Foil tape or clear tape
- Extra tie wrap mounting brackets (black or white, for cable routing and probe mount)
- Mild cleaning agent or rubbing alcohol
- Clean tissue or paper towel

## **Mounting Location Considerations:**

1. If installing a node inside equipment (for example a freezer or refrigerator), the wireless range may be diminished. The integrated node magnets are convenient for attaching the node to refrigerator/freezer shelving. Try to mount the node so that the **external sensor ports are covered by a shelf, or pointing downwards (to keep liquids from entering the ports)**. Skip to Installation instructions on the next sheet.
2. Preferred mounting location on outside equipment surface, is adhered at the highest available location. **Be aware of service panel locations that might be removed in the future for equipment repair (do not mount to service panels)**. It is common for equipment to be periodically moved for cleaning, so minimize cable routing between multiple equipment units. Make sure the node is in an "out of the way" location where it won't be bumped or disturbed. The forward left or right side of equipment is generally best.
3. Do not install the SN400 node closer than 5 feet to the gateway.
4. For wired sensors, the SN400 node must be located closer than 6 feet to the final sensor probe mounting location, due to sensor cable length. The temperature probe cable is 6 feet long (1800 mm) for most probe types.

5. The standard SN400 enclosure is not designed for outdoor use (an optional outdoor enclosure is available). Avoid areas of temperature extremes (heat exhaust) or direct sunlight. Install the node in a location that is free from dripping water, heavy dew, and humidity. For external sensors, make sure the cables exit downwards so moisture will not travel along the cables and into the node device.
6. For optimal signal reception, select a “free-space” installation location that is not near, or covered by, large metal objects. Note that the Node is designed to be attached to metal equipment surfaces with magnets (metal refrigerator, for example).
7. Locate the node in a place that allows easy access for servicing and changing batteries. Do not over-use tape or other adhesives, as removal and servicing of the system may be necessary in the future.



## **Installation Instructions:**

Once a mounting location has been identified, follow the installation steps listed below.

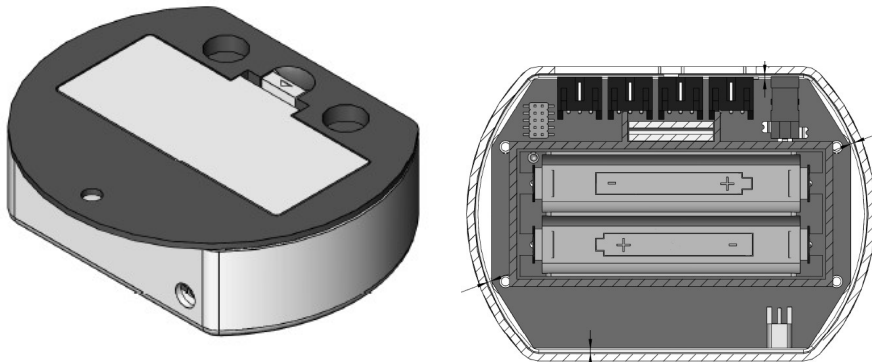
### **Step 1**

**Install Batteries** - Remove the battery compartment lid located on the rear of the SN400 and **install two AAA alkaline batteries** using the correct orientation (marked on battery holder) and replace lid. Refer to the image below. The battery compartment is opened by sliding the small tab towards the battery door, and lifting at the same time. **Note that there is no power switch on the SN400 sensor node.** Inserting the batteries will power the SN400.

**Option1:** Lithium chemistry batteries should be used in extreme cold environments (sensor node located inside a freezer below 0F or -18C). Alkaline batteries do not operate optimally at temperatures below 0F or -18C. Alkaline batteries are ok for use in a node that is located inside a refrigerator (temperatures down to about 35F), although longevity will likely be reduced. Lithium chemistry batteries operate at temperatures down to approximately -40F = -40C, Lithium chemistry batteries should be used in a freezer environment (temperatures below 32F).



**Option2:** an external 3.0V center pin positive DC power adapter can be used instead of batteries. The DC adapter can be inserted into the node without removing internal batteries. The DC adapter will take precedence over the internal batteries if inserted, and the batteries will be out of circuit. When using a DC power adapter, sensor values will not update if wall power is interrupted. For this reason, it is not recommended to use a DC wall adapter, unless absolutely necessary.



### **Step 2**

**Test Connectivity and Portal Operation** - Before physically installing the node to an appliance, ensure the node has good wireless reception in the general area of install (after using the online portal to setup your account and provision your gateway and node devices). Typically, the system devices are laid out in the general area of operation, and after verification, the devices are installed to their permanent locations. If data communication is not possible, the gateway and/or nodes will have to be moved to improve wireless performance (move

devices closer together, move gateway to central location). Steps for provisioning of the node/gateway system are located in the **R9 Online Portal User Guide**. After user account is setup and the devices are provisioned, connectivity can be verified as follows:

- **GATEWAY:** Cellular LTE service for the gateway is good as indicated by two “quick blink” green LED flashes at the start of the LED indication sequence. If first two LED blinks are green, LTE service is good. The gateway does not have to be provisioned in the portal for LTE service indication. The gateway only has to be powered on by plugging in to wall power.
- **SENSOR NODE:** Gateway and sensor node devices must be provisioned in the online portal for node connectivity to be tested. Wireless connection from the gateway to each node device is good if the node devices will pair to the gateway. Quick press the pair button on the node (marked P). If the LED flashes green, the node is paired to the gateway and the wireless connection is good. If the LED flashes red, the node device has not paired yet. After the entry of the device serial numbers into the portal, the pairing should happen within 3 to 10 minutes.

### Step 3

**Clean adhesive surfaces (if any)** - If the SN400 node will be mounted with an adhesive tape, use rubbing alcohol or other mild cleaning agent to remove debris and oils from any mounting surface where adhesive tape will be used. Rubbing alcohol can also easily remove frost from internal freezer surfaces. Always pre-test alcohol and cleaners on finished surfaces, as it might dis-color the surface.

### Step 4

**Mount the SN400 Device** – Mount inside, or on equipment (refer to figures below). Ensure the SN400 mounting flange is pointing upward, and sensor cables exit downwards.

Three mounting options are discussed below.

- **Magnet:** The SN400 enclosure has integrated magnets for mounting to metal surfaces.
- **Screw:** A single sheet metal screw can be used, attached through the SN400 mounting flange hole.
- **Tape or Velcro:** can be used to mount the node device. Do not cover the battery compartment, access to the battery compartment may be necessary in the future.

The following pictures show examples of node device mounting. **If you are mounting the node for temperature sensing only, without cabled sensors, you can skip to step 10 below.**



*Figures: SN400 Magnet Mount Outside Equipment*



*Figure: SN400 Magnet Mount Inside Refrigeration Equipment (affix to steel shelving)*



*Figure: SN400 Magnet Mount Inside Refrigeration Equipment (probe ports protected from spills by shelf)*

**Step 5**

**Identify External Probe Mounting Areas** - Identify the specific location(s) for probe mounting, based on the equipment to be monitored. Ensure the length of the probe wire is sufficient to route back to the SN400. The final installation should allow some slack in the wiring, avoid installation which results in tight wire runs. When mounting to a metal surface (freezer) do not allow metal probe housing to contact the metal freezer surface. It is convenient to use a tape adhered tie wrap mounting tabs, as shown in figure below. These mounting tabs can also be used for routing sensor wires.



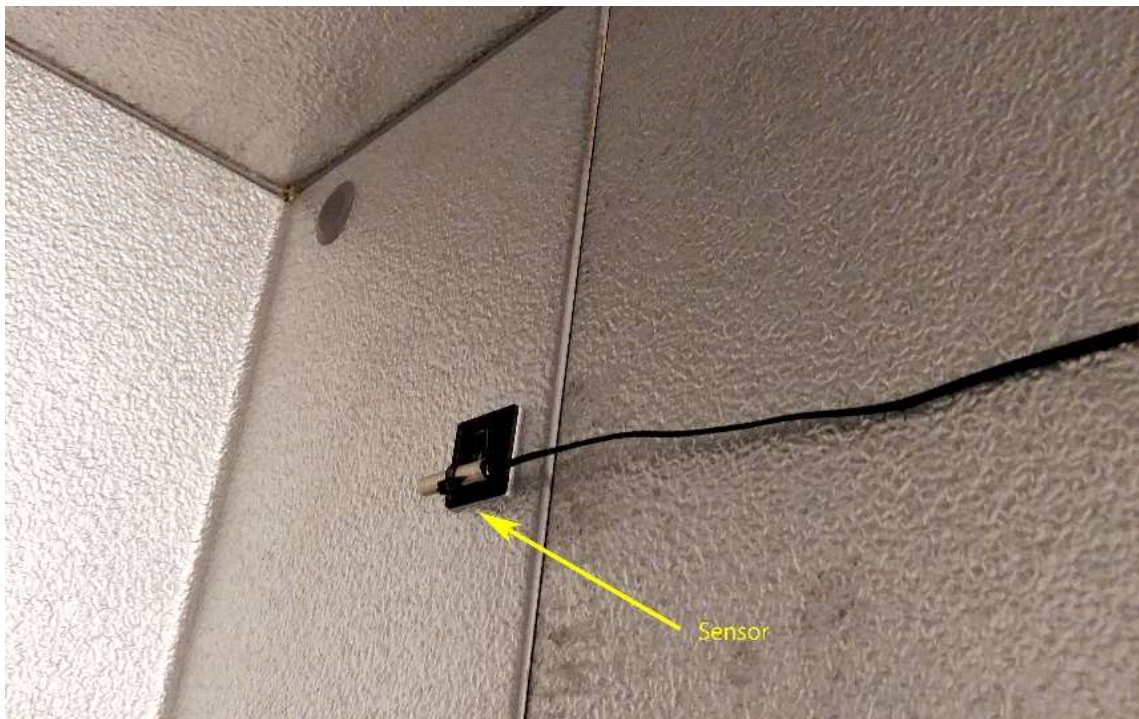
*Figure: Tie-wrap mounting base*

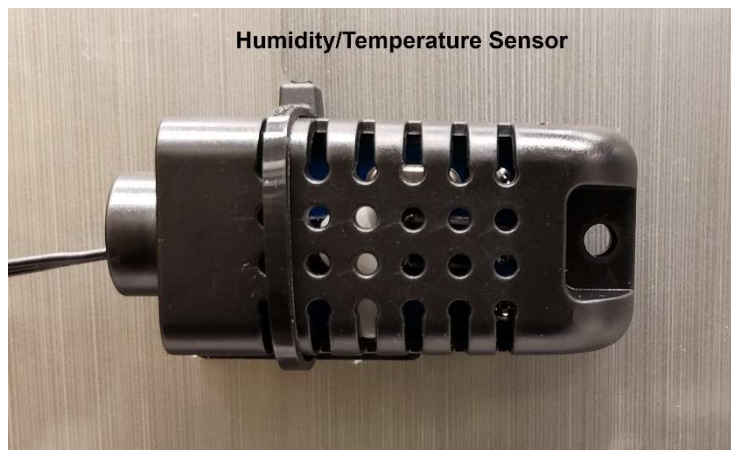
**Step 6**

**Clean adhesive surfaces (if any)** - Again, use alcohol or other mild cleaning agent to remove debris, oils and frost (inside freezer) from the mounting surface. Always remove freezer frost with rubbing alcohol and allow to dry, prior to affixing the adhesive tape products for probe mounting.

**Step 7**

**Attach Wired Probes** - Place the probe, and adhere wires in place using foil/clear tape, and/or tie wrap mounting bases. Humidity / temperature sensors can be adhered with tie wraps or double-sided adhesive tape (due to large surface area on back of humidity sensor). Refer to figures below.





### Step 8

**Organize and Affix Probe Cables** - Route probe's cables out of equipment being monitored and secure in place (foil tape, clear tape, tie wrap mount). If exiting equipment (refrigerator/freezer) which contains an **insulation gasket**, route the cable between the door and gasket. Ensure the cable position is such that the flat cable surface is parallel to the gasket surface, so to minimize gasket deformation. Also make sure to route the cable straight out to minimize contact with the gasket. Close the door and use tie wrap brackets, or foil/clear tape to adhere the cable in place. Do not place tape or other materials in contact with the insulation gasket. Commercial equipment is typically drilled and then sealed with gasket putty for routing cables. Some commercial units will also provide panels where cable access is available without drilling.



### Step 9

**Connect External Probes to the Node Device** - Plug the connector end of the specific sensor type into the appropriate port of the SN400. For the "Safezone" cold-chain, temperature monitoring application, the sensor types are installed into the SN400 node as indicated below. The port number is embossed in the plastic housing of the SN400. See two figures below. Note that the probe connectors are keyed, and cannot be installed in an incorrect orientation, however, they can be installed in the incorrect ports. The R9 online web application (portal) provides a lot of information on sensor port connection during port and alert configuration.



Figure: SN400 Ports





Port 1	Port 2	Port 3	Port 4
Temperature probe	Temperature probe	Temperature/humidity probe	Door Closure probe
			

Figure: SN400 Port Sensor Assignments

Note that in the online portal, the node device internal temperature port is referenced as P0 or **Port 0**. Cabled sensors are always located on Port 1, Port 2, Port 3, or Port 4.

### Step 10

**Test Sensor Operation** - Verify each sensor is recognized by the G200 Gateway via the online customer portal: [portal.r9technology.com](http://portal.r9technology.com) (provisioning details are in the **R9 Online Portal User Guide**). Using the portal "Safezone" dashboard, verify temperature, humidity, and door closure readings. Note that the system runs on a timed interval, and **sensor readings may take 15-20 minutes to register and update**. Both the gateway and sensor node devices have external reset buttons. Although not required, a quick press of the reset buttons on the gateway and sensor node(s) can expedite the connection of the wireless data link between the gateway and sensor nodes, and updating of sensor values. Press reset after all the devices are powered. The reset button on the SN400 sensor node is marked "R", a small screw driver will make it easier to press this button. The reset button on the gateway is next to the power cable on the bottom of the enclosure. Consult the "Hardware User Guides" for more information on these devices (separate documents for sensor node and gateway).

**Node Installation is now complete!**

## Door Contact Sensor Information

The door closure magnetic contact sensor is comprised of two metal housings, both of which can be attached with screws (via holes in sensor housing) or double-sided adhesive tape. The contact sensor uses a proximity magnetic circuit which is Normally Open (NO) when sensor halves are in close proximity. When the sensors move apart (such as door open) the sensor circuit closes. This open/close operation can be (optionally) checked with the continuity function of a multi-meter after the sensor is installed.

Note that mounting the door closure magnetic sensor to a ferrous metal surface (such as a steel refrigerator door) will affect the sensitivity of the magnetic sensor. When mounted to steel doors, the two metal sensor halves must be mounted closer together for proper operation (smaller gap distance). The following chart indicates recommended gap (between metal sensor halves) for different equipment surfaces.

Equipment and Door Material	Gap	Notes
Wood or non-metal	0.6 in (14-18mm) or less	Both frame and door are wood or non-metal. Use gap between sensor halves as indicated.
Metal frame, wood or non-metal door	0.4 in (8-12mm) or less	One side is metal, one side is wood or non-metal
Metal frame, metal door	0.2 in (4-6mm) or less	Recommend installing with adhesive tape. This elevates the magnetic switch from the metal surface and improves operation.

The picture indicates the orientation of the two magnetic sensor components. The screw holes should be located away from each other when mounting the magnetic contact sensors. In this example, the door frame is metal and the door itself is wood (8-12mm gap or less).

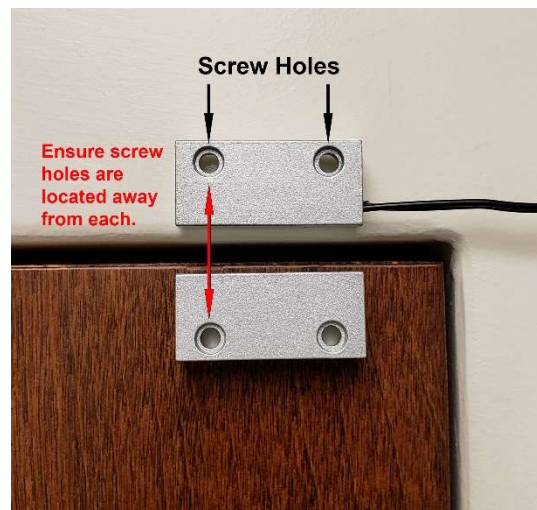


Figure 6: Contact closure sensor mounting

## Installation Considerations:

1. Home Depot stocks stick on cable tie bases, which attach very well, even to freezing surfaces. These are "Commercial Electric" brand PN 296153 and 295276. A number of these should be included in your sensor kit. Foil tape generally works well on frozen surfaces.
2. Roll-out, or mobile equipment should not be cabled to other equipment due to fragility of the sensor wiring. If freezer / refrigerators are not mobile, then they can share a sensor node. Equipment is commonly moved for cleaning, so avoid sharing cable runs between mobile equipment. **Be aware of service panel locations that might be removed in the future for equipment repair (do not mount to service panels).** The forward right or left side of equipment is generally best.
3. Large, walk in equipment, can be drilled and caulked to aid sensor cable routing. This is common practice for large, commercial equipment. Hand applied "gasket putty" is also an easy way to seal holes used for routing of cabled sensors.
4. Many freezers will audibly beep when the door is left open for extended periods. Get organized before opening the door to minimize door open duration.
5. Heat from ovens, cooling racks, or hot exhaust can adversely affect NODE / GATEWAY operation. Avoid these areas for installation.

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**For questions and support, please contact**

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