



**53-100187-15  
Refrigerator  
and Freezer  
Temperature  
Sensor Node**



## LEAP SENSORS 53-100187-15 Refrigerator and Freezer Temperature Sensor Node User Manual

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**LEAP SENSORS 53-100187-15 Refrigerator and Freezer Temperature Sensor Node**



## Specifications

- **Product Name:** LEAP Wireless Sensor System
- **Product Type:** Refrigerator and Freezer Temperature & Optional Door-Open Sensor Node
- **Model Number:** Document# 53-100187-15 Revision 2.0
- **Manufacturer:** LEAP SYSTEM

## Product Usage Instructions

### Thermal Buffer Bottle Purpose

- **Why Liquid Thermal Buffers Are Used with Refrigerator and Freezer Temperature Probes**

When monitoring refrigerators and freezers, it is common practice to use a jar of liquid as a thermal buffer to dampen the rise in temperature that the temperature probe may experience during defrost cycles or when the door is opened.

- **The Polypropylene Glycol – Water Liquid**

The liquid used as a thermal buffer is typically a mixture of Polypropylene Glycol and water. This liquid changes temperature slowly, mimicking the temperature change that food in the refrigerator or freezer undergoes.

## Installing the System Components

1. **Prepare the Jar for the Temperature Probe**

Ensure the jar is filled with the appropriate thermal buffer liquid and securely closed before attaching it to the temperature probe.

2. **Attaching the Jar Inside the Refrigerator**

Place the jar with the temperature probe inside the refrigerator to monitor temperature changes effectively.

3. **Attach Transceiver Device Node to Side of Refrigerator**

Securely attach the transceiver device node to the side of the refrigerator for data transmission.

## Optional Door-Open Sensor

### 1. Taking Data and Transmitting

The optional door-open sensor allows for monitoring door open and close events and transmitting data accordingly.

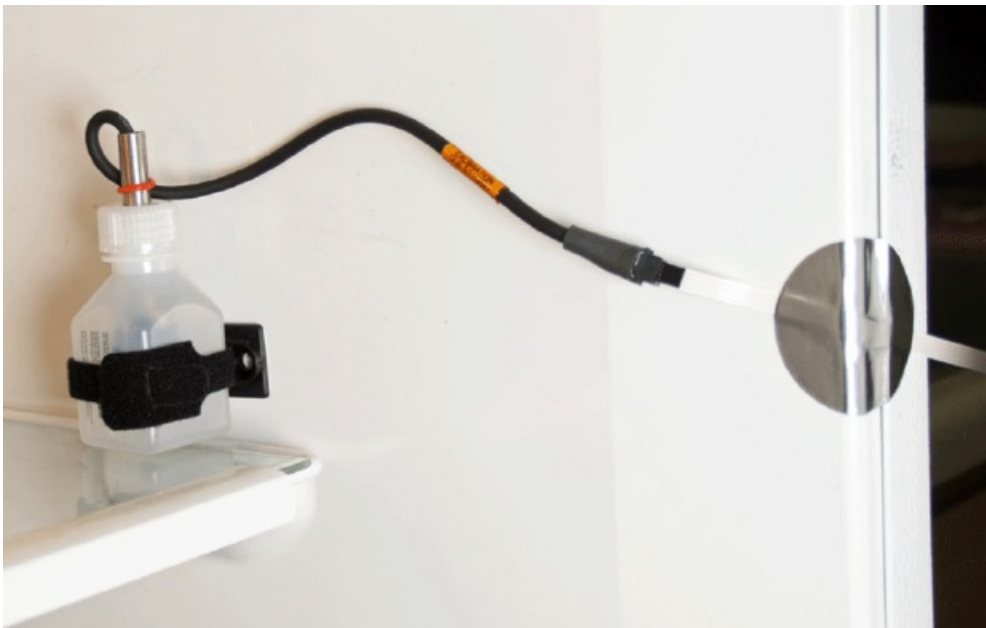
### 2. Sample and Transmit on Door Open and Door Close

The system samples data when the door is opened or closed and transmits this information for analysis.

### 3. Door Open Alerts

Receive alerts when the refrigerator or freezer door is left open for an extended period, indicating a potential issue.

## Thermal Buffer Bottle Purpose



Effect of a Liquid Thermal Buffer Jar

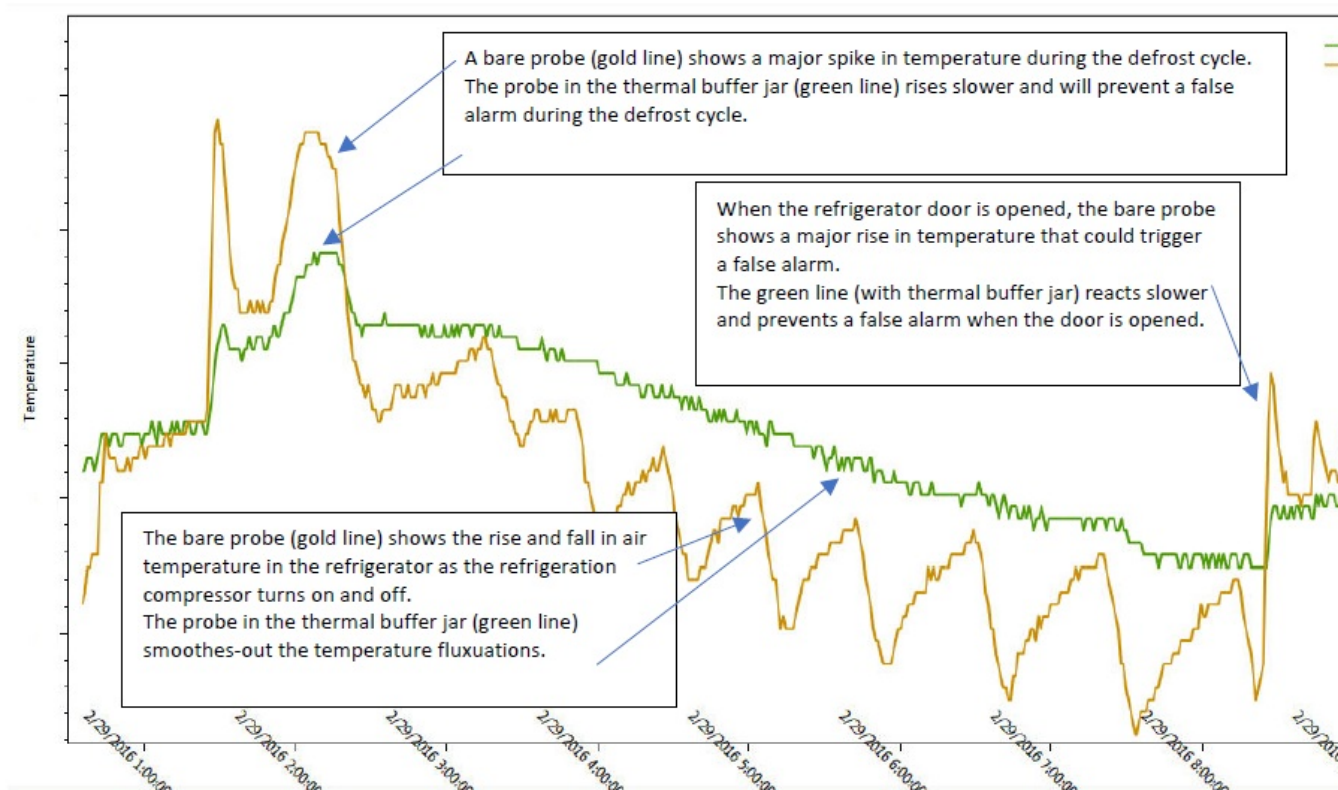
## Why Liquid Thermal Buffers Are Used with Refrigerator and Freezer

### • Temperature Probes

- When monitoring refrigerators and freezers it is common practice to use a jar of liquid to dampen the rise in temperature that the temperature probe sees during the normal defrost cycle or when the door is opened.
- Without the thermal buffer, the temperature monitoring system will be prone to send inappropriate high-temperature alarms during defrost cycles and when the door is opened.
- The Center for Disease Control (CDC) recommends this type of “liquid thermal buffering” when doing temperature monitoring of vaccine refrigerators. This type of liquid thermal buffer is also often used when conducting audits on refrigerators and freezers in commercial food operations. Liquids are used as thermal buffers in refrigerators because the liquid changes temperature slowly and emulates the temperature change that food in the refrigerator (or freezer) experience.
- The thermal mass of the liquid will slow-down the response time of the temperature sensor and will prevent false alarms. If the door is open for several minutes, this will be enough time for the liquid to heat-up and for the probe to detect an alarm condition.

## • Effect of a Liquid Thermal Buffer Jar

The graph below shows the effect of the liquid thermal buffer jar by comparing a bare probe with a probe that is in the jar.



## The Polypropylene Glycol – Water Liquid

- The liquid in the jar is 40% water and 60% polypropylene glycol USP. The polypropylene glycol prevents freezing of the liquid so that the jar can be used down to -25F in a freezer. Polypropylene glycol is often used as an additive in some foods.
- A Material Safety Data Sheet (MSDS) sheet for the Propylene Glycol USP (CAS No. 57-55-6) may be downloaded from the internet at: <http://www.chemworld.com/v/vspfiles/assets/images/SDS-CHEMWORLD-PGUSP.pdf>

## Installing the System Components

### 1. Prepare the Jar for the Temperature Probe

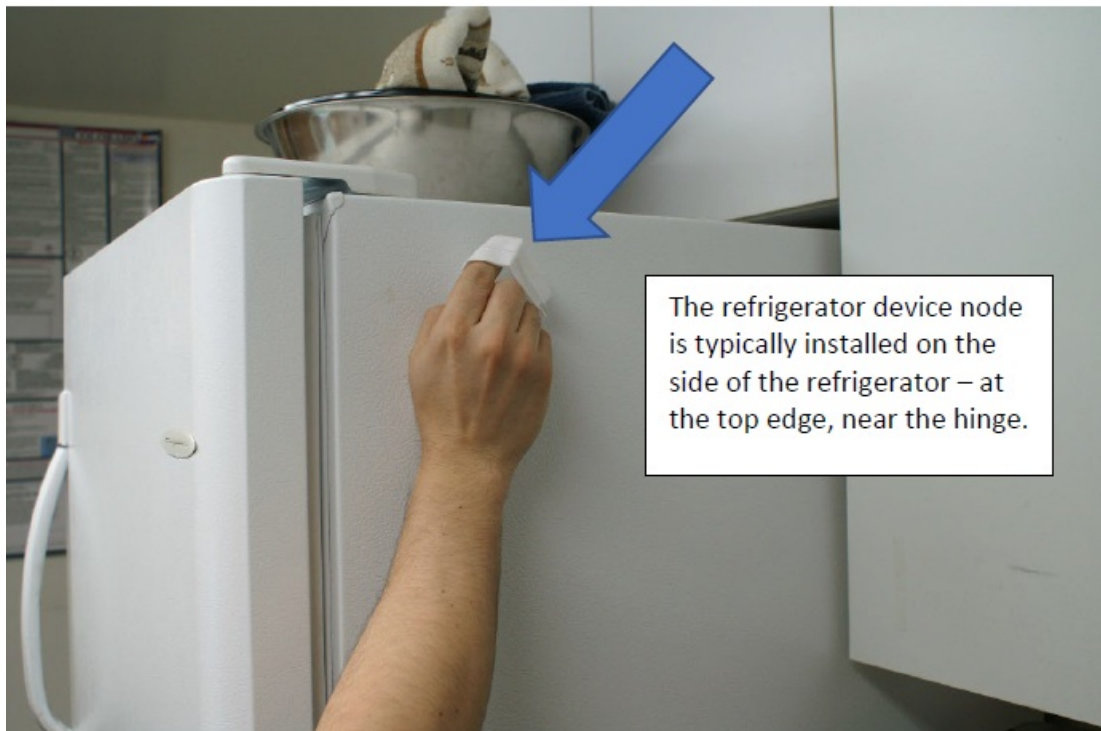
The thermal buffer jars are shipped with a normal cap. Remove the cap and install the cap that contains the sealed metal tube into the bottle.

### 2. Attaching the Jar Inside the Refrigerator

- Typically, the thermal buffer jar is installed on the hinge-side of the refrigerator to make cable routing easy.
- Use a wet wipe to clean the surface inside the refrigerator where the thermal buffer jar will be located. Let the area dry. It may be necessary to use a dry wipe or paper towel to remove frozen condensation from the area.
- When the area where you want to mount the bottle is clean, free of frozen condensation, and dry – remove the paper backing from the adhesive mount and press the adhesive to the side of the refrigerator.

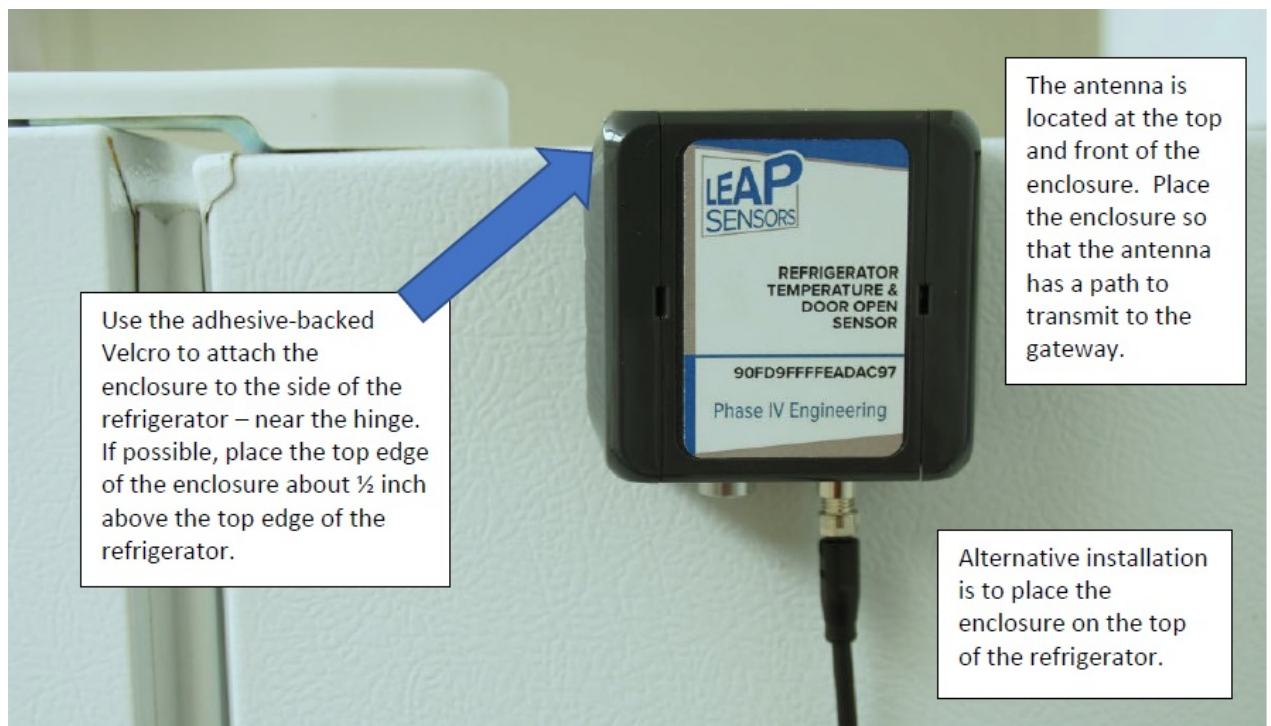


- **Attach Tranceiver Device Node to Side of Refrigerator**
- Typically the refrigerator device node enclosure is mounted on the side of the refrigerator, at the top edge, near the hinge. Clean the area where the it will be mounted with a wet wipe.



- Clean the back of the device node with the wet wipe.





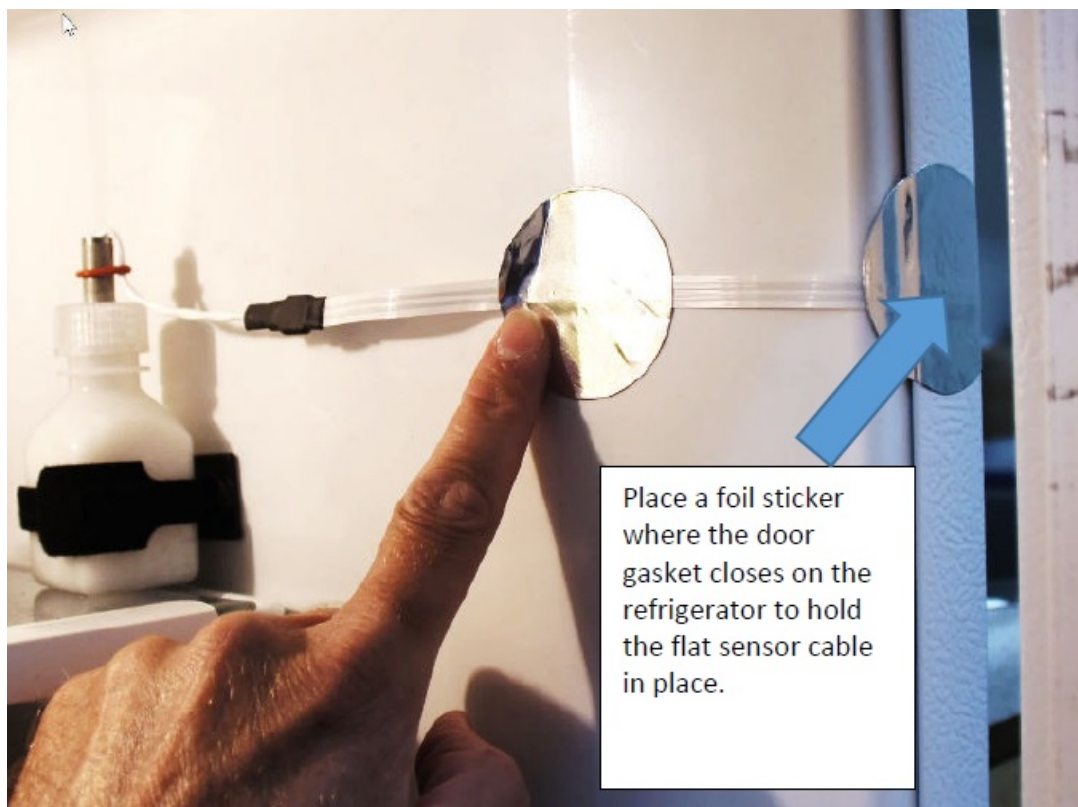
- Un-wind the temperature sensor flat cable and flatten and straighten the cable to the temperature sensor.
- Route the probe and wire into the refrigerator through the hinge.
- Remove the o-ring from the metal tube.
- Place the probe all the way down into the metal tube.



- Place the o-ring over the wire to keep the wire from pulling the probe out of the jar.



- Use the special cold-temperature foil stickers to route the cable out of the refrigerator.
- Place the foil sticker in the refrigerator to help route the wire out to the sensor module.



- Place additional foil stickers sticker on the outside of the refrigerator to route the wire to the outside.



- Extra cable may be folded-up and attached to the side of the refrigerator with foil stickers. It will not harm the thin cable to fold it.

Extra cable may be folded and kept in place with a foil sticker.



## Optional Door-Open Sensor

### Installing the Door-Open Sensor

- The door open sensor works best when it is installed on the side of the door that opens (not the hinge side).
- The door-open switch activates when the two parts are more than about ½ inch apart from each other.
- The air-gap between the sensors keeps them from being knocked off when the door is pressed closed.
- Select the location of the door sensor. Clean the area with a wet wipe.



- Remove the backing from the high-strength adhesive tape on the door switches.
- NOTE: The sensors can be repositioned after they are first installed, but the adhesive will gain strength over time.
- To achieve the proper spacing between the switches, use the supplied spacer to install the door-open sensors as shown below.



- Route the cable to the device node enclosure and install the cable to the panel connector on the enclosure.
- Use the foil stickers to hold the cables in place

## How the Door-Open Switch Operates – and Collects Data

### 1. Taking Data and Transmitting

The device node will always take temperature and door-open sensor readings at the time interval set in the Leap software. This is set by selecting the device, clicking on “Configure Device” then scrolling down to “Device Settings”. The sensor below is set with a sample and transmit interval of every 1 minute. Typically sample and transmit intervals of 10 to 15 minutes work well for refrigerators. This allows the battery to last many years.

Intervals

Transmit Interval

Days

Hours

Minutes

Seconds

0

00

01

00

Sampling Interval

Days

Hours

Minutes

Seconds

0

00

01

00

Software display:

Devices			
000D6FFFFE3AAFA9	Temperature	Door Open (0)/Closed (1)	Door Open Time (sec)
	74.05 °F	0	130
Last Communicated: 4/1/21 1:31:27 PM MDT Last Reading: 4/1/21 1:31:17 PM MDT Firmware Version: 1.00 Battery: 3.199V Signal: -61			
000D6FFFFE3CE2A6	Temperature	Door Open (0)/Closed (1)	Door Open Time (sec)
	74.35 °F	1	0
Last Communicated: 4/1/21 1:31:26 PM MDT Last Reading: 4/1/21 1:31:22 PM MDT Firmware Version: 1.00 Battery: 3.201V Signal: -58			

## 2. Sample and Transmit on Door Open and Door Close

In addition to sampling and transmitting on a time interval (as shown above), if the device has a door-open sensor installed, it will sample and transmit data every time the door is open and when the door is closed. Data will be collected showing how long the door was open. See a download of the data below:

	DeviceId	Name	Reading Timestamp (MDT)	Received Timestamp (MDT)	Temperature (°F)	Door Open (0)/Closed (1)	Door Open Time (sec)
36							
37	000D6FFFFE3CE2A6		4/2/2021 5:46	4/2/2021 5:47	38.05	0	26624
38	000D6FFFFE3CE2A6		4/2/2021 5:56	4/2/2021 5:57	40.33	0	27224
39	000D6FFFFE3CE2A6		4/2/2021 6:06	4/2/2021 6:07	42.44	0	27824
40	000D6FFFFE3CE2A6		4/2/2021 6:15	4/2/2021 6:17	43.54	0	28424
41	000D6FFFFE3CE2A6		4/2/2021 6:23	4/2/2021 6:23	42.53	1	28892
42	000D6FFFFE3CE2A6		4/2/2021 6:23	4/2/2021 6:23	42.46	0	0
43	000D6FFFFE3CE2A6		4/2/2021 6:23	4/2/2021 6:24	42.42	1	5
44	000D6FFFFE3CE2A6		4/2/2021 6:24	4/2/2021 6:24	42.33	0	0
45	000D6FFFFE3CE2A6		4/2/2021 6:24	4/2/2021 6:24	42.24	1	9
46	000D6FFFFE3CE2A6		4/2/2021 6:24	4/2/2021 6:24	42.15	0	0
47	000D6FFFFE3CE2A6		4/2/2021 6:24	4/2/2021 6:24	42.03	1	15
48	000D6FFFFE3CE2A6		4/2/2021 6:24	4/2/2021 6:24	41.85	0	0
49	000D6FFFFE3CE2A6		4/2/2021 6:27	4/2/2021 6:27	40.59	1	131

When the door is either open or closed (and not changing) the normal transmit interval is every 10 minutes for this device.

Not Changing

After a long time of the door being open, the door is closed at 6:23

Every time the door is open and closed, a reading is taken and the data is transmitted.

Data is transmitted every time the door is open or closed.

## 3. Door Open Alerts

Alerts may be set on the door open sensor and also the Door Open Time in the alerts section of the software.

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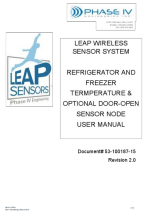
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## FAQ

### Q: Why is a thermal buffer bottle necessary for temperature monitoring?

A: A thermal buffer bottle helps prevent false alarms by slowing down the response time of the temperature sensor, especially during defrost cycles or when the door is opened.

## Documents / Resources

	<p><a href="#">LEAP SENSORS 53-100187-15 Refrigerator and Freezer Temperature Sensor Node</a> [pdf] User Manual 53-100187-15 Refrigerator and Freezer Temperature Sensor Node, 53-100187-15, Refrigerator and Freezer Temperature Sensor Node, Freezer Temperature Sensor Node, Temperature Sensor Node, Sensor Node</p>
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## References

- [Phase IV Engineering | Wireless Sensor Solutions for the Industrial IoT](#)
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