

TOP 3 REASONS WHY THE TEMPERATURE FLUCTUATES IN YOUR FRIDGE OR FREEZER

GUIDE TO IMPLEMENTING AUTOMATED REFRIGERATOR TEMPERATURE MONITORING

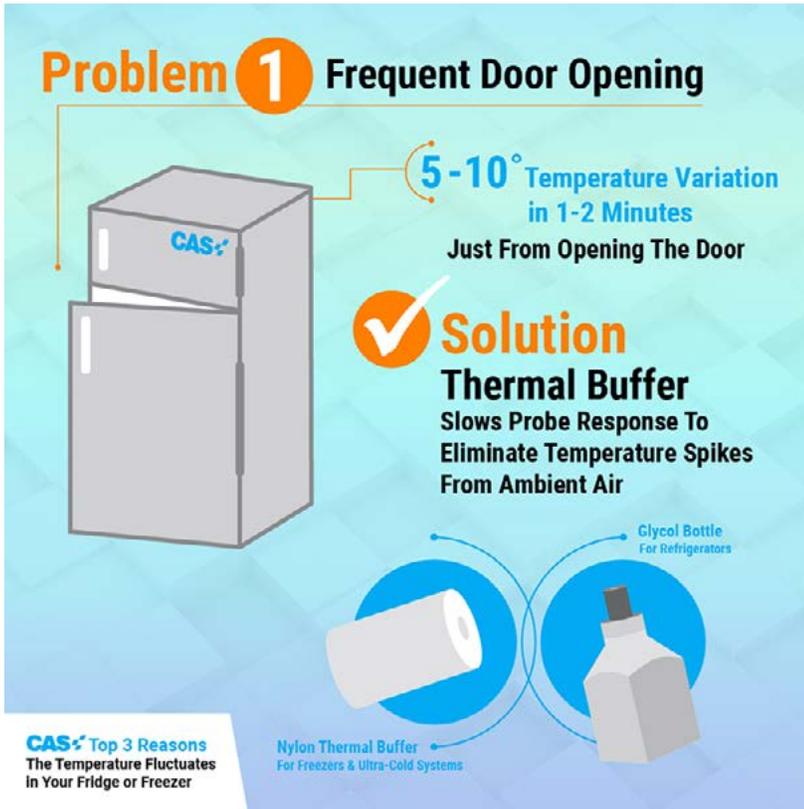
Personnel installing new [refrigerator monitoring systems](#) in their medical or storage refrigerators and freezers are often stumped as to why the temperature appears to vary unexpectedly. Our temperature data loggers and refrigerator temperature monitoring systems provide significantly faster response time and significantly more data than conveniently thermometers which often leads to the observation of temperature behavior that was previously missed. We have put together this quick guide to recommend some solutions and help you investigate so that over time you can identify the source and control the rhythm of your fridge.

There are 3 common reasons the recorded temperatures can periodically change:

1. Frequent Door Opening
2. Fridge/Freezer Compressor Cycling
3. Stray Electrical Noise



1. FREQUENT DOOR OPENING



Problem 1 Frequent Door Opening

5-10° Temperature Variation in 1-2 Minutes
Just From Opening The Door

Solution
Thermal Buffer
Slows Probe Response To Eliminate Temperature Spikes From Ambient Air

CAS Top 3 Reasons
The Temperature Fluctuates In Your Fridge or Freezer

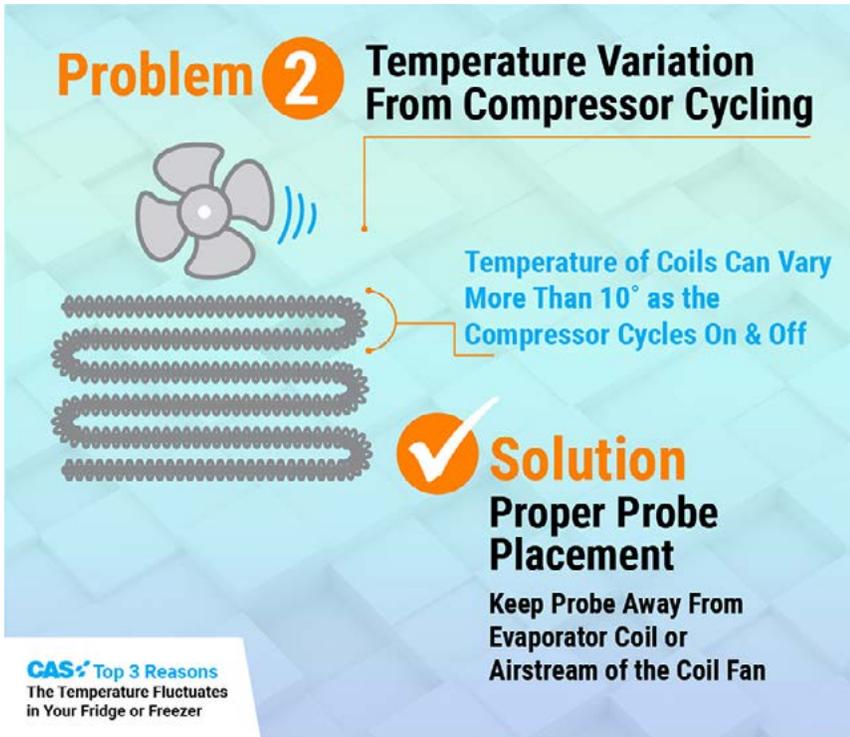
Nylon Thermal Buffer For Freezers & Ultra-Cold Systems

Glycol Bottle For Refrigerators

The first and simplest cause of unstable temperature readings occurs whenever people open the door, which almost immediately causes a change in your refrigerator/freezer's internal temperature. In this case, the temperature recorded by the electronic monitoring system is often comparable to a conventional thermometer located in the cabinet. What personnel often don't realize is that typical mercury thermometers have response times measured in minutes, meaning that it can take 5-10 minutes

for the temperature shown on the thermometer to stabilize at the new value after a rapid temperature change. Electronic temperature monitors have much faster response times on the order of tens of seconds. The net result is that the temperature displayed by the electronic monitoring system will display random jumps in temperature as much as 5-10 degrees that may be interpreted as a problem with the system. By looking at the data over a period of several hours or days, it often becomes apparent that these jumps are correlated with the time of the day when the door is open and the product is loaded or removed. If the presence of these jumps in temperature is an issue for your organization, you can add a thermal buffer, which can be a small bottle of glycol or a nylon block, to the probe. This provides thermal mass which will dampen the system's response time and eliminate the temperature spikes caused by opening the door. Thermal buffers also have the benefit of making the reported temperature more closely mimic the actual temperature of the refrigerated product.

2. FRIDGE/FREEZER COMPRESSOR CYCLING



Problem 2 **Temperature Variation From Compressor Cycling**

Temperature of Coils Can Vary More Than 10° as the Compressor Cycles On & Off

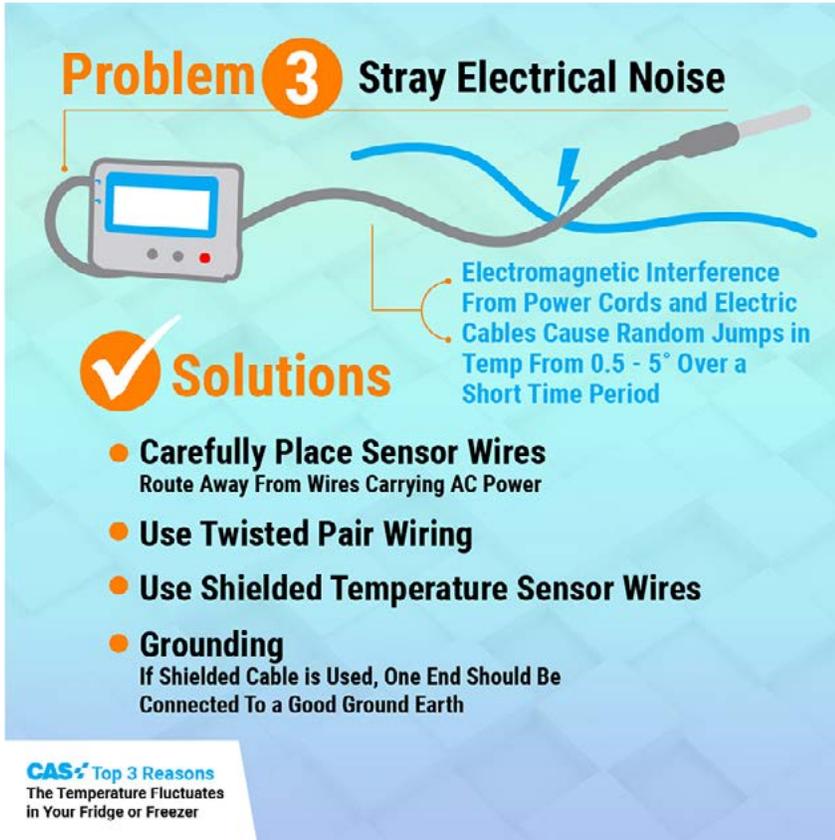
Solution
Proper Probe Placement
 Keep Probe Away From Evaporator Coil or Airstream of the Coil Fan

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The second source of temperature variation arises from the normal cycling of the compressor used to cool the refrigerator/freezer. Again, if the temperature displayed by your thermometer is being compared to the temperature reported by your electronic monitoring system, the response time of the thermometer may be masking the actual temperature fluctuations in the cabinet. By looking at a

graph of temperature vs. time, this cycling will be revealed by a regular, periodic change in temperature. Figure 1 shows the temperature of a freezer over a 6-hour period revealing a cycle time of approximately 30 minutes. Here too, you can add a [thermal buffer](#) to help reduce the amplitude of the variations, but this probably can't completely eliminate them, so proper placement of the probe can also help. We occasionally find the probe for the monitoring system placed very close to the evaporator coil or directly in the airstream of the coil fan (in the case of forced air-cooled systems). These locations aren't ideal since they experience the greatest change in temperature as the compressor cycles, so relocating the probe to a spot away from the coil or out of the airstream will usually help reduce variation amplitude.

3. ELECTRICAL NOISE



Problem 3 Stray Electrical Noise

Electromagnetic Interference From Power Cords and Electric Cables Cause Random Jumps in Temp From 0.5 - 5° Over a Short Time Period

Solutions

- **Carefully Place Sensor Wires**
Route Away From Wires Carrying AC Power
- **Use Twisted Pair Wiring**
- **Use Shielded Temperature Sensor Wires**
- **Grounding**
If Shielded Cable is Used, One End Should Be Connected To a Good Ground Earth

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The final cause is due to electrical noise in the [freezer monitoring system](#). This can often be identified from the temperature data in the form of random jumps in temperature from 0.5 to 5 degrees or more happening over a very short time period (such as seconds). The most common cause of electrical noise is the placement of wires from the sensor. The signal levels in an electronic measuring system are often millivolts or microvolts. If the wires carrying these signals pass

near to wires carrying line voltage power signals for motors or devices, it's easy to get stray voltage induced by the temperature signal from the sensor.

Common methods that can help reduce the effects of stray electrical noise:

- Carefully place the refrigerator temperature monitoring sensor wires – Be sure to keep them away from wires carrying AC power.
- Use twisted pair wiring – By using a sensor cable with twisted pair conductors, the effect of noise in one conductor will be partially canceled by the opposite signal coupled to the other conductor.

- Use shielded temperature monitoring sensor wires – By incorporating a cable that has an overall shield layer, you can minimize the coupling between any stray signals and the sensor signal.
- Grounding – If a shielded cable is used, one end should be connected to a good earth ground – the other end should be left free to minimize the potential of ground loops. Also, many monitoring systems include a provision for a ground connection to provide a path for stray signals to be shunted away from the sensitive measuring circuits.

Utilizing these suggestions with your refrigerator monitoring system, you should be able to minimize or remove the majority of temperature fluctuations in your medical refrigerator, perishable freezer, or any fridge/freezer/cooler unit you rely on to keep your product safe.

For further information on choosing a [temperature monitoring system](#), refrigerator temperature monitoring or to find the ideal solution for your application-specific needs, contact a CAS DataLogger Application Specialist at **(800) 956-4437** or www.DataLoggerInc.com.