

3 WAYS TEMPERATURE FLUCTUATES IN FRIDGE & FREEZER MONITORING

GUIDE TO USING AUTOMATED REFRIGERATOR TEMPERATURE MONITORING

Personnel installing new [temperature monitoring systems](#) in their refrigerators and freezers are often surprised to see the temperature appear to vary up and down unexpectedly. Our temperature data loggers and fridge monitoring systems provide significantly faster response time and significantly more data than conventional thermometers, which often leads to the observation of temperature behavior that was previously missed. We have put together this quick guide to help you investigate potential causes and suggest some solutions, so that over time you can identify the source and control the stability of the temperature in your fridge or freezer.



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

1. FREQUENT DOOR OPENING:

The first and simplest cause of unstable temperature readings is caused by staff opening the door, which almost immediately causes a change in the value of the refrigerator/freezer's temperature as reported by the sensor. Please note that the actual temperature of the products stored inside is not changing this rapidly, only the air temperature as recorded by the sensor. The sensors used by electronic data loggers have much faster response times than traditional mercury thermometers and will display rapid increases in temperature as much as 5-10 degrees, which might be interpreted as a problem with the system. 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, glass beads, or a nylon block, to the probe. If you take a look at the [CDC Vaccine Storage and Handling Toolkit](#), they recommend using a buffered thermal probe. The thermal buffer 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.



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

Nylon Thermal Buffer For Freezers & Ultra-Cold Systems

Glycol Bottle For Refrigerators

2. REFRIGERATOR/FREEZER COMPRESSOR CYCLING

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 inside the cabinet. By looking at a graph of temperature vs. time (see Figure 1), this cycling will be revealed by a regular, periodic change in temperature. 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. These locations aren’t ideal since they experience the greatest change in temperature as the compressor turns on and off, so relocating the probe to a spot away from the coil or out of the airstream will usually help reduce variation amplitude.

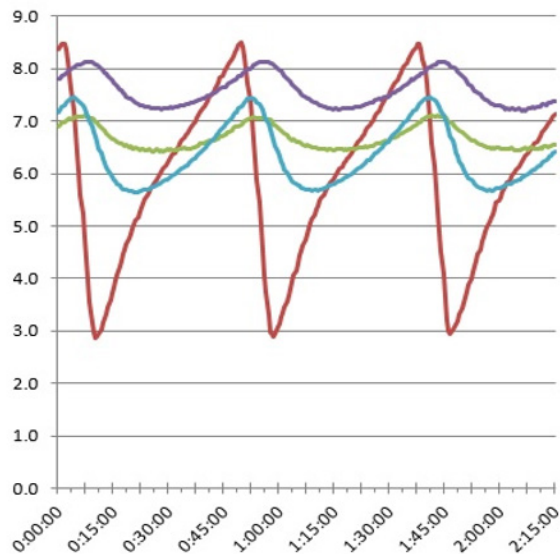


Figure 1. Typical temperature cycling behavior measured at several locations inside a typical refrigerator over a 2 hour period.

Problem 2 Temperature Variation From Compressor Cycling


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

3. ELECTRICAL NOISE

The final cause is due to electrical noise in the 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 running from the sensor to the actual measurement instrument. The signal levels generated with some of the common types of sensors is often in the millivolt or microvolt range. If the wires carrying

these signals pass near to wires carrying AC line voltage power signals for motors or other devices, it's easy to get stray voltage induced on the temperature signal from the sensor. To fix this, make sure to carefully route wires from the temperature sensor away from any wires away from wires carrying AC power, use twisted pair wiring, and use shielded cable for the sensor wires, ensuring that the shielded cable is connected to a good earth ground at just one end.

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

Solution

- 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

SUMMARY

Utilizing these suggestions with your fridge 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 [fridge monitoring systems](#), [freezer monitoring systems](#), or to find the ideal solution for your application-specific needs, contact a CAS Data Logger Application Specialist at (800) 956-4437 or www.DataLoggerInc.com.