Application Note: Cryogenic Freezing

Product Range: **Wireless Equipment List (Per Freezer):**

- A1-02b Sensor Pod
- E1-26 Type T Temperature Sensor
- E1- 16 Extended-life Battery Packs (if Pod is battery-powered)

Per wireless system:

- B1-06 Gateway

LAN-Wired Equipment List (Per Freezer):

- A2-05 LAN-Wired Sensor Pod
- E1-26NP Type T Temperature Sensor

Application: **Monitoring Cryogenic Freezers**
Monitoring the temperature of Cryogenic Freezers

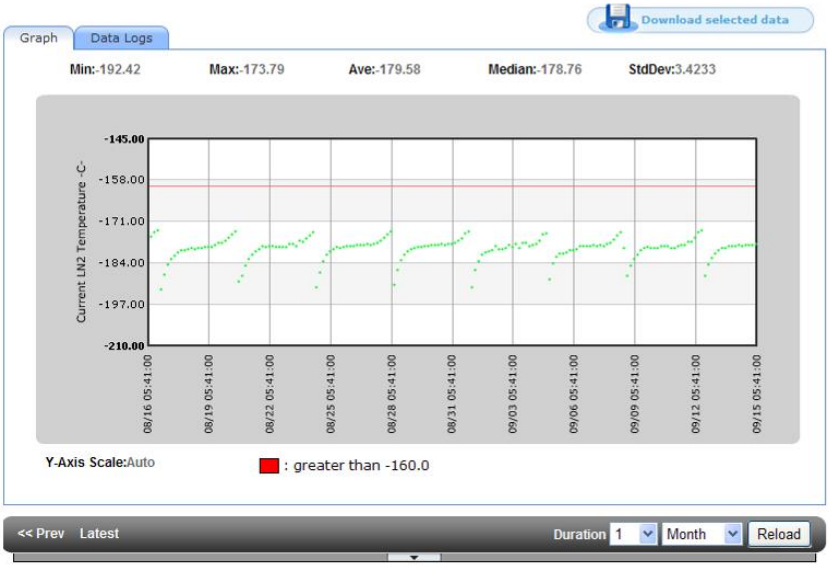
Background:
Hospitals, cryogenic storage farms, and research facilities often have multiple cryogenic freezers. Since the freezers operate at a temperature of -192°C, and are powered either by LN_2 (Liquid Nitrogen) or electric motors, they can fail. While failures are infrequent, they can be catastrophic, since each freezer can contain up to 2,000 samples.

The Problem:
Customers generally require 24/7 monitoring, 364 days per year for the temperature of their cryogenic freezers, with real-time remote alarming if the temperature rises above a given level.

The Solution:
Several methods of monitoring the cryogenic freezers are used by our customers.

For monitoring LN_2 freezers, most customers insert the Type T thermocouple probe into the vapor phase of the LN_2 and monitor the temperatures at approximately -175°C to -185°C. Alarms are then set when the temperature becomes greater than -150°C as this indicates that the freezer is running out of LN_2.

However, since the Type T thermocouple probe will survive the cryogenic temperatures, it can be inserted directly into the LN_2. Careful positioning of the sensor in the freezer allows the actual level (go/no-go) of the LN_2 to be monitored, using an alarm set for when the temperature is greater than -185°C. Some customers actually use the Grant system to tell them when to add LN_2 to the freezer to top it up.



The online software can display the data in a graph format as shown above. This shows typical cryogenic freezer data. This one month period clearly shows the fill cycles for the LN_2. The data is being recorded every 4 hours. A minimum of -191.7°C suggests the probe is barely touching the LN2 after the fill cycle.

Sampling rates for cryogenic freezers are typically very slow with data being recorded every 4 to 12 hours. Alarm checking occurs every 30 minutes with a 2 samples out of 2 samples filter i.e. 2 over temperature alarms in succession will generate an alarm. This means that if the freezer temperature is too high for ½ hour minimum and 1 hour maximum, an alarm is triggered.

The Benefits:
The alarms generated for each freezer can be sent to customized phone or email lists, as it is common in many facilities for the “owner” of each freezer to be different.

The inbuilt alarm output of most LN_2 and mechanical cryogenic freezers can be monitored via the alarm output of the freezer controller and the contact closure input of the Grant monitor Pod. Both the wireless A1-02b pod and the LAN-wired A2-05 can be used in this manner.

Note: For the A2-05, that the contact closure output is wired into an RTD input, and used to “rail” the temperature high or low when the switch status changes.

A 35-unit cryogenic installation at a major University Research Center, showing both LN_2 and mechanical freezers.

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