Debugging NPS Thermal Readback LabVIEW Program

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While debugging the thermal readback LabVIEW program for NPS it was noticed that if a user disables a sensor via the Phoebus GUI the program still scans the Keysight channel to which the sensor is attached and continues averaging values for the sensor. The program also continues to use the sensor's average values for interlocking. If a sensor is disabled, the interlocking and averaging for this sensor should automatically be disabled as well.

To start, I created a table to determine what state each of these three Boolean buttons should be in if one of the others is disabled (Fig. 1). If the sensor is disabled, both the interlock and averaging need to be disabled. If the interlock is disabled, just the averaging needs to be disabled. And finally, if the averaging is disabled, the sensor and interlock can remain enabled.

The LabVIEW program receives information from EPICS at the end of the loop iteration. After the LabVIEW program receives the information that a sensor has been disabled by the user via the Phoebus GUI, the next step is to disable the corresponding interlock and averaging before these values are used in the next loop iteration.

The sensor enables are grouped together into arrays by sections (e.g., crystal zone back 1 ,crystal zone back 2, and detector frame relative humidity). I created a for-loop for each of these arrays to iterate over each sensor enable individually. A true or false case structure is placed inside of the for-loop to check the Boolean value for each sensor enable.

- **During debugging noticed that interlocking and averaging were not automatically disabled when a sensor was disabled**

- **Determined when a sensor, interlock, or averaging should automatically be disabled**

- **Adding code to LabVIEW program to automatically disable interlocking and averaging when appropriate**

	enabled	disabled			enabled	disabled			enabled	disabled
sensor		x		sensor	o			sensor	o	
interlock		x		interlock		x		interlock	o	
averaging		x		averaging		x		averaging		x

FIG.1. Screenshot of Excel chart detailing what should happen if a sensor, interlock, or averaging is disabled.

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For the False case, the True Boolean values for interlock and average are replaced with the False Boolean value from the sensor enables array (Fig. 2). The True case is empty

There is a special case for the detector frame temperature and relative humidity sensors and the hall temperature and relative humidity sensors. The temperature and relative humidity values are used to calculate the dew point. There are no dew point sensors used in this system, but the dew point is averaged and able to be included in the interlock chain. If any of the detector frame temperature or relative humidity sensors is disabled, not only do the corresponding interlock and averaging have to be disabled, but the corresponding dew point interlock and averaging must be disabled as well.

So far, I have only implemented the changes based on the sensor enables and only in LabVIEW. The next step will be to add code to push this information to EPICS so the user will see, via the Phoebus GUI, that the appropriate interlock and averaging buttons have been disabled. Then I will add code to disable the averaging based on the interlock Boolean value.
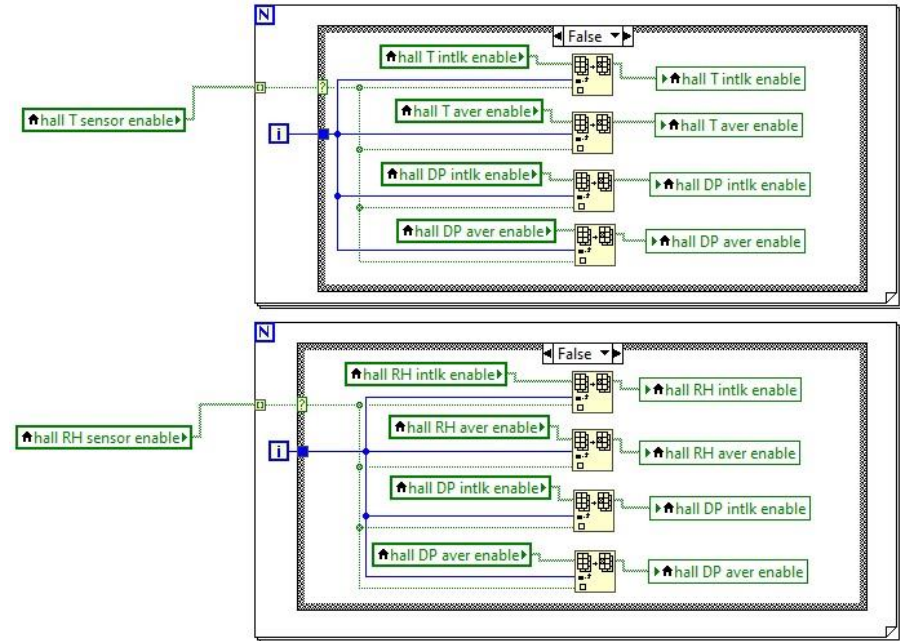

FIG.2. Screenshot of LabVIEW code to replace Boolean values for interlocking and averaging based on the sensor enable Boolean value