Linear Heat Conduction Module Procedure

Objective: Determine the thermal conductivity (k, )

1. Prepare DAQ
   1. Connect Arduino microcontroller to the PC (an UNO can be mounted to the bottom of the project base
   2. Open Serial Studio (will save data from Arduino as a .csv)
   3. Load LHCM.json in Serial Studio
   4. Ensure thermocouples are connected to MCP9601 thermocouple amplifiers
   5. Upload LHCM\_v4.ino to the microcontroller
   6. Verify that there are no I2C address conflicts, and that all thermocouples are correctly displaying reasonable room temperatures to the serial monitor  
      (It is important to verify that the serial monitor within the Arduino IDE is disabled for serial communication between the microcontroller and Serial Studio)
2. Prepare Ice Bath
   1. Fill red picnic cooler with ice by loading ice in from ice machine in the front of the room   
      (Ice machine is often disabled. A quick fix is to remove the top panel with a screwdriver, turn on the cleaning cycle and turn ice making mode back on)
   2. Make sure there is room to submerge pump
      1. If not, use secondary bucket to remove some ice
3. Calibrate Thermocouples
   1. Place thermocouple in ice bath and ensure thermocouples read 0°C within ±0.5°C and do not fluctuate for more than 5 minutes.
4. Test Cooling Loop
   1. Turn on pump by turning the 30 minute timer on
      1. Ensure outlet pipe is facing top of picnic cooler
      2. Make sure there are no leaks or spills
   2. Check inlet and outlet temps with handheld thermometer
      1. Ice bath temp should not exceed 2°C
      2. Outlet temp should be as close as possible to ice bath temp. (about ≤ 1°C)
   3. Listen to pump, is there enough water in the ice bath?
5. Build the conduction tower
   1. Stack from bottom to top modules.
      1. Bottom-most module has holes on the upper side of the module.
         1. Add thermal paste to top and bottom of sample module/ where needed on other modules.
         2. Note: it helps to insert thermocouples to sample module before adding thermal paste.
      2. Sample module.
      3. Above sample module has holes on the bottom side of module.
      4. Heater module
   2. Add thermocouples (currently, the chips are oriented horizontally on desk)
      1. The rightmost chip [1] corresponds to the uppermost hole on the tower.
      2. As the thermocouples descend on the tower, they correlate to the chips from right to left.
   3. Check if the heater is inserted to the tower. If not, insert it to the top module.
6. Turn on Extech PID Controller
7. Make sure the microcontroller is connected to the computer and Serial Studio is running
8. Turn on insertion heater using the switch on the variac
9. During experiment
   1. Periodically check and note the input power on the watt-meter, ice bath temperature, outlet temperature, and thermocouple temps.
   2. Periodically check to make sure the 30 min pump timer has not stopped the sump pump.