Environmental Chamber Controller
User Manual

This document contains a user manual for operating the environmental chamber in room D115A, located on the Sexton Campus at Dalhousie University. The digital controller for the existing chamber was designed, fabricated, and installed by Team 03 as part of the 2023 Mechanical Engineering Capstone program. For any inquiries, please contact reilly.pickard@dal.ca.

1. Downloading and Opening Software

An email has been sent to the user containing a folder named "ChamberController_Interface". Download this file. In your downloads you should see the folder, as shown in Figure 1:

Figure 1

Open the file and navigate to the ChamberController_Interface.exe file. It is the only file whose type is "Application". Open this file, as shown in Figure 2.
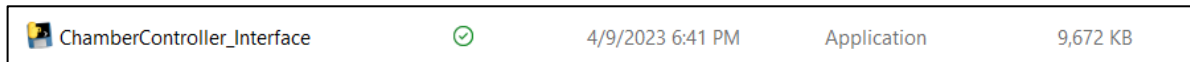

Figure 2

2. Connecting to the Arduino

Locate the USB port coming from the door (Figure 3) of the chamber and connect your USB-Mini to it as shown below in Figure 4. Connect the other end to the USB port on your computer.

Figure 3

Figure 4

If you are properly connected, you will see the message in Figure 5.

`Connected to USB-SERIAL CH340 (COM4) on COM4`

Figure 5

If not, you will receive the error shown in Figure 6.

`No ports available. Please connect your device.`

Figure 6

3. Controlling the Chamber

Once the app is open, wait about 10-20 seconds while it loads. You should begin to see temperature readings on the plot and being printed to the command window. To begin controlling the temperature and humidity, navigate to the window shown in Figure 7.

Figure 7

Enter the temperature and humidities you want to achieve, and the time you wish to hold them. Once the hold time is elapsed, the controller will go to the next row and aim to meet the second temperature and humidity, and hold these for the second hold time. Once you have filled out the table with your desired setpoints, press the "Send" button to start. To ensure that the chamber responds, make sure the power lever (Figure 8) is switched up, and that the circulation, heating, refrigeration, humidification, and dehumidification switches are flipped ON. If you wish to go below 0°F, also ensure the CO2 switch is on. See Figure 8.

Shown below in Figures 9 and 10 is an example of 3 setpoints being entered and met. **Note: the "hold time" counts the rising time. So, if the current temperature is 70 ⁰F and you wish to hold a temperature of 90 ⁰F for 10 minutes and the current rise time is 2 ⁰F/min, you must enter 20 minutes of time to account for the rise.**
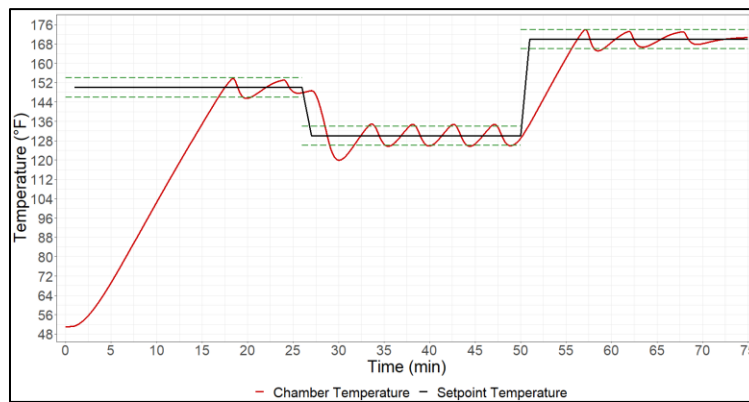
Figure 9

Figure 10

Note: Leaving the humidity portion blank just means that humidity will not be controlled during the run.

4. Safety

The user should also be made aware of the potential safety hazards associated with the system. Best practices include, but are not limited to:

    i.   Do not open the door to the controller housing while the machine is in operation. There is live AC flowing and this is very dangerous.

    ii.   Do not open the door to the chamber while the treatment is in process. Not only will the extreme temperatures be of danger to the user, but this will cause a large disturbance in temperature reading due to the loss of insulation.

iii.   Do not bring liquid around when operating. Liquid may damage not only your computer in the middle of a run but may damage the USB connection to the Arduino.

The user should also note that the design is equipped with the following safety features:

i.   If the system temperature exceeds 350 $^{\circ}$F or drops below -100 $^{\circ}$F, 'Off' signals are sent to each of the machine components.

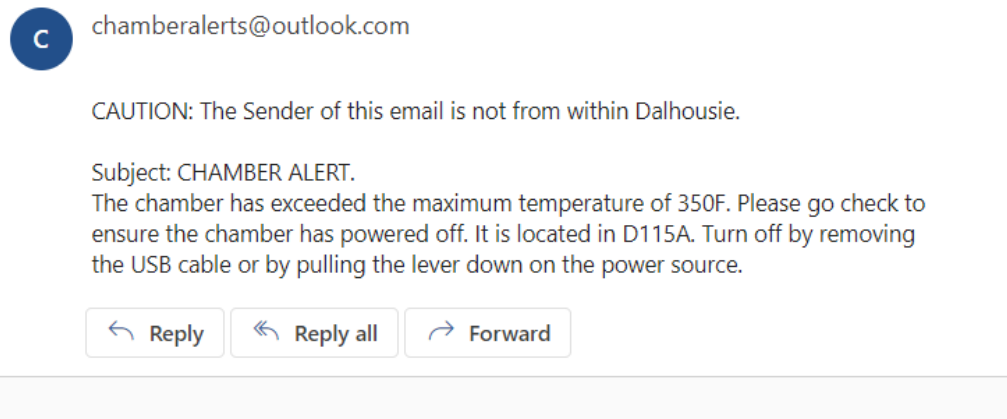ii.   If the temperature exceeds these defined bounds, an e-mail alert is also sent to the user, as shown below:

chamberalerts@outlook.com

CAUTION: The Sender of this email is not from within Dalhousie.

Subject: CHAMBER ALERT.
The chamber has exceeded the maximum temperature of 350F. Please go check to ensure the chamber has powered off. It is located in D115A. Turn off by removing the USB cable or by pulling the lever down on the power source.

Reply   Reply all   Forward

Figure 11

iii.   The machine may also be powered off by either disconnecting the USB, or closing the power lever shown in Figure 12. Should the machine be out of maximum range and the temperature doesn't seem to be changing, please disconnect the power rather than trying to change setpoints on the interface.

Figure 12