A Thesis Presented to

The Faculty of Alfred University

Data Logging and Interactive Documentation for Engineering Department Wind Tunnel

by

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In partial fulfillment of
the requirements for
the Alfred University Honors Program

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Under the Supervision of:

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Poster

Data Logging and Interactive Documentation for Wind Tunnel

The primary focus of this project was to improve and increase the use of Alfred University's wind tunnel. This goal required a multifaceted approach which included confirmation that the wind tunnel functioned, creation of an interactive educational presentation and operation manual, as well as, procurement of hardware, and programming of software for data logging which allowed for simplified data acquisition and analysis. These improvements ensure that the wind tunnel will see use by even the most unfamiliar of experimenters by giving them everything they need at their fingertips. The wind tunnel is now future proofed against graduating students, retiring professors or misplaced documentation.

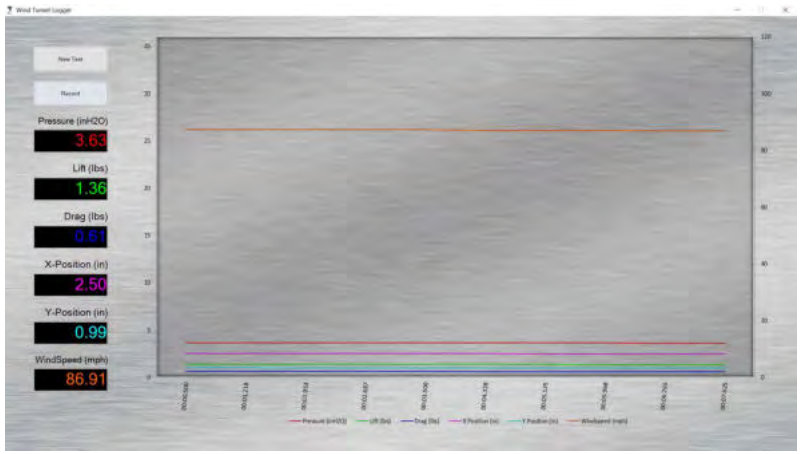


Figure 1: Data Logger User Interface

Time	Pressure (inH2O)	Lift (lbs)	Drag (lbs)	X Position (in)	Y Position (in)	Windspeed (mph)
00:00.516	4.42	1.77	0.73	3.24	1.35	95.9
00:01.016	4.42	1.77	0.73	3.24	1.35	95.9
00:01.516	4.42	1.77	0.73	3.23	1.35	95.9
00:02.016	4.42	1.76	0.73	3.23	1.35	95.9
00:02.516	4.41	1.76	0.73	3.23	1.35	95.79
00:03.016	4.41	1.76	0.73	3.23	1.34	95.79
00:03.516	4.41	1.76	0.72	3.23	1.34	95.79
00:04.016	4.41	1.76	0.72	3.22	1.34	95.79
00:04.516	4.39	1.76	0.72	3.22	1.34	95.57
00:05.016	4.39	1.75	0.72	3.22	1.34	95.57
00:05.516	4.39	1.75	0.72	3.21	1.34	95.57
00:06.016	4.39	1.75	0.72	3.21	1.34	95.57

Figure 2: Data Logger Output Table

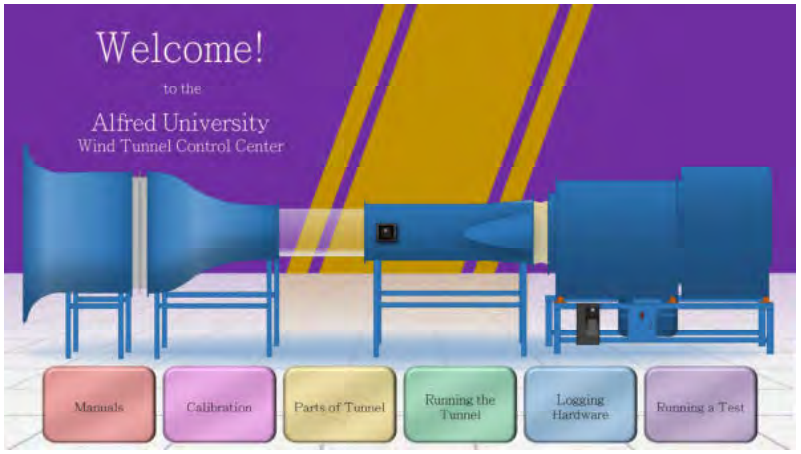


Figure 3: Documentation Main Menu

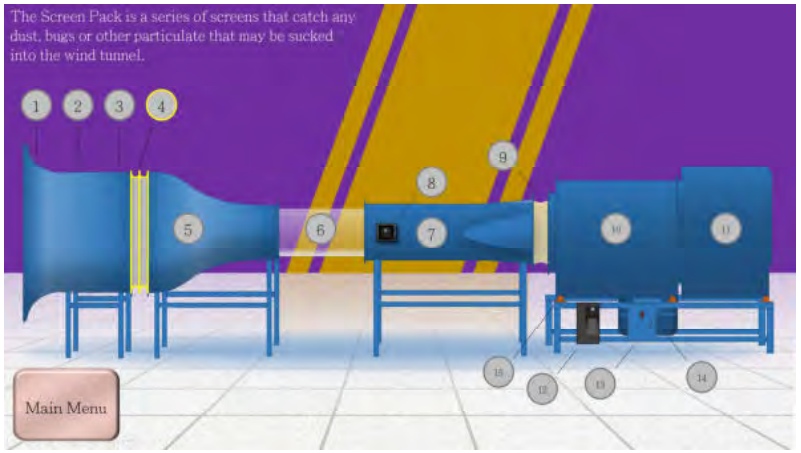


Figure 4: Interactive Diagram

Alfred University
Kasuo Inamori School of Engineering

Zachary Plesmid
Dr. Joe Rosiczkowski, Ian King, Thomas Minnick, Keaton Rowe, Daniel Weiner
May 5, 2020

Introduction

In 1897, Konstantin Tsiolkovsky invented the first practical wind tunnel. His design involved a fan moving air through a large tube and is still in use today. The air in the tunnel exerts forces on objects placed inside as it blows by. Sensors then measure properties like lift, drag, pressure, and wind speed.

Engineering depends on the measuring of properties and dimensions. Wind tunnels are essential for the measurements that engineers need for understanding an object's interaction with the air. By measuring a small model, an engineer can determine whether a full-scale version will work. The model in question may be a plane, a car, a building or anything where it is desired to understand the interaction between the model and the wind.

Not all wind tunnels are the same. The size of the tunnel is tailored to the task that an engineer or scientist needs to accomplish. Some wind tunnels are little, used to study small-scale phenomena. Some are large enough to enclose vehicles.

Alfred University owns a wind tunnel. Located in the Seidlin Annex Engineering Laboratories, the tunnel was purchased in 2010 from Engineering Laboratory Design, Inc. The cross section of the test area is eighteen inches square, nowhere big enough to house a vehicle. However, the wind tunnel is among the largest used by colleges in New York state, meaning it can accommodate a wider range of models. Several models and apparatuses for observing fluid properties were included in the acquisition. Despite this, none of my engineering classes have utilized the wind tunnel nor is there evidence of more than one senior project taking advantage of it.

A wind tunnel should be a great benefit to university classes like Fluid Dynamics, Wind Energy, and Thermal Science Lab; campus clubs like, Design Build Fly, SAE Baja and Tiny House; and students performing experiments in their free time. Unfortunately, it does not see as

much use as it should for such a useful piece of equipment. Through conversations with other students and professors, I learned that the wind tunnel had just been fixed and calibrated by some fellow students. The number of people on campus that knew how to use the tunnel was now the limiting factor on its use. I proposed a senior project where I would teach myself how to operate and calibrate the tunnel before compiling the relevant knowledge into a user-friendly guide. The guide would allow anyone, student or professor alike, to gain a working familiarity with the tunnel's operation quickly. It would cover everything a standard operator would need to know to conduct a test. Having the wind tunnel be more accessible to everyone on campus will allow the university to advertise it to prospective students and make the most of this underused instrument.

The wind tunnel lab was not in the state I had been told. It turned out the wind tunnel was functional, and the sensor array was set up properly. However, the sensors were not calibrated nor was there a manual, models or calibration equipment. I contacted the company for a copy of the manual and attempted to recreate the calibration equipment myself. Eventually, I was told about a cupboard in a locked room with wind tunnel accoutrements inside. Investigation found this cupboard contained the manual, the models, and the calibration equipment.

Despite the boon of finding everything I needed, some issues remained. Calibrating the sensors was a frustrating process. The drag sensor refused to cooperate. Even after enlisting the assistance of the tunnel's design engineer at ELD, it took a week to track down the reason. The signal conditioning cards inside the sensor readout box had been incorrectly setup and this was causing the two cards to interact with each other in odd ways. After correcting the settings and calibrating the system again, everything was working properly. There was still a problem, though.

I realized there was no way to capture any of the data continuously feeding out of the sensors. Many measurements made with wind tunnels are time dependent. With nothing but the live data on display, telling how much time had transpired between value changes was impossible. This was another major factor in why the wind tunnel was not being used. I would have to build a data logger.

A data logger is a piece of hardware and/or software that logs, or records, incoming data for later perusal and analysis. To create a data logger, I first needed a way to get the data from the sensor readout box to a computer. The sensor readout box has an output on the back, designed for this use, but it is analog. Analog means that the output can be any value in a certain range. Unfortunately, the computer only understands digital values. Digital means that the data can only be on or off. By switching between these two states in different orders, the computer can represent different symbols and values. It functions similarly to Morse code. To get the two systems to talk to each other would require a translator.

A data acquisition card had been left behind by others who had worked on the wind tunnel before me. I tried to use this in conjunction with every piece of software I could find, but nothing accomplished what I was looking for. Eventually, I found an analog-to-digital converter card (ADC), a circuit board that would translate analog signals into digital signals. This arrived with its own software, allowing the computer to communicate with the sensors and to log their data.

This bundled program was ugly, cluttered and decidedly not user-friendly. To remedy this, I wrote my own piece of software in a programming language called AutoHotKey to hide the real program and present a nicer user interface. It was merely a mask for the official program

to hide some of the complex, unnecessary features from novice users. This worked well except for the built-in data logger.

The data logger included in the official software had a strange quirk. When it saved the data to a spreadsheet, it wrote the units into the same cell as the value. This meant further math with the values was difficult, requiring a great deal of work beforehand. I decided that would not do, electing to build my own data logger instead. The functionality of a data logger was added to my program. This was by no means a smooth process. As soon as I struggled past one problem, there would be another issue. Luckily, I was able to find excellent documentation online, finishing the software in 24 weeks. Now the official software serves no purpose but to read values from the ADC. These were then read into my program to display, log, and graph. With that the data collection software was just about wrapped up. I still needed to make a user guide.

I was confident that I could make a user-friendly user manual for the wind tunnel, as I had done similar projects on two previous occasions and had received good reviews on both.

My senior year of high school, I made a technical manual for the school auditorium. It included a fold-out scale map of outlets and batons; a drawing of the breaker box, showing the purpose of all the breakers; and an instructional section with a step-by-step guide for common tasks on the digital lighting control board. Anyone, like the janitor, music director or the drama club technical crew, could easily manage the technical aspects of the theatre after reading the guide.

The summer after my junior year of college, I worked as an intern, conducting research on a piece of equipment being developed by my employer. From the beginning, it became apparent that I could not stand at the machine and record readings every thirty seconds with any semblance of accuracy or precision. To free up time, I created a data logger which recorded data

directly into an Excel spreadsheet. When I found out that the next intern would not arrive until after I had returned to school, I decided to write a digital help menu with hyperlinks and the aesthetic of an old monochrome monitor. Everyone in the office was quite impressed with the functionality of both items.

For this user manual, I decided to use what I was familiar with and create it in PowerPoint as I had done for the other two. I took advantage of every trick I knew and learned a few more. There are six main sections to my documentation: Manuals, Calibration, Parts of the Wind Tunnel, Logging Hardware, Running the Wind Tunnel, and Running a Test.

The Manuals section provides a simple menu that allows users to open the official manuals for the wind tunnel or the instrumentation.

The Calibration section presents an interactive diagram like the Parts of the Wind Tunnel and the Logging Hardware sections, listed below. Flowcharts are displayed, containing all the necessary steps to calibrate the sensory array. Selecting any of the steps results in a proffered diagram or photo, clarifying the step.

The Parts of the Wind Tunnel section displays a custom drawing of the wind tunnel situated in an Alfred University themed room. The sections of the tunnel are called out with numbered circles and leader lines. Clicking on these circles will highlight the associated piece of the tunnel and give a short explanation of what it is and what it does.

The Logging Hardware section is very similar to the Parts of the Wind Tunnel section. It shows pictures of the sensing hardware, arranged in a network, to represent how the pieces fit together. Upon clicking on the items pictured, users are presented with a similar highlighting and description.

The Running the Wind Tunnel section walks the user through turning the tunnel on, adjusting the motor speed and turning the tunnel off again. It is all presented as a step-by-step tutorial. The next step can only be reached once the current step is understood and executed on an onscreen replica. This ensures that users fully understand the task they are to perform before they do the same in real life.

The Running a Test section walks the user through running a test on the wind tunnel. Much like the Running the Wind Tunnel section, it ensures that users understand which buttons to press in the software before they use the real equipment.

All these sections were then linked together via a Main Menu section. This section displays a drawing of the wind tunnel, a welcome message, and friendly buttons that link to the other sections. Each of the sections contains a main menu button that returns the user to the Main Menu section.

My data logger program is also responsible for launching all the necessary accompanying programs, such as the ADC software and the PowerPoint help menu, upon start. An additional monitor was installed on the computer to allow my data logger software and the help menu to display full screen simultaneously. Everything launches with a single click of an icon. When the logger is closed, all support programs are closed automatically. That way the user never has to see any of the complex workings of the operation. It also prevents internal settings from being modified in error.

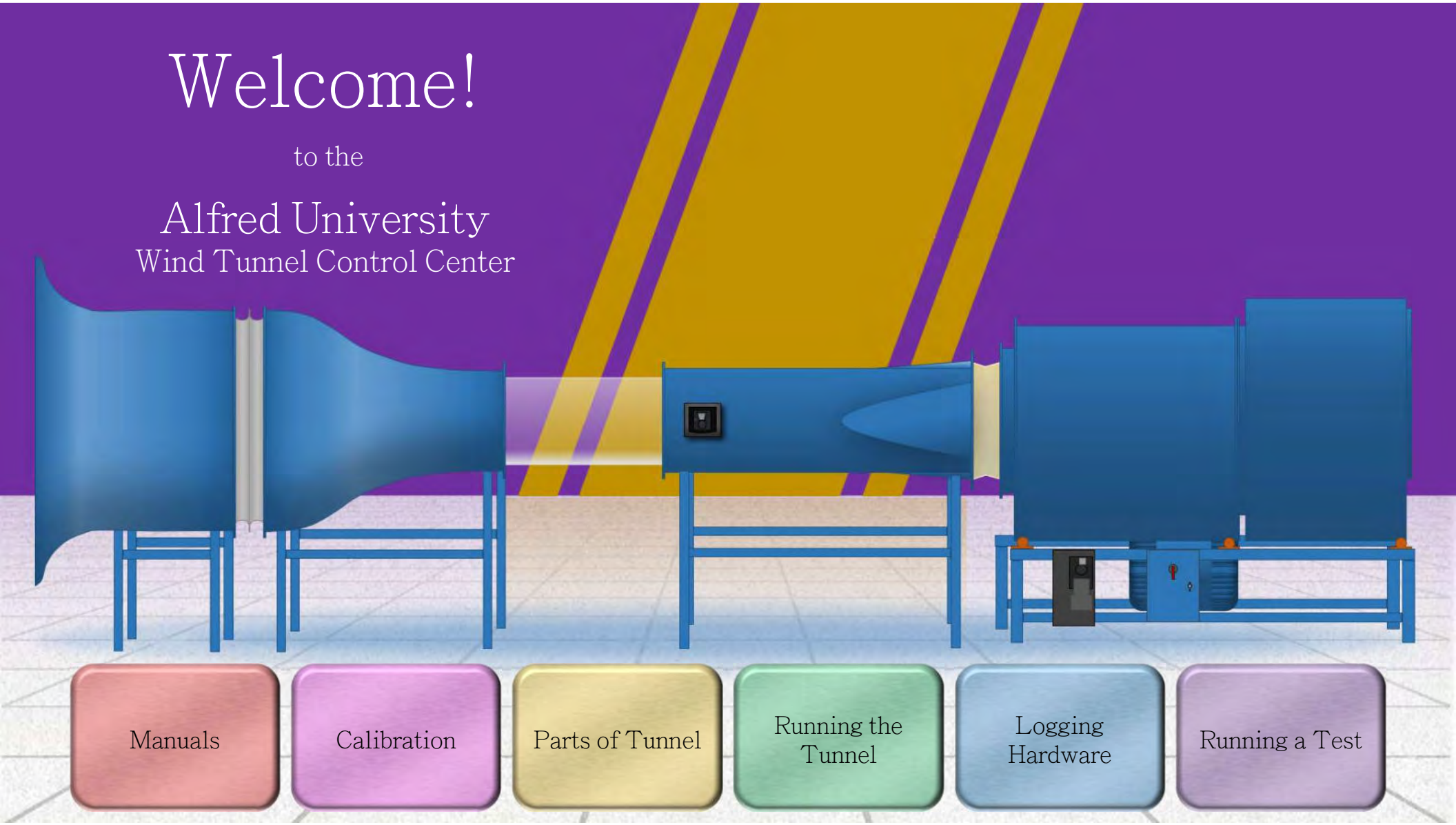
The software and its files are installed on a USB drive. This offers several advantages. First, it allows the software to be run on any computer by simply plugging in the drive. If the computer needs to be replaced, the software is easily moved to the new system. Second, the user files are stored on the USB drive and are thus moved along with the program, ensuring that they

are always easily accessible. Third, the software logs the operator's username and the use time so that if there is an issue with the wind tunnel, recent users can be identified, and usage may be tracked.

Alfred University has made a large investment in a wind tunnel. It will be worth far more to the school community with the new data logger and user start guide installed. Now, anyone can use the wind tunnel to improve their classes, clubs or projects.

Screenshots

Main Menu


Welcome!
to the
Alfred University
Wind Tunnel Control Center
Manuals
Calibration
Parts of Tunnel
Running the Tunnel
Logging Hardware
Running a Test

Manuals

Manuals

Wind Tunnel

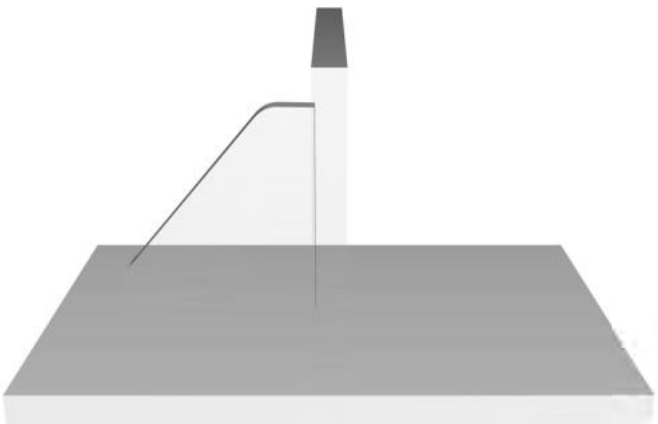
Instrumentation

Main Menu

Calibration

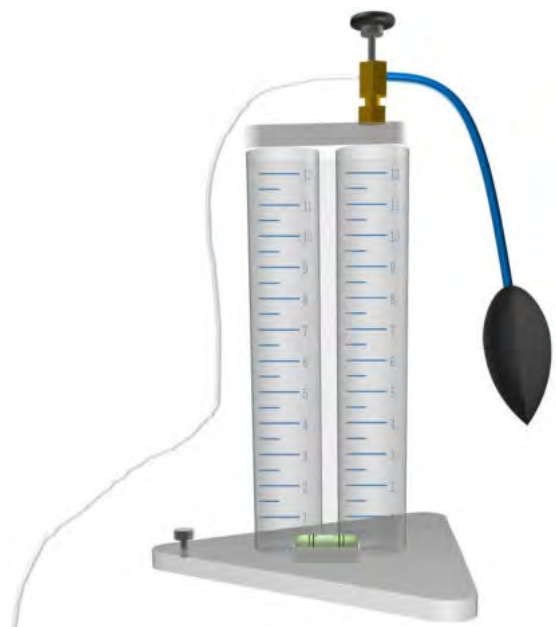
Calibration

Things you will need:



Mounting Fixture

Dynamometer

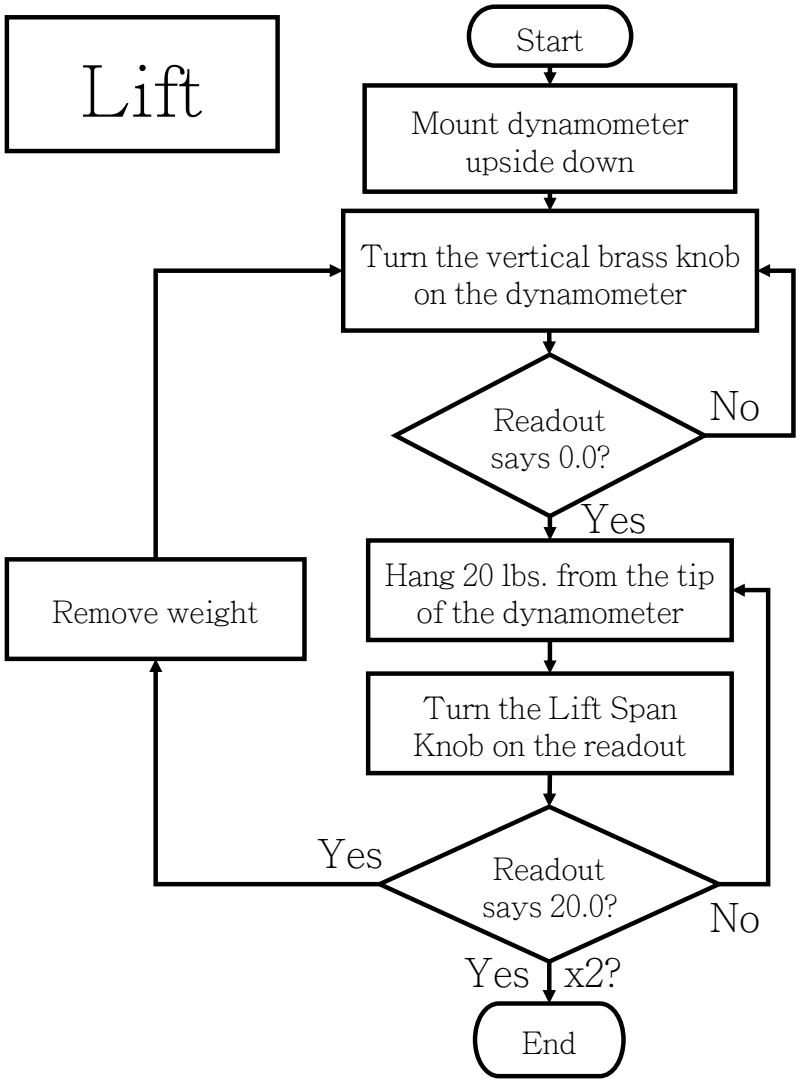


Manometer

Weights

Next

Lift



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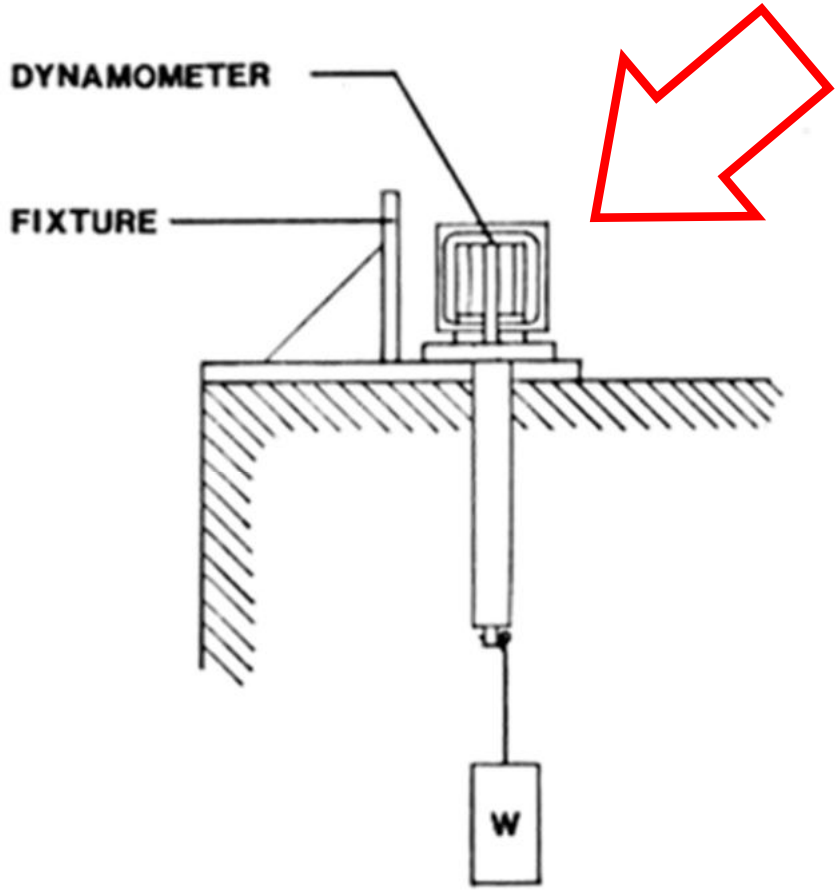
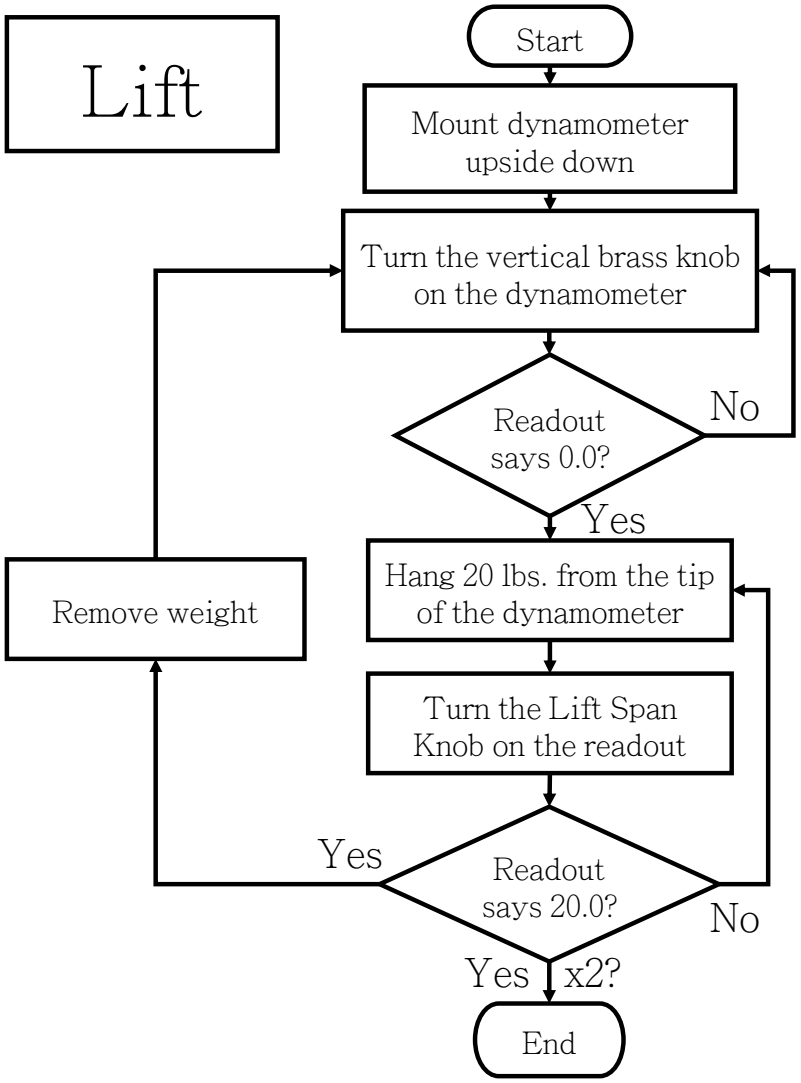
Click on 'End' to move on.



Lift



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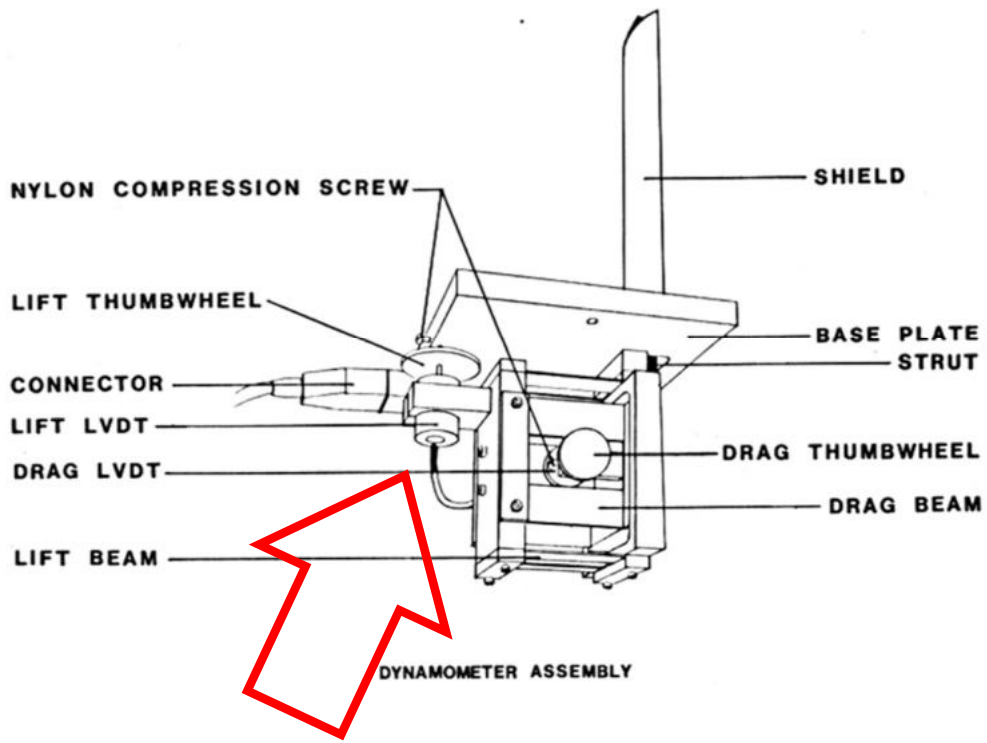

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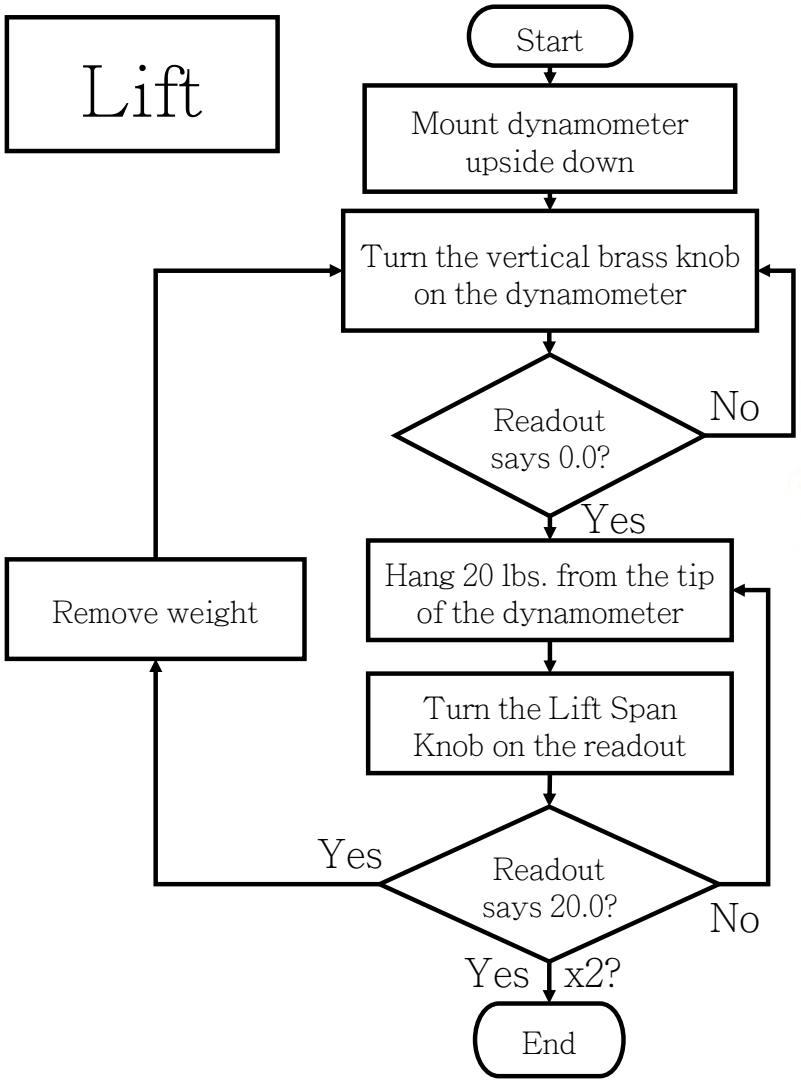

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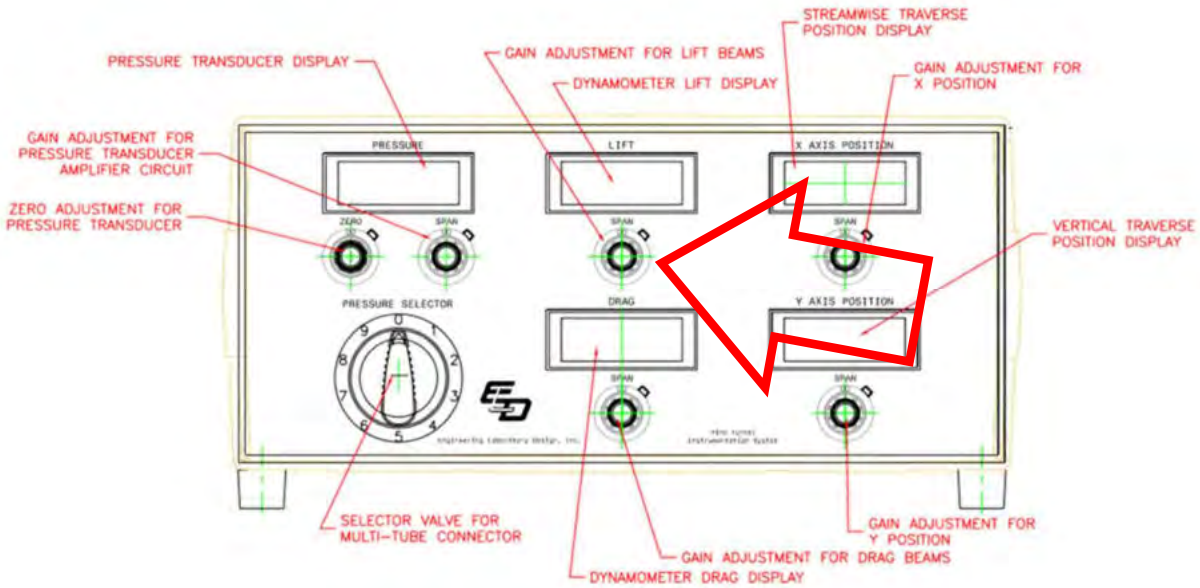

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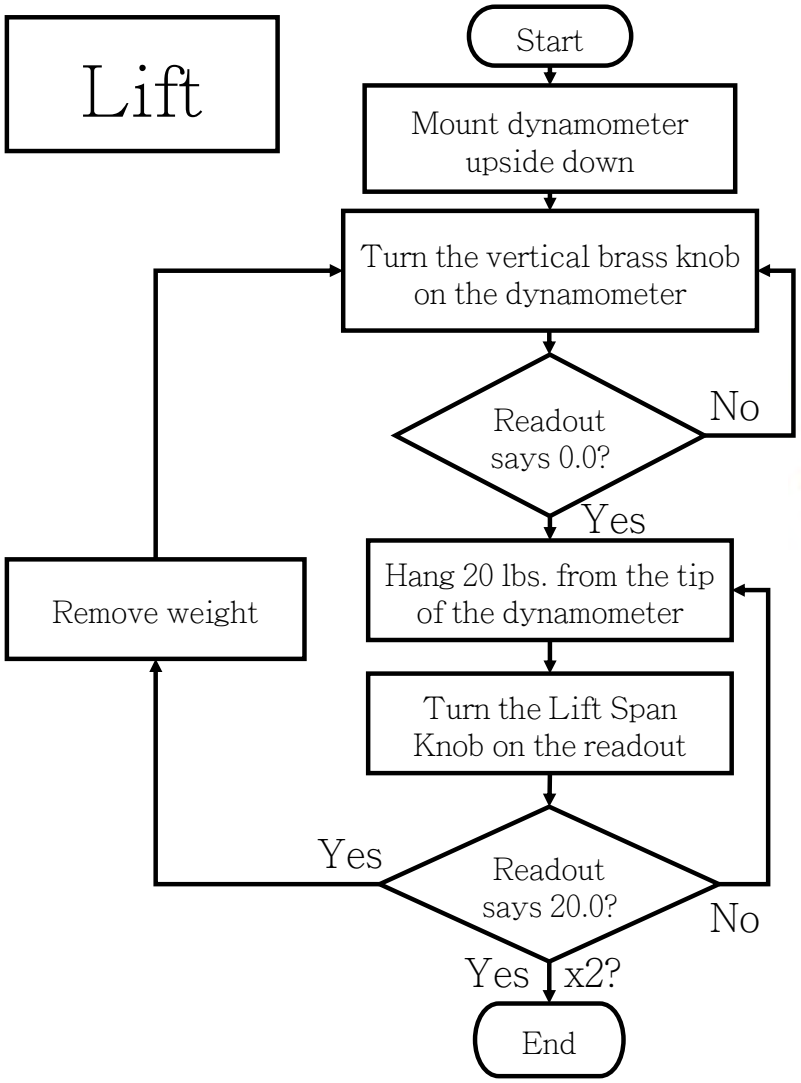

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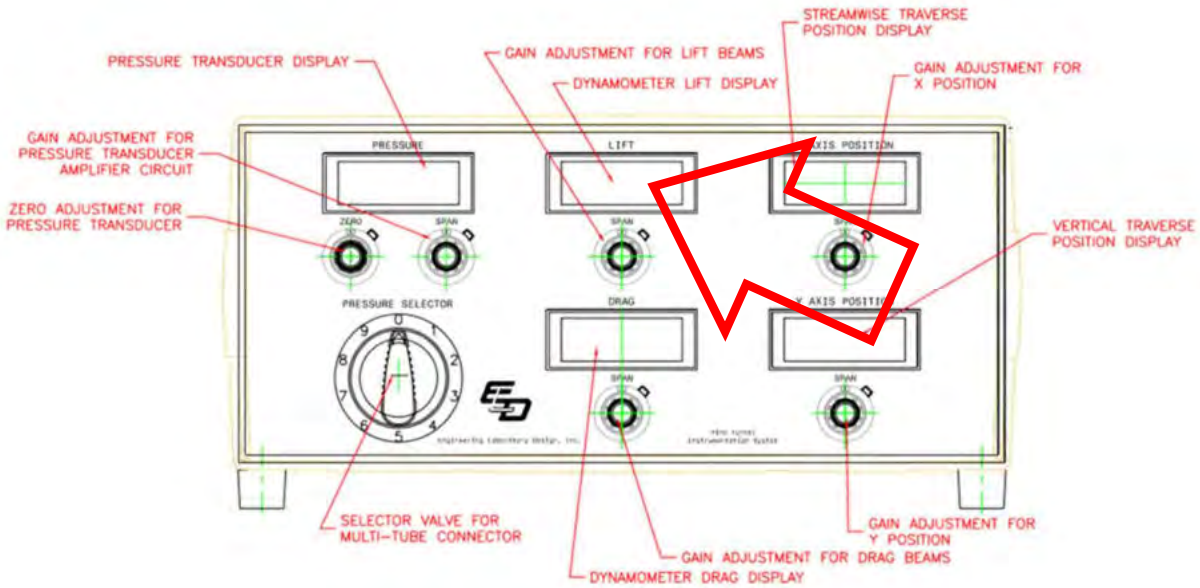

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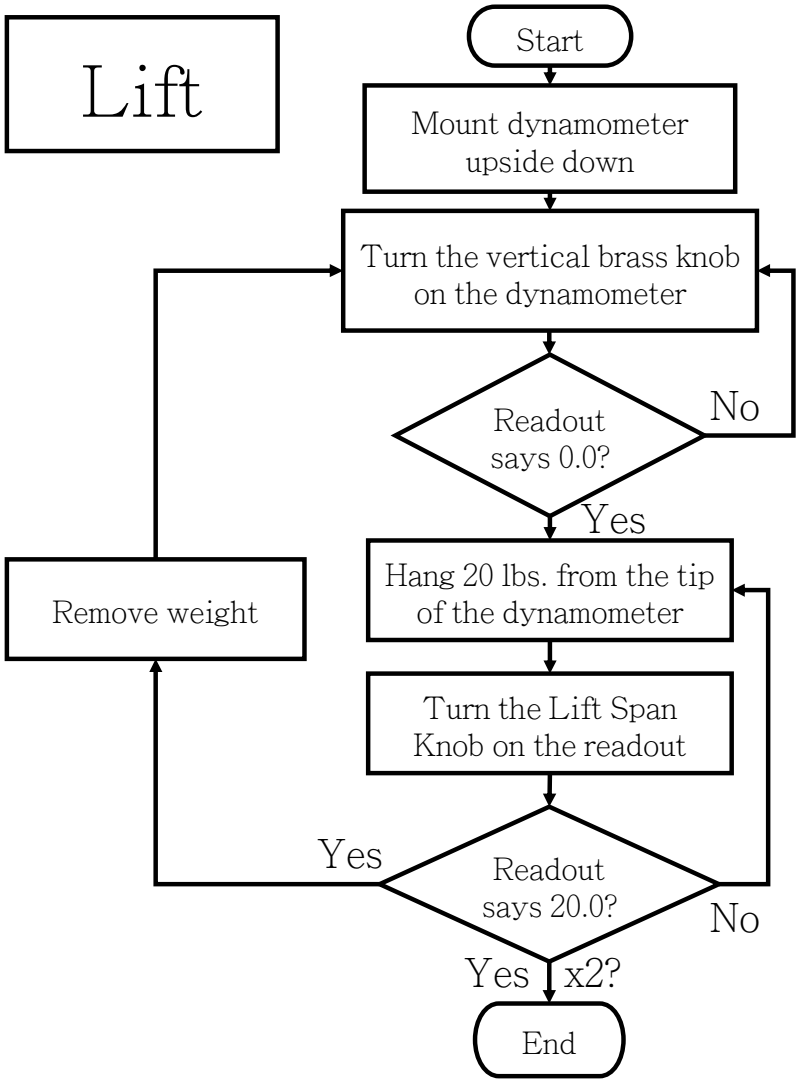

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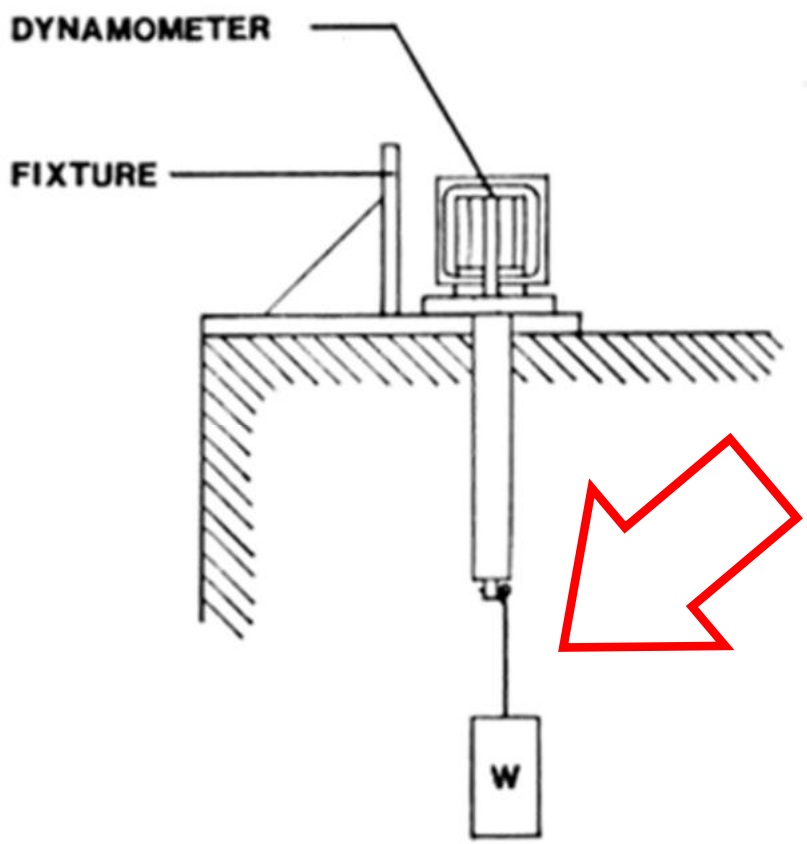

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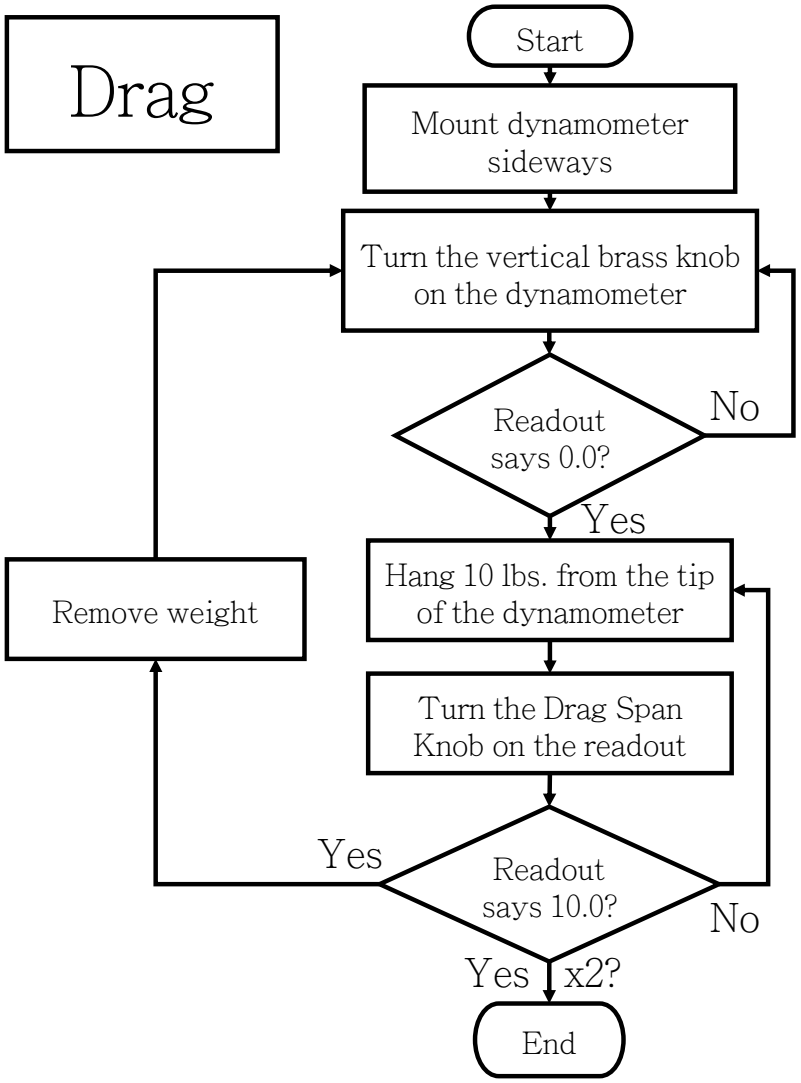

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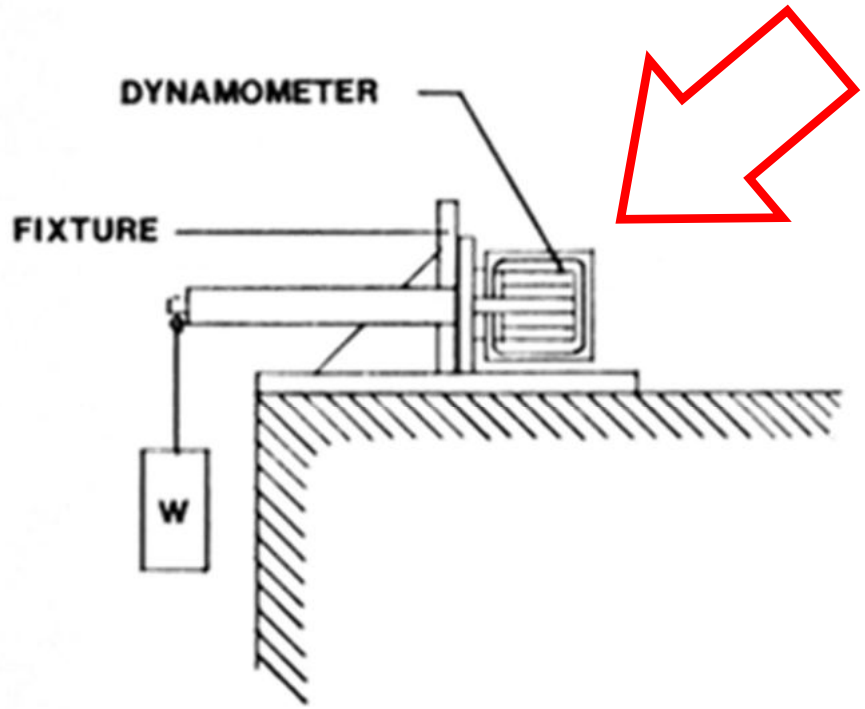

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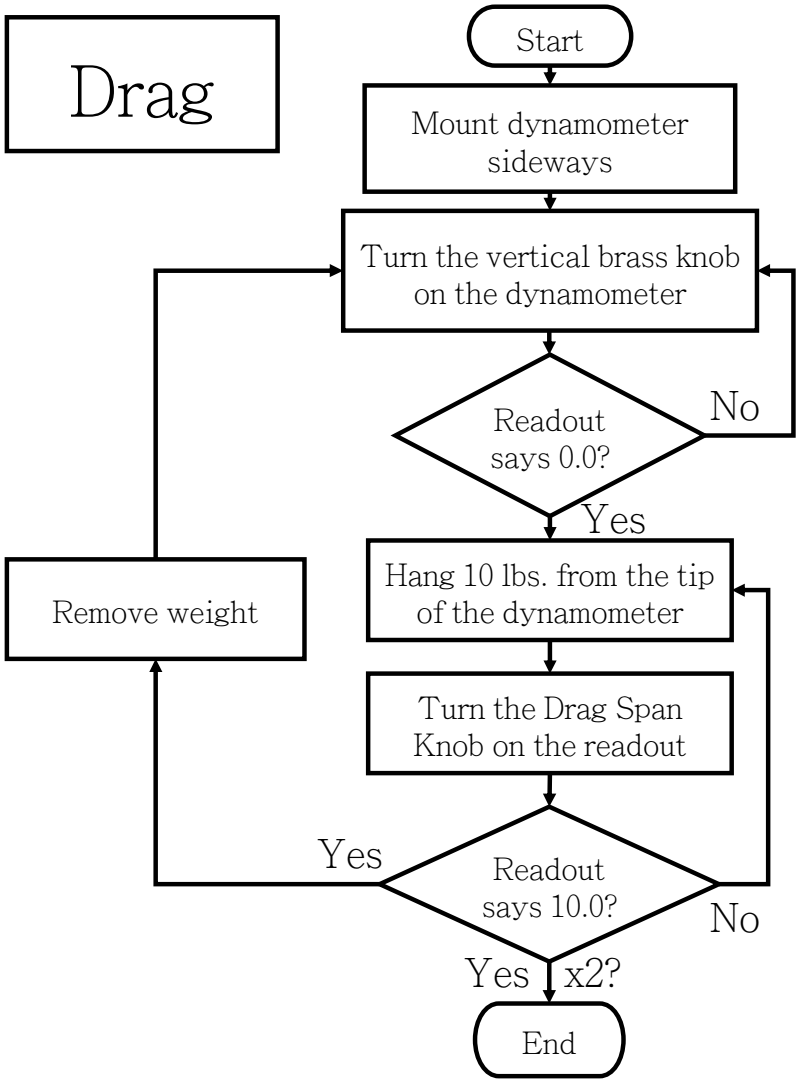

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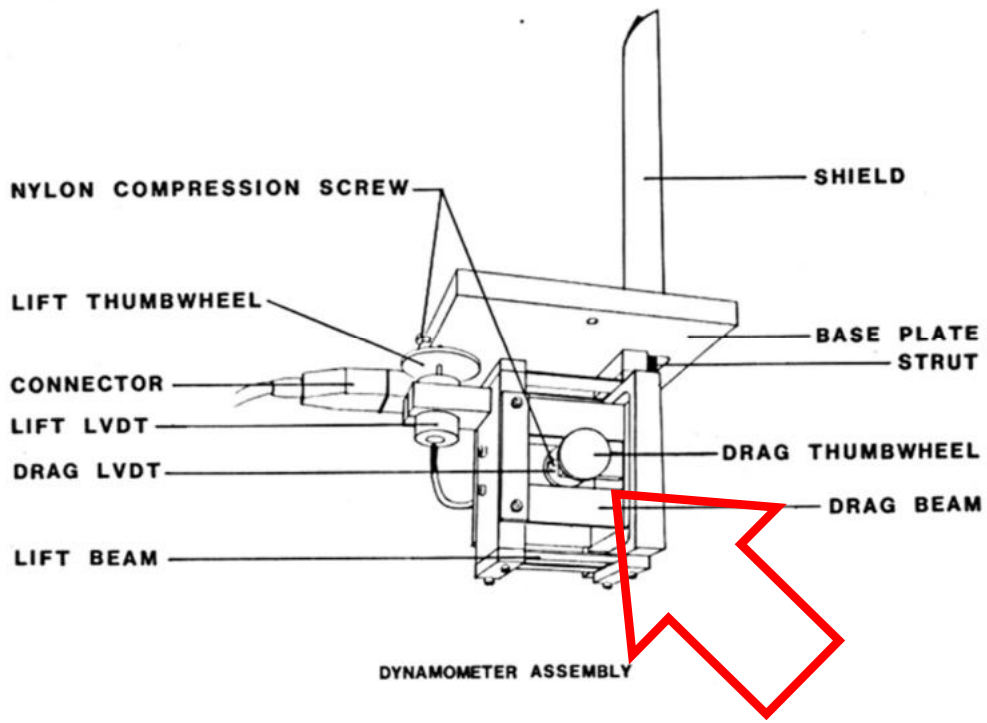

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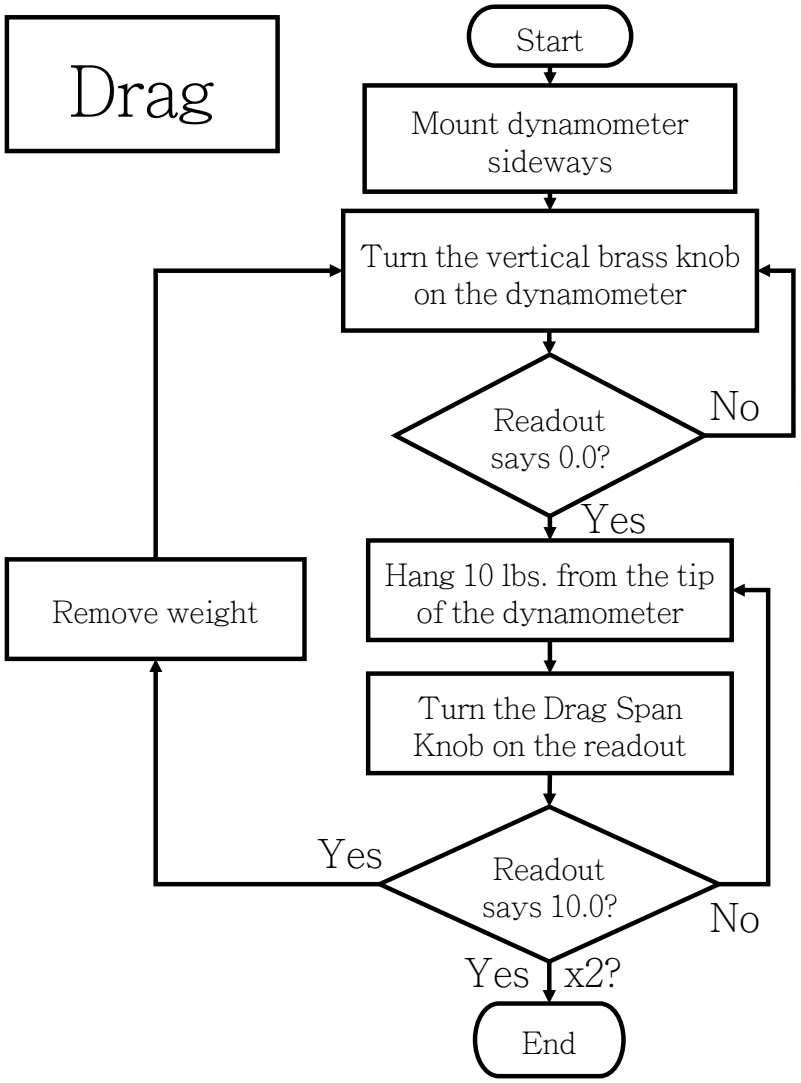

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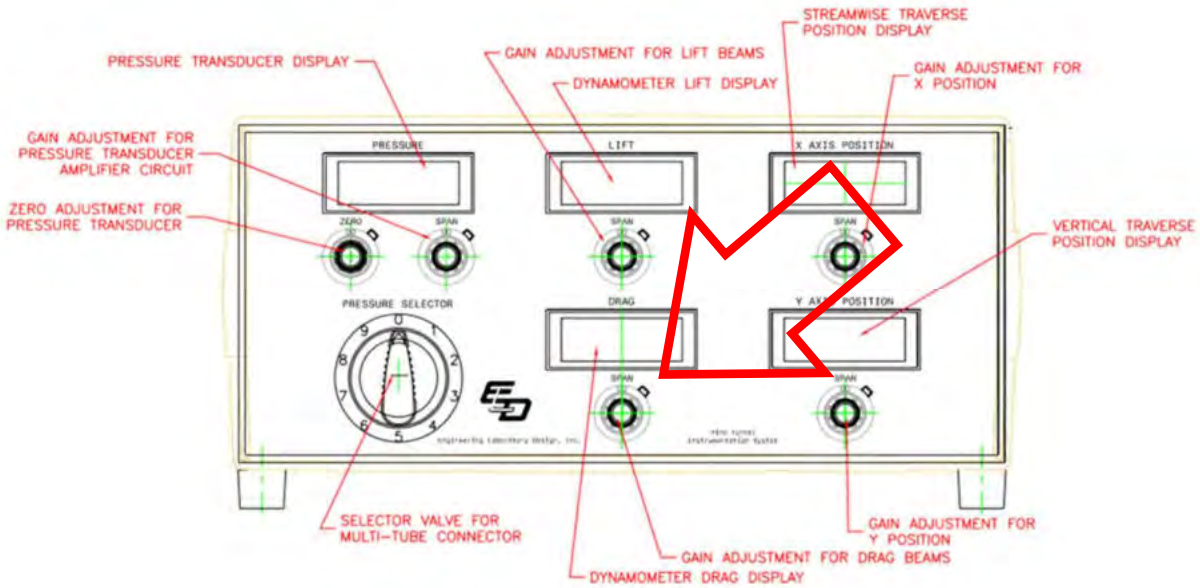

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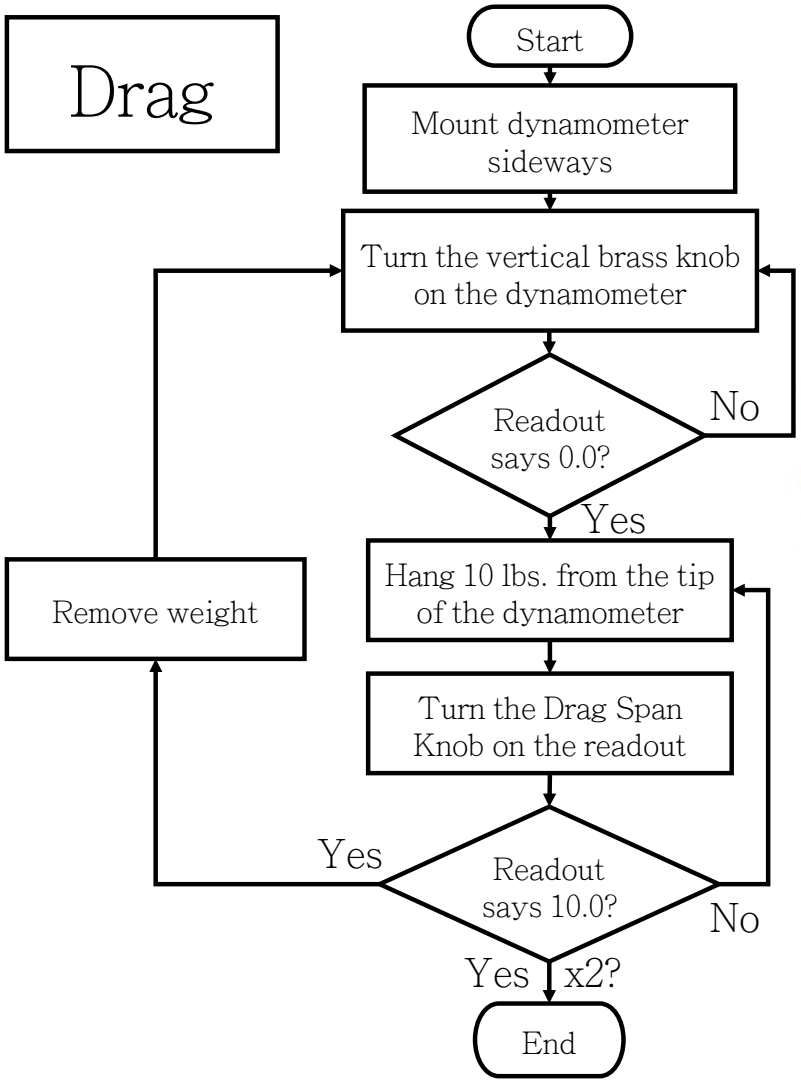

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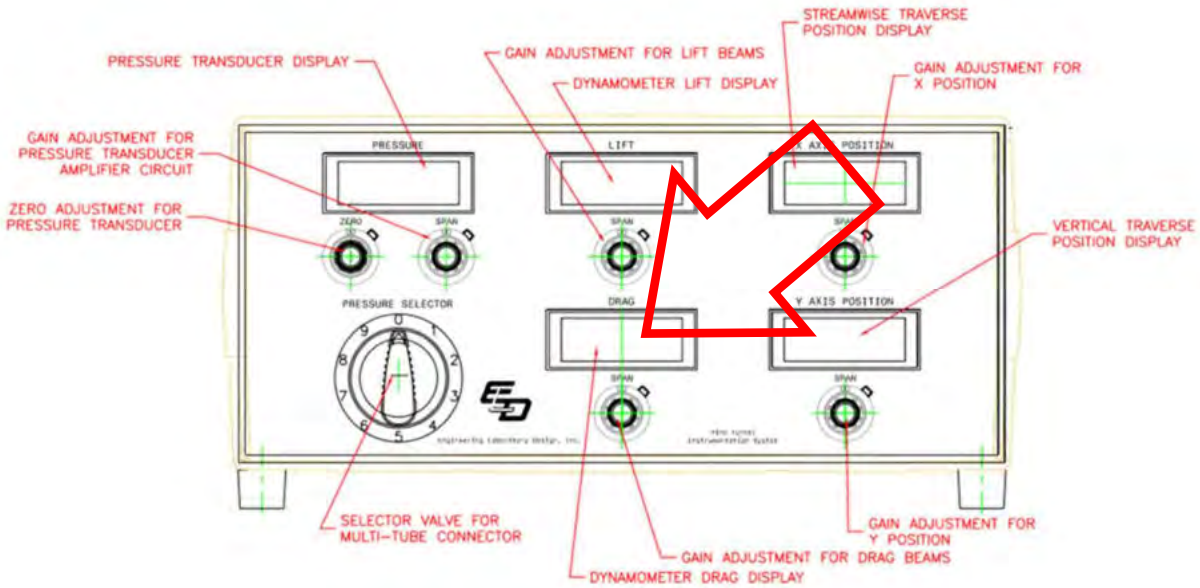

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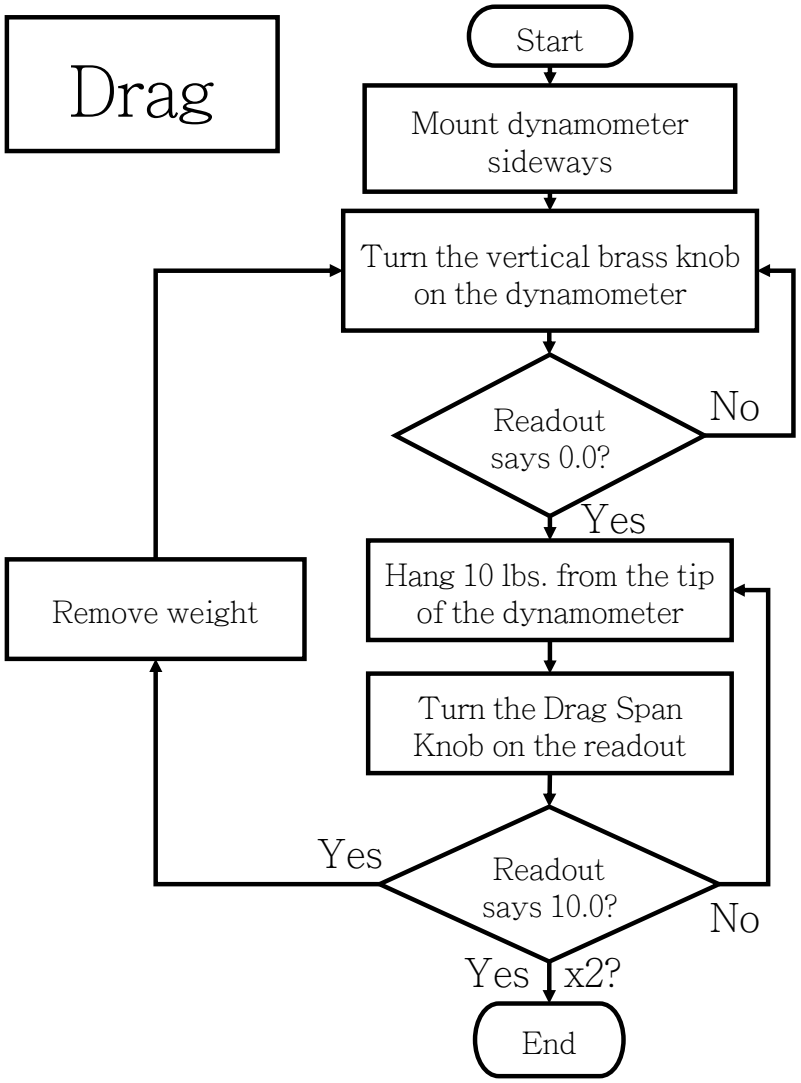

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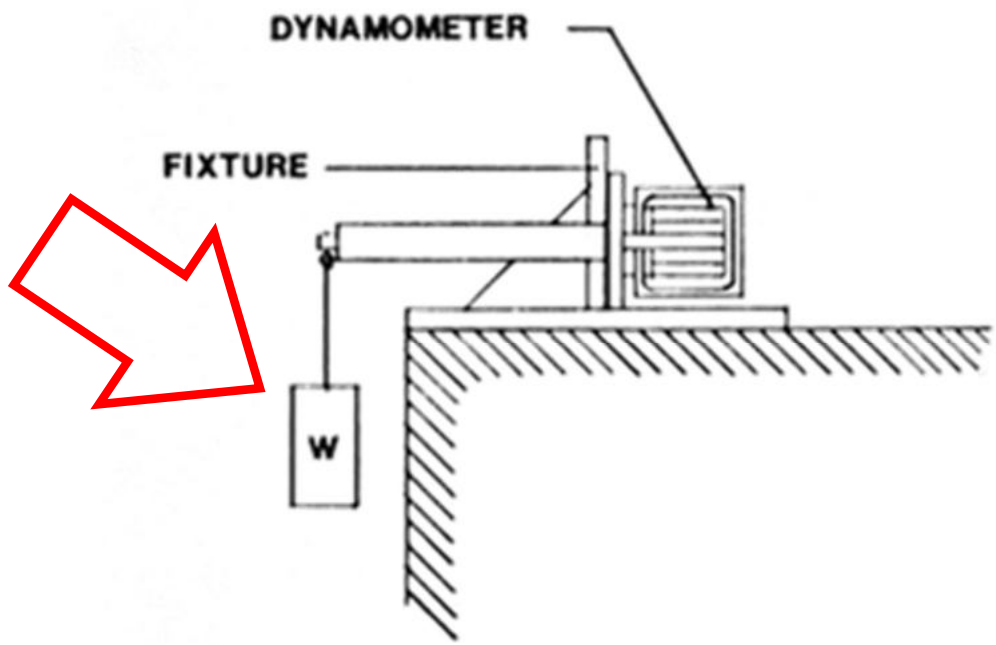
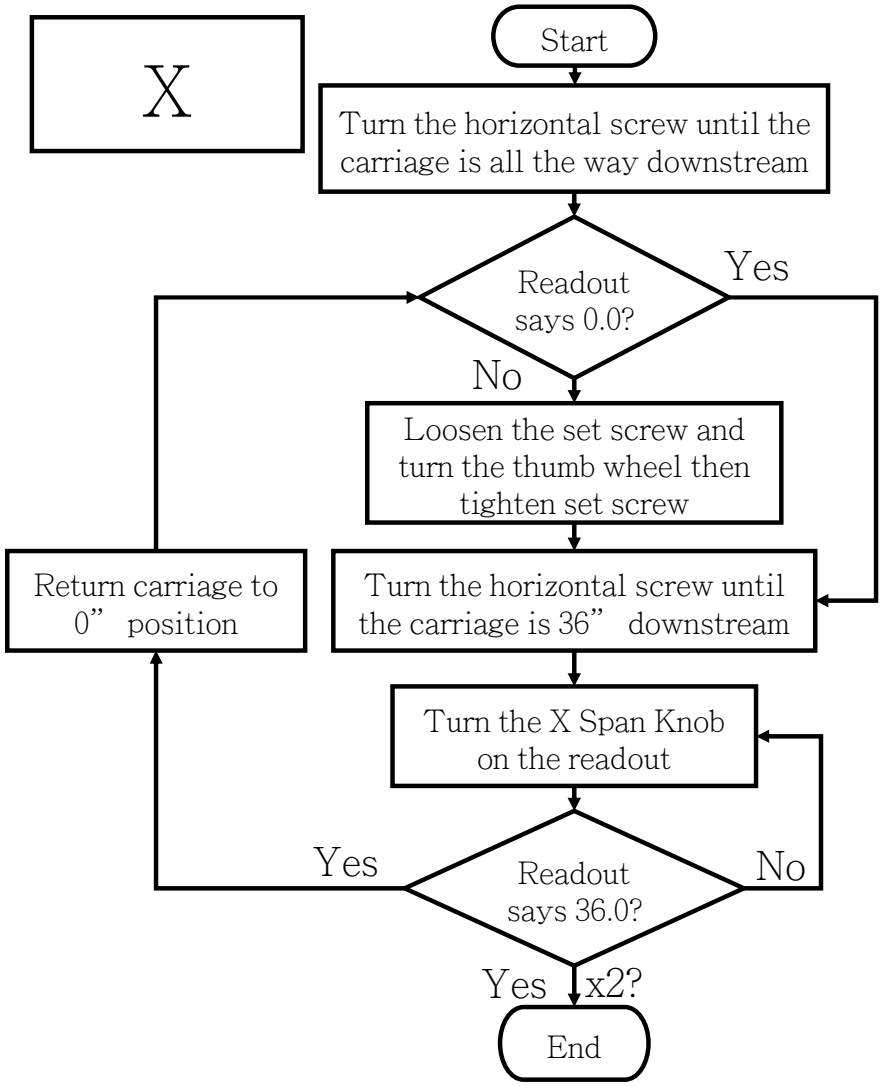


Remount the dynamometer in the test section of the wind tunnel.

After mounting a model, zero the readouts again by turning the brass knobs on the dynamometer.

Next



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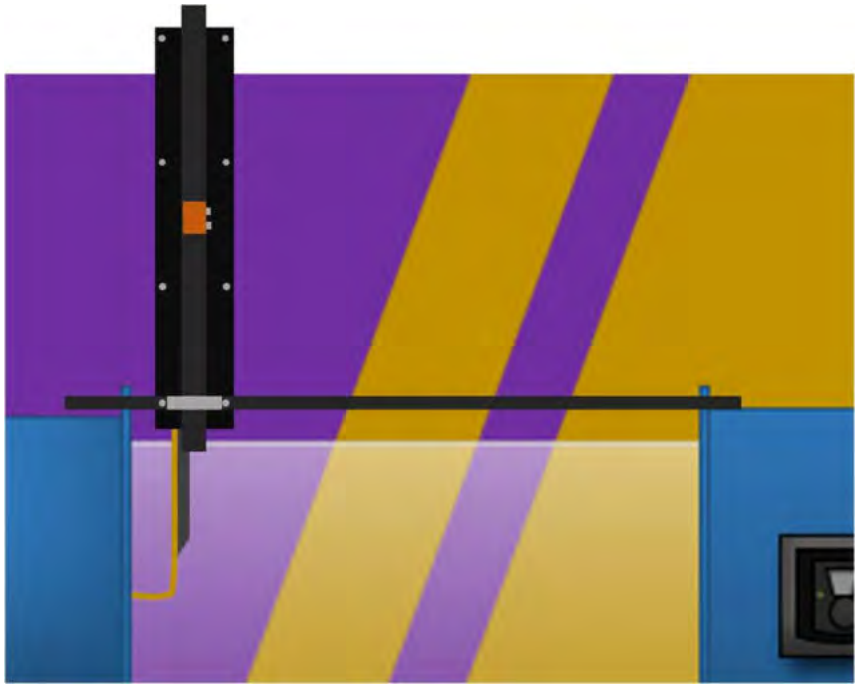

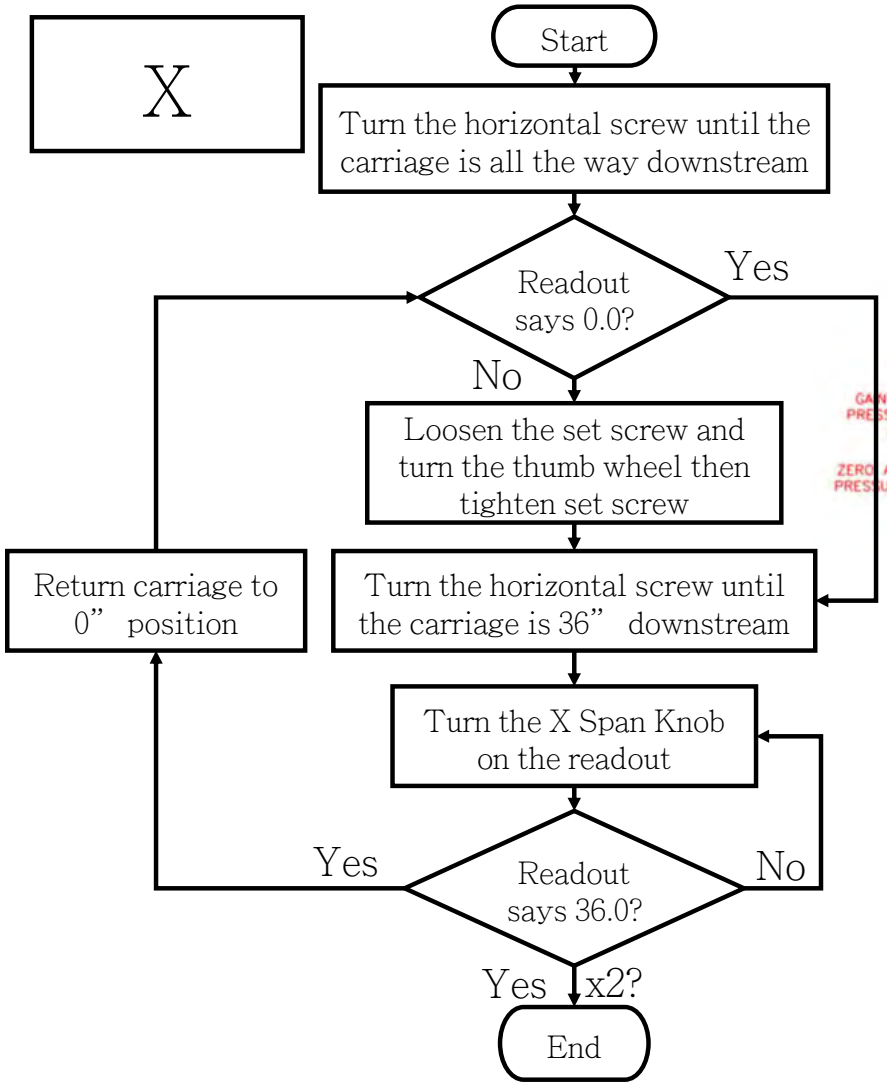

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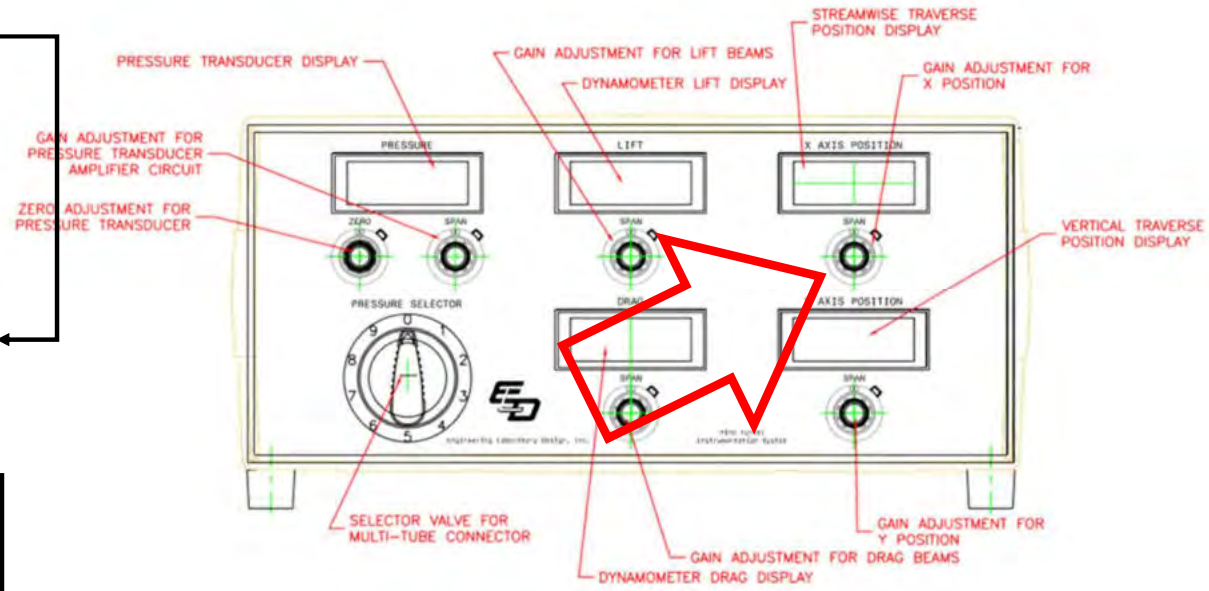

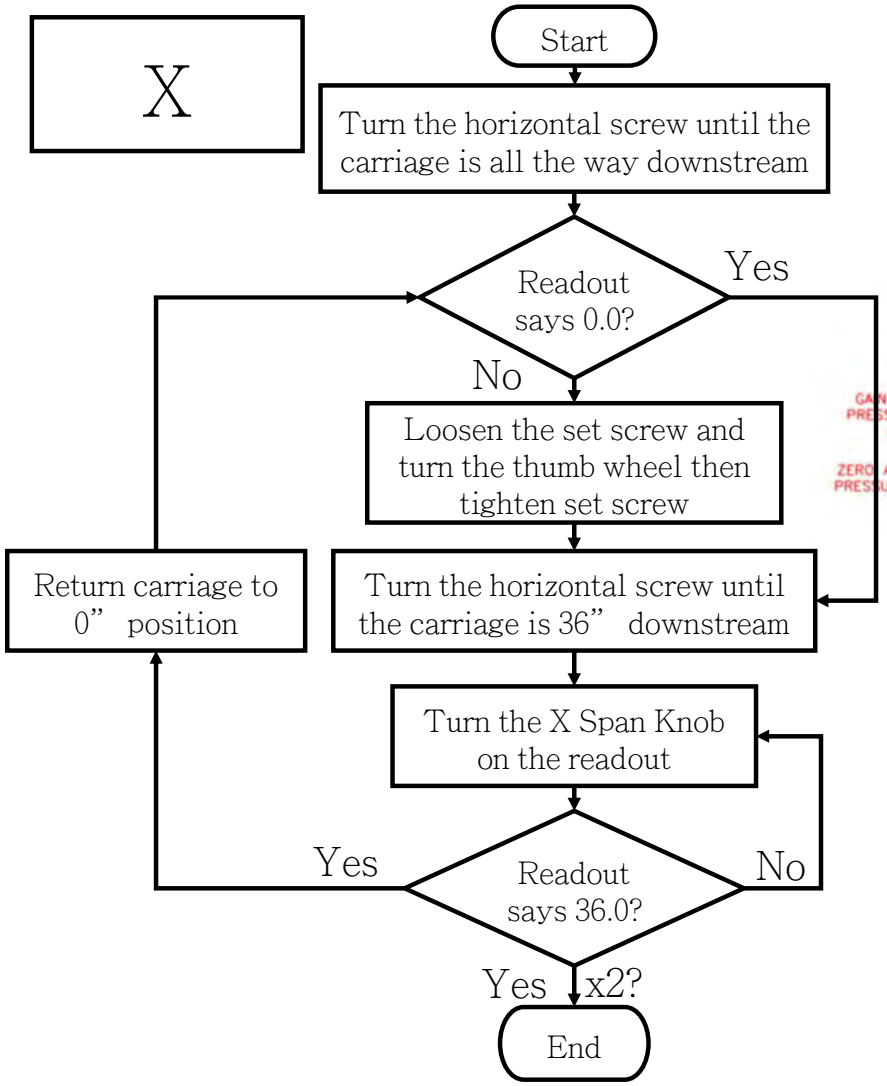

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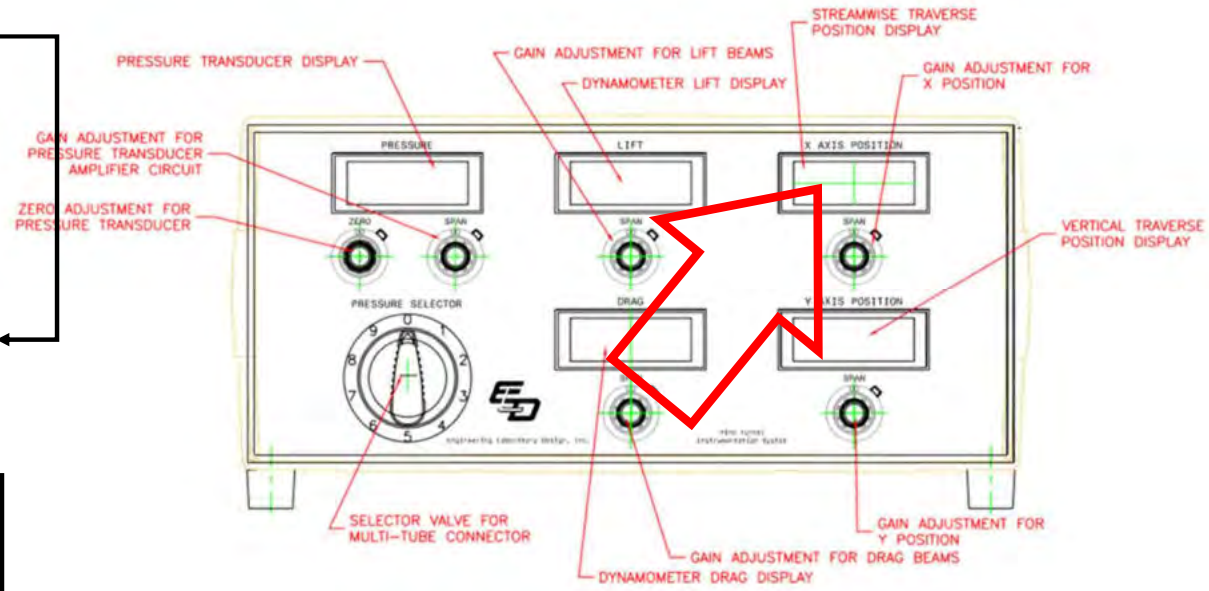

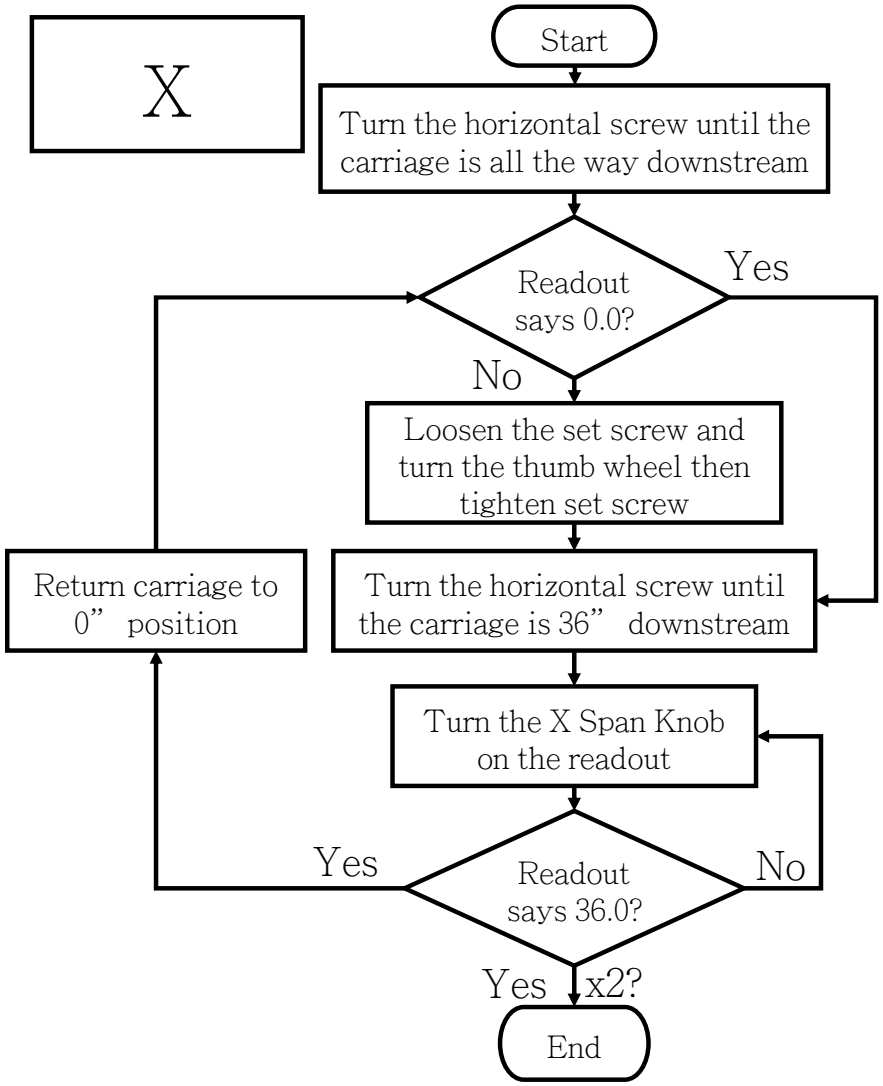

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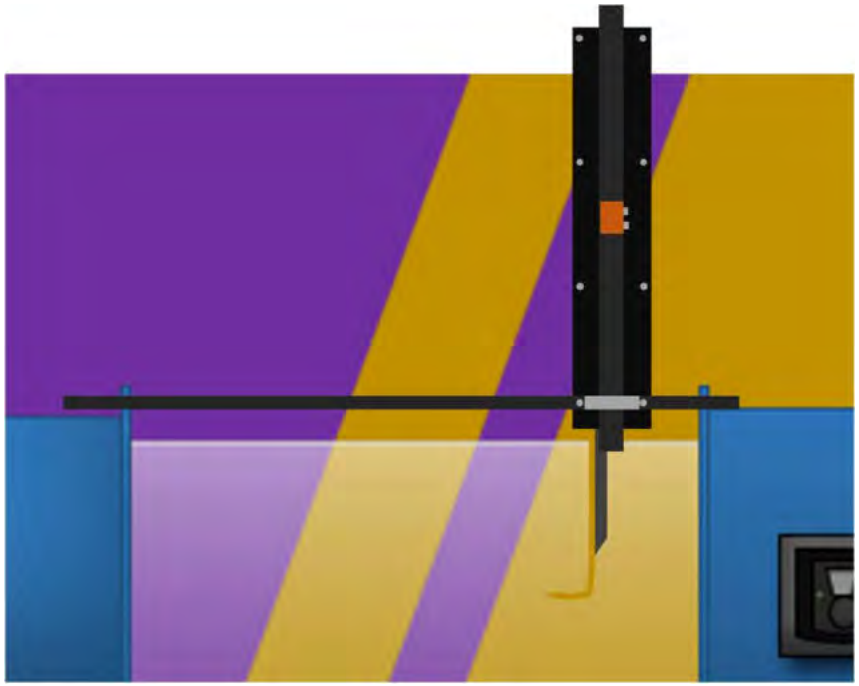
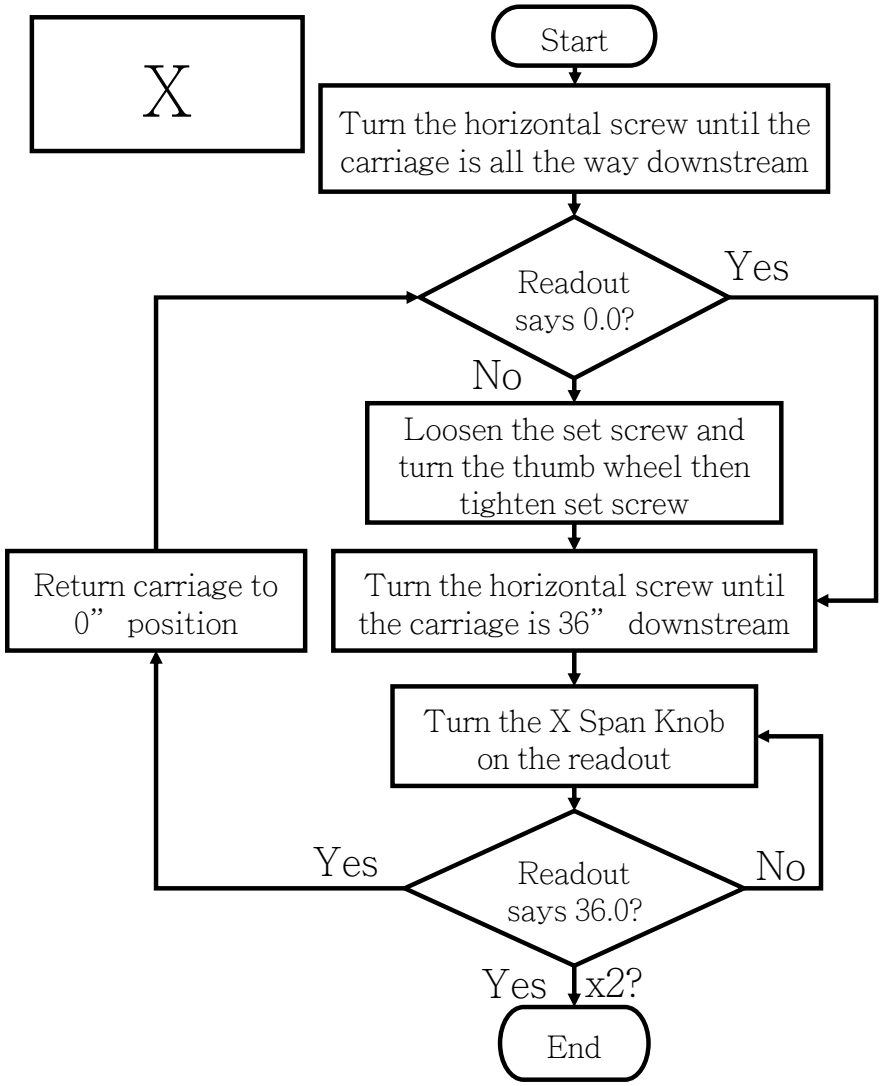
Click on ‘End’ to move on.





Click on the flowchart steps for additional information.
Click on 'End' to move on.

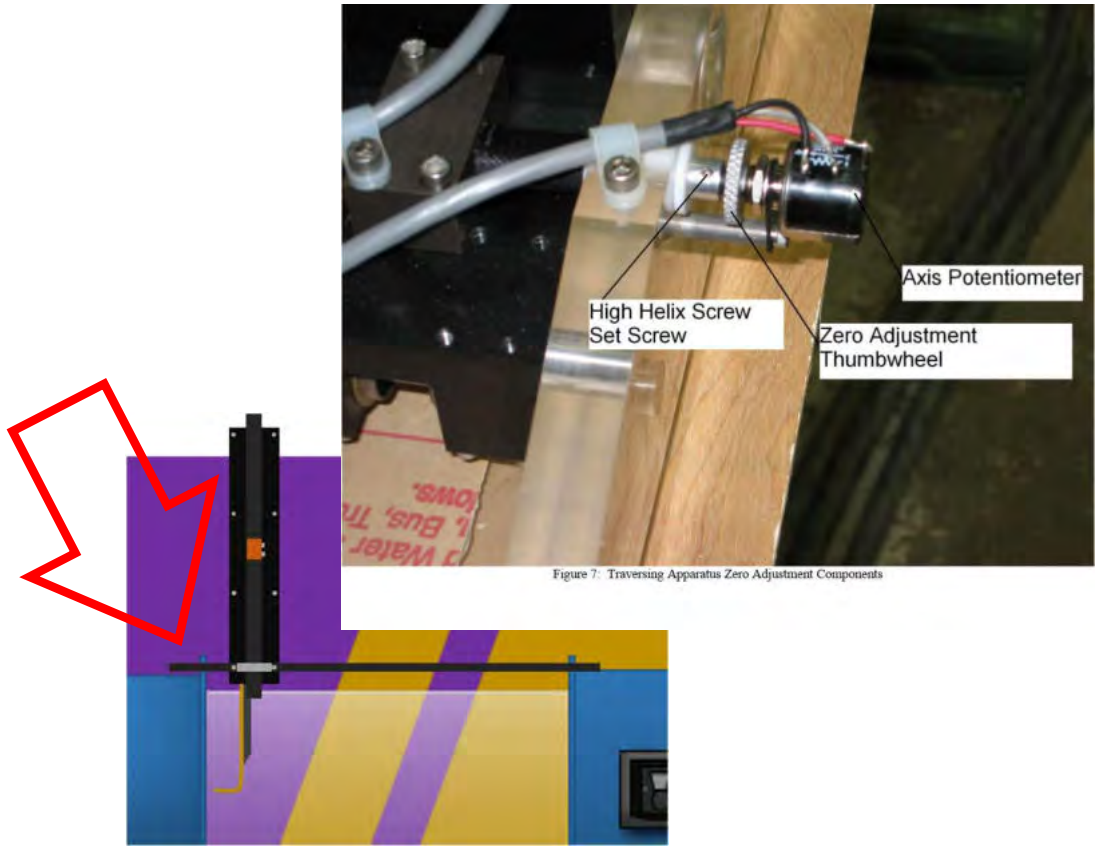
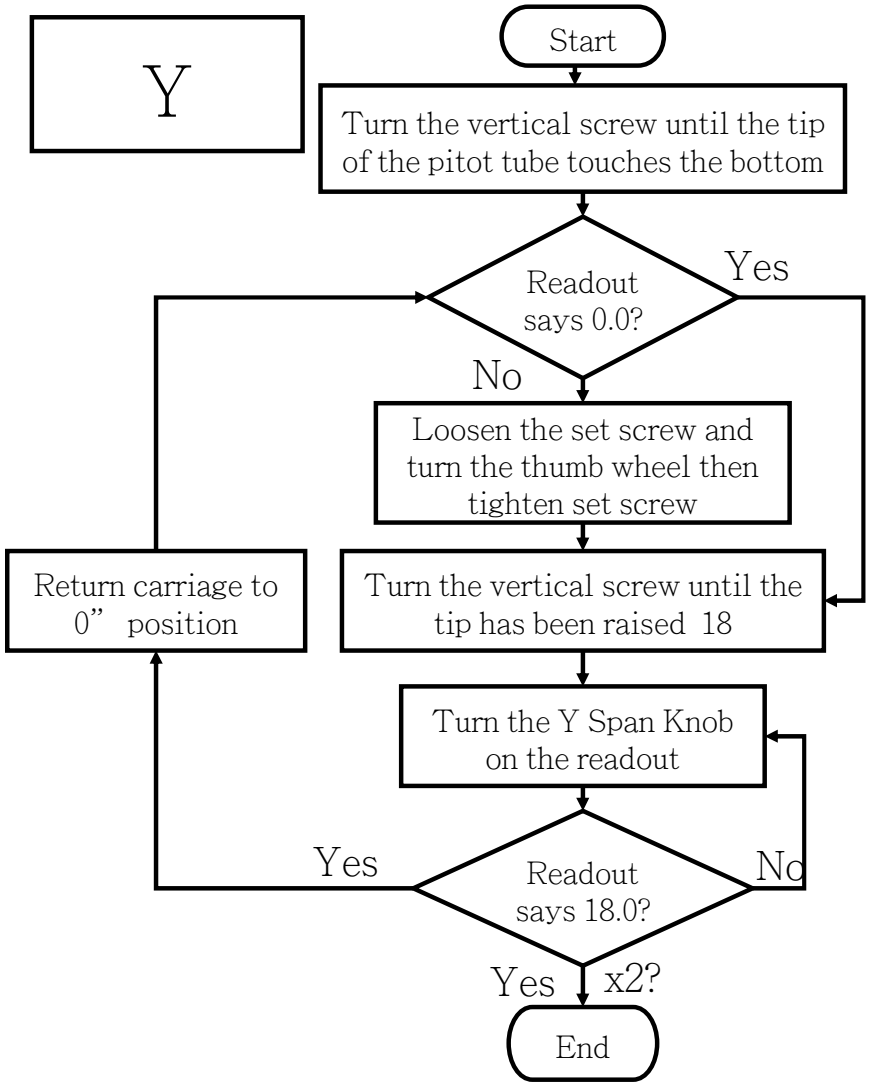
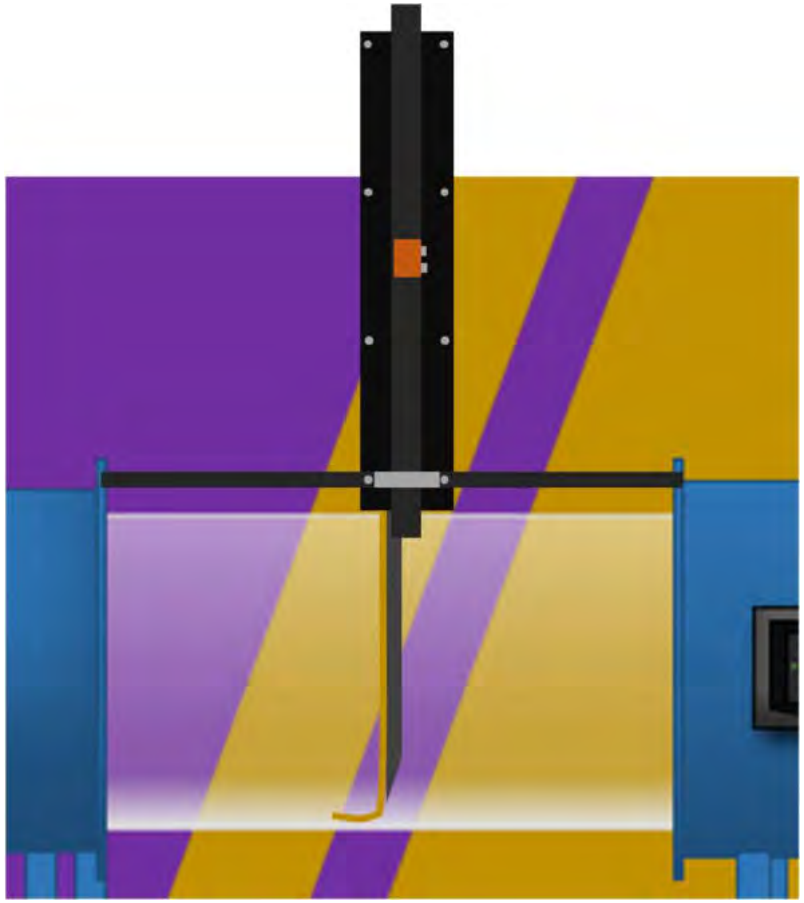
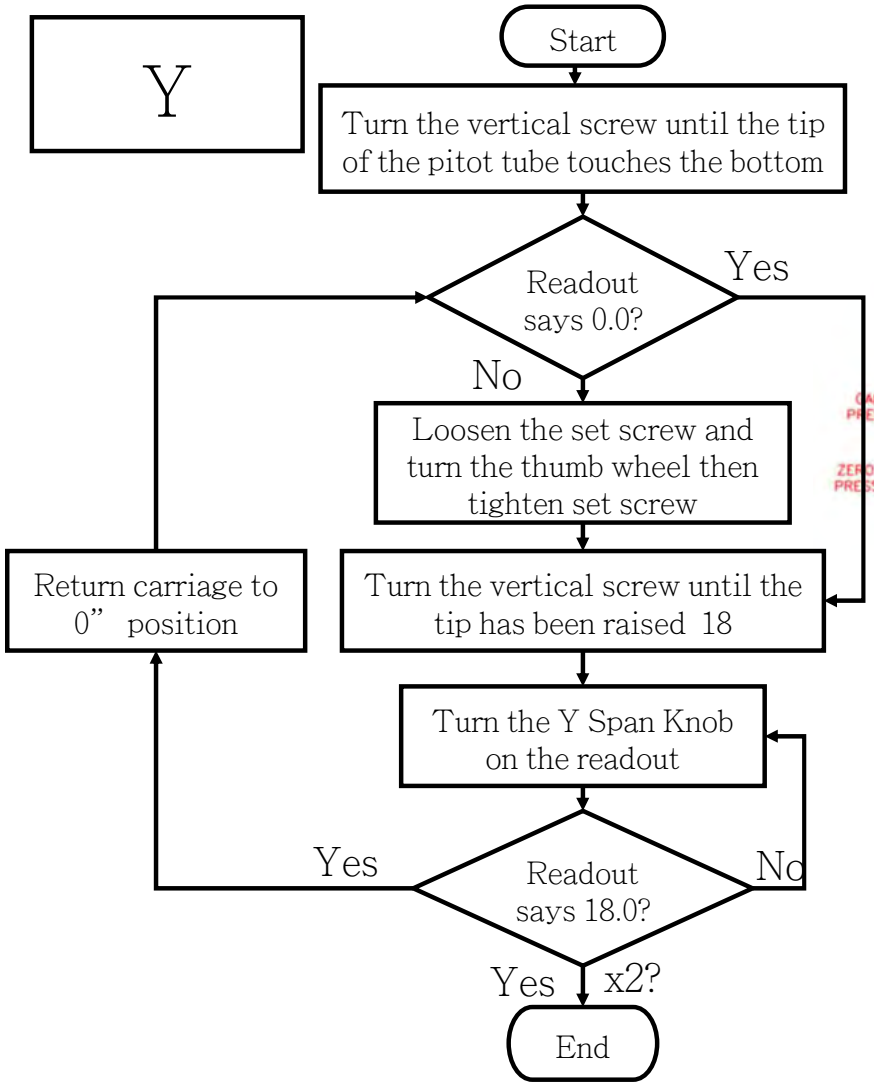


Figure 7: Traversing Apparatus Zero Adjustment Components

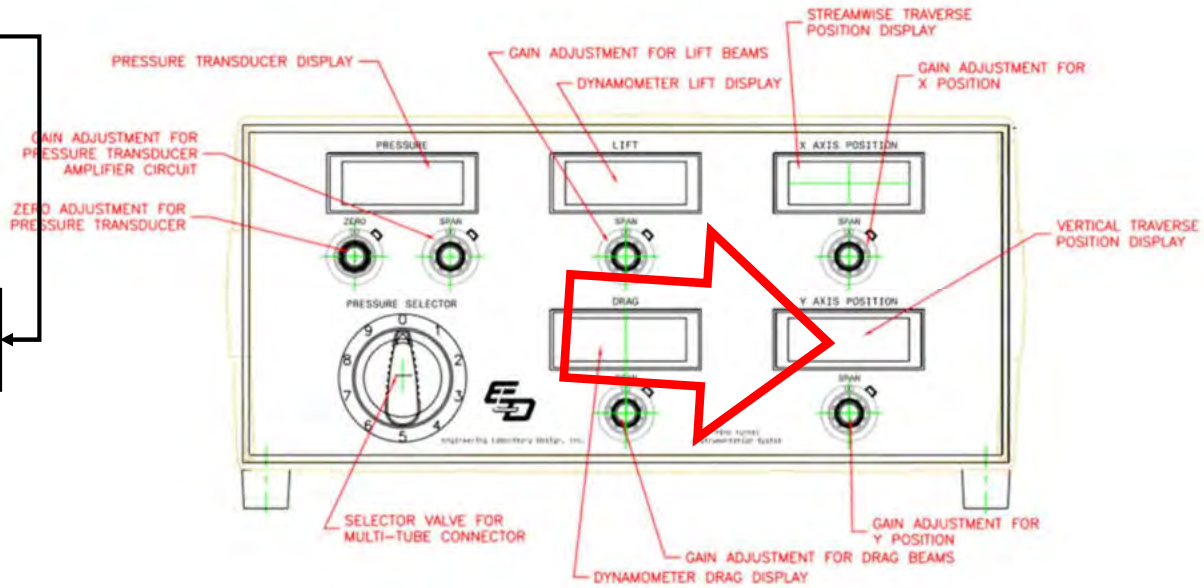


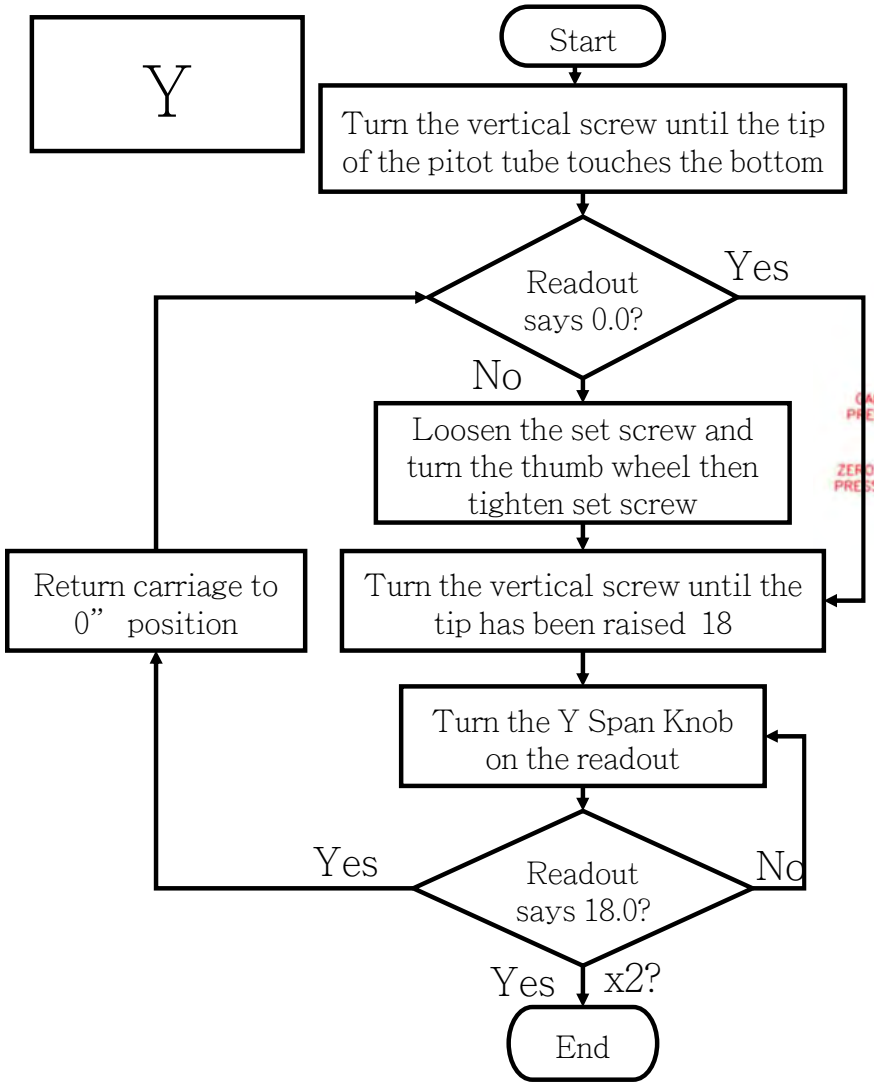
Click on the flowchart steps for additional information.
Click on ‘End’ to move on.



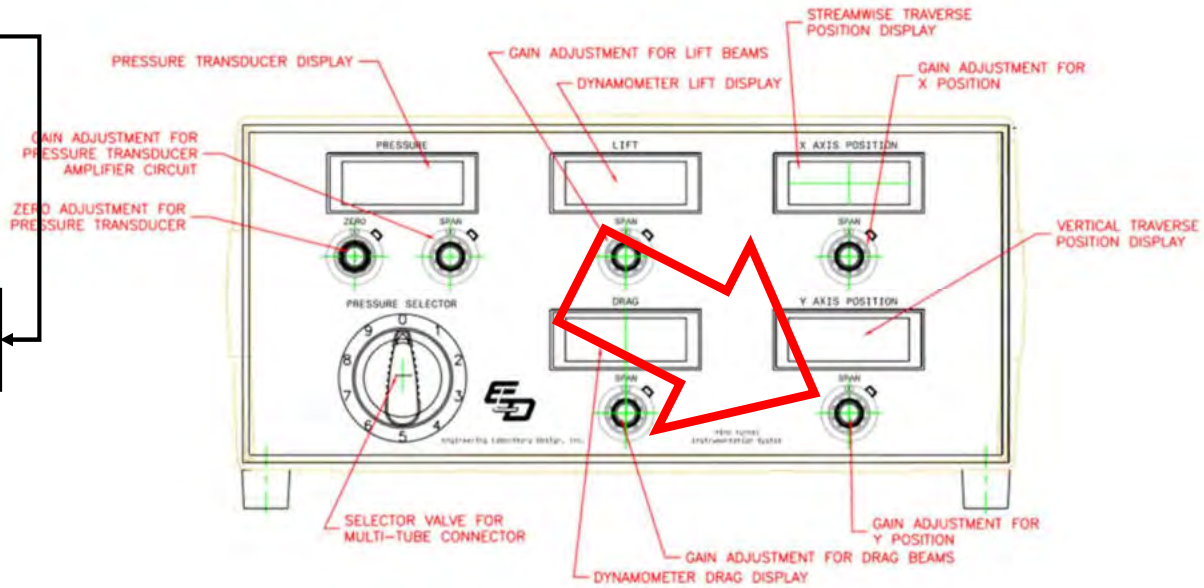


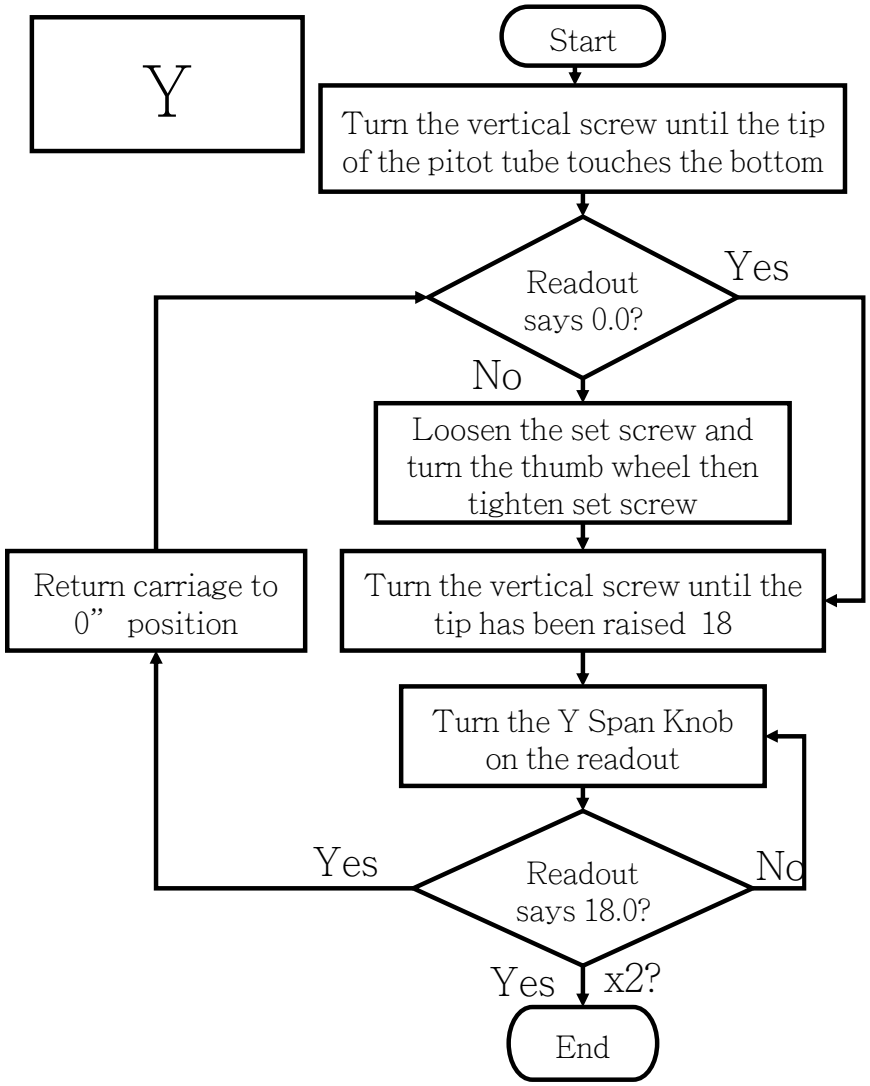
Click on the flowchart steps for additional information.
Click on 'End' to move on.



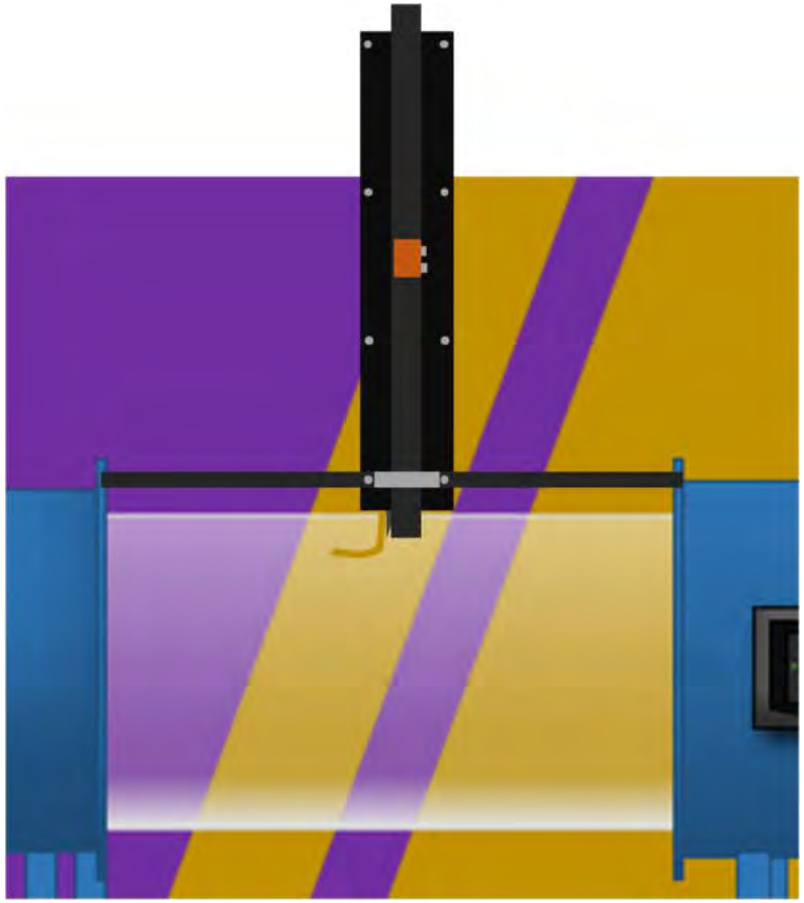


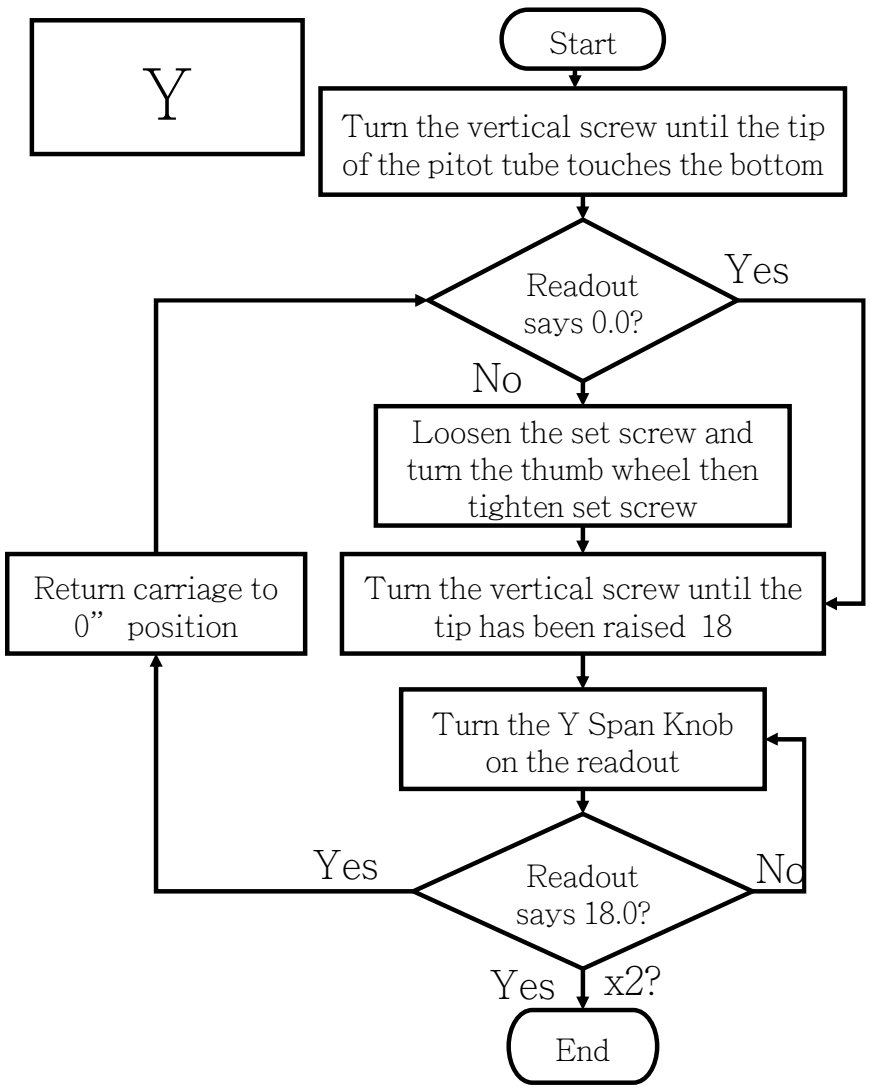
Click on the flowchart steps for additional information.
Click on 'End' to move on.





Click on the flowchart steps for additional information.
Click on ‘End’ to move on.





Click on the flowchart steps for additional information.
Click on 'End' to move on.

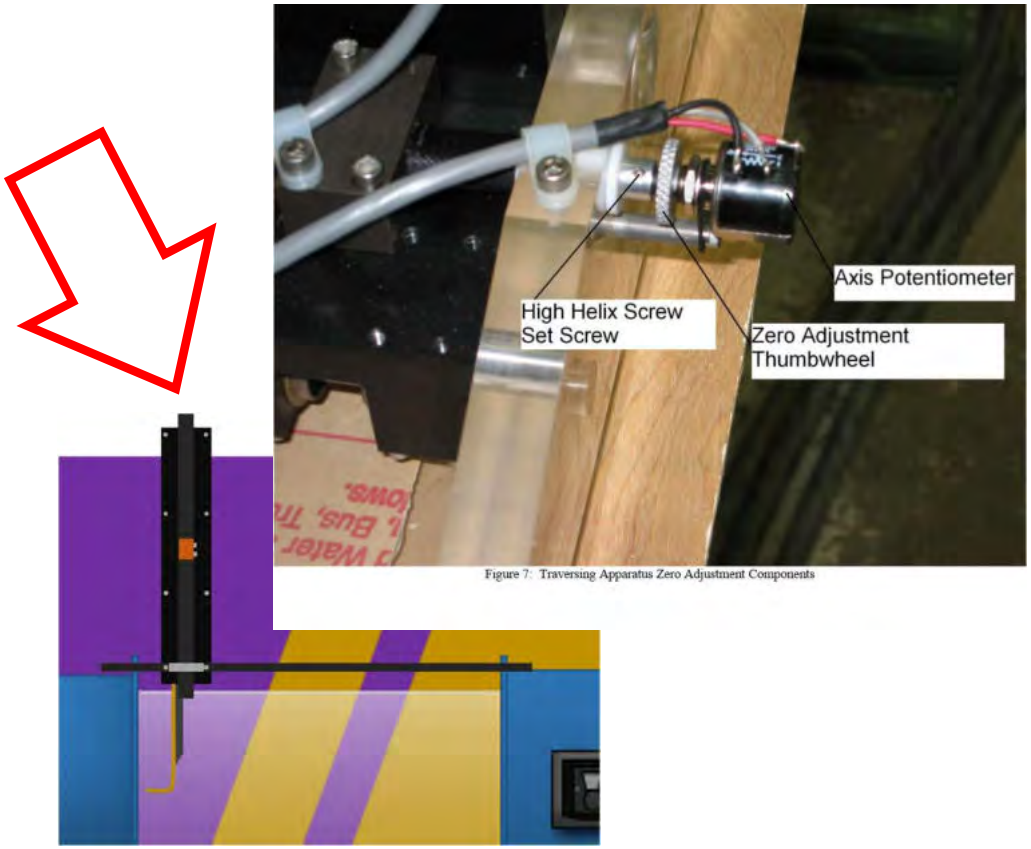
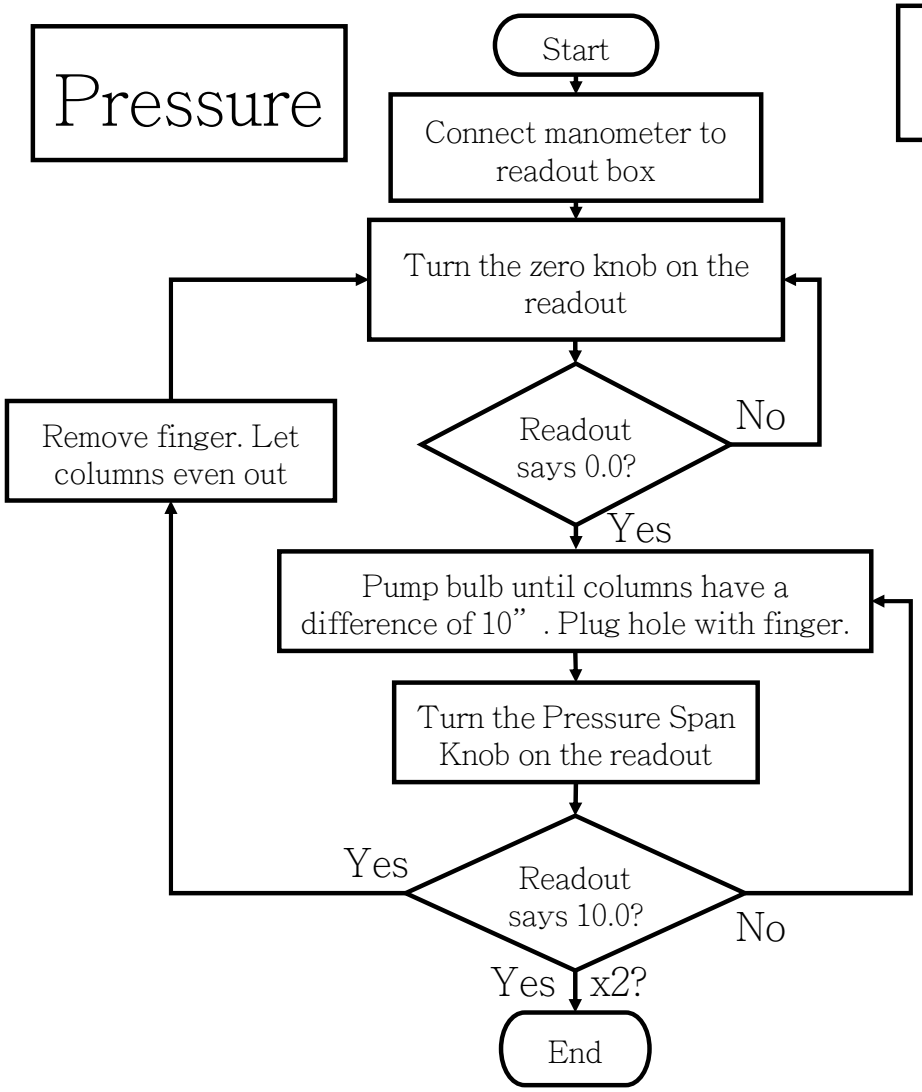
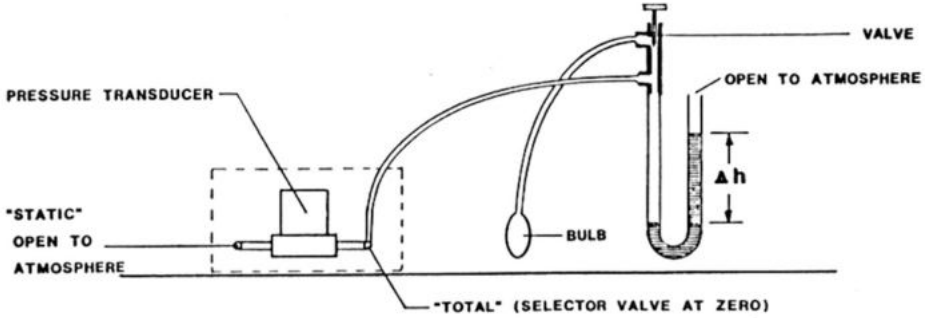


Figure 7: Traversing Apparatus Zero Adjustment Components

Pressure

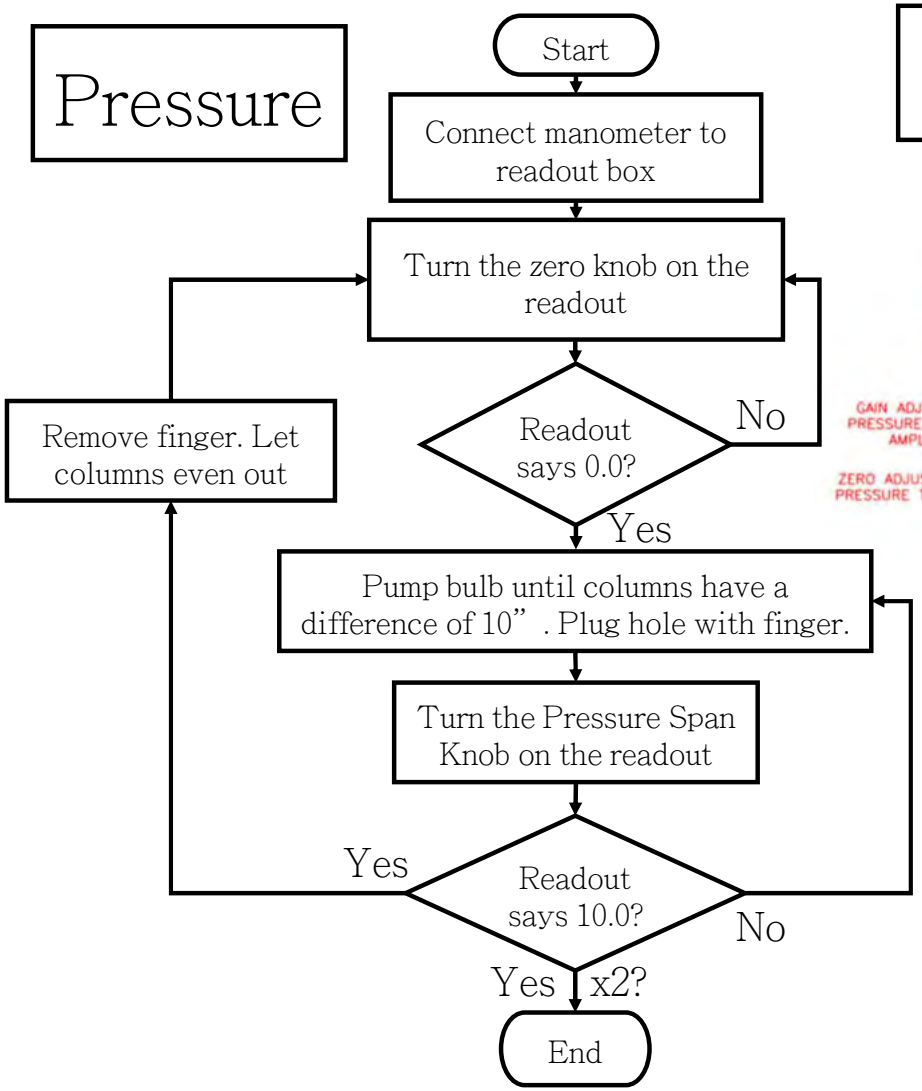


Click on the flowchart steps for additional information.
Click on ‘End’ to move on.

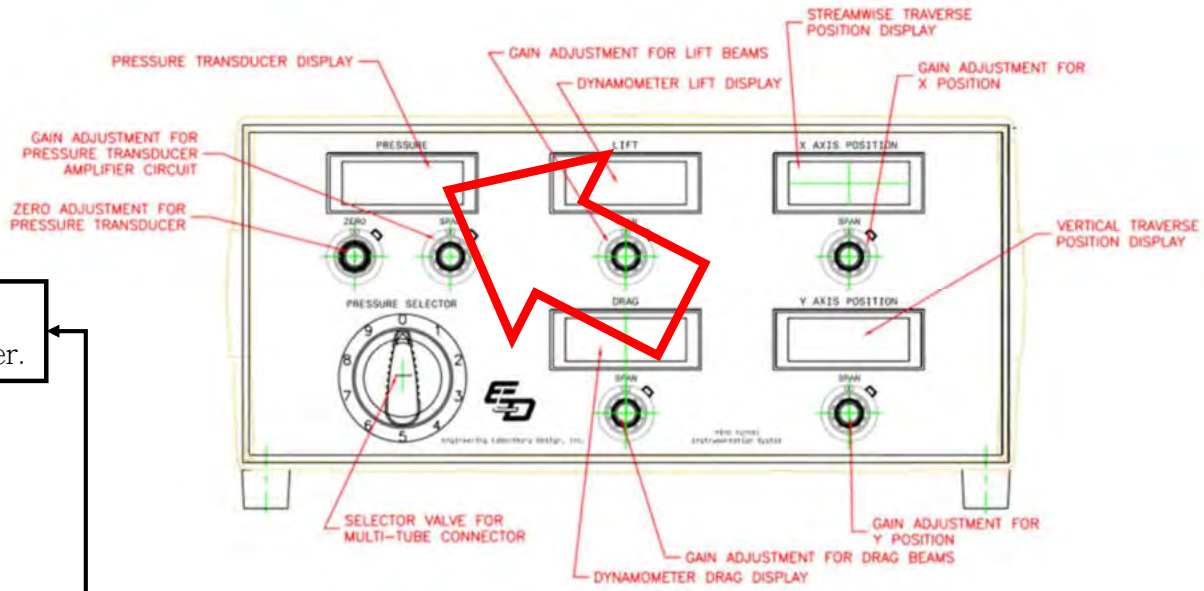


CALIBRATION ARRANGEMENT

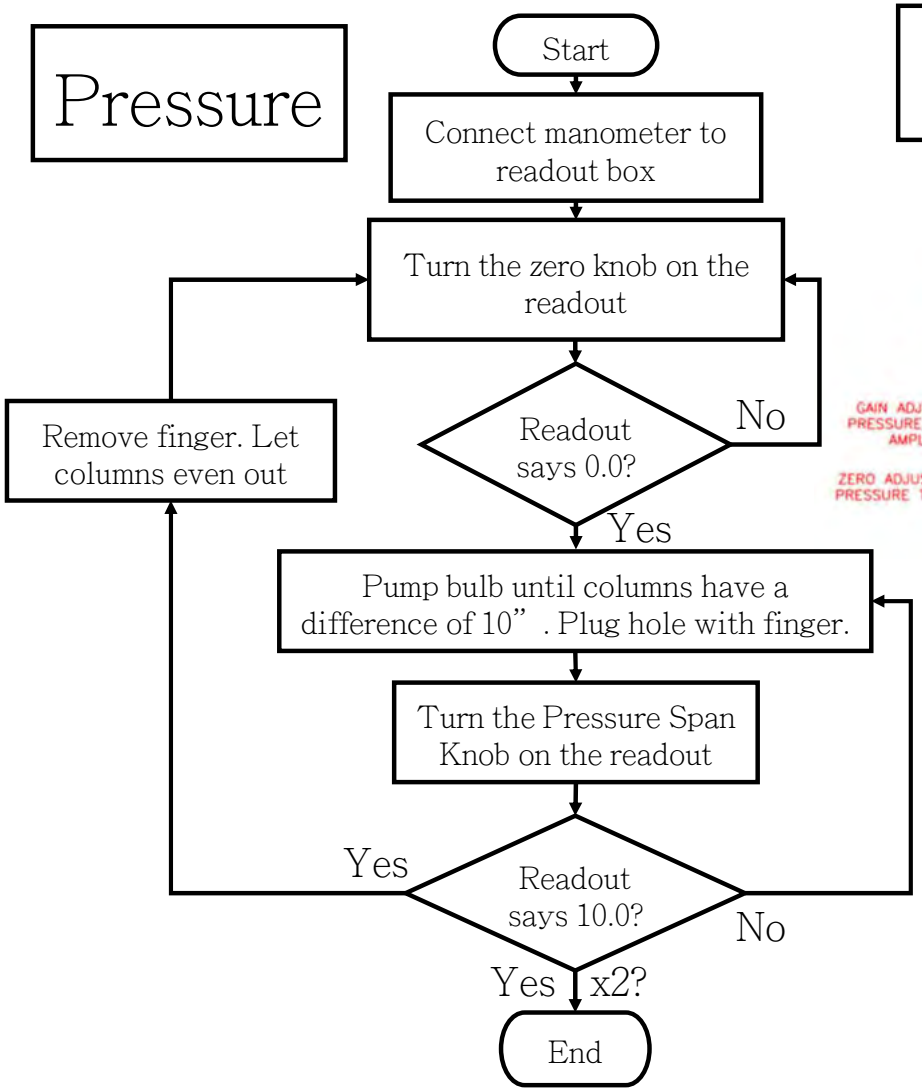
Pressure



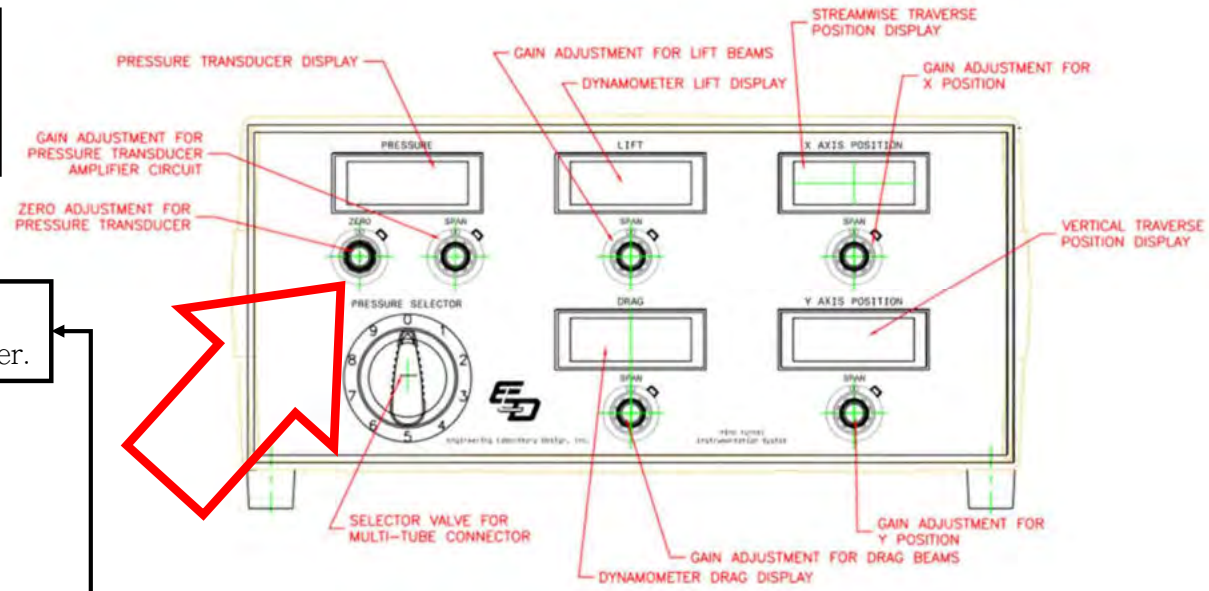
Click on the flowchart steps for additional information.
Click on ‘End’ to move on.



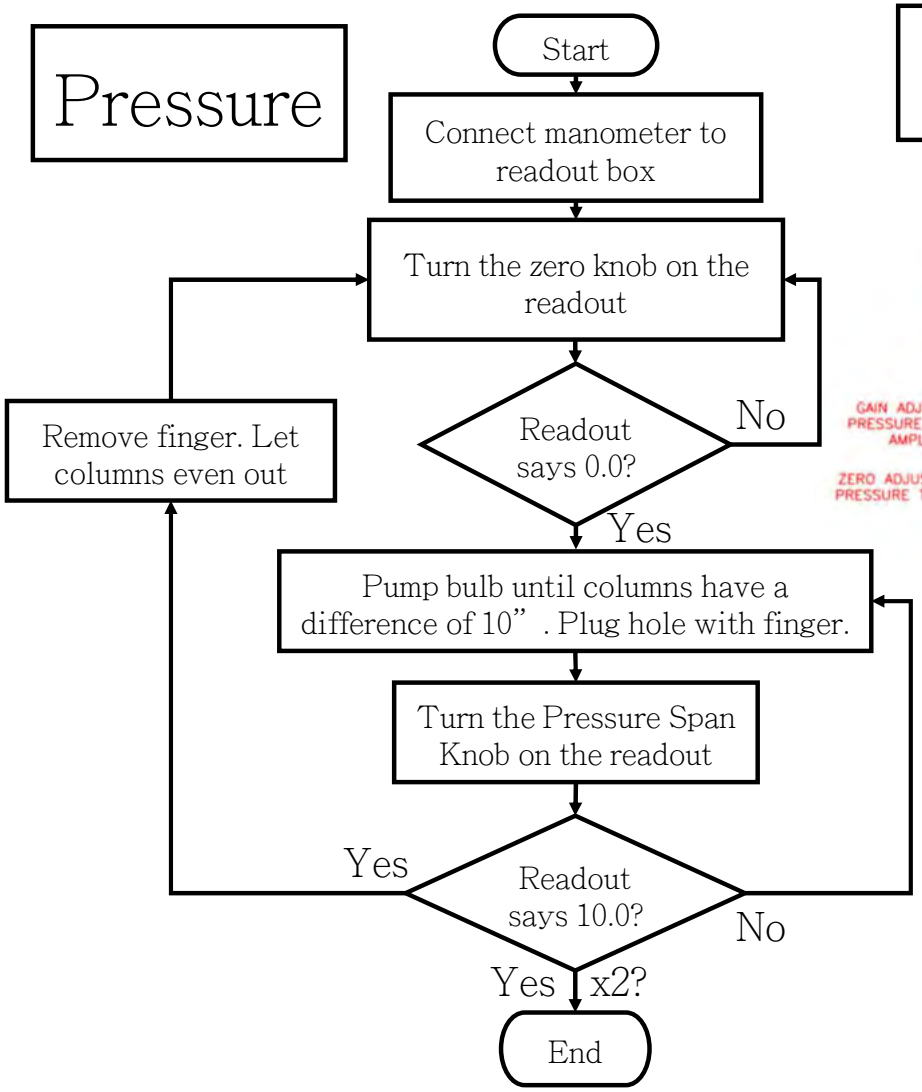
Pressure



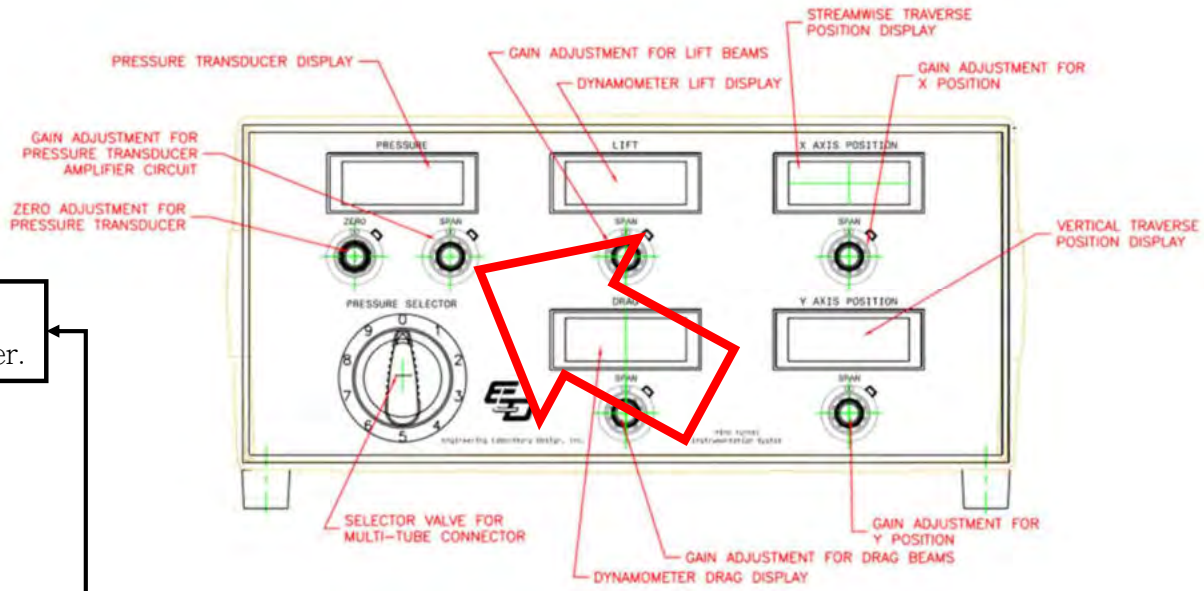
Click on the flowchart steps for additional information.
Click on ‘End’ to move on.



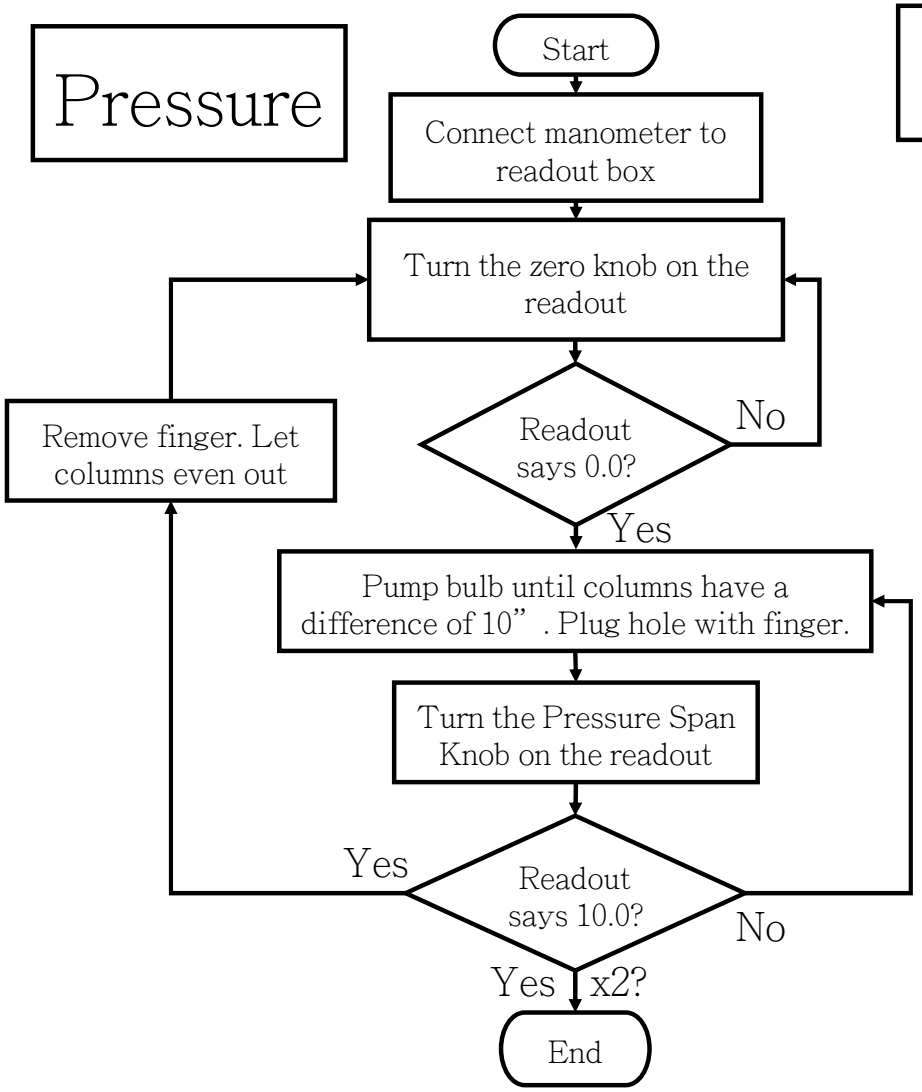
Pressure



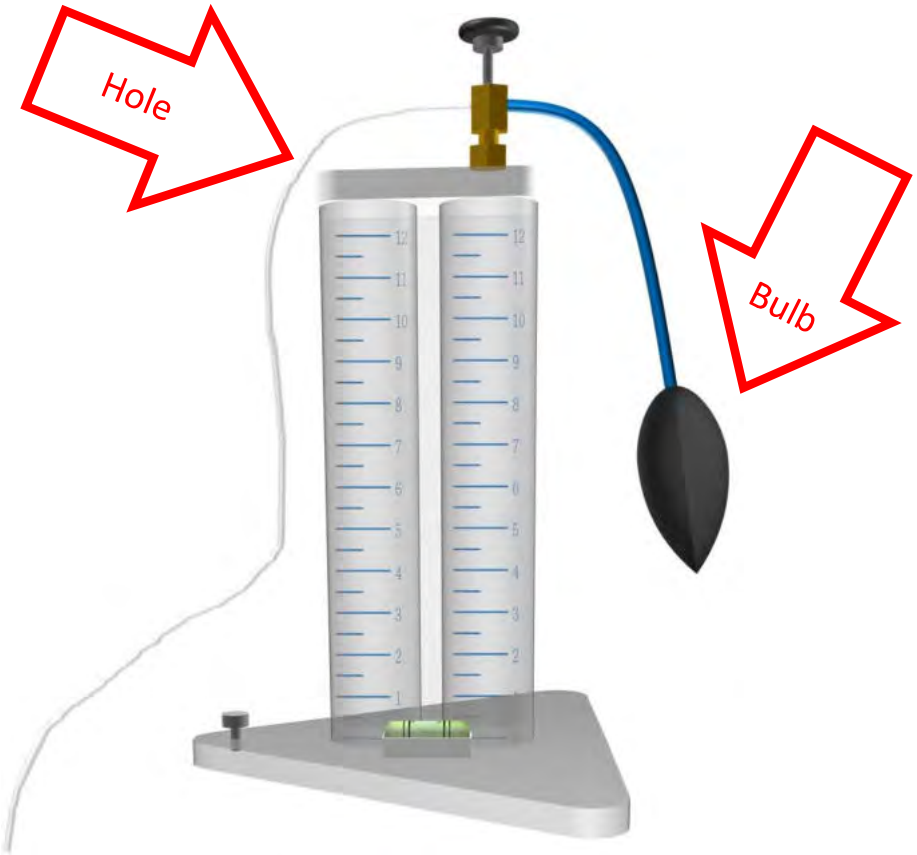
Click on the flowchart steps for additional information.
Click on ‘End’ to move on.



Pressure



Click on the flowchart steps for additional information.
Click on ‘End’ to move on.

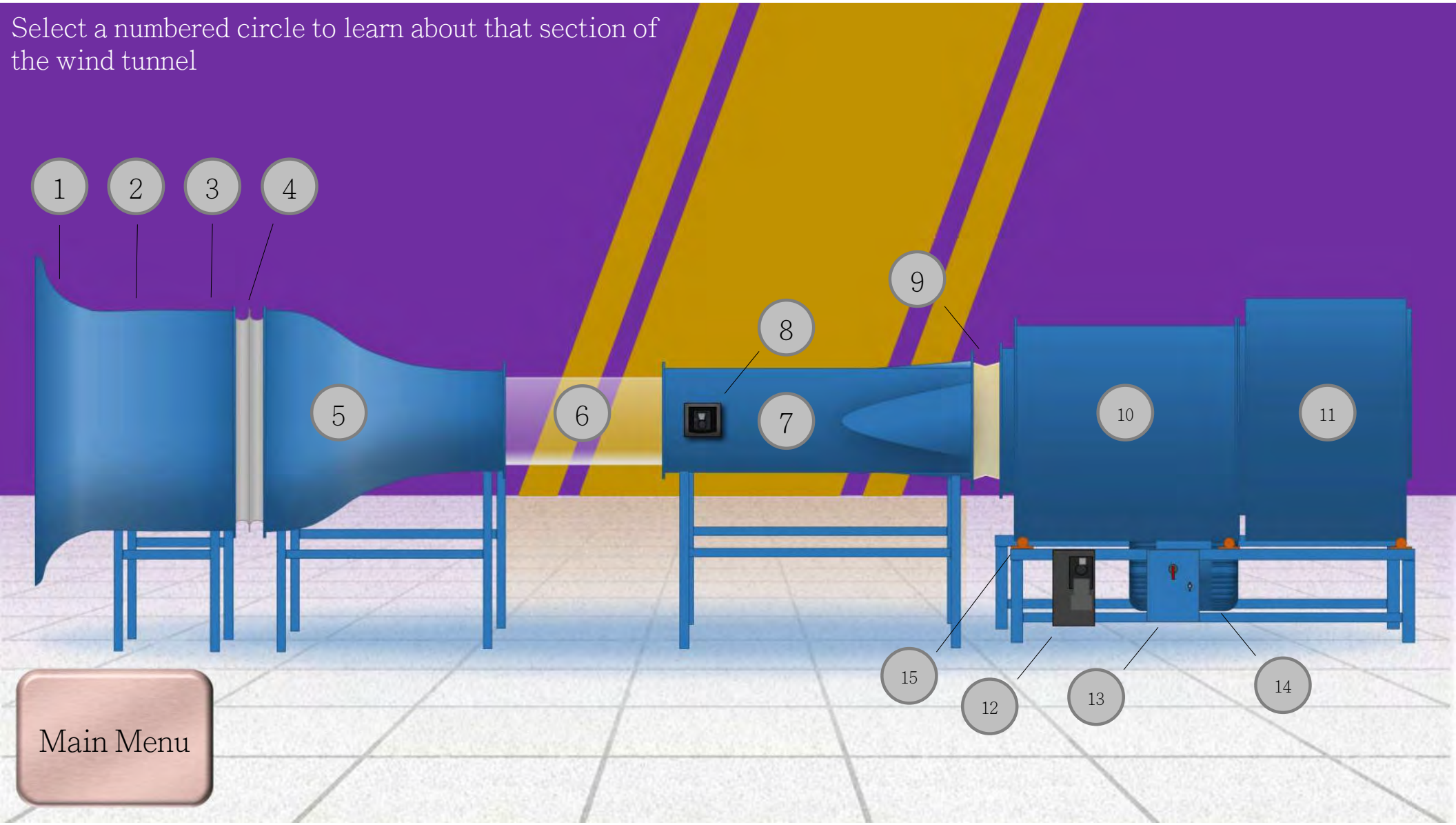


Return the pressure hosing to its original state.

Calibration is now complete.

Main Menu

Parts of Tunnel


Select a numbered circle to learn about that section of the wind tunnel
1
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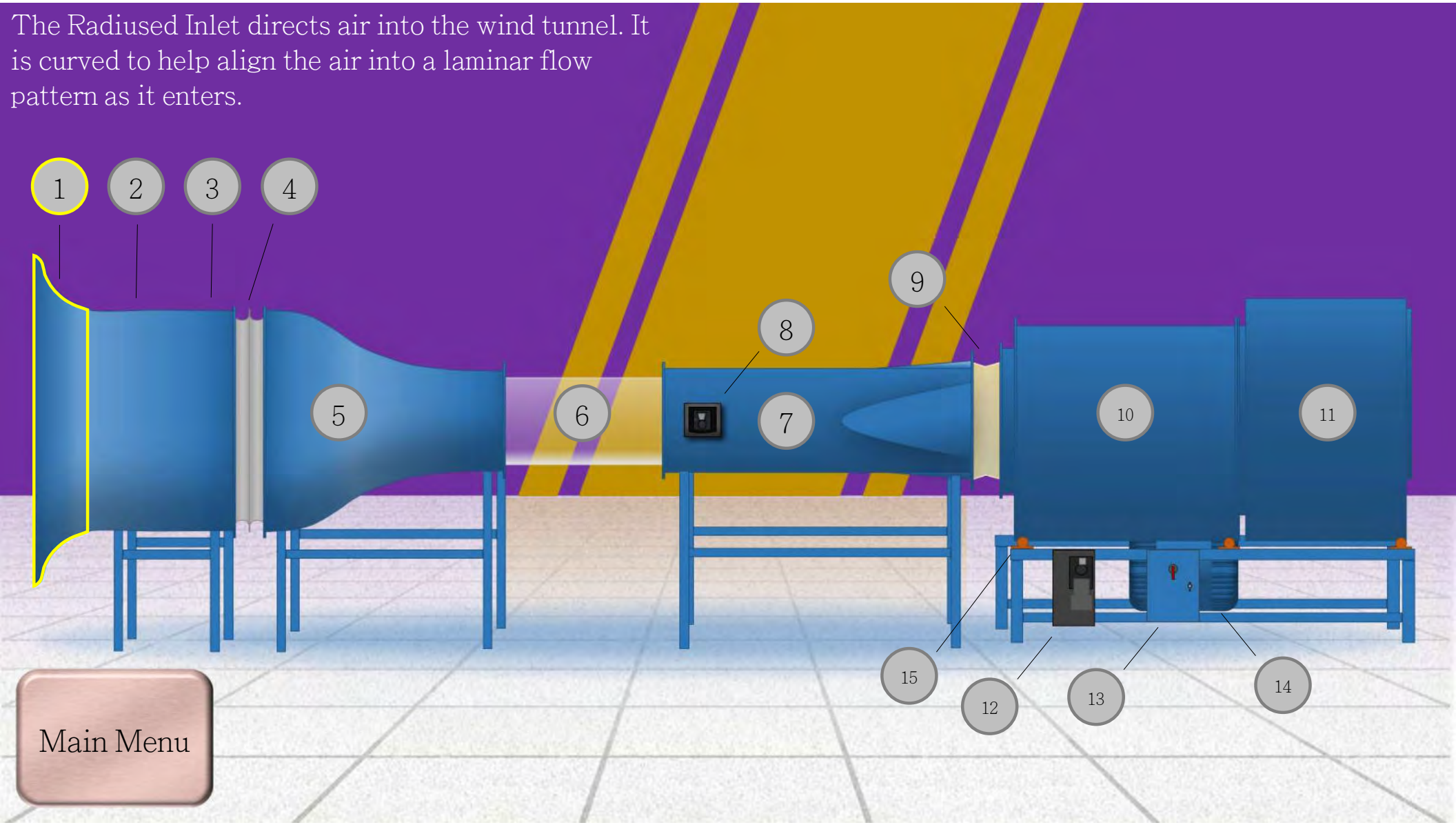
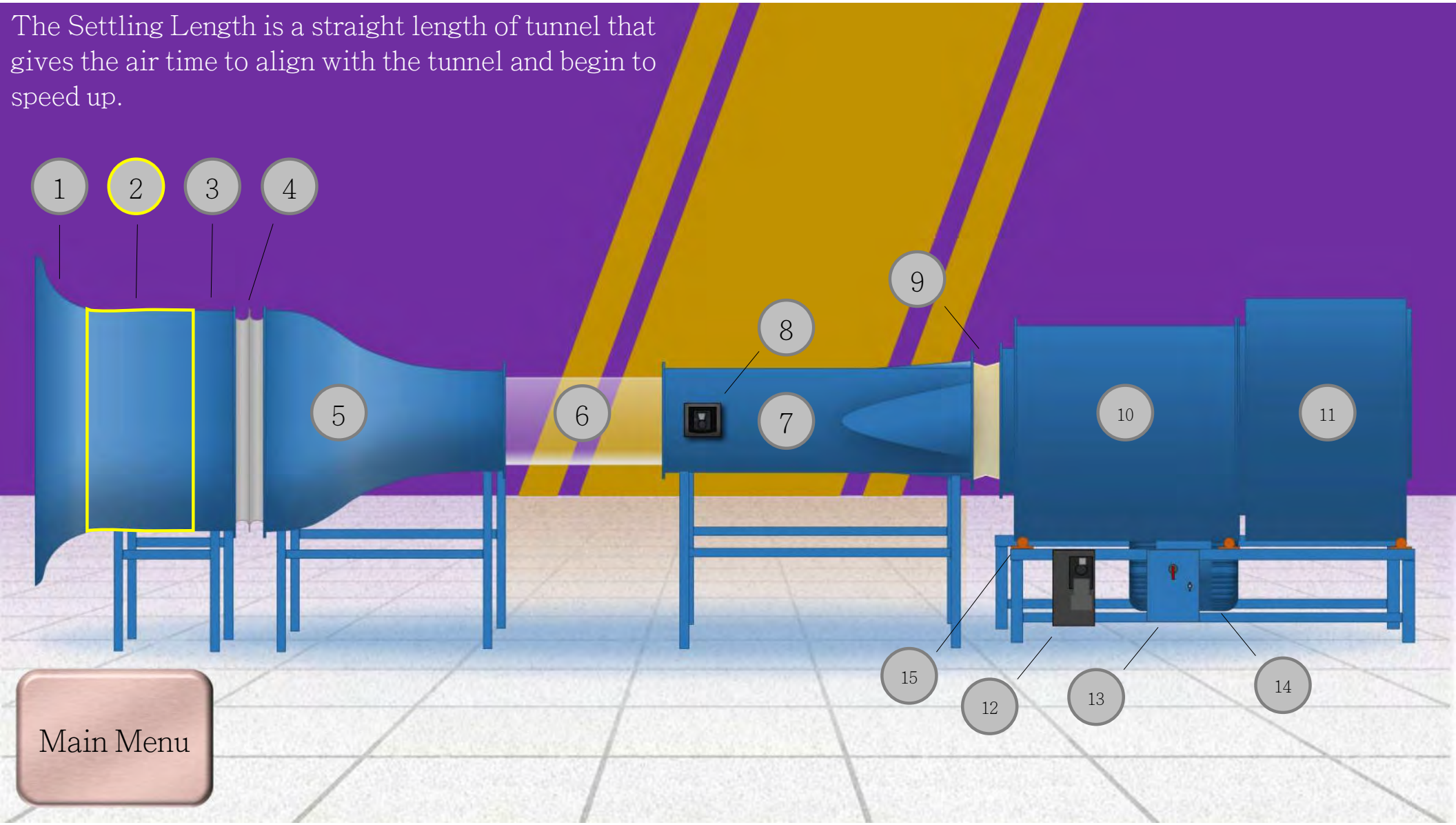
15
Main Menu

The Radiused Inlet directs air into the wind tunnel. It is curved to help align the air into a laminar flow pattern as it enters.



Main Menu


The Settling Length is a straight length of tunnel that gives the air time to align with the tunnel and begin to speed up.
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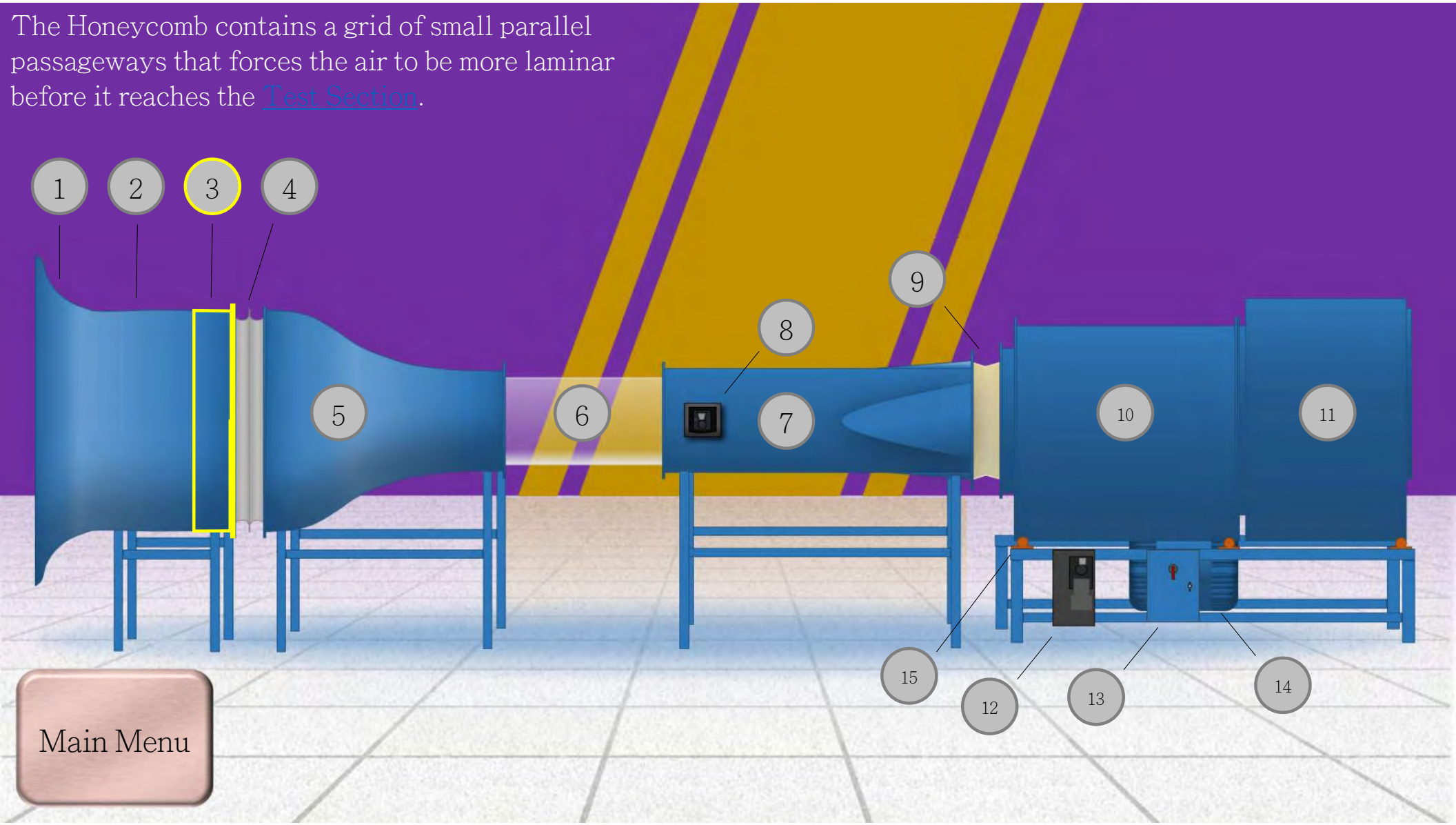
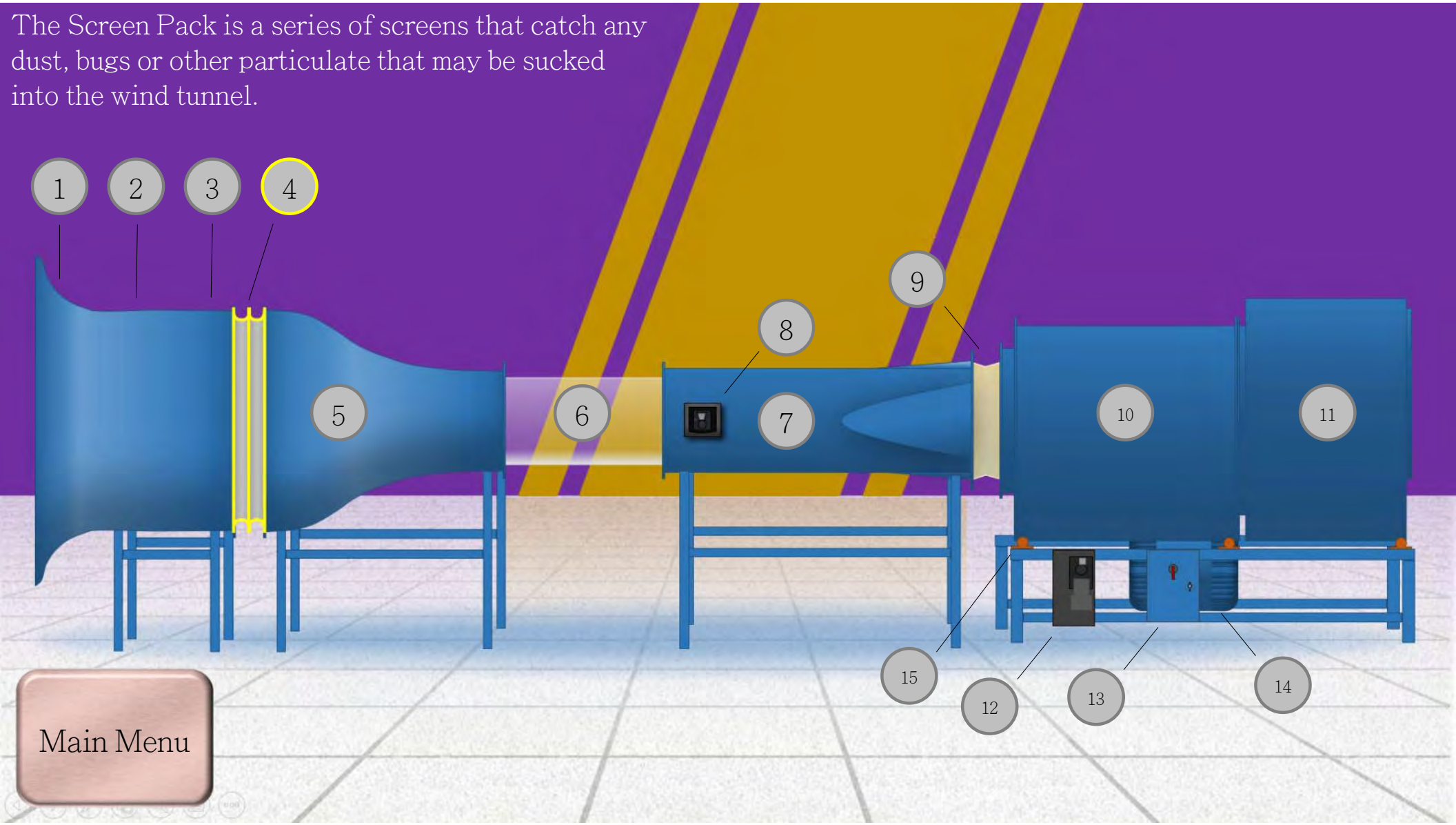
15
Main Menu

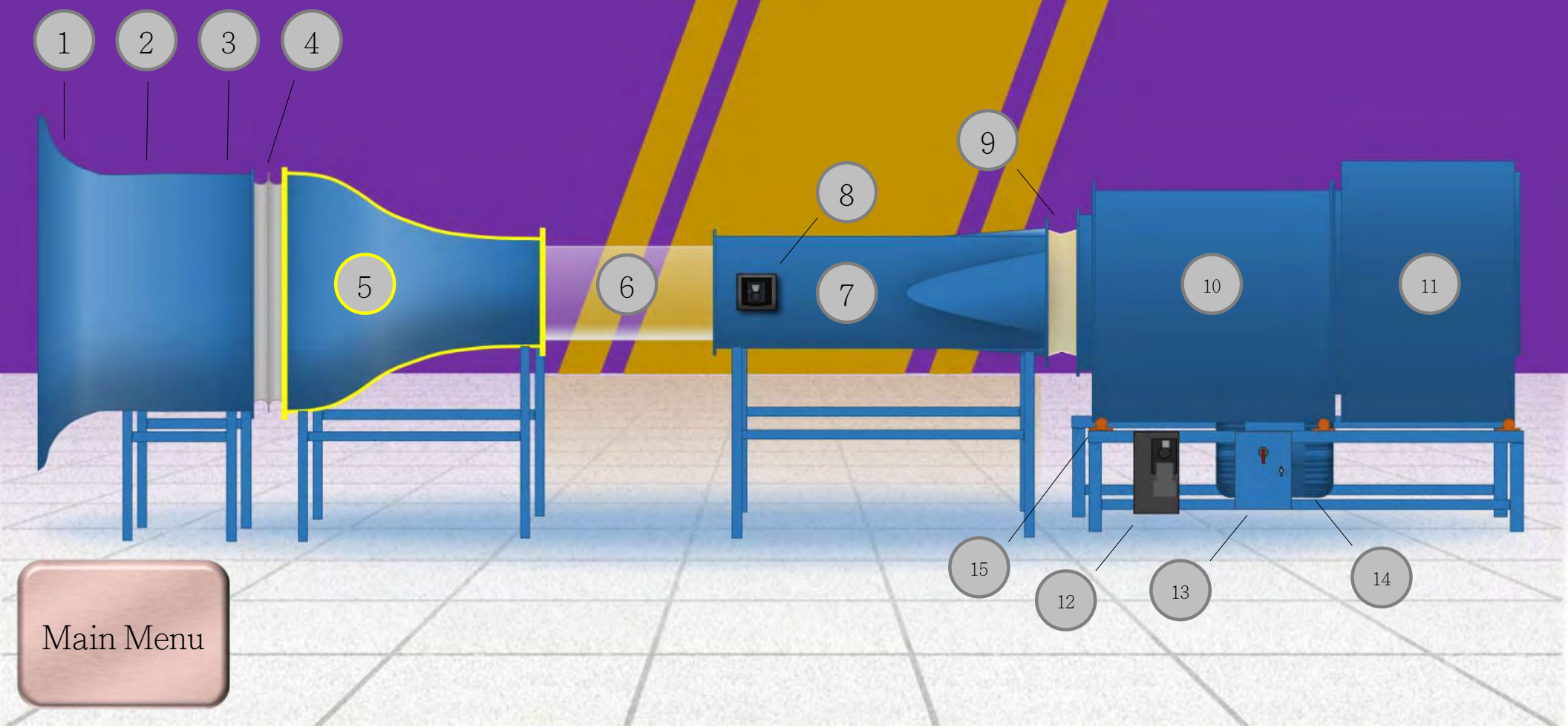
The Honeycomb contains a grid of small parallel passageways that forces the air to be more laminar before it reaches the Test Section.



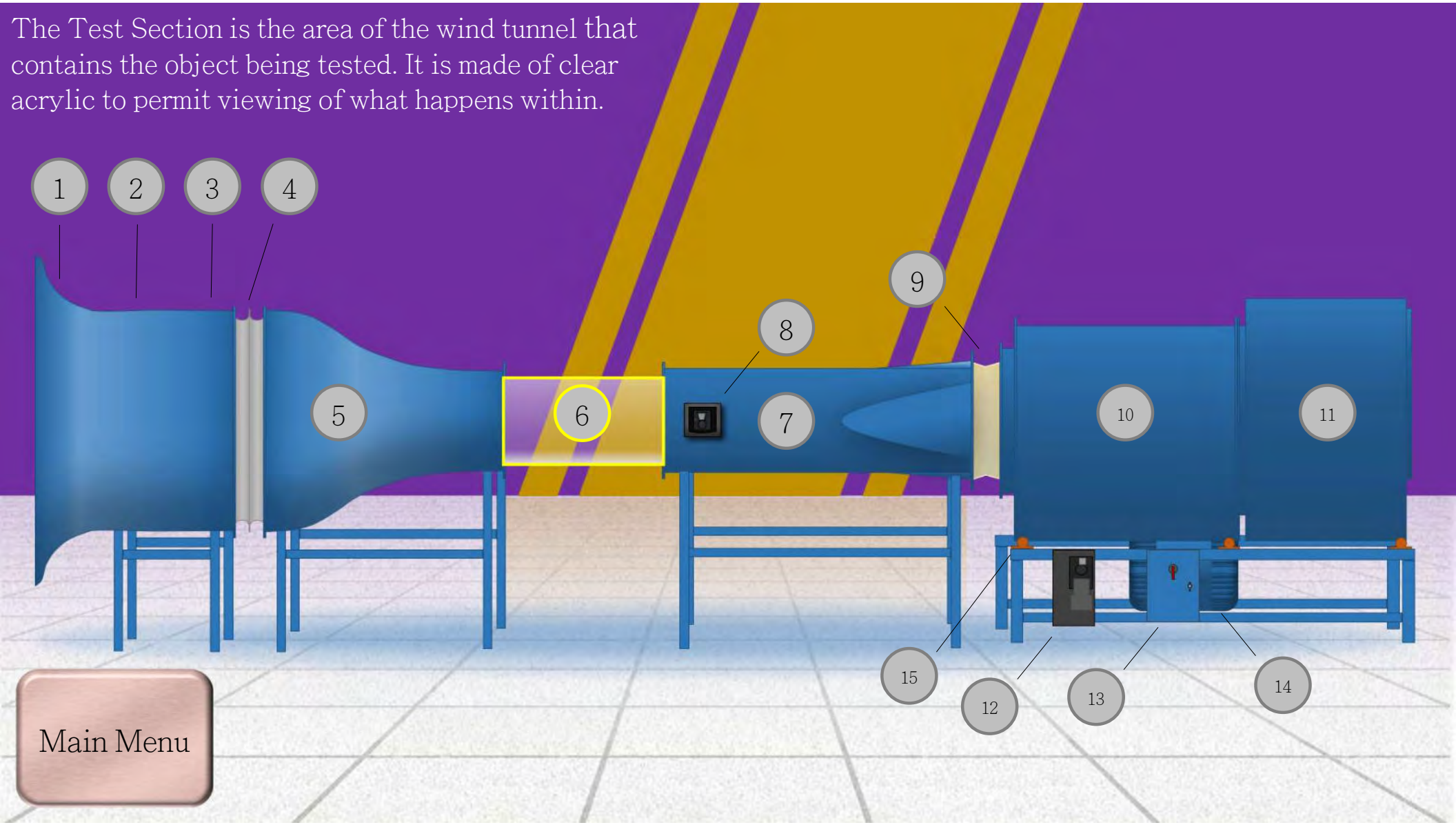
The Screen Pack is a series of screens that catch any dust, bugs or other particulate that may be sucked into the wind tunnel.



The Contraction is a length of tunnel that converges, shrinking in cross section. This compresses the air and forces it to speed up, according to Bernoulli’s equation. This prepares the air to travel through the Test Section.



Main Menu


The Test Section is the area of the wind tunnel that contains the object being tested. It is made of clear acrylic to permit viewing of what happens within.
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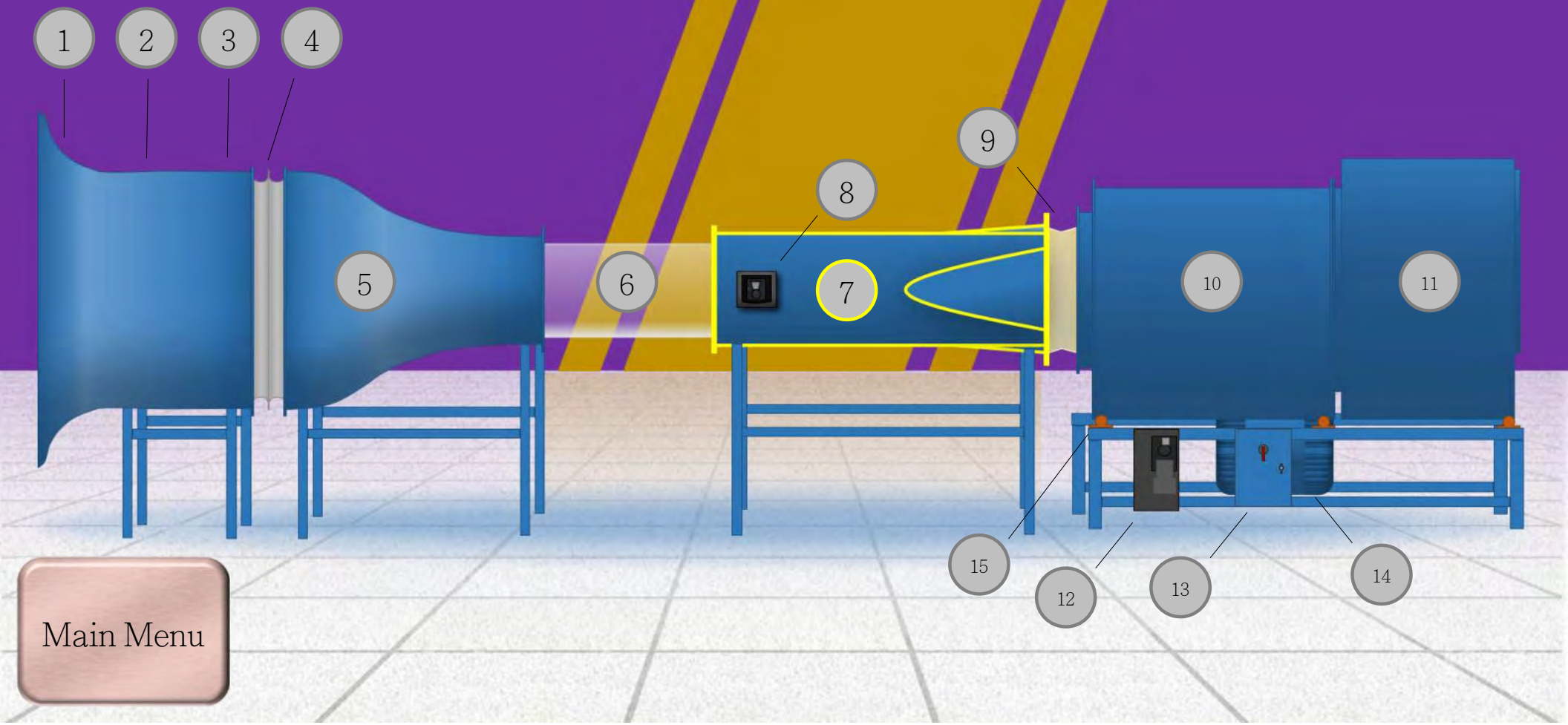
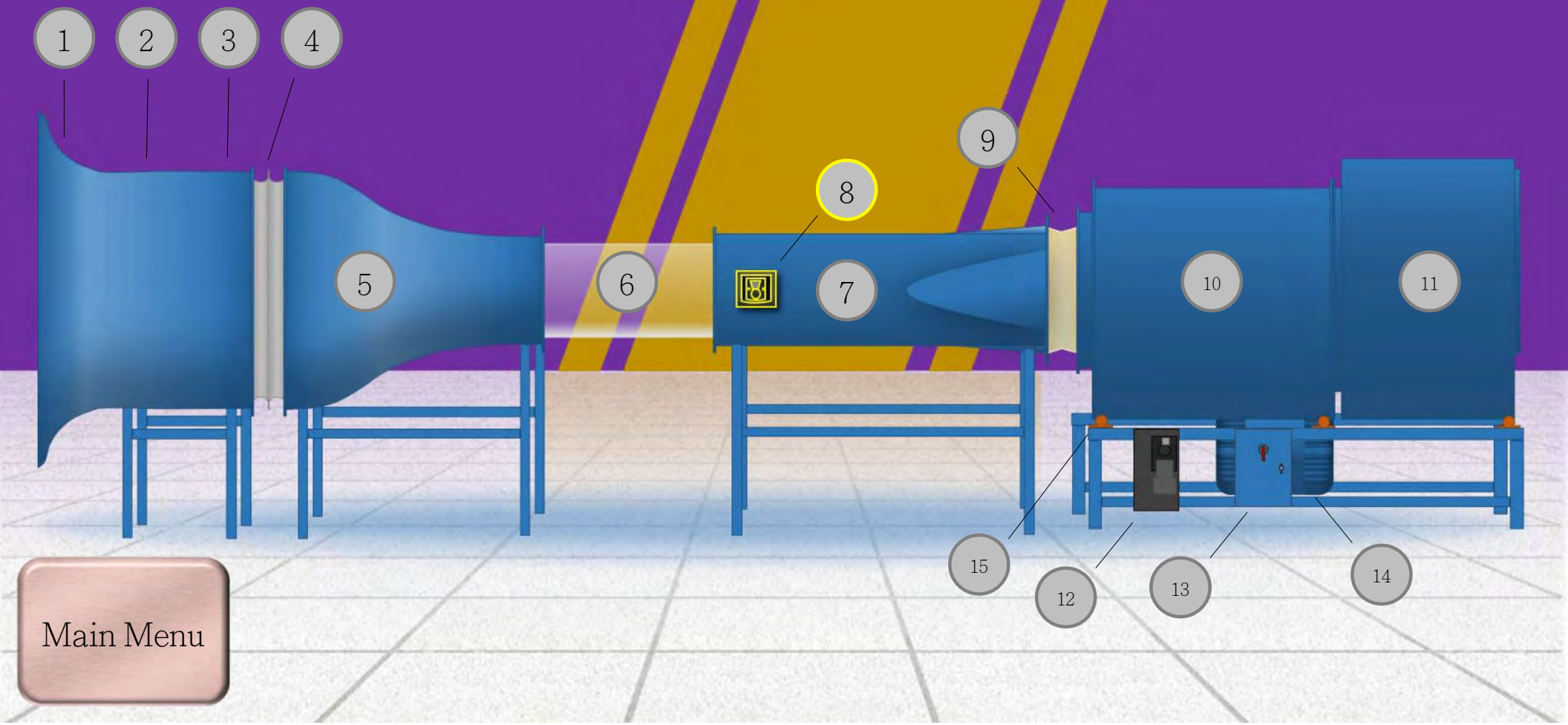
15
Main Menu

The Primary Diffuser provides a smooth, gentle transition for the air as it enters the Fan. This allows the Fan to be as efficient as possible and provides better control of airflow.



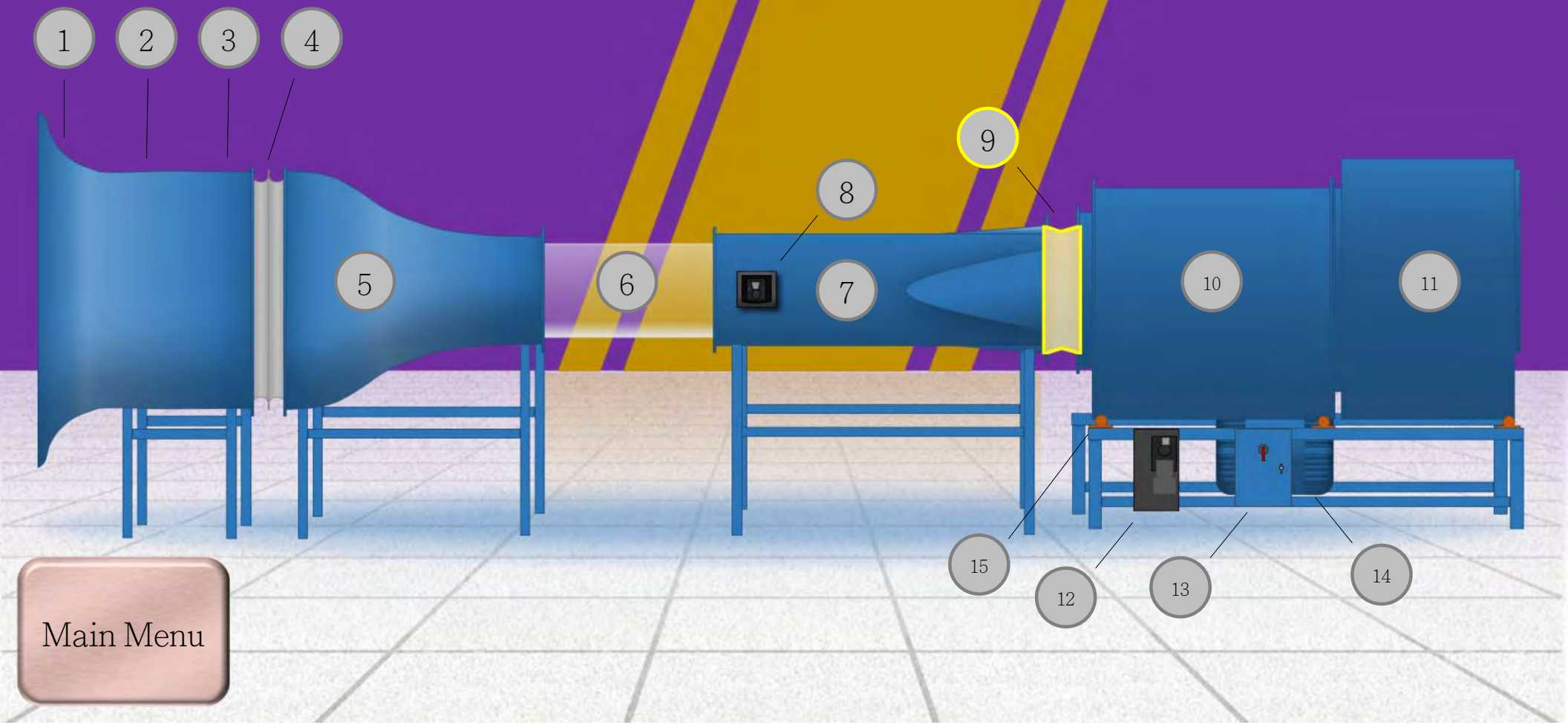
Main Menu

The Operator’s Console is a remote-control station for the Variable Frequency Inverter. It allows control of the motor speed, and by extension, wind speed, from near the Test Section.



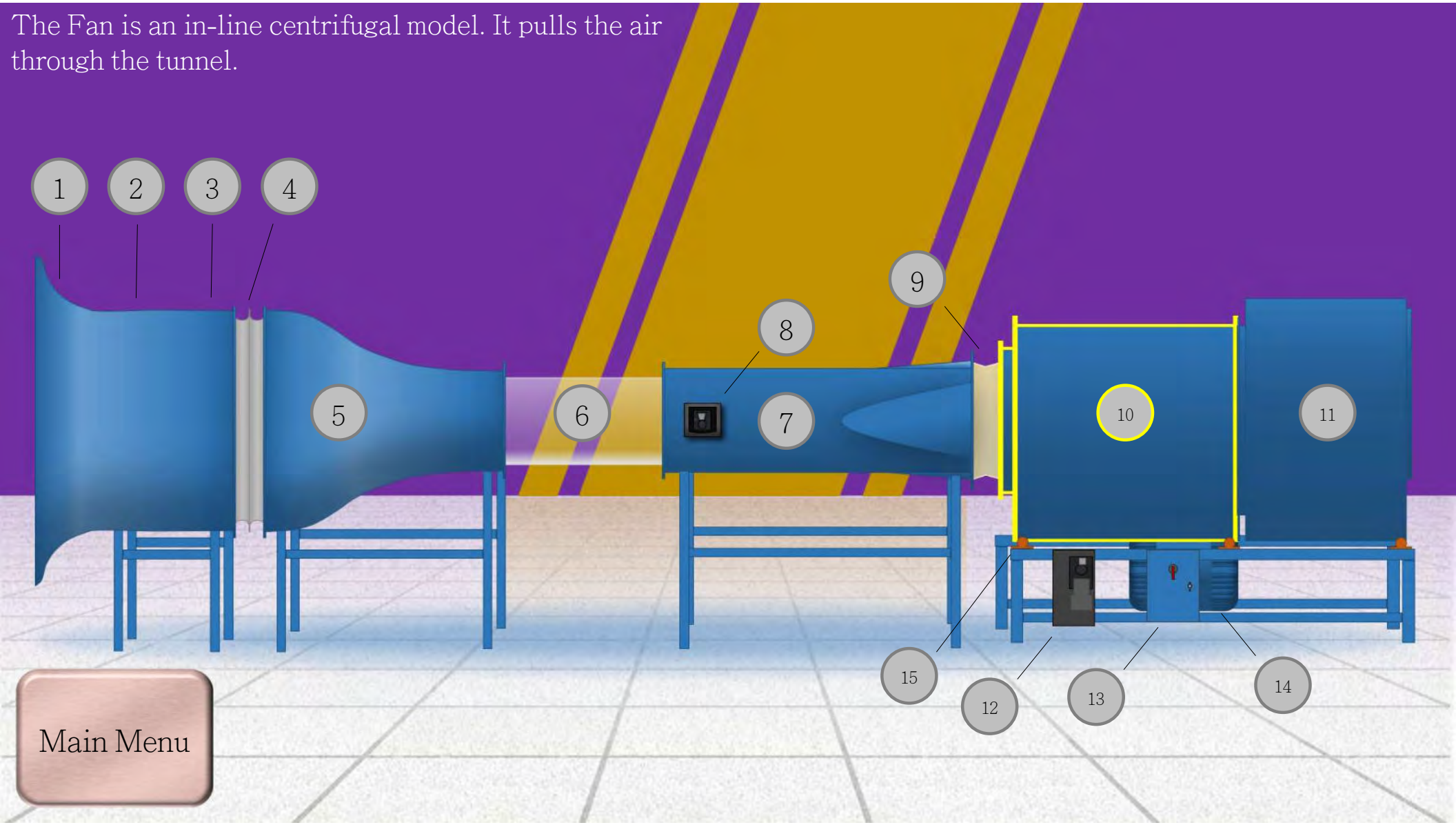
Main Menu

The Flexible Coupling is a rubber joint that allows air to travel from the Primary Diffuser to the Fan without the two sections needing to be perfectly aligned. It allows a small amount of ‘play’ or ‘slop’ to be present. It also isolates the rest of the tunnel from the vibrations of the Fan.

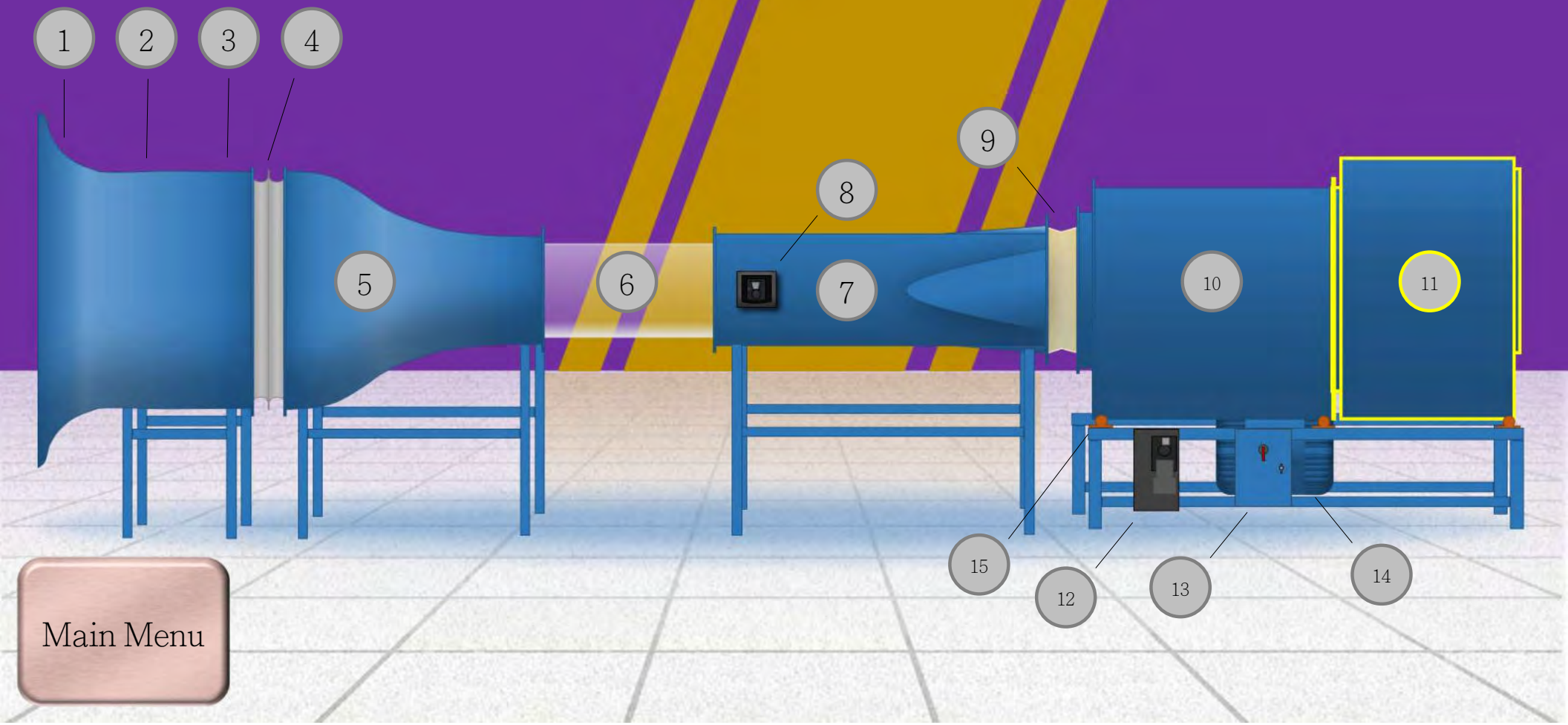


Main Menu

The Fan is an in-line centrifugal model. It pulls the air through the tunnel.

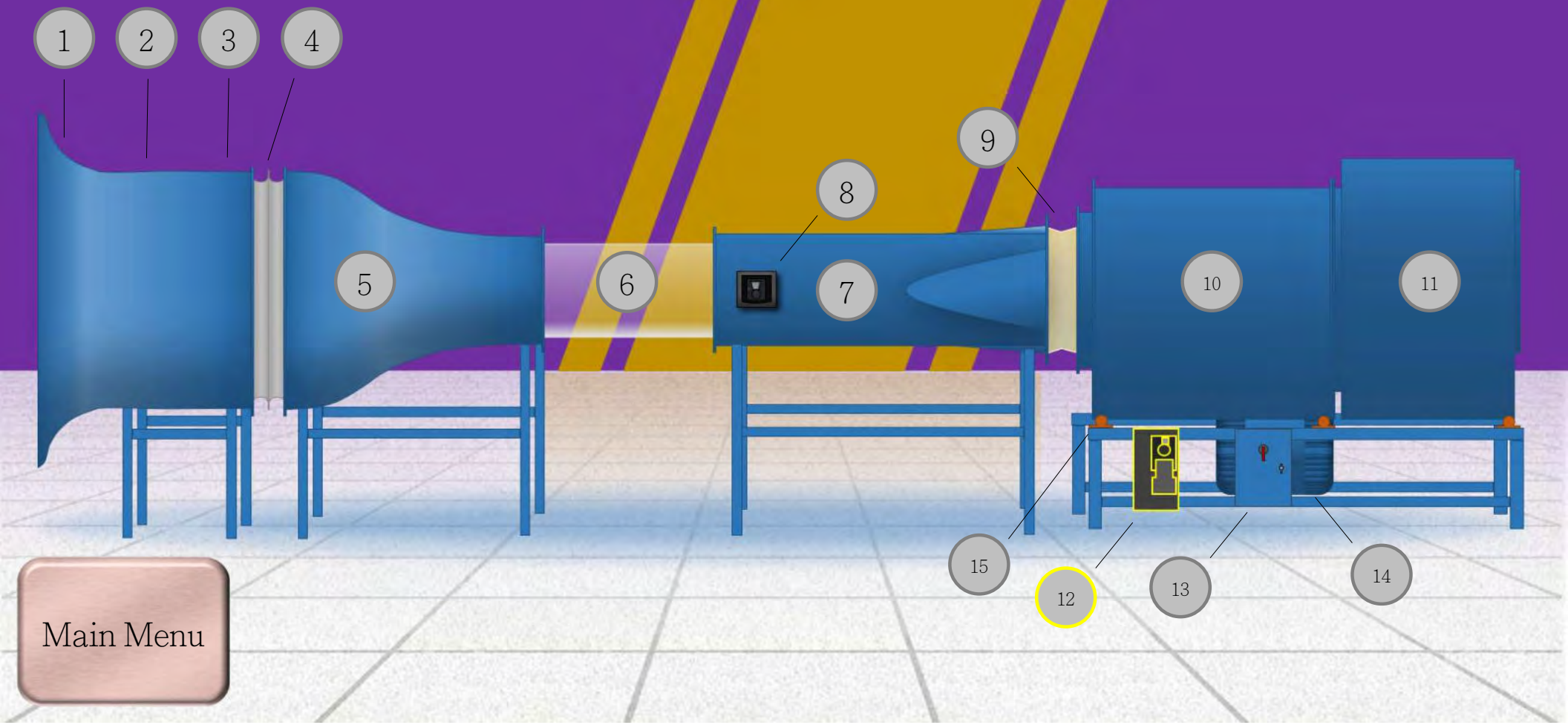


The Acoustic Diffuser consists of a set of baffles that cause the sounds of the Fan to partially cancel themselves. This helps reduce the volume of the wind tunnel during operation.



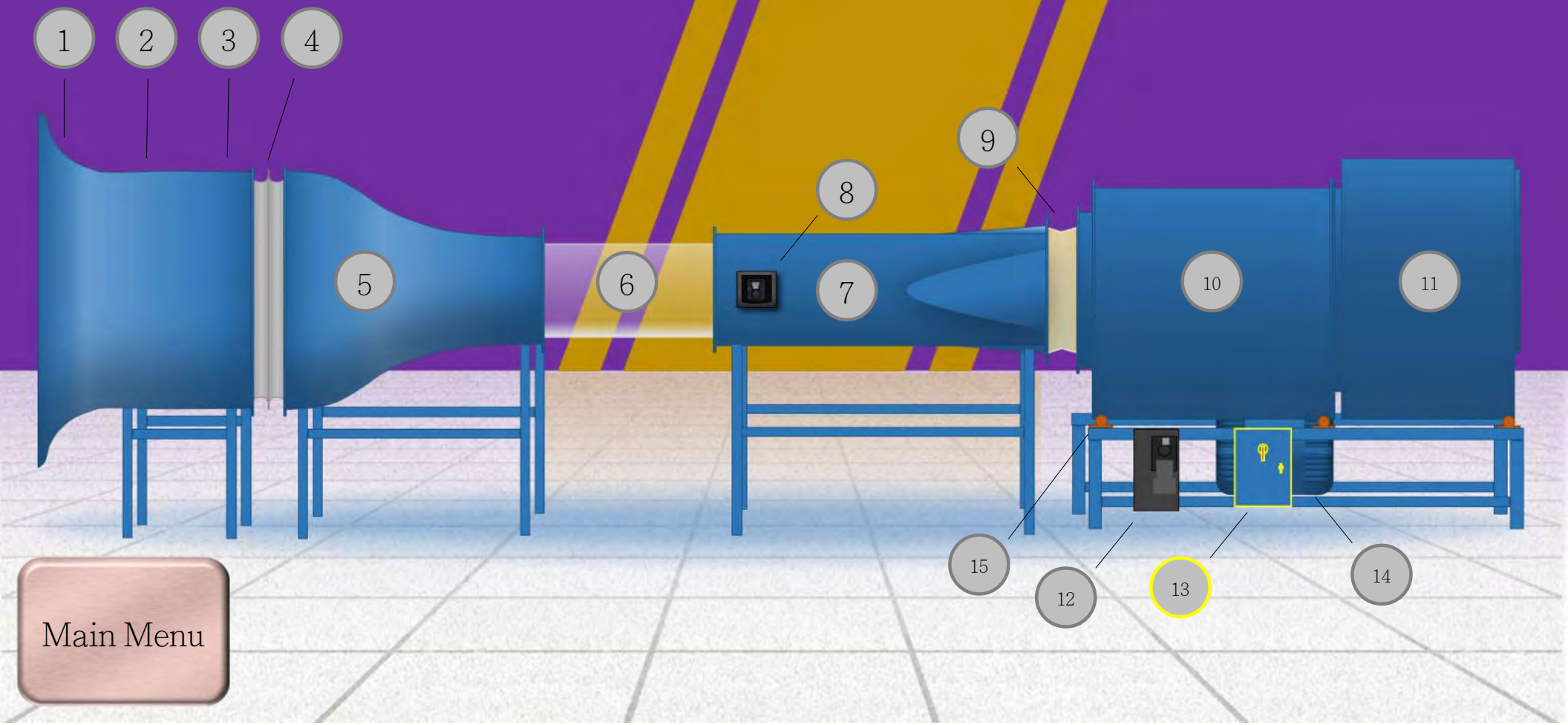
Main Menu

The Variable Frequency Inverter controls the speed at which the Fan runs. It accomplishes this by changing the frequency of the AC electricity going to the Motor. Normal wall power is 60 Hz. By reducing this number, the Motor will run slower.



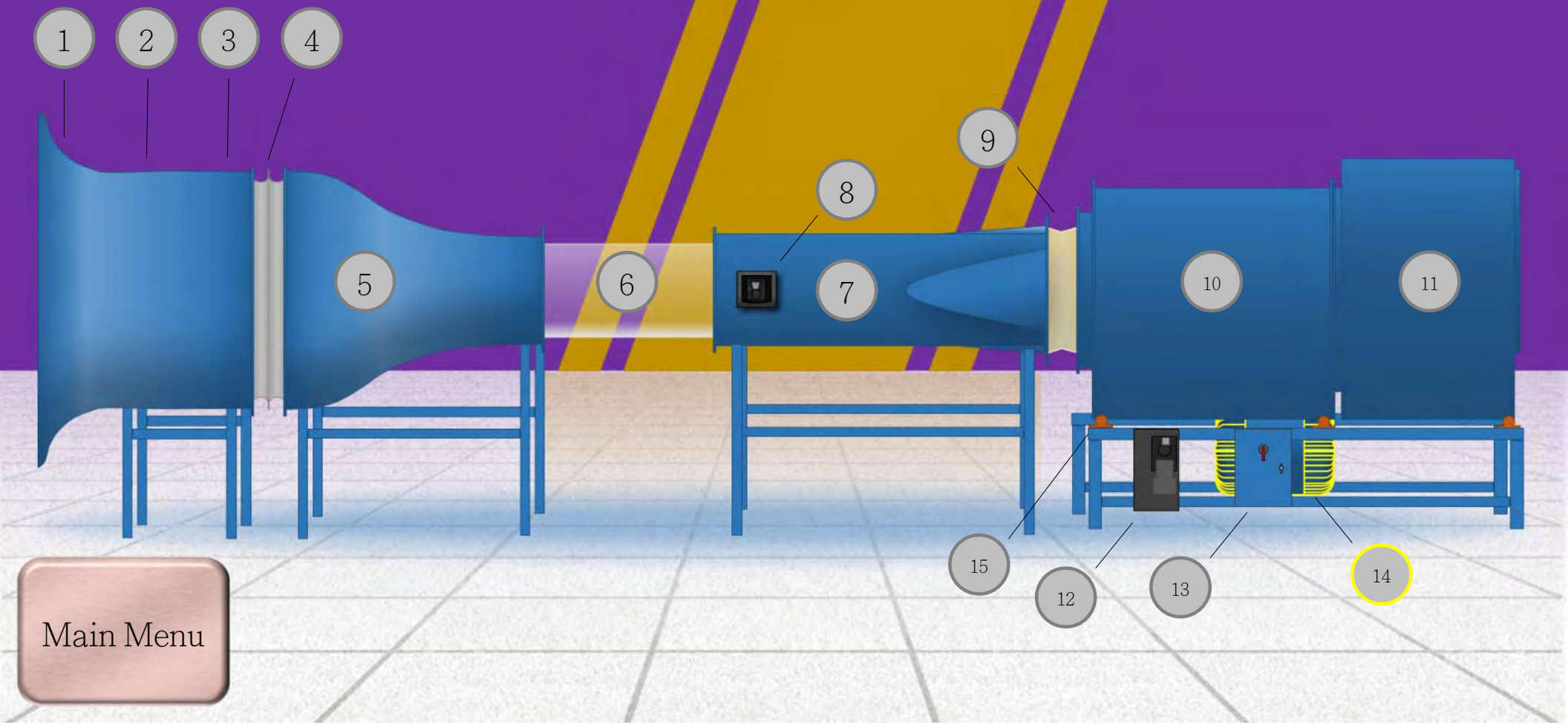
Main Menu

The Fusible Disconnect is a large switch that controls the power to the Variable Frequency Inverter. Three phase power at 480VAC runs through this box. Due to the risk of arc flash, only electricians should open it.



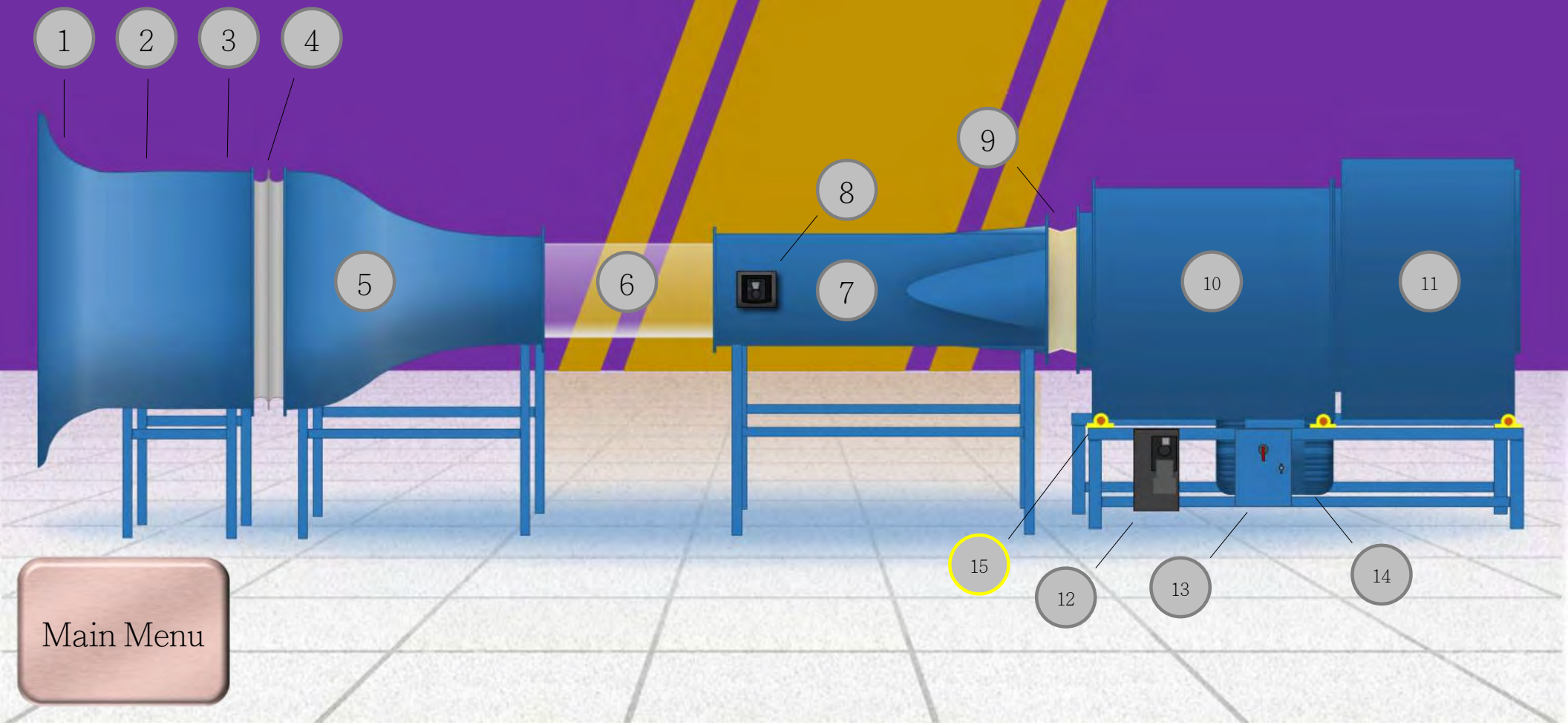
Main Menu

The Motor provides movement to the Fan.
TCF/Aerovent Model: 28-CBD-2120
P/N: 284T-X S/N: 13409641-1-1
It operates on 3Ø (phase) 480VAC power. It produces 25 HP



Main Menu

The Vibration Isolation Mounts are specially designed stand-offs that are used to mount the Fan, Motor and Acoustic Diffuser. They allow the listed components to vibrate and move without shaking the whole wind tunnel or the floor of the building.



Main Menu

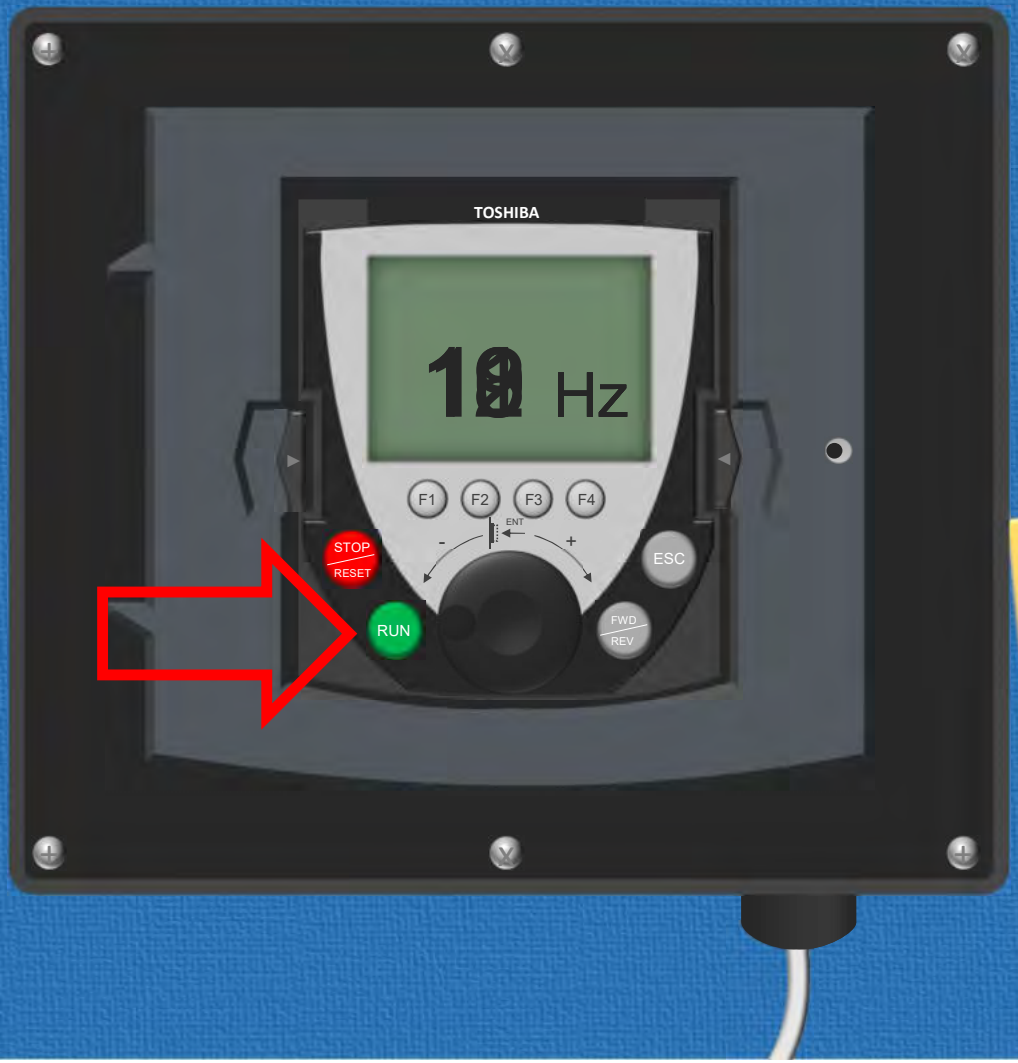
Running the Tunnel

To Turn On the Tunnel:

Turn the Power Switch on the Fusible Disconnect Box (13) to the 'On' position

To Start the Tunnel:

Press the Green 'Run' Button on the Operator's Console (8)

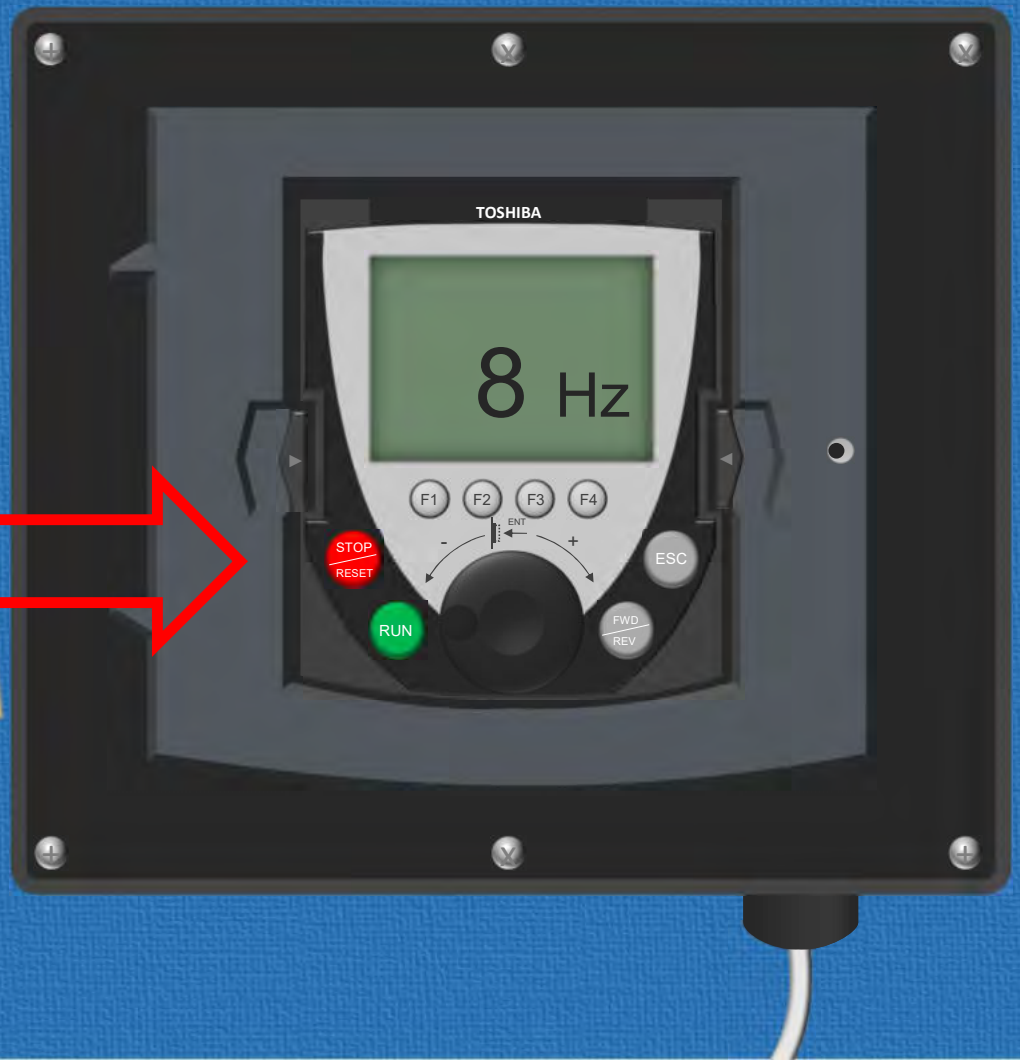


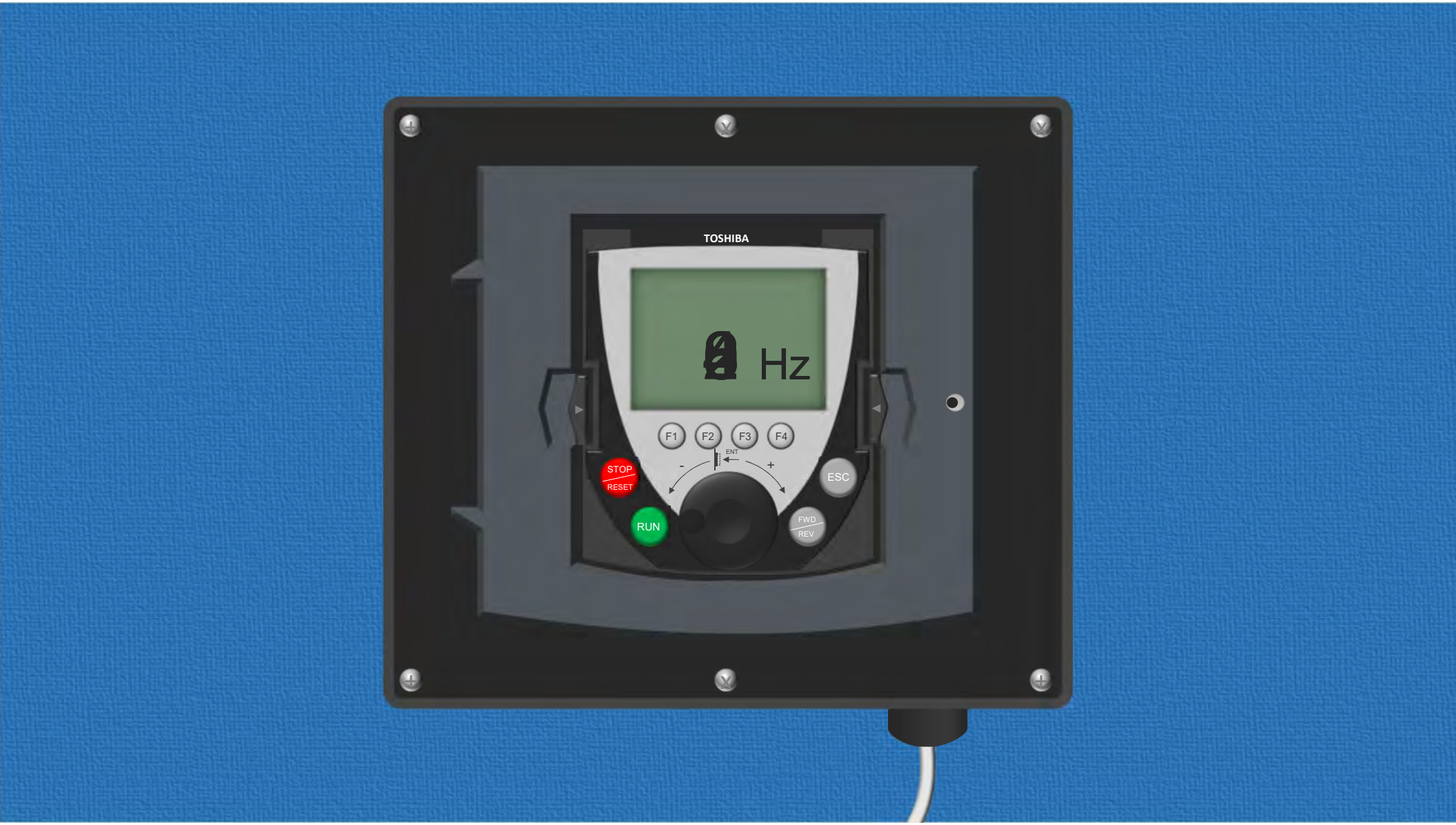
To Adjust the Speed of the Tunnel:

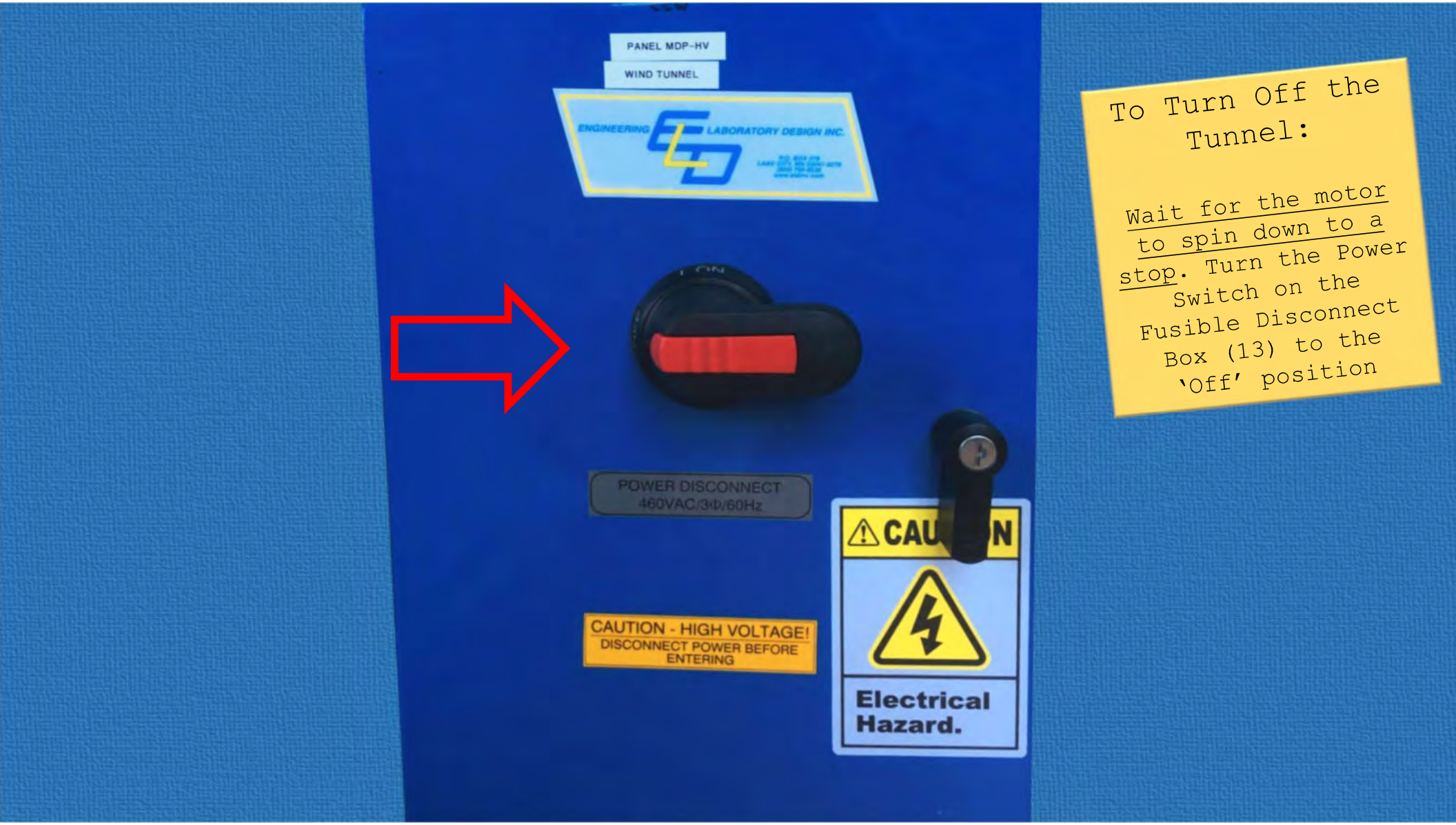
Rotate the knob on the Operator's Console (8). Stay between 8 and 60 Hz

To Stop the Tunnel:

Confirm that the Speed is greater than 8 Hz. Press the Red 'Stop/Reset' Button on the Operator's Console (8)




TOSHIBA
Hz
F1
F2
F3
F4
ENT
-
+
STOP
RESET
RUN
ESC
FWD
REV



To Turn Off the Tunnel:

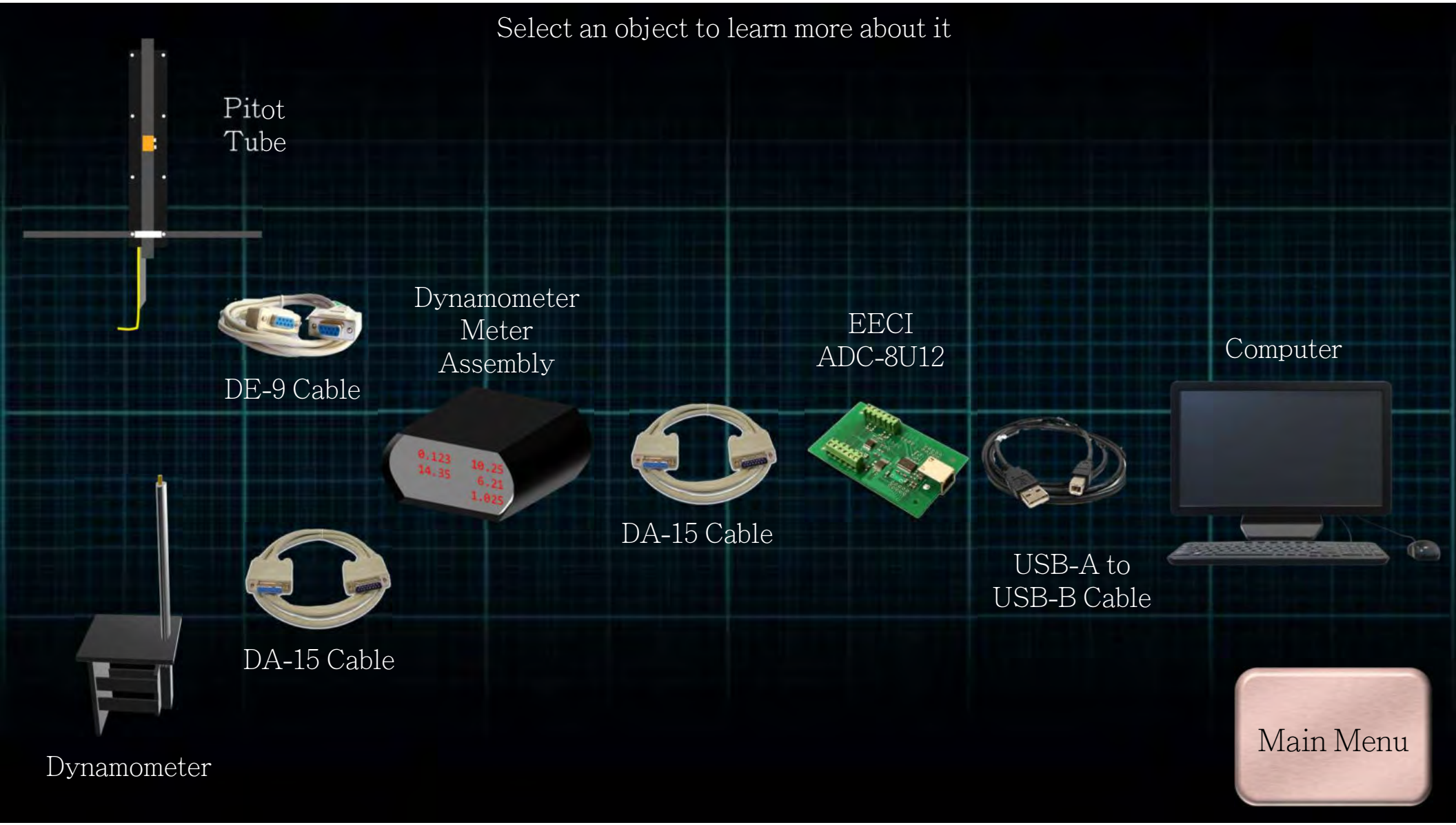
Wait for the motor to spin down to a stop. Turn the Power Switch on the Fusible Disconnect Box (13) to the 'Off' position

Congratulations!

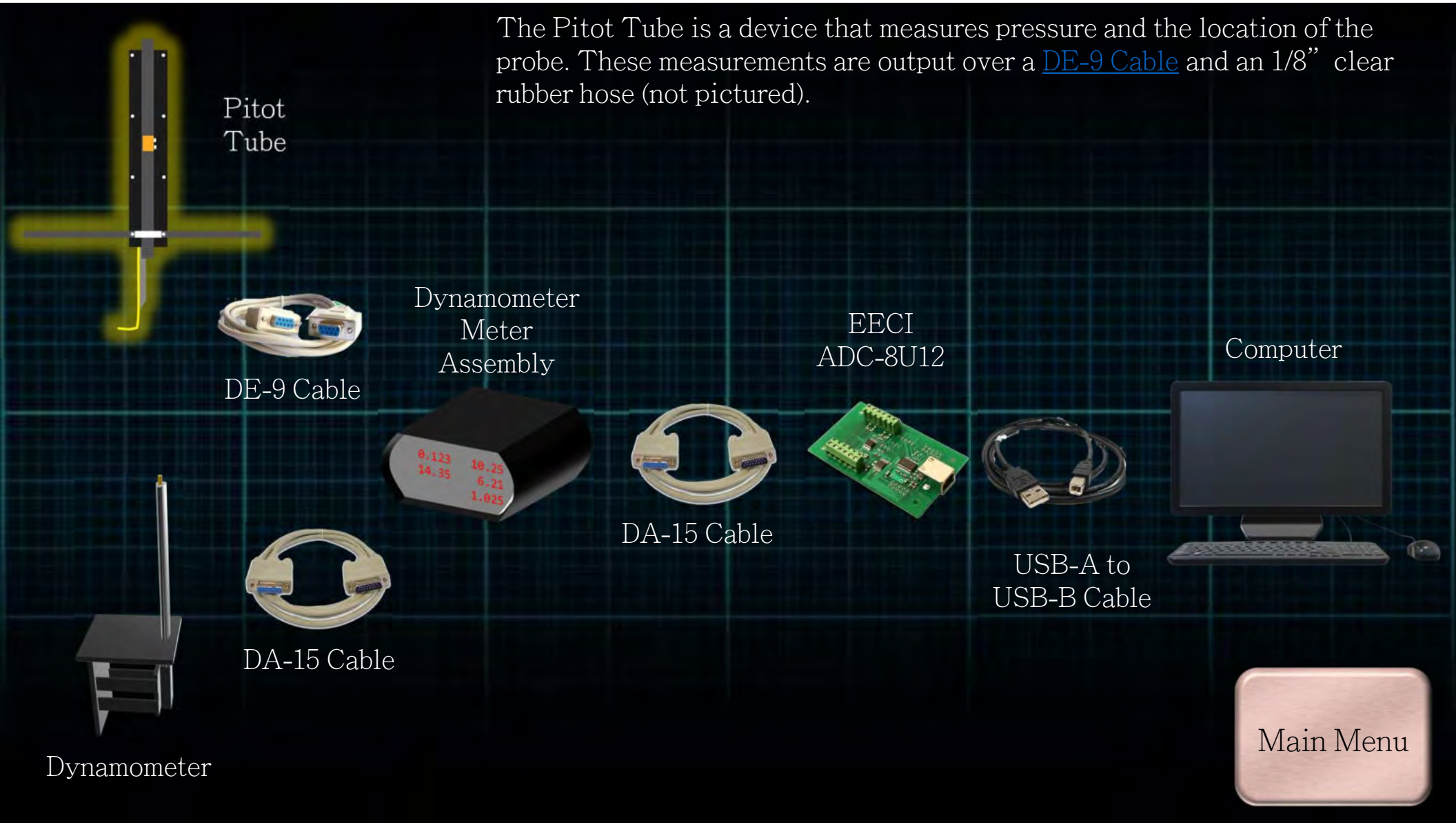
That's all there is to it

Main Menu

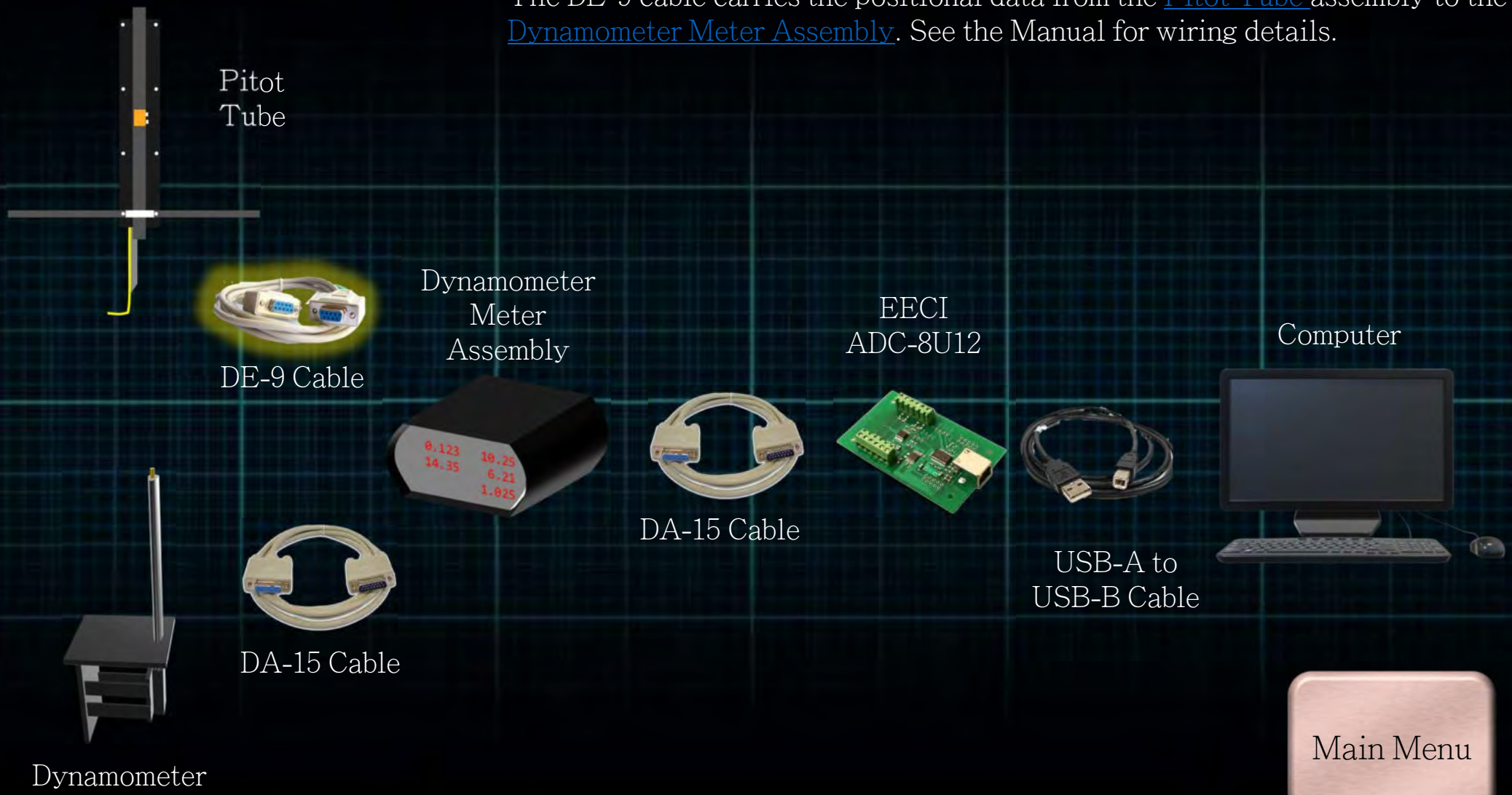
Logging Hardware


Select an object to learn more about it
Pitot Tube
DE-9 Cable
Dynamometer Meter Assembly
EECI ADC-8U12
Computer
DA-15 Cable
USB-A to USB-B Cable
DA-15 Cable
Dynamometer
Main Menu

The Pitot Tube is a device that measures pressure and the location of the probe. These measurements are output over a DE-9 Cable and an 1/8” clear rubber hose (not pictured).

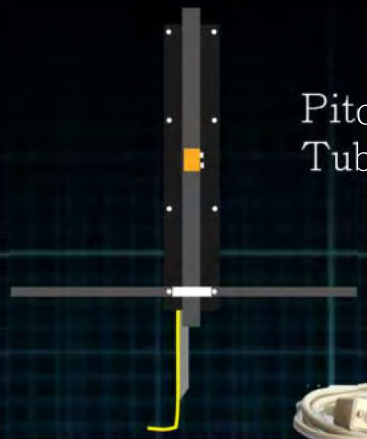


The DE-9 cable carries the positional data from the Pitot Tube assembly to the Dynamometer Meter Assembly. See the Manual for wiring details.



Main Menu

The Dynamometer is a device that uses Hooke’s Law to measure the forces applied to models in the wind tunnel. It is capable of measuring both the lift and drag forces acting on the model.

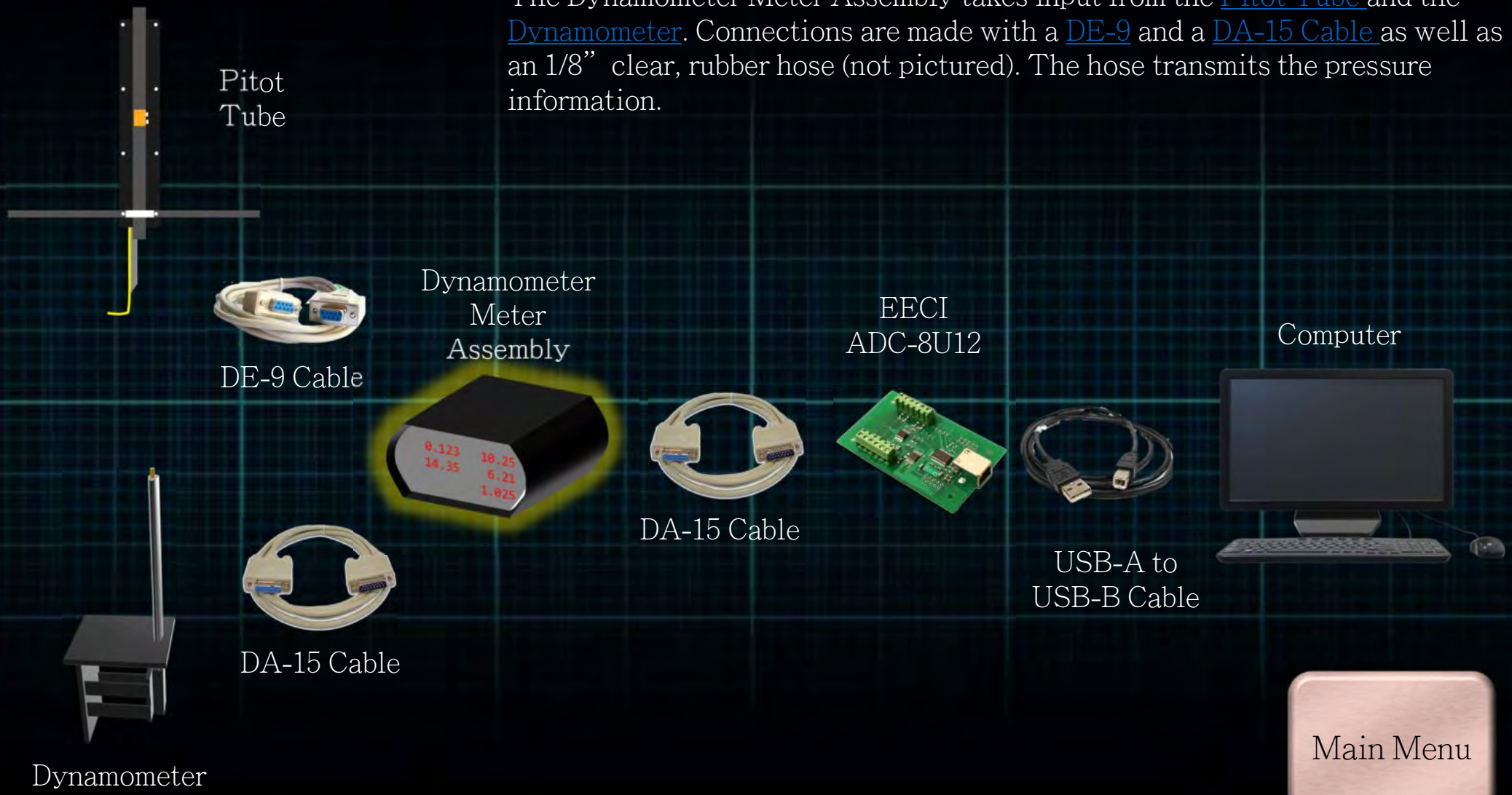


Main Menu

The DA-15 Cable carries the lift and drag data from the Dynamometer to the Dynamometer Meter Assembly. See the Manual for wiring details.

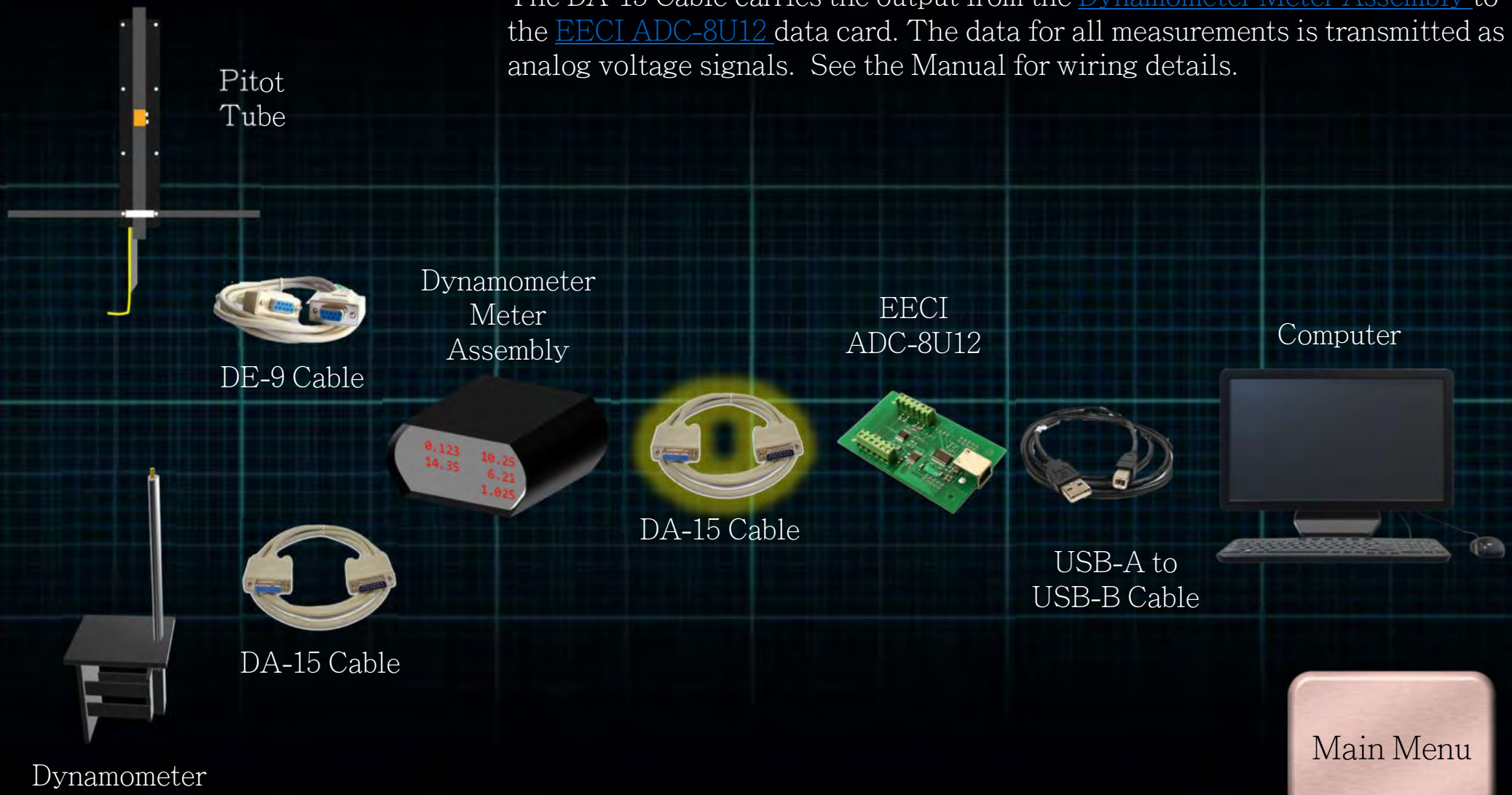
Main Menu

The Dynamometer Meter Assembly takes input from the Pitot Tube and the Dynamometer. Connections are made with a DE-9 and a DA-15 Cable as well as an 1/8” clear, rubber hose (not pictured). The hose transmits the pressure information.



Main Menu

The DA-15 Cable carries the output from the Dynamometer Meter Assembly to the EECI ADC-8U12 data card. The data for all measurements is transmitted as analog voltage signals. See the Manual for wiring details.

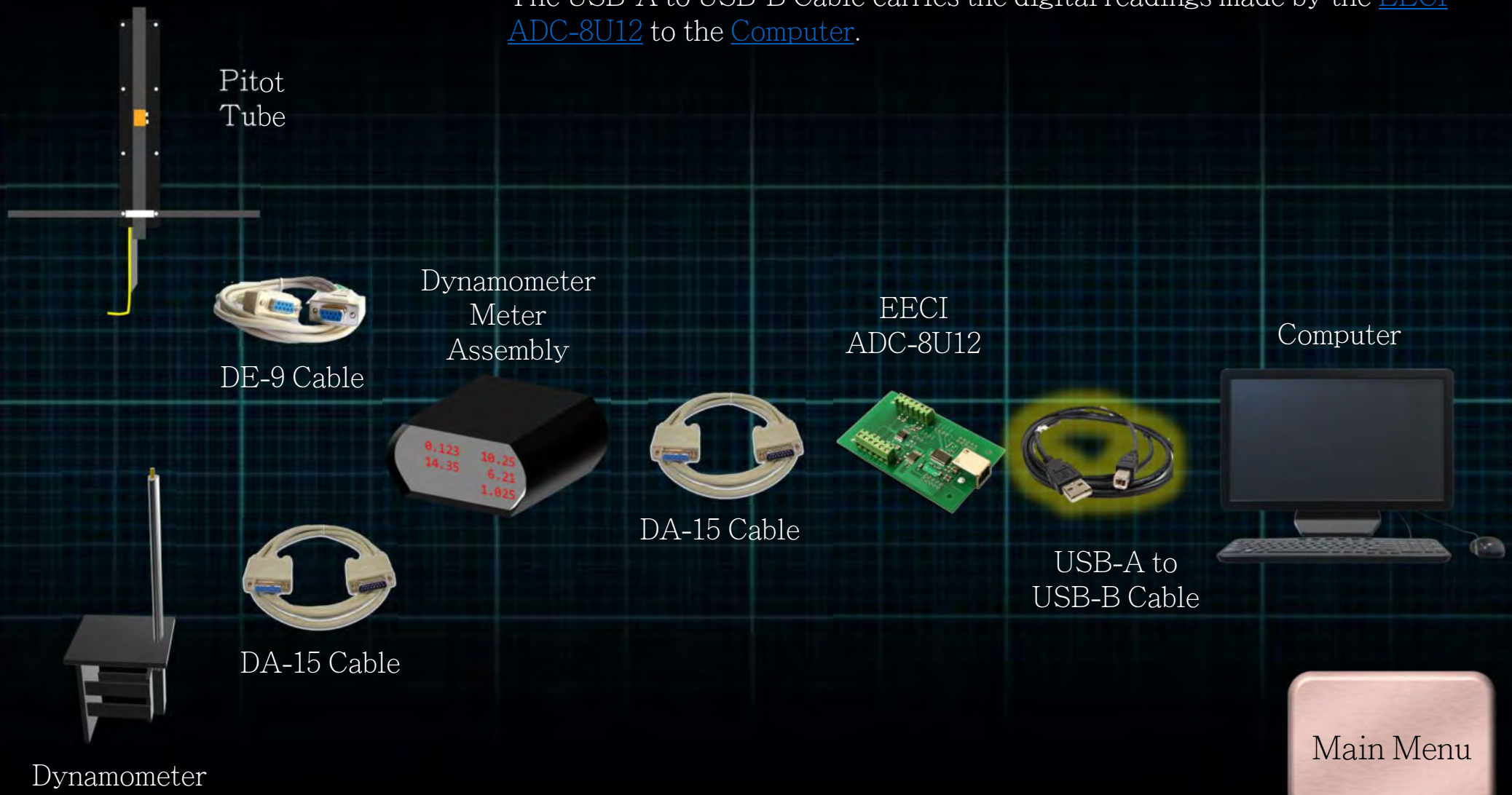


Main Menu

The EECI ADC-8U12 is an analog-to-digital converter with a resolution of 12 bits. It converts the analog voltage provided by the Dynamometer Meter Assembly into a digital number between 0 and 4096 so that the data can be interpreted by the Computer.

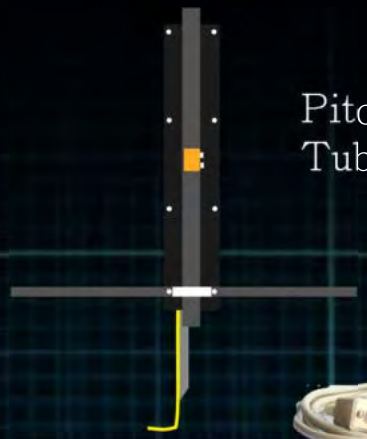
Main Menu

The USB-A to USB-B Cable carries the digital readings made by the EECI ADC-8U12 to the Computer.



Main Menu

The Computer uses software from EECI and a custom data logger to display and record the measurements.



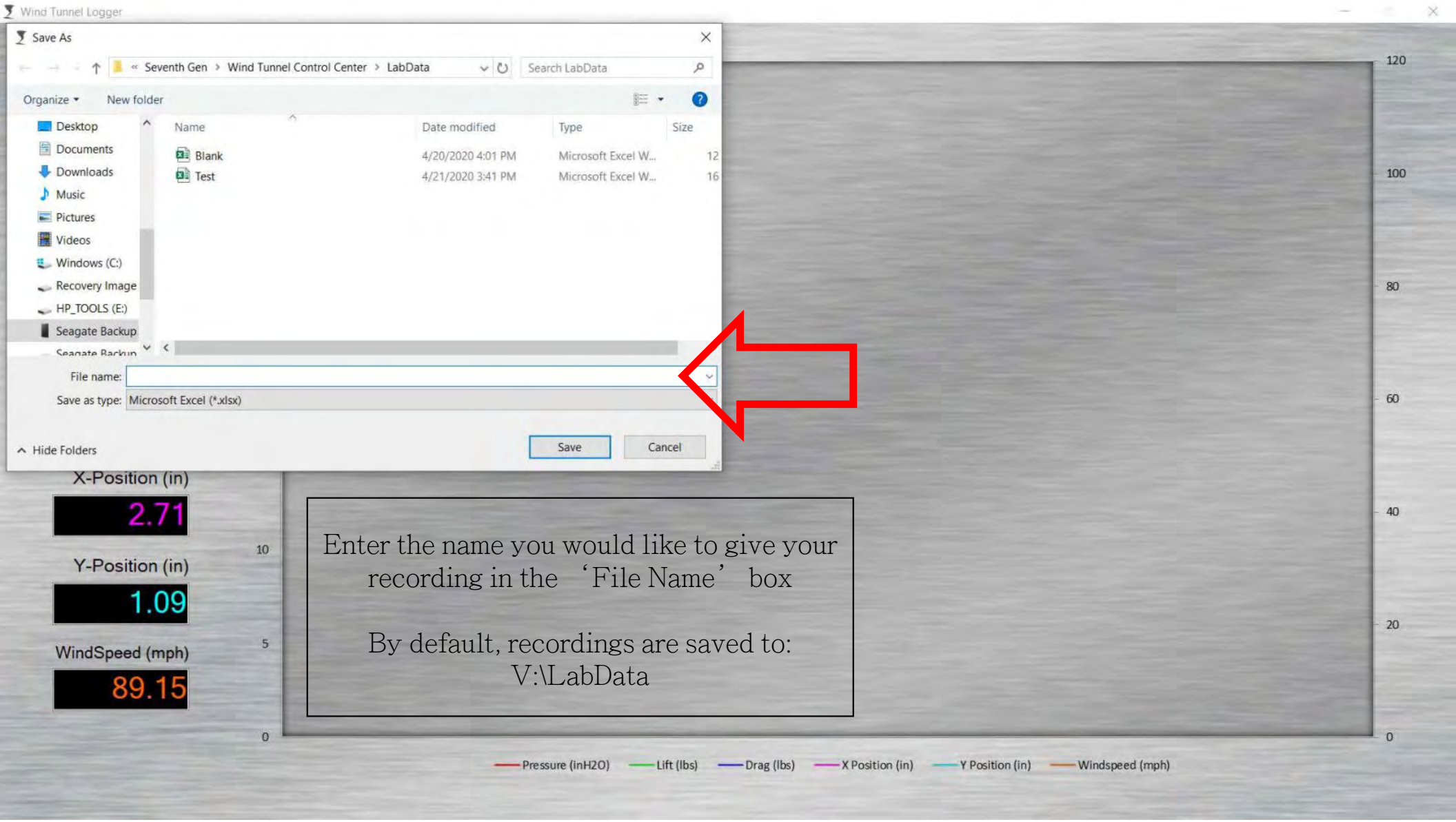
Main Menu

Running a Test


Wind Tunnel Logger
New Test
Record
Pressure (inH2O)
0
Lift (lbs)
0
Drag (lbs)
0
X-Position (in)
0
Y-Position (in)
0
WindSpeed (mph)
0
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)

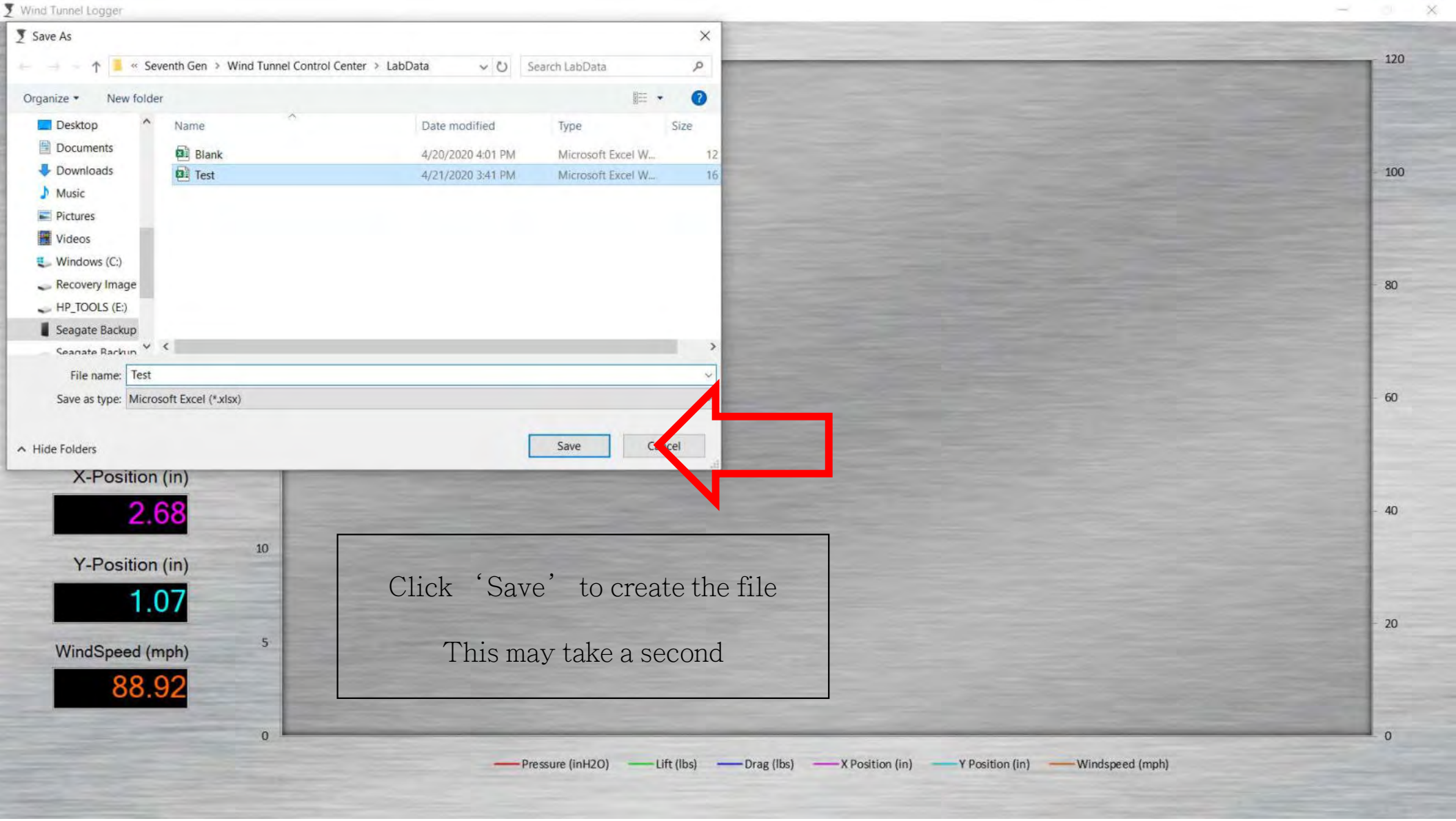
To start a new test, Click the 'New Test' button.

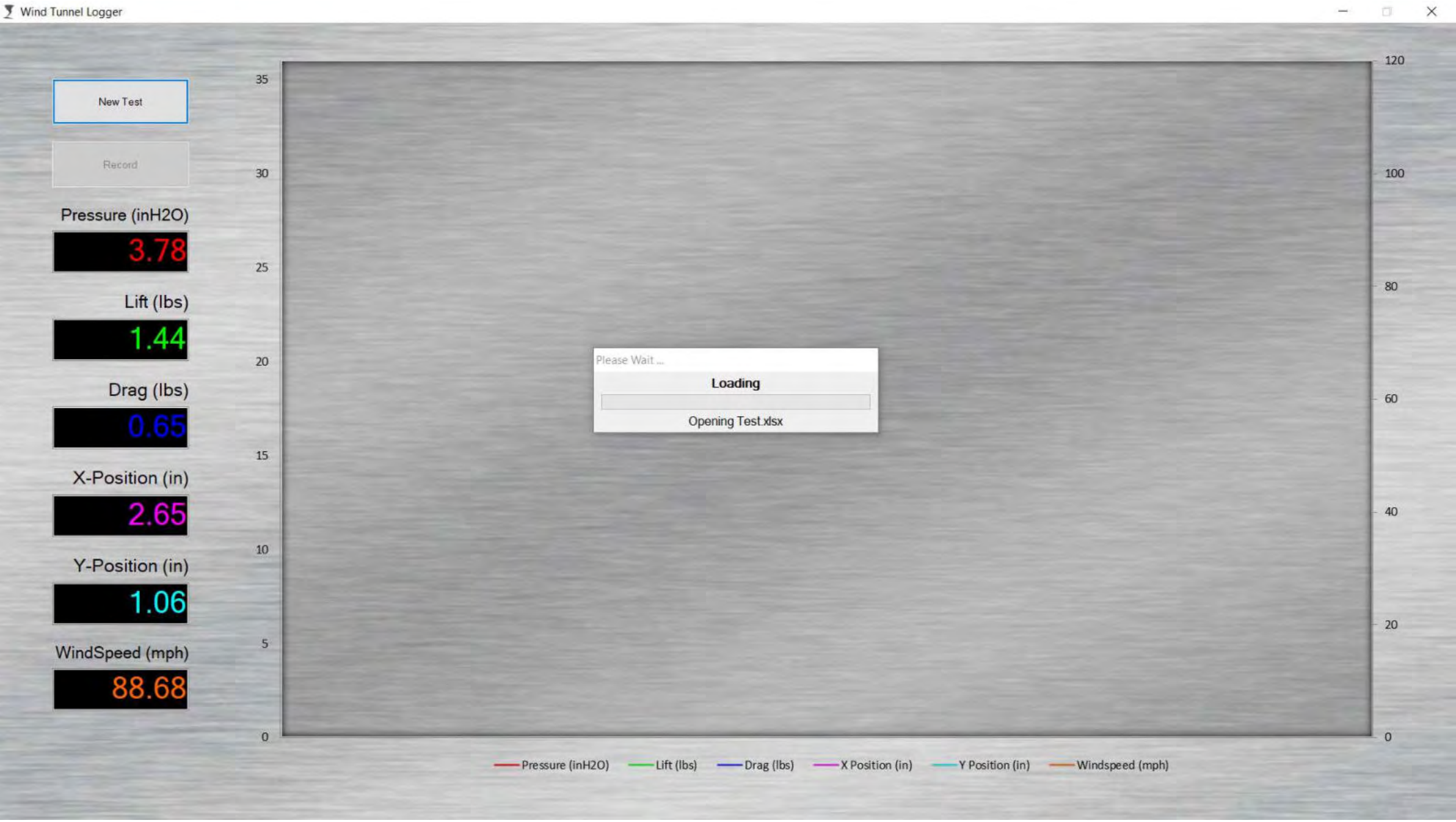
Note that the boxes on the left show the current values measured by the sensors, so test criteria can be dialed in before starting a recording.

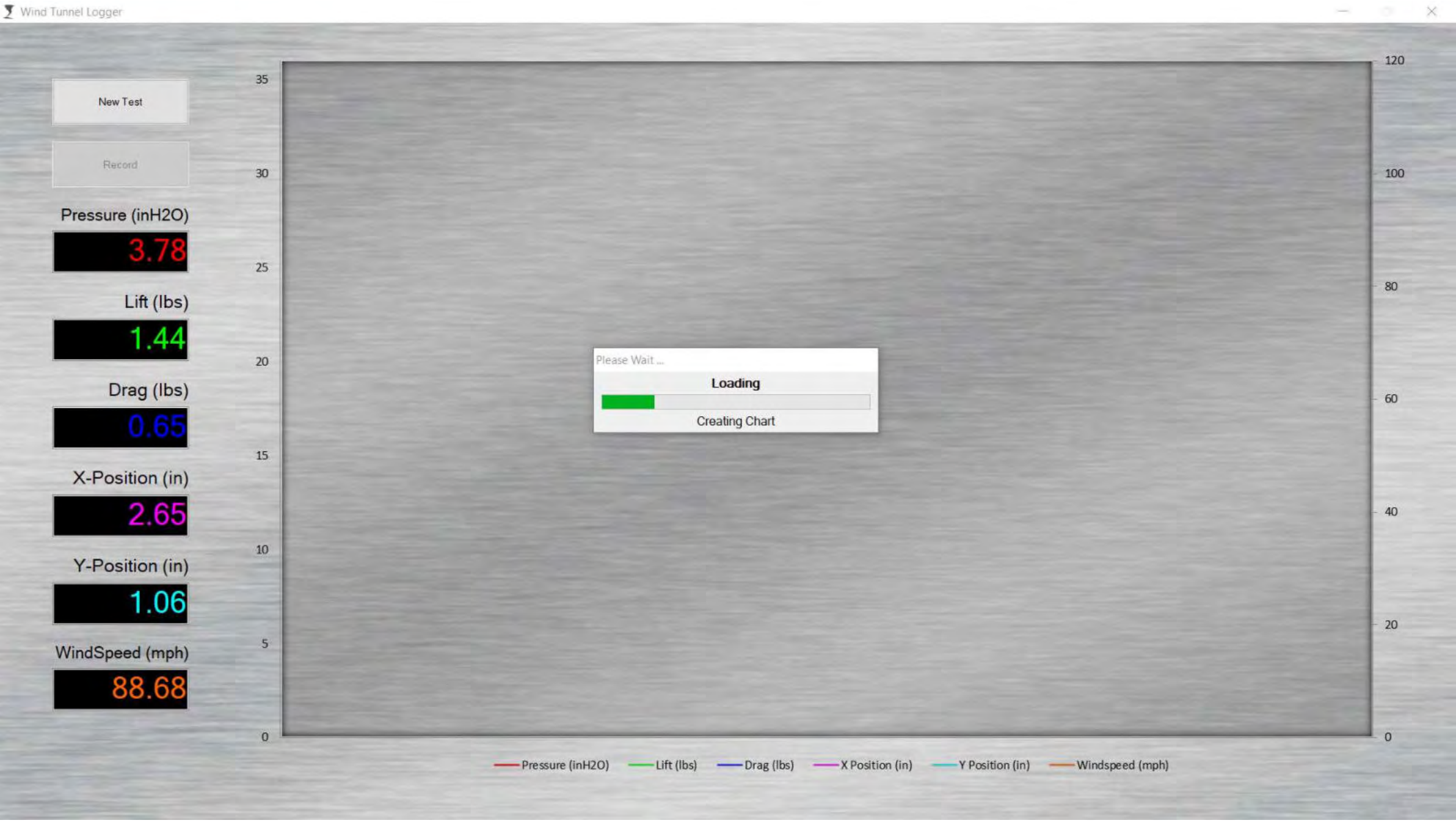


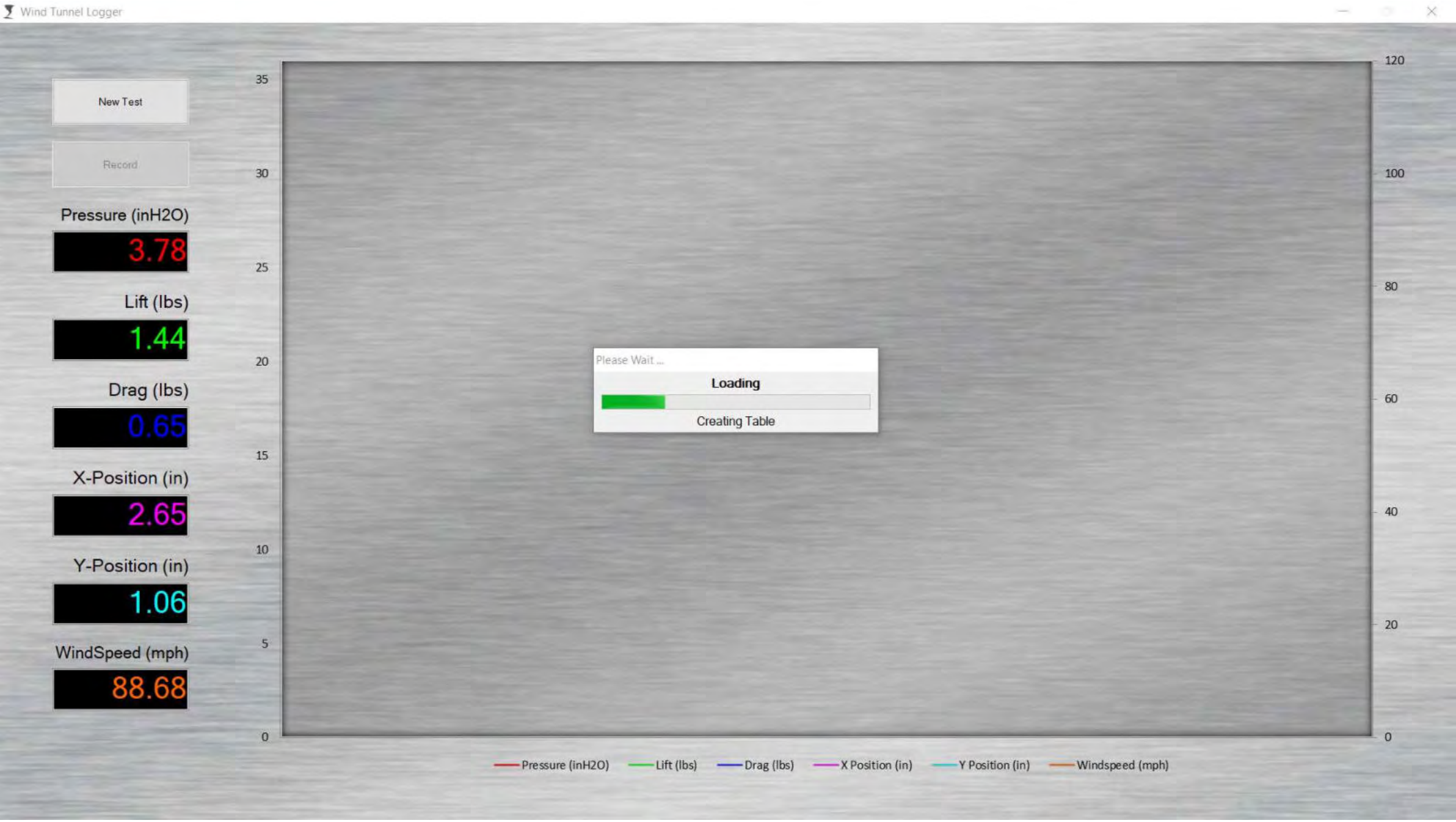
Enter the name you would like to give your recording in the 'File Name' box

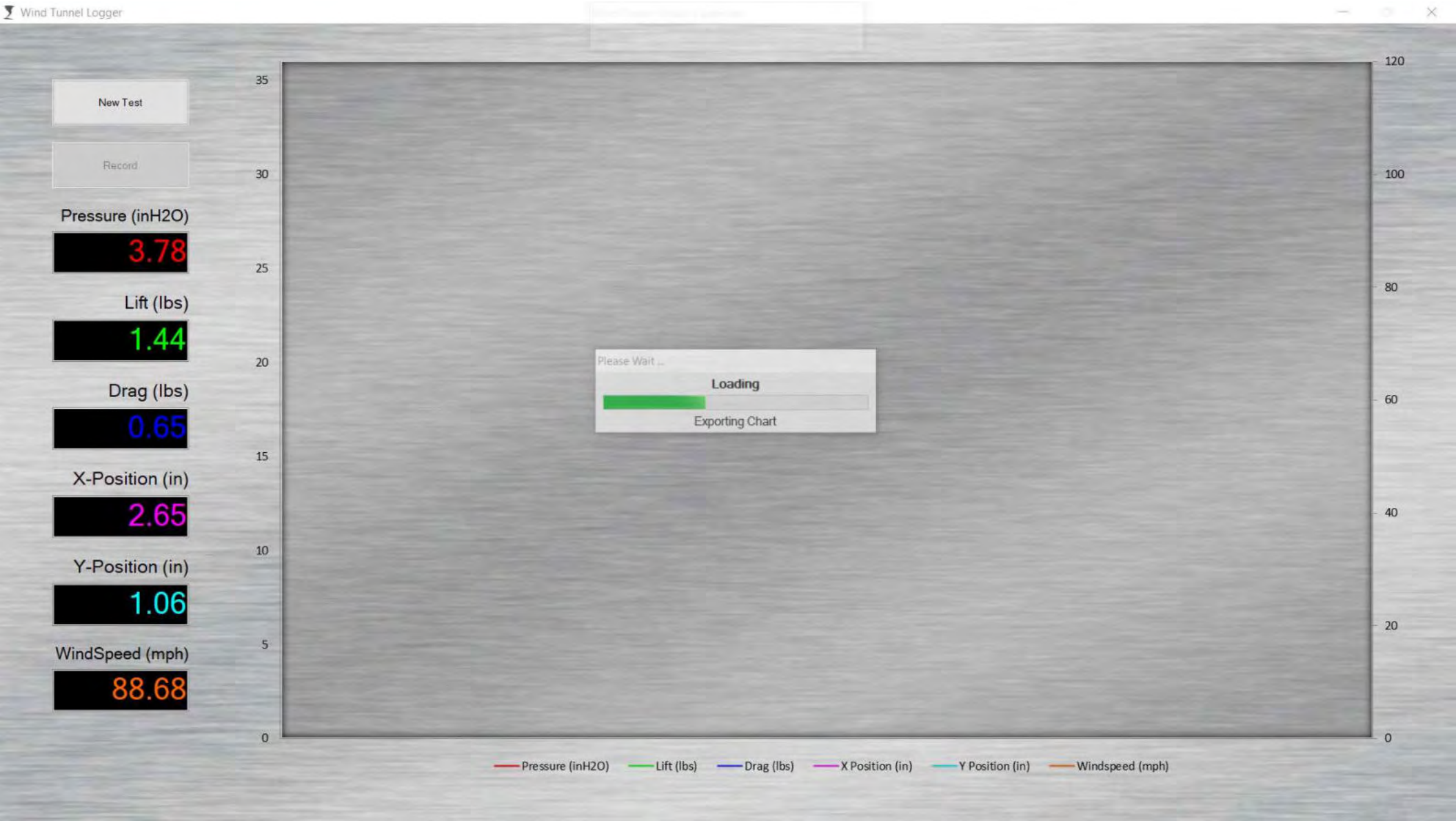
By default, recordings are saved to: V:\LabData

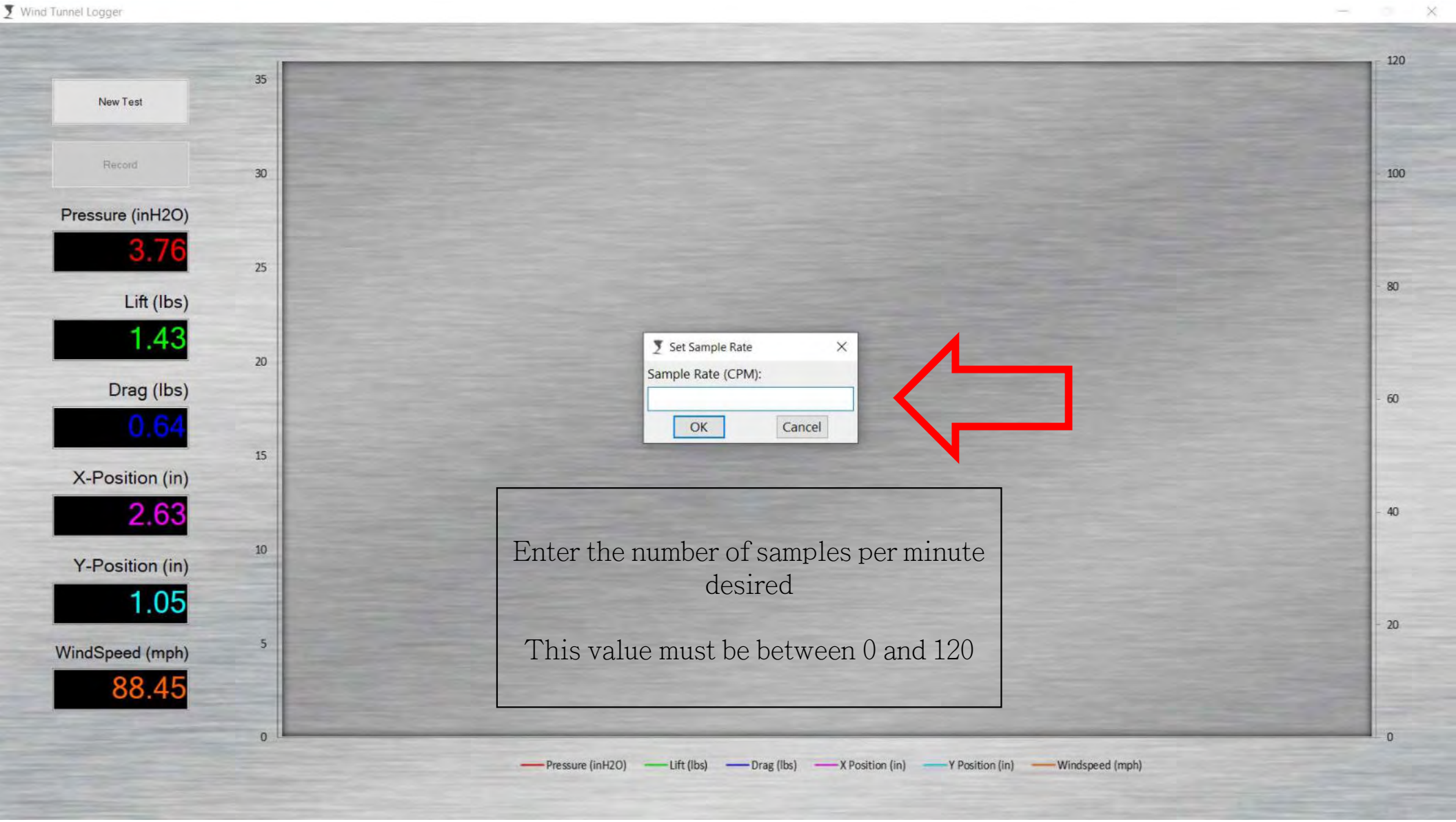

Wind Tunnel Logger
Save As
Seventh Gen > Wind Tunnel Control Center > LabData
Search LabData
Organize
New folder
Desktop
Documents
Downloads
Music
Pictures
Videos
Windows (C:)
Recovery Image
HP_TOOLS (E:)
Seagate Backup
Name
Date modified
Type
Size
Blank
4/20/2020 4:01 PM
Microsoft Excel W...
12
Test
4/21/2020 3:41 PM
Microsoft Excel W...
16
File name:
Test
Save as type:
Microsoft Excel (*.xlsx)
Hide Folders
Save
Cancel
X-Position (in)
2.68
Y-Position (in)
1.07
WindSpeed (mph)
88.92
Click 'Save' to create the file
This may take a second
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)

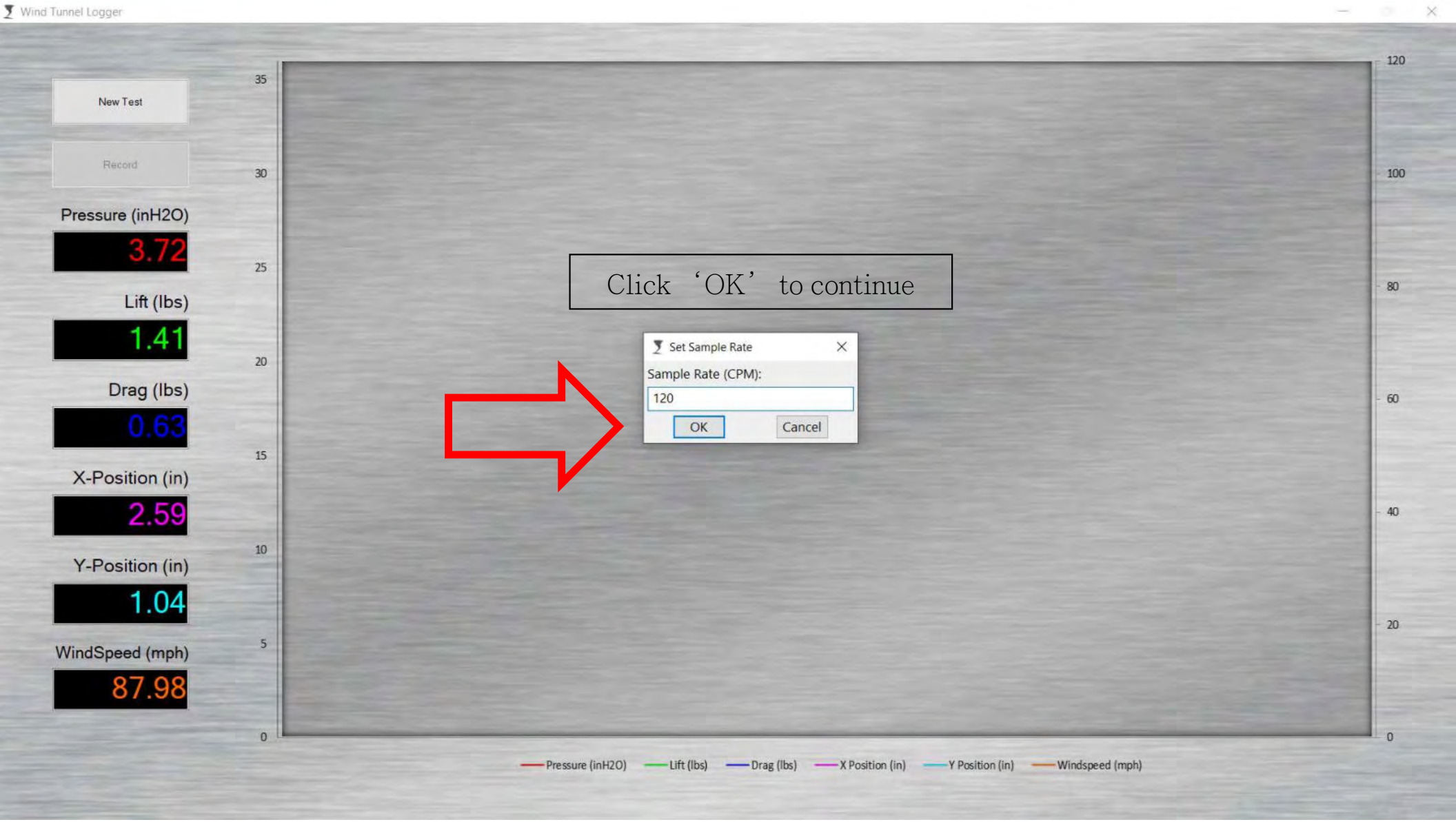

Wind Tunnel Logger
New Test
Record
Pressure (inH2O)
3.78
Lift (lbs)
1.44
Drag (lbs)
0.65
X-Position (in)
2.65
Y-Position (in)
1.06
WindSpeed (mph)
88.68
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
Please Wait ...
Loading
Opening Test.xlsx
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)


Wind Tunnel Logger
New Test
Record
Pressure (inH2O)
3.78
Lift (lbs)
1.44
Drag (lbs)
0.65
X-Position (in)
2.65
Y-Position (in)
1.06
WindSpeed (mph)
88.68
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
Please Wait ...
Loading
Creating Chart
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)


Wind Tunnel Logger
New Test
Record
Pressure (inH2O)
3.78
Lift (lbs)
1.44
Drag (lbs)
0.65
X-Position (in)
2.65
Y-Position (in)
1.06
WindSpeed (mph)
88.68
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
Please Wait ...
Loading
Creating Table
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)

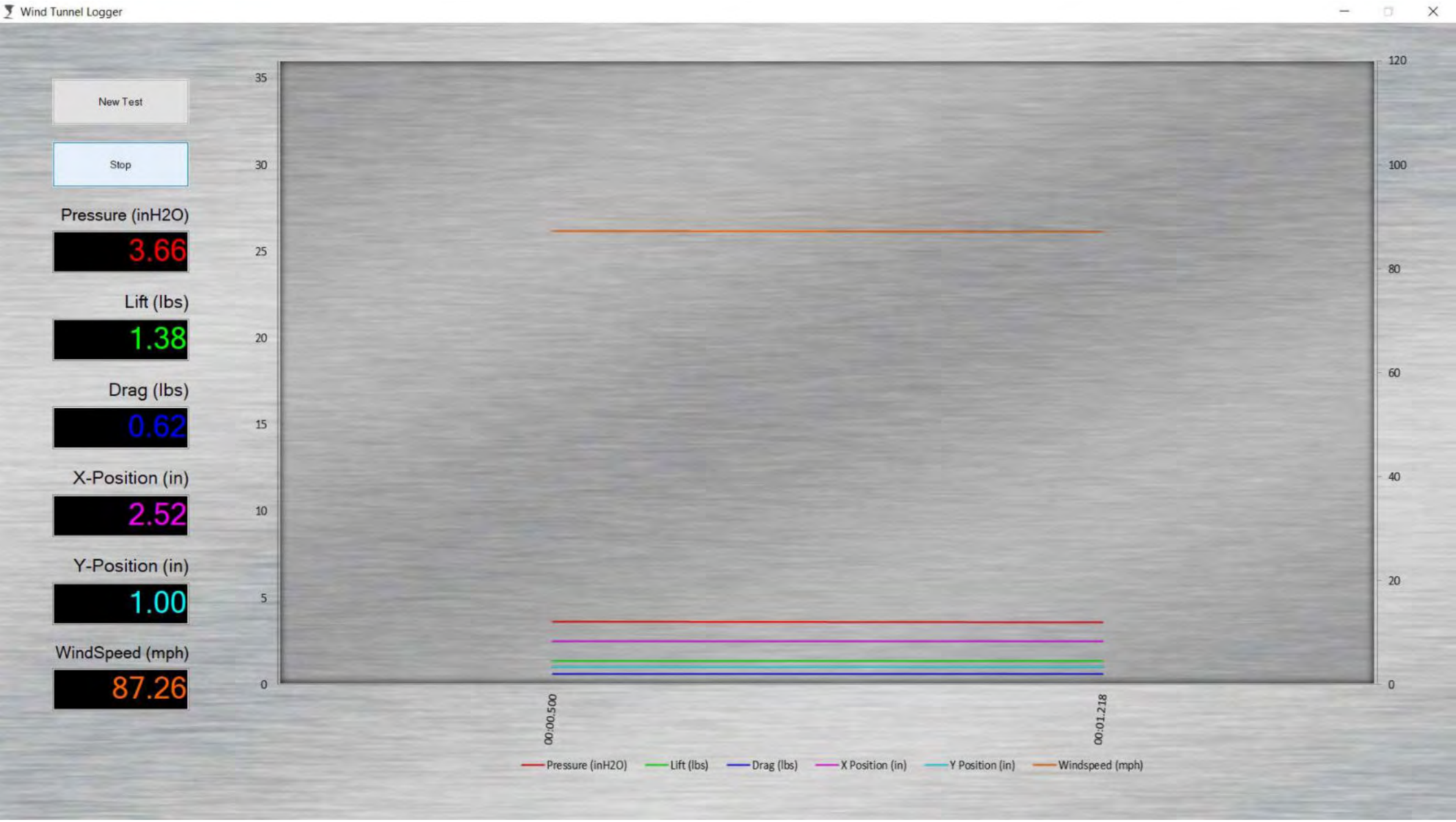

Wind Tunnel Logger
New Test
Record
Pressure (inH2O)
3.78
Lift (lbs)
1.44
Drag (lbs)
0.65
X-Position (in)
2.65
Y-Position (in)
1.06
WindSpeed (mph)
88.68
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
Please Wait ...
Loading
Exporting Chart
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)

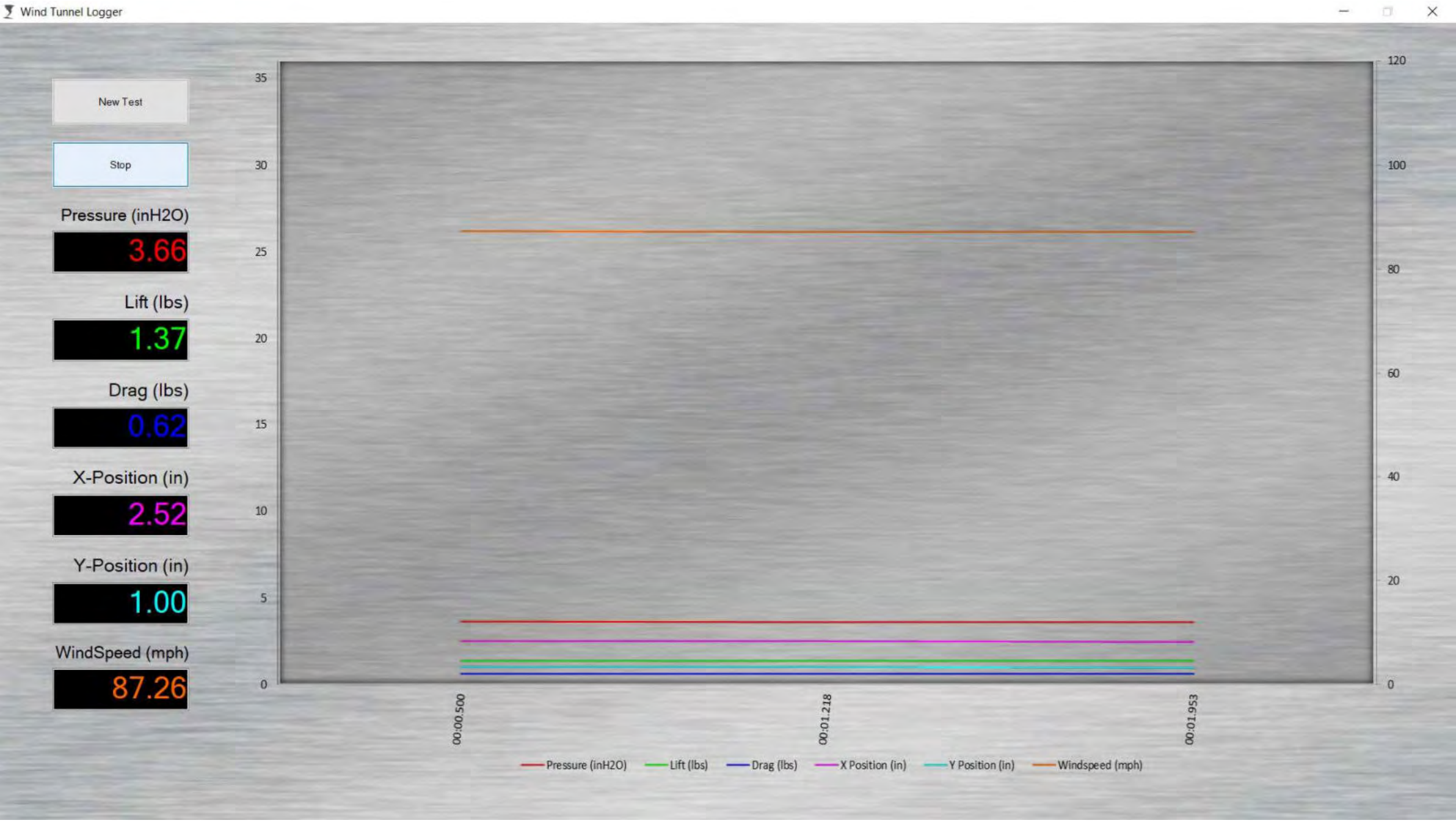

Wind Tunnel Logger
New Test
Record
Pressure (inH2O)
3.76
Lift (lbs)
1.43
Drag (lbs)
0.64
X-Position (in)
2.63
Y-Position (in)
1.05
WindSpeed (mph)
88.45
Set Sample Rate
Sample Rate (CPM):
OK
Cancel
Enter the number of samples per minute desired
This value must be between 0 and 120
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)

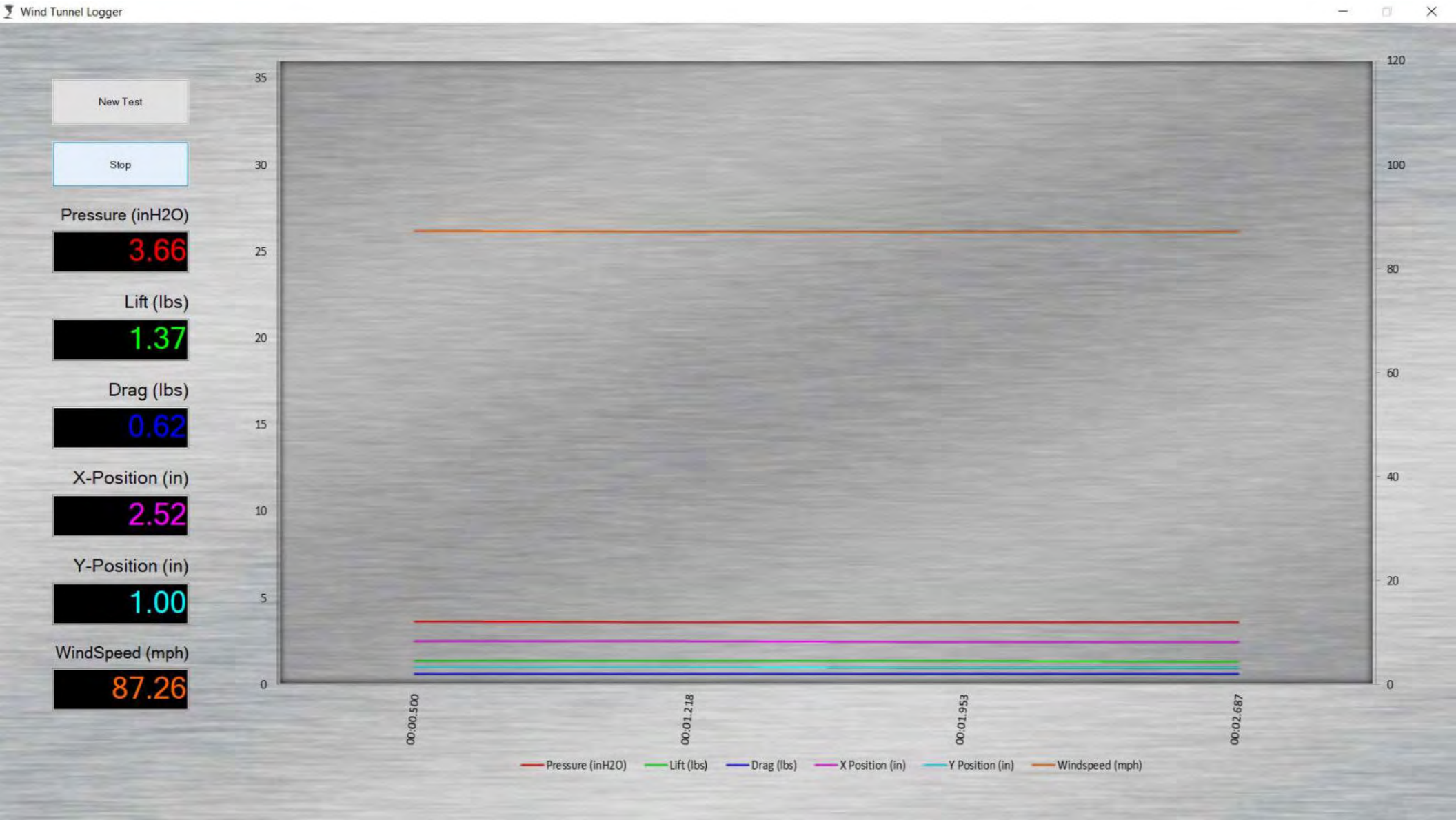

Wind Tunnel Logger
New Test
Record
Pressure (inH2O)
3.72
Lift (lbs)
1.41
Drag (lbs)
0.63
X-Position (in)
2.59
Y-Position (in)
1.04
WindSpeed (mph)
87.98
Click 'OK' to continue
Set Sample Rate
Sample Rate (CPM):
120
OK
Cancel
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)

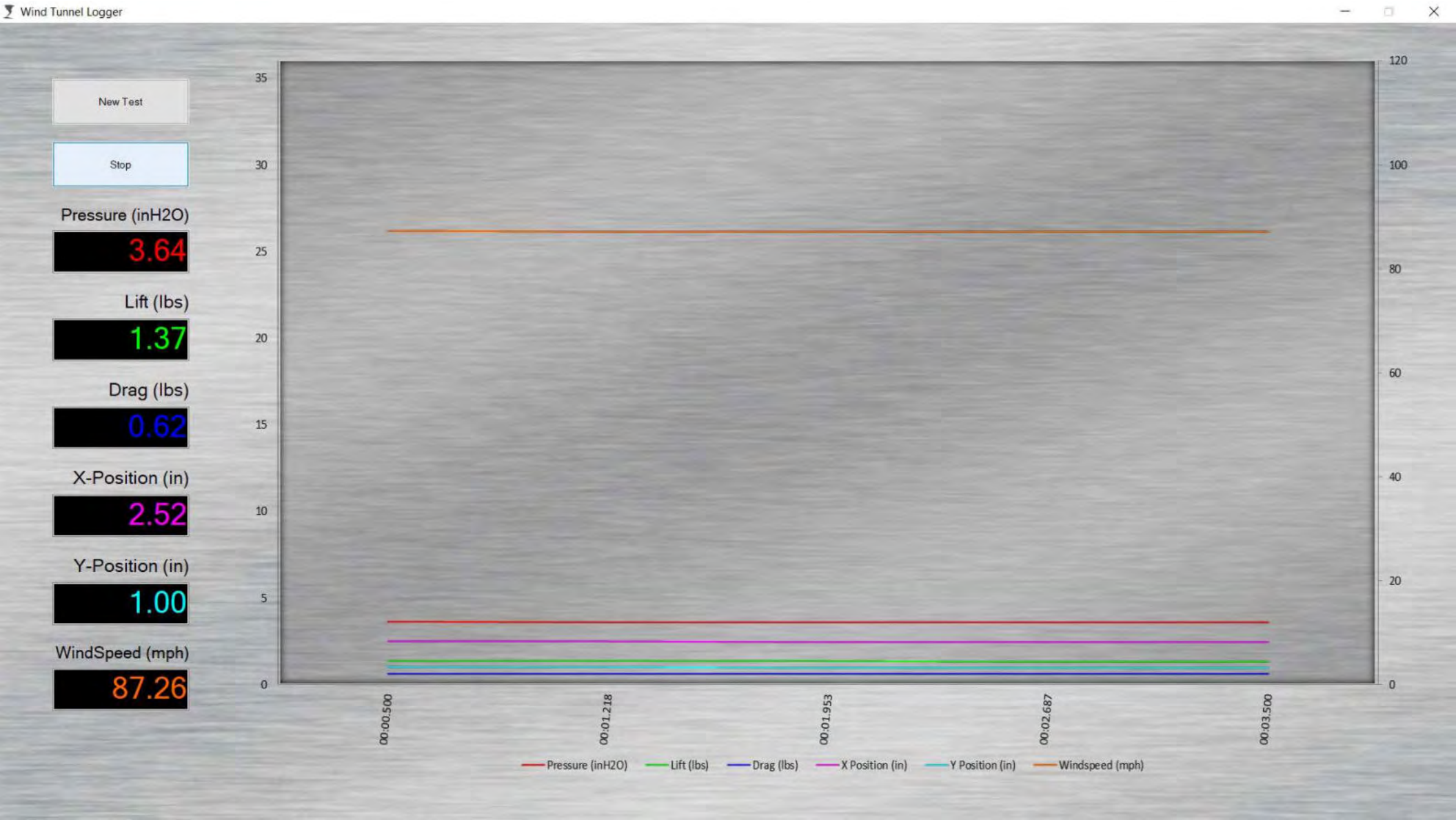
Press the 'Record' button to start recording data

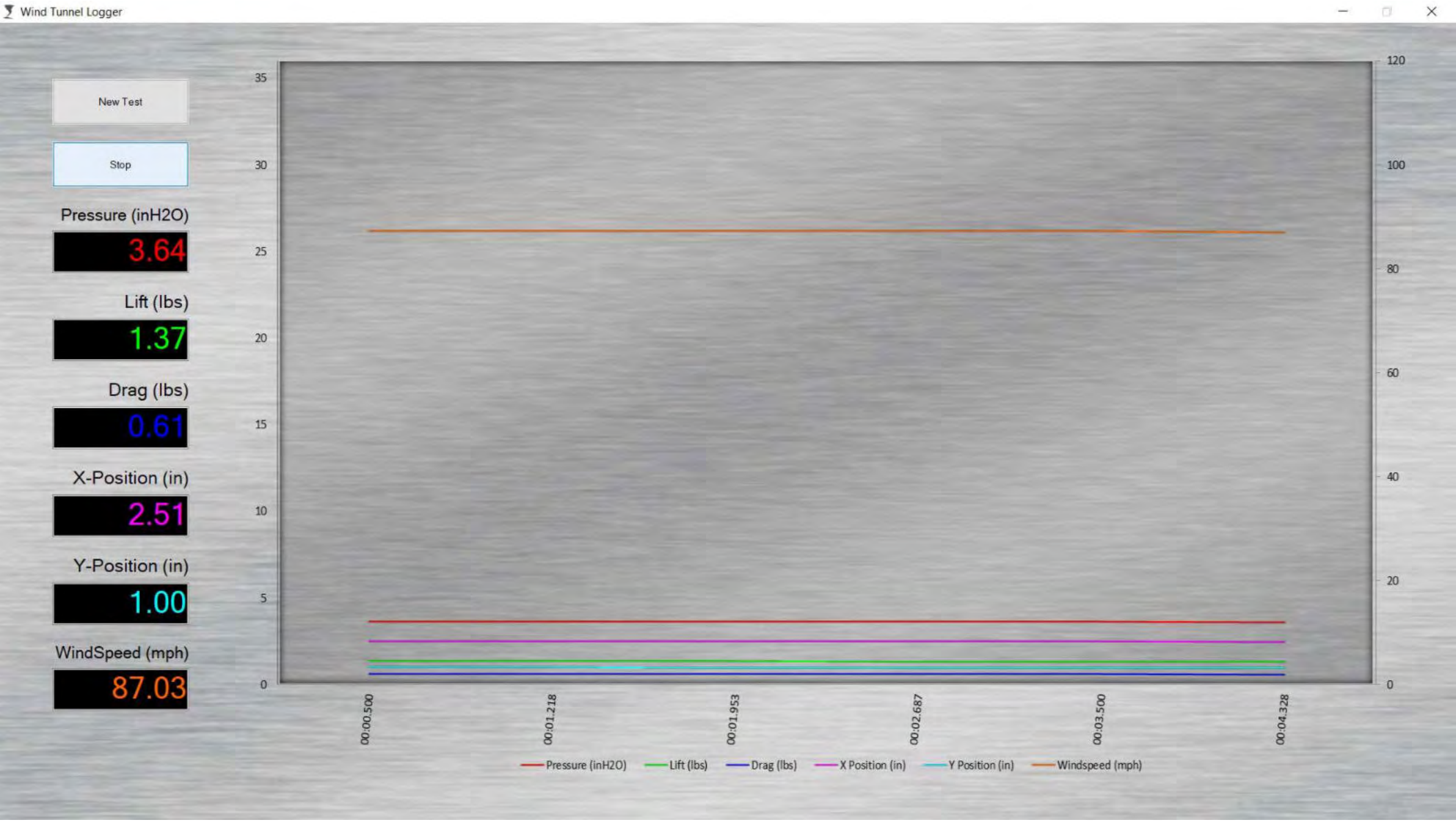

Wind Tunnel Logger
New Test
Stop
Pressure (inH2O)
3.66
Lift (lbs)
1.38
Drag (lbs)
0.62
X-Position (in)
2.53
Y-Position (in)
1.01
WindSpeed (mph)
87.38
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
00:00.500
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)

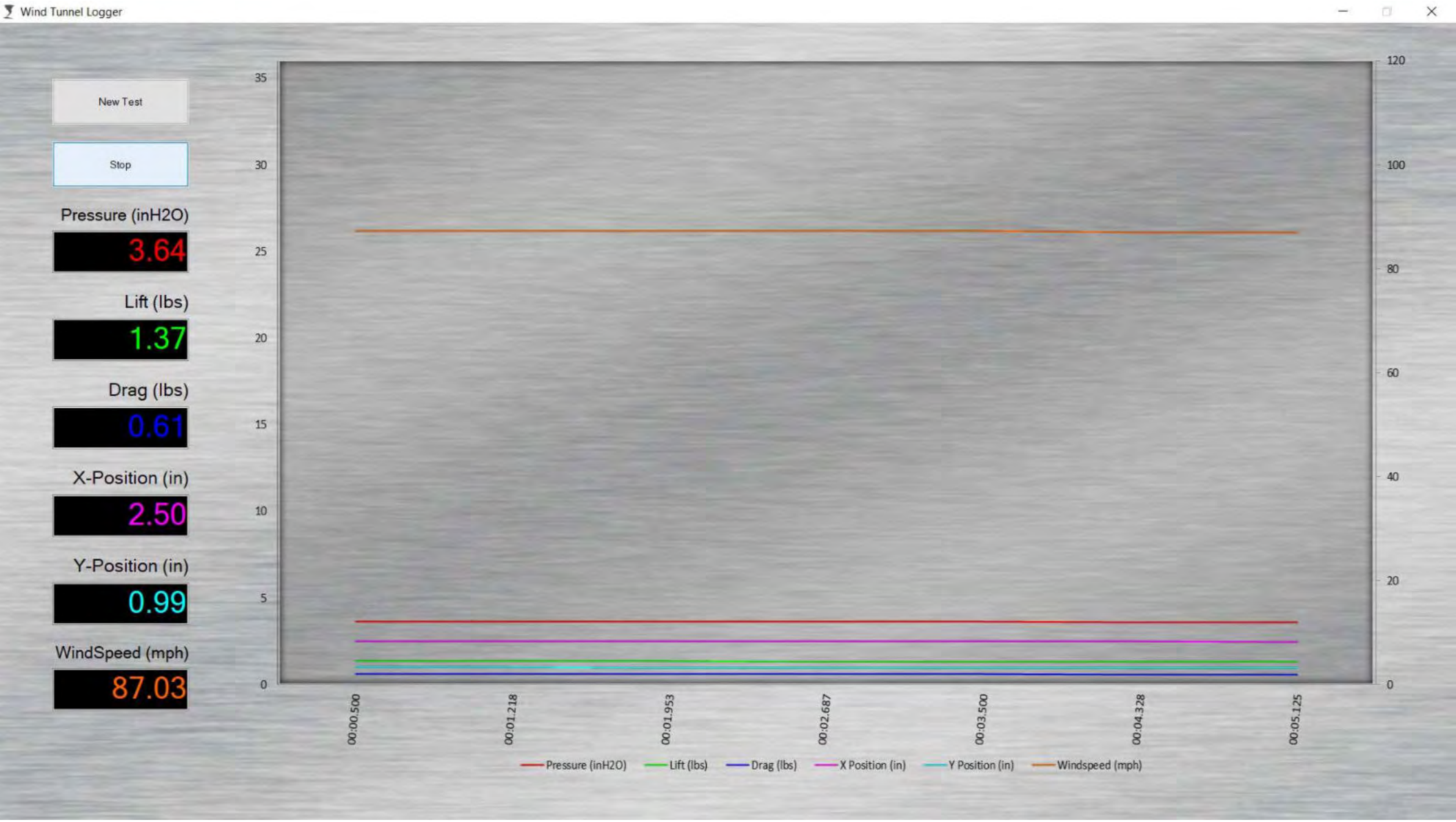

Wind Tunnel Logger
New Test
Stop
Pressure (inH2O)
3.66
Lift (lbs)
1.38
Drag (lbs)
0.62
X-Position (in)
2.52
Y-Position (in)
1.00
WindSpeed (mph)
87.26
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
00:00.500
00:01.218
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)

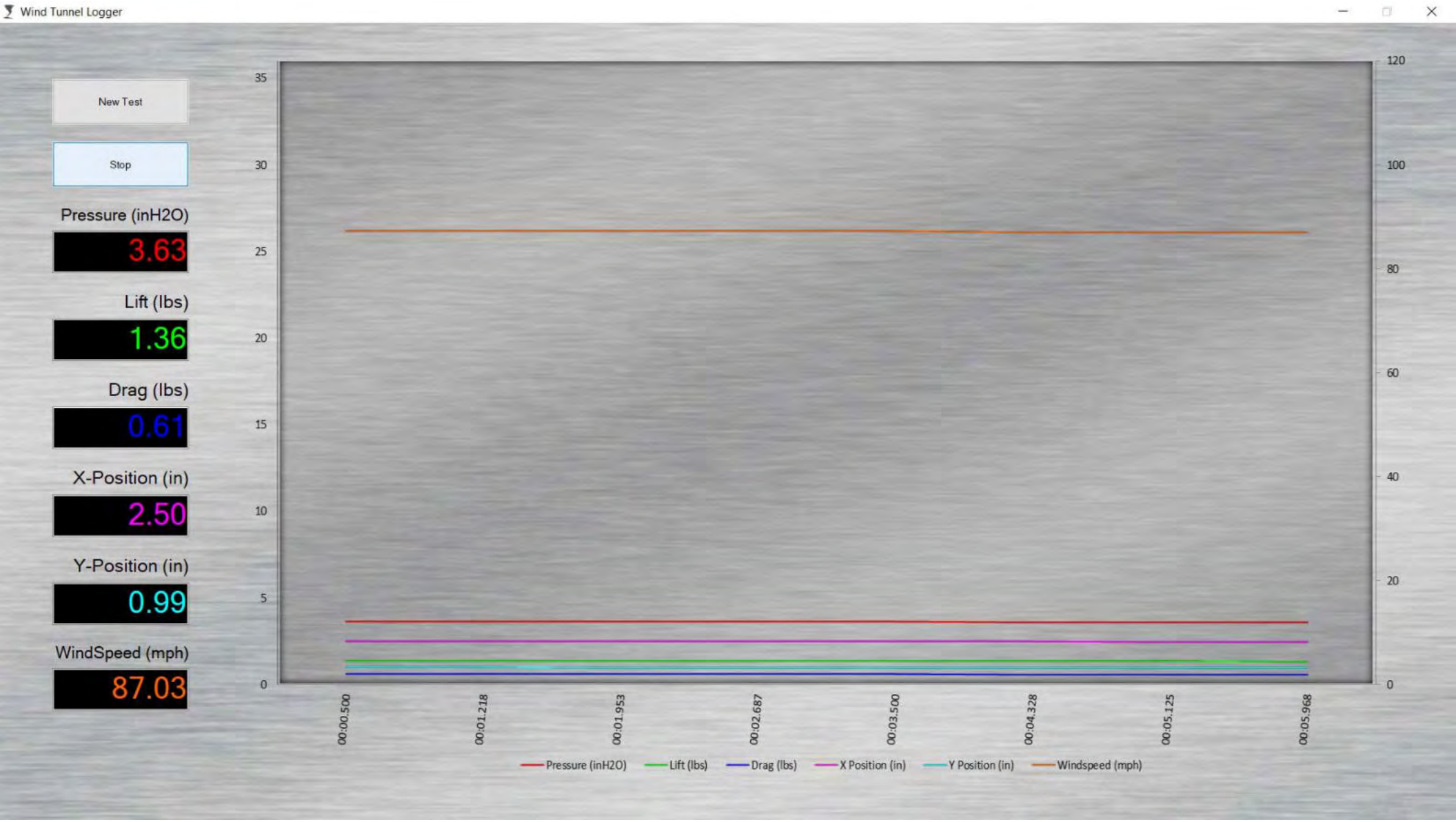

Wind Tunnel Logger
New Test
Stop
Pressure (inH2O)
3.66
Lift (lbs)
1.37
Drag (lbs)
0.62
X-Position (in)
2.52
Y-Position (in)
1.00
WindSpeed (mph)
87.26
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
00:00.500
00:01.218
00:01.953
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)

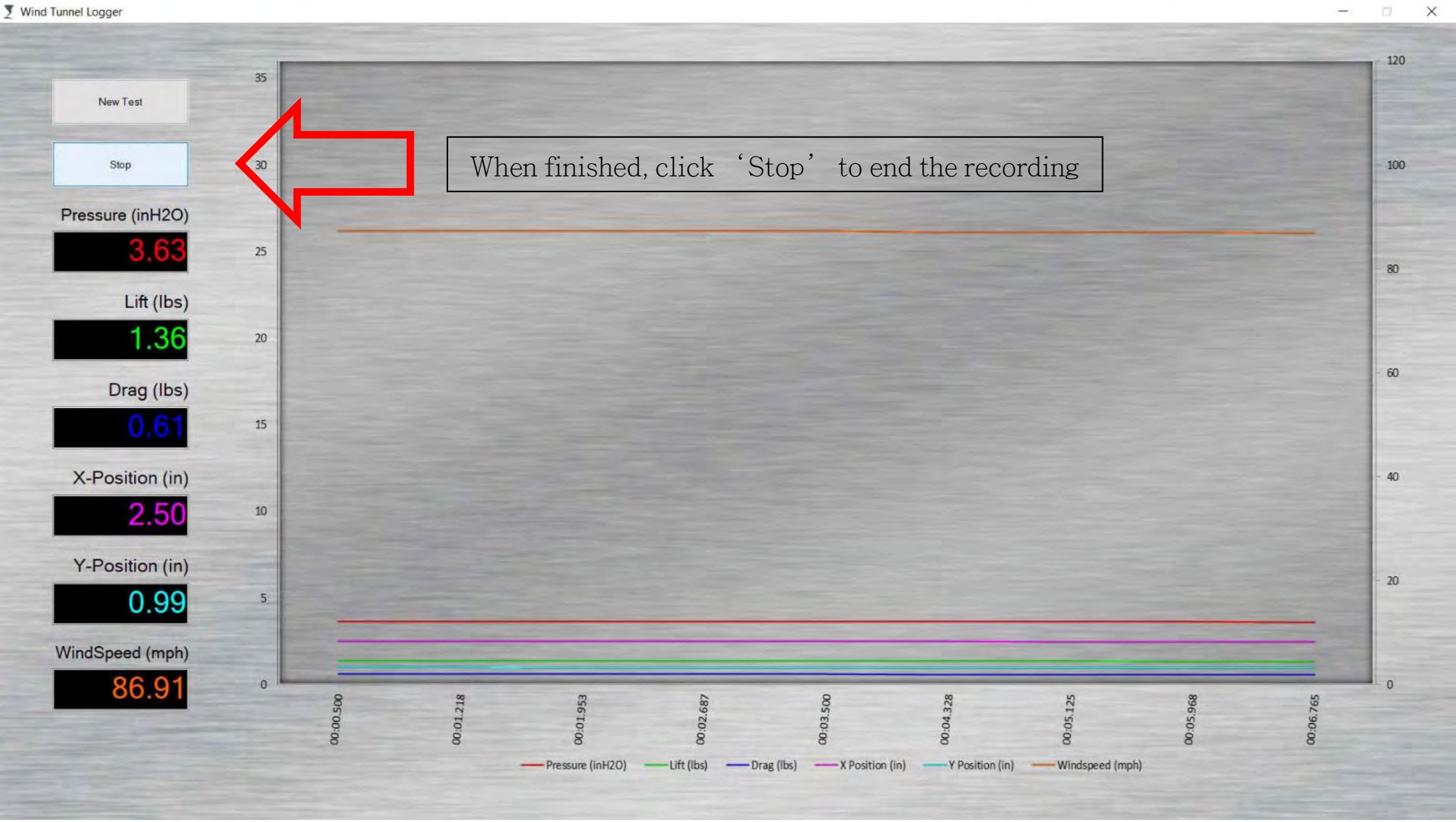

Wind Tunnel Logger
New Test
Stop
Pressure (inH2O)
3.66
Lift (lbs)
1.37
Drag (lbs)
0.62
X-Position (in)
2.52
Y-Position (in)
1.00
WindSpeed (mph)
87.26
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
00:00.500
00:01.218
00:01.953
00:02.687
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)

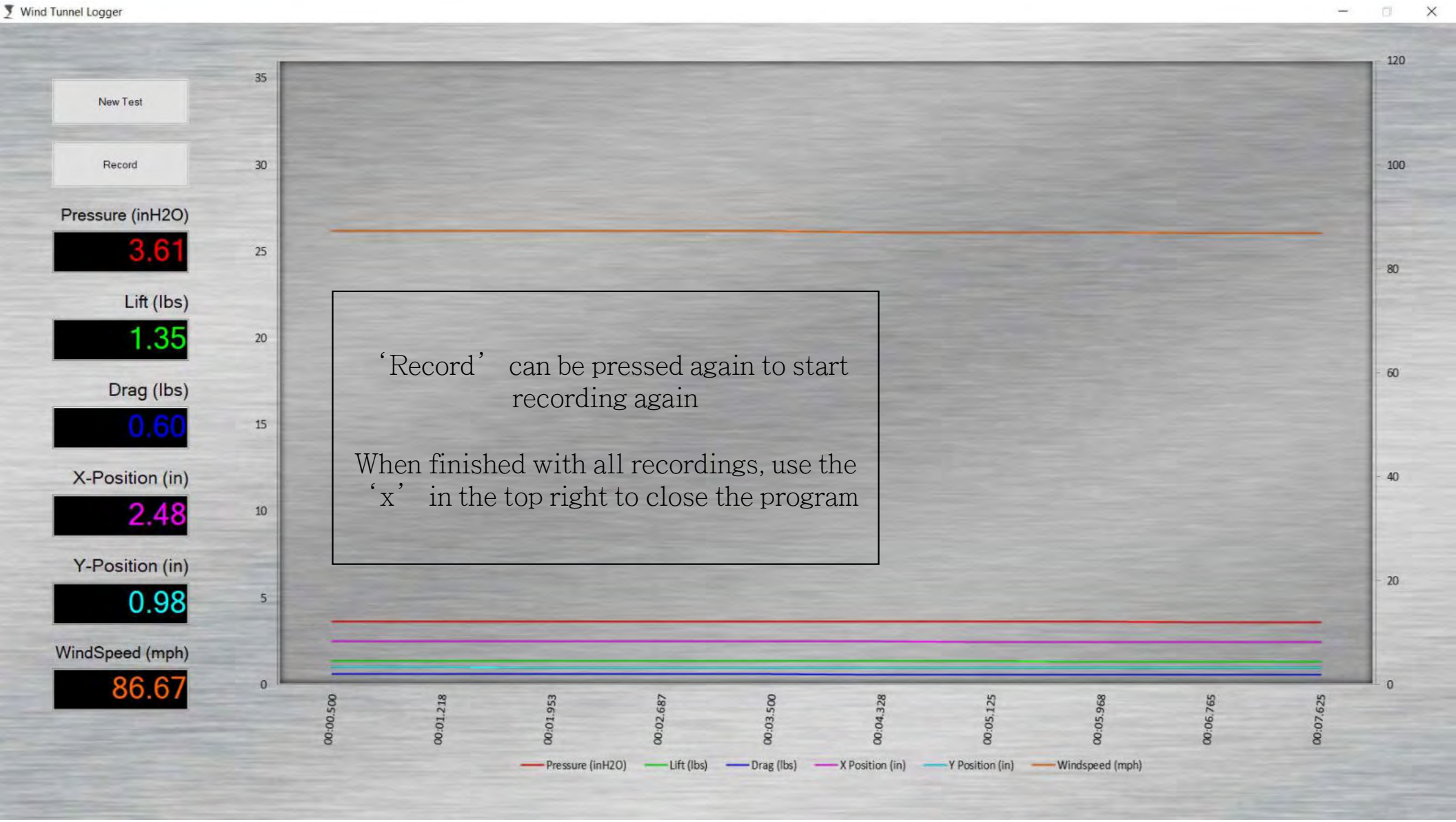

Wind Tunnel Logger
New Test
Stop
Pressure (inH2O)
3.64
Lift (lbs)
1.37
Drag (lbs)
0.62
X-Position (in)
2.52
Y-Position (in)
1.00
WindSpeed (mph)
87.26
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
00:00.500
00:01.218
00:01.953
00:02.687
00:03.500
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)


Wind Tunnel Logger
New Test
Stop
Pressure (inH2O)
3.64
Lift (lbs)
1.37
Drag (lbs)
0.61
X-Position (in)
2.51
Y-Position (in)
1.00
WindSpeed (mph)
87.03
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
00:00.500
00:01.218
00:01.953
00:02.687
00:03.500
00:04.328
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)


Wind Tunnel Logger
New Test
Stop
Pressure (inH2O)
3.64
Lift (lbs)
1.37
Drag (lbs)
0.61
X-Position (in)
2.50
Y-Position (in)
0.99
WindSpeed (mph)
87.03
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
00:00.500
00:01.218
00:01.953
00:02.687
00:03.500
00:04.328
00:05.125
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)


Wind Tunnel Logger
New Test
Stop
Pressure (inH2O)
3.63
Lift (lbs)
1.36
Drag (lbs)
0.61
X-Position (in)
2.50
Y-Position (in)
0.99
WindSpeed (mph)
87.03
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
00:00.500
00:01.218
00:01.953
00:02.687
00:03.500
00:04.328
00:05.125
00:05.968
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)


Wind Tunnel Logger
New Test
Stop
When finished, click 'Stop' to end the recording
Pressure (inH2O)
3.63
Lift (lbs)
1.36
Drag (lbs)
0.61
X-Position (in)
2.50
Y-Position (in)
0.99
WindSpeed (mph)
86.91
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
00:00.500
00:01.218
00:01.953
00:02.687
00:03.500
00:04.328
00:05.125
00:05.968
00:06.765
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)


Wind Tunnel Logger
New Test
Record
Pressure (inH2O)
3.61
Lift (lbs)
1.35
Drag (lbs)
0.60
X-Position (in)
2.48
Y-Position (in)
0.98
WindSpeed (mph)
86.67
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
00:00.500
00:01.218
00:01.953
00:02.687
00:03.500
00:04.328
00:05.125
00:05.968
00:06.765
00:07.625
Pressure (inH2O)
Lift (lbs)
Drag (lbs)
X Position (in)
Y Position (in)
Windspeed (mph)
'Record' can be pressed again to start recording again
When finished with all recordings, use the 'x' in the top right to close the program

Proposal

Data Logging and Interactive Documentation for Engineering Department Wind Tunnel

by
Zachary L Plesmid

Abstract
The objective of this project is to construct a data logging system for the Engineering Labs wind tunnel and to create a comprehensive, interactive help document. It will culminate in a working data logging setup that is easy to use for laboratory exploration, as well as, an in-depth document explaining the calibration, operation and troubleshooting of the wind tunnel and data logger.

1. Background

The Alfred University wind tunnel was installed in 2010. It provided students an opportunity to experiment with airflow and pressure over various geometries. Over the years, it has seen less use and its upkeep has fallen by the wayside.

Those who were privy to its operation have also graduated, retired or left, leaving manuals lost in the back of unknown cupboards and equipment scattered across the building, or worse.

Restoring the wind tunnel to its former glory and giving it some improvements will allow students to get hands-on experience with the material that they are covering in class. An interactive help document will allow the tunnel to be used no matter who graduates or leaves.

I will be the only team member working on this project. I built a data logger at my summer job. I also created an interactive manual for those who carried on my work when I returned to school. Before that, I created an in-depth manual for my high school auditorium, detailing all of the breakers, lights, outlets and programming. I believe that this past experience makes me uniquely qualified for completing this project.

2. Establishing the State-of-Technology

Seek out and review the manual for the wind tunnel and associated technology. Compare this to what actually exists in the lab.

3. Design

3.1 Project Objective

Construct a simple data logger and comprehensive, interactive literature for the system.

3.2 Critical Design Loads

1. An ignorant user entering unexpected commands
2. Out of range data

3.3 Performance Metrics

1. Measurement accuracy
2. Ease of use
3. Understandability

3.4 Analysis, Synthesis/Simulation Methodology

Upon completion of the manual, it will be tested by having an outside source attempt to operate the system using only the manual. If they are successful, the manual is also a success. Otherwise, revisions will be made.

4. Fabrication

Fabrication of calibration instruments will be accomplished by group members using the STEP lab resources. Data input to the data logging software will be done through the use of a data acquisition card connected to the computer. The logger itself will be created using signal processing (HP VEE) and spreadsheet (Microsoft Excel) software, communicating over DDE.

5. Experimentation/Verification/Correlation

The accuracy of the data logger is dependent on many factors. The data acquisition card must be of a high enough precision and the measuring equipment must be calibrated accurately. Special jigs are prescribed by the wind tunnel manufacturer. These will be used for calibration. If they cannot be found, new ones will be manufactured.

6. Schedule/Budget/Tasking

The following tasks must be completed:

1. Analyze the manual to find what equipment is missing and how to properly assemble and calibrate the equipment.

2. Recreate missing equipment
3. Install equipment that has not been
4. Obtain and connect the data acquisition card
5. Program the data logging software
6. Create help menu
7. Create tutorials
8. Create step-by-step guides
9. Conduct testing
10. Revisions

Abstract

The primary focus of this project was to improve and increase the use of Alfred University's wind tunnel. This goal required a multifaceted approach which included confirmation that the wind tunnel functioned, creation of an interactive educational presentation and operation manual, as well as, procurement of hardware, and programming of software for data logging which allowed for simplified data acquisition and analysis. These improvements ensure that the wind tunnel will see use by even the most unfamiliar of experimenters by giving them everything they need at their fingertips. The wind tunnel is now future proofed against graduating students, retiring professors or misplaced documentation.

Next Steps

- Intended but not accomplished
    - Install hardware
    - Install software
    - Calibrate sensors
    - Calibrate logger
- Next steps for this project
    - Install hardware
    - Install software
    - Calibrate sensors
    - Calibrate logger
    - Add project box to protect ADC
- Future projects based on this one
    - Improve the accuracy of pressure and wind speed measurements using a temperature sensor
    - Use wet and dry bulb temperature sensors to find wind chill and humidity psychometrically
    - Analyze vibrations in pressure front created by a cylinder in the stream

Installation Guide

Installation Guide

~ Z. Plesmid ~

This guide and the contents of this box will allow you to install the data logger on the wind tunnel. There is a hardware component and a software component to this installation.

Provided Materials

This box should contain:

- EECI ADC-8U12 Analog-to-Digital Converter Board

  Facilitates the communication between the wind tunnel and the computer.

- USB-A to USB-B Cable

  Connects the EECI ADC-8U12 to the computer.

- DA-15 Cable with one connector severed

  Connects the wind tunnel instrumentation to the ADC-8U12 There should be a beige cable already attached to the ADC-8U12.

- USB Drive

  Contains the data logging software and the interactive help menus.

Needed

You will need to provide:

- Computer with Microsoft® Office Excel and PowerPoint installed

  The software uses Excel for number crunching and data output. The software uses PowerPoint for help menu rendering.

- 2 available USB ports

  One for the ADC-8U12 and one for the software.

Process

This section will walk through the process of installing the data logging setup. It is a fairly simple task.

Hardware

To install the hardware:

1. Locate the EECI ADC-8U12 analog-to-digital card.

2. Locate the DA-15 cable, wired to the EECI card.

3. Plug the DA-15 connector into the port on the rear of the instrumentation box, labeled "Analog Output".

4. If rewiring the DA-15 cable to the ADC-8U12 becomes necessary, refer to Figure 1.

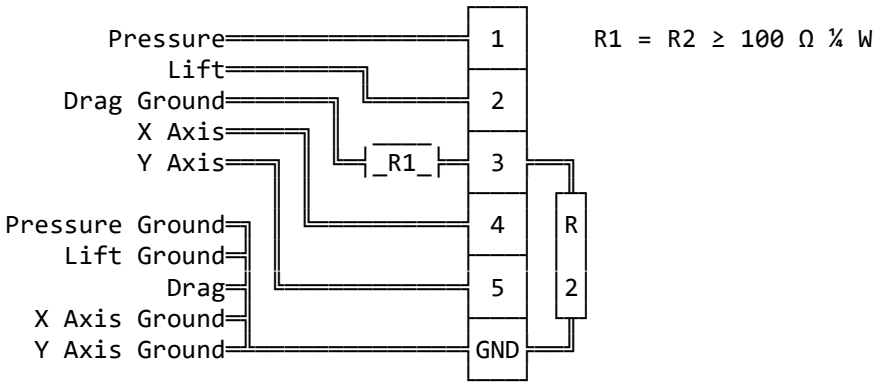


Figure 1: Analog to Digital Converter Wiring Diagram

6. Find the USB-A to USB-B cable.

7. Plug the USB-B end into the port on the ADC-8U12.

8. Plug the USB-A end into an available USB port on the computer.

The hardware installation is complete.

Software

To install the software:

1. Find the software USB included with this manual.

2. Turn on the computer and log in.

3. Plug the drive into an available USB port on the computer.

4. On the computer, navigate to the USB drive.

5. Navigate to the following folder on the USB:

   \Wind Tunnel Control Center\Calibration

6. Open 'Calibration.ini' with Notepad.

7. Follow the instructions in the file to calibrate the software.

   Note: Calibrating the software requires the prior calibration of the instrumentation box and the use of additional tools.

The software installation is complete.

Usage

To use the newly installed wind tunnel data logging system:

1. Turn on the instrumentation box using the switch on the rear panel.

2. Turn on the computer and log in.

3. Navigate to the USB drive.

4. Double click on the program called 'Wind Tunnel Control Center' to run it.

5. Wait while the software loads. This takes about 30 seconds.

6. Use the software. (see tips below)

Tips

- The system can utilize any computer that meets the following criteria:

  OS: Microsoft® Windows 10
  (newer versions may work but are untested)
  Office Suite: Microsoft® Office 365
  Screens: Two, side-by-side

- The software consists of a data logger and a help menu. When loaded, the data logging window will appear on the left screen and the help menu will appear on the right screen.

- The Help Menu explains the parts of the wind tunnel, how to operate the tunnel, how to wire the hardware, and how to run a test. Select the desired option from the main menu.

- The software package can be replicated by copying the contents of the USB drive to another USB drive.

- Usernames and program start times are stored for administrative purposes. They may be found on the software USB here:

  \Wind Tunnel Control Center\Logs\Users.log

- Data recorded using the program are stored as Excel files located on the software USB here:

  \Wind Tunnel Control Center\LabData

Contacts

Special thanks to the following helpful people:

```
  Name: Dr. Joe Rosiczkowski
 Title: Associate Professor of Mechanical Engineering
Reason: Senior Design Advisor
Office: Engineering Laboratories Room 214
 Phone: 607-871-2561
 Email: rosi@alfred.edu

  Name: Christina Vetter
 Title: Renewable Energy Engineering Secretary
Reason: Purchase Orders
Office: Engineering Laboratories
 Phone: 607-871-2135
 Email: vetterc@alfred.edu

  Name: Kurt Banaszynski
 Title: Project Engineer
Reason: Obtain wind tunnel documentation
Office: Engineering Laboratory Design, Inc.
        2021 South Highway 61
        P.O. Box 278
        Lake City, MN 55041
 Phone: 800-795-8536 / 651-345-4515 / 651-345-5095 fax
 Email: shinski@eldinc.com

  Name: Andrew Makasziw
 Title: ITS Desktop Technician
Reason: Obtain local admin on wind tunnel computer (AU18037)
Office: Information Technology Service, Herrick Library
 Phone: 607-871-2222
 Email: makasziwd@alfred.edu

  Name: Burt Brundage
 Title: EECI Customer Support
Reason: EECI ADC-8U12 setup questions
Office: Electronic Energy Control Inc.
 Phone: 937-349-6000
 Email: support@eeci.com

  Name: Liz Moore
 Title: Help Desk and Desktop Support Manager
Reason: Remote into wind tunnel computer (AU18037) from home
Office: Information Technology Service, Herrick Library Room 16
 Phone: 607-871-2222
 Email: mooreec@alfred.edu

  Name: Jonathan Long
 Title: Design Engineer
Reason: Troubleshooting wind tunnel instrumentation
Office: Engineering Laboratory Design, Inc.
        2021 South Highway 61
        P.O. Box 278
        Lake City, MN 55041
 Phone: 800-795-8536 / 651-345-4515 / 651-345-5095 fax
 Email: jonathan@eldinc.com

  Name: Jim Mighells
 Title: Technician/Machinist
Reason: Tools and equipment location
Office: STEP lab
 Phone:
 Email: mighells@alfred.edu
```

Other
Collegiate Tunnels

Colleges with Wind Tunnels from ELD inc.

Test Section Height	School	Year Installed
12"	Buffalo	'09
80cm	RPI	'07
24"	RPI	'05
36" x 48"	Clarkson	'04
12"	Columbia	'01
12"	Union	'00
24"	Syracuse	'96
18"	Cornell	'95
6"	Cornell	'93

Communications

TICKET 41132

Ticket 41132: Senior design project computer

Zachary, thanks for using the help desk. Your ticket (41132) has been closed.

.

On 9/30/19, at 11:59 am, Tier 2 wrote:

Zac,

I have given you administrative privileges on the specified computer.

Andrew Makasziw
ITS Desktop Technician

On 9/30/19, at 8:58 am, Tier 2 wrote:

Zac,

I have everything I need from you. I will send an email once I have put the permissions on the computer for you.

Andrew Makasziw
ITS Desktop Technician

On 9/27/19, at 12:12 pm, Zachary Plesmid wrote:

Hello,

I have spoken to Dr. Joe again. He confirmed that he forwarded you his permission to provide local admin on computer AU18037. Is there something else that you require from me?

Zac Plesmid

From: ITS Helpdesk

Sent: Friday, September 20, 2019 10:50 AM

To: Plesmid, Zachary L

Subject: [/helpdesk/WebObjects/Helpdesk.woa/wa/TicketActions/view?ticket=41132]Ticket 41132 Waiting for Customer (Updated) --> Senior design project computer: Hello,I will be...

On 9/20/19, at 12:34 pm, Zachary Plesmid wrote:

I spoke with Dr Joe on Wednesday and he said he'd given you permission to create a local admin account. Was this untrue? I cannot tell you what programs I require because I do not know, myself, yet. I need admin so that I can stop wasting your time and
mine. Please set this up, so I can get my project started.

Thank you

Zac

On Sep 20, 2019, at 10:50 AM, ITS Helpdesk helpdesksw@alfred.edu> wrote:

Ticket Message

On 9/20/19, at 10:50 am, ITS Helpdesk wrote:

Hello,
We have not heard back from you regarding our previous inquiry. Please let us know if you still need assistance or indicate if the ticket can be closed.

Thank you,

Gabrielle Dutton
ITS Helpdesk Consultant

On 9/18/19, at 8:09 am, Evan Linza wrote:

Good morning Zac,

Have you had the opportunity to speak with Dr. Joe about the programs you will be needing on that computer? I don't know as if we can give administrative privileges on it, but we can install the programs you need. If you have any questions, please feel free to contact us at (607) 871-2222 between the hours of 8:30 AM-4:30 PM Monday-Friday.

Thank you,

Evan Linza
ITS Help Desk Technician

On 9/10/19, at 4:10 pm, Zachary Plesmid wrote:

I have talked to Dr. Joe about it but he seems to keep forgetting. I hope to clear this up by the end of the week.

Thank you

Zac

From: ITS Helpdesk

Sent: Tuesday, September 10, 2019 3:58 PM

To: Plesmid, Zachary L

Subject: [/helpdesk/WebObjects/Helpdesk.woa/wa/TicketActions/view?ticket=41132]Ticket 41132 Waiting for Customer (Updated) --> Senior design project computer: Hello,I will be...

On 9/10/19, at 3:58 pm, Evan Linza wrote:

Hello Zac,

We have not heard back from you regarding our previous inquiry. Please let us know if you still need assistance or indicate if the ticket can be closed. Please contact us as soon you can so we can assist you with getting this installation done. You will need to have Dr. Joe contact us to let us know you need administrative privileges on that computer.

Thank you,

Evan Linza
ITS Help Desk Technician

On 9/5/19, at 2:25 pm, ITS Helpdesk wrote:

Hello,

In order to create the local account, we will need to receive an email from Dr. Joe stating that local admin access is required on lab computer for installation purposes.

Andrew Joiner
ITS Helpdesk

On 9/5/19, at 2:16 pm, Zachary Plesmid wrote:

I am working with Dr. Joe Rosiczkowski.

From: ITS Helpdesk

Sent: Thursday, September 5, 2019 2:14 PM

To: Plesmid, Zachary L

Subject: [/helpdesk/WebObjects/Helpdesk.woa/wa/TicketActions/view?ticket=41132]Ticket 41132 Open (Updated) --> Senior design project computer: Hello,I will be...

On 9/5/19, at 2:14 pm, ITS Helpdesk wrote:

Hello,

Could you provide the professor you are working with on the project?

Andrew Joiner
ITS Helpdesk

On 9/5/19, at 9:48 am, Zachary Plesmid wrote:

Hello,

I will be working on my senior design project all year. It will involve setting up a computer to log data from the wind tunnel in the Elabs. There is a computer there already. I need to install software on this computer but it will be on a day by day
basis when I know what it will be.

I would like to request a local admin account that I have access to on computer AU18037 in the Elabs.

Thank you,

Zac Plesmid

A00465061

TICKET

Re: [EXTERNAL] Wind Tunnel Documentation

Plesmid, Zachary L <ZLP1@alfred.edu>
Wed 10/16/2019 9:49 AM
To: Kurt Banaszynski <shinski@eldinc.com>

Mr. Banaszynski,

I am having trouble attaching the dynamometer readout to a computer for data collection. What is the recommended method of accomplishing this?

The manometer for calibration has gone missing. What is the proper model and from what source can I obtain another?

I also see that the airfoil on the dynamometer can be controlled by servos. There are no servos in our installation. How would I rectify this?

Thank you for your help,

Zac Plesmid

From: Kurt Banaszynski <shinski@eldinc.com>
Sent: Monday, September 16, 2019 4:22 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: [EXTERNAL] Wind Tunnel Documentation

Mr. Plesmid,

Thank you for your note.

Attached please find copies of the documentation that was supplied with the wind tunnel.

I hope that this is helpful. Please let me know if there are any questions or if anything else should be required.

Sincerely,

Kurt

Kurt A. Banaszynski
Project Engineer

Engineering Laboratory Design, Inc.

wind tunnel project

Vetter, Christina <vetterc@alfred.edu>

Fri 11/1/2019 12:09 PM

To: Plesmid, Zachary L <ZLP1@alfred.edu>

I talked to the Dean about your order. She is going to support this order and in the future we will go as needed. So if you have an idea of what you might need please get me some kind of budget even if you don't end up needing it ok?

Thank you,

Christina Vetter
Mechanical & Renewable Secretary

Christina
Vetter S

P 607-871-2135
E vetterc@alfred.edu

Alfred University
Kazuo Inamori School of Engineering
At the New York State College of Ceramics
1 Saxon Drive
Alfred, NY 14802
www.alfred.edu

Re: order

Plesmid, Zachary L <zlp1@alfred.edu>

Tue 11/5/2019 11:33 AM

To: Vetter, Christina <vetterc@alfred.edu>

I've looked on those sites and can't find anything equivalent. We have to get it from the company.

Thanks

Zac

On Nov 5, 2019, at 10:50 AM, Vetter, Christina <vetterc@alfred.edu> wrote:

> Hey I was wondering if you had to get that stuff from this company or it we could look elsewhere? Adafruit or amazon? something
>
> Thank you,
>
> **Christina Vetter**
> Mechanical & Renewable Secretary
>
> -<image001.jpg>
>
> P 607-871-2135
> E vetterc@alfred.edu
>
> **Alfred University**
> **Kazuo Inamori School of Engineering**
> **At the New York State College of Ceramics**
> 1 Saxon Drive
> Alfred, NY 14802
> www.alfred.edu

RE: Wind Tunnel Order Links

Vetter, Christina <vetterc@alfred.edu>
Fri 11/8/2019 9:53 AM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
ordered

From: Plesmid, Zachary L <ZLP1@alfred.edu>
Sent: Friday, November 8, 2019 9:49 AM
To: Vetter, Christina <vetterc@alfred.edu>
Subject: Wind Tunnel Order Links

Here are the links to the things for the wind tunnel.

Thank you

Zac

It is the third choice. The one that costs $79.95 with the correct part #
https://www.eeci.com/adc-8up.htm

It is the second choice. The six foot cable at $7.95
https://www.eeci.com/cables2.htm

USB Cables - Electronic Energy Control Inc

USB Connector Cables (1 foot/6 foot) and RCT-8/RCT-16 (ribbon cable to terminal block adapters)

www.eeci.com

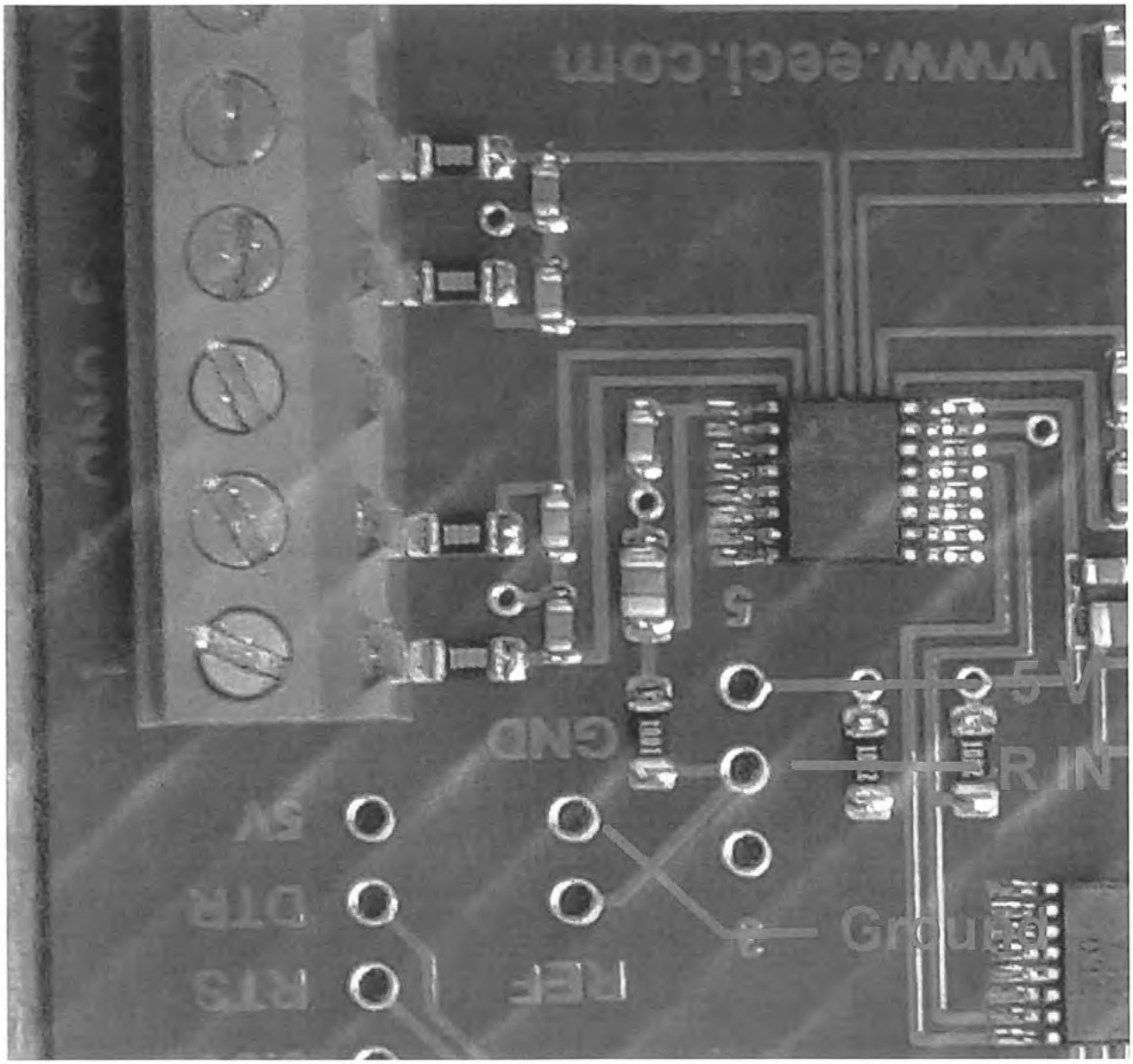
RE: [EXTERNAL] RE: ADC8U12 Set Up

EECI Support <support@eeci.com>
Mon 11/18/2019 3:42 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>

Hello Mr Plesmid,

You may use the 5 V VDD setting.

If noise is a problem, you may solder the points R IN and 5V with a jumper wire (then set to Supplied External). You must click Apply after checking.



Sincerely,

Bert Brundage
Customer Support
EECI

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Monday, November 18, 2019 2:58 PM

To: support@eeci.com
Subject: Re: [EXTERNAL] RE: ADC8U12 Set Up

Hi Mr. Brundage

I believe that I have solved the programming side of my issue.

I do still need to know how to set up 0-5v measuring. I tried to call the number in your signature several times and it never went through. Could you please provide a schematic or description of what I need for the conversion.

Thank you

Zac Plesmid

On Nov 15, 2019, at 11:40 AM, EECI Support <support@eeci.com> wrote:

> Hello Mr Plesmid,
>
> Please call when you get a chance.
>
> I can best assist you with this by phone.
>
> Sincerely,
>
> Bert Brundage
> Customer Support
> EECI
> phone (937) 349-6000
>
> **From:** Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
> **Sent:** Friday, November 15, 2019 11:16 AM
> **To:** support@eeci.com
> **Subject:** Re: [EXTERNAL] RE: ADC8U12 Set Up
>
> Thank you for the link. Unfortunately, I am busy all day Friday.
> What is needed for the 5v conversion?
> Is DDE supported?
>
> Zac Plesmid
>
> On Nov 14, 2019, at 11:22 PM, EECI Support <support@eeci.com> wrote:
>
>> Hello Mr Plesmid,
>>
>> Here is the link for the Visual Basic Express download: https://www.visualstudio.com/vs/visual-studio-express/
>>
>> Be sure to scroll to the bottom of the page and click this Blue link: Express 2017 for Windows Desktop
>>
>> This version is best as it will provide not only Visual Basic, but C#, C++ and lots of tools. After you install, be sure to update your license so that it will not expire in 30 days. You do this by clicking the help menu item then go to "About" and click the "license status" link on the top right of the page. You will need to log into your Microsoft account (you can create if you don't have one). This is the free version of Visual Basic and will not expire if you update your license.
>>
>> I can assist you further with Visual Basic examples after you get Visual Basic setup (it will take about an hour to download and setup).
>>
>> May I call you tomorrow to help you with the details and assist with setting the 0 to 5 volts?
>>
>> Sincerely,
>>
>> Bert Brundage
>> Customer Support
>> EECI
>> phone (937) 349-6000
>>
>> **From:** Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
>> **Sent:** Thursday, November 14, 2019 8:03 PM
>> **To:** support@eeci.com
>> **Subject:** Re: [EXTERNAL] RE: ADC8U12 Set Up

Mr. Brundage.

Yes I need to adjust this to 0-5V.

If you would provide the link to VB, it would be appreciated. Is there support in any other easily accessible languages such as windows batch file?

Thank you,

Zac Plesmid

On Nov 14, 2019, at 5:06 PM, EECI Support <support@eeci.com> wrote:

Hello Mr Plesmid,

I can assist you. The ADC-8U12 defaults to 0 to 4.1 volts. Do you need to adjust this to 0 to 5 volts?

You can download Visual Basic at no charge from the Microsoft website. Would you like for me to provide the download link?

Please feel free to contact me by phone at (937) 349-6000. This will save us a lot of time.

Sincerely,

Bert Brundage
Customer Support
EECI

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Thursday, November 14, 2019 3:05 PM
To: support@eeci.com
Subject: ADC8U12 Set Up

Hello,

I recently purchased an ADC8U12 for use as a data acquisition card for my university's wind tunnel. I have several questions on the set up of the device.

1) The signals I need to read range from 0-5 VDC. The manual mentions something about a shunt being needed in addition to the software setting. Is this true? What do I need to do?

2) I am interested in writing software to integrate the components of my project together. I have seen the example programs that came with the device. I do not have access to VB or C#. Is there a way to utilize the memory mapped data using Windows batch files, powershell, VBA, BASIC or AutoHotKey?

Thank you,

Zac Plesmid
Senior Mechanical Engineering Student
Alfred University

RE: monitor

Vetter, Christina <vetterc@alfred.edu>

Thu 2/6/2020 8:47 AM

To: Plesmid, Zachary L <ZLP1@alfred.edu>

Bring it back to me. If you think the monitor will be fine down there and no one will take it just bring the cord back to me. I will call ITS and see if they have the HDMI one.

From: Plesmid, Zachary L <ZLP1@alfred.edu>
Sent: Thursday, February 6, 2020 8:46 AM
To: Vetter, Christina <vetterc@alfred.edu>
Subject: Re: monitor

Hi

I tried to hook up the screen. Turns out the computer only has one vga jack. So I guess I need an hdmi cord for the new one. Let me know what I need to do.

Thanks

Zac Plesmid

On Feb 5, 2020, at 3:05 PM, Vetter, Christina <vetterc@alfred.edu> wrote:

> Hi I wanted to let you know that I have the second monitor for the wind tunnel and the cord for it as well. If you want to come to my office to get it and try getting it hooked up please let me know. I don't know what is going on with ITS and the ticket I've put through.
>
> Thank you,
>
> **Christina Vetter**
> Mechanical & Renewable Secretary
>
> <image001.jpg>
>
> P 607-871-2135
> E vetterc@alfred.edu
>
> **Alfred University**
> **Kazuo Inamori School of Engineering**
> **At the New York State College of Ceramics**
> 1 Saxon Drive
> Alfred, NY 14802
> www.alfred.edu

RE: [EXTERNAL] RE: Instrumentation system

Jonathan Long <jonathan@eldinc.com>
Wed 3/4/2020 4:22 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>

Unfortunately, you will be limited by your DAQ card and you won't be able to acquire data with that card near the maximum tunnel velocity.

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Wednesday, March 04, 2020 12:35 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

When I look inside the cabinet, it appears that the drag card that I need to adjust is already set to the lowest gain settings. Am I missing something?

Thank you,

Zac

From: Jonathan Long <jonathan@eldinc.com>
Sent: Monday, March 2, 2020 10:14 AM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

Hi Zac,

You can change the analog output voltage by adjusting the gain setting on the drag card. The switch settings are in the LVM-110 manual I sent you previously. You will have to recalibrate the dynamometer after you change the gain setting. Be sure to record the analog voltages as you calibrate to determine if you are in an acceptable range for your DAQ card.

You will be able to switch the sign of the voltage output by switching pins 7 and 8 on one end of the 15 pin dynamometer connector cable. A solder iron may be required to switch the connections on the cable. Verify the connections before you switch pins 7 and 8. I have also attached a copy of the full meter wiring diagram for your reference.

Please let me know if this gives you the desired results.

Regards,
Jon

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Saturday, February 29, 2020 12:17 PM

To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

Hello again,

I have adjusted the airfoil to about 11-12 degrees. At full 60 hz, the analog output for lift is around 2.6V. The output for drag is around -9.36V. As both of these are less than 10V I should be safe from damaging the cards inside the black box.

The DAC card that I'm using to read data into the computer can read up to 5V. The lift measurement will be fine. Is there a way to make the drag measurement fall in this range? Also it has to be positive in order for the card to read it. Is this possible?

Thank you,

Zac Plesmid

From: Jonathan Long <jonathan@eldinc.com>
Sent: Monday, February 24, 2020 5:27 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

Good question;

I changed what I was using for my reference area and now it better aligns with what you are measuring with the dynamometer. I was using the projected area in the first data set and now I have switched it to the airfoil surface area so you won't need to change anything. Seeing how you are measuring almost 25 lb of lift, I would measure the analog output voltage and make sure you are not exceeding 10 VDC. I would also consider using a combination weights that would encompass your anticipated load range so you are not having to extrapolate your calibration curve.

To answer your second question, it would be preferable the airfoil was not in the stalled condition when determining the maximum load range on the dynamometer. I would try to reduce the angle of attack to 12° which will get you closer to maximum lift for this airfoil.

Jon

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Monday, February 24, 2020 3:17 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

Why do the numbers need to be divided by ten? I have calibrated it to pounds following the current decimal points. So shouldn't it be 20 lbs? not 2? Is it important that it is in a stalled condition?

Thanks

From: Jonathan Long <jonathan@eldinc.com>
Sent: Monday, February 24, 2020 4:04 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

Hi,

I've attached a chart with your data and my estimations. Please note, these are rough estimations as I do not have the actual tunnel velocities on hand (see attached Sweep data for details). Judging by the coefficients, it looks as if the airfoil is in a stalled condition. I still had to divide both of your outputs by a factor of ten, effectively moving the decimal point to the left, to get accurate results.

If you want to avoid this work around you may move the decimal point position on the displays. You will need to disconnect power to the meter cabinet and access the interior. Section 3.1 in the OAM manual describes the procedure to move the decimal point location for each display.

Please let me know if I can be of further assistance.

Jon

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Monday, February 24, 2020 2:35 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

Hi,

I calibrated the lift and drag in lbs. I can have my program calculate Reynold's numbers then from collected data. I will look into these coefficients some more.

Thank you,

Zac

From: Jonathan Long <jonathan@eldinc.com>
Sent: Monday, February 24, 2020 3:30 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

Hi,

To answer your first question, it appears that you are just within the safe range for loading at the maximum test section velocity. You can leave your decimal point locations as is. Another question I should ask is what units you did you set them to output. Are you measuring in kg?

Your Reynolds number will be a function of the tunnel velocity and the chord length of your airfoils, which are all 6" in length. Reynolds number is desired as it is a good descriptor of the inertial and viscous forces in a system. It will tell you about the state of the flow and indicate whether it is laminar, transitional or turbulent. Knowing your Reynolds number allows you compare your data with data measured in different facilities with models of different scales. You will be able to compare the data you acquire with the data in the NACA report I sent you that was published in 1955. It also allows you to determine which coefficients of lift and drag you should use when determining aerodynamic loads on an airfoil.

Thanks,
Jon

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Monday, February 24, 2020 1:55 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

Hello,

I believe it is the NACA 0012. It is very symmetrical. It is at about 17 degrees. I don't have the pitot tube set up yet to measure wind speed, yet. Are the readout ranges safe for the cards? Drag has three place values and Lift only two. Should I change this or not? If so, how do I go about it? Is the Reynold's number something that I need to implement as a correction factor on a per wing basis or on an overall basis?

Thank you very much for your help,

Zac

From: Jonathan Long <jonathan@eldinc.com>
Sent: Monday, February 24, 2020 10:15 AM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

Hi Zac,

Would you be able to tell me which airfoil you used for testing as well as the angle of attack? Also, when comparing aerodynamic forces it would be more important to know the tunnel velocity versus the inverter frequency. I was able to compare some of your data using the velocity sweep data that I acquired a couple years ago and your data seems to compare well with theoretical lift and drag force relations. You are heading in the right track with the dynamometer and you will need to research the effects of Reynolds number on lift and drag coefficients to generate accurate curve fits. I have attached a NACA technical report which might have some useful information for you. There is abundant open source information available for NACA 4412 and 0012 airfoils online or possibly at your library.

I hope this helps and please let me know if you have further questions.

Regards,
Jon

From: Zachary Plesmid [mailto:zlp1@alfred.edu]
Sent: Friday, February 21, 2020 8:31 AM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

Hi Mr. Long,

I apologize for the much delayed answer; the wind tunnel has finally been repaired.

I just ran one of the airfoils at its greatest AOA. I recorded the lift and drag outputs (on the screens). You said that if any were too high the decimal would need to be moved around. How do these numbers look?

image1.jpeg

Thank you,

Zac Plesmid

On Jan 31, 2020, at 3:35 PM, Jonathan Long <jonathan@eldinc.com> wrote:

Hi Zac,

It sounds like everything is working as expected now. You certainly gained some good troubleshooting experience too.

The outputs allow you to interface with a data acquisition unit to enable you to log data on a computer. With your system, you would potentially be able to log time averaged velocity data from your pitot probe, aerodynamic loadings from your dynamometer, pressure data from your models as well as the X-Y locations using your streamwise traversing mechanism. Having a means to log your data will help you immensely with any kind of statistical analysis. To answer your 2nd question, you are able to tie all your grounds together.

I hope this helps!

Thanks,
Jon

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Friday, January 31, 2020 2:01 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

Hi Jon

Sorry for the late response. I have been busy with classes.

I have tared the dynamometer in it's mounted position successfully. I have yet to test the range as the handle on the fusible disconnect is being fixed.

In the mean time, could you tell me more about how I can use the output signals? Do I have to measure differentially or can I tie all of the grounds together?

Thank you,

Zac

On Jan 30, 2020, at 9:45 AM, Jonathan Long <jonathan@eldinc.com> wrote:

> Hi Zac,
>
> I'm glad to hear that both axis are in working order. The behaviors you noted when you hold the dynamometer upright are normal. The weight of the strut and cage components will impose a small deflection on the beams which will show up on your meter display as a tare weight. To remove this, you may adjust the thumbwheels on the dynamometer to zero each axis as necessary. Doing so will not affect your calibration. Alternatively, you may record the values at zero velocity and subtract them from your data later.

The analog output voltage of the signal conditioning cards are +/- 10 VDC. If you are wanting to know the range while the tunnel is operating you will want to plot it and make your own trend line.

You are able to change the decimal point location. You will need to open the meter cabinet enclosure and look for a jumper at the front end of the PCB near the ribbon cable connecter that leads to the lift display. Moving the jumper to the left, assuming the display is facing towards you, will move the decimal point towards the left side of the display.

I would wait to change the decimal point location until you verify the operating range of the dynamometer with an airfoil attached to the strut. You will need to determine the operating speeds of the tunnel which you can also correlate to a range of chord Reynolds numbers for your testing. I would test it over a range of angle of attacks prior to moving the dip switch to determine if you produce more than 10 lb. of lift. Be sure to start from a low velocity (5 Hz) at your maximum angle of attack (12° to 18°) and slowly increase the test section velocity. Be sure not to overload the dynamometer as you may over-range and potentially damage the signal conditioning cards.

Please let me know if there is anything else I can assist you with today.

Regards,

Jon

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Wednesday, January 29, 2020 4:50 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

I set the dip switches according to the manual and reinstalled the cards in the same slots they had come out of. I recalibrated both lift and drag. They both work fine now. I am still confused by a few things. The lift and drag calibrate properly when they are on the mounting. When I hold it upright as in the wind tunnel the numbers aren't zero. Why is this.

Also, if I want to read these value out through the analog port, is there a way to know the range of the voltage or do I just have to plot it?

Lift is of the form xx.xx and drag looks like x.xxx. Can I change lift to match?

Thank you,

Zac Plesmid

From: Jonathan Long <jonathan@eldinc.com>
Sent: Wednesday, January 29, 2020 4:35 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

I wonder if something got changed recently because the master/follower settings (S1-B) should not be identical. You will need to position the DIP switches to the settings described in the manual and then try to calibrate the dynamometer. You should be able to identify a card by tracing the path to the potentiometer below the digital display. I have attached a copy of the LVM110 manual. There are gain settings that you are able to adjust to alter your sensitivity range.

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Wednesday, January 29, 2020 3:14 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

I connected a multimeter to the analog output. I used pin 12 as ground (manual says that is Lift gnd. Also seems the same as pin 11 on the meter). Pin 2 for the red lead on the meter. I zeroed on the meter then spanned to 0.044V and checked zero. It continues to do the 0.030 then 0.070 oscillatory thing.

I opened up the cabinet. I removed the two cards. I checked their dip switches to identify which card was which. They have identical settings (11000000). This is not what the settings in the manual are. Is this a problem?

Zac

From: Jonathan Long <jonathan@eldinc.com>
Sent: Wednesday, January 29, 2020 3:42 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

I appreciate your patience going through this process and I am sorry if it is sounding a bit repetitive.

I have two more things for you to try. First, I would try to measure the analog voltages using a digital multimeter on the analog output connector. Be sure to use pins #2 and #11 for the lift card and pins #3 and #11 for the drag card. Ignore the displays on the meter cabinet for the moment. You can calibrate the dynamometer using the analog signal as a reference. Run through a calibration and send me a copy of the data.

If that does not yield desirable results, you will need to disconnect power to the meter cabinet and open the enclosure. The enclosure is accessed by unscrewing the four (4) rubber feet the bottom of the cabinet. Inside the cabinet you will see two (2) LVM-110 signal conditioning cards standing on edge. You will then need to pull the cards out of the 20 pin edge connectors and swap the connections. Be sure to adjust the dip switch settings on the cards to match the documentation. The card settings are found on page 2 on the manual. Take this time to inspect the interior of the enclosure for loose connections.

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Wednesday, January 29, 2020 2:07 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

I zero it. I add weight. I span to 00.44. I remove weight. It reads -0030. I zero. I add weight. It reads 0072. Repeat. It never changes. Always -0030 and 0070.

From: Jonathan Long <jonathan@eldinc.com>
Sent: Wednesday, January 29, 2020 2:58 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

Correct, you may have to go and forth several times adjusting the span dial on the meter cabinet and the thumbwheel on the dynamometer. You might be far off now but if you repeat the process you should get closer to zero.

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Wednesday, January 29, 2020 1:46 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

I did not for this test. The manual says to go back and forth adjusting zero and span until both are right. But, since the zero is so far off, I haven't been iterating.

From: Jonathan Long <jonathan@eldinc.com>
Sent: Wednesday, January 29, 2020 2:36 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

When you remove the weight, do you readjust the thumbwheel on the dynamometer so the display reads zero?

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Wednesday, January 29, 2020 1:28 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

I was. I've been starting with a span of 0. So I turned the span to somewhere in the 8 decade. Then I zeroed. Then I applied the weight. I adjusted span to read 00.44. I took the weight off and now the display says -00.30. The drag axis seems to be working fine. It is in the 4 decade.

From: Jonathan Long <jonathan@eldinc.com>
Sent: Wednesday, January 29, 2020 2:13 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

It looks like you are at the bottom end of the span setting. I would give it a few turns so decade on the dial shows 8 instead of 0. You will have to readjust the brass thumbwheel on the dynamometer to zero the display. The same procedure would have to be done on the drag axis too.

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Wednesday, January 29, 2020 1:01 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

The first picture is unloaded. The second is loaded. Span is as I left it after spanning to 0044 as discussed previously. The numbers jump quite a bit. The first around 22 and the second around 40.

Zac
<image001.jpg>
<image002.jpg>

On Jan 29, 2020, at 1:52 PM, Jonathan Long <jonathan@eldinc.com> wrote:

> Zac,
>
> May I get some photos of the meter display? I'd like to see an image with the dynamometer both loaded and unloaded. A close-up of the span settings would be helpful too.
>
> Thanks,
> Jon

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Wednesday, January 29, 2020 11:52 AM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

Hi Jon,

I zeroed the lift display with no weight on the strut. I then applied a 2 kg weight. I scaled the value until it read 02.00. I removed the weight. The display reads 01.79. If I span to read 00.20 then remove the weight the display reads 00.02.

If the decimal point position has an impact on the output then I did not know that. I did increase the output to get more resolution. I was treating the display as a fixed point number (i.e. the decimal isn't real). When I scale to 00.44 and remove the weight it reads 00.25.

Thanks,

Zac

From: Jonathan Long <jonathan@eldinc.com>
Sent: Tuesday, January 28, 2020 5:23 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: RE: [EXTERNAL] RE: Instrumentation system

Hi Zac,

Thank you for your quick feedback; I have a few more things for you to check.

First, what happens if you run through a calibration with your display set up to output your loads in kg? Does the display return to zero when you remove the weight?

Next, try adjusting your span so the display reads "0044" instead of "0441". From what I can tell, it looks like you increased your output by a factor of 10 in an effort improve your resolution. I believe that might be the source of your problem. When you applied your load, the display changed by 0046 which is reasonably close to 0044. To get closer to 0044 you would need to cycle through the calibration procedure outlined in the manual.

In order to increase your resolution you would have to move the position of the decimal point to the left. I can give you instructions on how to move the decimal point once we confirm the meter is outputting the correct values.

Regards,
Jon

From: Plesmid, Zachary L [mailto:ZLP1@alfred.edu]
Sent: Tuesday, January 28, 2020 3:04 PM
To: Jonathan Long <jonathan@eldinc.com>
Subject: Re: [EXTERNAL] RE: Instrumentation system

I am following the instructions in the manual to calibrate the dynamometer. The only difference is that I have calibrated the drag to always be positive (i.e. the maximum weight reads zero) because the computer can only read in positive values.

When I calibrate the lift, I mount the dynamometer with the strut pointing down to the ground. I use the thumbwheel to make the display read zero with no span applied. I then apply a 2 kg weight. I wish to calibrate in pounds. So I have converted this to 4.41 lbs. The display changes to read about 0020. I use the span knob to adjust the display until it reads 0441 or 441x. I then remove the weight to check zero and the display reads 0395 or 395x.

Calibrating the drag works as expected. I have only translated the zero point so that the output signal is positive because my ADC can only read positive numbers the way it is currently set up.

All of the other displays (pressure, x, y) calibrate as expected.

The core of the lift LVDT is ~0.1562 in from the end. The core of the drag LVDT is ~0.25 in from the end. The latter differs from what you have recommended probably due to the translation I have done as described above. I may recalibrate this if my ADC set up changes.

Thank you for your help. If there is anything else that I need to provide, please let me know.

Thank you,

Zac Plesmid

From: Jonathan Long <jonathan@eldinc.com>
Sent: Tuesday, January 28, 2020 3:08 PM
To: Plesmid, Zachary L <ZLP1@alfred.edu>
Subject: [EXTERNAL] RE: Instrumentation system

Hello Zac,

I am sorry that the dynamometer is giving you troubles. I have a few things for you to look into.

I am wondering if you could describe how you are calibrating the dynamometer. When calibrating the lift axis, the strut on the dynamometer needs to be vertical and pointing towards the floor so it may be gravity loaded. When calibrating the drag axis, the dynamometer needs to be repositioned so the strut is horizontal with the floor. The calibration procedures are described in detail in the manual. Could you confirm that you are following those procedures accordingly? Also, please take this opportunity to calibrate the dynamometer and send me a copy of your results.

Next, can you describe what the display on the meter cabinet is reading without a load applied? It will be best to have the dynamometer installed in the wind tunnel to ensure the proper orientation. Are you able to zero the meter display by making fine adjustments to the core thumbwheel? Please note, if the thumbwheel has been adjusted to far, one way or the other, the signal will become saturated and you will not see a response in the meter display when a load is applied. I have attached a troubleshooting guide which shows examples of the cores when they are properly aligned with the LVDT armatures. The cores will need to be approximately centered in the armatures for the unit to function properly. Please note, the measurements given in Figures 4 and 6 should only be used as approximations to help find zero for each axis as you will still need to make fine adjustments to the thumbwheels to precisely zero the unit.

Looking at my copy of your manual, the analog output voltage along the lift axis will not be the same as what is displayed on the meter cabinet. The analog output will be about a tenth of what is displayed on the meter cabinet. The analog output on the drag axis should be similar to what is shown on the meter cabinet display.

TICKET 44134

Ticket 44134: Online Help Request

Zachary, thanks for using the help desk. Your ticket (44134) has been closed.

On 4/1/20, at 12:59 pm, Liz Moore wrote:

Zac,

Please go to https://my.alfred.edu/information-technology-services /helpdesk/vpn.cfm and install the VPN on the computer you are using to remotely connect to AU18037. Once completed, follow the steps for remote desktop connection using the IP address below and your username and password. Please remember that FortiClient VPN must be running before a remote desktop connection can be made.

149.84.93.239

Please let me know if you have any troubles.

Thank you,

Liz Moore
Help Desk and Desktop Support Manager

On 4/1/20, at 8:20 am, Zachary Plesmid wrote:

Begin forwarded message:

> From: "Rosiczkowski, Joe" <rosi@alfred.edu>
> Date: March 28, 2020 at 10:24:11 PM EDT
> To: ITS Operations <operator1@alfred.edu>
> Cc: "Ghotbi, Ehsan" <ghotbi@alfred.edu>, "Vetter, Christina" <vetterc@alfred.edu>, "Plesmid, Zachary L" <ZLP1@alfred.edu>
> Subject: FW: Ticket 44134 Open (Updated) --> Online Help Request: Online Help Request ...
>
> Good day,
>
> I am requesting ITS permission to Zachary Plesmid to remote into the Wind Tunnel Computer to continue his Capstone Project Work. Thank you
>
> Dr Joe Rosiczkowski
>
> From: Plesmid, Zachary L <ZLP1@alfred.edu>
> Sent: Saturday, March 28, 2020 1:04 PM

From: ITS Helpdesk

Sent: Friday, March 27, 2020 10:48 PM

To: Plesmid, Zachary L

Subject: Ticket 44134 Open (Updated) --> Online Help Request: Online Help Request ...

On 3/27/20, at 10:48 pm, Liz Moore wrote:

Zac,

Please ask your advisor or a Professor to contact ITS and request that this particular computer be accessible remotely. This can be done, but being that the computer is outside of the lab environment I would like a formal request by a Professor in that area. Once received, we can change the settings and provide an IP address for you to connect to.

Thank you,

Liz Moore
Help Desk and Desktop Support Manager

On 3/27/20, at 6:01 pm, Zachary Plesmid wrote:

Online Help Request

Request Details:

Category: Other

Urgency: Urgent

Details: Hello,

I have been working on my senior project on the computer by the wind tunnel in the Elabs. Computer AU18037 to be exact. While I was moving my things out of my dorm, I copied my files to an external drive to take home. However, upon starting work again today, I have discovered that those files did not successfully copy to my drive. Would it be possible for the contents of the desktop of that computer to be emailed to me? Or can I remote in somehow to obtain my files?

Thank you

Requested By:

Name: Zac Plesmid (Student)

Email: zlp1@alfred.edu

Phone: 440-821-3707

Location: Elabs 107

TICKET

Source Code

Wind Tunnel Control Center.ahk

```
#include Initialization.ahk         ; Runs automatically, sets up program settings and file locations
#include ScreenConfig.ahk           ; Runs automatically, sets up screen sizing and location
#include UserLogging.ahk            ; Runs automatically, records the time and the current user to file
#include Constants.ahk              ; Runs automatically, sets up constants used throughout the program
#include COMConfig.ahk              ; Runs automatically, sets the COM port for the ADC software
#include GUICreate.ahk              ; Runs automatically, displays the GUI for the data logger
#include HelpMenuRun.ahk            ; Runs automatically, displays the Help Menu

Return

#include Buttons.ahk                ; Contains subroutines that run when buttons are clicked, the main loops
#include Excel.ahk                  ; Contains subroutines for communicating with Excel and writing to the live outputs
#include Closing.ahk                ; Contains the closing routines
```

Initialization.ahk

```
; only one copy of this program can run at a time
#SingleInstance Force

; set execution speed to fastest setting
SetBatchLines -1

; relative file paths start from this script's location
SetWorkingDir, %A_ScriptDir%

; create a virtual drive 'V'
RunWait, %ComSpec% /c subst V: /D
Run, %ComSpec% /c subst V: "%A_ScriptDir%"

; file/folder paths used throughout

Log := "Logs\Users.log"
Config := "C:\eeci\adc-8u12\adc8u12-set.ini"
eeci := "ADC-8U12\ADC-8U12.exe"
MainMenuPPT := "V:\PowerPoints\Main Menu.pptx"
LabData := "LabData"
BackGround := "Images\BackGround.png"
LivePic := "V:\Images\pic1.png"
BlankGraph := "Images\BlankGraph.png"
GraphShadow := "Images\Chart BG6.png"
Blank := "V:\LabData\Blank.xlsx"
Calibration := "Calibration\Calibration.ini"
```

ScreenConfig.ahk

```
; get the number of monitors
SysGet, #ofMonitors, MonitorCount

; check for two monitors installed
If (#ofMonitors != 2){

      ; on failure display error and exit this program
      SoundPlay, *16
      MsgBox This program requires two screens.
      ExitApp

}

; get size of monitor 1
SysGet, Mon1, Monitor, 1

; get size of monitor 2
SysGet, Mon2, Monitor, 2

; find the left and right screens

If (Mon1Left < Mon2Left){

      ; calculate the size of left screen
      LeftScreenX := Mon1Left
      LeftScreenY := Mon1Top
      LeftScreenW := Mon1Right - Mon1Left
      LeftScreenH := Mon1Bottom - Mon1Top

      ; calculate the size of right screen
      RightScreenX := Mon2Left
      RightScreenY := Mon2Top
      RightScreenW := Mon2Right - Mon2Left
      RightScreenH := Mon2Bottom - Mon2Top

} Else {

      ; calculate the size of left screen
      LeftScreenX := Mon2Left
      LeftScreenY := Mon2Top
      LeftScreenW := Mon2Right - Mon2Left
      LeftScreenH := Mon2Bottom - Mon2Top
```

```
    ; calculate the size of right screen
    RightScreenX := Mon1Left
    RightScreenY := Mon1Top
    RightScreenW := Mon1Right - Mon1Left
    RightScreenH := Mon1Bottom - Mon1Top

}
```

UserLogging.ahk

```
; get the current time and date
FormatTime, LogTime

; append time to current username
UserLog := A_UserName . A_Tab . LogTime . "`n"

; write log to file
FileAppend, %UserLog%, %Log%
```

Constants.ahk

```
; calculate horizontal center of left screen
LeftScreenXC := LeftScreenX + (LeftScreenW / 2)

; calculate width of progress bar
ProgressW := 0.1875 * LeftScreenW

; calculate size of frequency window
FrequencyW := 0.125 * LeftScreenW
FrequencyH := 0.144 * LeftScreenH * (96 / A_ScreenDPI)

; calculate horizontal center of left screen for progress bar
ProgressXC := LeftScreenXC - (ProgressW / 2)

; calculate horizontal center of left screen for frequency window
FrequencyXC := LeftScreenXC - (FrequencyW / 2)

; calculate the size of the chart in points
ChartWidth  := 0.8 * LeftScreenW / A_ScreenDPI * 72
ChartHeight := 0.9 * LeftScreenH / A_ScreenDPI * 72

; calculate the position of the chart
GraphX := 0.17 * LeftScreenW
GraphY := 0.03 * LeftScreenH

; resize the graph background to big
GBGSize := 1
GoSub GResize

; calculate button size
ButtonWidth  := 0.094 * LeftScreenW
ButtonHeight := 0.056 * LeftScreenH

; calculate live box width, font size and fill color
LiveBoxWidth := 0.094 * LeftScreenW
LiveFontSize := 24
LiveBoxColor := "Black"

; calculate text control width and font size
TextWidth := 0.094 * LeftScreenW
TextSize  := 14
```

```
; calculate margin and inter-control gap size
GuiMarginX := 0.0363 * LeftScreenW
GuiMarginY := 0.0689 * LeftScreenH
GuiGap     := 0.0222 * LeftScreenH

; read unit conversion factors from Calibration.ini

IniRead, PressureSlope,     % Calibration, Pressure, slope
IniRead, PressureIntercept, % Calibration, Pressure, intercept

IniRead, LiftSlope,         % Calibration, Lift,     slope
IniRead, LiftIntercept,     % Calibration, Lift,     intercept

IniRead, DragSlope,         % Calibration, Drag,     slope
IniRead, DragIntercept,     % Calibration, Drag,     intercept

IniRead, XSlope,            % Calibration, X,        slope
IniRead, XIntercept,        % Calibration, X,        intercept

IniRead, YSlope,            % Calibration, Y,        slope
IniRead, YIntercept,        % Calibration, Y,        intercept
```

COMConfig.ahk

```
; check for existence of EECI programs config file
If (FileExist(Config)){

      ;*****************************************************************************************
      ; WMI code borrowed from Shajul here: https://autohotkey.com/board/topic/60968-wmi-tasks-com-with-ahk-l/
      ;*****************************************************************************************

      ; start COM object to device manager
      strComputer := "."
      WMIService := ComObjGet("winmgmts:{impersonationLevel=impersonate}!\\" . strComputer . "\root\cimv2")

      ; get list of Plug N Play entities
      WMIResult := WMIService.ExecQuery("Select * from Win32_PnPEntity")._NewEnum

      ; for each object in list
      While WMIResult[objItem]{

            ; check name
            If (InStr(objItem.Caption, "Prolific")){

                  ; for each letter in name
                  Word := objItem.Caption
                  Loop, Parse, Word

                        ; find number of port
                        If A_LoopField is digit
                              COM := A_LoopField

            }

      }

      ; confirm ADC-8U12 is present
      If (COM){

            ; change config file port number
            Config := FileOpen(Config, "rw")
            Config.Seek()
            Config.Write(COM . "`r")
            Config.Close()
            Config := ""
```

```
            ; run EECI program not on top
            Run %eeci%
            WinWait, ahk_exe ADC-8U12.exe
            WinSet, AlwaysOnTop, Off, ahk_exe ADC-8U12.exe

      } Else {

            ; display error message and exit program
            SoundPlay, *16
            MsgBox, This program requires an EECI ADC-8U12 to be plugged into a USB port
            ExitApp

      }

} Else {

      ; run EECI program not on top
      Run %eeci%
      WinWait, ahk_exe ADC-8U12.exe
      WinSet, AlwaysOnTop, Off, ahk_exe ADC-8U12.exe

      ; tell it to create config file from scratch
      Send {Tab}{Tab}{Tab}{Enter}

}
```

GUICreate.ahk

```
; enable border on the GUI and disable DPI scaling
Gui +Border -DPIScale

; place background on GUI
Gui, Add, Picture, w%LeftScreenW% h%LeftScreenH% x0 y0 vBackground, %BackGround%

; place buttons on GUI
Gui, Add, Button, x%GuiMarginX% y%GuiMarginY% w%ButtonWidth% h%ButtonHeight% vNew, &New Test
Gui, Add, Button, Disabled y+%GuiGap% w%ButtonWidth% h%ButtonHeight% vRecord Section, &Record
Gui, Add, Button, Disabled xs ys w%ButtonWidth% h%ButtonHeight% vStop Hidden, &Stop

; place live boxes on GUI

Gui, Font, % "Black s" TextSize - 1
Gui, Add, Text, w%TextWidth% x%GuiMarginX% y+%GuiGap% Right +BackgroundTrans, Pressure (inH2O)
Gui, Font, cFF0000 s%LiveFontSize%
Gui, Color, , %LiveBoxColor%
Gui, Add, Edit, vEdit1 Right w%LiveBoxWidth% +BackgroundTrans, 0

Gui, Font, Black s%TextSize%
Gui, Add, Text, w%TextWidth% y+%GuiGap% Right +BackgroundTrans, Lift (lbs)
Gui, Font, c00FF00 s%LiveFontSize%
Gui, Color, , %LiveBoxColor%
Gui, Add, Edit, vEdit2 Right w%LiveBoxWidth%, 0

Gui, Font, Black s%TextSize%
Gui, Add, Text, w%TextWidth% y+%GuiGap% Right +BackgroundTrans, Drag (lbs)
Gui, Font, c0000FF s%LiveFontSize%
Gui, Color, , %LiveBoxColor%
Gui, Add, Edit, vEdit3 Right w%LiveBoxWidth%, 0

Gui, Font, Black s%TextSize%
Gui, Add, Text, w%TextWidth% y+%GuiGap% Right +BackgroundTrans, X-Position (in)
Gui, Font, cFF00FF s%LiveFontSize%
Gui, Color, , %LiveBoxColor%
Gui, Add, Edit, vEdit4 Right w%LiveBoxWidth%, 0

Gui, Font, Black s%TextSize%
Gui, Add, Text, w%TextWidth% y+%GuiGap% Right +BackgroundTrans, Y-Position (in)
Gui, Font, c00FFFF s%LiveFontSize%
Gui, Color, , %LiveBoxColor%
Gui, Add, Edit, vEdit5 Right w%LiveBoxWidth%, 0
```

```
Gui, Font, % "Black s" TextSize - 1
Gui, Add, Text, w%TextWidth% y+%GuiGap% Right +BackgroundTrans, WindSpeed (mph)
Gui, Font, cFF6600 s%LiveFontSize%
Gui, Color, , %LiveBoxColor%
Gui, Add, Edit, vEdit6 Right w%LiveBoxWidth%, 0

; generate a black graph at the current screen res
SelectedFile := Blank
GoSub CreateExcel
GoSub CreateChart
GoSub ExportChart
FileCopy, %LivePic%, %BlankGraph%, True

; place the graph background on GUI
Gui, Add, Picture, x%GraphBGX% y%GraphBGY% w%GraphBGW% h%GraphBGH% vGraphBG, %GraphShadow%

; place the graph on GUI
Gui, Add, Picture, x%GraphX% y%GraphY% +BackgroundTrans vGraph, %BlankGraph%

; draw GUI on screen
Gui, Show, Maximize, Wind Tunnel Logger

; GUI is always on top
WinSet, AlwaysOnTop, On, Wind Tunnel Logger

; dialogs created by this GUI will be modal
Gui +OwnDialogs

; starts live boxes updating every second
SetTimer, LiveCycle, 1000
```

HelpMenuRun.ahk

```
; check for open powerpoint windows
If WinExist("ahk_exe POWERPNT.EXE"){

      ; grab open window
      PPT := ComObjActive("PowerPoint.Application")

      ; save and close all open presentations
      For prs in PPT.Presentations{

            prs.Save
            prs.Close

      }

} Else {

      ; open a new powerpoint window
      PPT := ComObjCreate("PowerPoint.Application")

}

; open the main menu
PPT.Presentations.Open(MainMenuPPT)

; enter slideshow view
PPT.ActivePresentation.SlideShowSettings.Run.View

; disable escape and Alt-F4 for powerpoint
#IfWinActive ahk_exe POWERPNT.EXE

Escape::Return
!F4::Return
```

Buttons.ahk

```
ButtonNewTest:

      ; dialogs created by this GUI will be modal and DPI scaling is disabled
      Gui +OwnDialogs -DPIScale

      ; create a SaveAs box and get the selected filename
      FileSelectFile, SelectedFile, S, %LabData%, Save As, Microsoft Excel (*.xlsx)
      SplitPath, SelectedFile, FileName

      ; check that a file was created
      If (SelectedFile != ""){

            ; create a progress bar
            Progress, x%ProgressXC% , Opening %FileName%, Loading, Please Wait ...

            ; create the excel file specified
            GoSub CreateExcel

            ; update progress bar
            Progress, 20, Creating Chart

            ; Create a chart in excel file
            GoSub CreateChart

            ; update progress bar
            Progress, 40, Creating Table

            ; create a table in excel file
            GoSub CreateTable

            ; update progress bar
            Progress, 60, Exporting Chart

            ; export the chart as a picture
            GoSub ExportChart

            ; update progress bar
            Progress, 80 Displaying Chart

            ; update the GUI's graph
            GuiControl,, Graph, %LivePic%
```

```
            ; resize the graph backgroung to big
            GBGSize = 1
            GoSub GResize
            GuiControl, Move, GraphBG, x%GraphBGX% y%GraphBGY% w%GraphBGW% h%GraphBGH%

            ; destroy progress bar
            Progress, Off

            ; update GUI background image
            GuiControl,, Background, %BackGround%

            ; ask the user for the sample rate
            GoSub SetFrequency

            ; turn off recording
            Recording := False

            ; allow clicks on 'record' and 'stop' buttons
            GuiControl, Enable, Record
            GuiControl, Enable, Stop

            ; update the live boxes at sample rate
            SetTimer, LiveCycle, %Frequency%

      }

Return

ButtonStop:

      ; check if recording
      If (Recording){

            ; turn off recording
            Recording := False

            ; swap visibility of 'record' and 'stop' buttons
            GuiControl Hide, Stop
            GuiControl Show, Record

            ; stop recording, start updating live boxes at sample rate
            SetTimer, RecordCycle, Off
```

```
            SetTimer, LiveCycle, %Frequency%

      }

Return

ButtonRecord:

      ; disable DPI scaling
      Gui -DPIScale

      ; resize the graph background to small
      GBGSize := 0
      GoSub GResize
      GuiControl, Move, GraphBG, x%GraphBGX% y%GraphBGY% w%GraphBGW% h%GraphBGH%

      ; check that not already recording
      If (!Recording){

            ; start recording
            Recording := True

            ; start counting time
            StartTime := A_TickCount

            ; swap visibility of 'record' and 'stop' buttons
            GuiControl Hide, Record
            GuiControl Show, Stop

            ; start recording process
            SetTimer, LiveCycle, Off
            SetTimer, RecordCycle, %Frequency%

      }

Return

LiveCycle:

      ; read values from ADC-8U12
      GoSub ReadRow

      ; write values to live boxes
```

```
      GoSub WriteLive

Return

RecordCycle:

      ; can't be interrupted
      Critical On

      ; read values from ADC-8U12
      GoSub ReadRow

      ; write values to file
      GoSub WriteRow

      ; export chart as an image
      GoSub ExportChart

      ; import and display chart image on GUI
      GoSub DisplayChart

Return

GResize:

      ; calculate graph background width and height (changes with graph)
      GraphBGW := (0.936 + (!GBGSize * 0.0023)) * ChartWidth * (A_ScreenDPI / 72)
      GraphBGH := (0.916 - (!GBGSize * 0.072)) * ChartHeight * (A_ScreenDPI / 72)

      ; calculate graph background X and Y coordinate (changes with graph)
      GraphBGX := GraphX + ((0.030 - (!GBGSize * 0.002)) * ChartWidth * (A_ScreenDPI / 72))
      GraphBGY := GraphY + (0.020 * ChartHeight * (A_ScreenDPI / 72))

Return
```

Excel.ahk

```
CreateExcel:

	; check program has opened excel already (COM object exists)
	If (XL) {

		; close open workbook and save
		XL.ActiveWorkbook.Close(True)

		; create a new workbook
		XL.Workbooks.Add

		; make sure excel is invisible (defautlt)
		XL.Visible := False

		; turn off alerts
		XL.DisplayAlerts := False

		; save the workbook with the chosen file name
		XL.ActiveWorkbook.SaveAs(SelectedFile)

		; turn on alerts
		XL.DisplayAlerts := True

	} Else {

		; start excel
		XL := ComObjCreate("Excel.Application")

		; create a new workbook
		XL.WorkBooks.Add

		; make sure excel is invisible (default)
		XL.Visible := False

		; turn off alerts
		XL.DisplayAlerts := False

		; save the workbook with the chosen file name
		XL.ActiveWorkbook.SaveAs(SelectedFile)

		; turn on alerts
		XL.DisplayAlerts := True

	}

Return
```

```
SetFrequency:

	; disable DPI scaling
	Gui -DPIScale

	; create an input box to ask for the sample rate
	InputBox, Frequency, Set Sample Rate, Sample Rate (CPM):,, %FrequencyW%, %FrequencyH%, %FrequencyXC%

	; confirm value is within bounds
	If (Frequency <= 0 || Frequency > 120) {

		; ask again on failure
		GoSub SetFrequency

	}

	; convert cpm to ms between samples
	Frequency := (60/Frequency) * 1000

Return

CreateChart:

	; save units in strings
	Units := ["inH2O", "lbs", "lbs", "in", "in", "mph"]

	; write the headings to excel
	XL.Range("B1").Value :=   "Pressure ("  . Units[1] . ")"
	XL.Range("C1").Value :=       "Lift ("  . Units[2] . ")"
	XL.Range("D1").Value :=       "Drag ("  . Units[3] . ")"
	XL.Range("E1").Value := "X Position ("  . Units[4] . ")"
	XL.Range("F1").Value := "Y Position ("  . Units[5] . ")"
	XL.Range("G1").Value :=  "Windspeed ("  . Units[6] . ")"

	; create a chart
	XL.Range("A1:G13").Select
	XL.ActiveSheet.Shapes.AddChart2(227, 4).Select

	; write the last heading (throws of the chart if happens with the others)
	XL.Range("A1").Value := "Time"

	; remove the chart title
	XL.ActiveChart.HasTitle := False

	; move the legend to the bottom
	XL.ActiveChart.Legend.Position := -4107

	; convert to line graph
	XL.ActiveChart.ChartStyle := 4
```

```
; delete the gridlines in both directions
XL.ActiveChart.Axes(1).MajorGridlines.Delete
XL.ActiveChart.Axes(2).MajorGridlines.Delete

; set the x-axis labels at an angle
XL.ActiveChart.Axes(1).TickLabels.Orientation := 84

; for each data series
Loop, 6{

	; makes line visible, markers invisible
	XL.ActiveChart.FullSeriesCollection(A_Index).Format.Line.Visible := True
	XL.ActiveChart.FullSeriesCollection(A_Index).MarkerStyle := -4142

	; series 1-3
	If (A_Index < 4){

		; set line color
		XL.ActiveChart.FullSeriesCollection(A_Index).Border.ColorIndex := A_Index + 2

	; series 4-5
	} Else If (A_Index < 6){

		; set line color (avoids yellow)
		XL.ActiveChart.FullSeriesCollection(A_Index).Border.ColorIndex := A_Index + 3

	; series 6
	} Else {

		; set line color (orange)
		XL.ActiveChart.FullSeriesCollection(A_Index).Border.ColorIndex := A_Index + 40

	}


}

; create a second y-axis for windspeed
XL.ActiveChart.SeriesCollection(6).AxisGroup := 2

; set the y-axis bounds for left axis
XL.ActiveChart.Axes(2,1).MinimumScale := 0
XL.ActiveChart.Axes(2,1).MaximumScale := 36

; set the y-axis bounds for right axis
XL.ActiveChart.Axes(2,2).MinimumScale := 0
XL.ActiveChart.Axes(2,2).MaximumScale := 144

; turn off chart area perimeter line
XL.ActiveSheet.Shapes("Chart 1").Line.Visible := False
```

```
	; make graph background transparent
	Xl.ActiveChart.ChartArea.Select
	XL.ActiveSheet.Shapes("Chart 1").Fill.Visible := 0
	XL.ActiveChart.PlotArea.Fill.Visible := 0

	; change the size of the graph (adjust size here to prevent pixelling)
	XL.ActiveChart.Parent.Width := ChartWidth
	XL.ActiveChart.Parent.Height := ChartHeight

Return

CreateTable:

	; turn the headings into a table
	XL.Range("A1:G1").Select
	XL.ActiveSheet.ListObjects.Add(1, XL.Range("$A$1:$G$1"),_, 1)
	XL.ActiveSheet.ListObjects(1).Name := "Table"

	; set column A to display times
	XL.Columns("A:A").NumberFormat := "mm:ss.000"

	; set the active writing row for the table
	Row := 2

Return

ReadRow:

	; can't be disrrupted
	Critical On

	; simplify the complex control name
	Channel = WindowsForms10.STATIC.app.0.141b42a_r6_ad1

	; array of control names
	Channeln := [Channel . 15, Channel . 14, Channel . 17, Channel . 16, Channel . 11, Channel . 8, Channel . 10, Channel . 9]

	; initialize results array
	Results := []

	; for each input signal
	Loop, 5{

		; read value from ADC-8U12 program, filter units/commas and store
		ControlGetText, Reading, % Channeln[A_Index], ADC-8U12 - v1.29
		ValueUnit := StrSplit(Reading, A_Space)
		ValueUnit[1] := StrReplace(ValueUnit[1], ",", "")
```

```
            Results.Push(ValueUnit[1])

        }

        ; convert values to engineering units and round to two places
        Results[1] := Round(Results[1] * PressureSlope + PressureIntercept, 2)
        Results[2] := Round(Results[2] * LiftSlope     + LiftIntercept,     2)
        Results[3] := Round(Results[3] * DragSlope     + DragIntercept,     2)
        Results[4] := Round(Results[4] * XSlope        + XIntercept,        2)
        Results[5] := Round(Results[5] * YSlope        + YIntercept,        2)

        ; calculate windspeed from pressure (pitot tube/bernoulli's equation) and store
        WindSpeed := Sqrt(Results[1] * 2 * 32.2 * 5.2033 / 0.07487) * 3600 / 5280 ; inH2O to mph   v = √2gP/p
        Results.Push(Round(WindSpeed, 2))

        ; calculate elapsed time and convert to excel time
        CurrentTime := A_TickCount
        ElapsedTime := (CurrentTime - StartTime) * 0.000000011574074074 0741

Return


WriteRow:

        ; can't be interrupted
        Critical On

        ; write time to table
        XL.Cells(Row, 1).Value := ElapsedTime

        ; for each measured variable
        Loop, 6 {

            ; write value to file
            XL.Cells(Row, A_Index + 1).Value := Results[A_Index]

            ; write values to live boxes on GUI
            GoSub LiveBoxes

        }

        ; use the next row of the table next time
        Row := Row + 1

Return

WriteLive:

        ; for each measured variable
        Loop, 6
```

```
            ; write values to live boxes on GUI
            GoSub LiveBoxes

Return

LiveBoxes:

      ; update text in live box
      GuiControl, Text, Edit%A_Index%, % Results[A_Index]

Return




ExportChart:

      ; can't be interrupted
      Critical On

      ; export the chart as a picture
      XL.Worksheets("Sheet1").ChartObjects(1).Chart.Export(LivePic)

Return

DisplayChart:

      ; can't be interrupted
      Critical On

      ;update graph on GUI
      GuiControl,, Graph, %LivePic%
      Gui, Show

Return
```

Closing.ahk

```
GuiClose:

      ; close the EECI program
      WinClose, ADC-8U12 - v1.29

      ; close excel
      XL.ActiveWorkbook.Save
      XL.ActiveWorkbook.Close(0)
      XL.Quit
      XL := ""

      ; close powerpoint
      PPT.ActivePresentation.Close
      PPT.Quit
      PPT := ""

      ; end the program
      ExitApp
```

Time Sheets

Senior Design

Interactive Documentation for Windtunnel

9/3

12:14

inventoried available equipment
tested black box (needs calibration)
discovered measurement ports
discovered that lift and drag are weird and very sensitive
calibrated the readout
ran windtunnel
calibrations seem dubious need to check again. Lots of negs
logged on computer to check it was working
confirmed that there are two serial ports one real one virtual
tried to install software but it required admin
learned zero and span. Need to recalibrate

AU 15037 Administrator rcn_rcmc

Found admin solution or not
Might try old computer? Not ideal to go backwards

3:20

3:35

Asked ITS about computer specific admin rights

3:39

5:50

Found model of windtunnel on ELD website
same company as RPI uses theirs from 2006
ITS says I'll need to ask them for each program.

4:00

9/6

12:20

Discovered the wind tunnel is a Model 406
Found list of others in NY ours is pretty good
No documentation on anything.

12:51

9/7

5:40

Searched the elabs for wind tunnel paraphinalia. Fand drag flow kit dynomometer and read at but it has weaker springs than current one.

6:25

9/8

9:10

Investigated HP VEE. Now Keyway VEE. competitor to Labview. Pretty neat. I want a copy

9:50

9/10

10:15 pm

Discovered Game port. May be now the [illegible] sent over DA-15

10:45 pm

9/13

6:00 pm

Realized possibility of replacing black box with Data Aquisition Card and software

6:20 pm

9/16

5:01

Recieved documentation from Kurt Banaszynski at EED

5:01

8:30

skimmed documentation

9:00

10/10

9:15

Installed Calibration Program for DAC. Unable to get VEE running

10:45

10/11

1:15

Built manometer from hardware store parts

4:15

10/13

1:30

Found manometer laying on windowsill. Needs cleaned

1:45

10/14

10:00

Downloaded software for DAQ card. Nothing works well
Tried LabView but too confusing
Tried Matlab but have to buy the add on
Found Techlib.com Brilliant DAQ stuff.
has voltage to frequency adapter. I wonder if
I could use the mic jack and FFT the
channels back out. Amplitude modulate then multiplex

4:16

10/18

1:00

During visit day, learned of all equipment stored in 107C
No need to build anything. It all exists.

2:30

10/21

9:00

Talked to Christina about account set up.
No word back

9:15

10/25

12:34

Exploring cupboards of supplies
calibrated pressure

1:11

10/26

9:00

started construction of intractive wind tunnel drawing
emailed Samantha Dannick

10:30

1:00

continued constructing wind tunnel drawing

3:00

10/27

1:00

Finisled the wind tunnel drawing. Pondered pop up techniques

3:30

11/12

3:00

Board came in so now work can progress

3:00

11/14

9:00

Installed EECI board
Researcled better GUI w/ AHK

11:09

1:00

Researcled memory mapped files
emailed EECI for help

3:43

11/15

9:00

Turned in Honors intent form

9:30

12:00

wrote / submitted Project Description for honors

2:00

4:00 - 5:00 researcled AHK program for set up. 6:00-8:00

11/18

2:50

called Burt Brundage 937-349-6000 phone didn't work
emailed instead ✓ Fixed phone
5V is no hardware change. If noisey then needed
Downloaded AHK ✓ working good
Downloaded VB studio $800 ✓ ✓ free
worked on AHK

5:20

11/19

12:23

implemented toggle record
implemented new save file selection
implemented frequency setting
struggled with frequency setting time type
implemented movable window ✓

5:21

11/20

12:47

implemented application exit protocol
implemented invisible back panel
solved value reading command
solved value reading loop ✓

4:34

11/22

12:00

shared Ian King my progress. He wrote an excel code
to parse the ✓ logger output. Not sure of usefulness yet
implemented value reading to array
timer researched and ✓ logger planned

2:21

11/25

11:57

Tested Excel connection

Opening, writing to, creating tables are taken care of.

Stuck on graphing properly

5:06

11/26

9:38

researched chart selection

12:05

1:02

worked around charting

started formatting

5:15

11/27

9:50

added annotations/comments

worked on setting colors

alternative solution found

implemented colors, lines and other formatting

added AU Morgan printer

printed code

1:39

3:10

Frankensteined my code together

4:45

11/30

12:30

Typed up conjoined code

2:00

12/2

9:00

Discovered and researched linked charts and ranges in powerpoint. Might allow for better front end if I can set it up programticly

1:24

12/4

10:00

Researched OLE COM ACTIVEX controls

12:30

1:00

looking at reverting to AHK due to button issues. Possible excel chart control but looks like it doesn't exist.

4:00

12/6

10:51

Fixed bugs with typos
Writing/Recording works
Timing calculation and recording implemented
More chart formatting (Border removed) implemented
Chart resizing to fit window implemented

2:38

12/16

9:00

worked on wind tunnel parts map new idea looked promising but failed

12:00

12/17

9:00

Found better version of wind tunnel system. Implemented
Drew manometer model

3:00

12/18

9:00

Dynomometer model done

Dynomometer mount model done

2:00

12/19

9:00

Built the operator's console model drawing

Built the operation instructions

3:00

12/20

9:00

finished start/stop tutorial

learned loop and threading powerpoint trick

2:00

12/23

9:00

worked on main menu

11:30

12/26

9:00

Started logging hardware map

5:00

12/27

10:00

Fixed operator's console operation tutorial

11:30

5:30

Added Main Menu buttons to sub presentations

Added Next slide buttons to presentations

Created new Main Menu

Changed Wind Tunnel Parts instruction style

6:39

1/2

10:00

Worked on Logging Hardware drawing

12:30

2:00

Made Logging Hardware drawing Interactive
Made final centralized copy of subshows
Linked shows through main menu.
Everything works smoothly

3:47

1/12

3:00

made the tornado icon for the program

3:20

1/14

1:00

Added comments to all ppts

2:00

1/16

10:00

wrote honors paper

2:00

1/22

12:13

wired card into black box + think calibration and unit conversions should fix discrepancies

3:06

1/24

2:25

Calibrated the instruments or not. Doesn't work!

4:04

4:38

1/27

2:44

Calibrating Lift has to be reversed due to neg

4:50

1/28

12:38

Calibrating x3 emailed Jonathan Wong

1:40

3:40

Performed tests as instructed by Mr. Wong.

4:35

1/29

12:38

More tests at Wong's belest.

killed graph flicker

added loading bar

worked on chart creation again since hidden screens it up

5:51 Solved the calibration

2/4

2:22

Researched the chart drawing issue

4:00

2/5

12:00 flipped table and chart jobs also no top left corner in table when charting

Fixed problems with chart creation with hidden Excel

Added transparency to chart

Added Text and Edits for live data

Added color formatting to Edits

Added Background to GUI

Added Numbers update to Edits Got 2nd Screen

4:52 Added Live update when not recording

Added wind-speed calculation and display

2/6

9:00

obtained Display/Port code from Christina
Monitors are operational.
Researched antiminimization methods
Found detect method to hide everything if shrunk
Found Icon setting information
Found FPT disguise information with + OwnDialog
Researched Pitot tube equation
Determined maximum measurable speed

10:46

2/12

1:20

Added multi screen capability
Fixed SaveAs cancel error
Fixed multiple new tests error
Factored out file paths
Investigated program exci portability
Fixed screen locations of popups to appropriate screen
Added screen number check

5:30

2/17

2:50

Add error sound to screen number check

3:00

2/19

2:00

Added screen size independence & scaling
Added Blank graph space filler photo
Started consolidated directory of files
Added Spot for Unit conversions
Found ADC's EXE needs portability testing
out threaded a bunch of coordinates

5:00

2/21

9:00

ran through full gauntlet of test for screen
emailed Jon Long for feedback
researched device manager communication
researched WMI
researched file writing

12:20

2:33

figured out how to write to ini file
weird glitches almost fixed but won't work
ADC can't find COM

5:02

2/22

12:18

Tried overwriting ini
Tried manual approach
Tried restart fresh method
Found naming error when running from exe
Fixed file mod method with file close
Used mouse click to hit Okay
Checks existance of ini before changing file or loads program
Need to pull everything out to subroutines
Researched #including code in pieces

5:16

2/26

12:20

Found livebox error
Fixed liveboxes
Fixed windspeed color choice
Fixed BlankGraph
Divided program into sub files

Fixed bug
Tested compile worked
Self move is no go so installer
tested & good

4:25 Found ppt close bug

2/29

12:51

10V is too high

checked analog outputs for overloading. Box will be fine, ADC can't understand
livebox problem is back. Doesn't happen in test programs
Fixed livebox problem. It was reading strings so no math allowed.
Math was supposed to abto convert but commas kept it from
happening. Stripped out commas; now it works.
resecrcle'd shadowing the plot area. Some success but blur doesn't
work.

5:27

3/3

3:26

Found work around for shadow emboss chart Too slow
Found better work around background complete
Worked on correcting scale for chart movement

4:55

3/4

1:09

Poked inside cabinet doesn't make sense emailed
Figured out how to toggle location of graph background
Added keyboard shortcuts to program
Added user logging
Uninstalled non useful data card programs
Need reference voltage to read full range steal from board?

4:33

3/18

3:30

Copied program off computer onto portable harddrive

4:30

3/27

Discovered that the files had not been transferred
Emailed ITS about remoting in. They require permission
from Dr. Hoe

4/1

1:00

ITS didn't get Dr. Joe's response since it was sent to a different email. I forwarded it and got instructions.

Used VPN to spoof alfred network

then remote desktopped into AV18037 and retrieved files.

Found script for multiple virtual desktops.

Learned about child window's researched use for ppt window. No dice

Got organized

started fifth gen

5:24

4/3

2:20

Fixed references to run anywhere

Screen sizing is off

Fixed clean boot okay button problem ADC-8012.exe

screens coordinates are whacked

4:30

5:00

Changed resolution to 1600x900 works fine now mostly

Throws errors on LivePic. Trying placing a file already to write over

5:49

4/4

10:58

researched why LivePic won't export.

11:45

12:49

Problem was long file paths fixed with V:drive virtual subst

Discovered maximize parameter for gui, no resolution problem

Fixed progress bar verboseness

Investigated overhauling screen routines for portability

4.57

4/5

4:00

Fixed DPI scaling using Gi - DPIScale
started revamping drawing routines
Constants screen scaled

5:30

4/6

6:15

Finished drawing redo & screen independence

7:30

4/8

4:30

chart size is in points
made formula changes untested

6:04

4/9

10:19

Solved issues with chart sizing. works across resolutions

11:24

4/12

4:00

Fixed the powerpoint closing problem
Fixed powerpoint opening issue send F5 but wait until splash screen is gone

5:35

4/13

1:50

Fixed powerpoint escape key so it won't work
Changed background image
Removed AltF4 from powerpoint
Experimented with calibration menus

4:22

4/15

3:20

Exported powerpoints as images

4:30

7:12

Fixed startup error. Needed quotes in %Comspec% line
Added unit calibration .ini file
Started Readme file
Added second y axis to graph

3:23

4/17

12:45

Started work on installation guide
Added error check on ADC plugged in

2:30

4/20

1:00

Installation Guide work just about finished
Fixed name in title of main menu
Fixed chart background sizing (again) after adding code to set y axes bands and changing the angle of x axis labels to avoid creep.
Started commenting code
researched locking movement nothing yet

6:10

7:28

More research

8:17

9:07

finished commenting and formatting all code
corrected live boxes not running on startup
researched DA-15 cables

11:30

4/21

12:30

recording and compiling with icon

1:18

2:28

made seventh gen for compiled version
improved powerpoint control using COM so not a
problem to have another powerpoint open
screen recorded program for powerpoint
cut out frames for powerpoint

5:30

7:30 finished program 'running a test' powerpoint
fixed virtual drive problems not updating
recompiled
fixed powerpoint errors
exported pictures of newest powerpoint

9:15

9:40

fixed DA-15 labels in powerpoints
compiled new version
imported photos into powerpoint then changed to word.
set up margins and gutters
imported introduction and added title page

12:08

4/22

5:02

Planned thesis write-up

5:33

7:53

tried to insert code into word
found how to remove spellcheck for code

9:38

4/23

10:20

imported code without spellcheck

11:00

12:20

Overhauled headings / planned report outline
Added text pages
Edited Introduction
received DA15 cable
converted ~~PDFs~~ manual to PNGs
inserted manuals in Appendix, Formatted
wrote intro for manuals appendix

6:28

4/24

11:48

reworked install guide
remade the calibration powerpoint
fixed page alignment on install guide

5:31

6:30

fought with word after it lost 20 pages
Tried other options html css xml rtf
Tried master/sub documents so far so good
Loaded all sub documents
Created and Imported Calibration photos

12:47

4/25

10:51

learned how and added captions
learned about fields

12:00

1:00

made a custom quick part caption

2:30

6.09

started poster

6:52

8:07

built poster

9:22

4/26

1:20

wired DA-15 cable all soldered and wired pretty

3:30

4:30

organize this binder

5:30

6:56

organize binder revise installation guide

9:30

4/29

12:30

Revised introduction

Wrote Contact log

4:11

7:57

Planned sections of binder

Revised introduction

wrote future plan page

9:47

4/30

10:21

Correcting Introduction

10:54

11:45

Writing Introduction

Made Leading pages

Updated Contacts page made tab dividers

2:00

4:20

Put parts in binder

5:47

5/1

8:30

Embedded Fonts in Powerpoints

Fixed school tunnel spelling

10:00

12:55

Reworked Introduction for honors

2:12

5:10

Printed Poster

Printed and Installed Dividers

Printed Title Page

revised introduction

6:31

5/2

8:00

revised and printed introduction

9:00

Notes

Pressure

connect to manometer (picture)

zero knob to 0.0

pump until difference in column is 10"

~~close valve~~ plug vent with finger pad

span knob to 10.0

release finger

return to zero check 0.0

reconnect to tunnel

X Turn ~~screw~~ horizontal screw until at front (picture)

zero with hex nut on shaft if needed (picture)

turn screw until 36" back

span knob until 36.00

return to 0" check 0

Y Turn vertical screw until bottom (picture)

zero with hex if needed (picture)

turn screw until 18" up

span knob until 18.00

return to 0" check 0

Lift

mount upside down
turn brass knob vertical till 0
hang ~~weight~~ 20 lb
turn knob on box till 20.0
remove weight
adjust ~~zero~~ brass knob if ≠ 0
check weight adjust span if ≠ 20.0

Drag

mount sideways
turn brass knob vertical till 0
hang 10 lb
turn knob on box till 10.0
remove weight
adjust zero
weight adjust span

Remount zero after each wing is attached

SAINT-GOBAIN
CORHART REFRACTORIES

Menu, Tray, Icon, Filename, Icon#, 1

~~AHK2EXE.exe~~ Gui version probably better

Ahk2Exe.exe /in Myscript.ahk
/out MyScript.exe
/icon MyIcon.ico

spaces in ""

Make ppt an owned dialog
so that it has the same icon
or none

e .ini app ref config file

SysGet Monitor

SAINT-GOBAIN
CORHART REFRACTORIES

Headings except Time (blank)
Select range (Taller than wide)
Create line chart
select range
Create Table

```
Range ("A1 : F13"). Select
ActiveSheet.Shapes.AddChart2(227, xlLine).
ActiveChart.SetSourceData Source:=Range(
                "Sheet1!$A$1:$F$13")
ge ("A1:F3"). Select
ActiveSheet.ListObjects.Add(xlSrcRange,
    Range("$A$1:$F$13"), , xlYes).Name =
    "Table1"
```

SAINT-GOBAIN
CORHART REFRACTORIES

$$\frac{1 \text{ in } H_2O}{.03613 \text{ psi}} \cdot \frac{.2 \text{ psi}}{157.6 \text{ ft/s}} = \frac{.2}{5.694} = .03512$$

$$.03512 \text{ "}H_2O \rightarrow \text{ft/s}$$

$$10\text{"}H_2O \cdot \frac{\text{ft/s}}{.03512} = 284.74 \text{ ft/s}$$

$$\frac{1.93 \cdot 32.2174}{12} = 5.175$$

~~66.55 ft/s per "H2O~~

$$\sqrt{\frac{2 \cdot 5.175 \cdot (p\text{"}H_2O)}{\cancel{\text{ft}^3}\ 0.002337}} = V = \sqrt{4428.755 \ (\text{"}H_2O)}$$

SAINT-GOBAIN
CORHART REFRACTORIES

Measurable speed

$$\frac{210 \text{ ft}}{s} \cdot \frac{1 \text{ mi}}{5280 \text{ ft}} \cdot \frac{3600 \text{ s}}{1 \text{ hr}} = \cancel{.682 \text{ MPH}}\ 143$$

Change main menu button → Manuals

Figure 4 label

Fix click advance in wind tunnel parts
slide 13 no main menu button

options menu on that computer → Hide slide controls in corner (~~kiosk~~)

disable right click and scroll advance

kiosk

wind speed extension
commas

motor
operates on
produces

flex tape isolates vibration
from tunnel

Pitot voltage

no 'fluid prop'

2nd DB+5
as analog voltage
signals

measures pressure & location

flex dynamometer
ask DB-15

~~Photo of disconnect on operation slides~~

~~Reference numbers for components~~

Change 'Instrumentation'

Add switch on back of black box
to start up laser tutorial

Check Alt+F4 effect
Add code to disable if
necessary

Gui + Out Dialogs
in Frequency set
& Set File Box

0x800AD3EC

Scrn 1	-1600	900
Scrn 2	0	900

Wells Fargo Advisors, LLC
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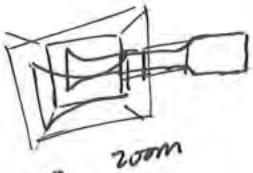
WELLS FARGO ADVISORS



zoom

Zoom menu
Zoom tunnel?

Parts of Tunnel
Parts of Sensor Apparatus
Parts of Electronics
Parts of Computer Software
How to Turn on Windtunnel
How to Adjust Speed
How to Log data
How to retrieve data
How to change Sample rate
How to Calibrate the sensors

Sub shows?
Zooming?

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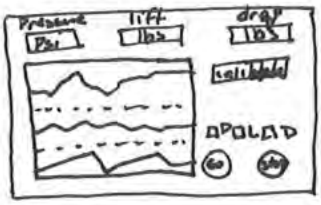
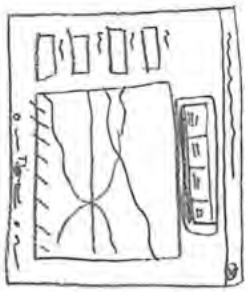
+ Position



P:T P:L P:D
L:T ~~P:D~~ L:D
D:T

WELLS FARGO ADVISORS

GUI
Ask Filenam
Create Folder
Create/Open needed programs eeci excel csv
Hide unnecessary visuals eeci excel
Headings → excel make table
Loop
Grab values
Calculations
Paste → excel table raw need counter
Export Graph
Display GUI
Take input
Transfer to actual program
End Loop



Click:
GuiControl Hide, x%xi%
xi := 3 - xi
GuiControl Show, x%xi%
Return

1
display 1
3 - 1 = 2
display 2
3 - 2 = 1
display 1

label on picture for onclick
+BackgroundTrans

.76 × 4.16
ComObject := ComObjActive (CLSID)

2. ExcelChart
{00020821-0000-0000-C000-000000000046}

SAINT-GOBAIN
CORHART REFRACTORIES

PPT := . . ~

PPT. ActivePresentation. Slides(#). Shapes(#)
. Title. TextFrame. TextRange. Text
:= " ~ "

write text to shape
for live data

= Index (Table [Pressure], CountA (Table[Pressure]))

PPT. ActivePresentation. UpdateLinks
add to timer loop

. Copy
~~PSLIDE~~ Slide. Shapes. PasteSpecial LINK = True

SAINT-GOBAIN
CORHART REFRACTORIES

LButton ::
If (GetPixelColor = red) {
recording = False
SetTimer, RecordCycle, off
SetTimer, LiveCycle, 100
} Else {
if (GetPixelColor = green) {
recording = True
SetTimer, LiveCycle, off
GoSub RecordCycle
SetTimer, recordcycel, frequency
}
Return

RecordCycle:
Read row
write row
write Gui

LiveCycle:
Read row
write Gui

windowsFormsIO.STATIC.app.0.34f5582_r6_ad1

1 – 17

4 – com label

Ch.	
1	15
2	14
3	17
4	16
5	11
6	8
7	10
8	9

Add units setting & Calibration

=Numbervalue(replace(□, Find("_", □), Len(□), ""))

StartTime := A_TickCount

CurrentTime := A_TickCount

ElapsedTime := CurrentTime - StartTime

ElapsedTime := ElapsedTime / 1000

.0000001574074074

XL.Workbooks.Open(Path)

XL.Workbooks.Save()

XL.Visible := True

red	255	0	0	255	0	0
orange	255	136	192 0	255	136	0
green	0	176	80	0	255	0
blue	0	176	240	0	0	255
Purple	112	48	160	255	0	255

StartTime := Now

Time := Now - StartTime

1 2 5 4 5

2 3

2	1	1	1	1	0	0
3	2	2	0	0	1	0
4	3	3	1	1	1	0
1	0	4	0	0	0	1
2	1	5	1	1	0	1

0	0
0	0
1	1
1	1
0	1
2	0

mod(L n/2), 2)

0
0
0
1
1

Header
- eeci setup
- Gi setup
- Excel setup ✱
  - Create chart

recording := false
q

Record
- button swap
- loop timer
  - read
  - write
  - save
  - display
- break on stop

closing
- q/ Close Excel
- Close link.com
- Close eeci

120 .047
65
20

1	Brown	Pressure
2	Red	Lift
3	Orange	Drag
4	Pink	X
5	Yellow	Y
6	Green	
7	Sea foam	
8	Blue	
9	light blue	Pressure Gnd
10	Purple	Lift Gnd
11	Gray	Drag Gnd
12	White	X Gnd
13	black	Y Gnd
14	brown black stripe	
15	Red black stripe	

9 $ 40 4.4xx lbs

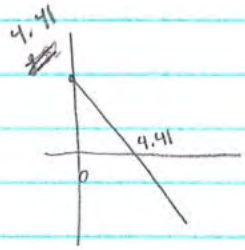
cable has prongs
box has holes

Pressure

0

Drag

4.41



hz	lift	drag
8	.29	.106
12	.88	.268
18	2.25	.638
24	3.40	1.222
30	5.57	1.956
35	8.57	2.706
40	10.99	3.578
45	13.81	4.668
56	21.61	7.493
60	24.38	8.274

mouse

168, 258 150, 248

158, 225 140, 215

18th byte

ahk_class MMCMainFrame

ahk_exe mmc.exe

SysTreeView321

175 168

00AF 00A8

AFA8

13 32 10

D 20 A

clean reset both program & device manager

run program

WindowsForms10.BUTTON.app.0.34f5582_r6_ad121

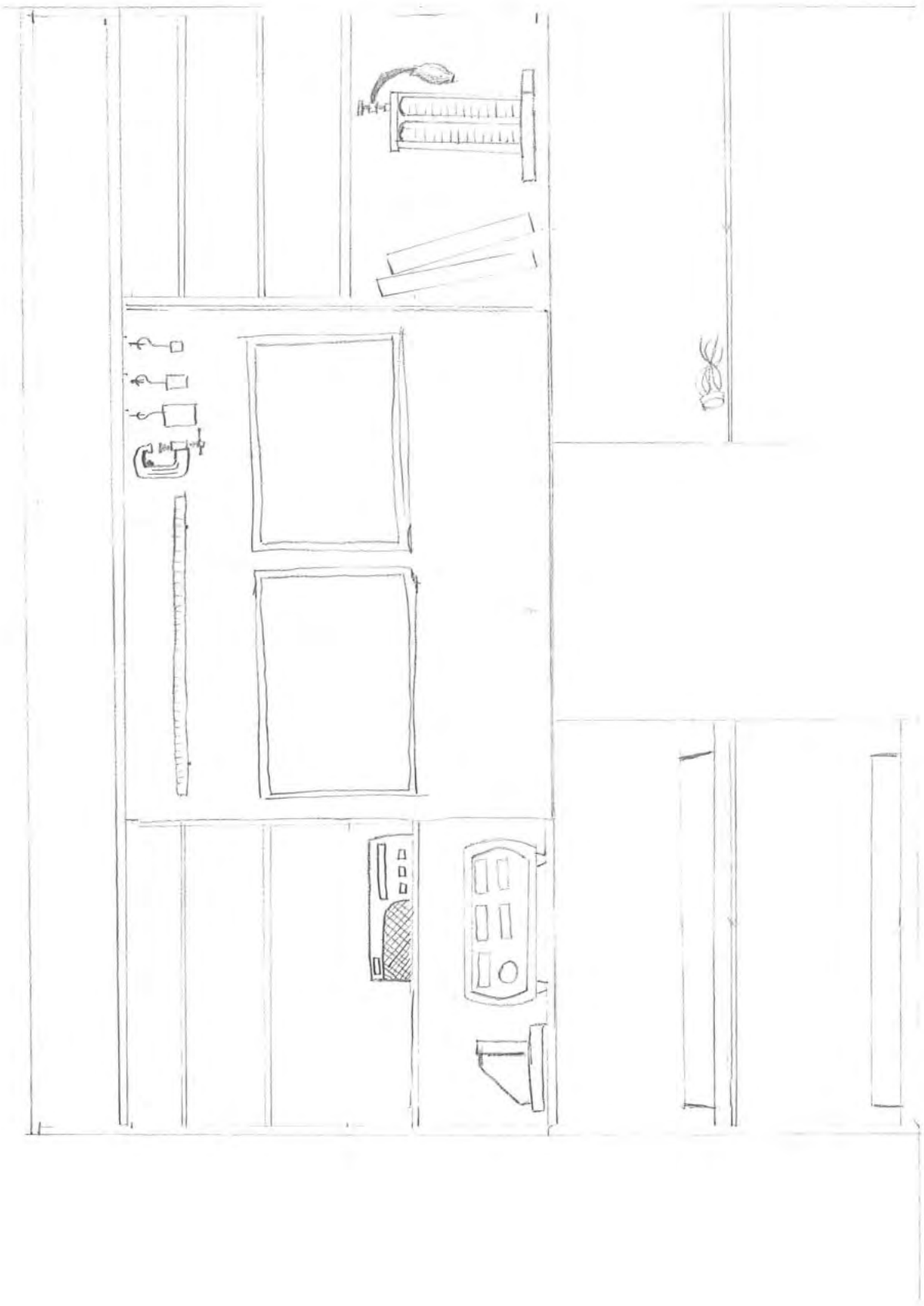
Com Port Setup

ahk_exe ADC-8U12.exe

WindowsForms10.BUTTON.app.0.141b42a_r6_ad11

WindowsForms10.COMBOBOX.app.0.34f5582_r6_ad11

ComboLBox1



By 12/14

weekly accomplishments list

Redo poster & get bigified

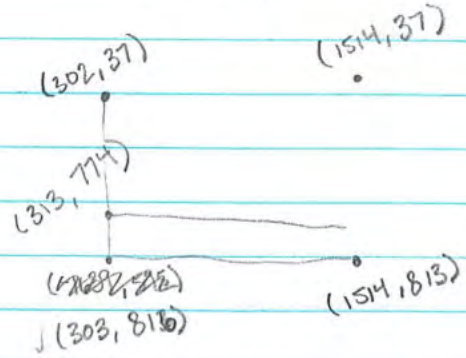
frequency check

$\neq 0$ higher limit

1	303
0	313
1	786
0	774
	42

slave master

2.5 KHz



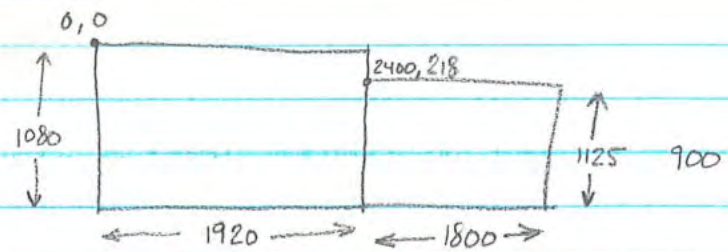
282.1

550.6

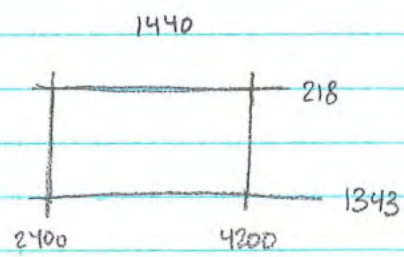
90

45

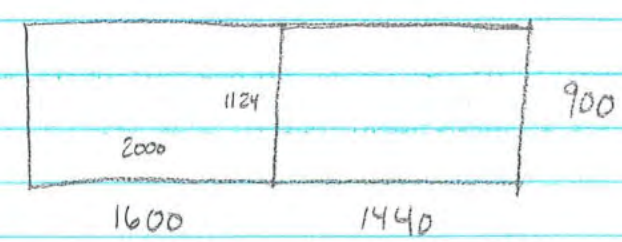
Windows Forms 10, BUTTON. app.0.141b42a_r6_ad11



130 = 104



$$\frac{1920}{1080}\ \frac{1600}{900} \cdot 24 \cdot \frac{900}{1600} = 24$$

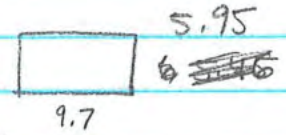


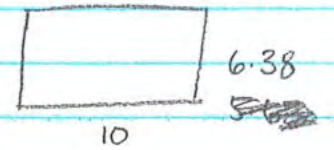
$(1926 + 2 \cdot -3)/2$

$1926 + -6$

$\frac{1920}{2} = 960$

$3 = 640$





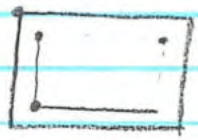
$\frac{5.95}{6.38} = 0.944 = Y$

$\frac{9.7}{10} = 0.97 = x$

$10 = 13.35 \cdot x$

$\frac{10}{13.35} = x = 0.75\ \%$

$\frac{6.38}{7} = Y = 0.91$



$\times 120$ dpi

121.33

120.158

495_{px} | 1.293 | 640_{px} | $\rightarrow$ | $72_{px}/in$ | 6.88" | 1.2906 | 8.88" | $\rightarrow$ | $120_{px}/in$ | 825 | 1.2935 | 1067 | $96\ px/in$ | 8.597 | 11.1145

$= 72 \cdot 1\frac{2}{3}$

$1.\overline{66} \approx 1.6671$ | $1.\overline{66}$ | $1\frac{2}{3}$

$$\cancel{\%} \cdot \frac{x\ px}{screen} \cdot \frac{1''}{96\ px} \cdot \frac{72\ pts}{1''} \cdot$$

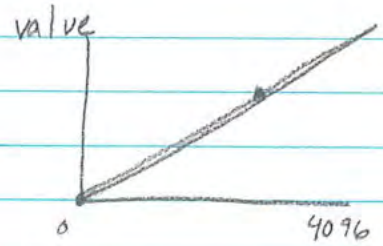
$$\frac{\cancel{\%}}{\cancel{screen}} \cdot \frac{1\ screen}{width_{px}} \cdot \frac{96\ px}{1''} \cdot \frac{1''}{72\ pts} = \frac{\cancel{\%}}{pts}$$

$$\frac{screen}{\%} \cdot \frac{width}{screen} \cdot \frac{1}{96} \cdot \frac{72\ pts}{1}$$

$$\frac{1\ \cancel{screen}}{\cancel{screen}} \cdot \frac{1600}{96} \cdot 72 = \frac{1200\ pts}{1\%\ w} \quad \frac{675\ pts}{1\%\ h}$$

$$X\ \cancel{screen} \cdot \frac{1600\ px}{1\ \cancel{screen}} \cdot \frac{1''}{96\ px} \cdot \frac{72\ pts}{1''}$$

~~V:\Vabl-ata\5F1E D300~~

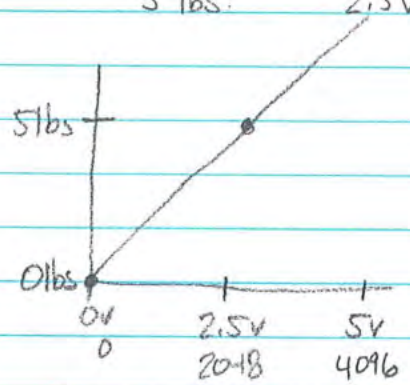


weight = 0 screen = ~0

weight = 4.41 screen =

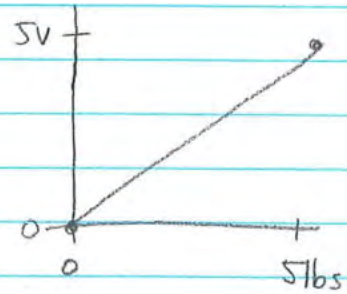
measurement → volts → number → measurement value

0 lbs.	0 V	0	0
10 lbs.	5V	4096	10
~~20 lbs.~~	~~5V~~	~~4096~~	~~20~~
5 lbs.	2.5V	2048	5



5v = 4096

0v = 0



2.5V · 1 = 2.5lbs

2048 / 819.2 = 2.5lb

$$\cancel{\frac{5-0}{2.5-0} = \frac{5}{2.5}}$$

$$\frac{5v \approx x}{\text{Lift} = 20\text{ lbs}}$$

Drag = 10 lbs

X = 36 in

Y = 18 in

Pressure = 10 in H_2O

$$\frac{4096}{5v} \cdot \frac{5v - 0v}{5\text{lbs} - 0\text{lbs}} = 1 = m$$

$$\frac{2.5v - 0v}{5\text{lbs} - 0\text{lbs}} \cdot \frac{4096}{5v} \cdot \frac{1}{2} \cdot \frac{1}{2} = .25$$

$$\frac{1}{2} \cdot 4096 = \frac{2048}{5} \cdot \frac{10\text{lbs}}{4096}$$

$$V = \sqrt{\frac{2 \cdot 9.81 \cdot 25h}{1.19930 \cdot 9.81}}$$

kg/m^3 $\frac{N}{kg}$

$\sqrt{1.6676 \cdot \Delta P}$

$\sqrt{4169.1} = 64.6\ m/s$

pressure	$pa = \frac{N}{m^2}$	2490.9 Pa	25 hPa
lift	N	89 N	90 N
drag	N	44.5 N	45 N
X	m	0.91 m	91 cm
Y	m	0.46 m	46 cm

windspeed m/s 64.6 m/s

100

$$\sqrt{\frac{2 \cdot 32.2 \cdot 12}{0.07487 / 1728} \cdot 0.361279}$$

$$1.469 = \sqrt{5.9753 \cdot 0.361279}$$

$$\sqrt{\frac{2 \cdot 32.2 \cdot 0.000278765}{3 \cdot 0.07487 \cdot 27}}$$

0.833 10

0.622

0.311

3

1.5

P	Psi	0.361279		
L	lbs	20	0.622	sl
D	lbs	10	0.311	sl
X	in	36	1	yd
Y	in	18	0.5	yd
W	in/s	1.469	0.054	yd/s

$$\sqrt{\frac{0.0179.5}{6.0644}} = 0.0544\ yd/s$$

$$\frac{2\ mi/min}{} \cdot \frac{120\ mi}{hr} \cdot \frac{1}{60 min}$$

$$\frac{ft}{s} \cdot \frac{3600}{5280}$$

$$\sqrt{\frac{2 \cdot 32.2}{0.07487} \cdot 52} = \sqrt{44728.196} = 211.5\ ft/s$$

$$\frac{3600 \cdot 859.463 \cdot 5.2}{5280}$$

$$\frac{ft}{s} = \sqrt{\frac{ft}{s^2} \cdot \frac{lb}{ft^2} \cdot \frac{ft^3}{lb}}$$

$$\frac{in}{s} = \sqrt{\frac{in}{s^2} \cdot \frac{lb}{in^2} \cdot \frac{in^3}{lb}}$$

$$\frac{ft}{s^2} \cdot \frac{12in}{ft} \quad \frac{2 \cdot 32.2 \cdot 12 \cdot 52 \cdot 1728}{144 \cdot 0.07487}$$

$$\frac{lb}{ft^2} \cdot \frac{ft^2}{144 in^2} \quad = \sqrt{6440860.1576}$$

$$\frac{ft^3}{lb} \cdot \frac{1728 in^3}{ft^3} \quad = 2537.9\ in/s$$

$\frac{lb}{ft^2}$ $\frac{lb}{ft^2}$

$$\sqrt{\frac{2 \cdot 10 \cdot 5.2}{0.07487}} = 16\ ft/s$$

$$2 \cdot \frac{32.2\ \frac{ft}{s^2}\ \ 10\ in\,H_2O \cdot 5.2033\ lb}{1\ in\,H_2O\ \ ft^2\ \ 0.07487\ \frac{lb}{ft^3}} \cdot \frac{ft^{3/2}}{s}$$

$$\frac{32.2 \cdot 10 \cdot 5.2033}{0.07487} = 2237.829$$

12 960 000

$$2237.829\ \frac{ft^2}{s^2} \cdot \frac{3600^2\ s^2}{5280^2\ ft^2}\ \frac{1\ mi}{1\ hr}$$

27 878400

1040.313

$$\sqrt{2 \cdot 32.2 \cdot \frac{10}{12}} = 7.326\ ft/s$$

1" 4005 fpm = 45.5 mph

10" 12665 fpm = 143.9 mph

$$h = \frac{\left(\frac{V}{C}\right)^2}{12} \qquad C\sqrt{h} = V$$

$$4005\sqrt{10} = 12665\ \frac{fpm}{min}\ \frac{60}{hr} \cdot \frac{mi}{5280}$$

$$v = \sqrt{\frac{2\,\Delta P}{\rho}}$$

$$\frac{ft}{s} = \sqrt{\frac{2 \cdot \text{in}H_2O}{\frac{lb}{ft^3}}} = \frac{psf}{\frac{lb}{ft^3}} = \frac{\cancel{lbs}\, ft^{\cancel{3}}}{\cancel{ft^2}\, \cancel{lb}}$$

$$\cancel{\frac{\cancel{s}\,\cancel{ft}}{\cancel{ft^2}\,\cancel{s^2}}} \quad \cancel{\frac{\cancel{s}}{\cancel{ft}} \cdot \frac{\cancel{ft}}{\cancel{s^2}}}$$

$$v = \sqrt{\frac{2g}{\nu}\Delta P} \qquad \frac{\cancel{ft}}{s^2} \cdot \frac{\cancel{lb}}{\cancel{ft^2}} \frac{\cancel{ft^3}}{\cancel{lb}}$$

$$\sqrt{\frac{2g\,\Delta P}{\rho}}$$

$$\sqrt{\frac{2 \cdot 32.174 \cdot \Delta P \cdot 5.2}{0.07487}}$$

Final Formula

$$\# \cdot \frac{5V}{4096} \cdot \frac{10lbs}{\sim 5V}$$

Wiring of ADC

Pins

1	2	3	4	5	6	G	
Brown	Red	Gray	Pink	Yellow			Light Blue
							Purple
							Orange
							White
							Black

Alfred University

Inamori School of Engineering

[WTCC]

- User log
- Config File
- Main menu ppt
  - → Powerpoints
- [Labdata]
- Background
- LivePic
- Blankgraph
- ADC-8012.exe
- WTCC.exe

→ [Images]

- → LivePic
- Background
- Blankgraph
- chart BG16

[Labdata]

- → spreadsheets

[PPTs]

- → powerpoints

[logs]

- → User log
- WTCC.exe
- [ADC-8012]

[eeci]

→ [ADC-8012]

- → ~~LivePic~~
- Config
- ADC-8012.exe

175 268

https://www.excelsupersite.com/what-are-the-56-colorindex-colors-in-excel/
https://docs.microsoft.com/en-us/windows/win32/cimwin32prov/win32-pnpentity
https://autohotkey.com/board/topic/60968-wmi-tasks-com-with-ahk-l/
https://www.autohotkey.com/docs/AutoHotkey.htm
https://docs.microsoft.com/en-us/office/vba/api/Excel.XlChartType
https://autohotkey.com/board/topic/88438-excel-charts/
https://autohotkey.com/board/topic/56987-com-object-reference-autohotkey-v11/
https://www.randomterrain.com/web-design-readability-and-backgrounds.html
https://autohotkey.com/board/topic/4104-close-all-windows/
https://autohotkey.com/board/topic/95788-set-3rd-party-windows-parent-to-ahk-gui/
https://autohotkey.com/board/topic/59929-expression-in-gui-solution-for-noobs-like-me-explanation/
https://www.reddit.com/r/AutoHotkey/comments/4dmu65/any_way_to_minimize_all_instances_of_a_program/
https://www.wikihow.com/Save-Your-PowerPoint-Slides-As-High-Resolution-Images
https://en.wikipedia.org/wiki/INI_file
https://www.sciencedirect.com/topics/engineering/pitot-static-tube
https://www.engineeringtoolbox.com/velocity-head-d_916.html
https://support.office.com/en-us/article/Add-or-remove-a-secondary-axis-in-a-chart-in-Excel-91da1e2f-5db1-41e9-8908-e1a2e14dd5a9
https://www.datanumen.com/blogs/2-methods-quickly-resize-pictures-word-document/
https://www.techrepublic.com/article/vertically-center-graphics-and-text-on-one-page-within-a-word-document/
http://www.addbalance.com/word/mirrored_margins_landscape.htm
https://www.addictivetips.com/microsoft-office/disable-spelling-grammar-check-for-a-paragraph-in-ms-word/
https://
support.office.com/en-us/article/Add-a-heading-3EB8B917-56DC-4A17-891A-A026B2C790F2
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