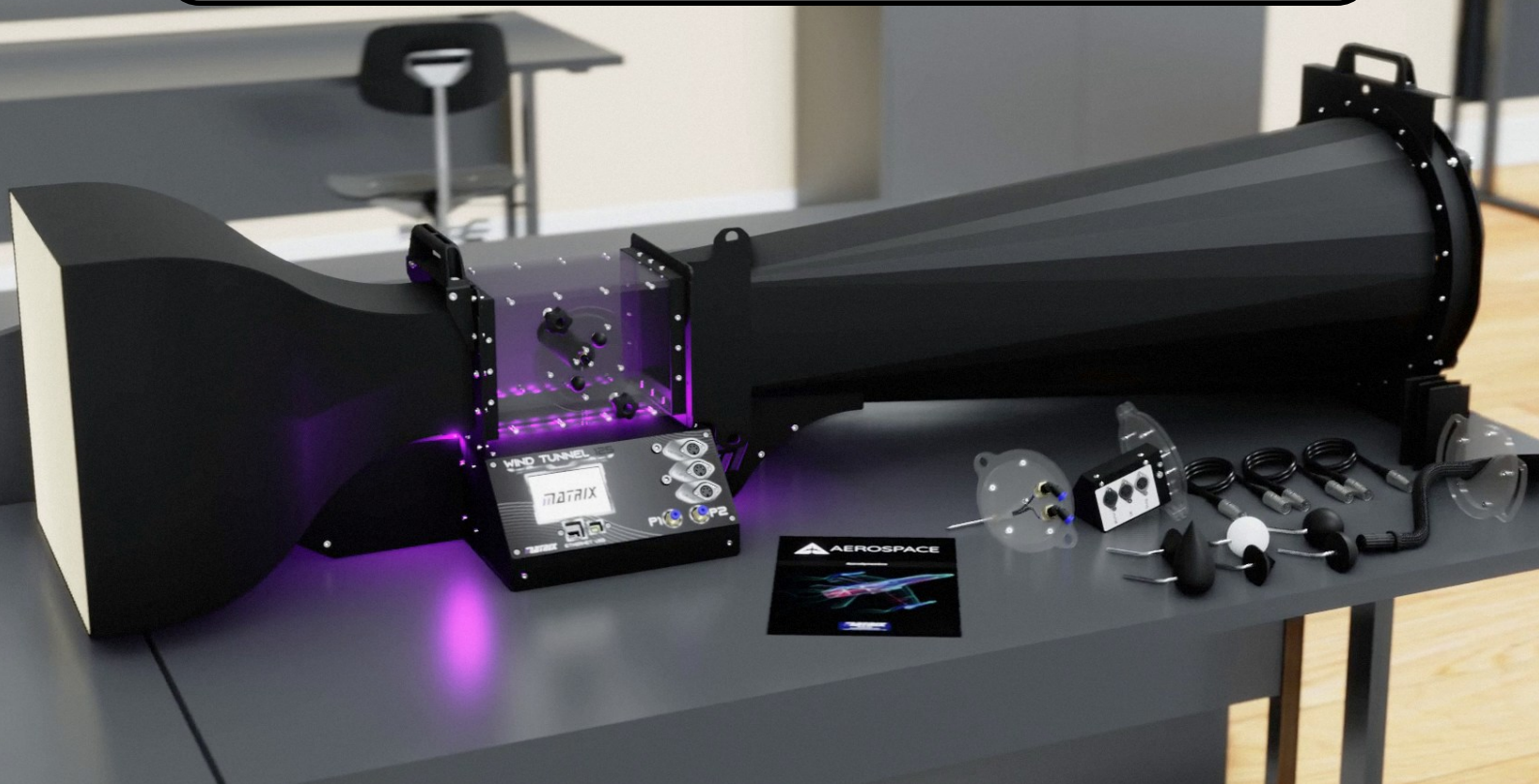


# **MATRIX** | WIND TUNNEL

## Wind Tunnel 125

# Manual



**MATRIX**

CP5135

[www.matrixtsl.com](http://www.matrixtsl.com)

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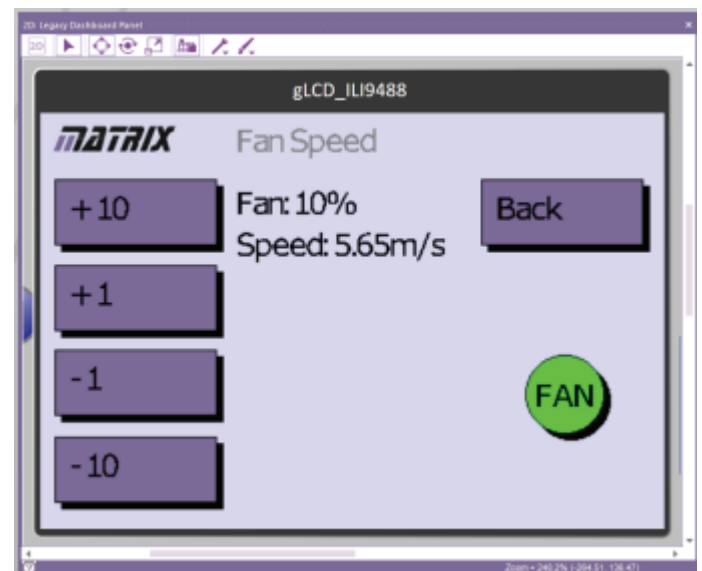
# Touch screen guide

## Home

On the home screen, the display shows the angle of attack, fan power in percentage and wind speed. It also then shows the readouts of lift, drag and pressure from the sensors (if connected). To turn on the wind tunnel to generate air flow. Push the 'speed' button.



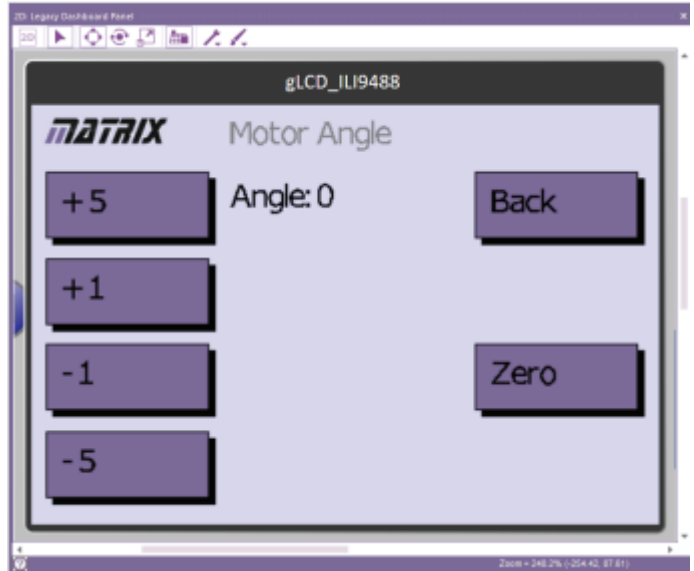
Then push the required amount of percentage change. If you want 10% more power, push the +10, then you'll see the fan percentage change accordingly. The speed is automatically generated from calibrated factory data. However, this can be recalibrated and entered for on site data. If the user wants to go back to the home page, push the 'Back' button. The Fan red/green button is an electronic e stop, when red the fan isn't on. When green the fan is running. By pressing the green button the fan will stop and the button will go red. Another press and it will return to the previous fan power setting and the button will be green. Once the setup of the sensors has been done by the user, the sensors can be zero'ed out to start the experiment from a known position by the using the 'Zero' button. This will make the lift, drag and pressure readouts zero.



# Touch screen guide

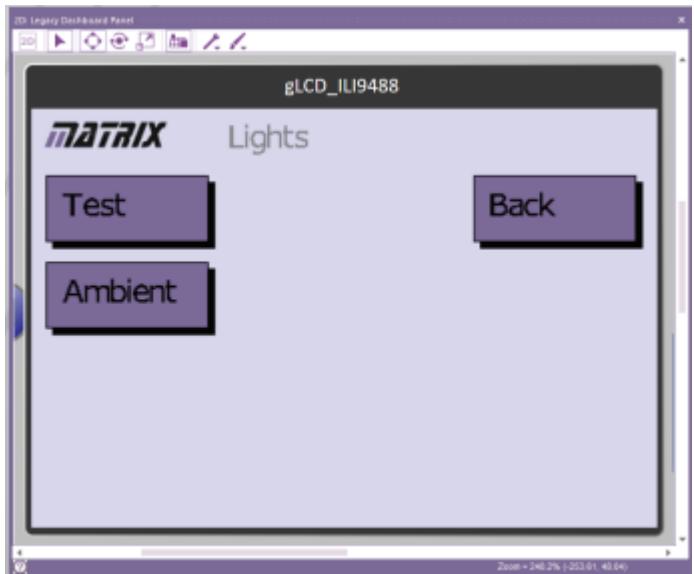
## To change the angle of attack

Once the 2 force component module is connected, the angle of attack can be numerically controlled by the touch screen. On the home screen push 'Angle' Then push the desired incremental change of angle which will be displayed. To zero out the angle of attack, move the object and angle of attack to desired position, then simply push 'Zero'



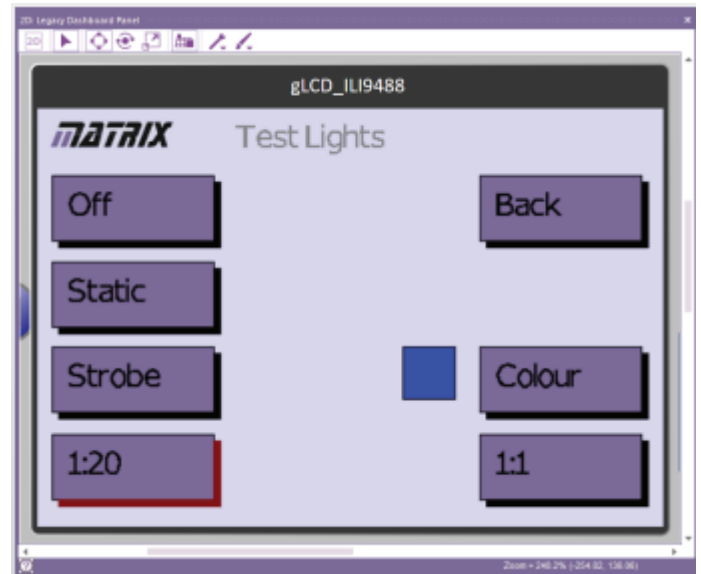
## The LED's

To change the LED settings push 'Lights' This will then display a menu for 2 options. 'Test' will control the LED's in the test section of the wind tunnel. 'Ambient' will change the settings for the LEDs underneath the tunnel. (the ambient lights do not effect functions of the tunnel)



# Touch screen guide

The test section has a few modes to choose between. 'O' is no lights in the test section 'Static' is a constant light, displayed in the colour chosen with the 'colour' button which cycles through a prescribed set of colours. Bright colours work well for illuminating the smoke. 'Strobe' -ashes all the LEDs' rapidly on and o. Giving a stop frame eect for the smoke patterns. '1:20' matches the speed of the wind tunnel air -ow in m/s but at 1/20th of the real speed. This is great for slow motion camera videoing of the smoke patterns. '1:1' is the real time representation of the air -ow speed through the through.



# How to recalibrate air speed

The wind speed is displayed on the touchscreen. The speed is factory calibrated. Each percentage increase has its own speed reading.

If you need to redo this due to error or difference in environment (ie altitude or ambient temperature) follow the below steps to overwrite the factory calibration.

Open the calibrate software in the downloaded software package off <https://www.matrixsl.com/windtunnel/resources/>

Connect the wind tunnel to a PC with the USB cable. Turn the power to the product on.

Place the pitot static module into the wind tunnel test section, making sure everything is set up correctly, like in worksheet of the curriculum using the digital pressure output.

Record the pressure values for every 10% increment of wind speed which are displayed on the home screen of the touchscreen menus (1).

Turn this Pa value into wind speed m/s which following formula:

$$V \text{ (m/s)} = \sqrt{\frac{2P}{1.2}}$$

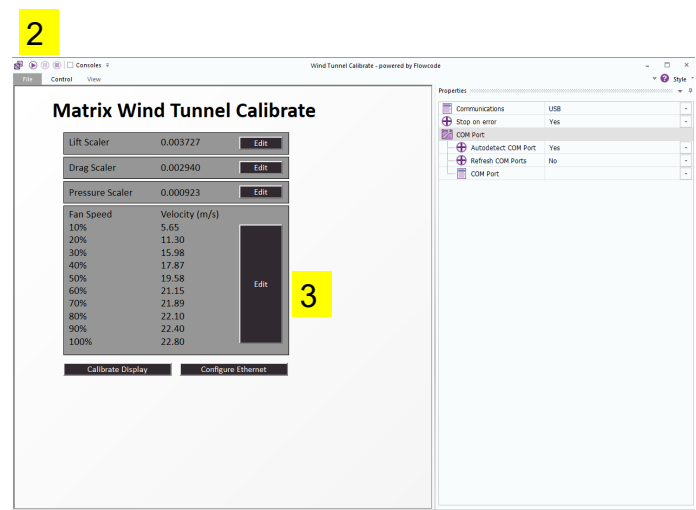
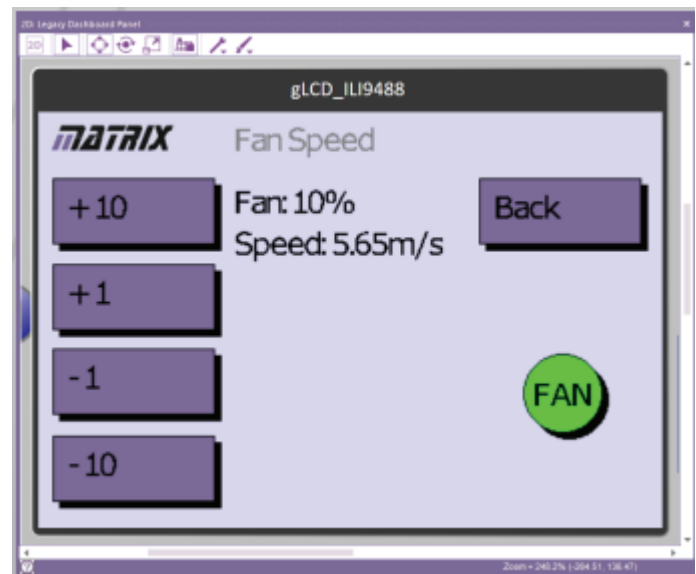
P (Pa)

Repeat for all 10 values

Run the calibration software, with the play button in top left corner (2)

Click edit (3) and follow the instructions that pop up.

Once all 10 values are entered. Check the display shows the same number in m/s for the percentage increment chosen.



# How to use wind tunnel software

Use the:

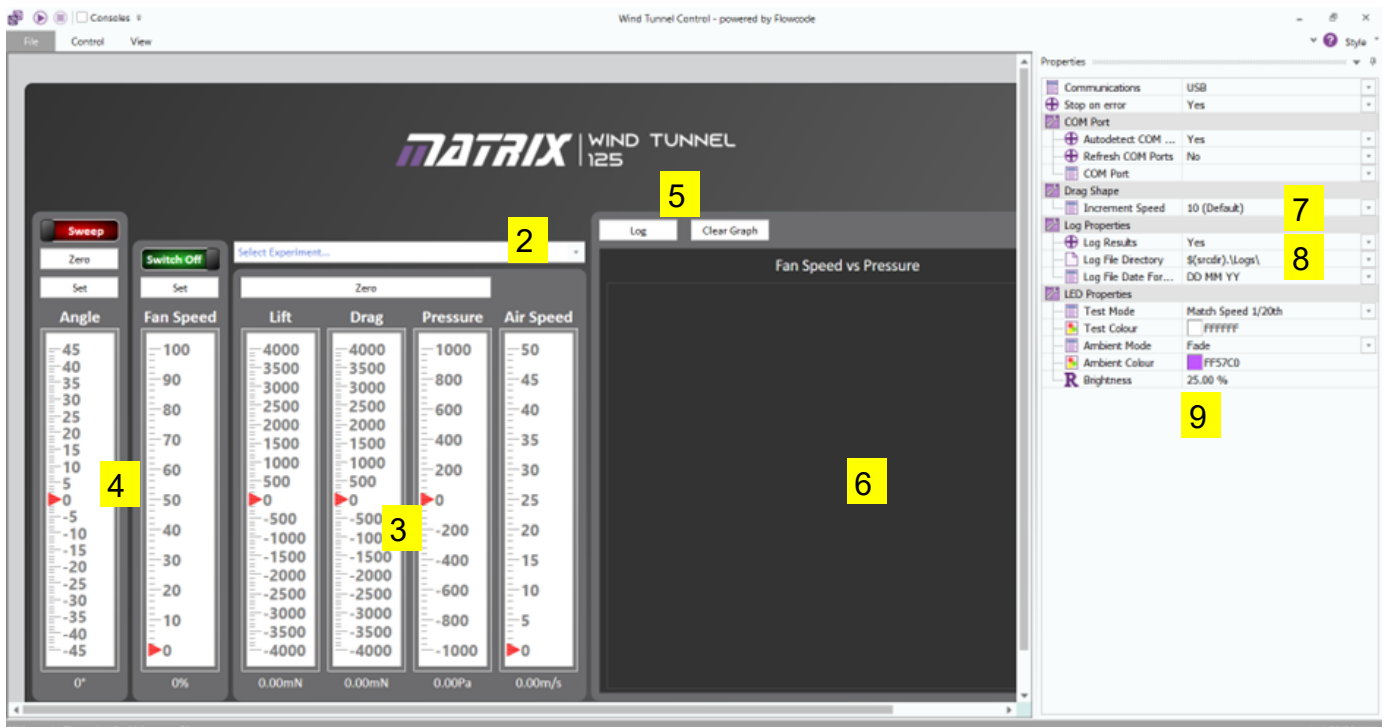
1. Wind tunnel control.exe

To use the wind tunnel via software control

Click run in the top left (play button) to run the software.

1

Name	Date modified	Type	Size
App Developer	21/02/2025 13:41	File folder	
Logs	26/03/2025 09:35	File folder	
Source	21/02/2025 13:41	File folder	
Calibrate	25/01/2023 18:18	Application	41 KB
Calibrate.mscada	30/01/2024 13:04	MSCADA File	1,003 KB
Wind Tunnel Control	25/01/2023 18:18	Application	41 KB
Wind Tunnel Control.mscada	21/02/2025 12:30	MSCADA File	2,688 KB



2. Experiment type drop down menu
3. Sensor readouts, with zero functionality
4. Control panels—fan speed and angle of attack each with set functionality and zero'ing for angle of attack
5. Log data and clear graph button
6. Graph area
7. Sweeping properties
8. Log file properties
9. LED functionality properties

# How to use wind tunnel software

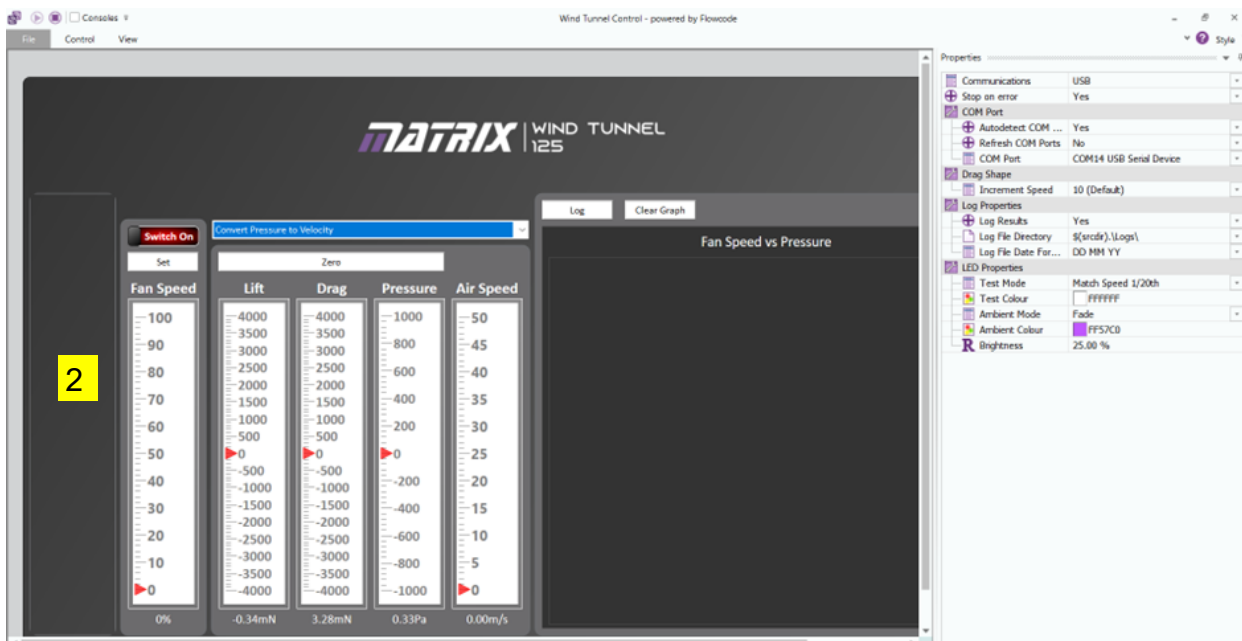
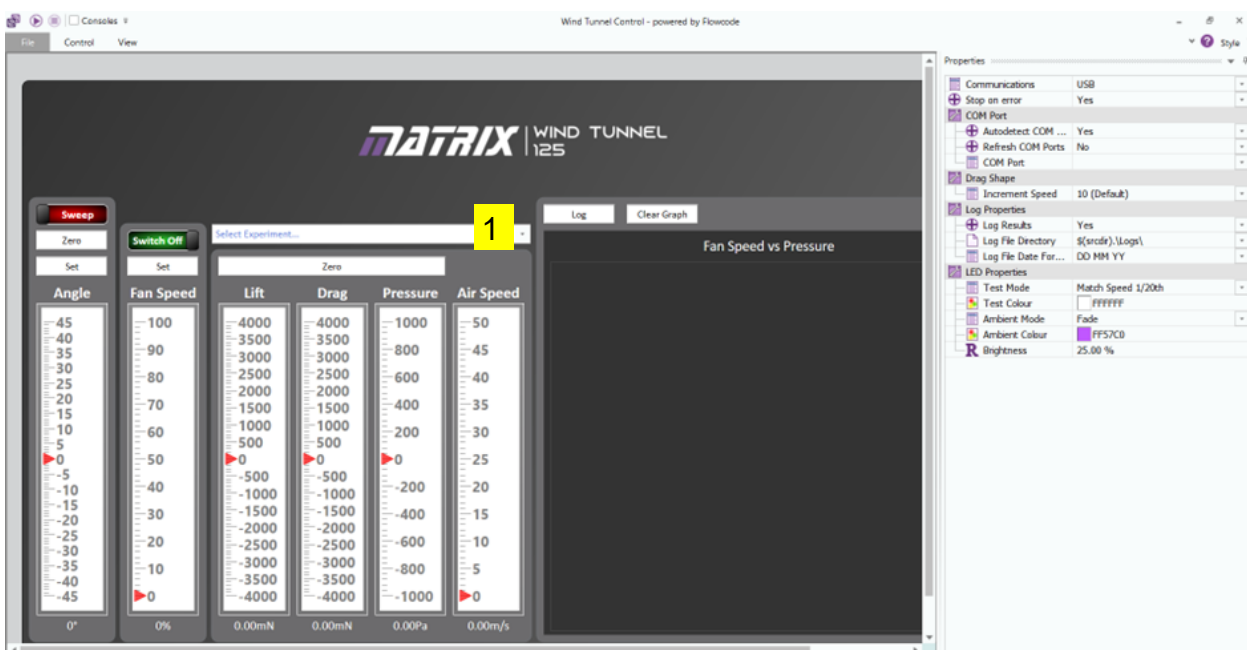
## Manual

1. Choose the experiment type from the drop down in the menu

Each worksheet is represented in the drop down menu with the experiment name

However experimental testing can utilise the functionality independently of the worksheets.

2. Different controls are represented depending on experiment. This is due to the experiment functionality not being required, so hiding controls that are not present in experiment streamlines the interface.





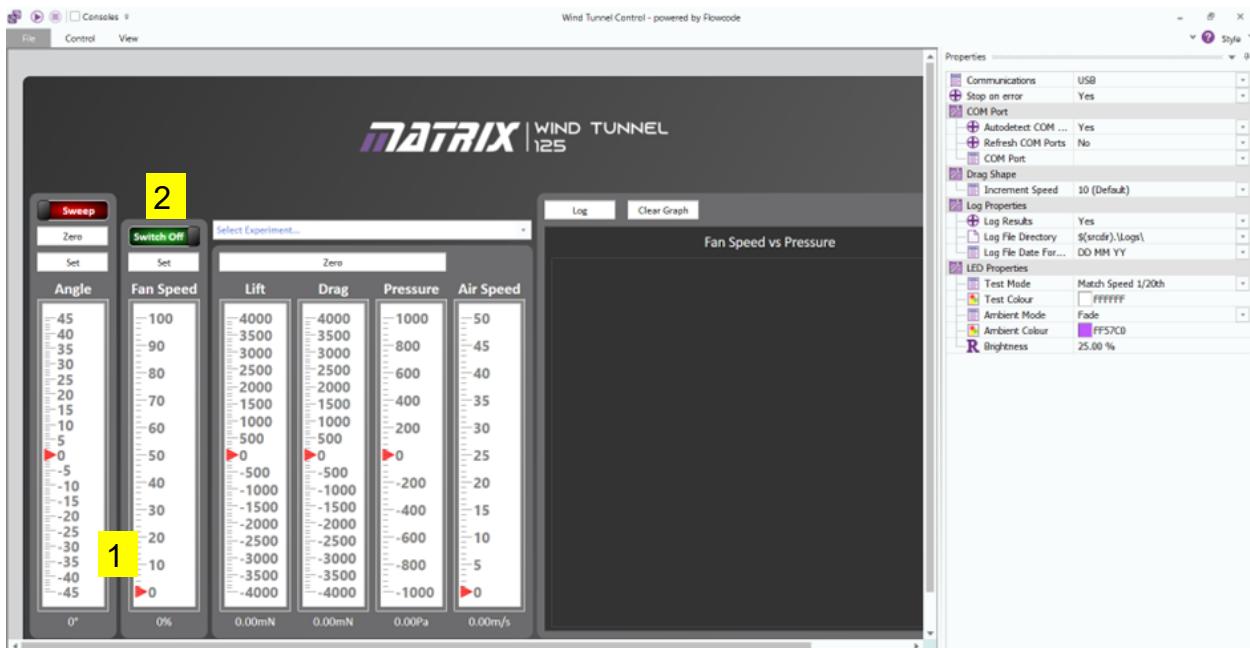
# How to use wind tunnel software

## 1. Control the fan speed

User can click on the red slider handle and drag to desired fan percentage, and click to confirm before moving away

Or  
Use the set button at the top of the slider, to type in the exact value of fan speed that is required

## 2. Click the switch fan on/off button to start or stop fan once speed has been set



# How to use wind tunnel software

Pitot static module—Pressure to velocity

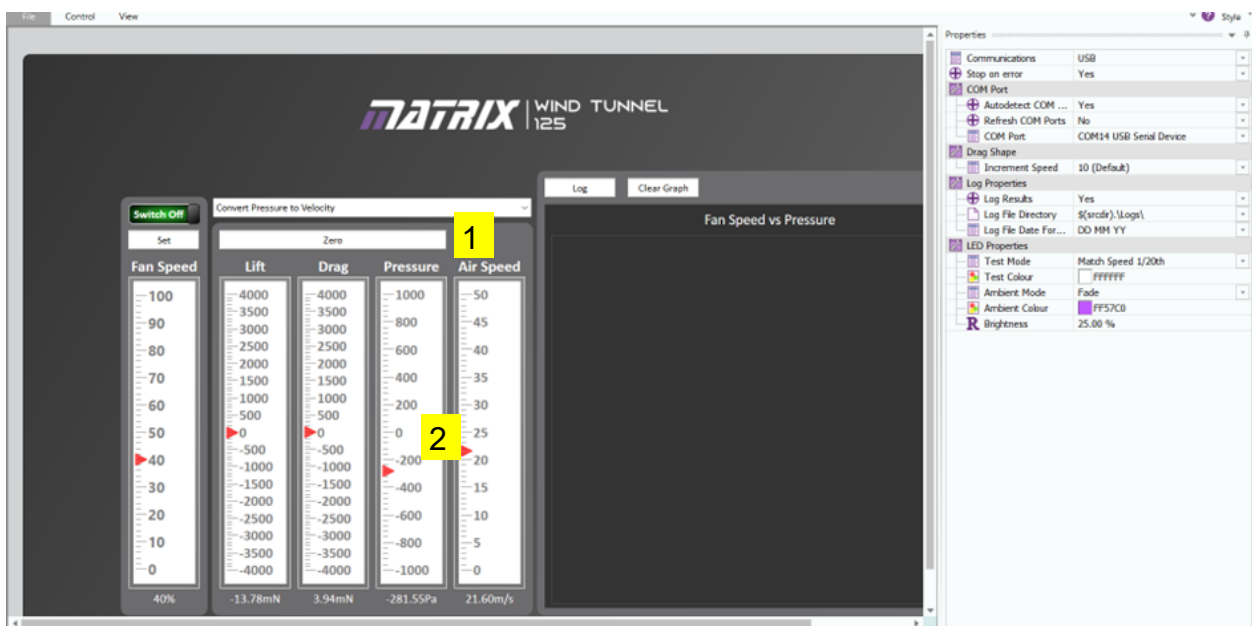
The first experiment in the worksheet requires the pitot static module to be attached to the test section. Both P1 and P2 pneumatic ports should be connected.

Pressure readouts

The zero button for sensor readout should be pushed before any experiment

Switch fan on as shown previously

The column for pressure is highlighted (2) and the sensor readout should be display in the slider and below numerically.



# How to use wind tunnel software

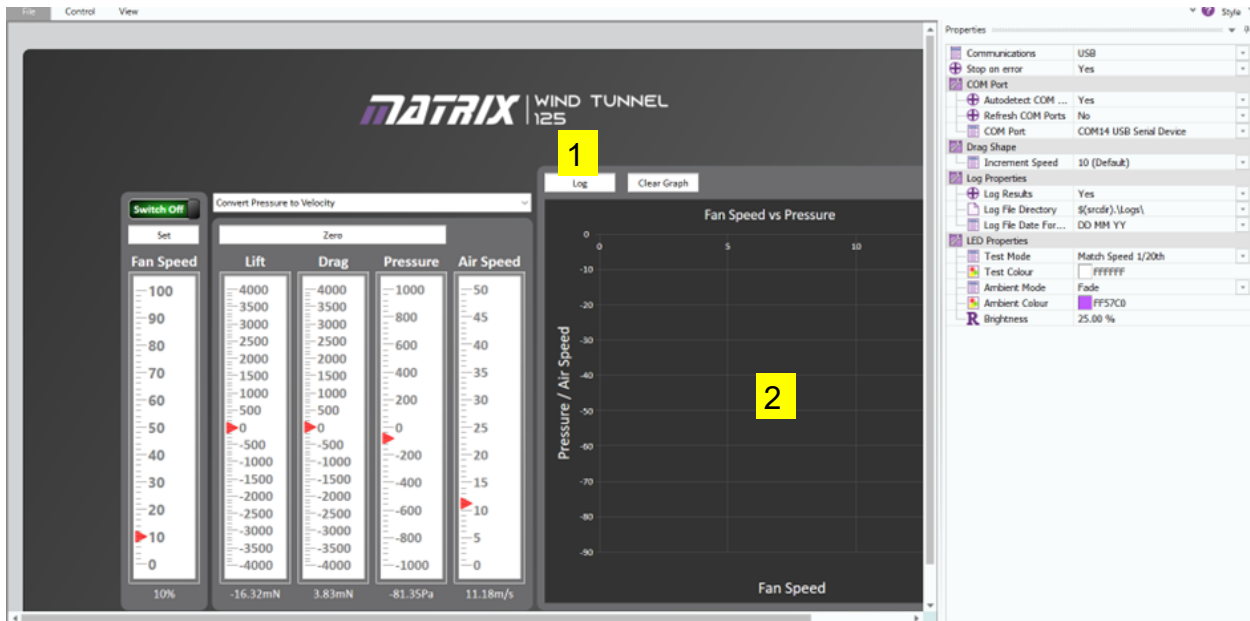
## Logging data/graphing

When the software has a sensor readout, a user may want to graph this value.

This is achieved by logging the data.

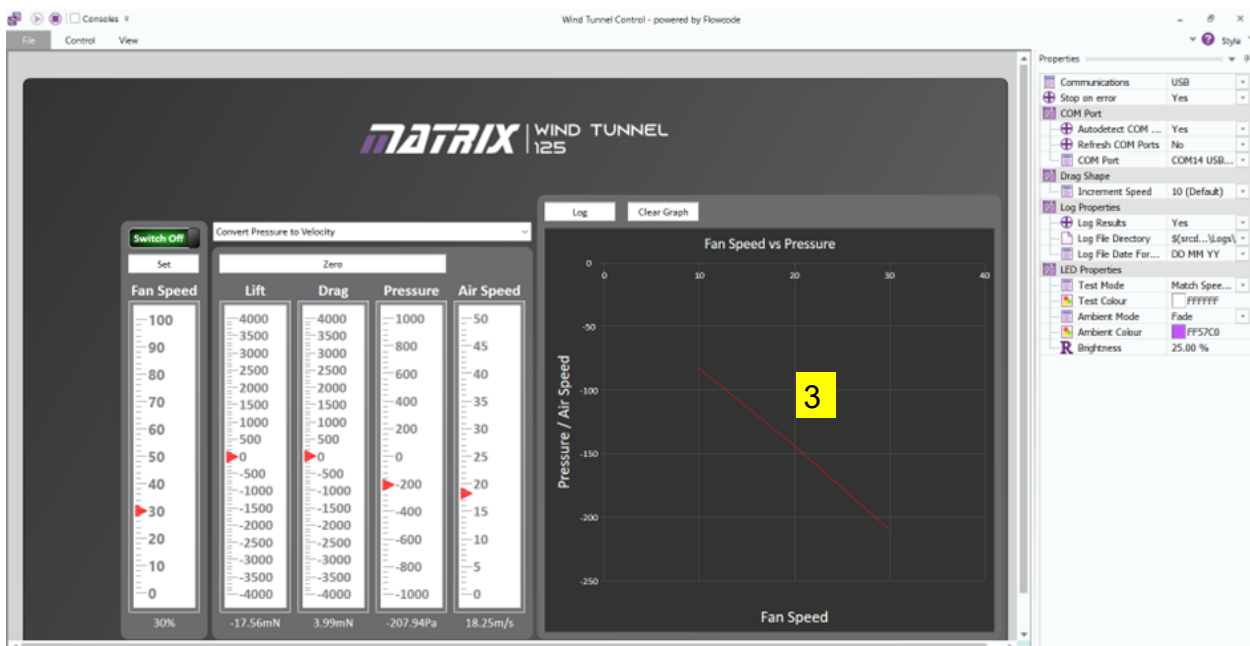
1. Click log button

The graph area should then display axis approximate to the experiment setup (2)



Change the speed to 10%, 20% and 30% clicking log between speeds. (for best results wait for sensors to settle)

The graph area should now display a graph (3)



# How to use wind tunnel software

## Manual

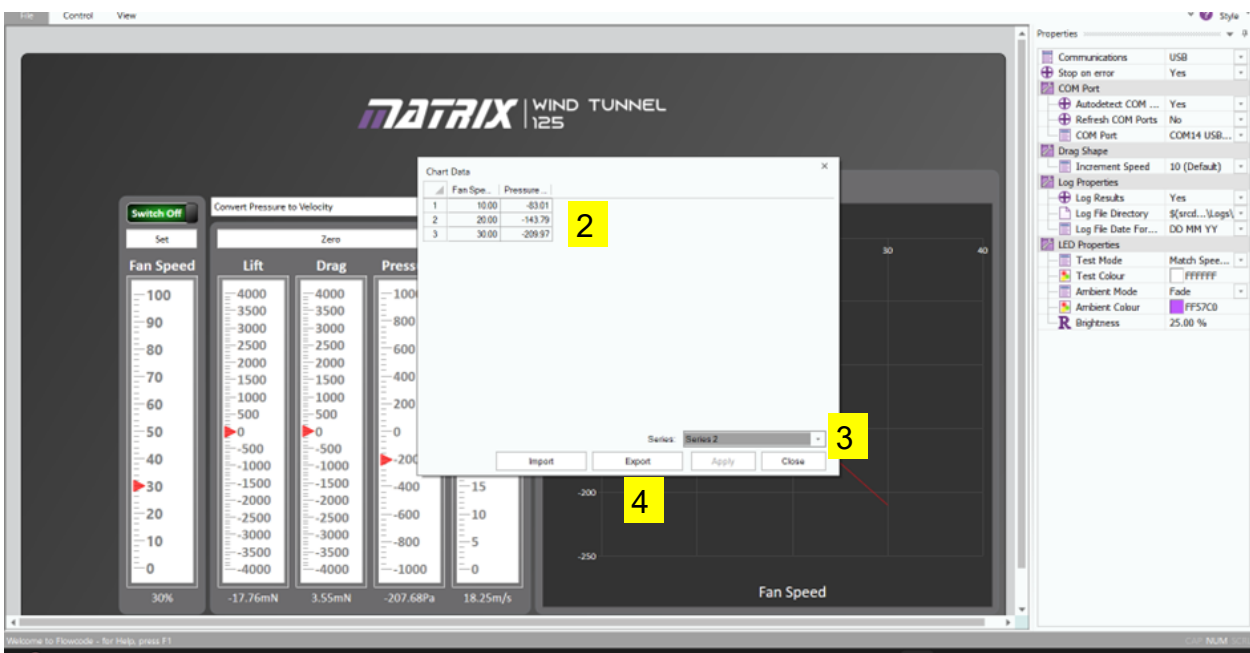
1. Right click the graph area

Click show stored data, and the following window will present the data taken in current experiment (2)

Changing the series is possible if multiple sensors are represented on the graph. For example, lift and drag load cell data. (3)



Data can be saved out as .csv file with export button (4)



Click clear graph to delete graph

Data is not lost even with clear graph, and the log file stores the data with a date stamp and experiment section.

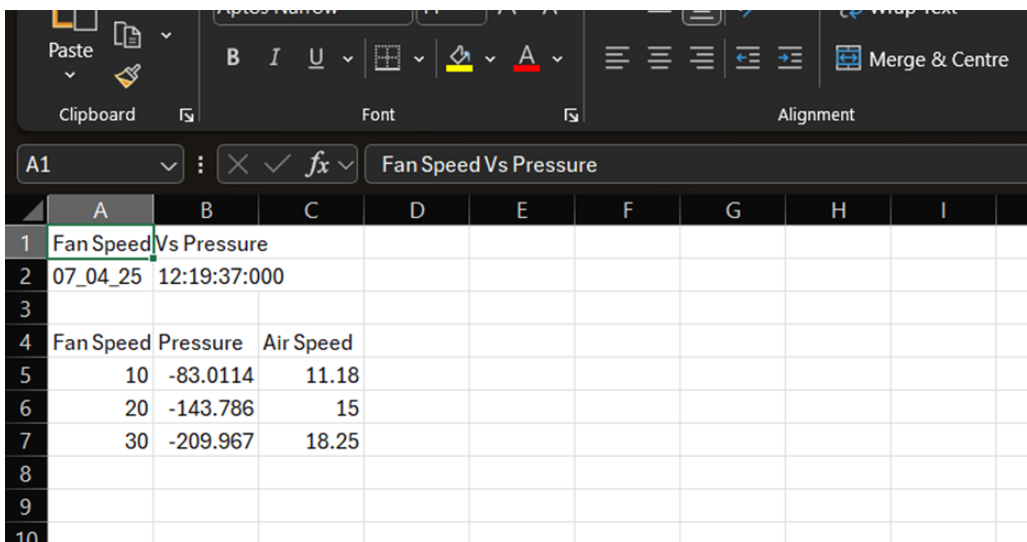
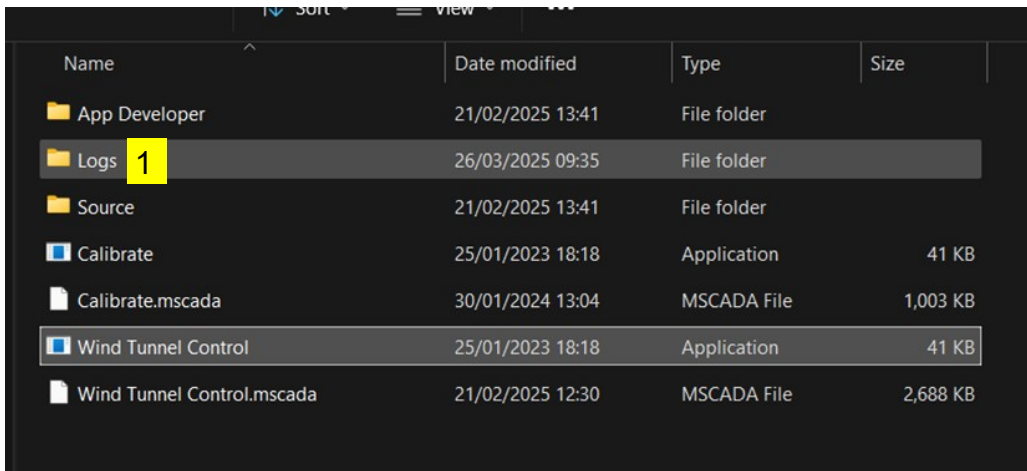
# How to use wind tunnel software

By default the log file will be in the logs folder in level above the wind tunnel control.exe (1)

You will need write access to this folder

Opening the log file, the data and time of the test is displayed and separates the experiments taken.

New log files are taken per day



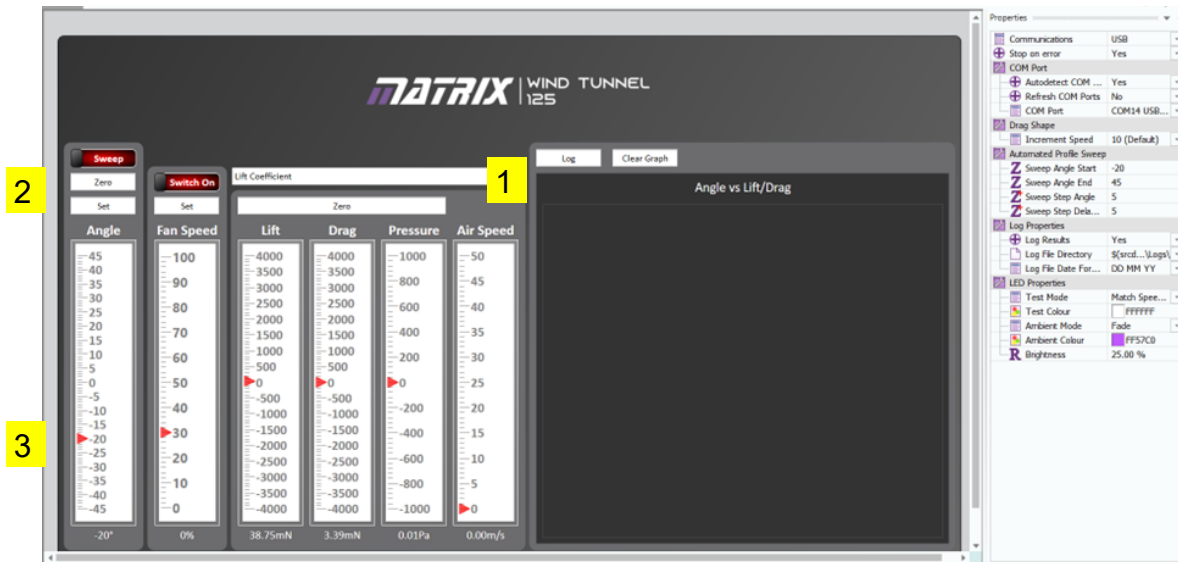
Log file location can be stored in the properties pane of the software, using windows explore to select location.

# How to use wind tunnel software

Control more functionality

Angle of attack control

1. Click the lift coefficient experiment, the angle of attack control slider will appear (requires 2 force component module and aerofoil to be connected)



2. set zero angle of attack

3. Click on the slider and pick a positive random number, the aerofoil attached to the 2 force component module should rotate.

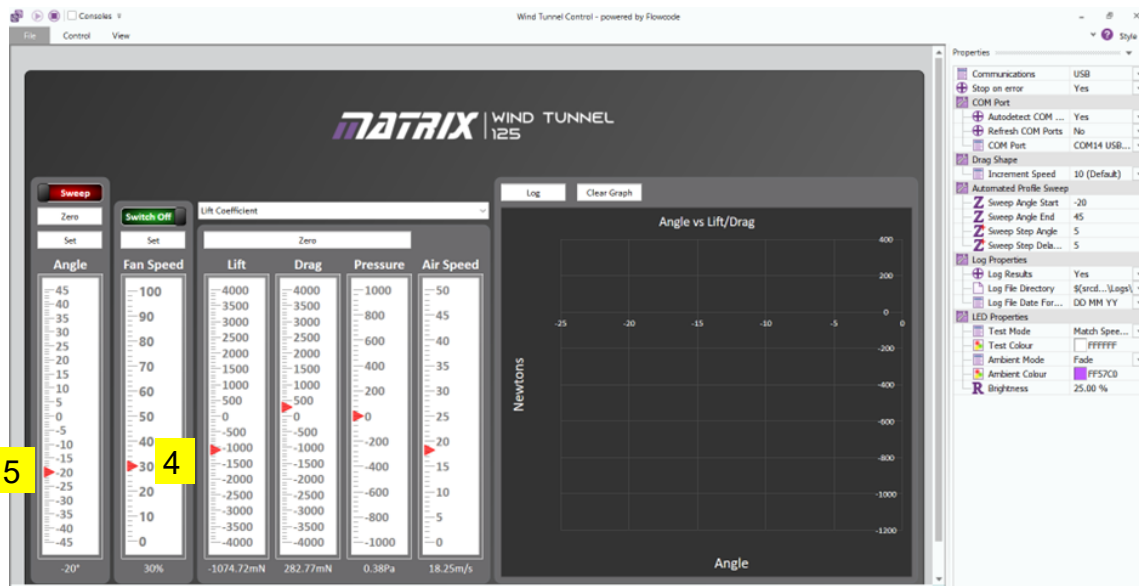
Rotate the aerofoil until its at 0 angle of attack if its close. Then click zero

If the aerofoil is over 45deg away from this position, click +45deg let the aerofoil rotate. Click zero and repeat process till the desired position is met.

Zero sensors out to reset them before experiment (2)

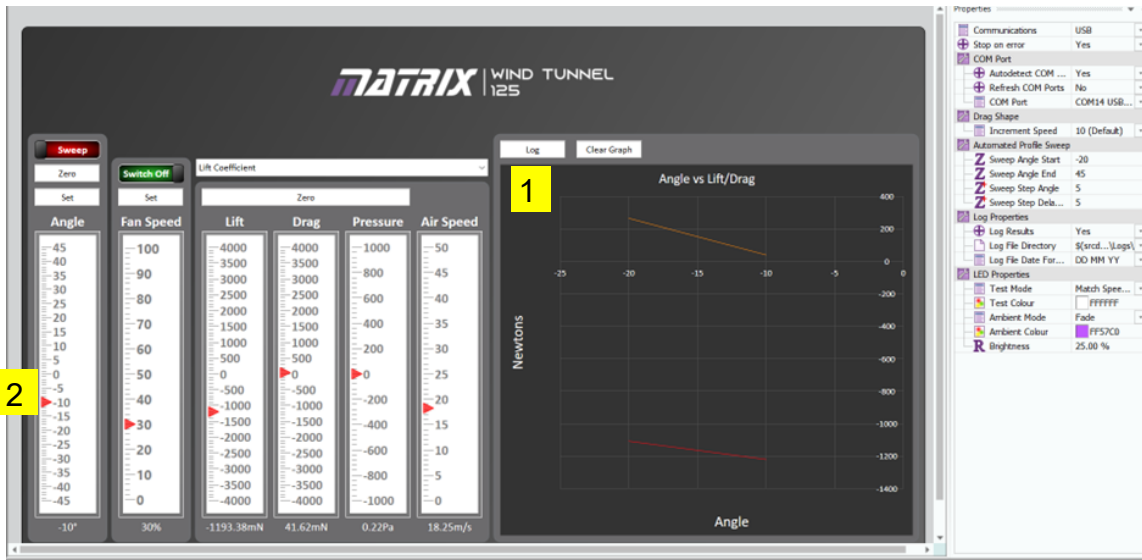
Set the speed on the fan speed slider or set button as before, in this example its at 30% (4)

Switch fan on and move aerofoil to -20deg angle of attack (5)

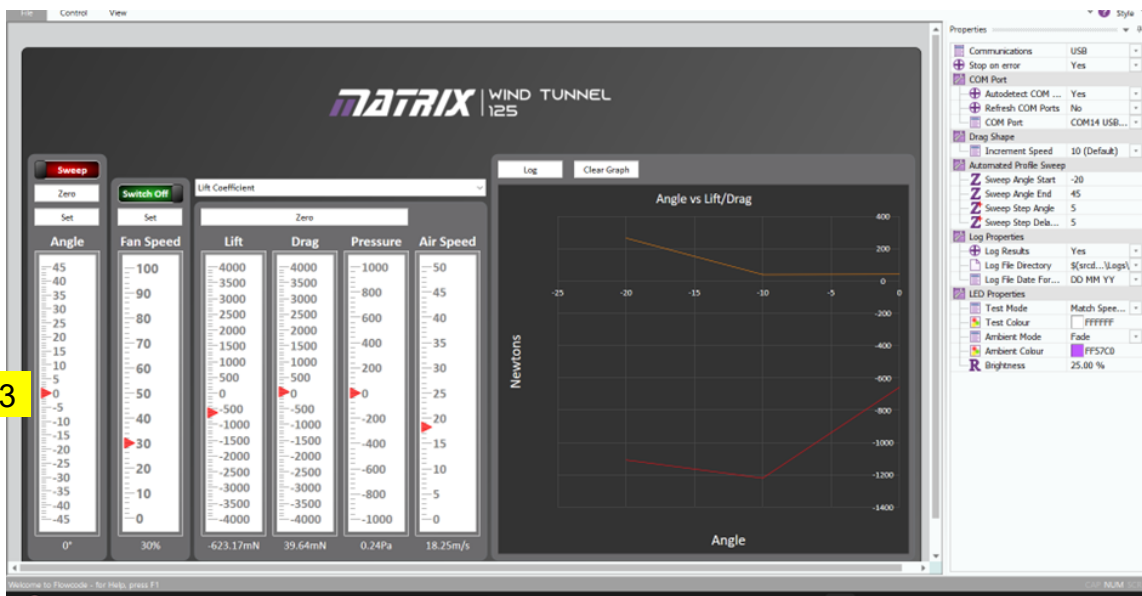


# How to use wind tunnel software

1. Click log to record data
2. Click -10deg for angle of attack and then click log (1)



3. Click 0deg of angle of attack, then click log  
This is a manual sweep of the angle of attacks at one test section wind speed.



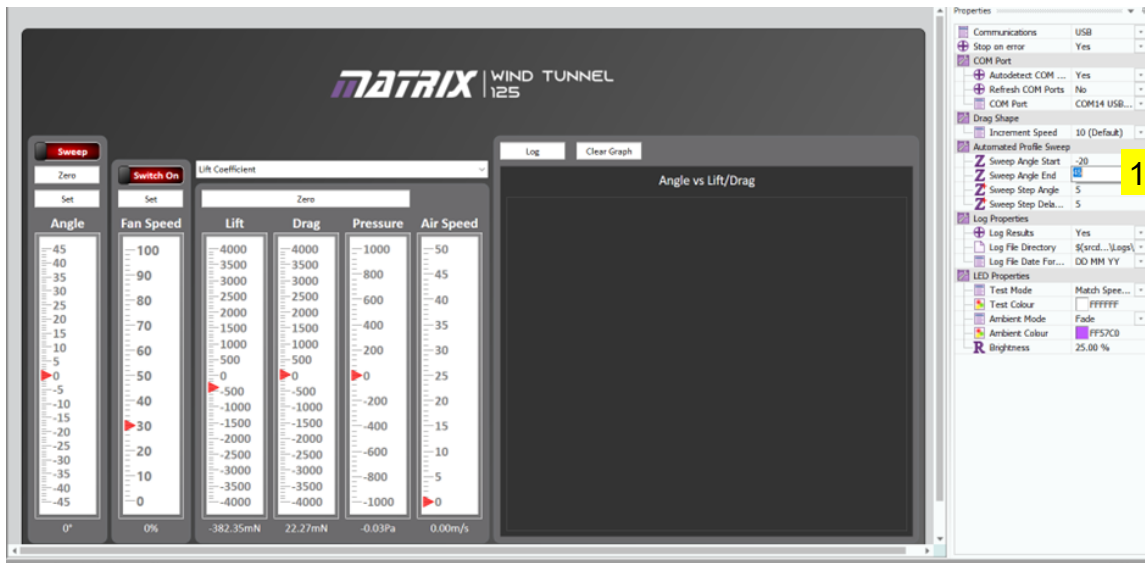
# How to use wind tunnel software

Automatic sweeps

Setting up an automatic sweep is done in the right hand properties.

Sweep angle start, sweep angle end, sweep step angle and sweep step delay, can be altered and inputted by clicking into the box.

This experiment is set at -20 to 45 deg angle of attack, with 5 deg steps every 5 secs. (1)



3. Switch fan on at desired experiment speed.

4. Click sweep, and wait for experiment to finish



(this is a course example of an experiment, not representative of data from worksheets)



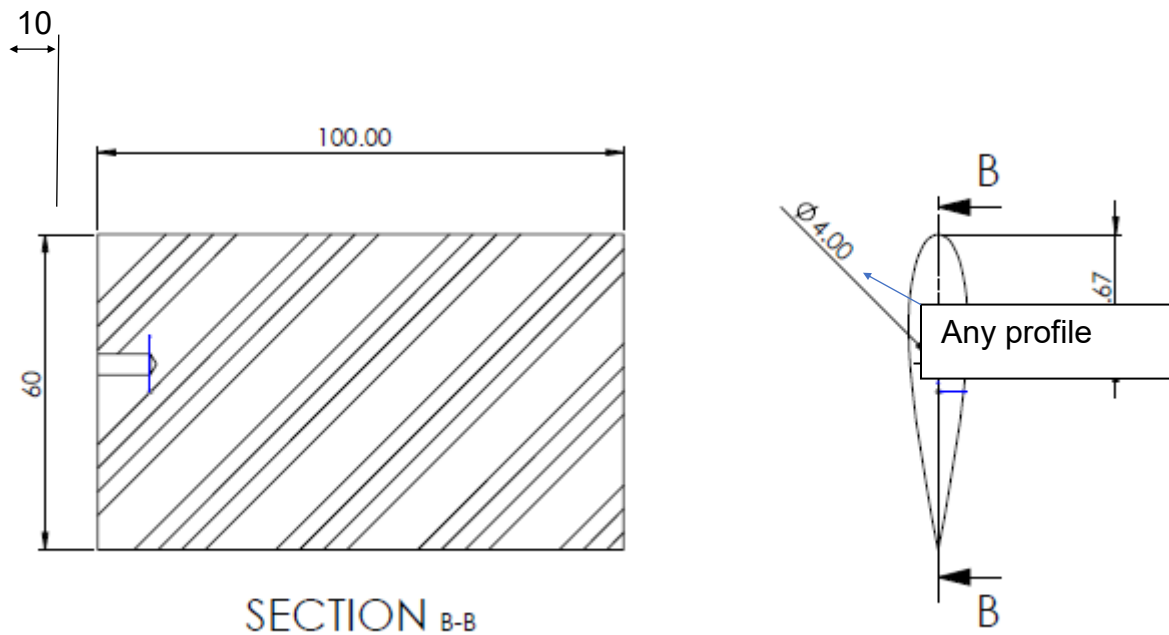
# How to make an aerofoil



## Step 1.

3D model a new aerofoil, this can be done in any 3D CAD software.

Please follow the following guide line dimensions (mm) to make sure the aerofoil is compatible.



<https://aerotoobox.com/naca-4-series-airfoil-generator/>

new NACA profile codes and shapes can be generated on a website like above.

# How to make an aerofoil

## Step 2.

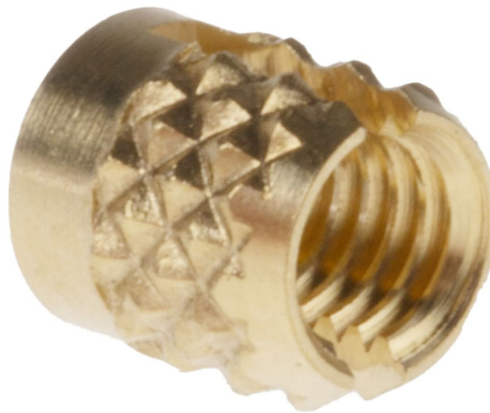
Create STL file of the 3D CAD model.  
Insert this into your 3D slicer software, for example CURA

Print model to desired quantity and quality.

## Step 3.

Insert a M3 threaded insert into the 4mm hole on side of the profile, to allow compatibility.

This can be done by melting the insert into the 3Dprint with a soldering iron gently.



Purchase a non-flanged m3 threaded insert.

If you want to change the type of insert, it has to be maintained M3, but type can be altered.  
Therefore make corresponding changes to the change 3D CAD model.