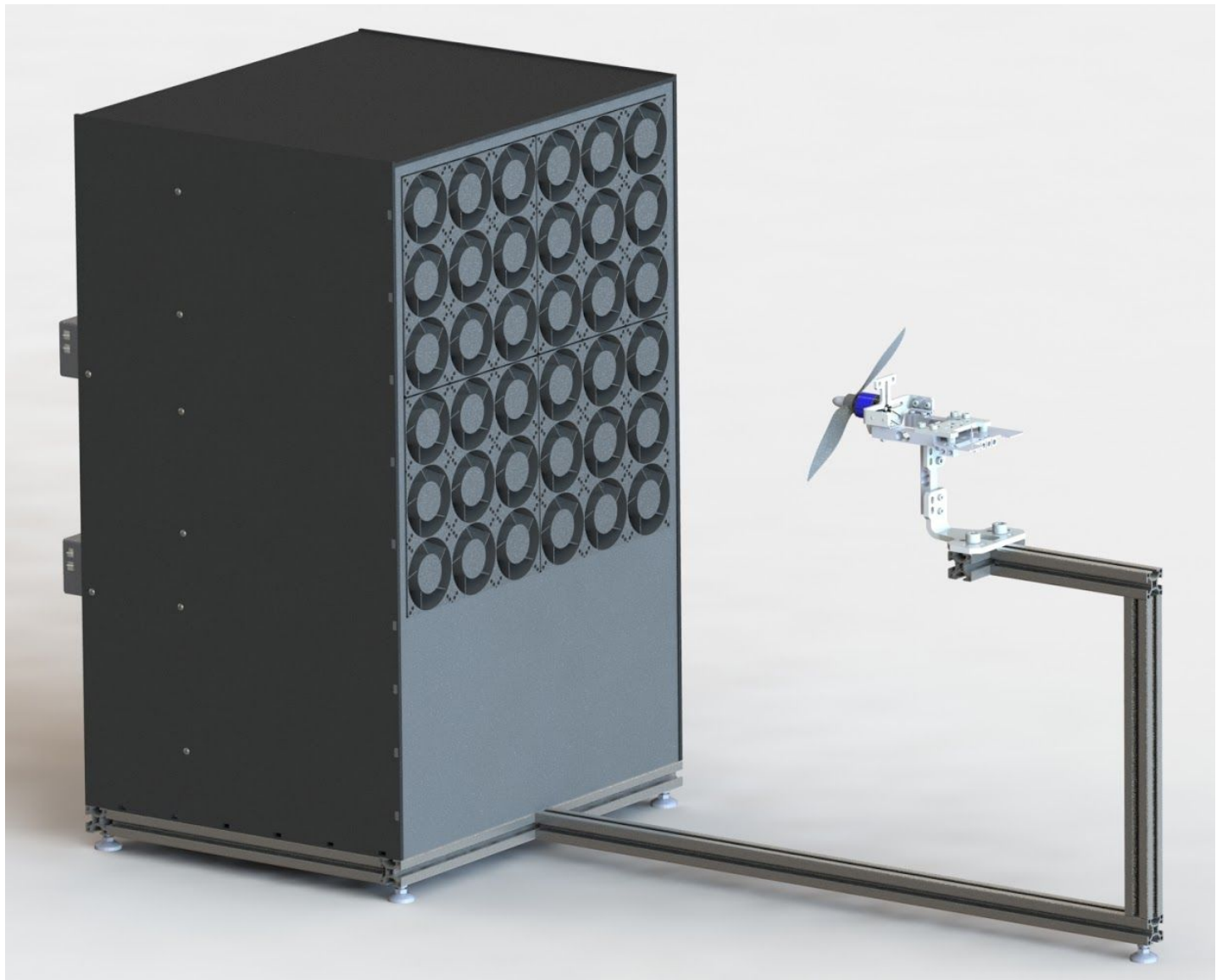


# Educational Wind Tunnel & Test Stand Datasheet



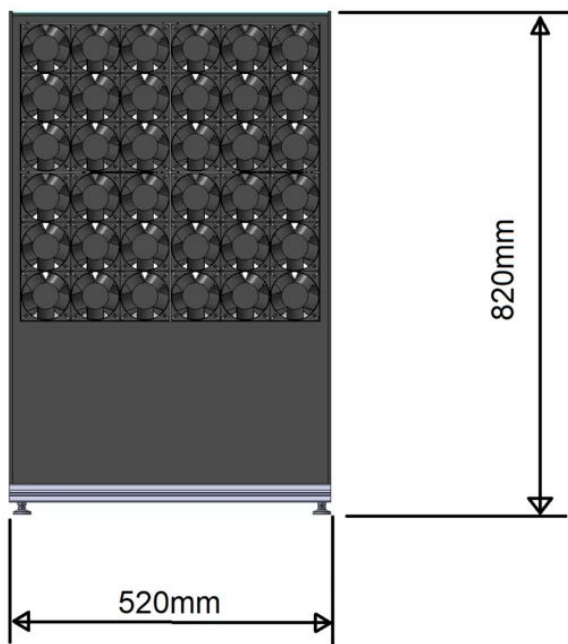
## Introduction

This educational testing set-up is designed to study the effects of different wind profiles on motors, propellers, ESCs and batteries. The kit includes an Educational Wind Tunnel and a Series 1585 Test Stand.

## Description

The **Educational Wind Tunnel** from Windshape is a 50x50cm open wind tunnel (figure 1). The wind generator is composed of 4 modules, each with 9 wind pixel fan units. Each wind pixel is equipped with 2 counter-rotating fans that can generate a flow speed up to 16 m/s. The wind tunnel is managed with the WindControl software that allows you to fully and precisely control wind settings with simple commands. You can manually select the wind pixels that you wish to activate or you can input a mathematical function to reproduce any steady or time-variable wind profile. You can also control your wind tunnel directly from a Python script using WindShape's Python 3.x control API.

The **Series 1585 Test Stand** measures thrust, torque, RPM, current and voltage (figure 2). System efficiency values are automatically calculated after the test is complete and additional sensors can be added to measure temperature and airspeed. The stand is controlled with the RCbenchmark software that allows you to control your ECS's throttle directly from the GUI and view your recorded data live. Once the data is recorded, it is easily exported to a .CSV file. Your tests will allow you to collect important information about propeller and motor efficiency as well as consumed power. The GUI features an easy to use scripting tab where you can use a pre-written script to automate your tests or write your own automated test scripts.



**Fig 1.** Educational Wind Tunnel Front View



**Fig 2.** Series 1585 Test Stand

## Technical specifications

**Table 2:** Design specifications of the Educational Wind Tunnel

<b>Fan module specifications</b>	Value	Unit
Number of pixels per module	9	(n/a)
Number of fans per wind pixel	2	(n/a)
Total number of fans per module	18	(n/a)
<b>Fan array design parameters</b>	Value	Unit
Number of modules along x-axis	2	(n/a)
Number of modules along y-axis	2	(n/a)
Number of modules	4	(n/a)
Width of the fan array	0.49	(m)
Height of the fan array	0.49	(m)
Surface of the fan array	0.24	(m <sup>2</sup> )
<b>Flow specifications</b>	Value	Unit
Minimum flow speed (without flow manipulator)	2	(m/s)
Maximum flow speed (without flow manipulator)	16	(m/s)
Maximum flow rate	3.8	(m <sup>3</sup> /s)
Ramp-up flow acceleration (hot wire at 1m from the fans)	4.0	(m/s <sup>2</sup> )
Ramp-down flow deceleration (hot wire at 1m from the fans)	3.6	(m/s <sup>2</sup> )
<b>Electrical specifications</b>	Value	Unit
Power consumption at max load and max pressure drop	5.0	(kW)
Power consumption at max load and zero pressure drop	3.9	(kW)
Power factor (higher than)	0.9	(n/a)
Input voltage (3P + N + GND)	230/400	(V)
Line current rating (per phase) <i>i</i> phase	7.2	(A)

**Recommended wall receptacles:**

- 1x CEE32 (3P + N + GND) for 0A < *i*phase < 32A
- 1x CEE63 (3P + N + GND) for 32A < *i*phase < 63A
- 1x CEE125 (3P + N + GND) for 63A < *i*phase < 125A
- N x CEE125 (3P + N + GND) for 125A < *i*phase

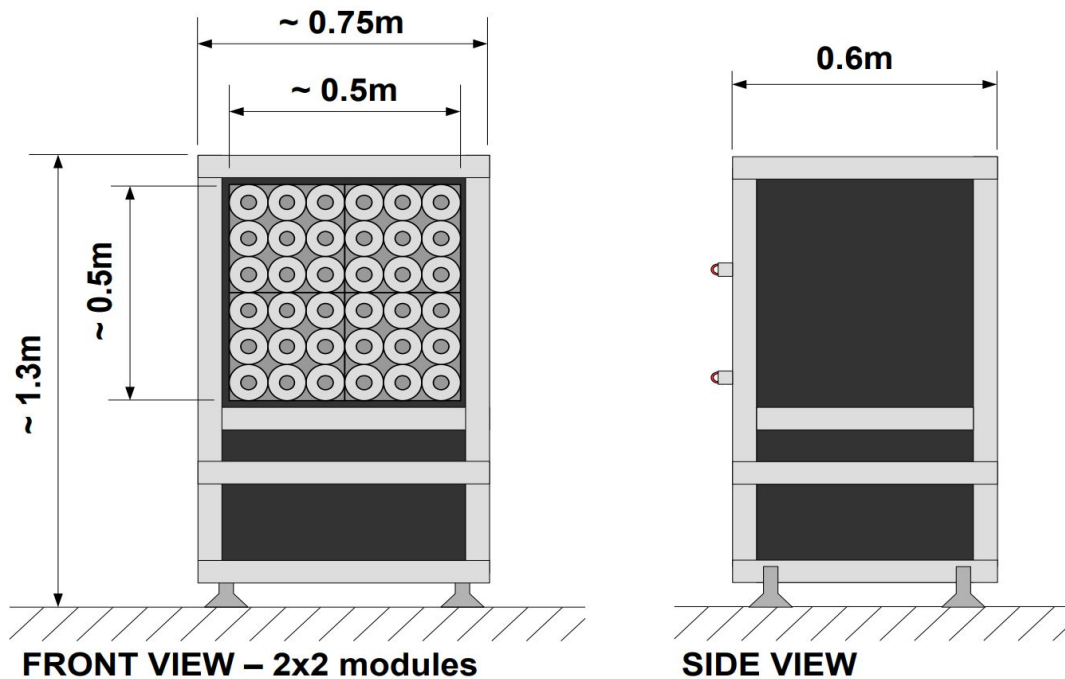
**Table 1:** Design specifications of the Series 1585 Test Stand

Test stand Specification	Min.	Max.	Tolerance	Unit
Thrust	-5	5	0.5%±0.001	kgf
Torque	-1.5	1.5	0.5%±0.001	Nm
Voltage	0	50	0.5%	V
Current	0	55	1%	A
Burst Current	0	60		A
Angular speed*	0	190k	1	eRPM
Coil resistance	0.003	240	0.5%	Ohm
Digital scale	0	3	0.5%	kgf

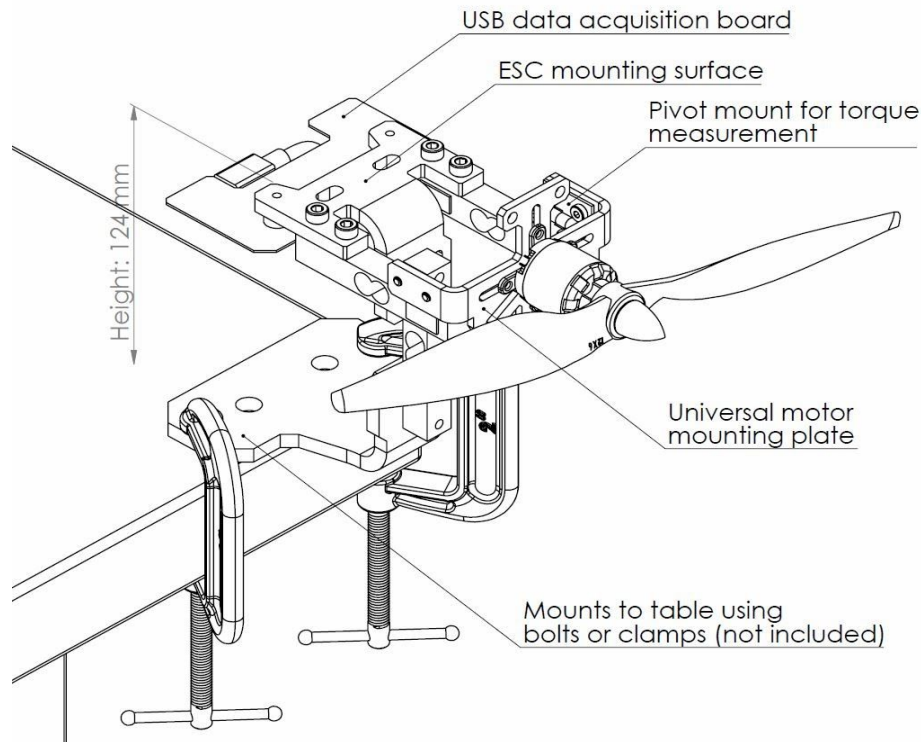
\*Electrical RPM, divide by the number of motor poles to obtain true mechanical RPM.

### Hardware

The Educational Wind Shape Tunnel is designed to provide the full wind tunnel experience while fitting in smaller labs and test facilities. Figure 3 shows the wind generator’s dimensions and module layout. The accompanying RCbenchmark test stand is designed to greatly reduce the time required for characterizing and testing brushless motors and propellers, while providing precise and accurate data. Figure 4 shows an overview of the important hardware components of the test stand.



**Fig. 3:** Wind tunnel hardware overview



**Fig. 4:** Series 1585 hardware overview

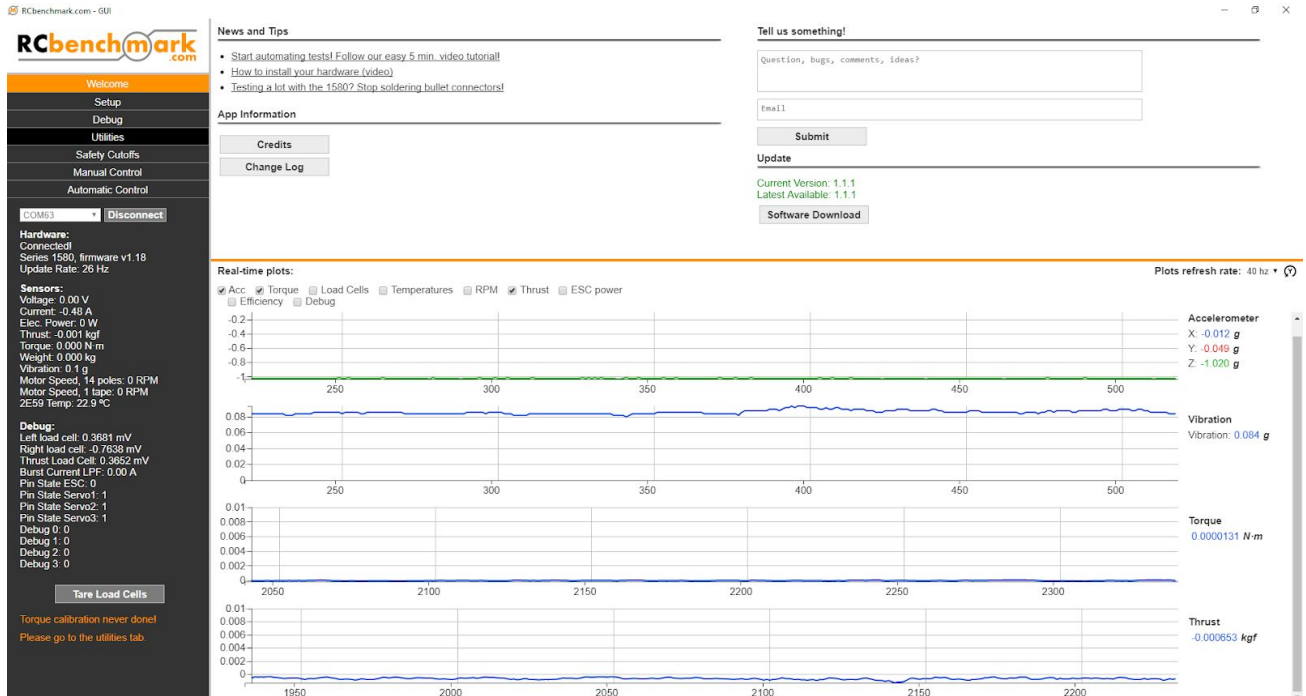
## Software features

RCbenchmark test stand GUI (figure 5):

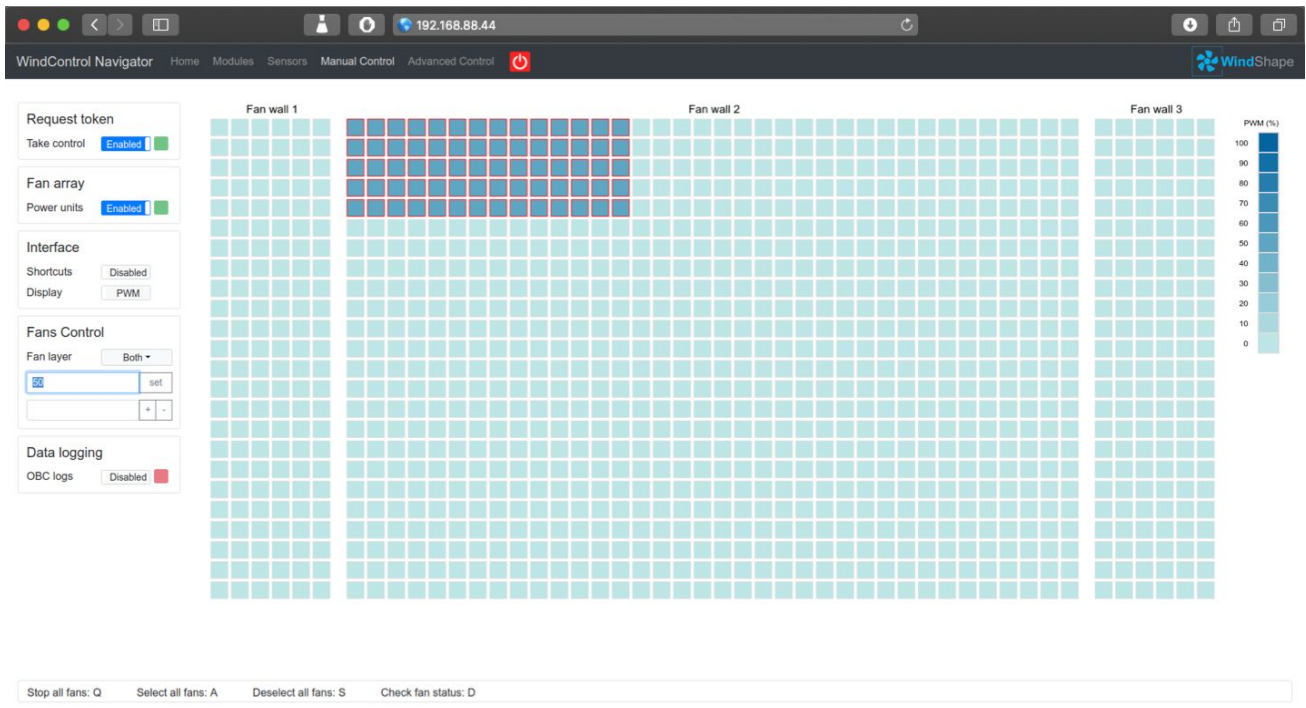
- Real time graphs
- Manual motor control
- Manual servo control (three channels)
- Calibration wizard
- Safety cutoffs based on any measured data
- CSV export
- Firmware update
- Automated test
  - Ramps
  - Steps
  - Measure Kv
  - Measure number of poles
  - And more...
- User scripts with documentation

WindControl wind tunnel GUI (figure 6):

- Dynamic control of the wind profile  $u = f(x, y, t)$
- Smallest possible time step with dynamic control: 0.1s
- Ready swirl control for each wind pixel
- Improved WindControl Version 2.2 software
- Cross-platform portability (operating system)
- Network communication between user and wind tunnel through Ethernet connexion
- Custom scripting interface using Python 3.x API
- Web-based graphical user interface



**Fig. 5: RCbenchmark GUI**



**Fig. 6: WindControl GUI**