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## 2 x 2 Windshaper Datasheet

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## Introduction

The 2 x 2 Windshaper allows the user to produce custom wind profiles in order to study their effects on propulsion systems, drones and aircraft profiles. The user has full control over the 3D wind profile, allowing for dynamic testing with wind flows up to 16 m/s.

## Description

The 2 x 2 Windshaper is a 50 x 50 cm open air wind tunnel. 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 generate a flow speed up to 16 m/s.

The wind tunnel is managed with the WindControl software that allows you to precisely control wind settings with simple commands. 3D dynamic wind profiles are created either manually or with the custom scripting interface that uses a Python 3.x API. Each wind pixel is individually controlled, giving the user maximum control over the shape and speed of the wind profile.



**Fig 1.** 2 x 2 Windshaper rear view

## Applications

- Study performance with diverse wind profiles
- Dynamic / endurance testing
- Characterize wind / surface interactions
- UAV propulsion system testing
- Conventional aerodynamic study

## Technical Specifications

**Table 1: Design Specifications of the 2 x 2 Windshaper**

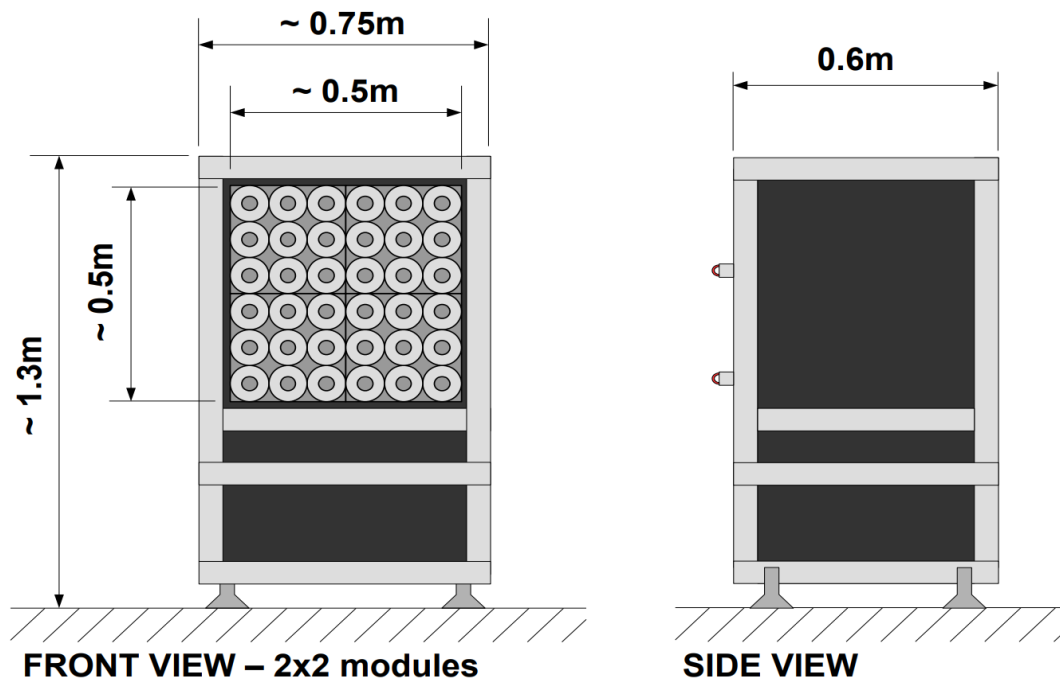
<b>Fan module specifications</b>	Value	Unit
Number of pixels per module	9	(n/a)
Number of fans per wind pixel	2	(n/a)
Total number of fans per module	18	(n/a)
<b>Fan array design parameters</b>	Value	Unit
Number of modules along x-axis	2	(n/a)
Number of modules along y-axis	2	(n/a)
Number of modules	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)

## Hardware

The 2 x 2 Windshaper is designed to provide the full open air wind tunnel experience while fitting in smaller labs and test facilities. The system comes with four modules of nine fans each, a power and control unit with ethernet interface, the structural and fastening elements and the power distribution box and cables. Figure 2 shows the Windshaper's dimensions and module layout.

### 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  $63A < i_{phase} < 125A$
- Nx CEE125 (3P + N + GND) for  $125A < i_{phase}$

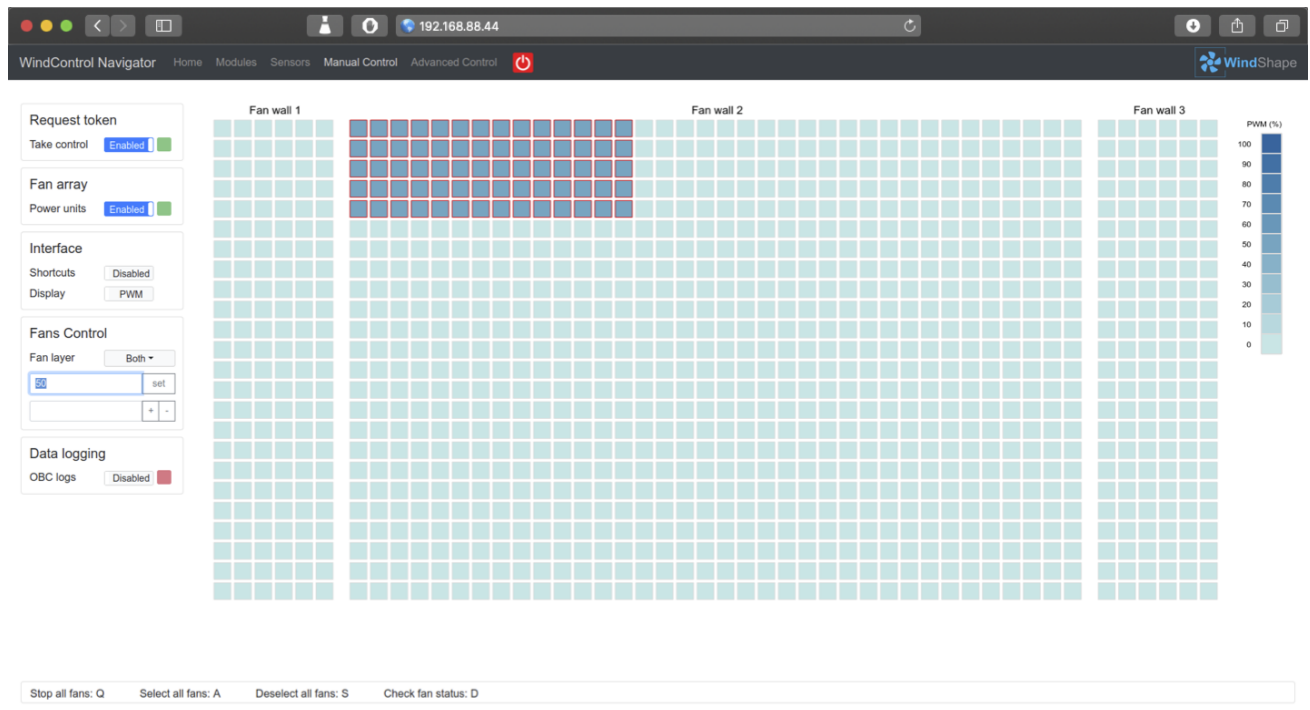


**Fig. 2:** Windshaper hardware dimensions

## Software

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.

- 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. 3:** WindControl GUI