



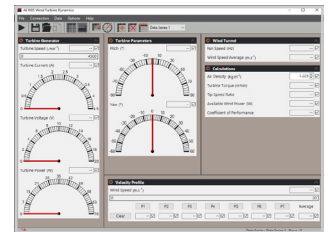
WIND TURBINE DYNAMICS



This is a versatile, compact apparatus for teaching the fundamentals of kinetic wind energy conversion into electrical power. Flexibility is at the core, it has a castor-mounted frame for mobility and functionality and allows students to 3D-print their own blades for advanced experimentation.



LAPTOP NOT INCLUDED



SCREENSHOT OF THE VDAS® SOFTWARE

KEY FEATURES

- 62 W turbine with calculated torque and power output
- Compatible with custom-designed 3D-printed blades
- Motorised blade pitch control
- Yaw control
- Integrated safety guards with solenoid interlock
- Automatic over speed, over current and thermal limit shutdown
- Castor-mounted and removable silencer for easy mobility and storage
- Uninterrupted Ø400 mm tunnel with a Ø300 mm turbine
- Standalone operation (no PC required)
- Flow settling on the inlet
- Viewing from both sides of the tunnel for groups
- Ergonomic front panel design
- Includes TecEquipment's Versatile Data Acquisition System (VDAS® Onboard) for data acquisition via USB
- Covid-19 mitigation: compatible with TecEquipment's e-lab remote learning software



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DESCRIPTION

The wind tunnel that the turbine is mounted in has a bell mouth and honeycomb for flow settling on the inlet. Speed is measured by an anemometer that is stowed away when not in operation so the flow is not disturbed. The turbine can be viewed from both sides of the tunnel through a transparent window and a sliding door with an interlock. The turbine features motorised blade pitching and digital read-back so down time during experiments is reduced.

Attached to the base of the turbine is the yawing mechanism and the setting handle. The turbine is compatible with custom-designed 3D-printed blades built upon the hub CAD file provided by TecQuipment. A removable silencer is attached to the rear of the wind tunnel to reduce noise pollution. The silencer can be stowed beneath the apparatus to reduce space when it is stored.

The built-in safety features include an interlock on the door so that it can't be opened while the turbine is turning and a smart shut down system that turns off the wind tunnel fan in the event that over current or over speed is detected.

The control box has two screens for standalone operation and a VDAS® output for connecting to an optional PC via USB. Controls for the operation of the product are on the top panel for:

- Door open (Interlock release)
- On/off buttons
- Wind speed
- Turbine speed
- Turbine pitch

STANDARD FEATURES

- Supplied with user guide
- Five-year warranty
- Made in accordance with the latest European Union directives
- ISO9001 certified manufacturer
- VDAS® software

LEARNING OUTCOMES

Comprehensive demonstration and investigation into the foundations of wind turbine energy conversion including:

- The relationship between turbine speed and wind velocity (TSR)
- Effect of blade pitch on turbine performance
- Effect of yaw angle on turbine performance
- Blade performance characteristics of different profiled blades
- Blade design theory

OPERATING CONDITIONS

OPERATING ENVIRONMENT:

Laboratory

STORAGE TEMPERATURE RANGE:

-25°C to +55°C (when packed for transport)

OPERATING TEMPERATURE RANGE:

+5°C to +40°C

OPERATING RELATIVE HUMIDITY RANGE:

80% at temperatures < 31°C decreasing linearly to 50% at 40°C



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DETAILED SPECIFICATIONS

TecQuipment is committed to a programme of continuous improvement; hence we reserve the right to alter the design and product specification without prior notice.

DIMENSIONS AND WEIGHT:

- 1530 mm (height), 1700 mm (width), 800 mm (depth), 195 kg (weight)

STORAGE DIMENSIONS

- 1530 mm (height) , 1300mm (width) x 800mm (depth)

SERVICES RECOMMENDED:

- Suitable computer (not supplied)

ELECTRICAL SUPPLY (SPECIFIED ON ORDER):

- 1 Phase, 220-240 VAC, 50/60 Hz, 20 A

OR

- 2 Phase, 220 - 240 VAC, 50/60 Hz, 20 A

TURBINE:

- Turbine Ø: 300 mm
- Turbine power: 62 W
- Turbine voltage: 17 V
- Turbine rated current: 4.13 A
- Number of blades: 3
- Blade pitch adjustment: -5° to 40°
- Live pitch adjustment: Yes
- Overspeed protection: Drive regulated
- Generated power management: Shunt regulated
- Max turbine speed: 4000 rpm
- Yaw adjustment: $\pm 50^{\circ}$
- Live yaw adjustment: Yes
- Turbine min speed: 100 rpm

WIND TUNNEL:

- Tunnel Ø: 400 mm
- Max flow rate: $6900 \text{ m}^3 \cdot \text{h}^{-1}$
- Wind speed: $1-15 \text{ m} \cdot \text{s}^{-1}$
- Fan power: 1.5 kW

SPACE REQUIRED:

- Solid, level floor: allow at least 2 m of free space around the inlet and 3 m at the outlet

ITEMS INCLUDED:

- Two sets of turbine blades
- User guide
- Software (VDAS®) free download from TecQuipment's website
- PZ1 Screwdriver and 3 mm Allen key

OPTIONAL COMPUTER (NOT SUPPLIED):

See the VDAS® datasheet for the computer specification

DATA ACQUISITION EXPORT FILE FORMAT:

- Comma Separated Values (CSV)

