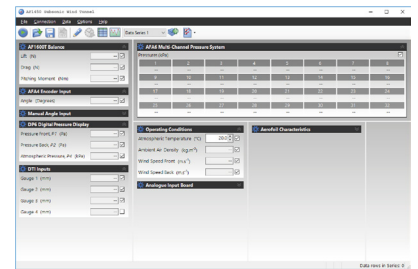




VDAS® AFI450S

SUBSONIC WIND TUNNEL 450 MM

An open circuit suction subsonic wind tunnel with a working section of 450 mm by 450 mm and 1000 mm long. All instrumentation required to begin experimentation is included.



SCREENSHOT OF THE VDAS® SOFTWARE

KEY FEATURES

- A cost effective solution when compared to full-scale wind tunnels or airborne laboratories
- Operates at meaningful Reynolds numbers
- Safe, open-circuit suction design
- Package includes an aerofoil with tappings, a three-component balance, angle feedback, dual differential pressure display, a 32-Way pressure display unit, 2 x Pitot static traverse, protractor, model holder and data acquisition (VDAS-F)
- High levels of safety
- Controls and instrumentation conveniently mount on a separate, free-standing frame



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DESCRIPTION

Air passes into the wind tunnel through a honeycomb flow straightener and a grille. It then passes into an aerodynamically designed effuser (cone) that accelerates the air in a linear manner before it moves through the working section. Finally it passes through a diffuser, then into the variable speed axial fan. The grille protects the fan from damage by loose objects. The air leaves the fan, passes through a silencer unit and then back out to atmosphere.

The speed of the axial fan (and therefore the air velocity in the working section) is controlled by an electronic drive control in the separate On/Off unit mounted on the tunnel's associated instrument frame along with other ancillaries.

WORKING SECTION

The working section is of a square section with an acrylic roof and floor. The sides are full length acrylic panels and can be removed. The whole unit is supported in an aluminium framework. Each side panel has a holder to support wind tunnel models. On the top of the working section are two Pitot devices and a wall tapping to measure the static pressure upstream and downstream of the working section.

INCLUDED WITH THE WIND TUNNEL:

- **THREE-COMPONENT BALANCE (AF1450T)**

The Three-Component Balance measures lift, drag and pitching moment exerted on the model.

- **BALANCE ANGLE FEEDBACK UNIT (AFA4)**

(Included with AF1450T). Measures the angular position of models mounted on the balance in the wind tunnel.

- **NACA 0012 AEROFOIL WITH TAPPINGS (AF1450B)**

A 150 mm chord 450 mm span NACA0012 aerofoil with pressure tappings.

- **DUAL DIFFERENTIAL PRESSURE DISPLAY (DP6)**

Measures and displays pressures with respect to the atmosphere or differential pressures.

- **32-WAY PRESSURE DISPLAY UNIT (AFA6)**

Measures and displays up to 32 different pressures from models, Pitot-static tubes and other measuring instruments fitted to the wind tunnel.

- **PITOT STATIC TRAVERSE X2 (AF1450X)**

Two traversing Pitot-static tube with electronic position measurement for use with TecQuipment's Subsonic Wind Tunnels.

- **PROTRACTOR**

For assisting with setting up models and rotating them during experiments.

- **MODEL HOLDER**

To hold models when the three component balance is not used. Also for use with the user's own models.

- **VERSATILE DATA ACQUISITION SYSTEM (VDAS-F)**

A frame mounting versatile data acquisition system (VDAS®) to allow computer-based data capture.

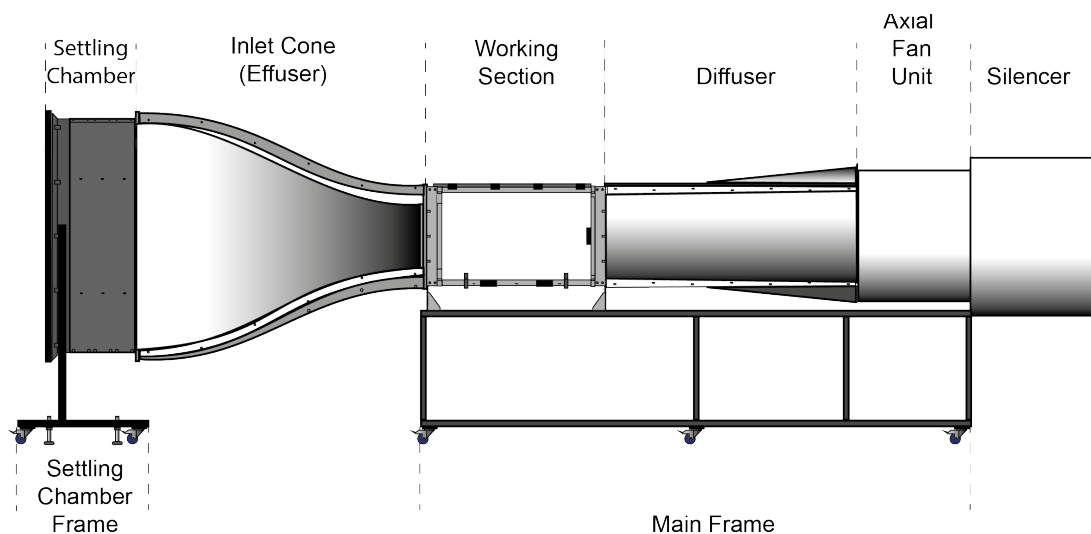
OPTIONAL EXTRAS INCLUDE:

- **MULTITUBE MANOMETER (AFAI)**

A tilting 36-tube manometer

- **SMOKE GENERATOR (AFAII)**

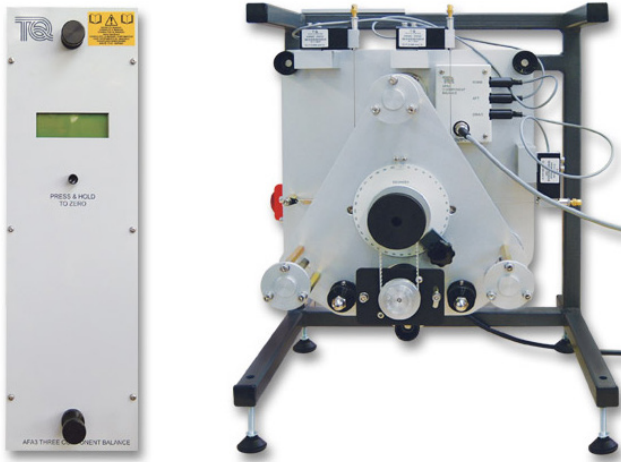
To assist with visualising air flow



SUBSONIC WIND TUNNEL 450 MM

INCLUDED ANCILLARIES DETAILS

THREE-COMPONENT BALANCE (AF1450T)



The Three-Component Balance fits onto the working section of TecEquipment's Subsonic Wind Tunnel (AF1450).

The Three-Component Balance provides an easy-to-use support system for wind tunnel models. It measures lift, drag and pitching moment exerted on the model.

The balance comprises a mounting plate secured to the wind tunnel working section. A triangular force plate is held on the mounting plate by a mechanism that constrains it to move in a plane parallel to the mounting plate only, while leaving it free to rotate about a horizontal axis. This arrangement provides the necessary three degrees of freedom.

Models for use with the balance are available from TecEquipment. Other models used with the equipment will need a mounting stem. The forces acting on the model are transmitted by cables to three strain gauged load cells. The output from each load cell is taken via an amplifier to a microprocessor-controlled display module. The display module mounts onto the wind tunnel control and instrumentation frame and includes a digital display to show the lift, drag and pitching moment directly.

The equipment is fully compatible with TecEquipment's Versatile Data Acquisition System (VDAS®) and can quickly and conveniently connect to the frame-mounted interface unit (VDAS-F).

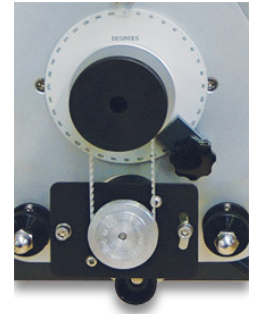
The model support of the balance can be rotated by 360 degrees. This allows adjustment of the angle of incidence of the model to the direction of air flow. The model support is locked in the required position by a simple clamp after adjustment.

BALANCE ANGLE FEEDBACK UNIT (AFA4)

The Balance Angle Feedback Unit is for use with the Three-Component Balance (see above) to measure the angular position of models mounted on the balance in the wind tunnel.

The Angle Feedback Unit mounts on the Three-Component Balance attached to the wind tunnel.

It then transmits the rotational angle of the model to (VDAS®). The angle of the model is logged on a suitable computer along with the other captured experimental data. The Feedback Unit is supplied fitted to the Three-Component Balance.



NACA 0012 AEROFOIL WITH TAPPINGS (AF1450B)

The aerofoil has 20 static pressure tapping along its chord on the upper and lower surfaces. They each connect to tubes that pass through the aerofoil

and then out to clear, numbered, flexible tubes. Students can connect the tubes to the 32-Way Pressure Display Unit. They can then measure the pressure distribution around the aerofoil, from which they can find the lift.

Using a Pitot tube (two included), students can traverse the aerofoil wake to find the downstream pressure distribution and find the drag on the aerofoil.

Students can compare these values of lift and drag with direct measurements found from the balance. They can also compare them with the results from another aerofoil with the same profile, such as the AF1450D (not included). Varying the angle of attack of the aerofoil with respect to the air stream allows students to find the changes to the pressure distribution. It also allows investigations into the critical conditions at stall.

TecEquipment's Smoke Generator AFA11, (not included) increases the educational value of the experiments by showing the flow of air around the model.



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DUAL DIFFERENTIAL PRESSURE DISPLAY (DP6)

The Dual Differential Pressure Display measures and displays pressures in Pitot-static tubes and other pressure-sensing devices fitted to the wind tunnel, with respect to the atmosphere or differential pressures.

It is microprocessor-controlled and contains calibrated pressure transducers. The unit has an integral liquid crystal display that allows the user to read pressures directly. The signals of the pressure sensors may be output to TecQuipment's Versatile Data Acquisition System (VDAS-F, included).

When the Differential Pressure Transducer is used with VDAS® it provides a significant advantage over conventional instruments such as manometers. Many readings can be taken and the user may use a suitable spreadsheet software package to obtain a more accurate overview of pressure distributions.

32-WAY PRESSURE DISPLAY UNIT (AFA6)

The 32-Way Pressure Display Unit measures and displays up to 32 different pressures from models, Pitot-static tubes and other measuring instruments fitted to a wind tunnel. It is ideally suited in applications where multiple pressure measurements are required, for example in boundary layer and tapped aerofoil model investigations.

The unit mounts onto the control and instrumentation frame of the AF1450 wind tunnel. The microprocessor-controlled unit contains 32 calibrated pressure transducers. Input connection to each of the pressure transducers is via quick-release pressure inputs mounted on the front panel of the unit. This allows easy and quick connection between the unit and an experiment mounted in a wind tunnel. All pressures are measured with respect to atmosphere. The unit has an integral liquid crystal display with a scroll switch that allows all 32 channels to be viewed in groups of four at any time.

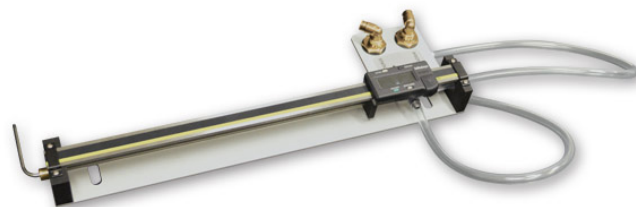
The conditioned outputs of the pressure sensors may be output to TecQuipment's Versatile Data Acquisition System (VDAS®).

When the 32-Way Pressure Display Unit is used with the system it allows laboratory time to be used more efficiently because data can be captured and processed much more quickly than when using manual techniques. The facility in the software to average data to remove the fluctuations



inherent in wind tunnel measurements, enhances the quality of the results by making their interpretation much easier. This option provides significant experimental advantages over conventional instruments such as manometers.

2X PITOT STATIC TRAVERSE (AF1450X)



Two Pitot-static tubes that mount in the working section of the wind tunnel, either upstream of the position of the test model or on the fore-aft traverse. This allows students to do 'wake' traverses, of a model. The vertical position of the tube, which is adjustable, is displayed on a digital indicator.

The digital indicator position can be set to zero in any position. This allows the datum or starting point of an experiment to be defined by the user.

To display differential pressure, each Pitot-static tube connects to the Tilting Multi-Tube Manometer (AFA1) (supplied as an optional extra).

Alternatively, pressures can be measured using one or more of the following (supplied) instruments:

- Differential Pressure Unit (DP6)
- 32-Way Pressure Display Unit (AFA6)

The position of the Pitot-static Traverse may be output to VDAS® to allow computer-based data acquisition and display.

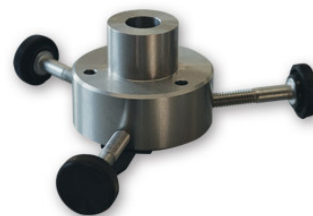
PROTRACTOR

The Protractor fits on to the shaft of a model when the Three Component Balance is not being used. It can be used when setting up models and rotating them during experiments.



MODEL HOLDER

The Model holder is supplied to hold a model if the Three Component Balance is not used. It is designed to hold a shaft of diameter 11.95 ± 0.015 mm (diameter) and 215 ± 1.25 mm (length) mounting stem.



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VERSATILE DATA ACQUISITION SYSTEM (VDAS-F)

TecEquipment's modern, cost-effective and accurate Versatile Data Acquisition System (VDAS®) improves laboratory teaching. It works with a growing list of over 50 TecEquipment products, enabling real-time display and capture of experiment data.

For both individual student use or for lecturers demonstrating experiments to a whole class, VDAS® gives real-time calculation, recording and charting with fast data export. This makes efficient, productive and effective use of time for both students and lecturers.

The digital inputs on the interface connect directly to the instrumentation on suitable TecEquipment products. These inputs are non-specific, for easy experiment setup and reduced connection errors. The mostly digital communications circuits make the equipment more resistant to electrical noise than purely analogue systems.

The interface units also have two analogue inputs. These are for fast-moving (transient) signals from some TecEquipment products or for transducers and sensors. These may include displacement or pressure measuring sensors and flow meters. VDAS® can display the analogue signals in real-time as traces on a computer screen. This allows VDAS® to work as a user-friendly alternative to an oscilloscope on selected products.

The output from the interface unit connects to a computer (not supplied) running the VDAS® software. The software has extra features that allow the addition of derivative traces and reference traces, based on each of the two analogue input signals. It is possible to adjust software filtering and smoothing of each signal trace, and scale the traces to best fit the trace area.

The software is intuitive and easy to use, with clear and convenient data display options. The software looks similar and works in a similar way for each TecEquipment VDAS®- compliant product. This saves time as students do not have to learn to use new software when changing experiments.

VDAS® SOFTWARE FEATURES INCLUDE:

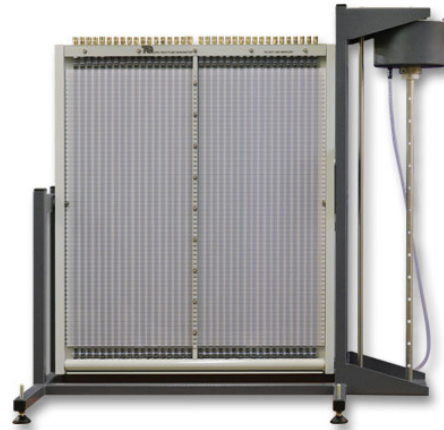
- Recording data manually or automatically
- Data capture set by time or intervals
- Display of real-time data, in digital form or as an analogue meter
- Real-time traces of analogue signals
- Logging data for printing and later analysis
- Exporting data for use by other software



- Performing real-time calculations to generate user-defined data
- Creating and printing charts and data tables
- Customisable layouts

OPTIONAL ANCILLARIES DETAILS

MULTITUBE MANOMETER (AFA1)



A 36-tube tilting manometer for measuring pressure in subsonic wind tunnels, including TecEquipment's AF1450. A backboard with a graduated scale holds each manometer tube.

For safety and convenience the manometer uses water as the manometer fluid. This is via an adjustable reservoir with a fine-adjust handwheel held at the side of the equipment. Water colouring is included to aid visibility.

The top of each manometer tube has a connection piece for tubing to connect to pressure tapings on the equipment being monitored. The whole manometer tube assembly is mounted on a swivel. This allows it to be tilted in preset increments to increase the sensitivity of measurement. Adjustable feet enable the whole apparatus to be precisely levelled before use.

The manometer is supplied with operating instructions, a filling funnel and a spirit level.

SMOKE GENERATOR (AFA11)



The smoke generator and probe is an optional ancillary to allow the observation of airflow in subsonic wind tunnels and other airflow situations.

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LEARNING OUTCOMES

A wide variety of subsonic aerodynamics experiments (some need ancillaries), including:

- Flow past bluff and streamlined bodies with pressure and velocity observations in the wake
- Investigations into boundary layer development
- Influence of aspect ratio on aerofoil performance
- Performance of an aerofoil with flap, influence of flap angle on lift, drag and stall
- Pressure distribution around a cylinder under sub and super-critical flow conditions
- Study of characteristics of models involving basic measurement of lift and drag forces
- Study of the characteristics of three-dimensional aerofoils involving measurements of lift, drag and pitching moment
- Study of the pressure distribution around an aerofoil model to derive the lift, and comparison with direct measurements of lift
- Drag force on a bluff body normal to an air flow
- Flow visualisation

STANDARD FEATURES

- Supplied with comprehensive user guide
- Five-year warranty
- Manufactured in accordance with the latest European Union directives
- An ISO 9001 certified company

INCLUDED ANCILLARIES

- Three-Component Balance (AF1450t)
- Angle Feedback Unit (AF1450u)
- Dual differential Pressure display (DP6)
- 32-Way Pressure display Unit (AFA6)
- Pitot Static Traverse x2 (AF1450x)
- Protractor
- Model Holder
- Versatile Data Acquisition System (VDAS-F)

INCLUDED MODEL

- NACA 0012 Aerofoil with Tappings (AF1450b)

ANCILLARY AND MODEL SPECIFICATIONS

For specifications of included and optional ancillaries and models please see their individual data sheets.

RECOMMENDED ANCILLARIES

- Multi-Tube Manometer (AFA1)
- Smoke Generator (AFA11)

EXPERIMENT MODELS:

- Cylinder Model (AF1450a)
- NACA 2412 Aerofoil with Flap (AF1450c)
- Set of 2 NACA 0012 Aerofoils (AF1450d)
- Flat Plate Drag Model (AF1450e)
- Boundary Layer (AF1450f)
- Aircraft Model – Low Wing (AF1450g)
- Aircraft Model – High Wing (AF1450h)
- Three-Dimensional Drag Models (AF1450j)
- Set of two vehicle drag models (AF1450k) – please enquire for details
- S1210 Aerofoil Model (AF1450l)

OPERATING CONDITIONS

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

SPECIFICATION WIND TUNNEL (AF1450)

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

NETT DIMENSIONS AND WEIGHT (ASSEMBLED):

6800 mm x 1850 mm x 2320 mm height; 900 kg

SPACE NEEDED

Solid, level floor – allow at least 2 m of free space around the inlet and 4 m at the outlet.

WORKING SECTION:

450 mm x 450 mm

RECOMMENDED MINIMUM ROOM SIZE

13 m x 5 m

AIR VELOCITY:

0 to 35 m.s⁻¹

ELECTRICAL SUPPLY (THREE PHASE):

380 VAC to 440 VAC 50 Hz/60 Hz 10 kW