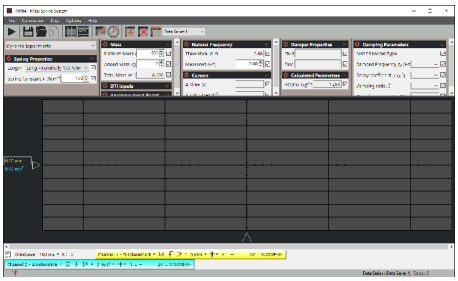
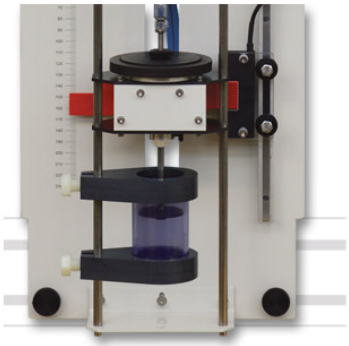
FREE VIBRATIONS OF A MASS-SPRING SYSTEM

VDAS® TM164

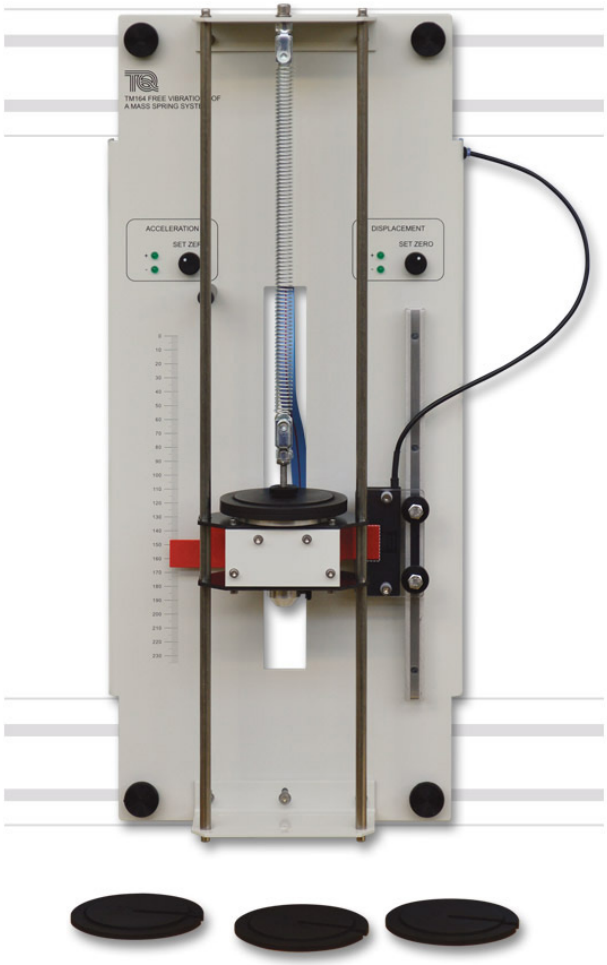
Experiment that uses simple harmonic motion theory to demonstrate how to calculate the frequency of oscillation of simple mass-spring systems; demonstrates Hooke's law. Fits on to the Free Vibrations test frame.



SCREENSHOT OF THE VDAS® SOFTWARE



SHOWN FITTED WITH THE OPTIONAL DAMPER KIT (TM164A)



KEY FEATURES

- One of a series of modular experiments that explore free vibrations in simple systems
- Uses the vertical movement of a mass suspended from a spring for a highly visual and intuitive display of simple harmonic motion
- Quick, safe and easy for students to use, needing minimal laboratory supervision
- Optional Damper Kit (TM164a) for extra experiments in oscillation damping using safe, easily available fluids
- Uses both a non-contacting displacement sensor and inbuilt accelerometer to provide two independent measurements of oscillatory motion with negligible damping effect
- Additional acceleration sensor for comparison with software-derived waveform
- Works with TecQuipment's VDAS® for real-time display of the displacement and acceleration waveforms and their derivatives

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FREE VIBRATIONS OF A MASS-SPRING SYSTEM

VDAS® TM164

DESCRIPTION

This product is part of a range that explores free vibrations in simple 'one degree of freedom' systems.

It introduces students to key scientific terms such as:

- Simple harmonic motion (SHM) and frequency of oscillation
- Spring constant and Hooke's Law
- Oscillation damping
- Phase difference between displacement and its derivatives

This product fits to the sturdy test frame (TM160) for study or demonstration.

The mass-spring system is one of the most easily explainable oscillatory systems. This is because students may already be familiar with Hooke's Law, showing the force exerted by a spring is proportional to the extension. Therefore, students can easily make the link to simple harmonic motion - defined as the oscillatory motion where the restoring force is proportional to the displacement.

A back panel fixes to the test frame. The panel holds two vertical guide rods and a non-contacting displacement sensor. A test spring suspends a balanced mass platform which vibrates (oscillates) vertically in the guide rods.

Students fit additional masses to the platform, and a second spring is provided to test various system combinations.

The displacement sensor measures the vertical oscillations of the platform. An additional sensor (accelerometer) built into the platform measures the acceleration of the platform as it moves up and down. Both sensors measure the motion, yet create negligible damping.

The back panel has a printed scale. Students use it with a cursor on the platform to measure accurately the spring extension, to show Hooke's Law and find the spring constant.

Students pull the platform gently down and release, allowing it to vibrate. They then find the frequency of oscillation and compare it with that predicted from theory.

TecQuipment calibrate the sensors to work with VDAS® (mkII) for real-time display and data acquisition of system oscillation waveforms. Students use the software to see both the displacement and acceleration waveforms to confirm the phase difference between them and measure frequency. The software calculates and shows the first two derivatives of displacement - velocity and acceleration.

Students can then see and compare both the measured and derived acceleration at the same time, to confirm the relationship.

TecQuipment have specifically designed the TM164 to work with VDAS® (mkII). However, the sensor outputs may be connected to your own data acquisition system or oscilloscope if desired.

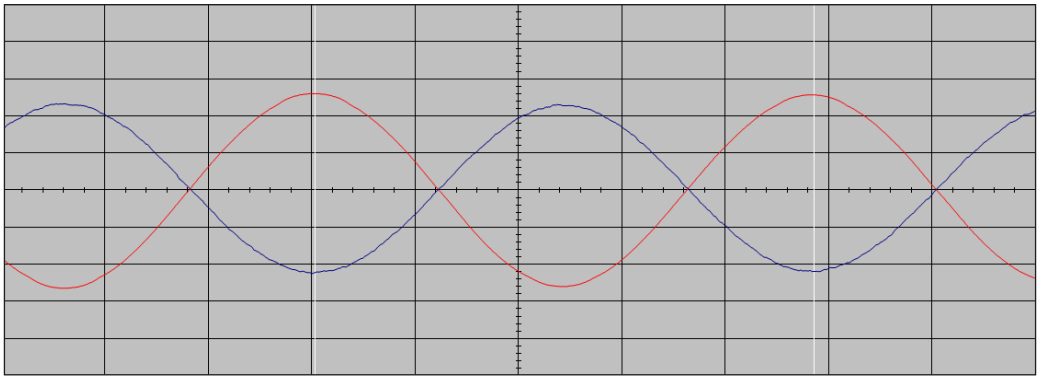
Students may fit an optional Damper Kit (TM164a) to test how viscous damping affects the system oscillations. This simple piston disc and cylinder form a dashpot damper that fits to the guide rods under the platform. It works with easily found non-toxic fluids (not supplied) for different damping levels. For example: water and vegetable oil will produce light damping, while castor oil produces heavy damping. Students may try their own fluids (provided they are safe and do not damage the equipment) and their own piston discs for project work.

When using the Damper Kit, VDAS® can fit its displayed data to underdamped and overdamped viscous damping models.

NOTE: You may purchase any number of damper kits to make the change between the various fluids more convenient.

STANDARD FEATURES

- Supplied with lecturer guide and student guide
- Five-year warranty
- Manufactured in accordance with the latest European Union directives
- ISO9001 certified manufacturer



VDAS® SOFTWARE SHOWING PLOT OF DISPLACEMENT AND ACCELERATION

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FREE VIBRATIONS OF A MASS-SPRING SYSTEM

VDAS® TM164

LEARNING OUTCOMES

- Spring extension and force (spring constant), and Hooke's law
- Frequency of oscillation, spring constant and varying mass
- Phase difference between displacement and its derivatives
- Comparison of measured and derived acceleration
- Oscillation damping and coefficient – needs optional Damper Kit (TM164a)

ESSENTIAL BASE UNIT

- Free Vibrations Test Frame (TM160)

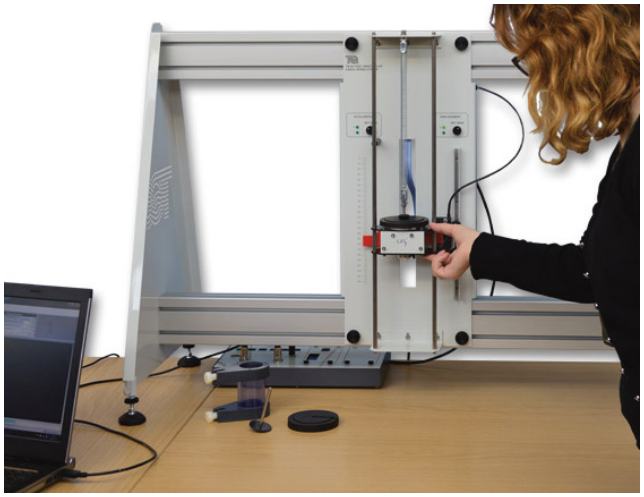
ESSENTIAL ANCILLARY

- Versatile Data Acquisition System – benchtop version VDAS-B (mkII)

NOTE: This equipment needs VDAS® (mkII) and will not work with earlier versions of VDAS®. If unsure, contact TecQuipment or your local agent.

RECOMMENDED ANCILLARY

- Damper Kit (TM164a)



THE TM164 IN USE (OTHER ITEMS NOT INCLUDED)

DEFLEX®

DefleX® is a complimentary tool designed to introduce students to the concept and technique of Digital Image Correlation (DIC). This product is compatible with our DefleX®-2D product that uses one video camera and our DefleX®-3D product that uses two video cameras to track the movement of materials during a dynamic event. They are complete and compact systems for measuring full-field displacements and strains over a material's surface in two and three dimensions, offering students a digital blended learning experience as part of their engineering courses.

To find out more, click here

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

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.

TM164

NETT DIMENSIONS AND WEIGHT:

580 mm high x 260 mm wide x 140 mm front to back and 7 kg

APPROXIMATE PACKED VOLUME AND WEIGHT:

0.07 m^3 and 10 kg

OTHER PARTS INCLUDED:

- 2 x Springs of different constant
- 5 x 200 g masses
- Analogue Leads to connect to VDAS

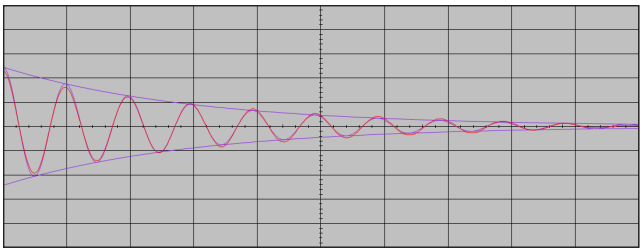
TM164A

NETT DIMENSIONS AND WEIGHT:

90 mm high x 105 mm wide x 70 mm front to back and 0.5 kg

APPROXIMATE PACKED VOLUME AND WEIGHT:

0.002 m^3 and 1 kg



VDAS® SOFTWARE SHOWING PLOT OF DAMPED OSCILLATION

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