



P1901
**TORSIONAL VIBRATION
APPARATUS**

FEATURES

Input/Output transducers facilitate phase and amplitude ratio measurement of angular motions and system behaviour by thermal array recorder or oscilloscope display

Designed for bench mounting

Electronic closed-loop speed control ensures stable frequency of operation

Suitable for classroom demonstrations or individual work by students from technician to graduate level

INTRODUCTION

The Cussons P1901 Torsional Vibration Apparatus, enables lecturers and students to set up a wide range of experiments covering the needs of many courses from technician to graduate level. It is of fundamental importance for the student to have a clear understanding of dynamically induced stresses arising in mechanically resonant systems such as transmission shafts and engine crank shafts, and this apparatus ensures valid and repeatable results. An additional Linear Vibration Apparatus P1906 is available and this extends the range of experiments with the P1901 and can also be used independently as the basis of introductory work on linear vibration study.

GENERAL DESCRIPTION

The basic structure consists of a D section tubular bed of great rigidity which carries the various bearing housing assemblies which can be clamped in any position along its length. A knife edge on the end frame may be used for compound pendulum experiments.

Four bearing housings are provided each carrying a hollow spindle mounted on ball bearings and furnished with a chuck for gripping the torsion shaft and a flange to receive the various inertia discs. One housing carries a splined collet for attachment of the hydraulic damping unit and two housings have provision for locking in order to provide a fixed end for the shaft.

GEARED DRIVE ASSEMBLY

This unit imparts simple harmonic motion to the torsion shaft and comprises an electric motor with closed-loop speed control driving a crank mechanism with phase control by a differential gear unit. Crank angle is read directly from the phase angle dial while crank speed is shown on an analogue meter in the Frequency Control Unit which contains all the electronic equipment for the closed-loop speed control over the frequency range 0 - 10 Hz.

HYDRAULIC DAMPING UNIT

A semi-rotary, silicone fluid viscous damper with coefficient adjustable from 0.1 to 1.4 Nm/rad/s with calibrated knob.

TRANSDUCER UNIT

Two precision angular motion transducers are provided and can be clamped adjacent to any of the bearing housings. They comprise carbon film potentiometers and are connected to a bridge circuit with its own trim control and power supply. The output is adequate to drive an oscilloscope or thermal array recorder with a gain of 0.05 V/cm.

TORSION SHAFT AND INERTIA DISCS

One torsion shaft is provided. This is of steel approximately 6.3 mm diameter but it can be replaced by any round bar in the diameter range 5 to 8 mm. Three sizes of inertia disc are provided and the largest has a groove around the periphery and scale calibrated in radians.

TENDER SPECIFICATION

Cussons Torsional Vibration Apparatus comprising D section tubular steel bed with feet for bench mounting, bearing housing (4) furnished with hollow spindle and fitted chuck and flange, inertia discs (2 plain, 1 divided) torsion shaft, geared drive assembly with differential crank mechanism, hydraulic damping unit, transducer units (2) and frequency control unit.

SERVICES

Single phase 110 or 220/240V 50 or 60 Hz supply. State voltage on ordering.

OPTIONAL ACCESSORIES

P1902 Two Beam Oscilloscope - for use with P1901 and P1906.

P1903 Twin Channel Recording Unit.

Comprising a portable mains operated two channel thermal array recorder with variable speed paper drive giving a range from 0.1 cm/s. Frequency response from DC to 100 Hz.

Built in pre-amplifier with switchable variable gain up to a sensitivity of 0.05 V/cm. Supplied with a roll of thermal sensitive paper, power cable, connector set and manual.

PRINCIPAL EXPERIMENTS

1. Torsional stiffness of a shaft.
 - a) variation of stiffness with length
 - b) effective length of a shaft
 - c) modulus of rigidity of shaft material
2. Calibration of the transducer system.
 - a) overall sensitivity of recording system for small displacements
 - b) effect of electrical loading on a potentiometric transducer
3. Polar moment of inertia (J) of flywheel by acceleration.
4. Polar moment of inertia (J) of flywheel by oscillation as compound pendulum.
5. Single-rotor system.
 - a) frequency of oscillation
 - b) Polar moment of inertia (J) of flywheel by oscillation
6. Calibration of the damping system.
7. Damped single-rotor system (step response).
 - a) light damping - logarithmic decrement
 - b) heavier damping - first overshoot
8. Damped single-rotor system (harmonic response).
 - a) amplitude ratio against frequency ratio
 - b) phase lag against frequency ratio
 - c) polar response diagram
9. Simple two-rotor system.
10. Multi-rotor system (Holzer method)
 - a) natural frequencies
 - b) elastic line for each vibration mode

NB Experiment 10 can only be carried out with the addition of P1906 Linear Vibrations Apparatus.

PHYSICAL DETAILS

	Nett Weight		Length		Width		Height	
	kg	lb	m	in	m	in	m	in
P1901	40	88	1.6	63	0.2	8	0.4	16
P1903	5	11	0.35	14	0.23	9	0.1	4

Cussons Technology Ltd.

102 Great Clowes Street, Manchester M7 1RH, England

Tel. +(44)161 833 0036

Fax. +(44)161 834 4688

E-mail: sales@cussons.co.uk Web: www.cussons.co.uk

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