MAM SERIES

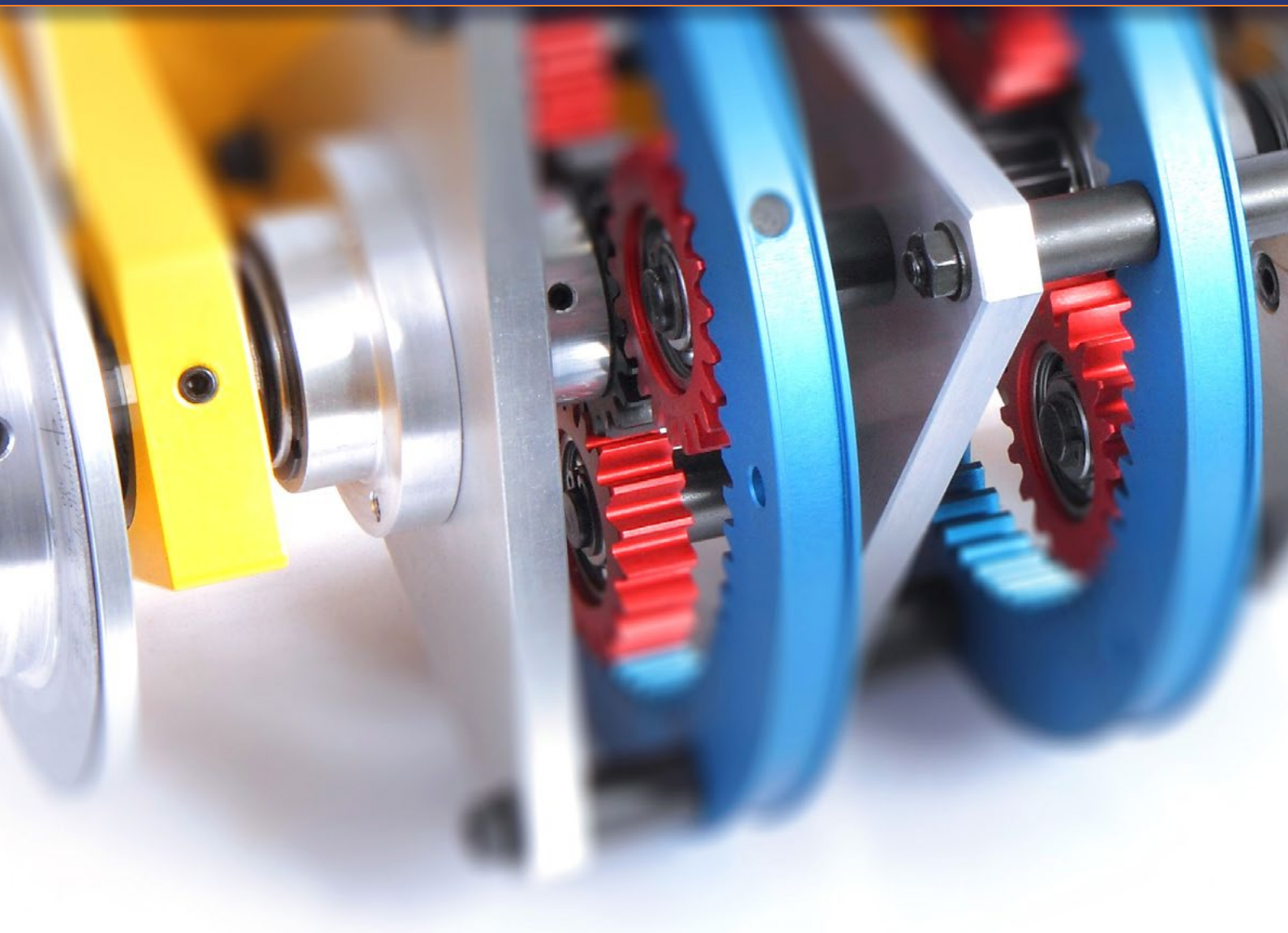
Series Datasheet – MAM

The MAM Series of engineering teaching equipment is renowned for excellent quality of build, ease of use and set-up for staff and student.

The Armfield range as it is now known has provided the fundamentals for Mechanical and Civil Engineering students the world over.

The products are available over two distinct series, The **MAM** series (this data sheet), and the complementary **SV** series.

MECHANICAL MECHANISMS | AUTOMOTIVE MECHANISMS | THEORY OF MACHINES



Topics covered by the MAM Series

Topics covered by this Mechanical & Automotive Mechanisms (MAM) data sheet:

- **Mechanical Mechanisms**
- **Automotive Mechanisms**
- **Theory of Machines**

Topics covered by the complementary SV Series

Topics covered by the complementary Statics & Vibrations (SV) data sheet:

- **Statics**
- **Vibration**
- **Materials Testing**
- **Structures**
- **Balancing**

UK office - email: sales@armfield.co.uk tel: +44 (0) 1425 478781 (for ROW)
USA office - email: info@armfield.inc tel: +1 (609) 208-2800 (USA only)

Issue: 2
URL: http://www.armfield.co.uk/sv
Applications ME IP

Universal Bench Mounted Frame - SD-1.10

The Universal Bench Mounted Frame provides a very sensible alternative to wall mounting, particularly since many new buildings are predominantly glass, with very flimsy dividing walls.

The frame is designed to accommodate two items of ADS apparatus, allowing adequate space for students to work on each piece of equipment simultaneously.

By mounting the apparatus on the frame, experiments can be transported between rooms to any convenient location.

SD-1.10 Universal Bench Mounted Frame

Image showing SD-1.10 and SD-4.14 mounted in place (not included with SD-1.10)

Overall dimensions	
Length	1.2m
Width	0.5m
Height	0.7m
Net weight	28Kg
Packed and crated shipping specifications	
Volume	0.62m^3
Gross weight	32Kg

Drum Brake Apparatus - SD-1.12

This apparatus has been developed specifically for Motor Vehicle Mechanics and Motor Vehicle Technicians Courses. It provides a means of demonstrating the difference in braking torque between leading (Primary) and trailing (Secondary) shoe braking systems and the effect on the braking systems and the effect on the braking torque of the various combinations of leading and trailing shoes. When the two shoes are linked together, the self energising action can be demonstrated.

The apparatus is suitable for use in the laboratory and may be used by the Students to carry out simple experiments to investigate the relationship between actuating forces and the braking torques and for the determination of the co-efficient of friction between the brake lining and the drum.

Two shoes with short brake linings are provided, additional shoes with full linings (SD-1.12a) are available should these be required. For more advanced work, a special shoe may be supplied, fitted with an adjustable lining (SD-1.12b); this enables the Student to investigate the effect on the braking torque when the pressure point on the brake shoe is displaced relative to the pivot point.

The apparatus is self contained and may be wall mounted or fitted to the Universal Bench Mounted Frame (Ref SD-1.10).

SD-1.12 Drum Brake Apparatus

Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.01 x 2 SD - 1.02 x 2

Overall dimensions	
Length	0.48m
Width	0.27m
Height	0.54m
Net weight	22Kg
Packed and crated shipping specifications	
Volume	0.14m^3
Gross weight	26Kg

Gearbox Apparatus - SD-1.15

Most road vehicles are fitted with variable ratio gearboxes as a means of obtaining the best power application under the varying road conditions.

Fundamentally the gearbox consists of gear wheels of different sizes which may be engaged as required. The sliding mesh box, although it is still used on heavy commercial vehicles, is seldom found on modern cars, but its basic construction and operation are important from the Student's point of view as it represents the basic layout from which most modern gearboxes have been developed.

This gearbox has been designed to represent a typical arrangement of a simple three forward ratio and reverse sliding mesh box.

The unit may be used for classroom demonstrations and by Students in the laboratory. Pulleys fitted with protractors are attached to the input and output shafts so that the Student may determine and verify velocity and torque ratios.

The Gearbox can be coupled to the Overdrive (Ref SD-1.17) and Differential (Ref SD-1.16) to represent a simple transmission system.

The unit may be wall mounted or fitted to the Universal Bench Mounted Frame (Ref SD-1.10).

SD-1.15 Grearbox Apparatus

Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.02 x 2
Overall dimensions	
Length	0.48m
Width	0.27m
Height	0.54m
Net weight	14Kg
Packed and crated shipping specifications	
Volume	0.14m^3
Gross weight	18Kg

Differential Apparatus, Crown Wheel & Pinion - SD-1.16A

Many students find it difficult to visualise the action of a differential when used as a means of providing a drive from the gearbox to each axle shaft while allowing independent motion between shafts.

This Differential Unit has been designed to demonstrate the action of:

Crown Wheel and Pinion rear axle drive and differential elements.

The teaching value of this unit is, however, not limited to it's use for demonstration purposes only, but may also be used for simple experimental work in the laboratory. A pulley fitted with a protractor is secured to the input shaft, the output bevels are grooved and may be loaded individually or by means of a differential pulley arrangement so that students can determine and verify velocity ratios and torque distribution.

The Differential can be coupled to the Overdrive (Ref SD-1.17) and/or Gearbox (Ref SD-1.15) to represent a simple transmission system.

The unit may be wall mounted or mounted on the Universal Bench Mounting Frame (Ref SD-1.10)

SD-1.16A Differential Apparatus, Crown Wheel & Pinion Apparatus

Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.02 x 2
Overall dimensions	
Length	0.40m
Width	0.38m
Height	0.30m
Net weight	16Kg
Packed and crated shipping specifications	
Volume	0.1m^3
Gross weight	20Kg

Overdrive Apparatus - SD-1.17

The Overdrive Unit has been designed to demonstrate the action of the gear elements in simple epicyclic gear arrangements. The unit may also be used by students in the laboratory to carry out simple experiments on epicyclic gearing.

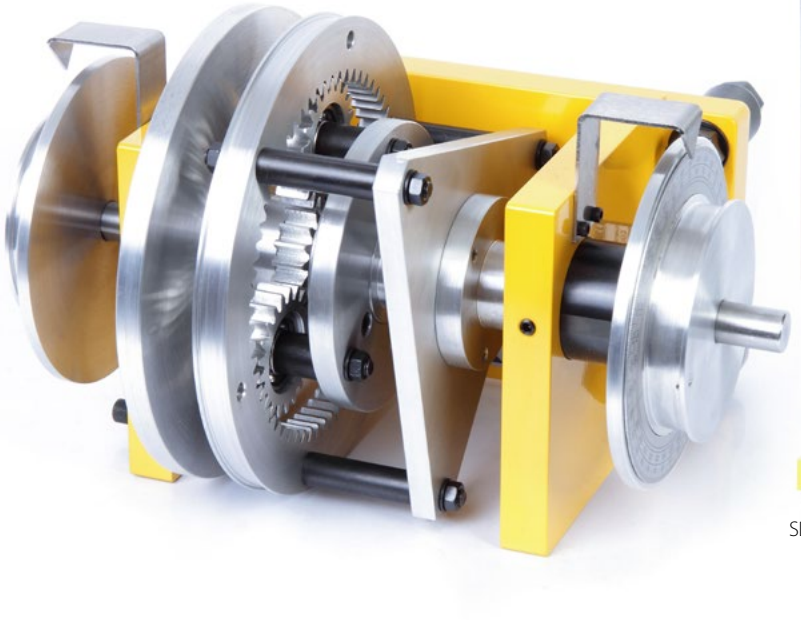
The apparatus illustrated has been designed specifically for Motor Vehicle courses and represents an application of a simple epicyclic arrangement of the type used in a motor vehicle overdrive.

Pulleys fitted with protractors are secured to the input and output shafts to enable the student to determine and verify velocity and torque ratios.

The unit may be wall mounted or attached to a Universal Bench Mounted Frame (Ref SD-1.10).

The apparatus is designed so that the overdrive can be coupled to the Gearbox (Ref SD-1.15) and Differential (Ref SD-1.16) to represent a simple transmission system.

SD-1.17 Overdrive Apparatus



Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.02 x 2
Overall dimensions	
Length	0.38m
Width	0.35m
Height	0.37m
Net weight	8Kg
Packed and crated shipping specifications	
Volume	0.1m^3
Gross weight	10Kg

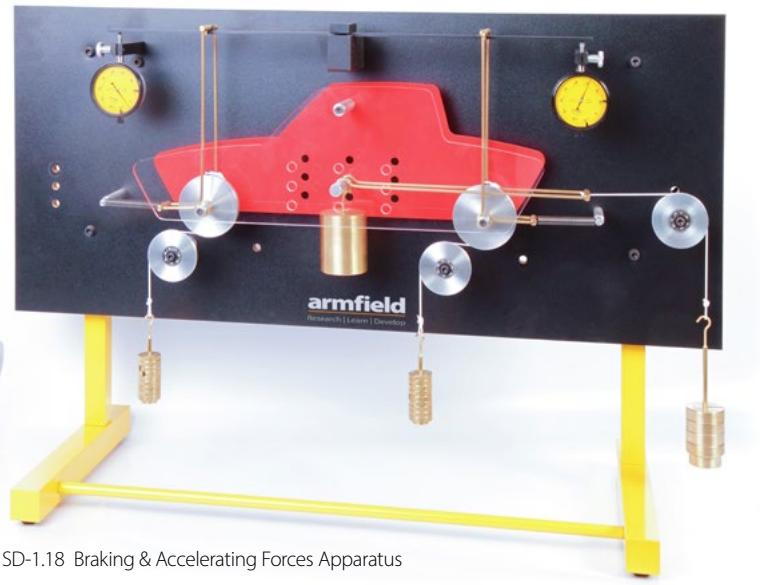
Braking & Accelerating Forces Apparatus - SD-1.18

Under conditions of braking or acceleration of a road vehicle, a load transfer between front and rear wheels occurs. The problem of load transfer arises since the accelerating or braking force is not applied to the centre of gravity of the vehicle but to the point of contact of the wheels with the road.

The Braking and Accelerating Forces Apparatus has been designed to demonstrate this load transfer and to enable the student to carry out simple experiments to investigate the relationship between the forces involved in vehicle braking and acceleration. The relationship between these forces on front wheel drive, rear wheel drive, and four wheel drive may also be demonstrated.

A "**Model**" Vehicle is supported on a beam load cell. The model has simulated road wheels and is drilled to receive a pin which may be inserted in varying positions to represent the centre of gravity of the vehicle.

Suitable weights, cords and pulleys are used to apply varying horizontal braking or acceleration and inertia forces to the vehicle. The apparatus is portable and may be used in either the classroom the laboratory.



SD-1.18 Braking & Accelerating Forces Apparatus

Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.01 x 2 SD - 1.02 x 2
Overall dimensions	
Length	0.70m
Width	0.3m
Height	0.80m
Net weight	16Kg
Packed and crated shipping specifications	
Volume	0.3m^3
Gross weight	24Kg

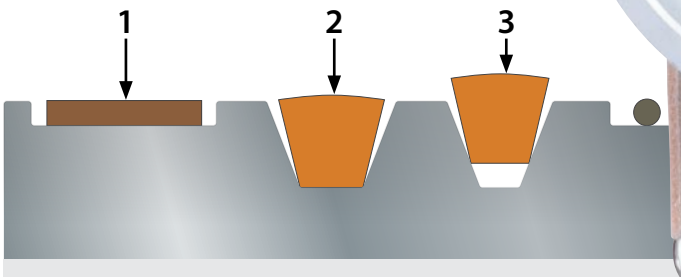
Belt Friction Apparatus - SD-1.20

The Belt Friction Apparatus has been designed to allow students to carry out investigations to compare the driving torque for a given degree of overlap of a flat leather belt, a badly fitted 'V' belt and a correctly fitted 'V' belt.

Tension is introduced into the belt by hanging a mass from the ring attached to the end. The slipping torque is determined by the addition of a suitable mass attached to a cord wrapped around the drum.

The angle of overlap can be varied from 30 to 210 degrees in increments of 30 degrees. The pulley is balanced and mounted on **bearings to reduce frictional losses to a minimum.**

The unit can be wall mounted or fitted to the Universal Bench Mounting Frame (Ref SD-1.10).



1) Flat Leather Belt

2) 'V' belt in badly machined groove, to simulate a worn pulley or a wrong belt (belt bottoms in groove).

3) Belt in correctly machined groove.

SD-1.20 Belt Friction Apparatus

Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.02 x 2 or SD - 1.03 x2
Overall dimensions	
Length	0.25m
Width	0.20m
Height	0.33m
Net weight	7Kg
Packed and crated shipping specifications	
Volume	0.045m^3
Gross weight	10Kg

SD-1.10 bench mounted frame

Borg-Warner Automatic Transmission Simulator - SD-1.22

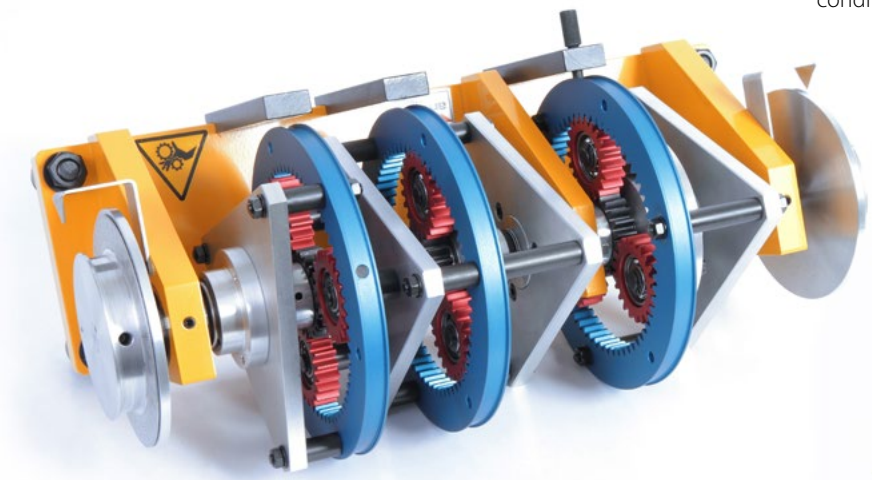
The simplicity of operation and the ease with which the student may understand the Mechanical Power Flow in the Borg-Warner 35 gearbox has made the Sanderson simulator extremely popular with lecturers and students alike, in Technical Colleges throughout the world.

Pins, inserted in accordance with the chart in the Laboratory Manual, lock discs to simulate the action of the clutches and brake bands.

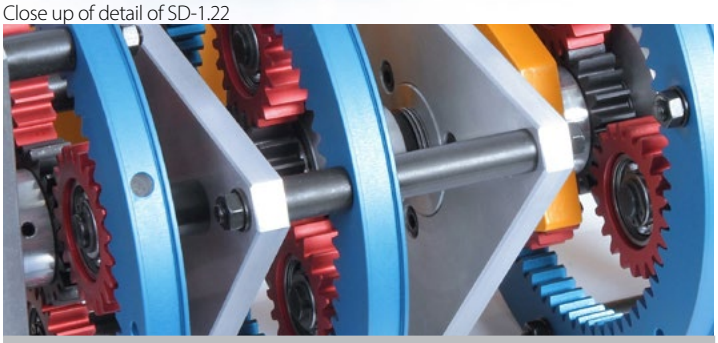
Each of the three forward ratios and reverse may be selected as required simply by inserting the appropriate pins as specified in the chart, and the relative movements of the different components can be clearly seen and studied.

When the student has become familiar with the Mechanical Power Flow, he may then proceed to use the unit for diagnostic purposes. By following the step by step procedure laid down in the Laboratory Manual he is able to study the effect of a faulty clutch or brake band. Also included in the Laboratory Manual are the calculations for the gear ratios which are the same for simulator and the Borg-Warner Box.

The unit may be wall mounted or fitted to the Universal Mounting Frame (Ref SD-1.10).



Close up of detail of SD-1.22



Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.02 x 2
Overall dimensions	
Length	0.26m
Width	0.25m
Height	0.60m
Net weight	15Kg
Packed and crated shipping specifications	
Volume	0.09m^3
Gross weight	19Kg

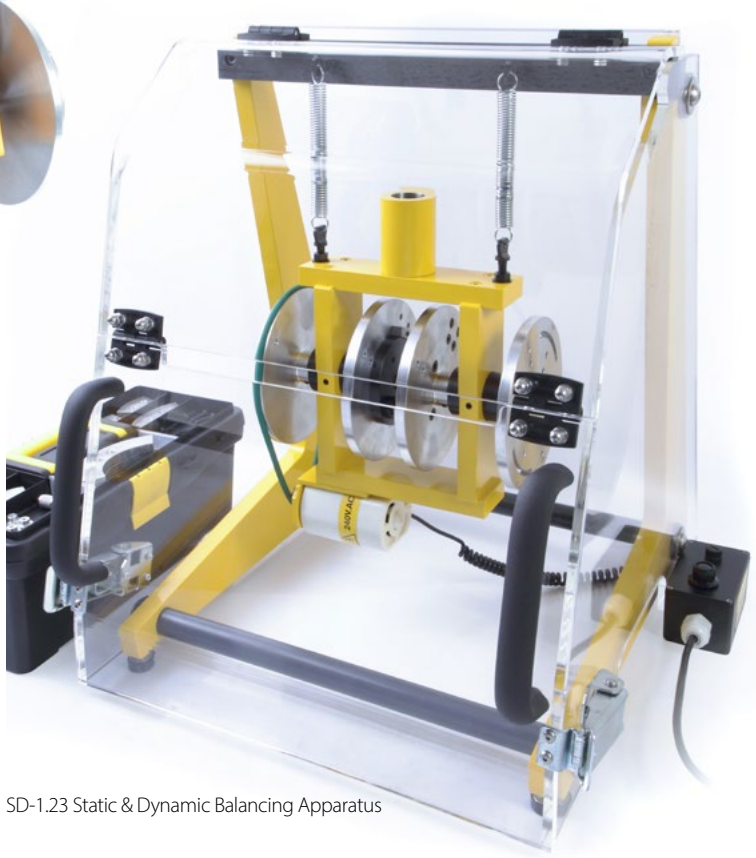
Static & Dynamic Balancing Apparatus - SD-1.23

The Static & Dynamic Balancing Apparatus may be used effectively in both the classroom and the laboratory for simple demonstrations and experiments in the dynamic balancing of rotating and reciprocating systems.

The rotating system is essentially a shaft, mounted on bearings, supported in a rigid frame, and driven by a small variable speed motor attached to the frame. Four discs, to which masses may be attached, are rigidly secured to the shaft. Each disc is suitably drilled and the sets of holes are positioned so that various conditions of un-balance in a rotating system can be simulated and the normal methods used to determine the magnitude and position of the counter-balance masses.

The unit is supported on springs attached to the main support frame so that the oscillations set up by any unbalanced forces may be observed.

The centre section of the shaft is in the form of a crank. A sleeve, piston and connecting rod are provided and may be fitted to the unit so that single cylinder engine balance conditions can be simulated. Various sector plates of suitable mass can be attached to the two inner discs so that the student can observe the effect on the oscillations of various conditions of partial balance of the reciprocating masses.



SD-1.23 Static & Dynamic Balancing Apparatus

Overall dimensions	
Length	0.60m
Width	0.44m
Height	0.47m
Net weight	28Kg
Packed and crated shipping specifications	
Volume	0.22m^3
Gross weight	32Kg

Plate Clutch Apparatus - SD-1.24

The Clutch Apparatus has been designed specifically for Motor Vehicle Technician Courses. It provides a means of demonstrating the effect of the mean radius of the friction surfaces and the spring pressure on the torque transmitted by a plate clutch.

The apparatus may be used effectively by the student in the laboratory to carry out simple experiments to investigate the relationship between the normal pressure applied to the friction surfaces, the mean radius of the friction rings and the torque at which slip occurs.

Three sets of clutch rings with varying mean radius are supplied and provision is made so that the student can observe the effect on the slipping torque when using more than one pair of friction surfaces.

The apparatus may be wall mounted or fitted to the Sanderson Universal Bench Mounting Frame (Ref SD1:10).

SD-1.24 Plate Clutch Apparatus

Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.02
Overall dimensions	
Length	0.30m
Width	0.28m
Height	0.30m
Net weight	14Kg
Packed and crated shipping specifications	
Volume	0.06m^3
Gross weight	14Kg

Disc Brake Apparatus - SD-1.25

The Disc Brake Apparatus has been designed specifically for Motor Vehicle Courses and may be used effectively for classroom demonstrations. It may also be used by the student in the laboratory to carry out simple experiments to investigate the relationship between the normal force acting on the brake pads and the braking torque.

The brake pads are located on bell crank levers to which the load hangers may be attached. A special load beam is provided for use when carrying out experiments with two brake pads. The supporting shafts are suitably drilled and pins provided so that the bell crank levers may be located in a number of radial positions.

By attaching suitable masses to a cord wrapped round the pulley on the disc shaft, the braking torque may be determined.

This apparatus may be considered complementary to the Drum Brake Apparatus (Ref SD-1.12) and may be wall mounted or fitted to the Universal Bench Mounting Frame (Ref SD-1.10).

SD-1.25 Disc Brake Apparatus

Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.02 x 2
Overall dimensions	
Length	0.34m
Width	0.32m
Height	0.34m
Net weight	12Kg
Packed and crated shipping specifications	
Volume	0.088m^3
Gross weight	16Kg

Simple Hydraulic System - SD-1.27

The Hydraulic System is a simple piece of apparatus designed specifically for Motor Vehicle and Mechanical Engineering Technician Courses. It is intended for use in either the classroom or laboratory and may be used for simple demonstrations to illustrate how liquid can be used to transmit a force. The apparatus may also be used by the student to carry out simple experiments to investigate the relationships between the force on the plungers, the cross sectional area of the plungers and the fluid pressure in the system.

The system consists essentially of three accurately machined cylinders and plungers whose cross-sectional areas are in the ratio 1, 2 and 6. The three cylinders and the pressure gauge are connected in parallel and "on/off" taps are included in the circuit so that any of the cylinder units may be isolated from the system. A clear Perspex oil reservoir is fitted to the "master" cylinder.

Two special load hangers are provided.

The unit may be wall mounted or fitted to the Universal Bench Mounting Frame (Ref SD-1.10).

SD-1.27 Simple Hydraulic System

Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.02 x 2
Overall dimensions	
Length	0.38m
Width	0.28m
Height	0.68m
Net weight	11Kg
Packed and crated shipping specifications	
Volume	0.14m³
Gross weight	14Kg

Crank Mechanism - SD-1.28

The apparatus is intended to represent a simple engine mechanism and may be used by the students for simple experiments to investigate:

1) The relationship between the piston displacement and the crank angle for a given connecting rod/crank radius ratio.

2) The relationship between the turning moment on the crank shaft and the crank angle for a given force on the piston.

The crank effort may be determined by attaching suitable masses to the beam balance arm.

The piston is fitted with brass rollers running on guide bars and needle roller bearings are fitted in the connecting rod so that friction is reduced to a minimum.

A protractor is attached to the crank which may be rotated on the beam balance arm and clamped in any predetermined angular position.

A linear scale is attached to the piston guide so that the piston displacement can be measured.

The unit may be wall mounted or fitted to the Universal Bench Mounting Frame (Ref SD-1.10).

SD-1.28 Crank Mechanism

Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.02 x 2
Overall dimensions	
Length	0.48m
Width	0.27m
Height	0.54m
Net weight	14Kg
Packed and crated shipping specifications	
Volume	0.14m³
Gross weight	18Kg

Acceleration of geared systems - SD-4.15

The Geared System consists essentially of three shafts, each mounted on ball races, supported in a suitable frame and connected by gearing. Alternative interchangeable gear ratios are supplied.

A flywheel is attached to one of the shafts, whilst discs having varying mass moments of inertia may be attached to the other two shafts.

A torque drum is secured to each shaft and suitable masses, attached to a cord wound on to one of the drums, provide a means of applying a torque to the system.

By allowing the mass attached to the drum to fall a predetermined distance and measuring the time taken, the acceleration of the system can be calculated.

The apparatus may be wall mounted or fitted to the Universal Bench Mounting Frame (Ref SD-1.10).

Close up of detail of SD-4.15

Optional Extra	
Mounting Frame	SD - 1.10
Requirements	
Weights	SD - 1.02 x 2
Overall dimensions	
Length	0.35m
Width	0.30m
Height	0.65m
Net weight	23Kg
Packed and crated shipping specifications	
Volume	0.14m³
Gross weight	27Kg

Epicyclic Gear Units - SD-4.17/ SD-4.18

The Epicyclic Gear Units have been developed to enable students to carry out investigations concerning epicyclic gearing in simple and more advanced forms.

A version of this apparatus is the Coupled Epicyclic Unit Ref SD-4.17 which uses two standard speed unit or a forward and reverse unit.

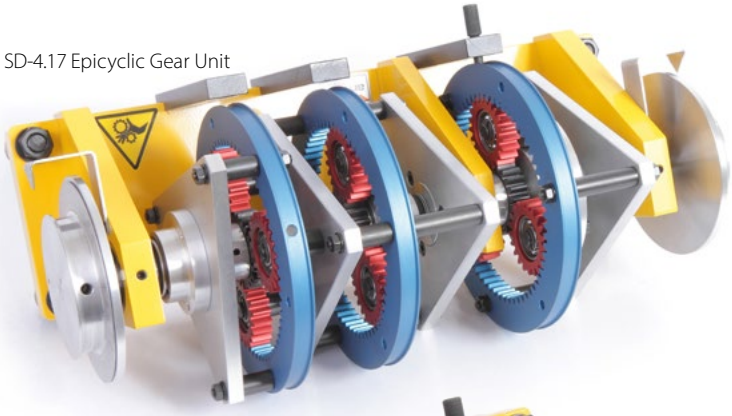
Recently introduced, the Three Speed Epicyclic Gearbox Ref SD-4.18 provides two forward speeds and reverse.

A bracket fitted with a spring balance which enables the student to measure the holding torque on each annulus can be supplied as an optional extra (Ref SD-4.18a).

Bearings are used extensively throughout these units to reduce frictional losses to a minimum.

All epicyclic units can be wall mounted or fitted to the Universal Bench Mounting Frame (Ref SD-1.10).

SD-4.17 Epicyclic Gear Unit



SD-4.18 Epicyclic Gear Unit

Optional Extra		
Mounting Frame	SD - 1.10	
Requirements		
Weights	SD - 1.02 x 2	
Overall dimensions	**SD4:17**	**SD4:18**
Length	0.26m	0.26m
Width	0.25m	0.25m
Height	0.60m	0.60m
Net weight	18Kg	18Kg
Packed and crated shipping specifications		
Volume	0.09m³	0.09m³
Gross weight	22Kg	22Kg

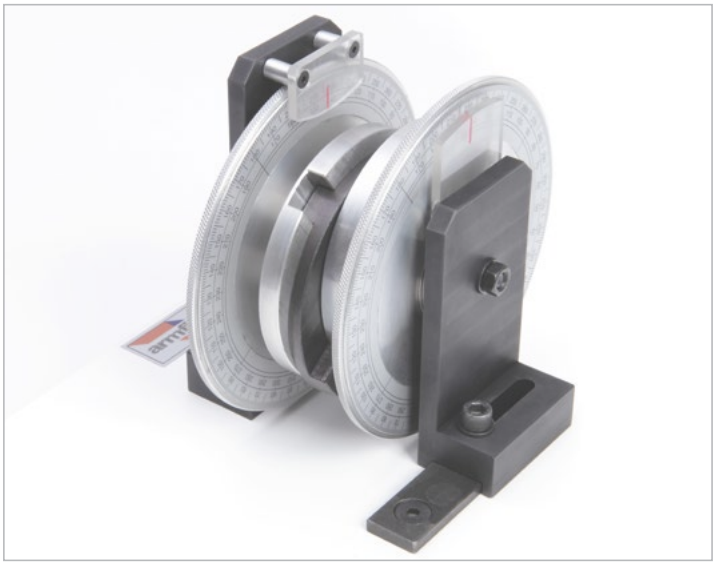
Mechanisms - DT9 Series

The DT series of mechanisms has been designed to provide simple equipment for use as classroom demonstrations or for simple laboratory exercises. The range covers some of the more commonly used mechanisms employed in engineering applications.

Features: 1 - Simple to operate
2 - All moving parts of the mechanism clearly visible
3 - Suitable scales provided
4 - Light and portable

Geneva Stop - DT-9.06

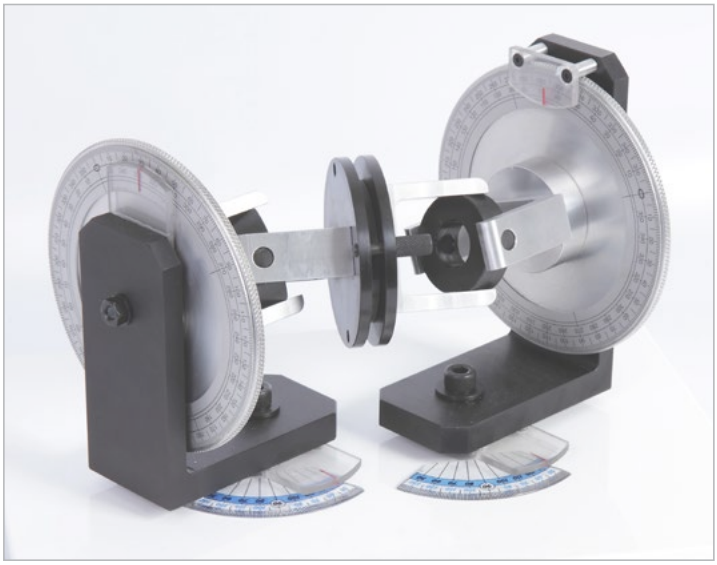
The Geneva mechanism produces intermittent motion from continuous circular motion. It is positive drive mechanism in which the driven wheel is positively moved or locked



Oldham Coupling - DT-9.07

The Oldham coupling is an example of an inversion of the double slider-crank chain.

▶ This type of coupling is used to connect two parallel shafts



Hooke's Joint - DT-9.08

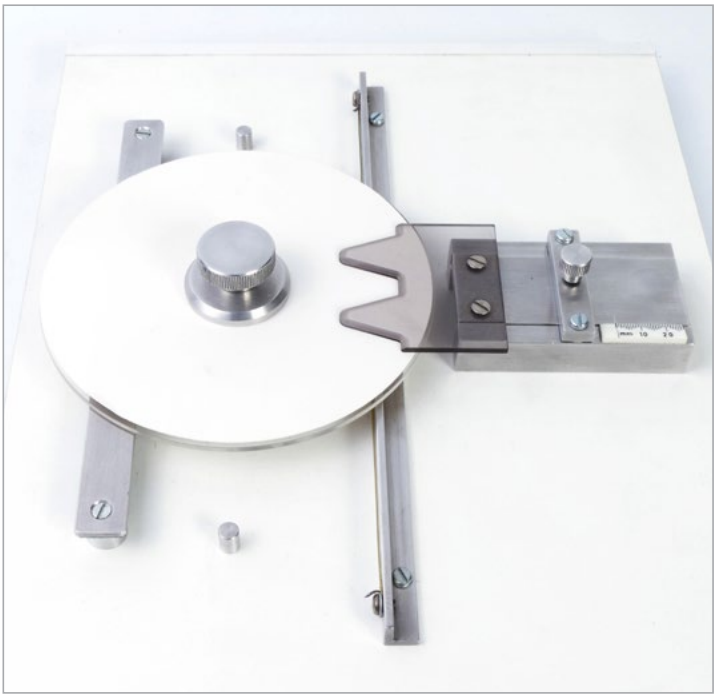
A Hooke's joint is a universal joint often used to transmit rotary motion from one shaft to another

Mechanisms - DT9 Series

Cam and Follower - DT-9.09

The cam and follower unit enables the study of cam and follower as well as eccentric follower mechanisms.

- The cam rotates on its axis imparting a reciprocating motion to the follower
- Three elements are determined; Displacement, Velocity and Acceleration of the follower



Gear Generation Apparatus - DT-9.10

The gear generation apparatus provides a simple mechanical aid for the graphical determination of producing gear tooth profiles.

Overall dimensions						Packed & Crated Shipping Spec	
Item	**Ref**	**Width**	**Depth**	**Height**	**Net Weight**	**Volume**	**Gross Weight**
Geneva Stop	DT9.06	0.23m	0.16m	0.16m	2.5Kg	0.06m^3	5Kg
Oldham Coupling	DT9.07	0.23m	0.16m	0.16m	2.5Kg	0.06m^3	5Kg
Hooke's Joint	DT9.08	0.35m	0.23m	0.18m	4.0Kg	0.09m^3	6.5Kg
Cam and Follower	DT9.09	0.39m	0.23m	0.07m	2.25Kg	0.04m^3	4.75Kg

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Armfield Agents

Armfield products are distributed throughout the world. It is our policy in most countries to deal direct or through proven and accredited sales agents, who after suitable approval, may become exclusive representatives.

In exchange for this exclusivity they are required to offer a comprehensive service including the highest degree of after sales support.

Customer Demonstration

To arrange a demonstration please contact your local Armfield representative. Details can be found on our website here: **www.armfield.co.uk**, or contact Armfield HQ directly using the information below.

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armfield worldwide

GLOBAL REPRESENTATION

To locate a contact in your area visit:

www.discoverarmfield.com/contact

U.S. Head Office:

Armfield Inc.
9 Trenton Lakewood Road
Clarksburg NJ 08510
USA

Tel/Fax: +1 (609) 208-2800
E-mail: info@armfieldinc.com
Support: armfieldassist.com

Head Office:

Armfield Limited
10 Headlands Business Park
Ringwood, Hampshire
BH24 3PB England

Telephone: +44 (0)1425 478781
E-mail: sales@armfield.co.uk
Support: armfieldassist.com

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