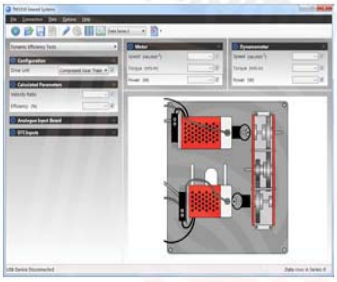
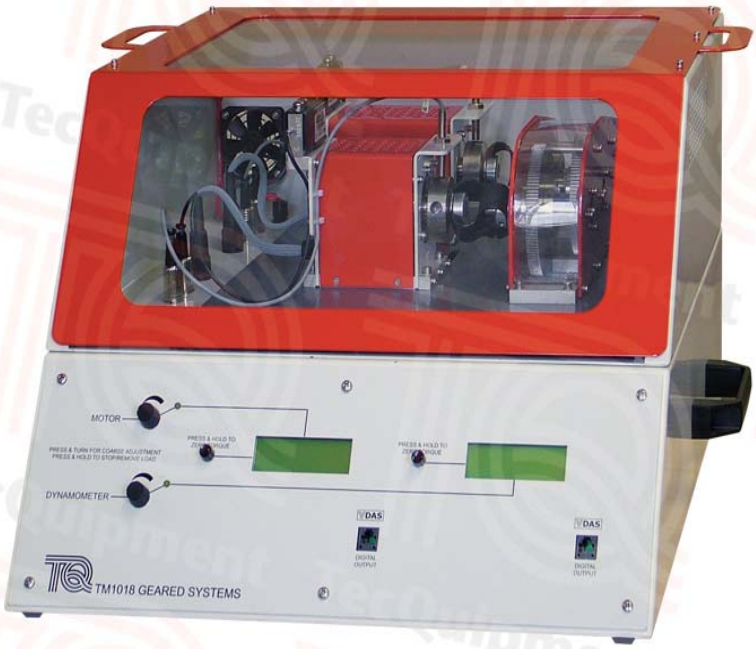
TM1018

Geared Systems

A set of products for dynamic and static experiments on geared and other drive systems



Screenshot of the optional VDAS® software



- For studies of velocity ratios and efficiencies of various geared systems
- Self-contained bench-mounted base unit for dynamic performance tests – including a dual-purpose simple and compound gear drive unit as standard
- Choice of optional drive units, including belt drives and a chain drive for comparative tests of different drive types.
- Interlocked transparent cover for safety, while allowing students to see the drive units working
- High stability drive motor and hysteresis effect dynamometer brake – for a constant torque at any given speed
- Simple tools provided for quick and easy changeover of drive systems
- Optional Test Stand (TM1018A) for static efficiency and inertia tests – including a flywheel as standard
- Can connect to TecQuipment's Versatile Data Acquisition System (VDAS®)

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TecQuipment

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Description – Base Unit

A bench-mounting base unit forms the main part of this set of products. Supplied with a three-shaft gear drive unit as standard, the base unit dynamically tests the gear drive and the other optional drive units (TM1018b, c and d).

The dynamic tests run the input of the different drive units at a given speed using a motor, while measuring the input power. At the same time, a dynamometer loads the output of the drive unit while measuring the output power. Students use the measurements to find the performance and efficiency of the drive unit.

Students may set the gear unit (supplied) as a simple or compound drive by sliding a gear in or out of mesh on the third shaft.

TecQuipment includes simple tools needed to fit the drive units to the base unit, and to adjust the compound gear drive.

In the base unit's upper level, the student fits their choice of drive unit. A variable-speed, low-voltage motor provides the shaft input turning force (effort) to the drive. A dynamometer provides the output braking force (load) to the drive. The dynamometer uses electromagnetic braking and a hysteresis effect to provide a variable load at a constant torque irrespective of the speed. Sensors on the motor and dynamometer measure their shaft speed, torque and therefore power in and out at the drive. Fans provide air cooling for both the motor and dynamometer. Flexible couplings with collets connect the drive unit to the motor and dynamometer for quick and accurate alignment.

Axial trunnions with race bearings hold the motor and the dynamometer for free rotation against their load cell sensors to measure torque accurately.

On the base unit's lower level, controls and microprocessor controlled multiline displays adjust the motor speed and the load while showing measurements of torque, speed and power.

The base unit's upper level includes an interlocked guard with transparent sections to prevent students touching any moving parts, while allowing them to see what is happening.

You can do tests with or without a computer connected. However, for quicker tests with easier recording of results, TecQuipment can supply the optional Versatile Data Acquisition System (VDAS®). This gives accurate real-time data capture, monitoring and display, calculation and charting of all the important readings on a computer (computer not included).

Standard Features

- Supplied with comprehensive user guide
- Five-year warranty
- Manufactured in accordance with the latest European Union directives

Description – Optional Test Stand (TM1018a)

Optional Test Stand (TM1018a)

A separate 'Acceleration and Static Test Stand' (TM1018a) gives extra experiments in measuring angular acceleration and static efficiency. You may use clamps to mount the Test Stand temporarily on the edge of a desk, but TecQuipment recommend a more permanent fixing to the desk or to a wall.

The test stand includes sets of weights to apply turning forces to the shaft of a flywheel (included as standard) or the gear drive from the TM1018. A sensor and a multiline display automatically calculate angular acceleration. Students use this to find inertia by experiment.

The flywheel forms a simplified version of one of the gears in the gear drive, to provide a starting point in understanding inertia calculations of more complex gear drives. The test stand also allows simple static efficiency tests on the gear drive for comparison with those from dynamic tests on the base unit. A slot to the front of the test stand holds a tray (supplied) to store your weights and other loose items.

Note: The Test Stand and Base Unit do not connect to each other.

Description – Optional drive units (TM1018b, c and d)

Optional Drive Units TM1018b, c and d

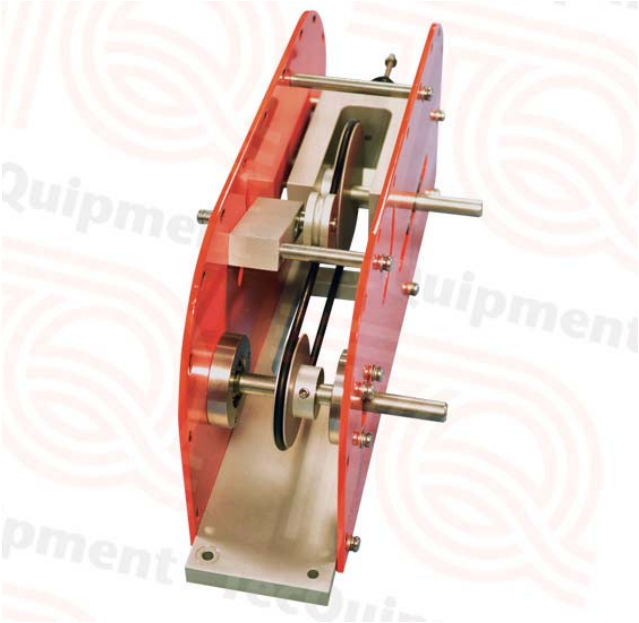
The optional drive units work with the TM1018 Base Unit for dynamic tests on performance, allowing comparison with the gear drive. For extended experiments, the optional drives each include three different methods of adjusting their tension to show how this affects performance. The three methods include:

- Distance between drive pulleys
- Fixed tension pulley
- Spring tension pulley

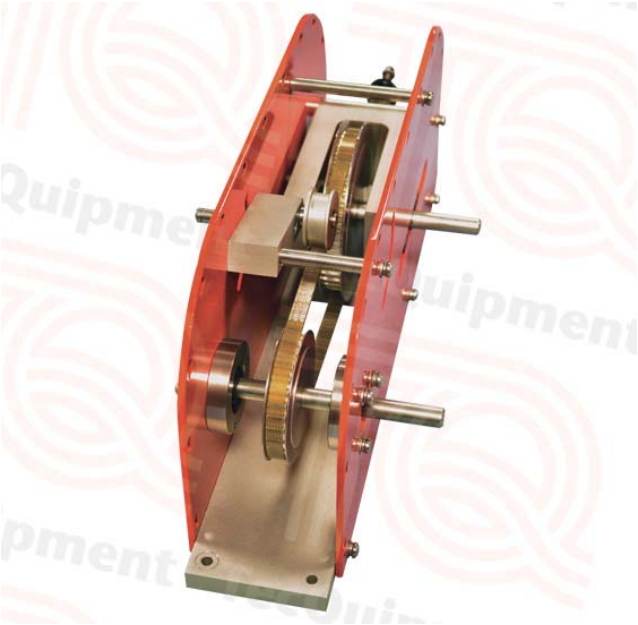
With each drive unit, TecQuipment supplies a tension spring and a spring balance to set the tension of the tension pulley.

The shafts of all drive units run on maintenance-free, low-friction ball races.

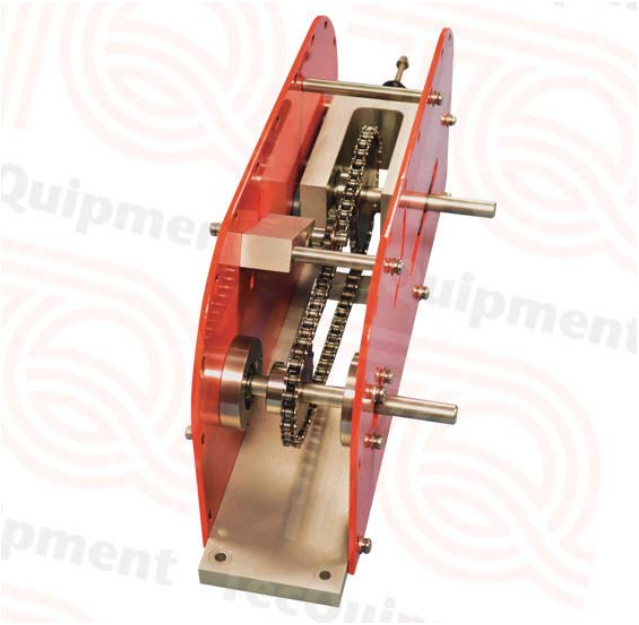
Note: Covers removed from drive units for photographs



TM1018c Round Belt Drive



TM1018b Toothed Belt Drive



TM1018d Chain Drive

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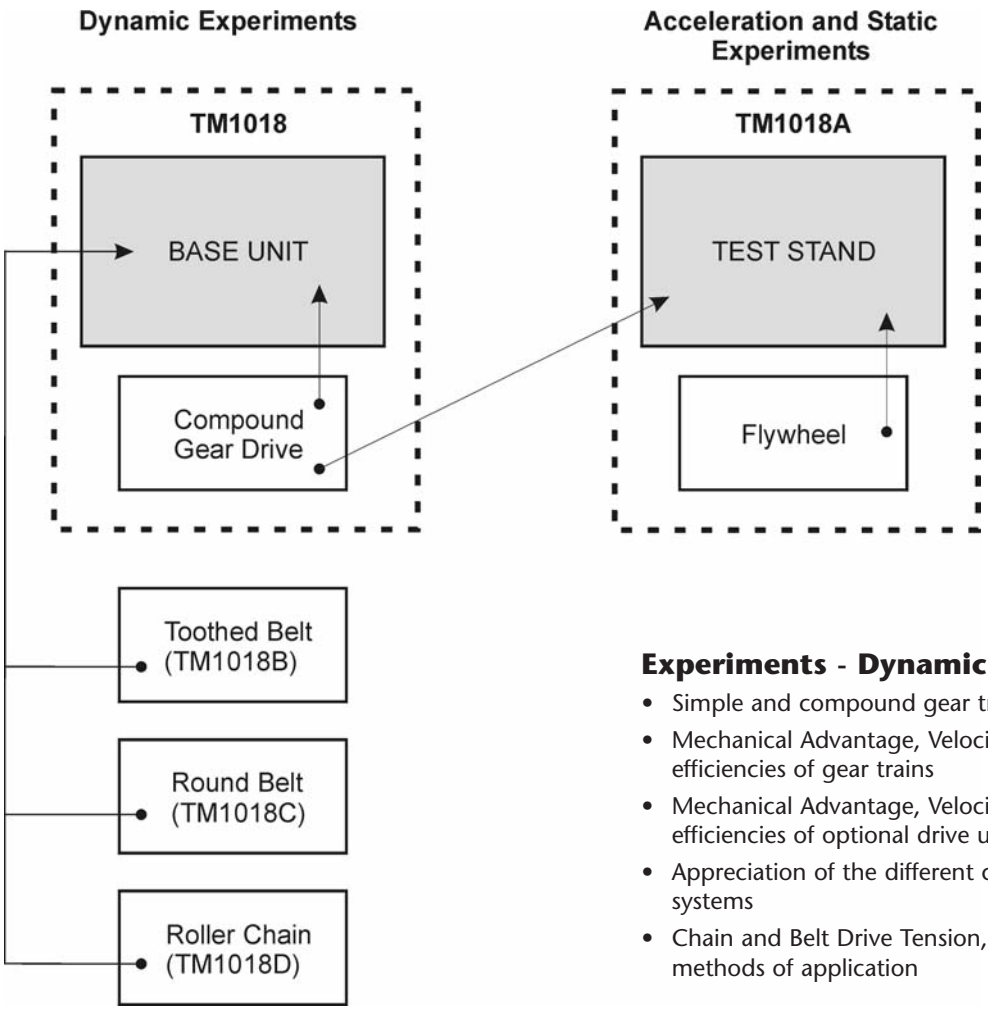

Experiments - Dynamic

- Simple and compound gear trains
- Mechanical Advantage, Velocity Ratio and dynamic efficiencies of gear trains
- Mechanical Advantage, Velocity Ratio and dynamic efficiencies of optional drive units (chain and belts)
- Appreciation of the different characteristics of drive systems
- Chain and Belt Drive Tension, including different methods of application

Experiments - Acceleration and Static

- Mechanical Advantage, Velocity Ratio and static efficiencies of gear drives
- Mass moment of inertia of a flywheel by experiment and calculation
- Mass moment of inertia of geared drive systems by experiment and calculation

Recommended Ancillaries

- VDAS-B (bench-mounted version of the Versatile Data Acquisition System)
- TM1018a Acceleration and Static Test Stand
- TM1018b Toothed Belt Drive
- TM1018c Round Belt Drive
- TM1018d Chain Drive

Operating Conditions

Operating environment:
Laboratory environment

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

Essential Services

Base Unit electrical supply:
90 VAC to 250 VAC
50 Hz to 60 Hz

Bench space needed for base unit:
Roughly 700 mm x 700 mm plus space for a computer and VDAS-B.

Test Stand electrical supply:
100 VAC to 240 VAC 50 Hz to 60 Hz

Minimum height to floor from bottom of Test Stand:
700 mm

Sound Levels

Maximum 70 dB

Specifications

Nett dimensions and weights:
Base Unit: 600 mm x 600 mm x 350 mm high and 32 kg with gear drive fitted.

Test Stand: 400 mm x 500 mm high x 200 mm with storage tray fitted. 9 kg plus 1 kg of weights.

Gear Drive (supplied with base unit):
Three shafts, with one gear on shafts 1 and 3, and two on shaft 2.

Shaft 1 has a gear of 80 teeth.

Shaft 2 has a gear of 60 teeth and a gear of 120 teeth.

Shaft 3 has a gear of 120 teeth and may be disengaged.

285 mm x 120 mm x 110 mm and 4 kg

Flywheel (supplied with Test Stand)
Single wheel of radius 48 mm (simplified version of the 80 tooth gear on the standard gear drive unit).

210 mm long x 110 mm wide x 115 mm high and 1.5 kg

Optional Toothed Belt Drive (TM1018b):
Flexible toothed belt with adjustable tension

Driver with 30 teeth

Follower with 45 teeth

285 mm x 110 mm x 120 mm and 2 kg

Optional Round Belt Drive (TM1018c):
Flexible, round cross-section belt with adjustable tension

40 mm diameter driver

60 mm diameter follower

285 mm x 110 mm x 120 mm and 2 kg

Optional Chain Drive (TM1018d):
Roller chain with adjustable tension

Driver with 20 teeth

Follower with 30 teeth

285 mm x 110 mm x 120 mm and 2 kg

Approximate packed dimensions:
Base Unit: 0.3 m^3 and 40 kg

Test Stand: 0.1 m^3 and 15 kg

Optional drive units (each): 0.02 m^3 and 3 kg