



A ball-on-disc instrument for measuring the frictional properties of lubricated and unlubricated contacts under a wide range of rolling and sliding conditions.

versatility

Interacting surfaces that have a relative motion span from pure rolling to pure sliding. The MTM has a unique ball and disc configuration, enabling any combination of rolling and sliding conditions to be inputted, spanning across all three lubrication regimes (boundary, mixed and EHL). This capability makes the MTM suitable for testing an unrivaled number of applications.

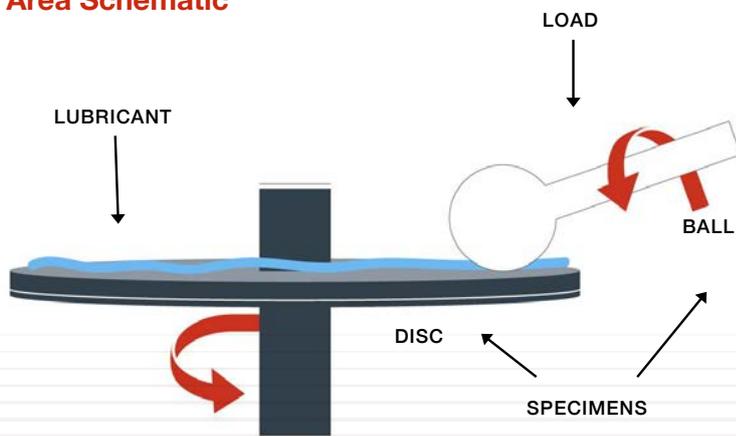
Compact and fully automated, the MTM measures the frictional properties under a wide range of speeds, loads and temperatures enabling quick characterisation of lubricants, materials and formulations.

As our most versatile instrument, the MTM is being used for fuel economy modelling of engine oils, developing new formulations for railway greases, reducing the wear of artificial joints and perfecting the mouth feel of food and the skin feel of cosmetics. MTM data is being utilised to improve efficiency and boost sustainability whilst decreasing product time to market and development costs

The novel configuration and 3D SLIM option has made the MTM a de-facto industry standard instrument amongst OEM's, lubricant manufacturers and additive suppliers.

Optimising the friction and wear properties of a system can significantly improve performance and reduce operating costs. Testing lubricants and materials under realistic contact conditions is imperative for understanding where improvements can be made.

Contact Area Schematic



Features & Benefits

Independently driven specimens enabling a wide range of contact conditions to be replicated across all three lubrication regimes

Unique configuration eliminates induced spin in the contact improving accuracy of results

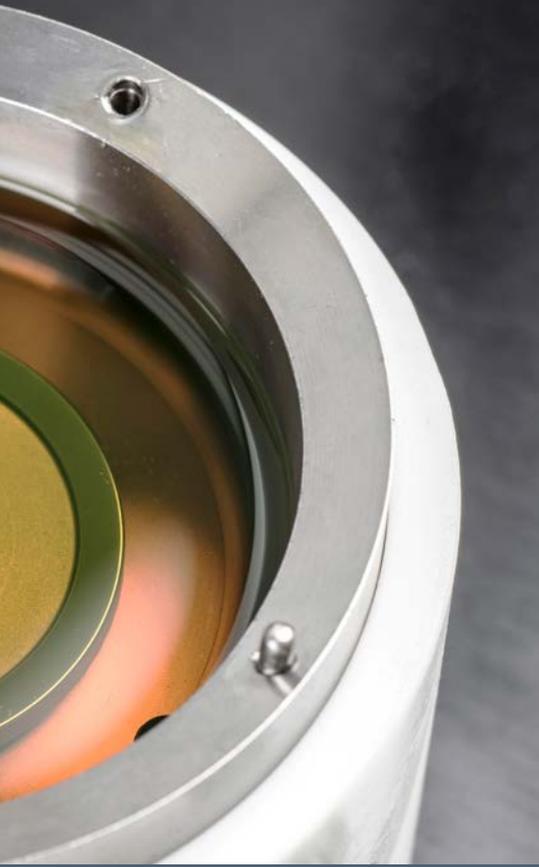
Extensive range of available specimen geometries and materials further expands the application range

Combined with the SLIM, the MTM can automatically measure anti-wear film build up throughout the test analysing the performance of additive packages

Compact and fully automated, the MTM requires minimal lab space and user intervention

Simple test setup and calibration procedure help users to produce fast, repeatable results and reduce training time

Over 500 technical papers covering all aspects of tribology enabling knowledge sharing between researchers across the fields



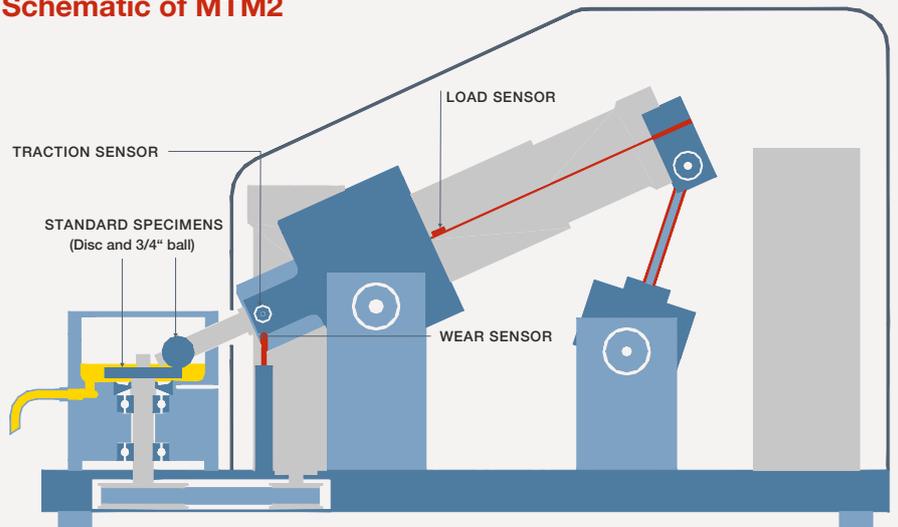
Principle

The specimens are fitted to the system and a small sample is added to the steel pot. The ball is loaded against the face of the disc and both specimens are driven independently. The frictional force between the two specimens is measured and recorded automatically throughout the test.

The test profile including the range of speeds, temperatures and loads are defined in an intuitive, stand alone software application. The MTM automatically runs through the sequence of profile steps, recording data without any intervention by the user.

Data is displayed graphically in real time and is available after the test for in-depth analysis and comparisons between samples.

Schematic of MTM2

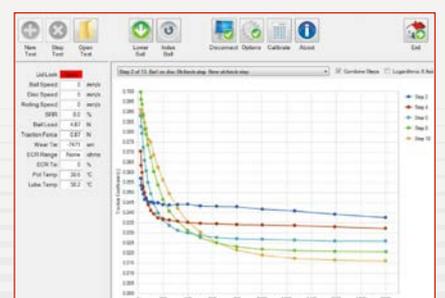
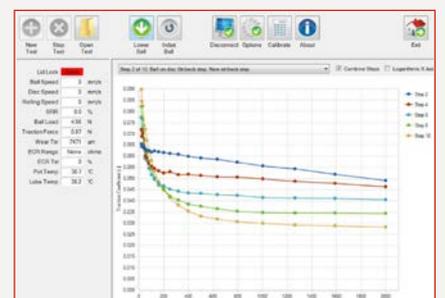
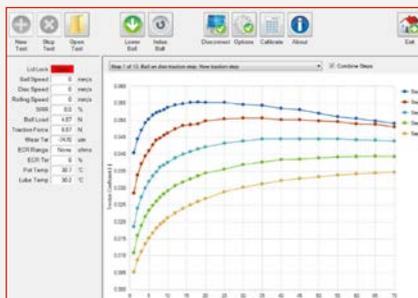


Specimens

The standard ball and disc specimens can be made from almost any combination of materials, including metals, ceramics, polymers, elastomers and coated substrates. The simple specimen geometry and small size means that the specimens are usually sufficiently inexpensive such that they can be treated as single-use.

Results:

Below are screen shots from two traction and two stribeck tests performed on the MTM2 for a mineral oil (top) and a 75W-90 gear oil (bottom). Test conditions: Load 37N (1GPa contact pressure), speed 0-2m/s, slide/roll ratio (SRR) 0-70%, temperature 40, 60, 80, 100, 120°C.



Specimen	Usage
3/4" Ball	Standard conventional specimen
1/2" Ball	Small volume testing (4ml per test). Requires mini-pot option
Low Pressure Barrel	Contact pressures down to 0.31 GPa
O-Ring	Test seal materials
Pin	Wear measurement testing. Requires pin-on-disc option

MTM

Options: 3D SLIM

Due to growing concerns around climate change, increased restrictions are being set regarding phosphorus concentration in engine oils. These restrictions make it more difficult to generate and retain effective antiwear films on lubricated surfaces at a reasonable cost.

The SLIM automatically measures the additive film formation on the upper specimen during the course of a test, allowing comparisons between additive packages to be drawn.

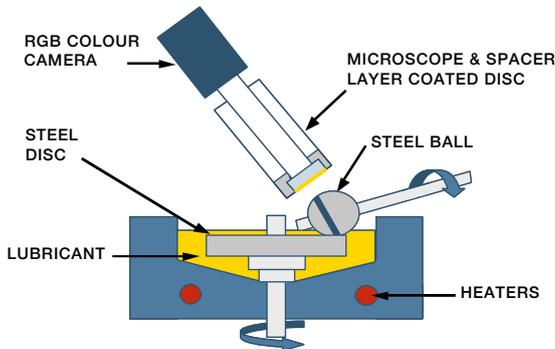
The effect of additive concentration and presence of dispersants on the tribofilm formation can be analysed. Formulators utilise this information to meet the ever changing regulation demands.

When used in tandem with the friction measurement, the instrument provides a full, real time picture of both the chemical and physical effects of the tribofilms.

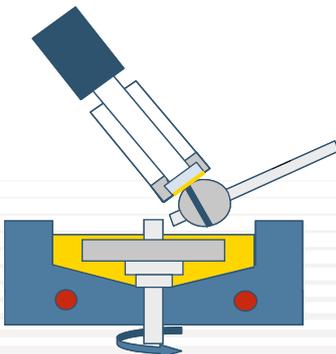
Principle

The upper specimen is loaded against the disc and run under preset conditions for a fixed duration. Periodically throughout the test, the ball is stopped, loaded in reverse against the glass disc and a film thickness map of the complete contact area is captured.

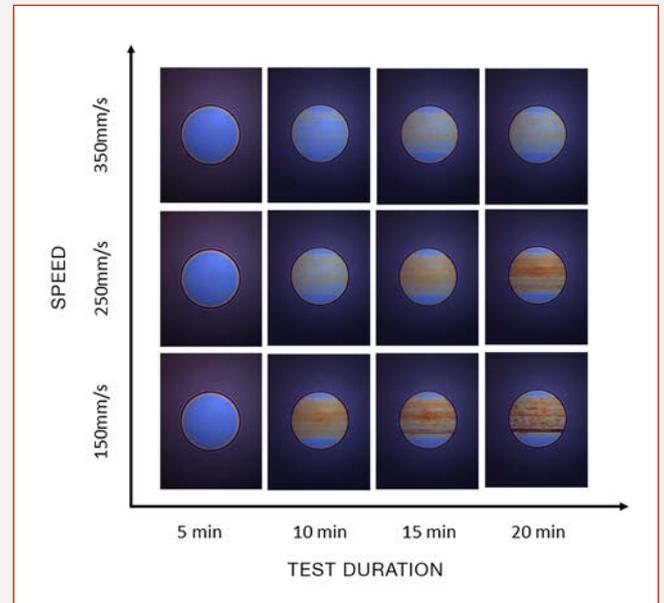
STEP 1: The test ball is run against a steel disc for a pre-defined time



STEP 2: The test ball is reverse loaded against a coated glass disc, an image is captured before the ball is lowered and the test continues

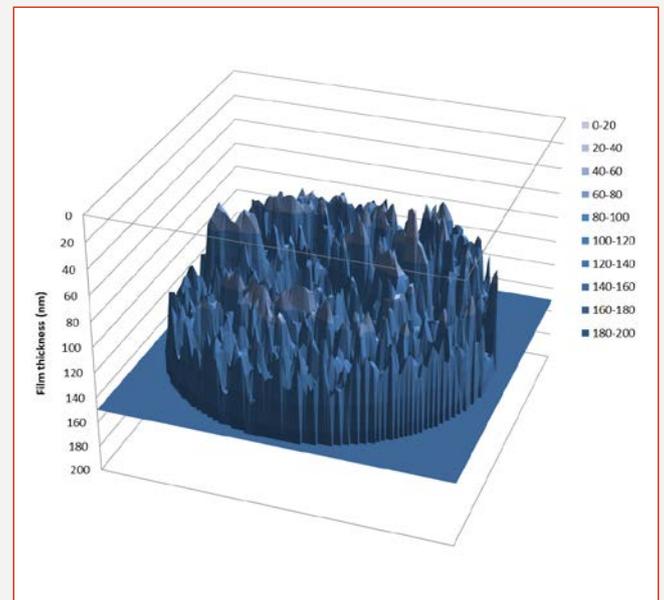


Once the test is completed, the images are analysed using a stand alone program. This program matches colours in the image to the calibration data supplied with the instrument to determine the film thickness at every point in the image up to 250nm. This allows the user to generate a complete film thickness map of the contact area, or point and line measurements of a specific area of interest. The data can be easily transferred into a visualisation package to produce 3D plots of the area.



▲ Effect of rubbing speed against time during an MTM SLIM test

▼ 3D surface map of the contact area



To further expand the capabilities of the MTM, we have developed a wide range of additional accessories. All accessories can be easily retrofitted to the instrument.



Cooler

Automatically switched on during and after a test to rapidly cool the pot, speeding up turn-around between tests and enabling testing at temperatures lower than ambient.



Reciprocating Option

Reciprocating option enables the disc to be driven with a sinusoidal (reciprocating) motion, further expanding the range of contact conditions. Commonly used for simulating the cam and follower interaction.



ECR

The ECR option gives an indication of surface interaction during the test. The disc drive is electrically insulated from the ball and the electrical contact resistance between the two specimens is logged during the test.



Pin-on-Disc

The POD option, substitutes the upper specimen for a fixed pin. This set up is commonly used for wear evaluation. Wear is measured throughout the test using a high precision on-line wear measurement system.



Mini Pot

Allows the sample to remain in a smaller pot during the test, reducing cleaning time and allowing for foreign particles (e.g. sand, soot etc.) to be examined.



Pot Filler

Reduces sample volume from 35ml to 10ml.



Glass Lid

To observe the contact area during testing.



Grease Scoop

Ensures a constant supply of grease through the test, eliminating the possibility of starvation in the contact.



Grease Applicator

Applies a consistent amount of grease onto the disc at twelve evenly distributed points, reducing sample wastage and cleaning time.



Specimen Holder

Brings the MTM specimens into the correct angle for an effortless focus on the contact track / wear scar, speeding up post test analysis.



Thin Load Beam

Enables load between 1 - 8 N to be applied consistently with minimal fluctuation. Commonly used for soft contact applications and clutch testing.

Technical Specification

The MTM2 system comprises a single integrated mechanical and electronic control unit and a PC with data logging software.

Industries

TEST PARAMETERS

Load	0 to 75 N
Contact Pressure	0 to 1.25 GPa (standard specimens) Up to 3.1 GPa with alternative specimens
Speeds	-4 to 4 ms ⁻¹
Temperature Range	Ambient to 150°C (below ambient with optional oil cooler)
Test Sample Volume	35 ml (10 ml with optional pot filler)

CONTROL SYSTEM

PC	Custom software running on Windows 10
Safety Checks	Dual platinum RTD's for temperature measurement, safety lock on reservoir cover
Power Supply	100-240 V, 50/60 Hz, 750 VA

DIMENSIONS & WEIGHT

Weight (Main Unit)	30 kg - 66 lb
Size (h x w x d)	400mm/18in x 400mm/18in x 600mm/24in



For further information or a demo,
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