2017

MICROTEST

MTEM4 Series

Modular Universal Tribometer

MICROTEST, S.A.
Instruments and equipment for material testing
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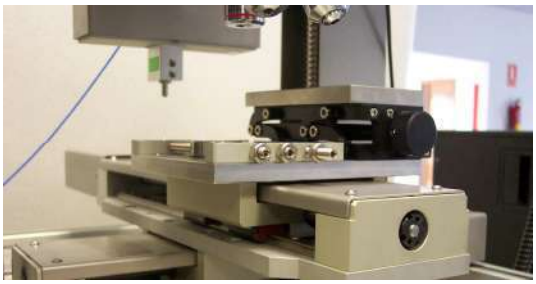
OVERVIEW

Comprehensive testing of machines and equipment, is usually a multilevel and multiscale task, involving the field tests, bench tests, tests of specific units and components, whereas the last would be always subdivided into natural tests of real components and simplified elements, modeling a real tribology contact. On the other hand, versatile tribology systems in various industries are making a scientist, practically in all situations to keep in a mind some friction and wear fundamentals, including the laws of friction, describing physically, chemically and mechanically a real contact between moving solids.

The MICROTEST Universal Tribometer is a modular multi-test equipment fully automatic and computer controlled. It is supplied with its own floor standing bench. The structure is made in steel and the plate bases are in cast and steel to minimize the effect of vibration during tests. The control system includes the personal computer and the installed software. This basic platform of this Universal Tribometer consists of a vertical load frame with a double screw electromechanical assembly driven by a servo DC electric motor. This system is used to apply the controlled vertical load. Depending on the model, normal forces are from 60N to up to 1000N. It includes an optical encoder for a continuous measuring of the crosshead position that allows also the control of the test speed.

Different interchangeable modules and sensors can be adapted to this platform and controlled by computer.

The Four axis motion control system allows the full automation of test sequences by using our Tribotester MT software. Tests are defined by a sequence of steps, each step containing parameters as set-point, number of cycles, speed, data recording rates and alarm level information.



The vertical load is applied by the vertical crosshead (Z axis electromechanical system) and the force is controlled and measured by the vertical load cell in the load carrier.

The system is delivered fully and precisely calibrated with traceable ENAC certificates for the involved quantities, for in situ measurement of friction.

GENERAL FEATURES OF MTEM4/60-1000N

- Computer Controlled vertical displacement and Applied Load.
- High precision four axis motion control electronics.
- High load capacity measurement and control: maximum load from 60N (<0.01N resolution) to 1000N (0.05N resolution)
- Exchangeable high resolution force transducers up to 1000N. Normal force and frictional forces.
- In situ Wear Measurement: high resolution capacitive and inductive probes.
- Lateral displacement carrier unit, computer controlled.
- Computerized Measurement Control.
- Multi-Channel High Speed Acquisition System.
- Programmable alarms and limits.

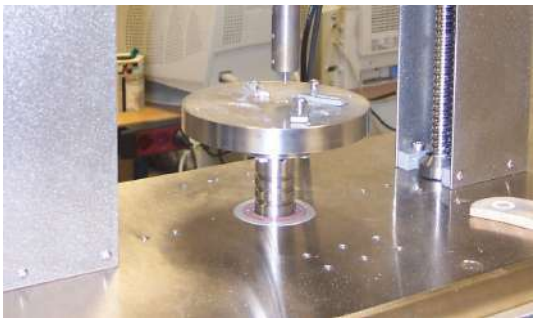
TRIBOMETER MODULES

Easily interchangeable rotary, reciprocating, linear and block on ring drives/stages on same tester. Software should automatically detect the installed configuration:

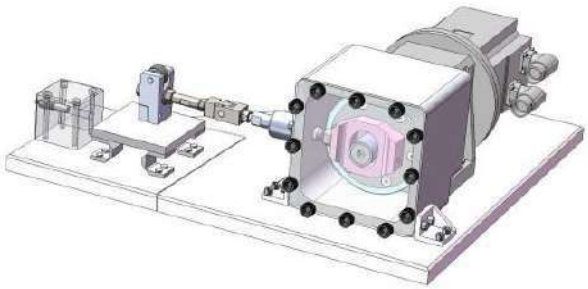
- Rotary Drive Module
- Linear Reciprocating Module
- Linear Drive (Long Stroke)
- Block On Ring Module
- Chamber heating module

ROTARY DRIVE MODULE

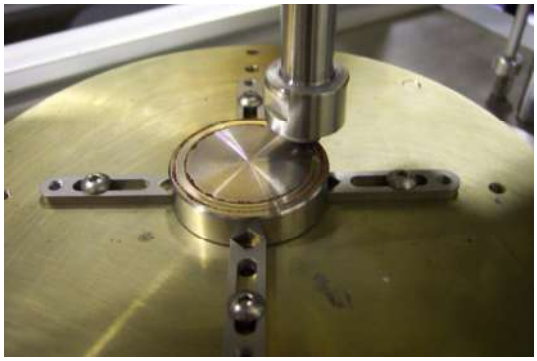
To perform pin on disk, ball on disk, disk on disk, ring on disk and cylinder on disk tests. The rotary module is a stand lone rotary table Dc drive and quickly integrable unit. Additionally to the high speed rotation, this Rotating-Positioning Spindle enables a precise angular positioning. The rotating module is controlled by the 4 axis motion control electronics with the TRIBOTESTER MT software. The software allows the selection of the control commands.



Computer controlled oscillation: The rotation can be clockwise or counterclockwise, as well as cyclic motions, programmed by the user. Rotating speed: from 0.1 rpm to 2000 rpm, or more under request.



The rotating movement can be combined with the lateral X movement (carrier in the platform) to obtain spiral track during tests. The rotation can be clockwise or anticlockwise, as well as cyclic motions, programmed by the user. The system Creation of both concentric and spiral wear tracks is also possible.



LINEAR RECIPROCATING MODULE

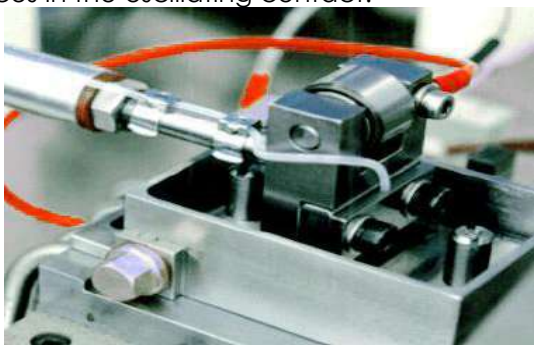
The Fretting/ Reciprocating module is a fast reciprocating unit to perform fretting or reciprocating tests over different sample configurations: pin on plate, ball on plate,

plate on plate, cylinder on plate, fretting tests setups.
This module is an adapted version, to be easily interchangeable, of our MTFR/250/NI unit to be integrated on this multitest platform. The design has been redefined to withstand higher loads than the 250N unit. The unit is a versatile reciprocating unit a maximum stroke of 25mm (others values are possible under request) and maximum load of 500 N for evaluation of lubricants, materials, coatings and surface treatments

LIQUID CONTAINER

Liquid container for reciprocating module: a stainless steel reservoir clamped to a block serves to locate the fixed specimen. Different special inserts are available for mounting specimens according to the standards as well as non standardized specimens. The block can be heated by electrical resistance cartridges and the temperature is monitored by a thermocouple pressed against the side of the specimen or holder. The reservoir can be moved sideways on the heater block so that multiple tests can be performed on one fixed specimen.

The heater block is mounted on flexures, which are stiff in the vertical (loading) direction, but offer limited resistance to horizontal forces. This system is used as a linear flexure bearing for frictionless horizontal guiding. Movement in the horizontal direction is restricted by an additional 500N KISTLER 9217A piezo-electric force transducer, which measures the friction forces in the oscillating contact.



FORCE MEASUREMENT

Force measurement in reciprocating module: the highly sensitive and repeatitive piezoelectric KISTLER 9217A force sensor is used for measuring quasi-static and dynamic friction forces from a few mN upwards. The sensor has a stainless steel sealed case (IP65) and is suitable for this application. The output range is set to match expected friction levels in the contact. The maximum friction level that can be measured is +/- 500 N.

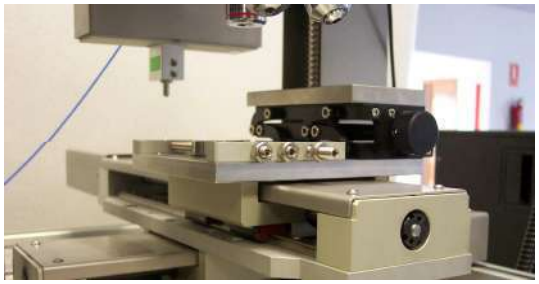
The preloaded, highly sensitive measuring element gives the sensor not only very high rigidity and but also provides a high tolerance to the bending moments.
The vertical load is applied by the vertical crosshead (Z axis electromechanical system) and the force is controlled and measured by the vertical load cell in the load carrier.

LONG STROKE LINEAR DRIVE MODULE

This unit is an easy interchangeable module driven by a servo controlled DC motor to perform long stroke reciprocating, unidirectional tribology and for customized motion tests. Creation of linear and customized wear tracks.
The HDLS unit consists in a linear motorized actuator with a carrier used to place the sample and accessories. The motor incorporates an optical encoder to close the control loop for measuring and controlling the position and the linear speed of the unit.

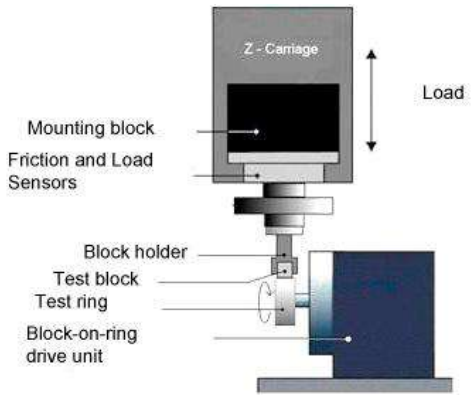
FEATURES

The unit can also be used for long stroke reciprocating up to 200mm stroke. The position and speed of the unit are controlled by the NI four axis motion control electronics via TriboTester MT software. Combined movements from the vertical z axis, lateral x (crosshead) and this y axis, can be obtained by the synchro function.
Tests are defined by a sequence of steps, each step containing parameters as set-point, data recording rates and alarm level information. Set-points may be adjusted by step change or ramp. The test sequence is followed unless interrupted by the operator or an alarm. Set-points may also be adjusted manually using on screen toggles.
Speeds & Forces
HDLS units can drive at speeds in excess of 5m/s if coupled to a suitable drive, but in this case the unit is limited to 15mm/s to have better resolution at lower speeds.



BLOCK ON RING DRIVE UNIT

Block-on-ring module is a stand lone rotary table DC drive and quickly integrable unit. The rotating axis is, in this case, horizontal and perpendicular to the vertical load axis (z). Additionally to the high speed rotation, this Rotating-Positioning Spindle enables a precise angular positioning.

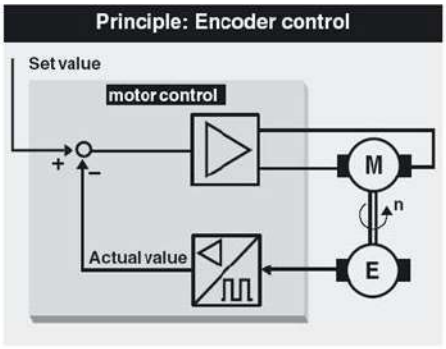


The vertical carriage (crosshead of the platform) applies the vertical force on the block on ring assembly. The friction force is measured by the horizontal component of the 3 axis Kistler sensor. The wear is measured by means of the high-resolution capacitive C30B type sensor (500µm, resolution 0,02µm as the crosshead is moving down to maintain the force constant. The carriage position can also be used to determine wear depth. The module allows for component-level tests of standard Falex and Timken rings, as well as custom rings. Rotating speed rates between 0.1 and 1000 rpm.

MEASUREMENT AND CONTROL SYSTEM

Four axis measurement and control system

Computerized measurement control and acquisition multi-channel system MICROTEST MT4-NI-4002. It has up to 8 input analogue channels and several pulse inputs. In the basic platform, one of these pulse input comes from rotary encoder in the main motor (measurement and control of testing frequency, number of cycles, speed, etc) The other pulse input serves to control the position of the electromechanical normal force system. It also has a signal conditioning for type K thermocouple (sample or environment temperature).



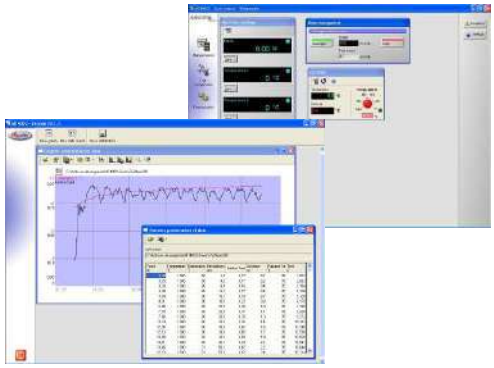
The Four axis motion control system allows the full automation of test sequences by using our TriboTester MT software.

An analogue output for each of the four axis is then used to command: the vertical position and normal load, the horizontal position for pin or ball sample, the rotary speed for the different modules, controlling the rotating speed in the pin on disc system, the frequency in the fretting/reciprocating unit or the speed in the rotary speed of the case of log stroke linear drive.

Closed loops by means of the different sensors: load cell in the case of vertical forces and optical encoder in the rest of cases. The four axis electronic NI controller card is used to generate this signal.

TRIBOTESTER MT SOFTWARE

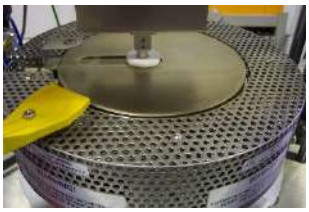
The TRIBOTESTER MT software provides PC based sequence programmable control and data acquisition. Tests are defined by a sequence of steps, each step containing parameters as set-point, number of cycles, speed, data recording rates and alarm level information. Set-points may be adjusted by step change or ramp. The test sequence is followed unless interrupted by the operator or an alarm. Set-points may also be adjusted manually using on screen toggles. Selection of the control commands: frequency, number of cycles, etc. The preset timer built in software stops the machine after a set time. Actually, tests can be defined up to more than 500h. For this purpose, the proposed system includes an uninterruptible power source for the whole tribometer and computer.

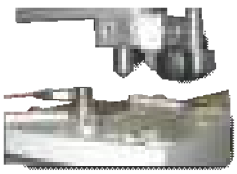


OTHER ELEMENTS AND ACCESORIES

Different instrumentation and measuring systems can be integrated in MTEM4 Tribometers, such as:

- High Temperature module (up to 800ºC or more).
- Acoustic Emission System (AE Option).
- Lubrication System (LUB option).
- Electrical Contact resistance Measurement.
- Wear sensors
- IR Thermal Imaging System.





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