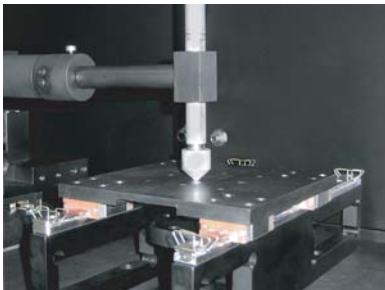
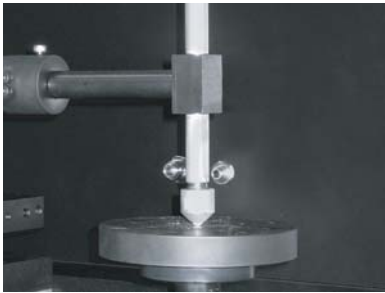


TRIBOMETERS

Wear | Friction Tribology



TRIBOMETERS

* INTRO:

Highly advanced Tribometer offers precise and repeatable wear/friction testing. Designed to allow pin-on-disk (standard) and linear reciprocating (optional) testing on the same system. The highly advanced motor gives an unmatched range of rpm speeds and high position accuracy with a 20bit encoder. The motor can move in both directions opening the door to arc reciprocating testing. Equipped with a self tuning feature to keep system in check through time. System is delivered with speeds from 0.1 to 2000rpm (6000rpm optional). Comes standard with motorized radius control and capability to measure torque variation during testing. Friction force is measured directly with a stiff high resolution load cell.

Plexiglas enclosure with integrated valve allows for controlled environment testing such as inert gases or certain humidity levels. Three high temperature options are available: up to 1000°C oven for the pin-on-disk, 300 °C heating plate for the linear and a 150°C liquid heating module. For high temperature testing, the arm is equipped with a motorized lift that automatically removes weight from sample surface allowing the sample to continue rotating during cool down without further wearing the surface. An RVDT sensor can also be added to measure total wear of ball and sample while tracking wear rate through time.

A full range of optic imaging integration including Video Zoom Camera and 3D Optical Profiler modules are optional for fast and convenient wear analysis. Software automatically calculates wear rate for the samples tested. The 3D Optical Profiler can also be used to measure roughness, dimension, topography and full pre and post test area profile. Software allows users to easily control test parameters including: speed, frequency and test time.

> TRIBOMETERS TESTING

Pin-on-Disk (ASTM G99)

Flat pin or sphere is loaded onto sample with precisely known weight which is applied to a stiff elastic arm. This ensures a nearly fixed contact point providing a stable position in the friction track. Friction coefficient is determined by measuring the deflection of the elastic arm. Wear rates for the pin and the disk are calculated from volume material loss.

Linear Reciprocating (ASTM G133)

Reproduces reciprocating motion typical in real-world mechanisms. Friction coefficient is produced for forward and backward movements of the stroke. This reciprocating technique is very useful for studying static coefficient of friction over time when direction changes. Frequencies up to 120Hz are achievable.

> CONTROLLED ENVIRONMENT TESTING

High Temperature (1000 °C)

Analysis of friction & wear properties at elevated temperatures is becoming increasingly important, as engineers face ever more challenging materials in applications such as the design of advanced fuel efficient combustion engines and power plants. The High Temperature Tribometer's removable heating element enables the rotating disk to reach temperatures up to 800 °C (1000 °C optional), suitable for use in the study of high temperature ceramics, lubricants, oils, additives and self-lubricating materials.



High Temperature (Below 300 °C)

Available for wear testing & friction testing of in-situ conditions, in a range of deposition technologies. This range is also ideal to study polymers just under their melting point.

Liquid Heating Module (Below 150 °C)

Heating coil available to heat liquids to up to 150 °C. This allows temperatures near 37°C which are suitable for bio material studies of wear and friction properties under bodily fluid, such as those found in artificial joint applications. This range of temperatures is also ideal for study of oils.

Humidity Control System

A standard Plexiglas enclosure makes it possible to use specific salt baths to create various humidity atmospheres. A full humidity control system is available for applications requiring a higher level of control. This advanced option makes it possible to accurately control humidity levels, and includes a dehumidification and humidification apparatus in addition to the automatic humidity controller with sensor.

Tri-Mode Lubrication System

System offers the choice of three lubrication modes: 1) Using a low pressure pulverization module, air is compressed and filtered then mixed with liquid to create a uniform spray that can be directed to the appropriate test zone. 2) A drop by drop lubrication with flow control. 3) The soak option performs friction tests and wear tests under fluid in a specialized cup surrounding sample holder, allowing full submersion of the sample.



SPECS	Pin On Disk (Standard)
Maximum Load	40N (60N optional)
Normal Force (Weights)	(1) 1N, (2) 2N, (1) 5N, (1) 10N, (1) 20N
Optional Weights	0.5N and 0.25N
Load Resolution	30mN
Rotational Speed	0.1 to 2000 rpm (6000rpm optional)
Maximum Torque	1270mN.m
Friction Force Maximum	20N (40N optional)
Friction Resolution (noise floor)	0.4mN (for 40N / 0.75mN)
X Motorized table for radius computer controlled	50mm
Maximum speed of X radius Motorized Table	0 to 5mm/s
Resolution of X radius position	2.5microns
Instrument Dimension	60 x 38 x 74 cm
Weight Approx.	67kg
Disk Size	80mm (Additional sizes optional)
Partner Geometry & Size	Pin, Ball or Plate (Variable Size Optional)
LINEAR RECIPROCATING (Optional)	
Linear Speed	Up to 100mm/s
Stroke Length (Amplitude)	0-35mm
Frequency at full stroke	2Hz
Frequency maximum	40Hz and up to 120Hz at 6000rpm
TRI MODE LUBRICATION MODULE (Optional)	
Pulverization Module – Liquid Consumption	60 – 90 cm ³ /hour
Drop Count Reservoir	120ml
Liquid Container	Included
HIGH TEMPERATURE (Optional)	
Oven Temperature (Pin On Disk)	800°C or 1000°C
Heating Plate (Linear Reciprocating)	300°C
Liquid Heating Module	150°C
Resolution	1°C
LVDT Depth (Optional)	
Maximum Displacement	1mm
Resolution (Noise Floor)	1µm
Electrical Resistance Contact Detector (Optional)	
Maximum resistance	0 to 1000 Ohms

> ENHANCED TESTING

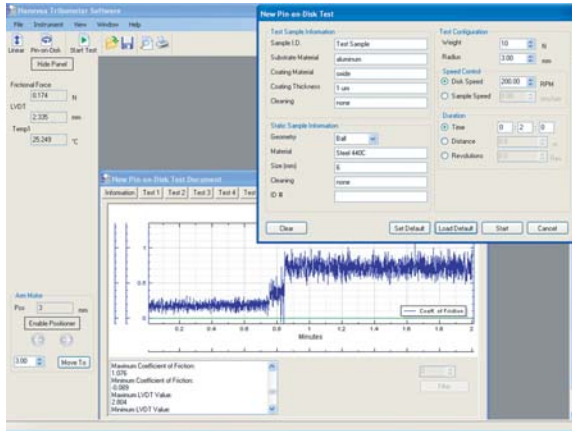
Electrical Resistance Contact Detector

Detects the first sign of substrate exposure by measuring the electrical contact resistance during wear and friction test. Critical in cases where an insulating coating is on top of a conductive substrate directed to the appropriate test zone.

} See Additional Brochures:
Optics, Software and Applications }

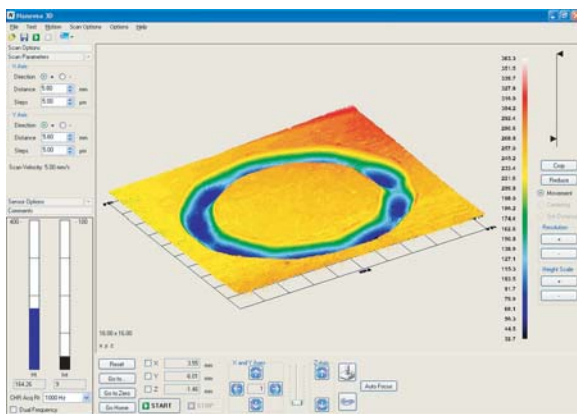
TRIBOMETERS SOFTWARE

> SOFTWARE



Tribometer Wear/Friction Software

Real-time display of coefficient of friction, temperature, depth and pin-substrate electrical contact. Includes a complete set of features for setting up the Tribometer and analyzing wear and friction data. Wear rates calculation of ball and disk from profile directly from profiles. Coefficient of friction average, maximum and minimum. Data exportable in CSV format for Excel. Filtering of data, graph manipulations, test parameters & information editing. Automated motorized positioning of radius of test. High temperature furnace control and ON-OFF lubrication control. Automatic switch off at friction threshold. Fix cycle view for friction coefficient at fixed position along the wear track. Selectable time or cycle zone for specific average friction coefficient. Integrated optical view from zoom video and 3D profiling from white light optical pen with automatic positioning on wear track.



3D Mechanical Software

The 3D Mechanical Software is a complete software package for scanning using the integrated non-contact profiling sensor. User friendly ability to scan specified areas of interest or a single profile. Creates 3D representation of the scan. Quick analysis of roughness, critical dimensions, topography and full pre and post test area profile. Zoom Functions. Data export in ASCII format & Mountain analysis software. Analyze surface distance and height. Allows user to compare scan with optical microscope observation.



TRIBOMETERS APPLICATIONS

> APPLICATIONS

Solar

- Film
- Glass
- Panel

Semiconductor Technology

- Passivation Layers
- Metallizations
- Bond Pads

Pharmacological

- Tablets, Pills
- Implants
- Biological Tissue

General Engineering

- Rubber Resistance
- Touch Screens & Coatings

Wear Resistance Coatings

- TiN, TiC, DLC
- Cutting Tools

Optical Components

- Contact Lenses
- Eye Glass Lenses
- Fiber Optics
- Optical Scratch Resist

MEMS

- MicroElectroMechanical Systems

Mass Storage

- Coating on Magnetic Disks
- Coatings on Disk Substrates
- Protective Coatings on CDs

Automotive

- Paints & Polymers
- Varnishes & Finishes
- Windows

Decorative Coatings

- Evaporated Metal Coatings

+ STANDARDS

Wear/Friction Testing

- ASTM G99
- ASTM G133