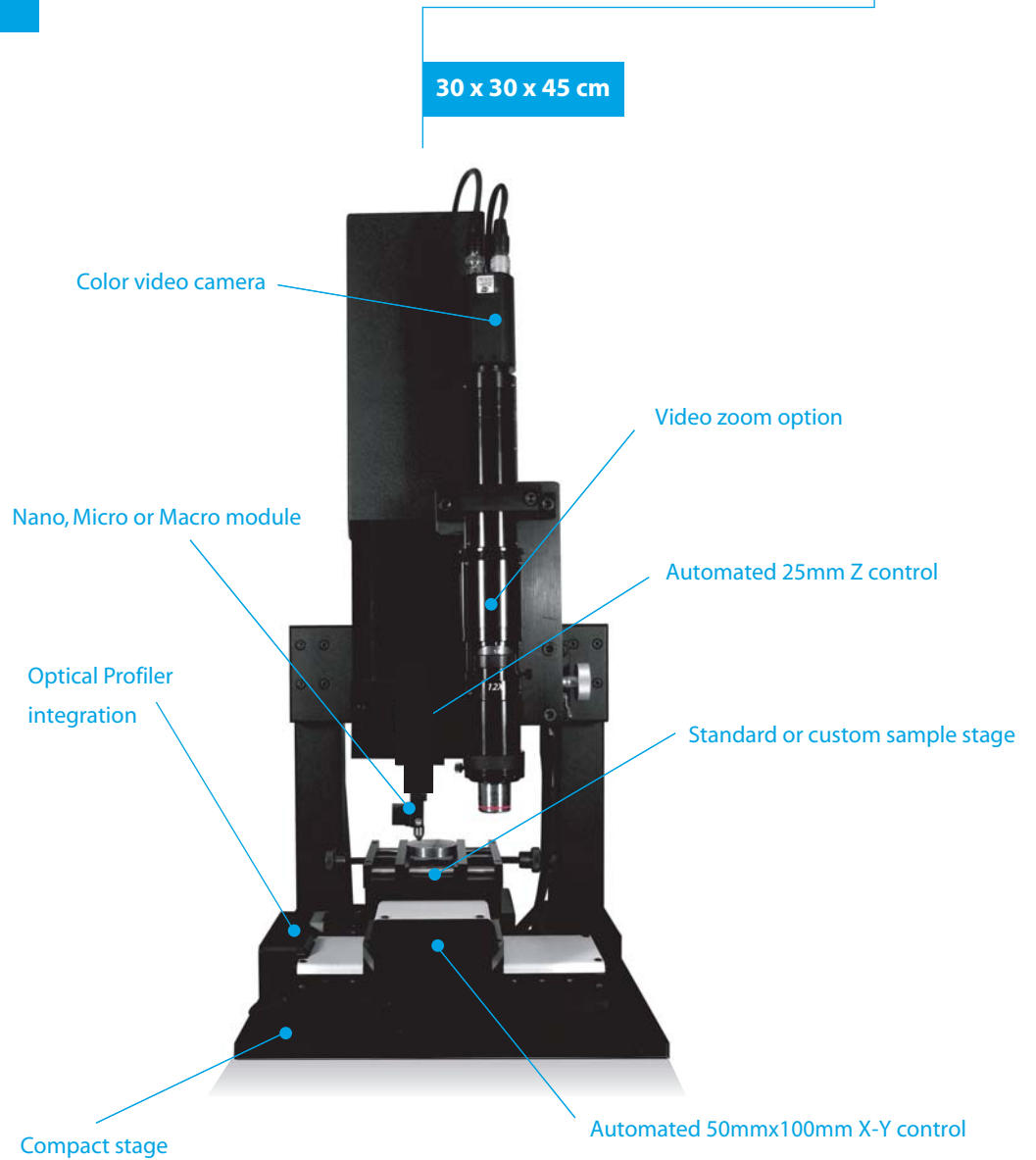# NANOVEA®

A Better Measure.

Nanovea Mechanical Testers provide unmatched multi-function Nano, Micro and Macro modules on a single platform. Each module includes indentation, scratch and wear tester modes providing the widest range of testing available on a single module. The modules use independent force & depth sensors to obtain depth vs load curves during indentation; plastic and elastic deformation during scratch; and friction coefficient and wear rate during linear or rotational wear testing. Additionally, force feedback loops insure quick and accurate load control during testing. It is the ideal solution for determining the full range of mechanical properties of (soft or hard, thin or thick) coatings, substrates and particles. Applications range from low loads to measure hardness and elastic modulus of biomaterials to high loads required to test the fracture toughness of protective glass. Both the Platform and Compact Base have been designed to be user friendly and versatile to allow a complete range of testing. In addition to a powerful microscope, several other optical imaging solutions are available including a 3D noncontact profiler and an AFM for 3D imaging. Multiple automated functions have been integrated for easy use in quality control applications.

The Compact Base allows a single module, either the nano, micro or macro, each with the full range of testing modes including hardness, scratch and wear. It is equipped with automated 50mm x 100mm X-Y stages and a 25mm Z stage. A video zoom camera can be combined with an optional 3D Optical Profiler. Ideal solution for budget limitations and small research facilities.

Compact Base

30 x 30 x 45 cm

Compact Modules

Nano

Micro or Macro

Color video camera

Video zoom option

Nano, Micro or Macro module

Automated 25mm Z control

Optical Profiler integration

Standard or custom sample stage

Compact stage

Automated 50mmx100mm X-Y control

The Platform Base allows up to two modules on a single system providing the widest testing capability available. Equipped with 150mm X-Y stages and a 50mm Z motorized stage. A gas-spring slide allows adjusting height clearance up to a total of 140mm for varying sample sizes. An optional rotational stage is available for long term wear testing. In addition to the full video microscope, an AFM and an Optical Profiler are optional. Further customizations are possible. The Platform is the ideal option for diverse and expanding measurement needs.
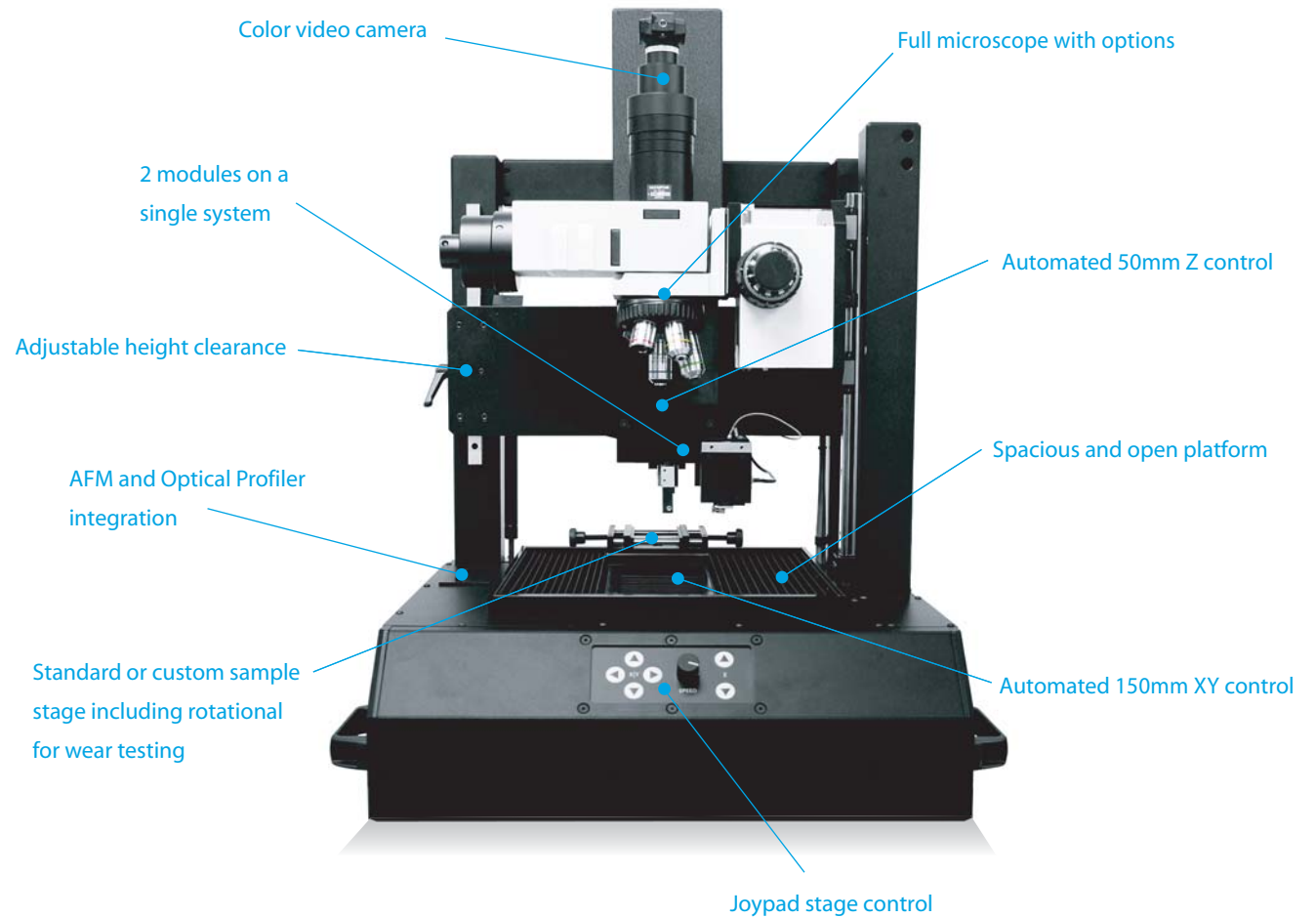
Platform Base

52 x 56 x 86 cm

Platform Modules

Nano

Micro or Macro

Color video camera

Full microscope with options

2 modules on a single system

Automated 50mm Z control

Adjustable height clearance

Spacious and open platform

AFM and Optical Profiler integration

Standard or custom sample stage including rotational for wear testing

Automated 150mm XY control

Joypad stage control
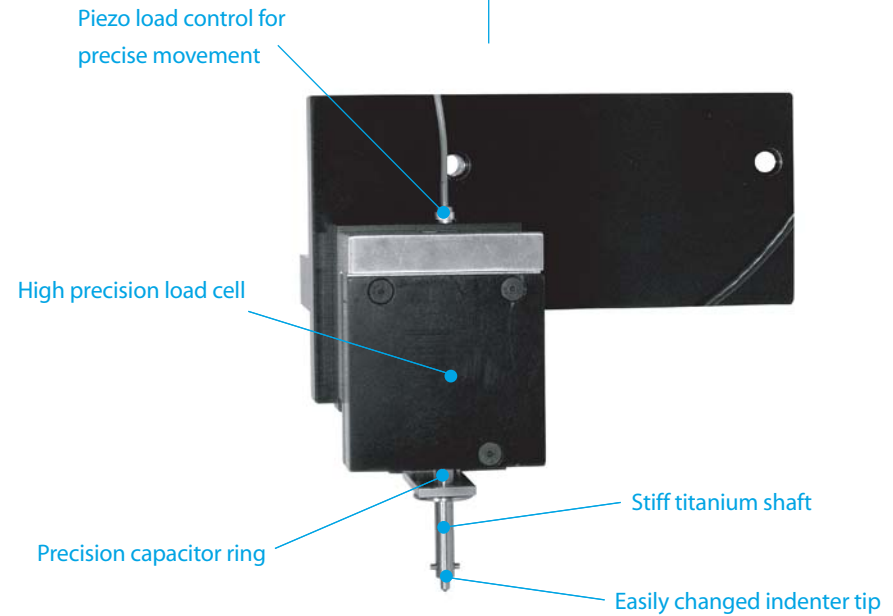
The Nano Module, retrofitted on Platform or Compact bases, offers nanometer range during nano indentation, scratch and wear tester modes. The Nano Module has been designed with independent force (precision load cell) and depth (precision capacitive) sensors which are separately calibrated and continuously record data. This combined with a piezo-electric stage allows quick force feedback providing precise and accurate load control during indentation, scratch and wear testing. This is ideal to accurately characterize thin films such as DLC overcoats on hard disk or to analyze thin polymer/plastic materials such as the ones found in the solar or optical lens industries. Another highly demanded application is the scratch marr testing of varnish clear coats such as those used in the automotive industry among many others.

Nano Module

Piezo load control for precise movement

High precision load cell

Stiff titanium shaft

Precision capacitor ring

Easily changed indenter tip

Nano Modes

| Nanoindentation | Scratch Adhesion | Wear Friction |

Properties Analyzed:
• Hardness • Elastic modulus • Creep • Stress-Strain • Fracture Toughness • Yield Strength • Compression • Fatigue • Puncture Resistance • Bend and many others possible.

Properties Analyzed
• Cohesive & Adhesive Failure • Adhesion Strength • Marring & Cracking • Plastic & Elastic deformation and many others possible.

Properties Analyzed:
• Friction Coefficient • Wear Rates and many others possible.

The Micro or Macro Module, retrofitted on Platform or Compact bases, provides loads from the mN to 200N range during indentation, scratch and wear tester modes. The Micro and Macro Module use independent force and depth sensors in combination with true load feedback providing precise control during indentation, scratch and wear testing. Contrary to competitors using LVDT sensors attached to a mechanical arm that must touch the surface to obtain useful data, Nanovea's Micro and Macro technology use an optical white light sensor (US Patent #8,281,648B2) directly connected to the diamond mounting which directly measures the depth of the diamond. This technique, which can be used also during scratch and wear testing, allows faster tests and eliminates depth errors caused by surface irregularities. The Optical sensor also performs as a full 3D non contact profiling tool which provides 3D measurement of indentation, scratch and wear track. The macro loads are ideal for testing hard coatings such as the ones used in the tooling industry. The more sensitive loads of the micro range are ideal for the characterization of industrial coatings; ranging from plasma processed layers used in semiconductor and optical technology, to decorative and protective coatings used for automotive and aerospace parts.

Micro & Macro Module

Load control by precision Z motor with encoder

Coarse adjustment for depth
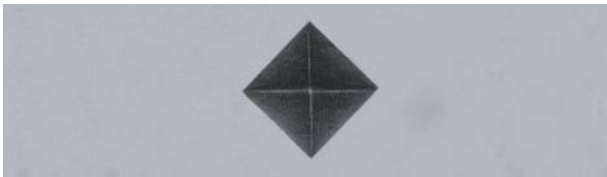
Precision load cell

Easily changed indenter tip

White light sensor for patented direct depth & surface measurement
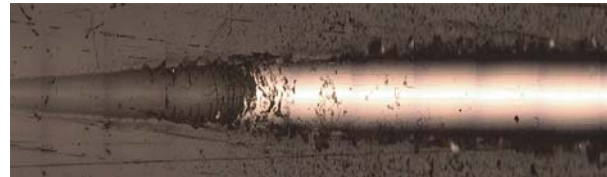
Micro & Macro Modes

| Microindentation | Scratch Adhesion | Wear Friction |

Properties Analyzed:
• Hardness • Elastic modulus • Creep • Stress-Strain • Fracture Toughness • Yield Strength • Compression • Fatigue • Puncture Resistance • Bend and many others possible.

Properties Analyzed
• Cohesive & Adhesive Failure • Adhesion Strength • Marring & Cracking • Plastic & Elastic deformation and many others possible.
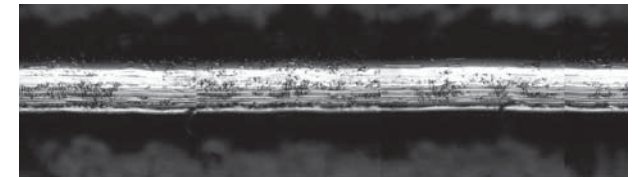
Properties Analyzed:
• Friction Coefficient • Wear Rates and many others possible.

Optics

AFM | The AFM system provides three-dimensional data at higher lateral and vertical resolution than what Optical Profiler white light technology can provide. AFM measurements are non-destructive and require no sample preparation. The AFM has been designed with ease of use in mind with the easiest probe exchange on the market. The AFM is mounted separately from the microscope on a rigid base which allows for better stability.

3D Optical Profiler | To precisely measure scratch, indentation and wear results, a full non-contact optical profiler can be integrated on the Mechanical Tester. It can also be used for roughness, dimensions and many other surface topography studies. Measure any material: transparent, opaque, specular, diffusive, polished, rough and high angled surfaces. Ideal solution when combined mechanical and non contact surface measurements are needed. This is included when the depth sensor is purchased with the Micro or Macro module.

Video Zoom Imaging | The Video Microscope is available for the compact base. The system is offset to the indenter with a calibrated distance for precise repositioning from one to the other. 12X Ultra zoom Lens with coax lighting & detent. Color Video Camera (PAL 1200x1600). 5X objective for total video magnification of 1X to 100X. Objectives up to 100x available for maximum magnification of 2000X.

Microscope Imaging | Available on the Platform base with similar functions to the Video Zoom Camera. The Microscope Turret allows the full capability of a microscope with options such as polarizer and analyzer slides. The Microscope Turret can be equipped up to 5 microscope objectives ranging from 5x to 100x, and provides an overall total magnification of up to 4000x. The Microscope Turret provides high level detail needed to resolve small features on any surface. Available Objectives = 5x, 10x, 20x, 50x, 100x.
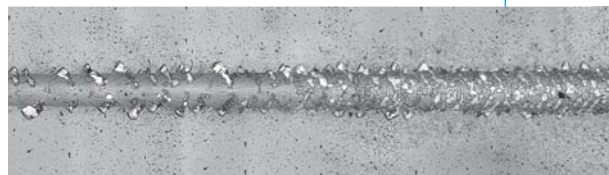
AFM

3D Profiler
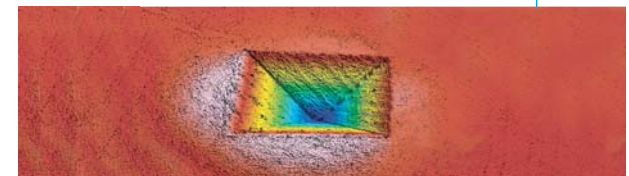
Microscope

Video Zoom

The powerful indentation software offers ASTM E2546 and also Martens method of analysis. User-friendly software with real-time display of depth versus load curves and calculation of hardness & elastic modulus. Automatic data averaging. Holding of the maximum load or depth constant over time for Creep data plotted separately on depth versus time graph. . Easily save and export images from color camera (JPEG). Full range of calculation including indentation, plastic work, flow stress, plastic & elastic energy. Automated multi-sample testing. Mapping and precise positioning of each indent with microscope. Data export in ASCII format. Sinus mode analysis (DMA) for viscoelastic properties. Multi cycle with increasing load for hardness and elastic modulus versus depth. Multi-cycle constant load for fatigue test and Yield Strength calculation from flat tip measurement. Automatic report for easy printing. User Channel (optional). Latest Windows OS software and free software updates.

Indentation Software

Organized filing for multiple tests

Depth vs. load curve
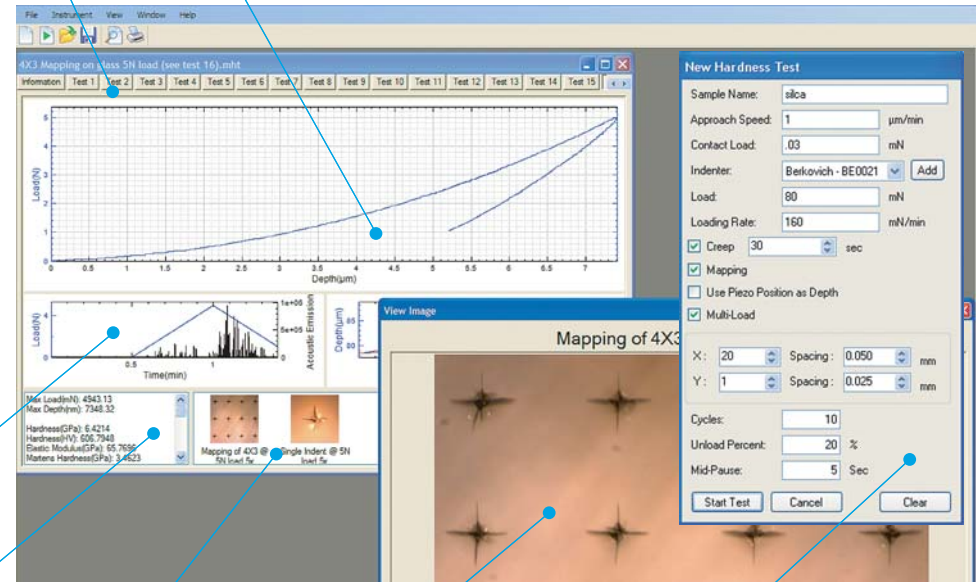
Load vs. time with Acoustic Emissions
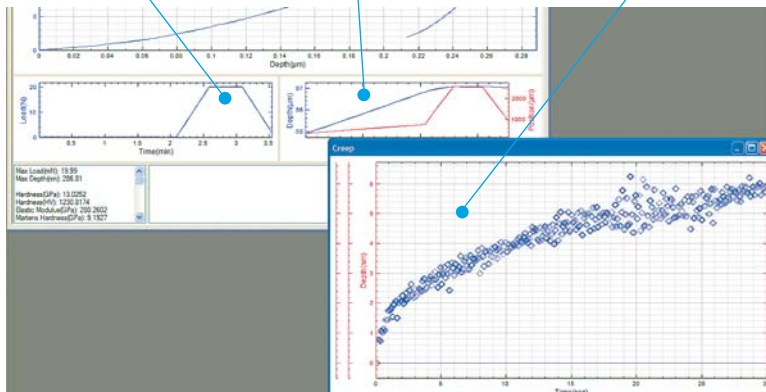
Results data

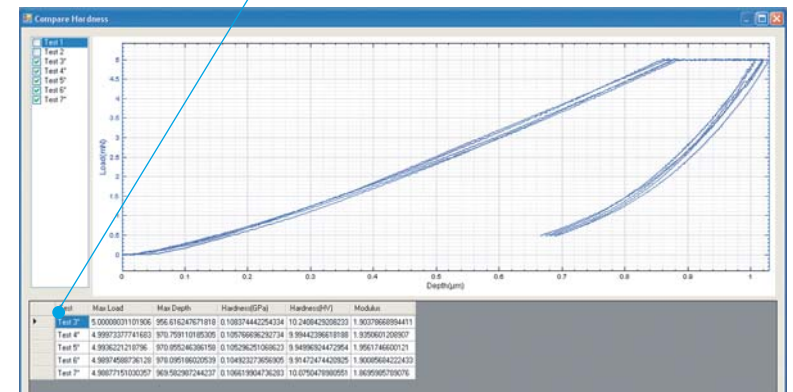Saved image files

Live image preview

Test Parameters

Constant loading for creep

Depth vs. time

Creep vs. time

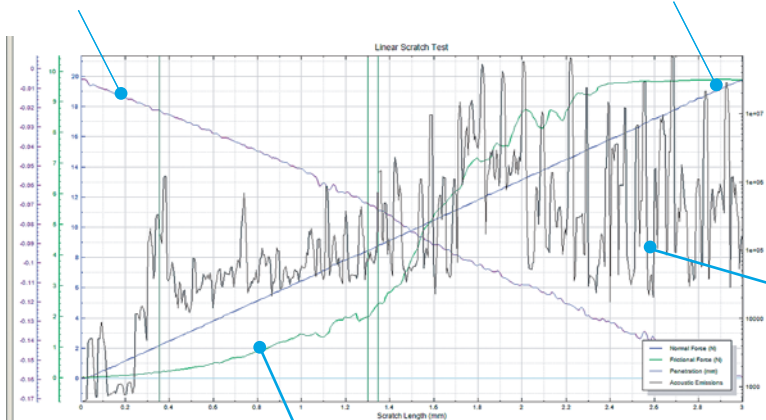Quick comparative analysis of multiple tests

A complete software package for controlling scratch test parameters such as speed, loading rate and scratch length, as well as easy analysis of test results for both constant and progressive loads scratch testing. Real-time display of all data during the test. Pre and post profile scans for the study of plastic and elastic deformations. Advanced panoramic view of the full scratch. All associated data acquired including load displayed on picture for easy identification of location and conditions at this specific point. Multi-pass scratch testing for the characterization of wear properties. Mapping of scratches and automatic multi samples testing. User-friendly software with multiple functions including easy zoom, critical load lookup table, report printing and data export (Jpeg and ASCII). User channel available. Latest Windows OS software and free software updates.
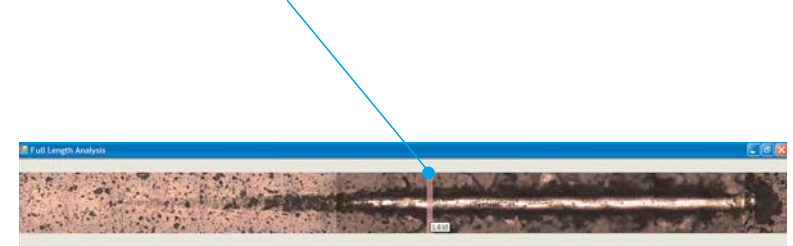
Scratch Software

Live image

Results data

Test Parameters
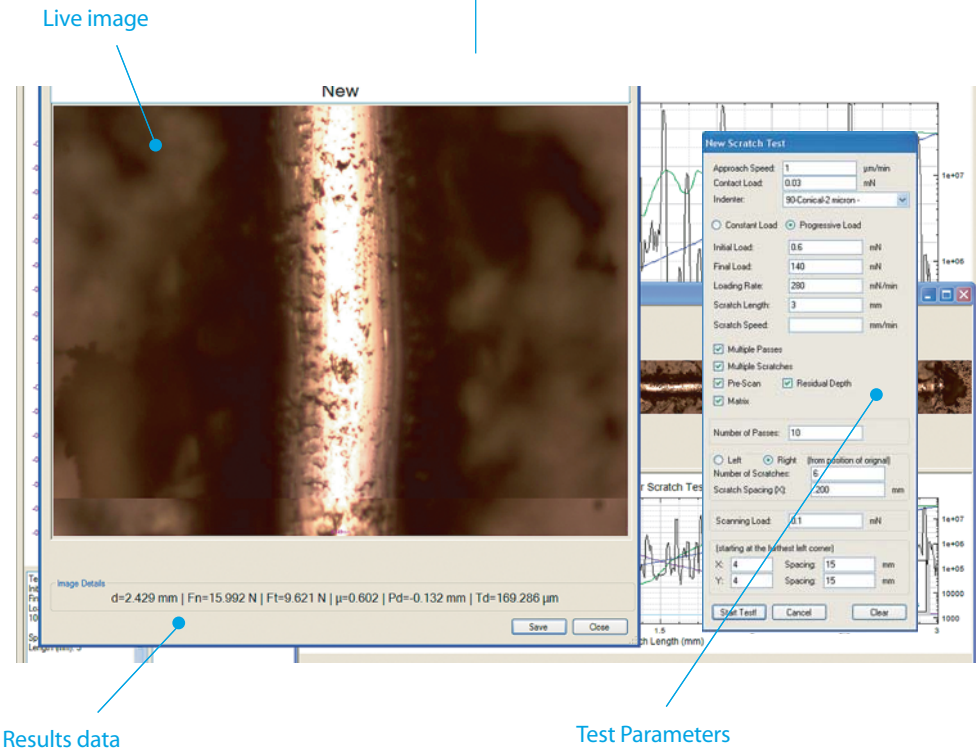
Depth (residual, profile & penetration)

Load curve

Panoramic preview with single data point and image selection.

Acoustic Emissions
(log or linear scale)

Friction force with coefficient of friction

3D Mechanical Software

The 3D Mechanical Software is the acquisition software used with optical profiler integration. User friendly ability to scan specified areas of interest or a single profile of indent, scratch or wear track. Scan can be compared with optical microscope observation. The software provides three different views in real-time: 3D false color, 2D false color and 2D analysis of roughness, step height and area. Zoom Functions. Data export in ASCII format & Mountain analysis software is available for extended surface analysis capability.
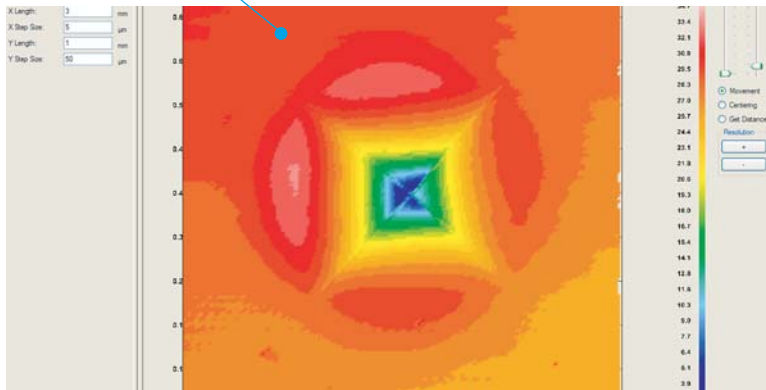

User defined scan parameters

3D false color

Height scale
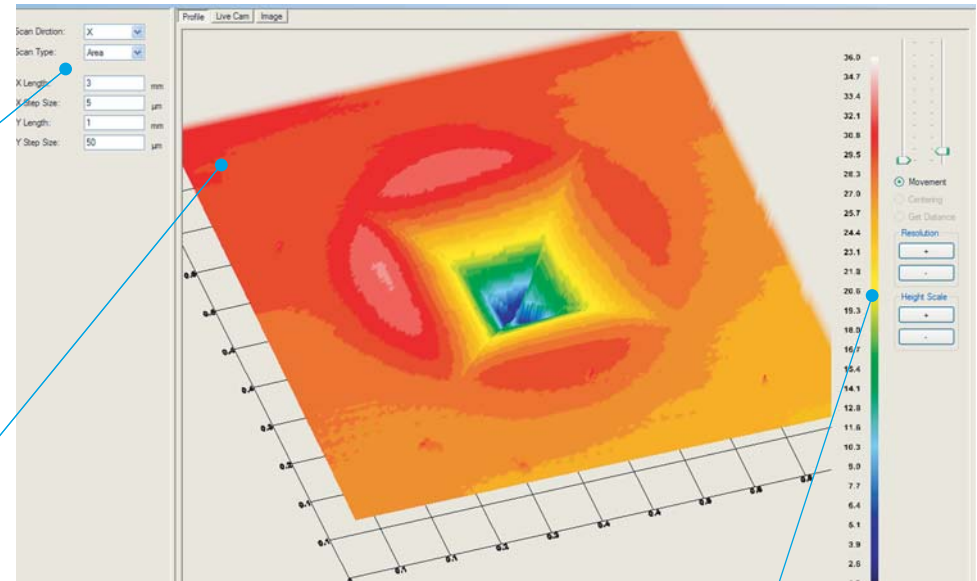
2D false color

2D preview with roughness, step height and area capability

The Wear & Friction Software includes a complete set of features for analyzing wear and friction data. Real-time display of Coefficient of friction and wear depth during linear and wear depth during rotational testing. Data export in CSV format for Excel. Data filtering. Graph manipulations. Test parameters & information editing. Note saving.
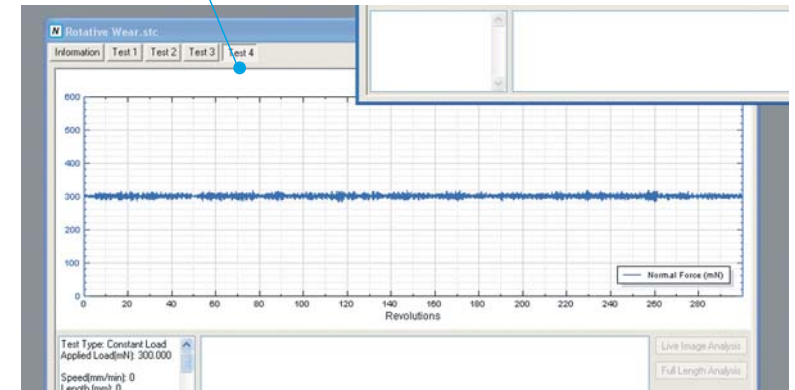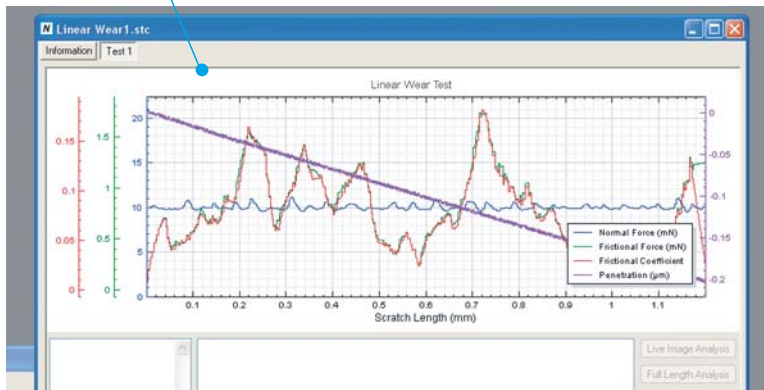
Wear|Friction Software

Rotational and linear wear option

Organized filing
for multiple tests
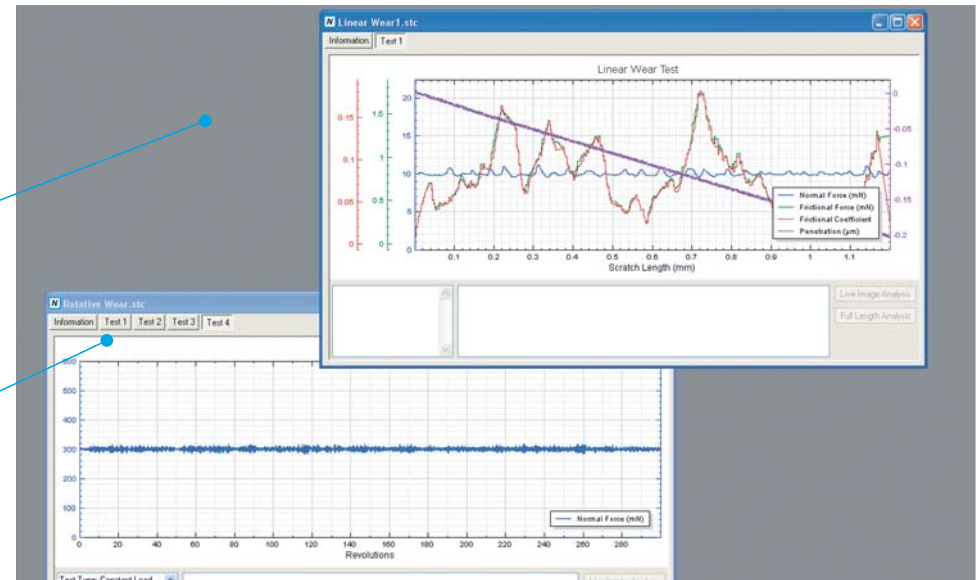
Linear wear graph including depth, load, friction force

Rotational wear graph including depth of wear

BASE	PLATFORM	COMPACT
X & Y Motorized Stages	150 mm x150mm	100 mm x 50 mm
X, Y Lateral Resolution with encoder	0.01 μm	0.4 μm
X,Y Lateral Accuracy	0.25 μm	1 μm
Z Maximum Clearance	140 mm	40mm
Z Motorized Approach (range)	50 mm	25 mm
Max Scratch Speed	240 mm/s	240 mm/s
Scratch Length w/Visual Inspection	90mm	25mm
Base Dimensions	52 x 56 x 86 cm	30 x 30 x 45 cm
Max Sample Size with custom holder	Up to 300mm	Up to 100mm
Optics with 1600x1200 Camera	Full Microscope	Zoom Video Imaging
Optical Profiler	Optional	Optional
AFM	Optional	N/A

MODULE	NANO	MICRO	MACRO
Load Range	400mN / 2000mN	0.05 - 40N	0.3 - 200N
Load Resolution (Theoretical)	0.03μN / 0.15μN	0.6mN	3.1mN
Load Resolution (Noise Floor)	1.5μN / 7.5μN	0.75 mN	3.5 mN
Depth Range	50μm / 250μm	100μm	300μm
Depth Resolution (Theoretical)	0.003nm / 0.02nm	2.5nm	8.0nm
Depth Resolution (Noise Floor)	0.4nm / 1.2nm	2.5nm	8nm
Friction Force Max	400mN	40N	200N
Friction Resolution (Noise Floor)	7μN	2mN	8mN
Sinus Mode Analysis (DMA)	Up to 20Hz	N/A	N/A

*Nanovea believes that listing only theoretical resolution is deceiving and often leads to resolutions that are physically impossible (such as depth resolution listed as low as 0.001nm (1/100 of the size of an atom) For clarity, Nanovea lists both the "theoretical" and "noise floor" resolutions. Noise floor is defined as the actual RMA noise in a standard laboratory environment on the signal measured which is directly related to the quality of the data. *Actual On-site performance will vary based on environmental conditions. *Specifications may change, please contact Nanovea for clarification.