NT-MDT
INTEGRATED SOLUTIONS FOR NANOTECHNOLOGY

SOLVER platform

SOLVER NEXT

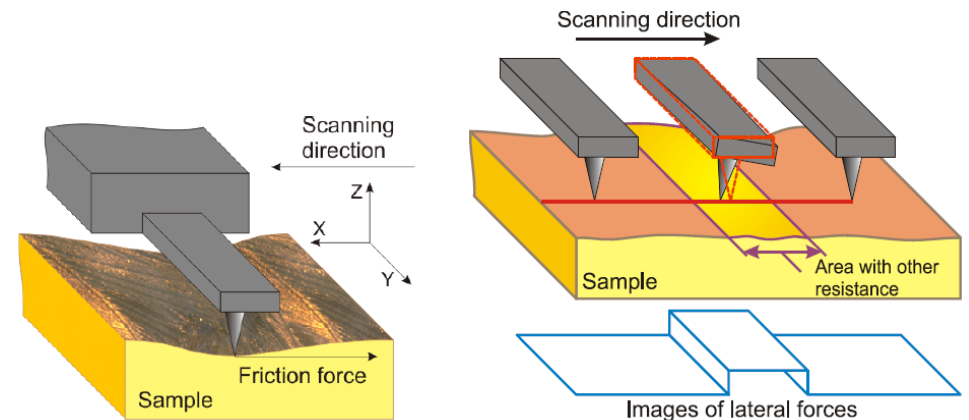**Instruction Manual**

www.ntmdt.com

Solver Next II atomic force microscope (AFM)

SOLVER NEXT is a multifunctional Scanning Probe Microscope of general purpose. It is a state-of-the-art instrument with highly automated operations. Its digital controller enables a wide range of SPM techniques. Automatic adjustment of cantilever deflections detection provides ease-of-operation even for an unexperienced user.

The key distinction of the SOLVER NEXT SPM from its analogues is availability of two built-in measuring heads (AFM and STM) that are automatically adjusted to their working position.

Besides, the design of the instrument provides insertion of auxiliary measuring heads. Currently, the kit of available auxiliary heads includes those for liquid and nanosclerometric measurements. The sample can be heated up to 150 °C with the use of the mountable heating stage. Focusing and zooming of the built-in optical videomicroscope are motorized. Selection of the scan area is motorized as well.

The Lateral Force Microscopy is based on the following physical ground.
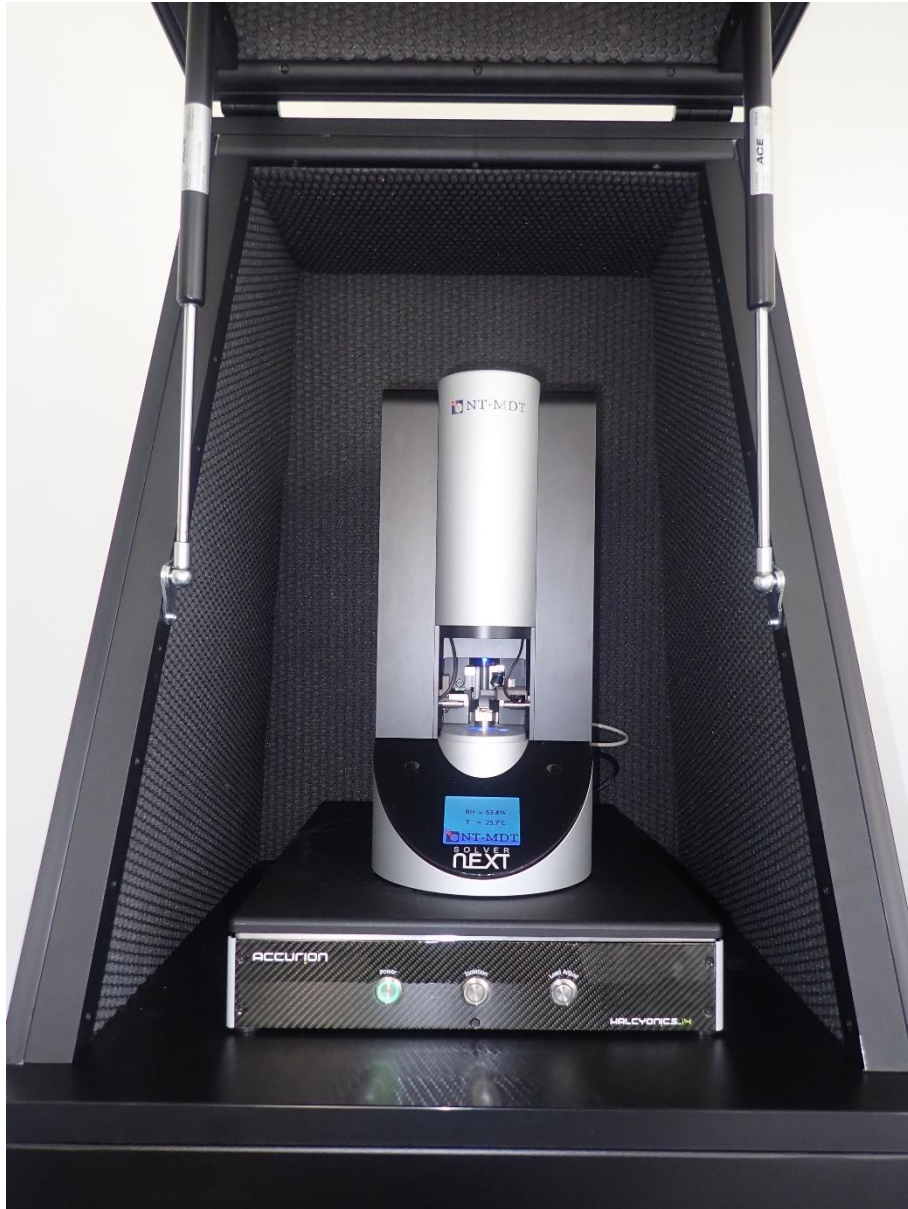
Solver Next II atomic force microscope (AFM)

Acoustic noise insulation

microscope control units

Atomic force microscope

screen keyboard mouse

Active vibration isolation kit

heavy-duty table

transport-pelicase

Computer

Vintage 2015
Original price: 139.000 €
- 125.000 € (AFM)
- 14.250 € (Acoustic noise insulation, Active vibration insulation kit and heavy duty table)

Solver Next II atomic force microscope (AFM)

ACCURION
solutions for science

HALCYONICS_i4

ACTIVE VIBRATION ISOLATION
DESKTOP UNIT

Solver Next II atomic force microscope (AFM)

Technical data

Measuring system	
Measuring heads	AFM and STM (stationary, automatically interchangeable); liquid AFM, and nanosclerometer head (removable, with manual insertion)
Available SPM modes	AFM, STM, nanosclerometry in air environment AFM in liquid environment
System of cantilever deflection registration	automated alignment
Sample	
Size	up to 20 mm in diameter, up to 10 mm in height
Sample weight	up to 40 g
Temperature control	from RT up to 150 °C
Scanning system	
Type of scanning	by sample
Scanning area	100x100x10 um (with feedback sensors) 3x3x2 um in the high resolution mode
Nonlinearity, XY	0.1 % (with feedback sensors)
Resolution	
Noise XY	less than 0.3 nm (with feedback sensors)
Noise level Z (RMS in the band of 10 -1000 Hz)	0.03 nm (typically) with feedback sensors 0.02 nm in the high resolution mode
System of sample positioning	
Method	automated, video monitored
Range, XY	5x5 mm
Min. step	0.3 um
Video monitoring system	
Resolution	2 um
Focus	motorized
Zoom	continuous
Overall dimensions and weight	
Sizing	470x210x260 mm
Weight	25 kg

Solver Next II atomic force microscope (AFM)

Measuring techniques

Coupled with the PX Ultra controller and newest Nova PX data processing software, NEXT realizes the largest suite of AFM and STM techniques both for beginner and advanced users. NEXT provides 60+ modes and techniques in basic configuration.

Advanced control electronics

Powerful and flexible PX Ultra controller allows high-quality AFM operations with small deflection noise (~25 fm/√Hz), low-noise high voltage drive (noise < 1 mV/600 V) and multi-frequency measurements with five lock-in amplifiers.

Easy-to-use and flexible software

Nova PX software contains predefined settings and smart algorithms for fast configuration of the NEXT operation in all advanced modes. Along with fast configuration Nova PX software allows researchers to have unlimited experiment flexibility.

Topography measurements

Contact AFM and AM-AFM (semicontact and non-contact modes) are available for topography measurements with the option of viewing several relevant signals.

Curves analysis

Analysis of data curves of various nature (distance relations of force, amplitude, frequency, phase, or current, as well as bias voltage relations of force or current) supplies a vast amount of diverse information on the sample.

Electrical studies

NEXT offers a wide variety of electric measurement techniques, including Electrostatic force microscopy with amplitude and frequency modulation, Kelvin probe force microscopy with amplitude or phase modulation, measurement of dC/dZ and dC/dV relations, quantitative probing of dielectric properties and Spreading resistance imaging.

STM measurements

STM measurements can be performed in the modes of constant current or of constant height. STM spectroscopy provides relations I(V), I(Z), dI/dV, and dI/dZ.

Magnetic properties

For MFM measurements, the two-pass mode with tracking the sample surface topography and the mode of constant height in the scanner coordinate frame are implemented.

Nanomechanics

NEXT allows much room for material research by its nanosclerometry feature. Quantitative measurements of hardness and Young modulus are available with Berkovich-type probes and commercial AFM cantilevers depending on the properties of the sample.

Solver Next II atomic force microscope (AFM)

Ultimate automation

Atomic Force Microscope NEXT provides motorized sample positioning and integrated high resolution optical microscope positioning, motorized continuous zoom and focusing of the optical microscope. But AFM automation is more than just motorization. Powerful Nova PX software algorithms remove a gap between optics and AFM providing continuous zoom from huge panoramic optical view down to atomic resolution.

Since all step movers are coupled together with the optical image, NEXT provides autofocus, fast one-click cantilever alignment, panoramic optical view and multiple scanning on 5×5 mm range.

Automation features

- Cantilever recognition and automatic laser alignment both in liquid and air
- Autofocus
- Panoramic optical field of view up to 7×7mm with 2um resolution
- Point-and-click motorized precise sample positioning
- Gentle engagement procedure and automatic feedback loop adjustment

- Automated MultiScan™ routine on 5x5mm range with stitching of overlapping scans
- 100s of scans per day automatically
- Automatic software configuration for all advanced modes
- 3D mouse for controlling sample stage and optical microscope step movers

Solver Next II atomic force microscope (AFM)

Applications

With its wide variety of techniques and modes of probe measurements, the NEXT measurement complex is applicable for many challenges in science and technology. Scanning with atomic resolution that by NEXT can offer is of high demand in physicochemical research of solid surfaces, low-dimensional nanostructures, and nanomaterials.

Surface morphology analysis provides parameters of roughness, texture, and anisotropy of the sample surface as well as distributions of adsorbed particles and geometrical characteristics of those particles.

Dedicated gentle scanning techniques are now available to study powders, soft materials, biological structures, biomolecules, biopolymers, and to perform measurements in liquid.

A peculiar place in applications of NEXT is taken by material science. It includes study of adhesion characteristics, friction factors, wear resistance of coatings, elasticity moduli, hardness etc.

Wide variety of techniques for measurement of electrical characteristics implemented in NEXT (local resistance, surface potential, capacitance, photovoltaic parameters) enables analysis of various functional structures, components of micro-, nano- and molecular electronics, and sensors of many types.
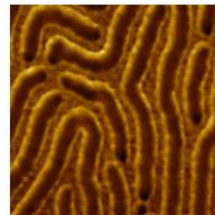
NEXT offers comprehensive capabilities to study ferroelectrics in terms of their domain structure, hysteresis properties, and thermal characteristics.
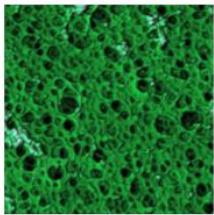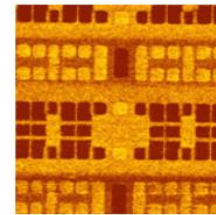
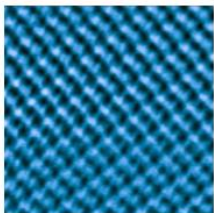Microporous nitrocellulose membrane AM-AFM. Scan size 7×7 µm
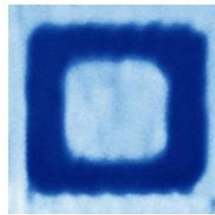
Monodomain BFO sample PFM Phase. Scan size 3×3 µm

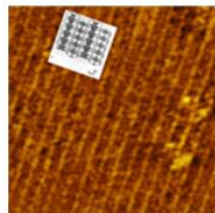PnBA molecules on mica Adhesion map, HybriD™ mode. Scan size 300×300 nm
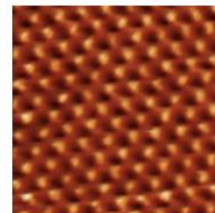
Surface Potential of SRAM Single-pass AM-KPFM. Scan size 40×40 µm
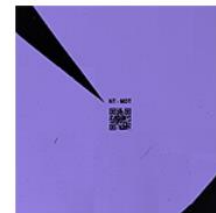
Calcite atomic resolution AM-AFM in liquid. Scan size 7×7 nm
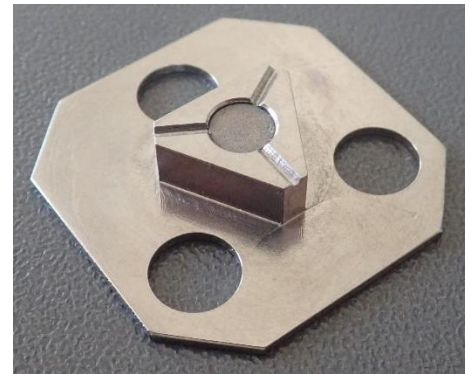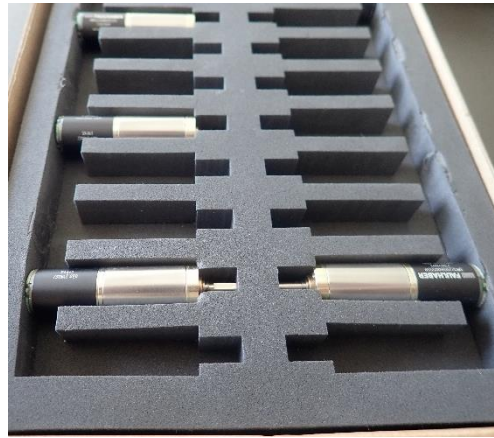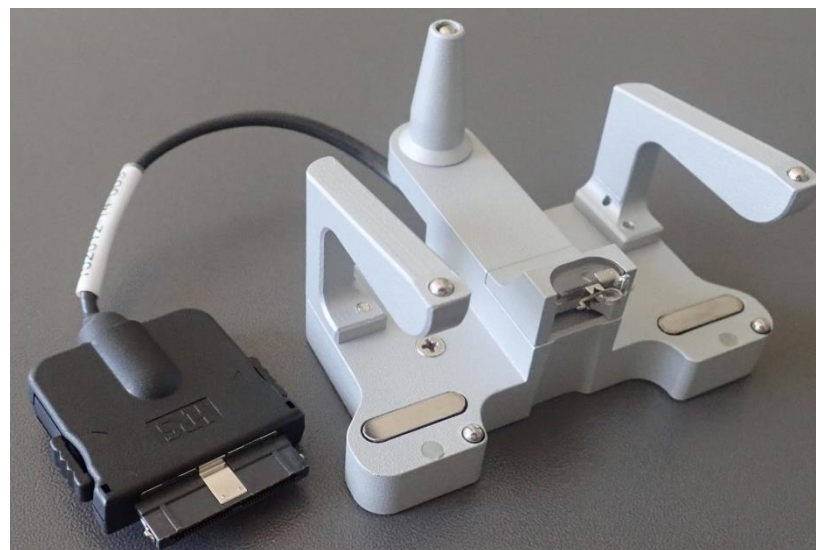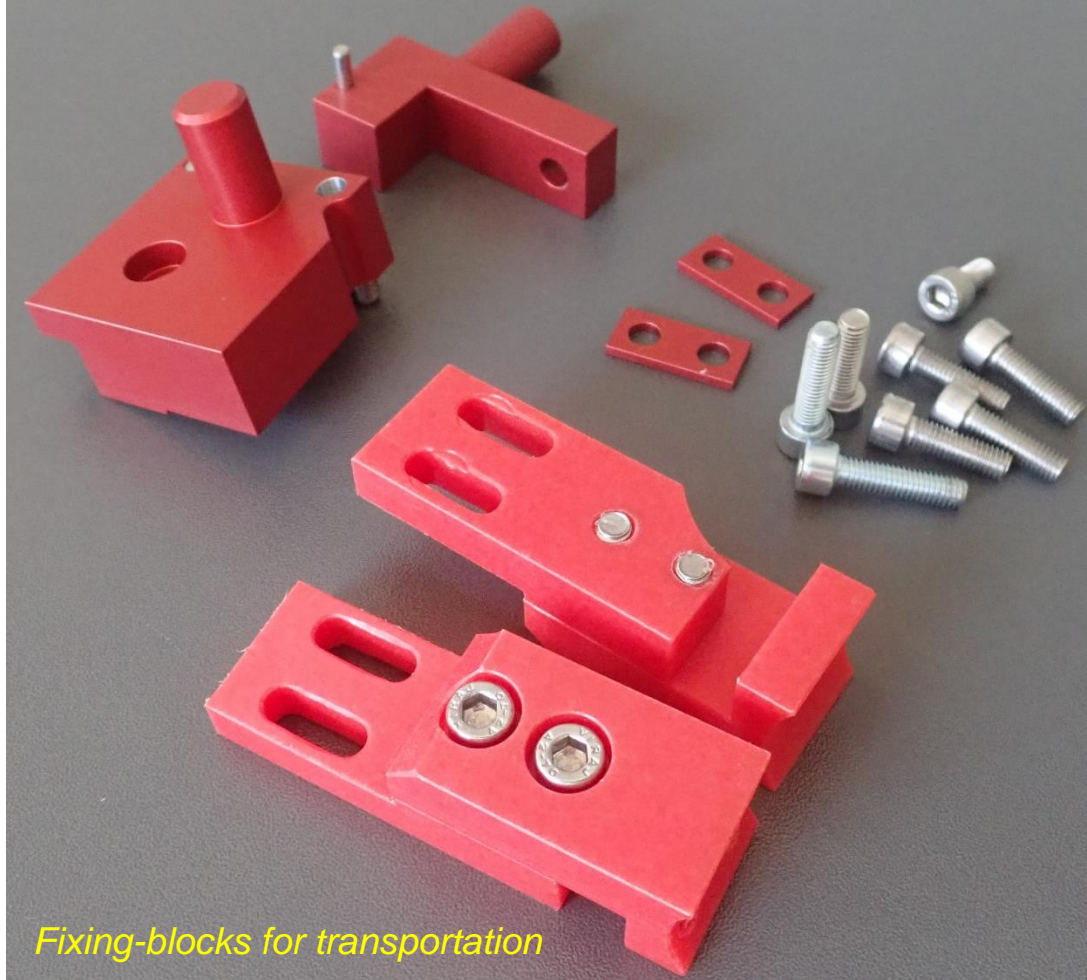
Height image of the ab plane of TTF-TCNQ crystal AM-AFM. Scan size 9×9 nm

HOPG atomic lattice resolution STM. Scan size 2.1×2.1 nm

MultiScan™ on NT-MDT SI test sample 12 stitched AFM images. Scan size 200×200 µm

CT_NC
Probe cartridge
(contains 38 noncontact cantilevers)
NT-MDT
Molecular Devices and Tools for Nanotechnology

NSC11/Cr-Au

Silicon chip size: 3.4x1.6x0.4mm with 1 triangular lever		
Silicon tip height, μm		20-25
Cantilever length, ±5 μm	200	90
Cantilever width, ±3 μm	40	60
Cantilever thickness,±0.5 μm		2.0
Resonant frequency, kHz	60	330
		(260-420)
Force constant, N/m	3.0	48
	(1.5-5.0)	(23-91)
Tip side coating, nm		Cr 20; Au 20
Back side coating, nm		Cr 20; Au 20

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NSG10   GOLDEN SILICON PROBES

Chip size: 3.4x1.6x03mm
Reflective side: Au
Tip height: 14-16μm
Tip curvature radius: 10 nm
Aspect ratio 3:1 - 5:1

Cantilever length, L±5 μm	Cantilever width, W±5 μm	Cantilever thickness, μm	Resonant frequency, kHz	Force constant, N/m
95	30	1.5 - 2.5	140 - 390	3.1 - 37.6

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ST_70AH_8-_262-BM_D833
Graphene on top

TGS1

Calibration grating set TGS1 is intended for Z-axis calibration of scanning probe microscopes and nonlinearity measurements.
Grating set contains 3 gratings TGZ1, TGZ2, TGZ3 with different step heights.

Material:	SiO₂
Pattern types:	In Z-axis direction
Step height:	TGZ1 - 20.3 ± 1,5 nm
	TGZ2 - 102.2 ± 2 nm
	TGZ3 - 518.4 ± 3 nm
Period:	3.00±0.01μm
Chip size:	5x5x0.5mm³
Effective area:	central square 3x3mm²

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Manual and Software

Case for transportation

Fixing-blocks for transportation