

NTEGRA

Scanning probe laboratories



concept



Introducing NTEGRA:

Central to NT-MDT's philosophy of the integrated lab is the **NTEGRA** line.

NTEGRA's name (pronounced as in-'te-gré) is derived from three sources:

- 1) In Latin, "integre" means perfect, absolute, or complete. For ages these ancient languages have been associated with "pure" and "absolute" scientific character. NTEGRA's Latin and Greek roots are reiterated in the naming for its models, from Solaris and Prima to Vita and Spectra.*
- 2) The concept of "completeness" reflects the NanoLaboratory concept: Each specialized system serves as a core for the whole laboratory.*
- 3) "NT," the first two letters in NTEGRA reflect key letters in both NanoTechnology and our company name, NT-MDT..*

The NTEGRA concept

NTEGRA is a revolutionary technological concept. It was designed specifically to form an SPM-based platform within which cutting-edge methods from other scientific analyses such as spectroscopy and sample preparation could be integrated. All the systems assembled on the **NTEGRA** platform share the same SPM core, electronic controllers and software. As a result, any **NTEGRA** base unit built for one particular application can easily be modified into a system suitable for another, very different application. The result: a complete solution for research, industry, and nanotechnology.

One integrated concept, many built-for-purpose models

Currently NT-MDT offers eight versions of the systems assembled on the NTEGRA platform. For superior performance, each system has its own application specialization.

NTEGRA Prima is a high-resolution, low-noise SPM ideal for the multi-user labs. Integrated optics coupled to the SPM provides imaging of samples with almost continuous zoom from the millimeter to angstrom range.

NTEGRA Therma performs SPM measurements either at constant temperatures from -30 °C to 300 °C or with changing temperature. Our low-drift THead maintains a drift of less than 15nm/°C.

NTEGRA Aura performs measurements in vacuums down to 10⁻² torr or under controlled atmosphere environments.

NTEGRA Maximus, unique in the industry, performs high throughput screening of multiple samples as well as measurements on large samples.

NTEGRA Solaris uses Scanning Near-Field Optical Microscopy (SNOM) to investigate optical properties beyond the conventional limits imposed by diffraction.

NTEGRA Vita combines the strengths of SPM with an inverted optical microscope for biological and medical applications.

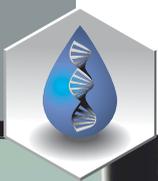
NTEGRA Tomo, another industry-leading NT-MDT invention, integrates a Scanning Probe Microscope with an ultramicrotome to perform AFM tomography and 3D reconstruction of biological and materials ultrastructure never seen before.

NTEGRA Spectra integrates SPM with Raman spectrometry and laser confocal microscopy to study the distribution of chemical properties with molecular resolution.

Live and delicate



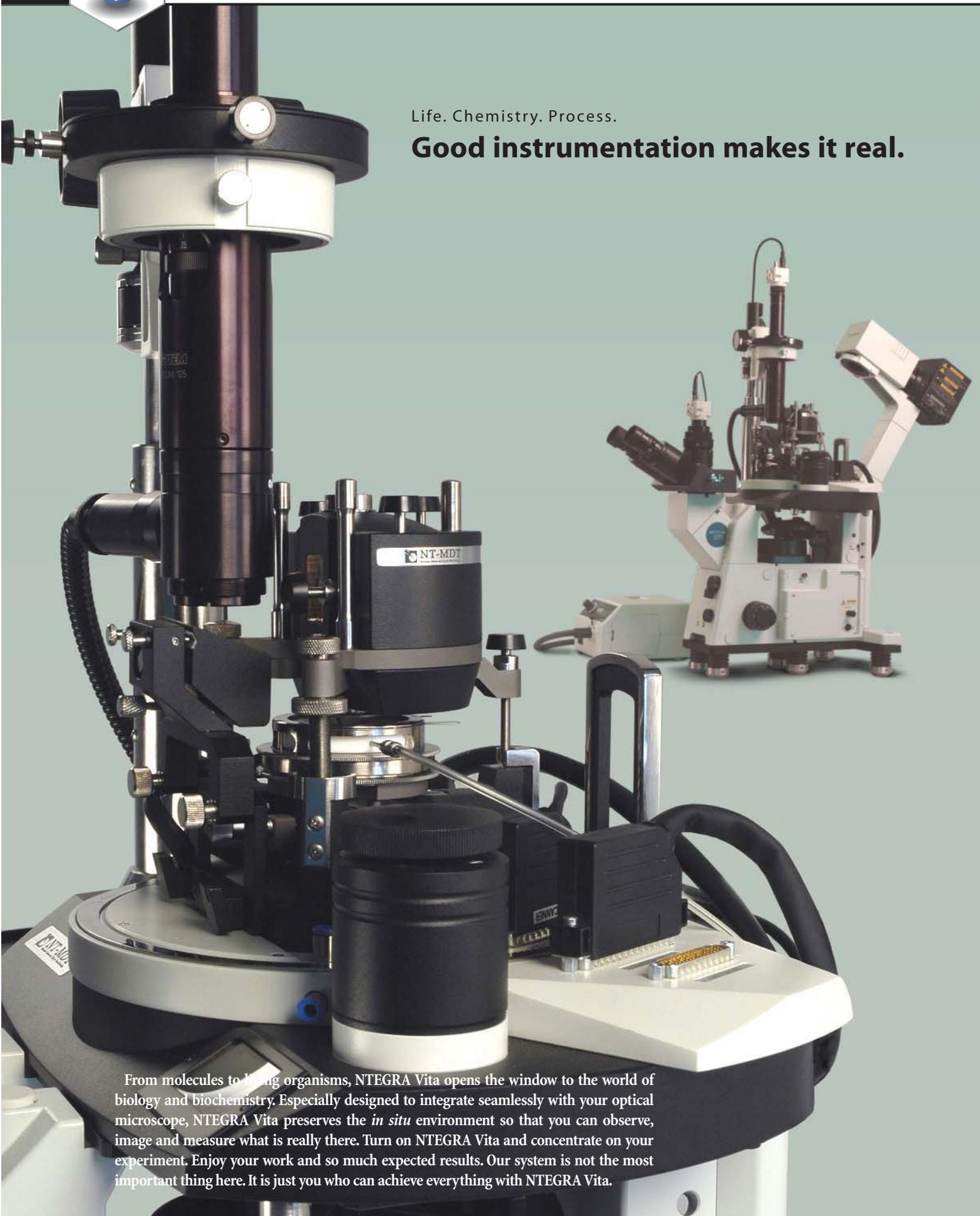
NTEGRA Vita



NTEGRA Vita

Life. Chemistry. Process.

Good instrumentation makes it real.



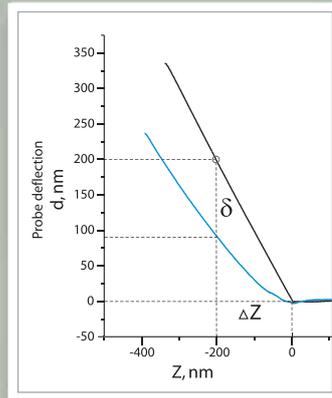
From molecules to living organisms, NTEGRA Vita opens the window to the world of biology and biochemistry. Especially designed to integrate seamlessly with your optical microscope, NTEGRA Vita preserves the *in situ* environment so that you can observe, image and measure what is really there. Turn on NTEGRA Vita and concentrate on your experiment. Enjoy your work and so much expected results. Our system is not the most important thing here. It is just you who can achieve everything with NTEGRA Vita.

Maintaining stasis

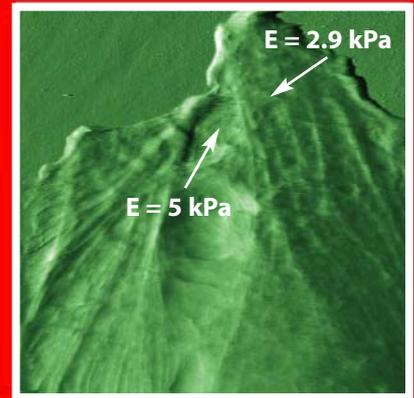
To maintain life and present the best conditions for measurement, most biological samples must be kept in fluid solutions. For conventional AFM biological imaging as well as biochemistry and bioorganic applications, NTEGRA Vita uses a unique sealed fluid cell which maintains an enclosed volume. Input/output pipes provide controlled flow of nutrient liquids and a heating element precisely maintains temperature, from room temperature to 60°C, with an accuracy of $\pm 0.005^\circ\text{C}$ (typically). Made of chemically stable materials, the fluid cell can withstand aggressive solutions, including acids, bases, or salt solutions.

From millimeters to angstroms

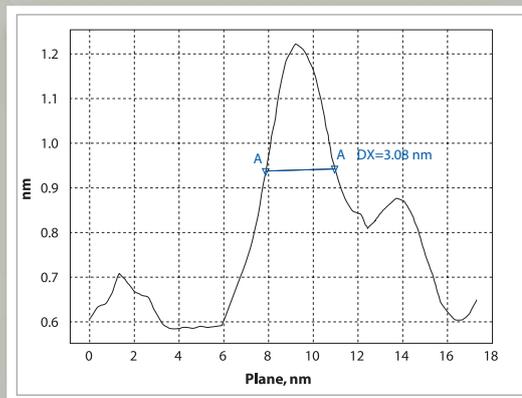
Need to study live cells? NTEGRA Vita offers a special cell to hold standard Petri dishes. As with our sealed liquid cell, this system maintains liquid flow and temperature control. Most importantly, you can still use your inverted microscope for classic optical methods. With NTEGRA Vita, use fluorescence to image internal structures and the SPM to provide higher resolution surface detail or physical parameters such as membrane conductance or elasticity. Merge fluorescence and SPM images for further comparison. NT-MDT DualScan™ option expands the scan size up to 200x200x20 μm , giving you the opportunity to image either whole cells or even larger cell aggregates.



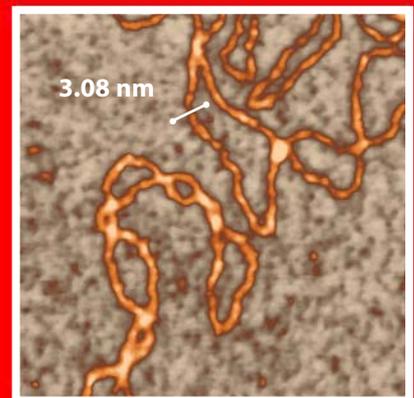
Two curves obtained from very stiff (black line) and rather soft (blue line) materials. Delta of probe deflection shows the sample deformation by the probe. It can be transformed into the Young's modulus.



Porcine kidney living cell. Difference in rigidity within a cell is estimated by Young's modulus (for comparison the Young's modulus value for the Petri dish surface underlying the cell was 1.4 GPa). Scan size: 28x28 μm .



DNA cross-section draft.



Unfolded DNA deposited on mica. AFM image obtained by DLC tip. DNA width 3.08 nm. Scan size 160x160 nm.

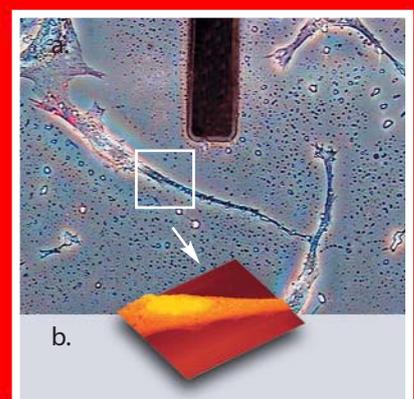
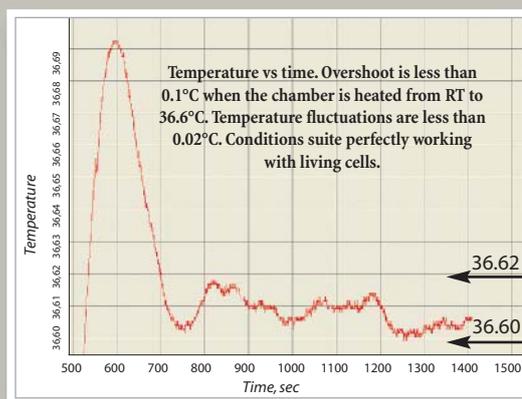
Ultimate resolution requires ultra-small volumes

Need the ultimate in resolution? You need "scanning-by-sample", a mode in which a small sample is scanned with great precision under a fixed probe. Our engineers have developed a special little fluid cell specifically for this application. This cell is also helpful when using expensive chemicals.

From large format to ultrahigh resolution, NTEGRA Vita has a solution for your lab.

Extremely small force measurements

Measurements and analysis of probe-to-sample forces in pico- and nano-Newton range provide new insight into cellular properties. "Pushing" a cell with the probe then evaluating the cantilever deflection provides qualitative information about the cell turgidity, cytoskeleton network rigidity, and cellular matrix density. "Touching" the surface-bound receptor molecules with a ligand-coated probe quantifies molecular interaction forces. NTEGRA Vita low noise closed loop sensors afford unprecedented accuracy of both probe movement and force measurements. Need even higher registration rate? Optional modules are available to achieve registration rate down to 10^{-6} sec.



Human embryo fibroblast (primary culture). (a) Phase contrast optical image of the cells, obtained during AFM scanning. (b) AFM image of the framed area. Semicontact mode in air. Scan size: 50x40x0.5 μm



Scanning probe microscopy

SPM methods	in air & liquid	AFM (contact + semi-contact + non-contact) / Lateral Force Microscopy / Adhesion Force Imaging/ Force Modulation/ Phase Imaging/ AFM Lithography (scratching)/ Force-Distance curves	
	in air only	STM/ Magnetic Force Microscopy/ Electrostatic Force Microscopy / Scanning Capacitance Microscopy/ Kelvin Probe Microscopy/ Spreading Resistance Imaging/ Lithography: AFM (Current), STM	
		Scanning by sample	Scanning by probe*
Sample size	in air	∅ 40 mm, 15 mm in height	∅ 100 mm, 15 mm in height
	in liquid	Up to 14x14x2.5 mm	Up to 15x15x3 mm
XY sample positioning range	in air	5x5 mm, readable resolution - 5 μm, sensitivity - 2 μm	
	in liquid	1x1 mm, readable resolution - 5 μm, sensitivity - 2 μm	
Scan range		100x100x10 μm, 3x3x2.6 μm	100x100x10 μm, 50x50x5 μm
		Up to 200x200x20 μm** (DualScan™ mode)	
Non-linearity, XY (with closed-loop sensors***)		<0.1%	<0.15%
Noise level, Z (RMS in bandwidth 1000 Hz)	With sensors	0.04 nm (typically), ≤0.06 nm	0.06 nm (typically), ≤0.07 nm
	Without sensors	0.03 nm	0.05 nm
Noise level, XY*** (RMS in bandwidth 200 Hz)	With sensors	0.2 nm (typically), ≤0.3 nm (XY 100 μm)	0.1 nm (typically), ≤0.2 nm (XY 50 μm)
	Without sensors	0.02 nm (XY 100 μm) 0.001 nm (XY 3 μm)	0.01 nm (XY 50 μm)
Temperature control (For operation in fluid environment)	Range	—	from RT to 60°C
	Stability	—	±0.005°C (typically), ≤±0.01°C

* Scanning head can be configured to serve as a stand-alone device for specimens of unlimited sizes.

** 200 μm scan range is possible with the unique DualScan™ mode when scanning by sample and scanning by probe can be done simultaneously.

*** Built-in capacitive sensors have extremely low noise and any area down to 50x50 nm can be scanned with closed-loop control.

Optical microscopy*

		Upright viewing		Inverted viewing
		Scanning by sample	Scanning by probe	Scanning by probe
Objective lens	Magnification	x1/ x10	x1	x60**
	Numerical aperture	0.1/ 0.28	0.1	0.7
Continuous zoom		available		NA
Observation methods***	Bright field imaging	available		available
	Fluorescence imaging	NA		optional
	Contrast methods	Phase contrast imaging, Polarization, DIC	NA	optional

* System upgrade is possible to convert it into a near-field optical microscope or a laser confocal microscope.

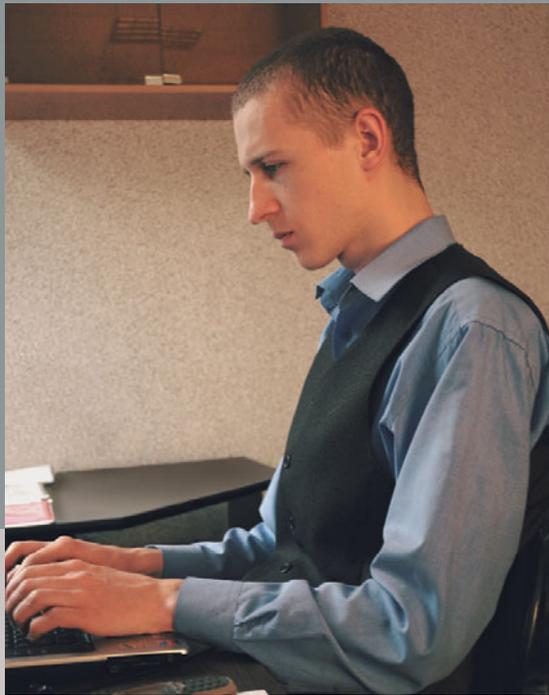
** Any additional objectives can be supplied optionally.

*** Can be performed without compromise in optical or AFM performance.

Articles:

• *Electrical properties of short DNA oligomers characterized by conducting atomic force microscopy.* C. Nogues, S.R. Cohen, S.S. Daubeb and R. Naaman. *Phys. Chem. Chem. Phys.*, 6, 4459 (2004).

• *A. Yu. Kasumov, D. V. Klinov, P.-E. Roche, S. Gueron, and H. Bouchiat. Thickness and low-temperature conductivity of DNA molecules.* *Appl. Phys. Lett.* 84, 2004, 1007-1009.



NT-MDT customer focus means ease of use and strong support

Modern scientific systems are getting more and more powerful and multifunctional. As systems become more complex, getting started can be daunting. NT-MDT designs systems that are easy to use then supports them with advanced-user workshops and strong installation training

Easy to use yet capable, expandable software

NTEGRA's global software is Window's based, with a friendly, comfortable software interface that makes alignment and measurement easy yet powerful. Need to adjust software to your specific experiment? Built-in NOVA PowerScript with the rich library of predefined macros are available either to program your routine measurements or to get access to the very specific functions of your hardware. We listen carefully to our users experience and input from our users, resulting in updates two to three times each year. All upgrades are free of charge.

SPM for the academic lab

NT-MDT is currently the only company that has developed a specialized mini-laboratory, academic SPM for learning first-level SPM skills. It includes a set of very simple, cost-effective, and student-proof SPM experiments, special software package for interactive study, a set of inexpensive accessories and probes, a special toolkit that allows students to prepare their own probes, well-defined specimens, and a package of training materials including specialized SPM training course written and edited by very experienced SPM users.

Training and workshops

For experienced SPM users, NT-MDT offers technique-focused training and workshops on the regular basis to enhance their skills and to expand the SPM usability. Interested in learning more about a specific NT-MDT's developments? Our staff scientists provide information and orientation. Interested in cutting edge technology and the newest applications? Attend one of our workshops. We invite world-renowned scientists to report on breakthrough applications and the latest in Scanning Probe Microscopy and SPM-based instrumentation.



Service and support

From tips and test gratings to on-line remote problem solving, NT-MDT provides extensive global after-sale support.

World-wide service

NT-MDT's systems are capably supported by a broad network of distribution and service world-wide. Qualified professional engineers in more than 20 centers in Europe, Asia, and America are ready to repair your SPM or perform hardware upgrades. For the nearest center go to <http://www.ntmdt.com/Distributors/index.html> or contact our head office +7 (095) 535 03 05

On-line support

Most problems can be solved quickly with a just little professional advice.

Just click on http://www.ntmdt.com/chat_eng and explain your question directly to a company expert via unique "[ASK-ONLINE](#)" service or e-mail. To make your experience more personal, you can also see our service engineers through the web camera installed in one of the service bays located in NT-MDT's central office.

Distant control facility

Facing a more difficult problem or one you just can't explain? NT-MDT has integrated a unique special software patch that allows us to access your system remotely, instantly putting an NT-MDT engineer at your elbow. The engineer can test all critical hardware and software parameters, perform the required tuning or adjustment, or advise you on optimizing operational algorithms.

Supercomputer power for advanced calculations

Need extra horsepower for advanced image processing? Specifically for NTEGRA customers, NT-MDT has launched exclusive access via the Internet NT-MDT's supercomputer-based information center.

Accessories on-line

NT-MDT manufactures a complete line of SPM accessories including wide range of probes, test samples, and test gratings, all available on-line at www.ntmdt-tips.com.

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