



## BioScope Resolve Atomic Force Microscope

- Unrivalled BioAFM for Biomechanics and Highest Resolution Imaging



# Reveal New Insights with the World's Most Advanced BioAFM

Bruker's BioScope Resolve™ BioAFM features the highest resolution atomic force microscopy imaging and most complete cell mechanics capabilities available for use with an inverted optical microscope. BioScope Resolve incorporates Bruker's exclusive PeakForce Tapping® technology to enable researchers to achieve the highest resolution biological imaging and piconewton-level force measurements and spectroscopy at every pixel. The system's real-time synchronization of optical and atomic force microscopy data opens the door to previously inaccessible data, including physical structure, biochemical interactions, and mechanical properties, to provide unique insights into life sciences research.



- Most quantitative live-cell mechanical property mapping with PeakForce QNM® and FASTForce Volume™ modes
- Highest resolution molecular and cellular imaging of any BioAFM
- Seamless AFM and inverted optical microscope integration for unsurpassed correlation of data
- Superior AFM performance powered by PeakForce Tapping

# • PeakForce Tapping — The Most Significant Advancement in BioAFM

Only Bruker's exclusive PeakForce Tapping provides biologists a unique combination of the highest resolution imaging, the most quantitative property mapping data, and the easiest to use imaging on the softest of biological samples.

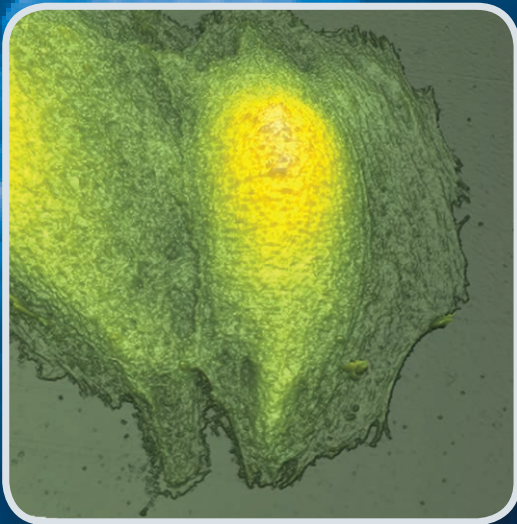
## PeakForce QNM provides:

- The fastest and highest resolution mechanical mapping of whole live cells
- Quantitative mapping of mechanical, chemical, and biological interactions
- Sub-molecular AFM imaging with the fastest quantitative mapping of mechanical, chemical, and biological interactions

## ScanAsyst-Cell delivers:

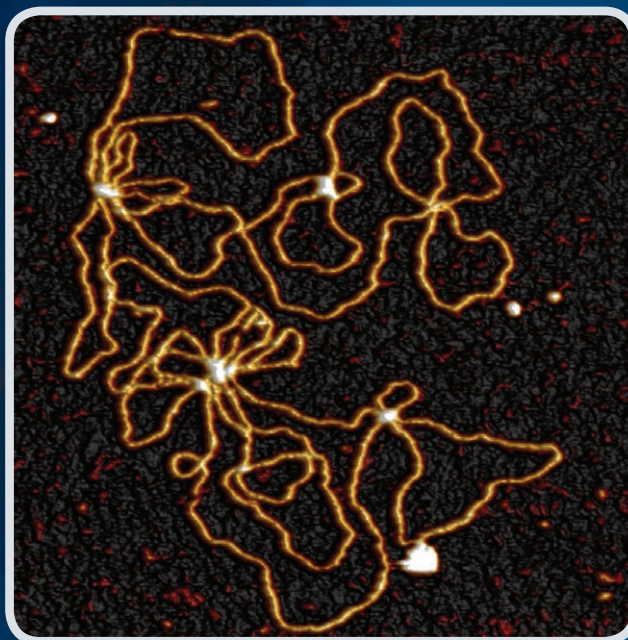
- Consistent, expert-quality results for AFM users of all experience levels
- More routine high-resolution live-cell imaging than any other AFM mode

BioScope Resolve is designed to take full advantage of PeakForce Tapping to deliver a more complete approach to biological investigation, allowing researchers, for the first time, to combine optical and (sub) molecular AFM imaging with the fastest property mapping. Simply put, it's how bioAFM should be.



PeakForce Tapping topography  
image of live MDCK cells  
(95 micron image)

PeakForce Tapping  
resolution of plasmid DNA  
(419 nm image)





# • Most Quantitative Cell Mechanics and Molecular Force Spectroscopy Data

Only Bruker's exclusive techniques, PeakForce QNM and FASTForce Volume, combine to provide the widest range of ramp frequencies and the most quantitative property mapping for biological samples. Additionally, higher imaging speeds and automated measurement capability, provide more data in less time, leading to faster time to publication.

## Unmatched Live-Cell Property Mapping

PeakForce QNM uniquely enables quantitative cell mechanics and imaging of whole, live cells with no artifacts and the fastest cell imaging times.

- High-speed mapping of entire live cells with an unrivalled level of resolution
- Repeatable, robust mechanical property measurements
- Highest resolution image and force curve acquisition with PeakForce Capture™

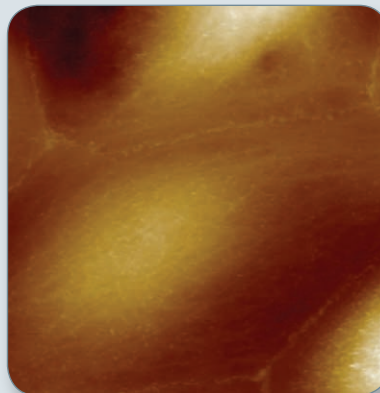
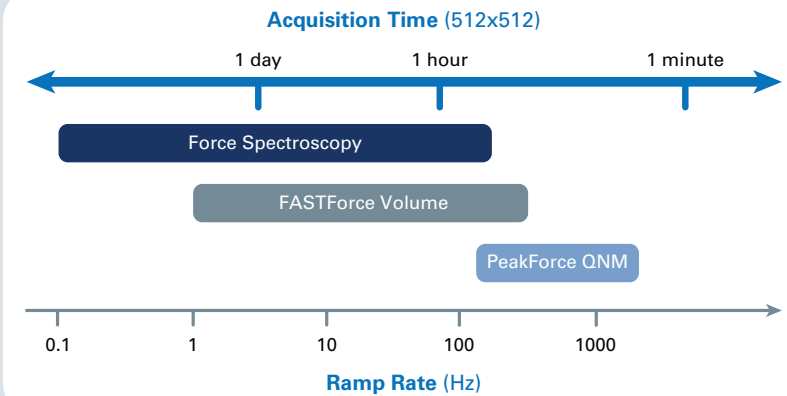
## Quantitative FASTForce Volume

Bruker's new FASTForce Volume mode complements PeakForce QNM to provide the widest range of ramp frequencies.

- FASTForce Volume data acquisition, from 1 Hz to 300 Hz
- pN level trigger forces for the most sensitive, highest resolution force distance curves for force spectroscopy
- Widest ramp frequency range, when combined with PeakForce QNM, from 0.1 Hz to 1 kHz in liquid or 2 kHz in air

## Superior Force Spectroscopy and Ramp Scripting

BioScope Resolve provides automated scripting and data-collection recipes, making it easy to design extended-time, biological-dynamics studies.



PeakForce QNM topography image (left) and corresponding modulus image (right) of living MDCK cells. Cell structures corresponding to actin fibers show higher modulus (lighter) while cell surface features, believed to be microvilli, appear softer (darker) than the cell membrane itself. (1 kHz PeakForce QNM, 32  $\mu$ m image).

"It was previously impossible to resolve the finest structures of a live cell like microvilli, but now with the improved PeakForce Tapping on BioScope Resolve I can image them easily in one hour."

—Dr. Hermann Schillers of the University of Munster, Germany

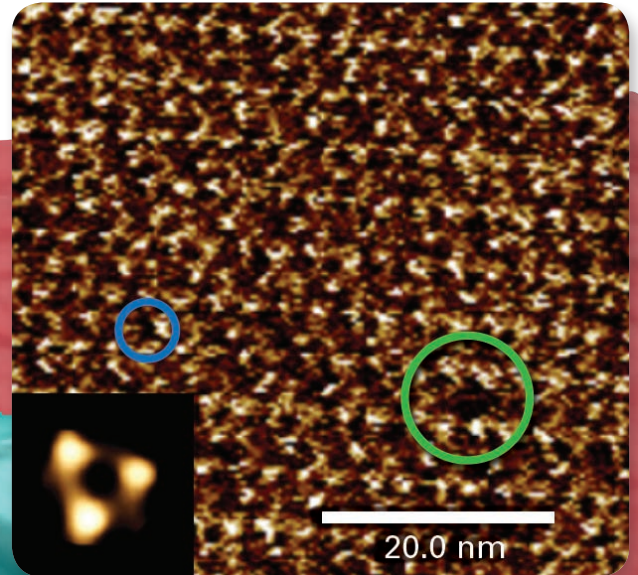
# ● Capture the Highest Resolution Molecular and Live-Cell Images Quickly and Easily

BioScope Resolve provides the highest resolution imaging for both molecules and live cells, revealing a level of structural detail never imaged before. This capability is achieved through a combination of stable instrument design, PeakForce Tapping, and Bruker's exclusive high-resolution ScanAsyst-Fluid probes.

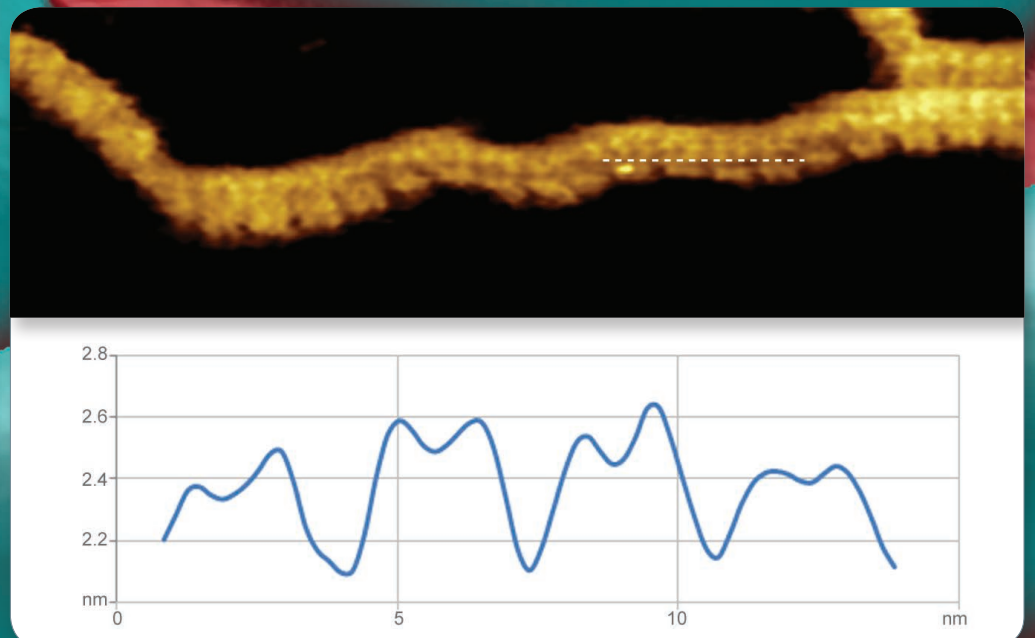
BioScope Resolve offers:

- ScanAsyst-Cell™ single-button imaging of whole, live cells with no imaging artifacts
- Imaging of high-resolution, sub-cellular structures on live cells, such as microvilli
- ScanAsyst-Cell single-button imaging for high-resolution molecular investigations

Whether imaging the DNA double helix or other biomolecules, BioScope Resolve with ScanAsyst-Cell enables researchers to easily and consistently achieve accurate sub-molecular resolution of biological samples.



PeakForce Tapping image of the bacteriorhodopsin membrane protein lattice structure taken on an inverted optical microscope. The inset shows a single particle averaging of the bacteriorhodopsin trimer. The green circle shows a single lattice defect. The blue circle shows the lattice substructures (Z scale = 0.6 nm).



Highest submolecular resolution imaging of the DNA double helix, showing both the major and minor grooves.



# ● Unrivalled AFM and Optical Synchronization Capabilities

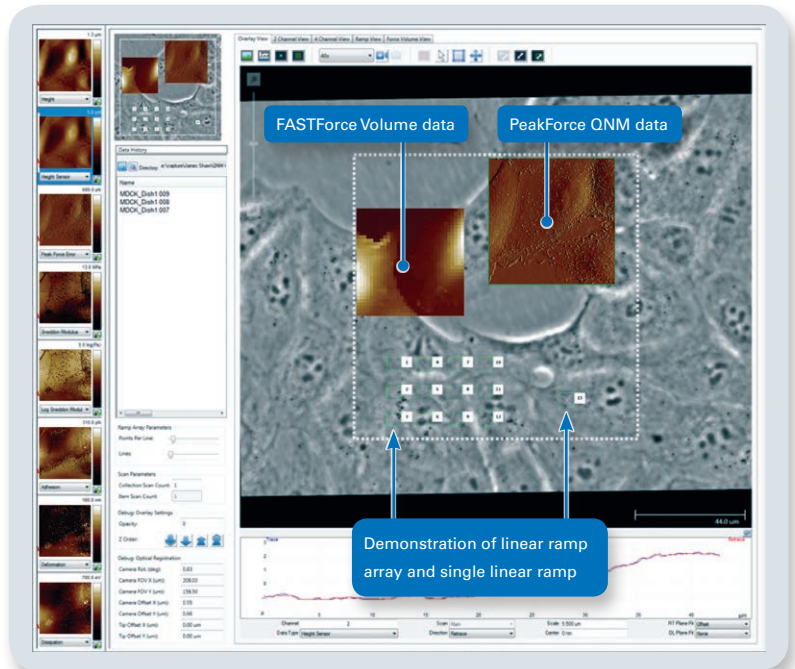
BioScope Resolve integration with light microscopy provides new biological detail and quantitative mapping unlike any other AFM. The system has a unique design that provides open access to the sample, and it is fully correlated with optical microscopy. Researchers can now perfectly connect real-time optical images with AFM images.

## Expand Measurement Possibilities with MIROView

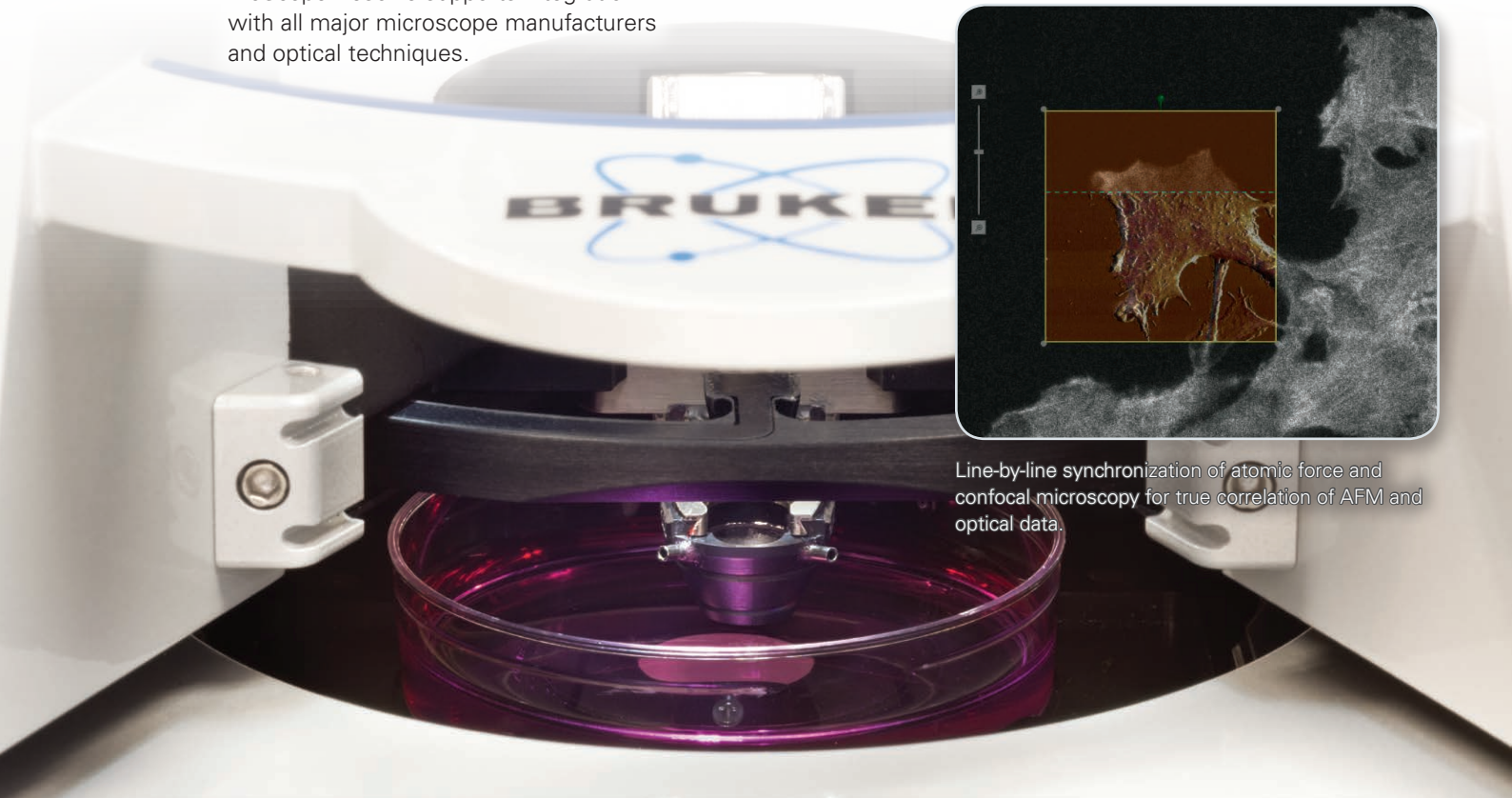
MIROView™ is a new graphical user interface (GUI) that supports seamless integration between the AFM and the light microscope. MIROView and ScanAsyst-Cell ensure expert data generation, regardless of the user's experience level.

- Single, integrated view for AFM or optical microscope for ease of use and enhanced productivity
- Fully synchronized AFM images, force maps, and single-force curves with optical images and data
- Point-and-click setup for automated force and imaging measurements
- Video creation of experiment sessions using MovieMaker™

BioScope Resolve supports integration with all major microscope manufacturers and optical techniques.



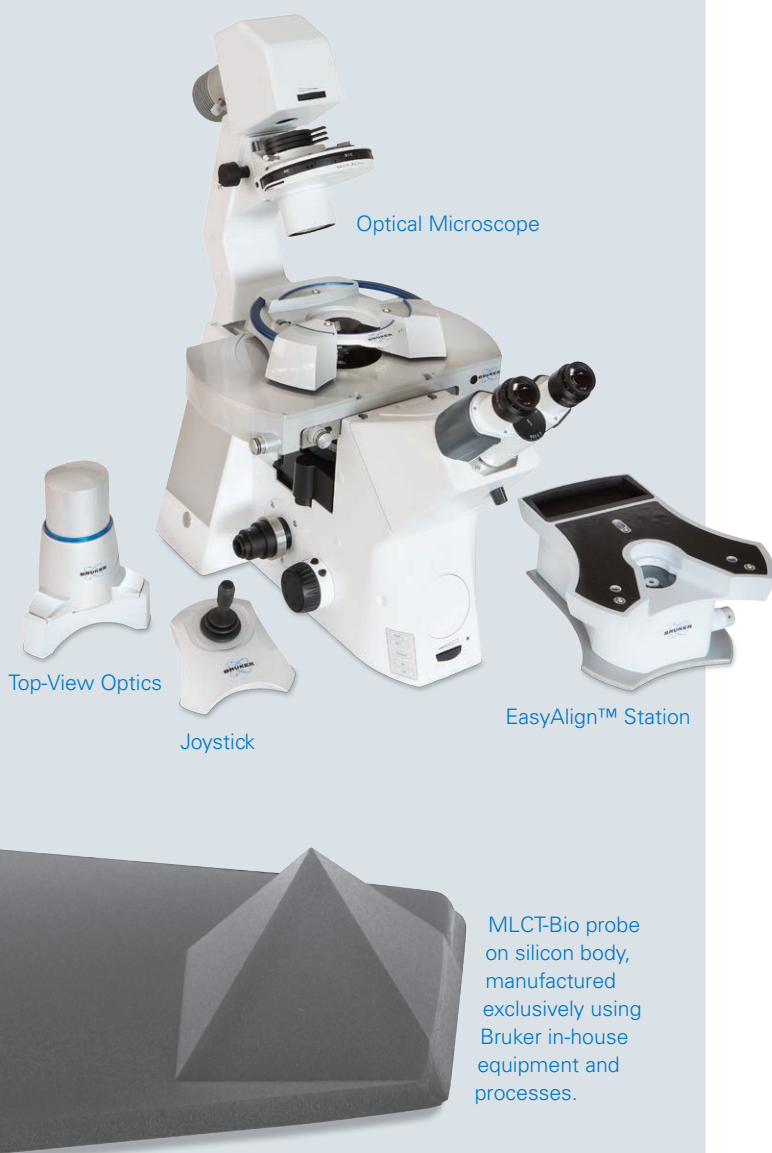
MIROView GUI enables seamless mode switching and automated measurements of multiple data types.



Line-by-line synchronization of atomic force and confocal microscopy for true correlation of AFM and optical data.

# • BioScope Resolve Accessories and Probes

## BioScope Resolve BioAFM System



Optical Microscope

Top-View Optics

Joystick

EasyAlign™ Station

MLCT-Bio probe on silicon body, manufactured exclusively using Bruker in-house equipment and processes.

BioScope Resolve was designed by biologists for biologists, resulting in a design that is flexible enough to meet a wide spectrum of application needs through optional accessories and application specific-probes.

### A wide range of AFM accessories for maximum experiment flexibility:

- Micro-volume fluid cell
- Full sample-carrier support with clear visual and physical access to sample (petri dishes, coverslips, and slides)
- Advanced Perfusing Stage incubator specially designed for long-term, live-cell studies
- Sample heater with temperature range for ambient to 60°C in liquid

### Other BioScope Resolve accessories:

- Top-view optics module for opaque sample viewing
- Isolation hood and anti-vibration table for the highest resolution imaging capabilities
- Air and fluid probe holders

### PeakForce Tapping BioAFM probes:

Bruker's new line of bioAFM high-quality probes set the industry standard for imaging in fluid and for force spectroscopy of biological samples. These probes enable new measurement capabilities using PeakForce Tapping's imaging force control and are optimized for use with BioScope Resolve.

- ScanAsyst Fluid-HR high-resolution imaging probe for unprecedented molecular imaging capabilities
- PeakForce QNM high-resolution probes for whole-cell imaging and mechanical property mapping of live cells
- MLCT Bio probes for high performance imaging and property measurement of biological samples or molecules with less topographic variables
- Molecular pulling/unfolding experiments

"For the first time bioAFM analysis can directly correlate high-resolution molecular structures with function on the same cell. BioScope Resolve provides the dynamic range and resolution necessary to allow a deeper understanding of structure-function relationships at cell and tissue surfaces."

—Dr. Lewis Francis of the College of Medicine and Center of NanoHealth at Swansea University, United Kingdom

## BioScope Resolve Specifications

|                              |  |
|------------------------------|--|
| Inverted Optical Microscopes | Zeiss;<br>Leica;<br>Olympus;<br>Nikon;<br>Inquire regarding specific models  |
| Transmitted Light Condensers | Zeiss (0.35NA, WD = 70 mm);<br>Leica (0.3NA, WD = 70 mm);<br>Olympus (0.3NA, WD = 73 mm);<br>Nikon (0.3NA, WD = 75 mm);<br>Inquire regarding specific models   |
| Confocal Laser Scanning      | Compatible with most models based on the inverted light microscope;<br>Inquire regarding specific model numbers  |
| Optical AFM Synchronization  | Real-time, functional AFM and optical data acquisition and integration   |
| Cameras                      | Enhanced support for Andor iXonEM, Hamamatsu ORCA, Hamamatsu Flash CMOS, and Photometrics CoolSNAP cameras allows direct image acquisition through NanoScope® software; Inquire regarding specific models;<br>Supports all other cameras through TIFF, JPEG or BMP image file import |
| AFM Controller               | NanoScope V  |
| Computer                     | Intel i-Series processor, 16GB RAM, 1TB HD, DVD-RW drive; single 30 in. LCD display  |

### AFM Specifications

|                      |   |
|----------------------|---|
| X-Y Scan Range       | ≥100 µm, open-loop or closed-loop operation                       |
| Z Scan Range         | ≥15 µm, open-loop or closed-loop operation                        |
| Deflection Detection | IR superluminescent diode (SLD) $\lambda=850$ nm                  |
| Baseline Tilt        | <0.25 nm/µm   |
| XY Sensor Noise      | <150 pm   |
| Height Noise         | 35 pm (typical with appropriate vibration and acoustic isolation) |
| XY Sample Stage      | Motorized stage with 10 mm x 10 mm range                          |

### Accessories

|                           |  |
|---------------------------|--|
| Perfusion Stage Incubator | Perfusing stage incubator for glass-bottom petri dishes for long-duration live-cell research               |
| Sample Heating            | Enables operation up to 60°C in liquid;<br>Physiological temperature range imaging up to 40°C              |
| Top-View Optics           | Available in configuration that allows use while AFM is mounted on inverted microscope                     |
| Nanomechanics Package     | PeakForce QNM, FASTForce Volume, force spectroscopy, and comprehensive suite of force curve analysis tools |

### Facility Requirements

|                     |   |
|---------------------|---|
| Vibration Isolation | Vibration isolation, vibration isolation table, or integrated vibration/acoustic isolation enclosure required |
| Power               | 650W, single-phase; 100, 120, 220, or 230 / 240V; 50 / 60 Hz  |
| Certification       | CE  |

## ● Bruker Nano Surfaces Division

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## Cover Images

Foreground top: PeakForce Tapping image of live *E. coli* cells.  
Foreground bottom: PeakForce Tapping topography image of MDCK live cells.  
Background left: PeakForce QNM image of microvilli on MDCK live cell.  
Background right: PeakForce Tapping image of DNA double helix.