

*Enabling Nanoscale Advances*



# Park NX20

The leading nanometrology tool for failure analysis  
and large sample research





# Park NX20

## The premiere choice for failure analysis

### Accurate AFM Solutions for FA and Research Laboratories

- Surface roughness measurements for media and substrates
- Defect review imaging and analysis
- High resolution electrical scan mode
- Sidewall measurements for 3D structure study\*

### Accurate and Reproducible Measurements for Better Productivity

- Non-contact mode to preserve tip sharpness for surface roughness accuracy
- Fastest defect imaging in non-contact mode
- Decoupled XY scanning system for 3D structure measurements
- Minimized system drift and hysteresis using thermally matched components

### Accurate AFM Topography with Low Noise Z Detector

- Sample topography measured by industry leading low noise Z detector
- True sample topography without edge overshoot or piezo creep error
- Accurate surface height recording, even during high-speed scanning
- Industry leading forward and backward scan gap of less than 0.15%

### Cost Savings with True Non-Contact™ Mode

- 10 times or longer tip life during general purpose and defect imaging
- Less tip wear from prolonged high-quality scans
- Minimized sample damage or modification

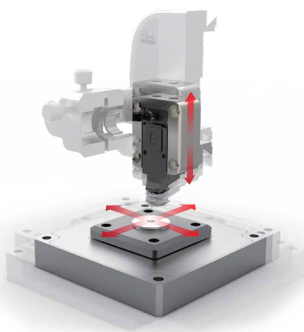
\* tilting sample chuck

# Park NX20

## AFM Technology

### Flat Orthogonal XY Scanning without Scanner Bow

Park's Crosstalk Elimination scanner structure removes scanner bow, allowing flat orthogonal XY scanning regardless of scan location, scan rate, and scan size. It shows no background curvature even on flattest samples, such as an optical flat, and with various scan offsets. This provides you with a very accurate height measurement and precision nanometrology for the most challenging problems in research and engineering.



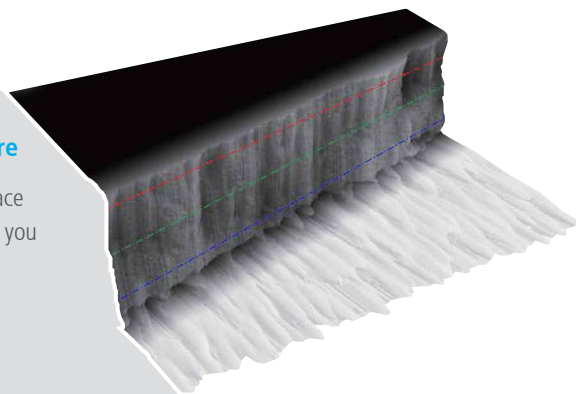
#### Decoupled XY and Z Scanners

The fundamental difference between Park and its closest competitor is in the scanner architecture. Park's unique flexure based independent XY scanner and Z scanner design allows unmatched data accuracy in nano resolution in the industry.

#### Tilting Sample Chuck for Sidewall Imaging lets you see more

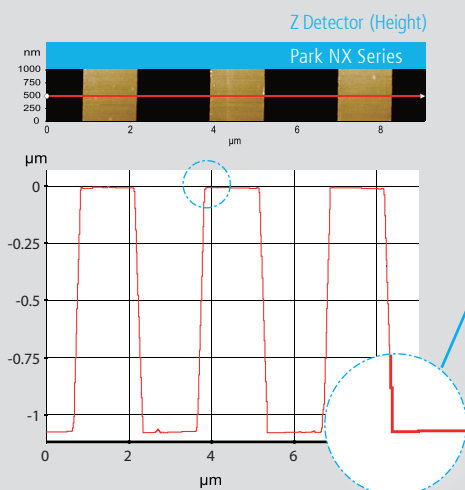
The NX20's innovative architecture lets you detect the sidewall and surface of the sample, and measure their angle. This gives the unit the versatility you need to do more innovative research and gain deeper insights.

- Tilting angle: 10°, 15°, and 20°
- Sample thickness: Up to 2 mm
- Sample size: Up to 20 mm x 20 mm



### Industry Leading Low Noise Z Detector

Park AFMs are equipped with the most effective low noise Z detectors in the field, with a noise of 0.02 nm over large bandwidth. This produces highly accurate sample topography and no edge overshoot. Just one of the many ways Park NX20 saves you time and gives you better data.



**No creep effect**

#### Accurate Sample Topography Measured by Low Noise Z Detector

- Uses low noise Z detector signal for topography
- Has low Z detector noise of 0.02 nm over large bandwidth
- Has no edge overshoot at the leading and trailing edges
- Needs calibration done only once at the factory

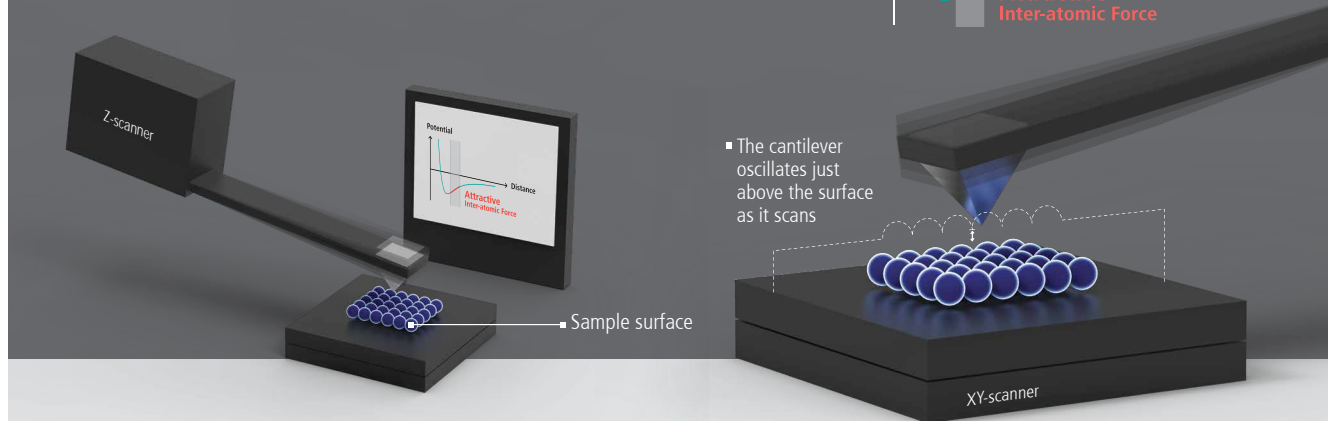
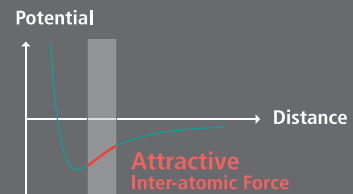
Sample: 1.2 μm Nominal Step Height  
(9 μm x 1 μm, 2048 pixels x 128 lines)

# True Non-Contact™ Mode

True Non-Contact™ Mode is a scan mode unique to Park AFM systems that produces high resolution and accurate data by preventing destructive tip-sample interaction during a scan.

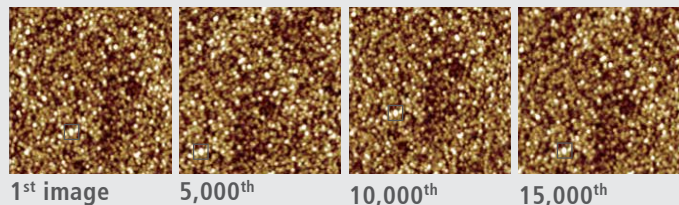
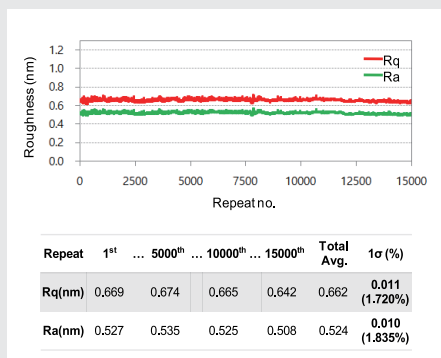
## Accurate Feedback by Faster Z-servo enables True Non-Contact AFM

- Less tip wear → Prolonged high-resolution scan
- Non-destructive tip-sample interaction → Minimized sample modification
- Maintains non-contact scan over a wide range of samples and conditions

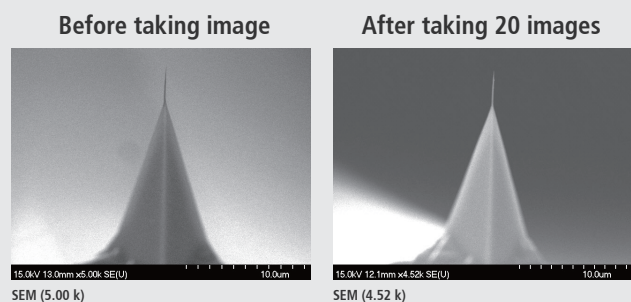
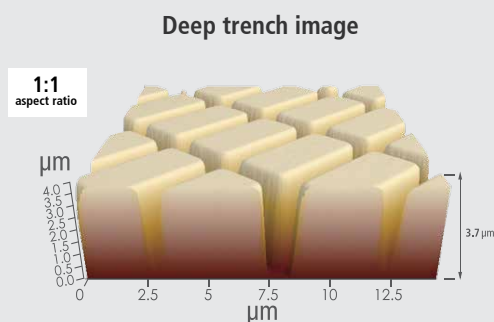


Unlike in contact mode, where the tip contacts the sample continuously during a scan, or in tapping mode, where the tip touches the sample periodically, a tip used in non-contact mode does not touch the sample.

Because of this, use of non-contact mode has several key advantages. Scanning at the highest resolution throughout imaging is now possible as the tip's sharpness is maintained. Non-contact mode avoids damaging soft samples as the tip and sample surface avoid direct contact.



Furthermore, non-contact mode senses tip-sample interactions occurring all around the tip. Forces occurring laterally to tip approach to the sample are detected. Therefore, tips used in non-contact mode can avoid crashing into tall structures that may suddenly appear on a sample surface. Contact and tapping modes only detect the force coming from below the tip and are vulnerable to such crashes.



# Park SmartScan™

Pixel / Scan size  
Quality / Speed

Quality ——— Speed

1 SETUP

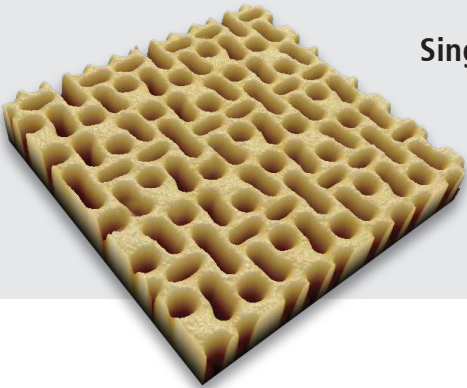
2 POSITION

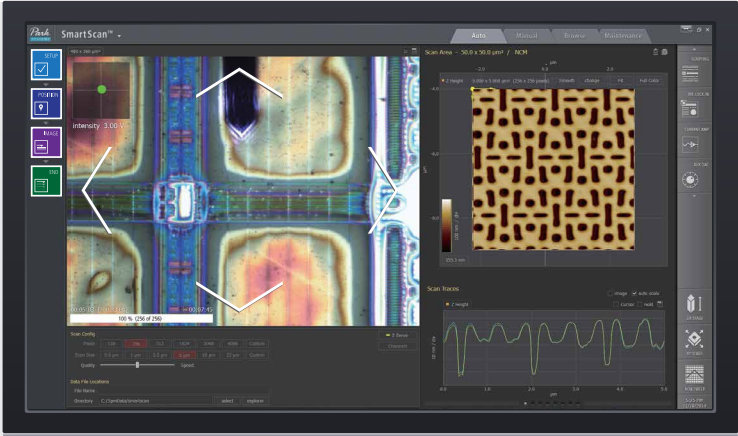
3 IMAGE

4 END

Start with sample A


Start with new sample B





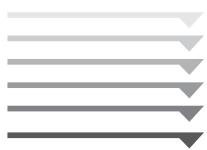
### Single-click Imaging with SmartScan™ Auto Mode

All you need to specify for AFM imaging are quality-speed preference, pixel density and scan size. Outside of those factors, you can leave all sophisticated AFM parameters up to the Auto mode of SmartScan™. The system will start a measurement with optimized conditions for imaging automatically at the click of a button.



## An AFM operation software for everyone, from amateurs to experts

Whether your AFM needs are focused on academic research, industrial metrology or failure analysis, SmartScan's Auto mode offers a streamlined system to generate publishable, high quality AFM data. Moreover, SmartScan™ promises productive sessions with an AFM even for beginners to obtain quality data as good as an expert's, in much shorter time.



### FastApproach™

Click the Position button, and the Z scanner approaches the sample automatically and at a much higher speed than the typical manual approach. Park's FastApproach™ safely takes the cantilever down to the sample surface at full speed without the user's intervention and engages in just 10 seconds after loading the cantilever.



### Easy to find an area of interest

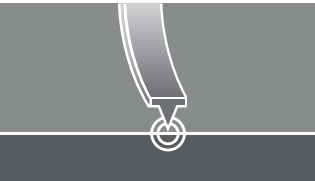
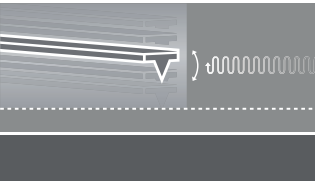
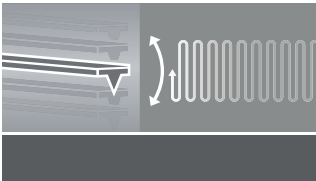
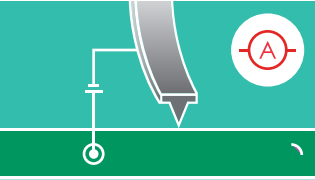
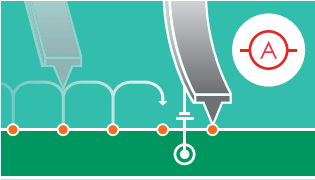
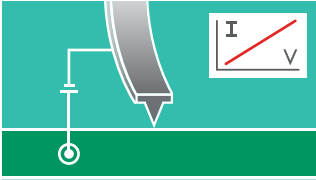

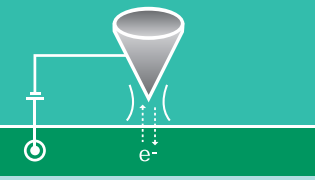
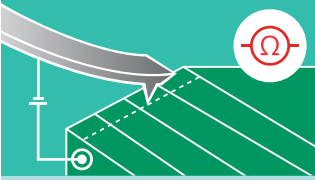


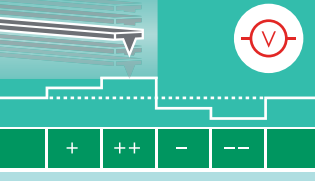
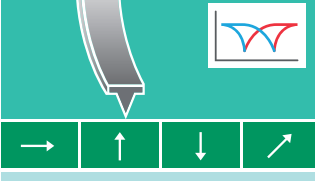
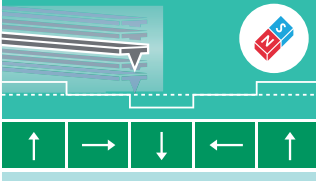



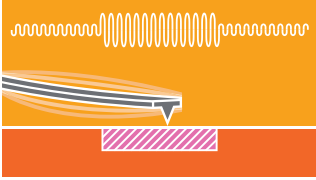




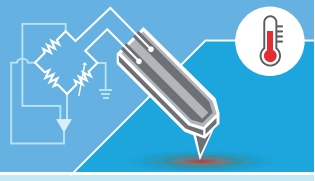
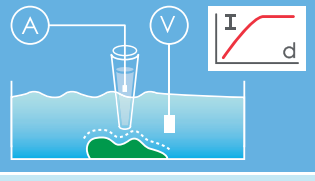
After tip-to-sample engagement, the optical camera will automatically focus on the sample to find your area of interest (AOI). The UX of SmartScan™ easily enables intuitive navigation of the sample by controlling the motorized stages in the integrated optical window. You can move the AOI of the sample directly by clicking the desired position in the optical window.

## Speeds up imaging with AdaptiveScan™

Park's innovative AdaptiveScan™ controls the scan speed automatically based on the peaks and valleys of the sample surface. AdaptiveScan™ adjusts the optimum scan speed dynamically to acquire a quality image of an unknown morphology at a higher speed. This effectually shortens the imaging time while retaining top image quality comparable to that obtained by a well-trained expert manually. When moving to neighboring locations or zooming-in to a target, AdaptiveScan™ automatically applies a new optimal condition.

## Park Atomic Force Microscopy Modes

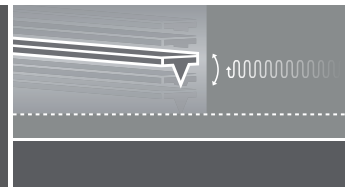
Get the data you need with Park's selection of scanning modes

TOPOGRAPHY IMAGING				
	Contact	Non-Contact	Tapping	
ELECTRICAL / MAGNETIC PROPERTIES				
	Conductive AFM	PinPoint Conductive AFM	IV Spectroscopy	Photocurrent Mapping
				
	Scanning Tunneling Microscopy	Scanning Spreading Resistance Microscopy	Scanning Capacitance Microscopy	Electrostatic Force Microscopy
				
	Kelvin Probe Force Microscopy	Piezoresponse Force Microscopy	Magnetic Force Microscopy	Tunable Magnetic Field MFM
NANOMECHANICAL PROPERTIES				
	Force Distance Spectroscopy	PinPoint Nanomechanical	Force Modulation Microscopy	Lateral Force Microscopy
				
	Nanoindentation	Nanolithography	Nanomanipulation	
OTHER PROPERTIES				
	Scanning Thermal Microscopy	Scanning Ion Conductance Microscopy		

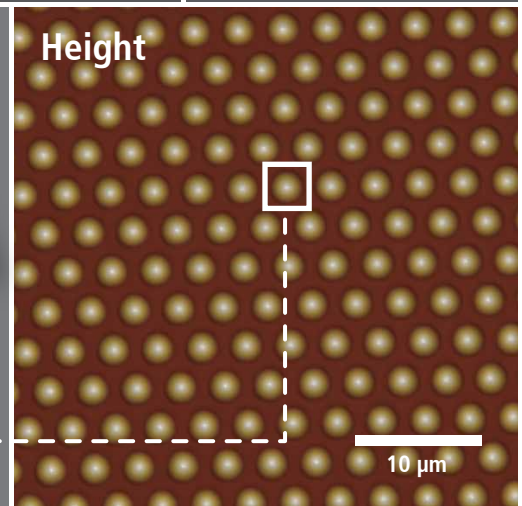
## Patterned Sapphire Substrate (PSS)

### Scanning conditions

Scan Mode: Non-Contact  
Cantilever: AR5T-NCHR  
( $k=42\text{N/m}$ ,  $f=330\text{kHz}$ )



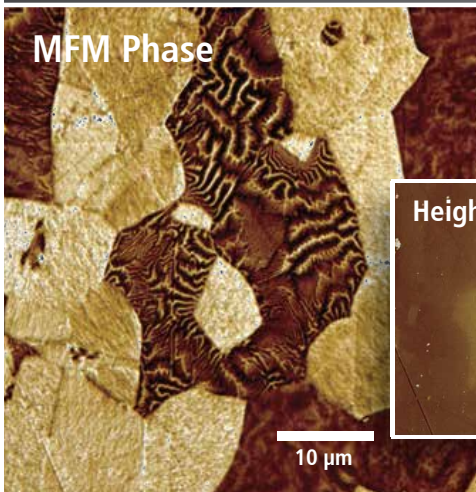
### Height



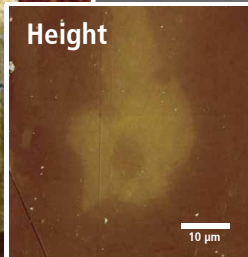
### Zoom in 3D

X:Y:Z scale=1:1:1

### MFM Phase



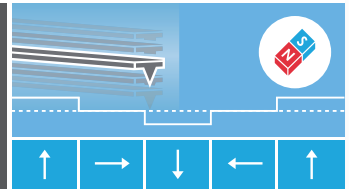
### Height



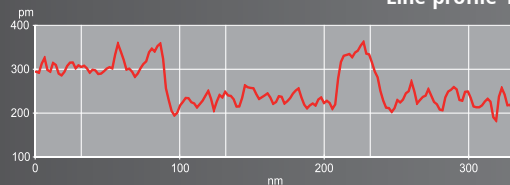
## Stainless Steel (Ferrite, Austenite)

### Scanning conditions

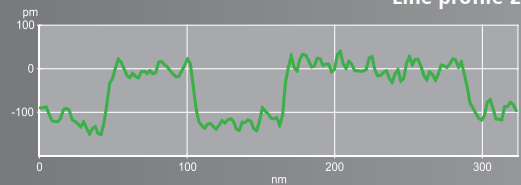
Scan Mode: MFM  
Cantilever: PPP-MFMR  
( $k=2.8\text{N/m}$ ,  $f=75\text{kHz}$ )



### Line profile 1



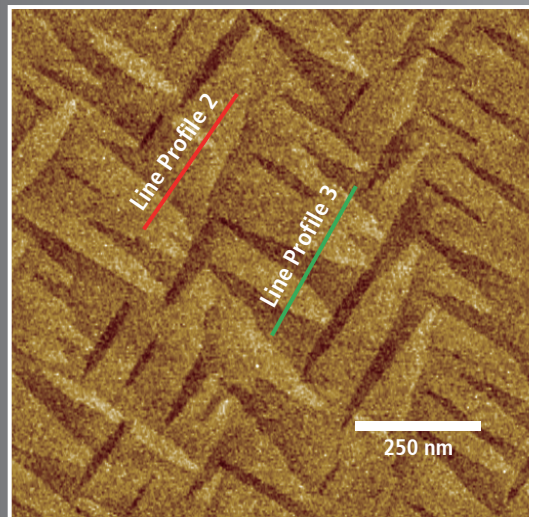
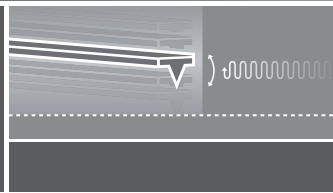
### Line profile 2



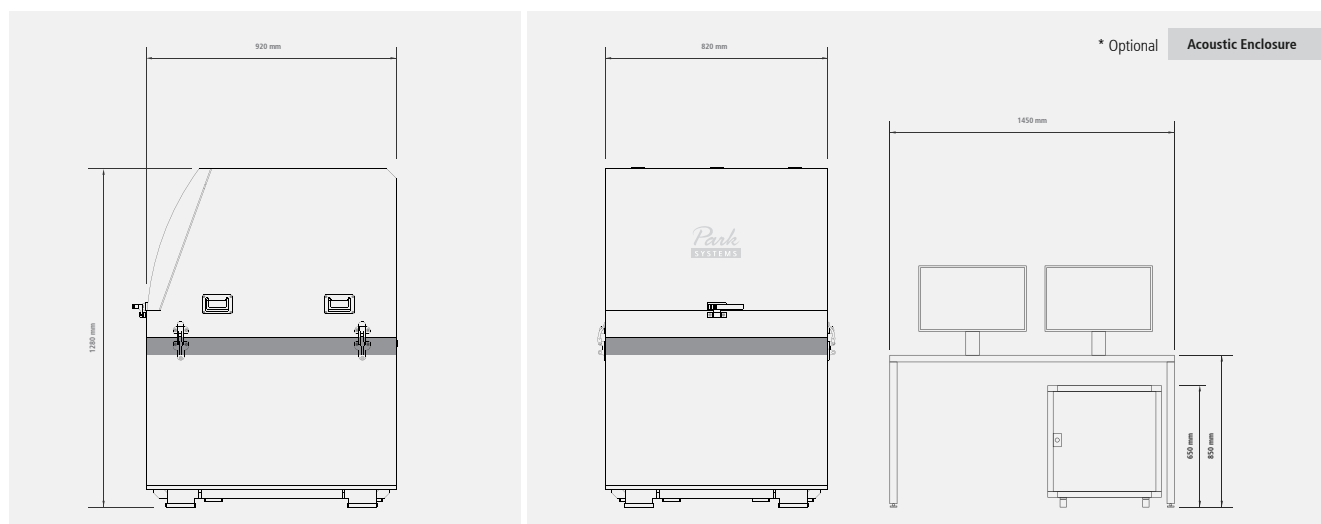
## (100) Si Epi Wafer

### Scanning conditions

Scan Mode: Non-Contact  
Cantilever: PPP-NCHR  
( $k=42\text{N/m}$ ,  $f=330\text{kHz}$ )



Scanner	Z scanner	XY scanner	Stage		
	<b>AFM Head</b> Flexure guided high-force scanner Scan range: 15 μm (optional 30 μm)	<b>SICM Head</b> Flexure-guided structure driven by multiply-stacked piezoelectric stacks Z scan range: 15 μm (optional 30 μm)	Dual-servo closed-loop feedback control for precise XY positioning Scan range: 100 μm × 100 μm (optional 50 μm × 50 μm)		
			XY stage travel range: 150 mm (200 mm optional) Z stage travel range: 25 mm Focus stage travel range: 8 mm Precision encoder for all axes (optional)		
Vision	Objective lens		Electronics	Integrated functions	
	Direct on-axis vision of sample surface and cantilever Field-of-view: 840 μm × 630 μm (with 10× objective lens) CCD: 5 M pixel	10 x ultra-long working distance lens 20 x high-resolution, long working distance lens		4 channels of flexible digital lock-in amplifier Spring constant calibration (Thermal method) Digital Q control	
Sample Mount	Sample size: Sample size: 1 small sample (10 x 10 mm, 20 mm thickness) or up to 150 mm wafer (200 mm optional) Vacuum grooves to hold wafer samples Up to 16 small samples (10 mm x 10 mm, 20 mm thickness) (Optional Multi Sample Chuck)				
Options/Modes	Topography Imaging	Magnetic Properties	Dielectric/Piezoelectric Properties	Electrical Properties	Mechanical Properties
	<ul style="list-style-type: none"><li>• Non-Contact</li><li>• Contact</li><li>• Tapping</li></ul>	<ul style="list-style-type: none"><li>• Magnetic Force Microscopy (MFM)</li></ul>	<ul style="list-style-type: none"><li>• Piezoresponse Force Microscopy</li><li>• PFM with High Voltage</li><li>• Piezoresponse Spectroscopy</li></ul>	<ul style="list-style-type: none"><li>• Conductive AFM (C-AFM)</li><li>• I/V Spectroscopy</li><li>• Kelvin Probe Force Microscopy (KPFM)</li><li>• KPFM with High Voltage</li><li>• Scanning Capacitance Microscopy (SCM)</li><li>• Scanning Spreading-Resistance Microscopy (SSRM)</li><li>• Scanning Tunneling Microscopy (STM)</li><li>• Photo Current Mapping (PCM)</li><li>• Current-Distance (I/d) Spectroscopy (with SICM)</li><li>• Electrostatic Force Microscopy (EFM)</li></ul>	<ul style="list-style-type: none"><li>• PinPoint Nanomechanical</li><li>• Force Modulation Microscopy (FMM)</li><li>• Nanoindentation</li><li>• Nanolithography</li><li>• Nanolithography with High Voltage</li><li>• Nanomanipulation</li><li>• Lateral Force Microscopy (LFM)</li><li>• Force Distance (F/d) Spectroscopy</li><li>• Force Volume Imaging</li></ul>
	Thermal Properties	Chemical Properties			
	<ul style="list-style-type: none"><li>• Scanning Thermal Microscopy (SThM)</li></ul>	<ul style="list-style-type: none"><li>• Chemical Force Microscopy with Functionalized Tip</li><li>• EC-AFM</li></ul>			
Software	Park SmartScan™	XEI	Accessories		
	<ul style="list-style-type: none"><li>• AFM system control and data acquisition software</li><li>• Auto mode for quick setup and easy imaging</li><li>• Manual mode for advanced use and finer scan control</li></ul>	<ul style="list-style-type: none"><li>• AFM data analysis software</li><li>• Stand-alone design—can install and analyze data away from AFM</li><li>• Capable of producing 3D renders of acquired data</li></ul>	<ul style="list-style-type: none"><li>• Universal Liquid Cell with Temperature Control</li><li>• Temperature Controlled Stages</li><li>• Electrochemistry Cell</li><li>• Glove Box</li></ul>	<ul style="list-style-type: none"><li>• Magnetic Field Generator</li><li>• Multi Sample Chuck</li><li>• Tilting Sample Chuck</li><li>• Snap-in Sample Chuck</li></ul>	



## Committed to contributing to impactful science and technology

Park Systems Corporation is a leading manufacturer of nanoscale microscopy and metrology solutions that encompasses the atomic force microscopy, white light interferometry, infrared spectroscopy and ellipsometry systems. Its products are widely used for scientific research, nanoscale engineering, and semiconductor fabrication and quality assurance. Park Systems provides a full range of AFM products from desktop to fully automated systems with integrated robotic arms. Furthermore, its product line includes WLI AFM, Photo-induced Force Microscopy spectroscopy and ellipsometry systems for those in the chemistry, materials, physics, life sciences, and semiconductor industries. In 2022, Park Systems acquired and merged Accurion GmbH, a leader in high-end ellipsometry and active vibration isolation, to form Park Systems GmbH, Accurion Division.

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