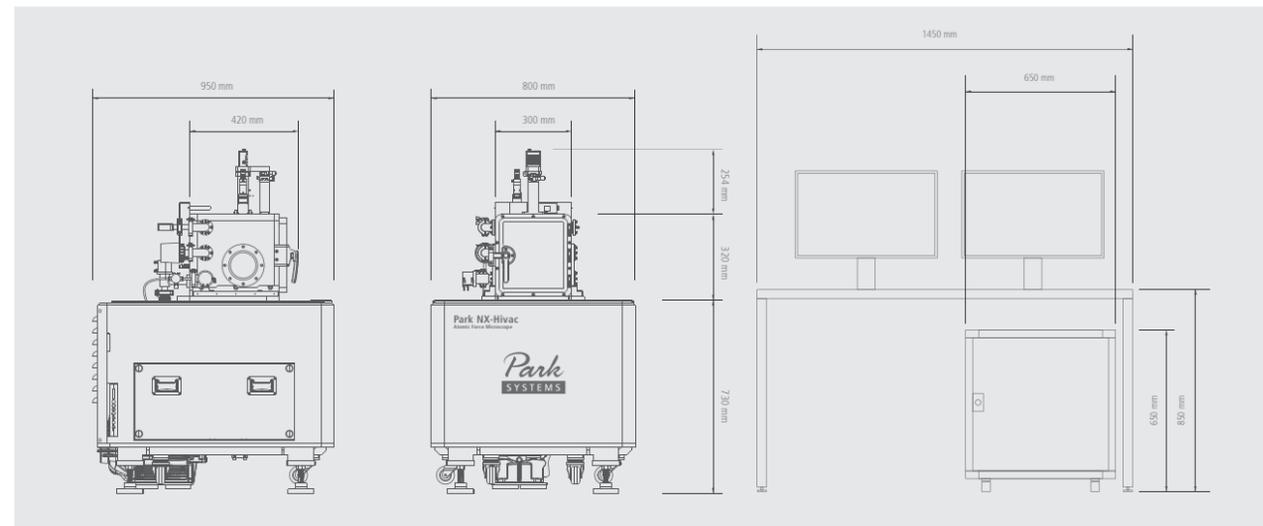


Scanner	Vision	Sample Stage	High Vacuum
XY scanner: 50 $\mu\text{m}$ $\times$ 50 $\mu\text{m}$ (100 $\mu\text{m}$ $\times$ 100 $\mu\text{m}$ optional) Z scanner: 15 $\mu\text{m}$	Direct on-axis vision of sample surface and cantilever Field-of-view: 840 $\mu\text{m}$ $\times$ 630 $\mu\text{m}$ (with 10 $\times$ objective lens) CCD: 5 M pixel	Sample size: Open space up to 100 mm $\times$ 100 mm using single sample and 10 mm $\times$ 10 mm using multi samples, thickness up to 20 mm XY stage travel range: 22 mm $\times$ 22 mm Z stage travel range: 24 mm Focus stage travel range: 11 mm	Vacuum level: Typically less than $1 \times 10^{-5}$ torr Pumping speed: Reach to $10^{-5}$ torr in about 5 min using Turbo & Dry pump
Electronics	Software	Options/Modes	Accessories
Integrated functions 4 channels of flexible digital lock-in amplifier Spring constant calibration (Thermal method) Digital Q control	Park SmartScan™ • AFM system control and data acquisition software • Auto mode for quick setup and easy imaging • Manual mode for advanced use and finer scan control XEI • AFM data analysis software • Stand-alone design—can install and analyze data away from AFM • Capable of producing 3D renders of acquired data Hivac Manager • Auto vacuum control software	<b>Topography Imaging</b> <ul style="list-style-type: none"> <li>• Non-Contact</li> <li>• Contact</li> <li>• Tapping</li> </ul> <b>Magnetic Properties</b> <ul style="list-style-type: none"> <li>• Magnetic Force Microscopy (MFM)</li> </ul> <b>Dielectric/Piezoelectric Properties</b> <ul style="list-style-type: none"> <li>• Piezoresponse Force Microscopy (PFM)</li> <li>• PFM with High Voltage</li> <li>• Piezoresponse Spectroscopy</li> </ul> <b>Electrical Properties</b> <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>• Electrostatic Force Microscopy (EFM)</li> </ul> <b>Mechanical Properties</b> <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> <b>Thermal Properties</b> <ul style="list-style-type: none"> <li>• Scanning Thermal Microscopy (SThM)</li> </ul> <b>Chemical Properties</b> <ul style="list-style-type: none"> <li>• Chemical Force Microscopy with Functionalized Tip</li> </ul>	• Temperature Controlled Stage • Tilting Sample Chuck • Snap-in Sample Chuck



**Note:** All specifications are subject to change without notice. Please visit our website for the most up-to-date specifications.

## Committed to Contribute to Impactful Science and Technological Development

More than 25 years ago, the foundations of Park Systems were laid at Stanford University, where Park Systems' founder, Dr. Sang-il Park, worked in Prof. Calvin Quate's group; the group that invented the world's first AFM. After years of development, Dr. Park introduced the first commercial AFM to the world, thus starting the successful path of Park Systems. With good foresight, a superior product and keen business acumen, Park has positioned themselves as the dominant industry leader in AFM Nanoscale Metrology and in 2020, Park Systems will roll out their most exciting line of AFM products in their history.

Park Systems continuously strives to live up to the innovative spirit of its origin. Throughout its long journey, the company has been committed to provide advanced, accurate, and reliable AFM instrumentation, with revolutionary features such as True Non-Contact™ mode and PinPoint™ Nanomechanical AFM. Cutting-edge AFM automation features, like SmartScan™, make Park Systems AFMs not only extremely easy to use, but they also enable users to obtain outstanding results faster, more efficiently, and more accurately.

## Park Systems

Enabling Nanoscale Advances

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Park Systems China: +86-10-6254-4360  
 Park Systems SE Asia: +65-66347470



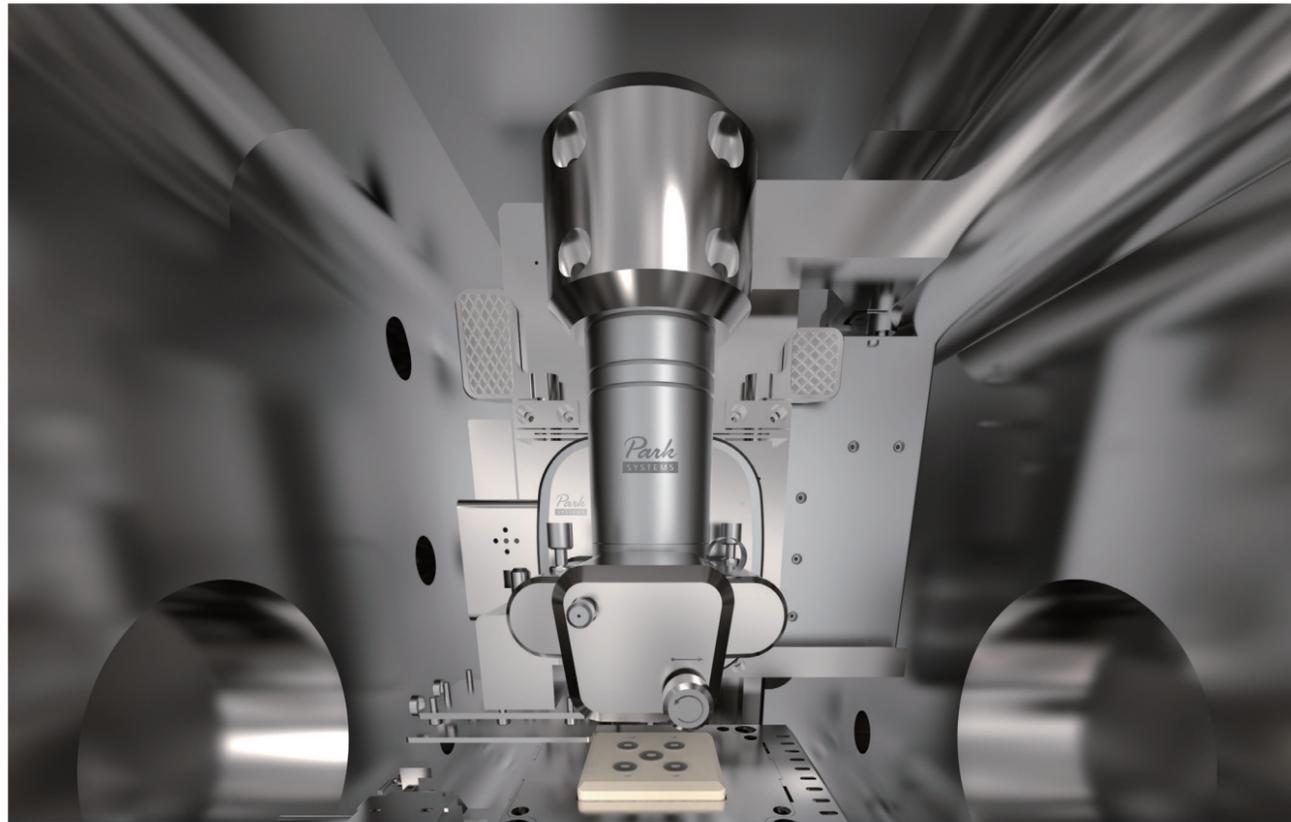
## ATOMIC FORCE MICROSCOPE



# Park NX-Hivac

Ideal for failure analysis  
and sensitive materials research





# Park NX-Hivac

## High vacuum Atomic Force Microscope for failure analysis and atmosphere-sensitive materials research

Park NX-Hivac allows failure analysis engineers to improve the sensitivity and repeatability of their AFM measurements in a high vacuum environment. Because high vacuum measurement offers greater accuracy, better repeatability, and less tip and sample damage than ambient or dry N<sub>2</sub> conditions, users can measure a wider range of signal response in various failure analysis applications, such as dopant concentration of Scanning Spreading Resistance Microscopy (SSRM).

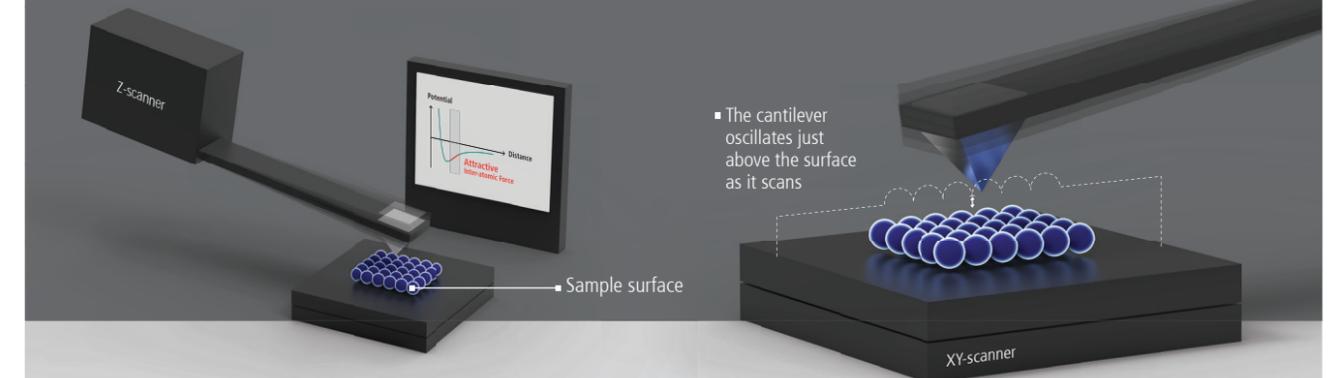
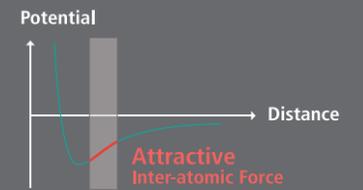
Park NX-Hivac enables materials scientific research that requires high accuracy and high resolution measurements in a vacuum environment free from oxygen and other agents.

## True Non-Contact™ Mode

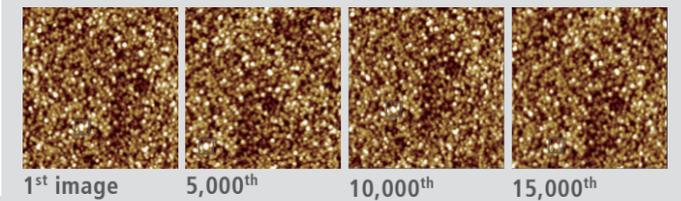
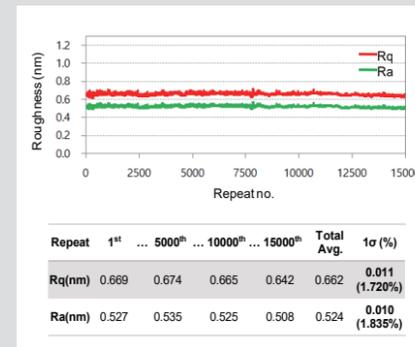
True Non-Contact™ Mode is a scan mode unique to Park AFM systems that produces high resolution and accurate data by preventing destructive tip-sample interaction during a scan.

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

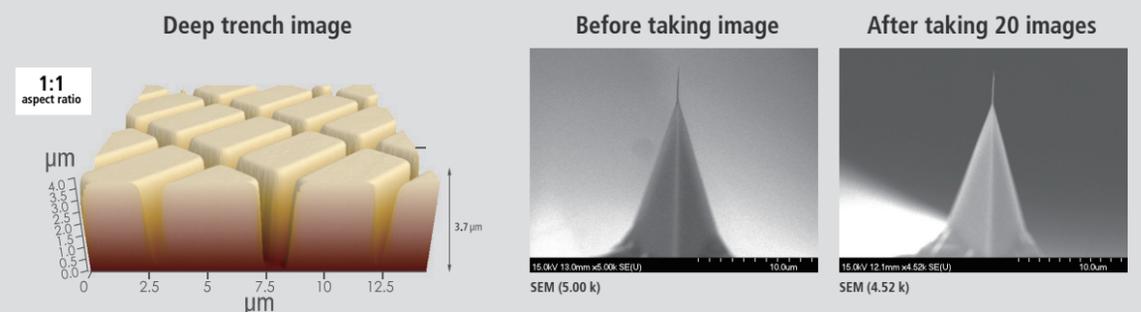
- Less tip wear → Prolonged high-resolution scan
- Non-destructive tip-sample interaction → Minimized sample modification
- Maintains non-contact scan over a wide range of samples and conditions



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

Choose pixel density and scan size.

Start with sample A

- 1 SETUP
- 2 POSITION
- 3 IMAGE
- 4 END

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 Hivac Manager

## NX-Hivac auto vacuum control

High vacuum is controlled by Hivac Manager, pumping for the optimized vacuum condition and venting processes are logically and visually controlled by one-button clicking. Each process is visually monitored by color and schematic changes, you do not need to worry about the sequence of vacuum operation after clicking on a button. Faster and easier vacuum control software brings you ease of use AFM operation and better productivity.

**Park Hivac Manager**  
NX-Hivac auto vacuum control

Status: Connected

Controls: Auto, Manual

Pumping, Venting

High Vacuum Gauge: 0-70 mTorr (ABM / Off)

Low Vacuum Gauge: 0-900 Torr (APCM / On)

Chamber: 1.28x10<sup>-4</sup> Torr

Turbo Pump: EXT750X / Running, Speed 82%, 80.5 W

Dry Pump: rXD5 / Running, Speed 100%, 352.0 W

Event Log:

when	description
12:02:06	Turn On Dry Pump Fan
12:02:06	Turn On Turbo Pump Fan
12:02:06	Open Roughing Valve
12:02:07	Open Foreline Valve
12:02:09	Start Dry Pump
12:02:10	Waiting for pressure dropped below 0.150...
12:04:23	Start Turbo Pump
12:04:25	Waiting for turbo pump started
12:05:40	Close Roughing Valve
12:05:43	Open Gate Valve

Started at 2015/06/23 11:58:47

## Automatic vacuum pumping and venting



The NX-Hivac lets users set up automatic controls for vacuum pumping and venting, further streamlining the scanning process and reducing required human input. The average pumping speed is to about 10<sup>-5</sup> torr in < 5 min using Turbo and Dry Pump.

# 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				● NOT AVAILABLE FOR THIS PRODUCT
	Scanning Thermal Microscopy	Scanning Ion Conductance Microscopy		

**Height** **SSRM Resistance**

Active material  
High-Conductance material  
High-Resistance Resin

10  $\mu\text{m}$

**Zoom-in Height** **Zoom-in Resistance**

1  $\mu\text{m}$  1  $\mu\text{m}$

**Li ion Battery Electrode** **SiC MOSFET**

**Scanning conditions**  
Scan Mode: SSRM  
Cantilever: CDT-NCHR  
( $k=80\text{ N/m}$ ,  $f=400\text{ kHz}$ )

**Scanning conditions**  
Scan Mode: SSRM  
Cantilever: Full diamond  
( $k=27\text{ N/m}$ )

**Current in Vacuum condition** **Current in Ambient condition**

0.4  $\mu\text{m}$  0.4  $\mu\text{m}$

\* Current in vacuum condition showed stronger than ambient by better tip-sample contact

**Current line profile**

$\mu\text{A}$

100  
1  
1.E-2  
1.E-4

0 0.25 0.5 0.75 1 1.25  $\mu\text{m}$

**I/V spectroscopy**

Current (nA)

2.5  
2  
1.5  
1  
0.5  
0

Sample Bias (V)

-3.0 -2.2 -1.5 -0.7 0.0 0.8 1.5 2.3 3.0

IV curve in P1 HV Air