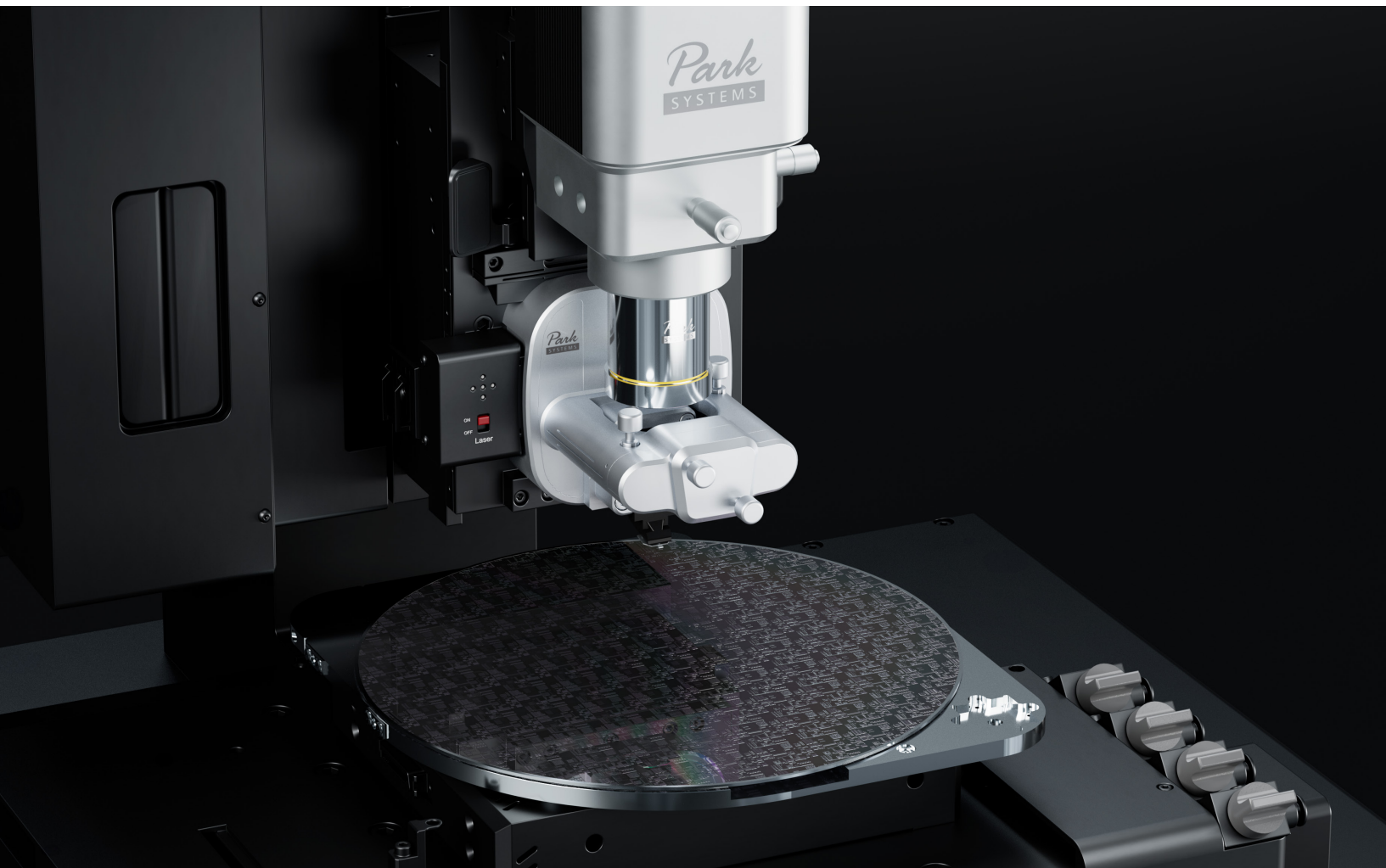


Park NX20

The Leading Nanometrology Tool
for Failure Analysis and Large Sample Research



Park
SYSTEMS

Park NX20 is a flagship atomic force microscope (AFM) designed for large-sample research, delivering unmatched accuracy, reliability, and ease of use. As Park Systems' original 200 mm sample AFM, it has earned global recognition in both academic and industrial laboratories for producing precise, repeatable nanoscale measurements.

At the core of NX20 are Park Systems' proprietary orthogonal scan system and True Non-contact™ mode, innovations that virtually eliminate lateral motion artifacts while protecting both tip and sample. Together, these technologies ensure artifact-free, high-resolution imaging even for the most delicate or challenging samples.

From materials science and semiconductors to polymers and bioengineering, NX20 delivers robust performance and dependable results, making it a trusted platform for advanced nanoscale metrology.

NX20 – Key Features

- | Outstanding AFM Performance | User Convenience | Additional Features |
|--|--|---|
| <ul style="list-style-type: none">True Non-Contact™ ModeOrthogonal Scan SystemDual Servo XY ScannerFast Z-Servo Speed | <ul style="list-style-type: none">Easy Probe ExchangeIntuitive Laser Beam AlignmentRecipe-Based Sequential Measurement | <ul style="list-style-type: none">Comprehensive Selection of AFM ModesVarious Sample Chuck Options |

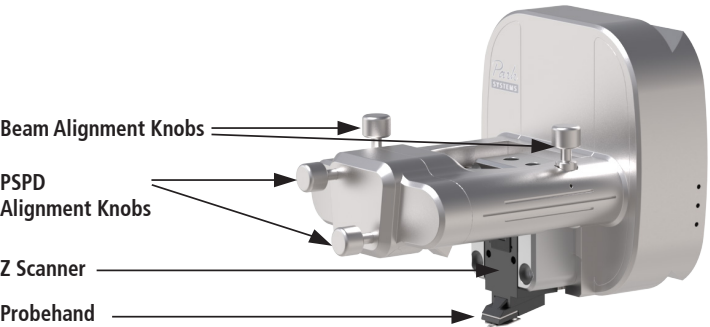


Park NX20

Next-Generation AFM for Large Samples

Fast Z Servo and High Resolution

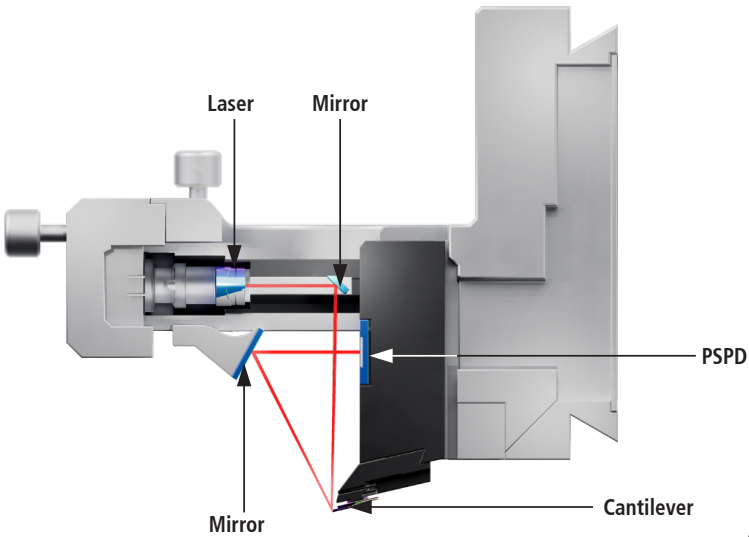
The resolution of the images in Park NX series has been further enhanced. The NX Z scanner, built with a stacked piezo actuator and a strain gauge sensor, delivers fast and precise measurements across a wide range of surfaces. From extremely flat to rough samples, it maintains consistent roughness linearity regardless of scan size, ensuring reliable results in any measurement.



NX Laser Beam Path

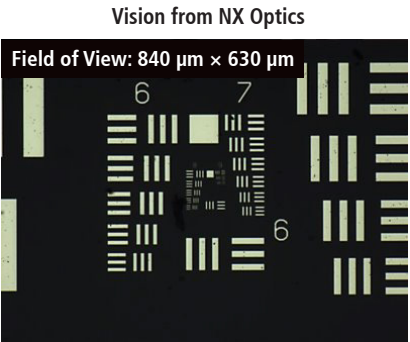
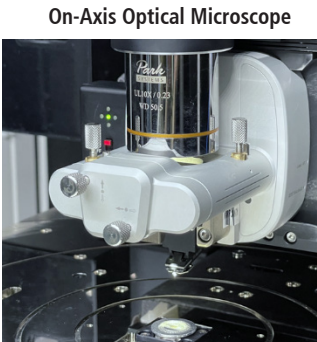
The NX head integrates a superluminescent diode that provides low coherence illumination, minimizing interference for stable signal detection. The laser beam is guided through precision mirrors to the cantilever and position-sensitive photodetector (PSPD), ensuring accurate signal alignment.

The knobs move the laser beam directly along the X and Y axes, allowing intuitive adjustment of the beam position and effortless realignment during probe replacement.



On-Axis Optical Microscope

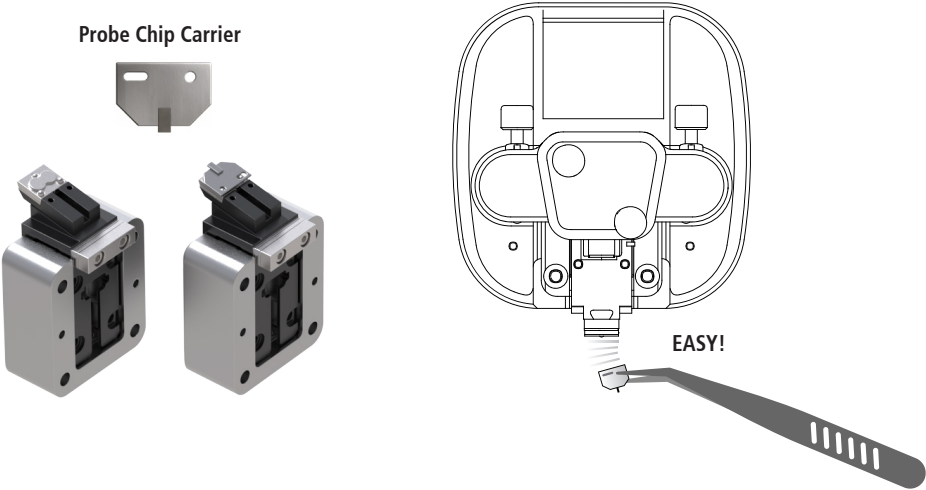
The high-power on-axis optical microscope provides a clear view of the sample surface. A software-controlled LED light source illuminates the sample surface for better observation.



Pre-Mounted Probe

AFM probe exchange can be challenging, even for experienced users, often resulting in cantilever breakage. Park AFM addresses this by using pre-aligned probe chip carriers with kinematic mounting points, ensuring reliable and consistent tip positioning.

The NX head's Z scanner features three precision balls for kinematic mounting, complemented by magnets at the base to ensure a secure, reliable, and repeatable mounting position.



Simple Expansion Slot for Modes and Options

Simply plug an option module into the expansion slot to enable advanced AFM modes.

Park NX series AFM features a modular design, ensuring compatibility with options across its product line.



Improved Z Scan Straightness

Park NX series Z scanner maintains straightness within 0.1% across the usable range, with out-of-axis motion under 5 nm even at a full 15 μm extension.

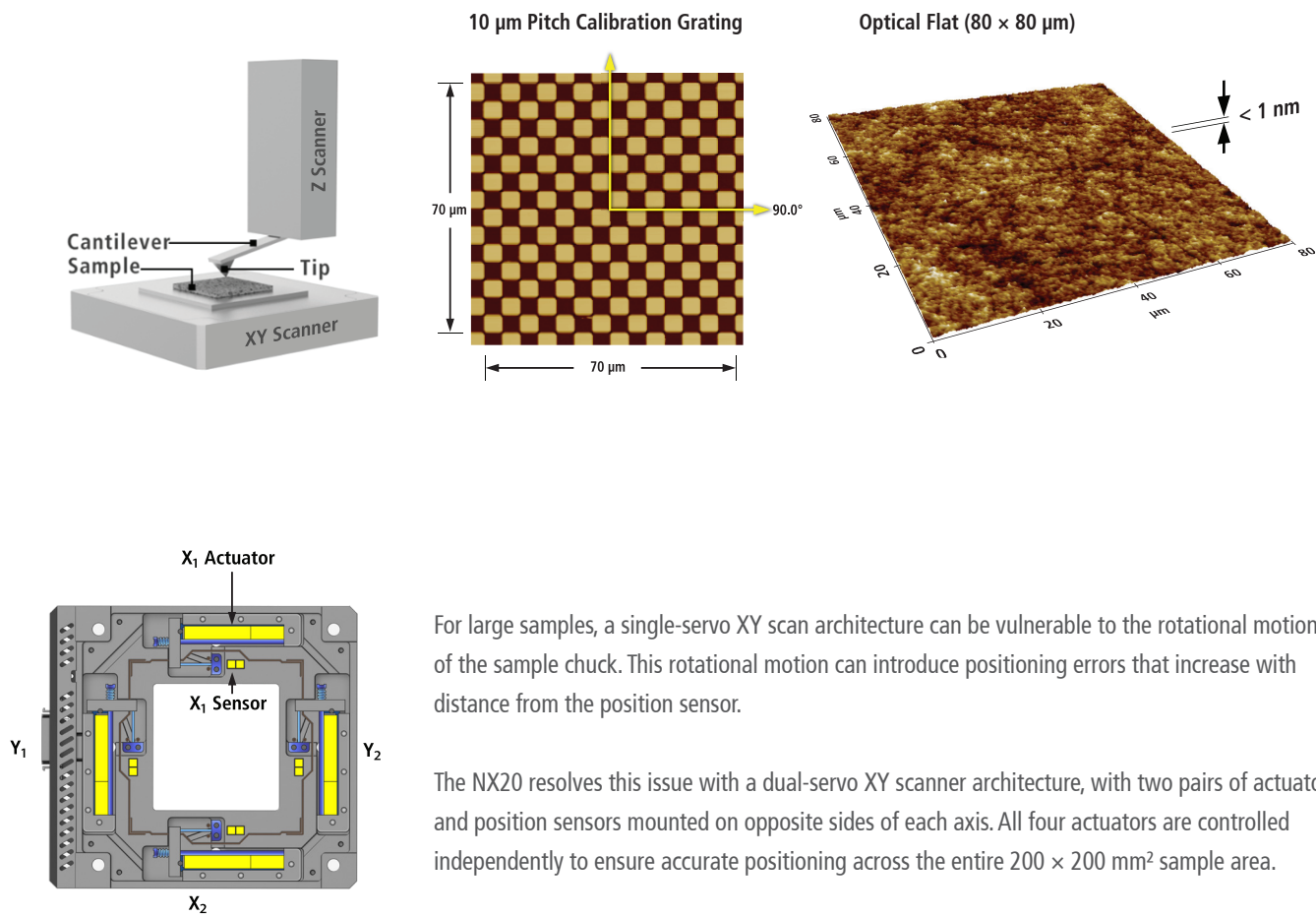
Its compact assembly, combining a preload spring, kinematic pin, and piezo actuator, minimizes drift and ensures accurate vertical motion for reliable, distortion-free nanoscale measurements.



Park AFM Technology

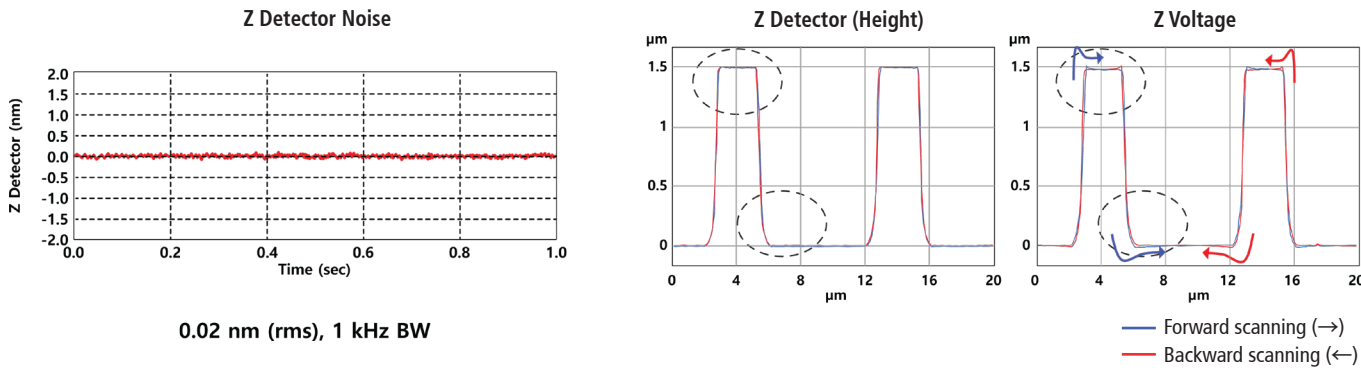
Orthogonal Scan

Conventional AFMs with tube scanners suffer from out-of-plane motion and axes crosstalk, resulting in image distortion, especially over large scan areas. NX20, like all Park AFMs, employs an advanced orthogonal scan system featuring a flexure-guided architecture: a 2D flexure scanner moves the sample in the XY plane, while a separate 1D flexure scanner independently controls the probe's Z-axis motion. Equipped with low-noise optical sensors for XY feedback and an ultra-low-noise strain gauge sensor for Z control, this separated scanner system ensures highly orthogonal, linear scans with minimal out-of-plane motion and fast dynamic performance.



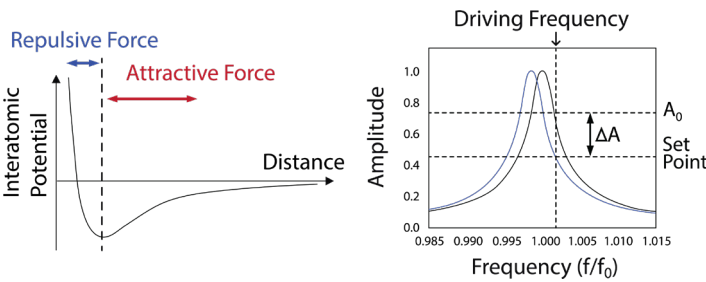
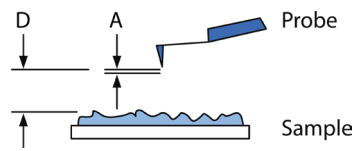
Low Z Detector Noise

The Z detector has a noise level of less than 0.02 nm, enabling height measurements with sub-nanometer accuracy, down to 0.1 nm. Unlike conventional Z voltage mapping, which often overshoots at stiff walls, the Z detector provides precise, conformal surface tracing.



True Non-Contact™ Mode

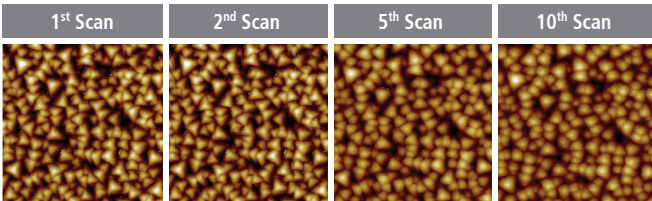
NX20 features True Non-contact™ mode, a proprietary technology exclusively offered by Park Systems. True Non-contact mode obtains topography by detecting the attractive van der Waals force between the AFM tip and the sample surface.



In True Non-contact mode, the tip oscillates at a frequency slightly higher than its resonance frequency, where the amplitude-frequency curve has its steepest slope.

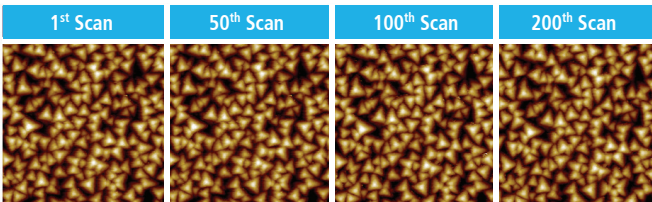
As the tip approaches the sample, the attractive force causes a downshift in the effective resonance frequency, leading to a decrease in oscillation amplitude at the driving frequency. The Z-servo maintains this new amplitude as the set point, keeping a constant tip-sample interaction while the tip scans in the XY direction.

Tapping Mode



An important advantage of True Non-contact mode, compared to tapping mode, is the prevention of tip wear and sample damage. The results of repetitive scans on a chromium nitride (CrN) tip-checking sample show that while the tapping mode image became blurry after just a few scans due to tip wear, the True Non-contact mode image remained sharp even after 200 scans.

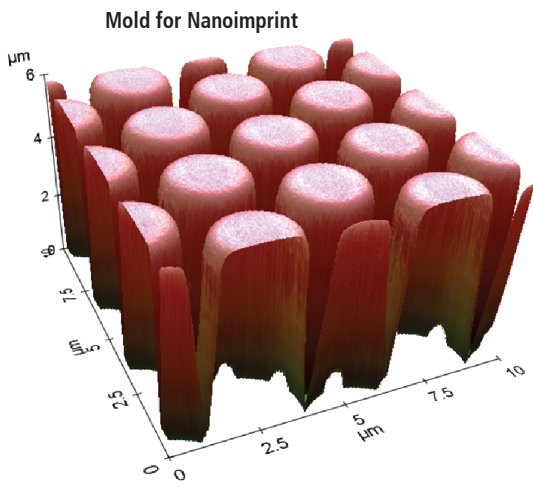
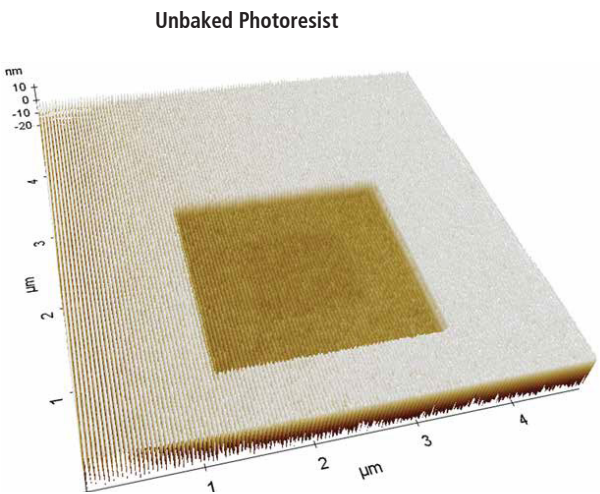
True Non-Contact Mode



CrN Tip-checking Sample

True Non-contact mode can measure soft and sticky samples as well as the most delicate and brittle samples, which cannot be imaged with tapping mode AFM. The image below is the topography of an unbaked photoresist acquired with True Non-contact mode, showing damages induced by electron beam irradiation during SEM scanning.

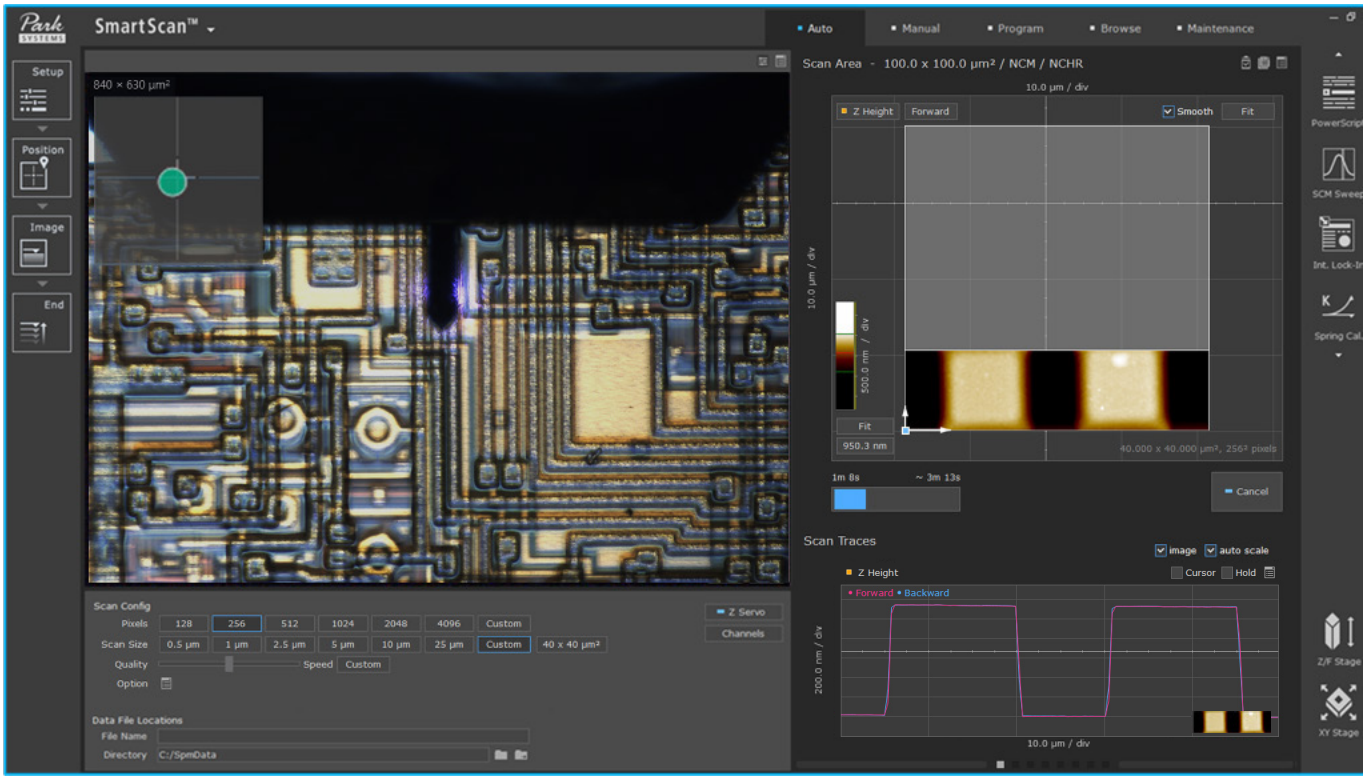
True Non-contact mode can also scan tall features. By sensing attractive forces not only at the apex of the tip but also along its sides, the Z-servo quickly retracts the tip as it approaches vertical features. With True Non-contact mode, deep holes and tall pillars like molds for nanoimprint can be measured, as in the image below.



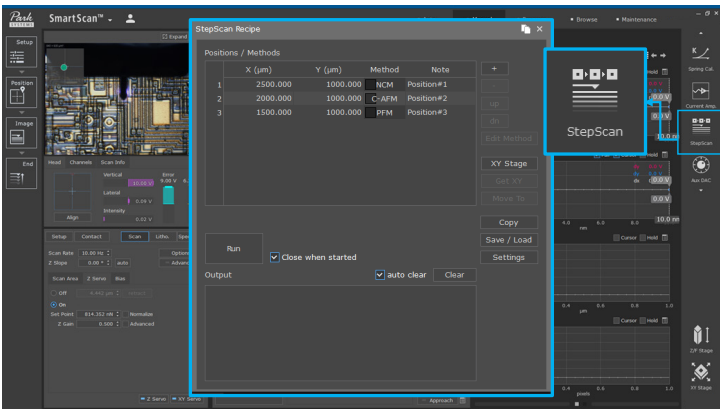
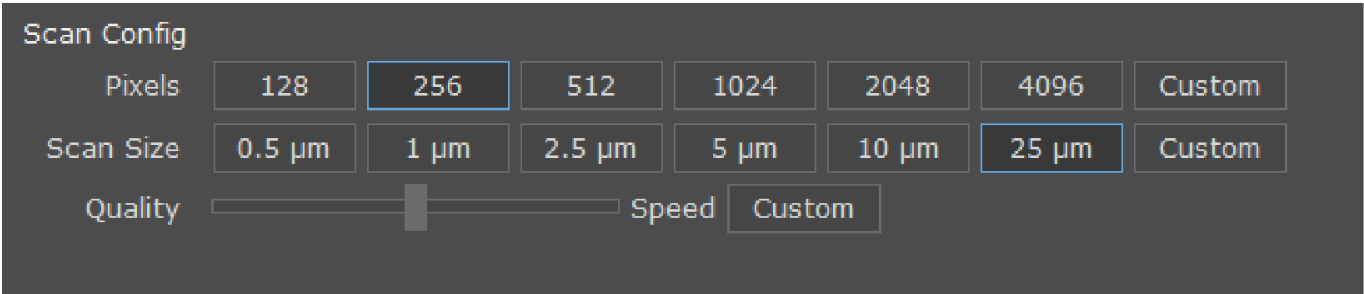
Park SmartScan™

Bringing the Power and Versatility of AFM Technology to Everyone

NX20 comes with Park SmartScan™, an advanced AFM operating software that simplifies image acquisition and enhances usability with its intuitive interface and powerful automation features.



In conventional AFM systems, users must manually adjust numerous parameters, such as Z servo gains, force set point, and XY scan speed, often through trial and error. SmartScan eliminates this complexity by allowing users to choose only three parameters: pixel density, scan size, and quality vs. speed preference. Then, all other settings are automatically optimized in real time by analyzing sample geometry and obtaining the best possible AFM images. SmartScan reduces the operational burden and makes high-quality imaging accessible to users of all experience levels.



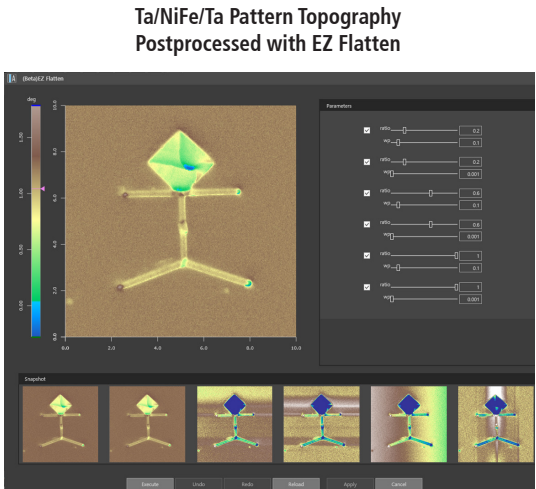
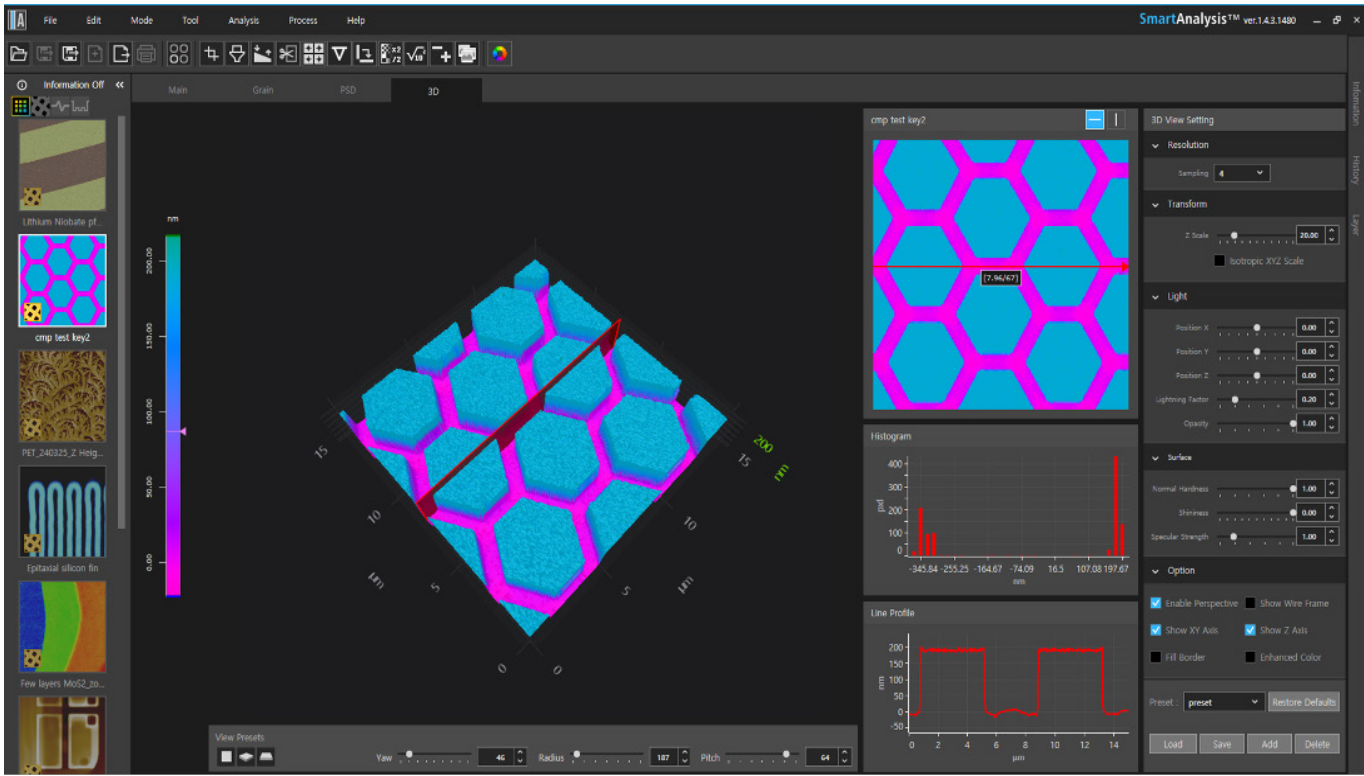
StepScan™

StepScan™ is an advanced Park SmartScan™ feature to pre-define measurement locations and recipes for efficient and consistent data acquisition.

Park SmartAnalysis™

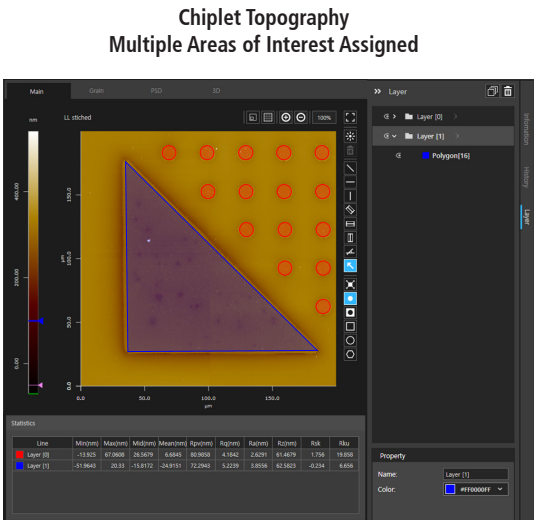
Streamlining AFM Data Workflow

Scan data from NX20 can be analyzed with Park SmartAnalysis™, a powerful AFM image analysis software that enables fast image processing, comprehensive data analysis, and efficient result publication.



EZ Flatten

Postprocessing AFM data to correct artifacts such as noise, sample tilt, and surface irregularities is a manual, tedious, and time-consuming task. SmartAnalysis simplifies this process through the EZ Flatten function. With six automatically flattened results using different flattening parameter sets, users can choose the version that most accurately represents the data.



Multilayer Analysis

Users can analyze and compare multiple areas of interest at once using a polygonal freeform area drawing tool. Unlike conventional AFM data analysis software that allows inspection of one region at a time, SmartAnalysis provides various metrics for all selected areas simultaneously.

Park NX20

Additional Features

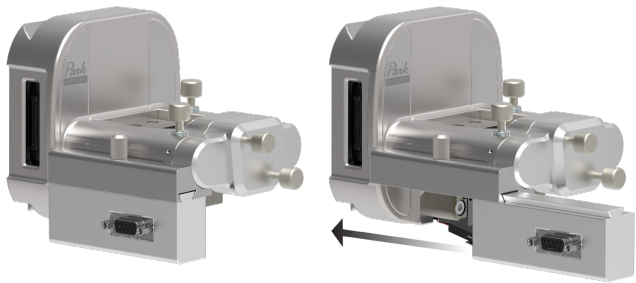
Broadest Range of AFM Modes and Options

NX controller integrates four built-in lock-in amplifiers, allowing advanced modes such as KPFM and PFM to be performed in a single scan instead of the conventional double-pass method. This significantly improves measurement efficiency.

With the Head Extension Module (HEM), even more advanced capabilities become available, including Heterodyne KPFM and Contact Resonance PFM.

Easy Head Extension Module (HEM) Setup

NX AFM heads are designed for seamless integration with Head Extension Modules (HEM). Depending on the application, an HEM can be quickly installed by sliding it into place and securing it with the top knob.

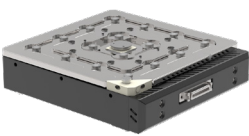


Sample Chuck Options

NX20 offers a versatile range of sample chucks to support diverse applications. Options include a multi-sample chuck that accommodates up to 16 samples, a wedge-type holder for sidewall measurements, and an AFM–SEM linkage holder for precise alignment across both AFM and SEM systems.



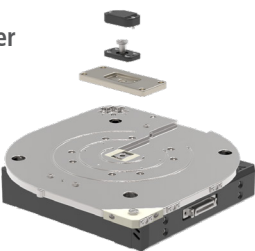
Vacuum Sample Chuck for 200 mm Wafer
Achieve precise sample handling with our vacuum chuck, designed for wafers up to 200 mm. Accommodates small samples as well as 50 mm, 100 mm, 150 mm, and 200 mm wafers.



Multi-Sample Chuck
The multi-sample chuck enables automated sequential scanning of multiple small samples, accommodating up to 16 samples.



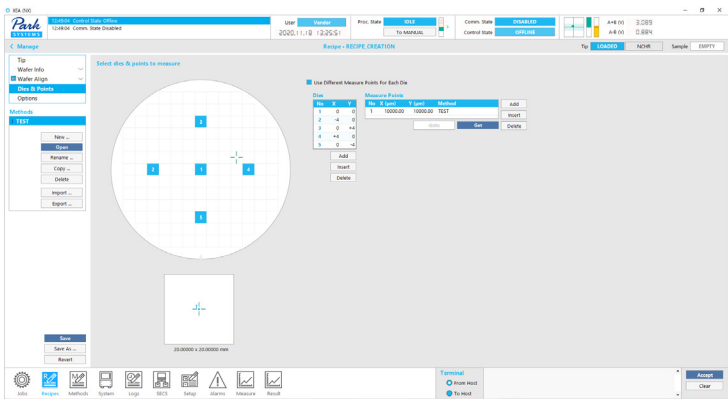
Wedge-Type Sample Holder for 150 mm Wafer
Designed for precision sidewall measurements, this vacuum-based sample plate tilts wafer samples to a fixed 20° angle. This sample plate supports 50 mm, 100 mm, and 150 mm wafers with dedicated vacuum grooves for each size.



AFM–SEM Linkage Sample Holder
Align samples with precision across both AFM and SEM systems. This versatile holder is designed for accurate XY position alignment and supports standard coupon-size samples.

Software Option

Automated Software (XEA) supports automated AFM measurement and analysis workflows. Users can create custom recipes to perform sequential scans and define analysis methods by selecting specific parameters and conditions. This enables consistent, high-throughput data acquisition and processing with minimal manual intervention.

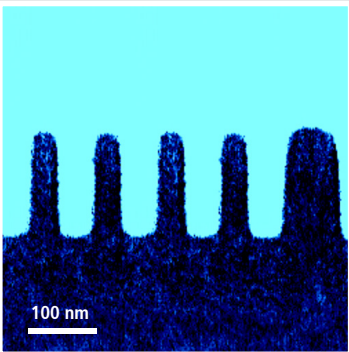
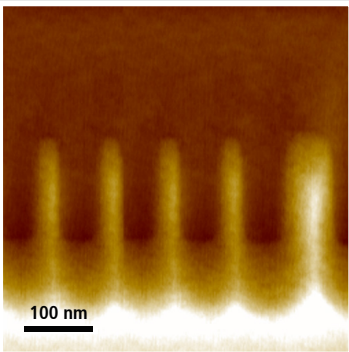


Park NX20

Designed for Your Applications

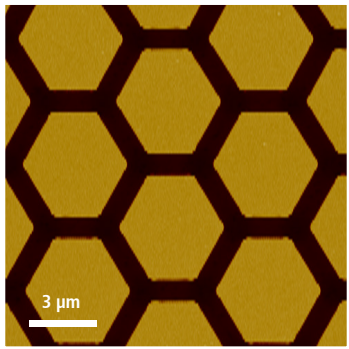
Park NX20 offers precise measurements for large samples, making it the ideal solution in research applications.

Semiconductors & Devices



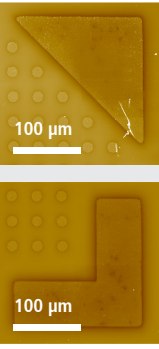
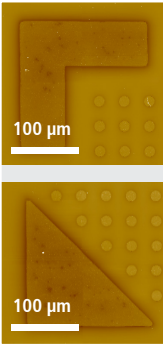
Ge Atom Layer Etching (ALE) on Patterned Wafer

The cross section of a Ge atom layer etching (ALE) patterned wafer was characterized using Scanning Spreading Resistance Microscopy (SSRM). The measurement clearly resolved the trench patterns, showing a peak-to-valley height (left) of 3.4 nm and a corresponding resistance (right) of 73 GΩ.



CMP Test Key

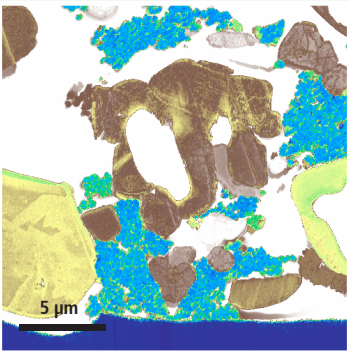
A CMP test key was measured in True Non-contact mode to acquire the surface topography. The image shows the hexagonal pattern of the CMP test key.



Stitched Image of Chiplet

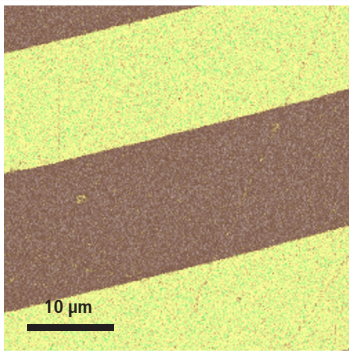
Stitched image of chiplet was measured in True Non-contact mode to acquire the surface topography. Each image is made by stitching with four 100 μm × 100 μm images and the image shows each pattern at the corner of chiplet.

Energy & Advanced Materials



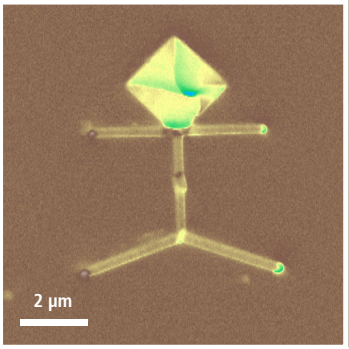
Li-ion Battery on Si Substrate

A Li-ion battery on a Si substrate was characterized using Scanning Spreading Resistance Microscopy (SSRM). The measurement revealed a peak-to-valley resistance difference of 51.7 GΩ, and the image clearly shows distinct structural features within the battery.



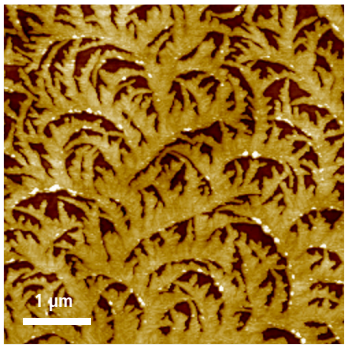
Lithium Niobate (LiNbO₃, LN)

Lithium niobate (LiNbO₃, LN) was characterized using Piezoresponse Force Microscopy (PFM). The resulting image reveals clear thick line patterns of the material.



Ta/NiFe/Ta Pattern

Ta/NiFe/Ta pattern was characterized using Magnetic Force Microscopy (MFM). The technique visualizes the magnetic response, and the resulting image clearly reveals a microman-shaped pattern in the sample.



Polyethylene Terephthalate (PET)

Polyethylene Terephthalate (PET) was characterized in PinPoint nanomechanical mode. The scan revealed a peak-to-valley height difference of 15.2 nm, and the image shows branch-like surface features.

Park NX20

Technical Specifications

AFM Modes

- Topographic Imaging
 - Contact Mode
 - Constant Height Mode
 - Constant Force Mode
 - True Non-Contact™ Mode
 - Tapping Mode
 - PinPoint™ Mode
 - Fast PinPoint™ Mode
- Mechanical Properties
 - PinPoint™ Nanomechanical Mode
 - Fast PinPoint™ Nanomechanical Mode *
 - Force-Distance (F-D) Spectroscopy
 - Nanoindentation
 - Force Modulation Microscopy (FMM)
 - Dynamic Mechanical Analysis (DMA) *
 - Torsional Force Microscopy (TFM) *
 - Lateral Force Microscopy (LFM)
- Electrical Properties
 - Conductive AFM (C-AFM) *
 - Current-Voltage (I-V) Spectroscopy
 - Photocurrent Mapping (PCM) *
 - Scanning Spreading Resistance Microscopy (SSRM) *
 - Scanning Tunneling Microscopy (STM) *
 - Scanning Capacitance Microscopy (SCM) *
 - Piezoresponse Force Microscopy (PFM)
 - Piezoresponse Spectroscopy
 - Off-resonance PFM
 - Contact Resonance PFM (CR-PFM) *
 - Dual Frequency Resonance Tracking PFM (DFRT-PFM) *
 - PinPoint™ Nanoelectrical Modes *
 - Electrostatic Force Microscopy (EFM)
 - Kelvin Probe Force Microscopy (KPFM)
 - Heterodyne KPFM *
 - Sideband KPFM
 - Amplitude Modulation KPFM (AM-KPFM)
 - Microwave Impedance Microscopy (MIM) *
- Magnetic Properties
 - Magnetic Force Microscopy (MFM)
 - Frequency Modulation MFM (FM-MFM)
 - Amplitude Modulation MFM (AM-MFM)
- Thermal Properties
 - Scanning Thermal Microscopy (SThM) *
 - Temperature Mapping
 - Thermal Conductivity Mapping
- Nanolithography & Manipulation
 - Nanolithography *
 - Nanomachining *
- In-liquid Operation
 - In-liquid Topography *
 - Scanning Ion Conductance Microscopy (SICM) *
- Electrochemical Properties
 - Electrochemical AFM (EC-AFM) *
 - Scanning Ion Conductance Microscopy-Scanning Electrochemical Microscopy (SICM-SECM) *
 - Scanning Electrochemical Cell Microscopy (SECCM) *

Scanner

- Dual-servo XY scanner (100 μm $\times$ 100 μm or 50 μm $\times$ 50 μm)
- Flexure-guided high-force Z scanner (15 μm or 30 μm)

Sample Mount

- Vacuum grooves for wafers (up to 200 mm)
- Magnetic mount for 16 small samples (optional)

Stage

- XY stage : 200 mm $\times$ 200 mm
- Z stage: 25 mm
- Focus stage: 8 mm

Dimension and Weight

- AE (Outer): 880 mm $\times$ 980 mm $\times$ 1450 mm
- Desk: 1410 mm $\times$ 810 mm $\times$ 740 mm
- Total weight: 410 kg (AFM Body + AE)

On-axis Optical Microscope

- Direct on-axis vision of sample surface and cantilever
- Field of view: 840 μm $\times$ 630 μm (w/ 10 $\times$ objective lens)
- CCD: 5 M pixels

Required Environment

- Required acoustic noise level: Below 65 dB
- Required floor vibration level: VC-D (6.25 $\mu\text{m}/\text{sec}$)
- Power: 1 kW (Maximum)

* Requires additional options

