



The World's Most Accurate AFM System

# Park NX-3DM

Innovation and Efficiency for 3D Metrology

[www.parkAFM.com](http://www.parkAFM.com)

*Park*  
SYSTEMS



# Park NX-3DM

## An Indispensable Tool for Wafer Fabrication

### A fully automated industrial AFM using NX technology

- Clean room compatible and fully automated for measurement and data analysis at the nanoscale level
- NX technology automatically constructs an extremely accurate topographical image and collects essential dimensional data
- The Industry leading, low noise Z-detector works on an independent, closed loop to minimize errors in topography (the “creep effect”)
- Non-contact mode allows for the collection of high resolution and accurate data without tip-sample damage, something that could otherwise cost youvaluable time and money

### Innovative head design for undercut and overhang structures

- Z-head’s unique sideways orientation allows access to the undercut and overhang structures of photoresist and other industrial material
- Patented decoupled XY and Z scanning systems work together with the tilted Z-scanner, letting users overcome normal challenges in accurate sidewall analysis associated with normal and flare tip methods
- Sidewall trench line profile, roughness, critical angle and critical dimension can all be measured using the NX-3DM
- Z-head tilting mechanism allows access to the sidewalls using an ultra-sharp tip to obtain the same high resolution and definition as is obtained over the rest of the material

### A Reliable, Seamless Measurement Tool for 3D materials

- No sample preparation (e.g. cutting, mounting or coating) is required to obtain the sidewall roughness or critical dimension measurements in this process
- By utilizing Z-head tilting and true Non-contact mode, the NX-3DM allows for both tip-preserving and high resolution collection of sidewall data



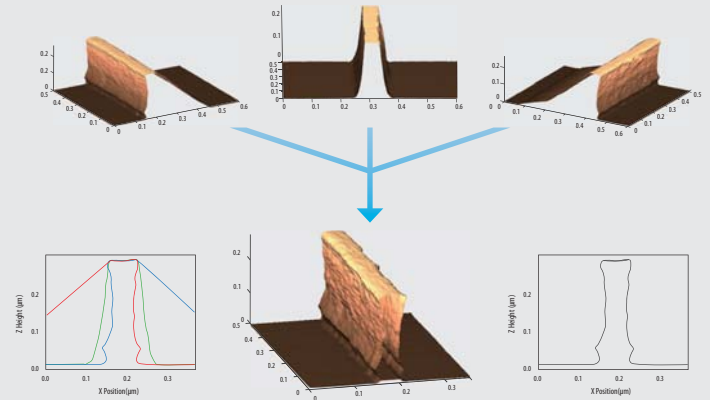
# Park NX-3DM

## An innovative 3D metrology solution

### Undercut and Overhang Profiling

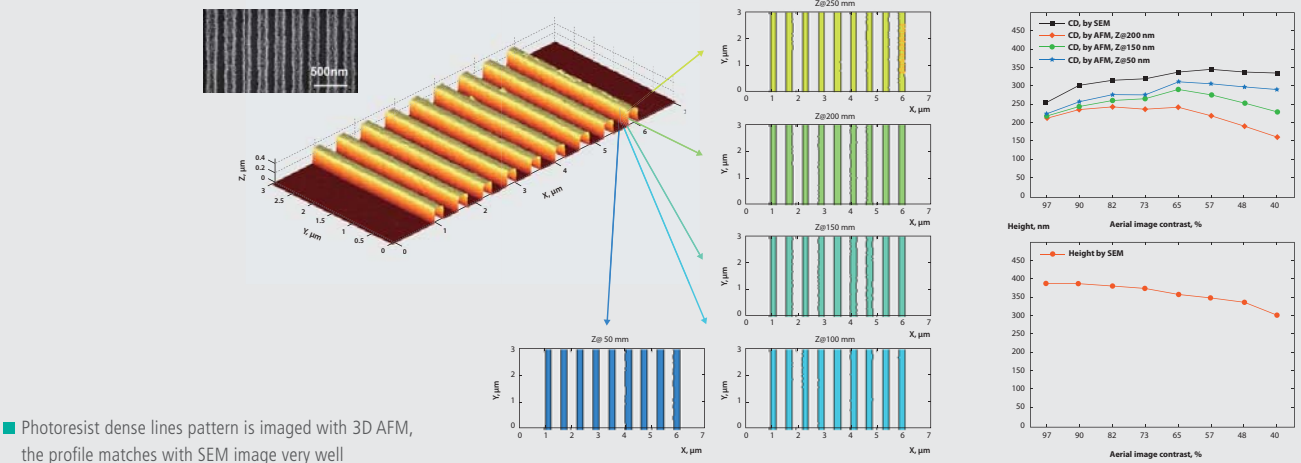
The NX-3DM allows unique access to the undercut and overhang structures of photoresist and other industrial materials, ensuring users receive accurate topographical data throughout the entire sample

- Images taken at three different tilting angles can be stitched to combined together automatically to form a complete 3D image



### Critical Dimension Measurement

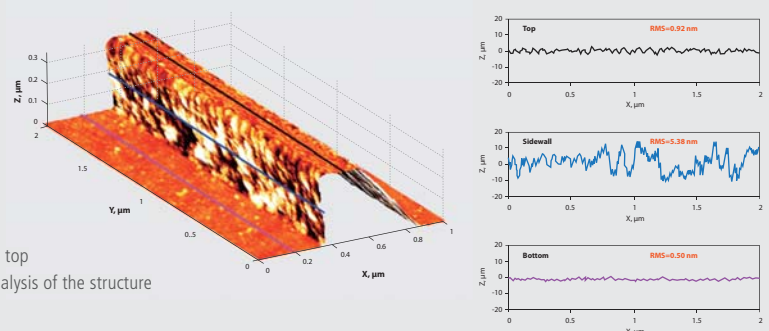
True Non-contact mode enables instrument and subject-preserving CD measurement without sacrificing image fidelity.



### Sidewall Roughness Measurement

The NX-3DM's innovative head tilting design allows access to the sidewalls using an ultra sharp tip to obtain high resolution, well-defined details of the area and its roughness. Innovative head tilting design allows access to the sidewalls using ultra sharp tip to obtain high resolution and (more defined) details of the side wall roughness

- 3D AFM image provide high resolution profiles for bottom, sidewall, and top of the photoresist line, which can be used for LER/sidewall roughness analysis of the structure



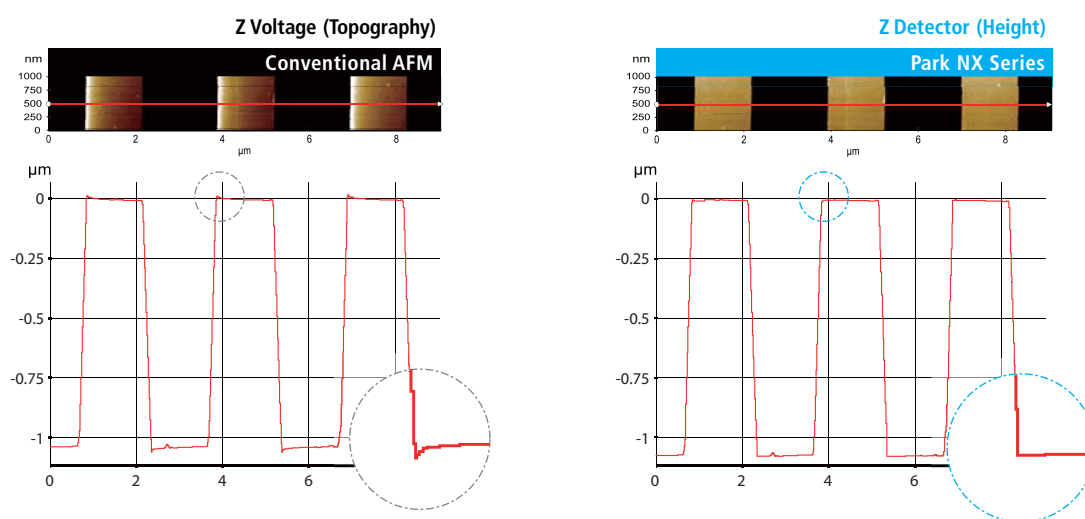
# Park NX-3DM

## Park AFM technology

### Industry Leading Low Noise Z Detector

Our AFMs are equipped with the most effective low noise Z detectors in the field, with a noise of 0.2 Å over large bandwidth. This produces highly accurate sample topography, no edge overshoot and no need for calibration. Just one of the many ways Park NX-3DM saves you time and gives you better data.

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

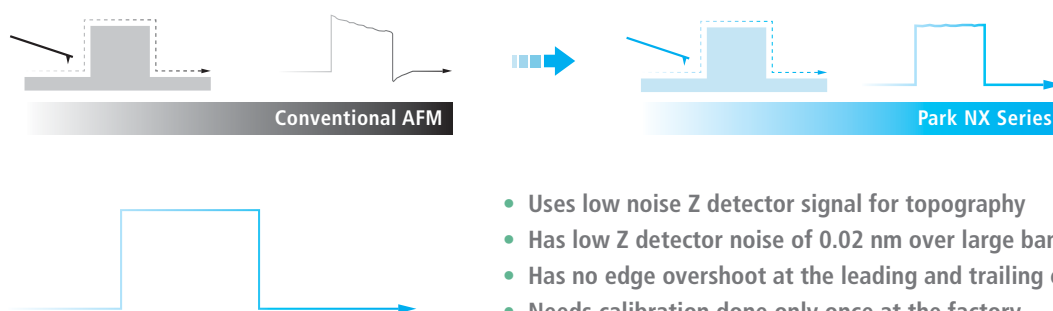


Sample: 1.2 μm Nominal Step Height (9 μm x 1 μm, 2048 pixels x 128 lines)

Piezoelectric creep effect

No creep effect

### No artifact by AFM scanner in low noise closed-loop topography



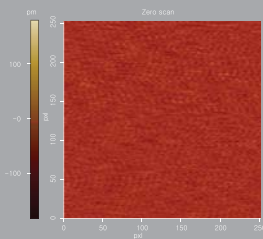
# Park NX-3DM

Powerful and yet reliable AFM

## Industry's Lowest Noise Floor

To detect the smallest sample features, and image the flattest surfaces, Park has engineered the industry's lowest noise floor specification of  $< 0.5 \text{ \AA}$ . The noise floor data is determined using a "zero scan." The system noise is measured with the cantilever in contact with the sample surface at a single point under the following conditions:

- 0 nm x 0 nm scan, staying at one point.
- 0.5 gain in contact mode
- 256 x 256 pixels



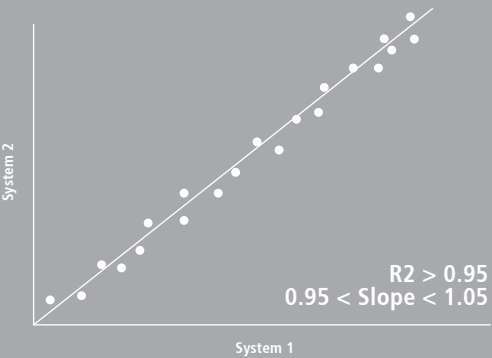
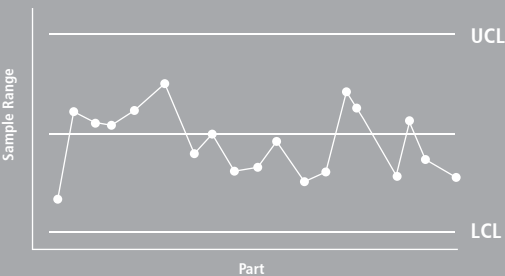
Typically  $0.3 \text{ \AA}$  rms or lower

Statistics

Region	Mid(pm)	Mean(pm)	Rpv(pm)	Rq(pm)	Ra(pm)
Red	0.000	-0.011	359.496	30.025	19.177

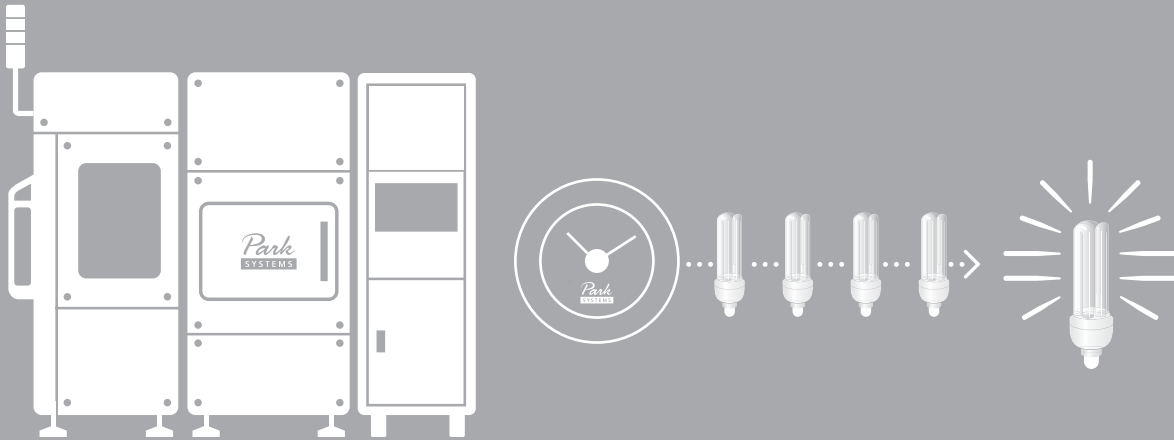
## Gauge Repeatability and Reproducibility

Due to the ever-decreasing size of components, manufacturers now require the highest level of quality control. Park AFM can provide 1 gauge sigma of less than 1 angstrom.



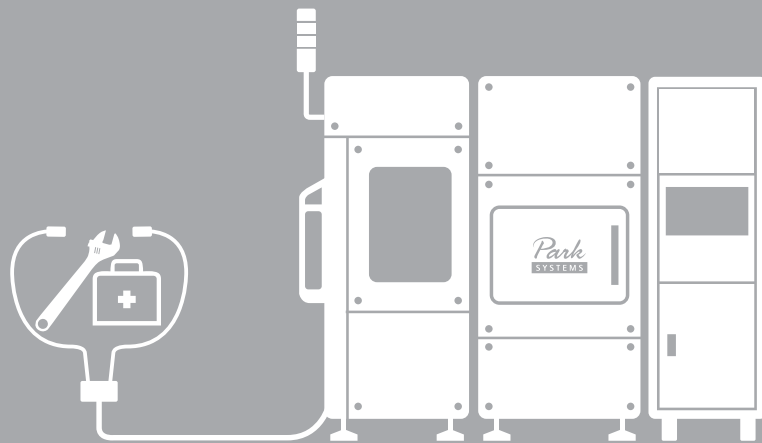
## Tool-to-tool Correlation

Thanks to Park's revolutionary AFM platform designed for industrial metrology, Park NX-3DM will correlate with any existing Park AFMs that have been previously used for manufacturing, inspection, analysis, or research.



## System Uptime

Our engineers and scientists have adopted the most rigorous industry standard product development to ensure the highest level of system reliability. Park NX-3DM can be incorporated seamlessly either as an inline or as an offline inspection tool, with minimal maintenance requirements.



## Service and Maintenance

Park is committed to the highest level of service and support. We put every effort to understand our customers' needs. We place the highest priority in meeting promised delivery dates, guaranteed quality, and thorough after-sales service.

# Park NX-3DM

## A revolutionary all-in-one system for 3D Metrology

### Innovative Z-Scan System

The many unique features of the NX-3DM are made possible by independently tilting the Z-scanner in its patented Crosstalk Eliminated platform, where XY and Z scanners are completely decoupled. This design allows users to access the vertical sidewalls as well as the undercut structures at various angles. Unlike in systems with flared tips, here high resolution and high aspect ratio probes can be used.

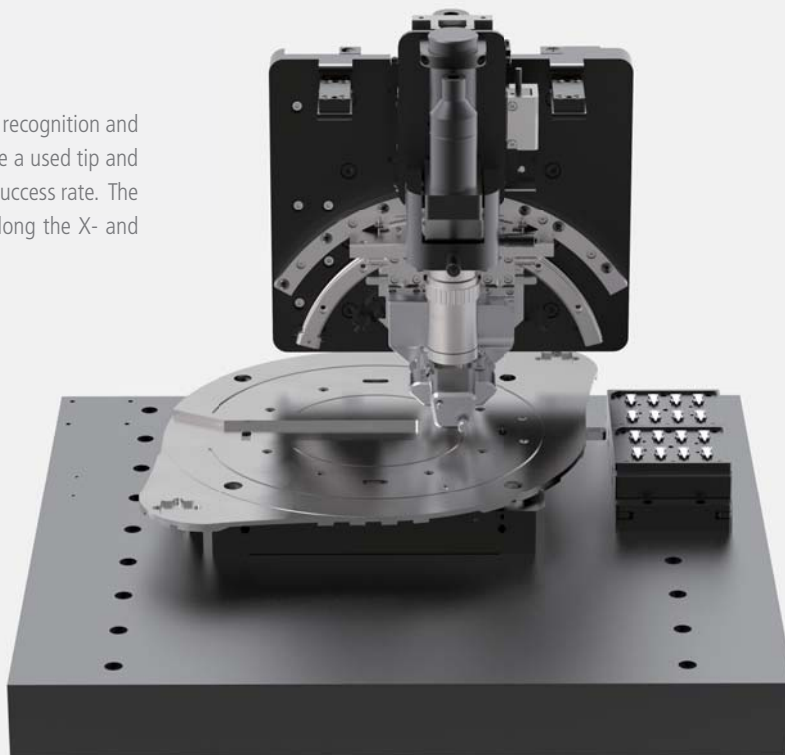


### Flexure-Guided XY Scanner with Closed-loop Dual Servo System

The 100  $\mu\text{m}$  x 100  $\mu\text{m}$  XY scanner consists of a symmetrical 2-dimensional flexure stage and high-force piezoelectric stacks that provide highly orthogonal movement with minimal out-of-plane motion, as well as the high responsiveness essential for precise sample scanning at the nanometer scale. Two symmetric, low-noise sensors are present on each axis of the XY scanner to retain a high level of orthogonality in the context of large scanning ranges and sample sizes. The secondary sensor corrects and compensates for non-linear and non-planar positional errors which might occur using a single sensor alone.

### Automatic Tip Exchanger (ATX)

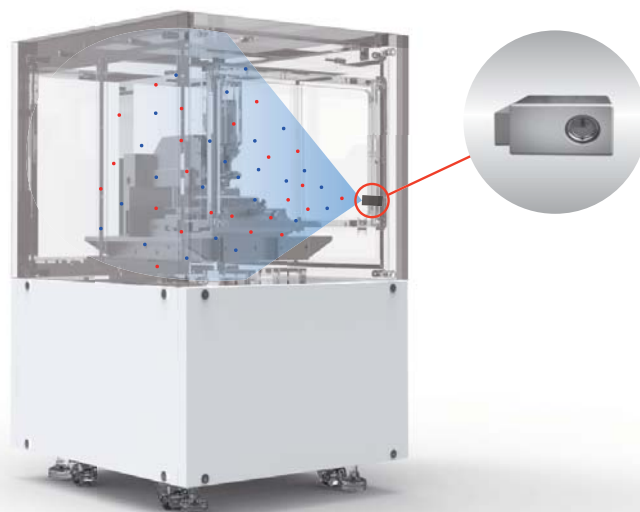
The ATX automatically locates tips by pattern recognition and uses a novel magnetic approach to disengage a used tip and pick up a new tip, with an incredible 99.9% success rate. The laser spot is then automatically optimized along the X- and Y-axis by motorized positioning knobs.





## Ionization System for a more stable scanning environment

Our innovative ionization system quickly and effectively removes electrostatic charges in the sample's environment. Since the system always generates and maintains the ideal balance of positive and negative ions, it can create an extremely stably charged environment with negligible contamination from the surrounding area and minimize the risk of accidental electrostatic charge during sample handling.

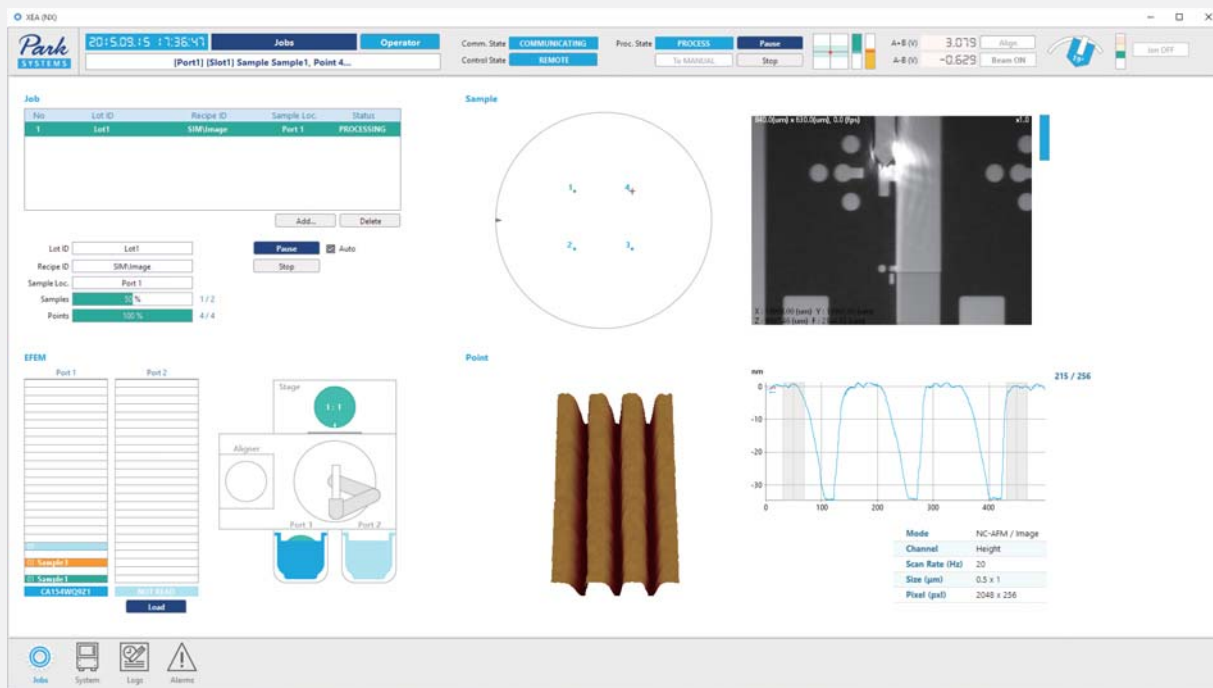


## Automatic Wafer Handler (EFEM or FOUP)

The NX-3DM can be configured for various automatic wafer handlers, such as EFEM and FOUP. The high-precision, robotic handling arm ensures users get fast and reliable wafer measurements every time.

## Automatic Measurement Control for Increased Efficiency

The NX-3DM is equipped with automated software that makes operation seamless. Just select the desired measurement program to get precise multi-site analysis and auto-optimized settings for cantilever tuning, scan rate, gain, and set-point parameters. Park's user-friendly software interface gives you the flexibility to create customized operation routines so you can make the most of the NX-3DM with the least amount of effort. Creating new routines is easy. On average it takes only 10 minutes to make a new routine, and less than 5 to modify an existing one.



# Park NX-3DM

## Specification

System Specification	200 mm Motorized XY stage	300 mm Motorized XY stage:
	travels up to 275 mm × 200 mm, 0.5 μm resolution	travels up to 400 mm × 300 mm, 0.5 μm resolution < 1 μm repeatability
Scanner Performances	XY Scanner	XY Scanner Resolution
	Single-module flexure XY scanner with closed-loop control 100 μm × 100 μm (large mode) 50 μm × 50 μm (medium mode) 10 μm × 10 μm (small mode)	0.28 nm (large mode) 0.03 nm (small mode)
Dimension & Weight	200 mm System	
	1500 mm (w) x 980 mm (d) x 2050 mm (h) w/o EFEM, 1020 kg approx. (incl. Control Cabinet) 2465 mm (w) x 1000 mm (d) x 2050 mm (h) w/ EFEM, 1230 kg approx. (incl. Control Cabinet)	Ceiling Height: 2500 mm or more Operator Working Space: 3300 mm (w) x 2300 mm (d), minimum
	300 mm System	
	1840 mm (w) x 1170 mm (d) x 2050 mm (h) w/o EFEM, 1320 kg approx. (incl. Control Cabinet) 3260 mm (w) x 1350 mm (d) x 2050 mm (h) w/ EFEM, 2120 kg approx. (incl. Control Cabinet)	Ceiling Height: 2500 mm or more Operator Working Space: 4540 mm (w) x 2850 mm (d), minimum

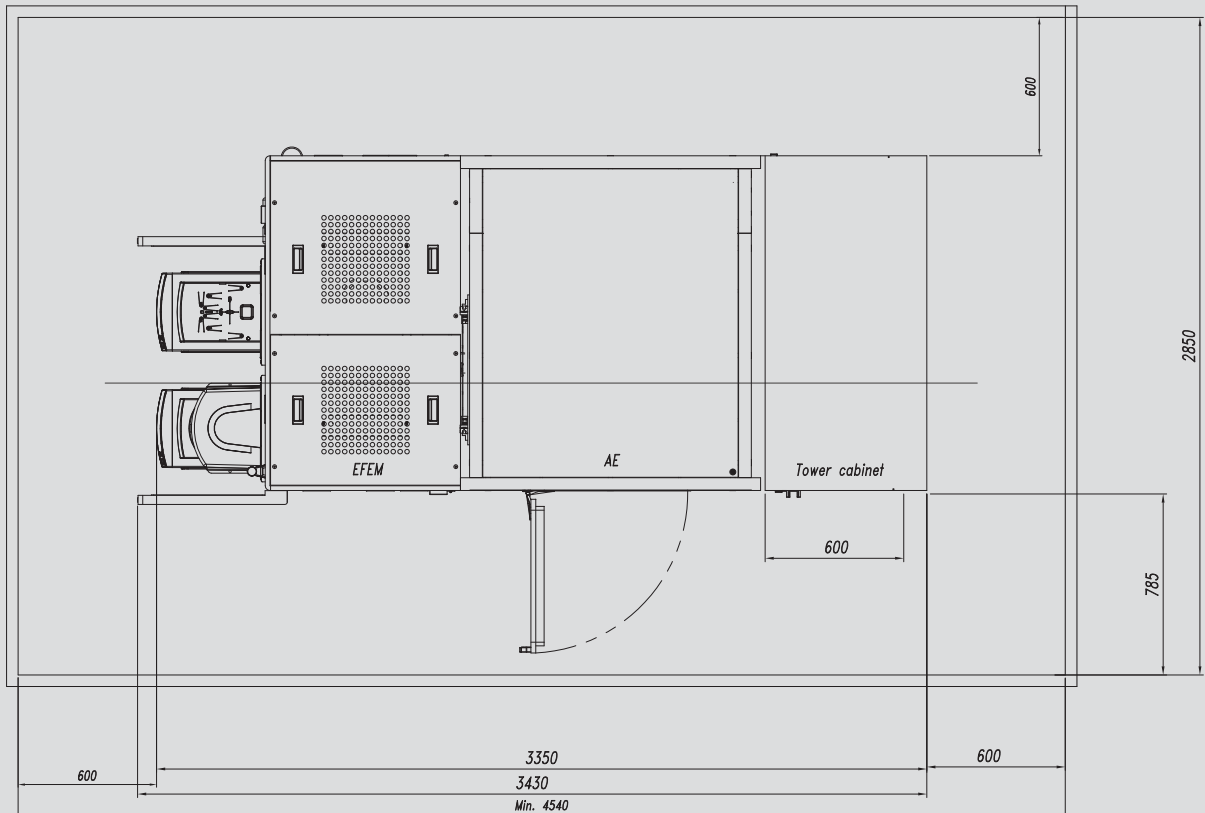
Motorized Z Stage	Motorized Focus Stage	Motorized Angle Range	COGNEX Pattern Recognition
27 mm Z travel distance 0.08 $\mu\text{m}$ resolution < 1 $\mu\text{m}$ repeatability	9 mm Z travel distance for on-axis optics	-19 degrees and +19 degrees -38 degrees and +38 degrees < 0.5 degree angle repeatability	pattern align resolution of 1/4 pixel

Z Scanner Range	Z Scanner Resolution	Z Scanner Noise Floor	Z Scanner Detector Noise
15 $\mu\text{m}$ (large mode) 2 $\mu\text{m}$ (small mode)	0.016 nm (large mode) 0.002 nm (small mode)	< 0.05 nm	0.02 nm @ 1kHz

Facility Requirements	Room Temperature (Stand By)	Room Temperature (Operating)	Humidity	Floor Vibration Level
	10 °C ~ 40 °C	18 °C ~ 24 °C	30% to 60% (not condensing)	VC-E (3 $\mu\text{m}/\text{sec}$ )

Acoustic Noise	Pneumatics	Power Supply Rating	Total Power Consumption	Ground Resistance
Below 65 dB	Vacuum: -80 kPa CDA (or N <sub>2</sub> ): 0.7 MPa	208V - 240 V, single phase, 15 A (max)	2 KW (typical)	Below 100 ohms

NX-3DM 300mm installation layout



# Park Systems

Dedicated to producing the most accurate and easiest to use AFMs

The global headquarters is located at  
Korean Advanced Nanotechnology Center (KANC) in Suwon, Korea.



More than a quarter century ago, the foundations for Park Systems were laid at Stanford University where Dr. Sang-il Park, the founder of Park Systems worked as an integral part of the group that first developed AFM technology. After perfecting the technology, he then went on to create the first commercial AFM and later Park Systems was born.

Park Systems strives everyday to live up to the innovative spirit of its beginnings. Throughout our long history, we have honored our commitment to providing the most accurate and yet very easy to use AFMs, with revolutionary features like True Non-Contact™ mode, and many automated software tools. We are not simply content to rest on our past success. All of our products are designed with same care and creativity that went into our first, allowing you to focus on getting results without worrying about the integrity of your tools.



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