

Dimension Industrial AFMs

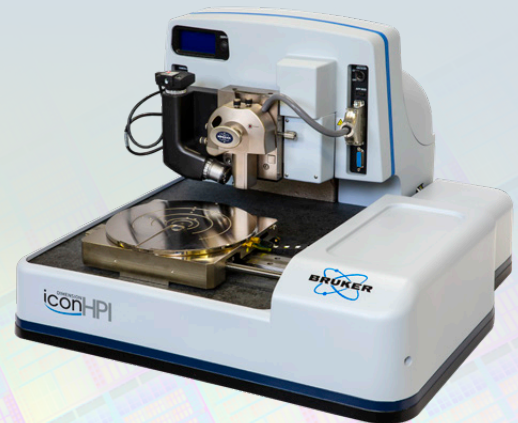
● Automated Nanometrology and Characterization

Cost-Effective Precision Metrology for R&D/QA/QC/FA

The Dimension® family of Atomic Force Microscopes (AFMs) have a long-standing reputation for providing the highest available speed and performance for industrial metrology applications. Designed specifically for high-volume, production environments, Dimension HPI and PRO systems enable automated measurements of many AFM modes while ensuring the utmost ease of use and the lowest cost per measurement for quality control, quality assurance, and failure analysis. Using contact, tapping, and PeakForce Tapping® mode techniques, these systems enable users to precisely control probe-to-sample interaction, providing long tip life-times with high-accuracy results in thousands of measurements.

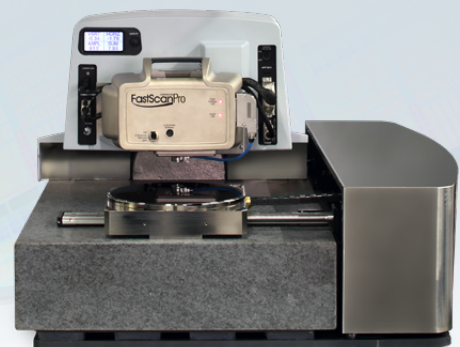
Dimension HPI is the world's newest and most productive industrial R&D AFM solution, featuring the very latest innovations in techniques for polymer characterization on a production-scalable platform:

- Exceptional metrology performance and capability in demanding, high-volume environments
- Automated measurements and the most flexibility available in a single AFM platform
- Support for the full range of applications, from R&D to production-run volumes



Dimension Pro is the industry standard for Production QA and QC, providing an ideal balance of performance, automation, and operator-to-operator ease of use:

- Highest resolution imaging and most, precise measurement performance for metrology applications
- Unique, quantitative results, whatever you measure
- Easy-to-use software, making every user an AFM Expert



● Exclusive Bruker AFM Technology for Industry

The Dimension platform has the largest AFM installed base in polymers, semiconductor, data storage, high-brightness LED, and micro-display industries, among others. The HPI and Pro instruments utilize an open-access platform, large- or multiple-sample holders, and numerous ease-of-use features to bring the power of atomic force microscopy to manufacturers, delivering the best, most state-of-the-art solution for nanoscale metrology in QA/QC/FA—cost effectively and reliably.

Revolutionary PeakForce Tapping Enables Exceptional Surface Characterization

Bruker's proprietary PeakForce Tapping is one of the most significant breakthroughs in AFM technology. By precisely controlling the peak normal force at every pixel, it minimizes the lateral force on the probe, providing:

- Sample protection from contact damage
- Extended probe lifetimes
- Consistent measurement performance

FastScan Technology Delivers Highest Throughput

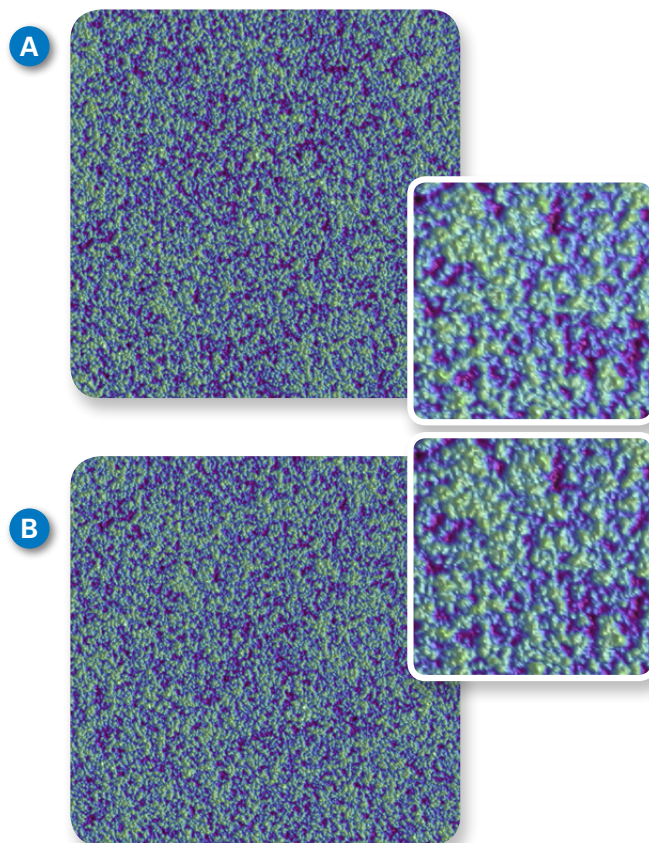
Dimension HPI and Pro systems are available with either Icon® or FastScan® AFM scan heads. FastScan technology sets new standards of AFM performance, enabling >10x scan rate increases without loss of data quality for the highest AFM throughput in the most challenging metrology applications. The FastScan option delivers:

- Highest AFM throughput with proven high-bandwidth technology
- No loss of accuracy at high scan rates for immediate efficiency improvements
- Seamless workflow in automated measurements

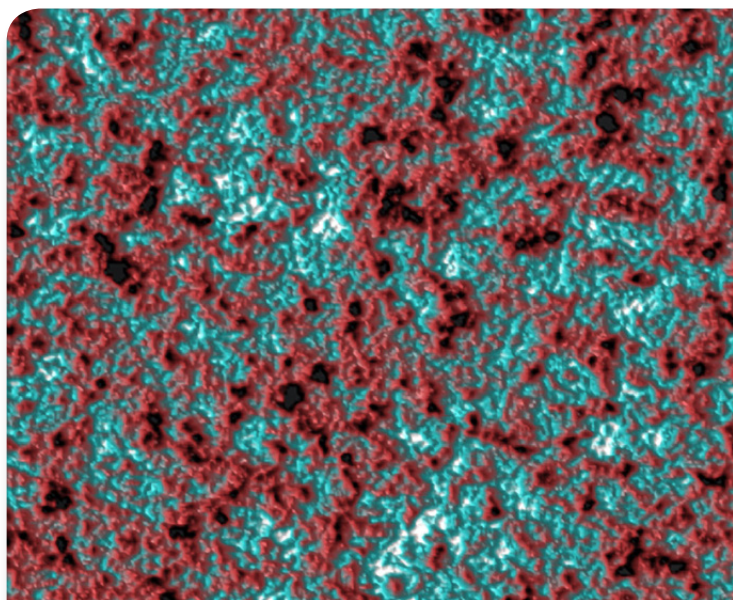
Proprietary FastScan AFM Probes Provide Lowest Cost per Measurement

Bruker's FastScan probes take the fullest advantage of PeakForce Tapping's precise control of probe-to-sample forces to ensure:

- Routine high-speed, high-resolution topography measurements
- Repeatable high-speed, electrical and magnetic measurements
- Minimal tip-to-tip measurement variations



An alkali-aluminosilicate sheet glass main property is characterized by its strength and scratch resistance, making it challenging to measure its nanometer topography consistently and reliably. Using FastScan AFM and a single Bruker HPI probe, a first image (A) rendered roughness $R_q=0.99$ nm, $R_a=0.79$. Image no. 615 (B) rendered the same roughness; $R_q=0.99$ nm, $R_a=0.79$. Insets are digitally zoomed images of scan no. 1 and no. 615 revealing insignificant topographical changes.




• Easy-to-Use Software Makes Every User an AFM Expert

ScanAsyst Eliminates the Complexity of AFM Operation


ScanAsyst is a PeakForce Tapping-based image-optimization mode that enables users of all experience levels to obtain the highest measurement performance. The user simply selects a sample scan area and scan size, and ScanAsyst takes over, creating a turnkey solution for AFM imaging. ScanAsyst eliminates the need to navigate complicated AFM interfaces and parameter settings. Intelligent algorithms automatically and continuously monitor the image quality and make needed parameter adjustments.

Select Sample Site


Site Name	X	Y	Enabled
Trench	1256.0	708.3	<input checked="" type="checkbox"/>
Via	1121.6	2638.7	<input checked="" type="checkbox"/>




Delete



Move Down






Move Up



Move to Site

Site Assignments

- ▲ Sites
 - ▲ Trench
 -  30um Overview
 -  7um Depth
 -  1um Detail

Easy measurement recipe creation, allows engineers to define location by name, assign any type, and number measurements at each location.


Automation Software Ensures Exceptional Ease of Use

New AutoMET full-recipe software delivers fast, automated metrology for polymers, semi, data storage, HB-LED and micro-optics (from multiple small-format wafers to single 300 mm wafer capability). AutoMET offers:


- Automated measurements on multiple samples or a single large sample for nanoscale characterization across multiple locations
- Optical and AFM image pattern recognition, tip-centering, full wafer or grid mapping support, and image-placement accuracy within tens of nanometers
- Comprehensive yet simple recipe writing for the advanced user or engineer available for real-time and offline use
- Easy setup to align sample to probe and alignment corrections to AFM environment

Create/Edit Measurements


Measurement Name	Mode	Zoom	Advanced
30um Overview	Tapping		...
7um Depth	Tapping		...
1um Detail	Tapping		...
5um PFT	PeakFor		...
750nm 4to1 HiRes PFT	PeakFor		...




New




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Import



Export



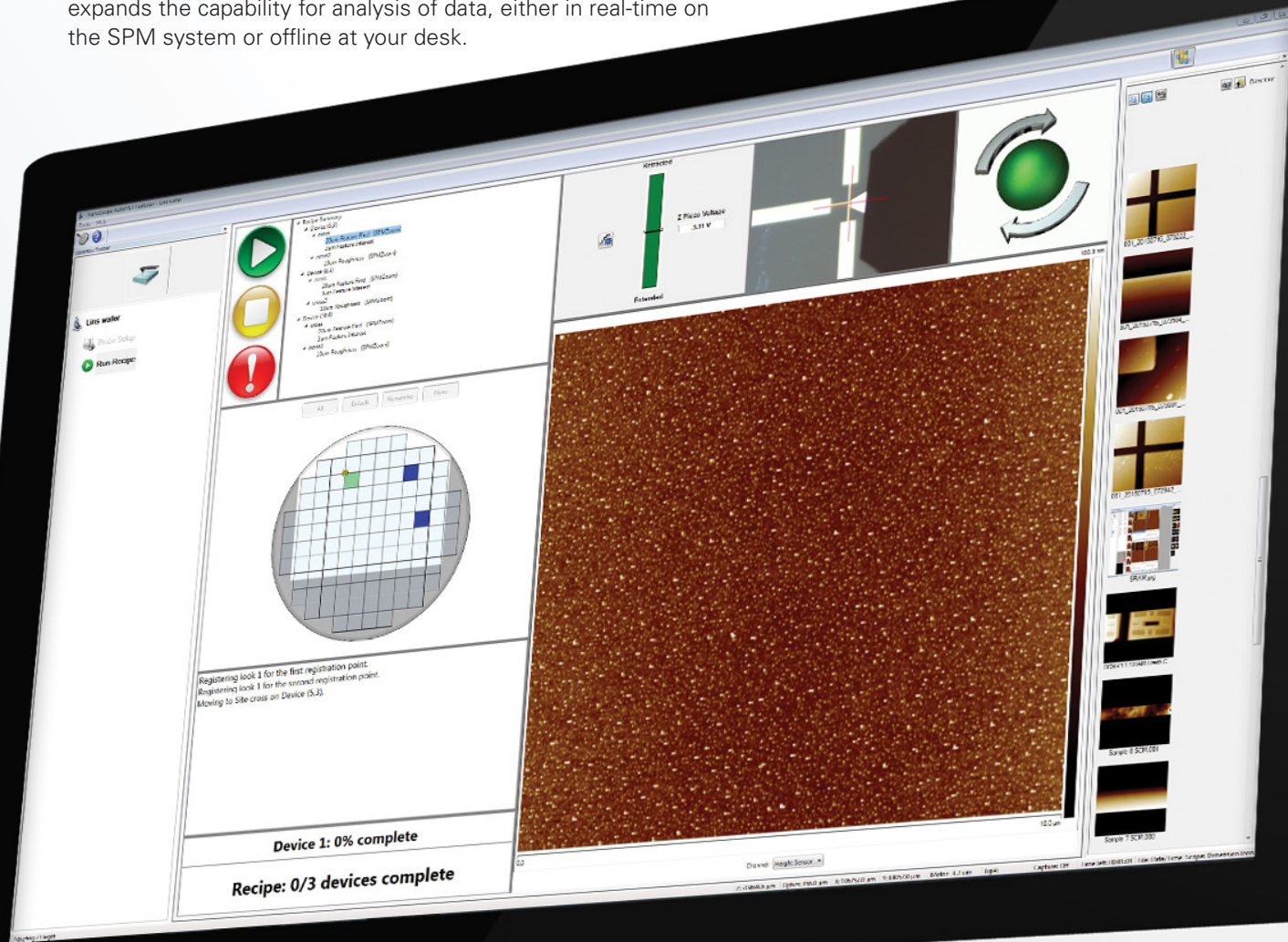
Edit

NanoScope Provides Fast, Intuitive Sample Navigation

Dimension industrial AFMs utilize Bruker's industry-best NanoScope software user interface to quickly and easily locate areas of interest. Pan and zoom features enable fast setup and scan speeds up to 100 times that of standard AFM scan rates, significantly reducing measurement time. Easy step-by-step navigation makes measurement sessions simple, and preconfigured software settings easily integrate the system into your manufacturing workflow.

Data Analysis Flexibility for Varied Measurement Needs

NanoScope Analysis is a robust software package that supports remote data analysis of images via linked communication to the Dimension HPI or Pro system. This greatly expands the capability for analysis of data, either in real-time on the SPM system or offline at your desk.



Consistently better data and faster metrology results, regardless of the operator's AFM experience level.

● Precision, Repeatability, and Flexibility for Production

Widest Range of Measurement Types

From our newest PeakForce Tapping modes to traditional AFM modes, Dimension HPI and PRO systems provide the greatest range and flexibility to meet your specific measurement and characterization needs on a wide range of samples

Highest Accuracy Roughness, Depth, and Height Measurements

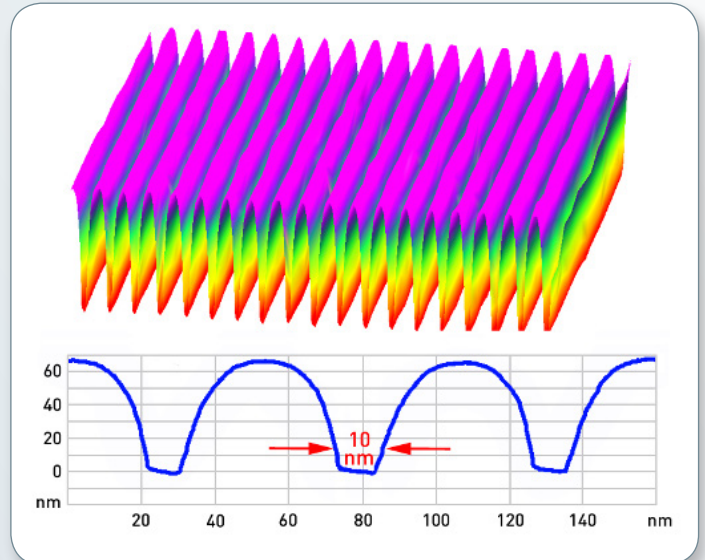
Dimension HPI and PRO provide highly repeatable and accurate roughness, height, and depth measurements, from sub-nanometer steps to high-aspect ratio trenches using PeakForce Tapping or tapping modes.

Most Comprehensive Defect Review Characterization

Nanoscale defects can be located and characterized on a variety of wafers, substrates, and sliders. PeakForce QNM[®] can uniquely provide combined 3D imaging and mechanical property information.

Fast Nanoelectrical Measurements

FastScan technology with Conductive-AFM (CAFM) can perform nanoscale current measurements at high scan rates, significantly increasing the efficiency of failure analysis measurements. Using a small magnetic force microscopy (MFM) cantilever, FastScan HPI and PRO provide greater than 10x scan rate improvements for MFM applications with exceptional data quality using PeakForce Tapping. PeakForce KPFM[™] provides the highest spatial resolution and most accurate measurements of surface potential. PeakForce TUNA[™] provides the most sensitive conductivity measurements.



Trenches are difficult to image with typical imaging modes due to excessive damping of the probe oscillation. ScanAsyst easily reaches the bottom of trenches. In this example, trenches with a depth of ~65 nm and a width of ~50 nm are routinely measured with standard Bruker probes.

Precise Nanoscale Mechanical Mapping

Bruker's unique PeakForce QNM and FastForce Volume[™] nanoscale mechanical mapping modes can precisely map mechanical properties—modulus, stiffness, adhesion, dissipation, and deformation—while simultaneously imaging sample topography and electrical properties. PeakForce QNM enables non-destructive measurements on polymers, thin films, and nanoscale defects not measurable by transmission electron or scanning electron microscopy techniques.



• Unlimited Industrial Metrology Applications

Semiconductor

- Bare wafer roughness metrology and defect review characterization
- Nanometer-node electrical device characterization and fault isolation
- Accurate step height and depth metrology measurements

Data Storage

- Most precise, highest resolution, and high-throughput, production-based slider metrology
- Media substrate roughness and defect review characterization with outstanding resolution
- Electrical and magnetic failure analysis characterization for wafers, media, and sliders

Polymers and Thin Films

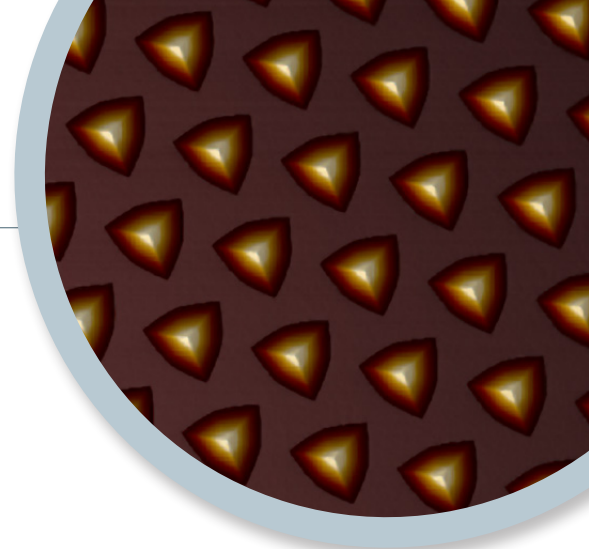
- High-throughput, topography measurements for quality control
- Simultaneous topography and mechanical property mapping
- High volume materials nanomechanical characterization measurements for quality control

High-Brightness LED and Solar Materials

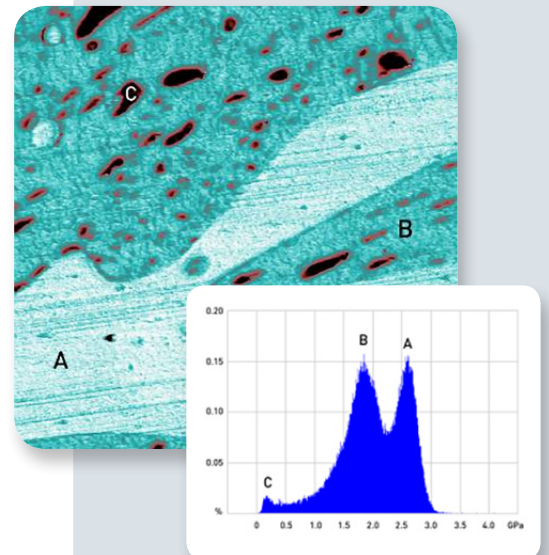
- Automated HB-LED pattern sapphire (PSS) depth and shape metrology
- Precise HB-LED substrate roughness
- Electrical characterization of HB-LED and solar materials

Display Manufacturing

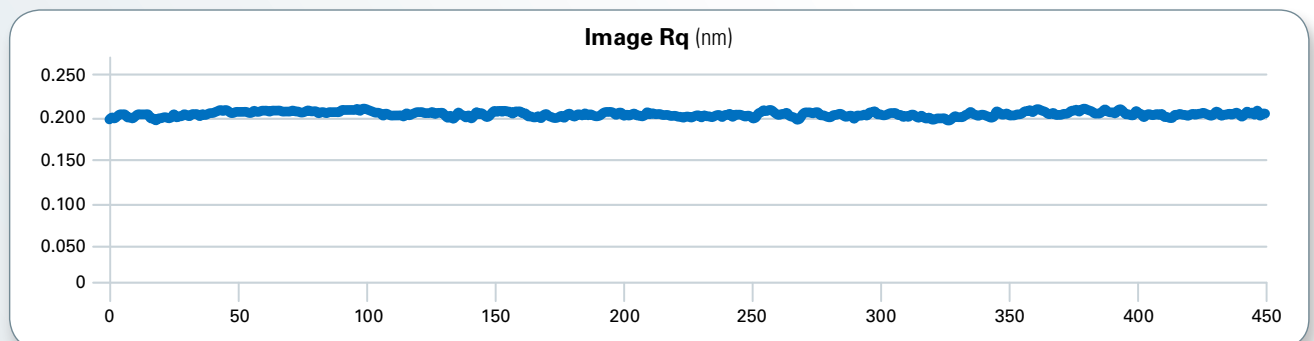
- Most accurate nanoscale measurements for display development
- Automated measurement of nanoscale roughness to control display quality
- Precise characterization of display nanotextures over 1000s of measurements



Semi-automated 24/7 operations using a Dimension AFM to characterize 3D geometry for process control.



Modulus map of a multi-component polymer blend imaged using PeakForce QNM. There are three different components clearly present, the light blue component (A), the darker blue component (B), and the red/black component (C). (7 μm scan).



Bruker's AFMs and high-performance industrial probes provide consistent and reliable measurements for the most demanding critical-to-quality nanoscale measurements.

Dimension Industrial AFMs

Most Reliable Platform and Unrivalled Support

Bruker has the largest service and applications support network of any AFM supplier, with regional customer support and programs for extended assistance. Major industrial companies and leading data storage and semiconductor manufacturers throughout the world have chosen Bruker systems for our reputation as the most reliable precision metrology platforms and quick, knowledgeable support.

		Dimension HPI		Dimension Pro (300 mm)	
		Icon	FastScan	Icon	FastScan
STAGES	Scan Head				
	XY accessible area, without manual interaction (mm)	150x105	150x135	210x200 300x300	210x230 300x300
	Sample size (mm)	210x210		200x200 or 300x300	
	XY stage repeatability, bi-directional, (µm)	3		6	
MODES	SCM, CAFM, TUNA, SSRM, sMIM, nano-TA, SThM	●	○	●	○
	PF-TUNA, PF-KPFM, PF-sMIM	●	○	●	○
	AutoMET software	●	●	●	●
	PF-QNM	●	●	●	●
	Contact, Tapping, PeakForce Tapping, EFM, MFM	●	●	●	●
SPECIFICATIONS*	X-Y Scan Range (µm)	≥ 90x90	≥ 35x35	≥ 90x90	≥ 35x35
	Z Range (µm)	≥ 12	≥ 3	≥ 12	≥ 3
	Vertical Noise Floor - RMS/Adev (pm)	≤ 30/25 <small>Height in appropriate environment, typical imaging BW (up to 625Hz)</small>	≤ 40/32 <small>Sensor in appropriate environment, typical imaging BW (up to 625Hz)</small>	≤ 35/28 <small>Height in appropriate environment, typical imaging BW (up to 625Hz)</small>	≤ 45/36 <small>Sensor in appropriate environment, typical imaging BW (up to 625Hz)</small>
	X-Y Position Noise, -RMS/Adev, closed-loop (pm)	≤ 125/100	≤ 145/116	≤ 125/100	≤ 145/116
	Z Sensor Noise, RMS/Adev (pm)	≤ 20/15 <small>Typical imaging BW (up to 625Hz)</small>		≤ 20/15 <small>Typical imaging BW (up to 625Hz)</small>	
	Laser and PD alignment	Manual	Automated	Manual	Automated

Legend: Included/Optional ● Not Available ○
 * Specifications for Dimension PRO are for 300 mm stage option.

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