Nikon

BW-S500

Super High Vertical Resolution Non-Contact 3D Surface Profiler

BW-D500

Series

Nikon's proprietary scanning-type optical interference measurement technology achieves **1pm*** height resolution.

* Height resolution specified by algorithm

Quickly and accurately measures surface profile from sub-nano to millimeter height ranges, using a single measurement mode. Fully supports high-precision processing technology and advanced material development of the Materials Science field.

4.19 Mpixel camera type

BW-S500 Series

BW-S501/BW-S502/BW-S503/BW-S505/BW-S506/BW-S507

Effective height resolution **15 pm** (including environmental noise)

Measurement speed **16 seconds** (1022×1022 pixel mode, 10µm scanning)

38 seconds (2046×2046 pixel mode, 10µm scanning)

General-purpose model with high-pixel resolution that measures both smooth and rough surfaces.
Delivers super high-resolution height measurement with 4.19 Mpixel high-resolution camera.

2000 fps high speed camera type

BW-D500 Series

BW-D501/BW-D502/BW-D503/BW-D505/BW-D506/BW-D507

Effective height resolution **15 pm** (including environmental noise)

Measurement speed **4 seconds** (510×510 pixel mode, 10µm scanning)

With its high-speed and high-precision, this model is suited for measurements of smooth surfaces such as glass and wafers.
Delivers with a 2000 fps high-speed camera.

Six models available to match application and cost

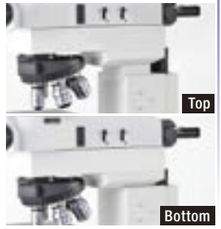
Both the BW-S and BW-D are available in the six types shown below.

	Piezo driven		Scanning			
	Objective lens drive	Nosepiece drive	Z axis		XY axis	
			Manual	Electric	Manual	Electric
BW-S501/D501	○		○		○	
BW-S502/D502	○			○	○	
BW-S503/D501	○			○		○
BW-S505/D505		○	○		○	
BW-S506/D506		○		○	○	
BW-S507/D507		○		○		○

Electric Z axis

502/503/506/507

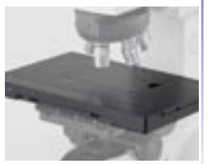
Enables measurement of steps in excess of 100µm (piezo scanning range).



Electric XY axis

503/507

Enables wide-area analysis through the stitching of multiple height images.



Nosepiece drive piezo

505/506/507

Allows easy switching of objective lens magnification.

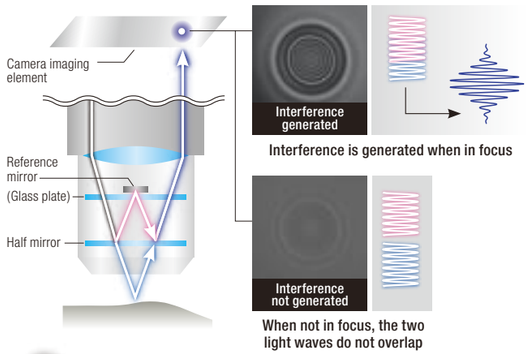
* An affordable objective lens drive piezo is also available.

High-precision/high-speed image acquisition via a two beam interference objective lens

The BW-S500 / D500 series uses a two beam interference objective lens and Nikon's proprietary algorithms to acquire height images with high speed and precision.

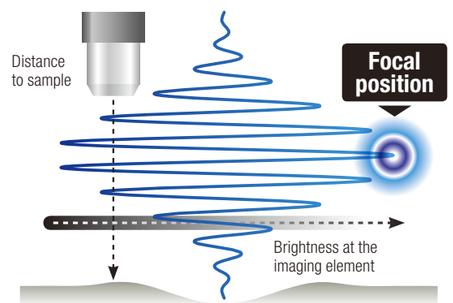
1 Interference created by two beam interference objective lens

By overlaying the light returning from the reference mirror inside the objective lens and the light returning from the sample, the two beams overlap at the focal position and create interference.



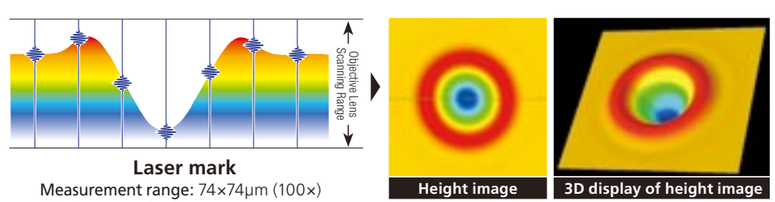
2 Focal position is determined with high precision from the interference waveform

The brightness of the interference is highest at the focal position (0-order interference position). The two beam interference objective lens is moved gradually by a piezo mechanism, and the position of greatest brightness is detected simultaneously and with ultra precision by all of the imaging elements.



3 Height information mapping

The focal position information acquired by each imaging element is mapped, and the surface profile of the sample is depicted in pseudocolor.

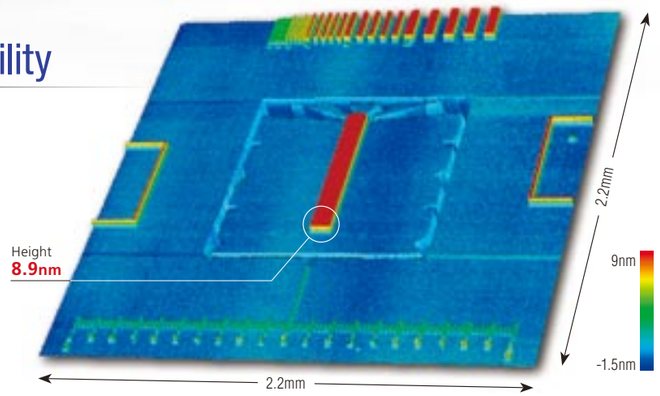


Laser mark
Measurement range: 74×74µm (100×)
Height range: 2µm

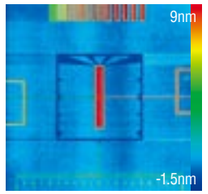
High Traceability and Repeatability

The BW-S500/BW-D500 series is calibrated by an 8nm or 8µm VLSI Step Height Standards sample, certified by the NIST. Achieves extremely high accuracy and repeatability as a height measurement system.

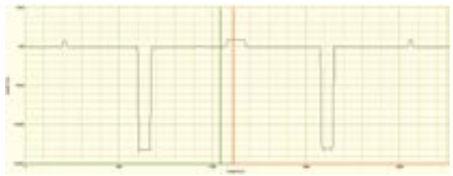
8nm Step Height Sample



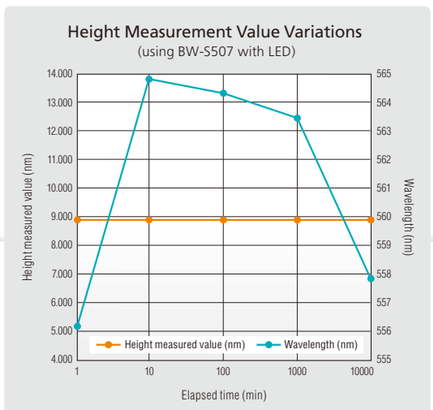
VLSI (8nm Step Height Sample)



Height image



Calibrated Value (NIST) : 8.9nm ±0.6nm
Average Value by BW-S507: 8.906nm(10 times/σ0.031nm)

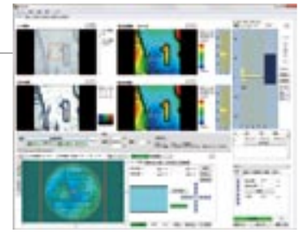


Measured value unsusceptible to variation of central wavelength of light source

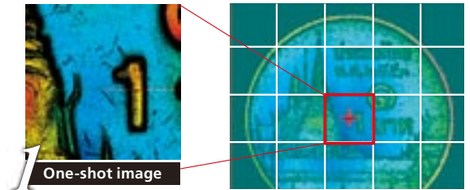
With Nikon's proprietary technology, measurement values with the BW-S500/ BW-D500 series are independent of central wavelength of light source. Measurements can be done immediately after switching on illumination source.

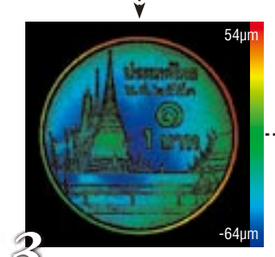
Wide region configuration analysis with stitching

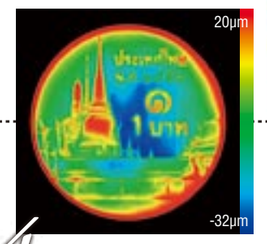
Electric XY stage and "Digital Stylus Imager 3" software allow stitching with BW-S503/507 and BW-D503/507.
Stitching can be done in both vertical and horizontal direction.

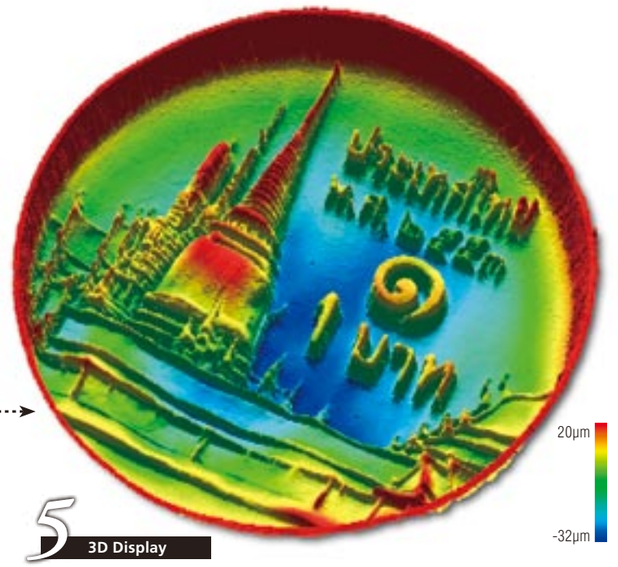


Coin (5×5 Stitching)







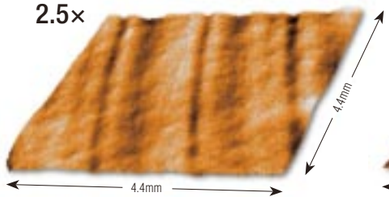


Capable of ø20mm order wide region stitching at 10µm order range.

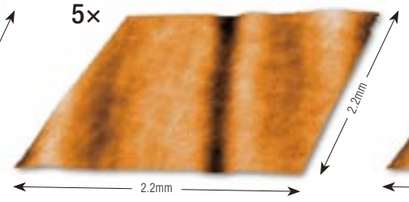
1pm height resolution achieved at magnifications from 2.5× to 100×

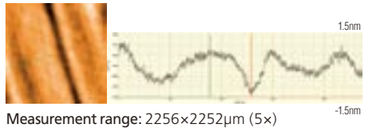
Ultra high-precision allows for measurement of grade-0.1nm 3D roughness Sa from minimum magnification (4.4mm) to maximum magnification (111µm).

SiC Wafer (2.5×-100×)

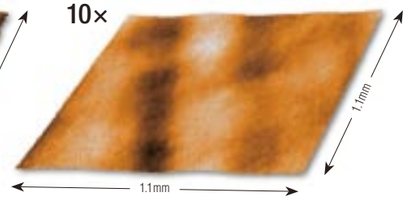


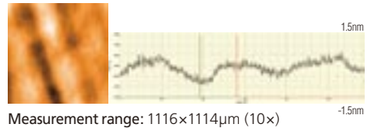
Measurement range: 4493×4486µm (2.5×)
Sa: 0.382nm Sq: 0.477nm Sz: 6.376nm



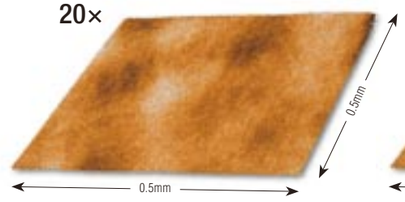


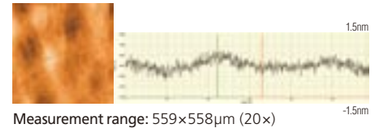
Measurement range: 2256×2252µm (5×)
Sa: 0.384nm Sq: 0.478nm Sz: 8.581nm



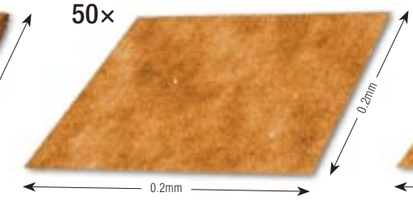


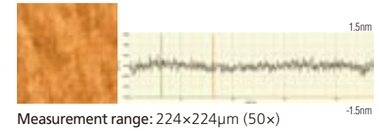
Measurement range: 1116×1114µm (10×)
Sa: 0.325nm Sq: 0.406nm Sz: 3.093nm



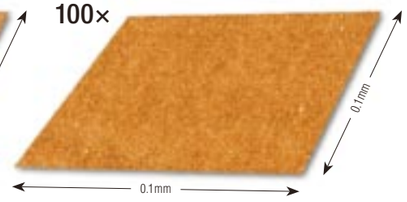


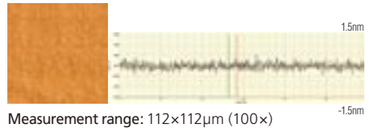
Measurement range: 559×558µm (20×)
Sa: 0.199nm Sq: 0.251nm Sz: 7.331nm





Measurement range: 224×224µm (50×)
Sa: 0.136nm Sq: 0.171nm Sz: 3.618nm





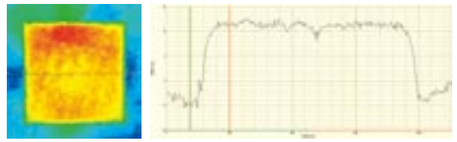
Measurement range: 112×112µm (100×)
Sa: 0.127nm Sq: 0.160nm Sz: 2.789nm

Software

Analytical software spanning basic measurement to advanced analysis

Image Transformer

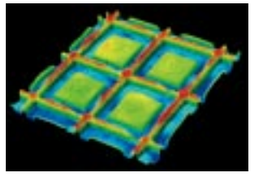
Performs automatic measurement of distance, height and angle between two points specified by the cursor, as well as two-dimensional roughness (Ra, Rq, Rz) / three-dimensional roughness (Sa, Sq, Sz)



Display of cross-section profile and measurement results at position specified on the height image

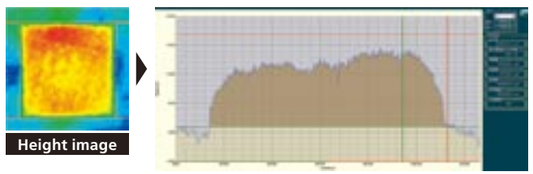
3DViewer

The acquired height image is displayed in 3D.



Geometric Parameter Measurement

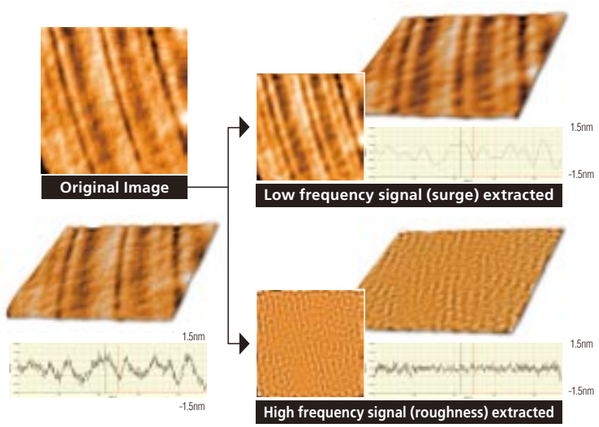
Through area and volume measurement of an irregular portion, as well as simultaneous analysis of the shapes of multiple irregular portions, uniformity and unevenness can be ascertained.



Display of the volume and area of specified indentations and protrusions

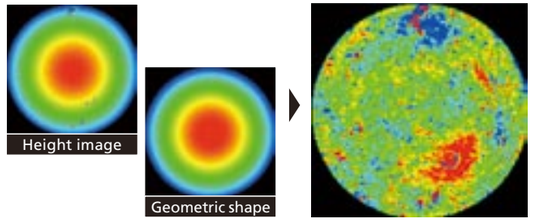
Surface Texture Analyzer

The low frequency / high frequency components of the height image are sampled, revealing approximate surface profile and allowing roughness analysis of detailed portions.



Zernike Polynomial Analyzer

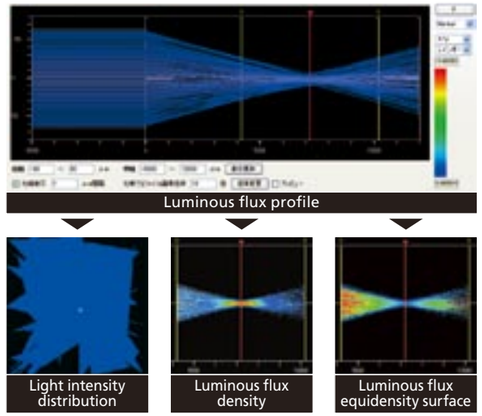
From the height image of a spherical sample, the ideal spherical surface curve (geometric shape) for the sample's form is calculated, allowing analysis of the sample's surface roughness.



The height image and the calculated geometric shape are compared, and surface roughness is detected

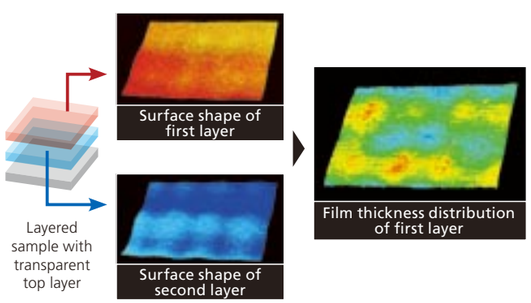
Optical Ray Tracer

From a simulation of light rays when light is shone on the backside of a lens-shaped sample, light intensity distribution, luminous flux density, and other data can be analyzed for the specified cross section.



Layer Thickness Analyzer

Analysis of transparent films can be performed to ascertain the surface shape of each layer and investigate the film thickness distribution. Measurement of multiple layers is possible.



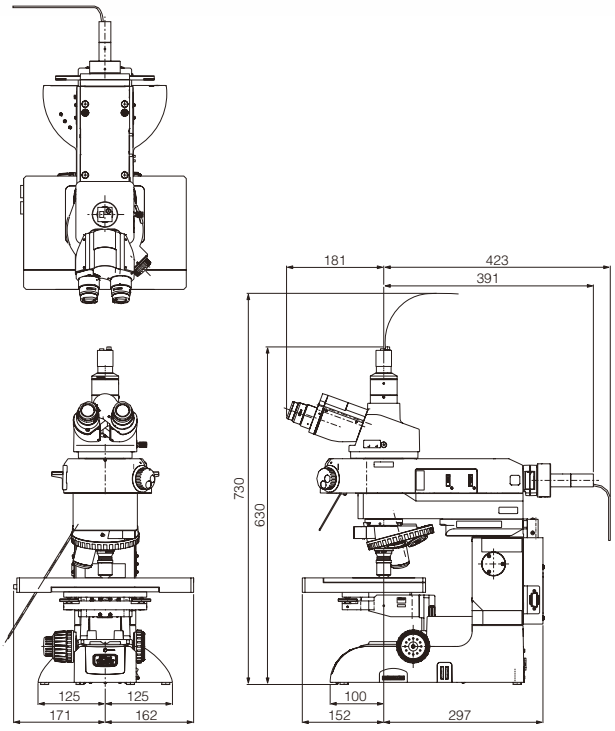
Specification

BW-S500 / BW-D500 Series

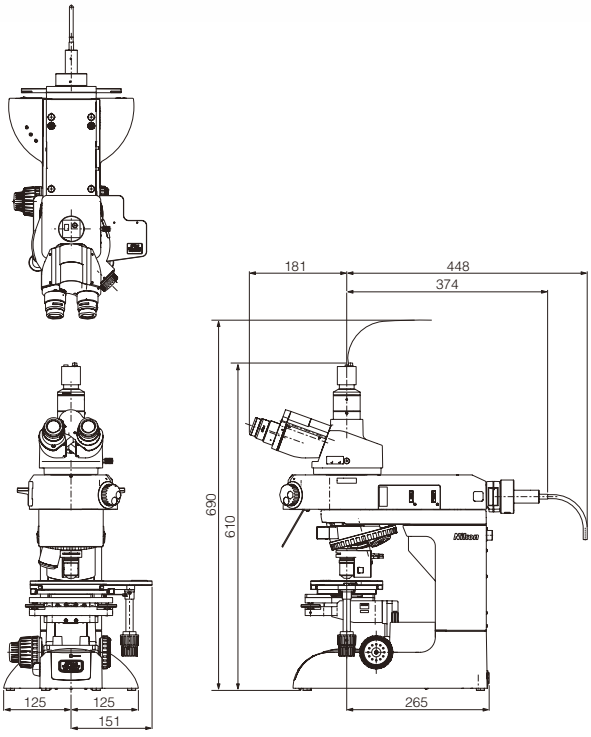
		BW-S501	BW-S502	BW-S503	BW-S505	BW-S506	BW-S507	BW-D501	BW-D502	BW-D503	BW-D505	BW-D506	BW-D507
Optical Microscope Unit		BW-LV150N	BW-FMA		BW-LV150N	BW-FMA		BW-LV150N	BW-FMA		BW-LV150N	BW-FMA	
	Piezo Driven	Objective lens driven			Nosepiece driven			Objective lens driven			Nosepiece driven		
	Piezo Scanning Range	100μm						100μm					
	Z Axis	Manual	Electric (standard stroke 20mm)		Manual	Electric (standard stroke 20mm)		Manual	Electric (standard stroke 20mm)		Manual	Electric (standard stroke 20mm)	
	XY Axis	Manual		Electric (standard travel range 130×85mm)	Manual		Electric (standard travel range 130×85mm)	Manual		Electric (standard travel range 130×85mm)	Manual		Electric (standard travel range 130×85mm)
Computer		High-performance specifications for BW											
Monitor		TFT 27" monitor											
Software		Bridgelements®											
Imaging Camera		CMOS USB 3.0 camera						High-speed camera					
Number of Pixels		2046×2046, 1022×1022 (selectable via software)						510 × 510					
Objective Lens		Two beam interference objective lens (2.5×, 5×, 10×, 20×, 50×, 100×)											
Observation and Measurement Range (Two Beam Interference Objective Lens 1 Field of View)		2.5×	5×	10×	20×	50×	100×	2.5×	5×	10×	20×	50×	100×
	Horizontal (H) μm	4448	2224	1112	556	222	111	2015	1007	503	251	100	50
	Vertical (V) μm	4448	2224	1112	556	222	111	2015	1007	503	251	100	50
	Working Distance (mm)	10.3	9.3	7.4	4.7	3.4	2.0	10.3	9.3	7.4	4.7	3.4	2.0
	Numerical Aperture (NA)	0.075	0.13	0.3	0.4	0.55	0.7	0.075	0.13	0.3	0.4	0.55	0.7
	Focal Depth (μm)	48.5	16.2	3.03	1.71	0.90	0.56	48.5	16.2	3.03	1.71	0.90	0.56
	Pixel Resolution (μm) 2046×2046	2.18	1.09	0.55	0.28	0.11	0.06	3.96	1.98	0.99	0.50	0.20	0.10
	Pixel Resolution (μm) 1022×1022	4.36	2.18	1.09	0.55	0.22	0.11						
	Optical Resolution (μm)	4.56	2.63	1.14	0.86	0.63	0.49	4.56	2.63	1.14	0.86	0.63	0.49
Measurement Optical System		White light interferometry											
Algorithmically-specified Height Resolution		1pm (0.001nm)											
Effective Height Resolution (Environmental Noise)		15pm (0.015nm) *When anti-vibration table is in environment not exceeding Vibration Criterion VC-C											
Step Measurement Reproducibility		σ:8nm (8μm step measurement) *When anti-vibration table is in environment not exceeding Vibration Criterion VC-C											
Height Measurement Time (1 Field of View, 10μm Scanning)	2046×2046	38 seconds						4 seconds					
	1022×1022	16 seconds											
Height Measurement Range		90μm	Lower of objective lens working distance or 20mm		90μm	Lower of objective lens working distance or 20mm		90μm	Lower of objective lens working distance or 20mm		90μm	Lower of objective lens working distance or 20mm	
Correction		Plane Term Correction, Quartic Term Correction											
Digital Enlargement		1/100 sub-pixel processing											
Roughness Measurement		2-dimensional roughness (Ra, Rq, Rz), 3-dimensional roughness (Sa, Sq, Sz)											
Profile Display		Cursor measurement of height, distance, and angle between two points; measurement of approximate circle radius of location specified in the profile											
Output		Output of processed images and roughness indices to an Excel file											
Automatic Processing		Automatic processing of multiple height images											
Three Dimensional Display		With MS Direct X											
Other Analysis Software (Optional)		Geometric Parameter Measurement, Zernike Polynomial Analyzer, Optical Ray Tracer, Surface Texture Analyzer, Layer Thickness Analyzer, Reference Surface Correction, Hole Shape Analyzer											
Height Calibration		Standard step sample (optional) made by VLSI Standards Inc.											
Anti-vibration Mechanism (Optional)		Active vibration isolation table or passive vibration isolation table											
Power Source		100-240±10%VAC											
Installation Space		Approx. 1800(W) ×700(D) ×1600(H) mm											
Dimensions/Weight		**Microscope Unit:** Approx. 500(W) ×560(D) ×700(H) mm / Approx. 23 kg											
		Computer: Approx. 173(W) ×471(D)×414(H) mm / Approx. 20kg											

Dimensions

BW-S507



BW-D501



N.B. Export of the products* in this catalog is controlled under the Japanese Foreign Exchange and Foreign Trade Law. Appropriate export procedures shall be required in case of export from Japan.
*Products: Hardware and its technical information (including software)

⚠ WARNING	TO ENSURE CORRECT USAGE, READ THE CORRESPONDING MANUALS CAREFULLY BEFORE USING THE EQUIPMENT.

NIKON CORPORATION
Shin-Yurakucho Bldg., 12-1, Yurakucho 1-chome
Chiyoda-ku, Tokyo 100-8331 Japan
phone: +81-3-3216-2384 fax: +81-3-3216-2388
http://www.nikon.com/instruments/

ISO 9001 Certified
for NIKON CORPORATION
Instruments Company

ISO 14001 Certified
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Yokohama Plant

NIKON METROLOGY, INC.
12701 Grand River Avenue, Brighton, MI 48116 U.S.A.
phone: +1-810-220-4360 fax: +1-810-220-4300
E-mail: Sales.US.NM@nikon.com
http://www.nikonmetrology.com/

NIKON METROLOGY EUROPE NV
Geldenaaksebaan 329, 3001 Leuven, Belgium
phone: +32-16-74-01-00 fax: +32-16-74-01-03
Email: Sales.Europe.NM@nikon.com
http://www.nikonmetrology.com/

NIKON INSTRUMENTS (SHANGHAI) CO., LTD.
CHINA phone: +86-21-6841-2050 fax: +86-21-6841-2060
(Beijing branch) phone: +86-10-5831-2028 fax: +86-10-5831-2026
(Guangzhou branch) phone: +86-20-3882-0550 fax: +86-20-3882-0580

NIKON SINGAPORE PTE LTD.
SINGAPORE phone: +65-6559-3618 fax: +65-6559-3668

NIKON MALAYSIA SDN. BHD.
MALAYSIA phone: +60-3-7809-3688 fax: +60-3-7809-3633

NIKON INSTRUMENTS KOREA CO., LTD.
KOREA phone: +82-2-2186-8400 fax: +82-2-555-4415

NIKON INDIA PRIVATE LIMITED
INDIA phone: +91-124-4688500 fax: +91-124-4688527

NIKON CANADA INC.
CANADA phone: +1-905-602-9676 fax: +1-905-602-9953

NIKON INSTRUMENTS S.p.A.
ITALY phone: +39-055-300-96-01 fax: +39-055-30-09-93

NIKON METROLOGY UK LTD.
UNITED KINGDOM phone: +44-1332-811-349 fax: +44-1332-639-881
E-mail: Sales.UK.NM@nikon.com

NIKON METROLOGY SARL
FRANCE phone: +33-1-60-86-09-76 fax: +33-1-60-86-57-35
E-mail: Sales.France.NM@nikon.com

NIKON METROLOGY GMBH
GERMANY phone: +49-6023-91733-0 fax: +49-6023-91733-229
E-mail: Sales.Germany.NM@nikon.com

Printed in Japan (1403-03) Am/M

Code No. 2CE-KHTH-1

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