OLYMPUS®

Your Vision, Our Future

3D Measuring Laser Microscope

OLS4000

LEXT™ NEW

OLS4000 — Ultimate Measurement Performance

Precision Roughness Analysis with the Accuracy of Light

LEXT™

Specifications are subject to change without any obligation on the part of the manufacturer.

OLYMPUS CORPORATION has obtained the ISO9001/ISO14001

OLYMPUS®

www.olympus.com

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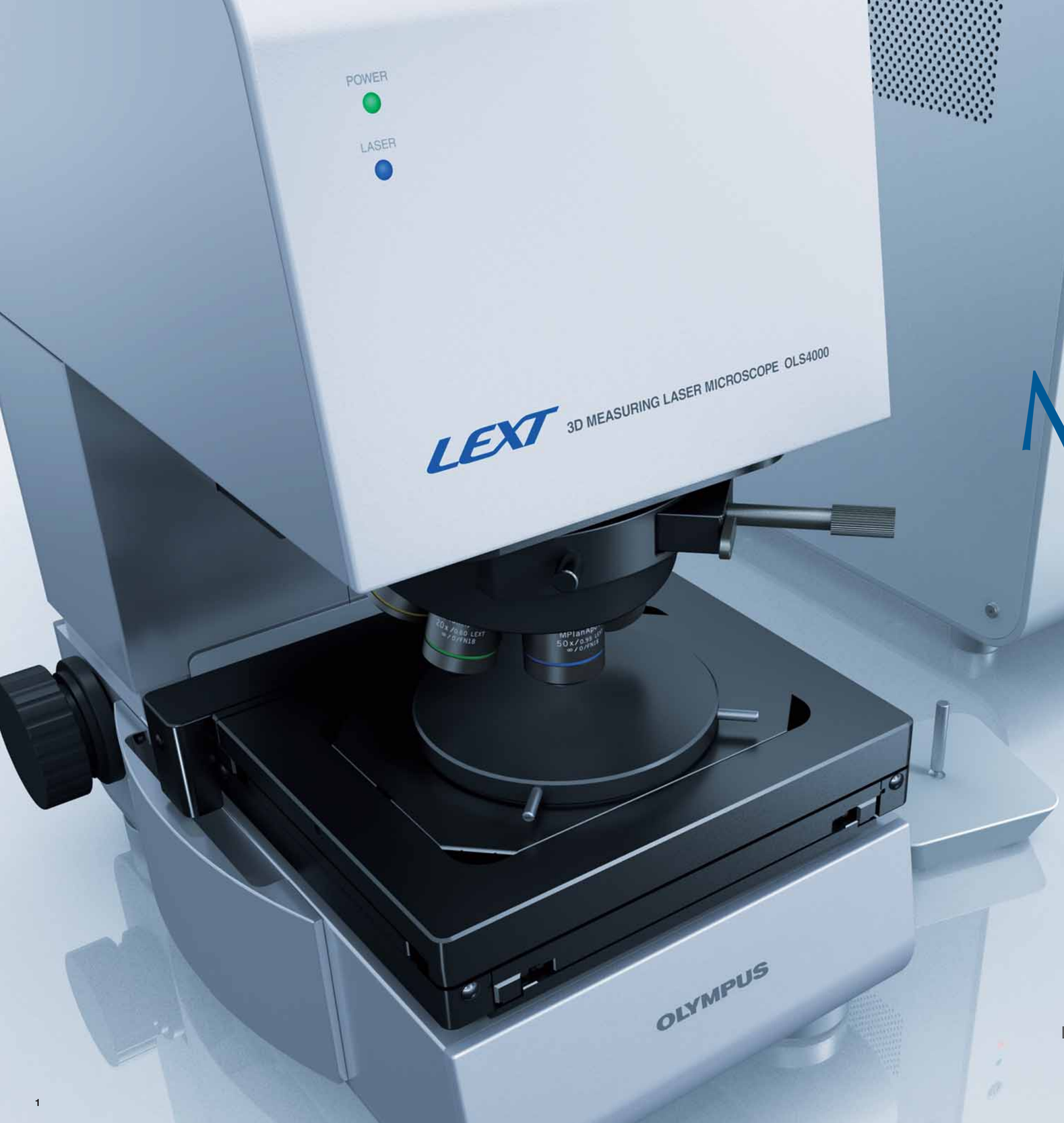


Beyond Common Measurement

The laser microscope has evolved to the next level.
— Advancing rapidly from only displaying 3D images to true measuring systems that measure and display micro geometry.
The LEXT OLS4000 writes a new chapter in the story of laser microscopy.

Olympus has been an Optical Instrument Manufacturer for over 90 years.
An exhaustive survey of our customers and their needs has allowed us to design an instrument that offers the ultimate in usability and exceeds the conventional limits of accuracy in surface roughness measurement.

Elegantly fusing unmatched accuracy with flexibility, Olympus's LEXT OLS4000 sets a new standard of performance in measuring technology.

Capabilities Specific to the New Age of Laser Microscopy

Advanced Laser Technologies, Diverse Observation and Measurement Modes

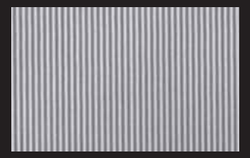
- Simultaneous acquisition of brightness, height, and color information in the same visual field.
- High-resolution observation with high-accuracy, non-contact measurement at near-nanometer precision.
- Ease of use even for first-time operators without sample preparation.

Five Key Laser Technologies

— Making the Most of the Power of Light —

Under Short-wavelength Laser Source

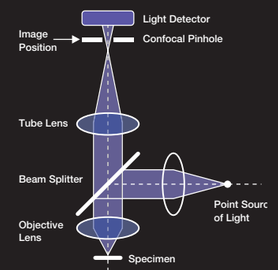
A laser microscope obtains a higher resolution by decreasing the wavelength of a light source. The LEXT OLS4000 features high resolution due to the employment of a 405 nm laser.



Texture with 0.12 µm Lines and 0.12 µm Spaces

Confocal Optical System

The LEXT OLS4000 is equipped with a confocal optical system that only captures the in-focus image while simultaneously eliminating flare. In addition, the confocal technology can be used as a height sensor because only thin image planes of the same height are captured.

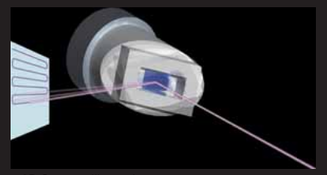


Principle Diagram of Confocal Optical System

Non-confocal Confocal

XY Scan

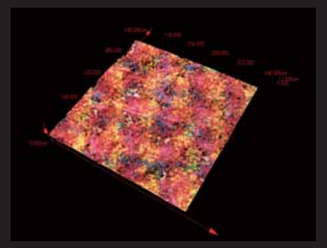
This laser microscope obtains a planar image with the laser light source scanning at high speeds in the XY direction.



2D Scanner Illustration

Real Color Image Acquisition

The laser microscope acquires color information by brightfield observation. It can also create a real-color 3D image by combining the 3D image and color information.



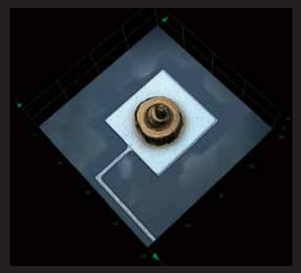
Laser Toner Powder

Linear Scale Z-scanning

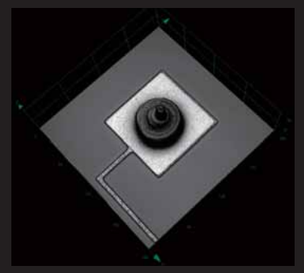
A 3D image is obtained by moving the objective lens in the Z direction. A piezo drive in coordination with a linear scale provides accurate Z axis location data.

Three Observation Modes

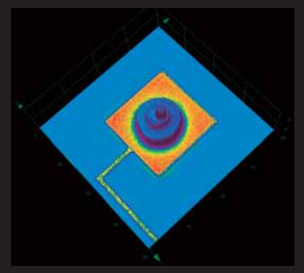
Real-color Dual Confocal 3D Observation



High-resolution Dual Confocal 3D Observation



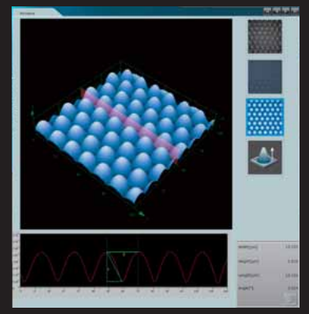
Height Data 3D Observation



Seven Measurement Modes

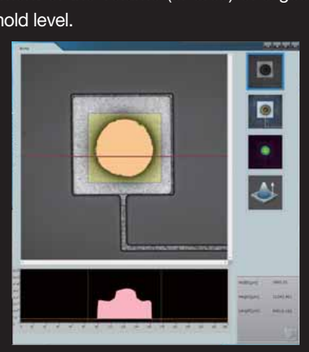
Step Measurement

This mode allows measurement of a step between any two arbitrary points on a surface profile.



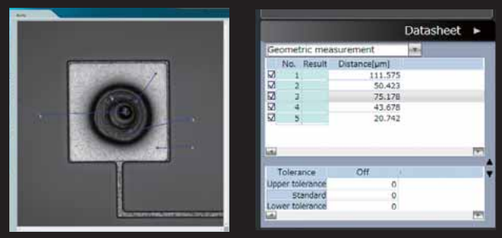
Area/Volume Measurement

With a user-defined threshold level on a surface profile, this mode allows measurement of the volume (or area) of a geometry above or below the threshold level.



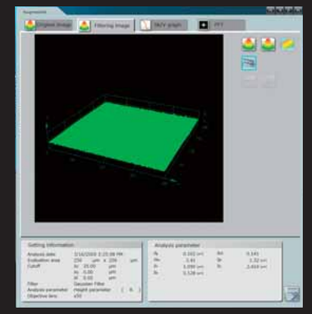
Under Geometric Measurement

This mode allows measurement of the distance between two arbitrary points on a geometric image. The geometric shape and angle for circle, rectangle, etc. are measured.



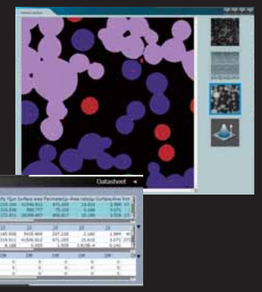
Surface Roughness Measurement

This mode allows measurement of line roughness on one line and plane roughness on the entire surface.



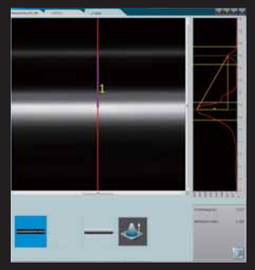
Particle Measurement*

This mode enables auto-separation of particles with the separator function, setting of a threshold level, and setting of a detection range within a region of interest.



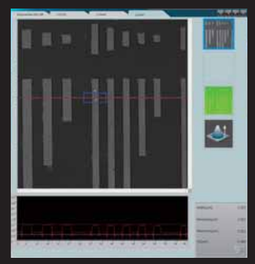
Film Thickness Measurement*

This mode allows the thickness of a film on a transparent body to be measured by detecting changes in refractive index.



Auto Edge Detection/ Measurement*

This mode allows a line width or a diameter to be measured by automatically detecting edges in a geometric image. This reduces uncertainty by eliminating operator error.



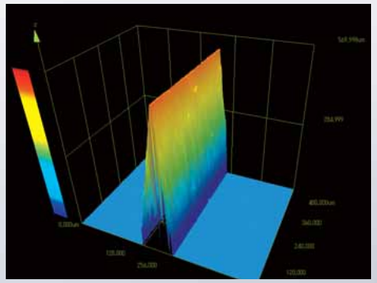
* These modes are available as options for the LEXT OLS4000.

"Beyond-the-Limit" Optical Performance

Imaging Slopes Up to 85 Degrees

Thanks to dedicated objective lenses with high numerical apertures and a dedicated optical system that obtains maximum performance from the 405 nm laser, the LEXT OLS4000 can reliably measure acute-angled specimens that were previously impossible to measure.

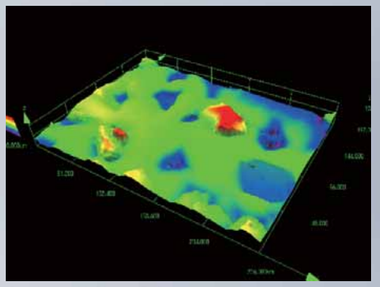
LEXT-dedicated Objective Lenses



Razor with an Acute Angle

Overcoming Reflectance Differences

The LEXT OLS4000 employs a newly developed dual confocal system. Thanks to the inclusion of two confocal optical systems, the LEXT OLS4000 can capture a clear image from a specimen consisting of materials with different reflectance characteristics.



Specimen with Diverse Reflectance
(Diamond-electrodeposited Tool)

Stabilizing Measurement Environments

To eliminate external influences on measurement and to stabilize the measurement environment, the LEXT OLS4000 incorporates a hybrid vibration-damping mechanism using coil springs and damping rubber. This eliminates the need for a dedicated vibration-damping stand, allowing measurements on any desktop.

Hybrid Vibration-damping Mechanism

World's First Double Performance Guarantees

The performance of a measuring tool or its accuracy is expressed in two different terms. One is “Accuracy”, which indicates how close a measurement value is to the true value, and the other is “Repeatability”, which indicates the degree of variations among repeated measurement values. The LEXT OLS4000 assures both accuracy and repeatability — a world's first for laser microscopes.

The LEXT OLS4000 uses a rigorous system of production for every component from the objective lens to the laser head, Olympus delivers only the highest quality systems to customers after thorough inspection based on stringent standards. Final adjustment and calibration is performed at delivery by qualified engineers in the actual measurement environment.

LEXT OLS4000 Traceability System Diagram

Reproducing More Realistic Images of Micro Asperities

Differential Interference Contrast (DIC) is an observation method for visualizing sub-nanometer micro asperities, which are far beyond the resolving power of a laser microscope. This DIC allows you to obtain live images comparable to those of an electron microscope under relatively low power magnifications.

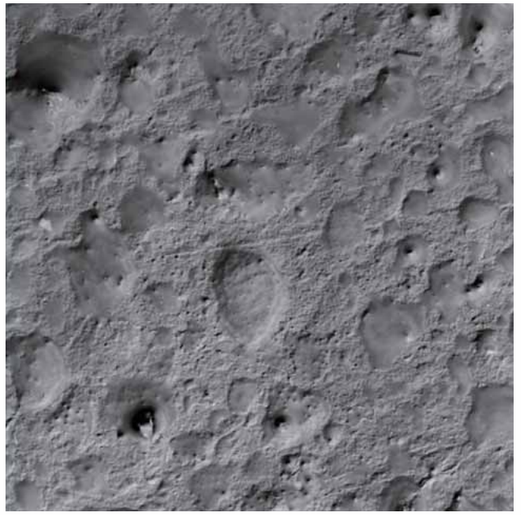


Image with DIC (Polymer Film)

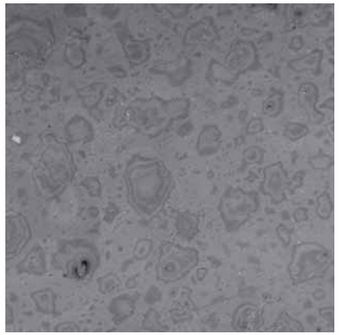
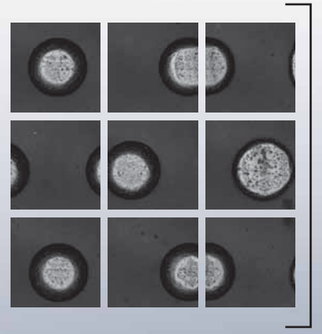
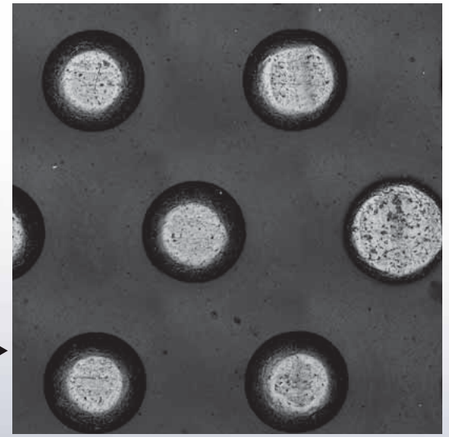


Image without DIC (Polymer Film)

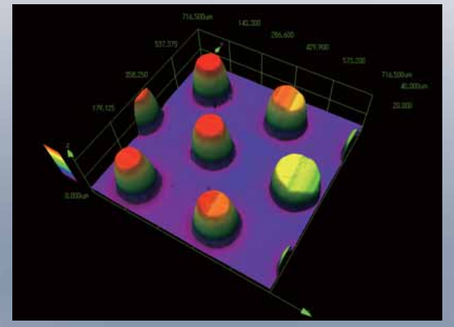
Supporting Wide-field Observation

A higher-magnification image generally narrows the visual field range. The stitching function enables you to stitch up to 500 images together to create high-resolution, wide-field image data.
Additionally, 3D display and 3D measurement are possible even for this wide-field image.



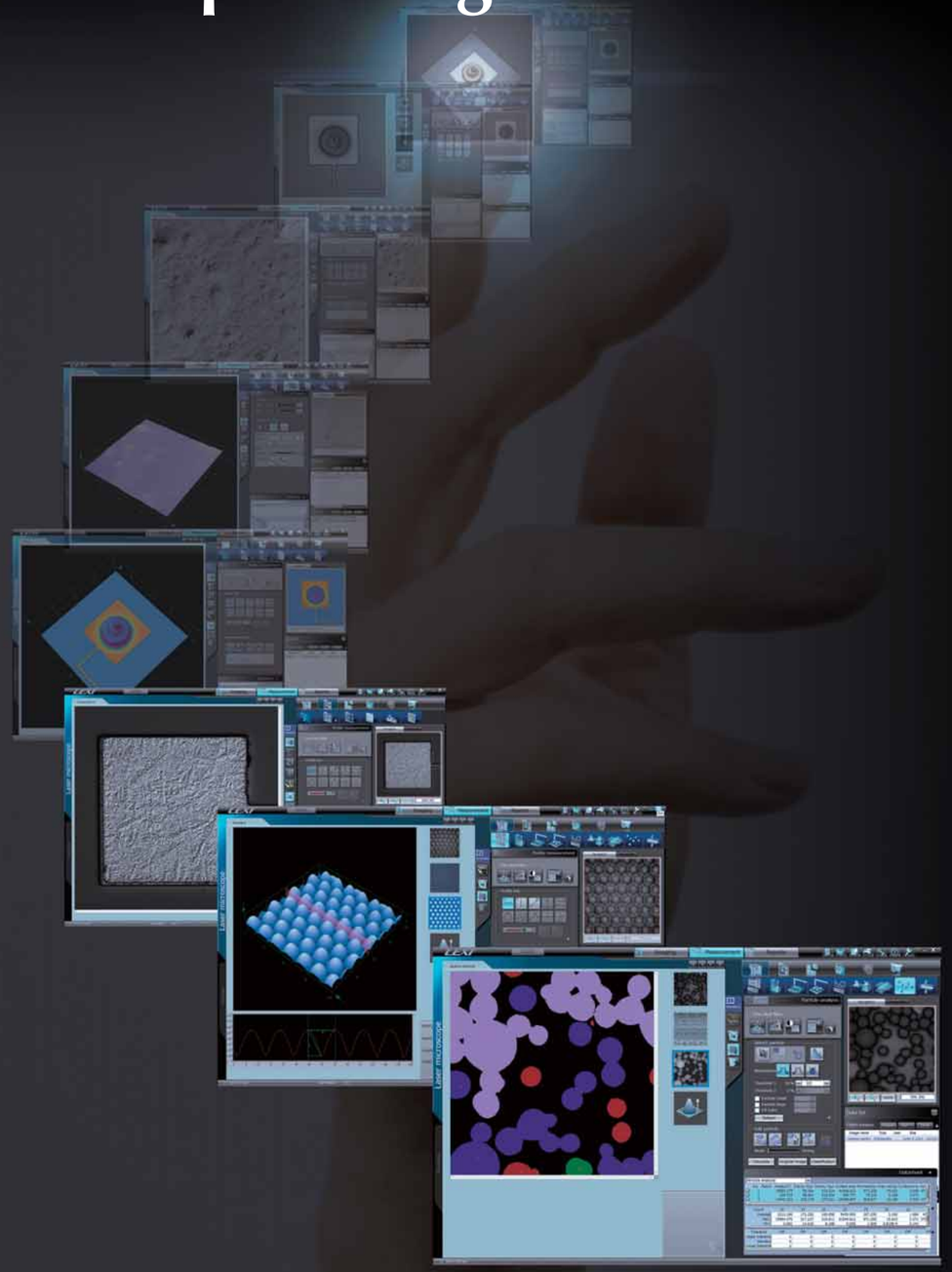


Brightness of Image After Stitching



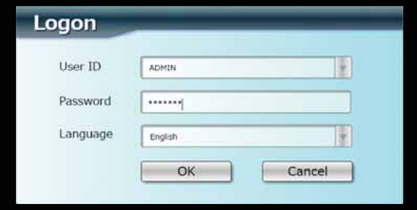
Stitched 3D Image

"Design of Behavior" Contributes to Ideal Operating Environment



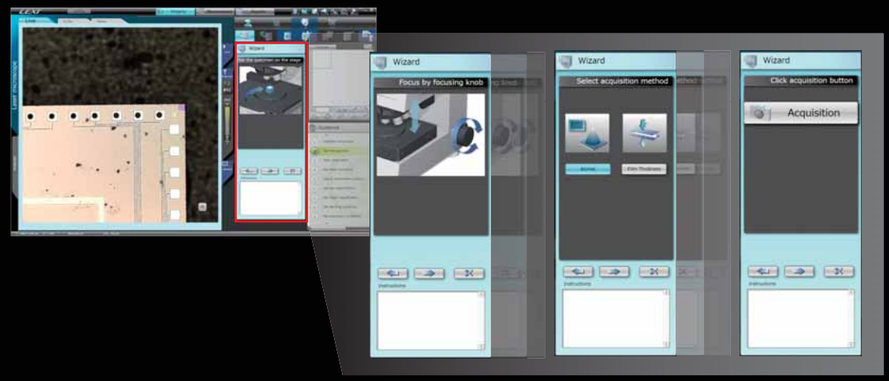
Customizable ID Control and Security Enhancement

Operators can log in to the LEXT OLS4000 using individualized IDs to customize the image database and operating environment. Each ID is displayed on every report and specimen image, giving the administrator an at-a-glance picture of when each report was created or each image was captured and who created each report or captured each image.



Wizard Function that Gives Novice Operators a Sense of Security

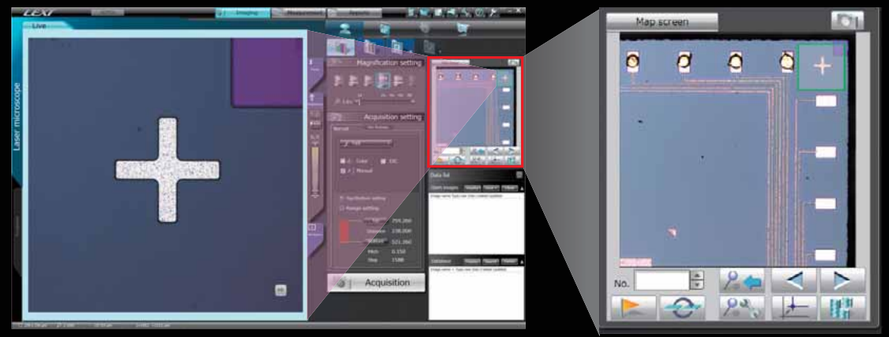
For quick and easy operation by new operators, the LEXT OLS4000 has a detailed user designed wizard function. This wizard function eliminates the time spent on reading the manual and lengthy training.



Enlarged Wizard Frame

Macro Map that Doesn't Get Lost for Observation

Since the visual field is narrowed during observation under high magnification, in many circumstances the operator can lose track of the location of the specimen. The LEXT OLS4000 is equipped with the macro map function. The screen always displays a wide-field image of the specimen under low magnification, displaying a rectangular observation marker on the macro specimen image.



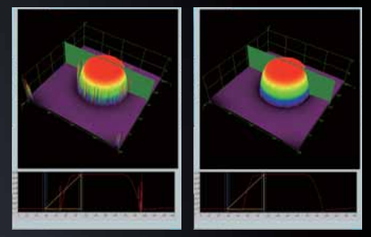
Enlarged Map Area

Motorized Revolving Nosepiece to Prevent Specimen Contact and Automatically Adjust Illumination for Optimized Imaging

The LEXT OLS4000 is equipped with a motorized revolving nosepiece as standard to prevent contact with a specimen during objective lens change. When a new lens is selected, the revolving nosepiece automatically retracts to avoid contacting the specimen. At the same time, the revolving nosepiece automatically brings the objective lens into focus along with image alignment and adjusts light intensity, allowing stress-free switchover of magnifications.

Intelligent Noise Removal (INR) Algorithm Allows Even First-time Users to Easily Visualize an Image Comparable to a Skilled Operator's

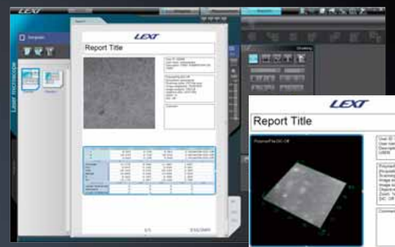
For optimal operation, Olympus has successfully preset a skilled operator's criteria in the system based on experience accumulated over Olympus's 90 year history. Much of this is attributable to the INR (Intelligent Noise Reduction) algorithm newly installed on the LEXT OLS4000. This algorithm allows even a new operator to easily obtain an image identical to that of a expert.



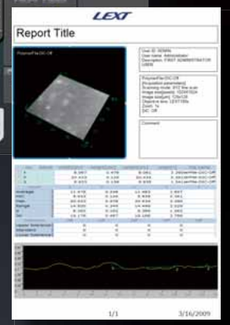
No INR Algorithm Installed　　INR Algorithm Installed

Speedy Generation of Easy-to-understand Reports

Fast production of easy-to-understand reports is vital to a laser microscope. The LEXT OLS4000 generates a report with one click. It is also provided with an edit function to allow the operator to customize each template.



Report GUI



Completed Report Form

The term "Design of Behavior" means that the designer assumes that there is a specific time, place, and situation in which the user will handle a specific object and comprehensively simulates its behavior under those conditions to determine problems and deduce the best solutions for them.

In other words, every bit of knowledge about the microscope is reviewed and then re-constructed. Out of this "Design of Behavior" concept comes the LEXT OLS4000's "multi-user" viewpoint, whereby a single microscope is shared by multiple users. The LEXT OLS4000 represents the best match for users of varying skill levels. Since the LEXT OLS4000 is desinged on a basis of the forecast of multiple users' operations, it delivers a no-stress operation environment, even for users unfamiliar with how to operate the microscope, allowing them to focus on report writing rather than observation.

This is just one of the ways that the LEXT OLS4000 has been designed to be an easy-to-operate microscope that provides expert-level accuracy. The LEXT OLS4000 also implements "Design of Behavior" in a variety of other ways.

Mr. Chiaki Murata
Hers Experimental Design Laboratory Inc.

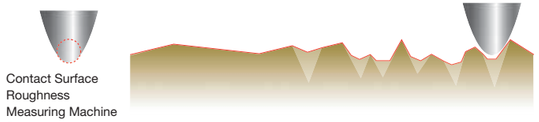
New "Roughness Measurement" Capabilities Open New Possibilities in Measurement

The LEXT OLS4000 has been developed to represent a new standard of surface roughness measuring tool. This system is calibrated in the same way contact surface roughness gauges are calibrated, and has the necessary roughness parameters and filters required per ISO and JQA. This allows users with contact surface roughness gauges to obtain output results from the system consistent with their existing instruments, with the advantage of greater speed and non-contact measurement.

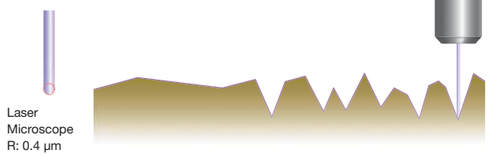
The LEXT OLS4000 has a new roughness-specific mode enabling roughness profile measurement for sample lengths up to 100 mm with the new automatic line stitching function.

Micro Roughness

Contact surface roughness measuring machines cannot measure micro asperities less than the stylus tip diameter. The laser microscope can measure the surface roughness of micro geometries at high resolution due to a minute laser spot diameter.



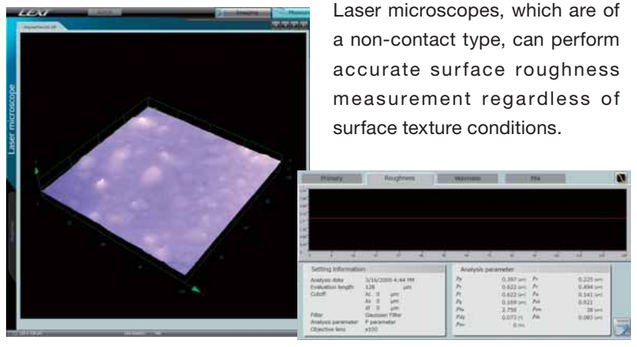
Contact Surface Roughness Measuring Machine
R: 2 µm



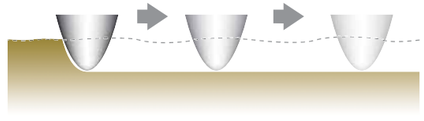
Laser Microscope
R: 0.4 µm

Non-contact

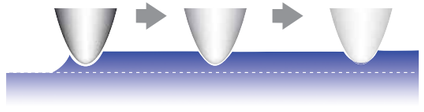
Since a contact surface roughness measuring machine uses a hard needle-shape stylus, it is more likely to scratch the surface of a soft specimen, damaging or deforming it. With adhesive specimens, on the other hand, the stylus could attach to the specimen and be damaged when pulled loose, making it impossible to obtain correct results.



Laser microscopes, which are of a non-contact type, can perform accurate surface roughness measurement regardless of surface texture conditions.



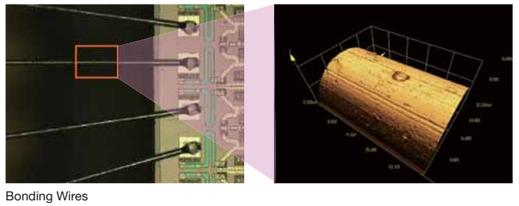
Soft Specimen



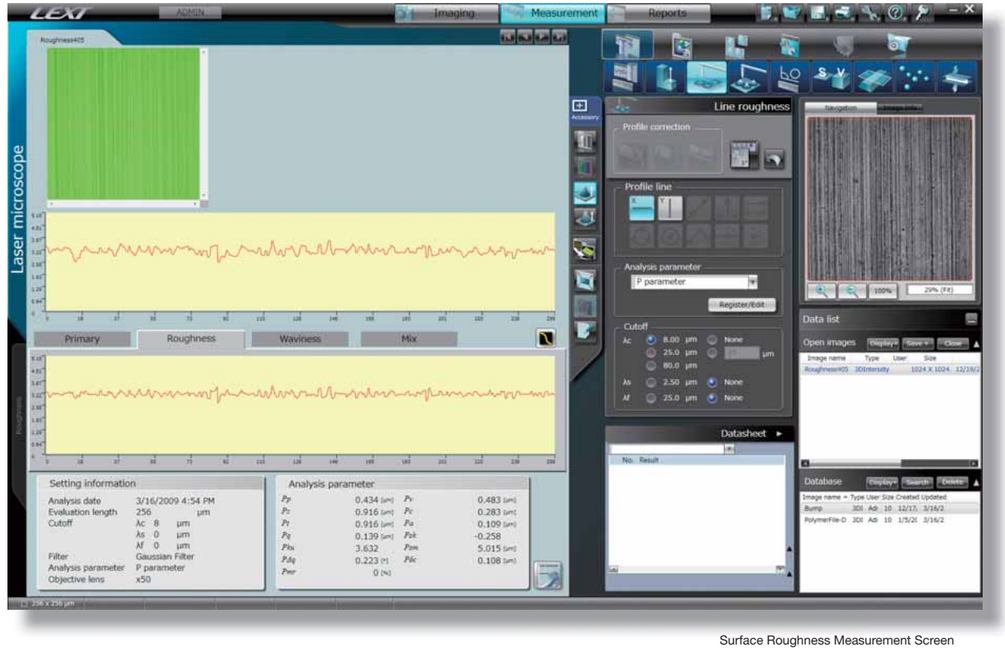
Adhesive Specimen

Measurement of Micro Areas

Surface roughness measuring machines cannot measure micro areas since their stylus are not able to access these areas. Laser microscopes can correctly identify a measuring position and easily perform roughness measurement of a target micro area.

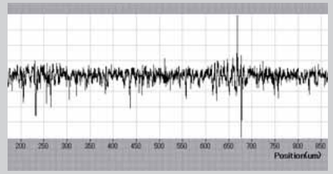


Bonding Wires

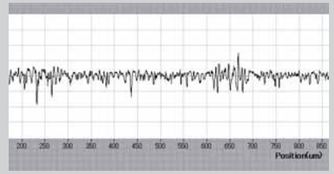


Surface Roughness Measurement Screen

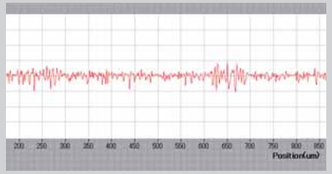
Entire Length of Profile: 1.6 mm



Primary Profile from LEXT OLS4000
λs=2.5 µm without Filtering



Primary Profile from LEXT OLS4000
λs=2.5 µm with Filtering



Primary Profile from a Contact Surface Roughness Measuring Machine

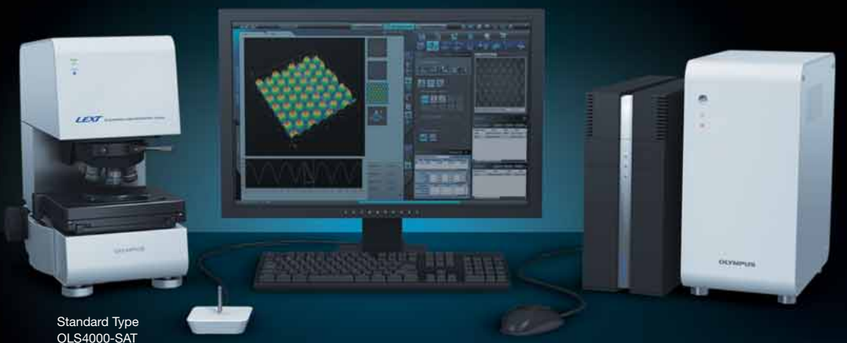
LEXT OLS4000 Surface Profile Parameters List

Primary Profile	: *Pp, Pv, Pz, Pc, Pt, Pa, Pq, Psk, Pku, Psm, PΔq, Pmr(c), Pδc, Pmr*
Roughness Profile	: *Rp, Rv, Rz, Rc, Rt, Ra, Rq, Rsk, Rku, Rsm, RΔq, Rmr(c),Rδc, Rmr, RzJIS, Ra75*
Waviness Profile	: *Wp, Wv, Wz, Wc, Wt, Wa, Wq, Wsk, Wku, Wsm, WΔq, Wmr(c), Wδc, Wmr*
Bearing Area Curve	: *Rk, Rpk, Rvk, Mr1, Mr2*
Motif	: *R, Rx, AR, W, Wx, AW, Wte*
Roughness Profile (JIS1994)	: *Ra(JIS1994), Ry, Rz(JIS1994), Sm, S, tp*
Others	: *R3z, P3z, PeakCount*

LEXT OLS4000 Surface Roughness Parameters List (Conforms to ISO25178 Draft)

Amplitude Parameters	: *Sq, Ssk, Sku, Sp, Sv, Sz, Sa*
Functional Parameters	: *Smr(c), Sdc(mr), Sk, Spk, Svk, SMr1, SMr2, Sxp*
Volumetric Parameters	: *Vv(p), Vvv, Vvc, Vm(p), Vmp, Vmc*
Lateral Parameters	: *Sal, Str*

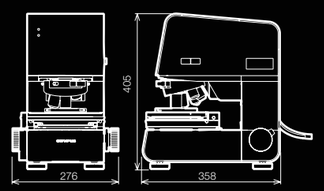
Lineup



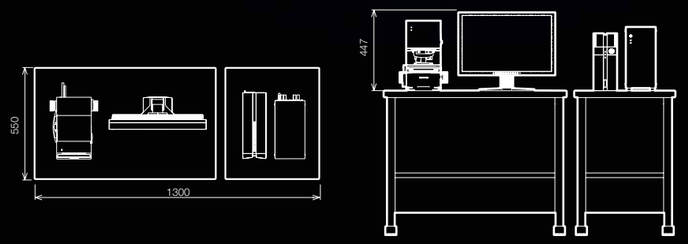
Standard Type
OLS4000-SAT

300mm-stage Type
OLS4000-LAT

Main Unit Dimensions



Combination System Dimensions



Unit: mm

Main Unit

LSM Section		Light Source/Detector	Light Source: 405 nm Semiconductor Laser, Detector: Photomultiplier
		Total Magnification	108x ～ 17,280x
		Zoom	Optical Zoom: 1x – 8x
Measurement	Planar Measurement	Repeatability	100x: $3\sigma_{n-1}$=0.02 µm
		Accuracy	Measurement Value ±2%
	Height Measurement	System	Revolving Nosepiece Vertical-drive System
		Stroke	10 mm
		Scale Resolution	0.8 nm
		Display Resolution	1 nm
		Repeatability	50x: σ_{n-1}=0.012 µm
		Accuracy	0.2+L/100 µm or Less (L=Measuring Length µm)
Color Observation Section		Light Source/Detector	Light Source: White LED, Detector: 1/1.8-inch 2-megapixel Single-panel CCD
		Zoom	Digital Zoom: 1x – 8x
Revolving Nosepiece			Motorized BF Sextuple Revolving Nosepiece
Differential Interference Contrast Unit			Differential Interference Contrast Slider: U-DICR, Polarizing Plate Unit Built-in
Objective Lens			BF Plan Semi-apochromat 5x, 10x LEXT-dedicated Plan Apochromat 20x, 50x, 100x
Z Focusing Unit Stroke			100 mm
XY Stage			100x100 mm (Motorized Stage), Option: 300x300 mm (Motorized Stage)

Objective Lens

Model	Magnification	Field of View	Working Distance (WD)	Numerical Aperture (NA)
MPLFLN5X	108x-864x	2,560-320 µm	20.0 mm	0.15
MPLFLN10X	216x-1,728x	1,280-160 µm	11.0 mm	0.30
MPLAPON20XLEXT	432x-3,456x	640-80 µm	1.0 mm	0.60
MPLAPON50XLEXT	1,080x-8,640x	256-32 µm	0.35 mm	0.95
MPLAPON100XLEXT	2,160x-17,280x	128-16 µm	0.35 mm	0.95