UC SANTA BARBARA
OASIS *Protofab*

Keyence VK-X3000 Confocal Microscope SOP# : OAS-PF-0410-00

User Responsibility, Training, and Consequences of Misuse

OASIS prototyping facility, Protofab, operates as a shared research and prototyping facility. All users are expected to follow this SOP, facility policies, and applicable safety guidelines to ensure safe operation, equipment longevity, and equitable access for all users.

This SOP is not a substitute for hands-on training or tool qualification. Refer to User's Manual and Guides for details.
Users must complete required Protofab training and receive authorization prior to independent tool use. In the event of misuse, unintentional error, or non-compliance, corrective actions will be educational, proportional, and focused on preventing recurrence, taking into account the user's experience level and the nature of the issue.

Corrective actions may include:

- Clarification or coaching on proper tool use
- Additional training or temporary supervision
- Temporary suspension of independent tool access
- Restriction to supervised use until competency is re-established

Users may be held responsible for repair, cleaning, or downtime costs only in cases of negligence or repeated misuse.

1. Purpose

The Keyence Digital Microscope is used in Protofab to perform high-resolution optical inspection, dimensional measurement, surface characterization, and documentation of micro- and opto-electronic devices and components.

The system supports process development, in-process verification, failure analysis, and final inspection across research, prototyping, and low-volume manufacturing activities.

2. Scope

This SOP applies to all uses of the Keyence microscope for non-destructive inspection and metrology of parts, assemblies, and substrates processed within Protofab.

The microscope is intended for room-temperature, dry inspection only and shall not be used for live electrical probing, destructive testing, or chemical exposure.

2. Safety & EHS

- PPE such as protective eyewear is mandatory except while using microscope eyepieces. Refer to facility rules for details.

⚠ CAUTION

- Do not stare at the LED light or reflected beam.
- Do not touch the lens revolver while it is moving. Doing so risks catching hands or fingers in the mechanism.
- Do not place your hand between the stage and the unit. Doing so may result in your hand getting caught and subsequent injury.

3. Tool Application

The Keyence microscope may be used for, but is not limited to:

- Die attach inspection (epoxy, eutectic, or solder joints)
- Wire bond inspection (ball, wedge, stitch, stud bumps)
- Optical alignment verification (fiber attach, free-space optics)
- Surface topography and defect inspection (scratches, voids, residues)
- Dimensional measurements (feature size, pitch, height, coplanarity)
- Documentation and image capture for reports, travelers, and failure analysis

The following materials are permitted for inspection on the Keyence microscope:

- Silicon, glass, quartz, and sapphire substrates
- Ceramic submounts (AlN, Alumina, BeO*)
- Metal leadframes and metallized substrates (Au, Cu, Ni, Pd, Al coatings)
- Optical fibers, ferrules, lenses, and passive optical components
- Packaged or partially assembled micro- and opto-electronic devices

Restrictions:

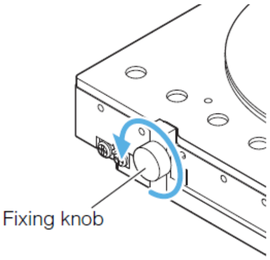
- No wet, liquid-bearing, or outgassing samples

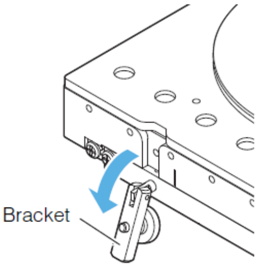
- No sample heavier than 6.6lbs (3kg)
- No loose powders or particles that may contaminate optics or stages

*BeO substrates require prior OASIS approval and proper labeling.

4. Pre-use checks (before every run)

- Visual inspection the cleanliness of the stage from debris or contamination
- Verify that stage was not locked for transportation. If so, unlock the stage as below:

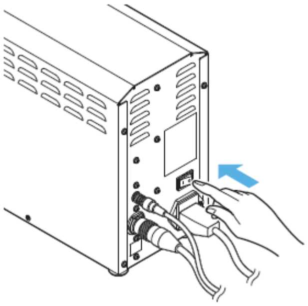




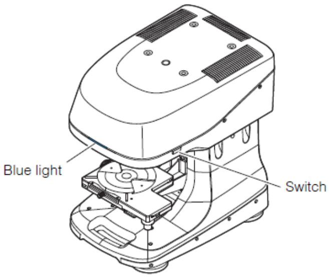
5. Standard operating procedure

5.1 Startup

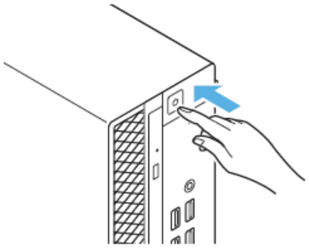
1. Turn on the main power switch



2. Turn on the power switch on measurement unit.



3. Turn on power of the control PC.

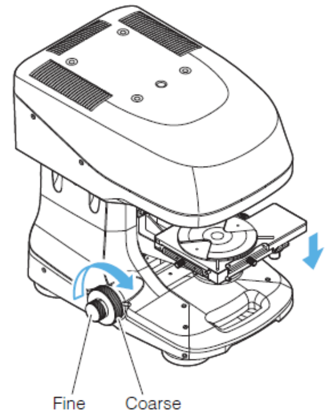


5.2 Normal operation

1. Initializing Lens Position

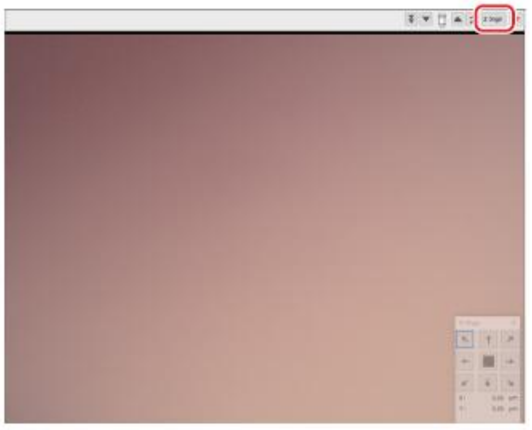
a) Strat the Viewer Application

b) Turn the focusing handle (coarse/fine) to lower the XY stage to lowest level possible.

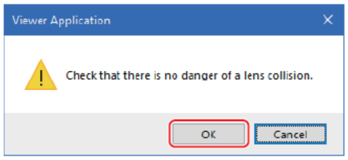


NOTICE	**When initializing the lens position, do not place the sample on the rotating stage.** **Contact between the objective lens and the sample could damage either one.**

c) and initialize the lens position and motorized XY stage (return them to their origin).



d) Click [OK] in the confirmation message.

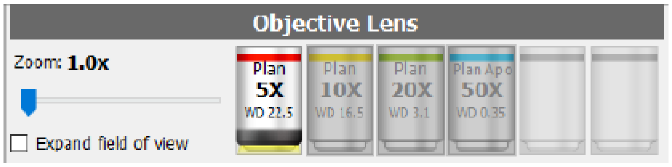


Check that there is no danger of a lens collision.

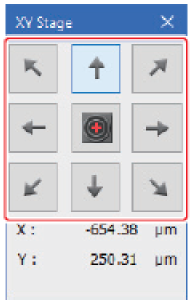
3. Load the sample: Place the sample on the rotating stage for observation/measurement.

NOTICE	- **The motorized XY stage can accommodate samples up to 70 mm in height and 3.0 kg in weight.** [redacted]

4. Select the objective lens to be used with the Viewer Application. The revolver rotates and the objective lens changes.



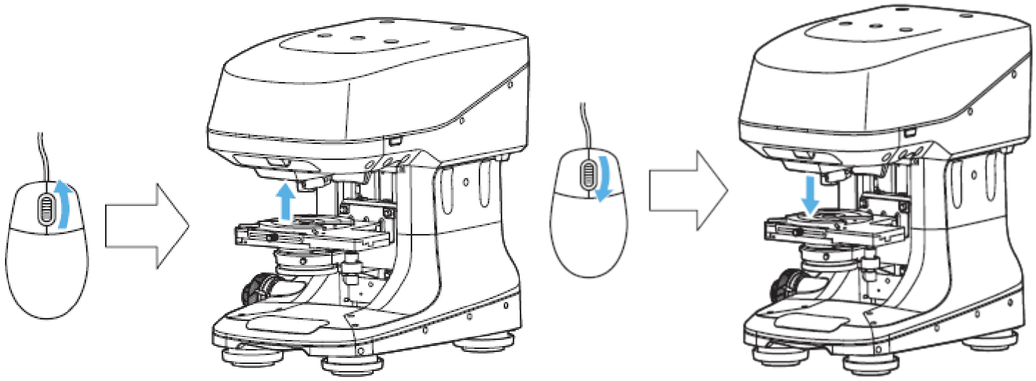
5. Adjust the observation Position by clicking the mouse in the Viewer Application or clicking the mouse. Refer to Reference manual for details.



X : -654.38 µm
Y : 250.31 µm

6. Adjust the focus by turning the handle (coarse/fine) or the Viewer Application. Refer to the manual for details.

Vertical position buttons for the objective lens



5.3 Shutdown

1. Shut down the PC after closing the applications.

2. Turn off the measurement unit.

3. Turn off the controller.

6. Metrology & Observation Procedures

Refer to below documents for general operation and features of the system.

- “User’s Manual_VK-X3000” for Hardware
- “Ref Manual Viewer Application” for operating software
- “Ref Manual Multifile Analyzer Software_VK-X3000

Refer to the documents below for detailed step-by-step guides to specific type of measurements.

- “Profile Measurement” for virtual cross-section.
- “Plane Measurement” for point height and exporting results.
- “Surface Roughness Measurement” for line, multiline and surface roughness.
- “Volume & Area Measurement” for concave and convex volume, cross sectonal area and surface area.
- “Gathering New Data using Laser Confocal” for setting used in confocal mode.
- “Gathering New Film Thickness Data” such as permeable films and glass as well as transparent coatings.
- “Process Image” to remove noise generated in the height data.
- “Average Step Height Measurement (Flatness)” is a function to gather height difference, maximum height, minimum height, and flatness.
- “Batch Analysis Recommendation” to efficiently conducting measurements across several similar samples.
- “Comparative Measurement” allows direct comparison of 2 profiles from different samples.

- “Teaching Module” is useful for evaluating multiple measurement positions by changing the lens to be used or measurement method.

7. Troubleshooting

Do not attempt to fix any issue if you are not authorized. Contact facility personnel through portal and report the issue to be addresses.