

Digital Microscope

VHX-6000

User's Manual

Read this manual before use.
Keep this manual in a safe place for future reference.











Introduction

This manual explains the handling and operating procedures, as well as warning information for the Digital Microscope VHX-6000 Series (hereinafter, "VHX-6000"). To take full advantage of the features of this microscope, read this manual thoroughly before using it. Store this manual where it can easily be referenced by anyone using this microscope.

Symbols

In this manual, the following symbols alert you to important messages.

Be sure to read the messages.

 DANGER	It indicates a hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	It indicates a hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	It indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
 NOTICE	It indicates a situation which, if not avoided, could result in product damage as well as property damage.
 Important	It indicates cautions and limitations that must be followed during operation.
 Point	It indicates additional information on proper operation.
 Reference	It indicates tips for better understanding or useful information.
	It indicates the reference pages and items in this manual.





General precautions

- No part of this manual may be reprinted in part or whole without prior written permission from KEYENCE.
- The contents of this manual are subject to change, due to improvements, without notice.
- Please direct any questions or report any errors or omissions regarding the content of this manual to your nearest sales office listed at the end of this manual.
- KEYENCE shall replace manuals with missing pages or paging disorders.

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Safety information for VHX-6000 Series



General Precautions

	<ul style="list-style-type: none"> Do not use this product for the purpose to protect a human body or a part of human body. This product is not intended for use as explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.
	<p>If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.</p>
	<ul style="list-style-type: none"> Check the functionality and performance of this instrument before using it. Take any and all safety precautions prior to using the VHX-6000 to prevent potential damages should it fail.
	<p>Do not subject the VHX-6000 or any peripheral devices to sudden temperature changes which could otherwise lead to condensation.</p>


Reference

- KEYENCE makes no warranty against functionality or performance issues arising from usage outside the standards specified for the VHX-6000, or modifications made to the VHX-6000.
- Note that the VHX-6000 may not function correctly or may fail to fulfill performance expectations if used with other devices due to unforeseen operating conditions, environment, etc. Be sure to confirm these conditions beforehand.
- Unplug the AC power cord set if the VHX-6000 will not be used for prolonged periods.

Caution

	<ul style="list-style-type: none"> Be sure to turn the main power switch off when connecting cables or servicing this instrument. Failure to do so may lead to electric shock. Do not bend the power cable with excessive force, or place it under heavy objects. Doing so may damage the cable and cause fires and electric shock. Do not use if cable is damaged. Do not insert foreign objects. Doing so may result in fires, electric shock, product failure, and other hazards. Never remove the case cover. Touching internal parts with your hands may result in electric shock. The power supply cord set is not provided with the VHX-6000 Series. Use the cord set, which complies with the regulations and standards in the country or the region in which the VHX-6000 Series are used. (In North America, use the cord set, which type of cable is SVT or equivalent, 18AWG or better, rated temperature 90°C or better.) When installing the VHX-6000, be sure to connect the protective earthing terminal on the AC power cable to the protective earthing conductor in the building installation. Otherwise, electric shock or product damage may result. Do not disassemble or modify the VHX-6000. Doing so may result in fires, electric shock, product failure, and other hazards.
	<p>Potentially hazardous optical radiation is emitted from the end of the optical fiber. Do not stare at this radiation to avoid any damage to your eyes.</p>

Precautions for abnormalities

	<p>Shut the power off immediately in these instances. Continued use under these conditions may result in fires, electric shock, or product failure. Contact your nearest KEYENCE sales office for repair work.</p> <ul style="list-style-type: none"> When water or foreign objects enter the instrument. When you drop the instrument or damage the case. If you notice smoke or abnormal odor coming from the instrument.
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Precautions for usage

NOTICE	<ul style="list-style-type: none"> • Do not block the air vents on any of the units. • Supply the correct power voltage. Otherwise the VHX-6000 may fail. • Do not stand on the VHX-6000. Doing so may damage it. • Do not place any objects on the VHX-6000. Otherwise the VHX-6000 may fail. • Do not wipe the LCD monitor or the VHX-6000 with thinners or other organic solvents. Doing so may damage the VHX-6000. • If the VHX-6000 becomes dirty wipe with a dry cloth. • Always turn the main power switch off before disconnecting or removing the AC power cord set, camera unit, etc. Otherwise the VHX-6000 may fail.
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Precautions for installation

NOTICE	<p>To ensure correct and safe operation, the VHX-6000 must be installed in an appropriate location. Failure to observe these warnings may result in fires, electric shock, or product failure. Do not install in areas subject to:</p> <ul style="list-style-type: none"> • ultraviolet rays which can cause wear on the LCD monitor, direct sunlight or strong ultraviolet rays for prolonged periods of time. • direct vibration or shock. • ambient temperatures outside the range of 5 to 40°C. • ambient humidity outside the range of 35 to 80% (no condensation). • sharp temperature changes. • air flow from an air-conditioner vent. • volatile flammable materials and corrosive gases. • large amounts of dust, salts, irons, greasy fumes. • water, oil, and chemicals. • intense magnetic or electric fields. • large voltage fluctuations.
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Precautions for storage

NOTICE	<p>Avoid storing in areas subject to:</p> <ul style="list-style-type: none"> • ambient temperatures outside the range of 5 to 40°C. • ambient humidity outside the range of 35 to 80% (no condensation). • direct sunlight or wind and rain. • volatile flammable materials and strong corrosive chemicals. • unstable surfaces where the microscope could fall from.
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Precautions for transportation

NOTICE	<ul style="list-style-type: none"> • Be sure to turn the main power switch off before disconnecting or removing cables for transporting. • Be sure to use packing material specified by KEYENCE for transporting. Otherwise the VHX-6000 may become damaged.
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Other precautions



- The VHX-6000 uses a hard disk drive (HDD) to store image data and measurement data. Data stored on the HDD may become lost if the VHX-6000 fails. Make a backup of the data stored on the HDD regularly. We recommend making backups immediately after acquiring important data.
- KEYENCE provides no warranty for data stored on the HDD when performing repairs. Make a backup of the data before repairing the VHX-6000.

Precautions on Regulations and Standards

1 CE Marking

Keyence Corporation has confirmed that this product complies with the essential requirements of the applicable EU Directive(s), based on the following specifications. Be sure to consider the following specifications when using this product in the Member States of European Union.

1.1 EMC Directive

- Applicable Standard: EN61326-1, Class A

These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of EMC Directive. The manufacturer of the end-product is solely responsible for the compliance on the end-product itself according to EMC Directive.

1.2 Machinery Directive

- Applicable standard: EN ISO12100
EN61010-1
EN62471, Risk group 3
- Overvoltage category II
- Use this product under pollution degree 2.
- Indoor use only.
- Use this product at the altitude of 2000 m or less.
- This product is designed as a Class I equipment. Be sure to connect the protective earthing terminal on the AC power cable to the protective earthing conductor in the building installation.
- The Appliance inlet is designed as a disconnecting device. Install this product so that the AC power cable can be removed immediately from the appliance inlet when an abnormality occurs.

2 CSA Certificate

This product complies with the following CSA and UL standards and has been certified by CSA.

- Applicable standard CAN/CSA C22.2 No.61010-1
UL61010-1

Be sure to consider the following specifications when using this product as a product certified by CSA.

- Overvoltage category II
- Use this product under pollution degree 2.
- Indoor use only.
- Use this product at the altitude of 2000 m or less.
- This product is designed as a Class I equipment. Be sure to connect the protective earthing terminal on the AC power cable to the protective earthing conductor in the building installation.
- The Appliance inlet is designed as a disconnecting device. Install this product so that the AC power cable can be removed immediately from the appliance inlet when an abnormality occurs.

3 Best Management Practice for Perchlorate Materials — California only

This product uses components containing perchlorate material. When you ship this product or your end-product installing this product to California, you must label or mark the following statement on the exterior of all outer shipping packages and on consumer packages or you must include the following statement in an instruction manual or MSDS accompanied with the product.

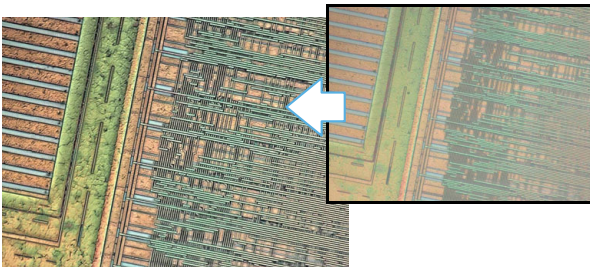
“Perchlorate Material - special handling may apply, See www.dtsc.ca.gov/hazardouswaste/perchlorate.”

Additional Features for Improved Observation

Clear observation of fine surface features

The High Resolution HDR function allows users to see surface details that otherwise could not be seen.

IC (1500x)

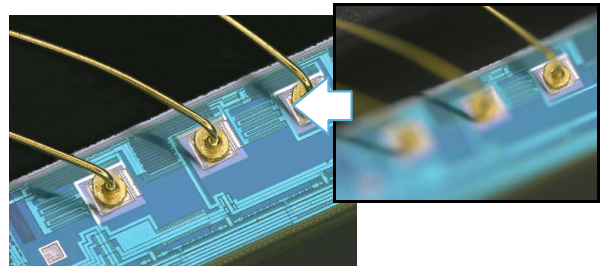


For details, refer to "Enhancing Resolution and Increasing Gradation" (Page 7-7).

Observe parts completely in focus even if the parts have significant height variation

The Depth Composition function overcomes depth-of-field limitations at high magnification.

Wire bonding (300x)

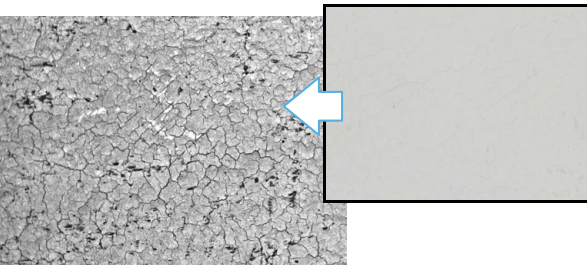


For details, refer to "Types and Features of Depth Composition" (Page 10-2).

Low contrast parts can be seen accurately

The HDR function gathers additional color information to render a detailed image on samples with low color gradation.

Inkjet paper (300x)

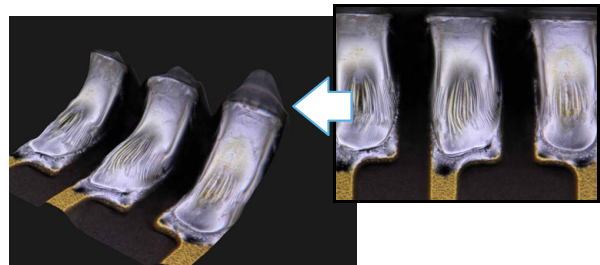


For details, refer to "Enhancing Resolution and Increasing Gradation" (Page 7-7).

The true shape of an object can be understood fully

The 3D Display function allows a user to view an object in 3D to truly understand the topography of the part.

HDD head connection (1000x)

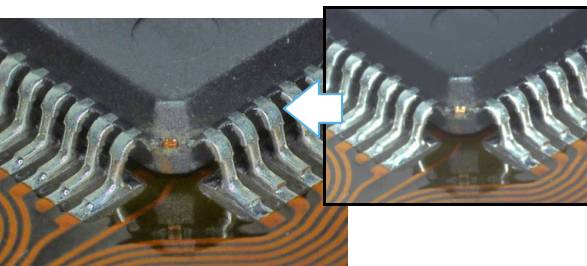


For details, refer to "3D View" (Page 10-15).

Glare of the highly reflective surfaces can be removed

The Remove Glare function minimizes the glare on reflective components.

Solder (50x)

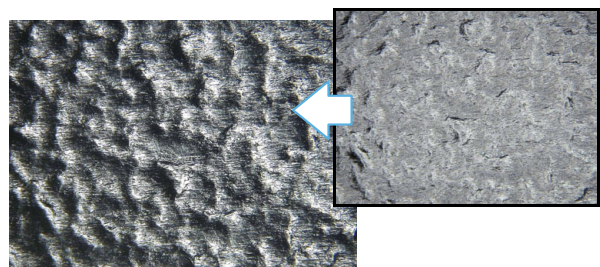


For details, refer to "Removing Glare (Reflected light removal)" (Page 7-11).

Surface features can be accentuated for inspection

Use the [Multi-lighting] function. The function can change the lighting angle to enhance flaws. The function also allows you to check the image with the lighting angle changed later.

Grain of resin (250x)



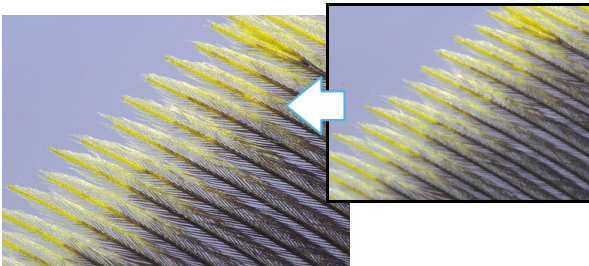
For details, refer to "Change illumination direction (Multi-lighting)" (Page 7-4).

Advanced Analysis Functions

Capture high resolution images of features

The HD Image function allows the user to capture high resolution images employing up to 18 mega pixels x 3CMOS of data.

Feathers of a Paradise bird (150x)

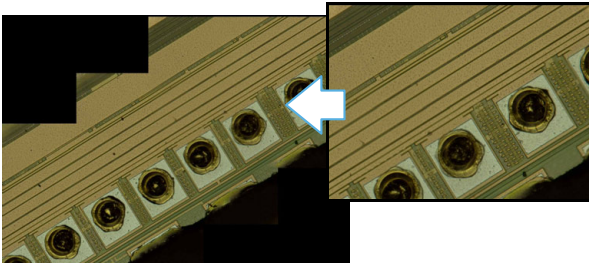


For details, refer to "Setting the Recording Size" (Page 5-5).

Expanded viewing area image capture

The Stitch Image function allows the user to capture wide area images without sacrificing resolution.

Wire bonding (1000x)

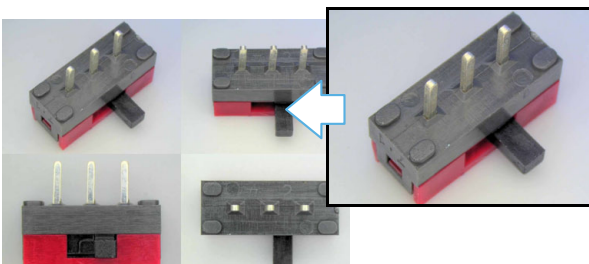


For details, refer to "Automatic Image Stitching" (Page 11-2).

Comparative analysis directly on the system

The Split Screen function allows the user to visually compare two objects side by side directly on the system.

Switch (20x)

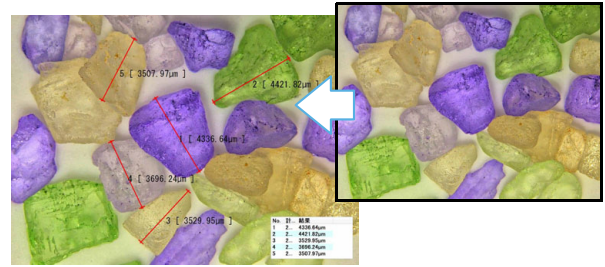


For details, refer to "Split Screen" (Page 8-2).

Measure critical features quickly

The Measurement function allows the user to measure observed features instantly.

Crystal grains (20x)

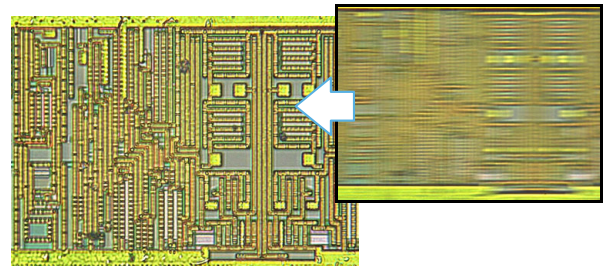


For details, refer to "Overview and Type of Measurements" (Page 9-2).

Eliminate vibration

The S.C.F. function allows for clear real time (video) observation by eliminating vibration.

IC pattern (3000x)

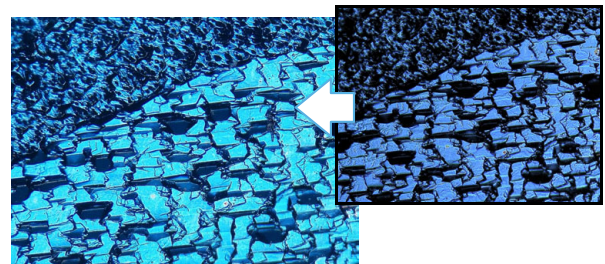


For details, refer to "Reducing the Effects of Vibration (Anti-vibration Mode)" (Page 7-13).

Capture sharp images

The Vivid & Sharp Image function brightens and sharpens for the image for improved observation.

Solar battery cell (500x)

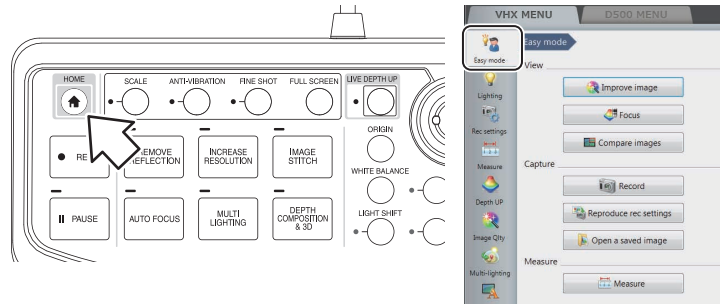


For details, refer to "Enhance Contours in Vivid Color (Sharpening Image Mode)" (Page 7-15).

Easy mode

This allows you to easily call useful functions.

Press the [HOME] button on the console or click the [Easy mode] on the VHX Menu.



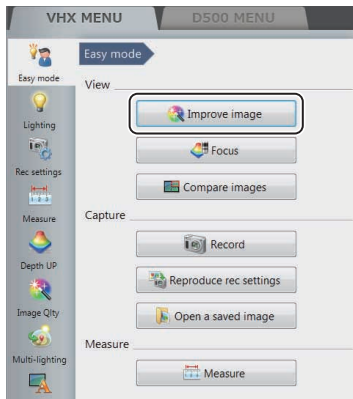
[Easy mode] menu displays.

Viewing

Improve image

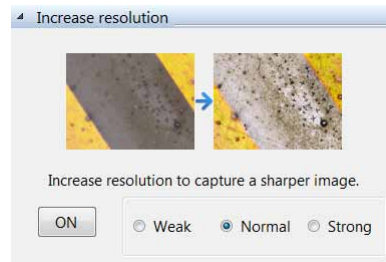
Functions used to improve the image quality are described below.

Click the [Improve image] button from the [Easy mode] menu.



■ Increase resolution

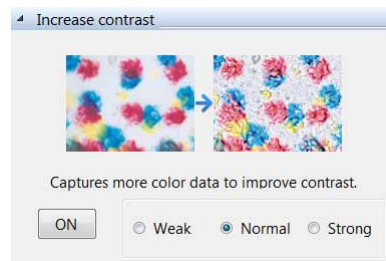
By using High Resolution HDR can observe a high resolution image. Intensity effect of this function can be selected to [Weak], [Normal] and [Strong].



For details of the fine adjustment, refer to "Enhancing Resolution and Increasing Gradation" (Page 7-7).

■ Increase contrast

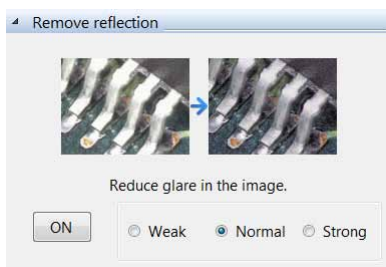
By using HDR observation can observe an optimized image. Intensity effect of this function can be selected to [Weak], [Normal] and [Strong].



For details of the fine adjustment, refer to "Enhancing Resolution and Increasing Gradation" (Page 7-7).

■ Removing reflection

By using this function can reduce glare in the image. Intensity effect of this function can be selected to [Weak], [Normal] and [Strong].



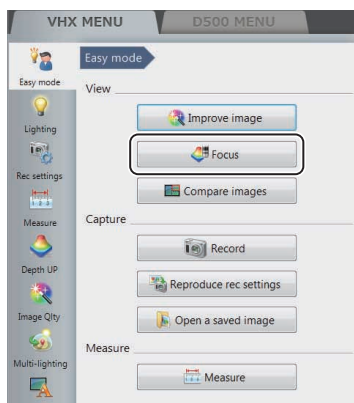
For details of the fine adjustment, refer to "Removing Glare (Reflected light removal)" (Page 7-11).

■ **[Select best image from preview] button**

The setting (processing) best suited to the application can be selected under 9 different settings in a 9-way split screen. For details, refer to "Selecting an Image from 9 Different Settings (Optimize)" (Page 7-16).

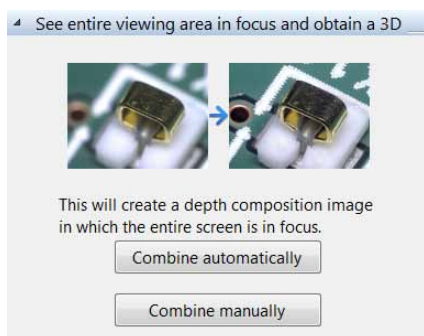
Focus

Functions used to adjust the focus are described below. Click the [Focus] button from the [Easy mode] menu.



■ **See entire viewing area in focus and obtain a 3D**

Create a depth composition image in which the entire screen is in focus. After that, the 3D image displays.



Automatic composition

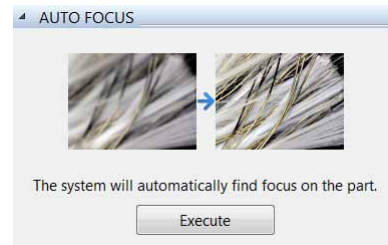
The Z stage automatically moves in the vertical direction to perform the depth composition. For details, refer to "Live Depth Composition" (Page 10-3).

Manual composition

The depth composition is performed regardless of a start position of the Z stage. For more details, refer to "Manual 3D composition" (Page 10-14).

■ **AUTO FOCUS**

Execute the AUTO FOCUS to find the focus on the part.



For details of the fine adjustment, refer to "Using auto focus" (Page 10-56).

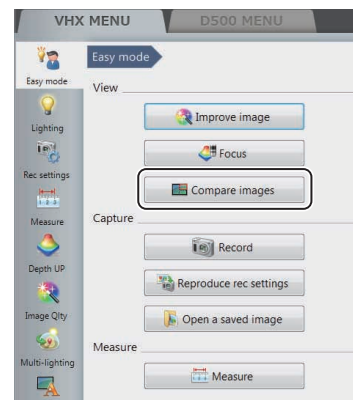
Compare images

The observation window can be split to show multiple images at once.

The split screen can be selected from the four types: vertical split, horizontal split, quarter split, and nine-way split.

The split screen allows you to compare the images being shown with each other or with those stored in the VHX.

Click [Compare images] on the [Easy mode] menu.

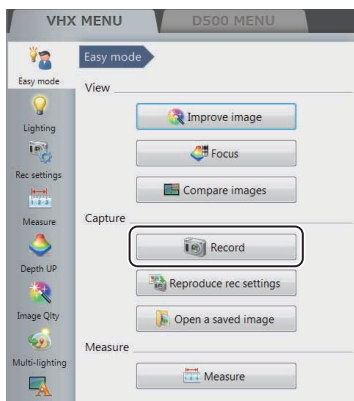


For more details, refer to "Split Screen" (Page 8-2).

Recording

Record

Adjust the focus and record (save) the observed image.

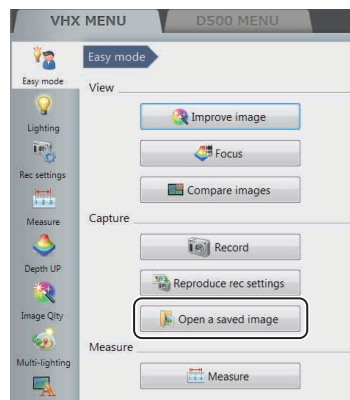


Open a saved image

■ Opening album

Open the album window to confirm the saved images on this device.

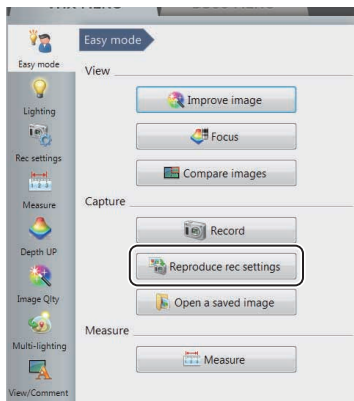
Click the [Open a saved image] button from the [Easy mode] menu.



Reproduce rec settings

Display the side album, and read the camera setting from the saved images to set the same setting.

Click the [Reproduce rec settings] button from the [Easy mode] menu.



For details, refer to "Album" (Page 6-2).

Outputting report

An image selected on an album is output as a report.

For details, refer to "Report Output" (Page 6-19).

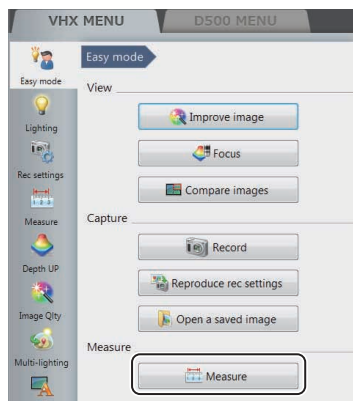
For details, refer to "Side Album" (Page 6-21).

Measuring

Measure

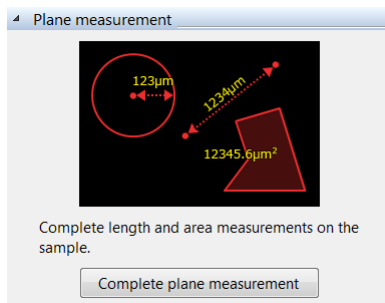
Plane measurement and 3D measurement functions are described below.

Click the [Measure] button from the [Easy mode] menu.



■ Plane measurement

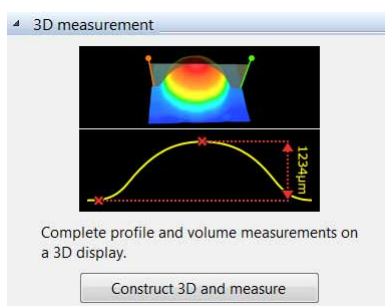
Measure the length and area of the sample.



For details, refer to "Measuring Dimensions and Area" (Page 9-1).

■ 3D measurement

Display the 3D image of the depth composition image sample, and measure the profile and volume.



For details, refer to "3D Profile Measurements (Optional)" (Page 10-27).

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Chapter 1

Before Using the VHX-6000

Package Contents and Product Overview

1

Before Using the VHX-6000

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Checking the Package Contents

Contents

VHX-6000 package contents



- Controller unit (VHX-6000)
- VHX-6000 communication software (CD-ROM)



- Manual binder
- User's manual (this document)
- Quick start guide

VHX-A60E package contents



- Console (OP88120)
- Mouse with wheel



- Capture/still photo remote terminal connector

Camera Units



Camera unit VHX-6100



Camera unit VHX-6020

Options

RZ lens



High-performance low-magnification zoom lens
VH-Z00R/VH-Z00W/VH-Z00T 0x to 50x



Ultra-small compact high-performance zoom lens
VH-Z20R/VH-Z20W/VH-Z20T 20x to 200x



Universal zoom lens
VH-Z20UR/VH-Z20UW/VH-Z20UT 20x to 200x



Wide-range zoom lens
VH-Z100R/VH-Z100W/VH-Z100T 100x to 1000x



Universal zoom lens
VH-Z100UR/VH-Z100UW/VH-Z100UT 100x to 1000x



- Dual-light high-magnification zoom lens
VH-Z250R/VH-Z250W/VH-Z250T 250x to 2500x



- High-resolution zoom lens
VH-Z500R/VH-Z500W/VH-Z500T 500x to 5000x



- Long-focal-distance, high-performance zoom lens
VH-Z50L/VH-Z50W/VH-Z50T 50x to 500x



- Swing-head zoom lens
VHX-ZST 20x to 2000x

Software



- 3D profile measurement software
VHX-H4M



- XY measurement software
VHX-H2M2

Stands



- VHX-S650 Free-angle observation system (XYZ motorized)



- VH-S5 Vibration-resistant, high-magnification zoom observation system



□ VH-M100E XY measurement system



Point

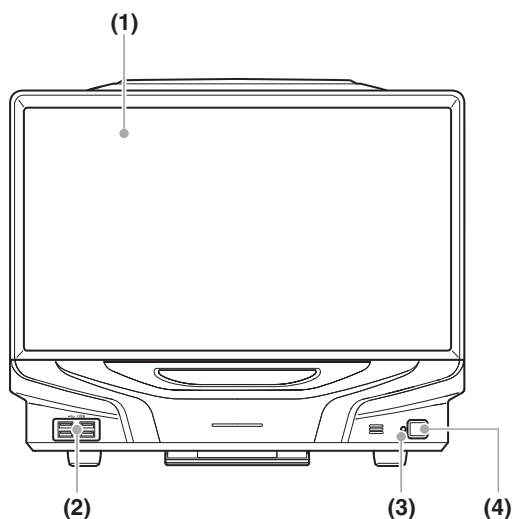
Requires separately sold XY measurement software, VHX-H2M2.

Part Names and Functions

The names and functions of each part are explained below.

Main Unit (VHX-6000)

Front view



(1) LCD monitor

23" full HD (1920 x 1080 pixels) LCD monitor.

(2) USB ports

Connect a keyboard, mouse, and USB memory including other USB devices.

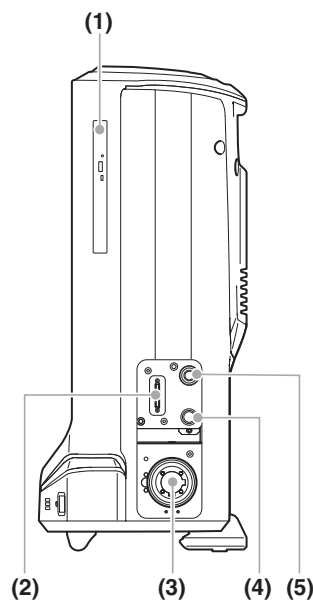
(3) Power indicator

Illuminated when the power is on.

(4) Power switch

Turn the power on or off. (The main power switch on the left side must be turned on.)

Right view



(1) DVD drive

Insert a CD-R, CD-RW, or DVD. Used to save and load images and video files.

(2) CAMERA connection port

Connect the camera cable for the camera unit.

(3) LIGHT connection port

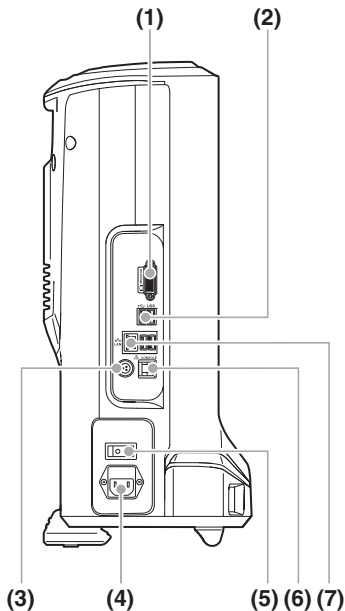
Connect the fiber optic cable.

(4) STAGE connection port

Connect the controller connection cable for the free angle observation system (VHX-S650/S660/S600/S90F) or the Z-axis motorized stage (VHX-S600F).

(5) TRIPLE'R connection port

Connect the Z-axis motorized stage/automatic lens/zoom recognition cable for the camera unit.

Left view**(1) MONITOR connection port**

Connect an external monitor or projector equipped with a DVI-I input (digital: full HD, 60 Hz/analog: full HD, horizontal 66 kHz, vertical 60 Hz).

Reference

An analog monitor (full HD, horizontal 66 kHz, vertical 60 Hz) can also be connected using a commercially available DVI-I/analog RGB converter.

(2) USB ports

Connect a keyboard, mouse, and USB memory including other USB devices.

(3) REMOTE connection port

A switch (such as a foot-activated switch) can be connected to the capture/pause REMOTE connection port to capture and pause images.

(4) AC power supply connection port

Connect the AC power cord set. (100 to 240 VAC, 50/60 Hz)

(5) Main power switch

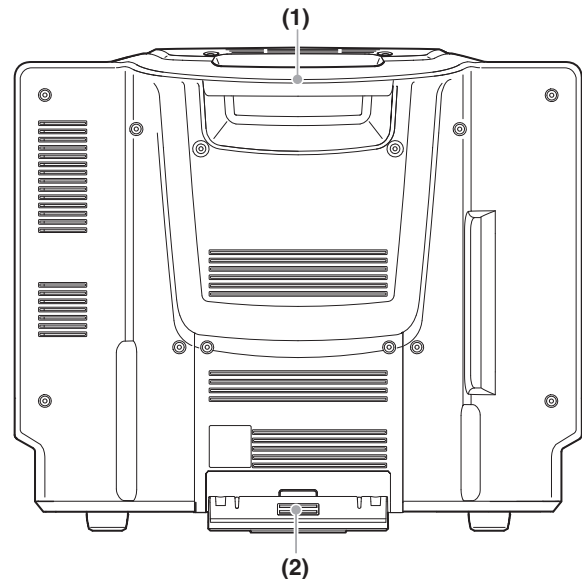
Turn the power on or off. When the main power switch is turned off, the power switch on the front panel will not work. This switch is normally left on. Turn this switch off when moving the microscope to another location or removing the camera unit.

(6) Console port

Connect the console.

(7) LAN port

Connect a LAN cable when connecting this microscope to a LAN. (RJ-45 10BASE-T/100BASE-TX/1000BASE-T)

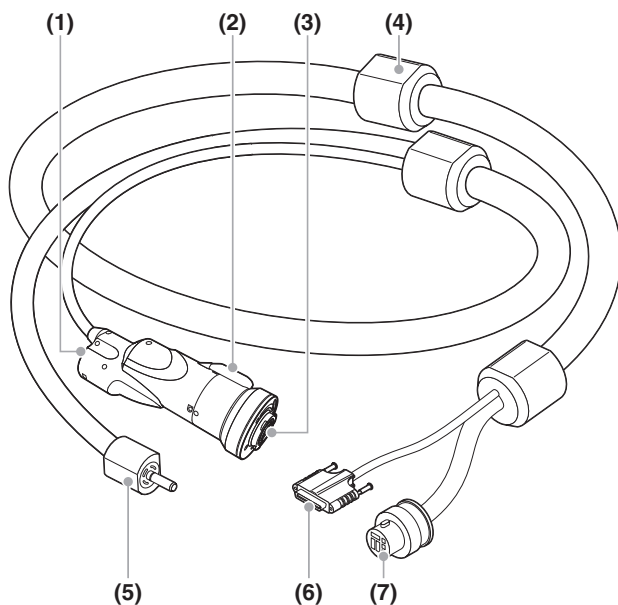
Rear view**(1) Handle**

Used when carrying the microscope.

(2) Tilt stand

Used to support the VHX if it is tilted backward.

Camera Unit (VHX-6100/6020)



(1) Fiber optic connector

Connect the fiber optic cable.

(2) Screw hole for stand

Threaded hole (1/4-20 UNC) used to secure the camera to a stand.

(3) Mount

Used to mount the lens.

(4) Holder

Hook to the stand and fix the cable.

(5) Fiber optic cable

Connect to the fiber optic connector of the camera unit or lens.

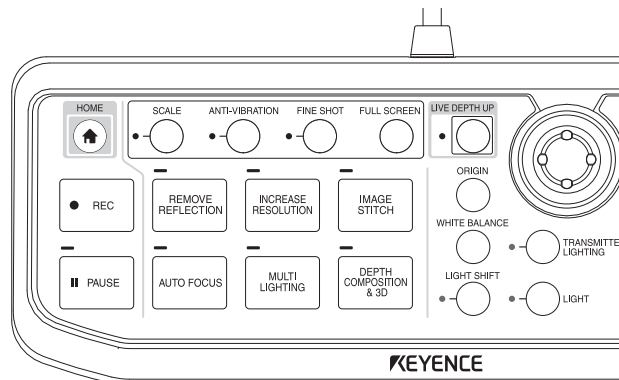
(6) Camera cable

Connect to the CAMERA connector on the controller.

(7) Fiber optic cable

Connect to the LIGHT connector of the controller.

Console



HOME button

Press this button to return to default settings. Settings such as remove glare are reset.

SCALE button

Toggles the scale display (Page 9-40) between on or off.

ANTI-VIBRATION button

Allows for observation without vibration.

📖 "Anti-vibration mode Settings" (Page 7-13)

FINE SHOT button

Pressing this button sharpens the captured images.

📖 "Fine shot Settings" (Page 7-14)

FULL SCREEN button

Toggles between full screen display (Page 8-4) and normal display.

LIVE DEPTH UP button

The system will automatically scan through the height of the sample, building a fully focused image even with the depth-of-field limited.

The Z-axis motorized stage must be connected to use this function.

📖 "Live Depth Composition" (Page 10-2)

REC button

Stores images on the screen to the hard drive in the microscope.

📖 "Recording/Saving Still Images" (Page 5-2)

PAUSE button

Pauses the screen temporarily. Press again to release the paused state and return to live image mode.

REMOVE REFLECTION button

Suppresses glare on highly reflective objects.

📖 "Removing Glare (Reflected light removal)" (Page 7-11)

AUTO FOCUS button

An area specified with the focus area automatically comes into focus.

The Z-axis motorized stage must be connected to use this function.

📖 "Using auto focus" (Page 10-56)

INCREASE RESOLUTION button

Improves visibility of the images with methods such as the high resolution and HDR.

📖 "Enhancing Resolution and Increasing Gradation" (Page 7-7)

MULTI-LIGHTING button

This button allows you to observe the object illuminated from several directions.

📖 "Change illumination direction (Multi-lighting)" (Page 7-4)

IMAGE STITCH button

Joins multiple adjacent images as they are captured.

Then calls up the [Image stitching] menu. (Page 11-2)

DEPTH COMPOSITION & 3D button

Performs depth composition and displays 3D images.

ORIGIN button

Move the XYθ stage to the origin (center).

While the focus adjustment dialog box appears, the Z stage moves with this button to the point of best focus.

WHITE BALANCE button

Adjusts the white balance. (Page 4-5)

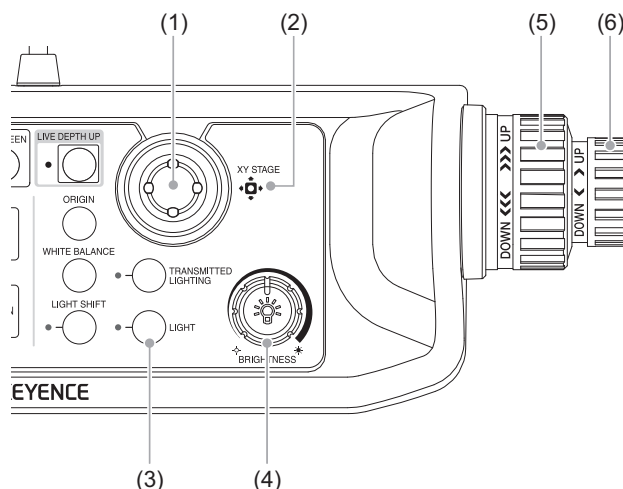
LIGHT SHIFT button

Changes the orientation of the light to emphasize height differences on the object.

📖 "Changing Lighting Method (Switching Lighting)" (Page 7-2)

TRANSMITTED LIGHTING button

Turns the transmitted lighting on or off.

**(1) Joystick**

Move the position of XYθ stage. Depending on the tilt angle, the movement speed changes in stages.

(2) XY STAGE

The LED blinks when the initialization of XYθ stage is not complete. The LED goes on and stays on when the initialization is complete.

(3) LIGHT button

Turns the lamp on or off.

(4) BRIGHTNESS dial

Adjusts the brightness of the image by adjusting the shutter speed. When observing dark images, the controller will automatically increase the gain or use the supercharge shutter.

📖 "Adjusting the Brightness and Focus" (Page 3-4)

(5) Coarse focus dial

Raises or lowers the Z-axis stage to adjust focus.

(6) Fine focus dial

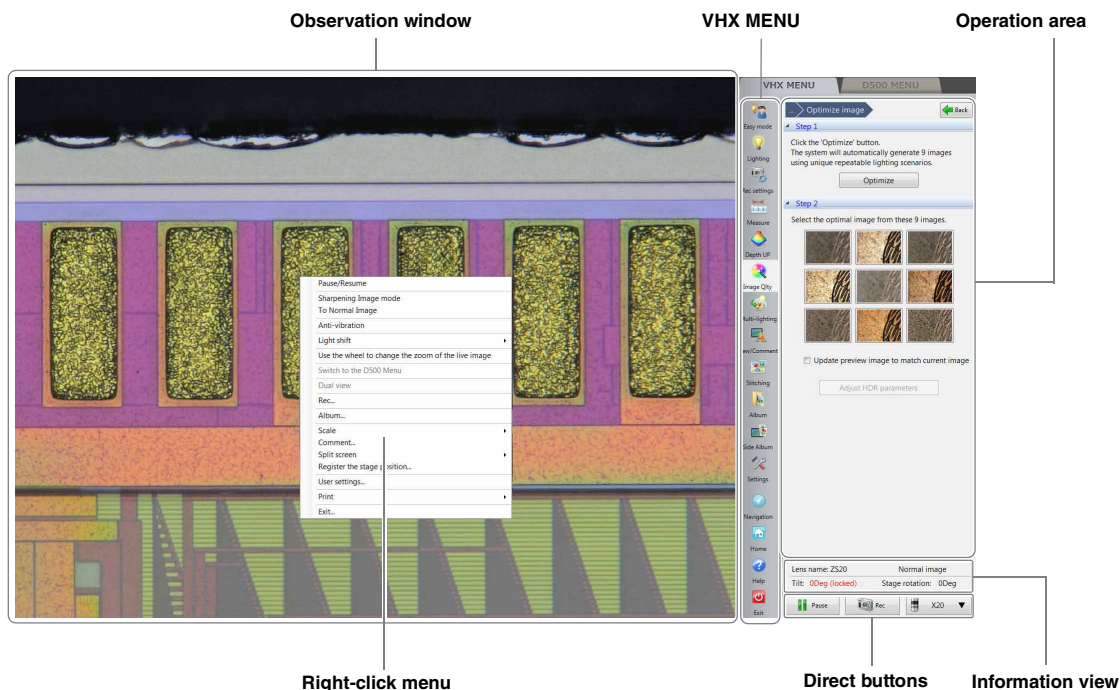
Raises or lowers the Z-axis stage to adjust focus.

Viewing the Screen

1

Before Using the VHX-6000

Refer to the following pages for details on the menus provided in the microscope interface.




Observation Window

Displays the image acquired by the camera in 1600 x 1200 pixels.

Right-click menu

This menu appears when the right mouse button is clicked over the observation window.

 **Point** "Switch to the D500 Menu" and "Dual view" are selectable when VHX-D500 has been installed.

Pause/Resume

Toggles the screen between a paused or frozen image and a live image.

Sharpening Image mode

Applies vivid color enhancements and profile emphasis to the image.

 "Sharpening Image Mode Settings" (Page 7-15)

To Normal Image

Returns the image to standard condition before applying emphasis on height difference and Vivid & Sharp mode enhancements.

Anti-vibration

This function corrects the shakiness during observation at a high magnification or hand-held observation.

 "Anti-vibration mode Settings" (Page 7-13)

Light shift

Switches a way to illuminate the object.

 "Changing the Lighting Method" (Page 7-2)

Use the wheel to change the zoom of the live image

Allows the user to zoom in or out of a live image using a mouse wheel.

 "Wide-view" (Page 5-9)

Switch to the D500 Menu

Switches the VHX MENU to D500 MENU.

Dual view

Displays an optical image and large-depth image next to each other.

Rec...

Captures the displayed image and stores it on the hard drive.

 "Recording/Saving Still Images" (Page 5-2)


Album...

Allows playback and editing of captured image files.

 "Playing Files" (Page 6-6)

Scale...

Displays a scale on the observation screen.

 "Displaying Text and Markers" (Page 9-34)

Comment...

Displays a toolbar for entering comments on the observed image, such as text and markings.

 "Displaying Text and Markers" (Page 9-34)


Split Screen

Splits the observation window to compare images.

 "Split Screen" (Page 8-2)

User Setup...

Stores various settings on the [Camera/Image Enhancement], [Options] menu.

 "User Setup" (Page 13-14)

Exit...








Turns the microscope power off.

VHX MENU

The following commands are displayed as icons. Clicking the icon executes the command.



**Easy mode**

This allows you to quickly access frequently used functions.

-  "Improve image" (Page 6)
-  "Focus" (Page 7)
-  "Compare images" (Page 7)
-  "Record" (Page 8)
-  "Reproduce rec settings" (Page 8)
-  "Open a saved image" (Page 8)
-  "Measuring" (Page 9)

**Lighting**

Use this to make advanced adjustments for images that are too bright (or too dark), to correct the color tone, or for fast moving objects.

-  "Adjusting the Lighting" (Page 4-2)
-  "Adjusting Image Brightness" (Page 4-3)









The following settings are available:

- Camera brightness (shutter speed, gain)
- Lighting (Epi-illumination, Transmitted illumination)

**Rec Settings**

Performs detailed settings and correction of capturing images and image saving.









The setting details are as follows.

-  "Adjusting the White Balance" (Page 4-5)
-  "Setting the Recording Size" (Page 5-5)
-  "Setting Auto Rec" (Page 5-6)
-  "Setting up Timer Recording" (Page 5-8)
-  "Recording and Saving Videos" (Page 5-10)
-  "Observing Tilted Z-Axis" (Page 3-7)
-  "Vision correction mode" (Page 8-4)
-  "Anti-vibration mode Settings" (Page 7-13)

**Measure**

Measures distances, areas, angles, etc., of the object.

Measurements can also be made while moving the object horizontally (XY direction) by using the VH-M100E stage.

-  "Main Measurements" (Page 9-12)
-  "Area Measurements" (Page 9-26)
-  "Displaying a Scale" (Page 9-40)
-  "One-Click Automatic Measurement" (Page 9-41)
-  "Automatic Area Measurements" (Page 9-46)
-  "Contamination analysis" (Page 9-67)
-  "Maximum Area Measurement" (Page 9-73)
-  "XY Stage Measurement (Optional)" (Page 9-76)

**Depth Up**

This command is used to adjust the focus on the entire object when it has large height differences.

It combines and displays the focused parts of multiple images with different focal points. The combined image can be used to form a 3D image.






-  "Live Depth Composition" (Page 10-3)
-  "Quick Composition and 3D" (Page 10-4)
-  "Fine Depth Composition" (Page 10-9)
-  "Manual 3D composition" (Page 10-14)
-  "Z Stage Control" (Page 10-56)



Image Qlty

Accurately reproduces the delicate state of objects difficult to observe normally.

- ☐ "HDR Settings" (Page 7-8)
- ☐ "High resolution HDR Observation Settings" (Page 7-9)
- ☐ "High resolution Observation Settings" (Page 7-10)
- ☐ "Remove Reflection Settings" (Page 7-11)
- ☐ "Selecting an Image from 9 Different Settings (Optimize)" (Page 7-16)
- ☐ "Image Setting Procedures" (Page 7-18)



Multi-lighting

You can change the direction of illumination and observe detailed changes that cannot be seen usually.

- ☐ "Change illumination direction (Multi-lighting)" (Page 7-4)



View/Comment

Sets the image display method.

These settings allow you to zoom in on an image or zoom out or split the screen and tile images for comparison.

- ☐ "Using the Split Screen" (Page 8-3)
- ☐ "List of Comments" (Page 9-34)
- ☐ "Registering a Stage Position" (Page 8-7)
- ☐ "Full Screen Image" (Page 8-4)
- ☐ "Wide-view" (Page 5-9)



Stitching

This allows you to observe an area larger than the normal field-of-view in its original clarity by connecting several images.

Place the object on the XY stage and capture an image while moving the stage.

Images can be connected to form 2D images or 3D images. A 2D stitch creates a large image by capturing multiple images of the object while moving the part via the stage in a serpentine motion.

A 3D stitch creates a large 3D image using the Z-axis motorized stage to move the lens vertically. The images are captured and connected using the Depth Up function.

- ☐ "Automatic Image Stitching" (Page 11-2)
- ☐ "Split recording" (Page 11-12)



Album

Displays thumbnails of captured (saved) images for review and management.

Double-clicking a thumbnail displays or plays the recorded image.

Images can be printed, written to a CD/DVD, or edited using copy and cut functions.

- ☐ "Album" (Page 6-2)



Side Album

Displays the album in the operation area. This allows you to display a screen in the observation window while viewing the thumbnail of another image.

Double click or drag and drop a thumbnail onto the observation window to display or play it back.

- ☐ "Side Album" (Page 6-21)



Option

Sets option settings.

- ☐ "Network/Security Settings" (Page 13-2)
- ☐ "Lens Settings" (Page 13-14)
- ☐ "Calibration Setup" (Page 13-14)
- ☐ "User Setup" (Page 13-14)
- ☐ "Show Software Keyboard" (Page 13-16)
- ☐ "System Initialization" (Page 13-16)
- ☐ "Initializing Automatic XY Stage" (Page 13-17)
- ☐ "Camera mount settings" (Page 13-17)
- ☐ "ZST vision misalignment correction" (Page 13-18)
- ☐ "D500 Maintenance" (Page 13-22)
- ☐ "Options" (Page 13-22)
- ☐ "Version Info" (Page 13-24)



Navigation

Registers a wide field-of-view image as the navigation image.

- ☐ "Navigation" (Page 8-6)



Home

Resets the settings to the default values just after startup.

Restores the setting screens of the HDR and depth composition, etc. to the initial observation status immediately.



Help

Displays a summary of operating procedures.



Exit

Turns the microscope power off. (Allows you to select between sleep, shut down, and restart.)

📖 "Shutting Down the Microscope" (Page 3-9)

Operation Area

Displays the settings of functions selected from the VHX MENU (Page 1-11) or the console buttons.

Information View

Lens name, effects such as HDR, tilt angle, rotated angle and playback file name are displayed.

Direct Buttons

Clicking the icon provides direct access to pause, save (Page 5-2), and specify the lens power (Page 9-5).

1

Before Using the VHX-6000

Chapter 2

Installation/Connection

Connecting Devices to the VHX-6000

This chapter will explain the steps from installation to connection of the VHX-6000 Digital Microscope with a zoom lens VH-Z20T and free-angle observation system VHX-S650.

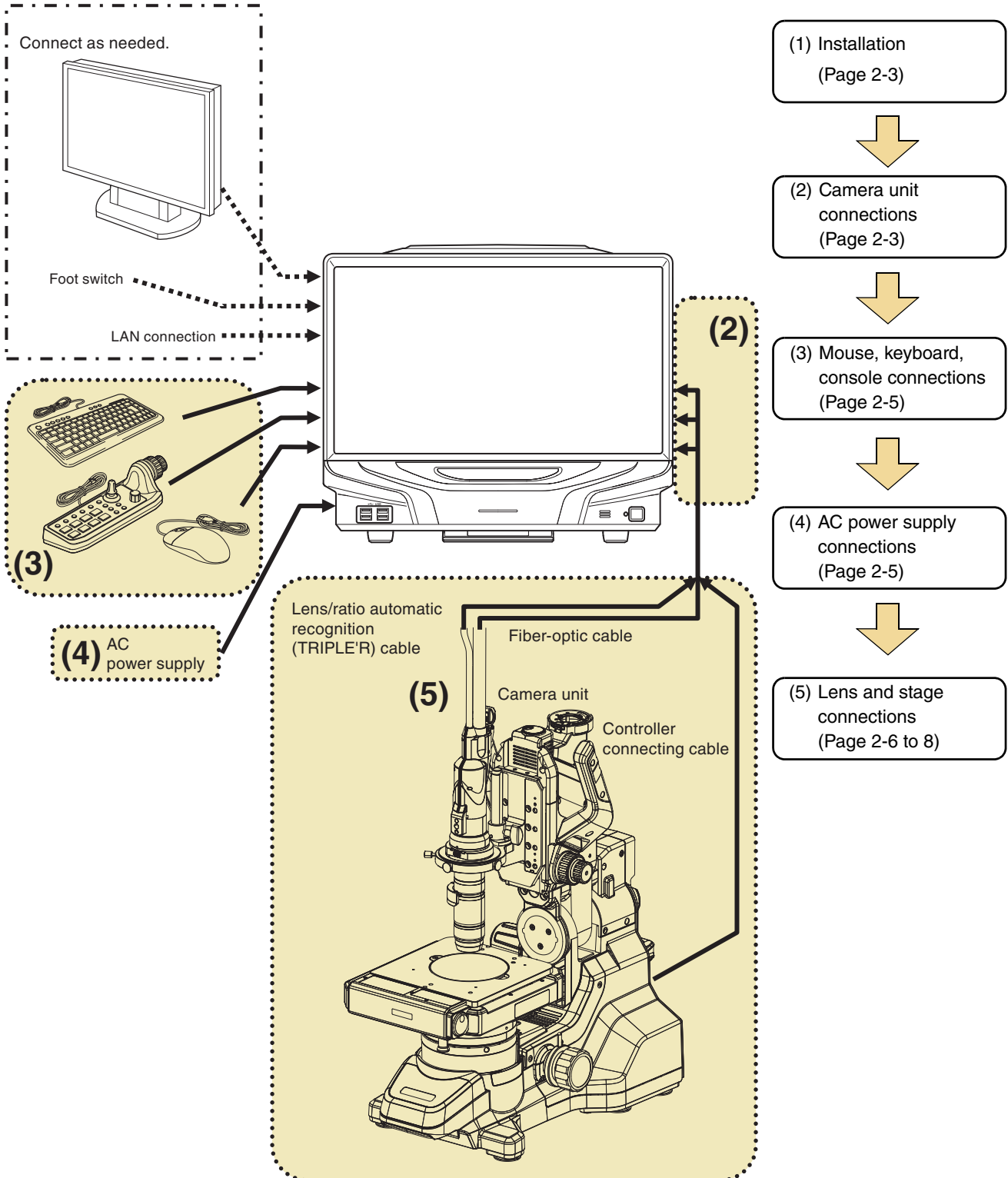
Installation/Connection.....	Page 2-2
System Configuration and Connection Flow	Page 2-2
Installing the VHX-6000	Page 2-3
Connecting the Camera Unit.....	Page 2-3
Connecting the Console, Mouse, etc.	Page 2-5
Connecting Power	Page 2-5
Installing the VHX-S650 Free-angle Observation Base Unit.....	Page 2-6
Mounting and Removing the Lens	Page 2-7
Connecting the Lens/Stage Cable	Page 2-8

Installation/Connection

2

This explanation is based on the VHX-6000/VHX-6100 Digital Microscope used with the ultra-small compact high-performance zoom lens VH-Z20T and the free-angle observation base unit VHX-S650.

System Configuration and Connection Flow

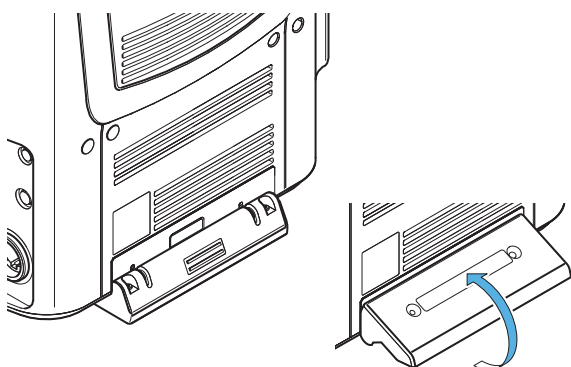


Installing the VHX-6000

NOTICE

Install the microscope on a fixed flat surface. Otherwise, the microscope may fall over and become damaged. Be sure to pull out the tilt stand.

- 1 Pull out the tilt stand and lock it in place with the magnetic catch located at the lower back side of the microscope.



- 2 Set up the microscope where observations are to be made.

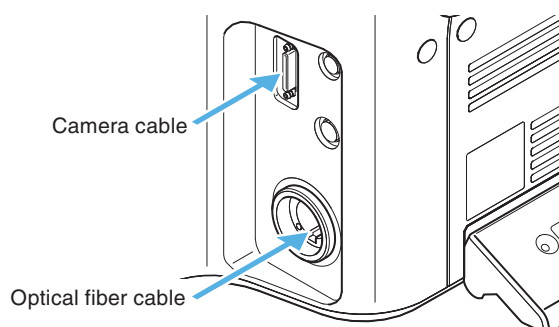
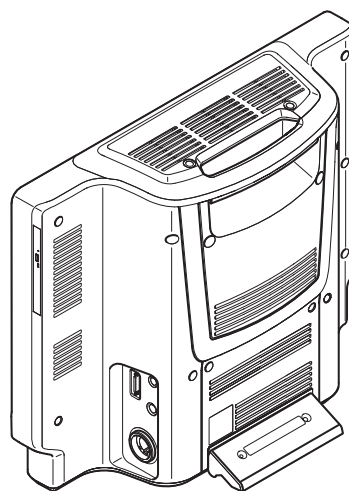
Connecting the Camera Unit

Connect the following camera cables to the microscope: camera cable, optical fiber cable.

These connection ports are located on the lower right side of the microscope.

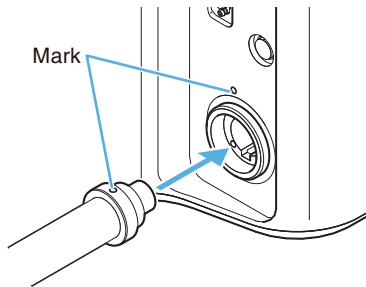
NOTICE

- Always turn the main power switch off before connecting or disconnecting the camera cable and lens/TRIPLE'R unit. Doing so with the power turned on may cause the camera unit to fail or become damaged.
- Check the orientation of the connectors before connecting them. Otherwise the connector pins may bend and cause failures.



Connecting the optical fiber cable

Align the O marks on the fiber optic cable and LIGHT connection port and insert until you hear a click.

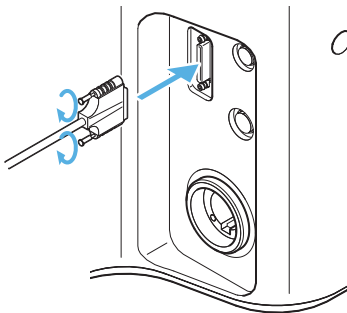


To remove

Pull out the cable to remove it.

Connecting the camera cable

Connect the camera cable to the connection port on the controller and then fasten the fixation screws on both sides of connector to fix the connection.



Fasten the fixation screws tightly. Loose screws may cause a failure such as a communication error.

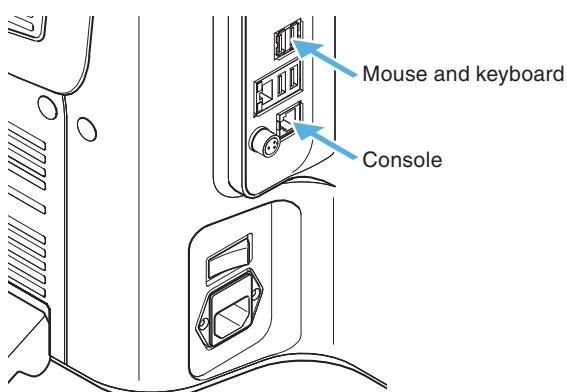
Connecting the Console, Mouse, etc.

Connect the AC power cord set, console, mouse, and keyboard to the microscope.
These connection ports are located at the lower left side of the microscope.

NOTICE Always turn the main power switch off before connecting or disconnecting the AC power cord set and console. Doing so with the power turned on may result in failure or damage.

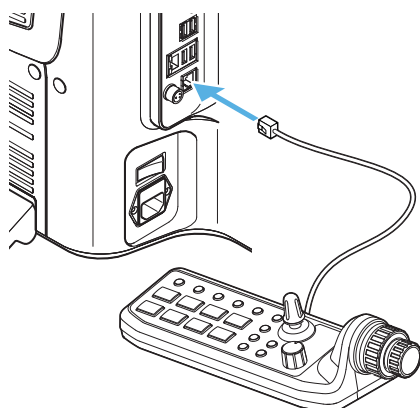
CAUTION

- The AC power cord set is not provided with the VHX-6000 Series. Use the cord set, which complies with the regulations and standards in the country or the region in which the VHX-6000 Series are used. (In North America, use the cord set, which type of cable is SVT or equivalent, 18AWG or better, rated temperature 90°C or better.)
- When installing the VHX-6000, connect the protective ground terminal of the AC power cord set to the protective ground conductor at the installation site. Failure to ground the VHX-6000 may result in electric shock or other product failure.



Connecting the console

Align the console connector to the orientation of the CONSOLE connection port on the left side of the microscope, and insert.



To remove

Remove while pushing on the tab on the connector.

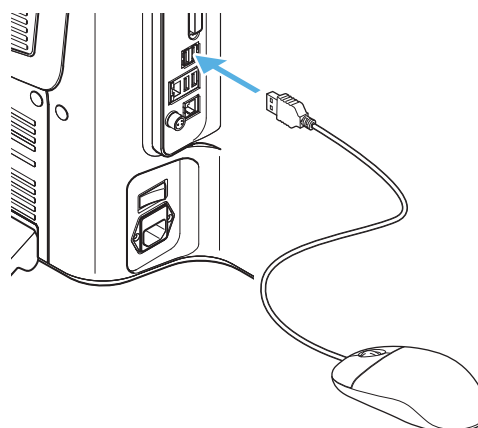
CAUTION Do not connect any other device, except for the supplied console, to the CONSOLE connector. Doing so may result in fires, electric shock, or product failure.

Connecting the mouse and keyboard*

Align the orientation of the mouse and keyboard connector and insert into the USB port located on the left side, or the lower left on the front panel of the microscope.

The mouse and keyboard can be connected to any of the eight USB ports provided.

* Keyboard is not provided.



To remove

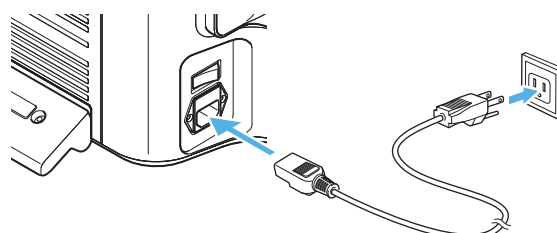
Hold the connector and pull.

Connecting Power

Connecting the AC power cord set

1 Connect the AC power cord set to the AC power supply connection port on the left side of the microscope.

2 Plug the other end into a wall outlet.



Installing the VHX-S650 Free-angle Observation Base Unit

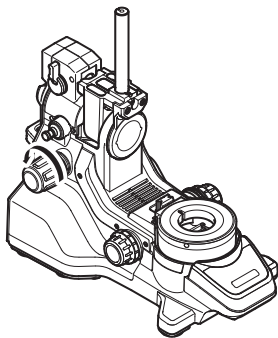
This section will explain how to install a stand using the free-angle observation base unit VHX-S650.

For further details, refer to the VHX-S650 User's Manual or Instruction Manual for the actual stand being used.

NOTICE

Install the free-angle observation base unit on a fixed flat surface. Otherwise, the stand may fall over and become damaged.

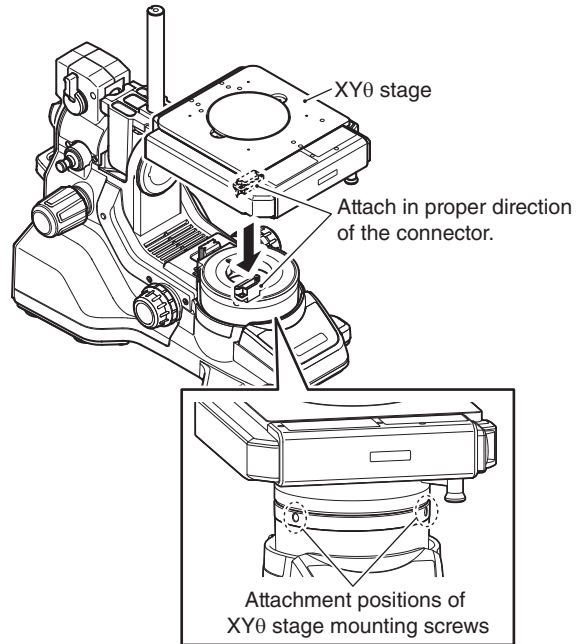
1 Install the free-angle observation base unit on a fixed flat surface.



2 Tighten the stand arm lock knob to lock the camera pole in place.

3 Place the XYθ stage on the XYθ stage mount. Tighten the XYθ stage mounting screw to fix the stage in place.

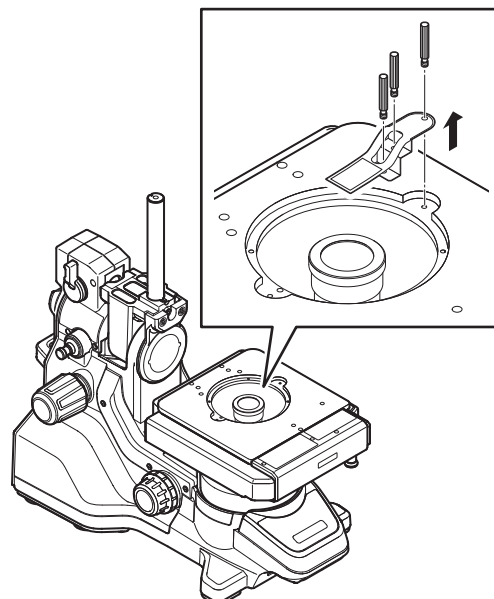
- Align the orientations of the connectors of XYθ stage and XYθ stage mount before attaching.
- 2 screws are used (1 screw is a spare).
- Use the provided hexagonal wrench.



4 Remove the protection bracket of the XYθ stage.

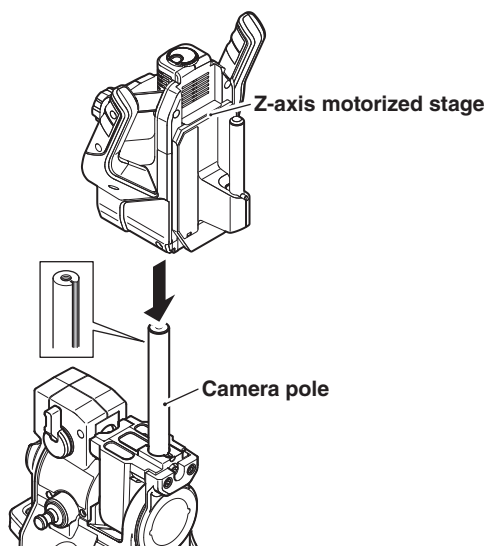
Point

Keep the removed protection bracket and screws so that they can be reused when moving the stage. Be sure to secure the XYθ stage during transportation.

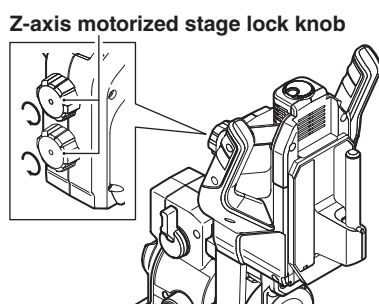


5 Insert the Z-axis Motorized Stage until it is at the bottom of the camera pole.

Insert so that the screw on the Z-axis motorized stage fits straight into the V-groove of the camera pole.



6 Tighten the Z-axis motorized stage lock knob.

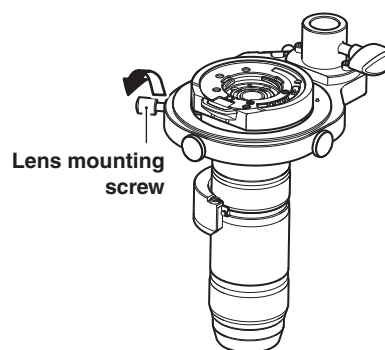


7 Connect the Z-axis motorized stage and base unit via cable.

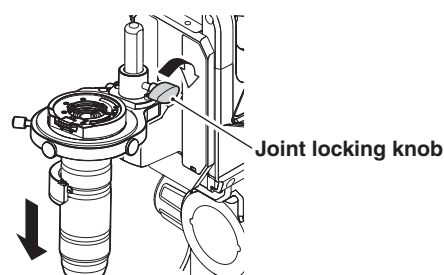
Mounting and Removing the Lens

Mount the lens by selecting the appropriate bayonet lens attachment matching the lens and stand specifications. The following explanation is based on the VH-Z20T.

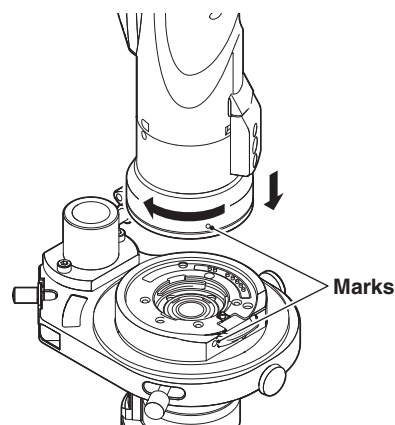
1 Mount the lens in the lens joint and affix using the lens mounting screw.



2 Insert the lens joint from the top of the joint attachment pole on the Z-axis motorized stage and tighten the joint locking knob.



3 Align the O marks on the VH-Z20T and camera and rotate the camera clockwise until you hear a click.

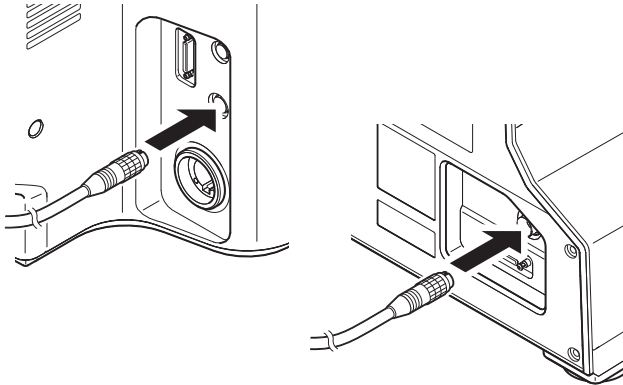


To remove

While pushing down the tab on the lens attachment, rotate the camera counterclockwise to align the O marks on the lens attachment then camera unit, then pull the camera out of the bayonet.

Connecting the Lens/Stage Cable**Connection with the VHX-6000**

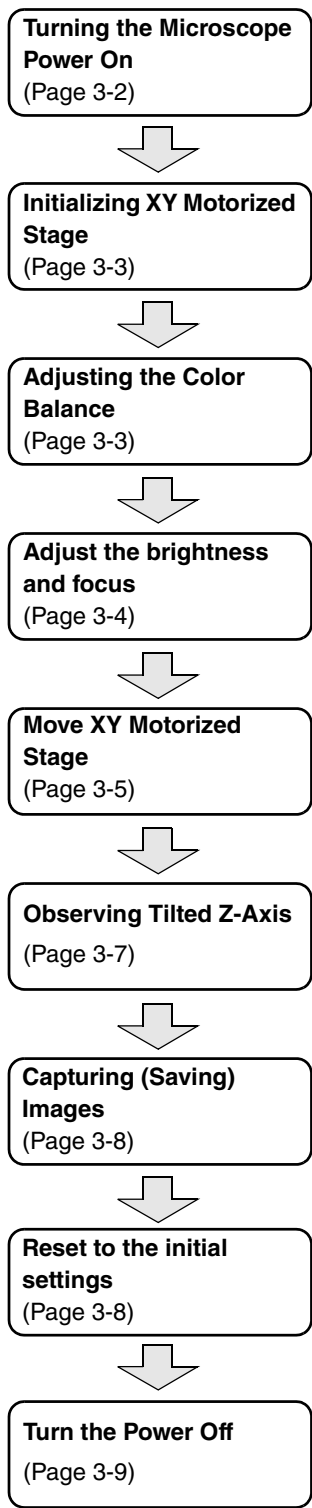
Connect the cable into the port at the back of the free-angle observation system base unit to the STAGE connection port at the right side of the VHX-6000 using a cable.



Flow from Adjustment to Observation

This chapter explains the settings and steps taken to acquire images.

Reference This explanation is based on the Digital Microscope VHX-6000 used with the ultra-small compact high-performance zoom lens VH-Z20T and free-angle observation base unit VHX-S650.



Basic Operation

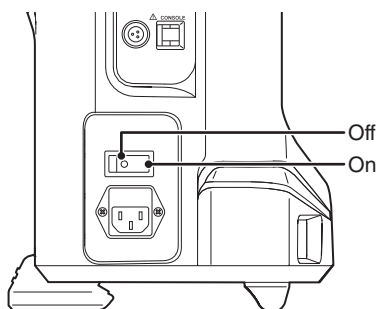
3

Basic Operation

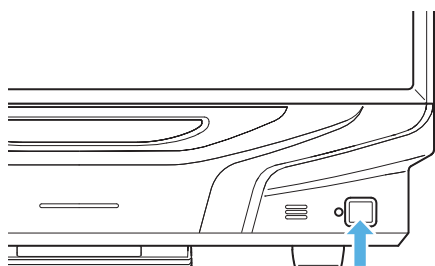
Turning the Microscope Power On

NOTICE If the Z-axis motorized stage is being used, the stage will move to confirm its point of origin when power is turned on.

- 1 Turn on the power switch of the VHX-S650.
- 2 Turn the main power switch on (lower left side of the microscope).
 This switch is normally left on. To turn the power on or off, use the POWER switch located on the lower right of the front panel.
 Turn the main power switch off when moving the microscope to another location, or if the microscope is not to be used for prolonged periods.



- 3 Press the POWER switch on the lower right of the front panel.
 The microscope will turn on and the screen will appear.



Language selection at initial startup

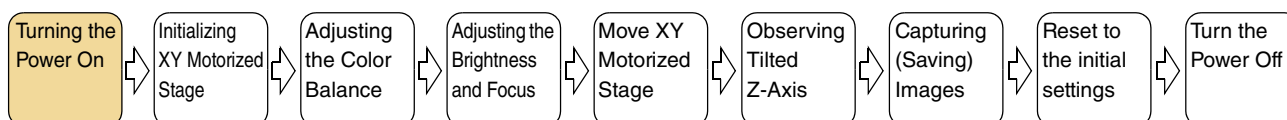
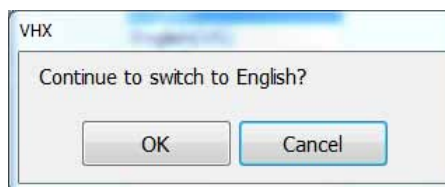
When starting up the microscope for the first time, a window for selecting the display language will appear.

- 1 In the window for selecting the language, select [English] and click [Next].



The confirmation window appears.

- 2 Click [OK].



Initializing XY Motorized Stage

Initialize the XYθ stage if you are using the Free-angle Observation Base Unit VHX-S650. If the last operation was completed with the stage moved to the origin, initialization will not be required upon startup.

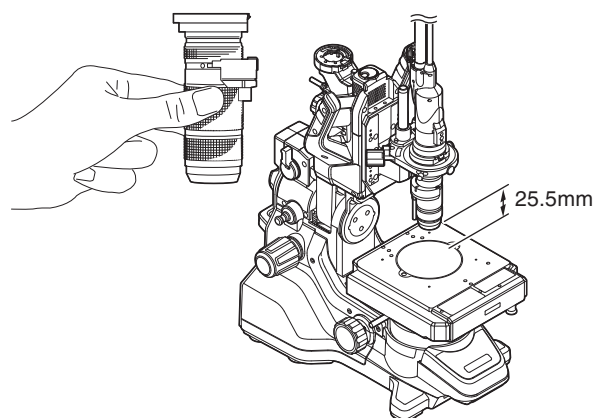
Adjusting the Color Balance (White Balance)

Adjust to obtain true color images.

1 Display a white object.

Turn the zoom ring on the ultra-small compact high-performance zoom lens VH-Z20T to the desired magnification.

Display the white object placed approximately 25.5 mm away from the tip of the lens.

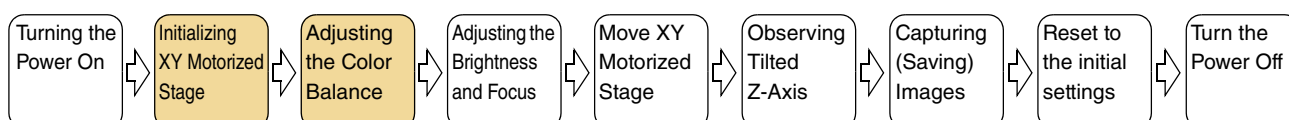
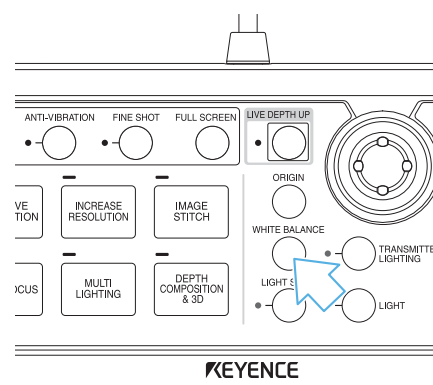


This distance differs according to the lens being used.

☞ "Adjusting the White Balance" (Page 4-5)

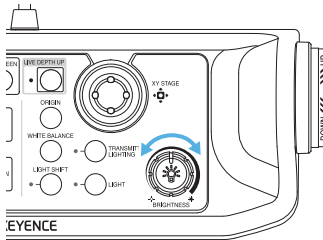
2 Adjust the color balance.

Press the WHITE BALANCE button on the console.

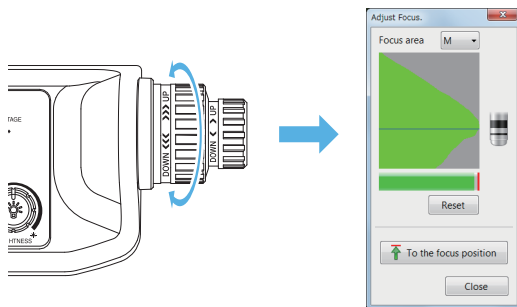


Adjusting the Brightness and Focus

- 1 Display the object to be observed.**
Place the object to be observed on the XYθ stage mounted to the VHX-S650.
- 2 Adjust the brightness.**
Adjust the brightness by turning the BRIGHTNESS dial on the console.

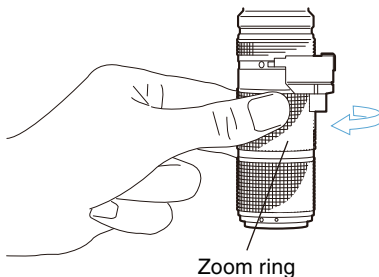


- 3 Adjust the focus.**
Adjust the focus by turning the FOCUS dial on the console.
Focus can also be adjusted using the auto focus function (Page 10-56).

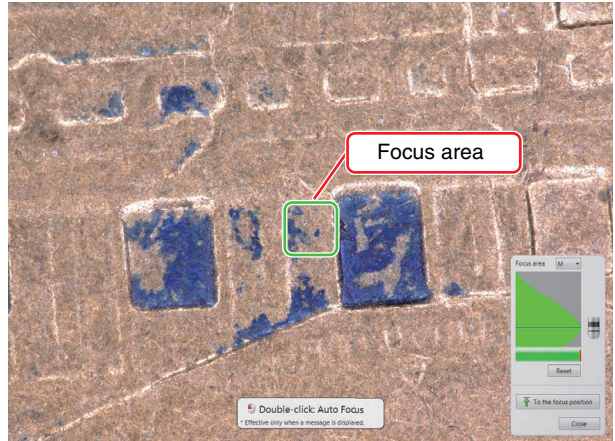


Turning the focus dial shows the Adjust Focus. dialog box on the screen. This allows you to check the focus level on the screen, and thereby easily adjust the focus best.

- 4 Adjust the zoom (magnification).**
Turn the zoom ring on the ultra-small compact high-performance zoom lens VH-Z20T to adjust the magnification.



Detailed focus adjustment



Turning the focus dial shows the focus area and the focus adjustment dialog box on the screen.

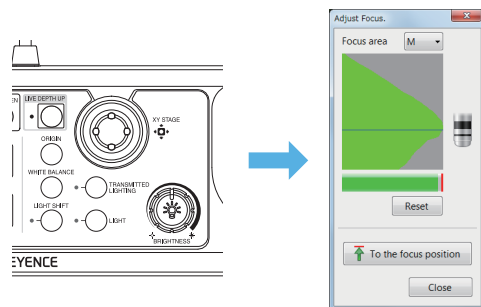
The focus level can be selected from among "S/M/L/XL"

The position of the focus area can be moved by mouse-clicking on the screen.

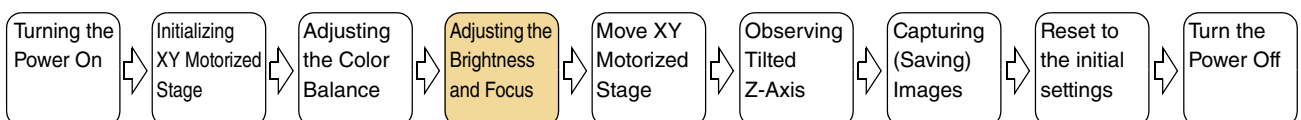
Manual adjustment of focus position

Turning the focus dial shows a graph of focus level in the focus adjustment dialog box. With this state, clicking [To the focus position] brings the image to a best focal point.

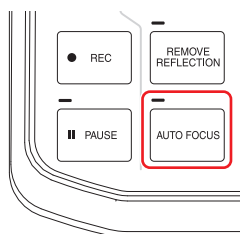
The same can be done by clicking the [ORIGIN] button of the console while the focus adjustment dialog box appears on the screen. (If the focus adjustment dialog box is hidden, the [ORIGIN] button moves to the origin of the XY stage.)



To clear the graph of the focus level, click [Reset].



Auto focus



Pressing the [AUTO FOCUS] button shows the focus adjustment dialog box and automatically brings images into focus.

The auto focus is also activated by double-clicking on the screen with the mouse while the focus adjustment dialog box appears on the screen.

NOTICE	<p>To prevent interference with the object, move the Z stage upward to adjust.</p> <p>To avoid interference while using auto focus, be sure there is at least 3 mm between the lens and object.</p>
---------------	---

Wrap-up of focus adjustment operation

Focusing method	Type	Operation
Manual adjustment	Console	<ol style="list-style-type: none"> 1. Move the focus adjustment dial up and down to scan the area you want to bring into focus. 2. Press the ORIGIN button of the console.
	Mouse operation	<ol style="list-style-type: none"> 1. Move the focus adjustment dial up and down to scan the area you want to bring into focus. 2. Click [To the focus position] in the focus adjustment dialog bog.
Auto focus	Console	Press the [AUTO FOCUS] button of the console.
	Mouse operation	<ol style="list-style-type: none"> 1. Move the mouse wheel to show the focus adjustment dialog box. 2. Double-click the screen.

Moving XY Stage Automatically

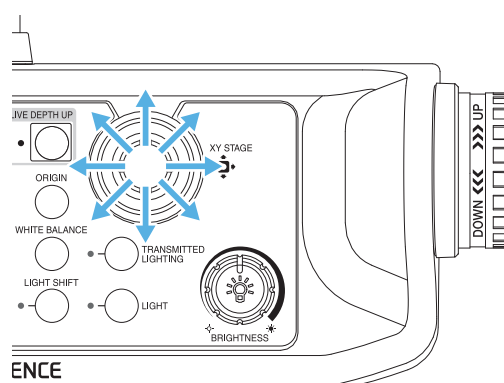
The methods mentioned below can be used to move the XY stage automatically in the X and Y directions.

- Moving the stage using the joystick on the console
- Moving the stage using the mouse

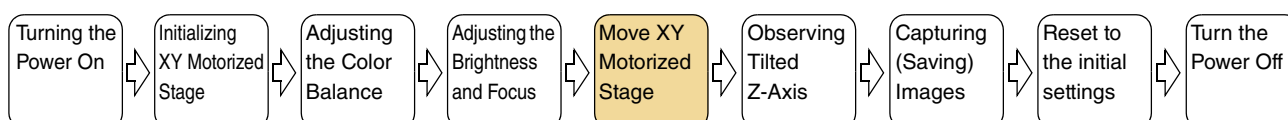
! Point

- **During image stitching and depth composition, the stage cannot be moved.**
- **The stage cannot be moved either when the camera image, such as 3D view, album and wide-view, is not displayed.**

Moving the stage using the joystick



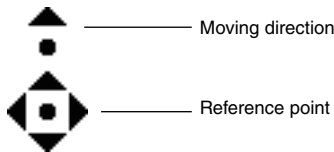
In the direction that the joystick is tilted, the displayed content of the observation window moves. According to the angle at which the joystick is tilted, the movement speed changes.



Moving the stage using the mouse

Based on the mouse movements in the observation window, the observation area moves. Dragging the observation window causes the displayed area to move toward the dragging direction. Double-clicking in the observation window moves the double-clicked point to the center of window.

Clicking with the mouse wheel on the observation window causes the reference point's picture to appear at the clicked position. In the direction of the mouse cursor as viewed from the reference point, the applicable arrow (in one of the eight directions) appears and the displayed content moves accordingly. Movement speed varies depending on distance of the mouse cursor position from the reference point. To stop moving the stage, click with the mouse wheel again at your desired stop position.

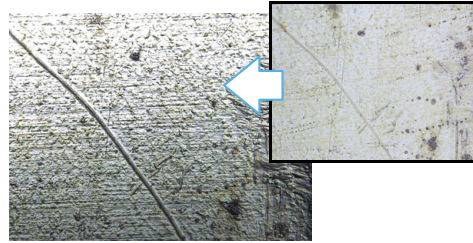


Point During measurement, no movements can be made by dragging and double-clicking.

Adjustment tips

■ **Features with height differences appear flat**

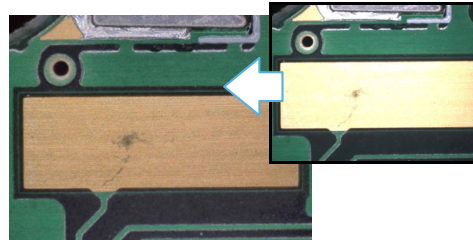
Use the Light Shift function.



For details, refer to "Changing Lighting Method (Switching Lighting)" (Page 7-2).

■ **Areas with intense light reflection appear white**

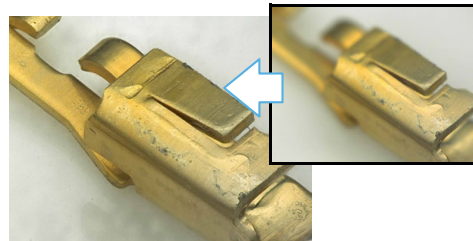
Use the Remove Glare function.



For details, refer to "Removing Glare (Reflected light removal)" (Page 7-11).

■ **Some parts of the image are out of focus**

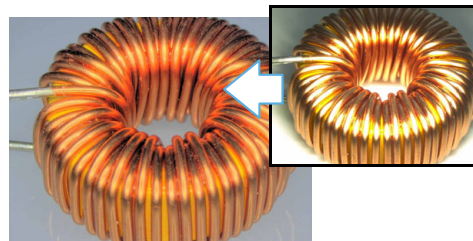
Use the Depth Composition function.



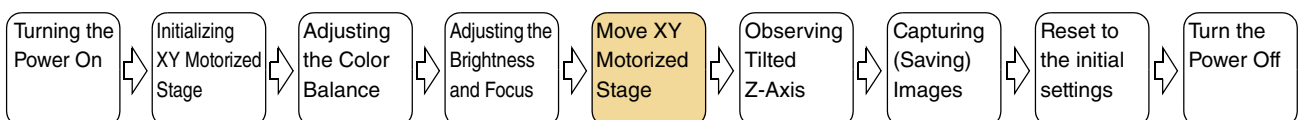
For details, refer to "Types and Features of Depth Composition" (Page 10-2).

■ **Areas of image whiteout or blackout**

Use the HDR function.



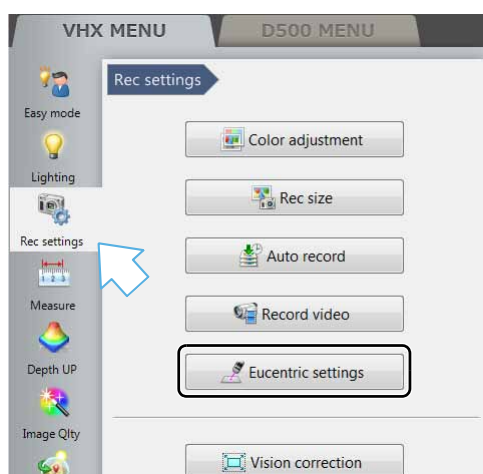
For details, refer to "Enhancing Resolution and Increasing Gradation" (Page 7-7).



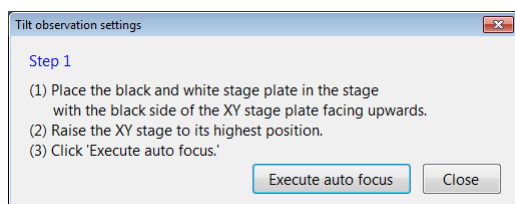
Observing Tilted Z-Axis

To observe with the Z-axis tilted, eucentric setting should be performed.

- 1 Click [Rec settings] from the VHX MENU, and click [Eucentric Settings].



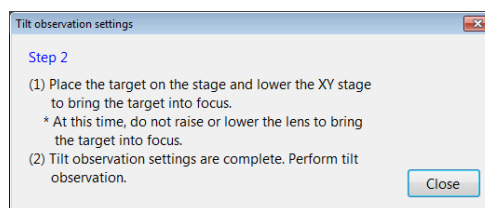
- 2 With the black side of the circular monochrome plate facing upward, set the XYθ stage.
- 3 Turn the focus handle of XYθ stage to lift the XYθ stage to the uppermost position.
- 4 Click [Execute auto focus].



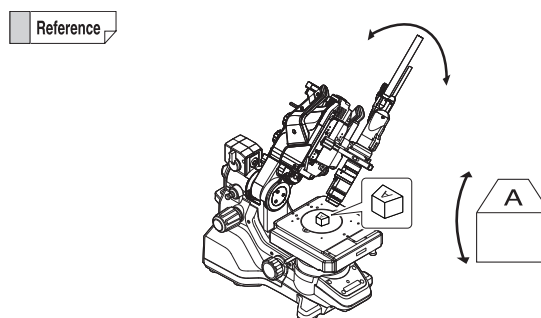
- 5 Place the object on the XYθ stage.
- 6 Turn the focus handle of XYθ stage to focus the object.

Important Do not focus the object by moving the lens up or down. Definitely use the focus handle of XYθ stage.

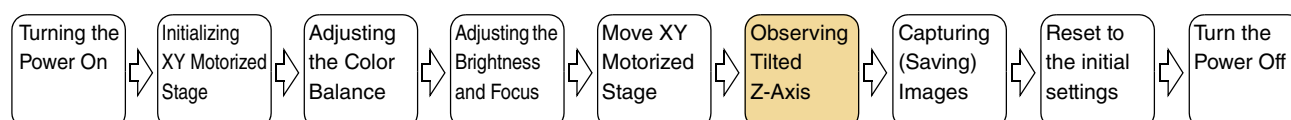
- 7 Click [Close].



- 8 Observe the tilted Z-axis.



While the mounting angle of the camera is shifted by 90 degrees, the object changes its angle in the vertical direction according to the mounting angle, which allows you to observe the object more naturally.

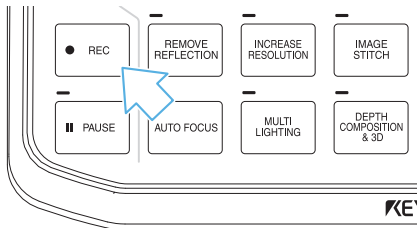


Capturing (Saving) Images

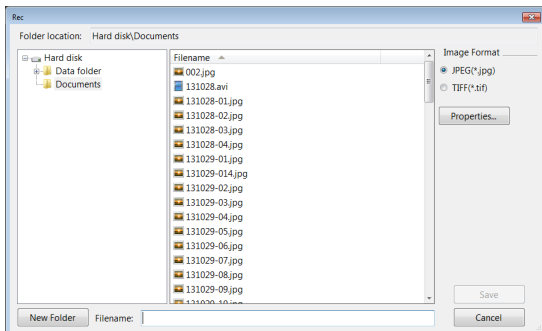
Capture the displayed image and store it on the internal hard drive.

Capturing (saving) images

1 Press the REC button.



2 Select the folder to save the image in and enter a file name.



3 Click [Save].

Saving without entering a file name

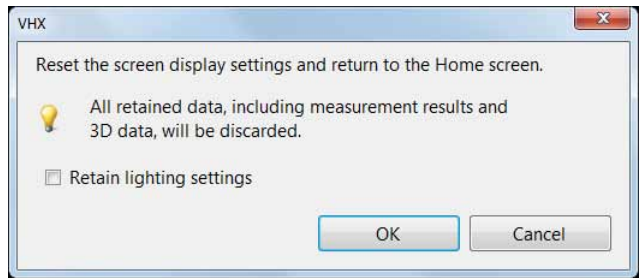
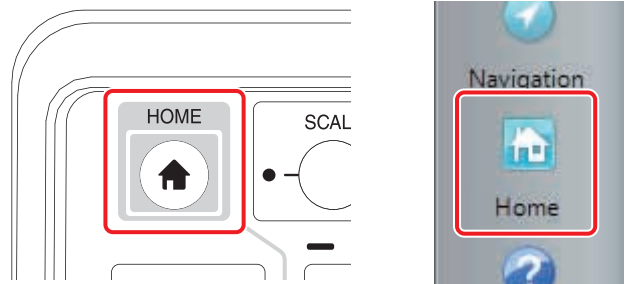
The auto capture feature (Page 5-6) can be set to automatically save images when pressing the REC button. To switch to auto capture, select [Rec Settings] from the VHX MENU and click [Auto Record ON] in the [Auto Record].

Saving videos

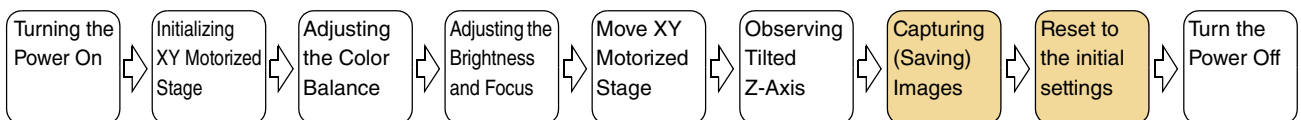
Select [Record Video] (Page 5-10) from the main menu. Specify the conditions and click [Start Recording].

Reset to the initial settings

The home button is convenient to go back to the initial settings after complicated operations such as the HDR and depth composition functions.



HOME button returns the setting to the initial state at startup. If [Retain lighting settings] is checked, the lighting and brightness will not be changed from the current setting.



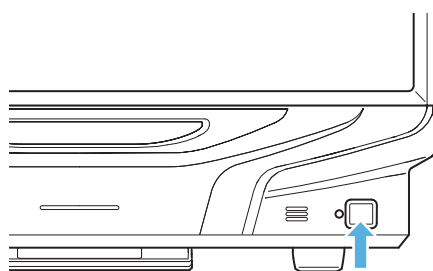
Shutting Down the Microscope

Turn the microscope power off.

Point The power settings (Page 13-24) determine how the microscope shuts down.

Press the **POWER** switch on the lower right of the front panel

The power turns off.



Click the **[Exit]** button

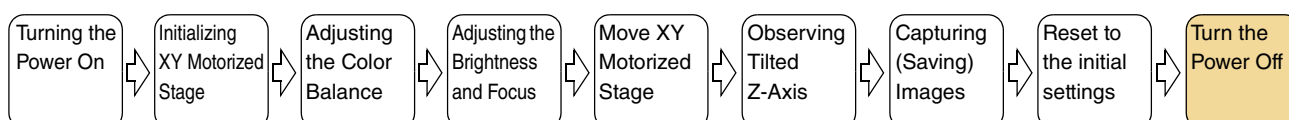
A menu of shut down options will appear. Select one and click [OK].

■ Shut down options

Shut Down : Turns off the power.

Sleep : Places the microscope in the standby condition for quick startup. (Default)

Reboot : Reboots the system.



Advanced Operations

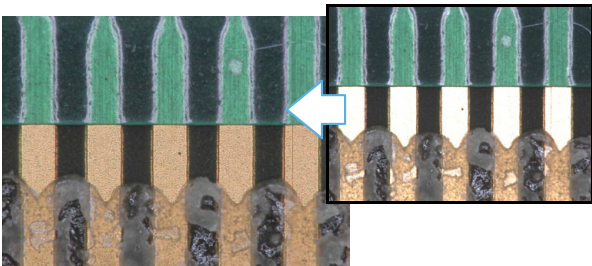
Change illumination angle, during or after capture



For details, refer to "Changing Lighting Method (Switching Lighting)" (Page 7-2).

Observe images without glare

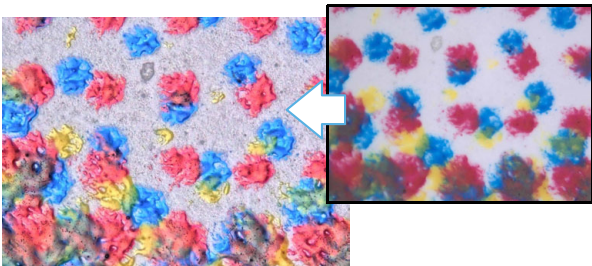
IC Pattern (200x)



For details, refer to "Removing Glare (Reflected light removal)" (Page 7-11).

Observe images using high color gradation

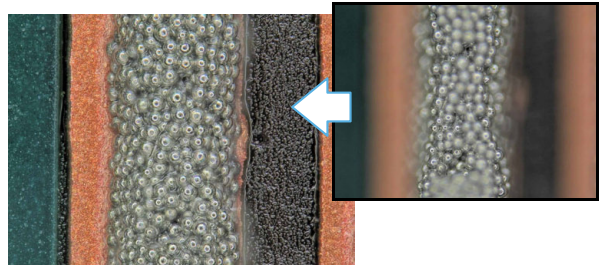
Dot printing (400x)



For details, refer to "Enhancing Resolution and Increasing Gradation" (Page 7-7).

Observe images with an extended depth-of-field

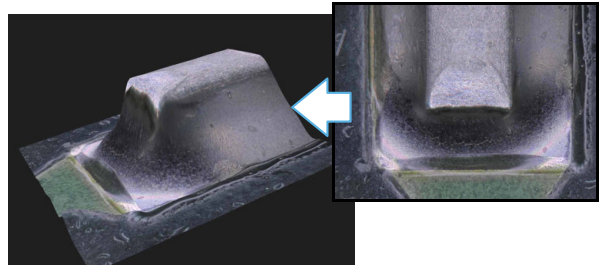
Solder paste (300x)



For details, refer to "Types and Features of Depth Composition" (Page 10-2).

Observe images in 3D

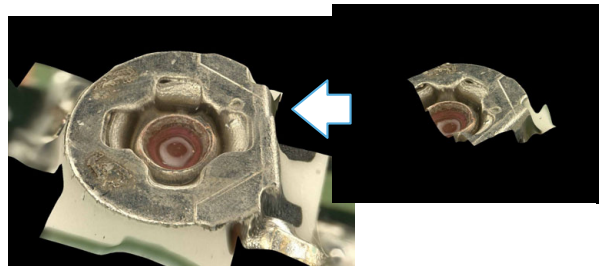
Solder (200x)



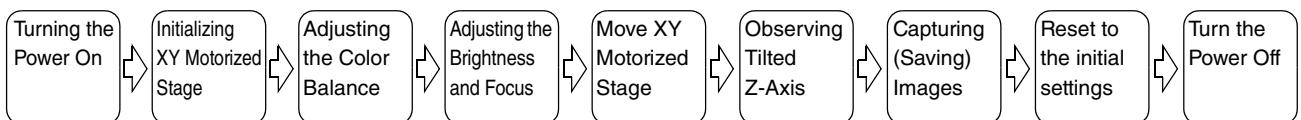
For details, refer to "3D View" (Page 10-15).

Observe a wide field-of-view under high magnification

Screw (200x)



For details, refer to "Automatic Image Stitching" (Page 11-2).



Chapter 4

Advanced Camera Settings

This chapter explains how to adjust the brightness, white balance, video frame rate, and lighting.

Camera settings are normally adjusted with the console. To adjust advanced settings, click [Lighting] or [Rec Settings] on the [VHX MENU] and use the menus presented in the operation area.

Adjusting the Lighting.....	Page 4-2
Using the LIGHT Button on the Console.....	Page 4-2
Adjusting with [Lighting] of the VHX MENU	Page 4-2
Adjusting Image Brightness	Page 4-3
Adjusting with the Brightness Dial on the Console	Page 4-3
Adjusting the Shutter Speed using [Lighting] from the VHX MENU	Page 4-3
Adjusting the Gain using [Lighting] from the VHX MENU	Page 4-4
Adjusting the White Balance	Page 4-5
Adjusting the White Balance on the Console	Page 4-5
Adjusting the White Balance using the Camera Settings from the VHX MENU	Page 4-5

Adjusting the Lighting

4

This section explains how to turn the lighting on and off and how to adjust the brightness. The brightness of the lighting can be adjusted using the LIGHT button on the console or through the [Lighting] from the VHX MENU.

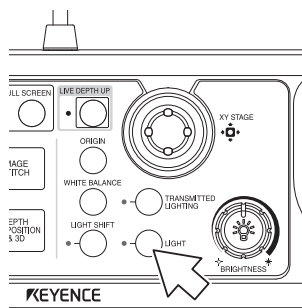
Normally, the light is turned ON at maximum intensity. Adjustments should be made as necessary if an external light is being used for the observation.

Using the LIGHT Button on the Console

ON/OFF of top down lighting

- 1 Press the LIGHT button on the console.

The LIGHT indicator on the console goes out and the top down lighting turns off. Pressing the LIGHT button again turns the top down light on.

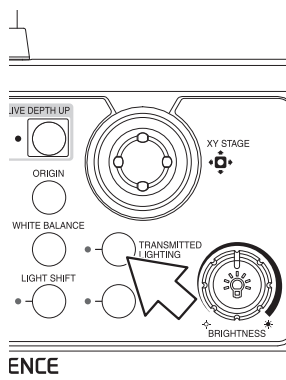


ON/OFF of transmitted lighting

This function is active when the VHX is connected with the transmitted illumination stage.

- 1 Press the TRANSMITTED LIGHTING button on the console.

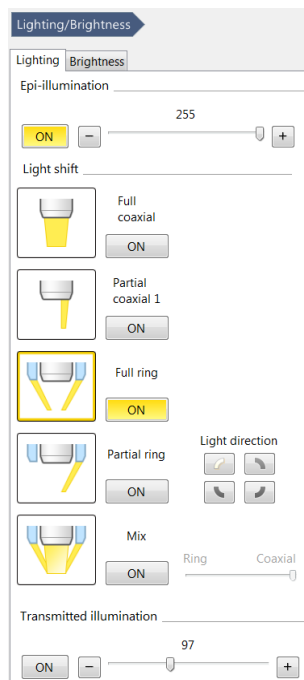
The transmitted lighting indicator light illuminates and the light comes on. When the TRANSMITTED LIGHTING button is pressed again, the light goes off.



Adjusting with [Lighting] of the VHX MENU

- 1 Click [Lighting] from the VHX MENU and select the [Lighting] tab.

This brings up the [Lighting/Brightness] dialog in the operation area.



Epi-illumination: ON

Sets the lighting to ON or OFF. This function is identical to the LIGHT button on the console.

This adjusts the brightness in 256 steps by dragging the slider on the screen. You can select the type of light at Light shift.

Point Available types of lighting change automatically according to the connected lens. For the details, refer to "Changing Lighting Method (Switching Lighting)" (Page 7-2).

Transmitted illumination: ON

Sets the transmitted lighting to ON or OFF. This function is identical to the TRANSMITTED LIGHTING button on the console.

This adjusts the brightness in 256 steps by dragging the slider on the screen. Normally used in the MAX (rightmost) position.

- 2 To turn off the lighting, click [ON] of the applicable lighting option to cancel the selective state (yellow). Adjust the light intensity by dragging the slider.

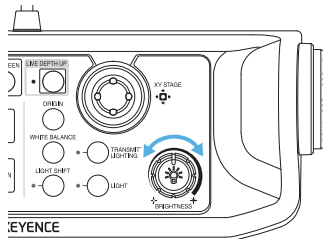
Adjusting Image Brightness

This section explains how to adjust image brightness. Image brightness can be adjusted using [Lighting/Brightness] on the console, or the camera setting options from the VHX MENU. Normally, the brightness is adjusted using [Lighting/Brightness] on the console. To make detailed settings, use the camera setting options from the VHX MENU.

Adjusting with the Brightness Dial on the Console

Adjust the brightness of the image by adjusting the shutter speed (Auto shutter). If the object is dark, the controller will automatically increase the gain.

- 1 Adjust the brightness by turning the BRIGHTNESS dial on the console.



Turning right brightens the image and turning left darkens the image.

With the brightness dial turned clockwise, the supercharge shutter function in the long exposure mode starts to work from a halfway rotated position.

Adjusting the Shutter Speed using [Lighting] from the VHX MENU

To use a fixed shutter speed, set the speed in [Lighting] from the VHX MENU.

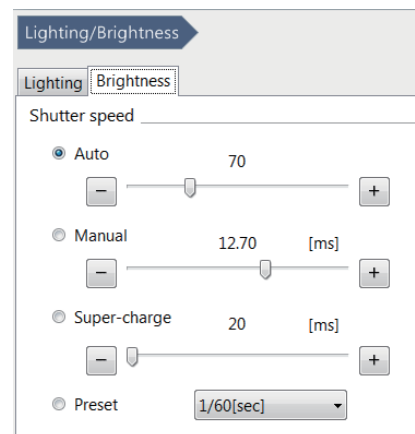


Point

When [Auto] is selected from the VHX MENU, the shutter speed behaves the same way the BRIGHTNESS dial does on the console. The BRIGHTNESS dial on the console always overrides the shutter speed set from the VHX MENU and sets the shutter speed to [Auto].

- 1 Click [Lighting] on the [VHX MENU].

This brings up the [Lighting/Brightness] dialog in the operation area.



- 2 Select [Manual], [Super-charge], or [Preset].

- 3 Adjust the image brightness.

For [Manual] or [Super-charge], adjust by dragging the slider.

For [Preset], select a value from the list box.

Shutter speed

Increasing the shutter speed results in darker images but reduces the blur of moving objects.

Reducing the shutter speed results in blurred images if the object is moving, but produces brighter images.

Auto

The shutter speed is automatically adjusted to the brightness setting. The shutter speed changes as the condition of the lighting or object changes.

Manual

The shutter speed is adjusted by dragging the slider on the dialog (0.02 ms to 20 ms) Manual allows a more precise adjustment than preset. The shutter speed never changes even if the condition of the lighting or object changes.

Super-charge

Adjust the exposure time (20 ms to 4 s) of the supercharge shutter by dragging the slider on the dialog.

Preset

Select from 9 values preset within the range of 1/60th to 1/19000th of a second. The shutter speed remains fixed even if the lighting condition of the object changes.

Adjusting the Gain using [Lighting] from the VHX MENU

Normally, the brightness is adjusted using the BRIGHTNESS dial on the console. Use the gain when you want to adjust the brightness according to the object or lighting while using a fixed shutter speed.

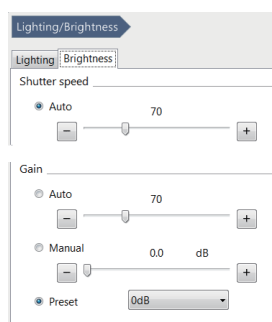


Point

- Increasing the gain causes noise that can degrade the picture quality.
- The BRIGHTNESS dial on the console always overrides the gain set from the VHX MENU and sets the gain to Manual, 0dB.

1 Click [Lighting] on the [VHX MENU].

This brings up the [Lighting] dialog in the operation area.



Auto

The gain is automatically adjusted to maintain the brightness setting.

The gain changes as the condition of the lighting or object changes.

Manual

Adjust the gain amplification ratio (0dB to 6dB) by dragging the slider on the dialog.

Manual allows a more precise adjustment than preset.

The gain remains fixed even if the condition of the object or lighting changes.

Preset

Select from two gain amplifications: 0dB or 6dB.

The gain remains fixed even if the condition of the object or lighting changes.

2 Click either [Auto], [Manual], or [Preset].

3 Adjust the image brightness.

For [Auto] or [Manual], adjust by dragging the slider.

For [Preset], select a value from the list box.

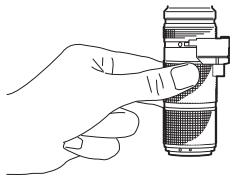
Adjusting the White Balance

This section explains how to adjust the white balance of the screen. White balance can be adjusted using the WHITE BALANCE button on the console, or through [Rec settings] from the VHX MENU.

Normally, this adjustment is made using the WHITE BALANCE button on the console. To make detailed adjustments, use [Lighting] from the VHX MENU.

Adjusting the White Balance on the Console

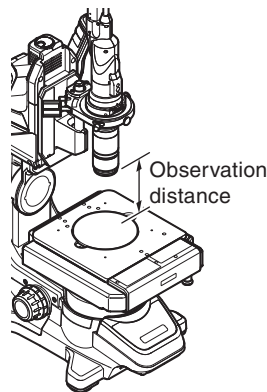
- 1 Turn the zoom ring on the lens to the desired magnification.



- 2 Place a white object on the stage and focus on the object.

The observation distance is set according to the lens used.

Lens model	Observation distance
VH-Z00R/W/T	95 mm
VH-Z20R/W/T	25.5 mm
VH-Z20UR/W/T	20.8mm
VH-Z100R/W/T	25 mm
VH-Z100UR/W/T	25 mm
VH-Z250R/W/T	6.5 mm
VH-Z500R/W/T	4.4 mm
VH-Z50L/W/T	85 mm
VH-ZST	15 mm

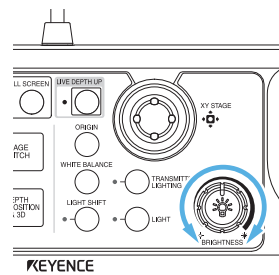


Reference Use an object with a matte white surface (such as copy paper) for best results.

- 3 Adjust the image brightness.

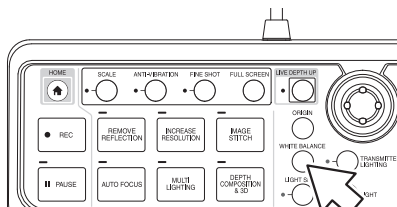
Adjust the image to the appropriate brightness (Page 4-3).

Point Adjust to prevent the image from becoming so bright that the image is saturated.



- 4 Press the [WHITE BALANCE] button on the console.

This will adjust the white balance.

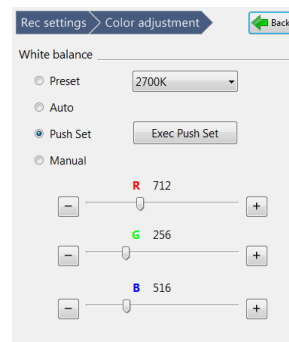


Adjusting the White Balance using the Camera Settings from the VHX MENU

To adjust the white balance in greater detail, use [Rec settings] - [Color adjustment] from the VHX MENU.

Point [Push Set] performs the same operation as the WHITE BALANCE button on the console.

- 1 Click [Rec settings] from the VHX MENU and click [Color adjustment].



This brings up the settings dialog of color adjustment in the operation area.

Preset

Select the color temperature according to the lighting and environment from 2700K, 3200K, 5600K, or 9000K.

- 2700K For imaging under an incandescent lamp.
- 3200K For imaging under a halogen lamp.
- 5600K For imaging under sunlight during the day.
- 9000K For imaging in shaded light on a clear day.

Auto

This mode automatically adjusts the white balance to the image being displayed. Auto mode reduces color variation caused by changes in the lighting environment which can occur, for instance, when the timer is used to capture images for extended period of time.

Push Set

This mode adjusts the white balance when the user clicks the Push Set button while observing a white object.

Manual

Adjust the white balance as desired by dragging each slider while viewing the target.

- 2 Select either [Preset], [Auto], [Push Set], or [Manual].

- 3 Adjust the white balance.

When [Preset] is selected, select a color temperature. When [Manual] is selected, adjust by dragging the sliders for R, G, and B.

4

Advanced Camera Settings

Chapter 5

Recording (Saving) Images

This chapter explains how to capture, retrieve, and edit images.

Recording/Saving Still Images	Page 5-2
Recording (Saving) from the Console	Page 5-2
Recording (Saving) using the Direct Buttons.....	Page 5-2
Names and Functions on the Rec Dialog Box....	Page 5-3
Rec Settings.....	Page 5-5
Setting the Recording Size.....	Page 5-5
Setting Auto Rec	Page 5-6
Loading Recording Settings	Page 5-7
Setting up Timer Recording.....	Page 5-8
Wide-view.....	Page 5-9
Observing in Wide-view	Page 5-9
Recording and Saving Videos.....	Page 5-10
Names and Functions on the [Record video] Dialog Box	Page 5-11

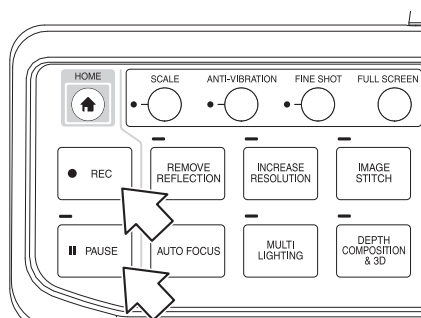
Recording/Saving Still Images

This section explains how to capture images. Images can be captured and saved using the [REC] button on the console, or through the VHX MENU.

5

Recording (Saving) from the Console

- 1 Press the [PAUSE] button on the console.
This pauses the image.



- 2 Press the [REC] button on the console.
This brings up the [Rec] dialog box (Page 5-3).

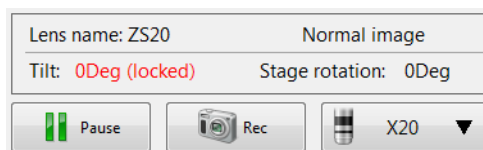
- Reference**
- The resolution of the image will be set to the resolution set in "Rec Settings" (Page 5-5) from the VHX MENU.
 - It is possible to save images simply by pressing the [REC] button.
 - "Setting Auto Rec" (Page 5-6)
 - If the REC button is pressed without pressing the [PAUSE] button, the observation image is paused and the Rec dialog box appears.

- 3 Select the folder to save the image in and enter a file name in the [Filename] box.

- 4 Click [Save].
This saves the image data and closes the [Rec] dialog box.

Recording (Saving) using the Direct Buttons

- 1 Click [Pause] from the direct buttons.
This pauses the image.



- 2 Click the Rec icon.
This brings up the [Rec] dialog box (Page 5-3).

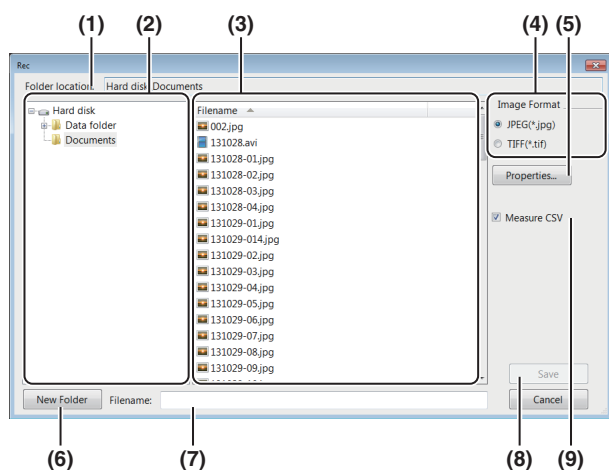
- Reference**
- If the Rec button is pressed without pressing the [Pause] button, the live image is paused and appears in the [Rec] dialog box.

- 3 Select the folder to save the image in and enter a file name in the [Filename] box.

- 4 Click [Save].
This saves the image data and closes the [Rec] dialog box.

To playback the saved image, use the Album function (Page 6-2).

Names and Functions on the Rec Dialog Box



(1) Folder location

Displays the folder containing the files being shown.

(2) Folder tree

Displays the drives and folders. Click the folder to save the image in.

(3) Filename

Displays the files in the currently selected folder.

(4) Image format

Choose the format to save the image (either JPEG or TIFF).

- Reference
- **JPEG format: (extension.jpg)**
This is a common image file format. The data is compressed and saved. The file size for JPEG files is small compared to the image size.
 - **TIFF format: (extension.tif)**
Saves the image data without compression. TIFF files offer better picture quality but have large file sizes which reduces the storage capacity.

(5) Properties

Used to add comments to image files.

☞ "Entering properties" (Page 5-4)

(6) New Folder

Creates a new folder.

☞ "Creating a new folder" (Page 5-4)

(7) Filename

Enter the file name to save the image as.

(8) Save

Saves the file.

(9) Measure CSV

If this option is checked, the image is saved as an image file with measurement data in CSV format.

The CSV data can be extracted using the VHX-6000 Communication Software and imported into Excel or other applications for comparison.

☞ "Measuring Dimensions and Area" (Page 9-1)

☞ "Extracting CSV data" (Page 14-19)

Entering properties

Comments can be added to image files. The information entered here is saved as part of the image files recorded hereafter.

Enter information in the properties as needed.

1 Click the [Properties] button.

This brings up the [File properties] dialog box.

2 Enter a title, subtitle, and any other information as needed.

Each field accepts up to 31 characters (comments can be up to 63 characters). Both double-byte or ASCII characters can be used.

3 Click [OK].

The settings are saved and the dialog box closes.



- The information entered in the property fields remain until the power is turned OFF and are reflected into all image files subsequently recorded. Restarting the microscope erases the information in the property fields.
- The information entered in the property fields is displayed in the preview area (Page 6-2) of the Album function (Page 6-2).
- Searches can be performed on the information entered in the property fields.

Creating a new folder

1 Click the folder where the new folder is to be created.

2 Click [New Folder].

A [New Folder] is created in the specified folder enabled for entering a folder name.

3 Enter a folder name and press the Enter key on the keyboard.

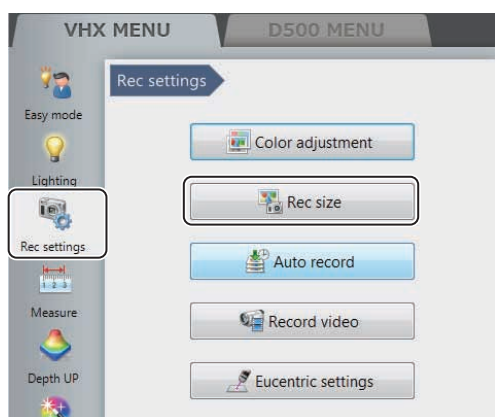
Rec Settings

Under the record settings, you can view recorded image size, automatic saving features and timer-recording settings.

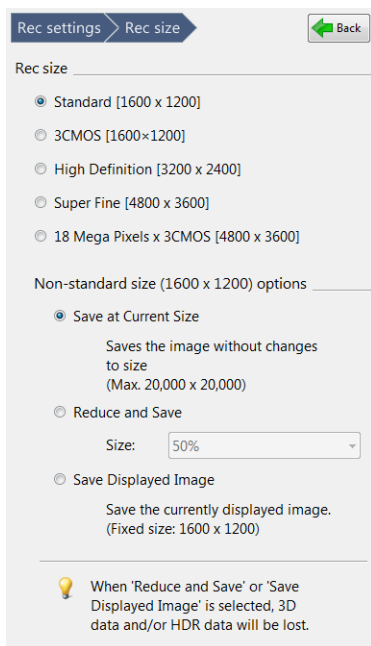
Setting the Recording Size

Select the resolution to use for recording images. Images can be recorded in higher picture quality than normal resolution by using the Pixel Shift function.

- 1 Click [Rec Settings] from the VHX MENU and click [Rec size].

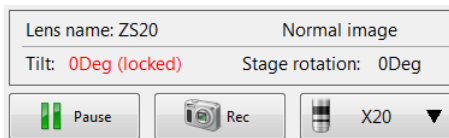


This brings up the [Rec Settings] menu in the operation area.



- 2 Specify the recording settings as needed.

The image size selected for recording is shown in the information view.



Point With camera type VHX-6020, only normal (1600x1200) can be selected.

Reference

● Rec size, resolution, pixels

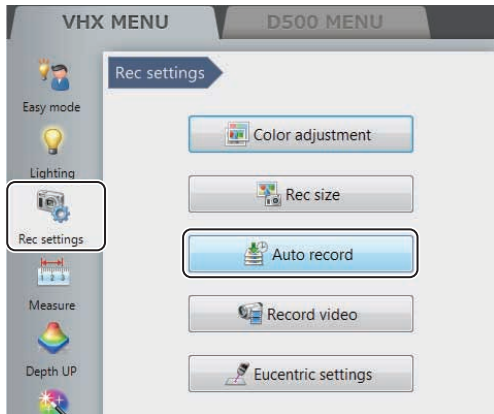
Rec size	Resolution (pixels)	Pixels
Normal	1600 x 1200	2-million pixels
3CMOS	1600 x 1200	2-million pixels x 3CMOS
High Definition	3200 x 2400	8-million pixels
Super Fine	4800 x 3600	18-million pixels
18 Mega Pixels x 3CMOS	4800 x 3600	18-million pixels x 3CMOS

- **Normal [1600 x 1200]**
Normal recording mode. Records without using the Pixel Shift function.
- **3CMOS [1600 x 1200]**
This mode provides good color reproduction. Records using the 3CMOS mode.
- **High Definition [3200 x 2400]**
High resolution mode. Captures image in Super Fine [4800 x 3600] mode and records the data in reduced size.
- **Super Fine [4800 x 3600]**
High resolution mode. Records using 9 times the number of pixels used in normal mode. The CMOS shifts three times vertically and horizontally between each pixel.
- **18 Mega Pixels x 3CMOS [4800 x 3600]**
This mode offers the best resolution and color reproduction. Images are recorded using the Pixel Shift function and the 3CMOS mode. This mode offers high resolution with good color reproduction.
- **Non-standard size (1600 x 1200) options**
- **Save at Current Size**
Saves images with their original resolution.
- **Reduce and Save**
Saves whole images in reduced resolution. Select reduction ratio (50%/25%/12.5%) from the dropdown list.
- **Save Displayed Image**
Saves the image displayed on the observation window as it is. The resolution is 1600x1200.

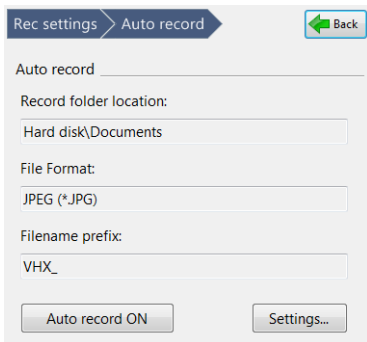
Setting Auto Rec

Press the [REC] button on the console, or simply click the [Rec] button on the direct menu to record (save) images using the predefined file name, folder, and image format.

- 1 Click [Rec Settings] from the VHX MENU and click [Auto record].

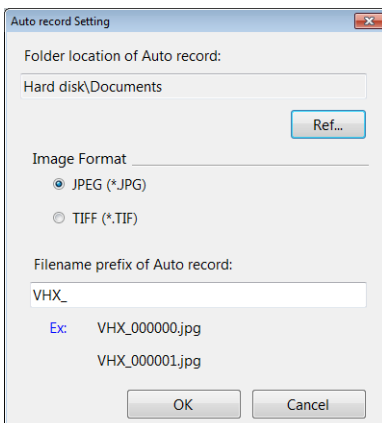


This brings up the [Auto record] menu in the operation area.



- 2 Click [Settings] under Auto Rec.

The [Auto Rec settings] dialog box appears.



- 3 Click [Ref...] under the Auto Rec folder destination and specify the folder to save image files in the [Select Folder] dialog box.

Reference To create a new folder, click [New Folder] in the [Select Folder] dialog box.
 "Creating a new folder" (Page 5-4)

- 4 Select an image format by clicking the appropriate option.

- 5 Enter a file name prefix to use with Auto Rec files.

The end of each file name is automatically numbered from 000000 to 999999 when the file is saved. The Auto Rec file name prefix can be up to 20 characters long. Both double-byte or ASCII characters can be used.

eg: The Auto Rec file names are named in following manner when the Auto Rec filename prefix is to "VHX_":

VHX_000000
 VHX_000001
 VHX_000002

- 6 Click [OK].

- 7 Click [Auto record ON].

The button turns yellow indicating Auto Rec mode is active.



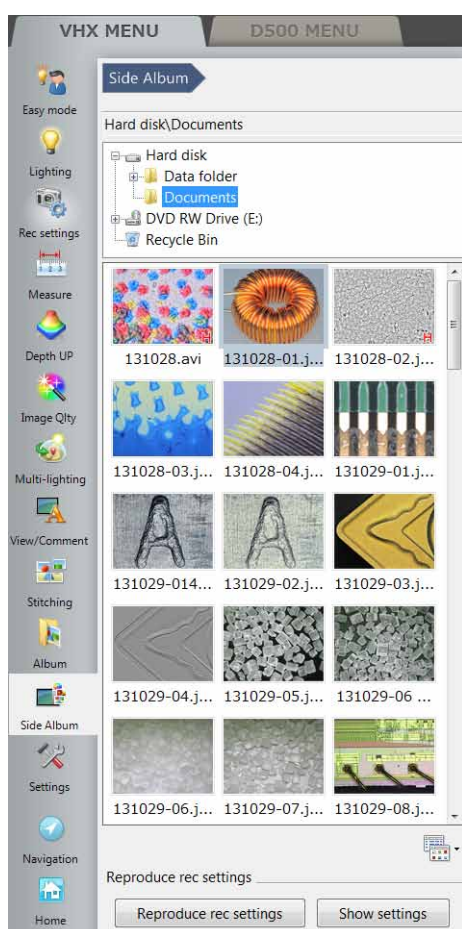
Clicking [Auto record ON] again returns to Normal Rec mode.

Loading Recording Settings

The VHX Settings that were used to record a saved image can be automatically applied to the current image. This is useful when observing similar objects that require the same observation conditions.

1 Click [Side Album] on the [VHX MENU].

This brings up the [Side Album] menu in the operation area.



2 In the side album, click the image whose settings you wish to replicate.

3 Click [Load recording settings].

This loads the recording settings from an existing image and sets those settings as the recording settings.

Reference

When clicking [Show settings], the [Show the recording settings] dialog box is displayed. You can confirm the recording settings of the selected image.

When clicking [Restore], you can replicate the recording settings.

5

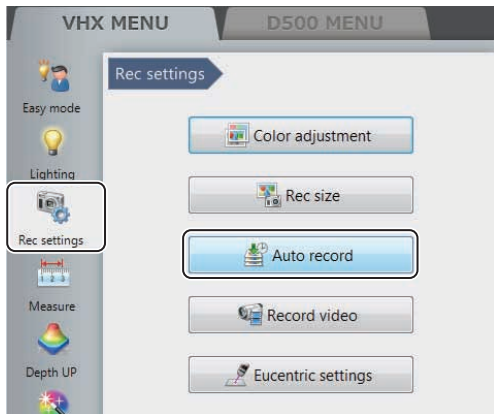
Recording (Saving) Images

Setting up Timer Recording

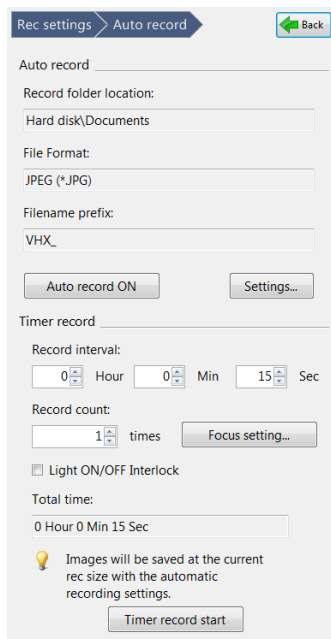
The Timer Rec function automatically records images at preset intervals and times. This is useful when observing objects that change or grow by automatically recording at fixed time intervals.

- Point**
- **The required recording intervals are as follows:**
 - For recording size set to normal (1600 x 1200) : 15 sec. or longer
 - 3CMOS mode: 3 min. or longer
 - High Definition mode: 3 min. or longer
 - Super Fine mode: 3 min. or longer
 - 18 Mega Pixels x 3CMOS mode : 5 min. or longer
 - For lamp ON/OFF interlock : 1 min. or longer
 - If the destination drive becomes full, timer recording ends.

1 Click [Rec Settings] from the VHX MENU and click [Auto record].



This brings up the [Auto record] menu in the operation area.



2 Set each of the recording time settings.

Record interval

Set the recording interval.

From 15 seconds to 23 hours 59 minutes 59 seconds.

Record count

Set the number of recordings to make at the preset recording interval.

1 to 9999 counts

Light ON/OFF Interlock

If the recording interval is 1 minutes or longer, setting this option turns the lamp on only while recording.

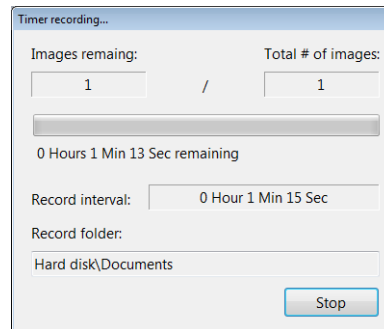
Focus setting

During timer recording, depth composition or autofocus can also be used. When either of these functions are used, set the recording interval to 3 minutes or longer.

3 Click [Timer record start].

This starts timer recording.

The message [Timer recording...] appears in the dialog while timer recording.



Clicking the [Stop] button stops timer recording.

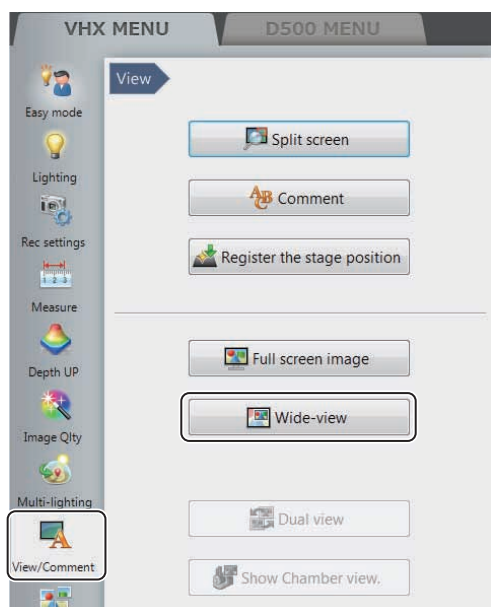
Recording data is saved to the hard disk until timer recording ends or is stopped. The recording can be played back and deleted using the Album function (Page 6-2).

Wide-view

When the [Wide-view] dialog box is displayed, you can confirm which part is being zoomed in on when the zoom ratio of the observed image has been changed. By dragging the green view area frame, you can also move the position to be observed (view area).

Observing in Wide-view

- 1 Display a live image or still image in the observation window.
- 2 Click [View/Comment] from the VHX MENU and click [Wide-view].



The [Wide-view] dialog box appears.

- 3 While the image is being zoomed in on, drag the green view area frame to the position you would like to observe.



The view of observed image changes according to the view area frame.

When the [Link zoom position and display position between the images in the split screen.] check box is ON, all images are enlarged when the image in the split screen is enlarged.

📖 "Enlarging the Image (Digital Zoom)" (Page 8-5)

- Reference**
- When clicking [Fit to screen], the observation window shows the entire image.
 - When clicking [X1.00 view], the image is displayed in the actual size (100%).

Recording and Saving Videos

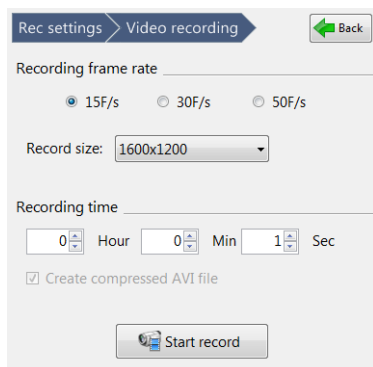
Observed images can be recorded as digital video (AVI format) and played back. Each image can be recorded in 1600 x 1200, 800 x 600, or 640 x 480-pixel resolution for up to three hours. Saved video files can be played back on the VHX-6000 or a PC.

5

- 1 Click [Rec Settings] from the VHX MENU and click [Record video].



This brings up the [Record video] menu in the operation area.



- 2 Set the [Recording frame rate], [Rec size], [Recording time], and the [Create compressed AVI file] option.

Recording frame rate

15F/s: records 15 frames per second.

30F/s: records 30 frames per second. Videos are smooth even when recording fast-moving objects.

50F/s: records 50 frames per second.

Point

- The recording size will be set to 800 x 600 or 640 x 480 when the frame rate is set to 30F/s.
- The recording size will be set to only 640 x 480 when the frame rate is set to 50F/s.

Rec size

Increasing the recording size improves the picture quality but shortens recording time.

Recording time

The [Hour], [Min], and [Sec] can be specified.

The recording time is from 1 second to 3 hours.

Point

To record at stable frame rates, set recording time to five seconds or more.

Reference

Frame rates and recording times

Frame rate	Compressed/Uncompressed	Recording time		
		1600 x 1200	800 x 600	640 x 480
50F/s	Uncompressed	/		1 sec to 8 min
	Compressed			1 sec to 50 min
30F/s	Uncompressed		1 sec to 10 min	1 sec to 15 min
	Compressed		1 sec to 1 hour	1 sec to 1 hour and 30 min
15F/s	Uncompressed		1 sec to 20 min	1 sec to 30 min
	Compressed		1 sec to 10 min	1 sec to 2 hour

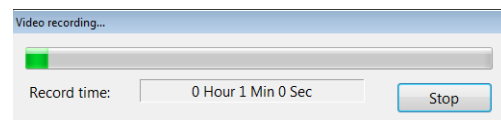
Create compressed AVI file

If this option is checked, the file is compressed when the AVI file is created.

This reduces the file size.

- 3 Click the [Start rec...] button.

The [Video recording...] dialog box appears and recording starts.



When the recording ends, the [Video recording...] dialog box (Page 5-11) will appear.

Reference

To exit while recording, click [Stop]. When a confirmation dialog appears, click [Yes] to save the partway recorded video.

- 4 Select the folder where the video will be stored and enter the file name in [Filename].

5 Click [Save].

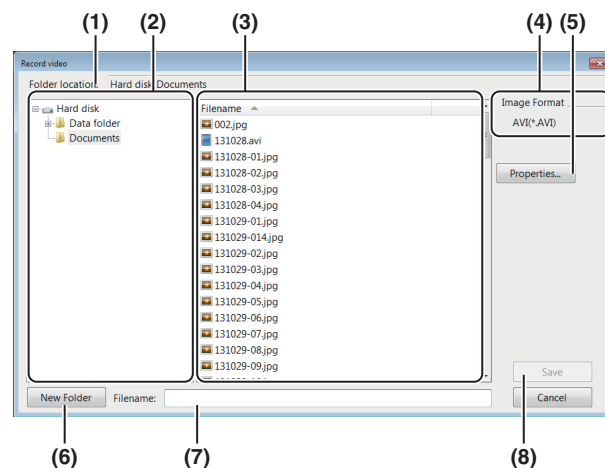
The video data are saved and the [Video recording..] dialog box closes.

To play the saved video, use the Album function (Page 6-2).

Point

Clicking [No] discards the recorded video data.

Names and Functions on the [Record video] Dialog Box



5

(1) Folder location

Displays the new folder containing the files currently showing.

(2) Folder tree

Displays the drives and the new folder. Click the new folder to save the image in.

(3) Filename

Displays the files in the currently selected folder.

(4) Image Format

Displays the format to save the image (AVI).

(5) Properties...

Used to add comments to video files.

📖 "Entering properties" (Page 5-4)

(6) New Folder

Creates a new folder.

📖 "Creating a new folder" (Page 5-4)

(7) Filename

Enter the file name to save the image.

(8) Save

Saves the file.

5

Recording (Saving) Images

Chapter 6

Playing and Editing Images

Working with Saved Files

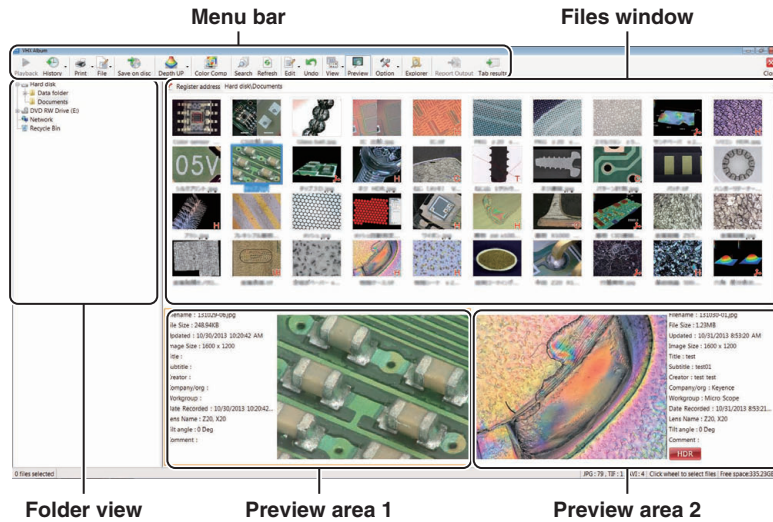
This chapter explains the Album function which provides the ability to play, edit, and view thumbnail previews of recorded (saved) still images and video files.

Album.....	Page 6-2
Names and Functions	Page 6-2
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Depth Up.....	Page 6-11
Creating Color Composition Images	Page 6-12
Searching Files	Page 6-14
Changing the View of the Files Window.....	Page 6-15
Options.....	Page 6-16
Explorer.....	Page 6-18
Report Output	Page 6-19
Measurement Result Summary	Page 6-20
Side Album.....	Page 6-21
Launching the Side Album	Page 6-21
Names and Functions	Page 6-21
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Album

Names and Functions

This section explains the names and functions used in the Album window.



Folder view

This is a tree view of the folders on the hard disk or other storage devices.

Hard disk

This shows the hard disk in the microscope. Users can store images in the data folder and create new folders.



Point

The VHX-6000 Communication Software can browse the Documents folder and the Data folder.

DVD RW drive (E:)

This is the DVD drive on the right side of the panel. Reading and writing DVD±R/-RAM/±R DL/±RW and CD-R/RW disks is possible.

Removable disk (F:)

Any USB memory device connected to the USB port will be recognized as a drive and added to the tree view.

Network

This shows any shared drives on the network. Refer to "LAN Connection" (Page 14-2) for setting procedures.

Recycle Bin

Deleted files are saved here.

Files window

This window shows the files currently saved in the selected folder. The view can be set to show thumbnails, details, or other views.

Change the view by clicking [View] on the menu as described in "Changing the View of the Files Window" (Page 6-15).



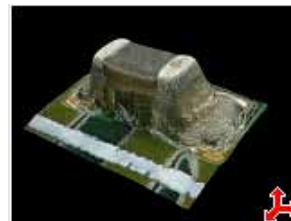
In thumbnail view, the contents of the file is indicated by a symbol displayed in the lower right of the thumbnail.

- **3D Files**



appears in the lower right of the thumbnail.

This indicates a 3D image (Page 10-2). The image can be played back in 3D.



- **Multi-lighting files**



appears in the lower right of the thumbnail.

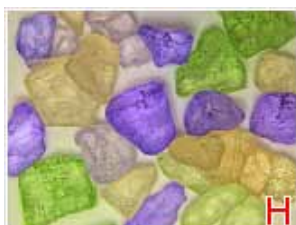
This image is recorded with the multi-lighting function (Page 7-4).




- **HDR files**

 appears in the lower right of the thumbnail.

This image was recorded using the High Dynamic Range (HDR) function (Page 7-7).



- **High resolution HDR files**

 appears in the lower right of the thumbnail.

This image was recorded using the High resolution HDR function (Page 7-9).



- **Video files**

 appears in the lower right of the thumbnail.

This file is a video recording (Page 5-10).



- **File with CSV data**

 appears in the lower right of the thumbnail.

This image file has measurement data in CSV format. The CSV data can be extracted using the VHX-6000 Communication Software and imported into Excel, or other applications to complete further analysis.

 "Extracting CSV data" (Page 14-19)



- **CSV data file**

This file contains measurement data such as length and area in CSV format (Page 9-24).

The data can be exported into Excel or other application for comparison.

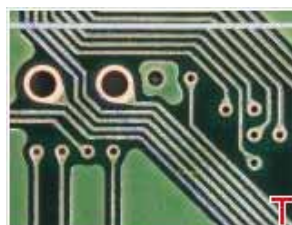


- **Template file**


 appears in the lower right of the thumbnail.

It is a template file that has been created with one-click automatic measurement (Page 9-41).

One-click automatic measurement can be conducted with a template applied to it.

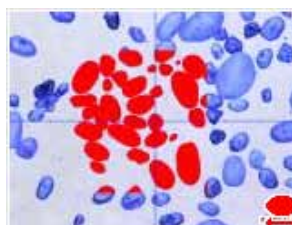


- **Automatic area measurement data file**


 appears in the lower right of the thumbnail.

It is a data file that contains measurement results and settings using the automatic area measurement (Page 9-46).

Measurement results can be confirmed and output or another automatic area measurement can be completed with the same settings.



- **Contamination analysis results file**

 appears in the lower right of the thumbnail.

This image file includes analysis results using the contamination analysis function (Page 9-67).



• **Color composition file**

CL appears in the lower right of the thumbnail.

This file was created using color composition (Page 6-12).



Preview area

The file preview area displays properties and a preview of the image.

Preview image

The file preview area displays the selected image.

File properties display

Symbols are used to indicate basic information about the selected file and its content, as well as information set in the file properties (Page 6-10).

Reference

Symbols that indicate the contents of the file are displayed under the properties display.

- 3D file
- Multi-lighting file
- HDR file
- HHDR file
- 3D HDR file
- 3D HHDR file
- Video file
- Measured image file
- Template file
- Automatic area measurement data file
- Contamination analysis results file
- Color composition file

Using the preview area

Clicking a preview area (1 or 2) makes it the active preview.

The preview area shows the file selected from the files window.

1 Click either the left or right preview area

The clicked preview area becomes active and an orange frame appears.

2 Click the desired file in the files window to display it in the preview area.

The preview image and file properties appear in the preview area.

Point

If a CSV file is selected, only the basic file information is displayed.

Menu bar

Playback



This button plays back an image file selected from the files window. Clicking the [Playback] button displays the file in the entire observation window.

Reference

You can also playback a file by double-clicking it in the files window. Or, you can right-click the file and click Playback on the pop-up menu. Playing a multiple selection of CSV files displays up to four measure results side by side.

History



This command displays a history of the files that have been previously played. These files can be played by selecting them from the list.

Print



This button prints (Page 12-2) the currently selected image with the printer. To install the printer driver, temporarily deactivate the system protection function (Page 13-2).

File

This button allows you to handle files.

New Folder

Creates a new folder on the hard disk in the microscope.

Select the folder, at the folder view, where a new folder is to be created before clicking.



You can create a new folder from the menu which is displayed by right-clicking a folder or files window.

Change name

Changes the name of the selected folder or file.



You can change a name of a file or folder by right-clicking a folder or file.

Delete

Move the selected file to the Recycle Bin.



You can delete a file or folder from the menu by right-clicking a folder or file.

Properties

You can display/set file properties (such as title and creator) and display file information (such as file type and size).



- When a folder is selected, the folder information is displayed.
- You can also display the file or folder properties by right-clicking a folder or file.

Save on disc

Save a selected file or folder to a disk (Page 12-4).

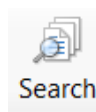
Depth Up

This command combines image files recorded at different focal points. The files can be displayed combined or in 3D. This is useful for viewing objects that are difficult to view completely in focus due to large height differences.

Refer to Page 10-2 for details on the Depth Up function.

Color Comp

This command allows you to perform color composition (Page 6-12) after selecting color image and large-depth image.

Search

This command searches (Page 6-14) within the hard disk. You can specify search criteria.



You can also search by right-clicking a folder and clicking Search on the pop-up menu.

Refresh

This command refreshes the album view.

Edit

This button drops down to show the Cut, Copy, Paste, and Select all commands.



You can also use these commands from the pop-up menu presented by right-clicking the folder or file.

Undo

This command undoes the most recent command.



[Undo] is allowed for only one command. Some operations cannot be undone.

View

This button sets the display format (Page 6-15) of the files window.



Or, you can change the view format from the pop-up menu presented by right-clicking in the files window.

Preview

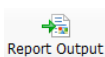
This button shows/hides the preview area.

Option

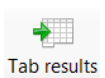
This button allows you to set the options (Page 6-16) of various functions.

Explorer

This button launches Explorer.

Report Output

This command prints the image and file information on a single sheet (Word, Excel) using a predefined format. (Page 6-19)

Tab results

This button combines multiple one-click automatic measurement results in Excel. (Page 6-20)

Close

This button closes the album function and returns to the observation window.

Playing Files

The following methods can be used to playback selected files.

- Click [Playback].



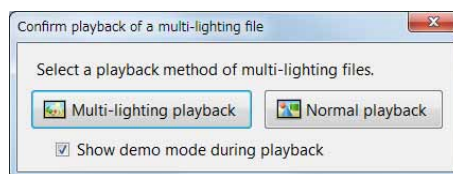
- Click [Playback] from the mouse right-click menu.
- Double-click the preview window.

Playing still images

- 1 Select the file to play in the files window.**
- 2 Click [Playback].**
The image appears in the entire observation window. To play and confirm high-resolution images, use the Wide-view window (Page 5-9).

Playing multi-lighting files

- 1 Select a multi-lighting file to play from the files window.**
- 2 Click [Playback].**
The "Confirm playback of multi-lighting files" message appears.

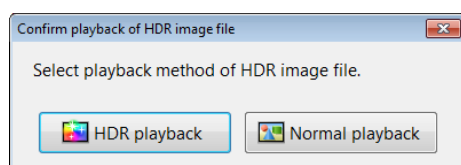


! Point

If the [Confirm playback method of multi-lighting files] option is turned OFF in the [Option Settings] (Page 6-16), the multi-lighting playback will start without displaying the "Confirm playback of multi-lighting files" message.

Playing HDR images

- 1 Select the HDR file to playback in the files window.
- 2 Click [Playback].
The "Confirm playback of HDR image file" message appears.

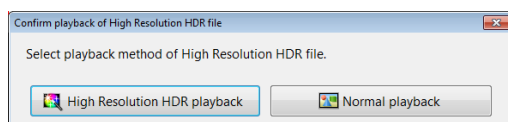


Point If the [Confirm playback method of HDR image files] option is turned OFF in the [Option Settings] (Page 6-16), the HDR playback will start without displaying the "Confirm playback of HDR image file" message.

- 3 Click [HDR Playback].
The HDR view (Page 7-7) appears.

Playing high resolution HDR image

- 1 Select the high resolution HDR file to play in the files window.
- 2 Click [Playback].
The "Confirm playback of High Resolution HDR file" message appears.

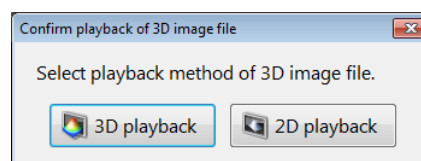


Point If the [Confirm playback method of HHDR file] option is turned OFF in the [Option Settings] (Page 6-16), the high resolution HDR playback will start without displaying the "Confirm playback of High Resolution HDR file" message.

- 3 Click [High Resolution HDR playback].
The high resolution HDR view (Page 7-9) appears.

Playing back 3D images

- 1 Select the 3D file to display in the files window.
- 2 Click [Playback].
The "Confirm playback of 3D image file" message appears.

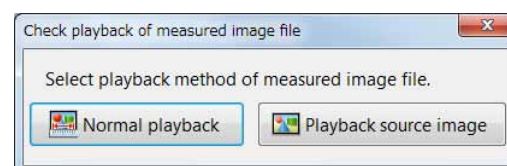


Point If the [Confirm playback method of 3D image file] option is turned OFF in the [Option Settings], the 3D playback will start without displaying the "Confirm playback of 3D image file" message.

- 3 Click [3D playback].
The 3D view (Page 10-15) appears.

Playing measured image files

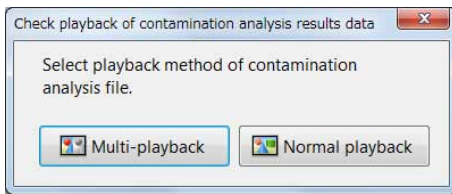
- 1 Select a measured image file to play from the files window.
- 2 Click [Playback].
The "Confirm playback of measure image files" message appears.



Point If the [Confirm playback method of measured image files] option is turned OFF in the [Option Settings] (Page 6-16), the measured image playback will start without displaying the "Confirm playback of measured image files" message.

Playing contamination analysis results files

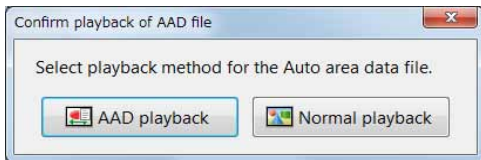
- 1 Select the contamination analysis results file to play from the files window.
- 2 Click [Playback].
The "Confirm playback of contamination analysis results files" message appears.



Point If the [Contamination analysis results files] option is turned OFF in the [Option Settings] (Page 6-16), the multi-playback will start without displaying the "Confirm playback of contamination results files" message.

Playing back automatic area measurement data file

- 1 Select the automatic area measurement data file to play in the files window.
- 2 Click [Playback].
The "Confirm replay of AAD file" message appears.

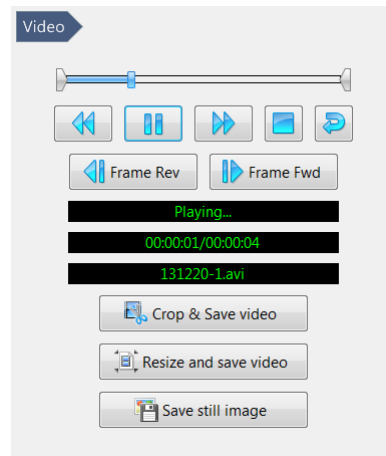


Point If the [Confirm playback method of Auto Area Data file] option is unchecked in the [Option Settings] (Page 6-16), the measurement result screen of automatic area measurement will be played back without displaying the "Confirm replay of AAD file" message.

- 3 Click [AAD playback].
The measurement result screen of automatic area measurement (Page 9-57) appears.

Playing video

- 1 Select the video file to play in the files window.
- 2 Click [Playback].
The video playback view appears.
Playback the video.



Fast forwards the video.



Click [Playback] to start playing the video. The button changes to the [Pause] button while playing.



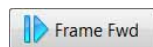
Rewinds the video.



Stops playback and pauses the video.



Click this button to turn repeat ON. A video will play repeatedly when the [Playback] button is clicked. Click again to turn repeat OFF.



Each click advances the video one frame.



Each click reverses the video one frame.



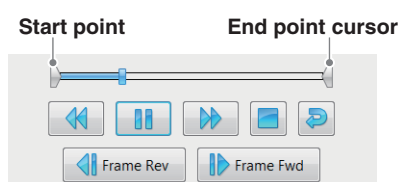
Clicking the slide bar displays the video at that point.

Editing videos

Crop & Save

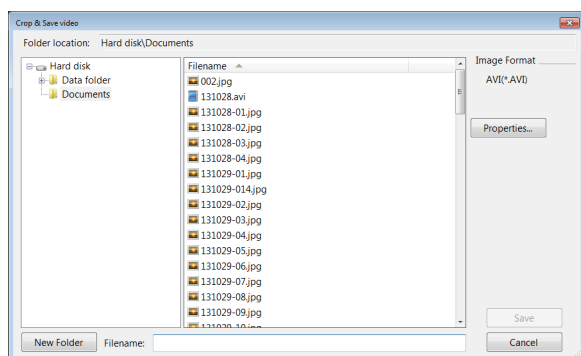
Specify start and end points to save a segment of the video.

- 1 Drag the start point cursor and end point cursor to specify the start and end of the segment to crop.



- 2 Click [Crop & Save].

The [Crop & Save] dialog box appears.



- 3 Enter the folder and file name to save the segment, and click [Save].

This will save the video between the start and end points.

Reference You can also create a new folder and save the video there. You can also enter information in the file properties when saving.

Resize

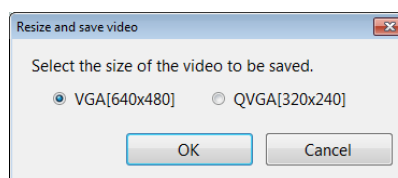
The resolution of the video file can be reduced before saving it. This reduces the file size.

Point Once the file is resized, it can no longer be played on this microscope. It can be played using a media player application on a PC.

- 1 Click [Resize].

The [Resize] dialog box appears.

- 2 Select the size to save and click [OK].

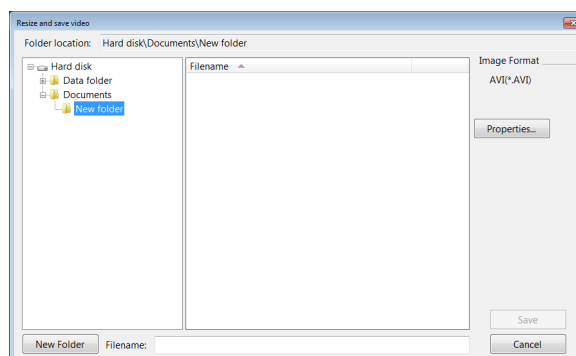


The [Resize and save video] dialog box appears.

- 3 Enter the folder where the file is to be saved and the file name, and click [Save].

The video is saved.

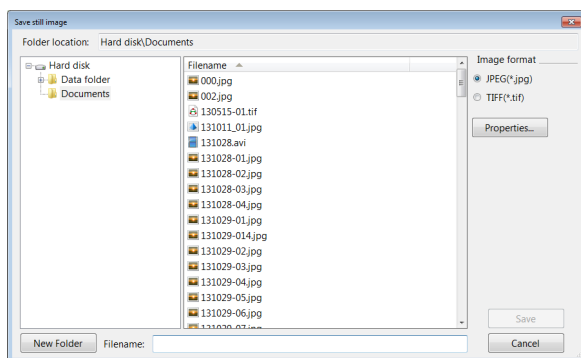
Reference You can also create a new folder to save the file. You can also enter file properties before saving.



Saving still images

Specified frames can be saved as still images.

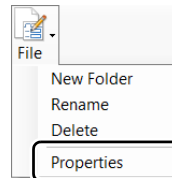
- 1 Play the video and pause at the frame to save.
- 2 Click [Captr Still...]
The [Rec] dialog box appears.
- 3 Enter the folder, image format, file name to save the image, and click [Save].



This saves the still image.

Displaying and Entering Properties

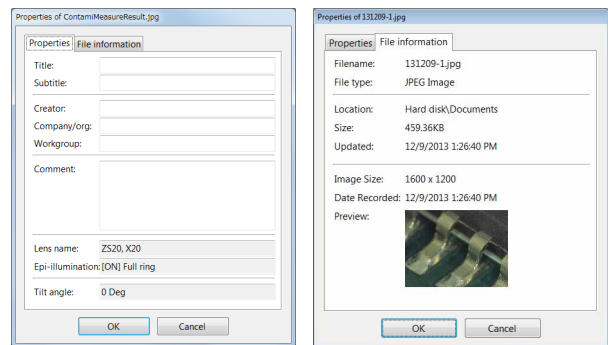
- 1 Click [File] and click [Properties].



The [File Properties] appears.

Point CSV files do not have the [Properties] tab.

Reference Clicking the [File information] tab displays basic information about the file.



- 2 Enter information into the [Properties] tab as necessary.

Point The [Lens Name], [Epi-illumination] and [Tilt angle] field cannot be changed.

- 3 Click [OK].

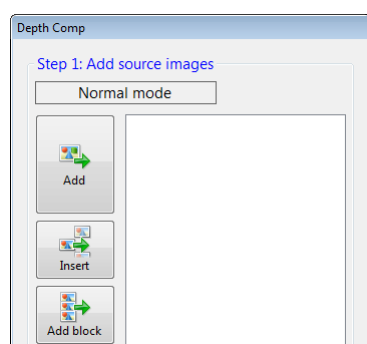
Depth Up

Before performing this procedure, do a Fine depth composition (Page 10-2) on multiple images suitable for depth composition.

- 1 Click [Depth UP] and select the depth composition menu.



The [Fine depth composition] dialog box appears.



- 2 Select image files from the files window on which you wish to perform depth composition.

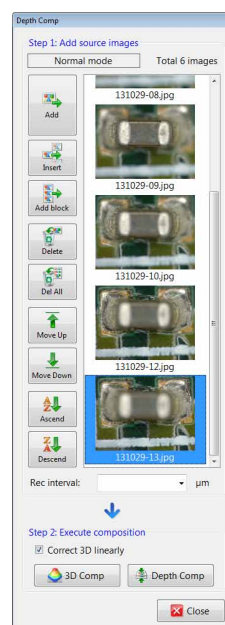
Reference Image data stored on USB flash memory devices and DVD/CD disks can also be used. Depth composition cannot be done on files stored on network drives.

- 3 Click [Add].

The image files are added to the [Fine depth composition] dialog box.

- 4 Repeat steps 2 and 3 until all image files to be used in the depth composition are included.

The images should be added to the list so that they are in order from the topmost layer of the object to the lowermost. The resulting image will not be displayed properly if the images are not in order.



Insert

Images can be inserted at specific positions by specifying the position and clicking [Insert].

Add Block

A block of images in the currently open folder can be added.

Delete, Delete All

These commands remove files (or all files) added to the [Depth Comp] dialog box. This will not delete the original image.

Move up, Move Down

This command moves the selected file up or down in the list.

Ascend/Descend

This command sorts the selected filenames on their names.

Rec interval

Enter the amount of travel represented by the recorded images.

- 5 Click [3D Comp] or [Depth Comp] .

Clicking [3D Comp] or [Depth Comp] displays the depth composed image using the full screen. Refer to Page 10-2 for details on the Depth Composition function.

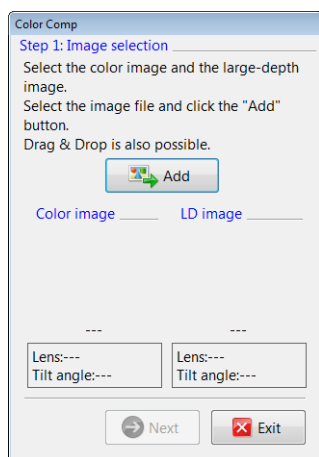
Creating Color Composition Images

Point This function is displayed when the VHX-D500 software has been installed.

1 Click [Color Composition].

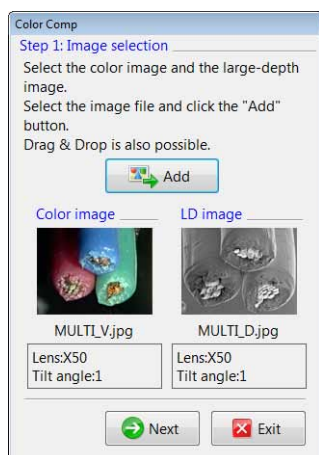


The [Color Composition] dialog box appears.



2 Select a color image to be used for color composition from the files window and click [Add].

3 Select a large-depth image to be used for color composition from the files window and click [Add].

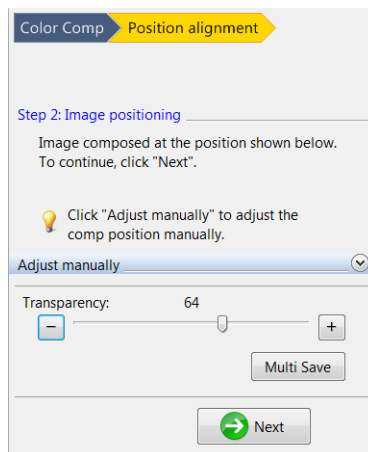


4 Click [Next].

"Position alignment" of color composition appears.

5 Confirm the image composition position (image at the bottom) and click [Next].

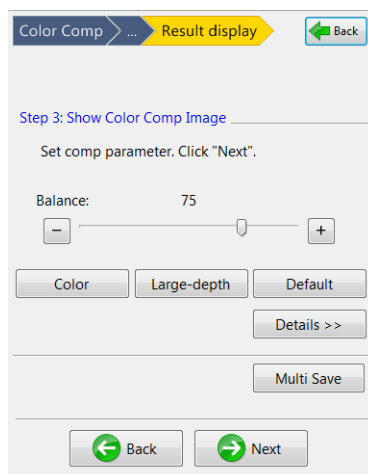
- To save the displayed images individually, click [Multi Save] (Page 6-14).
- To align the position manually, open the [Adjust manually] menu (Page 6-13).



"Result display" of color composition appears.

6 Set the image display balance and click [Next].

- The parameter will move to the prescribed position when you click "Color", "Large-depth" or "Default".
- You can adjust texture and color independently by clicking [Details].
- To save the displayed images individually, click [Multi Save] (Page 6-14).

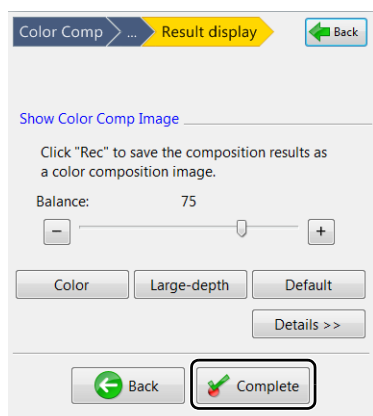


Color composition images are displayed in the entire observation window.

7 Click [Rec].

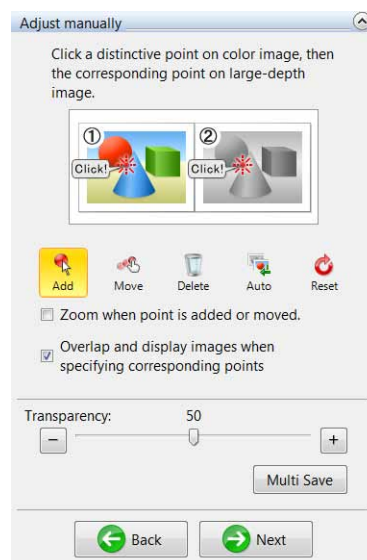
Adjust the image display balance as necessary.

8 Click [Complete].



Manual adjustment

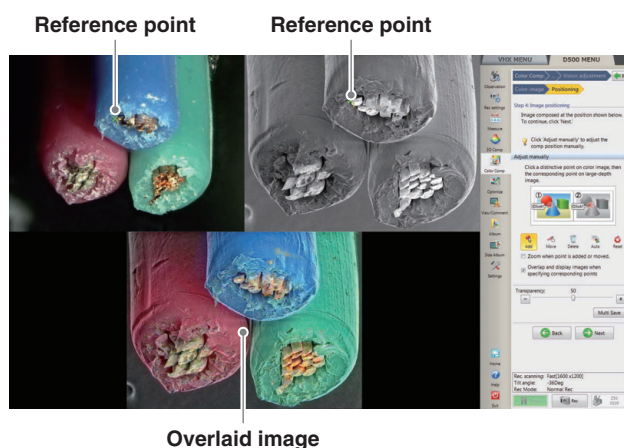
Open the [Adjust manually] menu to align the positions of images manually.



1 Select [Add], and click reference point (distinctive point) on the color image (left side).

2 Select [Add], and click reference point (distinctive point) on the large-depth image (right side).

The overlaid image appears in the bottom of the screen.



Move

Drag the reference point that has been set on the color image or large-depth image to move it.

Delete

You can delete a reference point.

Auto

Align image positions automatically.

Reset

Confirmation image will appear. When you click [Yes], the adjustment result of position alignment will be reset.

Zoom when point is added or moved.

If the checkbox is ON, the clicked position will be magnified when adding or moving a reference point.

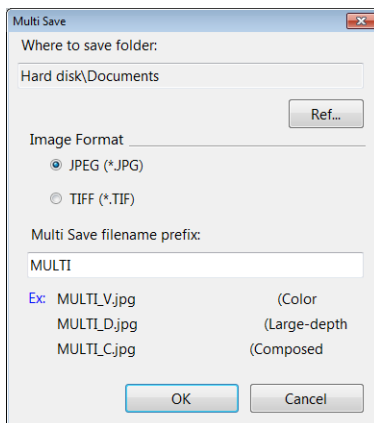
Overlap and display images when specifying corresponding points

If the checkbox is ON, the color image will be displayed as an overlay when specifying the reference point on the large-depth image.

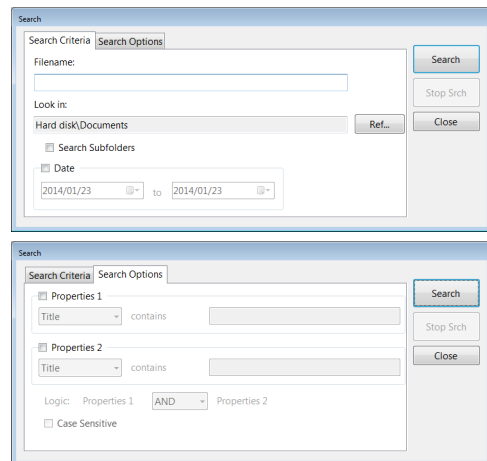
Multi Save

Saves the color image, large-depth image, overlaid image, and used for color composition separately.

Set the folder location, image format and initial characters of the file name of multi-images, and click [OK].

**Searching Files****1 Click [Search].**

This brings up the [Search] dialog box.

**2 Specify search criteria.****■ Search Criteria tab details****File name**

Enter the file name to search for.



- To search for all files that contain the specified characters, type an asterisk (*) before and after the characters. *observe*
- Manually entered file names must include the extension.

Look in:

This displays the folder to search in.

To change the location, click [Ref...] and select the desired folder.

Search Subfolders

Check this option to include the folders below the specified folder in the search.

Date

Check this option to narrow the search range to the recording date. Specify the start date and end date.

■ Search Options tab details

Properties

Check this option and select a property item, then enter the characters to search for.

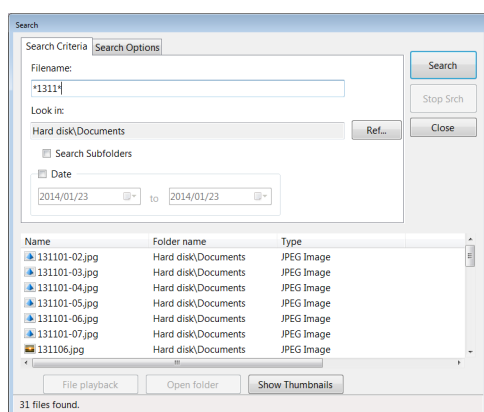
If you specify two properties, select AND (both) or OR (either).

Case Sensitive

Check this option to distinguish between upper and lower case.

3 Click [Search].

The search results will appear in the lower portion of the [Search] dialog box.



■ The following operations are available by selecting any of the files found.

File playback

Select any one of the files found and click [File playback]. The selected file will begin playing.

Open folder

To open the folder that contains a file in the search results, select the desired file and click [Open folder]. The contents of the folder will appear in the files window.

Show Thumbnails

This button will show the thumbnails of all files in the search results in the files window.



The locations that can be searched are the data folders, document folders, and the DVD/CD drive.

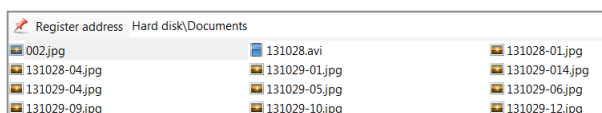
Changing the View of the Files Window

1 Click [View].



List

This view shows the filenames.



Details

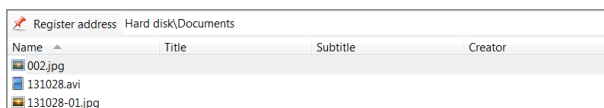
This view shows the file names with details.



The view shows the file name along with its type, size, and when it was last updated.

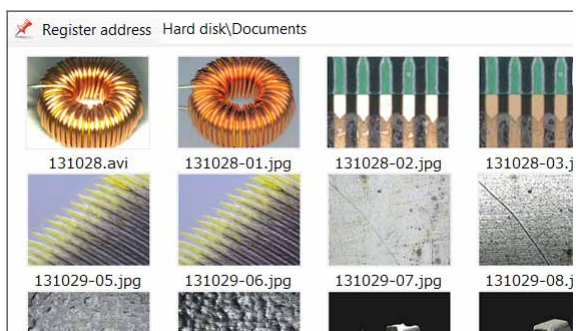
Show properties

This view shows the properties of the selected image files. The following items, if entered, are displayed: name, title, subtitle, creator, company/org., workgroup, lens name (lens type and power).



Show Thumbnails

This view displays all images in the selected folder as thumbnails.



Sort by

Select the item to sort by. A menu will appear with a choice of items you can sort by.

Ascending

The files are displayed in ascending order based on the selected "sort by" item.

Descending

The files are displayed in descending order based on the selected sort by item.

Options

1 Click [Option].



The items [Option Settings] and [Copy PC Software] appear.

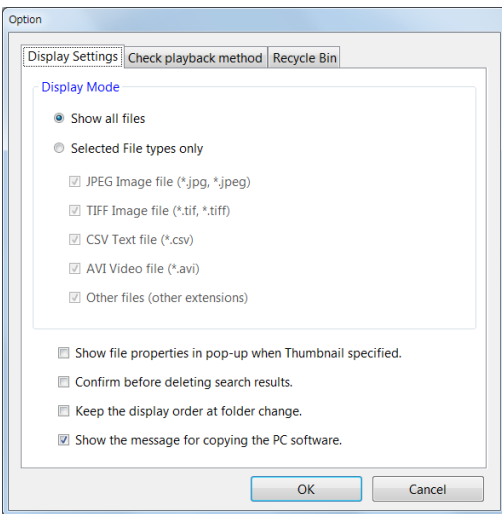
- Option Settings...
- Copy PC Software

Option Settings

Clicking Option Settings brings up the [Option] dialog box.

■ Display Settings

Specify the display settings.

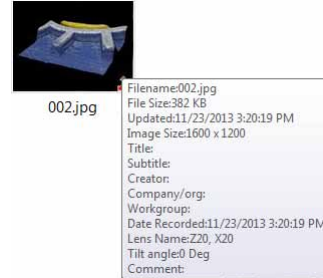


Display Mode

- Show all files
All files are displayed in the files window.
- Selected File types only
Select a feature from the [Select File type to display] options to specify the files to display in the files window.

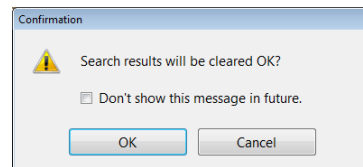
Show file properties in pop-up for the specified thumbnail.

Placing the mouse cursor over a thumbnail displays the properties for that file.



Confirm before deleting Search Results

After viewing thumbnails of the search results, navigating to another folder clears the search results. A confirmation message appears.

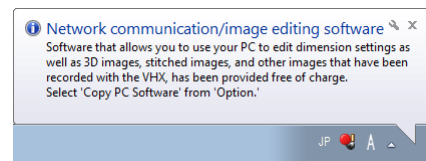


Keep the display order when navigating folders

Turn this option ON to apply the same display order to all folders.

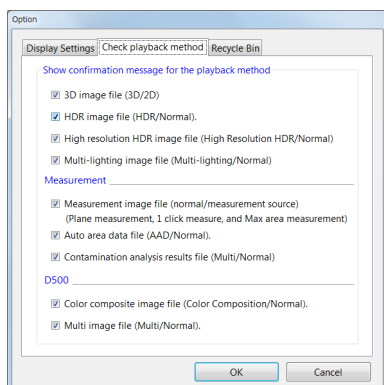
Show the message for copying the PC software

This [Copy PC Software...] message appears when you insert a memory device in the USB port.



■ Confirmation of playback method

Specify the playback settings.

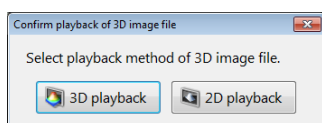


Show confirmation message for the playback method

When playing back the selected file, set whether to display the “Confirm file playback”.

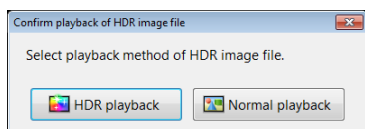
Confirm playback method of 3D image file (3D/2D)

When viewing 3D files, a message to confirm 3D playback or 2D playback appears. If this option is turned OFF, 3D playback starts automatically.



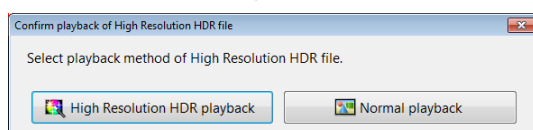
Confirm playback method of HDR image file (HDR/Normal)

When viewing HDR files, a message to confirm HDR playback or Normal playback appears. If this option is turned OFF, HDR playback starts automatically.



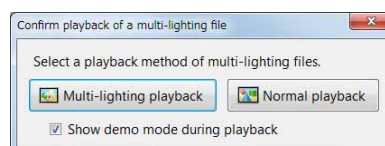
Confirm playback method of HHDR image file (HHDR/Normal)

When viewing high resolution HDR files, a message to confirm High Resolution HDR playback or Normal playback appears. If this option is turned OFF, High Resolution HDR playback starts automatically.



Confirm playback method of Multi-lighting image file (Multi-lighting/Normal)

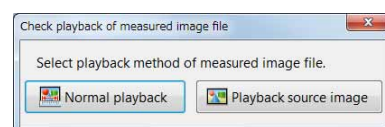
When playing multi-lighting image files, a message to confirm Multi-playback or Normal playback appears. If this option is turned OFF, multi-lighting playback starts automatically.



Measure

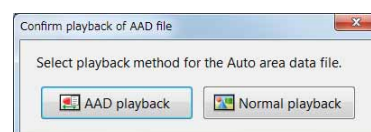
Measured image file (Measured/Source)

When playing measured image files, a message to confirm Measured-playback or Source-playback appears. If this option is turned OFF, the measured-playback starts automatically.



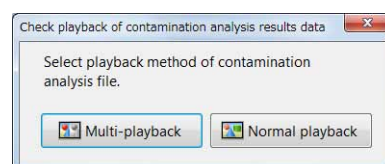
Confirm playback method of Auto Area Data file (AAD/Normal)

When playing an automatic area measurement data file, a message to confirm automatic area measurement data playback or Normal playback appears. If this option is turned OFF, the area measurement data playback starts automatically.



Contamination analysis results file (Multi/Normal)

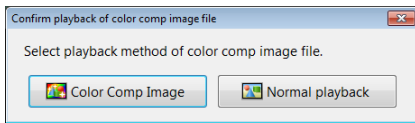
When playing contamination analysis results files, a message to confirm Multi-playback or Normal playback appears. If this option is turned OFF, the multi-playback starts automatically.



Confirm playback method of Color composition image file (Color composition/Normal)

Point This function is displayed when the VHX-D500 software has been installed.

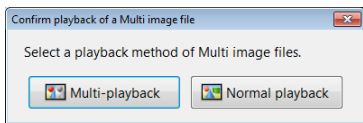
When viewing color composition image files, a message to confirm color composition playback or Normal playback appears. If this option is turned OFF, color composition playback starts automatically.



Confirm playback method of Multi image file (Multi/Normal)

Point This function is displayed when the VHX-D500 software has been installed.

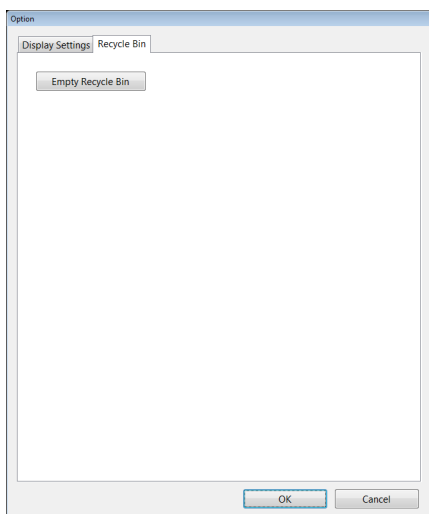
When viewing multi-image files, a message to confirm Multi-playback or Normal playback appears. If this option is turned OFF, multi-playback starts automatically.



Recycle Bin

Click on [Empty Recycle Bin] to delete the files in the recycle bin.

Point Deleted files cannot be recovered.

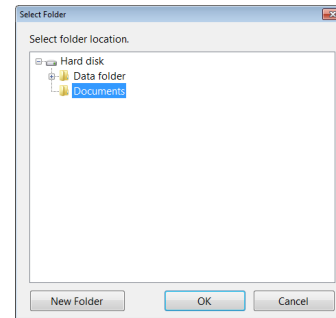


Copy PC Software

Clicking [Copy PC Software] displays the [Select Folder] dialog.

This software allows you to copy the VHX-6000 [Network Communication/Editing Application].

Select the destination folder and click [OK].



Explorer

This launches Explorer, included with Windows7.

Point The album function on this microscope treats and displays "D:\CommonData" as the "Data folder", and "D:\Personal(Computer name)\VHX_Admin\Documents" as the "Documents" folder.

If these folders are changed, the applications for the VHX-2000E may not function properly.

Report Output

This function generates images and file information using pre-formatted templates for Word and Excel. It allows you to easily create formatted reports.

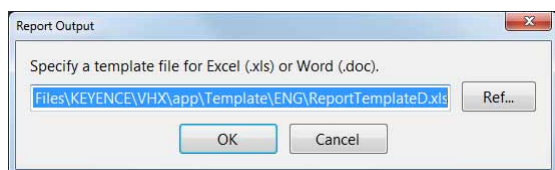
Point Word or Excel must be installed in order to use the Report Output function. Refer to "Completely disabling system protection" (Page 13-6) for details on installing these applications.

- 1 Select an image for which you wish to generate a report.
- 2 Click [Report Output].



The [Report Output] dialog box appears.

- 3 Select a template to use.



Reference Standard templates are stored in this folder.
 C:\Program Files\KEYENCE\VHX\app\Template\ENG
 You can also create and save your own templates using Word or Excel.

Point Output of multiple images is only supported in Excel. With this output format, multiple reports are included in one book. The format of the title pages of the images cannot be changed.

- 4 The application (Word or Excel) launches according to the selected template.



Quick placeholders for templates

The quick placeholders allow you to import the properties displayed for an image file in your template.

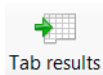
Keyword	Content displayed	VHX Image file	Non-VHX Image file	Image file with CSV data	Measure results CSV file
[image]	Image	Yes	Yes	Yes	No
[lensname]	Lens Name eg.) "VH-Z20"	Yes	No	Yes	No
[lenspower]	Lens power	Yes	No	Yes	No
[lighting]	Lighting	Yes	No	Yes	No
[title]	Title file property	Yes	No	Yes	No
[subtitle]	Subtitle file property	Yes	No	Yes	No
[creator]	Creator file property	Yes	No	Yes	No
[company]	Company/org: file property	Yes	No	Yes	No
[workgroup]	Workgroup file property	Yes	No	Yes	No
[comment]	Comment file property	Yes	No	Yes	No
[measurement]	Measure results	No	No	Yes	Yes
[datecreated]	Date recorded (date created)	Yes	Yes	Yes	Yes
[filename]	Filename	Yes	Yes	Yes	Yes
[tiltangle]	Tilt angle	Yes	No	Yes	No
[focus *]	Focus	Yes	No	Yes	No
[obsmode *]	Observation mode	Yes	No	Yes	No

Yes: this file type supports this quick placeholder.
 No: this file type does not support this quick placeholder.
 *: Available only on the images captured with VHX-D500.

Measurement Result Summary

This function combines one-click automatic measurement results in Excel.

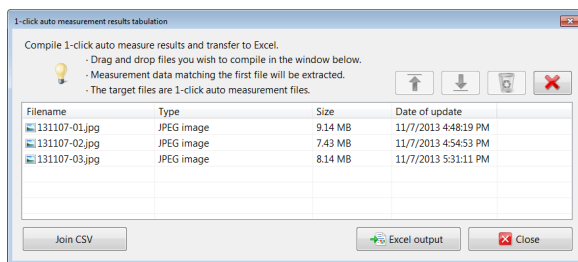
1 Click [Tab results] .



Tab results

The [1-click auto measurement results tabulation] dialog box appears.

2 Drag and drop files that were captured with the one-click automatic measurement to add them.



3 Click [Excel output].

The summary results appear in Excel.

No.	Radius	Radius	Radius	Radius	Radius	Edge Width	Edge Width	Edge Width	Count
Unit	μm	μm	μm	μm	μm	μm	μm	μm	pcs
VHX_000000.jpg	708	1060	1469	1531	703	1047	1023	2379	0
VHX_000001.jpg	712	1059	1501	1532	699	1045	1022	2341	0
VHX_000002.jpg	709	1062	1499	1564	698	1032	1019	2322	0

Reference

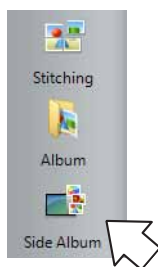
By clicking [Join CSV], measurement results of individual files added to the [1-click auto measurement results tabulation] dialog box can be saved together as a CSV file.

Side Album

The side album displays thumbnails next to the observation window. This allows you to rearrange images seamlessly without launching the album function.

Launching the Side Album

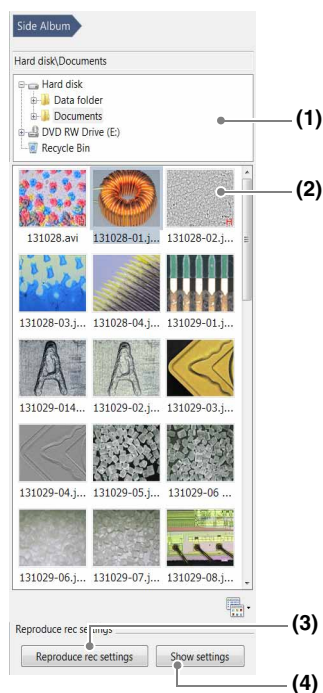
- 1 Select [Side album] from the VHX MENU.



The side album will appear on the right side of the screen.

Names and Functions

This section explains the names and functions on the side album.

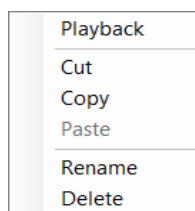


(1) Select Folder

This is a tree view of the folders on the hard disk or other storage devices.

(2) Show Thumbnails

The files in the selected folder are displayed as thumbnails. Right-click over the preview image to display a menu.



Right-click menu

- **Playback**

The image is played in the observation window as a 2D image.

The following file formats can be displayed.

JPEG, TIFF



The side album does not support 3D playback, video playback, or CSV files. These files must be played from the album (Page 6-2).

- **Cut**

Cuts the selected file.

- **Copy**

Copies the selected file.

- **Paste**

Pastes the cut/copied file.

- **Rename**

This changes the filename.

- **Delete**

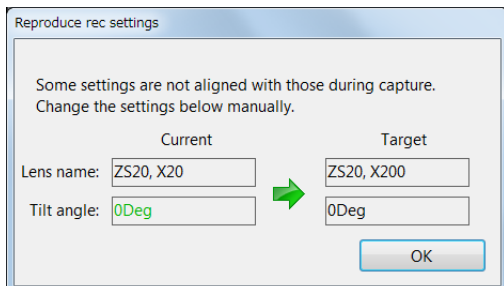
This command moves the selected folder or file to the recycle bin.

(3) Load recording settings

The settings used during recording can be applied to the observed image.

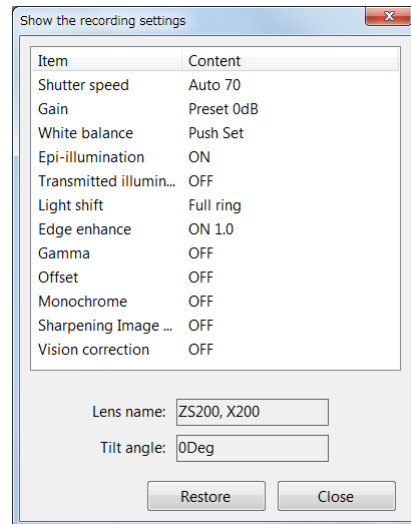
Only the settings shown in the [ShwSettingInfo] dialog can be applied.

If the lens, magnification, or tilt angle is different, a dialog box to ask to adjust the settings will appear.



(4) Show the recording settings

This shows the settings used when the image was recorded. Click [Restore] to load the recording settings.



Playing Images

The following methods can be used to play back selected files.

- Click [Playback] from the mouse right-click menu.
- Double-click over the preview image.
- Drag and drop the image to observe onto the observation window.

Chapter 7

Improving Images

Improving Image Quality

This chapter explains how to improve images easily.

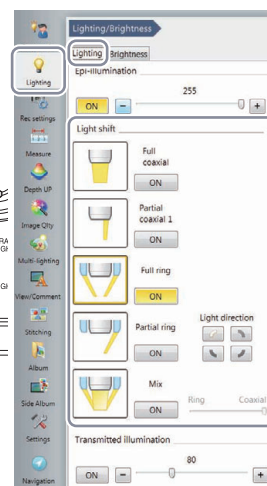
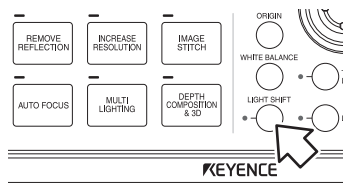
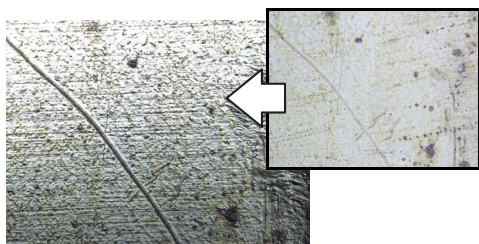
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Changing the Lighting Method	Page 7-2
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Changing Lighting Method (Switching Lighting)

Changing the Lighting Method

By changing how the light is applied, height differences of the object becomes more noticeable and clearer observation is possible.

Press the [LIGHT SHIFT] button on the console, or click [Lighting] from the VHX MENU, select the [Lighting] tab and click a lighting method.



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Improving Images

Illumination differences with different lenses and options

The illumination selections may differ depending on the lens and options used. Lenses and lighting available for the microscope are as follows.

Available lighting for each lens

Lens	Ring light unit	Lighting type				
VH-Z00R/W/T	-	Full ring	Partial ring	-	-	
VH-Z20R/W/T	-	Full ring	Partial ring	-	-	
VH-Z20UR/W/T	-	Full coaxial	Partial ring	Full ring	Mix	
VH-Z100R/W/T	Not attached	Full coaxial	Partial coaxial 1	Partial coaxial 2	-	
	Attached	Full coaxial	Partial coaxial 1	Full ring	Partial ring	Mix
VH-Z100UR/W/T	Not attached	Full coaxial	Partial coaxial 1	Partial coaxial 2	-	
	Attached	Full coaxial	Partial coaxial	Full ring	Mix	
VH-Z250R/W/T	-	Full coaxial	Full ring	-	-	
VH-Z500R/W/T	-	Full coaxial	Partial coaxial 1	Partial coaxial 2	-	
VH-Z50L/W/T	Not attached	Full coaxial	Partial coaxial 1	Partial coaxial 2	-	
	Attached	Full coaxial	Partial coaxial 1	Full ring	Partial ring	Mix
VH-ZST	-	Full coaxial	Partial coaxial 1	Full ring	Partial ring	Mix

Point

- To use ring light at VH-Z100R/W/T or VH-Z100UR/W/T, ring light unit (OP-88164) is required.
- To use ring light with VH-Z50L/W/T, the Z50 ring light unit (OP-88135) is required.

■ Lighting available at VHX-6000 and features

Lighting		Feature
	Full ring	Observation in dark field is possible.
	Partial ring	Observation in partial dark field is possible to emphasize height differences such as scratches. Four types of light directions can be selected.
	Full coaxial	Observation in bright field is possible.
	Partial coaxial 1	Observation in partial bright field is possible to emphasize height differences such as scratches.
	Partial coaxial 2	Observation in bright field with the brightness of center being reduced is possible.
	Mix	Mixing condition of Full ring and Full coaxial can be adjusted.
	Coaxial 2 *	Lighting method varies according to the fiber cable used. General lighting: Full coaxial Lighting when using base unit: Mixing of Ring and Full coaxial
	Coaxial 1 *	Lighting method varies according to the fiber cable used. General lighting: Partial coaxial 1 Lighting when using base unit: Partial ring
	Ring *	Lighting method varies according to the fiber cable used. General lighting: Partial coaxial 2
	Partial coaxial 2 *	Lighting when using base unit: Ring

* Displayed when using previously available fiber cables.

Change illumination direction (Multi-lighting)

You can change the direction of illumination and observe fine features that cannot be seen usually. The light direction can be changed later, which allows you to find defects after capture.

Multi-lighting

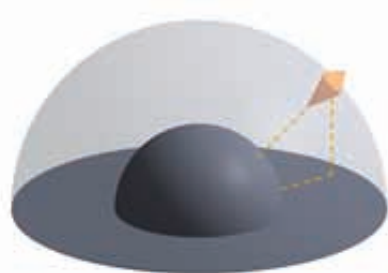
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Improving Images



This function can freely change the direction of illumination after recording.

This function allows you to observe changes in details that could not be seen before.



The multi-lighting can be combined with other imaging features.

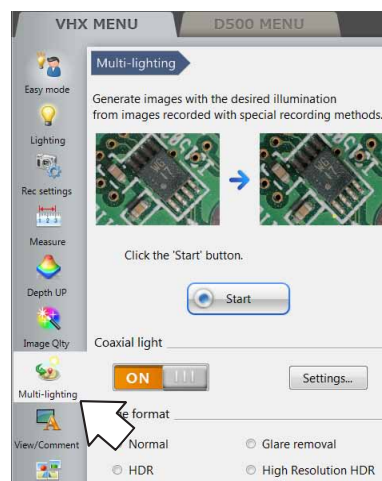
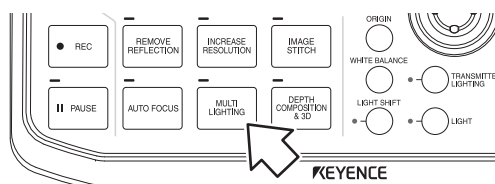
Image format: Normal, Glare removal, HDR, and High Resolution HDR

Type of lighting: Full coaxial, Partial coaxial, Combined, and Ring illumination

Depth Composition: With or Without

Start multi-lighting

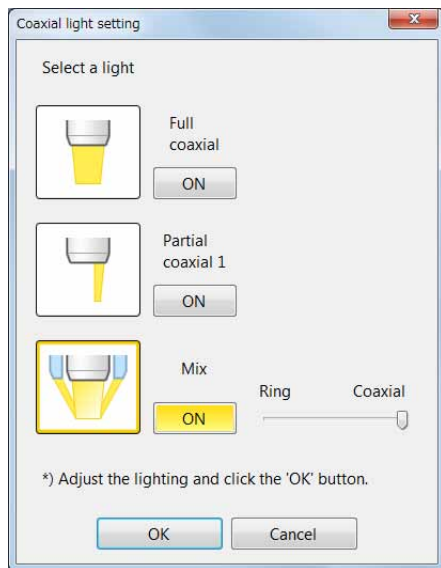
- 1 Press the [MULTI-LIGHTING] button on the console, or click [Multi-lighting] from the VHX menu.



2 Select a lighting type.

To change the lighting type, click [Settings] to show the [Coaxial light setting] dialog box.

To select other than the ring illumination when observing an object from straight above, turn the [Coaxial illumination] ON and press [Settings] to select an lighting type. For mixed illumination, also adjust the balance between ring and coaxial illumination.



For the full coaxial and mix illuminations, images may appear brighter than those with normal ring illumination. Therefore, use the brightness dial of the console to adjust the brightness properly.

3 Select [Image format] and click [Start].

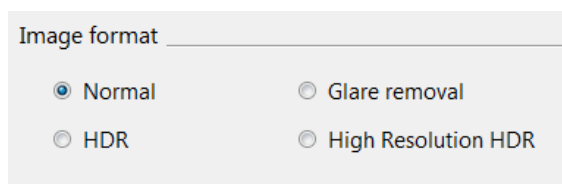


Image format

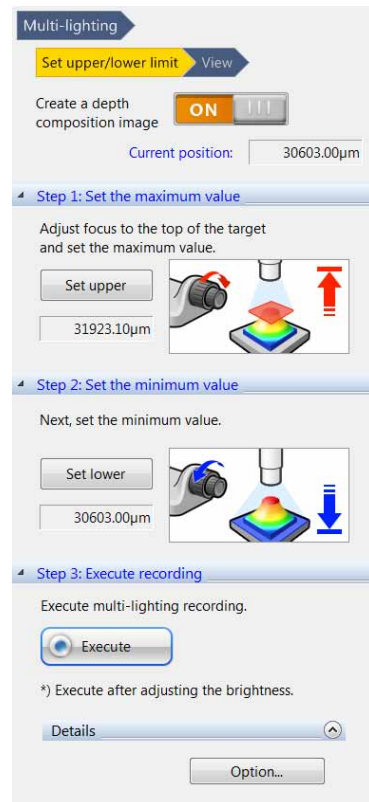
Generally, [Normal] is selected. To make height differences and gradation of surface clearer, select [HDR] (Page 7-7). To perform composition while suppressing glare, select [Glare removal] (Page 7-11).

Reference Because the multi-lighting function is used with the illumination methods switched, white balance must be adjusted properly for each illumination method. If no white balance is adjusted, press the [WHITE BALANCE] button to set.

4 Specify upper and lower limit.

If a part of image is out of focus, depth composition can also be applied.

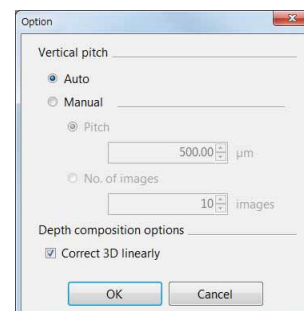
If the depth composition is required, turn [Create a depth composition image] ON.



Move the FOCUS dial up and down to the upper limit of the object, and click [Set upper].

Then, move to the lower limit of the object, and click [Set lower].

Reference The behavior of depth composition can be tuned finely by selecting an option. The Manual operation allows you to specify the vertical pitch and the number of images to be composed. When the object is tilted or has very few patterns, turning the 3D liner correction ON makes it easier to compose the objects.

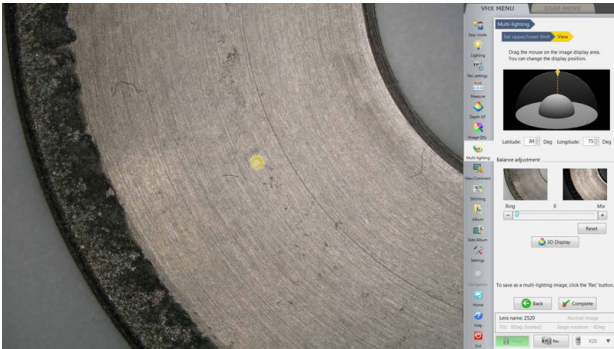


5 Click [Exec Comp].

The multi-lighting will start.

When creating depth composition images, the depth composition is done for each illumination direction.

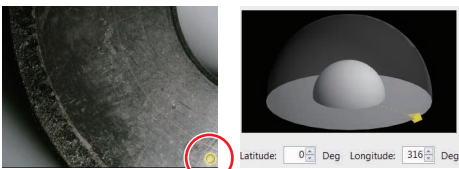
Checking results



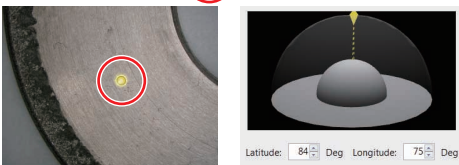
■ Illumination directions

Clicking the image changes the illumination direction.

The illumination indicator provides a reference for the direction of illumination.



Clicking the lower right of the screen shows an image



Clicking the center of the screen shows an image illuminated

■ Type of illuminations



An image illuminated from straight above can be converted to the full coaxial or coaxial combined illumination image.

The rate of composition of the ring and the full coaxial illuminations can be selected by moving the slider.

■ Others

Clicking “Reset” will reset the illumination to the initial state.

Clicking [Complete] moves the screen to the still image status.

Some operations such as measurement can be performed for the recorded images.

Clicking [Record] records images together with the multi-lighting information.

Playback from the album allows you to check results with different illumination direction.

Enhancing Resolution and Increasing Gradation

Parts that are difficult to inspect under normal observation can be observed in great detail with the high resolution HDR function.

About HDR

The HDR function captures multiple frames of an image in varying degrees of brightness by varying the shutter speed. These are composed into a single high-resolution image. Capturing a broader brightness spectrum provides better observation of objects that cause glare. It also increases the level of detail seen in the image by increasing the levels of color gradation.

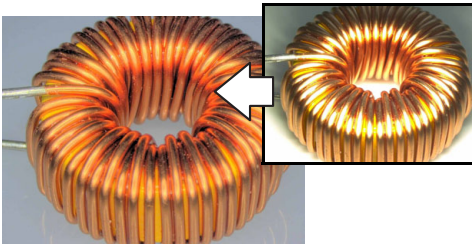


Point

The HDR function cannot be used with the following functions. Cancel these functions before using the HDR function:
Glare removal, Shake correction mode, non-normal recording sizes.

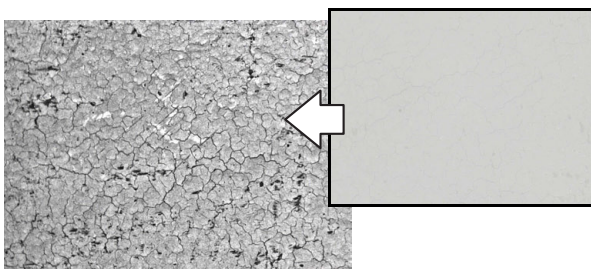
<Objects that cause glare>

[Coil (20x)]



<Objects with few gradation levels.>

[Inkjet paper (300x)]



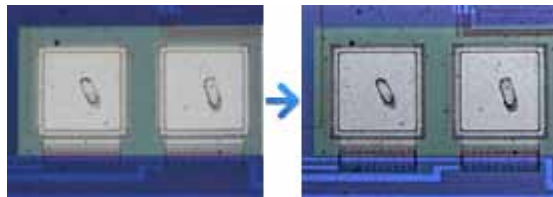
About high resolution HDR

With high resolution observation and the HDR function together, details that are too small to be seen under normal optical observation can be observed.



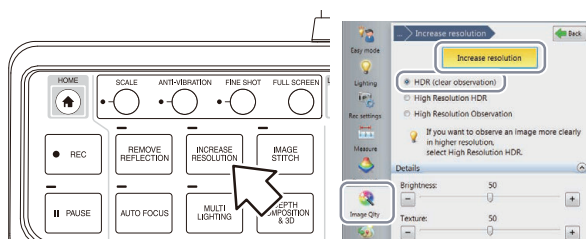
About high resolution Observation

Acquiring sharpen images than normal by employing the shortest wavelength of visible light, blue light.



HDR Settings

- 1 Adjust the position of the object to be observed and adjust the focus.**
 📖 "Adjusting the Brightness and Focus" (Page 3-4)
- 2 Press the [INCREASE RESOLUTION] button on the console. Or, click the [Image Qlty] from the VHX MENU and click [Increase resolution]. Select [HDR (clear observation)] as an effect.**



The HDR image appears in the observation window and the [Details] menu appears.

- 3 Drag the sliders left or right as needed to adjust each item.**

Brightness:

Adjusts the image brightness.

Texture:

Adjusts the image texture.

Contrast:

Adjusts the contrast of the image.

Color:

Adjusts the color intensity of the image.

Retain setting values:

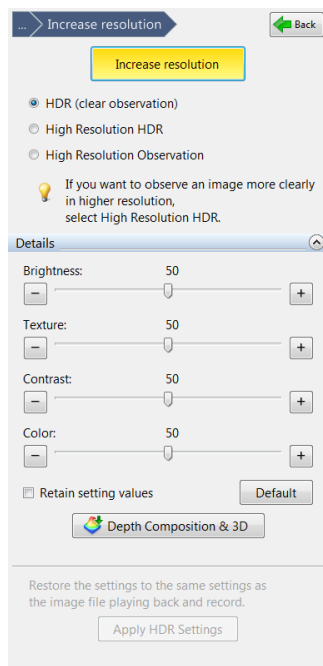
The HDR parameters are held even after the High Resolution HDR and HDR functions are terminated.

[Default] button

Clicking the default button returns the settings to the automatically set values.

[Depth Composition & 3D] button

This produces a Quick Composition and 3D (Page 10-4) display using the HDR image.



[Apply HDR Settings] button

This allows the user to apply previously used HDR settings onto a new image.

1. Set a new target on the stage for observation.
2. Play (Page 6-7) the HDR image with the desired settings using the album function and click the [Apply HDR Settings] button. Images will now be recorded with the same settings.

! Point These functions are only available when HDR files are played from the album.

Saving HDR images

- 1 Press the [REC] button or click [Rec] from the on-screen menu options.**

The [Rec] dialog box appears.

- 2 Select the [Save HDR Info] check box.**

Select the folder where to save the data, enter the filename, and click [Save].

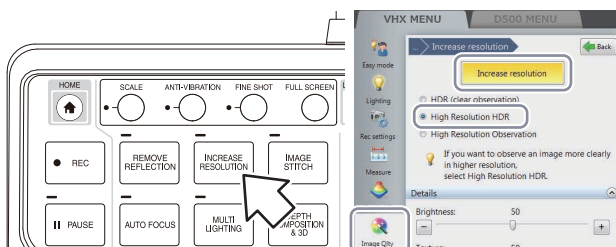
Releasing the HDR function

Press the [INCREASE RESOLUTION] button on the console or click [Increase resolution] from the VHX MENU again to release the activated state (yellow).

! Point While the HDR function is in effect, some features will not be available.

High resolution HDR Observation Settings

- 1 Adjust the position of the object to be observed and adjust the focus.
 [Book icon] "Adjusting the Brightness and Focus" (Page 3-4)
- 2 Press the [INCREASE RESOLUTION] button on the console.
 Or, click the [Image Qty] from the VHX MENU and click [Increase resolution]. Select [High Resolution HDR] as an effect.



The high resolution HDR image appears in the observation window and the "Details" menu appears.

- 3 Drag the sliders left or right as needed to adjust each item.

Brightness

Adjusts the image brightness.

Texture

Adjusts the image texture.

Contrast

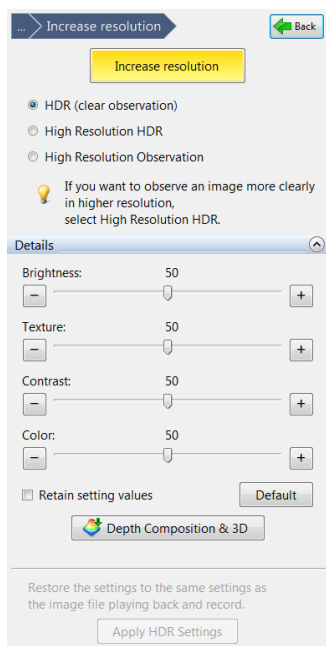
Adjusts the contrast of the image.

Color

Adjusts the color intensity of the image.

Retain setting values:

The HDR parameters are held even after the High Resolution HDR and HDR functions are terminated.



[Default] button

Clicking the default button returns the settings to the automatically set values.

[Depth Composition & 3D] button

This produces a Quick Composition and 3D (Page 10-4) display using the high resolution HDR image.

[Apply HDR Settings] button

This allows the user to apply previously used high resolution HDR settings to a new image.

1. Set a new target on the stage for observation.
2. Play (Page 6-7) the high resolution HDR image with the desired settings using the album function and click the [Apply HDR Settings] button. Images will be recorded with the same settings.

Point These functions are only available when high resolution HDR files are played from the album.

Saving high resolution HDR images

- 1 Press the [REC] button on the console or click [Rec] from the on-screen menu options.
 The [Rec] dialog box appears.
- 2 Check the [Save HHDR data] check box. Select the folder where to save the data, enter the filename, and click [Save].

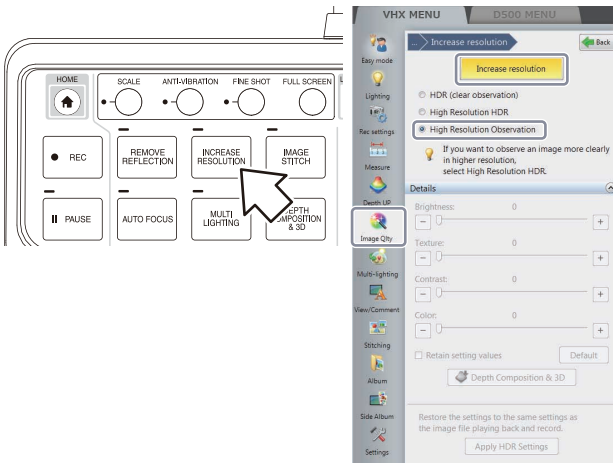
Releasing the high resolution HDR

Click [Increase resolution] from the VHX MENU again to deactivate the state (yellow) being selected.

Point While the high resolution HDR function is in effect, some features will not be available.

High resolution Observation Settings

- 1 Adjust the position of the object to be observed and adjust the focus.
 1 "Adjusting the Brightness and Focus" (Page 3-4)
- 2 Press the [INCREASE RESOLUTION] button on the console.
 Or, click the [Image Qlty] from the VHX MENU and click [Increase resolution]. Select [High Resolution Observation] as an effect.



The high resolution image appears in the observation window.

Saving high resolution images

- 1 Press the [REC] button on the console or click [Rec] from the on-screen menu options.
 The [Rec] dialog box appears.
- 2 Select the folder where to save the data, enter the filename, and click [Save].

Releasing the high resolution observation

Click [Increase resolution] from the VHX MENU again to release the activated state (yellow).

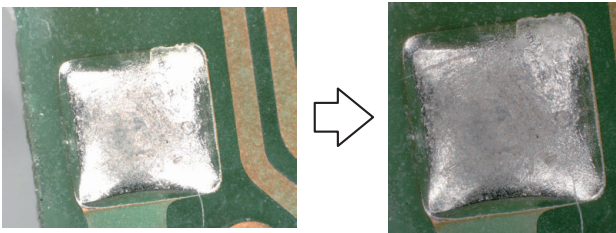
Point While the high resolution observation is in effect, some features will not be available.

Removing Glare (Reflected light removal)

This function easily removes glare from an object that reflects light heavily.

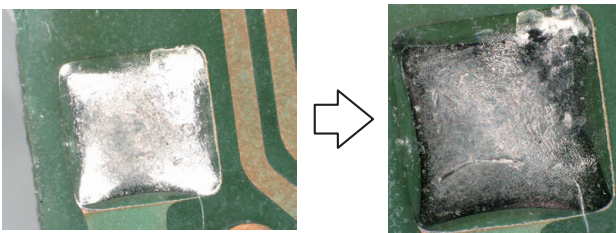
Point This function cannot be used together with the following functions.
HDR function, non-normal Rec sizes.

Glare removal



This function prevents a part of image from becoming excessively bright by composing multiple images having different sensitivities.

Ring removal

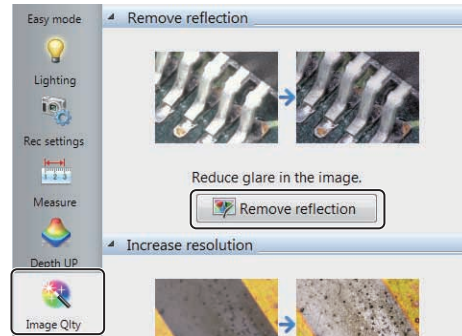


This function prevents a part of image from becoming excessively bright by composing multiple images with varying directions of ring illumination. Depending on the objects, this function may provide clearer images than those with the glare elimination. This function cannot be used with lens provided only with full coaxial illumination.

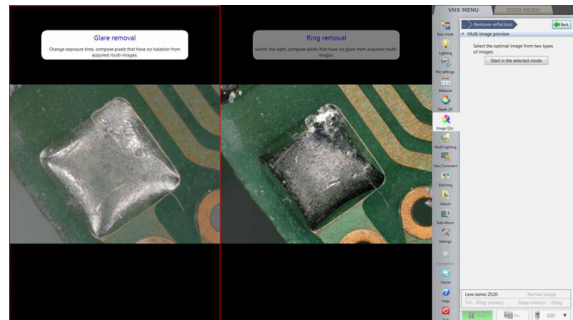
Remove Reflection Settings

Start from VHX MENU

1 Click the [Image Qty] from the VHX MENU and click [Remove reflection].

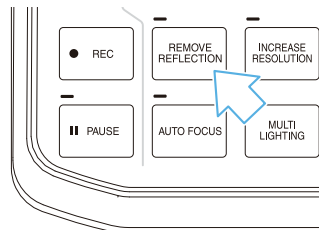


2 The screen for selecting the Glare removal or the Ring removal appears. Select the image that provides the best reduction in glare for your purpose.



Start from console

1 Press the [REMOVE REFLECTION] button on the console.



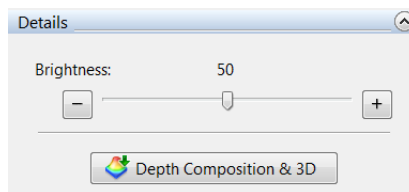
Either [Glare removal] or [Ring removal] will be activated, depending on your selection.

Deactivating “reflected light removal”

Press the [REMOVE REFLECTION] button on the console again, or click [Remove reflection] from the VHX MENU again to deactivate the current state.

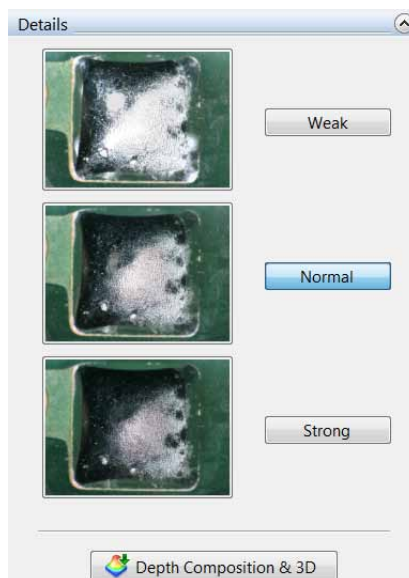
Adjusting reflected light removal

Adjusting glare removal



Moving the brightness slider can adjust the brightness.

Adjusting ring elimination



Effect level can be selected.

The ring elimination is shown with a still image and the image is renewed every time when the stage movement is detected.

When manual XY stage is used, press the [One shot] button to renew the image.

Depth Composition & 3D

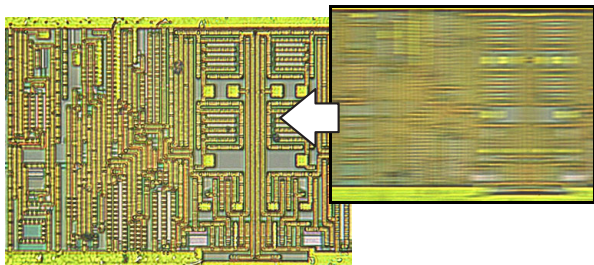
In addition to the effect of the reflected light removal, the depth composition & 3D function can be performed. For details, refer to "Depth Composition and 3D View" (Page 10-1).

Reducing the Effects of Vibration (Anti-vibration Mode)

This function corrects the shakiness that occurs when observing at high magnification or when performing hand-held observation.

Point Shake correction cannot be used with the depth composition function. Cancel these functions before using shake correction.

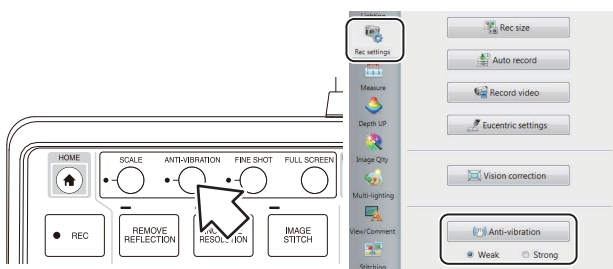
[IC pattern (3000x)]



Anti-vibration mode Settings

Press the [ANTI-VIBRATION] button on the console. You can also go through the VHX MENU, click [Rec settings] and click [Anti-vibration mode].

During the shake correction mode, a white frame appears at the observation window perimeter. Select a shake correction "Weak/Strong" according to the observation conditions.



Releasing [Anti-vibration mode]

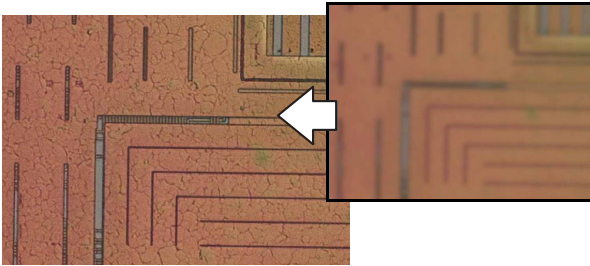
Press the [ANTI-VIBRATION] button on the console or click [Anti-vibration] from the VHX MENU again to release the activated state.

Record fine images (Fine shot)

This function increases sharpness of images to record finer images with consideration for properties of the lens.

This function is most effective at a higher magnification area.

[Sensor (x1000)]

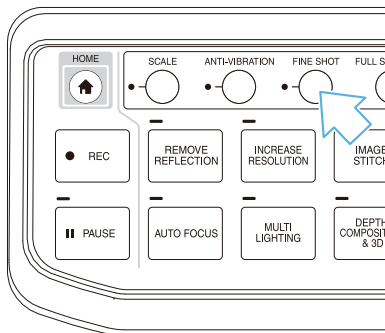


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Improving Images

Fine shot Settings

- 1 Press the [FINE SHOT] button on the console.



- 2 Pressing the [REC] button or the [PAUSE] button shows images with the fine shot effects added.

The fine shot function does not work for video capture.

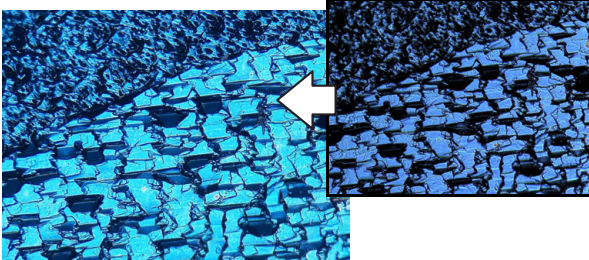
Deactivation of fine shot

Press the [FINE SHOT] button on the console again.

Enhance Contours in Vivid Color (Sharpening Image Mode)

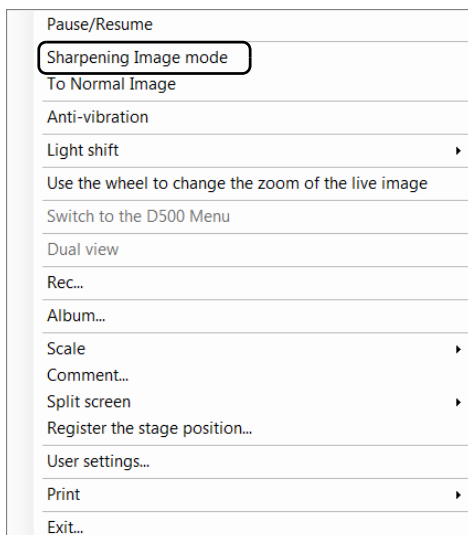
This function enhances contours in vivid color.

[Solar battery cell (500x)]



Sharpening Image Mode Settings

Right-click the mouse over the observation window and click [Sharpening Image mode] from the pop up menu.



This applies vivid color enhancements and profile emphasis to the image.

Releasing [Sharpening Image mode]

From the right-click menu, click [Sharpening Image mode] again, or click [To Normal Image].

Selecting an Image from 9 Different Settings (Optimize)

This feature presents the image under 9 different settings in a 9-way split screen. It allows you to select the setting (processing) best suited to the application. Selecting the image selects the most effective setting.

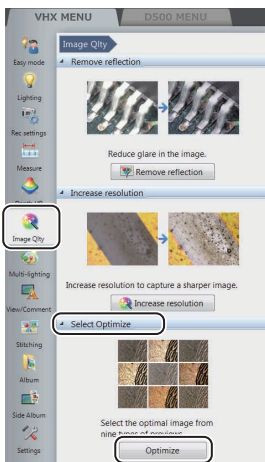
Selecting the Best Image

Point All images are displayed in normal (1600 x 1200) resolution even if the recording size (Page 5-5) is not set to normal.

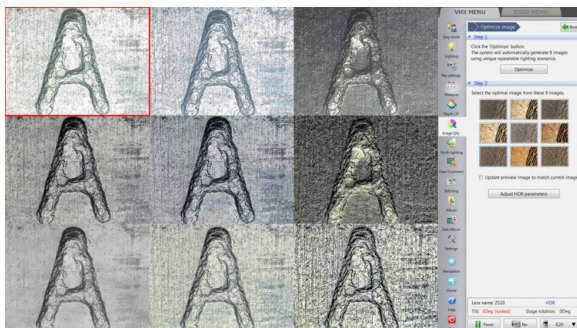
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Improving Images

- 1 Adjust the brightness, magnification, and focus.
 - ☞ "Adjusting the Brightness and Focus" (Page 3-4)
- 2 Click the [Image Qlty] from the VHX MENU and click [Optimize] from the [Select optimal image] tab.



The image is displayed in the observation window and operation view under 9 different settings.

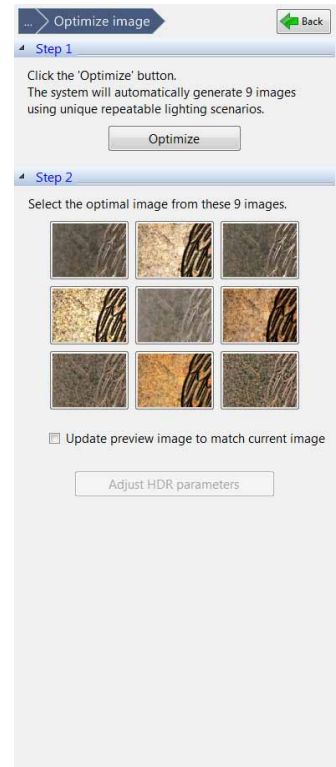


Reference To display the observed image on the side icons of images in the operation view, check the [Update the image on the button with the image that was last executed] option of side icon images.

3 Double-click the best image in the observation window.

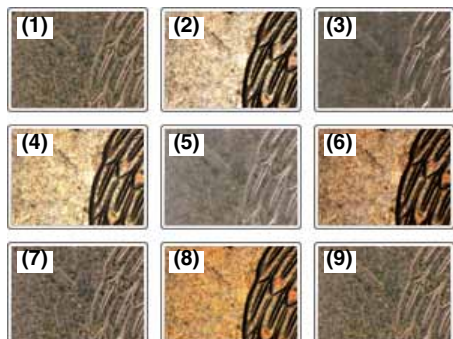
This displays the image in the full area of the window.

- Clicking one of the nine images on the [Optimize] tab displays the observed image using those settings.



Reference Clicking an HDR image enables the [Adjust HDR parameters] button under [HDR].
 ☞ "Enhancing Resolution and Increasing Gradation" (Page 7-7)

Settings of the 9 image types



(1) Normal mode

For observing using normal settings.

(2) Normal mode + Light shift (Page 7-2)

For observing with partial illumination. This emphasizes the minute height differences on the object.

(3) Sharpening Image mode (Page 7-15)

For observing with vivid color enhancements and profile emphasis.

(4) Sharpening image mode + Light shift

For observing with partial illumination. This emphasizes the minute height differences on the object and allows observing with vivid color enhancements and profile emphasis.

(5) Glare removal (Page 7-11)

Removes glare caused by reflected light from the target object.

(6) Glare removal + Light shift

For observing with partial illumination and removing glare caused by reflected light from the target object.

(7) HDR (clear image)

The HDR function is used to increase the texture on samples with bright spots or dark spots or low contrast samples.

(8) HDR (clear image) + Light shift

For observing in high dynamic range with partial illumination. The lighting increases the gradation levels, making it easier to observe minute height differences.

(9) High Resolution HDR (Page 7-7)

For observing a surface in detail by using HDR observation and High resolution observation together.

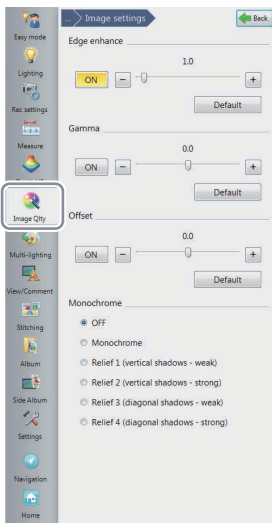
Reference When using VHX-6020, (9) is a monochrome image.

Image Settings

This section explains how to apply the image enhancement effects manually to improve image quality. The items that can be set manually are: edge enhancement, gamma correction, offset, and monochrome settings.

Image Setting Procedures

1 Click [Image settings] of [Image Qlty] from the VHX MENU.



2 Click "ON" of the items to enable and drag the slide bars to adjust their effect.

Releasing the image settings

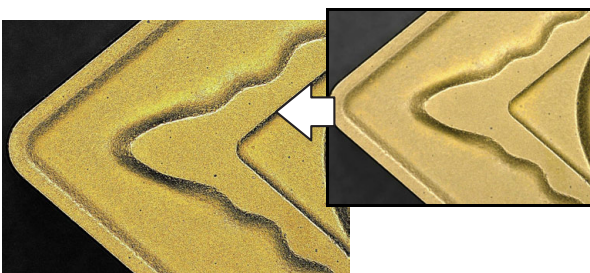
Click [ON] of each item to release the activated state (yellow). For the Monochrome/Relief effect, select OFF.

Edge enhance

This section explains the edge enhancement effect. Edge enhance makes scratches and minute features more noticeable by emphasizing the edges in the image.

Point Edge enhance function cannot be used together with the relief function of "enhancement effect".

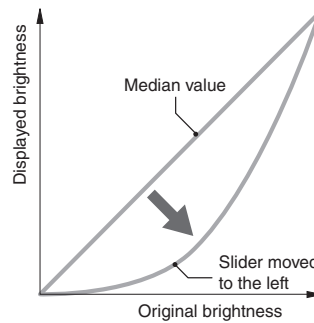
This shows the effects of edge enhancement.



Gamma correction

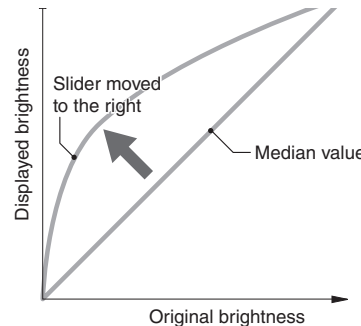
This section explains how the gamma correction corrects the contrast of the light or dark areas of an image.

Gamma correction works as follows:



Dragging the slider to the left emphasizes the contrast and gradation of the bright areas.

- This is useful for increasing the contrast of images that appear saturated white or lack gray-scale definition because they are too light.



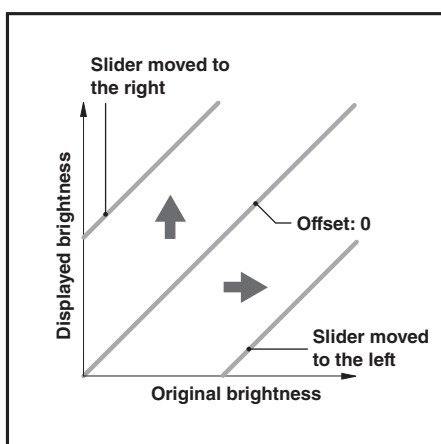
Dragging the slider to the right emphasizes the contrast and gradation of the dark areas.

- This is useful for increasing the contrast of images that lack gray-scale definition because they are too dark.

Offset adjustment

This section explains how offset adjusts the brightness and darkness of the overall image.

Offset adjustment works as follows:

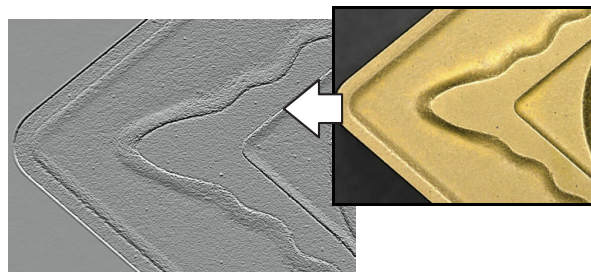


Dragging the slider to the right makes the overall image brighter (whiter).

Dragging it to the left makes the overall image darker (blackier).

Monochrome/Relief

This section explains the special monochrome and relief effects.



[Relief2]

The features of the effects are as follows.

■ Monochrome

This effect allows observation without the influences of color.



Point

The monochrome effect is only applied to the image observed by the camera. Image files saved in color can be processed with the monochrome effect, but not displayed in monochrome.

■ Relief

The relief effect highlights areas of the image where the brightness changes, making it easy to observe scratches and minute features.

Relief1	Displays the shadow from above and below (weak)
Relief2	Displays the shadow from above and below (strong)
Relief3	Displays the shadow from an angle (weak)
Relief4	Displays the shadow from an angle (strong)

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Improving Images

Chapter 8


Setting Image Views

This chapter explains how to use Split Screen, Full Screen, and Digital Zoom.

Split Screen.....	Page 8-2
Types of Split Screens.....	Page 8-2
Using the Split Screen	Page 8-3
Comparing Two Images	Page 8-3
Full Screen Image/Vision Correction Mode.....	Page 8-4
Full Screen Image	Page 8-4
Vision correction mode	Page 8-4
Enlarging the Image (Digital Zoom)	Page 8-5
Navigation	Page 8-6
Creating Navigation.....	Page 8-6
Specifying Observation Position on Navigation Image	Page 8-7
Moving vertically and horizontally	Page 8-7
Registering a Stage Position	Page 8-7
Recording registered positions in batch	Page 8-8

Split Screen


The observation window can be displayed as split screens. This allows you to view micro and macro view images of the target side by side, or compare a saved image to a live image side by side.

 **Point** Only one of the split screens can be used for viewing the live observation screen.

Types of Split Screens

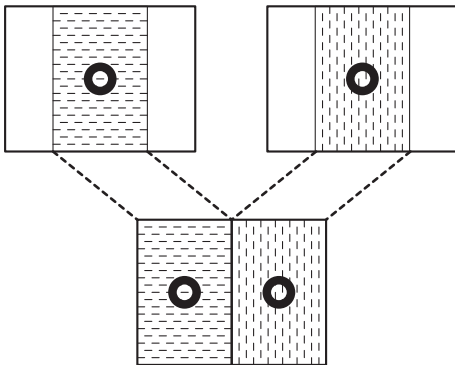
There are four split screen types: vertical split, horizontal split, quarter split, and ninth split. Split screens can be printed and saved.

 "Recording/Saving Still Images" (Page 5-2)

 "Printing" (Page 12-3)

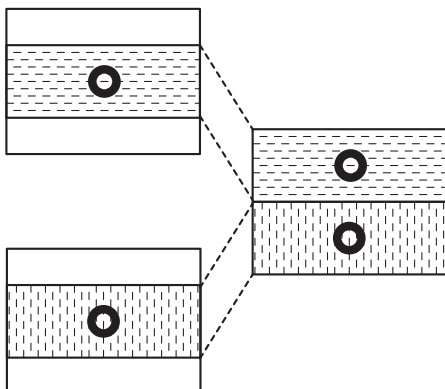
Vertical Split

This tiles the screen on the left and right. Each screen displays 50% of their respective observation images from the center. In the paused state, you can zoom in/out an image with a mouse wheel and can change the display position by dragging an image.



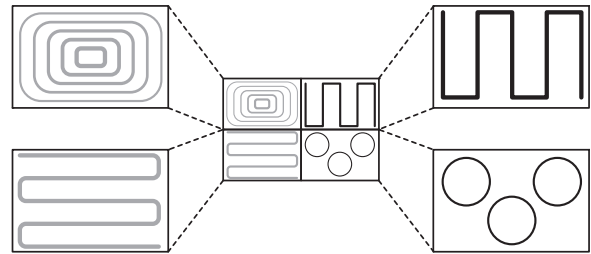
Horizontal Split

This tiles the screen on the top and bottom. Each screen displays 50% of their respective observation images from the center. In the paused state, you can zoom in/out an image with a mouse wheel and can change the display position by dragging an image.



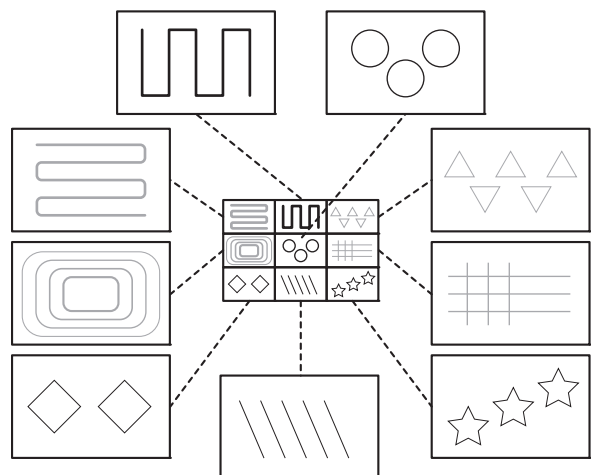
Quarter Split

This tiles the screen into four portions. The overall image is reduced to a fourth and displayed. In the paused state, you can zoom in/out an image with a mouse wheel and can change the display position by dragging an image.



Ninth Split

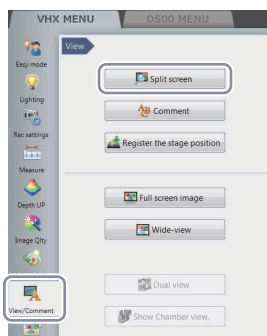
This tiles the screen into nine portions. The overall image is reduced to a ninth and displayed. In the paused state, you can zoom in/out an image with a mouse wheel and can change the display position by dragging an image.



Using the Split Screen

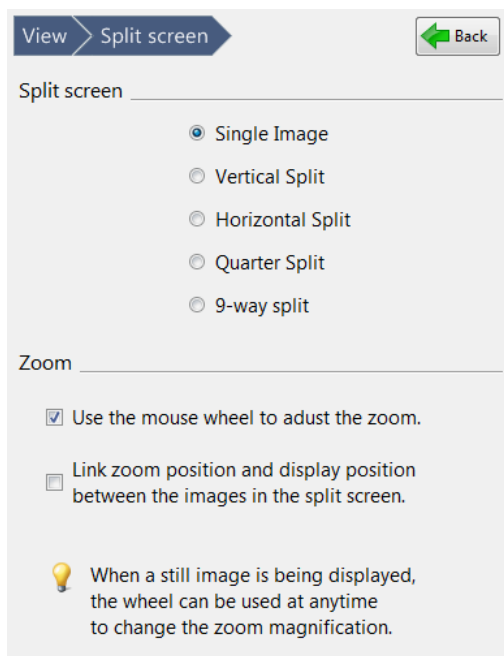
- 1 Click [View/Comment] from the VHX MENU and click [Split screen].

The Split/Display menu appears.



- 2 Select the type of split screen.

This splits the screen. If a half split is selected, the left (or top) screen shows the center portion of the original image. For a quarter split (or 9-way split), the upper left of the screen shows the entire original image reduced to a fourth (or a ninth).



- Reference**
- Checking at [Link zoom position and display position between the images in the split screen.] is valid only when normal size (1600x1200) images are displayed in all screens.
 - During the zoom view, you can move the display area at the [Wide-view] dialog box.

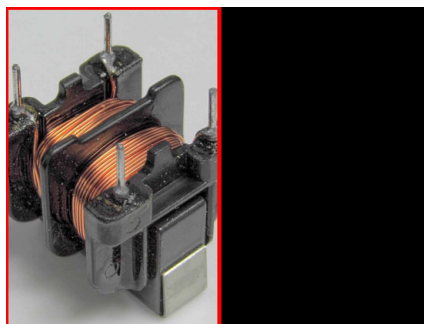
Comparing Two Images

This section explains how to observe and compare two images using the vertical split.

Comparing two views of the currently displayed image

- 1 Select [Vertical Split] on the split screen tab.

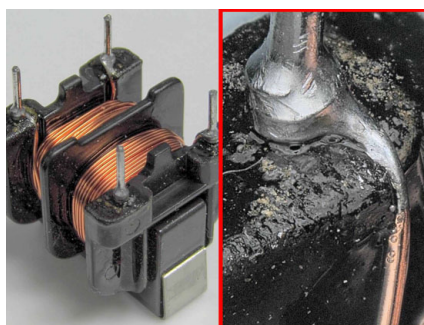
This tiles the screen on the left and right. The center portion of the original image is shown in the left screen. A red frame appears in the left screen to indicate the region under control.



- 2 Click the right screen (black screen).

This selects the right screen. The left screen changes to a still image while the right screen starts displaying the live video image (the observation window).

- 3 Display the image to compare against on the right screen.



- Reference**
- When clicking the left screen, the right screen changes to a paused image. The image inside the red frame is the target of control. When clicking the [Pause] from on-screen menu options or [Pause/Cancel Pause] at the right-click menu, the screen returns to the live observation screen.
 - To exit the split screen, select [Single Image] from the [Split screen] heading.

Comparing against a saved image

Split the screen and select an image from the album. You can also select and compare two stored images using both left and right screens.

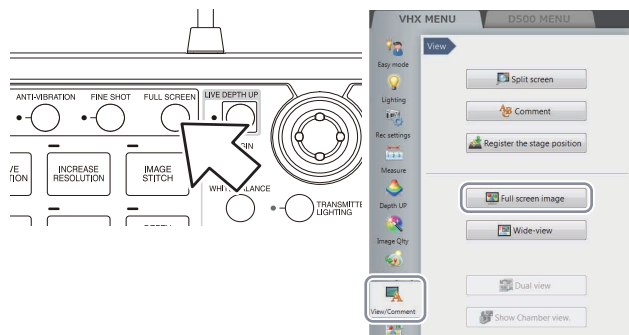
Full Screen Image/Vision Correction Mode

Full Screen Image

The VHX MENU on the right side of the screen can be closed to allow the observation window to occupy the entire screen.

Displaying a full screen image

- 1 Press the [FULL SCREEN] button on the console, or click [View/Comment] from the VHX MENU and click [Full screen image].



The observation window will expand to occupy all 1920 x 1080 pixels of the entire screen.

Reference The right-click menu enables you to pause, cancel pause, and record images while the full screen is shown.

Pause/Resume
Sharpening Image mode To Normal Image
Anti-vibration
Light shift
Use the wheel to change the zoom of the live image
Switch to the D500 Menu
Dual view
Rec...

- The following operations can be done through the console while the full screen image is showing.
 - Live Depth Composition
 - Depth Composition & 3D
 - Reflected light removal
 - Resolution increase

Canceling the full screen image

Press the [FULL SCREEN] button on the console while the full screen image is showing, or click the X in the upper right of the screen.

Vision correction mode

Images are 1600 x 1200 pixels. However, they are compressed to fit the resolution when being shown on the display. Those compressed images are corrected so the number of pixels of original images and images on display are the same (1 element pixel = 1 pixel on the display).

Activating vision correction mode

- 1 Click [Rec settings] from the VHX MENU and click [Vision correction].



The [Vision correction] button turns yellow and the corrected image appears in the observation window.

Canceling vision correction mode

Click [Vision correction] again to release the activated state (yellow). The normal image appears in the observation window.

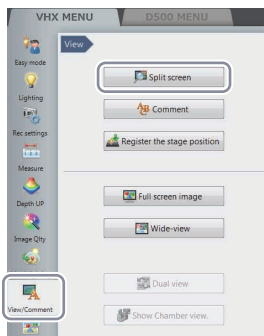
Enlarging the Image (Digital Zoom)

This function digitally enlarges the currently displayed image. This allows the image to be observed while it is enlarged.

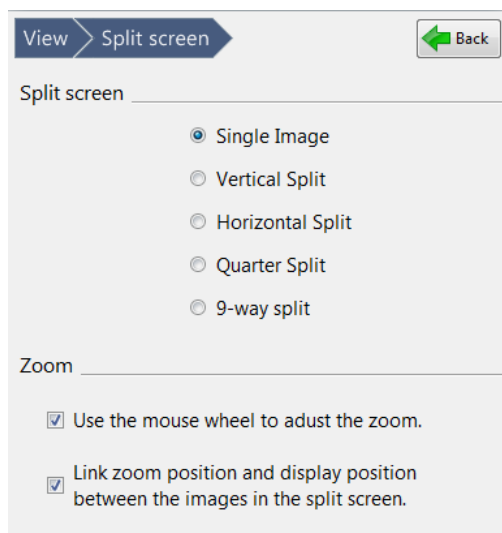
Point The screen will become grainy as you increase the zoom factor. To obtain a cleaner image, use a high power lens.

Zooming

- 1 Click [View/Comment] from the VHX MENU and click [Split screen].



- 2 Select the [Use the mouse wheel to adjust the zoom.] check box.



You can enlarge images by controlling the mouse wheel while the pointer is on the observation window. When checking the [Link zoom position and display position between the images in the split screen.] check box, all images are enlarged when image in the split screen is enlarged.

Reference When changing the zoom ratio, the [Wide-view] dialog box will be displayed.

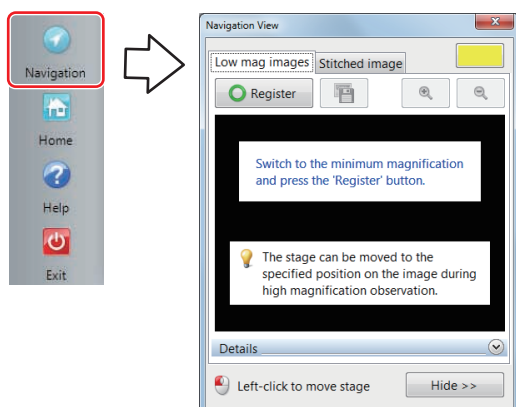
Navigation

This functions registers low magnification images or stitching images to provide a navigation image of a wider field-of-view. You can move to a specified point on the image by clicking with the mouse on the [Navigation view] dialog box. With this function, you can understand intuitively what area of the whole part you are observing when viewing at higher magnification, which results in efficient observation.

By registering the position of the stage, you can immediately move to a registered position on the XYθ stage. Up to 999 positions on the XYθ stage can be registered.

Creating Navigation

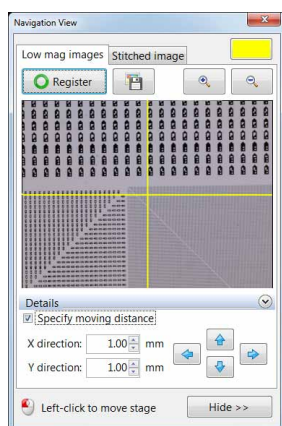
- 1 Click [Navigation] on VHX MENU to show the [Navigation view] dialog box.



- 2 If you put a check on [Specify movement amount], you can specify an amount of movement of the stage with the up, down, right, and left buttons in the [Navigation view] dialog box.

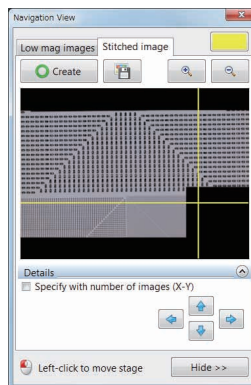
Registering low magnification images

- 1 Specify the position to be registered and its magnification and click the [Register] button.

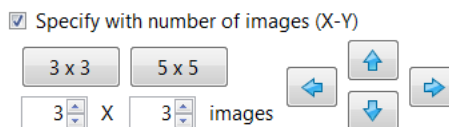


Registering stitching images

- 1 Select the [Stitching image] tab in the [Navigation view] dialog box.
- 2 Clicking the [Create] button stitches images centering around the current position along a spiral pattern on the XYθ stage.



- 3 If you put a check on [Specify with number of images], you can specify the range to be stitched with the number of images.



You can enter "3X3" and "5X5" with button operation. Other numbers also can be specified by entering them in the fields shown.

Specifying Observation Position on Navigation Image

1 Click on a position you want to observe on the image in the [Navigation view] dialog box.

The XYθ stage moves to the position you clicked.

Reference

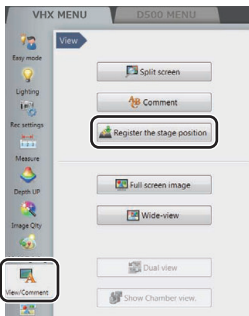
- By moving the mouse leftward while holding down its left button, the field of view of the navigation screen can be moved.
- Using the zoom in/out button, the navigation display can be zoomed in/out.
- Clicking [Save] enables you to display the [Rec] dialog box and to save the navigation image.

Moving vertically and horizontally

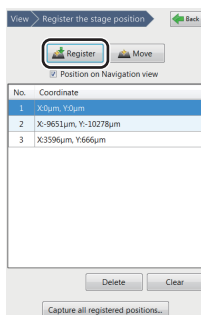
You can move to a specified direction by clicking the horizontal and vertical arrows on the [Navigation view] dialog box.

Registering a Stage Position

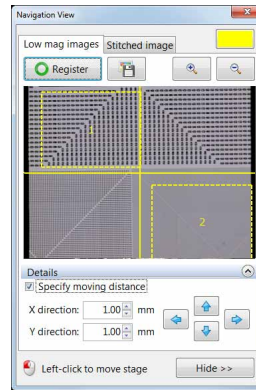
1 Click [View/Comment] from the VHX MENU and click [Register the stage position].



2 Click on a position on the navigation image that you want to register and click [Register].



The stage position's coordinates will be registered in the system and added to the list. Multiple positions (max. 999) can be registered.



Newly registered coordinates are added to the bottom of the list. If additional coordinates are registered, when 999 coordinates are already registered, the coordinates at the top of the list will be deleted.

To delete certain coordinates, select them from the list and click [Delete].

To delete all coordinates, click [Clear].

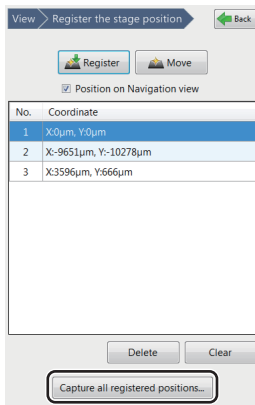
When checking the [Position on Navigation view] option, the registered position and list No. are displayed with yellow dashed line on the navigation image.

Recording registered positions in batch

Record all stage positions

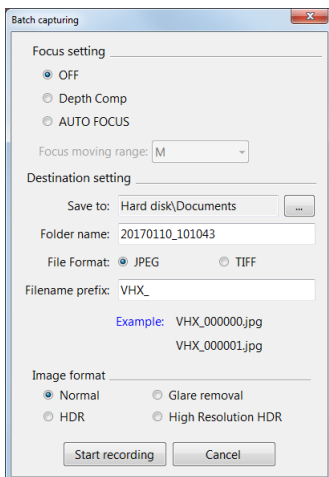
This function automatically moves all registered stage position to record.

- 1 Click [Capture all registered positions...].
The [Batch capturing] dialog box appears.



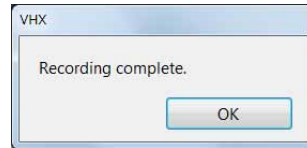
- 2 Modify [Setting depth composition], if required.

Point Put a check on "OFF", if the system is equipped with an illumination attachment and the distance between the lens and an object is small.



- 3 Specify the storage folder and click [Start recording].

All registered positions are recorded in batch. After completion, the message below will appear.



Chapter 9

Measuring Dimensions and Area

Measuring between two points, areas and other features on an image.

Measurements can be done without moving the object or by using the optional XY measurement system to measure distances over larger areas.

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Overview and Type of Measurements

The VHX-6000E can measure lengths, angles, areas, and other items on recorded still images by specifying the points or areas to measure. Additionally, the VH-M100E manual XY measurement system allows you to measure dimensions while moving the observation object over a 100-mm square range.

Measurement Types

Main Measurements: these tools measure distances and lengths on recorded still images.

Main measurements



Measures the distance between two specified points.
 [Book icon] "Measuring the distance between two points" (Page 9-12)



Measures the cumulative distance between multiple specified points.
 [Book icon] "Measuring the distance between multiple points" (Page 9-13)



Measures the radius of a circle that passes through three specified points.
 [Book icon] "Measuring the radius (or diameter) of a circle" (Page 9-13)



Measures the diameter of a circle that passes through three specified points.
 [Book icon] "Measuring the radius (or diameter) of a circle" (Page 9-13)



Measures the length and angle of arc that passes through three selected points.
 [Book icon] "Arc measurement" (Page 9-16)



Measures the interior angle at a corner formed by three specified points, including a vertex.
 [Book icon] "Calculating an angle (1)" (Page 9-14)



Measures the interior angle (the smaller of two angles) formed at a point where two specified lines intersect.
 [Book icon] "Calculating an angle (2)" (Page 9-15)



Measures the distance between a reference line and any straight line.
 [Book icon] "Measuring the distance between reference line and straight line" (Page 9-17)



Measures the center distance between two specified circles.
 [Book icon] "Measuring the center distance between two circles" (Page 9-14)



Measures the distance between the start and end points of a free line.
 [Book icon] "Free line measurement" (Page 9-16)



Measures the shortest distance from a selected reference line to a line parallel to the reference line.
 [Book icon] "Measuring the distance between two parallel lines" (Page 9-16)



Measures the angle formed at a point where two specified lines intersect.
 [Book icon] "Measuring the length of a perpendicular" (Page 9-15)



Measures the RGB values at specified measurement points.
 [Book icon] "Measuring RGB value" (Page 9-17)



Counts the number of specified measurement points.
 [Book icon] "Counting the number of points" (Page 9-18)

Area measurements

Area: these tools measure areas on recorded still images.

■ Area specifiers

Polygon



Specify the area to measure as a polygon.
 [Book icon] "Measuring the area of a polygon" (Page 9-27)

Circle



Specify the area to measure as a circle.
 [Book icon] "Measuring the area of a circle" (Page 9-28)

Free line



Specify the area to measure in freehand.
 [Book icon] "Measuring the area of a free-line area" (Page 9-28)

Rectangle



Specify the area to measure as a rectangle.
 [Book icon] "Measuring the area of rectangle" (Page 9-29)

■ Automatic area extractors

Brightness



Extracts and measures the area with the same brightness level as a specified point on the image.
 [Book icon] "Measuring the areas extracted based on brightness" (Page 9-29)

Color



Extracts and measures the area with the same color level as a specified point on the image.
 [Book icon] "Measuring the areas extracted based on color" (Page 9-31)

Filter



Removes granular components smaller than a specified size on a binary image.
 [Book icon] "Filter" (Page 9-32)

Fill



Fills holes smaller than a specified hole on the binary image.
 [Book icon] "Fill" (Page 9-32)

■ Individual and block measurement tools

Individual measurement



Measures the area of specified or extracted areas individually.

Block measurement



Measures the area of all specified or extracted areas in one operation.

■ Area deletion

Delete



Deletes the measurement areas shown on the screen individually.

Clicking on a line along the area deletes only the specified area. Clicking inside the area deletes the measurement results for the specified area.

You can delete multiple specified areas within a range by dragging around the desired area from the upper left to the lower right.

Reset



Resets the specified area and measurement results.

XY stage measurement

The VH-M100E XY measurement system allows you to measure a target while moving the stage to expand the field of view.



Point

The separately sold XY measurement application (model VHX-H2M2) is required to do XY stage measurements, Make sure this application is installed beforehand.

■ Measurement tools



Measures the difference of X and Y coordinates of two specified points, and the distance between the start and end points.



Measures each distance between the XY coordinates of multiple specified points, and the distance to the most recently specified point. This tool also measures the cumulative distance between all multiple points, and the cumulative angles formed with the origin.



Measures the angle formed by an average line connecting two specified points and the X-axis. It also measures the deviation from average lines connecting multiple points (if more than two are specified).



Measures a circle drawn by specifying three points on a circumference to provide the center coordinates (XY), diameter, and circularity.



Measures the center distance between two circles.



Calculates the interior angle of two sides specified in three points.



Measures the coordinates and angle of an intersection formed by two average lines. Each average line is created by specifying two points.



Measures the distance between an average line specified by two points and the vertical line from a specified point.



Measures the distance from a specified point and an average line specified by two points.



Measures the distance from a circle to a point where a perpendicular line dropped from the center of the circle intersects a specified line. The measured items are: shortest distance, longest distance, and distance to center.



Measures the angle of a line with respect to a line perpendicular to a specified reference line, and displays the length of deviation per unit length.



Measures the angle (parallelism) of a line with respect to a specified reference line, and displays the length of deviation per selected length.



Deletes the measurement tools shown on the screen individually.



Deletes all measurement tools shown on the screen.

■ Point/Intersection Coordinate



Point

Measures the coordinates of the specified point.



Midpoint

Measures the coordinates of the point at center distance between two specified points.



Ln - Ln

Measures the coordinates of the intersection point of two lines.



Ln-Cir

Measures the coordinates of the intersection point(s) of a line and circle.



Cir-Cir

Measures the coordinates of the intersection point(s) of two circles.

■ Setting coordinates



Origin

Moves the origin. Shifts the XY coordinates by defining a point as the origin.



Turn 1

Rotates the XY coordinates without moving the origin. The X coordinate axis becomes the line that passes through the origin and a point specified as the new X coordinate axis.



Turn 2

Rotates the XY coordinates centered on the origin so that the X coordinate axis is parallel to a line that passes through two specified points.



Perp.

Determines the XY coordinate axis by specifying a line using two points for the new X coordinate axis, and a third point for the new Y coordinate axis.



2-pt

Determines the XY coordinate axis by specifying the origin and one point along the X coordinate axis.



Intersect

Determines the Y coordinate axis the midpoint between two points specified along the desired X coordinate axis.



Midpoint

Determines the Y coordinate axis by specifying two points along the X coordinate axis and two points that pass through the origin.

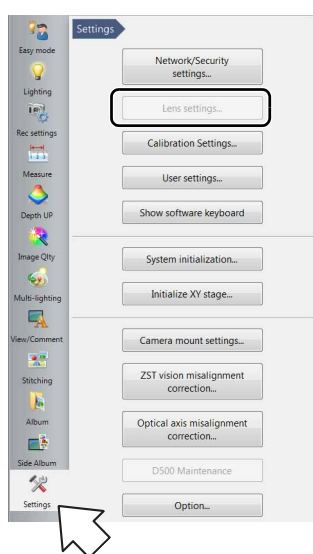
Preparing to Measure

Before taking measurements, specify the lens type and power, and calibrate the microscope. (This is only required for lenses that do not support the DOUBLE'R function)

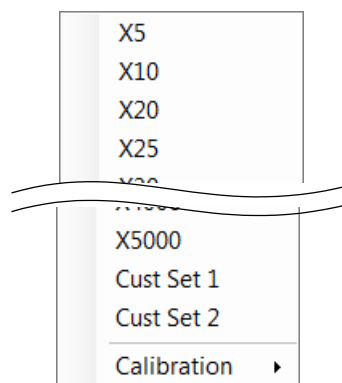
Lens Setting

Specify the lens type and power if you are using a lens that does not have the automatic lens/zoom recognition function.

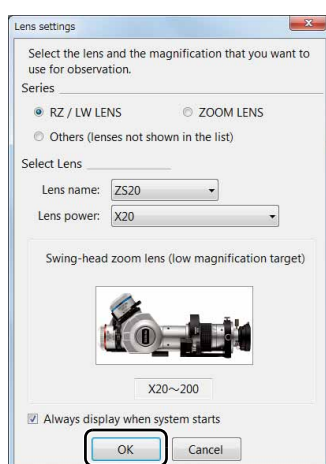
1 Click [VHX MENU] - [Settings] - [Lens Settings].



4 Select the power of the lens to be used.



2 Select the lens model and click [OK].



3 Click the [Lens] from the on-screen menu options.

The [Set lens power] menu appears.



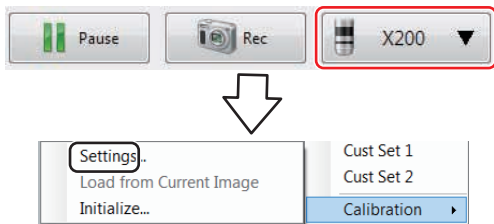
Calibration

This function sets a conversion rate between a distance on image and its real distance (μm) for measuring the image. Be sure to set this when you use a new lens for the measurement.

The calibration includes the following methods.

Methods	Positioning	Scale reading	Description
One-push auto calibration	Auto	Auto	Positioning and reading of the reference scale are automatically performed. The XY motorized stage is required.
Auto calibration	Manual	Auto	Reading of the reference scale is automatically performed. The lens magnification needs to be manually aligned with the corresponding scale graduation positions.
Manual calibration	Manual	Manual	Enter a known reference length and click on the screen to indicate the equivalent length.

To open the calibration, follow the procedure below. Click [Setting] from the VHX MENU or the lens power from the on-screen menu options and select [Calibration] - [Settings].



In addition, the settings of the calibration also cannot be modified while a calibration value of stored image is being used.

For the the calibration value of stored image, refer to "Loading from a saved image" (Page 9-10).

One-push auto calibration

This calibration requires the use either of OP-87426, OP-87427, OP-88141, or OP-84142 reference scale (sold separately) to perform calibration automatically.

This function requires no detailed positioning of the stage and makes the calibration easier.

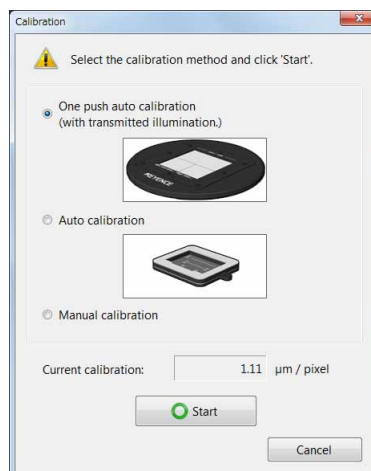
Notes for calibration

The calibration cannot be performed while the following functions are activated:

- HDR, High Resolution HDR, and High Resolution
- Glare elimination and ring elimination
- While the digital zooming is being used.
- While the split screen is active.
- While stitching images are displayed.
- Recording setting: Fine resolution [3200x2400], Super fine [4800x3600], and 18 Mega Pixels x 3CMOS [4800 x 3600]
- While the automatic area measurement function, the max area measurement, the contamination analysis, and the XY stage measurement are running.

Deactivate these functions easily by pressing the [HOME] button on the console, and select [Calibration] - [Settings].

1 Select [One-push auto calibration] and Click [Start].



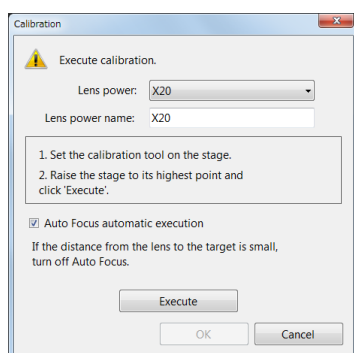
- Remove the plate from the XYθ stage and place the reference scale.



- Raise the XYθ stage as far as it can move up.

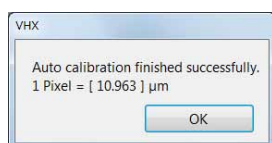
- As required, check the "Auto Focus automatic execution" option.

Point Put a check on "OFF" if the system is equipped with an illumination attachment or the distance between the lens and an object is small.



- Click [Exec Comp].

The calibrated starts automatically. After completion, the message below will appear.



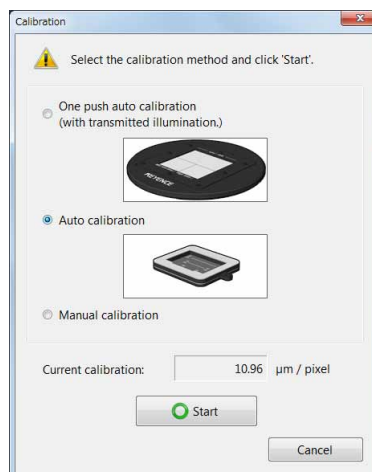
- Click [OK].

This confirms and exits the calibration.

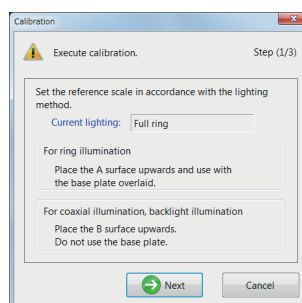
Auto calibration

Auto calibration requires the use of either OP-87656 or OP-87657 reference scale (sold separately).

- Select [Auto calibration] and Click [Start].



- Place the reference scale according to the lighting method.

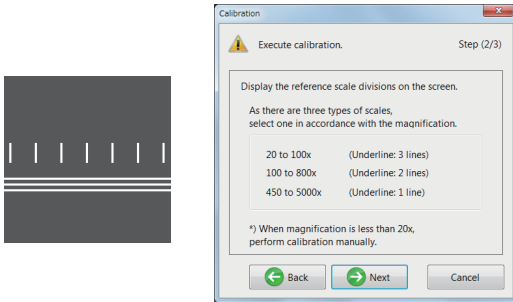


The [Calibration] dialog box appears.

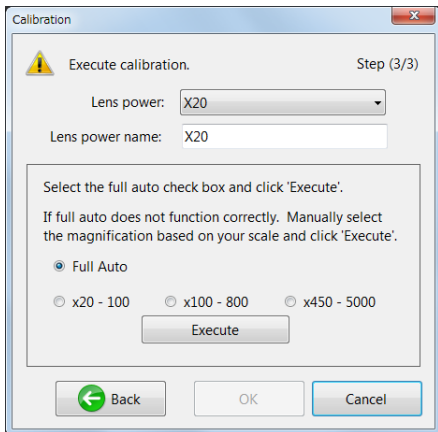
3 Display the reference scale hash marks on the screen.

Adjust the focus and brightness to obtain contrast between black and white.

Display the scale gradation that corresponds to the lens magnification.



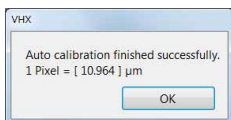
4 Select [Full Auto] and click [Execute].



[Full Auto] automatically determines the range of the power on the basis of the number of the horizontal lines.

If calibration fails when using [Full Auto], select a lens power range from [x20 - 100], [x100 - 800], or [x450 - 5000] according to the displayed hash marks and the horizontal lines.

The calibration starts automatically. After completion, the message below will appear.



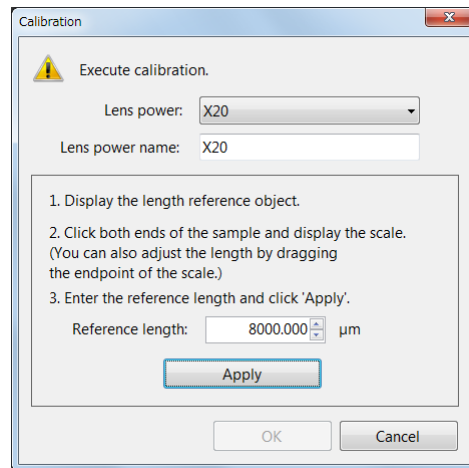
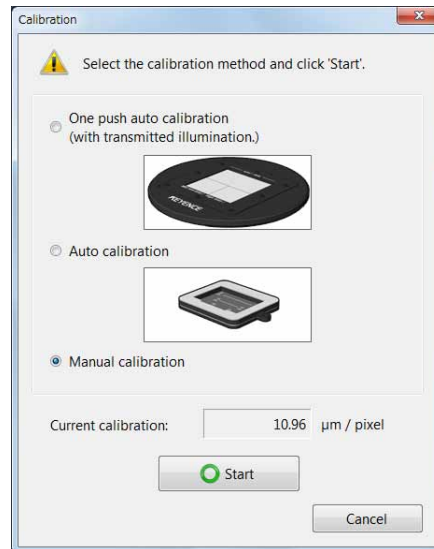
5 Click [OK].

This confirms and exits the calibration.

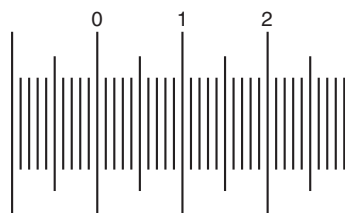
Manual calibration

Use the known dimensions of observable objects (ruler, carpenter's square, etc.) to manually set the calibration.

1 Select [Manual calibration] and Click [Start].

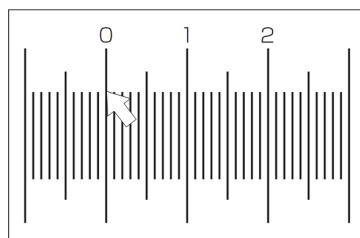


2 Display the image of the length reference observable object (calibration scale).

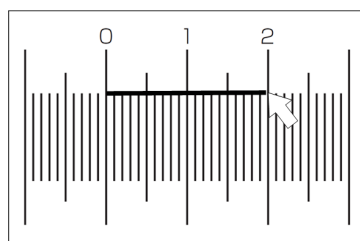


3 Click a start point along the scale.

The calibration scale can also be dragged on the screen and moved to the hash marks on the object.



4 Click the mouse at the end point of the reference length.



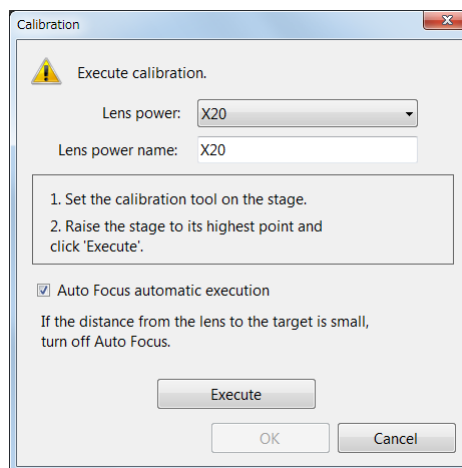
Reference To adjust the length of the scale, drag the end point.

5 Enter [Reference length] and click [Apply].

Common notes

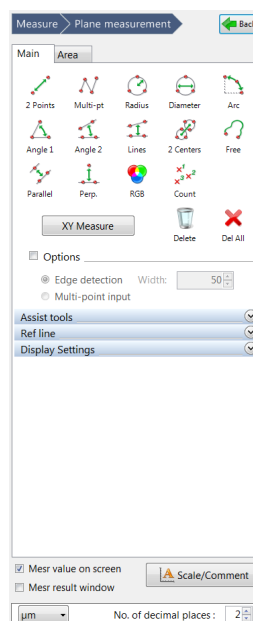
The calibration can be done continuously for multiple lens powers.

If you do not press [OK] when closing the following dialog boxes, the results from the calibration does not become active.



Unit and number of decimal

The units, etc. to be displayed together with the measurement results can be changed on the measurement screen.



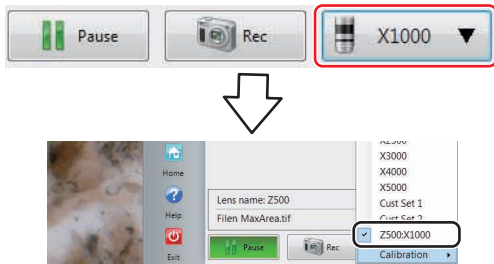
Loading from a saved image

Calibration values are stored within every saved image. When the images are replayed from the album, the calibration values read from the images are ready for use, which allows additional measurement using the same calibration as when the image was captured.

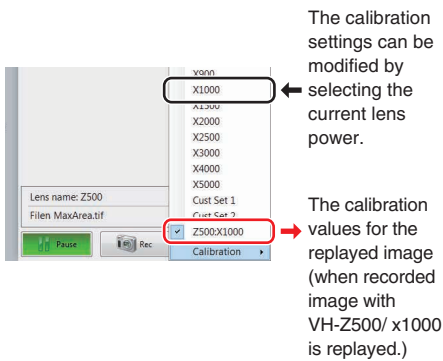
1 Load the image to replay using the Album.

📖 "Playing Files" (Page 6-6)

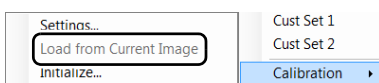
2 Clicking the lens power of the direct buttons allows you to see that [Lens of the replayed image: power] is selected.



Point The calibration settings cannot be modified while the saved images are replayed. To modify the calibration settings, select the current lens power and open the calibration settings.



Reference To restore the calibration values of the image after once changed, select [Load from Current Image].

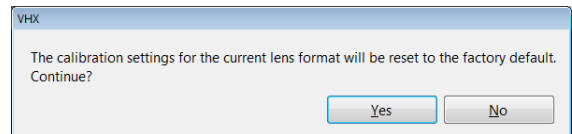


Initializing calibration

Initializing returns the calibration values to the factory-set values.

Point The calibration values for all lenses that were set are initialized by this process.

1 From the Lens Setting button at the lower right of the screen, click [Calibration] - [Initialize...].



2 Click [Yes].

This initializes the calibration values.

Setting the calibration password

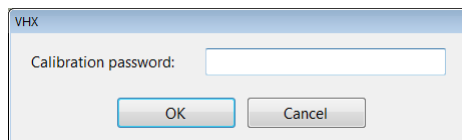
It is possible to set a password in order to set the calibration.

1 Set the calibration password.

📖 "Setting the calibration password" (Page 13-8)

2 Initialize the calibration settings.

3 Enter the set password and click [OK].

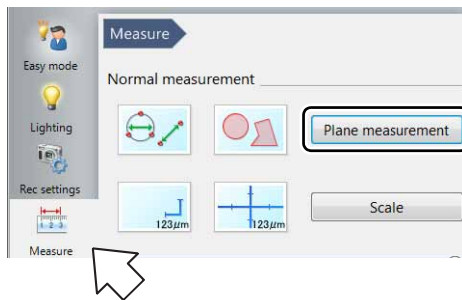


Main Measurements

These tools measure the distance between two points, angle, XY distance, and object count in the observation window. The measurement results are displayed in the observation window and measure result window, and can be saved in CSV format.

Measuring Procedures

- 1 Press the [MEASUREMENT] button on the console, or click [Measure] from the VHX MENU and click [Plane measurement].



An icon for each measurement tool appears in the operation area.

- 2 Click the [Main] tab, and click the icon for the desired measurement.

The icon turns yellow indicating it has been selected.

- 3 Specify the measurement points in the observation window.

The measurement result is displayed.

Refer to the procedures for each measurement for operating details.

- Refer to Page 9-24 for details on how to display measurement results in the observation window.
- Refer to Page 9-24 for details on how to display measurement results in the Measure Result dialog box.

Reference

- The measurement point and [Count] of following measurements can be measured up to 999 items: 2 Points, Multi-pt, 2 Centers, Radius, Diameter, Angle 1, Angle 2, Perp., Parallel.
- Refer to "Display Settings" (Page 9-23) for display settings.

Measurement Items

Reference

- If you make a mistake after clicking the start point, right-click to specify the correct start point.
- Right-clicking at any point before confirming a series of points will undo the last point.
- Display position of a label (subscript) can be specified after the determination of measurement position.

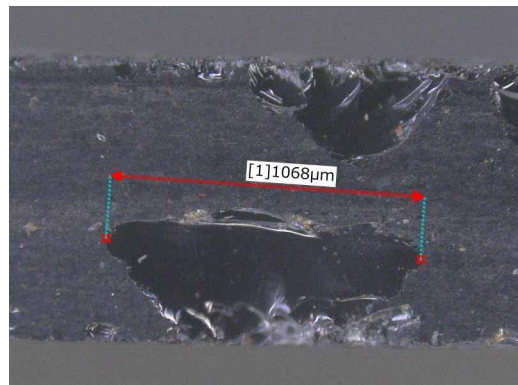
Measuring the distance between two points



Measures the distance between two specified points.

- 1 Click [2 Points]. On the observation window, click the start and end point.

A line connecting the two clicked points and a label (subscript) will appear and the measurement results will appear on the screen and in the [Measure Result] window.



Measuring the distance between multiple points



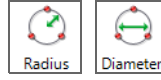
Measures the cumulative distance between multiple specified points.

- 1 Click [Multi-pt]. On the observation window, click the start point and the points to pass through. Double-click on the end point.

A line connecting the multiple clicked points and a label (subscript) will appear. The measurement results will appear on the screen and in the [Measure Result] window.



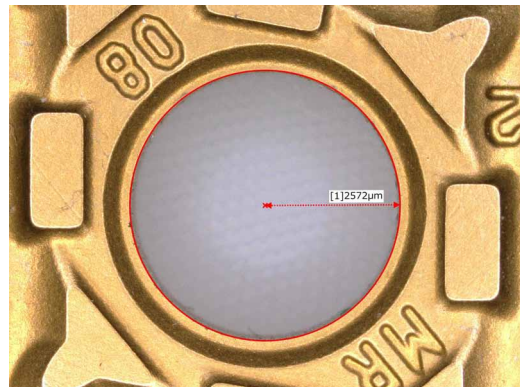
Measuring the radius (or diameter) of a circle



Measures the radius (or diameter) of a circle that passes through three selected points.

- 1 Click [Radius] (or [Diameter]). On the observation window, click three points.

A circle passing through the three clicked points and a label (subscript) will appear. The circle, radius (diameter) and center will appear and the measurement results will appear on the screen and in the [Measure Result] window.



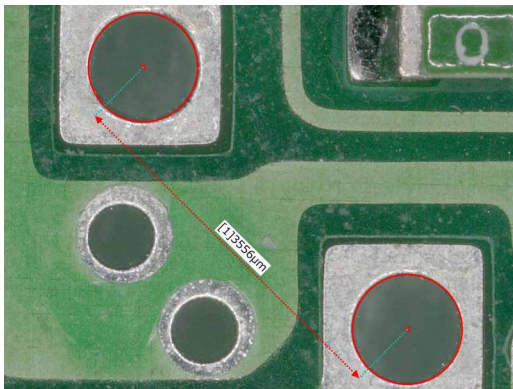
Measuring the center distance between two circles



Measures the center distance between two selected circles.

- 1 Click [2 Centers]. Specify the circles to be the start point and end point, in that order, using three points.

The two circles will serve as a start point and end point, and a line connecting the centers of each circle and a label (subscript) will appear. The measurement results will appear on the screen and in the [Measure Result] window.



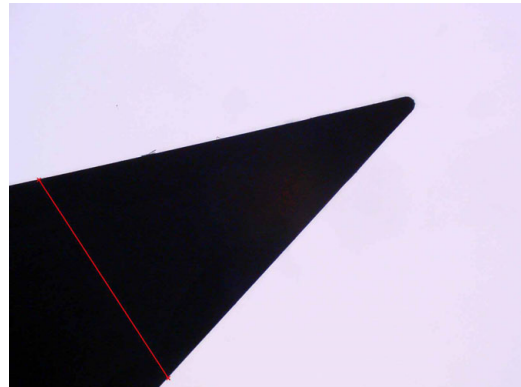
Calculating an angle (1)



Measures the interior angle of two sides formed by three specified points including a vertex.

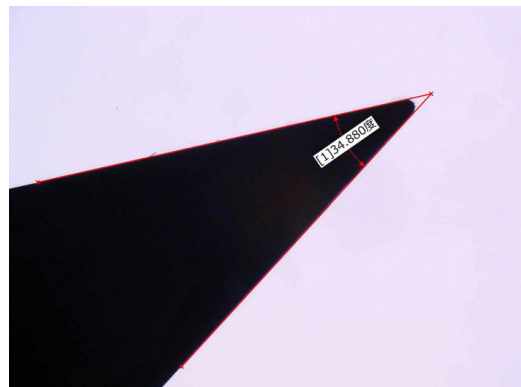
- 1 Click [Angle 1]. Click each side that form the interior angle.

A line connecting the two clicked points will appear.



- 2 Click the vertex.

A line connecting the three clicked points and a label (subscript) will appear, and the measurement results will appear on the screen and in the [Measure Result] window.

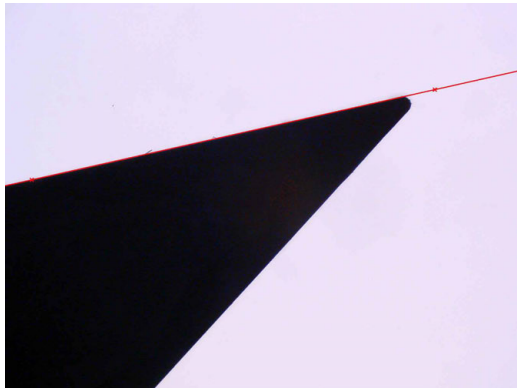


Calculating an angle (2)

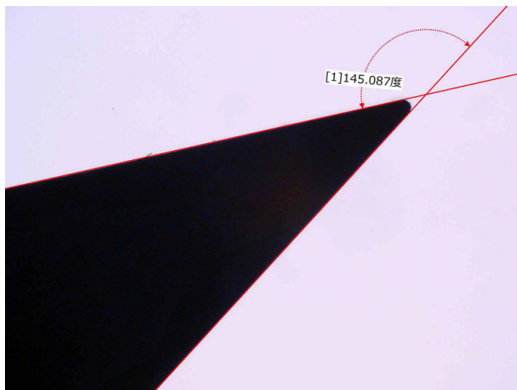


Measures the angle of the intersection created by two specified lines.

- 1 Click [Angle 2]. Select two points on the first side. The clicked points and a line connecting the two clicked points will appear.



- 2 Select two points on the second side. A line connecting the two clicked points and a label (subscript) will appear, and the measurement results will appear on the screen and in the [Measure Result] window.



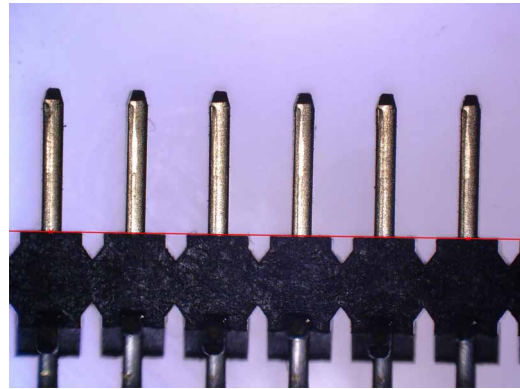
An angle is measured in conformity to the label (subscript) position. Determine the label (subscript) position according to the angle you wish to measure.

Measuring the length of a perpendicular

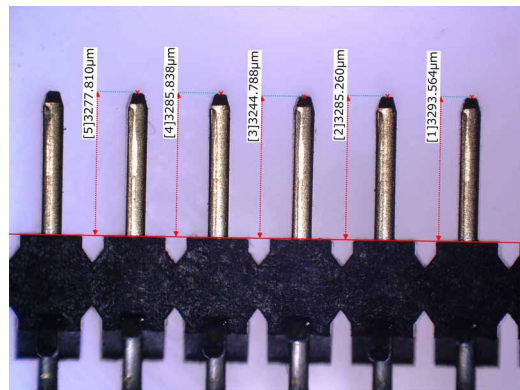


Measures the length of a perpendicular drawn from a selected point to the reference line.

- 1 Click [Perp.] and click two points along the line to be the reference line. The reference line appears.



- 2 Click the measurement position. A line drawn through the clicked point and a perpendicular line from the reference line appears along with a label (subscript). The measurement result appears on the screen and in the [Measure Result] window.



You can continue to specify measurement points relative to the same reference line.

To stop measuring perpendicular lines relative to the same reference line, double click the measurement point.

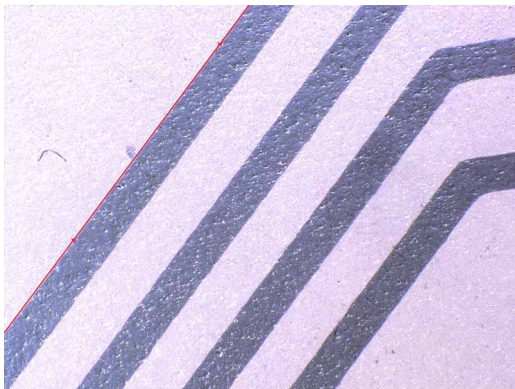
Measuring the distance between two parallel lines



Measures the distance between a reference line and another line parallel to the reference line.

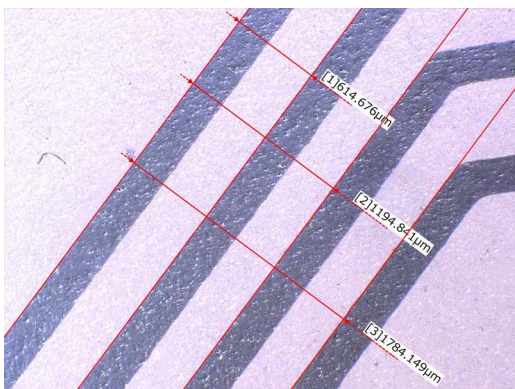
- 1 Click [Parallel]. Click two points along the line to be the reference line.

The reference line appears.



- 2 Click the position to measure.

A parallel line that passes through the clicked point and a perpendicular line from the reference line to the parallel line will appear along with a label (subscript). The measurement result appears on the screen and in the [Measure Result] window.



You can continue to specify measurement points relative to the same reference line.

To stop measuring parallel lines relative to the same reference line, double click the measurement point.

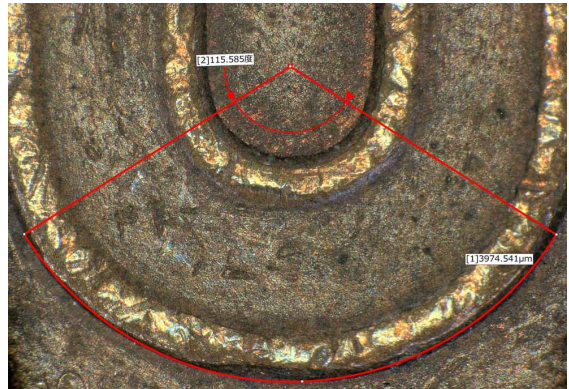
Arc measurement



Measures the length and angle of arc that passes through three selected points.

- 1 Click [Arc] and then click three points on the observation window.

The arc that passes through the three clicked points and a label (subscript) will appear and the measurement results will appear on the screen and in the [Measure Result] window.



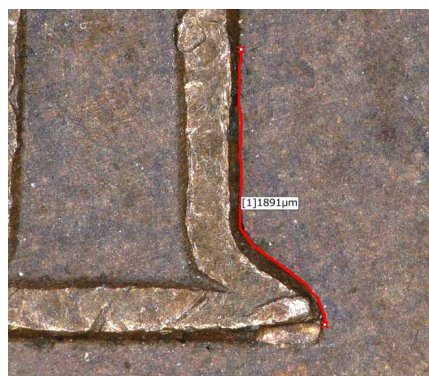
Free line measurement



Measures the distance between the start and end points of a free line.

- 1 Click [Free] first, then move the mouse while holding down its left button from the start point to the end point in the observation window.

A free line connecting the clicked start and end points together with a label (subscript) will appear and the measurement results will appear on the screen and in the [Measure Result] window.



Measuring the distance between reference line and straight line



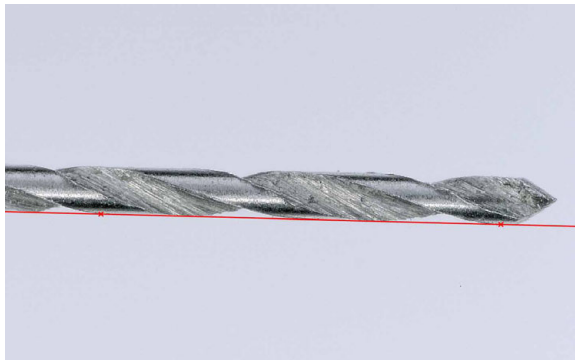
Measures the distance between a reference line and any straight line.

This distance is effective for measuring the average distance of a line including a curve.

Check the [Options] option for a proper use.

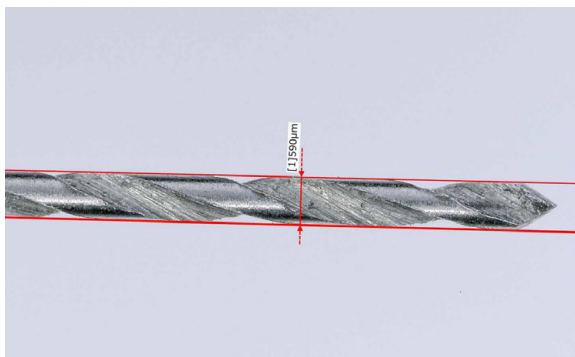
- 1 Click [Lines] and click two points on the line in sequence that you want to use as a reference line.

The reference line appears.



- 2 Click two points on the second line in sequence.

A vertical line drawn through the clicked two points and a perpendicular line from the reference line appears along with a label (subscript). The measurement result appears on the screen and in the [Measure Result] window.



Measuring RGB value

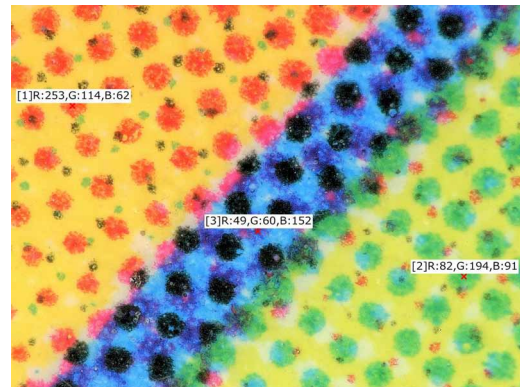


Measures the brightness of each RGB color at selected points on the image.

- 1 Click [RGB]. On the observation window, click the measurement points.

The clicked points will be indicated by an x and a label (subscript) that indicates the brightness of each RGB color.

The measurement results appear on the screen and in the [Measure Result] window.



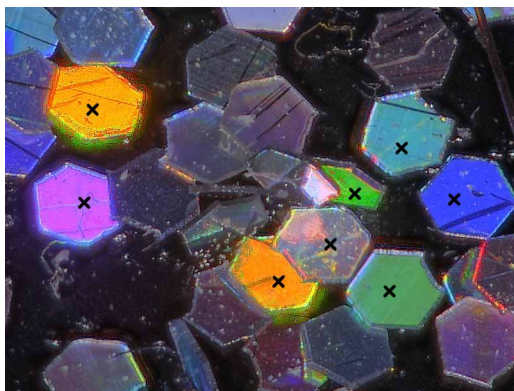
Counting the number of points



Counts the number of specified points on the image.

- 1 Click [Count]. On the observation window, click the measuring points.

The clicked points will be indicated by an x. The measurement results appear on the screen and in the [Measure Result] window.



9

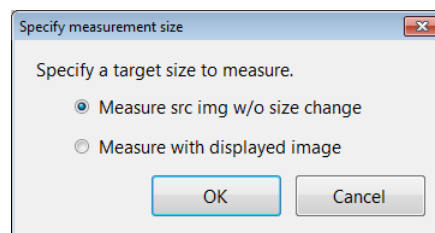
Measuring High Definition Images

When using images recorded in high definition (3200 x 2400) or higher recording sizes (Page 5-5), the part clicked when specifying measurement spot will be enlarged.



When edge auto extraction is activated, this function will not operate.

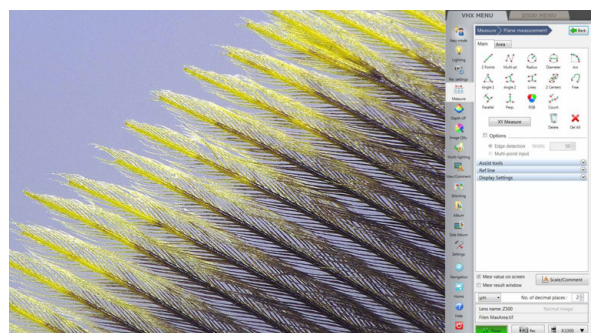
- 1 Select and open the image to measure from the album.
The [Specify measurement size] dialog box appears.
- 2 Select [Measure src img w/o size change] and click [OK].



The image appears in the observation window.

- 3 Click the icon of the measurement tool to use and click on the observation window.

The clicked part is enlarged.



- 4 Click where to measure.

The display in the observation window returns to the former magnification ratio.

- 5 Repeat steps 3 and 4 to complete the measurement.

Moving and Editing the Measurement Point

 **Point** Measurement points cannot be moved if the icon is selected. Deselect the icon by clicking it.



Changing and editing measurement points and values.

- 1 Drag the measurement point or value to move or edit and drop it at the correct position.

To move a line or an entire circle

- 1 Drag the line or circle and drop it at the correct position.

Delete

This procedure deletes measurement items displayed on the screen individually.

- 1 Click [Delete].
- 2 Click the line or point and draw a rectangle around the range to delete by dragging from the upper left to the lower right.

The selected measurement items are deleted.

Delete All

This procedure deletes all measurement lines and results.

- 1 Click [Del All].
A confirmation dialog box appears.
- 2 Click [Yes (Y)].
All measurement items and results are deleted.

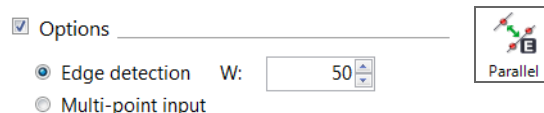
Auxiliary Functions

Edge auto extraction

This function extracts the edges of the object and automatically corrects the measurement line. The function minimizes human error. Edge auto extraction can be used for all assistance tools and the following measurements: 2 Points, Radius, Diameter, 2 Centers, Angle 2, Perpendicular Line, Parallel Line, Lines.

- 1 Select the [Options] check box and select [Edge detection].

The letter E will appear on the icons for measuring modes that support edge auto extraction.



- 2 Click two points along the line to use as the reference.

The closest edge will be extracted automatically to confirm the line.



Carry on with the procedures for the selected measurement item.

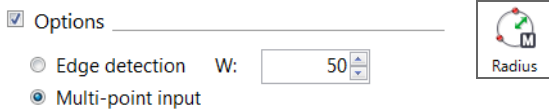
Multi-point input

This function allows for multiple points to be selected to create a reference line, circle, etc. Using the least squares method, this function will display the best-fit line for these selected measurement points. Multiple point input can be used for tools excepting Point and Midpoint, and the following measurements: Radius, Diameter, Angle 2, Reference line of Perpendicular Line, Reference line of Parallel Line, Lines, 2 Centers.

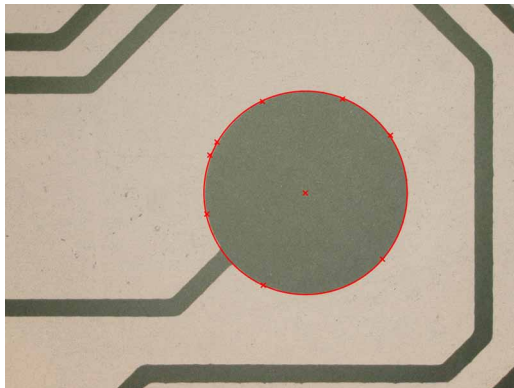
Reference The maximum number of multiple measurement points is 99.

1 Select the [Options] check box and select [Multi-point input].

The letter M will appear on the icons for measuring modes that support multi-point input.



2 Click points along the line (or circle) to measure.



3 To stop multi-point input mode, double click the last measuring point.

For perpendicular lines or parallel lines, continue specifying measuring points.

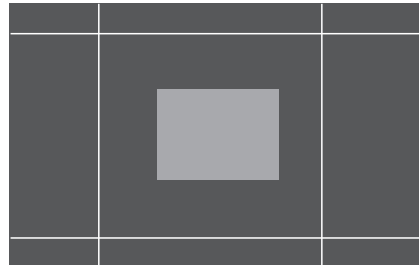
XY Measurement and Display

This mode measures the horizontal and vertical distance of an object enclosed by user-specified horizontal (X axis) and vertical (Y axis) lines. It also measures the length between diagonal corners of the square formed by the lines.

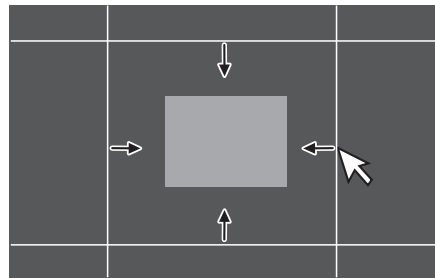
1 Click [XY Measure].



The [XY Measure] icon becomes selected. The screen displays an X-axis (horizontal axis) and a Y-axis (vertical axis).

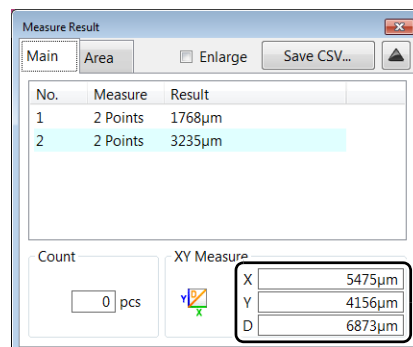


2 Move the measurement lines to the desired position by dragging the X and Y axes and enclose the object to be measured.



3 The XY measurement display area of the measure result window shows the object's horizontal distance (X), vertical distance (Y), and diagonal distance (D).

Refer to Page 9-24 for details on how to display measurement results in the measure result window.



Assist Tools

Elements created by using assist tools are called assist elements. Assist tools themselves do not create measurement results but can be used as assist points or assist lines.

By placing assist elements at places to be measurement points, you can set measurements more accurately and efficiently.

Assist tool items

■ Point



The clicked point becomes an assist point.

- 1 Click [Point] and click a point in the observation window.

An assist point (X) appears at the clicked point.

■ Line



The first clicked point becomes a reference and an assist line is created when another point is clicked.

- 1 Click [Line] and click two points in the observation window.

An assist line connecting two points appears.

■ Circle



Click three points to create a circular assist line.

- 1 Click [Circle] and click three points in the observation window.

A circular assist line that passes through the three clicked points appears.

■ Midpoint



Click two points to specify their halfway point.

- 1 Click [Midpoint] and click the start and end points in the observation window.

Assist points (X) appears at the start, end and halfway points.

■ Bisector



Specify two assist lines to specify the assist line at their halfway distance.

- 1 Click [Bisector] and click two points in the observation window.

An assist line appears.

- 2 Click two points in the observation window.

Another assist line appears.

- 3 Click any position to the bisector position.

An assist line as a bisector appears.

■ INtrCrCr



Specify two circular assist lines to set their intersections as assist points.

- 1 Click [INtrCrCr] and click three points in the observation window.

A circular assist line that passes through the three clicked points appears.

- 2 Click three points in the observation window.

Another circular assist line that passes through the three clicked points appears and assist points (X) appears at the intersections of two circles.

■ INtrCrLn



Specify a circular assist line and a straight assist line to set their intersections as assist points.

1 Click [INtrCrLn] and click three points in the observation window.

A circular assist line that passes through the three clicked points appears.

2 Click two points in the observation window.

An assist line connecting the clicked points appears and assist points (X) appears at the intersections with the circular assist line.

■ INtrLnLn



Specify two assist lines to set their intersections as auxiliary points.

1 Click [INtrLnLn] and click two points in the observation window.

An assist line connecting the clicked points appears.

2 Click two points in the observation window.

Another assist line connecting the clicked points appears and assist points (X) appears at the intersections of the assist lines.

■ Perp.



Create a line which passes through two points, and a perpendicular line.

1 Click [Perp.] and then click two points on the observation screen.

An assist line connecting two points appears.

2 Click one point in the observation window.

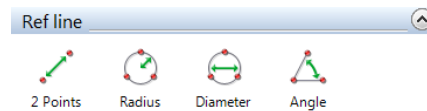
Perpendicular intersect the created assist line, and the line that connects the clicked point will appear.

Reference Lines

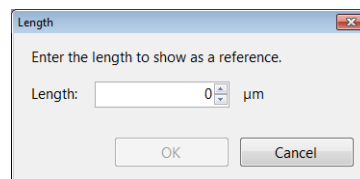
When displaying the measurement line, a numeric value can be entered as a reference length or size to simplify comparison and determine if the object is larger or smaller than the reference length, circle, or degree. Reference lines can be entered for these modes: 2 Points, Radius, Diameter, and Angle.

1 Open the [Ref line] menu.

2 Select the measurement line to use as the reference.



3 The [Length] dialog box appears.



4 Enter the length and click [OK].

5 Click the position to display the reference line.

The reference line appears.



- Move the reference line by dragging and dropping it.
- To change the orientation for [2 Points] and [Angle], drag the reference point (x).

Display Settings

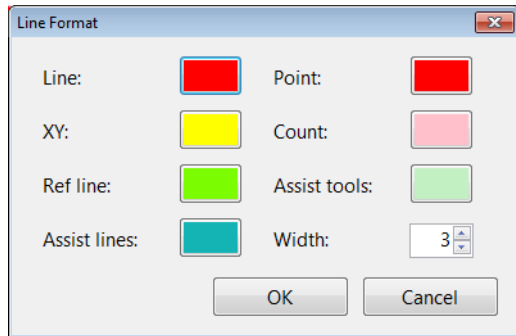
Appearance of lines, reference line, points, XY, width, and text

This procedure specifies the color and line width (thin or thick) of the measurement line, measurement points, and measurement values (subscripts) as they appear on the image.

■ Setting colors

1 Click [Line Format].

The [Line Format] dialog box appears.



2 Click the color button for each display item.

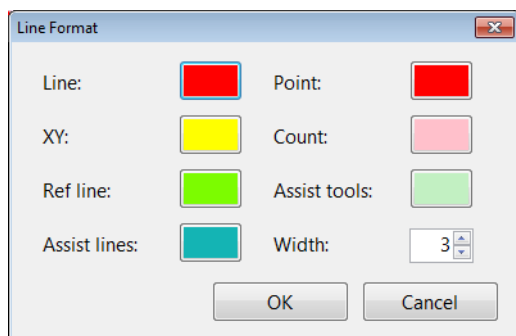
3 Select the desired color and click [OK].

Point Colors cannot be created.

■ Changing line width

1 Click [Line Format].

The [Line Format] dialog box appears.



2 Click the arrow buttons ▲/▼ next to the line width value, or type the desired width directly.

The width can be set from 1 to 10, where 10 is the thickest.

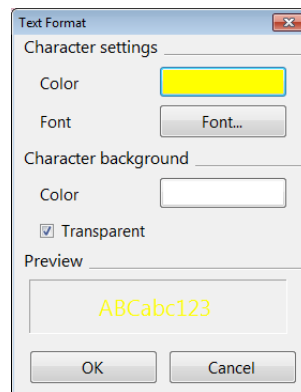
■ Text format

This setting formats the display format of the measurement results.

There are settings for font type, text color, and background color or clear.

1 Click [Text Format].

The [Text Format] dialog box appears.



2 To change the text color and background color, click the color button for each item.

Checking the [Transparent] check box option turns the background display off.

📖 "Changing the line color and line width" (Page 9-35)

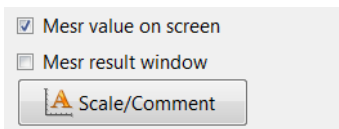
3 To change the text font, click [Font...].

The [Font] dialog box appears.

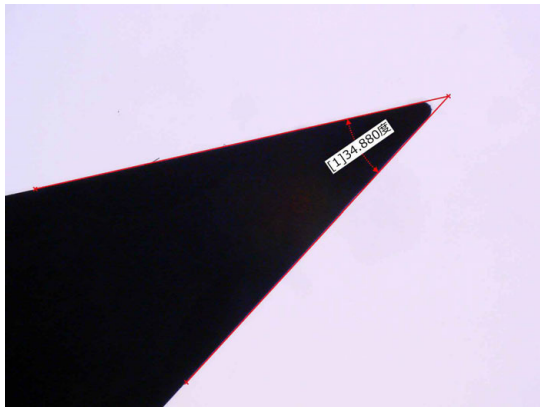
4 Specify the [Font], [Style], [Size], and [Effects]. Then click [OK].

Displaying measurement values on the screen

The [Mesr value on screen] option shows or hides the measurement values on the screen.

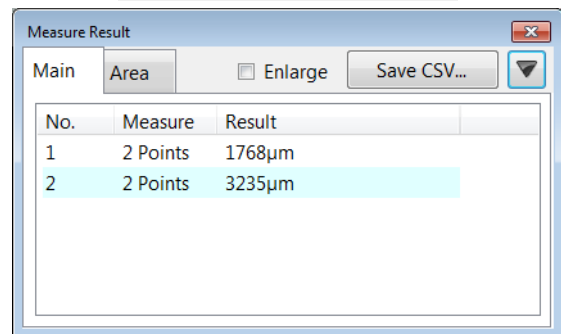
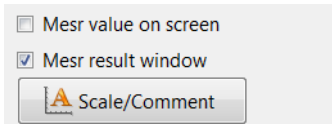


To hide the measurement value, uncheck the [Mesr value on screen] check box. Check the check box to show the measurement value.



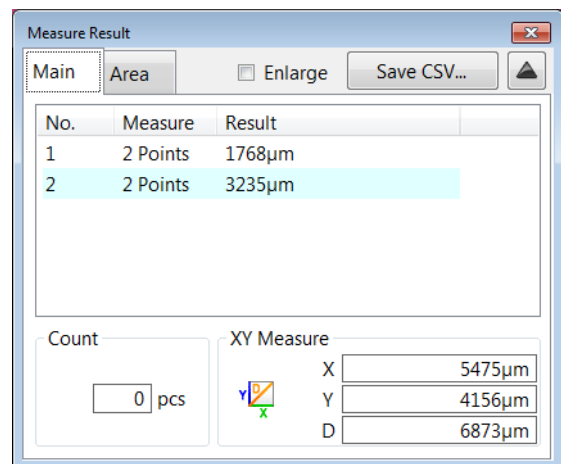
Displaying the measurement result window

This option shows or hides the [Measure Result] window which displays the measurement results as a list.



■ Reading the measurement results window

- No. : Corresponds to the label (subscript) displayed next to the measurement line.
- Measure : Displays the measurement item.
- Result : Displays the measurement result.
- Enlarge : When checked, enlarges the text size.
- Save as CSV : Saves the measurement result as a CSV formatted file.
- ▲(▼) : Hides or shows the Count and XY Measure results.



Reference

- To move the measurement result window, drag the title bar.
- To change the size of the measurement result window, drag any of the four sides of the window.
- To change the width of a column in the measurement result window, drag the separator line on the title row.

Checking the extracted point

When [Show edge-extraction points] check box is selected, you can check extracted points.

- Extracted point used during measurement: Yellow
- Extracted point not used during measurement: Red

Area Measurements

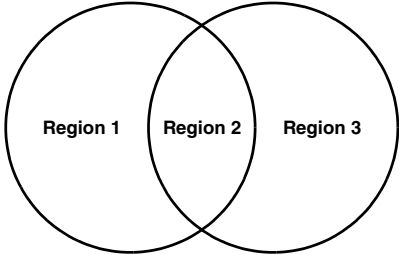
This microscope can measure areas on the object specified as a circle or polygon. The user can define an area by drawing a free-line as well. It can also extract and measures areas of the same brightness or color level.

NOTICE If the lens being used does not feature the automatic lens/zoom recognition function, be sure to calibrate the microscope (Page 9-6) before performing any measurements.

Measuring Procedures

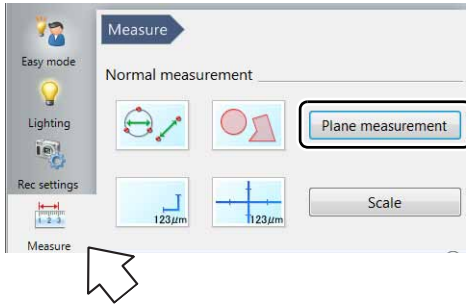
Reference

- The total maximum number of area measurements is 999.
- If the measurement lines of circles and polygons used to specify areas overlap, the area is measured for each divided region.



1 Click [Measure] from the VHX MENU and click [Plane measurement].

The [Plane measurement] menu appears.



2 Click the [Area Measure] tab, then click the icon for the desired area measurement.

The icon turns Yellow indicating it has been selected.

3 Specify the area to measure in the observation window.

Refer to the procedures for each measurement for operating details.

4 Click [Indv Mesr] and select the area to measure. Or, click [Blick Mesr].

The measurement is displayed.



- Refer to "Displaying measurement values on the screen" (Page 9-24), for details on how to display the measurement results on the observation window.
- Refer to "Displaying the measurement result window" (Page 9-24), for details on how to display the measurement results window.

9 Measuring Dimensions and Area

Measurement Items

This section explains how to specify areas for each area measurement. After specifying the area, click the individual measurement (or block measurement) icon to view the measurement results.

Reference

- If you make a mistake after clicking the start point, right-click to specify the correct start point.
- Right-clicking at any point before confirming a series of points will undo the last point.

5 Click the polygon you wish to measure.

This displays the area of the polygon.

Reference

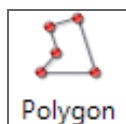
Multiple measurement areas can be specified and measured in a single operation. To do this, click [Blick Mesr].



Measuring the area of a polygon

Specify the polygon to measure the area of.

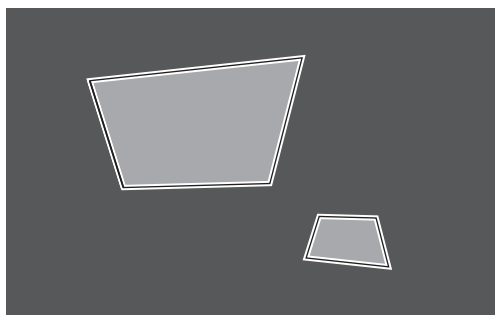
1 Click [Polygon].



2 Enclose the area to measure by clicking vertex points.

3 Double-click on the last vertex.

The polygon to be measured will appear superimposed on the image.



Reference

To change the area to measure, delete it and specify the area again.

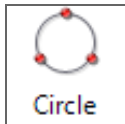
4 Click [Indv Mesr].



Measuring the area of a circle

Specify the circle of which you want to measure the area.

- 1 Click [Circle].



- 2 Click three points on the circumference of the circle that contains the area to be measured.

A circle that passes through the three points and a center point will appear.

Reference To change the area to measure, delete it and specify the area again.

- 3 Click [Indv Mesr].



- 4 Click the circle to measure.

This displays the area of the circle.

Reference Multiple measurement areas can be specified and measured in a single operation. To do this, click [Blick Mesr].



Measuring the area of a free-line area

Specify the area to measure using free lines.

- 1 Click [Free line].



- 2 Drag the perimeter of the area to measure.

The mouse trails specify the area.

Reference To change the area to measure, delete it and specify the area again.

- 3 Click [Indv Mesr]



- 4 Click the free line area to measure.

This displays the area in the free line shape.

Reference Multiple measurement areas can be specified and measured in a single operation. To do this, click [Blick Mesr].



Measuring the area of rectangle

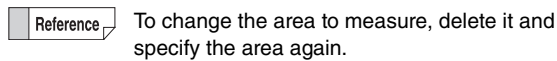
Specify the rectangular area to measure.

1 Click [Rectangle].



2 Drag the area to measure.

A rectangle appears.

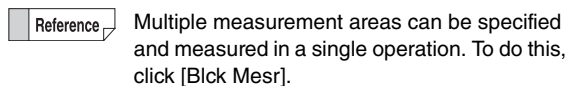


3 Click [Indv Mesr].



4 Click the rectangular area to measure.

This displays the area of the rectangle.



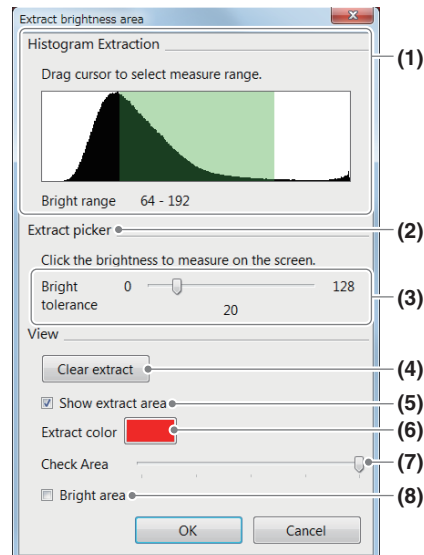
Measuring the areas extracted based on brightness

This procedure measures the size of an area extracted based on the brightness of the object.

You can use the Histogram or Extract picker to extract an area.

1 Click [Brightness].

The [Extract brightness area] dialog box appears.



(1)Histogram

The histogram displays brightness on the X axis, and the frequency (distribution) of pixels that exist per each level of brightness on the Y axis. The image is brighter as the scale moves to the right. Specify the range to extract by dragging the mouse. The parts of the image that match the specified brightness change to the specified extraction color.

(2)Extract picker

Specify a point and tolerance to use as the reference for the brightness level to measure. The Extract picker will then extract the areas with the same brightness level. The parts of the image that match the specified brightness change to the specified extraction color.

📖 "■ Using the Extract picker" (Page 9-30)

(3)Bright tolerance applied to the Extract picker

When specifying the brightness level with the Extract picker, specify a brightness range between 0 to 128 gradations by dragging the slide bar.

(4) Clear extract

Deletes all extracted ranges.

(5) Show extract area

If this option is checked, the area extracted based on brightness is displayed in the extraction color.

(6) Extract color

Select the color to paint the area extracted by brightness.

(7) Check Area

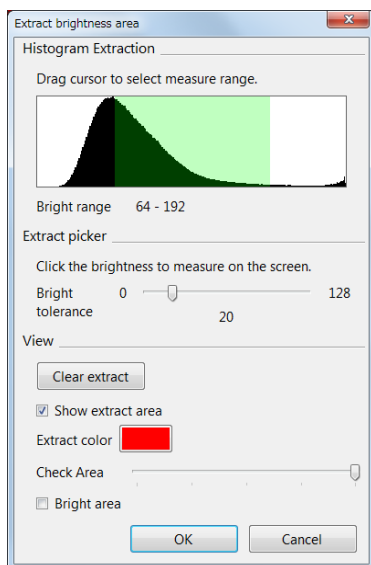
This button lightens the extraction color effect to allow checking of the specified area.

(8) Bright image

If this option is checked, the image is shown as a bright image (monochrome).

■ Using the histogram

- 1 On the brightness distribution histogram, adjust the boundary by dragging the mouse.**



The green-colored brightness range is extracted and displayed in the observation window using the extraction color.

- Reference**
- To start over from the beginning, click [Clear extract]. This will also clear the range display on the histogram. Specify the brightness range by dragging the mouse on the histogram.
 - After extracting with the histogram, you can continue to extract with the Extract picker.

- 2 Click [OK].**

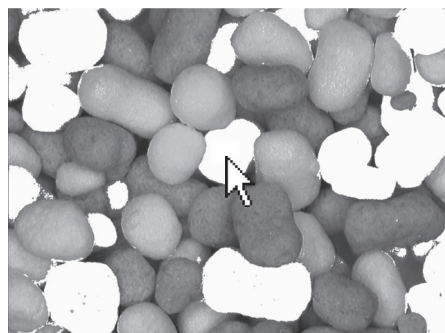
A binary image appears in the observation window.

■ Using the Extract picker

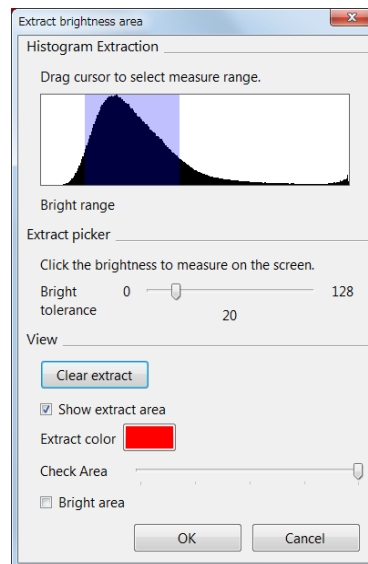
This method extracts areas within the same brightness range specified by the bright tolerance, where the center of tolerance is the brightness of the point picked (clicked) on the observation window.

Point Click [Clear extract] to clear any unwanted brightness areas that have already been selected.

- 1 Click [Clear extract].**
- 2 Click a point on the image to be selected.**



The extracted area is displayed in the observation window using the extraction color.



Reference Multiple areas can be picked by repeating step 1.

- 3 Adjust the bright tolerance while viewing the image.**

Dragging the bright tolerance slider bar to the right expands the area that will be extracted.

- 4 Click [OK].**

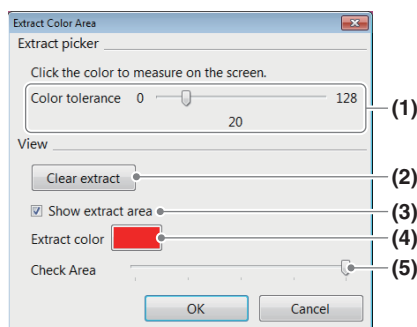
The binary image in the observation window displays.

Measuring the areas extracted based on color

This method extracts areas within the same color range specified by the color tolerance, where the center of tolerance is the color of the point picked (clicked) on the observation window.

1 Click [Color].

The [Extract Color Area] dialog box appears.



(1) Color tolerance

When specifying the color level with the Extract picker, specify the color range width by dragging the slide bar.

(2) Clear extract

Deletes all extracted areas.

(3) Show extract area

If this option is checked, the area extracted based on color is displayed in the extraction color.

(4) Extract color

Select the color to paint the area extracted by color.

(5) Check Area

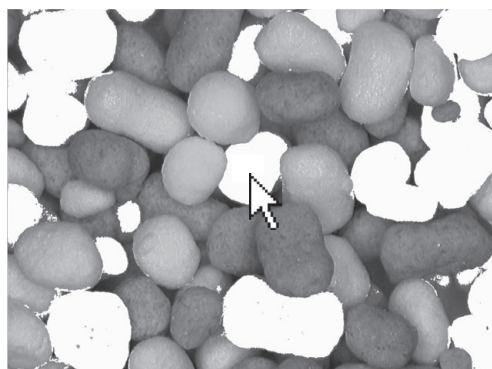
This button lightens the extraction color effect to allow checking of the specified area.

■ Extracting area by color



Click [Clear extract] to clear any unwanted color areas that have already been selected.

1 Click a point on the image to be selected.



The extracted area is displayed in the observation window using the extraction color.



Multiple areas can be picked by repeating step 1.

2 Adjust the color tolerance while viewing the image.

Dragging the color tolerance slider bar to the right expands the area that will be extracted.

3 Click [OK].

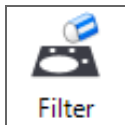
The binary image in the observation window displays.

Filter

The filter removes small areas of white in the binary image by painting them black.

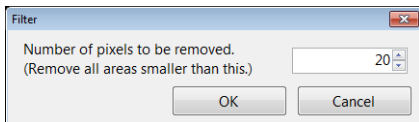
Use as necessary before doing an area measurement after using brightness or color extraction.

- 1 Click [Filter].



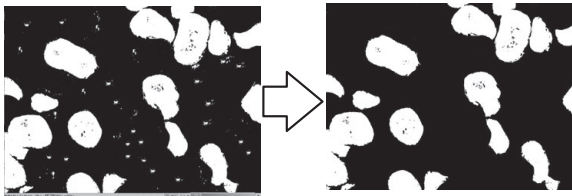
The [Filter] dialog box appears.

- 2 Adjust the number of pixels in the area to remove by clicking the ▲/▼ buttons. Click [OK] when done.



White areas in the image having fewer pixels than this setting will be removed.

Example of an image corrected using the filter.

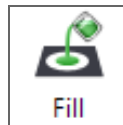


Fill

The fill tool fills the holes (black specs) in the white areas of the binary image by painting them white.

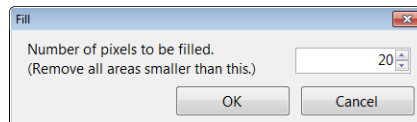
Use as necessary before doing an area measurement after using brightness or color extraction.

- 1 Click [Fill].



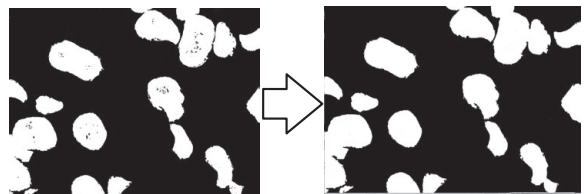
The [Fill] dialog box appears.

- 2 Adjust the number of pixels in the area to fill by clicking the ▲/▼ buttons. Click [OK] when done.



Black areas in the image having fewer pixels than this setting will be filled.

Example of an image corrected using the fill tool.



Undoing filters and fills

These operations cannot be undone. You must start over by clicking [Reset] and doing the [Brightness] (Page 9-29) or [Color] extraction (Page 9-31).

Measuring the extracted area

■ Individual measurement

- 1 Click [Indv Mesr].



- 2 Click the area to measure.

The area and perimeter of the extracted area appears in the [Measure Result] window. To measure multiple areas, click the remaining areas.

■ Block measurement


- 1 Click [Blck Mesr].



The area and perimeter of all extracted areas appear in the [Measure Result] window. Numbers are assigned automatically.

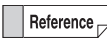
Displaying Text and Markers

Text comments and markers can be displayed on the observation window. When an image is recorded (saved) with the comment display turned on, the image is saved with the comment. Comments can be [Normal Comments], which are erased when the power is turned OFF, or [Residual Comments] which are saved even if the power is turned OFF.

 **Point** When an image file is saved with comments, the text or comments cannot be edited.

List of Comments

List of normal comments

 The total maximum number of normal comments that can be registered is 999.

Marker type	How the marker is drawn	Displayed image
Comments	Displays the comment in the location specified on the screen.	Comment
Circle	Draws a circle centered at the clicked point.	[Picture]
Rectangle	Draws a rectangle with one of its corners on the clicked point.	[Picture]
Ellipse	Draws an ellipse that starts at the clicked point.	[Picture]
Arrow	Draws a line that originates at the clicked point. The arrow appears at the origin.	[Picture]
Arrow/Text	Draws a line that originates at the clicked point. The arrow appears at the origin, and the comment appears at the end point.	[Picture]
Delete	Deletes the comment specified using the mouse. [Residual Comments] cannot be deleted.	-
Delete All	Deletes all normal comments. [Residual Comments] cannot be deleted.	-
Line Format	Color and line width for drawing circles, rectangles, etc., can be set.	-

List of residual comments

Comment type	Contents	Display format
Comment	Displays the applicable text.	
Date	Displays the date.	YYYY/MM/DD YY/MM/DD MM/DD/YYYY MM/DD/YY DD/MM/YYYY DD/MM/YY
Time	Displays the current time updated in real time.	hh:mm:ss
Lens Name	Displays the lens type and power.	Lens [type]: x [power]
Inclination angle	Displays the inclination angle of the stage.	Inclination angle: [value] degree
Magnification	Displays the magnification.	Magnification: x [magnification]

Hide

Hides all comments.

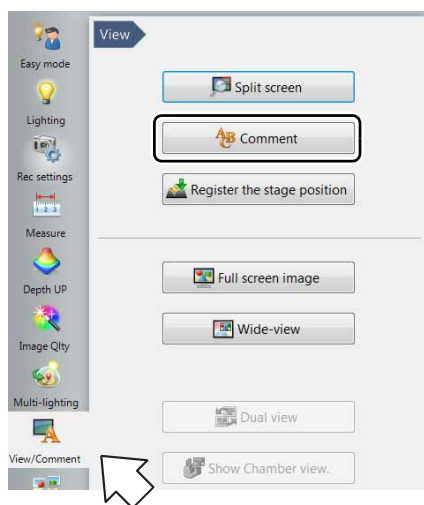
Delete All

Deletes all comments.

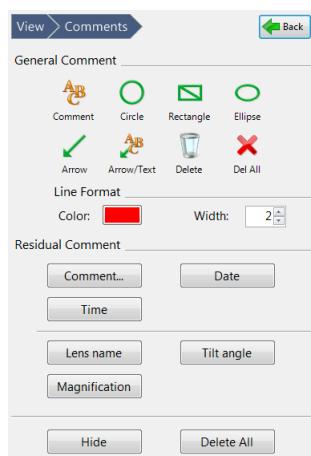
Entering and Specifying Comment Text and Markers

Point Normal comments are deleted when the power is turned off.

- 1 Click [View/Comment] from the VHX MENU and click [Comment].



This area displays a menu for the Normal Comments and Residual Comments.



- 2 Click the comment and marker (symbol) to enter from the Normal Comments.

The comment and marker is drawn on the observation window.

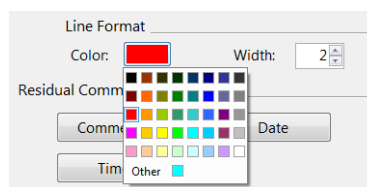
Changing the line color and line width

The color and width of the lines used to draw the markers for circles, rectangles, and arrows can be set beforehand. Any markers added after making these changes reflect the specified color and width.

Reference To modify the color and width of markers already drawn, double-click the marker.

Changing color

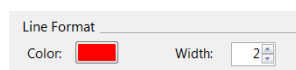
- 1 Click the color button and select a color.



Changing width

- 1 Click the arrow buttons ▲/▼ next to the line width value or type the value directly.

The width can be set from 1 to 10. 10 is the thickest.



Normal Comments

Comments

Text can be entered and displayed as a comment on the observation window.

Reference If you want the same comment to always appear in the observation window, specify a residual comment (Page 9-38).

■ Entering comments

- 1 Click [Comment] and enter the comment in the [Comment Properties] dialog box.



- 2 Click [OK] and click the position on the observation window to display the comment.

The comment appears.

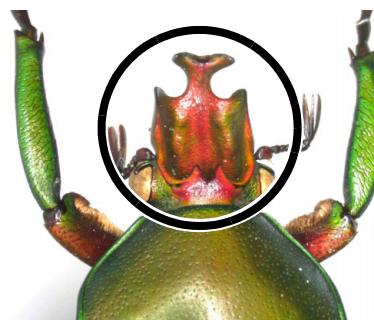
- Reference**
- The comment can be moved by clicking with the left mouse button and dragging.
 - Double-clicking the currently displayed comment displays its [Comment Properties] allowing you to edit the [Comment] and [Text display properties].

Circle marker

Drawing a circle marker on the observation window.

Click the [Circle] icon. On the observation window, click a point for the circle's center and then click a point on the circle's diameter.

The circle is drawn.

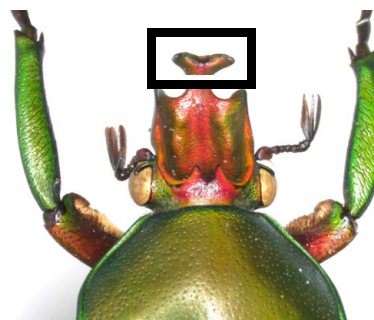


Reference The circle marker can be moved to another position by clicking on the circumference with the left mouse button and dragging.

Rectangle marker

Drawing a rectangle marker on the observation window.

Click the [Rectangle] icon. On the observation window, click two diagonal corners for the rectangle.



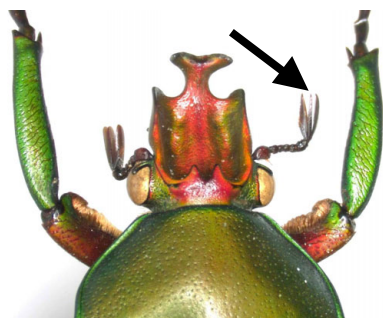
Reference The rectangle marker can be moved to another position by clicking on the outline with the left mouse button and dragging.

Arrow marker

Drawing an arrow marker on the observation window.

Click the [Arrow] icon. On the observation window, click the start and end point for the arrow.

An arrow that points to the start point will appear.



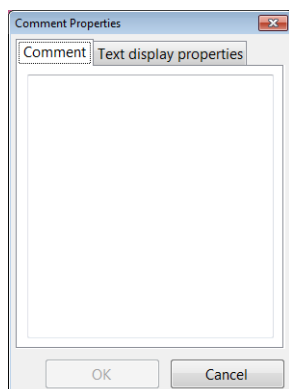
Reference The arrow marker can be moved to another position by clicking on the line with the left mouse button and dragging.

Arrow/Text comments

Drawing arrow/text comments on the observation window.

■ Entering arrow/text comments

1 Click the [Arrow/Text] icon and enter the comment when the [Comment Properties] dialog box appears.



2 Click [OK]. On the observation window, click the start and end point for the arrow.

An arrow marker that points to the start point and the comment will appear.

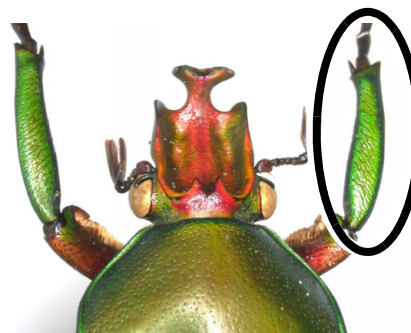
- Reference**
- The comment and arrow marker can be moved separately by clicking the left mouse button and dragging.
 - Double-clicking the currently displayed comment displays its [Comment Properties] allowing you to edit the [Comment] and [Text display properties].

Ellipse marker

Drawing an ellipse marker on the observation window.

Click the [Ellipse] icon. On the observation window, click two diagonal corners for a rectangle that will contain the ellipse.

The ellipse is drawn.



Reference The ellipse marker can be moved to another position by clicking on the perimeter with the left mouse button and dragging.

Deleting normal comments

After the normal comments show up on the screen, selected comments or markings can be deleted.

■ Deleting one specified normal comment

Click the [Delete] icon. On the observation window, click the comment or marker to delete.

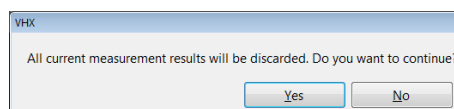
Click any of the text in the comment or on the line of the marker to delete only one item.

Reference Only normal comments can be deleted.

■ Deleting all normal comments

Click the [Del All] icon.

A confirmation dialog box appears. Click [Yes].



Entering and Setting Residual Comments

Residual comments show both user-specified comments and information on the observation image, such as its lens name, date, time, etc.

For residual comments, the display contents and position are retained for each user setting. The display contents and position can be changed by changing user setups (Page 13-14).

- Reference**
- The comment can be moved by clicking with the left mouse button and dragging.
 - Double-clicking the currently displayed comment displays its [Text display properties], allowing you to edit the color and font.

Comments

Entering text and displaying it as a comment on the observation window.

- 1 **Click [Comment] and enter the comment in the [Comment Properties] dialog box.**



- 2 **Click [OK].**
The comment appears.

- Reference**
- The comment can be moved by clicking with the left mouse button and dragging.
 - Double-clicking the currently displayed comment displays its [Comment Properties] allowing you to edit the [Comment] and [Text display properties].

Displaying the lens name

Displaying the lens type and power currently in use.

Click [Lens Name] .

For lenses with the automatic lens/zoom recognition function, the lens name appears automatically. For other lenses, the selected lens names are displayed.

- Reference**
- To move the lens name, click it with the left mouse button and drag.
 - Double-clicking the currently displayed lens name displays its [Text Format], allowing you to edit the font, font size, color, etc.
 - Selecting/deselecting the [Lens Name] in the menu toggles between hide/show.

Displaying the date

The date can be displayed on the observation window.

Click [Date].

The date appears.

- Reference**
- To move the date, click it with the left mouse button and drag.
 - Double-clicking the displayed date allows you to edit the display style, font, font size, and color.

The display style can be changed as shown below.

Display style	Display examples
YYYY/MM/DD	2009/1/15
YY/MM/DD	09/1/15
MM/DD/YYYY	01/15/2009
MM/DD/YY	01/15/09
DD/MM/YYYY	15/01/2009
DD/MM/YY	15/01/09

Time

Displaying the time.

Click [Time] .

The time appears at the clicked point.

- Reference**
- To move the time, click it with the left mouse button and drag.
 - Double-clicking the displayed time allows you to edit the display style, font, font size, and color.
 - Selecting/deselecting the [Time] in the menu toggles between hide/show.

Hiding Comments

After comments are placed on the screen, they can be hidden.

Clicking the [Hide] icon hides all comments.

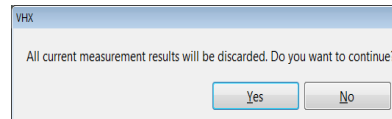
Clicking the [Hide] icon again will display the comments.

Delete All

Deletes all normal comments and residual comments.

Click [Delete All]. A confirmation dialog box will appear.

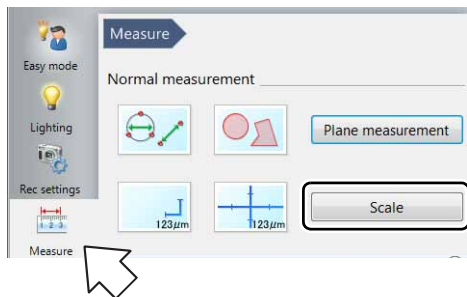
Click [Yes].



Displaying a Scale

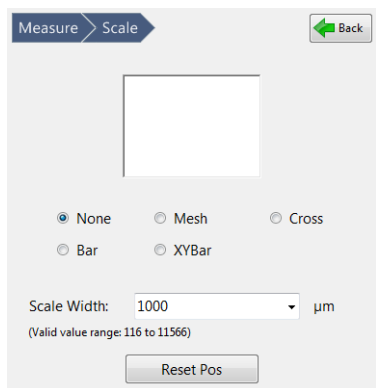
Displaying a scale on the observation window to serve as a reference during observation.

1 Click [Measure] from the VHX MENU and click [Scale].

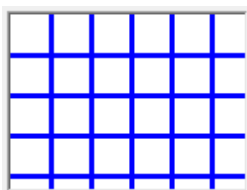


The Scale settings window appears.

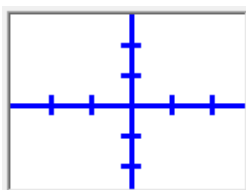
2 Select the scale type.



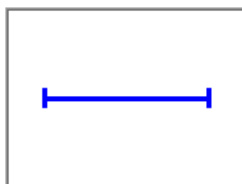
• Mesh



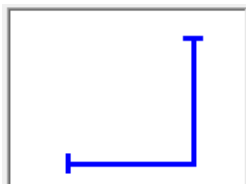
• Cross



• Bar



• XYBar



3 Enter the reference length of the scale to display as the scale width.

The scale and reference length appears on the observation window.

Point The size of the scale automatically adjusts according to the lens power currently selected. This must be matched with the lens power actually in use. ["Lens Setting" \(Page 9-5\)](#)

Reference The range of input for the scale width differs depending on the lens and power used. The scale can be dragged up and down, and left and right.

- **Reset position**
This restores the scale and the position of the text on the scale to its original position.
- **Line Format**
This changes the color and width of the lines.
["Appearance of lines, reference line, points, XY, width, and text" \(Page 9-23\)](#)
- **Text Format**
This sets the background color, text color, and font used to display the scale.
["■ Text format" \(Page 9-23\)](#)

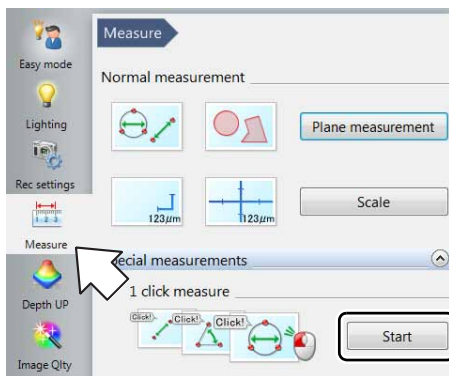
One-Click Automatic Measurement

It is possible to create a measurement template and use it to repeat a single measurement with a single click.

Creating a New Template

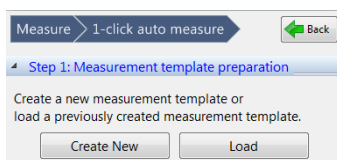
Point Only templates with the normal recording size (1600 x 1200) can be created.

- 1 Click [Measure] from the VHX MENU and click [1 click measure].



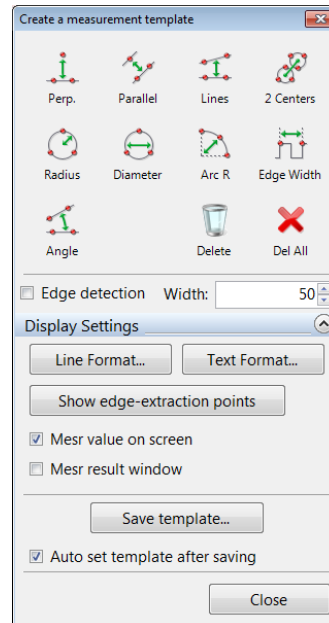
This brings up the one-click automatic measurement settings dialog in the operation area.

- 2 Click [Create New].



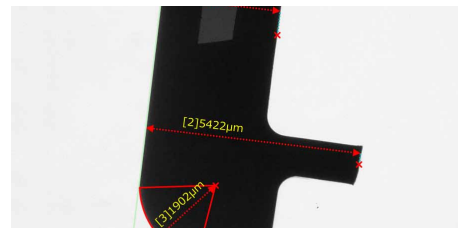
The [Create a measurement template] dialog box appears.

- 3 Click the icon for the desired measurement.



- 4 Specify the measurement points in the observation window and set the measurement object.

The measurement result is then displayed. A maximum of 99 measurement objects can be set within a single template.



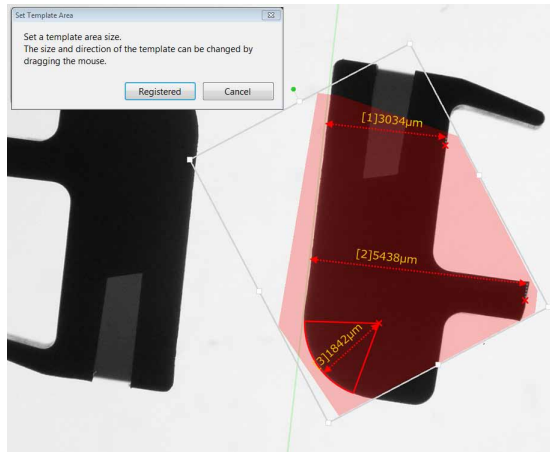
Reference

- The measurement procedure is the same as described in "Main Measurements" (Page 9-12).
- [Arc R] is equivalent to [Radius]. It measures the radius of an arc that passes through three specified points. This can be used to measure the radius of an angle when no complete circles are present on the screen.
- [Edge Width] is equivalent to [2 Points]. It measures the distance between two specified vertices.
- When the [Edge detection] checkbox is selected, edges of the object are extracted and an appropriate measurement line is automatically generated.
- For details on the display of measurement results and settings related to lines, text, and colors within images, refer to "Display Settings" (Page 9-23).

5 Click [Save template].

The template area will become transparent, zoom in and rotate handles will appear.

At the same time the [Set Template Area] dialog box appears.

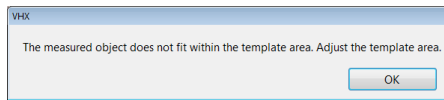


Reference When the [Set the template automatically after saving] checkbox is selected, a thumbnail is displayed in the operation area.

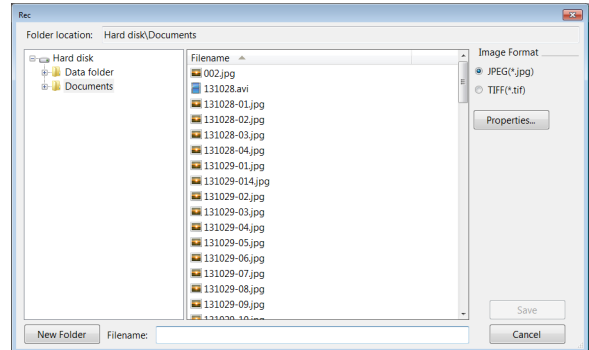
6 If necessary, adjust the template size and orientation and click [Registered].

The [Rec] dialog box appears.

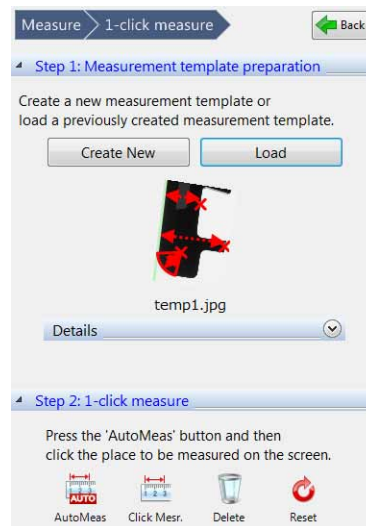
Point If the measurement object protrudes out from the template area, the following message will be displayed. Please ensure that the measurement object is contained within the template area.



7 Enter the file name and click [Save].



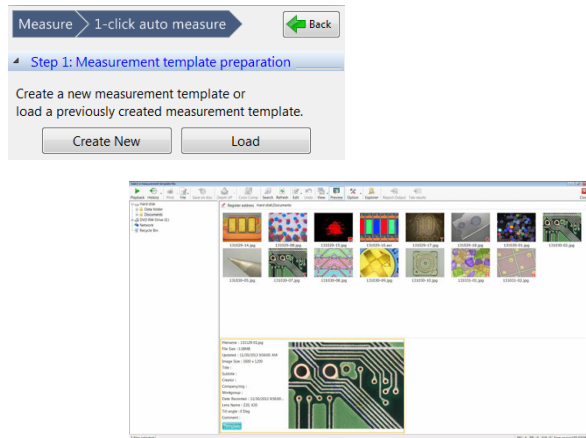
The measurement template area is displayed in the operation area and Step 2 is enabled.



Template Recalling

- 1 Click [Load] on the one-click automatic measurement settings dialog.

The album window will come up.

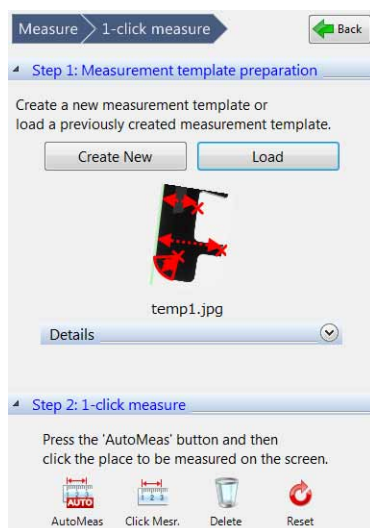


- 2 Select the appropriate template file and click [Playback].

Reference For template files, a small "T" is displayed in the corner of the thumbnail.



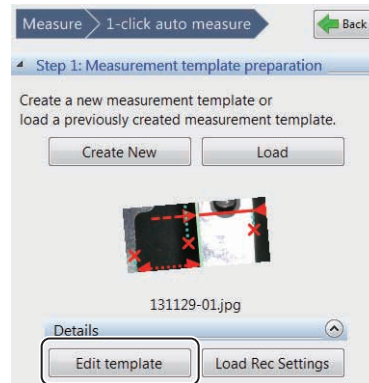
The measurement template area is displayed in the one-click automatic measurement screen and Step 2 is enabled.



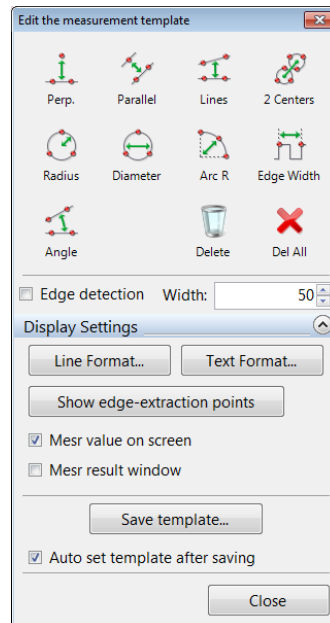
Editing a Template

It is possible to edit a previously created template file.

- 1 Click [Edit template].



The [Edit the measurement template] dialog box appears. The template for editing is displayed in the image window.



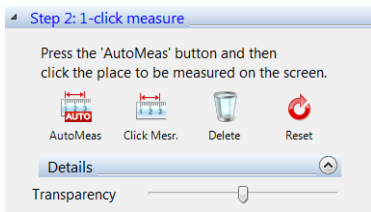
- 2 Add, delete, or move measurement points on the measurement object.

Load Rec Settings

This loads the recording settings from an existing saved image and applies the same recording settings.

Click measurement

- 1 Click [Album] from the VHX MENU.**
The album window will come up.
- 2 Select the image file for measurement and click [Playback].**
- 3 Click [Click Mesr.].**



Transparency

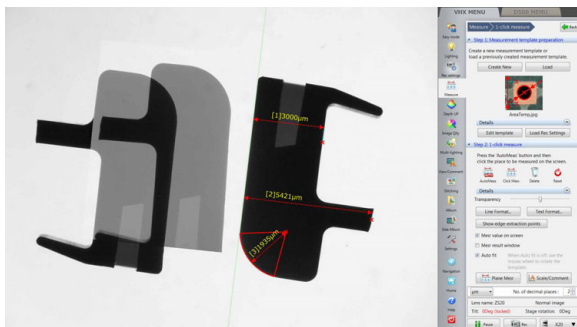
Transparency of the template can be adjusted by using the slide bar.

Auto fit

If this option is checked, template rotational correction is automatically performed when the mouse cursor is placed over the image to be measured.

Reference Refer to "Display Settings" (Page 9-23) for details on the display and settings of lines, texts and color on images.

- 4 Move the mouse to the position in the image that you would like to measure.**
The area of the image surrounding the cursor is magnified and a transparent template is displayed.
- 5 Click the position you would like to measure.**
Automatic measurement is carried out according to the template measurement lines and measurement results are displayed.



Delete

Deletes individual measurement lines and results.

- 1 Click [Delete].**
- 2 Click the measurement line you would like to delete.**

Reset

Deletes all measurement lines and results.

- 1 Click [Reset].**
- 2 Click [Yes].**

Edit

- 1 Click [Plane Mesr] or [Scale/Comment].**
This allows editing and adding comments to the results of measurements.
📖 "Main Measurements" (Page 9-12)

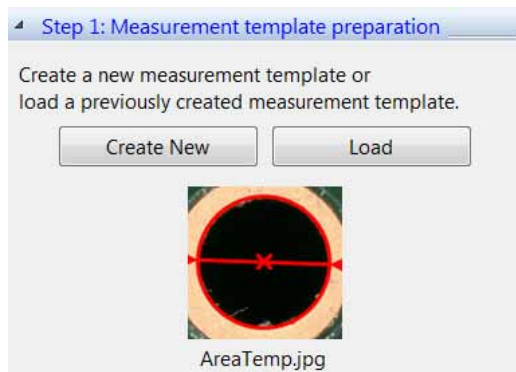
Auto-measurement

The click measurement and the auto-measurement are different each other in the followings.

Name	Measurement assignment with "Click"	Sample alignment and position identical to template
Click measurement	Required	Not required
Auto-measurement	Not required	Required

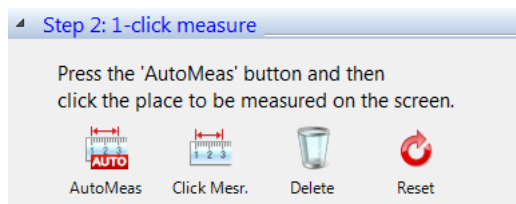
The Auto-measurement performs the template measurement without requiring clicking the object on the image if the object is placed on the same position as the template. This function is useful when the same measurement is repeated at the same position for many objects.

- 1 Create a new measurement template or load a existing one.**



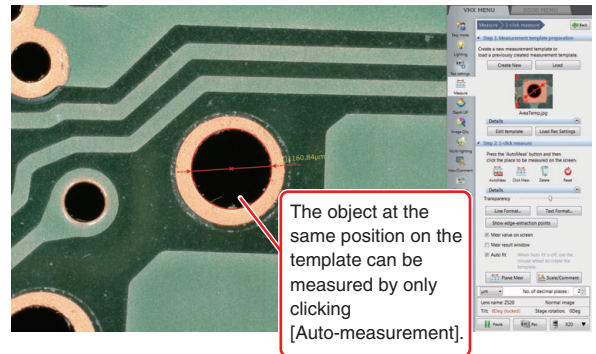
- 2 Place the object at the same location as that when the template is created.**

- 3 Click [Auto-measurement].**



- 4 The measurement result is displayed on the screen.**

You do not need to click the object on the image.



- 5 Place the next object at the same location as that when the template is created, and perform the next measurement.**

(Repeat the steps 2 to 4.)

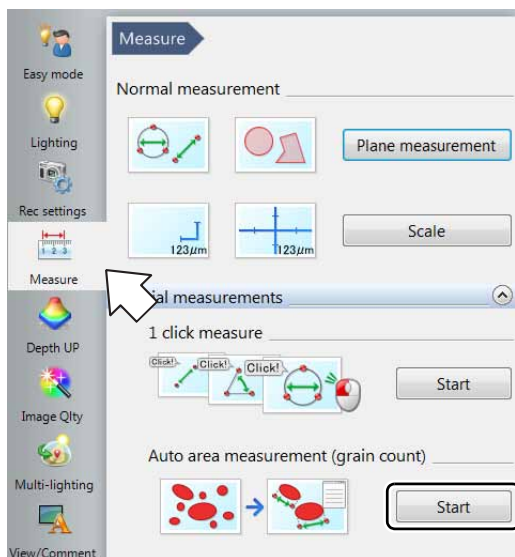
Automatic Area Measurements

It is possible to automatically extract areas with the same brightness level and measure the area of the target object after shape formatting the extracted area.

By saving the automatic area data file, it is possible to recreate the same settings and perform measurements as many times as you like when extracting/measuring other objects.

Measurement Mode Selection

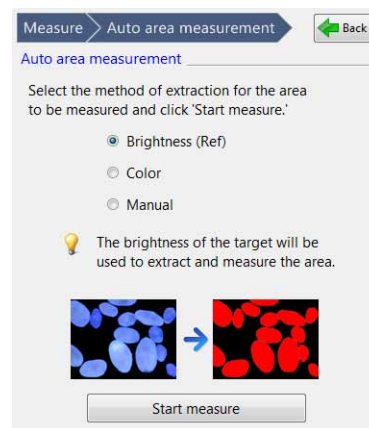
- 1 Click [Measure] from the VHX MENU and click [Auto area measurement].



This brings up the automatic area measurement settings dialog in the operation area.

- 2 For measurement of an image file that has been saved, click [Album] from the VHX MENU.
- 3 Select the image to be measured and play it back.

- 4 Select the extraction mode (brightness/color/manual).



Brightness (Ref)

This measures an area that was extracted based on the brightness of the object.

Color

This measures an area that was extracted based on the color of the object.

Manual

This sets the extraction parameters to manual and extracts/measures objects on the screen all at once.

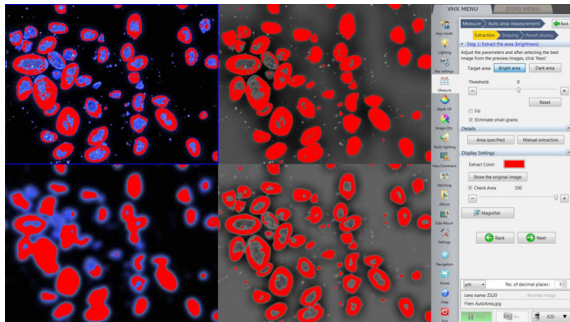
Measurement Area Extraction

1 Click [Start Measure].

This brings up the extraction parameter settings dialog in the operation area.

The settings dialog may change depending on the extraction mode chosen.

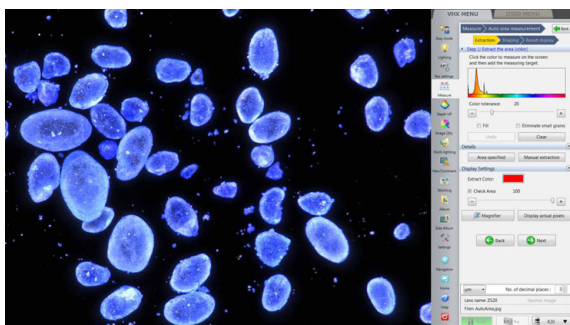
When the extraction mode is set to "Brightness"



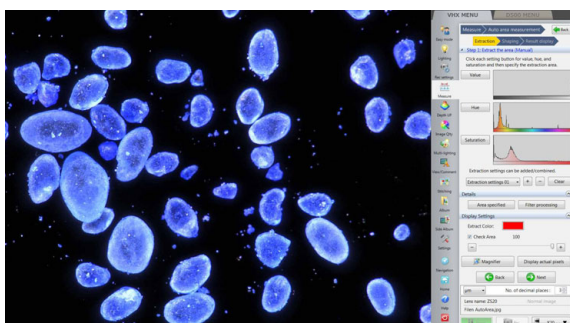
The following four types of images are displayed in the observation window.

Normal	Noise removal weak
Noise removal strong	Noise removal medium

When the extraction mode is set to "Color"



When the extraction mode is set to "Manual"



2 Specify the extraction parameters.

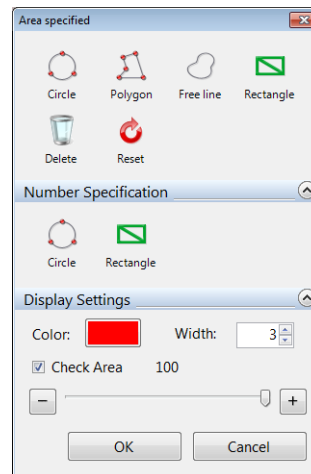
Refer to "Setting extraction parameters" (Page 9-48) for details on how to specify parameters for each extraction mode.

3 For extraction area specification, click [Area specified].

The [Area specified] dialog box appears.

4 Click the icon to specify the extraction area, set the extraction area on the observation window, and click [OK].

Multiple areas can be selected at once.



Circle

Click three points on the circumference of the circle that contains the area to be extracted.

Polygon

Enclose the area to be extracted by sequentially clicking each vertex point and double click to indicate the final vertex point.

Free line

Drag the mouse around the perimeter of the area to extract.

Rectangle

Drag the diagonally opposite corners of the rectangular area to extract.

Delete

Click the desired extraction area to delete a single one.

Reset

Deletes all extraction areas.

Number Specification (Circle/Rectangle)

Enter the length to specify the extraction area.

Color

Specify the color of extraction area lines.

Width

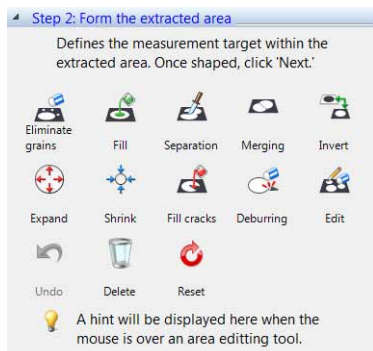
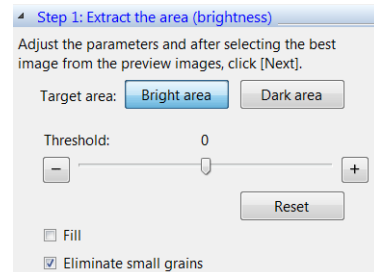
Specify the width of extraction area lines.

Check Area

This lightens the color of the extraction to allow checking of the specified area while comparing it to the original image.

- 5** When the extraction mode is set to "Brightness", select the most appropriate image from the four images in the image window and either click [Next] or double click the image itself. For other extraction modes, click [Next].

The object is extracted and the measurement procedure continues on to "Form the extracted area" (Page 9-52).

**Setting extraction parameters****■ Brightness Extraction****Bright area**

Extracts the bright area of the image.

Dark area

Extracts the dark area of the image.

Threshold

Sets the range of the brightness level threshold value at -255 to 255. Drag the slide bar to the left and right to change the appearance of the four parts of the image.

Reset

Returns the threshold value to zero.

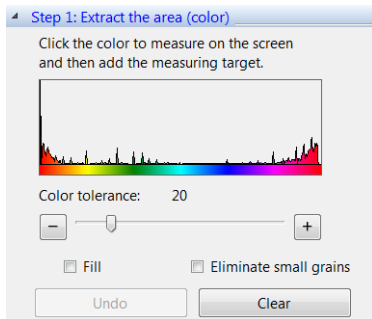
Fill

If this option is checked, all holes in the binary image are filled.

Eliminate small grains

When this option is checked, granular components with small areas are removed from the binary image.

■ Color Extraction



Histogram

When you click on the place in the image that contains the color you would like to measure, the blue area is displayed on the histogram and the measurement object is added.

Color tolerance

When specifying the color level with the Extract picker, specify the color range width by dragging the slide bar.

Fill

If this option is checked, all holes in the binary image are filled.

Eliminate small grains

When this option is checked, small granular components are removed from the binary image.

■ Manual Extraction

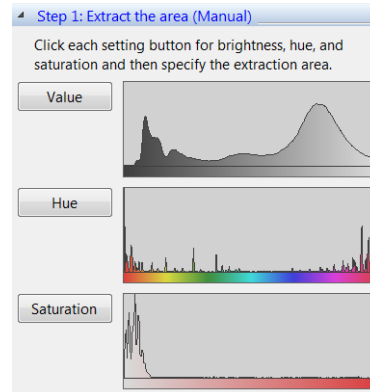
Using either the Histogram or Extract picker, the extraction range can be specified manually according to particular image brightness, hue, or saturation. The Histogram and Extract picker are operated on the dialog box displayed by clicking the corresponding button.

Each type of filter can also be used to allow the elimination of brightness variation, noise removal, and outline extraction. Filter processing is carried out on the [Filter] tab of the details menu.

📖 "Using the Extract picker" (Page 9-30), "Using the histogram" (Page 9-30)

Extraction operation of value, hue and saturation

1 Click [Value], [Hue] and [Saturation].

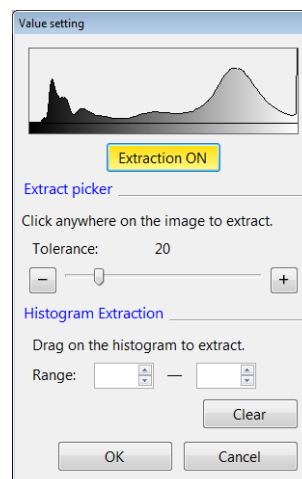


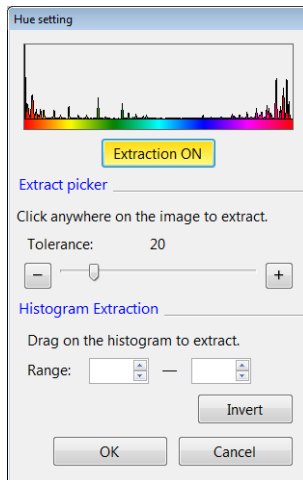
The corresponding dialog boxes will appear.

2 On each dialog box, specify the extraction range using either the Histogram or Extract picker and click [OK].

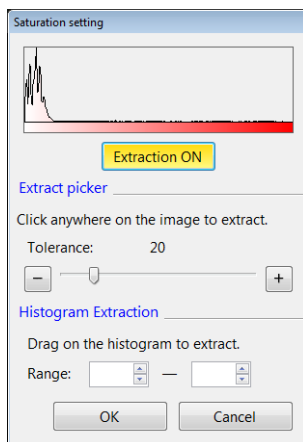
Only one extraction range is allowed for each.

[Value setting] dialog box

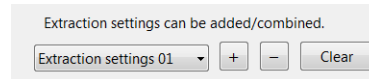
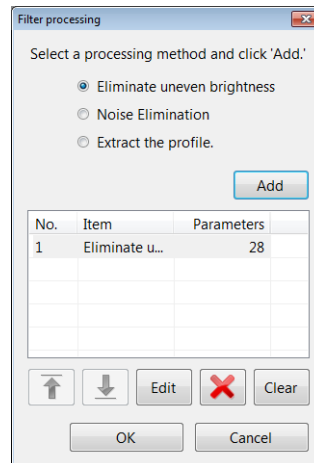


[Hue setting] dialog box**Reference**

When you would only like to extract red hues, it is necessary to specify both the left and right edges on the histogram. However, this is not possible when specifying two areas separately. In this case, drag the mouse over the space outside the area you would like to extract and click [Invert].

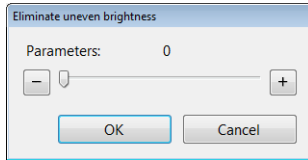
[Saturation setting] dialog box**3 Click [+].**

On each dialog box, specify the most appropriate type of processing to extract the object. Up to 20 necessary extraction processing types can be added to the list box.

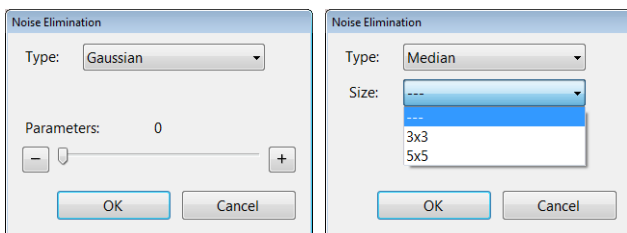
**4 Open the advanced menu and click [Filter processing]. Select either [Eliminate uneven brightness], [Noise Elimination], or [Extract the profile] according to the aims of the filter processing, and click [Add].**

The corresponding dialog boxes will appear.

5 Set the filter processing parameters for each dialog box and click [OK].



Use the slide bar to set the strength of the brightness variation removal.



Type

There are many types of noise removal filters such as [Gaussian], [Median], [Average filter], [Max filter], [Min filter], and [Remove texture].

Size

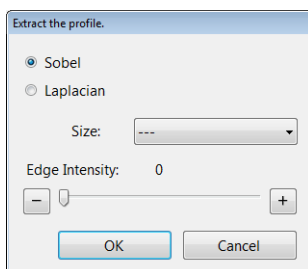
The filter processing size is specified for the [Median], [Average filter], [Max filter], and [Min filter].

[3x3]: The value of the central 3 x 3 pixel is calculated from the values of the pixels above, below, and to the left and right, and it is then replaced.

[5x5]: The value of the central 5 x 5 pixel is calculated from the values of the pixels above, below, and to the left and right, and it is then replaced.

Texture

For [Gaussian] and [Remove texture], the texture strength can be adjusted by using the slide bar.



Sobel

Enabled when you only want to enhance main edges.

Laplacian

Performs enhancement that does not depend on edge direction.

Size

[3x3]: The value of the central 3 x 3 pixel is calculated from the values of the pixels above, below, and to the left and right, and it is then replaced.

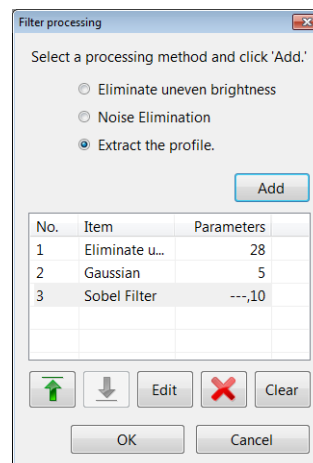
[5x5]: The value of the central 5 x 5 pixel is calculated from the values of the pixels above, below, and to the left and right, and it is then replaced.

Edge Intensity

The edge strength can be adjusted by using the slide bar.

6 Click [Add] and save the filter process.

On each dialog box, specify the most appropriate type of filter processing to extract the object. Up to 30 necessary filter processing types can be added to the list box.

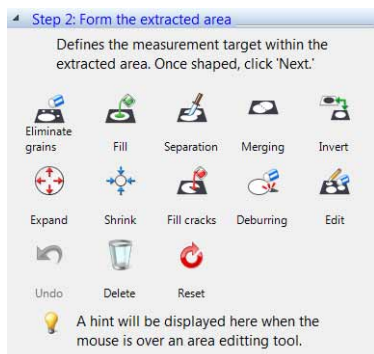


Filter processing types in the list box are set in descending order as they appear in the list box. Select the corresponding number in the list box and click the [Edit] button to edit its contents.

Form the extracted area

Format the shape of measured objects in the extracted area.

1 Click the icon for the shape formatting item.



With shape formatting processing, it is possible to specify areas and perform shape formatting separately on each area.

For more details on operation, refer to the following sections.

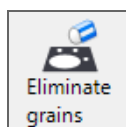
2 After shape formatting the extraction area, click [Next].

The measurement procedure continues on to "Display Measurement Results" (Page 9-57).

Eliminate grains

This removes any granular components that are not part of the measurement object from either the entire screen or the specified area.

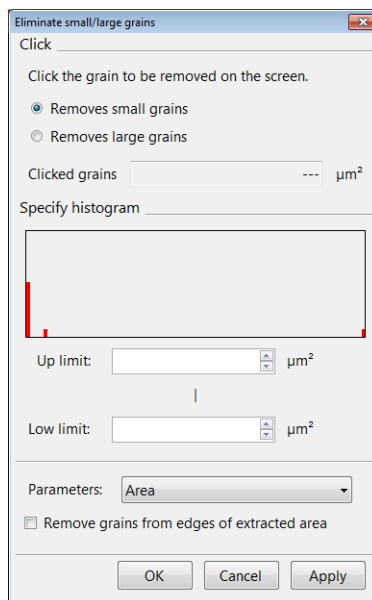
1 Click [Eliminate grains].



The [Eliminate small/large grains] dialog box appears.

2 To specify the area for processing, drag with the mouse over the area you would like to select.

3 Select the deletion standard (Area/Perimeter/Max diameter/Min diameter/Circularity/Circle equivalent dia/Envelope curve (Area)/Envelope curve (Perimeter)).



- The histogram represents the area/perimeter/max diameter/min diameter/circularity/circle equivalent dia/Envelope curve (Area)/Envelope curve (Perimeter), and displays the frequency of occurrence (distribution) for each pixel on the vertical axis.
- When the [Remove grains from edges of extracted area] check box is selected, the grains in contact with the edge of extraction area will be removed. Use this function when the entirety of all the grains are not captured and a correct measured value cannot be obtained.

4 Click either [Removes small grains] or [Removes large grains] and click on the grains you want to delete in the image.

The size of the clicked grain is displayed under the [Clicked grains].

When [Removes small grains] is selected, grains smaller than the one clicked are highlighted as targets for deletion.

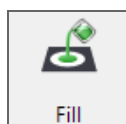
When [Removes large grains] is selected, grains larger than the one selected are highlighted as targets for deletion.

5 Click [OK].

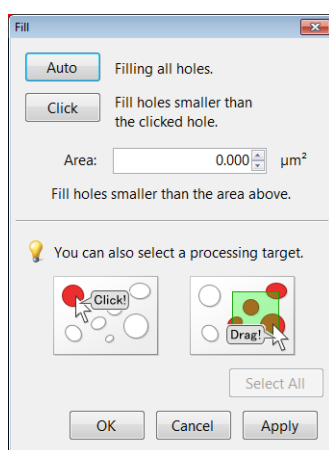
Fill

This fills any granular components that have less than a given area from either the entire screen or the specified area.

1 Click [Fill].



The [Fill] dialog box appears.



2 To specify the area for processing, drag with the mouse over the area you would like to select.

3 Enter the area you want to fill into the [Area] box.

4 Click [Auto] to fill all holes.

The area of the largest hole in the area box is displayed and all holes are highlighted.

5 To fill all holes that have less than a fixed area, click [Click] and then click on holes in the image.

Regions with holes that have areas less than the clicked hole are highlighted.

Reference Fine tuning of the fill area is possible by entering a value into the [Area] box.

6 Click [Apply].

Holes are filled and highlighted regions change to the extraction color.

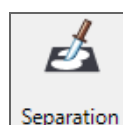
7 Click [OK].

Separate

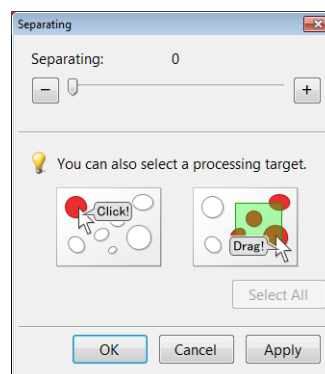
This separates any granular components from either the entire screen or the specified area according a given degree of separation.

This is more effective when fill processing is performed in advance.

1 Click [Separation].



The [Separation] dialog box appears.



2 To specify the area for processing, drag with the mouse over the area you would like to select.

Only the grains within this area will be displayed in the extraction color.

3 Specify the degree of separation with the slide bar.

Grains within the area will be separated by color according to the specified degree of separation.

4 Click [Apply].

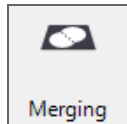
Separation processing is carried out and each respective color will change to the extraction color.

5 Click [OK].

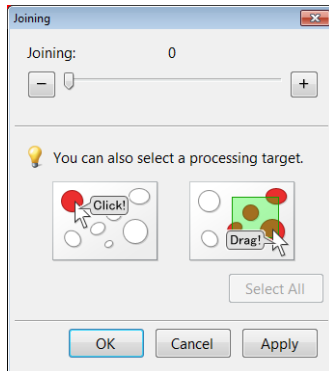
Conjoin

This combines granular components on either the entire screen or the specified area.

1 Click [Conjunction].



The [Conjunction] dialog box appears.



2 To specify the area for processing, drag with the mouse over the area you would like to select.

Only the grains within this area will be displayed in the extraction color.

3 Adjust the combination degree with the slide bar.

Separated grains are combined and highlighted.

4 Click [Apply].

Combination processing is carried out and the combined grains are changed to the extraction color.

5 Click [OK].

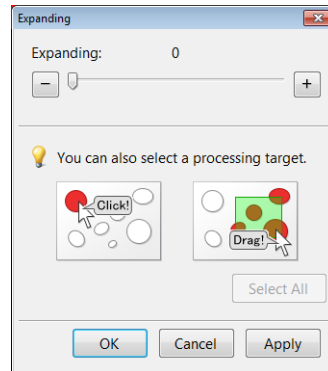
Expand

This expands granular components on either the entire screen or the specified area.

1 Click [Expand].



The [Expand] dialog box appears.



2 To specify the area for processing, drag with the mouse over the area you would like to select.

Only the grains within this area will be displayed in the extraction color.

3 Adjust the expansion degree with the slide bar.

Applicable grains are expanded.

4 Click [Apply].

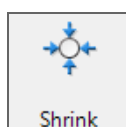
Expansion processing is carried out and applicable grains are changed to the extraction color.

5 Click [OK].

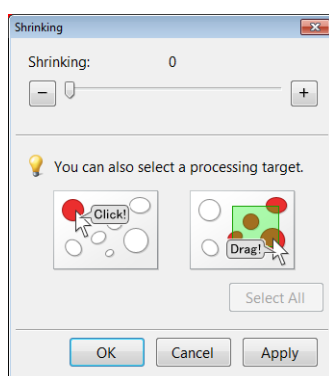
Shrink

This contracts granular components on either the entire screen or the specified area.

1 Click [Shrink].



The [Shrink] dialog box appears.



2 To specify the area for processing, drag with the mouse over the area you would like to select.

Only the grains within this area will be displayed in the extraction color.

3 Adjust the contraction degree with the slide bar.

Applicable grains are contracted.

4 Click [Apply].

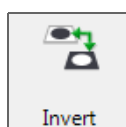
Contraction processing is carried out and applicable grains are changed to the extraction color.

5 Click [OK].

Invert

This inverts the area extracted on the screen.

1 Click [Invert].

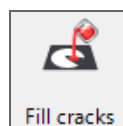


The extracted area is inverted.

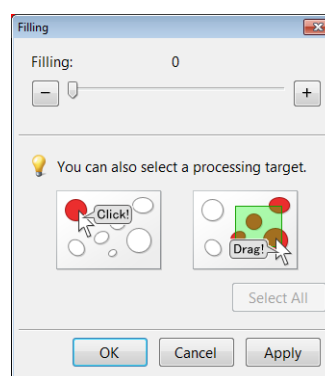
Fill missing parts

This fills any missing parts of granular components on either the entire screen or the specified area.

1 Click [Fill cracks].



The [Fill cracks] dialog box appears.



2 To specify the area for processing, drag with the mouse over the area you would like to select.

Only the grains within this area will be displayed in the extraction color.

3 Adjust the degree of missing parts with the slide bar.

Applicable grains are highlighted.

4 Click [Apply].

Fill missing parts processing is carried out and applicable grains are changed to the extraction color.

5 Click [OK].

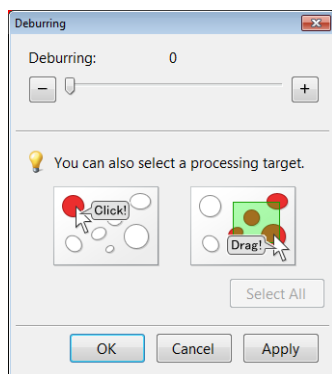
Deburring

This trims any protrusions from granular components on either the entire screen or the specified area.

1 Click [Deburring].



The [Deburring] dialog box appears.



2 To specify the area for processing, drag with the mouse over the area you would like to select.

Only the grains within this area will be displayed in the extraction color.

3 Adjust the degree of trimming with the slide bar.

Applicable grains are highlighted.

4 Click [Apply].

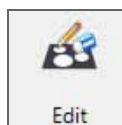
Trim processing is carried out and applicable grains are changed to the extraction color.

5 Click [OK].

Editing

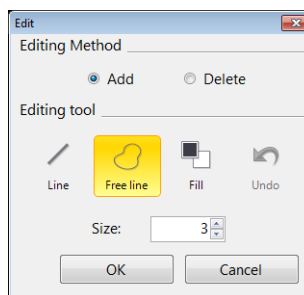
This allows manual editing of the specified area.

1 Click [Edit].



The [Edit] dialog box appears.

2 Select the editing method (Add/Delete).



3 Click the edit icon and then click [OK] after image editing is complete.

Line

Drag the mouse and draw a line from the start point to the end point to add/delete an area.

Free line

Drag the mouse and draw a free shape from the start point to the end point to add/delete an area.

Fill

Drag the mouse and draw a rectangle having the start and end points as its opposite corners to add/delete an area.

Undo

This returns to the previous editing state.

Size

This specifies the line width of the added/deleted area.

Delete

This deletes individual extraction areas.

1 Click [Delete].



2 Click the extraction area or drag the mouse over the area you would like to delete.

For each click, a single area will be deleted.

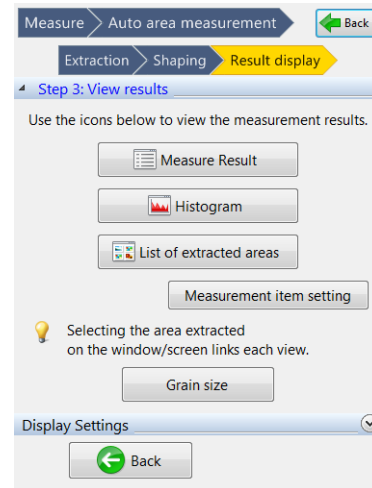
Restart shape formatting

Click [Undo] to return to the previous shape formatting editing state.

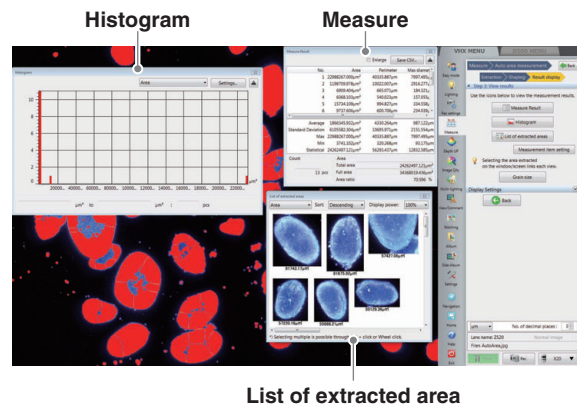
Click [Reset] to start over from the original shape formatting.

Display Measurement Results

After formatting the extraction area, click [Next] to bring up the result display in the operation area.



Click [Measure Result], [Histogram], or [List of extracted area] to display each window respectively.



Setting measurement items

Click [Measurement items] to bring up the [Measurement item setting] dialog box.

In this dialog box, measurement items shown under Measure Result, Histogram, and List of extracted area are able to be selected.

■ Selecting measurement items

The left list box contains items not displayed and the right list box contains items displayed.

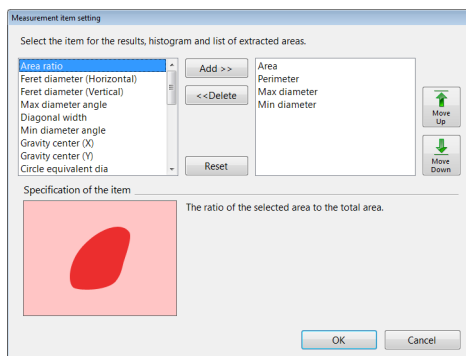
Clicking [Add] moves the selected measurement item from the left box to the right box.

Clicking [Delete] moves the selected measurement item from the right box, back to the left box.

Clicking [Move Up] or [Move Down] changes the order of the selected measurement item in the right box.

The measurement item at the top of the right box is displayed in the Histogram and Extracted Image List.

Click [Reset] to reset the box to the default values.



■ Types of measurement items

A description of the selected measurement item in the list box is displayed in [Item Description].

Area

The area of the figure.

Area ratio

The area ratio of the figure within the screen.

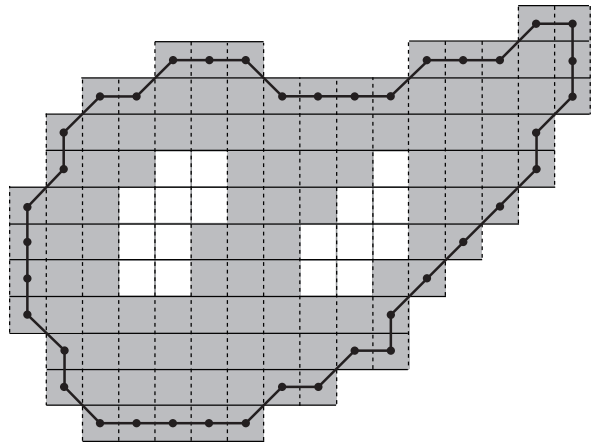
Perimeter

The length of the perimeter of the figure. This is calculated as the length of the line that passes through the center of the pixels that make up the inner perimeter.

Calculation method

This is the perimeter of the specified particle.

It is calculated as the length of the line that connects the centers of the pixels along the internal perimeter of the specified particle (the length of the black line in the figure below).



This is calculated while taking the length of the vertical or horizontal line of a pixel as 1, and the length of the diagonal line from a pixel to the diagonally adjacent pixel as $\sqrt{2}$. The value for the figure above is as follows:

Particle perimeter = 45.2132

Reference

When the particle consists of a single pixel, the particle perimeter becomes 0.0.

Feret diameter (Horizontal)

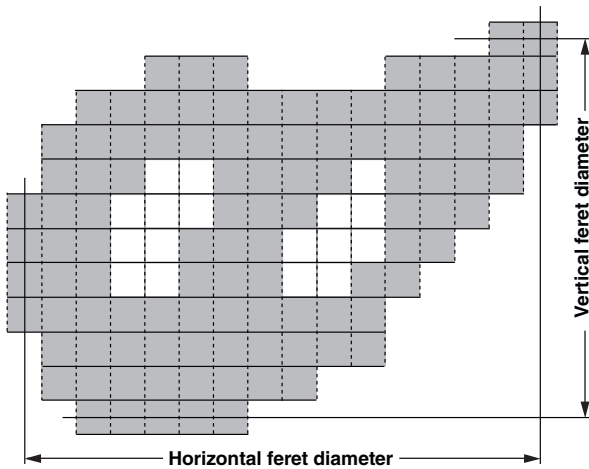
The horizontal length (number of pixels) of a rectangle circumscribed around the figure.

Feret diameter (Vertical)

The vertical length (number of pixels) of a rectangle circumscribed around the figure.

$$\text{Ferret diameter (Horizontal)} = \max_{p \in P} x - \min_{p \in P} x + 1$$

$$\text{Ferret diameter (Vertical)} = \max_{p \in P} y - \min_{p \in P} y + 1$$



The values for the figure above are as follows:

Horizontal Feret diameter = 16

Vertical Feret diameter = 12

Maximum diameter

The maximum length between any two points that lie on the inner perimeter of the figure.

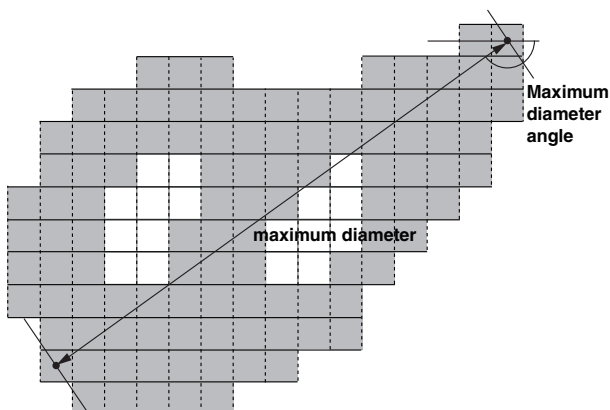
$$= \max_{p, q \in C} \sqrt{(px - qx)^2 + (py - qy)^2}$$

Maximum diameter angle

The angle between a line along the maximum diameter and the x-axis.

The maximum diameter is the maximum distance between any two pixels on the inner perimeter of the particle.

Distance is counted as the Euclidean distance between the centers of the two pixels.



The values for the figure above are as follows:

Maximum diameter = 17.2047

Maximum diameter angle = 144.46°

Minimum diameter

This is the minimum possible distance between two parallel lines on either side of the particle. It is calculated as the distance between the pixels that each of the two lines touches.

Minimum diameter angle

The angle between a line along the minimum diameter and the x-axis.

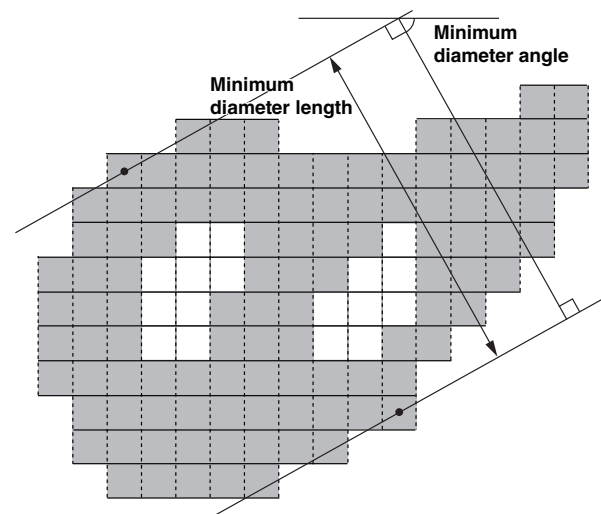
Minimum diameter/Minimum diameter angle

$$L(\alpha) = \max_{c \in C} (c_X \cos \alpha + c_Y \sin \alpha) - \min_{c \in C} (c_X \cos \alpha + c_Y \sin \alpha)$$

When α is defined as ($0^\circ \leq \alpha < 180^\circ$), the minimum value of $L(\alpha)$ will be the minimum diameter, and the α at the time will be the minimum diameter angle.

$\beta = -$ (minimum diameter angle)

First, the minimum diameter angle is determined with a precision of 0.1 degrees. Then the minimum diameter is determined based on the distance between the two pixels that touch the two lines that enclose the particle at that angle (as shown below).



The values for the figure above are as follows:

Minimum diameter = 9.8411

Minimum diameter angle = 63.4°



Reference When the particle consists of a single pixel, the values are as follows:

Maximum diameter = 0.0

Maximum diameter angle = 0.0

Minimum diameter = 0.0

Minimum diameter angle = 0.0

Diagonal width

This is the distance between two parallel lines that sandwich the particle and are parallel to the line along the maximum diameter.

It is calculated as the distance between the pixels that each of the two lines touches.

Gravity center X/Y

The coordinates of the center of gravity of the figure.

The X coordinate of the center of gravity

$$= \left(\sum_{p \in P} p_x \right) / Area$$

The Y coordinate of the center of gravity

$$= \left(\sum_{p \in P} p_y \right) / Area$$

Area is the particle area.

Circle equivalent dia

This is the diameter of a circle with the same area as the figure. It is sometimes referred to as the Heywood diameter.

The circle equivalent diameter for the figure can be shown as:

Circle equivalent diameter of the specified particle

$$= \sqrt{\frac{4 \cdot Area}{\pi}}$$

Area is the particle area.

Circularity

When the figure is a perfect circle, the maximum value is one. As it becomes long and thin, this value approaches zero.

The degree of circularity of the figure can be shown as:

The degree of circularity of the specified particle

$$= \frac{4\pi \cdot Area}{Perimeter^2}$$

Area is the particle area.

Perimeter is the particle perimeter.



When the particle consists of a single pixel, degree of circularity of the specified particle becomes 1.0.

Envelope curve (Area)

This is the ratio between the area of the figure and its convex envelope area.

This approaches one as the figure is less bumpy.

Convex envelope ratio (Area) = Area of the figure ÷ Convex envelope area

Envelope curve (Perimeter)

This is the ratio between the perimeter of the figure and its convex envelope perimeter.

This approaches one as the figure is less bumpy.

Convex envelope ratio (Perimeter) = Area of the figure ÷ Convex envelope area

Note: A convex envelope is defined as:

A convex polygon that tightly encloses the figure.

Convex envelope area: The area of the envelope enclosing the figure

Convex envelope perimeter: The perimeter of the envelope enclosing the figure

1st moment (X-axis)

The primary moment of the figure on the X-axis.

1st moment (Y-axis)

The primary moment of the figure on the Y-axis.

The primary moment of the specified particle on the

$$\text{X-axis} = \sum_{p \in P} p_x$$

The primary moment of the specified particle on the

$$\text{Y-axis} = \sum_{p \in P} p_y$$

2nd moment (X-axis)

The secondary moment of the figure on the X-axis.

2nd moment (Y-axis)

The secondary moment of the figure on the Y-axis.

The secondary moment of the specified particle on

$$\text{the X-axis} = \sum_{p \in P} p_x^2$$

The secondary moment of the specified particle on

$$\text{the Y-axis} = \sum_{p \in P} p_y^2$$

Product of inertia

The product of inertia of the figure on the X and Y axes.

The product of inertia of the specified particle on the X and Y axes

$$= \sum_{p \in P} p_x \cdot p_y$$

Gravity 2nd moment (X-axis)

This is the center of gravity secondary moment of the figure on the X-axis. G is the center of gravity of the figure.

Gravity 2nd moment (Y-axis)

This is the center of gravity secondary moment of the figure on the Y-axis. G is the center of gravity of the figure.

The center of gravity secondary moment of the specified particle on the X-axis

$$= \sum_{p \in P} (px - gx)^2$$

The center of gravity secondary moment of the specified particle on the Y-axis

$$= \sum_{p \in P} (py - gy)^2$$

(gx, gy) are the coordinates of the center of gravity.

Gravity product of inertia

The center of gravity product of inertia of the figure on the X and Y axes. G is the center of gravity of the figure.

The center of gravity product of inertia of the specified particle on the X and Y axes

$$= \sum_{p \in P} (px - gx) \cdot (py - gy)$$

Inertial moment**The moment of inertia of the specified particle**

$$= \frac{\sum_{p \in P} \{(px - gGx)^2 + (py - Gy)^2\}}{Area^2}$$

Normalization is achieved by dividing by the square of the area.

(gx, gy) are the coordinates of the particle's center of gravity.

Area is the particle area.

2nd moment major axis

This is the length of the figure's secondary moment major axis. Normalization is achieved by dividing by the area.

$$= \frac{(I_{XX} + I_{YY}) + \sqrt{(I_{XX} - I_{YY})^2 + 4I_{XY}^2}}{2Area}$$

2nd moment minor axis

This is the length of the figure's secondary moment minor axis. Normalization is achieved by dividing by the area.

$$= \frac{(I_{XX} + I_{YY}) - \sqrt{(I_{XX} - I_{YY})^2 + 4I_{XY}^2}}{2Area}$$

I_{XX}, I_{YY} is the center of gravity secondary moment.

i_{XY} is the center of gravity product of inertia.

Area is the particle area.

2nd moment angle

The figure's secondary moment major axis angle


$$= \frac{1}{2} \tan^{-1} \frac{2I_{XY}}{I_{XX} - I_{YY}}$$

Here we can show that I_{XX}, I_{YY} is the center of gravity secondary moment.

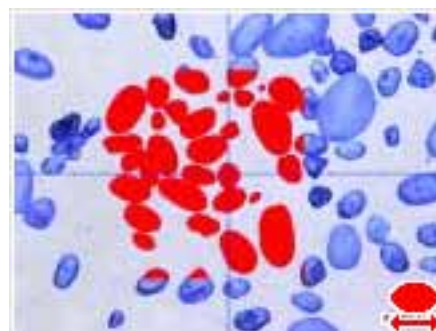
i_{XY} is the center of gravity product of inertia.

The automatic area data file

By saving the file after performing automatic area measurement, you can store a copy of the settings file that allows you to repeat the measurement (automatic area data file) at a later time.

After it is saved,  is displayed in the lower right corner of the thumbnail of the automatic area data file.

When retrieving an automatic area data file from an album, it is possible to change/modify the measurement.

**Comment/Scale**

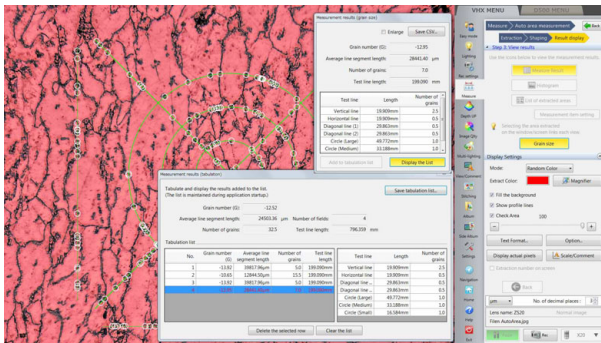
Markers or comments for the measurement results can be displayed by clicking [Scale/Comment] of display settings. When a comment is displayed, the comment is attached to the image when it is saved. A scale is displayed on the observation window to serve as a reference. For details on each operation, refer to "Displaying Text and Markers" (Page 9-34), and "Displaying a Scale" (Page 9-40).

Grain size analysis

According to JIS-G0551, ISO-643 and ASTM-E1382, grain size is measured.

The evaluation method for grain size can be either the cutting method and the counting method.

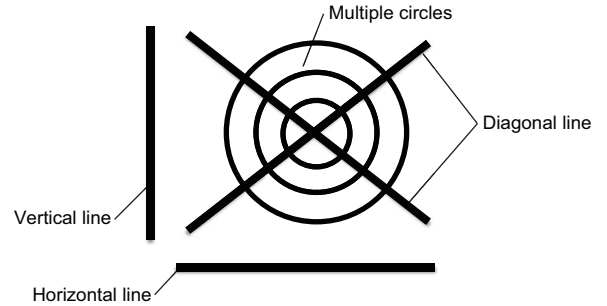
Measurement results of multiple images can be stored in a CSV file in batch.



Selecting test line

[Vertical line], [Horizontal line], [Diagonal line], and [Multiple circles] are available for the test line.

Grains on the test line are measured.



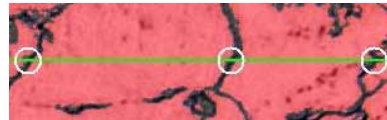
Measuring method

Number of captured grains



The number of grains on the test line are counted.

Number of intersect points



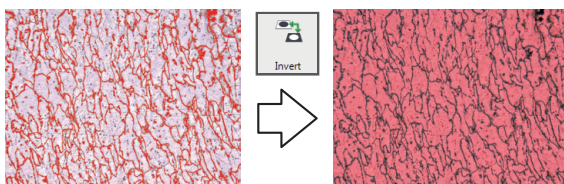
The number of intersect points between the test line and grain boundaries are counted.

Grain size analysis of one image

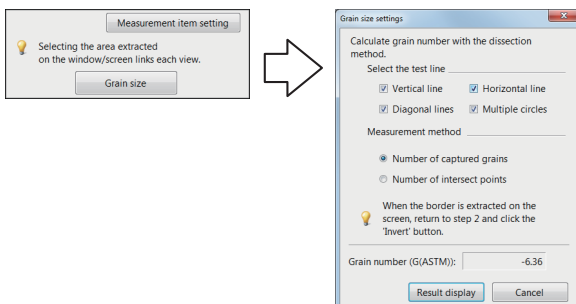
1 Perform automatic area measurement and displays the measurement result.

Extract target should not be boundaries between grains but grains.

If the target is boundary, return to the automatic area measurement and select "Invert" (Page 9-55) from the extraction area shape formatting.

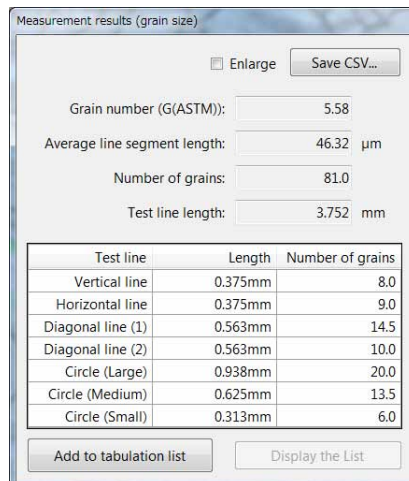


2 Click the [Grain size] button, open the [Grain size settings] dialog box, and set the measurement method.



3 Use the [Show result] button to check the counting results.

When the measuring method is the number of captured grains, the number of captured grains is shown instead of intersect points.



Grain number (G(ASTM))

The number is calculated with the standardized formula.

The larger number shows smaller grain size.

$$G = (-6.643856 \log_{10} L) - 3.288$$

L = Average line segment length (mm)

Average line segment length

Average line segment length = length/(Number of intersect points or Number of captured grains)

This shows an average length per one grain.

The larger number shows larger grain size.

Number of intersect points

This number is the total number of intersect points on each test line. This appears on the screen when the measurement mode is the number of intersect points.

Number of grains

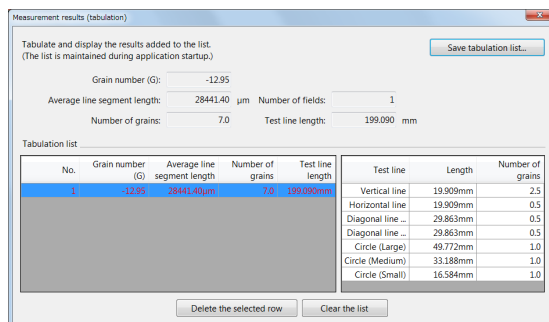
This number is the total number of captured grains on each test line. This appears on the screen when the measurement method is "Number of captured grains".

Length of test line

This is the sum total of test lines.

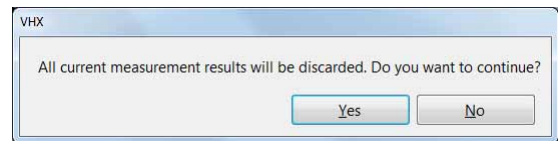
4 Clicking [Add to tabulation list] adds the measurement results to the tabulation list.

Clicking [Display the List] shows the tabulation list to which measurement results are already added.

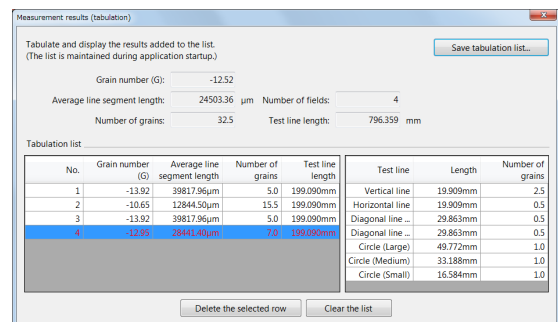


Grain size analysis of multiple images

- 1 Perform the grain size analysis for the first image, and add the results to the tabulation list.
- 2 Terminate the grain size analysis for the first image. Although the following message appears this time, click [Yes], which does not discard the tabulation list.



- 3 Perform the grain size analysis for the second image, and add the results to the tabulation list.
- 4 After the results of required number of images accumulated, the results can be saved in a CSV file by clicking [Save tabulation list...].



Clicking [Delete the selected row] deletes data in the selected line.

Clicking [Clear the list] deletes all data in the tabulation list.

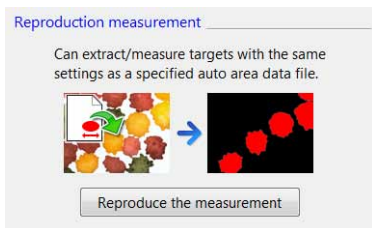
NOTICE

To add data to the tabulation list, the images used must be captured at the same magnification and with the same calibration settings.

Measurement Recreation

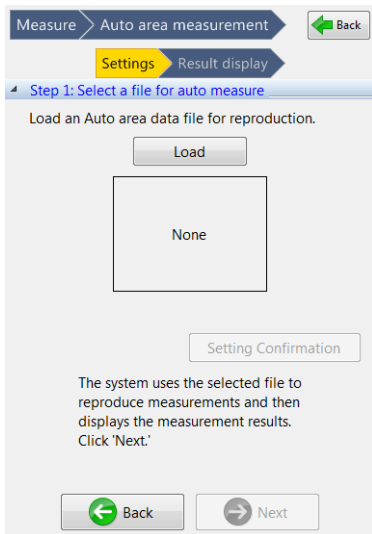
It is possible to extract/measure an object under the same settings as a specified automatic area data file.

- 1 Click [Album] from the VHX MENU, and select and play the image to complete a measurement.
- 2 On the automatic area measurement settings dialog, click [Reproduce the measurement].



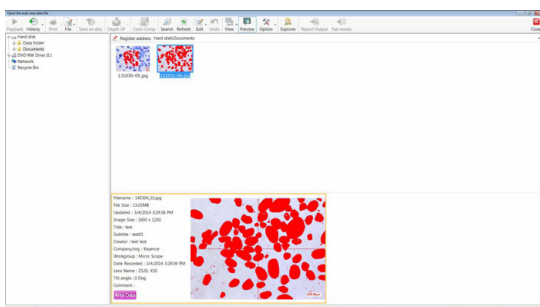
The settings dialog for the measurement repetition file appears.

- 3 Click [Open].

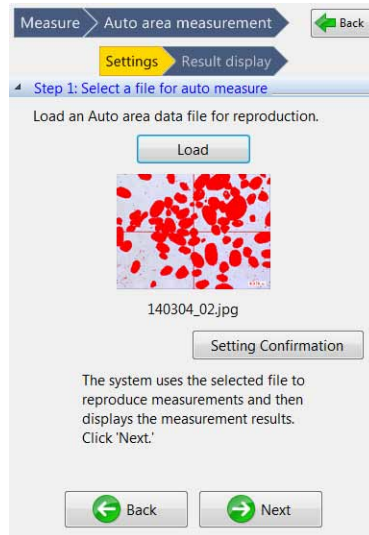


An album ([Open the auto area data file] window) will then appear.

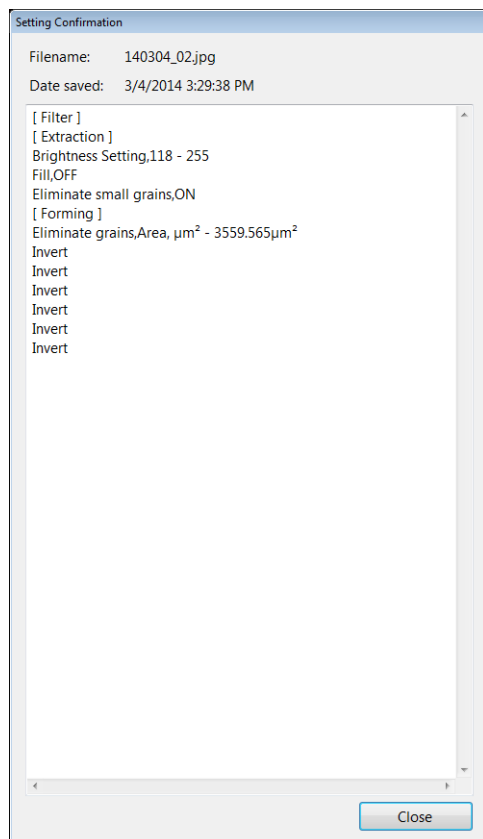
- 4 From the album, select the automatic area data file for measurement recreation and run it.



After opening the automatic area data file, an image thumbnail is displayed.



- Reference Click [Setting Confirmation] to check the contents of the [Setting Confirmation] dialog box.

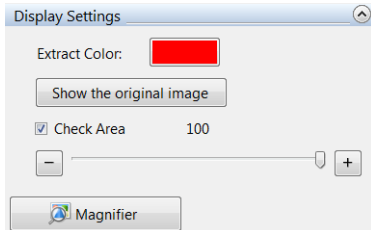


- 5 Click [Next].

The automatic area data file settings are applied to the measurement object image and the measurement results are displayed.

Display Settings

[Extract the area] display settings



Show the original image

This is displayed when the extraction mode is set to "Brightness".

If this button is pressed, the lower left, upper right, and lower right images are also displayed as original images.

Extract Color

Select the color to paint an area that is extracted by brightness.

Check Area

If this option is checked, the color of the extraction is lightened and you can check the specified area while comparing it to the original image.

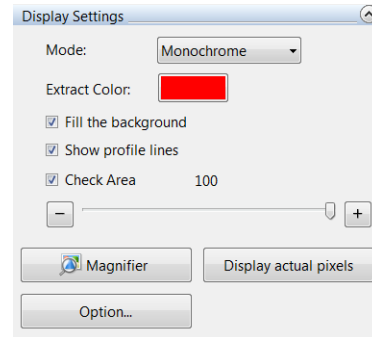
Magnifier

When this is clicked, a [Magnifier] window is displayed on the observation window.

The [Magnifier] window displays a magnified view of part of the observation window image, centered on the mouse position.

This allows checking of fine details of the image in the observation window. You can choose a magnification of 2 to 5 times.

[Form the extracted area] display settings



Mode

Select the extraction area display color. For [Monochrome], only the extraction color is displayed. For [Random Color], multiple random colors are displayed.

Fill the background

When this is enabled, the background is filled with the background color.

Show profile lines

This is enabled, an outline of the outer edge of the extracted area is displayed.

Display actual pixels

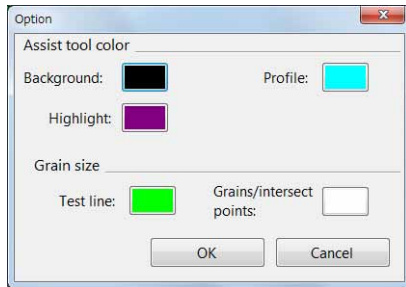
This command displays images the observation window with pixels in original magnification.

Options

Click this to bring up the [Options] dialog box.

For other settings, refer to "[Extract the area] display settings" (Page 9-65).

■ [Options] Dialog Box



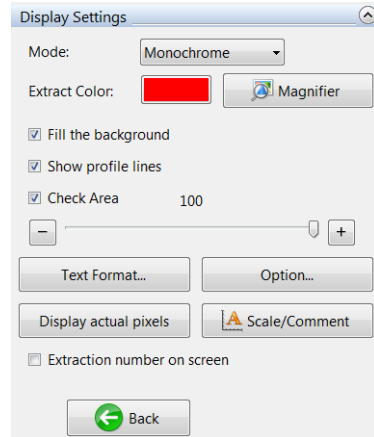
Auxiliary colors

Click each type of color button to select the desired color.
 Background: Specify the color used for [Fill the background].
 Profile: Specify the color used for [Show profile lines].
 Highlight: Specify the highlighted area color.

Grain size

Test line: Specifies the color of the test line.
 Grain/intersect point: Specifies the color of the grain or intersect point depending on the measurement method.

[Results View] display settings



Text Format

📖 "Text format" (Page 9-23)

Extraction number on screen

When this is enabled, the extraction number is displayed in the extraction area on the observation window.

For other settings, refer to "[Extract the area] display settings" (Page 9-65).

Contamination analysis

According to ISO-16232 and VDA 19, contamination, such as cleanliness level, is analyzed.

This analysis splits an object into multiple areas and records each area separately, thereby allowing for analysis of contamination over a wider area.

The number of extracted grains and their cleanliness levels are displayed and stored in a CSV file for each class (B to K) based upon the max. diameter.

The measurement can also be analyzed based on arbitrary sizing that does not match the standardized method.

Size class	B	C	D	E	F	G	H	I	J	K
Max diameter(μm)	5 - 15	15 - 25	25 - 50	50 - 100	100 - 150	150 - 200	200 - 400	400 - 600	600 - 1000	1000 -
Count	12050000.0	4620000.0	1680000.0	670000.0	170000.0	50000.0	70000.0	80000.0	110000.0	70000.0
Cleanliness level	24	23	21	20	18	16	17	17	17	17

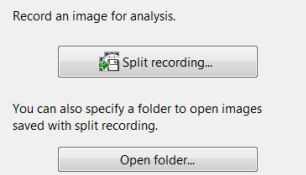
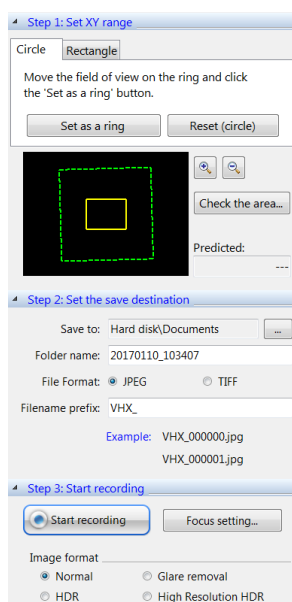
No.	Filename	Category	Max diameter	Area	Size class	Min diameter	Maximum/Minimu...	Average brightness
362	VHX_000011.jpg	Other	13.9μm	144.06μm ²	B	0.0μm	2.00	111
363	VHX_000011.jpg	Fiber	20.8μm	192.09μm ²	C	0.0μm	3.00	111
364	VHX_000011.jpg	Other	9.8μm	144.06μm ²	B	4.9μm	1.41	147
365	VHX_000011.jpg	Other	9.8μm	192.09μm ²	B	6.9μm	1.41	148
366	VHX_000011.jpg	Other	15.5μm	288.13μm ²	C	6.9μm	2.24	128
367	VHX_000012.jpg	Other	9.8μm	144.06μm ²	B	4.9μm	1.41	143
368	VHX_000012.jpg	Other	9.8μm	144.06μm ²	B	4.9μm	1.41	135
369	VHX_000012.jpg	Other	6.9μm	96.04μm ²	B	0.0μm	1.00	148
370	VHX_000012.jpg	Other	43.8μm	816.36μm ²	D	24.5μm	1.79	144
371	VHX_000012.jpg	Other	9.8μm	144.06μm ²	B	4.9μm	1.41	150
372	VHX_000012.jpg	Other	15.5μm	288.13μm ²	C	6.9μm	2.24	115
373	VHX_000012.jpg	Other	6.9μm	96.04μm ²	B	0.0μm	1.00	118
374	VHX_000012.jpg	Other	15.5μm	240.11μm ²	C	6.9μm	2.24	103
375	VHX_000012.jpg	Other	6.9μm	96.04μm ²	B	0.0μm	1.00	153
376	VHX_000012.jpg	Other	6.9μm	96.04μm ²	B	0.0μm	1.00	162
377	VHX_000012.jpg	Fiber	20.8μm	288.13μm ²	C	6.9μm	3.00	132

Specifying an area

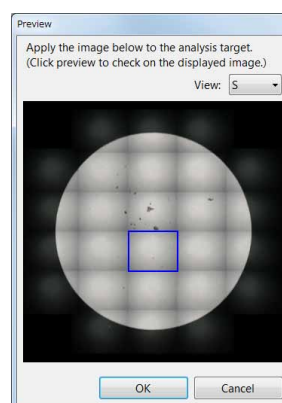
1 Specify the area for measurement.

Specify the split recording to define the area which will be measured.

For details of the split recording, refer to "Split recording" (Page 11-12) of the Image stitching.



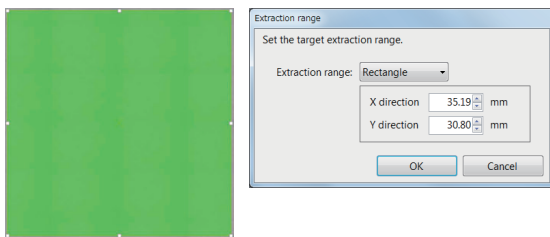
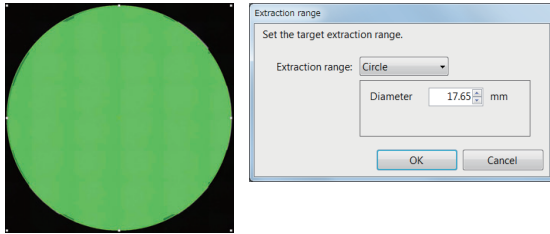
If any split recorded data already exists, the results can be specified by clicking [Open folder].



After images are loaded, the image of the measurement result can be enlarged to check by clicking the preview window. The size of the preview image can be selected from S, M, and L.

2 Specify an extraction range.

The extraction range can be specified to be a circle or a rectangle.



9

Measuring Dimensions and Area

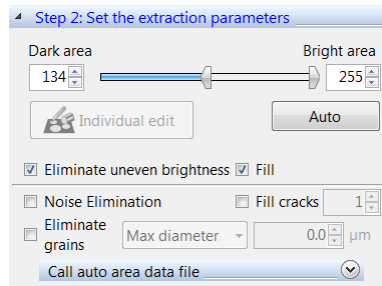
3 Click [Next] to go to selection of the extraction parameters.

If the extraction range is inappropriate, click [Extraction range] in the preview window to set it again.

Setting extraction parameters



1 Use the slider to adjust the threshold so as to extract only the object.



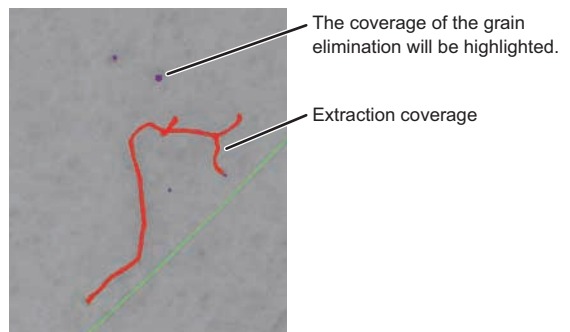
Areas darker than the threshold specified at [Dark area] and brighter than the threshold specified at [Bright area] are detected.

Clicking the [Auto] button returns the thresholds to the values calculated automatically.

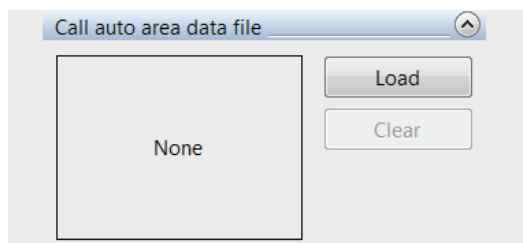
Extract targets can be adjusted with [Eliminate uneven brightness], [Fill], [Noise Elimination], [Fill cracks], and [Eliminate grains].

[Fill cracks] fills the missing part of the particle. The intensity can be adjusted within the range from 1 to 10.

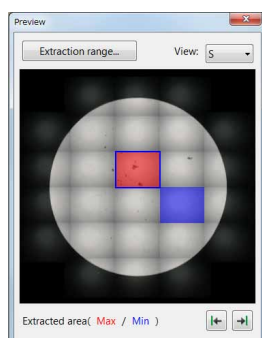
[Eliminate grains] eliminates targets whose max. diameter is smaller than the specified value.



Previous extraction conditions can be loaded from the results of the automatic area measurement.



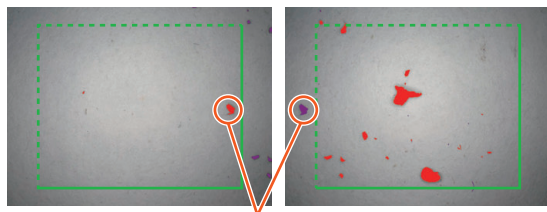
2 Click the preview window and check that extraction settings are appropriate.



The grain extraction areas are displayed with the maximum area colored in red, and the minimum areas colored in blue.

The image on the screen can be switched by clicking the image on the preview window or using the arrow buttons at the bottom of the preview window.

Only the area in the green frame line displayed on the screen is measured (so that the measurements in the neighboring images do not double-count any particles).

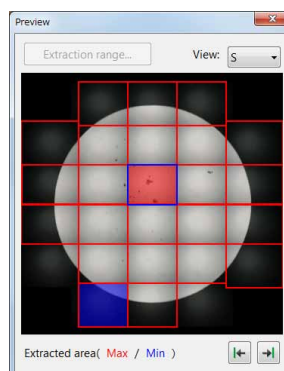


The same grain appears on the right and left images.
 Left image: In the green frame → to be counted
 Right image: Out of the green frame → not counted
 Grains to be excluded are shown highlighted.

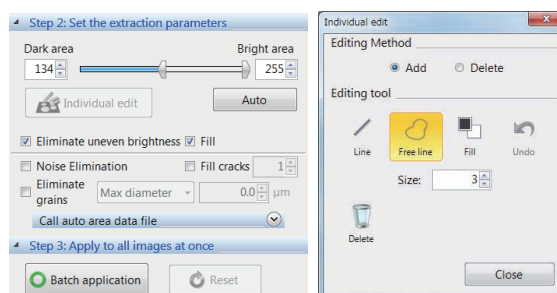
- Grains on the dotted line are measured.
- Grains on the solid line are excluded.

3 Click [Batch application] to measure all images.

Areas where measurement targets exist are shown with red frames on the preview window.



4 Adjusting the extraction results for each area.



Click [Individual edit] to edit the results, as required.

For the individual edit, refer to the shape formatting and editing tools of the automatic area measurements (Page 9-52) .

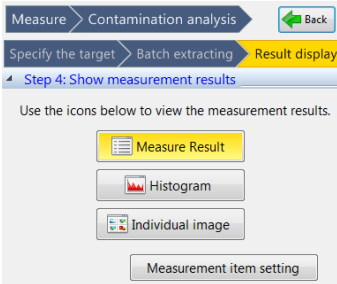
Adjustment of the threshold at this step is applied to the area being displayed.

To apply to all extracted areas, press the [Batch application] button again.

Pressing the [Reset] button restores the status before pressing the [Batch application] button, and then you can do adjustment again including ON/OFF of the eliminate uneven brightness, etc.

Confirm results

After formatting the extraction area, click [Next] to bring up the result display in the operation area.



Click [Measure Result], [Histogram], or [Individual Image] to display each window respectively.

[Measure Result] window

The number of grains in each size class and their cleanliness levels are displayed.

Standard	Surface area	0.1 cm ²	Weight	0.0 g	Flt Entrance	Save CSV				
Size class	B	C	D	E	F	G	H	I	J	K
Max diameter(μm)	15	25	50	100	150	200	400	600	1000	1000
Count	12050000.0	4620000.0	1680000.0	670000.0	170000.0	50000.0	70000.0	80000.0	110000.0	70000.0
Cleanliness level	24	23	21	20	18	16	17	17	17	17

No.	Filename	Category	Max diameter	Area	Size class	Min diameter	Maximum/Minimum	Average brightness
362	VHX_000011.jpg	Other	13.9μm	144.06μm ²	B	0.9μm	200	111
363	VHX_000011.jpg	Fiber	20.8μm	192.09μm ²	C	0.9μm	300	111
364	VHX_000011.jpg	Other	9.8μm	144.06μm ²	B	4.9μm	141	147
365	VHX_000011.jpg	Other	9.8μm	192.09μm ²	B	6.9μm	141	148
366	VHX_000011.jpg	Other	15.5μm	288.13μm ²	C	6.9μm	224	128
367	VHX_000012.jpg	Other	9.8μm	144.06μm ²	B	4.9μm	141	143
368	VHX_000012.jpg	Other	9.8μm	144.06μm ²	B	4.9μm	141	135
369	VHX_000012.jpg	Other	6.9μm	96.04μm ²	B	0.9μm	100	148
370	VHX_000012.jpg	Other	43.8μm	816.36μm ²	D	24.5μm	179	144
371	VHX_000012.jpg	Other	9.8μm	144.06μm ²	B	4.9μm	141	150
372	VHX_000012.jpg	Other	15.5μm	288.13μm ²	C	6.9μm	224	115
373	VHX_000012.jpg	Other	6.9μm	96.04μm ²	B	0.9μm	100	138
374	VHX_000012.jpg	Other	15.5μm	240.11μm ²	C	6.9μm	224	103
375	VHX_000012.jpg	Other	6.9μm	96.04μm ²	B	0.9μm	100	153
376	VHX_000012.jpg	Other	6.9μm	96.04μm ²	B	0.9μm	100	154
377	VHX_000012.jpg	Fiber	20.8μm	288.13μm ²	C	6.9μm	300	132

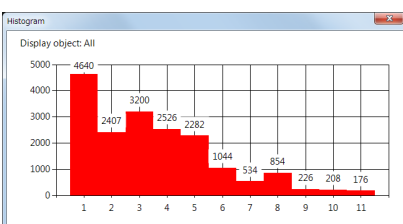
Information on the extracted grains of respective split measured files are displayed.

Precautions when selecting ISO output format

For the ISO output format, surface areas and weights can be entered. The entered values can be output in a CSV file. When "Standard" is checked, the number of the extracted grains is converted into the number of grains per 1000 cm² and displayed.

The extraction results are regarded as the results in the specified area in the "Surface area", and convert it into the area per 1000 cm². Input the proper value in "Surface area".

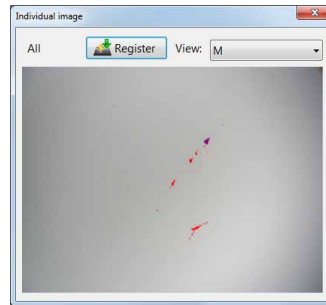
[Histogram] window



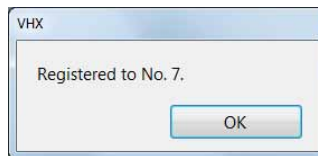
The number of grains in each size class is displayed.

[Individual Image] window

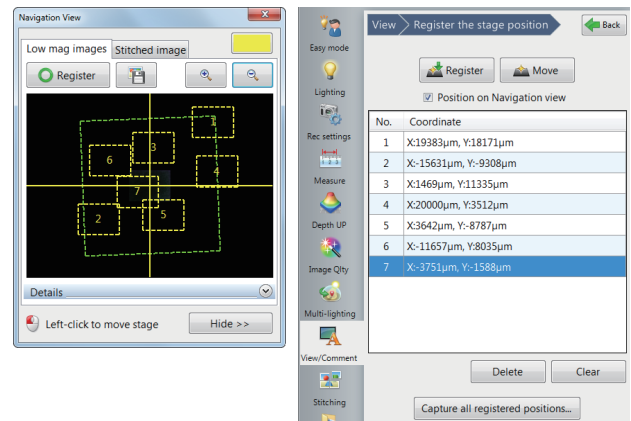
This window is used for enlarging each split image. The image size can be selected from M, L, and actual size.



Press the [Register] button, and the position displayed currently will be added to [Register the stage position].

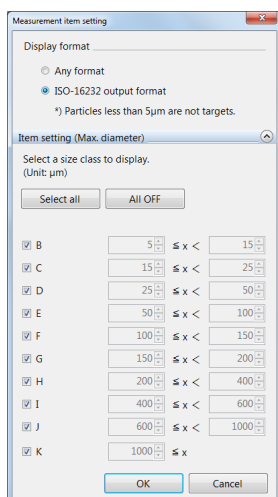


Select [Register the stage position] from [View/Comment] from the VHX MENU, and the registered position can be moved to that place. The extracted individual image for grains can be captured later.

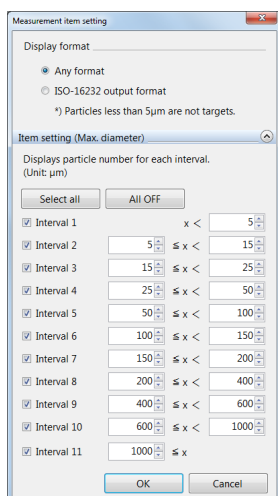


Measurement item setting

Click [Setting measurement items] to select a measurement target.



To measure with arbitrary intervals instead of ISO-specified intervals, select [Arbitrary interval] for display format.



Cleanliness level

"Cleanliness level" is displayed only when ISO output format is selected and [Standard] is checked.

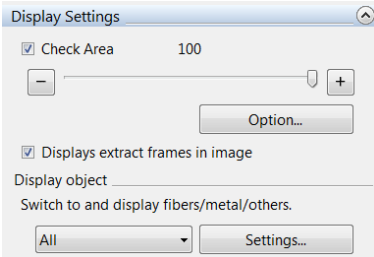
The cleanliness level displayed in the [Measure result] window follows the table below.

If the number of grains greater than 16×10^6 , "---" will appear.

Cleanliness level	Number of grains (n) per 1000cm ²
00	0
0	$0 < n \leq 1$
1	$1 < n \leq 2$
2	$2 < n \leq 4$
3	$4 < n \leq 8$
4	$8 < n \leq 16$
5	$16 < n \leq 32$
6	$32 < n \leq 64$
7	$64 < n \leq 130$
8	$130 < n \leq 250$
9	$250 < n \leq 500$
10	$500 < n \leq 1000$
11	$1 \times 10^3 < n \leq 2 \times 10^3$
12	$2 \times 10^3 < n \leq 4 \times 10^3$
13	$4 \times 10^3 < n \leq 8 \times 10^3$
14	$8 \times 10^3 < n \leq 16 \times 10^3$
15	$16 \times 10^3 < n \leq 32 \times 10^3$
16	$32 \times 10^3 < n \leq 64 \times 10^3$
17	$64 \times 10^3 < n \leq 130 \times 10^3$
18	$130 \times 10^3 < n \leq 250 \times 10^3$
19	$250 \times 10^3 < n \leq 500 \times 10^3$
20	$500 \times 10^3 < n \leq 1 \times 10^6$
21	$1 \times 10^6 < n \leq 2 \times 10^6$
22	$2 \times 10^6 < n \leq 4 \times 10^6$
23	$4 \times 10^6 < n \leq 8 \times 10^6$
24	$8 \times 10^6 < n \leq 16 \times 10^6$

Display Settings

Set the visibility of the extracted grains.



Check Area

Putting a check on this option gives a color to the extraction target to check.

You can lighten the extract color by moving the slider, which allows you to view the original image.

Options



Extract color: This color shows the extracted grains.

Highlight color: This color shows the grains, which are selected on the [Measure result] window, on the [Individual Image] window

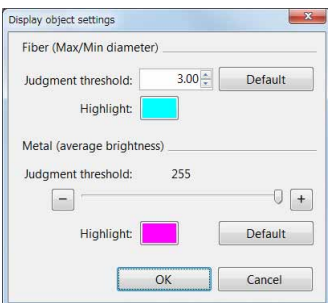
Displaying extract frame on image

Unchecking this option shows no frame on the extract results.

Adjusting determination of display target

Grains to be displayed on the screen can be switched by the option selected from among all, fiber, other than fibers, metal, and other.

Clicking [Setting] allows you to change the determination standard.



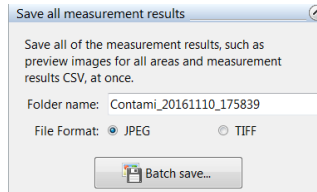
Metal: Targets having brightness greater than the threshold.

Fiber: Other than above and "max./min. diameter" is greater than the threshold.

Other: Those that are not classified as "Fiber" or "Metal".

Other than fibers: Those that are classified as "Metal" or "Other" (other than "Fiber")

Saving results



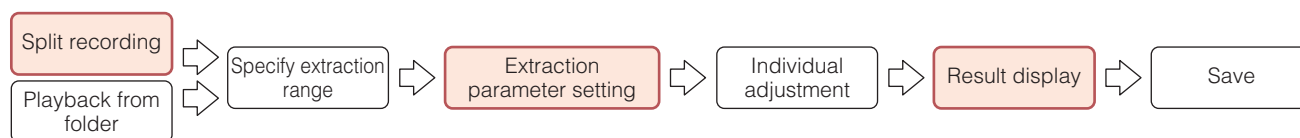
The measurement results are saved together with the split recording results.

Results saved with [Batch save] can be loaded from the album to use for checking the contamination analysis.

Although results saved with the [Rec] button are saved as an image tethered with the measurement values, some operations, such as enlarged display of target grains on the measurement result window, cannot be done with these results.

Contamination analysis according to VDA

Contamination analysis follows the steps below.



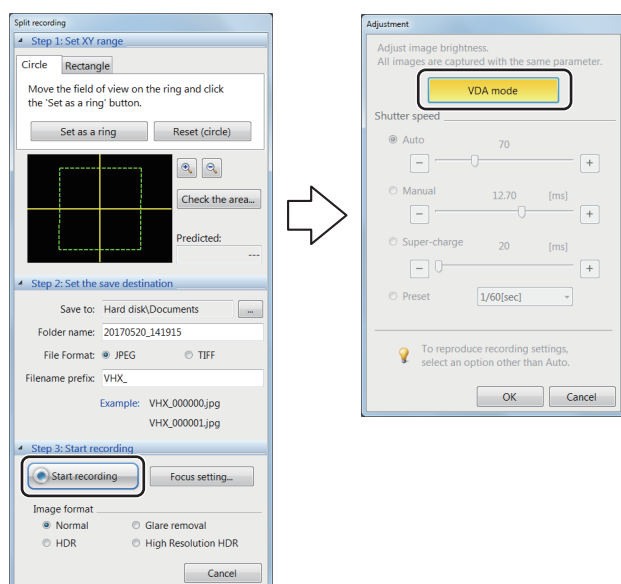
In the contamination analysis based on VDA, the split recording and result display are different from the normal contamination analysis.

Also, the default of the extraction parameter setting is the standard value prescribed by VDA.

Split recording

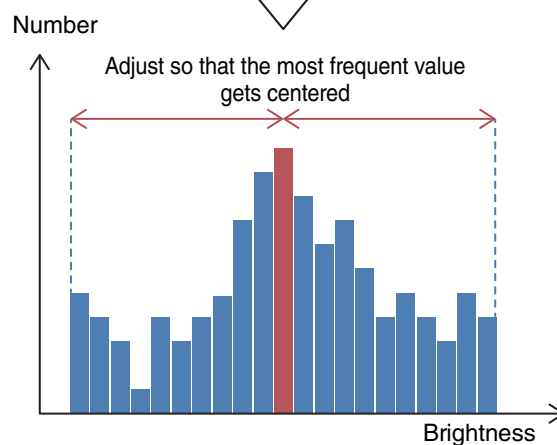
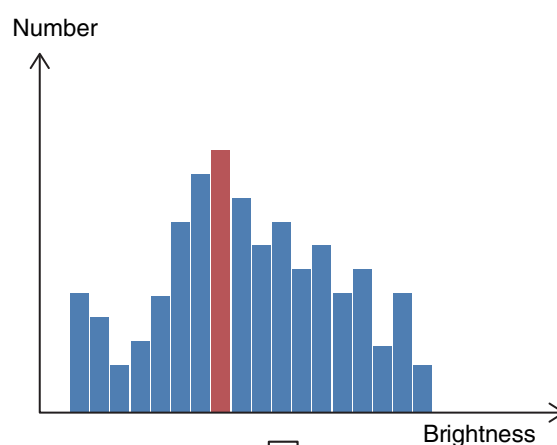
In split recording, the images are captured with the brightness fixed so that the brightness setting does not change during contamination capture.

Since the brightness during capture is prescribed in VDA, select [VDA mode] in the screen of setting the brightness. [VDA mode] can only be selected when [Image format] is [Normal]. When [HDR], [Glare removal] or [High Resolution HDR] is selected, [VDA mode] cannot be selected.



When [VDA mode] is selected, the brightness will be adjusted automatically, and the capture starts.

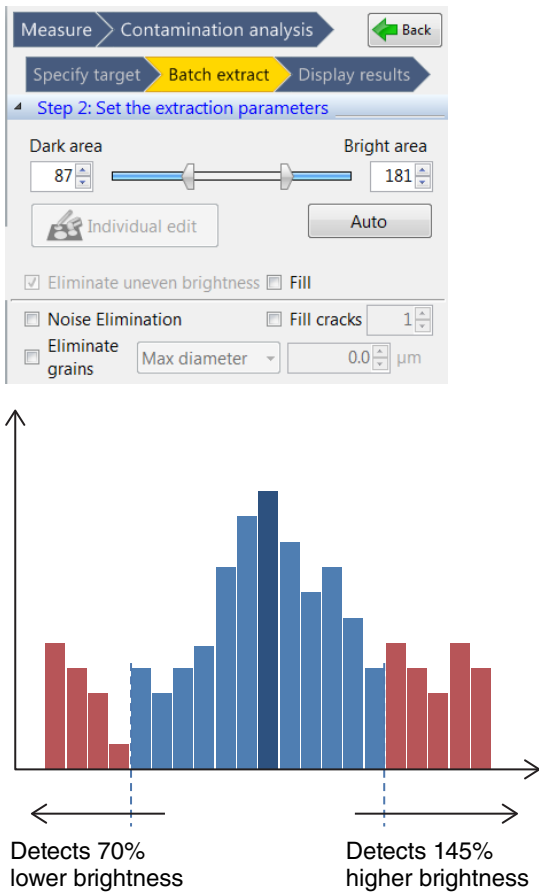
When the pixel brightness histogram has been created, the brightness is adjusted so that the most frequent value (brightness that has the greatest number of pixels) comes to the middle of the brightness range between the maximum and minimum values.



Setting extraction parameters

In [VDA mode], the extraction parameter default is a prescribed value defined by the VDA standard.

- Dark area: A value which is 70% of the most frequent value.
- Bright area: A value which is 145% of the most frequent value.



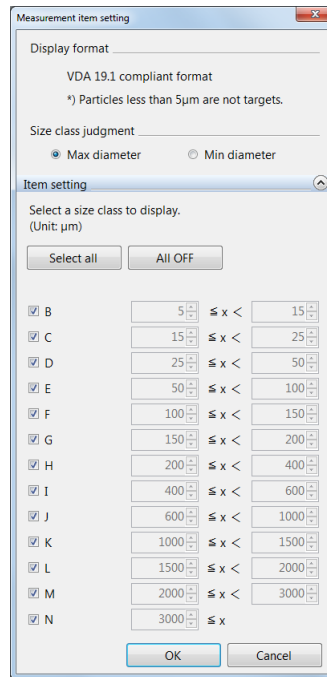
In [VDA mode], [Eliminate uneven brightness] is always ON. It cannot be changed.

Result display

In [VDA mode], the size class can be determined as either [Max diameter] or [Min diameter].

Also in [VDA mode], L to N will be additionally displayed in the choices for the size class.

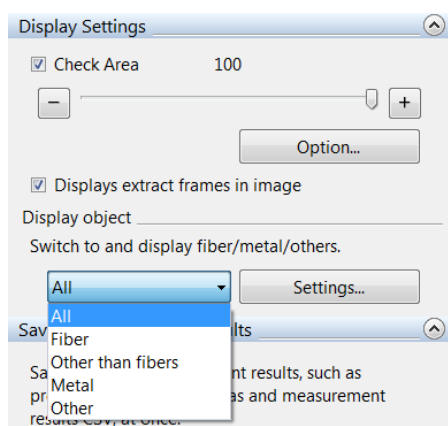
(Therefore, normally the Max diameter and Min diameter are not displayed as selections, the size class is determined automatically with the Max diameter being selected. Also the size class which can be selected at that time is B to K.)



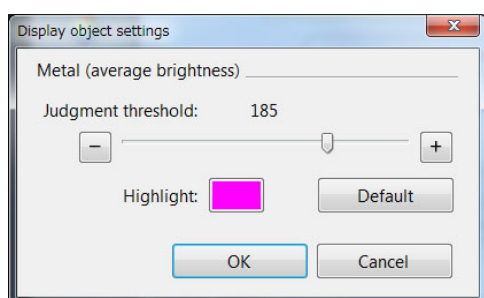
Display setting

As the display target, [Fiber] and [Other than fibers] can be selected. ([Other] and [Metal] can also be selected)

In [Other than fibers], the targets which belong to [Metal] or [Other] are displayed.



Only the threshold for metal can be changed as the display target setting.

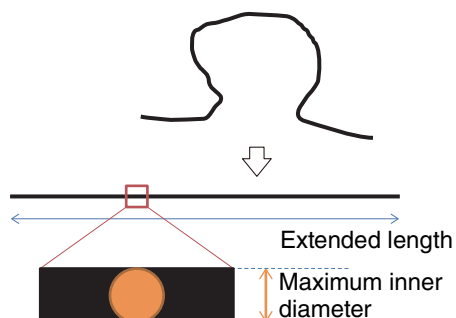


Fibers are judged by the method according to the standard.

The one that satisfies the following formula is determined as fiber.

Extended length ÷ Maximum inner diameter > 20

Maximum inner diameter ≤ 50 μm



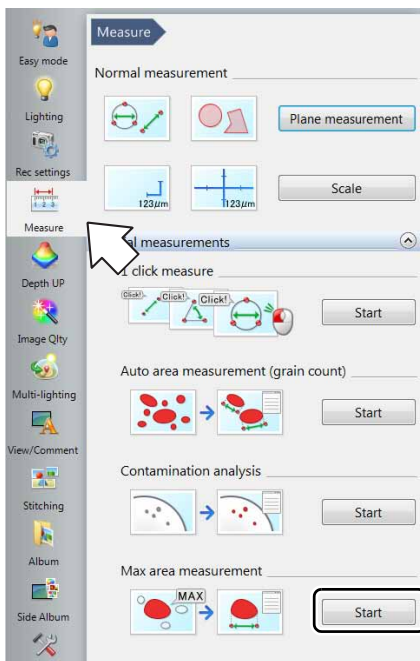
Maximum Area Measurement

Within the specified area, among the specified brightness threshold values, the one with the largest area is extracted and the [Circumscribed rectangle (smallest area)], [Circumscribed rectangle (Feret diameter)], [Circumscribed rectangle (arbitrary)], and [Maximum/minimum diameter] can be measured.

Multiple areas are able to be set with varying threshold values.

Measurement Area Specification

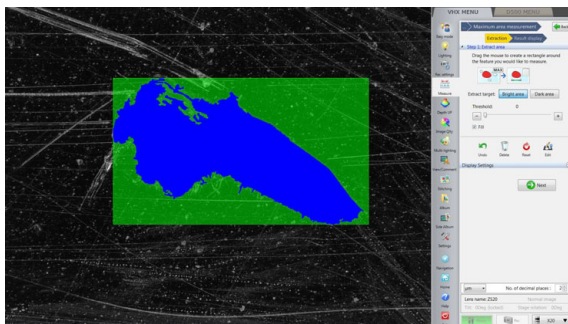
1 Click [Measure] from the VHX MENU and click [Max area measurement].



This brings up the maximum area measurement settings dialog in the operation area.

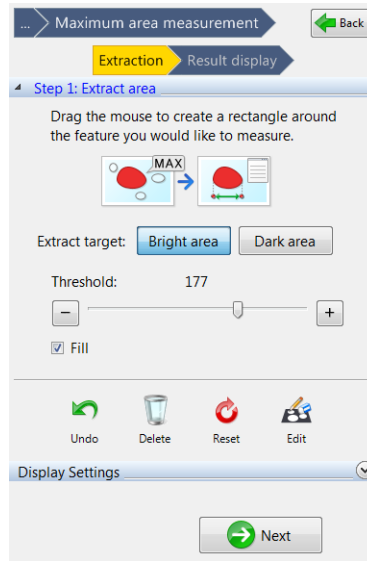
2 Drag the mouse in the observation window to specify a rectangular region to become the measurement area.

The measurement area will be green and the region with the maximum area within the measurement area is displayed in the selected area color.



Reference Right click the measurement area to delete it.

3 Specify each parameter required to extract the target area from the measurement area.



Bright area

Extracts the bright area of the image.

Dark area

Extracts the dark area of the image.

Threshold

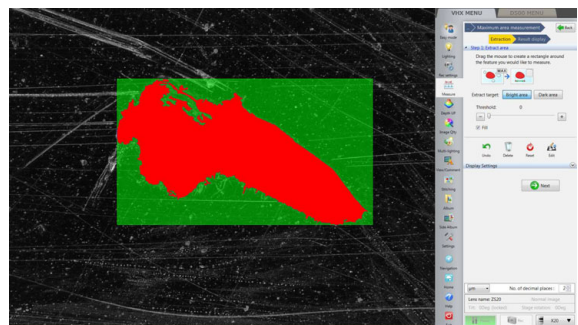
Sets the range of the brightness level threshold value at 0 to 255.

Fill

If this option is checked, all holes are filled in the binary image.

4 Click the extracted area on the screen.

The extraction is confirmed and displayed in the extraction color.



5 Repeat steps 2 to 4 to add additional areas.

Extraction area shape formatting

■ Edit

This allows manual editing of the specified area.

📖 "Editing" (Page 9-56)

■ Delete

This deletes individual extraction areas.

📖 "Delete" (Page 9-57)

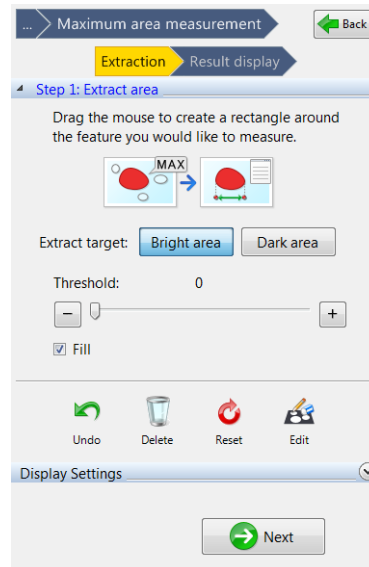
■ Restart Shape Formatting

Click [Undo] to return to the previous shape formatting editing state.

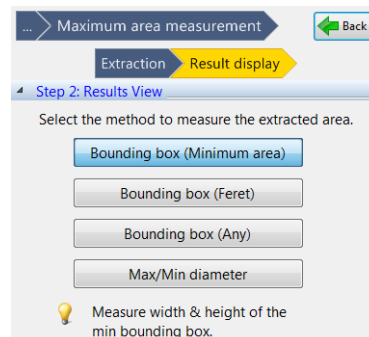
Click [Reset] to start over from the original shape formatting.

Perform Measurements

1 Click [Next].



2 Specify the measurement mode.



Measurement results are displayed in the observation window. When the measurement mode is changed, the results displayed in the measurement results window are also updated.

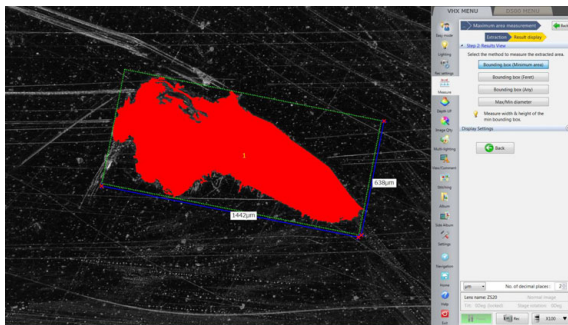
Refer to "Displaying measurement values on the screen" (Page 9-24) for details on how to display measurement values in the observation window.

Refer to "Displaying the measurement result window" (Page 9-24) for details on how to display measurement results in the measurement results window.

Measurement Modes

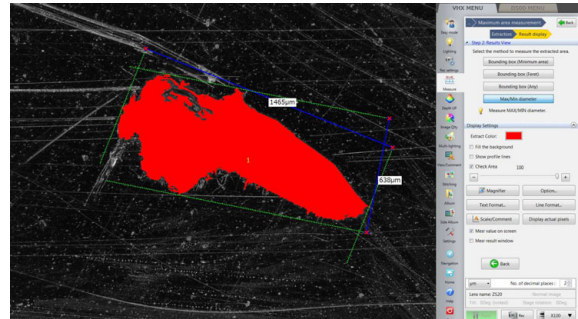
■ Bounding box (Minimum area)

Measures the width and height of the circumscribed rectangle with the smallest area.



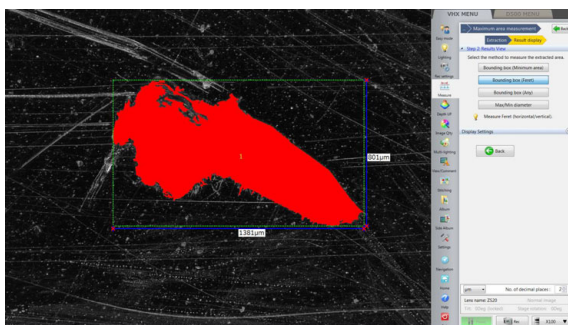
■ Max/Min diameter

Measures the maximum and minimum diameters.



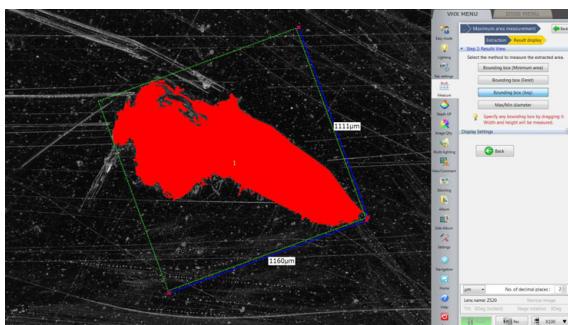
■ Bounding box (Feret)

Measures the Feret diameter (horizontal/vertical).



■ Bounding box (Any)

Measures the width and height of any circumscribed rectangle that is dragged with the mouse.



Display Settings

It is possible to change the color of items such as areas, measurement lines, or text on the observation window, or display the magnifier window to check fine image details. For display settings, refer to "Display Settings" (Page 9-65).

XY Stage Measurement (Optional)

The VH-M100E XY measurement system and the VHX-S660E large free-angle observation system allows you to measure objects while moving it over a wide range (100 x 100 mm) in the XY direction.

Point The optional VH-M100E XY measurement system or VHX-S660E, and the VHX-H2M2 XY measurement software are required.

Installation and Connections

NOTICE	When installing the measurement software, disconnect the LAN cable and all USB cables except for the mouse, and keyboard. Attempts to access the microscope from an external device during installation may cause the installation to fail.
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Point Installation will not erase the image data saved on your microscope, but we recommend you make a backup of all important data as a safety precaution.

Installing the VHX-H2M2 XY measurement software

- 1 Turn on the power for the VHX-6000.**
The observation window appears.
- 2 Insert the VHX-H2M2 disk in the DVD drive.**
- 3 Turn off the power for the VHX-6000.**
- 4 Turn on the power for the VHX-6000.**
The installation will begin. The power will automatically turn off during the installation.

Point Installation will take several minutes. Do not turn the power off during the installation process, and do not operate any of the buttons.

- 5 After the power turns off, allow three or more seconds and then turn the power on.**
The observation window appears.
- 6 Eject the VHX-H2M2 disk from the DVD drive.**

Installation and connections for the VH-M100E XY measurement stage

Install and connect the VH-M100E XY measurement stage by following the supplied user's manual.

When connecting to VHX-S660E, the connection with VH-M100E is not required.

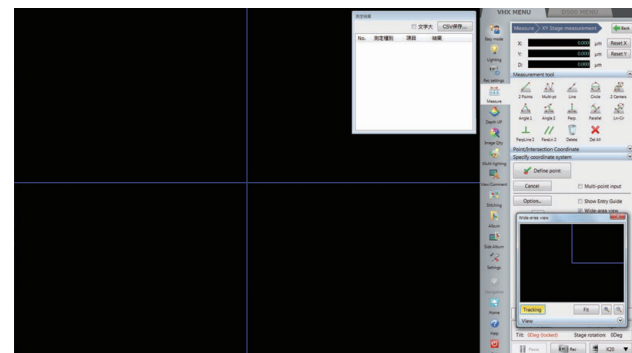
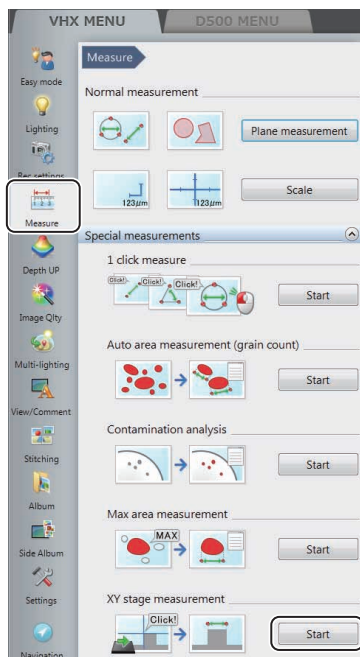
Preparing to Measure

- 1 Setup the lens.**
Refer to "Lens Setting" (Page 9-5).
- 2 Perform calibration.**
Refer to "Calibration" (Page 9-6).
- 3 Setup the options.**
Setup the options for display color, line width, image auto save, and startup settings as necessary.
Refer to "Option Settings" (Page 9-97).

XY Stage Measurement Procedures

1 Click [Measure] from the VHX MENU and click [XY stage measurement].

The XY stage measurement window appears along with the [Wide-area view] dialog box.

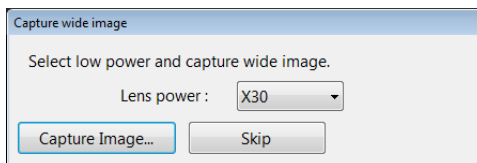


2 Click [Capture wide image] on the [Wide-area view] dialog box.

The [Capture wide image] dialog box appears.

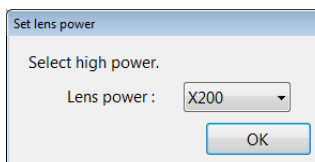
Reference The option for [Capture a wide image when measurement starts] (Page 9-97) can be turned off.

3 Set the lens magnification to its lowest magnification, select the current lens magnification from the [Lens power:] list box, and click [Capture Image].



The [Set lens power] dialog box appears.

4 Set the lens power to high power and select the current lens power from the [Lens power:] list box.



Reference It is not necessary to select the lens magnification for a lens with the automatic lens/zoom recognition function as the lens power is detected automatically.

5 Click [OK].

The [Set lens power] dialog box closes.

The microscope will change to measurement mode.

Reference It is not necessary to select the lens power for a lens with the automatic lens/zoom recognition function as the lens power is detected automatically.

6 Setup the coordinates.

Setup the XY coordinate axes based on the image of the object.

Even if the camera and the object are at an angle, it is possible to capture the XY coordinates correctly by correcting the angularity of the XY plane. Refer to "Specify Coordinates" (Page 9-82).

7 Select the measurement tool and do the measurement.

Refer to Page 9-86.

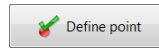
Reference To save the measurement as a numeric value, click [Save as CSV] on the [Measurement Result] window (Page 9-24). To save the measurement trail and data (CSV), click [Save Mesr Ln] on "Wide-area view dialog box" (Page 9-82).

XY Stage Measurement Menu

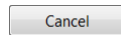


Settings area

This area is used to enter and confirm measurement points, and to set options such as display color, and units and decimal places used when measuring.



This defines the specified XY stage position as a measurement point. The point is at the center of the cross lines on the screen.



This button clears the last point defined by the [Define point] button.

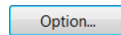


The last point cannot be cleared if the measurement is completed.

Multi-point input

When this option is checked, the least square method is used to define multiple entered points as a line or circle.

📖 "Multiple point input" (Page 9-97)



This button presents settings for line color and width, units, etc.

Show Entry Guide

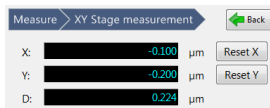
When this option is checked, the [Guide] dialog box is displayed.

Wide-area view

When this option is unchecked, the [Wide-area view] dialog box is hidden.

Coordinates area

This area shows the coordinate and distance of the cross point in the center of the screen to a predefined origin.



- **Reset X/Reset Y**

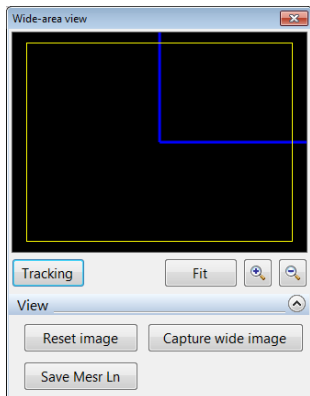
These buttons clear the X or Y coordinates of the center of the cross line in the center of the current screen to zero.

Tools area

This area shows the menus for measurement tools (Page 9-86), point/intersection coordinates (Page 9-94), and setting (correcting) coordinates. (Page 9-82)

Select according to the application.

Wide-area view dialog box



The wide image area displays images recorded at low magnification power, and connects and displays images as measurement points are defined. When observing under high power, the wide image area displays a general view of the area under observation along with measurement numbers.

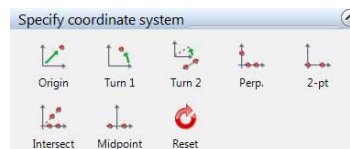
- **Tracking**
When clicking [Tracking] while zoomed in on an image, the observation area (yellow frame) will scroll automatically.
- **Fit**
Clicking [Fit] while zoomed in or out on an image cancels the zoom and displays the entire image.
- **Zoom in/Zoom out**
Zooms in or out of the image.
- **Reset image**
Deletes the image. Measurement results are not deleted.
- **Capture wide image**
Captures a wide image.
- **Save Mesr Ln**
Saves the measurement trails and measurement data (CSV) displayed. The image size is 1600 x 1200.

Specify Coordinates

Setting the XY stage origin and X/Y-axis coordinate axes.



This procedure must be done before using the measurement tools. Measured values cannot be corrected.



Coordinate specifying tools

There are seven types of tools for specifying coordinates. Coordinates can be set in six different ways. Select a method based on the object to be used to make the setting.

- [Origin] → [Turn 1]
- [Origin] → [Turn 2]
- [2-pt]
- [Perp]
- [Midpoint]
- [Intrsect]

■ Setting tool summary



Moves the origin.
Shifts the XY coordinates in parallel by defining a point as the new origin.



Rotates the XY coordinates without moving the origin.
The X coordinate axis becomes the line that passes through the origin and a point specified as the new X coordinate axis.



Rotates the XY coordinates centered on the origin so that the X coordinate axis is parallel to a line that passes through two specified points.



Determines the XY coordinate axis by specifying a line using two points for the new X coordinate axis, and a third point for the new Y coordinate axis.



Determines the XY coordinate axis by specifying the origin and one point along the X coordinate axis.



Determines the Y coordinate axis by specifying two points along the X coordinate axis and two points that pass through the origin.



Determines the Y coordinate axis the midpoint between two points specified along the desired X coordinate axis.

! Point

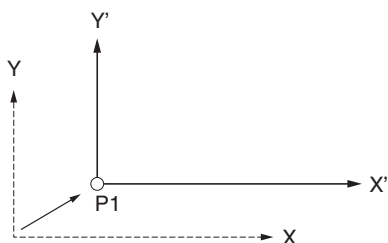
- Clicking [Reset] initializes the coordinate specifying and makes the clicked position the origin. The horizontal line on the screen becomes the X-axis, and the vertical line becomes the Y-axis.
- Restarting the system resets the coordinate specifying.

Using the coordinate specifying tools

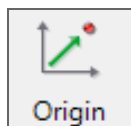
■ Origin

Moves the origin.

Shifts the XY coordinates in parallel by defining a point as the new origin.

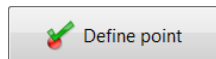


1 Click Origin.



2 Move the XY stage to align the center of the cross line over the position to set as the origin.

3 Click [Define point].



The current position becomes the origin and the stage coordinate display becomes zero.

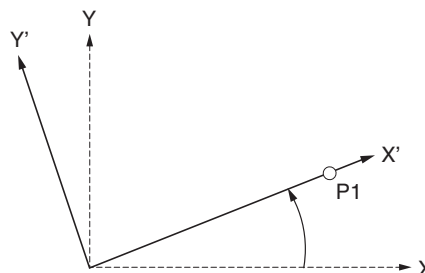
Reference

If the origin is defined after correcting the coordinates with another setting tool, corrections in the rotating direction will not change the origin.

■ Turn 1

Rotates the XY coordinates.

Makes the X axis the line that passes through the origin and a point specified on the new X axis.

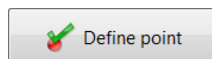


1 Click [Turn 1].



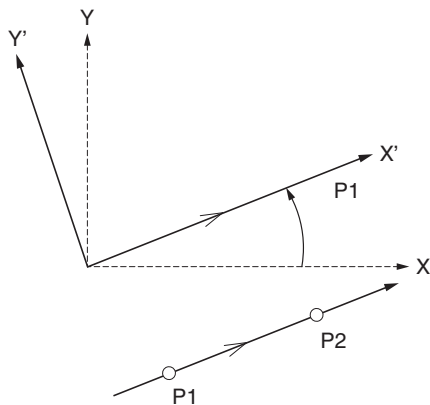
2 Move the XY stage to align the center of the cross line over a point on the X axis.

3 Click [Define point].

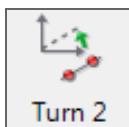


Turn 2

Determines the coordinate axis by rotating the XY coordinates centered on the origin so that the X axis is parallel to a line that passes through two specified points. Use this tool if the new reference line for the coordinate axis does not go through the origin.

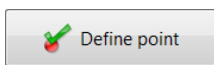


1 Click [Turn 2].



2 Move the XY stage to align the center of the cross line over a point on the new reference line for the X axis.

3 Click [Define point].

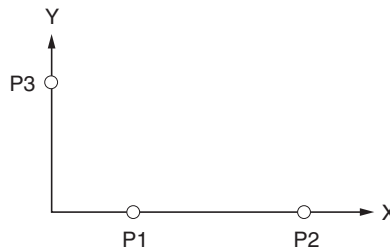


4 Align the center of the cross line over the second point on the new X-axis reference line and click [Define point].

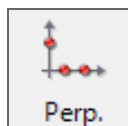
Reference Multi-point input (Page 9-97) can be used when specifying parallel lines.

Perpendicular

Determines the XY coordinate axis by specifying two points for the X axis, and one point (a third point) for the Y axis.

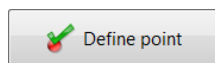


1 Click [Perp].



2 Move the XY stage to align the center of the cross line over one point on the X axis.

3 Click [Define point].



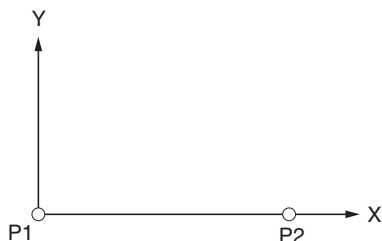
4 Align the center of the cross line over the second point on the X-axis and click [Define point].

Reference Multi-point input (Page 9-97) can be used when specifying the X axis.

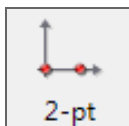
5 Align the center of the cross line over the point on the Y-axis and click [Define point].

■ **2 points**

Determines the XY axes by specifying the origin and one point along the X axis.

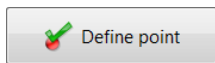


- 1 Click [2-pt].



- 2 Move the XY stage to align the cross line center over the position to set as the origin.

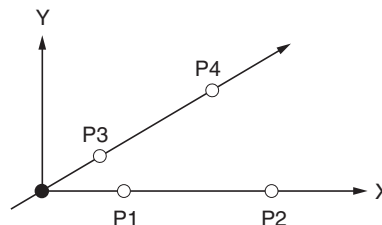
- 3 Click [Define point].



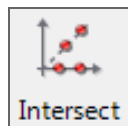
- 4 Move to the point on the X axis and click [Define point].

■ **Intersect**

Determines the Y axis and Origin by specifying two points on the X axis and two points on a line that passes through the origin.

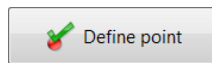


- 1 Click [Intersect].



- 2 Move the XY stage to align the center of the cross line over one point on the X axis.

- 3 Click [Define point].



- 4 Align the center of the cross line over the second point on the X-axis and click [Define point].

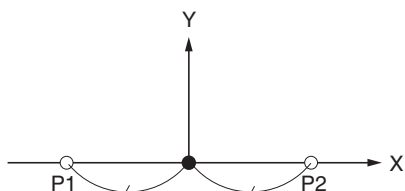
- 5 Align the center of the cross line over the first point on the line that passes through the origin and click [Define point].

- 6 Align the center of the cross line over the second point on the line that passes through the origin and click [Define point].

Reference Multi-points input (Page 9-97) can be used when specifying the X axis and origin.

Midpoint

Makes the Y axis the midpoint between two points specified on the X axis.

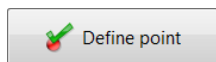


1 Click [Midpoint].



2 Move the XY stage to align the center of the cross line over one point on the X axis.

3 Click [Define point].



4 Align the center of the cross line over the second point on the X-axis and click [Define point].

Measuring with the XY Stage

2 Points

Measures the difference of X and Y coordinates of two specified points, and the distance from the first point to the second point.

Points to specify

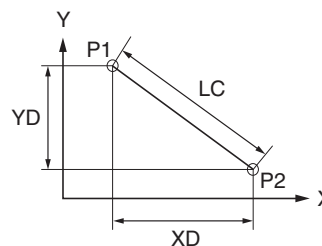
2 points: P1, P2

Measured items

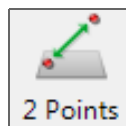
Distance: distance between coordinates of P1 and P2. LC

X-coord diff: difference in X-coordinates of P1 and P2. XD

Y-coord diff: difference in Y-coordinates of P1 and P2. YD

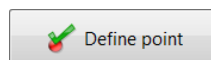


1 Click [2 Points].



2 Move the XY stage to align the center of the cross line over the first point.

3 Click [Define point].



4 Align the center of the cross line over the second point and click [Define point].

This defines the point and displays the results in the measurement results window.

Multi-points

For each of the multiple points specified, this tool measures the interior angle and distance between the last defined point and the origin.

At the end of the measurement, the cumulative distance and total of the interior angles are measured.

Points to specify

Multiple points: P1, P2...

Measured items

Distance: distance between P1 and P2.

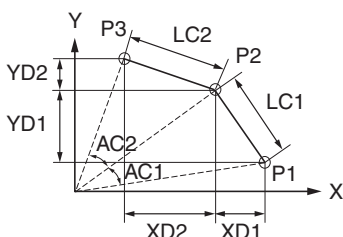
X-coord diff: difference in coordinates of P1 and P2. XD

Y-coord diff: difference in coordinates of P1 and P2. YD

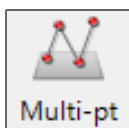
Angle: interior angle of lines that connect P1 and the origin and P2 and the origin. AC

Cumulative distance: cumulative value of distance. LC1 + LC2 + ...

Cumulative angle: cumulative value of angles. AC1 + AC2 + ...

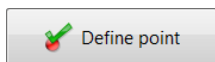


1 Click [Multi-pt].



2 Move the XY stage to align the center of the cross line over the first point.

3 Click [Define point].

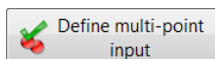


4 Align the center of the cross line over the second point and click [Define point].

Repeat this for as many points as required.

5 To stop specifying points, click [Define multi-point input].

This defines the point and displays the results in the measurement results window.



Line

Measures the angle of a line that connects two specified point, or an approximated line of multiple points, to the X-coordinate axis. If multiple points were entered, the straightness of the line is also measured.

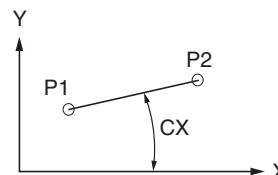
Points to specify

P1, P2 (multi-point input allowed)

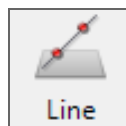
Measured items

Angle: angle of line connecting P1 and P2 to the X coordinate axis. CX

Straightness: straightness of an approximated line of multiple points.

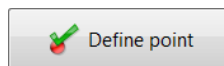


1 Click [Line].



2 Move the XY stage to align the center of the cross line over the first point.

3 Click [Define point].



4 Align the center of the cross line over the second point (angle vertex point) and click [Define point].

This defines the point and displays the results in the measurement results window.



Multi-point input (Page 9-97) can be used to specify the line.

Circle

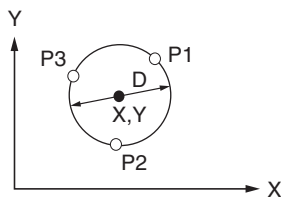
Measures a circle drawn by specifying three or more points on a circumference to provide the center coordinates (XY), diameter, radius, and circularity.

Points to specify

P1, P2, P3 (multi-point input allowed)

Measured items

- X-coord: X coordinate of center of circle that passes through the three points P1, P2, and P3.
- Y-coord: Y coordinate of center of circle that passes through the three points P1, P2, and P3.
- Radius: radius of the circle that passes through the three points P1, P2, and P3. D/2
- Diameter: diameter of the circle that passes through the three points P1, P2, and P3. D
- Circularity: circularity of the average line of multiple points.

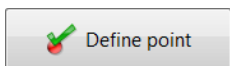


1 Click [Circle].




2 Move the XY stage to align the center of the cross line over one point on the circumference.

3 Click [Define point].



4 Align the center of the cross line over the second point on the circumference and click [Define point].

5 Align the center of the cross line over the third point on the circumference and click [Define point].

 Multi-point input (Page 9-97) can be used to specify the circle.

2 Centers

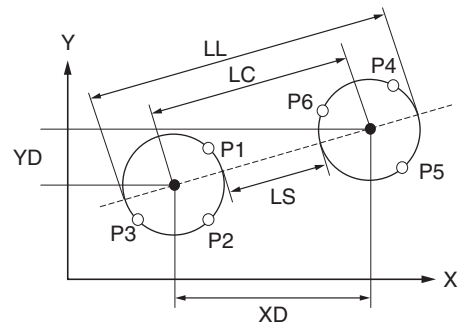
Measures the center distance between two circles.

Points to specify

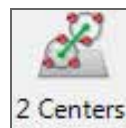
- First circle: P1, P2, P3 (multi-point input allowed)
- Second circle: P4, P5, P6 (multi-point input allowed)

Measured items

- Measures the first and second circles for:
- Distance: center distance. LC
- Shortest distance: shortest distance on the circumferences. LS
- Longest distance: farthest distance on the circumferences. LL
- X-coord diff: difference between X coordinates of centers. XD
- Y-coord diff: difference between Y coordinates of centers. YD

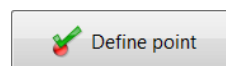


1 Click [2 Cntrs].



2 Move the XY stage to align the center of the cross line over the first point on the circumference.

3 Click [Define point].



4 Align the center of the cross line over the second point on the circumference and click [Define point].

5 Align the center of the cross line over the third point on the circumference and click [Define point].

This defines the first circle.

6 Repeat steps 2 to 5 to specify the circumference of the second circle.

This defines the second circle and displays the results in the measurement results window.

Reference Multi-point input (Page 9-97) can be used to specify the circles.

Angle 1

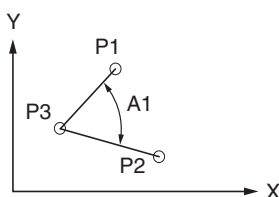
Calculates the interior angle by specifying three points.

Points to specify

3 points: P1, P2, P3

Measured items

Angle: interior angle of two lines formed by P1, P2, and P3. A1

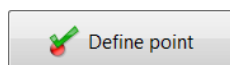


1 Click [Angle 1].



2 Move the XY stage to align the center of the cross line over the first point.

3 Click [Define point].



4 Align the center of the cross line over the second point and click [Define point].

5 Align the center of the cross line over the third point (angle vertex point) and click [Define point].

This defines the point and displays the results in the measurement results window.

Angle 2

Measures the coordinates and angle of the intersection of two lines.

Reference If the two lines do not actually intersect, the tool will measure the coordinates and interior angle at the imaginary intersection if the lines were extended.

Points to specify

P1, P2, P3, P4 (multi-point input allowed)

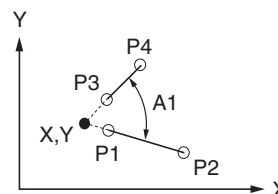
Measured items

Angle: interior angle of line connecting P1 and P2, and line connecting P3 and P4. A1

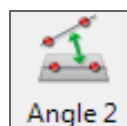
X-coord: X coordinate of intersection of line connecting P1 and P2, and line connecting P3 and P4.

Y-coord: Y coordinate of intersection of line connecting P1 and P2, and line connecting P3 and P4.

Distance: Distance from intersection (of line connecting P1 and P2 and line connecting P3 and P4) to origin.

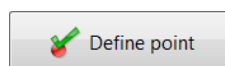


1 Click [Angle 2].



2 Move the XY stage to align the center of the cross line over the first point of one side.

3 Click [Define point].



4 Align the center of the cross line over the second point on one side and click [Define point].

5 Repeat this for the first and second points on the second side.

This displays the results in the measurement results window.

Reference Multi-point input (Page 9-97) can be used to specify the sides.

Perpendicular lines

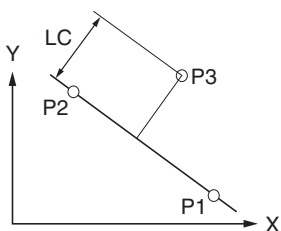
Measures the distance from a reference line specified by two points to an arbitrary point.

Points to specify

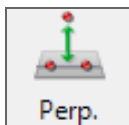
P1, P2, P3 (multi-point input allowed for P1 and P2)

Measured items

Distance: distance between line connecting P1 and P2, and P3. LC

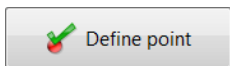


1 Click [Perp.].



2 Move the XY stage to align the center of the cross line over the first point on the reference line.

3 Click [Define point].



4 Align the center of the cross line over the second point on the reference line and click [Define point].

This defines the line.



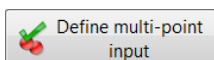
Multi-point input (Page 9-97) can be used to specify the line.

5 Align the center of the cross line over the point to which you wish to measure the distance of, and click [Define point].

This displays the results in the measurement results window.

Repeat step 5 to measure the distance between additional points and the reference line defined in step 4.

To stop measuring perpendicular lines, click [Complete].



Parallel lines

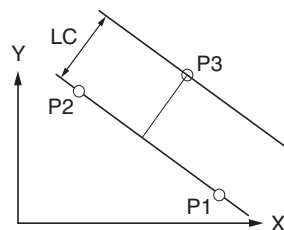
Measures the distance from a specified point to an average line specified by two or more points.

Points to specify

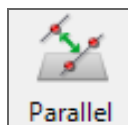
P1, P2, P3 (multi-point input allowed for P1 and P2)

Measured items

Distance: distance between line connecting P1 and P2, and P3. LC

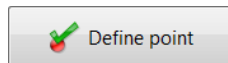


1 Click [ParaLn 1].



2 Move the XY stage to align the center of the cross line over the first point on the reference line.

3 Click [Define point].



4 Align the center of the cross line over the second point on the reference line and click [Define point].

This defines the line.



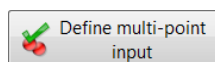
Multi-point input (Page 9-97) can be used to specify the line.

5 Align the center of the cross line over the point to which you wish to measure the distance of, and click [Define point].

This displays the results in the measurement results window.

Repeat step 5 to measure the distance between additional points and the reference line defined in step 4.

To stop measuring parallel lines, click [Define multi-point input].



Line to center distance

Measures the distance from a circle to a point where a perpendicular line dropped from the center of the circle intersects a specified reference line.

Points to specify

Line: P1, P2 (multi-point input allowed)

Circle: P3, P4, P5 (multi-point input allowed)

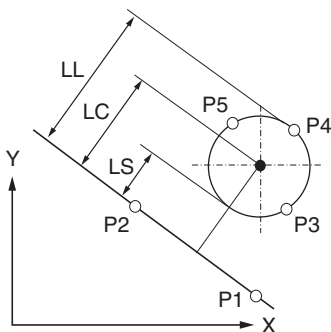
Measured items

Measures these items with respect to the point where a perpendicular line dropped from the center of the circle intersects the reference line:

Distance: distance to center. LC

Longest distance: distance to farthest point on the circumference. LL

Shortest distance: distance to shortest point on the circumference. LS

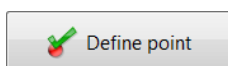


1 Click [Ln-Cir dist].



2 Move the XY stage to align the center of the cross line over the first point on the reference line.

3 Click [Define point].



4 Align the center of the cross line over the second point on the reference line and click [Define point].

This defines the reference line.

5 Align the center of the cross line over the first point on the circumference of the circle and click [Define point].

6 Align the center of the cross line over the second point on the circumference of the circle and click [Define point].

7 Align the center of the cross line over the third point on the circumference of the circle and click [Define point].

This defines the circle and displays the results in the measurement results window.



Multi-point input (Page 9-97) can be used to specify the line and circle.

Perpendicularity

Measures the perpendicularity of the measurement line with respect to a reference line, and the projected length of an evaluation length of the measurement line projected on the reference line.

Points and values to specify

Reference line: P1, P2 (multi-point input allowed)

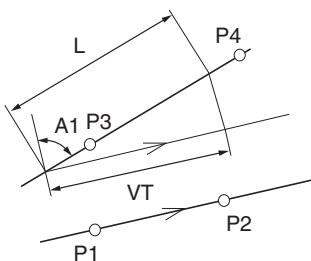
Measurement line: P3, P4 (multi-point input allowed)

Evaluation length: L (numeric entry)

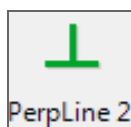
Measured items

Angle : interior angle of a perpendicular line to the reference line, and the measurement line. A1

Length : length of the Evaluation Length line L, projected on the reference line. VT

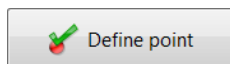


1 Click [PerpLn 2].



2 Move the XY stage to align the center of the cross line over the first point on the reference line.

3 Click [Define point].



4 Align the center of the cross line over the second point on the reference line and click [Define point]. This defines the reference line.

5 Align the center of the cross line over the first point on the measurement line and click [Define point]. This defines the measurement line. The [Set evaluation length] dialog box appears.

6 Align the center of the cross line over the second point on the measurement line and click [Define point].

7 Enter the evaluation length and click [OK].

This displays the results in the measurement results window.



Multi-point input (Page 9-97) can be used to specify the line.

Parallelism

Measures the angle (parallelism) of the measurement line with respect to a reference line, and the length of a measurement line based on an evaluation length thereof, projected on a line perpendicular to the reference line.



Point

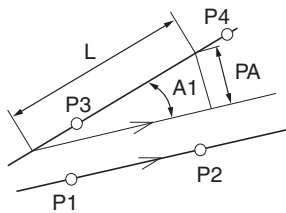
If the two lines do not actually intersect, the measurement will take place as long as an extension of the lines does intersect. The measurement input mode cannot be canceled if the extended segments of the line fail to intersect.

Points and values to specify

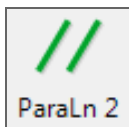
- Reference line: P1, P2 (multi-point input allowed)
- Measurement line: P3, P4 (multi-point input allowed)
- Evaluation length: L (numeric entry)

Measured items

- Angle : interior angle of the reference line and the line to measure. A1
- Length : length of evaluation length L, projected on a line perpendicular to the reference line. PA

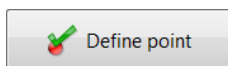


1 Click [ParaLn 2]



2 Move the XY stage to align the center of the cross line over the first point on the reference line.

3 Click [Define point].



4 Align the center of the cross line over the second point on the reference line and click [Define point].

This defines the reference line.

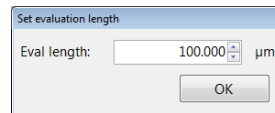
5 Align the center of the cross line over the first point on the measurement line and click [Define point].

This defines the measurement line. The [Set evaluation length] dialog box appears.

6 Align the center of the cross line over the second point on the measurement line and click [Define point].

7 Enter the evaluation length and click [OK].

This displays the results in the measurement results window.



Multi-point input (Page 9-97) can be used to specify the line.

Delete



Delete the selected measurement line.

Delete all



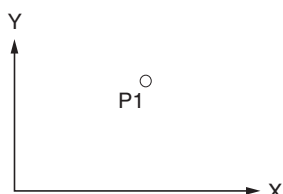
Deletes all measurement lines.

Point (point/intersect coordinates)

Finds the coordinates of a specified point.

Points to specify

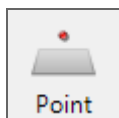
Point P1



Measured items

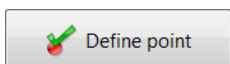
- X-coord: X coordinate of point.
- Y-coord: Y coordinate of point.
- Coordinate D: Distance in a straight line from origin.

1 Click [Point].



2 Move the XY stage over the point.

3 Click [Define point].



This defines the point and displays the results in the measurement results window.

Midpoint (point/intersect coordinates)

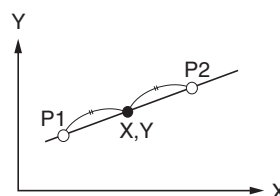
Measure the coordinates of the midpoint of two specified points.

Points to specify

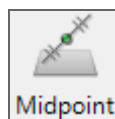
Point: P1, P2

Measured items

- X-coord: X coordinate at intersection.
- Y-coord: Y coordinate at intersection.

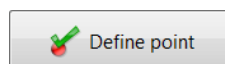


1 Click [Midpoint].



2 Move the XY stage to align points.

3 Click [Define point].



4 Repeat steps 2 and 3 for the second point.

This defines the midpoint and displays the results in the measurement results window.

Line-Line (point/intersect coordinates)

Measure the coordinates of the intersection of two specified lines.

Points to specify

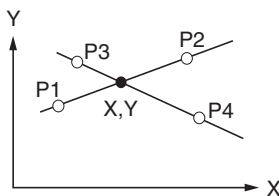
First line: P1, P2 (multi-point input allowed)

Second line: P3, P4 (multi-point input allowed)

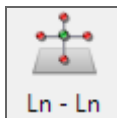
Measured items

X-coord: X coordinate at intersection.

Y-coord: Y coordinate at intersection.

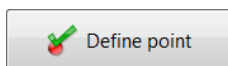


1 Click [Ln - Ln].



2 Move the XY stage to align the intersection of the cross line over the first point on the line.

3 Click [Define point].



4 Align the intersection of the cross line over the second point on the line and click [Define point].

This defines the line.

5 Repeat steps 2 to 4 for the two points on the second line.

This defines the second line and displays the results in the measurement results window.

Reference Multi-point input (Page 9-97) can be used to specify the lines.

Line to circle intersection (point/intersect coordinates)

Measures the coordinates of the intersection of a specified line and circle.



Point

Although the line and circle do not actually intersect, the measurement will take place as long as an extension of the line does intersect.

Points to specify

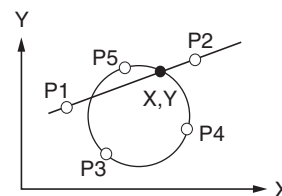
Line: P1, P2 (multi-point input allowed)

Circle: P3, P4, P5 (multi-point input allowed)

Measured items

X-coord: X coordinate at intersection.

Y-coord: Y coordinate at intersection.

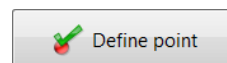


1 Click [Ln-Cir].



2 Move the XY stage to align the center of the cross line over the first point on the line.

3 Click [Define point].



4 Align the center of the cross line over the second point on the line and click [Define point].

This defines the line.

5 Align the center of the cross line over the first point on the circumference of the circle and click [Define point].

6 Align the center of the cross line over the second point on the circumference of the circle and click [Define point].

7 Align the center of the cross line over the third point on the circumference of the circle and click [Define point].

This defines the circle and displays the results in the measurement results window.

Reference Multi-point input (Page 9-97) can be used to specify the line and circle. This tool measures the intersection closest to P5 (or the last point defined if entering multiple points).

Circle to circle intersection (point/intersect coordinates)

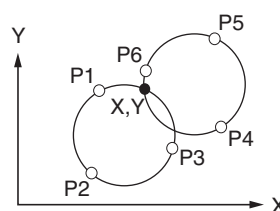
Measures the intersection of two circles.

Points to specify

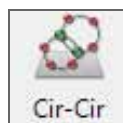
First circle: P1, P2, P3 (multi-point input allowed)
 Second circle: P4, P5, P6 (multi-point input allowed)

Measured items

X-coord: X coordinate at intersection.
 Y-coord: Y coordinate at intersection.

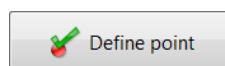


1 Click [Cir-Cir intrsect].



2 Move the XY stage to align the center of the cross line over the first point on the circumference.

3 Click [Define point].



4 Align the center of the cross line over the second point on the circumference of the circle and click [Define point].

5 Align the center of the cross line over the third point on the circumference of the circle and click [Define point].

This defines the first circle.

6 Repeat steps 2 to 5 for the three points on the circumference of the second circle.

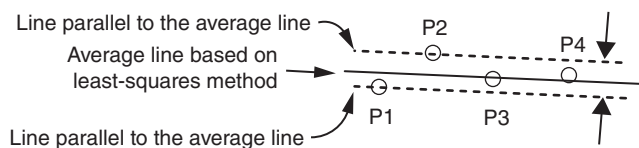
This defines the second circle and displays the results in the measurement results window.

Reference Multi-point input (Page 9-97) can be used to specify the circles.

Multiple point input

Multi-point input for lines

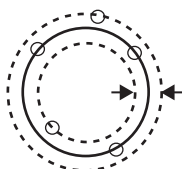
This method of input draws an average line of multiple points obtained using the least-squares method. Measurements are done with this average line. Additionally, the total distance (straightness) of the two points farthest above and below (or right and left) the average line is also measured. (The straightness of a line entered in two points will be zero.)



In example above, the straightness is the total of the distance between P1 and the average line, and P2 and the average line.

Multi-point input for circles

This method of input draws an average circle of multiple points obtained using the least-squares method. The total distance (circularity) between the circle's closest and farthest points from its center and the average circle is measured. (The circularity of a circle entered in three points will be zero.)



Multi-point input procedure

1 Select the [Multi-pt input] check box.

The letter M will appear on the measuring tool icons that support multi-point input.



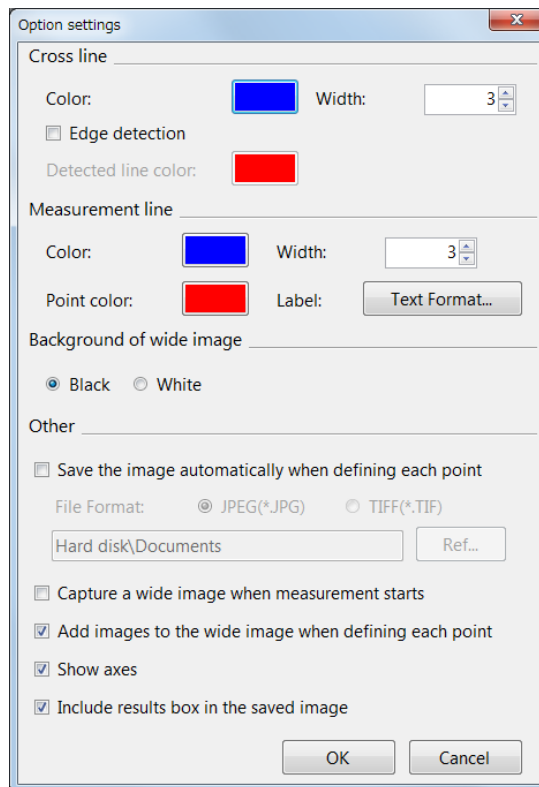
2 Click a measurement tool icon to select it.

📖 "Measuring with the XY Stage" (Page 9-86)

To stop using multi-point input and specify another line or circle, click [CompMulti].

To stop using multi-point input and stop measuring, click [Define multi-point input].

Option Settings



- Cross line**
 These options change the line color and width. The color of the cross line can be changed when it detects an edge in the image.
- Measurement line**
 These options set the line color and width, color of the measurement point, and text format used to display measurement numbers.
- Background of wide image**
 Select a color (black or white) for the portions the image does not occupy in the "Wide-area view" dialog box.
- Save the image automatically when defining each point**
 If this option is checked, the image is saved to the hard disk as each point is defined. Select the auto save option and the image format for saving, then click [Ref...] and specify the destination folder.
- Capture a wide image when measurement starts**
 Check this option to capture a wide image when the XY stage measurement starts.

- **Add images to the wide image when defining each point**
This option links the current live observation image to the image in the "Wide-area view" dialog box as each point is defined.
- **Show axes**
This option displays the XY axes in the "Wide-area view" dialog box. The intersection of the X and Y axes indicates the origin.
- **Include measurement results dialog when saving the image**
This option saves an image of the currently displayed measurement results dialog with the observation image.

Chapter 10

Observing in 3D

Depth Composition and 3D View

When observing tall or embedded objects, it may not be possible to focus on the entire object. Depth composition displays an image of the entire object in focus by composing images of the object recorded at different distances. This allows you to observe the image in 3D from different angles.

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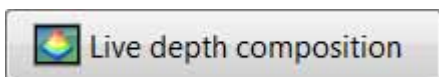
Types and Features of Depth Composition

This chapter explains how to obtain images focused on the object, and provides an overview of each method and their features.

Live Depth Composition

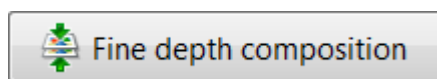
When moving the observation field, depth composition will be performed automatically and a fully-focused image will be displayed.

This method eliminates any additional operation to complete depth composition and provides a new observation style that does not require focus adjustment.



Fine Depth Composition

This method captures the image in focus at different heights, performs depth composition in fine resolution, and constructs and displays 3D images. Compared to quick depth composition, the image can be observed in higher picture quality.

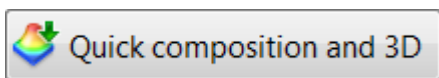


10

Observing in 3D

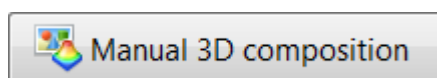
Quick Composition and 3D

This function can generate images with the depth composition and 3D image composition functions at high speed and can be combined with the effects of glare removal and HDR.



Manual 3D composition

The manual 3D composition can be started from an arbitrary Z position. This composition does not include unnecessary areas because you move the focus dial manually to determine the composition range.



Using Depth Composition

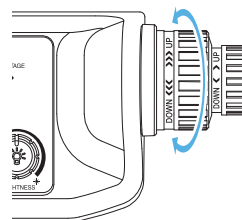
Live Depth Composition

Depth composition is performed automatically every time that the observation field is moved.

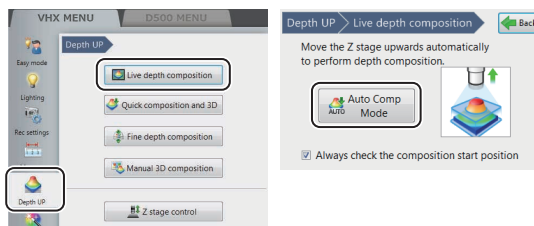
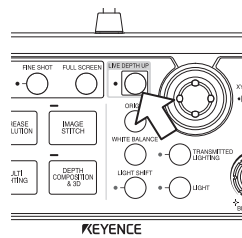


Images are acquired at different focal planes instantly and the depth composition image is displayed automatically.

- 1 Adjust the focus to the lowest point of the object using the FOCUS dial on the console.



- 2 Press the [LIVE DEPTH UP] button on the console, or click [Depth UP] from the VHX menu followed by [Live depth composition] - [Auto Comp Mode].

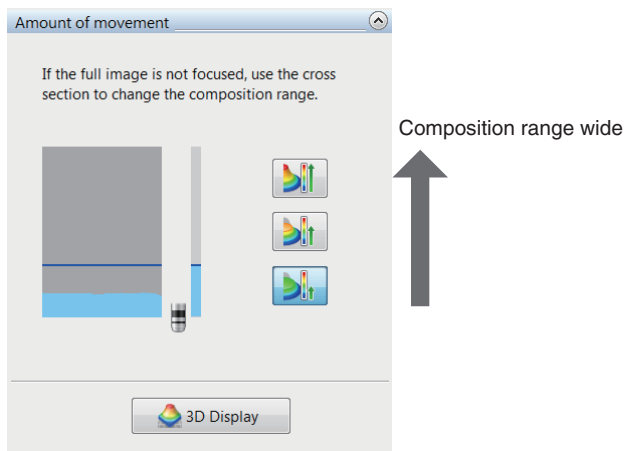


The Z-axis stage moves and the depth composition image is displayed in the observation window.

- Reference**
- To save the depth composition image, press the [REC] button on the console or click [Rec] on the on-screen menu options.
 - To turn OFF the live depth composition function, click [Auto Comp Mode] again to clear the selected state (yellow).

3 When the composition range is insufficient, you can adjust the the range to one of three levels with the adjusting button.

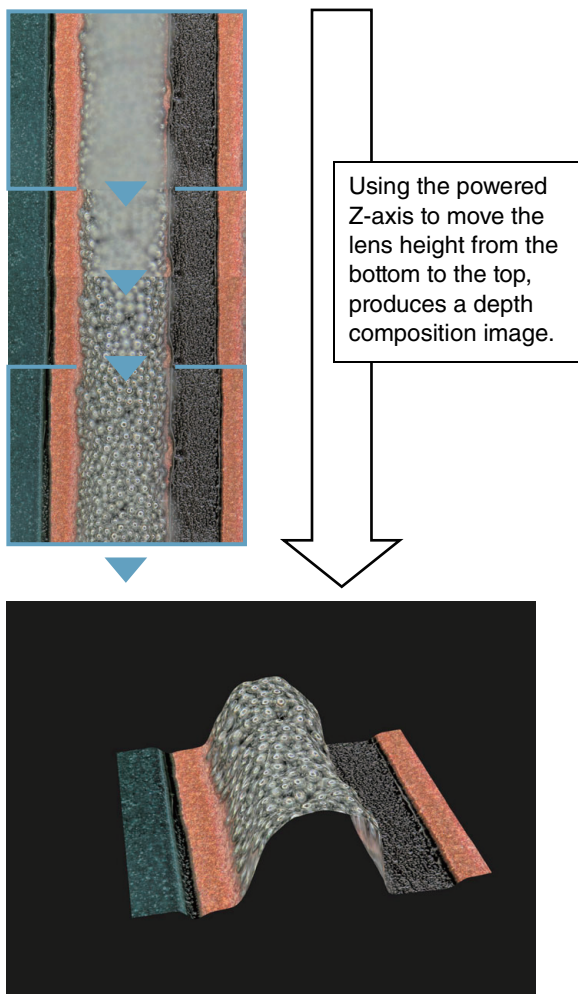
Point When the depth composition completes, a guide indicating the object silhouette appears on the right side of lens' movement adjusting button. If the upper limit is not above the silhouette, you may broaden the composition range by pressing the lens' movement adjusting button.



To display the 3D image, click [3D Display] (Page 10-15).

Quick Composition and 3D

Depth composition is performed by simply moving the focus from the lowest point to the highest point of the area to be observed. By moving the focus at a fixed speed, height information is available when the image is in focus which makes 3D observation possible.

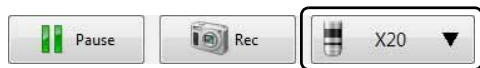


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Observing in 3D

Moving the Z-axis automatically

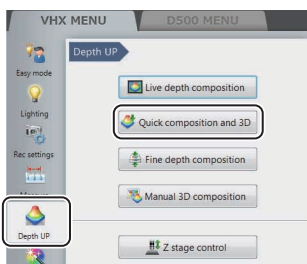
The Z-axis motorized stage, such as VHX-S650, is required.

Point If the lens being used does not support the automatic lens/zoom recognition function, it must be registered before executing composition. Specify the lens power in the status bar. "Preparing to Measure" (Page 9-5)

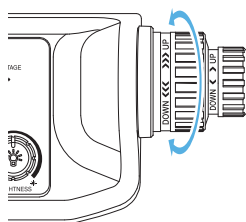


Simple mode

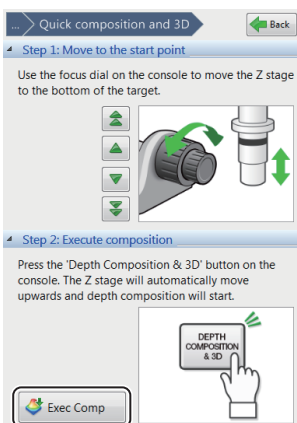
- 1 Press the [DEPTH COMPOSITION & 3D] button on the console, or click [Quick composition & 3D] under [Depth UP] from the VHX MENU.



- 2 Adjust the focus to the lowest point of the object using the FOCUS dial on the console.



- 3 Click [Exec Comp].



When the depth composition is complete, the depth composition image appears in the observation window.

- 4 Click [3D View].

The image is displayed in 3D (Page 10-15).

- To stop midway and redo the depth composition from the beginning, click [Reset].
- To exit the 3D View, click [Close].
- To save the depth composition image, click [Save].

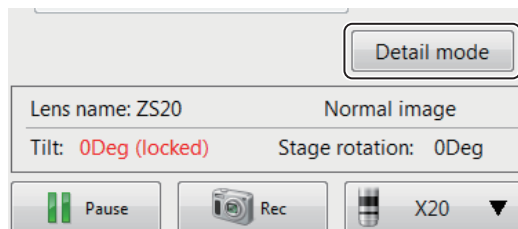
- 5 Click [Back].

Detail mode

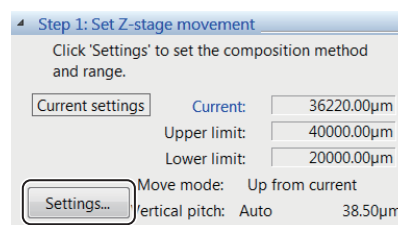
- 1 Press the [DEPTH COMPOSITION & 3D] button on the console, or click [Depth Up] from the VHX MENU and then [Quick composition and 3D].



- 2 Click [Detail mode].

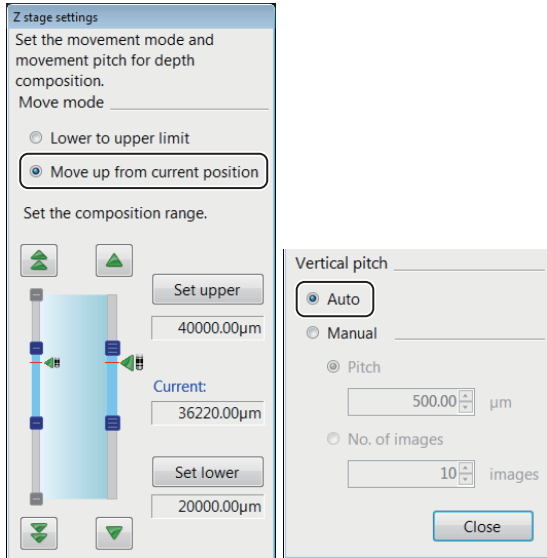


- 3 Click [Settings...].



The [Z stage settings] dialog box appears.

4 Select [Up from current] for the Move mode and [Auto] for the Vertical pitch.

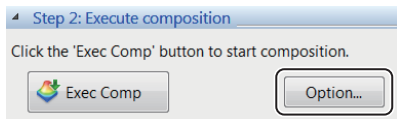


- Reference**
- You can also select [Lowlimit to Uplimit] at [Move mode].
 - [Vertical pitch] can be set manually.

5 Click [Close].

The [Z stage settings] dialog box closes.

6 Click [Option...].



The [Composition Options] dialog box opens.

7 Set the image format and depth composition option.

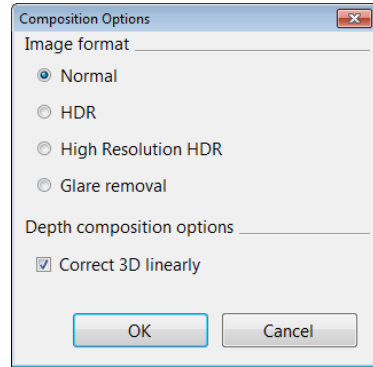


Image format

Generally, [Normal] is selected. To make height differences and gradation of surface clearer, select [HDR] (Page 7-7) or [High Resolution HDR] (Page 7-7). To perform composition while suppressing glare, select [Glare removal] (Page 7-11).

- Reference**
- You can also set HDR, high resolution HDR or glare removal before executing Quick Composition and 3D display.

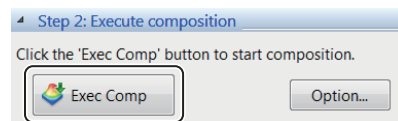
Correct 3D linearly

Checking this option makes it easier to convert objects to 3D when the object is tilted or has very few patterns.

8 Click [OK].

The [Composition options] dialog box closes.

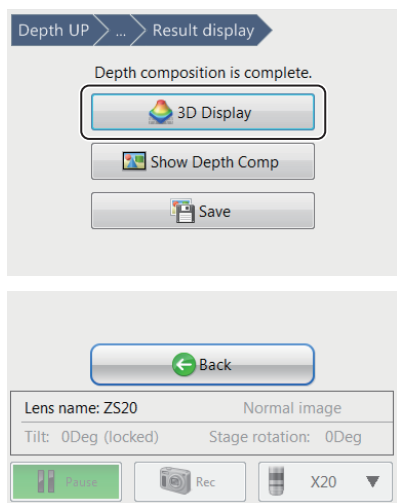
9 Click [ExecComp].



The Z-axis stage moves and the depth composition image appears in the observation window.

To stop the process midway or to start the depth composition, click [Reset].

10 Click [3D Display].



The 3D image (Page 10-15) appears.

- To exit the 3D display, click [Close].
- To save the depth composition image click [Save].

11 Click [Back].

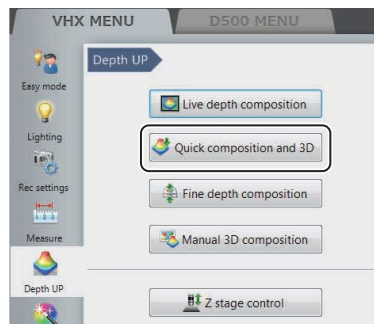
Moving the Z-axis manually

Manual motion is available when the Z-axis motorized stage is not connected.

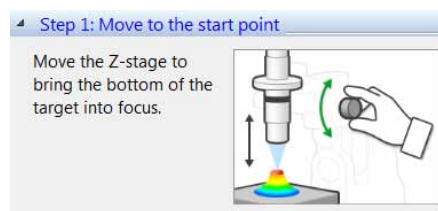
Point If the lens being used does not have the automatic lens/zoom recognition function, the magnification must be set before executing composition. Specify the lens power in the on-screen menu options. See "Preparing to Measure" (Page 9-5)



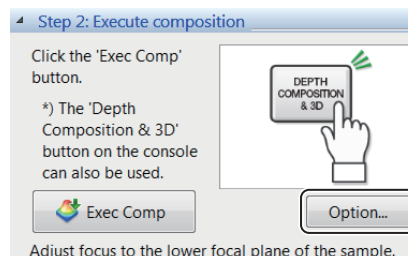
1 Click [Quick composition and 3D] under [Depth UP] from the VHX MENU.



2 Adjust the focus to the lowest point on the object.



3 Click [Option...].



The [Composition Options] dialog box appears.

4 Set the image format and depth composition option.

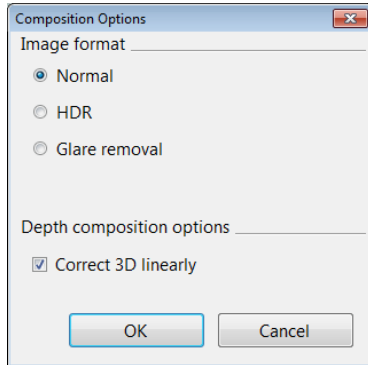


Image format

Generally, [Normal] is selected. To make height differences and gradation of surface clearer, select [HDR] (Page 7-7). To perform composition while suppressing glare, select [Glare removal] (Page 7-11).

Reference You can also set HDR or glare removing in advance before executing Quick 3D display.

Correct 3D linearly

Checking this option makes it easier to convert objects to 3D when the object is tilted or has very few patterns.

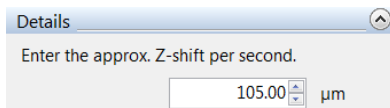
5 Click [OK].

The [Composition options] dialog box closes.

6 Open the advanced menu and set height range for the sample.

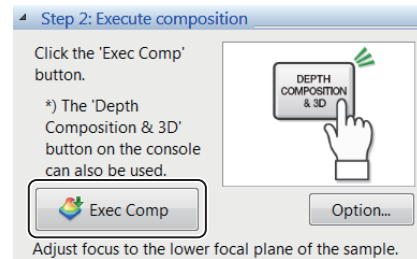
Enter the approximate speed for the lens movement.

An image is built from the bottom to the top of the height range defined.



7 Click [Exec Comp] and move the lens from the bottom plane of the sample to the top plane.

Move it with the speed set at step 6.



Reference

- A progress bar will appear. Move the stage while the progress bar is moving.
- If the moving completes before the progress bar ends, the 3D image will appear when you click [View composition results].
- To stop the moving midway, click [Reset].
- To save images (Page 10-15), press the [REC] button on the console or click [Save].

8 When the highest point of the target object is in focus, click [View composition results].

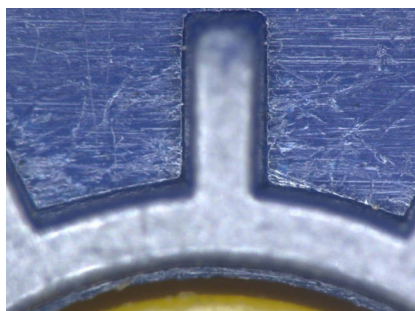
The result of depth composition appears.

If [HDR] was selected at the composition option, the high dynamic range setting window will appear. Make adjustments and click [3D View] to show the 3D image.

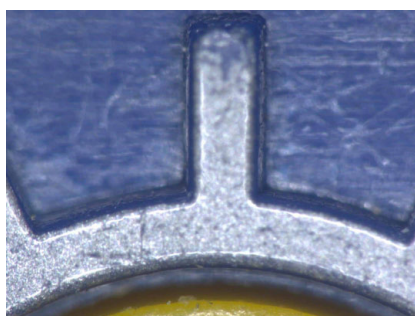
9 Click [3D Display] or [Show Depth Comp].

Fine Depth Composition

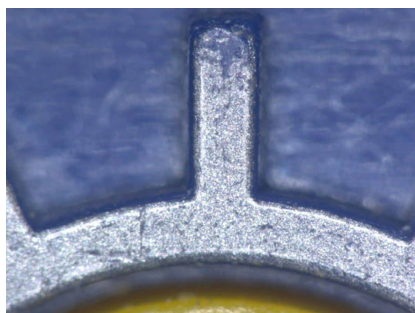
This method captures multiple images in focus at different heights, performs depth composition to produce a single, focused image and then composes and displays a 3D image. Even if the Z axis is moved manually, the height information is explicit so that images can be composed in high picture quality.



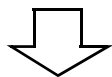
1st shot



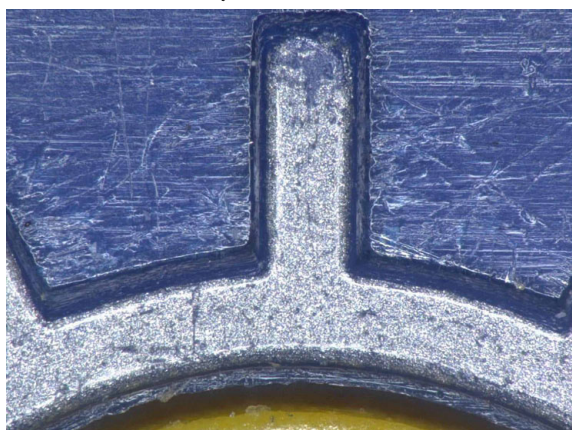
2nd shot



Last shot



After depth composition...



Moving the Z-axis automatically

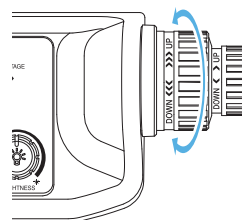
The Z-axis motorized stage, such as VHX-S650, is required.

Point

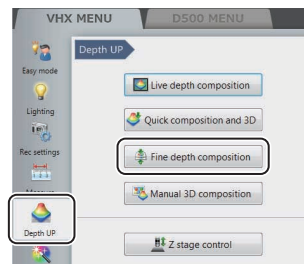
If the lens being used does not have the automatic lens/zoom recognition function, the magnification must be set before executing depth composition. Specify the lens power in the on-screen menu options. See "Preparing to Measure" (Page 9-5)



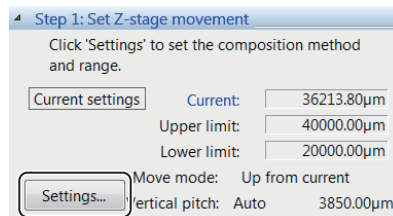
- Adjust the focus to the lowest point of the object using the FOCUS dial on the console.



- Click [Depth UP] from the VHX MENU and click [Fine depth composition].

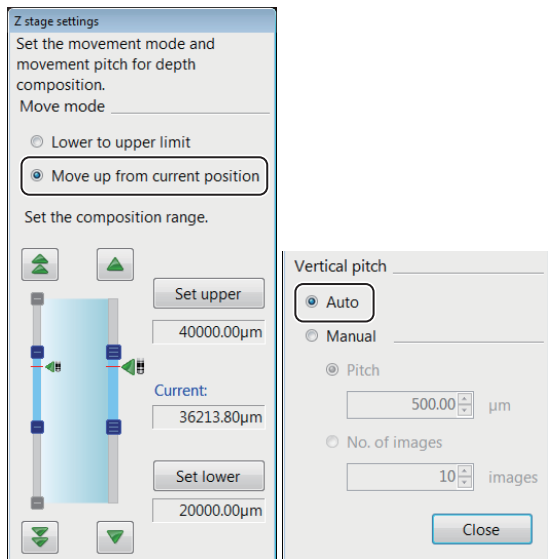


- Click [Settings...].



The [Z stage settings] dialog box appears.

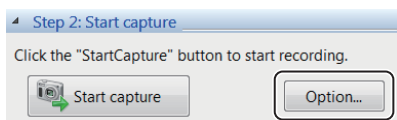
4 Select [Up from current] for the Move mode and [Auto] for the Vertical pitch.



- You can also select [Lowlimit to Uplimit] at [Move mode].
- [Vertical pitch] can be set manually.

5 Click [Close].
The [Z stage settings] dialog box closes.

6 Click [Option...].



The [Composition Options] dialog box opens.

7 Set the image format and depth composition option.

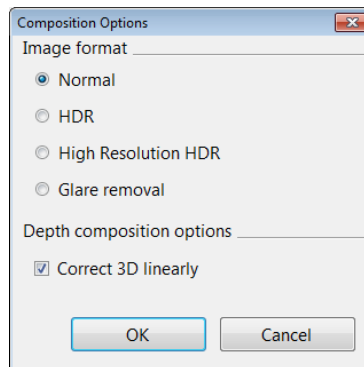


Image format

Generally, [Normal] is selected. To make height differences and gradation of surface clearer, select [HDR] (Page 7-7) or [High Resolution HDR] (Page 7-7). To perform composition while suppressing, select [Glare removal] (Page 7-11).

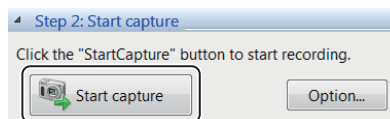
- You can also set HDR, high resolution HDR or glare removing in advance before executing Quick 3D display.

Correct 3D linearly

Checking this option makes it easier to convert objects to 3D when the object is tilted or has very few patterns.

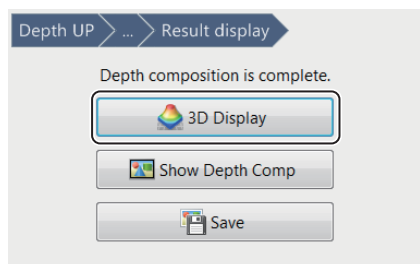
8 Click [OK].
The [Composition options] dialog box closes.

9 Click [Start capture].



The Z-axis stage moves and the depth composition image appears in the observation window.

10 To display the 3D image, click [3D Display].



The 3D image (Page 10-15) appears.

- To exit the 3D display, click [Close].
- To save the depth composition image, click [Save].

11 To recreate the depth composition image, click [Back].

Delete all the captured images before recreating the depth composition image.

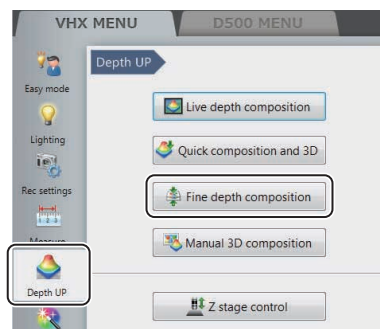
Moving the Z-axis manually

Move the Z-axis manually when the Z-axis electric stage is not connected.

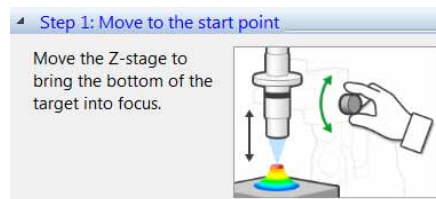
Point If the lens being used does not have the automatic lens/zoom recognition function, the magnification must be set before executing composition. Specify the lens power in the status bar. "Preparing to Measure" (Page 9-5)



1 Click [VHX MENU] - [Depth UP] - [Fine depth composition].

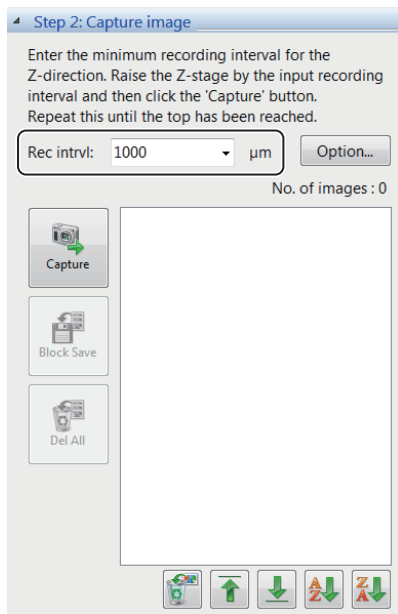


2 Adjust the focus to the lowest focal plane of the target.



3 Specify the recording pitch.

To account for depth-of-field variation caused by the magnification used, enter an appropriate recording pitch.



4 Click [Option...].

The [Composition option] dialog box appears.

5 Set the image format and depth composition option.

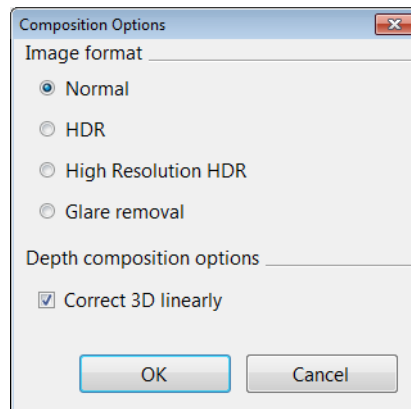


Image format

Generally, [Normal] is selected. To make height differences and gradation of surface clearer, select [HDR] (Page 7-7) or [High Resolution HDR] (Page 7-7). To perform composition while suppressing, select [Glare removal] (Page 7-11).

Reference You can also set HDR, high resolution HDR or glare removing in advance before executing fine depth composition.

Correct 3D linearly

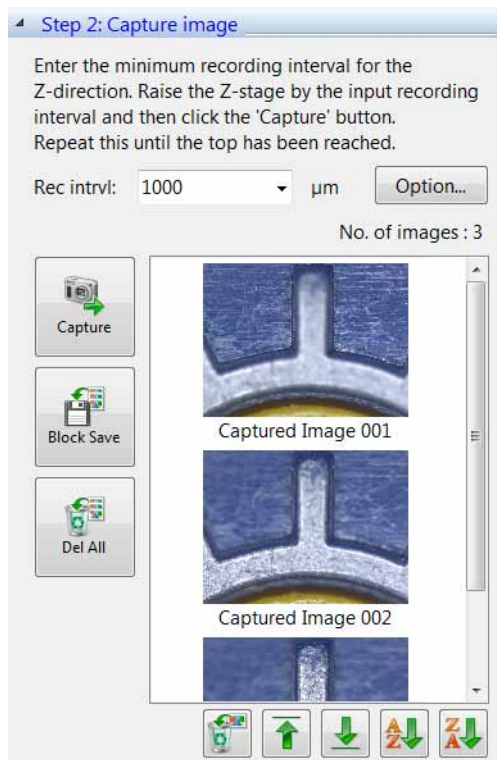
Checking this option makes it easier to convert objects to 3D when the object is tilted or has very few patterns.

6 Press the [REC] button on the console, or click [Capture].

This will save the current image.

7 Move the lens by the amount specified as the recording pitch in step 3.

- 8 Repeat steps 6 and 7 until you have captured the highest point of the object in focus.**



Block Save

Names the captured images and save them in a batch. The destination folder, file name prefix, and image format can be specified.

Delete All

Deletes all captured images.



Deletes the selected images. Multiple selection is available.



Moves the selected image up in the list.

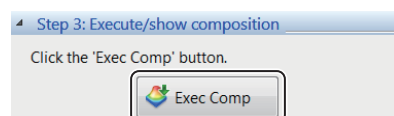


Moves the selected image down in the list.



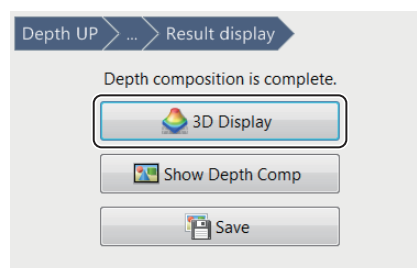
Sorts the images by name in ascending or descending order.

- 9 Click [Exec Comp].**



The fine depth composition result is displayed. If [HDR] or [High Resolution HDR] was selected at the composition option, the settings of [High dynamic range] or [High Resolution HDR] appears.

- 10 To display the 3D image, click [3D Display].**



The 3D image (Page 10-15) appears.

- To exit the 3D display, click [Close].
- To save the depth composition image, click [Save].

- 11 To recreate the depth composition image, click [Back].**

Delete all the captured images before recreating the depth composition image.

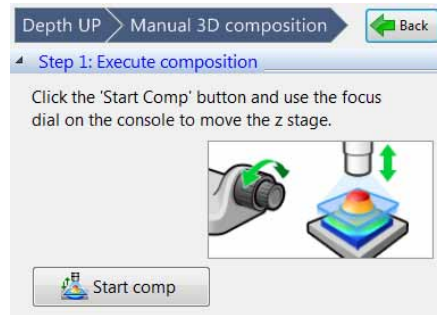
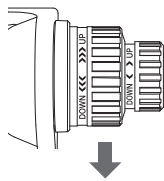
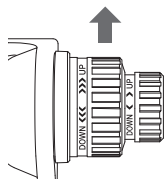
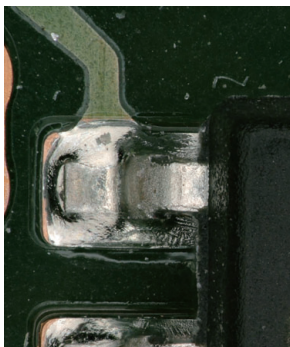
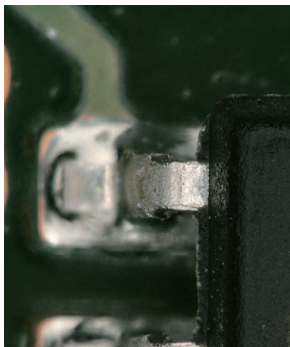
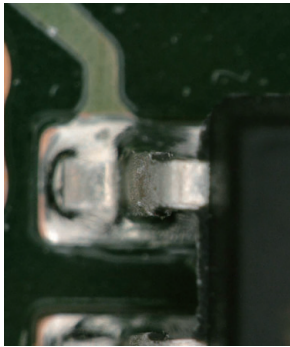
Manual 3D composition

The depth composition can be started easily and quickly from any position you want. You do not need to adjust the start point.

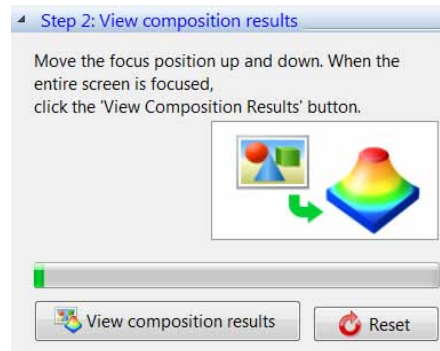
Use the console to move the Z stage so as to bring every part of the image into focus. 3D images can also be created this way.

10

Observing in 3D



- 1** Click [Depth UP] from the VHX MENU and click [Manual 3D composition].
- 2** Click [Start composition].
- 3** Move the focus dial up and down within a range you want to compose. You may move up and down repeatedly.



- 4** Click [View composition results].

Reference

- This function is not applicable to manual Z stages.
- This function cannot be used together with the HDR and the glare eliminating function.

3D View

The 3D view allows you to play, display, and observe compiled 3D images and 3D image data saved in the album. Displaying an image in 3D provides powerful observation from various directions to reveal scratches (dents), foreign matter (protrusions), and dirt (surface irregularities) otherwise difficult to detect in a 2D image.

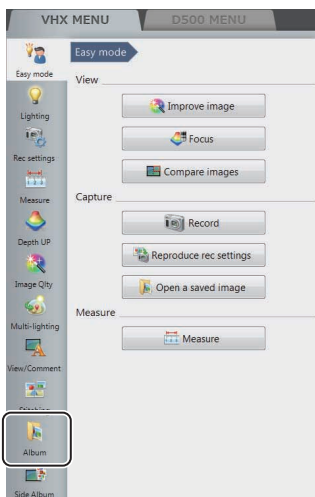
Playing Back and Saving 3D Images

Playing back 3D images

Recording in 3D automatically displays a 3D image. 3D images saved in the album are played in 3D.

1 Select [Album] from the VHX MENU.

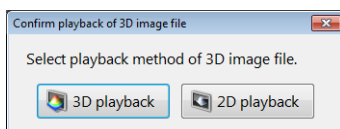
The album screen appears.



2 Select any 3D image from the images stored in the album.

The "Confirm playback of 3D image file" dialog box appears.

Click [3D playback].



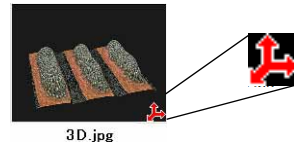
Point

If the [Confirm playback method of 3D image file] option is turned OFF in the Album [Options], the 2D playback will start without displaying the "Confirm playback of 3D image file" message.

📖 "Confirm playback method of 3D image file (3D/2D)" (Page 6-17)

Reference

- The 3D symbol appears on thumbnails for 3D images. The 3D symbol appears in the preview information window.



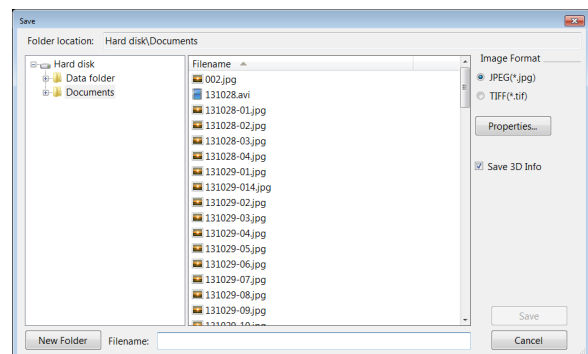
- To exit the 3D View, click [Exit] at the bottom right of the screen.
- If you selected [2D playback], the front view of the recorded (saved) image is shown. A 3D image can also be played as a 2D image if it was saved while being rotated, zoomed, or shown with a scale in 3D view,

Saving 3D images

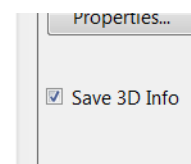
Saving the image observed in 3D to the hard disk.

1 Click [Save].

The [Rec] dialog box appears.



2 Check the [Save 3D Info] option.

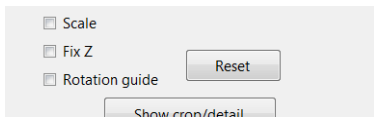


3 Enter the file name and click [Save].

Manipulating the 3D View

3D images can be rotated, zoomed in and out, and moved by using the wheel button on the mouse. All operations are executed using the center of the screen as the reference point.

Point If the image falls outside the view while manipulating it, click [Reset] or double-click the right mouse button. This will return the view to its initial state.

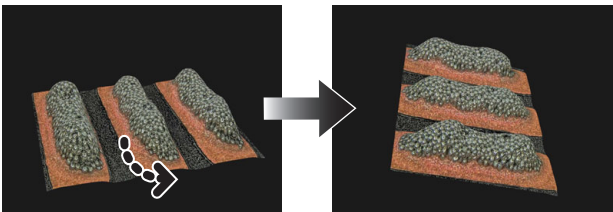


Reference The speed used to turn, zoom, and move an image is proportional to the speed at which the mouse is dragged.

Turn

To turn the image, hold the left mouse button down and drag it up, down, left, right, or diagonally. If you release the button while dragging the mouse, the image turns continuously.

(To stop turning continuously, click the left mouse button.)

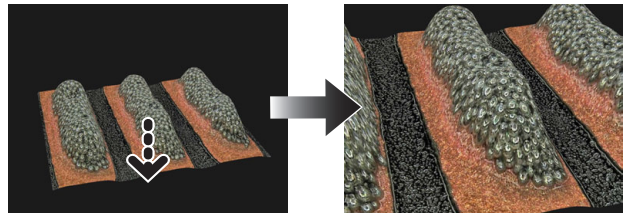


Zoom in

To zoom in on an image, drag the mouse down while holding the wheel button down.

If you release the button while dragging the mouse, the view will continue zooming in.

(To stop zooming continuously, click the left mouse button.)

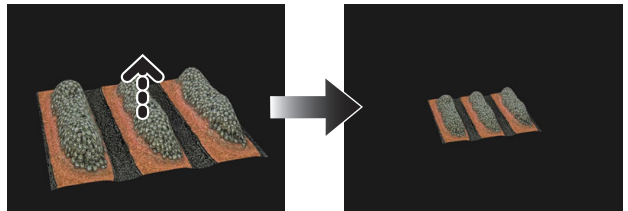


Zoom out

To zoom out of on an image, drag the mouse up while holding the mouse wheel button down.

If you release the button while dragging the mouse, the view will continue zooming out.

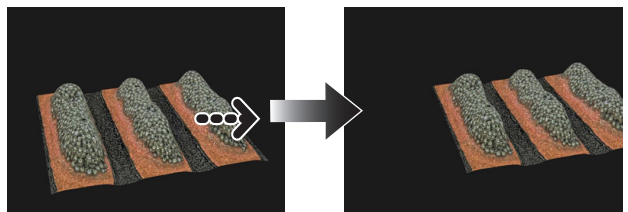
(To stop continuous zooming, click the left mouse button.)



Move

To move the image, hold the right mouse button down and drag it in the desired direction: up, right, left, right, or diagonally.

To move in the Z axis, turn the mouse wheel.



Using Height/Fix Z/Rotation Guide in 3D View

These options change the height of the 3D image, and set the axis of rotation guide and rotation limit.



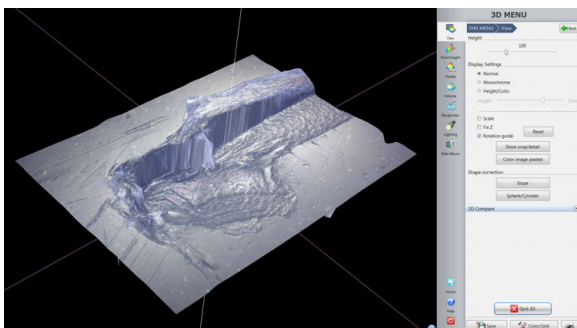
■ [Height]

This option changes the display scale in the height direction of the 3D image.

To view by extending the height from a reference value of 100, drag the slide bar to the right.

■ [Fix Z]

- Checking this option turns and moves the image with the Z axis fixed. Hold the left mouse button down and drag to turn while keeping the Z axis fixed. Hold the right mouse button down and drag to move the object.



■ [Rotation guide]

- When this option is checked, the X, Y, and Z axes are shown when the 3D image is dragged.

Display Settings

These settings allow for a scale or a topographical height-color overlay to be displayed.

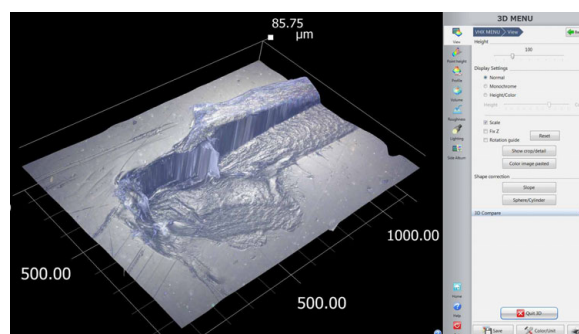
Displaying the scale

1 Check the [Scale] option on the display settings.

The [Scale] appears on the screen.

The height anywhere on the cross-section can be measured by pinching the upper and lower planes on the area to be measured by dragging the [●] and [■] on the Y-axis of the scale.

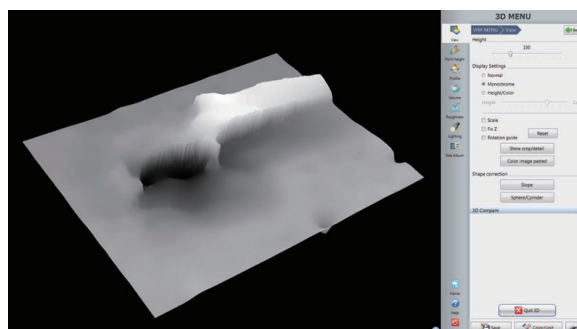
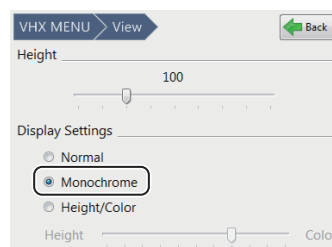
Turn the image for a better view.



Displaying as monochrome

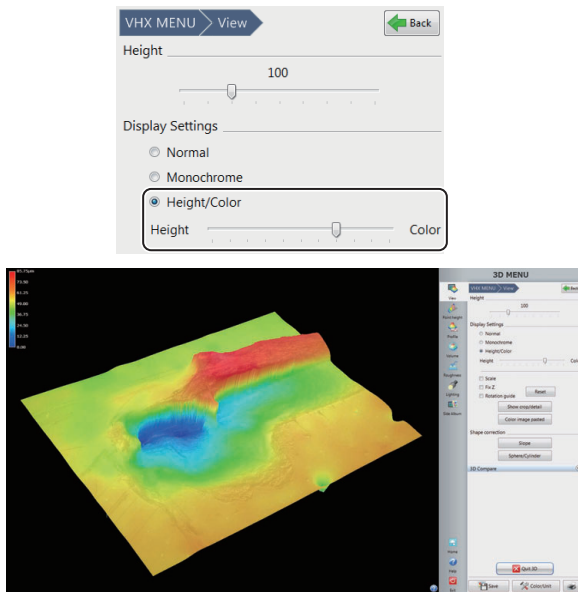
1 Select [Monochrome].

Texture of surface is removed to make the height differences clearer. By combining this with lighting simulation, greater clarity can be achieved.



Indicating height in color

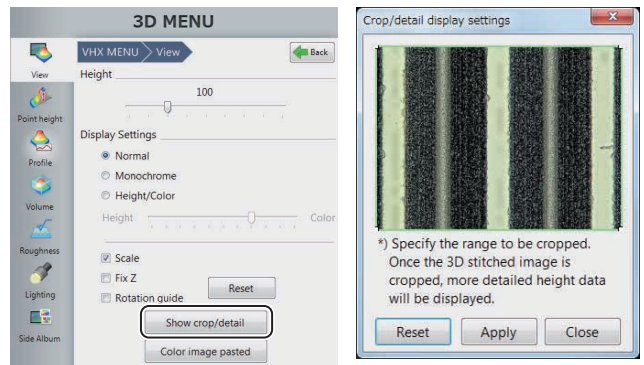
- 1 **Check the [Height/Color] option.**
This enables the slide bar for height and color.
Moving the slide bar toward [Height] color codes the 3D image according to its height.
Moving it toward [Color] displays the color of the object.



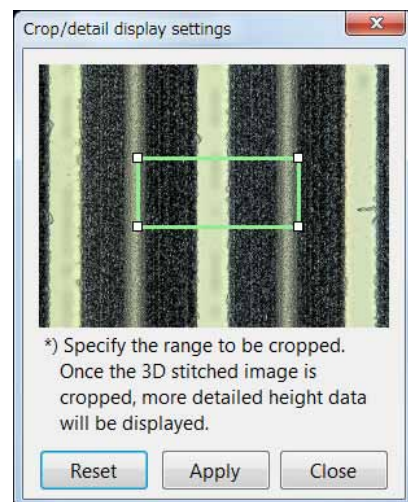
Show Crop/Detail

This tool allows you to crop a portion of the 3D image and observe or save it.
This is useful for observing portions of a 3D stitched image.

- 1 **Display the 3D image.**
Display the 3D image using the depth up function (Page 10-2), or the album function (Page 6-2).
- 2 **Click [Show crop/detail].**
The [Crop/detail display settings] dialog box appears.



- 3 **On the image in the crop/detail display settings dialog, specify the framing box size to encompass the area to be enlarged.**
An enlarged view of the specified area appears.
To return to the entire view, click [Reset].



4 Click [Close] on the [Crop/detail display settings] dialog box.

The enlarged image can be turned and moved using the mouse.

To observe a different location, click [Show crop/detail] again.

To save the cropped 3D image, click [Save] from the on-screen menu options.

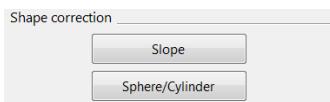
📖 "Saving 3D images" (Page 10-15)

Shape correction

This function corrects the tilt of a 3D image for display.

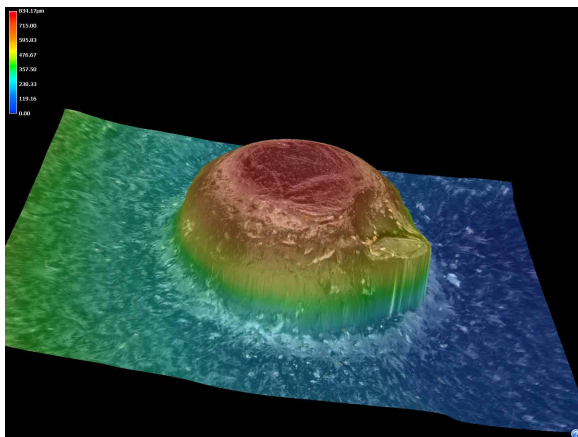
This function is useful when observing or measuring height differences on the surface of an object that lies at an angle.

It is also useful when observing height differences on the surface of a sphere or cylinder.

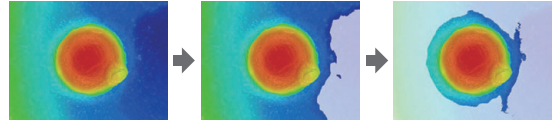


Correcting tilt of a planer area

1 Click [Slope].

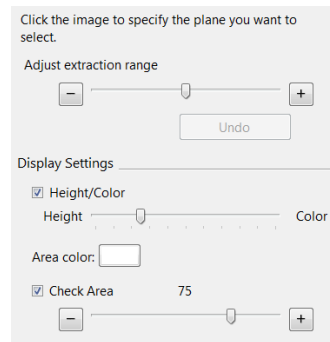


2 Click an area that should be level.



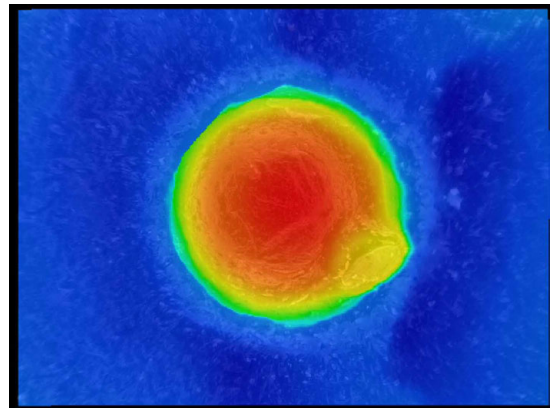
The clicked area is gradually painted with the "area color":

The area to be painted with each click can be adjusted with the [Adjust extraction range] slider.



3 As required, you may adjust the [Height/Color] display and the [Check area] display.

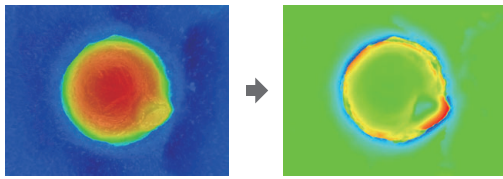
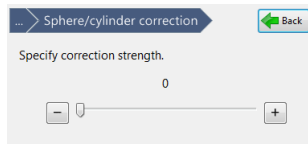
4 Click [Correct].



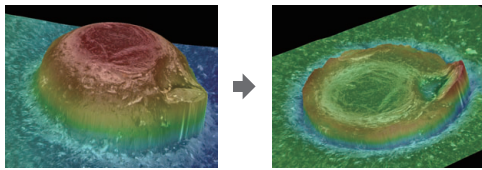
Correcting shapes of sphere and cylinder

Use this function to check height differences on the surface of a sphere and a cylinder.

1 Specify the correction strength with the slider.



2 Click [Finish].



This makes it easy to evaluate height differences on the surface of a sphere.

3D File Comparison View

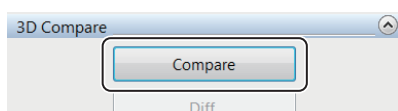
This feature allows you to tile two 3D images, turn them simultaneously, and display their differences. You can compare two recorded images or use the current image on one side.

Displaying 2 Files to Compare

1 Display the first image.

Display the 3D image using the depth up function (Page 10-2), or the album function (Page 6-2).

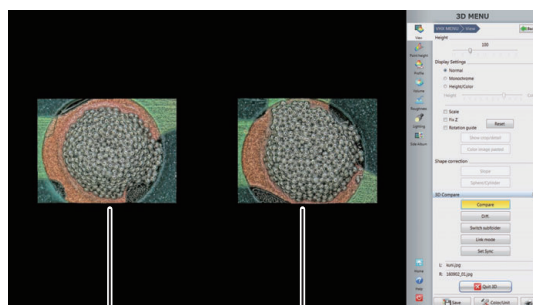
2 Open the [Compare] menu and click [Compare].



The [Select a file for 3D comparison] screen appears.

3 Select the second image to compare, and play it back as a 3D image.

For 3D HDR images, adjust high dynamic range and click [3D playback].



Main screen

Sub screen

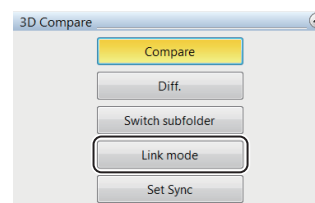
Linking the 2nd Image

The images you wish to compare can be linked so that both images turn and move simultaneously.

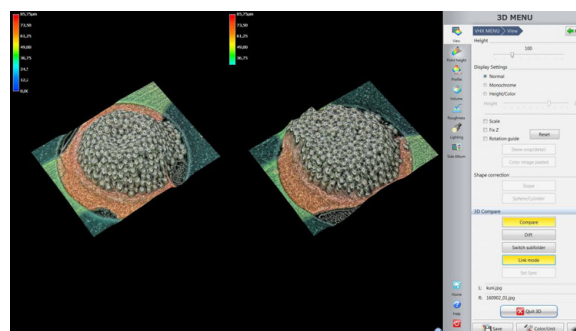
Link mode

Linking the main and sub image allows you to turn and zoom in and out of both images together.

1 Click [Link mode].



This automatically matches the angle and magnification of the sub image to the main image. To exit 3D linked mode, click [Link mode] again.



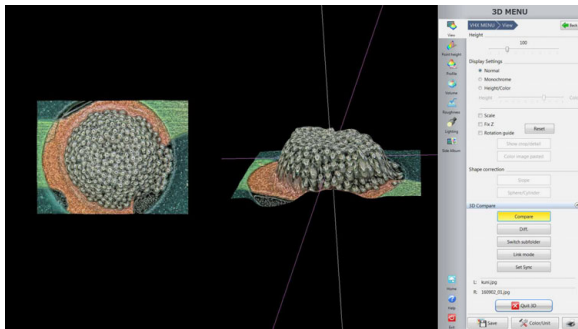
2 Operating the mouse on the main image causes the sub image to turn, zoom in and out, and move at the same time.

Refer to Manipulating the 3D View (Page 10-16) for details.

Set Sync

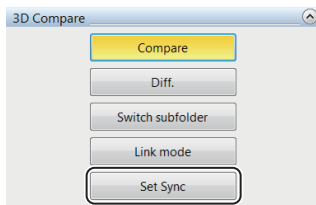
Before linking the main and sub images for comparing, you can correct recording differences, such as angle and position differences, and then synchronize the two images.

- 1 Adjust the angle of the main and sub images to make them easier to compare.



- 2 Click [Set Sync].

This sets the current angle and position as the reference point for link mode.



Point Set Sync cannot be used if Link mode is ON. Release [Link mode] first, then use Set Sync.

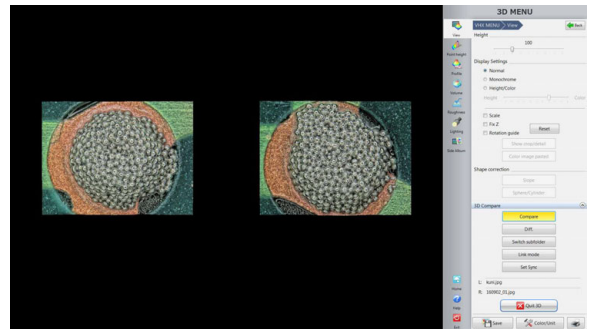
- 3 Click [Link mode].

This begins 3D Link mode.
To release linked mode, click [Link mode] again.

Differential View

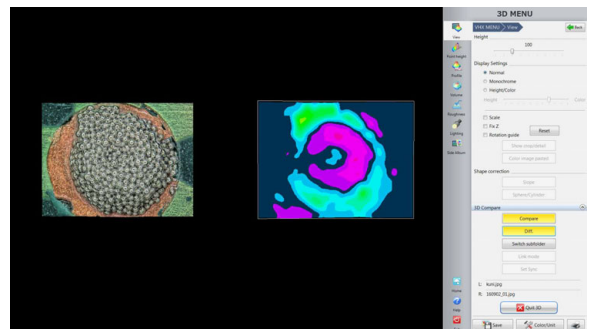
Differential view overlays the main and sub image and highlights the height differences in color.

- 1 Display the main and sub images to observe on the 3D comparison mode screen.



- 2 Click [Diff.].

The left screen shows the sub image overlapped on the main image, and the right screen shows the height differences highlighted in graduated colors.



Reference Images intended for comparison should be recorded under the same conditions, i.e., recording size, angle, lens, etc.

Manipulating the main image and sub image in link mode

Manipulate the images by operating the mouse on the sub image shown on the right.

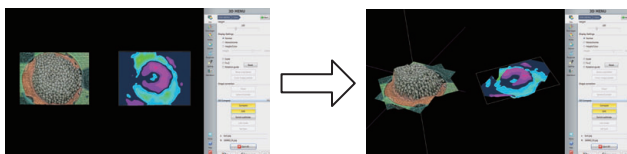
The main and sub images will both turn and move together.



Manipulating only the main image

Operate the mouse on the main image shown on the left.

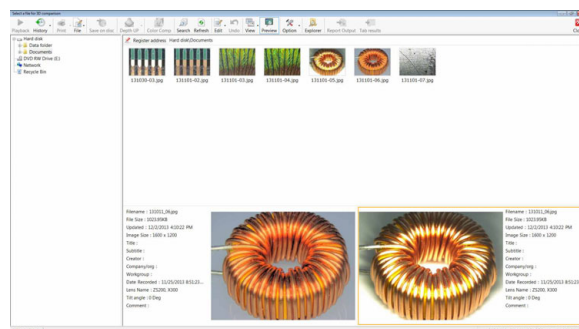
The sub image on the right screen cannot be turned or moved.



Switching Sub Images

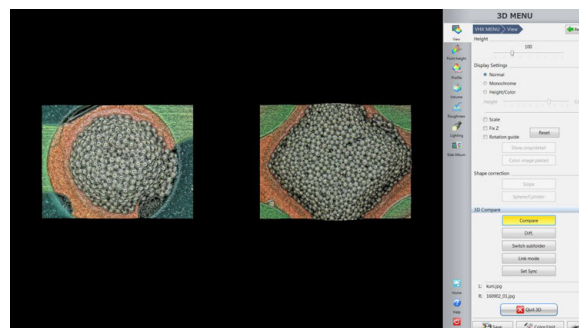
Switching the sub image.

- 1 Click [Select sub] on the 3D comparison mode screen. The album screen appears.



- 2 Select the sub image to display from the album, and play it back as a 3D image.

The screen returns to the 3D comparison mode and displays the selected image as the sub image.



Reference

To select another image for the main image, go back to selecting a file for 3D comparison. Click [Exit], then select the image to display from the album and play it back as a 3D image.

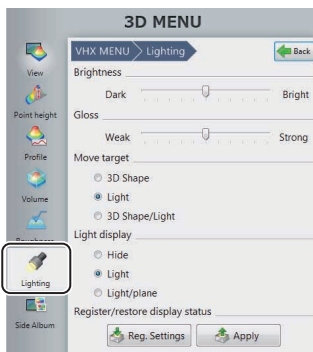
Lighting Simulations

This feature allows you to observe the surface of the object in greater detail by applying virtual lighting from various directions and brightness levels on the 3D image.

1 Display the 3D image.

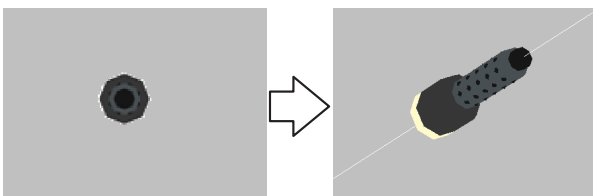
Display the 3D image using the depth up function (Page 10-2), or the album function (Page 6-2).

2 Select [Lighting].



3 The [3D Lighting] symbol appears in the center of the image.

You can change the orientation of the light by dragging the light over the image.



3D lighting settings

■ Brightness

Adjust the brightness of the light by dragging the slider bar.

■ Gloss

Adjust the glossiness of the object by dragging the slider bar.

■ Move target

Specify whether mouse movements move the object or the light.

3D Shape : Only the object moves. The lighting direction does not move.

Light : Only the lighting direction of the light moves. The object does not move.

Shape/Light : Both object and light move together.

■ Light display

Specify whether to show/hide the light beam.

Hide : Hides the light beam. The light will still emit light.

Light : Shows the light beam.


Light/Plane : Shows the light beam and the coordinates of the beam.

■ Register/restore display status

This command registers the lighting direction and the position and rotated angle of the object.

Reg. Settings : Registers the current settings.

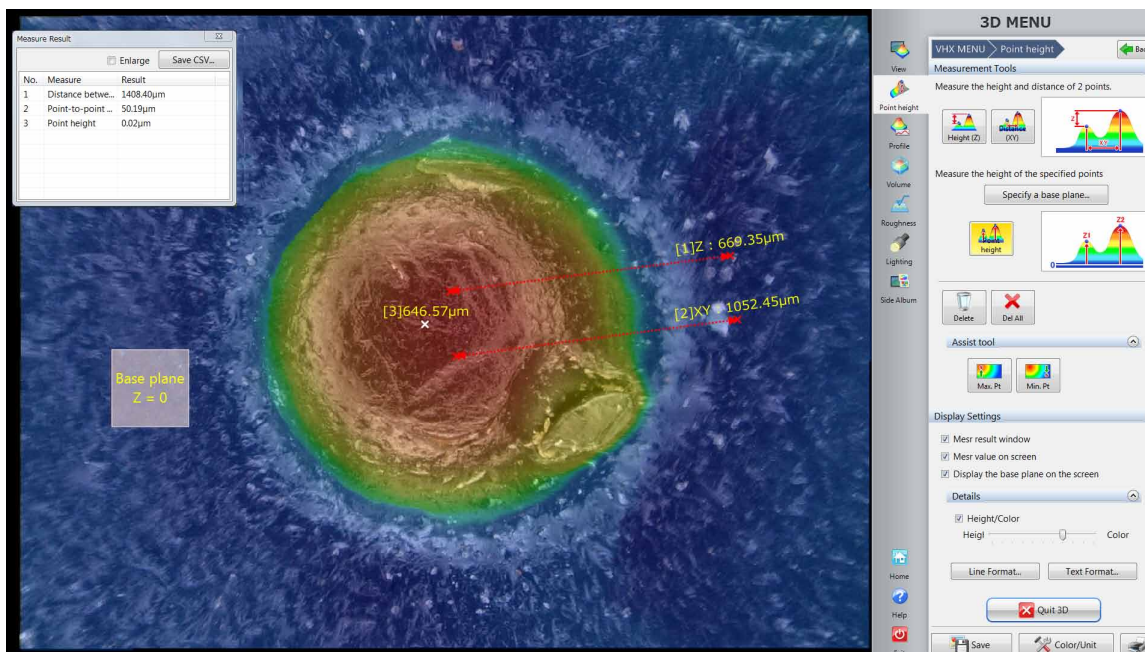
Apply : Reads and applies the registered settings.

 Saves the settings active when [Reg. Settings] is clicked. Use [Apply] to restore the display status.

Point height (optional)

This function can measure a height of 3D images by simple operations.

Point The separately sold “3D Profile Measurement Application” (model VHX-H4M) is required to perform the point height. Install the software previously.



Measuring height and distance easily

Height



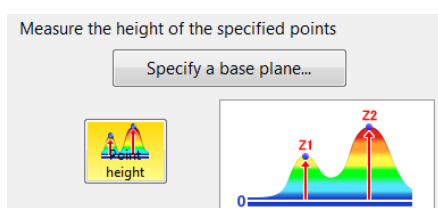
Height between two points are measured.

Distance

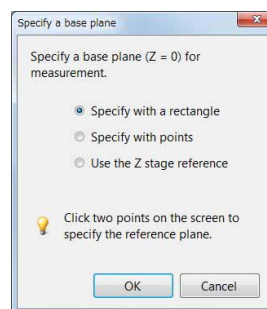


Distance between two points are measured.

Measuring heights of specified points



1 Click [Specify a base plane...].



If [Specify with a rectangle] and [Specify with points] are selected, specify the area to be a base on the screen.

If [Use the Z stage reference] is selected, the lowest Z position in the 3D composition will be set as the base. [Use the Z stage reference] cannot be used when the shape correction and replay from the album are performed, because there is no effective information on the Z stage.

2 Click [Point height] and a point you want to measure the height.

The height measured from the base is displayed.

Other measurement tools

Delete

Deletes the selected measurement results.

Delete all

Deletes all measurement results.

Max. height and Min. height

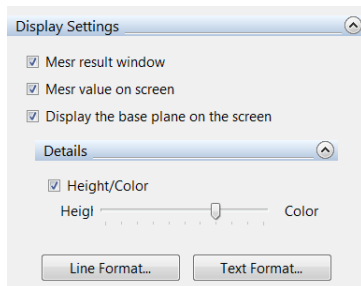
Displays the highest and lowest points in the selected area.



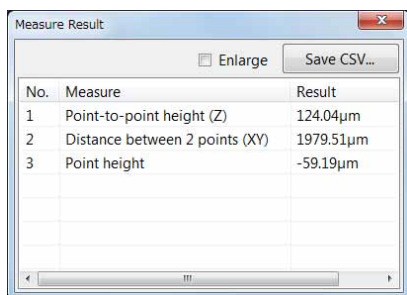
10

Observing in 3D

Display Settings

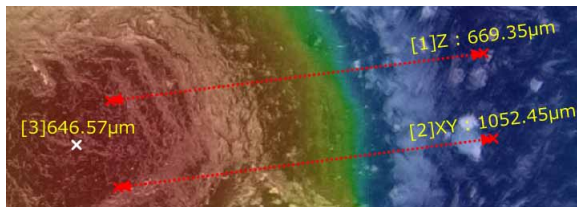


Displaying the measurement result window



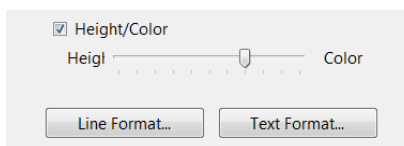
- **No:** Corresponds to the label (subscript) displayed next to the measurement line.
- **Measure:** Displays the measurement item.
- **Result:** Displays the measurement result.
- **Enlarge:** When checked, enlarges the text size.
- **Save CSV...:** Saves the measurement result as a CSV formatted file.

Displaying measurement values on the screen



Measurement values are displayed on the screen.

Indicating height in color

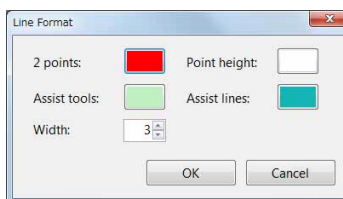


When the [Height/Color] option is checked, you can operate the slider.

Height: The 3D image is color coded depending on its height.

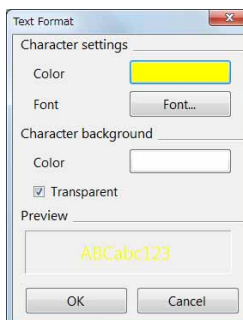
Color: The 3D image is displayed with the color of the target.

Line Format



To change the display settings such as dimension lines, click the [Line Format].

Text Format



To change the text colors and background colors such as measurement results, click the [Text Format].

3D Profile Measurements (Optional)

3D measurements allow you to measure cross-sections of 3D images.



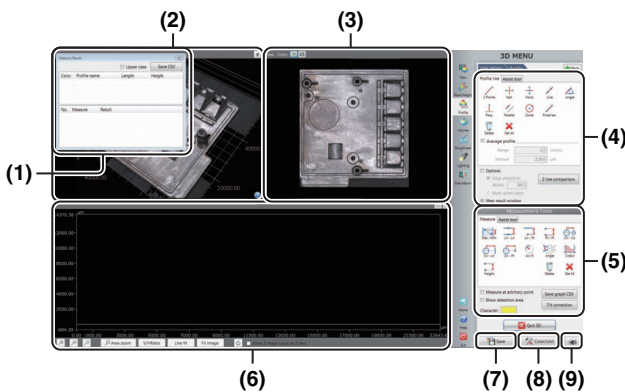
The separately sold "3D Profile Measurement Application" (model VHX-H4M) is required to perform 3D profile measurements. Make sure this application is installed beforehand.

Names and Functions in the Window

This section explains the names and functions of each part of the window used to measure 3D profiles.



The content of the display will vary based on the function being used.



(1) Measurement results

Lists profiles and elements placed on the image and measurement results.

☞ "Profile/Measurement List" (Page 10-28)

(2) 3D display area

Displays a stereoscopic shape of the target object and the cross section of the selected profile. You can change and manipulate the 3D image display.

☞ "Manipulating the 3D View" (Page 10-16)

(3) Image display area

Displays an image of the target object when you see it perpendicular to the reference plane. You can set a profile line on this image. You can also change the display type of the image.

(4) Profile tool

Contains buttons to draw various profile lines, such as a straight line or a circle.

(5) Measurement tool

Buttons used to measure the interval specified by the profile are displayed.

(6) Profile display area

Displays the profile graph for the profile line (or for the selected profile line for the multi-line) on the image.

☞ "Profile Display Area" (Page 10-28)

(7) Save

Saves the current display as a 2D image.

(8) Option

Displays the [Option] dialog box.

- Sets the scale line, scale auxiliary line and background color.
- Sets the unit (m/mm/μm/in/mil) and number of decimals.

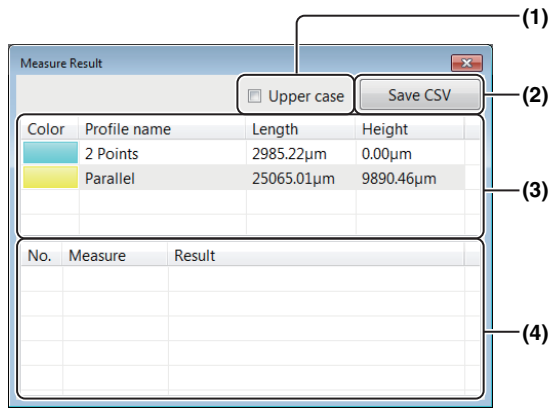
(9) Print

Displays the print menu.

☞ "Print Settings" (Page 12-2)

Profile/Measurement List

The [Measure result] dialog box displays the list of profiles and elements placed on the image, and the list of measurement results.



Reference When the [Measure result window] check box under Profile tools is unchecked, the [Measure Result] dialog box is hidden. When the check box is checked, the dialog box appears again.

(1) Upper case

When this check box is checked, the measurement results are displayed in larger fonts.

(2) Save CSV

Measurement results can be saved as CSV files.

(3) Profile list

Displays the list of profile lines.

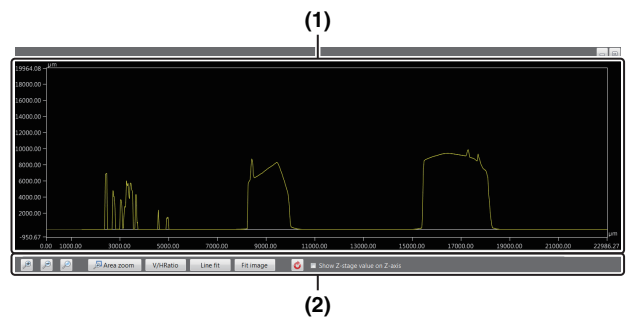
When profile is selected, displays in the 3D display area, image display area and profile display area change.

(4) Measure result list

Displays the following measured values of the selected profile.

Item	Description
Max. - Min.	Difference between max. and min. points in the specified area
LN - LN	Distance between line and line.
LN - PT	Distance between line and point.
PT - PT	Distance between two points.
CIR - CIR	Distance between circles.
CIR - LN	Distance between circle and line.
CIR - PT	Distance between circle and point.
Arc R	Radius value of circle or arc.
Angle	Angle between two lines at their intersection.
C.S. area	Area value between line and profile.
Height	The height value when considering the reference plane as 0.

Profile Display Area



(1) Profile list

Displays the list of profile lines.

The display switches according to the element that is selected in the image display area.

(2) Profile operation controls

Changes the method to view the profile graph.



Enlarges to 1.5 times of the original magnification.



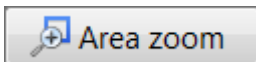
Reduces to 2/3 times of the original magnification.



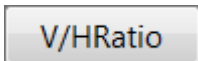
Displays the [Set axis] dialog box.

You can set a display area for each of the X-axis and Z-axis with maximum and minimum values.

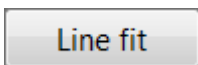
If the [Match Z-axis to X-axis scale] check box is selected, the maximum value of the Z-axis is adjusted to make the aspect ratio 1:1 based on the X-axis.



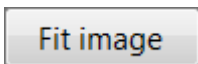
Specify a rectangular area on the profile graph by dragging the mouse, then the profile graph is enlarged to fit the specified rectangular area to the entire profile display area.



Adjust the scaling of the X-axis and Z-axis of the profile to make the aspect ratio 1:1. The X-axis is fixed and the scaling of the Z-axis is adjusted.



Enlarges or reduces the profile graph to fit it to the entire profile display area.



Adjusts the maximum or minimum of the Z-axis in the profile display area to the maximum or minimum of the entire height image. Also, adjusts the X-axis to fit the profile graph to the entire profile display area.



Resets the scaling of the X-axis and Z-axis.

Show Z-stage value on Z-axis

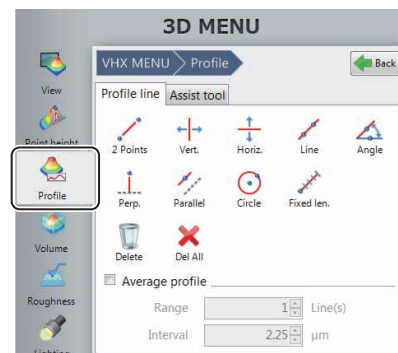
Displays the height of Z stage on the Z axis scale.

Starting Profile Measurements

1 Display the 3D image to observe.

Display the 3D image using the depth up function (Page 10-2), or the album function (Page 6-2).

2 Click [Profile] from the 3D MENU.



Setting Profile Line

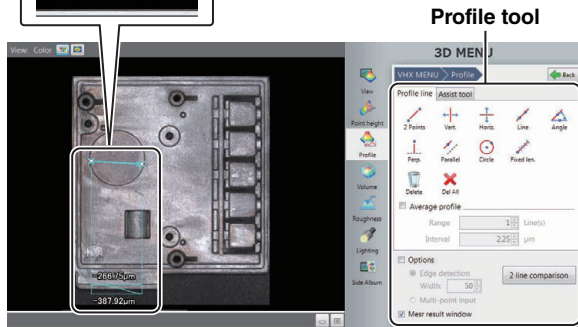
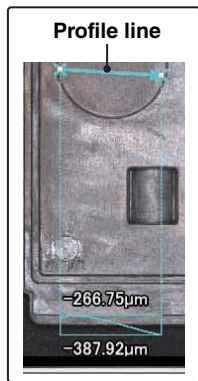
Set a profile line at the measurement position on the image displayed in the image display area. When the profile line is specified on the image, a profile graph at the measurement position is displayed.

1 Select the [Assist tool] tab of the profile tool and click the desired button to place an element on the image as needed for the setting of the profile line.

📖 "Assist tool (profile line)" (Page 10-33)

2 Click the desired button on the [Profile line] tab and draw a profile line on an image.

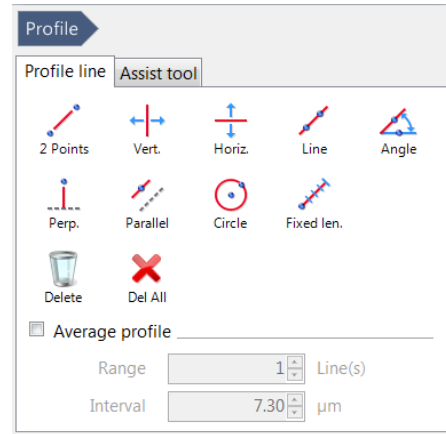
📖 "Profile line tools" (Page 10-30)



When a profile line is drawn on the image, an actual cross section of the sample where it is intersected by the profile line is displayed in the profile display area. Because the profile graph is updated in real time during the drawing process of the profile line, you can draw the profile line while confirming the waveform. The profile list is also displayed in the [Measure Result] dialog box.

Profile line tools

The following describes how to set a measurement line using the profile line tools.



■ 2 Points



Measures a line segment that connects two points specified arbitrarily as a measurement line.

- 1** Click [2 Points].
- 2** Click the starting point and move the mouse. After moving the mouse, the line segment appears.
- 3** Click a desired end point. The measurement line is determined.

■ Vertical



Measures a straight line that is vertical to the display image as a measurement line.

- 1** Click [Vertical].
- 2** Click the mouse at a desired point. The measurement line is created.

■ Horiz.



Measures a straight line that is horizontal to the display image as a measurement line.

- 1** Click [Horz.].
- 2** Click the mouse at a point. The measurement line is created.

■ Line



Measures a straight line that passes through two specified points.

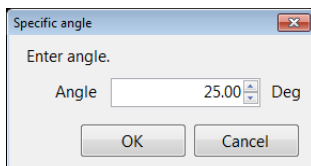
- 1** Click [Line].
- 2** Click the 1st point, and then move the mouse.
When you move the mouse, a straight line is displayed.
- 3** Move the mouse and click a second point.
The measurement line is created.

■ Angle



Measures a straight line that passes through a point specified by the user and intersects with a reference line at a specified angle as a measurement line.

- 1** Click [Angle].
The [Specific angle] dialog box appears.
- 2** Enter an angle against the reference line and click [OK].



- 3** Put the mouse over a position where you want to locate the reference line, and click the position.
- 4** Move the mouse to rotate the reference line through 360 degrees.
- 5** Select the desired position for the reference line, then click the mouse.
The reference line is determined and a line that intersects with the reference line at the specified angle is displayed.
When you move the mouse, the measurement line moves, keeping the angle against the reference line constant.
- 6** Click the position you want to measure.
The measurement line is created.

■ Perp.



Measures a straight line that is vertical to a reference line specified as a measurement line.

- 1** Click [Perp.].
- 2** Put the mouse over a position where you want to locate the reference line, and click the mouse.
Move the mouse to rotate the reference line through 360 degrees.
- 3** Select the desired position for the reference line, then click the mouse.
The reference line is created and a line that is perpendicular to the reference line is displayed.
- 4** Place the mouse over a position where you want to make a measurement, and click the position.
This sets the position of the line perpendicular to the reference line.

■ Parallel



Measures a straight line that is parallel to a reference line specified as a measurement line.

- 1** Click [Parallel].
- 2** Put the mouse over a position where you want to place the reference line, and click the mouse.
Move the mouse to rotate the reference line through 360 degrees.
- 3** Select the desired position for the reference line, then click the mouse.
The reference line is created and a line that is parallel to the reference line is displayed.
- 4** Place the mouse over a position where you want to make a measurement, and click the mouse.
This sets the position of the line parallel to the reference line.

■ Circle



Measures a circle that consists of two points specified as a measurement line.

1 Click [Circle].

2 Click a circle center and move the mouse.

When you move the mouse, a circle whose center is the first clicked point and the mouse's last position serves as a radial position of the circle appears.

3 Move the mouse and click the mouse at the desired position.

A circular measurement line, a line connecting the two points, appears showing the radius of the circle.

■ Fixed len.

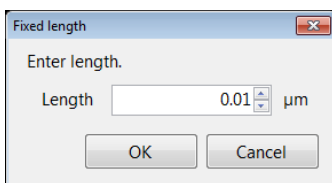


Measures a line segment that has a specified length and direction as a measurement line.

1 Click [Fixed len.].

The [Fixed length] dialog box appears.

2 Enter the length of the measurement line, then click [OK].



3 Click the starting point of the position you want to measure.

A line of the specified length appears.

4 Click a point in the direction you want the line to point.

The measurement line is created.

■ Delete



Deletes individual profile lines displayed in the image display area.

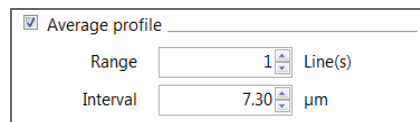
■ Delete all



Deletes all the profile lines displayed in the image display area.

■ Average profile

Specifying multiple measurement lines parallel to a measurement line allows variations in measurement areas to be eliminated and an average profile to be acquired. Check the box and set the number of profile lines and the spacing between the lines.



Range

In addition to a measurement line that is drawn on an image, enter the number of lines (n) to be drawn on both sides of the line. When drawing the base measurement line, the number of lines that have been specified are automatically drawn on both sides of the base line and total number of measurement lines will be $2n + 1$.

Interval

Sets an interval of measurement lines. The greater the value, the larger the interval.

■ Assist tool

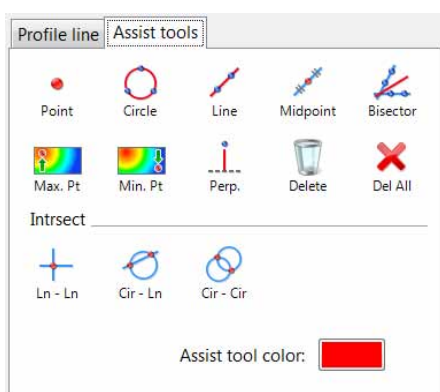
When the [Assist tool] check box is selected, auto extract edge and multi-point input are available.

For the details, refer to "Auxiliary Functions" (Page 9-19).

Assist tool (profile line)

Elements you create using the assist tools are called "assist elements". Assist elements themselves are not measurement lines, instead you can use them as an reference point or reference line when you set a measurement line.

Placing assist elements at the position that will be measurement points enables you to set a measurement line more accurately and efficiently.



■ Point



Makes the clicked point an assist point.

1 Click [Point] and click a point in the image display area.

An assist point (X) appears at the clicked point.

■ Circle



Creates a circular assist line by clicking 3 points.

1 Click [Circle] and click 3 points in the image display area.

The circular assist line that passes through the clicked 3 points appears.

■ Line



Creates an assist line by clicking 2 points.

1 Click [Line] and click 2 points.

The assist line that passes through the clicked points appears.

■ Midpoint



Creates a middle point of the clicked 2 points.

1 Click [Midpoint] and click a starting point and ending point in the image display area.

Assist points (X) appear at the starting point, ending point and middle point.

■ Bisector



Creates a middle line of the 2 assist lines that have been set.

1 Click [Bisector] and click 2 points in the image display area.

An assist line appears.

2 Click 2 points in the image display area.

Another assist line appears.

3 Click a position to set the middle line position.

The assist line that is the middle line appears.

■ Max. Pt and Min. Pt



1 Click [Max. Pt] or [Min. Pt], and then drag to specify a target area in the image display area.

Highest and lowest points are displayed with assist points (X).

■ Perp.



Create a line which passes through two points, and a perpendicular line.

1 Click [Perp.] and then click two points on the observation screen.

An assist line connecting two points appears.

2 Click one point in the observation window.

Perpendicular intersect the created assist line, and the line that connects the clicked point will appear.

■ Delete



Deletes individual assist points/lines displayed in the image display area.

■ Delete all



Deletes all assist points/lines displayed in the image display area.

■ Line-Line (intersection)



Sets 2 assist lines and makes their intersection point an assist point.

1 Click [Ln - Ln] and click 2 points in the image display area.

An assist line appears.

2 Click 2 points in the image display area.

Another assist line appears and the assist point (X) appears at the intersection point of those lines.

■ Circle-Line (intersection)



Sets a circular assist line and a linear assist line, and makes their intersection point an assist point.

1 Click [Cir - Ln] and click 3 points in the image display area.

The circular assist line that passes through the clicked 3 points appears.

2 Click 2 points in the image display area.

The assist line that passes through the clicked points appears and the assist point (X) appears at the intersection point with the circular assist line.

■ Circle-Circle (intersection)



Sets 2 circular assist lines and makes their intersection point an assist point.

1 Click [Cir - Cir] and click 3 points in the image display area.

The circular assist line that passes through the clicked 3 points appears.

2 Click 3 points in the image display area.

The circular assist line that passes through the clicked 3 points appears and the assist point (X) appears at the intersection point of those 2 circles.

■ Assist tool color

Sets the color of assist tools to be displayed in the image display area.

Setting Measurement Intervals

Set measurement intervals on the profile displayed in the profile display area to obtain measurement values for each interval.

- 1 Select the [Assist tool] tab in the measurement tool window and click the icon to place the desired element on the profile as needed.

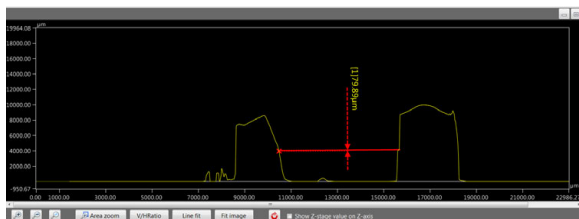
📖 "Assist tool" (Page 10-38)

- 2 Click the icon on the [Measurement] tab in the measurement tool window and set a measurement interval on a profile.

📖 "Measurement tool" (Page 10-35)



When a measurement interval is set on a profile, the measured value appears in the profile display area and in the profile/measurement list.

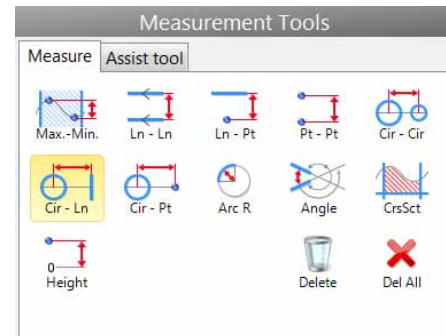


Measure at arbitrary point Save graph CSV
 Show detection area Tilt correction
 Character:

- **Measure at a point**
When this checkbox is selected, specifying and performing measurement on a measurement interval other than the profile are available.
- **Display scan area**
When this checkbox is selected, the scan area of a point element or a line element on the profile is displayed.
- **Save graphCSV**
Saves the graph shown in the profile graph as numerical data in CSV format.
- **Tilt Correction**
Tilt of a profile line can be corrected.
- **Character**
Display colors of measurement results can be changed.

Measurement tool

The following describes the measurement interval setting using measurement tools.



■ Max. - Min.



Detects the highest and lowest points in the Z direction in the specified area and calculates difference between the heights.

- 1 Click [Max. - Min.].
- 2 Specify the first point in the measurement area.
- 3 Specify the second point in the measurement area.
The measurement follows the mouse pointer and displayed in the measurement result window.
- 4 Click the position to display the measured value.
The position to display the measured value is set.

■ Line - Line



Measures the distance between two lines.

- 1 Click [Ln - Ln].
- 2 Specify Line 1.
- 3 Specify Line 2.
The measurement is completed and displayed in the measurement result window.
- 4 Click the position to display the measured value.
The position to display the measured value is set.

Line - Point



Measures the distance between a line and a point.

1 Click [Ln - Pt].

2 Specify a line.

3 Specify a point.

The measurement is completed and displayed in the measurement result window.

4 Click the position to display the measured value.

The position to display the measured value is set.

Point - Point

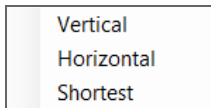


Measures the distance between two points.

1 Click [Pt - Pt].

Displays the measurement type menu.

2 Select the measurement type.



3 Specify Point 1 and Point 2.

Click the desired places to specify two points.

The measurement is completed and displayed in the measurement result window.

4 Click the position to display the measured value.

The position to display the measured value is set.

Circle - Circle



Measures the distance between two circles.

1 Click [Cir - Cir].

Displays the measurement type menu.

2 Select the measurement type.



3 Specify Circle 1 and Circle 2.

The measurement is completed and displayed in the measurement result window.

4 Click the position to display the measured value.

The position to display the measured value is set.

■ Circle - Line



Measures the distance between a circle and a line.

- 1 Click [Cir - Ln].**
- 2 Specify a circle.**
- 3 Specify a line.**
The measurement is completed and is displayed in the measurement result window.
- 4 Click the position to display the measured value.**
The location to display the measured value is set.

■ Circle - Point



Measures the distance between a circle and a point.

- 1 Click [Cir - Pt].**
Displays the measurement type menu.
- 2 Select the measurement type.**

Vertical
Horizontal
Shortest
- 3 Specify a circle.**
- 4 Specify a point.**
The measurement is completed and displayed in the measurement result window.
- 5 Click the position to display the measured value.**
The position to display the measured value is set.

■ Arc R



Measures the radius of an arc.

- 1 Click [Arc R].**
- 2 Specify a circle.**
The measurement is completed and displayed in the measurement result window.
- 3 Click the position to display the measured value.**
The position to display the measured value is set.

■ Angle



Measures the angle between two lines at their intersection.

- 1 Click [Angle].**
- 2 Specify Line 1.**
- 3 Specify Line 2.**
- 4 Specify which of the angles created with the two lines will be the angle to be measured.**
When you move the mouse, the position of the angle to be measured is indicated by an arrow with a dotted line. Click when the position to be measured is indicated. The measurement is completed and displayed in the measurement result window.
- 5 Click the position to display the measured value.**
The position to display the measured value is set.

■ Cross sectional area

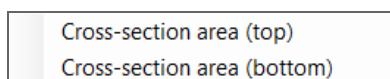


Measures the area between a line and the profile.

1 Click [CrsSct].

Displays the measurement type menu.

2 Select the measurement type.



3 Specify Line 1.

A vertical line (a line that is parallel to the z-axis) is displayed as a thick dotted line.

4 Click to specify vertical line 1.

5 Click to specify vertical line 2.

The area to be measured is filled with yellow. The measurement is completed and displayed in the measurement result window.

6 Click the position to display the measured value.

The position to display the measured value is set.

■ Height



Measures the height of the specified point when considering the reference plane as 0.

1 Click [Height].

2 Specify a point element or line element.

The measurement is completed and displayed in the measurement result window.

3 Click the position to display the measured value.

The position to display the measured value is set.

■ Delete



Deletes the selected measurement.

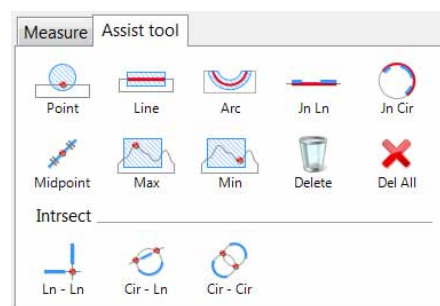
■ Delete all



Deletes all measurement displayed on the profile.

Assist tool

Elements you create using the assist tool are called assist elements. Assist elements do not create any measurements, instead, they are to be used as a reference point or a reference line when you set measurement lines. Placing assist elements where there will be placing measurement points, enables you to set measurement lines more accurately and efficiently.



■ Point



An element that expresses a point.

1 Click [Point].

2 Click the mouse at a point.

A point is placed.

■ Line



A line element that expresses a line segment on the profile.

1 Click [Line].

2 Click the 1st point.

When you move the mouse, the line scan area is displayed.

3 Click the 2nd point arbitrarily.

A line is placed on the profile.

■ Arc



An element that creates an arc on the profile.

- 1** Click [Arc].
- 2** Click the 1st point on the circle's circumference.
- 3** Click the 2nd point on the circle's circumference.
When you move the mouse, the circle area is displayed.
- 4** Click the 3rd point on the circle's circumference.
An arc is placed on the profile.

■ Join Line



Creates a line that joins more than one line.

- 1** Click [Jn Ln].
- 2** Select an existing line element or point element.
- 3** Repeat step 2.
A new line element is placed based on the selected point elements and the sets of points that created the selected line elements.
- 4** Double-click to fix it.

■ Join Circle



Creates a circle that connects multiple arcs.

- 1** Click [Jn Cir].
- 2** Select an existing circle element or point element.
- 3** Repeat step 2.
A new circle element is placed based on the selected point elements and the sets of points that created the selected circle elements.
- 4** Double-click to fix it.

■ Midpoint



Creates a middle point of two points as a point element.

- 1** Click [Midpoint].
- 2** Click an existing point element.
- 3** Click another existing point element.
The middle point of the selected point elements is placed.

■ Max



Creates the maximum point in the direction of the Z-axis within the specified area.

- 1** Click [Max].
- 2** Click the mouse at the start point of the area.
When you move the mouse, a rectangle appears accordingly.
- 3** Click the mouse at a diagonal point of the area.
The area is specified and the maximum point is placed.

■ Min



Creates the minimum point in the direction of the Z-axis within the specified area.

- 1** Click the [Min] button.
- 2** Click the mouse at the start point of the area.
When you move the mouse, a rectangle appears accordingly.
- 3** Click the mouse at a diagonal point of the area.
The area is specified and the minimum point is placed.

■ Delete



Deletes individual assist points/lines displayed on the profile.

■ **Delete all**



Deletes all assist points/lines displayed on the profile.

■ **Line-Line (intersection)**



Creates the intersection of two lines on the profile that have been selected as a point element.

1 Click [Ln - Ln].

2 Select an existing line element or point element.

3 Repeat step 2.

A new point element is placed at the intersection point of the selected line elements.

■ **Circle-Line (intersection)**



Creates the intersection of a line and a circle on the profile that have been selected as a point element.

1 Click [Cir-Ln].

2 Select an existing circle element.

3 Select an existing line element.

A new point element is placed at the intersection point of the selected circle element and line element.

■ **Circle-Circle (intersection)**



Creates the intersection of two circles on the profile that have been selected as a point element.

1 Click [Cir-Cir].

2 Select an existing circle element.

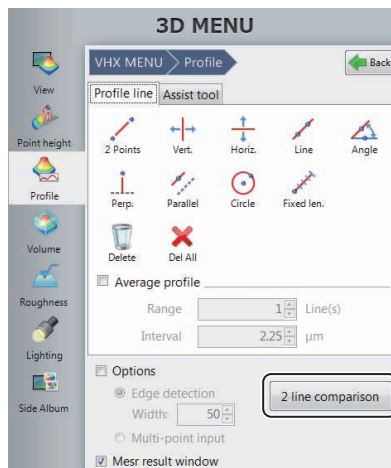
3 Repeat step 2.

A new point element is placed at the intersection point of the selected circle elements.

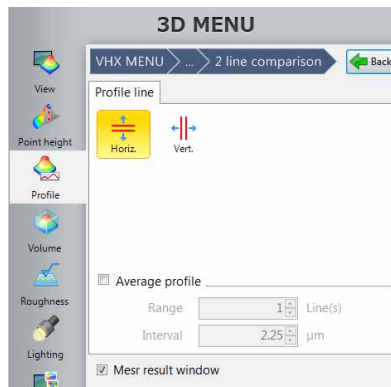
2 line comparison

Places 2 parallel profile lines (horizontal or vertical lines). Specifies the measurement intervals and acquire measurement values of the profile's increment/increment at each interval.

1 Click [2 line comparison].



2 Click [Horiz.] or [Vert.].



3 Drag a profile line to the position of the measurement target.

4 Click the icon on [Measurement tool] window and set a measurement interval on a profile.

📖 "Measurement tool (2 line comparison)" (Page 10-41)
When a measurement interval is set on a profile, the measured value appears in [Measure Result] dialog box.

- Save grphCSV

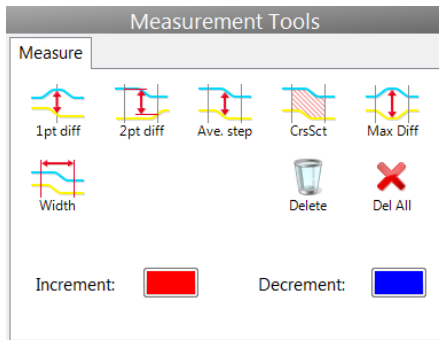
Saves the graph shown in the profile graph display area in CSV format.



Colors specifying increment/discrement can be changed.

Measurement tool (2 line comparison)

The following describes how to set measurement intervals using measurement tools (2 line comparison).



■ 1pt diff



Measures the profile's differential distance at the specified point.

1 Click a point.

A line is set at the clicked point and the measurement result appears.

■ 2pt diff



Measures the profile's differential distance between the specified points.

1 Click a point.

A line is set at the clicked point.

2 Click a point.

A line is set at the clicked point and the measurement result appears.

■ Ave. step



Measures the profile's average differential distance within the specified interval.

1 Click a point.

A line is set at the clicked point.

2 Click a point.

A line is set at the clicked point and the measurement result appears.

■ CrsSct



Measures the area of the domain between the specified interval and profile.

1 Click a point.

A line is set at the clicked point.

2 Click a point.

A line is set at the clicked point and the measurement result appears.

■ Max Diff



Measures the peak profile's differential distance within the specified interval.

1 Click a point.

A line is set at the clicked point.

2 Click a point.

A line is set at the clicked point and the measurement result appears.

■ Width



Measures the width of the specified interval.

1 Click a point.

A line is set at the clicked position.

2 Click a point.

A line is set at the clicked point and the measurement result appears.

■ Delete



Delete an individual measurement displayed on the profile.

■ Delete All



Deletes all of the measurement tools displayed on the profile.

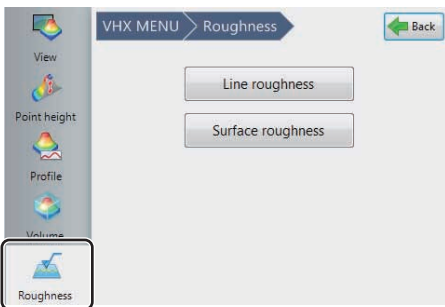
Roughness Measurement(optional)

Roughness of 3D images can be measured.

Machined parts have very different surfaces that are shiny, textured, etc. These differences come from differences in surface condition. Parameters that quantify the differences include the one dimensional profile roughness and the two dimensional surface roughness, which can be measured by this function.

Point The separately sold "3D Profile Measurement Application" (model VHX-H4M) is required to perform the roughness measurement. Install the software previously.

After the 3D recording, click [Roughness] and select [Line roughness] or [Surface roughness] to start the roughness measurement.

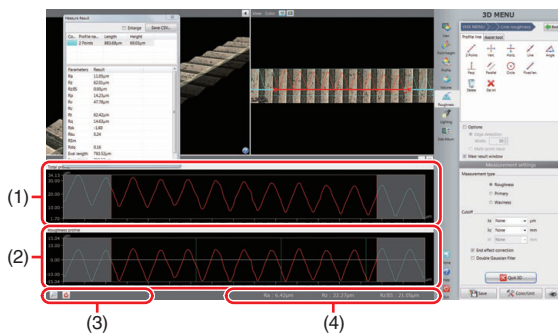


10 Observing in 3D

Line roughness measurement



Line roughness measurement screen



(1) Total profile

Displays the roughness/primary/waviness curve obtained using the profile line settings.

(2) Roughness/primary/waviness profile

Displays the roughness/primary/waviness curve to which the cutoff value specified in the line roughness measurement settings is applied.

(3) Profile operation controls

Changes the method to view the roughness/primary/waviness profile and the measurement primary profile in the direction of the Z axis.

📖 "Setting Evaluation Length" (Page 10-44)

(4) Measure result display area

Roughnesses Ra, Rz, and Rq and parameters corresponding to the roughnesses are displayed by measurement type.

Measurement result list

Displays measured values of the profile being selected in the image display area for the following selected profile parameters.

Parameter name	Roughness	Primary	Waviness
Evaluation length	Length of the part between vertical cursors in the X axis direction		
Sampling length	The cutoff value λ_c is displayed for the roughness curve; the cutoff value λ_f is displayed for the waviness curve; and the evaluation length is displayed for the primary curve. However, the value is equivalent to the evaluation length when the evaluation length is shorter than the cutoff value.		
Number of sampling length	The calculated number of sampling length is displayed according to the cutoff value λ_c for the roughness curve, and according to the cutoff value λ_f for the waviness curve. However, the number of evaluation length is 1 when the evaluation length is shorter than the cutoff value.		
Highest peak	Rp	Pp	Wp
Lowest valley	Rv	Pv	Wv
Max. height	Rz	Pz	Wz
Average height	Rc	Pc	Wc
Total height	Rt	Pt	Wt
Arithmetic mean roughness	Ra	Pa	Wa
Root mean square height	Rq	Pq	Wq
Skewness	Rsk	Psk	Wsk
Kurtosis	Rku	Pku	Wku
Element average length	RSm	PSm	WSm
Root mean square tilt	RΔq	PΔq	WΔq
Cross point average roughness	RzJIS	–	–

For details of each parameter, refer to "Roughness Definitions" (Page 10-45).

Line roughness measurement

■ Setting Profile Line

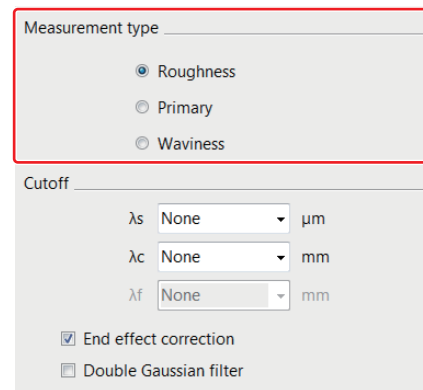
Set a profile line at the measurement position on the image displayed in the image display area. When the profile line is specified on the image, a profile graph at the measurement position is displayed.

For details, refer to "Setting Profile Line" (Page 10-30).

■ Changing the Measurement Type

1 Change the measurement type in [Measurement type] of [Line roughness measurement settings].

By default, Roughness is selected.



Roughness

Displays a graph of roughness profile (R: Roughness).

Primary

Displays a graph of primary profile (P: Primary).

Waviness

Displays a graph of waviness profile (W: Waviness).

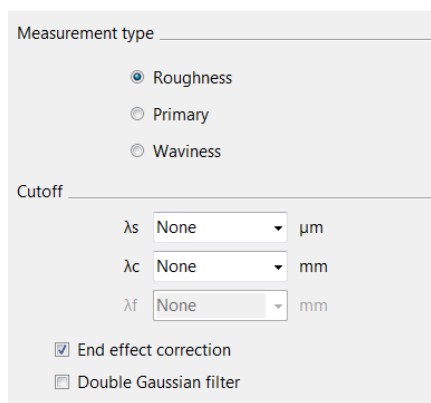
■ Filter setting

Sets the filter to ON/OFF.

1 Click the [Double Gaussian filter] checkbox to select ON/OFF.

[End effect correction] checkbox

When Double gaussian filter is selected, selecting [End effect correction] checkbox can correct the circumference of the surface so it is not distorted.



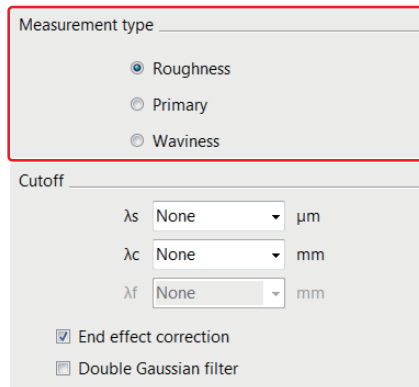
■ Setting a Cutoff Value

The cutoff value is a ISO standard parameter. The wavelength at which the gain of the phase compensation filter equals 50%.

The input fields (○) for the cutoff values that correspond to the roughness, primary, and waviness are as mentioned below.

	λs	λc	λf
Roughness profile	○	○	—
primary profile	○	—	—
Waviness profile	○	○	○

1 Select the cutoff value in [Cutoff] of [Line roughness measurement settings].



You can set each parameter by selecting a value from the dropdown list or typing a value directly.

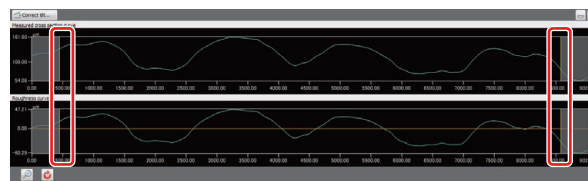
The minimum value for the λs is double of the pixel length, and the maximum value is one half of the profile length in the X axis direction.

The minimum value for the λc or λf is four times of the pixel length, and the maximum value is the minimum option that is longer than the profile length in the X axis direction.

■ Setting Evaluation Length

As required, specify an evaluation length on the profile graph. You can set an evaluation length by dragging two yellow vertical cursors that are displayed on the profile graph.

The cursor positions are shared between the roughness/primary/waviness profile and total profile.



Reference The evaluation length is set automatically, based on the cutoff value λc when the measurement type is roughness and the cutoff value λf when the measurement type is waviness.

For the horizontal direction of the roughness/primary/waviness curve profile and total profile, always the whole profiles are displayed fitting to the display area.

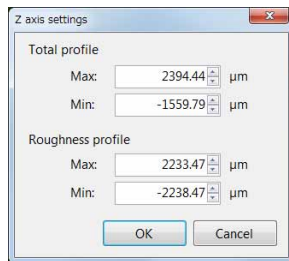
By default (right after the profile is updated), both of the roughness/primary/waviness profile and total profile are displayed fitting to the display area, you can configure the axis setting for the Z axis (vertical axis display of the profile graph).

Point

You can specify the range of the Z axis for each of total profile and the roughness/primary/waviness profile individually. However, you cannot adjust the X axis.


1 Click the button (specify value) in the profile operation controls.

The [Z axis settings] dialog box appears.



2 Set the maximum and minimum values on the Z axis of the desired profile graph, and click the [OK] button.

Reference

To return the Z axis scaling to the original state, click the  (Reset) button.

Roughness Definitions

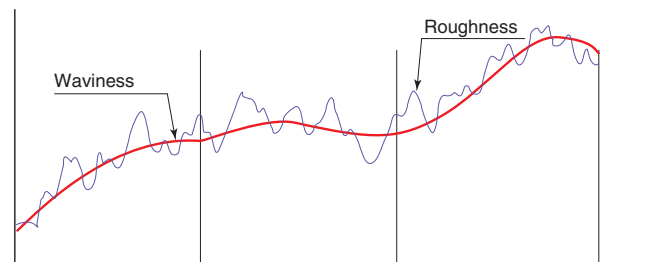
What is Surface Roughness

■ Roughness (surface roughness)

Roughness (surface roughness) has a complicated shape in which there are continuous peaks and valleys whose height, depth and intervals differ. The surface condition wherein uneven surfaces appear in a continuing sequence in relatively short cycles and at relatively shorter intervals than the depth is called the roughness (surface roughness).

■ Waviness

Waviness refers to uneven surfaces that appear periodically at longer intervals than the roughness, which can be defined as deviation from an ideal surface that appears repeatedly at relatively longer intervals than the depth.



■ Traced profile

“Traced profile” is a surface profile of a sample, which is calculated from measurements with this product.

■ Total profile

Total profile means a curve which is sampled (digitalized) at regular intervals as a coordinate (a continuously changing graph) of which measured curve consists of vertical and horizontal axes.

In the surface roughness measurement where surface irregularity is measured by tracing the stylus, up and down changes in the continuously moving stylus need to be sampled and digitalized at regular intervals. This product had sampled at a constant interval when measured the surface. The profile graph corresponds to the measured cross section curve.

■ Profile

Profile refers to a generic name of curves, such as measured cross section curve, cross section curve, roughness curve and waviness curve.

■ Primary profile

Primary profile means a curve in which a low-pass filter of phase compensation type of the cutoff value λ_s is applied to the measured cross section curve.

■ Roughness profile

Roughness profile means a curve in which only high frequency component of the cross section curve is recorded through a high-pass filter of phase compensation type (cut-off value λ_c).

■ Waviness profile

Waviness profile means a curve in which the phase compensation filter of cutoff values λ_f and λ_c is applied to the cross section curve.

■ Average line

As the average line, there are 3 types of average lines, such as average line for roughness curve, average line for waviness curve and average line for primary curve, all of which are curves.

■ Average line for roughness profile

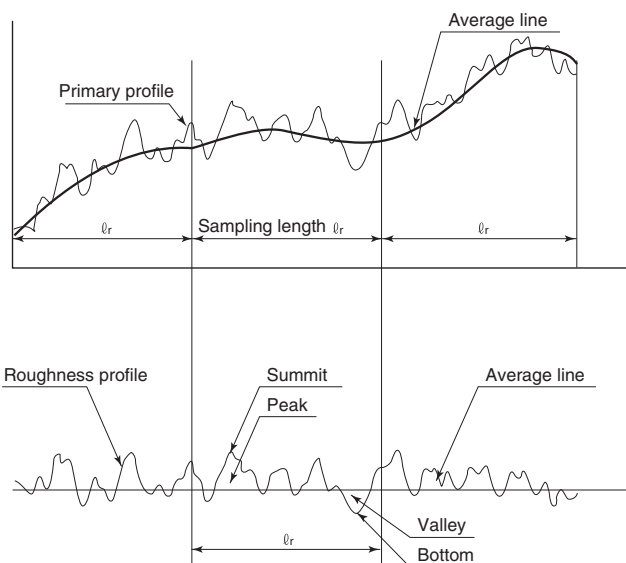
Average line for roughness curve means a curve in which low frequency component cut by a low-pass filter of phase compensation type λ_c (low-pass filter) is recorded.

■ Average line for waviness profile

Average line for waviness curve means a curve in which low frequency component cut by a low-pass filter of phase compensation type λ_f (low-pass filter) is recorded.

■ Average line for primary profile

Average line for primary curve means a curve which indicates a nominal shape applied to the cross section curve by means of the least squares method.



■ Sampling length

Arithmetic mean roughness and other roughness parameters are determined based on the extracted part of a given length from the profile.

This extracted length is called the "sampling length." The sampling lengths of the roughness profile and waviness profile are equivalent to their respective cutoff values (λ_c for the roughness profile and λ_f for the waviness profile).

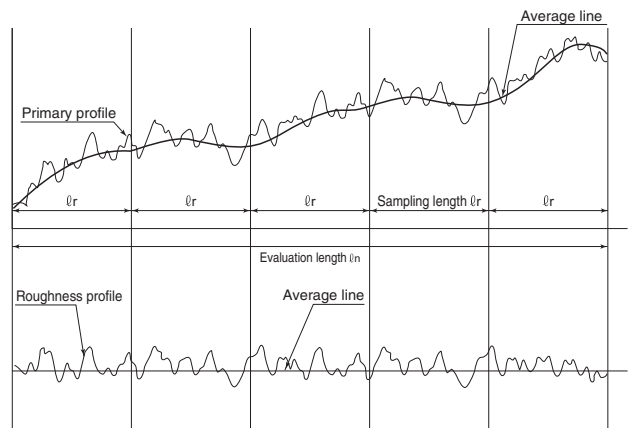
The sampling length of the primary profile is equivalent to the profile's evaluation length.

■ Evaluation length

"Evaluation length" refers to the part of a given length extracted from the profile in order to determine arithmetic mean roughness and other roughness parameters.

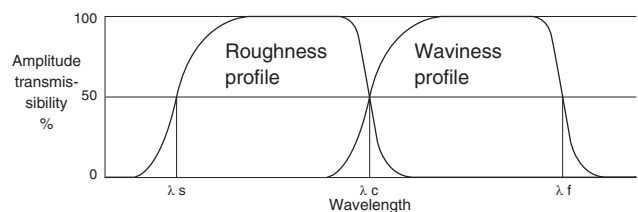
An evaluation length must contain at least one sampling length. Generally, an evaluation length is five times the corresponding sampling length.

However, there are no specific rules on evaluation lengths used for waviness parameters.



■ Cutoff (cutoff value)

The cutoff refers to the predetermined wavelength to be removed from a cross section curve. A roughness curve is created by removing the long-wavelength component from the cross section curve, and a waviness curve is created by removing the short-wavelength component from the same. When the contact-type surface roughness measuring equipment was the analog equipment that performs the measurement using its electric circuit consisting of capacitors and resistors, 2 CR filter was normally used. With trend of times toward digitalization, however, the phase compensation digital filter (Gaussian filter) has been widely used in recent years. The cutoff that this product uses is also a Gaussian filter.



Surface texture parameter definitions

This product uses equations that comply with "ISO 4287: 1997 Surface roughness-Definitions" and "ISO 13565: 1996". For more information, refer to the "ISO 4287: 1997" and "ISO 13565: 1996" standards issued by standardization organizations (BSI, DIN, JSA, etc.).

When discussing parameters, Pp is Highest primary profile peak, Rp is Highest roughness profile peak, and Wp is Highest waviness profile peak. Each refers to the corresponding curve to profile curve. However, some of the parameters for roughness and waviness profiles are referred to as different language for reasons of history or convenience.

ISO4287:1997

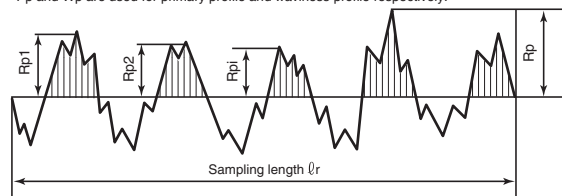
Maximum profile peak height

Maximum profile peak height indicates the point along the sampling length at which the curve is highest.

- Peaks are determined for each region that exceed the average line.
- Z(x) for each curve takes the average height of the roughness profile (when P, it is a primary profile, and when W, it is a waviness profile) to be 0 and determines the height of position x along the curve.

$$R_p = \max(Z(x))$$

* Pp and Wp are used for primary profile and waviness profile respectively.



Maximum profile peak height (for a roughness profile)

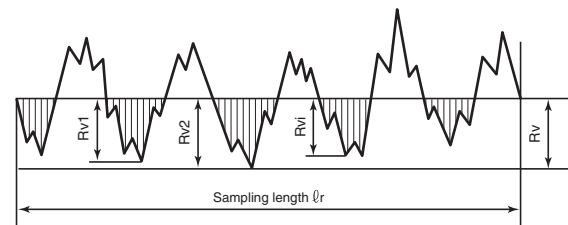
Maximum profile valley depth

Maximum profile valley depth indicates the point along the sampling length at which the profile curve is lowest.

- Valleys are determined for each region that falls below the average line.
- Z(x) for each curve takes the average height of the roughness profile (when P, it is a primary profile, and when W, it is a waviness profile) to be 0 and determines the height of position x along the curve.

$$R_v = |\min(Z(x))|$$

* Pv and Wv are used for primary profile and waviness profile respectively.



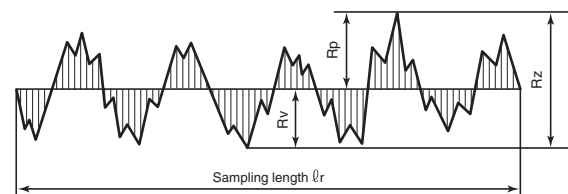
Maximum profile valley depth (for a roughness profile)

Maximum height of profile

Maximum height of the profile indicates the absolute vertical distance between the Maximum profile peak height and the Maximum profile valley depth along the sampling length.

$$R_z = R_p + R_v$$

* Pz and Wz are used for primary profile and waviness profile respectively.



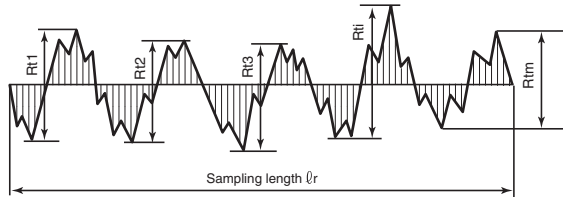
Maximum height of profile curve (for a roughness profile)

- When dealing with roughness profile, Rz is referred to as Maximum roughness while Wz is referred to as Maximum waviness when dealing with waviness profile.

Mean height of profile elements

Mean height of profile elements indicates the average value of the height of the curve element along the sampling length.

$$R_c, P_c, W_c = \frac{1}{m} \sum_{i=1}^m R_{ti}$$



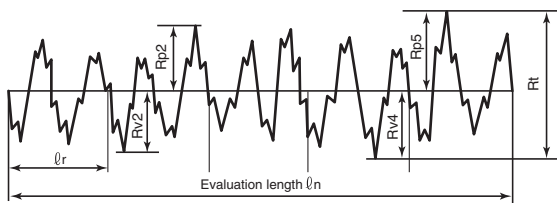
Mean height of profile elements (for a roughness profile)

Profile elements consist of a peak and a neighboring valley. The peaks (or valley) that constitutes element have minimum height and length standards such that they will be treated as noise and considered a part of the preceding valley (or peak) if the height (depth) is less than 10% of the maximum height or the length is less than 1% of the segment length.

Total height of profile

Total height of profile is the vertical distance between the Maximum profile peak height and the Maximum profile valley depth along the evaluation length.

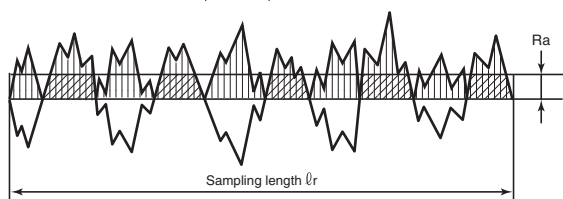
$$R_t, P_t, W_t = \max(R_{pi}) + \max(R_{vi})$$



Arithmetical mean height

Arithmetical mean height indicates the average of the absolute value along the sampling length.

$$R_a, P_a, W_a = \frac{1}{l_r} \int_0^{l_r} |Z(x)| dx$$



Arithmetical mean height (for a roughness profile)

Reference

When dealing with the roughness profile, Ra is referred to as Arithmetic mean roughness while Wa is referred to as Arithmetic mean waviness for the waviness profile.

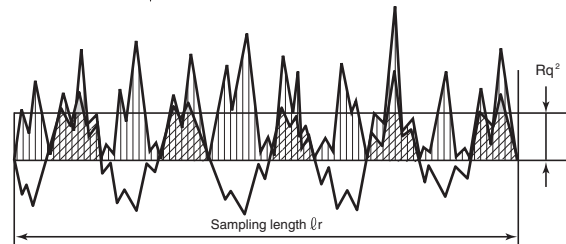
Root mean square deviation

Root mean square deviation indicates the root mean square along the sampling length.

Reference

For the roughness profile, Rq is referred to as Root-mean-square roughness while Wq is referred to as Root-mean-square waviness for the waviness profile.

$$R_q, P_q, W_q = \sqrt{\frac{1}{l_r} \int_0^{l_r} Z^2(x) dx}$$



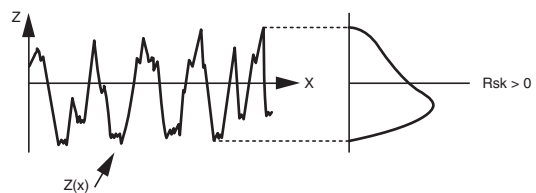
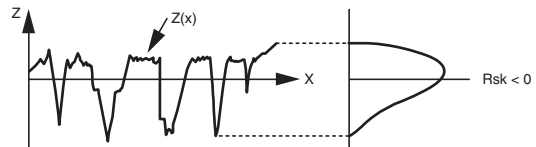
Root means square height (for a roughness profile)

Skewness

Skewness uses the cube of the root mean square deviation to display the dimensionless cube of the sampling length Z(x).

$$R_{sk} = \frac{1}{R_q^3} \left[\frac{1}{l_r} \int_0^{l_r} Z^3(x) dx \right]$$

* Psk and Wsk are used for primary profile and waviness profile respectively.

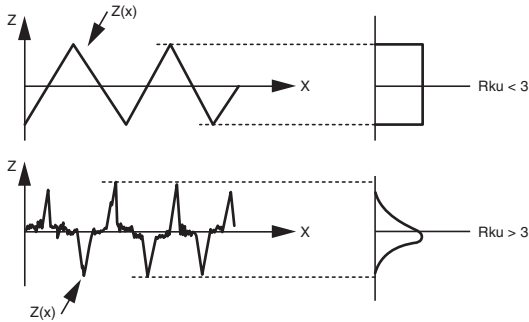


■ Kurtosis

Kurtosis uses the fourth power of the root mean square deviation to display the dimensionless fourth power of the sampling length $Z(x)$.

$$Rku = \frac{1}{Rq^4} \left[\frac{1}{\ell_r} \int_0^{\ell_r} Z^4(x) dx \right]$$

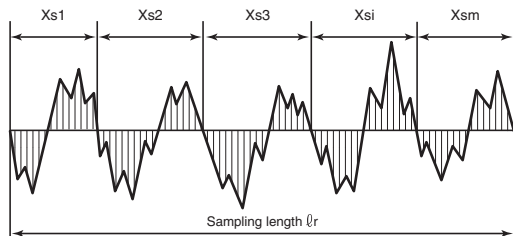
* Pku and Wku are used for primary profile and waviness profile respectively.



■ Mean width of the profile elements

Mean width of the profile elements indicates the average value of the length of the profile element along the sampling length.

$$RS_m, PS_m, WS_m = \frac{1}{m} \sum_{i=1}^m X_{si}$$



Mean width of the profile elements (for a roughness profile)

X_{si} is the length of a single profile element. The peaks (valley) that constitute element have minimum height and length standards such that they will be treated as noise and considered a part of the preceding valley(peak) if the height (depth) is less than 10% of the maximum height or the length is less than 1% of the segment length.

■ Root mean square slope

Root mean square slope indicates the root mean square of the local tilt dZ/dX along the sampling length.

$$R\Delta q, P\Delta q, W\Delta q = \sqrt{\frac{1}{\ell_r} \int_0^{\ell_r} \left[\frac{dZ(x)}{dx} \right]^2 dx}$$

The local tilt refers to the derivative of $Z(x)$. Derivatives generally use the seven-point formula shown below. (Because the first three points on either end lack sufficient data, three or five point formulae are used.)

$$\frac{dZ_i}{dx_i} = \frac{(Z_{i+3} - 9Z_{i+2} + 45Z_{i+1} - 45Z_{i-1} + 9Z_{i-2} - Z_{i-3})}{60x}$$

■ Cross point average roughness (Rz JIS)

Cross point average roughness is the value expressed in microns (μm) that is obtained by extracting only the sampling length (ℓ_r) from the roughness profile in the direction of its average line and finding the sum of the averages of the absolute values of the height (Y_p) from the highest peak to the 5th peak and those of the height (Y_v) from the lowest bottom to the 5th bottom.

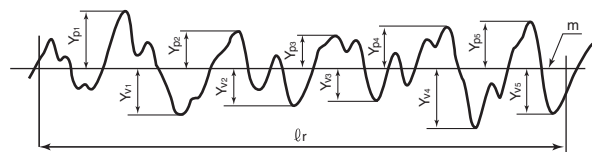
$$Rz = \frac{|Y_{p1} + Y_{p2} + Y_{p3} + Y_{p4} + Y_{p5}| + |Y_{v1} + Y_{v2} + Y_{v3} + Y_{v4} + Y_{v5}|}{5}$$

$Y_{p1} + Y_{p2} + Y_{p3} + Y_{p4} + Y_{p5}$

: The Height from the highest peak to the 5th peak of the extracted part for the sampling length (ℓ_r)

$Y_{v1} + Y_{v2} + Y_{v3} + Y_{v4} + Y_{v5}$

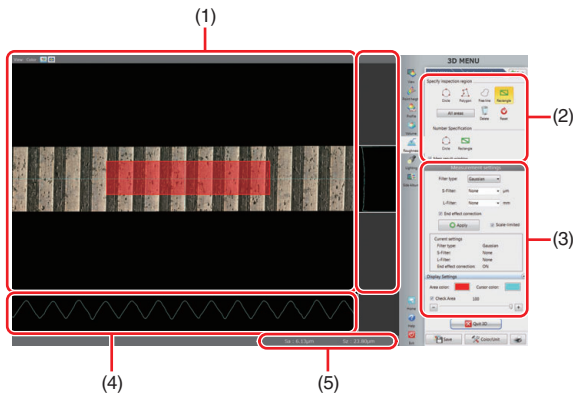
: The height from the lowest bottom to the 5th bottom of the extracted part for the sampling length (ℓ_r)



Surface roughness measurement



Surface roughness measurement screen



(1) Image display area

Displays an image of the sample when you see it from the perpendicular direction to the reference plane. You can also change the display type and magnification of the image.

(2) Area settings tool

Adds, edits, and deletes areas.

☞ "Setting measurement area" (Page 10-50)

(3) Measurement setting

Configure a cutoff value and an end effect correction of a filter, and switch displaying of height image.

☞ "Setting Filter" (Page 10-51)

(4) Profile display area

Displays the cross section profile of the sample which is cut perpendicularly to the reference plane at the cursor position in vertical and horizontal directions on the image.

(5) Measure result display area

Displays the surface roughnesses Sa and Sz.

Measurement result list

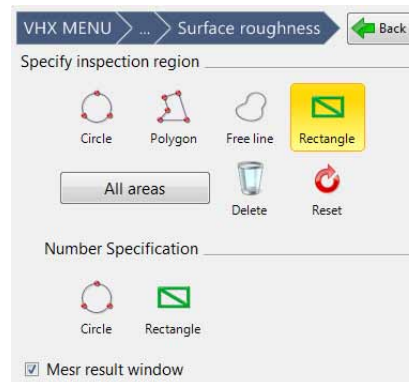
Item	Description
Sq (Root mean square height)	The root mean square of height at each point in the area. It is equivalent to the standard deviation of height.
Ssk (Skewness)	Indicates the skewness of the height distribution in the area.
Sku (Kurtosis)	Indicates the kurtosis of the height distribution in the area.
Sp (Maximum peak height)	The height of the highest point in the area.
Sv (Maximum pit height)	The absolute value of the height of the lowest point in the area.
Sz (Maximum height)	A sum of the maximum peak height and the maximum pit height in the area.
Sa (Arithmetic mean height)	The average value of the absolute value of height at each point in the area.
Area square measure	The square measure value of the area.

For details of each measurement item, refer to ☞ "Surface Roughness Definitions" (Page 10-52).

Surface roughness measurement

■ Setting measurement area

Determines the area over which roughness will be measured. Multiple areas can also be set.



Circle

Click three points on the circumference of the circle that contains the area to be extracted.

Polygon

Enclose the area to be extracted by sequentially clicking each vertex point and double click to indicate the final vertex point.

Free line

Drag the mouse around the perimeter of the area to extract.

Rectangle

Drag the diagonally opposite corners of the rectangular area to extract.

All areas

All areas are measured.

Delete

Click the desired extraction area to delete a single one.

Reset

Deletes all extraction areas.

Number Specification (Circle/Rectangle)

Enter the length to specify the extraction area.

■ Setting Filter

Filter type:	Gaussian
S-Filter:	None
L-Filter:	None
End effect correction:	ON

1 Select the filter from the dropdown list of [Filter type] for [Filter settings].

- Gaussian
- Double gaussian
- Spline

When Gaussian filter or Double gaussian filter is selected, selecting [End effect correction] checkbox can correct the circumference of the surface so it is not distorted.

* If the cutoff wavelength is large, processing takes additional time.

2 Select a cutoff wavelength for a S-filter.

On the profile graph, the components that have smaller scale than the cutoff wavelength specified will be removed from the image.

3 Select a cutoff wavelength for a L-filter.

On the profile graph, the components that have bigger scale than the cutoff wavelength specified will be removed from the image.

4 Specify the [End effect correction] setting.

When this checkbox is selected, distortion in the area that has distortion will be suppressed by the primary Gaussian regression filter.

When this checkbox is cleared, the area is extended with the image end pixel data, and then an ordinary Gaussian filter will be applied.

5 Click [Apply].

Filter type:	Gaussian
S-Filter:	None
L-Filter:	None
End effect correction:	ON

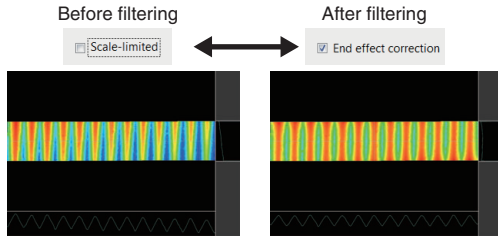
The filtering is executed and measured values in the measurement result list are updated.



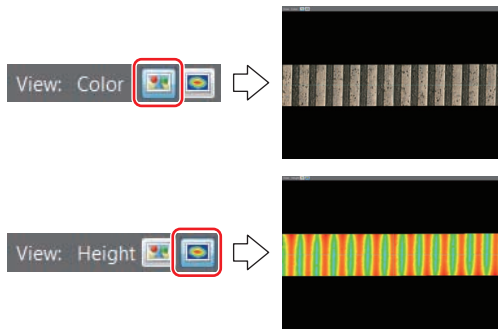
- Until [Apply] is clicked, measurement values in the measured result list are not renewed.
- When the cutoff frequency is large, processing takes additional time.

Reference

The surface profile before and after filtering can be switched by clicking [Measurement surface].



Just after [Measurement surface] is clicked, images are displayed in height view. As required, use the button in upper right of the image display area to switch the screen to the color image.



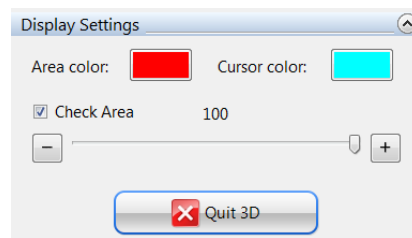
● L-Filter

This filter is the filter to remove waviness components which are large in scale (high-pass filter).

Set L-filter to a value that is five times of the cycle length of shapes you want to remove as waviness.

The minimum cutoff wavelength of L-filter is one hundred times of the pixel length, and the maximum cutoff wavelength is the wavelength of the first option that is longer than the longer side length of the image.

■ Setting display



Area color: Changes the color of measurement target areas.

Cursor color: Changes the color of profile lines.

Area check: Turns the display of the measurement target areas ON/OFF or lightens the colors.

Filter operation

In the surface roughness measurement, filtering is executed using a Gaussian filter.

When you execute filtering, filtering is performed in the order of S-filter and L-filter against the entire image. After the filtering is completed, the measurement result list will be updated.

Point

When the Gaussian filter is applied to an image, the margins (the area half of the cutoff wavelength distance away from the edge) will be distorted, therefore either set the area to avoid the margins, or turn on the [End effect correction] checkbox.

● S-Filter

This filter is the filter to remove roughness components which are small in scale like optical resolution (low-pass filter).

Set S-filter to a value that is more than three times of the measurement resolution in XY-plane. When the effect is not sufficient, make the setting bigger.

The minimum cutoff wavelength of S-filter is double of the pixel length, and the maximum cutoff wavelength is one half of the length of the longer side of the image.

Surface Roughness Definitions

Definitions of Terms

■ Filter operation

This product filters the image entirely first and then sets the area to start the measurement. Frequency filter at this time is different for each category.

Point

When the Gaussian filter is applied to an image, the margins (the area half of the cutoff wavelength distance away from the edge) will be distorted, therefore, either set the area avoiding the margins, or turn on the [End effect correction] setting.

● Gaussian filter

This is the Gaussian filter specified by JISB0632:2001 (ISO 11562:1996) and ISO 16610-21:2011 whose surface area has been extended.

● **Double gaussian filter**

This is the filter defined by JIS B0671-1: 2002 (ISO 13565-1: 1996) whose surface area has been extended.

This filter reduces undesirable distortion that occurs when evaluating function parameters.

● **Spline filter**

This is the Spline filter specified by ISO/TS 16610-22:2006 whose surface area has been extended.

Since Spline filter is applied in X direction and Y direction independently and synthesized for calculation, the cutoff wavelength characteristic changes according to the angle of the plane.

The cutoff wavelength specified by Spline filter represents the cutoff wavelength parallel to X axis and Y axis directions.

Height parameters

The height parameters are the parameters concerned only with change in height.

■ **Sq Root mean square height**

It is the root mean square of height at each point in definition area. It is equivalent to the standard deviation of height.

$$S_q = \sqrt{\frac{1}{A} \iint_A z^2(x, y) dx dy}$$

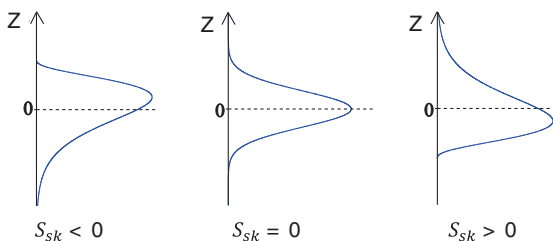
■ **Ssk Skewness**

It is the cubic average of height which is rendered dimensionless with the cube of Sq. It indicates the asymmetric property of height distribution which is centered on the reference surface.

When Ssk equals 0, it means that the height distribution is symmetric with respect to the reference plane.

While Ssk < 0, Ssk > 0, it means that the height distribution is skewed either higher or lower, relative to the reference plane.

$$S_{sk} = \frac{1}{S_q^3} \left[\frac{1}{A} \iint_A z^3(x, y) dx dy \right]$$



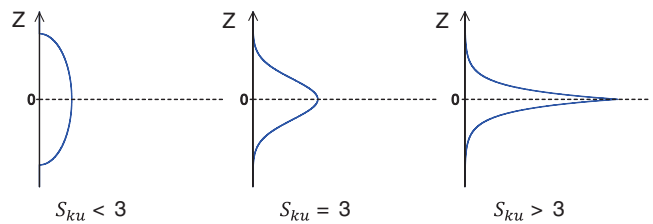
■ **Sku Kurtosis**

It is the average fourth power of height which is rendered dimensionless with the fourth power of Sq. Indicates the sharpness of the height distribution.

When Sku equals 3, it means that the height distribution of scale-limited surface is a normal distribution.

While Sku < 3, Sku > 3, it means that the height distribution takes either collapsed or sharpened shape.

$$S_{ku} = \frac{1}{S_q^4} \left[\frac{1}{A} \iint_A z^4(x, y) dx dy \right]$$



■ **Sp Maximum peak height**

It is the height of the highest point in definition area.

$$S_p = \max_A z(x, y)$$

■ **Sv Maximum valley depth**

It is the absolute value of height of the lowest point in definition area.

$$S_v = |\min_A z(x, y)|$$

■ **Sz Maximum height**

It is a sum of the maximum peak height and the maximum valley depth in definition area.

$$S_z = S_p + S_v$$

■ **Sa Arithmetical mean height**

It is the average value of the absolute value of height at each point in definition area.

$$S_a = \frac{1}{A} \iint_A |z(x, y)| dx dy$$

■ **End effect correction**

In the Gaussian filter, this option prevents a distortion from occurring in any shape of the surface periphery of image (the area half of the cutoff wavelength distance away from the edge). The larger the cutoff frequency, the longer the processing time.

■ **Original surface**

This surface refers to the surface consisting of height data at the start-up time of ISO 25178 surface roughness function.

■ Scale-limited surface

This represents a surface obtained by applying the S-filter and L-filter to the original surface.

■ S-filter

This is the filter (low-pass filter) to remove components which are small in scale.

This filter is equivalent to the cutoff value λ_s of JIS B0601-2001. It refers to a low-pass filter for a frequency filter such as a Gaussian filter.

■ L-filter

This is the filter (high-pass filter) to remove components which are large in scale.

This filter removes components such as waviness and extracts only roughness components. This is equivalent to the cutoff value λ_c of JIS B0633-2001. It refers to a high-pass filter for a frequency filter such as a Gaussian filter.

■ Height

It refers to a distance from the reference surface at each point in a scale-limited surface. Points lower than the reference surface will have negative values. In the definitional equation, the height in coordinates (x, y) is expressed by $z(x, y)$.

Volume Measurement (Option)

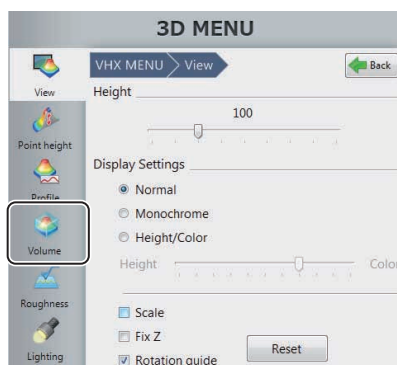
This function allows you to measure volumes and surface areas of 3D images.

Point The separately sold "3D Profile Measurement Application" (model VHX-H4M) is required to perform volume measurements. Make sure this application is installed beforehand.

1 Display the 3D image.

Display the 3D image obtained using the depth up function (Page 10-2), or the album function (Page 6-2).

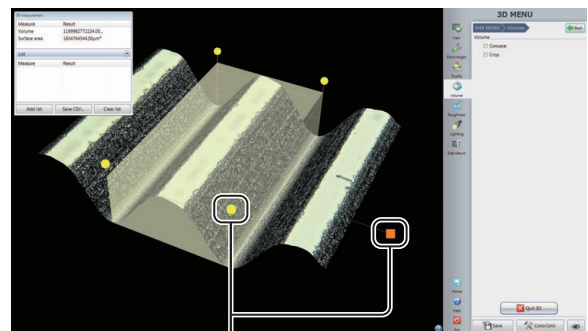
2 Click [Volume] from the 3D MENU.



Volume measurement menu appears.

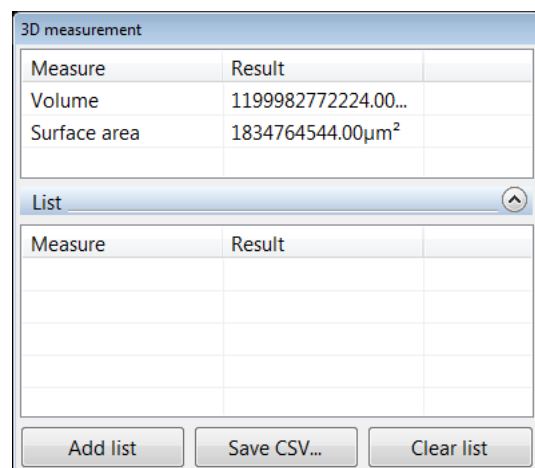
3 Move the handles (● and ■) displayed in the observation window and set the range of measurement target.

- If the [Concave] check box is checked, this display shows only the volume of the concave portion.
- If the [Crop] check box is checked, the display shows only the measurement range.



Handle

Measurement results appear on the [3D measurement] dialog box.



- **Add list**
This command adds the current measurement results to the list.
- **Save CSV**
This command allows you to save the current measurement results as CSV format.
- **Clear list**
This command clears the list contents.

Z Stage Control

Using the VHX-S650, S660, S600F, or others, this product can control the lens height to adjust the focus, measure height, and perform the depth composition and the 3D display.

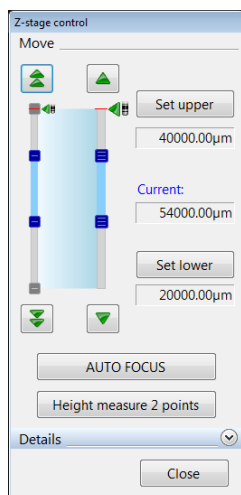
Adjusting Focus from the VHX MENU

Adjusting manually

Reference The Z stage can also be controlled using the FOCUS dial on the console.

- 1 Click [VHX MENU], then [Depth UP], and then [Z-stage control].

The [Z-stage control] dialog box appears.



- 2 Click the     icons to adjust focus.

  Moves in fine (small) increments.

  Moves in coarse (large) increments.

To exit, click [Close].

Using auto focus

NOTICE

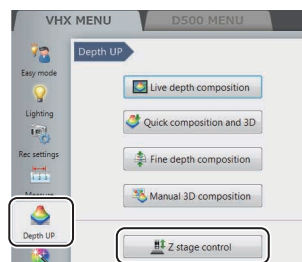
To prevent interference with the observation object, auto focusing is done by moving the Z stage upwards.

To avoid interference while using auto focus, be sure there is at least 3 mm between the lens and object.

Reference

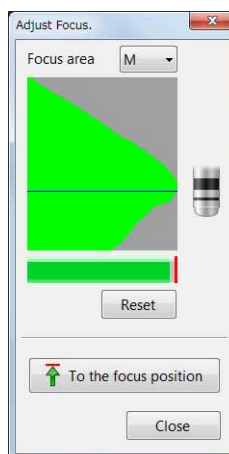
Auto focus can also be executed by pressing the AUTO FOCUS button on the console. In this case, auto focus begins immediately and the [Auto focus] dialog box appears.

- 1 Click [VHX MENU], then [Depth UP], and then [Z-stage control].



The [Z-stage control] dialog box appears.

- 2 Click [AUTO FOCUS].
- 3 The Z stage starts moving up and down and stops at the height where the image is in focus. The focus adjustment dialog box also appears.



- 4 Drag the focus area to the location to focus on, as required, and click [Auto focus] again. The size of the focus area can be changed with [Focus area] in the focus adjustment dialog box.

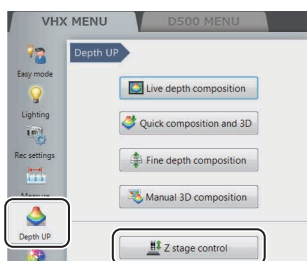
Measuring the Height between 2 Points

Auto focus can be used to measure the difference in height of two specified areas.

NOTICE

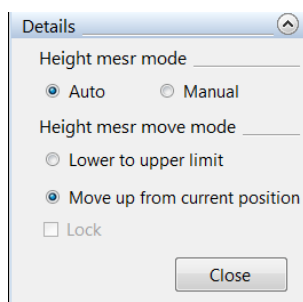
To prevent interference with the observation object, the height measurement between two points is done by moving the Z stage upwards. To avoid interference while using this measurement, be sure there is at least 3 mm between the lens and object.

- 1 Click [VHX MENU], then [Depth UP], and then [Z-stage control].



The [Z-stage control] dialog box appears.

- 2 Open the Details menu.



- 3 Specify the [Height mesr mode].

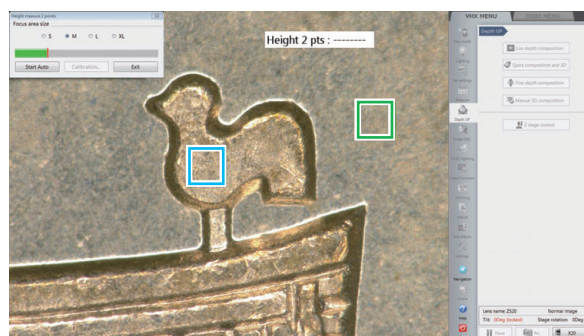
Auto : Specify the areas to measure the height difference. The measurement is performed automatically.

Manual : Manually adjust using the fine and coarse buttons.

- 4 Select [Move up from current position] under [Height mesr move mode].

- 5 Click [Z Measure 2pt].

The [Height measure 2 points] dialog box appears, and [Focus area 1] appears in a green frame, and [Focus area 2] appears in a blue frame in the observation window.



Auto mode

- 6 Drag focus areas 1 and 2 to the positions to measure.

To change the size, select a size from S to XL.

Point The measurement returns a positive value if focus area 1 (green frame) is lower than focus area 2 (blue frame), and returns a negative if focus area 1 is higher than focus area 2.

- 7 Adjust the focus on the lowest focal plane and click [Start Auto].

The Z stage moves up and the height between the two points appears in the text box.

You can calibrate the Z stage by clicking [Calibration] (Page 10-58).

To stop measuring the height of two points, click [Exit].





Manual mode

- 6 Click the     icons to focus on the lowest focal plane.

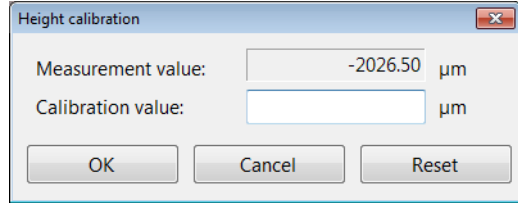
- 7 When the position is in focus, click a point near the measurement position.

An X appears at the clicked point.

Point Accidental clicks that cause the X to move will not affect the measurement value. The X represents the measurement location.

- 8 Click the     icons to focus on the highest focal plane.
- 9 When the position is in focus, click a point near the measurement position.
The height between the two points appears in the text box.
You can calibrate the Z stage by clicking [Calibration] (Page 10-58).

- 3 Enter the exact height measured in step 1 in the [Calibration value] box, and click [OK].

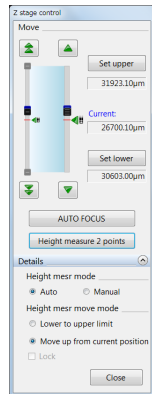


The calibrated value is reflected in the measurement.

To stop measuring the height of two points, click [Exit].

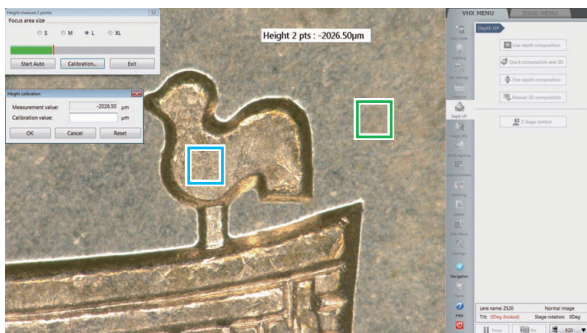
To initialize calibration, click [Reset].

- Reference
- The focus adjustment can be done using the jog dial on the console or the mouse wheel.
 - [Lock] in the detailed group is active only when VHX-S90F is used. Uncheck [Lock] before adjusting the Z stage manually. The [Lock] is always unchecked if the lens power is less than x350.



Calibration

- 1 Use [Z Measure 2 pt...] to measure a known height (Page 10-57).
- 2 Click [Calibration].



The [Height calibration] dialog box appears.

Chapter 11

Stitching Images

2D Image Stitching and 3D Image Stitching

This function allows you to stitch images while moving the object to obtain high-resolution wide-view images.

Image stitching can be done in both 2D and 3D.

Automatic Image Stitching	Page 11-2
Stitching 2D Images Automatically.....	Page 11-2
Stitching 3D Images Automatically.....	Page 11-5
Manual Image Stitching	Page 11-8
Stitching 2D Images.....	Page 11-8
Stitching 3D Images.....	Page 11-9
Split recording	Page 11-12
Splitting and saving original image before stitching	Page 11-12

Automatic Image Stitching

With these functions, the XYθ stage is moved automatically, multiple images are captured and assembled and wide-view images are obtained. The stitched image combines high resolution and a wide viewing angle.

Image stitching can be done in both 2D and 3D.

The automatic XYθ stage is required to use the automatic image stitching function.

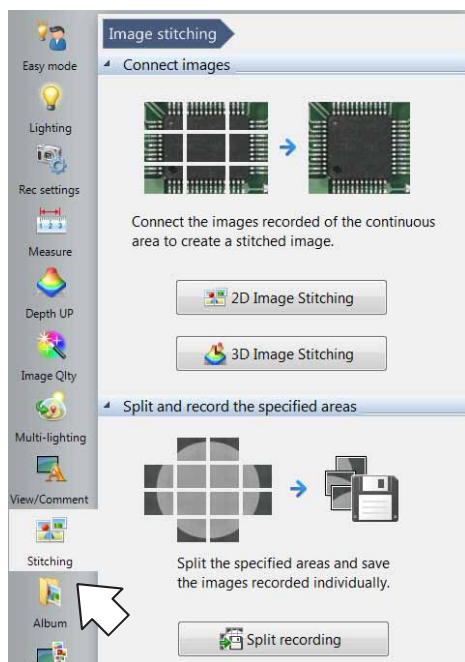
When the manual XYθ stage is in use, refer to the "Manual Image Stitching" (Page 11-8).

Stitching 2D Images Automatically

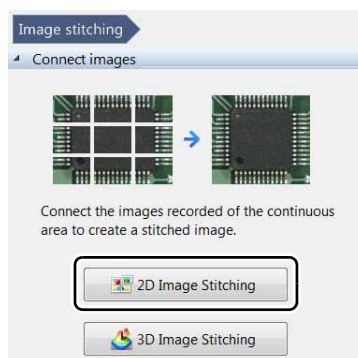
- Point
 - The maximum size of the stitched image is 20,000 x 20,000 pixels.
 - Image stitching cannot be used in conjunction with these modes: Recording sizes other than normal (1600 x 1200), split screen.

1 Click [Stitching] from the VHX MENU.

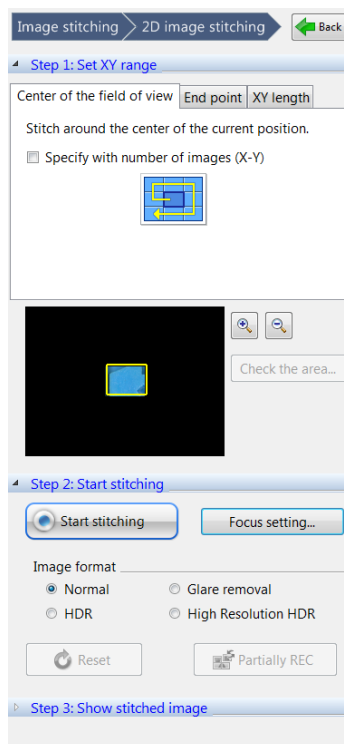
The [Image stitching] menu appears.



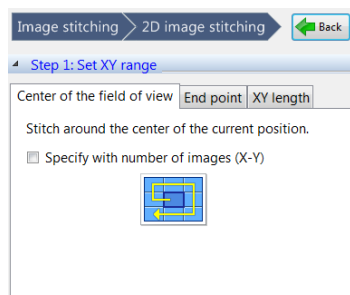
2 Click [2D image Stitching]



The [2D image stitching] menu appears.



3 Select the method for image stitching.



Center of the field of view

Centered on the current position, the XYθ stage is moved in a spiral pattern and the obtained images are assembled.

End point

Stitches an area including specified positions.

XY length

Stitches an area specified by length.

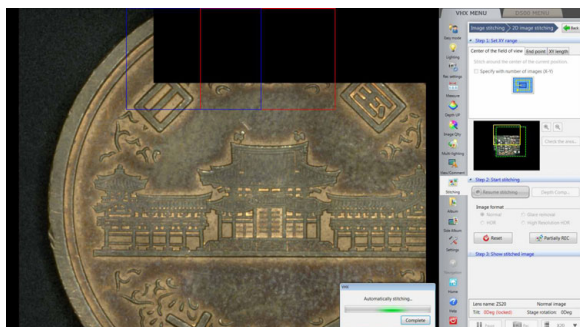
Stitching images centered on the current position

- Reference** Images can be assembled while auto focus and depth composition are being performed automatically.
- To stitch the specified number of images centering around the current position, put a check on [Specify with number of images].
- Book** "To perform the auto focus and the depth composition for objects with height variation" (Page 11-5)

1 Select an image capture type from; Normal, Glare removal, HDR, and High Resolution HDR.

2 Click [Start stitching].

The dialog box to indicate that the auto image stitching is in progress appears. At the same time, the XYθ stage moves with the current position at its center and images being stitched are displayed in the observation window. The blue frame and red frame refer to the current position and the next destination, respectively.



After the image stitching is complete, the stitched image appears.



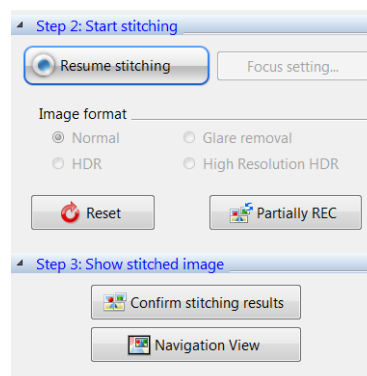
3 Click [Complete (Show stitched image)].

The [Wide-view] dialog box appears.

■ To exit while image stitching is in progress

Click [Complete] on the [Stitching...] dialog box.

[Start stitching] changes to [Resume stitching] and what is shown in Steps 2 and 3 also changes.



Resume stitching

Image stitching is resumed at the position where you had stopped.

Reset

Image stitching starts from the beginning.

Partially REC

When a portion to be captured again is clicked, it changes to a blue frame, and only such portion will be recaptured to update the stitched image.

Confirm stitching results

Image stitching is finished at the position where stitching was stopped, and the stitched image is displayed in the wide-view (Page 5-9).

Navigation display

To use the stitched result for the navigation image, click [Navigation display].

Specifying end points to stitch images

Reference

Images can be stitched while the auto focus and the depth composition are being performed automatically.

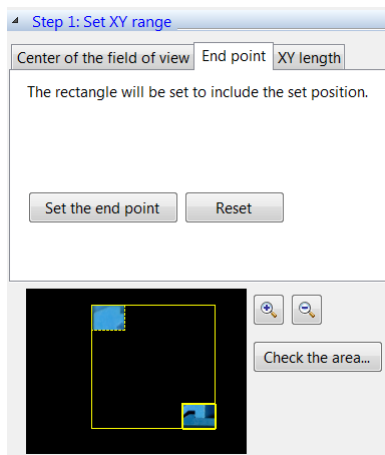
If the glare elimination, HDR, and High Resolution HDR are selected in [Image Type], the respective effects will be active on the stitched result.

"To perform the auto focus and the depth composition for objects with height variation" (Page 11-5)

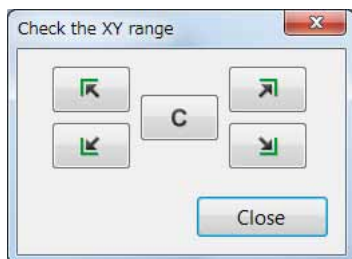
- 1 Open [End point] of [Set XY range].
- 2 Move the stage to a position you want to include in the stitching range, and click [Set the end point].

Reference

To narrow the area specified with [Set the end point] on the way, click [Reset] and set the area again from the beginning.



- 3 Click [Confirm the area], as required, and check the stitching range.



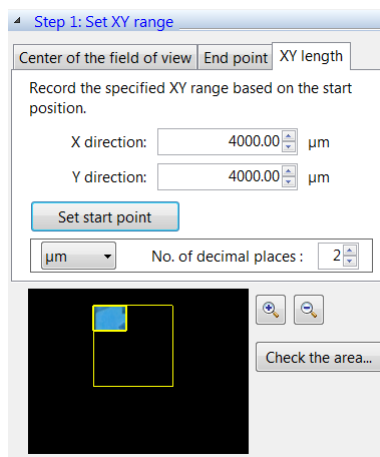
Clicking the arrow moves the stage to the four corners at the upper and lower in the left and right.

Clicking [C] moves the stage to the center of the stitching range.

- 4 Click [Start stitching].

Specifying [XY length] to stitch images

- 1 Open the [XY length] tab of [Set XY range].
- 2 Move the stage to the start point (upper left) for specifying the range and click [Set start point].
- 3 Specify the length in the X and Y directions.



- 4 Click [Confirm the area], as required, and check the stitching range.
- 5 Click [Start stitching]. After image stitching is complete, the stitched image appears.



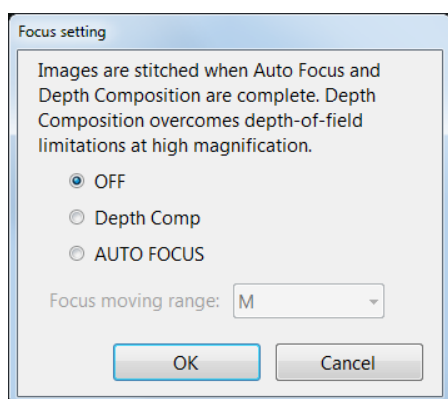
- 6 Click [Complete (Show stitched image)]. The stitched image appears and the [Wide-view] dialog box appears.

"Wide-view" (Page 5-9)

To perform the auto focus and the depth composition for objects with height variation

- 1 Click [Focus setting...].
The [Focus setting] dialog box appears.

- 2 Select [AUTO FOCUS] or [Depth Comp].



- 3 Select from among small, medium, and large for [Focus moving range].
- 4 Click [OK].
After clicking [Start stitching], a stitching image will be created in the form of depth composition image.

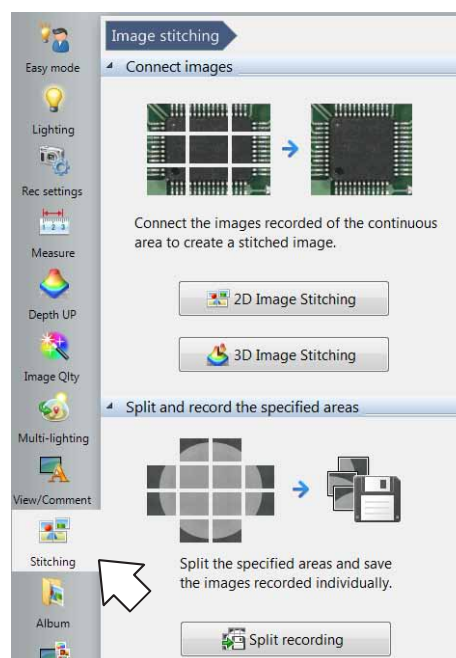
Stitching 3D Images Automatically

Stitching an image captured in 3D allows you to observe a 3D image over a larger area.

- Point**
- The maximum size of the stitched image is 20,000 x 20,000 pixels.
 - Image stitching cannot be used in conjunction with these modes: Recording sizes other than normal (1600 x 1200), split screen, or 28F/s.

Reference The Z-axis motorized stage, such as VHX-S650, is required to use this function.

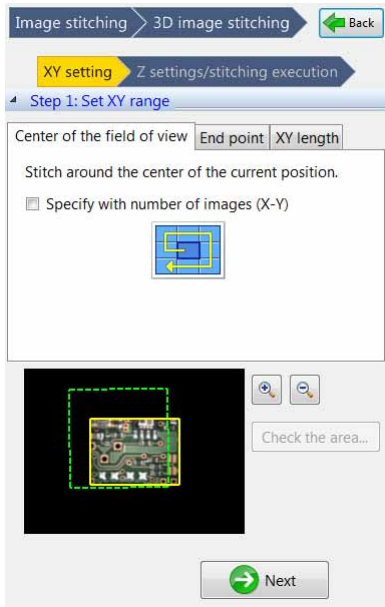
- 1 Click [VHX MENU], and then [Stitching].



The [Image stitching] menu appears.

- 2 Click [3D Image Stitching].

The [3D image stitching] menu appears.



3 Select the method for image stitching.

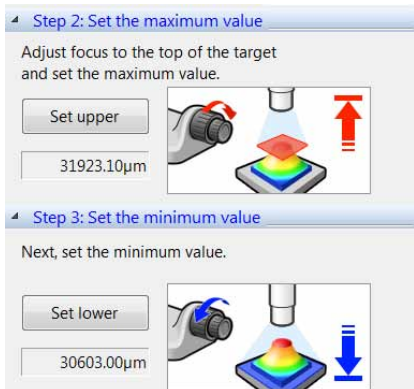
The same image stitching setup procedures as those for 2D image stitching apply to this setting.

📖 "Stitching 2D Images Automatically" (Page 11-2)

4 Specify travel of the Z stage.

5 Move the Z stage to the upper limit of the object, and click [Set upper].

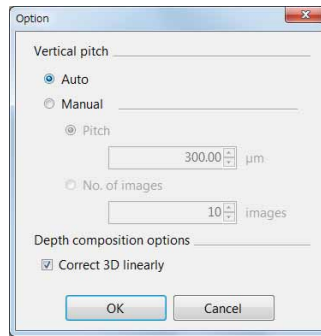
6 Move the Z stage to the lower limit of the object, and click [Set lower].



7 Set the image type and travel pitch, as required.

To use the effects of Glare removal, HDR, and High Resolution HDR, select a required effect from [Image type].

To change travel pitch, click [Option] of [Details], and set the pitch.



Correct 3D linearly

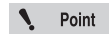
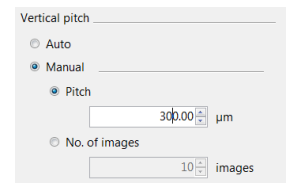
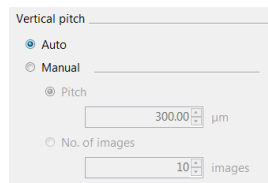
Turning the check box ON makes it easier to convert objects that are tilted or have very few patterns to 3D.

Auto: This automatically sets the best-suited pitch for the lens power.

Manual: Enter a travel pitch. Enter the vertical pitch in [µm] or enter the number of images to capture from the upper limit to the lower limit.

When [Auto] is selected.

When [Manual] is selected.



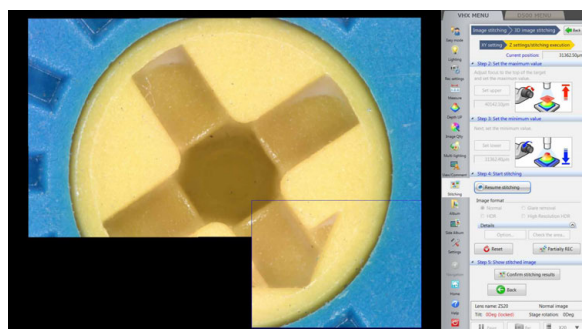
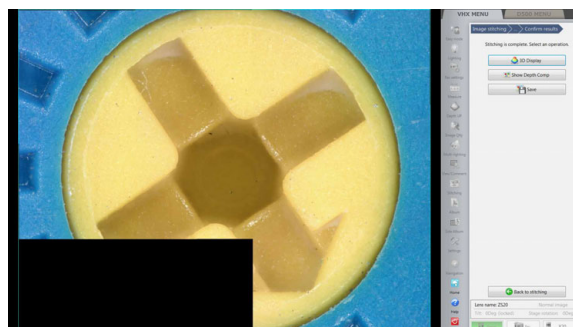
The number of images for composition must be set between 5 to 200 images.

8 Click [Start stitching].

The Z stage moves up and begins capturing depth composition images.


While the XYθ stage moves, images are captured one by one and assembled.

The [Stitching...] dialog box appears during image stitching.

**9 Select [3D Display] or [Show Depth Comp].**

[3D display] (Page 10-15) and [Depth composition] (Page 10-3) appear.

Reference

If a depth composition image was shown, the [Wide view] dialog box will be displayed.
 "Wide-view" (Page 5-9)

■ To exit while image stitching is in progress

Click [Complete] on the [Stitching...] dialog box.

[Start stitching] changes to [Resume stitching] and what is shown in Step 3 and 4 also changes.

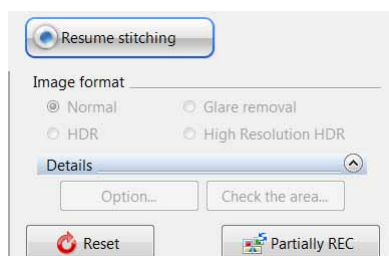
**Resume stitching**

Image stitching is resumed at the position where you had stopped.

Reset

Image stitching starts from the beginning.

Partially REC

When a portion to be captured again is clicked, it changes to a blue frame, and only such portion will be recaptured to update the stitched image.

Manual Image Stitching

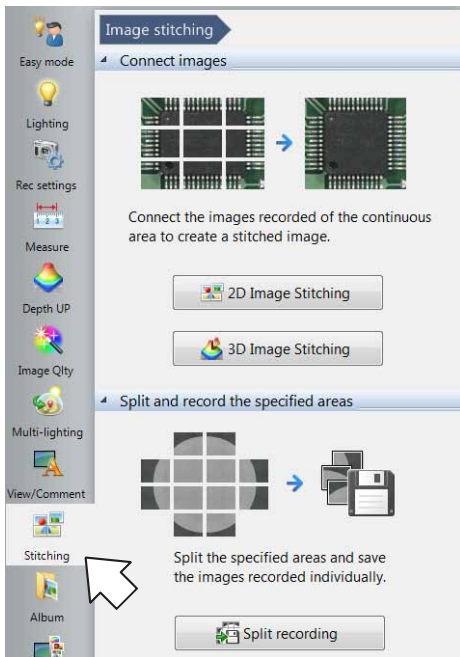
This function stitches images that are recorded while moving the object horizontally to produce wide-view images. The stitched image combines high resolution and a wide viewing angle.

Image stitching can be done in both 2D and 3D.

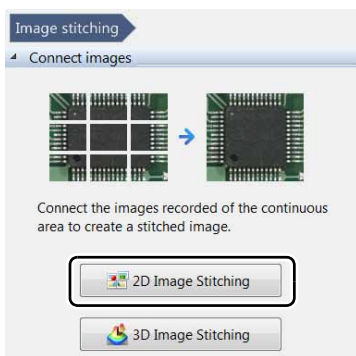
Stitching 2D Images

- Point**
 - The maximum size of the stitched image is 20000 x 20000 pixels.
 - Image stitching cannot be used in conjunction with these modes: Recording sizes other than normal (1600 x 1200), split screen.

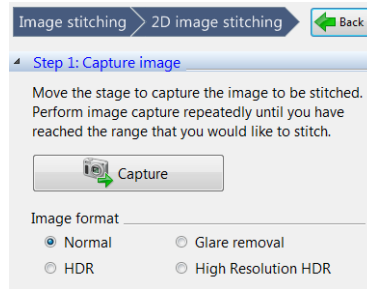
1 Click [VHX MENU], and then [Stitching].
The [Image stitching] menu appears.



2 Click [2D image Stitching]

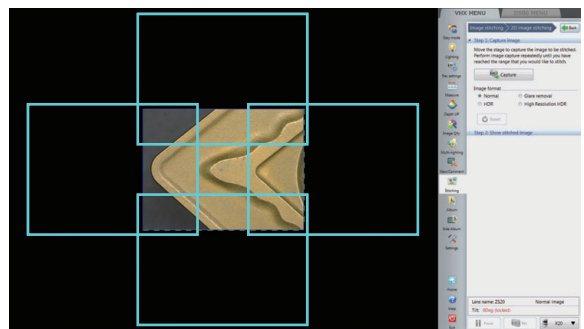


The [2D image stitching] menu appears.



3 To specify the format of images to be stitched, select from [Image format]

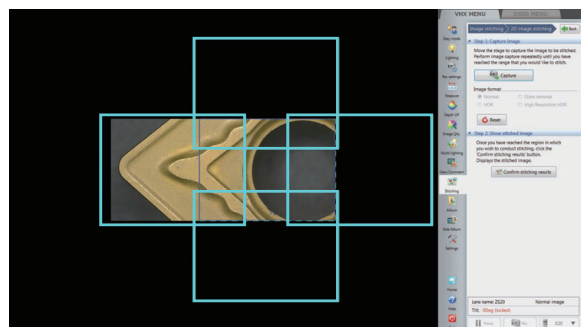
4 Click [Capture].



This captures the first image.

5 Move the object horizontally and click [Capture].
The next image is captured and stitched to the first image.

- Point** If the color of the image appears reversed, stitching failed. Move the object back to the original position and capture the image again.

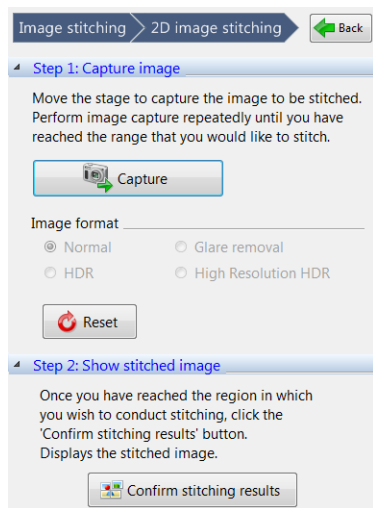


6 Repeat step 5 until the desired area is stitched.

To start over from the beginning, click [Reset].

Point If the stitched image exceeds 20000 pixels, an error message will appear.

7 Click [Confirm stitching results].



When image stitching completes, the stitched image appears.



8 Click [Complete (Show stitched image)].

The stitched image appears and the [Wide-view] dialog box appears.

"Wide-view" (Page 5-9)

Stitching 3D Images

Stitching an image captured in 3D allows you to observe a 3D image over a larger area.

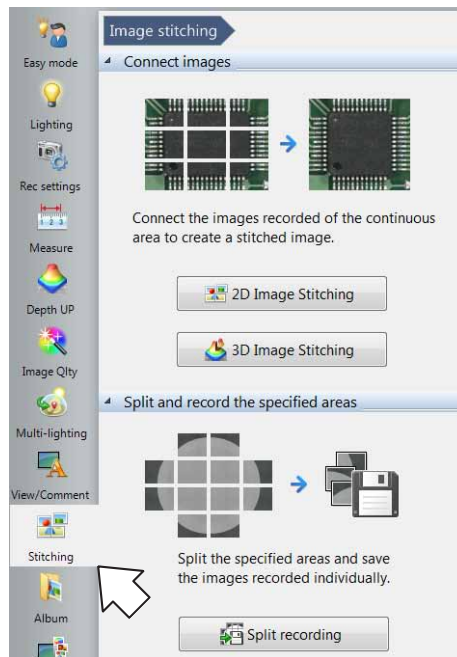
Point

- The maximum size of the stitched image is 20,000 x 20,000 pixels.
- Image stitching cannot be used in conjunction with these modes: Recording sizes other than normal (1600 x 1200), split screen.

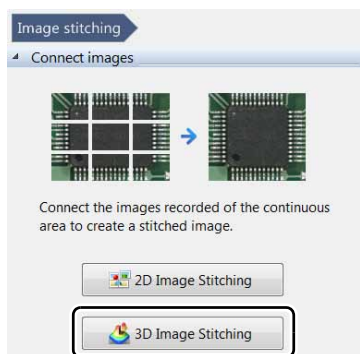
Reference The Z-axis motorized stage is required to use this function.

1 Click [VHX MENU], and then [Stitching].

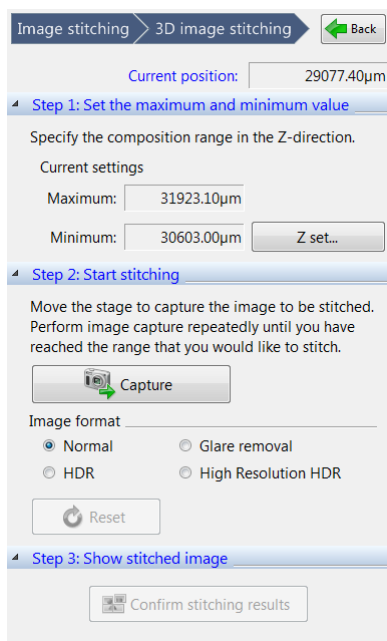
The [Image stitching] menu appears.



2 Click [3D Image Stitching]



The [3D image stitching] menu appears.



3 Click [Z set] and set the height range and pitch of the Z stage.

Settings of the height range and the pitch are the same as those of the auto image stitching.

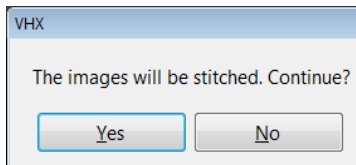
📖 "Setting Auto Rec" (Page 5-6)

4 To specify the format of images to be stitched, select from [Image format].

5 Click [Capture].

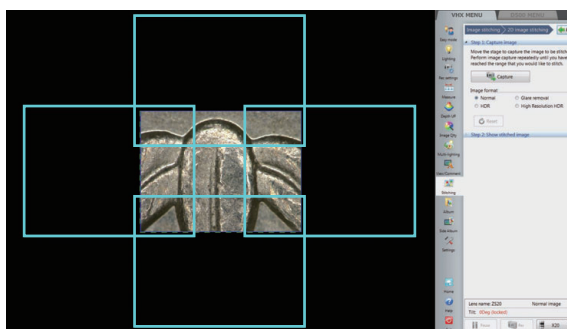
The microscope starts capturing depth composed images.

When the images have been captured, a confirmation dialog will appear.



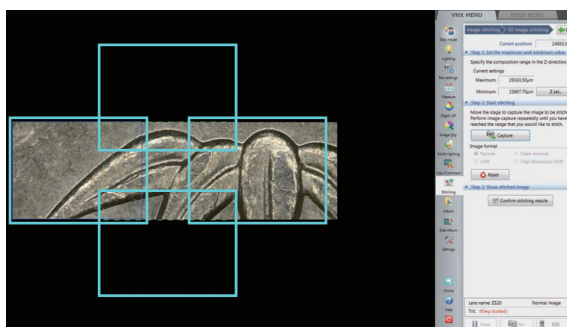
6 Click [Yes].

The stitched image appears.



7 Move the object horizontally and click [Capture].

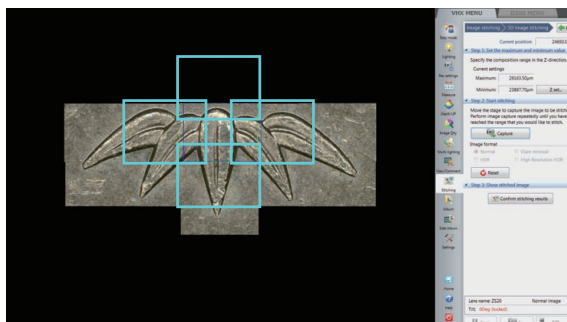
! Point If the color of the image appears reversed, stitching failed. Move the object back to the original position and capture the image again.



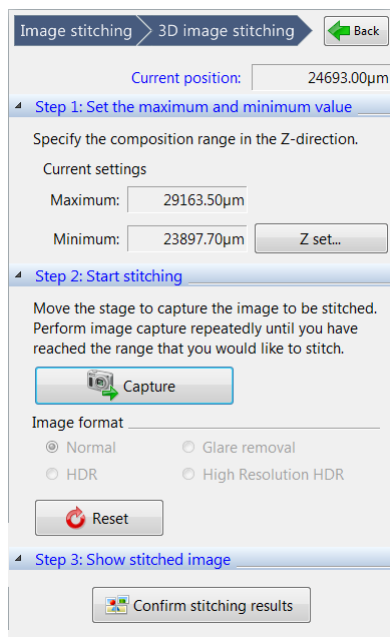
8 Repeat steps 6 to 7 until the desired area is stitched.

To start over from the beginning, click [Reset].

! Point If the stitched image exceeds 20000 pixels, an error message will appear.

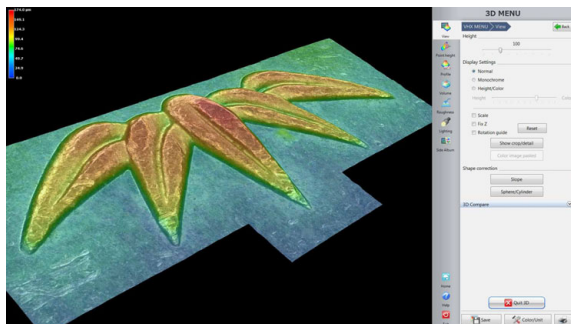


9 Click [Confirm stitching results].



When the image stitching is complete, the stitched image appears.

10 Select [3D Display] or [Show Depth Comp].



The [3D view] (Page 10-15) or [Depth Composition] (Page 10-3) appears.

Reference If a depth composition image was shown, the [Wide view] dialog box will be displayed.
 [Wide-view] (Page 5-9)

Split recording

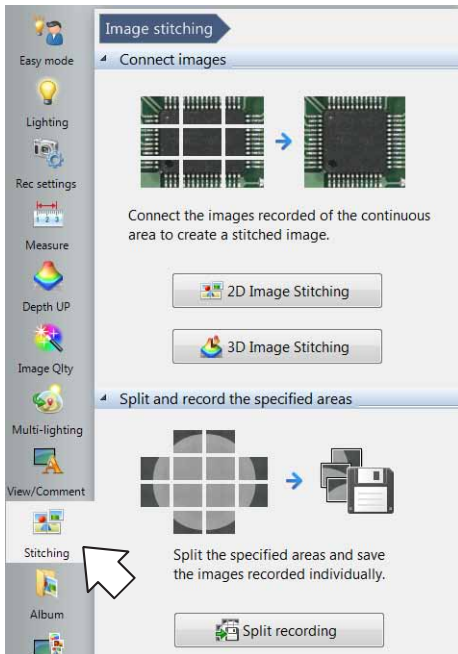
This function saves image data in each field of view in batch before stitching.

The recorded results can also be used as images for contamination analysis.

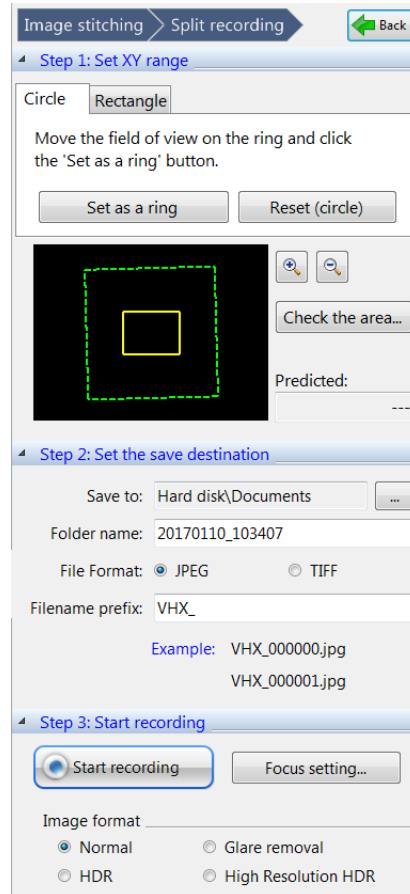
Splitting and saving original image before stitching

1 Click [VHX MENU], and then [Stitching].

The [Image stitching] menu appears.

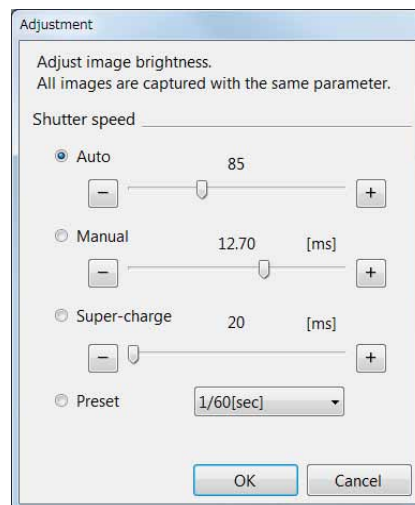


2 Click [Split recording].



3 Adjusts the image brightness with the [Adjust image] dialog box.

During the split recording, the brightness is fixed to the value specified here.

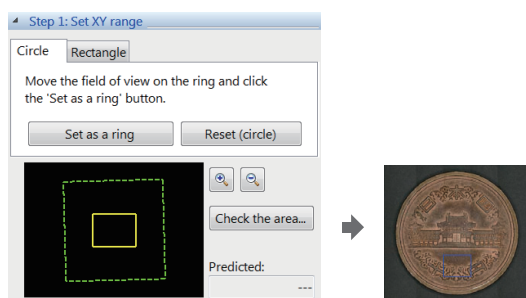


4 Select the method for Split recording.

Circle

To record a circular object, move to points on the circle and click [Set as a ring].

A circular area including the three or more points is the recording area.



Rectangle

An area specified by end points is the recording area.

5 Specify the destination folder.

Enter the destination folder in [Folder name].

The text line entered in [Filename prefix] is added to file names after stitching.

The file names of resulting images are the same as those of the auto recording.

"Setting Auto Rec" (Page 5-6)

6 Start stitching.

Select one from among Normal, Glare elimination, HDR, and High Resolution HDR for the image type, as required.

Click [Start stitching].

Reference The split recording specifies exposure conditions at the center position of the specified area and records all areas with these same exposure conditions.

11

Stitching Images

Chapter 12

Printing and Saving to a CD/DVD

Printing Images, Saving to a CD/DVD

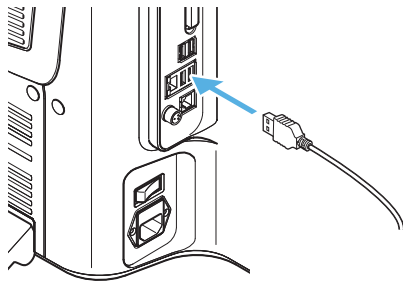
Printers	Page 12-2
Connecting the Printer.....	Page 12-2
Print Settings	Page 12-2
Printing	Page 12-3
Page Setup	Page 12-3
Saving to a CD/DVD.....	Page 12-4
Formatting a CD/DVD	Page 12-4
Writing Procedures	Page 12-5

Printers

Observed images can be printed directly, while recorded (saved) images can be selected for printing by using the album function.

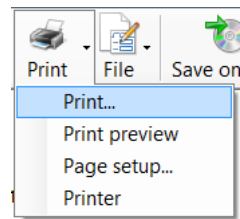
Connecting the Printer

- 1 Connect USB cable to the printer and the USB port on the microscope.



Print Settings

- 1 Click [Print] on the menu in the Album (Page 6-2). The menu appears.

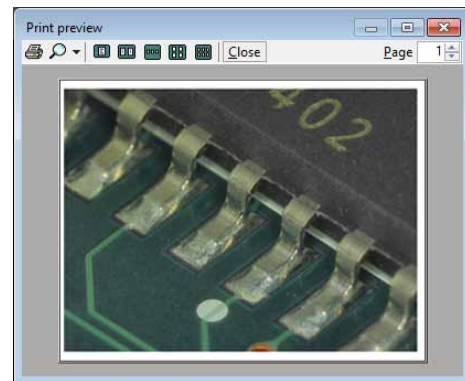


Print

The [Print] dialog (Page 12-3) appears.

Print preview

The [Print preview] dialog appears. This allows you to preview the printed image.



Page setup

The [Page Setup] dialog (Page 12-3) appears.

Printers

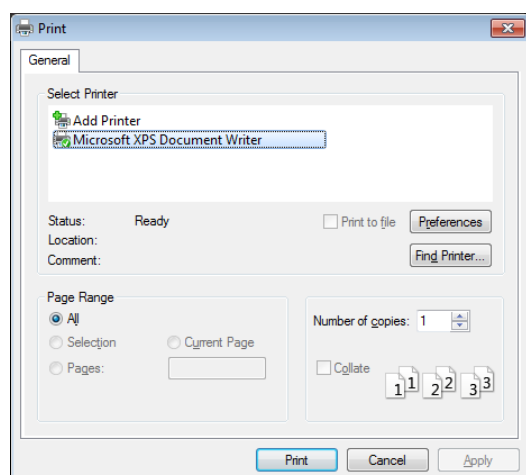
The available printers are displayed.

Select the printer to use. Normally, no changes are necessary.

Printing

1 Specify the number of copies and click [Print].

This prints the image.



Page Setup

Specify the paper size, orientation, and other settings.

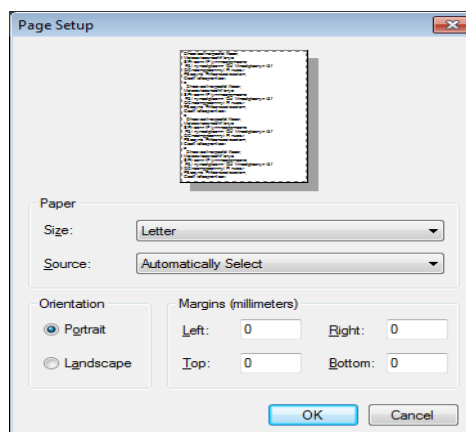
Paper size

Select S or L according to the paper size set on the printer.

Page orientation

Select landscape when printing images recorded on this microscope.

If portrait is selected, the image will be reduced to fit within the width of the paper.



Saving to a CD/DVD

Formatting a CD/DVD

Format the disk using the live file system.

The live file system allows you to write files by simply pasting them on the DVD drive.

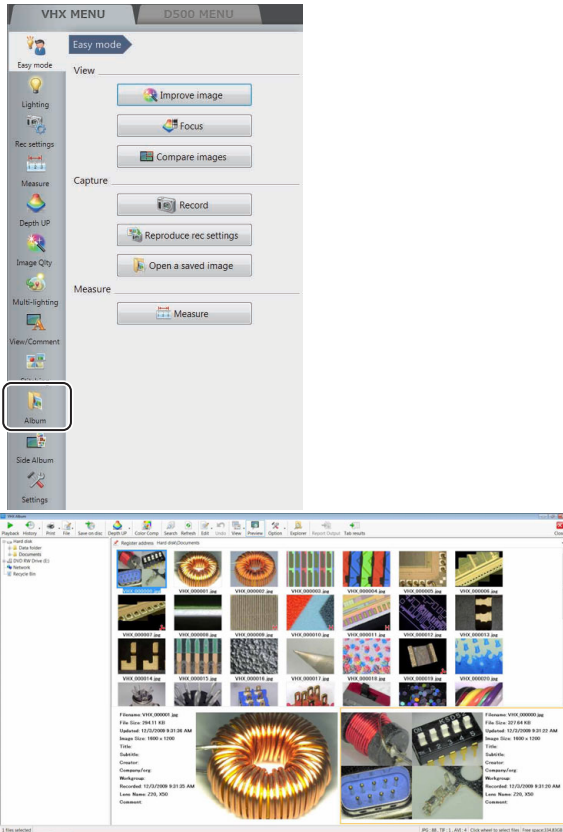
Disks formatted using the live file system can be browsed in Windows XP and later operating systems.

To create a CD/DVD that can be read on any personal computer, specify master format (Page 12-4).

1 Place a blank CD/DVD in the DVD drive.

2 Click [Album] from the [VHX MENU].

This brings up the Album.

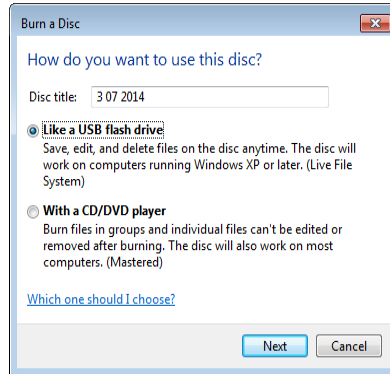


3 Click [Save on disc] on the menu bar.



The [Burn a Disc] dialog appears.

4 Enter a title in the [Title] box and click [Next].



Formatting begins.

When formatting completes, the [Burn a Disc] dialog closes.

Formatting for maximum compatibility (master format)

This procedure formats the disk using master format.

1 Place a blank CD/DVD in the DVD drive.

2 Click [Album] from the [VHX MENU].

This brings up the Album.

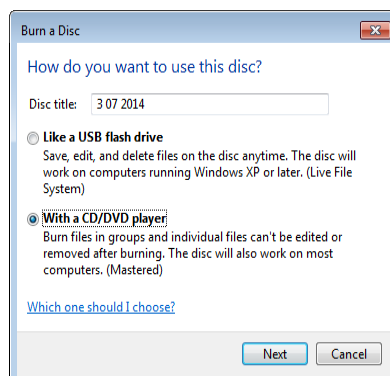
3 Click [Save on disc] on the menu bar.

The [Burn a Disc] dialog appears.

4 Enter a title in the [Disc title] box, select [With a CD/DVD player], and click [Next].

Formatting begins.

When formatting completes, the [Burn a Disc] dialog closes.

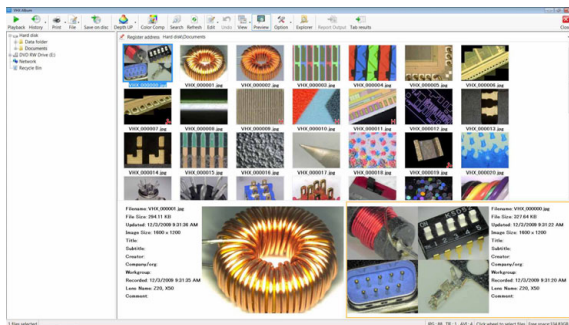
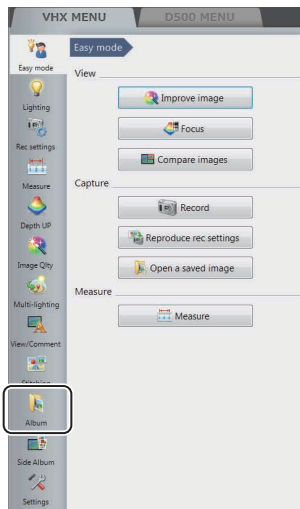


Writing Procedures

To use a blank CD/DVD, format it as described on (Page 12-4).

1 Place a CD/DVD in the DVD drive.

2 Click [Album] from the [VHX MENU].



3 Select the image file or folder to write.

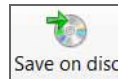
To select more than one file, hold the Ctrl key on the keyboard while clicking the desired files, or press the wheel button to select each file.

4 Click [Edit] from the menu bar and select [Copy].

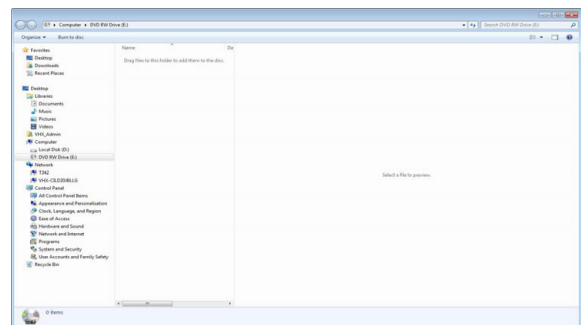
Reference

This command can also be selected from the pop-up menu shown by right-clicking on the selected files or folder to write to.

5 Click [Save on disc] from the menu bar.



The Explorer is launched and the DVD drive appears.



From the menu bar item [Organize], select [Paste].

The files and folder copied from the album will be written to the CD/DVD.

! Point

If the CD/DVD was formatted using the master format, the [Burn to disc] button will appear on the menu bar. Paste the files and click [Burn to disc].

Chapter 13

Configuring the Operating Environment

Option Settings

This chapter explains how to configure the operating environment and network communication settings.

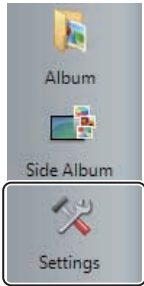
Settings	Page 13-2
Displaying the Settings Menu	Page 13-2
Network/Security Settings	Page 13-2
Lens Settings	Page 13-14
Calibration Setup	Page 13-14
User Setup	Page 13-14
Show Software Keyboard	Page 13-16
System Initialization	Page 13-16
Initializing Automatic XY Stage	Page 13-17
Camera mount settings	Page 13-17
ZST vision misalignment correction	Page 13-18
Optical axis misalignment correction	Page 13-20
D500 Maintenance	Page 13-22
Options	Page 13-22
Version Info	Page 13-24

Settings

Configuring the microscope's operating environment.

Displaying the Settings Menu

1 Click [Settings] from the VHX MENU.



Network/Security Settings

The microscope has been set with protection enabled to prevent changes from being made to the internal system. This protection must be disabled to configure the system for connecting external devices, network settings, etc.

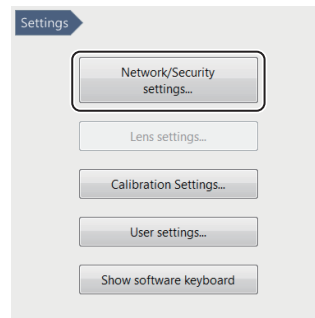
Temporarily disabling system protection

Point The following items can be configured or installed by temporarily disabling the system's protection. Operation of the microscope is not guaranteed if any other settings or installations are made.

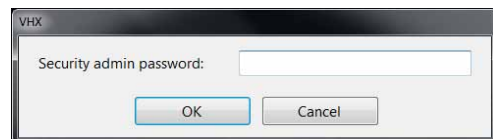
- (1) FTP and share folder settings
- (2) Network settings (IP address settings)
- (3) Printer driver installation
- (4) Language, country and region settings

1 Click [Network/Security Settings...] on the Settings menu.

The security administration password input dialog appears.

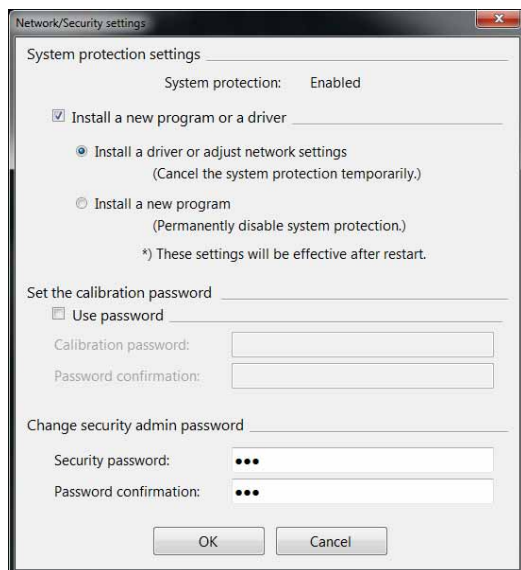


2 Enter the password and click [OK].



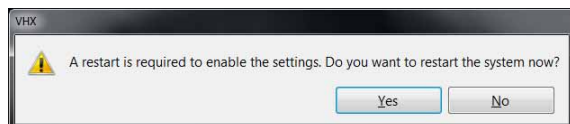
The password is preset to "VHX" (half-width characters all caps) at the time of shipping.

The Network/Security settings dialog appears.



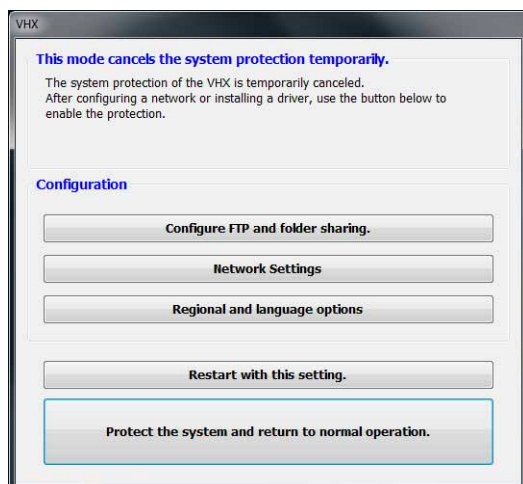
- 3 Check the [Install a new program or a driver] option, and select [Install a driver or adjust network settings], and click [OK].

You will be prompted to restart the system.



- 4 Click [Yes].

The system will start up with the system protection temporarily disabled and the following dialog will appear: "This mode cancels the system protection temporarily".

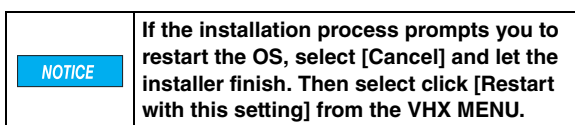


Installing drivers

- 1 Temporarily disable system protection.

Refer to the procedures to temporarily disable system protection (Page 13-2).

- 2 Install the driver as documented in the manual for the external device you wish to install.



- 3 When the installation completes, click [Protect the system and return to normal operation.].

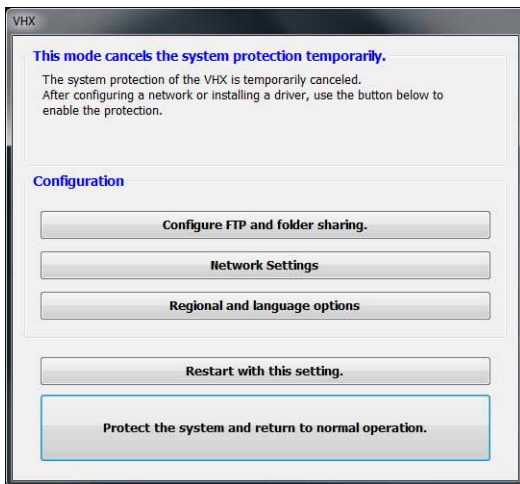
The microscope will restart.

Configuring FTP and file-sharing

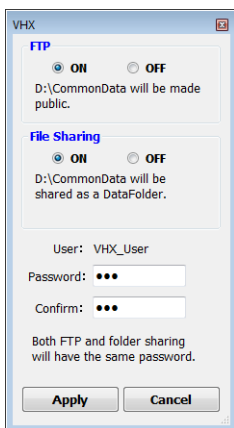
Point Password entry is required to use the FTP and file-sharing features.

Reference The following folders are used by the FTP server and for network sharing.
FTP server: D:\CommonData will be made public.
File sharing: D:\CommonData will be shared as the data folder.

- 1 Temporarily disable system protection.**
Refer to the procedures to temporarily disable system protection (Page 13-2).



- 2 Click [Configure FTP and folder sharing].**
The [FTP] and [File Sharing] settings dialog appears.



Point The user name cannot be changed.

- 3 Select the ON/OFF options as desired for FTP and file sharing.**
- 4 Specify a password for FTP and file sharing, as necessary.**
Passwords are case-sensitive. This password is necessary to connect to the microscope. Be sure to record it and store it in a safe place.
- Point** The network settings (Page 13-5) must be configured in order to use the FTP server.
- 5 Click [Protect the system and return to normal operation.].**
The system restarts.
- 6 Access the microscope from a PC using the FTP server and/or file sharing.**

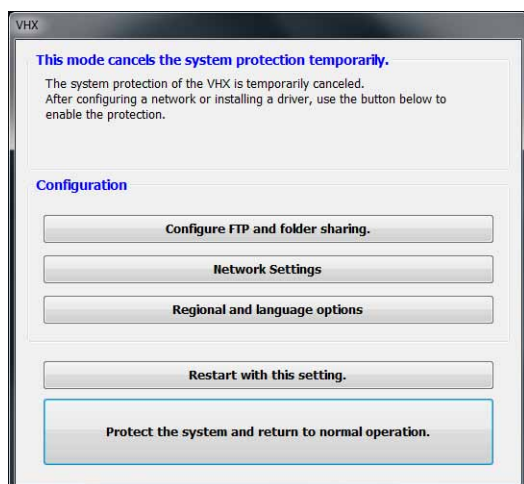
Configuring the network

Point

- Before connecting the microscope to an internal LAN, ask your system administrator to assign an IP address to the microscope, and to provide you with the subnet mask and default gateway address. Using incorrect or illegal settings will cause communications to fail and may interfere with your LAN.
- To connect the microscope to a PC in a peer-to-peer connection, use a crossed cable and assign IP addresses between 192.168.0.1 and 192.168.0.254 under IPv4. For example, set the microscope's IP address to 192.168.0.1, and the PC to 192.168.0.2, and set the subnet mask to 255.255.255.0.
- Use a category 5 or higher LAN cable if using a 10BASE-T/100BASE-TX connection, or category 5e or higher LAN cable for a 100BASE-T connection.
- In order to network the system through a domain, the system protection must be disabled permanently. See "Completely disabling system protection" (Page 13-6). The system will be added to the domain as a standard PC. Note that the microscope capabilities of the system will only be accessible from the master log in provided in the "Completely disabling system protection" section.

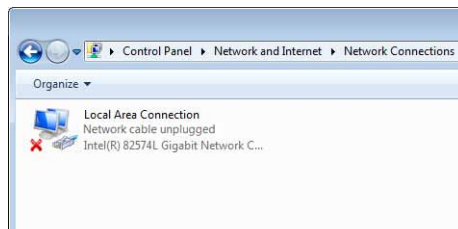
1 Temporarily disable system protection.

Refer to the procedures to temporarily disable system protection (Page 13-2).

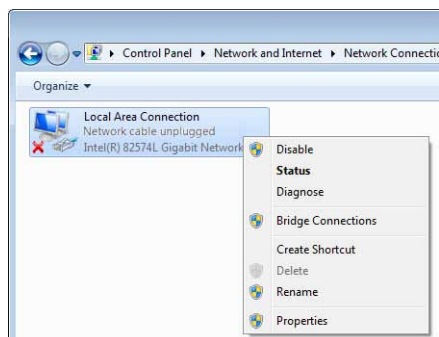


2 Click [Network Settings].

The [Network Connection] dialog box appears.

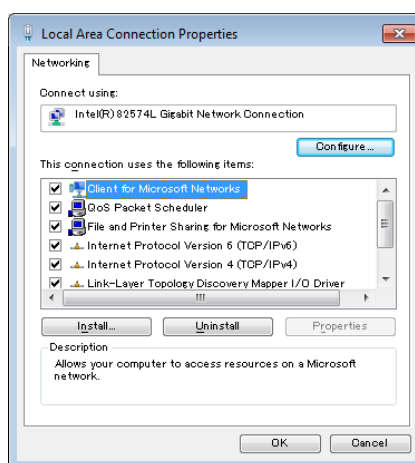


3 Right-click [Local Area Connection] and select [Properties].



The [Local Area Connection Properties] dialog box appears.

4 Select [Internet Protocol Version 4 (TCP/IPv4)], and click [Properties].



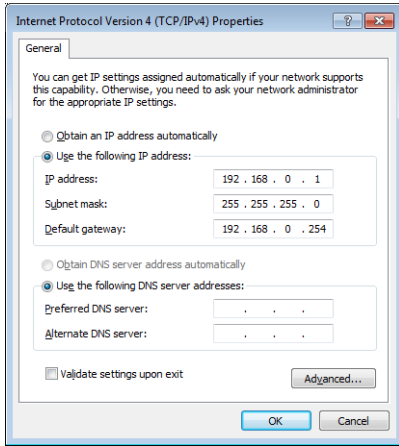
This displays the [Internet protocol version 4 (TCP/IPv4)] properties.

Reference

TCP/IPv4 is explained below as example.

- For a peer-to-peer connection, select [Internet protocol version 4 (TCP/IPv4)].
- If TCP/IPv6 has been specified when the microscope is connected to an internal LAN, select [Internet protocol version 6 (TCP/IPv6)].

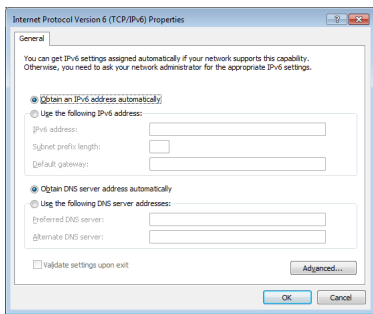
5 Specify the IP address, subnet mask, and default gateway, and click [OK].



	LAN connection	Peer-to-peer connection example
IP address		192.168.0.1
Subnet mask	Specify the value provided by your system administrator.	255.255.255.0
Default gateway		Not used

For a peer-to-peer connection, set the PC's IP address to 192.168.0.2, and the subnet mask to 255.255.255.0.

Reference When using TCP/IPv6, the following window appears. For the details of setting contents, ask your system administrator.



6 Close the [Local Area Connection Properties] and [Network Connection] dialogs.

7 Click [Protect the system and return to normal operation.].

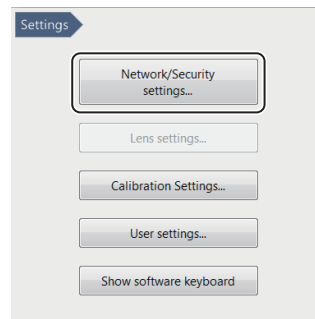
The microscope will restart.

Completely disabling system protection

To install applications that run on Windows7, it is necessary to disable system protection completely. This must be done when networking the system through a domain.

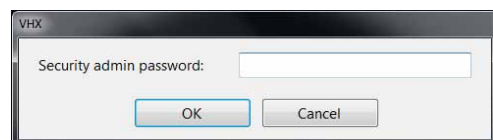
NOTICE	<p>Once system protection is disabled, the system cannot be returned to a protected state. This means that system files will no longer be write-protected. Be sure to install commercially available virus protection software. Connecting to a network or inserting an external memory device without virus protection software installed increases the risk of infection. Some applications may affect the VHX software and cause malfunctions. Users are responsible for verifying the operation of such applications, and shall use them at their own risk. Software installation and changes made to an unprotected VHX are outside of the software warranty. The user is responsible when using an unprotected system. Third-party software can not be supported by Keyence.</p>
---------------	---

1 Click [Network/Security Settings...] on the Settings menu.



The security administration password input dialog appears.

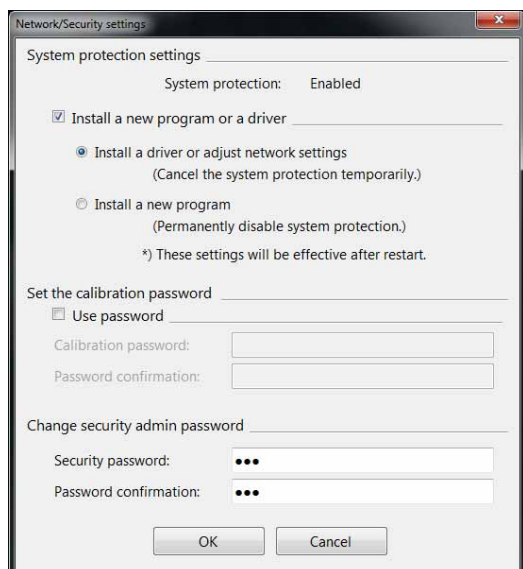
2 Enter the password and click [OK].



The password is preset to "VHX" (half-width characters all caps) at the time of shipping.

The Network/Security settings dialog appears.

- 3** Check the [Install a new program or driver] option, and select [Install a new program], and click [OK].

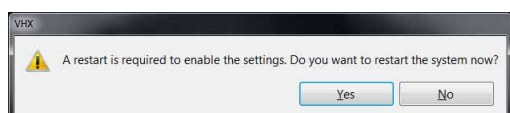


The following dialog appears.



- 4** Click [Confirmation]

You will be prompted to restart the system.



- 5** Click [Yes].

The system will restart and a confirmation dialog for disabling the system protection will appear.

- 6** Read the warning on the dialog carefully. If you accept the risks, check the checkbox and click [Yes].



The system will restart with the system protection disabled.

NOTICE

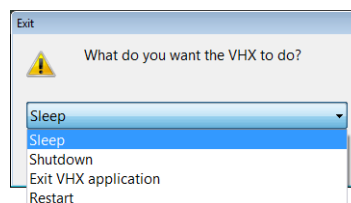
The system will restart several times. Do not turn the main power off during this time.

- 7** Install the application as necessary.

Reference

The following menu will change when system protection is completely disabled.

- You can now choose to exit only the VHX application by clicking [Exit] from the VHX MENU.



- The IP address, FTP, and share folder settings should be configured using the functions provided with Windows7. These functions are accessed by clicking [Exit] from the VHX MENU and selecting [Exit VHX application].

Point

If the system protection is disabled completely, the system may prompt you for the ID and password when the VHX-6000 starts up. If prompted, enter the ID and password shown below. The below credentials to be used for the master domain log in if networking through a domain.

ID: VHX_Admin
Pass: VHXADMIN

Setting the calibration password

A password can be set in order to set or change the calibration.

Click [OK] and restart the microscope to make this setting take effect.

- Point**
- Once you set the calibration password, you will need to enter it in order to change the calibration settings.
 - Record and store the calibration password in a safe place.

Changing the security administration password

Specify a password to allow installation of a driver or to configure network settings and communication software settings.

Click [OK] and restart the microscope to make this setting take effect.

- Point**
- Once you set the security administration password, you will need to enter it in order to change the Network/Security Settings.
 - Record and store the security administration password in a safe place.

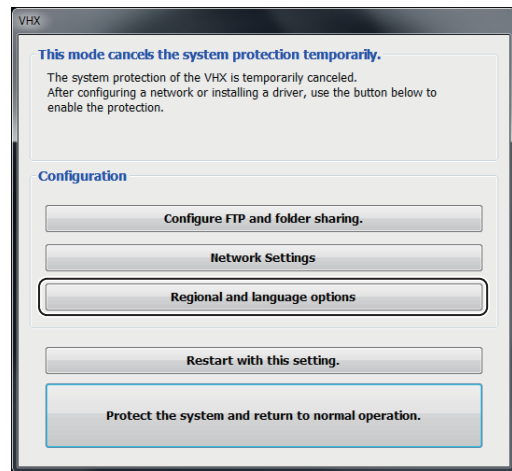
Changing the display language

■ Changing the language

The language used on the microscope can be switched to Japanese or German.

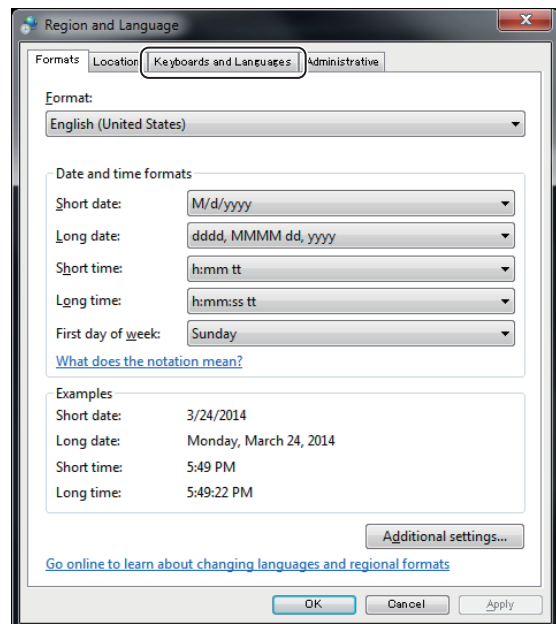
1 Temporarily disable system protection.

Refer to the procedures to temporarily disable system protection (Page 13-2).



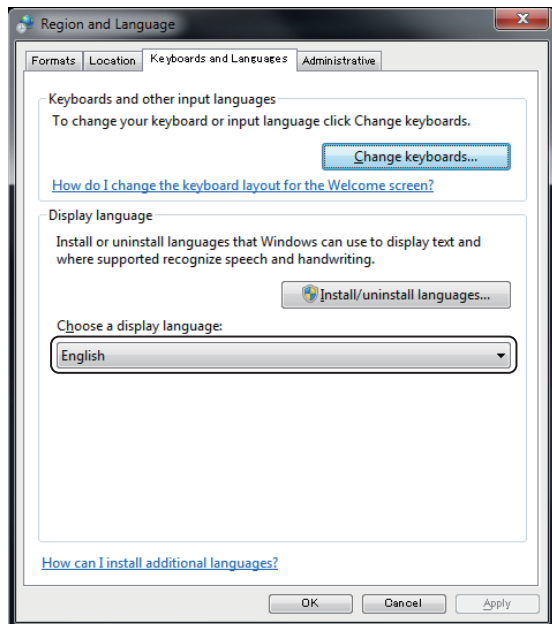
2 Click the [Regional and language options].

The [Region and Language] dialog appears.



3 Click the [Keyboards and Languages] tab.

The following dialog appears.



4 Select the list box under [Choose a display language:].

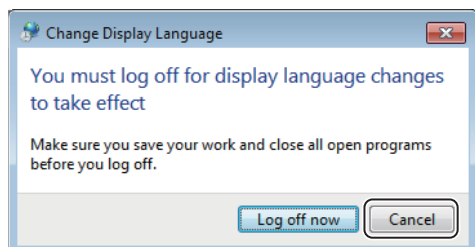
- Select [Japanese] for Japanese.
- Select [Deutsch] for German.

After making your selection, do not click [OK]. Instead, click the [Administrative] tab to the right of the [Keyboards and Languages] tab.

* If you accidentally click [OK]

If you click [OK], a dialog prompting you to log off will appear.

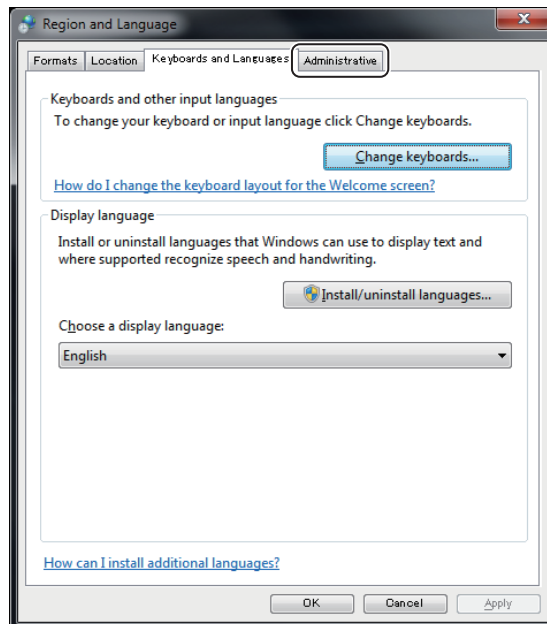
Click [Cancel].



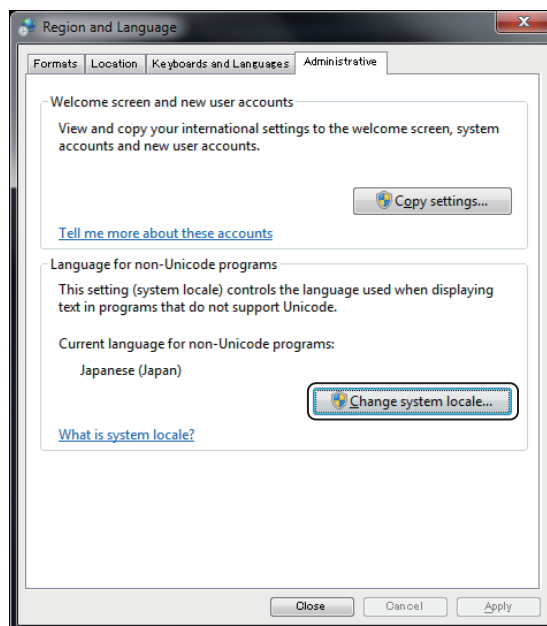
If you click cancel, the [Region and language] dialog will close.

Click [Regional and language options] to bring up the [Region and language] dialog. Return to step 1.

5 Click the [Administrative] tab at the top of the window.

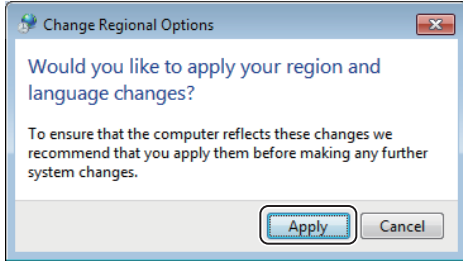


The following screen appears.



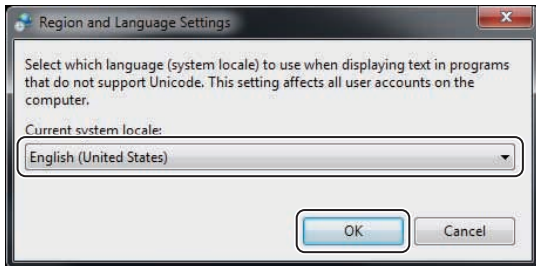
6 Click [Change system locale...].

The [Change Regional Options] dialog appears.



7 Click [Apply].

The following dialog appears.

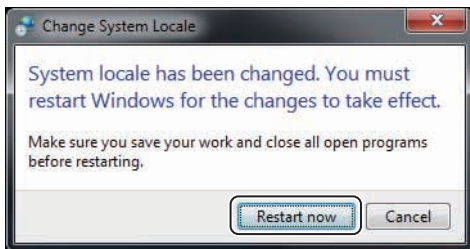


8 Select the list box under [Current system locale:].

- Select [Japanese (Japan)] for Japan.
- Select [Deutsch (Deutschland)] for German.

Then, click [OK].

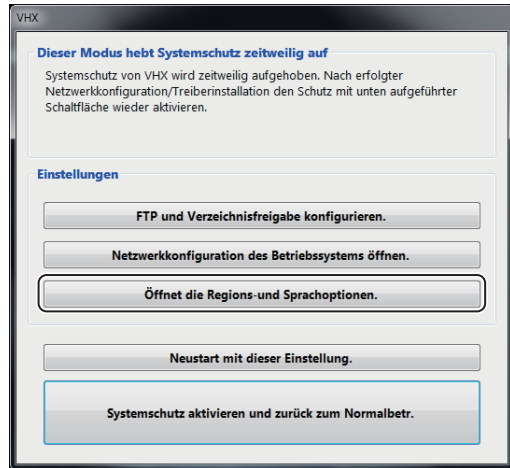
The [Change System Locale] dialog appears.



9 Click [Restart now].

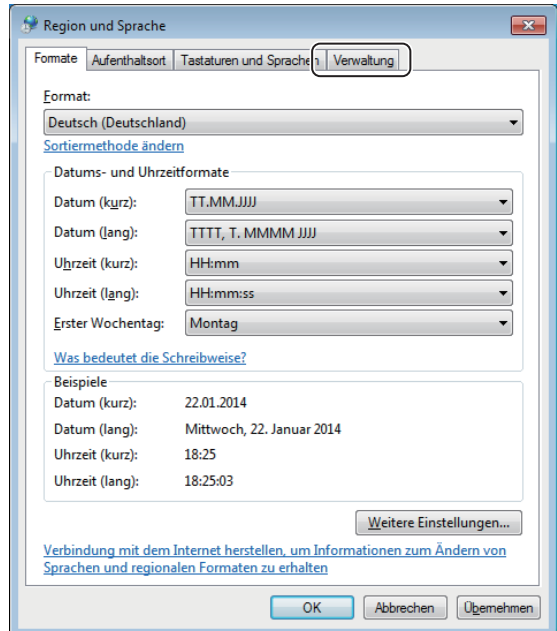
After restarting, the system will be displayed in the selected language.

The rest of this explanation assumes you have selected German.



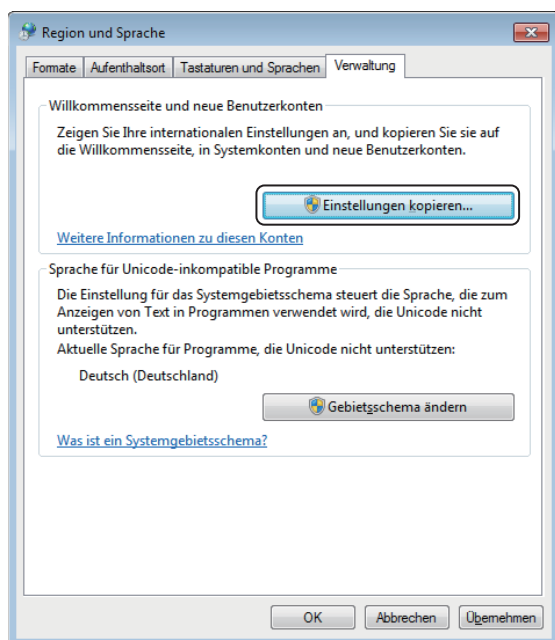
10 Click [Regional and language options] (shown as [Öffnet die Regions- und Sprachoptionen.] in German).

The region and language dialog appears.



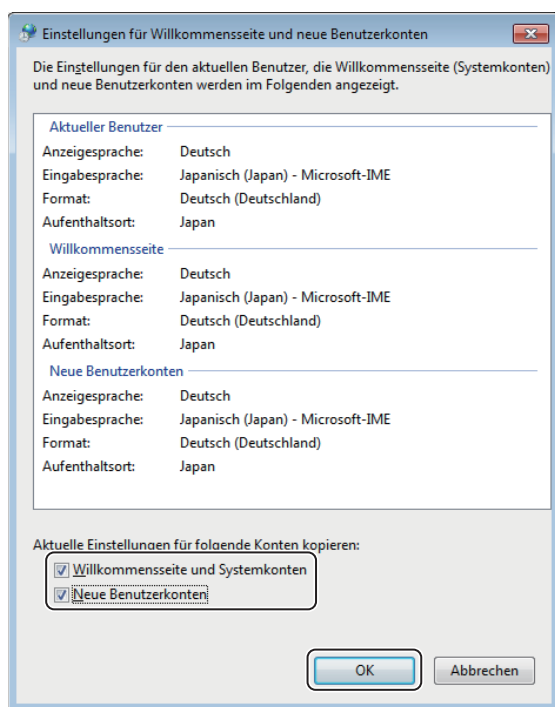
- 11** Click the [Administrative] tab (shown as [Verwaltung] in German).

The following screen appears.



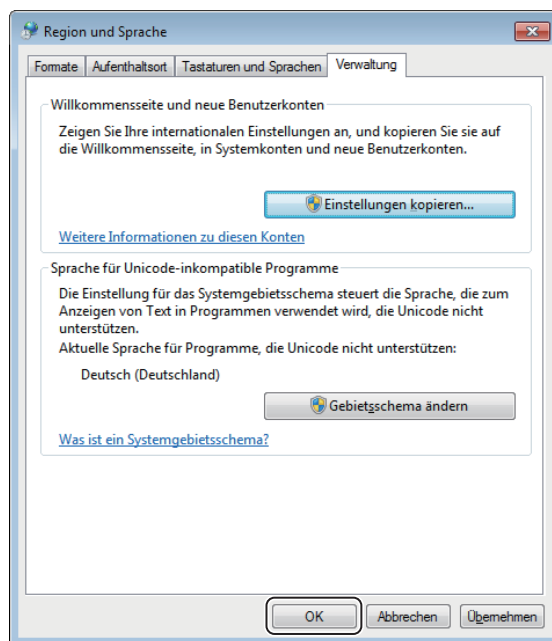
- 12** Click the [Copy settings...], (shown as [Einstellungen kopieren...] in German).

The following dialog appears.



- 13** Check the [Welcome screen and system accounts] (shown as [Willkommensseite und Systemkonten] in German) and [New user accounts] (shown as [Neue Benutzerkonten] in German) options and click [OK].

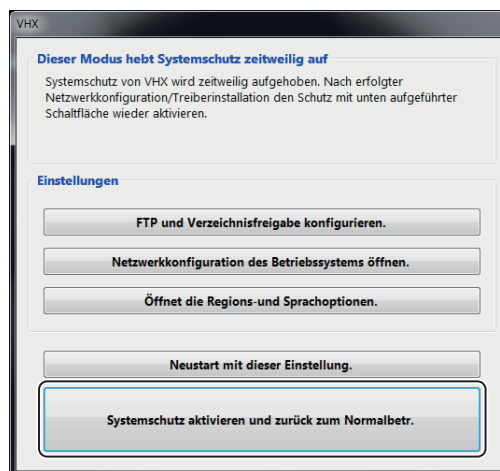
This returns you to the [Region and Language] dialog.



- 14** Click [OK].

This will copy the settings of the accounts reserved above and complete the language settings.

- 15** Click the [Protect the system and return to normal operation.] on the dialog (shown as [Systemschutz aktivieren und zurück zum Normalbetr.] in German).



The system will return to normal operation state from unprotected state and will be displayed in the selected language.

■ **Settings to be changed as needed**

- Changing the keyboard layout to Japanese or German.
- Changing the currency symbol and date display format to Japanese or German.

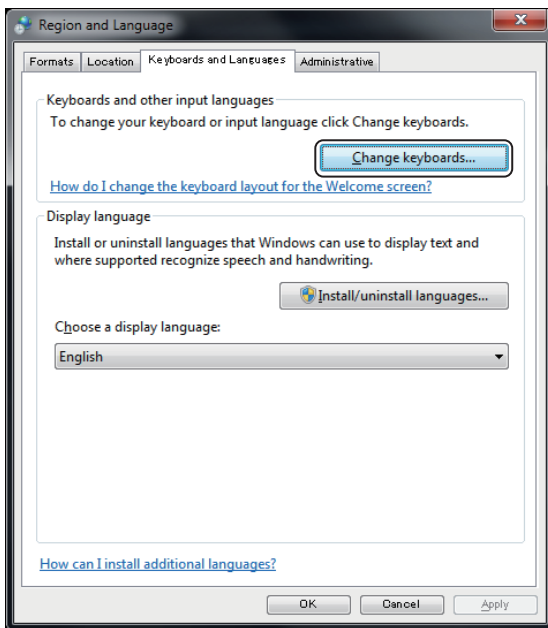
The rest of this explanation assumes you are changing from English.

Important These settings must be configured with the system protection disabled in order to save the settings.

To change the keyboard layout to Japanese or German, change the keyboard language.

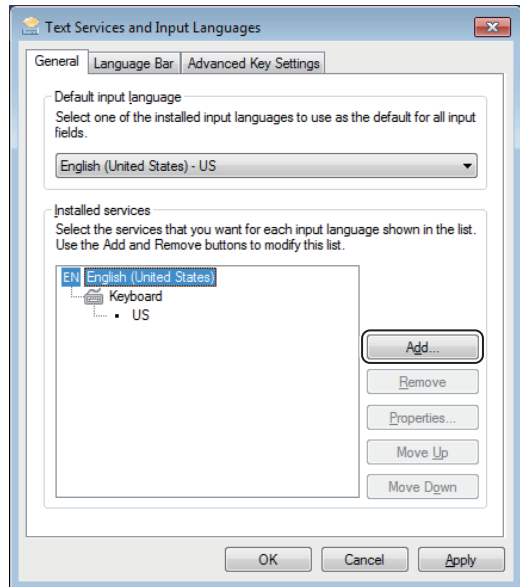
1 On the [Region and Language] dialog, select the [Keyboards and Languages] tab.

The following screen appears.



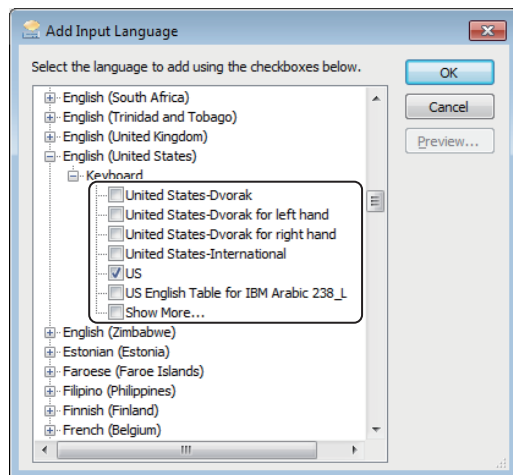
2 Click the [Change keyboards].

The [Text Services and Input Languages] dialog appears.



3 Click [Add].

The [Add Input Language] dialog appears.

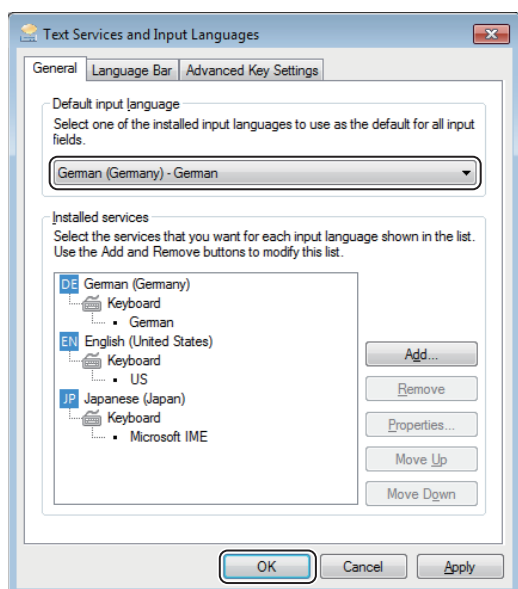


4 Place a check at the language you want to change to.

- To use a German keyboard, place a check in the [German (Germany) - Keyboard - German] checkbox.
- To use a Japanese keyboard, place a check in the [Japanese (Japan) - Keyboard - Microsoft IME] checkbox.

5 After checking the languages, click [OK].

The system returns to the [Text Services and Input Language] dialog.



6 Select the language in the list box under [Default input language] and click [OK].

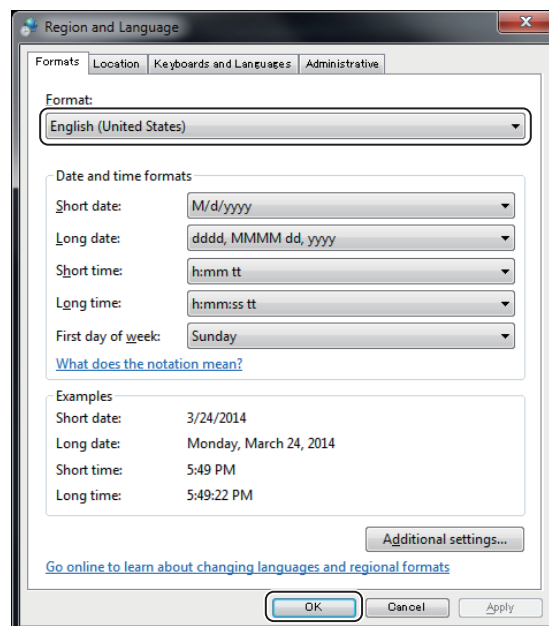
The changes are reflected and the dialog box closes.

- Select [German (Germany) - German] for German.
- Select [Japanese (Japan) - Microsoft IME] for Japanese.

To change the display format of the currency and dates, configure the following option.

1 On the [Region and Language] dialog, select the [Formats] tab.

The following dialog appears.



2 Select the desired language from the [Format:] list and click [OK].

The changes are reflected and the dialog box closes.

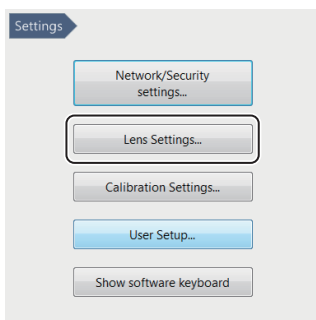
- Select [German (Germany)] for German.
- Select [Japanese (Japan)] for Japanese.

Lens Settings

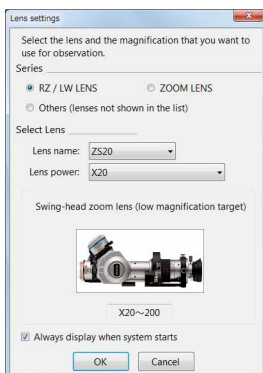
Specify the type of lens to attach to the microscope. The microscope stores the calibration value (Page 9-6), and push set value for white balance (Page 4-5) for each lens. This saves you from adjusting these settings each time you change the lens. Simply select the lens to use from the lens settings.

Reference The lens type and power is automatically recognized when a lens that supports the automatic lens/zoom recognition function is attached. These lenses do not require any lens setting.

- 1 Click [Settings], and then [Lens Settings...].
The [Lens Setting] dialog appears.



- 2 Select the lens to use and click [OK].



If the list does not include the model number for your lens, select Optional Lens 1/Optional Lens 2.

Display every time when the system started up (Default: ON)

The lens selection screen appears when the application starts up.

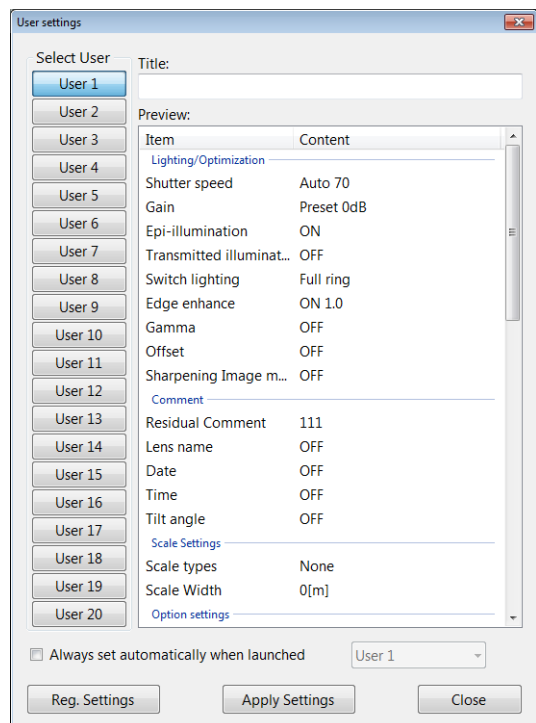
Calibration Setup

☞ "Calibration" (Page 9-6)

User Setup

This microscope can store the setup (camera, recording, and options) for each user.

Up to 20 user setups can be registered and recalled.

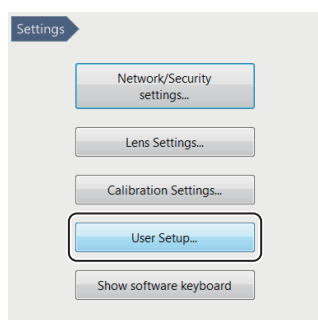


Registering a user setup

Point The user setup function registers the current settings of the microscope. Adjust each function on the microscope beforehand, then register the settings.

1 Click [User Settings] on the Settings menu.

The [User Settings] dialog appears.



2 Select the [Select User] to register under.

3 Specify a title, such as the observation name or observer's name for later reference.

4 Click [Reg. Settings].

This registers the current settings.

The following items will be registered.

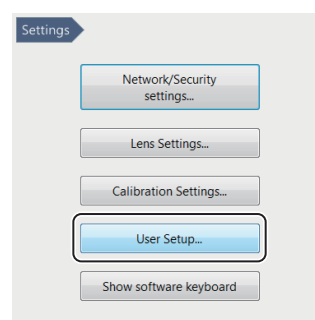
Lighting/Optimization	Shutter speed
	Gain
	Epi-illumination
	Transmitted illumination
	Switch lighting
	Edge enhance
	Gamma
	Offset
	Sharpening Image mode
Comments	Residual Comment
	Lens name
	Date
	Time
	Tilt angle
	Magnification
Scale Settings	Scale types
	Scale Width
Option settings	Sound function
	JPEG Compress
	Power button
Lens settings	Lens power

Rec settings	White balance
	Auto rec folder
	Auto rec image format
	Auto rec name prefix
	Auto Rec mode
	Vision correction
D500:Observation	FOCUS
	Stigmator
	Brightness
	Lens power
	Low-power mode
	Lens power interlock
	Observation mode
	High-speed frame rate
	Average
	Edge enhance
	Gamma
D500:Lens settings	Lens power
D500:Rec Settings	Rec. scanning
	Multi Save name prefix
D500:Option settings	Tracking

Recalling a user setup

1 Click [User Settings] on the Settings menu.

The [User Settings] dialog appears.



2 Select the [User Settings] and click [Apply Settings].

The loaded settings are reflected on the observation window.

Show Software Keyboard

This function displays an on-screen keyboard for entering text such as filenames.

To show the keyboard, click [Show software keyboard] on the options menu.

To close the software keyboard, click the red X in the upper right. The keyboard will remain on screen until it is closed.



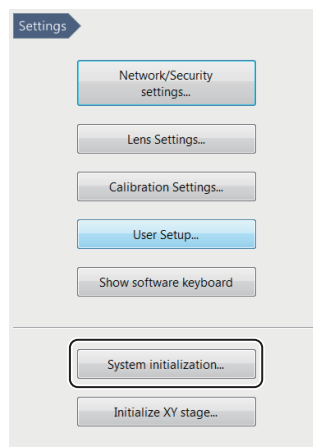
System Initialization

Initialization resets the settings for each function from the VHX MENU to the factory defaults.

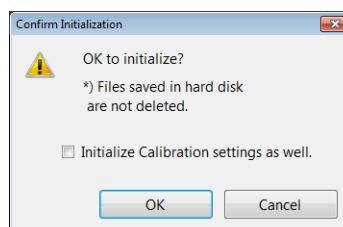
It will also initialize all user setups at [User Settings].

1 Click [Initialize] on the options menu.

The [Confirm Initialization] dialog appears.



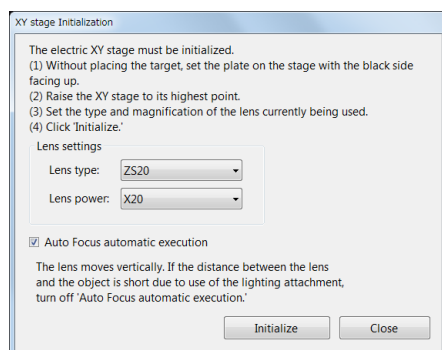
To reset the calibration values to the factory settings, check the [Initialize Calibration settings as well.] option.



2 Click [OK].

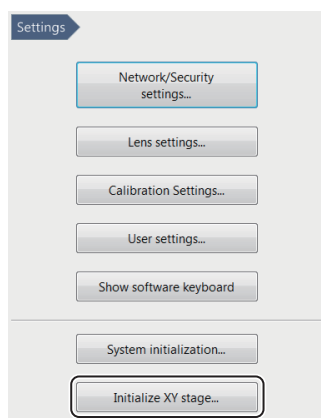
Initializing Automatic XY Stage

Performs the θ initialization of the stage.



1 Click [Initialize XY stage...] on the Settings menu.

[Initialize XY Stage] appears.



2 With the black area of circular monochrome plate facing upward, place the plate on the stage.

3 Raise the XY θ stage as far as it can move up.

4 In the [Lens Settings], specify the type and power of the lens in use.

This procedure is not required for lenses that have the automatic lens/zoom recognition function, because their types and powers are detected automatically.

5 As needed, turn on the "Auto Focus automatic execution".

6 Click [Initialize].

Then, the θ initialization starts.

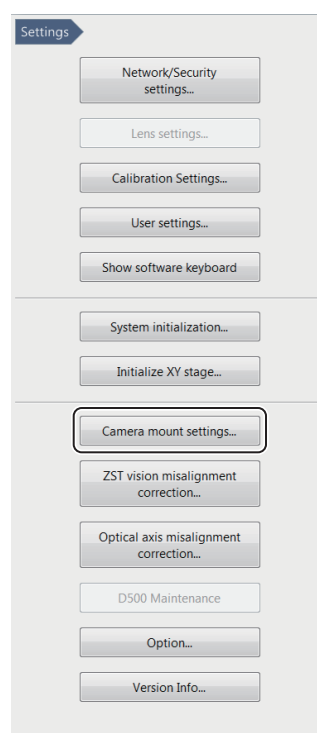
Camera mount settings

Sets the mounting position of the camera.

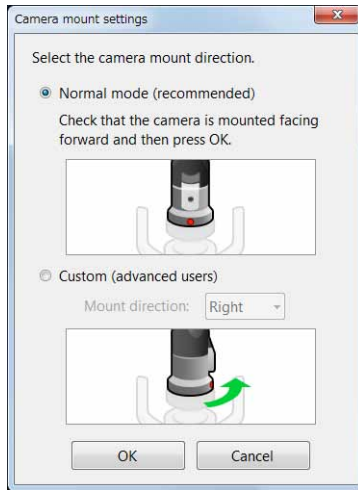
If, for example, the stage is to be tilted to the right, the mounting direction "Right" will provide more natural camera image.

1 Click [Camera mount settings...] on the Settings menu.

[Camera mount settings] opens.



2 Sets the mounting position of the camera.



Normal mode (recommended):

Check that the camera is mounted facing the front and click [OK].

Custom (advanced):

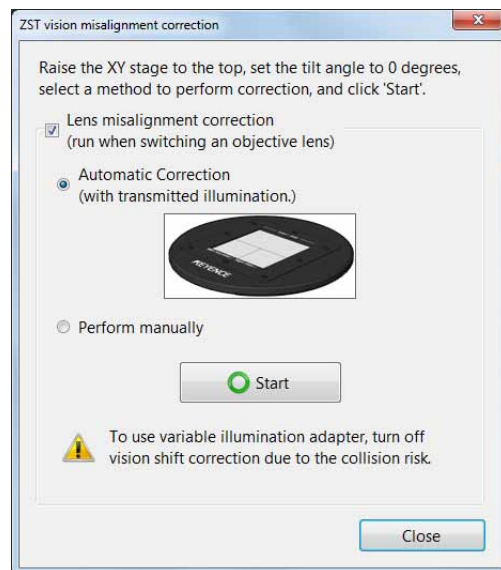
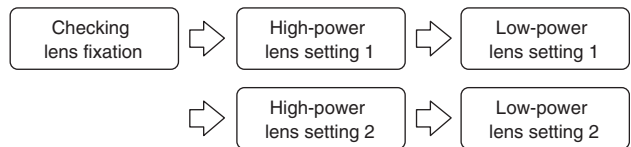
Select the tilt direction of the stand from Right or Left, mount the camera in the selected direction, and click [OK].

ZST vision misalignment correction

The stage position is corrected so that the field-of-view and focus do not change even if the objective lens is switched between low and high when the VH-ZST lens is used. This correction can be readjusted.

There are two adjustments: the automatic adjustment using a correction scale; and the manual adjustment that can use arbitrary samples. Both follow the steps below.

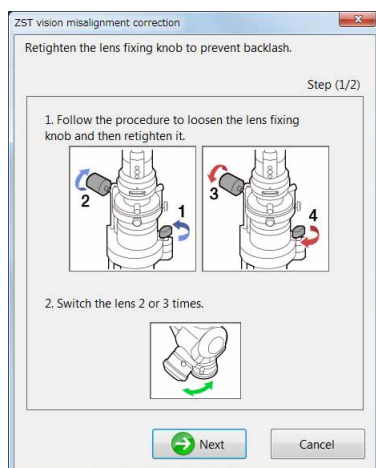
A correction value is calculated so as to provide the same field-of-view and focus for the high- and low-power lenses by multiple setting operations for the lenses.



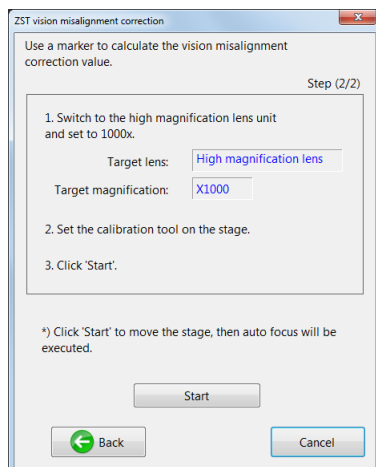
Uncheck [Lens misalignment correction (run when switching an objective lens)] if you do not want to activate the vision misalignment correction in switching the lens between high- and low-powers.

Correction using correction scale

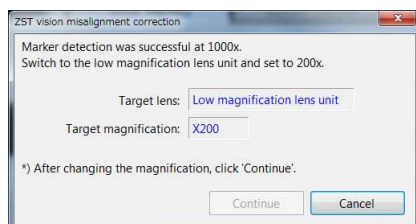
- 1 Select [Automatic Correction (with transmitted illumination.)] and click [Start].
- 2 Check the fixation of the lens.



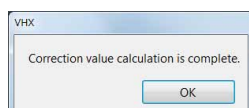
- 3 Setup the high-power lens.



- 4 Setup the low-power lens.

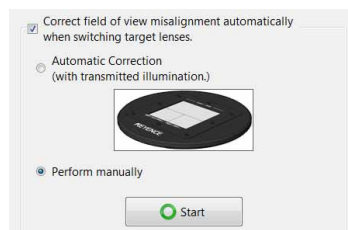


- 5 Setup the high- and low-power lenses again following the dialog.



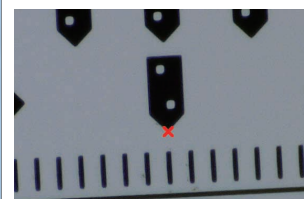
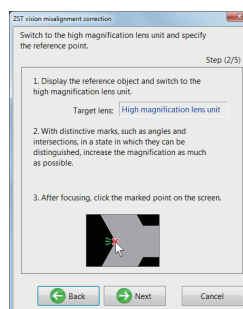
Correction using arbitrary sample

- 1 Select [Perform manually] and Click [Start].

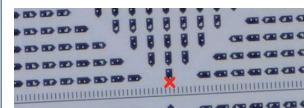
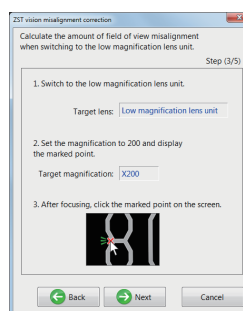


- 2 Check the fixation of the lens.

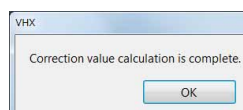
- 3 Setup the high-power lens. Click the mouse at a point having distinct features.



- 4 Setup the low-power lens. Click the mouse at the point where the mouse was clicked in the case of the high-power lens.



- 5 Setup the high- and low-power lenses again following the dialog.



Optical axis misalignment correction

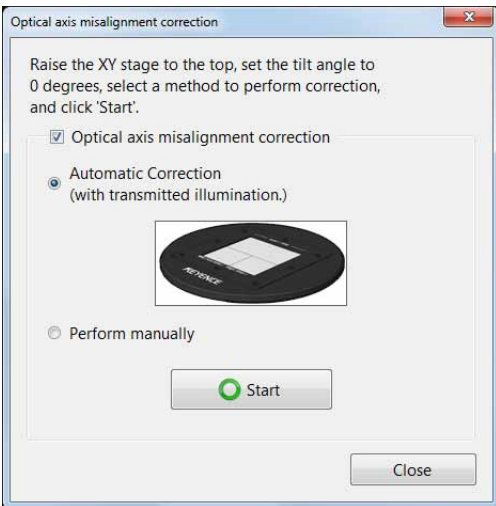
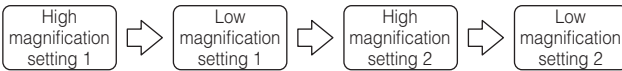
When lens power is changed, it corrects the viewing center which is shifted from the actual viewing position of the navigation image.

If the lens power is changed with the zoom ring, the center of the field-of-view moves slightly.

Correct the position on the navigation image depending on the deviation amount, match the navigation image with the viewing position you are observing.

There are two adjustments: the automatic adjustment using a correction scale; and the manual adjustment that can use arbitrary samples. Both follow the steps below.

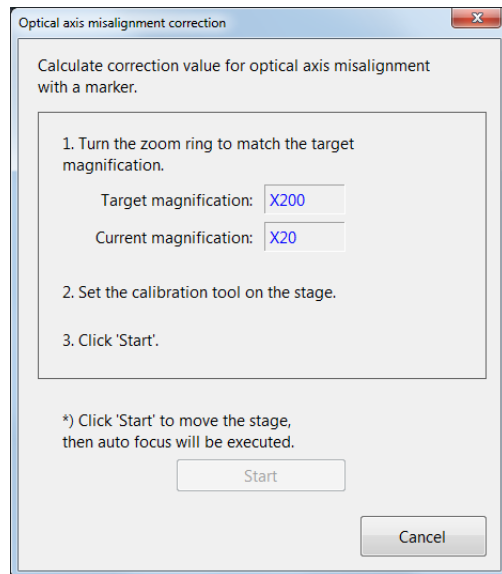
Calculate the amount of travel of the visual field due to the change in magnification since high/low magnification are set for more than one time with zoom ring.



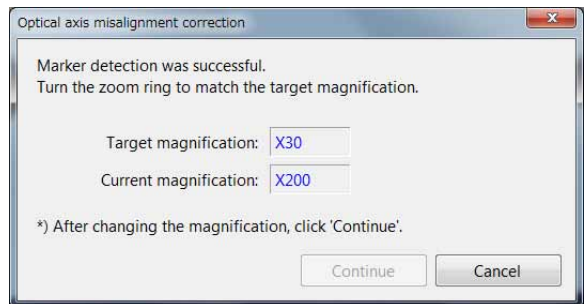
When changing the magnification, if you do not want the correction on the navigation image to work, remove the checkmark from [Optical axis misalignment correction].

Correction using correction scale

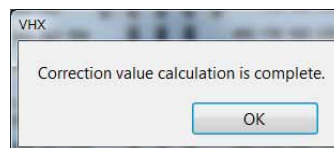
- 1 Select [Automatic Correction (with transmitted illumination.)] and click [Start].
- 2 Set high magnification. Set the lens power to the specified magnification.



- 3 Set low magnification. Set the lens power to the specified magnification.

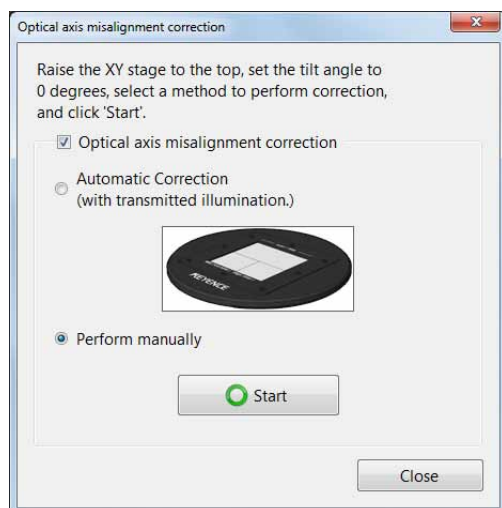


- 4 Follow the dialog, and once again set the high/low magnification.



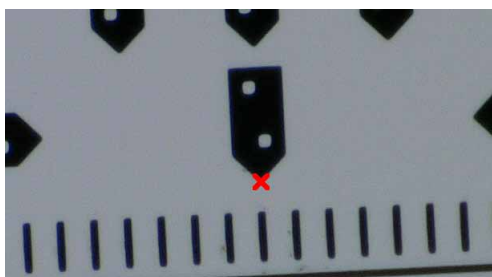
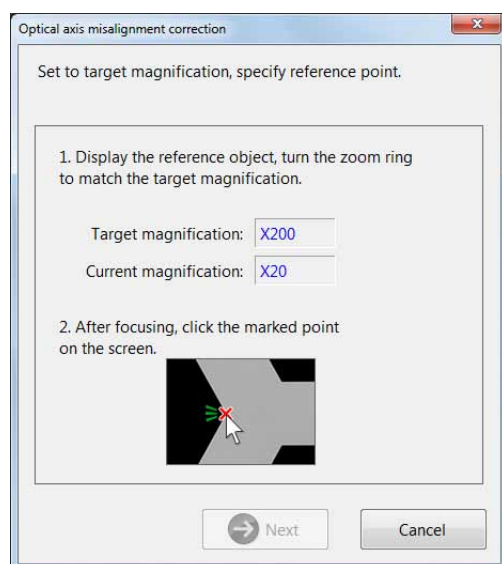
Correction using arbitrary sample

1 Select [Perform manually] and Click [Start].



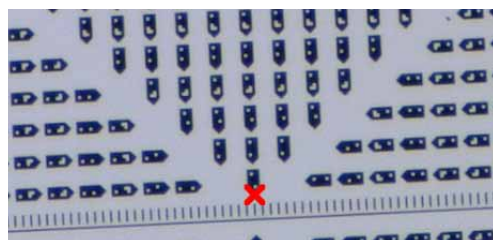
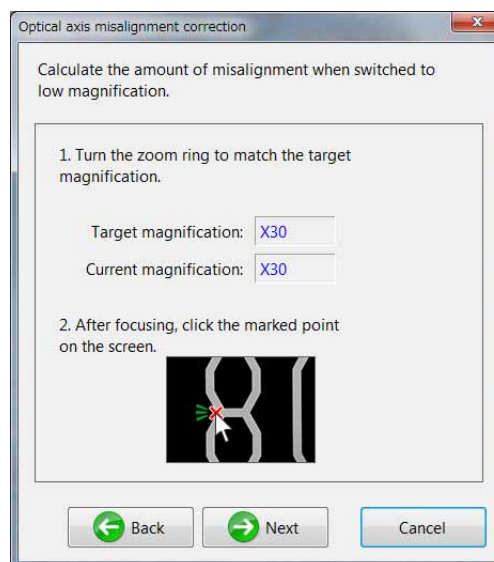
2 Set high magnification. Set the lens power to the specified magnification.

Align with the focus and click on a characteristic part with the mouse.

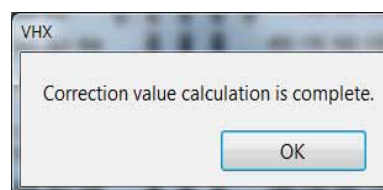


3 Set low magnification. Set the lens power to the specified magnification.

Align with the focus and click on the same place where you clicked with high magnification.



4 Follow the dialog, and once again set the high/low magnification.



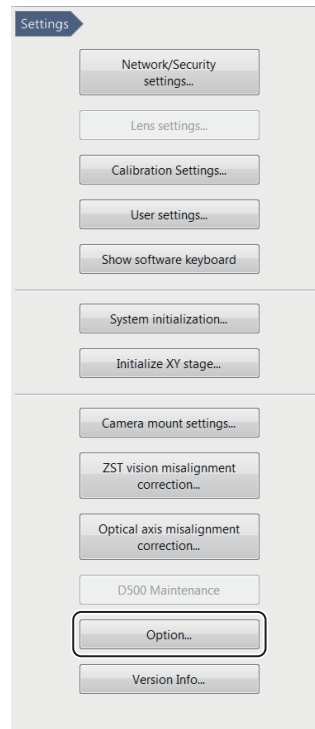
D500 Maintenance

The [D500 Maintenance] menu will appear.
Perform the consumables replacement and auto adjustment which optimizes the controller according to the procedure of [Maintenance Flow].
Refer to "VHX-D500/D510 User's Manual" for further details.

Options

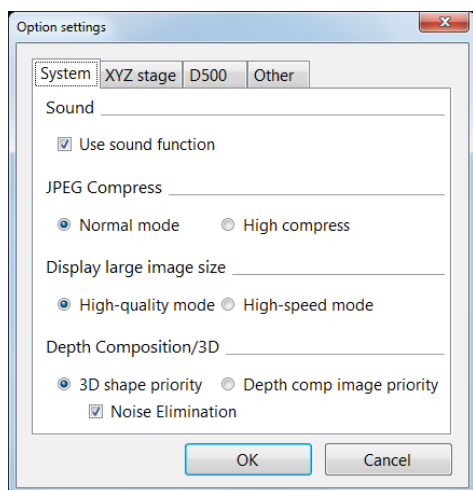
These settings configure the common operating settings for the microscope.

- 1 Click [Option...] on the Settings menu.



The [Option Settings] dialog box appears.

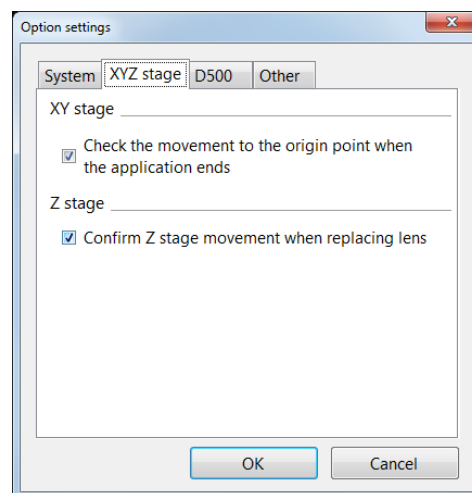
System



- **Sound**
Uncheck this option to turn off the sound functions (Default: Use sound).
- **JPEG Compress**
Specify the compression ratio to use when recording (saving) JPEG formats (Default: Normal mode).
Typically, file compression should be set to normal mode. While high compression reduces the size of the data file, it results in lower picture quality.
- **Display large image size**
Select the mode for when displaying images with large size (Default: High-quality mode).
For better picture quality, select High-quality mode.
For faster display speed, select High-speed mode.
- **Depth Composition/3D**
When creating depth composition images, select whether to give priority to 3D form or depth composition image (Default: 3D shape priority).
 - **Noise Elimination**
This option is active only when the 3D shape priority is active. Noises that will occur during the 3D composition are suppressed.

XYZ stage

Click the [XYZ stage] tab.

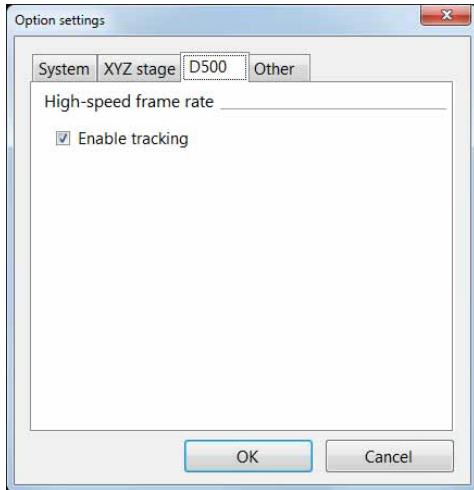


These options set the following functions to ON/OFF.

- Check movement to the origin point when the application ends (Default: ON)
- Confirm Z stage movement when replacing lens (Default: ON)

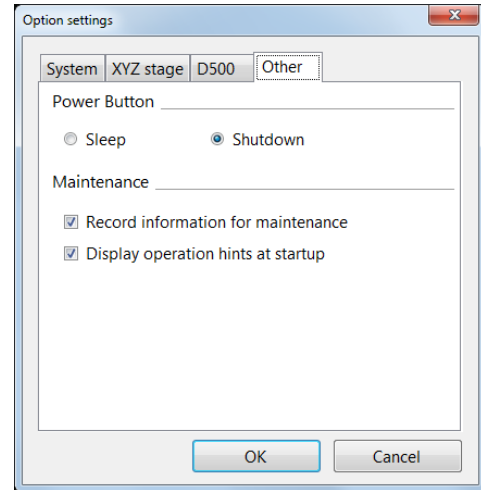
D500

Click the [D500] tab.



This option sets [Enable tracking] at high-speed frame rate to ON/OFF. (Default: ON)

Others



Operation of the power button

- Sleep
The sleep stores the system status in the internal memory and terminates the system. The next startup will require a shorter time because the status is loaded not from the hard drive but from the internal memory. In the sleep status, the system continue to supply power to the internal memory to store the status. If the main switch on the left side of the product is turned OFF or the power cable is pulled out, the system will follow the usual startup procedure. When you do not use this product for long period of time, turn off the power switch and pull out the power cable.
- Shutdown
This option shuts down the power to the system completely.

Maintenance

- Record information for maintenance (Default: ON)
- Display operation hints at startup (Default: ON)

Version Info

This command allows you to confirm the version of the system.

Use it to confirm the version when contacting KEYENCE, or to check for update availability.

Chapter 14

Connecting to an External PC

Connecting the Microscope to a PC

The PC can be connected to the microscope using the VHX-6000 Communication Software, via FTP, or via a network share.

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LAN Connection

Connecting the microscope to a PC via a LAN connection allows you to view and edit images recorded and stored on the microscope from the PC.

Overview of LAN Connection

VHX-6000 Communication Software

This software allows remote control operation of the microscope from a Windows-based PC, and provides file edit functions such as copy and delete.

FTP server function

This function allows you to copy files between the microscope and a PC.

File sharing function

File sharing provides Windows-based PCs with access to a shared folder on the microscope, allowing files to be copied to and from the microscope.

Flow of Preparations

This section explains the flow of work to complete before acquiring image data via the LAN connection.



Point

Before connecting the microscope to an internal LAN, ask your system administrator to assign an IP address to the microscope. Also find out the subnet mask and default gateway address.

Configuring the network on the VHX-6000. Page 13-5



PC connection and settings Page 14-3



FTP server function Page 14-21
File sharing function Page 14-23

Operating Environment of the PC

Supported operating systems	Windows Vista SP2 Windows 7 SP1 Windows 8.1 Windows 10
Processor	Intel Core™ 2 DUO E8400 or later
Memory	2 GB or more
Connection interface	PC must be equipped with one of these LAN ports: LAN (RJ-45 1000BASE-T/100BASE-TX/10BASE-T)
Display resolution	1280 x 1024 or higher
Hard disk	3 GB or more
Graphics memory	128 MB or more
Display colors	32 bits or more
Graphics chip	Support for DirectX 9.0c
Direct X	Version 9.0c or later
Others	CD-ROM drive or USB port

PC Connection and Settings

Point

- Before connecting the microscope to an internal LAN, ask your system administrator to assign an IP address to the microscope. Also find out the subnet mask and default gateway address. Using incorrect or illegal settings will prevent communications and may interfere with the internal LAN.
- To connect the microscope to a PC in a peer-to-peer connection, use a crossed cable and assign an IP address between 192.168.0.1 and 192.168.0.254. For instance, set the microscope's IP address to 192.168.0.1, and the PC to 192.168.0.2, and set the subnet mask to 255.255.255.0.
- Use a category 5 or higher LAN cable if using a 10BASE-T/100BASE-TX connection, or category 5e or higher LAN cable for a 1000BASE-T connection.

1 Configuring the network on the microscope.

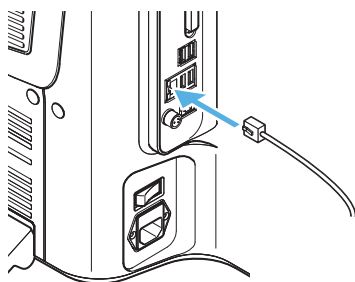
Configure the microscope from the [Settings] "Network/Security Settings" (Page 13-2) from the VHX MENU.

2 Confirming the network settings on the PC.

3 LAN cable connection

Connect the LAN cable to the LAN port on the left side panel and the LAN port on the hub.

To connect the microscope to a LAN within a group, use a straight cable. To connect peer-to-peer with a PC, use a crossed cable.



VHX-6000 Communication Software

VHX-6000 communication software enables remote control operation of the microscope, and can capture images to a PC.

Overview of Functions

File editing functions

- Browse files on the microscope and PC on the same screen, and effortlessly copy, move, and delete files.
- Export CSV formatted files to Excel files.

Measurement data tabulation function

- The image files with measurement data and the CSV file measurement data that is compiled inside a folder are tabulated, and can be output into Excel files.

Installing the Communication Software

This section explains the procedures for installing the VHX-6000 Communication Software.

Point To perform the installation, users must log in with an account that has Administrator privileges. To use the software, log in with an account that Normal or higher privileges for Windows Vista/7.

14

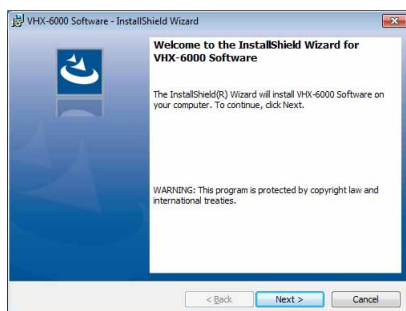
Connecting to an External PC

- 1 Turn the PC power on and start up Windows.
- 2 Insert the disk labeled [VHX-6000 Communication Software] in the CD-ROM drive.

The [VHX-6000 Communication Software] window appears.

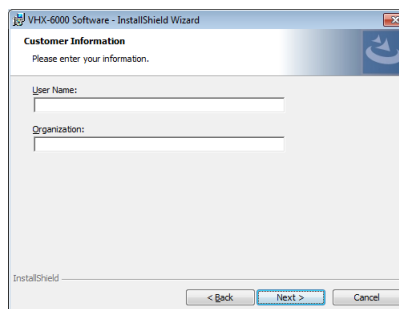
Point • If [User Account Control] appears, click [Yes].

- 3 Click [Next].



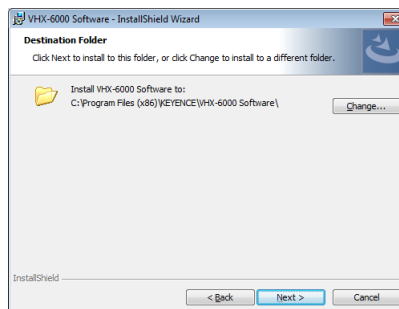
The window for entering the user information appears.

- 4 As required, enter [User Name] and [Organization] and click [Next].



The window for selecting the folder to be installation destination appears.

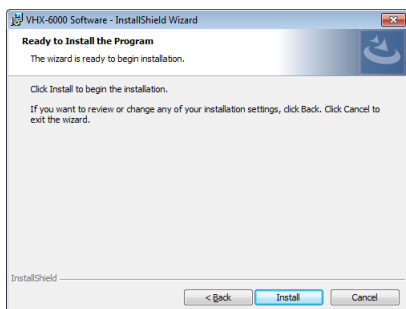
- 5 Click [Next].



Reference To change the folder to be installation destination, click [Change] and specified a different folder.

The [Ready to Install the program] dialog appears.

6 Click [Install].



The installation begins.

When the installation finishes, the [InstallShield Wizard Completed] dialog box appears.

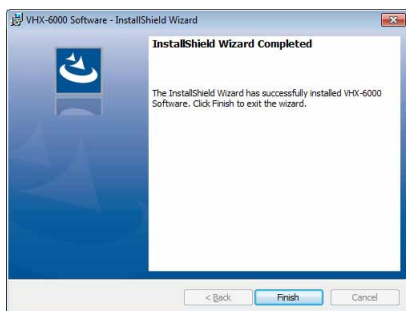


Point

The installation wizard will display a message indicating it will install some or all of the following components according to your PC's environment. Click [OK] and confirm acceptance of the usage agreement to proceed with the installation.

- .NET Framework 4.5.2
- Visual C++ 2008 SP1 redistributable package (x86)
- Visual C++ 2010 SP1 redistributable package (x86)
- Visual C++ 2013 redistributable package (x86)

7 Click [Finish].



8 Remove the CD-ROM.

Uninstalling the Communication Software

- 1** Turn the PC power on and start up Windows.
- 2** From the [Start] menu, select [Control Panel] - [Programs and Features].
- 3** Select the [VHX-6000 Communication Software] and click [Uninstall].
- 4** When the confirmation dialog box appears, click [Yes].



Point

If [User Account Control] appears, click [Yes].

Starting the VHX-6000 Communication Software

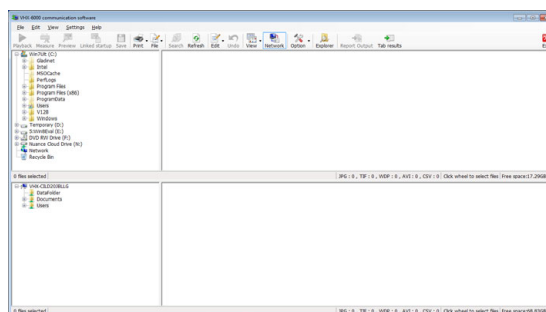
Startup

- 1** Double-click the VHX-6000 Communication Software icon on the desktop. The first time the program is started, the [VHX-6000 Communication Software] window appears.
- 2** If the network is connected, click [Network].

☞ "■ Network settings" (Page 14-18)



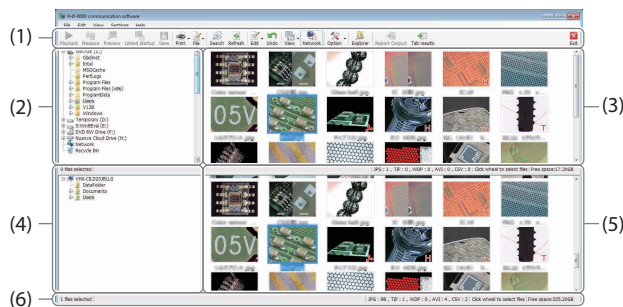
The contents of the hard disks of computer and microscope are displayed.



Names and Functions on the Window

The upper area of the window shows the contents inside the PC's hard disk and other storage devices.

The lower area of the window shows the contents of the microscope's hard disk.



(1) Toolbar

The toolbar presents the commonly used commands.

☞ "Toolbar" (Page 14-7)

(2) PC folder view area

This area shows the folders on the PC's hard disk, and on the drives connected to the PC. In this section, these folders are referred to as [PC folders].

(3) PC files list area

This area shows a list of files in the local folder. In this section, these files are referred to as [PC files].

Reference These four file types can be displayed as thumbnails.

- JPEG files (.jpg)
- TIFF files (.tif)
- HDPhoto (.wdp)
- AVI files (.avi)

(4) VHX folder view area

This area shows the folder structure on the hard disk in the microscope. In this section, these folders are referred to as [VHX data folders].

Point **The VHX-6000 Communication Software can only access the "Data folder"(D:\CommonData). The VHX-6000 PC Communication Software cannot access the Documents folder.**

(5) VHX files list area

This area shows a list of files in the VHX folder. In this section, these files are referred to as [VHX files].

(6) Status bar

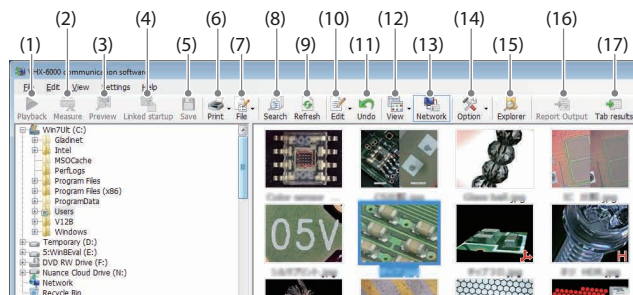
The right end of the status bar displays the following information:

- HD free space: Remaining space available on the microscope's hard disk.
- Files: Indicates the number of each file type in the current folder (JPEG, TIFF, WDP, AVI, and CSV).
- Selected files: Indicates the number of selected files.

Reference The toolbar and status bar can be hidden by selecting the settings on the [View] menu.

Toolbar

The names and functions of the toolbar icons are explained below.



(1) Playback



Plays back the selected file.
The display method varies according to the type of selected file.
"Playing Images" (Page 14-8)

(2) Measure



On 2D images, this command measures length and area, and allows additional comments.
"Measuring 2D images" (Page 14-15)

(3) Preview



Displays the selected file in a [Preview] window.
AVI files and images recorded in high definition (3200 x 2400) or higher resolution cannot be previewed.
"Preview" (Page 14-16)

(4) Linked startup



Automatically opens the selected file in the associated application based on the file extension in the PC's settings.
For example, the image file can be opened in a commercially available image editor application. The following file types are supported: JPEG, TIFF, AVI, and CSV.

(5) Save



Saves the captured images under automatically assigned names.
"Saving" (Page 14-17)

(6) Print



Print (Page 12-3) the selected images from the printer connected to the computer.

(7) File



Controls files.
Items that can be controlled are the same as those of [File] in Album.

Reference Available operations are the same in both the VHX folder and computer folder.

(8) Search



Searches files within the computer's hard disk.
"Searching Files" (Page 6-14)

(9) Refresh



Refreshes the display to reflect the latest information.

(10) Edit



This command is used to edit files or folders.
"Edit" (Page 14-17)

(11) Undo



Undoes the most recent command.
Point [Undo] is allowed for only one command. Some operations cannot be undone.

(12) View



Toggles display between thumbnail and properties.
"View" (Page 14-18)

(13) Network



Shows/hides VHX folder display area and VHX file list area.

(14) Option



You can set the network settings and options of various functions (Page 14-18).

(15) Explorer



Launches Explorer.

(16) Report Output



Output the information of the selected CSV file to an Excel or Word file.

(17) Tab Result



Collectively output the one-click automatic measurement results to Excel (Page 6-20).

Playing Images

Double-clicking a thumbnail image displays it using the method best suited for that image. Right-clicking on any selected image and clicking [Measure] changes the display to the measurement view.

Point 3D images opened by clicking [Measure] will be played as 2D images.

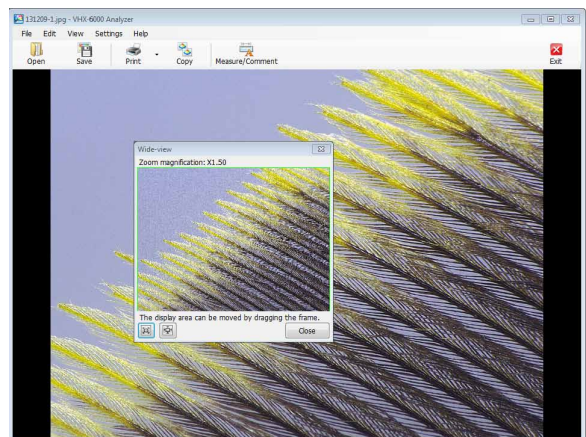
- 2D images**
 The image is displayed in a [Wide-view] window (Page 14-8), allowing zooming by rotating the mouse wheel, and area resizing by dragging the mouse. After zooming to the desired display size, the observation area can be changed by dragging on the image.
- 3D images**
 The image appears in the 3D view (Page 14-10). 3D images can be rotated and observed in the XYZ directions.
- Multi-lighting image**
 The images recorded with this function can be observed later with the lighting direction changed.
- HDR images / High resolution HDR images**
 HDR (Page 14-13) images can be displayed after adjusting the HDR effect.

Playing 2D images

When playing 2D images, they are shown in the wide-view window.

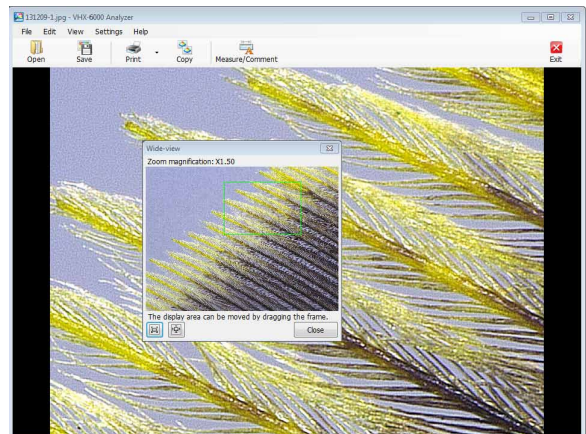
1 Double-click the file to play.

This brings up the [Wide-view] window and the playback window.

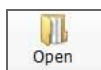


2 Rotating the mouse wheel changes the zoom ratio in the playback window.

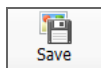
When the playback window is zoomed in on a portion of the entire image, the wide-view window will indicate the displayed area inside a green frame. Drag this frame to change the area displayed in the playback window.



■ **Toolbar**

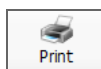


Select the image to display in a new window.

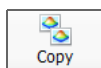


Saves the displayed image under a user-specified name.

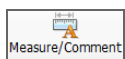
The size of the image can be set in the [Option Settings].



Prints (Page 12-2) the displayed image via the printer connected to the computer.



Copy the displayed image to the clipboard.

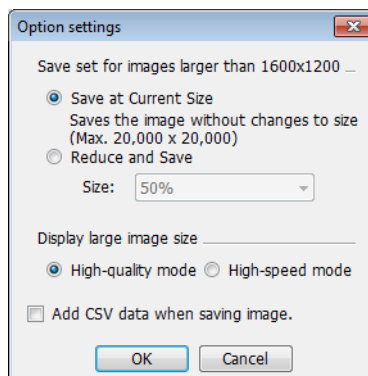


This command is used to measure the image or add comments.



Stops playback.

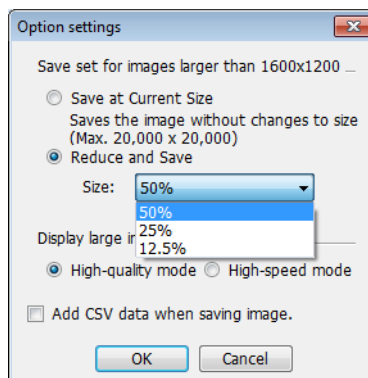
■ **Menu [Settings]**



Save set for images larger than 1600x1200

Select the size to save the displayed image.

To reduce the image size, select [Reduce and Save] and select a size from the drop down list box.



Display large image size

If the response time is slow when the display is [Highquality mode], select [High-speed mode]. This will make operations faster.

Add CSV data when saving image

This option exports saved CSV data to Excel for viewing the measurement data on the image.

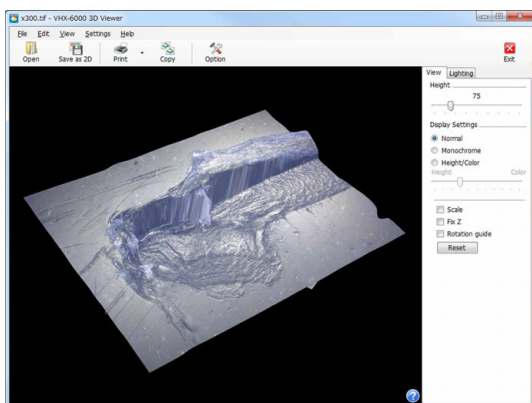
Displaying in 3D

Displaying 3D image files in 3D.

Reference Thumbnails of 3D image files will have a red 3D symbol in the lower right.

- 1 Select the 3D image file and click [Playback].**
The confirmation message appears.
- 2 Click [3D playback].**
- 3 The displayed 3D image can be edited.**
The displayed 3D image can be manipulated by turning it, zooming in and out, and moving it.

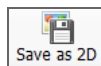
📖 "Manipulating the 3D View" (Page 10-16)



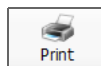
■ Toolbar



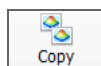
Select the image to display in a new 3D view.



Saves the displayed image as a 2D image.



Prints (Page 12-2) the displayed image via the printer connected to the computer.



Stores the displayed image on the PC's clipboard.

The copied image can be pasted into commercially available software.



Opens the [Option settings] dialog box. Setting of the following items is available.

- Color (scale line, scale assistance line, background)
- Unit (m/mm/μm/in/mil)
- Number of decimal



Exits the 3D view.

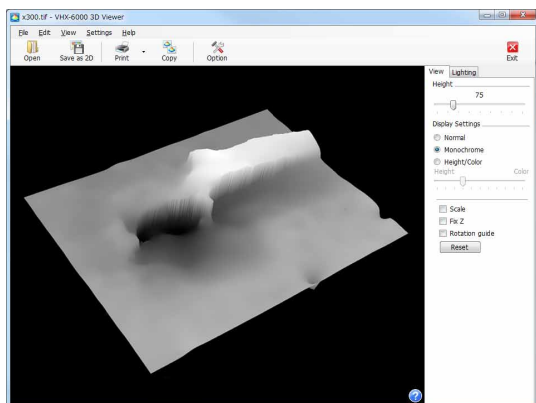
■ [Display] tab

• Height

Dragging the slider up or down adjusts the scale factor used to display the image height.

• Monochrome

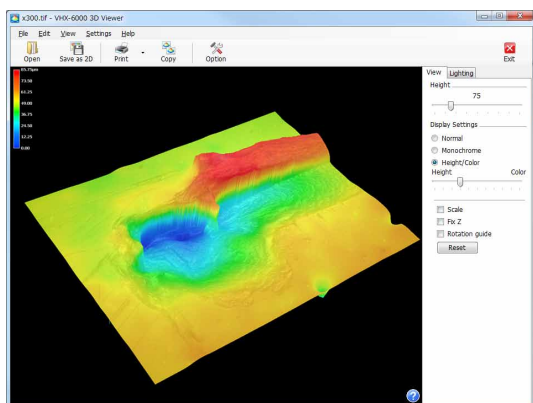
This option removes the surface texture to make height differences easy to understand. Combining it with the light simulation provides clearer height differences.



• Height/Color

Selecting the [Height/Color] option displays the image with emphasis on height. The highest areas of the 3D image are shown in red, and the lowest areas are shown in dark blue.

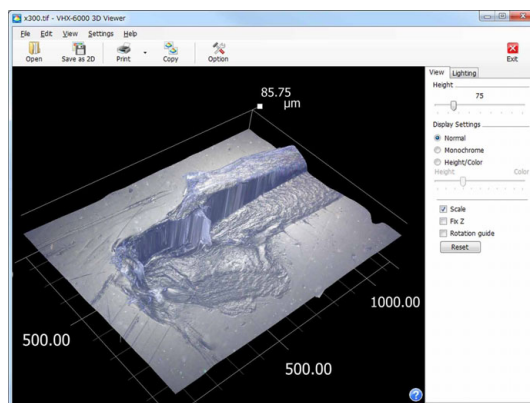
Adjust the height and color by dragging the slide bar.



• Scale

If the [Scale] option is checked, a simple scale will appear. Change the height of the (squares) or (dots) to measure the rough height.

📖 "Displaying the scale" (Page 10-17)

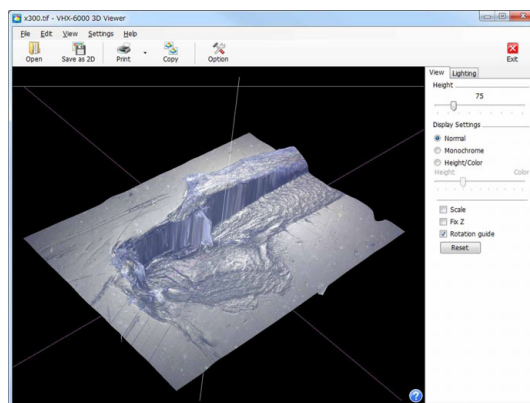


• Fix Z

Checking the [Fix Z] check box turns and moves the image with the Z-axis fixed. Hold the left mouse button down and drag to turn while keeping the Z-axis fixed. Hold the right mouse button down and drag to move the object.

• Rotation guide

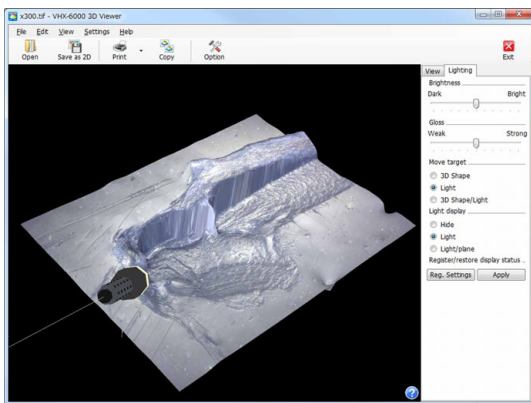
Checking the [Rotation guide] check box displays the X, Y, and Z axis during mouse drag movements. Click again to turn the [Rotation guide] display OFF.



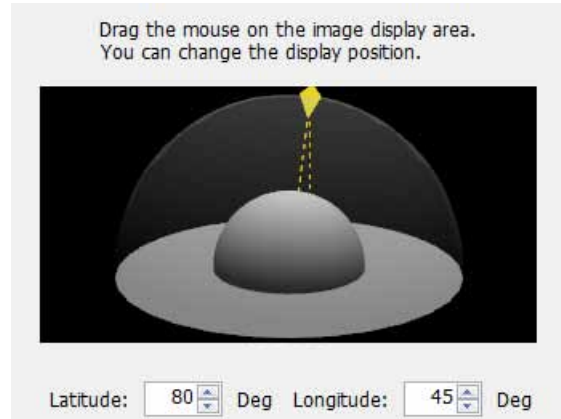
■ [Lighting] tab

Selecting the [Lighting] tab enables the lighting simulator which can be used to apply lighting from any direction. Drag the mouse to change the lighting direction. This allows you to observe height differences on the image in greater clarity.

📖 "Lighting Simulations" (Page 10-24)



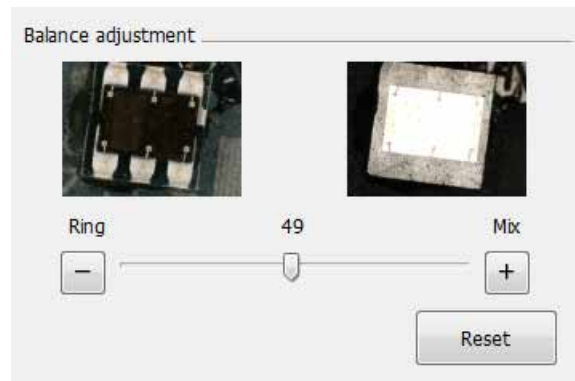
The following indicator shows the direction of illumination.



You can also set the lighting direction by entering a latitude and a longitude.

An image illuminated from straight above can be put in the state under the ring + coaxial combined illumination.

The ratio of the lighting methods can be adjusted with the balance adjustment slider.



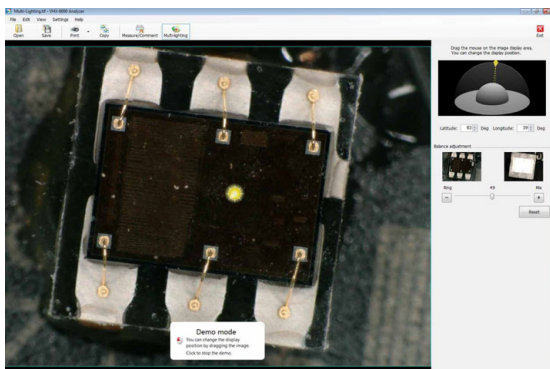
Clicking "Reset" resets the illumination angle and the combination ratio to the default values.

Multi-lighting playback

Plays back a Multi-lighting image.

Reference Thumbnails of Multi-lighting files will have a ML symbol in the lower right.

- 1** Select a Multi-lighting file and click "Playback?" The confirmation message appears.
- 2** Click "Multi-lighting playback?"
- 3** You can change the lighting direction of the Multi-lighting image to check.



You can change the lighting direction by clicking the display area.

Playing HDR images/high resolution HDR

Reference

- Thumbnails of HDR image files will have a red "H" symbol in the lower right.
- Thumbnails of high resolution HDR image files will have a red "UH" symbol in the lower right.

1 Select the HDR image file or high resolution HDR file and click [Playback].

Confirmation message appears.

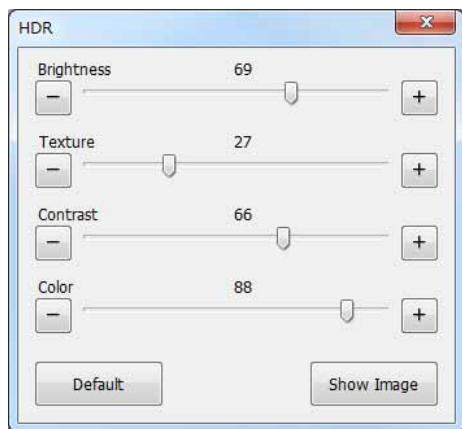
2 Click [HDR View] / [High Resolution HDR Playback].

This brings up the playback window and the [High dynamic range] dialog box.

3 Adjust each setting while viewing the image.

The following can be adjusted: brightness, texture, contrast, and color.

Click [Default] to return each setting to their optimum values.



4 Click [Show Image].

The [Wide view] window and play window opens.



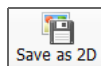
Reference

The [Playback in the wide-view window] dialog box (Page 14-8) appears if the image was recorded at high definition or a higher size.

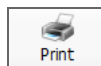
■ Toolbar



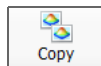
Select the image to display in a new window.



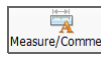
Saves the displayed image.



Prints (Page 12-2) the displayed image via the printer connected to the computer.



Copy the displayed image to the clipboard.



This command is used to measure the image or add comments.



Allows each item to be readjusted.



Stops HDR playback.

Playing color composition images

Reference Thumbnails of HDR image files will have a red CL symbol in the lower right.

1 Select the color composition image file and click [Playback].

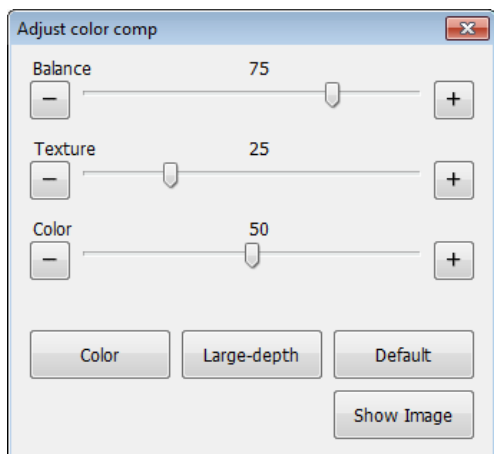
The confirmation message appears.

2 Click [Color Comp Image].

This brings up the playback window and the [Adjust color comp] dialog box.

3 Adjust each setting while viewing the image.

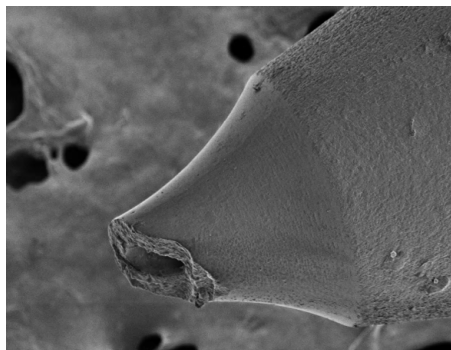
The following can be adjusted: balance, texture, and color.



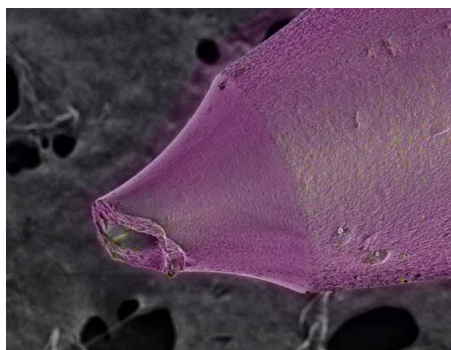
- "Color"
Displays the color image taken with VH lens.



- "Large-depth"
Displays the high resolution image.




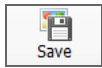
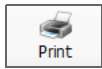
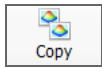
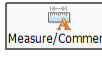
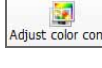

- "Default"
Displays the image synthesized from the color image and high resolution image



4 Click [Show Image].

This confirms the adjustments and closes the [Adjust color comp] dialog box.

■ Toolbar

-  Select the image to display in a new window.
-  Saves the displayed image.
-  Prints (Page 12-2) the displayed image via the printer connected to the computer.
-  Copy the displayed image to the clipboard.
-  This command is used to measure the image or add comments.
-  Allows each item to be readjusted.
-  Stops color composition image playback.

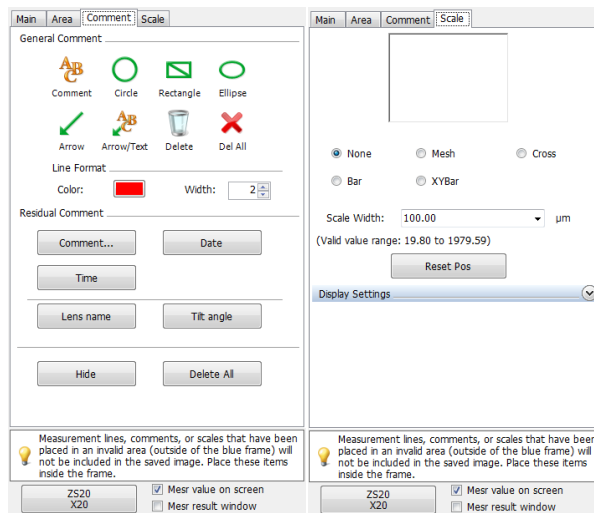
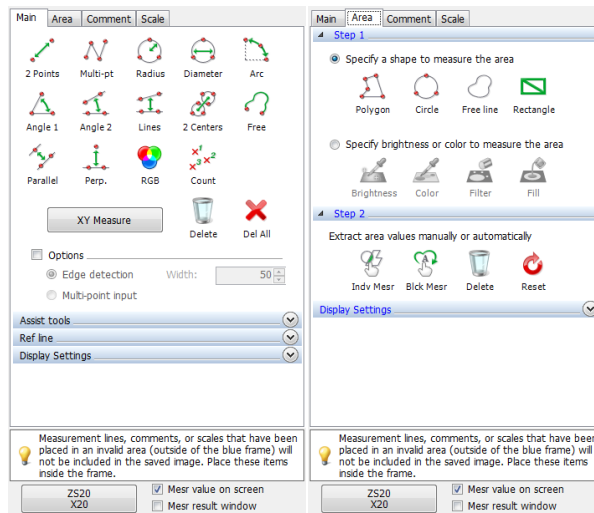
Measuring 2D images

With 2D images, you can measure length and area, enter comments, and save.

1 Select the file to measure and click [Measure/Comment].
The [Specify measurement size] dialog box appears.

2 Select the size of the image to measure and click [OK].
The [Wide view] window and play window opens.
There are four tabs for tools of [Measure/Comment].

- 📖 "Main measurements" (Page 9-2)
- 📖 "Area Measurements" (Page 9-26)
- 📖 "Comments" (Page 9-36)
- 📖 "Displaying a Scale" (Page 9-40)

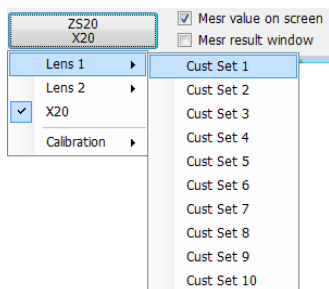


Changing calibration

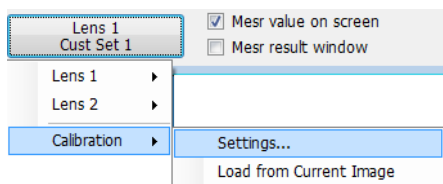
Normally, the calibration set when the image was recorded is loaded automatically.

The procedure below allows you to redo the calibration.

- 1 Click the lens power view and select [Lens 1] or [Lens 2].

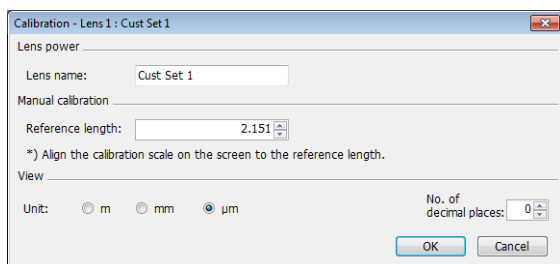


- 2 Click [Lens 1] or [Lens 2] - [Calibration] - [Settings...].

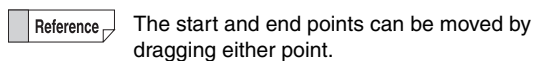


The [Calibration] dialog box appears.

- 3 Enter the a known length on the screen as the reference length.



- 4 Click the start and end points of the length specified as the reference in step 3.

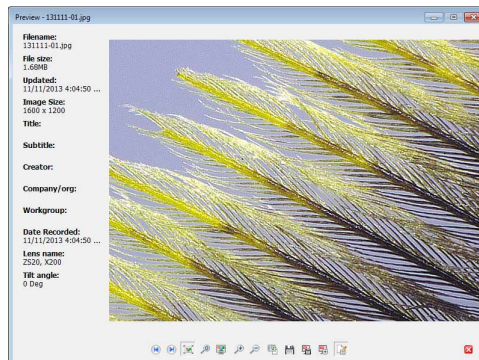


The start and end points can be moved by dragging either point.

- 5 Specify the display units and number of decimals to display, and click [OK].

The calibrated value is saved.

Preview



Preview shows the observed image and file properties. Various operations can be performed by using the icons below the image.

	Previous Image Displays one file before the currently displayed file in the same folder.
	Next Image Displays one file after the currently displayed file in the same folder.
	Fit to window size Adjusts and displays the image to the size of the window.
	Actual size Displays the image in actual scale.
	Full screen image Displays the image over the entire screen.
	Enlarge Enlarges the image display size. Zooming is also possible by rotating the mouse wheel button.
	Reduced-size Reduces the image display size. Zooming is also possible by rotating the mouse wheel button.
	Linked application startup Starts up the associated application with the image file opened in a new window.
	Save As Saves the captured image under a user-specified name. The image can also be resized.
	Specify area and save Cuts and saves the selected area of the image.
	Specify area and copy Cuts and copies the selected area of the image.
	Show properties ON/OFF Toggles the properties information display ON/OFF.

Saving

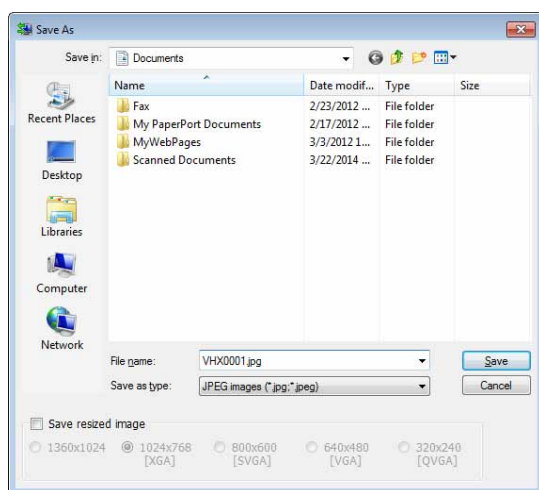
1 Select the file to save.

VHX files and PC files can be selected.

2 Click [Save].

The [Save As] dialog box appears.

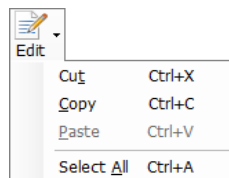
3 Select a folder and enter a filename to save the image as, then click [Save].



The selected file is saved.

To resize the image before saving it, check the [Resize to] option and select the size.

Edit



- **Cut**
Cuts the selected file or folder and copies it to the clipboard.
- **Copy**
Copies the selected file or folder and copies it to the clipboard.
- **Paste**
Pastes the file or folder copied to the clipboard, using Cut or Copy, to the selected folder.
- **Select All**
Selects all files in the currently open folder.

View

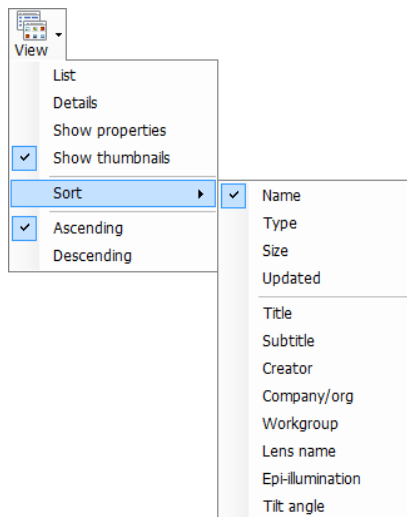


Image files can be viewed by selecting one of the following methods.

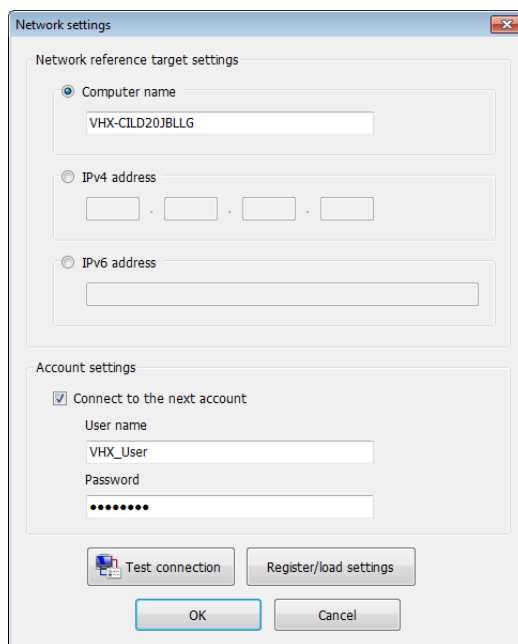
- List**
 Shows the filenames as a list.
- Details**
 Shows the filename, size, timestamp of last update, and other details as a list.
- Show properties**
 Shows the filename and properties information.
- Show thumbnails**
 Shows the files as thumbnails.
- Sort by**
 The following options are available.

Name	Title	Workgroup
Type	Subtitle	Lens name
Size	Creator	Epi-illumination
Updated	Company/org	Tilt angle
- Ascending**
 Displays files in ascending order (from smaller or newer) based on the selected sort by item.
- Descending**
 Displays files in descending order (from larger or older) based on the selected sort by item.

Option

■ Network settings

Configure settings for connecting the microscope to a network.



- Network interface target settings**
 Enter either [Computer name] / [IPv4 address] / [IPv6 address] of the microscope.
- Account settings**
 Check the option and input the "User name" and "Password" for connecting to the microscope. Choose the user name (VHX_User) specified in the file-sharing settings.
 - "Configuring FTP and file-sharing" (Page 13-4)
- Test connection**
 This command tests the connection with the microscope based on the "Network interface target settings" and "Account settings". If the connection succeeds, "Connection was successful." message appears.
- Register/load settings**
 This command registers the current network settings. Registered settings can also be read.

■ Option settings

The [Options] dialog box appears.

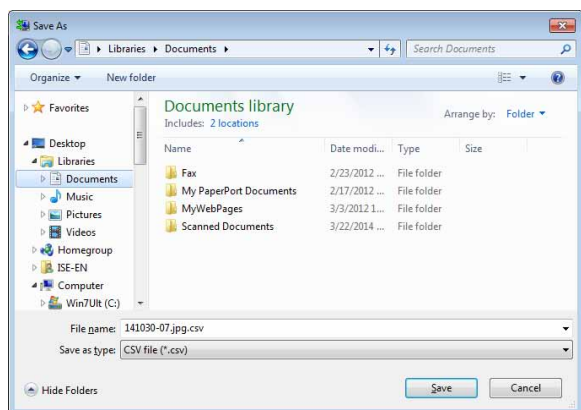
"Options" (Page 6-16)

Extracting CSV data

The measurement results embedded in an image as CSV data can be saved as a CSV formatted file.

Reference Thumbnails of images with CSV data will have a red C symbol in the lower right.

- 1 Select the image with CSV data.**
- 2 On the [File] menu, select [Extract CSV data].**
The [Save As] dialog box appears.



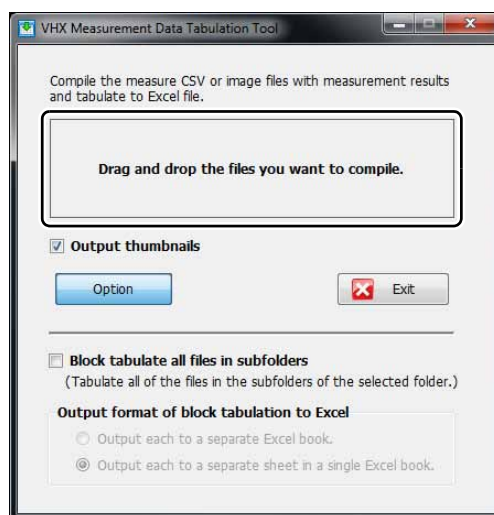
- 3 Enter a filename and click [Save].**
The CSV file is saved.

Measurement Data Tabulation

When the VHX-6000 Communication Software has been installed, the [VHX Measurement Data Tabulation Tool] icon is created automatically.

The [VHX Measurement Data Tabulation Tool] tabulates the image files with measurement data and the CSV file measurement data that is compiled inside a folder, and outputs it into Excel files.

- 1 Double-click the [VHX Measurement Data Tabulation Tool] icon.**
- 2 Drag the folder with the tabulated files (Measurement result images and CSV files) from explorer, etc. into the square frame.**

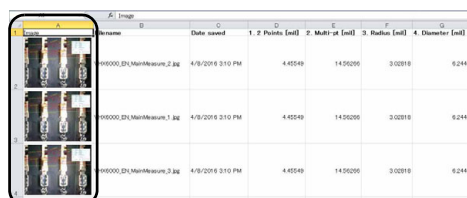


- 3 Automatically export the tabulated results to the Excel files.**
Enter a filename and save the file.

1	Filename	A	B	C	D	E	F
2	Filename	Date saved	1. 2 Points [mil]	2. Multi-pt [mil]	3. Radius [mil]	4. Diameter [mil]	5.
3	VHX6000_EN_MainMeasure_1.csv	4/8/2016 3:08 PM	4.45549	14.58266	3.02818	6.2446	
4	VHX6000_EN_MainMeasure_2.csv	4/8/2016 3:08 PM	4.45549	14.58266	3.02818	6.2446	
5	VHX6000_EN_MainMeasure_3.csv	4/8/2016 3:08 PM	4.45549	14.58266	3.02818	6.2446	
6	VHX6000_EN_MainMeasure_4.csv	4/8/2016 3:08 PM	4.45549	14.58266	3.02818	6.2446	
7	VHX6000_EN_MainMeasure_5.csv	4/8/2016 3:08 PM	4.45549	14.58266	3.02818	6.2446	
8	VHX6000_EN_MainMeasure_6.csv	4/8/2016 3:08 PM	4.45549	14.58266	3.02818	6.2446	

Output thumbnails

When [Output thumbnails] is selected, the thumbnail images are exported to the first column.



Point

- Since the thumbnail images are fixed in the cells, they are also linked in the measurement data sorting.
- Click a thumbnail image to display its original image file. This works for JPEG files (*.jpeg, *.jpg) and TIF files (*.tif, *.tiff). For HD Photo files (*.wdp), the original images will not be displayed even if the thumbnail images are clicked.

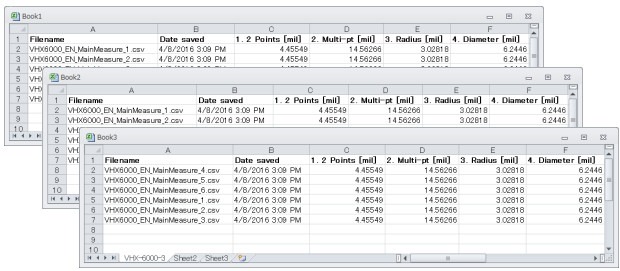
Option

Block tabulate all files in subfolders

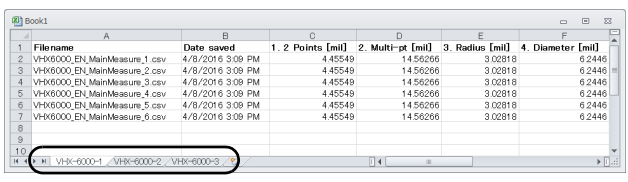
When [Block tabulate all files in subfolders] is selected, all the files inside the subfolders of the specified folders are exported as a batch.

Output format of block tabulation to Excel

When the [Output each to a separate Excel book.] is selected, the files inside the subfolders are output to separate Excel books.



When the [Output each to a separate sheet in a single Excel book.] is select, the files inside the subfolders are output to separate sheets in a Excel book.




Point

- The supported models for "VHX Measurement Data Tabulation Tool" are shown as below.
The CSV files and image files with measurement data output via VHX-500/500F/600/700F/900/900F/1000/2000/5000/6000 series
- The supported Excel versions are shown below.
Excel 2003/2007/2010/2013/2016 (does not function with Excel 2000)
- [Main measurements] and [1 click measure] are the types of measurements that can be output.
[Area Measure], [Auto area measurement] and [3D Profile Measurements] are not supported.
- All of the measurement result items and sequence numbers inside the folders need to match each other.
If the CSV files and the image files with measurement data are mixed inside the folders, the old files will be tabulated by the update dates.

14 Connecting to an External PC

FTP Server Function

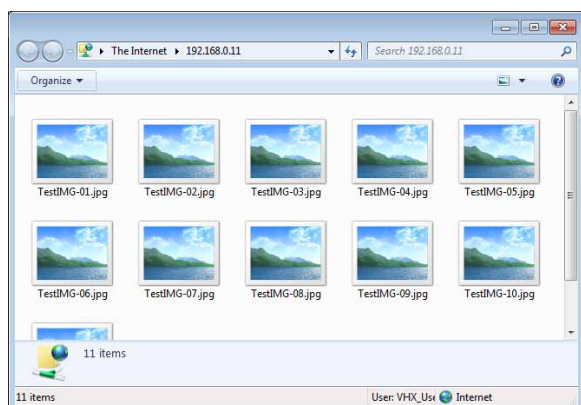
Using FTP client software, a PC can read image files saved on the hard disk in the microscope, and write image files on the PC to the hard disk in the microscope.

 **Point** Turn the [FTP] function (Page 13-4) on the microscope on.

Connecting using Internet Explorer

This procedure will explain how to use the FTP function using Internet Explorer as the FTP client.

- 1 Startup Internet Explorer.**
- 2 In the address bar, type "ftp://IP address of the microscope/".**
- 3 Click [Go].**
The first time you connect to the microscope, the [Logon method] dialog box appears.
- 4 Enter the user and password and click [Logon].**
Enter the [User] as "VHX_User", and [Password] as the password specified in the microscope's settings (Page 13-4).

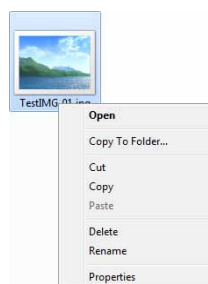


Reference

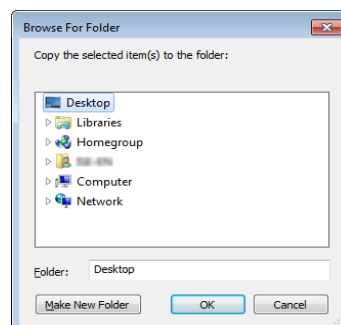
The FTP server allows access to the files and folders saved under D:\CommonData.

Copying images files on the microscope to the PC

- 1 Right-click the folder or file to copy.**



- 2 Select [Copy To folder]**
The [Browse For Folder] dialog box appears.
- 3 Select the destination folder and click [OK].**
The files on the microscope are copied to the PC.

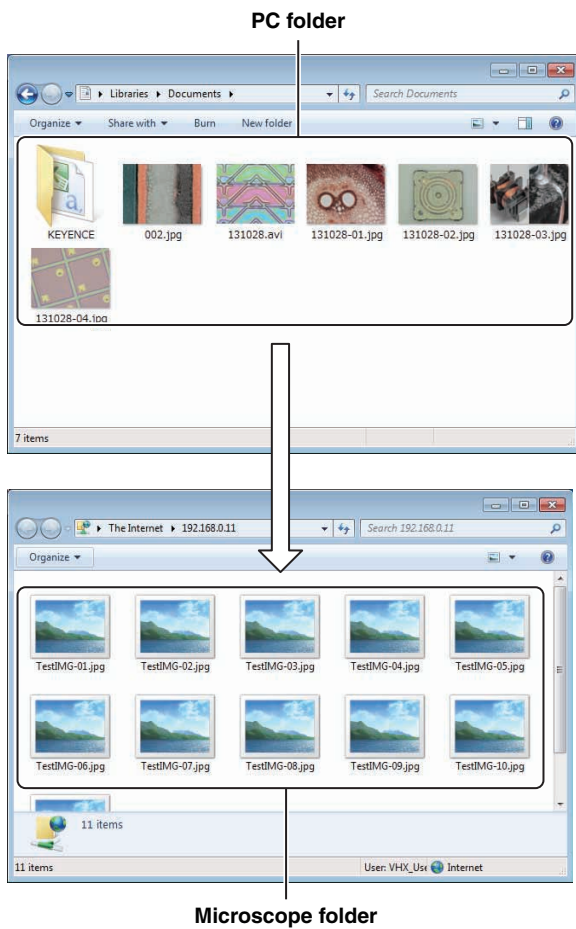


Copying image files or folders on the PC to the microscope

1 Drag the files to copy to the folder on the microscope.

The files or folders on the PC are copied to the microscope

Instead of dragging, you can also use copy and paste.



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Connecting to an External PC

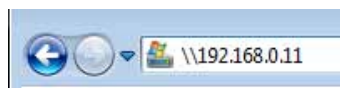
File Sharing Function

The file sharing function allows you to copy files between the microscope and the PC.

Point Turn the [File sharing] function (Page 13-4) on the microscope on.

Using Internet Explorer to Connect

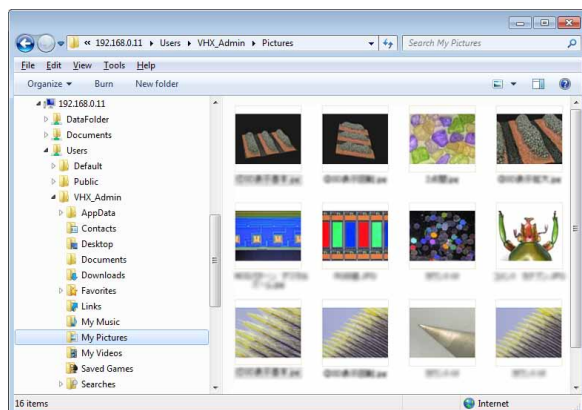
- 1 Startup Internet Explorer.
- 2 In the address bar, type "//IP address of the microscope".
- 3 Click [Go].



- 4 Enter the user and password and click [OK].

Enter the [User] as "VHX_User", and [Password] as the password specified in the microscope's settings (Page 13-4).

The contents of the D:\CommonData folder (data folder for the album function) on the microscope appears.



The files can be manipulated using Explorer.

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Connecting to an External PC

Appendix

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Specifications (Detailed Modules).....	Page A-10
Software Usage Agreement	Page A-11
Usage Agreement for Operation Software	Page A-12
Before asking repair and inspection.....	Page A-17

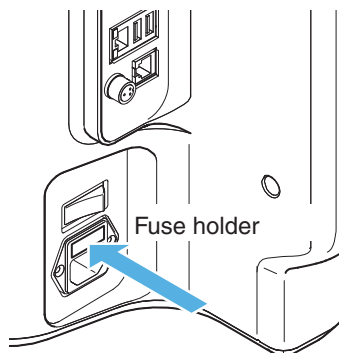
List of Necessary Authentication Information and Default Settings

Item	User name	Password	Related page
Calibration	-	Set by user	"Setting the calibration password" (Page 9-11)
Network/Security Settings	-	VHX	"Network/Security Settings" (Page 13-2)
FTP/File Sharing	VHX_User	Set by user	"Configuring FTP and file-sharing" (Page 13-4)
Windows log-on after Completely disabling system protection	VHX_Admin	VHXADMIN	"Completely disabling system protection" (Page 13-6)
Communication Software setting	-	Set by client	"Option" (Page 14-18)

Replacing the Fuse

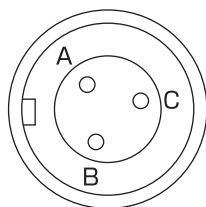
When replacing the fuse, be sure to use an FSL Series fuse from Nippon Seisen Corporation that meets the following rating:

Rated voltage:	250 V
Rated current:	4.0 A
Fuse characteristics:	Time lag



REMOTE Connector (Capture/Pause)

A switch (such as a foot-activated switch) can be connected to the capture/pause REMOTE connector to capture and pause images.



REMOTE connector (controller side)

Pin layout	
Pin number	Pin name
A	Pause remote
B	Capture remote
C	COM

Using the REMOTE Connector to Pause and Release Images

- 1 Using a foot switch or other device, short pins A and C on the REMOTE connector.

This will pause the image as indicated by the lit LED over the [PAUSE] button on the console.

Short pins A and C on the REMOTE connector again to release the pause. The LED over the [PAUSE] button on the console will go out.

Using the REMOTE Connector to Capture

- 1 Using a foot switch or other device, short pins B and C on the REMOTE connector.

The LED over the [PAUSE] button on the console will light up and a [Capture] dialog box will appear.

- 2 Specify the save conditions.

Specify the image format and other properties.

- 3 Click [Save].

The LED over the [PAUSE] button on the console will go out indicating the image has been captured.

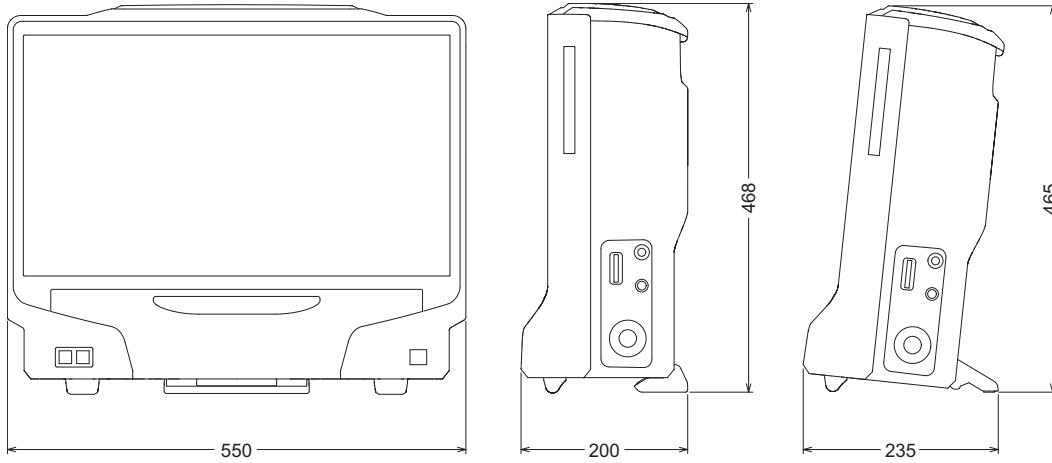
Refer to "Recording/Saving Still Images" (Page 5-2) for details on saving an image.

Reference You can continue capturing by setting the microscope to auto capture mode. (Page 5-6)

External Dimensions

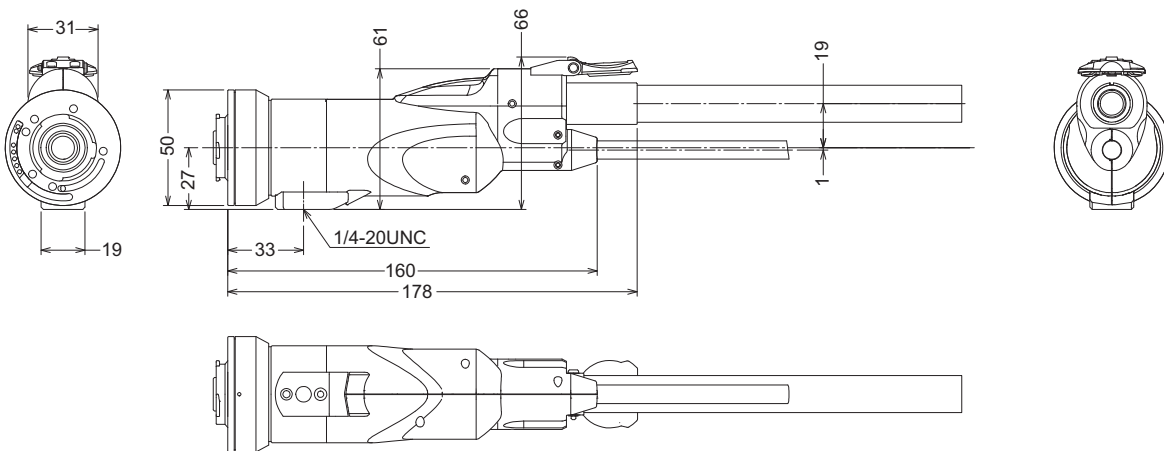
VHX-6000 Controller

Units: mm



VHX-6100/6020 Camera Unit

Units: mm



A

Appendix

Specifications

Specifications (Basic Performance)

Item		Specifications	
Camera	Image capture device	1/1.8 type 1.95 million pixel CMOS image sensor Total pixels 1612 (H) x 1212 (V) Executable pixels 1600 (H) x 1200 (V)	
	Scanning method	Progressive	
	Frame rate	50F/S (max.)	
	Resolution	Normal	1600(H) x 1200(V) Approx. 1000 TV lines
		3CMOS *1, *3	1600(H) x 1200(V) Approx. 1200 TV lines (2 million pixels x 3CMOS mode Excellent color reproducibility.)
		High definition*3	3200 (H) x 2400 (V) Approx. 1600 TV lines
		Super fine*3	4800(H) x 3600(V) Approx. 2000 TV lines or more
		18 Mega Pixel x 3CMOS *2, *3	4800 (H) x 3600 (V) Approx. 2000 TV lines or more (18 million pixels x 3CMOS mode Excellent color reproducibility.)
	High dynamic range	Each RGB pixel in 16-bit resolution	
	Gain	Auto, Normal, Preset	
	Electronic shutter	Auto, Manual, 1/60, 1/120, 1/250, 1/500, 1/1000, 1/2000, 1/5000, 1/9000, 1/19000	
	Supercharge shutter	0.02 sec. to 4 sec.	
	White balance	Push set, Auto, Manual, Preset (2700 K, 3200 K, 5600 K, 9000 K)	
Back-focus adjustment	Not required		
LCD monitor*5	Size	Color LCD (IPS) 23"	
	Panel size	509.184 (H) x 286.416 (V) mm	
	Pixel pitch	0.2652 (H) x 0.2652 (V) mm	
	Number of pixels	1920 (H) x 1080 (V) (FHD)	
	Display color	Approx. 16.77 million colors *4	
	Brightness	300 cd/m ² (Center 1 Point, typical)	
	Contrast ratio	1000:1 (typical)	
	Viewing angle	±89° (typical, horizontal), ±89° (typical, vertical)	
CD-R/CD-RW/DVD drive unit	Unit	DVD super-multi drive unit	
	Used disk	CD-R/CD-RW/DVD±R/DVD±R DL/DVD±RW/DVD-RAM	
	Storage capacity	8.7 GB (using DVD±R DL)	
Hard disk drive unit	Storage capacity	500GB (including 165GB reserved area) Approx. 1680000 images (when a 2 million-pixel image is compressed) to approx. 550000 images (when a 2 million-pixel image is not compressed)	
Image format		When compressed: JPEG When not compress: TIFF	
Maximum image size		20000 pixels (H) x 20000 pixels (V) (using image stitching function)	
Light source	Lamp	Super luminosity LED	
	Lamp life	40000 hours (referent value)	
	Color temperature	5700 K (typical)	

Item		Specifications
Video output	Output format	DVI 1920 pixels x 1080 pixels
	Scanning frequency	Special LCD monitor 66 kHz (H), 60 Hz (V)
	External monitor	66 kHz (H), 60 Hz (V)
Input	Mouse input	USB mouse support
	Keyboard input	USB keyboard support
	External remote input	Pause/Capture, Non-voltage input (Contact/non-contact)
Interface	LAN	RJ-45 (10BASE-T/100BASE-TX/1000BASE-T)
	USB2.0 Series A	6 ports
	USB3.0 Series A	2 ports
Power supply	Power supply voltage	100 to 240 VAC \pm 10%, 50/60 Hz
	Power consumption	280 VA
Environmental resistance	Ambient temperature	+5 to 40°C
	Relative humidity	35 to 80%, No condensation
	Pollution degree	2
	Overvoltage Category	II
Weight	Controller	Approx. 12.5 kg
	Camera unit	Approx. 1.20 kg (VHX-6100/6020)
	Console	Approx. 0.50 kg
Dimensions (excluding protrusions)		550 (W) x 470 (H) x 200 (D) mm (collapsed)

*1: Comparing with Normal mode, its color reproducibility is better.

*2: Comparing with Superfine mode, its color reproducibility is better.

*3: Only supported on multi-scan camera VHX-6100.

*4: Displays approximately 16.77 million colors using the FCR processing of the display controller.

*5: The LCD monitor provided with the microscope is based on extremely advanced technology.

You may, however, notice a permanent black spot (unlit pixels) or permanent bright spot (lit pixels) on the screen. This is normal and should not be considered a defect.

Specifications (Various Functions)

Function		Details	Console supported
Observation function	Auto focus function	Provided	○
	Focus level display function	Provided	
	Lighting shift function (height difference enhancement)	Provided (Full, Partial, Flanking, dark field, bright field, mix illumination modes)	○
	Multi-lighting function	Provided	○
	Camera-shake correcting function	Provided (for video)	○
Display function	Full screen display function	Provided	○
	Split function	Horizontal split, vertical split, 4-part split, 9-part split, Linkage display function	
	Real-time digital zoom	1.0 to 10.0x	
	Comment display function	Provided	
Image optimization function	Glare eliminating function	Provided	○
	Ring eliminating function	Provided	○
	HDR function	Provided	○
	High resolution HDR function	Displays high resolution images with high dynamic range.	○
	Optimization mode (9 types)	Provided (Automatically displays 9 types of image modes and allows selection of the optimal image)	○
	Fine shot function	Provided	○
Stitching function	Image stitching	Provided	○
	3D image stitching	Provided	○
	Navigation function	Provided	
3D function	Live depth composition function	Constantly provide deep image with depth in focus.	○
	Quick Composition and 3D function	Provided	○
	Fine depth composition	Provided	
	3D display function	Provided	
	3D shape correction function	Provided (Slope/Sphere/Cylinder)	
	3D 2-screen simultaneous comparison function	Provided (Combination/Comparison/Difference display mode)	
Recording function	Report output (Excel/Word)	Provided	
	Recording settings reproduction function	Provided	
	Timer capturing function	Provided	
	Video recording/playback function	Maximum 50 frames/sec. Video size (1600 x 1200, 800 x 600, 640 x 480)	

Function		Details	Console supported
Measurement function	Distance, angle, radius, area, etc.	Various functions provided	
	Automatic edge detection	Provided	
	Scale display	Various functions provided	○
	Automatic count, area measurement functions	Provided (enables distance/area measurement through brightness/color extraction)	
	Auto area measurement	Provided	
	Grain size analysis	Provided	
	Contamination analysis	Provided	
	One-click measurement	Provided	
	Auto-measurement	Provided	
	Lens/zoom automatic recognition function (TRIPLE'R)	Provided	
	Auto calibration	Provided (numerical input not required)	
	One-push auto calibration functions	Provided (scale position adjustment not required)	
	CSV file export	Provided	
3D-measurement function (VHX-H4M, VHX-S15, and Optional functions)	3D profile measurement	Provided	
	Point-to-point height measurement function	Provided	
	3D volume measurement	Provided	
	Roughness measurement	Provided	
Manual XY measurement system (VHX-H2M2 optional function)	XY stage measurement	Provided	
	Wide image display function	Provided	
Utility	Easy mode	Provided	○
	Space saving unit	Provided	
	Foot-switch support	Enabled	
	User settings	Provided	
	System protection settings	Provided	
	PC mode	Provided	
	Network connection settings	Provided	
	Function guide	Provided	
	Video help	Provided	
Software for PCs (available free of charge)	Communication software	Allows easy image data transfer between the VHX and PC (LAN).	
	3D playback software	Plays back 3D images saved in the VHX on a PC.	
	Multi-lighting playback software	Existing multi-lighting images can be played back with the VHX after their illumination orientations are changed.	
	HDR playback/measurement/stitched image playback software	HDR parameter adjustment, stitched image display and measurement can be performed.	
	One-click measurement summary software	Summarizes and transfer one-click measurement results to Excel.	

Specifications (Detailed Modules)

Software Package	Video recording module	Records and plays back video.
	Area measurement module	Measures area of 2D images.
	Timer capture module	Provides functions for capturing images automatically at specified time intervals.
	Split-screen module	Provides functions for tiling screens horizontally, vertically, into quarters or ninths.
	Comment entry module	Provides functions for entering and displaying comments such as text and markings on the observed image.
	Image improvement module	Provides image processing functions for correcting images to make observation easier.
	High-quality depth composition module	Composes a single image from multiple images captured in focus at different heights.

Software Usage Agreement

■ Software License Agreement

The use of VHX-6000 communication software (hereinafter referred to as [this software]) is subject to the terms outlined in this software license agreement (hereinafter referred to as [this agreement]) and to the customer's consent to this agreement. The customer's use or duplication of this software, in whole or in part, constitutes the customer's consent to enter into this agreement.

Article 1 (Usage Rights)

- 1 Contingent of the customer's compliance with the terms of this agreement, KEYENCE Corporation (hereinafter referred to as KEYENCE) extends to the customer non-exclusive usage rights.
- 2 The customer may install this software without the limit of the number of the licenses, provided that this software is used only in the same corporation in order to use our product you have purchased.

Article 2 (Limitations on Duplication)

The customer may make no more than 1 copy of this software for backup purposes only.

Article 3 (Prohibitions)

The customer is prohibited from doing the following with this software.

- a. Additions or changes to any or all of the functions of this software.
However, installation of updates or new features provided by KEYENCE is expressly allowed.
- b. Reverse compiling or reverse assembling of this software for the purposes of reverse engineering.
- c. Sale, transfer, redistribution, license, rental or lease to the third party.

This does not include instances where permission has been obtained from KEYENCE in advance.

Article 4 (Copyright)

The copyrights of this software and all associated documentation are the property of KEYENCE.

Article 5 (Exemption of Liability)

KEYENCE shall not be held liable by the user or third party for any damages arising from the use of the software.

Article 6 (Support)

Based on this agreement, KEYENCE agrees to provide the customer with technical support in response to customer questions regarding this software. However, KEYENCE makes no guarantee that the technical support offered will meet the customer's needs.

Article 7 (Termination of Agreement)

- 1 Should the customer destroy this software and any backup copies, this agreement will automatically expire with the customer's cessation of use of this software.
- 2 KEYENCE reserves the right to unilaterally terminate this agreement should the customer violate any of the terms of this agreement. In this instance, this software and all copies should be immediately returned to KEYENCE for destruction.
- 3 Should KEYENCE be caused damages by the customer's violation of this agreement, the customer will compensate KEYENCE for those damages.

Article 8 (Basis in Law)

This agreement is to be adjudicated according to Japanese law.

Usage Agreement for Operation Software

MICROSOFT SOFTWARE LICENSE TERMS

WINDOWS™ 7 ULTIMATE FOR EMBEDDED SYSTEMS

WINDOWS™ 7 PROFESSIONAL FOR EMBEDDED SYSTEMS (ALL VERSIONS)

These license terms are an agreement between you and KEYENCE. Please read them. They apply to the software included on this device. The software also includes any separate media on which you received the software.

The software on this device includes software licensed from Microsoft Corporation or its affiliate.

The terms also apply to any Microsoft

- updates,
- supplements,
- Internet-based services, and
- support services

for this software, unless other terms accompany those items. If so, those terms apply.

If you obtain updates or supplements directly from Microsoft, then Microsoft, and not KEYENCE, licenses those to you.

As described below, using the software also operates as your consent to the transmission of certain computer information for Internet-based services.

By using the software, you accept these terms. If you do not accept them, do not use the software. Instead, contact KEYENCE to determine its return policy for a refund or credit.

If you comply with these license terms, you have the rights below.

1. OVERVIEW.

- a. Software.** The software includes desktop operating system software. This software does not include Windows Live services. Windows Live services are available from Microsoft under a separate agreement.

2. USE RIGHTS.

- a. Use.** The software license is permanently assigned to the device with which you acquired the software. That device is the "licensed device". You may use the software on the licensed device.
- b. Processor Limit.** You may use the software with no more than two processors at any one time.
- c. Alternative Versions.** You may only use the version of the software that is installed on the licensed device. You may not change it to any other version (such as the 32-bit or 64-bit version, or another language version).

3. ADDITIONAL LICENSING REQUIREMENTS AND/OR USE RIGHTS.

- a. Specific Use.** KEYENCE designed the licensed device for a specific use. You may only use the software for that use.
- b. Other Software.** You may use other programs with the software as long as the other programs
- directly support the specific use for the licensed device, or
 - provide system utilities, resource management, or anti-virus or similar protection.

Software that provides consumer or business tasks or processes may not run on the licensed device. This includes email, word processing, spreadsheet, database, scheduling and personal finance software. The licensed device may use terminal services protocols to access such software running on a server.

- c. Device Connections.** You may not use the software as server software. In other words, more than one device may not access, display, run, share or use the software at the same time. You may allow up to twenty other devices to access the software to use
- File Services,
 - Print Services,
 - Internet Information Services, and
 - Internet Connection Sharing and Telephony Services.

The twenty connection limit applies to devices that access the software indirectly through "multiplexing" or other software or hardware that pools connections. You may use unlimited inbound connections at any time via TCP/IP.

- d. Remote Access Technologies.** You may access and use the software remotely from another device using remote access technologies as follows.

Remote Desktop. The single primary user of the licensed device may access a session from any other device using Remote Desktop or similar technologies. A "session" means the experience of interacting with the software, directly or indirectly, through any

combination of input, output and display peripherals. Other users may access a session from any device using these technologies, if the remote device is separately licensed to run the software.

Other Access Technologies. You may use Remote Assistance or similar technologies to share an active session.

Other Remote Uses. You may allow any number of devices to access the software for purposes other than those described in the Device Connections and Remote Access Technologies sections above, such as to synchronize data between devices.

e. Font Components. While the software is running, you may use its fonts to display and print content. You may only

- embed fonts in content as permitted by the embedding restrictions in the fonts; and
- temporarily download them to a printer or other output device to print content.

f. Icons, images and sounds. While the software is running, you may use but not share its icons, images, sounds, and media.

4. POTENTIALLY UNWANTED SOFTWARE. The software includes Windows Defender. If Windows Defender is turned on, it will search this device for "spyware," "adware" and other potentially unwanted software. If it finds potentially unwanted software, the software will ask you if you want to ignore, disable (quarantine) or remove it. Any potentially unwanted software rated "high" or "severe," will be automatically removed after scanning unless you change the default setting. Removing or disabling potentially unwanted software may result in

- other software on your computer ceasing to work, or
- your breaching a license to use other software on this device.

By using this software, it is possible that you will also remove or disable software that is not potentially unwanted software.

5. SCOPE OF LICENSE. The software is licensed, not sold. This agreement only gives you some rights to use the software. KEYENCE and Microsoft reserve all other rights. Unless applicable law gives you more rights despite this limitation, you may use the software only as expressly permitted in this agreement. In doing so, you must comply with any technical limitations in the software that allow you to use it only in certain ways. For more information, see the software documentation or contact KEYENCE. You may not:

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- reverse engineer, decompile or disassemble the software;
- make more copies of the software than specified in this agreement;
- publish the software for others to copy;
- rent, lease or lend the software; or
- use the software for commercial software hosting services.

Except as expressly provided in this agreement, rights to access the software on this device do not give you any right to implement Microsoft patents or other Microsoft intellectual property in software or devices that access this device.

INTERNET-BASED SERVICES. Microsoft provides Internet-based services with the software. Microsoft may change or cancel them at any time.

a. Consent for Internet-Based Services. The licensed device may contain one or more of the software features described below. These features connect to Microsoft or service provider computer systems over the Internet. In some cases, you will not receive a separate notice when they connect. For more information about these features, visit

go.microsoft.com/fwlink/?linkid=104604.

By using these features, you consent to the transmission of this information. Microsoft does not use the information to identify or contact you.

Computer Information. The following features use Internet protocols, which send to the appropriate systems computer information, such as your Internet protocol address, the type of operating system and browser, and the name and version of the software you are using. Microsoft uses this information to make the Internet-based services available to you. KEYENCE has elected to turn on the following features in the licensed device.

- Plug and Play and Plug and Play Extensions. You may connect new hardware to your device. Your device may not have the drivers needed to communicate with that hardware. If so, the update feature of the software can obtain the correct driver from Microsoft and install it on your device.
- Web Content Features. Features in the software can retrieve related content from Microsoft and provide it to you. Examples of these features are clip art, templates, online training, online assistance and Appshelp. You may choose not to use these web content features.
- Digital Certificates. The software uses x.509 version 3 digital certificates. These digital certificates confirm the identity of users sending information to each other and allow you to encrypt the information. The software retrieves certificates and updates certificate revocation lists over the Internet.
- Auto Root Update. The Auto Root Update feature updates the list of trusted certificate authorities. You can switch off this feature.
- Windows Media Digital Rights Management. Content owners use Windows Media digital rights management technology (WMDRM) to protect their intellectual property, including copyrights. This software and third party software use WMDRM to play

and copy WMDRM-protected content. If the software fails to protect the content, content owners may ask Microsoft to revoke the software's ability to use WMDRM to play or copy protected content. Revocation does not affect other content. When you download licenses for protected content, you agree that Microsoft may include a revocation list with the licenses. Content owners may require you to upgrade WMDRM to access their content. Microsoft software that includes WMDRM will ask for your consent prior to the upgrade. If you decline an upgrade, you will not be able to access content that requires the upgrade. You may switch off WMDRM features that access the Internet. When these features are off, you can still play content for which you have a valid license.

- Windows Media Player. When you use Windows Media Player, it checks with Microsoft for
 - compatible online music services in your region;
 - new versions of the player; and
 - codecs if your device does not have the correct ones for playing content.

For more information, go to: <http://go.microsoft.com/fwlink/?linkid=104605>.

- Malicious Software Removal/Clean On Upgrade. Before installation of the software, the software will check and remove certain malicious software listed at www.support.microsoft.com/?kbid=890830 ("Malware") from your device. When the software checks your device for Malware, a report will be sent to Microsoft about any Malware detected or errors that occurred while the software was checking for Malware. No information that can be used to identify you is included in the report.
- Network Awareness. This feature determines whether a system is connected to a network by either passive monitoring of network traffic or active DNS or HTTP queries. The query only transfers standard TCP/IP or DNS information for routing purposes. You can switch off the active query feature through a registry setting.
- Windows Time Service. This service synchronizes with www.time.windows.com once a week to provide your computer with the correct time. The connection uses standard NTP protocol.

b. Use of Information. Microsoft may use the computer information, error reports, and Malware reports to improve our software and services. We may also share it with others, such as hardware and software vendors. They may use the information to improve how their products run with Microsoft software.

c. Misuse of Internet-based Services. You may not use these services in any way that could harm them or impair anyone else's use of them. You may not use the services to try to gain unauthorized access to any service, data, account or network by any means.

6. VALIDATION.

- a. Validation verifies that the software has been activated and is properly licensed. It also verifies that no unauthorized changes have been made to the validation, licensing, or activation functions of the software. Validation may also check for certain malicious or unauthorized software related to such unauthorized changes. A validation check confirming that you are properly licensed, permits you to continue to use the software, certain features of the software or to obtain additional benefits. **You are not permitted to circumvent validation.** This is to prevent unlicensed use of the software. For more information, see go.microsoft.com/fwlink/?Linkid=104610.
- b. The software will from time to time perform a validation check of the software. The check may be initiated by the software or Microsoft. To enable the activation function and validation checks, the software may from time to time require updates or additional downloads of the validation, licensing or activation functions of the software. The updates or downloads are required for the proper functioning of the software and may be downloaded and installed without further notice to you. During or after a validation check, the software may send information about the software, the computer and the results of the validation check to Microsoft. This information includes, for example, the version and product key of the software, any unauthorized changes made to the validation, licensing or activation functions of the software, any related malicious or unauthorized software found and the Internet protocol address of the computer. Microsoft does not use the information to identify or contact you. By using the software, you consent to the transmission of this information. For more information about validation and what is sent during or after a validation check, see go.microsoft.com/fwlink/?Linkid=104611.
- c. If, after a validation check, the software is found to be counterfeit, improperly licensed, or a non-genuine Windows product, or if it includes unauthorized changes, then the functionality and experience of using the software will be affected. For example:

Microsoft may

- repair the software, and remove, quarantine or disable any unauthorized changes that may interfere with the proper use of the software, including circumvention of the activation or validation functions of the software; or
- check and remove malicious or unauthorized software known to be related to such unauthorized changes; or
- provide notice that the software is improperly licensed or a non-genuine Windows product;

and you may

- receive reminders to obtain a properly licensed copy of the software; or
- need to follow Microsoft's instructions to be licensed to use the software and reactivate;

and you may not be able to

- use or continue to use the software or some of the features of the software; or
- obtain certain updates or upgrades from Microsoft.

- d. You may only obtain updates or upgrades for the software from Microsoft or authorized sources (including KEYENCE). For more information on obtaining updates from authorized sources see go.microsoft.com/fwlink/?Linkid=104612.
7. **PRODUCT SUPPORT.** Contact KEYENCE for support options. Refer to the support number provided with the device.
 8. **MICROSOFT .NET BENCHMARK TESTING.** The software includes one or more components of the .NET Framework (".NET Components"). You may conduct internal benchmark testing of those components. You may disclose the results of any benchmark test of those components, provided that you comply with the conditions set forth at go.microsoft.com/fwlink/?LinkID=66406. Notwithstanding any other agreement you may have with Microsoft, if you disclose such benchmark test results, Microsoft shall have the right to disclose the results of benchmark tests it conducts of your products that compete with the applicable .NET Component, provided it complies with the same conditions set forth at go.microsoft.com/fwlink/?LinkID=66406.
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 16. **RESTRICTED USE.** The Microsoft software was designed for systems that do not require fail-safe performance. You may not use the Microsoft software in any device or system in which a malfunction of the software would result in foreseeable risk of injury or death to any person. This includes operation of nuclear facilities, aircraft navigation or communication systems and air traffic control.
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 19. **LIABILITY LIMITATIONS.** You can recover from Microsoft and its affiliates only direct damages up to two hundred fifty U.S. Dollars (U.S. \$250.00), or equivalent in local currency. You cannot recover any other damages, including consequential, lost profits, special, indirect or incidental damages.
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 - anything related to the software, services, content (including code) on third party internet sites, or third party programs, and
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 It also applies even if Microsoft should have been aware of the possibility of the damages. The above limitation may not apply to you because your country may not allow the exclusion or limitation of incidental, consequential or other damages.
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21. ENTIRE AGREEMENT. This agreement, additional terms (including any printed-paper license terms that accompany the software and may modify or replace some or all of these terms), and the terms for supplements, updates, Internet-based services and support services that you use, are the entire agreement for the software and support services.

22. APPLICABLE LAW.

a. United States. If you acquired the software in the United States, Washington state law governs the interpretation of this agreement and applies to claims for breach of it, regardless of conflict of laws principles. The laws of the state where you live govern all other claims, including claims under state consumer protection laws, unfair competition laws, and in tort.

b. Outside the United States. If you acquired the software in any other country, the laws of that country apply.

Before asking repair and inspection

This product is mounting a hard disk.

Before giving your VHX to Keyence for repair and inspection,

Be sure to back up data in the hard disk.

In case that data remains in the hard disk, it may disappear or cannot be retrieved because of repairs or during transportation. Please back up data in the hard disk.

When some defects are discovered in the hard disk during repair or inspection, we will replace it.

The data stored in the defective hard disk is transferred into a new hard disk.

If the data stored in the defective hard disk can be taken from it, the data will be transferred into a new hard disk as part of the replacement work. When, however, the data cannot be taken from it, only replacement of the hard disk is carried out.

Return of the replaced hard disk

In case that a hard disk is replaced, basically we discard the replaced hard disk. When such hard disk needs to be returned, please inform our sales office about that in advance, or when you request repairs.

Nondisclosure of the data when repair or inspection is taken place

In case that data remains in the hard disk, we may open the data file in the hard disk to confirm or analyze the phenomenon, and to move such data. Please delete all the data that must not be disclosed to us before requesting repairs. We will properly manage any data in the hard disk as our customer's confidential information. We will never disclose or leak it to any third parties, or make it available to the public.

Request for data backup

Please backup data in the hard disk regularly.

If you have any questions or concerns, please feel free to contact the nearest sales office.

Revision History

Date of printing	Version	Revision details
March 2017	Revised 1st edition	
May 2017	2nd revision 1st edition	
February 2018	3rd revision 1st edition	
March 2018	3rd revision 2nd edition	
August 2018	4th revision 1st edition	Change of applicable directive in CE Marking.

WARRANTIES AND DISCLAIMERS

- (1) KEYENCE warrants the Products to be free of defects in materials and workmanship for a period of one (1) year from the date of shipment. If any models or samples were shown to Buyer, such models or samples were used merely to illustrate the general type and quality of the Products and not to represent that the Products would necessarily conform to said models or samples. Any Products found to be defective must be shipped to KEYENCE with all shipping costs paid by Buyer or offered to KEYENCE for inspection and examination. Upon examination by KEYENCE, KEYENCE, at its sole option, will refund the purchase price of, or repair or replace at no charge any Products found to be defective. This warranty does not apply to any defects resulting from any action of Buyer, including but not limited to improper installation, improper interfacing, improper repair, unauthorized modification, misapplication and mishandling, such as exposure to excessive current, heat, coldness, moisture, vibration or outdoors air. Components which wear are not warranted.
- (2) KEYENCE is pleased to offer suggestions on the use of its various Products. They are only suggestions, and it is Buyer's responsibility to ascertain the fitness of the Products for Buyer's intended use. KEYENCE will not be responsible for any damages that may result from the use of the Products.
- (3) The Products and any samples ("Products/Samples") supplied to Buyer are not to be used internally in humans, for human transportation, as safety devices or fail-safe systems, unless their written specifications state otherwise. Should any Products/Samples be used in such a manner or misused in any way, KEYENCE assumes no responsibility, and additionally Buyer will indemnify KEYENCE and hold KEYENCE harmless from any liability or damage whatsoever arising out of any misuse of the Products/Samples.
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KEYENCE CORPORATION

1-3-14, Higashi-Nakajima, Higashi-Yodogawa-ku, Osaka, 533-8555, Japan PHONE: +81-6-6379-2211

www.keyence.com

AUSTRIA

Phone: +43-2236-378266-0

BELGIUM

Phone: +32-15-281-222

BRAZIL

Phone: +55-11-3045-4011

CANADA

Phone: +1-905-366-7655

CHINA

Phone: +86-21-3357-1001

CZECH REPUBLIC

Phone: +420-220-1847-00

FRANCE

Phone: +33-1-56-37-78-00

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Phone: +41-43-455-77-30

TAIWAN

Phone: +886-2-2721-8080

THAILAND

Phone: +66-2-369-2777

UK & IRELAND

Phone: +44 1908-696-900

USA

Phone: +1-201-930-0100

VIETNAM

Phone: +84-24-3772-5555

