INSTRUCTIONS

STM7-BSW/STM7-ASW-ME

Basic software / MIA,EFI option software

This instruction manual is for the Evident basic software.
To obtain optimum performance of this software and to ensure the safety,
study this manual thoroughly before operating the camera and keep it on
hand during operation of the software.
Keep this instruction manual in a safe place.

Optical Microscope Accessory

NOTE: This product has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the product is operated in a commercial environment. This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Operation of this product in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the product.

FCC Supplier's Declaration of Conformity

Hereby declares that the product
    Product name: Optical Microscope Accessory
    Model Number: STM7-BSW

Conforms to the following specifications:
    FCC Part 15, Subpart B, Section 15.107 and Section 15.109

Supplementary Information:
    This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Responsible Party Name: Evident Scientific, Inc.
Address: 48 Woerd Ave Waltham, MA 02453, USA
Phone Number: 781-419-3900

UK CA   CE

This product is applied with the requirements of standard IEC/EN61326-1 concerning electromagnetic compatibility.
- Emission   Class A
- Immunity   Industrial electromagnetic environment
Emissions exceeding the level required by aforementioned standards may occur if this product is electrically connected to other equipment.
Some interference may occur if this product is used in residential environments.

In accordance with European Directive on Waste Electrical and Electronic Equipment, this symbol indicates that the product must not be disposed of as unsorted municipal waste, but should be collected separately.
Refer to your local Evident distributor in EU for return and/or collection systems available in your country.

Contents

Important

This software is a basic software to measure various coordinates using the counter data of the measuring microscope STM7, STM6, STM6-LM, etc. on the controller.

Contents of instruction manuals

Read the instruction manual provided separately together with this manual to understand the operating procedures comprehensively.

When using STM7

Manual name	Main contents
Basic software STM7-BSW/STM7-ASW-ME (this manual)	Operating procedures of basic software
Measuring microscope STM7	Operating procedures of measuring microscope
Hand switch / Focus controller quick guide STM7-HS/STM7-MCZ	Easy operating procedures of hand switch or focus controller
Control box STM7-CB/CBA	Functions of control box STM7-CB or STM7-CBA
Autofocus unit STM7-AF	Functions of autofocus

When using STM6

Manual name	Main contents
Measuring microscope STM6/STM6-LM	Operating procedures of measuring microscope
Autofocus unit MM6-AF/MM6C-AF	Functions of autofocus
Focus navigator unit MM6-FN	Functions of focus navigator unit

Trademark

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Intel and Intel Core are trademarks of Intel Corporation in the U.S. and/or other countries.
Other company names or product names described in this manual are either registered trademarks or trademarks of respective companies.

Safety precautions

If the product is used in a manner not specified by this manual, the safety of the user may be imperiled. In addition, the product may also be damaged. Always use the equipment according to this instruction manual.

> The following symbols are used in this instruction manual.
>
> ⚠ CAUTION : Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
>
> CAUTION : Indicates a potentially hazardous situation which, if not avoided, may result in damage to the equipment or other property.
>
> ◎ Indicates commentary (for ease of operation and maintenance).

Intended use

This software is a basic software to calculate various coordinates using the measured values of the measuring microscope STM7/STM6 on the controller.

⚠ CAUTION   - Electric safety -

Be sure to turn OFF the power of the device before connecting /disconnecting cables and units.
As the software may be terminated abnormally, etc., you need to restart the controller.

Operating environments

This software can be used under following conditions.

Item	System configurations
CPU	When using DP23/DP28, Intel® Core™ i5 or more
	When using DP22/DP27/STM7-CU, Intel® Core™ i3 Processors 3GHz or more
Memory	When using DP22/DP27/STM7-CU, 4GB or more
	When using DP23/DP28, 8GB or more (16GB (8GB x 2 Dual channel) are recommended.)
HD available space	100GB or more hard disk space for installation SSD hard disk is recommended for high speed image acquisition.
Graphic card	Graphic card available for resolution 1980x1080 and 32bit color. * You must provide monitors and graphic cards that support the camera's resolution to display the entire image input by the camera at 100% display. 　DP27: 3840x2160 (4K) DP28: 4104x2174 　DP22: 2880x1620 (3K) DP23: 3088x2076 　STM7-CU: 3200x1800 (QHD+)
Drive	DVD Drive
PC input device	2-button mouse (3-button mouse with a wheel is recommended.) Keyboard
Operating system	Microsoft® Windows® 10 Pro/Pro for Workstations 　(Version 2004/20H2/21H1/21H2/22H2) 64bit Microsoft® Windows® 11 Pro/Pro for Workstations 　(Version 21H2/22H2/23H2) 64bit Microsoft® .NET Framework 4.7.2 , 4.8 , 4.8.1
OS languages	Japanese, English (Do not change the default settings for "Region and Language" in the Windows control panel.)

The operations in environments other than those described above are not ensured.

◎ The following external applications have been confirmed to operate on the same controller. Do not install any applications other than those described below.

· Microsoft® Office 2013/2016/2019/2021/365(SAC) (Only the same language as operating system)
· PRECiV 1.1, 1.2, 2.1 and OLYMPUS Stream 2.5, 2.5.2 (However, do not select the SC30 camera during installation.)

Restrictions

Basic software/optional software

1. If this product is connected to the network, the product may not work properly due to the following problems.
   · Virus infection through the network
   · Malfunction caused by applying OS service pack, security patch, or updating third party software including runtime libraries
   · The acquired images are missed or the acquisition process is delayed or stopped due to the overloaded system which is caused by running the antivirus software, etc.

2. If you start the software when the microscope digital camera DP22/DP23/DP27/DP28 or the digital camera STM7-CU is not connected, the digital camera is not recognized by the software.
   Connect the digital camera to the microscope and restart the software.

3. When using the microscope digital camera DP22/DP23/DP27/DP28, if the driver of USB3.0 is old, problems may occur, such as the live images are not displayed, etc. In this case, get the latest driver from the website or so of the manufacturer of the controller, and install it again.

4. The live images from the STM7-CU may not be displayed if the STM7-BSW is installed on a system on which the driver for the SC30 camera, which is manufactured by Evident Technology Center Europe, is installed.
   (See "5 Troubleshooting" (page 183).)

5. If a camera different from the camera specified by the software is connected to the microscope, the camera is not recognized by the software when you start the software.
   Set the camera again by the software and restart the software.

6. If the camera type is changed by the software, restart the software.

7. If you start the software when the main switch of the control box STM7-CB/STM7-CBA is not set to "Ⅰ" (ON), you need to set the main switch to "Ⅰ" (ON) and connect the control box to the microscope in [Communications Settings] of the software.

8. Stitching
   · The stitched images are not applicable for measurement.
   · The position gap could occur caused by the optical distortion.
   · The gap of the intensity data on seams caused by shading could be distinct on some measurement objects.
   · The number of stitchable images is limited depending on the camera binning setting or the image resolution.

9. When using the autofocus unit STM7-AF, only the focus indicator is available.

10. STM6
    When STM6 is selected, following functions are not available.
    · Illumination control
    · Autofocus function (focus navigator)
    · Unit selection function
    · Error notification function
    · Excel transfer tool

11. Selecting units
    · When the unit is changed, the settings of the software screen length are initialized.
    · When using files saved with a different unit, change the unit of the microscope to that unit before use.

3

- When you start measurement, the units cannot be selected. Therefore, select all measurement items in the [List] window and delete them or click the [Create New] button in the menu to set so that there are no measurement items in the [List] window.

12. Others
    - When transferring the acquired counter data to Excel®, Microsoft® Excel® must be installed in advance.
    - The encode to output the CSV file is Shift-JIS. Depending on the software, the characters may be garbled if character codes are not converted.
    - When the low resolution camera is set, the resolution will be reduced and, therefore, the measurement accuracy in the edge measurement will also be reduced.
    - The camera being used with this software cannot be used with other software at the same time.

13. Measurement objects where the extended focus images or the surface state may not successfully be obtained.
    - Measurement object with a vertical wall or a steep slope
    - A concave or a transparent measurement object where the reflected light from the backside or the inside may be erroneously detected.
    - Measurement object containing substances with higher reflectivity than the transparent surface beneath its surface.
    - Measurement object with significantly low contrast
    - Measurement object which causes a false focusing optically

14. When using the Z-axis manual type, the extended focus images cannot be acquired by specifying the Z-axis range.

15. Measurement objects where the brightness adjustment by auto exposure may not work properly
    - Measurement object containing the area where the reflectivity is significantly different than other areas

16. The tint of the image viewed from the eyepiece may be different from the tint of the live image due to optical characteristics or image processing.

17. This software does not support the settings of signs of the counting direction of X-, Y- and Z-axis except initial values.
    For setting values, refer to "2. Setting Function List" in "STM7 instruction manual".

18. When you install the STM7-BSW, an Excel Transfer tool that can only be used with STM7 is installed in following the folder path.
    - C:\Program Files\OLYMPUS\STM7\Tools\ExcelTransferTool.
    This tool can be used to easily transfer the coordinate data to Excel® or to adjust the STM7.

19. Restrictions when using OLYMPUS Stream / PRECiV.
    - The DP camera cannot be operated with STM7-BSW and OLYMPUS Stream / PRECiV at the same time.
    - When using STM7-BSW Ver.1.2.1 or earlier, if you use the coded revolving nosepiece with OLYMPUS Stream, the coded revolving nosepiece must be disconnected from STM7 and connected to U-CBS.
    - When measuring the image acquired with STM7-BSW using OLYMPUS Stream / PRECiV, the image must be calibrated with OLYMPUS Stream / PRECiV before measurement.
    (Because the calibration information is not included in the image acquired with STM7-BSW.)

20. When using STM7-BSW Ver.1.2.1 or earlier, if you have both the adapter to mount measuring objective STM7-MMOBAD and the coded revolving nosepiece and you want to use the adapter to mount measuring objective, remove the connection cable of the coded revolving nosepiece from STM7 in order to change the calibration settings.

21. When performing the replay measurement using teaching lists created by STM7-BSW Ver. 1.2.1 or earlier, if [Origin] of [Alignment] is not specified in the teaching list but [X-axis] is specified, [Origin] must be added to the teaching list.
    (If only [X-axis] of [Alignment] is specified in the teaching list, the origin position differs depending on the version of STM7-BSW at the time when the teaching list is created.
    With Ver.1.2.1 or earlier, either of two points specified when defining the line to specify the X-axis is set as an origin.
    With Ver.1.3.1 or later, the origin position of the reference coordinate system (counter coordinates XY) is set as the origin.)

22. Select the camera you want to use when installing STM7-BSW.
    If you want to use the camera different from the one you selected when installing STM7-BSW, reinstall STM7-BSW and reselect the camera you want to use.

1 Setup

Installation and Uninstallation of Software

1 Installation of software

CAUTION • Before installing this software, remove the USB license key from the USB port of the controller.

• Detach the interface cable of the microscope digital camera DP22/DP23/DP27/DP28 or the digital camera STM7-CU from the USB port of the controller.

• When using the microscope digital camera DP22/DP23/DP27/DP28, if the driver of USB 3.0 is old, the problems may occur, such as the live images are not displayed, etc. In this case, get the latest driver from the website or so of the manufacturer of the controller, and install it again.

• Login to Windows® with the authority as Administrator.

• If you use the controller without the COM port or if you use 2 or more COM ports to attach the coded revolving nosepiece to STM6/STM6-LM, use the USB serial conversion cable.

• Close all software before starting operations.

• This software supports only .NET Framework 4.7.2, 4.8 4.8.1 If .NET Framework of the other version is installed on the controller, uninstall it before installing this software.

• When the authorization inquiry screen appears, select the button indicating to permit all.

◎ If a restore point of Windows® is created before installing the software, you can restore the operating system environments in case of unexpected software problems. It is recommended to create a restore point.

1 Insert the installation media into the disk drive of the controller.

2 Right-click Setup.exe (or Setup) of the following folder of the installation media.

> D:\STM7-BSW Ver.X.XX folder
>
> ("D" indicates the drive name of the disk drive. Depending on the controller, a character other than "D" may be used for the disk drive.) (Ver.X.XX is the software version number.)

3 Select [Run as Administrator (A)] in the menu displayed.

◎ If .NET Framework 4.7.2 or later version is not installed on the controller, .NET Framework 4.7.2 will be installed first.
If the controller restarts on its own after .NET Framework 4.7.2 is installed, execute Setup.exe of STM7-BSW again.

4 When using an English operating system, select [English] and click the [Next] button.

5 Click the [Next] button.

6 Read the Software License Agreement on the screen carefully. If you agree to the terms and conditions described, select [Agree to all terms and conditions of Software License Agreement (A)], and click the [Next] button. The installation starts.

7 Click the [Next] button.

8 When the installation is completed halfway, click the [Next] button. The software and the device driver of Microsoft® are installed. Wait for a while.

◎ The message indicating "To enable the setting change, you need to restart the system." may appear in rare cases. In this case, press the [Restart now] button in Step **12** and select "Restart" in this message. Until then, do not operate this message.

9 When the camera selection screen appears, select [DP23/DP28] or [DP22/DP27/STM-CU] and click the [Next] button.

◎ To reselect the camera, you need to reinstall STM7-BSW.

10 If you use the previous setting information, select [Use previous adjusted values] and if you do not use it, select [Use default values]. Click the [Next] button.

◎ This selection item is displayed only when this software was used previously.

11 Select the software language, and click the [Next] button.

12 When the installation is completed, click the [Restart now] button. Wait until Windows® restarts.

CAUTION • After installing this software, insert the USB license key to the USB port of the controller.

• After installing this software, connect the camera to the USB port specified on the controller. If you are using the microscope digital camera DP22/DP23/DP27/DP28, confirm that the blue LED on the back of the camera lights after you connect it.

• If the message indicating the failure of installing the camera driver appears when the installation is completed, follow the instruction in the message.

CAUTION When the software is installed, Windows® settings described below are changed.

Item	Settings
Desktop	OLYMPUS Theme
Sreen saver	None
Taskbar	Auto hide the taskbar.
Change settings for the plan - Put the computer to sleep	None

Do not change Windows® settings. The software may not be operated properly.

Enable stitching/extended focus software

CAUTION • Login to Windows® with the authority as Administrator.

• Connect the USB license key to the USB port of the controller before starting operations. Be sure not to unplug it until you finish operations.

• Confirm that you can start the basic software properly before starting operations and close the basic software.

• Close all software before starting operations.

1 Insert the installation media of the stitching/extended focus software into the disk driver of the controller where the basic software has been installed.

2 Copy the following folder of the installation media to the desktop of the controller.
D:\STM7-ASW-ME folder

("D" indicates the drive name of the disk drive. Depending on the controller, a character other than "D" may be used for the disk drive.)

3 Double-click the following file in the STM7-ASW-ME folder.
STM7_ASW_ME.exe
The [STM7-ASW-ME] window is displayed.

4 Click the [Enable option] button.

When the message [Enabled option successfully.] appears, this operation is finished. Click the [OK] button to finish the operation.

2   Uninstallation of software

(CAUTION) • **Login to Windows® with the authority as Administrator.**

       • **Exit the STM7-BSW, Excel Transfer tool, and other software before starting.**

1   Select [Control panel] in the [Start] button in the lower left area of the Windows® screen.

2   Display [Programs and functions] in [Control panel].

3   Select [STM7-BSW] and click the [Uninstall] button.

4   Click the [Yes] button.

◎ The message indicating "The following application should be closed before continuing the installation (Logger-Watcher Application)." may appear in rare cases. In this case, select "Automatically close applications and attempt to restart them after setup is complete." and click the [OK] button.

5   The message "Do you delete the adjusted value?" appears. If you save the setting information, click the [No] button and if you do not save it, click the [Yes] button.
The uninstallation starts.

◎ The setting information can be used when the software is re-installed. It is recommended to save the setting information.

◎ The calibration information is saved regardless of whether the setting information is saved or not. When the software is re-installed, the calibration information is loaded to the software automatically.

6   When the screen disappears, the uninstallation is completed. Continue to do the following tasks.

7   Restart the controller.

8   Select [Control panel] in the [Start] button in the lower left area of the Windows® screen.

9   Display [Programs and functions] in [Control panel].

10   When [IDS uEye] is installed, select [IDS uEye] and click the [Uninstall] button.

11   Select [Remove] and click the [Next] button.

12   Click the [Yes] button.

13   Click the [Yes] button.

14   Click the [OK] button.

15   Click the [Finish] button.

16   Restart the controller.

1-2 Start and Exit Software

1 Start software
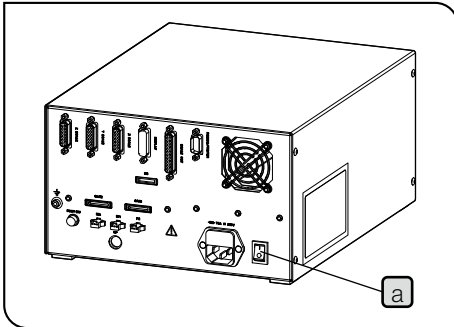
1 Set the main switch [a] on the rear of the control box STM7-CB/STM7-CBA to ❙(ON).

(CAUTION) • **Be sure to set the main switch of the control box to ON before starting the software.**
The software can be used when the main switch of the control box is set to ON.

• **The software cannot be started while you use the autofocus function or operate the focusing unit. Stop these operations before starting the software.**

2 Double-click the **STM** (STM7-BSW) icon on the desktop of the controller.

3 Register the Administrator on the [Administrator Registration screen]. Refer to "User registration" (page 178) for details.

◎ [Administrator Registration screen] appears each time when the software starts until the Administrator is registered.

4 Click the [Register] button or the [Cancel] button.

5 Login [Login authentication screen].

◎ When logging in by checking [Login as a guest], you can use the software without inputting the User ID and password. However, some functions are not available.
Refer to "User authority" (page 177) for details.

When you login, the software screen appears.

2 Exit software
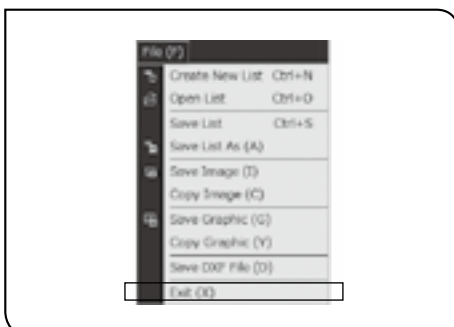
1 Click the ▬▬(Close) button in the upper right area of the software screen or [Exit] in [File] menu.

2 If the list is not saved, a message indicating to select whether or not to save the list appears. Save the list according to the message.

1-3 Setting Software

1 Setting the camera

This section describes the settings of the live image and the camera.
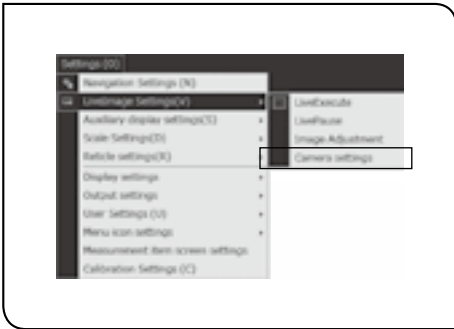
1 Select [Camera settings] in [Live image settings] in [Settings] menu. The [Camera settings] tab in the [Live image settings] window appears.

2 Select the camera you will use.

3 Click the [OK] button [a].
The [Live image settings] window is closed.

◎ If you change the camera after clicking the [OK] button, the "Change the camera. Press OK to resume the live view." message appears, so after you connect the selected camera to the appropriate USB port as indicated on the controller, click the [OK] button.
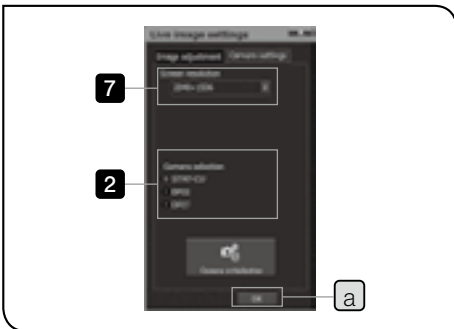
4 Click the ▄▄▄ (Close) button in the upper right area of the software screen or [Exit] in [File] menu.

◎ If the camera is changed, restart the software.

5 Double-click the ▄▄▄ (STM7-BSW) icon on the desktop of the controller to start the software.

6 Select [Camera settings] in [Live image settings] in [Settings] menu. The [Live image settings] window appears.

7 Select the screen resolution.

◎ When using the binning mode, select the resolution shown with "Binning".

◎ Using the binning mode improves the frame rate, but deteriorates the image quality.

8 Display the [Image adjustment] tab.

9 Set the exposure time.

10 Set the white balance.

CAUTION **If you perform one-touch white balance using the digital camera STM7-CU, the adjustment takes approximately 15 seconds. Do not move the adjustment sample during this time period.**

11 When settings are completed, click the [OK] button [a].
The [Live image settings] window is closed.

◎ Refer to "Camera setting" (page 167) and "Image adjustment" (page 166) for details.

2 Setting communications

This section describes the settings of the connection with the digital indicator.
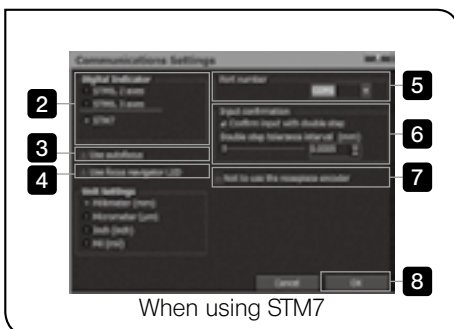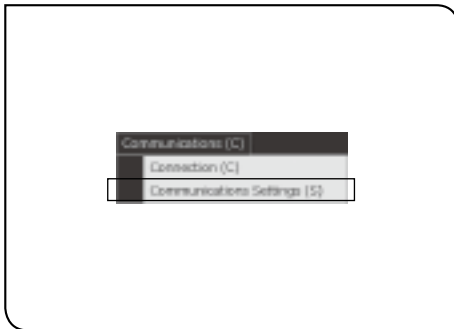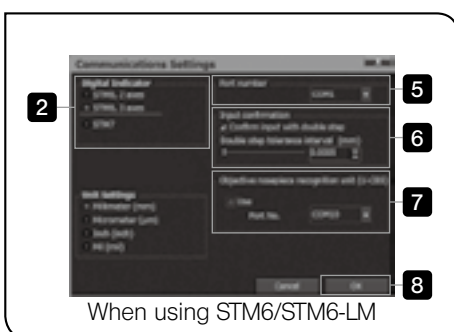
1 Select [Communications settings] in the [Communications] menu. The [Communications Settings] window appears.

◎ If [Communications settings] cannot be selected, uncheck [Connection] in the [Communications] menu.

2 Select the digital indicator you will use.

◎ When you are using STM7, select [STM7].

◎ When you are using STM6/STM6-LM to acquire the Z-axis coordinate data, select [STM6, 3 axes].

3 When using the STM7 autofocus unit STM7-AF, check [Use autofocus].

◎ When using STM6/STM6-LM, this check box is not displayed.

4 When using the STM7 focus navigator STM7-FN, select [Use focus navigator LED].

◎ When using STM6/STM6-LM, this check box is not displayed.

When using STM7

5 Select the COM port number used for communications among X-,Y- and Z-axes.

◎ You can confirm the COM port number used for communications by the device manager of the operation system.

6 When using the double step (page 66), check [Confirm input with double step] and specify the double step tolerance interval.

◎ The double step is an operation to input the same coordinates consecutively.
(It means to operate as if double-clicking the digital Indicator STM7-DI, Hand Switch STM7-HS, DATA button of Focus Controller STM7-MCZ or Foot Switch STM7-FS.)

◎ The initial tolerance interval is 0.0005 mm.
The counter data may be changed by the vibration even though the stage is stopped. If the tolerance interval of the double step is narrow, the input point could not be confirmed with the double step. In this case, make the tolerance interval wider than the current value.

When using STM6/STM6-LM

7 When using the coded revolving nosepiece, check [Use] and select the port number you want to use.

◎ When using STM7, the [Not to use the nosepiece encoder] check box is displayed instead of this group box. The coded revolving nosepiece is recognized automatically, but when you do not use the coded revolving nosepiece, check the [Not to use the nosepiece encoder] check box.

8 When settings are completed, click the [OK] button.
The [Communications settings] window is closed.

◎ Refer to "11 Communications" (page 181) for details.

1-4 Calibration

The calibration is set per objective lens attached to the revolving nosepiece of the microscope.

(CAUTION) **As the software uses the actual value per pixel when performing the following items, the calibration must be performed in advance.**
- **Measurement with edge tool**
- **Acquisition of stitched images**
- **Display of stage position (field of view) in [Graphic] window**
- **Display of scale and reticle**

After calibration, be sure to match the settings of the objective of this software with the magnification of the objective to be actually used. The objective information can be confirmed in the [Objective lens] window.

◎ If you change the camera to be used, the calibration must be performed again.

◎ Select the calibration method from 2 methods described below.
1. Set the actual value in the specified area on the image.
2. Set the actual value per pixel of the image

◎ The calibrated values can be saved as files or loaded.

◎ After calibration, the length of one pixel always shows the value when the camera is set to the high resolution regardless of the current resolution set to the camera.
If the camera is set to the resolution other than the high resolution, the software converts this value to the current camera resolution before using this value.

◎ For details of the camera resolution, refer to "Camera setting" (page 167).

1 Setting actual dimensions of the specified area on the image
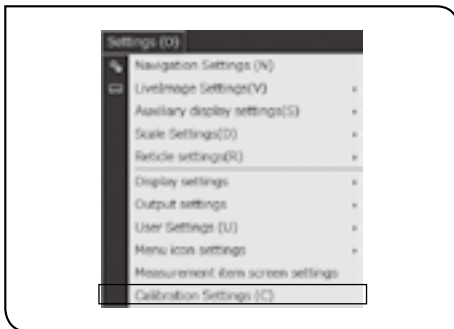
1 Place the micrometer or the scale which can measure the actual size on the stage.

2 Click the [Calibration Settings] in the [Settings] menu.

The [Calibration settings] window appears.

3 Change to the objective to be calibrated. Click [Edit No.] of the objective to be calibrated.
(When using the coded revolving nosepiece, if you change the objective, [Edit No.] is also changed in conjunction with the objective lens.)

4 Input the objective name in [Calibration name].

◎ Inputting the magnification of objectives, etc. allows you to identify objectives easily in measurement. (The initial value is set as "no settings".)

5 Click the [Setting from an image] button.
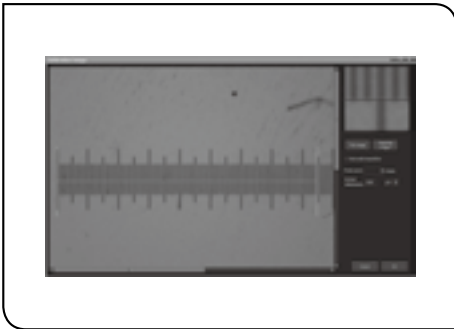
The [Calibration image] window appears.

◎ While setting the calibration, the camera resolution is changed to the high resolution automatically.
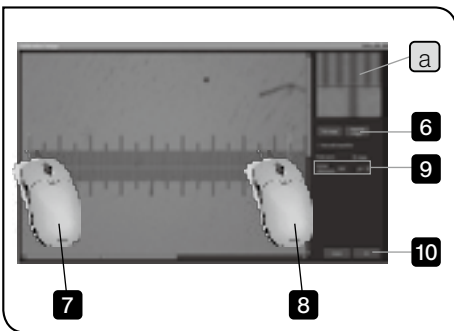
6 Click the [Acquiring images] button.
The live image is displayed.

◎ When using the image saved in advance, click the [File image] button and specify the file to be read in the window displayed.
In this case, specify the image acquired by setting the camera in use to the high resolution.

7 Click the start point of the area where the actual size will be set.

◎ When you click on the image with the mouse, the enlarged image of the clicked position is displayed in [Zoom] a .

8 Click the end point of the area where the actual size will be set.

9 Enter the actual size of the area in [Actual dimensions].

10 Click the [OK] button.
The window is returned to the [Calibration settings] window.

11 Repeat from **2** to **10** for the number of objectives to be set.

12 When the calibration of all objectives are completed, click the [OK] button.
The [Calibration settings] window is closed.

◎ The actual dimensions of up to 7 objectives can be set as the calibration information.
When using the coded revolving nosepiece, up to the number of objectives attachable to the coded revolving nosepiece can be set.

◎ The line has a width as shown on the left picture.
If the left side of the line is selected as a start point, be sure to specify the end point to the left side.

◎ The tool appears and automatically detects the edge if the Auto scale acquisition check box is checked.
You can change the size by dragging the tool's squares , rotate by dragging the tool's circles, and change the position by dragging other parts of the tool.
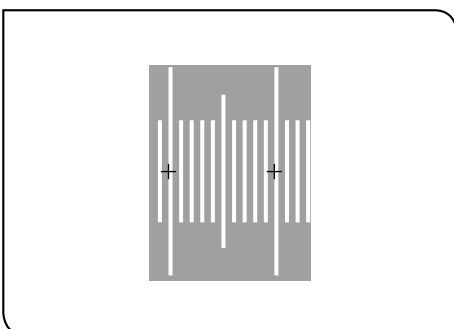
Note) Procedure to set the actual dimensions of the image per pixel when the actual dimensions are known
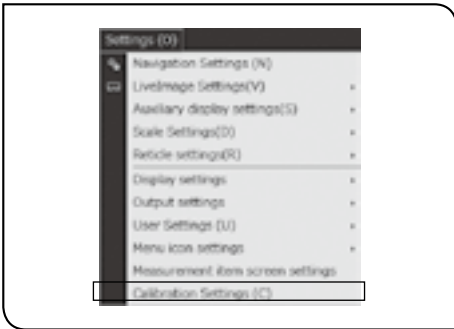
1 Click the [Calibration Settings] in the [Settings] menu.
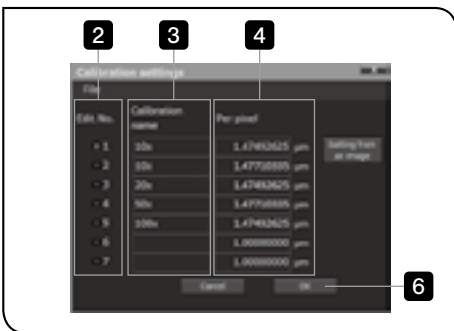
The [Calibration settings] window appears.

2 Change to the objective to be calibrated. Click [Edit No.] of the objective to be calibrated.
(When using the coded revolving nosepiece, if you change the objective, [Edit No.] is also changed in conjunction with the objective lens.)

3 Input the objective name in [Calibration name].

◎ Inputting the magnification of objectives, etc. allows you to identify objectives easily in measurement. (The initial value is set as "no settings".)

4 Input the length of one pixel.
(The initial value is set to 1 μm.)

◎ In this case, input the length of one pixel when the camera in use is set to the high resolution.

5 Repeat from **2** to **4** for the number of objectives to be set.

6 When the calibration of all objectives are completed, click the [OK] button.
The [Calibration settings] window is closed.

◎ The actual dimensions of up to 7 objectives can be set as the calibration information.
When using the coded revolving nosepiece, up to the number of objectives attachable to the coded revolving nosepiece can be set.

◎ If you use the coded revolving nosepiece with the measurement objective, input the length of one pixel of the measurement objective in the field corresponding to the blank [Edit No.]
When you do not use the coded revolving nosepiece, check [Not to use the nosepiece encoder] in the [Communications settings] window.

2   Saving calibration information

The calibration information set in "1. Setting actual dimensions of the specified area on the image" (page 12) and "Note) Procedure to set the actual dimensions of the image per pixel when the actual dimensions are known" (page 14) is saved to a file.
Loading the saved calibration information allows you to share the calibration information among multiple controllers.
Also, loading the saved calibration information after re-installing or upgrading the controller allows you to measure with the same calibration information as before.
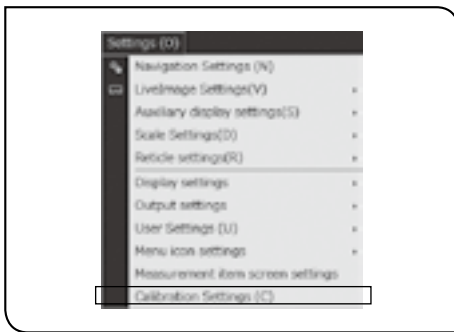
1 Click the [Calibration Settings] in the [Settings] menu.

The [Calibration settings] window appears.

2 Select [Save] in the [File] menu.
The [Save calibration files] window appears.

3 Specify the save destination of the calibration information and the file name, and click the [Save] button.
The calibration information is saved.

4 Click the [OK] button.
The [Calibration settings] window is closed.

3 Reading calibration information

The calibration information saved in "2 Saving calibration information" (page 15) is read out and applied to this software.

Using the saved calibration information allows you so share the calibration information among multiple controllers.

Also, loading the saved calibration information after re-installing or upgrading the controller allows you to measure with the same calibration information as before.

1 Click the [Calibration Settings] in the [Settings] menu.

The [Calibration settings] window appears.

2 Select [Load] in the [File] menu.
The [Open] window appears.

3 Select the saved calibration information (cal file), and click the [Open] button.
The calibration information is read out to each objective on the [Calibration settings] window.

4 Click the [OK] button.
The [Calibration settings] window is closed.

1-5 Confirmation of latest version

1 Confirming the version of installed software

1 Select [Version information] in the [Help] menu.
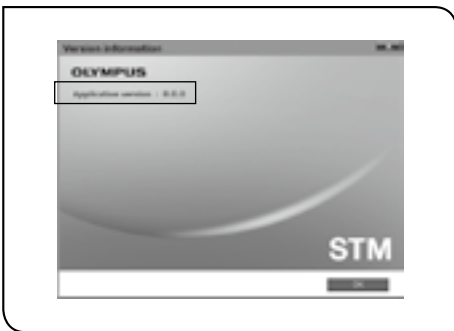
The current version is displayed in the [Version information] window.

2 When the confirmation of versions is completed, click the [OK] button. The [Version information] window is closed.

2 Confirming the latest version

This software is subject to update without notice.

Be sure to access to the following websites on regular basis to check the latest version.

http://www.olympus-ims.com/en/service-and-support/downloads/

2 Quick Operation Guide

2-1 Measurement flow

1 Direct measurement

This section describes the simple operating procedures of the basic direct measurement.
The direct measurement is a method to measure objects by acquiring the coordinate data while viewing the live image from the camera.

	(Operation area)	(Page)
Turn ON the main switch.	Main switch ON	(STM7/STM6/STM6-LM Instruction Manual)
Start software	[STM7-BSW] icon	(page 9)
Use the light path selector knob to set the light path to the camera side.	Light path selector knob	(STM7/STM6/STM6-LM Instruction Manual)
Place the measurement object on the stage.	X-axis/Y-axis knob	(STM7/STM6/STM6-LM Instruction Manual)
Engage the objective in the light path.	Revolving nosepiece	(STM7/STM6/STM6-LM Instruction Manual)
Bring the measurement object into focus.	Coarse/fine focusing knob	(STM7/STM6/STM6-LM Instruction Manual)
Adjust the brightness.	INTENSITY button	(STM7/STM6/STM6-LM Instruction Manual)

Measurement

Move the stage.	X-axis/Y-axis knob	(STM7/STM6/STM6-LM Instruction Manual)
Select the measurement item.	[Measurement items] window	(page 67)
Get the coordinate data.	[Get coordinates] button	(page 64)
	DATA button	(page 65)
Measure		

◎ The shaded areas in this procedure are set by the microscope. For details, refer to STM7 or STM6/STM6-LM Instruction Manual.

2   Measurement with edge tool

This section describes the simple measurement procedures using the edge tool.
The edge tool is a function to detect edges of measurement objects based on the intensity difference of the live image and to acquire the multiple coordinate data at a time. The variation in measurement results depending on users can be reduced by detecting the edges automatically using the software.

	(Operation area)	(Page)
Turn ON the main switch.	Main switch ON	(STM7/STM6/STM6-LM Instruction Manual)
Use the light path selector knob to set the light path to the camera side.	Light path selector knob	(STM7/STM6/STM6-LM Instruction Manual)
Place the measurement object on the stage.	X-axis/Y-axis knob	(STM7/STM6/STM6-LM Instruction Manual)
Engage the objective in the light path.	Revolving nosepiece	(STM7/STM6/STM6-LM Instruction Manual)
Bring the measurement object into focus.	Coarse/fine focusing knob	(STM7/STM6/STM6-LM Instruction Manual)
Set the transmitted illumination and adjust the brightness.	[Illumination] window	(page 156)

◎ The transmitted light illumination is recommended.

Alignment

Move the stage.	X-axis/Y-axis knob	(STM7/STM6/STM6-LM Instruction Manual)
Get the coordinate data.	[Get coordinates] button DATA button	(page 64) (page 65)
Specify the origin.	[Measurement items] window	(page 67)
Move the stage.	X-axis/Y-axis knob	(STM7/STM6/STM6-LM Instruction Manual)
Get the coordinate data.	[Get coordinates] button DATA button	(page 64) (page 65)
Set X-axis.	[Measurement items] window	(page 67)

Measurement

Select the measurement item.	[Measurement items] window	(page 67)
Specify the edge tool.	[Edge tool] window	(page 109)
Get the coordinate data.	[Get coordinates] button DATA button	(page 64) (page 65)
Measure		

2-2 Software Screens

1 Screen layout
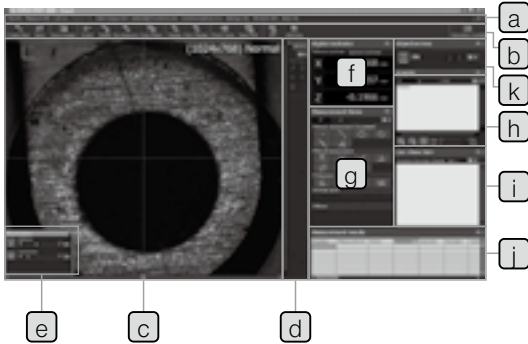
Names	Descriptions	Reference page
[a] Menu bar	Various basic menus	151
[b] Menu icon	Various shortcut icons	154
[c] Live window	Displays images from the camera.	156
[d] Edge Tool window	Various settings of the edge tool ◎ This window appears when the edge tool function is working.	109
[e] Illumination window	Controls the reflected, transmitted and focus navigator illuminations.	156
[f] Digital indicator window	Displays the coordinate data of the counter data and the coordinate data of the alignment coordinate system.	157
[g] Measurement items window	Displays various measurement items.	157
[h] Graphic window	Displays the measured points or figures.	158
[i] List window	Displays the teaching list (history of measured points or figures).	160
[j] Measurement results window	Displays the coordinates of measured points or figures and/or measurement results.	161
[k] Objective lens window	Selects objectives and displays the calibration settings window.	162

2 Docking windows
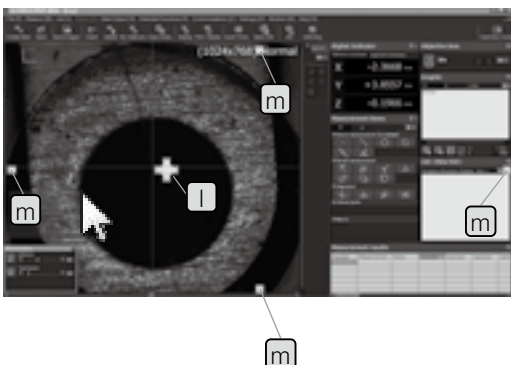
Each window can be docked.

Click on the title bar of the window. Drag to the software screen or the up/down/right/left button of the window you want to dock.

Docking destination	
[l]	Docking to the up/down/right/left area outside of the window
[m]	Docking to the up/down/right/left area inside of the software screen.

2-3 Basic Operations

You will learn the basic measurement procedures using the test piece provided with this software.

Before starting the measurement, place the test piece on the stage of the microscope.

◎ You don't need to care about the tilt of the test piece on the stage.

CAUTION The order to acquire coordinates is very important to acquire the correct measurement results. Be sure to measure objects according to the order to acquire coordinates described in this section. Acquiring coordinates in the opposite order will change the plus and minus directions of X- and Y-axis of the measurement results. Refer to "Caution and perception of measurement" (page 73) for details.

In "Basic Operations", you will learn three functions: 1. direct measurement, 2. recall measurement and 3. alignment.

1 Direct Measurement (Line and Circle)

This function measures objects by specifying coordinates directly.

In this section, you will measure a line and two circles.
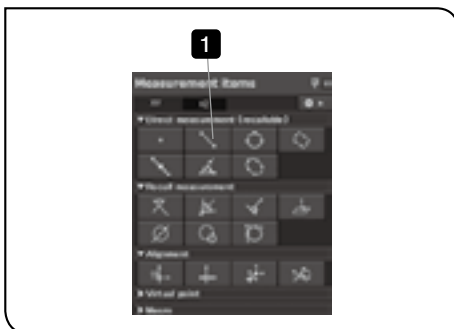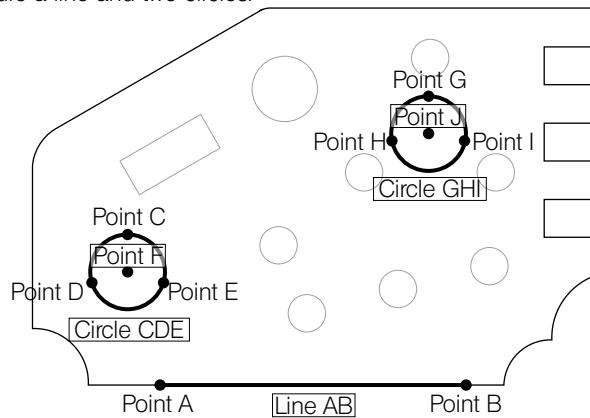
1 Click the [image] (Distance between 2 points) button in the [Measurement items] window.
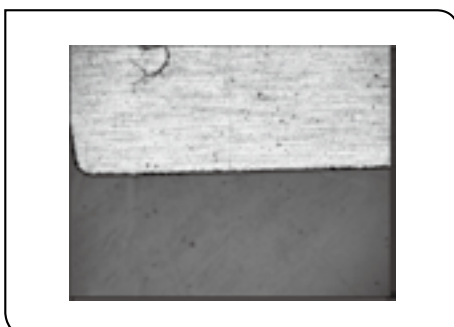
2 Move the stage to place the point A in the center of the live image.
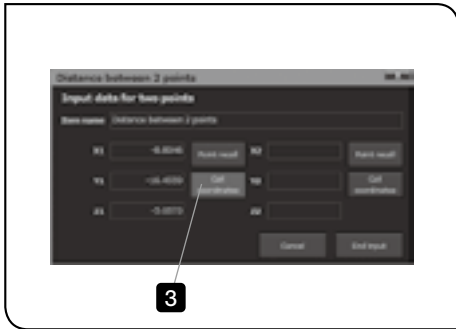
3 Click the [Get coordinates] button of [X1/Y1/Z1] in the [Distance between 2 point] window.
The coordinate data is acquired.

◎ The coordinate data can also be acquired either by Digital Indicator STM7-DI [a], Hand Switch STM7-HS [b], DATA button of Focus Controller STM7-MCZ [c] or Foot Switch STM7-FS [d].

Digital Indicator

Hand Switch

Focus Controller

Foot Switch
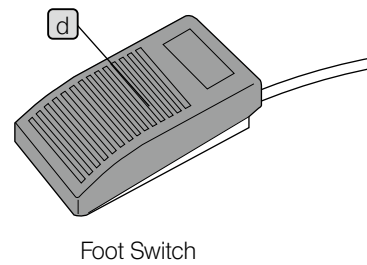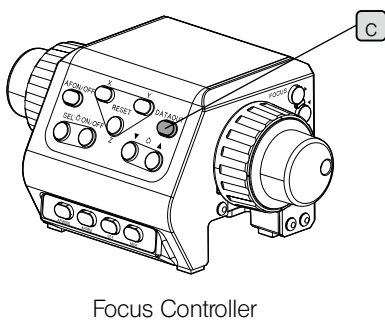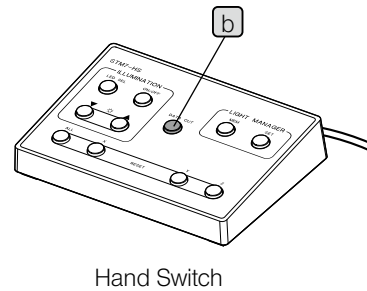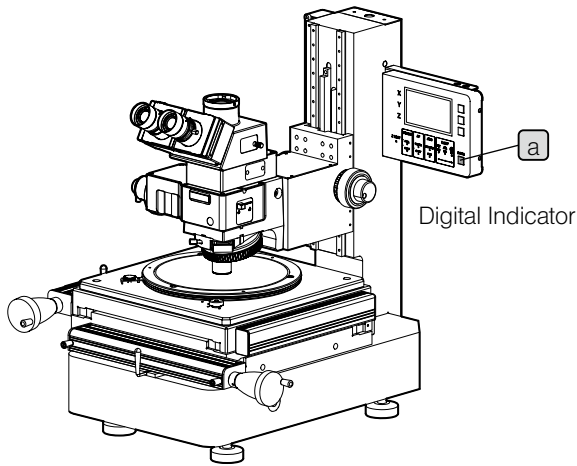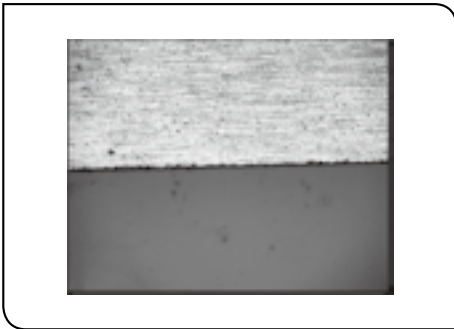
4 Move the stage to place the point B in the center of the live image.
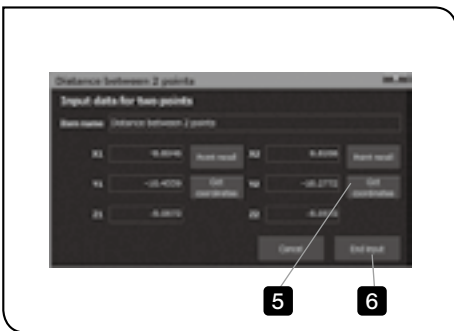
5 Click the [Get coordinates] button of [X2/Y2/Z2] in the [Distance between 2 points] window.
The coordinate data is acquired.

6 Click the [End input] button.
The line AB passing through the point A and the point B is created.

The line AB is displayed in the [Graphic] window.
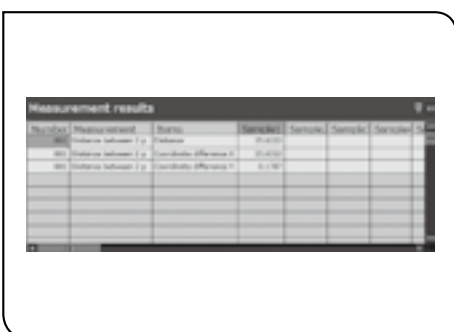
The measurement result of the line AB is displayed in the [Measurement results] window.
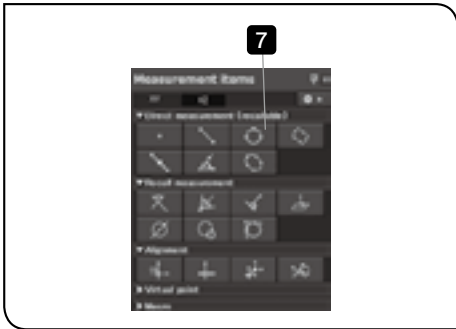
7 Click the ⟳ (Circle) button in the [Measurement items] window.
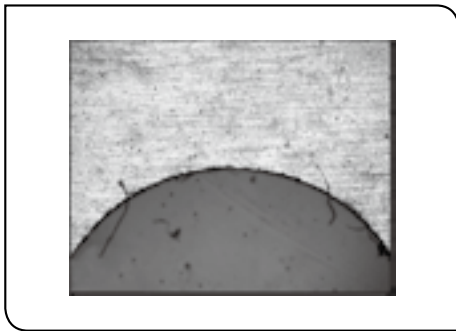
8 Move the stage to place the point C in the center of the live image.

9 Click the [Get coordinates] button 𝑒 in the [Circle] window.
The coordinate data is acquired.

◎ [No. of measurement points] is increased each time when the coordinate data is acquired.

◎ In the circle measurement, coordinates from 3 points to 100 points can be specified.
If you specify 4 points or more, the approximate circle is calculated by the method of least squares.
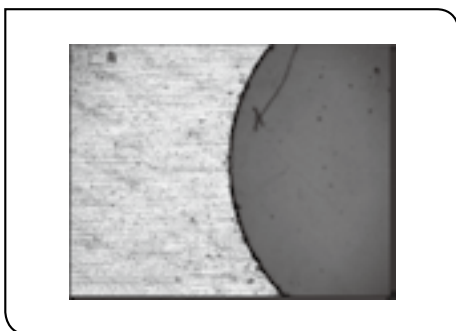
10 Move the stage to place the point D in the center of the live image.

11 Click the [Get coordinates] button [e].

The coordinate data is acquired.

12 Move the stage to place the point E in the center of the live image.

13 Click the [Get coordinates] button [e].

The coordinate data is acquired.

14 When the acquisition of the coordinate data is completed, click the [End input] button [f].

The circle CDE passing through the point C, point D and point E is created.

The circle CDE is displayed in the [Graphic] window.
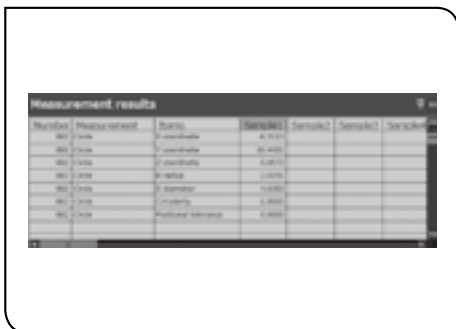
The measurement result of the circle CDE is displayed in the [Measurement results] window.
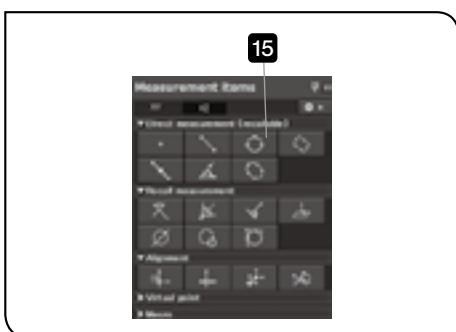
15 Click the ⟳ (Circle) button in the [Measurement items] window.
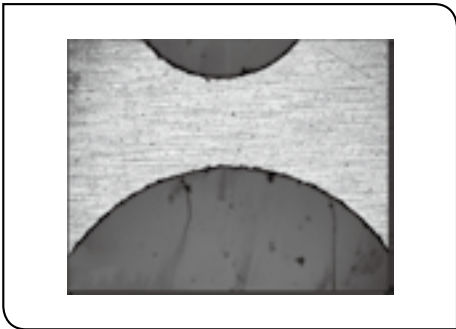
16 Move the stage to place the point G in the center of the live image.

17 Click the [Get coordinates] button [e].
The coordinate data is acquired.
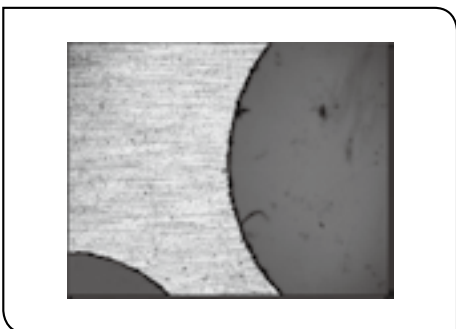
18 Move the stage to place the point H in the center of the live image.

19 Click the [Get coordinates] button [e].
The coordinate data is acquired.
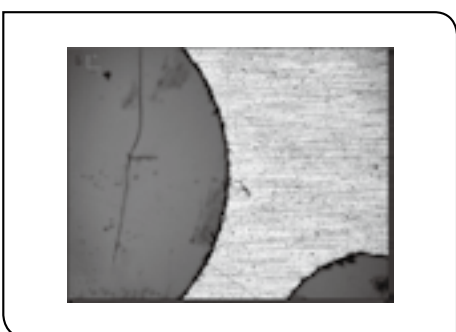
20 Move the stage to place the point I in the center of the live image.

21 Click the [Get coordinates] button [e].
The coordinate data is acquired.

22 When the acquisition of the coordinate data is completed, click the [End input] button [f].
The circle GHI passing through the point G, point H and point I is created.

The circle GHI is displayed in the [Graphic] window.
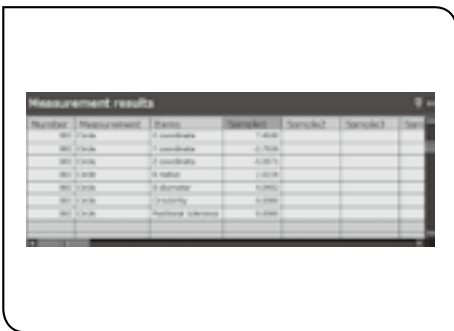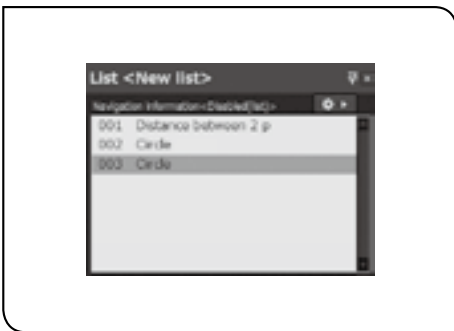
The measurement result of the circle GHI is displayed in the [Measurement results] window.
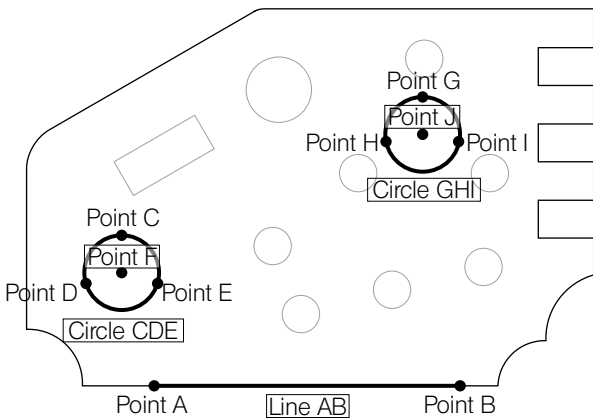
Summary of this section

The distance between 2 points, the coordinate difference X and the coordinate difference Y can be measured by specifying the line AB. By specifying the circle CDE and the circle GHI, the coordinate F and J of the center point, radius and diameter of each circle can be measured.

In the direct measurement, you can measure objects by specifying the coordinates after selecting the measurement items.

2 Recall measurement

This function recalls the acquired coordinate data to use for measurement.

In this section, you will calculate the line connecting the center points of two circles by using the recall measurement and then calculate the intersection point K of that line and the line AB.

◎ This section describes the procedures to perform the same direct measurement as "1 Direct Measurement (Line and Circle)" (page 21) and then to perform the recall measurement using the same coordinate data from the beginning.
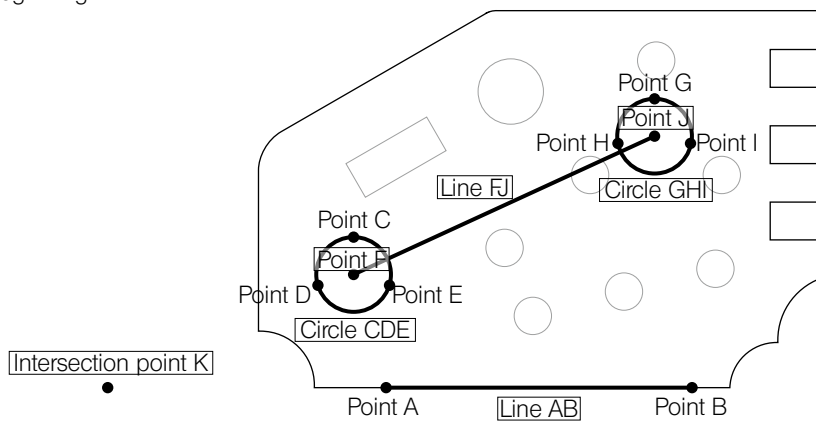
◎ The operations from **1** to **6** are the same procedures as the direct measurement described in "1 Direct Measurement (Line and Circle)" (page 21).

The operations from **7** are the procedures of the recall measurement.

1 Click the [image] (Distance between 2 points) button [a] in the [Measurement items] window.
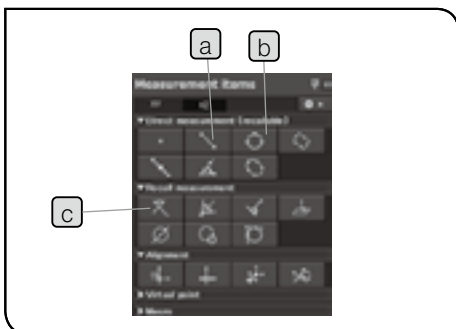
2 Acquire the coordinate data of the point A and B.
The line AB passing through the point A and the point B is created.

◎ For procedures to create the line AB, refer to "1 Direct Measurement (Line and Circle)" (from page 21 to page 23).
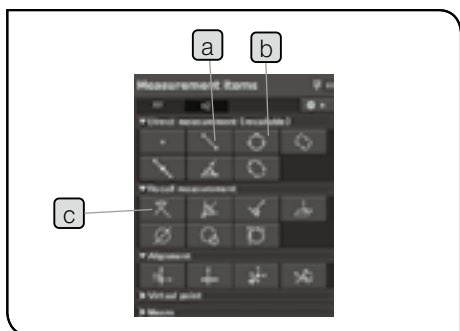
3 Click the (Circle) button [b] in the [Measurement items] window.

4 Acquire the coordinate data of the point C, point D and point E. The circle CDE passing through the point C, point D and point E is created.

◎ For procedures to create the circle CDE, refer to "1 Direct Measurement (Line and Circle)"(page 24 to page 25).

5 Click the (Circle) button [b] in the [Measurement items] window.

6 Acquire the coordinate data of the point G, point H and point l. The circle GHI passing through the point G, point H and point I is created.

◎ For procedures to create the circle GHI, refer to "1 Direct Measurement (Line and Circle)" (from page 25 to page 26).

◎ The operations up to here are the same procedures as the direct measurement. The operations from here are the procedures of the recall measurement.

7 Click the (Distance between 2 points) button [a] in the [Measurement items] window.

8 Select the point F in the [Graphic] window or [Circle] (first circle) in the [List] window, and click the [Point recall] button of [X1/Y1/Z1] in the [Distance between 2 points] window.
The coordinate data of the point F is recalled to [X1/Y1/Z1].

◎ In order to recall the coordinate data in the [Graphic] window, the [List] window must be displayed.

◎ The coordinate data can also be recalled by double-clicking figures in the [Graphic] window or items in the [List] window.
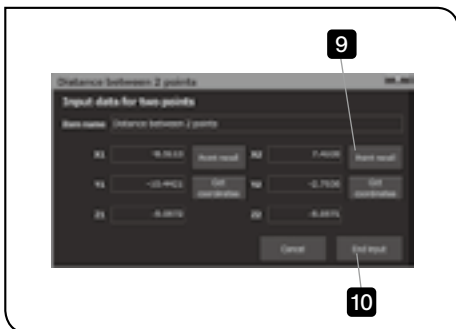
9 Select the point J in the [Graphic] window or [Circle] (second circle) in the [List] window, and click the [Point recall] button of [X2/Y2/Z2] in the [Distance between 2 points] window.
The coordinate data of the point F is recalled to [X2/Y2/Z2].

10 Click the [End input] button.
The line FJ passing through the point F and the point J is created.
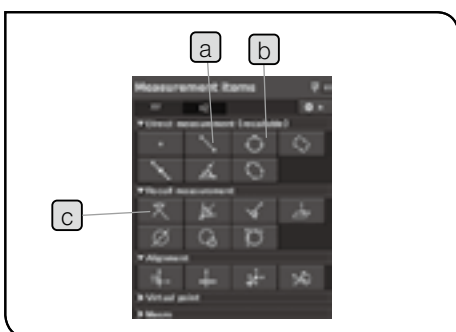
**11** Click the [icon] (Intersection between line and line) button [c] in the [Measurement items] window.
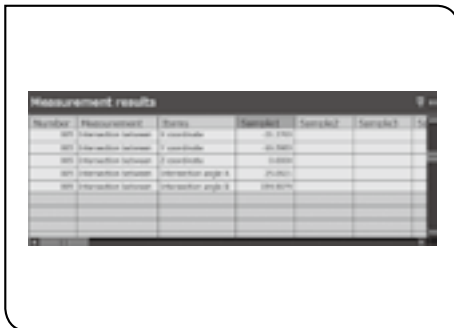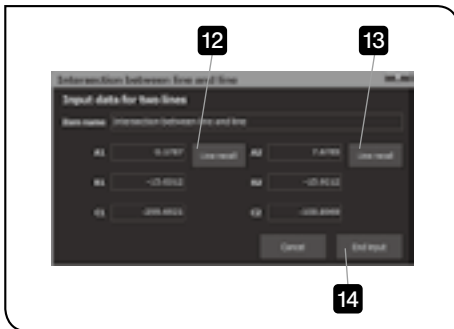
12 Select the line AB in the [Graphic] window or [Distance between 2 points] (first one) in the [List] window, and click the [Line recall] button in the [Intersection between line and line] window.

13 Select the line FJ in the [Graphic] window or [Distance between 2 points] (second one) in the [List] window, and click the [Line recall] button in the [Intersection between line and line] window.

14 Click the [End input] button.

The intersection point K between the line AB and the line FJ is created.

The measurement results are displayed in the [Measurement results] window.

Summary of this section

The distance between 2 points, the coordinate difference X and the coordinate difference Y can be measured by specifying the line AB.
By specifying the circle CDE and the circle GHI, the coordinate F and J of the center point, radius and diameter of each circle can be measured.
The distance between 2 points, the coordinate difference X and the coordinate difference Y can be measured by recalling the coordinates F and J to create the line FJ.
The coordinates of the intersection point K and the intersection between line and line (angle) can be measured by recalling the line AB and the line FJ.

The recall measurement is a function to recall the acquired coordinate data to use for measurement.

◎ For the display of the intersection angle, refer to "Display of intersection angle A and intersection angle B" (page 73).

3 Alignment
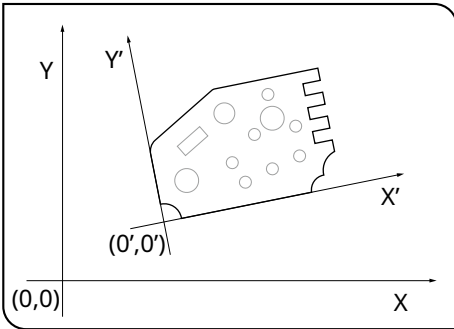
Alignment is a function to set a new origin (0',0') and the coordinate system (aligned coordinates X'Y') by the software, separately from the reference coordinate system (counter coordinates XY).
The origin or the X-axis can also be set on the measurement objects.
It is convenient to create the teaching lists to use for repetitive measurement.

in this section, you will calculate the intersection point E from the line AB and line CD, perform the alignment based on the intersection point E and the line AB, and calculate the angle of the line FG which is parallel to the X-axis of the alignment coordinate system.
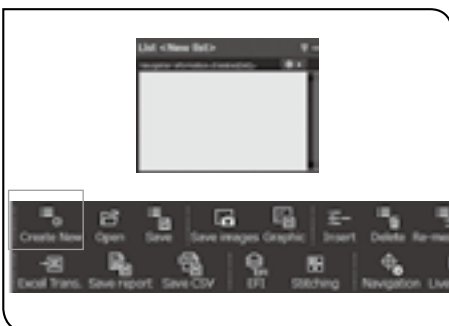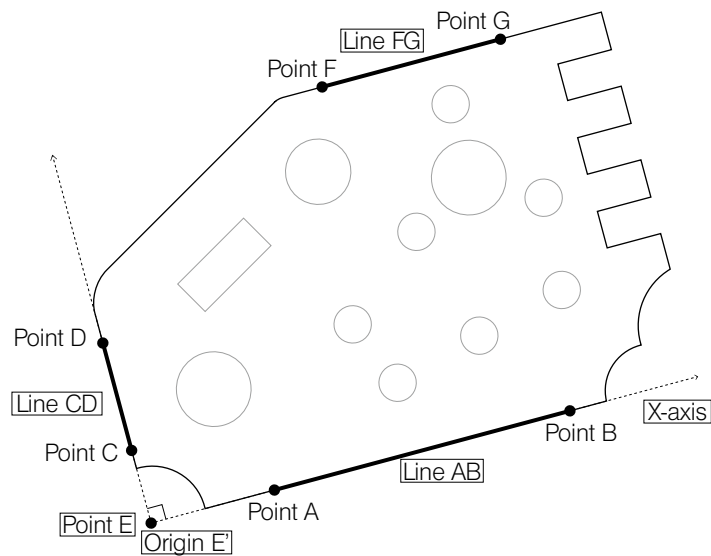
◎ Before measurement, confirm that there is no teaching list in the [List] window.

If a teaching list is in the [List] window, click the [Create New] button in the menu.
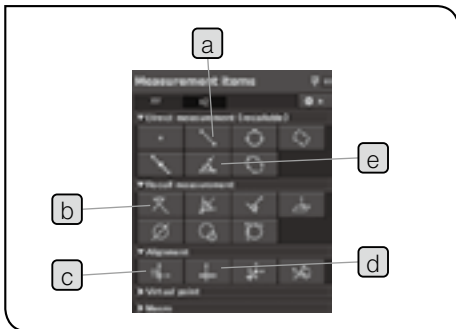
1 Click the (Distance between 2 points) button [a] in the [Measurement items] window.

2 Acquire the coordinate data of the point A and B.
The line AB passing through the point A and the point B is created.

◎ For procedures to create the line AB, refer to "1 Direct Measurement (Line and Circle)" (from page 21 to page 23).

3 Click the (Distance between 2 points) button [a] in the [Measurement items] window.

4 Acquire the coordinate data of the point C and point D.
The line CD passing through the point C and the point D is created.

5 Click the (Intersection between line and line) button [e] in the [Measurement items] window.

6 Select the line AB in the [Graphic] window or [Distance between 2 points] (first one) in the [List] window, and click the [Line recall] button in the [Intersection between line and line] window.

◎ In order to recall the coordinate data in the [Graphic] window, the [List] window must be displayed.

7 Select the line CD in the [Graphic] window or [Distance between 2 points] (second one) in the [List] window, and click the [Line recall] button in the [Intersection between line and line] window.

8 Click the [End input] button.
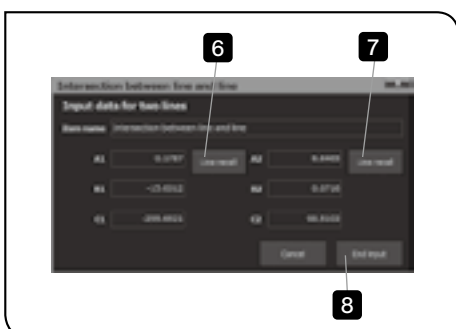
The intersection point E between the line AB and the line CD is created.
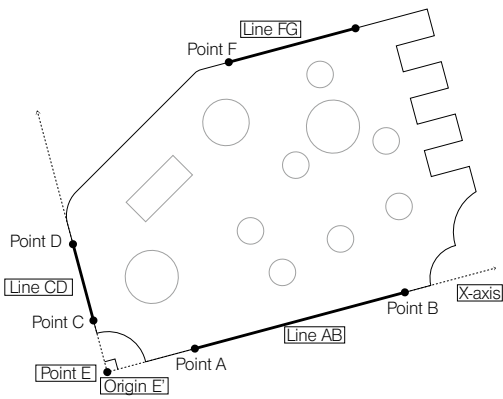
Review

Up to here, you created the line AB and the line CD and calculated the intersection point E between these two lines.

From here, you will perform the alignment based on the line AB, line CD and the intersection point E.
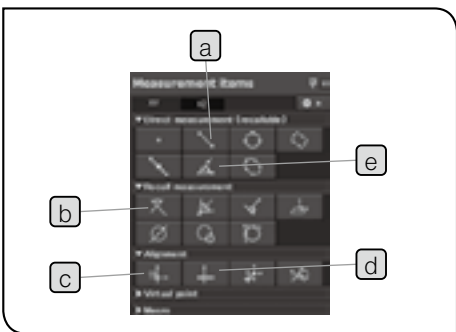
9 Click the [ ] (Origin) button [c] in the [Measurement items] window.
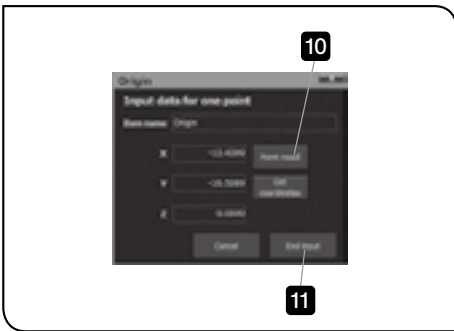
10 Select the point E in the [Graphic] window or [Intersection between line and line] in the [List] window, and click the [Point recall] button in the [Origin] window.

11 Click the [End input] button.
The origin of the aligned coordinate system becomes the point E.
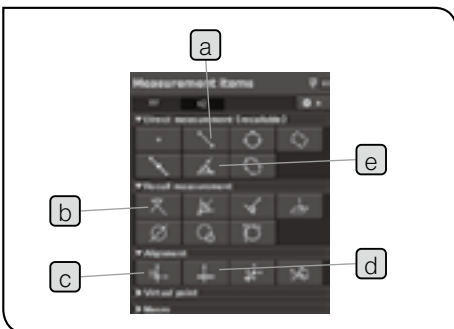
12 Click the ▦ (X-axis) button d in the [Measurement items] window.

13 Select the line AB in the [Graphic] window or [Distance between 2 points] (first one) in the [List] window, and click the [Line recall] button in the [X-axis] window.

14 Click the [End input] button.

The X-axis of the aligned coordinate system becomes the tilt of the line AB.

Y-axis
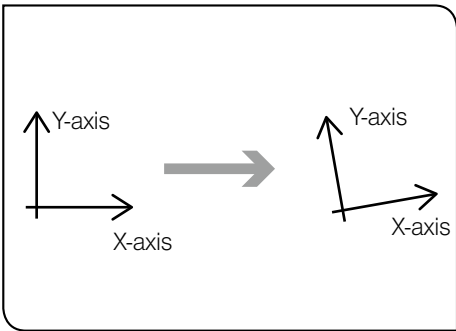
Y-axis

X-axis

X-axis

◎ The X- and Y-axis on the live image tilt along with the X-axis of the aligned coordinate system.
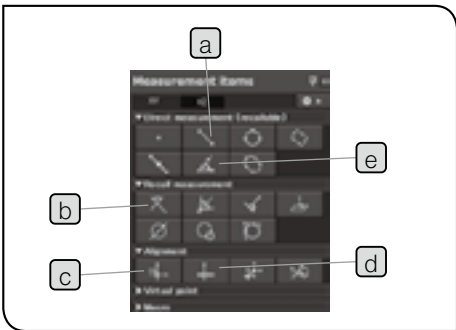
15 Click the ▱ (Line (Angle)) button [e] in the [Measurement items] window.

16 Acquire the coordinate data of the point F and the point G.
The line FG passing through the point F and the point G is created.
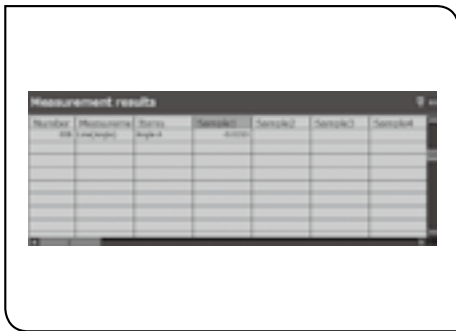
The measurement results are displayed in the [Measurement results] window.

Summary of this section

By specifying the line AB and line CD, the distance between 2 points, the coordinate difference X and the coordinate difference Y of each line can be measured.

The intersection point E calculated from the line AB and the line CD is set as the origin of the aligned coordinate system.

The line AB is set as the X-axis of the aligned coordinate system.
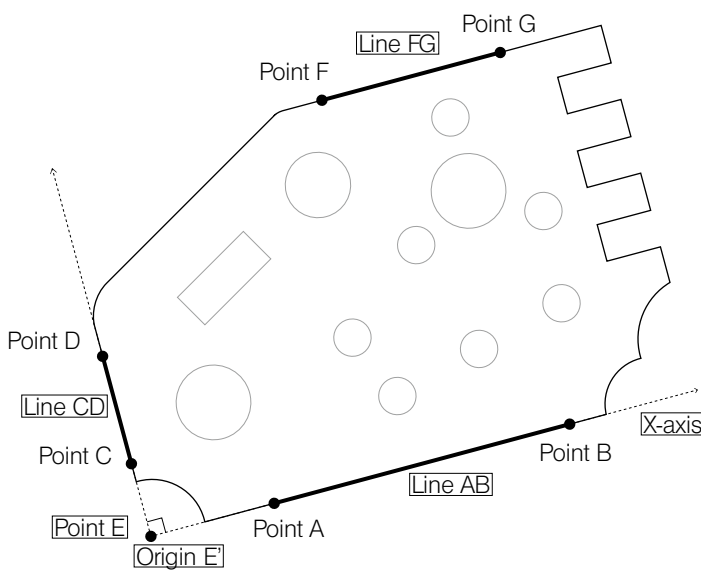
By specifying the line FG parallel to the x-axis of the aligned coordinate system, the angle can be measured.

Performing the alignment allows you to measure based on the origin or the X-axis specified by the software.

2-4 Advanced Operations 1 (Convenient functions in direct measurement and recall measurement)

This section describes measurement methods using the following convenient functions in the direct measurement or recall measurement.

· Copy measurement (Direct measurement and [Origin] of [Alignment] only)
· Teaching list
· Replay measurement
· Navigation (replay measurement only)

You will learn the measurement procedures using the test piece provided with this software.
Before measurement, place the test piece on the stage of the microscope.

◎ You don't need to care about the tilt of the test piece on the stage.

(CAUTION) **The order to acquire coordinates is very important to acquire the correct measurement results. Be sure to measure objects according to the order to acquire coordinates described in this section. Acquiring coordinates in the opposite order will change the plus and minus directions of X- and Y-axis of the measurement results. Refer to "Caution and perception of measurement" (page 73) for details.**

1   Copy measurement

When repeating the same measurement consecutively in the direct measurement, it is convenient to copy the measurement items (copy measurement).

In this section, you will create the line AB in the point to point measurement and create the line CD by copying the point to point measurement.
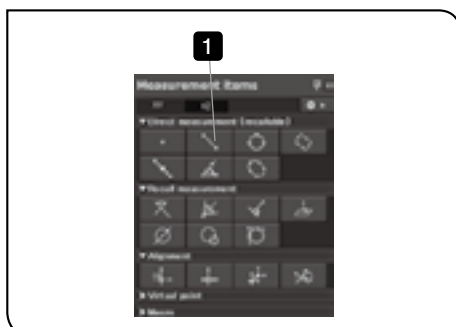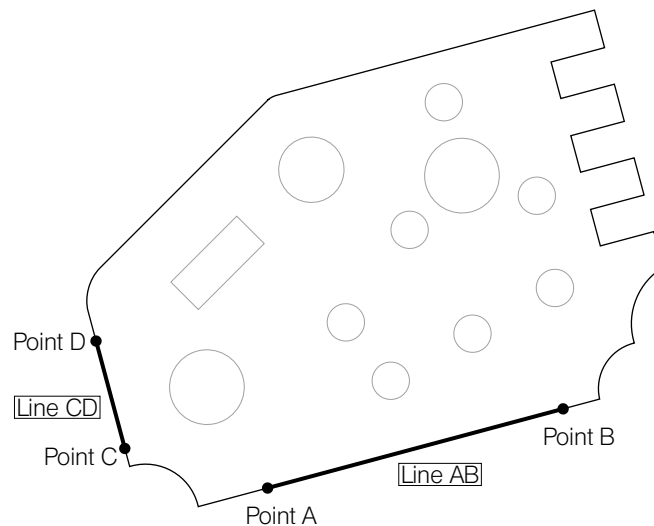
1 Click the ![] (Distance between 2 points) button in the [Measurement items] window.

2 Acquire the coordinate data of the point A and B.
The line AB passing through the point A and the point B is created.
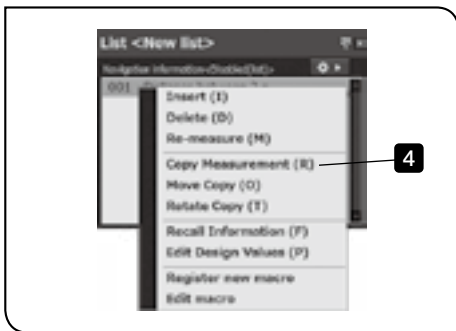
3 Right-click on the [Distance between 2 point] in the [List] window.

4 Select [Copy Measurement] in the menu displayed.

5 Acquire the coordinate data of the point C and point D.

6 Click the [The copy measurement is completed] button in the [Distance between 2 point] window to finish the copy measurement.

Summary of this section

The line AB is created with the point to point measurement.
The line CD is created by copying the point to point measurement used in the line AB.

Point D

Line CD

Point C

Point B

Line AB

Point A
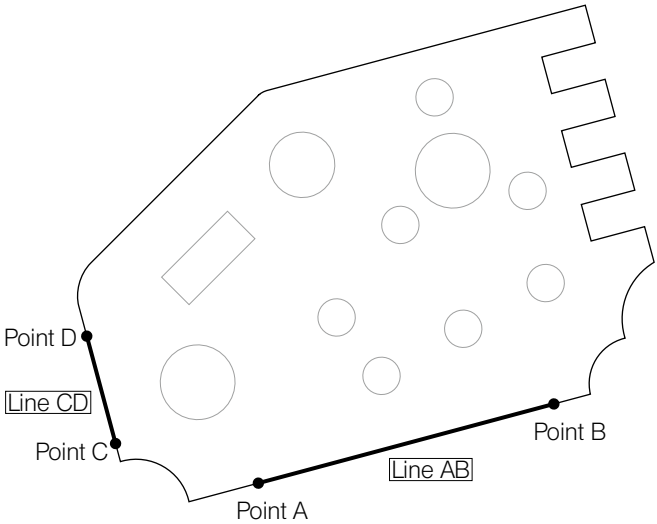
2 Teaching list

The teaching list is a list to record the measurement procedures. The teaching lists are displayed in the [List] window. This list is convenient for repeating same measurement procedures for multiple measurement objects in same shapes. In this section, you will save the measurement procedures to calculate the intersection point E from the line AB and the line CD, to perform the alignment based on the intersection point E and the line AB and to create the line IM based on the center points of the circle FGH and the circle JKL as a teaching list.
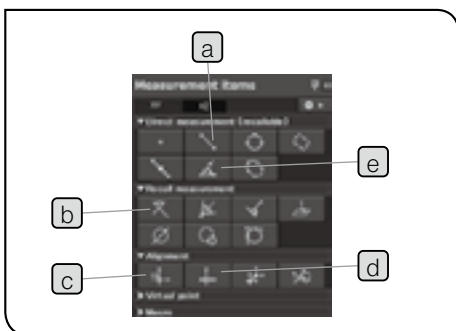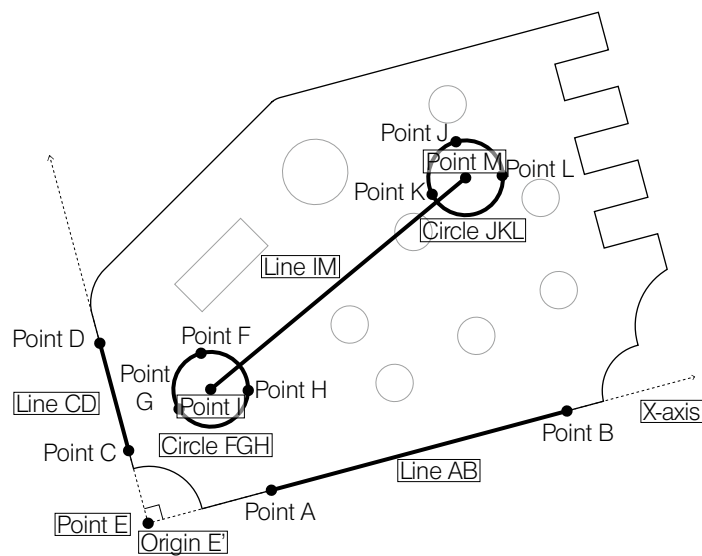
1 Click the [icon] (Distance between 2 points) button [a] in the [Measurement items] window.

2 Acquire the coordinate data of the point A and B.
The line AB passing through the point A and the point B is created.
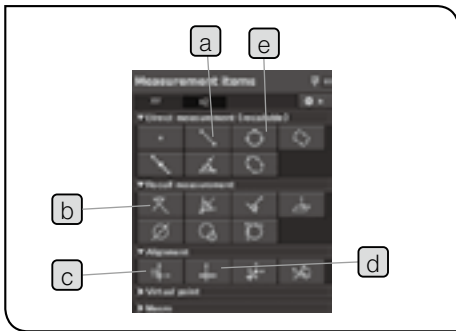
3 Click the [Distance between 2 point] button [a] in the [Measurement items] window.

4 Acquire the coordinate data of the point C and point D.
The line CD passing through the point C and the point D is created.

5 Click the [Intersection between line and line] button [b] in the [Measurement items] window.

6 Recall the coordinate data in the order of the line AB and line CD.
The intersection point E between the line AB and the line CD is created.

7 Click the [Origin] button [c] in the [Measurement items] window.

8 Recall the coordinate data of the point E.
The origin of the aligned coordinate system becomes the point E.

9 Click the [X-axis] button [d] in the [Measurement items] window.

10 Recall the coordinate data of the line AB.

The X-axis of the aligned coordinate system becomes the tilt of the line AB.
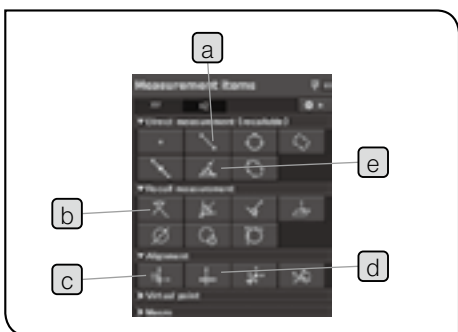
11 Click the [Circle icon] (Circle) button [e] in the [Measurement items] window.

12 Acquire the coordinate data of the point F, point G and point H.

The circle FGH passing through the point F, point G and point H is created.

13 Click the [Circle icon] (Circle) button [e] in the [Measurement items] window.

14 Acquire the coordinate data of the point J, point K and point L

The circle JKL passing through the point J, point K and point L
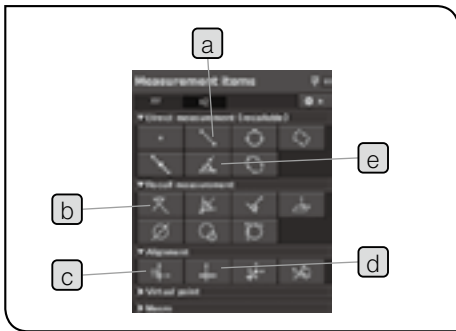
15 Click the ![icon](Distance between 2 points) button [a] in the [Measurement items] window.

16 Recall the coordinate data in the order of the circle FGH and the circle JKL, and click the [End input] button.
The line IM connecting the center point I of the circle FGH and the center point M of the circle JKL is created.
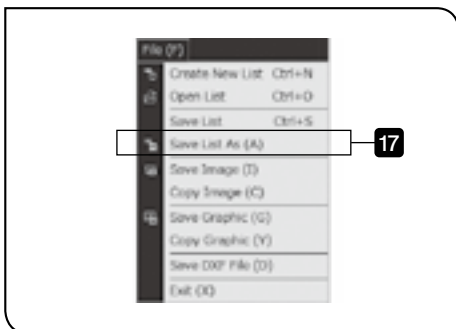
17 Select [Save lists as] in the [File] menu.
The [Save lists] window appears.

18 Specify the save destination of the teaching lists and the file names, and click the [Save] button.
The teaching lists are saved.
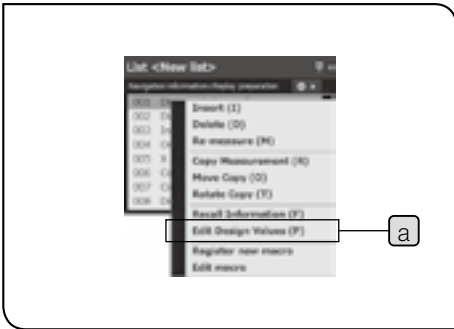
◎ When you right-click on the measurement items in the [List] window and select [Edit design values] [a] in the menu displayed, you can edit the design values or tolerance values of these measurement items. Refer to "Setting design values and Excel® transfer data of measurement items" (page 99) for details.
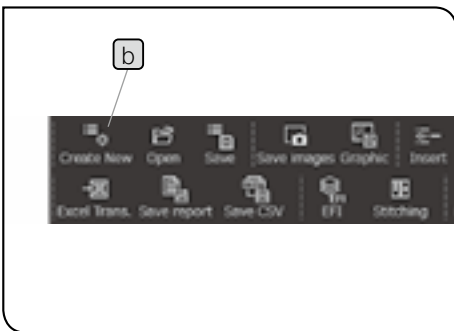
◎ To close the teaching lists opened currently, click the [Create New] button [b].

Summary of this section
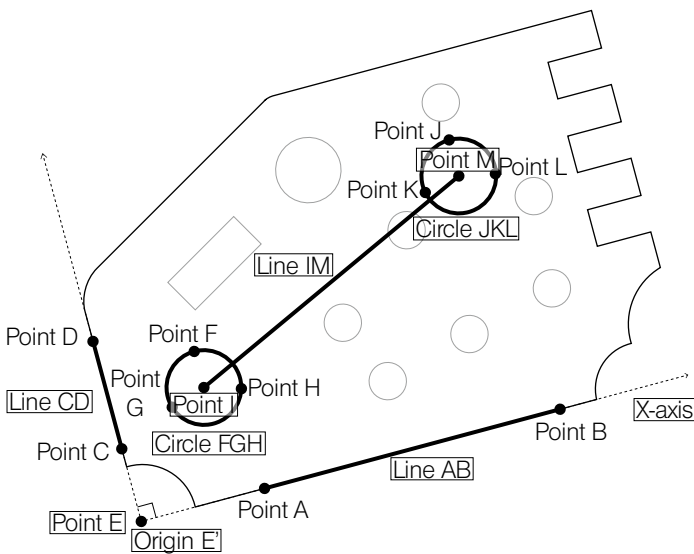
By specifying the line AB and line CD, the distance between 2 points, the coordinate difference X and the coordinate difference Y of each line can be measured. The intersection point E calculated from the line AB and the line CD is set as the origin of the aligned coordinate system.

The line AB is set as the X-axis of the aligned coordinate system.

By specifying the circle FGH and the circle JKL, the coordinates I and M of the center point, the radius and the diameter of each circle can be measured.

The distance between 2 points, the coordinate difference X and the coordinate difference Y can be measured by recalling the coordinates I and M to create the line IM.

The above procedures can be saved as a teaching list.

3 Replay measurement and navigation

The replay measurement is a function to open the teaching lists and repeat the same measurement.

With the teaching lists, users do not need to select the measurement items each time. Instead, the software requests users the necessary operations according to the list. Also, when items in the direct measurement are measured, the recall measurement which will use these measurement results is performed automatically by the software.

In this section, the measurement efficiency is improved by using the function (Navigation function) to show the direction and the distance to the next measurement point in the replay measurement.

In this section, you will open the teaching lists created in the previous section and perform the replay measurement while using the navigation function.
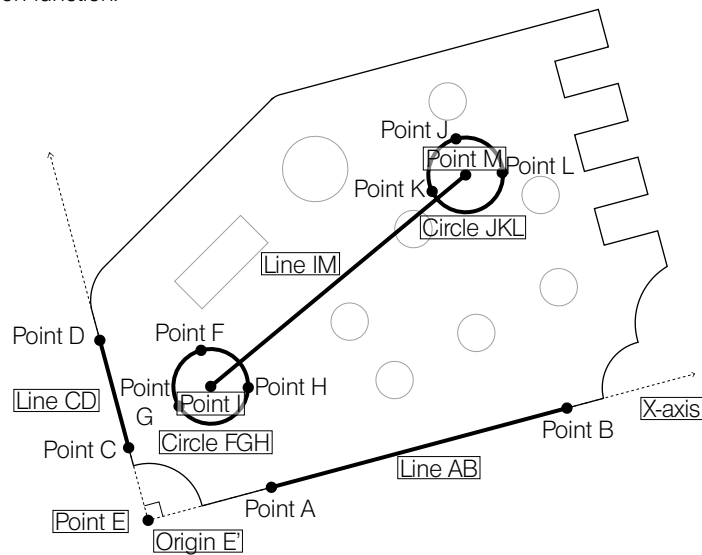
CAUTION **If you perform the replay measurement using teaching lists created by STM6/STM6-LM, the illumination is turned OFF. (STM6/STM6-LM is not supported for the illumination control.)**

◎ If teaching lists are created using the edge tool, the edge tool is ON when performing the replay measurement. If teaching lists are created by the direct measurement, the edge tool is OFF when performing the replay measurement.
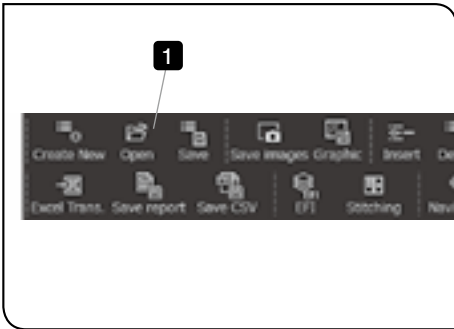
1 Click the [Open] button in the menu.

2 Select the saved teaching lists (lst file), and click the [Open] button. The teaching lists are displayed in the [List] window.

◎ Here, open the teaching lists created in "2 Teaching List" (page 41).

◎ The teaching lists created in "2 Teaching List" (page 41) are measurement procedures described below.

001 Distance between 2 points (Create line AB)
002 Distance between 2 points (Create line CD)
003 Intersection between line and line (Create intersection point E between E line AB and line CD)
004 Origin (Create origin E' based on intersection E)
005 X-axis (create X-axis based on line AB)
006 Circle (Create circle FGH)
007 Circle (Create circle JKL)
008 Distance between 2 points (Create line IM based on the center point I of circle FGH and the center point M of circle JKL)

◎ When teaching lists are opened, measurement results are also displayed in [Sample 1] in the [Measurement results] window. These measurement results are the values measured when teaching lists were created.

3 Click the [Replay] button in the menu.

4 Specify the number of replay times in [Sample] [a] (in this step, 2 or 3 times), and click the [Replay] button [b].

◎ The measurement results when the teaching lists were created are displayed in the [Measurement results] window as [Sample 1]. Specify the number of times to perform the replay measurement in [Sample] in the [Replay] window. As [Sample] is specified to 2 to 3 times in this step, measurement results of [Sample 2] and [Sample 3] will be acquired. The replay measurement is performed twice.

Measurement results when creating teaching lists

Measurement results to be calculated in replay measurement

The measurement is performed in the order from the beginning to the end of the lists.

◎ Operations from **5** to **8** are the alignment procedures.

◎ We recommend checking the check box for [FOV] in the [Graphic] window while navigating. The field of view currently being observed is displayed in the [Graphic] window, so it is easy to understand the relative position of the current field of view and the object being measured.

5 The teaching list 001 [Distance between 2 points] measurement starts.

6 Acquire the coordinate data of the point A and B.

7 The teaching list 002 [Distance between 2 points] measurement starts.

8 Acquire the coordinate data of the point C and point D.

◎ In the replay measurement, if you measure the direct input items, the recall measurement which will use these measurement results is performed automatically.
Here, the teaching lists 001 and 002 are the direct input measurement and those from 003 to 005 are the recall measurement. When 001 and 002 are measured, teaching lists from 003 to 005 are measured automatically.

9 The teaching list 006 [Circle] measurement starts.

◎ The navigation [c] is displayed on the live image.

● mark: Direction of measurement point
Color of navigation: The color changes from Red -> Yellow -> Green as you are closer to the measurement point

◎ The navigation color changes to blue and the navigation is locked as you approach the measurement point than the threshold value specified as the short distance in the [Navigation Settings] in the [Setting] menu. When the navigation is locked, the ● mark is hidden and it is possible to input measurement coordinates. It is not possible to input coordinates until the navigation is locked.

◎ Once the navigation is locked, the blue display does not change even if you move a distance from the measurement point that is beyond the short-distance threshold value.

◎ If the navigation is not shown, the navigation function is OFF. Refer to "1 Navigation" (page 165), and set the navigation function to ON.

10 Acquire the coordinate data of the point F, point G and point H.

11 The teaching list 007 [Circle] measurement starts.
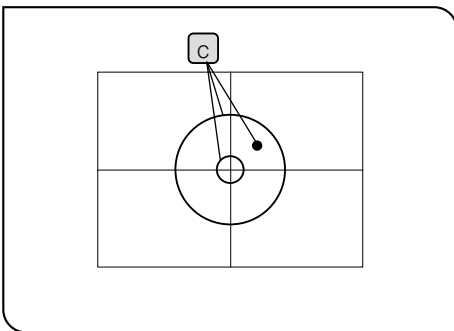
12 Acquire the coordinate data of the point J, point K and point L

◎ The teaching list 008 can be measured automatically when the circle FGH and the circle JKL are created.

13 When the last measurement in the teaching list is completed, the replay measurement finishes.

◎ The navigation is displayed when the alignment is finished. In this section, when the alignment is finished with operations up to **8**, the navigation is displayed with operations from **9**.

Summary of this section
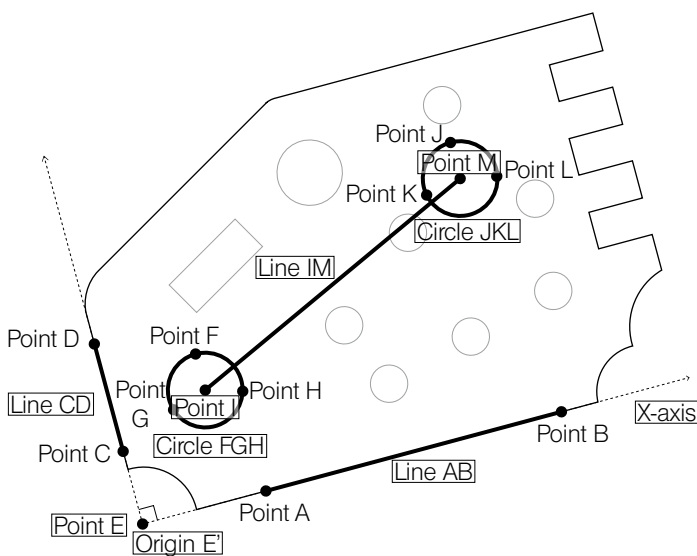
The replay measurement was performed by opening the teaching lists.
With the teaching lists, users do not need to select the measurement items each time. Instead, the software requests users the necessary operations according to the list.
Also, since items (001 and 002) in the direct measurement are measured, the recall measurement (from 003 to 005) which will use these measurement results is performed automatically by the software.

With the navigation function, you can find the measurement points easily.

Point J
Point M
Point L
Point K
Circle JKL
Line IM
Point D
Point F
Line CD
Point G
Point I
Point H
Circle FGH
Point C
Point B
X-axis
Point E
Origin E'
Point A
Line AB

2-5 Advanced Operations 2 (Edge Tool)

The edge tool is a function to detect the edges of measurement objects based on the intensity difference of the live image and to acquire the multiple coordinate data at a time. Also, the variation in measurement results depending on users can be reduced by detecting the edges automatically using the software.

CAUTION • In the direct measurement, the measurement is performed based on the counter data, but the edge tool measures based on the values calibrated from the actual measurement values per pixel. Therefore, the calibration must be performed in advance. Refer to "1-4 Calibration" (page 12) for details.

• With the test piece, it is easy to detect edges by using the transmitted light illumination (green LED illumination). Therefore, we recommend you to use the transmitted light illumination (green LED illumination).

• As the edge tool measures based on the intensity difference of the live image, the errors may occur in the edge detection depending on measurement objects and the illumination.

◎ In this section, you will perform the same measurement as "2 Teaching List" (page 41) in "2-3 Basic Operations" by using the edge tool.

You will learn the measurement procedures using the test piece provided with this software.

Before measurement, place the test piece on the stage of the microscope.

◎ You don't need to care about the tilt of the test piece on the stage.

CAUTION The order to acquire coordinates is very important to acquire the correct measurement results. Be sure to measure objects according to the order to acquire coordinates described in this section. Acquiring coordinates in the opposite order will change the plus and minus directions of X- and Y-axis of the measurement results. Refer to "Caution and perception of measurement" (page 73) for details.

1 Confirm that the magnification of the objective in the [Objective lens] window is same as the magnification of the objective to be used.

2 Click the (Transmission) button [a] in the [Illumination] window to turn ON the transmitted light illumination, and adjust the light intensity using the [Transmission] slider [b].

(Black) : Turned OFF

(Light blue) : Turned ON

(CAUTION) **Since the edge tool detects the edges based on the intensity difference, the clear intensity difference is required for detection.**
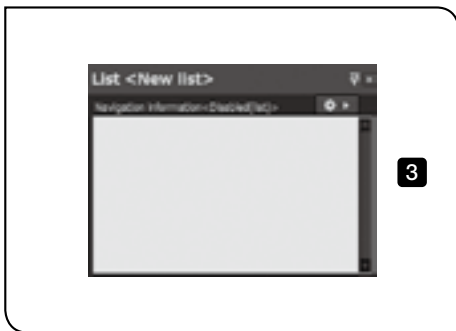
3 Before measurement, confirm that there is no teaching list in the [List] window.

If the teaching lists are in the [List] window, click the (Create New) in the menu.

(CAUTION) • **Before using the edge tool, confirm that there is no teaching list in the [List] window.**

• **The teaching lists which can be used in the measurement using the edge tool are only those created in the measurement using the edge tool.**

• **You cannot continue the measurement with turning OFF the edge tool in the middle.**
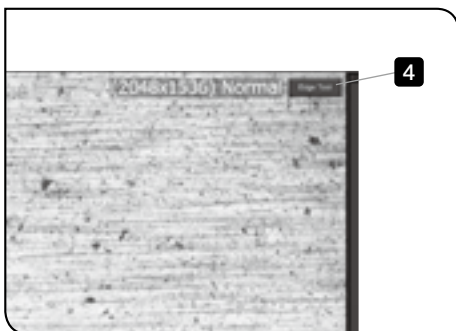
4 Click the [Edge Tool] button on the live screen.
The [Edge Tool] window appears.

Edge Tool (Black): The edge tool is OFF.

Edge Tool (Light blue): The edge tool is ON.

5 Click the (Distance between 2 points) button in the [Measurement items] window.

6 Click the [Line tool] (Line tool) button in the [Tool types].
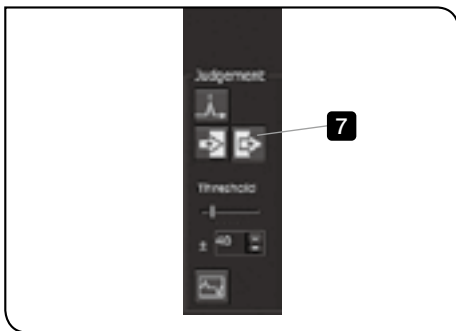
7 Click the [Detect the edge by Bright -> Dark] (Detect the edge by Bright -> Dark) button in [Judgment].
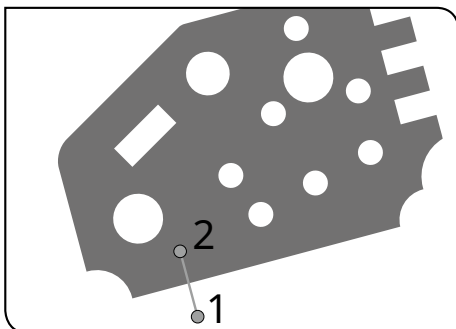
8 On the live image, click on the bright area and then on the dark area consecutively.

(CAUTION) **Since the judgment method was set to [Bright -> Dark] in 7 , be sure to click on the bright area first.**

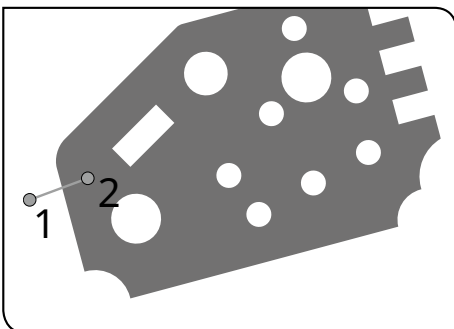**If the area is clicked in the reverse order of the judgment method, the correct measurement results cannot be acquired.**
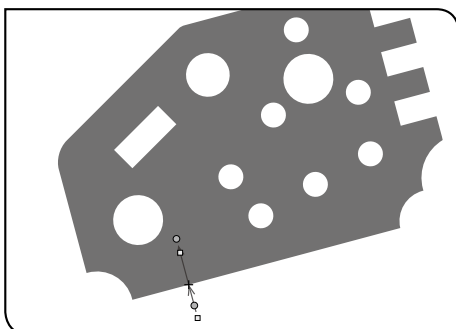
A line is created based on the clicked points, and then, one edge is detected.

The detected edge is displayed with a light blue cross line.

9 If the cross line position does not match with the edge of the live image, move the ○ mark or the ▢ mark to adjust the cross line position.

◎ If you cannot detect edges, attempt to adjust the values in [Threshold value] in the [Edge Tool] window or adjust the brightness of the illumination in the [Illumination] window.
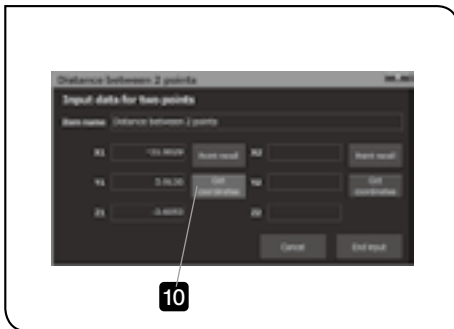
10 Click the [Get coordinates] button of [X1/Y1/Z1] in the [Distance between 2 point] window.
The coordinate data is acquired.
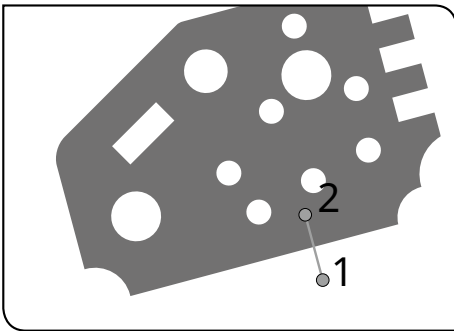
11 On the live image, click on the bright area and then on the dark area consecutively.
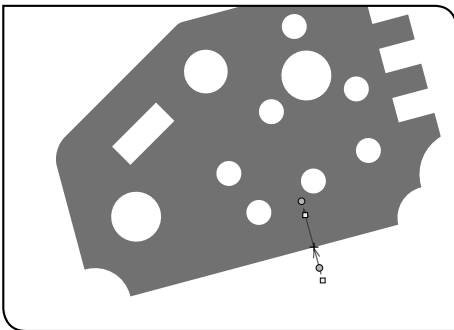
A line is created based on the clicked point, and then, one edge is detected.

12 If the cross line position does not match with the edge of the live image, move the ○ mark or the ☐ mark to adjust the cross line position.
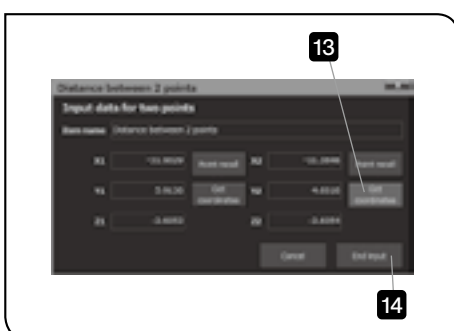
13 Click the [Get coordinates] button of [X2/Y2/Z2] in the [Distance between 2 points] window.
The coordinate data is acquired.

14 Click the [End input] button.
The line AB passing through the point A and the point B is created.

The line AB passing through the point A and the point B is created.
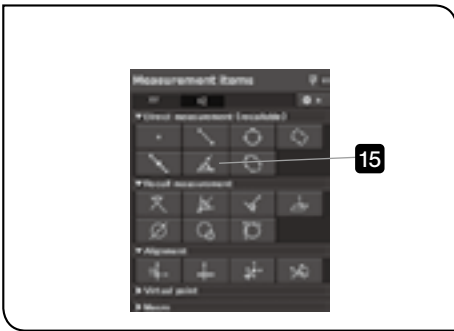
15 Click the [Line (Angle)] button in the [Measurement items] window.

16 Click the (Line tool) button in [Tool types].
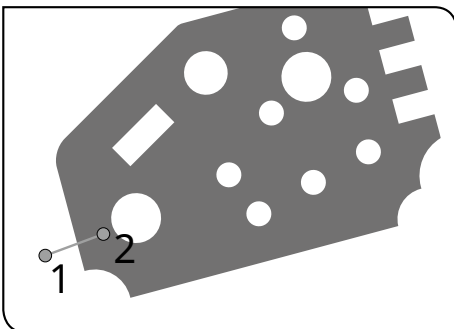
17 On the live image, click on the bright area and then on the dark area consecutively.

(CAUTION) **Since the judgment method was set to [Bright -> Dark] in 7, be sure to click on the bright area first.**

If the area is clicked in the reverse order of the judgment method, the correct measurement results cannot be acquired.
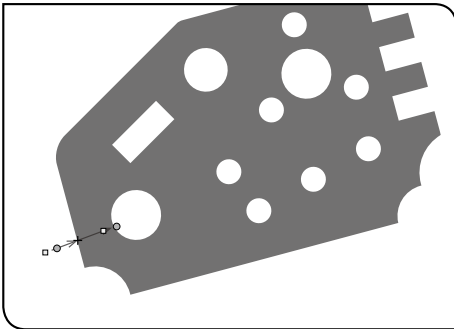
A line is created based on the clicked points, and then, one edge is detected.

18 If the cross line position does not match with the edge of the live image, move the ⬤ mark or the ◼ mark to adjust the cross line position.

19 Click the [Get coordinates] button in the [Line(Angle)] window.
The coordinate data is acquired.

20 On the live image, click on the bright area and then on the dark area consecutively.

CAUTION Since the judgment method was set to [Bright -> Dark] in **7**, be sure to click on the bright area first.

If the area is clicked in the reverse order of the judgment method, the correct measurement results cannot be acquired.
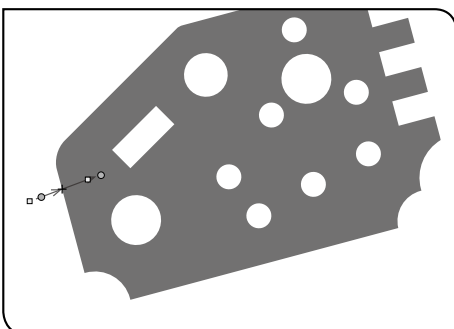
A line is created based on the clicked points, and then, one edge is detected.

21 If the cross line position does not match with the edge of the live image, move the ⬤ mark or the ◼ mark to adjust the cross line position.
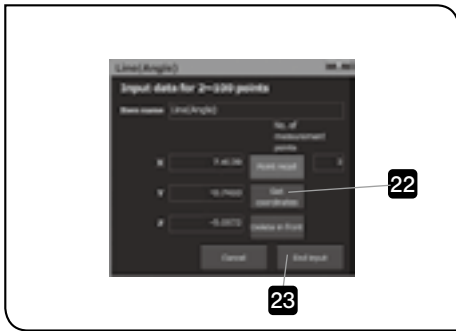
22 Click the [Get coordinates] button in the [Line(Angle)] window.
The coordinate data is acquired.

23 Click the [End input] button.

The line CD is created based on the coordinate data.
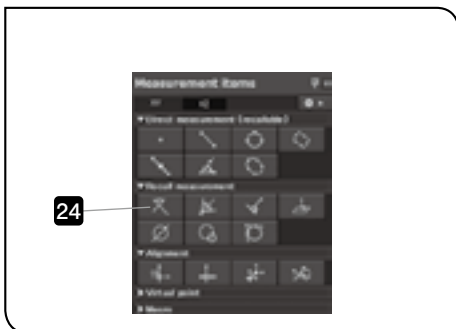
24 Click the [Intersection between line and line] button in the [Measurement items] window.

25 Recall the coordinate data in the order of the line AB and line CD.
The intersection point E between the line AB and the line CD is created.
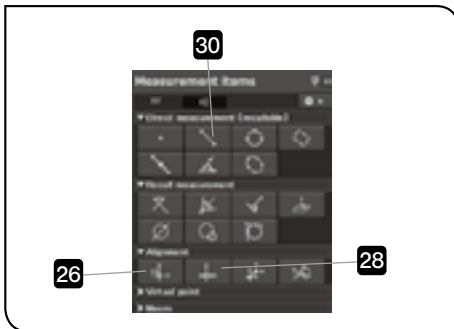
26 Click the ![Origin button] (Origin) button in the [Measurement items] window.

27 Recall the coordinate data of the point E.
The origin of the aligned coordinate system becomes the point E.

28 Click the ![X-axis button] (X-axis) button in the [Measurement items] window.

29 Recall the coordinate data of the line AB.
The X-axis of the aligned coordinate system becomes the tilt of the line AB.
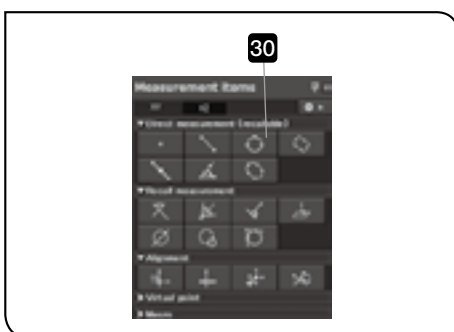
30 Click the ![Circle button] (Circle) button in the [Measurement items] window.
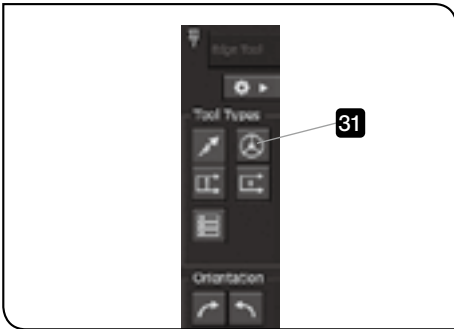
31 Click the (Circle tool) button in [Tool types].
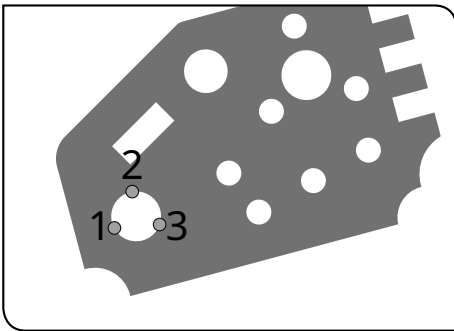
32 On the live image, click three positions you want them to be edges.
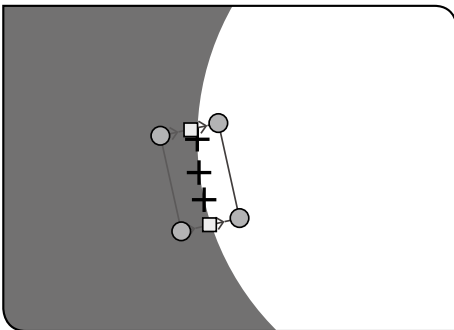
◎ If the circle you are measuring is large and cannot fit in the live image, the circle tool cannot detect the edge of the circle. If this happens, the circle can be detected by using (Multipoint tool).

◎ When detecting the edge of the circle shape using the mutipoint tool, be careful for followings.

· Make the contrast at the edge area larger.
· Make the rectangle larger (to the size where the ark can fit).
· Reduce the noise on the live image. (Increase the resolution. (page 167))
· Match the threshold with the intensity of the live image. (Refer to "Setting edge tool operations" (page 127) for details.)
· Increase the number of input points.
· Place the rectangle so that the red arrow direction and the blue arrow direction match with the directions set in [Judgment].
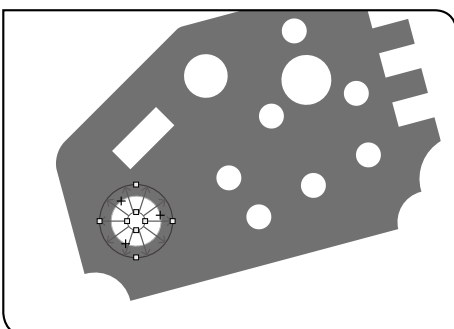
The edge is detected as a circle shape in orange color based on clicked points.

33 If the edge position does not match with the edge of the live image, move the circle or the ◻ mark to adjust the edge position.

34 Click the [Get coordinates] button in the [Circle] window.
The multiple coordinate data are acquired.

35 Click the [End input] button.
The circle FGH is created based on the coordinate data.

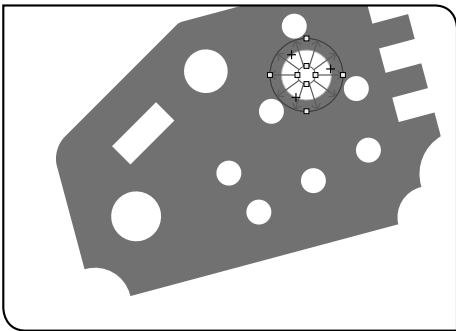**36** Click the ⬚ (Circle) button in the [Measurement items] window.
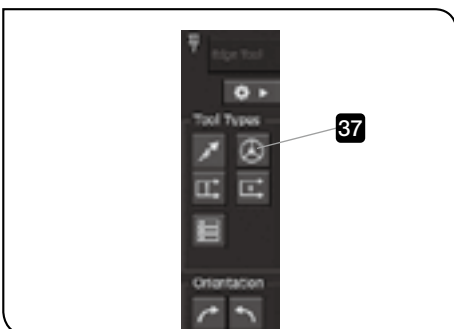
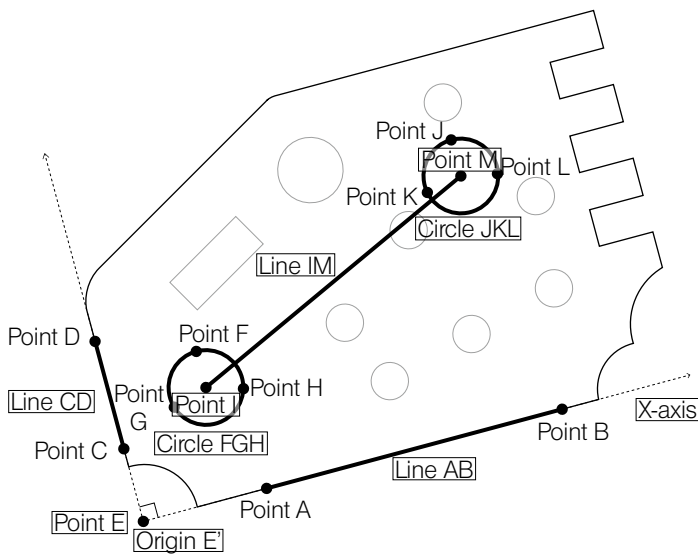**37** Click the ⬚ (Circle tool) button in [Tool types].
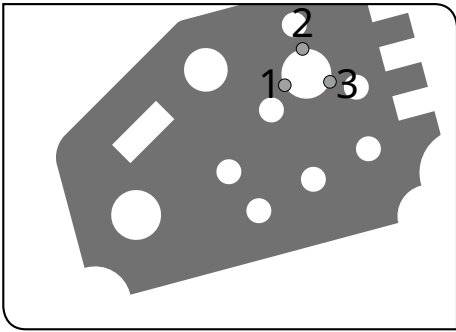
38 On the live image, click three positions you want them to be edges.

◎ If the circle does not fit within the live image, attempt to do so using a small hole of the test piece.

The edge is detected as a circle shape in orange color based on clicked points.

39 If the edge position does not match with the edge of the live image, move the circle or the ■ mark to adjust the edge position.
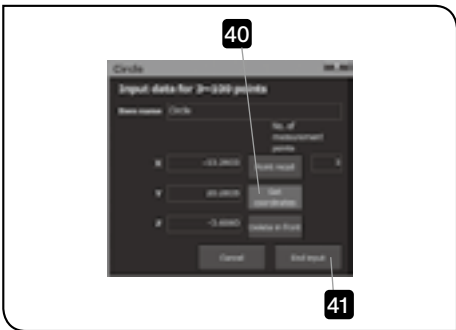
40 Click the [Get coordinates] button in the [Circle] window.
The multiple coordinate data are acquired.

41 Click the [End input] button.
The circle JKL is created based on the coordinate data.

42 Click the ⬚ (Distance between 2 points) button in the [Measurement items] window.

43 Recall the coordinate data in the order of the circle FGH and the circle JKL
The line IM connecting the center point I of the circle FGH and the center point M of the circle JKL is created.

Summary of this section

The line AB and the line CDis created using the line tool.
The circle FGH and the circle JKL are created using the circle tool.

Point J
Point M Point L
Point K
Circle JKL
Line IM
Point F
Point D
Point Point H
Line CD Point I
G Point
Circle FGH
Point C X-axis
Point B
Line AB
Point E
Point A
Origin E'

2-6 Operation Guide

Operation Guide is a function to guide users to understand measurement procedures so that even beginners can measure objects smoothly.
Users can learn measurement procedures by just operating the highlighted areas on the window with following the measurement procedures displayed on Operation Guide.

Click the [icon] (Guide Display ON/OFF) button in the menu to display Operation Guide.
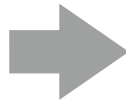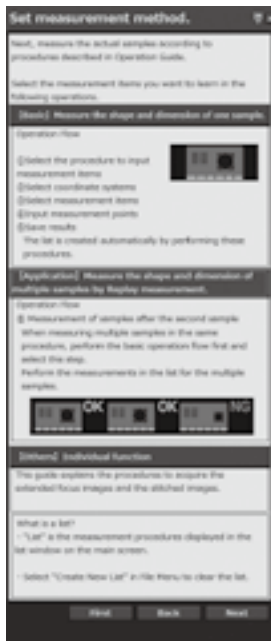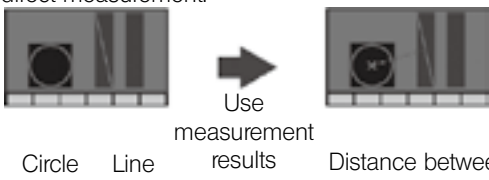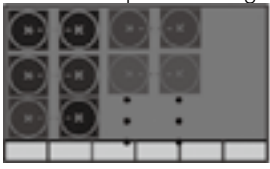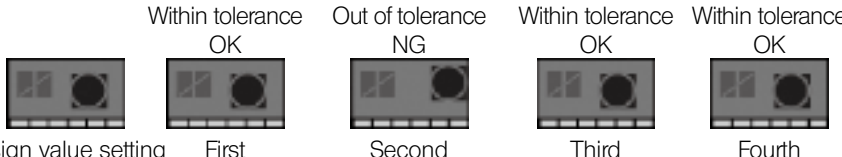
The operation areas are highlighted.

3 Functions

This section describes detail functions of this software, such as various measurement methods, procedures to acquire coordinates, procedures to view measurement results, etc.

3-1 Measurement

1 Measurement methods

This software has three measurement methods: Direct Measurement, Recall Measurement and Replay Measurement.
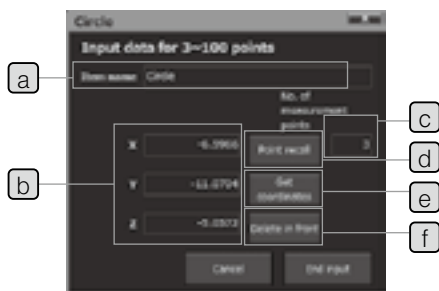Select the measurement method according to your measurement purpose.

Measurement methods	Descriptions	Reference page
Direct measurement	The coordinate data is inputted directly by selecting measurement items. The measurement using the edge tool is available as well. 	74
Recall measurement	The objects are measured by using (recalling) the coordinate data and the measurement data inputted in the direct measurement. Circle Line Use measurement results Distance between point and line	78
Copy Measurement	Useful for measuring multiple same shapes in a single measurement object. Circle Circle Distance between 2 points Repeat	100
Replay measurement	Useful for measuring the multiple same shape measurement objects. The measurement efficiency improves significantly by using the navigation function together. Within tolerance OK Out of tolerance NG Within tolerance OK Within tolerance OK Design value setting First Second Third Fourth	102

Input window

Click the measurement item button in [Measurement items] window to show the [Input] window for measurement items.

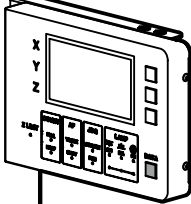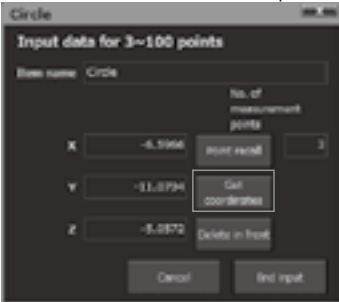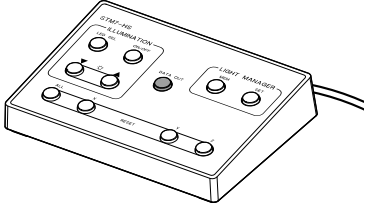◎ The contents displayed in the [Input] window are changed depending on measurement items.
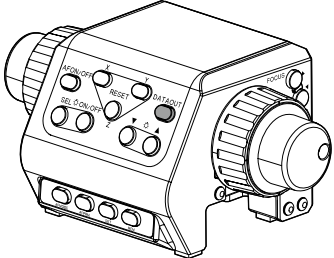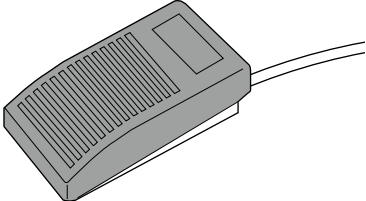

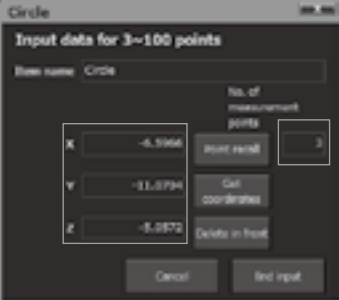| Names	Descriptions
[a] Item name	Displays measurement item names. ◎ The measurement item names can be changed. (10 two-byte characters or 20 one-byte characters) The measurement item names cannot be inputted in Copy Measurement (page 100) and Replay Measurement (page 102). ◎ The measurement item names are displayed in measurement items in the [List] window.
[b] Counter data	Displays the coordinate values inputted from the counter. The counter data is displayed by clicking the [Get coordinate] button or by inputting from external triggers (Digital Indicator STM7-DI, Hand Switch STM7-HS, DATA button of Focus Controller STM7-MCZ or Foot Switch STM7-FS).
[c] No. of measurement points	Displays the number of coordinates that have been acquired for the item currently being measured.
[d] Recall	This function is used for the recall measurement (page 78). The acquired coordinates are recalled for measurement.
[e] Get coordinates	Acquires the coordinate data. When using the external triggers, the same operations as those by clicking the [Get coordinates] button are completed by pressing the external triggers.
[f] Delete in front	Deletes the coordinate data acquired last in the multipoint input measurement. ◎ In the single point input measurement, the [Delete in front] button is not displayed. ◎ For behaviors when clicking the [Delete in front] button in the replay measurement, refer to "Procedures to re-acquire coordinates in the replay measurement" (page 104).

◎ The inputs can be confirmed by the double step (input same coordinate consecutively).
For details of the double step, refer to "Double Step" (page 66).

◎ For details of measurement items, refer to "A List of measurement items" (page 188).

Data acquisition methods

|	Input by external triggers	Input by clicking the mouse
Input measurement coordinates	DATA button of Digital Indicator STM7-DI DATA button of Hand Switch STM7-HS DATA button of Focus controller STM7-MCZ Foot Switch STM7-FS 	[Get coordinates] button in the [Input] window
	The input data is displayed in the [Counter data] display area and the measurement points in the [No. of measurement points] display area increases. 	

Double Step

The double step is a function to confirm the input points by inputting the same coordinates consecutively.

You can operate the double step as if double-clicking the Digital Indicator STM7-DI $\boxed{a}$, Hand Switch STM7-HS, DATA button of Focus Controller $\boxed{b}$, Foot Switch $\boxed{c}$, [Get coordinate] button $\boxed{d}$ in the [Input] window or Enter key of the keyboard.

Since it is not necessary to go back to the software screen for operation, the input points can be confirmed without releasing your hands from the stage.

◎ If the double step does not work, the tolerance interval of the double step may be narrow. Refer to "11 Communications" (page 181) and confirm the tolerance interval again.
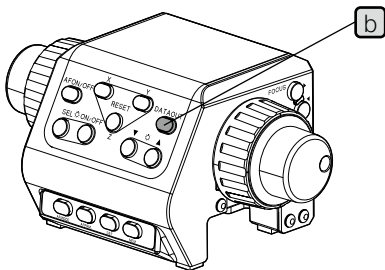
(CAUTION) The unit of the double step tolerance interval is calculated so that its length is same as the double step tolerance interval in the unit of mm. If you change the objective to change the unit to μm, etc., the coordinates may not be acquired. In this case, confirm the tolerance interval again.
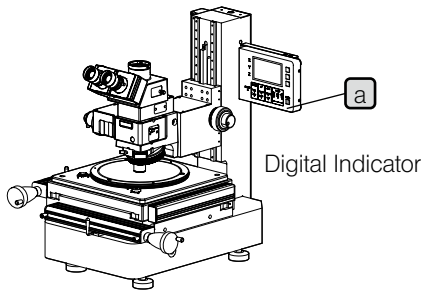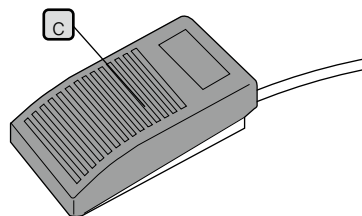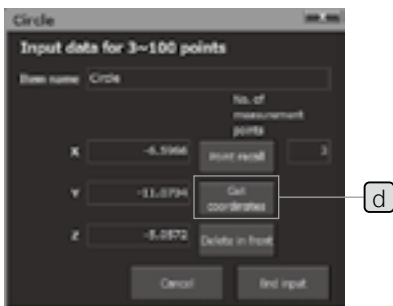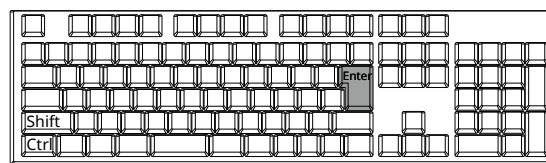

Digital Indicator
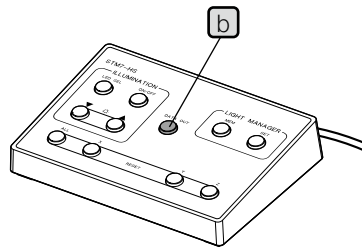
Hand Switch

Focus controller

Foot Switch

Input window

Keyboard

3 List of measurement items

◎ The tables include the measurement items available on the XY plane, macro registration methods and measurement items available on the XZ plane.

◎ The meanings of terms used in each table are described below.
  · Assigned key: Short-cut key of the keyboard to start measurement.
  · Confirmation method: Method to confirm input points.
                         Mostly, input points are confirmed by pressing the Enter key of the keyboard or using the double step.
                         The double step is an operation to input the same coordinates consecutively.
                         (It means to operate as if double-clicking the digital Indicator STM7-DI, Hand Switch STM7-HS, DATA button of Focus Controller STM7-MCZ or Foot Switch STM7-FS.)
                         If the tolerance interval of the double step is narrow, the software cannot recognize it as the same coordinate. Therefore, input points cannot be confirmed even though operating the double step. In this case, change the tolerance interval. Refer to "11 Communications" (page 181) for details.

◎ The inputs can be confirmed by the double step (input the same coordinate consecutively).

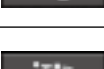◎ For details of measurement items, refer to "A List of measurement items" (page 188).
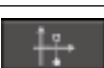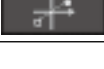
XY measurement items

Button	Measurement contents	No. of input points	Measurement/input method	Assigned key	Confirmation method
Direct measurement/Recall measurement					
	Points	1-100 points	Direct measurement/Recall measurement	F1	Double Step Enter key
	The acquired points are outputted as point elements. The calculation items are coordinate values of points. When 2 or more points are inputted, the gravity point is outputted. The inputs in the direct measurement are confirmed by the double step (input the same coordinate consecutively).				
	Distance between 2 points	2 points	Direct measurement/Recall measurement	F6	Double Step Enter key
	The distance is calculated by 2 points acquired. The calculation items are the distance, the coordinate difference X and the coordinate difference Y. The inputs in the direct measurement are confirmed by the double step (input the same coordinate consecutively).				
	Circle	3-100 points	Direct measurement/ Recall measurement	F3	Double Step Enter key
	The acquired points are outputted as circle elements. The calculation items are the coordinate value of the center of the circle, radius, diameter, circularity and positional tolerance. (The circularity is calculated when 4 or more points are inputted.) The inputs in the direct measurement are confirmed by the double step (input the same coordinate consecutively).				

67

| Button	Measurement contents	No. of input points	Measurement/input method	Assigned key	Confirmation method
	Rectangle	5 points	Direct measurement/ Recall measurement	F4	Enter key
	The acquired points are outputted as rectangle elements. The calculation items are width, height and angle of the rectangle.				
	Mid-point	2 points	Direct measurement/ Recall measurement	F5	Enter key
	The midpoint of the acquired points is outputted as a point element. The calculation item is a coordinate value of the midpoint.				
	Line (Angle)	2-100 points	Direct measurement/ Recall measurement	F2	Double Step Enter key
	The distance is calculated by 2 points acquired. The calculation item is the angle. The inputs in the direct measurement are confirmed by the double step (input the same coordinate consecutively).				
	Ellipse	5-100 points	Direct measurement/ Recall measurement	-	Double Step Enter key
	The acquired points are outputted as ellipse elements. The calculation items are minor radius, major radius and angle. The inputs in the direct measurement are confirmed by the double step (input the same coordinate consecutively).				

Button	Measurement contents	No. of input points	Measurement/input method
Recall measurement			
	Intersection between line and line (angle)	2 lines	Recall measurement
	Two line elements are recalled to output the point element. The calculation items are the coordinate value of the intersection point and the intersection between 2 lines (angle).		
	Center line	2 lines	Recall measurement
	Two line elements are recalled to output the line element. The calculation item is the angle of the center line.		
	Distance between point and line	1 point and 1 line	Recall measurement
	The point element and the line element are recalled to calculate the distance. The calculation item is the perpendicular distance.		
	Height between point and plane	Point and plane	Recall measurement
	The point element and the plane element are recalled to calculate the distance. The calculation item is the perpendicular distance.		
	Intersection between circle and line	1 line and 1 circle	Recall measurement
	The circle element and the line element are recalled to output the point element. The calculation item is the coordinate value of the intersection point.		
	Intersection between circle and circle	2 circles	Recall measurement
	Two circle elements are recalled to output the point element. The calculation item is the coordinate value of the intersection point.		
	Contact point between point and circle	1 point and 1 circle	Recall measurement
	The point element and the circle element are recalled to output the point element. The calculation item is the coordinate value of the contact point.		
Alignment			
	Origin	1 point	Direct measurement/Recall measurement
	The point directly inputted or the point measured is set as an origin. When the origin is set, the coordinates are calculated based on this specified origin in the subsequent measurements. Measurement items which can be outputted as point elements are the following: point, circle, rectangle, midpoint, ellipse, intersection between line and line, distance between point and line, intersection between circle and line, intersection between circle and circle, contact point between point and circle, height between point and plane, virtual point, move point, rotate point, point of symmetry in the X-axis, point of symmetry in the Y-axis, and point of symmetry in the origin.		

Button	Measurement contents	No. of input points	Measurement/input method
	X-axis	1 line	Recall measurement
	The line element already measured (line, distance between point and point, center line) is set as a X-axis. When the X-axis is set, the coordinates are calculated based on this specified X-axis in the subsequent measurements.		
	Move origin	-	Manual input
	The current origin is moved to set a new origin. Input the movement distance manually.		
	Tilt	-	Manual input
	The current X-axis is rotated to set a new X-axis. Input the rotation amount manually.		
Virtual point setting			
	Virtual point	-	Manual input
	The virtual points are outputted as point elements. Input the coordinate values of the point manually.		
	Move point	-	Recall measurement/Manual input
	The point element is recalled and the virtual point is created by moving that point in parallel. Input the movement distance manually.		
	Rotate point	-	Recall measurement/Manual input
	The point element is recalled and the virtual point is created by moving that point in rotation. Input the rotation amount manually.		
	Point of symmetry in the X-axis	-	Recall measurement
	The point element is recalled and the point symmetrical to the X-axis is created as a virtual point.		
	Point of symmetry in the Y-axis	-	Recall measurement
	The point element is recalled and the point symmetrical to the Y-axis as is created as a virtual point.		
	Point of symmetry in the origin	-	Recall measurement
	The point element is recalled and the point symmetrical to the origin is created as a virtual point.		

◎ For procedures to display the virtual point button on the [Measurement items] window, refer to "10 Measurement items screen" (page 180).

Button	Descriptions
Macro	
to	By registering measurement items to the macro button in advance, the multiple measurements registered can be started by this button. Up to 10 measurement items can be registered to one macro. Up to 8 macros can be registered.

Procedures to register the macro button
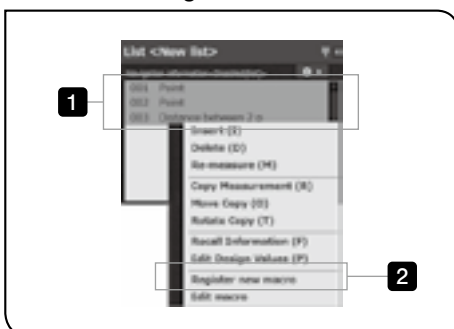
1 Select 2 or more measurement items you want to register as the macro in the [List] window and right-click on it.

2 Select [Register new macro] in the menu displayed.
The [Register new macro] window appears.

3 Select the macro No. to be registered.

4 Input the macro name.

5 Click the [Registration] button.
The [Register new macro] window is closed.

◎ The macro button is not displayed on the [Measurement items] window only by registering the macro.
For procedures to display the macro button on the [Measurement items] window, refer to "10 Measurement items screen" (page 180).
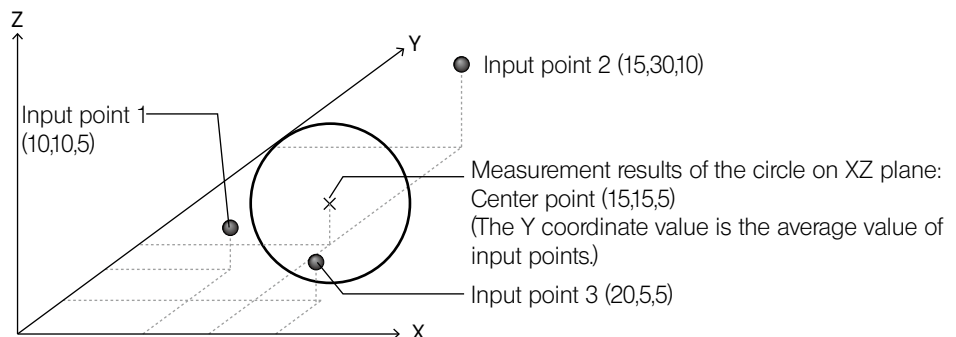
XZ Measurement items

Button	Measurement contents	No. of input points	Measurement/input method
Direct measurement/Recall measurement			
	Points	1-100 points	Direct measurement/Recall measurement
	The acquired points are outputted as point elements. The calculation items are coordinate values of points. When 2 or more points are inputted, the gravity point is outputted. The inputs in the direct measurement are confirmed by the double step (input the same coordinate consecutively).		
	Angle of the line (Z plane)	2-100 points	Direct measurement/Recall measurement
	The acquired points are outputted as line elements. The calculation item is the angle of the line. The inputs are confirmed by the double step (input the same coordinate consecutively).		
	Circle (Z plane)	3-100 points	Direct measurement/Recall measurement
	The acquired points are outputted as circle elements. The calculation items are the coordinate value of the center of the circle, radius and diameter. The inputs are confirmed by the double step (input the same coordinate consecutively).		
	Mid-point	2 points	Direct measurement/Recall measurement
	The midpoint of the acquired points is outputted as a point element. The calculation item is a coordinate value of the midpoint.		
	Distance between 2 points (Z plane)	2 points	Direct measurement/Recall measurement
	The distance is calculated by 2 points acquired. The calculation items are the distance, the coordinate difference X and the coordinate difference Y.		

Button	Measurement contents	No. of input points	Measurement/input method
	Height between point and point	2 points (Z plane)	Direct measurement/Recall measurement
	The coordinate difference is calculated by 2 points acquired. The calculation item is the coordinate difference Z. The inputs are confirmed by the double step (input the same coordinate consecutively).		
	Plane	3-100 points (Z plane)	Direct measurement/Recall measurement
	The acquired points are outputted as plane elements. The calculation item is the maximum slope angle of the plane. The inputs are confirmed by the double step (input the same coordinate consecutively).		
Recall measurement			
	Intersection between line and line (Z plane)	2 lines (Z plane)	Recall measurement
	Two line elements are recalled to output the point element. The calculation items are the coordinate value of the intersection point and the intersection between 2 lines (angle).		
	Center line (Z plane)	2 lines (Z plane)	Recall measurement
	Two line elements are recalled to output the line element. The calculation item is the angle of the center line.		
	Distance between point and line (Z plane)	1 point and 1 line (Z plane)	Recall measurement
	The point element and the line element are recalled to calculate the distance. The calculation item is the perpendicular distance.		
	Height between point and plane	Point and plane	Recall measurement
	The point element and the plane element are recalled to calculate the distance. The calculation item is the perpendicular distance.		
	Distance between circle and line (upper)	1 circle (Z plane) and 1 line (Z plane)	Recall measurement
	The circle element and the line element are recalled to calculate the distance. The calculation item is the perpendicular distance.		
	Distance between circle and line (lower)	1 circle (Z plane) and 1 line (Z plane)	Recall measurement
	The circle element and the line element are recalled to calculate the distance. The calculation item is the perpendicular distance.		

◎ Measurement example of XZ plane (Circle on XZ plane)

Z

Y

● Input point 2 (15,30,10)

Input point 1 (10,10,5)

Measurement results of the circle on XZ plane:
Center point (15,15,5)
(The Y coordinate value is the average value of input points.)

Input point 3 (20,5,5)

X

CAUTION   This is a XZ plane measurement, not a XYZ (three-dimensional) measurement.
Refer to "7 Measurement on XZ plane" (page 129) for details.

After measurement, the results are displayed in the [Measurement results] window.

"Sample 1" shows the measurement results when the teaching lists are created.
From "Sample 2" to "Sample n" show the measurement results in the replay measurement.

Measurement results
when creating the
teaching lists are
added.

Design value / upper tolerance limit /
lower tolerance limit / Excel Transfer

The measurement results are displayed in the following colors.

View in cell	Descriptions
Texts in blue	Within the tolerance of the specified measurement values
Texts in red	Out of the tolerance of the specified measurement values
Background in light blue	Measurement values without completing the replay measurement. After the partial replay measurement is performed: Measurement values inapplicable for partial replay measurement

◎ For details of the [Measurement results] window, refer to "7 Measurement results window" (page 161).
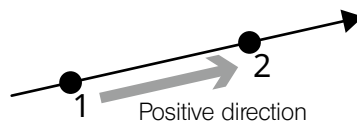
◎ The display contents of the [Measurement results] window can be changed. Refer to "Setting measurement results screen" (page 174) for details.

5   Details of measurement methods

Caution and perception of measurement

Line direction

The positive direction is determined by the order of acquiring the coordinate data when specifying the line

The direction of the line is determined by the order of acquiring the coordinate data. Do not use a different order of acquiring the coordinate data between when creating teaching lists and when performing the replay measurement When measuring the line, always acquire the coordinate data in the same order.

Display of intersection angle A and intersection angle B

This section describes the order of displaying the intersection angle A and the intersection angle B.

When the line is measured, the direction of that line is determined.

The direction of the line is created in the direction from the second point of the line toward the second point.

This is described using the "Step 5) Angle measurement (measure the intersection between line and line.)" (page 80) as an example.

If the directions of 2 lines are as follows, the intersection angle A will be the angle as shown in the picture.

The intersection angle A is displayed with the circular arc on the graphic window.
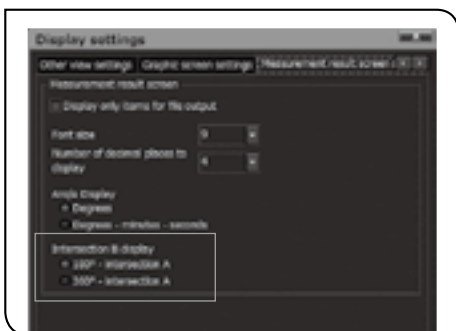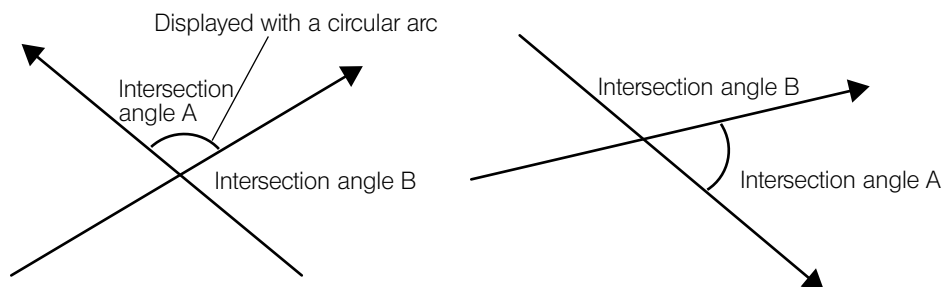
◎ The display of the intersection angle B changes depending on the setting of [Calculation result screen settings].

180 degrees - Intersection angle A: 360 degrees - Intersection angle A:
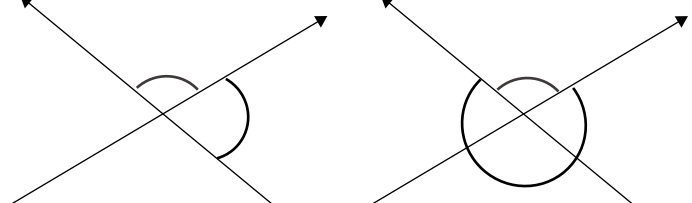
The intersection angles A and B are determined by the direction of the line. Do not change the order of acquiring the coordinate data of the line between when creating teaching lists and when performing the replay measurement.

If the order is changed, the direction of the line is changed. And as a result, the intersection angle A and the intersection angle B are reversed.

Direct Measurement

◎ For measurement items, refer to "3 List of measurement items" (page 67).

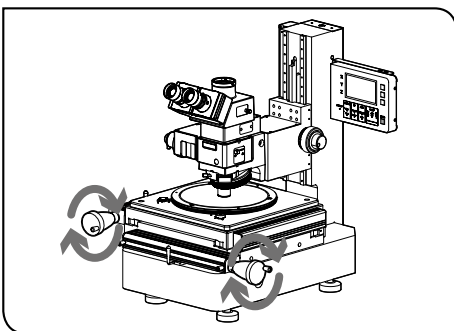### Step 1) Get the counter data.
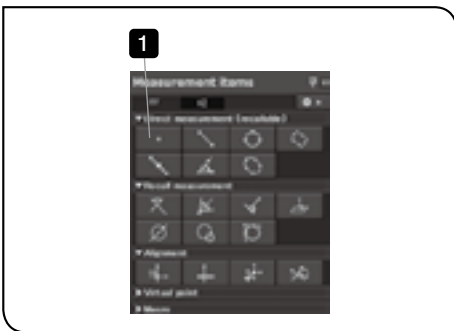
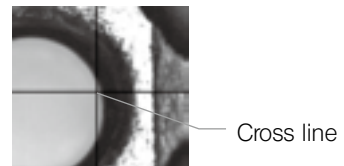**1** Click the ▢ (Point) button in the [Measurement items] window.

The [Input] window appears.

◎ For details of the [Input] window, refer to "Input window" (page 64).

2 Move the stage of the microscope and match the cross line of the live window with the input point.
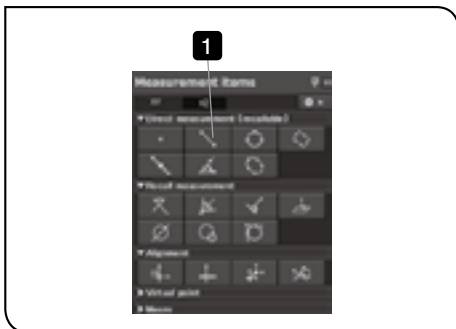

Cross line

3 Click the [Get coordinates] button in the [Input] window.
The coordinate data is acquired.

◎ The coordinate data can also be acquired by external triggers
(Digital Indicator STM7-DI, Hand Switch STM7-HS, DATA button of
Focus Controller STM7-MCZ or Foot Switch STM7-FS).
For procedures to acquire the coordinate data by the external
triggers, refer to "Data acquisition methods" (page 65).

4 Click the [End input] button.
The measurement results are displayed in the [Graphic] window
(page 158), [List] window (page 160) and [Measurement results]
window (page 161). For details of each window, refer to the
respective pages.
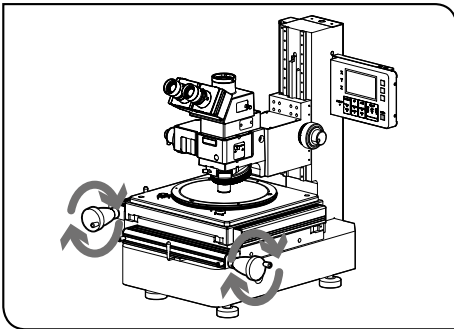
Step 2) Measure the distance between 2 points

1 Click the (Distance between 2 points) button in the
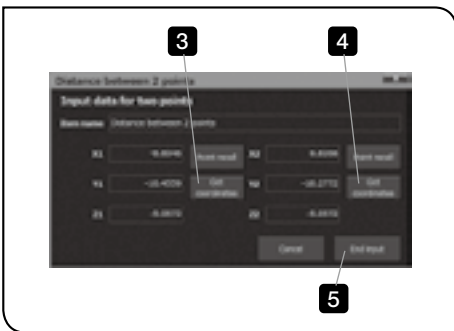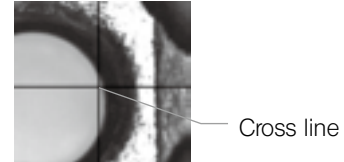[Measurement items] window.

The [Input] window appears.

◎ For details of the [Input] window, refer to "Input window" (page 64).

2 Move the stage of the microscope and match the cross line of the live window with the first input point.

Cross line

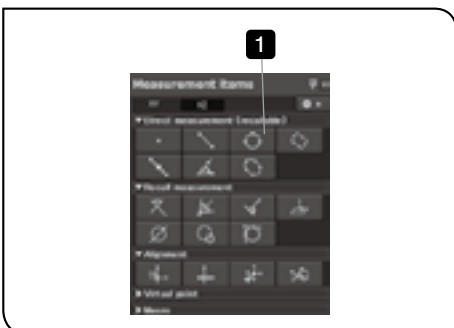**3** Click the [Get coordinates] button in the [Input] window.
The coordinate data is acquired.

◎ The coordinate data can also be acquired by external triggers (Digital Indicator STM7-DI, Hand Switch STM7-HS, DATA button of Focus Controller STM7-MCZ or Foot Switch STM7-FS).
For procedures to acquire the coordinate data by the external triggers, refer to "Data acquisition methods" (page 65).

4 Repeat from **2** to **3**, and acquire the coordinate data of the second point.

5 Click the [End input] button.
The measurement results are displayed in the [Graphic] window (page 158), [List] window (page 160) and [Measurement results] window (page 161). For details of each window, refer to the respective pages.

Step 3) Measure the circle (Diameter D/Radius R). (Direct measurement)
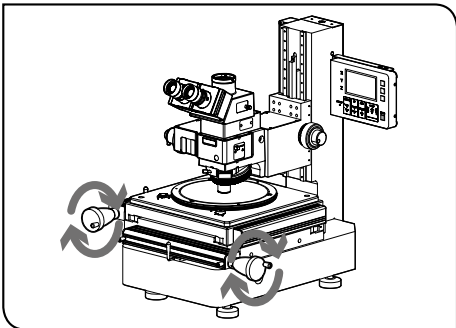

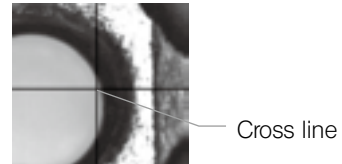**1** Click the [ ] (Circle) button in the [Measurement items] window.

The [Input] window appears.

◎ For details of the [Input] window, refer to "Input window" (page 64).

2 Move the stage of the microscope and match the cross line of the live window with the first input point.

Cross line

3 Click the [Get coordinates] button [a] in the [Input] window.
The coordinate data is acquired.

◎ The coordinate data can also be acquired by external triggers (Digital Indicator STM7-DI, Hand Switch STM7-HS, DATA button of Focus Controller STM7-MCZ or Foot Switch STM7-FS).
For procedures to acquire the coordinate data by the external triggers, refer to "Data acquisition methods" (page 65).

4 Repeat from **2** to **3**, and acquire the coordinate data of the second point, third point, etc.

No. of Measurement points = 1

No. of Measurement points = 2

No. of Measurement points = 3
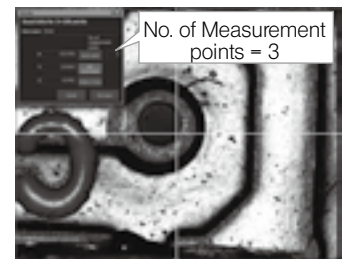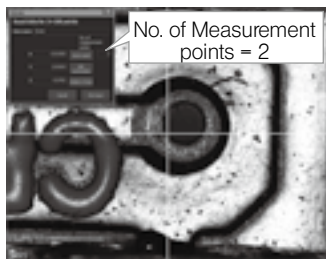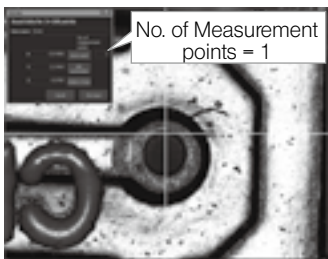
◎ In the circle measurement, the coordinate data from 3 to 100 points can be acquired.

5 Click the [End input] button.
The measurement results are displayed in the [Graphic] window (page 158), [List] window (page 160) and [Measurement results] window (page 161). For details of each window, refer to the respective pages.
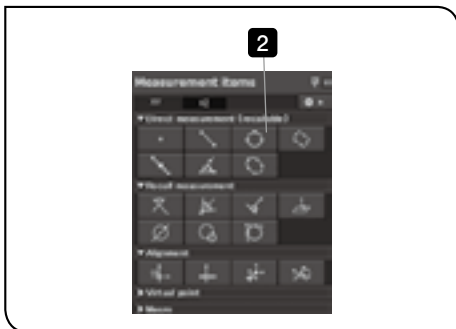
Recall measurement

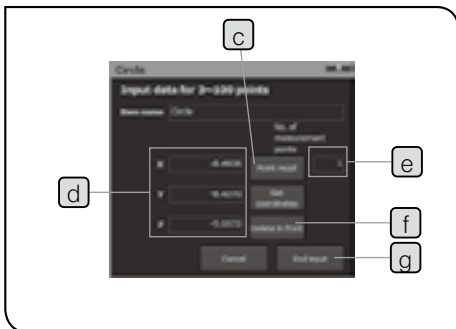This is a measurement method using the data measured previously.

Step 4) Measure the circle (diameter D/ radius R) (Recall measurement)

1 Refer to "Step 1) Get the counter data." (page 74), and acquire the coordinate data of 3 points in the direct measurement.

2 Click the ☼ (Circle) button in the [Measurement items] window.

The [Input] window appears.

◎ For details of the [Input] window, refer to "Input window" (page 64).

3 Select the first point in the [Graphic] window [a] or in the [List] window [b], and click the [Point recall] button [c] in the [Input] window.

The coordinate data of the first point is recalled to [Counter data] [d]

◎ The coordinate data can also be recalled by double-clicking figures in the [Graphic] window or items in the [List] window.

◎ In order to recall the coordinate data in the [Graphic] window, the [List] window must be displayed.

◎ "1" is displayed in [No. of measurement points] [e].

4 Repeat **3**, and recall the coordinate data of the second point and the third point.

◎ "3" is displayed in [No. of measurement points] [e].

◎ If the wrong coordinate data is inputted, click the [Delete in front] button [f] to delete the coordinate data and recall the correct data again.

5 Click the [End input] button g .

The circle passing through 3 points is added to the [Graphic] window.

The "004 Circle" is added to the [List] window.

The measurement results of [X coordinate / Y coordinate / Z coordinate / R radius / D diameter / Circularity / Positional tolerance] are added to the [Measurement results] window.

◎ When there are multiple recallable points:

The recall points can be changed by double-clicking on the figures in the [Graphic] window.

Target measurement items: Circle / Intersection between circle and line / Intersection between circle and circle / Contact point between point and circle
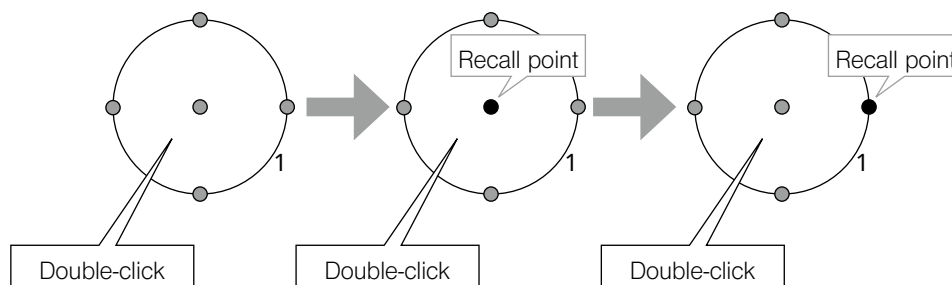
◎ "Using teaching lists" (page 89) describes the example using the contents measured in this step.

If you move to "Saving teaching lists" (page 89) and save the contents measured in this step, the subsequent operations can be performed smoothly.

Step 5) Angle measurement (measure the intersection between line and line.)

This measurement method is used for calculating the virtual intersection point when measuring the unclear work.
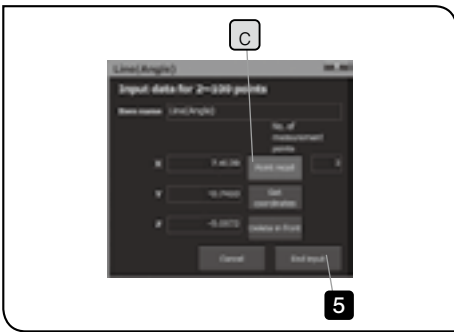

1 Refer to "Step 1) Get the counter data." (page 74), and acquire the coordinate data of 2 points on each line (4 points in total) in the direct measurement.
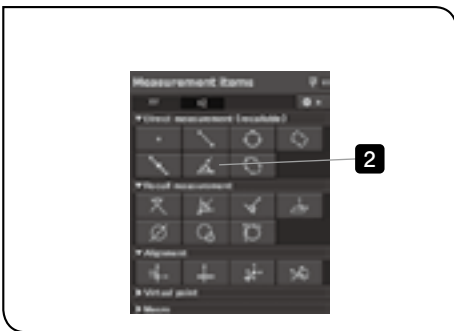
2 Click the ⊿ (Line (Angle)) button in the [Measurement items] window.
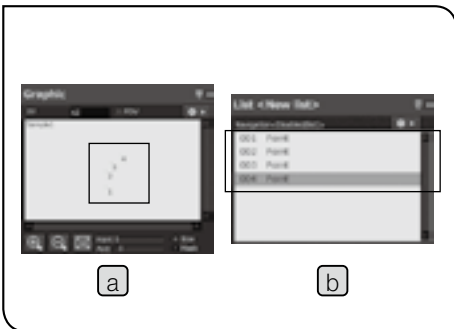
The [Input] window appears.

◎ For details of the [Input] window, refer to "Input window" (page 64).

3 Select the first point in the [Graphic] window [a] or in the [List] window [b], and click the [Point recall] button [c] in the [Input] window.
The coordinate data is recalled.

4 Select the second point in the [Graphic] window [a] or in the [List] window [b], and click the [Point recall] button [c] in the [Input] window.
The coordinate data is recalled.

5 Click the [End input] button [e].
A line connecting the first point and the second point is created.

6 Repeat from **2** to **5**, recall the coordinate data of the third point and the fourth point and create the line connecting the third point and the fourth point
2 lines passing through 2 points are added to the [Graphic] window.
The "005 Line (Angle)" and the "006 Line (Angle)" are added to the [List] window.
The "Angle" of 2 lines with 0 degree as the X-axis is added to the [Measurement results] window.

7 Click the [Intersection between line and line) button in the [Measurement items] window.
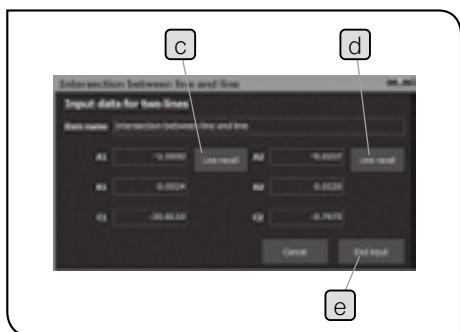
The [Input] window appears.

8 Select [Line(Angle)] (first line) in the [Graphic] window [a] or in the [List] window [b], and click the [Line recall] button [c] in the [Input] window.

**9** Select [Line(Angle)] (second line) in the [Graphic] window or in the [List] window, and click the [Line recall] button [d] in the [Input] window.

10 Click the [End input] button [e].
The intersection between the first line and the second line is added to the [Graphic] window.
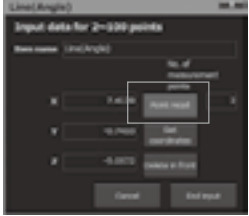The "007 Intersection between line and line" is added to the [List] window.
The measurement results of [X coordinates / Y coordinates / Z coordinates / Intersection angle A / Intersection angle B] are added to the [Measurement results] window.
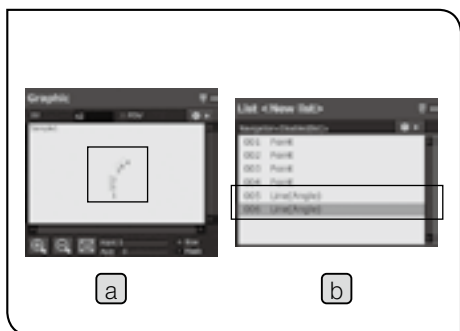
◎ For descriptions of the display of the intersection angle A and the intersection angle B, refer to "Display of intersection angle A and intersection angle B" (page 73).

Recall measurement methods

| Input methods	Double-click input	Single-click input
[List] window	Double-click "001 Point".	Click the [Point recall] button.
[Graphic] window	Double-click 1 point.	

Procedures to confirm the recall information of teaching lists
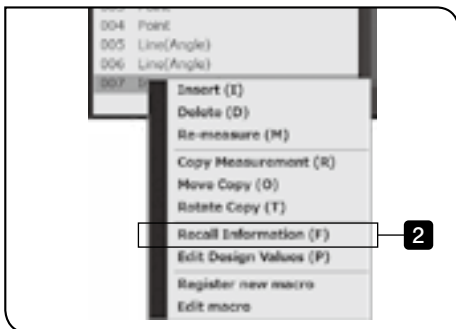
◎ This is described using the "Step 5) Angle measurement (measure the intersection between line and line." (page 80) as an example.

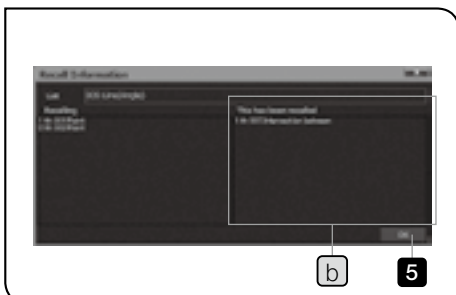**1** Right-click on the "007 Tolerance between line and line" in the [List] window.

2 Select [Recall information] in the menu displayed.
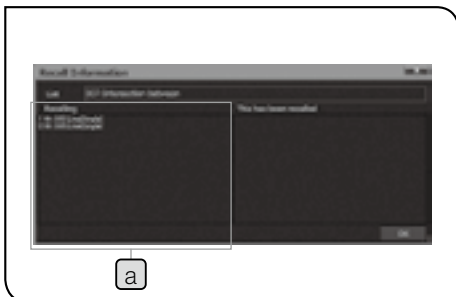
The [Recall information] window appears.

The recall information of the "007 Tolerance between line and line" is displayed in [Recalling] ⓐ.

3 Double-click "005 Line" in [Recalling] ⓐ.

The recall information of "005 Line" is displayed in [This has been recalled.] ⓑ.

4 Double-clicking "First 007 Tolerance between line and line" in [This has been recalled.] ⓑ will return to the previous list "007 Tolerance between line and line".

5 When the confirmation of the recall information is completed, click the [OK] button.
The [Recall information] window is closed.

Alignment

Outline of alignment settings

If the alignment is not set, the measurement objects must be placed parallel to the stage and the counter data of the measuring microscope must be reset to 0 at the origin.
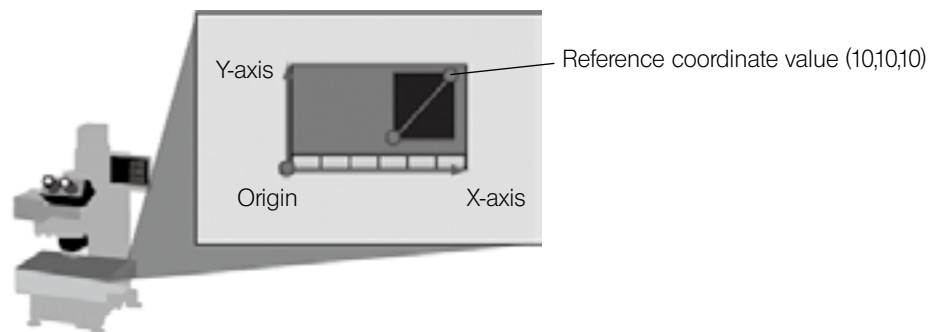
If the alignment is set, it is not necessary to place the measurement object parallel to the stage.

◎ For the display of the alignment coordinates, refer to "3 Counter window" (page 157).

Step 6) Alignment (origin/X-axis) setting (Input 2 points)
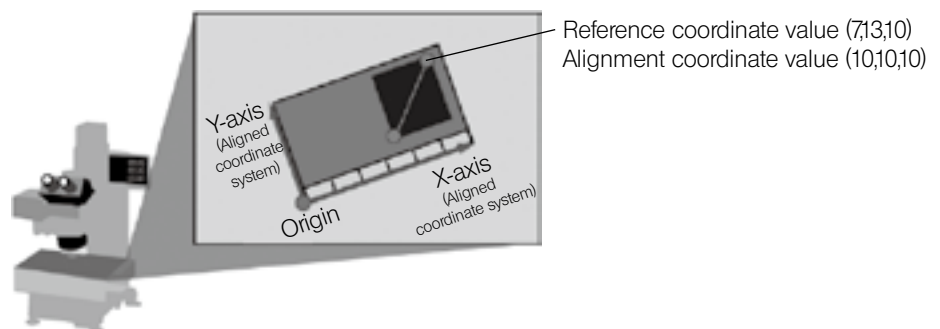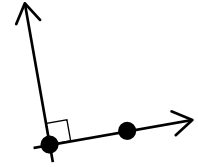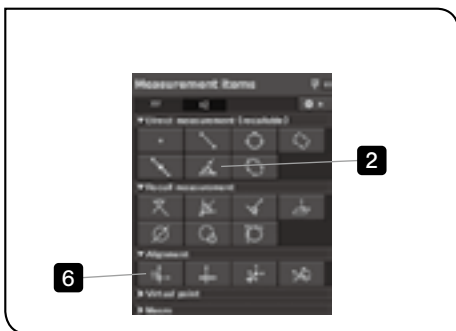
This method is used for setting to the aligned coordinate system.

The coordinate data of 2 points (better to use one point as an origin) on the X-axis is acquired and used for alignment.

1 Refer to "Step 1) Get the counter data." (page 74), and acquire the coordinate data of 2 points on the X-axis in the direct measurement.

2 Click the (Line (Angle)) button in the [Measurement items] window.

The [Input] window appears.

◎ For details of the [Input] window, refer to "Input window" (page 64).

3 Select the first point in the [Graphic] window ⓐ or in the [List] window ⓑ, and click the [Point recall] button ⓒ in the [Input] window.

4 In the same way as **3**, recall the second point with the [Point recall] button ⓓ.

5 Click the [End input] button.
The line connecting 2 points is created.

6 Click the (Origin) button in the [Measurement items] window.
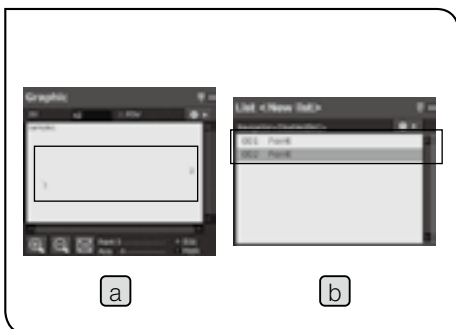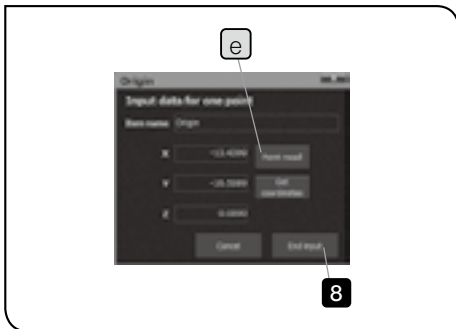
The [Input] window appears.

7 Select the first point in the [Graphic] window [a] or in the [List] window [b], and click the [Point recall] button [e] in the [Input] window.

8 Click the [End input] button.
The first point position becomes the origin of the aligned coordinate system.

◎ When moving the origin, use the [Move origin] button to move the origin.
For details of moving the origin, refer to 69 page.

9 Click the (X-axis) button in the [Measurement items] window.

The [Input] window appears.

10 Select "003 Line (Angle)" in the [Graphic] window [a] or in the [List] window [b], and click the [Line recall] button [f] in the [Input] window.

11 Click the [End input] button.
The line becomes the X-axis of the aligned coordinate system.

The alignment coordinates having the origin based on "001 Point" and "003 Line (angle)" as the X-axis is added to the [Graphic] window.
The "004 Origin" and "005 X-axis" are added to the [List] window.
The measurement results of the origin and the X-axis of the aligned system are added to the [Measurement results] window.

◎ After alignment, various measurement results are displayed in the aligned coordinate system.
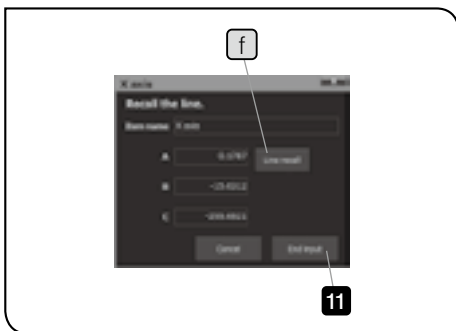
Step 7) Alignment (origin/X-axis) setting (Input 3 points)

In the same way as Step 6, this method is used for setting to the aligned coordinate system.
The coordinate data of 2 points on the X-axis and one point on the Y-axis are acquired and
used for alignment.

1 Refer to "Step 1) Get the counter data." (page 74), and acquire the coordinate data of 2 points on the X-axis in the direct measurement.
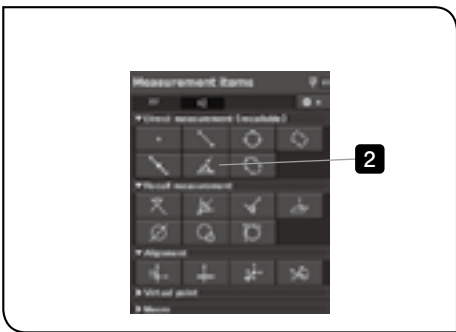

2 Click the [Line (Angle)] button in the [Measurement items] window.

◎ The coordinate data on the line on the X-axis can also be acquired with (Distance between 2 points)

The [Input] window appears.

◎ For details of the [Input] window, refer to "Input window" (page 64).

3 Select the first point in the [Graphic] window [a] or in the [List] window [b], and click the [Point recall] button [c] in the [Input] window.

4 In the same way as **3**, recall the second point with the [Point recall] button [c].

5 Click the [End input] button.
The line connecting 2 points is created.

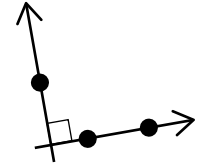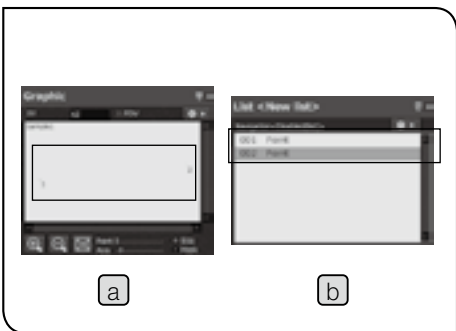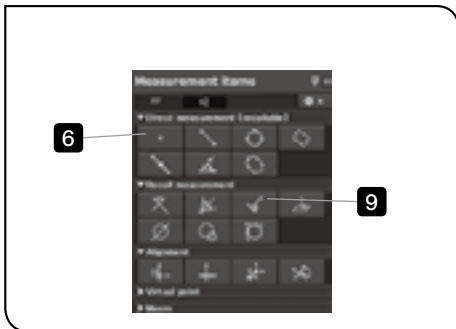**6** Click the [ ] (Point) button in the [Measurement items] window.

The [Input] window appears.

7 Acquire the coordinate data of 1 point on the Y-axis in the direct measurement.

8 Click the [End input] button.
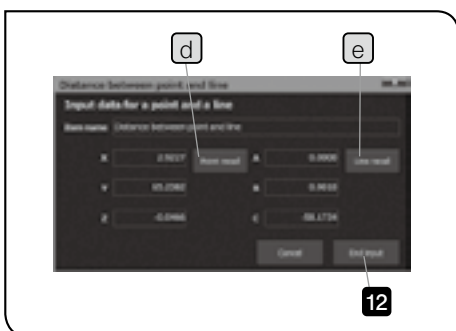
9 Click the [ ] (Distance between point and line) button in the [Measurement items] window. The [Input] window appears.

10 Select "004 Point" in the [Graphic] window [a] or in the [List] window [b], and click the [Point recall] button [d] in the [Input] window.

11 Select "003 Line" in the [Graphic] window [a] or in the [List] window [b], and click the [Line recall] button [e] in the [Input window.

12 Click the [End input] button.
The perpendicular is drawn from "004 Point" to "003 Line (Angle)".
And the perpendicular distance and the coordinates are calculated.

◎ Only the distance data is displayed in the [Measurement results] window.

13 Click the ⊞ (Origin) button in the [Measurement items] window.

The [Input] window appears.

14 Select "005 Distance between point and line" in the [Graphic] window [a] or in the [List] window [b], and click the [Point recall] button [f] in the [Input] window.

15 Click the [End input] button.
The "005 Distance between point and line" position becomes the origin of the aligned coordinate system.

16 Click the ⊞ (X-axis) button in the [Measurement items] window.
The [Input] window appears.

17 Select "003 Line (Angle)" in the [Graphic] window [a] or in the [List] window [b], and click the [Line recall] button [g] in the [Input window.

18 Click the [End input] button.
The line becomes the X-axis of the aligned coordinate system.
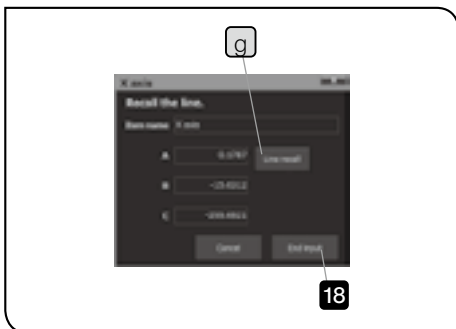
The alignment coordinates having the origin based on "005 Distance between point and line" and "003 Line" as the X-axis is added to the [Graphic] window.
The "006 Origin" and "007 X-axis" are added to the [List] window.
The measurement results of the origin and the X-axis of the aligned system are added to the [Measurement results] window.

◎ The aligned coordinate system in the [Measurement Results] window is displayed in red.

◎ After alignment, various measurement results are displayed in the aligned coordinate system.

◎ "Using teaching lists" (page 89) describes the example using the contents measured in this step. If you move to "Saving teaching lists" (page 89) and save the contents measured in this step, the subsequent operations can be performed smoothly.

Using teaching lists

The teaching lists must be combined to use the replay measurement, partial replay measurement or navigation function.

Creating teaching lists

View the [List] window after operating "Step 7) Alignment (origin/X-axis) setting (Input 3 points)" (page 86)
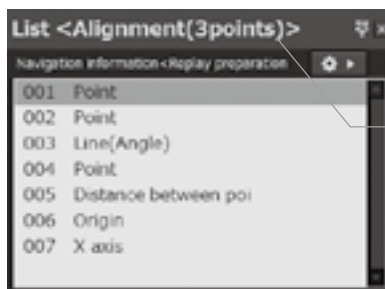
The file names of the teaching lists being measured is displayed in the title bar.

These lists (measurement methods) are created.

These will be the measurement methods (Teaching Lists).

Saving teaching lists
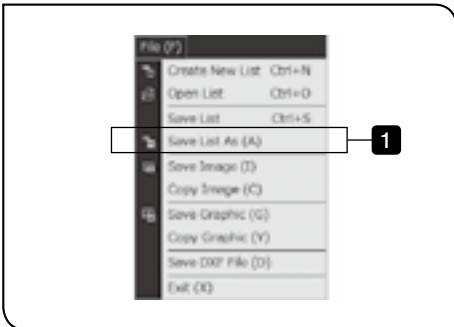
1 Select ▦ 💾 (Save) button in the menu or [Save lists as] in the [File] menu.
The [Save lists] window appears.

2 Specify the save destination of the teaching lists and the file names, and click the [Save] button.
The teaching lists are saved.
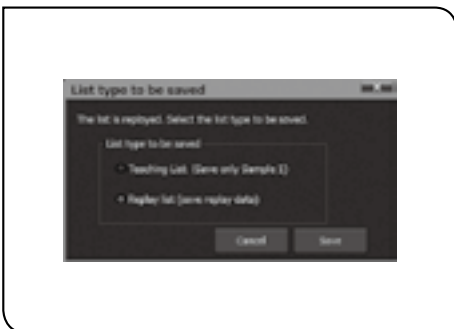
◎ Before saving the teaching lists, if you perform the replay measurement (page 102) using those teaching lists, the [List type to be saved] window is displayed. For list types, refer to "Saving replay lists" (page 104).

◎ If the teaching lists are saved overwriting, they are saved in the list type when the lists are opened.

Loading teaching lists
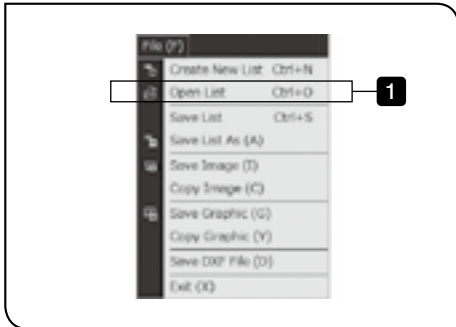
1 Select the ▣ (Open) button in the menu or [Open lists] in the [File] menu.
The [Open lists] window appears.

2 Specify the save destination of the teaching lists and the file names, and click the [Open] button.
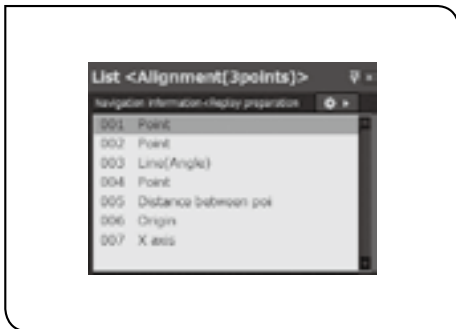
The teaching lists are loaded to the [List] window.

◎ If the replay lists are opened, the replay measurement data is also loaded to the [Measurement results] window.

◎ You can edit the names of the the measurement items, such as "Point", that are displayed when you open the list in the [Input] window as you are measuring.
The language displayed while measurements were performed is also displayed while the list is loading.

Editing teaching lists

a   b
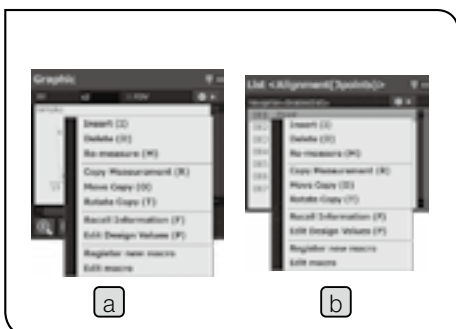
1 Select the measurement item in the [Graphic] window [a] or in the [List] window [b], and right-click it.

2 Select items you want to edit in the menu displayed.

Adding measurement items to teaching lists

Step 8) Measure the circle after setting alignment (3 points)

The measurement items are added after the saved teaching lists.
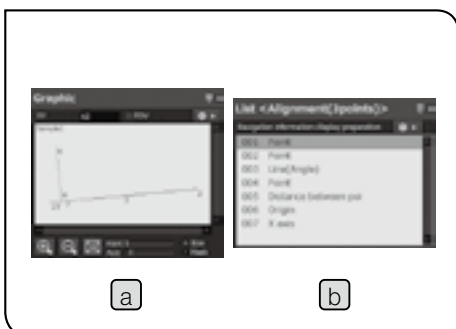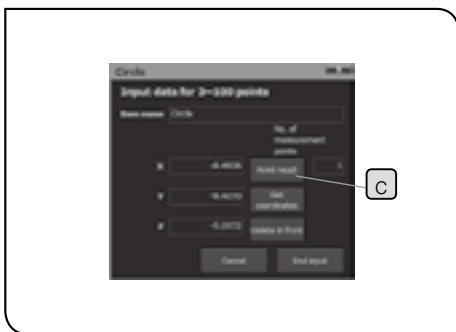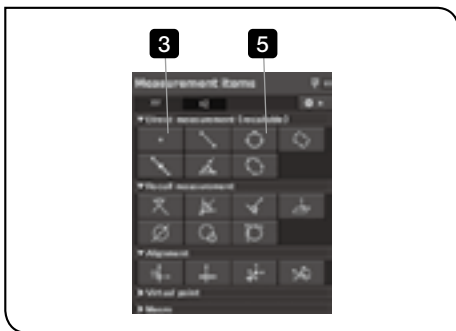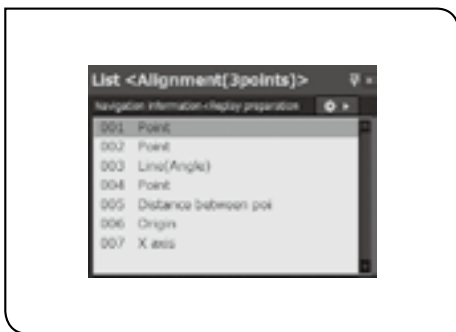
1 Refer to "Loading teaching lists" (page 90), and load the teaching lists created in Step 7.
The teaching lists up to "007 X-axis" are added to the [Graphic] window, [List] window and [Measurement results] window.

2 Click the [▤↻] (Replay) button in the menu, and start the replay measurement described in Step 7.

3 Click the [·] (Point) button in the [Measurement items] window.

The [Input] window appears.

◎ For details of the [Input] window, refer to "Input window" (page 64).

4 Refer to "Step 1) Get the counter data." (page 74), and acquire the coordinate data of 3 points on the circumference in the direct measurement.

5 Click the [○] (Circle) button in the [Measurement items] window.

6 Select the first point in the [Graphic] window [a] or in the [List] window [b], and click the [Point recall] button [c] in the [Input] window.

7 Repeat **6**, and recall the coordinate data of the second point and the third point.

8 Click the [End input] button.
A circle passing through 3 points is added to the [Graphic] window. The "011 Circle" is added to the [List] window.
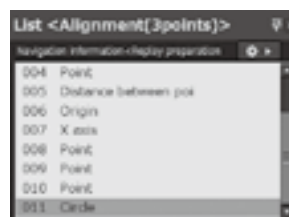
◎ Other steps describe the examples using the contents measured in this step. If you move to "Saving teaching lists" (page 89) and save the contents measured in this step, the subsequent operations can be performed smoothly.

Inserting measurement items to teaching lists

Step 9) After setting alignment (3 points), insert the circle measurement to the teaching lists and measure.
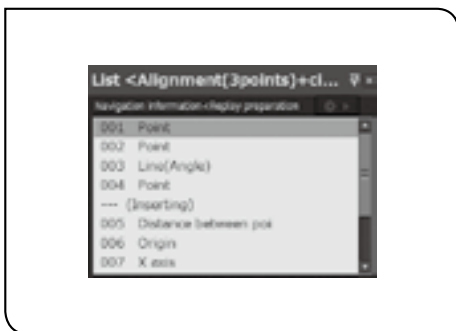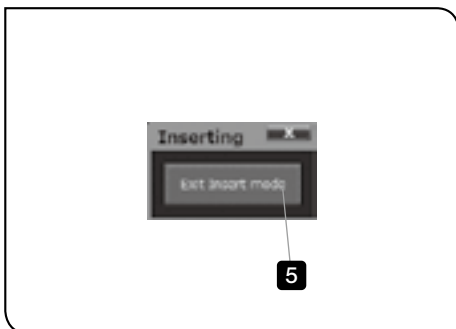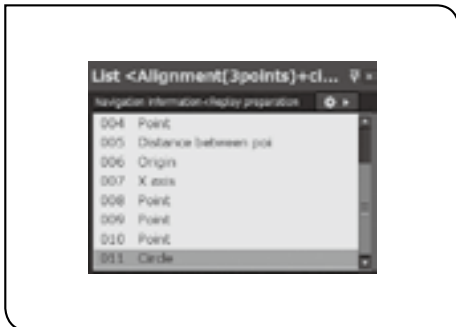
1 Refer to "Loading teaching lists" (page 90), and load the teaching lists created in Step 8.

The teaching lists up to "011 Circle" are added to the [Graphic] window, [List] window and [Measurement results] window.

2 Click the item you want to add (in this step, "005 Distance between point and line") in the [List] window.

3 Click the ![Insert icon] (Insert) button in the menu or right-click on the item being selected in the [List] window , and select [Insert] in the menu displayed.

The [Inserting] window appears.

4 Click the button of the measurement item you want to insert in the [Measurement items] window [a], and perform the direct measurement or recall measurement.

(In this step, use the ![Circle icon] (Circle) button to perform the recall measurement of "001", "002" and "004".)

"Inserting" appears on the item by one above the item selected in the [List] window.

◎ To stop inserting measurement items, click the [Cancel] button in the [Input] window.

The inserted measurement items are added to the [Graphic] window, [List] window and [Measurement results] window. ("005 Circle", in this step)
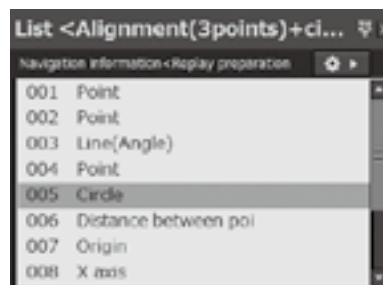
5 To stop inserting the measurement items, click the [Exit insert mode] button in the [Inserting] window.

◎ "Using teaching lists" (page 89) describes the example using the contents measured in this step. If you move to "Saving teaching lists" (page 89) and save the contents measured in this step, the subsequent operations can be performed smoothly.

Deleting measurement items from teaching lists
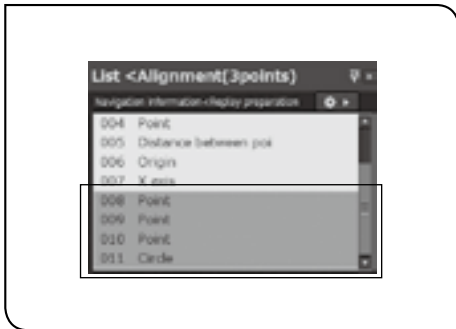
1 Select the item you want to delete in the [List] window.

◎ Multiple items can be selected by dragging items.

◎ Multiple items can be selected by clicking items while pressing the Ctrl key of the keyboard.

◎ Multiple items selected can be deleted together at a time.

2 Press the Delete key of the keyboard, click the [] (Delete) button in the menu or right-click on the item being selected in the [List] window to select [Delete] in the menu displayed.

3 Click the [OK] button in the message displayed.

◎ To stop deleting measurement items, click the [Cancel] button.

The selected items are deleted.

◎ The items used in the recall measurement are not deleted. If there are items which cannot be deleted, delete the items used in the recall measurement first and then delete them again.
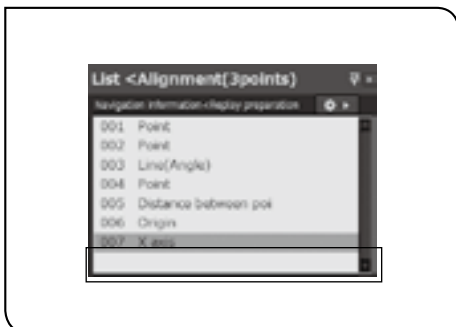
◎ To delete all items, click the [] (Create New) button in the menu. In the dialog box that appears, click the [Yes (Y)] button to save the list and then clear it, or click the [No (N)] button to clear the list without saving it.

Copying teaching lists

Step 10) Move copy measurement items

By setting the movement distance of X-axis and Y-axis and the number of copy times, the same measurement is repeated with the same interval.

Number of copy times

Y-axis movement distance

X-axis movement distance
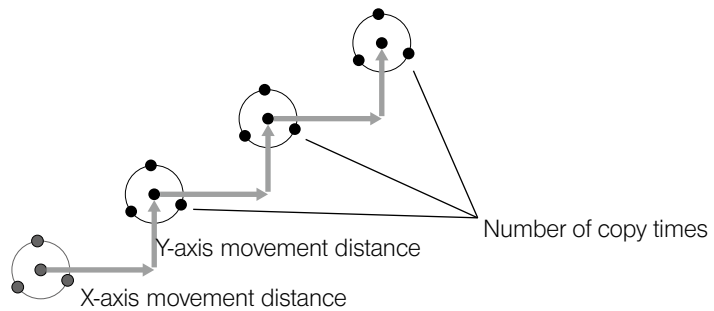
◎ The move copy intends to create teaching lists easily to perform the replay measurement afterward. The measurement is not performed actually.

◎ When repeating the same measurement items while measuring actually, refer to "Copy Measurement" (page 100).
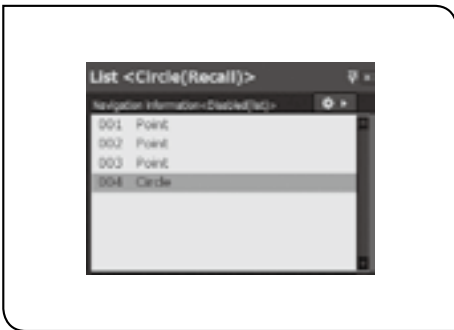
1 Refer to "Loading teaching lists" (page 90), and load the teaching lists created in Step 4.
The teaching lists up to "004 Circle" are added to the [Graphic] window, [List] window and [Measurement results] window.

2 Drag to select the items you want to copy (in this step, from "001" to "004") in the [List] window.

3 Right-click on the item being selected in the [List] window and select [Move copy] in the menu displayed.

The [Selection list] is displayed.

4 Click the [OK] button.
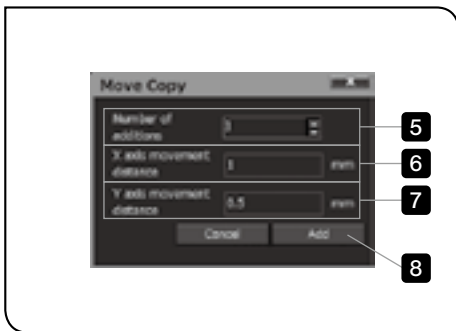
The [Move copy] window appears.

5 Input the number of copy times.

6 Input the X-axis movement distance.

7 Input the Y-axis movement distance.

8 Click the [Add] button.

◎ To stop the move copy, click the [Cancel] button.

The selected items are copied for the number of adding times.
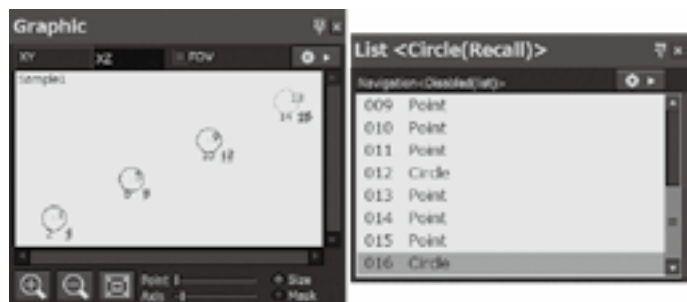
Step 11) Rotate copy measurement items

By setting the rotation angle and the number of copy times, the same measurement is repeated with the same interval.

Number of copy times

Rotation angle
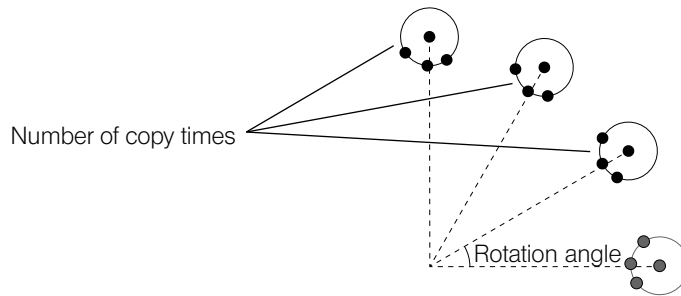
◎ The rotate copy intends to create teaching lists easily to perform the replay measurement afterward. The measurement is not performed actually.

◎ When repeating the same measurement items while measuring actually, refer to "Copy Measurement" (page 100).
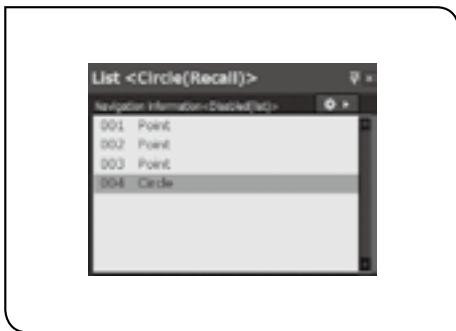
1 Refer to "Loading teaching lists" (page 90), and load the teaching lists created in Step 4.
The teaching lists up to "004 Circle" are added to the [Graphic] window, [List] window and [Measurement results] window.

2 Drag to select the items you want to copy (in this step, from "001" to "004") in the [List] window.

3 Right-click on the item being selected in the [List] window and select [Rotate copy] in the menu displayed.

Selection list

Selected list

M IPoint
M2Poin4
M3Poin4
M4Circle

Cancel   OK ── **4**

The [Selection list] is displayed.

4 Click the [OK] button.

Rotate Copy

Number of
additions   3 ── **5**

Angle   30 ── **6**

Cancel   Add ── **7**
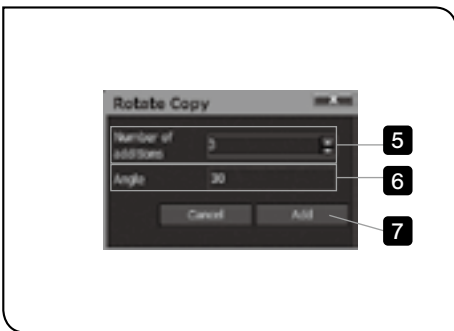
The [Rotate copy] window appears.

5 Input the number of copy times.

6 Input the rotation angle.

7 Click the [Add] button.

◎ To stop the rotation copy, click the [Cancel] button.

The selected items are copied for the number of adding times.

Graphic

XY   XZ   FOV

Sample1

Point 1
Axis   0   Size
Mask

List <Circle(Recall)>

Navigation<Disabled(fat)>

009   Point
010   Point
011   Point
012   Circle
013   Point
014   Point
015   Point
016   Circle

Measuring teaching lists again

Step 12) Re-measure measurement items

The items in the teaching lists are re-measured. The measurement results from re-measurement are displayed in [Sample 1].

◎ Measurement results of the replay measurement performed until the re-measurement start are deleted.
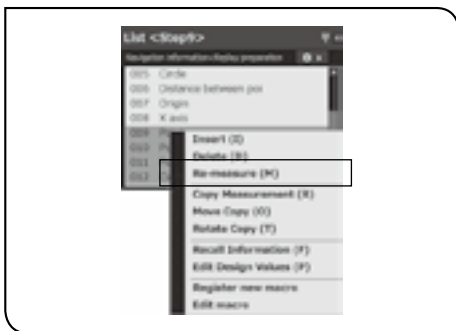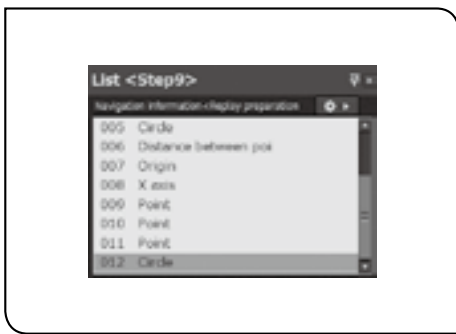
1 Refer to "Loading teaching lists" (page 90), and load the teaching lists created in Step 9.

The teaching lists up to "012 Circle" are added to the [Graphic] window, [List] window and [Measurement results] window.

2 Click the items you want to re-measure (in this step, from "009" to "012") in the [List] window.

3 Click the (Re-measure) button in the menu or right-click on the item being selected in the [List] window , and select [Re-measure] in the menu displayed.

The [Input] window appears.

◎ For details of the [Input] window, refer to "Input window" (page 64).

4 Re-measure the selected items.

◎ When re-measuring multiple items, the [Input] window appears each time.

When the re-measurement is completed, measurement items after the selected measurement items are re-calculated and displayed in the [Measurement results] window.
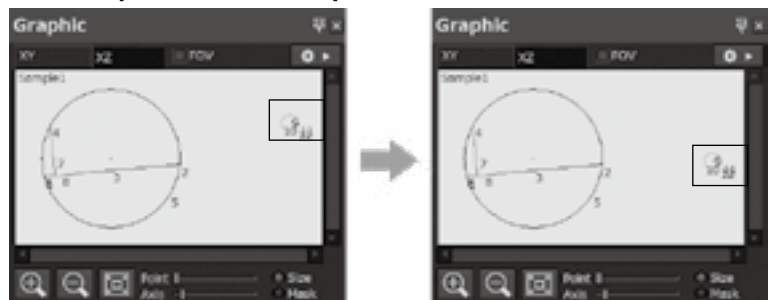
Before re-measurement   After re-measurement

Setting design values and Excel® transfer data of measurement items

Design values, the tolerance and whether to transfer to Excel® or not are set.
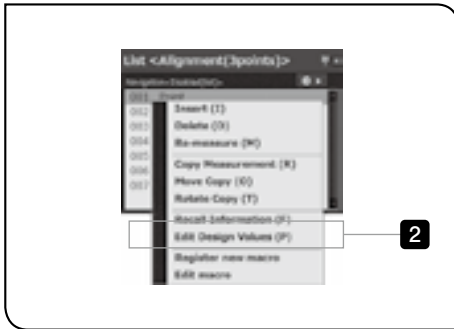
1 Right-click on the measurement item in the [List] window.

2 Select [Edit design values] in the menu displayed.
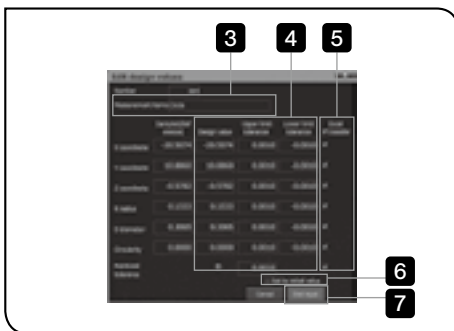
The [Edit design values] window appears.

◎ The contents in the [Edit design values] window differs depending on measurement items selected in **1**.

◎ From **3** to **6**, change the settings as needed.

3 Input the name of the measurement item selected in **1**.

◎ If the name of the measurement item is changed, the measurement item is displayed with the name changed.

4 Change the design value, upper tolerance limit and lower tolerance limit of the measurement item selected in **1**.

5 Check the check box of the data you want to transfer to Excel®.

◎ Only the data of the item of which check box is checked is transferred to Excel®.

◎ If you check [Excel transfer], all check boxes are checked.

6 To set each value to the initial value of the output item, check [Set to initial value].

7 When settings are completed, click [End input] button.
The [Edit design values] window is closed.

◎ If the values of [Design value], [Upper tolerance limit] or [Lower tolerance limit] are changed, the measurement values in the [Measurement results] window are displayed in the following colors.
Within tolerance   Blue
Out of tolerance   Red
No output settings   Black

Copy Measurement

This method is useful for repeating the same measurement procedures.

While measuring objects actually, the measurement items are measured repetitively.

For example, the circles in the measurement object as shown in the right picture are measured consecutively.
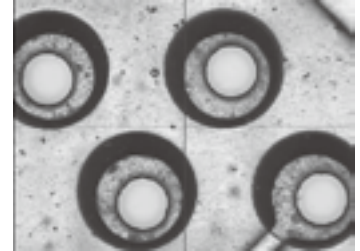
Step 13) Copy measurement
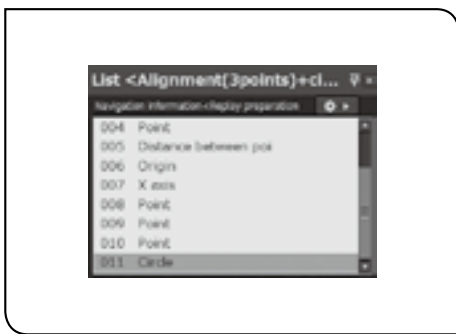
1 Refer to "Loading teaching lists" (page 90), and load the teaching lists created in Step 4.

The teaching lists up to "004 Circle" are added to the [Graphic] window, [List] window and [Measurement results] window.
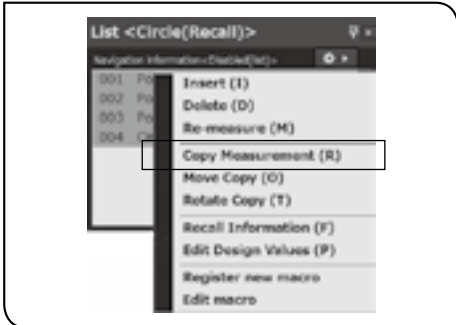
2 Drag to select the items you want to perform the copy measurement (in this step, from "001" to "004") in the [List] window.

3 Click the (Copy meas.) button in the menu or right-click on the item being selected in the [List] window, and select [Copy Measurement] in the menu displayed.

The [Selection list] is displayed.
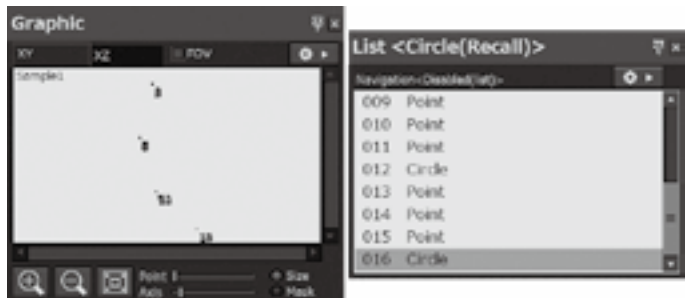
4 Click the [OK] button.

The [Input] window is displayed based on the teaching lists.

◎ For details of the [Input] window, refer to "Input window" (page 64).
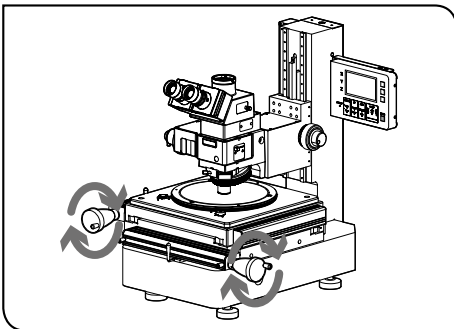
5 Move the stage of the microscope and acquire 3 points on the circumference of the other circle by the direct measurement.
The measurement results of "005 Point", "006 Point" and "007 Point" are added to the [Graphic] window, [List] window and [Measurement results] window.

◎ When "007 Point" is inputted, the results of "008 Circle" are added.

6 Repeat **5** until you reach the number of times you want to measure.

7 When the copy measurement is completed, click the [The copy measurement is completed] button.

The last coordinate data before pressing the [The copy measurement is completed] button is deleted.

◎ In this step, the copy measurement is performed once.
The [The copy measurement is completed] button is pressed after getting the coordinate data of "009 Point".
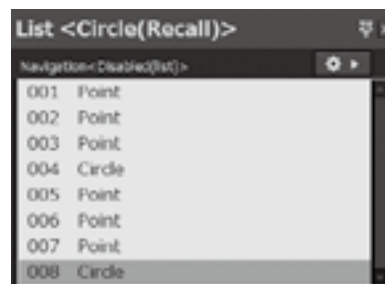
Replay Measurement

The measurement items in the area specified by teaching lists are measured repetitively.

This method is useful to perform the same measurement on the multiple measurement objects.

◎ This measurement can be repeated for up to 50 times consecutively.

Step 14) Replay measurement of all measurement items in teaching lists
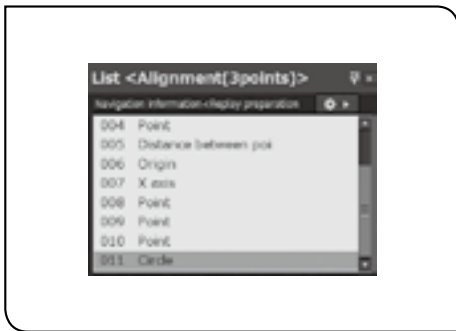
1 Refer to "Loading teaching lists" (page 90), and load the teaching lists created in Step 8.

The teaching lists up to "011 Circle" are added to the [Graphic] window, [List] window and [Measurement results] window.
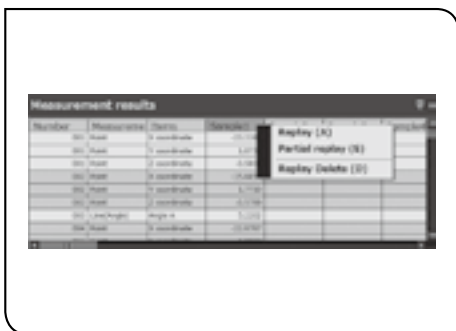
2 Click the (Replay) button in the menu or right-click on the [Sample 1] title in the [Measurement results] window, and select [Replay] in the menu displayed.

◎ To start replaying from the [Sample] title in the [Measurement results] window, right-click on the [Sample] title showing the measurement results.

If you right-click on the [Sample] title showing no measurement result, the menu is not displayed.
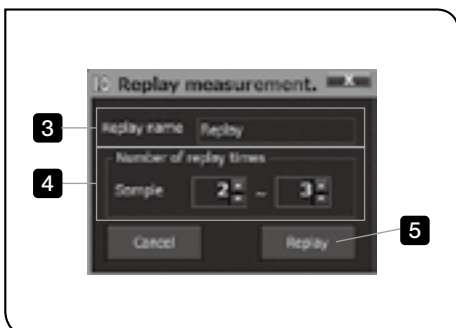
The [Replay] window appears.

3 Input the replay names as needed.

◎ The replay names can be edited after measurement.

4 Set the number of replay times.

5 Click the [Replay] button.

The [Input] window is displayed based on the teaching lists.

◎ For details of the [Input] window, refer to "Input window" (page 64).

6 Move the stage of the microscope and acquire 3 points on the circumference of the other circle by the direct measurement.
The measurement results of the replay measurement are displayed in the [Measurement results] window.
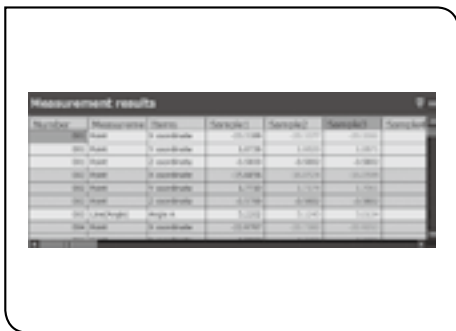
◎ The first round of measurement results are displayed in [Sample 1] and measurement results after the second round are displayed in [Sample 2].....[Sample n].

◎ During the replay measurement, the [Replaying] window appears. Click the [Stop replay] button to stop the replay measurement.

When the replay measurement is completed, a message appears.

7 Click the [OK] button.

◎ The next step describes the example using the replay measurement performed in this step. If you move to "Saving replay lists" (page 104) and save the contents measured in this step, the subsequent operations can be performed smoothly.

◎ Procedures to re-acquire coordinates in the replay measurement

The following table shows the behaviors when you click the [Delete in front] button or the [Cancel] button in the [Input] window or the [Stop replay] button in the [Replaying] window.

	Behavior	Status
During replay measurement		
[Delete in front] button ([Input] window)	Deletes the coordinate data which is acquired last. ◎ Only in the middle of measuring the measurement items of multipoint acquisition	The coordinate data acquired last are deleted and the stand-by status for acquisition is set.
[Cancel] button ([Input] window)	Deletes the measurement results of the last direct measurement item. ◎ When measuring the measurement items of the multipoint acquisition, the input starts from the first point.	When all coordinate data are deleted, the replay measurement finishes. ◎ The measurement results up to the last direct measurement item are remained.
[Stop reply] button [Replaying] window	Stops the replay measurement.	Stops the replay measurement. ◎ The measurement results up to the last direct measurement item are remained.

◎ If you want to measure again after the replay measurement is finished, use the following procedure.

1. Click the button in the menu or right-click on the [Sample] title in the [Measurement results] window, and select [Replay (A)] in the menu that is displayed to open the [Replay measurement] window.
2. Specify the sample number you want to measure again in [Number of replay times] in the [Replay measurement] window.
3. Click the [Replay] button in the [Replay measurement] window.

The replay measurement starts and the measurement results are overwritten by those of the measurement items measured again.

◎ To re-measure some measurement items in the teaching lists, use [Partial Replay] (page 106).

Saving replay lists

In the same way as the teaching lists, the replay lists can be saved.

The teaching list contains the measurement items and measurement results in [Sample 1] in the [Measurement results] window.

The replay list contains the measurement items and all measurement results of the replay measurement in the [Measurement results] window.

◎ The replay lists can be saved after performing the replay measurement.
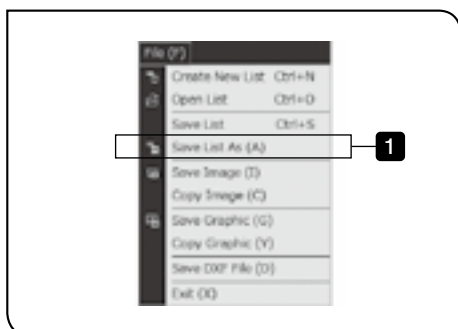
1 Select button in the menu or [Save lists as] in the [File] menu.
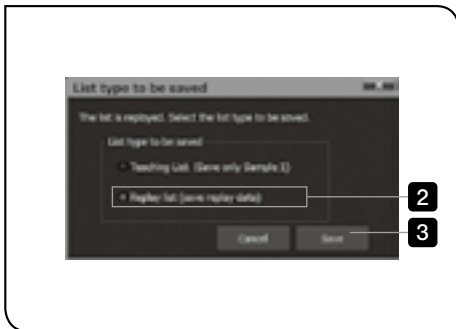
The [List type to save] window is displayed.

2 Click the [Replay list (save replay data)].

◎ If [Teaching list (save only Sample 1)] is clicked, the teaching list is saved.

3 Click the [Save] button.

The [Save lists] window appears.

4 Specify the save destination of the replay lists and the file names, and click the [Save] button.
The replay lists are saved.

[Measurement results] window in replay measurement

The measurement results of the measurement items selected in the [List] window are displayed in the [Measurement results] window.
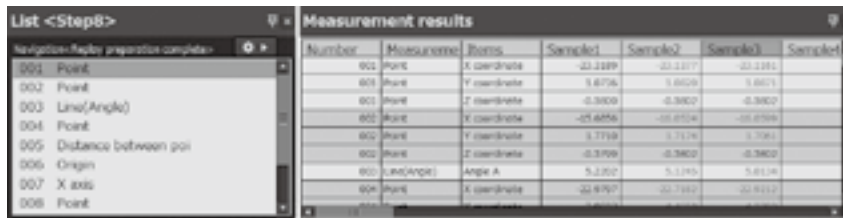
Cell color	Status	Descriptions
Blue	Waiting for replay measurement	When the replay measurement starts, the coordinate data is inputted according to the measurement items in teaching lists and the measurement is completed, the cell is displayed as "Replay measurement complete" (in white). After the partial replay measurement is performed, the cells inapplicable for partial replay measurement are displayed in light blue.
White	Replay measurement complete Measurement results are enabled.	

Delete measurement results of the replay measurement

The measurement results selected in the [List] window are deleted.
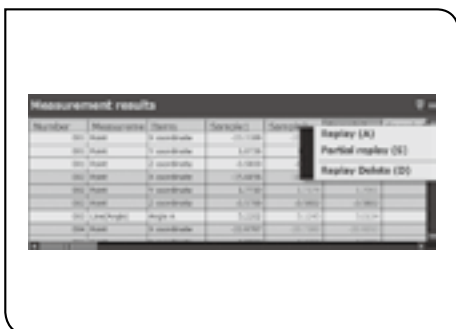
1 Click the [Sample] title you want to delete in the [List] window.

2 Select [Replay Delete] in the [Replay] menu or right-click on the [Sample] title in the [List] window, and select [Delete] in the menu displayed.

The [Sample] column selected in the [Measurement results] window is deleted.

Step 15) Replay measurement of measurement items selected in teaching lists

After the replay measurement is completed, the replay measurement is performed again on selected items in the teaching lists.
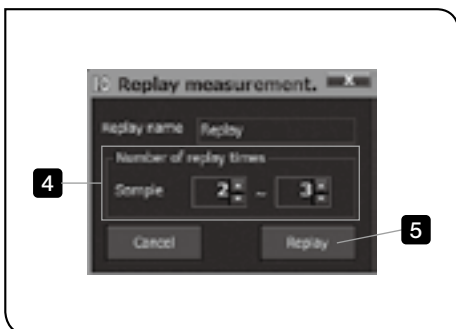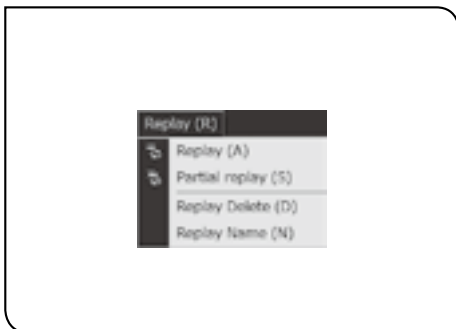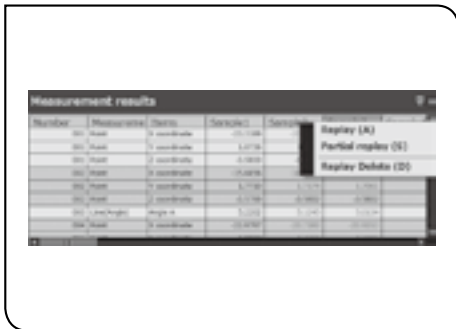
◎ In this step, you will perform the replay measurement in Step 14 for three times, and then, perform the partial measurement on measurement items "004 Point" and "008 Point" in [Sample 2] and [Sample 3] respectively.

1 Refer to "Step 14) Replay measurement of all measurement items in teaching lists" (page 102), and perform the replay measurement for three times.

The measurement results of the replay measurement are displayed on the [Graphic] window, [List] window and [Measurement results] window.

2 Select the items you want to perform the replay measurement (in this step, "004 Point" and "008 Point") in the [List] window.

◎ Multiple items can be selected by clicking items while pressing the Ctrl key of the keyboard.

3 Click the ⟳ (Part. Replay) button in the menu or right-click on the [Sample 1] title in the [Measurement results] window. Select [Replay measurement of selected part] in the menu displayed.

The [Replay] window appears.

◎ You can start the partial replay measurement by selecting [Partial replay] in the [Replay] menu .

4 Set the number of replay times. (Sample 2-3, in this step)

5 Click the [Replay] button.

The [Input] window is displayed based on the teaching lists.

◎ For details of the [Input] window, refer to "Input window" (page 64).

6 Move the stage of the microscope and acquire the coordinates by the direct measurement.

◎ When performing the partial replay measurement for multiple items, the [Input] window appears each time.

◎ The measurement items acquired in the recall measurement are calculated automatically based on the data acquired in the partial replay measurement.

When the replay measurement is completed, measurement items following the selected measurement items are re-calculated and displayed in the [Measurement results] window.

Navigation

This function improves the measurement efficiency by showing the next measurement points when performing the replay measurement or the partial replay measurement. For details of the replay measurement, refer to "Replay Measurement" (page 102).

◎ To use the navigation function, refer to "1 Navigation" (page 165), and set the navigation function to ON.

CAUTION Input [Origin] and [X-axis] settings of [Alignment] in the teaching list in the [List] window.
The navigation function is enabled when [Origin] and [X-axis] are specified.
For details of the [List] window, refer to "6 List window" (page 160).

Step 16) Measurement using the navigation function
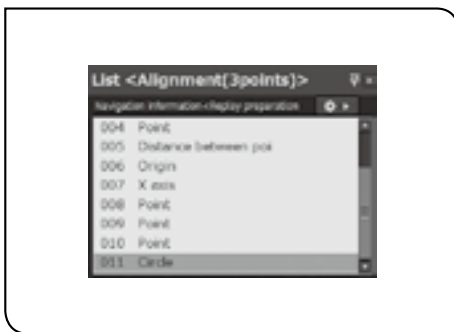
1 Refer to "Loading teaching lists" (page 90), and load the teaching lists created in Step 8.
The teaching lists up to "011 Circle" are added to the [Graphic] window, [List] window and [Measurement results] window.
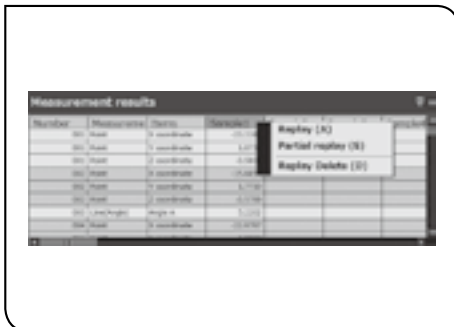
2 Click the (Replay) button in the menu or right-click on the [Sample 1] title in the [Measurement results] window, and select [Replay] in the menu displayed.

The replay measurement starts.

◎ For details of the replay measurement, refer to "Step 14) Replay measurement of all measurement items in teaching lists" (page 102).

3 Measure up to the [Origin] setting in the alignment by the direct measurement.

When the [Origin] of the alignment is specified, the navigation that indicates the next measurement point is displayed on the live image.

[a] ○ mark		Indicates the X-axis direction and the distance. When going closer to the measurement point in the Z-axis direction, the ○ mark moves closer to the ● mark. Adjust the Z-axis so that it comes to the center of the ● mark. (This is available only when you are using the motorized 3-axis measuring microscope and acquired the Z-axis coordinate data.)
[b] ● mark		Indicates the X- and Y-axis direction of the measurement point
[c] Color of navigation		The color changes from Red -> Yellow -> Green as you are closer to the measurement point in X- and Y-axis direction.

◎ If you are closest to the measurement point, the navigation color changes to blue and the navigation is locked.
When the navigation is locked. the navigation is not enabled.

(CAUTION) **Align the Z-axis direction and then align the X- and Y-axis direction. When the navigation is locked, the ○ mark is hidden.**

◎ If the current Z position moves closer to the Z position of the measurement point than the value same as [Double step tolerance interval] (page 181), it is locked.
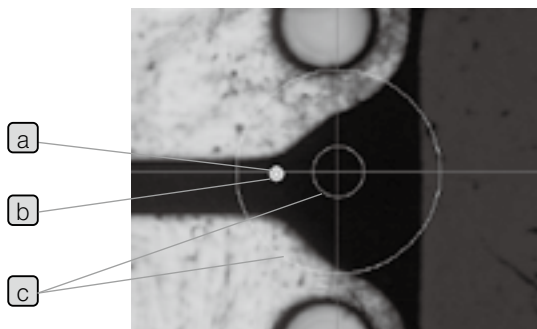
◎ The start timing or the color of the navigation can be specified. Refer to "1 Navigation" (page 165) for details.

4 Move the stage of the microscope according to the navigation.

5 Acquire the coordinate data.

The navigation that shows the next measurement point is displayed.

6 Repeat from **4** to **5** until the replay measurement is completed.
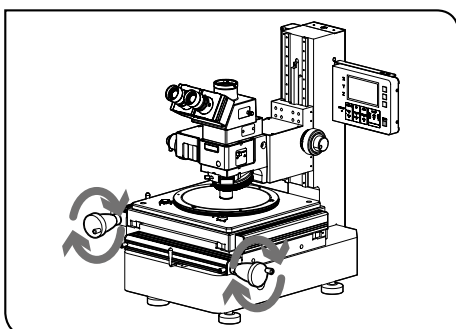
6   Edge tool

The edge is the point where the intensity changes drastically.

In the picture below, the position where the color changes to black first (color is changed) from the green circle in the center is called "Edge".

The position detected as an edge is displayed by "+".

The edge tool acquires the coordinate data of the position displayed by "+".

◎ Since the edge tool reads the position where the intensity on the live image changes, the clear intensity difference is required for detection.

◎ Since the ON/OFF status of the illumination or the light intensity control value when measuring the measurement items (when creating the teaching lists) are saved, the measurement can be performed under the same brightness condition in the subsequent replay measurement. Therefore, the variation of the edge detection caused by the brightness can be reduced. (Teaching lists created by STM6/STM6-LM are not supported for the illumination control.)

(CAUTION)   **When measuring with the edge tool, the calibration must be always performed. Refer to "1-4 Calibration" (page 12) for details.**
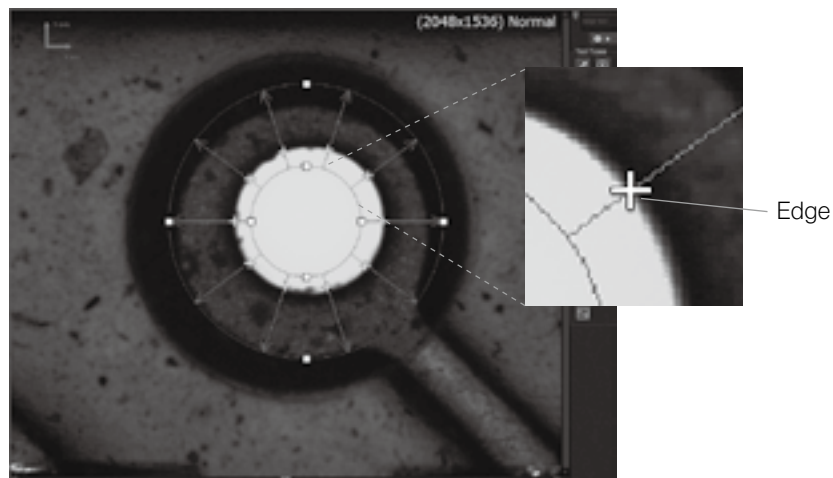
Edge

Procedures to start the edge tool
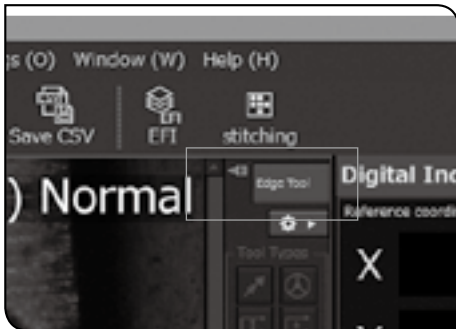
1 Click the [Edge tool] button on the live window.

(CAUTION) **If the measurement items (teaching lists) are in the [List] window, click the ☷ (Create New) button in the menu to set so that there is no measurement items in the [List] window. If teaching lists are in the [List] window, the edge tool cannot be used.**

◎ For details of the [List] window, refer to "6 List window" (page 160).

The [Edge Tool] window appears.

◎ For details of buttons, refer to "Edge tool functions" (page 124).
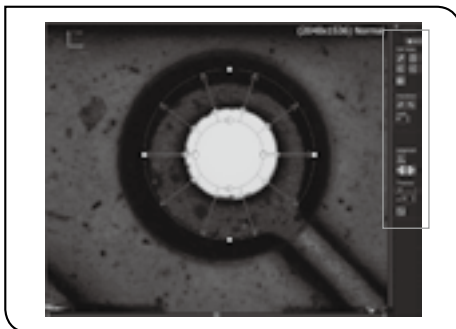
Direct measurement (line tool)

By using the line tool, the measurement points are detected automatically and the points are measured by the direct measurement.
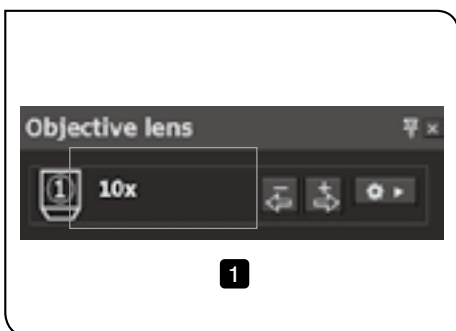
1 Confirm that the magnification of the objective in the [Objective lens] window is same as the magnification of the objective to be used.

◎ You need to set the magnification of the lens as the Calibration name in the Calibration settings screen in advance.
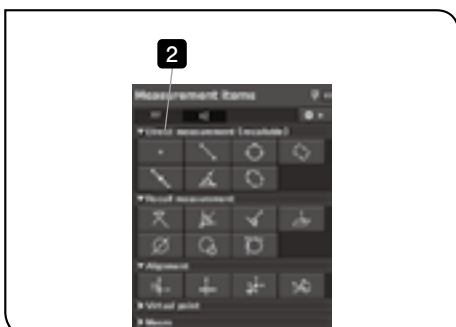
2 Click the ▪ (Point) button in the [Measurement items] window.

3 Click the [OK] button in the message displayed.

◎ The Message for confirming calibration appears if you enable the display of the Message for confirming calibration in the General display settings screen.
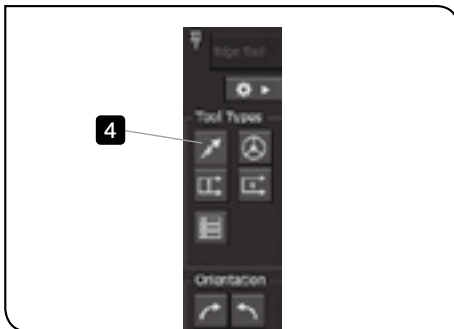
4 Click the button in the [Tool types].
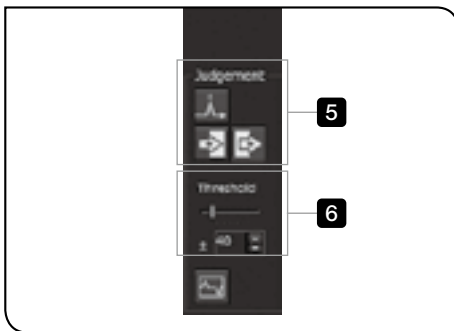
5 In [Judgment], click the button, the or the button.

◎ For details of buttons, refer to "Edge tool functions" (page 124).

6 In [Threshold], specify the value for judging the edge.

◎ Refer to "What is threshold?" (page 125) for details.

(CAUTION) **If the threshold is not set appropriately or the appropriate judgment method is not selected, the measurement points cannot be detected automatically.**
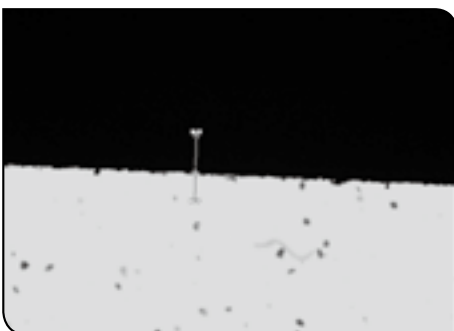
7 Drag the displayed line tool to determine the measurement points.

◎ You can align the edge tool again by clicking the area where the edge tool is not aligned on the live image.
Click 2 points so as to go across the edge you want to recognize.
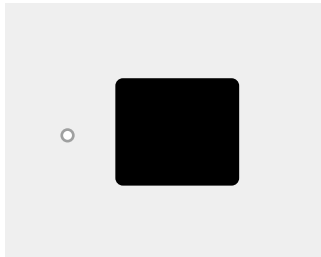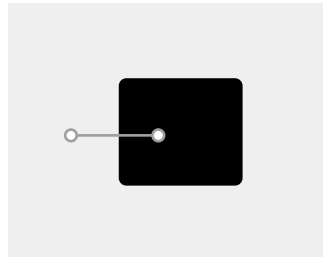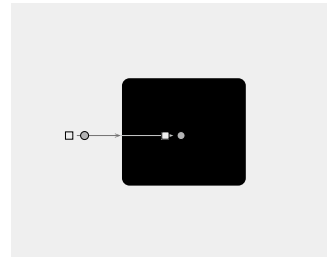
| 1) Click the start point. | 2) Click the end point. | The setting is completed. |
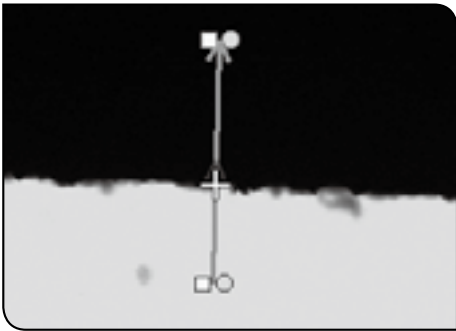
"+" is displayed at the measurement point (point judged as an edge).

◎ Depending on the display settings of the edge tool, "+" may not be displayed.
For details of display settings, refer to "Setting edge tool display" (page 128).

8 Click the [Get coordinates] button in the [Point (average)] window.
The coordinate data is acquired.

9 Click the [End input] button.

The measurement results are displayed on the [Graphic] window, [List] window and [Measurement results] window.

Direct measurement (multipoint tool, average point tool)

By using the multipoint tool or the average point tool, the measurement point is detected automatically and the distance between 2 points is measured by the direct measurement.
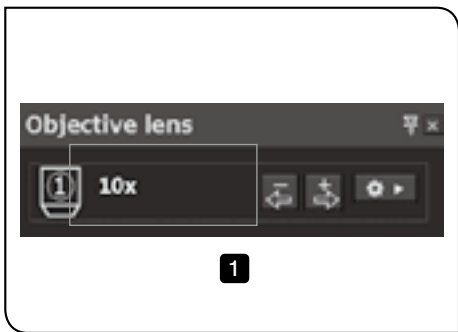
1 Confirm that the magnification of the objective in the [Objective lens] window is same as the magnification of the objective to be used.
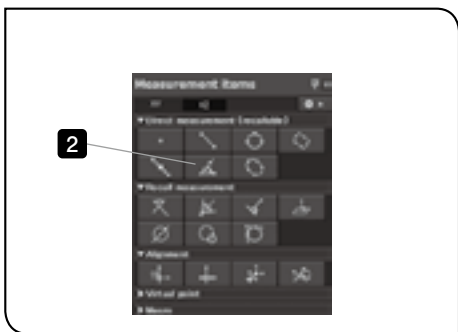
2 Click the [⚊] (Line (Angle)) button in the [Measurement items] window.

3 Click the [OK] button in the message displayed.
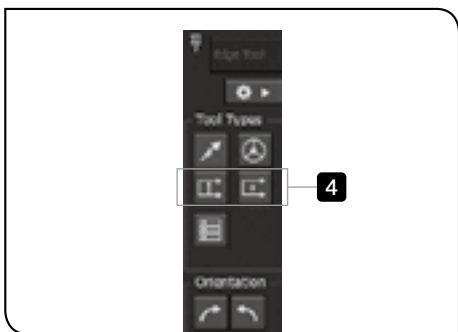
4 Click the [⚊] (Multipoint tool) button of the [⚊] (Average point tool) button in [Tool types].
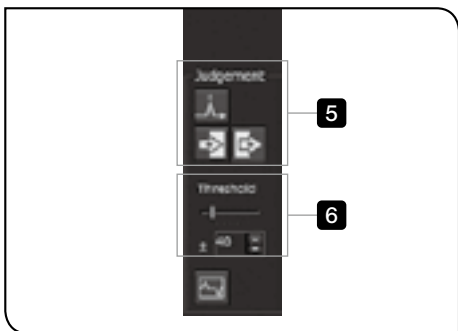
5 In [Judgment], click the [⚊] (Detect the edge by maximum absolute value) button, the [⚊] (Detect the edge by Dark -> Bright or the [⚊] (Detect the edge by Bright -> Dark) button.

◎ For details of buttons, refer to "Edge tool functions" (page 124).

6 In [Threshold], specify the value for judging the edge.

◎ Refer to "What is threshold?" (page 125) for details.
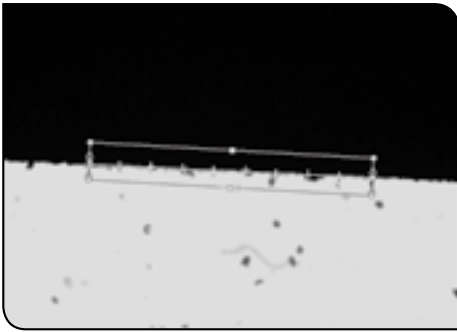
7 Drag the multipoint tool or average point tool displayed to determine the measurement points.

◎ You can align the edge tool again by clicking the area where the edge tool is not aligned on the live image.
Click 2 points along the edge you want to recognize.
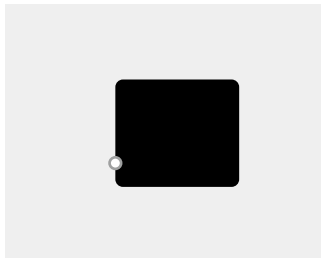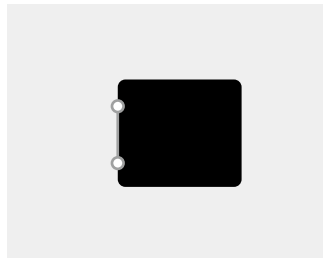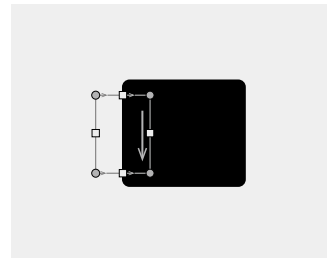
| 1) Click the start point. | 2) Click the end point. | The setting is completed. |
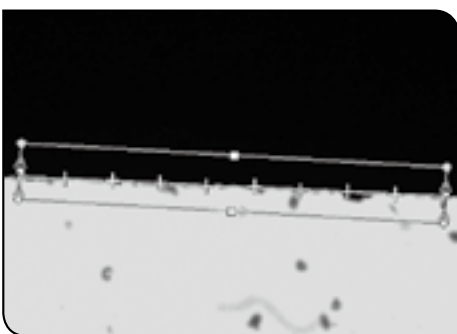
"+" is displayed at the measurement point (point judged as an edge).

◎ Depending on the display settings of the edge tool, "+" may not be displayed.
For details of display settings, refer to "Setting edge tool display" (page 128).
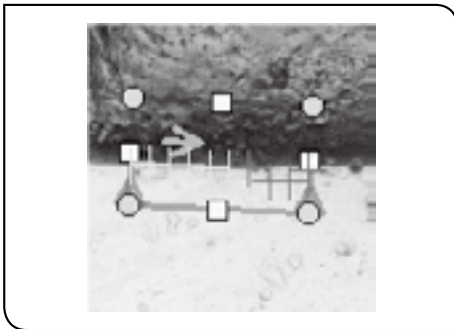
◎ **Direction of the edge tool**

The red side of the rectangle is the lower side of the tool and the blue side is the upper side respectively. The edge positions are detected in the direction from the lower side to the upper side.

In case of multipoint tool, the edges are detected by dividing the horizontal width of the tool for the number of points specified in [No. of input points]. The measurement point is the position which exceeds the threshold first among the devided area.

If you click the ⬚ (Detect the edge by Bright -> Dark) button in [Judgment], the point which becomes darker than the threshold first is detected in the lower area of the tool.

If you click the ⬚ (Detect the edge by Dark -> Bright) button in [Judgment], the point which becomes brighter than the threshold first is detected in the lower area of the tool.

Based on the detected points, the line is calculated by the least-squares method. The direction of the line is the direction toward the point detected on the right side of the tool to the point detected on the left side of the tool.
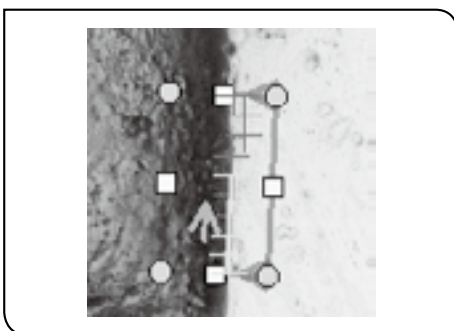
◎ **Direction of the multipoint tool when it is placed by clicking**

When two edges are clicked (The order does not matter.), the multipoint tool is placed across the edge.
At this time, it is judged which side is brighter or darker across the edge.

⬚ (Detect the edge by Bright ->Dark) button
The tool is placed in the direction toward the darker area from the brighter area across the edge.

⬚ (Detect the edge by Dark ->Bright) button
The tool is placed in the direction toward the brighter area from the darker area across the edge.
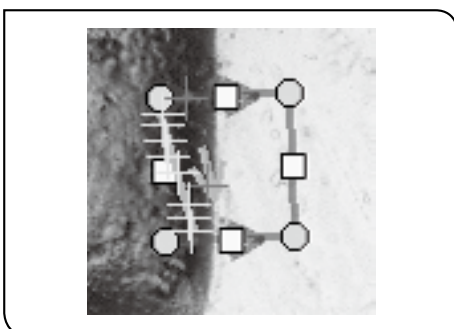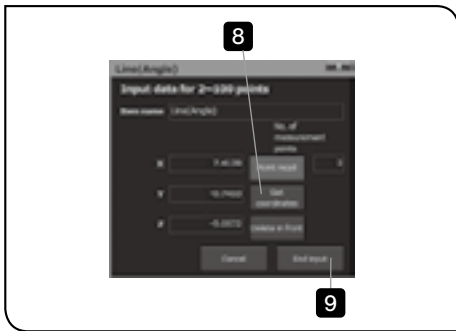
8 Click the [Get coordinates] button in the [Line(Angle)] window.
The multiple coordinate data are acquired.

9 Click the [End input] button.

The measurement results are displayed on the [Graphic] window,
[List] window and [Measurement results] window.

◎ The input point position is determined by the direction of the orange arrow.

Input point position 1   Input point position 2   Input point position 3
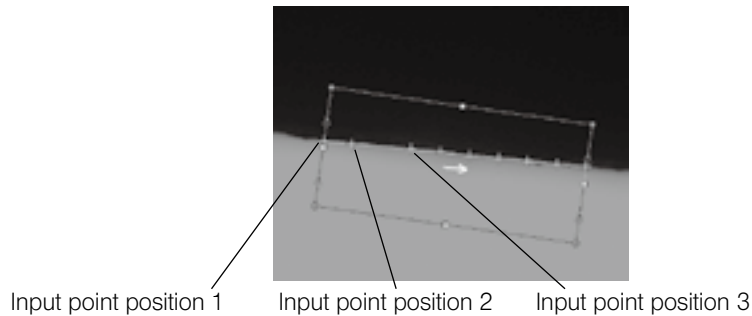
◎ If you want to detect the edge of the circle shape which does not fit

within the live image, the edge could be detected by using
(Multipoint tool).
(The circle shape is calculated using the points detected by the
multiple tool as a part of a circular arc.)

◎ When detecting the edge of the circle shape using the multipoint
tool, be careful for followings.
· Make the contrast at the edge area larger.
· Make the rectangle larger (to the size where the ark can fit).
· Reduce the noise on the live image. (Increase the resolution.
(page 167))
· Match the threshold with the intensity of the live image. (Refer to
"Setting edge tool operations" (page 127) for details.)
· Increase the number of input points.
· Place the rectangle so that the red arrow direction and the blue
arrow direction match with the directions set in [Judgment].

Direct measurement (circle tool)

By using the circle tool, the measurement points are detected automatically and the circle is measured by the direct measurement.
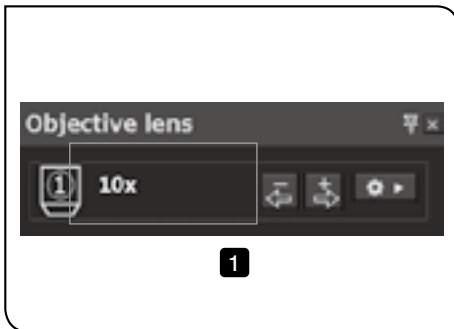
1 Confirm that the magnification of the objective in the [Objective lens] window is same as the magnification of the objective to be used.
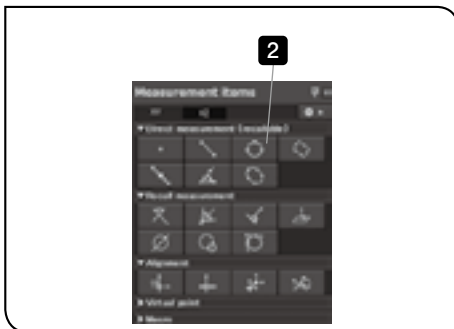
**2** Click the ⬡ (Circle) button in the [Measurement items] window.

3 Click the [OK] button in the message displayed.
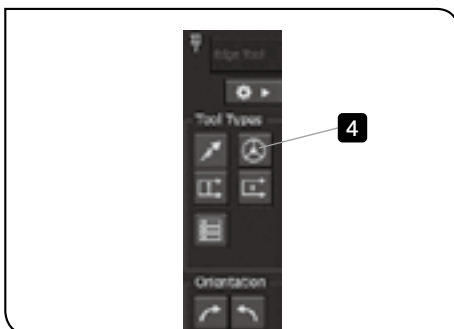
**4** Click the ⊕ (Circle tool) button in [Tool types].
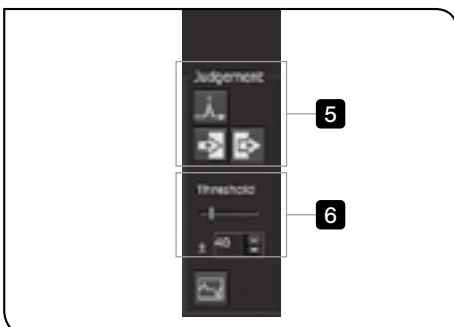
5 In [Judgment], click the 𝝠 (Detect the edge by maximum absolute value) button, the ➡ (Detect the edge by Dark -> Bright) or the ➡ (Detect the edge by Bright -> Dark) button.

◎ For details of buttons, refer to "Edge tool functions" (page 124).

6 In [Threshold], specify the value for judging the edge.

◎ Refer to "What is threshold?" (page 125) for details.
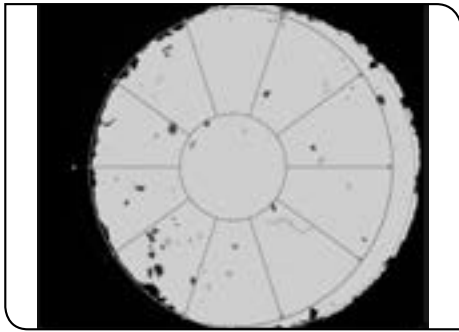
**7** Drag the center of the displayed circle tool to determine the measurement points.

◎ You can align the edge tool again by clicking the area where the edge tool is not aligned on the live image.
Click 3 points on the edge you want to recognize.
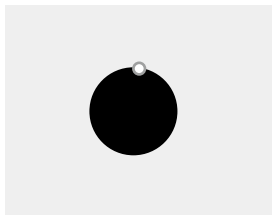

1) Click the first point.　2) Click the second point.　3) Click the third point.　The setting is completed.
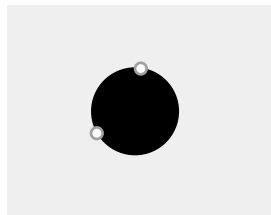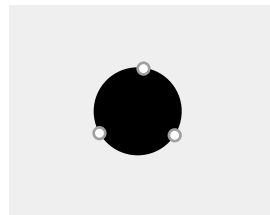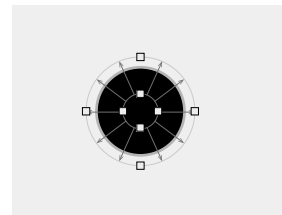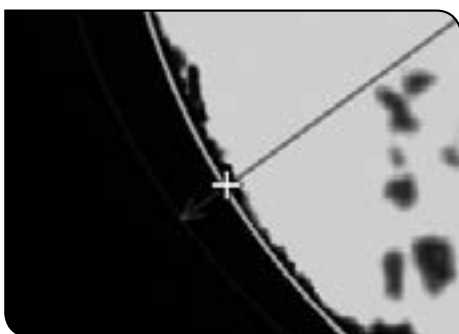
"+" is displayed at the measurement point (point judged as an edge).

◎ Depending on the display settings of the edge tool, "+" may not be displayed.
For details of display settings, refer to "Setting edge tool display" (page 128).

8 Click the [Get coordinates] button in the [Circle] window.
The multiple coordinate data are acquired.

9 Click the [End input] button.

The measurement results are displayed on the [Graphic] window, [List] window and [Measurement results] window.

◎ The input point positions are determined in the counterclockwise direction by setting the input point on the right side of the circle as the input point position "1".

Input point position 3

Input point position 2

Input point position 1
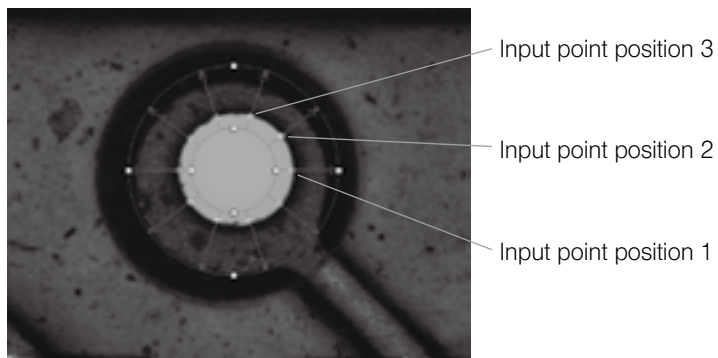
Replay measurement (without timer)

By using the edge tool, the replay measurement is performed for the circle measurement created in "Direct measurement (circle tool)" (page 117).

1 Click the [Replay] button in the menu.

Or right-click on the measurement value number in the [Measurement results] window, and select [Replay] in the menu displayed.

2 Specify the number of replay times in [Sample] [a] (in this step, 2 or 3 times), and click the [Replay] button [b].

◎ The measurement results when the teaching lists were created are displayed in the [Measurement results] window as [Sample 1]. Specify the number of times to perform the replay measurement in [Sample] in the [Replay] window. As [Sample] is specified to 2 to 3 times in this step, measurement results of [Sample 2] and [Sample 3] will be acquired. The replay measurement is performed twice.

Measurement results when creating teaching lists

Measurement results to be calculated in replay measurement

The replay measurement starts.

3 Move the stage (or the circle tool).

◎ While measuring, the relevant items in the [Measurement results] window and in the [List] window are displayed in blue.

4 Click the [Get coordinates] button in the [Circle] window.
The multiple coordinate data are acquired.

5 Click the [End input] button.
The measurement results are displayed in the [Measurement results] window, and the next measurement starts.

◎ The results of the replay measurement are displayed in the [Measurement results] window in red.
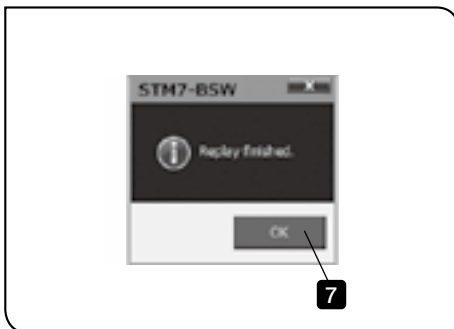
6 Repeat operations from **3** to **5** for the number of replay times specified.
When all operations are finished, a message appears.

7 Click the [OK] button.
The replay measurement is completed.

Replay measurement (with timer)

By using the edge tool, the replay measurement is performed for the circle measurement created in "Direct measurement (circle tool)" (page 117).

When the stage stops moving, the edge is detected. When a specified time is passed after the edge is detected, the software acquires the coordinate data.

With the timer function, the coordinate data can be acquired after passing specified time. Therefore, you can acquire the coordinate data without releasing the hands from the table.

◎ To use the timer, the timer display must be enabled in "Edge tool settings". Refer to "Setting edge tool operations" (page 127) for details.
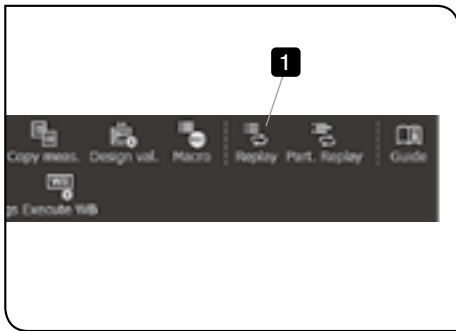
1 Click the [Replay] button in the menu.
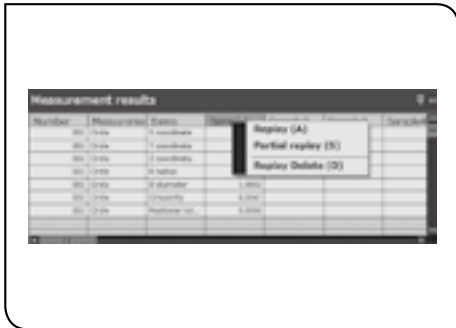
Or right-click on the measurement value number in the [Measurement results] window, and select [Replay] in the menu displayed.
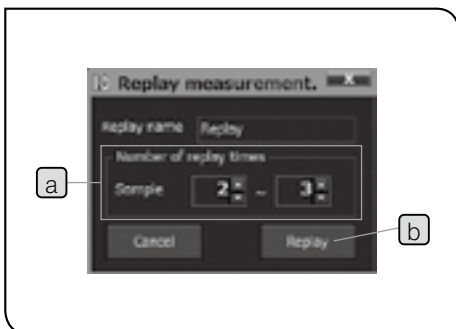
2 Specify the number of replay times in [Sample] (a), and click the [Replay] button (b).

◎ The measurement results when the teaching lists were created are displayed in the [Measurement results] window as [Sample 1]. Specify the number of times to perform the replay measurement in [Sample] in the [Replay] window. As [Sample] is specified to 2 to 3 times in this step, measurement results of [Sample 2] and [Sample 3] will be acquired. The replay measurement is performed twice.

Measurement results when creating teaching lists

Measurement results to be calculated in replay measurement

The replay measurement starts.

3 Move the stage (or the circle tool).

◎ While measuring, the relevant items in the [Measurement results] window and in the [List] window are displayed in blue.

4 When the stage movement completes, the timer starts automatically.

5 When the timer stops, the coordinates of the measurement points (points judged as edges) are acquired and measurement results are displayed in the [Measurement results] window. Then, the next measurement starts.

◎ The results of the replay measurement are displayed in the [Measurement results] window in red.

6 Repeat operations from **3** to **5** for the number of replay times specified. When all operations are finished, the message appears.
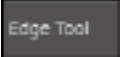
7 Click the [OK] button.
The replay measurement is completed.
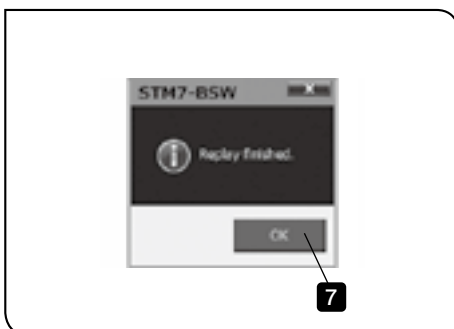
Edge tool functions

The details of buttons displayed in the [Edge tool] window are described below.

Button	Tool name	
	Description of tool	
[Edge Tool]		
Edge Tool	Changes ON or OFF of the edge tool. **Edge Tool** (Black): The edge tool is OFF. **Edge Tool** (Light blue): The edge tool is ON. ◎ If teaching lists are in the [List] window, the edge tool cannot be used. Delete all teaching lists or click the ⬛ (Create New) in the menu.	
↗	Line tool	
	Detects the point of the edge detection position from the start point.	Number of detection points: 1 point
⬛	Multipoint tool	
	Detects the edges of the specified input points in the arrow direction.	Number of detection points: 2-99 points (The upper limit is set in [Number of input points]).
⬛	Average point tool	
	Detects the average point of the edge detection position in the arrow direction. ◎ When the average point tool is placed horizontally (flatly, for example), the detection point is a position at the half of the tool in the Y-direction and at the average of each point in the X-axis direction.	Number of detection points: 1 point
⊗	Circle tool	
	Detects the edges of the specified input points from the center of the circle. The detection method can be selected as follows by clicking the button.	Number of detection points: 3-99 points (The upper limit is set in [Number of input points]).
▤	Counter reception tool	
	Even though the edge tool is ON, the current counter data can be acquired without using the edge tool.	
↰	90 degrees rotation in left direction	
	Rotates the edge tool 90 degrees in the left direction.	
↱	90 degrees rotation in right direction	
	Rotates the edge tool 90 degrees in the right direction.	
Angle 216	Rotation angle tool (manual setting)	
	Sets the rotation angle of the image arbitrarily. (The setting by 1 degree is available.)	
Points 10 Point	No. of input points	
	Sets the upper limits of the number of detection points.	

Button	Tool name
	Description of tool
[Detection method]	
	Edge detection by maximum absolute value
	The input point is specified as the position where the absolute value is maximum between the start point and the end point of the edge tool.
	Edge detection by Dark ->Bright
	The input point is specified as the position where the it becomes bright first from the start point of the edge tool (dark).
	Edge detection by Bright ->Dark
	The input point is specified as the position where it becomes dark first from the start point of the edge tool (bright).
	Threshold of edge detection [*1]
	Specifies the threshold of the maximum absolute value, Bright ->Dark or Dark ->Bright. The measurement items can be specified individually.
	Profile screen
	Displays the [Profile] window which can adjust the threshold.
	Advanced settings
	Displays the [Advanced edge settings] window of each edge tool. (See page 127.)
	ON/OFF of fixing the edge tool bar
	Fixes the [Edge tool] window.

*1   What is threshold?
       The threshold is a value to judge the edge. The threshold in the picture below is set as "±40".

The screen shown below is displayed by clicking the (Profile screen) button in the [Edge tool] window.
If the graph in the center of the picture shown below exceeds ±40 [a] (setting value of the threshold), that point is recognized and detected as an edge. (The value exceeds -40 in the picture shown below.)
The threshold value can be set arbitrarily.
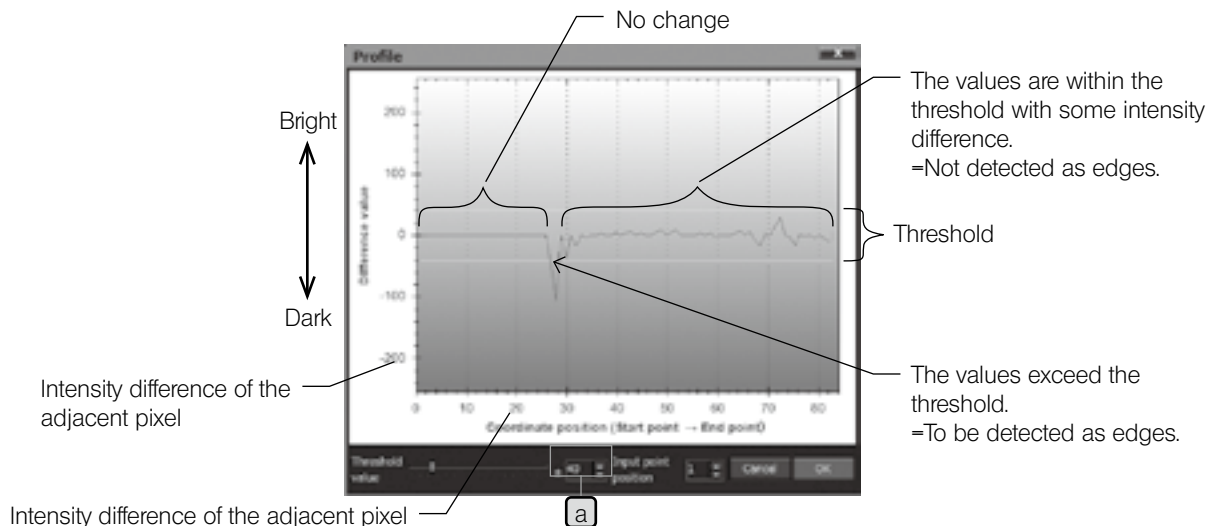
Fine adjustment of edge point acquisition position

In the [Profile] window displayed by clicking the (Profile screen) button in the [Edge tool] window, you can finely adjust positions to acquire points to be detected as edges.

2) The difference value width changes.

1) Change the slider position.

Position to acquire points

The position where the profile and the difference value are intersected is acquired as an edge point.
The edge point position can be adjusted finely by changing the threshold settings.

Position to acquire points
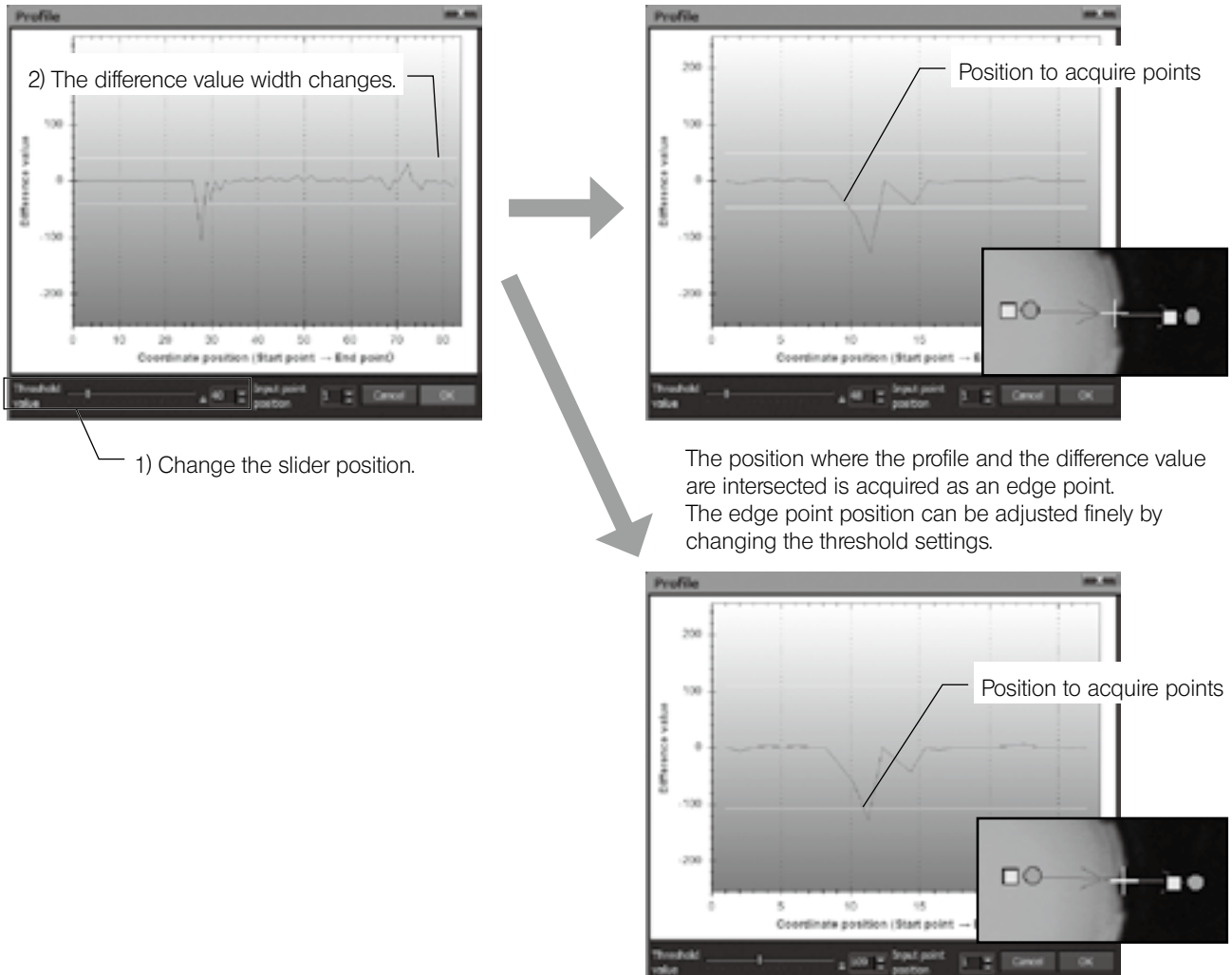
Order to acquire input points of circle tool and multipoint tool

Circle tool
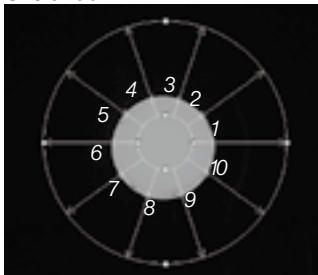
The input point positions are in the order of Input point *1*, Input point *2*, Input point *3* and so forth rotating counterclockwise from the 3 o'clock position.

Multipoint tool
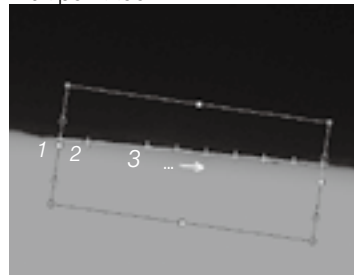
The line direction is displayed with the arrow (-»).
The input point positions are in the order of Input point *1*, Input point *2*, Input point *3* and so forth along with the arrow direction.

Setting edge tool operations

In the [Advanced edge settings] window displayed by clicking the ▣ ▶ (Advanced settings) button in the [Edge tool] window, the edge tool operations are set.

	Names	Descriptions
a	Stage movement distance for measurement	Sets the movement distance of the stage where edges are detected. If the stage movement distance is less than the setting value in the time specified in [Timer interval], the edge detection starts.
b	Timer to start measurement.	Measures by using the timer. Sets the time until acquiring the coordinates after edges are detected in [Timer interval]. ◎ If you set the timer to be displayed, the coordinates of the edge detection points are acquired when the timer stops. ◎ If you do not set the timer to be displayed, the coordinates are acquired after the edges are detected by clicking the [Get coordinates] button in the [Input] window (Manual acquisition).
c	Color to judge threshold value	Sets which color element of RGB of the color image the edges will be judged on. Judges the threshold (page 125) of the color element with a check mark.
d	Normal threshold value[1]	Sets the effective σ value in [Effective σ value (±)]. The larger the value is, the more the number of effective points increases. Sets the color of detection points outside of the effective σ value range in [Color of detection points outside of range].
e	Measurement accuracy[2]	Sets the number of sub pixels (0 to 30).
f	Setting initialization	Returns the settings to the initial status.

[1] Abnormal point deletion function (Function to delete the specified standard deviation)

If the abnormal point deletion function is not used, unnecessary detection points are also detected as shown in the picture on the left and the sufficient accuracy is not obtained.

If the abnormal point deletion function is used, the highly accurate process is performed as shown in the picture on the right. The abnormal positions (burr of metal, etc.) can be deleted from measurement objects automatically.

The unnecessary edges are detected.

The unnecessary edges are deleted by the abnormal point deletion process.
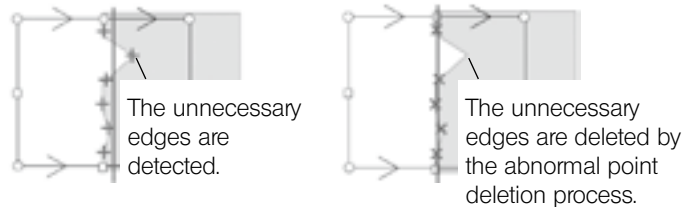
[2] Sub pixel

The sub pixel is a pixel divided into 0.5 to 0.03 pixels from one pixel by settings.

Before setting   1 pixels   After setting   0.5 to 0.03 pixels
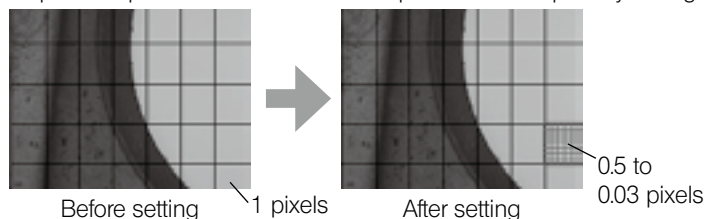
Setting edge tool display

In the [Advanced edge settings] window displayed by clicking the ▣ ▶ (Advanced settings) button in the [Edge tool] window, the edge tool display is set.

	Names	Descriptions
a	Display tool	Sets the color of the edge tool.
b	Auxiliary display	Displays the threshold slider on the edge tool screen.
c	Display measurement results	In [Display detection points (cross hair)], sets the size and the line color of the cross hairs of the point where edges are detected. In [Display detection edge lines], sets the circle or the straight line displayed when the edges are detected.
d	Display measurement values	Displays the measurement values on the live image after the edge points are acquired. Confirms the measurement by the [End input] button in the [Input] window after conforming the measurement values. Sets the size and the color of characters. ◎ Only measurement values of point, circle and line (angle) are displayed on the live image.
e	Setting initialization	Returns the settings to the initial status.

◎ Edge detection display

The point displayed by the cross hairs is the detection point.
The cross hairs in blue is reflected to the number of input points as an effective point.
(The color can be changed by setting.)

The line displayed by connecting detection points is the detection edge line.
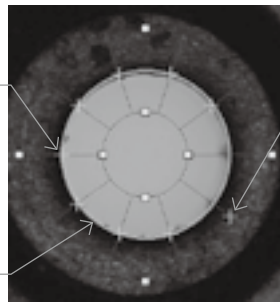
Points shown with the cross hairs in gray are the detection points outside of the effective σ value range. Therefore, they are not reflected to the input points. (The color can be changed by setting.)

7 **Measurement on XZ plane**

The cross section viewed from the side can be measured.

The measurements which used to be very difficult to operate in the past are available, such as R measurement in the height direction of the hemispherical solder ball, etc. or the height measurement between the bottom plane of the groove processed spherically and the reference line, etc.

◎ This function is available when coordinates of 3-axis are inputted. Refer to "11 Communications" (page 181) for details.

CAUTION **This is a XZ plane measurement, not a XYZ (three-dimensional) measurement.**

R measurement of hemispherical sample
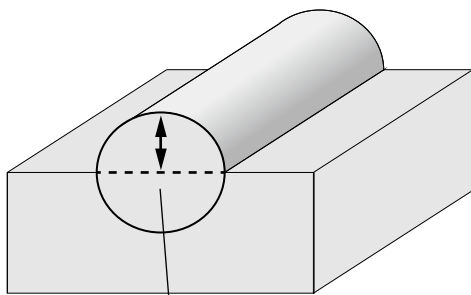
Measure the height of the raised work

Distance between circle and line (upper)

Height measurement between the bottom plane of the groove and the reference line
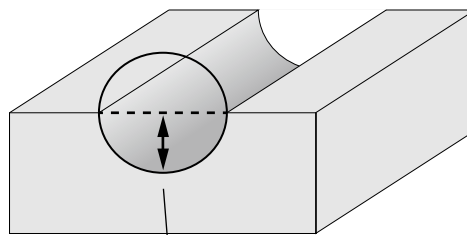
Measure the height of the dug work

Distance between circle and line (lower)

D measurement of hemispherical sample
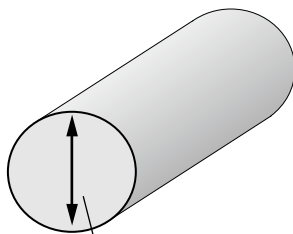
Measure the diameter.

Circle (Z plane)

Height measurement between the bottom plane of the groove and the reference line
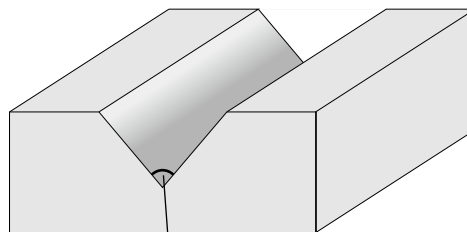
Measure the angle of V groove.

Intersection between line and line (Z plane)

◎ For measurement items on XZ plane, refer to "XZ Measurement items" (page 70).

3-2 Save images and graphics

Live images and graphics in the [Graphic] window are saved.
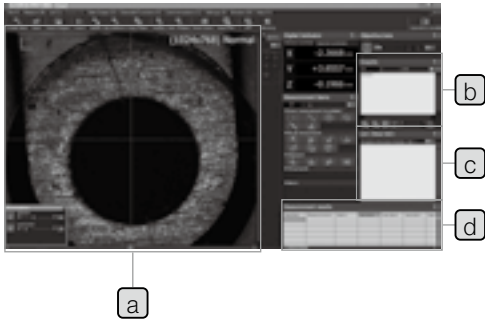
Names	Descriptions	Reference page
[a] Live image	Saves in BMP file format or JPEG file format.	130
[b] Graphic	Saves in BMP file format, JPEG file format or DXF file format.	131
[c] Teaching list (including graphic data)	Saves in lst file format.	89
[d] Measurement results	Transfers to Excel® or saves in CSV file format.	134

1 Saving images

The live images are saved in general image file format.
The data can be saved in BMP file format or JPEG file format.

◎ The compression rate when saving the image in JPEG file format can be specified. Refer to "Image save settings" (page 176) for details.

◎ The X- and Y-axis, grids, auxiliary lines, etc. displayed on the live image are not saved.
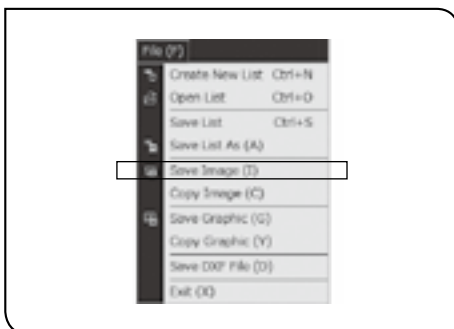
1 Click the ▣ (Save images) button in the menu or [Save images] in the [File] menu.
The [Save images] window appears.

2 Specify the destination to save the images and the file names.

3 Select [BMP] or [JPEG] in [File types].

4 Click the [Save] button.
The images are saved.

2 Saving graphics in general image file formats

The graphic data displayed in the [Graphic] window are saved in the general image file format.
The images can be saved in the BMP file format or the JPEG file format.
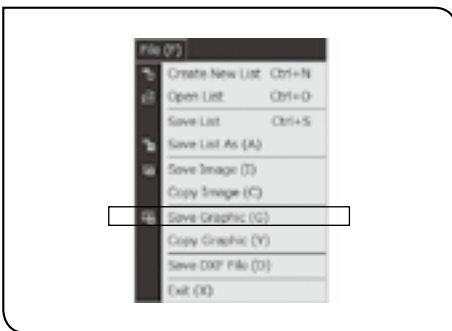
1 Click [Save graphics] in the [File] menu.
The [Save images] window appears.

2 Specify the destination to save the images and the file names.

3 Select [BMP] or [JPEG] in [File types].

4 Click the [Save] button.
The graphics are saved.

3 Saving graphics in DXF file format

The graphic data displayed in the [Graphic] window are saved in DXF file format which can be loaded by the applicable CAD software.

◎ If measurement item names or measurement results are displayed in the [Graphic] window, measurement item names and measurement results are also saved. To display measurement results in the [Graphic] window, refer to "Setting graphic screen" (page 173).

◎ The data version of the DXF file is Release 12J.
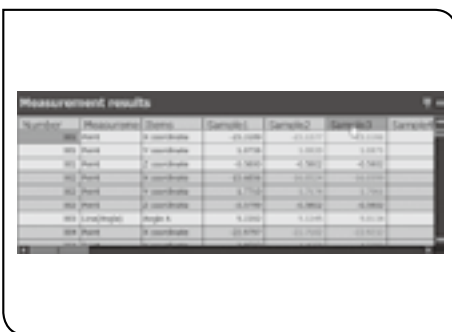
1 Select the measurement value number you want to save in the [Measurement results] window.

2 Click [Save DXF file] in the [File] menu.
The [Save DXF file] window appears.

3 Specify the destination to save the images and the file names.

4 Click the [Save] button.
The images are saved.

(CAUTION) • The 3D display is not supported by the CAD software.

• As the measurement item [Ellipse] is not applicable for the DXF file format, it is not displayed on the CAD software.

• The size of characters in measurement item names and measurement results depends on the settings of the CAD software.

• The unit information is not included in the DXF file.
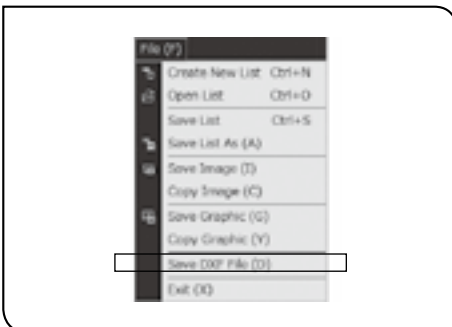
3-3 Output measurement results

The measurement results displayed in the [Measurement results] window are transferred to Excel® or saved in CSV file format.
The measurement results are transferred or outputted after transfer conditions or output conditions are set.

◎ To transfer the measurement results to Excel®, Excel® must be installed on the controller in advance. Please purchase Excel® if necessary. For applicable versions, refer to "Operating environments" (page 2).

1　Setting transfer/output conditions

The transfer or output conditions are set.

1 Select [Excel transfer settings] in the [Data Output] menu.
The [Excel transfer settings] window appears.

2 Specify the book to receive the data by Excel® in [Excel book at destination].

Names	Descriptions
New book	Transfers to the new book.
Active book	Transfers to the selected book among Excel® files currently open.
Specified book	Press the [···] button to transfer to the specified file.

3 Specify the sheet number and the cell number to receive the data by Excel® in [Transfer position].

Names	Descriptions
Sheet	Transfers to the specified sheet.
Start cell	Transfers to the specified cell number. Example: A1 cell -> Row1/Column1, B1 cell -> Row1/Column2, A2 cell -> Row2/Column1

4 Specify the order to receive the data by Excel® in [Output direction].

Names	Descriptions
Vertical	Transfers in the same order as the [Measurement results] window.
Horizontal	Transfers inverting vertically and horizontally of the [Measurement results] window

5 Check the check box of the item you want to transfer in [Output items].

Names	Descriptions
Output item titles	Sets whether or not to output the titles of "Numbers" or "Measurement items" in the [Measurement results] window.
Output items	Check or uncheck all output settings of the vertical items in the [Measurement results] window.
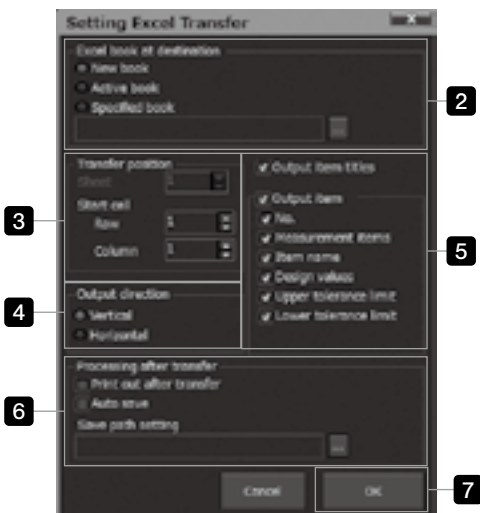
6 Specify the operations after transferring to Excel® in [Processing after transfer].

Names	Descriptions
Print out after transfer	Prints out automatically after transferring to Excel®
Auto save	After transferring to Excel®, saves the images to the location inputted in [Save path setting][1] automatically in Excel® file format or CSC file format.
Save path setting	Press the [...] button to save to the specified path.

7 Click the [OK] button.

The [Setting Excel transfer] window is closed.

*1 Parameters of [Save path setting]
  When saving the measurement results automatically after transferring to Excel® or when saving in CSV file format, the save destination of files or the file names are specified.
  When you input the parameter using the angle brackets ◊, the files are saved to the path according to the parameter.

  The paths described in "Example of paths of files to be saved" of parameters in the table are examples where measurement was performed under following conditions and the measurement results are saved automatically after transferring to Excel®.
  (Conditions)
  Date and time to save the file: 15:03:21 on October 1, 2014
  Path of the list file (lst file) used for measurement: C:\STM\LISTA.lst
  Replay name specified when the replay measurement started: REPLAY

Parameter	Descriptions	Setting example of [Save path setting]	Example of paths of files to be saved
(Extension)	When you input either xls (Excel® applicable until 2003), xlsx (Excel®applicable after 2007) or csv, the file format can be specified. If you do not specify the extension, specify the file name and the file format manually in the [Save in Excel book format] window displayed when saving files.		
‹Pn›	Rewrites to the file name and the folder name taken out from the path of the list being measured. ("n" is an integer larger than 0.) For example, P0 is the list file name and P1 and successive names are substituted in order to the folder name in the ascending hierarchy.	C:\DATA\‹P1›\‹P0›.xls	C:\DATA\LISTA.xls
		C:\DATA\‹P1›\‹P0›\ ("\" indicates the last.)	(Folder) C:\DATA\LISTA (Specify the file name and the file format manually in the [Save in Excel book format] window displayed when saving files.)
		C:\DATA\‹P1›\‹P0› (No extension)	(Folder) C:\DATA\LIST (Specify the file name and the extension manually in the [Save in Excel book format] window displayed when saving files.)
‹Y› ‹M› ‹D›	Rewrites to the year, month and date when the file is saved. (Year: 4-digit integer, Month and Date: 2-digit integer)	C:\DATA\‹Y›-‹M›-‹D›.xls	C:\DATA\2014-10-01.xls
‹H› ‹N› ‹S›	Rewrites to the hour, minute and second when the file is saved. (All are 2-digit integers.)	C:\DATA\‹H›‹N›‹S›.xls	C:\DATA\150321.xls
‹R›	Rewrites to the replay name specified when the replay measurement started.	C:\DATA\‹R›.xls	C:\DATA\REPLAY.xls

2 Transferring measurement results to Excel®
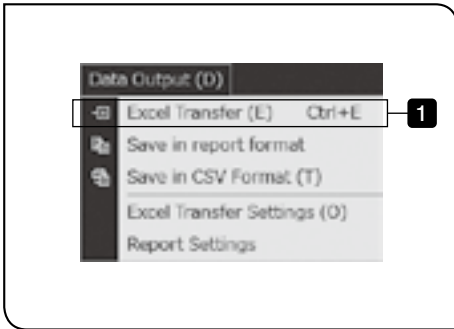
1 Click the (Excel Trans.) button in the menu or [Excel transfer] in the [Data Output] menu.
The measurement results are transferred to Excel® according to "1 Setting transfer/output conditions" (page 132).

◎ The values out of tolerance limit are displayed in red in accordance with the design value settings. For details of design value settings, refer to "Setting design values and Excel® transfer data of measurement items" (page 99).

◎ Save the data with the name.

3 Saving measurement results in CSV file format
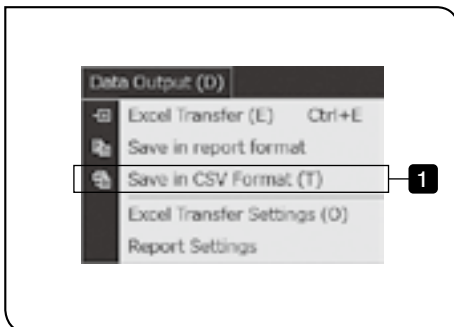
1 Click [Save in CSV format] in the [Data Output] menu.
The CSV file is created according to "1 Setting transfer/output conditions" (page 132).

◎ No color is displayed for cells of tolerance judgment, not-replayed or disabled measurement.

◎ You can also transfer measurement results to Excel® by clicking the [Excel transfer] button in the menu and save in CSV file format.

3-4 Create reports

The measurement results are processed into the report format by Excel®.

The reports are created after setting the creation conditions.

◎ To create the report with Excel®, Excel® must be installed on the controller in advance. Please purchase Excel® if necessary. For applicable versions, refer to "Operating environments" (page 2).

1 Setting creation conditions
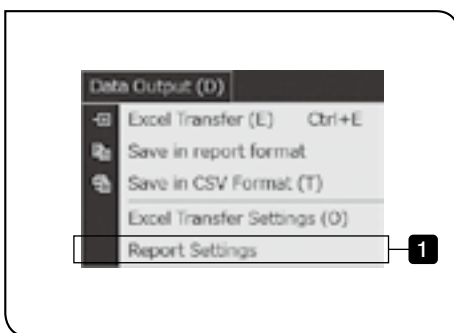
1 Select [Report settings] in the [Data Output] menu.
The [Report settings] window appears.

2 Select the report type[1] you want to create.

3 Click the [OK] button.
The [Report settings] window is closed.

*1 Report type

Template 1

Template 2

Template 3

Template 4

◎ Automatic calculation when reports are transferred:

1. Standard deviation
   The standard deviation expresses the degree of spreading of the variation in the normal distribution.
   The standard deviation is the square root of the sum of all samples' values which square the difference between the value of the sample and the average value.

   $$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(X_i - AVE)^2}$$

   The standard deviation σ is expressed as , where n is the data number, $X_1, X_2, ...$
   Xn are the measurement data and AVE is the average value.

2. Process capability index
   The process capability index is the capability to produce the products which satisfy the quality standards.

   This is used for quantitatively understanding the relation between the quality variation and the standard

   tolerance of the product.

   (1)CP value=(USL-LSL)/(6σ)

   (2)CPK value

       (i) Average value ≥(USL+LSL)/2

          Cpk=(USL - average value)/3σ

       (ii) Average value ‹(USL+LSL)/2

          Cpk=(Average - LSL)/3σ

       * Upper standard limit (USL)=Design value + Upper tolerance limit

        Lower standard limit (USL)=Design value + Lower tolerance limit

Cp value Cpk value	Judgment of process capability
Cp≥1.67	The process capability is high. The management and inspection can be simplified.
1.67›Cp≥1.33	The process capability exists. The important management and inspection can be streamlined.
1.33›Cp≥1.00	The process capability exists, but not sufficient. The process management must be maintained.
1.00›Cp	The process capability is insufficient. The process analysis and the process improvement must be pursued.

2 | Saving measurement results in CSV file format
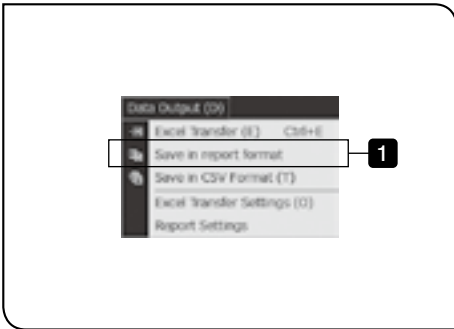
1 Click the ▣ (Save report) button in the menu or [Save in report format] in the [Data Output] menu.
The report is displayed in Excel® according to "1 Setting creation conditions" (page 135).

◎ The values out of tolerance limit are displayed in red in accordance with the design value settings. For details of design value settings, refer to "Setting design values and Excel® transfer data of measurement items" (page 99).

◎ If the macro is enabled when setting Excel®, the button for pasting images to the arbitrary cells in the report is displayed.

◎ Save the data with the name.

3-5 Optional functions

1 Auto focus
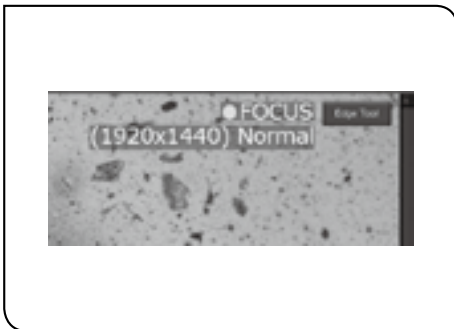
The focus indicator showing the focus status can be displayed on the live image.

Display	Descriptions
FOCUS (Turned ON)	In focus
FOCUS (Turned OFF)	Out of focus

◎ This function is available only when the focus unit STM7-AF is attached to STM7.

◎ You can show or hide the focus indicator and select the display position.
Refer to "11 Communications" (page 181), and "6 Display" (page 171) for details.

2 Extended focus image

Outline of function

This function acquires multiple images by moving the Z-axis and extracts focused areas from the acquired images to create one extended focus composite image.

Move in Z-axis direction

Acquire multiple images

Compose

The extended focus composite image is completed.
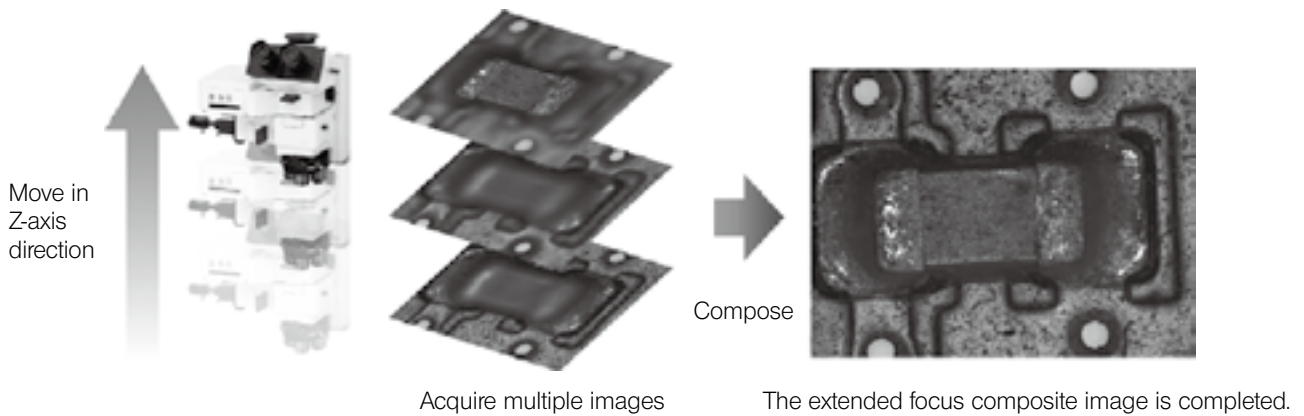
Operation flow

1. Acquire the image for composition by 3 types of acquisition methods.
   - Snapshot acquisition
     The image is acquired by clicking the acquisition button.
   - Equal time interval acquisition
     The image is acquired at the specified time interval.
   - Equal Z pitch interval acquisition
     This method is available only with the motorized 3-axis measuring microscope.
     The image is acquired at equal interval in the Z-axis direction by controlling the Z-axis.
2. Save the composite image.

Start
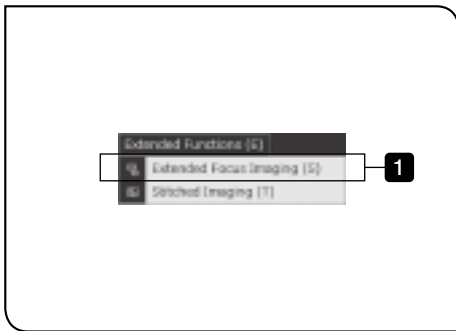
1 Click the [EFI] (EFI) button in the menu or [Extended focus imaging] in the [Extended functions] menu.

◎ If the [EFI] button is not displayed in the menu, you can display it in the [Menu icon settings] window (page 179).

◎ Extended focus composite cannot be performed while the autofocus function is used or while the focusing unit is operated. Stop these operations before using this function.

◎ If the camera is set at high resolution, when you start acquiring the extended focus image, the message appears to ask you whether or not to acquire the extended focus image at low magnification. If you want to reduce the process time, click [Yes].

[Screen for creating the extended focus image] appears.
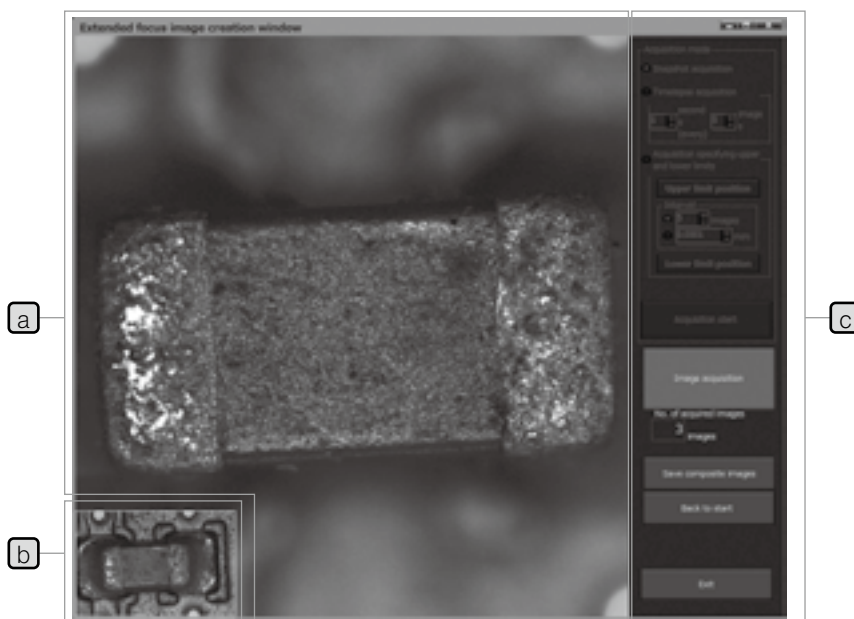
	Names	Descriptions
a	Live image display area	The live image is displayed.
b	Composite image display area for confirmation	The composite image whose settings are reflected to the setting/information display area is displayed.
c	Setting/information display area	The settings or information for creating the composite image are displayed.

Snapshot acquisition

Users acquire images for composition at the desired position each time by moving the Z-axis.
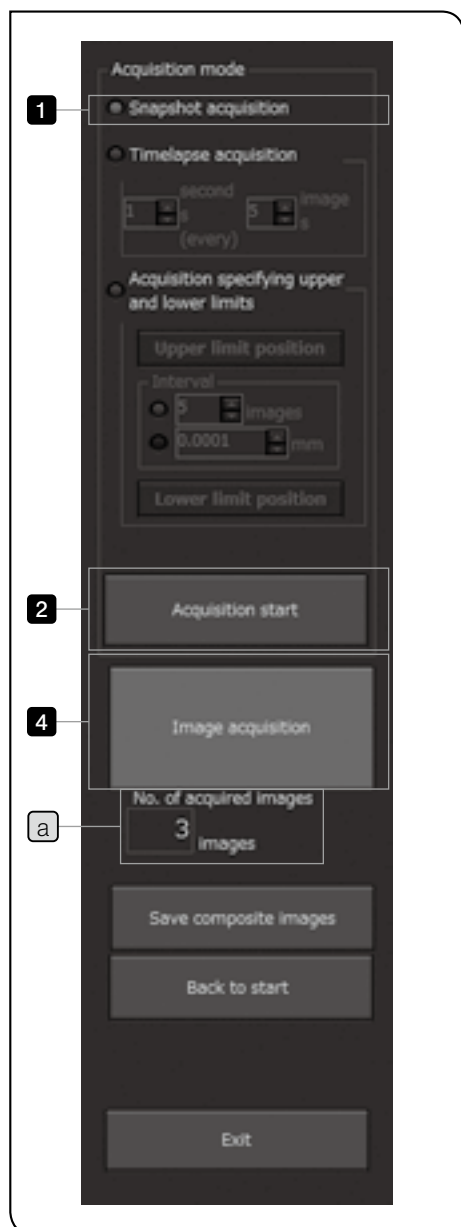
1 Click the [Snapshot acquisition] in [Acquisition mode].

2 Click the [Acquisition start] button.

3 Move the Z position to the acquisition point.

4 Click the [Image acquisition] button.

◎ The number of acquired images for composition is displayed in [No. of acquired images] a .

5 Repeat operations from **3** to **4** until the acquisition of images for composition is completed.

The preview image is displayed in the lower left area of the window.

◎ To save the composed image, go to "Save/exit" (page 145).

Equal time interval acquisition

The software acquires images for composition automatically at equal time interval. Therefore, users can acquire as many images for composition as they want without releasing the hand from the stage.
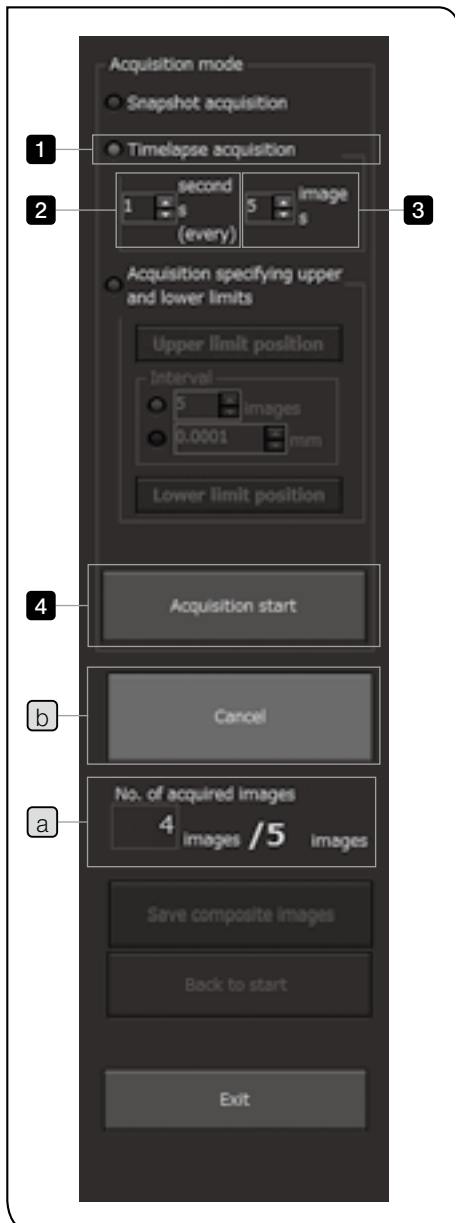
1. Click the [Timelapse acquisition] in [Acquisition mode].

2. Set the time interval in the unit of second in [Time interval setting].

3. Set the number of acquired images for composition in [Setting No. of acquired images].

4. Click the [Acquisition start] button.

5. Move the Z position to the acquisition point.

6. The images for composition are acquired at time interval specified.

   ◎ The number of acquired images is displayed in [No. of acquired images] a .

7. Repeat operations from 5 to 6 until the acquisition of the specified number of images for composition is completed.

   ◎ To cancel acquisition, click the [Cancel] button b . The images for composition acquired are not discarded.

8. When the acquisition of images for composition is finished, the message [The acquisition is finished.] appears.

   The preview image is displayed in the lower left area of the window.

   ◎ To save the composed image, go to "Save/exit" (page 145).

Equal Z pitch interval acquisition

The software acquires images for composition automatically at the Z position with equal interval. Therefore, users can acquire as many images for composition as they want only by specifying the Z positions of the start and end of acquisition.

◎ The equal Z pitch interval acquisition is available only with the motorized 3-axis measuring microscope.

CAUTION **While operating the software for this acquisition, do not reset Z-axis counter data.**
The focusing unit may move unexpectedly when you start acquisition, and the microscope or measuring objects may be damaged.

For resetting the counter data, refer to the instruction manual of STM7 or STM6/STM6-LM.
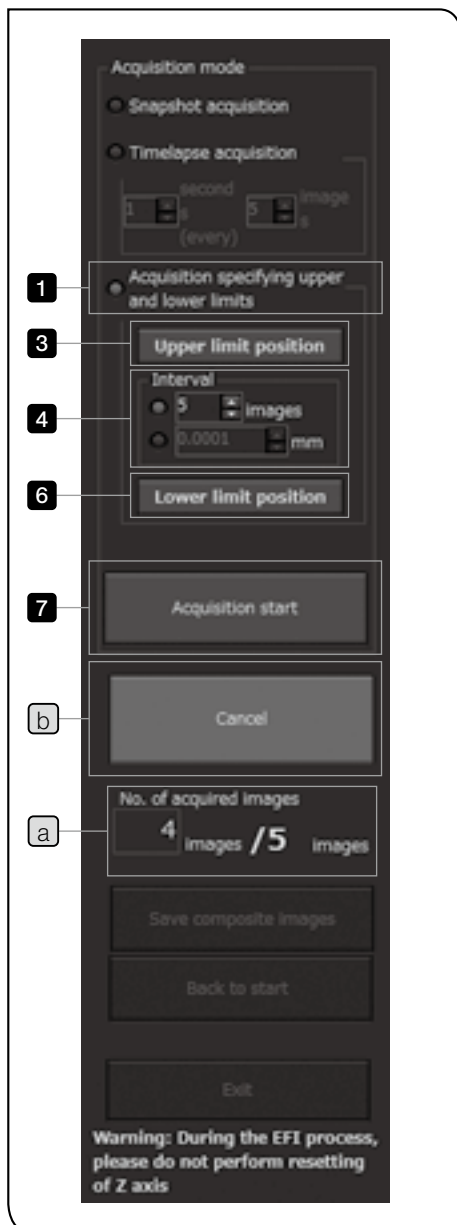
1 Click the [Acquisition specifying upper and lower limits] in [Acquisition mode].

2 Move the Z position to the top position to acquire the images for composition.

3 Click the [Maximum setting] button.
The top position of acquiring images for composition is set.

4 Set the interval of the Z position in [Interval].
[No. of acquired images]: The Z-axis interval is calculated from the specified number of acquired images (from 2 to 30 images) automatically.
[Z-axis interval]: The interval (mm) of the Z-axis is set.

5 Move the Z position to the lowest position to acquire the images for composition.

6 Click the [Lower limit position] button.
The lowest position of the image acquisition for composition is set.

◎ The Z position of the measuring microscope can be set at the position higher than the lower software limit by 0.003 mm.

7 Click the [Acquisition start] button.
The Z position is moved between the specified lowest position and top position automatically, and the images for composition are acquired.

◎ The number of acquired images for composition is displayed in [No. of acquired images] a .

◎ To cancel acquisition, click the [Cancel] button b . The images for composition acquired are not discarded.

◎ To save the composed image, go to "Save/exit" (page 145).

Save/exit

The composite image is not saved only by acquiring the images for composition. Save the composed image and exit this function.
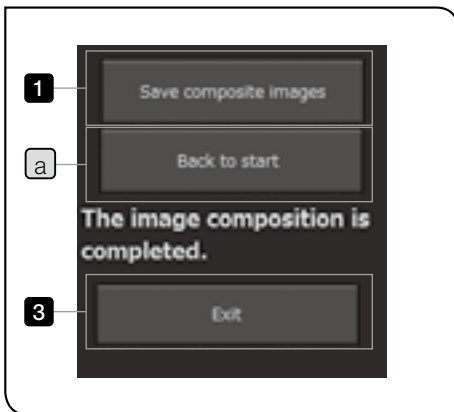
1 Click the [Save composite images] button.
The [Save composite images] window appears.

2 Specify the save destination of the image and the file name, and click the [Save] button.
The composed image is saved.

◎ The data can be saved in BMP file format or JPEG file format.

◎ To acquire images for composition again, click the [Back to start] button a.

3 Click the [Exit] button .
[Extended focus image creation window] is closed.

3 Stitched images

Outline of function

This function acquires multiple images to create one image with high magnification and wide range.

The coordinate values are acquired from the measuring microscope at the same time when acquiring images. Then, the stitching positions of acquired images are calculated to perform stitching.

Operation flow

1. When the stage is moved, the display area (framed in red) is moved based on the current coordinate values.

Current coordinate values
X=1.25
Y=2.45

RS-232C

X=1.25
Y=2.45
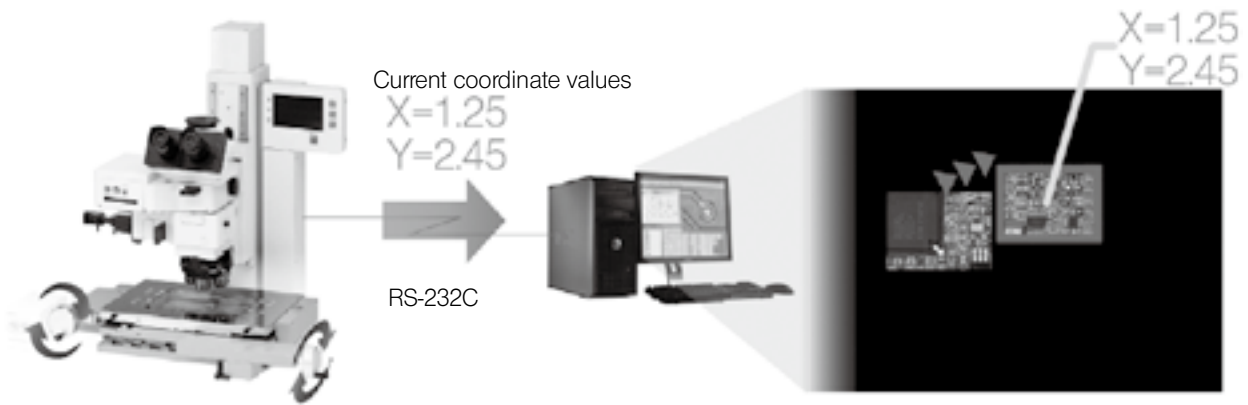
2. When the acquisition button is clicked, the current field of view is stitched to the wide range image.
   As the images are stitched based on the coordinate values, images can be stitched accurately.

◎ The images at the separate position as shown in the picture above can also be stitched.

Start
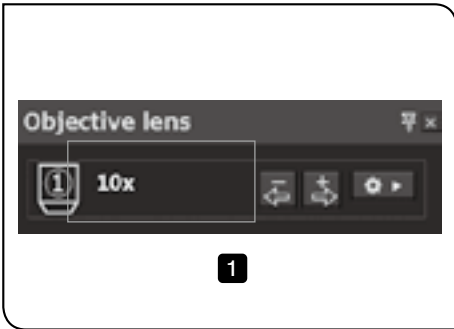
1 Confirm that the magnification of the objective in the [Objective lens] window is same as the magnification of the objective to be used.

(CAUTION) • **Before creating stitched images, be sure to match the magnification of the objective of this software with the magnification of the objective to be used actually. If the magnification of the objective of this software is different from the magnification of the objective to be used, the accurate stitched image cannot be acquired.**
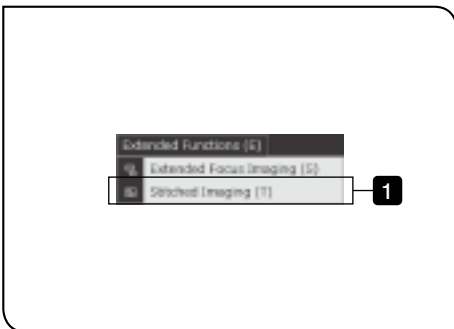
2 Click the (Stitching) button in the menu or [Stitched Imaging] in the [Extended functions] menu.

◎ If the [Stitching] button is not displayed in the menu, you can display it in the [Menu icon settings] window (page 179).

◎ If the camera is set to at high resolution, when you start acquiring the stitched image, a message appears to ask you whether or not to acquire the stitched image in the binning mode. If you want to increase the stitchable number of images, click [Yes].
For details of binning mode, refer to "Camera setting" (page 167).

The [Stitching] screen appears.

Names	Descriptions
[a] Live image display area	The live image is displayed.
[b] Image stitching results display area	The stitched image whose settings are reflected to the setting/operation display area is displayed. ◎ Maximize the [Stitching] screen when you want to check all the possible areas for stitching.
[c] Setting/operation display area	The settings or operations for creating the stitched images are displayed.

Items on screen
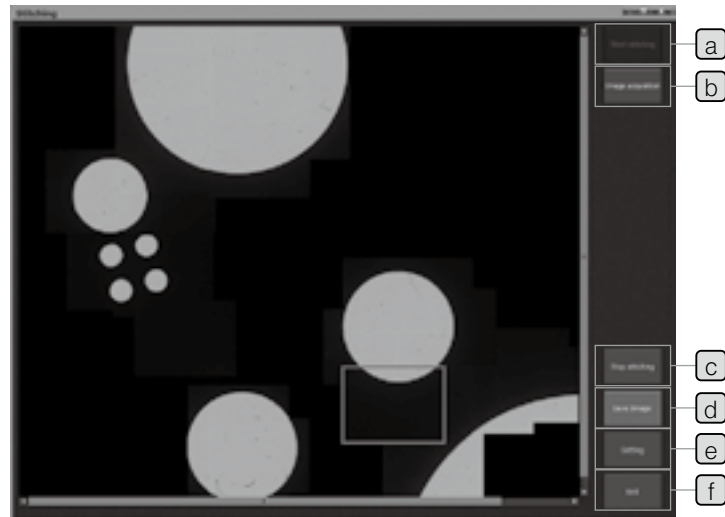
Names	Descriptions
a Start stitching	Starts the image stitching. ◎ The image displayed on the start screen is the first image.
b Image acquisition	Acquires the image displayed in the red frame.
c Stop stitching	The screen to select whether or not to stop stitching is displayed.
d Save images	Saves the stitched image. The images are saved in BMP file format or JPEG file format.
e Setting	[Stitching settings] screen (next page) appears.
f Exit	Exits the image stitching and closes the screen.

Names	Descriptions
[a] Panel size	Select the panel size from (Small/Medium/Large). ◎ Set before starting the stitching.
[b] Stitching start position	Select the image stitching start position[*1] from (Center/Upper left). ◎ Set before starting the stitching.
[c] Acquisition method	Select the acquisition method from (Manual acquisition /Auto acquisition). Manual acquisition: Images are acquired by user operation. Auto acquisition: Images are acquired automatically at the specified acquisition timing.
[d] Acquisition timing	This can be selected only when [Auto acquisition] is selected in [Acquisition method] [c]. Timer for counting seconds: The time can be set between 1 and 60 seconds. Set the number of seconds until acquisition after the counter is stopped. Counter movement distance: The distance can be set between 0.0001 and 60 mm. If you move from the last acquisition position and that movement distance exceeds the setting value, the image is acquired automatically.
[e] Blend process	Set the stitching margin[*2] between 1 and 30%.
[f] File save settings	Set the save image size. (Select from 8000x6000/4800x3600/2400x1800/1600x1200/1280x960/1024x768/800x600/640x480.) ◎ Unit: Pixel ◎ This setting is for setting whether to save the image being stitched and by how much to reduce it. (Example: 8000x6000 (100%), 4800x3600 (60%)) Areas that can be acquired and stitched are not changed by this setting. ◎ The size of the image that is saved is smaller than the value in this setting due to being saved with the areas with no images removed when all the areas that can be acquired and stitched are not used for stitching.

*1   Start position

Center   Upper left

*2   Stitching margin
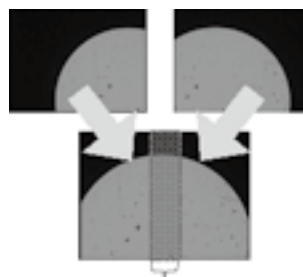
Stitching margin: 0 to 30%

Image acquisition

1 Click the [Start stitching] button.

2 Move the stage to the acquisition point.

3 Click the [Image acquisition] button.

◎ Clicking is not needed if [Acquisition method] is set to [Auto acquisition].

4 Repeat operations from **2** to **3** until the acquisition of images for composition is completed.

◎ To save the composed image, go to [Save/exit].

◎ To cancel the process after you have started stitching, click the [Stop stitching] button.

(CAUTION) • **If the moving direction or the movement distance of the live image is abnormal, review the calibration settings (see page 12) or the camera direction (refer to STM7 instruction manual.)**
  • **The position of the measurement object shifted. (vibration, wind, light-weight measurement objects)**
  • **Camera direction**
  • **Stage leveling**
  • **The calibration settings are not correct.**

• **The unevenness is noticed on the stitched image depending on measurement objects.**

• **The number of images that can be stitched is obtained by dividing the maximum size (8000x6000) of the image in [File save settings] of [Stitching settings] by the size of the camera's resolution.**

Save/exit

The stitched image is not saved only by acquiring the stitched image. Save the stitched image and exit this function.

1 Click the [Save image] button [a].
The [Save stitched image] window appears.

2 Specify the save destination of the image and the file name, and click the [Save] button.
The stitched image is saved.

◎ The image can be saved in BMP file format or JPEG file format.

3 Click the [Exit] button [b].
The [Stitching] window is closed.

4 Software screens

This section describes the details of software screens.

4-1 Menu bar

Menu name			Shortcut	Descriptions	Reference page
File					
	Create New List		Ctrl+N	Creates the new teaching list.	-
	Open List		Ctrl+O	Loads the teaching lists and the replay lists saved.	90
	Save List		Ctrl+S	Saves the teaching lists and the replay lists by overwriting.	
	Save List As			Save the teaching lists and the replay lists with different names.	89
	Save Image			Saves the live images (in BMP/JPEG file format).	130
	Copy Image			Copes the live images on the clip board.	-
	Save Graphic			Saves the graphic images (in BMP/JPEG file format).	131
	Copy Graphic			Copies the graphic images on the clip board.	-
	Save DXF File			Saves the graphic images in DXF file format.	131
	List file			Displays the lists (in lst file format) recently used.	
	Erase History			Deletes the list history recently used.	
	Exit			Exits this software.	9
Measurement					
	Direct measurement				
		Point	F1	Performs the direct measurement.	74
		Line (Angle)	F2		
		Circle	F3		
		Rectangle	F4		
		Mid-point	F5		
		Distance between 2 points	F6		
		Height between point and point	F7		
		Plane	F8		
		Ellipse			
	Recall			Performs the recall measurement.	78
	Alignment			Performs alignment.	83
	Virtual point			Displays the virtual point items in the [Measurement items] window.	69
	Z plane			Displays the measurement items on XZ plane in the [Measurement items] window.	129
	Macro			Displays the macro items in the [Measurement items] window.	69

Menu name		Descriptions	Reference page
Execute list			
	Re-measure	Re-measures the items in the selected area of teaching lists.	98
	Copy Measurement	Repeats the measurements of the selected area of teaching lists and adds to teachings lists.	100
Edit list			
	Insert	Inserts the measurement list immediately before the selected teaching lists.	92
	Delete	Deletes the selected items of teaching lists.	93
	Move Copy	Specifies the X- and Y-axis movement distance and copies the same measurement items on the teaching lists at equal interval.	94
	Rotate Copy	Specifies the rotation angle and copies the same measurement items on the teaching lists at equal interval.	96
	Recall Information	Confirms the recall information.	82
	Edit design values	Edits the design values.	99
Register new macro		Registers the measurement items in the macro.	69
Edit macro		Edits the macro already registered.	-
Replay			
	Replay	Repeats the replay measurement of teaching lists for the number of times specified.	102
	Partial replay	Performs the replay measurement of the selected part of teaching lists.	106
	Replay Delete	Deletes the measurement results of the replay measurement.	105
	Replay Name	Edits the replay name.	
Data Output			
	Excel Transfer	Transfers the measurement results to Excel® .	134
	Save in report format	Saves the measurement result in report format.	138
	Save in CSV format	Saves measurement results in CSV file format.	134
	Excel Transfer Settings	Sets the Excel® transfer.	132
	Report Settings	Sets a template for creating reports.	135
Extended Functions (Option)			
	Extended Focus Imaging	Acquires multiple images in the Z direction to create one extended focus point composite image (option).	140
	Stitched Imaging	Acquires multiple images to create one image with high magnification and wide range (option).	146
Communications			
	Connection	Connects the microscope and the software.	-
	Communications Settings	Sets the connection between the microscope and the software.	181

Menu name	Descriptions	Reference page
Settings		
Navigation settings	Sets the navigation function.	165
Live image settings	Sets the live image display and the camera.	166
Auxiliary display settings	Sets the display of the cross hair and the X- and Y-axis.	168
Scale display settings	Sets the scale.	169
Reticle display settings	Sets the reticle.	170
Display settings	Sets the window display.	171
Output settings	Sets the saving of lists or images.	175
User settings	Sets the user.	177
Menu icon settings	Sets the menu icons in the upper area of the screen.	179
Measurement item screen settings	Sets the measurement items displayed in the [Measurement items] window.	180
Calibration settings	Sets the calibration of the objectives.	12
Window		
List	Displays the [List] window.	160
Measurement results	Displays the [Measurement results] window.	161
Measurement items	Displays the [Measurement items] window.	157
Graphic	Displays the [Graphic] window.	158
Live	Displays the [Live] window.	156
Counter	Displays the [Counter] window.	157
Operation guide	Displays the operation guide.	163
Objectives	Displays the [Objective] window.	162
Illumination	Displays the [Illumination] window.	156
Restore initial layout	Initializes the window layout.	164
Register layout	Registers the window layout.	-
Delete layout	Deletes the information of all window layouts registered.	-
(The registered window layout name)	Sets the window layout registered.	-
Help		
Version information	Displays the version of this software.	17

4-2 Menu icon

Button name		Descriptions	Reference page
	Create New	Creates the new lists*.	-
	Open	Loads the lists* saved.	90
	Save	Saves the list files with different names.	89
	Excel Transfer	Transfers the measurement results to Excel® .	134
	Save report	Saves the measurement result in report format.	138
	Save CSV	Saves measurement results in CSV file format.	134
	EFI	Acquires multiple images in the Z direction to create one extended focus point composite image (option).	140
	Stitching	Acquires multiple images to create one image with high magnification and wide range (option).	146
	Save images	Saves the live images (in BMP/JPEG file format).	130
	Graphic	Saves the graphic images (in BMP/JPEG file format).	131
	Insert	Inserts the measurement lists immediately before the selected areas of lists*.	92
	Delete	Deletes the selected items in the lists.	93

Button name		Descriptions	Reference page
	Re-measure	Re-measures the selected items in the lists*.	98
	Copy measurement	Repeats the measurements of the selected areas of lists* and adds to the lists.	100
	Edit design values	Edits the design values.	99
	Register macro	Registers the macro.	69
	Replay	Repeats the replay measurement of lists* for the number of times specified.	102
	Partial replay	Performs the replay measurement of the selected parts of lists*.	106
	Navigation settings	Sets the navigation function.	165
	Live settings	Sets the live image display.	166
	Execute WB	Executes the white balance.	166
	Operation guide	Displays the operation guide.	163

* List indicates the teaching list and the replay list.

◎ You can select the icons you want to display. Refer to "4-2 Menu icon" (page 154) for details.

4-3 Window
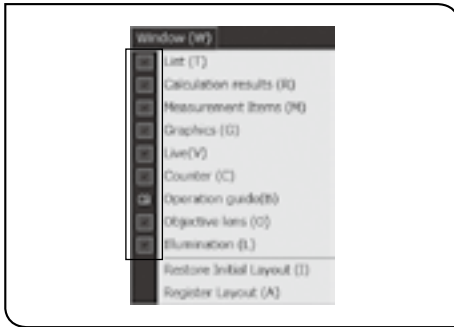
Check the window in the [Window] menu to display the window.

Window (W)
- List (T)
- Calculation results (R)
- Measurement Items (M)
- Graphics (G)
- Live(V)
- Counter (C)
- Operation guide(B)
- Objective lens (O)
- Illumination (L)
- Restore Initial Layout (I)
- Register Layout (A)

1 Live window

The live images from the camera are displayed.
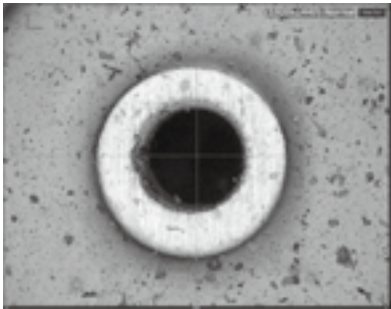
◎ For procedures to adjust the brightness, etc. refer to "Camera setting" (page 167).

◎ The grids or the X- and Y-axis can be displayed on the live image. Refer to "3 Auxiliary display" (page 168) for details.

◎ When the auto focus unit STM7-AF is installed on STM7, the focus indicator can be displayed on the live image. For details of the focus indicator, refer to "1 Auto focus" (page 104).

◎ You can change the display format of the live image by opening the menu shown on the left by right clicking the mouse in the [Live] window while viewing a live image.
For the [Live] window, you can select either fit-to-screen, to fit the image to fill the screen with the input from the camera, or 100% display, to show the actual size of the image input from the camera.
With the 100% display, you can view images without the deterioration in image quality that is associated with changing the size of the image.

Fit(F)
100%(O)

2 Illumination window

Illumination

a Reflection
b Transmission
c Focus Navigator

	Names	Descriptions
a	Reflection	Turns ON/OFF the reflected illumination and adjusts the light intensity.
b	Transmission	Turns ON/OFF the transmitted illumination and adjusts the light intensity.
c	Focus navigator	Turns ON/OFF the illumination for focus navigator and adjusts the light intensity.

3   Counter window

[Reference coordinates] tab

The counter data shown in the digital indicator STM7-DI of the microscope is displayed.

[Alignment coordinates] tab

The coordinate values of the aligned coordinate system are displayed.
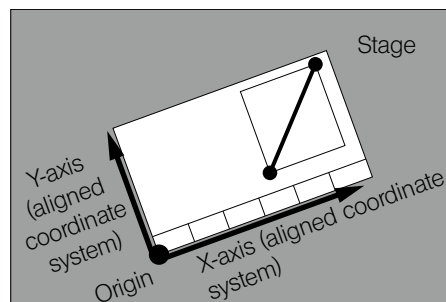
◎ The aligned coordinate system is displayed when the alignment settings are completed.

◎ For details of the alignment, refer to "Alignment" (page 83).

4   Measurement items window

The functions of direct measurement, recall measurement, alignment and virtual point and the macro button are displayed.

For details of this window, refer to "3 List of measurement items" (page 67).

5   Graphic window

The selected figures are displayed graphically.

(CAUTION) **To display the stage position (field of view) or edge tool measurement results properly in the [Graphic] window, the calibration must be performed in advance. Refer to "1-4 Calibration" (page 12) for details.**

[Size] tab

All figures are displayed.
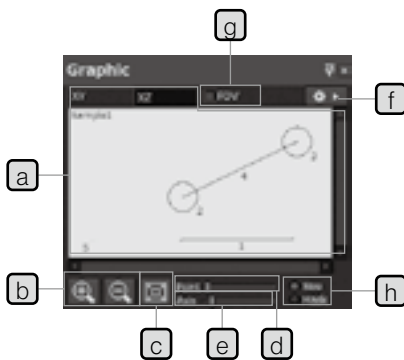
	Names	Descriptions
a	XY/XZ tab	Displays the figures measured on the XY plane or the XZ plane. Only the point elements measured on the XY plane are displayed on the XZ plane and the circle and line elements are not displayed.
b	Zoom in/out button	Adjusts the size of the figure displayed graphically. Adjusts coarsely by clicking the button. The figure can also be zoomed in and out by using the mouse wheel. (fine adjustment)
c	Display fitting button	Adjusts the display magnification so that all figures can fit within the display area.
d	Point size adjustment bar	Adjusts the display size of the measurement point.
e	Axis length adjustment bar	Adjusts the display length of X-axis and Y-axis.
f	Settings	Sets the details of the [Graphic] window. (See 173 page.)
g	Stage position display	Displays the stage position (field of view) in (blue).
h	Size/mask selection button	Displays the figure by the size or the mask.

[Mask] tab

Select the types of figures you want to be able to select for recall.

◎ For items common in the [Size] tab, refer to the descriptions of the [Size] tab.
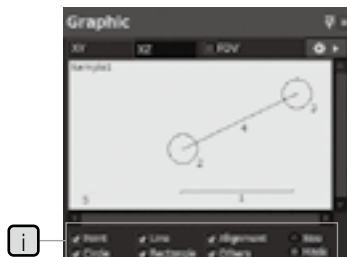
	Names	Descriptions
i	[Mask] tab	Only the types of figures you checked can be selected by double clicking. Point: Measured point Circle: Measured circle Line: Measured line Rectangle: Measured rectangle Alignment: Alignment coordinates Others: Figures other than those described above

Description of figures to be displayed (initial values)

Figure display	Color
Origin/Axis	Red
Figure being selected	Light blue
Selection points on the figure containing multiple recallable points	Red
Other figures	Black

◎ To change the color of the figure, refer to "Setting graphic screen" (page 173).

Display of figures usable for recall measurement

Possibility of recall measurement	Point type	Line type
Possible	●(Fill)	—— Solid line
Impossible	○(Outline)	----- Dashed line

◎ When the replay measurement is performed, measurement results of [Sample] selected in the [Measurement results] window are displayed graphically and the sample number is displayed in the upper left area.

Procedures to select multiple figures

Operation	Selection status
Shift key + click mouse	The measurement item clicked is selected.
	◎ The selection is not canceled by clicking on the selected figure.
Ctrl key + click mouse	The selected status of the measurement item clicked is reversed.
	◎ If you click the figure selected, the selection is canceled.
	If you click the figure not selected, that figure is selected.

◎ Display image of XY plane and XZ plane

Origin (0,0,0)
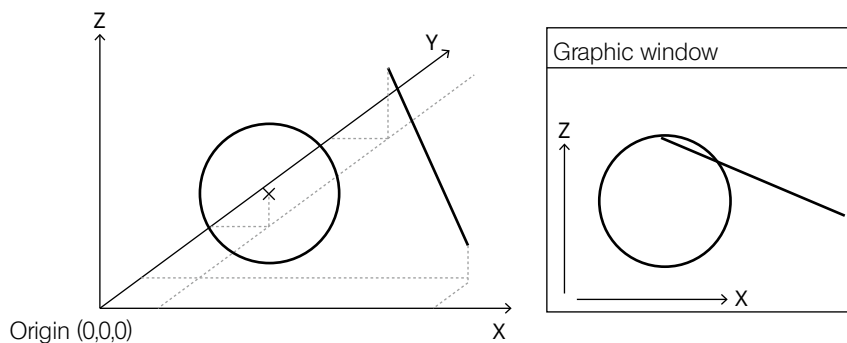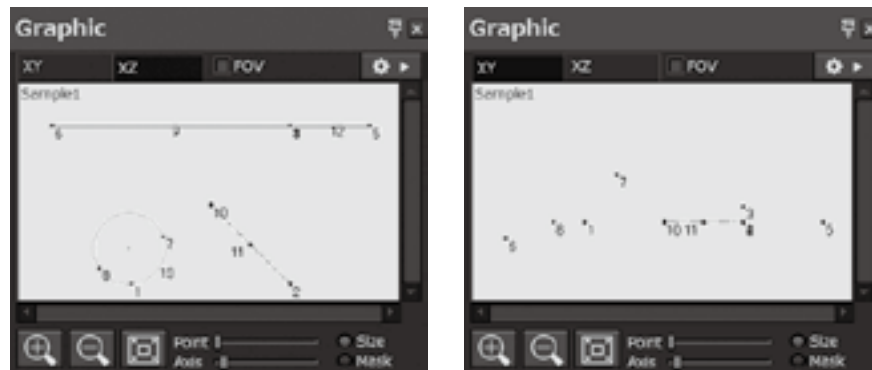
◎ In the [XZ plane] tab, the figure projected to the XZ plane is displayed on the graphic screen.
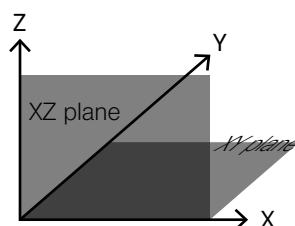
6   List window

The lists (teaching lists) of measurement items are displayed.

	Names	Descriptions
a	Teaching list	Displays the list of measurement items.
b	Navigation warning display	Displays the current navigation status. [1]
c	Settings	Sets the details of the navigation function. (See 165 page.)

*1   The display status are described in the table below.

Display	When registering lists	When executing replay measurement
‹Disabled (settings)›	The navigation settings are disabled.	The navigation settings are disabled.
‹Disabled (lists)›	-	There are no alignment registration effective for navigation in the lists.
‹!Alignment not complete›	The alignment settings specified in navigation settings are not completed yet.	The alignment settings specified in navigation settings are not completed yet. (The alignment setting procedures are included in the replay measurement lists.)
‹Replay preparation complete›	The alignment settings specified in navigation settings are completed. When the replay starts, the navigation is executed.	-
‹Executing›	-	The navigation is being executed.

Procedures to select multiple lists
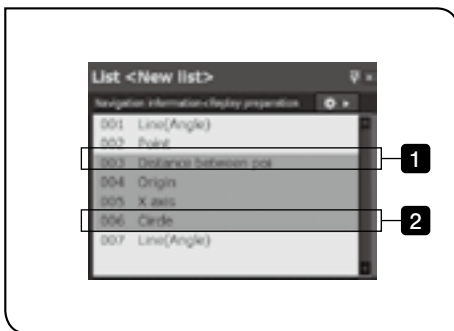
When selecting consecutive items in the list.

1 Click the mouse on the first item you want to select.
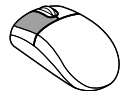
2 While pressing the Shift key of the keyboard on the last item you want to select, click the mouse.
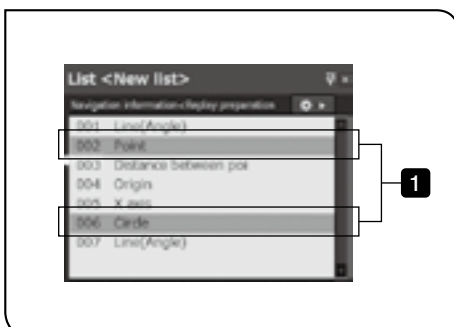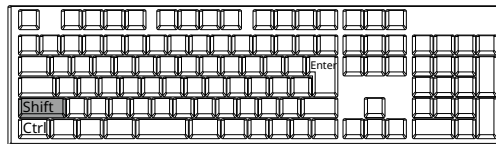
When selecting non-consecutive items in the list.

1 While pressing the Ctrl key of the keyboard on the item you want to select, click the mouse.
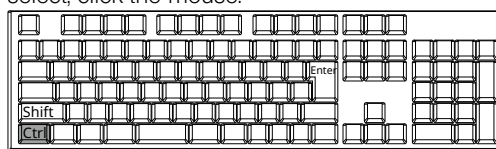
7   Measurement results window

Displays the measurement results.

	Names	Descriptions
[a]	Number/Measurement item/Item	Number: Displays the order of measurement results. Measurement item: Displays the item names of measurement results. Item: Displays the data item names of measurement results.
[b]	Sample (n)	If you click on the row title area ("Sample (n)") of the measurement value column which finished the replay measurement, the figures of the selected measurement items are displayed in the [Graphic] window. Measurement results up to 50 times of replay measurement are displayed. ◎ For the display of replay measurement results, refer to "Replay Measurement" (page 102).
[c]	Calculation results display	Displays the measurement results of [a]. <table><tr><td>View in Cell</td><td>Descriptions</td></tr><tr><td>Texts in blue</td><td>Within the tolerance of the specified measurement values</td></tr><tr><td>Texts in red</td><td>Out of the tolerance of the specified measurement values</td></tr><tr><td>Background in light blue</td><td>Measurement values without completing the replay measurement. After the partial replay measurement is performed: Measurement values inapplicable for partial replay measurement</td></tr></table>
[d]	Measurement results display	Displays the design value / upper tolerance limit / lower tolerance limit / Excel Transfer. ◎ The items you want to display can be set. Refer to "7 Output" (page 175) for details.

◎ The character size and the number of digits you want to display can be set. Refer to "Setting measurement results screen" (page 174) in "6 Display" (page 171) for details.

◎ If you select measurement items in the [Graphic] window or the [List] window, it scrolls automatically to the applicable measurement item row in the [Measurement results] window.

◎ During the replay measurement, if you start the replay measurement of the measurement values which are not displayed in the [Measurement results] window, it scrolls automatically.

◎ You can select not to output the measurement results. Refer to "7 Output" (page 175) for details.

8 Objective window

Select the calibration information using [icon] in this window according to objectives you are using.
If the objectives in use are not matched with settings in this window, the measurement using the edge tool cannot be performed precisely.
When you are using the coded revolving nosepiece, if you change the objective, the calibration information is also changed.

◎ To perform calibration, click [icon]. Refer to "1-4 Calibration" (page 12) for details.
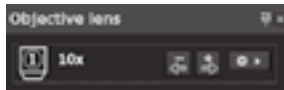
9 Edge tool window
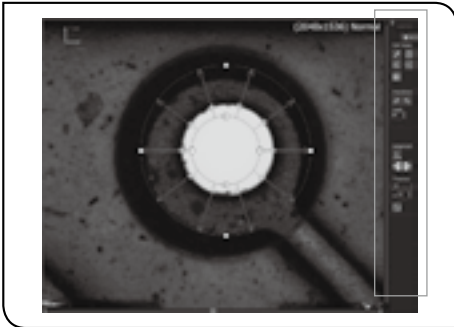
This screen is used for the edge tool.

◎ This screen is displayed by clicking the [Edge tool] button [a] on the live screen.

◎ For details of buttons, refer to "Edge tool functions" (page 124).

10　Operation guide window

This window is displayed by clicking the (Guide display ON/OFF) button.

Names	Descriptions
a Buttons	If you click the button containing descriptions, those descriptions are displayed below the button. If buttons do not contain the description, you can click the [Next] button while buttons are selected to display the next description screen. The relevant function areas of the software glow to guide the operations.
b First button	Returns to the first page.
c Back button	Returns to the previous page.
d Next button	Open the next detail page.

11　Zoom navigation

This window is displayed when placing the mouse pointer on the buttons in the [Measurement items] window or the [Edge tool] window.
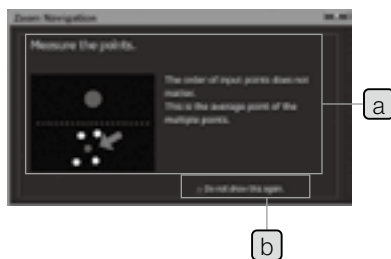
Names	Descriptions
a Descriptions	Displays the descriptions of functions.
b Do not show this again.	Hides the zoom navigation. This check box is displayed in the [Zoom navigation] window during measurement. This check box is not displayed in the [Zoom navigation] window which is displayed when placing the mouse pointer on the button.

◎ After the zoom navigation is hidden, if you want to show it again, refer to "General settings" (page 171).

12 Customizing window layout

Window docking
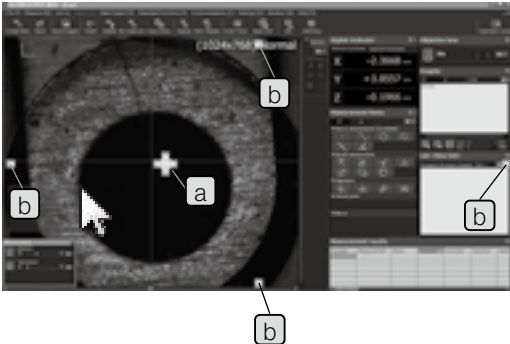
Each window can be docked at your desired position.
Click on the title bar of the window. Drag to the software screen or the up/down/right/left button of the window you want to dock.

Docking destination
a Docking to the up/down/right/left area outside of the window
b Docking to the up/down/right/left area inside of the software screen.

Fixing/Auto-hiding the window
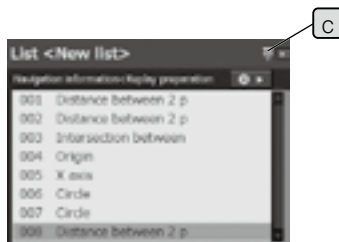
If you press the push pin c (or) in the upper right area of the window, the settings of Fix/Auto-hide are selected.

◎ The window docked to the window where Fix/Auto-hide is set is also set to Fix/Auto-hide.

13 Initialization of window layout
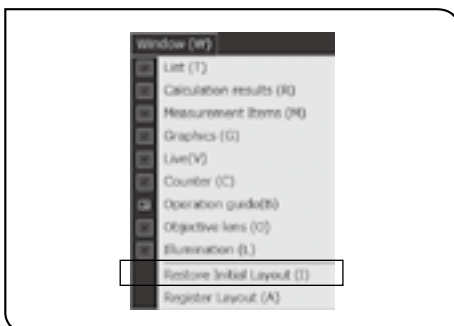
Select [Restore initial layout] in the [Window] menu.

4-4 Setting window

1 Navigation

In this window, the navigation function to display next measurement points while performing the replay measurement or the partial replay measurement is set to improve the measurement efficiency. For details of the replay measurement, refer to "Replay Measurement" (page 102), and for details of the navigation function, refer to "Navigation" (page 107).
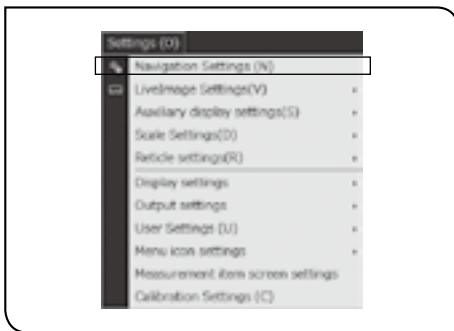
This is displayed when the [Navigation Settings] in the [Settings] menu is selected.

Names	Descriptions
a Use navigation	Check to enable the navigation function.
b Navigation start settings	Select the time to start navigation.[1]
c Color and threshold	While the navigation is displayed, set the distance (distance between the target position and the current position) where the display color changes. When the [Initial value] button is clicked, the settings of [Color and threshold] are returned to the initial values[2].

[1] Time to start navigation

Settings	Navigation function	Notes
	The navigation is enabled after setting the aligned origin and setting the aligned X-axis. The alignment is enabled after setting the aligned X-axis.	
	The navigation is enabled after setting the aligned origin. (Origin setting alignment)	The input point for setting the X-axis can be navigated.
	The navigation is enabled after setting the aligned X-axis. (X-axis setting alignment)	The input point for setting the origin can be navigated.

[2] Initial value (Color and threshold)

	Color	Threshold
Long distance	Red	1.00000 mm
Medium distance	Yellow	0.50000 mm
Short distance	Greenish yellow	0.10000 mm
Lock	Blue	

2 Live image

The display of the live screen is set.
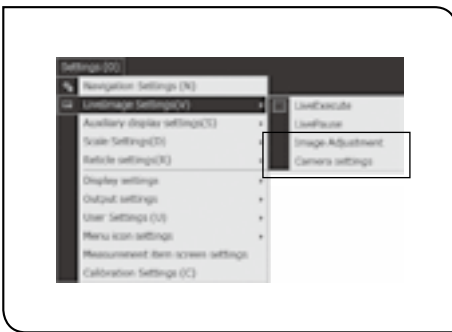
This is displayed when you select either [Image adjustment] or [Camera settings] in [Live image setting] in the [Settings] menu.

Image adjustment

This is displayed when [Image adjustment] is selected in [Live image settings] in the [Settings] menu.

Names	Descriptions
a Exposure time adjustment	AUTO: Adjusts the exposure time automatically. -(minus): Decreases the exposure time. The image becomes darker. +(plus): Increases the exposure time. The image becomes brighter.
b White balance.	Auto: Monitors the color temperature of the measurement objects constantly and sets the white balance automatically. One-touch: Sets the white balance based on the color temperature of the live image when the [WB] button is clicked. Manual setting: Sets the color (red/green/blue) balance.

CAUTION If you perform one-touch white balance using the digital camera STM7-CU, the adjustment takes approximately 15 seconds. Do not move the adjustment sample during this time period.

Camera setting

This is displayed when [Camera settings] is selected in [Live image settings] in the [Settings] menu.
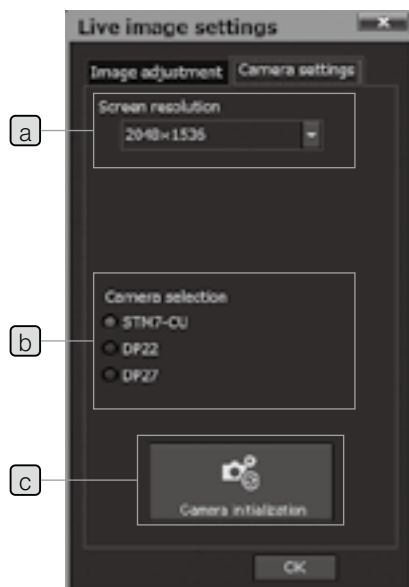
	Names	Descriptions
a	Image resolution[*1]	The selectable resolution is changed depending on the camera selected in [Camera selection]. To draw the live image in the binning mode, select the resolution shown with "(Binning)".
b	Camera selection	Selects the camera to be used.
c	Camera initialization	Initializes the exposure time and the white balance information.

*1 You can select the camera resolution from either high resolution or low resolution.

High resolution: Highest camera resolution

Low resolution: Resolution lower than high resolution
The binning mode can also be selected in addition to the normal mode.

◎ In general, when the high resolution is selected, the image is displayed clearly, but the frame rate of the live image becomes slower than that of the lower resolution.
When the binning mode is selected, you can acquire the brighter image with less noise than that in the normal mode.

3   Auxiliary display
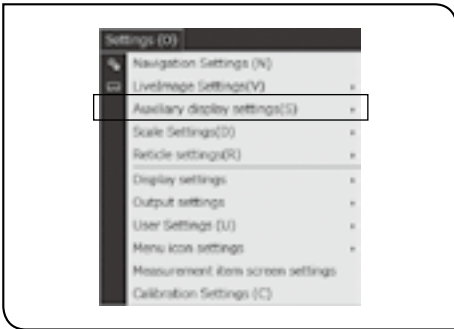
This is displayed when the [Advanced settings] is selected in the [Auxiliary display settings] in the [Settings] menu.

Names	Descriptions
a Display grid	Displays the grid (cross hairs) on the live image. Click the ⬚ button to change the grid color.
b Position	Sets the grid position using the scroll bar of the vertical and horizontal position. ◎ If the reticle of the eyepiece is different from the grid display position, confirm the position on the live screen to set it. Click the [Center] button to return to the initial setting (center of the live screen).
c Display auxiliary lines	Displays the auxiliary line to the grid at the angle specified. Click the ⬚ button to change the color of the auxiliary line.
d Display X- and Y-axis	Displays the X-axis and the Y-axis in the upper left area of the live screen. Click the ⬚ button to change the color of the X-axis and the Y-axis.

4　Scale
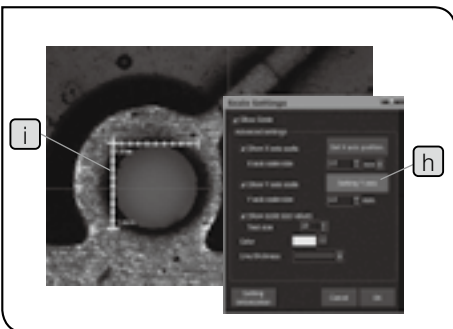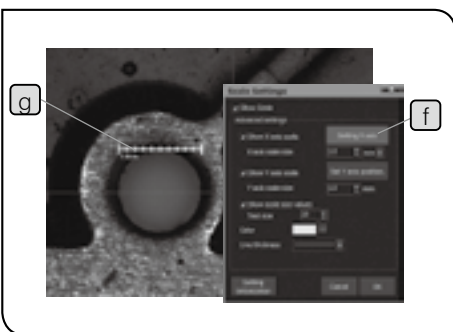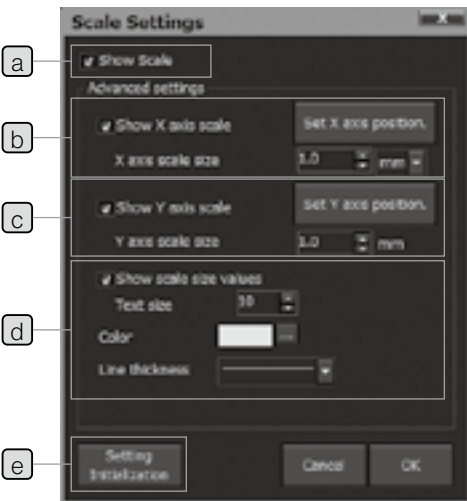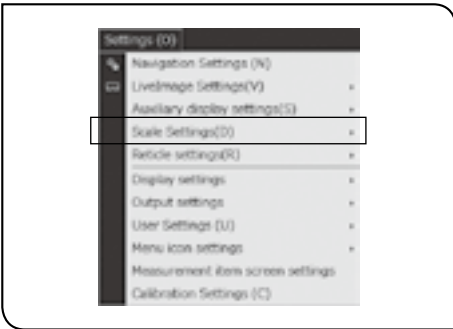
This is displayed when the [Advanced settings] is selected in the [Scale view settings] in the [Settings] menu.

CAUTION To display the scale properly, the calibration must be performed in advance. Refer to "1-4　Calibration" (page 12) for details.

Names	Descriptions
a Display scale	Displays the scale. ◎ The initial scale display position is the center of the live screen.
b Display X-axis scale	Displays the X-axis scale. Click the [Set X-axis position] button to adjust the scale position.[*1] Sets the scale size.
c Display Y-axis scale	Displays the Y-axis scale. Click the [Set Y-axis position] button to adjust the scale position.[*2] Sets the scale size.
d Display scale size value	Displays the scale. Sets the scale text size, scale color and line thickness.
e Setting initialization	Returns the settings to the initial status. CAUTION **Even though you click the [Cancel] button after clicking the [Setting initialization] button, the initialization cannot be canceled.**

*1　Procedure to set the X-axis position

1 Click the [Set X-axis position] button [f] to set to the [Setting X-axis] status.

2 Drag the X-axis scale [g] on the live image.

3 Click the [Setting X-axis] button [f] to set to the [Set X-axis position] button status.

*2　Procedure to set the Y-axis position

1 Click the [Set Y-axis position] button [h] to set to the [Setting Y-axis] status.

2 Drag the Y-axis scale [i] on the live image.

3 Click the [Setting Y-axis] button [h] to set to the [Set Y-axis position] button status.

CAUTION If you move the scale out of the live screen, click the [Setting initialization] button [e] to return the scale to the initial status.

5 Reticle
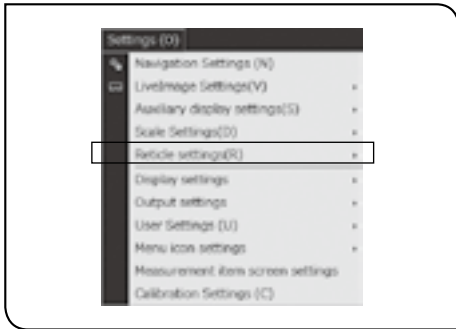
This is displayed when the [Advanced settings] is selected in the [Reticle settings] in the [Settings] menu.

(CAUTION) **To display the reticle properly, the calibration must be performed in advance. Refer to "1-4 Calibration" (page 12) for details.**
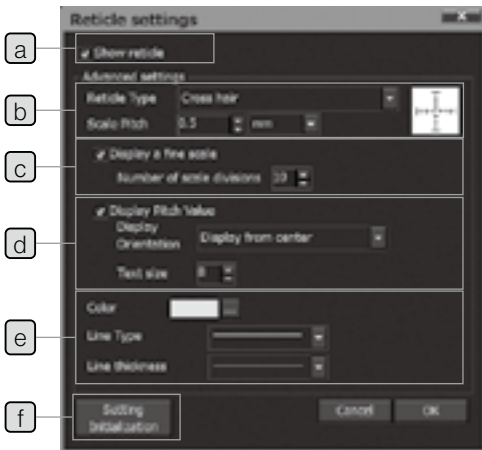
Names	Descriptions
a Show reticle	Displays the reticle.
b Reticle type / Scale pitch	Selects the reticle type[*1] and sets the scale pitch.
c Display a fine scale	Displays a fine scale. Sets the number of divisions as well.
d Display pitch value	Displays the pitch value. Sets the direction[*2] and the text size to display the pitch value.
e Color/Line type/ Line thickness	Sets the reticle color, line type and line thickness.
f Setting initialization	Returns the settings to the initial status. (CAUTION) **Even though you click the [Cancel] button after clicking the [Setting initialization] button, the initialization cannot be canceled.**

*1 Reticle types

Cross hair:
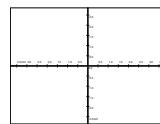
Concentric circle:
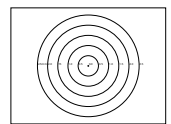
Cross concentric circle:
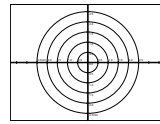
Grid:
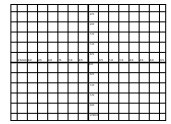
*2 Direction to show the pitch value

Show from the center: Start point 0

Show from lower left: Start point 0 / Start point 0
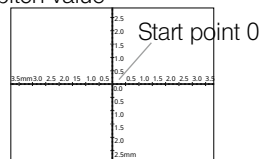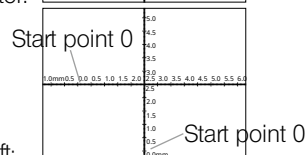
6 Display

The style of each window is set.
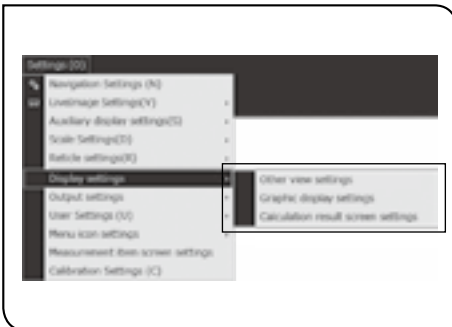
This is displayed when either [Other view settings], [Graphic screen settings] or [Calculation result screen settings] is selected in [Display settings] in the [Settings] menu.

General settings

This is displayed when the [Other view settings] is selected in [Display settings] in the [Settings] menu.
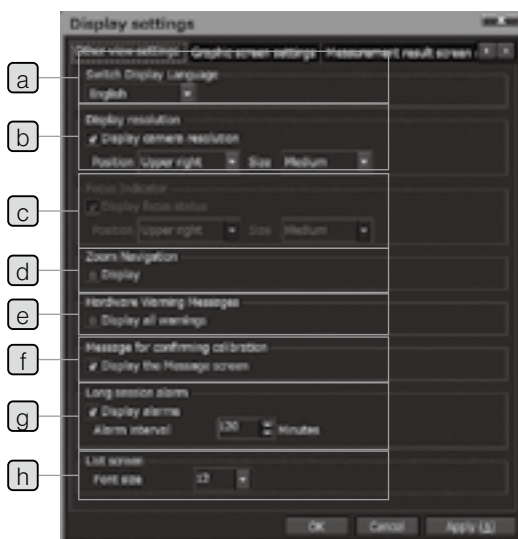
Names	Descriptions
a Switch display language	Selects the language of the software screen among 9 languages: English, Simplified Chinese, Korean, Traditional Chinese, Japanese, Spanish, Portuguese, German and Russian. ◎ When the language is changed, restart the software.
b Display resolution	Sets the display position and the size of the camera resolution.
c Focus indicator	Sets the display position and the size of the focus indicator (page 139).
d Zoom navigation	Displays the zoom navigation (See page 163).
e Hardware warning message	Displays the hardware warning message.
f Message for confirming calibration	Displays the message for confirming calibration.
g Long session alarm	Displays the alarm when the software is used for long hours. The time can be set from 1 to 720 minutes. ◎ From the time when the [Display settings] screen is closed, the alarm start counting with the new settings.
h List screen	Sets the text size of the [List] window. The size can be set from 9 to 72.

*1 Language names displayed by each language.

English	Japanese	Simplified Chinese	Korean	Traditional Chinese
Japanese	日本語	日语	일본어	日文
English	英語	英语	영어	英文
Simplified Chinese	中国語(簡体字)	简体中文	중국어 간체	簡體中文
Korean	韓国語	韩语	한국어	韓文
Traditional Chinese	中国語(繁体字)	繁体中文	중국어 번체	繁體中文
Spanish	スペイン語	西班牙语	스페인어	西班牙文
Portuguese	ポルトガル語	葡萄牙语	포르투갈어	葡萄牙文
German	ドイツ語	德语	독일어	德文
Russian	ロシア語	俄语	러시아어	俄文

English	Spanish	Portuguese	German	Russian
Japanese	Japonés	Japonês	Japanisch	Японский
English	Inglés	Inglês	Englisch	Английский
Simplified Chinese	Chino simplificado	Chinês simplificado	Vereinfachtes Chinesisch	Китайский упрощенный
Korean	Coreano	Coreano	Koreanisch	Корейский
Traditional Chinese	Chino tradicional	Chinês tradicional	Traditionelles Chinesisch	Традиционный Китайский
Spanish	Español	Espanhol	Spanisch	Испанский
Portuguese	Portugués	Português	Portugiesisch	Португальский
German	Alemán	Alemão	Deutsch	Немецкий
Russian	Ruso	Russo	Russisch	Русский

Setting graphic screen

This is displayed when the [Graphic screen settings] is selected in [Display settings] in the [Settings] menu.

The display contents of the [Graphic] window are set.
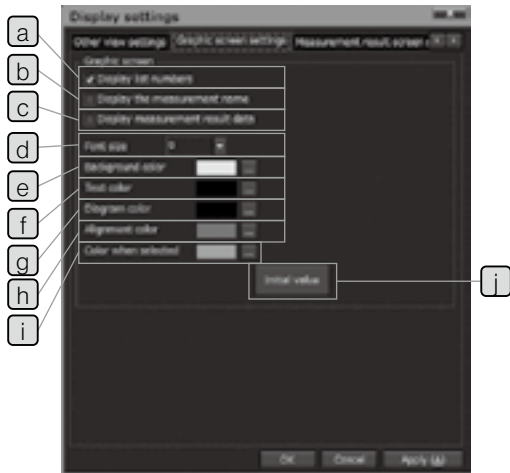
Names	Descriptions
a Display list number	Displays list numbers in the [Graphic] window.
b Display measurement name	Displays the measurement item names in the [Graphic] window. ◎ For editing the measurement item names, refer to "Input window" (page 64).
c Display measurement result data	Displays the measurement results in the [Graphic] window.
d Font size	Sets the text size of list numbers and measurement item names.
e Background color	Sets the background color of the [Graphic] window.
f Text color	Sets the display color of list numbers and measurement item names.
g Figure color	Sets the display color of the figure.
h Alignment color	Sets the display color of the alignment.
i Color when selected	Sets the display color of the figures selected when performing the recall measurement or editing the design values.
j Initial value	Returns the settings to the initial status[1].

*1   Initial status of graphic screen setting

Item	Initial status
Display list number	Checked
Display the measurement name	Unchecked
Display measurement result data	Unchecked
Font size	9
Background color	White
Text color	Black
Figure color	Black
Alignment color	Red
Color when selected	Cyan

Setting measurement results screen

This is displayed when the [Calculation result screen settings] is selected in [Display settings] in the [Settings] menu.

The display contents of the [Measurement results] window are set.
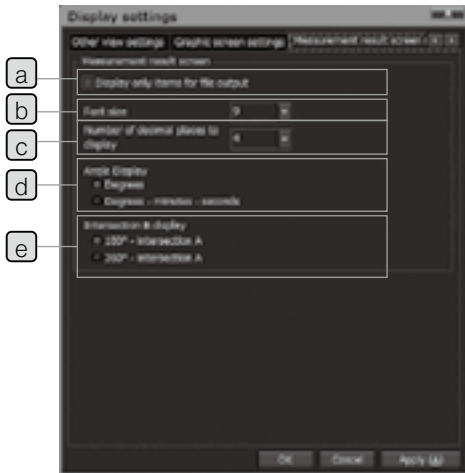
Names	Descriptions
[a] Display only items for file output	Displays only items to be transferred to the report in the [Measurement results] window. ◎ The report output measurement items can be set by selecting [List output settings] in [Output settings] in the [Settings] menu.
[b] Font size	Sets the text size of measurement results to be displayed in the [Measurement results] window.
[c] Number of decimal places to display	Sets the number of decimal places of measurement results to be displayed in the [Measurement results] window.
[d] Display angle	Sets the procedures to display the angle measurement data. ◎ If [Degrees, minutes, seconds] is used, the cell of the data transferred to Excel® is displayed in string format.
[e] Display Intersection angle B [*1]	Sets the procedures to display the intersection angle B calculated in the intersection measurement between line and line.

*1   Display of intersection angle B

180 degrees - Intersection angle A: 360 degrees - Intersection angle A:
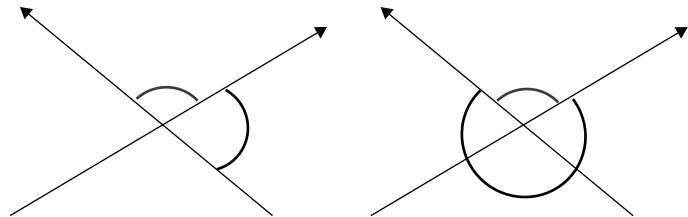
7　Output
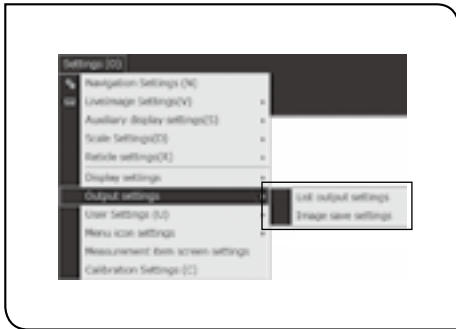
This is displayed when either [List output settings] or [Image save settings] is selected in [Output settings] in the [Settings] menu.

Setting list output

This is displayed when [List output settings] is selected in [Output settings] in the [Settings] menu.

◎ Whether or not measurement items are output to the report when performing measurements depends on the settings on this screen. Therefore, even if you change the settings after performing measurements, the measurement items are output according to the settings that existed while measurements were being performed.

	Names	Descriptions
a	Initial tolerance value	Input the value to be used as an initial tolerance value when the new measurement item was added to the [List] window.
b	Assign serial numbers when copying	The list name added during the repeat measurement, move copy or rotate copy measurement will be "Selected list name"-"Serial number".
c	Maximum number of replays	Sets the maximum number of times to perform the replay measurement. Can be set up to 50 times. ◎ If the maximum number of replay times is changed, restart the software. ◎ Depending on the performance of the controller, if the number of replay times is large, it may take a long time to start the software. It is recommended to set the number of replay times suitable for measurement.
d	Measurement items	Select the measurement items to change for the output to the report.
e	Measurement items	Sets the measurement result items outputted from measurement items selected in c. ◎ This setting sets whether or not an item is output to the report. To display the results of measurement items according to these settings in the [Measurement results] window, select [Measurement result screen setting] in [Display setting] on the [Setting] menu and check [Display only items for file output].
f	Output all items	Outputs all measurement result items.
g	Restore the default value	Returns the settings to the initial status.

Image save settings

This is displayed when [Image save settings] is selected in [Output settings] in the [Settings] menu.

	Names	Descriptions
a	JPEG compression quality	Sets the file compression quality when saving the live image in JPEG file format. The size can be set from 0 to 100.
b	Always save with the resolution of the normal image (high resolution).	Even though the live image is displayed at low resolution including the binning mode (page 167), the image is saved at high resolution. ◎ The extended focus image or the stitched image is saved at the resolution when acquiring each image.
c	Correct alignment when saving	When saving the graphic image, the graphic is corrected by setting the aligned coordinate system in the horizontal direction before saving.

8 User

The user operations can be controlled by setting the user authentication.

This function is enabled when the user authorized as Administrator checks in [Authenticate user on startup] in [User settings] in the [Settings] menu. If the user authentication is not performed, other users can perform the same operations as the authorized Administrator.

User authority

Users are divided into three authorities as shown below.

The available software operations differ depending on each authority.

User authority	User name	User ID	Password	Available operations
Guest	Guest (Fixed string)	Guest (Fixed string)	None	·Software operations
Operator	Arbitrary input[*1]	Arbitrary input[*2]	Arbitrary input[*3]	·Software operations ·Update user's own registration information
Administrator	Arbitrary input[*1]	Arbitrary input[*2]	Arbitrary input[*3]	·Software operations ·Enable/disable the user authentication at software startup. ·Add/update/delete other users.

*1 Can be set up to 15 two-byte characters or 30 one-byte characters
*2 Can be set up to 10 two-byte characters or 20 one-byte characters
*3 Settable up to 20 characters (only one-byte)

Setting user authentication
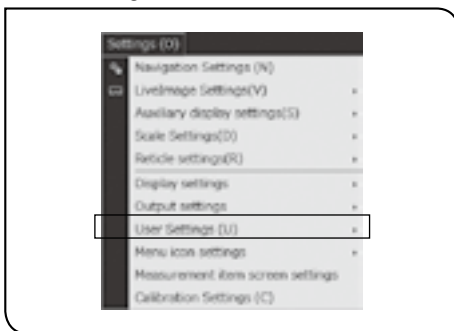
This is displayed when the [User information] is selected in [User Settings] in the [Settings] menu.

Names	Descriptions
[a] User ID	Displays the user ID to be inputted in the login authentication screen. Double-clicking this item will display the user correction screen.
[b] User name	Displays the user name displayed when transferring reports, etc. Double-clicking this item will display the user correction screen.
[c] Password	Displays the password to be inputted in the login authentication screen. All are displayed by "*".
[d] User authority	Displays the user authority.
[e] Delete selector	Deletes the user currently selected. If logging in with the operator authority, this item cannot be clicked.
[f] Modify selector	The user correction screen is displayed. Correct the user currently selected. If logging in with the operator authority, users other than those who are logging in cannot be corrected.
[g] Add users	The user registration screen is displayed. Register a new user. If logging in with the operator authority, this item cannot be clicked.

User registration

The user who can login the software is newly created.

This can only be set if you log in with the user ID of a user that has administrator's rights.

This window is displayed when the [Add users] button is clicked in [User information screen].

Names	Descriptions
[a] User ID	User ID inputted on the login authentication screen Up to 10 two-byte characters or 20 one-byte characters can be input.
[b] User name	User name displayed when transferring reports, etc. Up to 15 two-byte characters or 30 one-byte characters can be input.
[c] Password	Password to be inputted on the login authentication screen Only one-byte characters can be input, the maximum is 20.
[d] Password (for confirmation)	Input the same string as [Password].
[e] User authority	Sets the user authority.

Correction of user information

The user information registered is corrected.

In the [User correction screen] displayed when the [Modify selector] button is clicked in the [User information screen], set in the same way as in "User Registration".

Login authentication

The login authentication screen appears when the software starts up if you have checked [Authenticate User on Startup] in the [User Settings] on the [Setting] menu.
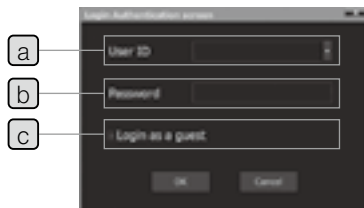
Names	Descriptions
[a] User ID	Input the user ID registered.
[b] Password	Input the password registered.
[c] Login as a guest	Login as a guest user.

9 | Menu icons

The display of menu icons are set in the upper area of the software screen.
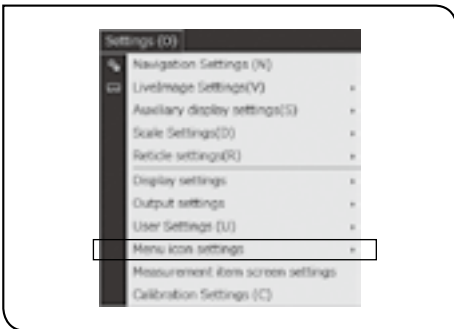
This is displayed when [Menu display item settings] is selected in [Menu icon settings] in the [Settings] menu.
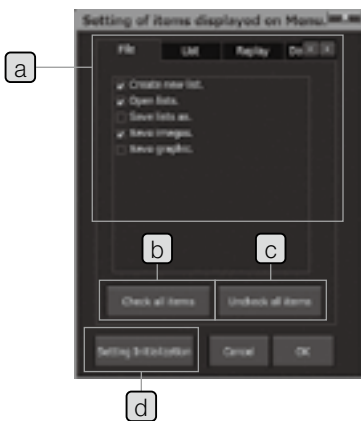
	Names	Descriptions
a	File/List/Replay/Data Output/Extended Functions/Setting/ Guide	Displays the icons of the checked items on the software screen.
b	Check all items	Checks all items.
c	Uncheck all items	Unchecks all items.
d	Setting initialization	Returns the settings to the initial status.

10 Measurement items screen
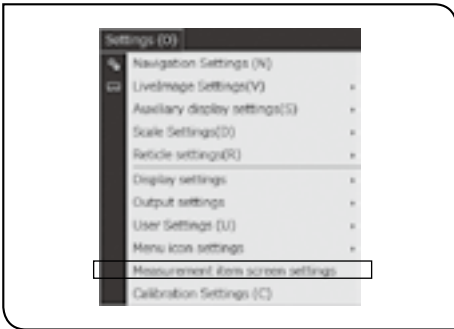
This is displayed when the [Measurement item screen settings] is selected in the [Settings] menu.

The items checked in the [Measurement items screen settings] are displayed in the [Measurement items] window.

XY plane

Display settings of measurement items buttons of "Direct measurement", "Recall measurement", "Alignment" and "Virtual point.
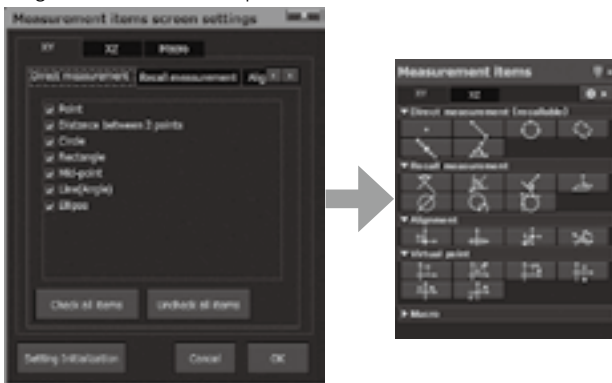
XZ plane

Display settings of measurement items buttons of "Direct measurement" and "Recall measurement".
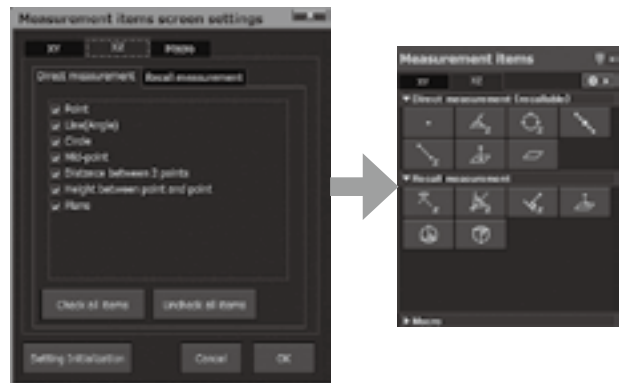
Macro

Display settings of measurement items buttons of "Direct measurement" and "Recall measurement".
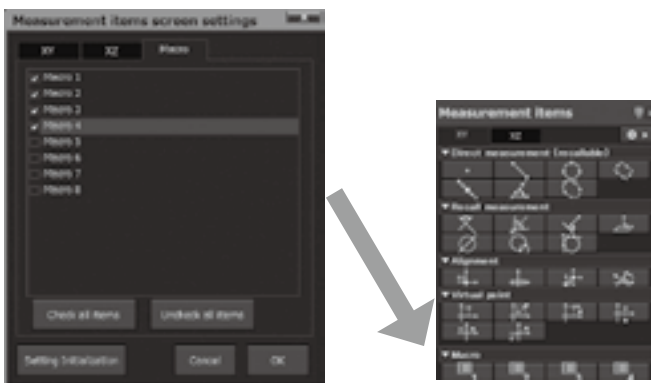
11 Communications

The connections with the digital indicator are set.

When using STM7

When using STM6/STM6-LM
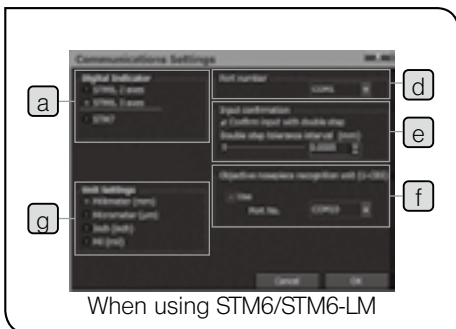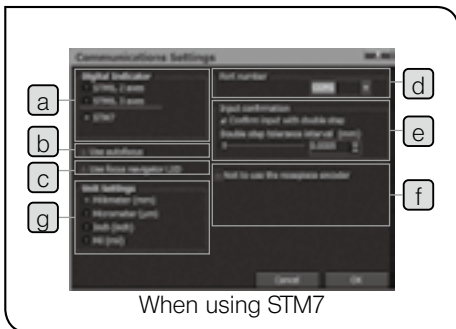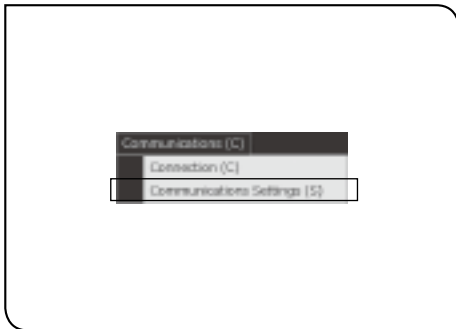
Select [Communications settings] in the [Communications] menu.

◎ If [Communications Settings] is grayout, click [Connection] to make it unchecked.

Names	Descriptions
a Counter	Select the digital indicator to be used.
b Use autofocus	When using the STM7 autofocus unit STM7-AF, check this item. ◎ When using STM6/STM6-LM, this check box is not displayed.
c Use focus navigator LED	When using the STM7 autofocus unit STM7-AF, check this item. ◎ Enable the focus navigator by setting the DIP switch of the control box STM7-CB/STM7-CBA. (Refer to "STM7 instruction manual" for details.) ◎ When using STM6/STM6-LM, this check box is not displayed.
d Port number	Select the COM port number used for communication of X-,Y-and Z-axes. ◎ You can confirm the COM port number used for communications by the device manager of the operation system. ◎ If the assignment of the COM port is changed by the device manager of the operating system, restart the controller and select the COM port No. on this screen. If you do not restart the controller, the port may not be recognized properly.
e Input confirmation	When using the double step for confirming input points, check this item and specify the tolerance interval. ◎ The double step is an operation to input the same coordinates consecutively. (It means to operate as if double-clicking the digital Indicator STM7-DI, Hand Switch STM7-HS, DATA button of Focus Controller STM7-MCZ or Foot Switch STM7-FS.) ◎ Set considering the resolution and the measurement accuracy of the digital indicator. ◎ If the tolerance interval is narrow, the software cannot recognize it as the same coordinate. Therefore, input points cannot be confirmed even though performing the double step. In this case, make the tolerance interval wider than the current value.

When using STM7

When using STM6/STM6-LM

Names	Descriptions
f Objective nosepiece recognition unit (U-CBS)	When using the coded revolving nosepiece, check this item and select the port number you want to use. ◎ When using STM7, the [Not to use the nosepiece encoder] check box is displayed instead of this group box. The coded revolving nosepiece is recognized automatically, but when you do not use the coded revolving nosepiece, check the [Not to use the nosepiece encoder] check box.
g Unit settings[*1]	Set the unit of the coordinate data. ◎ The settings are reflected only when using STM7. ◎ The unit can be specified by setting the DIP switch the control box STM7-CB/STM7-CBA, but while this software is running, the unit specified by this software is reflected. ◎ When using STM6, this group box is not displayed. The data is displayed in the unit of mm. ◎ The settings of the values shown below are reflected. · Interval of reticle lines · Scale length · Navigation interval · Upper and lower tolerance limit · [Edit design values] window (See 99 page for details.) · [Recall information] window (See 82 page for details.) · [Double step tolerance interval] in the [Communications settings] window. ◎ If you change the unit, the initial value is displayed. When you change the unit, set the relevant setting items again.

*1 You will not be able to use unit selection if you start measuring and create a list.
If the measurement items (teaching lists) are in the [List] window,

click the (Create New) button in the menu to set so that there are no measurement items in the [List] window.

5 Troubleshooting

Under certain conditions, the performance of this software may not be exhibited properly by factors other than failures depending on use procedures. If problems occur, please review the following list and take an appropriate action. If you cannot solve the problem, please contact Evident for assistance.

Problem	Cause	Remedy	Reference page
The software does not start.	Installation of the driver for the STM7-BSW may fail and the software may not start because of the type of controller.	Execute setup.exe (or setup) in the following folder of the installation media, and install the camera driver to the controller. C:\Program Files (x86)\OLYMPUS\STM7\Device Camera\STM7-CU\64 (For 32-bit controllers, C:\Program Files\OLYMPUS\STM7\Device Camera\STM7-CU\86)	-
	The protect key is not attached properly.	Attach the protect key to the controller properly.	-
When the software starts, "Security Key Not Found" is displayed.	The protect key is not attached properly.	Attach the protect key to the controller properly.	-
The communication with the digital indicator is not enabled.	The device is not connected properly.	Connect the device properly. Some controllers have 2 COM ports. Connect to Port No. specified by the software.	181
	The communications are not set correctly.	Confirm the communication settings again.	181
	The change of port settings is not reflected.	If the COM port settings are changed by the device manager of the operating system, restart the controller. If you do not restart the controller, this software may not be able to recognize the COM port and the communication may not be enabled.	-
The software screen does not appear on the monitor.	The device is not connected properly.	Connect the device properly. Some controllers have 2 monitor connection ports. Confirm the connection destination.	-
The window layout positions are shifted.		Reset the layout positions.	164
The coordinates cannot be inputted from the external trigger (foot switch).	The external trigger is not connected properly.	Connect the external trigger properly.	-
The double step input is not available.	The double step input is not enabled.	Enable the double step input in [Communications settings].	181
	The double step tolerance interval is not correct.	Confirm the double step tolerance interval again in [Communications settings].	181
The live image is not displayed.	The device is not connected properly.	Connect the device properly. Some controllers have 2 monitor connection ports. Confirm the connection destination.	-
	The camera is not connected properly. (When using the microscope digital camera DP22/DP23/DP27/DP28)	Terminate the controller. Connect the camera to the connector of USB 3.0 and start the controller. (Refer to the instruction manual provided with the microscope.)	-
	SC30 driver for is installed. (When using STM7-CU)	Open the device manager from the control panel and delete the SC30 driver.	-

Problem	Cause	Remedy	Reference page
The controller or the software is frozen or the blue screen appears. (When using the digital camera STM7-CU)	The camera is not connected properly.	Terminate the controller. Connect the camera to the connector of USB 2.0 and start the controller. (Refer to the instruction manual provided with the microscope.)	-
The live image is displayed in black.	The light path selector knob of the trinocular tube is placed at the ◁ position.	Place it at the ◻ position. (Refer to the instruction manual provided with the microscope.)	-
The live image is displayed in reddish color during observation with transmitted light illumination.	The Auto white balance is enabled.	Adjust the white balance with One-touch and change the white balance to Manual setting.	166
The live image is updated slowly or the software works slowly.	Other software is running.	Close this software and all other software except Excel®.	-
	The image is updated slowly due to insufficient brightness. (When [Exposure time adjustment] is set to [Auto].)	In the [Illumination] window, adjust the value set for the brightness to make the illumination brighter.	156
The grid is not displayed.	The grid display is not enabled.	Enable the grid display in [Live image settings].	168
The reticle of the eyepiece is different from the center position of the grid.	The grid display position is not correct.	Confirm the grid display position in [Live image settings] again.	168
The navigation is not displayed.	The navigation display is not enabled.	Enable the navigation display in [Navigation settings].	165
	It is not aligned.	Perform the alignment.	83
The edges cannot be detected properly by the edge tool.	The brightness is not appropriate.	When you are using the test piece, set the exposure time to AUTO and the white balance to One touch. This can be set in the [Image adjustment] in [Live image settings] in the [Setting] menu. While looking into the eyepiece, adjust the illumination roughly to make the contrast of the image clear. Then, adjust the illumination on the live image of the software.	167
Some operation has caused the detection point of the edge tool to be misaligned, even though no observation conditions were changed.	A different location may be detected as the edge when searching for the edge again is performed because the intensity difference of the object being measured is not large enough to trigger the threshold value set for the edge tool. Alternatively, the edge detection position may be changed because of a slight change in the position of the object being measured by the edge tool due to the disparity in the magnification in the display when the display was changed between fit display and 100% display.	Check the profile to be sure there is a sufficient difference of luminosity at the edge area and then adjust the threshold value. Alternatively, note that in some cases, changing the display format may misalign the position of the edge tool and alter the detected position.	125 156
The files cannot be transferred to Excel®.	Excel® is not installed on the controller.	Install Excel® on the controller.	-
	The Excel transfer settings are not correct.	Confirm the output settings again.	175

Problem	Cause	Remedy	Reference page
The direction to move the stage is opposite to the direction of the image displayed in [Graphic] window.	The direction to attach the camera is not correct.	Attach the camera correctly.	-
	The counting direction of the counter is reversed.	Review the instruction manual provided with the microscope and set the counting direction of the digital indicator correctly.	-
Lists cannot be opened. (The message "There are measurement items in the list. You cannot change the edge tool." appears.)	Lists created in the direct measurement are opened in the measurement using the edge tool.	Set the edge tool to OFF before opening the lists created in the direct measurement.	124
The live image is not updated even though the stage is moved.	[Execute live] in [Live image settings] is not enabled. (The drawing of the live image is paused.)	Click [Execute live] in [Live image settings] to make it checked and start drawing the live image.	-
When Microsoft® Office is uninstalled, this software does not start.	When Microsoft® Office is uninstalled, the information referred by this software is deleted from the controller.	Uninstall this software and install again.	5

Term	Explanation
BMP file format	Format to save the image as a still image.
COM port	When using STM7: Port to connect to the control box STM7-CB/CBA. When using STM6/STM6-LM: Port to connect to the digital indicator.
CSV file format	Format to output the data dividing by ","(comma). Example: 50,30,20
Excel transfer	Operation to transfer the measurement results to Excel®
JPEG file format	Format to save the image as a still image.
Active book	File selected among Excel® files currently opened.
Alignment	Operation to determine the origin or the X-axis of the measurement objects
Move copy	Operation to copy the lists per specified movement distance
Indicator	Round-shape reference point which is outputted when the navigation function is used
Rotate copy	Operation to copy per specified angle
External trigger	External switches such as foot switch, etc.
Counter	Device attached to the measuring microscope to display the stage movement distance
Extension	String to recognize the files. Example: test.xls (".xls" is an extension.)
Graphic window	Window to express the measured points or circles visually
Grid	Cross hair displayed on the live image
Cross line	Position where the grids are intersected
Origin	Point where both X and Y coordinates are (0,0).
Tolerance	Permitted limit in terms of designs
Copy measurement	Operation to repeat one measurement item consecutively
Re-measure	Operation to re-measure the position which was measured once
Maximum number of replay times	Maximum number of measurement times of replay measurement (up to 50 times)
Get coordinates	Operation to acquire the coordinate values from the digital indicator in the direct measurement.
Specified book	Specified Excel® file
Auto save	Function to save files (Excel®/CSV file format) automatically.
New book	New Excel® file
Design value	Values specified in the design documents The value of the teaching lists are initial values.
Measurement results window	Window to display calculation results of coordinates of measurement points
Measurement items window	Window to display measurement items using icons
Double step	Action to input same coordinates consecutively and confirm the coordinate data
Double step tolerance interval	Tolerable range regarded as same coordinate values when performing the double step
Direct measurement	Measurement method by acquiring the coordinate data from the measuring microscope.

Term	Explanation
Delete in front	Operation to delete the coordinate data inputted last in the multipoint input measurement
Teaching list	List where measurement methods are saved
Navigation	Function to guide to the measurement point when performing "Replay measurement" or "Partial replay measurement"
Path	Strings to show locations of files or folders
Foot switch	Device to input or confirm using the foot
Partial replay	Replay measurement of selected part of lists
Live window	Window to display images from the camera
Recall	Measurement method using the previous measurement results.
List window	Window to display measurement procedures
Replay measurement	Operation to repeat measurement items in the teaching lists consecutively.

A List of measurement items

A-1 XY

1 Direct measurement/recall measurement items
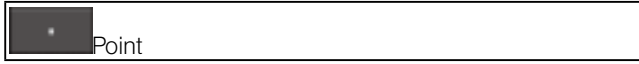
	Point

Function

By acquiring the coordinates of multiple points (from 1 to 100 points) or inputting the recalled coordinates, the average point is calculated.
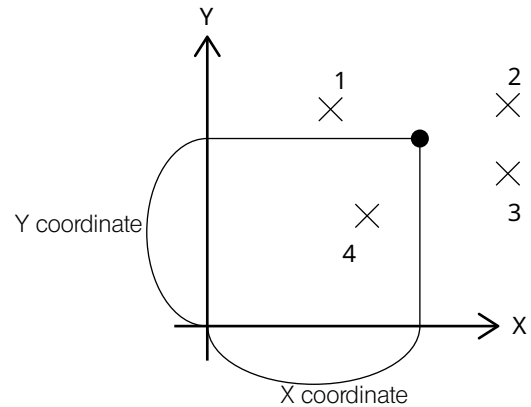
Measurement results

Number	Measurement items	Item	Sample 1	
001	Point	X coordinate	1.2345	X coordinate of average point
001	Point	Y coordinate	1.2345	Y coordinate of average point
001	Point	Z coordinate	0.1234	Z coordinate of average point

Recall output

The coordinate data can be recalled as a point.

	Distance between 2 points

Function

By acquiring the coordinate of 2 point or inputting the recalled coordinate, the origin is set.
Distance between 2 points
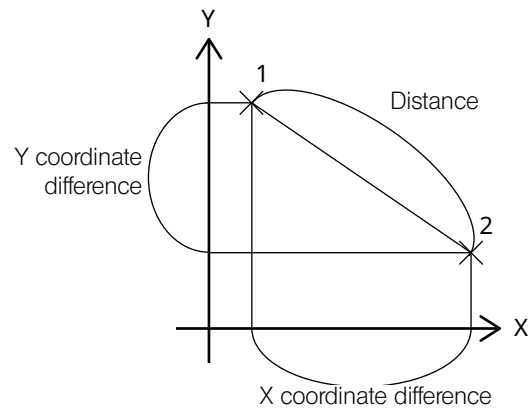
Measurement results

Number	Measurement items	Item	Sample 1	
010	Distance between point and point	Distance	2.8284	Distance between 2 points
010	Distance between point and point	Coordinate difference X	2.0000	X coordinate difference between 2 points
010	Distance between point and point	Coordinate difference Y	-2.0000	Y coordinate difference between 2 points

The coordinate difference is a value subtracting the coordinate value of the first point from the second point.

Recall output

The coordinate data can be recalled as a line.
The line direction is determined by the direction toward the second point form the first point.
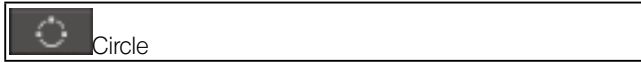
⟳ Circle

Function

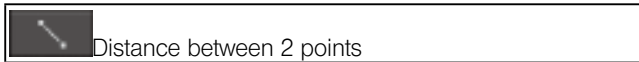By acquiring the coordinates of multiple points (from 3 to 100 points) or inputting the recalled coordinates, the circle determined by the least- squares method is calculated.
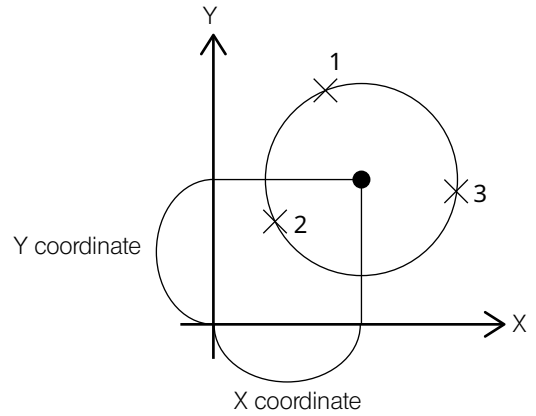
Measurement results

Number	Measurement items	Item	Sample 1	
001	Circle	X coordinate	1.62162	X coordinate of the center
001	Circle	Y coordinate	-5.1241	Y coordinate of the center
001	Circle	Z coordinate	-0.0018	Z coordinate of the center
001	Circle	R radius	14.5352	Radius of the circle
001	Circle	D diameter	29.0704	Diameter of the circle
001	Circle	Circularity	0.3009	*1
001	Circle	Positional tolerance	0.0000	*2

Recall output

The center of the circle can be recalled as a point or as a circle.

*1   Circularity
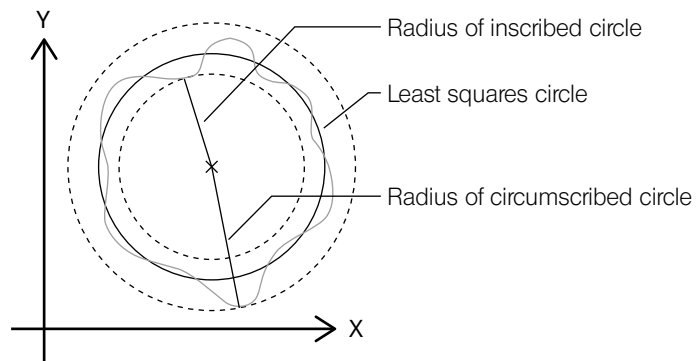
The circularity is calculated by the least- squares method.
The circularity is calculated by the difference between the radius of the inscribed circle and the circumscribed circle which are concentric with the center of the least squares circle. (Circularity=Radius of the circumscribed circle - Radius of the inscribed circle)

◎ The circularity is calculated when coordinates of 4 or more points are acquired or the recalled coordinates are inputted.

It is not calculated if 3 points are inputted.

*2   Positional tolerance

Within positional tolerance

Out of positional tolerance
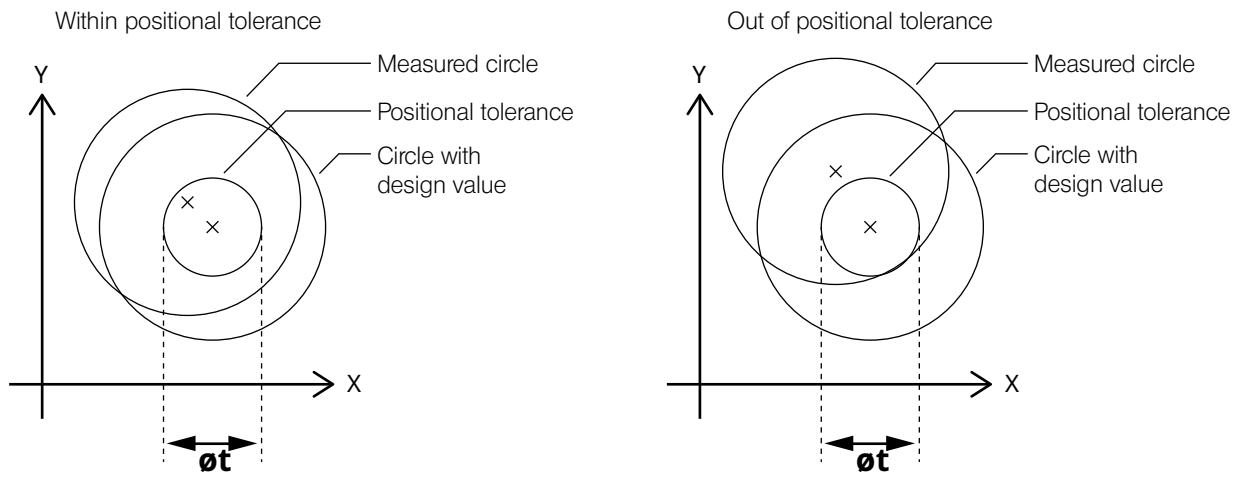
Judge whether the coordinates of the center of the measured circle are in the circular intersection area with diameter t.

◇ Rectangle
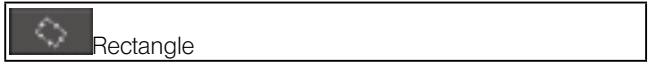
Function
By acquiring the coordinates of 5 points from P1 to P5 or inputting the recalled coordinates, the square determined by the line passing P1 and P2 as a bottom, line passing P3 and P4 as a width and line passing P5 as a height is calculated.
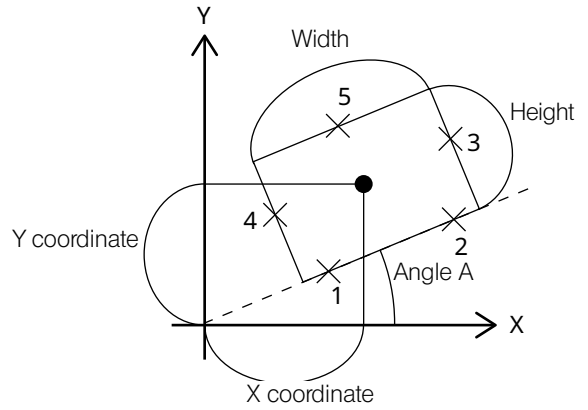
Measurement results

Number	Measurement items	Item	Sample 1	
009	Rectangle	Width	2.0000	Width of rectangle
009	Rectangle	Height	2.0000	Height of rectangle
009	Rectangle	Angle A	0.0000	Angle of the side in the width direction
009	Rectangle	X coordinate	0.0000	X coordinate of the center
009	Rectangle	Y coordinate	0.0000	Y coordinate of the center
009	Rectangle	Z coordinate	0.0000	Z coordinate of the center

Recall output
The center of the rectangle can be recalled as a point.

![Midpoint icon] Midpoint
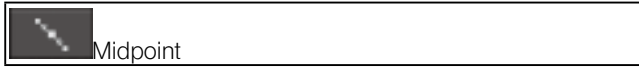
Function
By acquiring the coordinate of 2 point or inputting the recalled coordinate, the mid-point is set.
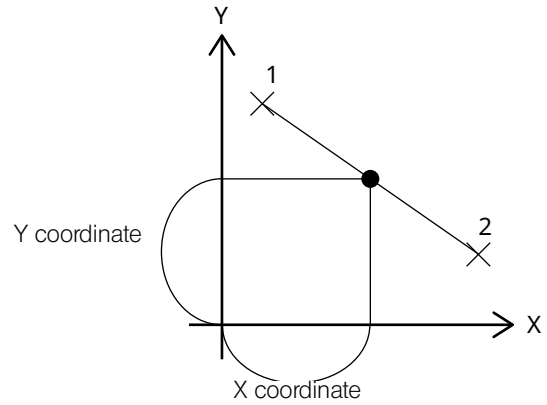
Measurement results

Number	Measurement items	Item	Sample 1	
008	Mid-point	X coordinate	0.0000	X coordinate of the mid-point
008	Mid-point	Y coordinate	1.0000	Y coordinate of the mid-point
008	Mid-point	Z coordinate	0.0000	Z coordinate of the mid-point

Recall output
The coordinate data can be recalled as a point.

![Line (Angle) icon] Line (Angle)

Function
By acquiring the coordinates of multiple points (from 1 to 100 points) or inputting the recalled coordinates, the line determined by the least-squares method is calculated.
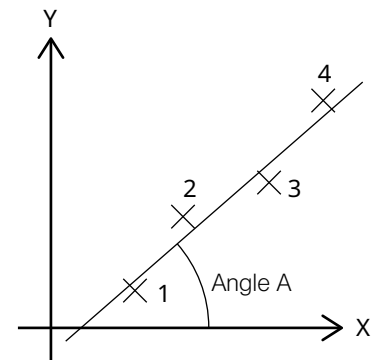
Measurement results

Number	Measurement items	Item	Sample 1	
003	Line (Angle)	Angle A	45.0000	Line angle

Recall output
The coordinate data can be recalled as a line.

The line direction is determined by the direction toward the second point form the first point.
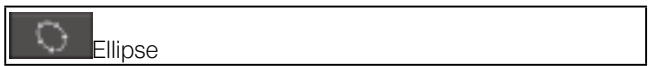
	Ellipse

Ellipse

Function
By acquiring the coordinates of multiple points (from 5 to 100 points) or inputting the recalled coordinates, the ellipse determined by the least-squares method is calculated.

Measurement results

Number	Measurement items	Item	Sample 1
001	Ellipse	X coordinate	4.7419
001	Ellipse	Y coordinate	3.2156
001	Ellipse	Z coordinate	0.0000
001	Ellipse	Minor radius	3.5940
001	Ellipse	Major radius	5.7617
001	Ellipse	Angle A	15.8408
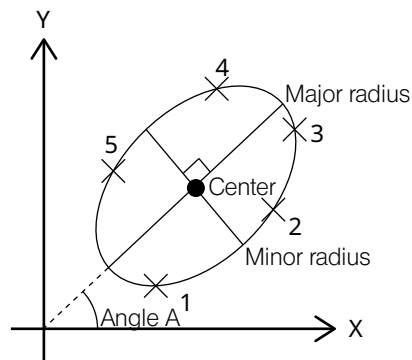
Recall output
The center of the ellipse can be recalled as a point.

Intersection between line and line (angle)
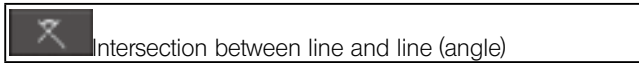
Function
By inputting the recalled 2 lines, the intersection point is calculated.
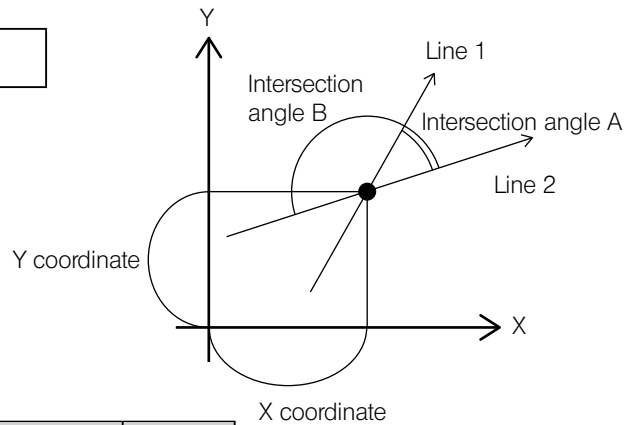
Measurement results

Number	Measurement items	Item	Sample 1	
017	Intersection between line and line	X coordinate	1.0000	X coordinate of the intersection angle
017	Intersection between line and line	Y coordinate	1.0000	Y coordinate of the intersection angle
017	Intersection between line and line	Z coordinate	0.0000	Z coordinate of the intersection angle
017	Intersection between line and line	Intersection angle A	90.0000	Intersection angle A
017	Intersection between line and line	Intersection angle B	90.0000	Intersection angle B

The intersection angle A is an angle between the direction lines of line 1 and line 2.

The intersection angle B is a supplementary angle for 180 degrees of the angle A.

Recall output

The coordinate data can be recalled as a point.

Center line

Function
By inputting the recalled 2 lines, the center line 1 and the center line 2 are calculated.

Measurement results

Number	Measurement items	Item	Sample 1	
018	Center line	Angle A1	90.0000	Angle of center line 1
018	Center line	Angle A2	0.0000	Angle of center line 2
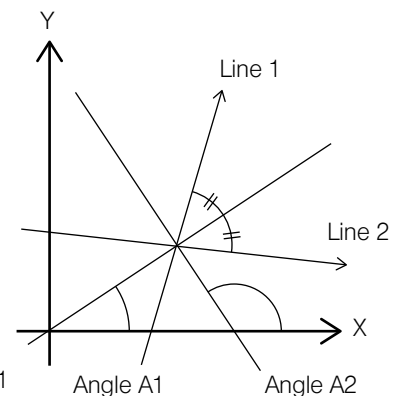
The center line 1 is a center line between the direction lines of line 1 and line 2.

The center line 2 is a perpendicular of the center line 1 at the intersection point between line 1 and line 2.

Recall output

The center line 1 and center line 2 can be recalled as a line.

Distance between point and line

Function
By inputting the recalled point and line, the distance between point and line is calculated.
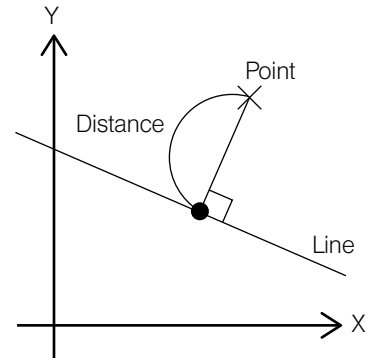
Measurement results

Number	Measurement items	Item	Sample 1	
019	Distance between point and line	Distance	0.7071	Distance between point and line

Recall output
The intersection point between perpendicular line and line can be recalled as a point.

Height between point and plane

Function
By inputting the recalled point and plane, the distance between point and plane is calculated.
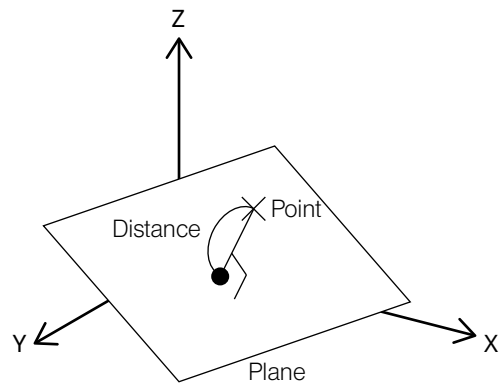
Measurement results

Number	Measurement items	Item	Sample 1	
020	Height between point and plane	Distance	1.7678	Height between point and plane

Recall output
The foot of the perpendicular line can be recalled as a point.

Ø Intersection between circle and line

Function
By inputting the recalled circle and line, the intersection point 1 and intersection point 2 are calculated.
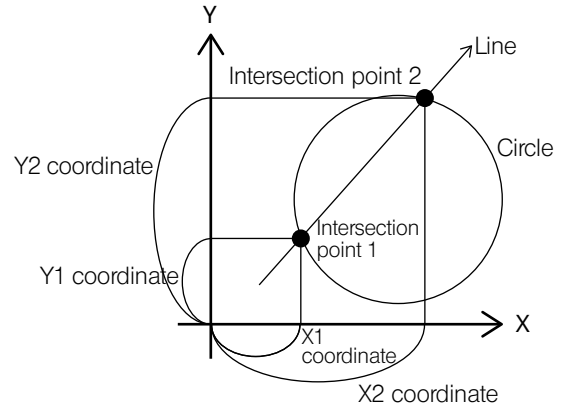
Measurement results

Number	Measurement items	Item	Sample 1	
021	Intersection between circle and line	X1 coordinate	-1.0000	X coordinate of intersection point 1
021	Intersection between circle and line	Y1 coordinate	-1.0000	Y coordinate of intersection point 1
021	Intersection between circle and line	Z1 coordinate	0.0000	Z coordinate of intersection point 1
021	Intersection between circle and line	X2 coordinate	1.0000	X coordinate of intersection point 2
021	Intersection between circle and line	Y2 coordinate	1.0000	Y coordinate of intersection point 2
021	Intersection between circle and line	Z2 coordinate	0.0000	Z coordinate of intersection point 2

The intersection point 1 is an intersection point back side of the direction line of the line.
The intersection point 2 is an intersection point front side of the direction line of the line.

Recall output
The intersection point 1 and the intersection point 2 can be recalled as a point.

Intersection between circle and circle

Function
By inputting the recalled circle and circle, the intersection point 1 and intersection point 2 are calculated.
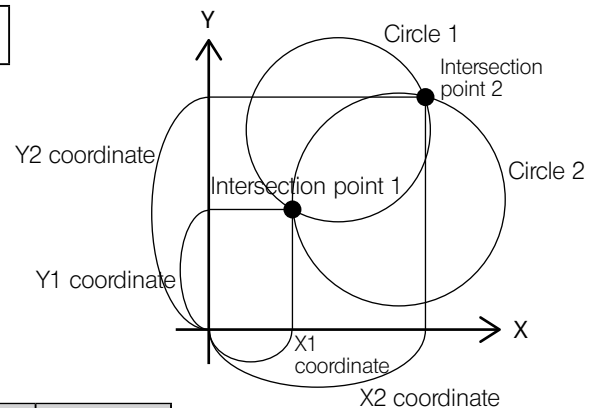
Measurement results

Number	Measurement items	Item	Sample 1	
023	Intersection between circle and circle	X1 coordinate	1.3660	X coordinate of intersection point 1
023	Intersection between circle and circle	Y1 coordinate	-0.3660	Y coordinate of intersection point 1
023	Intersection between circle and circle	Z1 coordinate	0.0000	Z coordinate of intersection point 1
023	Intersection between circle and circle	X2 coordinate	-0.3660	X coordinate of intersection point 2
023	Intersection between circle and circle	Y2 coordinate	1.3660	Y coordinate of intersection point 2
023	Intersection between circle and circle	Z2 coordinate	0.0000	Z coordinate of intersection point 2

Recall output
The intersection point 1 and the intersection point 2 can be recalled as a point.

Contact point between point and circle

Function
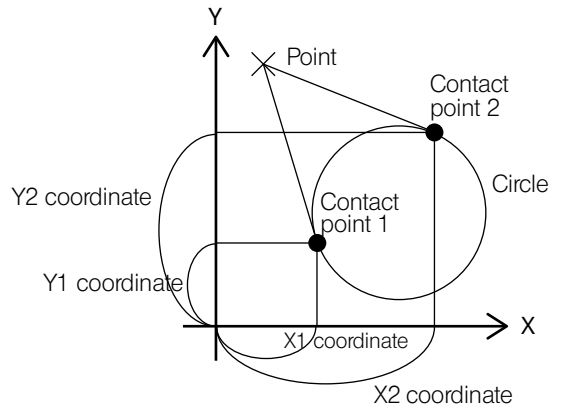By inputting the recalled point and circle, the contact point 1 and the contact point 2 between the circle and the line which passes the point and contacts the circle are calculated.

Measurement results

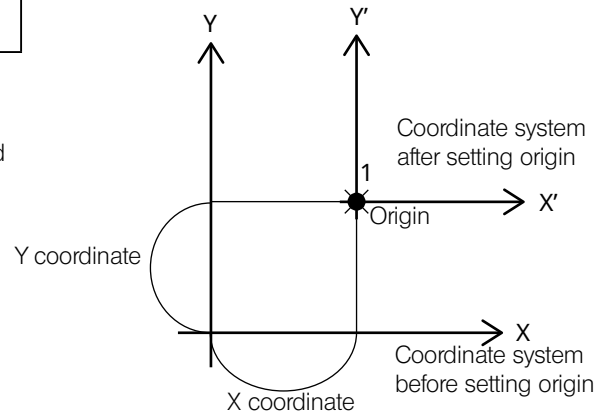| Number	Measurement items	Item	Sample 1	
024	Contact point between point and circle	X1 coordinate	1.0000	X coordinate of contact point 1
024	Contact point between point and circle	Y1 coordinate	1.0000	Y coordinate of contact point 1
024	Contact point between point and circle	Z1 coordinate	0.0000	Z coordinate of contact point 1
024	Contact point between point and circle	X2 coordinate	-1.0000	X coordinate of contact point 2
024	Contact point between point and circle	Y2 coordinate	1.0000	Y coordinate of contact point 2
024	Contact point between point and circle	Z2 coordinate	0.0000	Z coordinate of contact point 2

Recall output
The contact point 1 and the contact point 2 can be recalled as a point.

3   Alignment items

Origin

Function
By acquiring the coordinate of 1 point or inputting the recalled coordinate, the origin is set.
Sets the design values.

Measurement results

Number	Measurement items	Item	Sample 1	
025	Origin	X coordinate	1.0000	X coordinate of origin
025	Origin	Y coordinate	1.0000	Y coordinate of origin
025	Origin	Z coordinate	0.0000	Z coordinate of origin

Recall output
The origin can be recalled as a point.
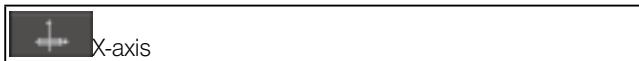
X-axis

Function
By inputting the recalled line, the line is set to as the X-axis.

Measurement results

Number	Measurement items	Item	Sample 1	
026	X-axis	Angle A	45.0000	Angle of X-axis

Recall output
The X-axis can be recalled as a line.

Move origin

Function
By inputting the movement distance of the X coordinate and the Y coordinate from the current origin, the point after movement is set as a new origin.
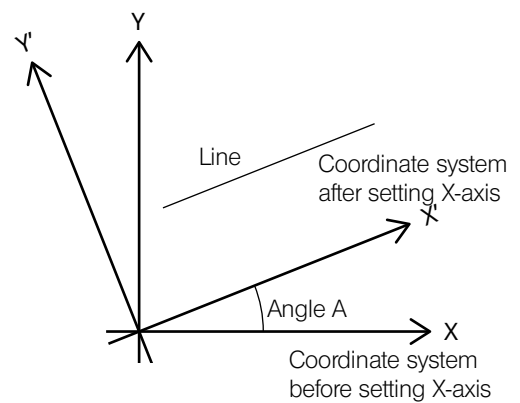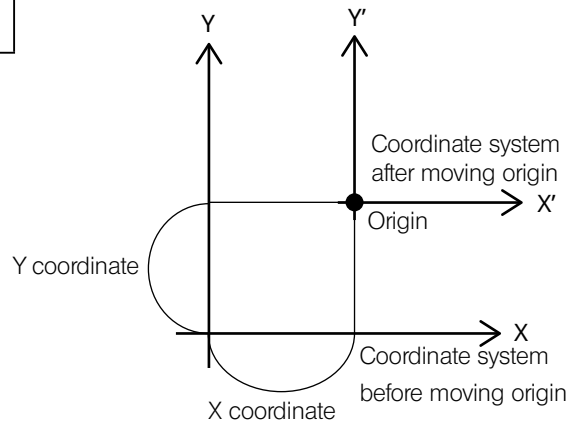
Measurement results

Number	Measurement items	Item	Sample 1	
027	Move origin	X coordinate	1.0000	X coordinate of origin
027	Move origin	Y coordinate	1.0000	Y coordinate of origin
027	Move origin	Z coordinate	0.0000	Z coordinate of origin

Recall output
The origin after moving can be recalled as a point.
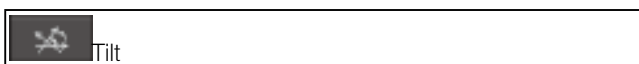
Tilt

Function
By inputting the rotation angle in counterclockwise direction for the current X-axis, the line after rotation is set as a new X-axis.
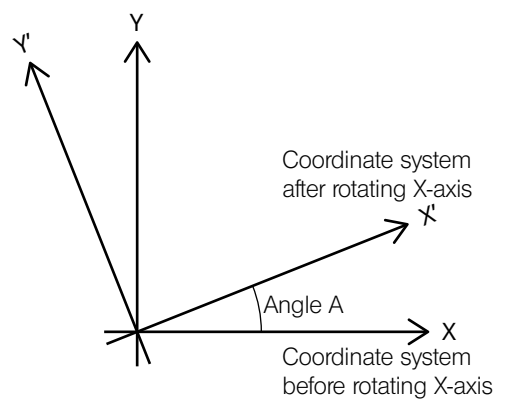
Measurement results

Number	Measurement items	Item	Sample 1	
028	Tilt	Angle A	45.0000	Angle of X-axis

Recall output
The X-axis can be recalled as a line.

4 Virtual point setting items

⊢ Virtual point

Function
By inputting the X coordinate, Y coordinate and Z coordinate for the current alignment, the virtual point is created.

Measurement results

Number	Measurement items	Item	Sample 1	
002	Virtual point	X coordinate	1.0000	X coordinate of virtual point
002	Virtual point	Y coordinate	1.0000	Y coordinate of virtual point
002	Virtual point	Z coordinate	0.0000	Z coordinate of virtual point

Recall output
The created virtual point can be recalled as a point.

⊢ Move point

Function
By inputting the one recalled point and also inputting the movement distance of the X coordinate and the Y coordinate from that point, the moved virtual point is created.

Measurement results

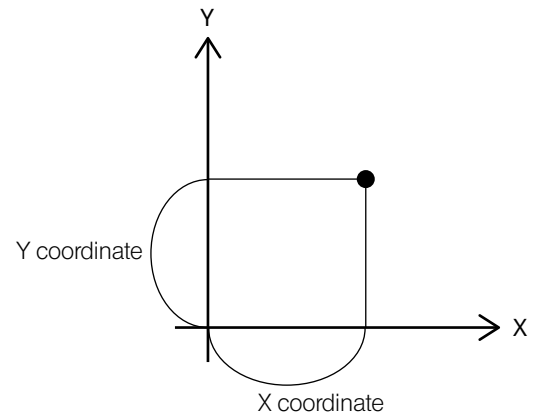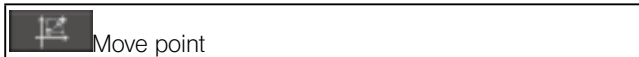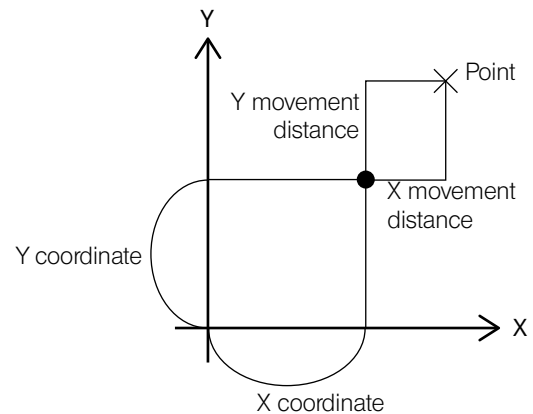| Number	Measurement items	Item	Sample 1	
029	Move point	X coordinate	-1.4142	X coordinate of point
029	Move point	Y coordinate	0.0000	Y coordinate of point
029	Move point	Z coordinate	0.0000	Z coordinate of point

Recall output
The created virtual point can be recalled as a point.

⊹ Rotate point

Function
By inputting the one recalled point and also inputting the rotation angle in counterclockwise direction for that point, the rotated virtual point is created.

Measurement results
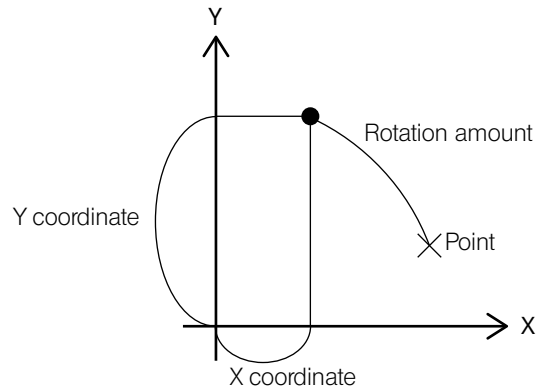
Number	Measurement items	Item	Sample 1	
030	Rotate point	X coordinate	-1.2247	X coordinate of point
030	Rotate point	Y coordinate	-0.7071	Y coordinate of point
030	Rotate point	Z coordinate	0.0000	Z coordinate of point

Recall output
The created virtual point can be recalled as a point.

⊹ Point of symmetry in the X-axis

Function
By inputting the one recalled point, the virtual point symmetry to that point in the X-axis is created.

Measurement results

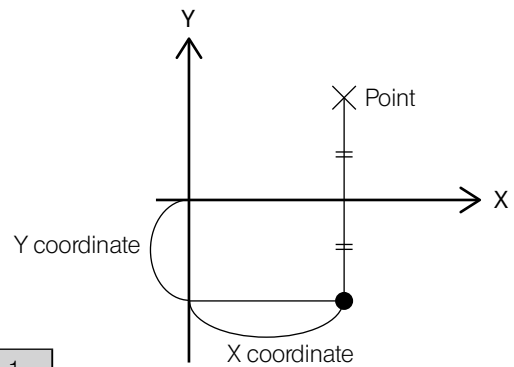| Number	Measurement items	Item	Sample 1	
031	Point of symmetry in the X-axis	X coordinate	-1.2247	X coordinate of point
031	Point of symmetry in the X-axis	Y coordinate	-0.7071	Y coordinate of point
031	Point of symmetry in the X-axis	Z coordinate	0.0000	Z coordinate of point

Recall output
The created virtual point can be recalled as a point.

Point of symmetry in the Y-axis

Function
By inputting the one recalled point, the virtual point symmetry to that point in the Y axis is created.

Measurement results

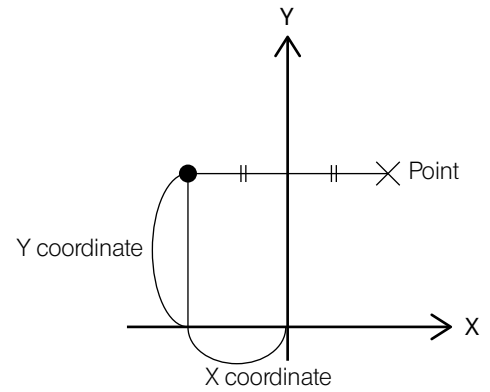| Number	Measurement items	Item	Sample 1	
032	Point of symmetry in the Y-axis	X coordinate	2.4142	X coordinate of point
032	Point of symmetry in the Y-axis	Y coordinate	-1.0000	Y coordinate of point
032	Point of symmetry in the Y-axis	Z coordinate	0.0000	Z coordinate of point

Recall output
The created virtual point can be recalled as a point.

Point of symmetry in the origin

Function
By inputting the one recalled point, the virtual point symmetry to that point in the origin is created.
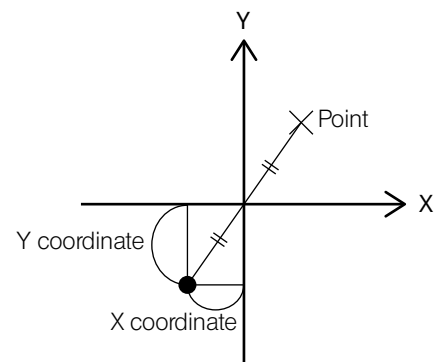
Measurement results

Number	Measurement items	Item	Sample 1	
033	Point of symmetry in the origin	X coordinate	1.2247	X coordinate of point
033	Point of symmetry in the origin	Y coordinate	0.7071	Y coordinate of point
033	Point of symmetry in the origin	Z coordinate	0.0000	Z coordinate of point

Recall output
The created virtual point can be recalled as a point.

A-2 XZ

1 Direct measurement/recall measurement items
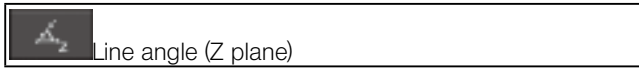
Line angle (Z plane)

Function
By acquiring the coordinates of multiple points (from 1 to 100 points) or inputting the recalled coordinates, the line determined by the least-squares method is calculated.

Measurement results

| Number	Measurement items	Item	Sample 1	
003	Line angle (Z plane)	Angle A	45.0000	Line angle
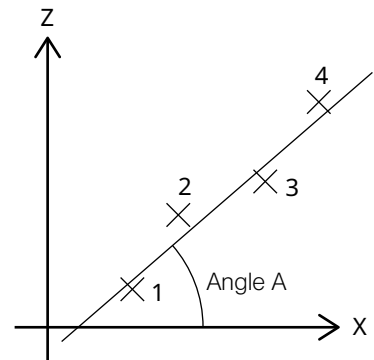
Recall output
The coordinate data can be recalled as the line on Z plane.

The line direction is determined by the direction toward the second point form the

first point.

Circle (Z plane)

Function
By acquiring the coordinates of multiple points (from 1 to 100 points) or inputting the recalled coordinates, the circle determined by the least-squares method is calculated.

Measurement results

Number	Measurement items	Item	Sample 1	
004	Circle (Z plane)	X coordinate	0.0000	X coordinate of the center
004	Circle (Z plane)	Y coordinate	0.0000	Y coordinate of the center
004	Circle (Z plane)	Z coordinate	0.0000	Z coordinate of the center
004	Circle (Z plane)	R radius	5.0000	Radius of the circle
004	Circle (Z plane)	D diameter	10.0000	Diameter of the circle
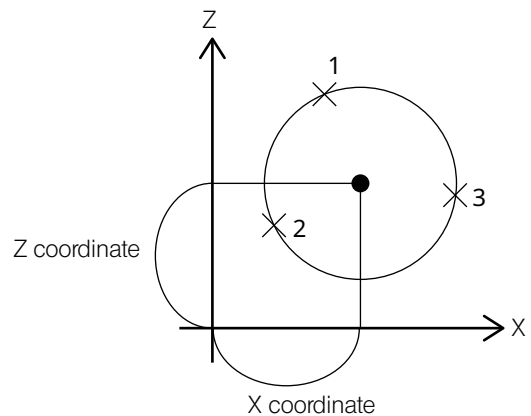
Recall output
The center of the circle can be recalled as a point or as a circle on Z plane.

Height between point and point (Z plane)

Function
By acquiring the coordinate of 2 point or inputting the recalled coordinate, the distance between 2 points is calculated.

Measurement results

Number	Measurement items	Item	Sample 1	
012	Height between point and point (Z plane)	Height	-1.0000	Z coordinate difference between 2 points

The Z coordinate difference is a value subtracting the Z coordinate value of the first point from the second point.

Recall output
There is no recall item.

Plane (Z plane)

Function
By acquiring the coordinates of multiple points (from 1 to 100 points) or inputting the recalled coordinates, the plane determined by the least-squares method is calculated.
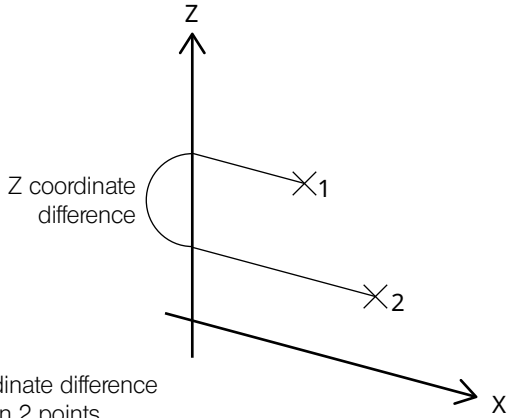
Measurement results

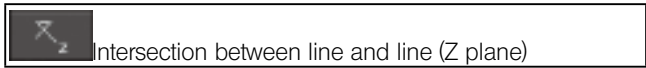| Number	Measurement items	Item	Sample 1	
013	Plane	Angle A	45.0000	Angle of plane

The angle of the plane is a maximum slope angle.

Recall output
The coordinate data can be recalled as a plane.

2   Recall measurement items
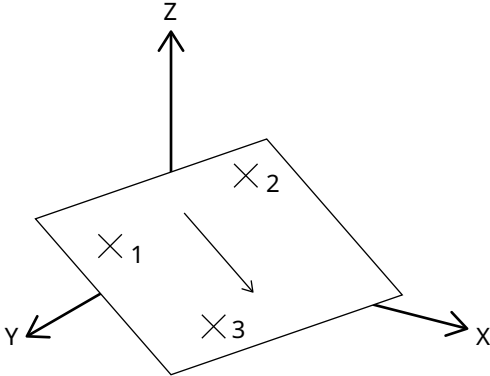
🔲 Intersection between line and line (Z plane)

Function
By inputting the recalled 2 lines (Z plane), the intersection point is calculated.
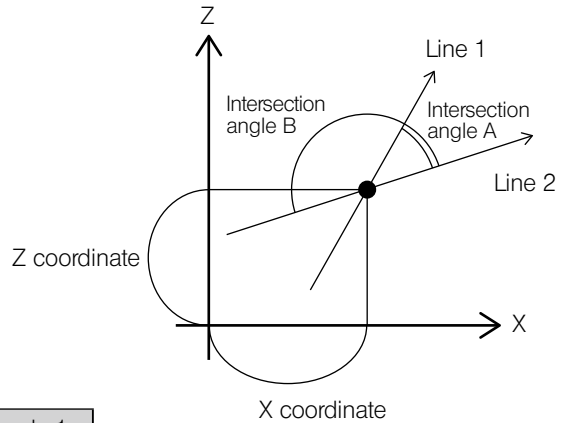
Measurement results

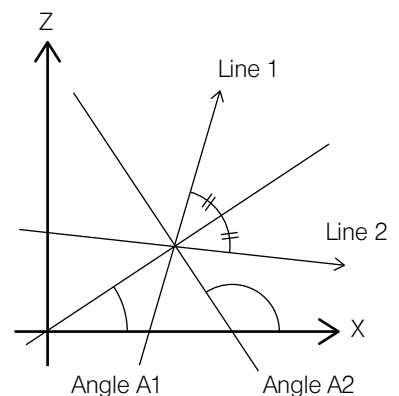| Number	Measurement items	Item	Sample 1	
007	Intersection between line and line (Z plane)	X coordinate	0.0000	X coordinate of the intersection angle
007	Intersection between line and line (Z plane)	Y coordinate	0.0000	Y coordinate of the intersection angle
007	Intersection between line and line (Z plane)	Z coordinate	0.0000	Z coordinate of the intersection angle
007	Intersection between line and line (Z plane)	Intersection angle A	90.0000	Intersection angle A
007	Intersection between line and line (Z plane)	Intersection angle B	90.0000	Intersection angle B

The intersection angle A is an angle between the direction lines of line 1 and line 2.
The intersection angle B is a supplementary angle for 180 degrees of the angle A.

Recall output
The coordinate data can be recalled as a point.
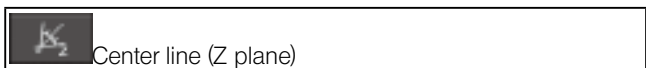
🔲 Center line (Z plane)

Function
By inputting the recalled 2 lines (Z plane), the center line 1 and the center line 2 are calculated.

Measurement results

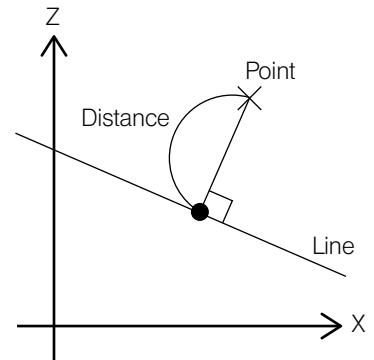| Number	Measurement items	Item	Sample 1	
007	Center line (Z plane)	Angle A1	0.0000	Angle of center line 1
007	Center line (Z plane)	Angle A2	90.0000	Angle of center line 2

The center line 1 is a center line between the direction lines of line 1 and line 2.

The center line 2 is a perpendicular of the center line 1 at the intersection point between line 1 and line 2.

Recall output
The center line 1 and center line 2 can be recalled as a Z plane line.

Distance between point and line (Z plane)

Function
By inputting the recalled point and line (Z plane), the distance between point and line is calculated.

Measurement results
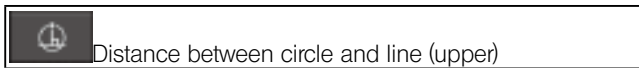
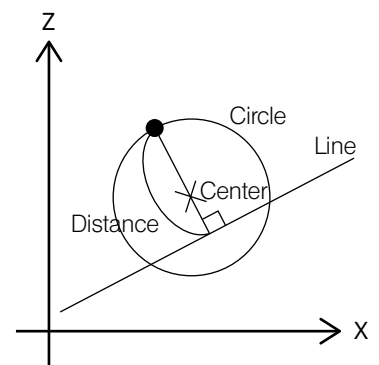| Number	Measurement items	Item	Sample 1	
005	Distance between point and line (Z plane)	Distance	6.1322	Distance between point and line

Recall output

The intersection point between perpendicular line and line can be recalled as a point.

Distance between circle and line (upper)

Function
By inputting the recalled circle (Z plane) and the line (Z plane), the distance to the upper circumference in the Z axis direction is calculated by using the straight perpendicular line passing the center of the circle.

Measurement results

Number	Measurement items	Item	Sample 1	
008	Distance between circle and line (upper)	Distance	7.4805	Distance between circle and line

Recall output

The intersection point between circle and the straight perpendicular line can be recalled as a point.

Example of measurement object

⊕ Distance between circle and line (lower)

Function

By inputting the recalled circle (Z plane) and the line (Z plane), the distance to the lower circumference in the Z axis direction is calculated by using the straight perpendicular line passing the center of the circle.
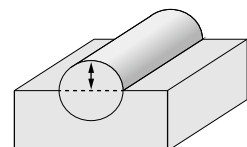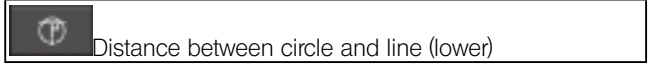

Measurement results

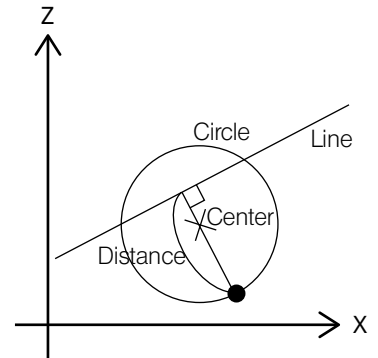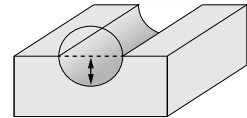| Number	Measurement items	Item	Sample 1	
009	Distance between circle and line (lower)	Distance	4.1148	Distance between circle and line

Recall output

The intersection point between circle and the straight perpendicular line can be recalled as a point.

Example of measurement object

—— Manufactured by ——

Evident Corporation

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—— Distributed by ——

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