

3D Data Processing Software  
***RANGE VIEWER***  
User's Guide



KONICA MINOLTA

## Safety Symbols

The following symbols are used in this manual to prevent accidents that may occur as a result of incorrect use of the instrument.

	<b>Indicates information that contains safety warnings or notes. Read the information carefully to ensure safe use.</b>
	<b>Indicates a prohibited act. Never commit such acts.</b>
	<b>Indicates an instruction. Affix to the instruction.</b>
	<b>Indicates safety information concerning the laser. Read the information carefully to ensure safe use.</b>

## Official Names for Application Mentioned in This Manual

(Indication in this manual)

(Official name)

Windows, Windows Vista

Microsoft® Windows® Vista® Business Operating System

Windows, Windows XP

Microsoft® Windows® XP® Professional Operating System

Windows, Windows 7

Microsoft® Windows® 7® Professional Operating System

## Trademarks

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- Other product names and company names are the registered trademarks or trademarks of their respective owners.

## Notes on This Manual

- It is strictly prohibited to copy or reproduce any of the content in this manual without the expressed permission of KONICA MINOLTA.
- The contents of this manual are subject to change without notice.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its content. However, should you have any questions or find any mistakes, please contact the place of purchase.
- KONICA MINOLTA assumes no responsibility whatsoever for accidents or other consequences arising from the use of this software in disregard of the content of this manual.

## About This Manual and Related Documents

This manual explains RANGE VIEWER commands in the sequence they appear in the menu bar. RANGE VIEWER is 3D scanning software created specifically for KONICA MINOLTA RANGE7/5.

The following manuals are related to the information contained herein.

Title	Description
RANGE VIEWER Reference Manual	Explains the commands selected from menus and buttons as key words regarding the various functions of RANGE VIEWER.
RANGE7/RANGE5 Instruction Manual	Explains the functions, operating procedures and warnings of the RANGE7/5 that acquires 3D profile data of diverse kinds of industrial products at high speed and to a high degree of accuracy.
RANGE VIEWER Installation guide	This sheet explains how to install or uninstall RANGE VIEWER.

## Safety Precautions

When using RANGE VIEWER, observe the following precautions to ensure correct safe use. Also, read this manual carefully and keep it in a handy place for future reference.

	<b>WARNING</b> Failure to observe the indicated information may result in serious injury or even death.	
	<b>Failure to observe the indicated information may result in fire or electric shock. Before using this system, carefully read the manuals provided with the RANGE7/5 and computer together with this manual to ensure correct safe use.</b>	
	<b>Do not look directly into the laser emission window of the RANGE7/5.</b>	
	<b>Keep lenses, objects with mirror-like surfaces and optical elements out of the optical path of the RANGE7/5 laser. These objects can focus the laser beam, resulting in damage to eyes, fire and burns. Also, to prevent inadvertent accidents, situate works in front of a wall or other structure that shields the laser beam.</b>	

## Package Contents

- RANGE VIEWER Install CD-ROM x 1
- Installation Guide

## Software Restrictions

The terms and conditions for using this software are provided in the Software User's Agreement window that appears online during installation. This software may only be installed by agreeing to those terms and conditions.

## Notes on Use

- This software is application software for Windows Vista, Windows XP or Windows 7. Neither the package nor product includes an OS.
- One of these operating systems must be installed in the computer before this software may be installed.
- Load the CD-ROM into the CD-ROM drive with the correct side up. Keep level and do not force into the slot.
- Do not dirty or scratch the CD-ROM. Dirt on the recording surface and scratches in the label may cause read errors.
- Be careful of sharp temperature changes and condensation.
- Keep the CD-ROM away from direct sunlight, heaters and other sources of heat.
- Do not subject the CD-ROM to strong impacts or drop it.
- Keep water, alcohol, thinner and other chemicals away from the CD-ROM.
- Turn ON power to the computer to eject the CD-ROM.

## Notes on Storage

- After use, return the CD-ROM to its case and store with care.
- Keep the CD-ROM away from direct sunlight, heaters and other sources of heat.
- Do not store the CD-ROM in highly humid environments.

Every effort has been made in the preparation of this product. However, should you have any questions or find any mistakes, please contact the place of purchase or a customer service center.

## Introduction

RANGE VIEWER is newly developed 3D scanning software capable of controlling RANGE7/5 scanning and registering, merging and editing scanned data. It adopts a new GUI that enables seamless scanning and editing of scanned data. Moreover, it runs on Windows Vista, Windows XP or Windows 7 and can handle large volumes of data.

It is equipped with a navigator for showing operating methods and procedures in a large navigation window, making it possible for anyone from skilled engineers to beginners to easily and speedily operate.

## Main Functions

<b>Data input</b>	Original format: .rgv (1 shot data set) .rvm (multiple data sets), Marker information: .rmk, .txt
<b>Data output</b>	ASCII, STL, original format: .rgv and .rvm, Marker information: .rmk
<b>Scanning support</b>	Monitored images, preview, AF and AE, scanning and rotational stage control
<b>Editing</b>	Data registration, data merging, point deletion
<b>Drawing</b>	Point shading

## Required Operating Environment

<b>OS</b>	Windows Vista Business SP2 (64bit), Windows XP Professional x64Edition SP2 (64bit) Windows 7 Professional (64bit)
<b>CPU</b>	Core2Duo, Xeon or faster
<b>RAM</b>	4GB or more
<b>Display</b>	1280 x 1024 or higher resolution graphics
<b>Graphic board</b>	OpenGL board (It is recommended to use boards tested and proven by KONICA MINOLTA.)
<b>Interface</b>	USB 2.0 port

## Installation and Uninstallation

Install and uninstall RANGE VIEWER in a computer as explained in the RANGE VIEWER Installation Guide.

## (Added/Changed Functions in Ver.2.0)

1. Compatible with Windows7 Professional 64bit.
2. From the viewpoint of improvement in operability and data visibility, the GUI design was modified. 3D view of the Scanning mode screen was changed from 3 screens to 2 screens.
3. [Edit marker holes] was added to the editing function. The marker holes became capable of being hole-filled by RANGE VIEWER.
4. By means of the paired points initial registration, selected data can be moved not just immediately after scanning but at other moments.
5. By means of the paired points initial registration, registration can be performed based on the plural number of data.
6. Background colors of windows and scanned data color scheme (surface, back side) were changed. Linkage of scanned data and an un-shot part can be identified easily.
7. Changed the marker display color of 2D view. A marker can be displayed at the time of contour display as well.
8. A selected element window is zoomed in while monitoring is being executed. A position during scanning became easy to confirm.
9. Rotary movement of a viewing position followed by 3D view provides more intuitive mouse operation.
10. Extensively speeded up the function to select point groups.
11. Displays version of firmware for the scanning device in [Scanning Device Information] dialog.
12. Automatically deletes groups of very small points at the time of scanning. Editing labor can be saved.
13. Strengthened the data noise deletion function, and improvement was made with the data quality of edge part.

# RANGE VIEWER User's Guide

## How to use this manual

The User's Guide explains the basic operation flow of RANGE VIEWER. After learning the flow of measurement and basic Operating procedures with this manual, use it together with the Reference Manual. The screen picture in this document is the display example of Windows 7 in use.

Chapter index

Command available on the edit window  
(The icon is ghosted if the command is not available.)

Command available on the scan window  
(The icon is ghosted if the command is not available.)

**4. Scanning [Scanning by Paired points]**

**Warning**

- Do not look directly into the laser emission window.
- Keep lenses, objects with mirror-like surfaces and optical elements out of the optical path. These objects can focus the laser beam, resulting in damage to eyes, fire and burns. Also, to prevent inadvertent accidents, situate works in front of a wall or other structure that shields the laser beam.

**Operating Procedure**

**1 Set the work.**

Set the Scan settings. ("2-4 Scan Settings" P.16)  
Select [Paired points] under [Initial registration method].

**2 Click [Monitor] button.**

The 2D image obtained by monitor imaging appears in the monitor window.  
This image is updated at a frequency of about five times per second.

**Point** For AE/AF, see "2-4 Scan settings" (P.16)

**5 Click [Preview] button.**

A preview appears in the 3D window after scanning at a speed faster than actual scanning.  
You can check the state of the image to scan by menu button and mouse operation.

**Supplement**  
If you dislike the preview results, see "2-4 Scan settings" (P.16).

**6 Check the preview image.**

From the preview image, you can understand the depth and identify dead spaces within the scan area, as well as the quality of scanning results based on surface conditions in advance. You can perform the operation for the preview image by mouse operation after switching the menu button.  
To delete the preview image, perform the measurement again or click the [Delete last data] button.

Chapter index

## Table of Contents

Safety Symbols

Official Names for Application Mentioned in This Manual

Trademarks

Notes on This Manual

About This Manual and Related Documents

Safety Precautions ..... 1

Package Contents

Software Restrictions

Notes on Use

Notes on Storage

Introduction ..... 2

Main Functions

Required Operating Environment

Installation and Uninstallation

How to use this manual ..... 3

Concept of RANGE VIEWER .....6

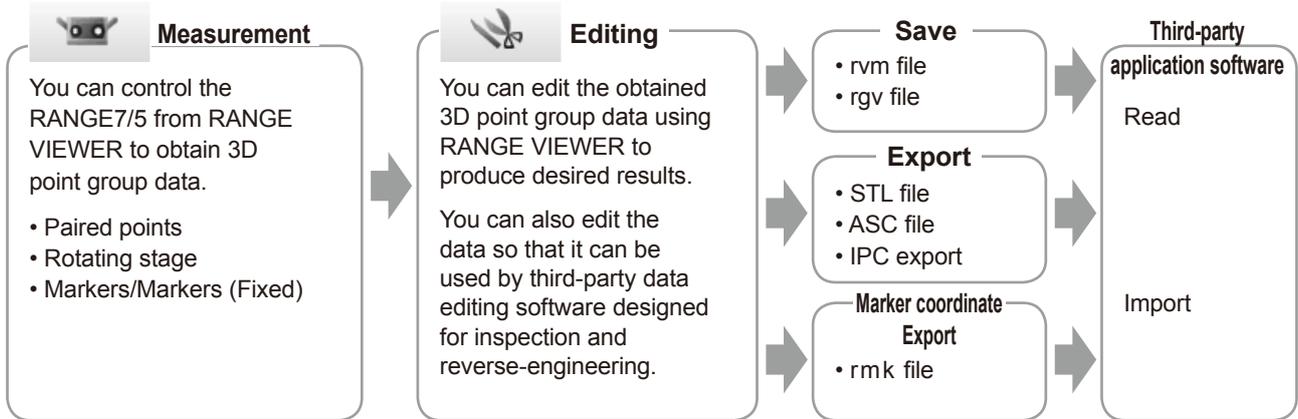
Flow of Measurement .....7

1. RANGE VIEWER Startup .....	8
1.1 Startup .....	8
1.2 Exit .....	9
1.3 Screen composition of [scan window] screen .....	10
1.4 Screen composition of [editing window] screen .....	12
2. Setting Work .....	14
2.1 Distance to and Size of Work .....	14
2.2 FOV indicator .....	15
2.3 Multi focus .....	15
2.4 Scan Settings .....	16
[AE/AF configuration] .....	16
Example of adjusting the focus and exposure by Spot AF or manually ...	17
Data reduction ratio .....	17
Number of Scans .....	17
3. Selecting Registration Mode .....	18
3.1 Registration Mode .....	18
3.2 Selecting from [Scan settings] Dialog Box .....	19
3.3 Scanning Flow by Registration Mode .....	19
3.4 How to Affix Markers .....	20
4. Scanning [Scanning by Paired points] .....	21
5. Scanning [Scanning by Rotating stage] .....	26
5.1 Flow of Measurement .....	26
5.2 Scanning by Rotating Stage .....	28
6. Scanning [Scanning by Markers/Markers (Fixed)] .....	32
7. Editing Scanned Data .....	36
7.1 Deleting Unnecessary Points .....	36
7.2 Registration .....	38
Mean Error and Standard Deviation .....	38
Registration with marker information .....	38
7.3 Edit marker holes .....	39
7.4 Merging .....	40
8. Saving Data and Exporting .....	41
8.1 Saving Data .....	41
8.2 Setting Automatic Save Feature .....	41
File Formats .....	41
8.3 Exporting .....	42
Exporting with the IPC function (File Transfer) .....	42
STL Files .....	42
ASC Files .....	42
9. Viewing 3D images .....	43
9.1 Changing Viewpoint and Zoom of Works .....	43
9.2 Changing 3D image Display Mode .....	45
10. Scanning Works Accurately .....	47
10.1 Calibration .....	47
10.2 Equipment for Calibration and Usage .....	48
11. Help .....	50
11.1 Tool Tips .....	50
11.2 Instruction Manual .....	51
11.3 About RANGE VIEWER .....	51
Index .....	52



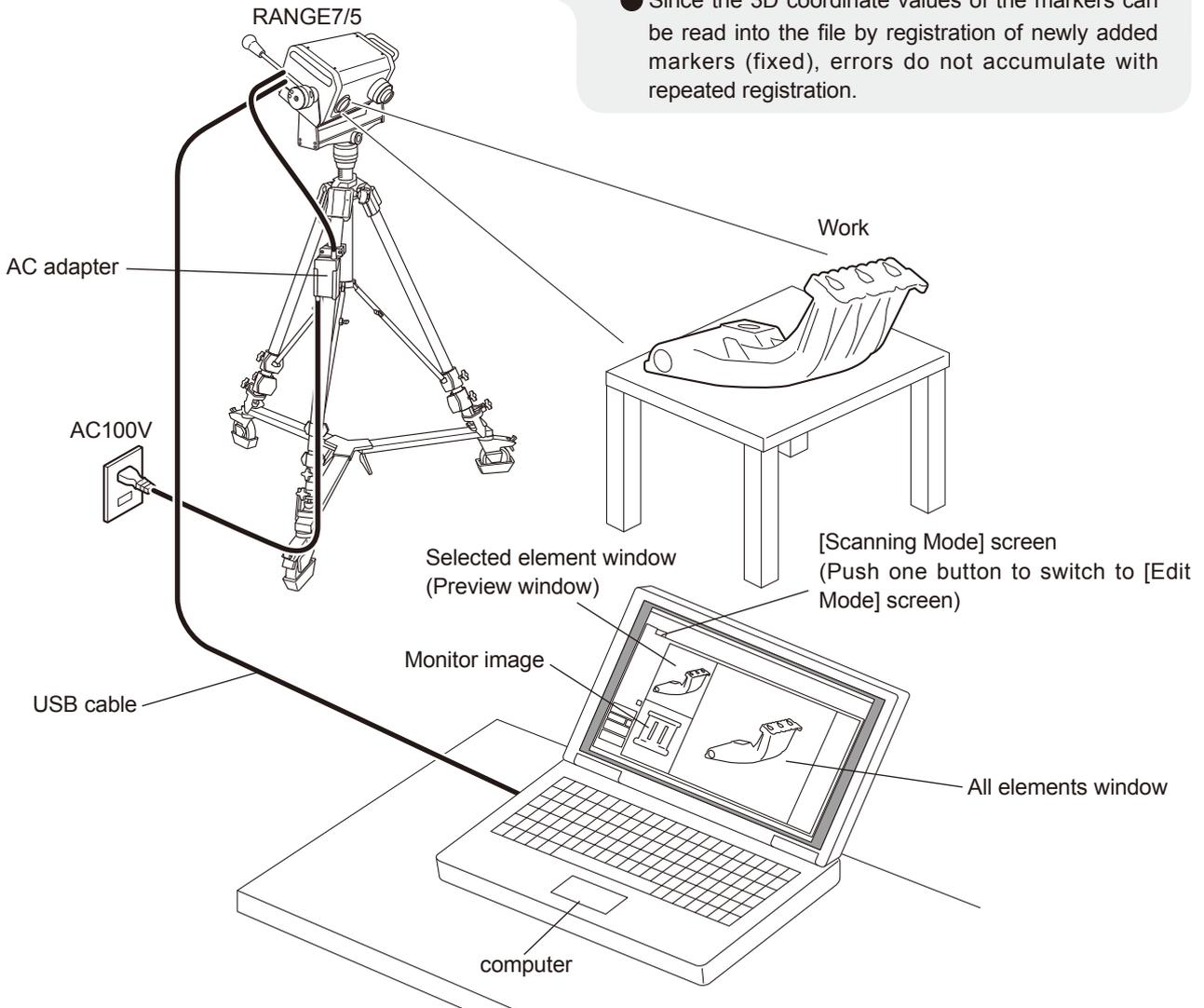
# Concept of RANGE VIEWER

You can process 3D data by using RANGE VIEWER, the RANGE7/5, and 3D point group processing software (third-party application software).



## Major features of RANGE VIEWER

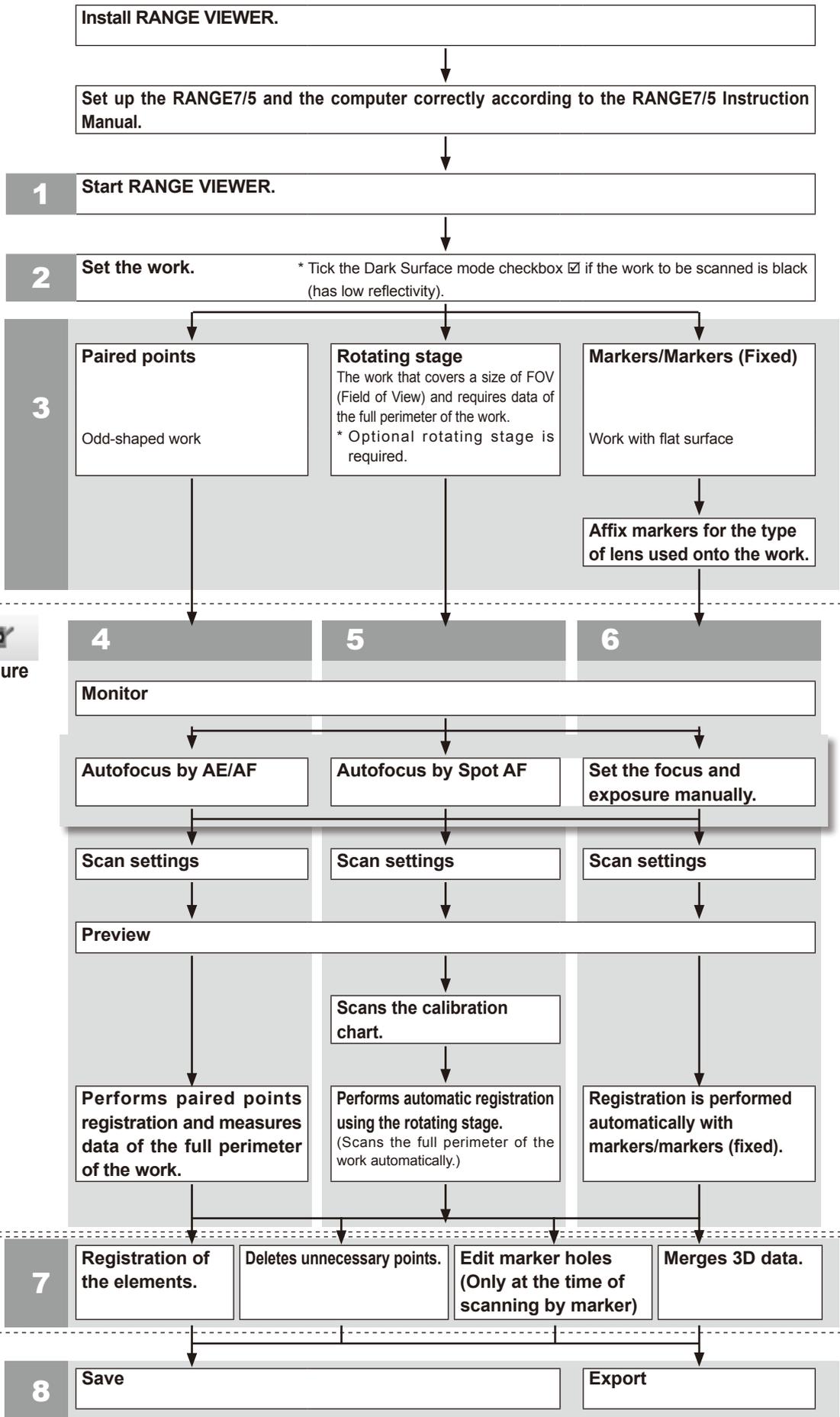
- Provides various editing functions from RANGE7/5 scanning control to data registration and integration.
- Adopted GUI that allows users to seamlessly perform scanning and scanned data editing operations.
- Compatible with Windows Vista, Windows XP and Windows 7 64bit, and a large volume of data can be managed.
- Equipped with a navigation function that displays operation methods and procedures on a navigation window.
- Allows scanning of black objects with a low reflectivity using the Dark Surface mode.
- Since the 3D coordinate values of the markers can be read into the file by registration of newly added markers (fixed), errors do not accumulate with repeated registration.





# Flow of Measurement (The numbers 1 to 11 represent the chapter number.)

Help
Instruction Manual
About RANGE VIEWER
<b>11</b>
<b>10</b>
Calibration
See the 3D image
<b>9</b>



1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11



# 1. RANGE VIEWER Startup

When you start RANGE VIEWER, the software will attempt to recognize the RANGE7/5. When the device is recognized, measurement becomes possible. Therefore, check that the RANGE7/5 is connected correctly to the computer before starting RANGE VIEWER. However, when only editing will be performed, it is not necessary to have the RANGE7/5 connected to the computer.

## 1.1 Startup

### Operating Procedure

- 1 From the Windows start menu, open [All Programs] – [KONICA MINOLTA] – [RANGE VIEWER], and select [RANGE VIEWER Ver. \*.\*].

The opening window appears for 3 sec as RANGE VIEWER starts up.

#### Supplement

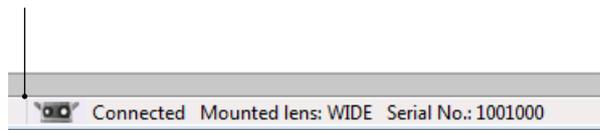
- Windows open at the maximum size when the application starts up.
- A warning appears if the display resolution is too low.
- You can also start directly by double clicking a RANGE VIEWER data file. (The splash screen is not displayed when you start directly from a file.)



- 2 Scanning status is shown in the status bar.

- Whether properly connected to the instrument or not.
- Scanning lens
- A warning appears until instrument temperature stabilizes.
  - A sensor icon appears when connection has been achieved.
  - A warning mark appears over the sensor icon until temperature stabilizes.
  - A warning mark appears over the sensor icon if the temperature changes (approx.  $\pm 1.5$  °C) from the last calibrated temperature.
- The sensor icon is ghosted if the instrument is not connected.

Status bar



Sensor icon



Sensor icon with warning mark



Ghosted sensor icon



#### Supplement

When scanning is done while a warning mark is ON, a warning dialog is displayed before starting to scan.

To avoid the display of the warning dialog, please calibrate after warming-up under uniformity temperature environment without a temperature change. Then, measure under the same temperature environment.

## 1.2 Exit

### Operating Procedure

#### 1 Select [Exit] from the [File] menu.

RANGE VIEWER quits.

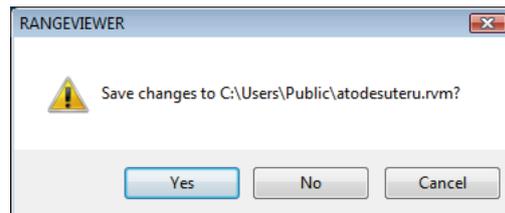
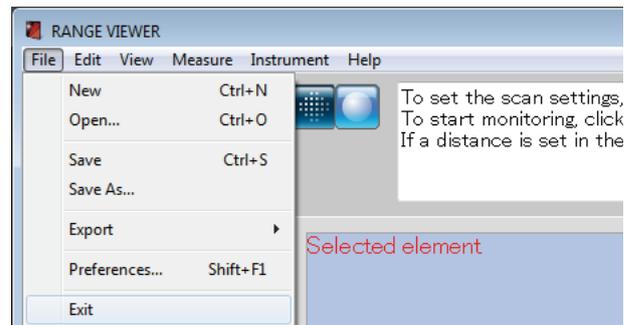
The message to confirm saving data will appear, if there are any elements that were changed after scanning or the last time that data was saved.

- When you click the [Yes] button, the measured and edited data are saved and the RANGE VIEWER is exited.
- When you click the [No] button, the RANGE VIEWER is exited without the measured and edited data being saved.

#### Supplement

“Element” is the 3D data unit used by RANGE VIEWER.

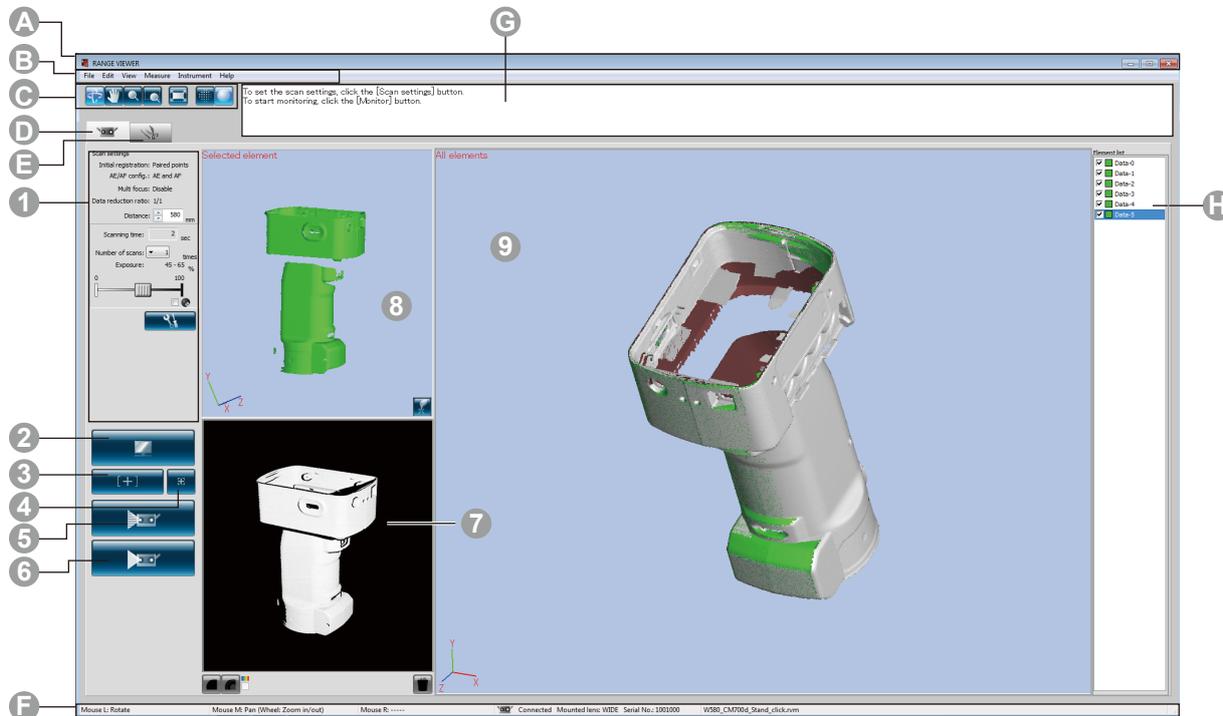
Normally, one element is generated and edited from scanning.





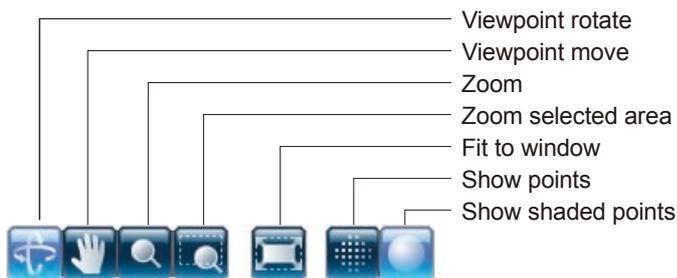
### 1.3 Screen composition of [scan window] screen

RANGE VIEWER has a “scan window” for scanning and an “editing window” for editing. These windows are opened by clicking the scan and edit tabs on the left side of the window.



■ Common GUI

- A Title bar** Displays the name of the software.
- B Menu bar** Contains various functions for operating RANGE VIEWER. Clicking a header opens a drop-down menu from which functions can be selected.
- C Menu buttons** Buttons for executing often-used functions of the menu bar.



- D Scan tab** Switches to the scanning mode for controlling the RANGE7/5 and acquiring 3D data. Screen switches to [scan window] screen by clicking.
- E Edit tab** Switches to the editing mode for viewing and editing acquired 3D data using editing tools. Screen switches to [editing window] screen by clicking.
- F Status bar** Displays the connection status of the RANGE7/5 and information such as operation and procedure hints.
- G Navigation message** Displays hints and messages on upcoming operations according to selected operations and status.
- H Element list** List of registered elements. Elements can be selected/unselected as well as shown/hidden by checkbox operation.  
 \*The element list for the "scan window" is different from that of the "editing window", and only a single element can be selected in the "scan window" element list.  
 \*Selected elements only can be displayed by selecting the elements while pressing the Alt key.

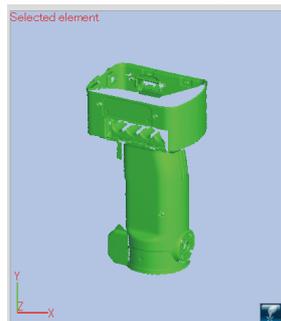


**Point** Only one RANGE VIEWER can be running at a time.

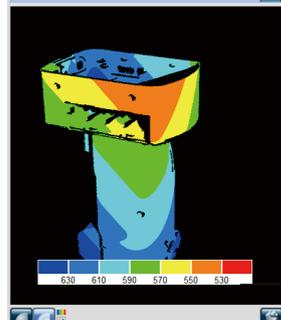
■ **Scan Window GUI**

- ① **Scan settings** The current settings of the scan parameters are displayed. Scan parameters can be changed. If the data reduction ratio setting is changed, data can be reduced when they are scanned.
- ② **Monitor button** Clicking projects the FOV (Field Of View) indicator on the work and displays a 2D image of the work in the monitor window.
- ③ **AE/AF buttons** Starts AE/AF, AF only or AE only based on scan settings.
- ④ **Spot AF button** When you press the point AF button and then specify the focus point on the monitor screen by clicking on the point you want to focus on, the RANGE7 focuses automatically on the specified point.
- ⑤ **Preview button** The object is prescanned.
- ⑥ **Scan button** Scans the work based on scan settings.
- ⑦ **Monitor window** Perform monitoring of the object by the monitor button, and display the zoomed out monitor screen. You can check and adjust the FOV (field of view = measurement area).

The green vertical line indicates the center of the lens, while the black vertical line is for adjusting scanning distance and focus.



-  Displays the scanned data in a monochrome view.
-  Displays scanned data in differing colors by distance.
-  Displays the color bar used to display scanned data in differing colors by distance.
-  Deletes previews and the last scanned element.



Unnecessary markers in scanning with marker points are deleted directly from the monitor window.

Set registration points button

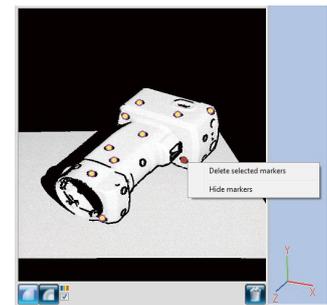
Color bar

Delete last data button

Show color bar button

Show contours button

Show monochrome view button



- ⑧ **Selected element window (Preview window)** Displays only the data selected from the element list. Scanned objects pre-scanned by the preview button or the data scanned by the scanning button are selected and displayed in this screen. The paired points registration is done by the 3D image on this screen and the 3D image on the All elements window.

When the scanned data are selected, the letters on the upper left indicate [Selected element] and if previewed data are selected, then the display becomes [Preview].

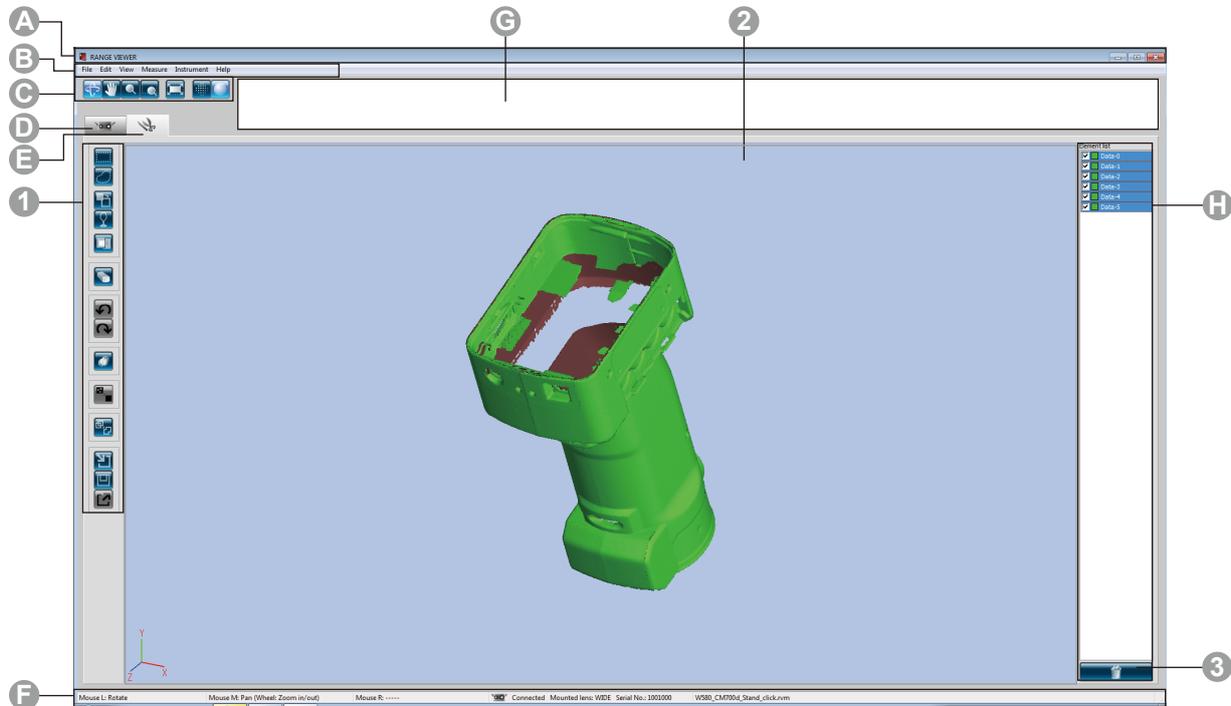
- ⑨ **All elements window** This is the window to confirm scanned data as 3D image. Shows setting of Display/Non-Display of the element list, and elements selected from the element list are shown in selected colors while the rest are in a non-selected color. Paired points are performed in 3D image of this screen and selected (preview) screen of 3D image.

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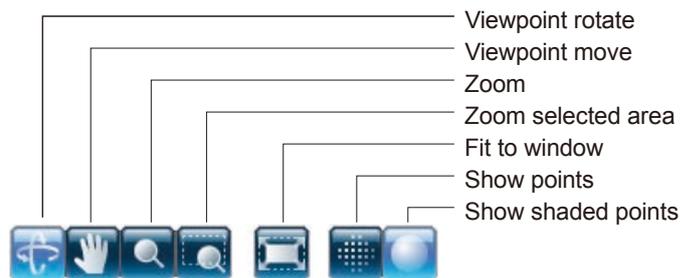
## 1.4 Screen composition of [editing window] screen

RANGE VIEWER has a "scan window" for scanning and an "editing window" for editing. These windows are opened by clicking the scan and edit tabs on the left side of the window.



### ■ Common GUI

- A Title bar** Displays the name of the software.
- B Menu bar** Contains various functions for operating RANGE VIEWER. Clicking a header opens a drop-down menu from which functions can be selected.
- C Menu buttons** Buttons for executing often-used functions of the menu bar.



- D Scan tab** Switches to the scanning mode for controlling the RANGE7/5 and acquiring 3D data. Click to switch the screen to the "Measurement Screen".
- E Edit tab** Switches to the editing mode for viewing and editing acquired 3D data using editing tools. Click to switch the screen to the "Edit Screen".
- F Status bar** Displays the connection status of the RANGE7/5 and information such as operation and procedure hints.
- G Navigation message** Displays hints and messages on upcoming operations according to selected operations and status.
- H Element list** List of registered elements. Elements can be selected/unselected as well as shown/hidden by checkbox operation.



**Point**

This window is for editing scanned data. Preview data cannot be edited. Also, reference markers are not shown.

**■ Editing Window GUI**

**1 Editing tool buttons**

For editing 3D images. The selected button is highlighted.

- Rectangle select**  
Draws a rectangular area for selecting/unselecting points.
- Bezier select**  
Draws a Bezier curve for selecting/unselecting points.
- Point selection invert**  
Inverts points between selected/unselected.
- Element boundary point select**  
Selects only boundary points of elements.
- Front point select**  
Enables selecting points having the normal facing towards the camera.
- Point delete**  
Deletes the paired points.
- Undo**  
This cancels the last edit operation and returns the software to the state just before that operation.
- Redo**  
This redoes the edit operation canceled with the "Undo" button.
- Element registration**  
Registers the selected elements.
- Edit marker holes**  
Edit data of the market part.
- Element merge**  
Merges the selected elements.
- Open**  
Opens files.
- Save**  
Saves files.
- Export**  
Exports elements to other applications.

**2 3D view**

Displays a 3D view of works as they are edited.

**3 Element delete button**

To delete an element, select the element to delete from the element list and then click the [Delete Element] button.

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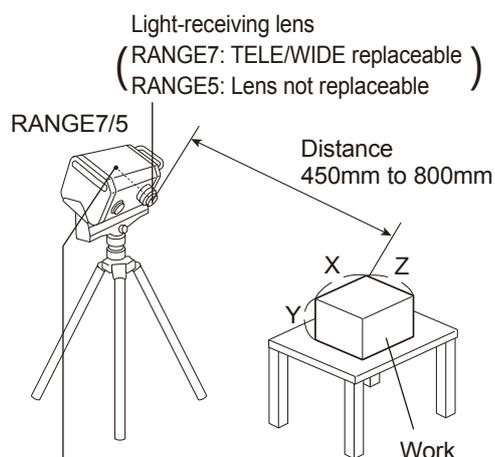
## 2. Setting Work

### Warning

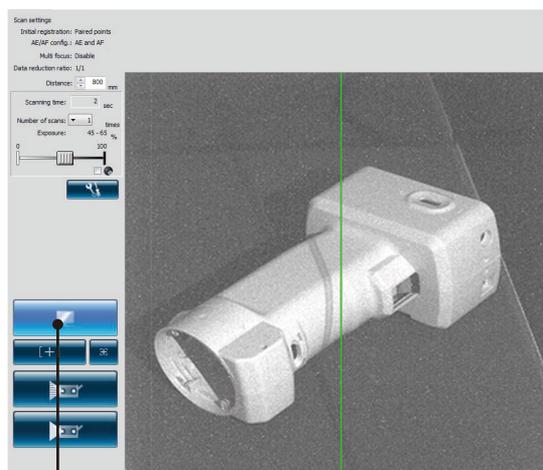
- Do not look directly into the laser emission window.
- Keep lenses, objects with mirror-like surfaces and optical elements out of the optical path. These objects can focus the laser beam, resulting in damage to eyes, fire and burns. Also, to prevent inadvertent accidents, situate works in front of a wall or other structure that shields the laser beam.

### 2.1 Distance to and Size of Work

To position the work appropriately in relation to the RANGE7/5, adjust the position and posture of the work and RANGE7/5. Make the adjustment while watching the work in the monitor window.



- The origin is set at the sensor position which is approximately 120 mm behind the center of the lens surface. Therefore, the Z dimension has an offset of around 120 mm applied.



By clicking the [Monitor] button, check the work on the monitor window.

Distance to and size of the work (Unit: mm)

Lens	TELE		WIDE	
	Distance	450	800	450
X × Y	79 × 99	141 × 176	150 × 188	267 × 334
Z	54	97	109	194

**Memo** For RANGE5, please refer to the WIDE lens data.

Distance to and size of the work in the case of multi focusing (Unit: mm)

Lens	TELE		WIDE	
	Distance	462	781	475
X × Y	81 × 102	138 × 172	159 × 199	256 × 320
Z	54	97	109	194

**Memo** For RANGE5, please refer to the WIDE lens data.

#### Point

Select the lens according to the size of the work. Although accuracy improves when you activate the Multi focus mode, note that the distance to and size of the work differ.



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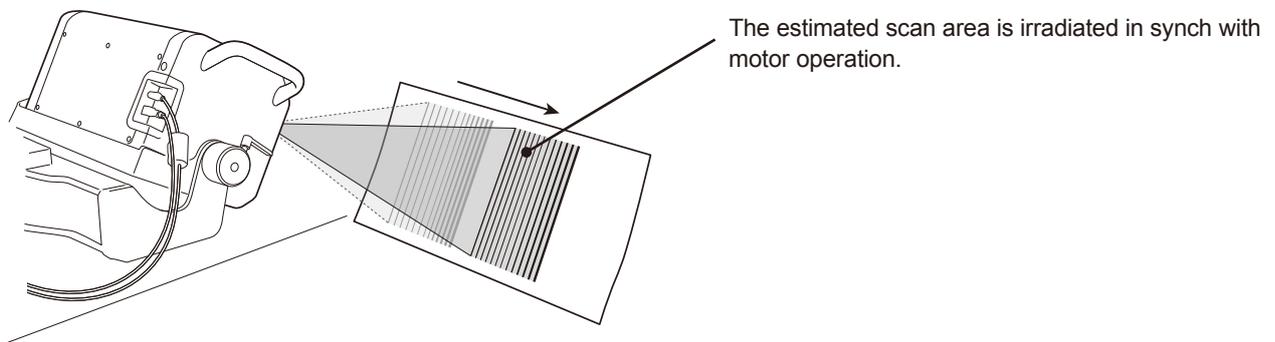
11

Index

## 2.2 FOV indicator

A FOV (field of view) indicator projects the below pattern of light on the work to make it easier to identify the scan area.

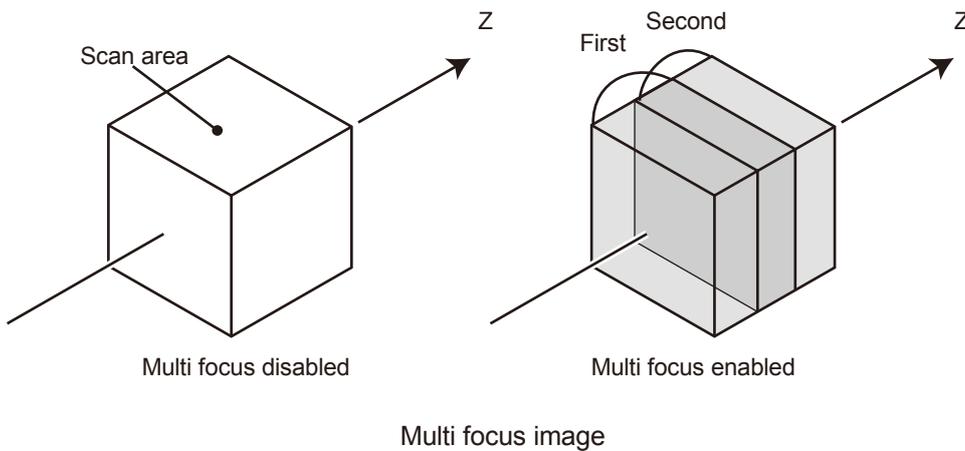
The FOV indicator is synchronized with motor operation to continuously project the light. (Note: FOV indicator updates slow while RANGE VIEWER windows are being operated.)



## 2.3 Multi focus

In the Multi focus mode, scanning is performed twice by changing the focal point.

When the Multi focus mode is active, the data of the area closer to the focal point is selected for calculation. Depending on the work, the effects may differ. However, when you want to obtain results with less data noise, set Multi focus to "Enable". Compared to when Multi focus is set to "Disable", it takes more time to display the results.



Multi focus is enabled and disabled from the Scan Settings dialog box.



## 2.4 Scan Settings

### AE (automatic exposure) and AF (autofocus)

AE (automatic exposure) and AF (autofocus) can be used in order to maximise scanning accuracy. AE/AF configuration and AF method can be changed according to the shape of the work to be scanned and scanning environment (brightness).

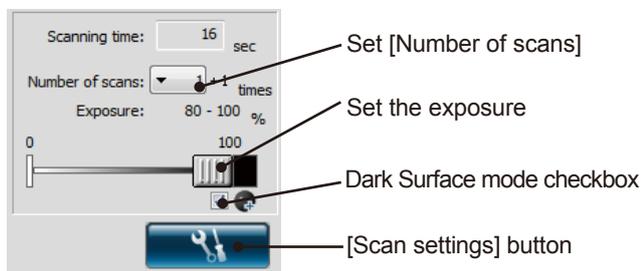
### Number of Scans

Setting the number of scans to be performed per shot can help you obtain 3D data, for example, the greater contrast can be got.

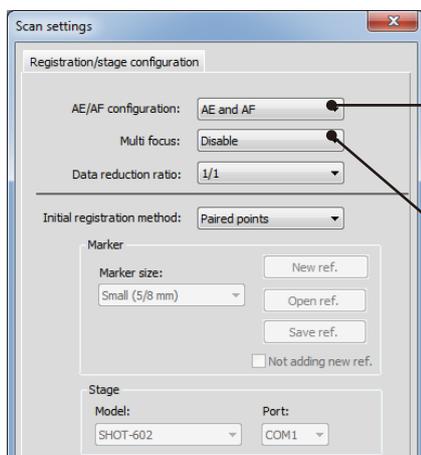
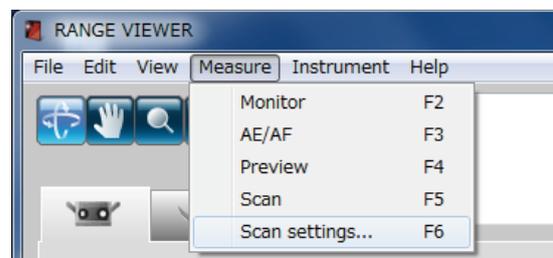
### Dark Surface Mode

The Dark Surface mode can be used to improve the accuracy when scanning a black work with a low reflectivity. [Exposure] Ticking the Dark Surface mode checkbox  automatically moves the exposure slider to maximum. At the same time, the number of scans to be performed increases by 1 from the preset value, which enables scanning of black objects.

● Buttons to be executed from the Scan window



● The "Measurement Setting" dialog is displayed when "Settings" is selected from the "Measurement" menu.



Select [AE/AF configuration].

Select either [AE and AF], [AE only], or [AF only].

Select [Multi focus]. Select [Disable] or [Enable].

### [AE/AF configuration]

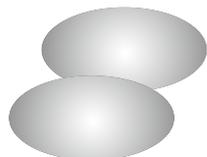
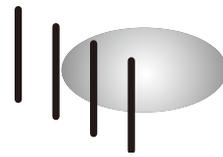
[AE/AF configuration]	AE/AF button	Spot AF button
[AE and AF]	Because both AE and AF are performed, the distance to the work and exposure are automatically measured.	Both AE and AF are performed for the points selected in the monitor window.
[AE only]	The exposure is automatically calculated.	Only AE (automatic exposure) is performed for the points selected in the monitor window.
[AF only]	The distance to the work is automatically measured and the instrument focuses on the work.	Only AF (auto focusing) is performed for the points selected in the monitor window.

Using the AE function in Dark Surface mode will result in the exposure level being set so that bright areas of the work are scanned.

In order to scan a black work, you are advised to set the scan setting to "AF only" using the scan settings dialog, so that the AE function is switched off.

## Example of adjusting the focus and exposure by Spot AF or manually

When AE and AF do not produce good results, perform the operation shown below.

At times like this		Operation example
When AF makes the area to be measured blurred or causes the focus to deviate from the scan area	-	Adjust the focus by the  [Spot AF] button or manually.
When there are two works to be measured of almost the same size, with one closer to the instrument than the other		Adjust the focus by the  [Spot AF] button or manually.
Work with a fence-like structure in front		Adjust the focus by the  [Spot AF] button or manually.
When scanning an extremely bright object	-	Manually adjust the exposure to around 0%.
When scanning an extremely dark object	-	Manually adjust the exposure to around 100%.

### Data reduction ratio

The scanned data are reduced evenly in both X and Y directions at the reduction ratio set in the scan settings mode.

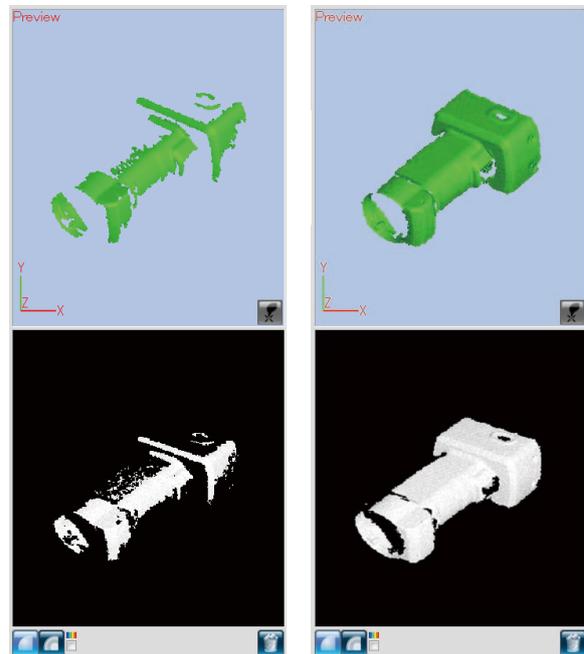
The following four items namely, 1/1, 1/4, 1/9 and 1/16 can be selected.

**Note:** Since the number of data in the original element is deleted for scanning, the data reduction ratio cannot be changed later.

To delete 1/4, do not delete data ends evenly and leave data size as much as possible.

### Number of Scans

The number of measurements can be set from 1 to 5 times. Higher-accuracy 3D data can be obtained by increasing the number of measurements. If the preview results are not acceptable, increase the number of measurements.



Preview example:  
1 measurement

Preview example:  
3 measurements

**Point** To obtain better 3D data, adjust room brightness, AE/AF settings, or number of measurements.



## 3. Selecting Registration Mode

### 3.1 Registration Mode

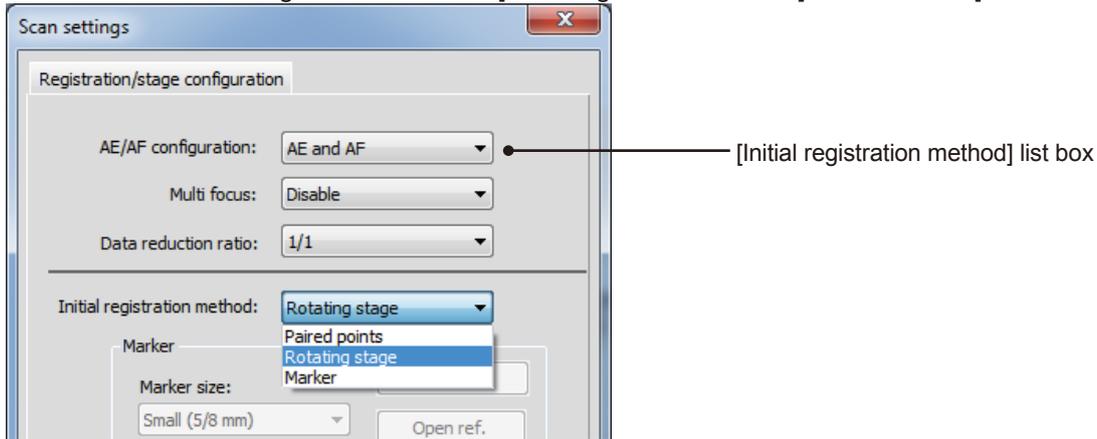
There are three methods for scanning work: [Paired points], [Rotating stage] and [Marker]. Each mode has the following features:

[Initial registration method]	Description	Advantage	Other
Paired points	Performs registration by interpolating the corresponding points of two scanned 3D images when you select corresponding points with click the left mouse button.	Because special equipment and markers are not needed, you can easily perform scanning.	-
Rotating stage	With the work placed on a rotating stage, registration is performed automatically.	Simple calibration of the axis of rotation is required. Automatic registration is possible.	The applicable controllers for the rotating stage are the SHOT-602* and SHOT-202.
Marker	With the markers affixed to the work, markers overlapping between measured shots are registered.	Because maker information makes automatic registration more accurate than manually selecting points, operability improves.	Set the marker size according to the lens in use: small (for TELE lens) and large (for WIDE lens).
Marker(Fixed)	Markers are affixed to the work and the file containing the 3D coordinate values of the affixed markers is read in. Marker registration is performed by the correspondence relationship between the markers in the scanned shots and those in the read file.	The 3D coordinate values of the markers are given in the file. Accordingly, errors do not accumulate with repeated registration compared to the normal marker registration.	Set the marker size according to the lens currently used. Small (for TELE lens), Large (for WIDE lens). When scanning with markers (fixed), select [Marker] from the initial registration and check [Not adding new ref.]. Determine the 3D coordinate values of each marker by means of photogrammetry etc. before scanning and then save it in the file. To record the 3D coordinate values of markers, rmk and txt files can be used. The markers scanned during scanning with markers (fixed) are not added to the reference markers.

\* Available only in Japan

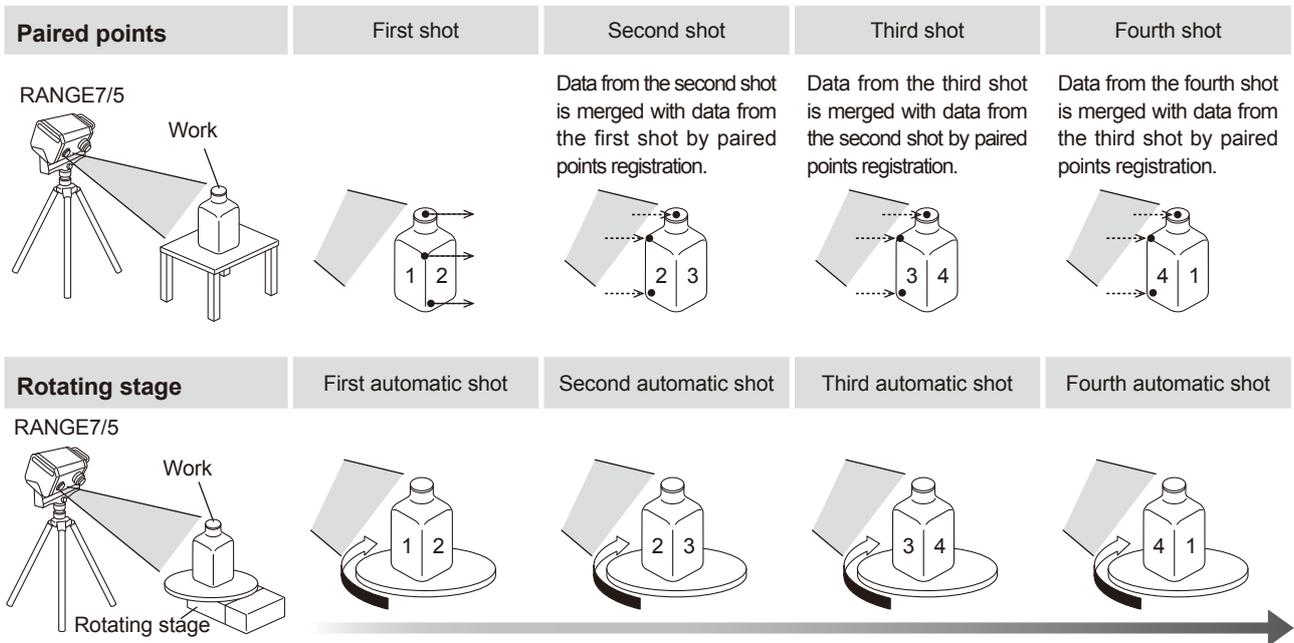
### 3.2 Selecting from [Scan settings] Dialog Box

Select the method of registration from the [Initial registration method] list box in the [Scan settings] dialog box.



### 3.3 Scanning Flow by Registration Mode

\* All the examples below are based on four scan shots with the work being rotated by 90° each time.



With the rotating stage set to rotate by 60° or 90° each time, scanned data is automatically merged to produce 3D data. Calibration of the axis of rotation is required.



Marker/Marker(Fixed)	First shot	Second shot	Third shot	Fourth shot
<p>RANGE7/5</p> <p>Work</p> <p>Affix markers of a size corresponding to the lens to the work.</p>	<p>Delete unnecessary markers.</p>	<p>Data is automatically merged based on the position information of the markers. Delete unnecessary markers.</p>	<p>Data is automatically merged based on the position information of the markers. Delete unnecessary markers.</p>	<p>Data is automatically merged based on the position information of the markers.</p>

### 3.4 How to Affix Markers

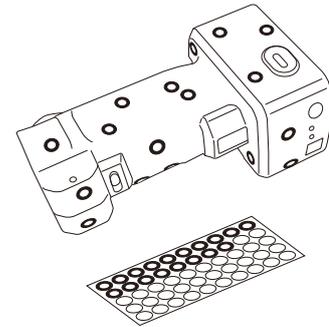
By affixing the markers to the work, you can register markers overlapping between scan shots. \*1

Affix the large or small markers to the work according to the TELE or WIDE lens mounted on the RANGE7/5: [Small (for TELE lenses), large (for WIDE lens)].

Affix the markers at intervals that enable five to ten markers to be displayed in the monitor window during scanning.

Perform scanning so that three or more markers (preferably five or more markers) can be commonly identified between the current scanned element and the next element.\*2 The recognized markers are shot and saved as reference markers, but misidentified markers need to be deleted. However, because the markers recognized in the preview will be automatically deleted in the next preview or measurement, they need not to be deleted whether or not they have been misidentified.

#### Examples of markers



\* Only [Large (for WIDE lens)] can be used for RANGE5.

\*1. Before scanning is performed with markers (fixed), registration is performed by automatically distinguishing the reference markers read in from an rmk file or a txt file.

\*2. During scanning with markers (fixed), it is not required to keep overlap on the previous scan.

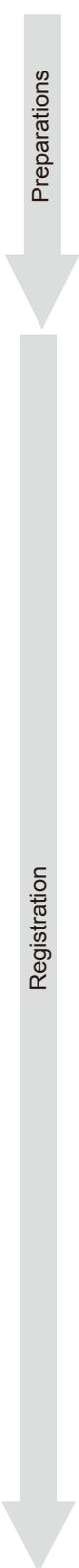


# 4. Scanning [Scanning by Paired points]

**Warning**

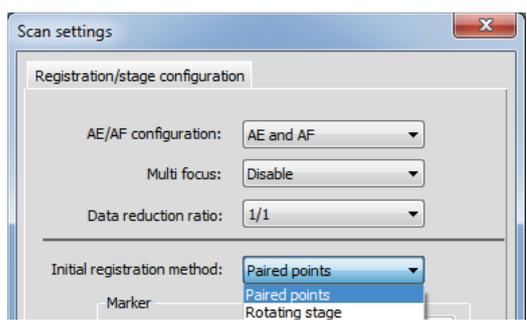
- Do not look directly into the laser emission window.
- Keep lenses, objects with mirror-like surfaces and optical elements out of the optical path. These objects can focus the laser beam, resulting in damage to eyes, fire and burns. Also, to prevent inadvertent accidents, situate works in front of a wall or other structure that shields the laser beam.

## Operating Procedure



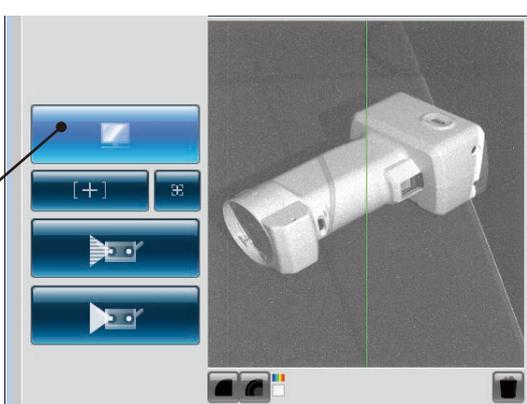
**1 Set the work.**

Set the Scan settings. ("2-4 Scan Settings" P.16)  
 Select [Paired points] under [Initial registration method].



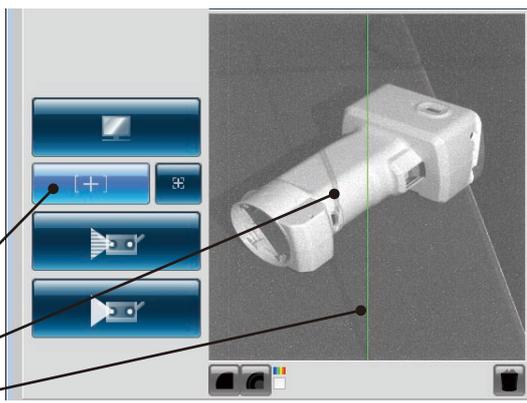
**2 Click [Monitor] button.**

The 2D image obtained by monitor imaging appears in the monitor window. This image is updated at a frequency of about five times per second.



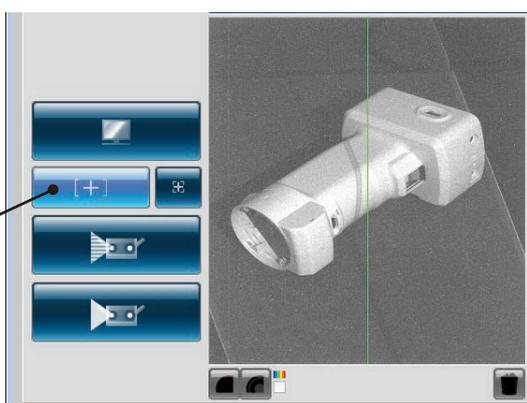
**3 Click [AE/AF] button.**

AF is performed, and the vertical black line in the monitor image moves. By looking at this image, adjust the work and the position and posture of the RANGE7/5 so that the area you want to scan is located within the monitor window and the vertical black line is near the vertical green line indicating the center of lens.



**4 If the lines are not aligned, change the position and posture again, and click [AE/AF] button.**

Make sure that the position of the vertical black line and the vertical green line displayed in the center of the window are almost aligned.



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**Point** For AE/AF, see “2-4 Scan settings” (P.16)

Preview

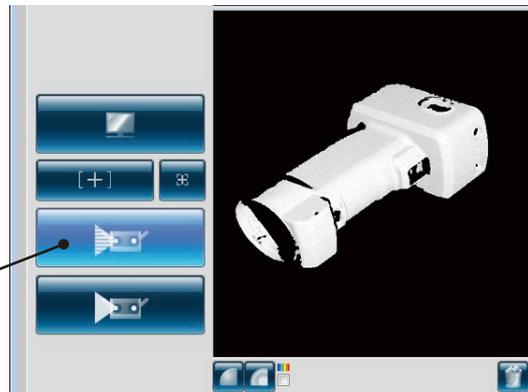
**5** Click  [Preview] button.

A preview appears in the 3D window after scanning at a speed faster than actual scanning. You can check the state of the image to scan by menu button and mouse operation.

**Supplement**

If you dislike the preview results, see “ 2.4 Scan settings” (P.16).

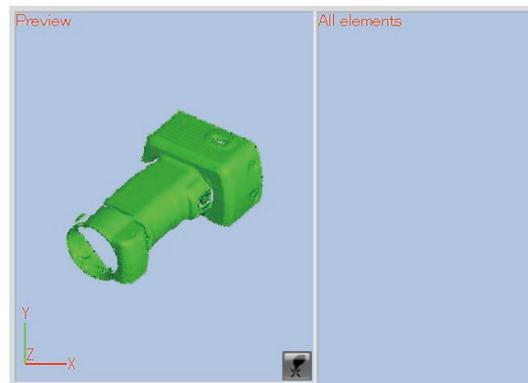
Preview button



**6** Check the preview image.

From the preview image, you can understand the depth and identify dead spaces within the scan area, as well as the quality of scanning results based on surface conditions in advance. You can perform the operation for the preview image by mouse operation after switching the menu button.

To delete the preview image, perform the measurement again or click the  [Delete last data] button.

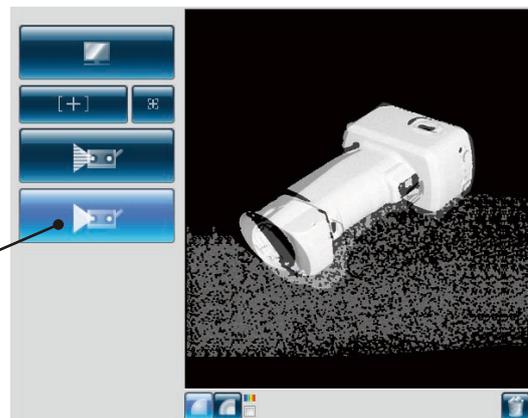


Scanning

**7** Click the  [Scan] button.

[Scan] dialog box is displayed, and the measurement starts.

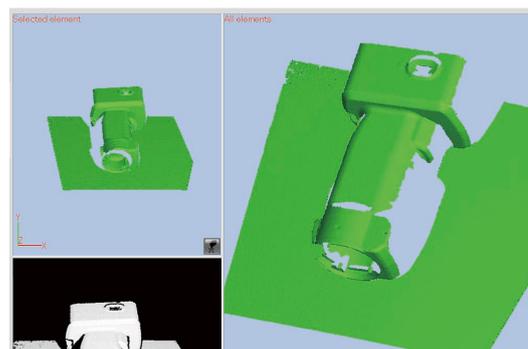
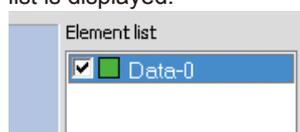
Scan button



**8** The measurement is completed with the set contents.

The measured 3D image is displayed on the Selected element window.

The name of data taken into the element list is displayed.

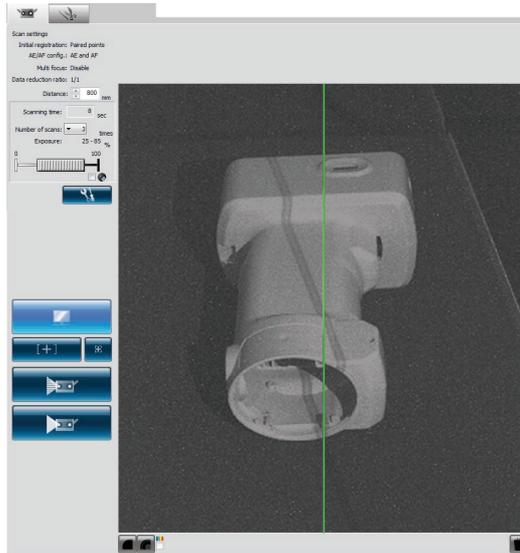




Scanning

**9** After rotating the work to a different angle, adjust the measurement position by monitoring.

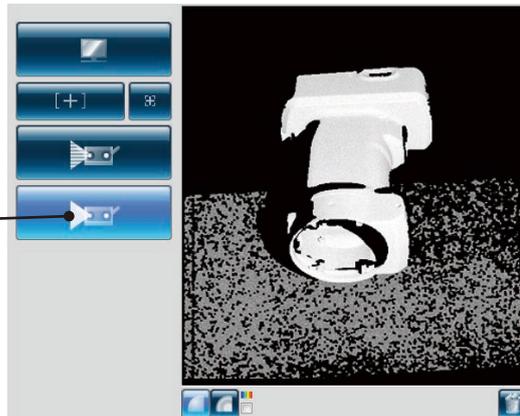
In the same way as 2 to 6, adjust the position.



**10** Click  [Scan] button.

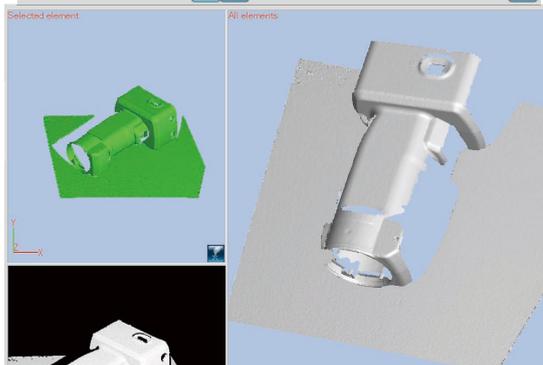
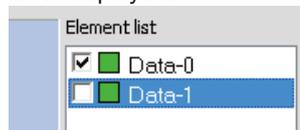
[Scan] dialog box is displayed, and the next measurement starts.

Scan button



**11** The scanning is completed with the set contents.

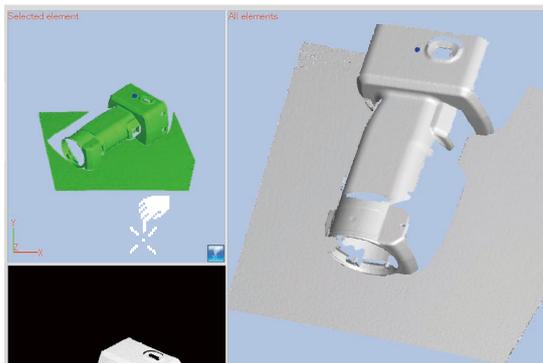
The image measured in the previous measurement is displayed on the window for the element already scanned, and the image scanned this time is displayed on the preview window. The name of data taken into the element list is displayed.



Registration

**12** Click  [Set registration points] button.

The icon changes to , completing the preparation for the selection of the corresponding points.

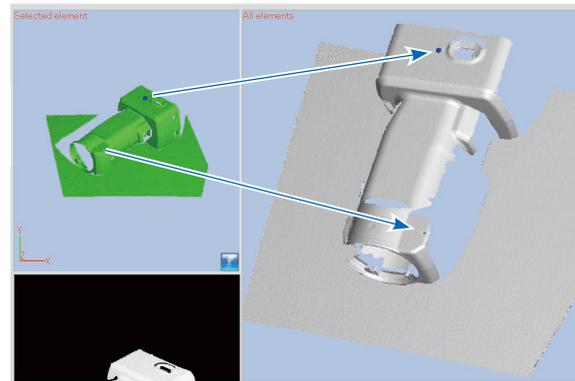




Registration

**13** Click the corresponding positions in turn.

Perform the registration by designating the corresponding positions between the latest measured data (left) and any measured element (right). Click the corresponding positions alternatively on the left and right images.

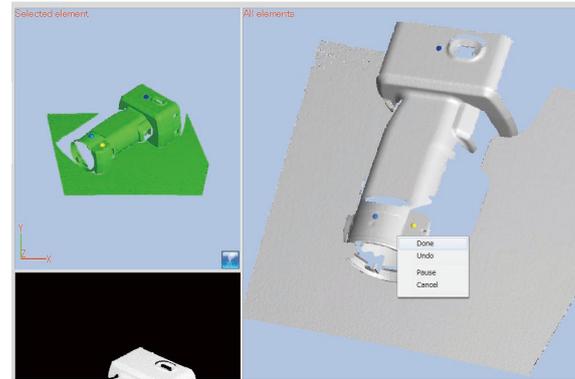


**14** When the selection of corresponding points is completed, perform the registration of the corresponding points.

When you have clicked one or more pairs of corresponding positions, you can perform the registration by selecting [Done] on the popup menu that opens by clicking the mouse right button.

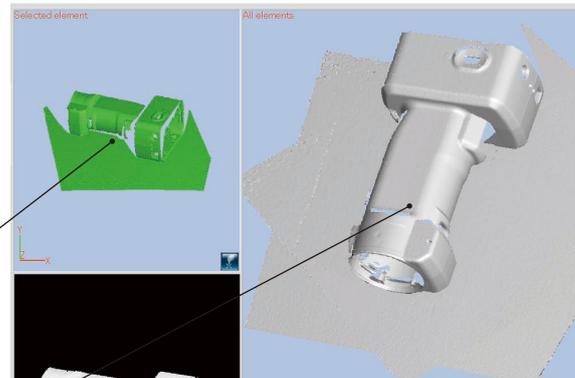
When the positions do not correspond, add a pair of corresponding points and perform the registration again.

Note: Addition of corresponding points can be temporarily interrupted by selecting interruption from the popup menu. To start again, select interruption from the popup menu again. In addition, interruption and restarting can be done by pressing the [Space] key.

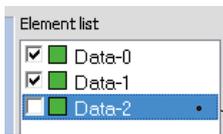


**15** Continue and repeat scanning from different directions.

In the same way as 9 to 14, measure the data at all the angles by repeating the adjustment of measurement position, measurement, and registration.



Scanning



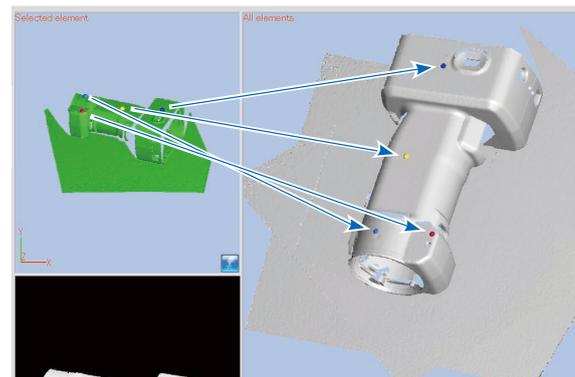
The third scanned data  
2 data already registered by 14

**16** Click [Paired Points Registration] button.

The icon becomes  and corresponding points can be selected.

Click corresponding positions of the data displayed on the Selected element window and All elements window, then register.

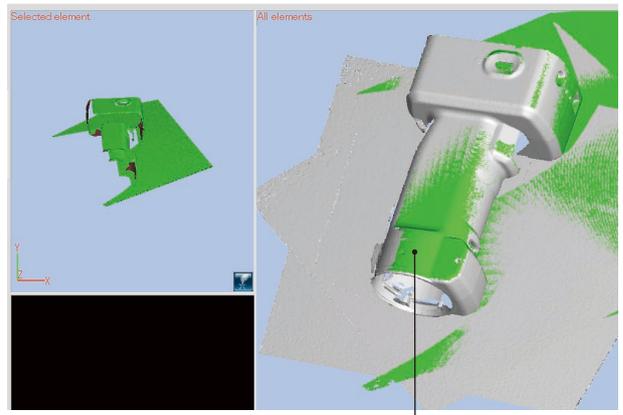
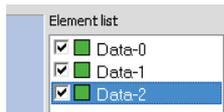
At this stage, paired points can be performed to all the plural number of data displayed on the All elements window.



Scanning

- 17** When clicking more than one pair in corresponding positions, registration is executed by selecting [Execution] in the pop-up menu provided by the right mouse click.

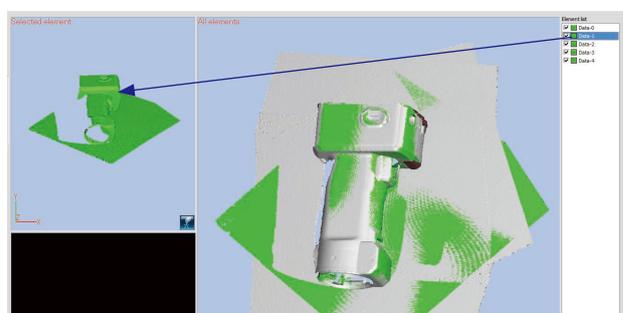
Scanned data finished with registration are automatically displayed in the scanned window.



Condition where registration is executed

- 18** The data which was registered once can be registered again by selecting them in the element list.

Displays data selected from the element list are displayed in the Selected element window.

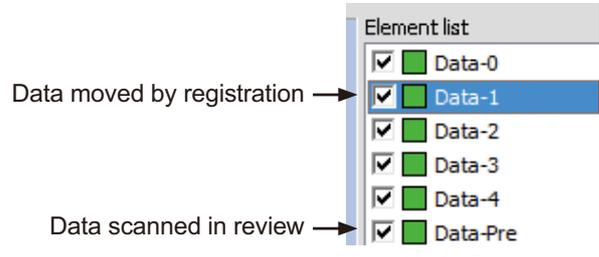


- 19** By clicking [Paired Points Registration] in this condition, registration can be done again for the data [Data-1] which was registered once.

Note: Data obtained by preview cannot be used as the bases for registration even though they are displayed on the All elements window.

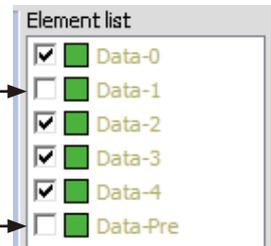
selected data itself is not used as bases of registration.

Therefore, these data automatically become [Non-display] to avoid displaying them on the All elements window (to disable clicking of corresponding points) during the work of paired points.



Start paired points registration

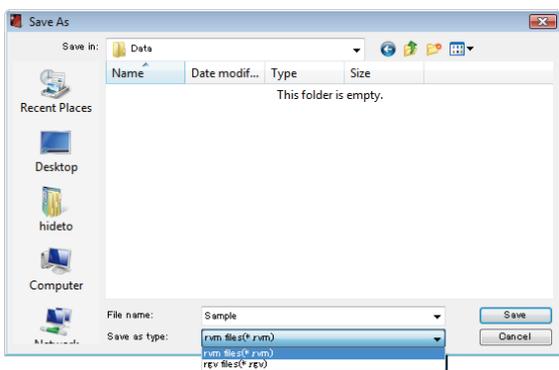
Check is turned off so as not to display data in the All elements window automatically while registration.



- 20** Select [Save as] from [File] menu.

Save the registered data. Registered data can be saved by merging into one. ("7.4 Merging" P.40)

Save





# 5. Scanning [Scanning by Rotating stage]

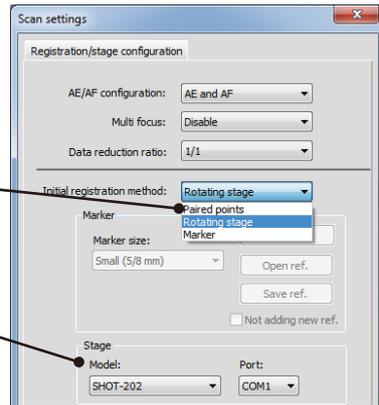
**Warning**

- Do not look directly into the laser emission window.
- Keep lenses, objects with mirror-like surfaces and optical elements out of the optical path. These objects can focus the laser beam, resulting in damage to eyes, fire and burns. Also, to prevent inadvertent accidents, situate works in front of a wall or other structure that shields the laser beam.

## 5.1 Flow of Measurement

The procedure for scanning 3D data using a rotating stage is as follows.

**1 Select the registration mode on the Scan settings window.**

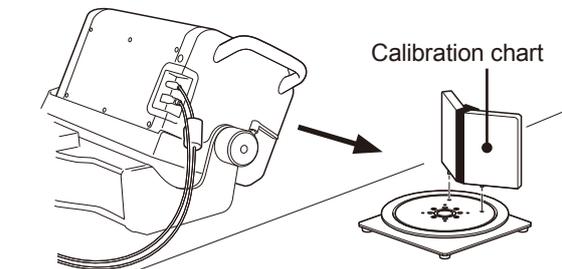


Initial registration method

Stage settings

**2 Scan the calibration chart.**

Scanning the calibration chart automatically saves the axis of rotation in the computer. First, set the work on the rotating stage and monitor it to confirm the position is within the scanning range, and then set the calibration chart on the stage.

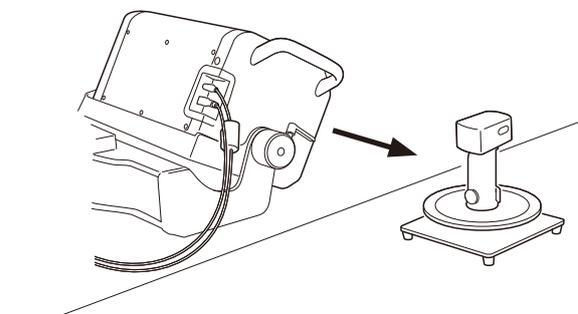


Acquire axis of rotation information.

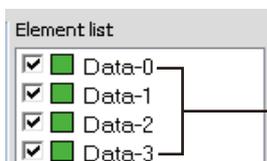
**3 Set the work on the rotating stage and scan it.**

Start without using existing scanned data. Set the work on the rotating stage with the axis of rotation information of step 2 viable (without altering the positional relationship between the rotating stage and the RANGE7/5 after scanning the calibration chart) and scan the work.

Position the rotating stage at each of the set angles using the axis of rotation information. In full auto scanning, the entire perimeter of the work is scanned automatically. For works with complicated profiles, it is a good idea to use free step angles and monitor the work's position after each rotation and scan.



Scan entire perimeter using axis of rotation information.

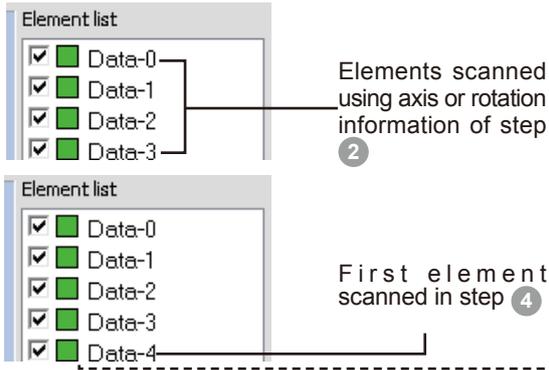


Elements scanned using axis of rotation information of step 2



**4** Once having scanned the full perimeter, scan the work from a different angle to complete the 3D data.

Scanning from a single angle does not complete the 3D data as some areas may not have been seen. By moving the RANGE7/5 and scanning the work from a different angle, points in the first element scanned from the new angle can be selected from elements captured just before from scanning with the rotating stage. This allows you to scan with the RANGE7/5 in a different position but using the same axis of rotation information.



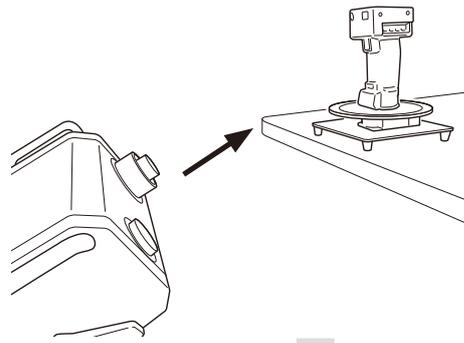
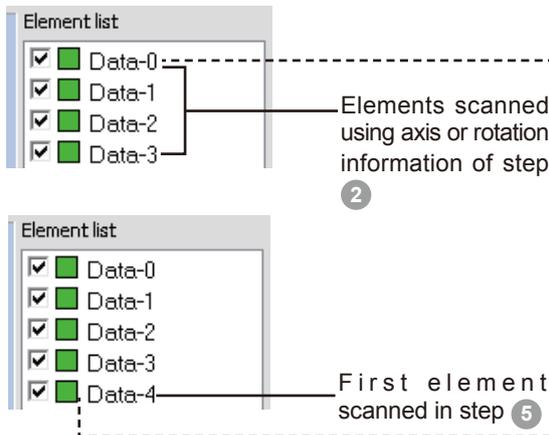
For details, see "Method 1" in "B. Initial Registration with Use of a Rotating Stage, 4.5 Measure" on p. 63 of the Reference Manual.

**5** If you want to move the work, scan the calibration anew.

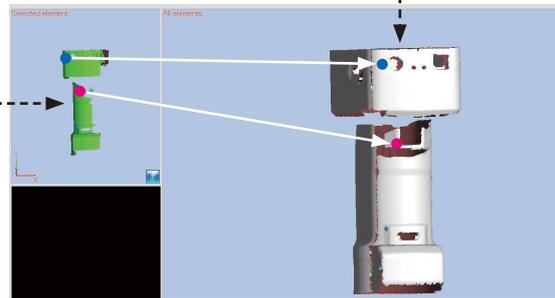
This present method does not work if the work is moved to scan unseen areas. New axis of rotation information is needed. In such case, rescan the calibration chart.

Scan data anew with the rotating stage at a 0° angle and select points to interpolate to the element scanned in step 2 at a 0° angle.

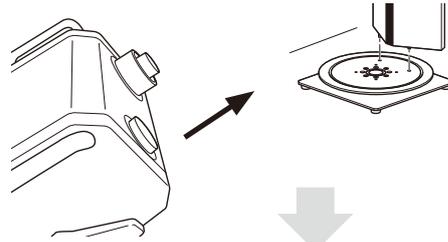
For details, see "Method 2: "B. Initial Registration with Use of a Rotating Stage, 4.5 Measure" on p. 64 of the Reference Manual.



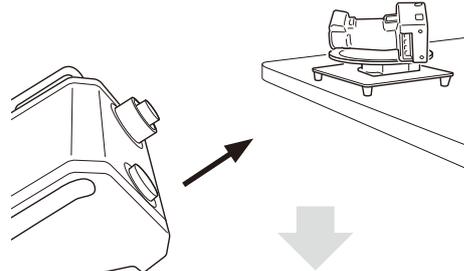
Scan entire perimeter using axis of rotation information.



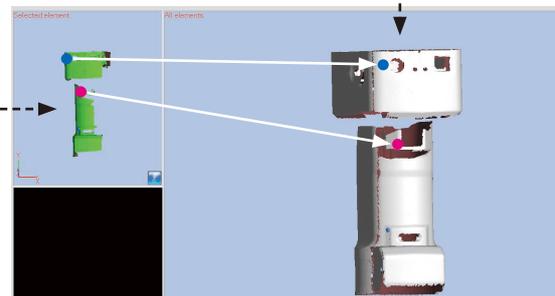
Select corresponding points from 2 elements.



Acquire new axis of rotation information.



Scan entire perimeter using axis of rotation information.



Select corresponding points from 2 elements.

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## 5.2 Scanning by Rotating Stage

The following example of scanning with a rotating stage scans the calibration chart first and then scans the work at 90° steps based on the acquired axis of rotation information. For a more detailed explanation, see “B. Merging with Use of a Rotating Stage” in “Scan Settings” on p. 56 of the Reference Manual.

### Operating Procedure

Setup for Registration Using a Rotating Stage

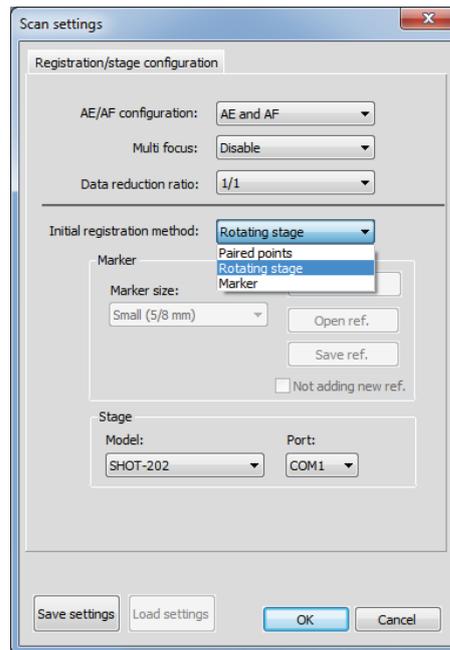
- 1 Click  [Scan settings] button to open the Scan Settings dialog box, and select [Rotating stage] under [Initial registration method].

This operation activates the [Stage] group of settings.

- 2 Set the communication port for the controller of the rotating stage.

The controller can be selected between [SHOT-602] and [SHOT-202] from the [Model] list box in the [Stage] group of settings. Select the controller connected to the computer.

Select a communication port to connect the controller from the [Port] list box in the [Stage] group of settings.



- 3 Click the [OK] button.

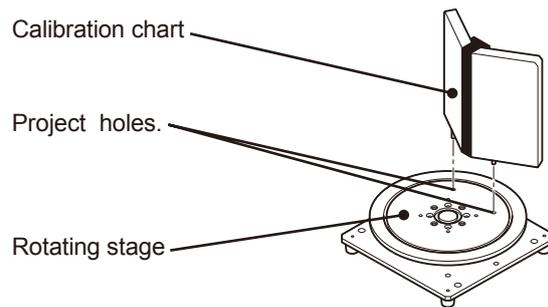
The rotating stage is initialized.

After the rotating stage has been recognized and initialized, one of the following messages appears.

“Cannot find the corresponding axis of rotation data.”

“Conditions differ from when the chart was scanned.”

“Axis of rotation data has been loaded.”

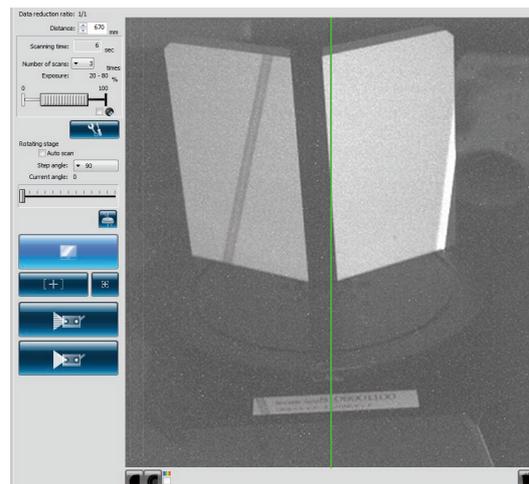
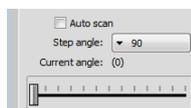


Rotating Stage Calibration

- 4 Set the calibration chart on the rotating stage and click  [Monitor] button.

Position and posture the instrument and the rotating stage so that the calibration chart appears in the monitor window as shown at right.

(Note: Prior to calibration, if the rotating stage is not at the first angle (0°), move the [Rotation Angle] slider to 0° to return the stage to the 0° angle.)

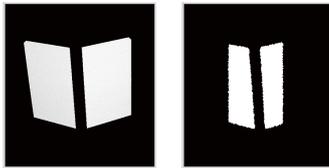


- 5** Click the  [AE/AF] button to adjust the stand-off distance and exposure.

Adjustments are made as determined by the [AE/AF configuration] setting on the Scan Settings dialog box.

- 6** Click  [Preview] button.

Check that the distance image of the calibration chart in the preview window looks like the good example at right. If it looks like the bad example, return to step 4.



Good example      Bad example

- 7** Click  [Stage calibrate] button.

Stage calibrate button

When clicked, a message appears asking, "Ready to initialize stage and scan chart?" Clicking the [Yes] button rotates the stage to the first angle.

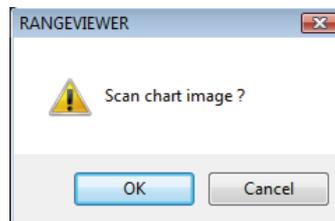
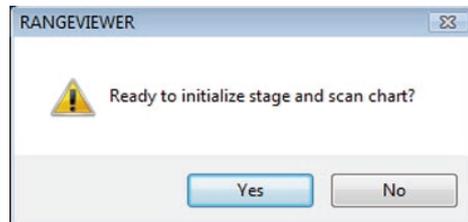
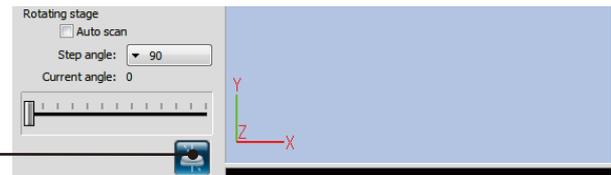
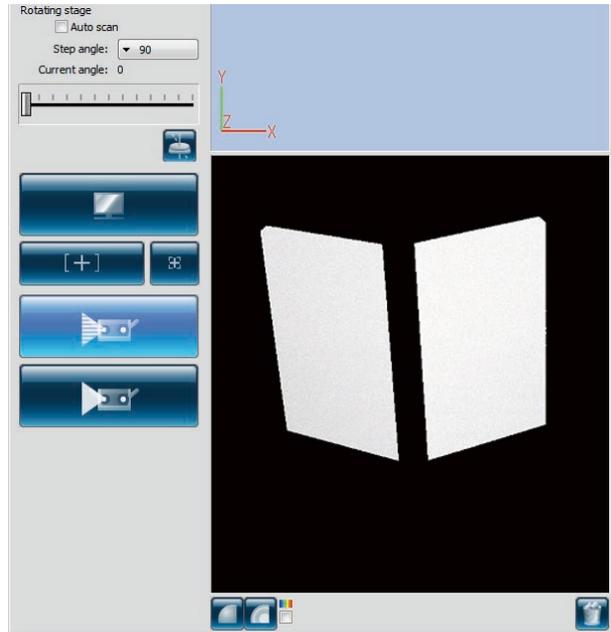
- 8** A message appears asking, "Scan chart image?"

Clicking the [OK] button starts calibration chart scanning.

- 9** The calibration chart is scanned.

When scanning has been completed, a message appears asking, "Use this image?"

Clicking the [Yes] button calculates the axis of rotation data and saves it as a file. The saved data is used the next time registration is done using the rotating stage.

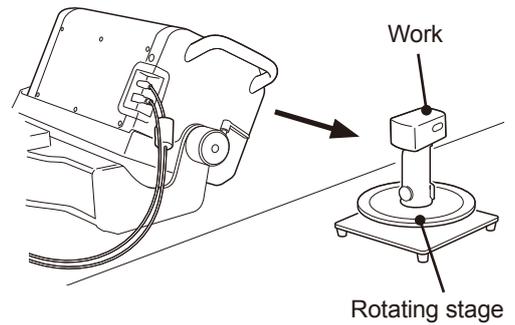


(Note: When using the rotating stage by setting RANGE7/5 vertically, place it in the physical relationship where the acceptance lens is above the rotating stage, and the laser projection window is below the rotating stage. Setting the acceptance lens below can obtain counter-rotating data in some cases.)



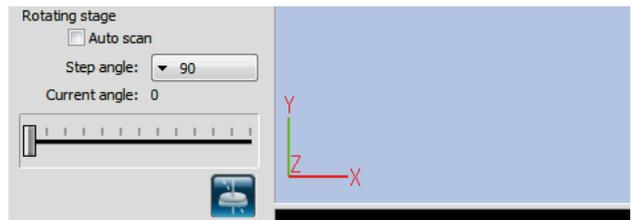
Registration Using a Rotating Stage

**10** Remove the calibration chart and set the work on the rotating stage.



**11** Set the step angle. This explanation sets step angle to 90°.

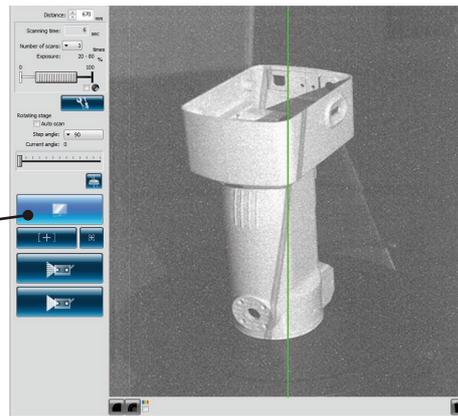
Select "90°" from the [Step angle] list box.



**12** Click  [Monitor] button.

The image obtained from monitoring appears as a 2D image in the monitor window.

Monitor button



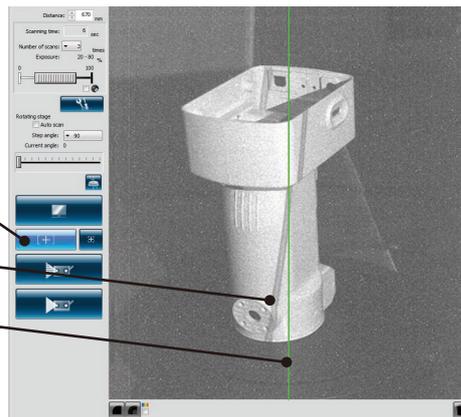
**13** Click  [AE/AF] button.

AF is executed and the vertical black line moves across the monitored image.

AE/AF button

Vertical black line

Vertical green line for indicating lens center

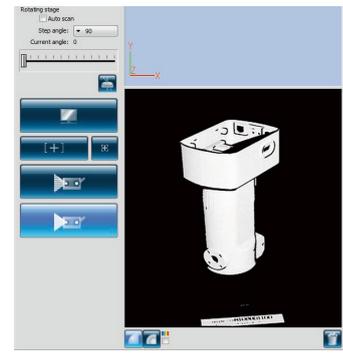




Registration Using a Rotating Stage

**14** Click [Scan] button.

The work is scanned at the current angle (0°) and registration results appear in the 3D view window. After scanning, the rotating stage rotates to the next angle (90°).



**15** Click [Scan] button and, if necessary, [AE/AF] button.

The work is scanned at the current angle (90°) and registration results appear in the 3D view window. After scanning, the rotating stage rotates to the next angle (180°).



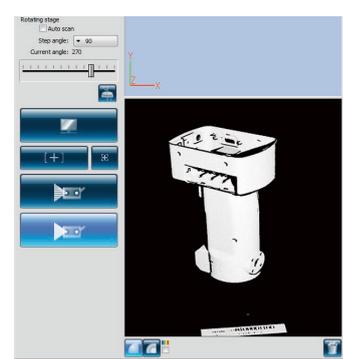
**16** Click [Scan] button and, if necessary, [AE/AF] button.

The work is scanned at the current angle (180°) and registration results appear in the 3D view window. After scanning, the rotating stage rotates to the next angle (270°).



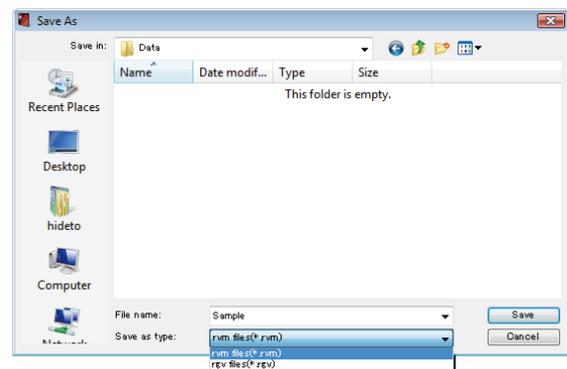
**17** Click [Scan] button and, if necessary, [AE/AF] button.

The work is scanned at the current angle (270°) and registration results appear in the 3D view window. When data has been obtained for the full perimeter, the rotating stage returns to 0°.



**18** Select [Save As] from the [File] menu.

The merged data is saved.



Saving

1

2

3

4

5

6

7

8

9

10

11

Index



## 6. Scanning [Scanning by Markers/Markers (Fixed)]

### ⚠ Warning

- ⚠⊘ Do not look directly into the laser emission window.
- ⚠⊘ Keep lenses, objects with mirror-like surfaces and optical elements out of the optical path. These objects can focus the laser beam, resulting in damage to eyes, fire and burns. Also, to prevent inadvertent accidents, situate works in front of a wall or other structure that shields the laser beam.

If there is a file containing 3D coordinates of markers that has been determined in advance by means of by photogrammetry etc, perform initial registration with "markers (fixed)".

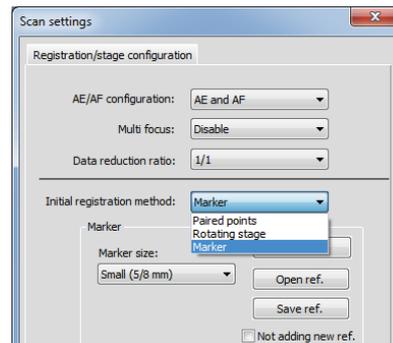
The markers scanned during scanning with markers (fixed) are not added to the reference markers.

### Operating Procedure

Preparations

#### 1 Set the work.

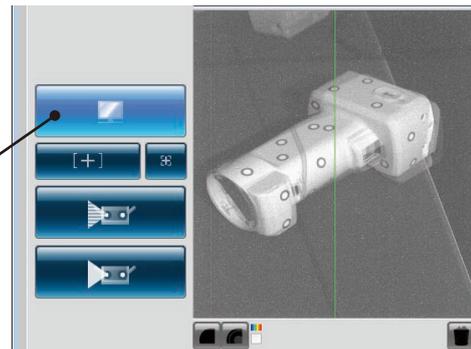
Affix the markers to the work.  
(See "3.4 How to Affix Markers" on P. 20)  
Set the Scan settings. (See "2.4 Scan Settings" on P. 16)  
When using [markers (fixed)], check [Not adding new ref.], click the [Open ref.] button, and read the reference markers out of the file.



#### 2 Click [Monitor] button.

The 2D image obtained by monitor imaging appears the monitor window.  
This image is updated at a frequency of about five times per second.

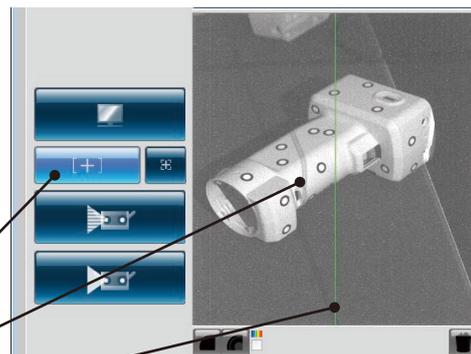
Monitor button



#### 3 Click [AE/AF] button.

AF is performed, and the vertical black line on the monitor image moves. By looking at this image, adjust the work, and the position and posture of RANGE7/5 so that the area you want to scan is located within the monitor window and the vertical black line is near the vertical green line indicating the center of lens.

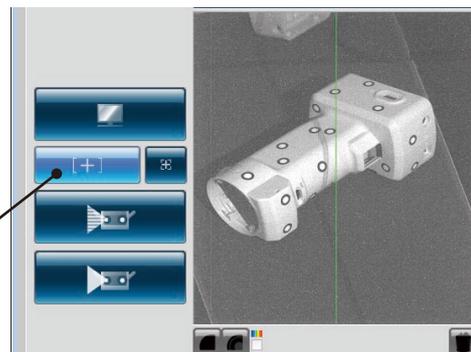
AE/AF button  
Vertical black line  
Vertical green line



#### 4 When lines are not aligned, change the position and posture again, and click the [AE/AF] button.

Make sure that the position of the vertical black line and the vertical green line displayed in the center of the window are almost aligned.

AE/AF button





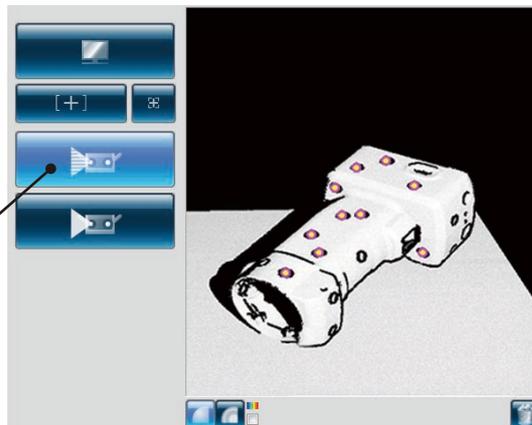
**Point** For AE/AF, see “2.4 Scan Settings” (P.16)

Preview

**5** Click  [Preview] button.

The preview appears in the 3D window after scanning at a speed faster than actual scanning. You can check the condition of the image to scan by menu button and mouse operation.

Preview button



**6** Check the preview image.

From the preview image, you can understand the depth and identify dead spaces within the scan area, as well as the quality of scanning results based on surface conditions in advance. To operate each item on the preview image, switch the menu button and operate the mouse.

To delete the preview image, perform the measurement again or click the  [Delete last data] button.

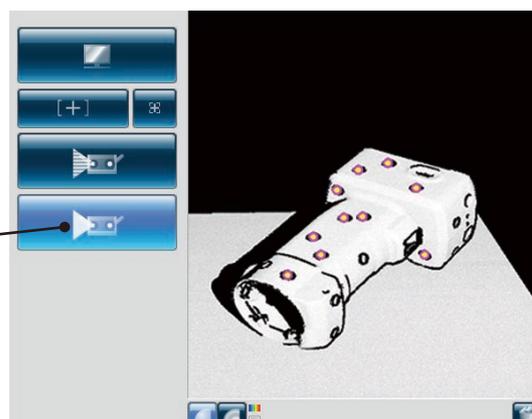
Regarding the preview data for the second shot and afterwards, you can check whether or not they have been automatically registered in the 3D view.



**7** Click  [Scan] button.

The [Scan] dialog box appears and scanning starts.

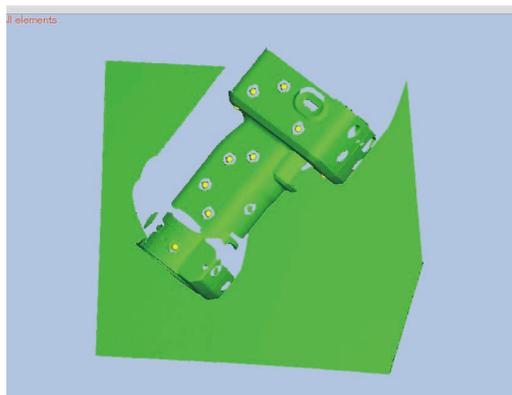
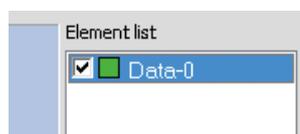
Scan button



**8** Scanning is completed as per settings.

Scanned 3D image is displayed on the selected element window.

The name of captured element appears in the element list.



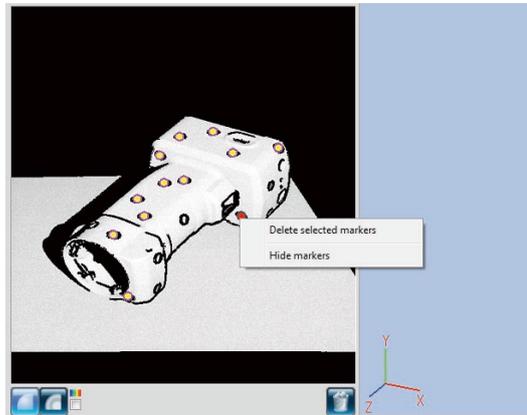
Scanning



Deleting unnecessary markers

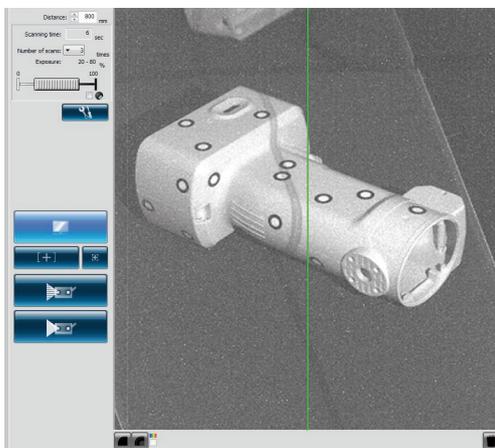
**9** When scanning is complete, delete unnecessary marker information from the monitor window.

You can specify a range and select markers by either clicking the misrecognized marker or a marker you want to delete with the left mouse button or by dragging the cursor while holding down the left mouse button. The selected markers are displayed in red. When you click the selected markers using the left mouse button again, the markers become unselected. After selecting a marker to delete, click the right mouse button to display the pop-up menu and then select [Delete Selected Marker] to delete the selected marker.



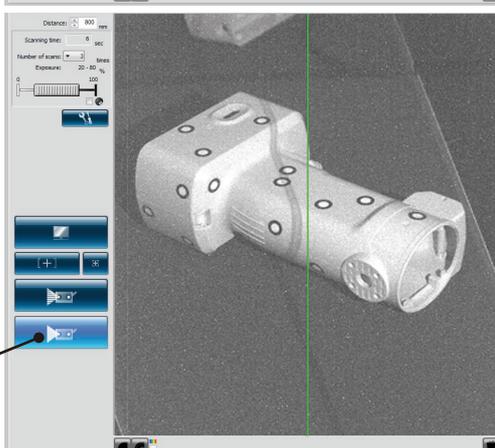
**10** Rotate the work to a different angle, and adjust the scan position by monitoring.

Decide the positions for scanning by overlapping three or more markers (preferably five or more markers) between the previous shot and the next shot. In the same way as steps 2 to 6, adjust the scan positions.



**11** Click [Scan] button.

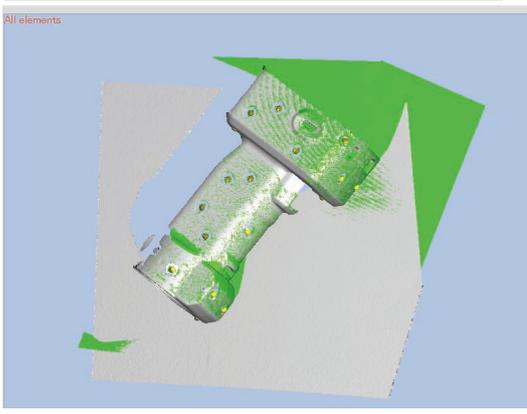
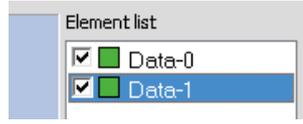
The registered elements appear in the 3D window. Obtain the necessary data from the work by repeating steps 3 to 6.



Scan button

**12** Scanning is completed as per settings.

The image scanned in the previous shot appears in the window for the already scanned element, and the imaged scanned this time appears in the preview window. The name of the captured data appears in the element list.

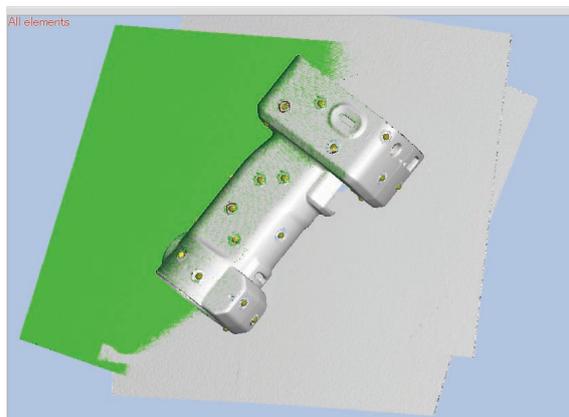
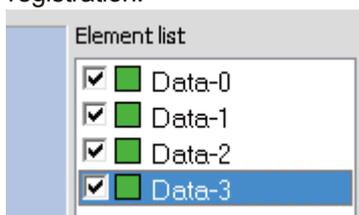


Scanning and registration



**13 After rotating the work to a different angle, adjust the scan position by monitoring.**

In the same way as steps 9 to 13, scan necessary data by repeatedly adjusting the scan position, scanning, and registration.



Scanning and registration

**Point**

**Saving Reference Markers**

Click the [Save ref.] button in the Scan Settings dialog box. The reference markers are saved as a rmk file. Also, you can resume interrupted operations by clicking the [Open ref.] button to recall saved reference markers (rmk file).

**Function to read out reference marker**

Registration can be started again with the interrupted "markers" by reading out the saved rmk file.

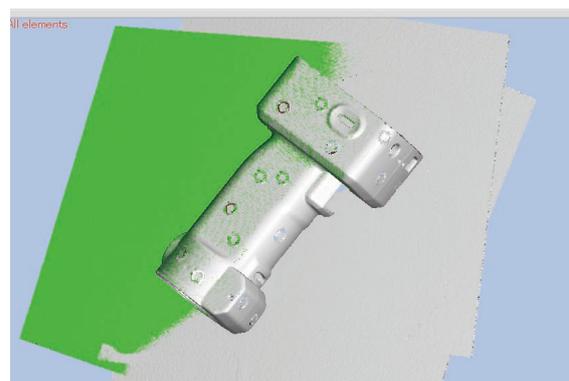
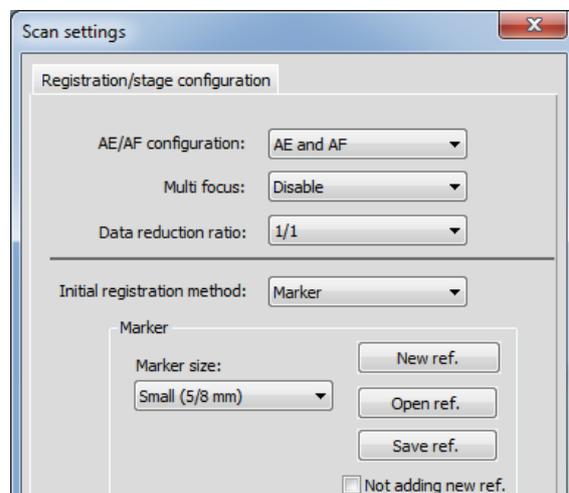
Also, since the 3D coordinates of each marker affixed to the work can be determined, registration can be performed with "markers (fixed)".

The files that can be read out are rmk file and txt file. The rmk file has an original format.

For details of txt file, see Reference Manual, P.90.

**Creating New Reference Markers**

To delete all captured reference markers, as might the case when ready to scan a new work, click the [New ref.] button. All reference markers are deleted.

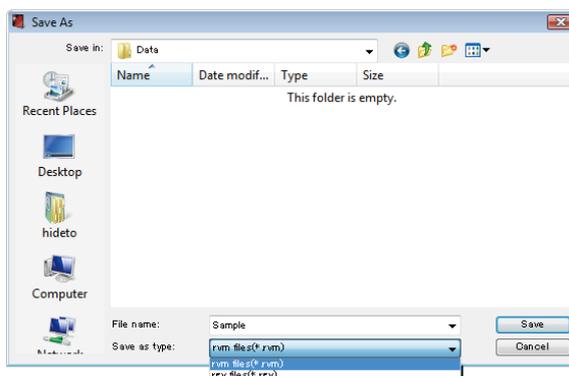


(Condition where all the reference markers are deleted)

**14 Select [Save As] from the [File] menu.**

Save the registered data.

Saving



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# 7. Editing Scanned Data

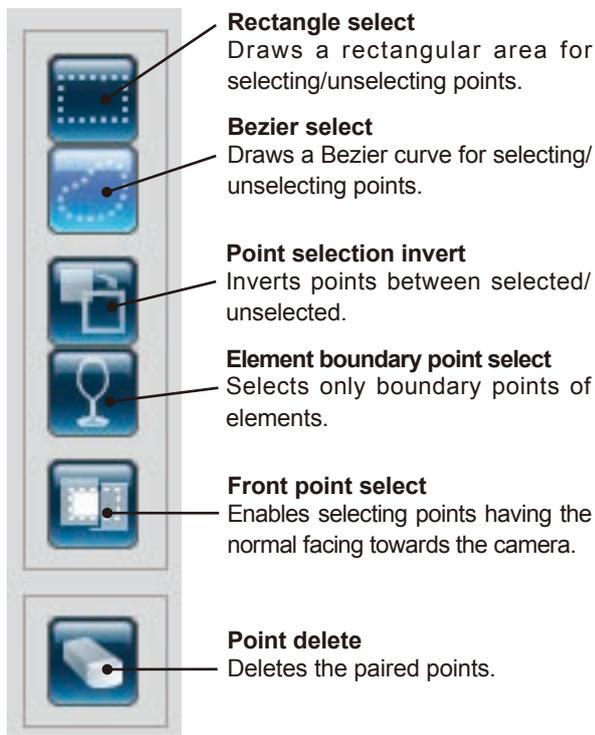
## 7.1 Deleting Unnecessary Points

When you want to erase unnecessary data taken with the measurement, such as a background, you can select the section you want to erase or select it by inverting and delete it. To use these commands, you must open the [Edit] tab and at least one element must be registered.

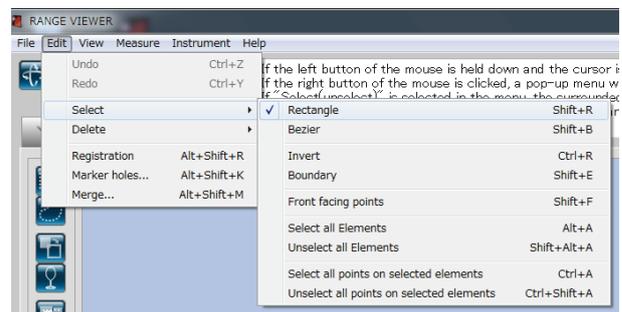
As the method of selecting points, there are rectangle selection, Bezier selection, point selection, element boundary, selecting / unselecting, and inversion of points.

Only the points of selected elements in the element list are selected. However, if front point selection is ON, only points facing to the front are selected. And, both points of elements selected in the element list and points of unselected elements appear in the 3D view.

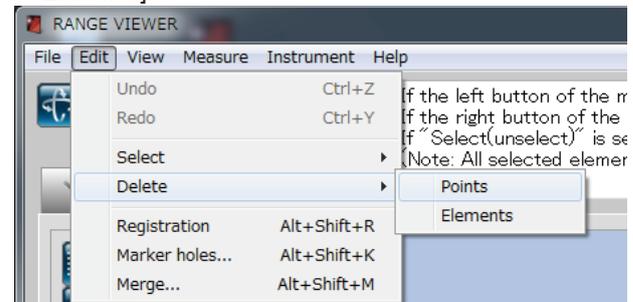
### ● Buttons for selecting / deleting points



### ● To select/unselect groups of points, select [Select] from the [Edit] menu .

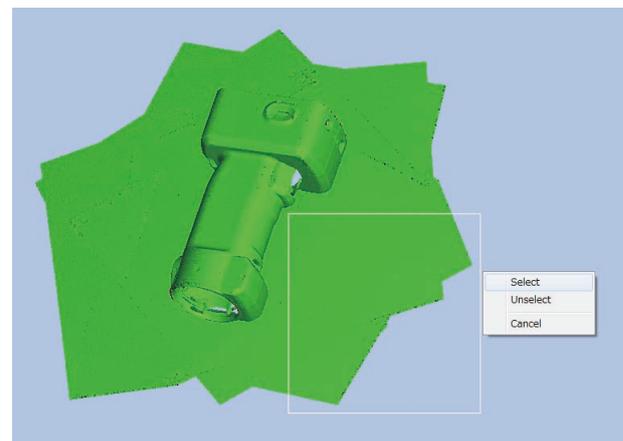


### ● To delete a group of points, select [Delete] from [Edit] menu and then click either [Select Points] or [Select Elements].



### Functions of the edit buttons

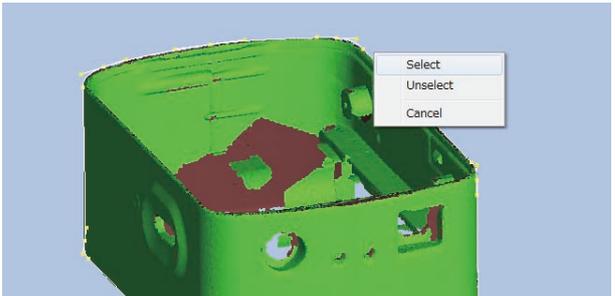
 **Rectangle select**  
Selects or unselects the points enclosed in a rectangle drawn by mouse operation.





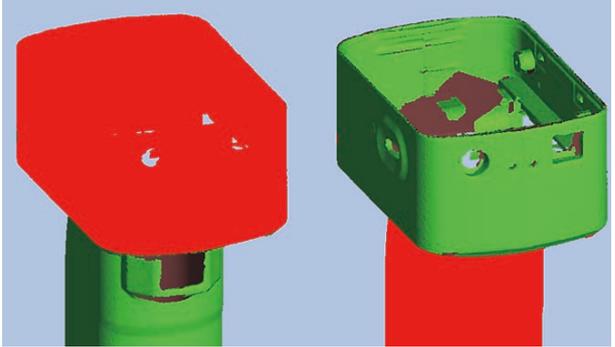
**Bezier select**

Selects or unselects the points enclosed by a Bezier curve drawn by mouse operation.



**Point selection inversion**

Inverts the selected / unselected status of the selected element points.



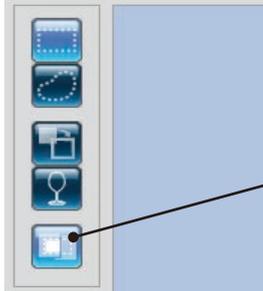
**Element boundary point select**

Selects the elements' boundary (the boundary of the holes) automatically. With merged elements, the boundary of all the merged elements is selected.

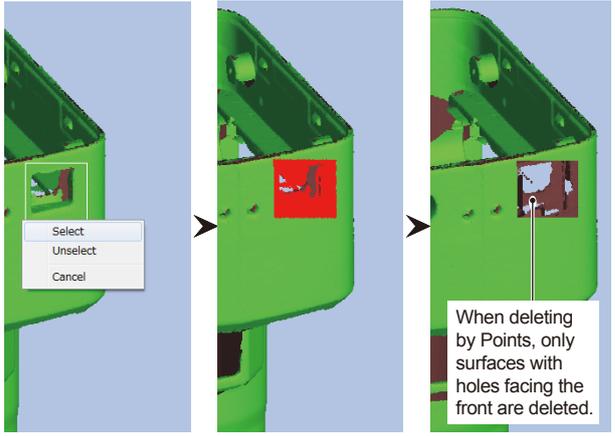


**Front point select**

Selects the points facing towards the front of the current view of elements selected by rectangle selection or Bezier selection.

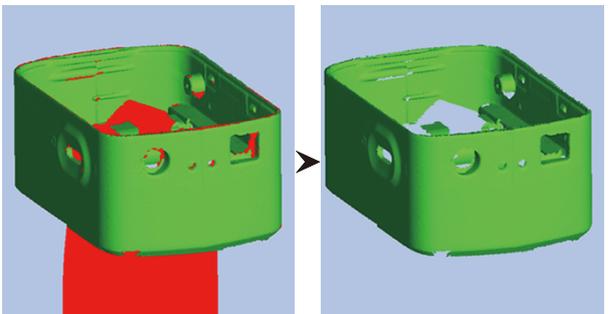


When the front point select button is highlighted, the function is active.



**Point delete**

Deletes the points that have been selected in the elements.



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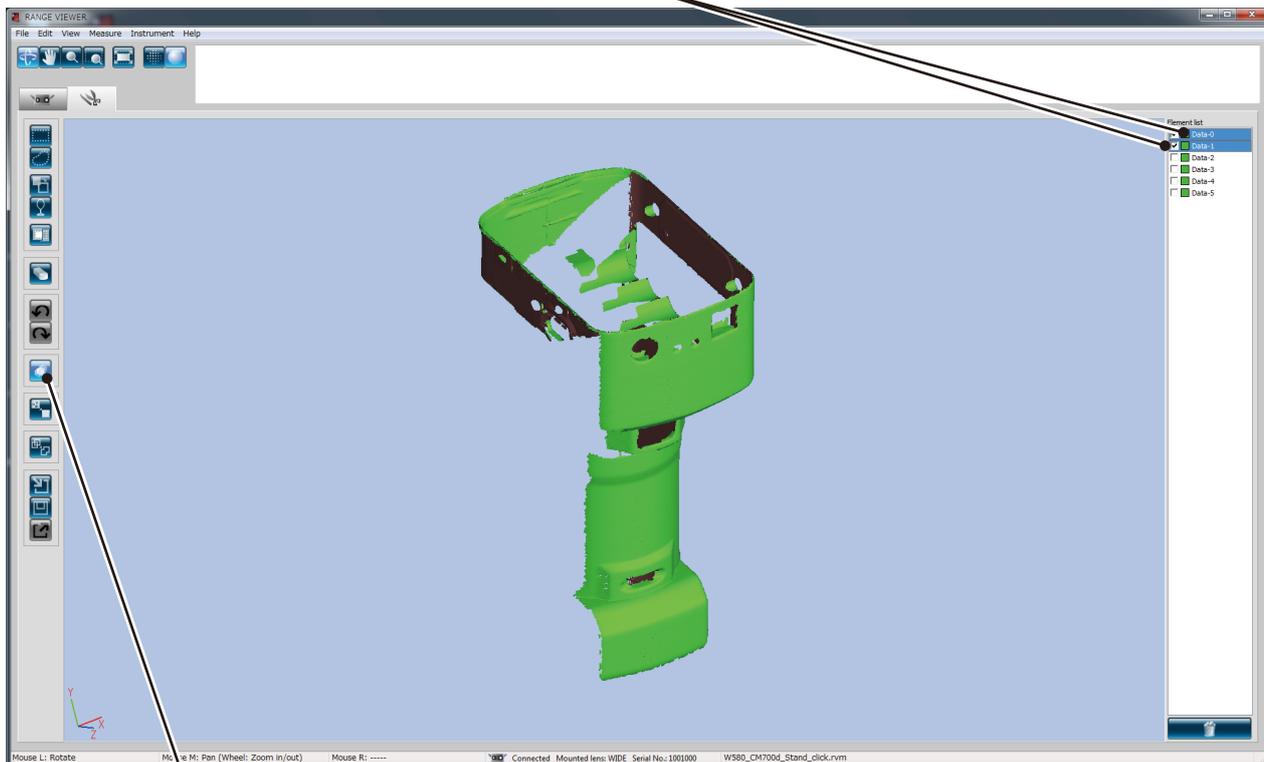


## 7.2 Registration

This command is for positioning two or more elements in the element list. When executed, the selected element of the highest position serves as the reference for positioning the other elements. A dialog box appears with the results.

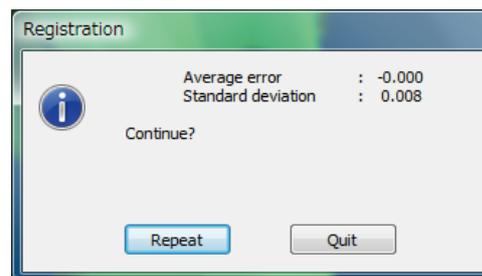
\*Before merging elements by “7.4 Merging”, perform the registration.

- Select the desired elements from the element list.



- Click the element registration button.

Registration calculations begin. Once ended, a dialog box appears with the calculated Mean Error and Standard Deviation. To finish registration, click [Quit].



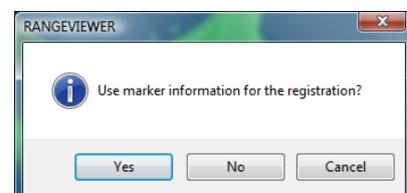
### Mean Error and Standard Deviation

The mean error and standard deviation are reference values for registration results. Both are indicated in units of mm: mean error giving the average amount of error in the registration result and the standard deviation giving the variance of that error. Normally, as the values approach “0”, the closer the position matches the reference position.

### Registration with marker information

If there are markers, registration can be performed with the marker information.

If registration is performed, the dialog at the left is displayed. To perform registration with the marker information, select [Yes]. If registration is performed with the marker information, each position is adjusted finely so that the shapes of the other parts will match while maintaining the congruency of the marker positions. Fine adjustment to the position can be made after registration is performed with the markers.

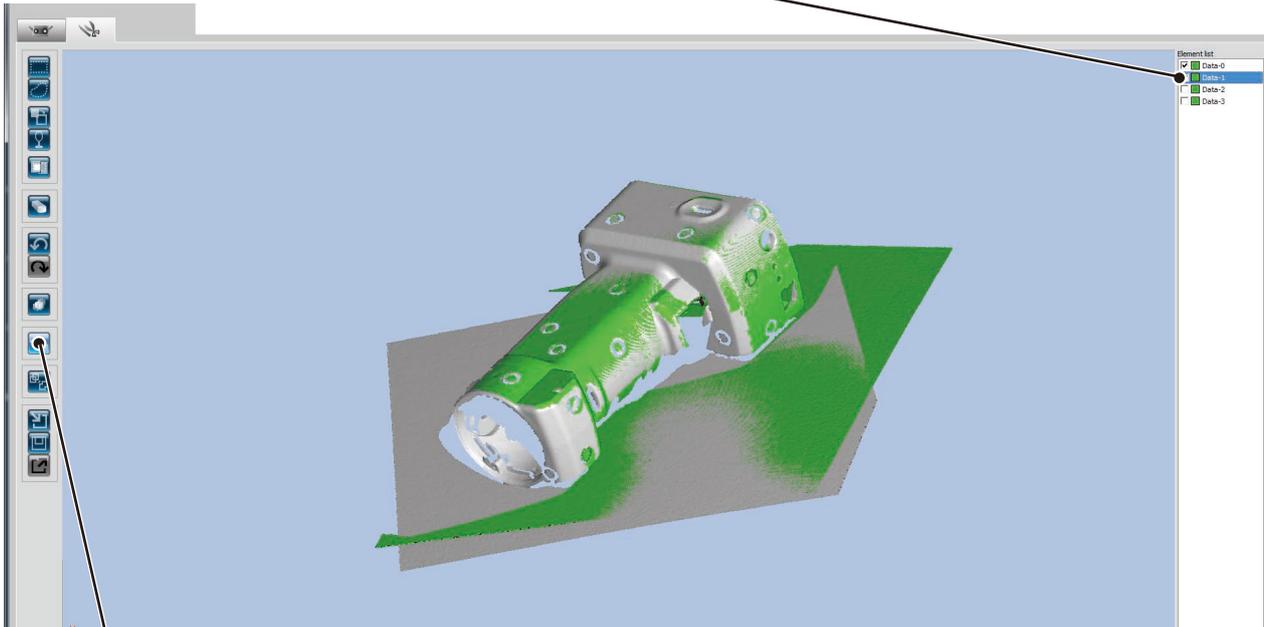


## 7.3 Edit marker holes

When registration is performed by using a marker, editing is done for data around the marker which is pasted to the scanned object. In case scanned data (rvm, rgv file) and a reference marker (rmk file) are read out, editing can be done for data around the marker in the same way.

The function to keep points on the marker selected (selection of points on the marker) and the function to replace point groups around the marker with the shape calculated based on point groups around the marker can be executed.

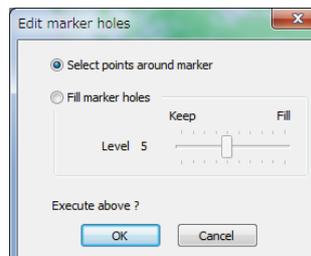
- Selects elements which are to be edited for point groups of the marker holes.



- Click the edit button of the marker holes.

### Select functions to be executed.

- By clicking [Yes], the selected function is executed.
- By clicking [No], the dialog is closed without executing the selected function.



#### Point

#### Selection of points on markers

Select all the points near the reference marker in the form of a discus. By deleting in the [Edit Mode] screen, a hole is formed.

##### Supplement

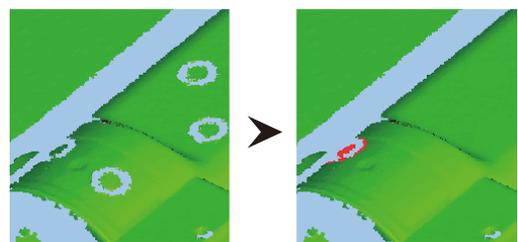
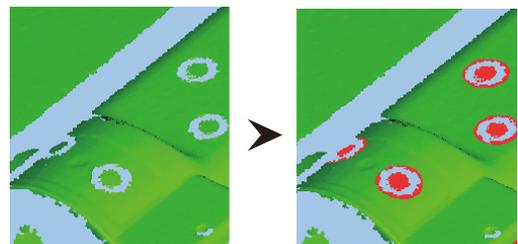
After executing selection of points on the marker, points which were selected before the execution become non-selected. Only the points on the marker are selected. This operation can return the condition to the original state by cancelling.

#### Marker hole-filling

Replace points on the reference marker with the shape calculated based on the point around the reference marker. By means of [Hole-filling level], the acceptance level of a hole-filling result can be set. By increasing the number, markers pasted to a round surface can be hole-filled.

##### Supplement

When the number of selected elements around a reference marker is few, the points around the reference marker are selected. Selected points before the execution are not selected, and only the points which failed to perform hole-filling are selected. This operation can return to the original state by cancelling.

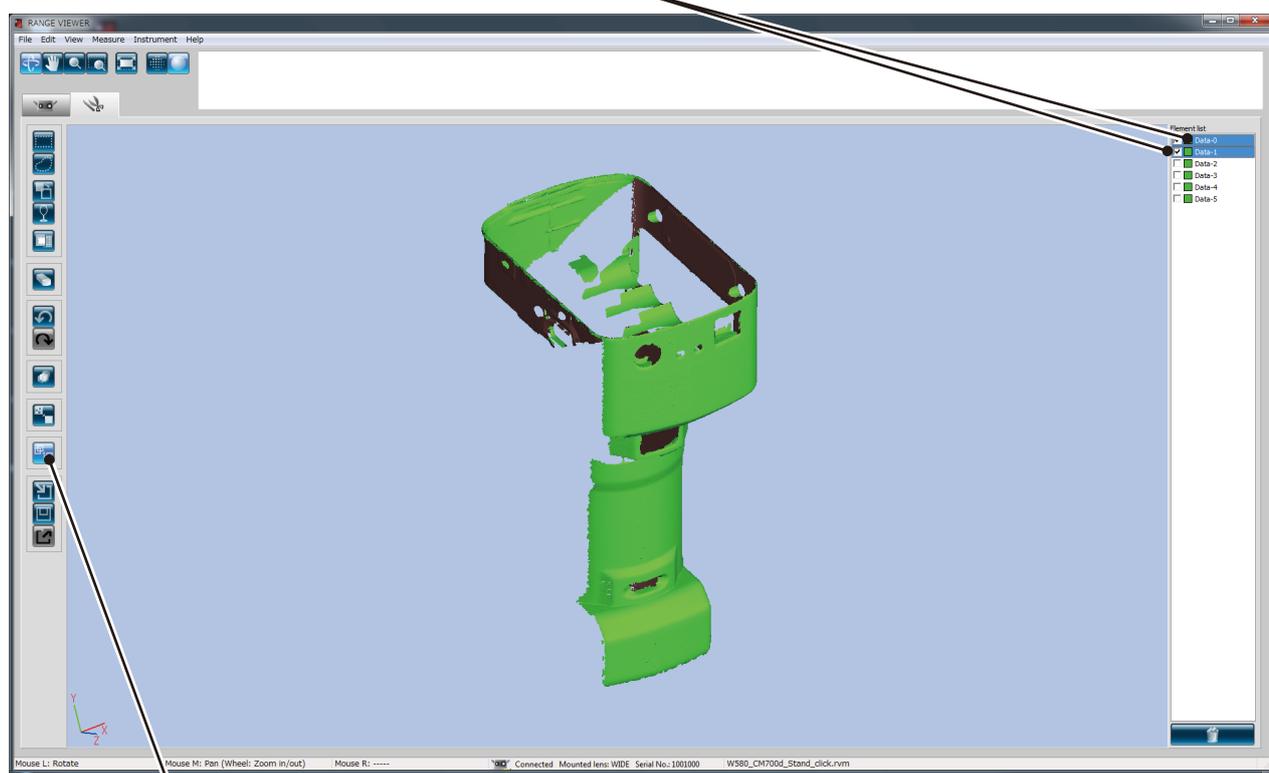




## 7.4 Merging

Select 2 or more elements to interpolate from the element list. When merged, the selected individual elements are deleted and only the merged element remains.

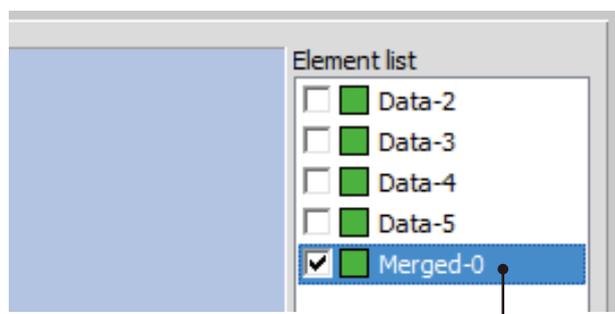
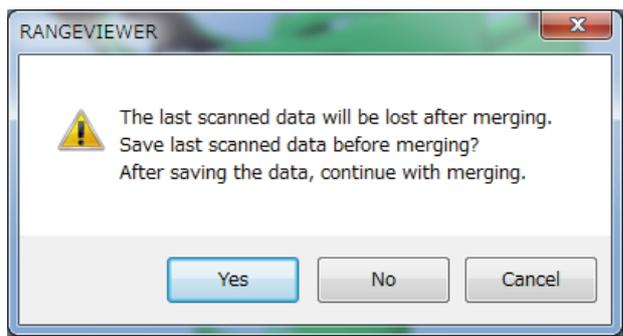
- Select registered elements from the element list.



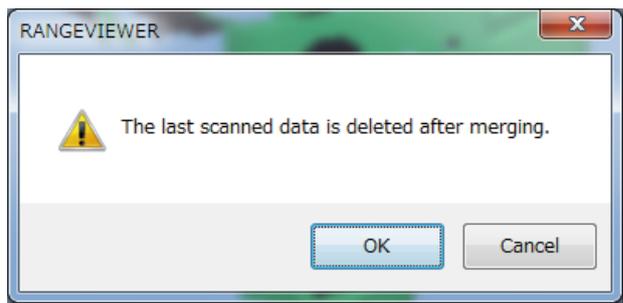
- Click the merge button.

Displays the dialog to save data and the dialog to proceed with the merging process, and the calculation begins when merging proceeds.

Once completed, the individual elements that existed prior to merging are deleted from the element list, whereas the newly merged element appears in the element list.



- A single merged element is created.



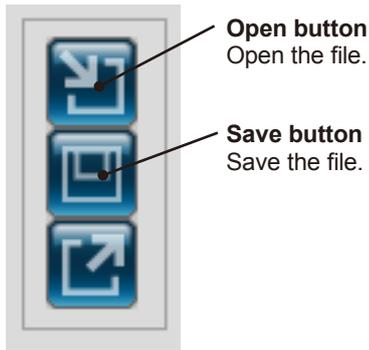
# 8. Saving Data and Exporting

## 8.1 Saving Data

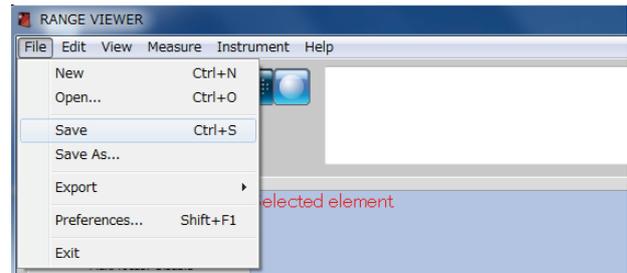
When you select [Save], the open file is saved. Files can be saved in either of two formats, rvm or rgv, but the Save function can save data only in rvm format.

\* When saving an "rgv" file with its current name, you must use [Save As] and specify the current name.

● Buttons to be executed from the editing window



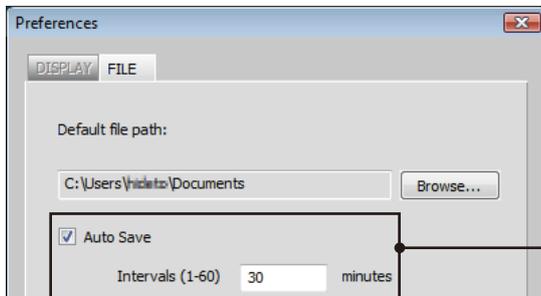
● To save a file, select [Save] or [Save As] in the [File] menu.



## 8.2 Setting Automatic Save Feature

It is recommended to save scanned and edited data frequently in anticipation of possible trouble. In consideration that you may want to restore data to its original state, it is also recommended to create backup files by saving the data under a separate file name or creating a duplicate file. In anticipation of possible trouble, you can set the automatic save feature.

● From the [Preferences] dialog box, select the [FILE] tab.



Set whether or not to use the automatic save feature. Placing a checkmark in this checkbox enables automatic saving at the set time interval. However, automatic saving is performed only when there has been a change to the element. The file format is rvm. The time interval for automatic saving can be set from 1 minute to 60 minutes.

### File Formats

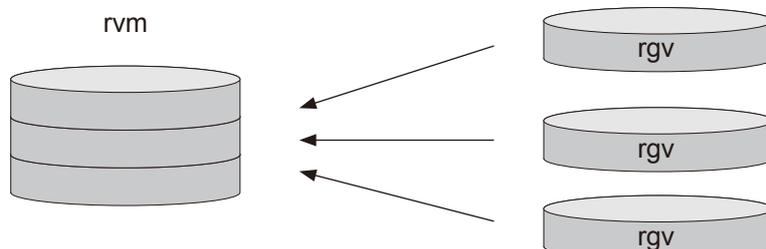
RANGE VIEWER uses two file formats: rvm that groups all elements into a single file and rgv that creates one file for each element.

#### rvm format

Multiple elements are grouped into a single file.

#### rgv format

Each element has its own file.





## 8.3 Exporting

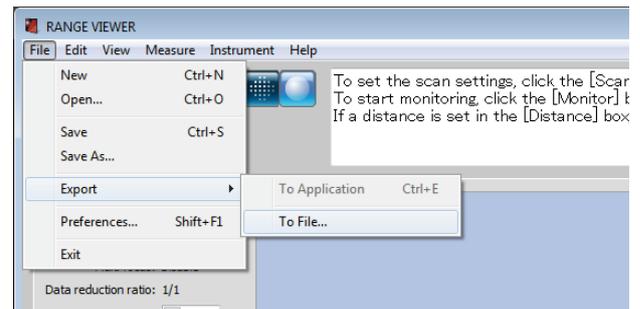
Scanning data and editing data can be exported to other 3D point processing software from other manufacturers. The 3D data can be exported via saving files or using IPC function sent directly to other applications.

- The buttons to be executed from the edit window



**Export button**  
Exports elements to an application software.

- To export, select [Export] in the [File] menu.



'Application' sub menu of Export will be activated when the third-party software is ready to import the 3D data from RANGE VIEWER. At this time, 'Application' menu name will be changed to the name that set by the third-party software.

### Exporting with the IPC function (File Transfer)

Exporting with [File] – [Export] – [Application Software \*] uses the IPC function.

Compared to exporting through a file (Export), the file transfer export method is simpler and faster because it eliminates the need to save the file or read in the file.

Confirm that the external software supports the IPC function.

\* "Application Software" is enabled when preparations are complete on the external software side for receiving the export from RANGE VIEWER, and shows the name set by the external software.

### STL Files

This file format is specifically for SLA CAD software by 3D Systems. It is supported by a wide range of analysis software and allows 3D data to be directly input in STL format for use with prototyping machines. The recorded 3D modeling data forms a polygon of the surface normal vectors and coordinates for three vertexes of a triangle. STL files can be ASCII or binary format, but RANGE VIEWER exports only the binary format.

Merged data is exported to a single STL file without connections between the merged elements.

### ASC Files

Exported ASC (ASCII) files contain 3D point data without normal information.

# 9. Viewing 3D images

## 9.1 Changing Viewpoint and Zoom of Works

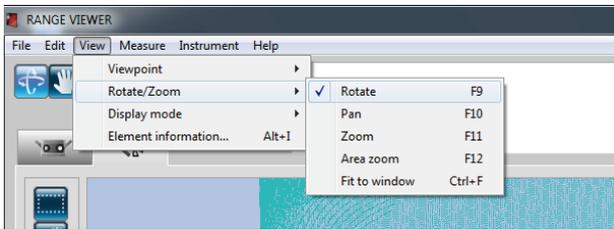
Previews and scanned data of works appear as 3D images. You can view enlarged 3D images and merged images by changing the viewpoint using the menu buttons. Select either one of the [Viewpoint rotate], [Viewpoint move], [Zoom], [Zoom selected area], and [Fit to window] buttons. The selected menu button is highlighted. You can also carry out the same operation by selecting [Rotation/Zoom] from the [Display] menu. A check is marked on the selected menu item.

### Menu button

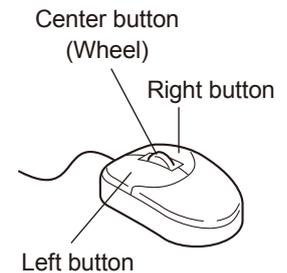
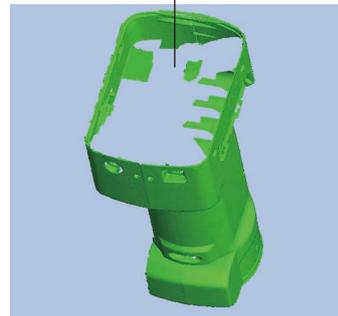


The selected button is highlighted.

### [View] menu



3D image is mainly displayed by mouse operation.



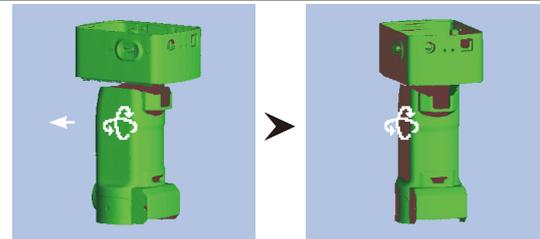
### Functions of the menu buttons



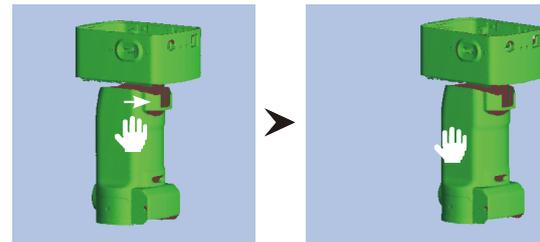
#### Viewpoint rotate

You can rotate the viewpoint by pressing and holding the left mouse button and dragging the pointer.

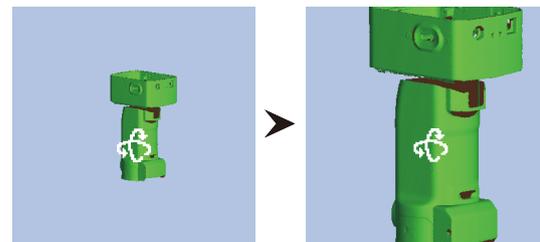
Left-clicking on a point above the scan data while holding down the [Ctrl] key will switch the center of rotation to the position of the point.



While you are pressing and holding the mouse center button (wheel), the icon becomes  and you can move the viewpoint by dragging the pointer.

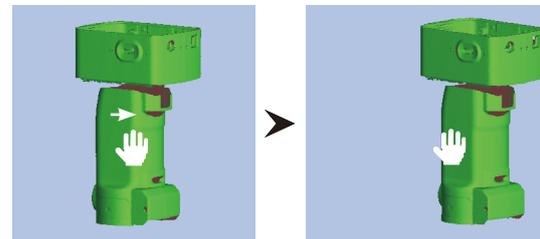


By rotating the mouse center button (wheel), you can zoom in / zoom out the display range.



#### Viewpoint move

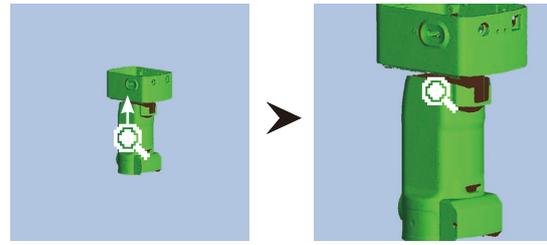
You can move the viewpoint by pressing and holding the left mouse button, and dragging the pointer.





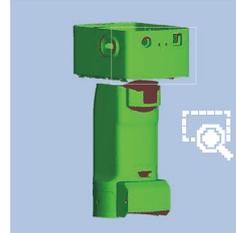
**Zoom**

You can zoom in/zoom out the display range by pressing and holding the left mouse button, and dragging the pointer up/down in the screen.

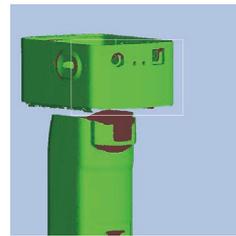


**Zoom selected area**

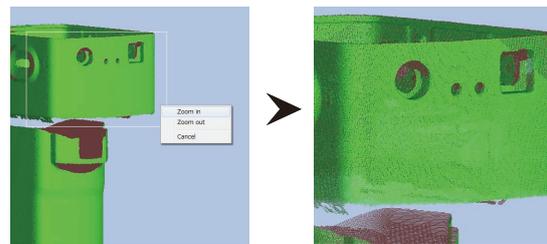
While pressing and holding the left mouse button, the display area can be drawn as a rectangle.



When you release the left mouse button, the display area is set as the drawn rectangle.

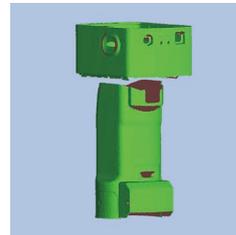


Display the popup menu for Zoom in / Zoom out / Cancel by clicking the right mouse button, and select one of the commands.



**Fit to window**

When you press and hold down the button, the display area is automatically zoomed in/out to display all the elements.



**Show points**

Displays the points in 3D data. Because the shaded 3D parts are not calculated and displayed, the points view enables faster drawing than the shaded points view.



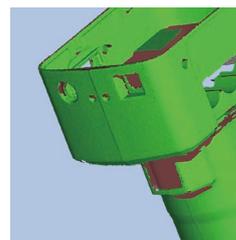
When you perform editing operations such as deleting unnecessary points, the points view enables faster processing.

The size of the points can be set from 1 to 10.



**Show shaded points**

3D data is displayed in shades. Shadows are calculated from the position of the light source and reflected light to display three-dimensional views.



 **The mouse right button also has functions.** (Clicking the right mouse button displays a popup menu)

- Fit to window**                      Resizes the whole 3D data to fit the window size.
- Points / Shades**                Switches to the view that is not selected at present.
- Switches the viewpoint.**      Display 3D data by switching the orientation from [Front], [Back], [Top], [Bottom], [Right], and [Left].

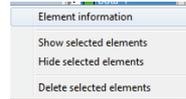


## 9.2 Changing 3D image Display Mode

To make it easier to edit elements before mergers, you can set the color of selected elements, the transparency of the last scanned element, and the color of unselected elements.

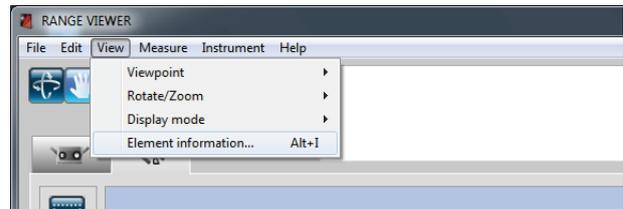
### Operating procedure

1 You can set the display mode by selecting [Preferences] from the [File] menu and using the [DISPLAY] tab in the [Preferences] dialog box.

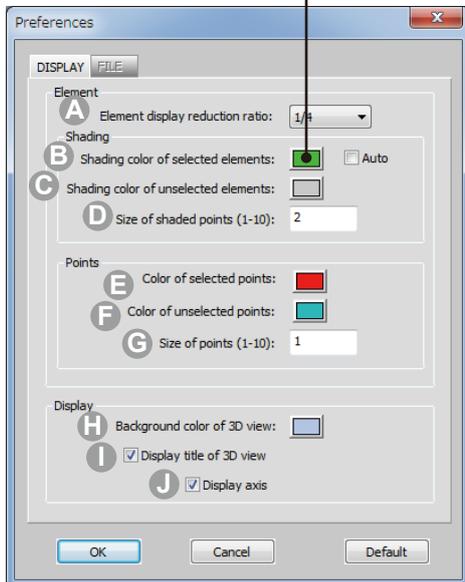


2 You can set the selected color for each element.

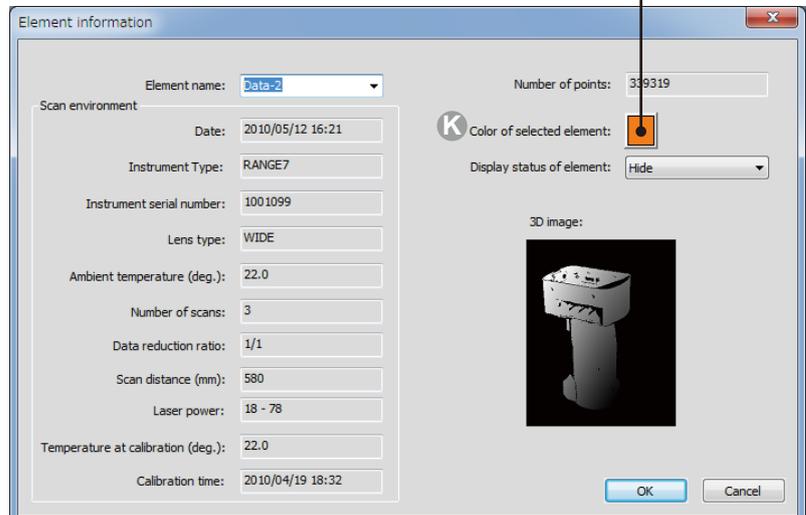
Select the element from the element list, and then select [Element Information] from the popup menu that opens by clicking the right mouse button. Or, select [Element Information] from the [View] menu.

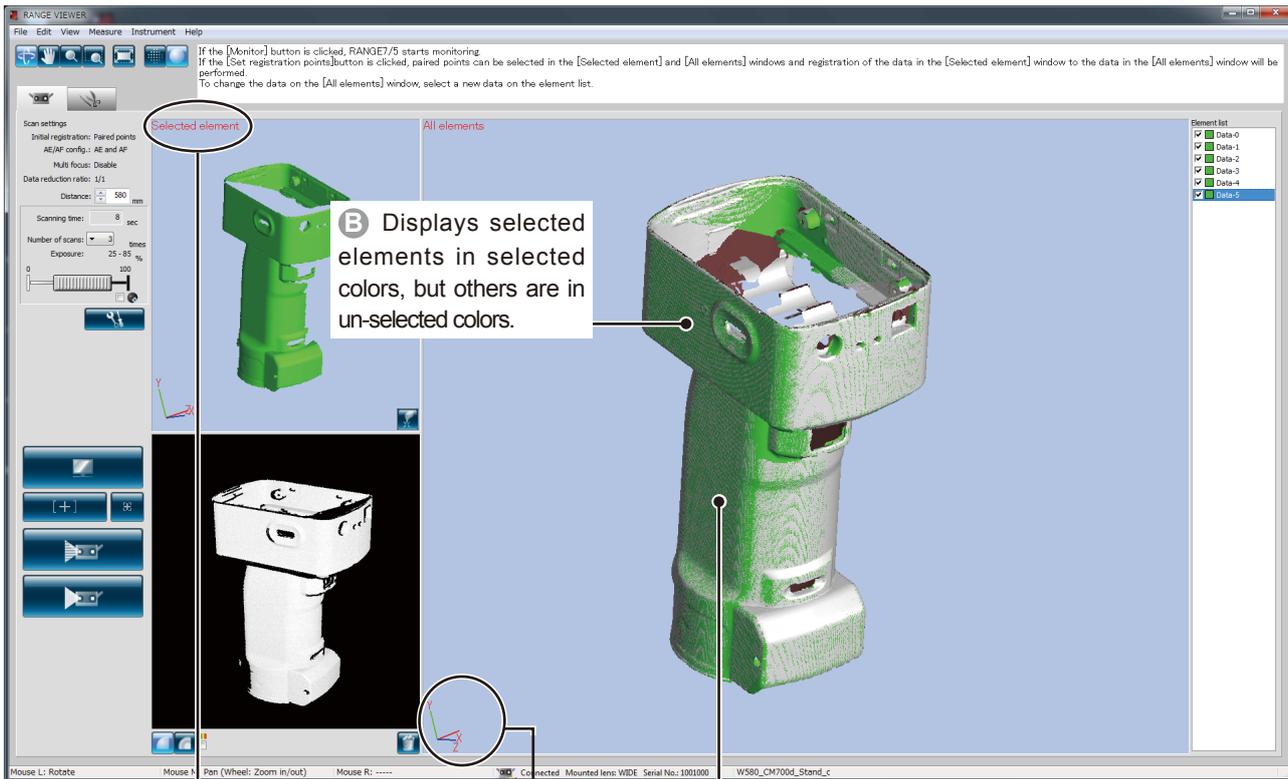


Example: Green



Example: Orange

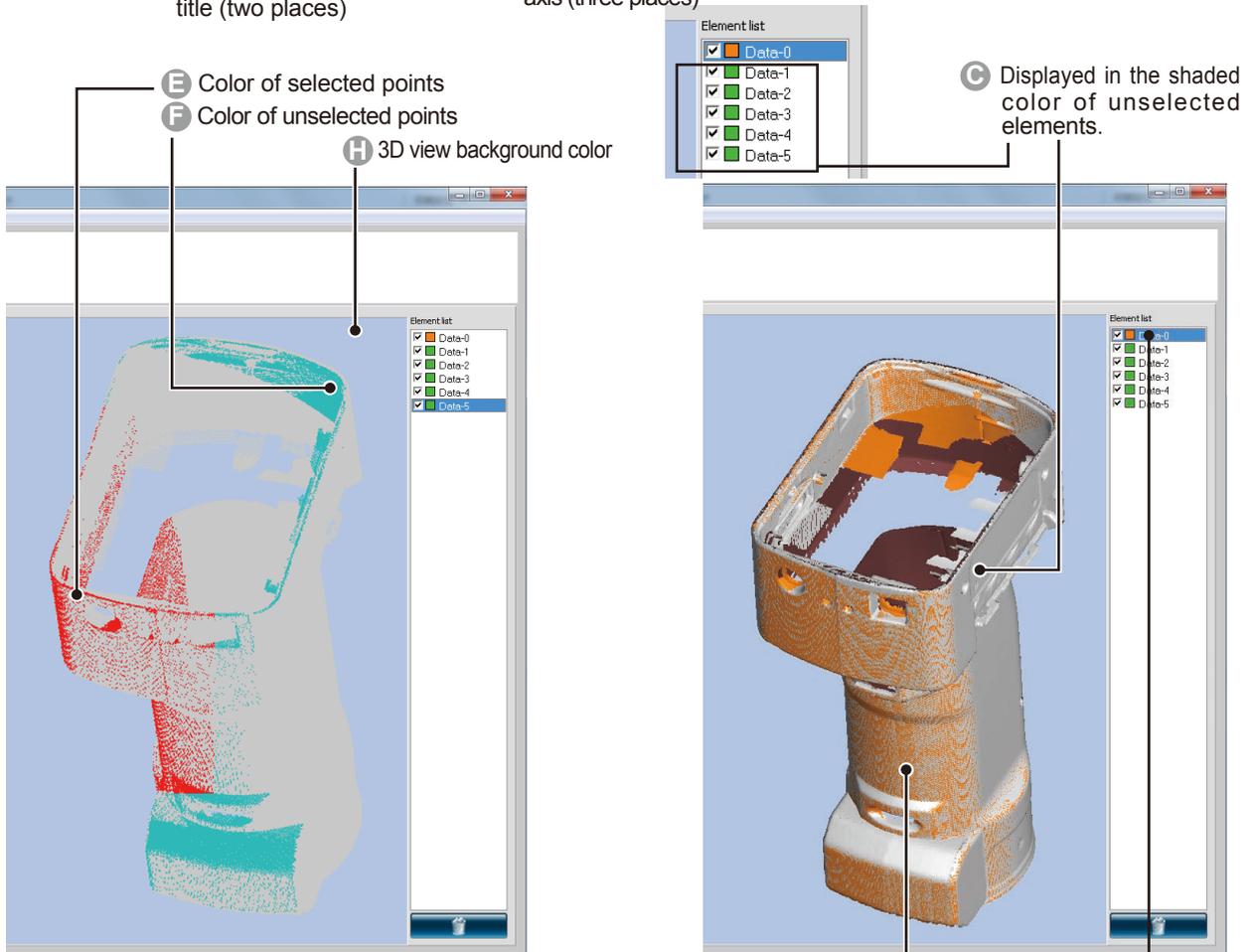




I Show 3D view title (two places)

J Show coordinate axis (three places)

D Size of shaded points



E Color of selected points

F Color of unselected points

H 3D view background color

C Displayed in the shaded color of unselected elements.

The color of the selected elements is set to “green” by [Preferences] “ B ”: the shaded color of the selected element. However, because the color of the element in the selection of [Element Information] “ K ” has been set to “ orange”, the individual setting of [Element Information] is prioritized, and the selected elements are displayed in “orange”.



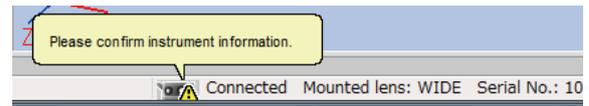
# 10. Scanning Works Accurately

## ⚠ WARNING

- ⚠⊘ Do not look directly into the laser emission window.
- ⚠⊘ Keep lenses, objects with mirror-like surfaces and optical elements out of the optical path. These objects can focus the laser beam, resulting in damage to eyes, fire and burns. Also, to prevent inadvertent accidents, situate works in front of a wall or other structure that shields the laser beam.

## 10.1 Calibration

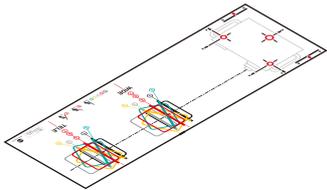
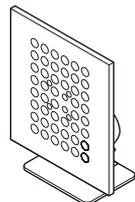
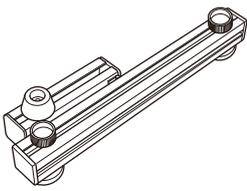
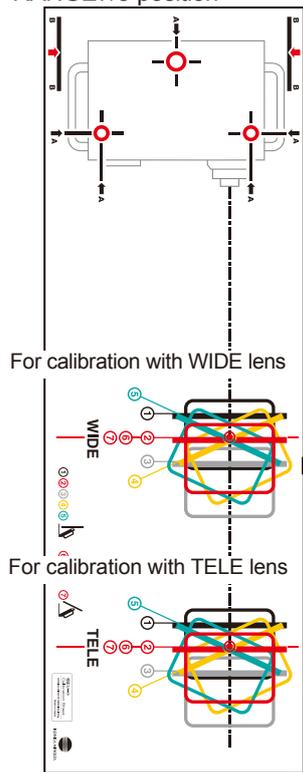
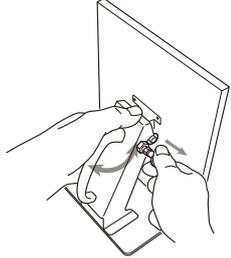
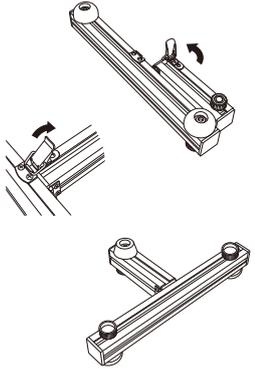
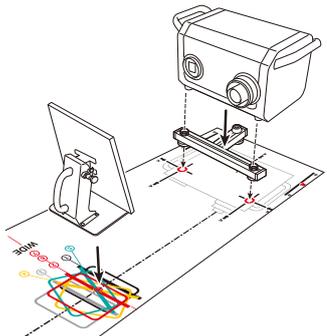
Calibration reduces errors caused by environmental changes or changes over time. Calibration should be performed if ambient temperature has changed since the last time the instrument was calibrated. If temperature changes  $\pm 1.5^{\circ}\text{C}$  from the time of calibration, RANGE VIEWER displays a warning to prompt you to perform calibration.



When scanning is executed while a warning mark is ON, a warning dialog is displayed before starting to scan. To avoid the display of the warning dialog, check when warming up is complete in the condition where no temperature change takes place in the environment at a certain temperature. Make sure to scan in the same temperature environment. Calibration is unnecessary when lenses are interchanged. (Calibration is required after interchanging lenses if temperature has changed since the last time the instrument was calibrated with the newly mounted lens.)

### Before Calibration (Calibration Set)

The calibration set includes the following.

Calibration sheet	Calibration chart	Calibration stand
		
<p>1280 x 430 (mm) plastic sheet. Sufficient space to spread out the calibration chart is required.</p>	<p>Do not touch the front side of the chart with bare hands.</p>	<p>Supports the RANGE7/5.</p>
<p>RANGE7/5 position</p>  <p>For calibration with WIDE lens</p> <p>For calibration with TELE lens</p>	<p>The chart can be tilted to three set angles by pulling the knob on the left face of the chart stand. The stand makes it easy to establish the angles shown in the RANGE7/5 Calibration Wizard.</p> 	<p>How to use</p> 
<p>•Calibration setup</p>  <p>* The RANGE7/5 can be calibrated on its scanning stand without using the calibration stand.</p>		

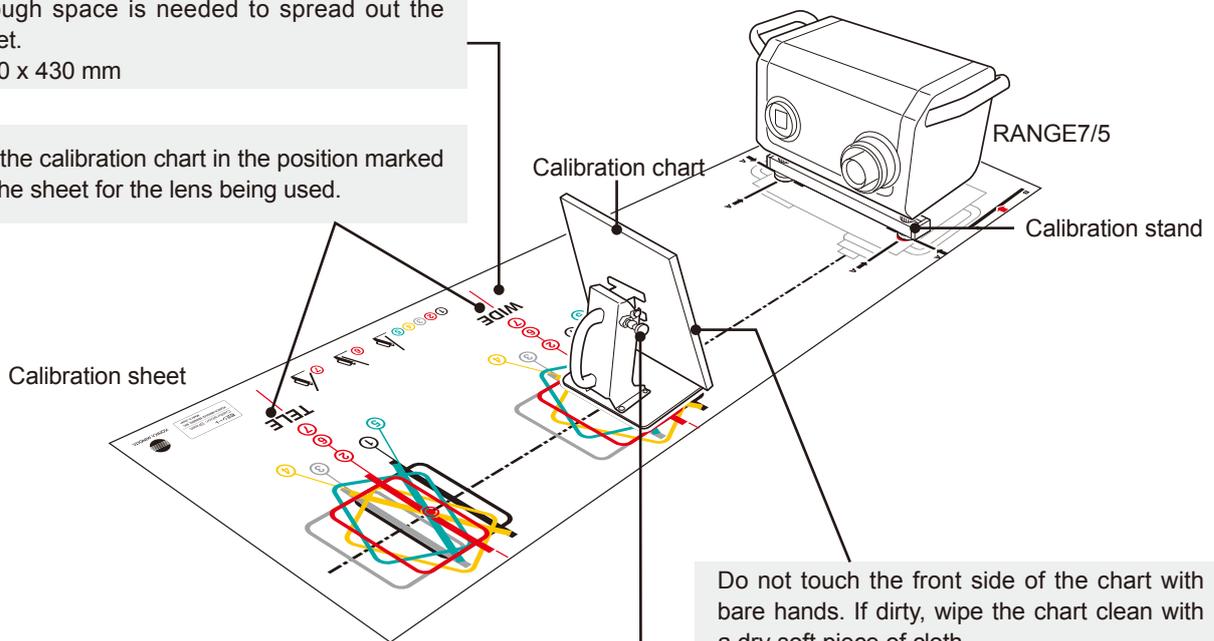
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## 10.2 Equipment for Calibration and Usage

Enough space is needed to spread out the sheet.  
1280 x 430 mm

Set the calibration chart in the position marked on the sheet for the lens being used.



Do not touch the front side of the chart with bare hands. If dirty, wipe the chart clean with a dry soft piece of cloth.

Calibration is easy to understand and perform with the Calibration Wizard. For details, see "5.1 Calibration" on p. 72 of the Reference Manual.

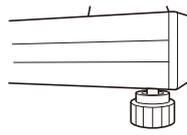
Scanning is done seven times for calibration. Position and angle the calibration chart as indicated in the Calibration Wizard.

**Calibration with the RANGE7/5 on the Scanning Stand**

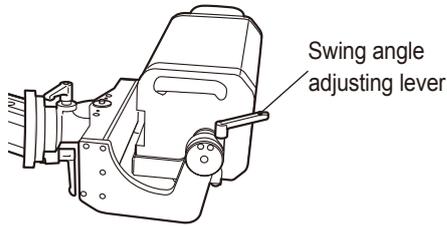
Adjust the stand in the height direction from the adjustable legs. In the horizontal direction, either fine-adjust the stand's position or reposition the calibration chart.

**Using the Stand Pan Head**

Adjust the stand in the height direction from the tilt lever, and lock in place. In the horizontal direction, either fine-adjust the stand's position or reposition the calibration chart.

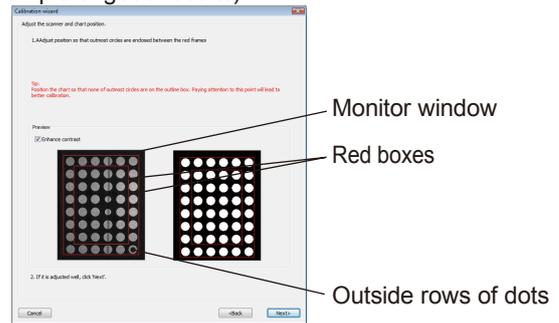


**Note:** As long as the outside rows of dots fit in the two red boxes, problems are not caused by the calibration chart being slightly displaced from the picture on the calibration sheet.



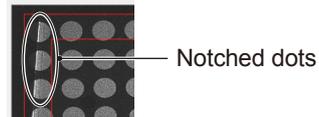
**Point** While watching the monitor window, fine-position the RANGE7/5 and calibration chart so that the outside rows of dots of the chart fit in the two red boxes. Make sure the outside dots do not cross the outside red frames.

(Example of good results)



**Point** If a dot is missing from the measurement data displayed on the "Monitor Screen" check screen, correct calibration is not possible.

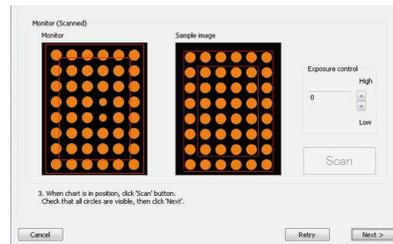
(Example of poor results)



**Point** Also be careful about the color of the dots displayed on the "Monitor Screen". The colors of the dots show whether or not the distance between the RANGE7/5 main unit and the calibration chart is correct. Be aware that if the distance is not correct, the difference in distance may make correct calibration impossible.

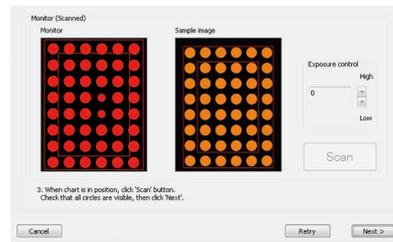
**(Example of good results)**

If the color is the same orange as that shown in the "Sample" on the right side, the distance is correct.

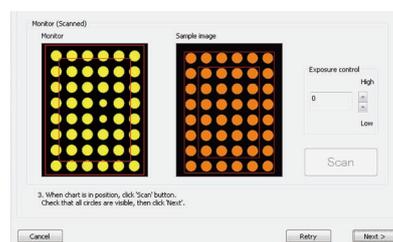


**(Example of poor results)**

If the dots on the "Monitor Screen" are red, this shows that the RANGE7/5 is too close to the calibration chart, so move the RANGE7/5 main unit 3 to 5 mm farther away from the calibration chart.



If the dots are yellow, this shows that the RANGE7/5 is too far from the calibration chart, so move the RANGE7/5 main unit 3 to 5 mm closer to the calibration chart.



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# 11. Help

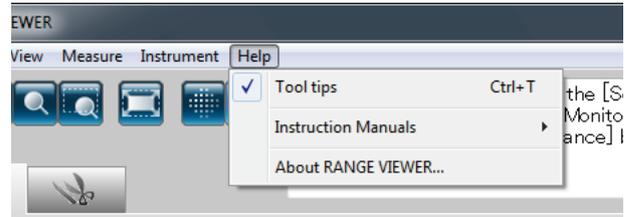
## 11.1 Tool Tips

Tool tips are a function that displays a description of the operation which would be performed by a button that you bring the mouse cursor close to (for example a menu button or edit button).

### Operating Procedure

#### 1 Select [Tool tips] from the [Help] menu.

A checkmark appears next to [Tool tips] and the tool tips feature is activated. To hide the tool tips, select [Help] - [Tool tips] from the menu bar again. This removes the checkmark.



#### Example tool tip display



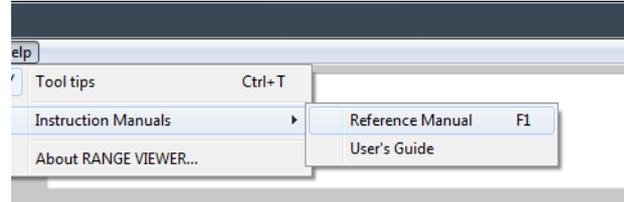
## 11.2 Instruction Manual

This command calls pdf files of the RANGE VIEWER user's guide (this manual) and reference manual.

### Operating Procedure

- 1 Select either one of the instruction manuals from the [Instruction Manuals] from the [Help] menu.

The table of contents pages for the respective manuals are displayed in PDF format.



## 11.3 About RANGE VIEWER

This command displays the version of the installed RANGE VIEWER as well as the version of the firmware used in the connected sensor.

### Operating Procedure

- 1 Select [About RANGE VIEWER] from the [Help] menu.

The same opening window seen when the software is started up appears.



# Index

3D view ..... 11, 13, 46

## A

AE/AF buttons ..... 11  
AE/AF configuration ..... 16  
ASC Files ..... 42  
Automatic Save Feature ..... 41  
axis of rotation information ..... 26

## B

Bezier select button ..... 13, 36

## C

Calibration ..... 47  
Calibration chart ..... 26, 47  
Calibration sheet ..... 47  
Color of paired points ..... 46  
Color of unpaired points ..... 46

## D

Data sub-sampling rate ..... 17  
DISPLAY ..... 45  
Distance ..... 14

## E

Editing ..... 6, 36  
Edit tab ..... 10, 12  
Element ..... 9  
Element boundary point select button ..... 13, 36  
Element delete button ..... 13  
Element Information ..... 45  
Element list ..... 10, 12  
Element merge button ..... 13  
Element registration button ..... 13, 38  
Export button ..... 13, 42  
Exporting ..... 41

## F

Fit view to frame button ..... 10, 12, 44  
FOV indicator ..... 15  
Front point select button ..... 13, 36

## H

Help ..... 50

## I

Instruction Manual ..... 51

## M

Marker ..... 18, 20  
Mean Error ..... 38  
Measurement ..... 6  
Menu bar ..... 10, 12, 43  
Menu button ..... 10, 12, 43  
merge button ..... 40  
Merging ..... 39, 40  
Monitor button ..... 11  
Monitor window ..... 11  
Move viewpoint button ..... 10, 12, 43

Multi focus ..... 15, 16

## N

Navigation message ..... 10, 12  
Number of scans ..... 16, 17

## O

Open button ..... 13, 41

## P

Paired points ..... 11, 18, 19, 21  
Paired points registration mode button ..... 23  
Point delete button ..... 13, 36  
Point selection invert button ..... 13, 36  
Preview button ..... 11  
Preview delete button ..... 22

## Q

Quitting ..... 9

## R

Rectangle select button ..... 13, 36  
Redo button ..... 13  
Registration ..... 38  
Registration mode ..... 18  
rgv ..... 2  
Rotate viewpoint button ..... 10, 12, 43  
Rotating stage ..... 19, 18, 26, 28  
rvm ..... 2

## S

Save button ..... 13, 41  
Saving Reference Markers ..... 35  
Scan button ..... 11  
Scanned image window ..... 11  
Scan settings ..... 19  
Scan settings ..... 11, 16  
Scan tab ..... 10, 12  
Scan Window ..... 10  
Show 3D view title (three places) ..... 46  
Show coordinate axis ..... 46  
Show points button ..... 10, 12, 44  
Show shaded area button ..... 10, 12, 44  
Size of shaded points ..... 46  
size of the work ..... 14  
Spot AF ..... 17  
Spot AF button ..... 11  
Standard Deviation ..... 38  
Startup ..... 8  
Status bar ..... 10, 12  
status bar ..... 8  
STL Files ..... 42

## T

the shaded color of unselected elements ..... 46  
Title bar ..... 10, 12  
Tool Tips ..... 50  
TXT ..... 18

**U**

Undo button ..... 13

**Z**

Zoom button ..... 10, 12, 44

Zoom selected area button ..... 10, 12, 44



KONICA MINOLTA