3D Data Processing Software

Reference Manual



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.

Image: A constraint of the information that contains safety warnings or notes. Read the information carefully to ensure safe use.Image: A constraint of the information carefully to ensure safe use.Image: A constraint of the information carefully to ensure safe use.Image: A constraint of the instruction. A constraint of the instruction.Image: A constraint of the instruction. A constraint of the instruction.Image: A constraint of the instruction of the instruction. Constraint of the instruction.Image: A constraint of the information concerning the laser. Read the information carefully to ensure safe use.

Official Names for Application Mentioned in This Manual

(Indication in this manual) Windows, Windows Vista Windows, Windows XP Windows, Windows 7 (Official name) Microsoft [®] Windows [®] Vista [®] Business Operating System Microsoft [®] Windows [®] XP Professional Operating System 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.

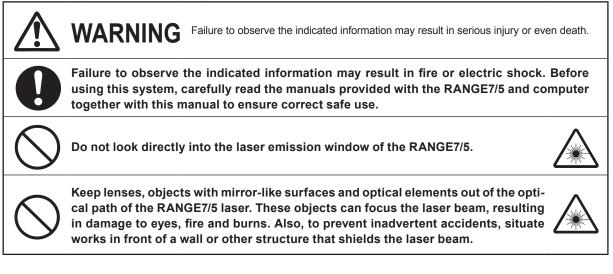
About This Manual and Related Documents

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 User's Guide	Explains basic operation 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.



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 7, Windows Vista or Windows XP 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

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

Required Operating Environment

OS	Windows Vista Business SP2 (64bit), Windows XP Professional x64Edition SP2 (64bit)
	Windows 7 Professional (64bit)
CPU	Core2Duo, Xeon or faster
RAM	4GB or more
Display	1280 x 1024 or higher resolution graphics
Graphic board	OpenGL board (It is recommended to use boards tested and proven by KONICA MINOLTA.)
Interface	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 part became capable of being holefilled 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 and scanned data color scheme (surface, back side) of windows 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 selection screen 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 [Instrument 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 Reference Manual

How to Use this Manual

This Reference Manual explains RANGE VIEWER features and functions by focusing on the commands selected from menus and buttons. As in the Users Guide, explanations follow the sequence of the menu bar to elucidate the details of setting items, etc.

The screen picture in this document is the display example of Windows 7 in use.

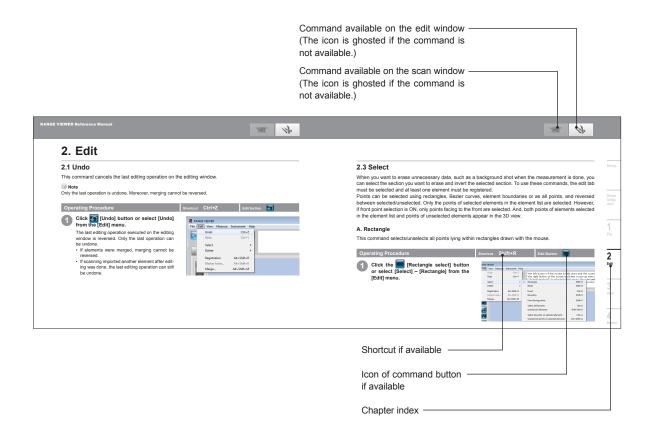


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RANGE VIEWER Startup

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.

Startup

Operating Procedure

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.)

ANGE VIEWER Copyright (C) NCHACA MENCLEA, 39C, 2009-2013 All rights reserved. Warning: This computer program is protected by copyright law and international treaties. Unauthorized reproduction of this program or any portion of it may result in severe civil and criminal penalties, and will be prosecuted to the maximum article possible under law.

vare Ver.2.02.0000

Status bar Connected Mounted lens: WIDE Serial No.: 1001000 Connected Mo Sensor icon Connected Mou Sensor icon with warning mark Disconnected M Ghosted sensor icon

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. ±1.5°C) from the last calibrated temperature.
 - · The sensor icon is ghosted if the instrument is not connected.

Supplement

The RANGE7/5 requires time to warm-up. RANGE VIEWER displays a warning for a short time after power is turned ON based on the internal temperature of the RANGE7/5.



1p

Startup

Window

1

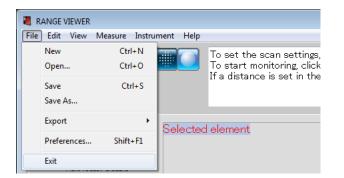
Exit

Operating Procedure



Select [Exit] from the [File] menu.

RANGE VIEWER quits.

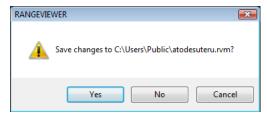


The message to confirm saving data will appears, if there are any elements that were changed after scanning or the last time that data was saved.

- 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.



2

3

6 Help

Error Messages

Menu Items

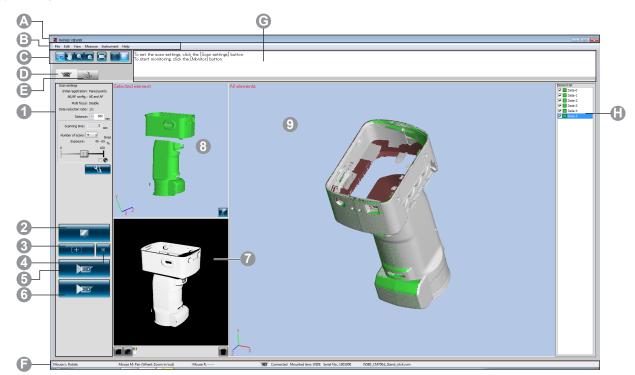
Glossary

Index

Window Configuration

Scan Window

RANGE VIEWER has a "scan window" for scanning and an "editing window" for editing. These windows can be opened by clicking the scan and edit tabs at the top of the window.



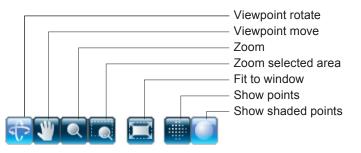
Common GUI

Menu buttons

- A Title bar
- B Menu bar

Displays the name of the software.

Contains various functions for operating RANGE VIEWER. Clicking a header opens a drop-down menu from which functions can be selected. Buttons for executing often-used functions of the menu bar.



- Scan tab
- Edit tab

Switches to the scanning mode for controlling the RANGE7/5 and acquiring 3D data. Click to switch the screen to the "Measurement Screen".

- Switches to the editing mode for viewing and editing acquired 3D data using editing tools. Click to switch the screen to the "Edit Screen".
- Status bar Displays the connection status of the RANGE7/5 and information such as operation and procedure hints.

 Navigation Displays hints and messages on upcoming operations according to selected message operations and status.

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.

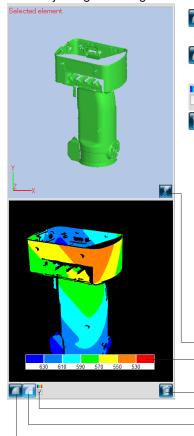
> *Selected elements only can be displayed by selecting the elements while pressing the Alt key.



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

Scan Window GUI

 Scan settings Monitor button 	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 reducted when they are scanned. Clicking projects the FOV (Field Of View) indicator on the work and displays a 2D image of the work in the monitor window.
AE/AF buttons	Starts AE/AF, AF only or AE only based on scan settings.
Spot AF buttonPreview 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. The object is prescanned.
6 Scan button	Scans the work based on scan settings.
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 checkbox Show contours button Show monochrome view button

(Preview screen)

Previous window

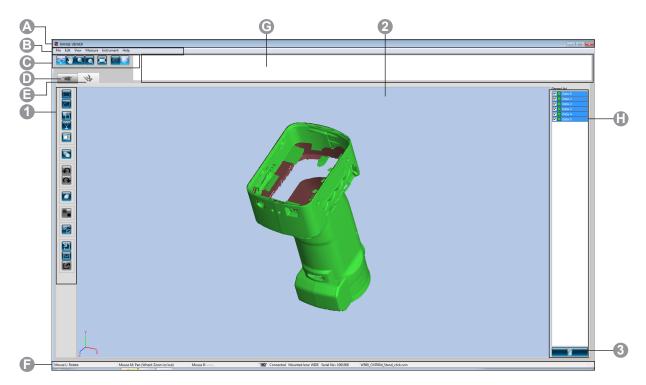
(3) Selection screen Displays only the data selected from the element list. Scanned objects prescanned by the preview button or the data scanned by the scanning button are selected and displayed in this screen. The paired points registration is done by the 3D image on this screen and the 3D image on the measured screen. When the scanned data are selected, the letters on the upper left indicate [Selection] and if previewed data are selected, then the display becomes [Preview].

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.



Editing Window

RANGE VIEWER has a "scan window" for scanning and an "editing window" for editing. These windows can be opened by clicking the scan and edit tabs at the top of the window.



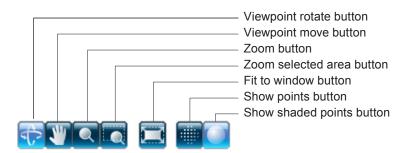
Common GUI

Menu buttons

A Title barB Menu bar

Displays the name of the software.

Contains various functions for operating RANGE VIEWER. Clicking a header opens a drop-down menu from which functions can be selected. Buttons for executing often-used functions of the menu bar.



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".
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".
🕞 Status bar	Displays the connection status of the RANGE7/5 and information such as op-
-	eration and procedure hints.
Navigation	Displays hints and messages on upcoming operations according to selected
message	operations and status.
Element list	List of registered elements. Elements can be selected/unselected as well as
-	shown/hidden by checkbox operation.



Window

Configuration

1

4 Measure

Menu Items

Glossary

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

Editing Window GUI Editing tool buttons

Point

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 facing points Enables selecting points having the normal facing towards the camera **Point delete** Deletes the selected 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** Ðc 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.

S Element delete button To delete an element, select the element to delete from the element list and then click the [Delete Element] button. Multiple elements may be selected at a time.



1. File

1.1 New

When selected, the currently open file is discarded and a new file is created in rvm format. If opened files need to be saved, save them before selecting [New].

Operating	Procedur
-----------	----------



Select [New] from the [File] menu.

The currently open file closes and a new file is created.

Shortci	ut Ctrl+	N		-
File	ANGE VIEWER) Edit View	Measure Inst	rument Help	
	New Open	Ctrl+N Ctrl+O		To set the scan settings, To start monitoring, click If a distance is set in the
	Save Save As	Ctrl+S		in a distance is set in the
	Export	I	Selecter	d element
	Preferences Exit	Shift+F1		

Supplement

Files can be created in rvm and rgv formats. See below.

File Formats

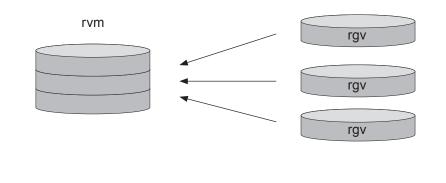
RANGE VIEWER uses two file formats: rvm that groups all elements into a single file and rgv that creates one file for each element.

rvm format

Multiple elements are grouped into a single file.

rgv format

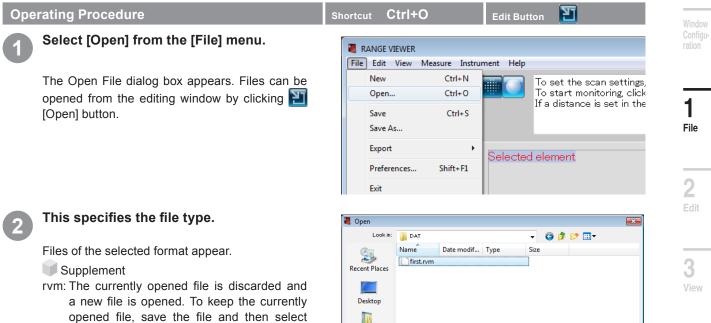
Each element has its own file.





1.2 Open

This command opens files. You can select whether to open rvm or rgv files.



"Open". rgv: Elements are added to the currently open file.





Select a file and click [Open] button.

When having selected rvm file, only one file can be opened at a time.

Supplement

Only files of rvm or rgv format can be opened. For details on the file format, see the column on the bottom row of Page 12.

4

5

6

Messages

Menu Items

Measure



1.3 Save

When you select [Save], the file that is currently open and being worked on is saved with its current name, overwriting the older version of the file. Only rvm file format can be saved.

Select [Save] from the [File] menu. If the file has been newly created, the Save As dialog box appears. If an existing file has been edited, the file is overwritten and saved. Files can be saved from the editing window by	Operating Procedure	Shortcut Ctrl+S Edit Button
If the file has been newly created, the Save As dialog box appears. If an existing file has been edited, the file is over-written and saved.	Select [Save] from the [File] menu.	
clicking 🔲 [Save] button.	dialog box appears. If an existing file has been edited, the file is over- written and saved. Files can be saved from the editing window by	New Ctrl+N Open Ctrl+O Save Ctrl+S Save As Export Preferences Shift+F1

Supplement

- 1. For details on the file format, see the column on the bottom row of Page 12.
- You can set automatic save as described in "1.6 Preferences" on Page 18.
- Only rvm files can be overwritten and saved.

 rvm format files can be Even when saving an ' The path for saving a r When you save a file i 	e saved with 'rgv" file with new file is the n rgv format	lifferent file formats. [Save] button, but "rgv" files can in its current name, you must use [e default file path set in the enviro t, the file name becomes Input file ill be created as the number of the	Save As]. Inmental sett e name + "- (,
Element list	ile name: ave as type:	test rvm files(* rvm) rvm files(* rvm) rev files(* rev)	Can →	Look in: Recent Places	Name Date mi test-name1.rgv test-name2.rgv



1.4 Save As

Selecting [Save As] allows you to rename open files and save them under different names.

Operating Procedure Window Select [Save As] from the [File] menu. RANGE VIEWER File Edit View Measure Instrument Help The Save As dialog box appears. Ctrl+N New To set the scan settings, 1 Ctrl+O To start monitoring, click Open... If a distance is set in the File Ctrl+S Save Save As... Export ⊧ Selected element 2 Shift+F1 Preferences... Exit Select a file format and input a file name. 2 💐 Save As Save in: 🚺 Data 🌀 🌶 📂 🖽 - -3 File names must conform to Windows restric-Name Size Date modif... Type 9 tions. This folder is empty. Recent Places Desktop R 4 Measure Computer 2 File name Sample Save •

Save as type

rvm files(* rvm)

rgv file



Click the [Save] button.

The file is saved in the selected format.

Supplement

For both rvm files and rgv files, you can save with the current name by selecting [Save As]. For details on the file format, see the column on the bottom row of Page 12.

> Error Messages

5

6 Help

Cancel

-

Menu Items

Glossary



1.5 Export

Scanning data and editing data can be exported to other 3D point processing software from other manufacturers. Data can be exported for use with other programs either by saving the 3D data in a file or by directly exporting the 3D data to external software using IPC function.

A. Exporting Files

Memo

The method of exporting to a file is generally called "Exporting".

This converts from the unique formats (rvm and rgv) used as the standard with this software into other file formats and saves the file in that format.

Оре	rating Procedure	Shortcut – –
1	Select [Export] – [To File] from the [File] menu. The Save As dialog box appears.	RANGE VIEWER File Edit View Measure Instrument Help New Ctrl+N To set the scan settings, To start monitoring, click Save Ctrl+S To set in the Save As Save As
		Export To Application Ctrl+E Preferences Shift+F1 To File Exit Exit Exit
2	Select a file format for export and input a file name.	Save As
	Data can be exported in STL or ASC format.	Save in: Date Image: Computer Name: Date modif Type Size Name: Date modif Type Size No Items match your search. No No Items match your search. Items No Items match your search. Items No Items Same Items Save as type: Same Cancel
3	Click the [Save] button.	

The file is saved in the selected (STL or ASC) format.

Supplement

For details on STL (binary) and ASC formats, see below.

To read rgv files on other 3D point processing software, select [File] - [Export] and save the file in rgv format. See "When Saving rvm and rgv Files" on p. 14.

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 (Normal line) information.



B. Exporting Directing to Other Software with the IPC function

Memo

- · The method of directly exporting to external software is generally called "File Transfer".
- Note
- When exporting directly to external software, it is necessary to first start the external software that will receive the export and prepare it to be able to import.
- For details on how to prepare the external software for import operation, see the user's manual for the external software.

	Operating Procedure	Shortcut Ctrl+E	Edit Button 🗾
--	---------------------	-----------------	---------------

- Check that the external software that will receive the export has started and that it is ready to import.
- (2

Select [Export] – [To Application] from the [File] menu.

Files can be exported from the editing window by clicking **[** [export] button.

* "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.



Click **[[**Export] button.

The file is sent to the connected software. The transfer is monitored by the progress bar. The time required to transfer the file varies according to the amount of data and number of scanned points.

Supplement

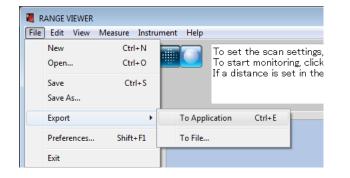
To connect to external software, it is necessary that the external software recognizes RANGE VIEWER beforehand.

Exporting with the IPC function (File Transfer)

eliminates the need to save the file or read in the file.

Note Note

The sent scanned data is deleted.



Glassary

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

Compared to exporting through a file (Export), the file transfer export method is simpler and faster because it

export from RANGE VIEWER, and shows the name set by the external software.

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

1 File





1.6 Preferences

The preferences allow you to set 3D image viewing, file saving operations and more.

Operating Procedure	Shortcut Shift+F1 –
Select [Preferences] from the [File] menu.	RANGE VIEWER
The Preferences dialog box appears.	File Edit View Measure Instrument Help New Ctrl+N Open To set the scan settings, To start monitoring, click To start monitoring, click Save Ctrl+S Save As To set the scan settings, click To start monitoring, click
	Export Preferences Shift+F1 Exit Exit
To set display settings, click the [Display] tab. To set file settings, click the [File] tab.	Preferences
3 After making settings, click the [OK] but- ton. Preferences are immediately applied. To default the settings, click the [Default] button.	Element display reduction ratio: 1/4 Shading Shading color of selected elements: Shading color of unselected elements: Size of shaded points (1-10): 2
Shading color of selected elements	Points Color of selected points: Color of unselected points: Size of points (1-10): 1
	Display Background color of 3D view: Display title of 3D view Display axis
	OK Cancel Default

About parameters in [Preferences Dialog Box]

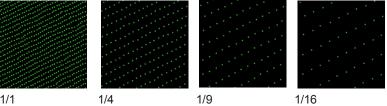
[DISPLAY] tab **Element display reduction ratio**

Only while the viewpoint is rotating or moving, the display ratio is reduced. Sets the display ratio of points to elements for element views. Make a selection from the drop-down list.

Selectable ratios: 1/1, 1/4, 1/9, 1/16

18

Note: Only the display ratio is reduced; points of the original element are not deleted.



1/1

1/9

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4 Measure

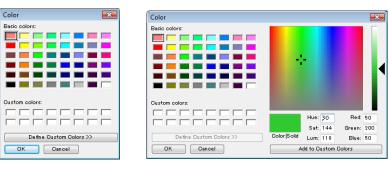
5

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Shading color of selected elements

Sets the shading color of selected elements and all elements of the scan tab. Clicking the button of the currently selected color opens the Color Setting dialog box where colors can be freely selected.



Auto	☑ When a checkmark is placed in the checkbox, the color select button is hid- den and shading colors for selected elements are automatically set.
Shading color of unselected elements	Sets the shading color of unselected elements. The currently selected color appears in the button. Clicking the button opens the Color Setting dialog box where colors can be freely selected.
Size of shaded points	Sets the size of shaded points. Setting range: 1 ~ 10
Color of selected points	Sets the color of selected points. The currently selected color appears in the button. Clicking the button opens the Color Setting dialog box where colors can be freely selected.
Color of unselected points	Sets the color of unselected points. The currently selected color appears in the button. Clicking the button opens the Color Setting dialog box where colors can be freely selected.
Size of points (1 - 10)	Sets the size of points. Setting range: 1 ~ 10
Background color of 3D view	Sets the background color of 3D views. The currently selected color appears in the button. Clicking the button opens the Color Setting dialog box where colors can be freely selected.
☐ Display title of 3D view	\checkmark Sets whether to show/hide the title of the 3D view. The title appears in the 3D view when a checkmark is placed in the checkbox.
☐ Display axis	☑ Sets whether to show/hide the 3D coordinate axes. The axes appear in the 3D view when a checkmark is placed in the checkbox.
OK button	When you click the [OK] button, the contents set in the [Environmental Set- tings] dialog are applied and the dialog is closed.
Cancel button	When you click the [Cancel] button, the changes made in the [Environmental Settings] dialog are discarded and the dialog is closed.
Default button	Returns the settings to the default values.

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[FILE] tab Default file path

Browse button

This displays the default file path. The file path displayed here is the default file path for the dialog for opening/saving a file. If Preferences ends with the default file path being empty, the folder that was previously opened will open when the file is saved, exported or opened.

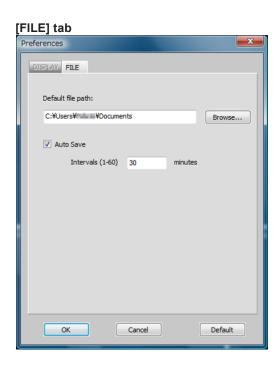
For browsing file paths. When clicked, the Browse Folder dialog box appears whereby enabling you to select the default file path. The selected path appears in the [Default file path] box.

Browse for Folder	X	Preferences
Floppy Disk Drive (A:) Local Disk (C:) Data DebugData Program Files PSFONTS Users Mideto Contacts Desktop Documents OK Cance	4 III +	DIEPLAY FILE Default file path: C:#UsersW WDocuments Browse V Auto Save Intervals (1-60) 30 minutes
		OK Cancel Default

☐ Auto Save	\checkmark Data is saved at the input time interval when a checkmark is placed in the checkbox. Automatic saves are executed only if an element is changed. Files are saved in the rvm format.
Intervals (1 – 60)	Sets the time interval at which data is automatically saved. Setting range: 1 ~ 60 min.
OK button	When you click the [OK] button, the contents set in the [Environmental Set- tings] dialog are applied and the dialog is closed.
Cancel button	When you click the [Cancel] button, the changes made in the [Environmental Settings] dialog are discarded and the dialog is closed.

[DISPLAY] tab

Preferences	×
DISPLAY FILE	
Element	
Element display reduction ratio: Shading	1/4 🔹
Shading color of selected elements:	Auto
Shading color of unselected elements:	
Size of shaded points (1-10):	2
Points	
Color of selected points:	
Color of unselected points:	
Size of points (1-10):	1
Display	
Background color of 3D view:	
Display title of 3D view	
✓ Display axis	
OK	Default





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1.7 Exit

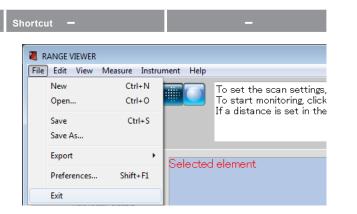
This command quits RANGE VIEWER.

Operating Procedure

1

Select [Exit] from the [File] menu.

RANGE VIEWER quits.



The message to confirm saving data will appears, 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 message is closed.
- When you click the [No] button, the message is closed without the measured and edited data being saved.

RANGEVIEWER	×
Save changes to C:\Users\Public\atodesuteru.rvm?	
Yes No Cancel	

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2. Edit

2.1 Undo

This command cancels the last editing operation on the editing window.

Note

Only the last operation is undone. Moreover, merging cannot be reversed.

Operating Procedure Shortcut Ctrl+Z Edit button 5 Click on [Undo] button or select [Undo] RANGE VIEWER from the [Edit] menu. File Edit View Measure Instrument Help The last editing operation executed on the editing Undo Ctrl+Z ٩. Redo Ctrl+Y window is reversed. Only the last operation can be undone. Select ۲ · If elements were merged, merging cannot be Delete reversed. Registration Alt+Shift+R · If scanning imported another element after edit-Marker holes. Alt+Shift+K ing was done, the last editing operation can still Merge... Alt+Shift+M be undone.

0.0

k

2.2 Redo

This command reexecutes the last editing operation on the editing window that was undone by the [Undo] command.

Note

Only the last undone operation can be reapplied.

$\overline{\mathbf{a}}$ **Operating Procedure** Ctrl+Y Edit button Click 💽 [Redo] button or select [Redo] RANGE VIEWER from the [Edit] menu. File Edit View Measure Instrument Help Ctrl+Z The last undone operation executed on the editing Undo 1 Ctrl+Y Redo window is reapplied. Only the last undone operation can be redone. Select • · If scanning imported another element after edit-Delete ing was done, the last undone operation can still Registration Alt+Shift+R be reapplied. Marker holes Alt+Shift+K Merge... Alt+Shift+M



2.3 Select

When you want to erase unnecessary data, such as a background shot when the measurement is done, you can select the section you want to erase and invert the selected section. To use these commands, the edit tab must be selected and at least one element must be registered.

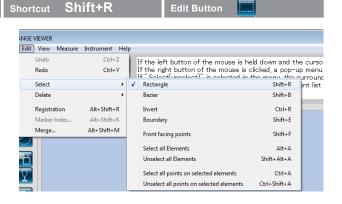
Points can be selected using rectangles, Bezier curves, element boundaries or as all points, and reversed between selected/unselected. Only the points of selected elements in the element list are selected. However, if front point selection is ON, only points facing to the front are selected. And, both points of elements selected in the element list and points of unselected elements appear in the 3D view.

A. Rectangle

This command selects/unselects all points lying within rectangles drawn with the mouse.

Operating Procedure

Click the [Rectangle select] button or select [Select] – [Rectangle] from the [Edit] menu.



While holding down the left mouse button, drag to enclose the area you want to select (deselect) with a rectangle.

Rectangle is set when left mouse button is released.

When you click the right mouse button inside the area enclosed by the rectangle, a pop-up menu is displayed.

When you click the right mouse button inside the area enclosed by the curved line or at the end of drawing the curved line, a pop-up menu is displayed.

The selected area appears in the color set for [Color of selected points] on the Preferences dialog box.

- To redraw the target area, click on [Undo] button and reselect the area.
- To add more target areas, repeats steps 2
 ~ 4
- Selecting [Cancel] in the pop-up window cancels the drawn rectangle.



- · Delete selected points.
- Invert selected points between selected/unselected.
- · Unselect selected points.

Supplement

Click mouse button at start point. Release mouse button at end point.

To Change the Color of a Selected Area

Change the color in the preferences. See "1.6 Preferences" on p.18.

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All selected elements in the element list are subject to this operation.



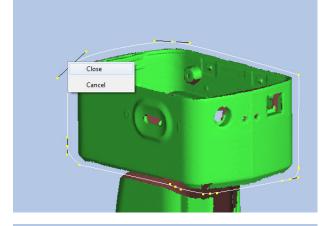
B. Bezier

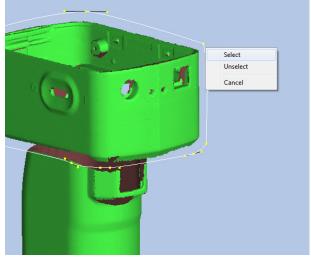
This command selects/unselects all points lying within Bezier curves drawn with the mouse.

Operating Procedure

Click the [Bezier curve select] button or select [Select] – [Bezier] from the [Edit] menu.

Shor	tcut Sh	ift+B			Edit Button			
NGE	VIEWER							
Edit	View Measure	Instrument He	lp					
	Undo Redo	Ctrl+Z Ctrl+Y	I	f the rig	t button of the mouse ht button of the mous is colocted in the m	se is clic	ked, a pop-u	p menu
	Select	۱.		Rectangl			Shift+R	allsho
	Delete	•	\checkmark	Bezier			Shift+B	
	Registration	Alt+Shift+R		Invert			Ctrl+R	
	Marker holes	Alt+Shift+K		Boundar	у		Shift+E	
	Merge	Alt+Shift+M		Front fac	ing points		Shift+F	
				Select all	Elements		Alt+A	
Đ				Unselect	all Elements		Shift+Alt+A	
2					points on selected element all points on selected eleme		Ctrl+A Ctrl+Shift+A	





To Change the Color of a Selected Area Change the color in the preferences. See "1.6 Preferences" on p.18.

While holding down the left mouse button, draw a line to enclose the area you want to select (deselect) with a curved line. For instructions on enclosing areas in Bezier

curves, see "Bezier Curves" on the next page.

When you click the right mouse button inside the area enclosed by the curved line or at the end of drawing the curved line, a pop-up menu is displayed.

Select [Close] from the pop-up menu to close the encompassed area.

Select [Select] ([Unselect]) from the popup menu to include (exclude) the selected area.

- To redraw the target area, click [Undo] button and reselect the area.
- To add more target areas, repeats steps 2
 ~ 5.
- Selecting [Cancel] in the pop-up window cancels the drawn curve.



Edit the selected areas as needed.

- Delete selected points.
- Invert selected points between selected/un-selected.
- Unselect selected points.

Supplement

All selected elements in the element list are subject to this operation.

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Bezier Curves

Left-clicking the mouse creates control points.

Holding and pressing the left mouse button and dragging the pointer creates a continuous line from the last control point.

Targeted areas are drawn by a combination of control points and continuous lines from them.

Repeat these operations to enclose the targeted areas in a Bezier curve.

Note

• You cannot undo the last operation when drawing a Bezier curve.

Lastly, as stated in the procedure of the previous page, rightclick the mouse to open the pop-up menu and, select [Close] to close the drawn area.

- Selecting [Cancel] in the pop-up window cancels the draw curve.
- Pressing the [ESC] key on the computer cancels the Bezier curve mode.

Fine-Adjusting Bezier Curves

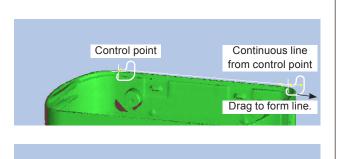
After a Bezier curve has been closed, the curve can be moved by placing the center of the + pointer on the yellow points of the Bezier curve, pressing and holding the left mouse button and dragging the pointer. Release the left mouse button when the point is at the desired position.

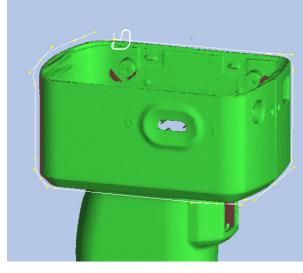
The length of the continuous line represents the amount of pulling force, therefore that force can be increased or decreased. This changes the curvature of the line.

As when moving curves, the curve can be reshaped by placing the center of the + pointer on the yellow point at the end of a continuous line on the curve, pressing and holding the left mouse button and dragging the pointer. Release the left mouse button when the point is at the desired position.

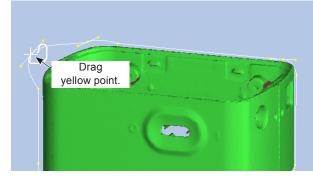
Supplement

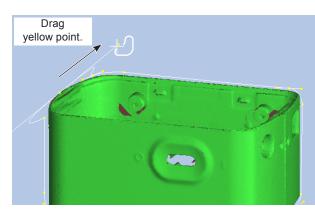
You cannot undo to return to the previous point during outlining of a selection area with a Bézier curve. When the area has been outlined to some extent, it is more efficient to continue outlining as is and after the outline is completed, revise with the method above.











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C. Point Selection Invert

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

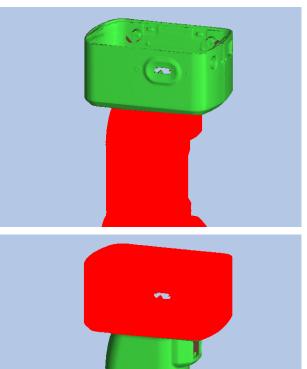
Operating Procedure

Select points using either a rectangle or Bezier curve, and click Frage [Point selection invert] button or select [Select] - [Invert] from the [Edit] menu.

nortcut Ct	rl+R		Edit Button	1	
NGE VIEWER					
Edit View Measure	Instrument Help				
Undo	Ctrl+Z	If the le	ft button of the mou	se is held down and	the curs
Redo	Ctrl+Y	If the r	ght button of the mo	use is clicked, a pop-	-up mer
Select	•	Rectan		Shift+R	
Delete	•	✓ Bezier		Shift+B	
Registration	Alt+Shift+R	Invert		Ctrl+R	
Marker holes	Alt+Shift+K	Bounda	ary	Shift+E	
Merge	Alt+Shift+M	Front fa	icing points	Shift+F	
<u> </u>		Select a	II Elements	Alt+A	
<u>í</u>		Unsele	t all Elements	Shift+Alt+A	
$\overline{\nabla}$		Select a	Il points on selected eleme	ents Ctrl+A	
-		Unsele	t all points on selected eler	ments Ctrl+Shift+A	

Invert points between selected and unselected.

When there is no element selected partially with the rectangle or Bézier curve, the points in all elements selected in the element list are inverted between selected and unselected.





Click [] [Point selection invert] button to invert the area back.



Edit the selected areas as needed.

- Delete selected points.
- · Invert selected points between selected/unselected.
- Unselect selected points.

To Change the Color of a Selected Area Change the color in the preferences. See "1.6 Preferences" on p.18.

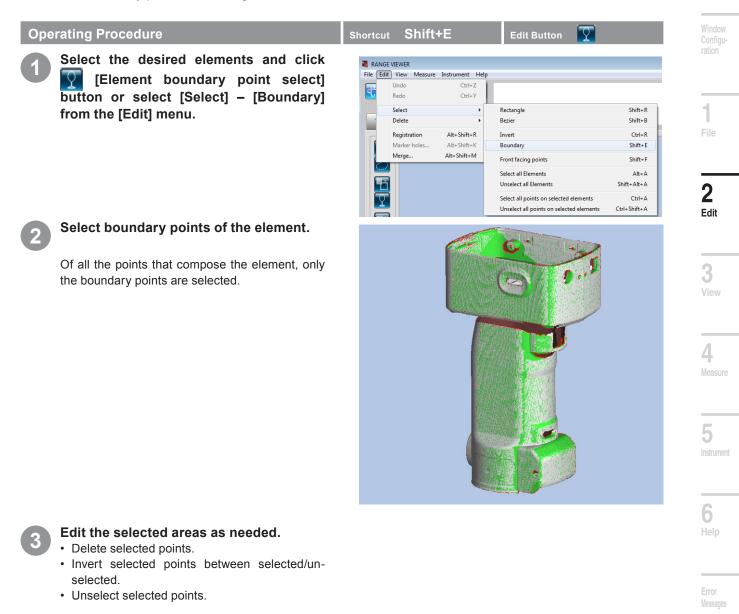
Supplement

All selected elements in the element list are subject to this operation.

· ·

D. Element Boundary Point Select

This button automatically selects boundary points (circumference of holes) of elements. With merged elements, the boundary points of all merged elements are selected.



Supplement

All selected elements in the element list are subject to this operation.

Menu Items



E. Front Facing Points

This button automatically selects only the points that compose polygons in the current view of the selected elements (rectangle or Bezier curve used) that are facing front and visible.

Operating Procedure

1

Click [] [Front facing points] button to highlight it or select [Select] – [Front facing points] from the [Edit] menu.

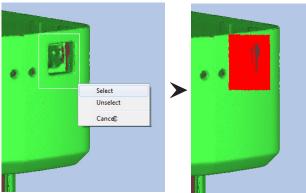


Front facing points selection is ON when the front point select button is highlighted.

hor	rtcut S	hift+F	Edit Button 📕						
INGE VIEWER									
Edit	View Measur	e Instrument Help							
	Undo	Ctrl+Z							
	Redo	Ctrl+Y							
	Select	+	Rectangle	Shift+R					
	Delete	Þ	Bezier	Shift+B					
	Registration	Alt+Shift+R	Invert	Ctrl+R					
	Marker holes	Alt+Shift+K	Boundary	Shift+E					
	Merge	Alt+Shift+M	Front facing points	Shift+F					
·			Select all Elements	Alt+A					
6			Unselect all Elements	Shift+Alt+A					
$\overline{\mathbf{O}}$			Select all points on selected elements	Ctrl+A					
4			Unselect all points on selected elements	Ctrl+Shift+A					

Select the desired areas using a rectangle or Bezier curve, while the front point select button is highlighted.

Only the points facing front in the current view of the elements in the selected areas are selected.

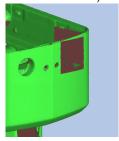


3

Edit the selected areas as needed.

- · Delete selected points.
- Invert selected points between selected/unselected.
- · Unselect selected points.

(Example: When deleting by Points, only surfaces with holes facing the front are deleted.)



Supplement All selected elements in the element list are subject to this operation.

···· \}

F. All Elements/Unselect All Elements

These commands select and unselect all elements, respectively. The commands apply only to elements, therefore point selection does not change.

Operating Procedure

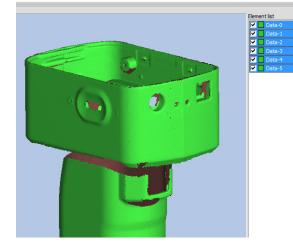
Select [Select] – [Select all Elements] from the [Edit] menu.

To unselect all elements, select [Unselect all Elements].

hor	tcut Alt+	A/ Shift+Al	t+A –	
NGE	VIEWER			
Edit	View Measur	e Instrument Help		
	Undo	Ctrl+Z		
	Redo	Ctrl+Y		
	Select	+	Rectangle	Shift+R
	Delete	•	Bezier	Shift+B
	Registration	Shift+Alt+R	Invert	Ctrl+R
	Marker holes	Shift+Alt+K	Boundary	Shift+E
	Merge	Shift+Alt+M	Front facing points	Shift+F
·			Select all Elements	Alt+A
Ð			Unselect all Elements	Shift+Alt+A
2			Select all points on selected elements Unselect all points on selected elements	Ctrl+A Ctrl+Shift+A

All elements in the element list are selected and displayed in the [Shading color of selected elements] set in the Preference dialog box.

Selected points remain the color set for selected points.



Supplement

All selected elements in the element list are subject to this operation.

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These commands select and unselect all points of selected elements, respectively.

Operating Procedure

Select the desired elements and select [Select] – [Select all points on selected elements] from the [Edit] menu.

To unselect all points of the selected elements, select [Unselect all points on selected elements].

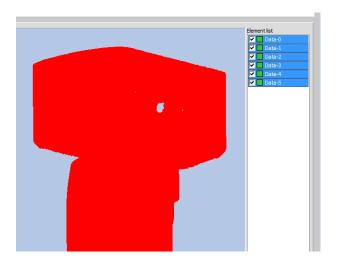
Shortcut Ctrl+A/ Ctrl+Shift+A Edit Button

View Measure	Instrument Help		
Undo	Ctrl+Z		
Redo	Ctrl+Y		
Select	+	Rectangle	Shift+R
Delete	Þ	Bezier	Shift+B
Registration	Alt+Shift+R	Invert	Ctrl+R
Marker holes	Alt+Shift+K	Boundary	Shift+E
Merge	Alt+Shift+M	Front facing points	Shift+F
		Select all Elements	Alt+A
		Unselect all Elements	Shift+Alt+A
		Select all points on selected elements	Ctrl+A
		Unselect all points on selected elements	Ctrl+Shift+A

E

All points of the selected elements are selected and displayed in the [Color of selected points] set in the Preference dialog box.

With [Unselect all points on selected elements], all points are unselected and displayed in the [Shading color of selected elements] set in the Preference dialog box.



Supplement

All selected elements in the element list are subject to this operation.

2.4 Delete

ton.

A. Deleting Selected Points

This command deletes selected points of elements.

Operating Procedure

Select an area of elements and click 💽 [Delete] button or select [Delete] - [Points] from the [Edit] menu.

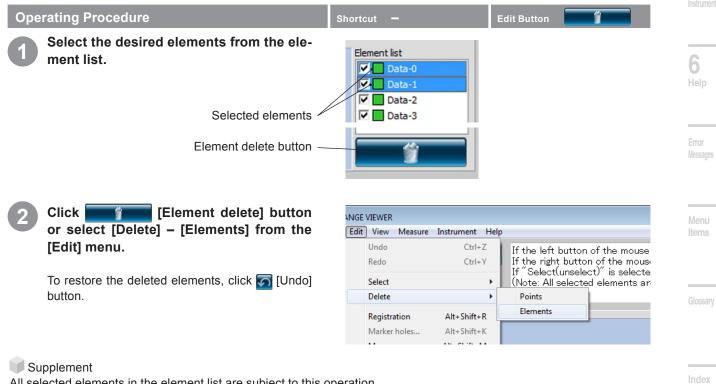
The selected points are deleted.

To restore the deleted points, click 🔽 [Undo] but-

Short	cut –		Edit Button
_			
NGE	VIEWER		
Edit	View Measure	Instrument H	lelp
	Undo	Ctrl+Z	If the left button of the mouse
	Redo	Ctrl+Y	If the right button of the mouse If "Select(unselect)" is selecte
	Select	•	
	Delete	•	Points
	Registration	Alt+Shift+R	Elements
	Marker holes	Alt+Shift+K	
		ALC 0120 A.	

B. Deleting Selected Elements

This command deletes elements selected in the element list.



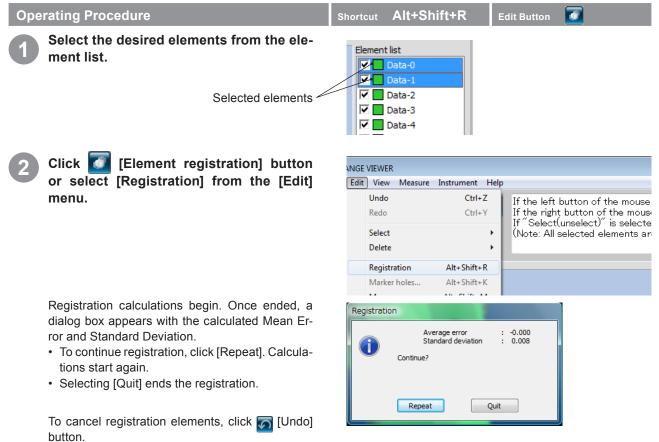
All selected elements in the element list are subject to this operation. Before dealing with of operation in, alert warning message is displayed.

_		
~		



2.5 Registration

This function should be used for more precise registration of elements for which initial registration has already been completed. 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.



Supplement

Recalculate the mean error and standard deviation until the values no longer change.

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 right 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 matching of the marker positions is maintained. Positions can be adjusted finely after [Initial registration] is performed with markers.

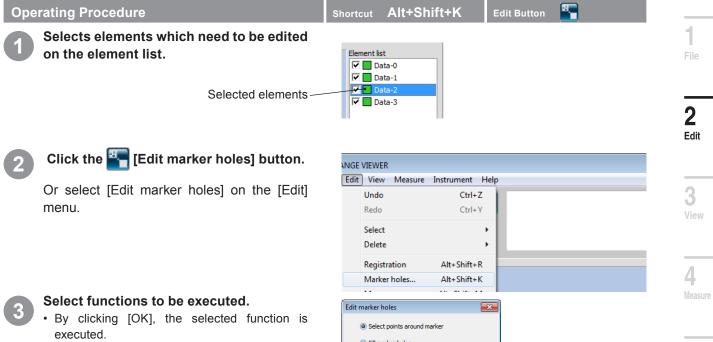
	RANGEVIEV	ER Jse marker information for the reg	istration?
Yes No Cancel		Yes No	Cancel



2.6 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.



• By clicking [Cancel], the dialog is closed without executing the selected function.

Select points around marker			
Fill marker holes			
Level 5	Keep Fill		
Execute above ?	Cancel		

[Edit marker holes] dialogue

[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

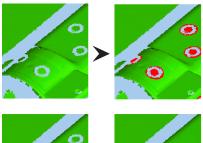
After executing selection of points on the marker, points which were selected before the execution become non-selected. Only the points on the marker are selected. This operation can return the condition to the original state by cancelling.

[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.





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2.7 Merge

This command merges two or more registered elements from the element list. When executed, unless saved under another name, the original elements are deleted and only the resulting merged element remains.

Note

Element combination cannot be undone with the [Undo] button.

Operating Procedure	Shortcut Alt+Shift+M Edit Button
Select the desired elements from the ele- ment list. Selected elements	Element list Image: Data-0 Image: Data-1 Image: Data-2 Image: Data-3
Click 📴 [Merge] button or select [Merge] from the [Edit] menu.	NGE VIEWER Edit View Measure Instrument Help Undo Ctrl+Z
A confirmation message appears asking whether to save the data or not.	Redo Ctrl+Y Select • Delete • Registration Alt+Shift+R Marker holes Alt+Shift+K
3 Select whether to save the original data or not, before merging the elements.	RANGEVIEWER
If [Yes] is selected, the Save As dialog box appears for you to save the current scanned data. After inputting a file name and clicking the [Save] button, the data is saved before the elements are merged.	The last scanned data will be lost after merging.¥nSave last scanned data before merging?¥nAfter saving the data, continue with merging.
Selecting [No] merges the elements without sav- ing their original data. Selecting [Cancel] cancels merge processing.	Save As Save As Save in: Name Date modif Type Size No items match your search. Save File game: Save Save Save Save Save Save Save Save
 When the merge command is executed, a confirmation message appears. Selecting [OK] merges the elements. Selecting [Cancel] cancels merge processing. 	RANGEVIEWER
5 The merged elements are deleted from the element list and appear as a single merged element. The file name is "Merged-x" (x being an integer — from 0 up).	OK Cancel



3. View

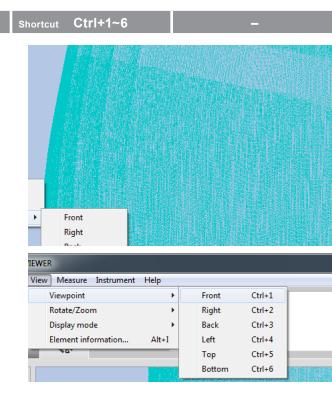
3.1 Viewpoint

Change the viewpoint direction of the 3D data by selecting the command from the mouse right-click pop-up menu or from the menu bar.

Operating Procedure

Click the right mouse button to open a pop-up menu of commands and select [Viewpoint] - [Front], [Back], [Top], [Bottom], [Right] or [Left], or select [Viewpoint] and select a viewpoint from the [View] menu.

3D data are displayed from the direction selected.



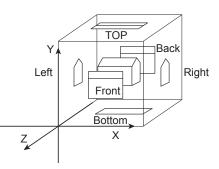
3D Orthogonal Coordinates

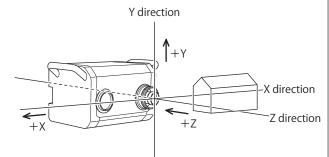
The position of a point in a 3D space is represented by coordinates in a 3D orthogonal coordinate system. The coordinate system here uses a point near to the center of the RANGE7/5's receiver lens. The Z direction extends from directly behind the light receptor along the optical axis to the front, the Y direction is above the receiver and the X direction is to the right.

* In the output 3D data, specific offsets are applied respectively along the XYZ axes.

Viewpoint

RANGE VIEWER lets you view elements from the front, back, top, bottom, right or left, or in most any orthogonal projection.







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3.2 Rotate/ Zoom

The viewpoint can be rotated, moved, zoomed in/out and matched to the display size. Selected areas can be zoomed in/out, as well. The commands can be executed from menu buttons or the menu bar. You can also perform this operation from the pop-up menu displayed by clicking the right mouse button menu.

Operating Procedure	Shortcut F9~F12, Ctrl+F Edit Button	
1 Click a CONCONTRACT Click a CONCONTRACT Click a CONTRACT CONTRAC	IEWER View Measure Instrument Help Viewpoint Rotate/Zoom Display mode View Pan F10	
The selected command is activated. See the following for command details.	Element information Alt+I Area zoom F12 Fit to window Ctrl+F	

Menu Button Functions



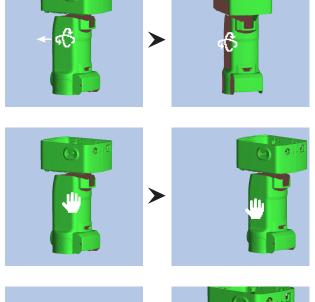
Viewpoint rotate

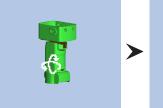
The viewpoint can be rotated by pressing and holding the left mouse button and dragging the mouse.

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.

The viewpoint can be moved by pressing and holding the center mouse button (wheel) and dragging the mouse. While the button is depressed, the cursor appears as

The viewpoint can be zoomed in/out by spinning the mouse wheel.









area.

Viewpoint move

Zoom

Zoom selected area

angle area is set.

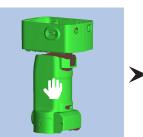
The viewpoint can be moved by pressing and holding the left mouse button and dragging the mouse to move the cursor up and down on the screen.

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.

A rectangle target area appears over the view

while pressing and holding the left mouse button. The mouse can be dragged to enlarge/reduce the

When the left mouse button is released, the rect-





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Window

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View

4 Measure

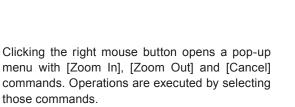
5

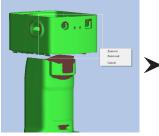


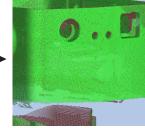
Messages

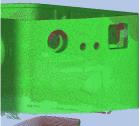
Menu Items

Glossary











Fit to window

Clicking the button automatically zooms the image so that all elements appear in the view.







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3.3 Display Mode

3D data views can be switched between shaded images and images made up of points.

The commands can be executed from menu buttons, You can also perform this operation from the pop-up menu displayed by clicking the right mouse button menu.

Operating Procedure

Click either [Show points] button or [Show shaded points] button, or select [Display mode] – [Points] or [Shading] from the [View] menu.

The 3D data view appears in the selected display mode.

'iew	/ Measure Instrument	Help	_		
	Viewpoint	+	Г		
	Rotate/Zoom	+			
	Display mode	•	\checkmark	Points	Ctrl+Space
	Element information	Alt+I		Shading	Ctrl+Space
Γ	×0*				

Points and Shades Display Modes



Show points

Displays 3D data as a set of points.

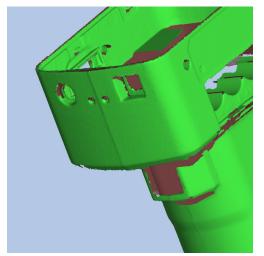
The points image does not calculate the 3D shading used in shaded images, therefore it can be drawn more quickly than shaded views. Processing goes faster with the points image when deleting unnecessary points and other editing operations. The size of the points can also be set from 1 to 10. See "1.6 Preferences" on p. 18.





Show shaded points

Displays 3D data with shading. A sense of volume is created by calculating shadows from the location of the light source and reflected light.



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Startu

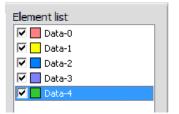
3.4 Element Information

Element information is recorded in scanned data. To make it easier to view and edit this information, elements can be selected from the element list and commands executed from the menu bar or a pop-up menu opened by right-clicking the mouse.

Ope	rating Procedure		Shortcut Alt+I –	Window Configu-
1 a	Select an element fro right-click the mouse menu and select [Eler The Element Information of	to open the pop-up nent information].	Element list V Data-0 V Data-1 V Data-2 V Data-3 Element information Show selected elements Hide selected elements Delete selected elements	ration 1 File
1 b	Select [Element info [View] menu. The Element Information of	-	RANGE VIEWER File Edit Viewpoint Rotate/Zoom Display mode Element information	2 Edit
	Select an element f name] combo box.	from the [Element	Element information Element name: Data-1 Scan environment Data-1 Data-1 Data-2 Data-2 Color of s Data-3 Data-4 Instrument Type: Data-5	View 4. Measure
2	Set element information lected and whether to element. In the [Measurement Environment Environment] recorded during measurem [Number of points] indicate that compose the 3D data	o show or hide the ironment], the contents nent are displayed. es the number of points		5 Instrument
	Element information	1000		
	Element name: Scan environment Date:	Data-3 ▼	Number of points: 260830	Error Messages
	Instrument Type:	RANGE7	Display status of element: Show	
	Instrument serial number: Lens type: Ambient temperature (deg.):	1001099 WIDE 22.0	3D image:	Menu Items
	Number of scans: Data reduction ratio: Scan distance (mm): Laser power:	3 1/1 580 18 - 78		Glossary
	Temperature at calibration (deg.): Calibration time:	22.0 2010/04/19 18:32	OK Cancel	Index

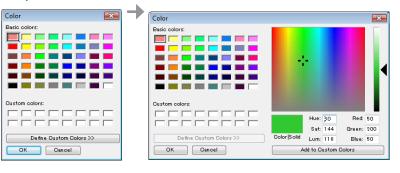


	Element Information Dialog Box
Element name	Displays the element name. Element information differs according to the ele- ment selected in the combo box. The name in the combo box may also be changed.
Scan environment	Displays parameters used in element scanning.
Date	The date of measurement of the selected element is displayed.
Scanning instrument type	Displays the type of the instrument used to scan this element.
Instrument serial number	The serial number of the measurement device used to measure the element is displayed.
Lens type	Displays "TELE/WIDE" as the type of lens used to scan the element. "" appears with merged elements if different types of lenses were used to scan the individual elements.
Ambient temperature (deg.)	Displays the temperature of the instrument at the time the element was scanned.
Number of scans	Displays the number of times the selected element was scanned. "+1" is displayed if the element was created through a Dark Surface mode.
Data reduction ratio	Select a data reduction ratio from [1/1], [1/4], [1/9] and [1/16]. Since the number of data in the original element is deleted for scanning, the data reduction ratio of the scanned data cannot be changed.
Scan distance (mm)	Displays the distance from the selected element in scanning.
Laser power	Displays the exposure level used in element scanning.
Temperature at calibration (deg.)	Displays the instrument temperature after calibration.
Calibration time	Displays the date and time that the instrument was calibrated.
Number of points	Displays the effective number of points of the element.
Color of selected element	Displays the color used when the element is selected. Although the shading color of selected elements is set in the Preferences dialog box, this shading color can be individually set for each element. The color in the element list is



that selected here.

Clicking the color button opens the [Color] dialog box where colors can be freely selected.



 \checkmark Displays whether the element is shown or hidden. The setting can be changed. This item is linked to the checkbox in the element list.

Displays the 3D image of the element in two dimensions. The XY points are the horizontal and vertical edges of the image, while the Z coordinate is displayed on a grey scale. "Merged" is displayed for merged elements.

Display status of element

3D image



4. Measure

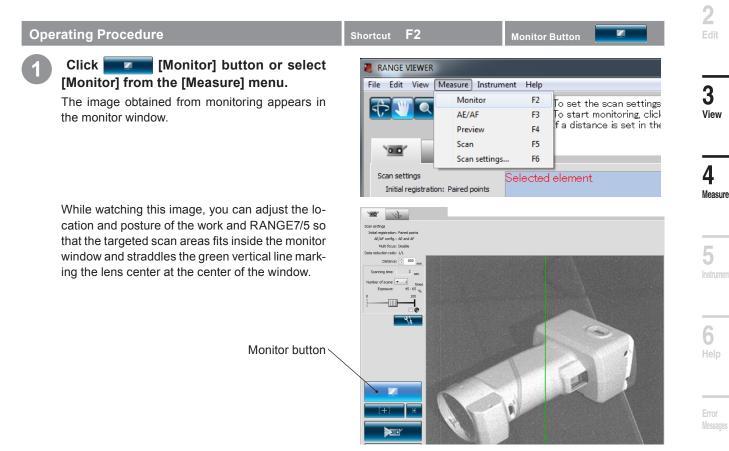
\Lambda WARNING

 $\underline{\&} \bigcirc$ 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.

4.1 Monitor

This command monitors the work and displays it in the monitor window so that you can position the scanning area. A vertical green line representing the center of the lens to aid positioning, and a vertical black line to help you adjust the stand-off distance and focus will appear.



Supplement

- Monitoring automatically ends 10 min after being started.
- If another button is clicked while monitoring is in progress, monitoring ends and the software transitions to the processing of the clicked button.

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The location and posture of the work and RANGE7/5 can be adjusted so that the two are appropriately positioned for scanning. These adjustments are made by activating the monitoring feature and watching the work in the monitor window.

Distance t	o work and		(Unit: mm)	
Lens	TELE lens		WIDE	Elens
Distance	450	800	450	800
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 work and work size N 4. . 14: C

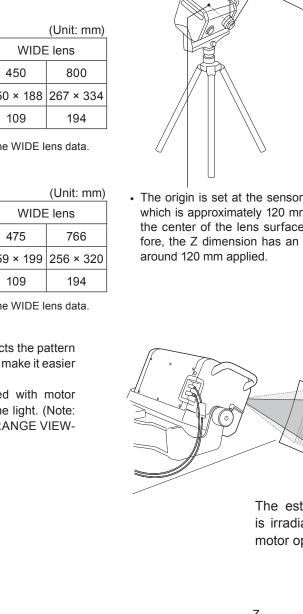
in Multi focus mode				(Unit: mm)
Lens	TELE lens		WIDE	E lens
Distance	462	781	475	766
X×Y	81 × 102	138 × 172	159 × 199	256 × 320
Z	54	97	109	194

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

FOV Indicator

A FOV (field of view) indicator projects the pattern of light shown at right 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 VIEW-ER windows are being operated.)

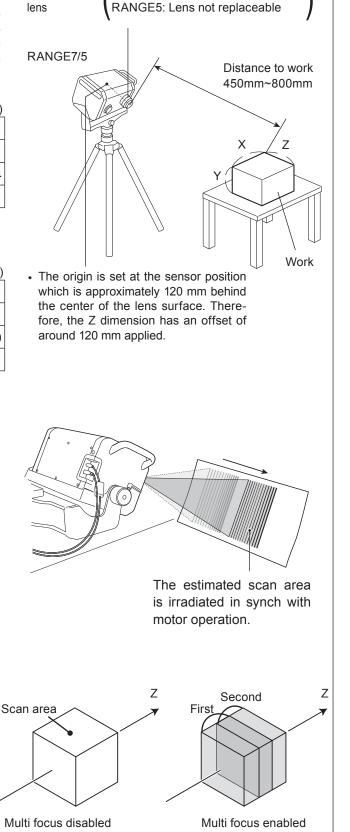


Multi focus

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. See "4.6 Scan settings" on p. 67.



Light-receiving RANGE7: TELE/WIDE replaceable

Multi focus image



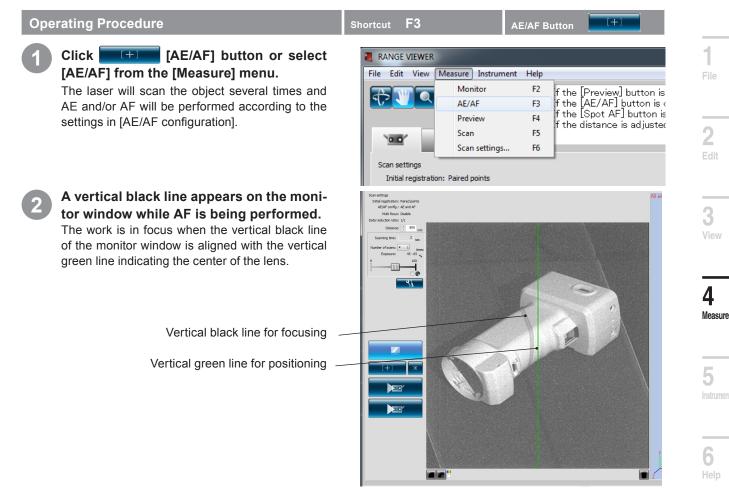
Startup

Window

4.2 AE/AF

Automatic exposure (AE) and automatic focusing (AF) are available to accurately scan works. To use AE/AF and spot AF, it is necessary to select [AF only], [AE only] or [AE/AF] under [AE/AF configuration] on the Scan settings dialog box. See "4.6 Scan settings" on p. 67.

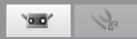
AE/AF



Glossary

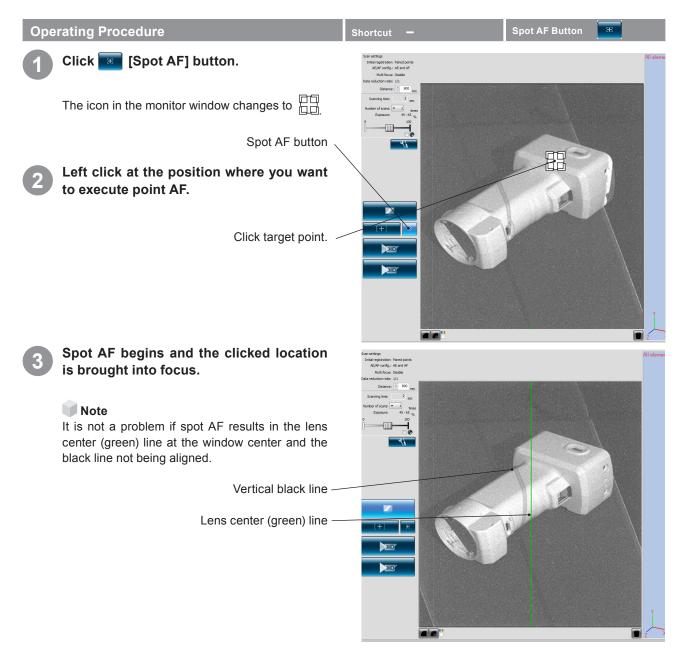
AE (Auto Exposure) and AF (Auto Focus)

AF (Auto Focus) is a mechanism for automatically setting the focal distance to the work. AE (Auto Exposure) is a mechanism for automatically setting image exposure conditions.



Spot AF

If the target area is out of focus or outside of the scan area after AF, the spot AF feature can be used to bring it into focus. With point AF, line up the mouse cursor with the location you want to focus on in the monitor screen, and then click the left mouse button. Scanning for spot AF begins when the mouse is left-clicked. When the targeted area is brought into focus, the scanning parameter settings of RANGE VIEWER are updated to the results obtained in spot AF. Spot AF ends when monitoring operations start.





mm

times 19 - 79 %

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Manual Focusing and Exposure Level Setting

The focus and exposure level can be adjusted manually for works that are hard to focus on with AE/AF or spot AF.

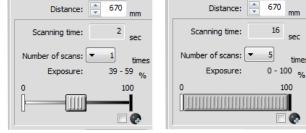
Operating Procedure Shortcut Set the measurement distance by clicking the ▲ or ▼ button at the side of the [Mea-0.0 surement Distance] list box or inputting the number directly. Scan settings The stand-off distance can be set between 450 Initial registration: Marker and 800 mm. In the Multi focus mode, this range AE/AF config .: AE and AF is 462 \sim 781 mm for TELE and 475 \sim 766 mm Multi focus: Disable for WIDE. For correlations between stand-off dis-Data reduction ratio: 1/1 tance and work size, see "Scan Position Adjust-Distance: ____ 670 ment" on p. 42. Scanning time: Distance list box Number of scans: Slide the [Exposure] slider left and right Exposure: to set the exposure level. 0 Adjust the exposure level according to the bright-ness of the work. A low percentage (%) is effective for scanning bright works. Inversely, a setting a higher ratio is effective for scanning dark works.

Exposure slider Select the number of scans from the Distance: 🚔 670 Distance: [Number of scans] list box.

The number of scans can be selected from 1 to 5.

The slider width varies with the number of measurements set.

Each measurement covers 20% of the entire size. Setting 5 measurements gives a size of 100%.





· The Scanning time displays the estimated time required for scanning. It is based on the Distance, Exposure level and Number of scans.

Window

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Measure

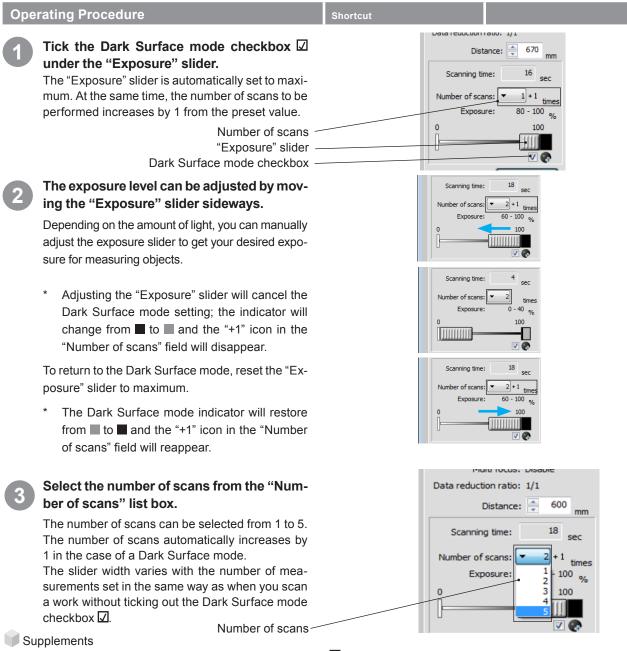


4.3 Dark Surface mode setting

Measurement of objects with ultra-low reflectivity (the dark surface with 2.5% reflectivity), until now considered difficult using camera-type non-contact 3D digitizer, is now made easy using this industry-pioneering function.

NOTE

The Dark Surface mode setting screen is unavailable in RANGE7 models which do not have the Dark Surface mode function. Please warm up the sensor before use it. Low temperature may result in problems such as incomplete data.



- You may tick or not tick the Dark Surface mode checkbox 🛛 as you go along depending on the condition of the work surface to be scanned.
- The checkbox 🗹 will not be displayed while the sensor is disconnected.
- The Dark Surface mode will carry through to the next startup if remained it on at the end of the session; when you want to carry out a regular scan next time, please do not tick the Dark Surface mode checkbox 🗹.
- When a change is made to the number of scans while the Dark Surface mode is on, and if the exposure is set to maximum before the change, then it is automatically set to maximum after the change.
- When the Dark Surface mode is switched on, there will be 8 seconds more than the time cost for the regular scan displayed in the "Scanning time" field.



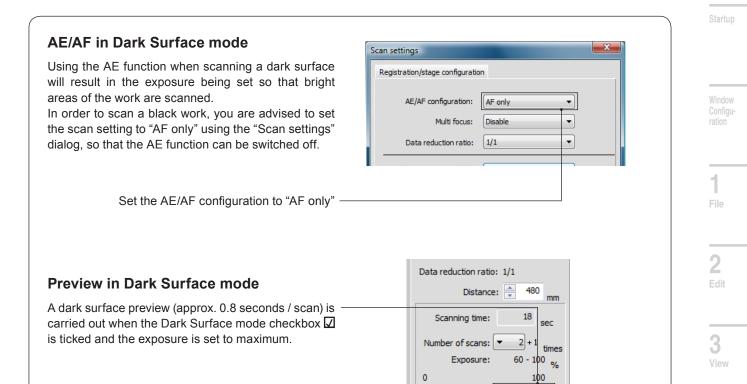
J

4 Measure

5

Error

Menu Items



Element information in Dark Surface mode

In the "Element information" dialog, for an element created using a scan in Dark Surface mode, the "Number of scans" field will display a "+1" in addition to the preset number of scans, for example, "4+1".

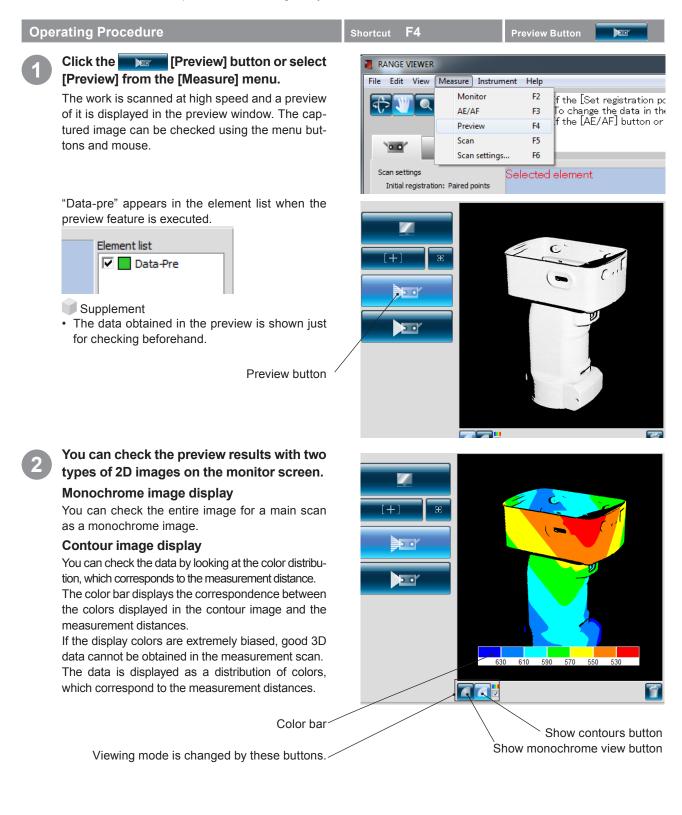
Element information			
Element name:	Data-Pre 🔻	Number of points:	626430
Scan environment			
Date:	2009/05/28 1:01	Color of selected element:	
Instrument Type:	RANGE7	Display status of element:	Show -
Instrument serial number:	1001003	3D image:	
Lens type:	TELE		
Ambient temperature (deg.):	37.0		
Number of scans:	2		
Data reduction ratio:	1/1		
Scan distance (mm):	600	-	
Laser power:	60 - 100		
Temperature at calibration (deg.):	37.0		
Calibration time:	2009/05/26 16:01		OK Cancel

·····

4.4 Preview

The measurement results can be forecast with the 3D preview function.

This makes it possible to predetermine the depth in the measurement area and any blind spots before the actual measurement takes place, and it can greatly reduce measurement mistakes.



Preview data is deleted by clicking

Show monochrome

view button



Delete last data button

4 Measure

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Monitor Window

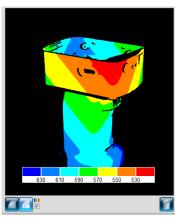
Displays the scanned data in a monochrome view.



C Sho

Show contours button The data is displayed as a distribution of colors, which correspond to the measurement distances.

Show color bar checkbox When a checkmark *✓* is placed in the checkbox, A bar is displayed giving the correspondence between the colors and the distances shown on the contour display.



Data close to the RANGE7/5 appears red and that far away is blue. The scale is evenly spaced across the distance from the RANGE7/5 to the focal point. Auto scaling is not performed according to depth.

Images with little change in distance change little in color.

Messages

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Delete last data button De

Deletes previews and the last scanned element.

Supplement

 Switching of monitor screens can be executed by the shortcut below as well. Monochrome image display button Shift + M
 Contours display button Shift + C

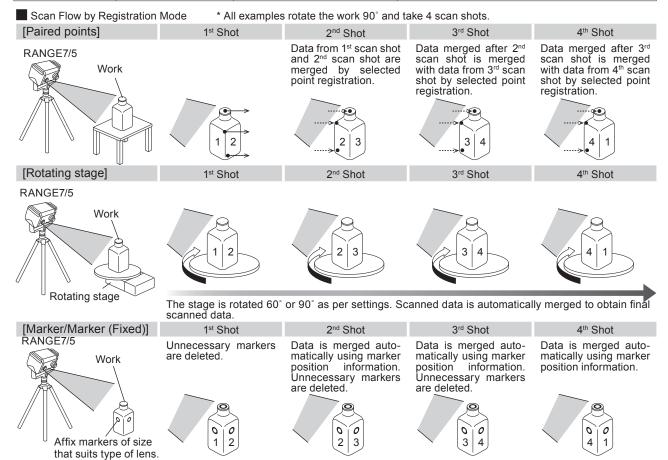
Color bar display check button Shift + V



4.5 Measure

Clicking [Scan settings] button opens the Scan settings dialog box with the [Initial registration method] selected as the registration mode. During scanning, scanning time is monitored on a progress bar. There are three registration modes: [Paired points], [Rotating stage] and [Marker]. Their features are outlines below:

[Initial registration method]	Description	Advantages	Other
Paired points	The position of a work is registered by left- clicking correspond- ing points of two scanned 3D images in order to interpolate their positions in 3D space.	Scanning is easy as special in- struments and markers are un- necessary.	_
Rotating stage	The work is set on a rotating stage and automatically scanned to register its position in 3D space.	The axis of rotation requires simple calibration. The position of a work can be registered au- tomatically.	SHOT-602* and SHOT-202 are applicable control boxes for the rotating stage.
Marker	Markers are affixed to works and their po- sitions are registered when they overlap in differing scan shots.	This mode is more accurate than [Paired points] and oper- ability is improved because the marker information basically automates registration work.	Set marker size for the type of lens being used. Use [Small] for TELE and [Large] for WIDE.
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 themarkers are given in the file. Accordingly, errors do not ac- cumulate with repeated regis- tration 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 [Mark- er] from the initial registration and check [Not add- ing new ref.]. Determine the 3D coordinate value 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 mark- ers (fixed) are not added to the reference markers.



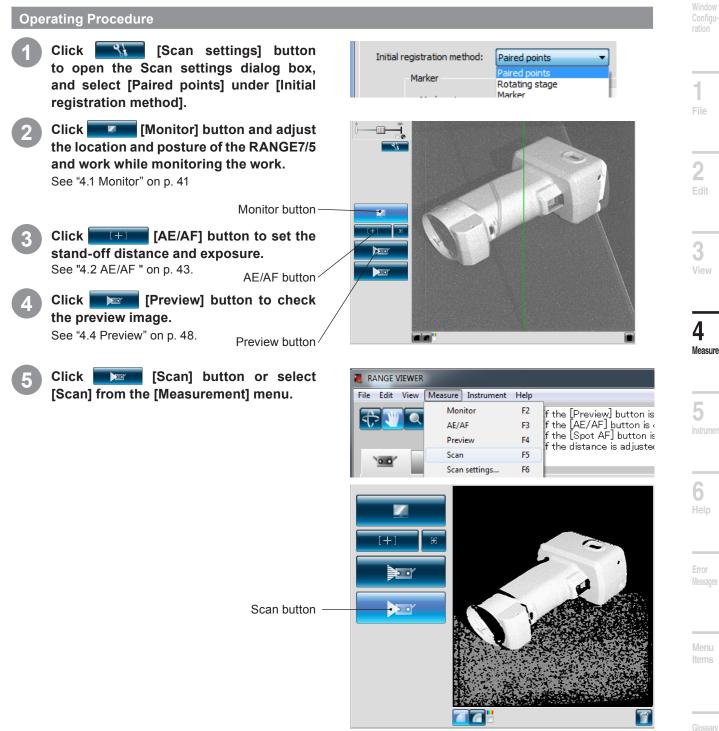
50



Before Scanning

Before scanning, it is necessary to set up scanning, registration mode and other parameters. For details, see "4.6 Scan settings" on p. 67.

A. Registration by [Paired points] Mode



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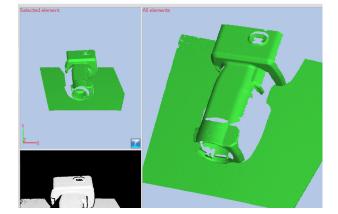


Scanning ends as per settings.

Displays the measured 3D images on the selected screen and measured screen.

A name appears in the element list for the acquired data.





Rotate the work to another angle and adjust location and posture while monitoring.

Monitor button <

9 Click [Scan] button or select [Scan] from the [Measure] menu.

The Scanning dialog box appears and scanning starts.

Scan button_



Scanning ends as per settings.

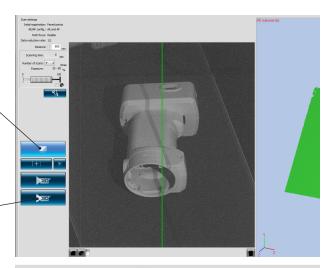
The second scanned data are displayed on the selected screen.

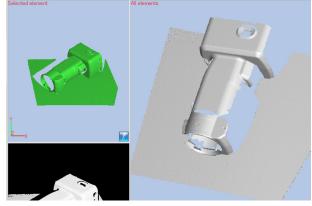
The second scanned data name is displayed in the element list as selected.

In addition, scanned data after the second data are not displayed on the scanned screen until registration is complete.

However, checking the check box manually enables the data to be displayed on the scanned screen.







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Click 👿 Set registration points button.

The pointer changes to *w* when preparations for selecting points are complete.



Click sequentially on the corresponding points in the two images.

Perform the registration by designating the corresponding positions of the second measured data (left) and the first measured data (right). Click as close to the same point as possible in the left and right images.

When the pointer looks like , right-clicking the mouse opens a pop-up menu of the following commands.

Selecting [Undo] deletes clicked points in backwards order from the most recent.

Selecting [Pause] pauses clicking and enables you to rotate and zoom the 3D images.

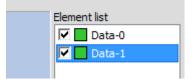
To start again, select interruption from the popup menu again. In addition, interruption and restarting can be done by pressing the [Space] key.

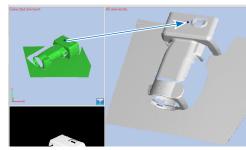
Selecting [Cancel] cancels the selected points registration mode regardless if any points have been selected or not.

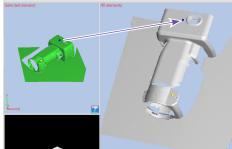
You can select points sequentially in either of the images first and then in the other image. Marker colors change sequentially with each click.

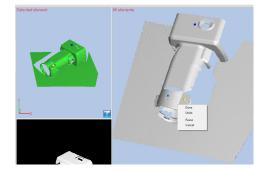
Once one or more pairs of corresponding points have been selected, select [Done] from the pop-up menu opened by right-clicking the mouse, to register the points.

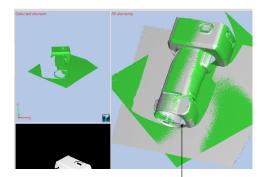
Scanned data finished with registration are automatically displayed in the scanned window.











Condition where registration is executed.

Δ

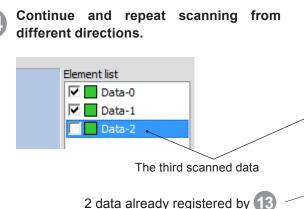
Measure

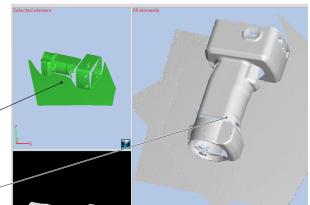
ltems

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- Supplement
- If positions do not align properly, add a pair of corresponding points and register the positions again.
- Preview data obtained by clicking the preview button can be aligned with already scanned elements.
- If scanning is executed immediately after positioning preview data, the preview data is automatically registered with the scanned element.
- Because registration is complete even though it is immediately after scanning, a checking mark is put in the check box and the element is displayed on the scanned screen.
- Rotate works to a profile that makes it easy to select corresponding points.
- After the measurement, in case preview or measurement is done without paired points registration, the message "Trying to preview (measure) without paired points registration, do you continue to preview (measure)?" is displayed. Press the [No] button, and stop preview or measurement. By pressing the [Yes] button, preview or measurement continues.

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The icon becomes *i*, and corresponding points can be selected.

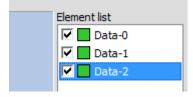
Click corresponding positions of the data displayed on the selection screen and scanned screen, then register.

At this stage, paired points can be performed to all the plural number of data displayed on the scanned screen.

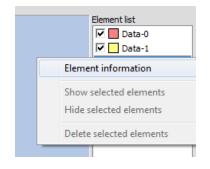


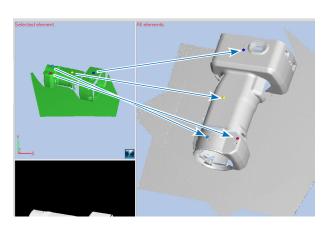
When clicking more than one pair in corresponding positions, registration is executed by selecting [Execution] in the pop-up menu provided by the right mouse click.

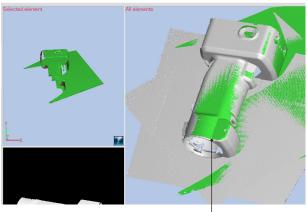
Scanned data finished with registration are automatically displayed in the scanned window.



With regard to element information, if colors of elements change, registration results become easier to see. ("3.4. Element information" p. 39 – 40)

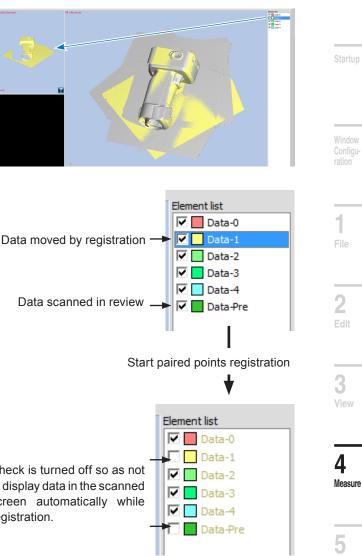






Condition where registration is executed.







list.

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

The data which was registered once can be registered again by selecting them in the element

Displays data selected from the element list are

displayed in the Selection screen.

Note: Data obtained by preview cannot be used as the bases for registration even though they are displayed on the scanned screen. Selected data themselves are not used as bases of registration.

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

Check is turned off so as not to display data in the scanned screen automatically while registration.

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Using the rotating stage to measure the object and determining the rotation axis with the calibration chart results in 3D data on a specific circle.

By using this as the measured data, and repeating the initial alignment with other 3D data on other circles, you can obtain full-circle 3D data with minimal measurement omissions.

Scan settings

Setup for Registration Using a Rotating Stage

This setup is for registering works in 3D space using a rotating stage.

Operating Procedure

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.

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.

Registration/stage configuration	n
AE/AF configuration:	AE and AF
Multi focus:	Disable 🔻
Data reduction ratio:	1/1 -
Initial registration method:	Rotating stage
Marker	Paired points Rotating stage
Marker size:	Marker
Small (5/8 mm)	Open ref.
	Save ref.
	Not adding new ref.
Stage	
Model: SHOT-202	Port: COM1
Save settings	OK Cancel

Click the [OK] button.

The rotating stage is initialized.

• If the Rotating Stage Is Not Recognized

An error message appears stating, "Unable to communicate with stage." \rightarrow In this case, switch the control box power Off, then On again and re-do the operation from the start.

• If the Rotating Stage Is Recognized and Successfully Initialized

If the computer does not contain a file of the axis of rotation data, a message appears stating, "No stage axis information exists. Please measure a chart."

If the computer has a file of the axis of rotation data, it is automatically read and the information on the registered instrument and lens is checked.

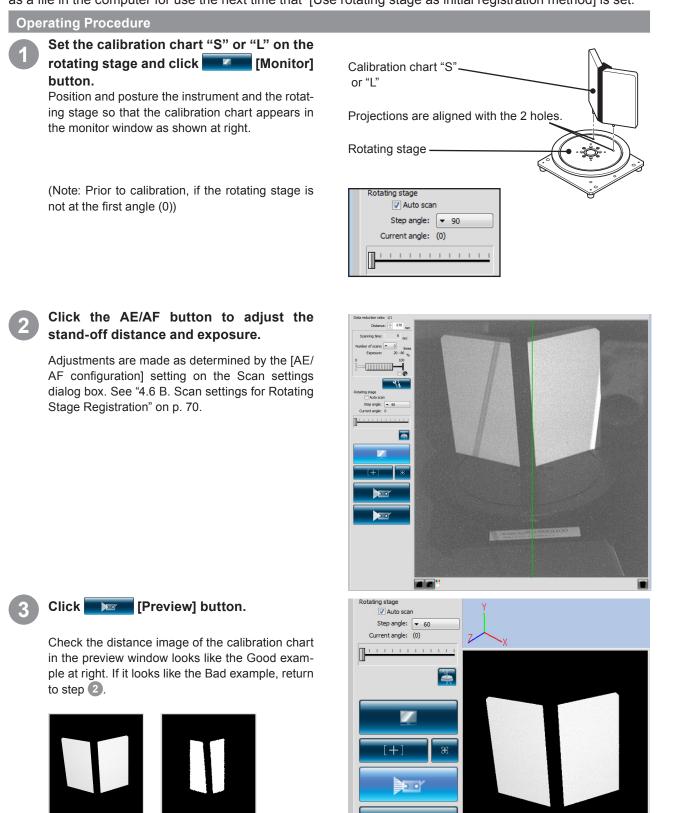
- If the registered instrument and lens in that axis of rotation data differ from the current instrument and lens, a message appears stating, "Conditions differ from when the chart was scanned."
- If the registered instrument and lens in that axis of rotation data are the same as the current instrument and lens, a message appears stating, "Axis of rotation data has been loaded."

(Note: This message appears as long as the instrument and lens match the registered data even if calibration is needed because the stand-off distance has changed from when the axis of rotation data was last calibrated. Accordingly, when this message appears, it is not guaranteed that the loaded axis of rotation data is appropriate.)



Rotating Stage Calibration

The axis of rotation data needed to automatically register the scanned data of a work turned on a rotating stage is calculated by scanning the calibration chart. The resulting axis of rotation data is automatically saved as a file in the computer for use the next time that [Use rotating stage as initial registration method] is set.



Good example

Bad example

1

1

2

4

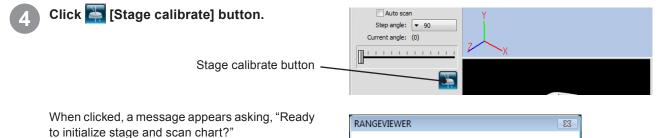
5

Measure

30

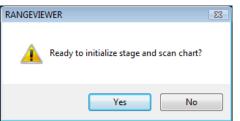


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Clicking the [Yes] button rotates the stage to the first angle.

• Clicking the [No] button cancels rotating stage calibration.



A message appears asking, "Scan chart image?"

Clicking the [OK] button starts calibration chart scanning.

• Clicking the [Cancel] button cancels rotating stage calibration.



The calibration chart is scanned.

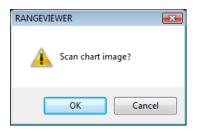
When scanning has been completed, a message appears asking, "Use this image?"

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.

If no data was obtained at all, a warning message will appear.

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 stage.

By setting the acceptance lens below, counter-rotated data can be obtained.







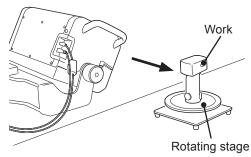
Registration Using a Rotating Stage

If scanning is started without any existing scanned data, the full-perimeter data of a work is obtained by rotating the work around the axis of rotation using the acquired axis of rotation data and scanning it at various angles on the rotating stage.

This axis of rotation data is calculated as explained in "Rotating Stage Calibration" and loaded as explained in "Setup for Registration Using a Rotating Stage".

Operating Procedure

If you performed the steps in "Rotating Stage Calibration", remove the calibration chart and set the work on the rotating stage.



If you loaded the axis of rotation data as explained in "Setup for Registration Using a Rotating Stage" without calibrating the rotating stage, calibrate the stage to obtain the most recent axis of rotation data in the following cases.

	Rotating Stage Must Be Calibrated	Comment
1	If the message "Cannot find the corresponding axis of rotation data." appears	_
2	If the message "Conditions differ from when the chart was scanned." appears	_
3	If the message "Axis of rotation data has been loaded." appears, but the positional relationship of the rotating stage and instrument differs from when the axis of rotation data was obtained	This message does not guarantee that the axis of rotation data is appropriate. (See step 3 of "Setup for Registration Using a Rotating Stage" p. 56.)

If the message "Axis of rotation data has been loaded." appears and the positional relationship of the rotating stage and instrument is the same as when the axis of rotation data was obtained, use the loaded axis of rotation data.

Note: Calibrate the rotating stage if any displacement in the [Use rotating stage as initial registration method] data appears when the loaded axis of rotation data are used.

Click [Scan] button and do the following based on the step angle. If Not Using Free Step Angles

Scan at the current angle, display the scanned result in the 3D view window and turn the stage to the next angle.

If Using Free Step Angles (* Free step angles cannot be selected in full auto scanning.) :

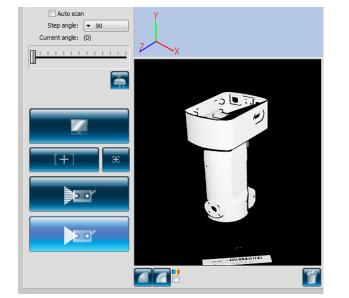
Scan at the current angle and display the scanned result in the 3D view window.

Do not turn the stage. With free stepping, use the slider bar to turn the stage to a specific angle.

If Using [Auto scan] :

Start the measurement from the 0° angle, and then automatically measure one complete circle according to the step angle.

When you measure the data for one circle, the rotation stage returns automatically to the 0° angle.



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Note: Clicking the [Cancel] button that appears on the Scan dialog box during scanning stops scanning and rotating stage rotation. \Rightarrow To change the angle, do so from the [Rotation Angle] slider.

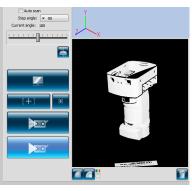
(Example of scanning at 90° steps)

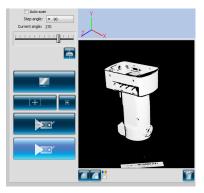












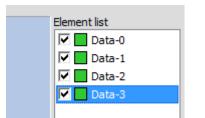


When the scanning for one circle is complete, the rotation stage stops and measurement ends.

270°

The scanned 3D image appears in the preview window.

A name appears in the element list for the acquired data.

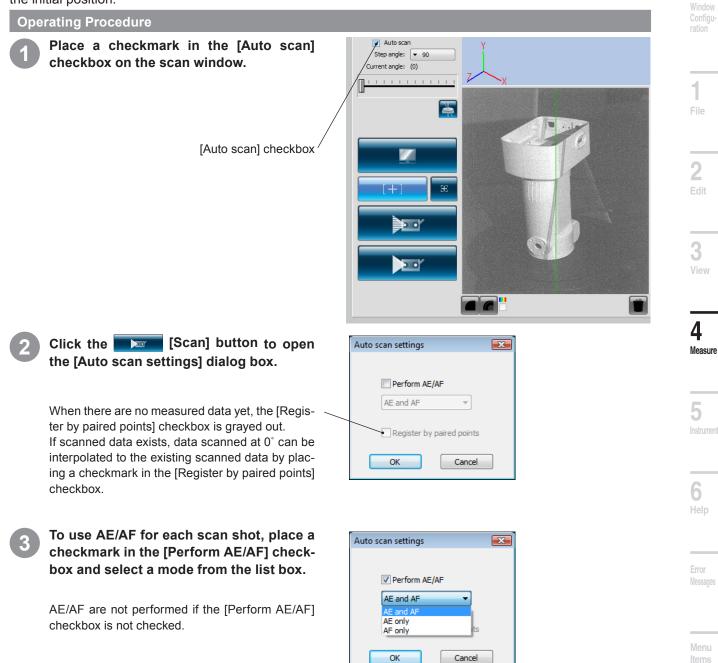




Setup for Full Auto Scanning

To use full auto scanning, place a checkmark in the [Auto scan] checkbox.

* When full auto scanning is used, At the start of measurement, by just clicking the [Measure] button once, you can measure automatically until the measurement for one circle is complete and the stage is aligned at the initial position.



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Click the [OK] button.

If a checkmark is not placed in the [Register by paired points] checkbox.

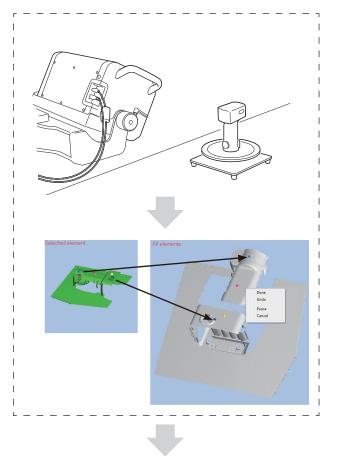
The rotating stage angle is initialized at 0° and the full perimeter of the work is scanned automatically at the set step angles. When data has been obtained for the full perimeter, the rotating stage returns to 0° .

If a checkmark is placed in the [Register by paired points] checkbox.

- The rotating stage angle is initialized at 0° and, after obtaining scan data for 0°, scanning stops so as to interpolate the data by selected points registration.
- Clicking the [Set registration points] button performs paired points registration.
- After selected points registration has been completed, clicking the [Scan] button starts full auto scanning.
- Scanning is automatically performed for the remaining step angles. When data has been obtained for the full perimeter, the rotating stage returns to 0°.

Note: Clicking the [Cancel] button that appears in the [Scan] dialog shown during full auto scanning stops scanning.





Scanning is automatically performed for the remaining step angles.



Registration combining rotating stage registration and measurement from different positions

Groups of data registered around the axis of rotation can be registered even after changing the RANGE7/5 position by following the specified procedure. Using this feature can provide full-perimeter 3D view results with fewer gaps in the scanned data.

Method 1: Method in which the rotating stage is not calibrated at each different instrument position

With this method, repeated registration around the axis of rotation (with the instrument position changed in order to scan the work on the rotating stage from different angles for example) is performed to create a full-perimeter 3D view without calibrating the rotating stage each time the instrument position is changed.

The procedure is as follows

	Procedure	Illustration
Step 1	 Place the instrument, rotating stage and scanning works in any position (Position1). Start scanning and registration using the rotating stage from a rotating stage angle of 0 degrees with- out any prior data present. Registration of first series of data is performed. (Data group A) 	
Step 2	 Change the instrument position (Position 2). Do not change the positional relationship between the work and the rotating stage. Scan at a rotating stage angle of 0 degrees. Perform selected points registration of the new data just scanned at an angle of 0 degrees to one of the first 0-degree data scanned in Step 1 (Data group A) as a reference. Scan data at remaining rotating stage angles. Data are registered around the axis of rotation. 	
Step 3	Repeat Step 2 as many times as necessary.	_

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Method 1 cannot be used in the following cases.

	Method 1 Cannot Be Used	Comment
1	If the work was moved \Rightarrow Use method 2. Also, use method 2 for all subsequent scan shots until scan- ning the full perimeter.	Point If only the step angle is changed in scanning without repositioning the work on the stage, the stage does not require calibrating. (Selected points registration is unnecessary.)
2	If another method of registration is used than selected points registration \Rightarrow Use method 2. Also, use method 2 for all subsequent scan shots until scanning the full perimeter.	Point Delete all scanned data from the ele- ment list in order to perform regis- tration using method 1 again
3	If all scanning is done using a rotating stage for registration and existing scanned data from the element list that contains data loaded from rgv or rvm files as reference	Point Even if the rgv or rvm file contains data regis- tered using a rotating stage, it cannot be used.
4	If all scanning is done using a rotating stage for registration af- ter calibrating the rotating stage or loading axis of rotation data when existing scanned data exists in the element list	_

Method 2: Method in which the rotating stage is calibrated at each different instrument position

With this method, new data can be registered to any existing data. Use this method when registration by Method 1 could not be performed.

The procedure is as follows

Procedure		Illustration
Step 1	 Place the instrument, rotating stage and scanning works in any position (Position1). Start scanning and registration using the rotating stage from a rotating stage angle of 0 degrees with- out any prior data present. Registration of first series of data is performed. (Data group A) 	
Step 2	 Change the positional relationship between the work and the rotating stage (Position 2). (The instrument position can also be changed.) Calibrate the rotating stage. Scan at a rotating stage angle of 0 degrees. Perform selected points registration of the new data just scanned at an angle of 0 degrees to one of the first 0-degree data scanned in Step 1 (Data group A) as a reference. Scan data at the remaining angles. Data are regis- tered around the axis of rotation. 	
Step 3	Repeat Step 2 as many times as necessary.	_



C. Initial Registration with Markers/Markers (Fixed)

The position of a work in 3D space can be automatically registered by affixing markers to the work and identifying where the markers overlap in differing scan shots.

Registration is performed by automatically recognizing the markers read out from the file containing the 3D coordinates of the markers and the markers of the scanned shot.

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

Operating Procedure

Click [Scan settings] button to open the Scan settings dialog box, and select [Marker] under [Initial registration method].

When scanning with markers (fixed), please check [Not adding new ref.].

Affix either large or small markers to the work.

Space the markers apart so that about $5 \sim 10$ appear on the monitor window during scanning. Set marker size according to the type of lens being used.

[Small]: TELE, [Large]: WIDE

Before scanning with markers (fixed), determine the 3D coordinates of the stuck markers by means of photogrammetry etc. and save them in an rmk or txt file, and then read the markers out of that file with the [Read out reference] button.

Click [Monitor] button and adjust the location and posture of the RANGE7/5 and work while monitoring the work. See "4.1 Monitor" on p. 41.

Monitor button <

Click [Preview] button to check the preview image.

See "4.4 Preview" on p. 48.

Check in the 3D view window that preview data from the second and subsequent scan shots can be automatically registered.

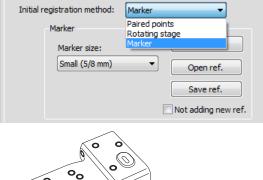
Preview button /

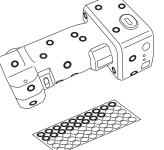


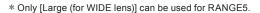
Click [Scan] button or select [Scan] from the [Measure] menu.

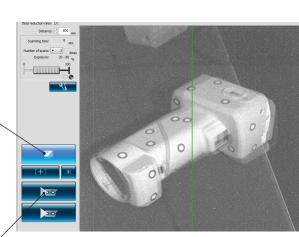
The Scanning dialog box appears and scanning starts. The recognized markers are captured and collected as reference markers.

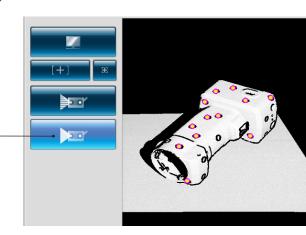
Scan button













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Once scanning has been completed, delete unnecessary marker information in 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. When selected, these markers appear red.

Left-clicking the selected markers again unselects them.

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.

Right-clicking the marker on the 3D view displays the popup menu. Selecting [Delete] deletes the selected marker.



Perform the next scan shot.

Position the work so that at least three (preferably five or more) markers overlap and are common to both the scanned element and upcoming scan shots.

Repeat steps 2~6 to obtain the necessary data.

Saving Reference Markers (See p. 71.)

Point 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** (See p. 71.) 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.

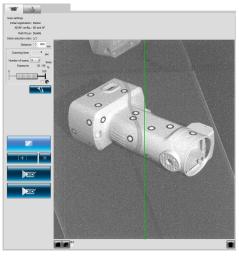
In the format of the txt file, the X coordinate value, Y coordinate value and Z coordinate value of the 3D coordinates of the marker are entered in each line. Each coordinate value is separated by commas or tabs.

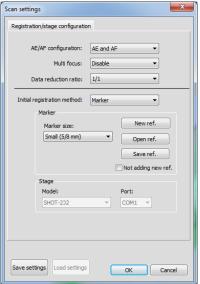
Creating New Reference Markers (See p. 71.)

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.

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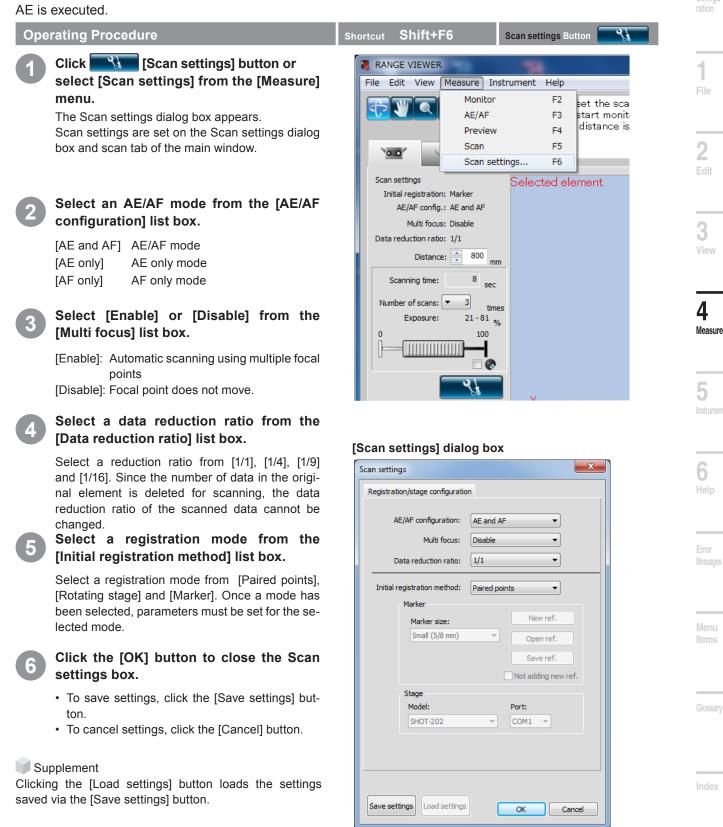




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4.6 Scan settings

Scan settings are controlled by the Scan settings dialog box that is opened by clicking [Scan settings] button, and the vertice (scan) tab of the main window. The number of scans, stand-off distance, exposure level and rotating stage drive settings (This is only displayed when the rotating stage is used.) are set on the scan tab. The exposure is automatically set to the best level for the set conditions (i.e., number of scans, etc.) when AE is executed.





AE/AF

AE and AF configuration must be set to focus and expose works for registration processing. To perform only AF, select [AF only]. AE can be performed in conjunction with AF particularly when working with works that are dark or bright (shiny) so as to automatically set exposure to the best level.

But, using the AE function when scanning a dark surface will result in the exposure 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 can be switched off.

AF is difficult with the following works.

1. Works of equal size overlapping from front to back 2. Works with fence-like structures at the front







When using AF with these kinds of works, the best focal distance is not always determined. In these cases, spot AF is effective. Clicking the spot AF button starts monitoring and displays the monitored image in the 2D view window, therefore a point for focusing the image can be selected by clicking the mouse pointer somewhere on the image. Monitoring makes it easy to check the image after spot AF.

Cases Where Spot AF Is Unsuccessful

1. If the mouse is clicked on a point off the work 2. If the mouse is clicked on a point at an extremely close distance

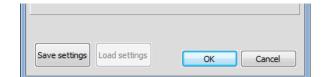


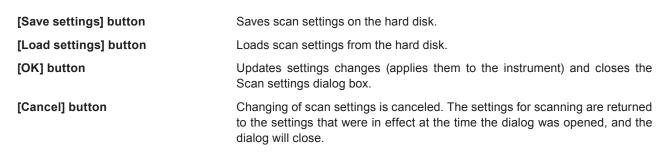


If an error message appears, adjust the location and posture of the work.

The focus and exposure level can be adjusted manually for works that are hard to focus on with AE/AF or spot AF. The exposure level can be set to $0 \sim 100\%$ of the brightness of the work. A low percentage (%) is effective for scanning bright works. Inversely, a high setting is effective for scanning dark works.

Scan settings Dialog Box * Other parameters are discussed on p. 69 ~ 71.

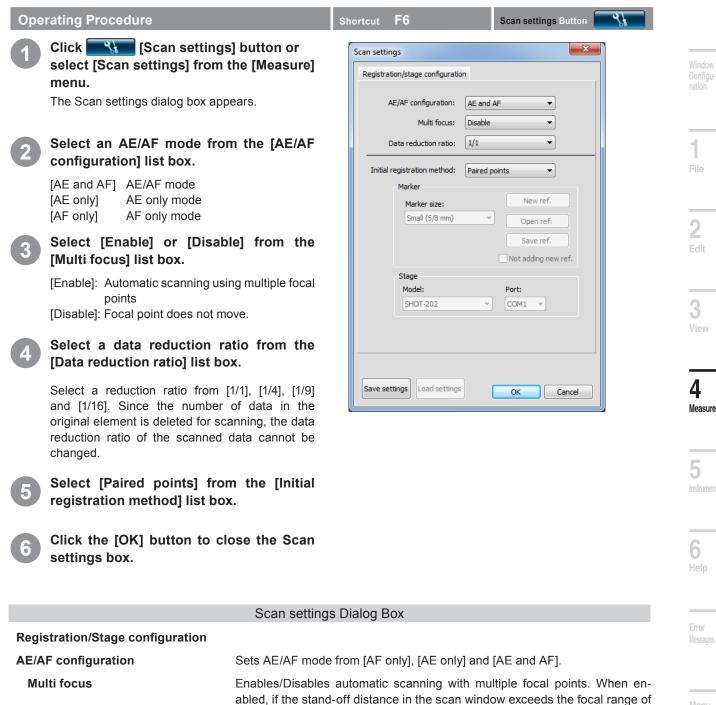








A. Scan settings for Paired Points Registration



Data reduction ratio

Initial registration method Sets the registration mode between [Paired points], [Rotating stage] and [Marker].

ment" on p. 42) when the [OK] button is clicked.

the Multi focus mode, it is set within this focal range ("Scan Position Adjust-

The data can be reducted when they are scanned. Select a reduction ratio

Note: Since the number of data in the original element is deleted for scanning, the data reduction ratio of the scanned data cannot be changed. [Related item:

For 1/4 deletion, the algorithm which leaves the edge part as much as possible

from the drop-down list. Selectable items: 1/1, 1/4, 1/9 and 1/16

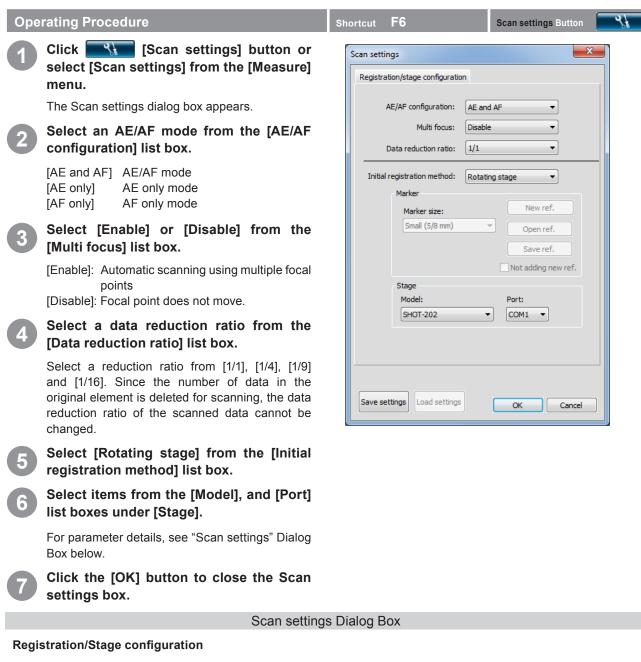
[Element display reduction ratio] p. 18]

is applied.



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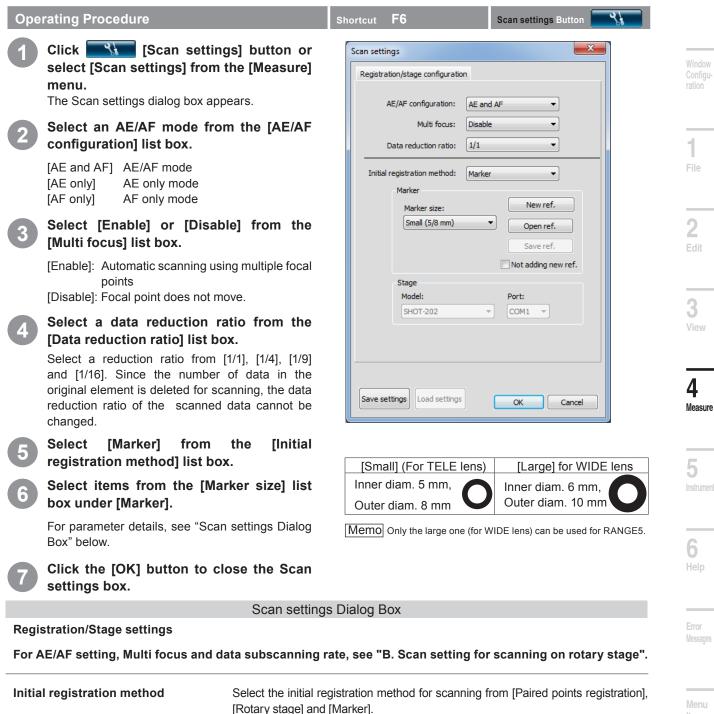


For AE/AF setting, Multi focus and data sub-scanning rate, see "A. Scan setting for scanning by paired point registration"

Initial registration method	Select the initial registration method for scanning from [Paired points registration], [Rotary stage] and [Markers].
Stage	Available only when [Rotating stage] is selected for [Initial registration method].
Model	Selects the rotating stage controller. Selection can be made from SHOT-602, SHOT-202.
Port	Sets the RS communication port that connects to the rotating stage. Available settings vary according to the PC environment.



C. Scan settings for scannig with Markers/Markers (Fixed)



	[Rotary stage] and [Marker].
Marker	Available only when [Marker] is selected for [Initial registration method].
Marker size	Sets the marker size.
[New ref.] button	Creates new reference markers. All reference markers in memory are discard- ed and the reference marker list is cleared.
[Open ref.] button	Loads reference markers from the file. All reference markers in memory are dis- carded and the reference markers saved as a rmk file are read from the file to memory.
[Save ref.] button	Saves the reference markers as a file. The reference markers in memory are saved as a rmk file.
Not adding new ref.	If there is a file containing 3D coordinates of markers determined by photo- grammetry etc., check the box. If the box is checked, registration with "mark- ers (fixed)" is performed. The markers scanned during scanning with markers (fixed) are not added to the reference markers.

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5. Instrument

\Lambda WARNING

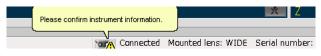
 $\textcircled{}\otimes \bigcirc$ Do not look directly into the laser emission window.

▲ ○ 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 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 ±1.5°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 temerature. 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
	00000000000000000000000000000000000000	
1280 x 430 (mm) plastic sheet. Sufficient space to spread out the calibration chart is required.	Do not touch the front side of the chart with bare hands.	Supports the RANGE7/5.
RANGE7/5 position	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 Calibra- tion Wizard.	How to use
For calibration with TELE lens	Calibration setup	* The RANGE7/5 can be calibrated on its scan- ning stand without using the calibration stand.

B

Tabletop

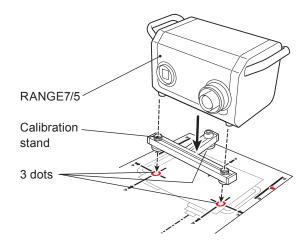
Operating Procedure

Prepare the RANGE7/5 and calibration sheet.

Calibration with Only the RANGE7/5

- Spread the calibration sheet out on a table.
- Set the calibration stand on the sheet where indicated by the picture. Position the stand's legs in the three circles.
- · Set the RANGE7/5 on the stand.

Shortcut **F8**



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Calibration with the RANGE7/5 on the Scanning Stand

Spread the calibration sheet out on a table.

• Spread the sheet out so that the edge of the RANGE7/5's body comes to the edge of the table.

Hold the RANGE7/5 level and adjust the height so that the bottom of the scanning stand pan head almost contacts the tabletop.

- Anchor the RANGE7/5 securely to the pan head with the bottom of the pan head above the tabletop.
- Loosen the stand pan head enough that it can rotate around the optical axis. Then, lower the stand arm with the RANGE7/5 mounted on it until the bottom of the pan head is flush with the tabletop. Determine the direction and height of the RANGE7/5 and lock in place.

Fine-adjust the position of the RANGE7/5.

Move the stand so that the RANGE7/5 is on the picture on the calibration sheet.
 (Note: Be careful not to contact the stand legs with the table legs.)

2

Prepare the calibration chart.

The chart can be titled to three set angles by pulling the knob on the left face of the chart stand.

The stand make it easy to establish the angles shown in the RANGE7/5 Calibration Wizard.

Knob on left face

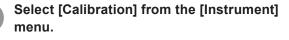
Table edge

Bottom of scanning

stand pan head

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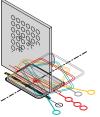
The Calibration Wizard appears.

Set the calibration chart in a position suitable for the type of lens. For a WIDE lens, the chart should be placed in position ① nearest the RANGE7/5. For a TELE lens, it goes in position ① farther from the RANGE7/5.

Once the calibration chart has been set, click the [Next] button.

Fine-position the chart.

While watching the monitor screen, finely adjust the position of the calibration chart and RANGE7/5 so that 24 O's fit into the outermost side of the area sandwiched between the two red box lines. Make sure the outside dots do not cross the outside red frames.



Using the Stand Pan Head

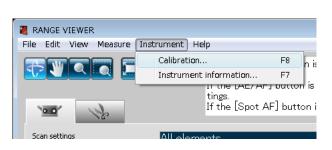
Adjust the stand in the height direction from the tilt lever, and lock in place.

In the horizontal direction, either fine-adjust the stand's position or reposition the calibration chart.

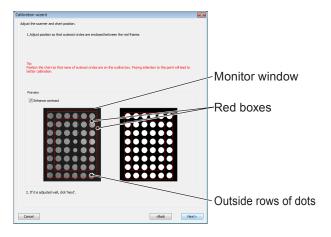
Using the RANGE7/5 and Calibration Stand Adjust the calibration stand in the height direction from the tilt lever.

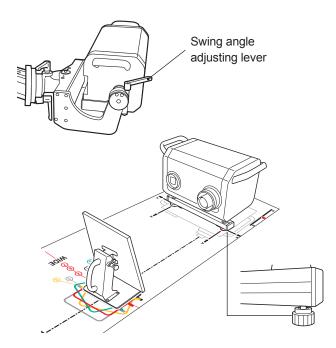
In the horizontal direction, either fine-adjust the stand's position or reposition the calibration chart.

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

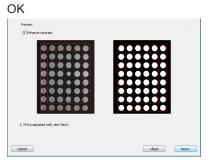












Once positions have been set, click the [Next] button.

4

Scan at position ①.

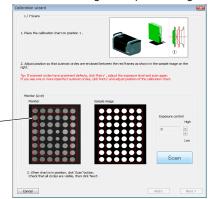
Check that the angle of the calibration chart surface is like the picture in the Calibration Wizard. If OK, click the [Scan] button.

Monochrome image on screen.

NG (Outside row of dots cross outside red frame.)



Before scanning, after positioning



Verify results on the check screen.

The [Monitor screen] on the check screen shows the scan results. Compare these results with the [Sample results].

Memo

About the dots on the "Monitor Screen".

- · Is not the dot notched?
- If the color is same colors as that shown in the "Sample" on the right side, the position is correct.

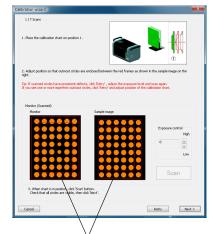
If there is no problem, click the [Next] button. Position 1 scan data will be made valid.

If there is a problem, click the [Retry] ,after the position is adjusted.

Note

For the possible problem and the solution method, refer to the column in page 76-77.

- When the [Retry] button is clicked, a message requesting confirmation of whether or not to discard the most recent measurement data will be displayed.
- Click the [OK] button to perform a retry.
- [Cancel] button to cancel the retry and return to the previous screen.



Example of poor results:

RANGEVIEWER

The latest scan data will be lost.

Cancel

OK

Measure



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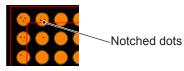
Possible problem and the corresponding solution method

Example1)

State: Several dots are missing.

Cause: Exposure level problem.

Action: Readjust exposure level and perform retry.

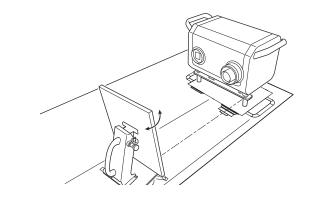


Example2)

State: 3 colors of dots are shown.

- Cause: Calibration chart is at an angle instead of directly facing the RANGE7/5.
- Action: Adjust the positions of the RANGE7/5 and calibration chart so that they directly face each other and perform retry.

Monitor	Sample image	Exposure control High Low
---------	--------------	---------------------------------





Start

Example 3)

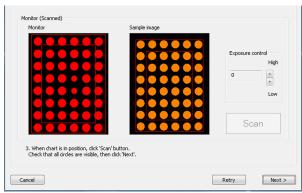
State: The color is different than the dot colors of the sample.

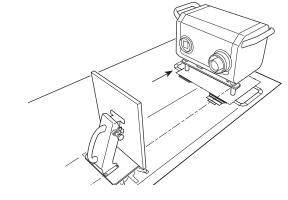
Cause: Improper distance.

- The direction of distance shift is different according to the color of dots.
- Almost all dots are red: Range7/5 is too close to calibration chart.
- Almost all dots are red: Range7/5 is too far from calibration chart.

Action: Handle the problem according to the direction of distance shift as follows

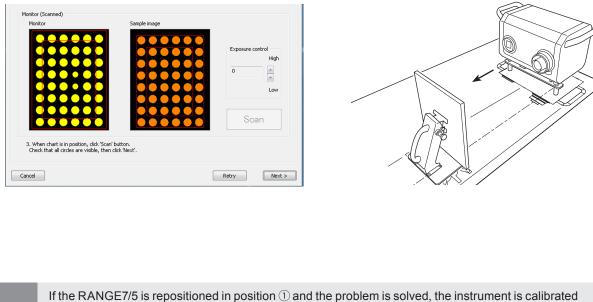
- Almost all dots are red.
 - Move RANGE7/5 from its current position to 3 to 5mm further away from the calibration chart and perform retry.
 - Almost all dots are yellow Move RANGE7/5 from its current position to 3 to 5mm closer to the calibration chart and perform retry.
- Almost all dots are red





· Almost all dots are yellow

Point



for other position (2-7) as well.

If you proceed to the next step without solving the problem by performing Retry, correct calibration may not be possible. Be sure to solve the problem before proceeding to the next step.

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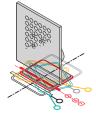




5

Scan at position 2.

Set the calibration chart to position 2. Check that the angle of the calibration chart surface is like the picture in the Calibration Wizard.



If OK, click the [Scan] button.

Scan at position 3.

If OK, click the [Scan] button.

dow.

before clicking the [Scan] button.

Set the calibration chart to position 3.

Check that the angle of the calibration chart surface is like the picture in the Calibration Wizard.

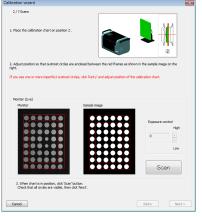
• If the chart is displaced, fine-adjust its position before clicking the [Scan] button.

Check scan results on the monitor window.

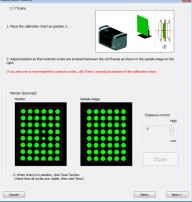
Check scan results in the same way as with position (1).

If there are no problems, click the [Next] button. If there is a problem, click the [Retry] button.

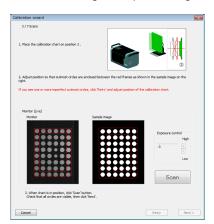
Before scanning, after positioning



Monitor window



Before scanning, after positioning



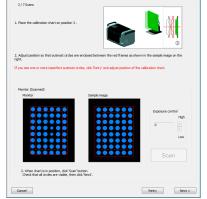
Monitor window

Check scan results in the same way as with position 1.

If there are no problems, click the [Next] button. If there is a problem, click the [Retry] button.

· If the chart is displaced, fine-adjust its position

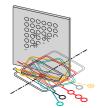
Check scan results on the monitor win-





Scan at position ④.

Set the calibration chart to position ④. Check that the angle of the calibration chart surface is like the picture in the Calibration Wizard.



If OK, click the [Scan] button.

 If the chart is displaced, fine-adjust its position before clicking the [Scan] button.

Check scan results on the monitor window.

The bottom left monitor window shows good scan results. Compare them to those on the bottom right.

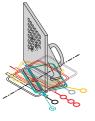
In the NG example, there are two and five colors, meaning the chart is tilted. If dots are missing or notched, the exposure is incorrect.

If there are no problems, click the [Next] button. If there is a problem, click the [Retry] button.

Scan at position (5).

8

Set the calibration chart to position (5). Check that the angle of the calibration chart surface is like the picture in the Calibration Wizard.



If OK, click the [Scan] button.

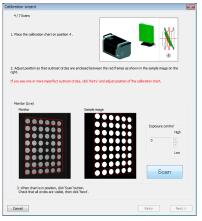
• If the chart is displaced, fine-adjust its position before clicking the [Scan] button.

Check scan results on the monitor window.

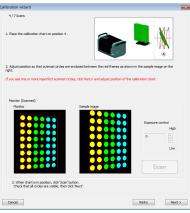
Check scan results in the same way as with position ④.

If there are no problems, click the [Next] button. If there is a problem, click the [Retry] button.

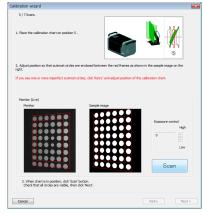
Before scanning, after positioning



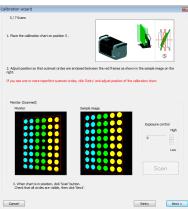
Monitor window



Before scanning, after positioning



Monitor window



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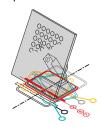




9

Scan at position (6).

Set the calibration chart to position 6. Check that the angle of the calibration chart surface is like the picture in the Calibration Wizard.



- If OK, click the [Scan] button.
- If the chart is displaced, fine-adjust its position before clicking the [Scan] button.

Check scan results on the monitor window.

The bottom left monitor window shows good scan results. Compare them to those on the bottom right.

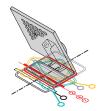
In the NG example, the color sequence and pattern steadfast differ, meaning the chart direction and tilt are wrong. If dots are missing or notched, the exposure is incorrect.

If there are no problems, click the [Next] button. If there is a problem, click the [Retry] button.



Scan at position $\overline{7}$.

Set the calibration chart to position \bigcirc . Check that the angle of the calibration chart surface is like the picture in the Calibration Wizard.



If OK, click the [Scan] button.

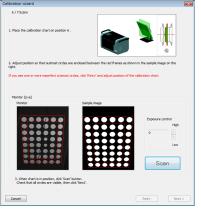
• If the chart is displaced, fine-adjust its position before clicking the [Scan] button.

Check scan results on the monitor window.

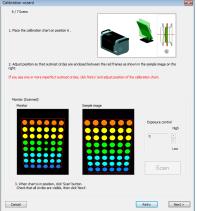
Check scan results in the same way as with position 6.

If there are no problems, click the [Finish] button. If there is a problem, click the [Retry] button.

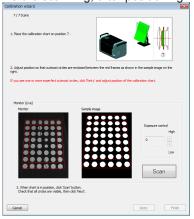
Before scanning, after positioning



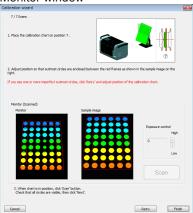
Monitor window



Before scanning, after positioning



Monitor window









Data has been scanned in seven positions.

To cancel calibration halfway through, click the [Cancel] button. The confirmation message at right appears. To cancel calibration, click the [OK] button.

• If calibration is canceled, previous calibration data will continue to be used.



Execute calibration calculations.

These calculations use the seven sets of data to minimize error. Click the [Perform calculation] button.

Once calibration calculations have been

completed, the residual error and result

Perform the below operations according to the

evaluation are displayed.

displayed result evaluation.

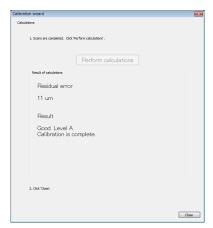
Calibration will be aborted. OK ?	
OK Cancel	
libration wizard	
Calculations	
1. Sam are conjetted. Old "Perform calculation". Perform calculations	
Result of calculations	
2. Cirk Touri	
	Close

x

RANGEVIEWER

Calibration calculation in progress (The estimated time remaining is displayed.)

alcular	tors
	1. Scans are completed. Click 'Perform calculations' .
	Perform calculations
	Result of calculations
	Estimated remaining time 5 minutes, 0 seconds





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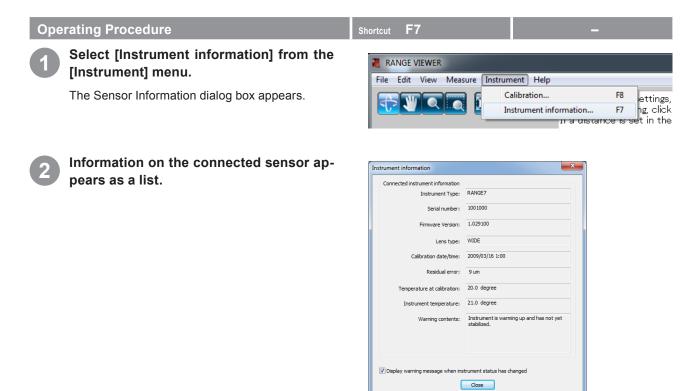
Glossary

Displayed Result Evaluation	Meaning	Operation
Calibration ended successfully.	Calibration results are good.	Click the [Close] button to end calibration.
CAUTION	Caution is need- ed with calibra- tion results.	Click the [Close] button to end calibration. Be careful of the ambient temperature. To recalibrate the instrument, click the [Return to Beginning] button. If the same evaluation results after recalibration, contact Konica Mi- nolta.
Calibration failed.	There is a prob- lem with calibra- tion results.	Click the [Return to Beginning] button and reperform calibration.



5.2 Instrument information

Information on the connected instrument can be displayed as a list. The information includes the type of model, the serial number of the sensor, type of lens, date of calibration, sensor temperature and residual error.



	Sensor Information Dialog Box
Connected Instrument information	Displays information on the connected sensor.
Instrument Type	Displays the type of the connected instrument.
Serial number	Displays the serial number of the connected sensor.
Firmware number	Displays the firmware number of the connected scanning device.
Lens type	Displays "TELE/WIDE" as the type of lens used by the connected sensor.
Calibration date/time	Displays the date and time that the connected sensor was calibrated.
Residual error	Displays the residual error calculated during the calibration.
Temperature at calibration	Display the instrument temperature when calibration was performed.
Instrument temperature	Displays the current temperature of the connected sensor.
Warning contents	Displays whether the connected sensor is ready for scanning or not.
	Ready: The sensor is ready for scanning. Wait: The sensor is not ready for scanning.
Display warning message when instrument status has changed	✓ Displays a warning message about sensor status changing when a checkmark is placed in the checkbox.



6. Help

6.1 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).

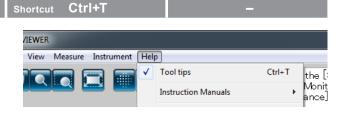
Operating Procedure



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





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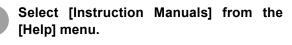
Glossary



6.2 User's Guide

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

Operating Procedure



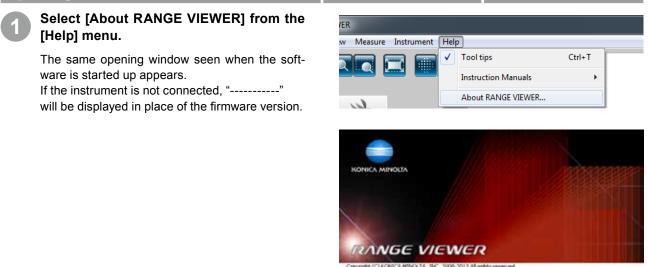
The table of contents pages for the respective manuals are displayed in PDF format.

hortc	ut F1		-	
Hel	р			
	Tool tips	Ctrl+T		
	Instruction Manuals	•	Reference Manual	F1
	About RANGE VIEWER		User's Guide	

6.3 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



Copyright (C) KORICA MINOLTA, INC. 2008-2013 All rights reserved. Warning: This computer program is protected by copyright line and international briaties. Unauthorized reproduction of this program or any portion of it may result in severe civil and criminal penalties, and will be protected for the monitorium extent possible under law. Software Ver. 2.02,0000 Preview IV (* 202100) Open

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Error Messages

The following error messages appear if RANGE VIEWER is incorrectly operated or trouble occurs with it. Take the measures as explained in "Action".

When a message not indicated in the list is displayed, please contact our Service Department.

Error Messages	Cause	Action	ref. page
Memory allocation error.	There is not enough memory	Use a PC equipped with the recommend-	2
Could not export for memory was insufficient.	space for the operation.	ed or higher (4 GB) memory capacity.	17
Export was canceled because there were many exports of data.			17
Available memory is low. Save elements?			14
Instrument is still initial unstable status.	Little time has passed since the instrument was started up. The instrument is unstable.	Wait until the error message disappears.	6
Instrument temperature has changed since calibrating.	The temperature of the instru- ment changed since the last time it was calibrated.	Recalibrate the instrument to ensure ac- curacy.	6
LD safety circuit has worked.	Trouble occurred in the laser	Shut power to the instrument OFF, wait	_
LD safety circuit error had oc- cured.	circuit.	at least 10 sec and turn it back ON. If the error message appears again, the instru-	-
LD safety circuit has been dis- abled.		ment may be damaged, therefore contact a customer service center listed in "Autho- rized Service Facility".	_
AE failure.	Exposure could not be mea- sured because the distance to the work was improper.	Check the status of the work and reper- form AE.	-
AF failure.	The difference between the set standoff distance and actual distance is too large.	Change the stand-off distance setting so that it matches the actual distance to the work.	42
	The work is not suited for auto focusing.	Scan the work in the manual mode or try using spot AF.	43-45 68
Unable to communicate with the stage.	The wrong rotating stage was selected.	Select the correct model number.	56
Unable to finish the stage.	The communication cable is not connected to the rotating stage.	Check that the communication cable is correctly connected. If not, connect it correctly.	-
Unable to control the stage.	Power to the rotating stage is OFF.	Turn ON power to the rotating stage.	_
Connection error	Communications with the in- strument cannot start.	Shut power to the instrument OFF, wait at least 10 sec and turn it back ON. If the error message appears again, the instru- ment may be damaged, therefore contact a customer service center listed in "Autho- rized Service Facility".	_
Timeout error while transmitting	An error occurred during com-	Shut power to the instrument OFF, wait	_
Timeout error (while obtaining er- ror code)	munications with the instru- ment.	at least 10 sec and turn it back ON. If the error message appears again, the instru-	_
Timeout error (while obtaining de- vice list)		ment may be damaged, therefore contact a customer service center listed in "Autho- rized Service Facility".	-
USB API error	Trouble occurred with the USB API.	Shut power to the instrument OFF and shut down the RANGE VIEWER applica- tion. Then, turn power to the instrument back ON and start up RANGE VIEWER.	_

Error Messages	Cause	Action	ref. page
I/O error	An I/O error occurred.	Shut power to the instrument OFF, wait at least 10 sec and turn it back ON. If the	
USB instrument not connected	Communications with an active instrument were interrupted.	error message appears again, the instru- ment may be damaged, therefore contact	
Communication error	An error occurred during com- munications with the instru- ment.	a customer service center listed in "Ser- vice Support".	_
Lens not attached	A lens is not mounted on the instrument or the lens is not se- curely mounted.	Mount a lens. Choose a lens according to the size of the work and the distance to it. Mount the lens as instructed.	-
AF motor error	Trouble occurred with the AF motor. Shut power to the instrument OFF, wait at least 10 sec and turn it back ON. If the error message appears again, the instru-		
Shutter motor error	Trouble occurred with the shut- ter motor, preventing the shut- ter from opening and closing correctly.	ment may be damaged, therefore contact a customer service center listed in "Ser- vice Support".	_
Could not perform measurement. Please check that lens cap is re- moved and check the measure-	Measurement was performed with the lens cap attached.	Remove the lens cap.	_
ment environment.	The difference between the set standoff distance and actual distance is too large.	Change the stand-off distance setting so that it matches the actual distance to the work.	
	Exposure could not be mea- sured because the distance to the work was improper.	Check the status of the work and reper- form AE.	42

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Menu Items

Each window has buttons to facilitate operations in line with scanning and editing procedures. The following list outlines the functions of those buttons, their location in the menu bar and their shortcuts.

Menu	Main Header	Sub Header	Shortcut	Button	Operation	Ref. Page
File	New		Ctrl+N	-	Creates a new file.	12
	Open		Ctrl+O	<u>الا</u>	Opens an existing file.	13
	Save		Ctrl+S		Saves the opened file.	14
	Save As		-	-	Saves the opened file under an- other name.	15
	Export	To File	-	-	Exports elements to files.	16
		To Application	Ctrl+E		Exports elements to other applications.	17
	Preferences		Shift+F1	-	Accesses settings for 3D view displays, file saving processing, etc.	18
	Exit		-	-	Quits RANGE VIEWER.	21
Edit	Undo		Ctrl+Z	<u>S</u>	Reverses the last editing operation.	22
	Redo		Ctrl+Y	$\overline{\mathbf{C}}$	Reapplies the last undone editing operation.	22
	Select	Rectangle	Shift+R		Selects/unselects all points lying within drawn rectangles.	23
		Bezier	Shift+B		Selects/unselects all points lying within drawn Bezier curves.	24
		Invert	Ctrl+R	Ē	Inverts points between selected/ unselected.	26
		Boundary	Shift+E	Ţ	Selects only boundary points of elements.	27
		Front facing points	Shift+F		Enables selecting points having the normal facing towards the camera.	28
		Select all Elements	Alt+A	-	Selects all elements.	29
		Unselect all Elements	Shift+Alt+A	-	Unselects all elements.	29
		Select all points on selected elements	Ctrl+A	E	Selects all points of selected elements.	30
		Unselect all points on selected elements	Ctrl+Shift+A	E	Unselects all points of selected elements.	30
	Delete	Points	Ctrl+X		Deletes selected points.	31
		Elements	-		Deletes selected elements.	32
	Registration		Shift+Alt+R	F	Registers selected elements.	32
	Edit marker holes		Shift+Alt+K		Edit data near markers.	33
	Merge		Shift+Alt+M	æ	Merges selected elements.	34

Menu	Main Header	Sub Heade	r Shortcut	Button	Operation	Ref. Page
/iew	Viewpoint	Front	Ctrl+1	-	Displays 3D data from the front.	35
		Right	Ctrl+2	_	Displays 3D data from the right.	35
		Back	Ctrl+3	-	Displays 3D data from the back.	35
		Left	Ctrl+4	-	Displays 3D data from the left.	35
		Тор	Ctrl+5	-	Displays 3D data from the top.	35
		Bottom	Ctrl+6	-	Displays 3D data from the bot- tom.	35
	Rotate/Zoom	Rotate	F9	₹ >	Viewpoint can be rotated, moved and zoomed in/out.	36
		Pan	F10	N	Moves the viewpoint.	37
		Zoom	F11		Zooms the view in/out.	37
		Area zoom	F12		Zooms the square target area in/ out.	37
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	630 610 590 570 550	530	(2) Contours display	button	Shift+C	
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2 i 4

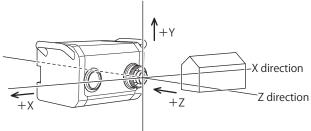
3 Color bar display check button

4 (Current scanning element) Delete

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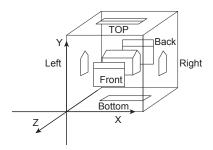
rvm format	Multiple elements are grouped into a single file.
rgv format	Each element has its own file.
STL Files	This file format is specifically for SLA CAD software by 3D Systems. It is supported by a wide range of analysis software and allows 3D data to be directly input in STL format for use with 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 ele- ments.
ASC Files	Exported ASC (ASCII) files contain 3D point data without normal information.
rmk Files	Reference marker information is processed in this format.
txt Files	Files in the ordinary text format. RANGE VIEWER can read in the X coordinate value, Y co- ordinate value and Z coordinate value of the marker in each line. The X, Y and Z coordinate values are separated by commas or tabs.
IPC Export	IPC (Inter Process Communication) uses available internal memory space to transfer data scanned by RANGE VIEWER to other software at high speed. Compared to normal file transfers, transmission is easier and faster because it does not require operations to save or read files.
3D Orthogonal Coordinates	The position of a point in a 3D space is represented by coordinates in a 3D orthogonal coordinate system. The coordinate system here uses a point near to the center of the RANGE7/5's receiver lens. The Z direction extends from directly behind the light receptor along the optical axis to the front, the Y direction is above the receiver and the X direction is to the right.

* In the output 3D data, specific offsets are applied respectively along the XYZ axes.
Y direction



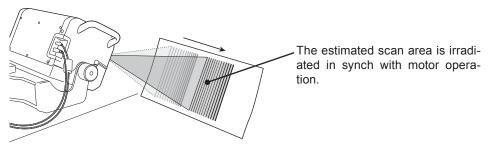
Viewpoint

RANGE VIEWER lets you view elements from the front, back, top, bottom, right or left, or in most any orthogonal projection.



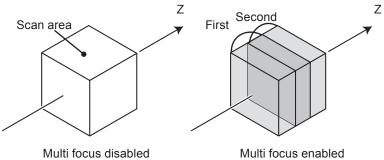
FOV Indicator A FOV (field of view) indicator projects the below pattern of light on the work to make it easier to identify the scan area.

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.)



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 image

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

AE (Auto Exposure) and AF (Auto Focus)	AE (Auto Exposure) is a mechanism for automatically setting image exposure conditions. AF (Auto Focus) is a mechanism for automatically setting the focal distance to the work.
Polygon	Polygons refer to areas (surfaces) enclosed by lines (edges) connecting vertices.
Element	"Element" is the 3D data unit used by RANGE VIEWER. Normally, one element is generated and edited from scanning.

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