KEYENCE

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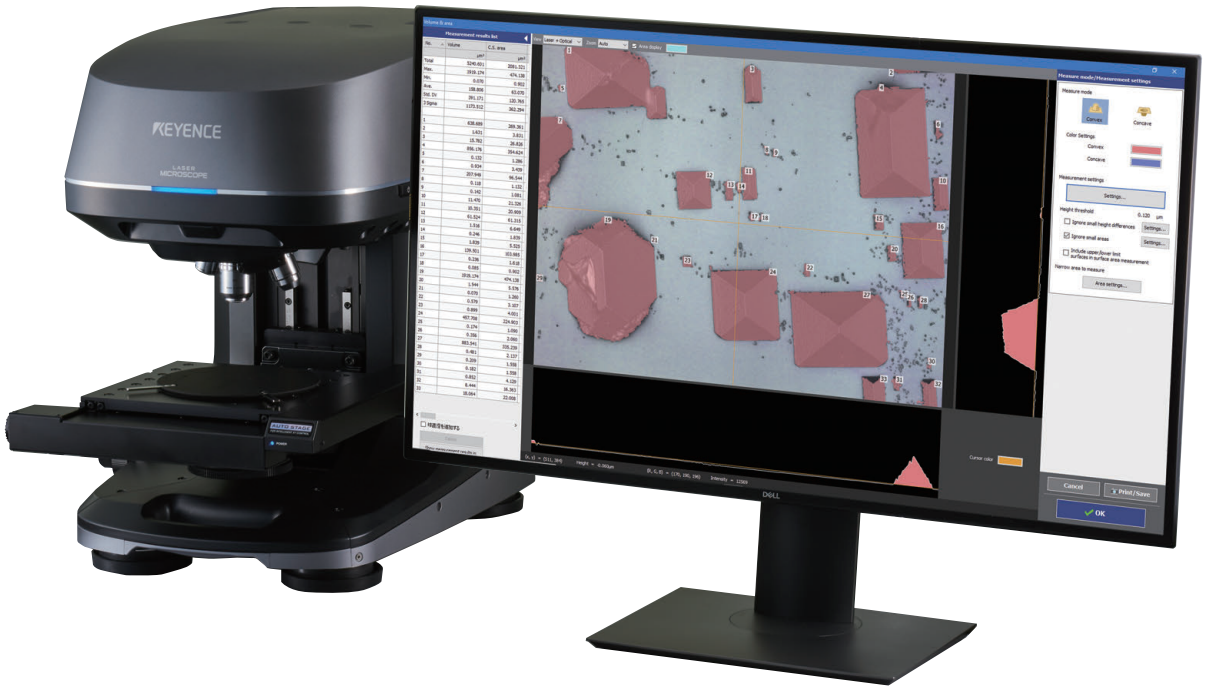


## 3D Surface Profiler

# Quick Start Guide

### - Volume & Area Measurement -

KEYENCE CORPORATION

# Introduction

Thank you for your purchase of the VK-X3000 Series 3D Surface Profiler.
First, we will introduce basic operation.
You can understand basic operation using a common object such as a coin.

This manual describes volume & area measurement of 3D data gathered by the VK-X3000.

The volume & area measurement tool is a function used to measure convex or concave volume, cross sectional area, and surface area.

## Contents

# Chapter 1

# Before Starting Operation

# 1-1 Understanding the Operation Flow

The operation flow of the VK-X3000 Series is as follows.

Step 1: New data acquisition → Obtain a 3D image by measuring a sample
Step 2: Measurement preprocessing → Correct the tilt of the obtained 3D image and remove the noise
Step 3: Use the measurement function → Measure preprocessed data using various functions
Step 4: Export measurement result → Output a measurement result to a report or Excel

This manual describes the Step 3 and Step 4.

**Step 1**

**New data acquisition**

↓

**Step 2**

**Measurement preprocessing**

↓

**Step 3**

**Setting measurement area**

▽

**Setting the height threshold value**

↓

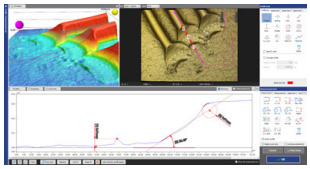
**Step 4**

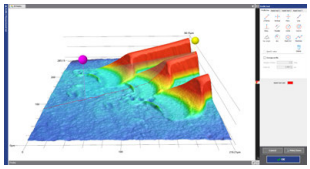
**Exporting measurement result**

● **New data acquisition**
Measure an object and obtain a 3D image including color information.
For details, see 📖 "Quick Start Guide: Gathering New Data using Focus Variation/White Light Interferometer", and 📖 "Quick Start Guide: Gathering New Data using Laser Confocal".

● **Measurement preprocessing**
For details, see 📖 "Quick Start Guide: Image Processing".

● **Using the measurement function**
Perform various measurements from an obtained 3D image.
- Cross section shape measurement
- Roughness measurement
- Comparison of two types of data
- Film thickness measurement



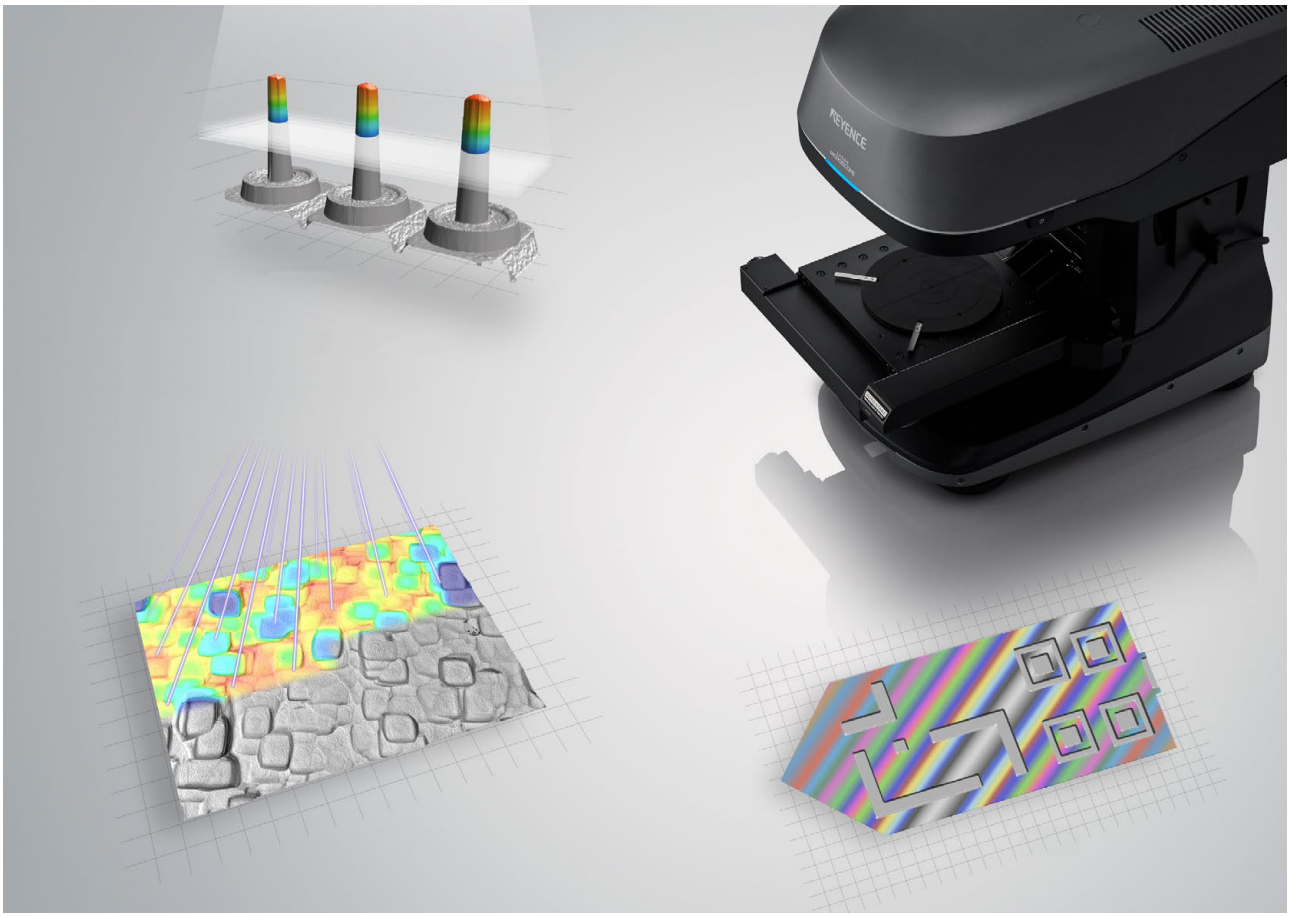


● **Setting measurement area**
Set a position you want to measure to the measured data.

● **Height threshold**
A height reference position can be set to specify convex and concave areas of the sample. This is called "Height threshold".

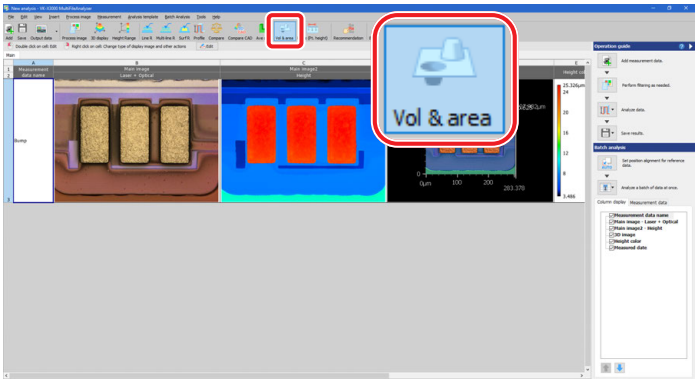
# Chapter 2

# Measuring Volume & Area



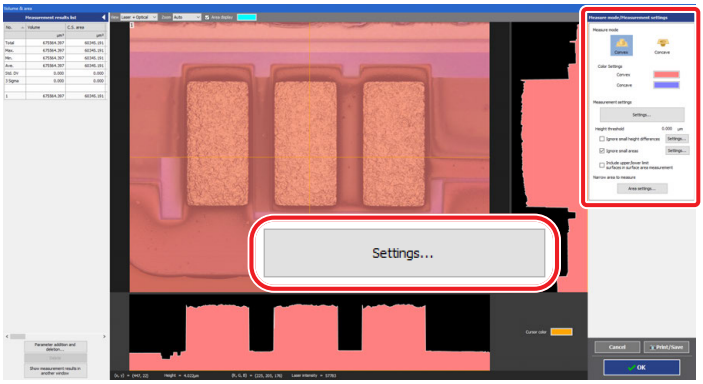
## 1. Select the volume & area measurement.

Click the [Vol & area] button on the toolbar. Alternatively, select [Volume & area measurement] from the menu.



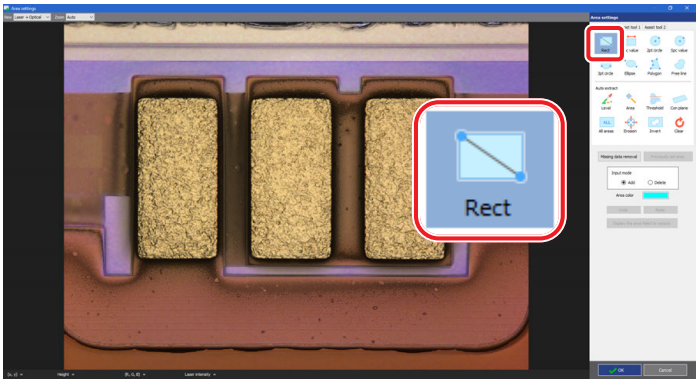

## 2. Select the area settings.

Click the [Settings] button in the measurement mode/measurement settings on the right middle of the screen.



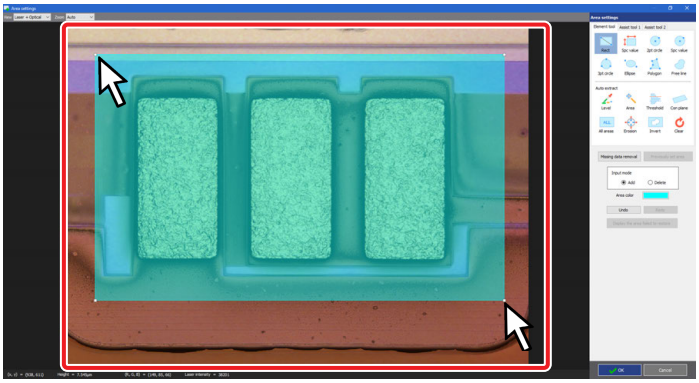

## 3. Click the [Rect] button from [Element tool].

Click the [Rect] button from [Element tool] on the top right of the screen.



## 4. Select the range you want to select in the measurement data screen.

Click the top left (start point) of the range you want to select, move the cursor, and click the bottom right (end point) in the measurement data screen.



## 5. Click the [OK] button.

Click the [OK] button to set the area.

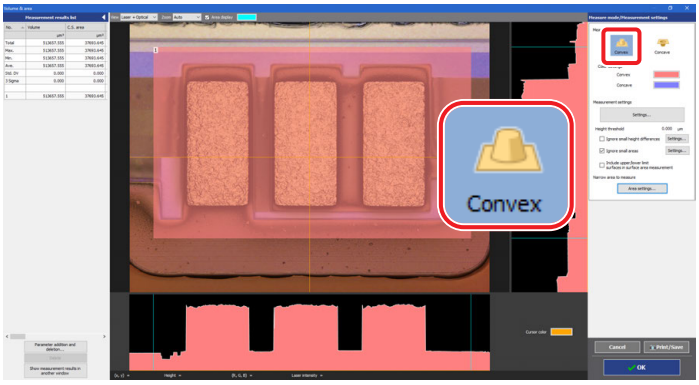

The measurement results will be displayed. Next, set a height threshold value.

# 2-2 Setting the Height Threshold Value

Set a reference height threshold to specify convex and concave areas of the sample.

## 1. Select a convex or concave area.

Click the [Convex] or [Concave] button in the measurement settings tool on the top right of the screen.

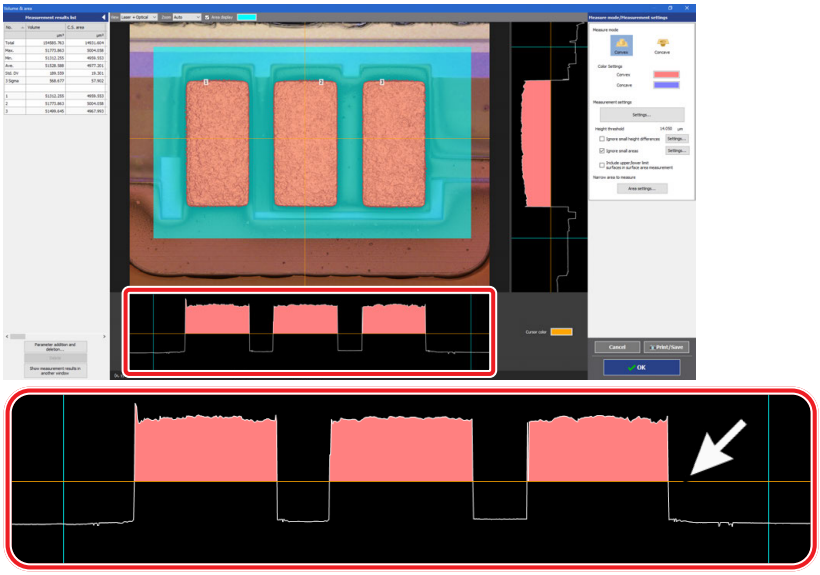



## 2. Move the vertical/horizontal cursor to the area you want to measure on the image display area.

Drag the vertical and horizontal cursors on the image display area to the area you want to measure.

## 3. Move the reference line to set the height threshold value.

Drag the vertical or horizontal reference line of the profile graph, and set the height threshold.
The measurement results appear in [Measurement results list] on the left side of the screen.
The operation is complete.



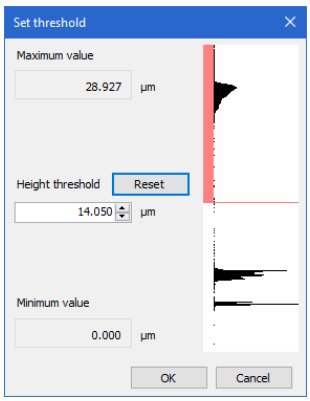
- **Ignore small height differences**
  When the lower limit is set, areas of which height is less than or equal to the lower limit are excluded from the measurement target areas.

- **Ignore small areas**
  When the lower limit is set, areas less than or equal to the lower limit are excluded from the measurement target areas.

- **Include upper/lower limit surfaces in surface area measurement**
  Depending on the ON/OFF status for this checkbox, the value of surface area in measurement results is calculated as follows.
  OFF: Surface area that does not include the area of the surfaces at the upper and lower limits (a)
  ON: Surface area that includes the area of the surfaces at the upper and lower limits = (a) + cross-sectional area (area of the cross-section obtained when the object is cut at the threshold value)

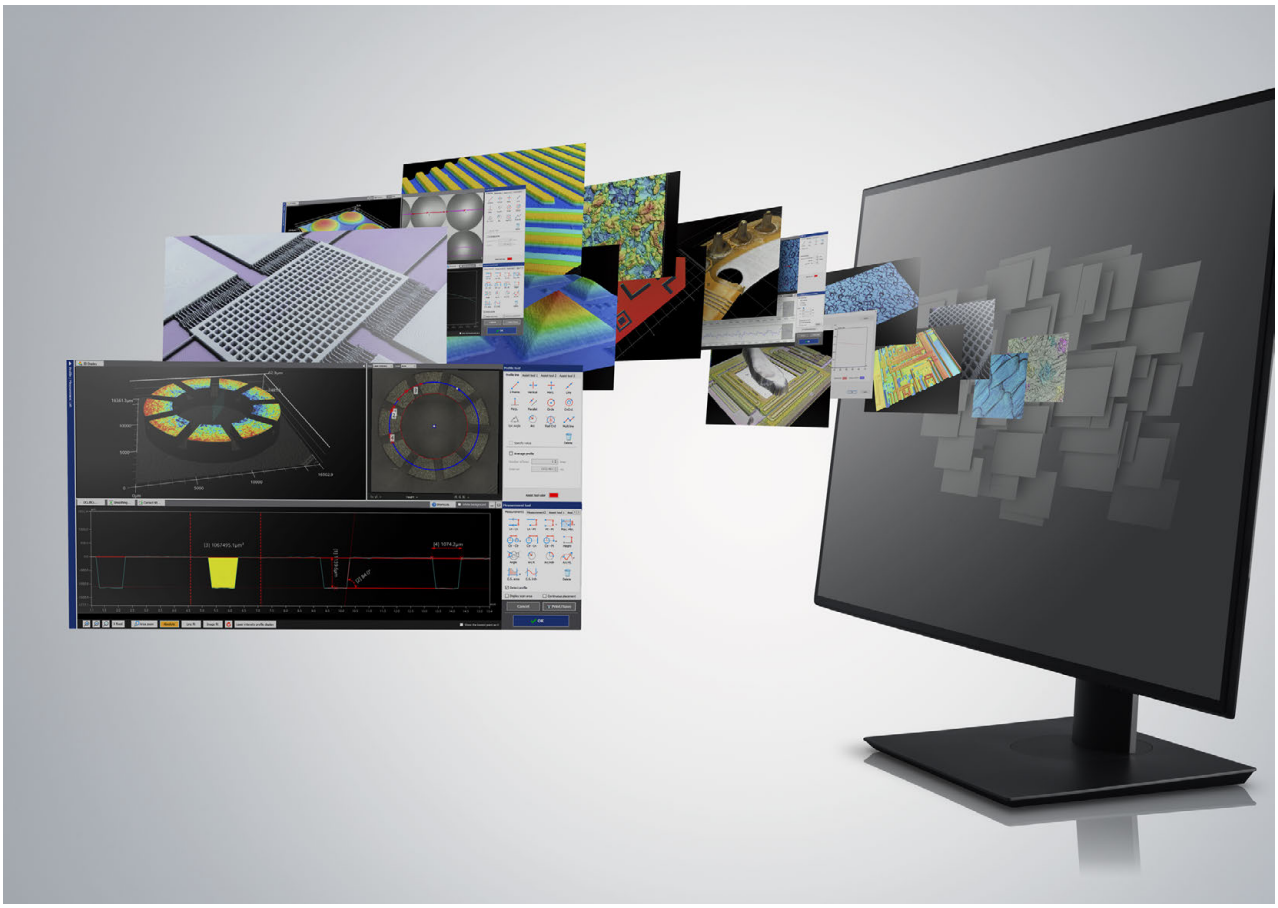
- **Determine the measurement position while confirming the waveform**
  The profile graphs are updated in vertical and horizontal directions in real-time as the cursor is moved on the image area.

- **Set the height threshold value specifically**
  In the [Set threshold] dialog box, the value can be set by entering a value, adjusting the height threshold, or dragging the threshold cursor on the histogram.
  To open the [Set threshold] dialog box, click the [Settings] button of the height threshold in the [Measurement settings] in the measurement settings tool.



# Chapter 3

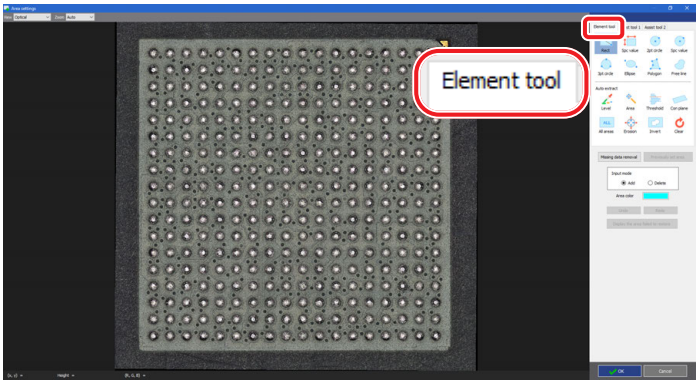
# Advanced Settings

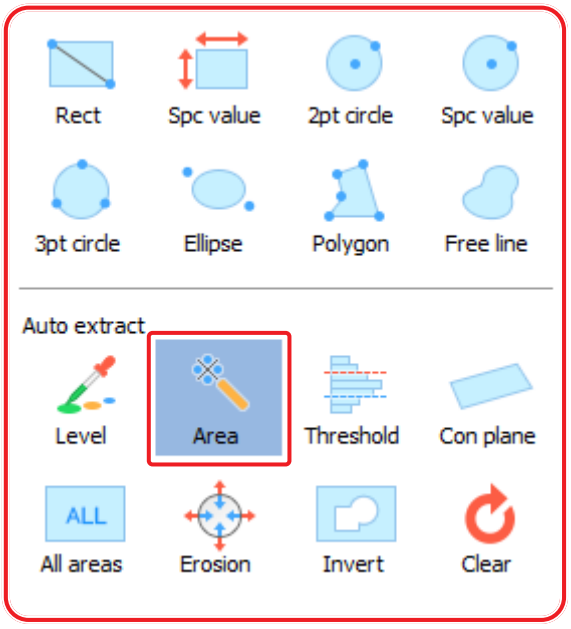


The element tool and assist tools are used to determine a region of interest to be measured more accurately and effectively. This section includes an example of how to use the area extraction by color method, as well as dilation/erosion tools. The sample used is a BGA on an IC package.

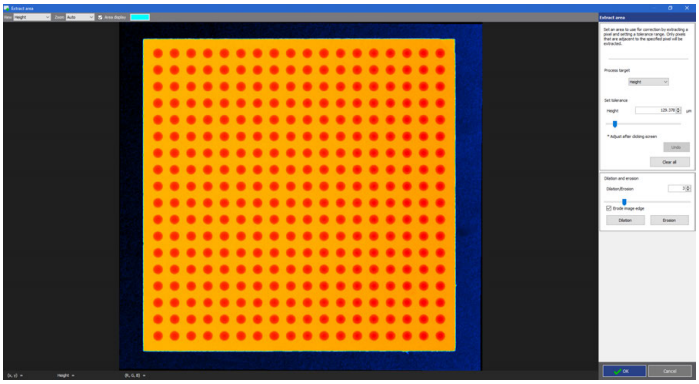
## 1. Check the conditions to set the area from the differences of colors, height, or reflectance of BGA of the sample (IC package) and the package itself.

Click the [Area] button in the [Element tool] in the area settings.



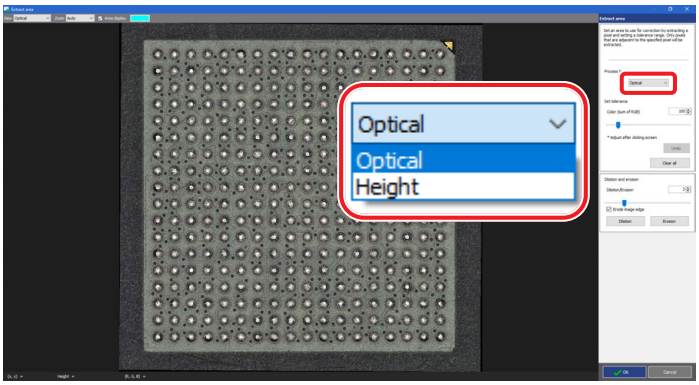




The [Extract area] window appears.



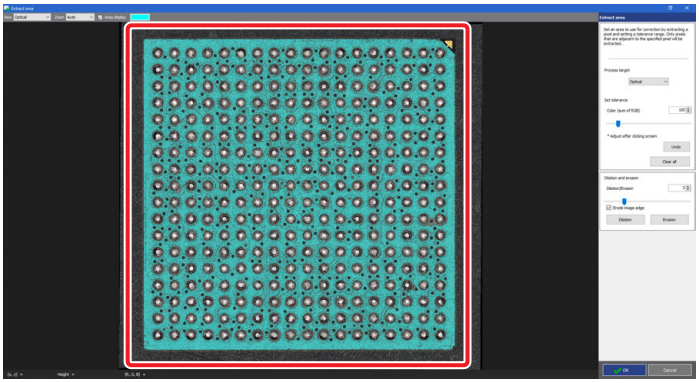
● **BGA (Ball grid array)**
This is the package having soldered electrodes positioned on a grid at regular intervals.

**2.** **Select [Optical] from the process target.**



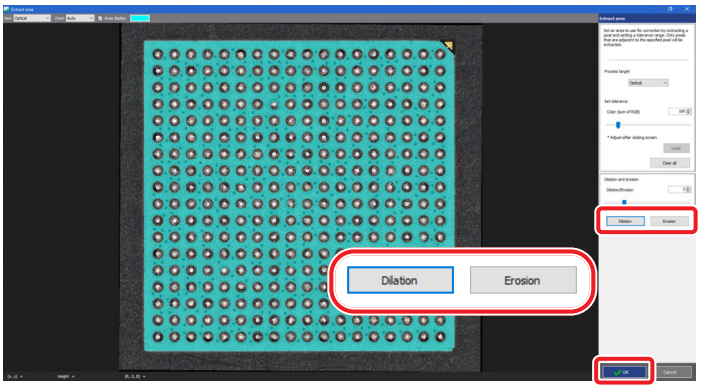

**3.** **Click the base surface of the package (green section) to extract the target area.**

The area without BGA and dents on the package is selected.



**4.** **Click the [Dilation] or [Erosion] button to clean up the extraction method.**

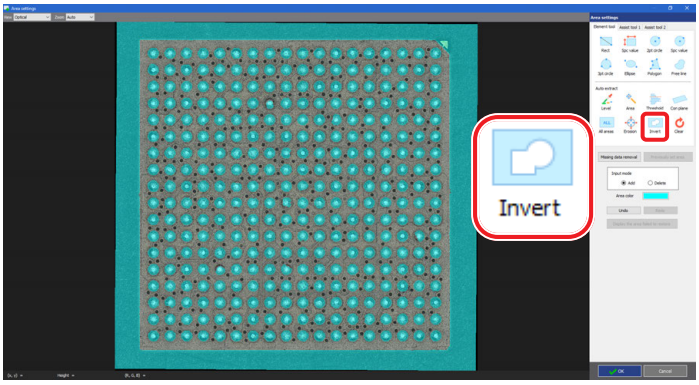
Normally, dilation and erosion are both used in succession.



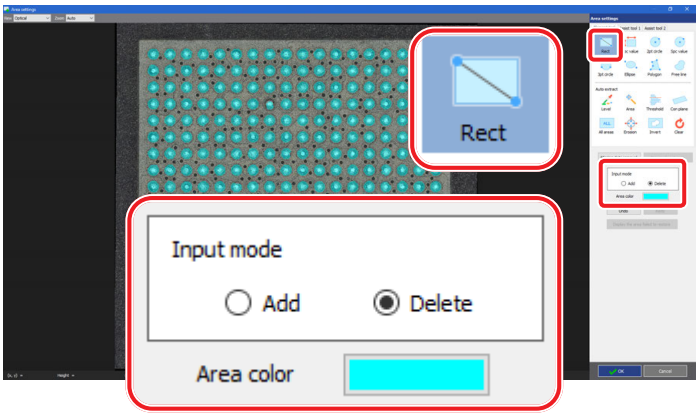

**5.** **Click the [OK] button.**

**6.** **Click the [Invert] button in the [Element tool] in the area settings.**

The area is inverted.

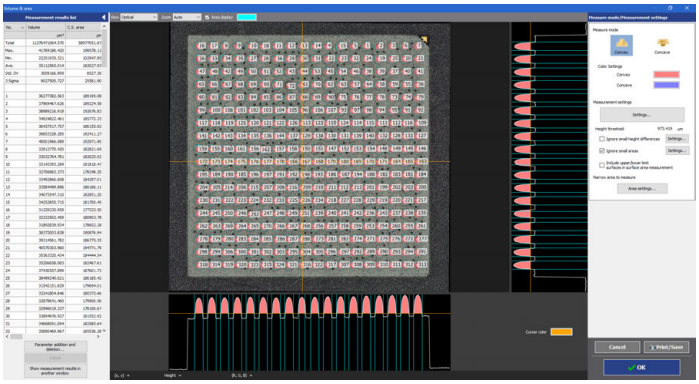



**7.** **Click the [Rect] button in the [Element tool] in the area settings, and select [Delete] for the input mode. Clear the specified area other than BGA.**



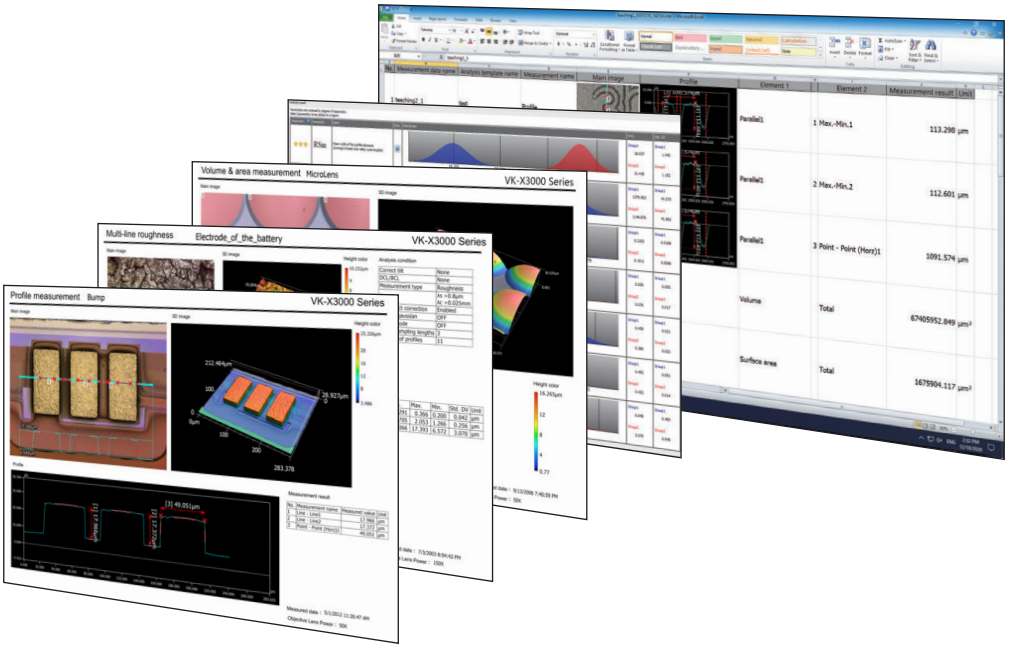

**8.** **Click the [OK] button.**

BGA has been set as the measurement area.



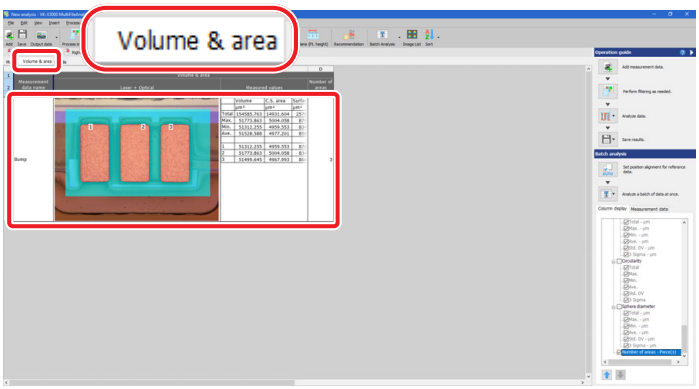
# Chapter 4

# Exporting Measurement Result



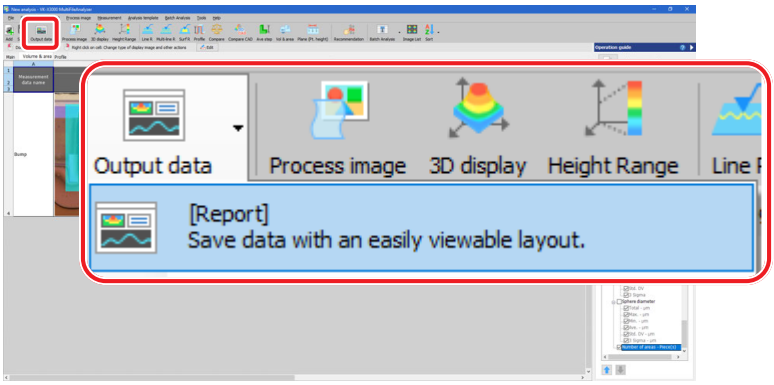
The Multifile Analyzer can display a report of measurement results in another window. For the report, its layout can be edited and file can be output.

## 1. Select the grid sheet including the measurement result you wish to display in report.

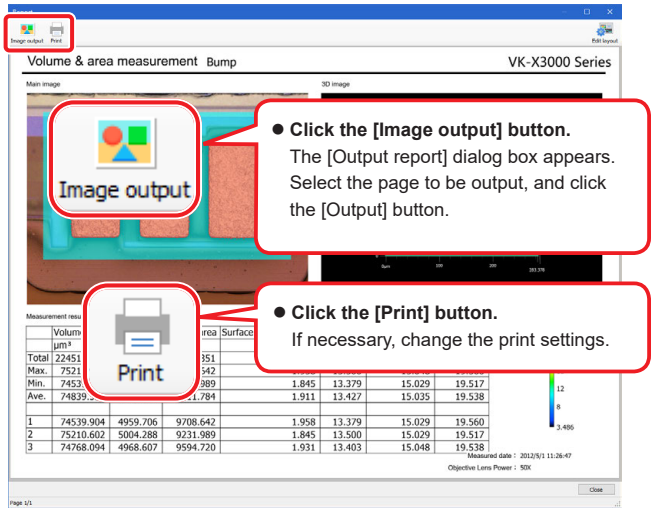



## 2. Select [Report] from the [Output data] button on the toolbar.

The report screen appears.

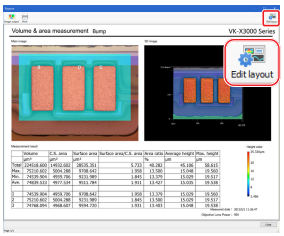



## 3. Save it as an image file by clicking the [Image output] button on the toolbar. Click the [Print] button to print.

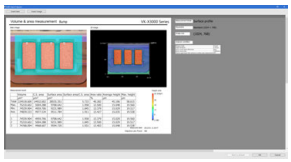



## 4. Click the [Close] button to close the screen.

● **Edit the report layout**
Clicking the [Edit layout] button displays the [Edit report layout] screen.




The report layout can be edited.



- Click the [Insert text] button to insert the text box.
- Select an image and right click it, a menu related to layout editing will appear.
- Click the [Insert image] button to insert the image.
- Click the [Back to default] button to return to default.

# Exporting to Excel file

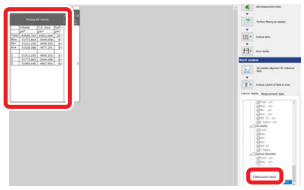
For the result measured by the Multifile Analyzer, the content of the grid view area is output to Excel file in unaltered form.

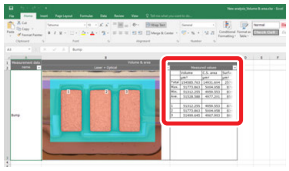
- The file is saved as an Excel workbook (*.xlsx). This extension is the standard file format for Excel 2007 and later.
- When you export to an Excel file, images, graphs, tables within cells and all other content of the grid sheet is output in unaltered form. Before performing the output, adjust the size of the grid sheet.

● **About the grid sheet layout and the cell of the Excel output**

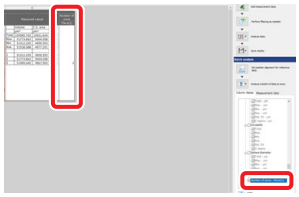
The layout of the grid sheet is applied on the Excel sheet as it is.

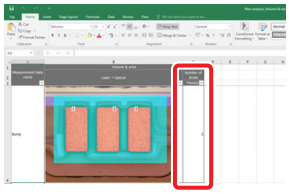
- The measurement results displayed in the [Measurement value list] checkbox of the [Column display] tab are output as images on the Excel sheet.



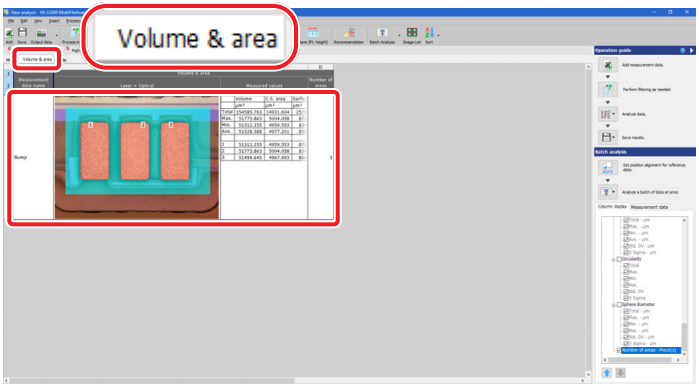


- The measurement results displayed individually in the [Column display] tab are output as numeric values to each cell on the Excel sheet.



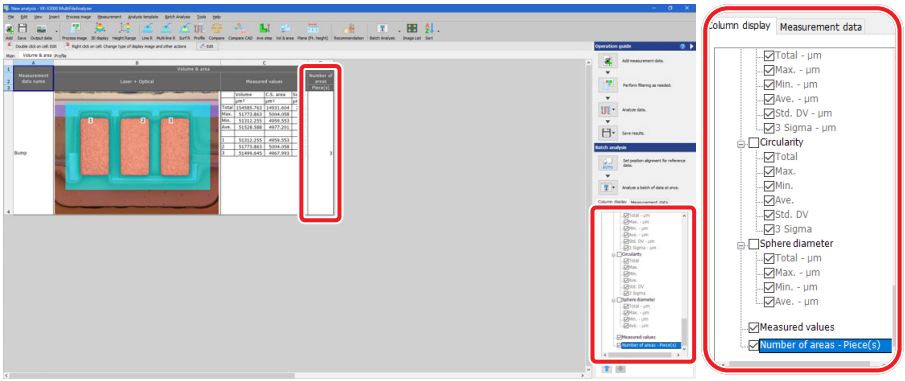


## 1. Select the grid sheet including the measurement result you wish to output in an Excel file.



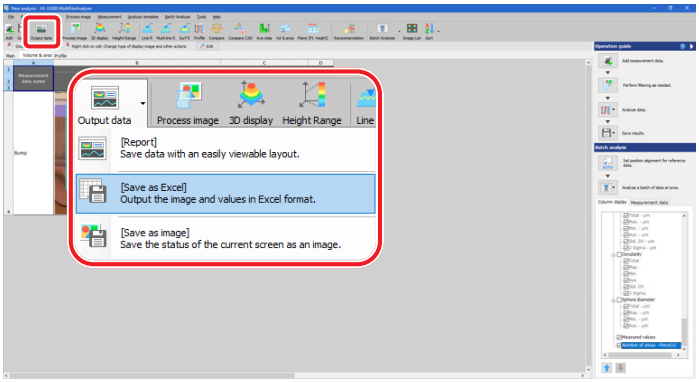

## 2. Select the measurement results you wish to output to cells in the Excel worksheet from the checkbox of the [Column display] tab.

Selecting the [Column display] tab adds the cell of the result of each measurement item.

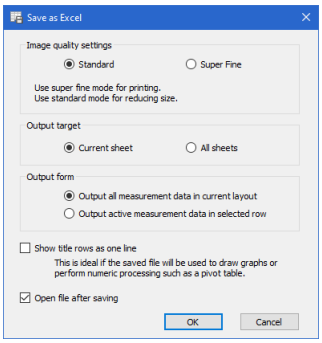



## 3. Select [Save Excel] from the [Output data] button on the toolbar.

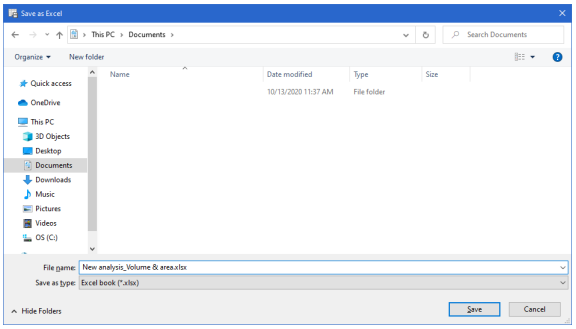
The [Save as Excel] dialog box appears.



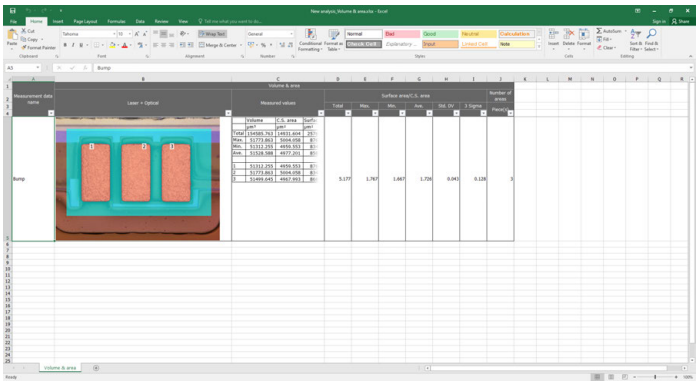
## 4. Change items as needed, and click [OK].




## 5. Select a destination folder in which to save the Excel file. Enter the file name, and click the [Save] button.




If Microsoft Office or Microsoft Excel is installed on your PC, the output file is displayed automatically.



Even if Microsoft Office or Microsoft Excel is not installed on your PC, the measurement results can be saved as an Excel format file.
In this case, use the output file with another PC.

- Microsoft Office, Microsoft Excel and Excel are registered trademarks of Microsoft Corporation.
- It is necessary to prepare Microsoft Office and Microsoft Excel separately when KEYENCE delivers the PC.

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Specifications are subject to change without notice.


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