

Surface Flatness

Purpose

The Flatness tool returns various measurements related to the flatness of one or more regions on the surface of your target. The tool is ideal for general fit and finish inspection.

The tool lets you set a grid over a specific region or create arrayed regions, or more flexibly with multiple individual regions manually. In each case, "local" minimum and maximum heights, as well as flatness indicators (maximum - minimum), are returned (for grid cells or individual regions, depending on the tool's settings). In addition, "global" minimum, maximum, and flatness measurements, that combine data from all flatness measurement areas, can also be returned. The tool measures the maximum and minimum distances from a different best-fit plane for each local measurement, and from another plane fit to all data for the "global" measurements.

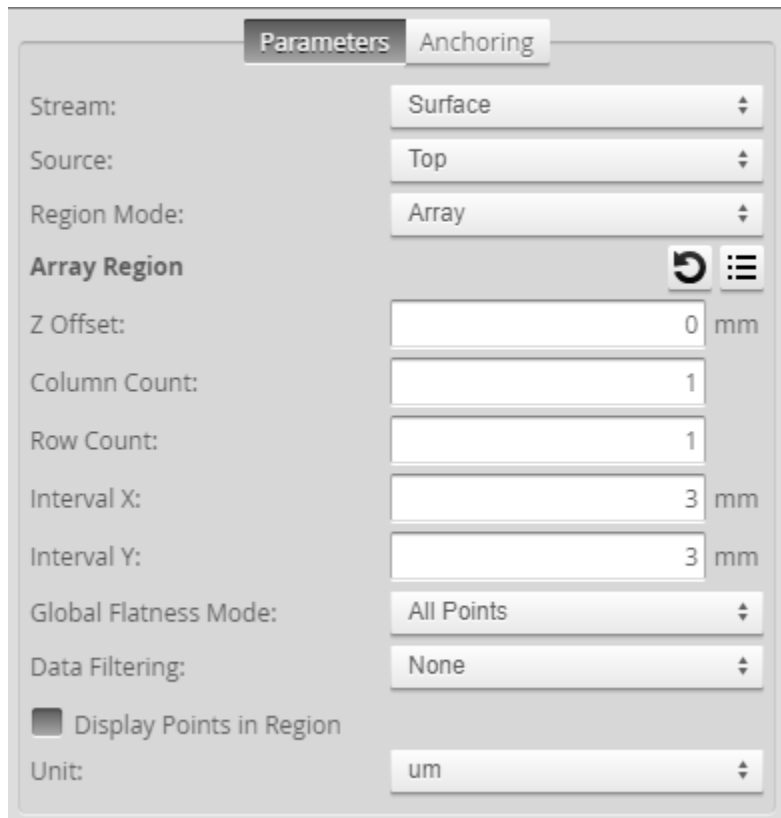
You can control how many data points the tool uses in its calculations to account for noise or smooth data, or otherwise exclude unwanted data.

Inputs

Stream:	Surface
Source:	Top

Name	Description
Stream	It's possible for more than one type of data to be available for a tool as input. You use the Stream drop-down in a tool to choose which type. If only one type of data is available for a tool, the Stream drop-down may not be displayed.
Source	The sensor, or combination of sensors, that provides data for the tool's measurements.

Parameters



The screenshot shows the 'Parameters' tab of a software interface. It contains several settings for flatness measurement:

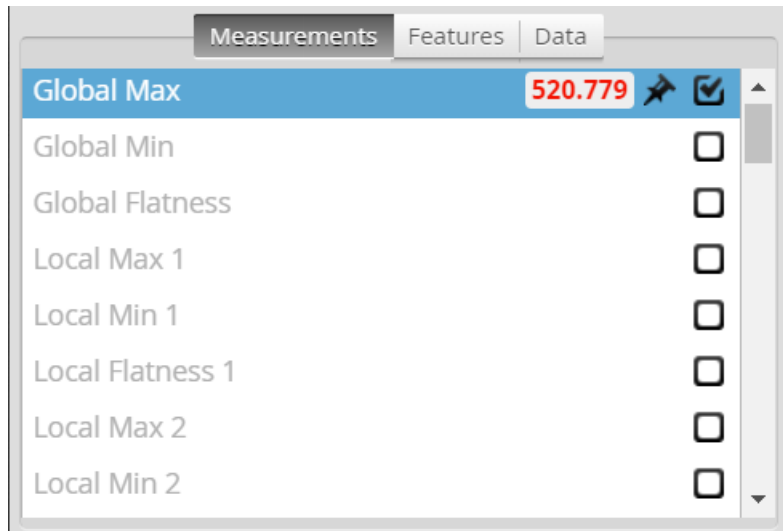
- Stream:** Surface
- Source:** Top
- Region Mode:** Array
- Array Region:** Includes a refresh icon.
- Z Offset:** 0 mm
- Column Count:** 1
- Row Count:** 1
- Interval X:** 3 mm
- Interval Y:** 3 mm
- Global Flatness Mode:** All Points
- Data Filtering:** None
- Display Points in Region:** Checked (indicated by a filled square)
- Unit:** um

Name	Description
Region Mode	<p>Determines how flatness measurement areas are set up on the target. One of the following:</p> <p>Flexible: The tool determines flatness using one or more (up to 16) regions that you define individually on the target.</p> <p>Grid: The tool determines flatness in a grid you define on the target. This option enables settings that let you set the size and location of a region that contains the grid (Grid Region setting), as well as the width and length of the grid cells (Grid Width and Grid Length). The combination of the values of these settings determines the number of cells in the grid region.</p>

	<p>Array: The tool determines flatness in arrayed regions that you define on the target.</p> <p>This option enables settings that let you set the column count and row count and the intervals of the array. The combination of the values of these settings could generate different regions.</p>
Array Region (used with Array region mode)	Determines the position, the size, and the rotation angle around the z-axis of the referred region.
Z Offset(used with Grid region or Array region mode)	Determine the offset of the source points in the z direction.
Column Count(used with Array region mode)	Determine the column count of the array.
Row Count(used with Array region mode)	Determine the row count of the array.
Interval X(used with Array region mode)	Determine the spacing in the x-direction.
Interval Y(used with Array region mode)	Determine the spacing in the y-direction.
Grid Width (X) Grid Length (Y) (used with Grid region mode)	These settings determine the size of the cells in the grid. (See details under Grid Pattern in Region Mode above.)
Flexible Regions (used with Flexible region mode)	Determines the parameters of the flexible regions.
Global Flatness Mode	Chooses which points the tool uses to calculate global flatness. One of the following:

	<p>All Points: The tool uses all points in the measurement area (all flexible regions or the grid pattern in the region).</p> <p>Single Average Point: The tool uses an average of the points in the measurement area. When you choose this option, the global measurements require at least four data points to calculate the plane and statistics. This means that if you set Region Mode to Flexible, you must choose a minimum of four regions; if you set Region Mode to Grid, the size of the grid and the cells must result in at least four cells; If you set Region Mode to Array, the product of Column Count and Row Count is not less than 4.</p>
Data Filtering	<p>Lets you filter scan data before the tool performs its calculations.</p> <p>Percentile - Limits the data to points between the values you set in High Percentile and Low Percentile, which are displayed when you choose this option.</p> <p>None - The tool performs no filtering.</p>
Unit	<p>Lets you choose which units the tool uses for measurement results. One of the following:</p> <ul style="list-style-type: none"> • um (micrometers) • mm (millimeters)
Enable Median Detection	<p>When enabled, median (X, Y, and Z positions) is included in the Output Measurement data output.</p>

Outputs



Type	Name	Description
Measurement	Global Max	The maximum distance, minimum distance, and flatness (maximum - minimum) calculated using the valid data points from all the cells in the grid (when Region Mode is set to Grid), or all the individual regions (when Region Mode is set to Flexible or Array).
	Global Min	
	Global Flatness	
Measurement	Local Max {n}	The maximum distance, minimum distance, and flatness (maximum - minimum) calculated using the valid data points from a specific grid cell (when Region Mode is set to Grid), or an individual regions (when Region Mode is set to Flexible). or those arrayed regions, where {n} represents the index of row arrangement in the array(when Region Mode is set to Array).
	Local Min {n}	
	Local Flatness {n}	
Features	Global Plane	The plane fitted to the valid data points from all the cells in the grid (when Region Mode is set to Grid), or all the individual regions (when Region Mode is set to Flexible). or

		those arrayed regions, where {n} represents the index of row arrangement in the array(when Region Mode is set to Array).
Features	Local Plane {n}	The plane fitted to the valid data points from grid cell {n} (when Region Mode is set to Grid), or those from region {n} (when Region Mode is set to Flexible) or those arrayed regions, where {n} represents the index of row arrangement in the array(when Region Mode is set to Array).
Data	Output Measurement	Data containing the measurement results. The web interface only displays up to 15 local measurements. However, if you define the grid and cell size so that you have more than 15 flatness measurement areas, these are included in the tool data. The data contains the X, Y, and Z positions of each max and min. It also contains the median if Enable Median Detection is enabled.

Major Revisions

Application Examples

Algorithm Details