



TECHNICAL USER
MANUAL

GDK Custom Tools

Document revision: A

Copyright

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This product is designated for use solely as a component and as such it does not comply with the standards relating to laser products specified in U.S. FDA CFR Title 21 Part 1040.

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Introduction

This documentation describes the custom GDK tools that LMI provides.

For more information on the GDK, download the technical user manual (15201-4.x.x.xxx_MANUAL_Technical_Gocator-Measurement-Tool.pdf) by going to <http://lmi3d.com/support/downloads/>, selecting a Gocator series, and clicking on the *Product User Area* link. You can download the GDK from the same location.

Notational Conventions

This documentation uses the following notational conventions:



Consider this information in order to make best use of the product.

Tools

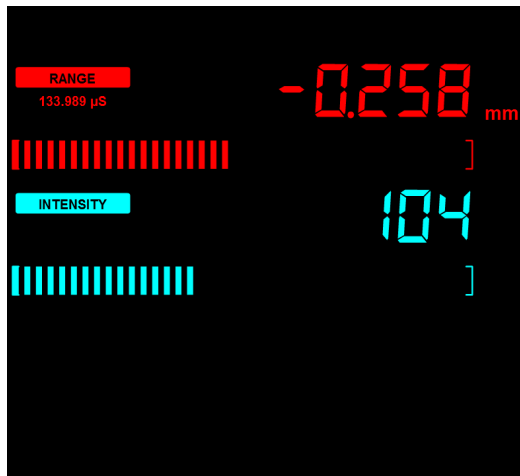
The following sections describe the custom GDK tools and the parameters common to the tools.

Range

Filter Tool

Filter Tool provides five filters that can be applied to range values from a Gocator displacement sensor.

The filters use a window size (**FilterSize** setting) that defines the number of values to use when computing the result.



Filters

Filter	Description
Average Applies the filter selected in FilterType using the window selected in FilterSize to the range points in the buffer.	Returns the average of the values included in the window. Recommended for smoothing out noisy values or high frequency fluctuations.
Median Applies the filter selected in FilterType using the window selected in FilterSize to the intensity values in the buffer.	Retains the value in the executing window that has the same number of values below as the number of values above. In other words, when ordering the window values from the lowest to the highest, the result will be the center value. This filter can be useful to exclude outlier or extreme

Filter	Description
	values that can be acquired in a noisy environment.
Low Pass Applies the filter selected in FilterType using the window selected in FilterSize to the range points in the buffer.	Used with low frequency signals, the filter excludes high frequencies from the final result.
High Pass Applies the filter selected in FilterType using the window selected in FilterSize to the range points in the buffer.	Used with high frequency signals, the high pass filter removes the low or constant portion of the signal.
Band Pass Applies the filter selected in FilterType using the window selected in FilterSize to the range points in the buffer.	Applies the low pass filter and then the high pass filter, to only retain the middle frequencies of the signal.
 For the pass filters, the cut-off frequencies are determined by the size of the window and the acquisition speed. Tweaking is required when using these filters, as the frequencies cannot currently be set.	

Measurements

Measurement

Range

Applies the filter selected in **FilterType** using the window selected in **FilterSize** to the range points in the buffer.

Intensity

Applies the filter selected in **FilterType** using the window selected in **FilterSize** to the intensity values in the buffer.

Parameters

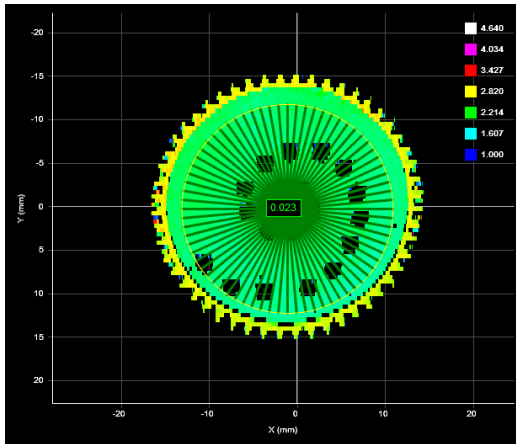
Parameter	Description
FilterType	The type of the filter to apply. One of the following: • median • average • low pass • high pass • band pass
FilterSize	The number of range points the filter will use to calculate a value, from 1 to 15. Applies only to the current value and the previous X values. As new range points are acquired or played back, the window is moved to include the latest value acquired, and the oldest value is dropped.
Decision	See <i>Decisions</i> on page 15
Output	See <i>Filters</i> on page 16.

Surface

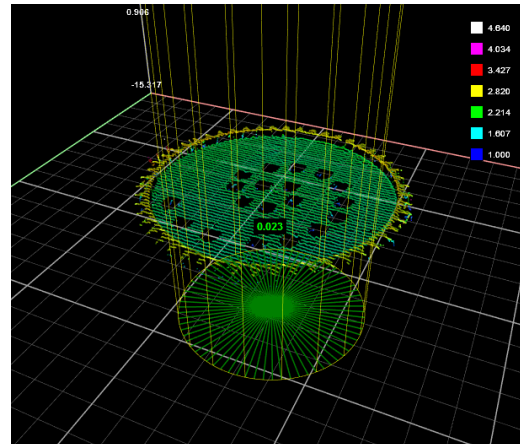
Texture

The Texture tool provides measurements that you can use to measure the characteristics of the scanned surface, such as roughness.

The tool performs its measurements in a user-configurable cylindrical region of interest (using inner and outer radius).



2D View



3D View

Parameters Anchoring

Source: Top

ScanType: Radial

☒ Use Region

Outer Radius: 12

Inner Radius: 0

Path Count: 72

AvgAbsDiff: 0.023 ☒

InvalidCount: ☐

ValidCount: ☐

InvalidArea: ☐

ValidArea: ☐

ID: 0

Parameters Output

Filters

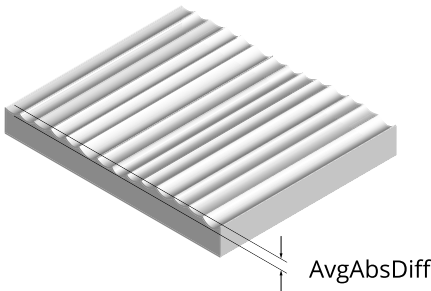
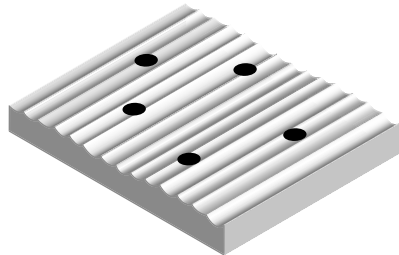
Decision

Min: 0 mm

Max: 0.03 mm

Measurement Panel

Measurements

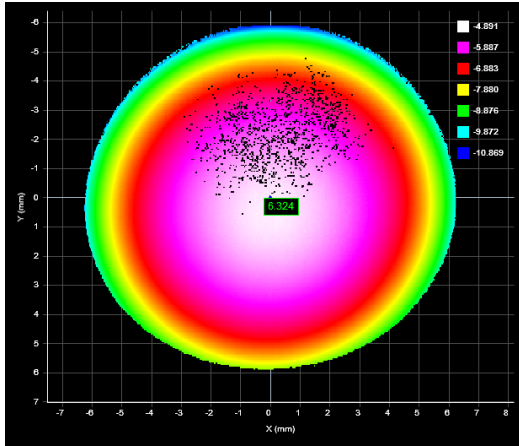
Measurement	Illustration
AvgAbsDiff Determines the average absolute difference in millimeters between all neighboring points within a cylindrical region of interest. Can be used to identify a target with an uneven surface, for example, one resulting from folded material or debris.	 A 3D perspective view of a rectangular block with a series of parallel ridges. A vertical double-headed arrow on the right side of the block indicates the height difference between the ridges and the valleys, labeled 'AvgAbsDiff'.
InvalidCount Returns the percentage of invalid points in the cylindrical region of interest.	 A 3D perspective view of a rectangular block with a series of parallel ridges. Four black dots are placed on the ridges, representing invalid points. The other areas are valid.
ValidCount Returns the percentage of valid points in the cylindrical region of interest.	
InvalidArea Returns the area of invalid points in the cylindrical region of interest.	
ValidArea Returns the area of valid points in the cylindrical region of interest.	

Parameters

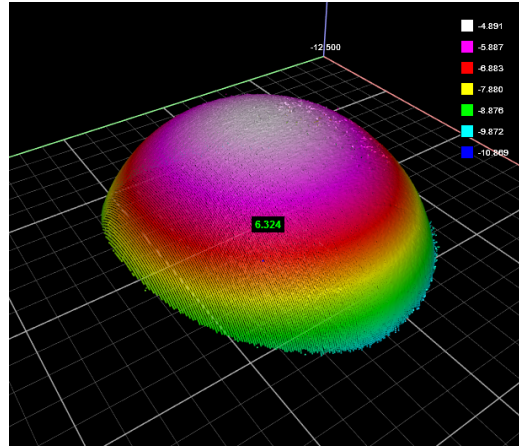
Parameter	Description
ScanType	Represents the way the internal algorithm checks the values. By default, Radial . (The other values are currently reserved.)
Inner Radius	Sets the inner radius. Points inside the inner radius are ignored. Default value is 0.
Path Count	The number of outward spokes from the center of the region. The default value is 72. Decreasing this value improves speed, but will affect the precision of the results.
Decision	See <i>Decisions</i> on page 15.
Use Region	See <i>Regions</i> on page 17.
Output	See <i>Filters</i> on page 16.

Sphere Fit

The Sphere Fit tool lets you compute characteristics of a scanned sphere by specifying a region to inspect.



2D View



3D View

ParametersAnchoring

Source:

Top

☐ Use Region

CenterX
☐

CenterY
☐

CenterZ
☐

Radius

6.324

☒

StandardDeviation
☐

ID:

3

ParametersOutput

Filters

Decision

Min:

6.3 mm

Max:

6.4 mm

Measurement Panel

Measurements

Measurement

Illustration

Center X

Determines the X position of the center of the sphere.

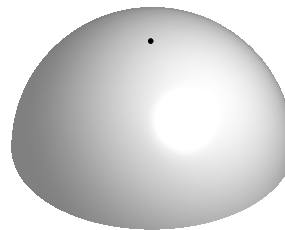
Center Y

Determines the Y position of the center of the sphere.

Center Z

Determines the Z position of the center of the sphere.

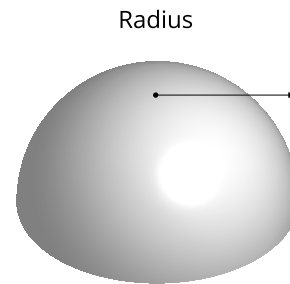
X, Y, or Z



Measurement	Illustration
-------------	--------------

Radius

Determines the radius of the sphere.



StandardDeviation

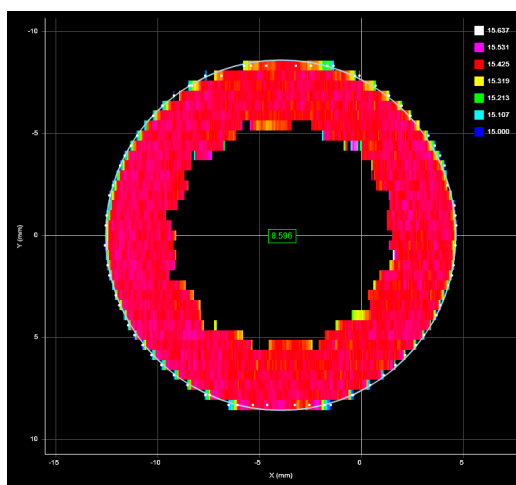
Determines the error of the points compared to the computed sphere. It is defined as the square root of the variance of the distance of every point to the computed sphere.

Parameters

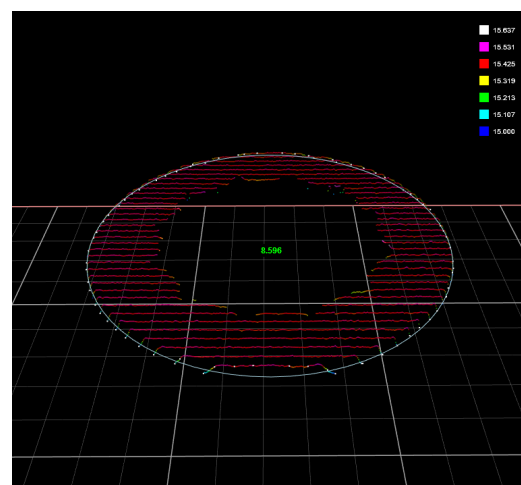
Parameter	Description
Decision	See <i>Decisions</i> on page 15.
Use Region	See <i>Regions</i> on page 17.
Output	See <i>Filters</i> on page 16.

Circle Fit

The Circle Fit tool lets you compute the characteristics of a scanned circle, by specifying a region to inspect and whether to use the points closer to or farther from the region's circle. The points taken for the circle fit are extracted by parsing the region from the center, moving outward.



2D View



3D View

ParametersAnchoring

Source:Top
Position:Outermost
☐ Use Region

CenterX☐
CenterY☐
CenterZ☐
Radius8.596☒
StandardDeviation☐
Time☐

ID:1

ParametersOutput

Filters
Decision

Min:8.5 mm
Max:8.6 mm

Measurement Panel

Measurements

Measurement

Illustration

Center X

Determines the X position of the center of the circle.

Center Y

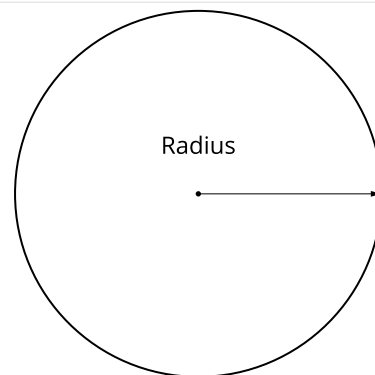
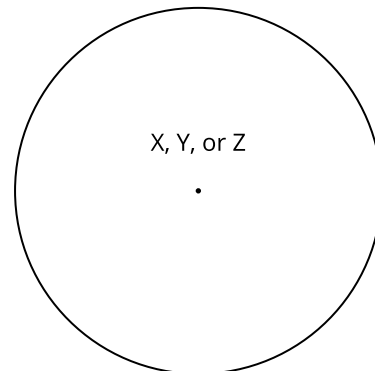
Determines the Y position of the center of the circle.

Center Z

Determines the Z position of the center of the circle.

Radius

Determines the radius the circle.



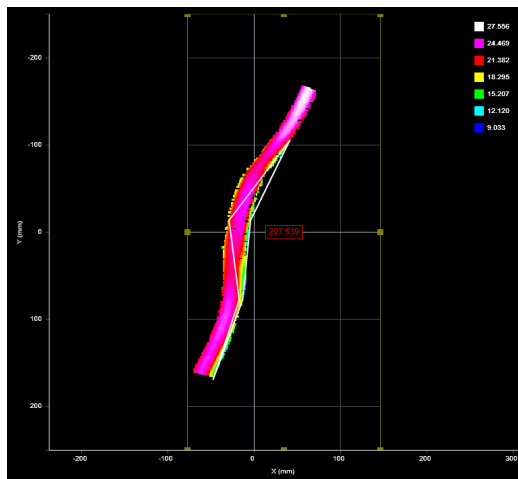
StandardDeviation

Measurement	Illustration
Determines the error of the points compared to the computed circle. It is defined as the square root of the variance of the distance of every point to the computed circle.	
Time Returns the time, in milliseconds, that the tool required to process the data.	
Parameters	
Parameter	Description
Position	Can be one of the following: Outermost: The extracted points are selected by inspecting outward spokes starting at the center of the region. Innermost: The first encountered point is used. Otherwise, the last one is used.
Decision	See <i>Decisions</i> on page 15.
Region	See <i>Regions</i> on page 17.
Output	See <i>Filters</i> on page 16.

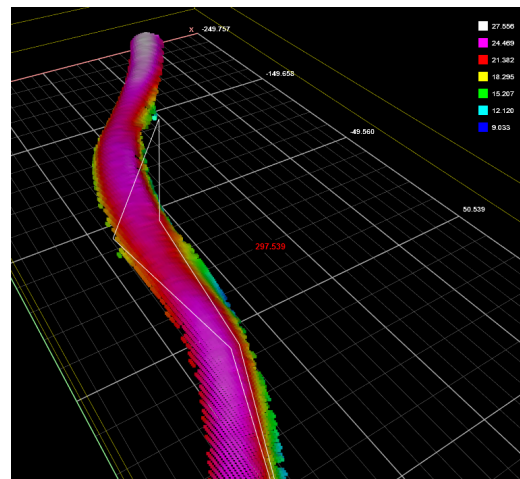
Irregular Length

The Irregular Length tool approximates the length or width of objects in the region of interest.

For vertical length, the tool parses the ranges for the first and last value of each row, and builds two vertical lines. The length of both lines is measured. The average length is also provided, as it is sometimes a better approximation.



2D View



3D View

ParametersAnchoring

Source:

Top

☒ Use Region

Region

↺⋮

☒ Vertical

☒ Use Sections

Sections

3

AverageLength297.539

Length1303.698

Length2291.380

Perimeter595.078

Time0.027

ID:

0

ParametersOutput

Filters

⋮

Decision

Min:

0 mm

Max:

0 mm

Measurement Panel

Measurements

Measurement

Illustration

AverageLength

Returns the average of the Length1 and Length2 measurements.

Length1

Length2

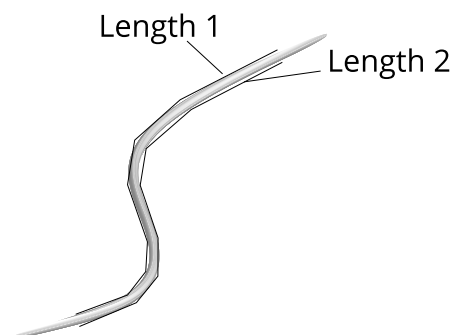
Determines the length of one side of the scanned target.

Perimeter

Determines the full perimeter of the object scanned. The gaps between the two lines are closed, and added to the lengths of both lines.

Time

Returns the time, in milliseconds, that the tool required to process the data.



Parameters

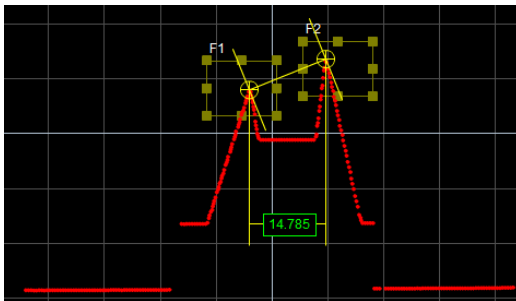
Parameter	Description
Vertical	If checked, the vertical length is computed. Otherwise, the width is computed, by parsing the columns instead of the rows.
Use Sections	If checked, the part is divided into sections. Using this setting can speed up the process and better evaluate the lengths when the part is not smoothed. If not checked, every column/row (depending on the Vertical setting) is taken into account.
Sections	The number of sections to use (from the start to the end of the bounding box that contains the part) if Use Sections is checked.
Decision	See <i>Decisions</i> on page 15.
Region	See <i>Regions</i> on page 17.
Output	See <i>Filters</i> on page 16.

Common Parameters

Decisions

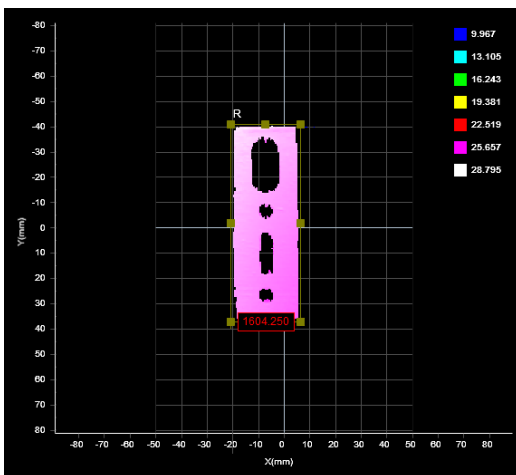
Results from a measurement can be compared against minimum and maximum thresholds to generate *pass / fail* decisions. The decision state is *pass* if a measurement value is between the minimum and maximum threshold. In the data viewer and next to the measurement, these values are displayed in green. Otherwise, the decision state is *fail*. In the user interface, these values are displayed in red.

All measurements provide decision settings under the **Output** tab.



Width	☐
Height	☐
Distance	14.785 ☒
Center X	☐
Center Z	☐
Id: 4	
Output	
Filters ☐	
Decision	
Min:	14 mm
Max:	15 mm

Value (14.786) within decision thresholds (Min: 14, Max: 15). Decision: Pass



Parameter Anchoring	
Source:	Top
☒ Region	☐
Volume ☐	
Area	1604.250 ☒
Thickness	☐
Id: 4	
Output	
Filters ☐	
Decision	
Min:	1500 mm ²
Max:	1600 mm ²

Value (1604.250) outside decision thresholds (Min: 1500, Max: 1600). Decision: Fail

Along with measurement values, decisions can be sent to external programs and devices. In particular, decisions are often used with digital outputs to trigger an external event in response to a measurement.

To configure decisions:

1. Go to the **Measure** page by clicking on the **Measure** icon.



The scan mode must be set to the type of measurement you need to configure. Otherwise, the wrong tools, or no tools, will be listed on the **Measure** page.

2. In the **Tools** panel, click on a tool in the tool list.
3. In the measurement list, select a measurement.
To select a measurement, it must be enabled.
4. Click on the **Output** tab.
For some measurements, only the **Output** tab is displayed.
5. Enter values in the **Min** and **Max** fields.

Filters

Filters can be applied to measurement values before they are output from the Gocator sensors.

All measurements provide filter settings under the **Output** tab.

Filter	Description
Scale and Offset	The Scale and Offset settings are applied to the measurement value according to the following formula: $\text{Scale} * \text{Value} + \text{Offset}$ Scale and Offset can be used to transform the output without the need to write a script. For example, to convert the measurement value from millimeters to thousands of an inch, set Scale to 39.37. To convert from radius to diameter, set Scale to 2.
Hold Last Valid	Holds the last valid value when the measurement is invalid. Measurement is invalid if there is no valid value.
Smoothing	Applies moving window averaging to reduce random noise in a measurement output. The averaging window is configured in number of frames. If Hold Last Valid is enabled, smoothing uses the output of the Hold Last Valid filter.

To configure the filters:

1. Go to the **Measure** page by clicking on the **Measure** icon.



The scan mode must be set to the type of measurement you need to configure. Otherwise, the wrong tools, or no tools, will be listed on the **Measure** page.

2. In the **Tools** panel, click on a tool in the tool list.
3. In the measurement list, select a measurement.
To select a measurement, it must be enabled.
4. Click on the **Output** tab.
For some measurements, only the **Output** tab is displayed.
5. Expand the **Filters** panel by clicking on the panel header or the  button.
6. Configure the filters.
Refer to the table above for a list of the filters.

Regions

Many measurement tools use region parameters to limit the area in which a measurement will occur



You can turn regions off by unchecking the checkbox next to the **Regions** setting. When you do this, the measurement tool uses the entire active area.

All tools provide region settings under the **Parameters** tab.



Parameter	Value	Unit
X:	-54.122	mm
Z:	-36.593	mm
Width:	109.67	mm
Height:	109.67	mm



The **Region** settings apply to all of a tool's measurements.

See the individual tools for any details on using this parameter with each tool.

This parameter is also referred to as a measurement region.



In 2D mode, the tool region defaults to the center of the current data view, not the global field of view. In 3D mode, the region defaults to the global field of view.

To configure regions:

1. Go to the **Measure** page by clicking on the **Measure** icon.



The scan mode must be set to the type of measurement you need to configure. Otherwise, the wrong tools, or no tools, will be listed on the **Measure** page.

2. In the **Tools** panel, click on a tool in the tool list.
3. Expand the region section by clicking on the expand button :≡.
Some region settings are found within other settings in this area.
4. Configure the region using the fields or graphically using the mouse in the data viewer.