



HP 3D Process Control

User Guide

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Edition 1

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1 Introduction


HP 3D Process Control is a software tool for MJF 5200 series users looking to produce repeatable 3D-manufactured parts, or to produce parts with final part-level accuracy requirements. The Process Control tool targets both print accuracy and repeatability by reducing dimensional variability across the entire printable area through machine learning based algorithms. Dimensional profiles are created and stored in the tool's Profile Library, establishing a guideline for fundamental process control across a fleet of machines for both local and distributed sites.


2 Prerequisites

To use HP 3D Process Control, you need:

- Windows 10 or later
- A dual-core processor
- 4 GB of RAM
- 250 MB of free disk space
- An HP 3D Center by PrintOS account
- HP SmartStream Command Center configured

Command Center must be configured.

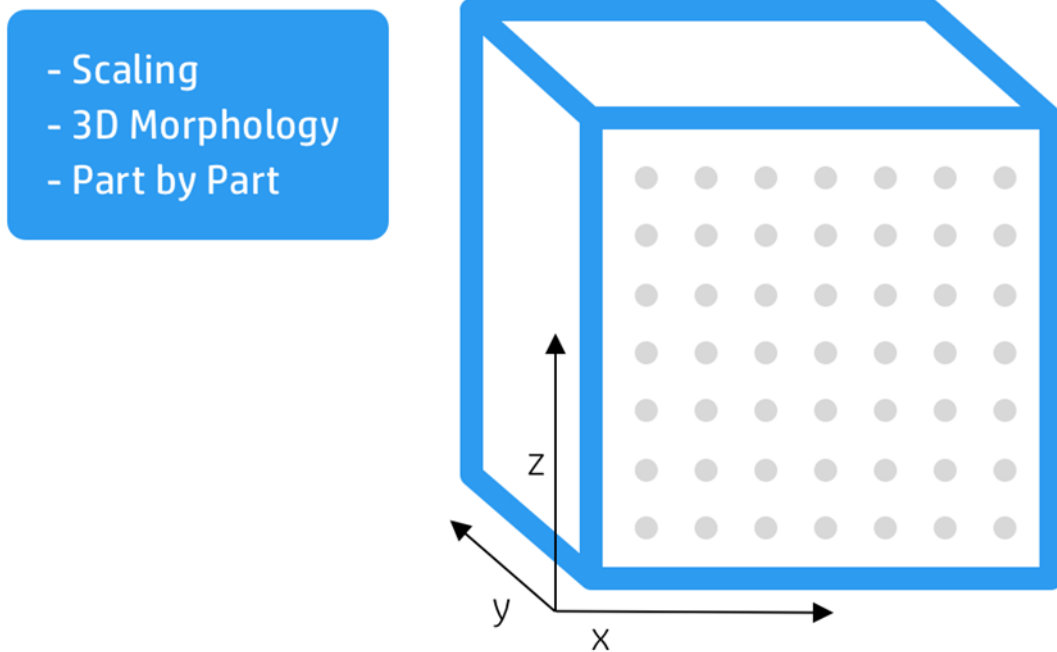
 **NOTE:** To use the application features, you must have a license for the device you wish to create a profile or send a profile to. Notice that licenses are per device. To learn more, consult <https://www.printos.com/market/#/product/3dprocesscontrol>.

 **NOTE:** To create your HP 3D Center by PrintOS account (www.hp3dcenter.com), talk to your support representative. For more details, follow the instructions in the *HP Jet Fusion 5200, 5210, 5210 Pro 3D Printing Solution Site Preparation Guide*.

3 Product features

Dimensional Profiles

HP MJF 3D printing process is based on selective melting of plastic material. Once melted, the material cools down until it is solidified, changing its internal structure. During its solidification, the melted volume suffers a shrinkage in volume. Dimensional Profiles are used to compensate the variation of this effect along the printing volume, automatically applying geometrical transformations to each part being printed.



Above: Graphic represents conceptually geometrical transformations managed by 3D HP Process Control.

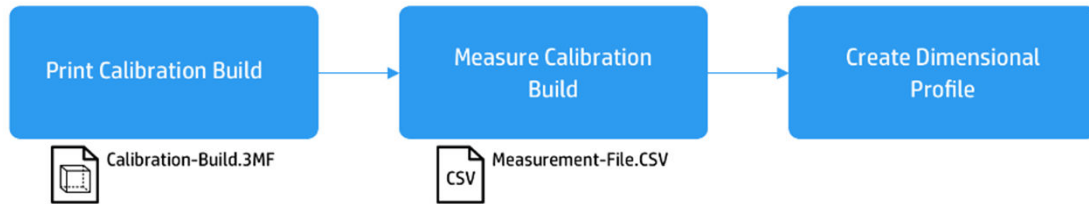
Geometrical transformations are applied differently on each axis, which ensures optimal results for every part orientation. For example, non-uniform scaling is used to compensate for solidification shrinkage.

In addition to the volumetric compensations explained; Dimensional Profiles can act on the surface of the parts with axis-dependent 3D morphology.

General Profiles are a unique type of Dimensional Profile which are embedded in HP Jet Fusion 5200 Series 3D printers. Each Print Mode has a General Profile associated with it that optimizes part geometry based on the average behavior of a wide sample population of HP Jet Fusion 3D printers.

Hardware-specific Dimensional Profiles

In use cases with very tight dimensional requirements, particularly when producing the same type of parts with a fleet of printers, the dimensional particularities of each piece of hardware can be equalized by means of Hardware-specific Dimensional Profiles. This process relies on the impression of a calibration build and the measurement of the calibration parts obtained.



Details on how to use the Calibration Build and how to prepare the Measurement file are included in the appendix.

Profile Management

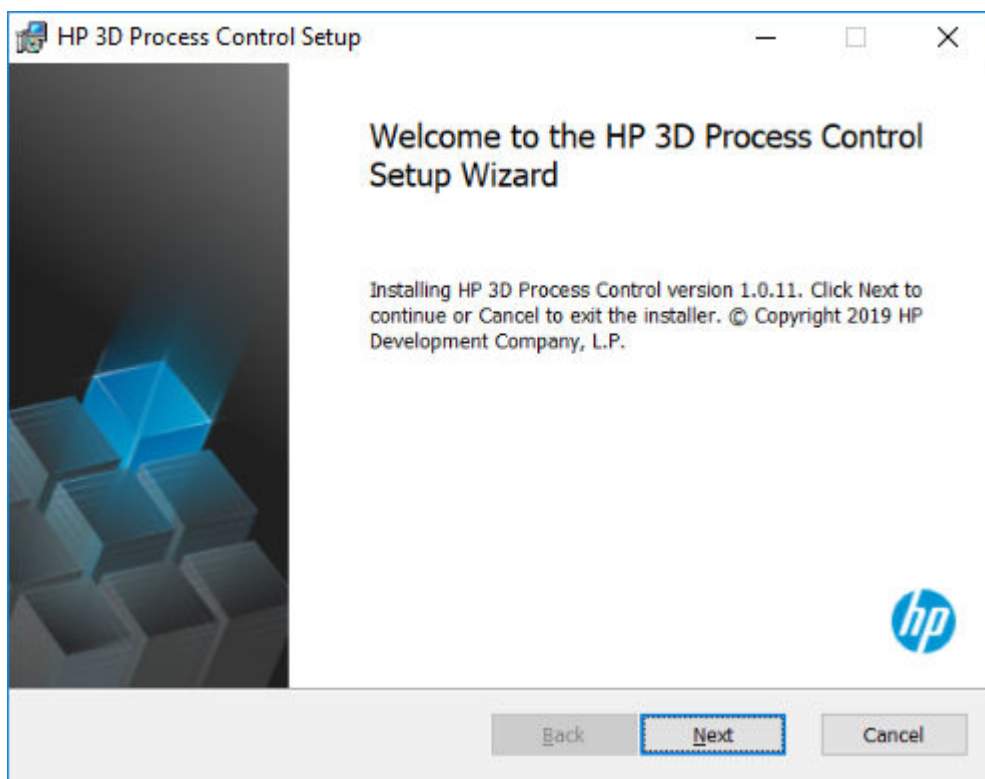
HP 3D Process Control adds the Profile Management capability so that different profiles can be selected depending on specific printing needs. One can:

- Visualize all the Dimensional Profiles based on printer compatibility
- Configure the Dimensional Profiles to be used for each printer
- Trigger Hardware-specific profiling

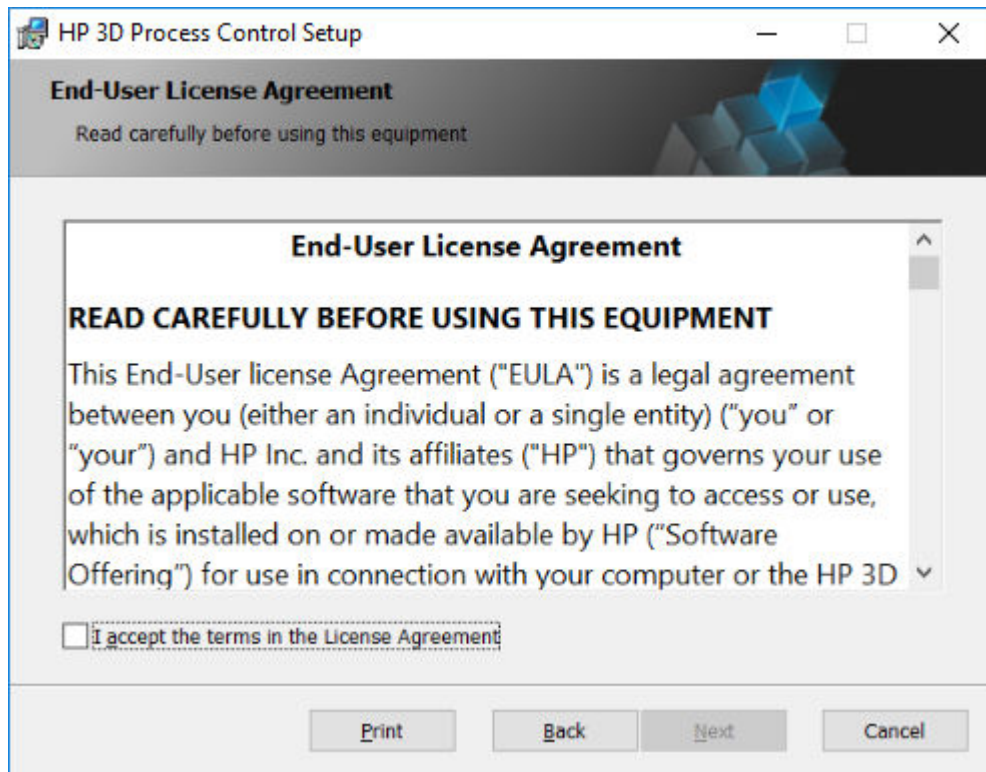
4 Getting started

Installation

Double-click the HPProcessControl.msi file to open the HP 3D Process Control setup wizard.



Click **Next** and follow the installation steps to install the application. The End User License Agreement is required to proceed with the installation.



When installation has completed, an application icon appears on the computer's desktop:



Login

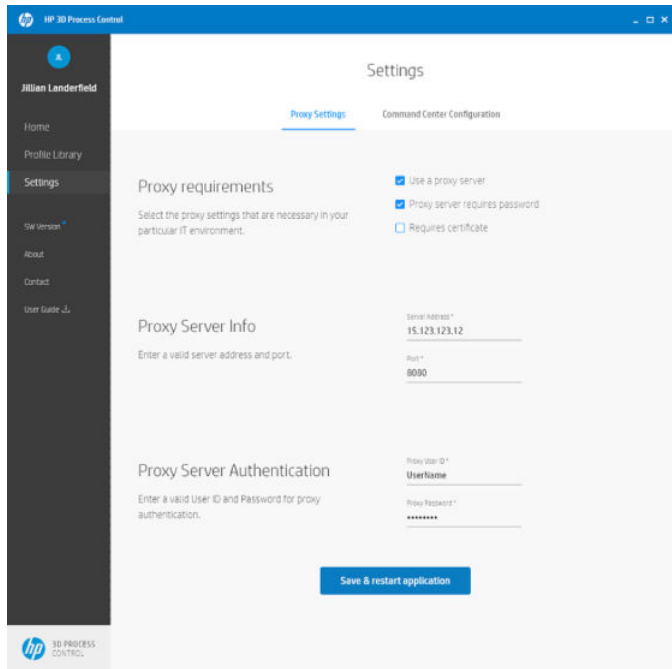
 **IMPORTANT:** An Internet connection is required to log in.

Open the application and enter a valid HP 3D Center by PrintOS account user name and password. If you do not have a HP 3D Center by PrintOS account, contact your HP reseller.

Proxy Configuration

Depending on the network environment, the user might require a proxy to connect to the network. The application supports the use of proxies and certificates (*.crt, *.cert). In order to apply the changes, the application will restart.

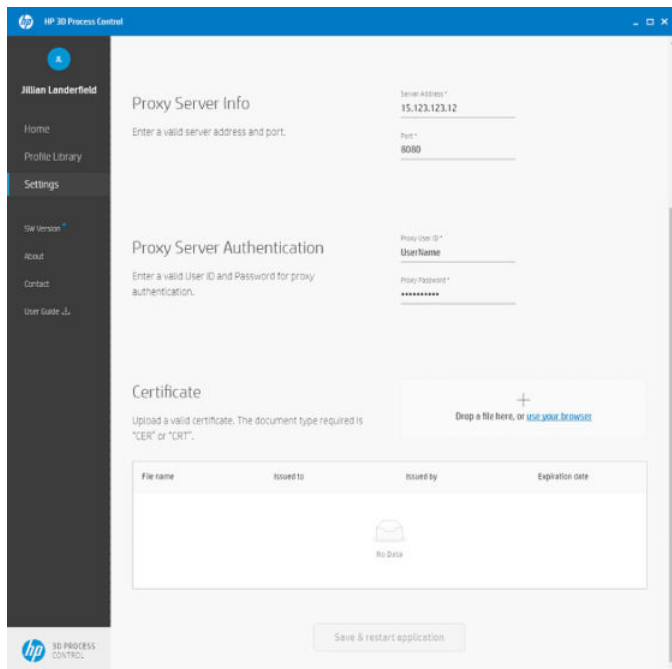
The application uses the system settings by default, but it gives you the option to choose proxy settings. If you want to do so, just click **Use a proxy server**. When you open the application, it always tests its connectivity. If it's not possible to connect due to a proxy, the application will display the "Proxy Settings" configuration screen.



If your environment requires “user/password” for the proxy, you must configure the proxy in the application and in the system and give the user/password permission for the application. For environments that require certificates, you must import the certificates into the application and into the system.

Errors are displayed if the application has a proxy error or connectivity issue. In such a case, contact your IT service.

To change the Proxy Settings later, just navigate to the **Settings** item on the sidebar and select **Proxy Settings**. The application will restart in order to apply the settings.

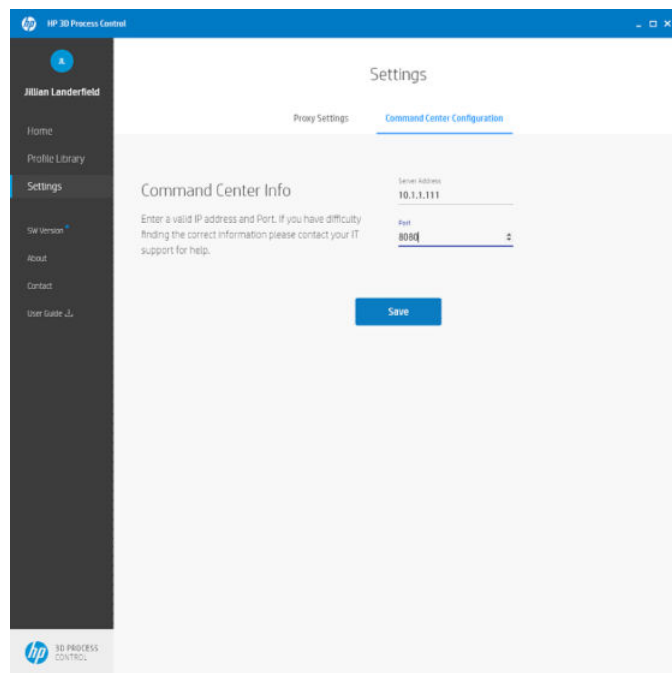


Command Center Configuration

The configuration of Command Center is mandatory to send Dimensional Profiles to a printer. The application requires connection to it because it's responsible for communication with the printers.

To see how to set up and configure Command Center, refer to the *HP Jet Fusion 5200 Series 3D Printing Solution Site Preparation Guide*.

After Command Center is connected to HP 3D Center by PrintOS, you must configure its address in HP 3D Process Control. Go to the **Settings** item on the sidebar and select **Command Center Configuration**.



You must enter a valid IP address and a port. Once configured, click **Save**.

Contact

If there is any need to contact HP, contact information is available in the “Contact” item on the sidebar, or contact your reseller.

About and Terms of Use

The terms of use of the application can be found in the “About” item on the sidebar. Click “Read our EULA” to review the terms that were accepted during the installation process.

5 Dimensional Profiles

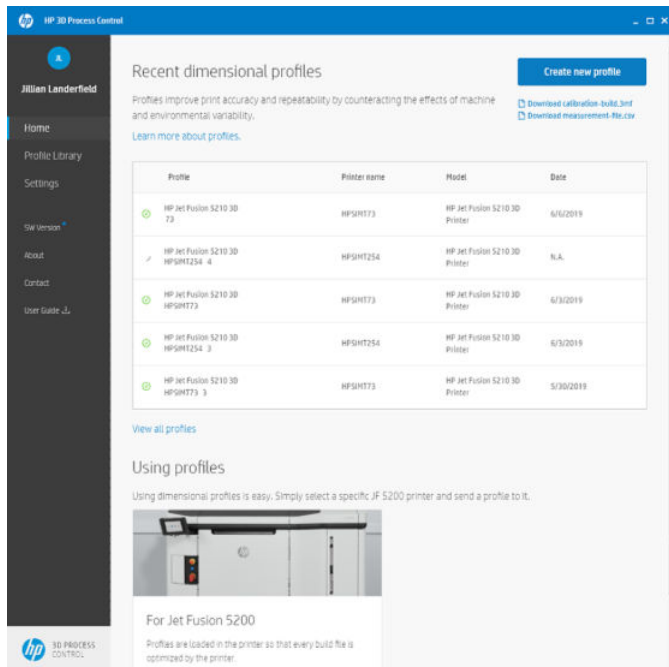
How to Use Dimensional Profiles

The HP 3D Process Control application has a Home screen where a summary of the available dimensional profiles is available as well as a set of actions to either create or apply to a Dimensional Profile. Dimensional Profiles are specific to the printer model, the material and Print Mode being used.

Also, a set of actions to either create or apply a dimensional profile can be triggered:

- General Dimensional Profiles are created and provided by HP
- Hardware-specific Dimensional Profiles are created by the user for a particular printer

To create a Hardware-specific Profile, information about the printer and the job that was used to print the Calibration Build is used to generate it. In the Create Profile screen, that information will be collected along with the measurements. A request for a new profile will be created, and afterwards, the profile will become available to use.




Creating a Profile

To be able to create a profile—a Hardware-specific Profile—that it will be targeted to a specific printer, a few steps are required:

1. Download the HP Calibration Bucket (it can be found on the Home screen or in the “Learn more about profiles” option).
2. Print the Calibration Build.

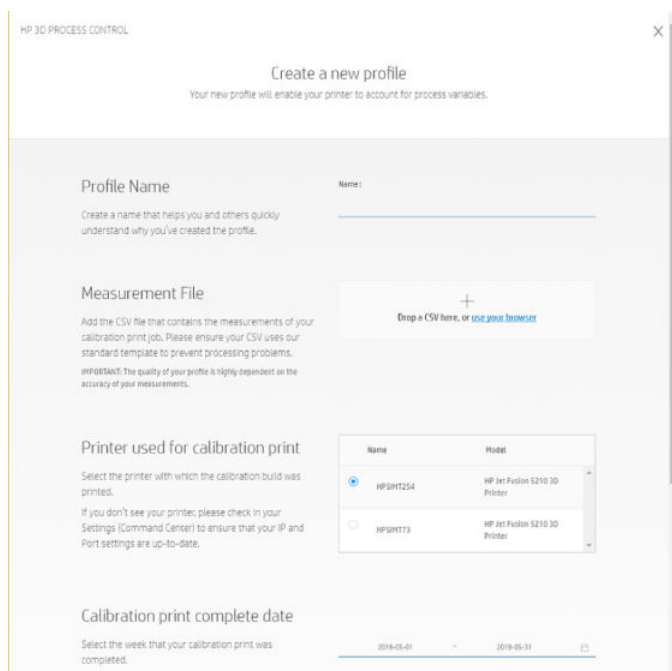
 **NOTE:** Store these parts until the next hardware-specific profile creation of the same print profile.

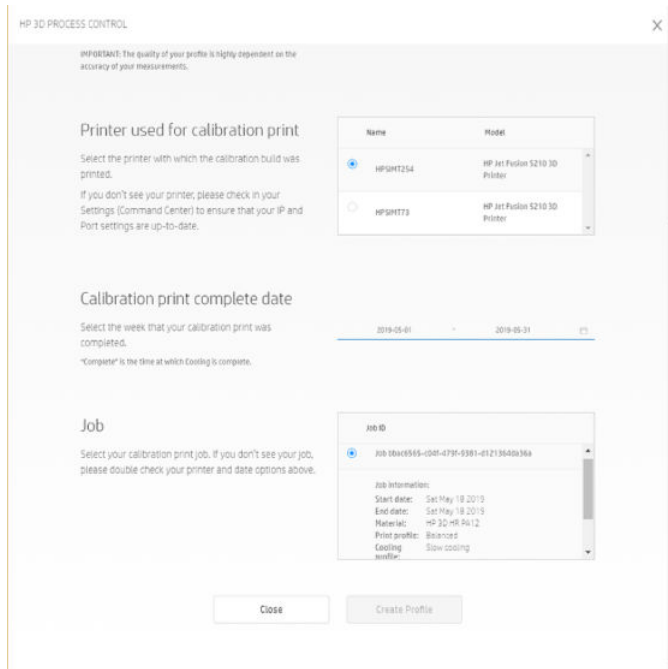
3. Measure the printed parts.
4. Input the measurements in the template provided (it can be found on the Home screen or in the “Learn more about profiles” option).

 **IMPORTANT:** The file to be used to input measurements is a *.csv file with default separation by “.”. Make sure you import it into the tool you choose for edition, but ensure the format is still the same when you export it and save it.

Once these steps have been performed, the option to create a new profile appears on the Home screen.

5. Select **Calibration Build Printing date** so that in the Job ID library, only Calibration Build job ID appears. If it is not well selected, the Dimensional Profile may be applied to a wrong print profile.
6. Select **Job ID**.



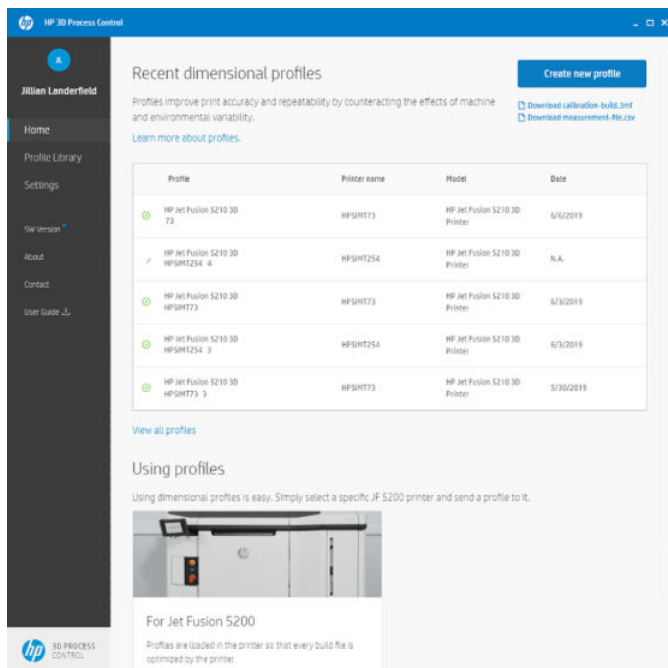


Dimensional Profiles exhibit three states:

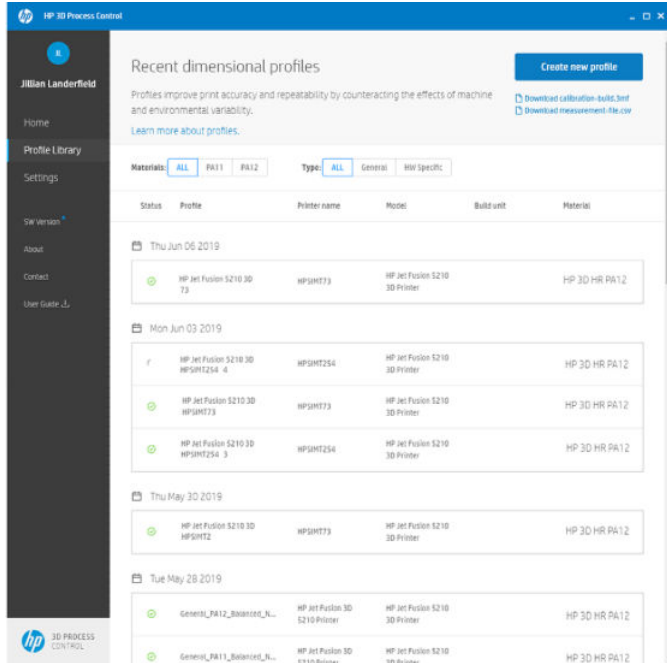
- **Processing:** The profile request has been created and the Hardware-specific Profile is being processed by HP
- **Ready:** The Profile is ready to use
- **Fail:** Something went wrong in the creation of the Profile. This state could be caused by an invalid measurements file, for example

These states are visible on the Home and Profile Library screens:

Home screen



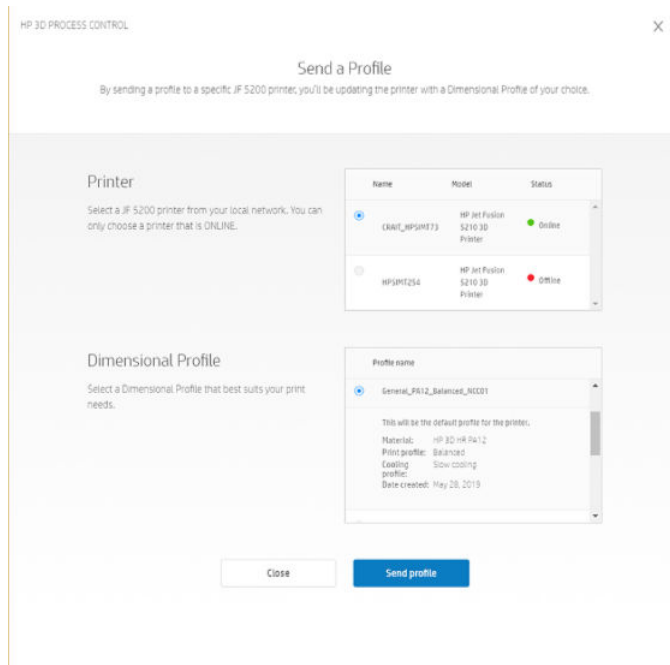
Profile Library screen



Applying a Profile

To use a Dimensional Profile, it must be sent to the printer. The printer itself can perform the proper calibration based on the profile to improve its printing accuracy. The printer can receive both General and Hardware-specific profiles.

There is an option to send the profile to the printer on the Home screen:



Profiles are either Model-specific (General) or printer-specific (Hardware-specific), and they are displayed according to the printer selected.



IMPORTANT: Command Center must be configured in the Settings area to enable communication with the printer.

Profiles have information about the material and print mode that they will be associated with. Hardware-specific Profiles will yield better results than General Profiles.

6 Troubleshooting

Unable to reach server

Check your Internet connection and proxy settings and try again.

Proxy error

Check your proxy settings and try again.

No printer list on send profile to printer

Check your Command Center configuration in the Settings area. Command Center must be configured to enable communication with the printer.

No Internet connection

Check your Internet connection and try again.

Printer displayed in Create New Profile or Send Profile displays a subscribe message and it's not available for selection

Product features for 3D Process Control are on a license per device control. If you wish to add a license for a device, consult the Contact page for more information.

7 When you need help

Request support

Support is provided by your support representative: usually from the company from which you bought the printer. If this is not the case, contact HP Support on the Web:

- <http://www.hp.com/go/jetfusion3D5200/support>, or
- <http://www.hp.com/go/jetfusion3D5210/support>, or
- <http://www.hp.com/go/jetfusion3D5210pro/support>, or
- <http://www.hp.com/go/jetfusion3Dprocessingstation/support>

Before calling your support representative, prepare for the call as follows:

- Review the troubleshooting suggestions in this guide
- Review your software documentation, if relevant
- Check that you have the following information ready:
 - The product and serial numbers of the printer you are using
 - If there is an error code on the front panel, make a note of it
 - The name and version number of your software
 - If you have a print-quality problem, the name and product number of the material that you were using

Service information

Command Center can produce, on request, a list of many aspects of the printer's current status, some of which may be useful to a service engineer trying to fix a problem.

A Measuring the Calibration Build

This guide explains the procedure metrology used to design, compute and validate the dimensional calibrations of MJF technology. Other measurement systems could be used under user's responsibility, but the consequences cannot be guaranteed.

Technology: 3D Scan

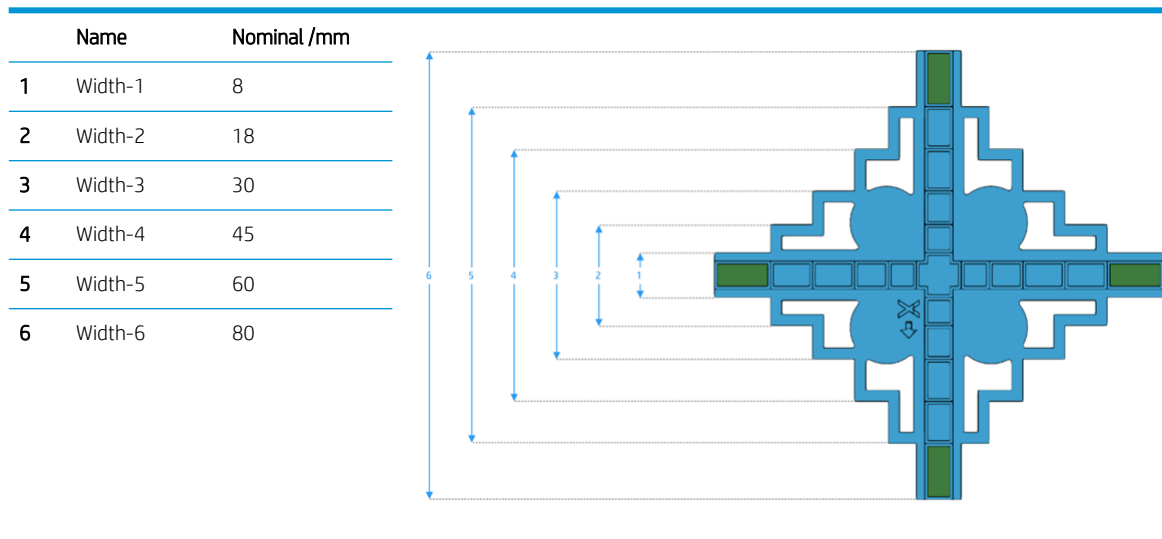
About the precision of the 3D Scanner for tolerances of ± 0.2 mm in the nominals:

- Scanner's sigma recommended: 20 μm or below, in instance to obtain a ratio precision to tolerance P/T below 0.3.
- For the same reason, for a tolerance in the printing of ± 0.3 mm, a sigma of 30 μm or below will be enough.

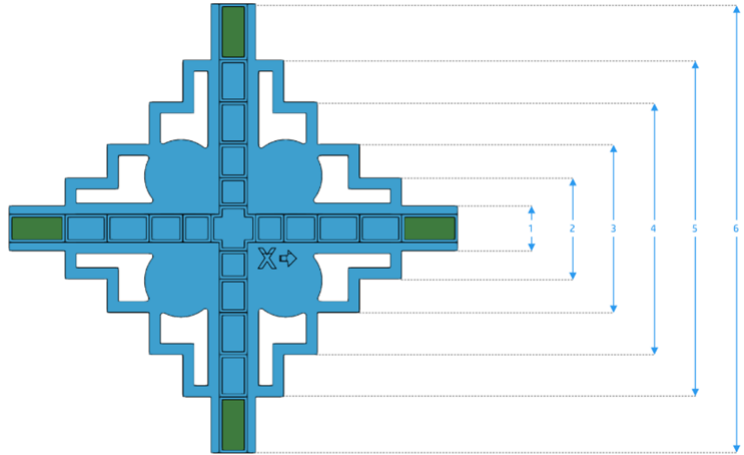
In the following pages, the **critical dimensions** that have to be measured, the **type of linear distances** that should be used, the **types of fitting elements**, the use of **virtual calipers**, and the **imprinted edge definitions** are described in 5 different sections.

Critical dimension definitions:

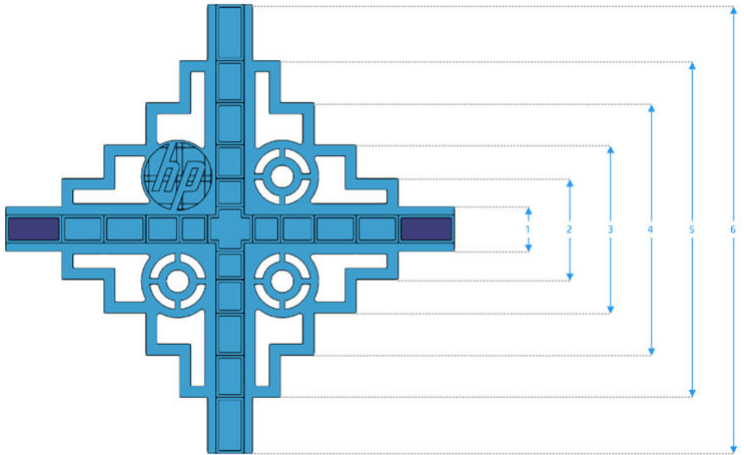
Middle



	Name	Nominal /mm
1	Depth-1	8
2	Depth-2	18
3	Depth-3	30
4	Depth-4	45
5	Depth-5	60
6	Depth-6	80

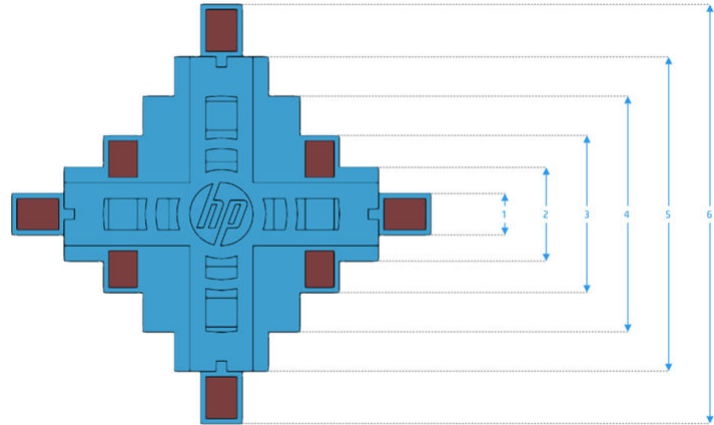


	Name	Nominal /mm
1	Height-1	8
2	Height-2	18
3	Height-3	30
4	Height-4	45
5	Height-5	60
6	Height-6	80



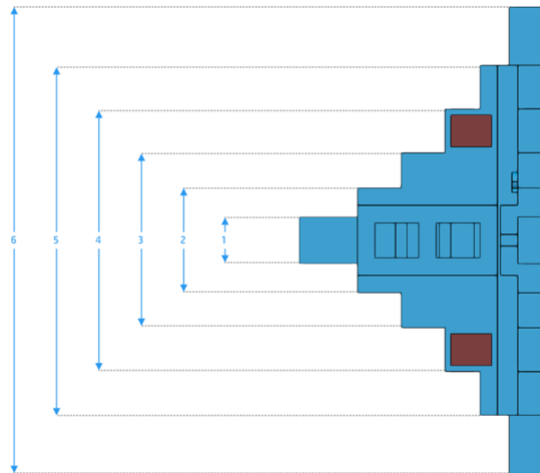
Vertice

	Name	Nominal /mm
1	Height-1	8
2	Height-2	18
3	Height-3	30
4	Height-4	45
5	Height-5	60
6	Height-6	80



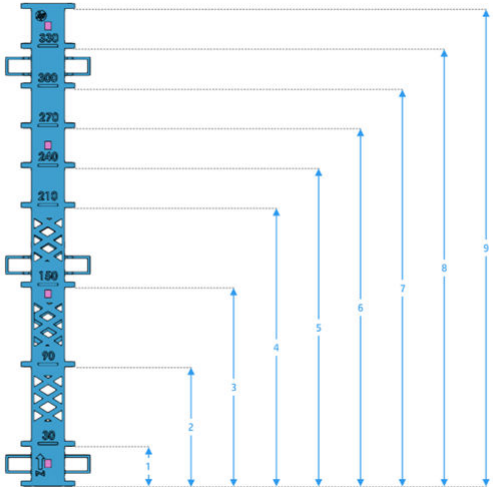
Edge

	Name	Nominal /mm
1	Height-1	8
2	Height-2	18
3	Height-3	30
4	Height-4	45
5	Height-5	60
6	Height-6	80



Large

	Name	Nominal /mm
1	Height-1	30
2	Height-2	90
3	Height-3	150
4	Height-4	210
5	Height-5	240
6	Height-6	270
7	Height-7	300
8	Height-8	330
9	Height-9	360



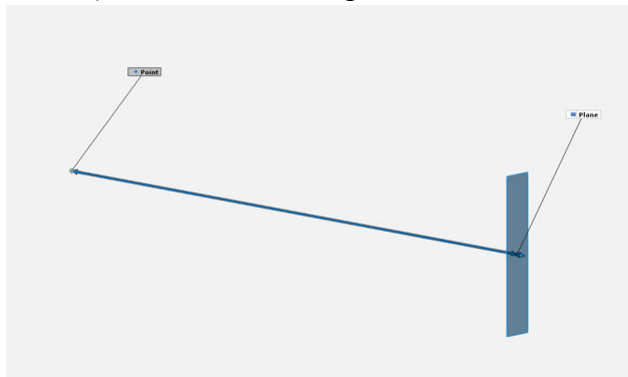
Types of distances

Types of fitting elements distances:

It is possible to measure two different types of linear distances:

- Projected point into a plane without specifying axis. As the point is projected perpendicularly to the plane, the direction is already defined.

Point to plane distance, in orthogonal direction



- Point to Point specifying axis. As there's no projected element, the measurement direction has to be defined using the CAD axes (X, Y, Z, XY, XZ, YZ or a customized direction).

Distance point to point



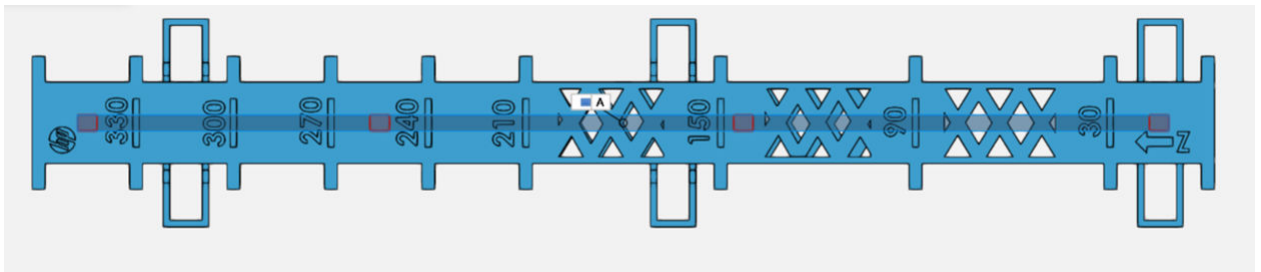
Types of fitting elements

The elements (points and planes) are fitted in different ways depending on the type of file that we are using. The procedure to have a stable and representative measure will be different if we are fitting them in a CAD file or in a mesh file:

Planes

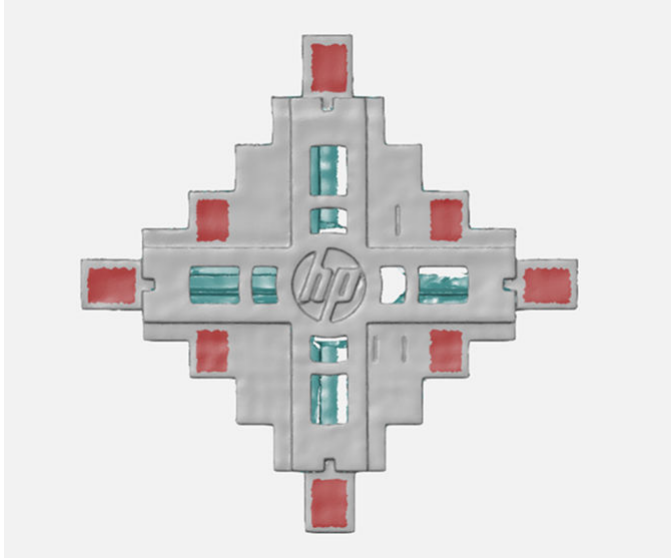
In the CAD file: all the triangular elements of the CAD located in the imprinted edge defined area are used to generate an average plane (see [Imprinted Edge Definition on page 24](#)), which has a perfect straightness and flatness value (GD&T measuring methods).

Plane A is obtained as the best plane that fits the 4 red marked areas

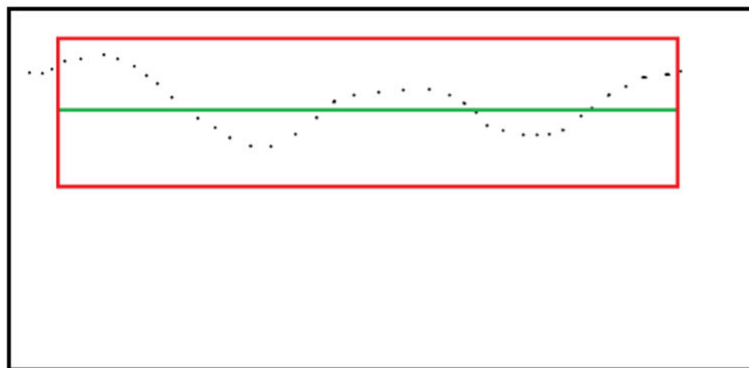


In the mesh file: all the triangular captured surface points inside the imprinted edge are used to generate an average plane.

Eight areas are selected for find the best plane to represent them



Scheme that explain how the best plane (green) is chosen for represent the real mesh (black dots).

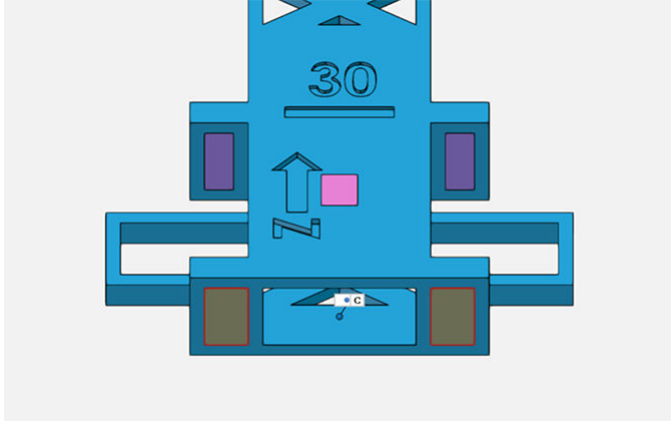


Total surface points of the scanned mesh
Imprinted edge defined area
Average plane generated using all the points
inside the imprinted edge area

Points

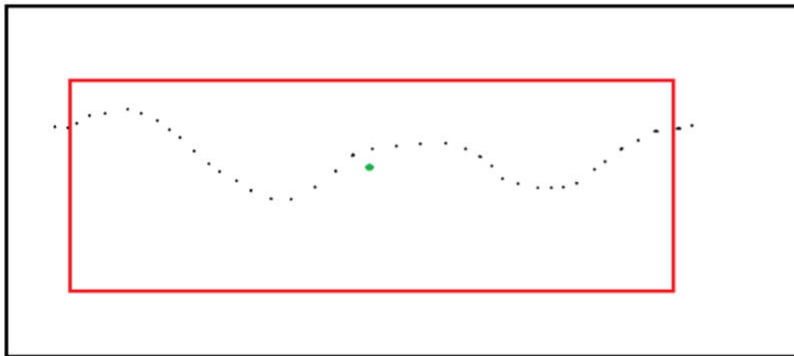
In the CAD file: all the triangular elements of the CAD are used to generate an average point. As all the elements are located in the same flat surface, the average point is constructed in the middle of the imprinted edge zone, in the same coordinate level as all the other points.

Point C is computed as the point that best fits the points in the 2 red marked areas



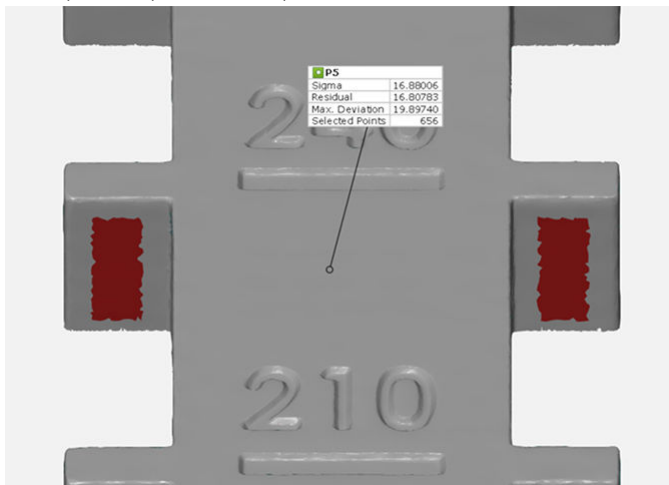
In the mesh file: all the triangular captured surface points inside the imprinted edge are used to generate an average point, which is represented in the middle of the imprinted edge.

Scheme that illustrates how is chosen the point C (green) that best represent the high of the irregular surface (black dots)



Total surface points of the scanned mesh
Imprinted edge defined area
Average point generated using all the points inside the imprinted edge area

Example of a point that represents the 2 red marked areas in a mesh



Surface caliper points

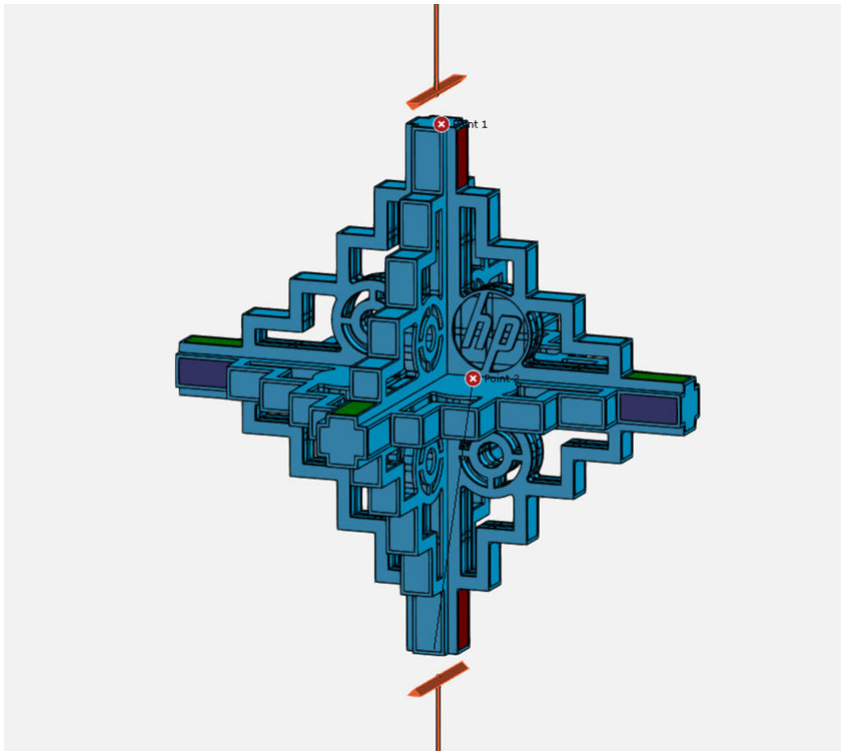
Alternatively, it is possible to measure the critical dimensions with a virtual caliper. Caliper points are generated through a virtual caliper which approximates in a customizable defined direction, contacts the part (the whole surface or specific zone selection) and returns the first surface captured point of the mesh.

In the **Z axis**, it is recommended to use only this kind of measuring. There are two different types of calipers:

Edge caliper point

The virtual caliper is an edge that needs two directions to contact the part. The height and length of the edge caliper is customizable.

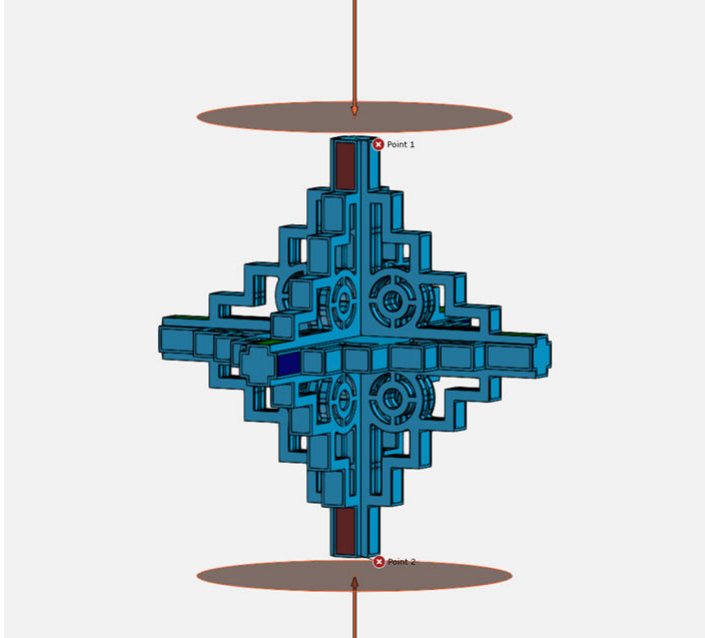
Virtual edge-caliper illustration



Disc caliper point

The virtual caliper is a disc that needs one direction to touch the mesh. The radius of the disc can be modified as needed.

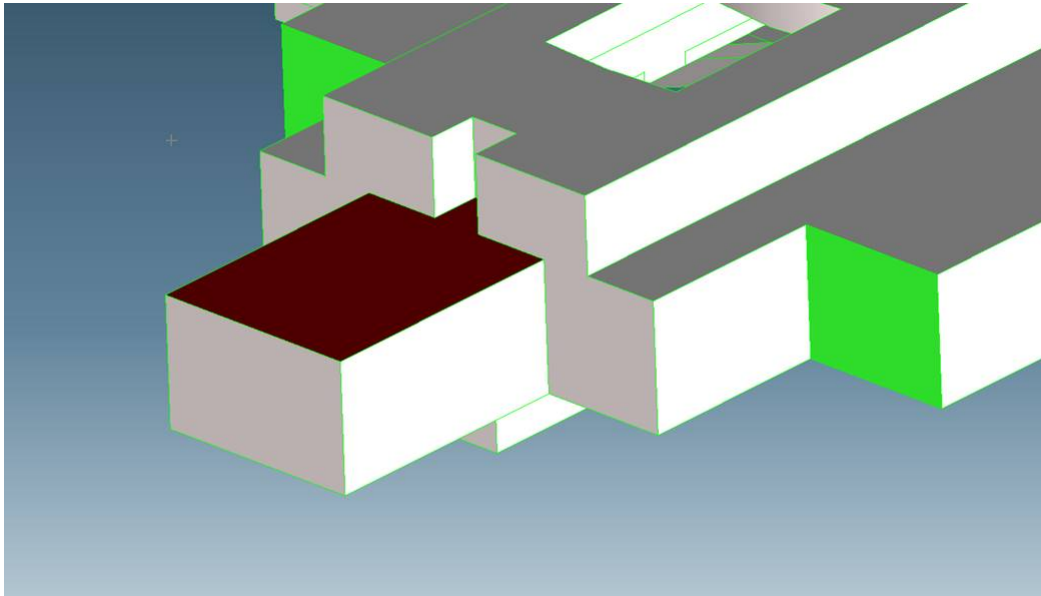
Virtual disc-caliper



Imprinted Edge Definition

The imprinted edges are a method of defining a specific zone of the part to be selected. In this case, is recommended to restrict the edges of the measuring area.

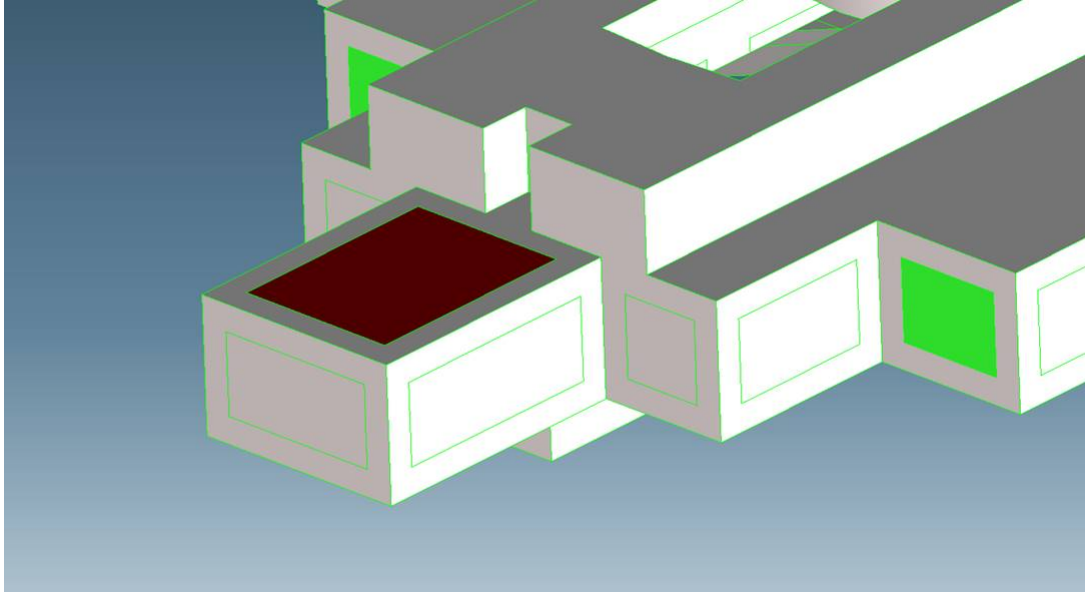
The chosen area for measure is the entire surface that the part geometry allows



No imprinted edges

The part has the faces which the designer has put on it. When constructing geometries, a face (which contains points) has to be selected. In this case the selected face would be all.

The area chosen for measure is restricted, avoiding possible estrange behaviors in the part edges.



Imprinted edges drawn on the part

In this case the selected face would be the new area. The edges are excluded to help in several dimensional studies. **It is recommended to measure critical dimensions with Imprinted edges drawn on the part** in order to have more repeatability in the metrology results.