



HORUS

3D SCANNING FOR EVERYONE

GUIDE FOR OPTIMUM SCANNING

Conditions for obtaining optimum scanning results

The scanning process is affected by environmental factors, the scanner configuration and calibration, as well as the object to be scanned. The most important environmental factor that affects the scanning is the light conditions.

The conditions to bear in mind will vary, depending on whether you want to scan with or without texture.

Ambient light

To obtain the best result when scanning with texture, place the scanner in an area with adequate levels of light, bearing in mind that the light must be indirect and medium intensity. This will prevent reflection and glare on the surface of the object to be scanned. Wherever possible, avoid circumstances in which shadows are projected onto the object.

When scanning without texture, the light can vary. When an object is scanned without texture, the lasers illuminate the scanning area, so if the colour of the object is not captured, there is no need for an additional light source (in contrast to when scanning with texture). Scanning with an additional light source is not an issue as long as you bear in mind the same light conditions as for scanning with texture.

Material of object

The material that the object to be scanned is made from is also a factor to be considered for obtaining the best results.

Objects with a shiny or reflective finish are difficult to scan, as glare is produced when the laser is projected onto the material and they are captured by the camera as though they were part of the object.

In contrast, objects with a matt finish result in excellent scanning results, as they do not produce any such glare or reflections.

Colour of object

The light beam of the laser is red. The segmentation software uses this colour to capture the points of the object to be scanned. Consequently, issues may arise when scanning red-coloured objects. It is advisable to adjust the scanning **Threshold** to obtain coherent results.

Issues may also arise when scanning very light-coloured objects, especially in environments with elevated light levels. In these instances, reduce the **Brightness** setting until a clearer image is achieved.



Brightness without adjustment

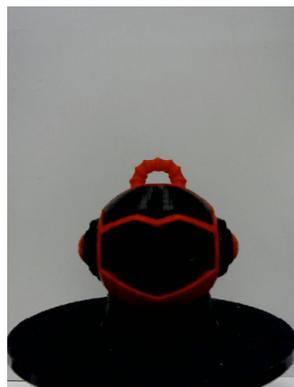


Brightness adjusted

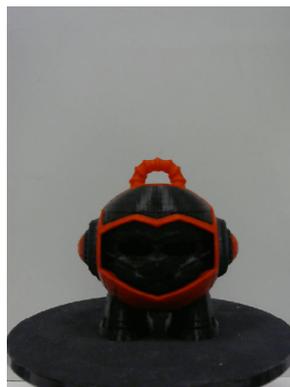


Very dark colours should be avoided when scanning as the results might not be accurate.

Likewise, dark-coloured objects may also produce inaccurate results, especially in poor light conditions. This is due to the fact that dark colours reflect an inferior quantity of light and as a result, the camera does not capture the light beam projected onto the object very well. To achieve a defined image, it is advisable to reduce the **Contrast**. To achieve good results it is also advisable to reduce the **Threshold**.



Contrast without adjustment



Contrast adjusted

Shape of object

The shape of the object to be scanned also affects the scanning results.

Point clouds generated by scanning objects with holes, cavities or hidden faces might lead to points being displayed in areas where there is no material, or parts which have been hidden might be displayed at all. The solution for the first scenario is to clean the scanning results using point cloud processing software. In the latter, we recommend scanning the object several times, placing it in different positions on the platform, and then merge them using point cloud processing software.

Image acquisition

The image acquisition depends on the camera. The configurable settings are as follows:

- **Brightness:** the luminosity of the image. This setting can be adjusted to the existing ambient light in the area that the scanner is located. A brightness level of 0 will result in a very dark image. In contrast, a value of 255 will produce an excessively light image.



Brightness too high



Brightness correctly adjusted



Brightness too high

- **Contrast:** the relevant difference in the intensity of the image.



Contrast too low



Contrast correctly adjusted



Contrast too high

- **Saturation:** this setting affects the colour purity of the image. Highly saturated colour is vivid and intense, whereas colours with low saturation are washed out and grey.



Saturation too low



Saturation correctly adjusted



Saturation too high



Changes to the acquisition and image segmentation parameters must be made in the scanning workbench. Changes made to settings of other workbenches will not affect the scanning workbench, and therefore will not affect the scanning results.

- **Laser exposure:** this only affects scanning *Without texture*. The laser exposure is the length of time, in milliseconds, that the lens of the camera is exposed in order to capture light beam projected by the laser. By default, the exposure value is 6. For low light environments it is advisable to increase this value.
- **Colour exposure:** this only affects scanning *With texture*. As with the previous setting, the **Exposure** is the length of time, measured in milliseconds, that the camera lens is exposed during the image capture. By default, the exposure value is 10. For low light environments it is advisable to increase this value.
- **Frame rate:** refers to the number of frames that the camera captures per second. It is recommended to always use the highest value permitted by the camera.
- **Resolution:** expressed in two whole numbers which refer to the number of columns and rows of pixels in an image. It is recommended to always use the highest resolution value permitted by the camera, as the image processing algorithms have been optimised.
- **Distortion:** Enables the lens distortion to be corrected. If the lens of the camera being used causes any distortion, this setting will correct it. This option is disabled by default.

Image segmentation

The image segmentation is the process that converts the images captured by the camera into the points that form the final cloud of the 3D model. This process is based on algorithms for image post-processing. Two of these algorithms are the **Open** algorithm (only available single for scanning with texture) and the **Threshold** algorithm (available for both types of scanning).

Both are filters that reduce the noise during scanning and produce better results when used correctly.

Threshold

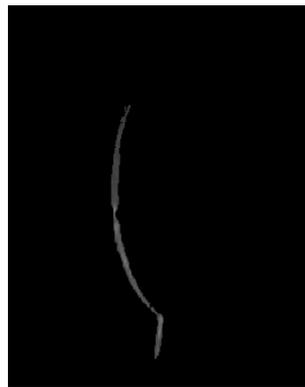
The **Threshold** setting is part of an algorithm that filters and eliminates noise. It allows points with an intensity above the **Threshold** value to pass through and eliminates those that fall below this value.

To adjust the **Threshold** correctly, the simplest way is to do it in real time. To do this, place the object to be scanned on the platform and click the button to **Start** scanning. Once the scanning process has started, click the button with the image of an eye and select the **Grey** viewing mode. Then click on the **Image segmentation** section and the **Threshold** value will vary until a well-defined grey line is achieved (the shape of this line depends on the geometry of the object to be scanned).

The images below are examples of different adjustments of this setting:



Threshold too low



Threshold correctly adjusted

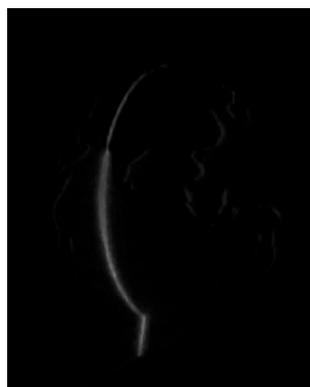


Threshold too high

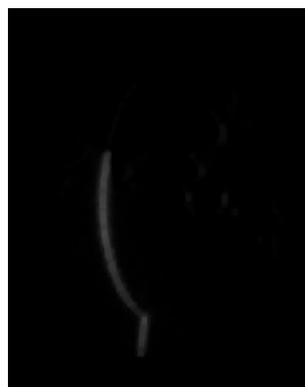
- **Threshold too low:** a threshold below the ideal results in a blurred line, with glare and reflection. This threshold value causes non-existent points to appear on the cloud generated from scanning the object.
- **Threshold correctly adjusted:** a correctly adjusted threshold results in a well-defined line, with minimal loss of points. This value enables the desired points of the object to be captured.
- **Threshold too high:** a threshold over the ideal results in a discontinuous line of points, which causes a loss of points in the final model.

Open

This parameter is part of an algorithm that filters noise by fading out the isolated points and joining the points which are close together. It should be used together with the Threshold for improved noise elimination. This parameter can be set from 1 to 10, with 1 being the value that filters the signal the least and 10 being the value that filters it the most. Increasing the **Open** value will also reduce the detail and the number of points scanned, which is why the recommended values are 2 or 3. Similarly with the **Threshold**, the best thing to do in this case is to make “a live” adjustment, as explained earlier



With Open



Without Open (10)

- **Without Open:** the appearance of noise can be observed (grey lines which are not from the laser) on the scanning.
- **With Open (10):** the **Open** algorithm fades out the points captured and the reduction in noise and in the amount of points captured can be observed.

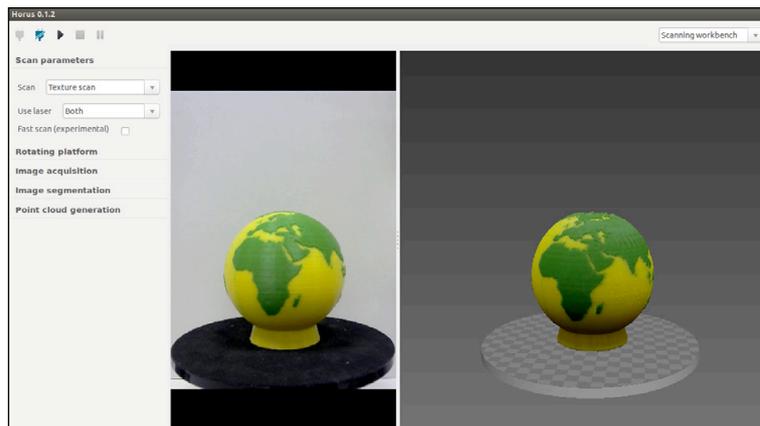
Scanner calibration

A good quality calibration is required to obtain optimum results. If unsuitable results are repeatedly obtained, regardless of the nature of the object, the camera configuration or the environmental conditions, you will need to review the scanner calibration. More specifically, you will need to review the pattern settings and the calibrations of the *Laser triangulation* and *Platform extrinsics*.

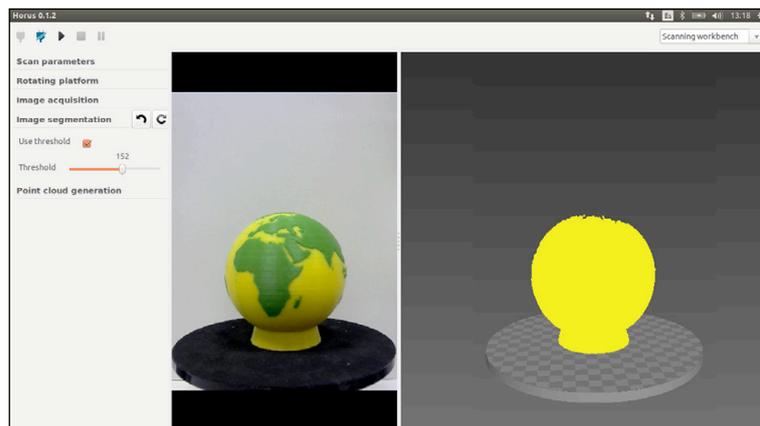
Scanning results

Once the program has finished scanning an object, a window will appear to advise that it has finished. You can see the point cloud generated from the scanning in the 3D viewfinder. If you selected the option to scan with texture, the point cloud will reflect the colours of the object. If, on the other hand, you selected the option to scan without texture, the point cloud will reflect the colours that you selected earlier. The point cloud generated from the scanning can be processed with reconstruction software in order to obtain a 3D model with faces.

Scanning with texture



Scanning without texture





For more information, please contact:
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