



# IT3D SCAN

Setup and calibration

# ONE



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# 1. Introduction

Thank you for choosing IT3D SCAN ONE 3D scanner!

Please read this manual before using IT3D SCAN ONE 3D scanner. Here are described the procedures for preparing the scanner, installing the required drivers, calibration procedure, scanning procedure, and tips for acquiring high-quality three-dimensional object model.

Information may be amended from time to time. These changes will be inserted into the new versions of the manual, or in the additional documents and publications.

## Description and instructions

The IT3D SCAN ONE is an optical 3D scanner with structured light technology. It connects to a computer via 3.0 USB and HDMI. It requires no external power supply and features 2MP colour cameras. It includes an automatic turntable, and the protective hard road case makes it easy to transport. It is intended to scan objects between 3 cm and 120 cm using 3D scanning. It can be used in educational, industrial, scientific or cultural environments.

Throughout the manual you will find texts framed in **blue** and **orange** squares. They correspond to warnings, precautions and solutions to problems that may arise.

- For safe and proper use of this product, be sure to read and fully understand the instructions contained in this manual.
- Keep the manual with you for convenient reference.
- Keep the manual in a proper manner and avoid any loss.
- If you need any other information, please contact our specialists.

## Technical specifications

Model	ONE
Weight Protective Case	4.8 kg / 10.6 lb
Dimensions Protective Case	410 x 330 x 170 mm
Camera resolution	2 Mpix
Diagonal of the matrix	1/3"
Texture scanning	Yes
FOV	200 x 150 x 150 mm
3D point accuracy	0.05 mm
3D resolution	0.13 mm
Working distance	30 cm

## System requirements

- Operating system - Windows 7/8/10 64bit.
- Processor - Intel Core i3/i5 1.8 GHz and better.
- Graphics card with HDMI output.
- RAM - Not less than 8 GB.
- 2 USB-ports.

### WARNING!

- Do not expose the scanner to liquids.
- Do not use liquid cleaners or aerosol cleaners.
- Do not store or use the scanner in dusty or humid environments.
- Do not expose the scanner and its components to contamination, shock or drops.
- Do not connect power to a faulty wall outlet.
- Do not aim the scanner at people and animals in order to avoid directing the bright projectors light at the eyes.
- Patterns and holes are provided for ventilation of the scanner to ensure its reliable operation and to prevent overheating. Do not block or cover the openings.

## 2. Preparing for work

### Package contents

IT3D SCAN ONE 3D scanner is supplied in a protective hard road case.

FOV is represented by a calibration plate and a stand for the calibration plate, which are used to calibrate the scanner.



N°	NAME	QTY.
	Scanning module:	
1	Mounting structure with projector	1
	Cable kit for PC connection (USB + HDMI)	1
2	Tripod	1
3	Calibration plate	2
4	Stand for the calibration plate	1
5	Turntable	1
6	Power adapter for the turntable	1
7	USB cable for the turntable	1
8	USB with software, information material and additional content	1

## Software and Drivers

Open the USB included in the IT3D SCAN ONE case and access the folder [03. Instalación - Installation IT3D SCAN ONE](#) and run the file [IT3D Everscan Studio setup 2023.1.2.exe](#), to install the software and the drivers for the cameras, licence and turntable.

Once finished, we will start the IT3D Everscan Studio software. The software will start with the image below, and will be ready to be used.



## Setting up your computer for work

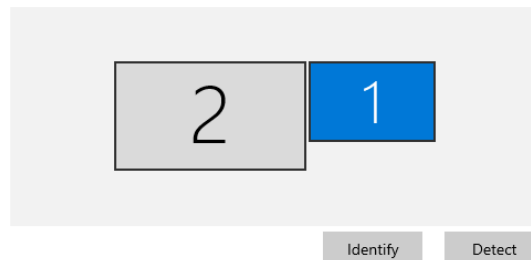
For the correct operation of IT3D SCAN ONE 3D scanner you will need to setup your computer. This procedure is performed once before the first use of the scanner.

### Connecting projector

First, connect the USB cable to power up the projector and then connect it to the HDMI-port of your video card. After connecting the projector, it should be displayed in the system. If the computer has several video outputs, define the one to be used.

If the second monitor (projector) is not defined by the system, check the cable connections and restart the computer. Also, try to connect the cable to your computer when the projector is on, if it was off earlier.

1. Right click on the desktop, select [Screen resolution](#).
2. Make sure that the projector has been successfully recognized by the system and that both connected screens are displayed.



#### Multiple displays

Multiple displays

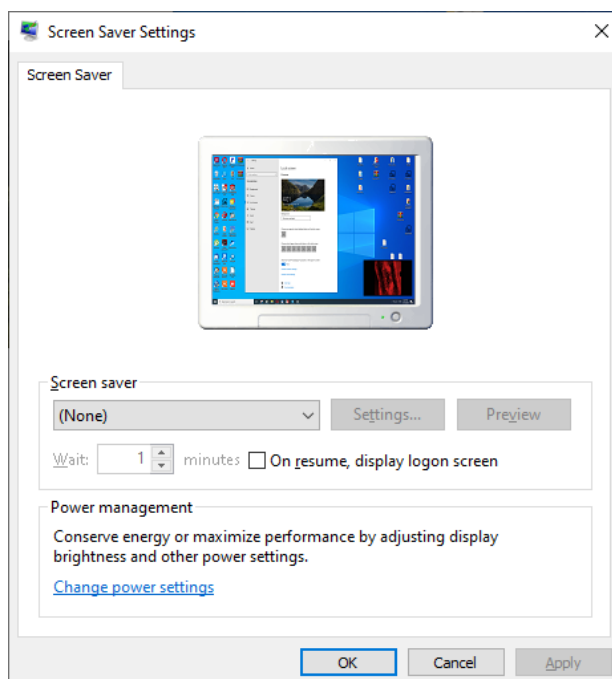
Extend these displays

Make this my main display

## Configuring computer parameters

To avoid a recurrence of the problems during the scanner operation, you must turn off the screensaver and sleep mode.

Go to [Screen Saver Settings](#) menu and turn off the screen saver, disable turning off the display and putting the computer in sleep mode.



#### Change settings for the plan: Balanced

Choose the sleep and display settings that you want your computer to use.

Turn off the display: Never

Put the computer to sleep: Never

[Change advanced power settings](#)

[Restore default settings for this plan](#)

## Scanner assembly

1. Install the scanning module onto the tripod.
2. Connect USB cable to your PC.
3. Connect HDMI cable to your PC.
4. When using the turntable, connect it to the power source, then connect the USB cable to your PC.



## Tips for setting up the 3D scanner

In this section, in order of sequence, the steps for optimally setting the 3D scanning parameters are presented.

When selecting operating parameters, it is necessary to take into account the individual performance of the PC; for adjustment, you need to connect a scanner and perform preliminary focusing of the optics and calibration.

Some software settings that are suitable for one PC may not be optimal for another, limiting scanning speed or negatively affecting data quality, so it is recommended to select individual settings for each PC.

It is especially important to save the selected scan settings in case of a quick recovery after an emergency reset of all settings or a change in work profile.

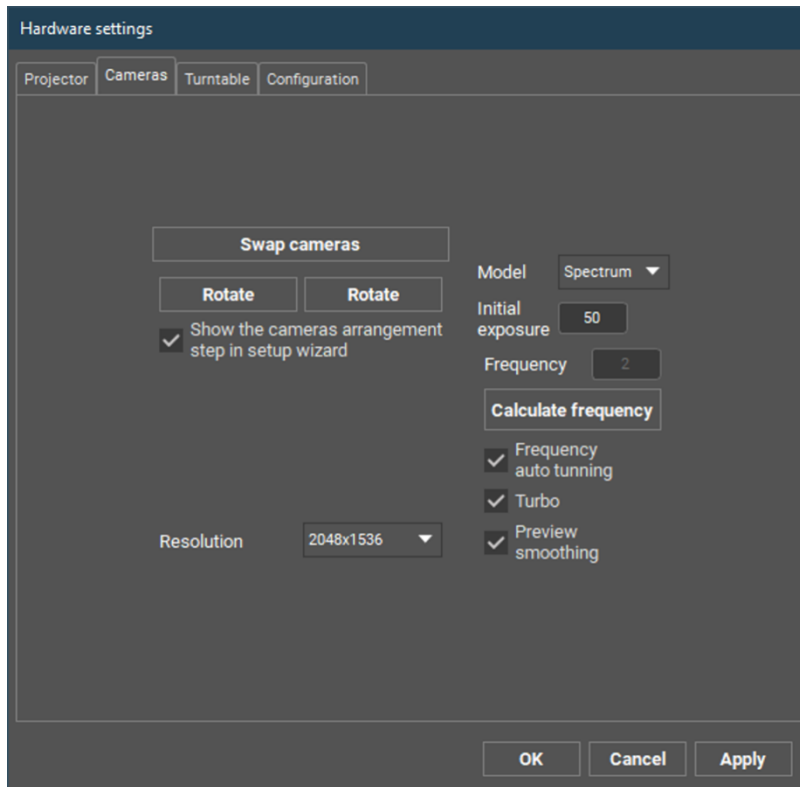
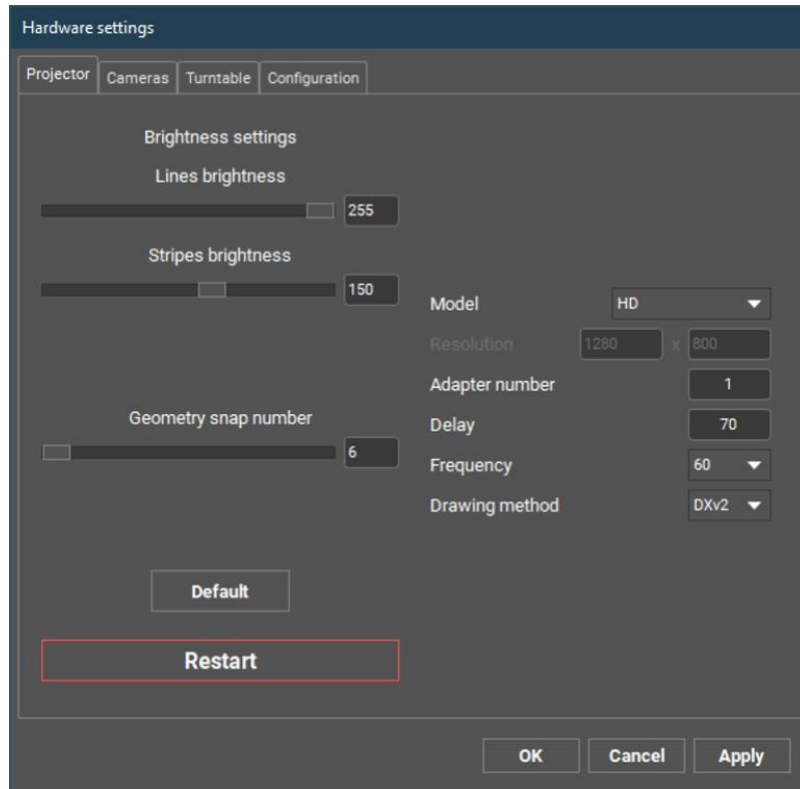
### **WARNING!**

To restore previously selected user settings, it is recommended to write out especially important ones before updating the software and after updating, replace the default ones with the ones written out.



Note: In the future, it is planned to implement saving user settings to a file and loading from a file.

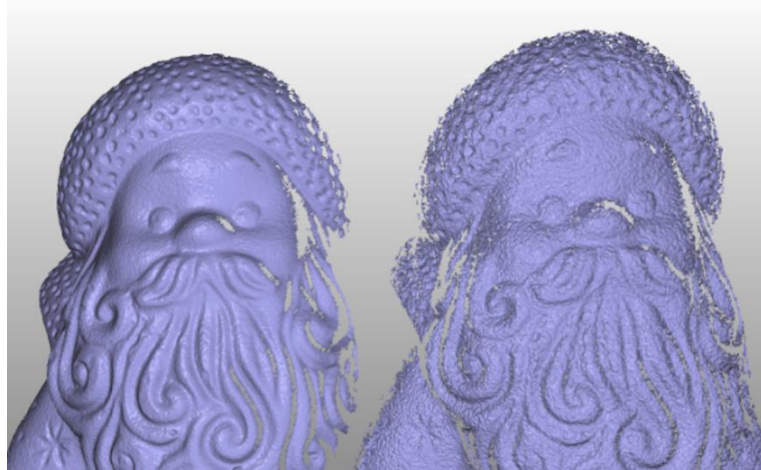
The quality and speed of obtaining scans are significantly affected by the software settings of the projector and cameras located in the “Hardware Settings” and on the “Scanning” widget:



- **Lines/Stripes brightness settings:** allows you to adjust the brightness of the projector backlight depending on the color and degree of illumination of the scanned object.

The setting affects the quality of the scan, because if the lines and stripes are not bright enough, then the scans may lack geometry, noise or small holes.

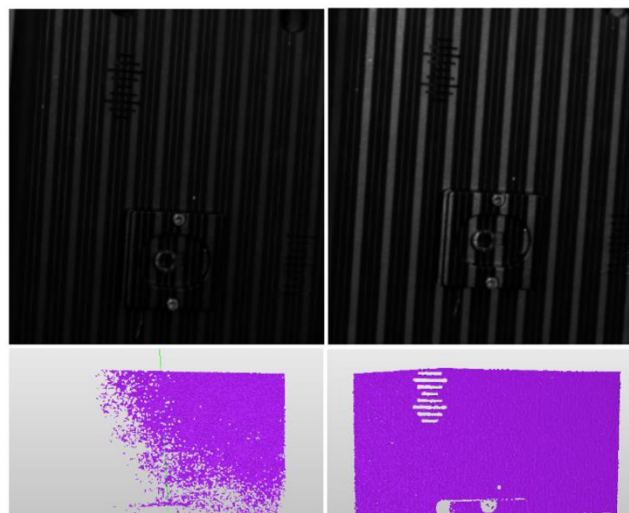
It is not recommended to reduce the brightness of the lines (default 255) as this reduces the contrast between lines and stripes, which increases the noise of scans.



Example 1. The effect of reducing the brightness of the lines on the left 255 and on the right 150.

If the surface of the scanned object has several different colors, then it is recommended to individually correct the brightness of the stripes to scan the surface of each color or matting the surface in one color.

For black surfaces, it is recommended to increase the brightness of the Stripes to get more data.

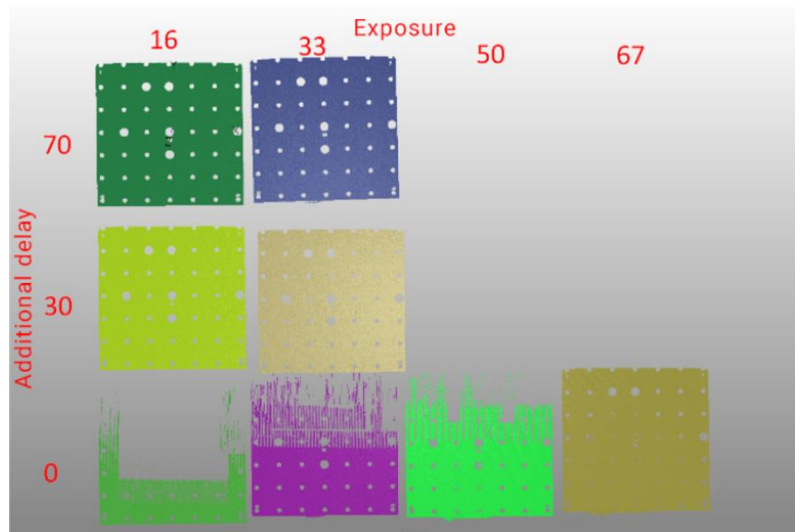


Example 2. Influence of the brightness of the stripes on the scanning of a black surface. On the left - Poor stripe brightness settings (brightness 150, exposure 50ms. On the right - Good stripe brightness settings (brightness 255, exposure 50ms.

- **Delay:** the amount of time it takes for the projector lights to change during scanning, measured in milliseconds.

Increasing the delay helps in cases where the speed of the cameras is reduced and they do not have time to capture the frame before changing the light, as a result of which artifacts appear on the surface of the scans in the form of torn borders or vertical holes.

The setting affects the quality and time of obtaining a scan, depends on the speed of the cameras and the available data transfer rate on the PC.



Example 3. Dependence of additional delays 0 - 30 - 70 ms for the appearance of artifacts.

The absence of delay in this example demonstrates the appearance of artifacts.

It is recommended to gradually increase the delay with a minimum shutter speed of 16 ms and make several scans, if artifacts are no longer observed, then the delay is chosen correctly.

- **Cameras Exposure:** an electronic parameter that regulates the brightness of the image from the cameras through the driver.

Increasing the electronic shutter speed increases the scan time.

Increasing the shutter speed is useful for scanning black surfaces or in low light conditions.

If you have no skills or have difficulties with selecting the shutter speed parameter, you can use the automatic shutter speed calculation function by following the interface prompts.

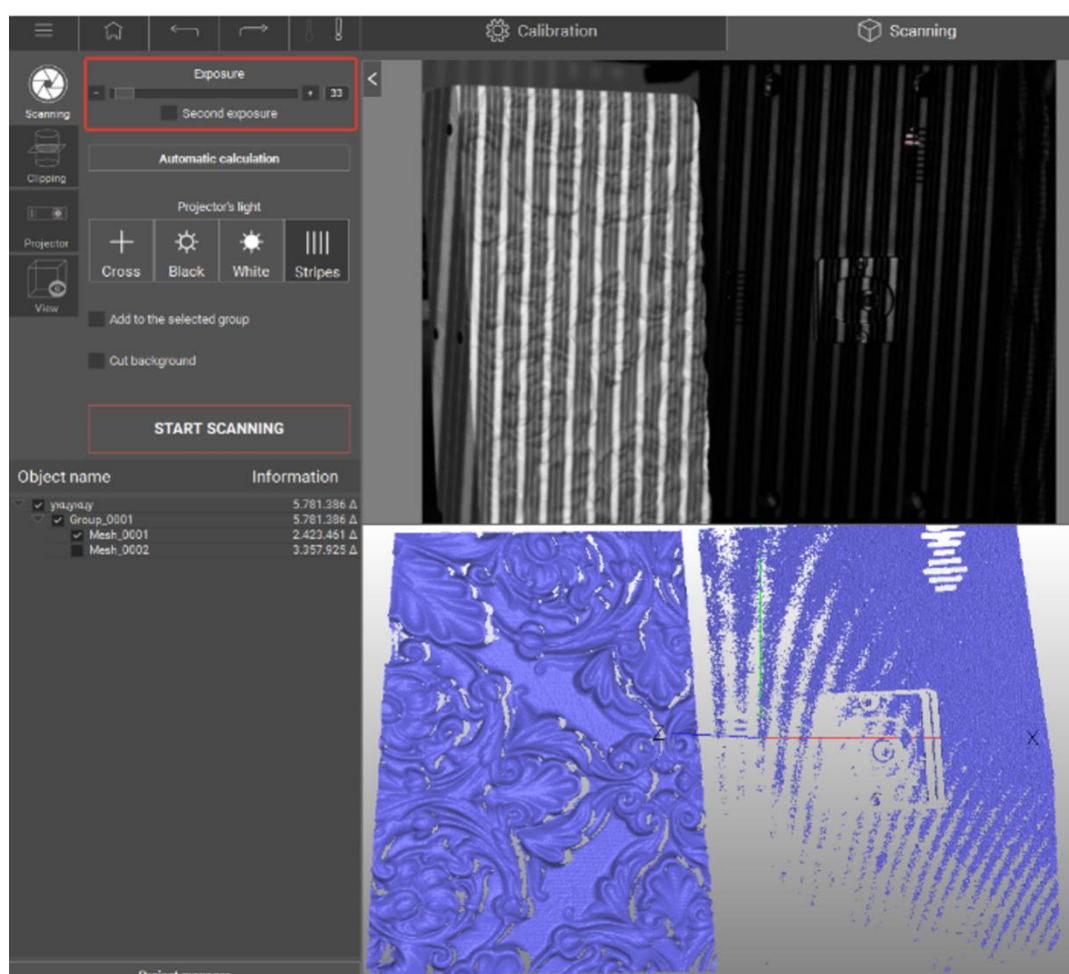
If there are black and white surfaces on the scanned object at the same time, it is recommended to turn on the "Second Exposure" option.

If you scan in the single exposure mode, then it is almost impossible to select one optimal exposure for two contrasting colors.

As a result, there may be an excess of brightness on the surface of one color or a deficiency on the surface of the second, which will reduce the amount of data.

In this case, it is recommended to adjust the first shutter speed on a white surface, the second - on a black one.

When setting the second shutter speed on a dark surface, pay no attention on the overbrightened areas. Light surfaces were captured with the first exposure. Using the "Second Exposure" option saves time!

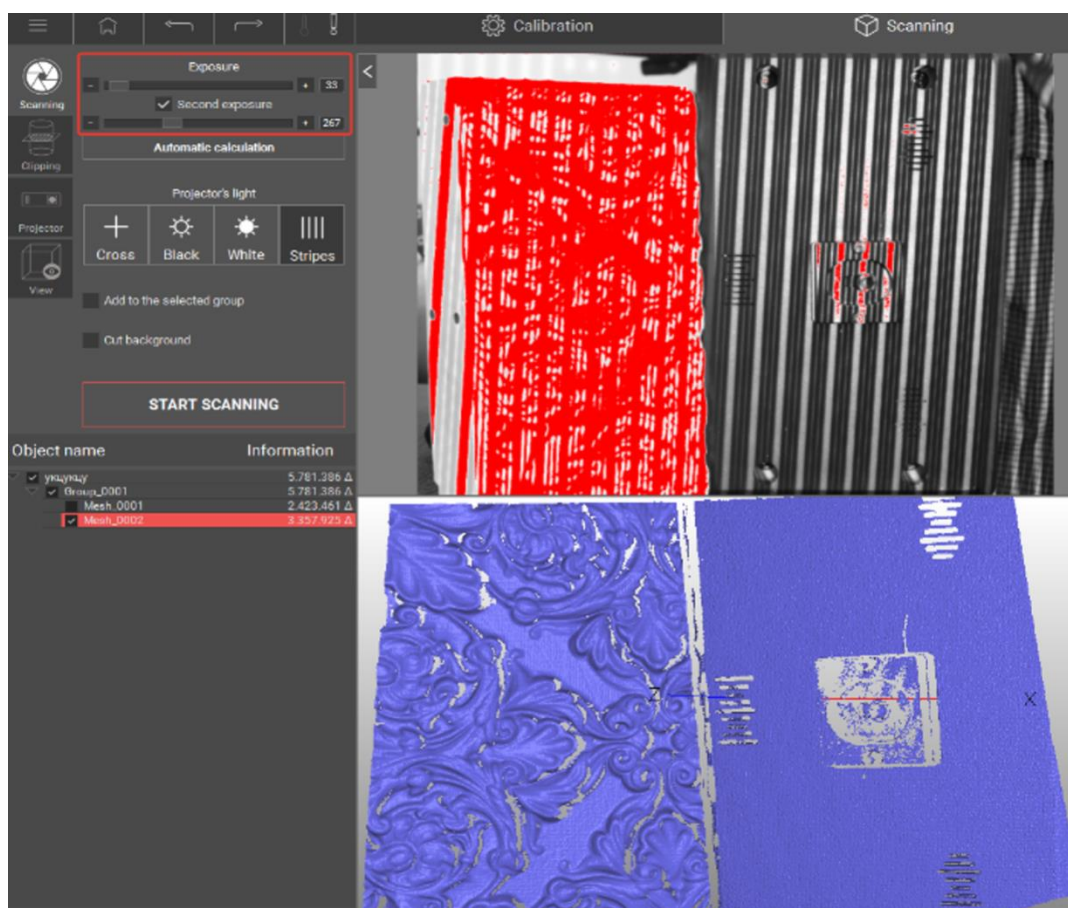


Example 4. Not optimal scanning of a contrasting object with one exposure.

The result - less data on a dark surface, because exposure = 33 ms is optimal for white.

You can set the shutter speed to a dark surface, but then there will be overbrightened areas on a white surface and its scanning quality will decrease.

A solution to the problem is to turn on the second exposure mode.



Example 5. Optimal scanning of a contrasting object with double exposure.

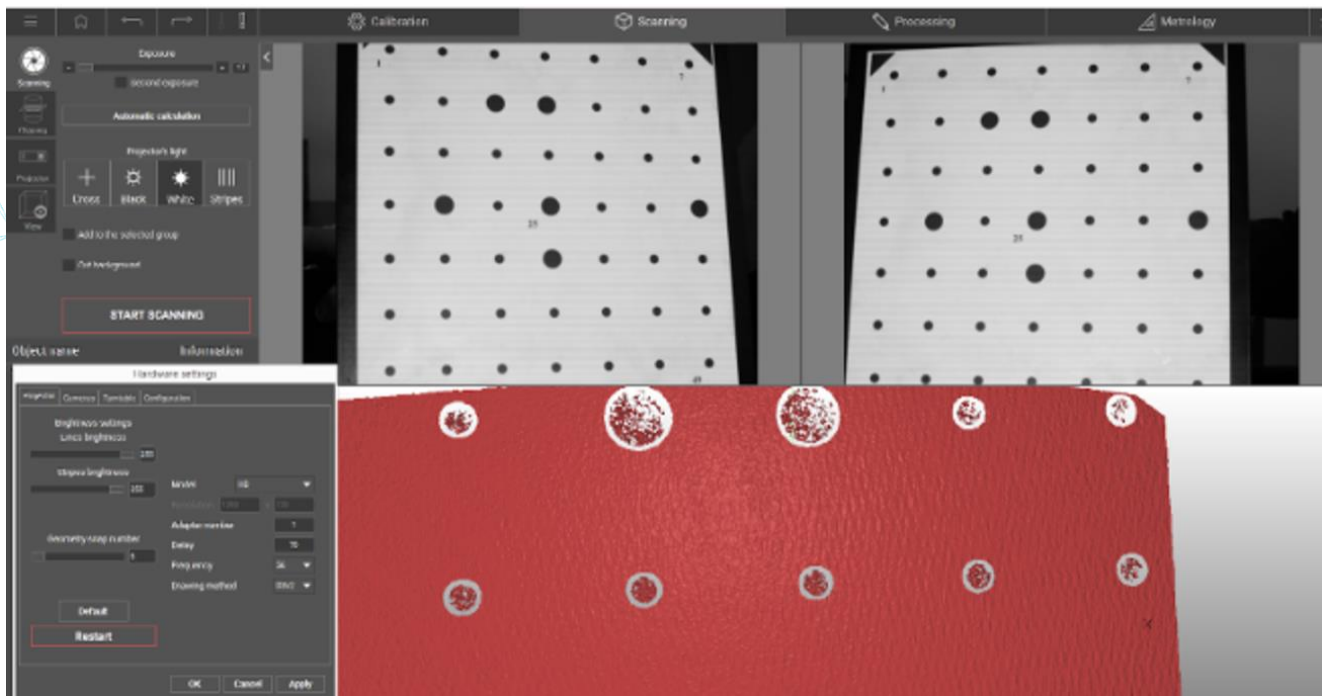
The result is a lot of data on both surfaces, because exposure= 33 ms is optimal for white, and 267 ms for dark.

The time to complete a scan in double exposure mode is longer than in single exposure mode, but the better data quality, saving PC resources by reducing the number of scans, and not having to scan each surface at a separate exposure compensates for the wait.

- The projector's frequency is an electronic parameter measured in Hz that affects the quality of the scan.

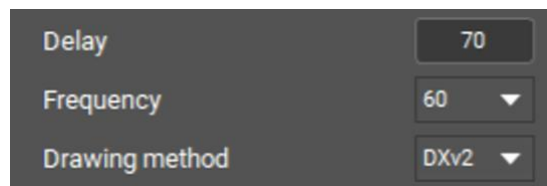
If horizontal stripes are observed on the images from the cameras, this means that the update rate of the projector and cameras is critically out of sync.

In the case of work with desynchronization, artifacts in the form of stripes will be observed on the scanning surface.



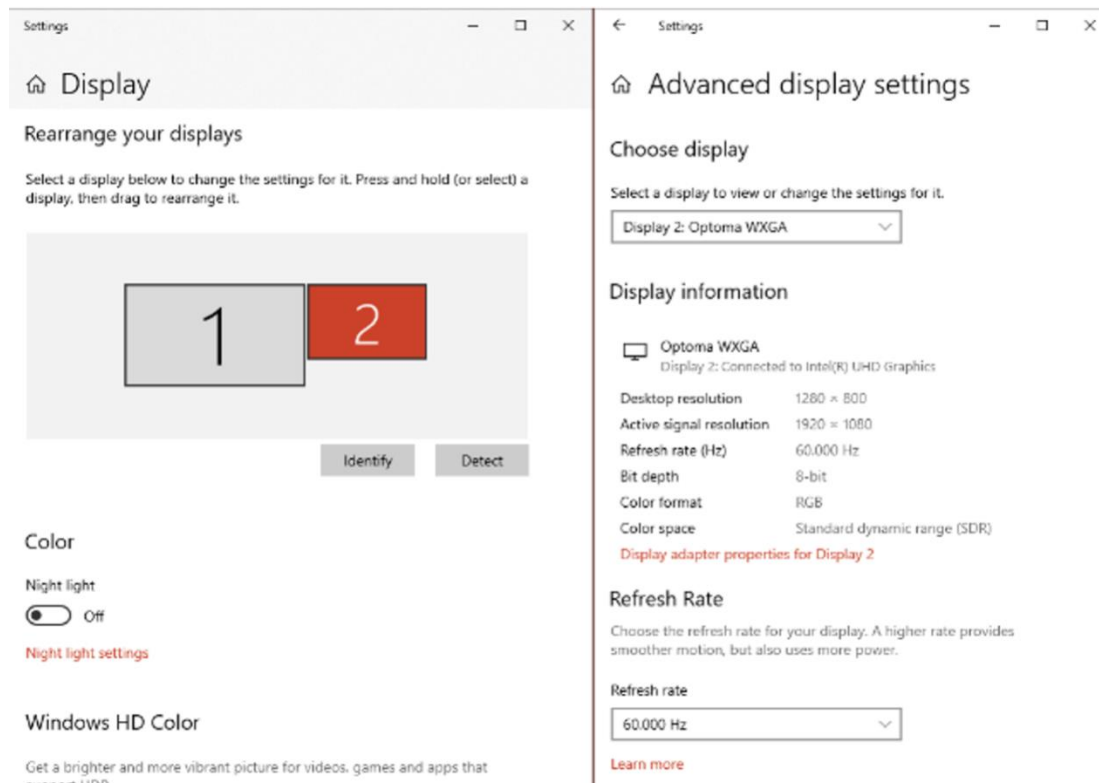
Example 6. Artifacts caused by cameras and projector out of sync.

To eliminate the desynchronization, it is necessary to select from the list the optimal frequency at which there will be no horizontal lines in the views from the cameras.



In most cases, 60Hz is the optimal projector frequency.

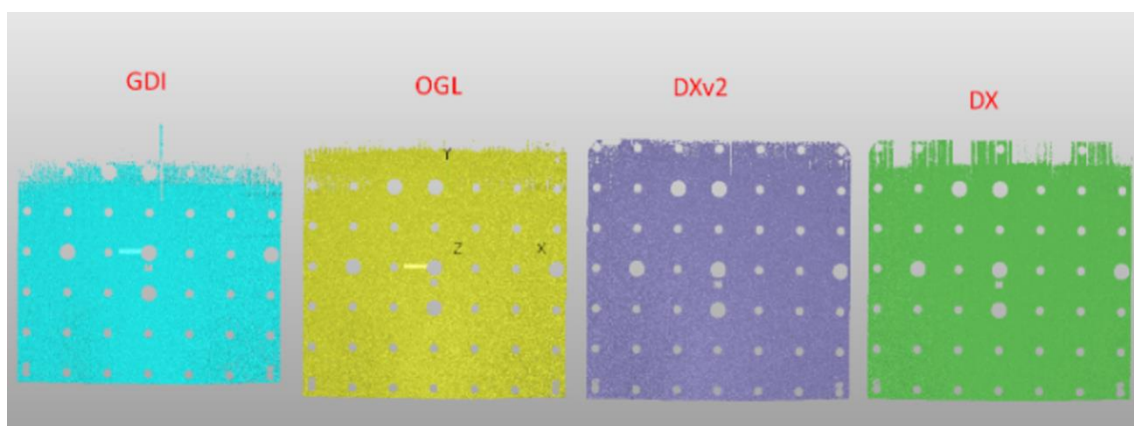
It is recommended to set the program frequency in the system settings for the projector.



- **Drawing method** is the choice of the method of displaying the image on the projector.

Changing the method helps in cases when the proportions of the light are broken or distorted, or the light is changing incorrectly.

Rendering methods differ in the performance and quality of scans, so it is important to choose the best one for your PC.



Example 7. The effect of changing the drawing method on the quality of scans with the same projector delay.

### 3. Calibrating the scanner

You need to perform [calibration](#) in order to ensure the work of the scanner after the adjustment of lenses. Specifically for this purpose we use the calibration plate, which is pre-measured with high accuracy. Scanning software analyses the image of the plate, obtained from the cameras and compares it with the mathematical model, marked by the algorithm.

There are 3 types of calibration: [Full calibration](#), [automatic calibration](#), [fast calibration \(orientation\)](#) and [Calibration of turntable \(finding the table axis\)](#).

Full and automatic calibrations are used:

- before work with the scanner.
- after transporting the scanner.

Fast calibration is used:

- if you suspect that the camera moved due to unreliable mounting.
- if you want to check the accuracy of performed calibration.

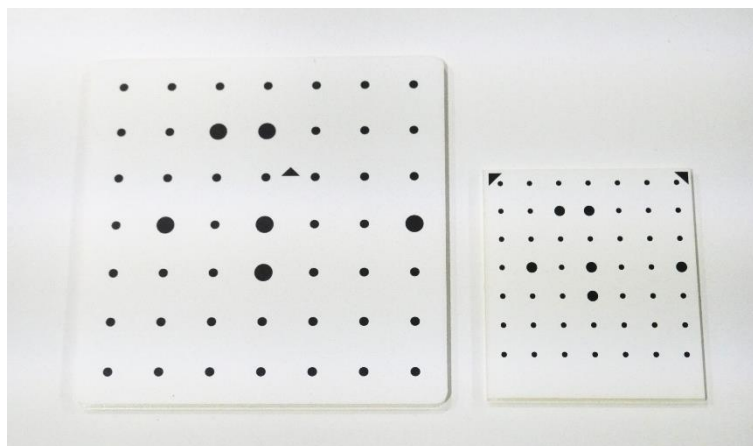
Calibration of rotary table is performed:

- in case of any change in the position of the rotary table to the scanner (when scanning on the turntable).

Calibration of rotary table is described in the [Scanning on the turntable](#) section.

## Calibration plate

Calibration plate is a special plate with markers, the distance between which is measured with high accuracy. It is used for setting up a scanner and its calibration.





# Full Calibration

Calibration should be performed in the same light, in which an object will be scanned. If there is too much change of level in lighting conditions it is necessary to recalibrate the system. It is not allowed to carry the calibration procedure on direct sunlight.

The full calibration dialogue can be accessed from [Calibration](#) → [Calibrate](#) menu.

Calibration procedure:

1. In the drop-down list choose the correct calibration plate size, specified on the back side of the plate, or add a new one.

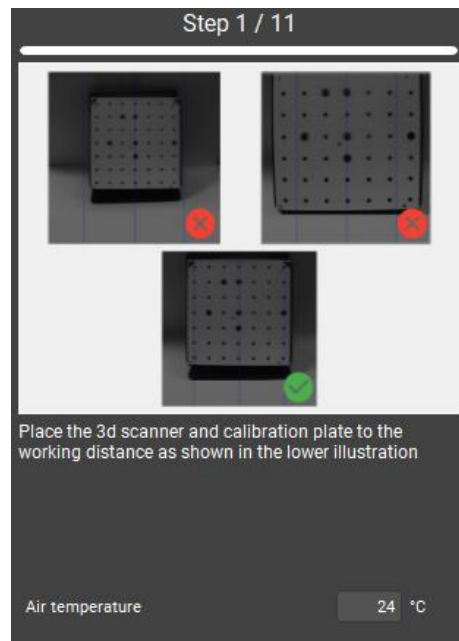
## WARNING!

Make sure that the plate size specified in the software matches the actual plate size written on its back side. Incorrect size may cause errors and geometric distortions on meshes.

It is possible that camera images in the software will be swapped or flipped from the start. In this case, go to [Hardware settings](#) → [Cameras](#) menu and use [Rotate](#) and [Swap](#) cameras buttons to set the images in proper positions.

Camera image interpolation can be turned on and off in [Hardware settings](#) → [Cameras](#) using [Preview smoothing](#) option. In some cases interpolation can make it easier to determine if the image is sharp or not.

2. In accordance with the text prompt and symbol image install the calibration plate in the desired position. The brightness of the images of calibration plate can be adjusted with [exposure](#) slider. You should not allow very dark images or images with excessive brightness areas. Press the [Capture](#) button. Original plate position - the position at the working distance from the scanner (marking on the view from cameras matches the markers on the plate), the cross is projected on the central marker.
3. If the plate placement is incorrect, an error message will appear. Correct the placement and repeat the step.



In case if not all marks are found on the image, you will also see the error message. It may mean the following:

- Not all markers are visible on one of the snapshots.
- Not all markers are lit by the projector.
- Calibration plate is placed at large angle to the scanner.
- Plate is too close or too far from the scanner - the image is not sharp.
- The plate is damaged or dirty.

Correct all deficiencies and press [Capture](#).

Calibration is carried out by the results of 11 snapshots. Carefully observe the position of the plate during each capture! In some positions it will be necessary to switch the bottom side of the plate.

After all the necessary snapshots are taken, wait for the result of calibration procedure. From now on the resulting accuracy of calibration will be specified on the home screen [in pixels](#). A good result is accuracy **no worse (not higher) than 0.2 pix**. If you get a higher result, repeat the calibration, carefully checking the plates position and brightness. If it is necessary, repeat calibration without blue light and filters.

## WARNING!

Calibration result in pixels is not equal to scanner accuracy in millimetres!

### Some advice on calibration:

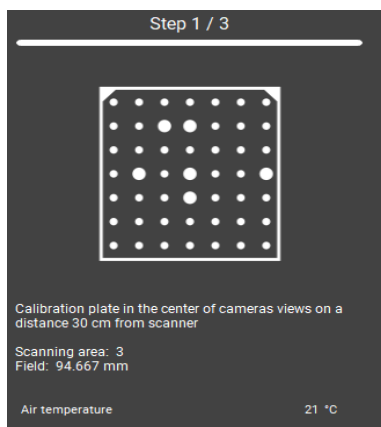
- Do not change the distance from the center of the plate to the scanner when turning the plate. The exception are only snapshots in positions 10 and 11.
- Do not rotate the plate at a very high angle. Ensure that all marks on the plate are visible from both cameras, when you turn the table.
- Be careful with calibration plates! It is not permitted to contaminate or perform any mechanical damage to the surface with the marks. After the use store the plates in designated case.
- Before the calibration procedure ensure that cameras and cables are secure in the designated position.

## Fast calibration (orientation)

### WARNING!

When scanning large objects and moving the scanner frequently, the scanner eventually may report that it cannot find markers. In such case you need to perform fast calibration.

Orientation is carried out by the results of 3 snapshots. Orientation is done with the same conditions as the last calibration. The corresponding controls in the dialog are disabled.



The orientation can be started from the [Calibration window](#) on the [Start screen](#).

- Place the calibration plate at the working distance to the scanner (the first calibration position).
- Press the Capture button.
- Following the steps, make two more shots.
- After this, the accuracy of orientation will be shown. It should be approximately equal to the accuracy value of the last calibration.

If the accuracy during orienting starts to be very different from the original one, you need to re-calibrate the equipment.

Example: The initial accuracy is 0.084, accuracy after orientation is 0.25. The value exceeded 0.2, re-calibration is required.

**WARNING!**

After calibration or orientation, the calibration plate should be removed in order to avoid the damage or contamination!

## Automatic calibration

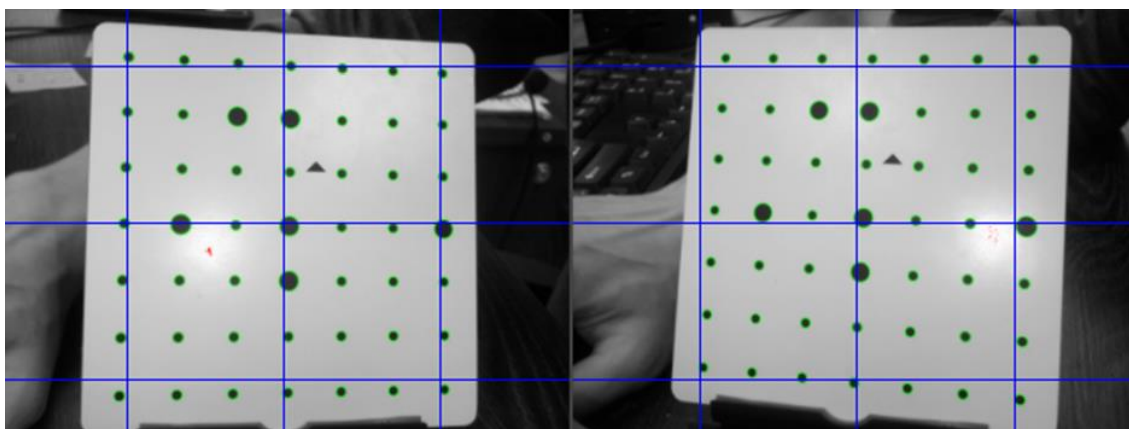
The automatic calibration can be started from the [Calibration window](#) on the [Start screen](#), but it is only accessible when turntable is connected and recognized by the software.

Automatic calibration serves the same purpose as full calibration, but it is easier to perform, because it uses turntable to shift the calibration plate between positions.

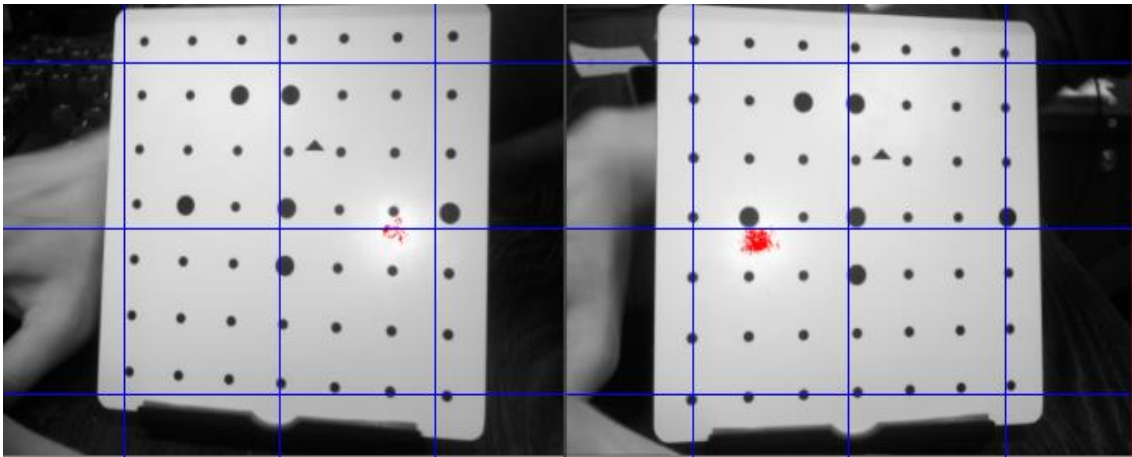
## Tips for calibration and scanning

### Calibration tips for the IT3D SCAN ONE

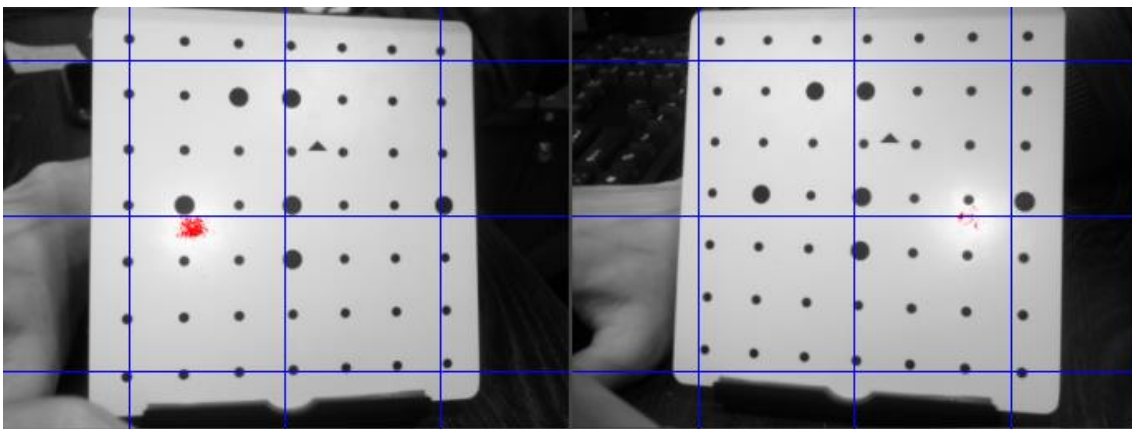
- The [calibration plate](#) must be located at the working distance (vertical blue lines intersect the vertical rows of dots). The intersection of lines and rows of dots does not have to be perfect. When setting the field to the working distance, it is enough to focus on the image from one camera.



- It is important to make sure that the [cameras](#) are not reversed (swapped). The image in the view from the right camera corresponds to the right camera. You can check this by covering the camera with your hand. A sign that the location of the cameras in the program is correct can be the image of the field in the camera views: if the location is correct, the field planes will face each other in the camera views (refer to images below).

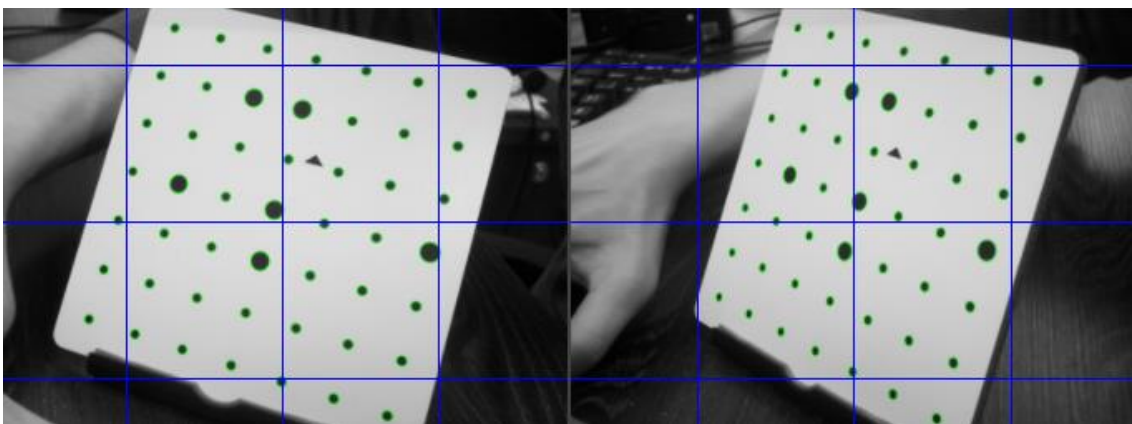


Wrong: Cameras are swapped (image from left camera is on the right on the screen).

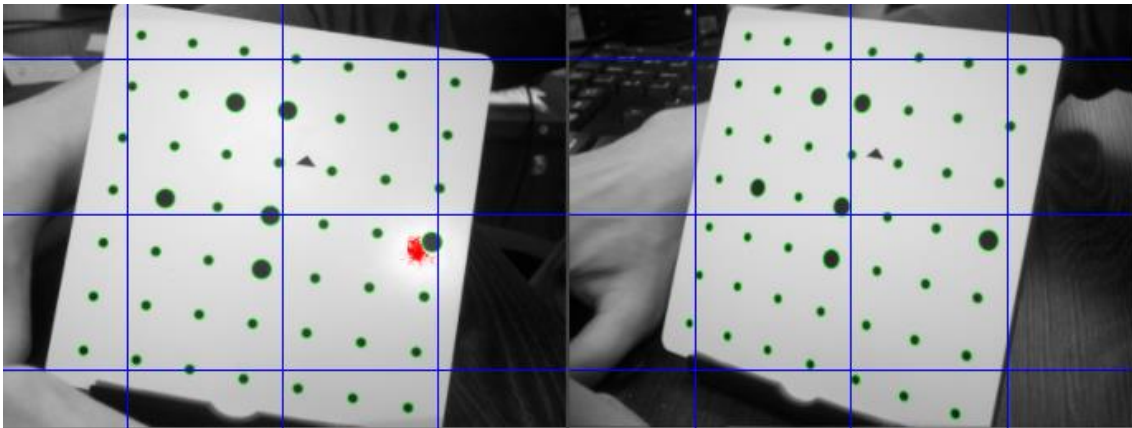


Correct: Cameras are not swapped (image from the left camera is on the left and image from the right camera is on the right).

- For IT3D SCAN ONE scanner, it is permissible to disable focus evaluation or raise the evaluation threshold (Program settings - "Advanced" tab).
- **Angles of rotation** of the calibration plate on steps 2 and 3 should not be too large.

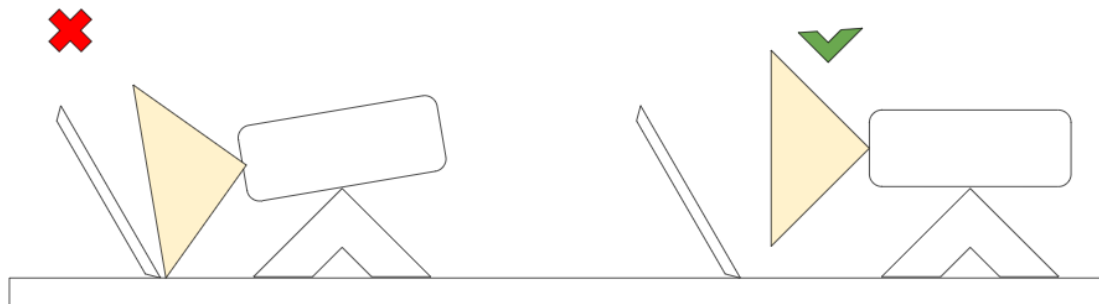


Wrong: The field rotation angle is too large.

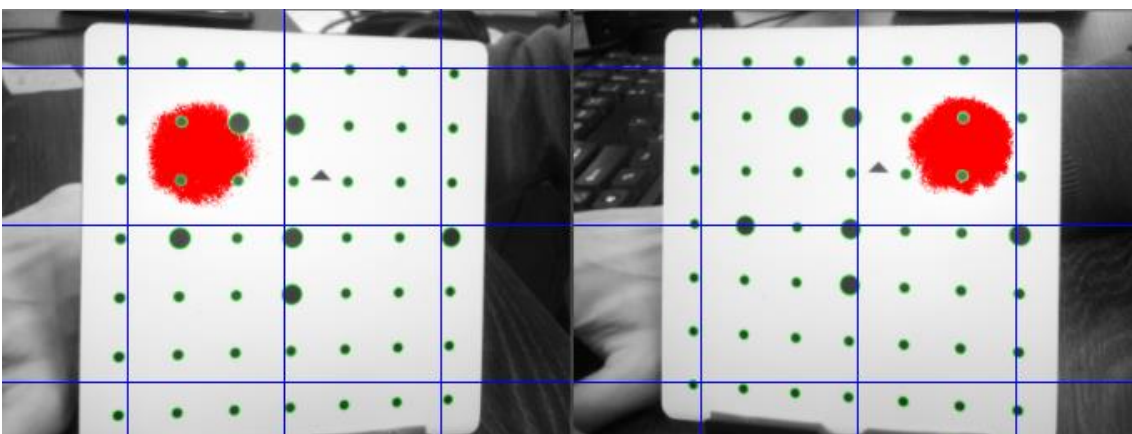


Correct: The angle of rotation of the field is sufficient.

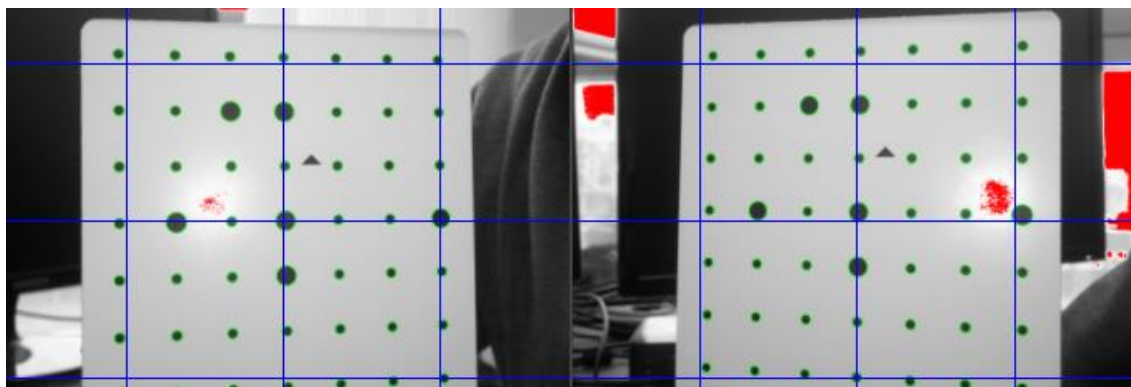
- If excessive light (red) appears on the view of the calibration plate and interferes with the correct recognition of targets on the plate, then it must be minimized by changing the **angle of inclination**. Most often, setting the angle of inclination of the scanning module parallel to the plane of the table helps:



- Minimizing the influence of **external lighting** may also help to minimize glare: you may need to turn off the fluorescent lamp above the calibration area or close the blinds on the window.



Glare on the field is bad.

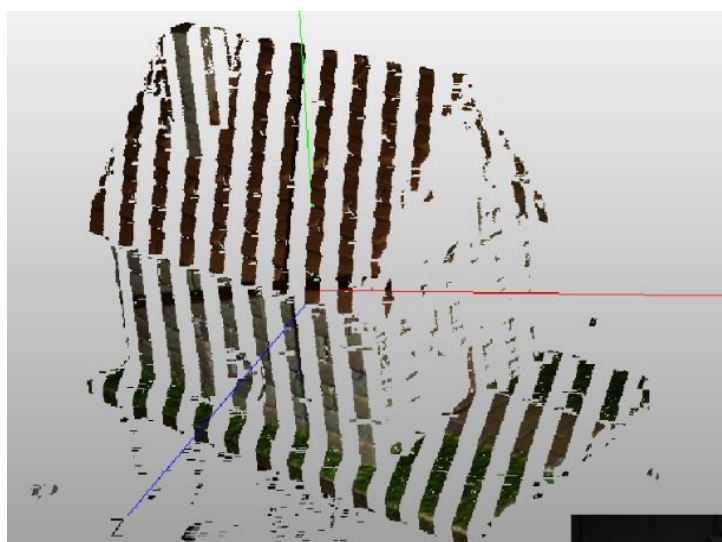


Acceptable glare.

- If targets on the **calibration plate** are difficult to recognize by the software, increasing the electronic exposure may help.
- In the case of automatic calibration using a **rotary table**, it is important to ensure that during the calibration process the table platform rotates and the field changes its position relative to the cameras. If the rotary table is defined correctly, but the table platform does not rotate, you should check the external power connection to the table.

### Consejos para la digitalización con IT3D SCAN ONE

- If, during scanning, the resulting **geometry** looks scattered, **with a large number of gaps**, then you may need to increase the projector delay (Hardware settings - projector tab) or reduce the camera frequency (Hardware settings - camera tab, auto-frequency detection will need to be turned off).

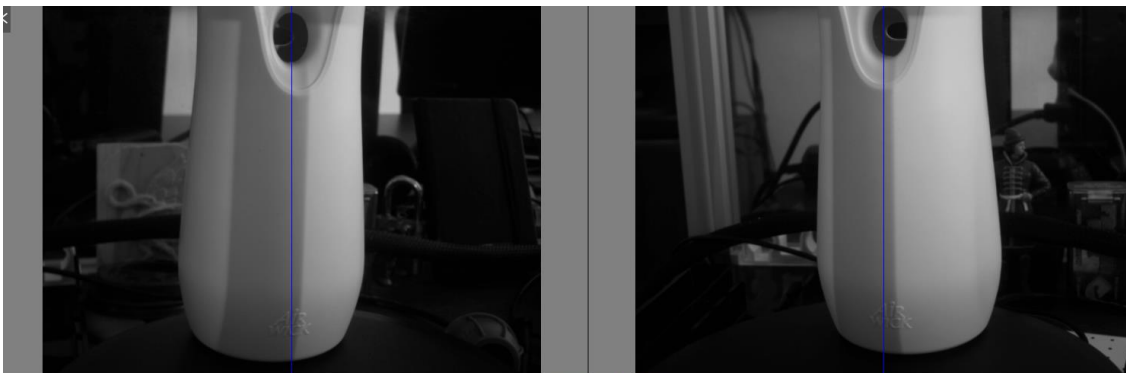


Ejemplo de escaneo 3D con desincronización.

- The projector's peak **brightness** is limited and ambient lighting may affect results. If the backlight from the projector does not have sufficient contrast, the scanning result may be unsatisfactory.
- To increase the **contrast** of the backlight, you may need to change the ambient lighting conditions (turn off lightning, close windows) or increase the projector brightness (Hardware Settings - Projector tab - Bar brightness (default 150)).



An example of strong external lighting - the backlight is not contrasting.



External lighting conditions have been improved (the nearest lamp is turned off) - the backlight is more contrasting.

- If, when scanning starts, the % in the scanning status bar increases, but the backlight does not change (the pattern of the projected stripes does not change), then the projector will need to be restarted (Hardware setup - projector tab - restart, or the restart button on the projector widget).



## 4. Maintenance and storage

### Maintenance

1. Remove any stains with a **soft, dry cloth**.
2. Wipe dirt from the body, tripod, platform and plates with a soft cloth, use a cotton swab or a soft cloth stained with alcohol and gently wipe the camera lenses.
3. Do not wash with water or detergent containing abrasive or benzene.
4. Do not immerse in liquids.

### Storage

The device must not be stored or used in excessively high or low temperatures or humidity, in sunlight or in dusty places. Otherwise, inaccuracies in scanning and even total disabling of the equipment may occur. Transport Preferences: Fragile contents. Keep upright. Protect from rain and moisture.



### WEEE Statement

Do not dispose of electronic products as unsorted municipal waste, use separate collection facilities. Contact your local government for information on available collection systems. If electrical appliances are disposed of in landfills or drums, hazardous substances can leach into the groundwater and enter the food chain, damaging your health and well-being.



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### Warranty

A one-year warranty is available from the date of purchase, excluding the user-caused failures listed below:

1. Failure resulted in unauthorised disassembly and modification.
2. Failure resulted in an unexpected drop during application or transportation.
3. The failure resulted in operation away from the proper instructions in the User's Manual.

Model: ONE. Optical 3D scanner. Made in China. Fabricated for International Technology 3D Printers, S.L. Input: 5V. Production year: 2023. According to 2014/30/EU Directive, the IT3D SCAN ONE is CE marked. Certification no: CTE22111100301. According to ROHS 2011/65/EU and 2015/863/EU Directive, complies with ROHS certificate. Certification no: CTE22111100401.



# IT3D

G R O U P

International Technology 3D Printers, S.L.  
ESB97179311  
Pol. La Foia C/ Proyecto 10, Nave 18, 46510 Quartell,  
Valencia (España)  
[www.it3d.com](http://www.it3d.com)  
[info@it3d.com](mailto:info@it3d.com)  
(+34) 961 18 83 30

Original Manual IT3D SCAN ONE