

Integration of an LMI Gocator 3D camera

Version 1.3

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Summary: This document describes the installation and integration procedure of an LMI Gocator 3D camera into NeuroCheck 6.2 over the GenICamTL driver for 3D cameras

Notes: This document is not part of the official product documentation of the NeuroCheck software.

Gocator is a registered trademark of LMI Technologies Inc.

Revision history

Version	Date	Description	Modified by
1.0	05.07.2024	First version	LO
1.1	09.09.2024	Multi-layer acquisition	LO
1.2	21.11.2024	Fixes	LO, PW
1.3	30.10.2025	Included notes on GoPXL v1.2.30.56	LO

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1. Introduction

1.1. Prerequisites

This document presents the basic information on installation and integration procedure for the LMI Gocator 3D camera in NeuroCheck over the NeuroCheck GenICamTL driver for 3D cameras. The user should follow the provided steps to correctly install, connect, configure, acquire and transfer images from the sensor.

This document primarily covers the integration of Gocator Snapshot (3000 Series) and Gocator Profile (2000 Series) sensors with the Gocator firmware versions 6.0 - 6.4 installed. Alternatively the GoPxL firmware starting from version 1.1.11.1 can also be used.

Experimental support for Gocator Confocal Sensors (4000 and 5000 Series) with GoPxL firmware is also enabled.

The user who follows this manual should already be familiar with:

- NeuroCheck 6.2
- NeuroCheck GenICamTL driver for 3D cameras
- Basic 3D data processing (depth images, XYZ images, 3D objects)
- Ethernet network adapter configuration, IP configuration

1.2. Tested setup

The described installation and integration procedure was performed on the following system:

- PC:
 - Windows 10 22H2, x86-64
 - CPU Intel i5-9600KF
 - RAM 32GB
 - GPU NVIDIA GeForce GTX1660 SUPER
 - Intel I350 network adapter
- Gocator 2330 Profile sensor
 - firmware version 6.3.7.2
- Gocator 3210A Snapshot sensor
 - firmware version 6.3.7.2
- Software:
 - NeuroCheck 6.2.24 Premium
 - NeuroCheck GenICamTL Driver for 3D Cameras, version 6.2.13
 - NeuroCheck 3D-Xtension, version 6.2.5.
 - Go2GenTL and GoAccelerator version 6.3.7.2.

The minimum recommended software configuration is:

- NeuroCheck version 6.2.19+
- Gocator firmware and GoAccelerator version 6.0.21.13+
 - Older firmware versions (4.5 - 6.0) may still work fine but were not tested.
- NeuroCheck GenICamTL Driver version 6.2.9

Minimum recommended configuration when using Gocator GoPxL firmware:

- Gocator GoPxL version 1.1.11.1+
 - Older versions are not supported.
- NeuroCheck GenICamTL Driver version 6.2.13+
 - GoPxL v1.2.30.56 requires driver version 6.2.15+ to transfer measurements (section 7.6)

1.3. Read to the end

Read carefully to the end before you start integrating your hardware.

2. Hardware installation

For the detailed information on hardware installation consult the Gocator Profile sensors or Gocator Snapshot sensors user manual (section **Getting Started >> Installation**).

1. Install a Gigabit Ethernet compliant network adapter for the communication with the camera.
2. Attach the sensor to the network adapter.
3. Attach the sensor to the 24V or 48V DC power supply according to the device specifications. Power on the sensor after all individual parts are correctly wired together.
4. Check LED status indicators. Make sure the sensor is sufficiently cooled.

3. Software installation

3.1. Configuration of the network adapter

The network adapter IP settings recommended by LMI are:

- IP address: 192.168.1.5
- Subnet mask: 255.255.255.0

3.2. Camera software installation

Software installation steps slightly depend on the kind of Gocator firmware, which is installed on the sensor.

- If you use the Gocator firmware (version 6.0 - 6.4), proceed with section 3.2.1.
- If you use the GoPXL firmware (version 1.1.11.1+), proceed with section 3.2.2.

3.2.1. Software installation with Gocator firmware

Download the Gocator Software Utilities package from the LMI website:

<https://lmi3d.com/product-downloads/>

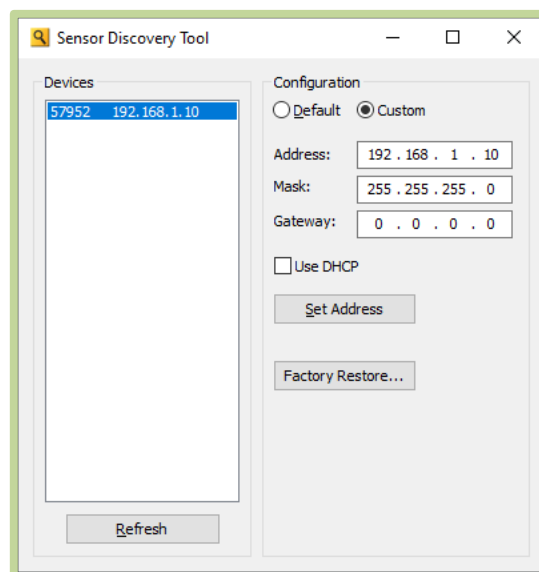
- Note that the version of the utilities package must match exactly the version of the firmware currently installed on the device.

The utilities package contains the following components that are required for the integration:

- GenTL producer (Go2GenTL)
- Discovery Tool (kDiscovery)
- GoAccelerator

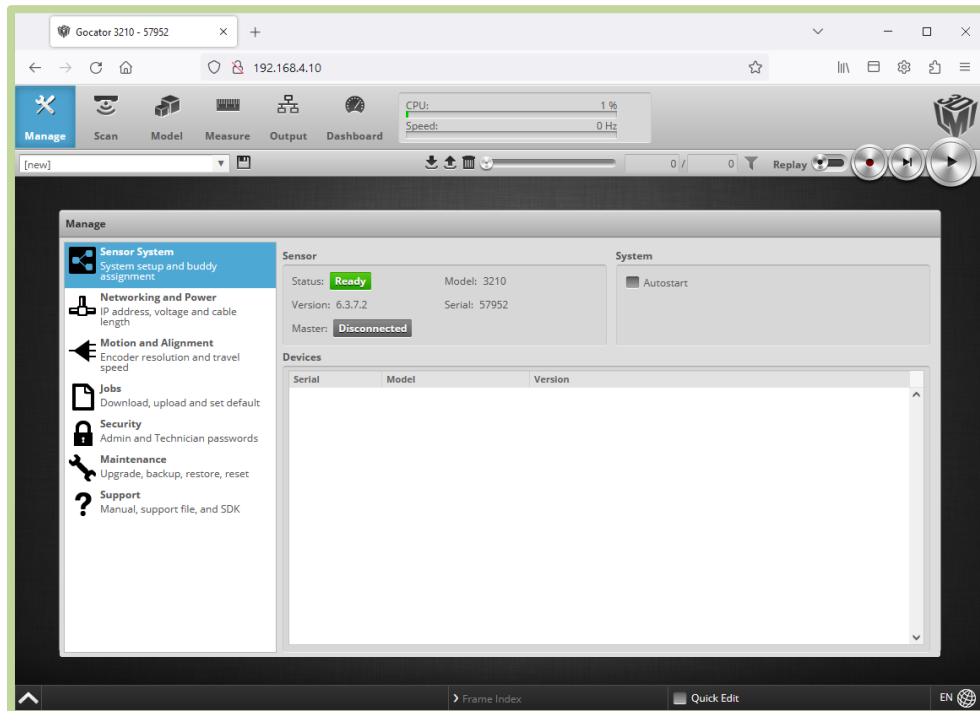
Sensor discovery

- Unpack and open **kDiscovery.exe** from the Utilities package (**\Tools\Discovery**).
- Select the camera and choose the Custom configuration. Specify the IP address of the camera. It should be static and in the same network as the network adapter of your PC.
- Press **Set Address** and wait until the sensor is discovered again (click **Refresh** button to update the list) and check if the new IP address was properly assigned.

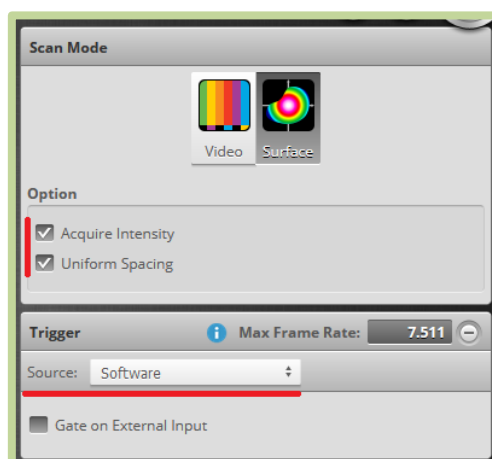


Sensor configuration in web interface

- Open the Gocator UI in the web browser using the Gocator's IP address, which was previously assigned in the discovery tool. Use the HTTP protocol instead of HTTPS, you may need to specify **http://** in the address bar explicitly to avoid ambiguity. If you can see the web interface of the Gocator, it means you can successfully connect to the camera.

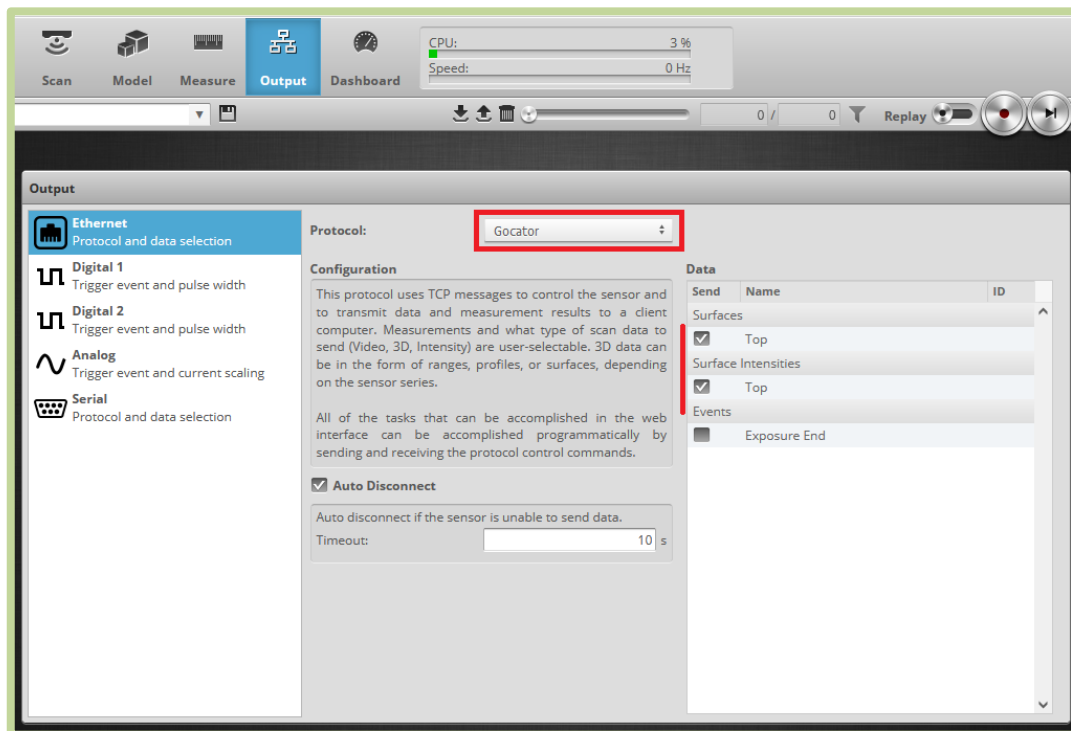


- In the **Scan** page:
 - set the scan mode to **Surface**;
 - enable **Uniform Spacing**;
 - enable **Acquire Intensity** (if you need an intensity image);

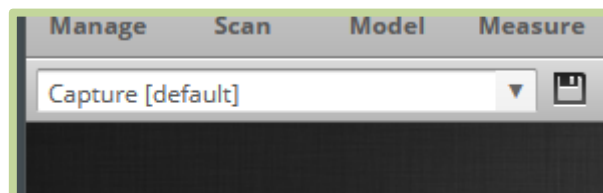


- configure the acquisition trigger:

- for Gocator 2000 Series we recommend trigger sources **External Input**, **Encoder**, **Time**;
- for Gocator 3000 Series with firmware version 4.5 and newer the recommended trigger sources are **External Input** and **Software** (or **Time** for devices with older firmware).
- In the **Output** page select **Ethernet** and enable the **Gocator** protocol, then on the right side check the Surfaces (e.g. Top) to transmit. If you need an intensity image, also check the Surface intensities.



- Save the settings as a Gocator job. The job name should be composed of at most 15 ASCII characters. The jobs are stored on the Gocator device and loaded when the GenICamTL driver selects a job by its name.

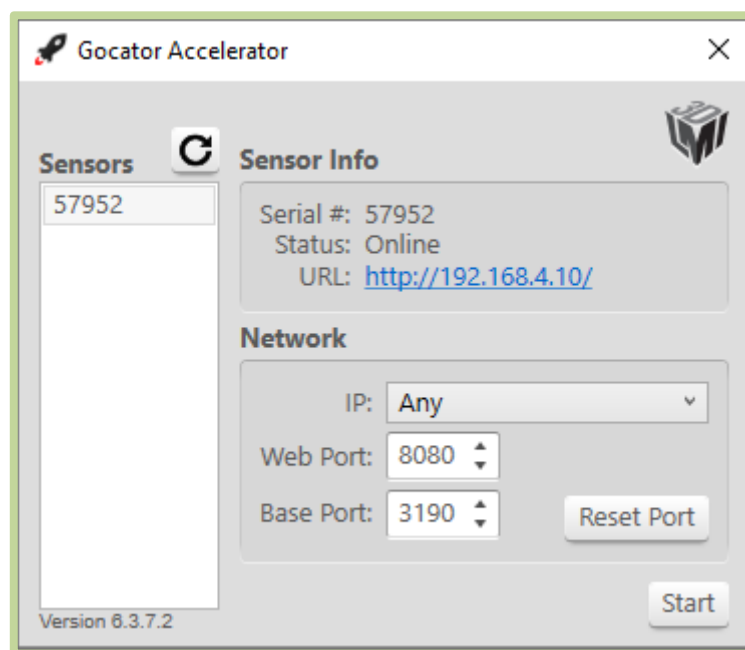


Installation of Go2GenTL

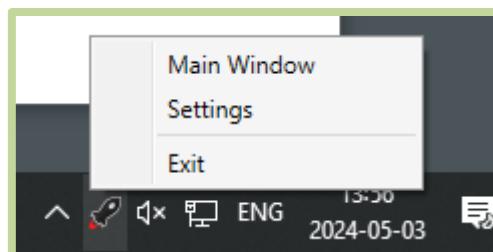
- Extract the files Go2GenTL.cti and Go2GenTL.xml from the Gocator Utilities package (**Integration\GenTL**). Choose the x86 or x64 bit folder depending on your operating system installation.
- Copy both files to the NeuroCheck installation directory. The firmware version of Gocator must match exactly the version of these two files.

Configuration of the Gocator Accelerator

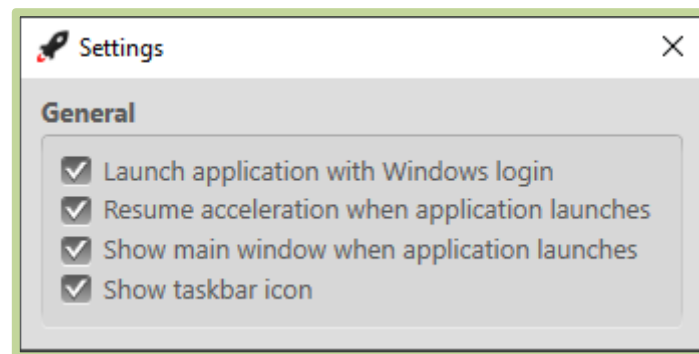
- Extract the Accelerator from the **Utilities** package (**Emulator and Accelerator**).
- Run **GoAccelerator**.



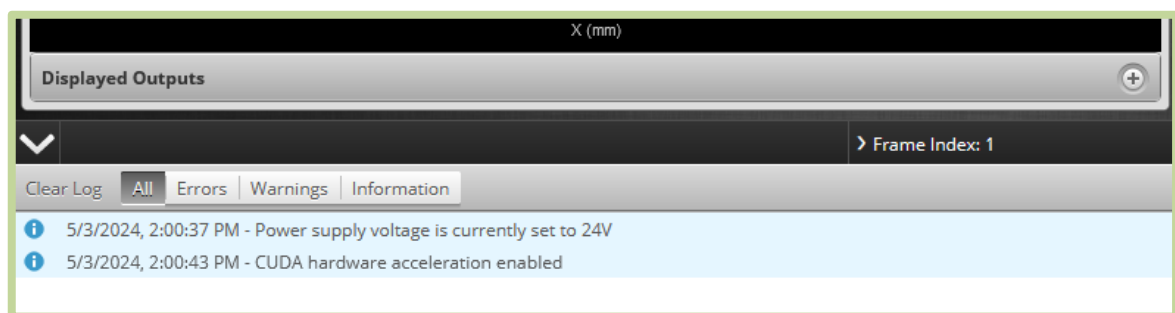
- Select the sensor and the web port and click Start.
- Configure Accelerator to start automatically (if necessary):
 - open Accelerator settings via right click on the tray icon;



- enable **Launch application with Windows login**



- Open the accelerated sensor web interface by following the shown URL. In the info panel you can see if the CUDA hardware acceleration is enabled (requires a CUDA capable graphics card).



3.2.2. Software installation with GoPxL firmware

Download the GoPxL Software Utilities package from the LMI website:

<https://lmi3d.com/product-downloads/>

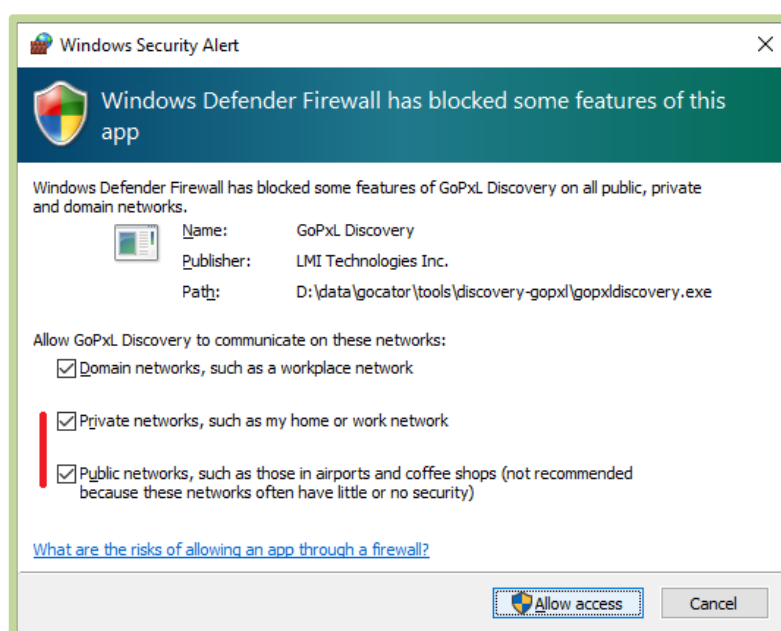
- Note that the version of the utilities package must match exactly the version of the firmware currently installed on the device.

The utilities package contains the following components that are required for the integration:

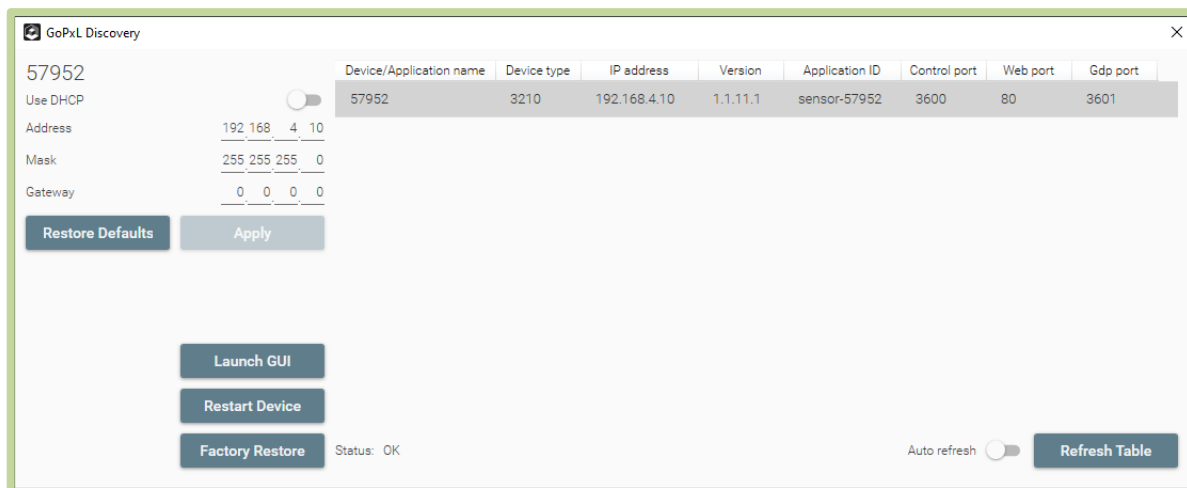
- GenTL producer installer (Go2GenTL)
- GoPxL software
- Discovery Tool

Sensor discovery

- Extract and run the Discovery Tool from the Utilities package (**Tools\Discovery**). Allow the app through Firewall if a prompt appears.



- Press **Refresh Table** and select the device.
 - Note that the tool does only discover devices with GoPxL firmware. If your device has an older firmware, you must first follow the sensor discovery steps from section 3.2.1 and update the sensor firmware.



The GoPxL Discovery window displays configuration options on the left and a table of discovered devices on the right.

Configuration Options:

- Device ID: 57952
- Use DHCP: ☐
- Address: 192.168.4.10
- Mask: 255.255.255.0
- Gateway: 0.0.0.0
- Buttons: Restore Defaults, Apply, Launch GUI, Restart Device, Factory Restore
- Status: OK
- Auto refresh: ☐
- Refresh Table button

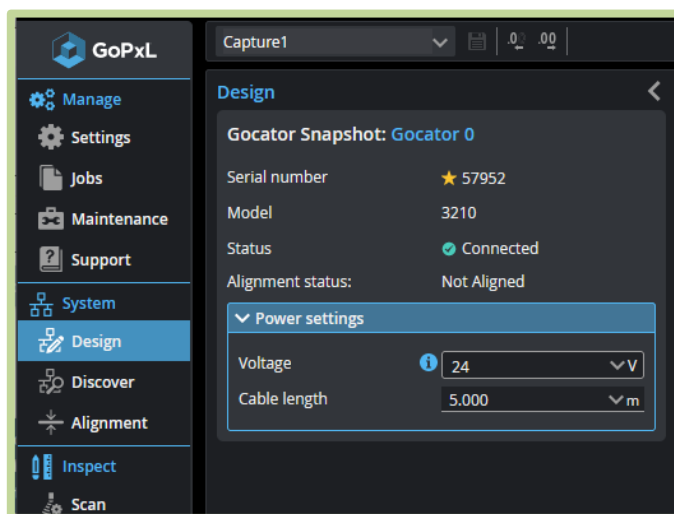
Discovered Devices Table:

Device/Application name	Device type	IP address	Version	Application ID	Control port	Web port	Gdp port
57952	3210	192.168.4.10	1.1.11.1	sensor-57952	3600	80	3601

- Configure IP address and subnet mask, then click **Apply**, and wait for sensor to be rediscovered.
- Press **Launch GUI**.

Sensor configuration in web-interface

- Open the Gocator UI in the web browser using the Gocator's IP address, which was previously assigned in the discovery tool. Use the HTTP protocol instead of HTTPS; you may need to specify http:// in the browser address bar explicitly to avoid ambiguity. If you can see the web interface of the Gocator, it means you can successfully connect to the camera.
- **Design** settings: specify the correct voltage (may be necessary for some models).

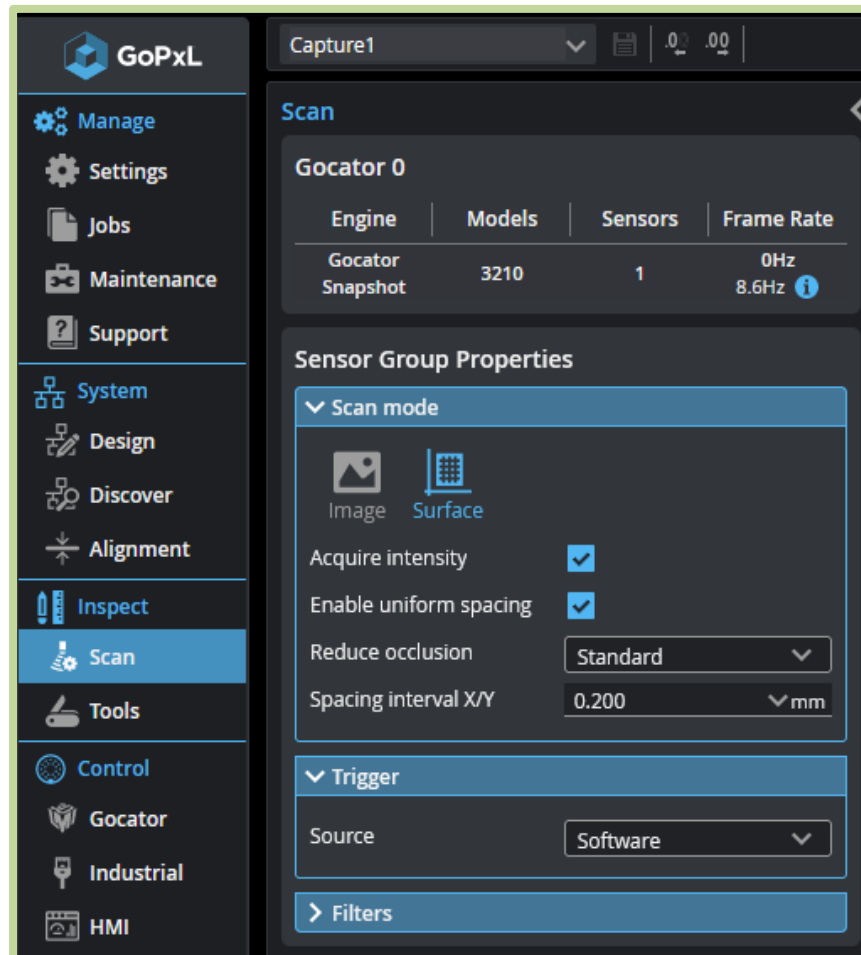


The Gocator web interface shows the Design settings for a Gocator 0 camera.

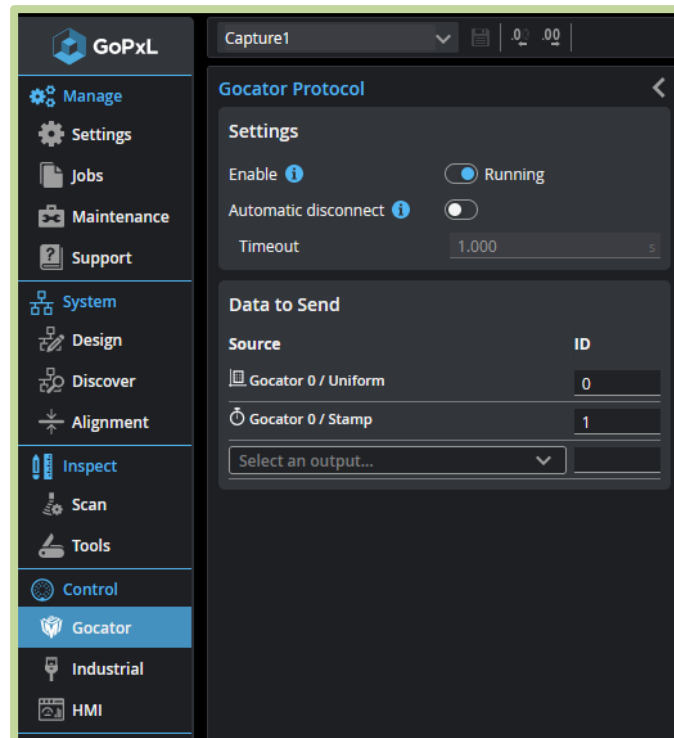
Design Settings:

- Gocator Snapshot: Gocator 0
- Serial number: 57952
- Model: 3210
- Status: Connected
- Alignment status: Not Aligned
- Power settings:
 - Voltage: 24 V
 - Cable length: 5.000 m

- **Scan** settings:
 - select the scan mode **Surface**.
 - enable **Uniform spacing**.
 - enable **Acquire Intensity** (if necessary).



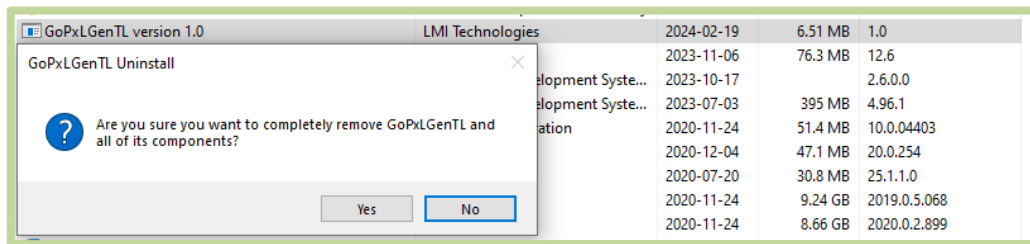
- **Control > Gocator** settings:
 - enable the Gocator protocol
 - add the output data (stamp data, uniform surface, and intensities) to the list of data objects to send.



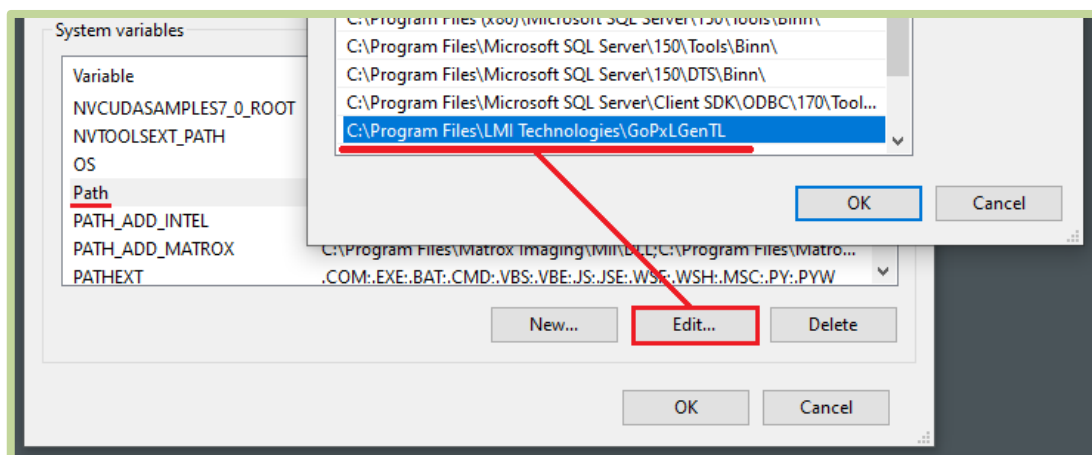
- Save the settings as a Gocator job. The job name should be composed of at most 15 ASCII characters. The jobs are stored on the Gocator device and loaded when the GenICamTL driver selects a job by its name.

Installation of Go2GenTL

- Uninstall the older versions of Go2GenTL:
 - uninstall older GoPxLGenTL installations (if present);



- remove **Go2GenTL.cti** and **Go2GenTL.xml** from the NeuroCheck installation folder (if present).
- Extract and run the GoPxL GenTL installer from the Utilities package (**\\Integration\\GenTL**)
- If you use the NeuroCheck GenICamTL Driver **v6.2.14** and earlier:
Add the Go2GenTL installation path (e.g. **C:\\Program Files\\LMI**

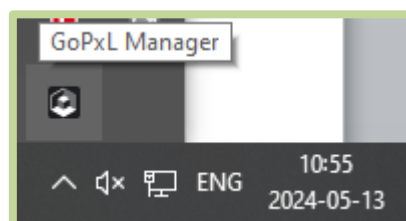


Technologies\\GoPxLGenTL) to the **PATH** environment variable:

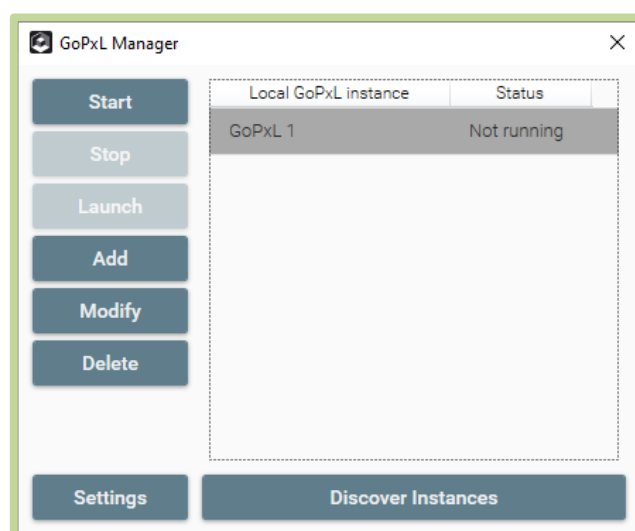
Environment variable **GENICAM_GENTL64_PATH** must also contain this path (the installer updates it automatically).

Configuration of the Accelerator

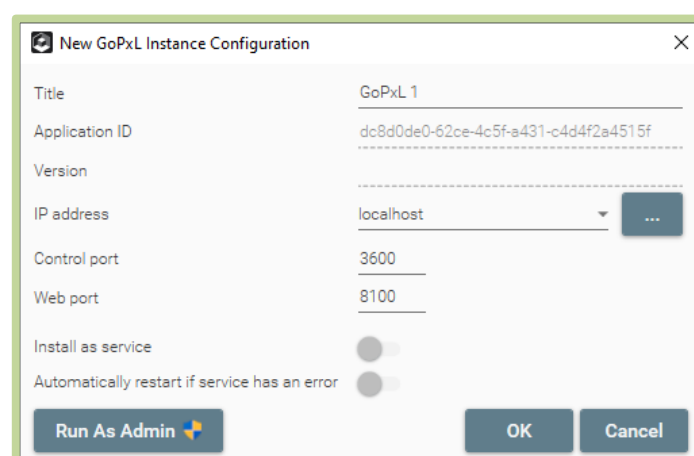
- Extract the GoPxL software from the Utilities package (**GoPxL**)
- Start GoPxL and open the main window via tray icon:



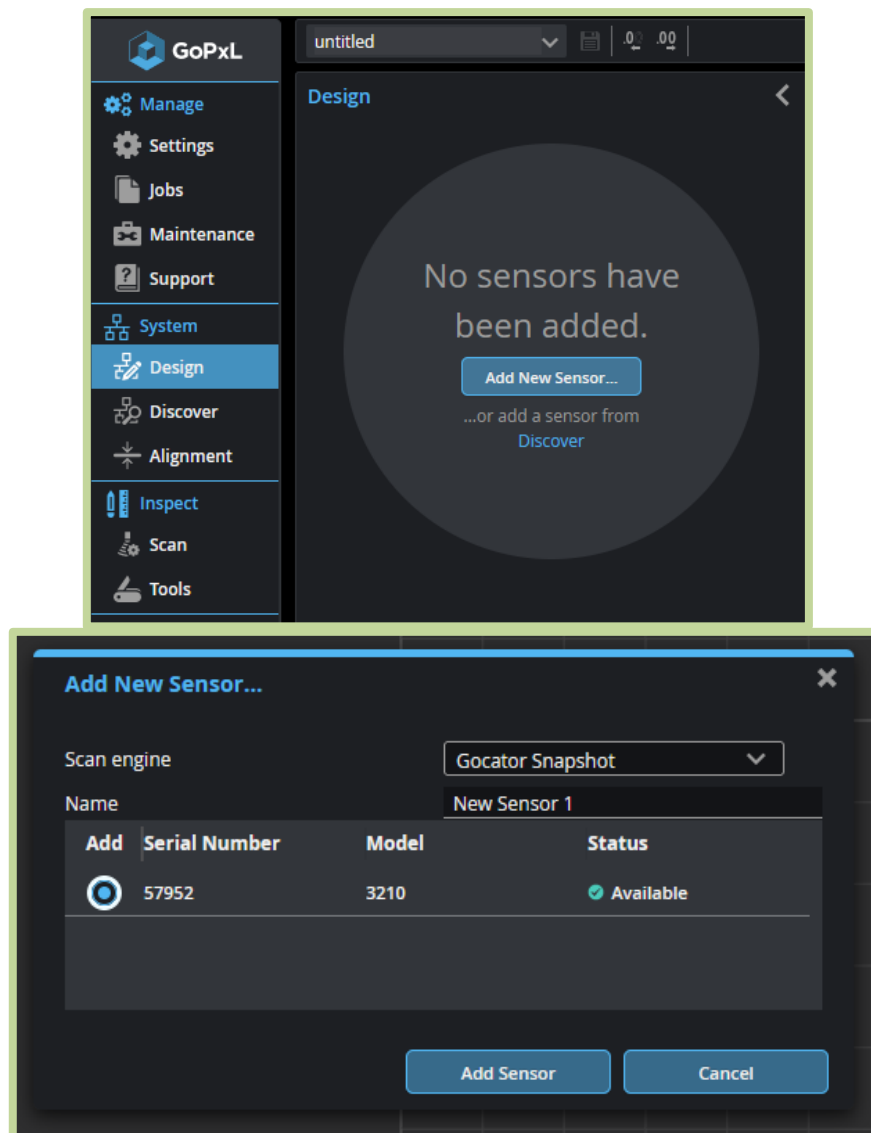
- Allow GoPxL through Firewall (if a prompt is shown)
- Create a GoPxL instance by pressing **Add**.



- enable **Install as service** to start the instance automatically after restarting the PC (Running as Admin may be necessary for this action).



- Start the instance and click **Launch** to open the web interface.
- Select and add the sensor to be accelerated in the **Design** page.



- Repeat the configuration steps that were earlier performed in the web interface on the sensor. To transfer the previously configured settings from the sensor to the GoPxL instance you should first save the sensor configuration in a job file, then download this file from the device as a **.gpjob**-file; finally start the GoPxL instance and upload the job file.

3.3. Installation of the NeuroCheck GenICamTL Driver for 3D Cameras

1. Copy the driver files from the installation package:

<https://www.neurocheck.com/service/downloads/neurocheck-62/neurocheck-62-driver/>

Replace all existing files if an older version of the driver was installed earlier.

/Binaries/: → /NeuroCheckInstallationFolder/

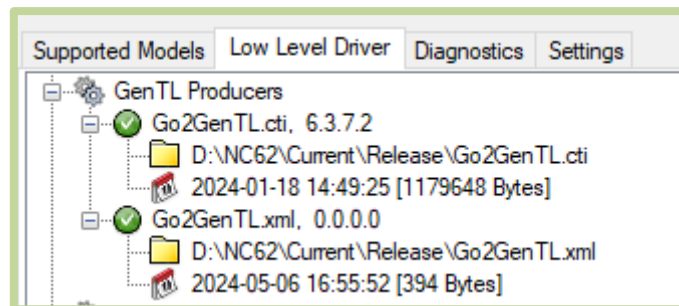
/Documentation/: → /NeuroCheckInstallationFolder/Documentation/Help/

2. Validate the driver installation:

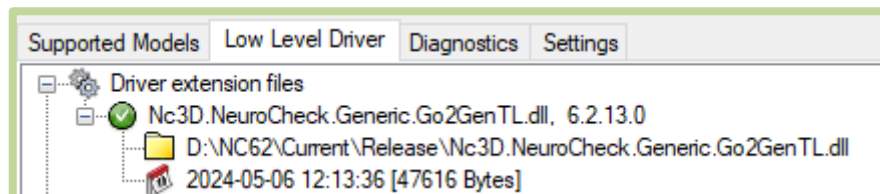
- Open **NeuroCheck > Device Manager > New**
- Select **3D Cameras**, then select the driver and click **About**.
- Verify installed DLLs on page **Low-level-driver**
- Allow **NeuroCheck62.exe** the network access though Firewall (approve if the prompt is shown)

3. Validate the GenTL-Producer **Go2GenTL.cti** is discovered.

- Open the driver's **About** dialog.
- Select the **Low level driver** page, check if **Go2GenTL.cti** and **Go2GenTL.xml** are listed under **GenTL Producers** and their file paths are correct (depending on the installation package).



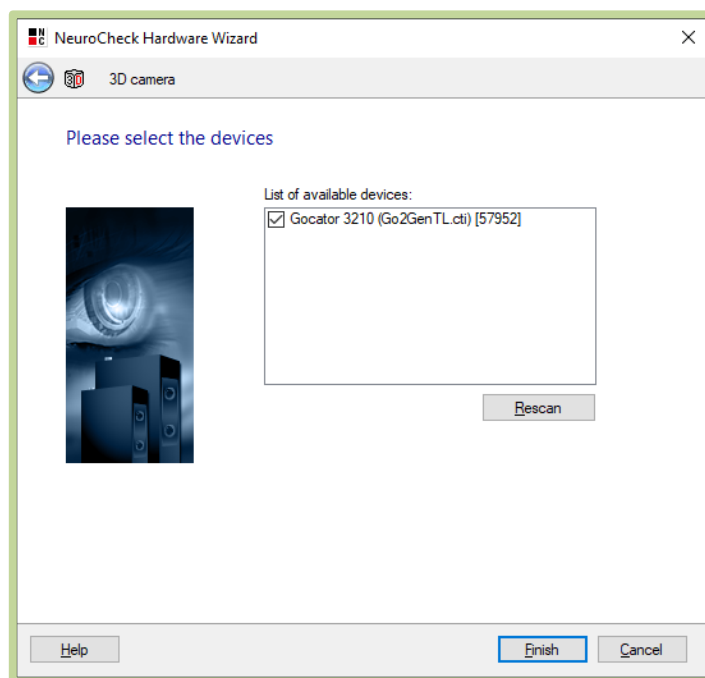
- Check if **Nc3D.NeuroCheck.Generic.Go2GenTL.dll** is listed under **Driver extension files**.



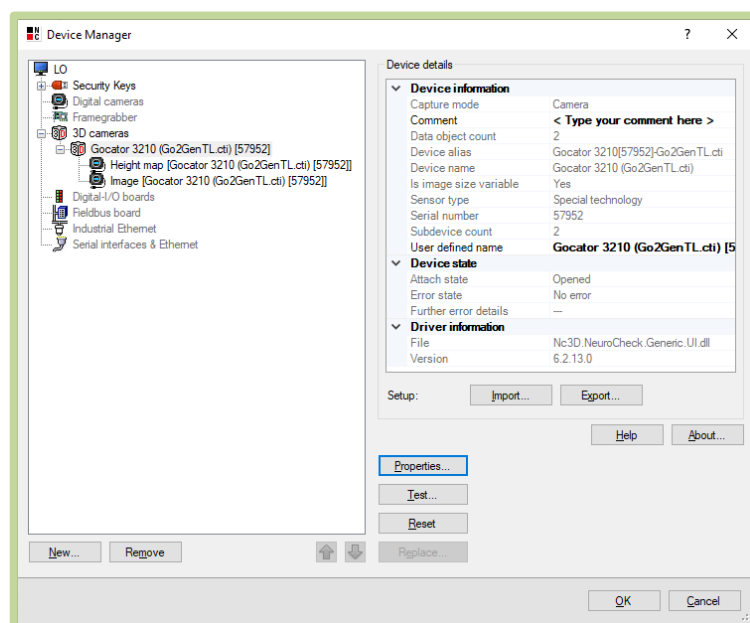
- Select the page **Settings**, make sure **Go2GenTL.cti** is not listed among ignored GenTL-Producers.

3.4. Integration of the camera in NeuroCheck Device Manager

1. Make sure the sensor or Gocator Accelerator are connected and running. You can keep the web interface open, but it is not recommended to do any configuration changes while the camera is controlled by NeuroCheck.
2. Open **NeuroCheck > Device Manager**.
3. Select **3D Cameras**.
4. Select **Various 3D cameras (GenICamTL)**. Wait until discovery is finished. The properly connected and configured camera should appear in the list.



5. Select the Gocator camera and finish.



The camera should appear in the tree view. The name of the currently selected Gocator job is retrieved when the camera is added and saved to a default camera setup. This setup is applied when NeuroCheck is restarted.

If you don't need automatic application of the camera setup on start-up, you can disable it in the driver **About** dialog. Open the dialog, move to page **Settings**, and disable the option **Initialize devices on start-up**. Remove and add the device again afterwards.

4. Configuration

4.1. Camera setup files

The camera configuration is primarily managed via the job files, which are stored in the Gocator device memory. Always save the device configuration to a job before adding the device in NeuroCheck.

- It is recommended to keep a copy of the job file in the **/Configuration/Camera Settings/** folder of the NeuroCheck project so that the complete configuration can easily be transferred to another device.

The GenICam driver only manages the Gocator job name (**ConfigFile** property) and some driver-specific settings. These settings are exported and imported from the ***.3DSX** camera setup files.

When NeuroCheck starts, the last saved camera setup is loaded. If some Gocator job was previously selected, the driver switches the device to that job.

Available Gocator settings

Property	Description
ConfigFile	The property selects the active job on the Gocator device. This property is saved to the camera setup file. To switch jobs dynamically in the check routine use check function Control Device. In the check function parameter dialog select the device and set the property "ConfigFile" to the name of the Gocator job in the web-interface. Job name length should not exceed 15 characters. Depending on the Gocator firmware it might be necessary to append the characters ".job" to the end of the job name. For example, if your job has the name QuickImage, you would need to write QuickImage.job into the "ConfigFile" property.
Exposure	Property Exposure is not available in the 3D camera properties dialog and will not be saved to the camera setup file. Older camera setup files may still contain this setting. The user should use ConfigFile to switch the Gocator jobs, which already include exposure configuration, or configure "Exposure" manually using check function Control Device.
AcquisitionMode	Most Gocator firmware versions only support Continuous mode. SingleFrame may also be available in some cases. It is not recommended to modify this property.

Available NeuroCheck settings

Property	Description
Invert Z axis	Inverts Z axis of the point cloud data coordinate system. This setting is activated by default since NeuroCheck 3D-Xtension processes data in right-handed coordinate system. Z values in height maps are inverted as well.
Custom Z axis range	Changes the range of the Z axis to the user defined minimum and maximum Z values. Use this property to restrict or expand the range of Z values stored in the 16-bit height map.
Maximum Z [mm]	Specify the maximum allowed Z-value in the custom range. The value is specified in the initial Gocator coordinate system (before inversion of Z axis).
Minimum Z [mm]	Specify the minimum allowed Z-value in the custom range. The value is specified in the initial Gocator coordinate system (before inversion of Z axis)
Crop image to frame size	Crops the transferred image to the actual frame size. Note that the frame size depends on the current device configuration and may change dynamically.
Compute XYZ image	Enable if an XYZ image containing the 3D point coordinates should be computed. An XYZ image is generated for every height map and is provided as an additional data object.
Parallel acquisition mode (Gocator 2000 Series only)	Specify how the driver should control image acquisition when the parallel image acquisition process is running (see section 7.2). Mode SingleShot stops acquisition on the device when the first image is acquired. Use mode "SingleShot" if you neither capture continuous surfaces nor use the parallel acquisition. Mode Sequence continues acquisition on the device after an image is acquired. Use mode "Sequence" if you configure a new parallel acquisition process in the check function Capture Image in Parallel or acquire an image stack to avoid gaps while scanning continuous surfaces.

Note that newer releases of the camera firmware may change the number of available features or change the valid value ranges for existing features, making the camera setup partially incompatible or incomplete.

4.2. Data objects

The following data objects are available:

- Height map
- Intensity (optional)
- XYZ Image (optional)

When an image is captured, multiple data objects are transmitted. To access each individual object in the 3D camera properties dialog, select it from the **Data source** selector above the live image viewer. To access each data object in the check routine, select the data object in the **Transfer Image** property dialog.

Height map

Height maps (or depth images) are transmitted as 16-bit grayscale images. Zero value indicates missing or invalid data in the corresponding pixel. Values from 1 to 65535 encode the distance value.

The distance values provided in the height maps of LMI Gocator cameras are not distances from the camera, but rather from the zero reference. Depending on the configuration of the camera, this can be for example a conveyor belt.

Distance values in the height maps are sampled depending on the current Gocator configuration. If you want to fix the range of Z values, you can specify the range manually by enabling the **Custom Z axis range** property and defining the **Minimum Z** and **Maximum Z** (see sections 4.1 and 7.4)

Intensity

Depending on the sensor configuration, an intensity image is also transmitted. The image is available in NeuroCheck as an 8-bit grayscale image.

XYZ Image

Gocator provides the stamp data containing scaling factors and offsets for each transmitted height map. When uniform spacing is enabled, these factors can be used to convert each pixel value in the height map to a 3D point.

The GenICamTL driver produces a point cloud from the height map automatically and provides it as an XYZ image. If you need XYZ images, set the property **/NeuroCheck Settings/Compute XYZ Image** to **Yes**.

4.3. Acquisition

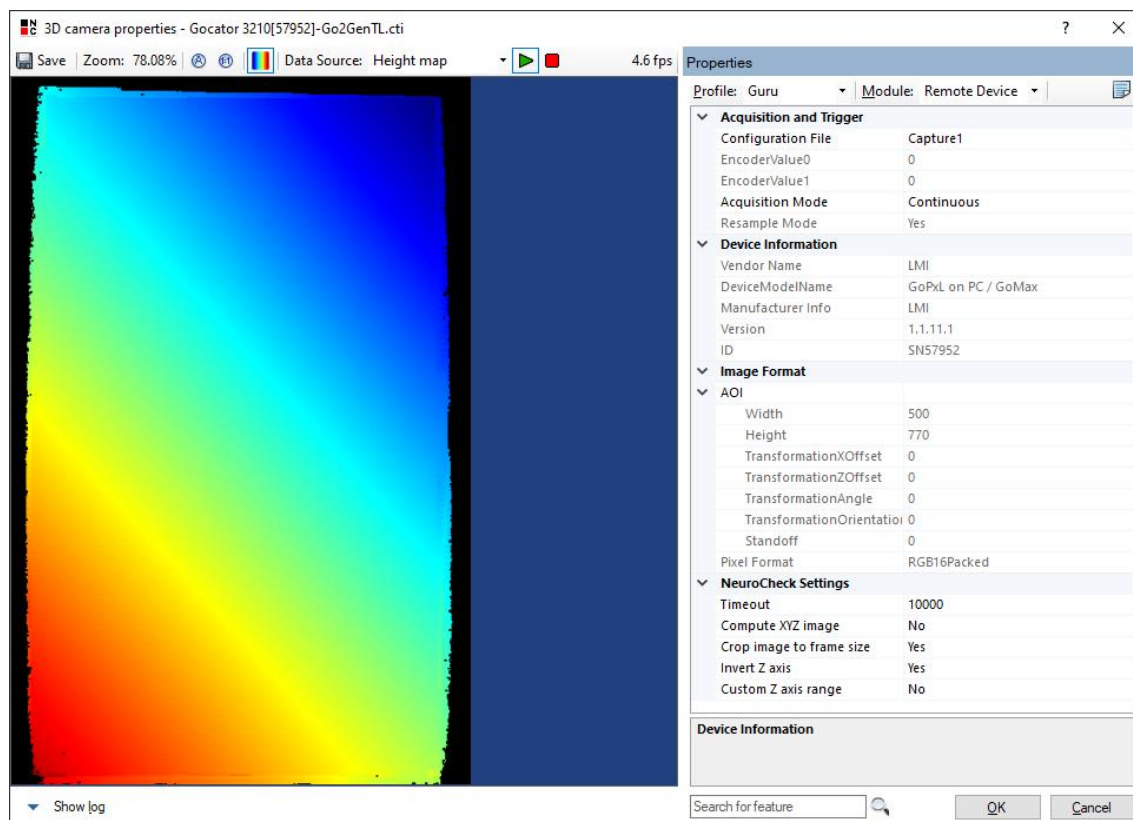
If the camera is properly configured in the web interface (see section 3.2), the image acquisition should work fine without any additional configuration in the 3D camera properties dialog.

In some cases the user must set the correct job name manually (**ConfigFile** property).

In case of low acquisition rates the timeout value should be increased (**/NeuroCheck Settings/Timeout**).

5. Property dialog

In the property dialog the user can see the live image and the properties provided by the camera. The user can modify the property values depending on their type and on the range of valid values as provided by the GenTL producer. Only the properties belonging to the module **Remote Device** should be modified.



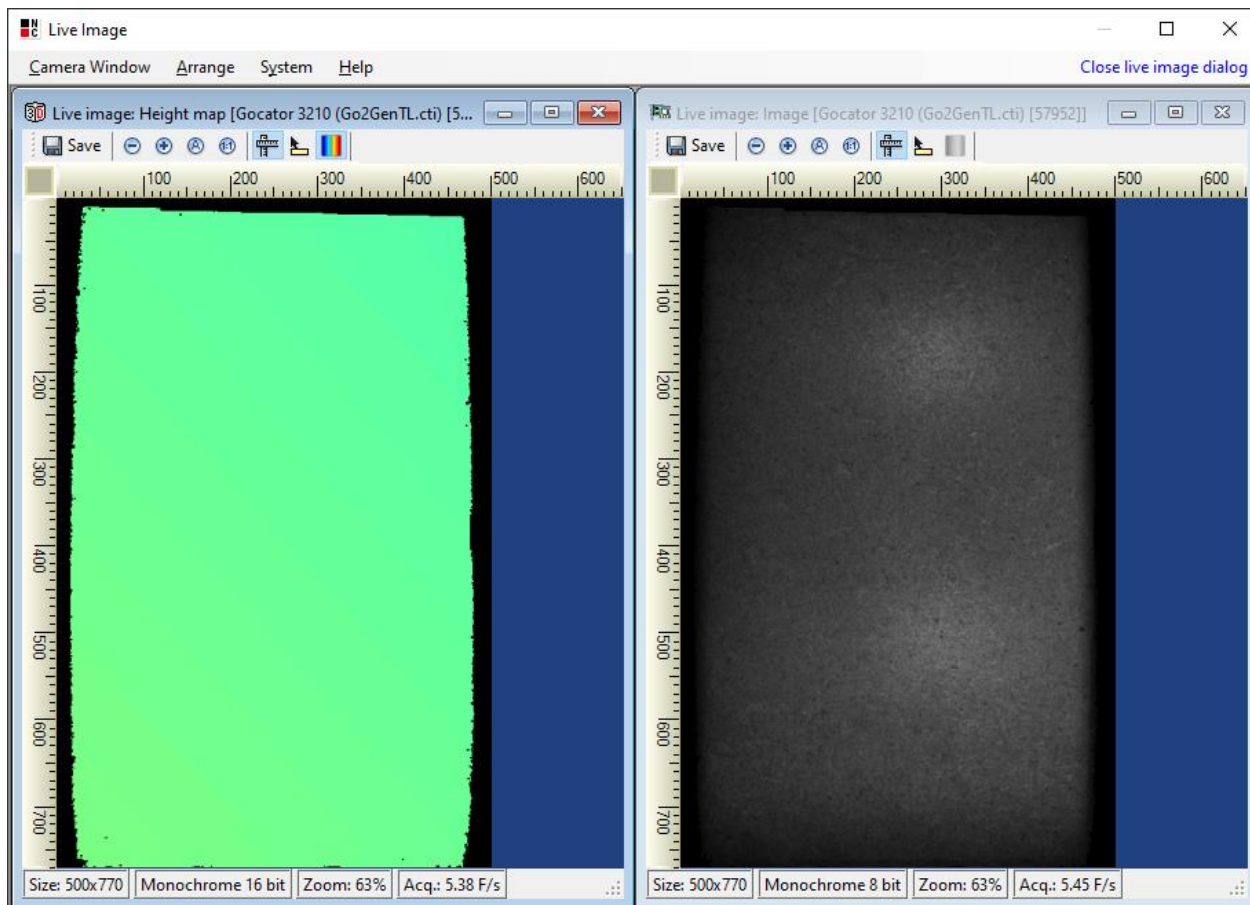
When a property is being modified, the live acquisition is paused and resumed after the new value is applied.

- Note that the scope of the presented features is limited according to the currently selected profile. To show all features available in the UI select the **Guru** profile.
- It is recommended to stop the live image acquisition during the when multiple properties are being edited.
- It is recommended to avoid editing the Gocator configuration in the web interface while the device is controlled via NeuroCheck. This may cause unwanted side-effects both in the web interface and in NeuroCheck.
- If you change the Gocator job name via NeuroCheck, it is recommended to refresh the web interface page manually afterwards.

The configured camera setup is saved when both the camera properties dialog and the device manager are closed with **OK**. If the camera properties dialog is closed with **Cancel**, the previously saved camera setup is applied.

6. Live image dialog

The live image acquisition runs the same way as in the camera property dialog. All configured image components are presented in the view.



7. Check routine

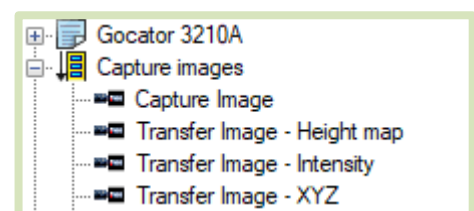
7.1. Image acquisition (with multiple data objects)

After each **Capture Image** execution multiple data objects can be transferred.

Each data object is selected and transferred via **Transfer Image**. The user may select only those objects, which are particularly needed in the check routine. If some data objects are never used throughout the project, consider disabling them to speed up the processing.

To capture and transfer Height map, Intensity, and XYZ image consecutively add the following check functions:

- Capture Image
- Transfer Image, data object **Height map**.
- Transfer Image, data object **Intensity**.
- Transfer Image, data object **XYZ Image**.

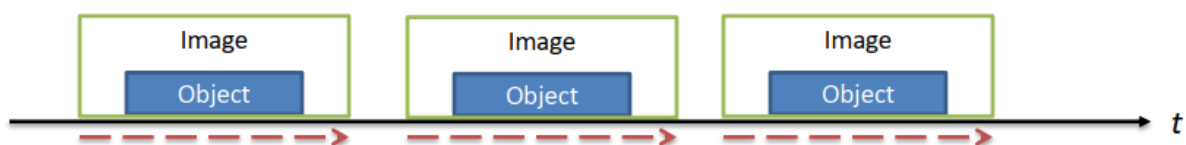


7.2. Parallel image acquisition

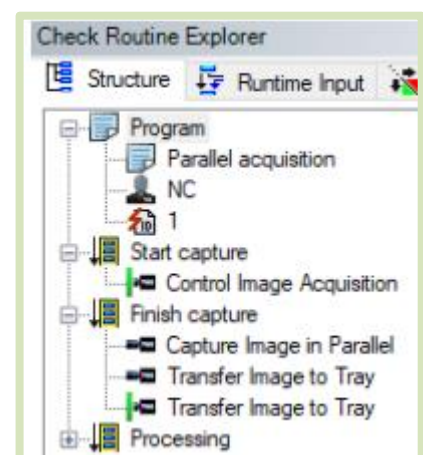
The GenICamTL driver supports parallel image acquisition and image stack acquisition. This section lists several possible use cases for the parallel acquisition.

In cases when the surface is scanned with a profile sensor and no gaps and pauses are allowed (e.g. due to external trigger configuration), the proper camera setup must be applied before the parallel acquisition process is initiated.

Case 1: Scanning separate objects, gaps are allowed



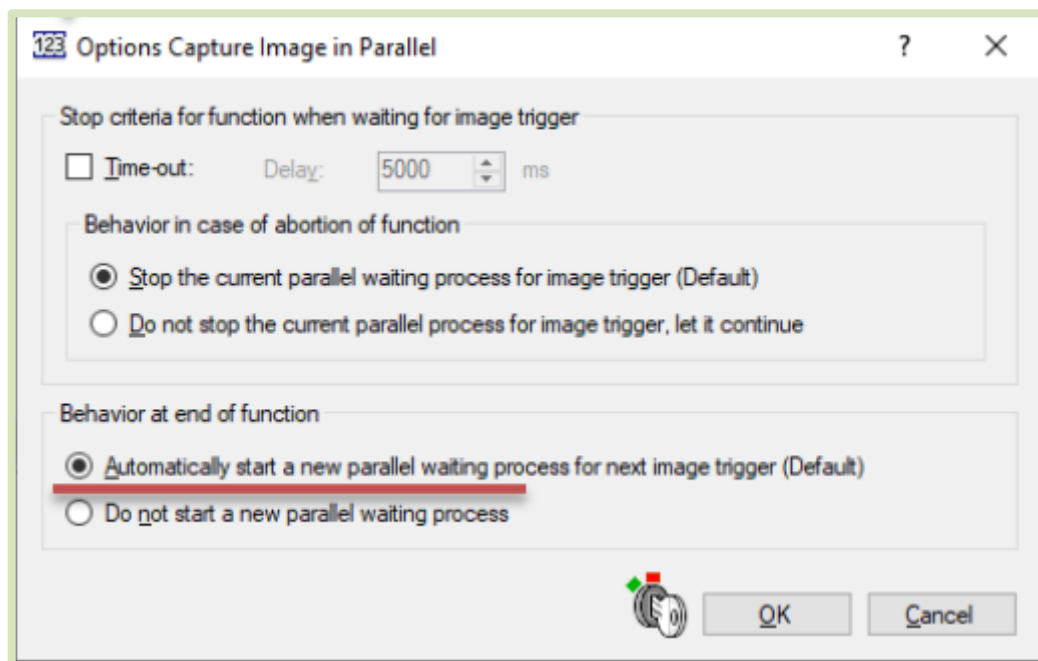
- Set the property **ParallelAcquisitionMode** to **SingleShot** (profile sensors only).
- Start the parallel acquisition process with **Control Image Acquisition**.
- Finish the parallel acquisition process with **Capture Image in Parallel** (without starting a new waiting process)



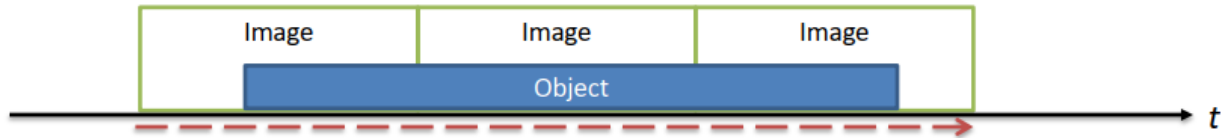
Case 2: Scanning separate objects or endless surface, no gaps are allowed



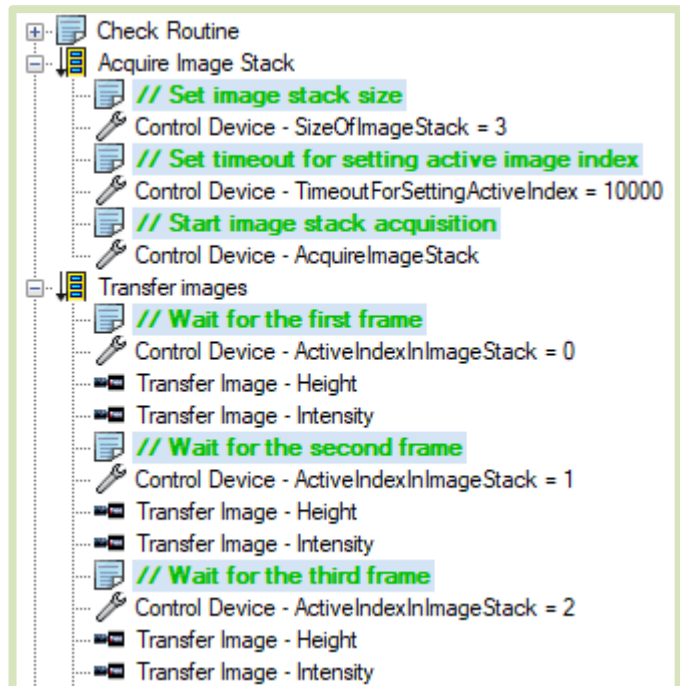
- Set the property **ParallelAcquisitionMode** to **Sequence** (profile sensors only) and **AcquisitionMode** to **Continuous**
- Start the parallel acquisition process with **Control Image Acquisition**.
- Finish the parallel acquisition process with **Capture Image in Parallel** and configure the check function to start a new process.



Case 3: Scanning continuous surface with fixed number of frames, no gaps are allowed (profile sensors only).

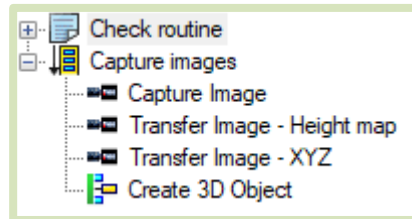


- Set the property **ParallelAcquisitionMode** to **Sequence** and **AcquisitionMode** to **Continuous**.
- Setup image stack acquisition:
 - set the fixed number of frames;
 - start image stack acquisition;
 - transfer every captured image consecutively from the stack.



7.3. 3D Data processing

The sensor transmits the height map in 16-bit grayscale format including the corresponding scaling factors and offsets. The GenICamTL driver automatically computes an XYZ image (if **Compute XYZ Image** is enabled) from this data. The XYZ image can be converted to a 3D object using the check function **Create 3D Object**.



Make sure the property **Invert Z axis** is enabled in the camera setup. Alternatively you can also invert the Z axis directly in the parameter dialog of **Create 3D Object**.

7.4. Height map normalization

The transmitted height maps represent the uniformly spaced 3D point cloud, which is sampled on each axis (X, Y, Z) according to the configured sampling distances (stored in the job file). Z axis values or distances are encoded as 16 bit grayscale integer values. The user can specify the range in which these values will be normalized manually by enabling the property **Custom Z axis range** and setting the **Minimum Z** and **Maximum Z**.

Converting real world distances into 16-bit grayscale values and back

In order to process the height map e.g. for thresholding objects by distance, it is necessary to convert distances into grayscale values and vice versa. To do this, you have to specify the custom Z axis range in the 3D camera settings (**Maximum Z** and **Minimum Z**). All distances in this range will be mapped to the 16-bit range[1, 65535]. The value 0 is used to show that there is no depth information at the position in the image.

Conversion of the real height value **Z** to the grayscale depth value **depth** proceeds as follows:

$$depth = 1 + Round \left(65534 \times \frac{(Z - MinimumZ)}{(MaximumZ - MinimumZ)} \right),$$

where:

- **Z** is the Z-coordinate of the point in mm;
- **MinimumZ** the corresponding value in the camera settings;
- **MaximumZ** the corresponding value in the camera settings;
- the **Round** function rounds the value to the nearest integer value, e.g. 0.6 is rounded to 1 while 4.3 rounds to 4.

For the backward conversion of the grayscale depth value **depth** to the 3D point coordinate **Z** use the following formula:

$$Z = \left((MaximumZ - MinimumZ) \times \frac{(depth - 1)}{65534} \right) + MinimumZ$$

The depth mapping direction depends on the state of the setting **Invert Z axis**, which is enabled by default. When it is enabled, the following formulas are used:

$$depth = 65535 - Round \left(65534 \times \frac{(Z - MinimumZ)}{(MaximumZ - MinimumZ)} \right)$$

$$Z = \left((MaximumZ - MaximumZ) - MinimumZ \times \frac{(depth - 1)}{65534} \right)$$

Checking height tolerances

If you want for example to compute tolerances, you need to know the grayscale value of your target height and of the tolerance itself. The grayscale value of the height can be computed with the formula of the previous section. Here is an example:

Minimum Z is 1 mm and **Maximum Z** is 5 mm. The expected Z value is 2.5 mm with a tolerance of ± 0.2 mm.

The grayscale value for 2.5 mm in this example, using the previous formula, is

$$depth = 1 + Round \left(65534 \times \frac{(2.5 - 1)}{(5 - 1)} \right),$$

which results in a value of 24576. The tolerance can be computed in two different ways. First, you can compute the minimum and maximum distance based on the tolerance, which in this case is 2.3 and 2.7 mm and calculate the grayscale values for these two distances with the previous formula.

The calculated grayscale values for these tolerances are 21300 and 27853. Use these for the check to see, if a certain pixel value is in the allowed tolerance.

You can also calculate the grayscale value that corresponds to a difference of 0.2 mm and add this to the grayscale value for the expected value. The formula for this is

$$depth_{diff} = Round \left(65534 \times \frac{Difference}{(MaximumZ - MinimumZ)} \right).$$

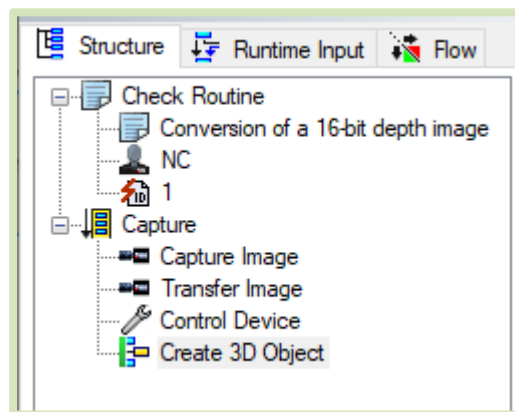
So with the difference of 0.2, the result is 3277. Add and subtract this number from the grayscale value 24576 for the expected height and the results are 21299 and 27853 (the small difference is due to rounding).

7.5. Depth conversion matrix

DepthConversionMatrix property provides the conversion matrix which can be used to create a 3D object directly from the 16-bit height map. The matrix consists of 12 floating point numbers separated by semicolons and wrapped by brackets. This property is accessed via **Control Device**. The matrix can be saved to a data register cell of type **String**.

Example: Using the depth conversion matrix to create 3D object from height maps

- Capture an image.
- Transfer the height map.
- Read the value of **DepthConversionMatrix** to a register cell.
- Configure the Create 3D Object function:
 - take the height map as input, check **16-bit depth image** as the input image type;
 - provide the ID of the register cell containing the depth conversion matrix;
 - **uncheck** the **Perspective projection**. Gocator transmits uniformly spaced data.



It is recommended to read the depth conversion matrix each time an image is captured. The matrix matches the height maps as long as the sensor configuration stays unchanged, changes in image size, spacing, region of interest (partial scan) and others make the new images incompatible with an old matrix.

Note that there may also be some slight changes to 3D point coordinates in comparison to XYZ data due to precision loss coming from the 16-bit normalization of the original depth values.

7.6. Measurements

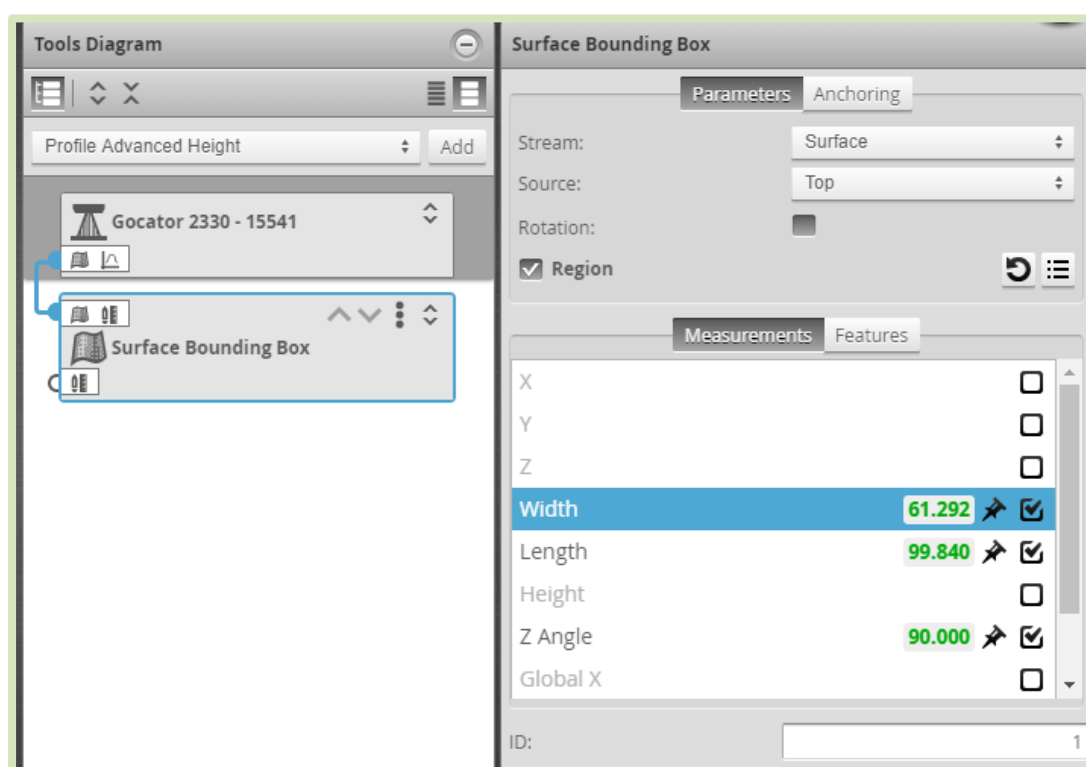
LMI Gocator devices with firmware version **6.0.21.13** and later provide measurement data, which can be used to position 3D ROIs on the 3D object or derive other measurements using the flexible 3D expression editor.

Measurements are configured in the Gocator UI and are sent together with images. In the NeuroCheck program you can use the following properties to access the measurements:

Property name	Description
NCMeasurementSelector	Selects the measurement by its ID as configured in the Gocator UI.
NCMeasurementValue	Provides the measurement value. The user must first set value of property NCMeasurementSelector to the measurement ID and then read the corresponding property value to a data register cell of type Floating point number.

Configuration

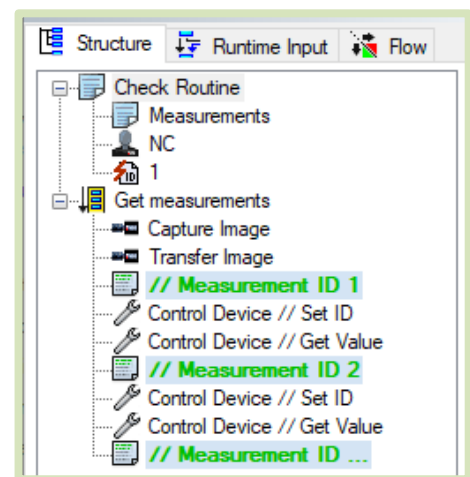
1. Configure measurements in the Gocator web-interface:
 - Tab **Measure**: add necessary steps, enable desired measurement items, and assign a unique ID to each measurement.



- Tab **Output**: enable outputs for the configured measurements. Note the measurement IDs.



- Save the current job.
2. Start NeuroCheck and capture an image at least once using the check function Capture Image. Measurement data should come with image data.
 3. Add a check function **Control Device**. Configure the function to write the property **NCMeasurementSelector**. The written value should match the ID of the requested measurement. Finally execute the check function.
 4. Add a check function **Control Device**. Configure the function to read value of the property **NCMeasurementValue**. Output measurement value will be written to the data register of type floating point number.
 5. Execute the check function.

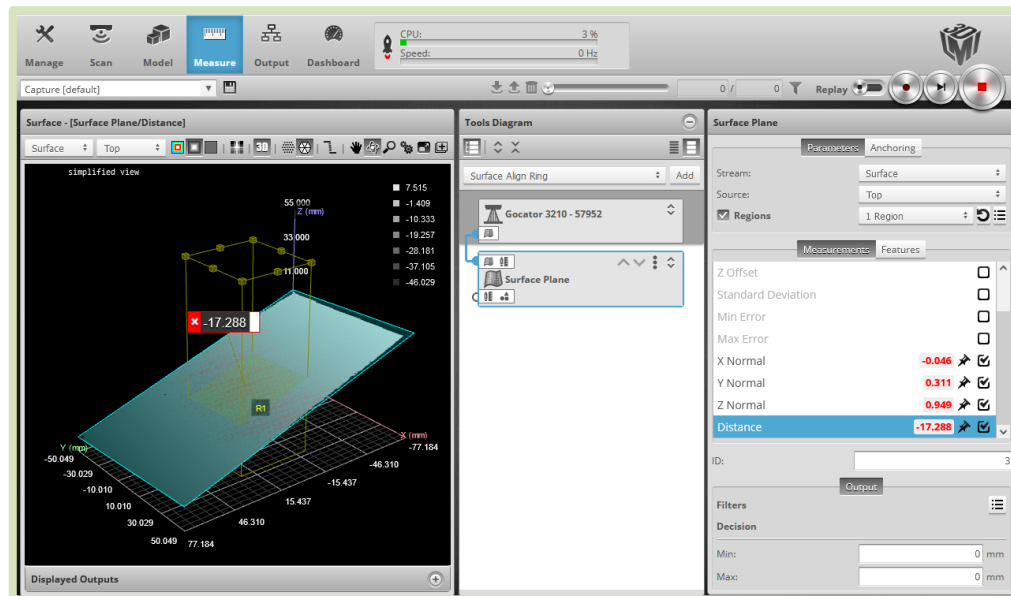


This way you can sequentially set measurement IDs and read all transferred measurement values. Measurement values are recomputed for each captured image.

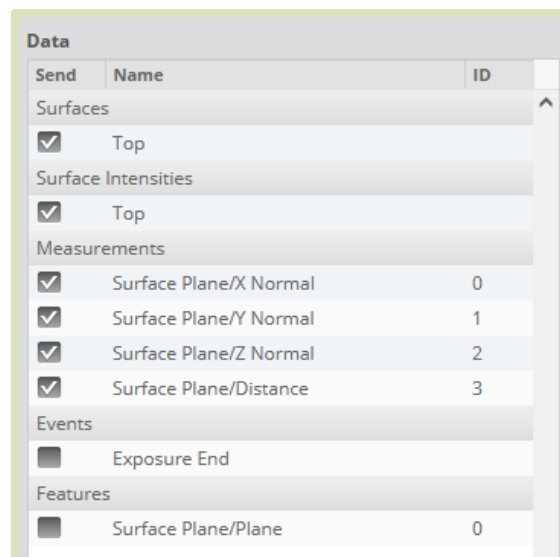
- Note that the coordinate system of Gocator differs from the right-handed coordinate system of NeuroCheck 3D-Xtension. You may need to invert some measurements, like Z-position, Z-offset and X-angle, and adjust the sequence of rotations to position 3D ROIs properly

Example: Create a 3D plane from Gocator measurements:

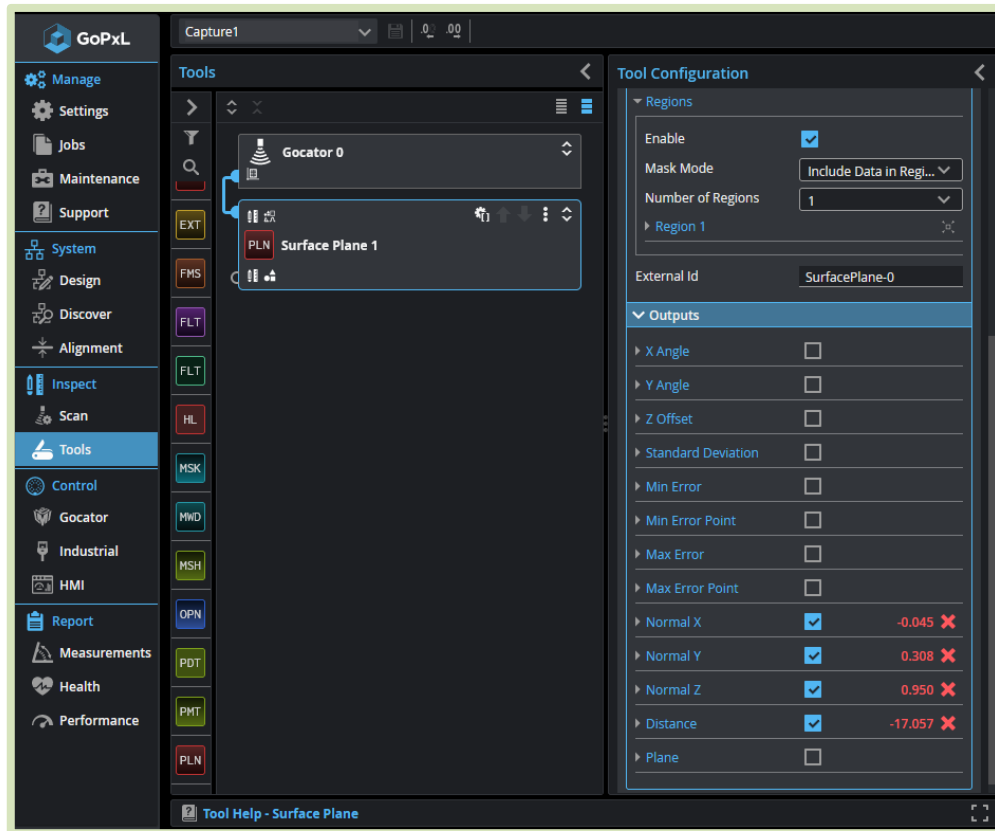
- Configure the tool Surface Plane in tab **Measure**:



- Select the region (or disable it to compute plane using all data points).
- Select the measurements **Normal X**, **Normal Y**, **Normal Z**, **Distance**.
- Enable sending measurements in tab **Output**:



- When using **GoPxL** UI:
 - Configure the tool **Surface Plane** in tab **Inspection >> Tools**:



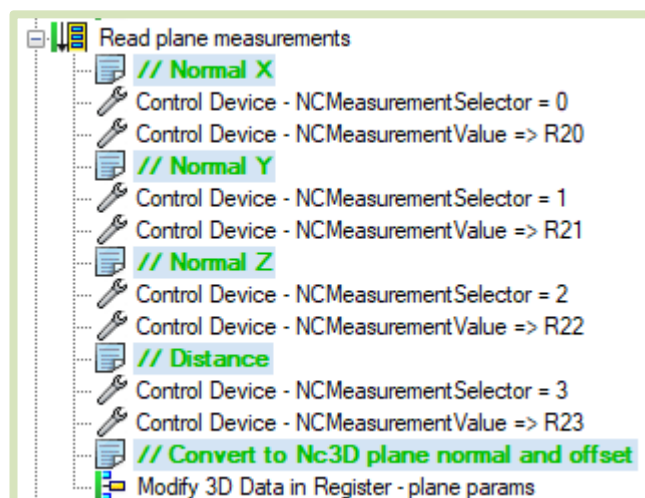
- Enable measurement outputs (**Control >> Gocator**):



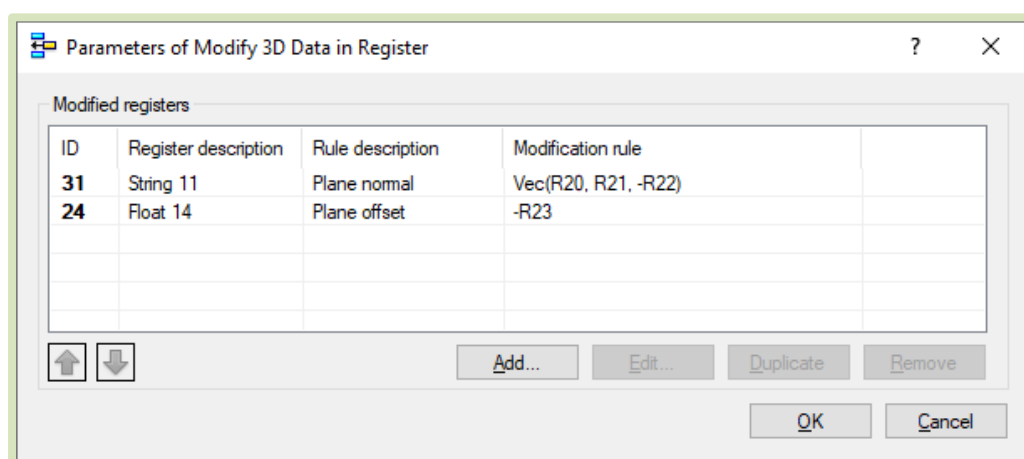
- Save the job configuration.

- Start NeuroCheck and configure the program as follows:

- Capture an image.
- Read all measurements with a sequence of **Control Device** functions.

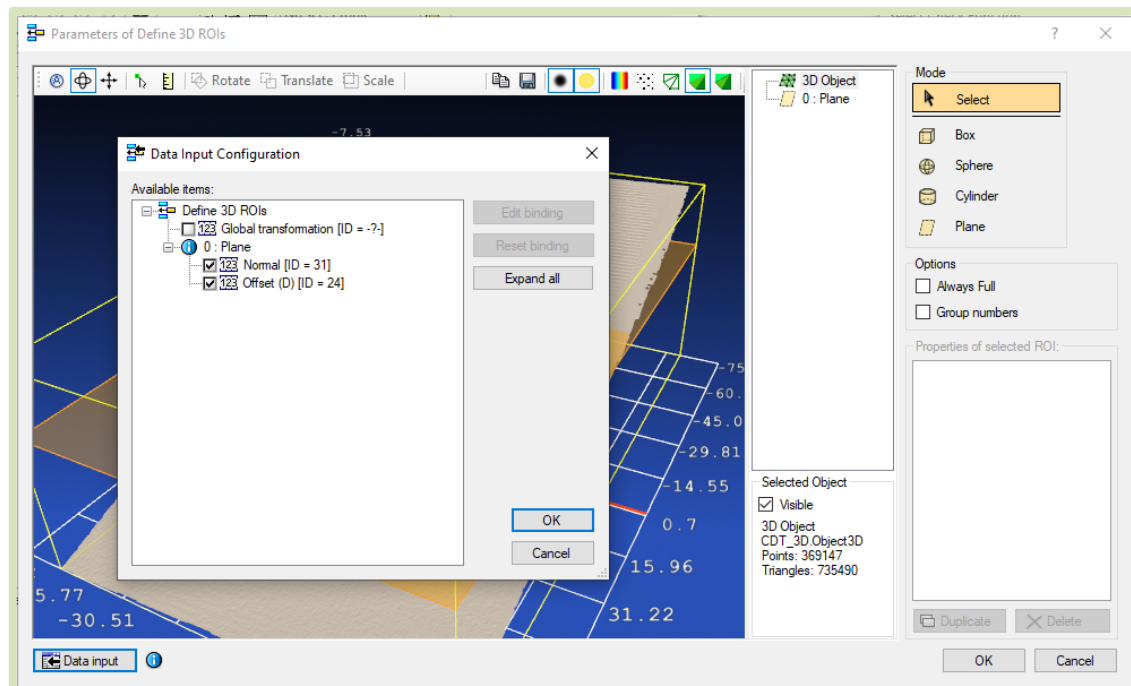


- Convert measurements before passing the data to **Define 3D ROIs**:
 - Compose the plane normal from the measurements **Normal X**, **Normal Y**, **Normal Z**. Invert the **Normal Z** value.
 - Plane offset is the inverted **Distance** value.

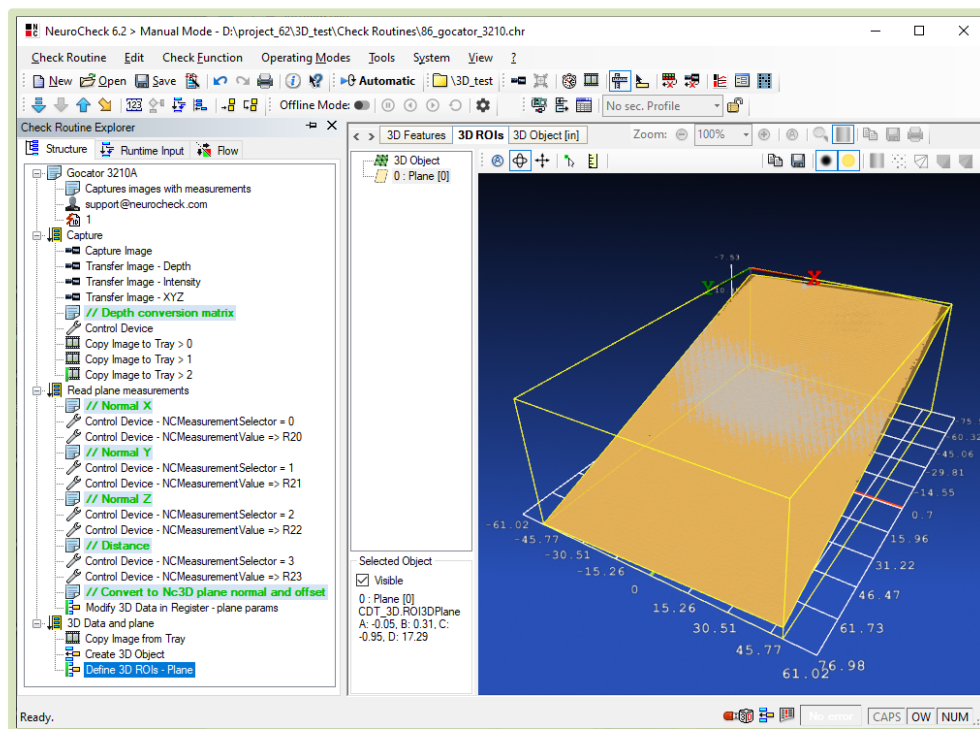


- Create a 3D object from the captured image.

- pass the normal and the offset as data input for a single plane in **Define 3D ROIs**

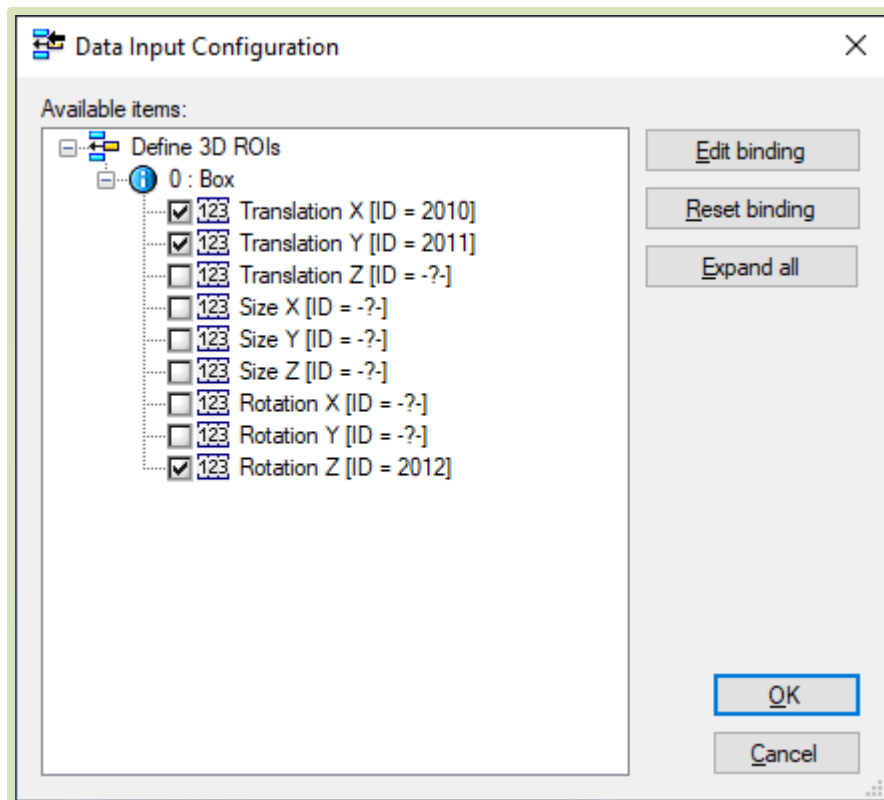


- Execute the program.



Example: Create a 3D box from Gocator measurements

- Specify measurements for **X Position**, **Y Position** and **Z Angle** in the Gocator web-interface.
- Assign IDs and enable outputs for these measurements.
- Capture an image in NeuroCheck and read all measurements to three data registers of type Floating point number.
- Create a 3D object from the captured image.
- Add and configure the check function **Define 3D ROIs**:
 - Add a single 3D box.
 - Set the box position and rotation angles to 0.
 - Open the data input dialog.
 - Configure the data input for items Translation X, Translation Y, Rotation Z.

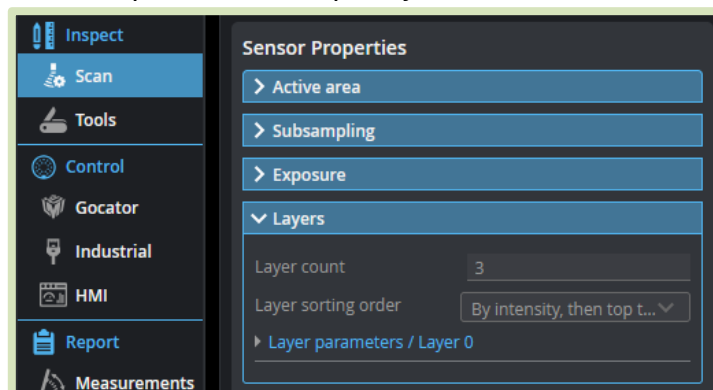


- Execute the check function. The 3D box should be positioned same as shown in the Gocator web interface.

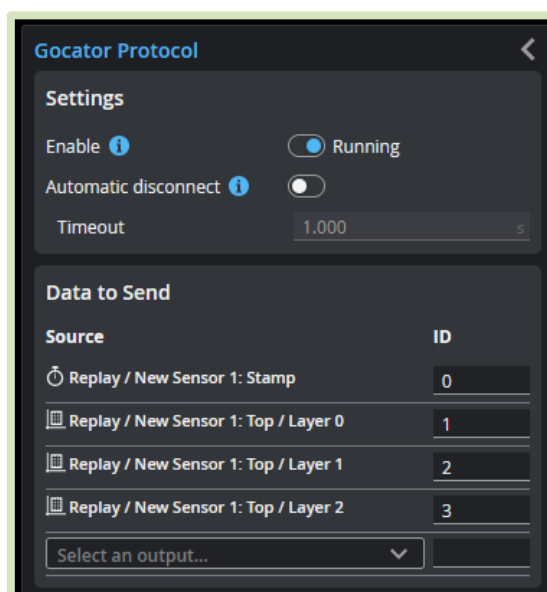
7.7. Multi-layer acquisition

Gocator 5000 Series can capture multiple surface layers at once. For each configured layer both the height map and the intensity image may be available. Starting with the GoPxL firmware version **1.2.30.56** the user can transfer multiple layers into NeuroCheck.

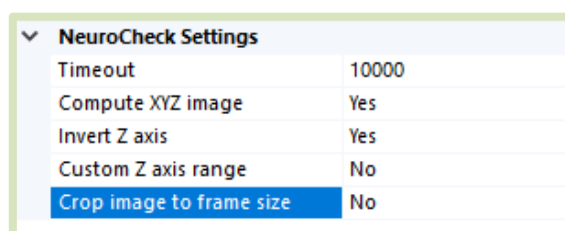
1. First configure the acquisition of multiple layers in the GoPxL web interface.



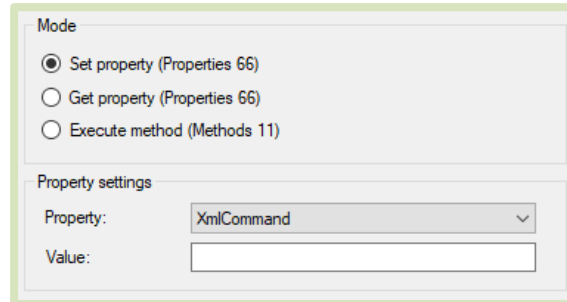
2. Add all layers to the output in the Gocator Protocol page. Each layer must have a unique ID.



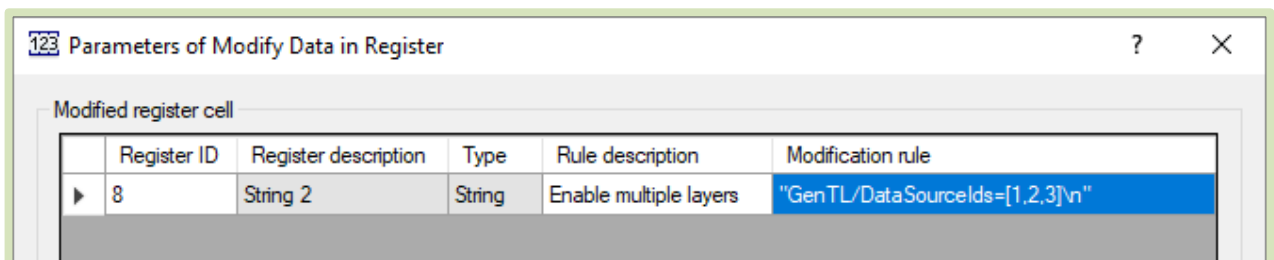
3. Add and configure the sensor as usual in the NeuroCheck device manager. Go to the properties dialog and disable the property **Crop image to frame size**.



4. Create a new single check with a check function **Control Device** inside. Configure the check function as follows:
 - Mode: **Set property**
 - Property: **XmlCommand**
 - Value: empty string



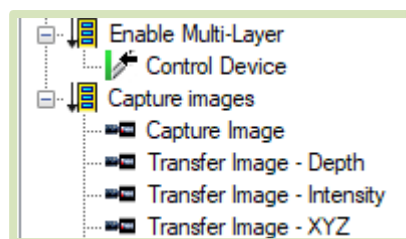
5. Create or select a data register cell of type **String**. Put the following value into this cell:
GenTL/DataSourceIds=[1,2,3]\n



Register ID	Register description	Type	Rule description	Modification rule
8	String 2	String	Enable multiple layers	"GenTL/DataSourceIds=[1,2,3]\n"

Note that the value ends with the new line character **\n**. Replace **[1,2,3]** with IDs of the corresponding layer data object IDs.

6. Configure the data input into the check function **Control Device**, select the register cell configured in the previous step.



7. Execute **Control Device**.
8. Capture a new image. All selected layers are now concatenated into one image. Split the image into separate layers with **Crop Image** check function if needed.

8. Miscellaneous

8.1. Device Manager – Test device

The test command performs acquisition of a single image.

8.2. Device Manager – Reset device

The reset command resets the camera configuration to the default:

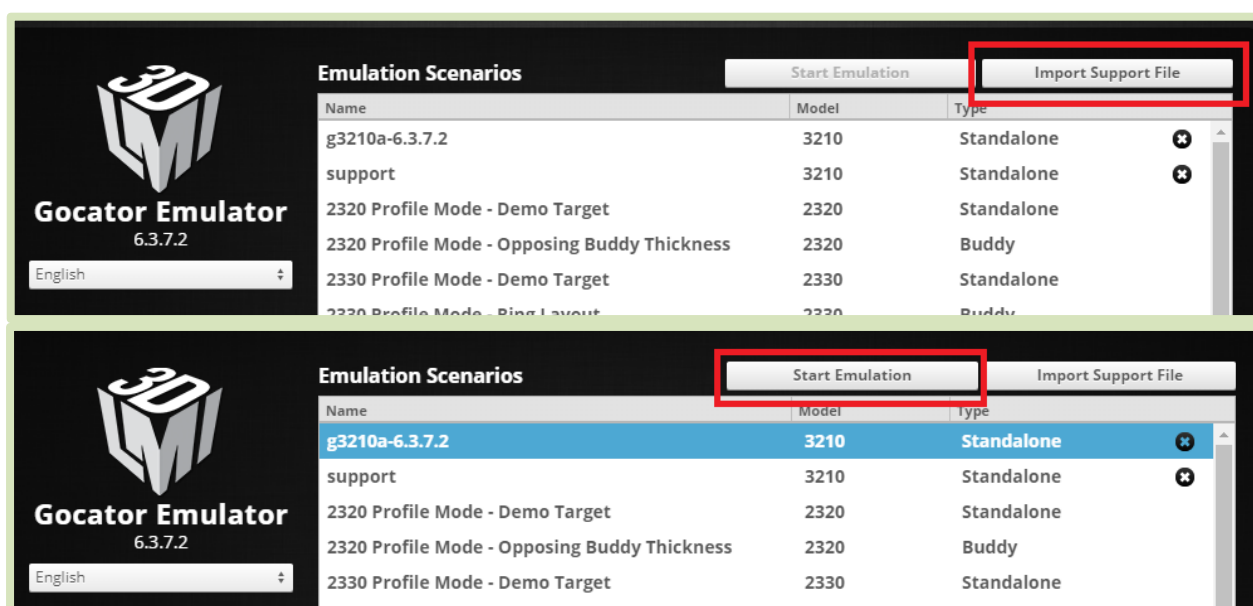
- sets **AcquisitionMode** to **SingleFrame** (if available) or **Continuous**;
- changes the **MinimumZ** and **MaximumZ** values to cover the complete scan volume
- resets the timeout;
- disables creation of XYZ images.

If resetting the device fails, the existing device connection is closed and reopened.

8.3. Offline Gocator recordings

Sensor configuration including the captured images can be saved to a support file and then reloaded in a Gocator Emulator (included in the Software Utilities package). The Gocator Emulator creates a virtual device, which is added in the NeuroCheck device manager in place of real device.

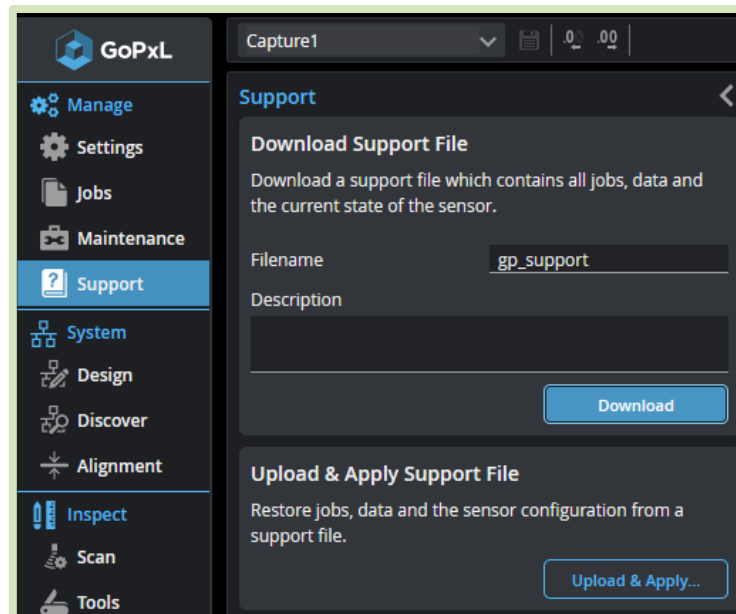
1. Configure the sensor in the web interface and save the job. Note that the configuration of the emulated device cannot be changed after the data is exported to a file and loaded into the Emulator.
2. Press the **Recording** button and capture the required amount of images.
3. Stop recording and create a support file (*.gs).
4. Start the Gocator Emulator, import the support file and start emulation.



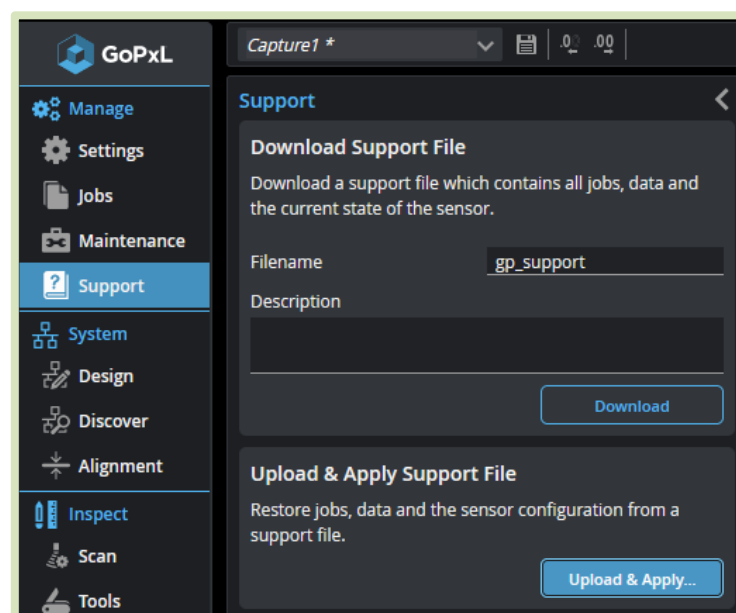
5. Start NeuroCheck and add the emulated sensor in the device manager.

When using the **GoPxL** firmware:

1. Configure the sensor in the web interface and save the job.
2. Press the Recording button and capture the required amount of images
3. Stop recording and create a support file (*.gpsup).



4. Create and start a new GoPxL instance.
5. Launch the web interface of the GoPxL instance, upload the support file.



6. Start NeuroCheck and add the emulated sensor in the device manager.

8.4. Troubleshooting

The sensor does not capture images, projector does not emit light

- Check the power unit voltage.
- Check if the correct voltage is selected in the Gocator interface. If the value is wrong, change it, save the configuration and restart the sensor.
- Check if the light safety signal is properly wired.
- Check the scan and exposure settings.
- Check the trigger configuration. Make sure the trigger signal is actually generated. Try using another trigger source (e.g. **Time**) to isolate the problem.

Why there are no data coming from Gocator?

- Make sure the trigger is correctly configured in the Gocator web-interface and the image acquisition is actually running.
- Make sure the acquired data is shown in the Gocator web-interface and the Surface mode is active.
- Make sure that the Gocator output protocol is set to Gocator and both Surface > Top and Surface Intensities > Top are checked.

Why do I get completely black intensity images?

- Make sure that the Gocator acquires intensity images (**Scan >> Acquire Intensity**) and transmits them to NeuroCheck (**Output >> Ethernet** (Gocator protocol) >> **Surface Intensities >> Top**). Also make sure that your exposure level is reasonable.

Why does the image acquisition in NeuroCheck finish immediately instead of waiting till the camera finishes acquisition?

This may happen when the camera stores previously captured images that were not yet sent to NeuroCheck.

- Do not start the image acquisition in the web interface of the Gocator while NeuroCheck is running.
- Check if the Gocator is set to use the encoder or external signal and not the time trigger.
- Check the configured acquisition timeout in the 3D camera properties dialog.

Why does the Gocator not properly switch between jobs?

- Make sure that the job name does not exceed 15 characters and includes ".job" at the end.
- Do not edit or switch between jobs in the web-interface of Gocator while simultaneously working with Gocator in NeuroCheck.
- Refresh the web-interface every time the job is changed from NeuroCheck.

Why do I get an extremely large image with only small portion of it actually containing some data?

- Try enabling the setting **Crop Image to Frame Size**. It reduces the size of the output image to the actual data frame size.
- Try setting the variables **OverrideImageWidth** and **OverrideImageHeight** in the **Go2GenTL.xml** file to fit the maximum image size expected by your application.

Why is it sometimes not possible to acquire images in Gocator web-interface?

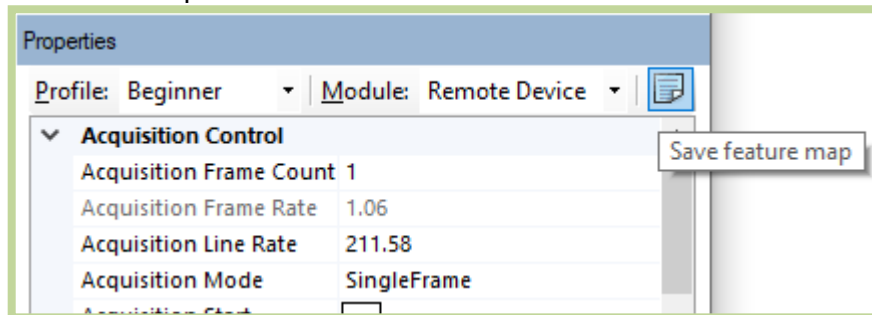
- Make sure that the Gocator is disconnected from NeuroCheck and reload the interface. It is generally not recommended to use Gocator over the web-interface and over NeuroCheck simultaneously.

Why some device properties are not listed in the check function Control Device?

- NeuroCheck has probably tried to read some property value, which was not yet available (e.g. measurement value). Try resetting the device in the Device Manager over the button Reset.

8.5. Debugging

1. Enable NeuroCheck and driver logging (detailed)
2. Save the feature map of the remote device.



3. Enable **Tracing** with **level = 2** in the driver configuration file NC62.DRV.CFGX.

```
<driver name="Driver" assembly="Nc3D.NeuroCheck.Generic.dll"
version="6.2.11.0" date_time="2023-03-02 - 17:10:22">
  <logging name="Logging enabled" display="Yes">1</logging>
  <trace_level name="Low-level driver trace level" display="
High">2</trace_level>
  <timeout name="Timeout">2000</timeout>
```

4. Reproduce the issue.
5. Send the log files, feature maps and trace data from the folder **/System Output/** of the NeuroCheck project to support@neurocheck.com.

9. Known issues

9.1. Incomplete (cropped) images

Gocator devices determine the output image size based on the currently loaded job file. Switching between several jobs at runtime does not change the maximum output image size, causing the larger images to be cropped when transmitted over the GenTL interface. There are two possible solutions to this problem.

- Try setting the variables **OverrideImageWidth** and **OverrideImageHeight** in the **Go2GenTL.xml** file to fit the maximum image size expected by your application.
- Try using the check function **Control Device** to execute the method **NCREopenDevice** each time the Gocator job is changed (i.e. after importing the camera setup file or setting the property **ConfigFile**). Reopening the device forces the internal image buffer size to be reinitialized. Note that reopening a device is a relatively slow operation which may take several seconds to complete, so it shouldn't be used in significantly time-constrained applications.

9.2. Sensor does not start acquisition due to image size overflow

Go2GenTL may in some cases incorrectly report the expected image size, which results in failed image buffer allocations.

- Try setting the variables **OverrideImageWidth** and **OverrideImageHeight** in the **Go2GenTL.xml** file to fit the maximum image size expected by your application.

9.3. No data transmitted in profile or video mode

The scan modes **Video** and **Profile** are not supported due to limitations of the Gocator GenTL producer.

9.4. Image acquisition fails after changing AcquisitionMode

When using the Gocator firmware 6.3 the device may stop acquiring images after **AcquisitionMode** is switched from **SingleFrame** to **Continuous** and back to **SingleFrame**.

- Use the same **AcquisitionMode** value in all camera configurations of your project. Do not change this value dynamically (whether over the 3D camera properties dialog or over **Control Device**).

10. References

- [1] LMI Technologies, Inc, Gocator Snapshot Sensors User Manual,
Firmware version: 6.3.x.xx, 2023.
- [2] LMI Technologies, Inc, Gocator Line Profile Sensors User Manual,
Firmware version: 6.3.x.xx, 2023.
- [3] LMI Technologies, Inc, GoPxL for Gocator Snapshot Sensors User Manual,
Firmware version: 1.1.x.x, 2024.
- [4] LMI Technologies, Inc, GoPxL for Gocator Laser Profilers User Manual,
Firmware version: 1.1.x.x, 2024.
- [5] LMI Technologies, Inc, "Product Downloads | LMI3D Downloads" [Online].
Available: <https://lmi3d.com/product-downloads/>. [Accessed 14 05 2024].