

NeuroCheck GenICamTL

3D Camera Driver



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Introduction

Support for GenICam GenTL 3D cameras

This driver uses the **GenICam GenTL** interface to connect, configure and transfer data from 3D cameras into NeuroCheck. The driver makes it possible to use and interchange a wide range of **GenICam GenTL** compliant 3D cameras from different manufacturers over a standardized interface.

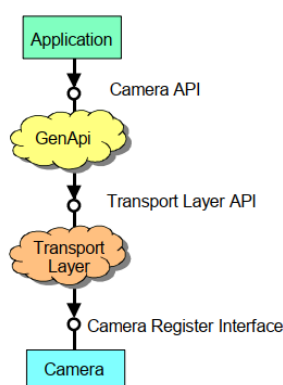
1. GenICam

GenICam stands for Generic Interface for Cameras and provides a unified generic API for camera control and configuration. The standard consists of multiple modules, each describing some subset of functionality. This driver is based on the following modules:



- **GenApi**: Application Programming Interface for configuring the camera. The camera device must expose a set of **features**, representing either device properties or device commands and their mapping to the actual registers of the camera device, which are packed in an XML description file and transferred to the application. Over this description file the application can identify how to control the device, configure the parameters, determine how the parameters should be shown in the user interface, what are their value ranges, etc.
- **SFNC**: Standard Feature Naming Convention. The module defines how the features should be named and operate, so that the camera controlling experience could stay identical over different devices.
- **GenTL**: Generic transport layer interface that allows enumerating and connecting the camera devices, grabbing images and transferring data.

The camera manufacturer may support only a selection of GenICam standard modules. **GenICam** compliant cameras provide the **GenApi** XML description file, which mostly follow the **SFNC**. Connection to a camera and data transferring are done via some particular transport layer protocol, in case of **GenICam** compliant cameras typically **GigE Vision** or **USB3 Vision**. In order to use those cameras with the driver, the generic transport layer **GenICam GenTL** interface must also be implemented.



2. GenICam GenTL

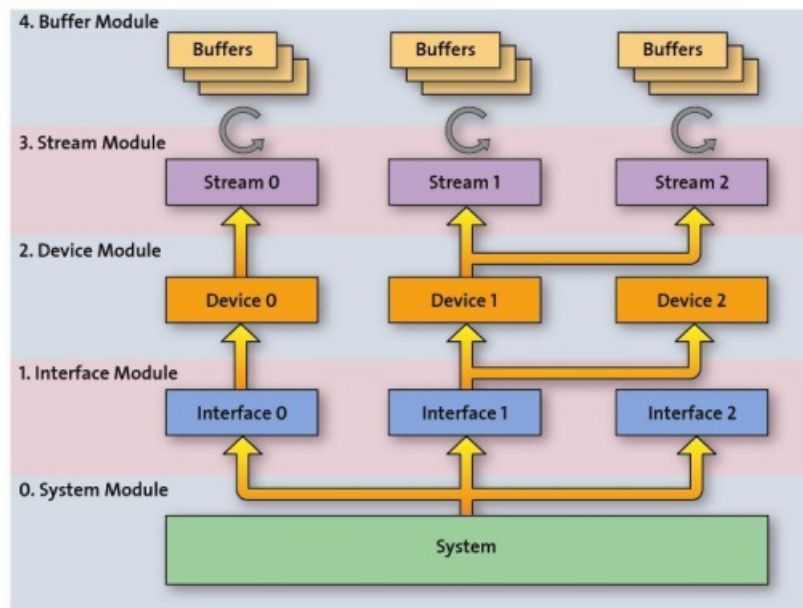
GenTL provides a unified transport layer interface which makes connection to cameras and data transmission independent of the actual underlying protocol used to communicate with the camera.



The implementation of this generic interface is contained in a so called **GenTL Producer**. This producer provides its functionality to find the available devices and to communicate with the camera to an application (called a **GenTL Consumer**). **GenTL Producer** is a file with the ***.CTI** extension and is typically provided by the camera manufacturer as part of the driver or SDK installation package. When this file is available, the camera can be considered **GenICam GenTL** (or **GenICamTL**) compliant and is potentially supported by the driver.

GenTL defines the following internal layered structure to enumerate available devices and transfer data:

- **System**: represents the whole GenTL Producer.
- **Interface**: represents one physical interface in the system, e.g. a network card or a frame grabber.
- **Device**: represents a proxy for one physical remote device.
- **Data stream**: represents a single data stream, which is used to transmit image data. One device may have one or multiple data stream. The current version of the driver supports only one data stream per device.
- **Buffer**: represents a memory buffer, which holds the actual image data transferred from the camera.



The actual physical camera device is represented by the **Remote Device** (not shown in the picture). This device provides the **GenApi** XML description file, which is used to control and configure the camera device. Each GenTL module can also have its own XML description file, making it possible to configure the modules themselves. The configuration of all modules is done in the [Camera Properties Dialog](#).

More information on GenICam and GenICam GenTL can be found here:

- [GenICam - EMVA](#)
- [GenICam Standard](#)
- [GenICam Standard Features Naming Convention \(SFNC\)](#)
- [GenICam Pixel Format Naming Convention \(PFNC\)](#)
- [GenICam GenTL Standard](#)
- [GenICam Group Members - EMVA](#)
 - NeuroCheck GmbH is a member of the GenICam standard group

Supported Cameras

General

The driver potentially supports **GenICam** compliant 3D cameras with an available and compatible **GenICam GenTL** producer. The camera itself may also be not GenICam compliant, but in this case the GenTL producer must itself generate a valid GenApi XML description file for the remote device.

The driver is based on GenICam GenApi reference implementation version 3.5 and GenICam SFNC version 2.7. The driver supports GenTL producers starting from the GenTL interface version 1.0.

There are several additional requirements imposed by the NeuroCheck driver:

- The camera XML description file must expose the following features: **AcquisitionStart**, **AcquisitionStop**, **AcquisitionMode**, **Width**, **Height**, **PixelFormat**.
 - The listed features are always available in particular when the camera supports **GigE Vision** or **USB3 Vision**.
- The camera must support at least one of the standard acquisition modes: **Continuous**, **SingleFrame**, **MultiFrame**.
 - Continuous acquisition mode is always available in particular when the camera supports **GigE Vision** or **USB3 Vision**.
- The camera must support at least one of the following **pixel formats** (as defined in the **Pixel Format Naming Convention**):
 - **BayerRG8**, **BayerRG10**, **BayerRG10p**, **BayerRG10Packed**, **BayerRG12**, **BayerRG12p**, **BayerRG12Packed**, **BayerRG16**
 - **BayerGR8**, **BayerGR10**, **BayerGR10p**, **BayerGR10Packed**, **BayerGR12**, **BayerGR12p**, **BayerGR12Packed**, **BayerGR16**
 - **BayerBG8**, **BayerBG10**, **BayerBG10p**, **BayerGB10Packed**, **BayerBG12**, **BayerBG12p**, **BayerGB12Packed**, **BayerBG16**
 - **BayerGB8**, **BayerGB10**, **BayerGB10p**, **BayerGB10Packed**, **BayerGB12**, **BayerGB12p**, **BayerGB12Packed**, **BayerGB16**
 - **Mono1p**, **Mono2p**, **Mono4p**, **Mono8**, **Mono8s**, **Mono10**, **Mono10p**, **Mono10Packed**, **Mono12**, **Mono12p**, **Mono12Packed**, **Mono14**, **Mono16**
 - **R8**, **G8**, **B8**, **RGB8**, **RGB8Packed**, **RGB8_Planar**, **BGR8**, **BGR8Packed**
 - **R10**, **G10**, **B10**, **RGB10**, **RGB10Packed**, **RGB10_Planar**, **RGB10V1Packed**, **RGB10p32**, **BGR10**, **BGR10Packed**
 - **R12**, **G12**, **B12**, **RGB12**, **RGB12Packed**, **RGB12_Planar**, **BGR12**, **BGR12Packed**
 - **R16**, **G16**, **B16**, **RGB16**, **RGB16Packed**, **RGB16_Planar**, **BGR16**, **BGR16Packed**
 - **YUV422_8**, **YUV422_8_UVYV**, **YUVPacked**, **YUV422Packed**
 - **RGBa8**, **BGRa8**, **RGBa16**, **BGRa16** (alpha channel is skipped)
 - **Data8**, **Data8s**, **Data16**, **Data16s**
 - **Coord3D_A8**, **Coord3D_B8**, **Coord3D_C8**, **Coord3D_AC8**, **Coord3D_ABC8**
 - **Coord3D_A10p**, **Coord3D_B10p**, **Coord3D_C10p**, **Coord3D_AC10p**, **Coord3D_ABC10p**
 - **Coord3D_A12p**, **Coord3D_B12p**, **Coord3D_C12p**, **Coord3D_AC12p**, **Coord3D_ABC12p**
 - **Coord3D_A16**, **Coord3D_B16**, **Coord3D_C16**, **Coord3D_AC16**, **Coord3D_ABC16**
 - **Coord3D_A32f**, **Coord3D_B32f**, **Coord3D_C32f**, **Coord3D_AC32f**, **Coord3D_ABC32f** (32f values are rounded to the nearest 16-bit unsigned integer value)
 - **Confidence1**, **Confidence1p**, **Confidence8**, **Confidence16**
 - **Data32f**, **Confidence32f** (32f values are rounded to the nearest 16-bit unsigned integer value)

Note that the driver assumes that the aforementioned features are implemented in compliance with the **GenICam Standard** and the **GenICam SFNC** and controls the device during the synchronous, parallel and image stack acquisition accordingly. Due to the high variance of different devices and specific interface implementations, controlling some features or command execution order may not work properly on some particular devices. In such rare cases it may be necessary to switch to the fully custom image acquisition and control the device directly over these features.

There are also several limitations of the current driver:

- A camera device can only have one GenTL data stream. Devices with multiple data streams may work incorrectly.
- Image data must be transferred directly via the GenTL buffer in any supported format, buffers with multiple parts and chunk data are supported as well. GenICam GenDC format is not supported.
- Transferring custom event data is not supported.
- The same camera can only be detected once by the same GenTL producer. If a single GenTL producer detects the same camera twice (e.g. on two separate interfaces), the second camera device or both of them may be unusable.
- Since only image data can be currently transferred to NeuroCheck, all 3D information must be packed into 8 bit or 16 bit images or into XYZ images. XYZ image are generated automatically when **Scan3dOutputMode** is available.



Important Note:

A machine vision system consists of a variety of hardware and software components which must be well coordinated (PC system, BIOS, operating system and version, hardware drivers, GenTL producers, quality and completeness of the particular GenTL producer implementation and of GenCam SFNC compliance, camera model, camera firmware, PCI boards, etc.). In general, NeuroCheck as producer of only one of these components cannot take responsibility for the complete system, i.e. we cannot guarantee that each possible combination of devices and components works properly. However, your NeuroCheck partner will be glad to help you selecting the right components for your machine vision application.

Tested cameras

The tables below list the properly tested 3D cameras. Please do not hesitate to contact your NeuroCheck partner for details on supported cameras or new developments.

Heliotis		
Designation	Scan type	GenTL Producer
heliInspect H8	Area	diaphus.cti

Mech-Mind		
Designation	Scan type	GenTL Producer
Mech-Eye Pro S	Area	bgapi2_gige.cti

LMI Gocator

The driver package contains a special extension for LMI Gocator profile and area scan sensors, providing additional functionality, including extraction of intensity data, generation of XYZ images, and other.

LMI Gocator - properly tested	
Designation	Scan type
2320	Profile
2330	Profile
2420	Profile
3110	Area
3210	Area
3506	Area

LMI Gocator - complete series - experimental unlocked		
Designation	Scan type	GenTL Producer
2xxx	Profile	Go2GenTL.cti
3xxx	Area	Go2GenTL.cti
4xxx	Area	Go2GenTL.cti

LMI Gocator - complete series - experimental unlocked

5xxx

Area

Go2GenTL.cti

System Requirements

The minimum system requirements for this NeuroCheck Driver are:

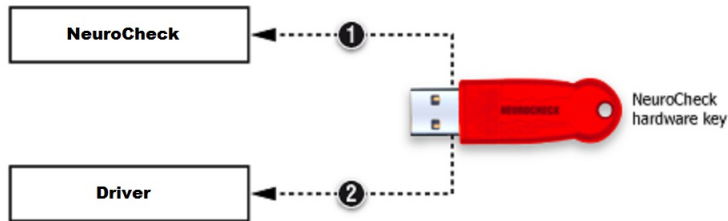
Element	Description
Operating system	Windows® 11 (64 bit) Windows® 10 Anniversary Update Version 1607 (32 bit and 64 bit) Windows® 7 SP1 (32 bit and 64 bit)
Processor	Dual-Core 3.1 GHz
RAM	2 GB RAM (3 GB recommended)
HDD/SSD	1 GB
Software	NeuroCheck 6.2.17 (recommended) NeuroCheck 6.2.3 RTM (minimum supported version)

Installation

1. Make sure your system meets the minimum requirements.
2. Install the Visual C++ 2015-2019 Redistributables by executing the file `VC_redist.x64.exe` or `VC_redist.x86.exe` for the 64-bit or 32-bit system respectively from the `Prerequisites` directory.
3. Copy all files in the `Binaries\[CPU architecture]\` directory from the zip archive to the NeuroCheck installation directory (e.g. `C:\Program Files\NeuroCheck 6.2\`). Depending on the CPU architecture of your system you have to select the appropriate subdirectory (e.g. for 64-bit systems choose `Binaries\64-Bit_x64\`).
4. Copy the documentation file `Nc3D.NeuroCheck.Generic.UI.chm` from the `Documentation` directory to `Documentation\Help` inside the NeuroCheck installation directory.
5. Proceed with the integration of a 3D camera.

Licensing

This section describes the licensing mechanism for this NeuroCheck Driver.



1. Protection of NeuroCheck

NeuroCheck requires a valid license which is provided as hardware security key (dongle). You obtain the standard NeuroCheck license by purchasing the software from your local NeuroCheck dealer.

2. Protection of Driver

In addition to the standard NeuroCheck license, also a license for the NeuroCheck **3D Camera Driver** is required. The protection of the driver is stored as special flag in the same dongle as for the NeuroCheck license. The driver allows regular operation in demo mode, however the height image will contain a demo label and the XYZ image will not have all the 3D information.

In order to get the license for the driver, please contact your local NeuroCheck partner. The license can be added to a standard NeuroCheck license by remote-programming of the dongle. The remote-programming works in the same way as a NeuroCheck update.

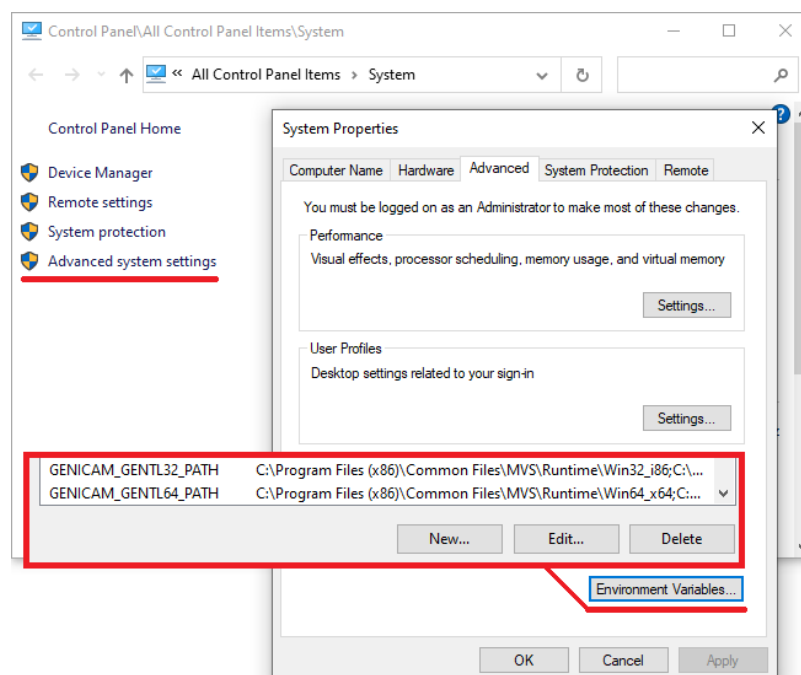
3D Camera Integration

Please make sure the system complies with the [minimum requirements](#) of the driver and of the camera hardware and software itself, and the camera is supported by this driver. The integration of a camera should follow the installation of the driver itself.

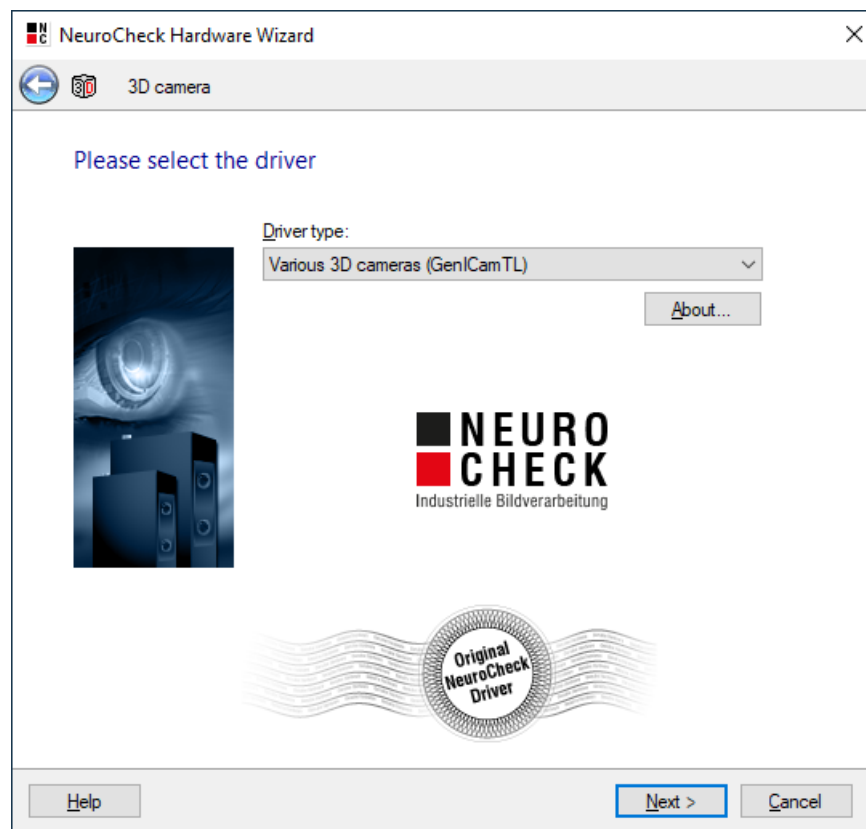
Integration of a **GenICamTL** compliant 3D camera requires an available and compatible (with the camera) **GenICam GenTL Producer** (a *.CTI file). This file is typically supplied by the camera manufacturer as part of the driver package or SDK. If the manufacturer does not provide a GenTL Producer, a substitute GenTL Producer may be taken, e.g. if the camera is a **GigE Vision** camera, and a **GigE Vision** compatible GenTL Producer is already installed on the system.

Integration of a generic GenICamTL compliant 3D camera

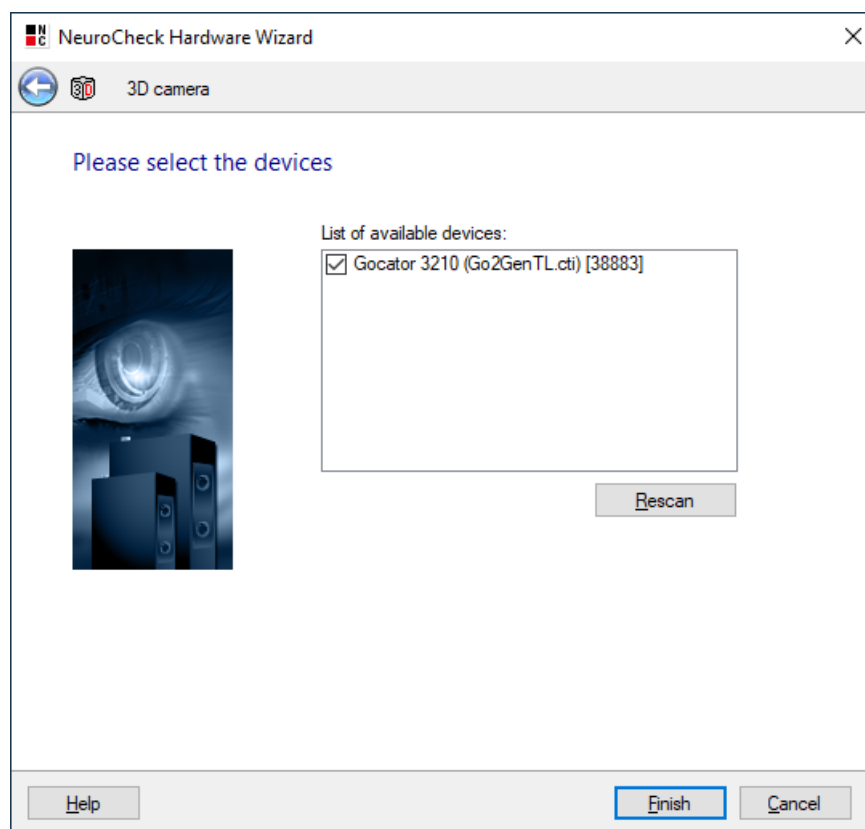
1. Install the drivers and/or SDK for the selected camera including the low level and filter drivers. Depending on the camera additional tools like an IP configuration tool or a separate viewer app can also be installed. Refer to the specific camera manual for more details. If the camera is a **GigE Vision** camera, check the [dedicated network configuration section](#). If the camera is an LMI Gocator, check the separate [LMI Gocator GenICamTL Integration manual](#) provided with this driver.
2. Identify the location of the installed driver package/SDK in the system and find the **GenTL Producer** (*.CTI file) at the location. Some driver packages put the path to their GenTL producers to the environment variable **GENICAM_GENTL32_PATH** or **GENICAM_GENTL64_PATH** for 32 bit and 64 bit applications respectively during the installation. Note that there may be multiple files present in the driver folder, since different *.CTIs can manage different underlying protocols like **GigE Vision** (typically contain "gige" or "gev" in their file name) or **USB3 Vision** ("usb", "u3v", etc). If the path is present in the environment variable, NeuroCheck will find the GenTL producers automatically. Otherwise you must copy the file manually to the NeuroCheck installation folder or add the path to it to the environment variable. Note that the driver first scans the NeuroCheck installation folder and then the external paths. If you have multiple paths which contain GenTL providers with the same file name, only the first detected producer file will be loaded.



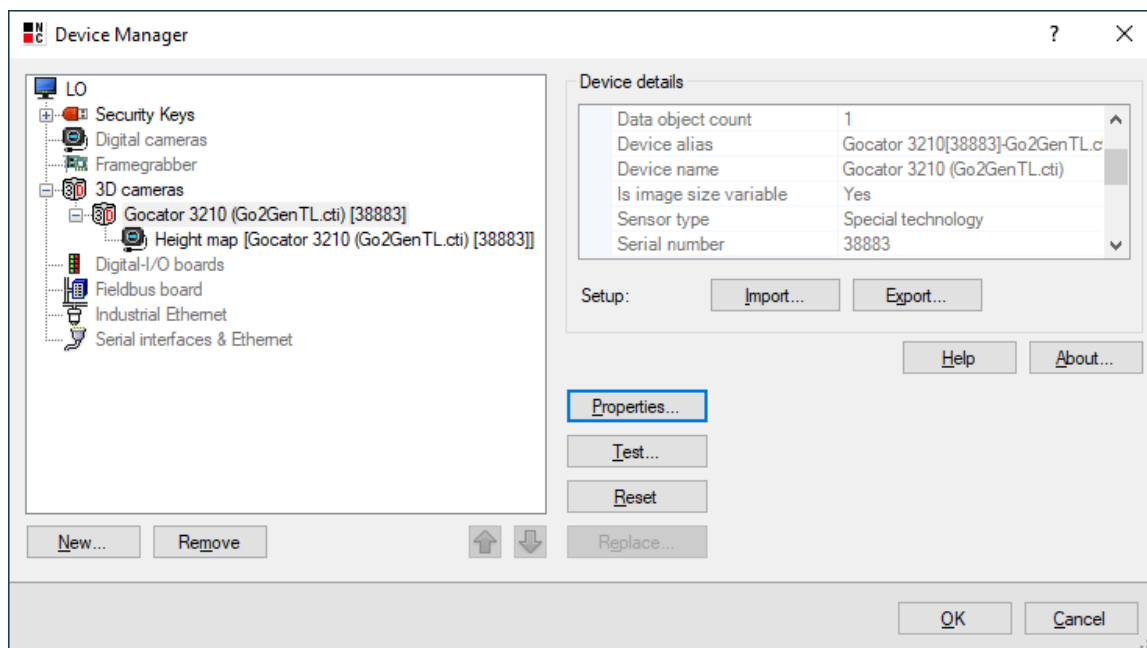
3. Physically connect and configure the hardware connection of the camera. This step depends on the underlying camera protocol. Refer to the camera manual for more details. It is recommended to make sure that the camera can be discovered by the manufacturers software and is able to acquire and transmit images over it (if this software is available).
4. Start **NeuroCheck**, proceed to the Device Manager, Select **New... > 3D Camera**.
5. Make sure "**Various 3D cameras (GenICamTL)**" is present in the list of recognized camera drivers. Check in the driver info dialog if the required GenTL Producer was successfully found by the driver (Page "**Low Level Driver**")



6. Click next, find the connected camera. The shown camera name is composed from three parts: the camera model name, the GenTL producer name, and the camera serial number. Note that the same camera may appear several times in the list, if discovered by several GenTL producers simultaneously. It is still recommended to connect the camera only using the matching GenTL producer supplied by the camera manufacturer.



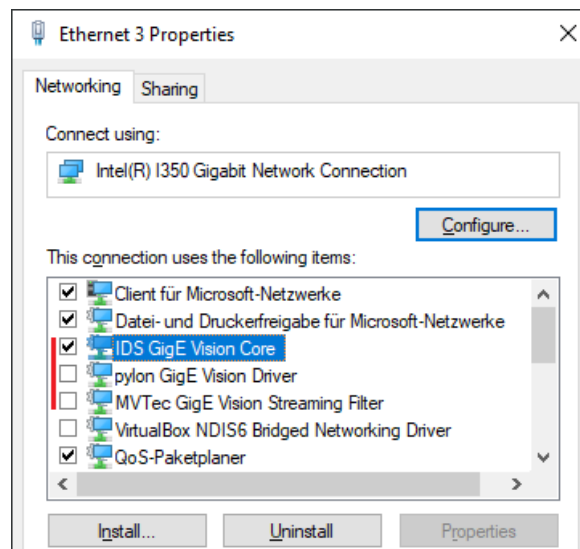
7. After the successful connection the camera will appear in the list of 3D cameras:



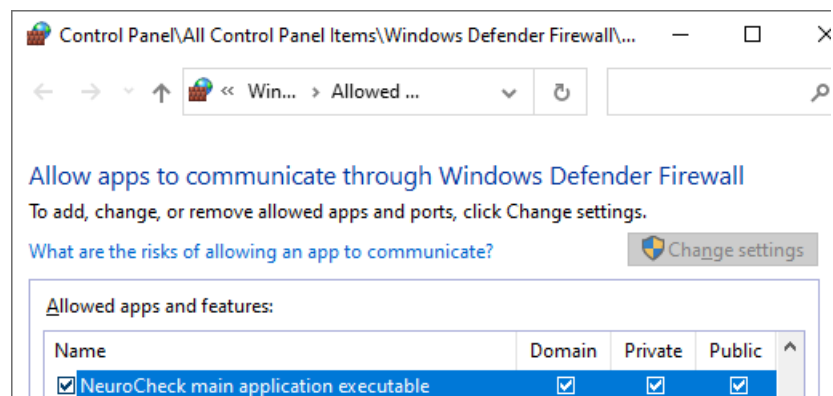
8. The 3D camera is ready, you can now proceed with [configuration](#), [image acquisition](#) and [integration with NeuroCheck 3D-Xtension](#).

Network configuration of a GigE Vision Camera

1. Install Gigabit Ethernet compliant network adapter for the communication with the cameras.
All further instructions refer to this network adapter (not to possibly existing company or production line network adapters).
2. Install the GigE Vision filter driver supplied with the GenTL Producer for the selected network adapter.
3. Connect the camera to the PC.
4. Open the Windows network connection dialog. Select the LAN connection list entry that represents your network adapter. Open the network connection properties dialog. Press the "**Configure ...**" button.
 - On Page "**Advanced**":
 - Search for the setting "**Jumbo Frame**" and set it to "**Enable**" or to maximum size supported by the network adapter and connected switch (if present).
The availability of this property depends on the network adapter.
 - Search for the setting "**Receive Buffers**" and set it to maximum.
For most Intel cards the settings is found under **Advanced | Receive Buffers**.
 - Search for the setting "**Interrupt Moderation Rate**" (if available) and set it to '**Adaptive**'.
 - Search for the setting "**Energy Efficient Ethernet**" (if available) and set it to '**Off**'.
 - On Page "**Power Management**"
 - **Disable all**, e.g. "Allow the computer to turn off this device to save power".
 - Go back to the network connection dialog, select the property "**Internet Protocol (TCP/IP)**" and open the dialog "**Properties**".
Select "**Use the following IP address**". Configure a suitable IP address and subnet mask. Leave the fields "Default gateway", "Preferred DNS server" and "Alternate DNS server" empty.
 - Note that only one GigE Vision filter driver that matches the GenTL producer should be activated for the connection. If you have multiple GigE Vision filter drivers installed, deactivate the unused drivers:



- Close the network connection properties dialog afterwards.
5. The camera must be identified by a unique and persistent IP address. The factory setting will most probably define no persistent address. Therefore a persistent IP address must be assigned to each camera once. To assign the IP address the **Baumer GigE IPConfig** tool can be used, which is included in the NeuroCheck installation and is located in the subfolder `\Tools\CameraIPConfigurator\`. Alternatively some other GigE Vision IP Configuration tool can be used, preferably one from the camera driver package. Wait until the camera is discovered again after assigning a persistent IP address.
 6. Open the **Windows Firewall** and allow the NeuroCheck app all kinds of communications ("**Allow an app through Firewall**"):
 -



7. Proceed with the integration of a [GenlCamTL compliant 3D camera](#).

Camera Configuration

GenICam features

A 3D camera is controlled using the set of GenICam features exposed by the camera over the **GenApi**. Some features represent properties, which can be read or written, others represent methods (commands), which can be executed. Features are arranged in a tree structure. Nodes of this tree are categories, which group features by their purpose e.g. Acquisition control, Image format control. These categories are used to present the features in the [3D Camera Properties Dialog](#).

Properties can have the following types:

- **Enumeration** (e.g. Acquisition mode, Pixel format)
- **Integer** (e.g. Number of frames, Width, Height)
- **Floating point number** (e.g. Exposure time, Gain)
- **String** (e.g. Device name)
- **Boolean** (e.g. Reverse X, Reverse Y)

Access to features may be restricted, e.g. they might be only readable, only writable, or both readable and writable, or not available at all. Some features are not writable particularly during image acquisition. Features may also depend on each other, restricting the range of possible values or availability, etc.

Some features are used to index other features, which may have multiple instances (like arrays or sets). These features are called **selectors** and typically control an array index or a set enumeration value, thus pointing to the particular feature instance. If there exist multiple instances of the property **Gain** corresponding to individual channels **Red**, **Green**, **Blue**, then, using a selector feature **GainSelector**, the particular gain channel can be specified, read or written:

Gain[GainSelector = Red] = 1

Gain[GainSelector = Green] = 2



Note that some 3D cameras may additionally require advanced configuration over an external interface (e.g. a web interface) and expose only a small subset of settings over the GenICam interface.

Saving and loading camera setup files

When a camera is connected to NeuroCheck, values of all available camera features are saved. Only features which are both readable and writable are considered. Features which are not present in the feature tree are not saved. If a feature has multiple instances, all available instances of this feature are saved. These values are stored in the NeuroCheck project configuration file (*.DP.CFGX) and reapplied to the camera when NeuroCheck is restarted.

The user also can save the 3D camera configuration to a separate ***.3DSX** camera setup file. This file can later be loaded using the check function **Control Image Acquisition**. Each property value receives a **<parameter>** XML node in the setup file. If a feature has multiple instances, selector values are also specified with **<selector>** XML nodes. Property values in the setup file are grouped by the GenTL module name. When loading the camera setup file, all properties are applied sequentially in the same order inside their group as they appear in the setup file.

The driver typically tries to determine features that depends on other features and order them accordingly while creating the setup file. However, this automatic behavior may be insufficient in some special cases and require manual modification of the camera setup file.

Due to the wide variety of possible camera configurations and feature dependencies some property values may fail to be written. Such write failures will be logged by the driver, but they do not prevent loading the camera configuration in general. Make sure that all necessary properties are initialized correctly when testing the camera.



On some camera models it is possible to save the complete camera configuration directly on the camera using the GenICam features **UserSetSelector**, **UserSetLoad** and **UserSetSave**. The user can first configure the camera and save the settings with the **UserSetSave** command in the property dialog and then load the settings with the **UserSetLoad** command using the **Control Device** check function (see [User Set Control](#)).

Excluding features from the camera configuration

The driver typically tries to save all detected and available properties to a setup file. However, this approach has multiple drawbacks:

- Some of the properties might not be intended for modification, even if their modification is possible.
- Trying to read or write some properties may take too much time or cause an unwanted behavior.
- Some properties might have too many instances, iterating over all available selector values may take much time.
- Some properties are completely irrelevant to the user and can be ignored.
- Some property values are specific for the particular device and cannot be transferred to another device.

In case saving all properties is not necessary, a list of excluded features can be defined. This list can be configured on the [driver configuration](#) page. Features with the specified names or from the specified categories will not be added to the camera configuration.

Image Acquisition

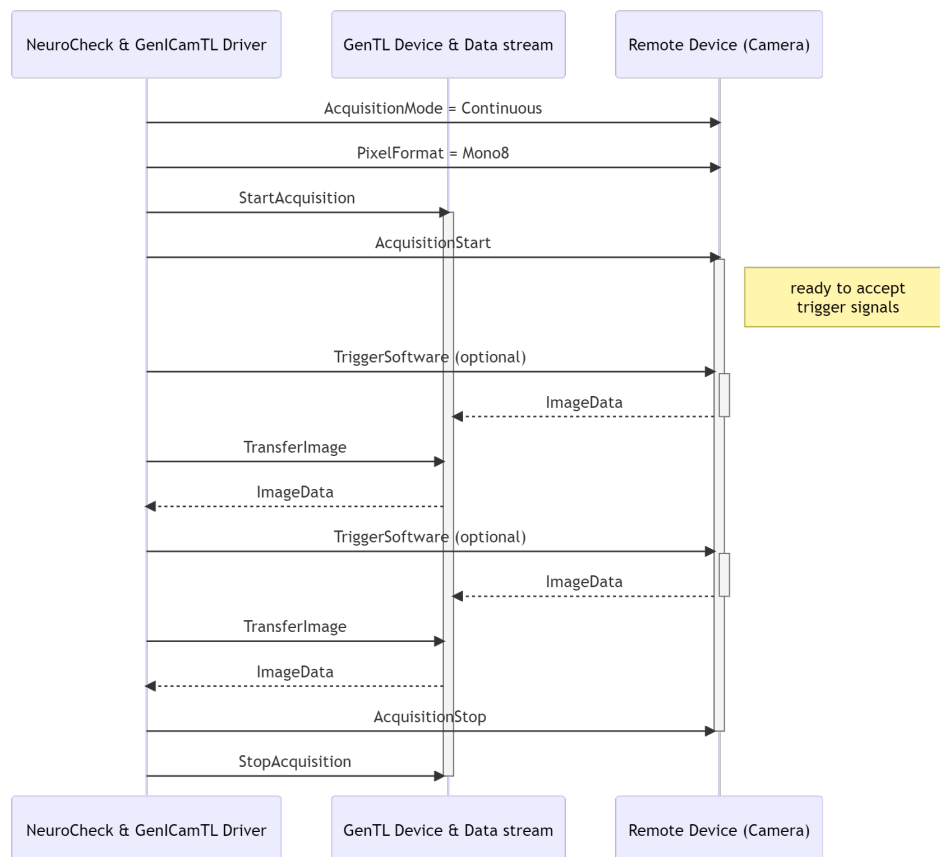
Image acquisition must be correctly configured and controlled in order to get images from the camera. Normally the driver takes care of the correct order of operations to get images unless the custom acquisition control steps are required. Nevertheless proper configuration of image acquisition will lead to the optimal acquisition duration and help to avoid various acquisition problems.

GenICam GenTL acquisition control

The driver uses the standard GenICam GenTL interface and GenICam standard features to control image acquisition. The most important functions are also exposed to the user (available via check function **Control Device**):

- **Start Acquisition** (GenTL data stream)
- **AcquisitionStart** (GenICam feature)
- **AcquisitionStop** (GenICam feature)
- **Stop Acquisition** (GenTL data stream)

In a simplified diagram below communication between NeuroCheck and the camera as well the intermediate GenTL representation of the device are shown during the typical image acquisition process. First, the camera is configured by setting all the necessary property values (**PixelFormat**). Then the acquisition engine is started on the GenTL data stream of the GenTL device (**Start Acquisition**). This allows for data buffers to be filled and transferred from the camera device to NeuroCheck. Then, the actual image acquisition on the camera is started using the **AcquisitionStart** method. Depending on acquisition and trigger configuration the camera takes one or more images. Acquisition of images is stopped with **AcquisitionStop** method. Acquisition engine can then be stopped completely (**Stop Acquisition**).



The camera is typically ready to acquire images already when NeuroCheck is started and the camera is connected. However, when some acquisition related camera property has to be explicitly changed, stopping acquisition engine might be necessary. After setting the property the acquisition engine should be started again before making further calls to GenICam image acquisition features.

Acquisition modes

The GenICam feature **AcquisitionMode** specifies the acquisition mode of the device. The number of captured image frames depends on the selected mode.

- **SingleFrame**: the camera captures only one frame at a time.
- **MultiFrame**: the camera captures multiple images sequentially. The number of captured images is specified by **AcquisitionFrameCount** property. This mode is particularly useful when capturing a continuous surface with a line scan camera where the total length of the captured surface can only be covered with multiple frames.
- **Continuous**: the camera captures images continuously after **AcquisitionStart** until the acquisition is stopped explicitly with **AcquisitionStop**.

Selecting the best camera acquisition mode is crucial for the application since minimizing the number of calls to **AcquisitionStart** and **AcquisitionStop** also increases the system performance.

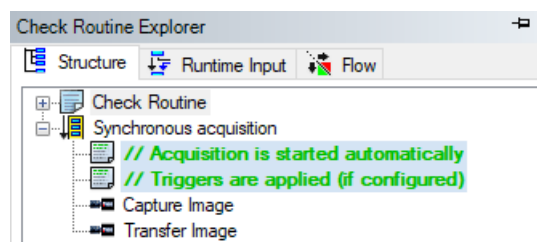
NeuroCheck image capturing modes

The driver controls the image acquisition depending both on the configured acquisition mode and on the particular NeuroCheck capturing mode. Available image capture modes are synchronous acquisition, parallel acquisition and image stack acquisition. In addition the user has the ability to control the GenICam acquisition and trigger features manually using the custom image acquisition.

Synchronous acquisition

The simplest image capture mode acquires one image at a time, used in applications with sequential capture and processing. **AcquisitionStart** is called automatically depending on the selected **AcquisitionMode**. This capture mode suits best when capturing images with **AcquisitionMode** set to **SingleFrame** or with **AcquisitionMode** set to **Continuous** with the configured software trigger.

[Example: Check routine](#)



Parallel acquisition

This capture mode is used to capture an image while simultaneously processing the previously captured image. Otherwise its functionality is similar to the synchronous acquisition. Here, in addition to acquisition modes **SingleFrame** and **Continuous**, the mode **MultiFrame** can be used, if the number of images to capture is known in advance and stays constant.

[Example: Check routine](#)

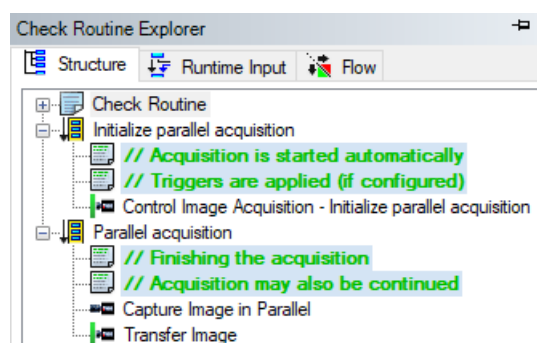
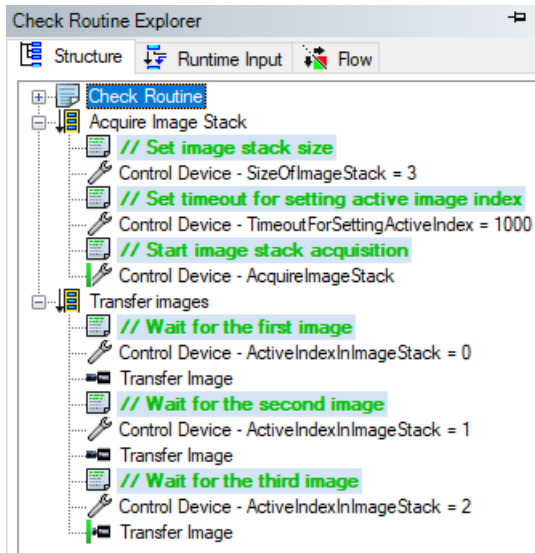


Image stack acquisition

This capture mode is specifically designed to capture multiple images in parallel while processing already captured images. Only the first image capture must be called explicitly and further images are captured automatically. Here the acquisition mode **MultiFrame** would be the optimal choice, but other modes may be used as well. The result similar to **MultiFrame** mode can also be achieved using acquisition mode **Continuous** with **FrameBurstStart** trigger and **BurstFrameCount** (if available).

☑ [Example: Check routine](#)

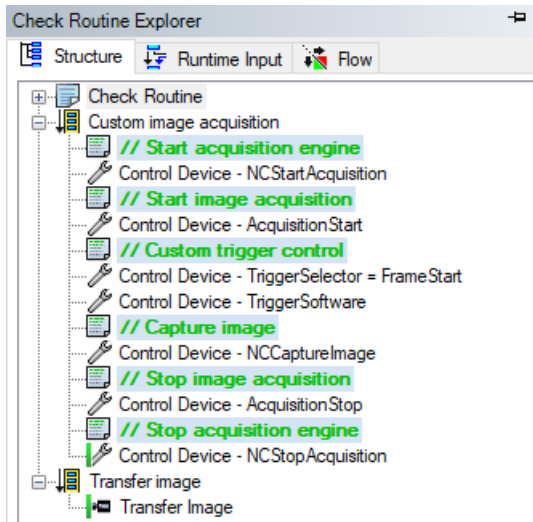


For more information on image stack acquisition please refer to the NeuroCheck whitepaper Image Stack Acquisition

Custom image acquisition

Some devices may behave either in a way which is not described in the GenICam SFNC or require a special control sequence which is currently not supported by the driver. In such cases the user has the ability to define a custom sequence of GenICam feature calls and then capture an image. Here the user must make all the necessary calls manually, such as setting **AcquisitionMode**, executing the software trigger, calling **AcquisitionStart** and **AcquisitionStop**, etc. To actually capture an image the user must call the method **NCCaptureImage**.

☑ [Example: Check routine](#)



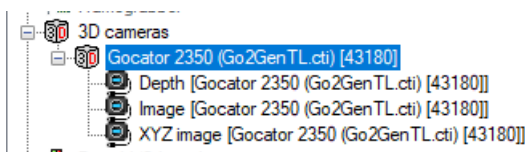
Multiple data objects

Some 3D cameras can be configured to produce multiple image components or capture multiple regions of interest while acquiring a single frame. In this case the camera will generate multiple data objects. Depending on the subset of available GenICam features, these components are recognised automatically or must be selected manually after the acquired data is transmitted.

Automatic component detection

Image components are detected automatically when the camera provides information via GenICam features **ComponentSelector**, **ComponentEnable**, **Width**, **Height**, **PixelFormat**. Components are listed in the Device Manager and the [3D Camera properties dialog](#).

☑ [Example: 3D Camera with multiple data objects](#)

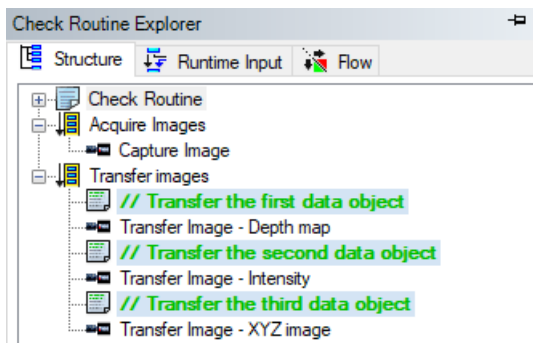


- If the camera provides multiple components, each component can be enabled or disabled by setting the feature **ComponentEnable**.
- If the camera provides multiple regions, each region can be enabled or disabled by setting the feature **RegionMode**.
- If the camera provides **3D point coordinates**, XYZ image generation can be enabled using the feature **Compute XYZ Image**.

In order to access a particular data object, the user selects it directly in the check function **Transfer Image**.

☑ [Example: Check routine](#)



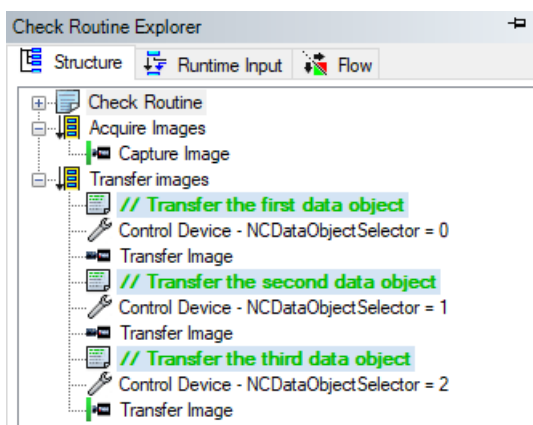


Manual component selection

If the camera does not provide enough information on the image components before the acquisition then the data objects are created dynamically and must be accessed manually. In the device manager a single data object named **Data** is provided. In the [3D Camera properties dialog](#) the list of image components is available after an image is acquired.

In order to access these objects in the check routine, the user must first select them by index using the property **NCDDataObjectSelector**. If the camera provides three data objects, the user must sequentially set the property value to 0, 1, and 2, using **Control Device** followed by **Transfer Image**.

Example: Check routine



3D Data and XYZ Images

3D Data formats

3D Camera can provide 3D data in the following data formats:

- **Coord3D_C**: contains calibrated or uncalibrated depth values.
- **Coord3D_AC**: contains calibrated depth values and X axis values (typically used by linescan cameras).
- **Coord3D_ABC**: contains a calibrated point cloud with three coordinates.

Each 3D data format can be converted to a point cloud when the conversion method is specified over the GenICam feature **Scan3dOutputMode**. Depending on the conversion mode the following features are used:

- **Scan3dCoordinateOffset**, **Scan3dCoordinateScale**: define scaling and offset applied the particular axis of the input 3d data.
- **Scan3dInvalidDataFlag**, **Scan3dInvalidDataValue**: define if some data value is used as an invalid value for the particular axis.
- **Scan3dCoordinateSystem**: defines in which coordinate system the data is transmitted. Supported systems are: **Cartesian**, **Spherical**, and **Cylindrical**.
- **Scan3dPrincipalPointU**, **Scan3dPrincipalPointV**, **Scan3dBaseline**, **Scan3dFocalLength**: stereo setup parameters used when the 3d output mode is **DisparityC**.



Some cameras provide the listed features as chunk data only. Make sure the chunk data transmission is available and activated for each individual feature if you want to generate point clouds.

Supported 3D output modes are:

- **UncalibratedC**: Z values are taken from the uncalibrated depth map values, X and Y come from the pixel location.
- **CalibratedC**, **CalibratedC_Linescan**: Z values are taken from the calibrated depth map values, X and Y come from the pixel location. Y comes from the per line encoder value when linescan mode is specified.
- **RectifiedC**, **RectifiedC_Linescan**: Z values are taken from the calibrated depth map values, X and Y come from the transformed pixel location (with uniform scaling). Y comes from the per line encoder value when linescan mode is specified.
- **DisparityC**, **DisparityC_Linescan**: 3D point is computed based on the stereo setup from the depth map and pixel locations. Y comes from the per line encoder value when linescan mode is specified.
- **CalibratedAC**, **CalibratedAC_Linescan**: X and Z values come from the input data, Y comes from the pixel location or from the per line encoder value. Scaling and offsets are applied if necessary.
- **CalibratedABC_Grid**, **CalibratedABC_PointCloud**: 3D point is taken from the input data, scaling and offsets are applied if necessary.

The generated point cloud is saved in as an **XYZ image**. XYZ image is a special image which packs floating point values of the 3d point coordinates to a 8-bit image. These images can be further processed by [NeuroCheck 3D-Xtension](#) or, alternatively, by Halcon over the **PI_HalconWrapper** plug-in. This image is 8 times wider and 3 times longer than the original image and each 24 bytes contain X, Y, Z point coordinates as doubles in little-endian byte order.

Point cloud generation is enabled over the custom property **Compute XYZ Image (NCComputeXYZImage)**. If enabled, XYZ Images are generated for all incoming images encoded in 3D data formats and are available as additional data objects. The original image data stays available in a separate data object.



Note that 32-bit float images cannot be transferred as is in NeuroCheck. Pixel values in these images are rounded to the nearest 16-bit value. XYZ image generation is not affected and preserves the original data range and precision.

Integration with NeuroCheck 3D-Xtension

The point cloud data captured by 3D cameras can be processed using NeuroCheck 3D-Xtension. There are two ways to transfer point cloud data into NeuroCheck:

- **XYZ Images**

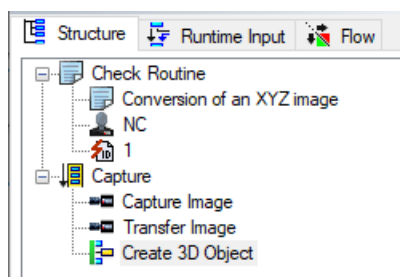
These images contain the 3D coordinates of all point cloud data points. An XYZ image is transferred to NeuroCheck as a regular 8-bit single channel image and then interpreted as a point cloud by the check function Create 3D Object. XYZ images are created automatically from the 3D data received from the camera.

- **16-bit depth images**

These images contain only 16-bit depth values. A 16-bit depth image can be converted to a 3D object using a special depth conversion matrix, which transforms each pixel into a 3D point using its location and depth value. This matrix must be constructed manually from the 3d calibration parameters provided by the sensor. In some cases the matrix is provided by the GenICamTL driver (e.g. for LMI Gocator devices).

Creating 3D Objects from XYZ images

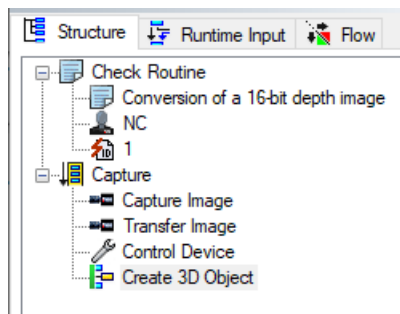
☒ [Sample check routine](#)



1. Open the 3D camera property dialog, navigate to the category **NeuroCheck settings**.
2. Enable the property **Compute XYZ Image** and close the dialog and the Device Manager with OK.
3. Create a simple NeuroCheck check and add the following check functions:
 - **Capture Image**
 - **Transfer Image**
 - **Create 3D Object** (from the **PI_3DTools** plug-in)
4. Configure the capture on the 3D camera in **Capture Image** and select transfer of an XYZ Image in **Transfer Image**.
5. Configure creation of a 3D Object from an XYZ image in **Create 3D Object**.
6. Execute the check.

Creating 3D Objects from 16-bit depth images

☒ [Sample check routine](#)



1. Create a simple NeuroCheck check and add the following check functions:
 - **Capture Image**
 - **Transfer Image**

- **Control Device**
 - **Create 3D Object** (from the **PI_3DTools** plug-in)
2. Configure the capture on the 3D camera in **Capture Image** and select transfer of a 16-bit depth Image in **Transfer Image**.
 3. Prepare a data register of type **String** to hold the depth conversion matrix.
 4. Configure the check function **Control Device**: the check function should read the value of the device property **DepthConversionMatrix** and save it to the prepared data register. If the property is not available, you have to read all the necessary parameters and compose the matrix manually using the check function **Modify 3D Data in Register** (from the **PI_3DTransformationTools** plug-in).
 5. Configure creation of a 3D object from a 16-bit depth image in **Create 3D Object**. and set the data register ID of the conversion matrix. Leave the **Perspective projection** box **unchecked**.
 6. Execute the check.



Note that the retrieved conversion matrix is only valid for the last captured image. Only the corresponding conversion matrix can transform an unmodified 16-bit depth image back to the original point cloud. There may also be some slight changes to 3D point coordinates due to precision loss coming from the 16-bit normalization of the original depth values.

Trigger configuration

The user has access to all GenICam features provided by the camera, including the trigger configuration. Exported camera setup files include the trigger configuration as well. The user can either configure the external trigger (physical input, encoder, etc) or the software trigger. Trigger configuration is done either via the [Trigger configuration dialog](#) or manually over the check function [Control Device](#).

In the simplest case there are no special triggers required for the image acquisition, especially if **SingleFrame** acquisition mode is used, since automatic calls to **AcquisitionStart** and **AcquisitionStop** are sufficient. But if the application is more complex and involves line scan cameras, more elaborate trigger configuration may be necessary.

Trigger configuration includes specifying the following basic properties:

- **TriggerSelector**: used to select the trigger type which is currently being configured. Note that you can configure multiple triggers by switching the selected trigger type.
- **TriggerMode**: activates or deactivates the selected trigger
- **TriggerSource**: specifies the signal used for the selected trigger.

Please refer to **GenICam SFNC** for more information on the possible trigger types and sources.

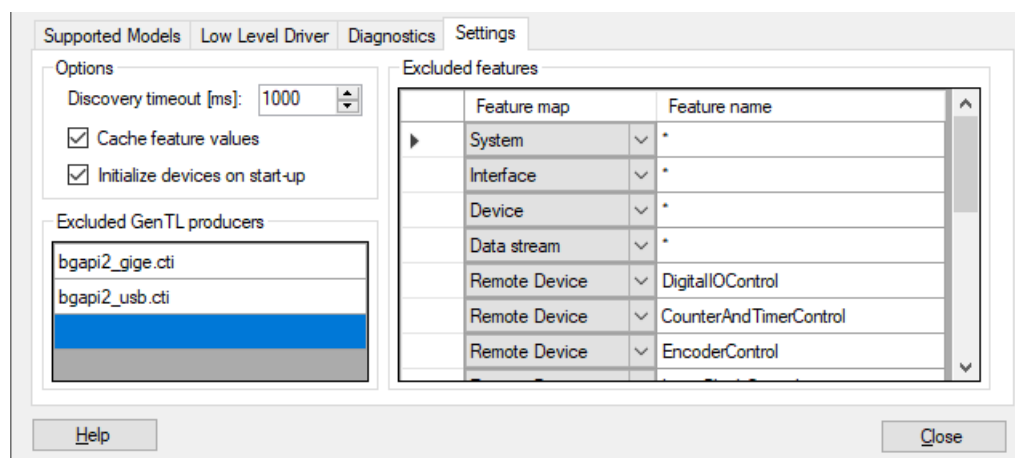
Software trigger

TriggerSoftware command generates a trigger signal if the software trigger is configured for the selected trigger. The driver executes the **TriggerSoftware** command when capturing an image for the following standard trigger types:

- **AcquisitionStart**
- **FrameStart**
- **FrameBurstStart**
- **ExposureStart**

Software trigger for other trigger types must be triggered manually using check function [Control Device](#).

Driver configuration



The driver configuration holds project specific driver settings. These settings are loaded when the driver is initialized. The driver configuration is stored in the NeuroCheck project folder at `\Configuration\NC62CFG.DRV.CFGX`. The user can either modify these settings manually by editing the configuration file or via the Driver Info Dialog on page **Settings**.

Excluded GenTL producers

The driver usually tries to load all GenTL producers that are present in the NeuroCheck installation folder and use them to find and connect available cameras. However, in some cases having multiple GenTL producers loaded simultaneously increases the overall discovery time and may also cause other problems. It is therefore recommended to identify GenTL producers which are not relevant for the current project. By default the GenTL produces used by the NeuroCheck Digital Camera Driver (`bgapi2_gige.cti` and `bgapi2_gige.cti`) are excluded.

Excluded features

The user can specify which GenICam features (properties) can be excluded from the camera setup files either to speed-up the time to load the camera configuration or to avoid trying to access irrelevant properties. When added to the list, the feature is ignored when the camera setup file is composed and will not be written when the file is loaded.

Each entry contains the feature map (corresponding to the GenTL module name) where the excluded feature is located and of the actual feature name. The feature name can also be *, meaning that all features of the feature map are ignored, or a category name, meaning that all features from the particular category should be ignored. Specifying simply the feature name will exclude only this one feature. Feature names are case sensitive and must match the actual internal feature name (as defined in the XML description file or in **GenICam SFNC**), e.g. **PixelFormat** instead of **Pixel Format**. The original XML description file for each module can be downloaded in the [3D Camera Properties Dialog](#).

By default all feature maps for GenTL modules except for the **RemoteDevice** are disabled. For the remote device multiple categories are disabled: **DeviceControl**, **LUTControl**, **DigitalIOControl**, **CounterAndTimerControl**, **EncoderControl**, **LogicBlockControl**, **ActionControl**, **EventControl**, **UserSetControl**, **FileAccessControl**, **SourceControl**, **TransferControl**, **LightControl**, **SequencerControl**, **TestControl**, **TransportLayerControl**, **OpticControl**. If you want to configure some features from these categories, you must remove the corresponding entry from the list.

Options

Name	Description
Discovery Timeout [ms]	Time in ms spent to discover camera devices on each available GenTL interfaces of each available GenTL producer.
Initialize devices on start-up	NeuroCheck saves configuration of added cameras, applies it automatically when NeuroCheck is restarted, and starts the GenTL data stream when the device is reconnected. The user can disable this option if it is not necessary to initialize devices on start-up. If disabled, the camera will preserve its current configuration, and the data stream is started with the first image acquisition request.

Name	Description
Cache feature values	This option specifies if the GenApi feature values can be cached internally for the fast feature value retrieval. Note: some older GenICam devices may work incorrectly when caching is enabled.

Internal options

The following options can only be configured manually in `NC62CFG.DRV.CFGX`. Make sure NeuroCheck is closed before editing the configuration file.

Tag	Name	Description
<trace_level>	Low-level driver trace level	Activates or deactivates GenICamTL tracing: Value 0 deactivates tracing. Value 1 activates basic tracing, which only includes the most important calls and errors. Also the feature maps of all available GenTL modules are downloaded. Value 2 activates detailed tracing, which includes all GenICam and GenTL calls.
<continuous_acq_control>	Preemptive start of acquisition in Continuous mode	Activates or deactivates automatic preemptive start (AcquisitionStart in GenICam) of acquisition when the camera runs in acquisition mode Continuous: Value 0 deactivates preemptive start of acquisition. Value 1 starts acquisition automatically if any acquisition trigger is configured (default). Value 2 always starts acquisition automatically.
<continuous_buffer_handling>	Excessive buffer handling in Continuous mode	Specifies how excessive (coming outside of timeframe when NeuroCheck expects an image) incoming image buffers are handled when the camera runs in acquisition mode Continuous: Value 0 discards all excessive buffers (default). Value 1 keeps only the last incoming buffer. Value 2 keeps all incoming buffers if any acquisition trigger is configured. Value 3 keeps all incoming buffers for future processing.
<buffer_count>	Count of acquisition buffers	Specifies how many image buffers are created. Default count is 4. A larger buffer count may be necessary to process data produced using parallel acquisition at very high framerates.

Control Device

The user can control the GenICam features via the check function **Control Device**, including reading property values, setting property values, executing methods. All properties and methods which are exposed over the GenApi for all available GenTL modules are available. In the list of features the prefix denotes the GenTL module, e.g. "[System]" for the GenTL system module, "[Interface]" for the GenTL interface module, "[Device]" for the GenTL device module, and "[DataStream]" for the GenTL data stream module. Features of the RemoteDevice module do not have any prefix.

There are two additional feature categories available:

- Device control features: advanced control of the device and acquisition engine, includes features **NCStartAcquisition**, **NCStopAcquisition**, **NCCaptureImage**, **NCFlushBuffers**, **NCReopenDevice**.
- Image stack acquisition features: control of image stack acquisition, includes features **SizeOfImageStack**, **TimeoutForSettingActiveIndexInImageStack**, **ActiveIndexInImageStack**, **AcquireImageStack**, **AbortImageStack**.

GenICam features

When you control device **GenICam** features you should keep the following in mind:

- Some properties or methods may require acquisition to be stopped in advance. If you try to read or write a property or a method, you will typically get an error. In some cases it is not possible even to get access to these features. In this case you must first stop the acquisition using the device method **NCStopAcquisition** in a check function **Control Device** right before setting the property or executing the method. You can resume the acquisition after setting all the necessary properties again with **NCStartAcquisition**.
- Properties which directly change the size of the transferred image, like **Width**, **Height**, **PixelFormat**, **Binning**, etc, also require stopping and restarting the acquisition.
- Executing device methods **AcquisitionStart** and **AcquisitionStop** also sets the value of the property **TLPParamsLocked** to 1 and 0 respectively.

Image stack acquisition

Properties

Element	Description
SizeOfImageStack	Sets the size of the image stack.
TimeoutForSettingActiveIndexInImageStack	Specifies the timeout [ms] for setting the property ActiveIndexInImageStack .
ActiveIndexInImageStack	Sets the active image index in image stack, waits until the image is available. Setting fails when timeout is exceeded and the image is still not available.

Methods

Element	Description
AbortImageStack	Aborts acquisition of the image stack. Already captured images are removed from the stack.
AcquireImageStack	Starts acquisition of the image stack. Images are captured asynchronously until the number of images specified by SizeOfImageStack is reached.

Advanced device control

Element	Description
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Element	Description
NCTestAcquisition	Starts internal acquisition engine: • Updates GenTL buffer sizes • Clears all pending acquired buffers • Calls DSStartAcquisition on the GenTL data stream This method is called automatically after the camera setup file is loaded (e.g via check function Control Image Acquisition).
NCTestStopAcquisition	Stops internal acquisition engine: • Stops active acquisition process (AcquisitionStop) • Calls DSStopAcquisition on the GenTL data stream This method is called automatically before the camera setup file is loaded (e.g via check function Control Image Acquisition).
NCTestCaptureImage	Captures a single image. Does not control remote device and simply tries to receive any image that comes from the camera. This method is used in the custom image acquisition when the device control sequence is reproduced manually.
NCTestFlushBuffers	Clears all pending acquired buffers. This call may be necessary if there is a possibility of transferring an image which was already acquired by the camera previously and is outdated.
NCTestReopenDevice	Closes and reopens the device. This method can be used either to dynamically reconnect the device or to force refresh of the device state. Note that device configuration might be partially lost if the device was disconnected.

Troubleshooting

General

Why are there holes in the height map?

- 3D cameras are not always able to acquire 3D information for every part of the scene. This can be due to their limited depth range or because the objects are not suited for the kind of 3D camera that is used (for example time-of-flight, depth from focus).
Try changing the lighting conditions, a different camera or moving the 3D camera to get a different angle to the object that may work better.

Why is there noise in the image / Why is my object not fully scanned?

- The depth values of the 3D cameras can slightly change between each image acquisition. Also make sure that the depth normalization range (minimum and maximum Z values) is correctly specified.

Why is my camera not detected by the driver?

- Check if you set the correct IP address for the camera. The camera and the network adapter need to be in the same network. You may also need to restart NeuroCheck to detect a newly appeared camera in some cases.
- Sometimes the device discovery is blocked by the Windows Firewall. Make sure **NeuroCheck62.exe** is added to the list of allowed apps for all connection types.

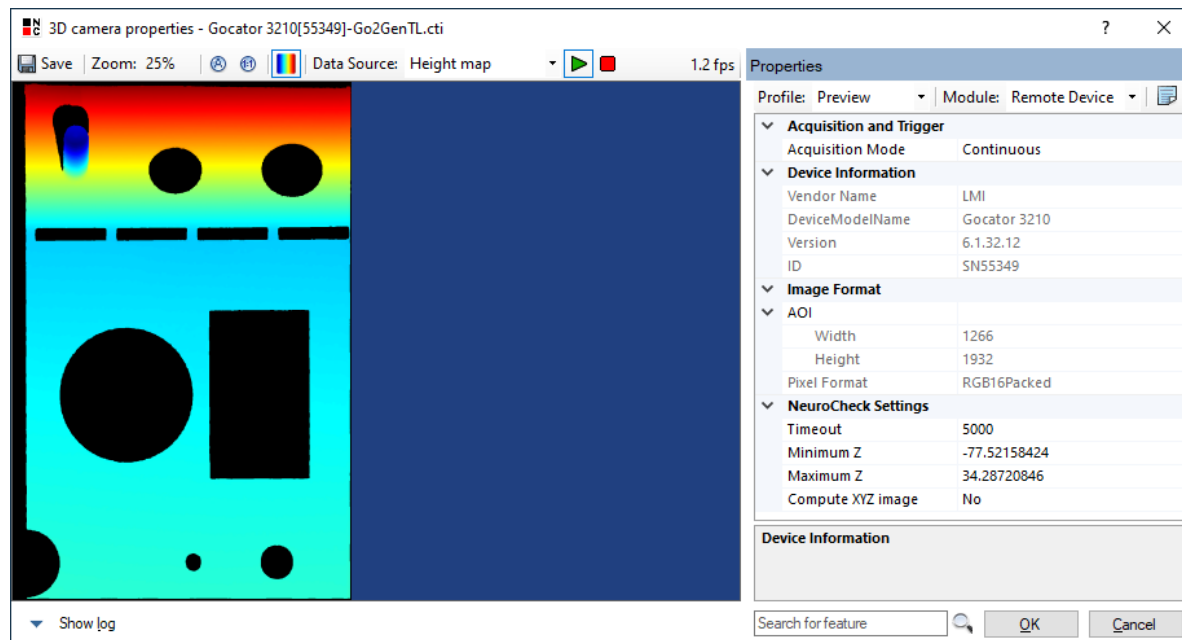
Why does NeuroCheck crash at startup or when searching for a new 3D camera in the device manager?

- The cause of this problem is very likely that the IP address of the 3D camera is not in the same subnet as the network adapter.

3D Camera Properties Dialog

Dialog to configure the properties of a 3D camera

[3D Camera properties dialog](#)



The **3D Camera Properties Dialog** contains the live image viewer and a table of properties. The names of the properties are displayed in the left column of the table whereas the right column contains the current values of the properties. The properties are structured into **categories** and they can vary with each camera model depending on the original XML feature description provided by the camera. The feature names and the categories normally follow the **GenICam SFNC**. An additional category **NeuroCheck Settings** contains settings which are added by the NeuroCheck driver itself.

Categories and properties which are marked with '~' correspond to features, which are excluded from the camera setup files. If you want to save configuration of these features, you need to remove the corresponding feature or category name from the feature list in the driver configuration.

The log panel in the bottom shows the latest log entries. It will show some details in case acquisition or property editing fails. Logging must be enabled in the driver settings.

Acquisition and image panel control

Element	Description
	Scales the shown image 1:1 to screen resolution
	Scales the shown image to fit completely to the image panel size.
	Shows the image in false color mode. Available for 16 bit grayscale images only.
Data Source	Selects the output data object where the image comes from. There may be multiple objects available if the camera supports multiple components or regions, or if generation of an XYZ image is enabled.
	Starts the live image acquisition. In the live image mode an image is repeatedly taken synchronously and shown in the panel.
	Stops the live image acquisition. Stopping acquisition may be necessary when changing multiple property values at once. Some properties may also be disabled or not available at all while acquisition is running.

Element	Description
	Saves the currently displayed image to a file.

Feature selection

The **profile** drop-down menu allows you to select the profile that best describes your knowledge of **GenICam SFNC** and the particular 3D camera.

Profile	Description
Beginner	Contains features visible for all users.
Expert	Includes features which require more in-depth knowledge of the camera functionality.
Guru	Includes advanced features, which might occasionally bring the camera into a state where it will not work properly anymore if are set incorrectly for the cameras current mode of operation.
Preview	Extra profile which contains features which are mostly used when configuring the camera for the basic applications.

The **module** drop-down menu allows you to select the module with the corresponding feature map:

Module	Description
Remote Device	Contains the features of the actual physical camera device. All the basic features related to acquisition, image format, triggers, user sets and other are available here.
[GenTL] System	Contains information about the GenTL System module (including info about the GenTL producer).
[GenTL] Interface	Contains information about the GenTL Interface module the current device is connected to (network adapter, etc).
[GenTL] Device	Contains information about the GenTL Device module, for example model or vendor name.
[GenTL] Data Stream	Contains configuration settings for the GenTL Data stream module, e.g. data transfer between the camera and the PC.

You can download the original XML description file for the selected module by clicking the button  next to the module selection.

Editing properties

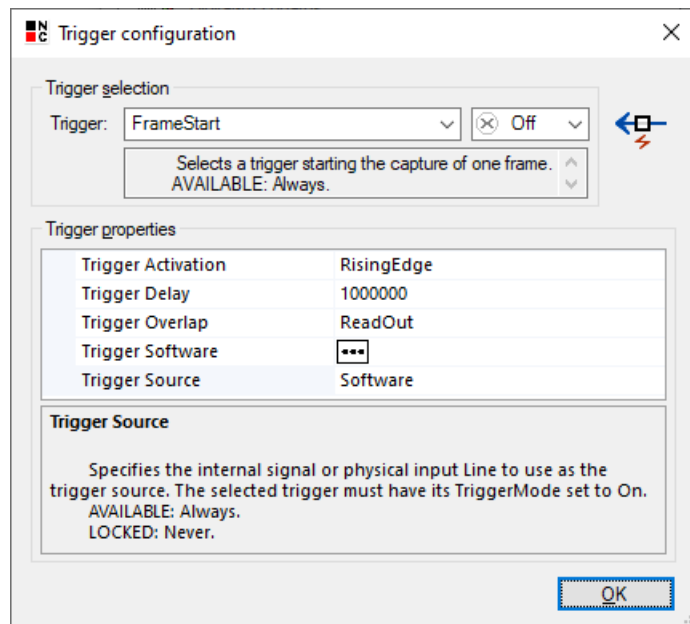
Depending on the selected property the value can be edited by:

- Directly typing the value in the cell in the right column.
- Some property values can be selected in a list of possible values. This list drops down after clicking the expand button  in the right column.
- Some properties are composed of several sub-properties. These sub-properties are shown after clicking  on the left of the property. To hide the sub-properties click . The sub-properties can be edited in the same way as other properties.
- Methods and sub-dialogs are marked with . Click on the value field and the expand button to execute the method or open the sub-dialog.

Trigger Configuration Dialog

Dialog to configure the image acquisition triggers

☑ [Trigger configuration dialog](#)



The **Trigger Configuration Dialog** contains the trigger-related features. The trigger is first selected from the list of all available trigger types and then activated or deactivated (**On/Off**). Note that each trigger is configured independently so if you need only one active configured trigger, you must also check other triggers and set their state to **Off**.

Available features for the currently selected trigger are displayed in the property table. The names of the properties or methods are displayed in the left column of the table whereas the right column contains the current values of the properties.

Element	Description
Trigger	Selects which type of trigger to configure. Corresponds to the feature TriggerSelector .
On/Off	Activates or deactivates the selected trigger. Corresponds to the features TriggerMode .
Trigger Activation	Specifies the activation mode of the trigger.
Trigger Delay	Specifies the delay to apply after the trigger signal reception before effectively activating it.
Trigger Overlap	Specifies the type of trigger overlap permitted with the previous frame/line.
Trigger Software	Method which generates an internal trigger signal when the trigger source is Software .
Trigger Source	Specifies the physical input or internal signal to use for the selected trigger.

Acquisition Control

In this category you can configure properties related to image acquisition including trigger and exposure control. The corresponding features are found in the remote device module.

Here the most basic features only are listed:

Element	Description
Acquisition Mode	Controls the mode of acquisition for the device. The following standard modes are usually available: • SingleFrame: One frame is captured. • MultiFrame: The number of frames captured consecutively is specified by <code>AcquisitionFrameCount</code>. • Continuous: Frames are captured continuously until stopped with the <code>AcquisitionStop</code> command. See also Image Acquisition for the more information on acquisition modes.
Acquisition Frame Count	Number of frames to acquire in MultiFrame acquisition mode.
Exposure Auto	Sets the automatic exposure mode: • Off: Exposure duration is user controlled over ExposureTime • Once: Exposure duration is adapted once by the device. Image acquisition must be active during the estimation. The value later returns to Off when automatic exposure estimation converges. • Continuous: Exposure duration is constantly adapted by the device to maximize the dynamic range.
Exposure Time	Controls the exposure time and is typically expressed in milliseconds or microseconds. ExposureAuto must be set to Off. May also depend on the property ExposureMode .
Trigger	Opens the trigger configuration dialog

Image Format Control

In this category you can configure the image size and format. The corresponding features found in the remote device module.

Here the most basic features only are listed:

Element	Description
Height	Height of the image provided by the device (in pixels).
Height Max	Maximum height of the image (in pixels).
Width	Width of the image provided by the device (in pixels).
Width Max	Maximum width of the image (in pixels).
Offset X	Horizontal offset from the origin to the region of interest (in pixels).
Offset Y	Vertical offset from the origin to the region of interest (in pixels).
Pixel Format	Format of the image pixels provided by the device. Only a subset of GenICam pixel formats listed in supported cameras is correctly handled and automatically converted to the corresponding NeuroCheck image format by the driver

Device Control

In this category you can get general information on the connected remote device and its sensor. The corresponding features are found in the remote device module.

Here the most basic features only are listed:

Element	Description
Device Model Name	Model of the device.
Device Serial Number	Device's serial number.
Device Vendor Name	Name of the manufacturer of the device.
Device Version	Version of the device.

Scan 3D Control

In this category you can get the parameters of the 3d data extraction. These are typically used to convert the incoming 3d coordinates into an XYZ image, which is done internally by the driver itself. The corresponding features are located in the remote device module.

Here the most basic features only are listed:

Element	Description
Scan3dDistanceUnit	The unit used when delivering distance data: meter, millimeter, etc.
Scan3dCoordinateSystem	Defines the used coordinate system. The generated XYZ images will be converted from the selected coordinate system into the cartesian system. Supported coordinate systems are: • Cartesian: A,B,C coordinates are interpreted as coordinates within the right-hand orthogonal X-Y-Z axes. • Cylindrical: A,B,C coordinates are interpreted as Theta-Y-Rho, where Theta denote the angle and Rho the distance. • Spherical: A,B,C coordinates are interpreted as Theta-Phi-Rho, where Theta and Phi denote angles and Rho the distance.
Scan3dOutputMode	Defines the data organisation of the transmitted coordinates. Depending on this mode 3d data is converted to XYZ images. The following output modes are available: • UncalibratedC: data represents the uncalibrated linear or non-linear depth map without known physical units. • CalibratedC: data represents the calibrated linear depth map, X and Y axes configuration is unknown. • DisparityC: data represents the disparity map. X, Y, Z coordinates are determined using the available stereo setup feature values from Scan3dBaseline, Scan3dFocalLength, Scan3dPrincipalPointU and Scan3dPrincipalPointV. • RectifiedC: data represents the rectified depth map, the X and Y coordinates are derived from the point row and column indices. • CalibratedAC: data represents two point coordinates, the third coordinate has fixed sampling and is derived from the point row index. • CalibratedABC_Grid: data represents the point coordinates, points are organised in a grid. • CalibratedABC_PointCloud: data represents the point coordinates, points are unorganised. The output modes CalibratedC_Linescan, DisparityC_Linescan, RectifiedC_Linescan, CalibratedAC_Linescan take the Y coordinate values from the encoder values instead of the image row indices. The encoder values are transmitted as Chunk Data.
Scan3dInvalidDataFlag	Enables or disables usage of a special value to denote non-valid pixels. Defined separately for each coordinate axis selected by Scan3dCoordinateSelector .
Scan3dInvalidDataValue	Special value to denote non-valid pixels of the current axis (selected by Scan3dCoordinateSelector).
Scan3dCoordinateScale	Scale factor applied to the original coordinate value of the current axis (selected by Scan3dCoordinateSelector).
Scan3dCoordinateOffset	Offset applied to the original coordinate value of the current axis (selected by Scan3dCoordinateSelector).
Scan3dAxisMin	Minimum valid transmitted coordinate value of the current axis (selected by Scan3dCoordinateSelector). Note: this value is not used to eliminate invalid pixels when generating an XYZ image.
Scan3dAxisMax	Maximum valid transmitted coordinate value of the current axis (selected by Scan3dCoordinateSelector). Note: this value is not used to eliminate invalid pixels when generating an XYZ image.

Chunk Data Control

In this category you can configure the transfer of chunks, or tagged blocks of data. Each chunk feature must first be selected over **ChunkSelector** and activated over **ChunkEnable**. Then the value of the corresponding chunk feature is transmitted in addition to the images inside the GenTL buffer. The chunk feature becomes available when a frame is acquired and stays accessible until the acquisition is restarted. The corresponding features are found in the remote device module.

Here the most basic features only are listed:

Element	Description
ChunkModeActive	Activates the inclusion of chunk data in the transmitted payload. Note: enabling each individual chunk with ChunkEnable may still be necessary for transmission.
ChunkSelector	Selects the chunk.
ChunkEnable	Enables the inclusion of the chunk data selected by ChunkSelector in the payload of the image.
ChunkTimestamp	Image timestamp.
ChunkScan3dOutputMode ChunkScan3dCoordinateSystem ChunkScan3dCoordinateScale ChunkScan3dCoordinateOffset ChunkScan3dInvalidDataFlag ChunkScan3dInvalidDataValue	Chunk counterparts to the corresponding scan 3d control features. If the corresponding features are not available, these chunk features must be explicitly enabled, so that XYZ image generation could automatically determine the conversion mode, scaling factors and offsets.
ChunkEncoderValue	Provides access to the encoder counter's value for the specific line selected by ChunkScanLineSelector . These values are used when generating an XYZ image from 3d data in the following modes: RectifiedC_LineScan , CalibratedC_Linescan , DisparityC_Linescan , CalibratedAC_Linescan .

User Set Control

In this category you can configure, load, and save all device settings as User Sets directly on the device. The corresponding features are found in the remote device module.

If you prefer User Sets to NeuroCheck camera setup files, you can disable device initialization on start-up in [driver configuration](#) and use **Control Device** to select and load the User Set.

Here the most basic features only are listed:

Element	Description
User Set Default	Selects the User Set to load and make active by default when the device is reset (after DeviceReset),
User Set Selector	Selects the User Set to load, save or configure.
User Set Load	Method which loads the User Set specified by UserSetSelector to the device and makes it active.
User Set Save	Method which saves the User Set specified by UserSetSelector to the non-volatile memory of the device.

NeuroCheck Settings

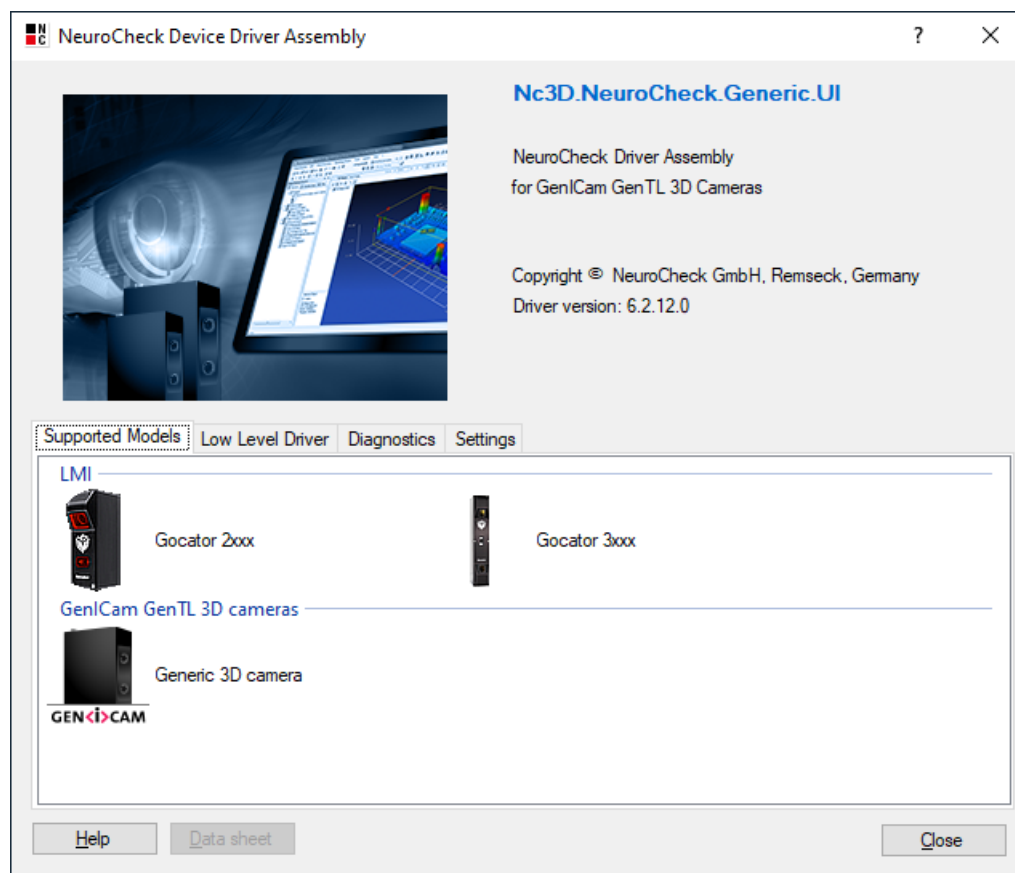
In this category you can specify the settings used by NeuroCheck for the image acquisition. They are found in the remote device module.

Common settings

The following settings are used by NeuroCheck on every 3D camera:

Element	Description
Timeout [ms]	Select how long the image acquisition should wait for an image. If no image was received within the maximum time span, the driver will report an error.
Compute XYZ image	Select if an XYZ image containing the 3D point coordinates should be computed. An XYZ image is generated for every transmitted data object with 3D data format and is provided as an additional image object.

Info Dialog



This dialog displays information about the NeuroCheck driver DLL. You can select between three pages with specific information the dialog provides. On each page the context menu provides a further function.

Element	Description
Help	Click here to open this help file you are currently reading.
Data sheet	Click here to open the data sheet of the selected 3D camera model. (Only available on page Supported Models.)
Enable logging	Check the box to activate logging. Please note that the creation of log messages can slow down the system. (On page Diagnostics only.)

Page Supported Models

This page provides information about the 3D camera models that are supported by this NeuroCheck driver DLL.

Context menu element	Description
Data sheet	Click here to open the data sheet of the selected 3D camera model.

Page Low Level Driver

This page provides a list of all driver files. Additionally to the drivers name the list provides information about the version, the location on your computer, the date and time of the last change and the size of the driver file.

Context menu element	Description
Copy to clipboard	Click here to copy the entire list of driver files to the clipboard. From the clipboard you can paste the list to a word processor, text editor or E-mail client.

Page Diagnostics

This page provides a list of all the last events that occurred within the driver. The list is empty if the logging is disabled. If logging is enabled and the logging of NeuroCheck is enabled as well, all events are written to the NeuroCheck log file (`NcLog.XML`). Every entry in the list contains the priority, the date and time when it occurred and a description of the event.

Context menu element	Description
Copy to clipboard	Click here to copy the entire list of events to the clipboard. From the clipboard you can paste the list to a word processor, text editor or E-mail client.

Page Settings

This page shows driver configuration settings. See Driver configuration for more information.

Support Services

For technical support, please contact your local NeuroCheck partner or NeuroCheck GmbH:

Phone: +49 (0) 7146 - 89 56-40

E-Mail: support@neurocheck.com

Web: www.neurocheck.com

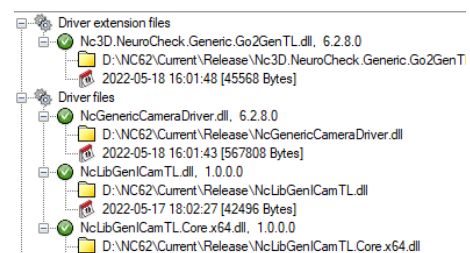
Before contacting us, please provide some important information about your system:

- **Information about the connected 3D cameras:**

the number and the model names of the connected 3D cameras can be seen in the Device Manager of NeuroCheck. If possible, please also provide a CSUX export of your current 3D camera input settings by clicking the Export button for each 3D camera. Please attach the generated CSUX files to your email.

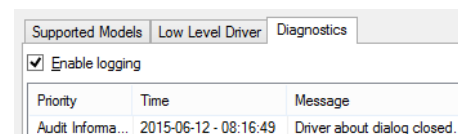
- **Information about your low level driver installation:**

this can be found in the [Info Dialog](#) of the NeuroCheck driver DLL which can be opened by clicking the info button when the 3D camera is selected in the Device Manager of NeuroCheck. On page Low Level Driver you see the list of installed low-level drivers. Copy this list to your E-mail by right clicking.



- **Log file information:**

Logging for the driver can be activated in the [Info Dialog](#) of the NeuroCheck driver DLL. It can be opened by clicking the info button when the 3D camera is selected in the Device Manager of NeuroCheck. On page Diagnostics of the Info Dialog check the box Enable logging.



Please note that logging will be written to the NeuroCheck log file which must be activated too. Logging for NeuroCheck is activated in the General Software Settings on page Diagnostics.

- **GenTL tracing:**

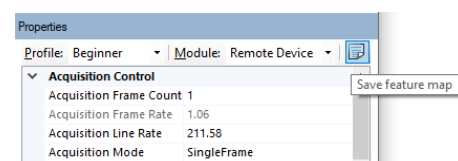
More info about the internal device connection via the GenTL interface is available when GenTL call tracing is activated. Trace output can only be activated manually in the NeuroCheck [driver configuration](#) file.

```
<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>
```

Open the file `\Configuration\NC62CFG.DRV.CFGX` in your NeuroCheck project folder, locate the driver node **Nc3D.NeuroCheck.Generic.dll**, find the node `<trace_level>` and set its value to **1** for basic tracing or **2** for detailed tracing. Close NeuroCheck before modifying the driver configuration file. After restarting NeuroCheck a series of additional log files will be created in `\System Output\` as `NcGenericCameraDriver_TraceOutput_000.log`.

- **GenlCam XML description files:**

More info about the available GenlCam features is contained in the original XML description files. You can download them in the 3D Camera Properties Dialog. Please download these files for all available modules.



Release Notes

Please visit our website or contact support to check if newer version of NeuroCheck software components is available than you have.

Version 6.2.17

- Updated GenICam GenApi to version 3.5.
- Minor fixes.

Version 6.2.16

- Various fixes in GenTL producer management.
- Fixed camera connection issues when using IDS GigE GenTL Producer.

Version 6.2.15

- Added configurable acquisition buffer count (see [Driver Configuration](#)).

Version 6.2.14

- Added configurable preemptive acquisition start in Continuous mode (see [Driver Configuration](#)).
- Added configurable excessive buffer handling in Continuous mode (see [Driver Configuration](#)).

Version 6.2.13

- Added support for LMI Gocators with GoPXL firmware (version 1.1.11+). See the LMI Gocator GenICamTL integration manual for more details.
- Added experimental support for LMI Gocators 4000 and 5000 Series.
- Allowed connection of cameras with invalid initial PayloadSize.
- Improved detection of enabled image components.
- Improved detection of trigger-related features.
- Improved ring buffer processing of GenICam trace log files.

Version 6.2.12

- Added image formats: BayerXX10p, BayerXX12p, Coord3D_XXX10p, Coord3D_XXX12p.
- Searching for features by name in the camera properties dialog.
- Improved image component name detection.
- Improved acquisition in mode Continuous when using Baumer GigE GenTL Producer.
- Improved GenICam trace logging, extended the number of log files to 8 and the maximum file size to 256MB.

Version 6.2.11

- Added detailed mode for GenICam trace log, which provides information on each GenTL and GenICam request and also dumps feature maps for every device and GenTL module.
- Added image format: YUV422_8_UYVY.
- Improved extraction of GenICam feature maps from ZIP files.

Version 6.2.10

- Added support for NeuroCheck evaluation license.

Version 6.2.9

- Added support for cameras with multiple image components.
- Added support for chunk features. Chunk feature values are taken from the last acquired buffer.
- Automatic creation of XYZ images based on Coord3D_xxx pixel formats and Scan3d features.
- Added various image formats.
- Live image can be saved directly from the camera properties dialog.

GenICam 3.5

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