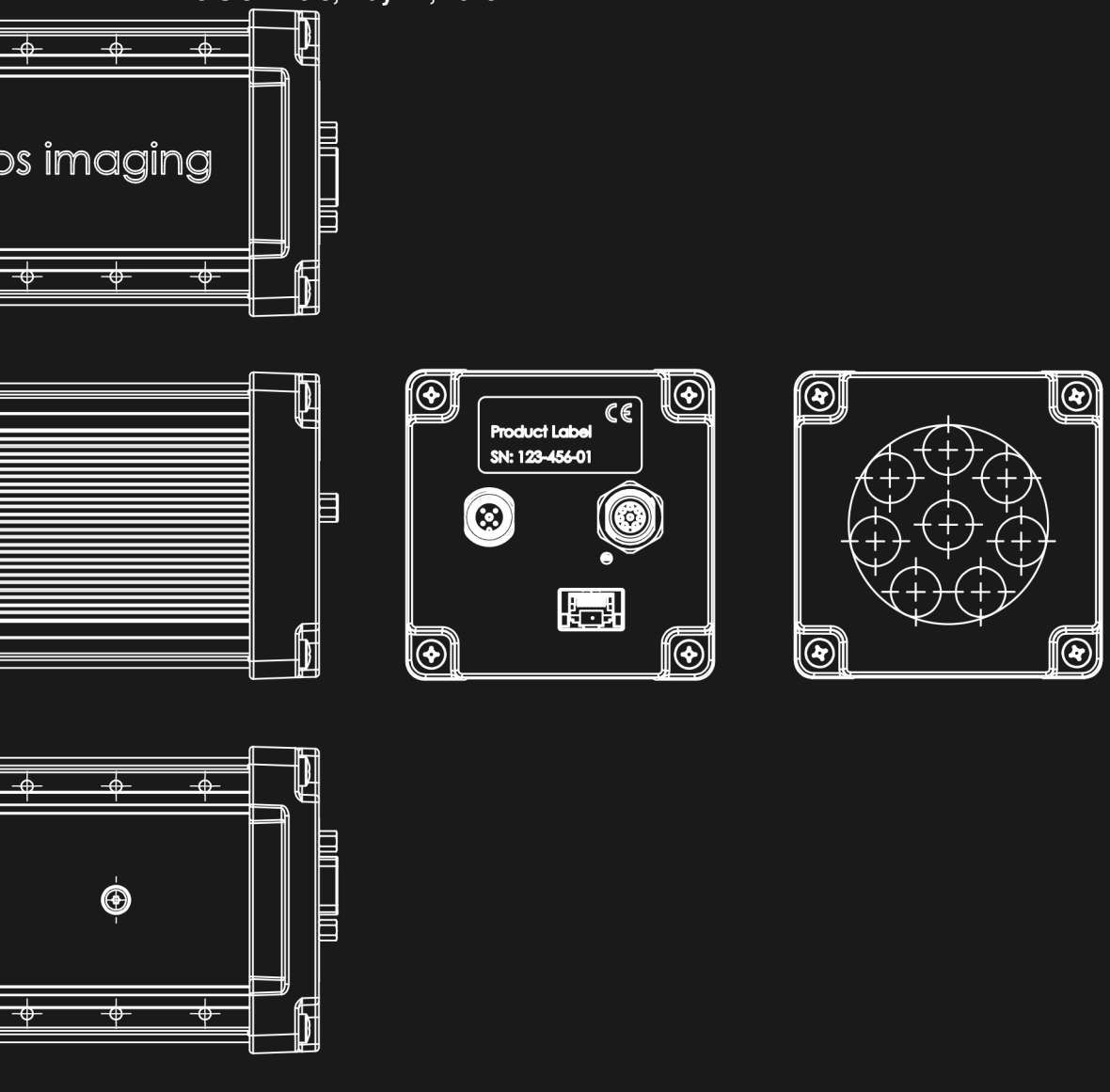
StarForm™ Swift-G

3D Time-of-Flight Camera

OI-G1480, OI-G1480-R

User Manual

Version 2.0.3, May 27, 2019



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1 Contact

Note

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2 Introduction

This manual describes various software and firmware packages and applications available to support the StarForm™ Swift-G 3D camera. It includes quickstart step-by-step guides, references and pointers to online help where available.

2.1 Styles and Convention

This manual uses certain typographical conventions in order to maintain an easily accessible and consistent layout. The styles contained in Table 2.1 and symbols noted below are used throughout the manual.

Table 2.1: Description of typographical styles used throughout this manual.

Style	Function	Example
Bold	important information, key words, headings	**Bold**
Emphasis	GenICam™ features	**ComponentEnable**
Menu sequences	GUI menu sequences, e.g. About on Help menu	Help 〉 About...
Keys	Keys to press, e.g. Control and C together	Ctrl + C
Italic	filenames	`helpfile.pdf`
Monotype	code	`perl -00 -pe ''`

This symbol highlights important information to note.

Use of the CAUTION heading throughout this manual explains risks that are potentially harmful to either the product or personnel. These sections should always be read carefully and understood.

3 Software Available

This chapter provides an overview of the various software and firmware packages and applications available to support the StarForm™ Swift-G 3D camera.

3.1 StarStream GUI

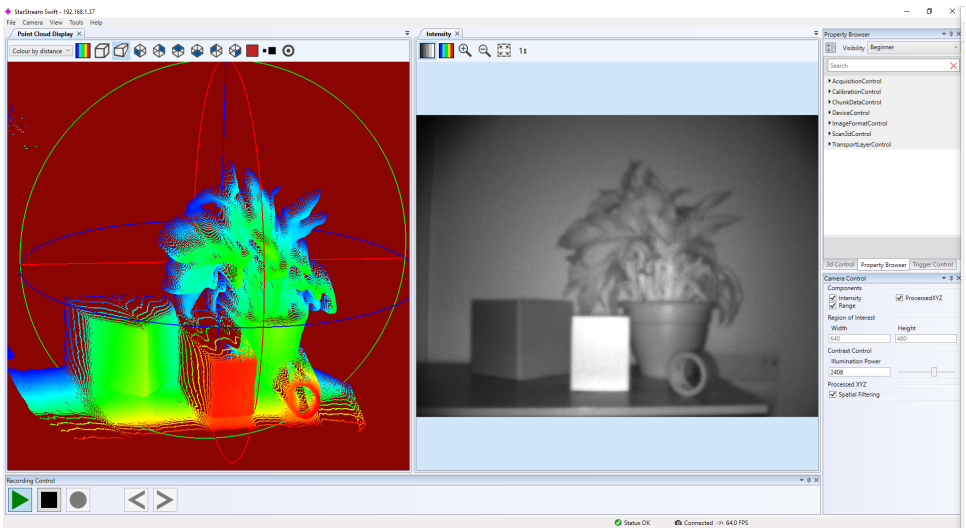

Figure 3.1: StarStream GUI

The StarStream GUI application is a demonstration viewer and control application for the StarForm™ Swift-G 3D camera.

In addition to the quickstart guide in chapter 4 full online help is available from the Help > View Help... menu command or by pressing the F1 key.

3.1.1 Supported Platforms

The StarStream GUI application is available for Windows 7 and higher.

3.1.2 Installation

Use the *StarStreamSwiftSetup.exe* available from `https://www.odos-imaging.com/downloads` to install.

3.2 SwiftCapture

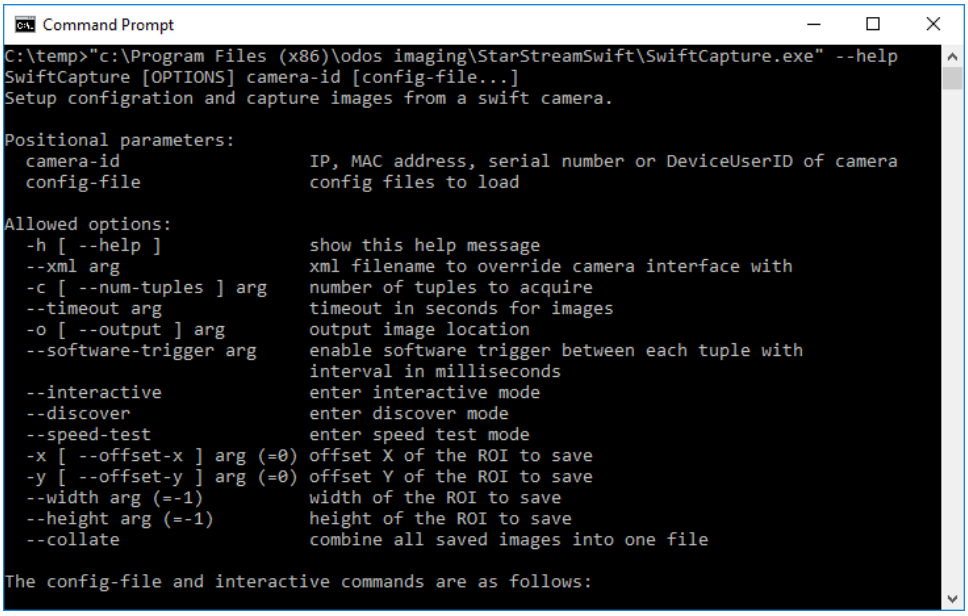

Figure 3.2: SwiftCapture

The SwiftCapture application is a demonstration command line control and image streaming application for the StarForm™ Swift-G 3D camera. It can save images to file and set or query any supported GenICam™ features as described in chapter 8.

Online help is available using the `--help` command line option and the `help` command when in `--interactive` mode.

3.2.1 Supported Platforms

The SwiftCapture application is available for Windows 7 and higher and recent Linux distributions (i686 and x86_64).

3.2.2 Installation

On machines running Windows operating systems, the SwiftCapture application is installed with the StarStream GUI application. Use the *StarStreamSwiftSetup.exe* available from `https://www.odos-imaging.com/downloads` to install. It installs to the x86 Program Files directory as:
`odos imaging\StarStreamSwift\SwiftCapture.exe`.

On Linux use either *SwiftCapture.i686.AppImage* or *SwiftCapture.x86_64.AppImage* as appropriate for your 32 or 64-bit distribution.

3.3 Swift SDK

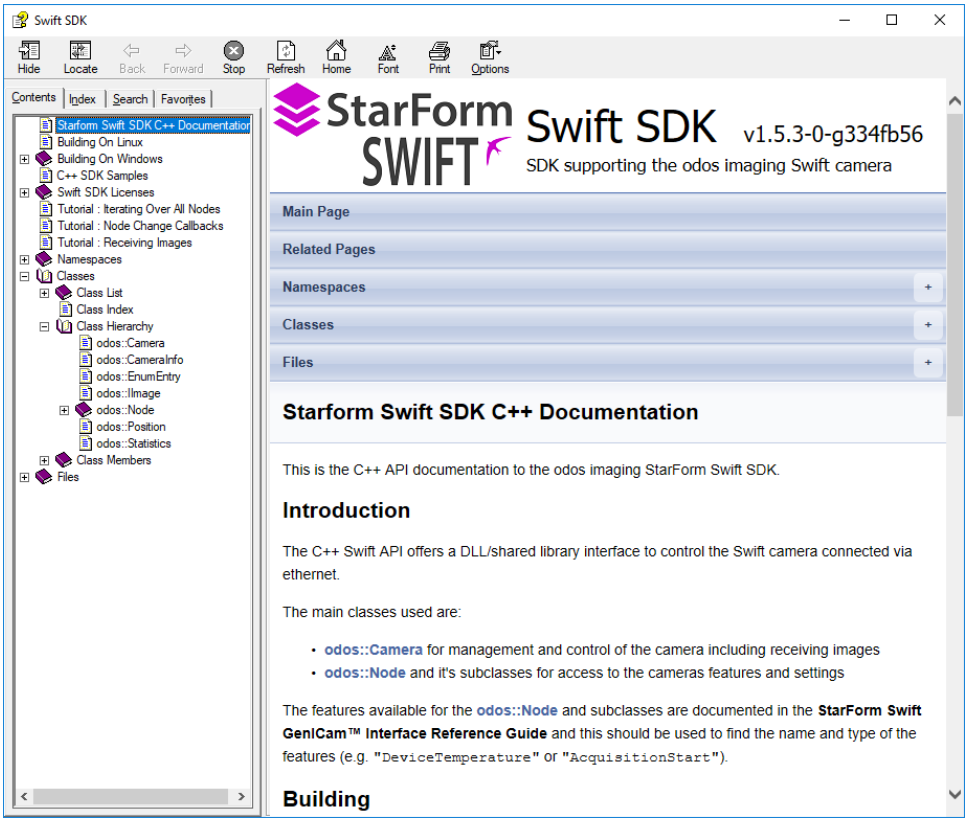

Figure 3.3: Swift SDK

The Swift SDK is a C++ Software Development kit for the StarForm™ Swift-G 3D camera. It contains shared libraries, headers, documen-

tation and sample applications needed to allow custom application development for the StarForm™ Swift-G.

On Windows the Swift SDK also contains a .Net v4.5 assembly (`odos-swift.net.dll`) allowing the development of .Net applications if required.

Online help is also available on Windows operating systems in the `odos-swift.chm` help file (installed as "Swift C++ SDK" in the start menu). On Linux online help is available by opening `$INSTALL_DIR/swift_sdk.html` in a web browser.

3.3.1 Supported Platforms

The Swift SDK is available for Windows 7 and higher and recent Linux distributions.

The target platforms available are:

- Windows 7+, 32-bits (i686)
- Windows 7+, 64-bits (x86_64)
- Linux i686
- Linux x86_64
- Linux armhf
- Linux aarch64

The SDKs for the Linux armhf and aarch64 targets do not include ProcessedXYZ support

3.3.2 Installation

Windows Operating Systems
Use the *StarFormSwiftSdkSetup.exe* or *StarFormSwiftSdkSetup_x64.exe* available from `https://www.odos-imaging.com/downloads` to install. The Swift SDK will install to an `odos imaging/StarForm Swift SDK` subdirectory in either the 32 or 64-bit Program Files directory depending on the installer selected.

Linux Operating Systems
Use one of the `swift_sdk.$TARGET.run` installers where $TAR-

GET matches the target platform (one of i686, x86_64, armhf or aarch64).

If the installer is run as root the install directory will be `/opt/odos_imaging/swift_sdk_$TARGET` otherwise it installs under current users home directory ($HOME) in `$HOME/odos_imaging/swift_sdk_$TARGET`. Note for backwards compatibility the `_$TARGET` suffix is removed for the x86_64 $TARGET.

3.4 SwiftUpdater

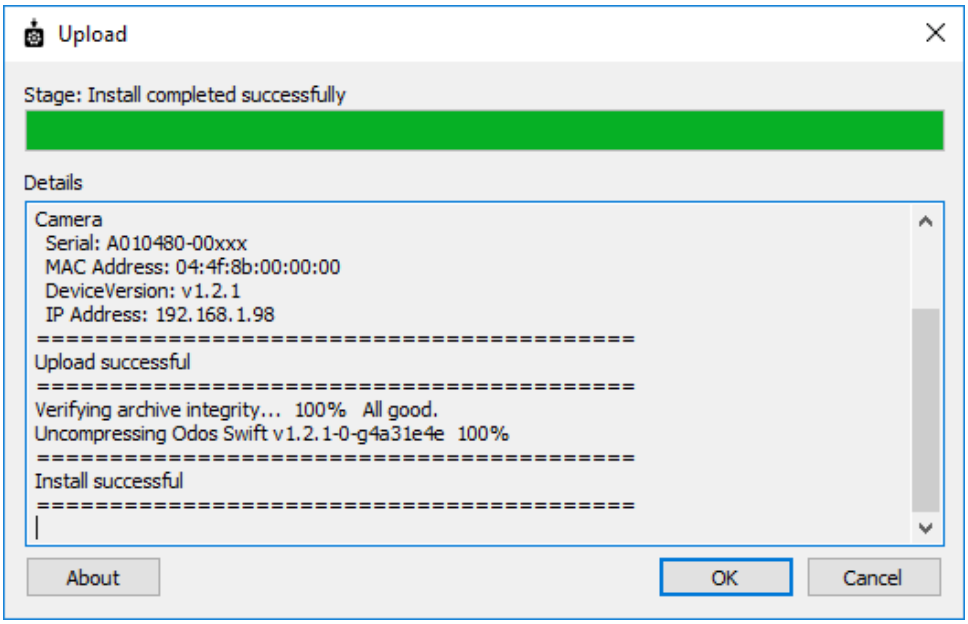

Figure 3.4: SwiftUpdater

The SwiftUpdater application is a Windows utility for updating the firmware on a StarForm™ Swift-G 3D camera using `.swift` update files. Details for use are described in chapter 5.

3.4.1 Supported Platforms

The SwiftUpdater application is available for Windows 7 and higher.

3.4.2 Installation

The SwiftUpdater application is a single stand-alone executable `SwiftUpdater.exe` that can be downloaded from `https://www.`

odos-imaging.com/downloads. It may also be packaged in a single zip file with a .swift file and associated documentation for convenience.

3.5 StarForm™ Swift-G Firmware

Firmware updates for the StarForm™ Swift-G 3D camera are distributed as .swift files that can be installed using the SwiftUpdater application as described in chapter 5.

4 Quickstart

This chapter provides a quick start guide to working with the StarForm™ Swift-G 3D camera. The following sections provide details on how to assemble the camera, install software, and connect and configure the camera to stream and save 3D images, using the StarStream GUI program.

4.1 Assemble StarForm™ Swift-G Hardware

The StarForm™ Swift-G 3D camera requires $12\,V_{DC}$ power supply and ethernet connectivity. Follow the steps below to assemble the camera hardware ready for connection to a host PC.

1. Carefully remove all the components from their packaging, and store the packaging for later use.
2. Connect an ethernet cable to a suitable host PC. Base requirements for the PC are 32bit Windows 7,8,10, with 4 MB memory, and 50 MB of storage.
3. Source 12V from a suitable power supply (M12 power connector pinout can be seen in *swift-g_hardware_manual_<MODEL>.pdf*).
4. Connect the M12 $12\,V_{DC}$ connector to the StarForm™ Swift-G camera. After several seconds, the LED indicator light will illuminate solid red (during internal firmware boot), before briefly flashing white, and then solid blue indicating that the camera is ready for connection to a host PC.

4.2 Install Software

Follow the steps below to install the required software components to the host PC.

1. Download both the *StarFormSwiftSdkSetup.exe* and *StarStream-SwiftSetup.exe* binaries from `https://www.odos-imaging.com/downloads`.

2. Run the each installer program by double clicking, or execute from a command prompt. Note: you may require administrator permissions to install software, depending on your local configuration. Contact your System Administrator for more details.

3. Each installer provides specific components:
   StarStream GUI, provided by *StarStreamSwiftSetup.exe*. A simple program to allow connection to, and configuration of the StarForm™ Swift-G camera. Images can be simply streamed to the host PC and saved for further analysis.
   Swift SDK, provided by *StarFormSwiftSdkSetup.exe*. A fully functional C++ software development kit is provided together with documentation, to allow programmatic control of StarForm™ Swift-G cameras.

4. Each installation is self-contained and will install to a new folder 'odos imaging' located on a default Windows install in '`C:/Program Files (x86)`'.

5. The Swift SDK contains all the necessary libraries and header files to compile user programs to control StarForm™ Swift-G cameras. The top level folder contains the compiled HTML file *odos-swift.chm*, which contains details of the SDK classes, namespaces, and files.

6. Additional detail on the GenICam™ interface to the StarForm™ Swift-G camera can be found in chapter 8.

7. By default the StarForm™ Swift-G camera will first attempt to get an IP address from a DHCP server. This can be provided either by a DHCP server running on the user network or on the host PC. If no DHCP server is found the camera will then move on to using an automatic link-local-address (LLA) in the range 169.254.1.0 to 169.254.254.255. In addition to these default options the camera can also be configured to use a static IP address as described in chapter 6.

4.3 Run StarStream GUI

Run the StarStream GUI program the Windows Start menu. Figure 4.1 shows an overview of the program and several control windows referenced in the sections below.

Full online help is available from the Help > View Help... menu command or by pressing the F1 key.

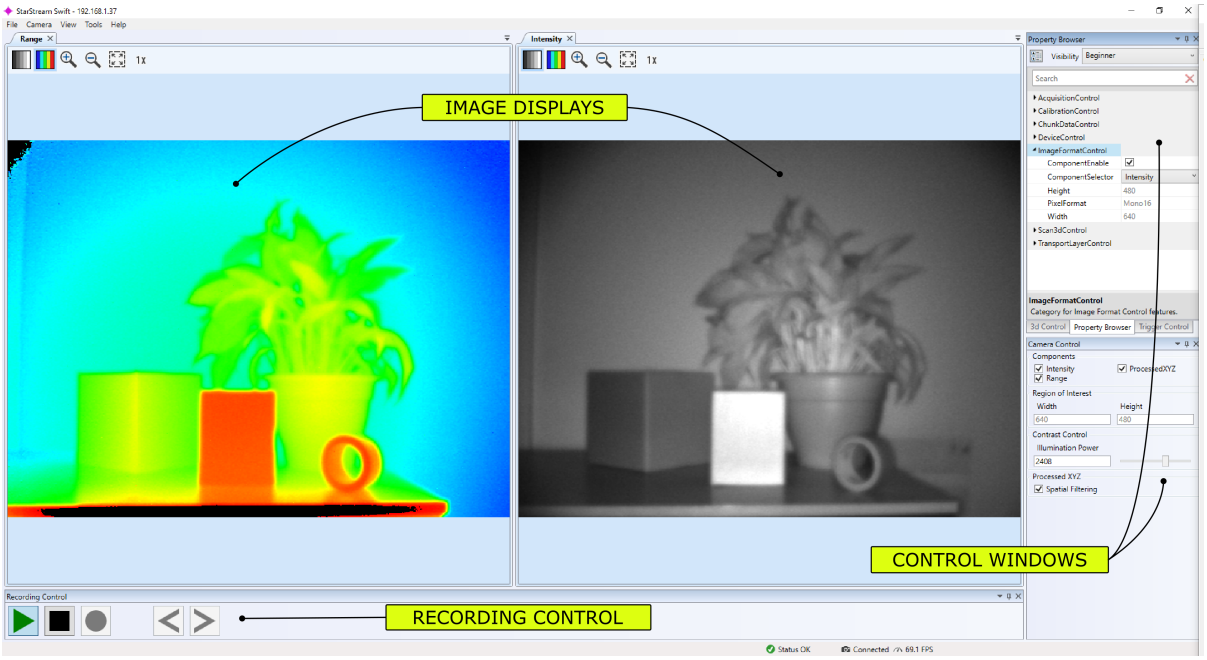

Figure 4.1: Overview of StarStream GUI program.

4.3.1 Connect and Stream

The following steps outline basic control of the StarForm™ Swift-G camera. The views referred to below are shown by default after a new install. If they are currently hidden you can use the View menu commands to display them again.

1. Connect to a StarForm™ Swift-G camera by selecting the menu item Camera » Connect... . This will open the connection dialogue. Each available StarForm™ Swift-G camera will be listed and identified by MAC Address, IP Address and serial number. Highlight the required camera and press **OK** to complete the connection.
2. Start the StarForm™ Swift-G camera streaming by pressing the **Play** button on the **Recording Control**. Streaming images will be visible in the **Intensity** and **Range** display windows.
3. In the **Camera Control** view check and uncheck the **Components** checkboxes for **Intensity** and **Range** components. Notice that when the checkboxes are not checked the corresponding image no longer streams to the display windows.
4. Each display window provide controls over the rendering of the streamed images. Use the toolbar located at the top of the display window to access these controls.
   - **False Colour**. Images can be displayed either in greyscale or as a false colour heat-map. If the heat-map is selected a dialog is opened which allows the colour scaling to be adjusted by the user. This feature can allow for fine visualisation of range data.
   - **Zoom**. Zoom in and out tools are provided to closely inspect the image data. The zoom level can be set by using the **Toolbar** ⇒**Zoom In** or **Toolbar** ⇒**Zoom Out** buttons or by using the mouse wheel when the mouse cursor is over the image.
5. Ensure that the **Range** viewing window is visible, and adjust the **Illumination Power** slider to vary the power of the optical signal. Increasing the optical signal can provide more precision in the range measurement, but can cause saturation of pixels in the image if too much signal is received.
6. Ensure that the **Point Cloud Display** viewing window (View »

New Point Cloud) is visible and the **Components** checkbox for **ProcessedXYZ** is checked. The point cloud can be viewed in either **Colour by Distance** (like heat map) or **Colour by intensity** (like greyscale). Other advanced controls for point cloud viewing are available on the toolbar – for example, it is possible to change the point size or the point of rotation.

Viewing of streaming point clouds requires significant resources on computer, and may impact displayed frame rate.

7. To set the point of rotation in the point cloud, click the target icon, then the pointer icon, then the desired point of rotation on the point cloud.
8. Stop the StarForm™ Swift-G camera streaming data by pressing the **Stop** button on the **Recording Control** view.

4.3.2 Record Images

The following steps outline how images and data can be saved from the StarForm™ Swift-G camera to a host PC.

1. Enable the save function within the StarStream GUI program by opening the File > Save Images... dialog box. This dialog box allows the specification of a save location on the host PC by browsing and selecting a folder with the **Save Location** browser.
2. Use the various checkboxes within the **Formats** box to select which types of output format are required.
   - **Raw format**. This format provides a binary export of the raw image data with two bytes per pixel for both **Range** and **Intensity** components.
   - **PNG format**. This format outputs images as .png files.
   - **JPEG format**. This format outputs images as .jpeg files.
   - **PCD format**. This format outputs calibrated 3D in 'point cloud' data format, .pcd[1]. Note that PCD files will **only**

[1] For more details see http://pointclouds.org/documentation/tutorials/pcd_file_format.php

be saved if the Components checkbox for ProcessedXYZ is checked.

3. Start the StarForm™ Swift-G camera streaming by pressing **Play** on the **Recording Control** dockable window. The camera will start streaming images to the host PC. Recording can be initiated by pressing the **Record** button on the **Recording Control** window. The **Record** button will be highlighted while images are saved to the host PC.

If the camera is left to record continuously with save images enabled, many images will be stored to the host PC. This should always be monitored to avoid exhausting available disk space.

4.3.3 Access GenICam™ Features

All properties of the StarForm™ Swift-G camera can be accessed through the GenICam™ interface. This interface is available within StarStream GUI with the following steps.

1. Open the **Property Browser** by selecting View > Property Browser from the menu.
2. The **Property Browser** dockable window provides a tree of all GenICam™ features available for the StarForm™ Swift-G camera as a hierarchical list of feature-value pairs. These parameters may be directly read out, or written to within the **Property Browser** window[2].

[2] Note some GenICam™ features may be read-only, or may only be writeable when the camera is not streaming images. Please consult chapter 8 for more details.

5 Installing New StarForm™ Swift-G Firmware

This chapter provides a step-by-step guide for user update of a StarForm™ Swift-G 3D camera firmware using a simple Windows based GUI program.

The SwiftUpdater installs the contents of a selected *.swift* to a StarForm™ Swift-G 3D camera. These files generally contain firmware updates or other improvements to camera operation. The steps below outline the operation of the SwiftUpdater, which can be simply downloaded from `https://www.odos-imaging.com/downloads`.

For more information please contact support@odos-imaging.com

If the installation of a firmware update is interrupted it is possible to leave the camera in a non-working state. Please ensure that the camera power supply is stable during the update procedure.

5.1 Firmware Update Steps

1. **Select File to Upload**. On startup, SwiftUpdater will ask for the *.swift* file to upload. The **File Open** dialog shows the text label from the selected *.swift* file (the user can choose to rename the file).
2. **Select Camera**. The next dialog allows the user to select the StarForm™ Swift-G camera for update. The dialog shows the list of detected StarForm™ Swift-G cameras on the current network and also allows the user to enter an IP or MAC address manually (e.g. when the internal firmware is not running on the StarForm™ Swift-G camera such that it cannot be found in the list, for example if power has been interrupted during update).

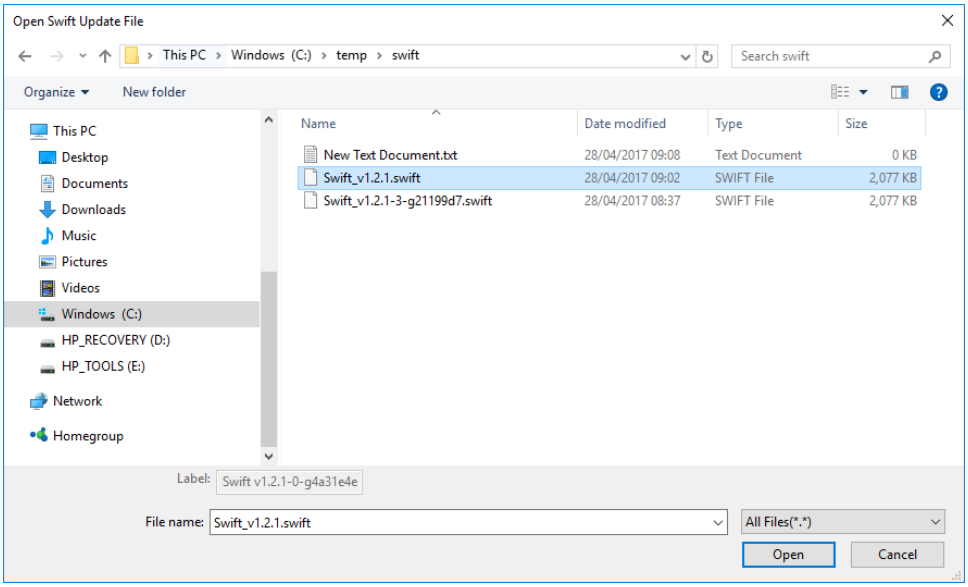

Figure 5.1: Step 1. Valid *.swift* selected showing label.

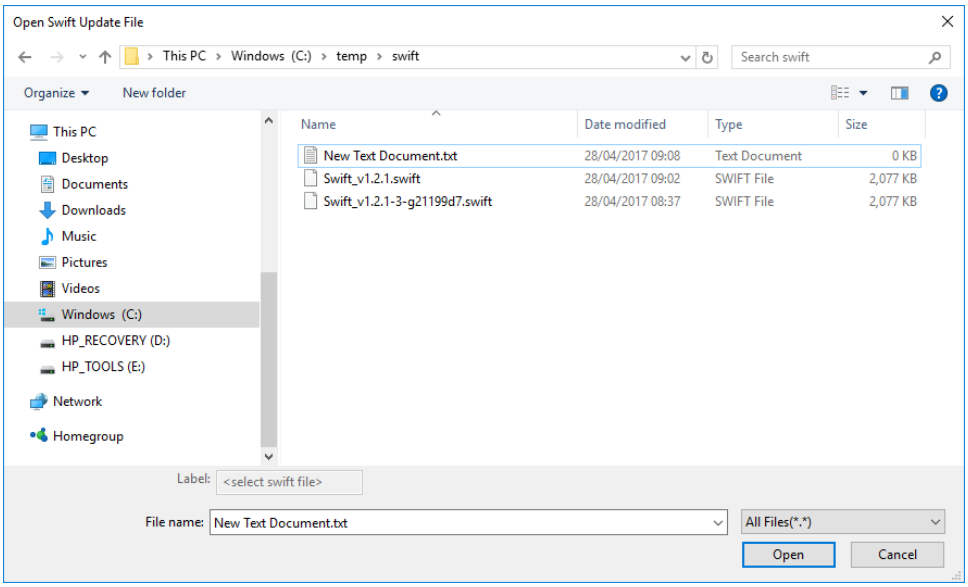

Figure 5.2: Step 1. No valid *.swift* selected.

Note

Using a MAC address requires the camera to be connected to an interface that supports IPv6.

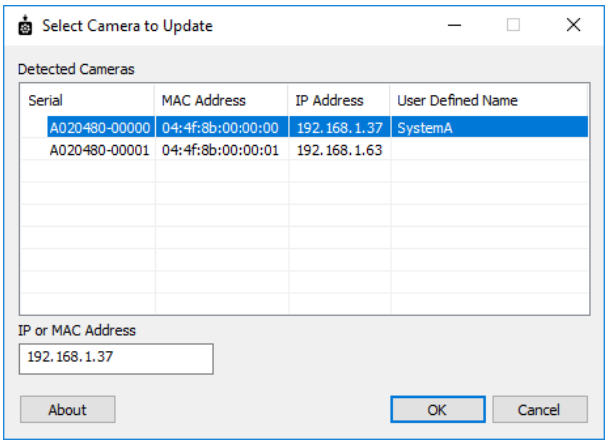

Figure 5.3: Step 2. Select the appropriate StarForm™ Swift-G camera for firmware update by IP address.

3. **Enter Update Key**. The next dialog (figure 5.4) asks for the camera specific update key. This key is provided on a per customer basis by Odos Imaging. Please contact support@odos-imaging.com if additional keys or support are required.

4. **Upload**. The next dialog is the upload dialog. This uploads the *.swift* file, for installation on the camera. If the upload key is incorrect an error dialog is displayed and the **Details** text shows the update key was rejected. If the upload key is correct the file is uploaded and then installed on the camera. The **Details** text will update with progress eventually showing that the install was successful.

Note

The dialog can only be cancelled during the upload stage as the install must run to completion otherwise the camera may be left in a non-operational state.

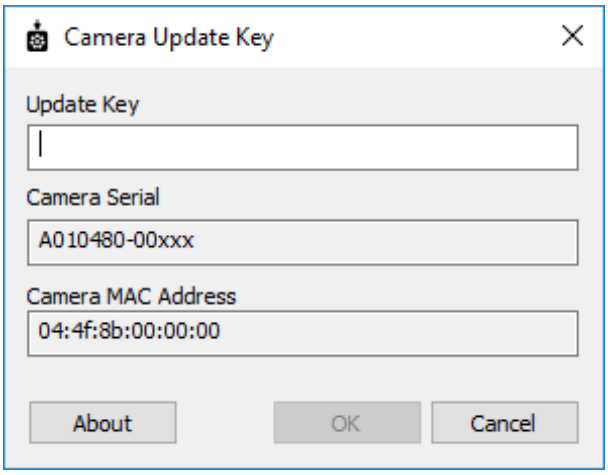

Figure 5.4: Step 3. Enter the update key as provided by Odos Imaging.

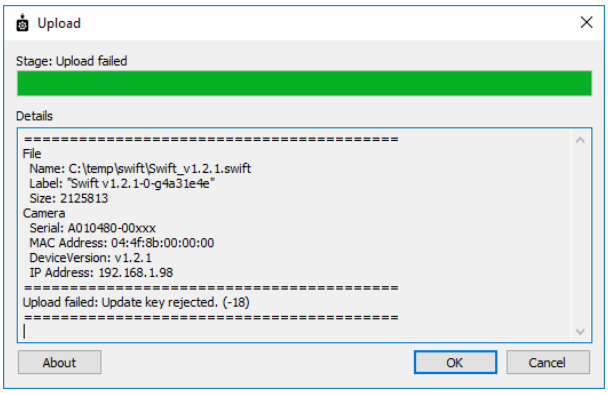

Figure 5.5: Step 4. Example of SwiftUpdater output after entry of an incorrect or invalid update key.

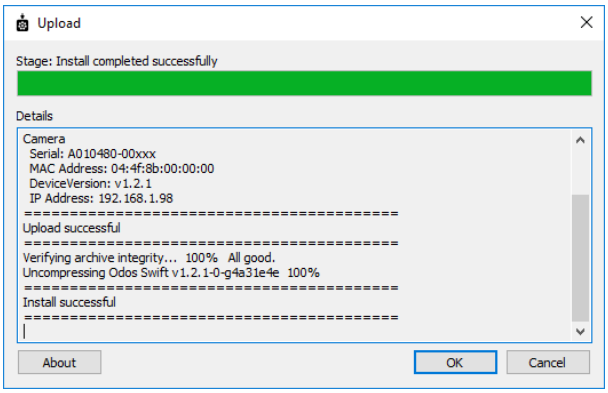

Figure 5.6: Step 4. Output from SwiftUpdater on successful installation of updated firmware.

5. **Camera Restart**. During the firmware update, the internal firmware within the StarForm™ Swift-G camera is stopped. After the install has successfully completed the camera should be restarted (power-cycle) in order to start the new camera firmware.

Note

It is important to power-cycle the StarForm™ Swift-G camera after the installation process has been successfully completed.

6. **File Download**. Some *.swift* files may produce files from the camera. For example log files to be sent back to Odos Imaging for debug purposes. When these *.swift* files are opened the SwiftUpdater will indicate if the user wishes to save the output. Should the user answer **Yes** then a file **Save as...** dialog will be shown.

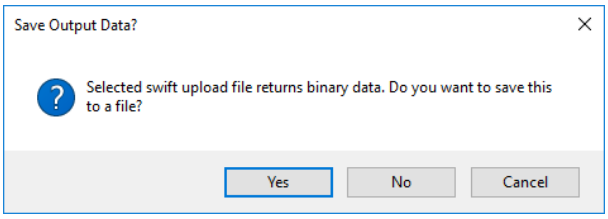

Figure 5.7: Optionally save the installation binary data for record and support requests.

6 Identification and Network Settings

This chapter describes how to use features provided by the StarForm™ Swift-G 3D camera in order to identify and connect to the desired camera on a network where multiple cameras may be connected.

The following sections provide details on how to identify a specific camera, how to configure persistent properties such as user identifier or IP address, and the different mechanisms by which a camera is assigned an IP address on the network. This is illustrated using the StarStream GUI program provided, however the camera properties used are part of the GigE Vision / GenICam™ interface and so are also available through the SDK provided, as well as via GenICam™ compliant third-party software.

6.1 Identifying StarForm™ Swift-G Cameras

The StarForm™ Swift-G 3D camera provides a number of GenICam™ properties that can be used to identify a specific unit. These details are shown in the Camera > Connect dialog in the StarStream GUI, as shown in figure 6.1, and are described below. Please see chapter 8 for further details.

- **GevMACAddress**. The unique MAC address associated with the Ethernet interface in the StarForm™ Swift-G camera, also printed on the product label.
- **GevCurrentIPAddress**. The current IP address of the StarForm™ Swift-G camera. This can be defined by several means; see section 6.3 IP Address Determination for details.
- **DeviceSerialNumber**. The unique, factory-assigned serial number of the StarForm™ Swift-G camera, also printed on the product label.
- **DeviceUserID**. A user-programmable string that can be used as an identifier for the StarForm™ Swift-G camera. This is stored in non-volatile system flash memory, and will persist until removed or updated by the user.

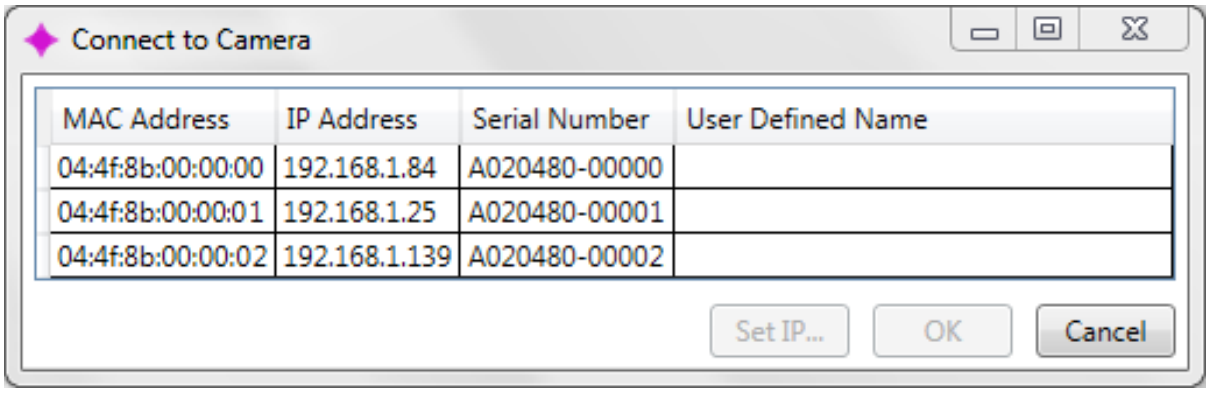

Figure 6.1: StarStream GUI Connect dialog.

The GigE Vision protocol defines a standard discovery mechanism to identify all GigE Vision devices on a network. The StarForm™ Swift-G 3D camera includes all of the above information in the response to a GigE Vision discovery command. As a consequence, it is possible to specify any of the above properties as the 'key' by which to select a system to connect to when using the Swift SDK, and in many third-party software tools also. In the Swift SDK, the `Camera::open()` function provides this functionality. The SwiftCapture command-line tool can also use any of these properties to select a camera. Note, however, that connecting to a camera by IP address has the shortest execution time, since in this case the GigE Vision discovery process can be avoided.

The MAC address and serial number are pre-programmed unique values for each system. As such, these can be used directly to uniquely identify a system. However, there are some limitations to this approach:

- If an implementation is to be rolled out across multiple installations, it is undesirable to hard-code these values for each install.
- If a camera requires to be replaced in an installation, the software configuration will have to be updated to reflect the identifiers of the replacement camera.
- These values bear no relationship to the role of the camera in the installation, or where it is physically located.

Of these issues, the first two can be addressed by a one-time

programming of a fixed IP address to each camera in a given installation, together with a software implementation that connects using the IP address. All three issues can be resolved by means of the user-defined identifier (**DeviceUserID**). These methods are discussed in the following sections.

6.2 Using Persistent Properties

Persistent properties are GenICam™ properties that are permanently stored in the flash memory of the StarForm™ Swift-G 3D camera. Two user-programmable persistent properties are available that can be used to aid in identifying and connecting to StarForm™ Swift-G 3D cameras.

6.2.1 User Identifier

The **DeviceUserID** GenICam™ property is a user-configurable free text field which can be set to any string of up to 16 characters in length. For widest compatibility, it is recommended to restrict entries to ASCII-encoded strings using codes 32 to 126 (decimal) only.

This value is stored persistently to the flash memory of the camera immediately upon any change.

6.2.2 Persistent IP Configuration

The GigE Vision protocol sets out the mechanisms by which a compliant camera should determine its IP configuration on a network. One such mechanism is a persistent IP configuration, stored within the camera.

The persistent IP configuration mechanism provides a means to specify an IP address, subnet mask, and optional gateway, that the StarForm™ Swift-G 3D camera will use by default upon start-up. Once suitable values for these parameters have been programmed to the camera, it is necessary to explicitly select this mode of operation by means of the **GevCurrentIPConfigurationPersistentIP** GenICam™ property.

The steps to use a persistent IP configuration on a typical network are as follows:

1. Set the **GevPersistentIPAddress** property to the required IP address, for example `192.168.1.139`. Doing so will immediately store this value in the camera.

2. Set the **GevPersistentSubnetMask** property to the required subnet mask, for example `255.255.255.0`. Doing so will immediately store this value in the camera.
3. Set the **GevPersistentDefaultGateway** property if required, or retain the default value of `0.0.0.0`. Any change will be immediately stored within the camera.
4. Enable the **GevCurrentIPConfigurationPersistentIP** boolean property. This indicates that the above values will be used as defaults at the next boot, and is immediately stored within the camera.
5. Reboot the camera. It will restart with the requested configuration.
6. Connect to the camera using the new IP configuration using StarStream GUI or any other means. The camera will take this as confirmation of the validity of the new persistent IP configuration.

Figure 6.2 shows a valid, enabled persistent IP configuration in the StarStream GUI Property Browser.

6.2.3 Recovering from Incorrectly Programmed IP Configuration

Should an incorrect or unknown persistent IP configuration be stored and enabled on a StarForm™ Swift-G 3D camera, there are several ways in which access to the camera may be regained.

1. The GigE Vision Discovery command is able to locate any camera on the network, regardless[1] of its IP configuration, whilst the GigE Vision Force IP command is able to assign a new IP configuration. It is therefore possible to locate and re-configure the camera from the StarStream GUI, which implements these commands. There are corresponding Swift SDK functions, and mechanisms in common third-party tools also. See section 6.3 IP Address Determination for details of overriding the IP configuration using the StarStream GUI.
2. If there has been no successful GigE Vision connection to the camera since the configuration was programmed, restarting the camera three times without making a GigE Vision

[1] Some special IP addresses / address ranges may be blocked by common firewall policies or network infrastructure. In case of such issues, a direct connection to a PC with any firewall functions disabled is recommended. If the system still can not be discovered or connected to, contact support.

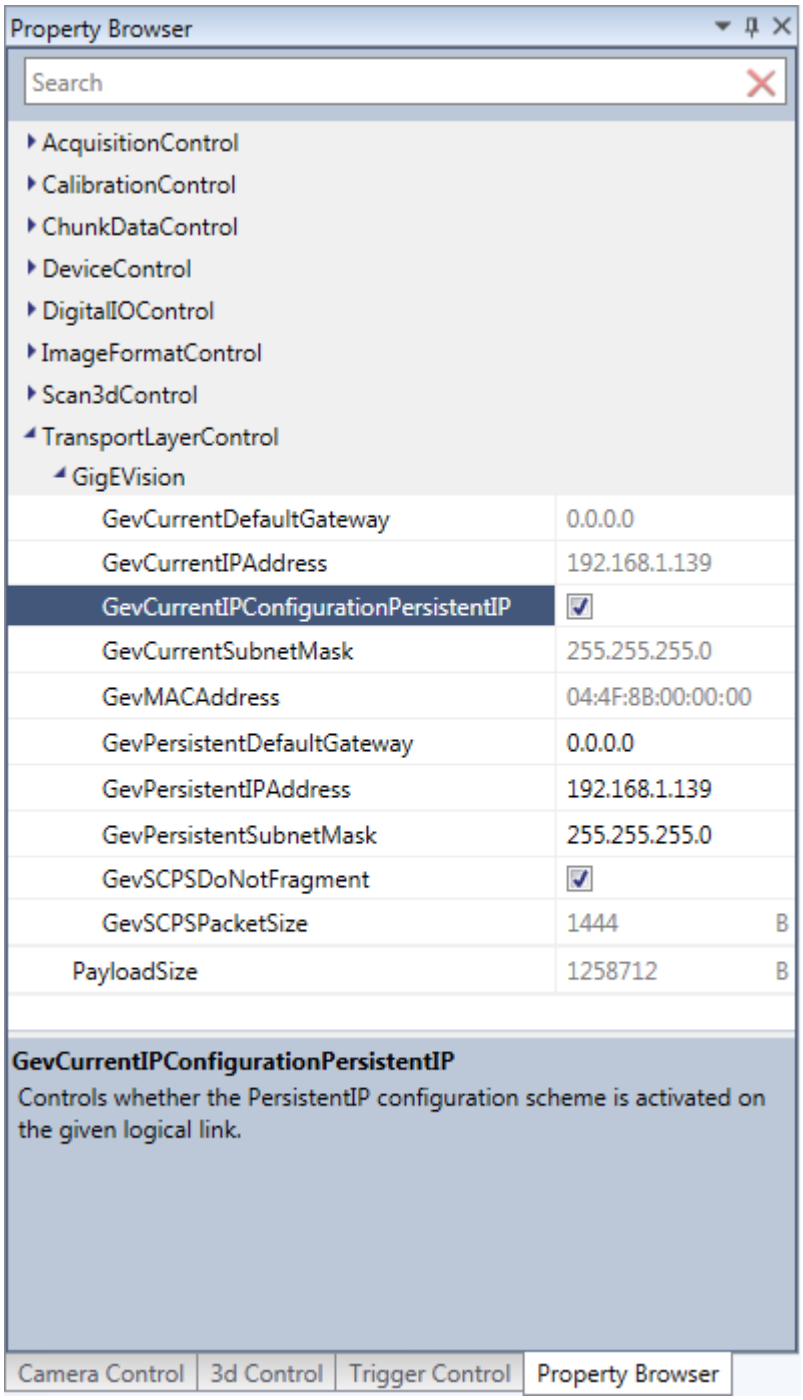

Figure 6.2: StarStream GUI Property Browser showing valid Persistent IP configuration.

connection will cause the camera to automatically disable the **GevCurrentIPConfigurationPersistentIP** boolean property, such that the use of the persistent IP configuration will be disabled from the fourth restart onwards.

6.3 IP Address Determination

The IP configuration of a StarForm™ Swift-G 3D camera will be initially determined on start-up, but can also be changed during operation. Details are provided in the following sections.

6.3.1 Initial IP Configuration at Start-Up

The GigE Vision standard sets out how a compliant camera should determine its IP configuration on start up. In the case of the StarForm™ Swift-G camera, the behaviour is as follows:

1. If the **GevCurrentIPConfigurationPersistentIP** persistent property is set, then the **GevPersistentIPAddress**, **GevPersistentSubnetMask**, and **GevPersistentDefaultGateway** persistent properties will be used for the IP configuration.
2. Otherwise, the camera will attempt to obtain an address via DHCP.
3. If IP configuration cannot be achieved via DHCP, the camera will attempt to determine a suitable link-local address (LLA) in the range 169.254.1.0 to 169.254.254.255 in accordance with RFC 3927 (this approach is also known as 'auto-IP' or 'APIPA').

As a general rule, the first two cases are preferable over the third. These allow the camera startup time to be minimised, and are more robust. See section 6.2 Using Persistent Properties for further details of persistent IP configuration.

6.3.2 IP Configuration During Operation

The GigE Vision standard defines a mechanism to set a new IP configuration on a device during operation. This 'Force IP' command is supported by the StarForm™ Swift-G camera, and is accessible in the StarStream GUI application as follows:

1. Select **Camera** ⇒**Connect**.
2. Select the camera to configure from the list of 'discovered' GigE Vision devices.

3. Select **Set IP...**
4. Enter the required IP address in the **IP** field, and the required subnet mask in the **Netmask** field.
5. Set a gateway address in the **Default Gateway** field if required, or accept the default of 0.0.0.0.
6. Click OK.
7. After a brief delay, the list of devices will update to show the new IP configuration on the selected camera.
8. You may now connect to the system as normal.

IP address set in this way is NOT persistent. If a persistent setting is required, instructions in 6.2.2 should be followed.

Figure 6.3 shows an example of the associated StarStream GUI dialogs.

Besides explicit reconfiguration of the IP address by the above mechanism, it is also possible that the IP address of a camera can change during use:

- In some cases, where the camera was assigned a link-local address, but a conflict is later detected, or a DHCP server becomes available.
- In some cases, where the camera was assigned an address by DHCP, the DHCP server can cause a change to the address.

These cases are not very common, but are undesirable, since the protocols and software libraries used in connection with the StarForm™ Swift-G camera are not designed to react gracefully to a change in IP configuration during operation.

6.3.3 Recommended Means of Setting IP Configuration

In order to achieve a known, stable IP configuration for all StarForm™ Swift-G 3D cameras in a system, the following best practice is proposed:

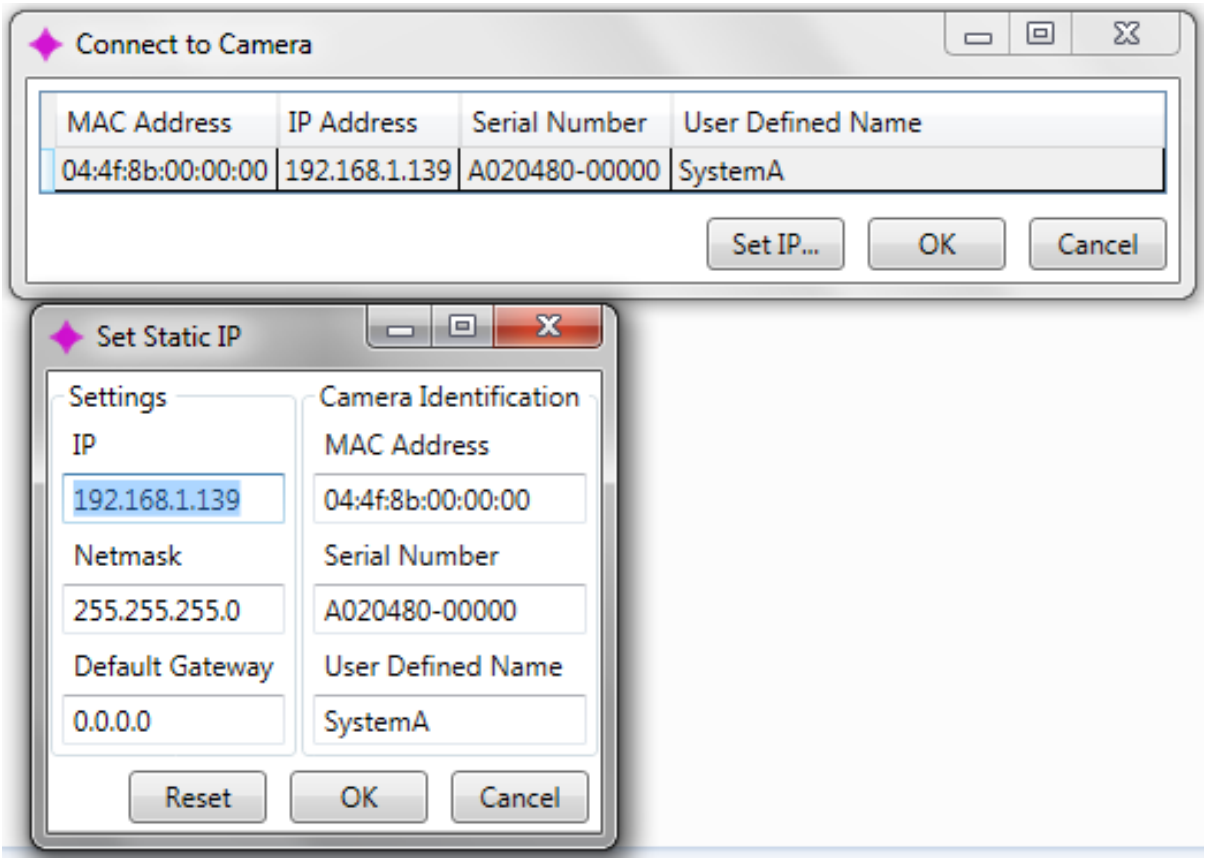

Figure 6.3: StarStream GUI Connect and Set Static IP dialogs.

1. Use the **DeviceUserID** to set a meaningful name for each camera in the system. This is a one-time configuration, required at system install.
2. EITHER: At system start-up, connect to each camera in a system in turn by **DeviceUserID**, and assign a fixed IP address to each camera.
3. OR: Use the persistent IP configuration of each camera to assign fixed IP addresses.

In both cases, ensure that the IP addresses used are in a reserved range known to any DHCP server / DNS on the network.

In this way:

- IP addresses will not change during operation (once initialisation has completed).
- Systems can be readily identified by the **DeviceUserID**.
- The same software can be used across multiple installs.
- In the case that a camera fails and has to be replaced, all that is required is a one-time configuration of the user ID on the replacement unit (or the user ID and persistent IP configuration).
- There is no dependency on a DHCP server (other than to reserve the address range in which the fixed IP addresses of the cameras reside) such that changes to the DHCP server software or configuration have minimal impact on the camera installation.

7 Camera Triggering

This chapter describes how to use the hardware interface and software features provided by the StarForm™ Swift-G 3D camera in order to control the triggering of the camera's acquisition cycle.

The following sections provide details on how to configure properties to control the camera's trigger function such as **TriggerMode**. This is illustrated using the StarStream GUI program provided, however the camera properties used are part of the GigE Vision / GenICam™ interface and so are also available via the SDK provided, and any GenICam™ compliant third-party software.

7.1 Camera Acquisition Cycle

By default the StarForm™ Swift-G 3D camera continuously runs acquisition cycles. During each cycle, the camera outputs pulses of infrared illumination, and captures data (in the form of the intensity and return time of each pulse at each pixel). The data is processed internally, and at the end of each acquisition cycle the camera produces two images - a **Range** and an **Intensity** image. The entire acquisition cycle normally runs at 44 Hz however if the **Block** filter is enabled in the **Scan3dFilterMode** GenICam™ property then the frequency of output will be divided by the value of the **Scan3dFilterLength** GenICam™ property.

7.2 Hardware Trigger Input

The hardware trigger input and associated signal levels are described in the hardware guide for your camera:
(*swift-g_hardware_manual_<MODEL>.pdf*).

The camera trigger functionality can be set to be triggered on rising, falling and both rising and falling edges detected on this input using the **TriggerActivation** GenICam™ property.

7.3 Camera Triggering Properties

The following sections discuss the GenICam™ properties that can be used to control and monitor the StarForm™ Swift-G camera triggering functions. Please see chapter 8 for further details.

7.3.1 Enabling Triggering

By default, after power-up the StarForm™ Swift-G camera is in free-running mode and will stream images continuously (after acquisition has been initiated).

The **TriggerMode** property controls whether triggering is enabled or disabled.

- **Off**. Triggering is disabled and the streaming of images is continuous (free-running).
- **On**. Triggering is enabled and the streaming of images is controlled by the selected trigger in **TriggerSource**. The acquisition cycle is either free-running or waiting for a trigger as described in section 7.1 Camera Acquisition Cycle.

7.3.2 Trigger Sources

The StarForm™ Swift-G camera offers two possible sources of triggering. These are available in the **TriggerSource** property.

- **Software**. A software trigger where the camera is triggered when the **TriggerSoftware** property is executed.
- **Line0**. A hardware trigger where a user defined transition on the StarForm™ Swift-G GPIO trigger pin causes a camera trigger. The **TriggerActivation** property controls the transitions that will cause a camera trigger.

7.3.3 Trigger Wait Modes

There are two possible modes of operation for the StarForm™ Swift-G 3D camera when waiting for a trigger. These are available in the **TriggerWaitMode** property.

- **Pause**. The camera waits for a trigger with the acquisition cycle paused. After a trigger is received a single acquisition cycle runs and then camera resumes waiting for the next trigger.
- **Run**. The camera waits for a trigger while running continuous acquisition cycles at the default rate but discarding the images produced. When triggered the camera captures the next set of images produced at the end of the acquisition cycle and streams them to the user before returning to discarding images while waiting for the next trigger.

As the Pause wait mode stops the continuous running of the acquisition cycle, the camera's temperature and timing stabilisation functions are also paused. In order to allow the camera's operating point to remain stable and maintain consistency of range measurement, it is necessary to regularly trigger the camera - allowing the stabilisation functions to run. As the required settings will be application specific, contact Odos Imaging via support@odos-imaging.com for guidance.

7.3.4 Trigger Input Transition Selection

The **Line0** hardware trigger can be set to have one or more input pin transitions trigger the camera. These are available in the **TriggerActivation** property.

- **RisingEdge**. A rising edge from logical 0 to logical 1 triggers the camera.
- **FallingEdge**. A falling edge from logical 1 to logical 0 triggers the camera.
- **AnyEdge**. Both a rising edge and a falling edge triggers the camera.

The actual level used for the above transition detections is the logical pin level after capture by the camera hardware. This is available for inspection via the **LineStatus** and **LineStatusUpdate** GenICam™ properties.

7.3.5 Hardware Trigger Input Monitoring

The current state of the **Line0** hardware GPIO input pin can be read using the **LineStatus** property.

The StarStream GUI and Swift SDK automatically update this property at 1 Hz and it can also have an immediate update triggered using the **LineStatusUpdate** property.

7.3.6 Causing a Software Trigger

The **Software** trigger can be activated by executing the **TriggerSoftware** command property. When the **TriggerSource** is not set to **Software** this command is ignored.

7.3.7 Interaction With Scan3d Filtering

When **Scan3dFilterMode** is enabled along with triggering (default setting = **ContinuousAdaptive**), the two features interact. The following describes the interaction for the different **Scan3dFilterMode** settings:

- **None** - No filtering is enabled so no interaction occurs and output is as expected.
- **Block**
  - **TriggerWaitMode** = **Pause**
    It takes **Scan3dFilterLength** triggers to generate a single pair (**Range** and **Intensity**) of images. One frame for filtering is captured after each trigger.
  - **TriggerWaitMode** = **Run**
    It takes a single trigger to generate a single pair (**Range** and **Intensity**) of images - as the acquisition cycles are continuously running in the background, the required frames for filtering are being captured and processed.
- **ContinuousAdaptive**
  - **TriggerWaitMode** = **Pause**
    It takes a single trigger to generate a single pair (**Range** and **Intensity**) of images. One frame for filtering is captured after each trigger so if the triggers are not close to the normal acquisition cycle rate then motion in the scene will produce artifacts in the final image.
  - **TriggerWaitMode** = **Run**
    It takes a single trigger to generate a single pair (**Range** and **Intensity**) of images. As the acquisition cycles are running in the background the frames for filtering are being continuously captured and processed.

For the above reason it is NOT recommended to use **TriggerWaitMode** = **Pause** along with **Scan3dFilterMode** = **ContinuousAdaptive**.

7.4 Using Hardware Trigger

This section gives a step by step guide to using the StarStream GUI application to setup and control the StarForm™ Swift-G camera hardware trigger.

7.4.1 Connect to Hardware Trigger Input

The hardware trigger input should be connected as described in the hardware guide for your camera (*swift-g_hardware_manual_<MODEL>.pdf*).

7.4.2 Camera Trigger Wait Modes

The hardware trigger allows the selection of **Pause** and **Run** for the **TriggerWaitMode** property as described in section 7.3.3. As discussed care must be taken when selecting the **Pause** option to periodically trigger the camera often enough to allow the camera to maintain temperature and timing stability and remain inside the camera performance specification for measurement.

7.4.3 Configure Hardware Trigger

To configure the hardware trigger we will use the **Trigger Control** view in the StarStream GUI as follows:

1. Select Camera » Connect.
2. Select the camera to configure from the list of 'discovered' GigE Vision devices.
3. If the **Trigger Control** view is not shown select View » Trigger Control.
4. If required select **Trigger Control** ⇒**Trigger Source** ⇒**Line0**.
5. The **Trigger Control** view should be showing its default state as shown in Figure 7.1.
6. You can now use the **Trigger Control** ⇒**Pin Status** to look at the currently detected logical level of the hardware trigger input pin.
7. Use the **Trigger Control** ⇒**Update** button to trigger an immediate update of the **Trigger Control** ⇒**Pin Status** indicator. It will automatically update once per second.
8. Monitor **Trigger Control** ⇒**Pin Status** while providing steady state high and low inputs on the hardware trigger input pin

Trigger Control ⇒**Pin Status** to verify input cabling is functioning as expected.

9. Select **Trigger Control** ⇒**Trigger Mode** ⇒**On**.
10. The camera is now in hardware trigger mode and will not stream any more images until the configured **Trigger Activation** occurs.
11. Select **Control** ⇒**Trigger Mode** and then select the type of activation required. The rising and falling edges use the level being shown in **Trigger Control** ⇒**Pin Status**.
12. The **Trigger Control** view should now be showing a configured state similar to the example shown in Figure 7.2.
13. Select Tools ⟩ Start Acquisition. If you are not already generating triggers at the input then the status bar will show 0 FPS and no images will be shown.
14. Cause triggering edges on the hardware trigger input. For each edge that the **Trigger Control** ⇒**Trigger Activation** setting has enabled the camera will send the next set of images produced at the end of the acquisition cycle as described in section 7.1 Camera Acquisition Cycle.

The camera can only accept triggers at equal to or less than the acquisition cycle rate. See section section 7.1 Camera Acquisition Cycle for details. Some triggers will be ignored if received faster than this rate.

7.5 Using Software Trigger

This section gives a step by step guide to using the StarStream GUI application to setup and control the StarForm™ Swift-G camera software trigger.

7.5.1 Camera Trigger Wait Modes

The software trigger allows the selection of **Pause** and **Run** for the **TriggerWaitMode** property as described in section 7.3.3 Trigger Wait Modes. As discussed care must be taken when selecting the

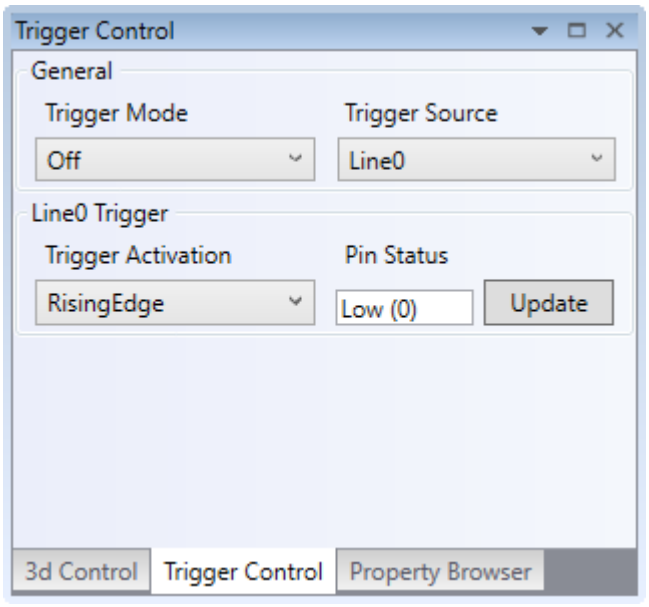

Figure 7.1: Default Trigger Control.

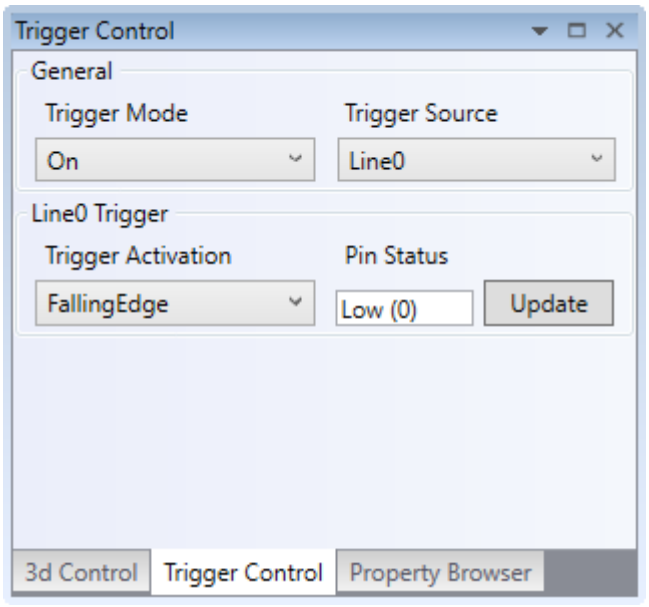

Figure 7.2: Example Hardware Trigger Control.

Pause option to periodically trigger the camera often enough to allow the camera to maintain temperature and timing stability and remain inside performance specification for measurement.

7.5.2 Configure Software Trigger

To configure the software trigger we will use the **Trigger Control** view in the StarStream GUI as follows:

1. Select Camera » Connect.
2. Select the camera to configure from the list of 'discovered' GigE Vision devices.
3. If the **Trigger Control** view is not shown select View » Trigger Control.
4. Select **Trigger Control** ⇒**Trigger Source** ⇒**Software**
5. The **Trigger Control** view should be showing its software trigger state as shown in Figure 7.3.
6. Select Tools » Start Acquisition. Images will start streaming and being displayed.
7. Select **Trigger Control** ⇒**Wait Mode** ⇒**Pause**.
8. Select **Trigger Control** ⇒**Trigger Mode** ⇒**On**.
9. Image streaming will stop and the illumination windows on the front of the camera (the outer ring of opaque windows) will go dark (as the acquisition cycle has been paused).
10. Click the **Trigger Control** ⇒**Trigger Software** button. A single acquisition cycle will be triggered and a single set of images will be streamed and displayed. You can click repeatedly to issue more triggers.
11. Select **Trigger Control** ⇒**Wait Mode** ⇒**Run**.
12. Image streaming will remain stopped but the illumination windows on the front of the camera (the outer ring of opaque windows) will glow red (as the acquisition cycle is running).
13. Click the **Trigger Control** ⇒**Trigger Software** button. A single acquisition cycle will be triggered and a single set of images will be streamed and displayed. You can click repeatedly to issue more triggers.
14. Select **Trigger Control** ⇒**Trigger Mode** ⇒**Off**.

15. Images will start to be streamed continuously (as triggering is now disabled).

Note

The camera can only accept triggers at equal to or less than the acquisition cycle rate. See section 7.1 Camera Acquisition Cycle for details. Some triggers will be ignored if received faster than this rate.

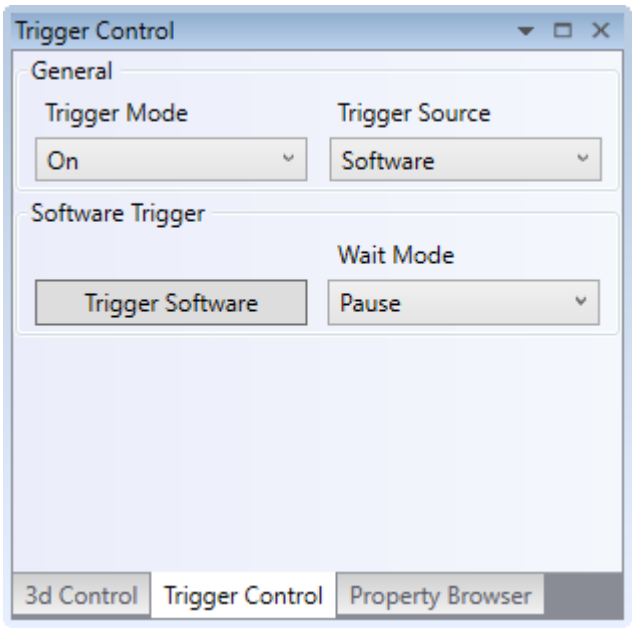

Figure 7.3: Example Software Trigger Control.

8 GenICam™ Interface

This chapter contains a complete reference of all available features which are required to configure and control the StarForm™ Swift-G camera. The features are grouped into a hierarchical tree of categories with the **Root** category as the root of the tree.

The feature categories are listed first, in alphabetical order, along with a table showing their child features.

The non-category features follow, again listed in alphabetical order. Each GenICam™ feature is itemised as shown in the example below.

Name	name of feature [selector]
Category	category of feature
Interface	data type of feature
Access	read/write access
Unit	physical units
Visibility	visibility level
Values	possible values

8.1 Categories

8.1.1 AcquisitionControl

Category for the acquisition and trigger control features.

Name	Descripton
AcquisitionMode	Sets the acquisition mode of the device.
AcquisitionStart	Starts the Acquisition function of the device.
AcquisitionStop	Stops the Acquisition function of the device at the end of the current Frame.
IlluminationEnable	Controls if the illumination is enabled.
IlluminationPower	Sets the emission and exposure counts.
TriggerActivation	Specifies the activation mode of the trigger.
TriggerMode	Controls if the selected trigger is active.
TriggerSelector	Selects the type of trigger to configure.
TriggerSoftware	Generates an internal trigger.
TriggerSource	Specifies the internal signal or physical input Line to use as the trigger source.
TriggerWaitMode	Specifies camera action when waiting for a trigger.

8.1.2 CalibrationControl

Category that contains camera calibration related features.

Name	Descripton
CalibrationCameraSerial	Serial number of camera for calibration data.
CalibrationDate	Date for camera calibration data.
CalibrationIdentifier	Identifier for calibration data.
CalibrationStatus	Indicate state of camera calibration.
SensorTemperatureRegulationEffort	Indicates the proportion of the available cooling / heating capability currently being applied to provide stabilization of the sensor temperature.
SensorTemperatureRegulationStatus	Indicates state of sensor temperature regulation.
SensorTemperatureRegulationTarget	Center of operating temperature range used to select regulation and calibration profile.

8.1.3 ChunkDataControl

Category that contains the Chunk Data control features.

Name	Descripton
ChunkComponentSelector	Selects the Component from which to retrieve data from.
ChunkDeviceStatus	Device status information in chunk.
ChunkDeviceStatusSelector	Selector for device status information in chunk.
ChunkModeActive	Activates the inclusion of Chunk data in the payload of the image.

8.1.4 DeviceControl

Category for device information and control.

Name	Descripton
DeviceFirmwareIdentifier	Identifier for device firmware.
DeviceFirmwareVersion	Version of the firmware in the device.
DeviceLicenses	Category that contains features to document the open source licenses in use.
DeviceManufacturerInfo	Manufacturer information about the device.
DeviceModelName	Model of the device.
DeviceSFNCVersionMajor	Major version of the Standard Features Naming Convention that was used to create the device's GenICam XML.
DeviceSFNCVersionMinor	Minor version of the Standard Features Naming Convention that was used to create the device's GenICam XML.
DeviceSFNCVersionSubMinor	Sub minor version of Standard Features Naming Convention that was used to create the device's GenICam XML.
DeviceSerialNumber	Serial number of the device.
DeviceStatus	Device status information.
DeviceStatusSelector	Selector for device status information.
DeviceTLType	Transport Layer type of the device.
DeviceTLVersionMajor	Major version of the Transport Layer of the device.
DeviceTLVersionMinor	Minor version of the Transport Layer of the device.
DeviceTLVersionSubMinor	Sub minor version of the Transport Layer of the device.
DeviceTemperature	Device temperature in degrees Celsius (C).
DeviceTemperatureSelector	Selects the location within the device, where the temperature will be measured.
DeviceType	Returns the device type.
DeviceUserID	User-programmable device identifier.
DeviceVendorName	Name of the manufacturer of the device.
DeviceVersion	Version of the device.

8.1.5 DeviceLicenses

Category that contains features to document the open source licenses in use.

Name	Descripton
DeviceLicenseName	Package name for license.
DeviceLicensePage	Selected page from selected license.
DeviceLicensePageSelector	Selects the page of the license to view.
DeviceLicenseSelector	Selects the license to view.

8.1.6 DigitalIOControl

Category that contains the digital input and output control features.

Name	Descripton
LineMode	Controls if the physical Line is used to Input or Output a signal.
LineSelector	Selects the physical line (or pin) of the external device connector or the virtual line of the Transport Layer to configure.
LineSource	Selects which internal acquisition or I/O source signal to output on the selected Line.
LineStatus	Returns the current status of the selected input or output Line.
LineStatusUpdate	Trigger a read of the current **LineStatus** from the camera.
UserOutputSelector	Selects which bit of the User Output register will be set by **UserOutputValue**.
UserOutputValue	Sets the value of the bit selected by **UserOutputSelector**.

8.1.7 GigEVision

Category that contains the features pertaining to the GigE Vision transport layer of the device.

Name	Descripton
GevCurrentDefaultGateway	Reports the default gateway IP address to be used on the given logical link.
GevCurrentIPAddress	Reports the IP address for the given logical link.
GevCurrentIPConfigurationPersistentIP	Controls whether the PersistentIP configuration scheme is activated on the given logical link.
GevCurrentSubnetMask	Reports the subnet mask of the given logical link.
GevMACAddress	MAC address of the logical link.
GevPersistentDefaultGateway	Controls the persistent default gateway for this logical link.
GevPersistentIPAddress	Controls the Persistent IP address for this logical link.
GevPersistentIPValidity	Checks the current settings for GevPersistentIP.
GevPersistentSubnetMask	Controls the Persistent subnet mask associated with the Persistent IP address on this logical link.
GevSCPSDoNotFragment	The state of this feature is copied into the ‘do not fragment’ bit of IP header of each stream packet.
GevSCPSPacketSize	This GigE Vision specific feature corresponds to DeviceStreamChannelPacketSize and should be kept in sync with it.

8.1.8 ImageFormatControl

Category for Image Format Control features.

Name	Descripton
ComponentEnable	Controls if streaming of the selected component is active.
ComponentSelector	Selects a component to activate/deactivate its data streaming.
Height	Height of the image provided by the device (in pixels).
PixelFormat	Format of the pixels provided by the device.
Width	Width of the image provided by the device (in pixels).

8.1.9 Root

Provides the Root of the GenICam features tree.

Name	Descripton
AcquisitionControl	Category for the acquisition and trigger control features.
CalibrationControl	Category that contains camera calibration related features.
ChunkDataControl	Category that contains the Chunk Data control features.
DeviceControl	Category for device information and control.
DigitalIOControl	Category that contains the digital input and output control features.
ImageFormatControl	Category for Image Format Control features.
Scan3dControl	Category for control of 3D camera specific features.
TLParamsLocked	Used by the Transport Layer to prevent critical features from changing during acquisition.
TransportLayerControl	Category that contains the transport Layer control features.

8.1.10 Scan3dControl

Category for control of 3D camera specific features.

Name	Descripton
Scan3dCalibrationXaUrl	File URL for XA calibration data.
Scan3dCalibrationYaUrl	File URL for YA calibration data.
Scan3dCalibrationZaUrl	File URL for ZA calibration data.
Scan3dCoordinateOffset	Range conversion offset.
Scan3dCoordinateScale	Range conversion scale.
Scan3dFilterControl	Category that contains the 3D filter features.
Scan3dRangeSpan	Selects time-of-flight pulse settings for different spans of interest.
Scan3dSignalThresholdLower	Lower signal threshold setting.

8.1.11 Scan3dFilterControl

Category that contains the 3D filter features.

Name	Descripton
Scan3dFilterLength	Length of filter to apply (number of frames) for **Scan3dFilterMode** other than None.
Scan3dFilterMode	Select type of filter to apply to the range component.

8.1.12 TransportLayerControl

Category that contains the transport Layer control features.

Name	Descripton
GigEVision	Category that contains the features pertaining to the GigE Vision transport layer of the device.
PayloadSize	Provides the number of bytes transferred for each image or chunk on the stream channel.

8.2 Features

8.2.1 AcquisitionMode

Name	AcquisitionMode
Category	**AcquisitionControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Beginner
Values	Continuous

Sets the acquisition mode of the device. It defines mainly the number of frames to capture during an acquisition and the way the acquisition stops.

- **Continuous**. Frames are captured continuously until stopped with the **AcquisitionStop** command.

8.2.2 AcquisitionStart

Name	AcquisitionStart
Category	**AcquisitionControl**
Interface	Command
Access	Write
Unit	-
Visibility	Beginner
Values	-

Starts the Acquisition function of the device. The number of frames captured is specified by **AcquisitionMode**.

8.2.3 AcquisitionStop

Name	AcquisitionStop
Category	**AcquisitionControl**
Interface	Command
Access	Write
Unit	-
Visibility	Beginner
Values	-

Stops the Acquisition function of the device at the end of the current Frame. It is mainly used when **AcquisitionMode** is Continuous but can be used in any acquisition mode.

8.2.4 CalibrationCameraSerial

Name	CalibrationCameraSerial
Category	**CalibrationControl**
Interface	IString
Access	Read
Unit	-
Visibility	Expert
Values	-

Serial number of camera for calibration data. Used to identify calibration in camera.

8.2.5 CalibrationDate

Name	CalibrationDate
Category	**CalibrationControl**
Interface	IString
Access	Read
Unit	-
Visibility	Expert
Values	-

Date for camera calibration data. Used to identify calibration in camera.

8.2.6 CalibrationIdentifier

Name	CalibrationIdentifier
Category	**CalibrationControl**
Interface	IString
Access	Read
Unit	-
Visibility	Expert
Values	-

Identifier for calibration data. Used to identify calibration in camera.

8.2.7 CalibrationStatus

Name	CalibrationStatus
Category	**CalibrationControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Beginner
Values	OK, InvalidCalibration

Indicate state of camera calibration.

- **OK**. Calibration status is good.
- **InvalidCalibration**. The camera calibration is invalid.

8.2.8 ChunkComponentSelector

Name	ChunkComponentSelector
Category	**ChunkDataControl**
Interface	IEnumeration
Access	Read
Unit	-
Visibility	Expert
Values	Intensity, Range, PointCloudMultiplierX, PointCloudMultiplierY, PointCloudMultiplierZ

Selects the Component from which to retrieve data from. See also **ComponentSelector**.

- **Intensity**. The image data is the intensity component (active IR).
- **Range**. The image data is the range component (distance or depth).
- **PointCloudMultiplierX**. The image data is the point cloud multiplier X component.
- **PointCloudMultiplierY**. The image data is the point cloud multiplier Y component.

- **PointCloudMultiplierZ**. The image data is the point cloud multiplier Z component.

8.2.9 ChunkDeviceStatus

Name	ChunkDeviceStatus
Category	**ChunkDataControl**
Interface	IEnumeration
Access	Read
Unit	-
Visibility	Beginner
Values	InRange, OutOfRange, Error

Device status information in chunk. See **DeviceStatus** for description.

- **InRange**. Selected attribute is in stable range.
- **OutOfRange**. Selected attribute is not in the stable/calibrated range.
- **Error**. Serious error in camera status or configuration - contact Odos Imaging for support.

8.2.10 ChunkDeviceStatusSelector

Name	ChunkDeviceStatusSelector
Category	**ChunkDataControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Beginner
Values	All, TemperatureRegulation, TimingStabilization, IlluminationTemperature, CalibrationValidity

Selector for device status information in chunk.

- **All**. Summary of all **ChunkDeviceStatus** entries.
- **TemperatureRegulation**. Indicate state of sensor temperature regulation.
- **TimingStabilization**. Indicate state of timing stabilization.

- **IlluminationTemperature**. Indicate state of illumination temperature.
- **CalibrationValidity**. Indicate validity of calibration.

8.2.11 ChunkModeActive

Name	ChunkModeActive
Category	**ChunkDataControl**
Interface	IBoolean
Access	Read/Write
Unit	-
Visibility	Expert
Values	-

Activates the inclusion of Chunk data in the payload of the image. Some camera interface software may need this setting disabled if they cannot handle Chunk data. The Odos SDK requires this setting to be enabled.

8.2.12 ComponentEnable

Name	ComponentEnable
Category	**ImageFormatControl**
Interface	IBoolean
Access	
Unit	-
Visibility	Beginner
Values	-

Controls if streaming of the selected component in **ComponentSelector** is active.

8.2.13 ComponentSelector

Name	ComponentSelector
Category	**ImageFormatControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Beginner
Values	Intensity, Range, PointCloudMultiplierX, PointCloudMultiplierY, PointCloudMultiplierZ

Selects a component to activate/deactivate its data streaming.

- **Intensity**. The acquisition of intensity (monochrome) of the visible reflected light is controlled.
- **Range**. The acquisition of range (distance) data is controlled. The data produced is range (2.5D) which can be converted to an XYZ point cloud using the PointCloudMultiplierX/Y/Z.
- **PointCloudMultiplierX**. The image used to multiply a raw Range image to convert to a point cloud X coordinate. Enabling this will disable all other components and enabling a different component will disable this.
- **PointCloudMultiplierY**. The image used to multiply a raw Range image to convert to a point cloud Y coordinate. Enabling this will disable all other components and enabling a different component will disable this.
- **PointCloudMultiplierZ**. The image used to multiply a raw Range image to convert to a point cloud Z coordinate. Enabling this will disable all other components and enabling a different component will disable this.

8.2.14 DeviceFirmwareIdentifier

Name	DeviceFirmwareIdentifier
Category	**DeviceControl**
Interface	IString
Access	Read
Unit	-
Visibility	Expert
Values	-

Identifier for device firmware.

8.2.15 DeviceFirmwareVersion

Name	DeviceFirmwareVersion
Category	**DeviceControl**
Interface	IString
Access	Read
Unit	-
Visibility	Beginner
Values	-

Version of the firmware in the device.

8.2.16 DeviceLicenseName

Name	DeviceLicenseName
Category	**DeviceLicenses**
Interface	IString
Access	Read
Unit	-
Visibility	Guru
Values	-

Package name for license.

8.2.17 DeviceLicensePage

Name	DeviceLicensePage
Category	**DeviceLicenses**
Interface	IString
Access	Read
Unit	-
Visibility	Guru
Values	-

Selected page from selected license.

8.2.18 DeviceLicensePageSelector

Name	DeviceLicensePageSelector
Category	**DeviceLicenses**
Interface	IInteger
Access	Read/Write
Unit	-
Visibility	Guru
Values	≥ 0

Selects the page of license to view.

8.2.19 DeviceLicenseSelector

Name	DeviceLicenseSelector
Category	**DeviceLicenses**
Interface	IInteger
Access	Read/Write
Unit	-
Visibility	Guru
Values	≥ 0

Selects the license to view.

8.2.20 DeviceManufacturerInfo

Name	DeviceManufacturerInfo
Category	**DeviceControl**
Interface	IString
Access	Read
Unit	-
Visibility	Beginner
Values	-

Manufacturer information about the device.

8.2.21 DeviceModelName

Name	DeviceModelName
Category	**DeviceControl**
Interface	IString
Access	Read
Unit	-
Visibility	Beginner
Values	-

Model of the device.

8.2.22 DeviceSFNCVersionMajor

Name	DeviceSFNCVersionMajor
Category	**DeviceControl**
Interface	IInteger
Access	Read
Unit	-
Visibility	Beginner
Values	-

Major version of the Standard Features Naming Convention that was used to create the device's GenICam XML.

8.2.23 DeviceSFNCVersionMinor

Name	DeviceSFNCVersionMinor
Category	**DeviceControl**
Interface	IInteger
Access	Read
Unit	-
Visibility	Beginner
Values	-

Minor version of the Standard Features Naming Convention that was used to create the device's GenICam XML.

8.2.24 DeviceSFNCVersionSubMinor

Name	DeviceSFNCVersionSubMinor
Category	**DeviceControl**
Interface	IInteger
Access	Read
Unit	-
Visibility	Beginner
Values	-

Sub minor version of Standard Features Naming Convention that was used to create the device's GenICam XML.

8.2.25 DeviceSerialNumber

Name	DeviceSerialNumber
Category	**DeviceControl**
Interface	IString
Access	Read
Unit	-
Visibility	Expert
Values	-

Serial number of the device. This string is a unique identifier of the device.

8.2.26 DeviceStatus

Name	DeviceStatus
Category	**DeviceControl**
Interface	IEnumeration
Access	Read
Unit	-
Visibility	Beginner
Values	InRange, OutOfRange, Error

Device status information. When any status is OutOfRange the data provided by the camera may be invalid or outside specification.

- **InRange**. Selected attribute is in stable range.

- **OutOfRange**. Selected attribute is not in the stable/calibrated range. The data provided by the camera may be invalid or outside specification.
- **Error**. Serious error in camera status or configuration - contact Odos Imaging for support.

8.2.27 DeviceStatusSelector

Name	DeviceStatusSelector
Category	**DeviceControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Beginner
Values	All, TemperatureRegulation, TimingStabilization, IlluminationTemperature, CalibrationValidity

Selector for device status information.

- **All**. Summary of all **DeviceStatus** entries.
- **TemperatureRegulation**. Indicate state of sensor temperature regulation.
- **TimingStabilization**. Indicate state of timing stabilization.
- **IlluminationTemperature**. Indicate state of illumination temperature.
- **CalibrationValidity**. Indicate validity of calibration.

8.2.28 DeviceTLType

Name	DeviceTLType
Category	**DeviceControl**
Interface	IEnumeration
Access	Read
Unit	-
Visibility	Beginner
Values	GigEVision

Transport Layer type of the device.

- **GigEVision**. GigE Vision.

8.2.29 DeviceTLVersionMajor

Name	DeviceTLVersionMajor
Category	**DeviceControl**
Interface	StructEntry
Access	Read
Unit	-
Visibility	Beginner
Values	-

Major version of the Transport Layer of the device.

8.2.30 DeviceTLVersionMinor

Name	DeviceTLVersionMinor
Category	**DeviceControl**
Interface	StructEntry
Access	Read
Unit	-
Visibility	Beginner
Values	-

Minor version of the Transport Layer of the device.

8.2.31 DeviceTLVersionSubMinor

Name	DeviceTLVersionSubMinor
Category	**DeviceControl**
Interface	IInteger
Access	Read
Unit	-
Visibility	Beginner
Values	-

Sub minor version of the Transport Layer of the device.

8.2.32 DeviceTemperature

Name	DeviceTemperature
Category	**DeviceControl**
Interface	IFloat
Access	Read
Unit	C
Visibility	Expert
Values	-

Device temperature in degrees Celsius (C). It is measured at the location selected by **DeviceTemperatureSelector**.

8.2.33 DeviceTemperatureSelector

Name	DeviceTemperatureSelector
Category	**DeviceControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Expert
Values	Sensor, Mainboard, Illumination, IlluminationBoard

Selects the location within the device, where the temperature will be measured.

- **Sensor**. Temperature of the image sensor of the camera.
- **Mainboard**. Temperature of the device's mainboard.
- **Illumination**. Temperature of the image illumination of the camera.
- **IlluminationBoard**. Temperature of the device's illumination board.

8.2.34 DeviceType

Name	DeviceType
Category	**DeviceControl**
Interface	IEnumeration
Access	Read
Unit	-
Visibility	Guru
Values	Transmitter

Returns the device type.

- **Transmitter**. Data stream transmitter device.

8.2.35 DeviceUserID

Name	DeviceUserID
Category	**DeviceControl**
Interface	IString
Access	Read/Write
Unit	-
Visibility	Beginner
Values	-

User-programmable device identifier. This is stored persistently and can be used to easily identify and connect to a specific camera.

8.2.36 DeviceVendorName

Name	DeviceVendorName
Category	**DeviceControl**
Interface	IString
Access	Read
Unit	-
Visibility	Beginner
Values	-

Name of the manufacturer of the device.

8.2.37 DeviceVersion

Name	DeviceVersion
Category	**DeviceControl**
Interface	IString
Access	Read
Unit	-
Visibility	Beginner
Values	-

Version of the device.

8.2.38 GevCurrentDefaultGateway

Name	GevCurrentDefaultGateway
Category	**GigEVision**
Interface	IInteger
Access	Read
Unit	-
Visibility	Beginner
Values	-

Reports the default gateway IP address to be used on the given logical link.

8.2.39 GevCurrentIPAddress

Name	GevCurrentIPAddress
Category	**GigEVision**
Interface	IInteger
Access	Read
Unit	-
Visibility	Beginner
Values	-

Reports the IP address for the given logical link.

8.2.40 GevCurrentIPConfigurationPersistentIP

Name	GevCurrentIPConfigurationPersistentIP
Category	**GigEVision**
Interface	IBoolean
Access	
Unit	-
Visibility	Beginner
Values	-

Controls whether the PersistentIP configuration scheme is activated on the given logical link.

8.2.41 GevCurrentSubnetMask

Name	GevCurrentSubnetMask
Category	**GigEVision**
Interface	IInteger
Access	Read
Unit	-
Visibility	Beginner
Values	-

Reports the subnet mask of the given logical link.

8.2.42 GevMACAddress

Name	GevMACAddress
Category	**GigEVision**
Interface	IInteger
Access	Read
Unit	-
Visibility	Beginner
Values	-

MAC address of the logical link.

8.2.43 GevPersistentDefaultGateway

Name	GevPersistentDefaultGateway
Category	**GigEVision**
Interface	IInteger
Access	Read/Write
Unit	-
Visibility	Beginner
Values	-

Controls the persistent default gateway for this logical link. It is only used when the device boots with the Persistent IP configuration scheme.

8.2.44 GevPersistentIPAddress

Name	GevPersistentIPAddress
Category	**GigEVision**
Interface	IInteger
Access	Read/Write
Unit	-
Visibility	Beginner
Values	-

Controls the Persistent IP address for this logical link. It is only used when the device boots with the Persistent IP configuration scheme.

8.2.45 GevPersistentIPValidity

Name	GevPersistentIPValidity
Category	**GigEVision**
Interface	IEnumeration
Access	Read
Unit	-
Visibility	Beginner
Values	Valid, DefaultGatewayNotInSubnet, IPAddressIsBroadcast, DefaultGatewayIsBroadcast, IPAddressIsZero, SubnetMaskIsZero

Provides guidance on the validity of the current settings for GevPersistentIP.

- **Valid**. GevPersistentIP settings are valid.
- **DefaultGatewayNotInSubnet**. Invalid - **GevPersistentDefaultGateway** is not in subnet. Set to address in subnet or all zero.
- **IPAddressIsBroadcast**. Invalid - **GevPersistentIPAddress** is the broadcast address for the subnet.
- **DefaultGatewayIsBroadcast**. Invalid - **GevPersistentDefaultGateway** is the broadcast address for the subnet. Set to address in subnet or all zero.
- **IPAddressIsZero**. Invalid - **GevPersistentIPAddress** is all zero.
- **SubnetMaskIsZero**. Invalid - **GevPersistentSubnetMask** is all zero.

8.2.46 GevPersistentSubnetMask

Name	GevPersistentSubnetMask
Category	**GigEVision**
Interface	IInteger
Access	Read/Write
Unit	-
Visibility	Beginner
Values	-

Controls the Persistent subnet mask associated with the Persistent IP address on this logical link. It is only used when the device boots with the Persistent IP configuration scheme.

8.2.47 GevSCPSDoNotFragment

Name	GevSCPSDoNotFragment
Category	**GigEVision**
Interface	IBoolean
Access	Read/Write
Unit	-
Visibility	Guru
Values	-

The state of this feature is copied into the 'do not fragment' bit of IP header of each stream packet. It can be used by the application to prevent IP fragmentation of packets on the stream channel.

8.2.48 GevSCPSPacketSize

Name	GevSCPSPacketSize
Category	**GigEVision**
Interface	IInteger
Access	Read/Write
Unit	B
Visibility	Expert
Values	≥ 256, ≤ 1500

This GigE Vision specific feature corresponds to DeviceStreamChannelPacketSize and should be kept in sync with it. It specifies the stream packet size, in bytes, to send on the selected channel for a GVSP transmitter or specifies the maximum packet size supported by a GVSP receiver.

8.2.49 Height

Name	Height
Category	**ImageFormatControl**
Interface	IInteger
Access	Read
Unit	-
Visibility	Beginner
Values	-

Height of the image provided by the device (in pixels).

8.2.50 IlluminationEnable

Name	IlluminationEnable
Category	**AcquisitionControl**
Interface	IBoolean
Access	Read/Write
Unit	-
Visibility	Guru
Values	-

Controls if the illumination is enabled.

8.2.51 IlluminationPower

Name	IlluminationPower
Category	**AcquisitionControl**
Interface	IInteger
Access	Read/Write
Unit	-
Visibility	Beginner
Values	≥ 256

Sets the emission and exposure counts. When changed this will cause the **DeviceStatus** for TimingStabilization to go OutOfRange briefly the user should wait until back InRange before acquiring images.

8.2.52 LineMode

Name	LineMode
Category	**DigitalIOControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Expert
Values	Input, Output

Controls if the physical Line is used to Input or Output a signal.

- **Input**. The selected physical line is used to Input an electrical signal.
- **Output**. The selected physical line is used to Output an electrical signal.

8.2.53 LineSelector

Name	LineSelector
Category	**DigitalIOControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Expert
Values	Line0, Line1

Selects the physical line (or pin) of the external device connector or the virtual line of the Transport Layer to configure.

- **Line0**. Index of the physical line and associated I/O control block to use.
- **Line1**. Index of the physical line and associated I/O control block to use.

8.2.54 LineSource

Name	LineSource
Category	**DigitalIOControl**
Interface	IEnumeration
Access	Read
Unit	-
Visibility	Expert
Values	Off, UserOutput0, FrameOutputToggle

Selects which internal acquisition or I/O source signal to output on the selected Line. **LineMode** must be Output.

- **Off**. Line output is disabled.
- **UserOutput0**. The chosen User Output Bit state as defined by its current **UserOutputValue**.

- **FrameOutputToggle**. Output is toggled on reception of a frame.

8.2.55 LineStatus

Name	LineStatus
Category	**DigitalIOControl**
Interface	IBoolean
Access	Read
Unit	-
Visibility	Expert
Values	-

Returns the current status of the selected input or output Line.

8.2.56 LineStatusUpdate

Name	LineStatusUpdate
Category	**DigitalIOControl**
Interface	Command
Access	Read/Write
Unit	-
Visibility	Expert
Values	-

Trigger a read of the current **LineStatus** from the camera.

8.2.57 PayloadSize

Name	PayloadSize
Category	**TransportLayerControl**
Interface	IInteger
Access	Read
Unit	B
Visibility	Expert
Values	-

Provides the number of bytes transferred for each image or chunk on the stream channel. This includes any end-of-line, end-of-frame

statistics or other stamp data. This is the total size of data payload for a data block.

8.2.58 PixelFormat

Name	PixelFormat
Category	**ImageFormatControl**
Interface	IEnumeration
Access	
Unit	-
Visibility	Beginner
Values	Mono16, Coord3D_ABC32f, Coord3D_A32f

Format of the pixels provided by the device. It represents all the information provided by PixelSize, PixelColorFilter combined in a single feature.

- **Mono16**. Monochrome 16-bit.
- **Coord3D_ABC32f**. 3D coordinate A-B-C 32-bit floating point.
- **Coord3D_A32f**. 3D coordinate A 32-bit floating point.

8.2.59 Scan3dCalibrationXaUrl

Name	Scan3dCalibrationXaUrl
Category	**Scan3dControl**
Interface	IString
Access	Read
Unit	-
Visibility	Expert
Values	-

File descriptor for XA calibration data.

8.2.60 Scan3dCalibrationYaUrl

Name	Scan3dCalibrationYaUrl
Category	**Scan3dControl**
Interface	IString
Access	Read
Unit	-
Visibility	Expert
Values	-

File descriptor for YA calibration data.

8.2.61 Scan3dCalibrationZaUrl

Name	Scan3dCalibrationZaUrl
Category	**Scan3dControl**
Interface	IString
Access	Read
Unit	-
Visibility	Expert
Values	-

File descriptor for ZA calibration data.

8.2.62 Scan3dCoordinateOffset

Name	Scan3dCoordinateOffset
Category	**Scan3dControl**
Interface	IFloat
Access	Read
Unit	-
Visibility	Expert
Values	-

Offset to apply when converting raw range to meters.

8.2.63 Scan3dCoordinateScale

Name	Scan3dCoordinateScale
Category	**Scan3dControl**
Interface	IFloat
Access	Read
Unit	-
Visibility	Expert
Values	-

Scale to apply when converting raw range to meters.

8.2.64 Scan3dFilterLength

Name	Scan3dFilterLength
Category	**Scan3dFilterControl**
Interface	IntConverter
Access	
Unit	-
Visibility	Beginner
Values	-

Length of filter to apply (number of frames) for **Scan3dFilterMode** other than None. Greater lengths result in a greater influence of the filter on the range data.

8.2.65 Scan3dFilterMode

Name	Scan3dFilterMode
Category	**Scan3dFilterControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Beginner
Values	None, Block, ContinuousAdaptive

Select type of filter to apply to the range component.

- **None**. No filtering is applied.

- **Block**. Simple block-wise filter resulting in one frame of output for every **Scan3dFilterLength** frames acquired, with a corresponding decrease in output frame rate.
- **ContinuousAdaptive**. [Pre-release Preview] Adaptive filter offering the following benefits as compared to “Block’: full frame-rate, reduced motion artifacts, fewer missing (0/65535) pixels.

  This is a pre-release preview of this feature. Behaviour may change in future revisions of the firmware as we continue to make improvements.

8.2.66 Scan3dRangeSpan

Name	Scan3dRangeSpan
Category	**Scan3dControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Beginner
Values	Small, Standard, Large

Selects time-of-flight pulse settings for different spans of interest.

- **Small**. Small span.
- **Standard**. Standard span.
- **Large**. Large span.

8.2.67 Scan3dSignalThresholdLower

Name	Scan3dSignalThresholdLower
Category	**Scan3dControl**
Interface	IInteger
Access	Read/Write
Unit	-
Visibility	Beginner
Values	-

Lower signal threshold setting.

8.2.68 SensorTemperatureRegulationEffort

Name	SensorTemperatureRegulationEffort
Category	**CalibrationControl**
Interface	IInteger
Access	
Unit	%
Visibility	Beginner
Values	$\geq$ -100, $\leq$ 100

Indicates the proportion of the available cooling / heating capability currently being applied to provide stabilization of the sensor temperature. Positive values indicate cooling, negative values indicate heating.

If the system can not bring the sensor temperature into the selected range, this value can be checked to identify whether the system is too hot (maximum cooling effort will be reached) or too cool (maximum heating effort will be reached) for the chosen **SensorTemperatureRegulationTarget**.

8.2.69 SensorTemperatureRegulationStatus

Name	SensorTemperatureRegulationStatus
Category	**CalibrationControl**
Interface	IEnumeration
Access	
Unit	-
Visibility	Beginner
Values	InRange, OutOfRange

Indicates state of sensor temperature regulation.

- **InRange**. Regulation is in stable range.
- **OutOfRange**. Regulation is not in the stable range. This can arise due to a change in **SensorTemperatureRegulationTarget**, or a change in environmental conditions, as well as on power-up.

  Usually the status will change to InRange after a period of time. if it does not, it may be that the selected **SensorTemperatureRegulationTarget** is not suitable for the ambi-

ent temperature, and a different **SensorTemperatureRegulation-Target** should be selected. If the system can not achieve temperature regulation at any **SensorTemperatureRegulation-Target** contact support.

8.2.70 SensorTemperatureRegulationTarget

Name	SensorTemperatureRegulationTarget
Category	**CalibrationControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Beginner
Values	Temp_10C, Temp_25C, Temp_40C, Temp_55C

Center of operating temperature range used to select regulation and calibration profile. Note that these temperatures relate to the temperature of the system housing, after a warm-up period.

The relationship between system housing temperature and ambient temperature depends on several factors, such as airflow, any thermal connection between the system and mounting hardware, and illumination setting and duty cycle. In a typical situation, the housing temperature will stabilise at around 20 to 25 degrees above ambient.

- **Temp_10C**. Temperature range centered on 10C.
- **Temp_25C**. Temperature range centered on 25C.
- **Temp_40C**. Temperature range centered on 40C.
- **Temp_55C**. Temperature range centered on 55C.

8.2.71 TLParamsLocked

Name	TLParamsLocked
Category	**Root**
Interface	IInteger
Access	Read/Write
Unit	-
Visibility	Invisible
Values	-

Used by the Transport Layer to prevent critical features from changing during acquisition.

8.2.72 TriggerActivation

Name	TriggerActivation
Category	**AcquisitionControl**
Interface	IEnumeration
Access	
Unit	-
Visibility	Beginner
Values	RisingEdge, FallingEdge, AnyEdge

Specifies the activation mode of the trigger.

- **RisingEdge**. Specifies that the trigger is considered valid on the rising edge of the source signal.
- **FallingEdge**. Specifies that the trigger is considered valid on the falling edge of the source signal.
- **AnyEdge**. Specifies that the trigger is considered valid on the falling or rising edge of the source signal.

8.2.73 TriggerMode

Name	TriggerMode
Category	**AcquisitionControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Beginner
Values	Off, On

Controls if the selected trigger is active.

- **Off**. Disables the selected trigger.
- **On**. Enable the selected trigger.

8.2.74 TriggerSelector

Name	TriggerSelector
Category	**AcquisitionControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Beginner
Values	FrameBurstStart

Selects the type of trigger to configure.

- **FrameBurstStart**. Selects a trigger starting the capture of the bursts of frames in an acquisition.

8.2.75 TriggerSoftware

Name	TriggerSoftware
Category	**AcquisitionControl**
Interface	Command
Access	Write
Unit	-
Visibility	Beginner
Values	-

Generates an internal trigger. **TriggerSource** must be set to Software.

8.2.76 TriggerSource

Name	TriggerSource
Category	**AcquisitionControl**
Interface	IEnumeration
Access	
Unit	-
Visibility	Beginner
Values	Software, Line0

Specifies the internal signal or physical input Line to use as the trigger source. The selected trigger must have its **TriggerMode**

set to On.

- **Software**. Specifies that the trigger source will be generated by software using the **TriggerSoftware** command.
- **Line0**. Specifies which physical line (or pin) and associated I/O control block to use as external source for the trigger signal.

8.2.77 TriggerWaitMode

Name	TriggerWaitMode
Category	**AcquisitionControl**
Interface	IEnumeration
Access	
Unit	-
Visibility	Beginner
Values	Pause, Run

Specifies camera action when waiting for a trigger.

- **Pause**. Specifies that the acquisition cycle is paused waiting for a trigger (no-illumination). In order to allow the camera to run internal calibration routines and maintain accuracy the trigger should be supplied periodically.
- **Run**. Specifies that the acquisition cycle keeps running and the next burst of frames completed after a trigger is returned.

8.2.78 UserOutputSelector

Name	UserOutputSelector
Category	**DigitalIOControl**
Interface	IEnumeration
Access	Read/Write
Unit	-
Visibility	Expert
Values	UserOutput0

Selects which bit of the User Output register will be set by **UserOutputValue**.

- **UserOutput0**. Selects the bit 0 of the User Output register.

8.2.79 UserOutputValue

Name	UserOutputValue
Category	**DigitalIOControl**
Interface	IBoolean
Access	Read/Write
Unit	-
Visibility	Expert
Values	-

Sets the value of the bit selected by **UserOutputSelector**.

8.2.80 Width

Name	Width
Category	**ImageFormatControl**
Interface	IInteger
Access	Read
Unit	-
Visibility	Beginner
Values	-

Width of the image provided by the device (in pixels).

9 Document History

Date	Version	Changelog
16.05.2018	2.0.2	Updated to 2.0.2 firmware release
27.05.2019	2.0.3	Updated to 2.0.3 firmware release

Manual Build: e736e1185062c8f2e5a31af98435a9ec3d76d8f8