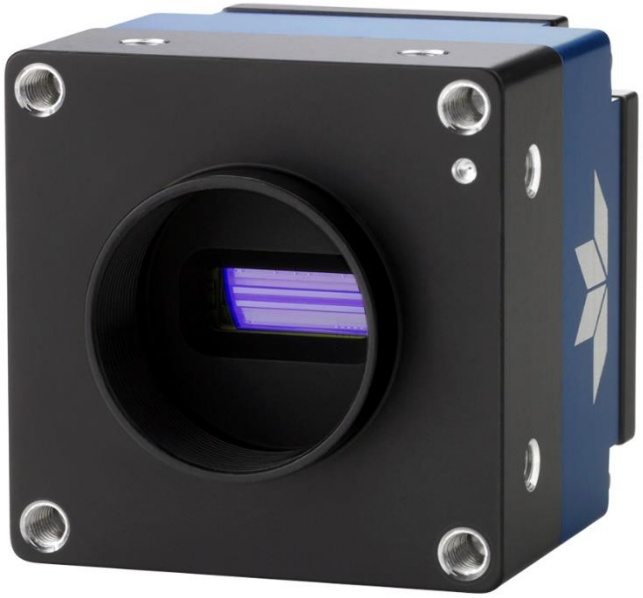
Linea SWIR GigE

Camera User's Manual

InGaAs Line Scan Camera

sensors | **cameras** | frame grabbers | processors | software | vision solutions



Models

SL-GA-01K04A-00-R
SL-GA-05H04A-00-R

P/N: 03-032-20280-03
www.teledynedalsa.com

TELEDYNE DALSA
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Notice

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About Teledyne DALSA

Teledyne DALSA, a business unit of Teledyne Digital Imaging Inc., is an international high performance semiconductor and Electronics Company that designs, develops, manufactures, and markets digital imaging products and solutions, in addition to providing wafer foundry services.

Teledyne DALSA offers the widest range of machine vision components in the world. From industry-leading image sensors through powerful and sophisticated cameras, frame grabbers, vision processors and software easy-to-use vision appliances and custom vision modules.

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Linea SWIR GigE Series Overview

Description

Teledyne DALSA's SWIR GigE line scan camera features a cutting-edge InGaAs sensor in a compact package for a wide variety of machine vision applications.

This high speed, high resolution camera is the first product in DALSA's SWIR family. The uncooled sensor delivers exceptional responsivity. The small pixels allow for a 512/1024 resolution sensor, which is capable of operating at 40 kHz. With high speed, high sensitivity, cycling mode and programmable I/Os, the versatile Linea SWIR is ideal for optical sorting, solar wafer inspection and general-purpose machine vision.

The camera is one of a new series of affordable digital cameras specifically engineered for industrial imaging applications requiring embedded image processing and improved network integration. The camera provides features to cycle a user defined sequence of imaging setups along with features providing line & frame triggers, image transfer-on-demand, all forming a part of a comprehensive camera package.

Linea SWIR GigE combines standard gigabit Ethernet technology (supporting GigE Vision 1.2) with Teledyne DALSA Trigger-to-Image-Reliability; It dependably captures and transfers images from the camera to the host PC.

Note: screen images were made using the 1k model but instructions also apply to the 512 model.

Figure 1: Camera Back View

Linea SWIR GigE Application Advantages

- Compact form factor.
- Optimized, rugged design.
- GigE Vision 1.2 compliant.
- Gigabit Ethernet (GigE) connection to a computer via standard CAT5e or CAT6 cables.
- Supports connection to the host computer NIC through a GigE network switch.
- 8-bit or 12-bit output.
- High line rates.
- Configurable full well.
- 2 general-purpose inputs with programmable threshold.
- 2 general-purpose outputs.
- Visual status LED on camera back plate.
- Supported by Sapera™ LT software libraries.
- Camera power via a 10-pin GPIO connector or Power over Ethernet (PoE).
- Digital binning for increased sensitivity.
- 4 User Settings sets for camera configuration storage.

Linea SWIR GigE Firmware

Teledyne DALSA's Linea SWIR GigE camera firmware contains open source software. Information about these open source licenses and documentation are available at www.teledynedalsa.com.

Firmware updates for Linea SWIR GigE are available for download from Teledyne DALSA's web site [http://www.teledynedalsa.com/imaging/support/downloads/firmware/]. Choose Linea SWIR GigE Firmware from the available download section and update the camera using CamExpert (see File Access via the CamExpert Tool (Quick Camera Firmware Upgrade)). Camera firmware is upgradable or downgradable.

Part Numbers and Software Requirements

This manual covers the Linea SWIR GigE models summarized below. This manual is updated with the release of new models. See Sensor Specifications for details of each Linea SWIR GigE model.

Camera	Resolution	Pixel size	Max. Line Rate	Lens Mount (treaded)	Product Number
Linea SWIR GigE 1K	1024 x 1	12.5 x 12.5 µm	40 kHz	C-Mount	SL-GA-01K04A-00-R
Linea SWIR GigE 512	512 x 1	25 x 25 µm	40 kHz	C-Mount	SL-GA-05H04A-00-R

Teledyne DALSA Software Platform	
Sapera LT version 8.00 and later includes the Sapera Network Imaging Package and GigE Vision Imaging Driver. Sapera provides everything needed to develop imaging applications. New or alternative Linea SWIR GigE Firmware Designs.	Available for download http://www.teledynedalsa.com/imaging/support/downloads/sdks/
Sapera Processing Imaging Development Library.	Via web download

Third Party GigE Vision Software Platform Requirements	
Support of GenICam GenApi version 2.3	General acquisition, control and File access: firmware, FFC, configuration data, upload & download.
Support of GenICam XML schema version 1.1	
Support of GigE Vision 1.2	
GenICam™ support — XML camera description file	Embedded within Linea SWIR GigE.

GigE Vision Sapera Application Description

GiGE VISION®	Linea SWIR GigE cameras are 100% compliant with the GigE Vision 1.2 specification, which defines the communication interface protocol used by any GigE Vision device. The device description and capabilities are contained in an XML file. For more information see: A3 Vision & Imaging – GigE Vision Standard
GENICAM	Linea SWIR GigE cameras implement a superset of GenICam™ specification, which defines device capabilities. This description takes the form of an XML device description file respecting the syntax defined by the GenApi module of the GenICam™ specification. For more information see: emva – GenICam Standard.

Teledyne DALSA's GigE Vision Module provides a license free development platform for Teledyne DALSA GigE hardware or Sapera vision applications. Additionally supported are Sapera GigE Vision applications for third party hardware with the purchase of a GigE Vision Module license or Sapera processing SDK with a valid license.

The GigE Vision Compliant XML device description file is encoded within Linea SWIR GigE firmware. GigE Vision Compliant applications access the camera's capabilities and controls immediately after connection.

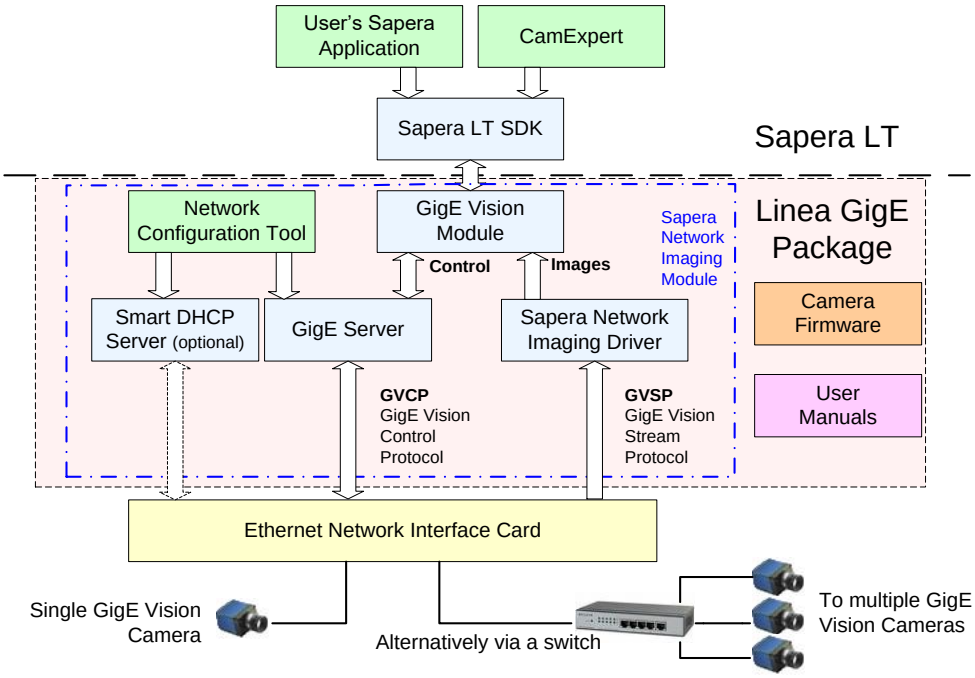


Figure 2: GigE Application Diagram

Camera Specifications

Camera Controls		
Synchronization Modes	Free running, External triggered **Note:** Encoder STOP supported but the current frame is completed with the lines based on internally generated triggers.	
Minimum Line Rate (internal)	>100 Hz (Camera produces errors at 100Hz)	
Maximum Line Rate	40 kHz	
Exposure Modes	Programmable in increments of 15 MHz clocks (66.6 ns) 21 µs — 9996 µs Maximum	
Trigger Inputs	Line Triggers (GPI0 & GPI1) and Frame Trigger (GPI1) Opto-isolated, 2.4 V to 24 V typical, 16 mA minimum Debounce range from 0 to 255 µs Trigger delay from 0 to 2,000,000 µs	
Trigger Outputs	Output opto-isolated: Line & Frame	
Item/Feature		
Flat Field Correction	1 Factory FFC plus 4 User Defined FFC.	
Binning	Digitally based: Horizontal & Vertical (2 and 4 pixels)	
AOI	Select one region of interest.	
Sensor Gain	4 user selectable gain settings	
Digital Gain	1x to 8x, resolution 0.0078	
	(1K model) SL-GA-01K04A-00-R	**(512 model) SL-GA-05H04A-00-R**
Dynamic Range	72dB @ Sensor Gain setting 1 65dB @ Sensor Gain setting 2 55dB @ Sensor Gain setting 3 51dB @ Sensor Gain setting 4	66dB @ Sensor Gain setting 1 61dB @ Sensor Gain setting 2 52dB @ Sensor Gain setting 3 48dB @ Sensor Gain setting 4
Random Noise (12-bit, rms)	1.5 DN @ Sensor Gain setting 1 2.5 DN @ Sensor Gain setting 2 7 DN @ Sensor Gain setting 3 12 DN @ Sensor Gain setting 4	2.4 DN @ Sensor Gain setting 1 3.6 DN @ Sensor Gain setting 2 10 DN @ Sensor Gain setting 3 17 DN @ Sensor Gain setting 4
FPN (corrected, 12-bit)	14 DN_{p-p}	20 DN_{p-p}
PRNU (corrected, 12-bit)	5 %	5 %
Counter and Timer	User programmable, acquisition independent with event generation	
Pixel Format	User selectable 8-bit or 12-bit	
Test Image	Internal generator with choice of static patterns	
User Settings	Select factory default or one of four user camera configurations	
Onboard Memory		
Minimum Reserved Data Buffer	6 MB	
Reserved Packet Resend Buffer	6 MB default (user defined feature)	
Total Memory	32 MB	
Back Focal Distance		
C-Mount	17.526 mm	

Mechanical Interface	
Camera Size	46 x 46 x 55 mm For complete dimensions, refer to the Camera Mechanical Specifications section.
Mass	<150 g (no lens)
Power Connector	via 10-pin I/O connector, or RJ45 in PoE mode
Ethernet Connector	RJ45
Electrical Interface	
Input Voltage	+12 to +24 Volt DC (+10 +/- 10 %) auxiliary connector Supports the Power Over Ethernet standard (PoE Class 2 as per IEEE 802.3af)
Power Dissipation	< 4 W
Output Data Configuration	Gigabit Ethernet 1000 Mbps (10/100 Mbps are not supported) 115 MB/sec maximum
Data and Control	GigE Vision 1.2 compliant
Environmental Specifications	
Storage Temperature Range	-20 °C to +70 °C
Humidity (operation and storage)	15 % to 85 % relative, non-condensing
Operating Temperature	0 °C to 50 °C range at front plate

Test Conditions

- Values measured using 12-bit, 1x Digital gain, Maximum sensor gain
- Light source: 1050 nm
- Front plate temperature: 45 °C

Sensor Performance

The sensor description below provides a specification table and response graph. The graph describes the sensor response to different wavelengths of light (excluding lens and light source characteristics).

Sensor Specifications

Item / Feature	Specification
Camera Model	SL-GA-01K04A-00-R / SL-GA-05H04A-00-R
Sensor Used	InGaAs, 1024 pixels
Spectral Band	950 to 1700 nm
Peak Wavelength	1550 nm typical
Pixel Size	12.5 x 12.5 µm (1k) / 25 x 25 µm (512k)
Sensor Gain Range	4 user selectable gain settings
Output Dynamic Range	Up to 72 dB
Full Well	10,000 ke- (@min gain), 135 ke- (@ max gain)
Random Noise	2860e- (@min gain), 400e- (@ max gain)
Dark Current	<5 pA

Spectral Responsivity

The responsivity graph illustrates the sensor's response to different wavelengths of light (excluding lens and light source characteristics).

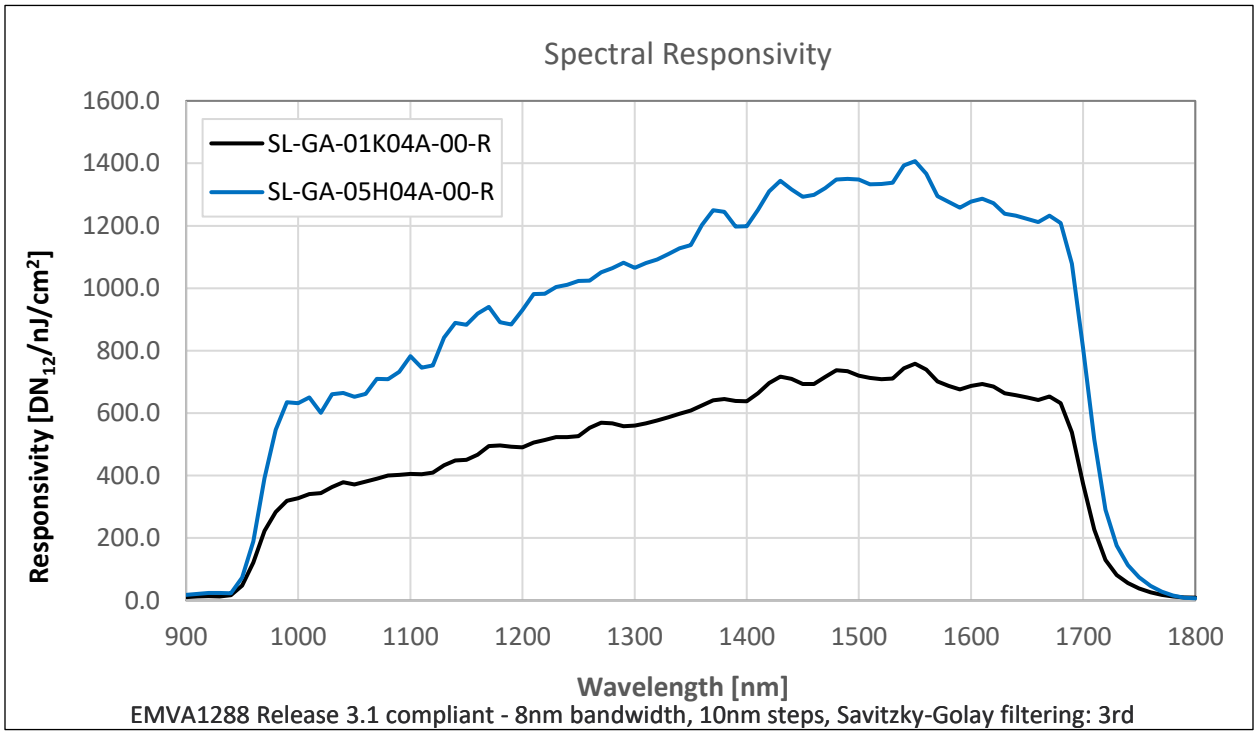


Figure 3: Spectral Responsivity

PRNU Derating Curve

The sensor profile shape changes as it approaches the maximum line rate for a given exposure time. For best PRNU performance, the camera flat field calibration should be calibrated at the target line rate and exposure time.

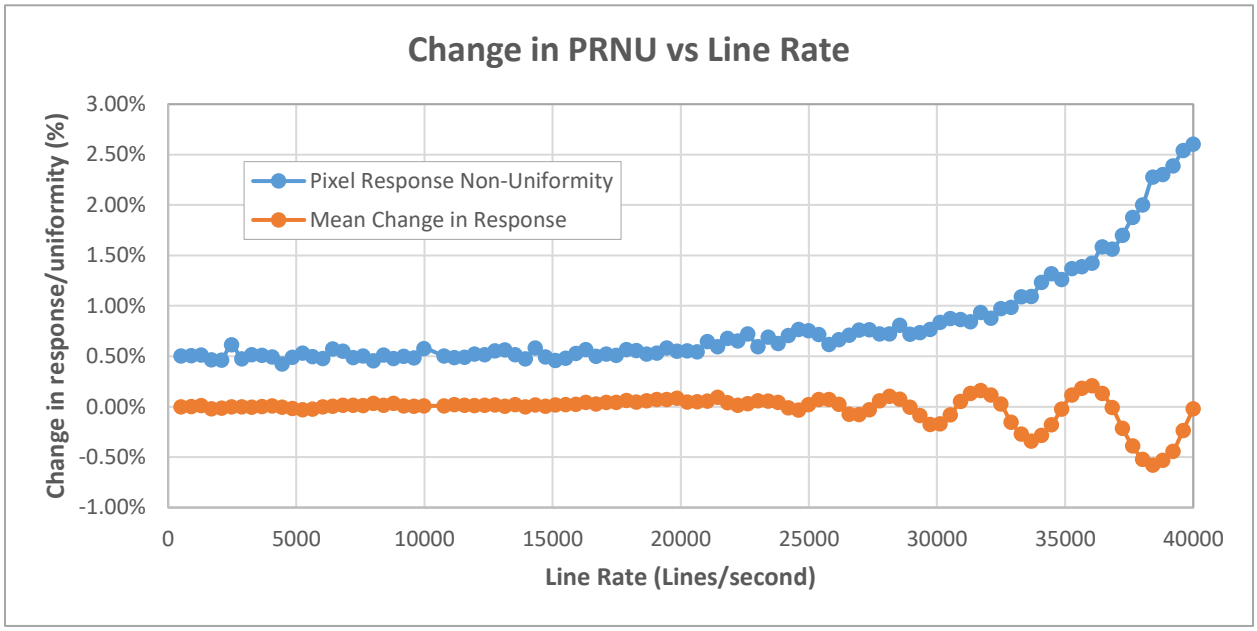


Figure 4: PRNU Derating Curve

Connecting the Linea SWIR GigE Camera

GigE Network Adapter Overview

The host computer requires an available Gigabit network port. Typically, Windows will recognize the Gigabit NIC automatically when Windows boots and assign an IP address.

When installing a high performance Gigabit NIC adapter, review the NIC documentation concerning any specific driver required for your operating system.

Note: Teledyne DALSA engineering has seen cases where a PCI Express bus Gigabit NIC has better overall performance than the same NIC hardware in PCI bus format.

Connect the Linea SWIR GigE Camera

Connecting a Linea SWIR GigE camera to a network system is independent of whether the Teledyne DALSA's Sapera LT package or a third party package is used.

- Before connecting power to the camera, test the power supply. Power supplies must meet the requirements defined in section Camera Power-up Configuration.
- Connect Linea SWIR GigE to the host computer with a GigE network adapter or an Ethernet switch via a CAT5e or CAT6 Ethernet cable.
  Note: Cable should be longer that 1 meter (3 feet) and less than 100 meters (328 feet) long.
- Once communication with the host computer has begun, the automatic IP configuration sequence will assign an LLA IP address as described in section Linea SWIR GigE IP Configuration Sequence or a DHCP IP address if a DHCP server is present on your network.
- The diagnostic LED will be initially red then switch to flashing blue while waiting for IP configuration. See Camera Status LED Indicator for Linea SWIR GigE LED display descriptions.
- The factory defaults for Linea SWIR GigE is Persistent IP disabled and DHCP enabled with LLA always enabled as per the GigE Vision specification. For additional information, see IP Configuration Mode Details. See the next section Connectors for an overview of the interface.
- **Note:** If Camera fails to connect, refer to section 'Camera Fails to Establish Connection with Host PC or Persistent IP section.

Connectors

The camera has two connectors.

- An **RJ45 Ethernet** connector for control and data transmitted between the camera and Gigabit NIC. See Ruggedized Cable Accessories for secure cables.
- A **10-pin I/O** connector for camera power, plus trigger, strobe and general I/O signals. Teledyne DALSA provides an optional breakout cable (see Cable Assembly G3-AIOC-BRKOUT2M).

The following figure shows the 10-pin connector and LED location. See Camera Mechanical Specifications for connector and camera mounting details and dimensions.

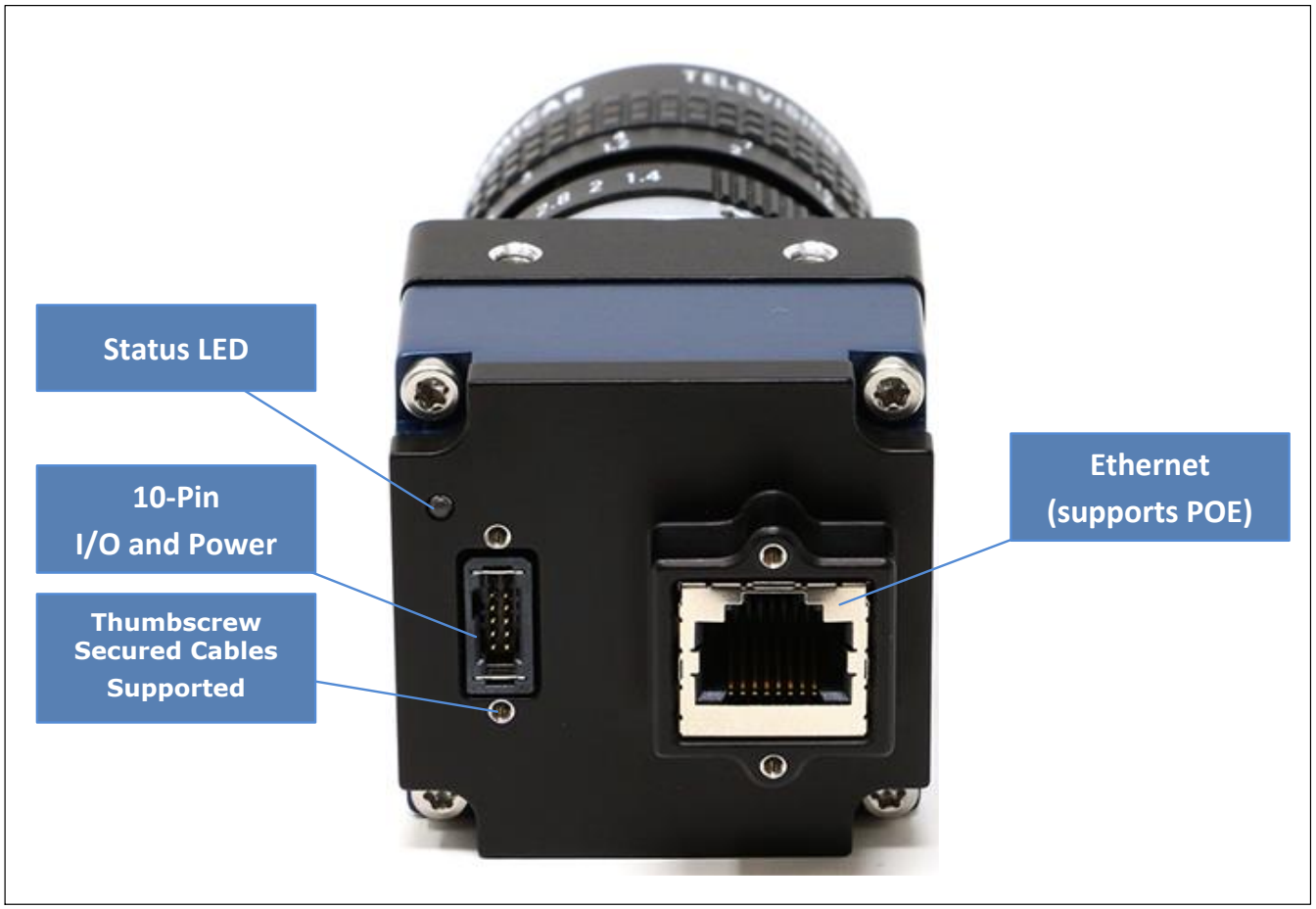


Figure 5: Rear View with Labels

LED Indicators

The camera has a multicolor LED to provide visible camera state as described below. The Ethernet connector does not have indicator LEDs. The user should use the LED status on the Ethernet switch or computer NIC to observe networking status.

Camera Status LED Indicator

The camera is equipped with a LED to display the operational status of the camera. When more than one condition is active, the LED color indicates the condition with the highest priority (i.e. Acquisition in progress has higher priority than a valid IP address assignment).

Once the camera is connected to a network, the Status LED will turn to steady blue when the IP address is assigned. Now the GigE Server or application will be able to communicate with the camera. The following table summarizes the LED states and corresponding camera status.

LED State	Definition
LED is off	No power to the camera.
Steady **Red**	Initial state on power up before flashing. Remains as steady Red only if there is a fatal error.
Flashing **Red**	Wait a few minutes for the camera to reboot itself.
Steady **Red** + Flashing **Blue**	Fatal Error. If the camera does not reboot itself contact Technical Support.
Slow Flashing **Blue**	Ethernet cable disconnected. The camera continuously attempts to assign itself an IP address.
Fast Flashing **Blue**	File Access Feature is transferring data such as a firmware update or FCC transfer, etc.
Steady **Blue**	IP address assigned. No application is connected to the camera.
Steady **Green**	Application connected.
Flashing **Green**	Acquisition in progress — flashing occurs on frame acquisition but does not exceed a rate of 100ms for faster frame rates.

Figure 6: Status LED Colors

Note: The Linea SWIR GigE has obtained an IP address but it might be on a different subnet than the attached NIC. If the Linea SWIR GigE LED is blue but an application cannot see the camera, this indicates a network configuration problem. See the troubleshooting section in this manual.

LED States on Power Up

A camera with GigE Vision software connected to a network and powered on will display the following LED sequence.

Figure 7: Status LED Color Sequence

Linea SWIR GigE IP Configuration Sequence

The IP (Internet Protocol) Configuration sequence to assign an IP address is executed automatically on camera power-up or when connected to a network. As a GigE Vision compliant device, the Linea SWIR GigE camera attempts to assign an IP address as follows.

The IP configuration protocol sequence is:

- Persistent IP (if enabled)
- DHCP (if a DHCP server is present such as the Teledyne DALSA Smart DHCP server)
- Link-Local Address (default enabled by factory)

The factory defaults for the camera is Persistent IP disabled and DHCP enabled with LLA enabled as per the GigE Vision specification. For additional information, see IP Configuration Mode Details.

Supported Network Configurations

The camera obtains an IP address using the Link Local Address (LLA) or DHCP by default. A LLA IP is generated within seconds using Microsoft Windows. If required, a Persistent IP address can be assigned (see Running the Network Configuration Tool).

Preferably, a DHCP server is present on the network to provide a DHCP address when the camera requests an IP address. The Sapera Teledyne DALSA Network Imaging Package installed with Sapera LT provides a DHCP server, which is enabled on the NIC used with the camera.

Refer to the Teledyne DALSA's Network Imaging Package for Sapera LT Optimization Guide, available through the Start menu under Teledyne DALSA.

The LLA method automatically assigns the camera a randomly chosen IP address on the 169.254.xxx.xxx subnet. The LLA sends an ARP query with that IP address onto the network checking to see if it is assigned. If no response is received, the IP is assigned to the camera or the LLA repeats the process.

Note: LLA is unable to forward packets across routers.

Preventing Operational Faults due to ESD

Install the camera in an ESD (electro-static discharge) safe environment to reduce potential noise.

Note: Using a simple power supply and Ethernet cable will not connect the camera to earth ground. Ethernet cables have no ground connection and a power supply's 0-voltage return line is not necessarily connected to earth ground.

The following methods will reduce or prevent ESD problems:

- Method 1: Use a shielded power supply to connect the camera case to earth ground.
- Method 2: Use a shielded Ethernet cable to provide a ground connection from the controlling computer, to the Linea SWIR GigE.
- Method 3: Mount the camera on a metallic platform with a good connection to earth ground.
- Method 4: Avoid running the Ethernet cable near AC power lines.

Using Linea SWIR GigE with the Sapera API

A Linea SWIR GigE camera installation with Teledyne DALSA's Sapera API generally follows the sequence described below. Detailed installation instructions follow this overview.

Network and Computer Overview

- The camera requires a computer with a GigE network adapter. See the previous section Connecting the Linea SWIR GigE Camera.
- Laptop computers with built in GigE network adapters may not stream full line rates from the camera. Thorough testing is required with any laptop computer to determine the maximum frame rate possible. **Note:** Refer to the "Network Imaging Package for Sapera LT" manual (NetworkOptimizationGuide.pdf) found by clicking Windows Start and scrolling down to Teledyne DALSA.
- The camera connects through a Gigabit Ethernet switch. When using VLAN groups, the Linea SWIR GigE and controlling computer must be in the same group.
- In a Sapera development environment, Sapera LT 8.50 or later is required with the GigE Vision Module software package.
- All GigE Vision support is automatically installed in Sapera LT 8.50 or later.
- If third party GigE Vision Compliant software is used, Sapera or Sapera runtime is not required. Refer to third party instruction manual.
- The Windows Firewall exceptions feature is automatically configured to allow the Sapera GigE Server to pass through the firewall.
- Computers with VPN software (virtual private network) may need to have the VPN driver disabled in NIC properties. This would be required on the NIC used with the Linea SWIR GigE. Testing by the user is required.
- When a Linea SWIR GigE is connected a small camera icon is added to the Windows tray (adjacent to clock) or in the tray pop up (Show hidden Icons). Right click the icon and select 'SHOW Status Dialog Box' to confirm camera connection.
- **Note:** The icon may remain hidden in Windows until a camera is connected.
- A firmware update may be required for a new camera. See File Access via the CamExpert Tool (Quick Camera Firmware Upgrade) for additional information.
- Use CamExpert (installed with either Sapera or Sapera runtime) to test the camera installation. Set the Internal Test Image Generator.

	**Note:** to install Sapera LT and the GigE Vision package, logon to the workstation as an administrator or with an account that has administrator privileges.

Installation

Sapera development environment requires Sapera LT 8.50 or later when using a Linea SWIR GigE camera where GigE Vision support is automatically installed.

If Sapera development is not required then Sapera LT SDK is not required to control the camera. Sapera runtime with CamExpert provides everything to control the camera.

Procedure

- Download and install Sapera 8.50, which automatically provides GigE Vision support.
- **Note:** If the Sapera LT SDK package is not required, only install the Linea SWIR GigE camera firmware and user manuals.
- Connect the camera to an available Gigabit NIC.

Refer to Sapera LT User's Manual concerning application development with Sapera.

	**Note**: Teledyne DALSA's Sapera CamExpert tool (used throughout this manual to describe Linea SWIR GigE Vision features) are installed with either the Sapera LT runtime or the Sapera LT development package. If Sapera application development is required, install Sapera (8.50 or later for all firmware support) as described in the previous section.

Camera Firmware Updates

Download firmware updates from Teledyne DALSA [http://www.teledynedalsa.com/en/support/downloads-center/firmware/125/].

Use File Access Control Category to upload the latest firmware via Sapera CamExpert.

GigE Server Verification

The GigE Server icon is visible in the desktop taskbar tray or in the tray pop up (Show hidden Icons) after a successful Sapera GigE Vision package installation.

(**Note:** The icon remains hidden in Windows until a camera is connected).

After connecting a camera (see following section) allow a few seconds for the GigE Server status to update. **Note:** The camera must be on the same subnet as the NIC to be recognized by the GigE Server.

	Device Available	Device IP Error	Device Not Available
GigE Server Tray Icon:			
	The normal GigE server tray icon when the camera device is found. It will take a few seconds for the GigE Server to refresh its state after the camera has obtained an IP address.	The GigE server tray icon shows a warning when a device is connected but there is some type of IP error.	A red X will remain over the GigE server tray icon when the camera device is not found. This indicates a network issue. **Or in the simplest case,** there is no camera connected.

Figure 8: GigE Server Icon States

If you hover the mouse over the tray icon, the GigE Server will display the number of GigE Vision devices found by the PC. Right click the icon and select 'SHOW Status Dialog Box' to view

information about those devices. See Running the Network Configuration Tool and Troubleshooting for more information.

GigE Server Status

The Status LED turns steady blue after the Linea SWIR GigE camera is assigned an IP address and the GigE server tray icon will indicate the device was found.

When a Linea SWIR GigE is connected a small camera icon is added to the Windows tray (adjacent to clock) or in the tray pop up (Show hidden Icons). Right click the icon and select 'SHOW Status Dialog Box' to confirm camera connection.

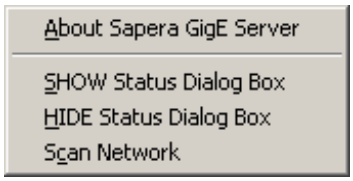


Figure 9: GigE Server Tray Icon Menu

GigE devices with assigned IP and MAC addresses are displayed. The screen shot below shows a connected Linea SWIR GigE camera with no networking problems.

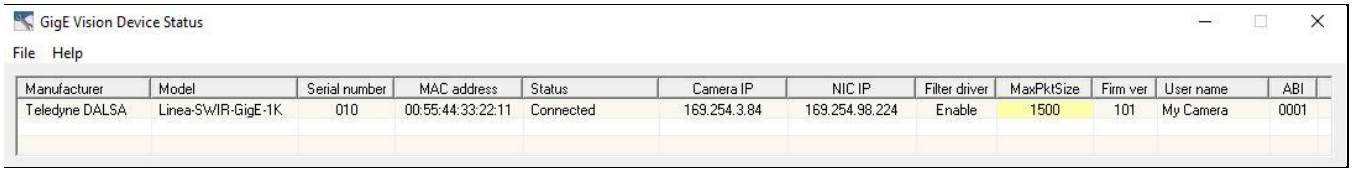


Figure 10: GigE Server Status Dialog

If the camera is physically connected, but the Sapera GigE Server icon is indicating that the connected device is not recognized. Click 'Scan Network' to restart the discovery process.

Note: The GigE server periodically scans the network to refresh its state. See Troubleshooting to resolve network problems.

Optimizing the Network Adapter used with Linea SWIR GigE

Adjust parameters of the Gigabit network interface controllers (NIC) during the installation to optimize its use with the Linea SWIR GigE.

Note: Refer to Sapera LT user's manual for optimization information.

Running the Network Configuration Tool

The Network Configuration tool provides information and parameter adjustments for network adapters installed in the system and connected GigE Vision camera.

This tool allows you to:

- Activate the Network Imaging driver used for image acquisition on any NIC or disable the imaging driver for any unused NIC.
- Configure the NIC as a DHCP server for connected GigE Vision camera.
- Change the Auto Discovery Interval from the default of 15 seconds if required.
- Configure the NIC and camera IP settings.
- Assign a User Defined name to a connected camera.
- Assign a Persistent IP address to a camera instead of the default DHCP / LLA assigned address.

	**Important:** Changes made with this tool may update Linea SWIR GigE parameters stored in flash memory. Do not remove power from the camera for a minimum 10 seconds.

Refer to the "Network Imaging Package for Sapera LT" manual (NetworkOptimizationGuide.pdf) for more information on using this tool. The Network Configuration tool can quickly verify and modify certain network configuration parameters of the imaging system.

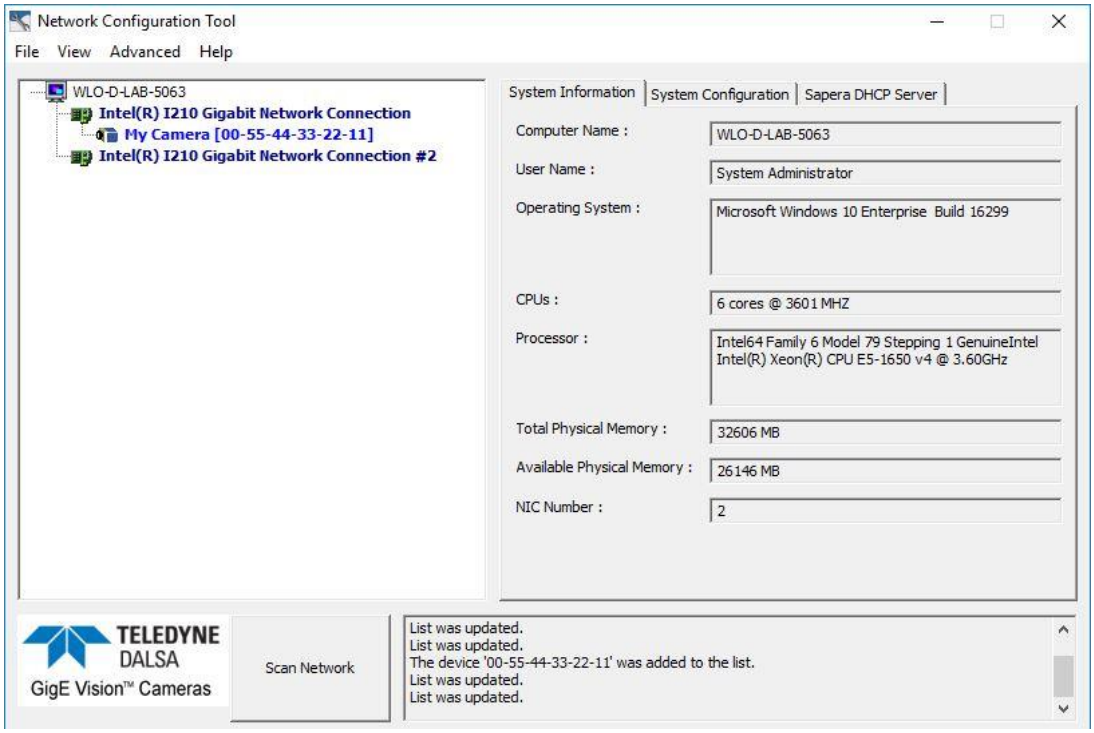


Figure 11: Network Imaging Tool

Run the tool from the Windows Start menu: **Teledyne DALSA ● Network Configuration Tool**. Verify the camera appears as a child of the NIC card it is connected to. By default the camera is identified by its serial number if no user defined name has been assigned.

Quick Startup with CamExpert

Follow the steps below to test a CamExpert installation using a Linea SWIR GigE camera connected to a Gigabit network adapter.

- Start Sapera CamExpert by double clicking the desktop icon created during the Sapera installation.
- CamExpert will search the 'Device:' list displayed on the left side for installed Sapera devices. The connected camera is displayed seconds after CamExpert completes the automatic device search.
- Select the device by clicking on the camera's user-defined name. By default, the camera is identified by its serial number. The camera's status LED will turn green, indicating the CamExpert application is now connected.
- Camera defaults will set AcquisitionLineRate = "20000 Hz", TriggerMode = Off, ExposureMode = Timed, and ExposureTime = "40.0 us"
- Click the Grab button for live acquisition. **Note**: The Linea SWIR GigE camera's factory default is Internal Trigger mode with a vertical height parameter, which defines the virtual image frame. See Operational Reference for information on CamExpert parameters.
- If the camera has no lens, select one of the internal test patterns available (Image Format Controls – Test Image Selector).
- **Note:** CamExpert cannot grab at high virtual frame rates due to it generating an interrupt for each virtual video frame. The Sapera Grab Demo tool is better suited for high frame rates.
- If the AcquisitionLineRate is reduced and / or frame buffer Height is increased, you may need to increase the value for GigE Vision Host Control feature "Image Timeout".
- Refer to Teledyne DALSA's Network Imaging package manual if error messages are displayed in the Output Messages pane. Try increasing the value of the camera's Interpacket Delay feature available from the GigE Vision Transport Layer Category group in CamExpert. An increase from default may correct errors with NIC interfaces that do not have adequate performance.

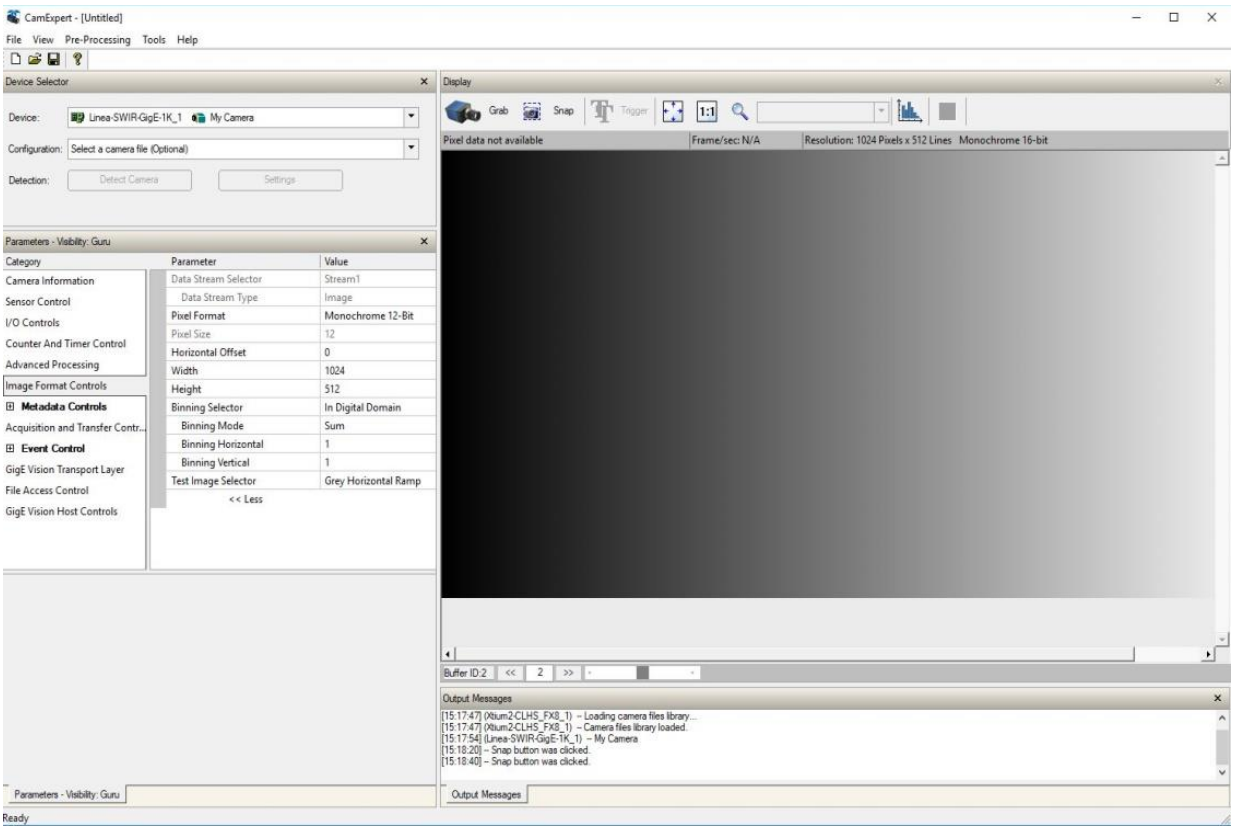


Figure 12: CamExpert

About the User-Defined Camera Name

The Linea SWIR GigE camera can be programmed with a user-defined name to aid identifying multiple cameras connected to the network. For instance, on an inspection system with four cameras, the first camera might be labeled “top view”, the second “left view”, the third “right view” and the last one “bottom view”. The Factory Default User Name is the camera serial number for quick initial identification.

Note: The factory programmed camera serial number and MAC address are not user changeable.

When using CamExpert, multiple Linea SWIR GigE cameras on the network are seen as different "Linea-SWIR-GigE-xxx” devices. Non Teledyne DALSA cameras are labeled as “GigEVision Device”. Click on a device User Name to select it for control by CamExpert.

An imaging application uses any one of these attributes to identify a camera: its IP address, MAC address, serial number or User Name. Some important considerations are listed below.

- Do not use the camera's IP address as identification (unless it is a persistent IP) because it can change with each power cycle.
- A MAC address is unique to each camera therefore the control application is limited to the vision system with that unique camera if it uses the camera's MAC address.
- The User Name can be freely programmed to represent the camera usage. This scheme is recommended for an application to identify cameras. In this case, the vision system can be duplicated any number of times with cameras identified by their function, not their serial numbers or MAC address.

Operational Reference

Using CamExpert with Linea SWIR GigE Cameras

The Sapera CamExpert tool is the interfacing tool for GigE Vision cameras and is supported by the Sapera library and hardware. When used with a Linea SWIR GigE camera, CamExpert allows a user to test most of the operating modes. Additionally CamExpert saves the Linea SWIR GigE user settings configuration to the camera or saves multiple configurations as individual camera parameter files on the host system (*.ccf).

An important component of CamExpert is its live acquisition display window, which allows immediate verification of timing or control parameters without the need to run a separate acquisition program.

Click any parameter and a short description is displayed below the Category Pane. Click the  button to open the help file for more descriptive information on CamExpert.

	**Note**: The examples shown may not entirely reflect the features and parameters available from the camera model and camera mode used in your application.

CamExpert Panes

Various features of CamExpert are described in the figure below. GigE Vision device Categories and Parameter features are displayed as per the device's XML description file. The number of parameters shown is dependent on the View mode selected (Beginner, Expert, Guru – see description below).

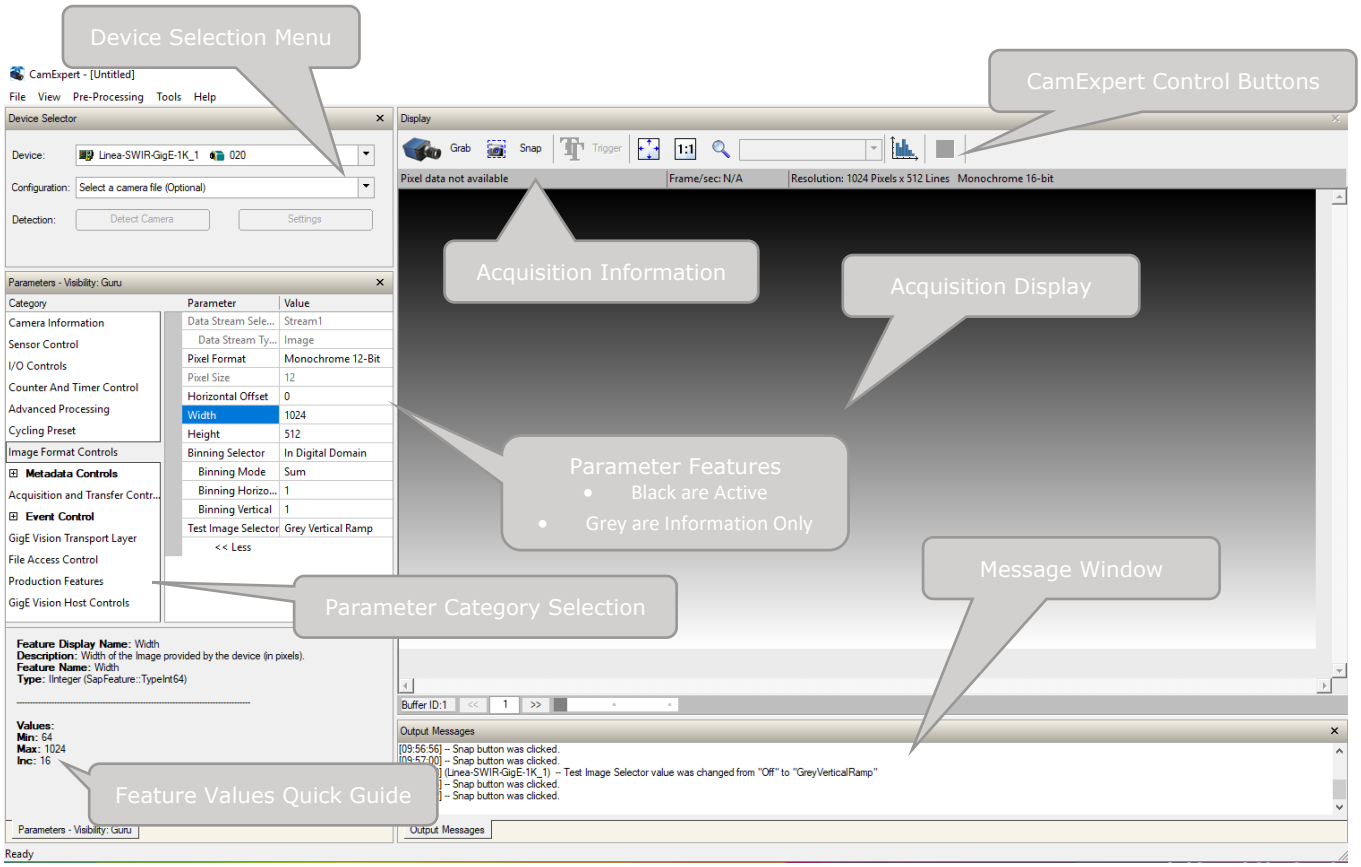


Figure 13: CamExpert Panes

- **Device Selector Pane:** View and select from any installed GigE Vision or Sapera acquisition device. After a device is selected, CamExpert will only present parameters applicable to that device. Optionally select a camera file included with the Sapera installation or saved by the user.
- **Parameters Pane:** Allows viewing or changing all acquisition parameters supported by the acquisition device. CamExpert displays parameters only if those parameters are supported by the installed device. This avoids confusion by eliminating parameter choices when they do not apply to the hardware in use.
- **Display Pane:** Provides a live or single frame acquisition display. Frame buffer parameters are shown in an information bar above the image window.
- **Control Buttons:** The Display Pane includes CamExpert control buttons.
- **Output Pane:** Displays messages from CamExpert or the GigE Vision driver.

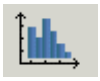
	**Acquisition control button:** Click once to start live grab, click again to stop.
	**Single frame grab:** Click to acquire one frame from device.
	**Software trigger button:** With the I/O control parameters set to Trigger Enabled / Software Trigger type, click to send a single software trigger command.
	**CamExpert display controls:** (Do not modify the frame buffer data) Stretch or shrink image to fit, set image display to original size, zoom the image to any size and ratio. Does not affect the acquisition.
	**Histogram / Profile tool:** Select to view a histogram or line / column profile during live acquisition.

Figure 14: CamExpert Control Buttons

CamExpert View Parameters Option

All camera features have a visibility attribute, which defines its requirement or complexity. The states vary from Beginner (features required for basic operation of the device) to Guru (optional features required only for complex operations).

CamExpert presents camera features based on their visibility attribute. CamExpert provides quick visibility level selection via controls below each Category Parameter list [<< Less More >>]. The user can also choose the visibility level from the View · Parameters Options menu.

Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in CamExpert or programmable via an imaging application.

Features listed in the description table but tagged as Invisible are usually for Teledyne DALSA or third party software usage — not typically required by end user applications.

Additionally the View & Standard column indicates which parameter is a member of the DALSA Features Naming Convention (indicated by DFNC), versus the GenICam Standard Features Naming Convention (SFNC not shown).

Creating a Camera Configuration File in the Host

- When using Teledyne DALSA's Sapera SDK – the CCF is created automatically via a save.
- When using 3rd party SDK application that supports **GenAPI 2.4**, the process is automatic. Follow the third party Save Camera method as instructed.
- If the SDK is based on **GenAPI 2.3** or lower, the user must call the command DeviceFeaturePersistenceStart before using the SDK Save Camera method and the command DeviceFeaturePersistenceEnd at the end of the save function.

Camera Information Category

Camera information is retrieved via a controlling application. Parameters such as camera model, firmware version, etc. uniquely identify the connected Linea SWIR GigE device. These features are typically read-only.

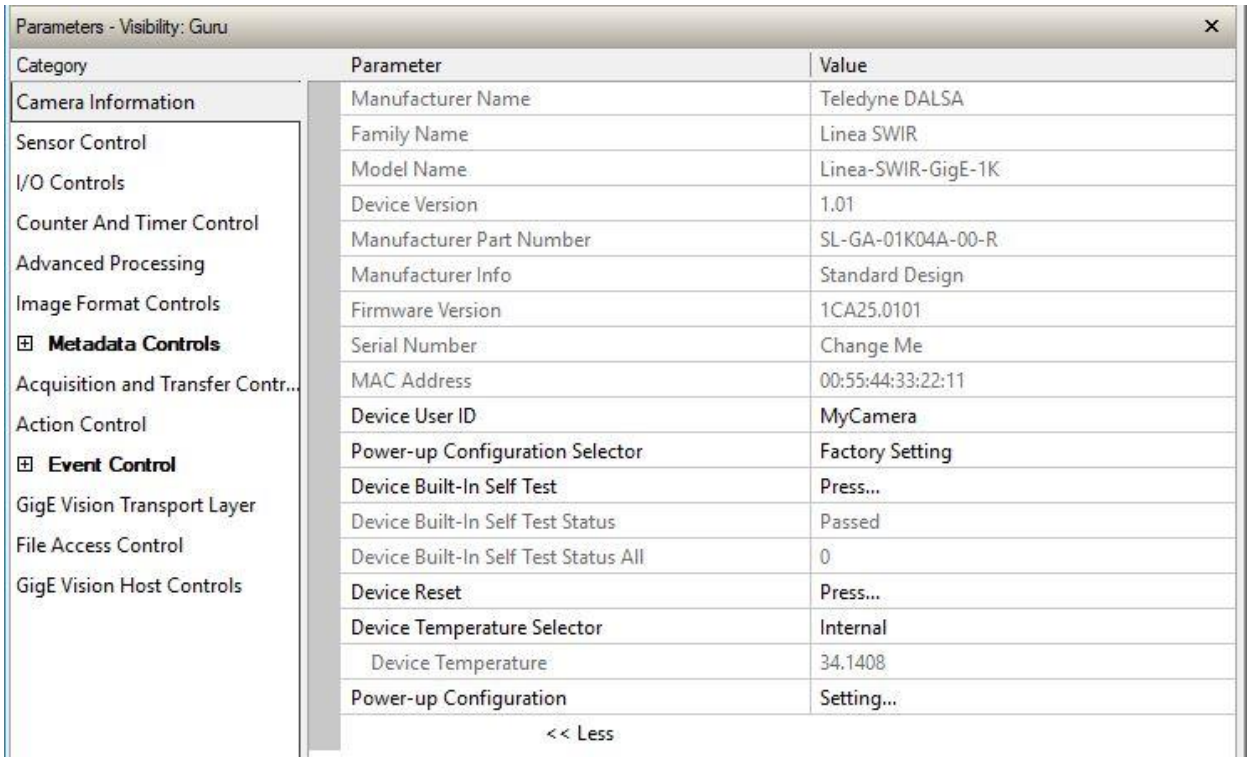


Figure 15: Camera Information Features

Camera Information Feature Descriptions

Display Name	Feature & Values	Description	Device Version & View
Manufacturer Name	DeviceVendorName	Displays the device vendor name. (RO)	1.00 Beginner
Model Name	DeviceModelName	Displays the device model name. (RO)	1.00 Beginner
Manufacturer Part Number	deviceManufacturerPartNumber	Displays extended manufacturer part number information about the device.	1.00 Beginner
Device Version	DeviceVersion	Displays the device version. This tag will also highlight if the firmware is a beta or custom design. (RO)	1.00 Beginner
Manufacturer Info	DeviceManufacturerInfo	This feature provides extended manufacturer information about the device, such as the firmware design type. (RO)	1.00 Beginner
Firmware Version	DeviceFirmwareVersion	Displays the currently loaded firmware version number. Firmware files have a unique number and have the .cbf file extension. (RO)	1.00 Beginner
Serial Number	DeviceSerialNumber	Displays the device's factory set camera serial number. (RO)	1.00 Beginner

Display Name	Feature & Values	Description	Device Version & View
MAC Address	deviceMacAddress	Displays the unique MAC (Media Access Control) address of the Device. (RO)	1.00 DFNC Beginner
Device User ID	DeviceUserID	Feature to store a user-programmable identifier of up to 15 characters. The default factory setting is the camera serial number. (RW)	1.00 Beginner
Power-up Configuration Selector	UserSetDefault	Selects the camera configuration set to load and make active on camera power-up or reset. The camera configuration sets are stored in camera non-volatile memory. (RW)	1.00 Beginner
None	*None*	*Keep Internal configuration.*	
Factory Setting	*Default*	*Load factory default feature settings.*	
UserSet 1	*UserSet1*	*Select the user defined configuration UserSet 1 as the Power-up Configuration.*	
UserSet 2	*UserSet2*	*Select the user defined configuration UserSet 2 as the Power-up Configuration.*	
UserSet 3	*UserSet3*	*Select the user defined configuration UserSet 3 as the Power-up Configuration.*	
UserSet 4	*UserSet4*	*Select the user defined configuration UserSet 4 as the Power-up Configuration.*	
User Set Selector	UserSetSelector	Selects the camera configuration set to load feature settings from or save current feature settings to. The Factory set contains default camera feature settings. User camera configuration sets contain features settings previously saved by the user. (RW)	1.00 Beginner
Factory Setting	*Default*	*Select the default camera feature settings saved by the factory.*	
UserSet 1	*UserSet1*	*Select the user defined Configuration space UserSet1 to save to or load from features settings previously saved by the user.*	
UserSet 2	*UserSet2*	*Select the user defined Configuration space UserSet2 to save to or load from features settings previously saved by the user.*	
UserSet 3	*UserSet3*	*Select the user defined Configuration space UserSet3 to save to or load from features settings previously saved by the user.*	
UserSet 4	*UserSet4*	*Select the user defined Configuration space UserSet4 to save to or load from features settings previously saved by the user.*	
Load Configuration	UserSetLoad	Loads the camera configuration set specified by the User Set Selector feature to the camera and makes it active. (W)	1.00 Beginner
Save Configuration	UserSetSave	Saves the current camera configuration to the user set specified by the User Set Selector feature. The user sets are located on the camera in non-volatile memory. (W)	1.00 Beginner
Device Built-In Self Test	deviceBIST	Command to perform an internal test which will determine the device status. (W)	1.00 DFNC Beginner
Device Built-In Self Test Status	deviceBISTStatus	Return the status of the device Built-In Self Test. Possible return values are device-specific.	1.00 Beginner
Passed	*Passed*	*No failure detected.*	
Firmware Update Failed	*FirmwareUpdateFailure*	*Last firmware update operation failed.*	
FPGA Cyclic Redundancy Check Failed	*FPGA_CRC_Failure*	*FPGA cyclic redundancy check failed.*	
Unexpected Error	*Unexpected_Error*	*Switched to recovery mode due to unexpected software error.*	

Display Name	Feature & Values	Description	Device Version & View
Device Built-In Self Test Status All	deviceBISTStatusAll	Return the status of the device Built-In Self Test as a bitfield. The meaning for each bit is device-specific.	1.00 DFNC Beginner
Device Reset	DeviceReset	Resets the device to its power up state. (W)	1.00 Beginner
Device Temperature Selector	DeviceTemperatureSelector	Select the source where the temperature is read.	1.00 Beginner
Device Temperature	DeviceTemperature	The temperature of the selected source in degrees Celsius	1.00 Beginner
Device ID	DeviceID	Displays the device's factory set serial number.	1.00 Invisible
Calibration Date	deviceCalibrationDateRaw	Date when the camera was calibrated.	1.00 DFNC Invisible
Device Acquisition Type	deviceAcquisitionType	Displays the Device Acquisition Type of the product. (RO)	1.00 DFNC Invisible
Sensor	*Sensor*	*The device gets its data directly from a sensor.*	
Device TL Type	DeviceTLType	Transport Layer type of the device.	1.00 Invisible
GigE Vision	*GigEVision*	*GigE Vision Transport Layer*	
Device TL Version Major	DeviceTLVersionMajor	Major version of the device's Transport Layer.	1.00 Invisible
Device TL Version Minor	DeviceTLVersionMinor	Minor version of the device's Transport Layer.	1.00 Invisible
Power-up Configuration Selector	UserSetDefaultSelector	Selects the camera configuration set to load and make active on camera power-up or reset. The camera configuration sets are stored in camera non-volatile memory. (RW)	1.00 Invisible
None	*None*	*Keep Internal configuration.*	
Factory Setting	*Default*	*Select the Factory Setting values as the Power-up Configuration.*	
UserSet1	*UserSet1*	*Select UserSet1.*	
UserSet2	*UserSet2*	*Select UserSet2.*	
DFNC Major Rev	deviceDFNCVersionMajor	Major revision of Dalsa Feature Naming Convention which was used to create the device's XML. (RO)	1.00 DFNC Invisible
DFNC Minor Rev	deviceDFNCVersionMinor	Minor revision of Dalsa Feature Naming Convention which was used to create the device's XML. (RO)	1.00 DFNC Invisible
SFNC Major Rev	DeviceSFNCVersionMajor	Major Version of the Standard Features Naming Convention which was used to create the device's XML. (RO)	1.00 Invisible
SFNC Minor Rev	DeviceSFNCVersionMinor	Minor Version of the Standard Features Naming Convention which was used to create the device's XML. (RO)	1.00 Invisible
SFNC SubMinor Rev	DeviceSFNCVersionSubMinor	SubMinor Version of the Standard Features Naming Convention which was used to create the device's XML. (RO)	1.00 Invisible

Camera Configuration Selection Dialog

CamExpert provides a dialog, which combines the features to select the camera power up state and for the user to save or load a camera state from camera memory.

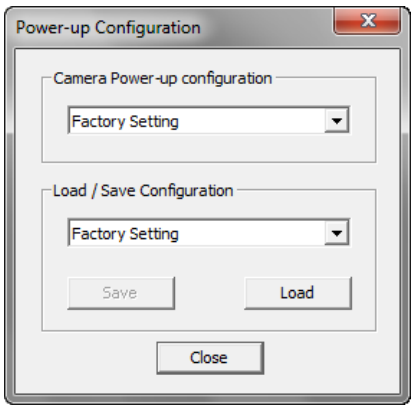


Figure 16: Power up Mode Menu

Camera Power-up Configuration

The drop down list displays the camera configuration state to load during power-up (see feature UserSetDefaultSelector). The user chooses Factory Setting or one of four possible saved User Sets.

User Set Configuration Management

The drop down list displays the configuration to load after power-up (see feature UserSetSelector).

	NOTE: To reset the camera to the factory configuration, select Factory Setting and click Load. To save a current camera configuration, select a User Set and click Save. Select a saved user set and click Load to restore a saved configuration.

Sensor Control Category

CamExpert groups sensor specific features in the Linea SWIR GigE camera. The group includes controls for line rate, exposure time, etc.

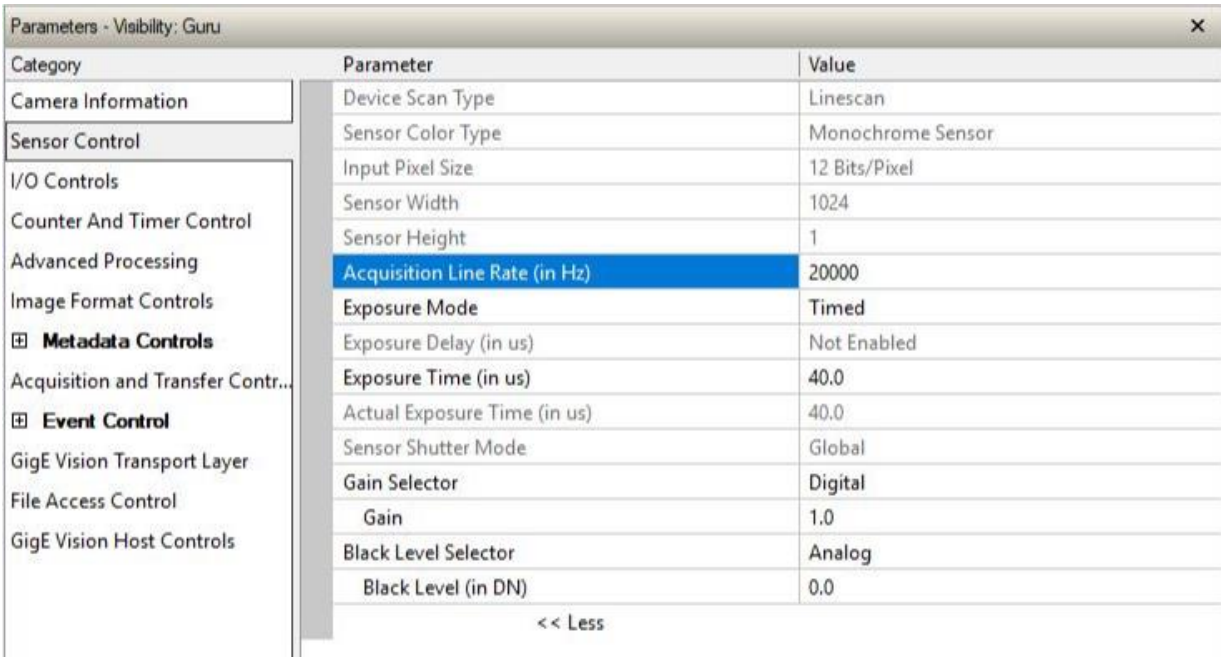


Figure 17: Sensor Control Features

Sensor Control Feature Descriptions

Display Name	Feature & Values	Description	Device Version & View
Device Scan Type	DeviceScanType	Scan type of the sensor. < RO>	1.00 Beginner
Linescan	*Linescan*	*1D Linescan sensor.*	
Sensor Color Type	sensorColorType	Defines the camera sensor color type. < RO >	1.00 Beginner DFNC
Monochrome Sensor	*Monochrome*	*Sensor color type is monochrome.*	
Sensor Width	SensorWidth	Defines the sensor width in active pixels. < RO>	1.00 Expert
Sensor Height	SensorHeight	Defines the sensor height in active lines. < RO>	1.00 Expert
Input Pixel Size	pixelSizeInput	Size of the image input pixels, in bits per pixel. < RO >	1.00 Expert DFNC
12 BPP	*Bpp12*	*Sensor output data path is 12 bits per pixel.*	
Acquisition Line Rate	AcquisitionLineRate	Specifies the camera internal line rate, in Hz.	1.00 Beginner

Display Name	Feature & Values	Description	Device Version & View
Exposure Mode	ExposureMode	Sets the operation mode for the camera's exposure.	1.00 Beginner
Timed	*Timed*	*The exposure duration time is set using the Exposure Time feature and the exposure starts with a LineStart event.*	
Trigger Width	*TriggerWidth*	*Uses the width of the trigger signal pulse to control the exposure duration. Use the Trigger Activation feature to set the polarity of the trigger. The Trigger Width setting is applicable when the LineStart trigger is enabled and a signal is selected as trigger source.*	
Exposure Time	ExposureTime	Sets the exposure time (in microseconds) when the Exposure Mode feature is set to Timed.	1.00 Beginner
Exposure Delay	exposureDelay	Specifies the delay in microseconds (µs) to apply after the LineStart event before starting the ExposureStart event.	1.00 Beginner DFNC
Sensor Gain Selector	SensorAnalog	Selects which gain is controlled when adjusting gain features.	1.00 Beginner
Sensor	*SensorAnalog*	*Apply an analog gain adjustment within the sensor to the entire image. Conversion Efficiency table: Gain = 4.0 is about 4.0 uV/e-; Gain = 3.0 -> 2.91 uV/e-; Gain = 2.0 -> 1.07 uV/e-; Gain = 1.0 -> 0.128 uV/e*	
Digital	*DigitalAll*	*Apply a digital gain adjustment to the entire image. This independent gain factor is applied to the image after the sensor.*	1.00 Beginner
Gain	Gain	Sets the selected gain as an amplification factor applied to the image.	1.00 Beginner
Black Level Selector	BlackLevelSelector	Selects which tap is controlled by the Black Level feature.	1.00 Beginner
Analog	*AnalogAll*		
Black Level	BlackLevel	Black level (offset) in DN.	1.00 Expert

Gain and Black Level Control Details

The Linea SWIR GigE camera provides gain and black level adjustments. The Gain and Black Level controls can make small compensations to the acquisition in situations where lighting varies and the lens iris is not easily adjusted. Optimal gain and black level adjustments maximizes the camera's dynamic range for individual imaging situations. The user can evaluate Gain and Black Level by using CamExpert.

- **Black Level:** This is expressed as a digital number providing +/- offset from the factory setting. The factory setting optimized the black level offset for maximum dynamic range under controlled ideal dark conditions.
- **Sensor Gain:** This is an analog gain adjustment within the sensor. The sensor has four selectable conversion gain settings, from value of 1 (highest full well and signal to noise ratio) to value of 4 for (default, maximum light sensitivity).
- **Digital Gain:** This is expressed as a multiplication factor. Digital gain is applied to the image after sensor gain.

Exposure Controls Details

Exposure Control modes define the method and timing for controlling the sensor integration period. The integration period is the amount of time the sensor is exposed to incoming light before the video line data is transmitted to the controlling computer.

- Exposure control is defined as the start of exposure and exposure duration.
- The feature Exposure Mode selects the controlling method for the exposure.
- The start of exposure can be driven by an internal timer signal, an external trigger signal, or a software function call.
- For External Trigger signals, the relationship between an external line trigger and the exposure period is only applicable while the external line trigger does not exceed the maximum allowable line rate.

Internal Programmable Exposure

The Linea SWIR GigE camera in the Internal Programmable Exposure mode has the following features:

- The Trigger Source feature (see I/O Control category) selects an internal signal as trigger.
- The programmable internal trigger maximum line rate limit is related to the ExposureTime feature.
- Exposure duration is user programmable (exposure maximum is dependent on the line rate). Minimum exposure (in µs) is model dependent.

External Programmable Exposure

The External Programmable Exposure mode is similar to Internal Programmable except the exposure start being an external user input.

- The Trigger Source feature (see I/O Control category) selects an external signal line as trigger.
- Line rate and exposure limits are defined by Internal Programmable Exposure.

Exposure Delay Constraints

- Exposure maximum delay specified by the user should not exceed the period of the signal.
- If the exposure trigger is edge rather than level, the delay should not exceed half the period.
- If these parameters are violated, the camera ignores new transitions / pulses / triggers until the specified delay has passed.

I/O Control Category

The Linea SWIR GigE camera's I/O Control features configure external inputs and acquisition actions based on the inputs and output signals to other devices.

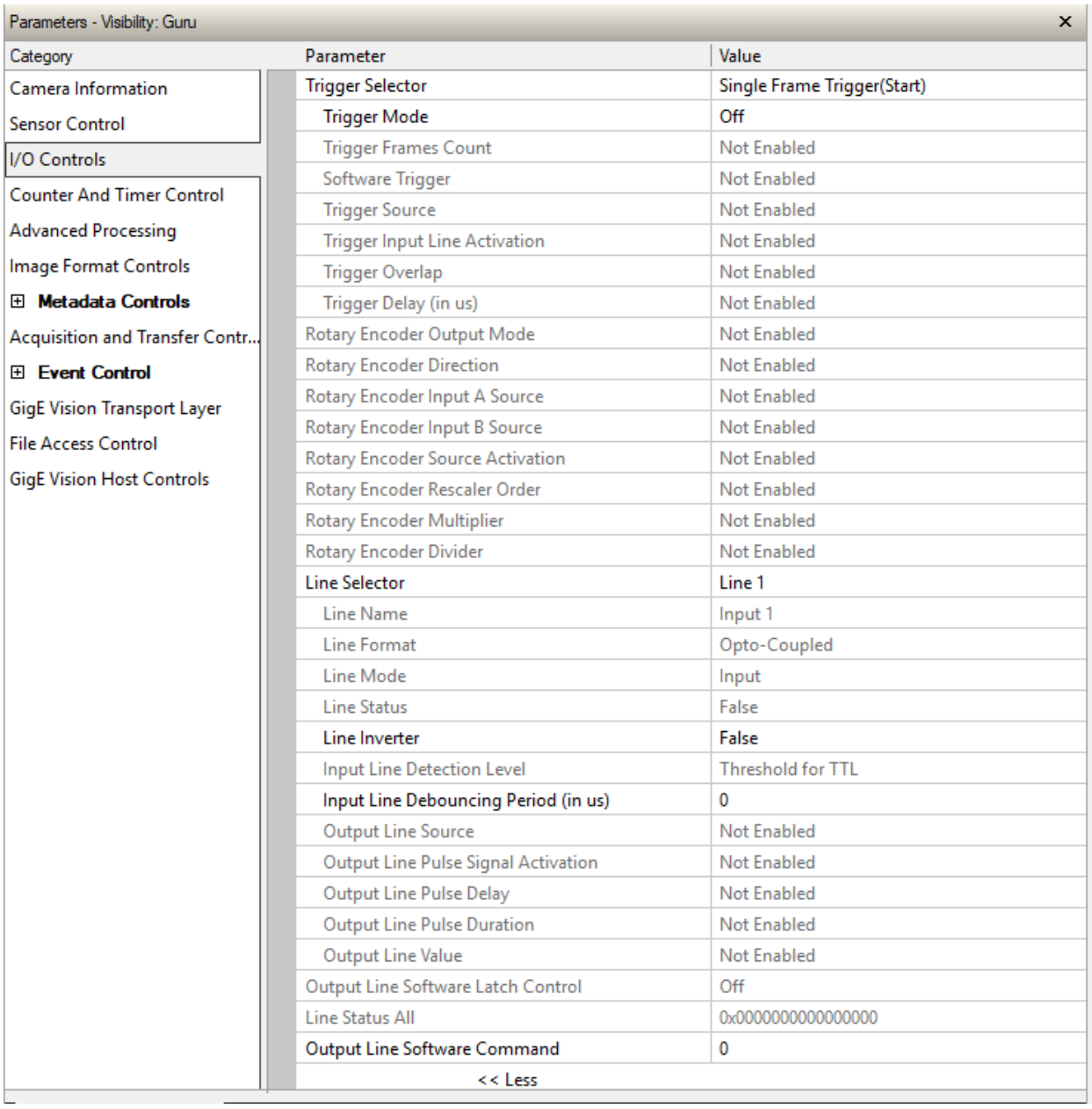


Figure 18: I/O Control Features

I/O Control Feature Descriptions

Display Name	Feature & Values	Description	Device Version & View
Trigger Selector	TriggerSelector	Selects which type of trigger to configure with the various Trigger features.	1.00 Beginner
Single Line Trigger (Start)	*LineStart*	*Selects a trigger starting the capture of a single line.*	
Single Frame Trigger(Start)	*FrameStart*	*Selects a trigger starting the capture of a single frame. Frame size is determined by image format feature "Height".*	
MultiFrame Trigger(Start)	*FrameBurstStart*	*Selects a trigger to capture multiple frames. The number of frames is specified by the triggerFrameCount feature.*	
Frame Active	*FrameActive*	*Selects a trigger controlling the duration of one frame. The number of lines in the frame is variable and is determined by the length of the frame active signal.*	
Frame Burst Active	*FrameBurstActive*	*Selects a trigger controlling the duration of the capture of bursts of frames in an acquisition. The burst lasts as long as the trigger is asserted.*	
Trigger Mode	TriggerMode	Controls the enable state of the selected trigger.	1.00 Beginner
Off	*Off*	*The selected trigger is turned off.*	
On	*On*	*The selected trigger is turned active.*	
Trigger Frames Count	triggerFrameCount	Sets the number of frames to acquire when a valid trigger is received. This feature is available when the Trigger Selector is set to MultiFrames Trigger.	1.00 DFNC Beginner
Trigger Line Count	triggerLineCount	Sets the number of lines to acquire when a valid line trigger pulse is received.	1.00 DFNC Beginner
Software Trigger	TriggerSoftware	Generate a software command internal trigger immediately no matter what the TriggerSource feature is set to.	1.00 Beginner
Trigger Source	TriggerSource	Specifies the internal signal or physical input line to use as the trigger source. The selected trigger must have its TriggerMode set to ON. (Source availability may depend on the TriggerSelector setting.)	1.00 Beginner
Line 1	*Line1*	*Select Line 1 (and associated I/O control block) to use as the external trigger source. See LineSelector feature for a complete list.*	
Line 2	*Line2*	*Select Line 2 (and associated I/O control block) to use as the external trigger source. See LineSelector feature for complete list.*	
Rotary Encoder	*rotaryEncoder1*	*Select Rotary Encoder to use as the external line trigger source.*	
Timer1End Event	*Timer1End*	*Select the TimerEnd Event as the internal trigger source.*	
Counter1End Event	*Counter1End*	*Select the Counter1End Event as the internal trigger source.*	
Trigger Input Line Activation	TriggerActivation	Select the activation mode for the selected Input Line trigger source. This is applicable only for external line input.	1.00 Beginner
Rising Edge	*RisingEdge*	*The trigger is considered valid on the rising edge of the line source signal (after any processing by the line inverter module).*	
Any Edge	*AnyEdge*	*The trigger is considered valid on any edge*	
Level High	*LevelHigh*	*The trigger is considered valid as long as the level of the source signal is high.*	
Level Low	*LevelLow*	*The trigger is considered valid as long as the level of the source signal is low.*	

Display Name	Feature & Values	Description	Device Version & View
Trigger Overlap	TriggerOverlap	Specifies if a trigger overlap is permitted with the Active Frame or Active Line signal. This defines if a new valid trigger will be accepted (or latched) for a new frame or line.	1.00 Beginner
Off	*Off*	*No trigger overlap is permitted. (Frame Trigger).*	
Readout	*ReadOut*	*Trigger is accepted immediately after the exposure period (readout). (Line Trigger)* *Overlapped exposures must not end before readout of the previous exposure.*	
Previous Line	*previousLine*	*Trigger is accepted (latched) at any time during the capture of the previous line. (Line Trigger)*	
Trigger Delay	TriggerDelay	Only frame triggers can be delayed. Specifies the delay to apply after receiving the trigger and before activating trigger event. The delay can be set in microseconds or in line trigger signals. The delay can buffer and apply the specified delay to a maximum of 128 frame trigger pulses simultaneously. Any additional triggers will be lost if the trigger delay buffer is full.	1.00 Beginner
Trigger Delay Source	triggerDelaySource	Sets the event that increments the trigger delay counter.	1.00 DFNC Beginner
Internal Clock	*InternalClock*	*The delay counter increments on each microsecond tick of the device internal Clock.*	
Line Trigger Signal	*lineTriggerSignal*	*The delay counter increments on each pulse received by the line trigger module. The delay counter increments even if the pulse is rejected by the line trigger module.*	
Line Trigger Input Frequency	lineTriggerInputFrequency	Current line frequency measured by the camera.	1.00 Beginner
Rotary Encoder Output Mode	rotaryEncoderOutputMode	Specifies the conditions for the Rotary Encoder interface to generate a valid Encoder output signal.	1.00 Expert DFNC
Position	*Position*	*On the camera, the "position" behaviour exists, but the number of counts is small (7-bits / 128 counts). The encoder can reverse for 256 ticks and then go forward and behave as expected for "position" style behaviour. If the user exceeds 256 ticks, the count will max out, but will not reset. When the user starts going forward again, 256 lines will be dropped / ignored and then resume output.*	
Motion	*Motion*	*The triggers are generated for all motion increments in either direction.*	
Rotary Encoder Rescaler Order	rotaryEncoderRescalerOrder	Specifies the order that the multiplier and divider are applied.	1.00 Guru DFNC
Multiplier Divider	*multiplierDivider*	*The signal is multiplied before been divided.*	
Divider Multiplier	*dividerMultiplier*	*The signal is divided before been multiplied.*	
Rotary Encoder Multiplier	rotaryEncoderMultiplier	Specifies a multiplication factor for the rotary encoder output pulse generator.	1.00 DFNC Beginner
Rotary Encoder Divider	rotaryEncoderDivider	Specifies a division factor for the rotary encoder output pulse generator.	1.00 DFNC Beginner
Rotary Encoder Direction	rotaryEncoderDirection	Specifies the phase which defines the encoder forward direction.	1.00 Expert DFNC
Clockwise	*Clockwise*	*Inspection goes forward when the rotary encoder direction is clockwise (phase B is ahead of phase A).*	
Counter Clockwise	*CounterClockwise*	*Inspection goes forward when the rotary encoder direction is counter clockwise (phase A is ahead of phase B).*	

Display Name	Feature & Values	Description	Device Version & View
Rotary Encoder Input A Source	rotaryEncoderInputASource	Rotary Encoder Input A Assignment	1.00 Expert DFNC
Line 1	*Line1*	*Line1 is assigned to the Rotary Encoder Input A.*	
Rotary Encoder Input B Source	rotaryEncoderInputBSource	Selects which input line to assign to the Rotary Encoder input B (also known as shaft encoder). **Note:** that the Line Mode feature must be set to Input. The list of supported input line sources is device-specific.	1.00 Expert DFNC
GND	*GND*	*Rotary Encoder Input B is not used.*	
Line 2	*Line2*	*Line2 is assigned to the Rotary Encoder Input B.*	
Rotary Encoder Source Activation	rotaryEncoderSrcActivation	Specifies the signal edge(s) used to increment the rotary encoder.	1.00 Expert DFNC
Rising Edge	*RisingEdge*	*The rotary encoder uses the rising edge of the source signal.*	
Rotary Encoder Multiplier	rotaryEncoderMultiplier	Specifies a multiplication factor for the rotary encoder output pulse generator.	1.00 Expert DFNC
Rotary Encoder Divider	rotaryEncoderDivider	Specifies a division factor for the rotary encoder output pulse generator.	1.00 Expert DFNC
Line Selector	LineSelector	Selects the physical line (or pin) of the external device connector to configure.	1.00 Beginner
Line 1 *Line 2*	*Line1* *Line2*	*Index of the physical line and associated I/O control block to use.*	
Line Format	LineFormat	Specify the current electrical format of the selected physical input or output. Applies to all physical lines.	1.00 Expert
Opto-Coupled	*OptoCoupled*	*The line is opto-Coupled.*	
Line Mode	LineMode	Reports if the physical line is an Input or Output signal.	1.00 Expert
Input	*Input*	*The line is an input line.*	
Output	*Output*	*The line is an output line.*	
Input Line Detection Level	lineDetectionLevel	Specifies the voltage threshold required to recognize a signal transition on an input line.	1.00 Expert DFNC
Threshold for TTL	*Threshold_for_TTL*		
Line Status	LineStatus	Returns the current status of the selected input or output line. (RO)	1.00 Expert
False / True	*False / True*	*A signal below 0.8V will be detected as a Logical LOW and a signal greater than 2.4V will be detected as a Logical HIGH on the selected input line.*	
Line Inverter	LineInverter	Controls whether to invert the polarity of the selected input or output line signal.	1.00 Beginner
False / True	*False / True*		
Input Line Debouncing Period	lineDebouncingPeriod	Specifies the minimum delay before an input line voltage transition is recognized as a signal transition.	1.00 Beginner DFNC
Line Electrical Termination	lineElectricalTermination	Controls if the electrical termination of the selected line is enabled or disabled.	1.00 Expert DFNC
Disabled	*Disabled*	*Disables electrical line termination for the selected line.*	
Enabled	*Enabled*	*Enables electrical line termination for the selected line.*	

Display Name	Feature & Values	Description	Device Version & View
Output Line Source	outputLineSource	Selects which internal signal or event driven pulse or software control state to output on the selected line. **Note:** The Line Mode feature must be set to Output. The List of supported output line sources is product-specific. The Event Control section provides details and timing diagrams for the supported trigger modes.	1.00 Beginner DFNC
Off	*Off*	*Line output is Open.*	
Software Controlled	*SoftwareControlled*	*The OutputLineValue feature changes the state of the output.*	
Pulse on: Start of Frame	*PulseOnStartofFrame*	*Generate a pulse on the start of the Frame Active event.*	
Pulse on: Start of Line	*PulseOnStartofLine*	*Generate a pulse on the start of the Line Active.*	
Pulse on: Start of Exposure	*PulseOnStartofExposure*	*Generate a pulse on the ExposureStart event. This option is typically used to trigger a strobe light.*	
Pulse on: End of Exposure	*PulseOnEndofExposure*	*Generate a pulse on the ExposureEnd event. This option is typically used to trigger a strobe light.*	
Pulse on: Start of Readout	*PulseOnStartofReadout*	*Generate a pulse on the ReadoutStart event.*	
Pulse on: End of Readout	*PulseOnEndofReadout*	*Generate a pulse on the ReadoutEnd event.*	
Pulse on: Valid Line Trigger	*PulseOnValidLineTrigger*	*Generate a pulse on the LineTrigger event.*	
Pulse on: Invalid Line Trigger	*PulseOnInvalidLineTrigger*	*Generate a pulse on the Invalid LineTrigger event.*	
Puls on: Rejected Frame Trigger	*PulseOnInvalidFrameTrigger*	*Generate a pulse on the Invalid Frame Trigger event.*	
Pulse on: Start of Acquisition	*PulseOnStartofAcquisition*	*Generate a pulse when the AcquisiontStart event occurs.*	
Pulse on: End of Acquisition	*PulseOnEndofAcquisition*	*Generate a pulse when the AcquisiontStop event occurs.*	
Pulse on: End of Timer 1	*PulseOnTimer1End*	*Generate a pulse on the TimerEnd 1 event.*	
Pulse on: End of Counter 1	*PulseOnCounter1End*	*Generate a pulse on the CounterEnd 1 event.*	
Pulse on: Input Line 1 Signal	*PulseOnInput1*	*Generate a pulse on the Input signal 1 pulse.*	
Pulse on: Input Line 2 Signal	*PulseOnInput2*	*Generate a pulse on the Input signal 2 pulse.*	
Pulse on: Rotary Encoder 1	*PulseOnRotaryEncoder1*	*Generate a pulse on the Rotary Encoder 1 event.*	
Pulse on: Software Command	*PulseOnSoftwareCmd*	*Generate a pulse on the Input of a Software Command.*	
Frame Trigger	*FrameTriggerActive*	*Generate a signal that is active when the frame trigger is active.*	
Frame Valid	*FrameActive*	*Generate a signal that is active when the Frame is active.*	
Exposure Active	*ExposureActive*	*Generate a signal that is active when the Exposure is active.*	
Line Active	*ReadoutActive*	*Generate a signal that is active when the line valid is active.*	
Smart Strobe Active	*SmartStrobeActive*	*Generate a signal that is active when the Readout or the ExposureDelay are active. The smart strobe only works when triggerLineCount is greater than 1*	
Output Line Pulse Signal Activation	outputLinePulseActivation	Specifies the input line activation mode to trigger the OutputLine pulse.	1.00 Beginner DFNC
Rising Edge	*RisingEdge*	*Specifies that the trigger is considered valid on the rising edge of the source signal.*	
Falling Edge	*FallingEdge*	*Specifies that the trigger is considered valid on the falling edge of the source signal.*	
Any Edge	*AnyEdge*	*Specifies that the trigger is considered valid on the falling or rising edge of the source signal.*	

Display Name	Feature & Values	Description	Device Version & View
Output Line Pulse Delay	outputLinePulseDelay	Sets the delay (in µs) before the output line pulse signal. Applicable for the OutputLineSource feature. Note, the LineMode feature must be set to output.	1.00 Beginner DFNC
Output Line Pulse Duration	outputLinePulseDuration	Sets the width (duration) of the output line pulse in microseconds.	1.00 Beginner DFNC
Output Line Software Latch Control	outputLineSoftwareLatchControl	When Off, the selected output line is set with the value in Output Line Value. (RO)	1.00 Invisible DFNC
Off	*Off*	*Output pin state set by outputLineValue.*	
Output Line Value	outputLineValue	Sets the output state of the selected Line if the outputLineSoftwareLatchControl = OFF. OutputLineSource must be SoftwareControlled. If the outputLineSoftwareLatchControl = Latch , the state of the pin will change with the outputLineSoftwareCmd command.	1.00 Beginner DFNC
Active	*Active*	*Sets the Output circuit to close.*	
Inactive	*Inactive*	*Sets the Output circuit to open.*	
Line Status All	LineStatusAll	Returns the current status of all available line signals, at time of polling, in a single bitfield. The order is Line1, Line2, Line3, ... (RO)	1.00 Expert
Output Line Software Command	outputLineSoftwareCmd	Writing a value of 1 in the bit field executes the PulseOnSoftwareCmd for any output line programmed for software control. The feature outputLineSoftwareCmd can take any binary value and each bit set to 1 corresponds to a Icommand for an Output. Note that Outputs are numbered from 1 to N, therefore Bit 1 of outputLineSoftwareCmd corresponds to Output1. This is applicable to OutputLineSource = Pulse On.	1.00 Expert DFNC

I/O Module Block Diagram

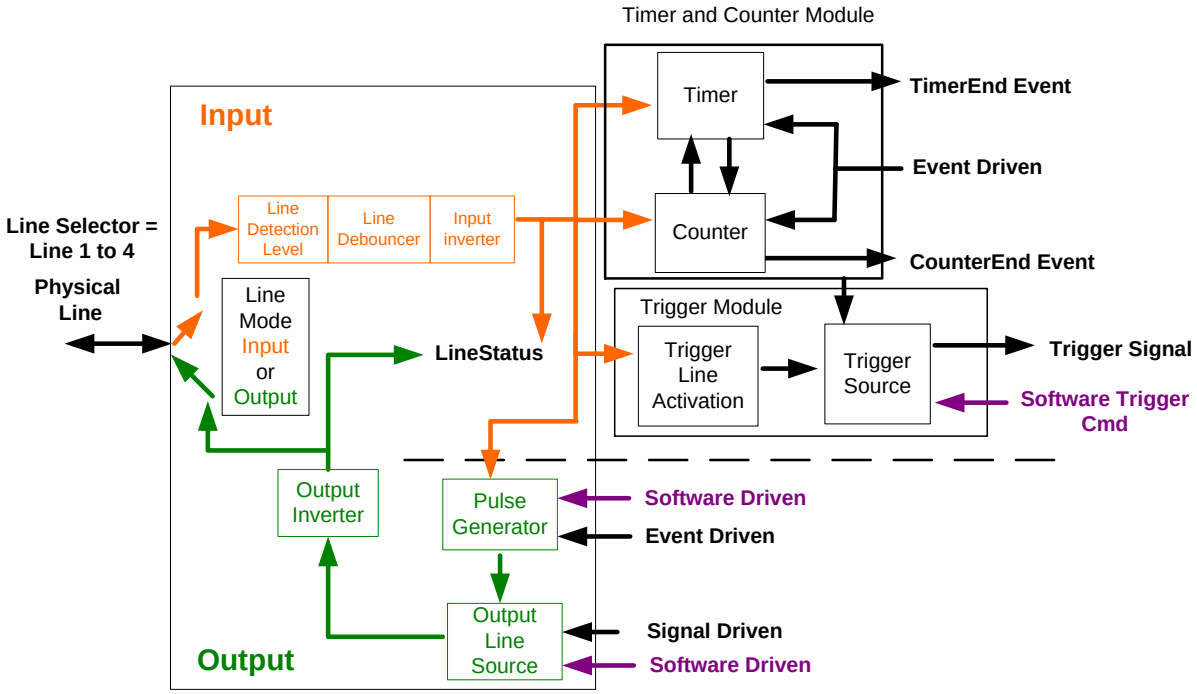


Figure 19: I/O Module Block Diagram

Trigger Overview

Linea SWIR GigE line exposures are initiated by a trigger event. The device can acquire images using its own internal trigger (free-running mode) or using an external trigger (EXSYNC) with several options for the trigger source.

A trigger can be:

- the camera's programmable internal clock used in free running mode
- an external input used for synchronizing exposures to external triggers
- a programmed function call message by the controlling computer.

Trigger Modes

The Trigger Mode feature determines if the camera is in free-running mode or uses an external trigger.

- **Free running —** (Trigger Mode = *Off*): The free-running mode has programmable internal timers for line rate/exposure period. In this mode, the maximum exposure time is determined by the Acquisition Line Rate feature.
- **External trigger** (Trigger Mode = *On*): Exposures are controlled by an external or internal trigger signal. The Trigger Source feature determines the specific input line or source. External signal inputs have a time programmable debounce circuit.

For any exposure type, a virtual frame is specified by the number of lines per frame as set by the Height feature. A buffer contains one virtual frame.

In case the trigger frequency exceeds the allowable line rate, the camera will buffer one trigger.

If the Acquisition Line Rate is reduced and / or frame buffer Height is increased, the value of the Image Timeout feature (part of the GigE Vision Host Control category) may require increasing (see Buffer Incomplete Error Message).

If error messages are shown in the Output Messages pane, try increasing the value of the Linea SWIR GigE Interpacket Delay feature available from the GigE Vision Transport Layer Category group in CamExpert. An increase from default may correct errors with NIC interfaces that do not have adequate performance. For more information, refer to Teledyne DALSA Network Imaging Package for Sapera LT Optimization Guide, available through the Start menu under Teledyne DALSA.

External Triggers

The Trigger Selector feature selects the type of external trigger to use and configure.

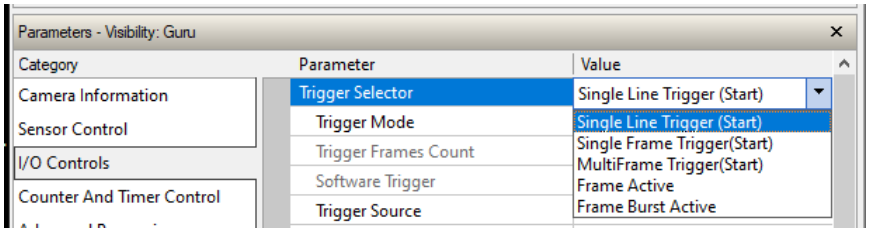


Figure 20: CamExpert – Trigger Selector

Three types of external trigger are available:

- **Single Line Trigger (Start):** Starts the acquisition of one line when acquisition is active. While the Single Line Trigger is active image frame buffers will continuously be filled. If the trigger stops while capturing a frame, a partial frame will be acquired and the remaining lines filled with pixel value 0. The next trigger following a pause will start a new frame.
- **Single Frame Trigger (Start):** Starts the acquisition of one frame when the acquisition is active. The number of lines in the frame is defined by the Height feature.
- **MultiFrame Trigger (Start):** Starts the acquisition of a number of frames. The number of frames in this burst mode is defined by the Trigger Frames Count feature. No line is lost between frames.
- **Frame Active:** Starts the acquisition of a single frame. The width of the trigger signal controls the number of lines in the frame, up to the maximum set by the Height feature.
- **Frame Burst Active:** Starts the continuous acquisition of frames. No line is lost between frames. The width of the trigger signal controls the number of frames to capture.

Note: The Single Frame Trigger and MultiFrame Trigger are mutually exclusive; that is, only one type of frame trigger may be used at a time.

Single Frame Trigger

The following timing diagram shows an example of grabbing images (Height = 10) using a single frame trigger to define when an image line is stored at the beginning of the frame buffer.

In this example, the single frame trigger is configured for rising edge. The single line acquisition trigger can be generated by an external trigger, timestamp modulo or internal clock (free-running).

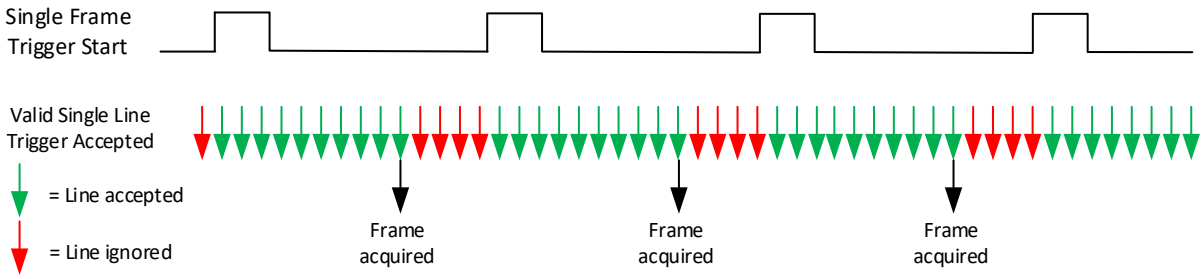


Figure 21: 10-Line Single Frame Trigger Example

MultiFrame Trigger

The following timing diagram shows a multiframe trigger example grabbing 3 frames (Height = 10, Trigger Frame Count = 3).

In this example, the multiframe trigger is configured for rising edge. The single line acquisition trigger can be generated by an external trigger, timestamp modulo or internal clock (free-running).

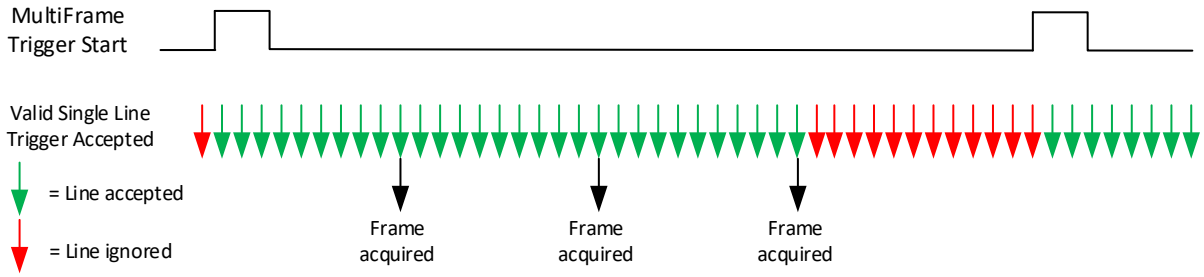


Figure 22: 10-Line Single Frame Trigger Example

If the acquisition of consecutive images of the specified Trigger Frame Count is interrupted before the count is reached no additional frames will be acquired for the MultiFrame trigger that initiated the acquisition.

Trigger Source Types

- **Trigger Source = Line x.** Line Input x is used as an external trigger source. The width of the trigger signal can be used to control the exposure time by setting Exposure Mode = *Trigger Width* (Sensor Control category).
- **Trigger Source = Rotary Encoder.** External trigger is via one or both Rotary Encoder inputs. A number of features allow selecting encoder signal direction, scaling and other parameters, to suit the imaging application. This option is only available when Trigger Selector = *Single Line Trigger(Start)*.

- **Trigger Source = Timer1End Event.** Timer1End Event is used as the internal trigger source. Refer to Counter and Timer Control Category for information on those features.
- **Trigger Source = Counter1End Event.** Counter1End Event is used as the internal trigger source.

Input Line Details

The input line signals have the following features for control or status indication.

- **Feature Set:** LineSelector (R/W), LineFormat (R/W), LineMode (R/W), lineDebouncingPeriod (RW), LineInverter (R/W), LineStatus (RO), lineDetectionLevel.
- **Connector:** See Connectors section for connector pinout and electrical information. The cable shell and shield should electrically connect the camera's chassis to computer chassis for maximum EMI protection.
- **Line Transition Validation:** Each input incorporates a signal debounce circuit to eliminate shot noise transitions that could be wrongly interpreted as a valid pulse. The duration is user - programmable from 0 to 255 µs with CamExpert.
- **Line Input Signal Characteristics:** See Input Signals Electrical Specifications.

Output Line Details

The output line signals are dedicated outputs.

- **Feature Set:** LineInverter (R/W), outputLineSource (R/W), outputLinePulseDelay (R/W), outputLinePulseDuration (R/W), outputLineValue (R/W), outputLineSoftwareCmd (R/W), LineSelector (R/W), LineFormat (R/W), LineMode (R/W), LineStatus (RO). See Output Signals Electrical Specifications for more information.
- **External Outputs:** Used to control external lighting or generate programmable pulses.
- **Output on Events:** Each output can be set independently to one of the available event modes defined by the outputLineSource feature. The output delay can be set from 0 to 16 seconds, in increments of 1 µs. The pulse duration can be set from 1 to 16 seconds in increments of 1 µs.

Output Line Delay Constraints

- The exposure maximum delay specified by the user should not exceed the period of the signal.
- If the exposure trigger is edge rather than level, the delay should not exceed half the period.
- In case these conditions are violated, the camera simply ignores any new transitions / pulses / triggers until the specified delay has passed.

Counter and Timer Control Category

The Linea SWIR GigE Camera's Counter and Timer Controls shown in CamExpert groups parameters used to configure acquisition counters, timers and signal edge detection.

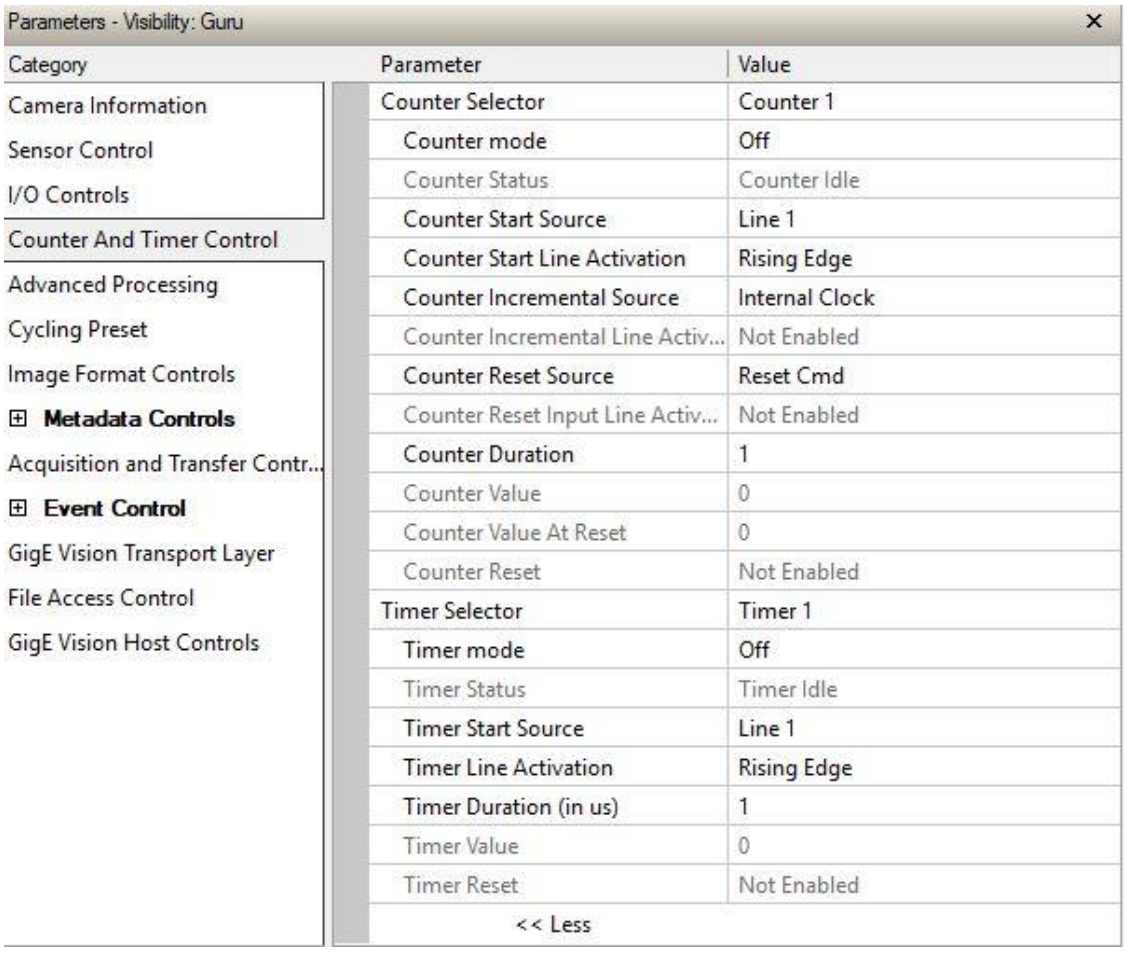


Figure 23: Counter and Timer Features

Counter and Timer Control Feature Description

Display Name	Feature & Values	Description	Device Version & View
Counter Selector	counterSelector	Selects the counter to configure.	1.00 Expert DFNC
Counter 1	*Counter1*	*Select counter 1.*	
Counter Mode	counterMode	Selects the counter mode. The selected Counter is either Active or Disabled. When Disabled, the Counter can be configured.	1.00 Expert DFNC
Off	*Off*	*The selected Counter is Disabled.*	
Active	*Active*	*The selected Counter is Enabled.*	
Counter Status	counterStatus	Returns the current state of the counter. (RO)	1.00 Expert DFNC
Counter Idle	*CounterIdle*	*The counter is idle.* *The CounterStartSource feature is set to off.*	
Counter Trigger Wait	*CounterTriggerWait*	*The counter is waiting for a start trigger.*	
Counter Active	*CounterActive*	*The counter is counting for the specified duration.*	
Counter Completed	*CounterCompleted*	*The counter reached the CounterDuration count.*	
Counter Overflow	*CounterOverflow*	*The counter reached its maximum possible count.*	
Counter Start Source	counterStartSource	Select the counter start source. Counter increments from 0 to the value of the counterDuration feature.	1.10 Expert DFNC
Off	*Off*	*Counter is stopped.*	
Acquisition Start	*AcquisitionStart*	*Counter starts on the reception of the Acquisition Start event.*	
Exposure Start	*ExposureStart*	*Counter starts on the reception of the Exposure Start event.*	
Exposure End	*ExposureEnd*	*Counter starts on the reception of the Exposure End event.*	
Frame Start	*FrameStart*	*Counter starts on the reception of the Frame Start event.*	
Rejected Frame Trigger	*InvalidFrameTrigger*	*Counter starts on the reception of the Invalid Frame Trigger.*	
Rejected Trigger	*InvalidTrigger*	*Counter starts on the reception of the Invalid Trigger.*	
Line 1	*Line1*	*Counter starts on the specified transitions on Line 1.*	
Line 2	*Line2*	*Counter starts on the specified transitions on Line 2.*	
Timer 1 End	*Timer1End*	*Counter starts on the reception of the Timer 1 End event.*	
Counter 1 End	*Counter1End*	*Counter starts on the reception of the Counter 1 End event.*	
Counter Start Line Activation	counterStartLineActivation	Select the activation mode of the input line trigger which starts the counter. This is only applicable when the counterStartSource feature selects a physical Line.	1.00 Expert DFNC
Rising Edge	*RisingEdge*	*Starts counting on rising edge of the selected Line.*	
Falling Edge	*FallingEdge*	*Starts counting on falling edge of the selected Line.*	
Any Edge	*AnyEdge*	*Starts counting on the falling or rising edge of the selected Line.*	

Display Name	Feature & Values	Description	Device Version & View
CounterIncremental Source	counterIncrementalSource	Select the event source which increments the counter. The Event Control section provides details and timing diagrams for the supported events.	1.00 Expert DFNC
Off	*Off*	*Counter is stopped.*	
Acquisition Start	*AcquisitionStart*	*Counts the number of Acquisition Start events.*	
Exposure Start	*ExposureStart*	*Counts the number of Exposure Start events.*	
Exposure End	*ExposureEnd*	*Counts the number of Exposure End events.*	
Frame Start	*FrameStart*	*Counts the number of Frame Start events.*	
Line 1	*Line1*	*Counts the number of transitions on Line 1 (based on the counterIncrementalLineActivation feature setting)*	
Line 2	*Line2*	*Counts the number of transitions on Line 2 (based on the counterIncrementalLineActivation feature setting)*	
Rotary Encoder	*rotaryEncoder1*	*The counter increments on rotary encoder ticks.*	
Internal Clock	*InternalClock*	*The counter increments on each microsecond tick of the device internal Clock.*	
Timer 1 End	*Timer1End*	*Counts the number of Timer 1 End events.*	
Rejected Trigger	*InvalidTrigger*	*Counts the number of invalid triggers.*	
Counter Incremental Line Activation	counterIncrementalLineActivation	Selects the counter signal activation mode for line inputs. The counter increments on the specified signal edge or level.	1.00 Expert DFNC
Rising Edge	*RisingEdge*	*Increment the counter on the rising edge of the selected I/O Line.*	
Falling Edge	*FallingEdge*	*Increment the counter on the falling edge of the selected I/O Line.*	
Any Edge	*AnyEdge*	*Increment the counter on the falling or rising edge of the selected I/O Line.*	
Counter Reset Source	counterResetSource	Selects the signal source to reset the counter then waits for the next countStartSource signal or event.	1.00 Expert DFNC
Reset Cmd	*Off*	*Reset on reception of the Reset Icommand.*	
Acquisition Start	*AcquisitionStart*	*Reset on reception of the Acquisition Start.*	
Acquisition End	*AcquisitionEnd*	*Reset on reception of the Acquisition End.*	
Exposure Start	*ExposureStart*	*Reset on reception of the Exposure Start event.*	
Exposure End	*ExposureEnd*	*Reset on reception of the Exposure End event.*	
Frame Trigger	*FrameStart*	*Reset on reception of the Frame Trigger.*	
Valid Frame Trigger	*ValidFrameTrigger*	*Reset on reception of the Valid Frame Trigger.*	
Rejected Frame Trigger	*InvalidFrameTrigger*	*Reset on reception of the Invalid Frame Trigger.*	
MultiFrame End Trigger	*FrameBurstEnd*	*Reset on reception of the Frame Burst end.*	
Line 1	*Line1*	*Reset counter on the specified transition on line 1.*	
Line 2	*Line2*	*Reset counter on the specified transition on line 2.*	
Timer 1 End	*Timer1End*	*Reset on reception of the Timer 1 End.*	
Counter 1 End	*Counter1End*	*Reset on the reception of the Counter 1 End.*	

Display Name	Feature & Values	Description	Device Version & View
Counter Reset Input Line Activation	counterResetLineActivation	Specify the edge transition on the selected line that will reset the selected counter.	1.00 Expert DFNC
Rising Edge	*RisingEdge*	*Reset counter on rising edge of the selected signal.*	
Falling Edge	*FallingEdge*	*Reset counter on falling edge of the selected signal.*	
Any Edge	*AnyEdge*	*Reset counter on the falling or rising edge of the selected signal.*	
Counter Duration	counterDuration	Sets the duration (or number of events) before the CounterEnd event is generated.	1.00 Expert DFNC
Counter Value	counterValue	Read the current value of the selected counter. (RO)	1.00 Expert DFNC
Counter Value At Reset	counterValueAtReset	Reads the value of the selected counter when it was reset by a trigger or by an explicit Counter Reset command. (RO)	1.00 Expert DFNC
Counter Reset	counterReset	Resets the selected counter to zero. The counter starts immediately after the reset. To temporarily disable the counter, set the Counter Event Source feature to Off. (WO)	1.00 Expert DFNC
Timer Selector	timerSelector	Selects which timer to configure.	1.00 Expert DFNC
Timer 1	*Timer1*	*Configure Timer 1.*	
Timer Mode	timerMode	Select the timer mode. The selected Timer is Active or Disabled. When Disabled, the Timer can be configured.	1.00 Expert DFNC
Off	*Off*	*The selected Timer is Disabled.*	
Active	*Active*	*The selected Timer is Enabled.*	
Timer Status	timerStatus	Returns the current state of the timer. (RO)	1.00 Expert DFNC
Timer Idle	*TimerIdle*	*The timer is idle. The CounterStartSource feature is set to off.*	
Timer Trigger Wait	*TimerTriggerWait*	*The timer is waiting for a start trigger.*	
Timer Delaying	*TimerDelaying*	*The timer is counting the requested delay.*	
Timer Active	*TimerActive*	*The timer is counting for the specified duration.*	
Timer Completed	*TimerCompleted*	*The timer reached the TimerDuration count.*	
TimerStartSource	timerStartSource	Select the trigger source to start the timer. The Event Control section provides details and timing diagrams for the supported events.	1.00 Expert DFNC
TimerReset Cmd	*Off*	*Start on reception of the TimerReset Icommand.*	
Acquisition Start	*AcquisitionStart*	*Start Timer on Acquisition Start event.*	
Exposure Start	*ExposureStart*	*Start Timer on Exposure Start event.*	
Frame Start	*FrameStart*	*Start Timer on Frame Start event.*	
Line 1	*Line1*	*Start Timer on a transition of I/O Line 1 event.*	
Line 2	*Line2*	*Start Timer on a transition of I/O Line 2 event.*	
Timer 1 End	*Timer1End*	*Start Timer on Timer 1 End event.*	
Counter 1 End	*Counter1End*	*Start Timer on Counter 1 End event.*	

Display Name	Feature & Values	Description	Device Version & View
Timer Line Activation	timerStartLineActivation	Select the trigger activation mode which starts the timer.	1.00 Expert DFNC
Rising Edge	*RisingEdge*	*Starts counter on rising edge of the selected signal.*	
Falling Edge	*FallingEdge*	*Starts counter on falling edge of the selected signal.*	
Any Edge	*AnyEdge*	*Starts counter on the falling or rising edge of the selected signal.*	
Timer Delay	timerDelay	Sets the duration (in microseconds) of the delay to apply at the reception of a trigger before starting the timer.	1.00 Expert DFNC
Timer Duration	timerDuration	Sets the duration (in microseconds) of the timer pulse.	1.00 Expert DFNC
Timer Value	timerValue	Reads the current value (in microseconds) of the selected timer.	1.00 Expert DFNC
Timer Reset	timerReset	Resets the timer to 0.	1.00 Expert DFNC

Counter and Timer Block Diagram

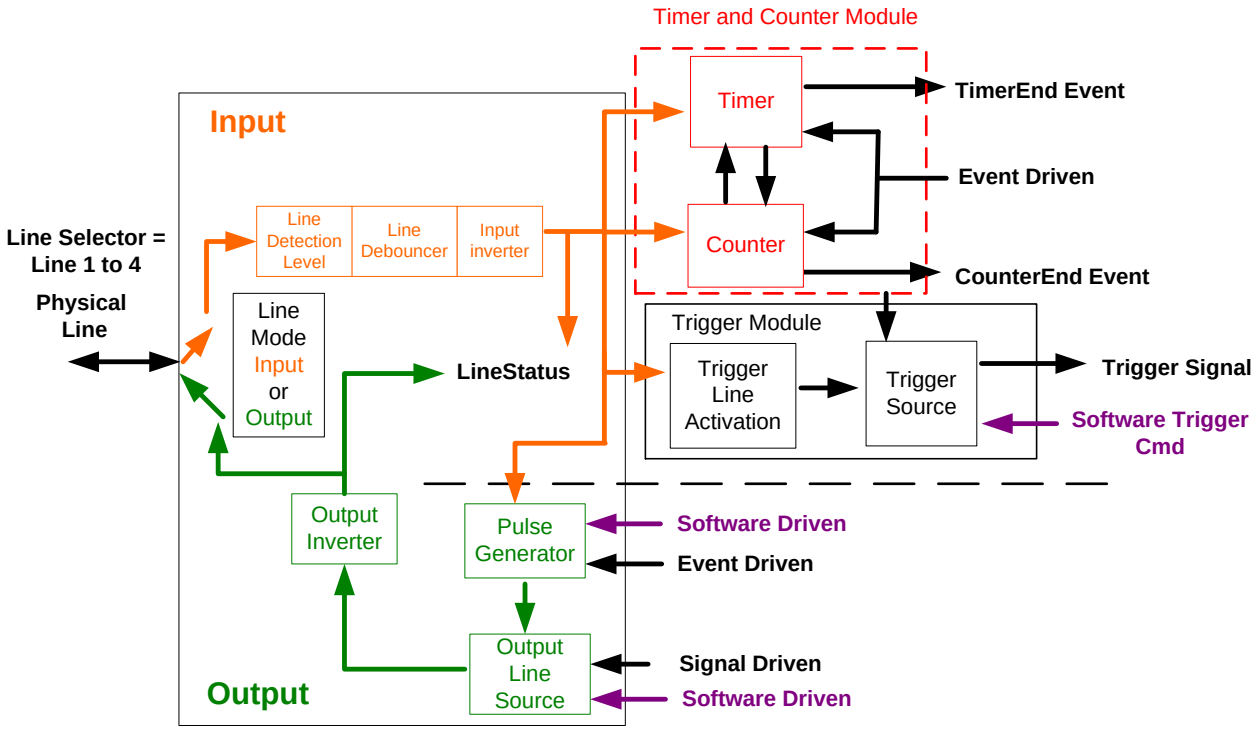


Figure 24: Counter and Timer Block Diagram

Example: Counter Start Source = OFF

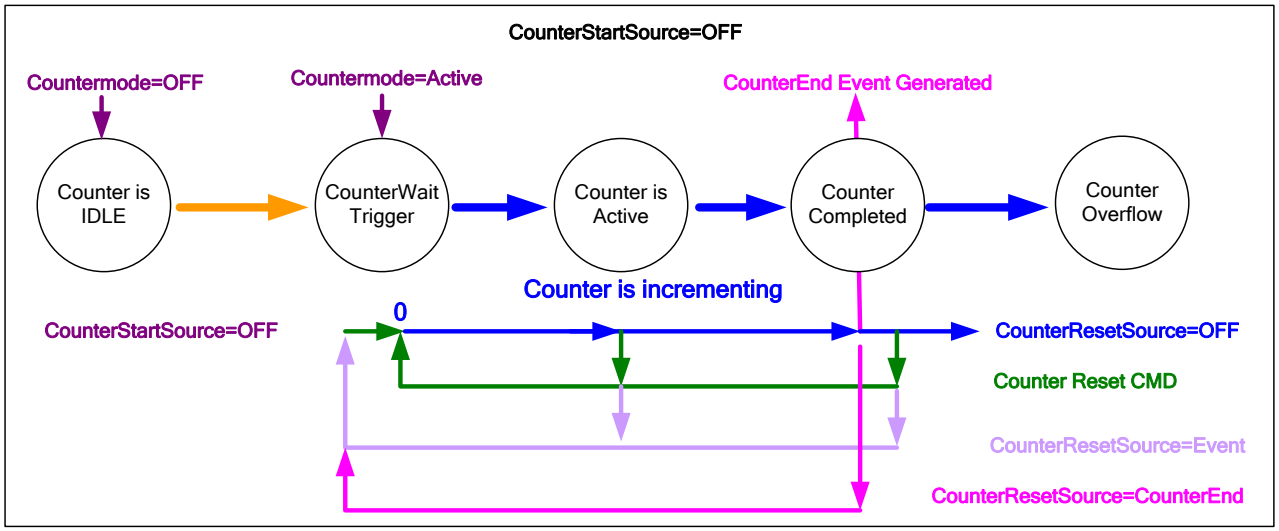


Figure 25: Counter Start Source = OFF

- The counter starts on the **counterReset Cmd**.
- The counter continues unless a new **counterReset Cmd** is received. That restarts the counter at 00.
- When **Counter Reset Source = 'Event' or 'CounterEnd'** the counter is reset to 00 but does not restart counting until the next **CounterReset Cmd**.

Example: Counter Start Source = CounterEnd (itself)

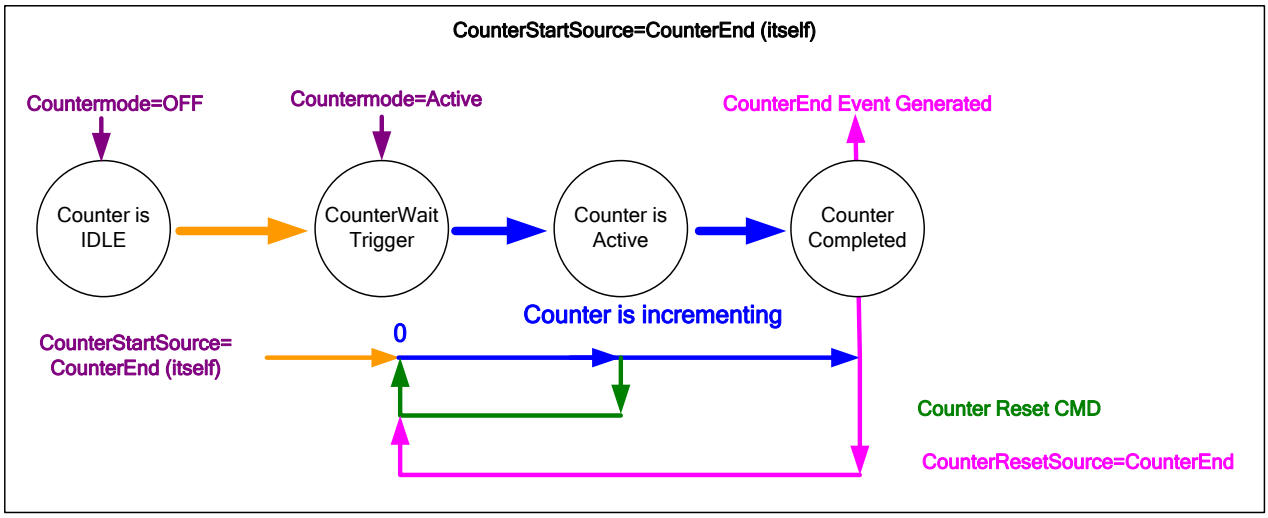


Figure 26: Counter Start Source = CounterEnd

- Counter starts when Counter Mode is set to Active.
- A **Counter Reset CMD** will reset the counter to 00 and continue counting.
- **counterResetSource** must be set to **CounterEnd**. When the counterValue feature reaches the counterDuration value an event is generated and the counter is reset to 00 and continues.

Example: CounterStartSource = EVENT and Signal (Edge Base)

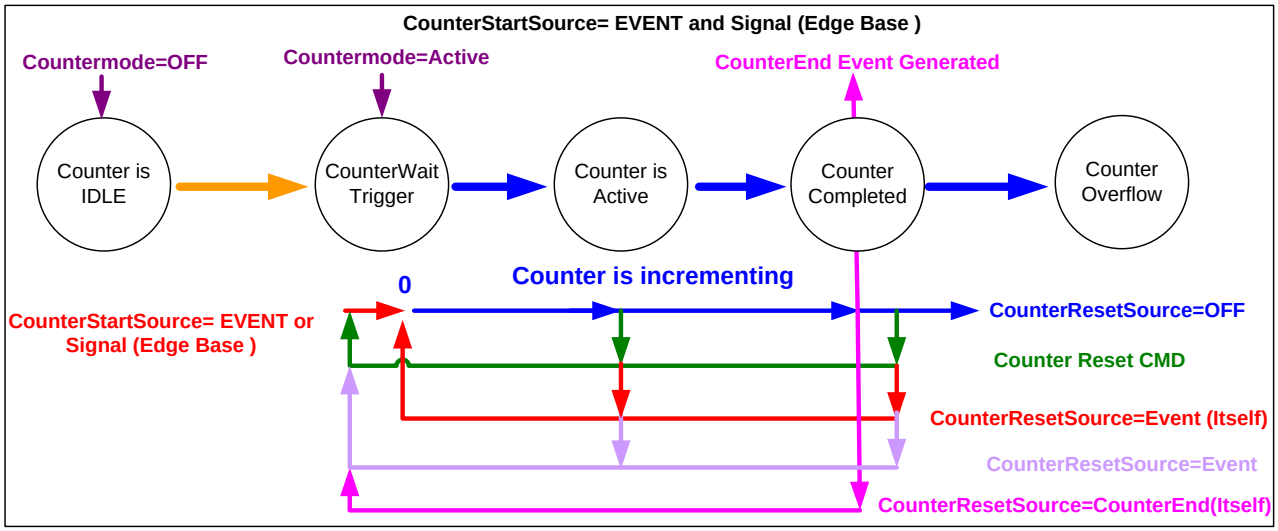


Figure 27: CounterStartSource = EVENT

Example: CounterStartSource = Signal (Level Base) Example 1

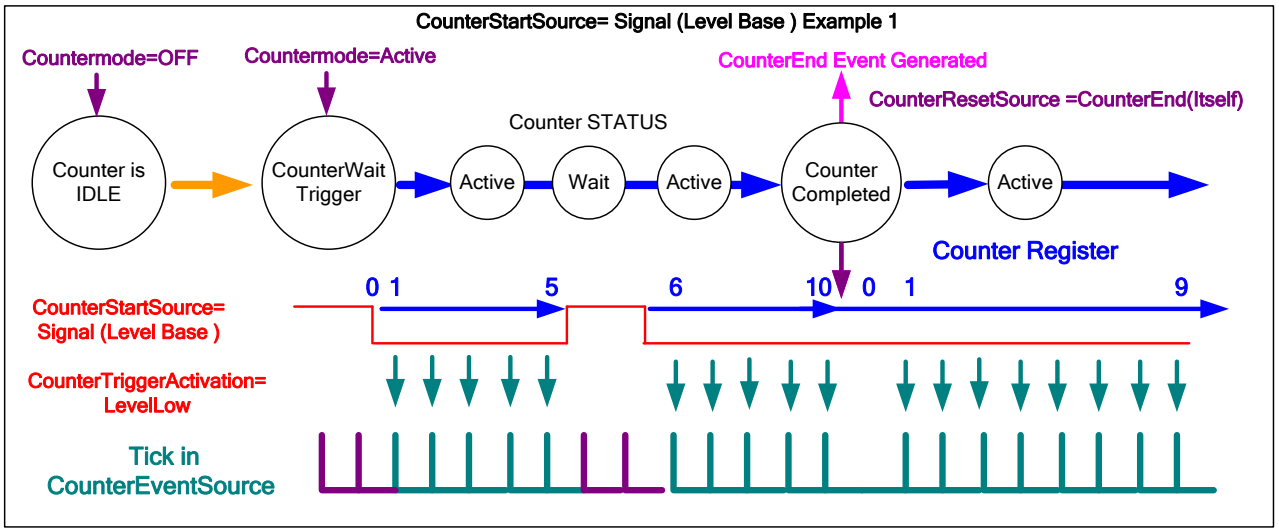


Figure 28: CounterStartSource = Signal

Example: CounterStartSource = Line (Edge Base) Example 2

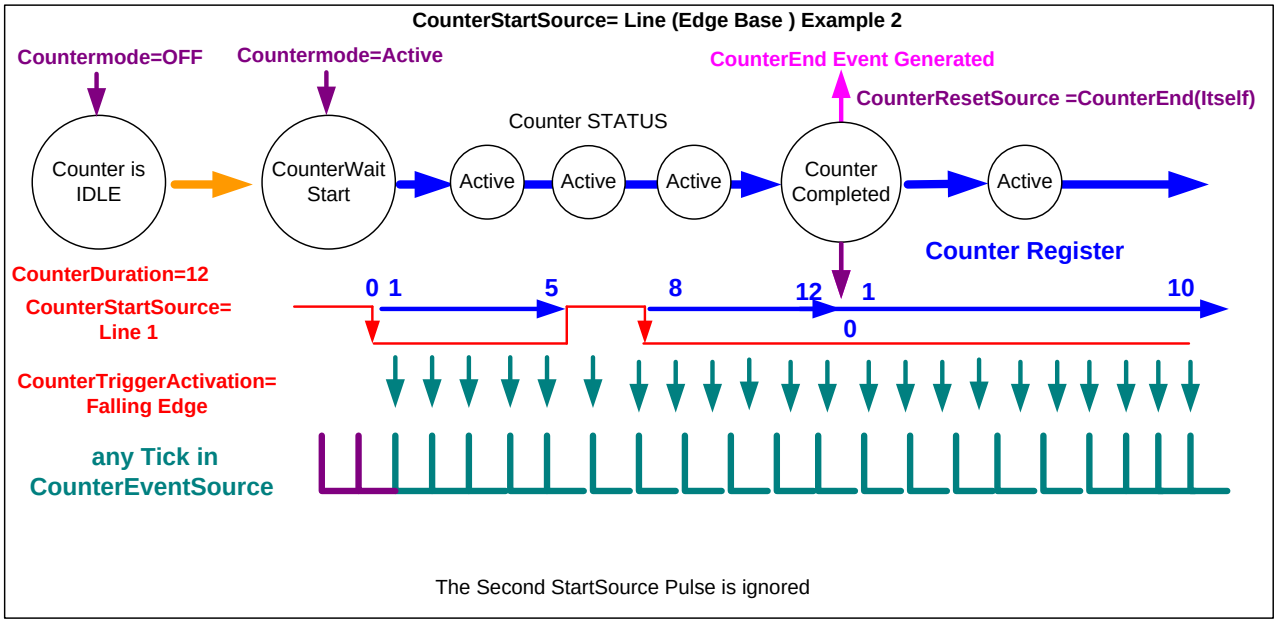


Figure 29: CounterStartSource = Line

Note: Counters and events with trigger or exposure sources will, for each frame or multi-frame acquisition of Y lines, report Y+1 triggers. This is due to each trigger starting both a new acquisition and reading out the previous acquisition. See Trigger Overview for more details.

Advanced Processing Control Category

The Linea SWIR GigE Camera's Advanced Processing controls shown by CamExpert group's parameters used to configure Flat Field calibration.

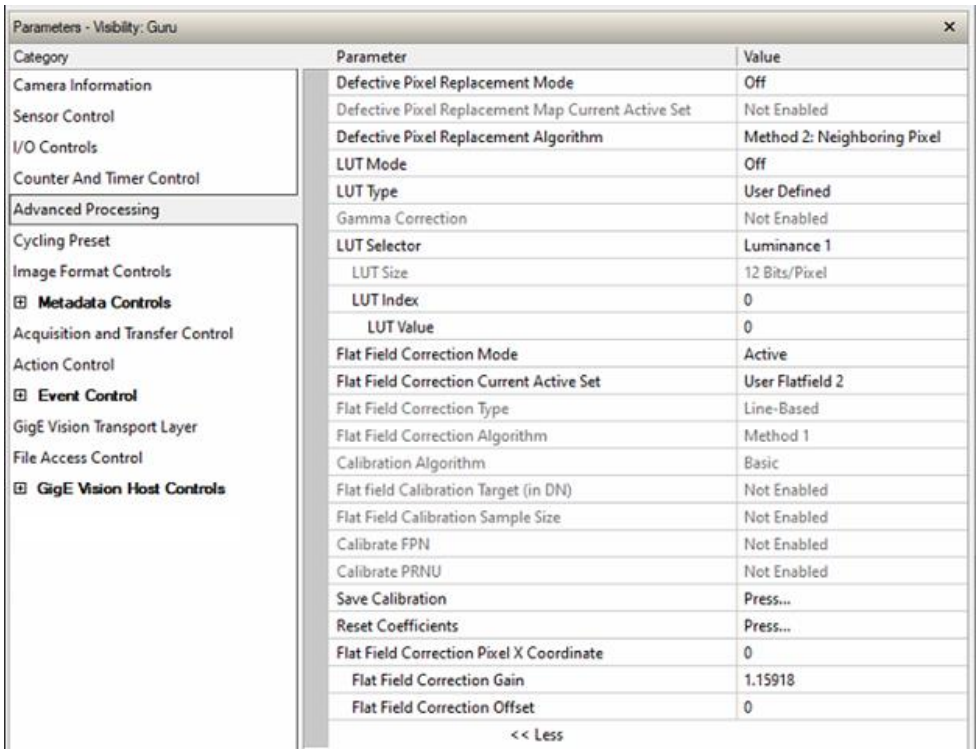


Figure 30: Advanced Processing Features

Advanced Processing Control Feature Descriptions

Display Name	Feature & Values	Description	Device Version & View
Defective Pixel Replacement Mode	defectivePixelReplacementMode	Sets the mode for the defective pixel replacement.	1.00 Expert DFNC
Off	*Off*	*Defective Pixel Replacement is disabled.*	
Active	*Active*	*Defective Pixel Replacement is enabled.*	
Defective Pixel Replacement Map Current Active Set	defectivePixelReplacementMapCurrentActiveSet	Sets the defective pixel replacement set.	1.00 Expert DFNC
Factory Map	*FactoryMap*	*Sets the factory coefficient table as active.*	
User Map 1	*UserMap1*	*Sets the User Map coefficient table as active.*	
Defective Pixel Replacement Algorithm	defectivePixelReplacementAlgorithm	Specifies the defective pixel replacement algorithm.	1.00 Expert DFNC
Method 1: Average Two Adjacent Pixels	*Method1*	*This algorithm replaces a defective pixel with the average value of the pixel to the left and right of the pixel to be replaced.*	
Method 2: Neighboring Pixel	*Method2*	*This algorithm replaces a defective pixel with a neighbor.*	

Display Name	Feature & Values	Description	Device Version & View
LUT Mode	lutMode	Sets the enable state of the selected LUT module (Lookup Table).	
Off	*Off*	*Disables the LUT.*	
Active	*Active*	*Enables the LUT module.*	
LUT Type	lutType	Displays the LUT type of the currently selected Lookup Table.	
User Defined	*UserDefined*	*Uses the user programmable LUT.*	
Gamma Correction	*GammaCorrection*	*Uses gamma LUT.*	
Gamma Correction	gammaCorrection	Sets the gamma correction factor (i.e. inverse gamma). The gamma correction is applied as an exponent to the original pixel value. (Min: 0.001, Max: 2.0, Increment: 0.001)	
LUT Current Active Set	lutCurrentActiveSet	Specifies the current LUT to use.	
User Defined 1	*UserDefined1*	*Sets the current LUT as User Defined 1.*	
User Defined 2	*UserDefined2*	*Sets the current LUT as User Defined 2.*	
LUT Selector	LUTSelector	Selects which LUT to control and adjust features.	
User Defined 1	*UserDefined1*	*User Defined 1 is under control.*	
User Defined 2	*UserDefined2*	*User Defined 1 is under control.*	
LUT Size	lutSize	Specify the LUT size of the selected LUT (Lookup Table). Available choices are model dependent.	
8 Bits/Pixel *10 Bits/Pixel* *12 Bits/Pixel*	*Bpp8* *Bpp10* *Bpp12*	*8 bits per pixel.* *10 bits per pixel.* *12 bits per pixel.*	
LUT Index	LUTIndex	Selects the index (offset) of the coefficient to access in the selected LUT.	
LUT Value	LUTValue	Returns the value at specified LUT index entry of the LUT selected by the LUT Selector feature.	
Flat Field Correction Mode	flatfieldCorrectionMode	Sets the mode for the Flat Field correction.	1.00 Beginner DFNC
Off	*Off*	*Flat Field Correction is disabled.*	
Active	*Active*	*Flat Field Correction is enabled.*	
Calibration	*Calibration*	*When selected, the camera is configured for flat field correction calibration. The device may automatically adjust some of its features when calibrate mode is enabled. The features that are automatically adjusted are device specific. The device will not restore these features when the Flat Field Correction Mode feature is changed from Calibrate mode to another mode.*	
Flat Field Correction Current Active Set	flatfieldCorrectionCurrentActiveSet	Specifies the current set of Flat Field coefficients to use.	1.00 Beginner DFNC
Factory Flatfield	*FactoryFlatfield*	*Sets the factory Flat Field coefficient table as the current Flat Field.*	
User Flatfield 1	*UserFlatfield1*	*Sets User Flat Field 1 coefficient table as the current Flat Field.*	
User Flatfield 2	*UserFlatfield2*	*Sets User Flat Field 2 coefficient table as the current Flat Field.*	
User Flatfield 3	*UserFlatfield3*	*Sets User Flat Field 3 coefficient table as the current Flat Field.*	
User Flatfield 4	*UserFlatfield4*	*Sets User Flat Field 4 coefficient table as the current Flat Field.*	

Display Name	Feature & Values	Description	Device Version & View
Flat Field Correction Type	flatfieldCorrectionType	Specifies the Flat Field correction type.	1.00 Guru DFNC
Line-Based	*LineBase*	*Flat Feld correction is based on an individual line (FlatLine).*	
Flat Field Correction Algorithm	flatfieldCorrectionAlgorithm	Specifies the Flat Field correction algorithm to use.	1.00 Guru DFNC
Method 1	*Method1*	*The following formula is used to calculate the Flat Field corrected pixel: newPixelValue[x] = (sensorPixelValue[x] - FFCOffset[x]) * FFCGain[x]*	
Calibration Algorithm	flatfieldCorrectionCalibrationAlgorithm	Specifies the Flat Field calibration algorithm to use.	1.00 Guru DFNC
Basic	*Basic*	*Direct calculation of coefficients based on average line values and target.*	
Flat field Calibration Target (in DN)	flatfieldCalibrationTarget	Sets the target pixel value for the gain (PRNU) calibration.	1.00 Expert DFNC
Flat Field Calibration Sample Size	flatfieldCalibrationSampleSize	Set flat field calibration sample size. (number of lines to sum)	1.00 Guru DFNC
Calibrate FPN	flatfieldCalibrationFPN	Performs Fixed Pattern Noise (FPN) calibration by reducing to zero dark pixel current using a pixel offset. PLEASE Grab image to enable it.	1.00 Guru DFNC
No Error	*NoError*	*No Error.*	
Calibration Failed	*GenericError*	*FPN calibration failed.*	
Camera Busy	*BusyError*	*The camera is busy and cannot perform the FPN calibration.*	
Timeout Error	*TimeoutError*	*The FPN calibration did not finished on time.*	
Memory Error	*MemoryError*	*The camera cannot allocate the memory needed for FPN calibration.*	
Target Error	*TargetError*	*The FPN calibration was not able to reach the targets.*	
Calibrate PRNU	flatfieldCalibrationPRNU	Performs Photo Response Non Uniformity (PRNU) calibration to a targeted, user-defined value. PRNU calibration eliminates the difference in responsivity between the most and least sensitive pixel, creating a uniform response to light. PLEASE Grab image to enable it	1.00 Guru DFNC
No Error	*NoError*	*No Error.*	
Calibration Failed	*GenericError*	*PRNU calibration failed.*	
Camera Busy	*BusyError*	*The camera is busy and cannot perform the PRNU calibration.*	
Timeout Error	*TimeoutError*	*The PRNU calibration did not finished on time.*	
Memory Error	*MemoryError*	*The camera cannot allocate the memory needed for PRNU calibration.*	
Target Error	*TargetError*	*The PRNU calibration was not able to reach the targets.*	
Save Calibration	flatfieldCalibrationSave	Save the calibration performed by flatfieldCalibrationFPN and flatfieldCalibrationPRNU to the active set.	1.00 Expert DFNC

Display Name	Feature & Values	Description	Device Version & View
Reset Coefficients	flatfieldResetCoefficients	Reset all FFC coefficients to pass-through. aka Offset = 0; Gain = 1	1.00 Expert DFNC
Flat Field Correction Pixel X Coordinate	flatfieldCorrectionPixelXCoordinate	Specifies the X coordinate of the Flat Field pixel coefficient to access. SL-GA-01K04A only. See note SL-GA-05H04A model and FFC Coefficients.	1.00 Guru DFNC
Flat Field Correction Gain	flatfieldCorrectionGain	Sets the gain to apply to the currently selected pixel. SL-GA-01K04A only. See note SL-GA-05H04A model and FFC Coefficients.	1.00 Guru DFNC
Flat Field Correction Offset	flatfieldCorrectionOffset	Sets the offset to apply to the currently selected pixel. SL-GA-01K04A only. See note SL-GA-05H04A model and FFC Coefficients.	1.00 Guru DFNC
Processing Path Bits Per Pixel	processingPathBpp	Processing path bits per pixel.	1.00 Invisible DFNC
Flat Field Algorithm Buffer Format	flatfieldAlgorithmBufferFormat	Flat Field Algorithm Buffer Format.	1.00 Invisible DFNC
Mono 8	*Mono8*	*Mono8.*	
Flat Field Algorithm Buffer Width	flatfieldAlgorithmBufferWidth	Flat Field Algorithm Buffer Width.	1.00 Invisible DFNC
Flat Field Algorithm Buffer Height	flatfieldAlgorithmBufferHeight	Flat Field Algorithm Buffer Height.	1.00 Invisible DFNC
Flat Field Algorithm Gain Max	flatfieldAlgorithmGainMax	Flat Field Algorithm Gain Max.	1.00 Invisible DFNC
Flat Field Algorithm Gain Min	flatfieldAlgorithmGainMin	Flat Field Algorithm Gain Min.	1.00 Invisible DFNC
Flat Field Algorithm Gain Divisor	flatfieldAlgorithmGainDivisor	Flat Field Algorithm Gain Divisor.	1.00 Invisible DFNC
Flat Field Algorithm Gain Base	flatfieldAlgorithmGainBase	Flat Field Algorithm Gain Base.	1.00 Invisible DFNC
Flat Field Algorithm Offset Max	flatfieldAlgorithmOffsetMax	Flat Field Algorithm Offset Max.	1.00 Invisible DFNC
Flat Field Algorithm Offset Min	flatfieldAlgorithmOffsetMin	Flat Field Algorithm Offset Min.	1.00 Invisible DFNC
Flat Field Algorithm Offset Factor	flatfieldAlgorithmOffsetFactor	Flat Field Algorithm Offset Factor.	1.00 Invisible DFNC

Lookup Table (LUT) Overview

The Linea SWIR cameras include a user programmable LUT table as a component of its embedded processing features. A LUT is used for operations such as gamma adjustments, invert and threshold processes.

The camera LUT tables are dependent on the sensor (per pixel – see feature *LUT Size*) and is illustrated in the following figure. Pixel data from the sensor is passed through the LUT memory array, where the new programmed pixel value is then passed to the Linea SWIR output circuit. The LUT data table is stored along with other parameters with the user configuration function.

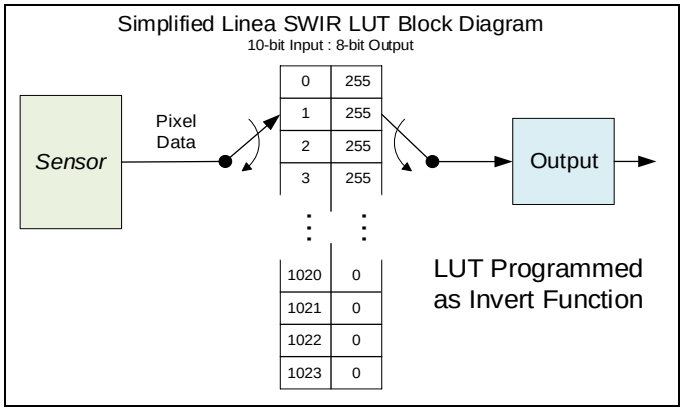


Figure 31: Simplified Example of a 10-bit to 8-bit LUT invert function.

LUT Size vs. Output Pixel Format

The LUT size will be the same as the camera's sensor pixel size; for the current Linea SWIR standard firmware this is a 12-bit. All camera processing is performed at the 12-bit sensor pixel format of the camera, while the output pixel format is 8-bit.

The Linea SWIR default neutral LUT programming is as follows:

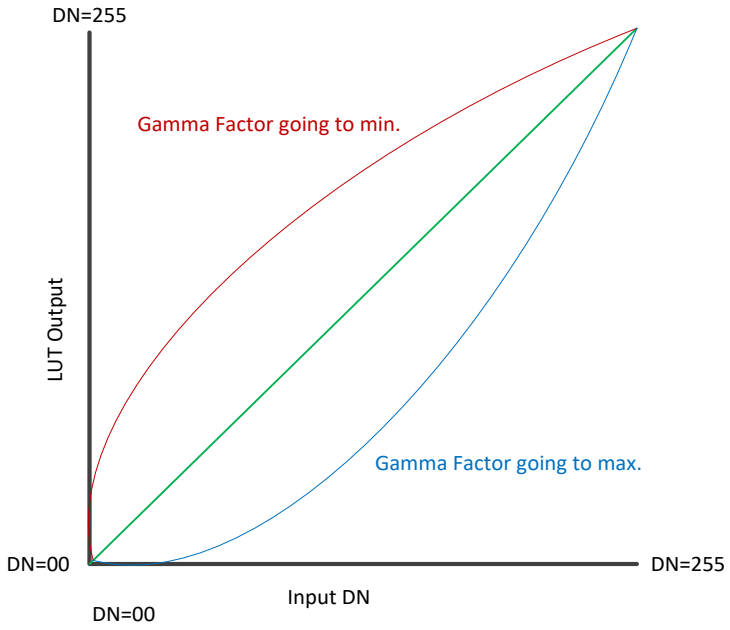
- With **Output Pixel format = 12-bit**, the default LUT data value is equal to the LUT index value for each index. This linear LUT does not modify the sensor data.
- With **Output Pixel format = 8-bit**, the default LUT data is programmed to map the 4096 sensor pixel values to 256 output values. Therefore, LUT indices 0 to 15 have value 0, LUT indices 16 to 31 have value 1, and so on.

LUT data is selected either as a predefined gamma correction, or is programmed with individual values for various LUT index entries, or a user LUT data file is upload using the File Access controls. Refer to the Sapera documentation for information about the SapLut Class. Note that a SapLut file can be uploaded to the Linea SWIR but cannot be read back.

Gamma Correction Factor

The following graphic shows LUT output data as a function of the gamma correction factor programmed by the user. An 8-bit LUT is shown as an example and importantly the graphic is not to scale.

- As Gamma Correction is reduced in value to the minimum allowed, the nonlinear output of acquisition data through the LUT effectively boosts low value data.
- As Gamma Correction is increased in value to the maximum allowed, the nonlinear output of acquisition data through the LUT effectively reduces low value data.



Defective Pixel Replacement

The Pixel Replacement algorithm is based on a predefined bad pixel map (as an XML file), either factory supplied (file loaded as "Factory Map") or generated by the user (file uploaded as "User Map 1"). The number of bad pixel entries is maximum 12. The following XML code sample forms the template for the user to build bad pixel maps.

Note: Identifying bad pixels is the user's discretion. Teledyne DALSA technical support can provide guidance.

Methods

There are two replacement algorithms available to the user.

- **Method 1:** This algorithm replaces a defective pixel with the average value of the pixel to the left and right of the pixel to be replaced.
- **Method 3:** This algorithm replaces a defective pixel with a neighbor.

Example User Defective Pixel Map XML File

The following example shows the required components of the defective pixel map file. Each bad pixel position (relative to the image origin, which is the upper left corner), must be identified by the XML statement:

<DefectivePixel OffsetX=”**number**” OffsetY=”0”/>

The pixel format (8 or 12-bit) is handled transparently, thus requires no special consideration by the user. This example XML listing has four “bad” pixels identified.

```
<?xml version=”1.0” encoding=”UTF-8” ?>
<!--Example User Defective Pixel Map -- >
<!-- maximum 512 coordinates -- >
<!--filename: ExampleBadPixels.xml  -- >

<Coordinates>

<DefectivePixel OffsetX=”12” OffsetY=”0”/>
<DefectivePixel OffsetX=”17” OffsetY=”0”/>
<DefectivePixel OffsetX=”103” OffsetY=”0”/>
<DefectivePixel OffsetX=”206” OffsetY=”0”/>

</Coordinates>
```

Image Response Uniformity & Flat Field Calibration

The Flat Field Correction function (FFC) consists of using two coefficients per pixel to correct the gain and offset of the corresponding pixel. These corrections compensate for Photo-Response Non-Uniformity (**PRNU**) and Fixed Pattern Noise (**FPN**) unique to each camera sensor and the lens used.

It is common to find an image has a lower response at the edges of the camera’s field of view compared to its center. This is typically the result of a combination of lens vignetting (cos4th) roll-off and the beam structure of the illumination source. Using a more diffused light may reduce the roll-off effect. However, if decreasing the lens aperture improves the edge roll-off, then barrel vignetting (a shadow cast on the sensor by the focus helical or extension tubes) may also be present.

The camera can compensate for edge roll-off and other optical non-uniformities by activating Flat Field Correction after the calibration procedure acquires correction coefficients.

Flat Field Correction Overview

Flat Field Correction function (FFC) consists of using two coefficients per pixel to correct the gain and offset of the corresponding pixel. These corrections compensate for Photo Response Non-Uniformity (PRNU) and Fixed Pattern Noise (FPN), unique to each camera sensor.

It is imperative to perform FFC calibration under the same conditions the camera will be operated. CMOS sensor variations (over temperature and exposure) will render the FFC calibration invalid.

Linea SWIR GigE cameras have multiple FFC user memory locations for storage for different optimized exposure setups.

Flat Field Calibration Preparations

Before calibration, the Linea SWIR GigE should be powered on long enough to achieve its nominal temperature (a minimum of 30 minutes).

When performing Flat Field (PRNU) Calibration, the camera should image a front illuminated white target or rear bright field illumination source. The optical setup should be as per the inspection system, including lens magnification, aperture and illumination intensity, spectral content, plus illuminator beam structure.

When performing Flat Field Calibration, all pixels are adjusted to the same value as the peak pixel value or target level selected.

If the Flat Field Calibration Target value is lower than the peak value and the system gain is set to a low value, then it is possible that the sensor will maximize its output before the camera output reaches 255 DN in 8-bit or 4095 DN in 12-bit output format. Visible when a portion of the output stops increasing before reaching 255 DN with increasing illumination and the PRNU deteriorates. This effect is resolved by decreasing the light level or exposure control time.

Following a Flat Field Calibration, all pixels will be at the target value. Changing sensor gain values allow the user to make refinements to the operating responsivity level.

- **Note:** The Linea camera has many different modes of operation. A Flat Field Calibration should be performed using the camera's intended operating mode.
- **Note:** The best Flat Field Calibration is achieved when performed at mid-level DN of the working operating range. Any flat field error associated with residual pixel non-linearity will be halved as compared to performing a calibration at the peak value of the operating range. A simple method is to reduce the exposure time to half of what is used in typical operation in order to get the mid DN level for Flat Field Calibration. Once complete, return the exposure time to its original setting.
- **Note:** Areas of the image where high luminance roll-off is present will show higher noise levels after Flat Field Calibration due to higher gain values of the correction coefficients. Flat Field Calibration compensates up to an 8:1 variation. If the variation exceeds 8:1 the line profile after calibration will include pixels that are below un-calibrated peak level.

Flat Field Correction Algorithm Description

Flat Field Correction Algorithm – Method 1 (feature: flatfieldCorrectionAlgorithm) applies the following FFC formula for correcting pixel values.

newPixelValue[x] = (sensorPixelValue[x] - FFCOffset[x]) * (FFCGain[x])

- FCC Gain ranges from 0.0 to 3.999 with a resolution of 1/1024
- [**x**] is the Flat Field Correction Pixel coordinate.
  See the FlatfieldCorrectionPixelXCoordinate features.
- **newPixelValue** is the pixel value after Flat Field Correction is applied.
- **sensorPixelValue** is the pixel value before Flat Field Correction is applied.
- **FFCOffset** is the offset coefficient value to subtract from the sensorPixelValue.
- **FFCGain** is the gain coefficient value that is multiplied with the sensorPixelValue.

Important: FFCOffset and FFCGain are derived factors calculated from a number of camera specific feature values (Invisible DFNC features). These values are meaningless to the user.

Information on the Sapera Flat Field Coefficients File

The Flat Field Coefficients File is a standard 16-bit TIFF file for both 8-bit and 12-bit acquisition modes. If the Flat Field Calibration is performed while using a 12-bit buffer, the user Flat Field Calibration coefficients file is applicable to both 8-bit and 12-bit acquisitions. If a Flat Field Calibration is performed while using an 8-bit buffer, switching to 12-bit acquisition will lose coefficients.

SL-GA-05H04A MODEL AND FFC COEFFICIENTS

In the 512 SWIR model (SL-GA-05H04A), individual coefficients cannot be adjusted directly through CamExpert. However, you can modify them by downloading the Flat Field Coefficients file from the camera. Note that when retrieving the Flat Field coefficients from the camera for the 512 model, data for 1024 pixels will be received, as the 512 model is a binned version of the 1K model. If adjustments to the coefficients are necessary, please ensure that modifications are made in pixel pairs.

Important Factors about Flat Field Processing

Important: Before calibration, the Linea SWIR GigE should be powered on long enough to achieve its nominal temperature (a minimum of 30 minutes). A low ambient temperature may increase the time required for the camera to reach a stable internal temperature.

Important: During calibration, no other Linea SWIR GigE features should be accessed or modified.

How to do a FFC Setup

The process requires images be snapped in black and bright conditions, followed by the FFC process.

- If using a sheet as a white target, it must be completely free of blemishes and texture.
- Dirt or texture will generate variating in the image and incorporate it into the calibration coefficients of the camera. Vertical stripes are visible while imaging after the target is removed.
- A moving target during calibration will average out any dirt or texture present.

Set up Black and Bright Acquisitions with the Histogram Tool

Verify the camera's acquisition with a live grab and prepare to grab a flat light gray image required for calibration. Ideally, a controlled diffused light source aimed directly at the lens should be used or a non-glossy paper with the lens slightly out of focus (or evenly lit wall). Note the lens iris position for a bright but not saturated image.

Verify a Black Acquisition

Cover the lens with a lens cap. Using CamExpert, click on the grab button and then select Histogram. The following figure shows a typical histogram for a camera grabbing a dark image.

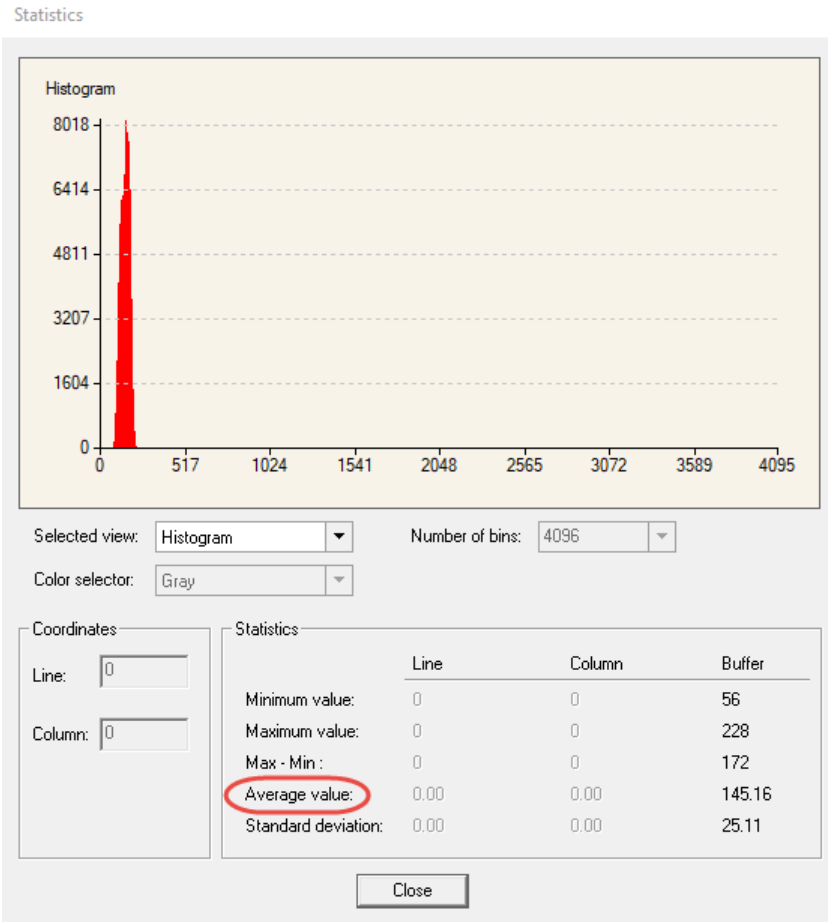


Figure 32: Black Acquisition Histogram

	Important: the **average** pixel value for the frame is close to black. **Note:** Sensors might show a much higher maximum pixel value due to one or more "hot pixels".

Verify a Bright Acquisition

Point the camera at a diffused light source or evenly lit white wall with no shadows falling on it. Click the grab button, followed by 'histogram' in the drop down menu. Use the lens iris to adjust for a bright gray approximately pixel value 200 (for 8-bit pixels). The following figure displays a histogram while grabbing a bright gray image.

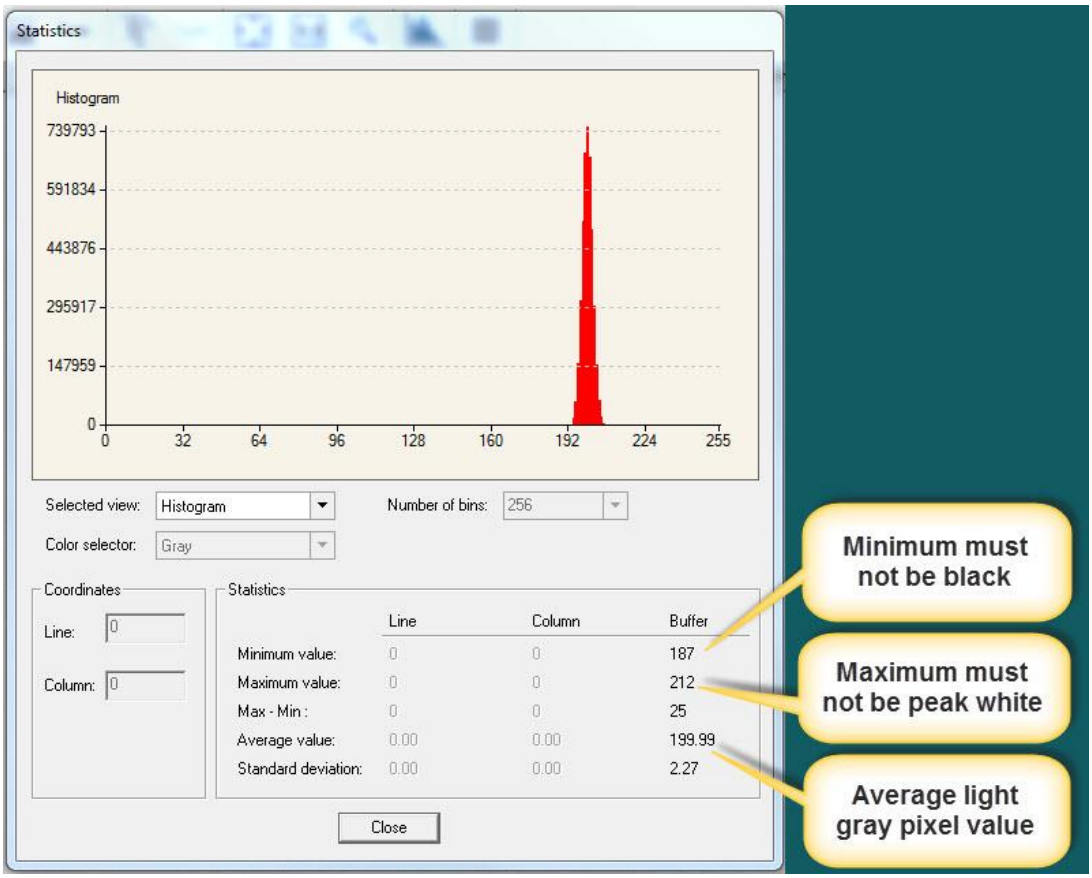


Figure 33: Bright Acquisition Histogram

	Important: In this example, the **average** pixel value for the frame is bright gray. **Note:** Sensors may show a much higher maximum or a much lower minimum pixel value due to one or more "hot or dead pixels". The sensor specification accounts for a small number of hot, stuck or dead pixels (pixels that do not react to light over the full dynamic range specified for that sensor).

When the bright gray acquisition setup is complete, note the camera and lens iris position for repeatability in the future.

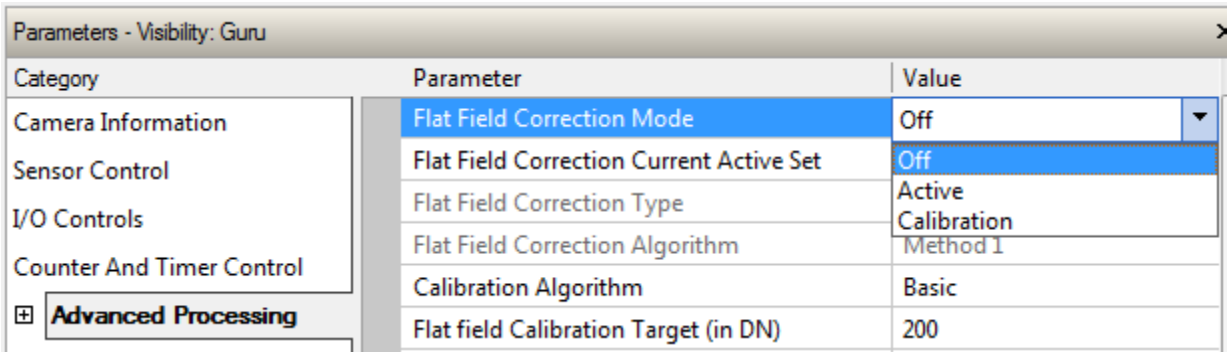
Flat Field Correction Calibration

Flat Field Correction Calibration (FFC) contains FPN (Fixed Pattern Noise) and PRNU (Photon Response non-uniformity) corrections.

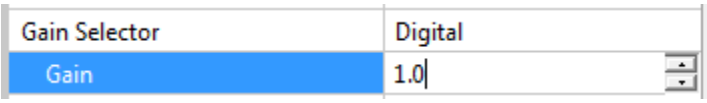
Note: Before performing a FFC, we recommend you evaluate the "bare image" characteristics, which determine the quality of FFC, applied to the image.

To obtain a bare image, disable FPN and PRNU coefficients:

1. Choose Off from Flat Field Correction Mode.



2. Set Gain to 1.0



3. Use the line profile tool shown below to evaluate the bare image.

Line Profile Example

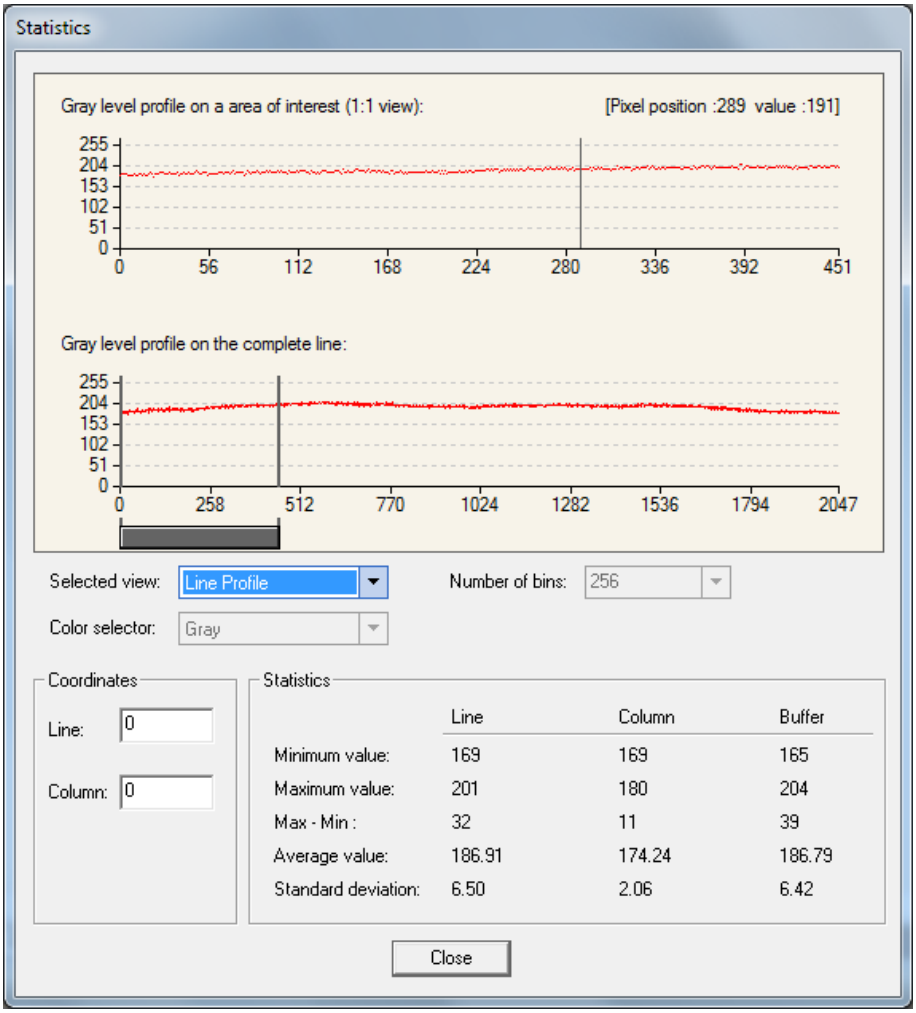


Figure 34: Bare Image Line Profile of a White Uniform Object

A line profile is mainly determined by two factors: Flatness and Height

1) Flatness: The Line profile represents a Flat Field measurement. Due to lens-shading effect, light falls-off near the edges and results in lower output. This produces higher noise levels near the edge. A smaller aperture opening and longer focal length can reduce lens - shading effect. In some demanding applications, optimized low - shading lenses should be considered.

2) Height: An average value near your calibration target is ideal.
An extremely low output compared to the target will increase noise level significantly after the PRNU is corrected. To avoid SNR and / or DNR not meeting your application requirements, the profile should reach a level near the calibration target.

Note: Changes to gain do not improve image quality from a SNR perspective. Gains are analog and digital multipliers that scale up signal and noise proportionally.

Before performing a FFC keep the following in mind:

- Ensure the camera's temperature is at nominal operating condition. Power-on for minimum 30 min.
- All parameters should meet your application's specifications. If parameters change after FFC completion, the results may no longer be accurate. Perform another FFC.

FPN Correction

Step 1: Cover the lens (place the sensor in black).
Step 2: Select *Off* from Flat Field Correction Mode drop-down menu and check the line profile / histogram. If pixel outputs are zero, adjust the "Black level (in DN)" to increase Minimum value above zero. The Black Level adjustment is located in the Sensor Control category.

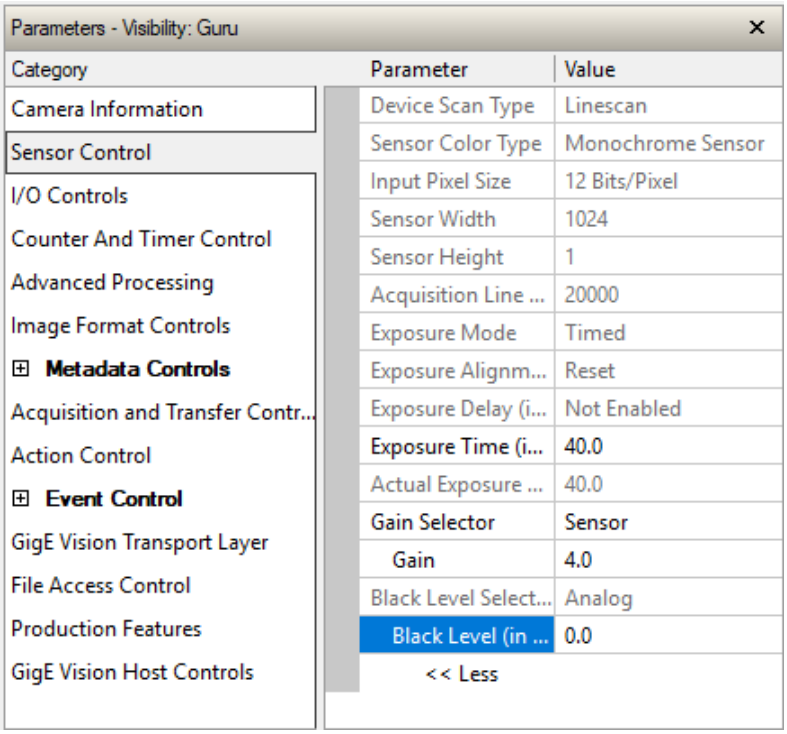


Figure 35: Sensor Control category

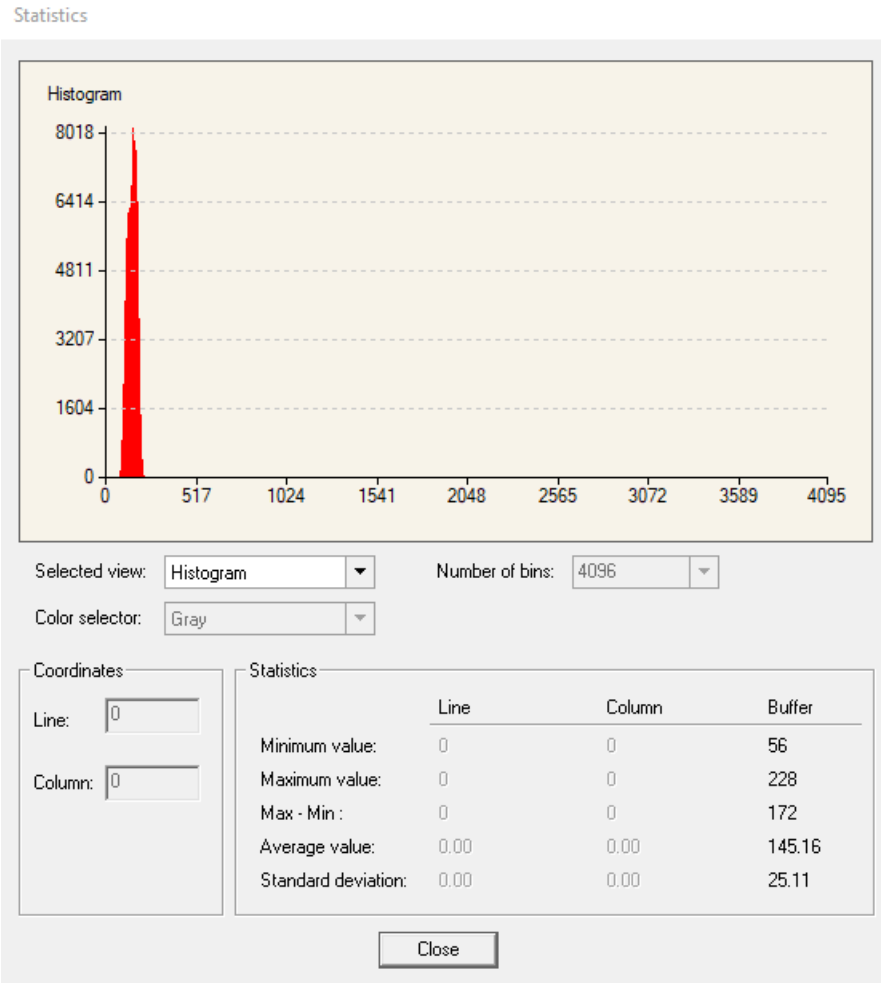


Figure 36: A histogram of a black image.

Step 3: Select *Calibration* from Flat Field Correction Mode drop-down menu.

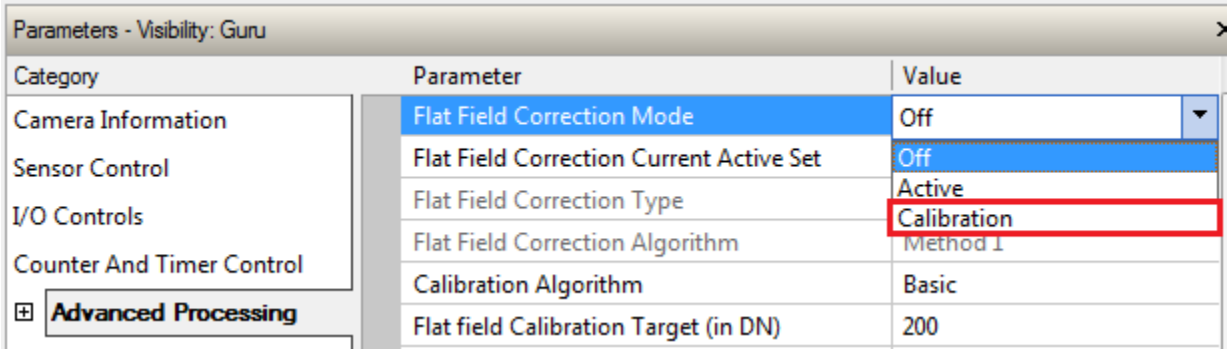


Figure 37: FFC Calibration Selection

Step 4: Select *2048* or *4096* option from Flat Field Calibration Sample Size. The 2048 option reduces calculating time; 4096 option returns result that is more accurate.
Step 5: Press the *Press…* command in the Calibrate FPN menu

PRNU Correction

Step 1: Apply illumination and place a white flat target in the location where the real object will be. Ideally, you would use a professional target. For convenience, you can use white paper as the target. The result of using paper may produce grain effect — where visible vertical lines show up in grabbed images.
Two common ways to correct the grain effect are:
1) Target in motion while PRNU Correction is performed.
2) Defocus lens while PRNU Correction is performed.

Select *Off* from Flat Field Correction Mode drop-down menu and check the bare image line profile.

Step 2: Select *Calibration* from Flat Field Correction Mode drop-down menu.

Step 3: Adjust the calibration target in the Flat Field Calibration Target (in DN) if necessary.
Note: 200 DN is commonly used target in 8-bit output format.

Step 4: Select *2048* or *4096* from Flat Field Calibration Sample Size drop-down menu.

Step 5: Press the *Press…* command in Calibrate PRNU menu.

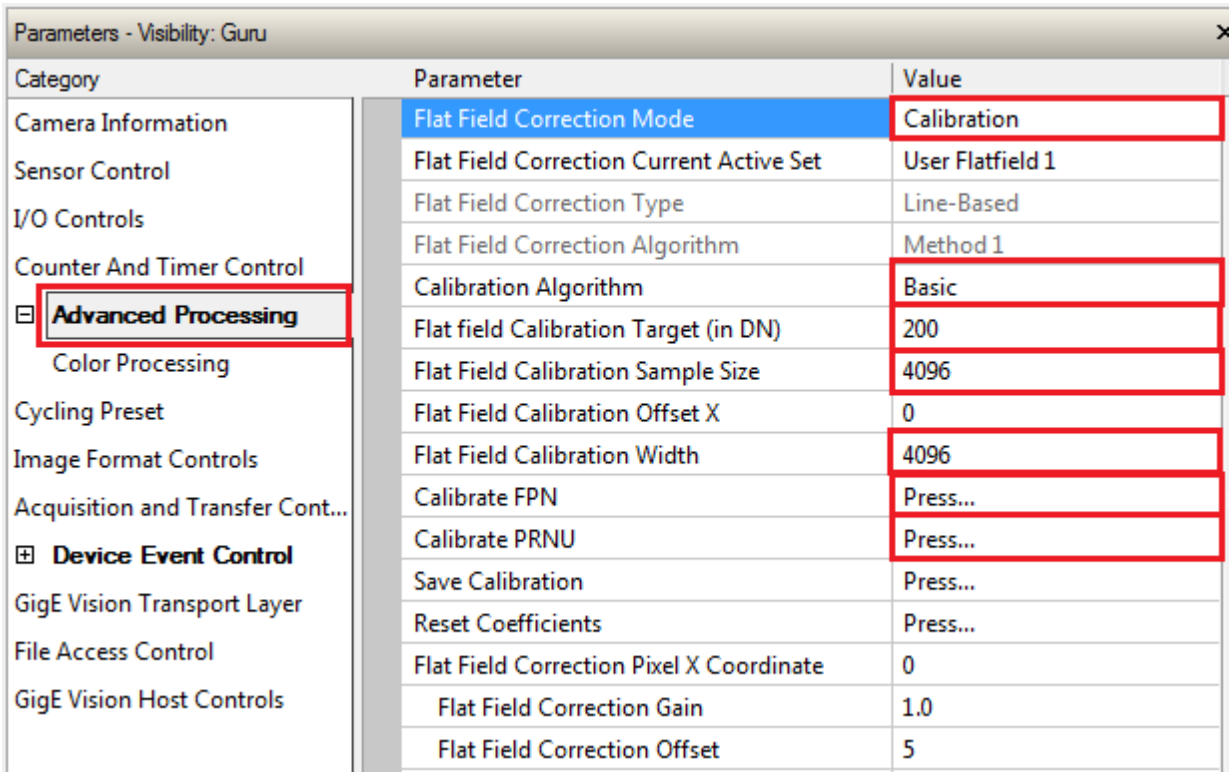


Figure 38: PRNU Correction

Step 6: Select a User Flat field set from the Flat Field Correction Current Active Set. Press the Press… command in Save Calibration menu to Active the Set. If not saved, the FFC result will be lost when the Active Set or Calibration mode is changed.
Step 7: Select *Active* from *Flat Field Correction Mode* drop-down menu to apply the calibrated FPN and PRNU parameters. Refer to the figure below to verify the line profile.

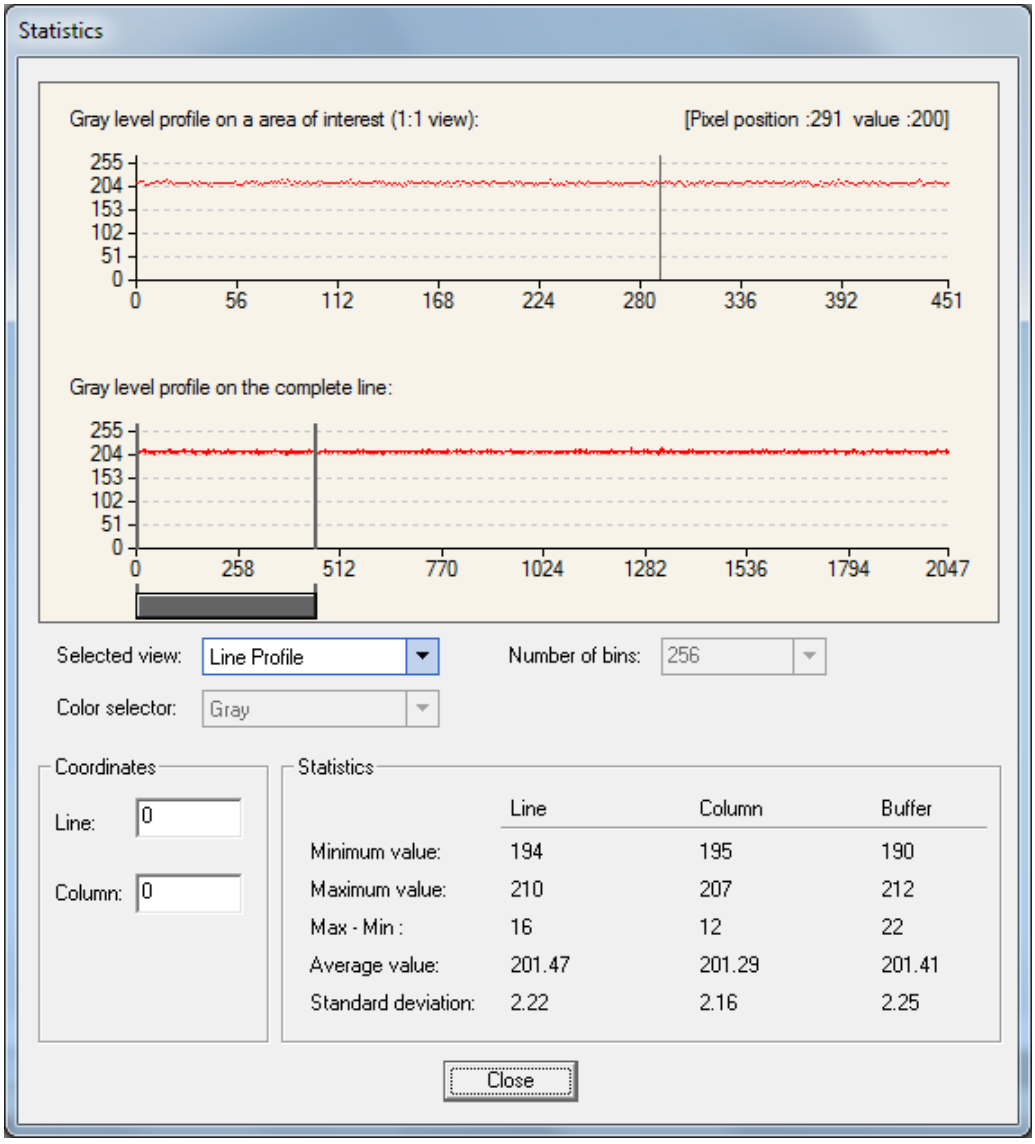


Figure 39: Line profile of a white uniform target after PRNU calibration.

Cycling Preset Mode Control Category

The Linea SWIR GigE Cycling Preset controls shown by CamExpert groups' parameters used to configure the camera cycling features. Cycling controls configure camera operational states so it automatically switches between states in real-time. The programmed features are updated while the camera switches ensuring immediate response. A cycling mode setup example is provided.

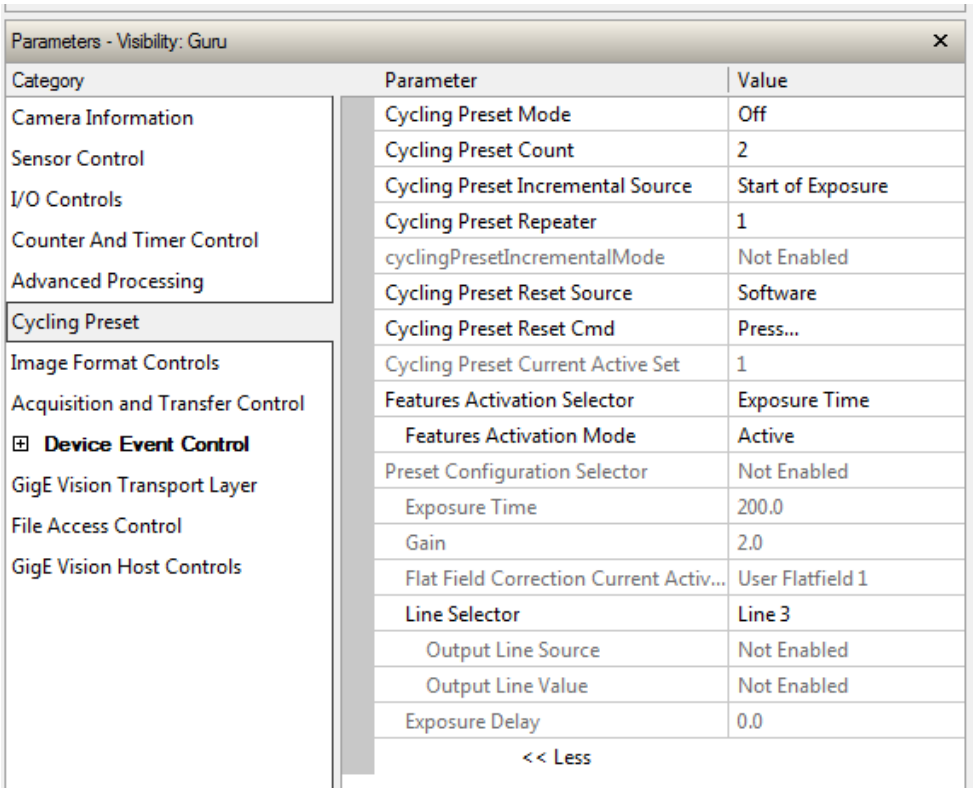


Figure 40: Cycling Preset

Cycling Preset Mode Control Feature Description

Display Name	Feature & Values	Description	Device Version & View
Cycling Preset Mode	cyclingPresetMode	Sets the Cycling Presets module mode.	V1.00 Expert DFNC
Off	*Off*	*Disable the Cycling Preset module.*	
Active	*Active*	*Enable the Cycling Preset module.*	
Cycling Preset Count	cyclingPresetCount	Specifies the number of Presets to use.	V1.00 Expert DFNC
Cycling Preset Incremental Source	cyclingPresetIncrementalSource	Specifies the source that increments the currently active cycling preset.	V1.00 Expert DFNC
Start of Line	*StartOfLine*	*Increment on start of line event*	
Start of Frame	*StartOfFrame*	*Increment on start of frame event*	
Line 1	*Line1*	*Select Line 1 (and associated IO control block) as cycling preset incremental source*	
Line 2	*Line2*	*Select Line 2 (and associated IO control block) as cycling preset incremental source*	

Display Name	Feature & Values	Description	Device Version & View
Cycling Preset Incremental Mode	cyclingPresetIncrementalMode	Sets the synchronization point after a increment trigger occur. This is use when the increment source is an line, counter or timer.	V1.00 Expert DFNC
Line	*NextLine*	*The next set will take effect when the next line acquisition will start.*	
Frame	*NextFrame*	*The next set will take effect when the next line acquisition will start.*	
Cycling Preset Repeater	cyclingPresetRepeater	Specifies the required number of cycling preset increment events (generated by the Cycling Preset Incremental Source) to increment the index of the Cycling Preset Current Active Set.	V1.00 Expert DFNC
Cycling Preset Reset Source	cyclingPresetResetSource	Specifies the source that resets the currently active preset. On reset the current preset index is set to 1.	V1.00 Expert DFNC
Start of Frame	*StartOfFrame*	*Reset when a valid frame trigger occurs.*	
Software	*Software*	*Use a software command as the reset source.*	
Cycling Preset Reset Cmd	cyclingPresetResetCmd	Reset the position of the preset cycling to 1 and the count to 0.	V1.00 Guru DFNC
Cycling Preset Current Active Set	cyclingPresetCurrentActiveSet	Returns the index of the currently active cycling preset.	V1.00 Guru DFNC
Features Activation Selector	cP_FeaturesActivationSelector	Selects the feature to control by the cP_FeaturesActivationMode feature.	V1.00 Expert DFNC
Exposure Time	*ExposureTime*	*The cP_FeaturesActivationMode feature controls the exposure time.*	
Digital Gain	*DigitalGain*	*The cP_FeaturesActivationMode feature controls the Digital Gain.*	
Flat Field Correction	*FlatFieldCorrection*	*The cP_FeaturesActivationMode feature controls the flat field correction.*	
Output Line3	*OutputLine3Control*	*The cP_FeaturesActivationMode feature controls the output line3.*	
Output Line4	*OutputLine4Control*	*The cP_FeaturesActivationMode feature controls the output line4.*	
Features Activation Mode	cP_FeaturesActivationMode	Enables the selected feature to be part of the cycling. When activating the selected feature, this will automatically set the corresponding standard camera feature to read only.	V1.00 Expert DFNC
Off	*Off*	*Exclude the selected feature from the cycling.*	
Active	*Active*	*Activate the selected feature in the cycling.*	
Preset Configuration Selector	cP_PresetConfigurationSelector	Selects the cycling preset to configure.	V1.00 Expert DFNC
Exposure Time	cP_ExposureTime	Sets the exposure time (in microseconds) for the selected set.	V1.00 Expert DFNC
Gain Selector	cP_GainSelector	Selects which gain is controlled when adjusting cp_Gain features.	Expert DFNC
Digital	*Digital*	*Apply Digital gain adjustment to the image.*	
Gain	cP_Gain	Sets the selected gain as an amplification factor applied to the image.	V1.00 Expert DFNC
Flat Field Correction Current Active Set	cP_flatfieldCorrectionCurrentActiveSet	Specifies the current set of Flat Field coefficients to use.	V1.00 Expert DFNC
User Flatfield 1	*UserFlatfield1*	*Sets User Flat Field 1 coefficient table as the current Flat Field.*	
User Flatfield 2	*UserFlatfield2*	*Sets User Flat Field 2 coefficient table as the current Flat Field.*	
User Flatfield 3	*UserFlatfield3*	*Sets User Flat Field 3 coefficient table as the current Flat Field.*	

Display Name	Feature & Values	Description	Device Version & View
User Flatfield 4	*UserFlatfield4*	*Sets User Flat Field 4 coefficient table as the current Flat Field.*	
Line Selector	cP_LineSelector	Selects which physical line (or pin) of the external device connector to configure.	V1.00 Expert DFNC
Line 3 or pin 6	*Line2*	*Index of the physical line and associated Output control block to use.*	
Line 4 or pin 8	*Line4*	*Index of the physical line and associated I/O control block to use.*	
Output Line Source	cP_OutputLineSource	Selects which internal signal, or event driven pulse, or software control state to output on the selected output line.	V1.00 Expert DFNC
Off	*Off*	*Line output is Open.*	
Software Controlled	*SoftwareControlled*	*The OutputLineValue feature changes the state of the output.*	
Pulse On: Start of Exposure	*PulseOnStartofExposure*	*Generate a pulse on the ExposureStart event. This option is typically used to trigger a strobe light.*	
Output Line Value	cP_OutputLineValue	Sets the output state of the selected Line if the outputLineSoftwareLatchControl = OFF. OutputLineSource must be SoftwareControlled. If the outputLineSoftwareLatchControl = Latch , the state of the pin will change with the outputLineSoftwareCmd command.	V1.00 Expert DFNC
Active	*Active*	*Sets the Output circuit to closed.*	
Inactive	*Inactive*	*Sets the Output circuit to open.*	

Using Cycling Presets

The Cycling Prese feature sets camera configurations that change dynamically and repeatedly with minimum overhead. Features can be updated while the camera is acquiring. The features allow applications to perform tracking algorithms.

Presets Example

The following example describes a simple cycling sequence of gain change steps which will repeat until stopped by the user. The example uses Sapera tool CamExpert to set features and test the sequence. This does not represent a real world application but serves to describe the cycling features of Linea SWIR GigE.

Initial Example Setup

- Configure a free running acquisition of 1 kHz line rate with an exposure time and gain that's somewhat short (dark).
- Select the Cycling Preset Category to setup and test the following example.
- Set *cyclingPresetMode* to *Active*. This feature enables the Cycling Preset Module.
- Set *cyclingPresetCount* to the number of presets, which will be configured and used. For this example set it to 3.
- Set the feature *cyclingPresetIncrementalSource* to the event, which will be used to increment the cycling presets index. For this example, set the feature to *EndOfFrame* that is a logical choice for a simple free-running acquisition setup.

Cycling Example: Changing Gain

The following steps program three presets to create a cycling sequence, starting with preset index 1.

- Set cP_PresetConfigurationSelector to index 1.
- Set cP_FeaturesActivationSelector to Gain.
- Set *cP_FeaturesActivationMode* to *Active*. This defines the camera exposure as one variable stored in this preset index 1.
- The feature *cP_Gain* now is in dark text (active) and shows the last Gain used by the camera if cycling was not enabled. This field now controls the camera gain. The gain field in the Sensor Control Category is in gray text indicating a read only field.

The next steps show how to make changes to the camera and save those changes as additional cycling preset steps.

- Set cP_PresetConfigurationSelector to index 2.
- Set the feature *cP_Gain* to a higher value, increasing the acquisition brightness.
- Repeat for index 3 with a Gain that is higher again.

Test the Example

- With 3 gain values saved in three presets, click the CamExpert Grab button to start the cycling free-running acquisition.
- The CamExpert live display window will show a live grab where each virtual frame shows an increase in exposure, and then returns to the first exposure cycling continuously until stopped by the user.

Image Format Control Category

The Linea SWIR GigE Image Format controls shown by CamExpert, group parameters used to configure camera pixel format, image cropping and binning functions. An internal test image function is used to qualify camera setup without a lens.

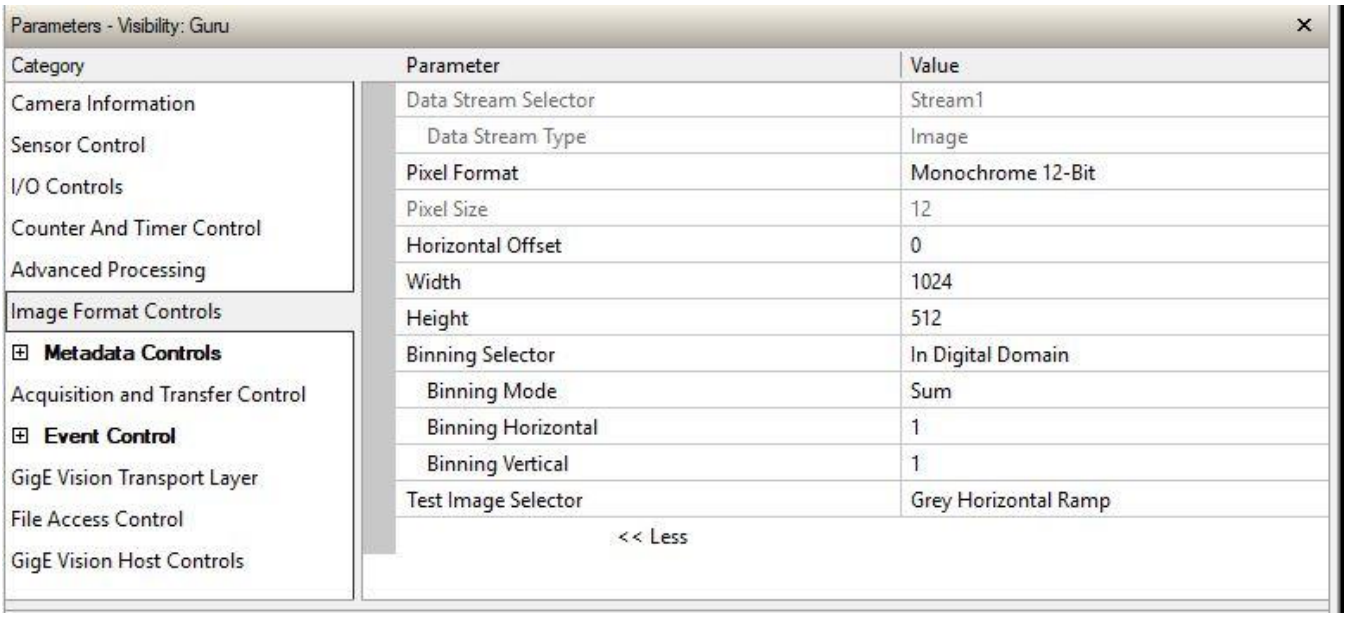


Figure 41: Image Format Features

Image Format Control Feature Description

Display Name	Feature & Values	Description	Device Version & View
Data Stream Selector	dataStreamSelector	Select which data stream to control (default is Stream 1)	1.00 Beginner DFNC
Stream1	*Stream1*	*Adjust parameters for Stream1*	
Data Stream Type	dataStreamType	This feature is used to select or retrieve the transfer protocol used to stream blocks.	1.00 Beginner DFNC
Image	*Image*	*The Image data blocks are streamed using the payload type "Image".*	
Image_MetaData	*Image_MetaData*	*The Image_MetaData blocks are streamed using the payload type "Extended Chunk Data with Image".*	
Pixel Format	PixelFormat	Contains all format information as provided by PixelCoding, PixelSize, PixelColorFilter, combined in one single value. Decimation must be Off.	1.00 Beginner
Monochrome 8-Bit	*Mono8*	*Mono8: Monochrome 8-Bit.*	
Monochrome 12-Bit	*Mono12*	*Mono12: Monochrome 12-Bit.*	
Pixel Size	PixelSize	Total size in bits of an image pixel.	1.00 Guru
8 Bits/Pixel	*Bpp8*	*Bpp8: 8 bits per pixel.*	
12 Bits/Pixel	*Bpp12*	*Bpp12: 12 bits per pixel.*	
Horizontal Offset	OffsetX	Horizontal offset from the Sensor Origin to the Area Of Interest (in pixels).	1.00 Beginner

Display Name	Feature & Values	Description	Device Version & View
Width	Width	Width of the Image provided by the device (in pixels).	1.00 Beginner
Height	Height	Height of the Image provided by the device (in lines).	1.00 Beginner
Binning Selector	binningSelector	Select how the Horizontal and Vertical Binning is done. The Binning function can occur in the digital domain of a device or at the actual sensor.	1.00 Beginner DFNC
In Digital Domain	*InDigitalDomain*	*The Binning function can be done inside the device but with a digital processing function. Binning doesn't affect the current data rate from the sensor or camera.*	
Binning Mode	binningMode	Sets the mode used to combine pixels together when BinningHorizontal and/or BinningVertical is greater than 1.	1.00 Beginner DFNC
Sum	*Sum*	*The responses from the individual pixels are added together, resulting in increased sensitivity.*	
Average	*Average*	*The responses from the individual pixels are averaged, resulting in increased signal to noise ratio.*	
Binning Horizontal	BinningHorizontal	Number of horizontal photo-sensitive cells to combine together. This increases the intensity of the pixels but reduces the horizontal resolution.	1.00 Beginner
Binning Vertical	BinningVertical	Number of vertical photo-sensitive cells to combine together. This increases the intensity of the pixels but reduces the vertical resolution of the image.	1.00 Beginner
Test Image Selector	TestPattern	Selects the type of test image output by the camera.	1.00 Beginner
Off	*Off*	*Image is from the camera sensor.*	
Grey Horizontal Ramp	*GreyHorizontalRamp*	*Image is filled horizontally with an image that goes from the darkest possible value to the brightest.*	
Grey Vertical Ramp	*GreyVerticalRamp*	*Image is filled vertically with an image that goes from the darkest possible value to the brightest.*	

Binning

Binning is the process where charge on two (or more) adjacent pixels is combined. This results in increased light sensitivity. The sensor spatial resolution is reduced by improved low-light sensitivity and lower signal-noise ratio. The user can evaluate the results of the binning function (factor of 2x or 4x) on the camera by using CamExpert.

The camera supports horizontal and vertical binning independently. Binning is performed over multiple acquisition lines within the camera. The virtual frame buffer height is automatically reduced when binning is enabled.

Note: Binning is performed digitally therefore there is no increase in acquisition line rate. The following graphic illustrates binning.

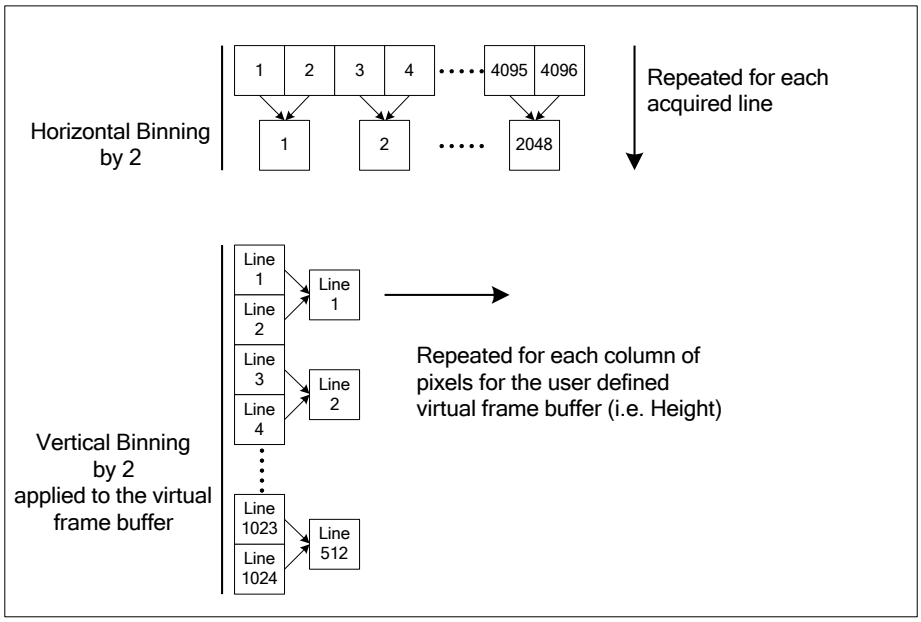


Figure 42: How Binning Works

Area of Interest (AOI)

The camera's field of view, in this case its acquisition line length relative to the total line length can be reduced to decrease the data transferred and enhanced performance. This may result in an increase to the maximum allowable line rate when using 12-bit output data.

The camera accommodates one AOI by using the features **Width** and **OffsetX** to reduce the AOI from the maximum line length. Image data outside the AOI is discarded. First reduce the Width then adjust the offset (step size is 16 pixels). The step size may differ for different models.

Internal Test Image Generator

The camera includes a number of internal test patterns, which confirm Ethernet connection and driver installation without the need for a camera lens or proper lighting. The patterns are subject to camera processing and Binning functions.

Use CamExpert to enable and select Test Image from the drop down menu while the camera is not in Acquisition Mode. Click Grab to display the pattern output.

Metadata Control Category

The Metadata Controls category enable the inclusion of chunk data with the image payload (as specified by the specification GigE Vision 1.2).

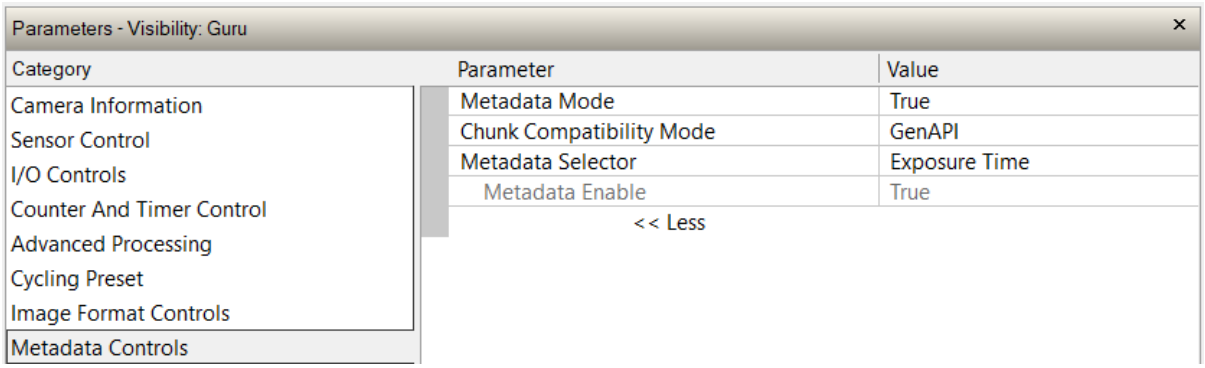


Figure 43: CamExpert –Metadata Category.

Metadata Controls Feature Descriptions

Display Name	Feature & Values	Description	Standard & View
Metadata Mode	ChunkModeActive	Activates the inclusion of chunk data (metadata) in the payload of the image.	Expert
	False	*No chunk data.*	
	True	*Chunk data included in payload.*	
Chunk Compatibility Mode	chunkCompatibilityMode	Selects the format of the chunk data (metadata) in the payload of the image.	Beginner DFNC
Sapera LT	*SaperaLT*	*Metadata compatible with Teledyne DALSA Sapera LT 8.0.*	
Gen API	*GenAPI*	*Metadata compatible with GenICam GenAPI and Teledyne DALSA Sapera LT 8.10.*	
Metadata Selector	ChunkSelector	Selects the specific metadata to control, when enabled.	Expert
Offset X	*OffsetX*	*Add the OffsetX value used during the image acquisition to the metadata attached to the image.*	
Offset Y	*OffsetY*	*Add the OffsetY value used during the image acquisition to the metadata attached to the image.*	
Width	*Width*	*Add the Width value used during the image acquisition to the metadata attached to the image.*	
Height	*Height*	*Add the Height value used during the image acquisition to the metadata attached to the image.*	
Pixel Format	*PixelFormat*	*Add the PixelFormat value used during the image acquisition to the metadata attached to the image.*	
Exposure Time	*ExposureTime*	*Add the ExposureTime value used during the image acquisition to the metadata attached to the image.*	
cyclingPresetCurrentActiveSet	*cyclingPresetCurrentActiveSet*	*Add the cyclingPresetCurrentActiveSet value used during the image acquisition to the metadata attached to the image.*	
Timestamp	*Timestamp*	*Copies the timestampValue value at the start of exposure to the metadata attached to the image.*	
Line Status All	*LineStatusAll*	*Copies the LineStatusAll value at the start of exposure to the metadata attached to the image.*	
Gain	*Gain*	*Add the Gain feature value used during the image acquisition to the metadata attached to the image.*	

Display Name	Feature & Values	Description	Standard & View
counter1ValueAtReset	*counter1ValueAtReset*	*Copies the value of the feature "*counterValueAtReset*" at the start of Frame Readout, to the Metadata attached to the image. Supported only in GenAPI compatibility mode.*	
DeviceID	*DeviceID*	*Add the DeviceID value to the metadata attached to the image.*	
DeviceUserID	*DeviceUserID*	*Add the DeviceUserID value to the metadata attached to the image.*	
TestImageSelector	*TestImageSelector*	*Add the TestImageSelector value used during the image acquisition to the metadata attached to the image.*	
BinningVertical	*BinningVertical*	*Add the BinningVertical value used during the image acquisition to the metadata attached to the image.*	
BinningHorizontal	*BinningHorizontal*	*Add the BinningHorizontal value used during the image acquisition to the metadata attached to the image.*	
ExposureDelay	*ExposureDelay*	*Add the ExposureDelay value used during the image acquisition to the metadata attached to the image. Supported only in GenAPI compatibility mode.*	
Metadata Enable	ChunkEnable	Sets the enable state of the selected metadata. When enabled, the metadata is included in the payload of the image.	Expert
	False	*Selected metadata disabled*	
	True	*Selected metadata enabled.*	

Extracting Metadata Stored in a Sapera Buffer

For Sapera LT developers, the SapMetadata class (included with Sapera LT version 8.10 and higher) provides functions for manipulating image metadata. Metadata is appended to the end of virtual frame buffers; Sapera LT automatically adjusts the buffer size to accommodate metadata.

Sapera provides two methods to view metadata. The Sapera CamExpert tool provides a tab (when the Metadata feature is enabled) to view the metadata of the last frame capture.

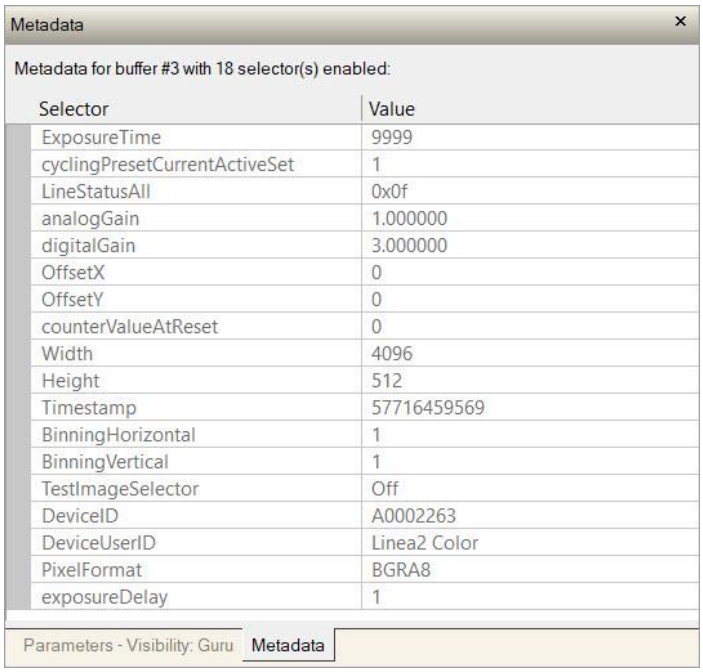


Figure 44: CamExpert – Metadata Tab

Alternatively, Sapera LT provides a demo program called GigEMetaDataDemo.exe which will grab a number of frames and display the metadata or save it to a file (.csv). In addition, source code and C++ project files are included for a console-based executable.

	When an internal test pattern image is selected, the Metadata feature values for Exposure Time and Exposure Delay are not valid values and must be ignored. When in free-running (not triggered) mode, the Metadata value for feature Exposure Delay is not a valid value and must be ignored. The value of LineStatusAll is updated on the start of exposure.

The following figure shows Sapera Explorer with the Metadata Example highlighted.

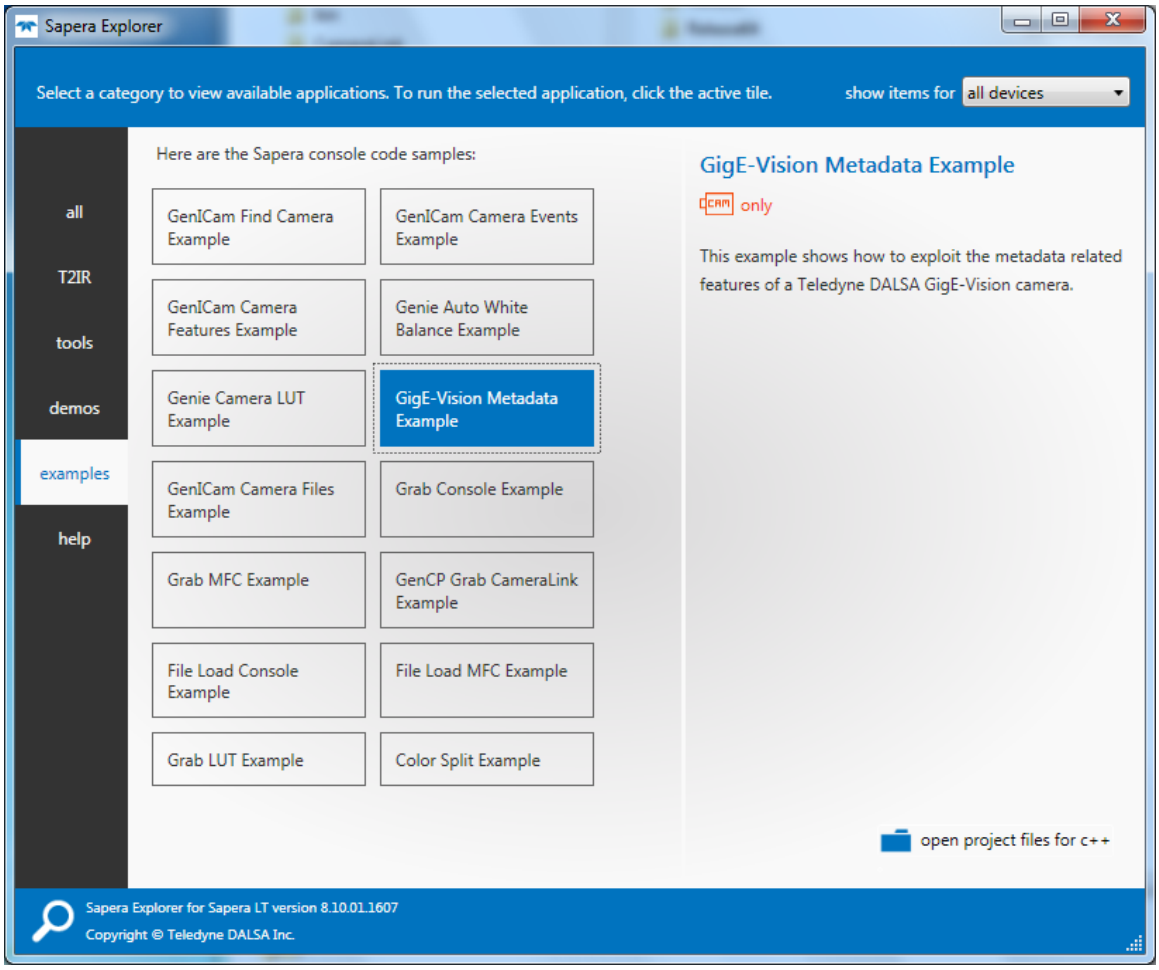


Figure 45: Sapera Explorer with the GigE Vision Metadata example selected.

Acquisition and Transfer Control Category

The Linea SWIR GigE Camera's Acquisition and Transfer Controls shown by CamExpert shows parameters used to configure the optional acquisition modes of the device. These features provide the mechanism to have acquisitions coupled to transfers (basic mode) or decoupled acquisitions from both the camera and host transfer modules.

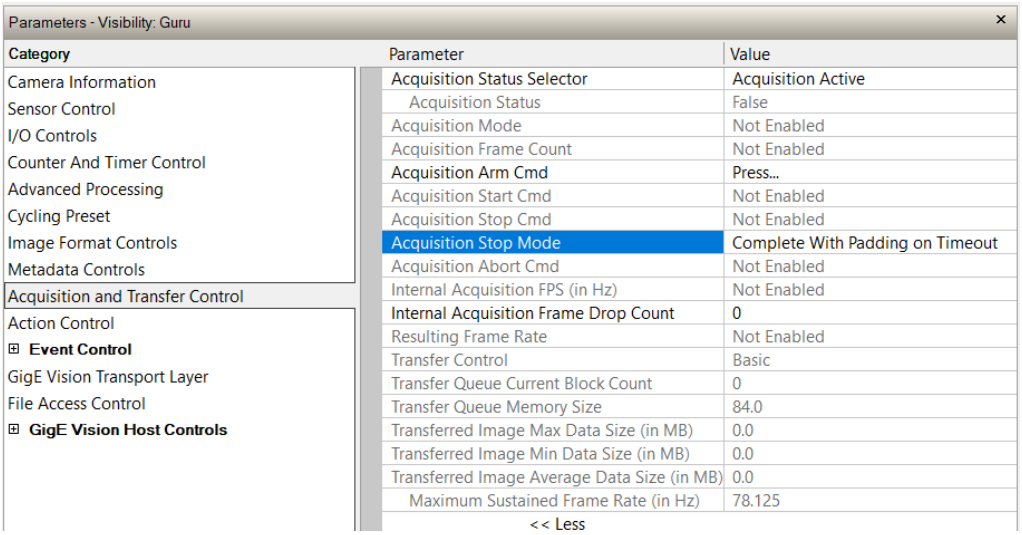


Figure 46: Acquisition and Transfer Features

Acquisition and Transfer Control Feature Descriptions

Display Name	Feature & Values	Description	Device Version & View
Acquisition Status Selector	AcquisitionStatusSelector	Selects the internal acquisition signal to read using AcquisitionStatus.	1.00 Expert
Acquisition Trigger Wait	*AcquisitionTriggerWait*	*Device is currently waiting for a trigger to capture one or more frames.*	
Acquisition Active	*AcquisitionActive*	*Device is currently doing an acquisition of one or more frames.*	
Acquisition Status	AcquisitionStatus	Reads the state of the internal acquisition signal selected using the AcquisitionStatusSelector feature.	1.00 Expert
Acquisition Mode	AcquisitionMode	Set the acquisition mode of the device. It defines the number of frames to capture during an acquisition and the way the acquisition stops.	1.00 Beginner
Single Frame	*SingleFrame*	*One frame is captured for each AcquisitionStart Command. An AcquisitionStop occurs at the end of the Active Frame.*	
Multi-Frame	*MultiFrame*	*A sequence of frames is captured for each AcquisitionStart Command. The number of frames is specified by AcquisitionFrameCount feature. An AcquisitionStop occurs at the end of the Active Frame(s)*	
Continuous	*Continuous*	*Frames are captured continuously with AcquisitionStart until stopped with the AcquisitionStop command.*	

Display Name	Feature & Values	Description	Device Version & View
Acquisition Frame Count	AcquisitionFrameCount	Number of frames to be acquired in MultiFrame acquisition mode.	1.00 Beginner
Acquisition Arm Cmd	AcquisitionArm	Arms the device before an AcquisitionStart command. This optional command validates all the current features for consistency and prepares the device for a fast start of the acquisition. If not used explicitly, this command is automatically executed at the first AcquisitionStart but will not be repeated for subsequent ones unless a data transfer related feature is changed in the device. (WO)	1.00 Guru
Acquisition Start Cmd	AcquisitionStart	Start image capture using the currently selected acquisition mode. The number of frames captured is specified by AcquisitionMode feature. (WO)	1.00 Beginner
Acquisition Stop Cmd	AcquisitionStop	Stops the Acquisition of the device at the end of the current frame unless the triggerFrameCount feature is greater then 1. (WO)	1.00 Beginner
Acquisition Abort Cmd	AcquisitionAbort	Aborts the acquisition immediately. This will end the capture without completing the current Frame or aborts waiting on a trigger. If no acquisition is in progress, the command is ignored. (WO)	1.00 Beginner
Acquisition Stop Mode	AcquisitionStopMode	Controls how the AcquisitionStop command and the acquisition stopped using a trigger,ends on an ongoing frame.	Beginner
Complete	*Complete*	*When stopped during a frame, the device will continue acquisition of line until the specified height is reached to deliver a complete default size frame.*	
Immediate With Padding	*ImmediateWithPadding*	*Acquisition stops immediately even during a frame but the remaining of the frame will be padded with data to deliver a complete default height frame.*	
Complete With Padding On Timeout	*CompleteWithPaddingOnTimeout*	*When stopped during a frame, the device will continue acquisition of lines until the specified height is reached or a trigger timeout occurs. In the case of a timeout the remaining frame will be padded with data to deliver a complete default height frame.*	
Internal Acquisition FPS	internalAcquisitionFPS	Specifies the camera internal frame rate, in Hz. Use the AcquisitionFrameRate feature to control this value.	1.00 Guru DFNC
Internal Acquisition Frame Drop Count	internalAcquisitionFrameDropCount	Number of acquired frames to drop internally between each transmitted frame.	1.00 Guru DFNC
Resulting Frame Rate	resultingTransferFPS	Reports the transfer frame rate, based on the current AcquisitionFrameRate and internalAcquisitionFrameDropCount. This features does not take bandwidth limitations into account.	1.00 Guru DFNC
Transfer Control	TransferControlMode	Sets the method used to control the transfer.	1.00 Expert
Basic	*Basic*	*Basic mode ensures maximum compatibility but does not allow for control of the transfer flow.*	
User Controlled	*UserControlled*	*Manual mode allows maximum control of the transfer flow.*	
Transfer Queue Current Block Count	transferQueueCurrentBlockCount	Returns the current number of blocks in the transfer queue.	1.00 Expert DFNC

Display Name	Feature & Values	Description	Device Version & View
Transfer Queue Memory Size	transferQueueMemorySize	Indicates the amount of device memory (in MBytes) available for internal image frame accumulation in the transfer queue. Increasing or decreasing memory reserved by devicePacketResendBufferSize will affect total memory available here.	1.00 Expert DFNC
Transferred Image Max Data Size	transferMaxBlockSize	Biggest image (GEV blocks) data size sent on the GigE cable. The value is displayed in Megabytes. Use this value to calculate the frame rate transferred on the GigE cable. GigE Link speed (~115 MB) divided by Biggest image (value) = Max fps transferred.	1.00 Beginner DFNC
Transferred Image Min Data Size	transferMinBlockSize	Smallest image (GEV blocks) data size sent on the GigE cable. The value is displayed in Megabytes.	1.00 Beginner DFNC
Transferred Image Average Data Size	transferAverageBlockSize	Average size of the last 16 images (GEV blocks) of data sent on the GigE cable. The value is displayed in Megabytes. Use this value to calculate the sustained frame rate transferred on the GigE cable. GigE Link speed (~115 MB) divided by Average size (value) = Max fps transferred. When TurboDrive is enabled, this feature allows monitoring the average throughput.	1.00 Beginner DFNC
Maximum Sustained Frame Rate	maxSustainedFrameRate	Maximum sustained frame rate that can be achieved by the camera in the current configuration (Resolution, Pixel Format and the camera's internal bandwidth limitations). When TurboDrive is enabled, this value also takes the feature transferAverageBlockSize into account.	1.00 Beginner DFNC

Acquisition Buffering

Acquisitions are internally buffered then transferred to the host system. This internal buffer allows uninterrupted acquisitions without transfer delays. When the internal buffer is full an Image Lost Event will be generated.

Using Transfer Queue Current Block Count with CamExpert

This feature returns the number of frames buffered within the camera pending transfer to the host system. Image lines / frames are buffered in cases where the host system is experiencing high network traffic with other devices through the same Ethernet switch.

Note: By buffering image frames, the camera will not drop data when there are temporary delays to the transfer.

When using CamExpert, right click on this parameter and then click on Refresh from the pop-up menu. The current frame count in the transfer buffer is displayed in the Value field. During live grab, if the number of frames in the transfer buffer is increasing, then there is a problem with the network or host bandwidth being exceeded. Review the Troubleshooting section of this manual and then contact Technical Support for help in reviewing your camera setup.

Note: The ImageLost event occurs when all buffer space is consumed.

Overview of Transfer Control (TransferControlMode)

The acquisition transfer function operates in basic coupled mode or independent decoupled user-controlled mode.

TransferControlMode = Basic

Basic Transfer Mode provides maximum compatibility with any control application running on the host computer. The host based acquisition program commands the camera to do a frame grab and send it through the camera's frame buffer to the camera's transfer module and the host. The acquisition rate is limited by the host transfer rate.

TransferControlMode = UserControlled

User Controlled Transfer Mode decouples the camera acquisition module from the camera and host computer's transfer module. The user has control of the three control modules.

Some important points are:

- The acquisition module writes frames to the camera's circular frame buffer memory. When all buffers are written, the next acquisition overwrites a previously stored image (this also generates the ImageLost event).
- The camera transfer module is independent of the acquisition. It allows the acquisition to run continuously ignoring any interruption by network delays or traffic on the connection with the controlling host computer.
- The host computer has independent control of the host transfer module, allowing the host application to optimize receiving image packets and other tasks running on the host.
- **Important:** Under user controlled transfers, the feature TransferOperationMode sets the transfer as either continuous or a specific image frame count (MultiBlock). The transfer frame count is set by the feature TransferBlockCount, which must be equal or less than the number of image frames available in the camera's circular frame buffer (else the command is rejected). The feature transferQueueCurrentBlockCount is used to read the available buffer count before starting a block count transfer.

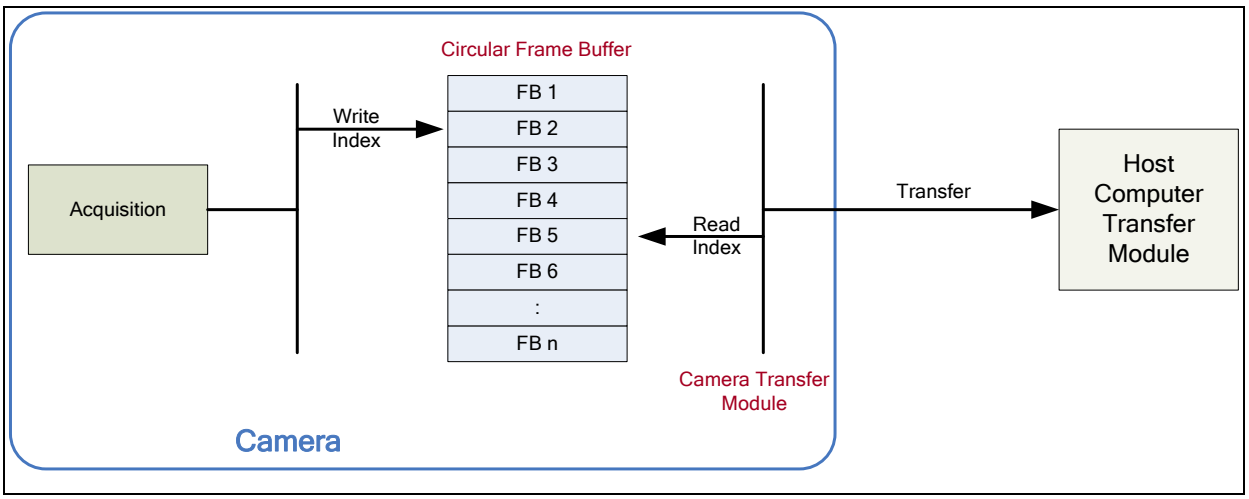


Figure 47: Camera Circular Frame Buffer

Features that cannot be changed during a Sapera Transfer

The following features cannot be changed during an acquisition or Sapera transfer.

Feature Group	Features Locked During a Sapera Transfer
CAMERA INFORMATION	UserSetLoad
SENSOR CONTROL	NA
I/O CONTROL	NA
COUNTER AND TIMER CONTROL	NA
ADVANCED PROCESSING CONTROL	flatfieldCorrectionMode
IMAGE FORMAT CONTROL	PixelFormat OffsetX OffsetY Width Height BinningHorizontal BinningVertical
ACQUISITION AND TRANSFER CONTROL	DeviceRegistersStreamingStart DeviceRegistersStreamingEnd
EVENT CONTROL	NA
GIGE VISION TRANSPORT LAYER CONTROL	GevSCPSPacketSize
GIGE VISION HOST CONTROL	InterPacketTimeout InterPacketTimeoutRaw ImageTimeout
FILE ACCESS CONTROL	NA

Event Control Category

The Event Control category groups parameters used to configure Camera Event related features.

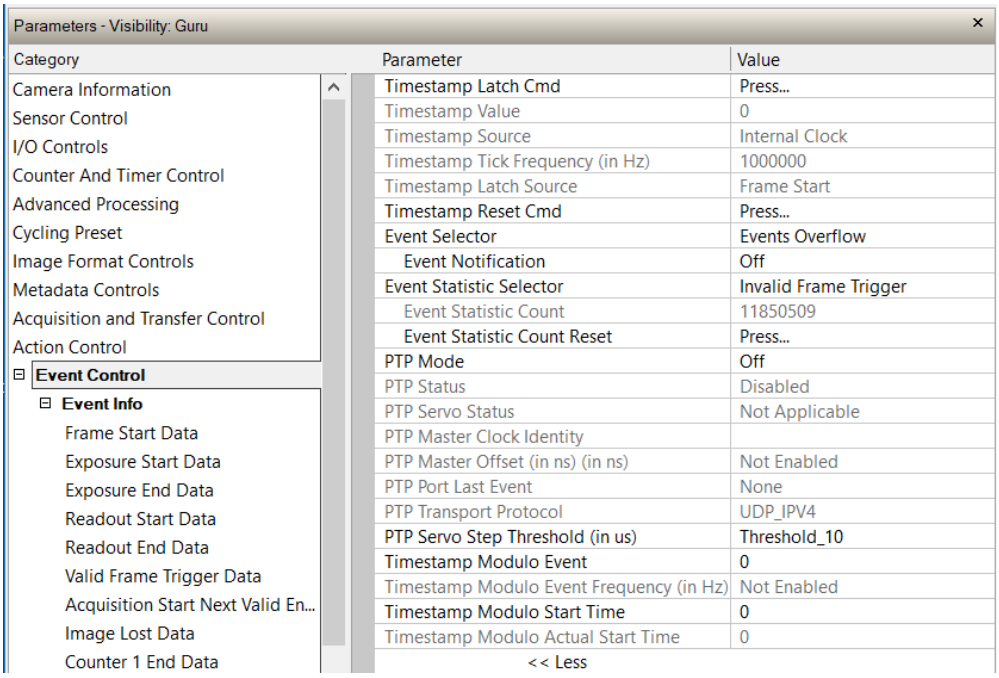


Figure 48: CamExpert – Event Control Category

Event Control Feature Descriptions

Display Name	Feature & Values	Description	Standard & View
Timestamp Latch Cmd	timestampControlLatch	Latch the current timestamp internal counter value in the timestampValue feature.	Expert DFNC
Timestamp Value	timestampValue	Returns the 64-bit value of the timestamp, which is the internal Clock timer or the PTP clock timer, depending on the Timestamp Source selection. (RO)	Expert DFNC
TimeStamp Source *Internal Clock* *IEEE1588*	timestampSource *InternalClock* *IEEE1588*	Specifies the source used as the incrementing signal for the Timestamp register. *The timestamp source is generated by the camera internal clock. Refer to timestampTickFrequency feature for the time base.* *The Timestamp source is controlled by the network IEEE1588 protocol. This source is automatically selected when PTP mode is enabled.*	Expert DFNC
Timestamp Tick Frequency (in Hz)	timestampTickFrequency	Indicates the number of timestamp ticks (or increments) during 1 second (frequency in Hz). This feature changes depending on the Timestamp Source. (RO)	Expert DFNC
Timestamp Latch Source *Frame Start*	timestampLatchSource *FrameStart*	Specifies the internal event or signal that will latch the Timestamp counter into the Timestamp buffer. *The timestamp is latched on frame start.*	Expert DFNC
Timestamp Reset Cmd	timestampControlReset	Resets the timestamp counter to 0. This Feature resets both the internal Clock timer and the PTP clock timer. Note that the PTP Mode must be disabled first to reset the PTP clock timer. (WO)	Expert DFNC

Display Name	Feature & Values	Description	Standard & View
Event Selector	EventSelector	Select the Event to enable/disable with the EventNotification feature.	Expert
Start of Frame	*FrameStart*	*Event sent on control channel on an Active Frame. This occurs with the start of the exposure delay.*	
Start of Exposure	*ExposureStart*	*Event sent on control channel on start of exposure.*	
End of Exposure	*ExposureEnd*	*Event sent on control channel on end of exposure.*	
Acquisition Start Next Valid	*AcquisitionStartNextValid*	*Event sent on control channel when the AcquisitionStart command can be used again.*	
Valid Frame Trigger	*ValidFrameTrigger*	*Event sent on control channel when a valid frame trigger is generated.*	
Rejected Frame Trigger	*InvalidFrameTrigger*	*Event sent on control channel when a frame trigger occurs in an invalid Trigger region. The trigger is rejected and no frame acquisition occurs.*	
Image Lost	*ImageLost*	*Event sent on control channel when an image is lost due to insufficient memory.*	
Counter 1 End	*Counter1End*	*Event sent when counter 1 has reached the counterDuration count.*	
Line1 Rising Edge	*Line1RisingEdge*	*The event will be generated when a Rising Edge is detected on the Line 1.*	
Line1 Falling Edge	*Line1FallingEdge*	*The event will be generated when a Falling Edge is detected on the Line 1.*	
Line2 Rising Edge	*Line2RisingEdge*	*The event will be generated when a Rising Edge is detected on the Line 2.*	
Line2 Falling Edge	*Line2FallingEdge*	*The event will be generated when a Falling Edge is detected on the Line 2.*	
Events Overflow	*OverflowError*	*Event sent on control channel when all previous active events have been disabled because the camera cannot send them fast enough, generating an internal message overflow. All required events must be re-enabled manually.*	
Event Notification	EventNotification	Enable Events for the event type selected by the EventSelector feature.	Expert
Off	*Off*	*The selected event is disabled.*	
On	*On*	*The selected event will generate a software event.*	
GigEVisionEvent	*GigEVisionEvent*	*The selected event will generate a software event. This entry is deprecated. Using "On" is recommended.*	
Event Statistic Selector	eventStatisticSelector	Selects which Event statistic to display.	Expert DFNC
Invalid Frame Trigger	*InvalidFrameTrigger*	*Counts the frame triggers occurring in an invalid Trigger region.*	
Image Lost	*ImageLost*	*Image is acquired but lost before it's been transferred.*	
Packet Resend	*PacketResend*	*Counts the number of individual packets that are resent.*	
Packet Resend Request Dropped	*PacketResendRequestDropped*	*Counts the number of packet resend requests dropped. The camera queues the packet resend requests until they are processed. There is a limit to the number of requests that can be queued by the camera. When a new request is received and the queue is full, the request is dropped but this statistic is still incremented.*	
Ethernet Pause Frame Received	*EthernetPauseFrameReceived*	*Counts the number of Ethernet Pause Frame received. See also PAUSE Frame Support for information on Ethernet Packet size.*	
Event Statistic Count	eventStatisticCount	Display the count of the selected Event.	Expert DFNC
Event Statistic Count Reset	eventStatisticCountReset	Reset the count of the selected Event.	Expert DFNC

Display Name	Feature & Values	Description	Standard & View
PTP Mode	ptpMode	Specifies the PTP (IEEE-1588: Precision Time Protocol) operating mode as implemented by the camera.	Expert DFNC
Off	*Off*	*PTP is disabled on the device.*	
Automatic	*Automatic*	*PTP is enabled on the device. The camera can become a Master or Slave device. The Master device is automatically determined as per IEEE-1588.*	
Slave	*Slave*	*Device will operate in PTP slave-only mode.*	
PTP Status	ptpStatus	Specifies dynamically the current PTP state of the device. (ref: IEEE Std 1588-2008)	Expert DFNC
Initializing	*Initializing*	*The port initializes its data sets, hardware, and communication facilities. No port of the clock shall place any PTP messages on its communication path. If one port of a boundary clock is in the INITIALIZING state, then all ports shall be in the INITIALIZING state.*	
Faulty	*Faulty*	*The fault state of the protocol. A port in this state shall not place any PTP messages except for management messages that are a required response to another management message on its communication path. In a boundary clock, no activity on a faulty port shall affect the other ports of the device. If fault activity on a port in this state cannot be confined to the faulty port, then all ports shall be in the FAULTY state.*	
Disabled	*Disabled*	*The port shall not place any messages on its communication path. In a boundary clock, no activity at the port shall be allowed to affect the activity at any other port of the boundary clock. A port in this state shall discard all PTP received messages except for management messages.*	
Listening	*Listening*	*The port is waiting for the announceReceiptTimeout to expire or to receive an Announce message from a master. The purpose of this state is to allow orderly addition of clocks to a domain. A port in this state shall not place any PTP messages on its communication path except for Pdelay_Req, Pdelay_Resp, Pdelay_Resp_Follow_Up, or signaling messages, or management messages that are a required response to another management message.*	
PreMaster	*PreMaster*	*The port shall behave in all respects as though it were in the MASTER state except that it shall not place any messages on its communication path except for Pdelay_Req, Pdelay_Resp, Pdelay_Resp_Follow_Up, signaling, or management messages.*	
Master	*Master*	*The port is behaving as a master port.*	
Passive	*Passive*	*The port shall not place any messages on its communication path except for Pdelay_Req, Pdelay_Resp, Pdelay_Resp_Follow_Up, or signaling messages, or management messages that are a required response to another management message.*	
Uncalibrated	*Uncalibrated*	*One or more master ports have been detected in the domain. The appropriate master port has been selected, and the local port is preparing to synchronize to the selected master port. This is a transient state to allow initialization of synchronization servos, updating of data sets when a new master port has been selected, and other implementation-specific activity.*	
Slave	*Slave*	*The port is synchronizing to the selected master port.*	

Display Name	Feature & Values	Description	Standard & View
Grand Master	*GrandMaster*	*The port is in the Grand Master state (i.e. has the best clock). The camera can become GrandMaster only if the PTP Mode=Automatic and there's another device on the network that was Master.*	
Error	*Error*	*One or more ports have an error state.*	
PTP Servo Status	ptpServoStatus	Specifies the IEEE1588 servo status.	Expert DFNC
Unlocked	*Unlocked*	*The servo is not yet ready to track the master clock.*	
Synchronizing	*Synchronizing*	*The servo is unlocked and synchronizing to the master clock.*	
Locked	*Locked*	*The servo is adjusting (syntonizing to the master clock.*	
Not Applicable	*NotApplicable*	*The servo state is currently not applicable.*	
PTP Master Clock Identity	ptpMasterClockId	Port identity of the current best master. The clock ID is an Extended Unique Identifier (EUI)-64 64-bit ID, converted from the 48-bit MAC address, by inserting 0xfffe at the middle of the MAC address.	Guru DFNC
PTP Master Offset (in ns)	ptpMasterOffsetNs	Dynamically returns the 64-bit value of the PTP offset with the master, in nanoseconds. This value is the input for clock corrections for the slave device clock servo algorithms.	Guru DFNC
PTP Port Last Event	ptpPortLastEvent	Logs the last PTP changed state event defining the last current status.	Expert DFNC
None	*None*	*None*	
Power up	*Powerup*	*Power up*	
Initialize	*Initialize*	*Initialize*	
Designated Enabled	*DesignatedEnabled*	*Designated Enabled*	
Designated Disabled	*DesignatedDisabled*	*Designated Disabled*	
Fault Cleared	*FaultCleared*	*Fault Cleared*	
Fault Detected	*FaultDetected*	*Fault Detected*	
State Decision Event	*StateDecisionEvent*	*State Decision Event*	
Qualification Timeout Expires	*QualificationTimeoutExpires*	*Qualification Timeout Expires*	
Announce Receipt Timeout Expires	*AnnounceReceiptTimeoutExpires*	*Announce Receipt Timeout Expires*	
Synchronization Fault	*SynchronizationFault*	*Synchronization Fault*	
Master Clock Selected	*MasterClockSelected*	*Master Clock Selected*	
Recommended State Master	*RS_Master*	*Recommended State Master*	
Recommended State Grand Master	*RS_GrandMaster*	*Recommended State Grand Master*	
Recommended State Slave	*RS_Slave*	*Recommended State Slave*	
Recommended State Passive	*RS_Passive*	*Recommended State Passive*	
PTP Transport Protocol	ptpTransportProtocol	Describes the PTP Transport Protocol used.	Expert DFNC
UDP_IPV4	*UDP_IPV4*	*PTP runs over UDP/IPV4*	
PTP Servo Step Threshold (in us)	ptpServoStepThreshold	Specifies the servo step threshold (in µs). When the clock offset with the master exceeds the threshold, the servo unlocks and offset adjustment is started.	Expert DFNC
Threshold_10	*Threshold_10*	10	
Threshold_20	*Threshold_20*	20	
Threshold_100	*Threshold_100*	100	
Threshold_500	*Threshold_500*	500	
Threshold_1000	*Threshold_1000*	1000	
Threshold_2000	*Threshold_2000*	2000	

Display Name	Feature & Values	Description	Standard & View
Timestamp Modulo Event	timestampModulo	Specifies the additional interval between the current timestamp tick and the event generated. This interval has an 80ns accuracy. Note that the value zero disables the event generator.	Expert DFNC
Timestamp Modulo Event Frequency (in Hz)	timestampModuloFrequency	Returns the frequency of the timestamp Modulo Event (in Hz).	Expert DFNC
Timestamp Modulo Start Time	timestampModuloStartTime	Specifies the timestamp value that must be exceeded by the incrementing timestamp counter before the modulo event starts. This Feature is also used for a "Future" Frame Acquisition.	Expert DFNC
Timestamp Modulo Actual Start Time	timestampModuloActualStartTime	Displays the actual modulo event start time as used by the device. When the user specified "timestampModuloStartTime" is in the future, timestampModuloActualStartTime= timestampModuloStartTime. When the user specified "timestampModuloStartTime" has already past, the camera automatically recalculates a future value for "timestampModuloStartTime" using the user set "timestampModulo" feature value. This new start time is reported by "timestampModuloActualStartTime".	Expert DFNC

GigE Vision Transport Layer Control Category

The Linea SWIR GigE Camera Vision Transport Layer Control as shown by CamExpert, shows parameters used to configure features related to GigE Vision specification and the Ethernet Connection.

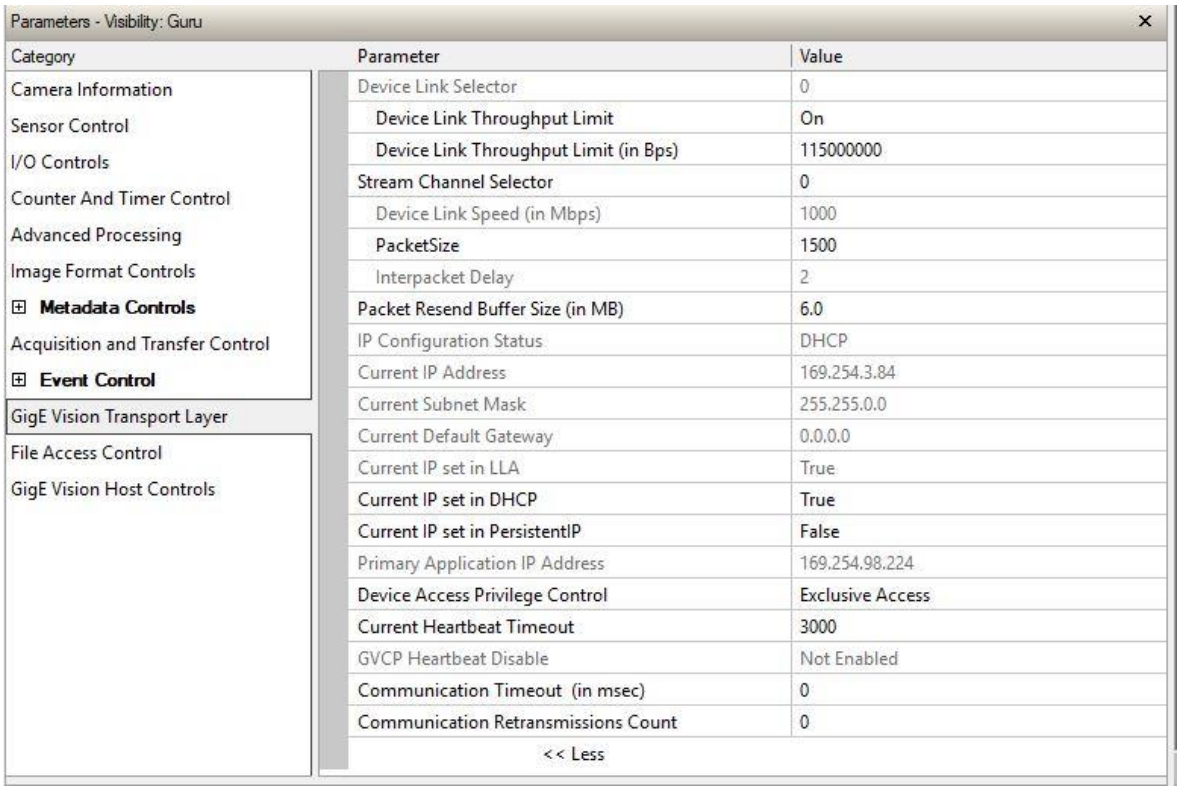


Figure 49: GigE Vision Transport Layer Features

GigE Vision Transport Layer Feature Descriptions

Display Name	Feature & Values	Description	Device Version & View
Device Link Selector	DeviceLinkSelector	Selects which Link of the device to control.	1.00 Expert
Device Link Throughput Limit	DeviceLinkThroughputLimitMode	When disabled, lower level TL specific features are expected to control the throughput. When enabled, DeviceLinkThroughputLimit controls the overall throughput.	1.00 Guru
Device Link Throughput Limit (in Bps)	DeviceLinkThroughputLimitMode	Limits the maximum bandwidth of the data that will be streamed out by the device.	1.03 Guru
Stream Channel Selector	GevStreamChannelSelector	Selects the stream channel to control.	1.00 Expert
Device Link Speed (in Mbps)	GevLinkSpeed	Indicates the transmission speed negotiated by the given network interface. (in Mbps) (RO)	1.00 Expert
PacketSize	GevSCPSPacketSize	Specifies the stream packet size in bytes to send on this channel.	1.00 Expert

Display Name	Feature & Values	Description	Device Version & View
Interpacket Delay	GevSCPD	Indicates the delay (in µs) to insert between each packet for this stream channel.	1.00 Expert
Packet Resend Buffer Size (in MB)	devicePacketResendBufferSize	Indicates the amount of memory to reserve in MBytes for the packet resend buffer.	1.00 DFNC Guru
IP Configuration Status	GevIPConfigurationStatus	Reports the current IP configuration status. (RO)	1.00 Guru
None	*None*	*Device IP Configuration is not defined.*	
PersistentIP	*PersistentIP*	*Device IP Address Configuration is set to Persistent IP (static).*	
DHCP	*DHCP*	*Device IP Address Configuration is set to DHCP (Dynamic Host Configuration Protocol). Network requires a DHCP server.*	
LLA	*LLA*	*Device IP Address Configuration is set to LLA (Link-Local Address). Also known as Auto-IP. Used for unmanaged networks including direct connections from a device to a dedicated NIC.*	
ForceIP	*ForceIP*	*Device IP Address Configuration is set to ForceIP. Used to force an IP address change.*	
Current IP Address	GevCurrentIPAddress	Reports the IP address for the given network interface. (RO)	1.00 Beginner
Current Subnet Mask	GevCurrentSubnetMask	Reports the subnet mask of the given interface. (RO)	1.00 Beginner
Current Default Gateway	GevCurrentDefaultGateway	Reports the default gateway IP address to be used on the given network interface. (RO)	1.00 Beginner
Current IP set in LLA	GevCurrentIPConfigurationLLA	Controls whether the LLA (Link Local Address) IP configuration scheme is activated on the given network interface. (RO)	1.00 Guru
Current IP set in DHCP	GevCurrentIPConfigurationDHCP	Controls whether the DHCP IP configuration scheme (Dynamic Host Configuration Protocol) is activated on the given network interface.	1.00 Guru
Current IP set in Persistent IP	GevCurrentIPConfigurationPersistentIP	Controls whether the PersistentIP configuration scheme is activated on the given network interface.	1.00 Guru
Primary Application IP Address	GevPrimaryApplicationIPAddress	Returns the IP address of the device hosting the primary application. (RO)	1.00 Guru
Device Access Privilege Control	deviceCCP	Controls the device access privilege of an application.	1.00 Guru DFNC
Exclusive Access	*ExclusiveAccess*	*Grants exclusive access to the device to an application. No other application can control or monitor the device.*	
Control Access	*ControlAccess*	*Grants control access to the device to an application. No other application can control the device.*	
Current Heartbeat Timeout	GevHeartbeatTimeout	Indicates the current heartbeat timeout in milliseconds.	1.00 Guru
GVCP Heartbeat Disable	GevGVCPHeartbeatDisable	Disables the GVCP (GigE Vision Control Protocol) heartbeat monitor. This allows control switchover to an application on another device.	1.00 Expert
Communication Timeout (in msec)	GevMCTT	Provides the transmission timeout value in milliseconds.	1.00 Guru

Display Name	Feature & Values	Description	Device Version & View
Communication Retransmissions Count	GevMCRC	Indicates the number of retransmissions allowed when a message channel message times out.	1.00 Guru
Send Test Packet	GevSCPSFireTestPacket	When this feature is set to True, the device will send one test packet.	1.00 Invisible
MAC Address	GevMACAddress	MAC address of the network interface. (RO)	1.00 Invisible
Current Camera IP Configuration	GevCurrentIPConfiguration	Current camera IP configuration of the selected interface. (RO)	1.00 Invisible
LLA	*LLA*	*Link-Local Address Mode.*	
DHCP	*DHCP*	*Dynamic Host Configuration Protocol Mode. Network requires a DHCP server.*	
PersistentIP	*PersistentIP*	*Persistent IP Mode. (static)*	
Persistent IP Address	GevPersistentIPAddress	Persistent IP address for the selected interface. This is the IP address the camera uses when booting in Persistent IP mode.	1.00 Invisible
Persistent Subnet Mask	GevPersistentSubnetMask	Persistent subnet mask for the selected interface.	1.00 Invisible
Persistent Default Gateway	GevPersistentDefaultGateway	Persistent default gateway for the selected interface.	1.00 Invisible
Primary Application Socket	GevPrimaryApplicationSocket	Returns the UDP (User Datagram Protocol) source port of the primary application. (RO)	1.00 Invisible
Device Access Privilege Control	GevCCP	Controls the device access privilege of an application.	1.00 Invisible
Open Access	*OpenAccess*	*OpenAccess.*	
Exclusive Access	*ExclusiveAccess*	*Grants exclusive access to the device to an application. No other application can control or monitor the device.*	
Control Access	*ControlAccess*	*Grants control access to the device to an application. No other application can control the device.*	
Interface Selector	GevInterfaceSelector	Selects which physical network interface to control.	1.00 Invisible
Number Of Interfaces	GevNumberOfInterfaces	Indicates the number of physical network interfaces supported by this device. (RO)	1.00 Invisible
Message Channel Count	GevMessageChannelCount	Indicates the number of message channels supported by this device. (RO)	1.00 Invisible
Stream Channel Count	GevStreamChannelCount	Indicates the number of stream channels supported by this device (0 to 512). (RO)	1.00 Invisible
Gev Supported Option Selector	GevSupportedOptionSelector	Selects the GEV option to interrogate for existing support. (RO)	1.00 Invisible
	IPConfigurationLLA *IPConfigurationDHCP* *IPConfigurationPersistentIP* *StreamChannelSourceSocket* *MessageChannelSourceSocket* *CommandsConcatenation* *WriteMem* *PacketResend* *Event* *EventData* *PendingAck* *Action* *PrimaryApplicationSwitchover* *ExtendedStatusCodes* *DiscoveryAckDelay* *DiscoveryAckDelayWritable* *TestData* *ManifestTable*		

Display Name	Feature & Values	Description	Device Version & View
	CCPApplicationSocket *LinkSpeed* *HeartbeatDisable* *SerialNumber* *UserDefinedName* *StreamChannel0BigAndLittleEndian* *StreamChannel0IPReassembly* *StreamChannel0UnconditionalStreaming* *StreamChannel0ExtendedChunkData*		
Gev Supported Option	GevSupportedOption	Returns TRUE if the selected GEV option is supported. (RO)	1.00 Invisible
LLA Supported	GevSupportedIPConfigurationLLA	Indicates if LLA (Auto-IP) is supported by the selected interface. The LLA method automatically assigns the camera with a randomly chosen address on the 169.254.xxx.xxx subnet. After an address is chosen, the link-local process sends an ARP query with that IP onto the network to see if it is already in use. If there is no response, the IP is assigned to the device, otherwise another IP is selected, and the ARP is repeated. Note that LLA is unable to forward packets across routers. LLA is the recommended scheme when only one NIC is connected to GigE cameras; ensure only one NIC is using LLA on your PC, otherwise IP conflicts will result. (RO)	1.00 Invisible
DHCP Supported	GevSupportedIPConfigurationDHCP	Indicates if DHCP is supported by the selected interface. This IP configuration mode requires a DHCP server to allocate an IP address dynamically over the range of some defined subnet. The camera must be configured to have DHCP enabled. This is the factory default settings. The DHCP server is part of a managed network. Windows itself does not provide a DHCP server function therefore a dedicated DHCP server is required. The DALSA Network Configuration Tool can be configured as a DHCP server on the NIC used for the GigE Vision network. (RO)	1.00 Invisible
Persistent IP Supported	GevSupportedIPConfigurationPersistentIP	Indicates if Persistent IP is supported by the selected interface. This protocol is only suggested if the user fully controls the assignment of IP addresses on the network and a GigE Vision camera is connected beyond routers. The GigE Vision camera is forced a static IP address. The NIC IP address must use the same subnet otherwise the camera is not accessible. If the camera is connected to a different subnet, it cannot be accessed.	1.00 Invisible
GVCP Extended Status Codes	GevGVCPExtendedStatusCodes	Enables generation of extended status codes. (RO)	1.00 Invisible
Gev MCP HostPort	GevMCPHostPort	Indicates the port to which the device will send messages. (RO)	1.00 Invisible
Gev MCDA	GevMCDA	Indicates the destination IP address for the message channel. (RO)	1.00 Invisible
Gev MCSP	GevMCSP	This feature indicates the source port for the message channel. (RO)	1.00 Invisible
Stream Channel Interface Index	GevSCPInterfaceIndex	Index of network interface. (RO)	1.00 Invisible
Gev SCP HostPort	GevSCPHostPort	Indicates the port to which the device will send the data stream. (RO)	1.00 Invisible
Gev SCDA	GevSCDA	Indicates the destination IP address for this stream channel. (RO)	1.00 Invisible

Display Name	Feature & Values	Description	Device Version & View
Gev SCSP	GevSCSP	Indicates the source port of the stream channel. (RO)	1.00 Invisible
Gev First URL	GevFirstURL	Indicates the first URL to the XML device description file. (RO)	1.00 Invisible
Gev Second URL	GevSecondURL	Indicates the second URL to the XML device description file. (RO)	1.00 Invisible
Gev Major Version	GevVersionMajor	Major version of the specification. (RO)	1.00 Invisible
Gev Minor Version	GevVersionMinor	Minor version of the specification. (RO)	1.00 Invisible
Manifest Entry Selector	DeviceManifestEntrySelector	Selects the manifest entry to reference.	1.00 Invisible
XML Major Version	DeviceManifestXMLMajorVersion	Indicates the Major version number of the XML file of the selected manifest entry. (RO)	1.00 Invisible
XML Minor Version	DeviceManifestXMLMinorVersion	Indicates the Minor version number of the XML file of the selected manifest entry. (RO)	1.00 Invisible
XML SubMinor Version	DeviceManifestXMLSubMinorVersion	Indicates the SubMinor version number of the XML file of the selected manifest entry. (RO)	1.00 Invisible
Schema Major Version	DeviceManifestSchemaMajorVersion	Indicates the Major version number of the Schema file of the selected manifest entry. (RO)	1.00 Invisible
Schema Minor Version	DeviceManifestSchemaMinorVersion	Indicates the Minor version number of the Schema file of the selected manifest entry. (RO)	1.00 Invisible
Manifest Primary URL	DeviceManifestPrimaryURL	Indicates the first URL to the XML device description file of the selected manifest entry. (RO)	1.00 Invisible
Manifest Secondary URL	DeviceManifestSecondaryURL	Indicates the second URL to the XML device description file of the selected manifest entry. (RO)	1.00 Invisible
Device Mode Is Big Endian	GevDeviceModeIsBigEndian	Endianess of the device registers. (RO)	1.00 Invisible
Device Mode CharacterSet	GevDeviceModeCharacterSet	Character set used by all the strings of the bootstrap registers. (RO)	1.00 Invisible
	reserved1 *UTF8* *reserved2*		
GevSCPSDoNotFragment	GevSCPSDoNotFragment	This feature state is copied into the "do not fragment" bit of IP header of each stream packet. (RO)	1.00 Invisible
Gev SCPS BigEndian	GevSCPSBigEndian	Endianess of multi-byte pixel data for this stream. (RO)	1.00 Invisible
TLParamsLocked	TLParamsLocked	Flag to indicate if features are locked during acquisition.	1.00 Invisible

Defaults for devicePacketResendBufferSize

The default minimum for devicePacketResendBufferSize allows at least two maximum sized buffers. Resend buffers hold the last images transferred to host.

Note: Increasing the Packet Resend Buffer allows more resend packets but it consumes internal memory used for image transfers. This reduces the number of frames acquired at frame rates exceeding the possible transfer rates. Memory size is monitored with the feature "transferQueueMemorySize".

GigE Vision Host Control Category

GigE Vision Host controls group parameters used to configure the host computer system GigE Vision features used for camera networking management. None of the parameters are stored in the camera.

The features allow optimizing the network configuration for maximum bandwidth. Settings for the parameters are highly dependent on the number of cameras connected to a NIC, the data rate of each camera and the trigger modes used.

Teledyne DALSA's Network Imaging Package for Sapera LT Optimization Guide provides information on these features.

File Access Control Category

File Access control in CamExpert allows the user to quickly upload camera firmware and Flat Field coefficients or download data.

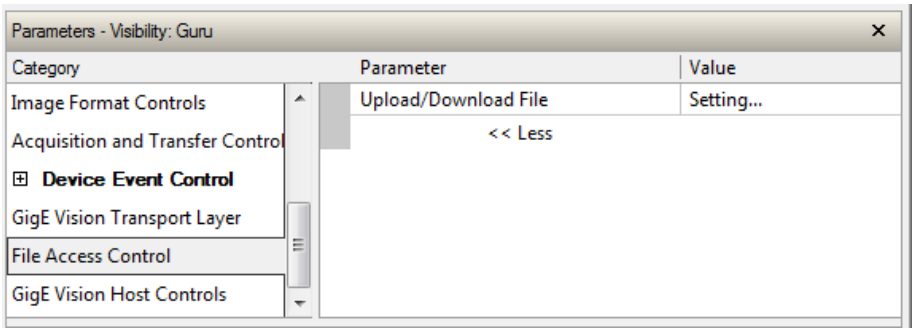


Figure 50: File Access Features

File Access Control Feature Descriptions

Display Name	Feature & Values	Description	Device Version & View
File Selector	FileSelector	Selects the file to access. The file types which are accessible are device-dependent.	1.00 Guru
Firmware	*Firmware1*	*Upload new firmware to the camera, which will execute on the next camera reboot cycle. Select the DeviceReset feature after the upload completes.*	
Factory Flat Line coefficients 1	*FlatFieldCoefficients01*	*Select Factory Flatfield coefficients 1.*	
User Flat Line coefficients 1	*FlatFieldCoefficients1*	*Select user Flat Line coefficients1.*	
User Flat Line coefficients 2	*FlatFieldCoefficients2*	*Select user Flat Line coefficients2.*	
User Flat Line coefficients 3	*FlatFieldCoefficients3*	*Select user Flat Line coefficients3.*	
User Flat Line coefficients 4	*FlatFieldCoefficients4*	*Select user Flat Line coefficients4.*	
Factory Defective Pixel Map	*BadPixelCoordinate0*	*Select the Factory Defective Pixel Map.*	
User Defective Pixel Map	*BadPixelCoordinate1*	*Select the User Defective Pixel Map.*	
User Defined Saved Image	*userDefinedSavedImage*	*Upload and download an image in the camera.*	
Open Source Licenses	*SoftwareLicenses*	*Open Source Software Licenses.*	

Display Name	Feature & Values	Description	Device Version & View
File Operation Selector	FileOperationSelector	Selects the target operation for the selected file in the device. This operation is executed when the File Operation Execute feature is called.	1.00 Guru
Open	*Open*	*Select the Open operation - executed by FileOperationExecute.*	
Close	*Close*	*Select the Close operation - executed by FileOperationExecute*	
Read	*Read*	*Select the Read operation - executed by FileOperationExecute.*	
Write	*Write*	*Select the Write operation - executed by FileOperationExecute.*	
Delete	*Delete*	*Select the Delete operation - executed by FileOperationExecute.*	
File Operation Execute	FileOperationExecute	Executes the operation selected by File Operation Selector on the selected file.	1.00 Guru
File Access Buffer	FileAccessBuffer	Defines the intermediate access buffer that allows the exchange of data between the device file storage and the application.	1.00 Guru
File Access Offset	FileAccessOffset	Controls the mapping offset between the device file storage and the file access buffer.	1.00 Guru
File Access Length	FileAccessLength	Controls the mapping length between the device file storage and the file access buffer.	1.00 Guru
File Operation Status	FileOperationStatus	Displays the file operation execution status. (RO)	1.00 Guru
Success	*Success*	*The last file operation has completed successfully.*	
Failure	*Failure*	*The last file operation has completed unsuccessfully for an unknown reason.*	
File Unavailable	*FileUnavailable*	*The last file operation has completed unsuccessfully because the file is currently unavailable.*	
File Invalid	*FileInvalid*	*The last file operation has completed unsuccessfully because the selected file in not present in this camera model.*	
File Operation Result	FileOperationResult	Displays the file operation result. For Read or Write operations, the number of successfully read/written bytes is returned. (RO)	1.00 Guru
File Size	FileSize	Represents the size of the selected file in bytes.	1.00 Guru

File Access via the CamExpert Tool (Quick Camera Firmware Upgrade)

- Click on "Setting…" button to show File Access Control menu.

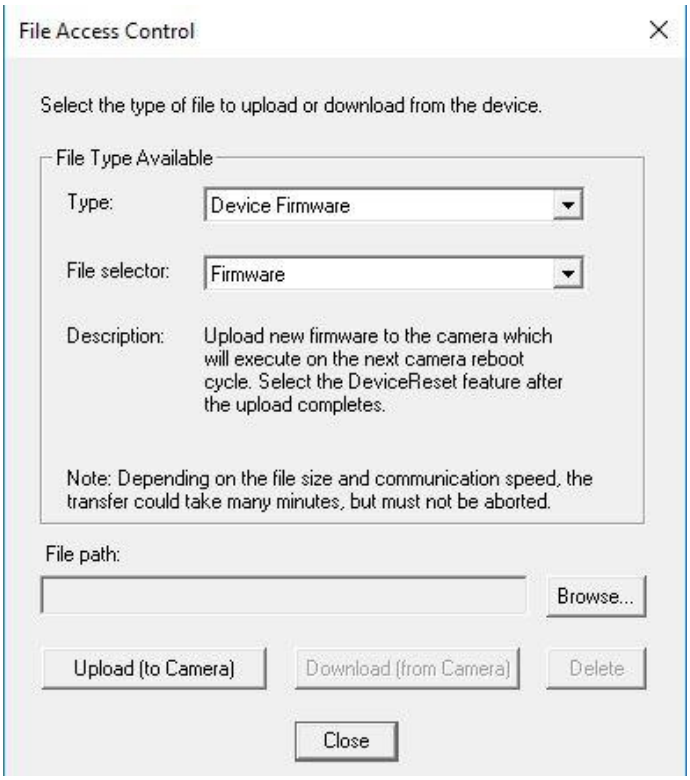


Figure 51: File Access Menu

- Select the File Type: to upload to the camera.
- Select the File selector: choose Firmware.
- Click the Browse button to open Windows Explorer.
- Select the specific file to Upload.
- Click the Upload (to Camera) button to execute the file transfer to the camera.

Device Streaming Registers

Start – End Command Requirements

Important: Every start command must have a corresponding end command. If not, the camera can be in an unpredictable state. This pertains to DeviceRegistersStreamingStart, DeviceRegistersStreamingEnd, DeviceFeaturePersistenceStart, and DeviceFeaturePersistenceEnd.

Device Registers Streaming Start	DeviceRegistersStreamingStart	Announces the start of registers streaming without immediate checking for consistency.	1.00 Invisible
Device Registers Streaming End	DeviceRegistersStreamingEnd	Announces end of registers streaming and performs validation for registers consistency before activating them.	1.00 Invisible
Device Feature Streaming Start	DeviceFeaturePersistenceStart	Announces the start of feature streaming without immediate checking for consistency.	1.00 Invisible
Device Feature Streaming End	DeviceFeaturePersistenceEnd	Announces end of feature streaming and performs validation for feature consistency before activating them.	1.00 Invisible
Register Check	DeviceRegistersCheck	Performs an explicit register set validation for consistency.	1.00 Invisible
Registers Valid	DeviceRegistersValid	States if the current register set is valid and consistent.	1.00 Invisible

Network Overview & Tools

IP Configuration Mode Details

The following descriptions provide more information on IP configuration modes supported by Linea SWIR GigE. Automatic IP configuration assignment (LLA/DHCP) is sufficient for most installations.

Refer to Teledyne DALSA's Network Imaging Package manual for information on the Network Configuration tool and optimization for GigE Vision cameras and devices.

Link-Local Address (LLA)

- LLA is also known as Auto-IP. It is used for unmanaged networks including direct connections from a GigE Vision device to a dedicated NIC.
- A subnet configured with LLA cannot send packets across routers but only via Ethernet switches.
- LLA is recommended when one NIC is connected to a GigE camera. LLA is fully automatic requiring no user input.
  Important: Ensure only one NIC is using LLA on your PC otherwise IP conflicts will result.
- The NIC will automatically assign a random IP address within the 169.254.x.x subnet. The LLA protocol ensures there are no conflicts with other devices through an arbitration scheme.
- The Windows NIC configuration must be set to DHCP (the typical default case) and no DHCP server must be present on the network. Otherwise, an IP address is assigned by the DHCP server. Windows will turn to LLA when no DHCP server answers requests coming from the NIC.
- While Windows and the camera are running, the DHCP process runs in the background. If a DHCP server becomes available on the network, the NIC will get a DHCP assigned IP address for the connected device but connections on the LLA IP address will be lost. Teledyne DALSA's Network Configuration Tool can enable Teledyne DALSA DHCP server on the NIC used for the GigE Vision network.
- **Important:** If the host system has multiple NIC devices configured with LLA, the communication stack cannot resolve which NIC to forward an IP packet too. Limit the number of NICs configured using LLA to one interface. It is preferable that Teledyne DALSA DHCP server is used instead of LLA mode (see next section).
- If multiple NIC devices and cameras are connected use Teledyne DALSA's Network Configuration Tool to change the camera from the default DHCP/LLA mode to Persistent IP mode. **Note:** Teledyne DALSA recommends DHCP/LLA as the mode of operation when a switch is used to connect multiple devices.

DHCP (Dynamic Host Configuration Protocol)

- This IP configuration mode requires a DHCP server to allocate an IP address dynamically over a defined subnet. The factory default setting is DHCP enabled.
- The DHCP server is part of a managed network. Windows does not provide a DHCP server function therefore a dedicated DHCP server is required. Teledyne DALSA's Network Configuration Tool can configure the Teledyne DALSA DHCP server on the NIC used for the GigE Vision network.
- Teledyne DALSA's DHCP server is recommended where there are multiple NIC ports with multiple GigE Vision devices attached. Each NIC port must use a different subnet to avoid IP address conflicts. Persistent IP assignment is required if there is no DHCP server for any additional subnet.
- Windows configures a NIC in DHCP mode by default. If no DHCP server is present on the subnet, Windows will revert to LLA mode.
- Ensure a different subnet is assigned to each NIC on the network. Teledyne DALSA's DHCP server is enabled on one or all subnets used for GigE Vision devices to manage subnets. The graphic below illustrates a system with one NIC having Teledyne DALSA's DHCP server enabled.

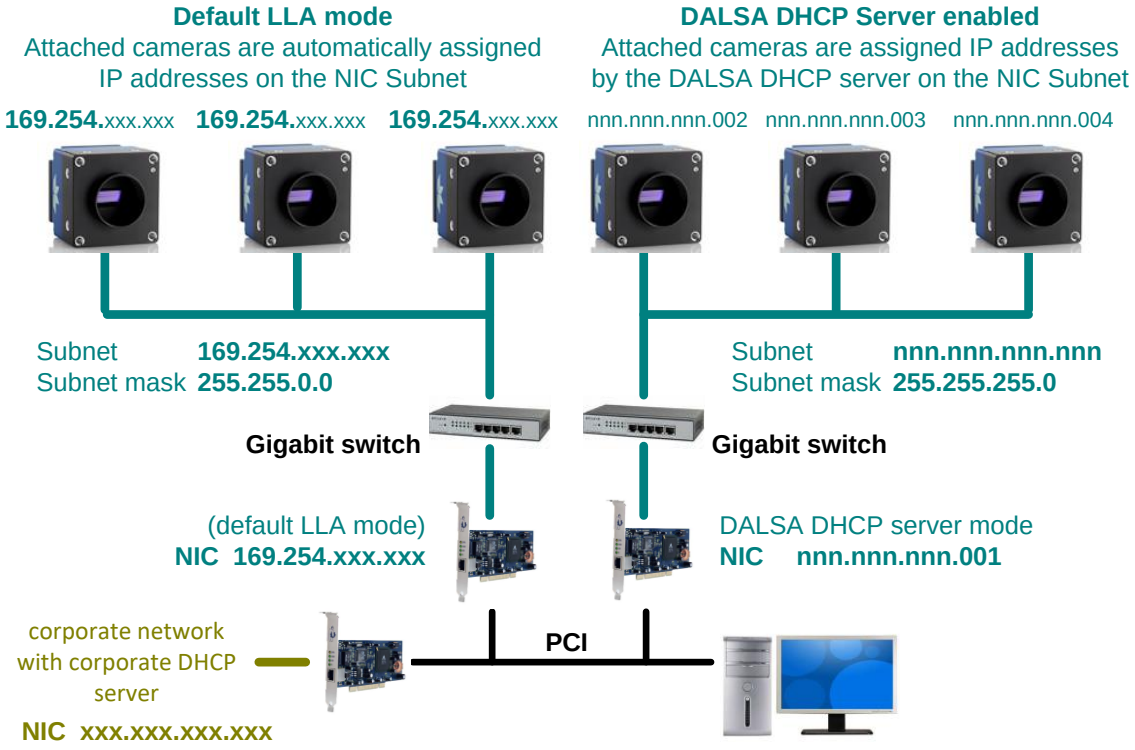


Figure 52: DHCP Network

Persistent IP

- This configuration allows the user full control of IP address assignment on the network.
- The camera is forced a static IP address. The NIC IP address must be the same to access the camera.
- If the camera is connected to a network with a different subnet, it cannot be accessed.
- Use Teledyne DALSA's Network Configuration Tool to set a persistent IP address. Refer to Teledyne DALSA's Network Imaging manual.
- An example of a Persistent IP address assignment on a class B network:
  - NIC Subnet = 192.168.1.1
  - Subnet Mask = 255.255.0.0
  - Persistent IP = 192.168.1.2
  - Default Gateway = 0.0.0.0
- **Warning:** An incorrect IP address assignment may block connecting to the camera. Use Teledyne DALSA's Network Configuration tool to recover a camera with an unknown persistent IP. It will reset the camera's factory default mode, DHCP/LLA. The camera's MAC address displayed on the exterior camera is required to perform this function.
- For GigE Vision applications, the FORCEIP command is used to force a new persistent IP or to change the IP configuration protocol. The camera's MAC address must be known to use the FORCEIP command.
- The following illustration shows a functional computer setup with three NIC ports, but no DHCP server. Two NIC ports are used for private GigE Vision networks. The first uses the default LLA mode for IP addresses, while the second NIC and cameras connected to it are configured with persistent IP addresses. An application on the computer can control each camera, on each subnet, without conflict.

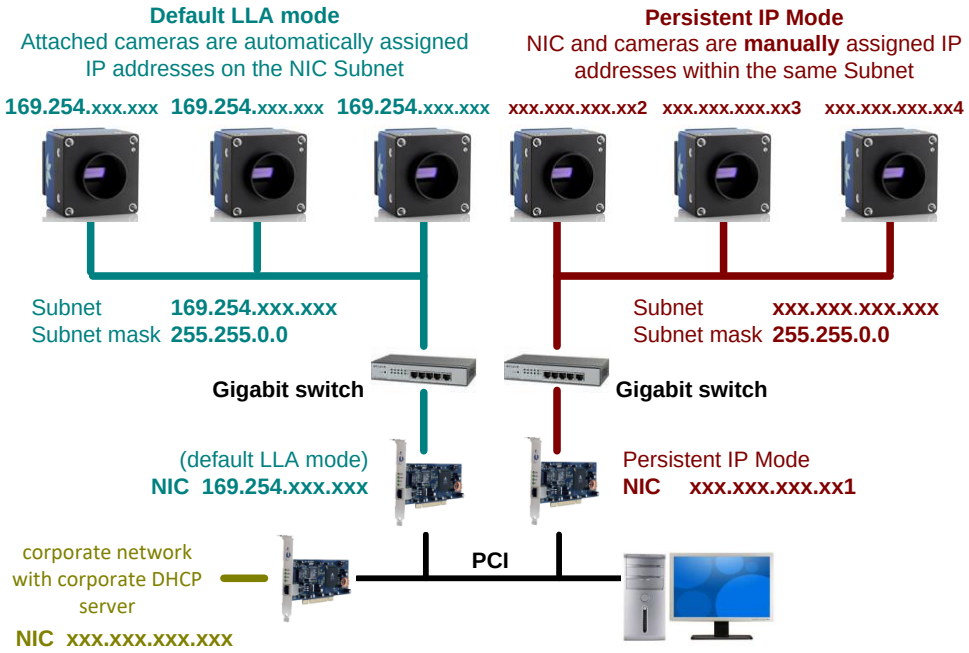


Figure 53: Persistent IP Network

Technical Specifications

Camera Mechanical Specifications

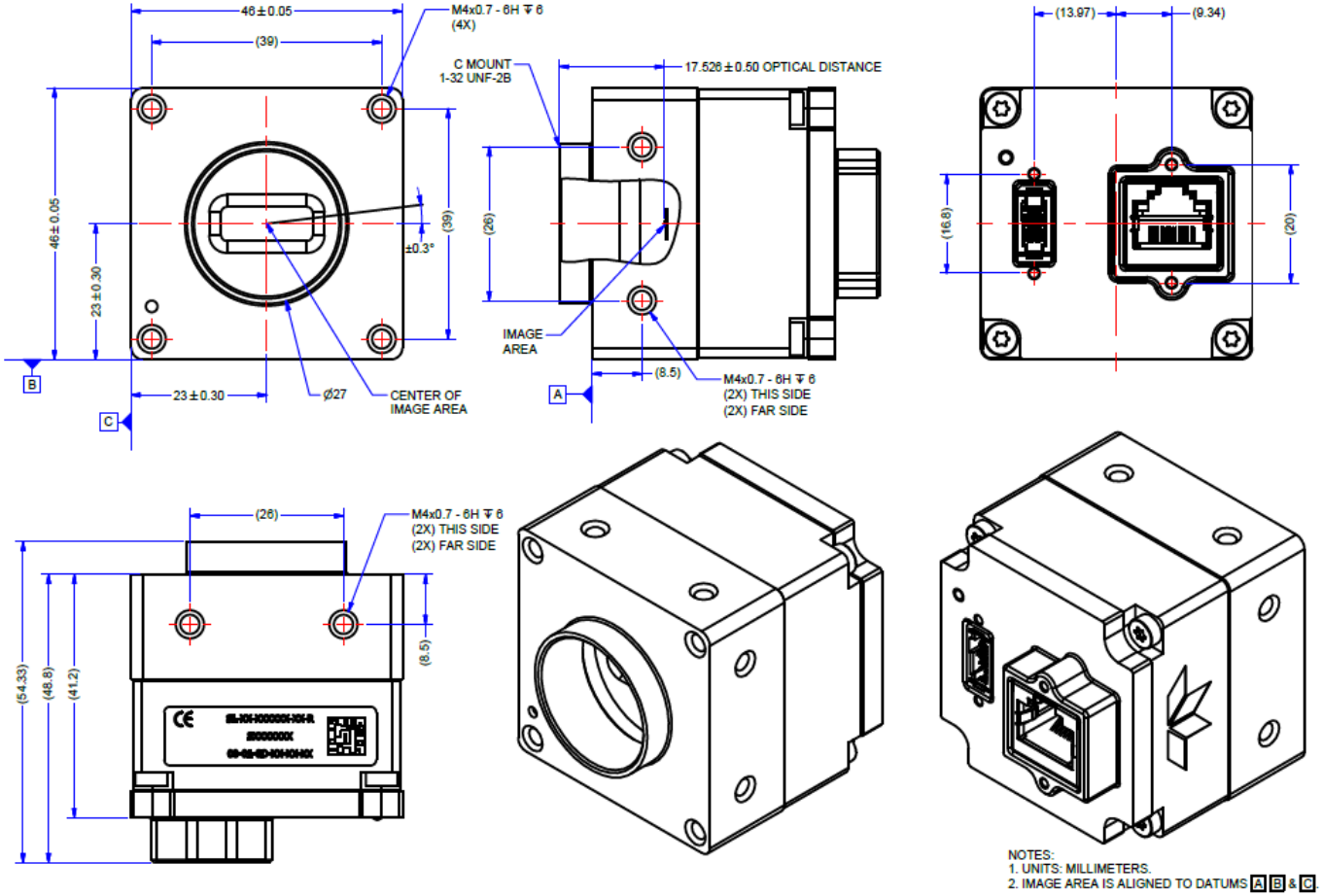


Figure 54: Mechanical

Additional Notes on Camera Identification and Mechanical

Identification Label

	Linea SWIR GigE cameras have an identification label applied to the bottom side, with the following information: Model Part Number Serial Number MAC ID 2D Barcode

Sensor Alignment Specification

The following figure specifies sensor alignment for the camera; the specifications define the absolute maximum tolerance allowed for production cameras. Dimensions "x, y, z" are in microns and referenced to the camera's mechanical body or the optical focal plane (for the z-axis dimension). Theta specifies the sensor rotation relative to the sensor's center and camera mechanical.

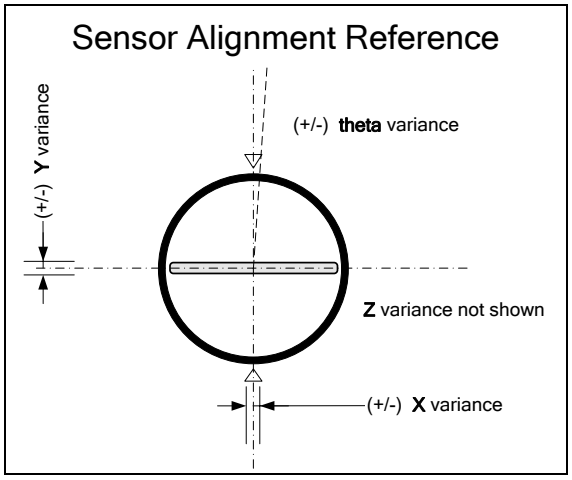


Figure 55: Sensor Alignment Reference

	Linea SWIR GigE
X variance	± 300 µm
Y variance	± 300 µm
Z variance	± 500 µm
Theta variance	± 0.3°

Connectors

- The camera has a single **RJ45 Ethernet** connector for control and video data to the host Gigabit NIC. For industrial environments, the camera supports the use of screw lock Ethernet cables (see Ruggedized RJ45 Ethernet Cables).
- **Note:** Connect power via PoE or the I/O connector, **not both**. Although the camera has protection, differences in ground levels may cause operational issues or electrical faults.
- There is a single 10-pin connector (SAMTEC connector TFM-105-02-L-D-WT) for all I/O signals and auxiliary DC power source. The camera supports connecting cables with retention clips or screw locks.
- See I/O Mating Connector Sources for information about the mating connector or complete cable solutions with retention clips. See 10-Pin I/O Connector Pinout Details for the pinout number assignment (external view of the camera body connector).

3D View of the camera's connector TFM-105-02-L-D-WT

Series	TFM
Number of Positions per Row	-05
Number of Rows	-D - Double Row
Lead Style	-02
Tail Option	Not Available
Plating Option	-L - 15micro" Selectiv
Alignment Pins	Not Selected
Locking Clips	Not Selected
Dual Screw Down Option	Not Selected
Weld Tabs	-WT - Weld Tab
Pick and Place Pad	Not Available
Tape and Reel	Not Selected
Part Number	TFM-105-02-L-D-WT

Figure 56: I/O Connector 3D View

10-Pin I/O Connector Pinout Details

Teledyne DALSA manufactures optional I/O cables as described in Optional Cable Accessories. Contact Sales for availability and pricing.

Pin Number	Linea SWIR	Direction	Definition
1	PWR-GND	-	Camera Power - Ground
2	PWR-VCC	-	Camera Power – DC +12 to +24 Volts
3	GPI-Common	-	General Input Common Ground
4	GPO-Power	-	General Output Common Power
5	GPI 1	In	General External Input 1
6	GPO 1	Out	General External Output 1
7	GPI 2	In	General External Input 2
8	GPO 2	Out	General External Output 2
9	RESERVED	-	Reserved for Future Use
10	Chassis	-	Camera Chassis

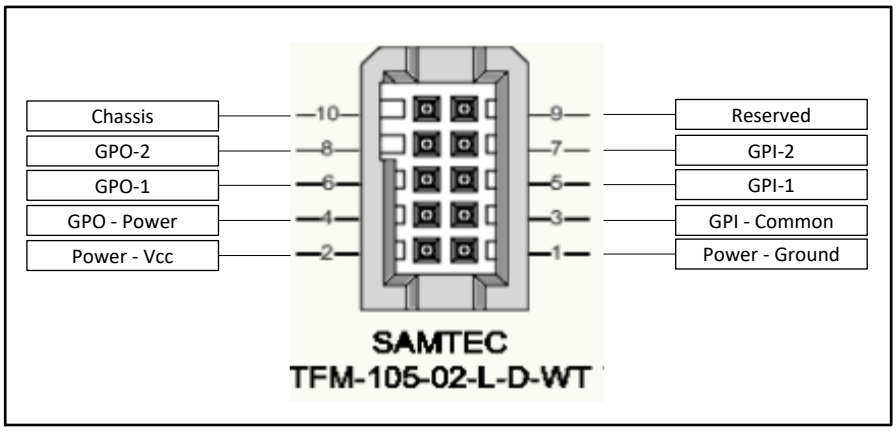


Figure 57: I/O Connector ID

Camera DC Power Characteristics

DC Operating Characteristics		
Input Voltage	+12 Volts minimum	
Input Power Consumption	@+12 Volt Supply	3.72 Watts typical
Input Power Consumption	@+20 Volt Supply	3.80 Watts typical
Input Power Consumption	@+24 Volt Supply	3.84 Watts typical

Absolute Maximum DC Power Supply Range before Possible Device Failure		
Input Voltage	-58 Volts DC	+58 Volts DC

I/O Mating Connector Specifications & Sources

Users wishing to build their own custom I/O cabling can use the following product information to expedite your cable solutions. The table lists Samtec web information for the discrete connector and a cable assembly with retention clips follows the table.

MFG	Part #	Description	Data Sheet
Samtec	ISDF-05-D ISDF-05-D-M (see image below	Discrete Connector (see example below)	http://www.samtec.com/products/isdf
Samtec	SFSD-05-[WG]-G-[AL]-DR-[E2O] WG: Wire Gauge AL: Assembled Length E2O: End 2 Option	Discrete Cable Assembly (see example below)	http://www.samtec.com/products/sfsd
ISDF-05-D-M Connector Availability On-Line			
North America (specific country can be selected)	http://www.newark.com/samtec/isdf-05-d-m/connector-housing-receptacle-10/dp/06R6184		
Europe (specific country can be selected)	http://uk.farnell.com/samtec/isdf-05-d-m/receptacle-1-27mm-crimp-10way/dp/2308547?ost=ISDF-05-D-M		
Asia – Pacific (specific country can be selected)	http://sg.element14.com/samtec/isdf-05-d-m/receptacle-1-27mm-crimp-10way/dp/2308547?ost=ISDF-05-D-M		

Important: Samtec ISDF-05-D-S is not compatible with Linea SWIR GigE

Samtec ISDF-05-D-M Mating Connector

Used for customer built cables w/retention clips ".050" Tiger Eye™ Discrete Wire Socket Housing"

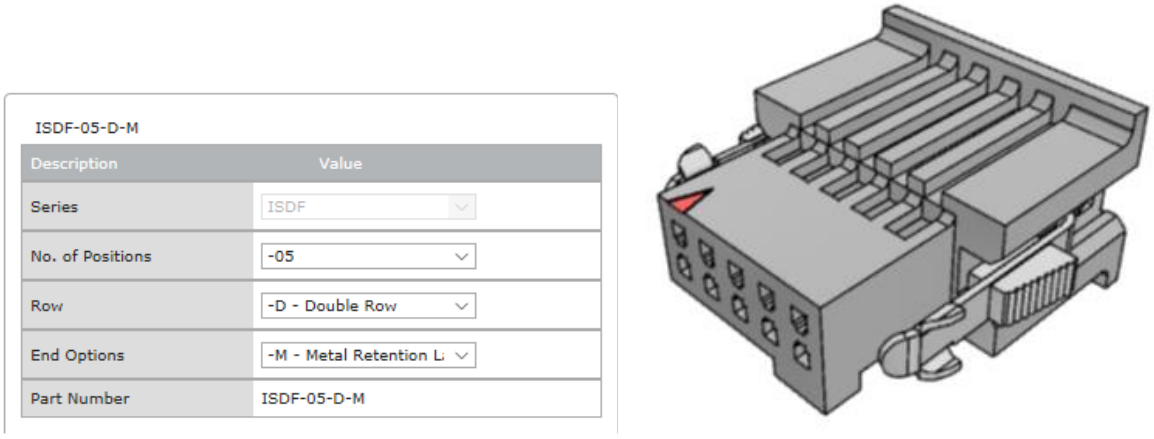


Figure 58: Samtec ISDF-05-D-M Mating Connector

Samtec Assembly SFSD-05-28-H-03.00-SR

Samtec connector-cable assembly SFSD-05-28-H-03.00-SR w/retention clips ".050" Tiger Eye™ Double Row Discrete Wire Cable Assembly, Socket"

SFSD-05-28-H-03.00-SR

Description	Value
Series	SFSD
No. of Positions	-05
Wire Gauge	-28 AWG
Wire Color Code	All Black Wire
Plating Options	-H - 30µ" Heavy Gold
Assembly Length	3.00 INCH
End Option	-SR - Single Ended wit
Notch Option	Not Available
Part Number	SFSD-05-28-H-03.00-SR
Cable Type Option	PVC Cable

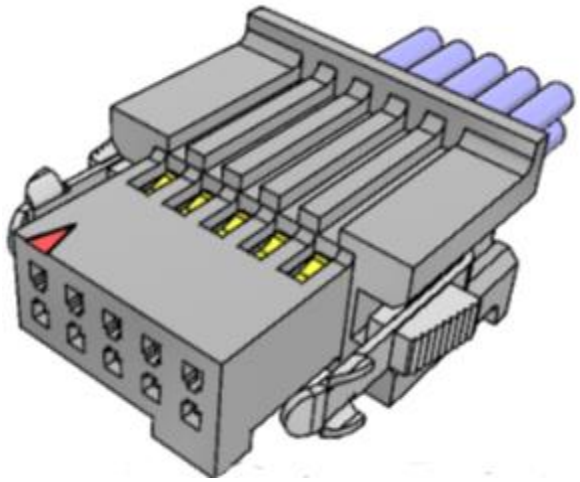


Figure 59: Cable Assembly SFSD-05-28-H-03.00-SR

Power over Ethernet (PoE) Support

- The Linea SWIR GigE requires a PoE Class 0 or Class 2 (or greater) power source for the network if not using a separate external power source connected to pins 1 & 2 of the camera's I/O Connector.
- To use PoE, the camera network setup requires a powered computer NIC supporting PoE, or a PoE capable Ethernet Switch or an Ethernet power injector.
- **Important:** Connect power via PoE or the I/O connector, **not both**. Although the camera has protection, differences in ground levels may cause operational issues or electrical faults.
- If both supplies are connected and active, the camera will use the I/O power supply connector. Ground differences may cause camera faults or failure.
- **Important:** When using PoE, the camera's I/O pin 1 (Camera Power – Ground) must not be connected to I/O pin 3 (General Input Common Ground).

Input Signals Electrical Specifications

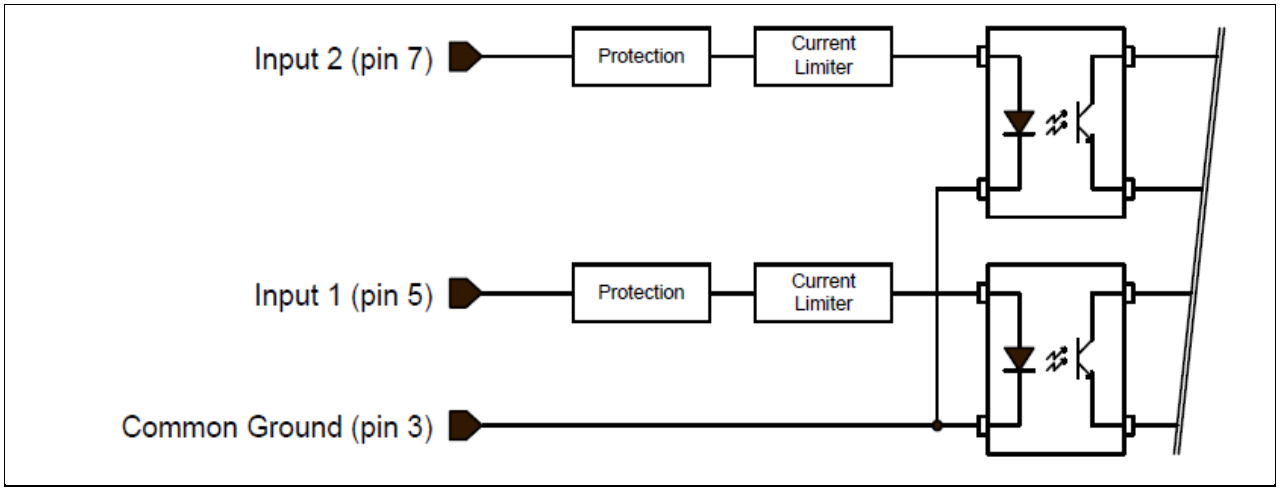


Figure 60: External Inputs Block Diagram

External Input Details

- Opto-coupled with internal current limit.
- Single input trigger threshold level. (TTL standard: <0.8 V = Logical LOW, >2.4 V = Logical HIGH. See lineDetectionLevel feature).
- Used as trigger acquisition event, counter or timestamp event, or integration control.
- User programmable debounce time from 0 to 255 µs in 1 µs steps.
- Source signal requirements:
  - Single-ended driver meeting TTL, 12 V or 24 V standards (see table below)
  - If using a differential signal driver, only one input can be used due to the shared input common (see details below).

External Input DC Characteristics

Operating Specification	Minimum	Maximum
Input Voltage	+3 Volts	+36 Volts
Input Current	7 mA	10.1 mA
Input logic Low		0.8 Volts
Input logic High	2.4 Volts	

Absolute Maximum Range before Possible Device Failure

Absolute Ratings	Minimum	Maximum
Input Voltage	–36 Volts	+36 Volts

External Input AC Timing Characteristics

Conditions	Description	Min	Unit
Input Pulse 0 – 3V	Input Pulse width High	1.3	µs
	Input Pulse width Low	1.7	µs
	Max Frequency	315	kHz
Input Pulse 0 – 5V	Input Pulse width High	0.6	µs
	Input Pulse width Low	2	µs
	Max Frequency	247	kHz
Input Pulse 0 -12V	Input Pulse width High	0.39	µs
	Input Pulse width Low	3	µs
	Max Frequency	160	kHz
Input Pulse 0 – 24V	Input Pulse width High	0.39	µs
	Input Pulse width Low	4.9	µs
	Max Frequency	103	kHz

External Inputs: Using TTL / LVTTL Drivers

- External Input current is limited by camera circuits to a maximum of 10 mA.

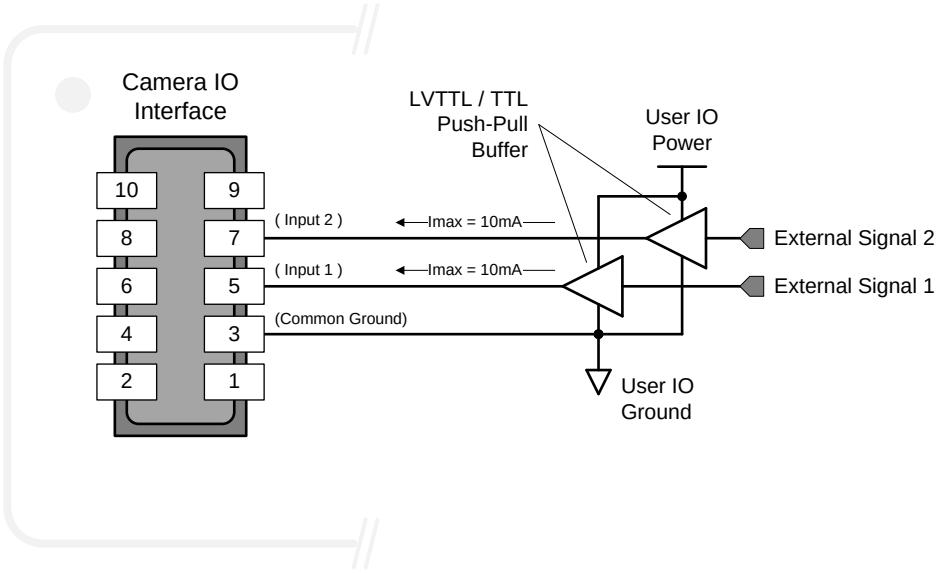


Figure 61: External Inputs with TTL Sources

External Inputs: Using Common Collector NPN Drivers

- External Input current is limited by the camera circuits to a maximum of 10 mA.

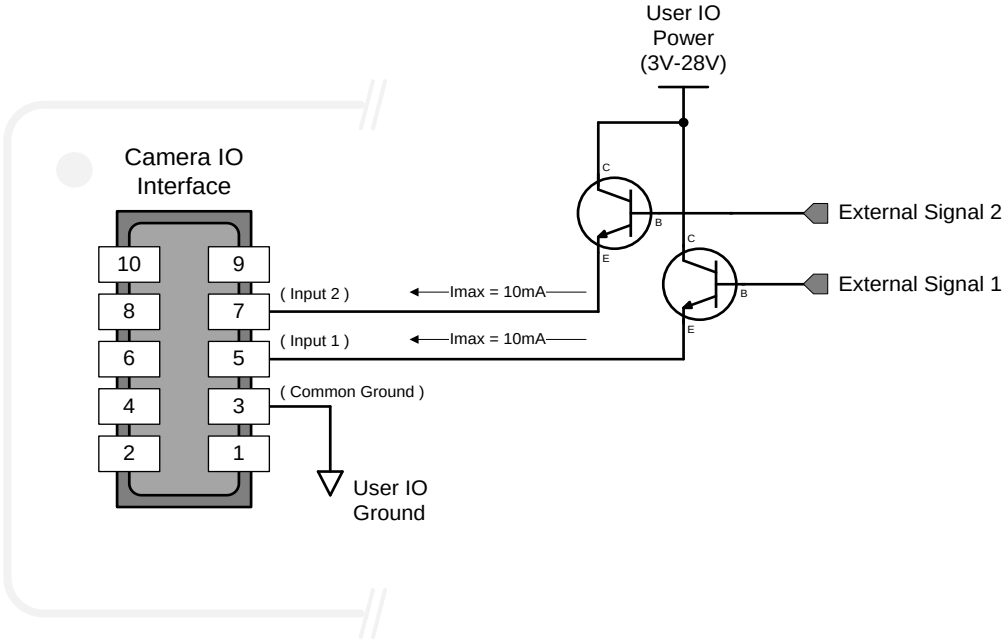


Figure 62: External Inputs with Common Collector Sources

External Inputs: Using Common Emitter NPN Driver

- External Input maximum current is limited by camera circuits to a maximum of 10 mA.
- **Warning:** Only one External Signal can be used (input 1 or 2).

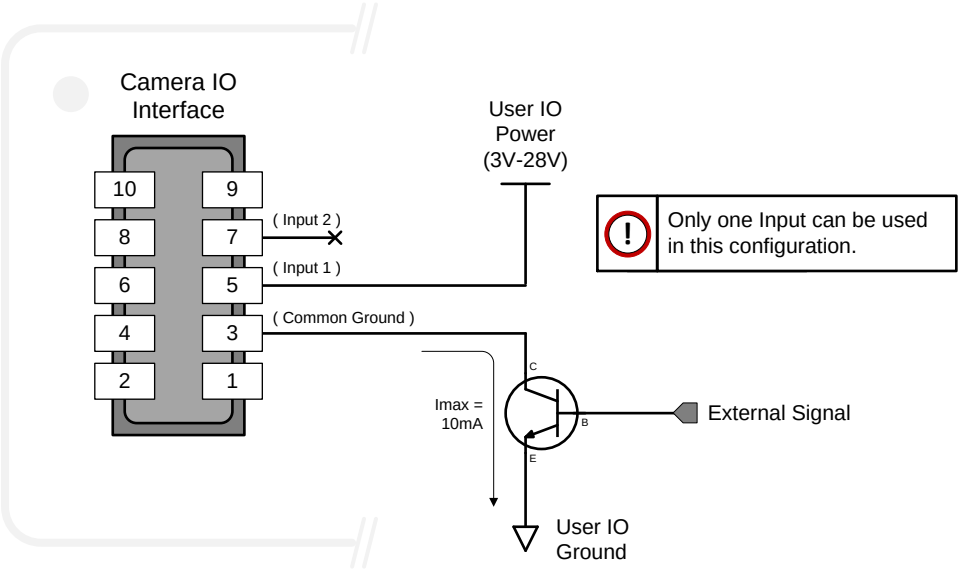


Figure 63: External Inputs with Common Emitter Sources

External Inputs: Using a Balanced Driver

- External Input maximum current is limited by camera circuits to a maximum of 10 mA.
- **Warning:** Only one External Signal can be used (input 1 or 2).

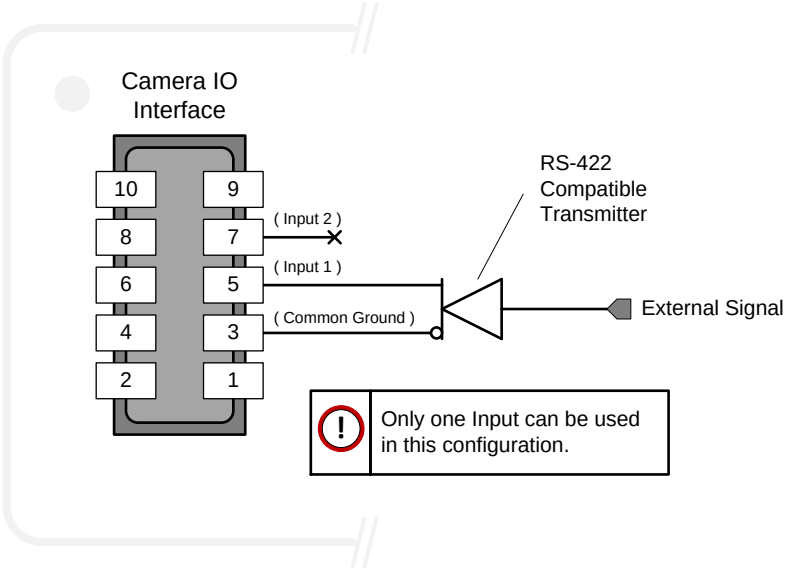


Figure 64: External Inputs with Balanced Driver Source

Output Signals Electrical Specifications

External Outputs Block Diagram

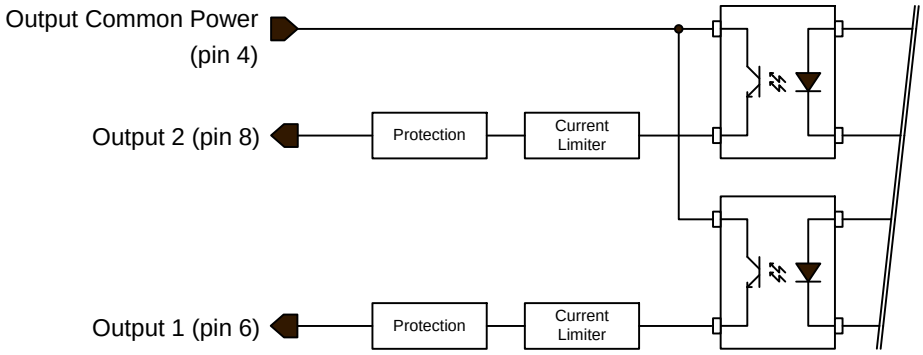


Figure 65: External Outputs Block Diagram

External Output Details and DC Characteristics

- Programmable output strobe mode, event notification, etc (outputLineSource feature).
- Outputs are open on power-up with default factory settings.
- A software reset will not reset the outputs to open state if the outputs are closed.
- A user setup configured to load on boot will not reset the outputs to open state if the outputs are closed.
- No output signal glitch on power-up or polarity reversal.
- Typical Operating Common Power Voltage Range: +3 V to 28 Vdc at 24 mA.
- Maximum Common Power Voltage Range: ±30 Vdc.
- Maximum Output Current: 36 mA

External Output AC Timing Characteristics

The figure and table below defines the test conditions used to measure the camera's external output AC characteristics as detailed in the table below.

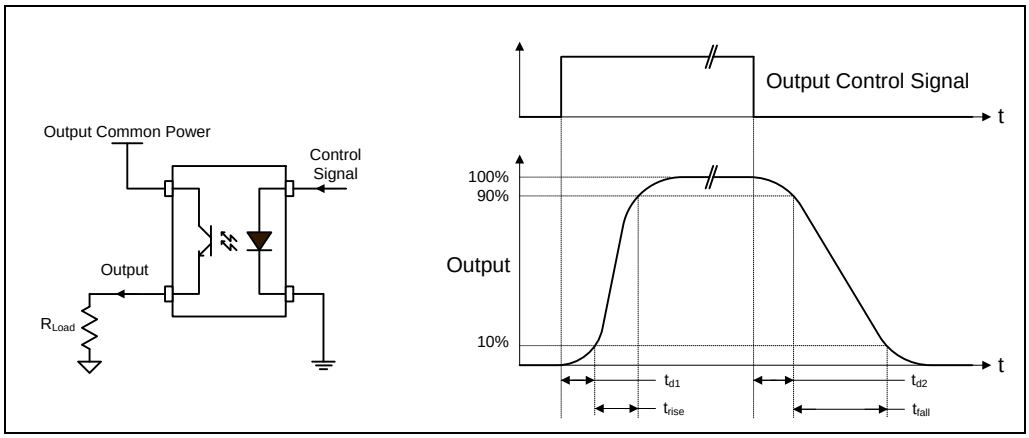


Figure 66: External Output AC Timing

Opto-coupled Output: AC Characteristics at an internal FPGA temperature of 83°C

Note: *All measurements subject to value rounding*

Output Common Power	Output Current (mA)	Rload *Test*	t_{d1} (µs) *Leading Delay*	t_{rise} (µs) *Rise Time*	t_{d2} (µs) *Trailing Delay*	t_{fall} (µs) *Fall Time*
3V	8	250 Ω	0.47	2.9	11.4	26.6
	16	124 Ω	0.47	4.7	4.3	19.5
5V	8	514 Ω	0.47	2.6	13.3	25.3
	16	236 Ω	0.5	7.0	4.4	17.9
	21	73 Ω	0.45	4.4	3.1	10.7
12V	8	1.4 kΩ	0.62	2.0	18.1	24.9
	16	677 Ω	0.54	4.8	7.5	19.9
	24	316 Ω	0.5	3.5	3.8	11.5
24V	8	2.88 kΩ	0.62	2.1	18.9	39.9
	16	1.42 kΩ	0.63	4.7	10.9	27.1
	24	810 Ω	0.79	4.9	5.2	17.4

External Outputs: Using External TTL/LVTTL Drivers

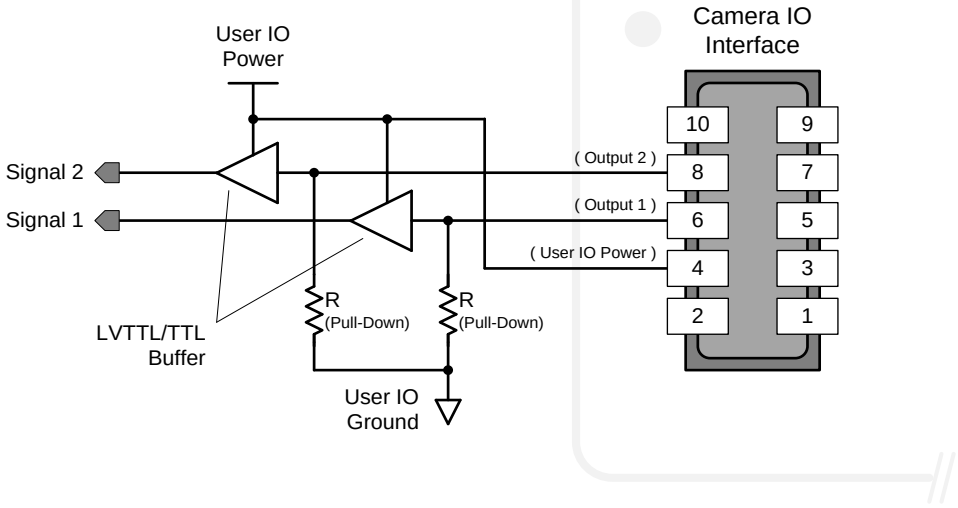


Figure 67: External Outputs with External TTL/LVTTL Drivers

External Outputs: Using External LED Indicators

- One external LED connected in Common Anode configuration.

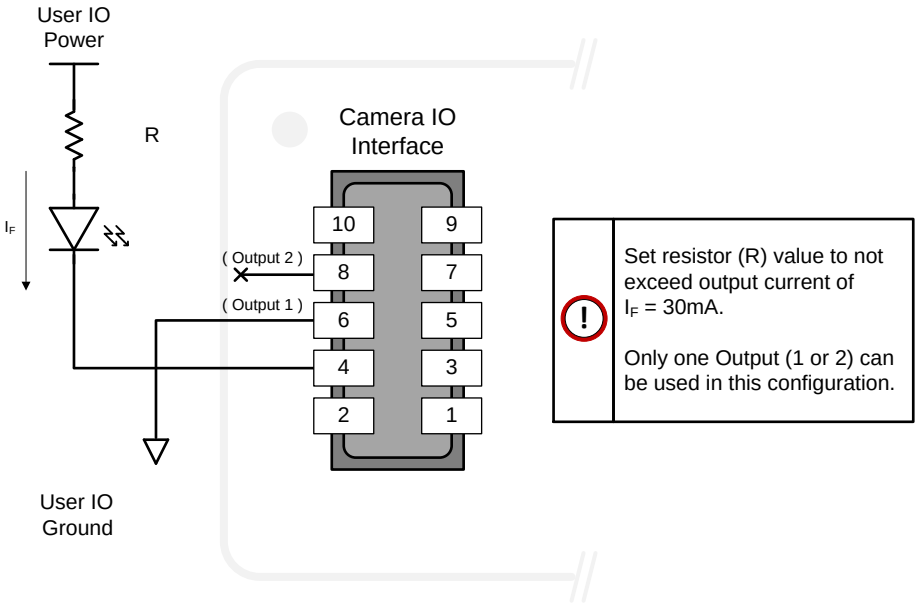


Figure 68: External Output with External Common Anode LED

- Two external LEDs connected in Common Cathode configuration.

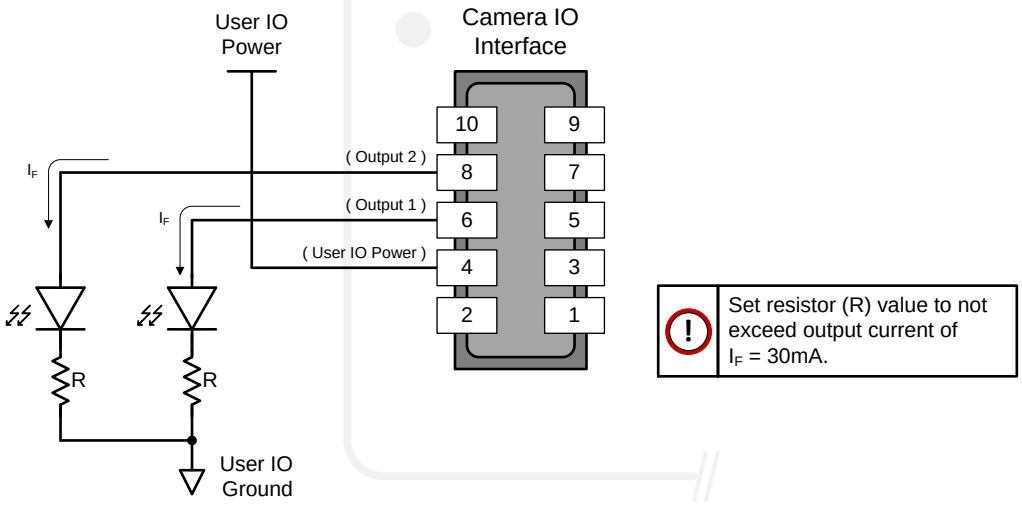


Figure 69: External Outputs with External LEDs

Computer Requirements for Linea SWIR GigE Cameras

The following information is a guide to computer and networking equipment required to support the camera at maximum performance. The Linea SWIR GigE camera series complies with current IPv4 Internet Protocol; current Gigabit Ethernet (GigE) equipment should provide trouble free performance.

Host PC System

- Refer to your GigE-Vision compliant SDK for computer requirements.

Recommended Network Adapters

- Integrated or add on GigE network adapter like the Intel PRO/1000 MT high performance NIC. Typically, a system will need an Ethernet GigE adapter to supplement the single NIC on the motherboard.
- PCI Express adapters will outperform PCI adapters.
- Network adapters that support Jumbo Frames will outperform adapters with fixed packet size frames. Optimal settings will be system dependent.
- **Important:** 10/100 Mb Ethernet is not supported by the Linea SWIR series cameras. The camera Status LED will show it acquired an IP address (solid Blue) but will not respond or function at these slower connections.

Ethernet Switch Requirements

When there is more than one device on the same network or a camera-to-PC separation greater than 100 meters, an Ethernet switch is required. Since the camera complies with the Internet Protocol, it should work with all standard Ethernet switches. However, switches offer a range of functions and performance grades, so care must be taken to choose the right switch for a particular application.

Important: The maximum virtual frame rate possible from a large number of simultaneously triggered cameras depends on the camera model, frame size, and network configuration. Additionally using Pause Frame may change the Jumbo Frame value, which maximizes data throughput. Each imaging system should be tested for data rate maximums.

Ethernet to Fiber-Optic Interface Requirements

In cases of Camera-to-PC separations of more than 100 meters but an Ethernet switch is not desired, a fiber-optic media converter can be used. The FlexPoint GX from Omnitron Systems (www.omnitron-systems.com) converts GigE to fiber transmission and vice versa. It supports multimode (MM) fiber over distances of up to 220 m (720 ft.) and single-mode (SM) fiber up to 65 km (40 mi.) with SC, MT-RJ, or LC connector types.

Important: The inclusion in this manual of GigE to fiber-optic converters does not guarantee they will meet specific application requirements or performance. The user must evaluate any supplemental Ethernet equipment.

Declarations of Conformity

Copies of the Declarations of Conformity documents are available on the product page on the Teledyne website or by request.

FCC Statement of Conformance

This equipment complies with Part 15 of the FCC rules. Operation is subject to the following conditions:

The product may not cause harmful interference; and

The product must accept any interference received, including interference that may cause undesired operation.

FCC Class A Product

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment is intended to be a component of a larger industrial system.

CE and UKCA Declaration of Conformity

Teledyne DALSA declares that this product complies with applicable standards and regulations.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This product is intended to be a component of a larger system and must be installed as per instructions to ensure compliance.

TELEDYNE IMAGING
Everywhereyoulook™

CE

EU DECLARATION OF CONFORMITY

Manufacturer:
Teledyne Digital Imaging, Inc.
605 McMurray Road
Waterloo, Ontario, Canada
N2V 2E9

This CE EU Declaration of Conformity is issued under the sole responsibility of the Manufacturer identified above.

Product Description: **Linea SWIR**
Model Number: **SL-GA-01K04A-00-R, SL-GA-05H04A-00-R**

The Product described above complies with the **Directive 2014/30/EU (EMC) & Directive 2011/65/EU as amended by EU 2015/863 (RoHS2).**

The Product described above also complies with the following standards:

EMC 2014/30/EU	EN55032(2015)+AC 2016, EN55032(2012)+AC 2013	Electromagnetic Compatibility of Multimedia Equipment –Emission Requirements
	EN55011(2016)+A1, EN55011(2009)+A1	Industrial, scientific and medical (ISM) radio-frequency equipment – Radio disturbance characteristics
	EN61326-1(2013)	Electrical equipment for measurement, control and laboratory use – EMC requirements - Limits and methods of measurement
	EN 55024(2010)	Information technology equipment - Immunity characteristics - Limits and methods of measurement
	EN55035(2017)	Electromagnetic compatibility of multimedia equipment - Immunity requirements

Please note, the Product described above is intended to be a component of a larger industrial system. The Product is not intended for use in a residential system.

Waterloo, Ontario, Canada — Location
Apr 30, 2020 — Date

Cheewee Tng, P. Eng
Director, Quality Assurance

Figure 70: EC Declaration of Conformity

TELEDYNE IMAGING
Everywhereyoulook™

FCC SUPPLIER DECLARATION OF CONFORMITY

Teledyne Digital Imaging, Inc.
605 McMurray Road
Waterloo, Ontario, Canada
N2V 2E9

hereby declares that the following product(s):

Product Description: **Linea SWIR**
Model Number: **SL-GA-01K04A-00-R, SL-GA-05H04A-00-R**

conform to:

(i) FCC CFR 47, Chapter 1 Subchapter A part 15 (2019), for a class A product; and

(ii) ICES-003 Issue 6, Information Technology Equipment (ITE) - Limits and Methods of Measurement (Canada).

The product(s) above also complies with Part 15 of the FCC rules. Operation is subject to the following conditions:

1. The product may not cause harmful interference; and
2. The product must accept any interference received, including interference that may cause undesired operation.

Responsible Party – US Contact Information:
Teledyne Digital Imaging US, Inc.
700 Technology Park Drive
Billerica, MA
USA 01821
(978)-670-2000

Waterloo, Canada	Apr 30, 2020	Cheewee Tng, P. Eng
Location	Date	Director, Quality Assurance

Figure 71: FCC Declaration of Conformity

Additional Reference Information

Lens Selection Overview

This section provides an overview to selecting a lens for the Linea SWIR GigE camera. Mechanical drawings and Teledyne DALSA part numbers for available lens adapters are provided.

Lens Mount and Lens Image Circle are important for correctly matching the lens to the sensor. Brief information on other lens parameters to consider follows those sections.

For best performance, use a lens designed for short wave infrared wavelengths between 900 and 1700 nm. **Note:** Standard lenses designed for visible light may not transmit IR light fully or perform to specification outside of their intended wavelength range.

There are several manufacturers producing C-mount SWIR lenses specifically designed for machine vision systems. For assistance selecting suitable optics, please contact our regional sales offices.

Lens Mount Types

Linea SWIR GigE cameras use a C-mount lens.

Lens Image Circle Illustration

The graphic below illustrates the camera's active sensor relative to the lens image circle.

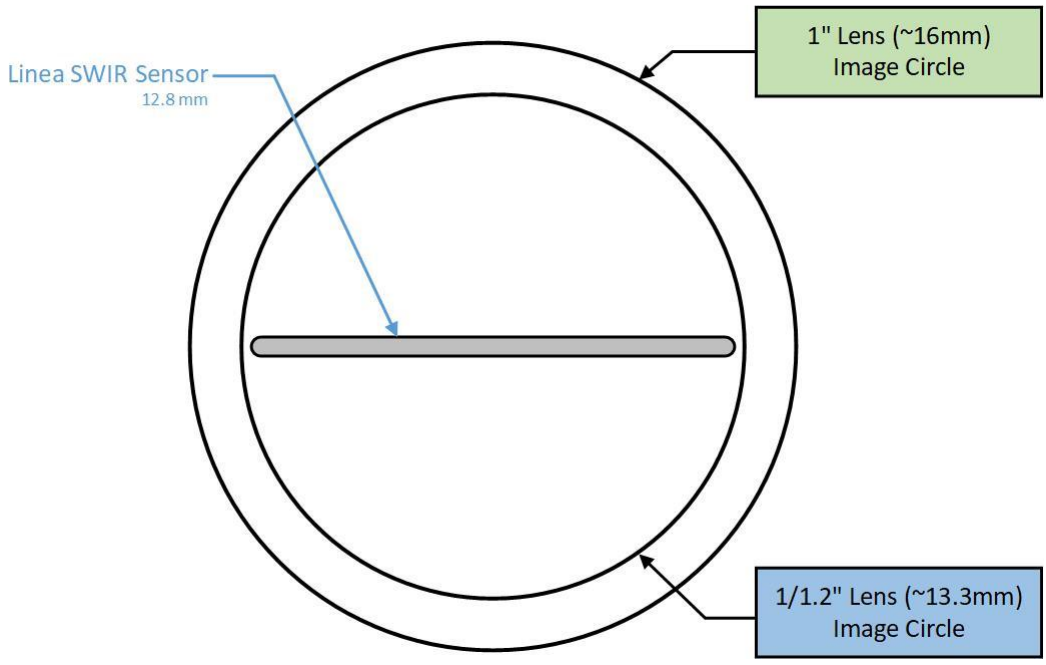


Figure 72: Lens Image Circle Illustration

Additional Lens Parameters (Application Specific)

There are other parameters to consider while meeting the requirements of the vision application.

- **Focal Length**: Defines the focus point of light from infinity.
  See Camera Specifications — Back Focal Distance.
- **Field of View**: A lens is designed to image objects at some limited range, at some positive or negative magnification. This defines the field of view.
- **F-Number (aperture)**: The lens aperture defines the amount of light entering. Lenses may have fixed or variable apertures. Additionally the lens aperture affects Depth of Field and defines the distance range when the lens is focused at some specific distance.
- **Image Resolution and Distortion**: As a general definition of image quality, a lens with poor resolution will not be in focus when used to image fine details.
- **Aberrations (defect, chromatic, spherical)**: Aberrations are specific types of lens faults affecting resolution and distortion. Lens surface defects or glass faults distort light and specific colors. Aberrations are more visible when imaging fine details.
- **Spatial Distortions**: Describes non-linear lens distortions across the field of view. Distortion limits the accuracy of measurements made with that lens.

Optical Considerations

This section provides an overview of illumination, light sources, filters, lens modeling and lens magnification. Each of these components contributes to the successful design of an imaging solution.

Illumination

The wavelengths and intensity of light required to capture useful images vary per application. The image will be affected by speed, spectral characteristics, exposure time, light source characteristics, environmental and acquisition system specifics, etc. Teledyne DALSA's Web Site introduces this potentially complicated issue. Click on Knowledge Center and select Application Notes and Technology Primers.

Exposure settings have more effect than illumination. The total amount of energy (which is related to the total number of photons reaching the sensor) is more important than the rate at which it arrives.

Example: 5 $\mu J/cm^2$ can be achieved by exposing 5 mW/cm^2 for 1ms just the same as exposing an intensity of 5 W/cm^2 for 1 μs.

Light Sources

Keep these guidelines in mind when selecting and setting up a light source:

- LED light sources are inexpensive and provide a uniform field with a longer life span compared to other light sources.
- Halogen light sources generally provide very little blue relative to infrared light (IR).
- Fiber-optic light distribution systems generally transmit very little blue relative to IR.
- Some light sources age and produce less illumination. A light source may produce progressively less light in some areas of the spectrum.

Lens Modeling

A lens surrounded by air may be modeled for camera purposes using three primary points: first and second principal points and the second focal point. The primary points for a lens should be available from the data sheet or manufacturer. Primed quantities denote characteristics of the image side of the lens, h is the object height and h′ is the image height.

The focal point is the point at which the image of an infinitely distant object is brought to focus. The effective focal length (f′) is the distance from the second principal point to the second focal point. The back focal length (BFL) is the distance from the image side of the lens surface to the second focal point. The object distance (OD) is the distance from the first principal point to the object.

Primary Points in a Lens System

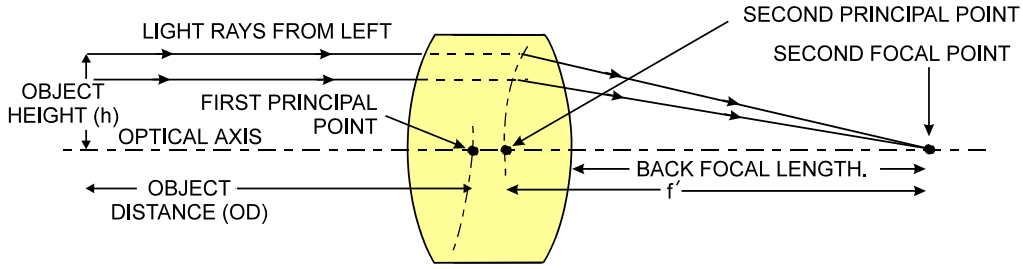


Figure 73: Lens System Diagram

Magnification and Resolution

The magnification of a lens is the ratio of the image size to the object size:

$m = \frac{h'}{h}$	Where m is the magnification, h′ is the image height (pixel size) and h is the object height (desired object resolution size).

By similar triangles, the magnification is alternatively given by:

$m = \frac{f'}{OD}$

These equations can be combined to give their most useful form:

$\frac{h'}{h} = \frac{f'}{OD}$	This is the governing equation for many object and image plane parameters.

Example: An acquisition system has a 512 x 512-element 10 um pixel pitch, a lens with an effective focal length of 45 mm and requires that 100 μm in the object space correspond to each pixel in the image sensor. Using the preceding equation, the object distance must be 450 mm (0.450m).

$\frac{10\mu m}{100\mu m} = \frac{45mm}{OD}$	$OD = 450mm(0.450m)$

Sensor Handling Instructions

This section reviews procedures for handling, cleaning or storing the camera. The sensor must be kept clean and away from static discharge to maintain design performance.

Electrostatic Discharge and the Sensor

Camera sensors containing integrated electronics are susceptible to damage from electrostatic discharge (ESD).

Electrostatic charge introduced to the sensor window can induce charge buildup on the underside of the window. The dry nitrogen gas in the sensor package cavity cannot readily dissipate the ESD. Problems such as higher image lag or non-uniform response may occur.

Note: The charge normally dissipates within 24 hours and the sensor returns to normal operation.

	**Important**: Charge buildup will affect the camera's flat-field correction calibration. To avoid an erroneous calibration, ensure that you perform flat-field correction only after a charge buildup has dissipated over 24 hours.

Protecting Against Dust, Oil and Scratches

The sensor window is part of the optical path and must be handled with extreme care.

Dust can obscure pixels producing dark patches on the sensor image. Dust is most visible when the illumination is collimated. The dark patches shift position as the angle of illumination changes. Dust is normally not visible when the sensor is positioned at the exit port of an integrating sphere where illumination is diffused.

Blowing compressed air on the window will remove dust particles unless they are held by an electrostatic charge. In this case, either an ionized air blower or a wet cleaning is necessary.

Touching the surface of the window will leave oily residues. Using rubber finger cots and rubber gloves can prevent oil contamination. Avoid friction between the rubber and window or electrostatic charge build up may damage the sensor.

When handling or storing the camera without a lens always install the protective cap.

Note: When exposed to uniform illumination a scratched window will normally have brighter pixels adjacent to darker pixels. The location of these pixels will change with the angle of illumination.

Cleaning the Sensor Window

The following steps describe various cleaning techniques to clean minor dust particles and accidental fingerprints.

- **Important:** Avoid using canned air as it contains particulates that can increase the contamination of the sensor window.
- Teledyne DALSA recommends the use of an ionized air gun and compressor to blow off the sensor.
- Use compressed air to blow off loose particles. This step alone is usually sufficient to clean the sensor window. Avoid moving or shaking the compressed air container and use short bursts of air while moving the camera in the air stream. Agitating the container will cause condensation to form in the air stream. **Note:** Extended airbursts will chill the sensor window causing more condensation. Condensation when left to dry naturally will deposit particles on the sensor.
- Use lint-free ESD-safe cloth wipers. The Anticon Gold 9”x 9” wiper made by Milliken is both ESD safe and suitable for class 100 environments. Another ESD acceptable wiper is the TX4025 from Texwipe.
- An alternative to ESD-safe cloth wipers is Transplex swabs that have desirable ESD properties. There are several varieties available from Texwipe. **Note:** Do not use regular cotton swabs, since these can introduce static charge to the window surface.
- Wipe the window carefully and slowly when using these products.

Ruggedized Cable Accessories

Teledyne DALSA provides optional I/O cable assemblies for this model of camera. Users wishing to build their I/O cabling by starting from available cable packages should consider the popular assemblies described below. Contact Sales for pricing and delivery.

Users may order cable assembly quantities directly from Alysium-Tech or Components Express. In that case, use the manufacturer’s part number shown on the cable assembly engineering drawing.

Cable Manufactures Contact Information

Alysium-Tech
101 Montgomery Street, Suite 2050
San Francisco, CA 94104
Phone: 415 248 7807
Fax: 415 248 7800

https://www.alysium.com/

Components Express, Inc. (CEI)
10330 Argonne Woods Drive, Suite 100
Woodridge, IL 60517-4995
Phone: 630-257-0605 / 800.578.6695 (outside Illinois)
Fax: 630-257-0603

http://www.componentsexpress.com/

Cable Assembly G3-AIOC-BLUNT1M

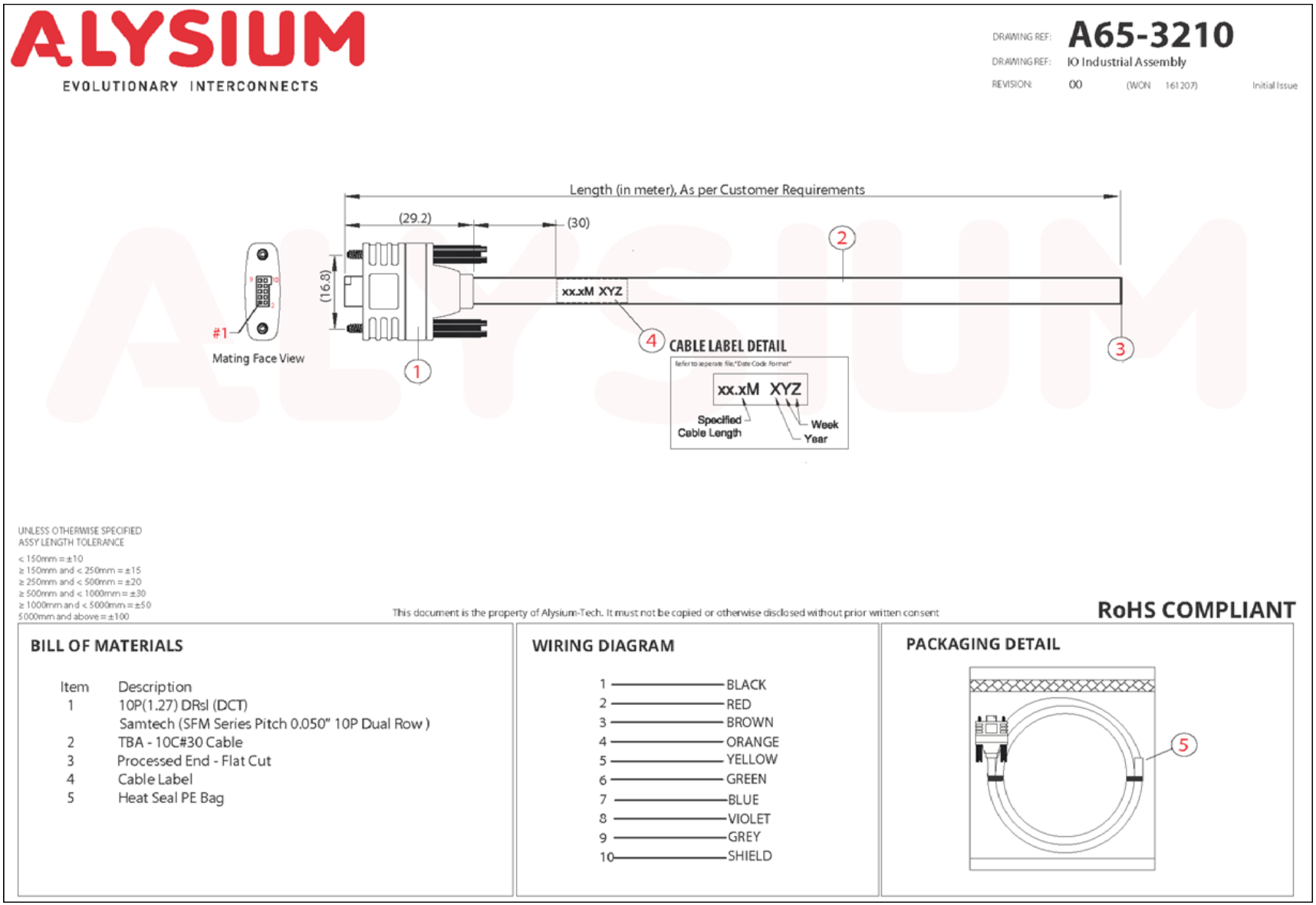


Figure 74: Cable Assembly G3-AIOC-BLUNT1M

Cable Assembly G3-AIOC-BLUNT2M

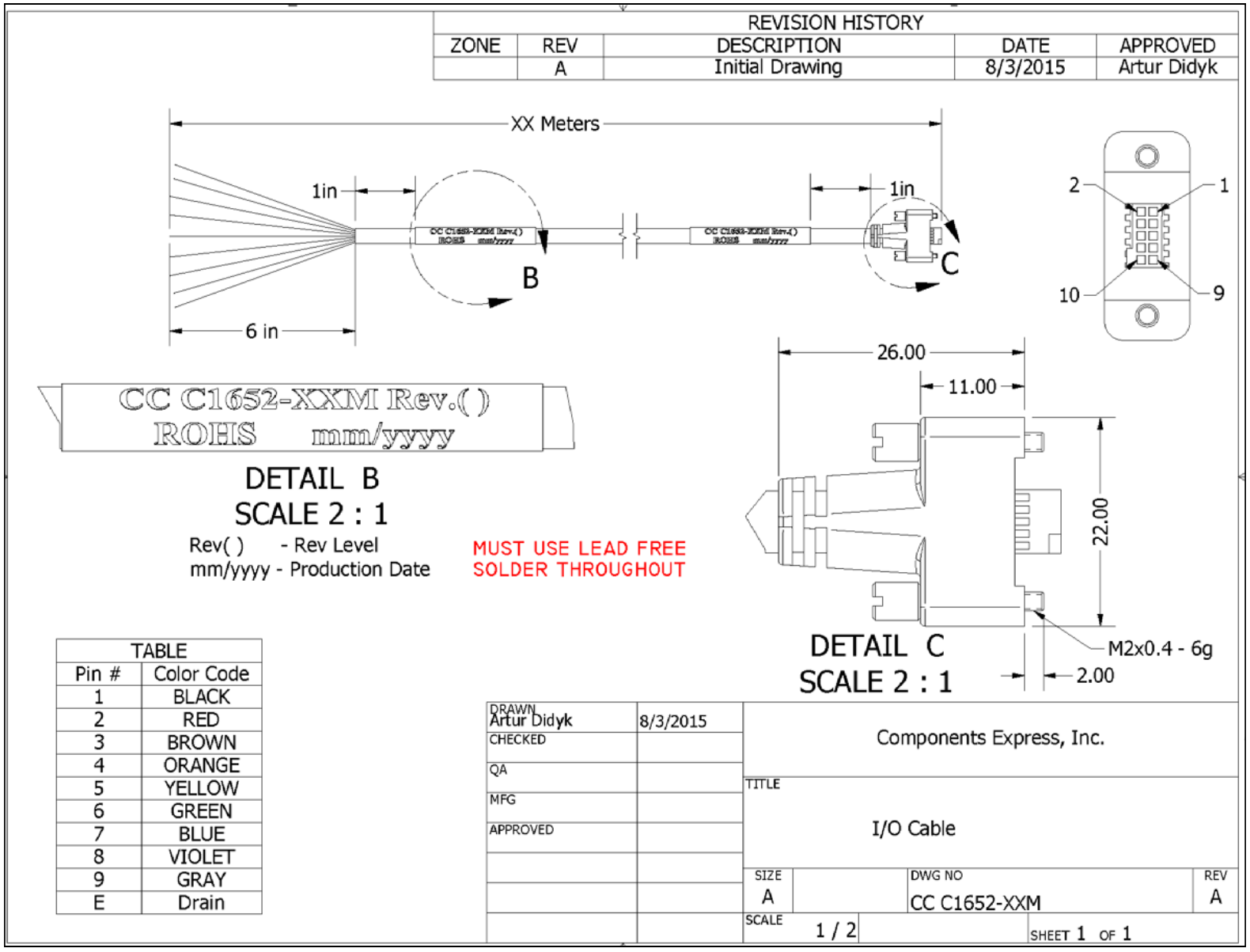


Figure 75: Cable Assembly G3-AIOC-BLUNT2M

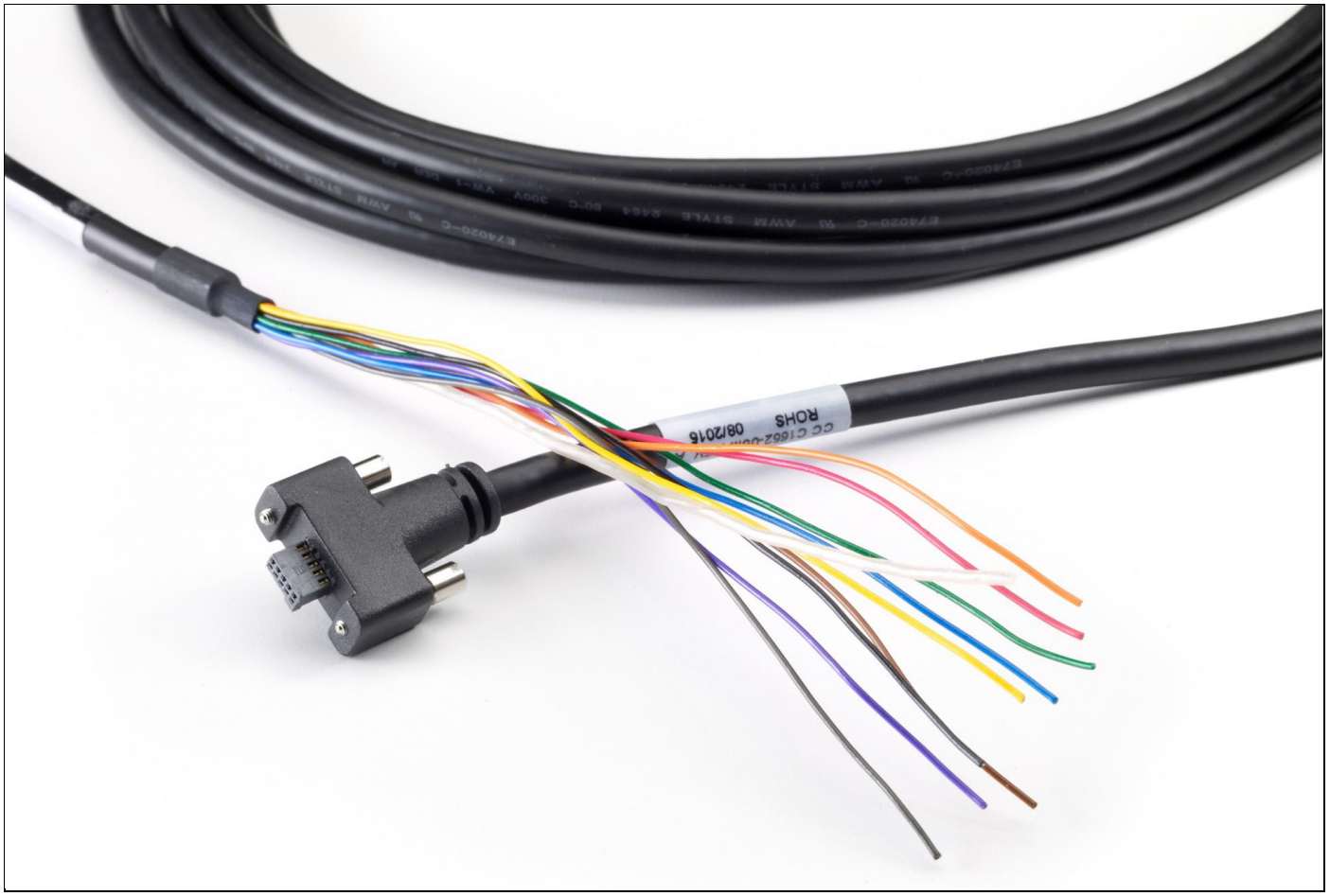


Figure 76: Cable Assembly G3-AIOC-BLUNT2M Photo

Cable Assembly G3-AIOC-BRKOUT2M

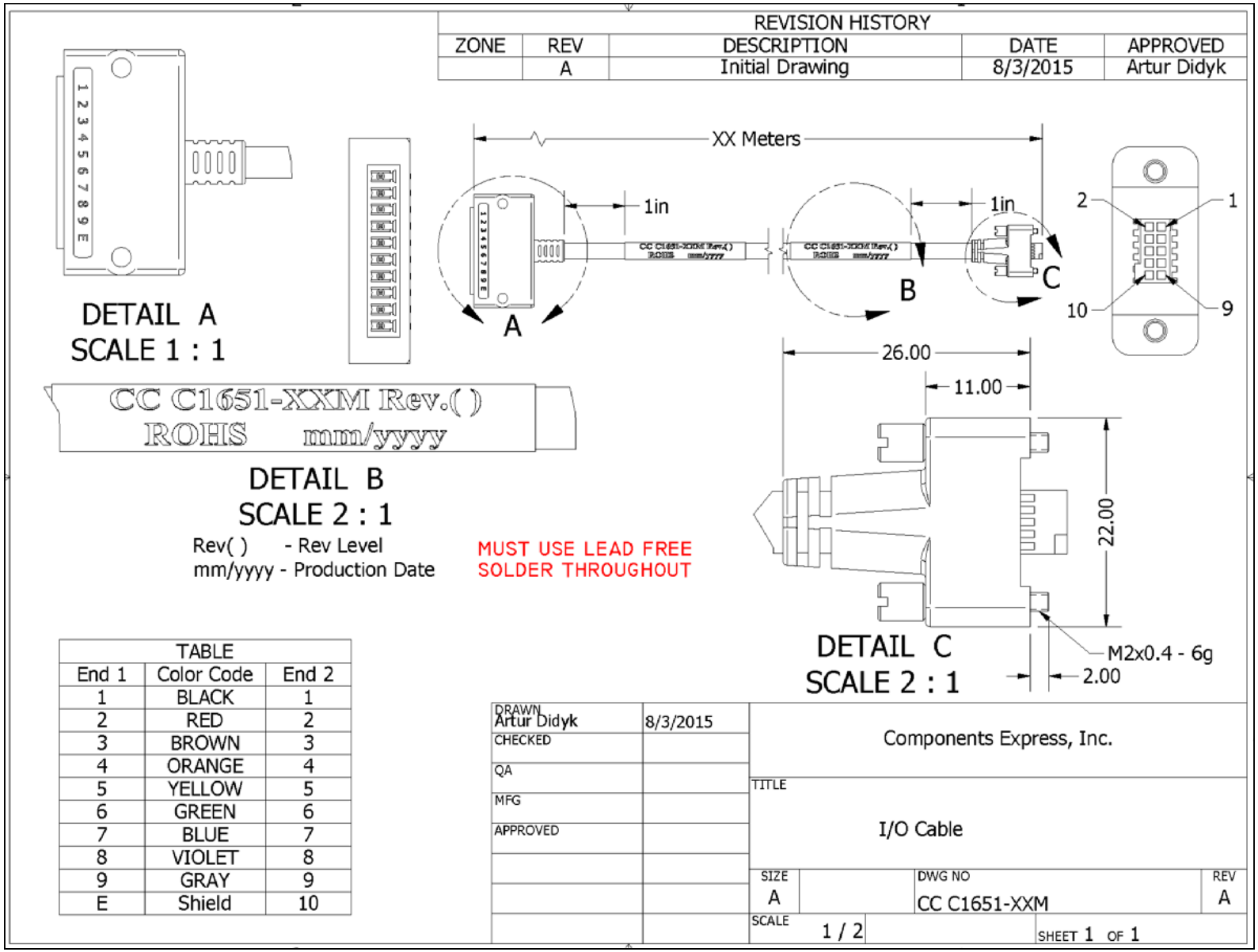
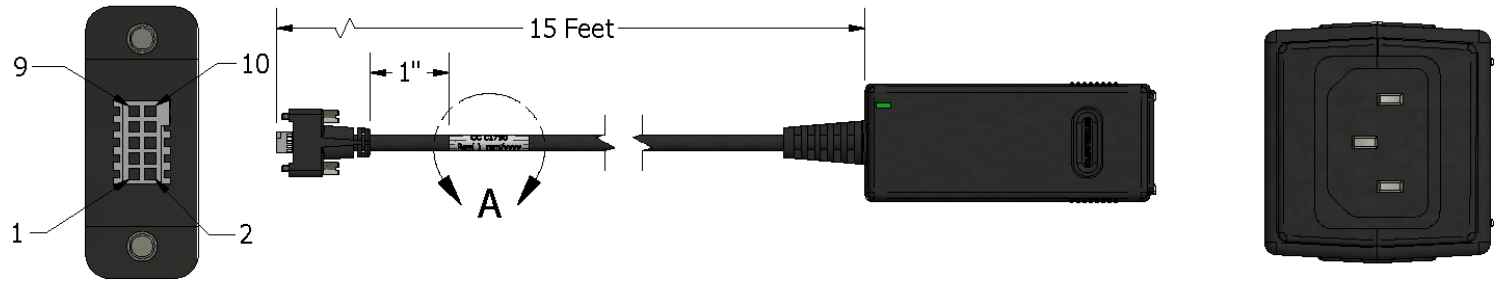


Figure 77: Cable Assembly G3-AIOC-BRKOUT2M

Figure 78: Cable Assembly G3-AIOC-BRKOUT2M Photo

Linea Generic Power Supply Without I/O

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	Initial Drawing	05/19/2017	Artur Didyk



MUST USE LEAD FREE
SOLDER THROUGHOUT

DETAIL A
SCALE 3 : 1

Rev( ) - Rev Level
mm/yyyy - Production Date

End 1	Color Code
1	GROUND
2	12VDC

DRAWN Artur Didyk	5/19/2017	Components Express, Inc.
CHECKED		
QA		TITLE
MFG		Dalsa Genie Nano Power Supply
APPROVED		

SIZE		DWG NO	REV
A		CC C1790	A
SCALE 1 / 2		SHEET 1 OF 1	

Figure 79: Linea Generic Power Supply

Components Express Right-Angle Cable Assemblies

These cable assemblies are available from our partner Components Express. Use the manufacturer's part number shown on the cable assembly engineering drawing.

Cable Assembly: Right-Angle I/O Bunt End

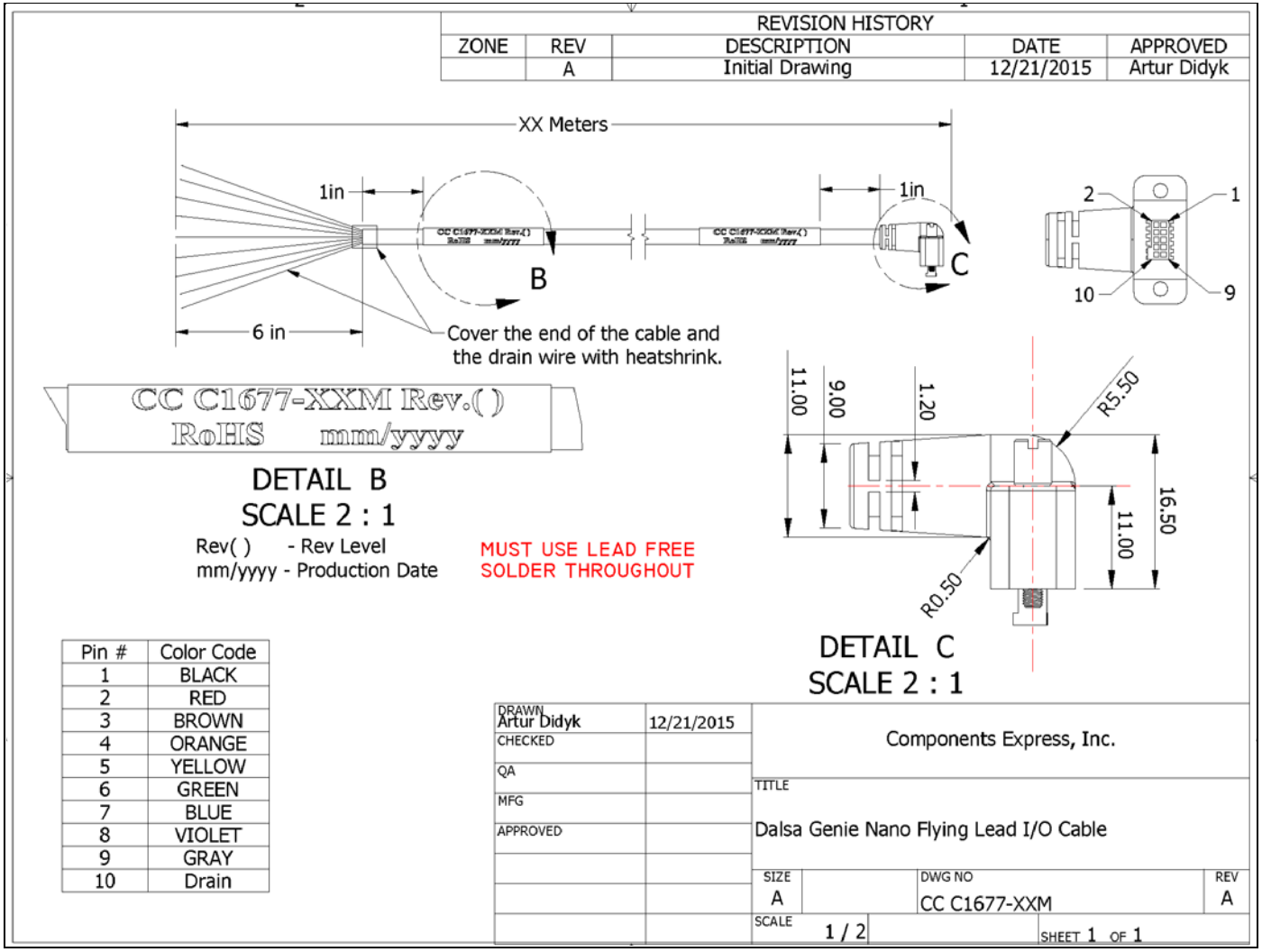


Figure 80: Cable Assembly: Right-Angle I/O Bunt End

Cable Assembly: Right-Angle I/O to Euro Block

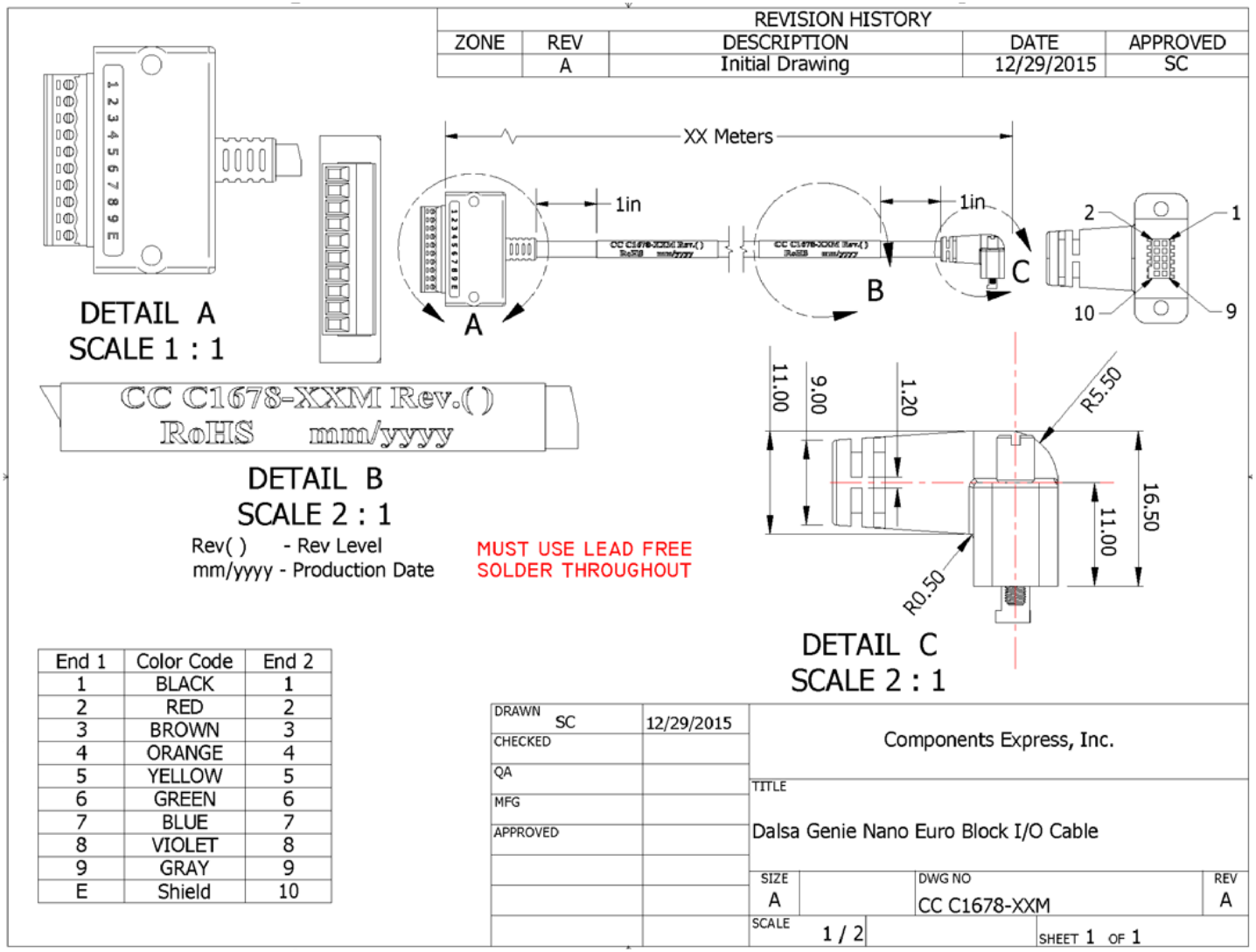


Figure 81: Cable Assembly: Right-Angle I/O to Euro Block

Ruggedized RJ45 Ethernet Cables

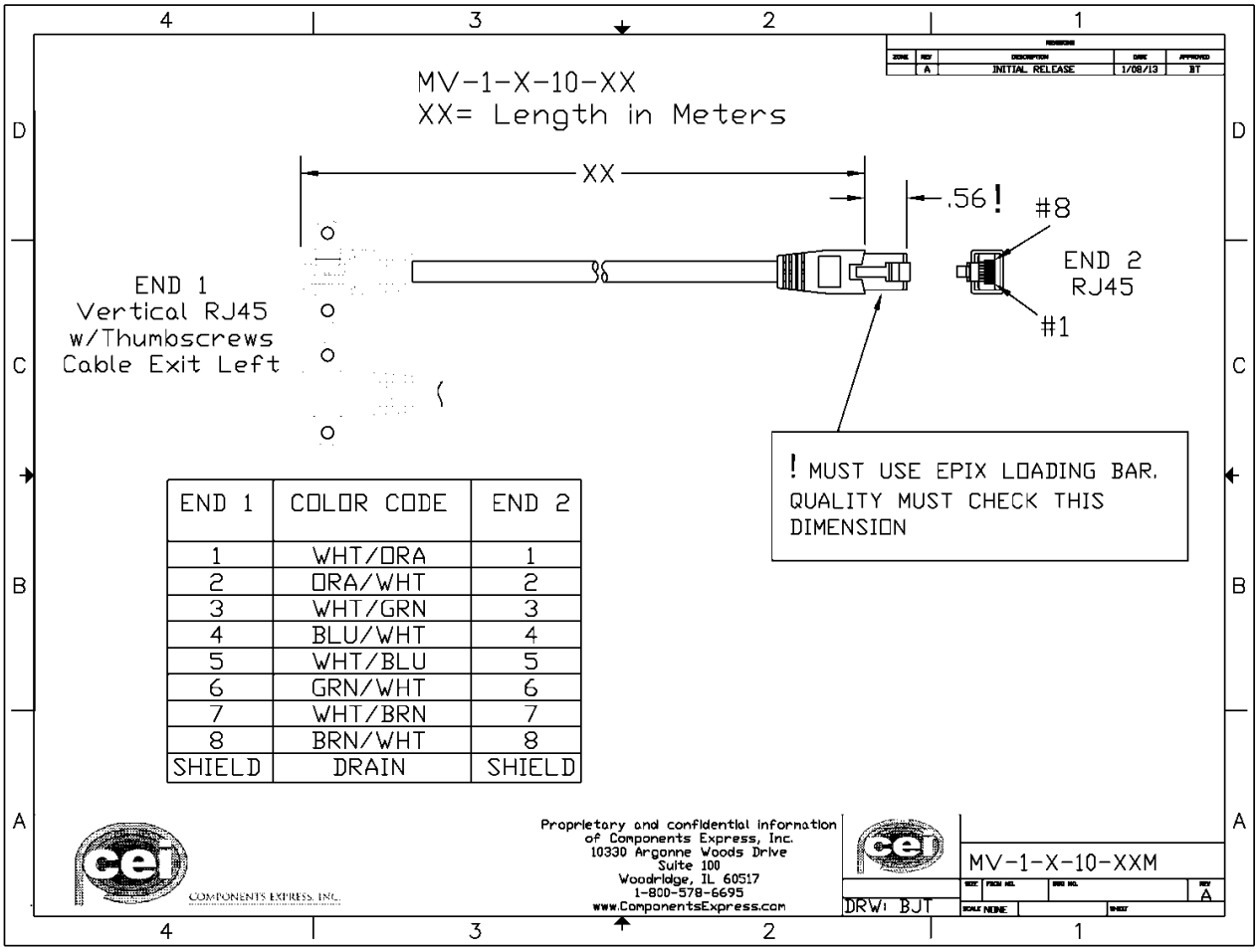
Components Express Inc. supplies an industrial RJ45 CAT6 cable. One end has a molded shroud assembly with top / bottom thumbscrews while the other end has a standard RJ45.

Note: Ruggedized RJ45 cable is recommended in a high vibration environment.

Figure 82: Ruggedized RJ45

All cables made in U.S.A. – all cables RoHS compliant.	CAT6 certified (tested for near end / far end crosstalk and return loss). IGE-3M (3meters) IGE-10M (10meters) IGE-25M (25meters) IGE-50M (50meters) IGE-100M (100meters)

Cable Assembly: Right-Angle Ethernet



END 1	COLOR CODE	END 2
1	WHT/ORA	1
2	ORA/WHT	2
3	WHT/GRN	3
4	BLU/WHT	4
5	WHT/BLU	5
6	GRN/WHT	6
7	WHT/BRN	7
8	BRN/WHT	8
SHIELD	DRAIN	SHIELD

Figure 83: Cable Assembly: Right-Angle Ethernet

Alysium-Tech “Extreme Rating” HiFlex Ethernet Cable

Alysium-Tech has a cable series for constant movement applications such as cameras mounted on robotic arms or other locations where reliable interconnects are required. Contact Alysium-Tech directly for pricing.

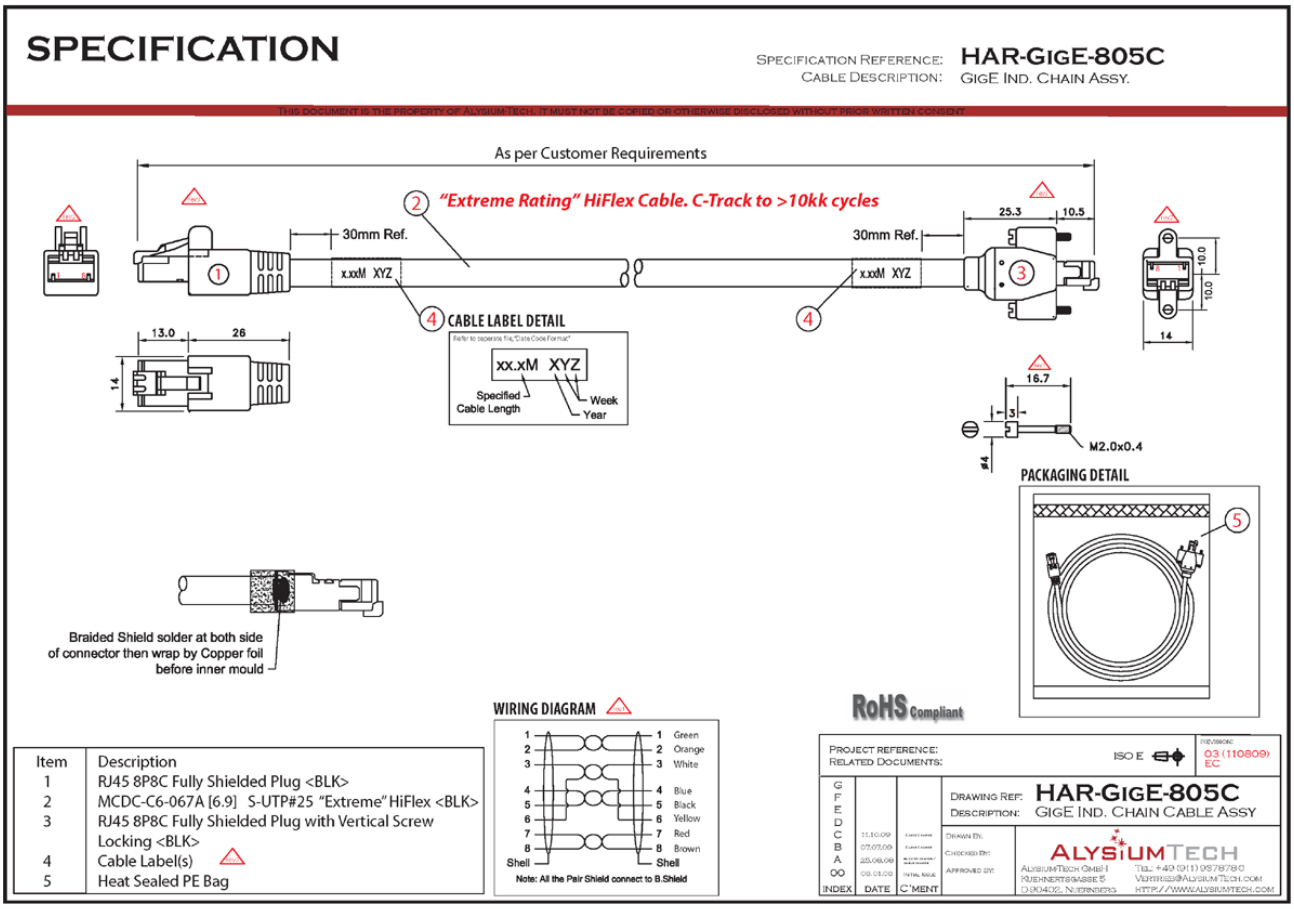


Figure 84: “Extreme Rating” HiFlex Ethernet Cable

Troubleshooting

Overview

If an installation fails or experiences problems controlling and using the Linea SWIR GigE camera, the user may perform diagnostics with the methods and tools provided to correct the problem.

The GigE Server status provides visual information on possible camera problems. The three states are displayed in the following table with descriptions of possible conditions.

Note: An installation with no networking issue may still require optimization to perform to specification.

	Device Not Available	Device IP Error	Device Available
GigE Server Tray Icon:			
Note: It will take a few seconds for the GigE Server to refresh its state after any change.	A red X will remain over the GigE server tray icon when the camera device is not found. This indicates a network issue where there is no communication with the camera.	The GigE server tray icon shows a warning when a device is connected but there is some type of IP error.	The GigE server tray icon when the device is found. The camera has obtained an IP address and there are no network issues. Optimization may still be required to maximize performance.

Figure 85: GigE Server Status

Problem Type Summary

Camera problems are either installation or setup related where the camera is found but not controllable. Additionally the camera may be properly installed but network optimization is required for maximum performance.

Device Not Available


A red X over the GigE server tray icon indicates that the camera device is not found. This indicates either a major camera fault or condition such as disconnected power, or a network issue where there is no communication.

- Review section Using Linea SWIR GigE with the Sapera API to verify required installation steps.
- Refer to Teledyne DALSA's Network Imaging manual to review networking details.
- The camera cannot acquire a DHCP.
- In multiple NIC systems where the NIC for the camera is using LLA mode, ensure that no other NIC is in or switches to LLA mode. It is preferable that the Teledyne DALSA DHCP server is enabled on the NIC used with the camera instead of using LLA mode, which prevents errors associated with multiple NIC ports.
- Verify that your NIC is running the latest driver available from the manufacturer.

Device IP Error

 The GigE server tray icon shows a warning with IP errors. Review the following topics on network IP problems to identify and correct the condition.

Refer to Teledyne DALSA's **Network Imaging Package manual** for information on the Network Configuration tool and optimization for GigE Vision cameras and devices.

Multiple Camera Issues

- When using multiple cameras with a computer with multiple NIC ports, confirm each camera has been assigned an IP address by checking the GigE server.
- To reduce network traffic in configured problem free systems, use the Network Configuration tool to stop camera discovery broadcasts. Refer to Teledyne DALSA's Network Imaging manual.
- When using multiple cameras connected to a VLAN Ethernet switch, confirm that all cameras are on the same subnet setup on that switch. See Teledyne DALSA's Network Imaging package manual for more information.
- If a camera installed with other GigE Vision cameras cannot connect properly with the NIC or has acquisition timeout errors, there may be a conflict with the third party camera's filter driver. In some cases, third party filter drivers modify the NIC properties so Teledyne DALSA's Sapera Network Imaging Driver does not install. Verify by uninstalling the third party driver and installing the camera package again.
- Verify that your NIC is running the latest driver available from the manufacturer.

Device Available but with Operational Issues

 A properly installed camera with no network issues may still not perform optimally. Operational issues concerning cabling, Ethernet switches, multiple cameras and camera exposure are discussed in the following sections:

Always Important

- Camera firmware updated. Refer to File Access via the CamExpert Tool (Quick Camera Firmware Upgrade).
- Power Failure During a Firmware Update–Now What?.
- Cabling and Communication Issues.
- Preventing Operational Faults due to ESD.

No Timeout messages

- CamExpert grabs (with no error message) but there is no image (display window stays black). Refer to Acquisition Error without Timeout Messages.
- CamExpert grabs (with no error message) but the frame rate is lower than expected. Refer to Camera acquisition is good but acquisition rate is lower than expected.
- No image and the line rate is lower than expected.
  Refer to Camera is functional but acquisition rate is lower than expected.
- No image but the frame rate is as expected.
  Refer to Camera is functional, line rate is as expected, but image is black.

Other problems

- Buffer Incomplete Message.

Verifying Network Parameters

Teledyne DALSA provides a Network Configuration tool to verify and configure network devices and camera network parameters. If there are problems with the automatic camera software installation, see section Network Configuration Tool of the Teledyne DALSA's Network Imaging manual or section below Camera Fails to Establish Connection with Host PC.

Before Contacting Technical Support

Carefully review the issues described in this Troubleshooting section. To aid Teledyne DALSA personnel when support is required the following should be included with the request for support.

- From the **Start** menu go to **Teledyne Dalsa Sapera LT** and run the **Log Viewer** program. Open the **File** menu to **Save Messages** to generate a log text file.
- Record the version of GigE Vision software and Sapera version used.

Camera Fails to Establish Connection with Host PC

If 'no device found' is displayed a manual IP address assignment must be made.
Left click Show Hidden Icons. *(Located bottom right task bar)*

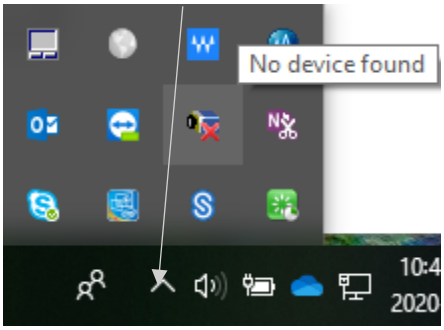


Figure 86: Open GigE Vision Device Status

 Right-click the GigE server tray icon. Select 'Scan Network' to update the GigE Vision Device Status and Camera IP.

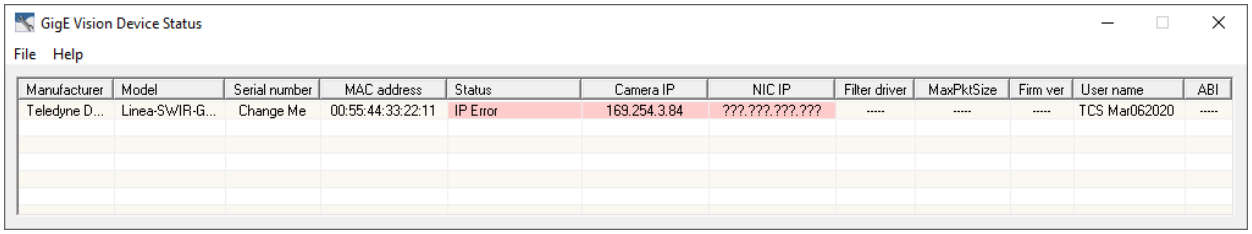


Figure 87: GigE Vision Device Status

 The camera is connected but a NIC IP is not assigned. The GigE server tray icon is displaying a warning.

Open the Teledyne DALSA's Network Configuration Tool from Window's Start Menu.

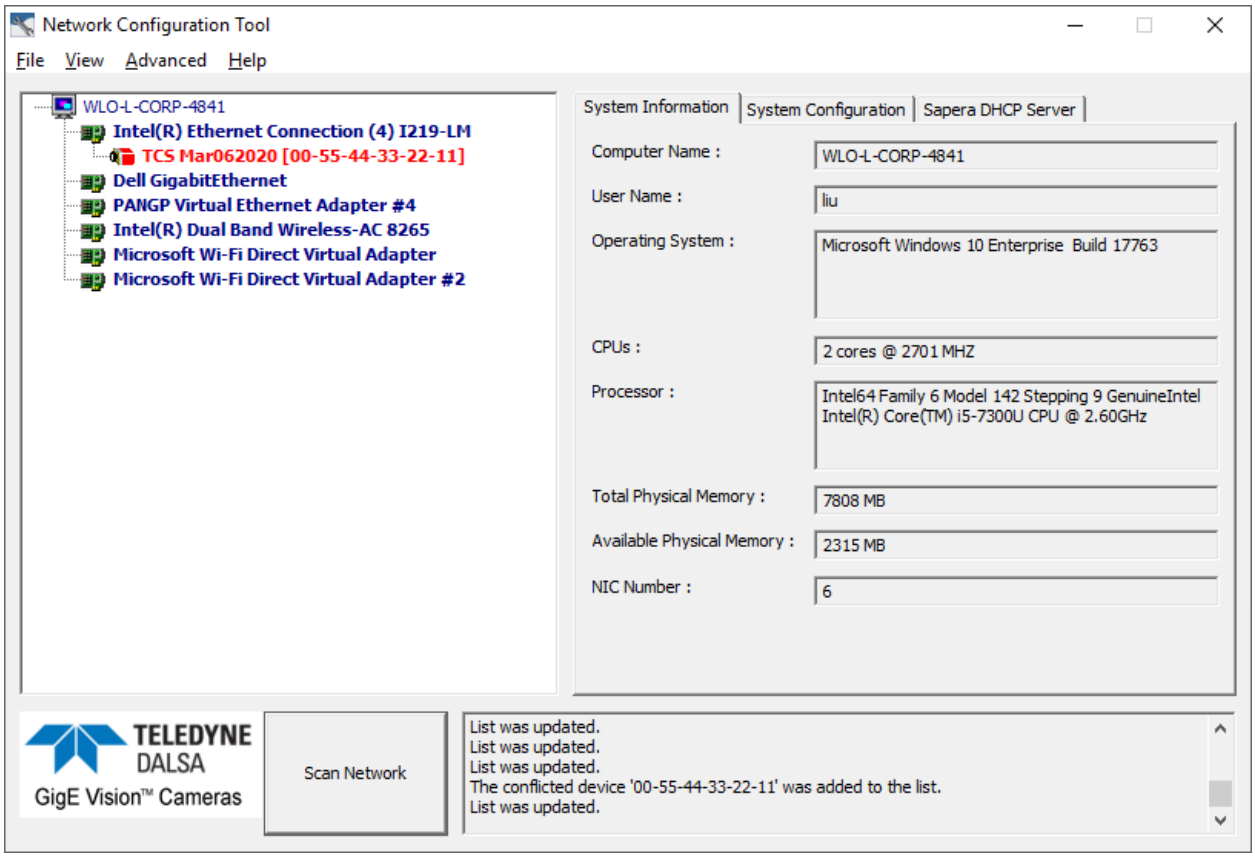


Figure 88: Network Configuration Tool

Cameras displayed in red require a NIC IP. Click the camera name and Select 'Device IP Configuration' tab. **Note:** The network tool provides a 'Scan Network' button if no cameras are displayed.

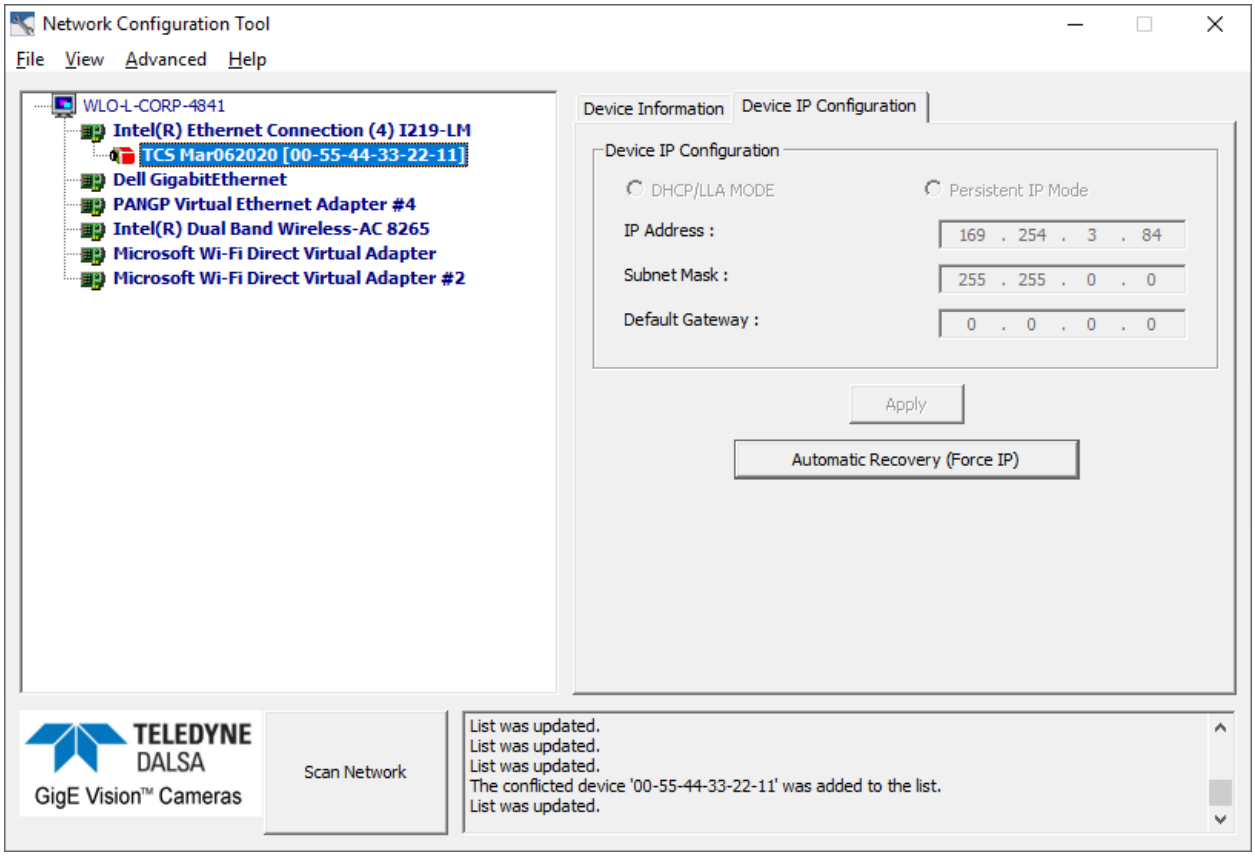


Figure 89: Network Configuration Tool – IP Configuration

Click 'Automatic Recovery (Force IP)' button.

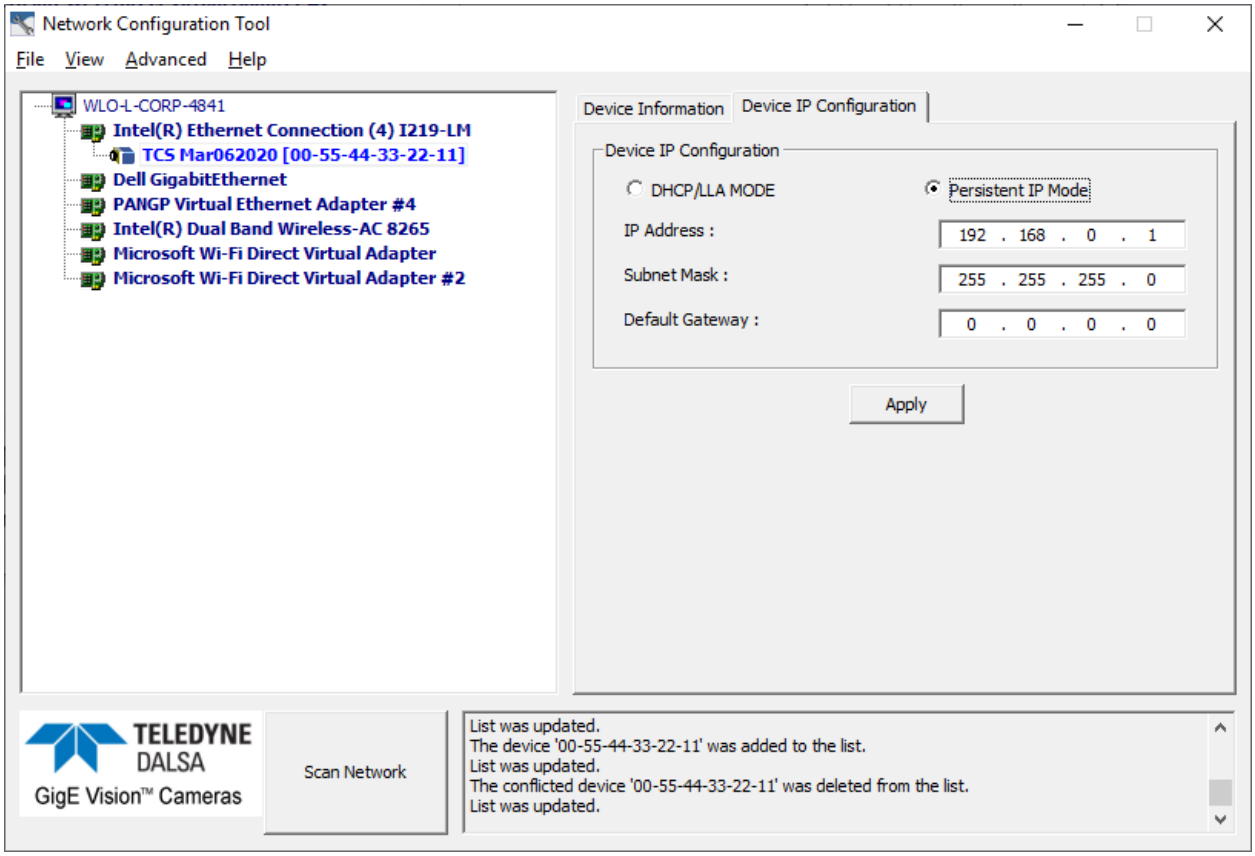


Figure 90: Network Configuration Tool – Persistent IP

Cameras displayed in blue have a proper NIC IP assigned.

Note: The Network Configuration Tool assigns a dynamic IP address, which is lost on power down. To avoid this issue assign a persistent IP address to the camera.

Click the 'Persistent IP Mode' (shown above) and press the Apply button to assign the IP address. It will automatically connect to the host PC if the IP address does not conflict with other network IP addresses. See Persistent IP section for more information.

Note: Assigning two devices the same IP Address will cause conflicts.

Installation Issues and Functional Problems

This section covers issues that are apparent after installation or are indicated by the GigE server tray icon showing a warning symbol.

Device Available with Operational Issues

This section considers issues with cabling, Ethernet switches, multiple cameras and camera exposure. Information concerning the Teledyne DALSA Network Configuration Tool and other networking considerations are available in the **Teledyne DALSA Network Imaging manual**.

Firmware Updates

Any Linea SWIR GigE camera installation must follow the firmware update procedure (see File Access via the CamExpert Tool (Quick Camera Firmware Upgrade).

Note: Camera firmware that does not match a newer version of installed GigE Vision software is likely to have unpredictable behavior.

- The device discovery process does not find camera.
- The Sapera GigE Server finds camera but an application such as CamExpert does not see the camera.
- A camera that had a fault with a firmware update will automatically recover by booting with the previous firmware version.

	**Important**: New cameras installed in previously deployed systems are fully backward compatible with the older vision application.

Power Failure During a Firmware Update–Now What?

There is greater possibility the host computer OS is damaged during a power failure, not the camera. When electrical power returns and the host computer system reboots, follow this procedure:

- Connect power to the camera. (The camera knows that the firmware update failed)
- The camera will boot with the previous version of firmware and will operate normally.
- Perform the firmware update procedure (see File Access via the CamExpert Tool (Quick Camera Firmware Upgrade).

Cabling and Communication Issues

With only two cables connected, the Linea SWIR GigE camera cabling issues are limited.

Power supply problems

- If the status LED is off, the DC supply power is not connected or faulty. Verify the power supply voltage.

Communication Problems

- Use a shielded cable where the connector shell electrically connects the camera chassis to a power supply earth ground. This can eliminate trigger issues in a high EMI environment.
- Check that the Ethernet cable is clipped both to the camera and the NIC or switch on the other end.
- Verify the Ethernet cabling. Poor cables will cause connections to auto-configure at lower speeds.
- Use a secured Ethernet cable when the camera is in a high vibration environment. See Ruggedized RJ45 Ethernet Cables.
- Check the Ethernet status LEDs on the NIC used with the camera. The Link Status indicator is on and the activity LED should flash with network messages.
- Verify that the Ethernet cable is CAT6 or better. This is very important with long cable lengths.
- When using very long cables, up to the maximum specified length of 100 m for gigabit Ethernet, different NIC hardware and EMI conditions can affect the quality of transmission.
- Minimum recommended Ethernet cable length is 3 feet (1 meter).
- Use the Log Viewer tool (see point below) to check on packet resend conditions.
- Run the Sapera Log Viewer: from the **Start** menu select **Teledyne DALSA Sapera LT** > **Log Viewer**. Start the camera acquisition program, such as CamExpert. There should not be any "packet resend" messages, else this indicates a control or video transmission problem due to poor connections or extremely high EMI environments.

Acquisition Error without Timeout Messages

Streaming video issues range from total loss of image data to occasional loss of video data packets. The following section describes conditions identified by Teledyne DALSA engineering while working with GigE Vision cameras in various computers and setups. See Teledyne DALSA's Network Imaging manual for information on network optimizations.

No camera exposure when expected

- Verify by using the camera in free-running mode. Do not use external trigger mode when testing a camera setup.
- While using free-running mode verify the exposure period is set to the maximum for the set frame rate.
- Load Factory Default from the Power-up Configuration in CamExpert. This will reset the camera to its nominal acquisition rate.

Camera is functional but acquisition rate is lower than expected

- Verify Ethernet link speed. If the LAN connection is limited to 100 Mbps the line rate maximum will be limited once the internal buffers are filled. Review the Teledyne DALSA Network Imaging manual for information on network optimizations.
- If using an external trigger, verify the trigger source rate and camera parameters such as trigger to exposure delay.

Camera acquisition is good but acquisition rate is lower than expected

- While running CamExpert and grabbing in free-run mode at the maximum frame rate, start the **Sapera Monitor** tool from the Sapera Tools installed with Sapera.
- Make sure the **Memory Overflow** event monitor is enabled.
- Continue grabbing at maximum frame rate. If any memory overflow events are counted, the internal buffer could not be transmitted on time and was discarded. Such a condition may occur at high frame rate cameras.
- **Note:** Sapera CamExpert tool limits the maximum frame rate possible due to CamExpert generating an interrupt for each acquired frame. The Sapera Grab Demo may be better suited for testing at higher frame rates.
- Verify network parameters are optimal as described in the Teledyne DALSA's Network Imaging Package for Sapera LT Optimization Guide. Ensure the host computer is not executing other network intensive tasks. Try a different Gigabit NIC.
- **Note:** Changed acquisition frame rate becomes active after the acquisition is stopped and restarted.

Camera is functional, line rate is as expected, but image is black

- Verify the lens iris is open.
- Point the camera at a bright light source.
- Check the programmed exposure duration is not too short or set it to maximum. See Sensor Control Category.

Using CamExpert set the camera to output its Internal Pattern Generator. This step is typically done for any camera installation, to verify the camera and its software package. See Internal Test Image Generator for information on using CamExpert to select internal patterns.

Other Problems or Issues

This section describes problems that do not fit any of the categories above. Typically, these are issues found in the field under specific or unusual conditions.

Buffer Incomplete Error Message

Error Messages are generated when the logical acquisition frame buffer takes longer to fill (line rate x frame buffer height) than the time set for the GigE Vision Host Control. Increase the "Image Timeout" value as required.

Issues with Cognex VisionPro

When the Cognex VisionPro package is uninstalled, the Linea SWIR GigE becomes unavailable within CamExpert due to the Cognex uninstaller removing GigE Vision components. This forces the user to reinstall Camera Expert until Cognex resolved this issue.

Revision History

Revision	Date	Change
01	2020-05-15	
02	2020-06-08	Addition of 512k model. Update on sensor specifications (full well, random noise). New spectral responsivity graph. Additional details on Sensor Gain and Triggers. A few feature updates in Counter and Timer and Cycling Preset categories.
03	2024-10-15	Various feature additions and related updates. Detailed features on Metadata Controls and Event Controls. Revised Trigger Overview section. Support of LUTs. Exposure delay removed from cycling presets features. Note about FFC coefficients for the 512 SWIR model.

Contact Information

Sales Information

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Fax: 519 886 8023

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Tel: +86-21-64279081
Fax: +86-21-64699430

Technical Support

Submit any support question or request via our web site:

Technical support form via our web page: Support requests for imaging product installations, Support requests for imaging applications	http://www.teledynedalsa.com/mv/support
Camera support information	
Product literature and driver updates	