Helios Camera Technical Manual

V1.0.0

Revised on July 25, 2019

Contents

Product Specification

Basic Information	
Model	HLS003S-001
Resolution	0.3MP (640 x 480 px)
Framerate	30fps
Sensor	Sony DepthSense™ IMX556PLR CMOS
Optical Format	½”
Pixel Size	10um

Physical, Interface and Power Information	
Digital Interface	Gigabit Ethernet with M12 connector IEC 61076-2-109
GPIO Interface	8-pin M8 connector IEC 61076-2-104
I/O ports	1 input, 1 output, 2 bidirectional
Dimension	55 x 55 x 76 mm
Lens Mount	Integrated S-mount lens (not user changeable)
Weight	280 g
Power Consumption	12-24Vdc, P_{avg} <10W, 2.8A peak pulse current

Imaging Properties	
Working Range	Near Mode: up to 1.5m; Far Mode: up to 6m
Lens Field of View	59^{o} x 45^{o} (nominal)
Illumination	4 x VCSEL laser diodes @ 850nm

Camera Features	
User Sets	1 default and 2 custom
Exposure Control	Manual with 2 modes
Output Formats	3D Point Cloud, Intensity and Confidence
OS Support	Windows and Linux

Standard and Certification	
Standard	GigE Vision 2.0, GenICam 3D
Compliance	CE, FCC, RoHS, REACH, WEEE, Eye Safety IEC 60825-1:2014
Operating Case Temperature	-10°C to 60°C (case temperature)

Accuracy & Precision			
Accuracy	+/- 5mm over range 0.3-1.5m (1.5m mode)		
	+/- 10mm over range 0.3-6.0m (6m mode)		
Precision	**Distance (m)**	**1.5m Mode (mm)**	**6m Mode (mm)**
	0.5	0.69	0.53
	1	1.6	1.25

	1.5	3.11	2.24
	2	-	3.17
	3	-	6.81
	4	-	10.8
	5	-	16.8
	6	-	25.4

Welcome

HLS003S is a GigE Vision and GenICam compliant Time of Flight camera featuring Sony's DepthSense ToF sensor, along with 4 VCSEL laser diodes operating at 850nm. The camera calculates depth data by measuring the time it takes for light emitted from the diodes to reflect off objects in the scene and return to the sensor for each point of the image. HLS003S can produce 3D point cloud data, confidence value as well as raw intensity image data.

Designed for industrial applications such as factory automation, logistic applications such as palletizing, package identification, measurement and handling.

Safety and Precautions

Follow these guidelines carefully before using your Helios camera.

Definitions and Symbols

Below is some warning, safety, and/or tips icons used in this document.

	The **Warning** icon indicates a potentially hazardous situation. If not avoided, the situation can result in damage to the product.
	The **ESD** icon indicates a situation involving electrostatic discharge. If not avoided, the situation can result in damage to the product.
	This symbol is used in this manual to indicate a procedure that may cause hazardous exposure to laser radiation.
	The **Help** icon indicates important instructions and steps to follow.
	The **Light Bulb** icon indicates useful hints for understanding the operation of the camera.
	The **Computer** icon represents useful resources found outside of this documentation.

General Safety Notices

	**Powering the Camera** The camera may not work, may be damaged, or may exhibit unintended behavior if powered outside of the specified power range. When using the GPIO, the supplied power must be within the stated voltage range. See the Power section for further information.

	**Operating Temperature** The camera may not work, may be damaged, or may exhibit unintended behavior if operated outside of the specified temperature range. See the Temperature section for further information.
	• Caution, use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. • Do not open the Helios camera housing. • Do not contact the laser apertures with any objects. Damage to the laser modules could produce hazardous radiation levels.
	**Electrostatic Discharge** Ensure proper precautions are implemented to prevent damage from an electrostatic discharge.
	**Image Quality** Dust or fingerprints on the sensor may result in a loss of image quality. Work in a clean and dust-free environment. Use only compressed ionized air or an optics cleaner to clean the surface of the sensor window. Pleaser refer to the Maintenance section for details.

Laser Radiation

The Helios camera emits infrared radiation that is invisible to the human eye. Helios has been tested to IEC / EN 60825-1: 2014 and classified as Class 1 (eye safe). The location and a sample of the laser safety classification label are shown in Figure 1. The location and a sample of the product label are shown in Figure 2.

Emission is produced by 4 VCSEL (Lasers) with integrated diffusers that illuminate the field of view. The laser apertures are shown in Figure 3.

	The diffusers are integral to the eye safety classification and must not be damaged or removed. The emission characteristics are as follows: • Wavelength: 850 nm +/- 10 nm • Divergence (FWHM): 60°×45° • Maximum average power: 2.2 mW (through IEC / EN 60825-1: 2014 limiting aperture)

Figure 1. Location and Sample of Laser Safety Classification Label

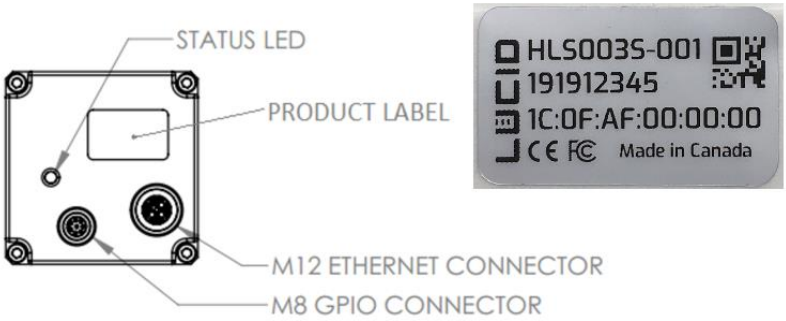


Figure 2. Location and Sample of Product Label

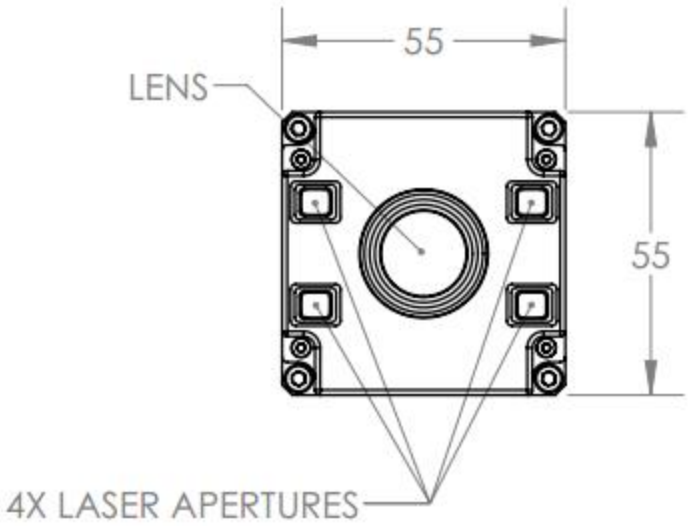


Figure 3 Locations of 4 Laser Apertures

Service and Maintenance

Service

Helios is a precision optical instrument and contains no user serviceable parts.

	If the unit sustains any damage or ceases to function as expected please contact Lucid Vision Labs, Inc. to begin the RMA process.

Maintenance

	Ensure the Helios is unpowered during inspection and cleaning.

The laser apertures should be kept clear and clean.

	The laser apertures should only be cleaned with a gentle dust blower such as a hand-squeeze type lens blower. Do not contact the laser apertures during cleaning or any other process. Do not use solvents to clean the laser apertures. If a laser aperture becomes contaminated, e.g., splattered with paint, oils or other hard to remove sources, contact LUCID Vision Labs, Inc. to begin the RMA process.

To achieve the specified accuracy of the Helios, the lens (see Figure 3) must be kept clean. Avoid touching the lens – fingerprints will significantly degrade performance. Dust should be blown off with a gentle clean air source (do not use aerosol cans) and or lens brush if necessary. Any smudges on the glass should subsequently be removed by applying a very small amount of optical grade lens cleaning solution or isopropanol to an optical grade swab and gently removed.

Contact Us

Think LUCID. Go LUCID.

Contact Sales

https://www.thinklucid.com/contact-us/

Contact Support

https://thinklucid.com/support/

Installing the Camera Hardware

	**Camera Installation** • Systems must be installed and operated by trained personnel. • Safety warnings and procedures specified in this user manual must be observed.

Mounting

The camera is equipped with four M4 mounting holes. The camera front contains one pair of M4 holes. An additional pair of M4 holes are found at the back of the bottom side.

GigE Cable

- The Helios camera uses x-coded 8 position M12 connector (compliant with IEC 61076-2-109 standard) for Ethernet communication.
- For the best performance, a shielded Ethernet Cat5e or higher should be used. STP shielding is recommended for minimal electromagnetic interference in environments with harsh EMI conditions.
- An unshielded or lower grade/quality Ethernet cable may result in loss of camera connection and/or lost and inconsistent image data.
- The maximum cable length from camera to host with no switch or repeater in between is 100 meters.
- Lucid Vision Labs recommends using qualified Ethernet cables from our web store.

GPIO Cable

The Helios camera is equipped with an 8-pin General Purpose Input/Output (GPIO) connector at the back.

- The GPIO cable should be shielded for best performance.
- Poor quality unshielded GPIO cable may result in false triggers or missing triggers.
- Any GPIO cable with M8 connector compliant with IEC 61076-2-104 will work. An example connector that mates with Helios is Phoenix Contact Part Number 1424237.
- Recommended wire thickness is AWG26 or AWG28.
- Lucid Vision Labs recommends using qualified GPIO cables from our web store.

	Consult the GPIO Characteristics section for a GPIO pinout diagram.

Lens

The M12 integrated lens is designed specifically for the Helios camera. The lens is 6mm in focal length and has a nominal field of view of 59° x 45° (nominal).

	To get the best performance, the lens needs to be perfectly clean. The slightest smudge or fingerprint on the glass vastly more inaccurate depth data.

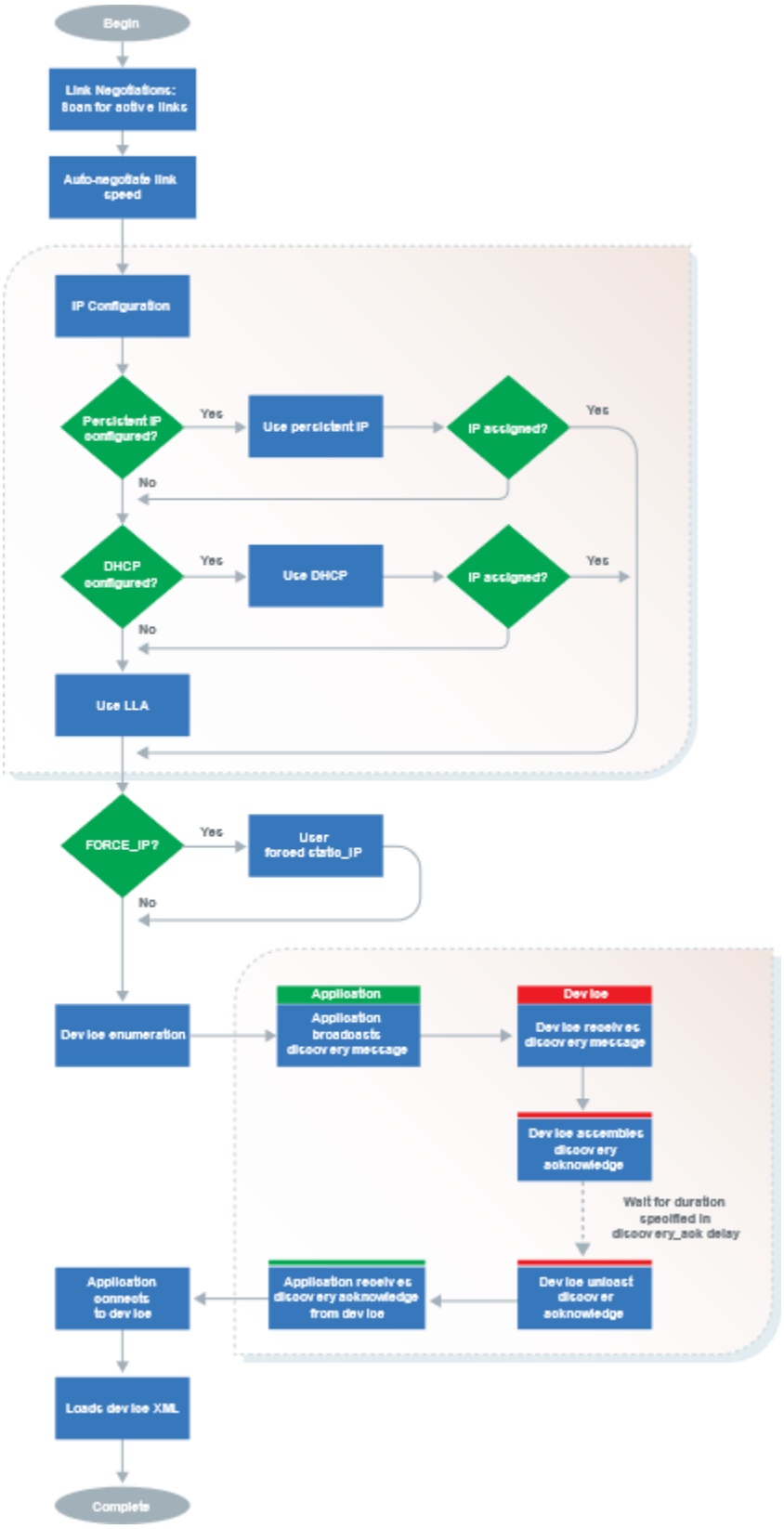
Configuring the Camera and Host System

Installing the Ethernet Driver

LUCID Vision Labs recommends updating to the latest version of your Ethernet adapter's driver before connecting your camera. You may need to navigate to the manufacturer's website to find the latest version of the driver.

Device Discovery and Enumeration

Lucid cameras are discovered and enumerated with the following process:


Begin
Link Negotiations: Scan for active links
Auto-negotiate link speed
IP Configuration
Persistent IP configured?
Yes
Use persistent IP
IP assigned?
Yes
No
DHCP configured?
Yes
Use DHCP
IP assigned?
Yes
No
Use LLA
FORCE_IP?
Yes
User forced static_IP
No
Device enumeration
Application
Application broadcasts discovery message
Device
Device receives discovery message
Device assembles discovery acknowledge
Wait for duration specified in discovery_ack delay
Device unicast discover acknowledge
Application receives discovery acknowledge from device
Application connects to device
Loads device XML
Complete

Camera IP Setup

There are three methods used by LUCID cameras to obtain an IP address:

- Persistent - The camera uses a fixed IP address
- Dynamic Host Configuration Protocol (DHCP) - The camera is assigned an address from a DHCP server
- Link-Local Address (LLA) - The camera obtains an address in the Link-Local Address range from 169.254.1.0 to 169.254.254.255

	A Link-Local Address is selected with a pseudo-random number generator, so an LLA address cannot be reliably predicted. If you require a consistent IP address, you should set up a persistent IP on the camera. For more information on Link-Local Address selection, refer to Section 2.1 in RFC 3927.
	The camera must be on the same subnet as the Ethernet adapter and have a valid IP address before use.

Persistent IP and DHCP configurations can be disabled on the camera. The default camera configuration is as follows:

Persistent IP	Disabled
DHCP	Enabled
LLA	Enabled (always enabled)

Out of the box, the camera first attempts to connect using DHCP. If the camera is unable to connect using DHCP, it will use Link-Local Addressing.

Setting Up Persistent IP

The following pseudocode demonstrates setting up persistent IP:

```
// Connect to camera
// Get device node map

GevCurrentIPConfigurationPersistentIP = true;
GevPersistentIPAddress = 192.168.0.10; //Enter persistent IP address for the camera
GevPersistentSubnetMask = 255.255.255.0;
GevPersistentDefaultGateway = 192.168.0.1;
```

Bandwidth Management

Jumbo Frames

Lucid Vision Labs recommends enabling jumbo frames on your Ethernet adapter. A jumbo frame is an Ethernet frame that is larger than 1500 bytes. Most Ethernet adapters support jumbo frames; however, it is usually turned off by default.

Enabling jumbo frames on the Ethernet adapter allows a packet size of up to 9000 bytes to be set on the Helios camera. The larger packet size will enable optimal performance on high-bandwidth cameras, and it usually reduces CPU load on the host system. Please note in order to set a 9000-byte packet size on the camera, the Ethernet adapter must support a jumbo frame size of 9000 bytes or higher.

The following table are some of the Ethernet adapters that Lucid Vision Labs has tested:

Product Name	Maximum Jumbo Frame Size
ADLINK PCIe-GIE64+	9000
Neousys PCIe-PoE354at	9500
Intel EXPI9301CT (non-POE)	9000

If you still experience issues such as lost packets or dropped frames, you can also try:

- Updating the Ethernet adapter driver (you may need to enable jumbo frames again after updating).
- Increasing the receive buffer size in your Ethernet adapter properties.
- Reducing the DeviceLinkThroughputLimit value (this may reduce maximum frame rate).

Receive Buffers

A receive buffer is the size of system memory that can be used by the Ethernet adapter to receive packets. Some Ethernet adapter drivers or the operating system itself may set the receive buffer value to a low value by default, which may result in decreased performance. Increasing the receive buffer size, however, will also result in increased system memory usage.

Device Link Throughput Limit

The Device Link Throughput Limit is the maximum available bandwidth for transmission of data represented in bytes per second. This can be used to control the amount of bandwidth used by the camera. The maximum available frame rate may decrease when this value is lowered since less bandwidth is available for transmission.

User Sets, Streamables, and File Access

User Sets

The Helios camera features two customizable user sets to load or save user-defined settings on the camera. Accessing the user set named Default will allow loading or saving of factory default settings. The camera will load the user set selected in UserSetDefault when powering up or when reset.

If the camera is acquiring images, AcquisitionStop must be called before loading or saving a user set.

Streamables

A camera feature marked as Streamable allows the feature's current value to be stored to and loaded from a file.

File Access

The Helios camera features persistent storage for generic file access on the camera. This feature allows users to save and load a custom file up to 16 megabytes with UserFile. Users can also save and load User Set contents to and from a file.

Loading new firmware onto the camera may overwrite existing UserFile contents.

The following pseudocode demonstrates reading from the camera using file access:

```
// Connect to camera
// Get device node map
FileSelector = UserFile1;
FileOpenMode = Read;
FileOperationSelector = Open;
FileOperationExecute();
// Device sets FileOperationSelector = Close
// Read custom file from camera
FileOperationExecute();
// Device sets FileOperationSelector = Open
```

The following pseudocode demonstrates writing to the camera using file access:

```
// Connect to camera
// Get device node map
FileSelector = UserFile1;
FileOpenMode = Write;
FileOperationSelector = Open;
FileOperationExecute();
// Device sets FileOperationSelector = Close
// Write custom file to camera
FileOperationExecute();
// Device sets FileOperationSelector = Open
```

User Sets, Streamables, and File Access functions do not load or save camera IP configuration settings.

Using the Camera

Using Arena SDK

The Arena Software Development Kit (SDK) is designed from the ground up to provide customers with access to the latest in industry standards and computer technology. The SDK supports Lucid GigE Vision cameras on both Windows and Linux platforms.

Using ArenaView

The Arena SDK includes Lucid's easy to use GUI called ArenaView. Based on the GenICam standard, ArenaView allows you to access and validate camera features quickly and easily through the GenICam XML based feature tree. Optimized for today's diverse range of user preferences, our viewer improves readability on higher resolutions and includes options for different color schemes.

ArenaView also has the following 3D image processing options with a HLS003S:

- Visualize X-Y-Z 3D point cloud data, with the ability to zoom, rotate and pan the point cloud.
- Visualize intensity image overlaid on top of the 3D point cloud data above.
- Visualize depth data in 2D false color heat map.
- Visualize raw intensity data only.

For more information on Arena SDK and ArenaView, please refer to our website.

Camera Specifications

Power

The Helios can be powered via the GPIO using the pins described in the GPIO Characteristics section.

Average Camera Power Consumption	< 10W
Recommended Power Supply Voltage	15W, 12V – 24Vdc via GPIO
Average Current	1 A
Peak Pulse Current	2.8A

Temperature

The HLS003S should be kept in the following storage, operating, and humidity conditions.

Storage Temperature	-30 to 60°C
Operating Temperature	-10 to 60°C case temperature
Humidity	Operating: 20% ~ 80%, relative, non-condensing

Placing the camera outside of these conditions may result in damage to the device.

The HLS003S is equipped with a built-in temperature sensor that can be read by the DeviceTemperature property.

	The camera can get hot to touch if it has been streaming images for an extended period of time.
	DeviceTemperature can show values outside of the operating temperature range. This is generally acceptable as long as the camera is kept within the stated operating temperature range.

GPIO Characteristics

GPIO Pinout Diagram

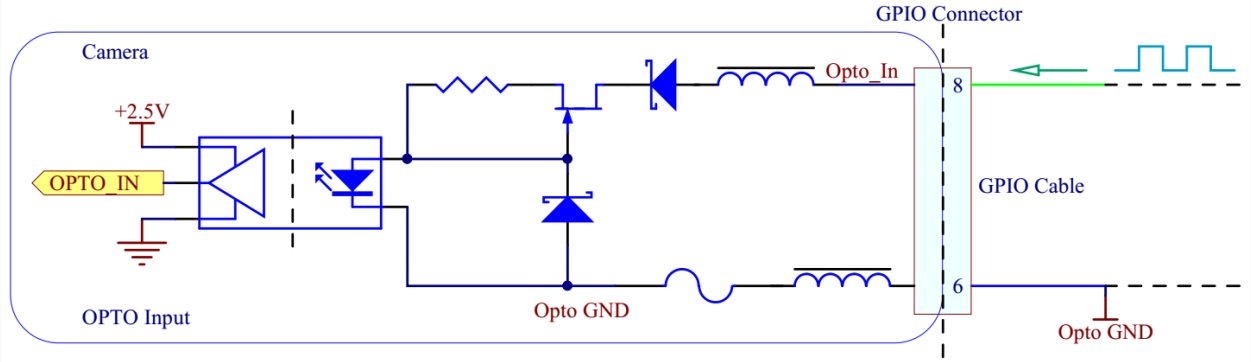
GPIO connector as seen from rear Helios view. Pin colors correspond to GPIO-M8 cable from Lucid Vision Labs.

Pin Number	Pin Description
1 (Red)	V_{AUX} (12-24V DC Power Input)
2 (Brown)	Non-isolated bi-directional GPIO channel (Line 2)
3 (Orange)	V_{DD} GPIO (3.5V Power Output) (Line 4)
4 (Purple)	Non-isolated bi-directional GPIO channel (Line 3)
5 (Black)	GND (Camera GND)
6 (Blue)	OPTO GND (Opto-isolated Reference)
7 (Yellow)	OPTO OUT (Opto-isolated Output) (Line 1)
8 (Green)	OPTO IN (Opto-isolated Input) (Line 0)

Consult the Turning on GPIO Voltage Output section for enabling V_{DD}.

GPIO Schematics

Opto-isolated Input – GPIO Line 0

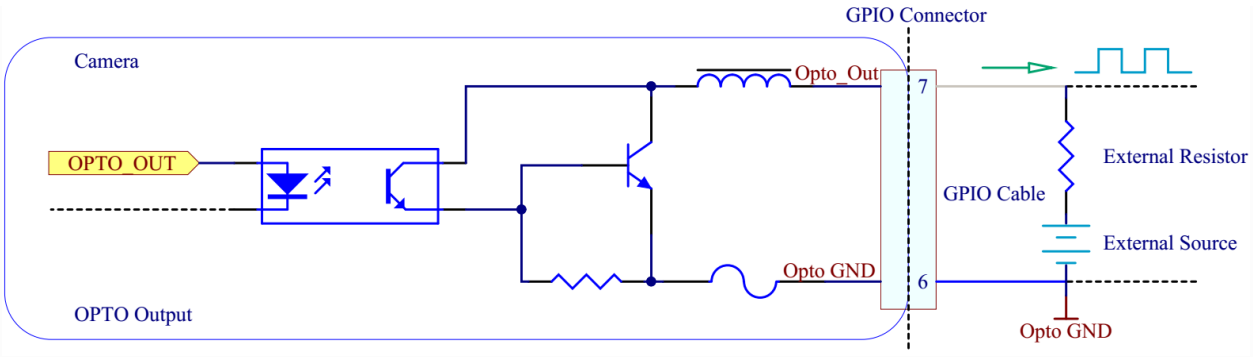


Opto-isolated Input Measurements:

Voltage (V)	Max Rise Delay (us)	Max Fall Delay (us)	Max Rise Time (us)	Max Fall Time (us)	Min Pulse Input (us)	Min Input High (V)	Min Input Low (V)
2.5	1	1	1	1	2	2.5	1.0
5	1	1	1	1	2	2.5	1.0

Sample values measured at room temperature. Results may vary over temperature and setup.

Opto-isolated Output – GPIO Line 1

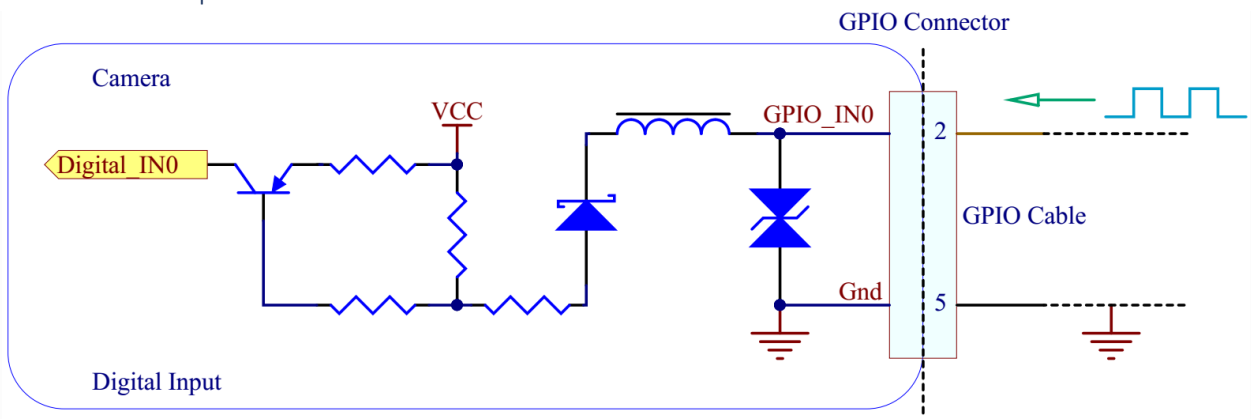


Opto-isolated Output Measurements:

Voltage (V)	External Resistor (Ω)	Max Rise Delay (us)	Max Fall Delay (us)	Max Rise Time (us)	Max Fall Time (us)	Current (mA)	Low Level (V)
2.5	150	50	5	40	5	5.7	0.9
2.5	330	50	5	40	5	2.9	0.8
2.5	560	50	5	40	5	1.9	0.5
2.5	1k	50	5	40	5	1.2	0.3
5	330	50	5	50	5	6.6	0.9
5	560	50	5	50	5	4	0.7
5	1k	50	5	50	5	2.4	0.5
5	1.8k	50	5	50	5	1.4	0.4
12	1k	50	5	60	5	6	0.9
12	1.8k	50	5	60	5	3.4	0.9
12	2.7k	50	5	60	5	2.4	0.7
12	4.7k	50	5	60	5	1.5	0.5
24	1.8k	60	5	60	5	7.1	0.9
24	2.7k	60	5	60	5	4.7	0.9
24	4.7k	60	5	60	5	2.8	0.7
24	6.8k	60	5	60	5	2.1	0.6

Sample values measured at room temperature. Results may vary over temperature and setup.

Non-isolated Input - GPIO Line 2

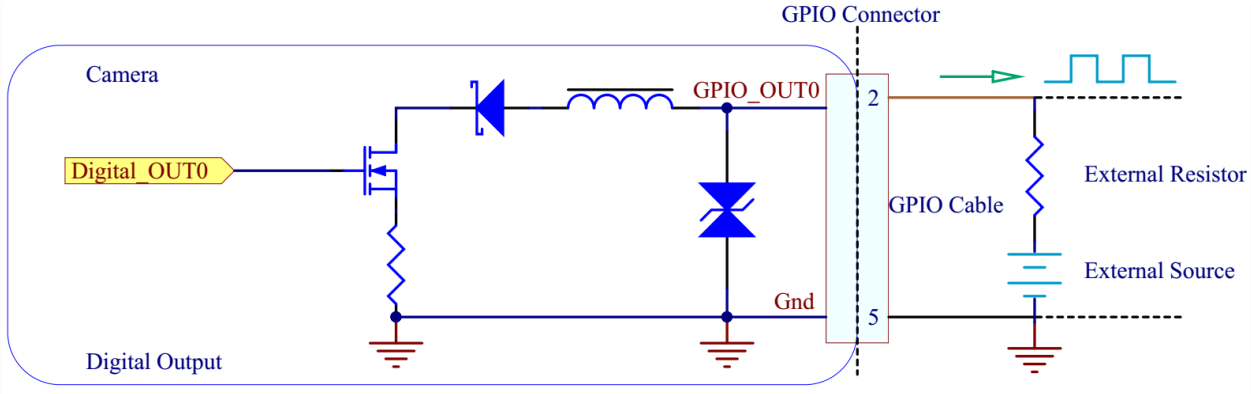


Non-isolated Input Measurements:

Voltage (V)	Max Rise Delay (us)	Max Fall Delay (us)	Max Rise Time (us)	Max Fall Time (us)	Min Pulse Input (us)	Min Input High (V)	Min Input Low (V)
2.5	1	1	1	1	2	2.5	0.5
5	1	1	1	1	2	2.5	0.5

Typical values measured at room temperature. Results may vary over temperature.

Non-isolated Output - GPIO Line 2



Non-isolated Output Measurements:

Voltage (V)	External Resistor (Ω)	Max Rise Delay (us)	Max Fall Delay (us)	Max Rise Time (us)	Max Fall Time (us)	Current (mA)	Low Level (V)
2.5	150	0.5	0.5	1	0.5	4.3	1.3
2.5	330	0.5	0.5	1	0.5	2.6	1
2.5	560	0.5	0.5	1	0.5	1.8	0.8
2.5	1k	0.5	0.5	1	0.5	1.1	0.6
5	330	0.5	0.5	1	0.5	5.6	1.4
5	560	0.5	0.5	1	0.5	3.7	1.1

5	1k	0.5	0.5	1	0.5	2.3	0.9
5	1.8k	0.5	0.5	1	0.5	1.4	0.7
12	1k	0.5	0.5	1	0.5	5.5	1.4
12	1.8k	0.5	0.5	1	0.5	3.2	0.9
12	2.7k	0.5	0.5	1	0.5	2.3	0.9
12	4.7k	0.5	0.5	1	0.5	1.5	0.7
24	1.8k	0.5	0.5	2	0.5	6.5	1.6
24	2.7k	0.5	0.5	2	0.5	4.5	1.3
24	4.7k	0.5	0.5	2	0.5	2.6	0.9
24	6.8k	0.5	0.5	2	0.5	1.8	0.8

Typical values measured at room temperature. Results may vary over temperature.

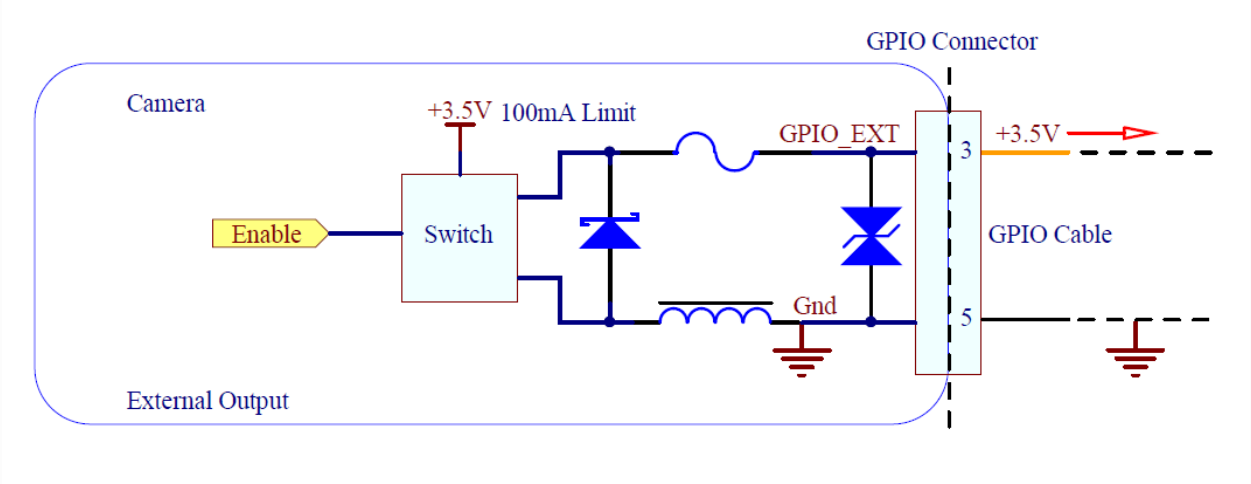
Non-isolated Input - GPIO Line 3

Same as Non-isolated Input – GPIO Line 2 (GPIO_IN is Pin 4, GND is Pin 5)

Non-isolated Output - GPIO Line 3

Same as Non-isolated Output – GPIO Line 2 (GPIO_OUT is Pin 4, GND is Pin 5)

3.5V Output



LED Status

The Helios camera is equipped with an LED that identifies the current state of the camera.

LED Status	Status Information
Flashing red	Camera powered, but no Ethernet link established.
Flashing green	Camera powered, Ethernet link established, but no network traffic.
Solid green	Camera powered, Ethernet link established, and there is network traffic.
Flashing red/green	Firmware update in progress.

Solid red	Error. Firmware update failed.

The following LED sequence occurs when the camera is powered up and connected to a network:

1. LED off, plug in the Ethernet cable.
2. LED on, flashing red.
3. After link is established, LED becomes flashing green.
4. Launch application and start capturing images, LED becomes solid green.

The status LED can also be controlled using the DeviceIndicatorMode property. Possible values are:

- Inactive: LED is off.
- Active: LED indicates camera status according to the above table.

Specification Tests

FCC

This product has been tested and complies 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.

Users are advised that any changes or modifications not approved by Lucid Vision Labs will void the FCC compliance. The product is intended to be used as a component of a larger system; hence users are advised that cable and other peripherals may affect overall system FCC compliance.

RoHS, REACH, and WEEE

LUCID Vision Labs declares the Helios camera is in conformity of the following directives:

- RoHS 2011/65/EC
- REACH 1907/2006/EC
- WEEE 2012/19/EC

CE

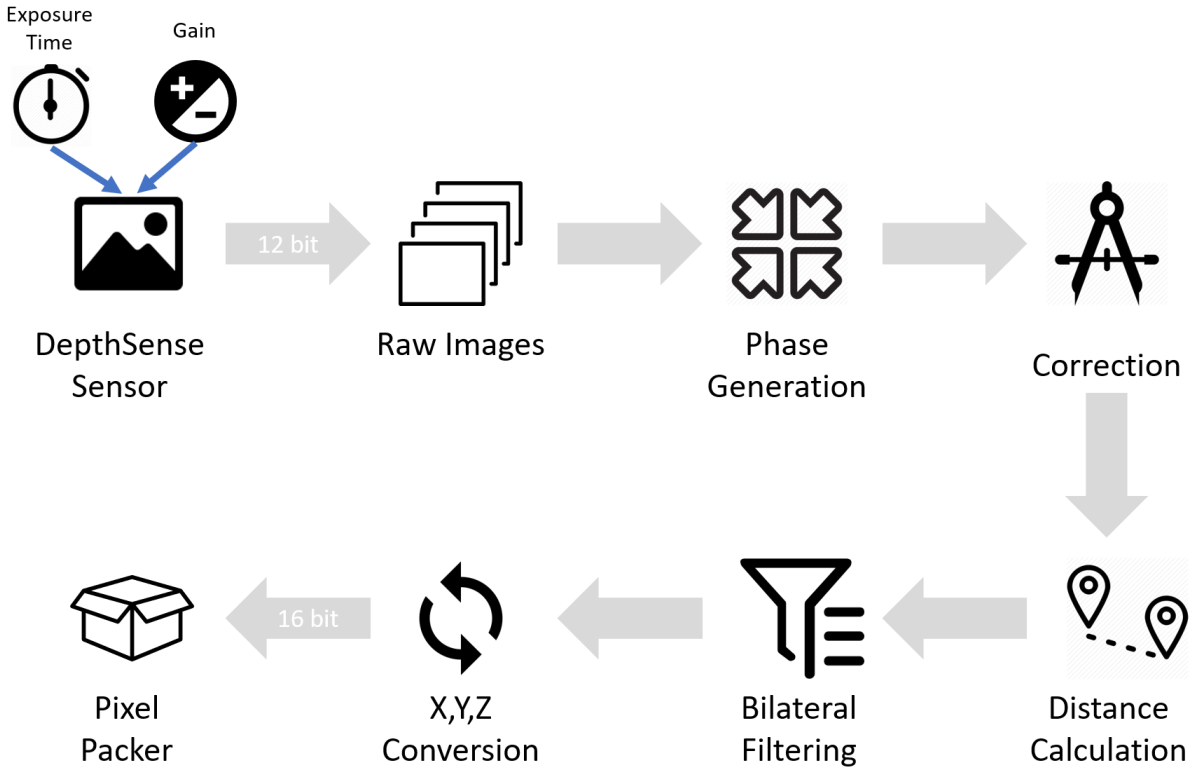
LUCID Vision Labs declares the Helios camera meets requirements necessary for CE marking. The product complies with the requirements of the listed directives below:

- EN61000-4-2
- EN61000-4-3
- EN61000-4-4

Camera Features

Image Processing Controls

The HLS003S camera is equipped with the following image processing control flow.



The details of each of the image processing controls are described below.

Operating Mode

The camera allows for 2 operating modes - one is close-ranged (within 1.5m working distance) and another is far-ranged (up to 6m working distance).

Under 1.5m mode, the camera can generate depth data at 30fps; under the 6m mode, the camera is capable of generating depth data at 15fps.

Exposure Time

The HLS003S camera enables two discrete exposure time settings - 1000us and 250us. The 1000us setting is the default exposure time and the maximum exposure time allowed. Longer exposure time should be used for scenes further away from the camera, or when imaging objects with low reflectivity. Shorter exposure time should be used for scenes closer to the camera, or objects appearing over saturated.

Gain

The HLS003S camera allows the user to adjust to two gain settings. High gain settings should be used for objects that are further away or objects with low reflectivity. High gain setting will amplify sensor reading including any noise.

Image Accumulation

The HLS003S camera's processing pipeline can accumulate multiple frames of images for depth calculation. The higher number of frames accumulated on the camera's pipeline, the slower the depth date is generated as more images need to be captured to calculate the data. The higher number of images accumulated, the better the noise performance would be on the resultant depth data. Note that if 4 images are accumulated under 1.5m operating mode, the maximum frame rate achievable would be around 7fps due to 30fps slowed down by a factor of 4.

Confidence Threshold

The HLS003S camera allows configuration of a confidence threshold using the Confidence Threshold parameter. To turn this feature on, please set Confidence Threshold Enable to True. Pixels with values above the confidence threshold are deemed valid and will have valid X, Y, Z and Y values (assuming Coord3D_ABCY16 pixel format). Values below the threshold will have their X, Y, Z and intensity values set to 0x8000 (denoting invalid).

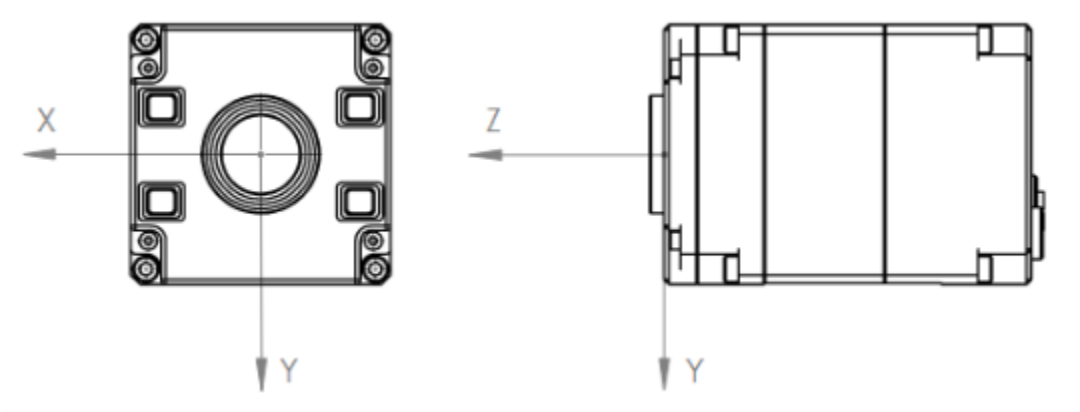
Pixel Formats

Range Data

Range data represent the depth image. These pixel formats below represent the radial distance between the target and the camera. The following pixel formats are available:

Coord3D_ABCY16	4-channel point cloud XYZ + Intensity, 16 bits for each channel
Coord3D_ABC16	3-channel point cloud XYZ, 16 bits for each channel
Coord3D_C16	Depth Map Z plane, 16 bits

The range data pixel formats listed above represent points in the point cloud with each of the ABC values representing the XYZ coordinates of the object's surface from which the light pulse has been reflected from. For distance value in mm, the user can query nodes under the Scan 3D control in order to convert digital count to millimeter. For example, for a depth reading of 1000 digital count using Coord3D_C16, the real-world distance can be calculated by querying Scan 3D Coordinate Selector "Coordinate C" and Scan 3D Coordinate Scale "0.25". Given the Scan 3D Distance Unit "Millimeter", the real-world distance is 1000 x 0.25mm = 250mm. The image data ordering is row by row in raster order. The origin of the coordinate system is defined by: * The X and Y coordinates are zero at the center of the lens optical axis. * The Z coordinate is zero at the front of the camera housing.



Intensity Image

The intensity image shows the brightness of the reflected laser light pulses as values per pixel. Because the wavelength of the light sent out by the camera has an influence on this, the intensity image may differ from the human perception of the targeted scene. The intensity image is useful for checking the image for over or under-saturated pixels. To avoid these, try changing the exposure time or the camera position and check whether the image improves. The following pixel format is available:

Mono8	8 bit per pixel monochrome raw image
Mono12Packed	12 bit per pixel monochrome raw image
Mono12p	12 bit per pixel in bit stream, monochrome raw image
Mono16	16 bit per pixel monochrome raw image

Confidence Data

The confidence value represents a measure of how reliable the depth data is. By analyzing the temporal variations of the light pulse signal, a 16-bit integer value per pixel is generated. The higher the confidence value for that pixel, the more reliable the depth measurement. The following pixel format is available:

Confidence16	Confidence map, 16 bits

Time of Flight Invalidation

Multipath

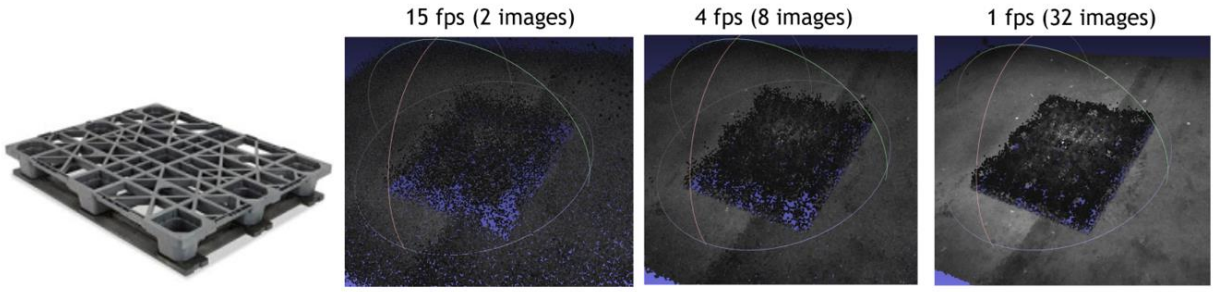
Multipath occurs when light is bounced off several surfaces before it is reflected back to the camera. These extra bounces can introduce error in the depth measurement. This phenomenon occurs commonly when imaging concave objects such as corners of a box or the bottom of a cup.

High Reflectivity

Objects with high reflectivity could cause the pixel to saturate. When this happens, the phase information is lost, and the depth calculation becomes invalid.

Low Reflectivity

When imaging objects with dark colors or low reflectivity, the return signal could be weak and close to the noise floor, making is difficult to differentiate valid data from noise. To mitigate this, averaging of frames can help improve the quality of the data.



Aliasing/Ambiguity

If an object is outside the working distance of the camera's operating mode (1.5m for near mode or 6m for far mode), the distance of the object becomes ambiguous. For example, when in near mode, an object at a distance of 1.8m will appear as 0.3m.

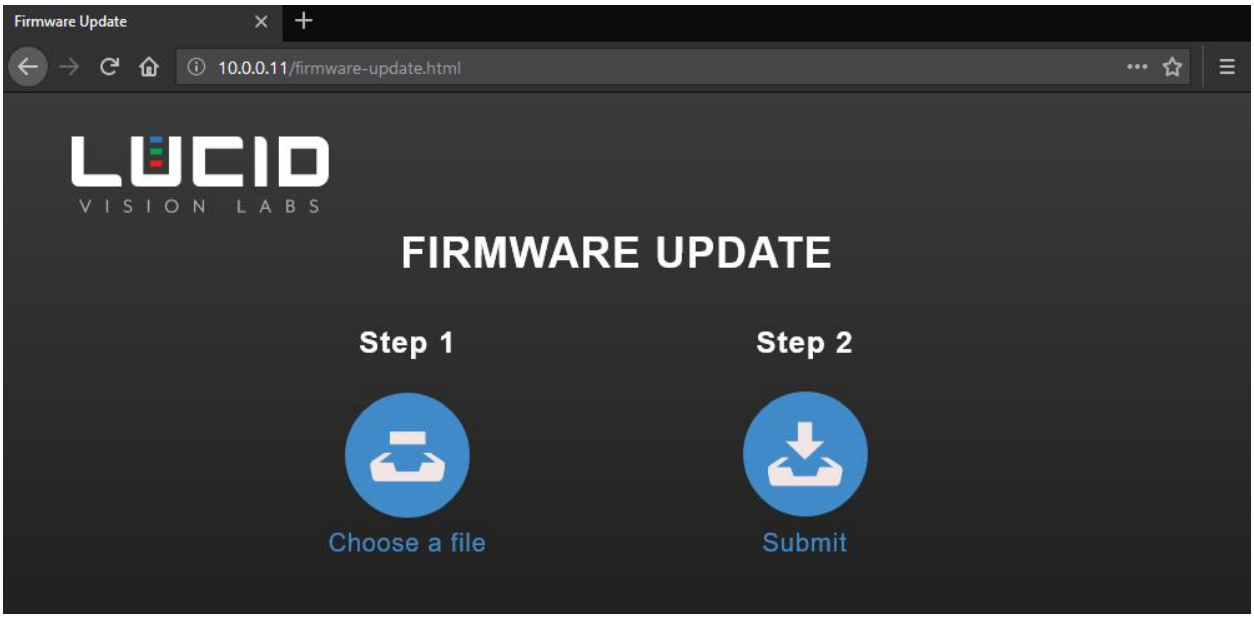
Veiling Glare

Lenses are inherently imperfect and could introduce stray light via scattering inside the lens which then manifest itself as image noise. When imaging a dark spot next to a bright spot (e.g. black text and white paper), veiling glare from the bright spot will cause the depth calculation for the dark spots to be less accurate.

Firmware Update

Use the camera's Firmware Update page to update your camera's firmware. Updating your camera's firmware is easy with our firmware fwa file. The firmware fwa files for each camera are located on our Downloads page.

Every Lucid camera comes with an on-board firmware update page that can be directly accessed in a web browser. If you already know your camera's IP address you can access it at http://{your-camera-ip-address}/firmware-update.html.



Updating your Camera Firmware

1. Navigate to your camera's firmware update page in your web browser (http://{your-camera-ip-address}/firmware-update.html).
2. Click **Choose a file** on the Firmware Update page and select your fwa file.
3. Click **Submit** on the Firmware Update page. This will start the firmware update process.

The Firmware Update page will show the progress of the update. During the update, the camera will not be accessible for control or image capture. The update may take a few minutes to complete. Please refrain from removing power from the camera during the update.

When the firmware update is complete, the camera will reboot. Once the update is finished, you can close the Firmware Update page and access the camera again.

Device Nodes

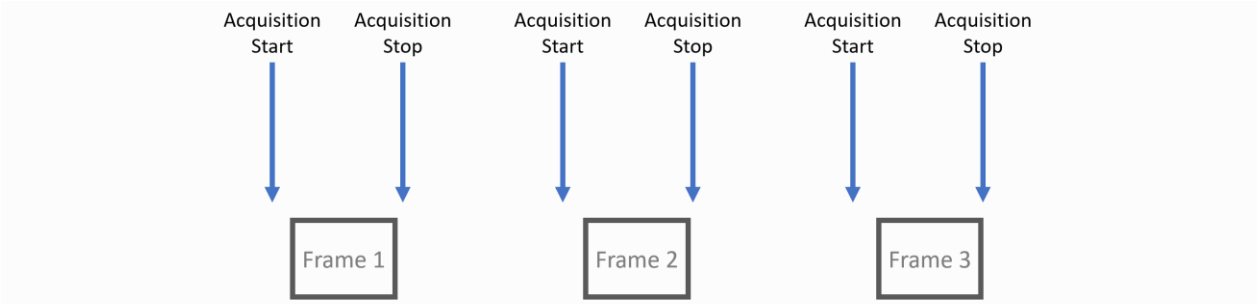
Acquisition Control

Acquisition Control contains features related to image acquisition. Triggering and exposure control functionalities are included in this section.

Acquisition Modes

There are 3 main types of acquisition modes - SingleFrame acquisition, MultiFrame acquisition, and Continuous acquisition.

SingleFrame Acquisition



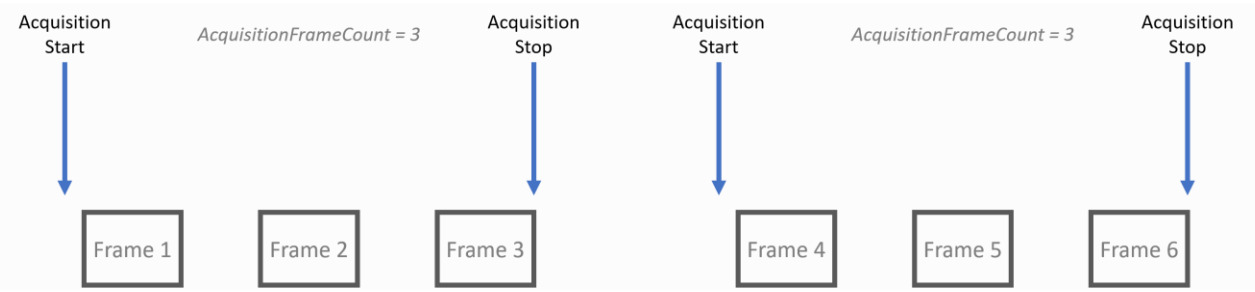
Under SingleFrame acquisition mode, one frame is acquired after AcquisitionStart is called. AcquisitionStop is an optional call as the acquisition process automatically stops after the single frame is acquired. During the acquisition process, all Transport Layer parameters are locked and cannot be modified.

Note that if "Acquisition Stop" is executed after "Acquisition Start" but prior to a frame is available, it is possible that no frame is acquired.

The following code block demonstrates configuring camera to single frame acquisition mode.

```
// Connect to camera
// Get device node map
AcquisitionMode = SingleFrame;
```

MultiFrame Acquisition

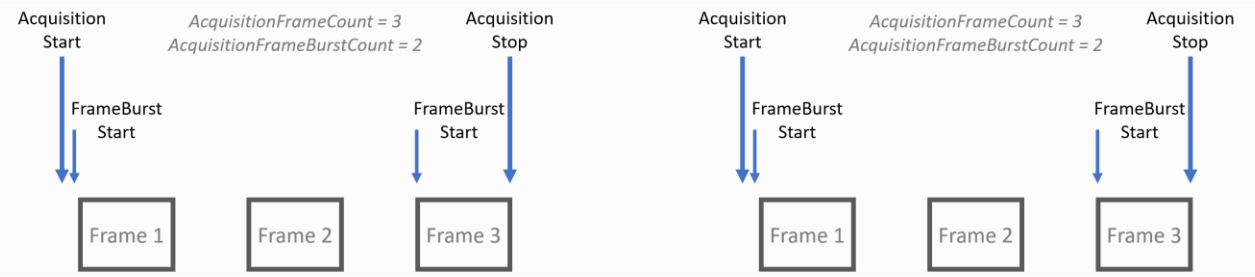


Under MultiFrame acquisition mode, frames are acquired once AcquisitionStart is called. The number of frames acquired is dictated by the parameter AcquisitionFrameCount. During the acquisition process, all Transport Layer parameters are locked and cannot be modified.

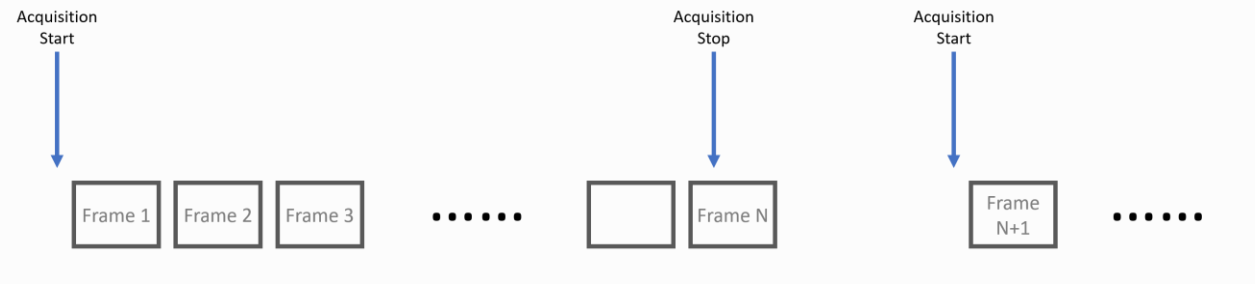
Note that AcquisitionStop is optional under this acquisition mode.

MultiFrame with FrameBurstStart

A burst of frames is defined as a capture of a group of one or many frames within an acquisition. This can be achieved with MultiFrame acquisition mode as demonstrated in the diagram below. Note in the diagram, the second FrameBurstStart in each acquisition sequence only results in 1 frame acquired since AcquisitionFrameCount is set to a value of 3.



Continuous Acquisition



Under Continuous acquisition mode, frames are acquired once AcquisitionStart is called. Frames are acquired until AcquisitionStop is called. During the acquisition process, all Transport Layer parameters are locked and cannot be modified.

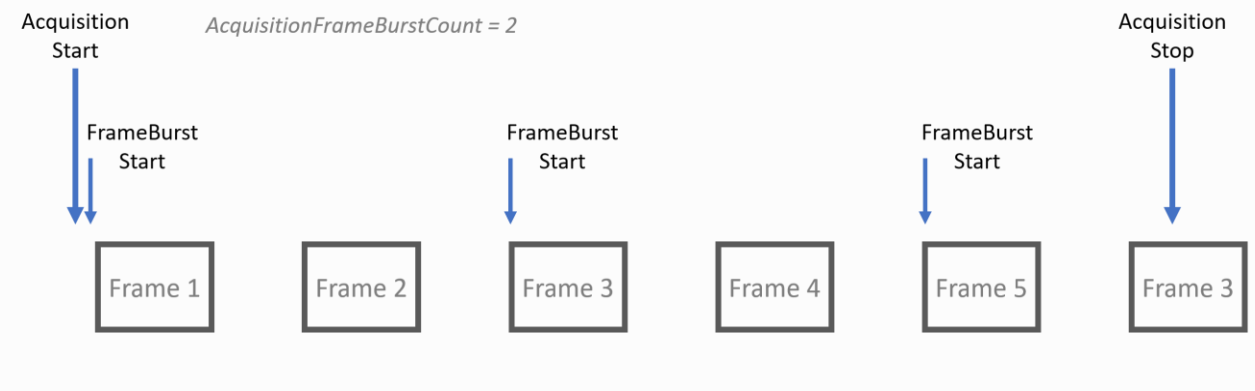
Note that if AcquisitionStop is called during the last frame then the acquisition sequence will stop after the current frame finishes.

The following pseudocode demonstrates configuring the camera to Continuous acquisition mode:

```
// Connect to camera
// Get device node map
AcquisitionMode = Continuous;
```

Continuous Acquisition with FrameBurstStart

A burst of frames is defined as a capture of a group of one or many frames within an acquisition. This can be achieved with Continuous acquisition mode as below. Note that when AcquisitionStop is called, the current frame will need to be finished.



Node Name	Description
AcquisitionMode	Specifies the acquisition mode of the current device. It helps determine the number of frames to acquire during each acquisition sequence.
AcquisitionStart	Start the acquisition sequence for the current device.
AcquisitionStop	Stop the acquisition sequence for the current device.
AcquisitionFrameCount	This node specifies the number of frames to be acquired under MultiFrame AcquisitionMode.
AcquisitionBurstFrameCount	This parameter is ignored if AcquisitionMode is set to SingleFrame. This feature is also constrained by AcquisitionFrameCount if AcquisitionMode is MultiFrame.
AcquisitionFrameRate	Specifies the frequency in which frames are acquired. Note that TriggerMode must be off for this parameter to take effect.
TransmissionFrameRate	Specifies the frequency in which frames are transmitted. Note that TriggerMode must be off for this parameter to take effect.
AcquisitionFrameRateEnable	Controls if the AcquisitionFrameRate feature is writable and used to control the acquisition rate.
AcquisitionLineRate	Controls the rate (in Hertz) at which the Lines in a Frame are captured.

TriggerSelector	This node selects the specific trigger type to configure.
TriggerMode	Controls the On/Off status of the current trigger.
TriggerSoftware	Executing this will generate a software trigger signal. Note that current TriggerSource must be set to Software.
TriggerSource	This node specifies the source of the trigger. It can be a software internal signal of a physical input hardware signal.
TriggerActivation	This node specifies the state in which trigger is activated.
TriggerOverlap	Specifies the type of trigger overlap permitted with the previous frame or line. This defines when a valid trigger will be accepted (or latched) for a new frame or a new line.
TriggerLatency	Enables low latency trigger mode.
TriggerDelay	Specifies the delay in microseconds (us) to apply after the trigger reception before activating it.
TriggerArmed	Specifies whether the trigger is armed. If the trigger is not armed, triggers will be ignored.
ExposureTimeSelector	Selects the exposure time.

Analog Control

Analog Control contains features that describe how to influence the analog features of an image, such as gain, black level, and gamma. Features related to white balance are not available on monochrome cameras.

Node Name	Description
ConversionGain	Sets the conversion gain mode.

Chunk Data Control

Node Name	Description
ChunkModeActive	Activates the inclusion of Chunk data in the payload of the image.
ChunkSelector	Selects which Chunk to enable or control.
ChunkEnable	Enables the inclusion of the selected Chunk data in the payload of the image.
ChunkCRC	CRC chunk data.
ChunkPixelFormat	Chunk Pixel Format chunk data.
ChunkWidth	Chunk Width chunk data.
ChunkHeight	Chunk Height chunk data.
ChunkOffsetX	Chunk Offset X chunk data.
ChunkOffsetY	Chunk Offset Y chunk data.
ChunkPixelDynamicRangeMin	Chunk Pixel Dynamic Range Min chunk data.
ChunkPixelDynamicRangeMax	Chunk Pixel Dynamic Range Max chunk data.

Device Control

Device Control contains features that provide information of the capabilities of the device. There are also features that describe the particular device in detail. These features can be used in applications to query the capabilities of the device and report them to the end user if needed.

Below is a list of the available features that are contained in the specific category.

Node Name	Description
DeviceType	Returns the device type.
DeviceScanType	Scan type of the sensor of the device.
DeviceVendorName	Name of the manufacturer of the device.
DeviceModelName	Model of the device.
DeviceFamilyName	Identifier of the product family of the device.
DeviceManufacturerInfo	Provides additional information from the vendor about the device.
DeviceVersion	Version of the device.
DeviceFirmwareVersion	Version of the firmware in the device.
DeviceSerialNumber	Device's unique serial number.
DeviceUserID	A device ID string that is user-programmable.
DeviceSFNCVersionMajor	Major version of the Standard Features Naming Convention (SFNC) that was used to create the device's GenICam XML.
DeviceSFNCVersionMinor	Minor version of the Standard Features Naming Convention (SFNC) that was used to create the device's GenICam XML.
DeviceSFNCVersionSubMinor	Sub minor version of the Standard Features Naming Convention (SFNC) that was used to create the device's GenICam XML.
DeviceManifestEntrySelector	Manifest entry selector.
DeviceManifestXMLMajorVersion	Indicates the major version number of the GenICam XML file of the selected manifest entry.
DeviceManifestXMLMinorVersion	Indicates the minor version number of the GenICam XML file of the selected manifest entry.
DeviceManifestXMLSubMinorVersion	Indicates the sub minor version number of the GenICam XML file of the selected manifest entry.
DeviceManifestSchemaMajorVersion	Indicates the major version number of the schema file of the selected manifest entry.
DeviceManifestSchemaMinorVersion	Indicates the minor version number of the schema file of the selected manifest entry.
DeviceManifestPrimaryURL	Indicates the first URL to the GenICam XML device description file of the selected manifest entry.
DeviceManifestSecondaryURL	Indicates the second URL to the GenICam XML device description file of the selected manifest entry.
DeviceTLType	Transport Layer type of the device.
DeviceTLVersionMajor	Major version of the Transport Layer of the device.
DeviceTLVersionMinor	Minor version of the Transport Layer of the device.

DeviceTLVersionSubMinor	Sub minor version of the Transport Layer of the device.
DeviceMaxThroughput	Maximum bandwidth of the data that can be streamed out of the device.
DeviceLinkSelector	Selects which Link of the device to control. In general, the device only has one link.
DeviceLinkSpeed	Indicates the speed of transmission negotiated on the specified Link selected by DeviceLinkSelector.
DeviceLinkThroughputLimitMode	Controls if the DeviceLinkThroughputLimit is active.
DeviceLinkThroughputLimit	Limits the maximum bandwidth of the data that will be streamed out by the device on the selected Link.
DeviceLinkThroughputReserve	Allocates the maximum percentage of bandwidth reserved for re-transmissions.
DeviceLinkHeartbeatMode	Activate or deactivate the selected Link's heartbeat.
DeviceLinkHeartbeatTimeout	Controls the current heartbeat timeout of the specific Link in microseconds.
DeviceLinkCommandTimeout	Indicates the command timeout of the specified Link in microseconds.
DeviceStreamChannelCount	Indicates the number of stream channels supported by the device.
DeviceStreamChannelSelector	Selects the stream channel to control.
DeviceStreamChannelType	Reports the type of the stream channel.
DeviceStreamChannelEndianness	Endianness of multi-byte pixel data for this stream.
DeviceStreamChannelPacketSize	Specifies the stream packet size, in bytes, to send on the selected channel for the device.
DeviceEventChannelCount	Indicates the number of event channels supported by the device.
DeviceCharacterSet	Character set used by all the strings of the device.
DeviceReset	Resets the device to its power up state.
DeviceFactoryReset	Resets device to factory defaults.
FirmwareUpdate	Starts a firmware update.
DeviceFeaturePersistenceStart	Indicate to the device and GenICam XML to get ready for persisting of all streamable features.
DeviceFeaturePersistenceEnd	Indicate to the device the end of feature persistence.
DeviceRegistersStreamingStart	Prepare the device for registers streaming without checking for consistency.
DeviceRegistersStreamingEnd	Announce the end of registers streaming.
DeviceIndicatorMode	Controls the behavior of the indicator LED showing the status of the Device.
DeviceTemperatureSelector	Selects the temperature sensor to read from.
DeviceTemperature	Device temperature in degrees Celsius.
DevicePressure	The internal device pressure in kilopascals.
DevicePower	Device power in Watts.
DeviceClockSelector	Selects the clock frequency to access from the device.
DeviceClockFrequency	Returns the frequency of the selected Clock.
Timestamp	Reports the current value of the device timestamp counter.

TimestampReset	Resets the current value of the device timestamp counter. Executing this command causes the timestamp counter to restart automatically.
TimestampLatch	Latches the current timestamp counter into TimestampLatchValue.
TimestampLatchValue	Returns the latched value of the timestamp counter.
DeviceUpTime	Time the device has been powered in seconds.
LinkUpTime	Time the device link has been established in seconds.

Digital IO Control

Node Name	Description
LineSelector	Selects the physical line (or pin) of the external device connector to configure.
LineMode	Controls if the physical Line is used to Input or Output a signal.
LineInverter	Controls the inversion of the signal of the selected input or output Line.
LineStatus	Returns the current status of the selected input or output Line.
LineStatusAll	Returns the current status of all available Line signals at time of polling.
LineSource	Selects which internal acquisition or I/O source signal to output on the selected Line. LineMode must be set to Output.
LineFormat	Controls the current electrical format of the selected physical input or output Line.
LineFilterSelector	Selects the input filter to configure. LineMode must be Input.
LineFilterWidth	Width of the filter in microseconds.
VoltageExternalEnable	Controls if the external voltage is enabled.
UserOutputSelector	Selects which bit of the User Output register will be set by UserOutputValue.
UserOutputValue	Sets the value of the bit selected by UserOutputSelector.
UserOutputValueAll	Sets the value of all the bits of the User Output register. It is subject to the UserOutputValueAllMask.
UserOutputValueAllMask	Sets the write mask to apply to the value specified by UserOutputValueAll before writing it in the User Output register. If the UserOutputValueAllMask feature is present, setting the user Output register using UserOutputValueAll will only change the bits that have a corresponding bit in the mask set to one.

Event Control

Event Control has the device inform the host application that an event has occurred. Below is a list of the available features that are contained in the specific category.

Node Name	Description

EventSelector	Selects which Event to signal to the host application.
EventNotification	Activate or deactivate the notification to the host application of the occurrence of the selected Event.
EventDestinationAddress	Controls the destination IP address for events.
EventExposureStartData	Category that contains all the data features related to the ExposureStart Event.
EventExposureEndData	Category that contains all the data features related to the ExposureEnd Event.
EventTestData	Category that contains all the data features related to the Event Test generated using the TestEventGenerate command.

Event Exposure End Data

Node Name	Description
EventExposureEnd	Returns the unique identifier of the ExposureEnd type of Event.
EventExposureEndTimestamp	Returns the Timestamp of the ExposureEnd Event.
EventExposureEndFrameID	Returns the unique Identifier of the Frame (or image) that generated the ExposureEnd Event.

Event Exposure Start Data

Node Name	Description
EventExposureStart	Returns the unique identifier of the ExposureStart type of Event.
EventExposureStartTimestamp	Returns the Timestamp of the ExposureStart Event.
EventExposureStartFrameID	Returns the unique Identifier of the Frame (or image) that generated the ExposureStart Event.

Event Test Data

Node Name	Description
EventTest	Returns the unique identifier of the Event Test type of event generated using the TestEventGenerate command.
EventTestTimestamp	Returns the Timestamp of the Event Test event.

File Access Control

Node Name	Description
FileSelector	Selects the target file in the device.
FileOperationSelector	Selects the target operation for the selected file in the device. This operation is executed when the FileOperationExecute feature is called.
FileOperationExecute	Executes the operation selected by FileOperationSelector on the selected file.
FileOpenMode	Selects the access mode in which a file is opened in the device.
FileAccessBuffer	Defines the intermediate access buffer that allows the exchange of data between the device file storage and the application.
FileAccessOffset	Controls the offset of the mapping between the device file storage and the FileAccessBuffer.

FileAccessLength	Controls the length of the mapping between the device file storage and the FileAccessBuffer.
FileOperationStatus	Represents the FileOperationExecute status.
FileOperationResult	Represents the file operation result. For Read or Write operations, the number of successfully read/written bytes is returned.
FileSize	Represents the size of the selected file in bytes.
FileStorageSize	Represents the total size of the file storage selected by FileSelector in bytes.
FileStorageUsedSize	Represents the used size of the file storage selected by FileSelector in bytes.
FileStorageFreeSize	Represents the free size of the file storage selected by FileSelector in bytes.

I2C Access Control

Node Name	Description
I2COperationSelector	Selects the target operation for the I2C communication on the device. This operation is executed when the I2COperationExecute feature is called.
I2COperationExecute	Executes the operations selected by I2COperationSelector on the I2C communication.
I2CAccessBuffer	Defines the intermediate access buffer that allows the exchange of data between the device's I2C communication and the application.
I2CRegisterAddress	Controls the register address for the operation selected by the I2COperationSelector.
I2CRegisterAddressLength	Controls the register address length used for the I2C communication.
I2CAccessLength	Controls the number of bytes to transfer to or from the I2CAccessBuffer.
I2COperationStatus	Represents the I2COperationExecute status.
I2COperationResult	Represents the number of successfully read/written bytes for the I2C operation.
I2CSlaveDeviceAddress	Controls the device address for the slave.
I2CSlaveDeviceAddressLength	Controls the slave device address length used for the I2C communication.
I2CSclSource	Selects the physical line to use for the I2C SCL source.
I2CSdaSource	Selects the physical line to use for the I2C SDA source.

Image Format Control

Node Name	Description
PixelFormat	Format of the pixels provided by the device.
PixelColorFilter	Type of color filter that is applied to the image.
IspBayerPattern	Reports the image Bayer pattern in the ISP.
SensorWidth	Effective width of the sensor in pixels.
SensorHeight	Effective height of the sensor in pixels.
WidthMax	Maximum width of the image in pixels.
HeightMax	Maximum height of the image in pixels.
PhysicalPixelSize	None

ADCBitDepth	None
ImagerWidth	Width of the sensor image after binning and decimation.
ImagerHeight	Height of the sensor image after binning and decimation.
ImagerOffsetX	Horizontal offset from the origin of the sensor region.
ImagerOffsetY	Vertical offset from the origin of the sensor region.
Width	Width of the image provided by the device in pixels.
Height	Height of the image provided by the device in pixels.
OffsetX	Horizontal offset from the origin to the region of interest in pixels.
OffsetY	Vertical offset from the origin to the region of interest in pixels.
PixelSize	Total size in bits of a pixel of the image.
ReverseX	Flip horizontally the image sent by the device.
ReverseY	Flip vertically the image sent by the device.
PixelDynamicRangeMin	Minimum value that can be returned during the digitization process.
PixelDynamicRangeMax	Maximum value that can be returned during the digitization process.
TestPattern	Selects the type of test pattern that is generated by the device as image source.

Scan 3D Control

Node Name	**Description**
Scan3dDistanceUnit	Specifies the unit used when delivering (calibrated) distance data.
Scan3dCoordinateSystem	Specifies the Coordinate system to use for the device.
Scan3dCoordinateSelector	Selects the individual coordinates in the vectors for 3D information/transformation.
Scan3dCoordinateScale	Scale factor when transforming a pixel from relative coordinates to world coordinates.
Scan3dAxisMax	Maximum valid transmitted coordinate value of the selected Axis.
Scan3dModeSelector	Selects which Scan 3D Mode is enabled.
Scan3dOperatingMode	Selects the time of flight operating mode.
Scan3dIlluminatorStatusAll	Status of all the illuminators.
Scan3dIlluminatorSelector	Selects the illuminator.
Scan3dIlluminatorStatus	Status of the diffuser for the selected illuminator.
Scan3dConfidenceThresholdEnable	Controls if the confidence threshold is enabled and applied to the output.
Scan3dConfidenceThresholdMin	Controls the minimum threshold value that determines whether or not the depth of a pixel is reliable.
Scan3dSpatialFilterEnable	Controls if spatial filtering is applied.
Scan3dImageAccumulation	Number of images to accumulate.

Serial Access Control

Node Name	Description
SerialOperationSelector	Selects the target operation for the serial communication on the device. This operation is executed when the SerialOperationExecute feature is called.
SerialOperationExecute	Executes the operation selected by SerialOperationSelector on the serial communication.
SerialAccessBuffer	Defines the intermediate access buffer that allows the exchange of data between the device's serial communication and the application.
SerialAccessLength	Controls the number of bytes to transfer to or from the SerialAccessBuffer.
SerialOperationStatus	Represents the SerialOperationExecute status.
SerialOperationResult	Represents the Serial operation result. For Read or Write operations, the number of successfully read/written bytes is returned.
SerialReceivedSize	Represents the number of bytes received from or transfered to the serial communication.
SerialReceiveSource	Selects the physical line to use for the serial communication receive source.
SerialBaudRate	This feature controls the baud rate used for serial communication.
SerialParity	This feature controls the parity used for serial communication.
SerialStopBits	This feature controls the number of stop bits used for serial communication.
SerialDataBits	This feature controls the number of data bits used for serial communication.
SerialFlowControl	This feature controls the flow control used for serial communication.

Test Control

Node Name	Description
TestPendingAck	Tests the device's pending acknowledge feature.
TestEventGenerate	Generates a Test Event.
TestMode	None

Transfer Control

Transfer Control allows the device to accumulate on the on-camera buffer in a queue. The data stored in the queue, referred to as blocks, can be transmitted to the host application at a later time. The host application will be able to request the device transmit one or more block. By default, this control is disabled on the Helios and acquired images are automatically transmitted.

Node Name	Description
TransferSelector	Selects which stream transfers are currently controlled by the selected Transfer features.
TransferControlMode	Selects the control method for the transfers.
TransferOperationMode	Selects the operation mode of the transfer.
TransferBlockCount	Specifies the number of data Blocks that the device should stream before stopping.

TransferQueueMaxBlockCount	Controls the maximum number of data blocks that can be stored in the block queue of the selected stream.
TransferQueueCurrentBlockCount	Returns the number of Block(s) currently in the transfer queue.
TransferQueueMode	Specifies the operation mode of the transfer queue.
TransferStart	Starts the streaming of data blocks out of the device.
TransferStop	Stops the streaming of data Block(s).
TransferAbort	Immediately abort the streaming of data block(s).
TransferPause	Pauses the streaming of data Block(s).
TransferResume	Resumes a data Blocks streaming that was previously paused by a TransferPause command.
TransferStatusSelector	Selects which status of the transfer module to read.
TransferStatus	Reads the status of the Transfer module signal selected by TransferStatusSelector.

Transport Layer Control

Transport Layer Control includes a list of features related to the GigE Vision bootstrap registers and GigE Vision transport medium.

Node Name	Description
PayloadSize	Provides the number of bytes transferred for each image or chunk on the stream channel.
GigEVision	Category that contains the features pertaining to the GigE Vision transport layer of the device.
PtpControl	Category that contains the features related to the Precision Time Protocol (PTP) of the device.
ReceivedPacketResendCount	Returns the number of received packet resend commands.
ValidPacketResendCount	Returns the number of valid packet resends handled by the device.
UnavailablePacketResendCount	Returns the number of unavailable packet resends handled by the device.

GigE Vision

Node Name	Description
GevPhysicalLinkConfiguration	Controls the principal physical link configuration to use on next restart/power-up of the device.
GevCurrentPhysicalLinkConfiguration	Indicates the current physical link configuration of the device.
GevSupportedOptionSelector	Selects the GEV option to interrogate for existing support.
GevSupportedOption	Returns if the selected GEV option is supported.
GevInterfaceSelector	Selects which logical link to control.
GevMACAddress	MAC address of the logical link.
GevPAUSEFrameReception	Controls whether incoming PAUSE Frames are handled on the given logical link.
GevPAUSEFrameTransmission	Controls whether PAUSE Frames can be generated on the given logical link.

GevCurrentIPConfigurationLLA	Controls whether the Link Local Address IP configuration scheme is activated on the given logical link.
GevCurrentIPConfigurationDHCP	Controls whether the DHCP IP configuration scheme is activated on the given logical link.
GevCurrentIPConfigurationPersistentIP	Controls whether the Persistent IP configuration scheme is activated on the given logical link.
GevCurrentIPAddress	Reports the IP address for the given logical link.
GevCurrentSubnetMask	Reports the subnet mask of the given logical link.
GevCurrentDefaultGateway	Reports the default gateway IP address to be used on the given logical link.
GevIPConfigurationStatus	Reports the current IP configuration status.
GevPersistentIPAddress	Controls the Persistent IP address for this logical link.
GevPersistentSubnetMask	Controls the persistent subnet mask associated with the Persistent IP address on this logical link.
GevPersistentDefaultGateway	Controls the persistent default gateway for this logical link.
GevDiscoveryAckDelay	Indicates the maximum randomized delay the device will wait to acknowledge a discovery command.
GevGVCPExtendedStatusCodesSelector	Selects the GigE Vision version to control extended status codes for.
GevGVCPExtendedStatusCodes	Enables the generation of extended status codes.
GevGVCPPendingAck	Enables the generation of PENDING_ACK.
GevPrimaryApplicationSwitchoverKey	Controls the key to use to authenticate primary application switchover requests.
GevGVSPExtendedIDMode	Enables the extended IDs mode.
GevCCP	Controls the device access privilege of an application.
GevPrimaryApplicationSocket	Returns the UDP source port of the primary application.
GevPrimaryApplicationIPAddress	Returns the address of the primary application.
GevMCPHostPort	Controls the port to which the device must send messages.
GevMCDA	Controls the destination IP address for the message channel.
GevMCTT	Provides the transmission timeout value.
GevMCRC	Controls the number of retransmissions allowed when a message channel message times out.
GevMCSP	This features indicates the source port for the message channel.
GevStreamChannelSelector	Selects the stream channel to control.
GevSCPInterfaceIndex	Index of the logical link to use.
GevSCPHostPort	Controls the port of the selected channel to which a GVSP transmitter must send data stream or the port from which a GVSP receiver may receive data stream.
GevSCPSFireTestPacket	Sends a test packet. When this feature is set, the device will fire one test packet.
GevSCPSDoNotFragment	The state of this feature is copied into the ‘do not fragment’ bit of IP header of each stream packet.

GevSCPSPacketSize	It specifies the stream packet size, in bytes, to send on the selected channel for a GVSP transmitter or specifies the maximum packet size supported by a GVSP receiver.
GevSCPD	Controls the delay (in GEV timestamp counter unit) to insert between each packet for this stream channel.
GevSCDA	Controls the destination IP address of the selected stream channel to which a GVSP transmitter must send data stream or the destination IP address from which a GVSP receiver may receive data stream.
GevSCSP	Indicates the source port of the stream channel.

PTP Control

Node Name	Description
PtpEnable	Enables the Precision Time Protocol (PTP).
PtpStatus	Returns the latched state of the PTP clock.
PtpSlaveOnly	Enables slave only operation of the PTP.
PtpClockAccuracy	Indicates the expected accuracy of the device PTP clock when it is the grandmaster, or in the event it becomes the grandmaster.
PtpServoStatus	Returns the latched state of the clock servo.
PtpDataSet	Reports the current value of the PTP's timestamp.
PtpDataSetLatch	Latches the current values from the device's PTP clock data set.
PtpDataSetLatchValue	Returns the latched value of the PTP clock.
PtpOffsetFromMaster	Returns the latched offset from the PTP master clock in nanoseconds. If PtpOffsetFromMaster returns -1 then the synchronization has not started.
PtpClockID	Returns the latched clock ID of the PTP device.
PtpParentClockID	Returns the latched parent clock ID of the PTP device.
PtpGrandmasterClockID	Returns the latched grandmaster clock ID of the PTP device.

User Set Control

Node Name	Description
UserSetSelector	Selects the feature User Set to load, save, or configure.
UserSetLoad	Loads the User Set specified by UserSetSelector to the device and makes it active.
UserSetSave	Save the User Set specified by UserSetSelector to the non-volatile memory of the device.
UserSetDefault	Selects the feature User Set to load and make active by default when the device is reset.
UserSetFeatureSelector	Selects which individual User Set feature to control.
UserSetFeatureEnable	Enables the selected feature and make it active in all the User Sets.

Revision History

Version Number	Date	Changes
V1.0.0	July 25, 2019	First Public Release of this document.