IMPERX

Cheetah Pregius Cameras

User Manual

with GigE Vision® Interface

The Imperx Cheetah CMOS cameras provide exceptional video image quality in a remarkably compact and ruggedized design with resolutions from 2.86 to 31 MP. The cameras use Sony 2nd and 3rd generation Pregius CMOS sensors for their high sensitivity, image clarity, and high dynamic range. They achieve frame rates up to 40 frames per second with GigE Vision® output interface and support power over ethernet (PoE).

Revision 1.1

IMPERX
Industrial Cameras & Imaging Systems

About Imperx, Inc.

IMPERX, Inc. is a leading designer and manufacturer of high performance, high quality digital cameras, frame grabbers, and accessories for industrial, commercial, military, and aerospace imaging applications including flat panel inspection, biometrics, aerial mapping, surveillance, traffic management, semiconductors and electronics, scientific & medical Imaging, printing, homeland security, space exploration, and other imaging and machine vision applications.

Fortune 100 companies, federal and state government agencies, domestic and foreign defense agencies, academic institutions, and other customers worldwide use IMPERX products.

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Warranty

IMPERX warrants performance of its products and related software to the specifications applicable at the time of sale in accordance with IMPERX's standard warranty, which is 2 (two) years parts and labor.

Do not open the housing of the camera. Warranty voids if the housing has been open or tampered.

IMPORTANT NOTICE
This camera has been tested and complies with the limits of Class A digital device, pursuant to part 15 of the FCC rules.

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REVISION HISTORY

Revision	Date	Reviser	Comments
1.0	8/27/2019	K. Wetzel I. Barabanova	Initial release.
1.1	11/27/2019	I. Barabanova	Added POE-C1911 and P67-C1911 cameras Added Accessories section Added p/n of IP67 lens tubes and cables Added mounting plates drawings Updated P67 camera drawings Added IP67 lens tubes drawings Added IP67 cables drawings Added Network Adapter adjustment procedures

1 About the Camera

1.1 General

The GigE Vision® with Power over Ethernet (PoE) Cheetah CMOS cameras are built around advanced Sony Pregius CMOS image sensors with global shutter for high quality images in a small ruggedized form factor. Cheetah cameras are progressive scan digital cameras featuring a built-in image-processing engine, low power consumption, low noise, and high dynamic range (71 dB). The cameras provide several trigger modes and output strobes allowing you to synchronize the image capture of one or more cameras to an external event. They also provide an Area of Interest (AOI), programmable look-up tables (LUT) and the ability to store up to four different camera configurations. Using the simple GenICam™ compliant user interface, you can quickly apply image corrections to enhance recognition or quality.

The cameras are suitable for a wide range of environmental conditions and applications, such as machine vision, industrial inspection, surveillance, aerospace, and more.

The C2000 and C2400 cameras are ultra-compact with a slimmed down feature set for cost-sensitive applications.

The C1911 and C3210 camera have large 4.5-micron square pixels for improved sensitivity and dynamic range.

The Cheetah P67 cameras feature IP67-rated enclosure that protects a camera from ingress of water, dirt, dust, sand and other contaminants and can be utilized in harsh environments. Imperx offers IP67 lens tubes of different diameters to be used with varying lens sizes to suit your specific requirements.

The C4410, C5410, and C6410 cameras feature 20 MP, 17 MP, and 31 MP Sony Pregius CMOS sensors respectively, provide support for active Canon EOS lens with iris and focus controls, and are available with optional thermal cooling that lowers the sensor temperature to a certain level reducing thermal noise.

The C2410Y/Z and C4110Y/Z cameras feature micro-polarized Sony Pregius CMOS sensors. The sensors have a 2x2 pixel sub-array where each pixel within the sub-array blocks a different polarization angle (0, 45, 90 or 135 degrees).

The cameras ship with the Imperx SDK and IpxPlayer for playing/recording videos and setting camera features.

Table 1 enlists the Cheetah CMOS camera models featuring GigE Vision® with PoE interface.

The cameras use global shutter operation for superior motion capture with exceptionally high frame rates for high throughput applications. You can synchronize the cameras to an external trigger source and vary exposure times using internal controls or an external pulse width. An Area of Interest (AOI) can be programmed for each acquisition frame.

Built-in gamma correction and user-defined look-up table (LUT) capabilities optimize the camera's dynamic range features. Bad pixel correction is used for pixels that are over-responding or under-responding. Auto White Balance (AWB) is available in color cameras to correct for color temperature.

Table 1: Cheetah cameras with GigE Vision® PoE interface

Camera Model	Resolution (MP)	Resolution (H x V)	Frame Rate (Max)	Type (Color/ Mono)	Optical format	Pixel Size (microns)	Sony Sensor Model
POE-C1911	2.86	1944 x 1472	40	C, M	2/3”	4.5	IMX429
P67-C1911	2.86	1944 x 1472	40	C, M	2/3”	4.5	IMX429
POE-C2000	3	2064 x 1544	36	C, M	1/1.8”	3.45	IMX265
POE-C2010	3	2064 x 1544	36	C, M	1/1.8”	3.45	IMX265
P67-C2010	3	2064 x 1544	36	C, M	1/1.8”	3.45	IMX265
POE-C2400	5	2464 x 2056	22	C, M	2/3”	3.45	IMX264
POE-C2410	5	2464 x 2056	22	C, M	2/3”	3.45	IMX264
POE-C2410Y/Z	5	2464 x 2056	22	Y, Z	2/3”	3.45	IMX250MY/ZR
P67-C2410	5	2464 x 2056	22	C, M	2/3”	3.45	IMX264
POE-C3210	7	3216 x 2208	16	C, M	1.1”	4.5	IMX428
P67-C3210	7	3216 x 2208	16	C, M	1.1”	4.5	IMX428
POE-C4010	9	4112 x 2176	13	C, M	1”	3.45	IMX267
P67-C4010	9	4112 x 2176	13	C, M	1”	3.45	IMX267
POE-C4110	12	4112 x 3008	9	C, M	1.1”	3.45	IMX304
POE-C4110Y/Z	12	4112 x 3008	9	Y, Z	1.1”	3.45	IMX253MY/ZR
P67-C4110	12	4112 x 3008	9	C, M	1.1”	3.45	IMX304
POE-C4410	20	4432 x 4436	6	C, M	4/3”	3.45	IMX367
POE-C5410	17	5472 x 3084	7	C, M	4/3”	3.45	IMX387
POE-C6410	31	6464 x 4852	3.7	C, M	APS-C	3.45	IMX342

1.1.1 Key Features

- Global shutter (GS)
- Color and monochrome versions
- Fast frame rates
- High data transfer rates up to 1000 megabits per second (or 1Gbit/s)
- Uses CAT5e or CAT6 cables and standard RJ45 connectors (exception: P67 cameras)
- Data transfer up to 100 meters in length
- Internal, external exposure controls
- Automatic exposure and gain control (AEC/AGC) (exception: C2000 and C2400)
- Analog and digital gain control
- Offset control
- Built-in pulse generator
- Area of interest (AOI)
- Programmable external inputs and outputs
- Multiple Trigger/Synchronization options
- Automatic and manual white balance
- Four 12-bit look-up tables (LUT)
- Bad pixel correction, user-defined and factory
- Flat field correction, user defined and factory (exception: C2000, C2010, and C1911)
- Dynamic transfer function and gamma corrections
- Optional P-Iris (exception: C4410, C5410, C6410, C2000, C2400, and P67 cameras)
- Canon EOS EF lens control (C4410, C5410, C6410 cameras only)
- Temperature monitor
- Field upgradeable firmware

1.2 Technical Specifications

1.2.1 C1911 Camera Specifications

Table 2: C1911 Camera Specifications

Specifications		**POE-C1911, P67-C1911 – 2.86 MP**
Active image resolution		1944 (H) x 1472 (V)
Pixel size		4.5 µm
Optical format		2/3 inch
Shutter		Global
Frame rate (max)		40 fps (8-bit), 20 fps (10, 12-bit unpacked), 26 fps (10, 12-bit packed)
Sensor digitization		12-bit
Dynamic range		73 dB
Output bit depth		8, 10, or 12-bit
Shutter speed		1 µs/step, 5 µs to 16.0 s
Analog / Digital gain		Manual, auto; 0-48 dB (0.1 dB step)
Digital gain		1x (0 dB) to 4x (12 dB), 0.001x step
AEC/AGC		Yes
Black level offset		Manual (0-255), auto
Exposure control		Manual, auto, external, off
White balance		Once, manual, auto, off
Area of Interest (AOI)		Two
Trigger Inputs		External, pulse generator, software
Trigger options		Edge, pulse width, trigger filter, trigger delay, debounce
Trigger modes		Free-run, standard, fast
I/O control	**POE**	2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)
	P67	1 IN (OPTO) / 2 OUT (OPTO, TTL)
Strobe output		2 strobes, programmable position and duration
Pulse generator		Yes, programmable
Lens mount	**POE**	C-mount (default), P-Iris (optional)
	P67	C-mount (default)
Camera housing		6000 series aluminum
Upgradeable firmware		Yes
Data correction		4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, bad pixel correction (static, dynamic)
Supply voltage range		12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)
Power		Typical: 3.84 W @ 12 V; PoE: 5.18 W
Camera size (W x H x L)	**POE**	(37 x 37 x 61.5) mm
	P67	(48.5 x 42 x 61) mm (without lens tube)
Weight	**POE**	113.2 grams
	P67	196 grams (without lens tube)
Vibration, shock		20G (20-200 Hz XYZ) / 100G
Environmental		-30 °C to +75 °C (-40 °C to +85 °C tested) – Operating; -40 °C to +85 °C – Storage
Relative humidity		10% to 90% non-condensing
Regulatory		FCC part 15 Class A, CE, RoHS

1.2.2 C2000 and C2400 Cameras Specifications

Table 3: C2000 and C2400 Cameras Specifications

Specifications		C2000 – 3 MP	C2400 – 5 MP
Active image resolution		2064 (H) x 1544 (V)	2464 (H) x 2056 (V)
Pixel size		3.45 µm	3.45 µm
Optical format		1/1.8 inch	2/3 inch
Shutter		Global	Global
Frame rate (max)		36 fps (8-bit), 18 fps (10, 12-bit unpacked), 24 (10, 12-bit packed)	22 fps (8-bit), 11 fps (10, 12-bit unpacked), 15 fps (10, 12-bit packed)
Sensor digitization		12-bit	12-bit
Dynamic range		71 dB	71 dB
Output bit depth		8, 10, or 12-bit	8, 10, or 12-bit
Shutter speed		1 µs/step, 14 µs to 16.0 s	1 µs/step, 14 µs to 16.0 s
Analog / Digital gain		0-48 dB (0.1 dB step)	0-48 dB (0.1 dB step)
Digital gain		1x (0 dB) to 4x (12 dB), 0.001x step	1x (0 dB) to 4x (12 dB), 0.001x step
Black level offset		Manual (0-255), auto	Manual (0-255), auto
Exposure control		Manual, external, off	Manual, external, off
White balance		Once, manual, auto, off	Once, manual, auto, off
Area of Interest (AOI)		One	One
Trigger inputs		External, pulse generator, software	External, pulse generator, software
Trigger options		Edge, pulse width, trigger filter, trigger delay, debounce	Edge, pulse width, trigger filter, trigger delay, debounce
Trigger modes		Free-run, standard, fast	Free-run, standard, fast
I/O control		1 IN (OPTO) / 1 OUT (OPTO)	1 IN (OPTO) / 1 OUT (OPTO)
Strobe output		1 strobe, programmable position and duration	1 strobe, programmable position and duration
Pulse generator		Yes, programmable	Yes, programmable
Lens mount		C-mount (default)	C-mount (default)
Camera housing		6000 series aluminum	6000 series aluminum
Upgradeable firmware		Yes	Yes
Data correction		4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, bad pixel correction (static, dynamic)	4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, flat field correction bad pixel correction (static, dynamic)
Supply voltage range		12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)	12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)
Power consumption		Typical: 3.72 W @ 12 V; PoE: 5 W	Typical: 3.48 W @ 12 V; PoE: 4.96 W
Camera size (W x H x L)		(29 x 29 x 59.4) mm	(29 x 29 x 59.4) mm
Weight		77.6 grams	77.6 grams
Vibration, shock		30G (20-200 Hz XYZ) / 500G	30G (20-200 Hz XYZ) / 500G
Environmental	Operating	-30 °C to +70 °C	-30 °C to +70 °C
	Storage	-40 °C to +85 °C	-40 °C to +85 °C
Relative humidity		10% to 90% non-condensing	10% to 90% non-condensing
Regulatory		FCC part 15, CE, RoHS	FCC part 15, CE, RoHS

1.2.3 C2010 and C2410 Cameras Specifications

Table 4: C2010 and C2410 Cameras Specifications

Specifications		POE-C2010, P67-C2010 – 3 MP	POE-C2410, P67-C2410 – 5 MP
Active image resolution		2064 (H) x 1544 (V)	2464 (H) x 2056 (V)
Pixel size		3.45 µm	3.45 µm
Optical format		1/1.8 inch	2/3 inch
Shutter		Global	Global
Frame rate (max)		36 fps (8-bit), 18 fps (10, 12-bit unpacked), 24 fps (10, 12-bit packed)	22 fps (8-bit), 11 fps (10, 12-bit unpacked), 15 fps (10, 12-bit packed)
Sensor digitization		12-bit	12-bit
Dynamic range		71 dB	71 dB
Output bit depth		8, 10, or 12-bit	8, 10, or 12-bit
Shutter speed		1 µs/step, 14 µs to 16.0 s	1 µs/step, 14 µs to 16.0 s
Analog / Digital gain		Manual, auto; 0-48 dB (0.1 dB step)	Manual, auto; 0-48 dB (0.1 dB step)
Digital gain		1x (0 dB) to 4x (12 dB), 0.001x step	1x (0 dB) to 4x (12 dB), 0.001x step
AEC/AGC		Yes	Yes
Black level offset		Manual (0-255), auto	Manual (0-255), auto
Exposure control		Manual, auto, external, off	Manual, auto, external, off
White balance		Once, manual, auto, off	Once, manual, auto, off
Area of Interest (AOI)		Two	Two
Trigger inputs		External, pulse generator, software	External, pulse generator, software
Trigger options		Edge, pulse width, trigger filter, trigger delay, debounce	Edge, pulse width, trigger filter, trigger delay, debounce
Trigger modes		Free-run, standard, fast	Free-run, standard, fast
I/O control	**POE**	2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)	2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)
	P67	1 IN (OPTO) / 2 OUT (OPTO, TTL)	1 IN (OPTO) / 2 OUT (OPTO, TTL)
Strobe output		2 strobes, programmable position and duration	2 strobes, programmable position and duration
Pulse generator		Yes, programmable	Yes, programmable
Lens mount	**POE**	C-mount (default), P-Iris (optional)	C-mount (default), P-Iris (optional)
	P67	C-mount (default)	C-mount (default)
Camera housing		6000 series aluminum	6000 series aluminum
Upgradeable firmware		Yes	Yes
Data correction		4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, bad pixel correction (static, dynamic)	4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, flat field correction, bad pixel correction (static, dynamic)
Supply voltage range		12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)	12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)
Power consumption		Typical: 3 W @ 12 V; PoE: 4.64 W	Typical: 3.24 W @ 12 V; PoE: 4.69 W
Camera size (W x H x L)	**POE**	(37 x 37 x 61.5) mm	(37 x 37 x 61.5) mm
	P67	(48.5 x 42 x 61) mm (without lens tube)	(48.5 x 42 x 61) mm (without lens tube)
Weight	**POE**	113.2 grams	113.2 grams
	P67	196 grams (without lens tube)	196 grams (without lens tube)
Vibration, shock		20G (20-200 Hz XYZ) / 100G	20G (20-200 Hz XYZ) / 100G
Environmental	Operating	-30 °C to +75 °C (-40 °C to +85 °C tested)	-30 °C to +75 °C (-40 °C to +85 °C tested)
	Storage	-40 °C to +85 °C	-40 °C to +85 °C
Relative humidity		10% to 90% non-condensing	10% to 90% non-condensing
Regulatory		FCC part 15 Class A, CE, RoHS	FCC part 15 Class A, CE, RoHS

1.2.4 C3210 and C4010 Cameras Specifications

Table 5: C3210 and C4010 Cameras Specifications

Specifications		POE-C3210, P67-C3210 – 7.1 MP	POE-C4010, P67-C4010 – 9 MP
Active image resolution		3216 (H) x 2208 (V)	4112 (H) x 2176 (V)
Pixel size		4.5 µm	3.45 µm
Optical format		1.1 inch	1 inch
Shutter		Global	Global
Frame rate (max)		16 fps (8-bit), 8 fps (10, 12-bit unpacked), 10 fps (10, 12-bit packed)	13.2 fps (8-bit), 6.6 fps (10, 12-bit unpacked), 8.8 fps (10, 12-bit packed)
Sensor digitization		12-bit	12-bit
Dynamic range		77 dB	71 dB
Output bit depth		8, 10, or 12-bit	8, 10, or 12-bit
Shutter speed		1 µs/step, 5 µs to 16.0 s	1 µs/step, 14 µs to 16.0 s
Analog / Digital gain		Manual, auto; 0-48 dB (0.1 dB step)	Manual, auto; 0-48 dB (0.1 dB step)
Digital gain		1x (0 dB) to 4x (12 dB), 0.001x step	1x (0 dB) to 4x (12 dB), 0.001x step
AEC/AGC		Yes	Yes
Black level offset		Manual (0-255), auto	Manual (0-255), auto
Exposure control		Manual, auto, external, off	Manual, auto, external, off
White balance		Once, manual, auto, off	Once, manual, auto, off
Area of Interest (AOI)		Two	Two
Trigger Inputs		External, pulse generator, software	External, pulse generator, software
Trigger options		Edge, pulse width, trigger filter, trigger delay, debounce	Edge, pulse width, trigger filter, trigger delay, debounce
Trigger modes		Free-run, standard, fast	Free-run, standard, fast
I/O control	**POE**	2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)	2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)
	P67	1 IN (OPTO) / 2 OUT (OPTO, TTL)	1 IN (OPTO) / 2 OUT (OPTO, TTL)
Strobe output		2 strobes, programmable position and duration	2 strobes, programmable position and duration
Pulse generator		Yes, programmable	Yes, programmable
Lens mount	**POE**	C-mount (default), P-Iris (optional)	C-mount (default), P-Iris (optional)
	P67	C-mount (default)	C-mount (default)
Camera housing		6000 series aluminum	6000 series aluminum
Upgradeable firmware		Yes	Yes
Data correction		4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, flat field correction, bad pixel correction (static, dynamic)	4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, flat field correction, bad pixel correction (static, dynamic)
Supply voltage range		12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)	12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)
Power consumption		Typical: 4.32 W @ 12 V; PoE: 5.95 W	Typical: 3.36 W @ 12 V; PoE: 4.91 W
Camera size (W x H x L)	**POE**	(37 x 37 x 61.5) mm	(37 x 37 x 61.5) mm
	P67	(48.5 x 42 x 61) mm (without lens tube)	(48.5 x 42 x 61) mm (without lens tube)
Weight	**POE**	113.2 grams	113.2 grams
	P67	196 grams (without lens tube)	196 grams (without lens tube)
Vibration, shock		20G (20-200 Hz XYZ) / 100G	20G (20-200 Hz XYZ) / 100G
Environmental	Operating	-30 °C to +75 °C (-40 °C to +85 °C tested)	-30 °C to +75 °C (-40 °C to +85 °C tested)
	Storage	-40 °C to +85 °C	-40 °C to +85 °C
Relative humidity		10% to 90% non-condensing	10% to 90% non-condensing
Regulatory		FCC part 15 Class A, CE, RoHS	FCC part 15 Class A, CE, RoHS

1.2.5 C4110 Camera Specifications

Table 6: C4110 Camera Specifications

Specifications		**POE-C4110, P67-C4110 – 12 MP**
Active image resolution		4112 (H) x 3008 (V)
Pixel size		3.45 µm
Optical format		1.1 inch
Shutter		Global
Frame rate (max)		9.6 fps (8-bit), 4.8 fps (10, 12-bit unpacked), 6.4 fps (10, 12-bit packed)
Sensor digitization		12-bit
Dynamic range		71 dB
Output bit depth		8, 10, or 12-bit
Shutter speed		1 µs/step, 14 µs to 16.0 s
Analog / Digital gain		Manual, auto; 0-48 dB (0.1 dB step)
Digital gain		1x (0 dB) to 4x (12 dB), 0.001x step
AEC/AGC		Yes
Black level offset		Manual (0-255), auto
Exposure control		Manual, auto, external, off
White balance		Once, manual, auto, off
Area of Interest (AOI)		Two
Trigger Inputs		External, pulse generator, software
Trigger options		Edge, pulse width, trigger filter, trigger delay, debounce
Trigger modes		Free-run, standard, fast
I/O control	**POE**	2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)
	P67	1 IN (OPTO) / 2 OUT (OPTO, TTL)
Strobe output		2 strobes, programmable position and duration
Pulse generator		Yes, programmable
Lens mount	**POE**	C-mount (default), P-Iris (optional)
	P67	C-mount (default)
Camera housing		6000 series aluminum
Upgradeable firmware		Yes
Data correction		4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, flat field correction, bad pixel correction (static, dynamic)
Supply voltage range		12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)
Power		Typical: 3.48 W @ 12 V; PoE: 4.86 W
Camera size (W x H x L)	**POE**	(37 x 37 x 61.5) mm
	P67	(48.5 x 42 x 61) mm (without lens tube)
Weight	**POE**	113.2 grams
	P67	196 grams (without lens tube)
Vibration, shock		20G (20-200 Hz XYZ) / 100G
Environmental	Operating	-30 °C to +75 °C (-40 °C to +85 °C tested)
	Storage	-40 °C to +85 °C
Relative humidity		10% to 90% non-condensing
Regulatory		FCC part 15 Class A, CE, RoHS

1.2.6 C2410Y/Z and C4110Y/Z Cameras Specifications

Table 7: C2410Y/Z and C4110Y/Z Cameras Specifications

Specifications		POE-C2410Y/Z – 5 MP	POE-C4110Y/Z – 12 MP
Active image resolution		2464 (H) x 2056 (V) 1232 (H) x 1028 (V) per polarization angle	4112 (H) x 3008 (V) 2056 (H) x 1504 (V) per polarization angle
Pixel size		3.45 µm	3.45 µm
Optical format		2/3 inch	1.1 inch
Shutter		Global	Global
Frame rate (max)		22 fps (8-bit), 11 fps (10, 12-bit unpacked), 15 fps (10, 12-bit packed)	9.6 fps (8-bit), 4.8 fps (10, 12-bit unpacked), 6.4 fps (10, 12-bit packed)
Sensor digitization		12-bit	12-bit
Dynamic range		71 dB	71 dB
Output bit depth		8, 10, or 12-bit	8, 10, or 12-bit
Shutter speed		1 µs/step, 14 µs to 16.0 s	1 µs/step, 14 µs to 16.0 s
Analog / Digital gain		Manual, auto; 0-48 dB (0.1 dB step)	Manual, auto; 0-48 dB (0.1 dB step)
Digital gain		1x (0 dB) to 4x (12 dB), 0.001x step	1x (0 dB) to 4x (12 dB), 0.001x step
AEC/AGC		Yes	Yes
Black level offset		Manual (0-255), auto	Manual (0-255), auto
Exposure control		Manual, auto, external, off	Manual, auto, external, off
White balance		Once, manual, auto, off	Once, manual, auto, off
Polarization Angles		0, 45, 90, and 135 degrees	0, 45, 90, and 135 degrees
Area of Interest (AOI)		Two	Two
Trigger Inputs		External, pulse generator, software	External, pulse generator, software
Trigger options		Edge, pulse width, trigger filter, trigger delay, debounce	Edge, pulse width, trigger filter, trigger delay, debounce
Trigger modes		Free-run, standard, fast	Free-run, standard, fast
I/O control		2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)	2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)
Strobe output		2 strobes, programmable position and duration	2 strobes, programmable position and duration
Pulse generator		Yes, programmable	Yes, programmable
Lens mount		C-mount (default), P-Iris (optional)	C-mount (default), P-Iris (optional)
Camera housing		6000 series aluminum	6000 series aluminum
Upgradeable firmware		Yes	Yes
Data correction		4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, flat field correction, bad pixel correction (static, dynamic)	4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, flat field correction, bad pixel correction (static, dynamic)
Supply voltage range		12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)	12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)
Power		Typical: 3.27 W @ 12 V; PoE: 4.69 W	Typical: 3.8 W @ 12 V; PoE: 4.91 W
Camera size (W x H x L)		(37 x 37 x 61.5) mm	(37 x 37 x 61.5) mm
Weight		113.2 grams	113.2 grams
Vibration, shock		20G (20-200 Hz XYZ) / 100G	20G (20-200 Hz XYZ) / 100G
Environmental	Operating	-30 °C to +75 °C (-40 °C to +85 °C tested)	-30 °C to +75 °C (-40 °C to +85 °C tested)
	Storage	-40 °C to +85 °C	-40 °C to +85 °C
Relative humidity		10% to 90% non-condensing	10% to 90% non-condensing
Regulatory		FCC part 15 Class A, CE, RoHS	FCC part 15 Class A, CE, RoHS

1.2.7 C4410 and C5410 Cameras Specifications

Table 8: C4410 and C5410 Cameras Specifications

Specifications		POE-C4410 – 20 MP	POE-C5410 – 17 MP
Active image resolution		4432 (H) x 4436 (V)	5472 (H) x 3084 (V)
Pixel size		3.45 µm	3.45 µm
Optical format		4/3 inch	4/3 inch
Shutter		Global	Global
Frame rate (max)		6 fps (8-bit), 3 fps (10, 12-bit unpacked), 4 fps (10, 12-bit packed)	7 fps (8-bit), 3.5 fps (10, 12-bit unpacked), 4.6 fps (10, 12-bit packed)
Sensor digitization		12-bit	12-bit
Dynamic range		71 dB	71 dB
Output bit depth		8, 10, or 12-bit	8, 10, or 12-bit
Shutter speed		1 µs/step, 30 µs to 16.0 s	1 µs/step, 30 µs to 16.0 s
Analog / Digital gain		Manual, auto; 0-48 dB (0.1 dB step)	Manual, auto; 0-48 dB (0.1 dB step)
Digital gain		1x (0 dB) to 4x (12 dB), 0.001x step	1x (0 dB) to 4x (12 dB), 0.001x step
AEC/AGC		Yes	Yes
Black level offset		Manual (0-255), auto	Manual (0-255), auto
Exposure control		Manual, auto, external, off	Manual, auto, external, off
White balance		Once, manual, auto, off	Once, manual, auto, off
Area of Interest (AOI)		Two	Two
Trigger Inputs		External, pulse generator, software	External, pulse generator, software
Trigger options		Edge, pulse width, trigger filter, trigger delay, debounce	Edge, pulse width, trigger filter, trigger delay, debounce
Trigger modes		Free-run, standard, fast	Free-run, standard, fast
I/O control		2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)	2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)
Strobe output		2 strobes, programmable position and duration	2 strobes, programmable position and duration
Pulse generator		Yes, programmable	Yes, programmable
Lens mount		F-mount (default), Canon EOS active or passive, M42 (optional)	F-mount (default), Canon EOS active or passive, M42 (optional)
Camera housing		6000 series aluminum	6000 series aluminum
Upgradeable firmware		Yes	Yes
Data correction		4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, flat field correction, bad pixel correction (static, dynamic)	4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, flat field correction, bad pixel correction (static, dynamic)
Supply voltage range		12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)	12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)
Power consumption		Typical: 5.4 W @ 12 V; Max: 7.8 W; PoE: 6.5 W; PoE (Max): 7 W (Max – with enabled Canon controller)	Typical: 5.4 W @ 12 V; Max: 7.8 W PoE: 6.5 W; PoE (Max): 7 W (Max – with enabled Canon controller)
Camera size (W x H x L)		(60 x 60 x 59.5) mm	(60 x 60 x 59.5) mm
Weight		475.7 g	475.7 g
Vibration, shock		20G (20-200 Hz XYZ) / 100G	20G (20-200 Hz XYZ) / 100G
Environmental	Operating	-30 °C to +75 °C (-40 °C to +85 °C tested)	-30 °C to +75 °C (-40 °C to +85 °C tested)
	Storage	-40 °C to +85 °C	-40 °C to +85 °C
Relative humidity		10% to 90% non-condensing	10% to 90% non-condensing
Regulatory		FCC part 15 Class A, CE, RoHS	FCC part 15 Class A, CE, RoHS

1.2.8 C6410 Camera Specifications

Table 9: C6410 Camera Specifications

Specifications		POE-C6410 – 31 MP
Active image resolution		6464 (H) x 4852 (V)
Pixel size		3.45 µm
Optical format		APS-C
Shutter		Global
Frame rate (max)		3.7 fps (8-bit), 1.8 fps (10, 12-bit unpacked), 2.5 fps (10, 12-bit packed)
Sensor digitization		12-bit
Dynamic range		71 dB
Output bit depth		8, 10, or 12-bit
Shutter speed		1 µs/step, 30 µs to 16.0 s
Analog / Digital gain		Manual, auto; 0-48 dB (0.1 dB step)
Digital gain		1x (0 dB) to 4x (12 dB), 0.001x step
AEC/AGC		Yes
Black level offset		Manual (0-255), auto
Exposure control		Manual, auto, external, off
White balance		Once, manual, auto, off
Area of Interest (AOI)		Two
Trigger Inputs		External, pulse generator, software
Trigger options		Edge, pulse width, trigger filter, trigger delay, debounce
Trigger modes		Free-run, standard, fast
I/O control		2 IN (OPTO, LVTTL) / 2 OUT (OPTO, TTL)
Strobe output		2 strobes, programmable position and duration
Pulse generator		Yes, programmable
Lens mount		F-mount (default), Active or passive Canon EOS, M42 (optional)
Camera housing		6000 series aluminum
Upgradeable firmware		Yes
Data correction		4 LUTs: pre-programmed with Gamma 0.45 and negative LUT, flat field correction, bad pixel correction (static, dynamic)
Supply voltage range		12 VDC (6 V – 30 V), 1.5 A inrush @ 12 V; PoE (IEEE 802.3af/IEEE 802.3at)
Power consumption		Typical: 5.4 W @ 12 V; Max: 7.8 W (w/enabled Canon controller) PoE: 6.5 W; PoE (Max): 7 W (w/enabled Canon controller)
Camera size (W x H x L)		(60 x 60 x 59.5) mm
Weight		475.7 g
Vibration, shock		20G (20-200 Hz XYZ) / 100G
Environmental	Operating	-30 °C to +75 °C (-40 °C to +85 °C tested)
	Storage	-40 °C to +85 °C
Relative humidity		10% to 90% non-condensing
Regulatory		FCC part 15 Class A, CE, RoHS

1.3 Ordering Information

When ordering a camera, please specify the camera ordering code. To create your own customer Cheetah ordering code, simply choose one element from each column in Table 10.

For P67 camera, please select a lens tube that matches the size of your lens (see Table 13).

Table 10: Cheetah Camera Ordering Codes

Interface	Camera model	Sensor Type	Ruggedized	Lens Mount (see Note 1)	Filter/customization options
POE = GigE Vision® with Power over Ethernet	C1911 – 1944 x 1472 C2000 – 2064 x 1544 C2400 – 2464 x 2056 C2010 – 2064 x 1544 C2410 – 2464 x 2056 C3210 – 3216 x 2208 C4010 – 4112 x 2176 C4110 – 4112 x 3008 C4410 – 4432 x 4436 C5410 – 5472 x 3084 C6410 – 6464 x 4852	C = Color M = Monochrome Y = Color Polarized Z = Monochrome Polarized (Y and Z types are only available for POE-C2410 and POE-C4110 models)	R= Ruggedized	C = C-Mount S = CS-Mount I = P-Iris C A = P-Iris CS F= F-Mount M = M42 L= Canon EF EOS Active Mount E = Canon EF EOS Passive Mount	000 = none
P67 = GigE Vision® with Power over Ethernet (in IP67-rated enclosure)	C1911 – 1944 x 1472 C2010 – 2064 x 1544 C2410 – 2464 x 2056 C3210 – 3216 x 2208 C4010 – 4112 x 2176 C4110 – 4112 x 3008	C = Color M = Monochrome	R= Ruggedized	C = C-Mount	000 = none

Notes:

1) **C-Mount** is supported by the POE-C1911, POE-C2000, POE-C2400, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, POE-C4110Y/Z, P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, and P67-C4110 cameras.
   CS-Mount is supported by the POE-C1911, POE-C2010, POE-C2410, POE-C3210, POE-C4010, POE-C4110 cameras.
   F-Mount, M42, Canon EOS EF active or passive are supported by the POE-C4410, POE-C5410, and POE-C6410 cameras.
   P-Iris C-Mount and P-Iris CS-Mount are supported by the POE-C1911, POE-C2010, POE-C2410, POE-C3210, POE-C4010, and POE-C4110 cameras.
2) A POE Power Supply injector/ LAN Power or external power supply is required.
3) The Imperx PS12V04A power supply is available for use with POE camera models (except, C2000 and C2400) and can be purchased separately. To power the P67 cameras use an appropriate external power supply and IP67-rated cables.
4) 000 (none) filter/customization option means that a color camera has IR filter, a monochrome camera does not have any filters.
5) Sample codes:
   POE-C2400C-RC000: Cheetah Color 5 MP camera with C mount and GigE Vision® w/PoE interface;
   POE-C3210M-RI000: Cheetah Monochrome 7.1 MP camera with P-Iris C-Mount and GigE Vision® w/PoE interface;
   POE-C5410C-RL000: Cheetah Color 17 MP camera with Canon EF EOS active mount and GigE Vision® w/PoE interface;
   P67-C4010M-RC000: Cheetah Monochrome 9 MP camera with C-Mount and GigE Vision® w/PoE interface in IP67-rated enclosure;
   POE-C4110Y-RC000: Cheetah Color Polarized 12 MP camera with C-Mount and GigE Vision® w/PoE interface.

1.3.1 Accessories

Imperx offers a wide variety of accessories – power supply, cables, lens tubes – for use with the cameras. The accessories are listed in the tables below and sold separately.

Table 11: Power Supply

Part Number	Description	Compatible with:
PS12V04A	Standard Power Supply 12.6 V DC, 2 A, With one strobe and one trigger, 1.5 m length	POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, POE-C4110Y/Z POE-C4410, POE-C5410, POE-C6410

Table 12: Cables

Part Number	Description	Length	Compatible with:
CBL-COM01	Input/Output, 6-pin (F) Hirose to loose end	2 m	POE-C2000, POE-C2400
CBL-PWIO01	Power and Input/Output, 12-pin (F) Hirose to loose end,	2 m	POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, POE-C4110Y/Z, POE-C4410, POE-C5410, POE-C6410
CBL-IO08-0001	Input/Output, 8-pin (F) BULGIN CONN to Pigtail	2 m	P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, P67-C4110
CBL-XRJ45-0002	RJ45 to 8 position M12/Xcode (IP67 METZ CONN)	2 m	
CBL-XRJ45-0003	RJ45 to 8 position M12/Xcode (IP67 METZ CONN)	3 m	
CBL-XRJ45-0005	RJ45 to 8 position M12/Xcode (IP67 METZ CONN)	5 m	
CBL-XRJ45-0010	RJ45 to 8 position M12/Xcode (IP67 METZ CONN)	10 m	
CBL-XRJ45-0015	RJ45 to 8 position M12/Xcode (IP67 METZ CONN)	15 m	
CBL-XRJ45-0020	RJ45 to 8 position M12/Xcode (IP67 METZ CONN)	20 m	

Table 13: IP67 C-mount Lens Tubes

Part Number	Inner diameter	Outer diameter	Inner length*	Outer length	Protective Glass	Material
Tube-0044-0055	Ø 44 mm	Ø 50 mm	55 mm	69 mm	Clear Glass Ø 49 mm x 2 mm with oleophobic coating	Aluminum
Tube-0064-0080	Ø 64 mm	Ø 70 mm	80 mm	95 mm	Clear Glass Ø 69 mm x 2 mm with oleophobic coating	Aluminum
Note: *Custom Tube Lengths are available, please contact your local distributor or Imperx sales at: Email: sales@imperx.com Tel.(+1) 561-989-0006						

1.4 Technical Support

Each camera is fully tested before shipping. If, for some reason, the camera is not operational after power up, check the following:

1. Check the power supply and all I/O cables. Make sure that all the connectors are firmly attached.
2. Check the status LED and verify that it is steady ON, if not – refer to the section 2.5 Camera LED Status Indicator.
3. Enable the test mode and verify that the communication between a computer and the camera is established. If the test pattern is not present, power off the camera, check all the cabling, frame grabber settings, and computer status.

If you still have problems with the camera operation, contact technical support at:

Email: techsupport@imperx.com
Toll Free 1 (866) 849-1662 or (+1) 561-989-0006
Fax: (+1) 561-989-0045
Visit our website: www.imperx.com

2 Hardware

This chapter contains the detailed information needed for the initial design-in process:

- Connector types, pin numbering and assignments.
- Power supply and cabling.
- Electrical connectivity and voltage requirements.
- Mechanical drawings.
- Optical and environmental information.

2.1 C2000 and C2400 Cameras Connectivity

The back panel of the POE-C2000 and POE-C2400 camera provides all the connectors needed to operate and control the camera. The RJ-45 connector provides link status LED indicators.

Figure 1: POE-C2000 and POE-C2400 camera back panel connectors

The camera provides the following connectors:

1. A standard RJ-45 connector provides data, sync, control, and serial interface with LED indicator to indicate link status. Power can be provided to the camera using a POE power injector or LAN Power.
2. Male 6-pin Hirose miniature locking receptacle #HR10A-7R-6PB(73) providing alternative power input and I/O interface.

2.1.1 Pin Assignment

The RJ-45 connector's pin assignment conforms to the Ethernet standard IEEE 802.3 1000BASE-T.

The Hirose connector on the camera's back panel is a male type miniature locking receptacle #HR10A-7R-6PB(73) mating to a female Hirose type miniature locking plug #HR10A-7P-6S(73).

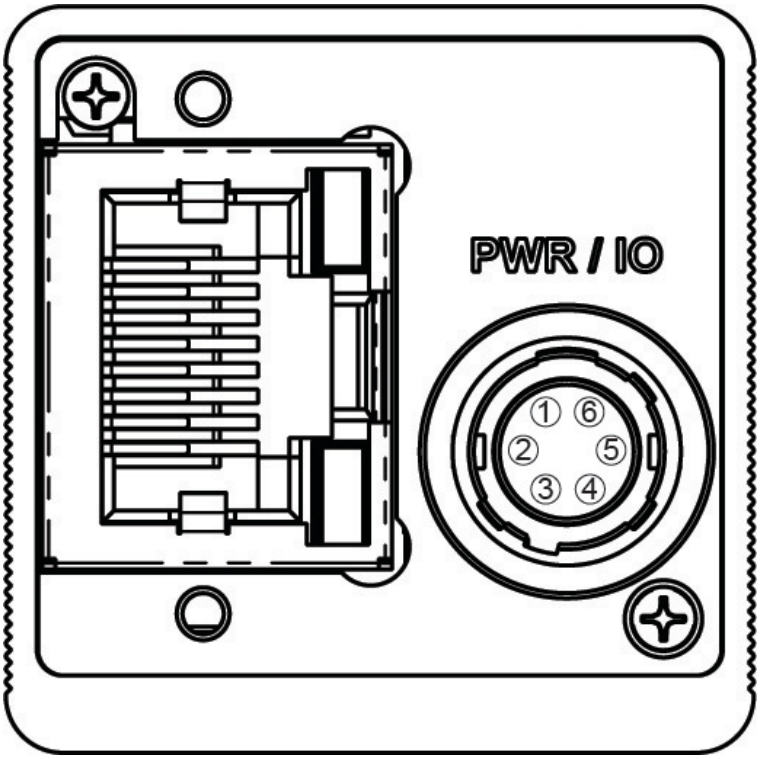


Figure 2: 6-pin Hirose Connector Pin-outs (C2000 and C2400 cameras)

Table 14: 6-pin Hirose Connector Pin Mapping

Pin	Signal Name	Use
1	+12 V DC	12 VDC Main Power
2	IN1	General Purpose Input 1 (Opto-isolated)
3	IN1 RTN	General Purpose Input 1, Return (Opto-isolated)
4	OUT1	General Purpose Output 1, Contact 1 (Opto-isolated)
5	OUT1 RTN	General Purpose Output 2, Contact 2 (Opto-isolated)
6	+12 V DC RTN	12 VDC Main Power Return

2.2 POE-C1911, POE-C2010, POE-C2410, POE-C3210, POE-C4010 and POE-C4110 Cameras Connectivity

The back panel of the camera provides all the connectors needed to operate and control the camera and an LED status indicator. The RJ-45 connector also features Ethernet link status LED indicators.

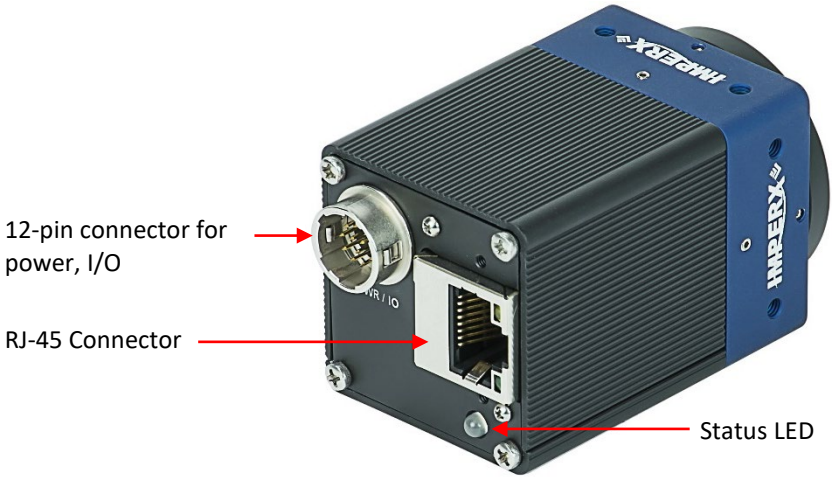


Figure 3: POE-C1911, POE-C2010, POE-C2410, POE-C3210, POE-C4010, and POE-C4110 camera back panel connectors

The camera provides the following connectors:

1. A standard RJ-45 connector providing data, control, and serial interface. Power can be provided to the camera using a POE power injector or LAN power.
2. Male 12-pin Hirose miniature locking receptacle #HR10A-10R-12PB (71) providing alternative power input and I/O interface.
3. A camera status LED indicator.
4. The camera's model and serial number.

2.2.1 Pin Assignments

The RJ-45 connector's pin assignment conforms to the Ethernet standard IEEE 802.3 1000BASE-T.

The Hirose connector on the camera's back panel is a male type miniature locking receptacle #HR10A-10R-12PB(71). The Imperx PS12V04A power supply (sold separately – see 2.6 POE and External Power Supply) terminates in a female Hirose type miniature locking plug #HR10A-10P-12S(73) and has two small BNC pig-tail cables for the external trigger input (black) and strobe output (white).

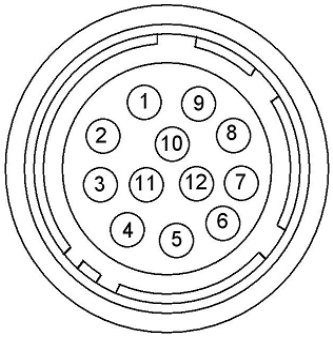


Figure 4: 12-pin Hirose Connector Pin-outs
(POE-C1911, POE-C2010, POE-C2410, POE-C3210, POE-C4010, POE-C4110, POE-C4410, POE-C5410, and POE-C6410 cameras)

Table 15: 12-pin Hirose Connector Pin Mapping

Pin	Signal Name	Use
1	+12 V DC RTN	12 VDC Main Power Return
2	+12 V DC	12 VDC Main Power
3	Reserved	Reserved
4	Reserved	Reserved
5	OUT2 RTN	General Purpose Output 2, Contact 1 (Opto-isolated)
6	OUT1 RTN	General Purpose Output 1 Return (TTL)
7	OUT1	General Purpose Output 1 (TTL)
8	IN1	General Purpose Input 1 (Opto-isolated)
9	IN2	General Purpose Input 2 (TTL/LVTTL)
10	IN1 RTN	General Purpose Input 1 Return (Opto-isolated)
11	IN2 RTN	General Purpose Input 2 Return (TTL/LVTTL)
12	OUT2	General Purpose Output 2, Contact 2 (Opto-isolated)

2.3 C4410, C5410, C6410 Cameras Connectivity

The back panel of the camera provides all the connectors needed to operate and control the camera and an LED status indicator. The RJ-45 connector also features Ethernet link status LED indicators.

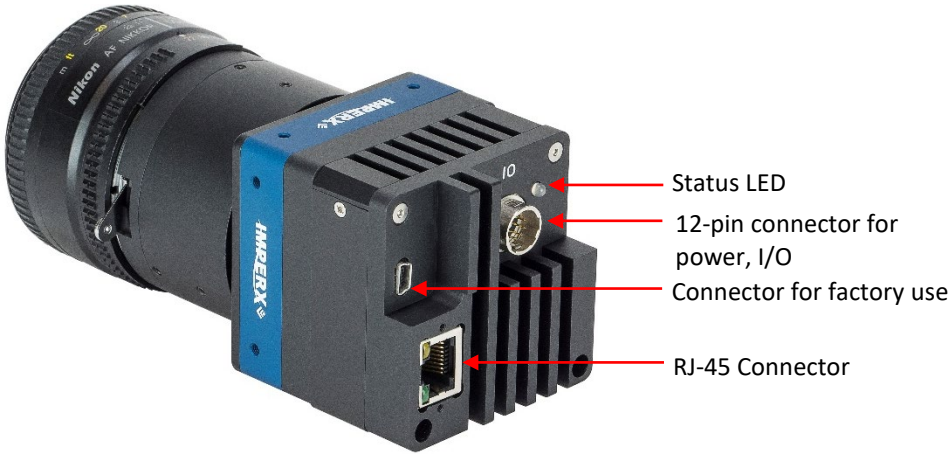


Figure 5: POE-C4410, POE-C5410, and POE-C6410 camera back panel connectors

The camera provides the following connectors:

1. A standard RJ-45 connector providing data, control, and serial interface. Power can be provided to the camera using a POE power injector or LAN power.
2. Male 12-pin Hirose miniature locking receptacle #HR10A-10R-12PB(71) providing alternative power input and I/O interface.
3. A camera status LED indicator.
4. USB type B programming/SPI connector.
5. The camera's model and serial number

2.3.1 Pin Assignments

The RJ-45 connector's pin assignment conforms to the Ethernet standard IEEE 802.3 1000BASE-T.

The POE-C4410, POE-C5410, and POE-C6410 cameras have 12-pin Hirose connector. For pin-out and pin mapping please refer to the section 2.2.1 Pin Assignments.

2.4 P67 Cameras Connectivity

The back panel of the camera provides all the connectors needed to operate and control the camera. The back panel also provides two LED status indicators.

Figure 6: P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, and P67-C4110 camera back panel connectors

The camera provides the following connectors:

1. IP67-rated female MACOM MMT361A315 receptacle for the Ethernet interface. Power can be provided to the camera using a POE power injector or LAN power. The mating connector is an IP67-rated M12 X-coded 8-position male plug.
2. IP67-rated 8-pin male BULGIN PXMBNI12RPM08APCM12 connector providing alternative power input and I/O interface. The mating part is an IP67 female plug BULGIN PXPTPU12FBF08ACL020PUR.
3. Two status LED indicators.

2.4.1 Power and I/O Connector Pin Assignments

The IP67-rated 8-pin male BULGIN PXMBNI12RPM08APCM12 connector provides alternative power input and all external input/output signals supplied to the camera.

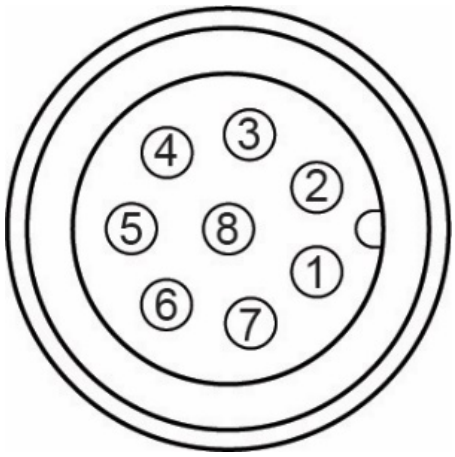


Figure 7: BULGIN PXMBNI12RPM08APCM12 connector pin-outs
(P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, and P67-C4110 cameras)

Table 16: 8-pin BULGIN Connector Pin Mapping

Pin	Signal Name	Use
1	Reserved	Reserved
2	+12 V DC	12 VDC Main Power
3	IN1	General Purpose Input 1 (Opto-isolated)
4	IN1/OUT1 RTN	General Purpose Input1 Return and Output 1, Contact 1 (Opto-isolated)
5	OUT2 RTN	General Purpose Output 2 Return (TTL)
6	OUT1	General Purpose Output 1, Contact 2 (Opto-isolated)
7	+12 V DC RTN	+12 VDC Main Power Return
8	OUT2	General Purpose Output 2 (TTL)

2.4.2 Ethernet Connector Pin Assignment

An IP67-rated MACOM MMT361A315 connector provides 1000BASE-T Ethernet interface. The pin assignment conform to the Ethernet standard.

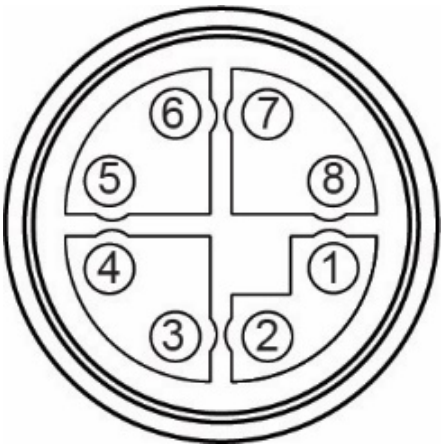


Figure 8: MACOM MMT361A315 connector pin-outs
(P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, and P67-C4110 cameras)

Table 17: MACOM Connector Pin Mapping

Pin	Signal Name	Cable wires
1	TD0+	White/Orange
2	TD0-	Orange
3	TD1+	White/Green
4	TD1-	Green
5	TD3+	White/Brown
6	TD3-	Brown
7	TD2-	White/Blue
8	TD2+	Blue

2.5 Camera LED Status Indicator

The camera has a red-green-yellow LED on the back panel of the camera. The following LED colors and light patterns indicate the camera status and mode of operation:

Table 18: LED status Indicator Descriptions

LED Condition	Status Indication
Green steady ON	Normal operation. You should see a normal image coming out of the camera.
Green blinks at ~0.5 Hz	Trigger enabled.
Green blinks at ~2.0 Hz	Long integration enabled.
Amber steady ON	Test mode. You should see one of the test patterns.
Amber blinks at ~0.5 Hz	Camera is in AGC/AEC mode. In this mode, changing the shutter slider does not affect image luminance.
Amber blinks at ~2.0 Hz	Camera receives an external synchronization pulse
Red steady ON	Communications or firmware load error.*
Red blinks at ~2.0 Hz	Power failure
Green – Red blinks at ~1 Hz	GigE Vision firmware error.
LED OFF	Power not present. Possible power supply failure or faulty external AC adapter. Re-power camera and load factory settings. If the LED is still OFF, contact the factory.

2.6 POE and External Power Supply

The camera can be powered using Local Area Network power, an external POE injector or an external Power Supply providing 6 V to 30 V DC with an inrush current capability of 1.5 A @ 12 V DC. If both a POE injector and external Power Supply are connected to the camera simultaneously, the camera will draw power from the external Power Supply, as long as the input voltage exceeds 12.6 V. If the external voltage drops below 12.6 V, the camera will draw power from the Power Injector.

Imperx offers the PS12V04A Standard Power Supply adapter for use with the following cameras: POE-C1911, POE-C2010, POE-C2410, POE-C3210, POE-C4010, POE-C4110, POE-C4410, POE-C5410, and POE-C6410 (see 2.6.1 PS12V04A Standard Power Supply).

The PS12V04A Power Supply can be purchased separately. It ships with a power cable that terminates in a female HIROSE plug #HR10A-10P-12S(73). The PS12V04A includes connectors for trigger (black wire) and strobe (white wire).

Imperx does not offer an external Power Supply for use with the C2000 and C2400 cameras, but does offer a cable assembly (P/N: CBL-COM01, Input/Output, 6-pin Hirose to unterminated cable, 2 meters long, see Figure 11) so you can connect the camera to an external Power Supply and make connections to the trigger Input or Strobe Output.

Imperx offers IP67-rated cable assemblies for use with the P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, and P67-C4110 cameras (see 2.6.4 Power and I/O Cable CBL-IO08-0001, 2.6.5 Gigabit Ethernet Cables CBL-XRJ45-00XX and 1.3.1 Accessories).

2.6.1 PS12V04A Standard Power Supply

Figure 9: PS12V04A power supply (ordered separately)

PS12V04A Power Supply Specs:

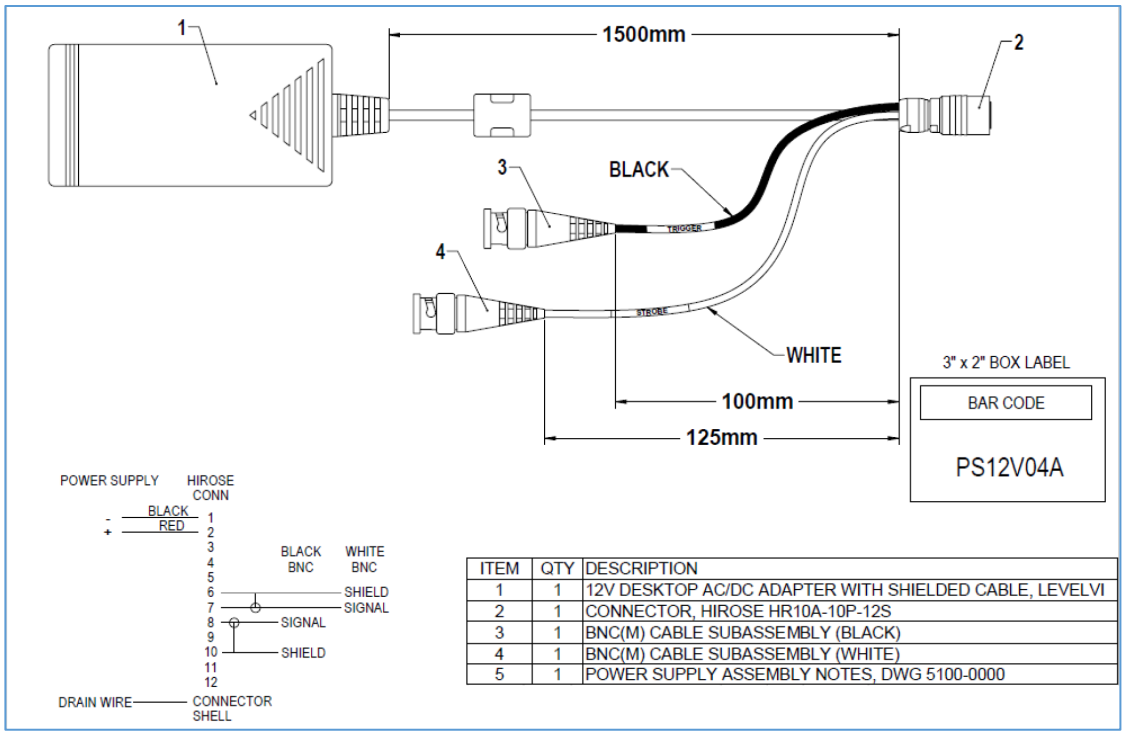
Cable length:
Supplied AC power input cable (IEC): 1.8 m (6') 100 - 240 V AC, 50 – 60 Hz 1 A.
Power supply Output (+12 V): 1.5 m (5') ± 15 cm (6") connector HIROSE #HR10A-10P-12S.
Strobe & Trigger: 15 cm (6") ± 1 cm (0.5") connector BNC male.
Auto Iris Option: 15 cm (6") ± 1 cm (0.5") Video type 4 Pin MINI plug connector E4-191J.

Electrical:
Over-Voltage Protective Installation.
Short-circuit Protective Installation.
Protection Type: Auto-Recovery.
12 V to 13 V DC, 12.6 V DC nominal, 2 A.
Load regulation ± 5%.
Ripple & Noise 1% Max.

Regulatory:
Class 1
Safety standards UL60950-1, EN60950-1, IEC60950-1.
Safety (1) EMC UL/CUL, CE, TUV, DoIR+C-Tick, Semko, CCC, FCC.
Safety (2) BSMI, FCC.

⚠CAUTION

It is strongly recommended that you use the PS12V04A power adapter from Imperx for powering POE-C1911, POE-C2010, POE-C2410, POE-C3210, POE-C4010, POE-C4110, POE-C4410, POE-C5410, and POE-C6410 cameras.

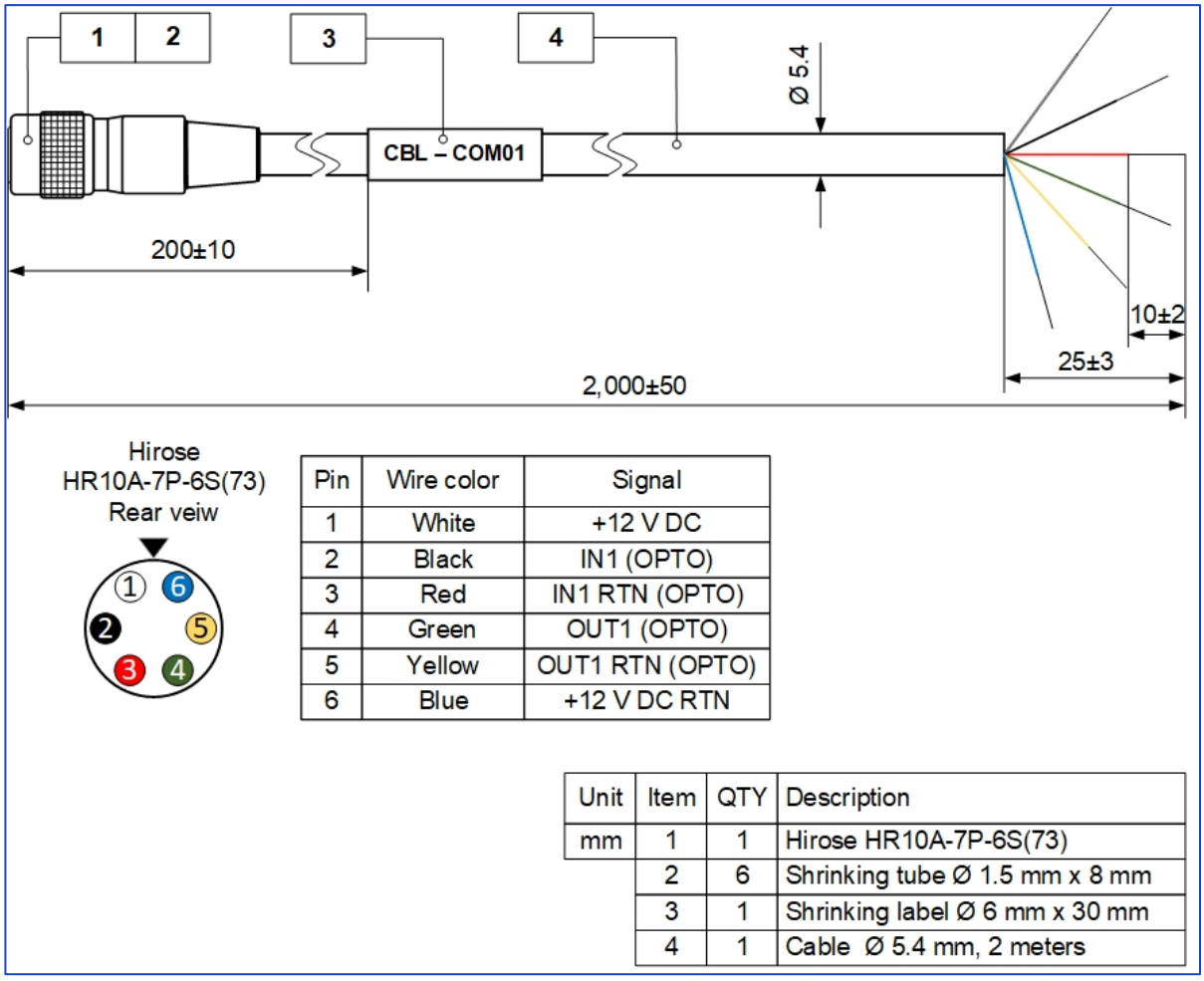


ITEM	QTY	DESCRIPTION
1	1	12V DESKTOP AC/DC ADAPTER WITH SHIELDED CABLE, LEVELVI
2	1	CONNECTOR, HIROSE HR10A-10P-12S
3	1	BNC(M) CABLE SUBASSEMBLY (BLACK)
4	1	BNC(M) CABLE SUBASSEMBLY (WHITE)
5	1	POWER SUPPLY ASSEMBLY NOTES, DWG 5100-0000

Figure 10: PS12V04A Power Supply assembly

2.6.2 Power and I/O cable CBL-COM01

The optionally purchased CBL-COM01 cable is used with C2000 and C2400 cameras for transmitting power, external trigger and strobe signals. It terminates in a female HIROSE plug #HR10A-7P-6S(73) on one end and 6 loose wires on the opposing (see Figure 11).



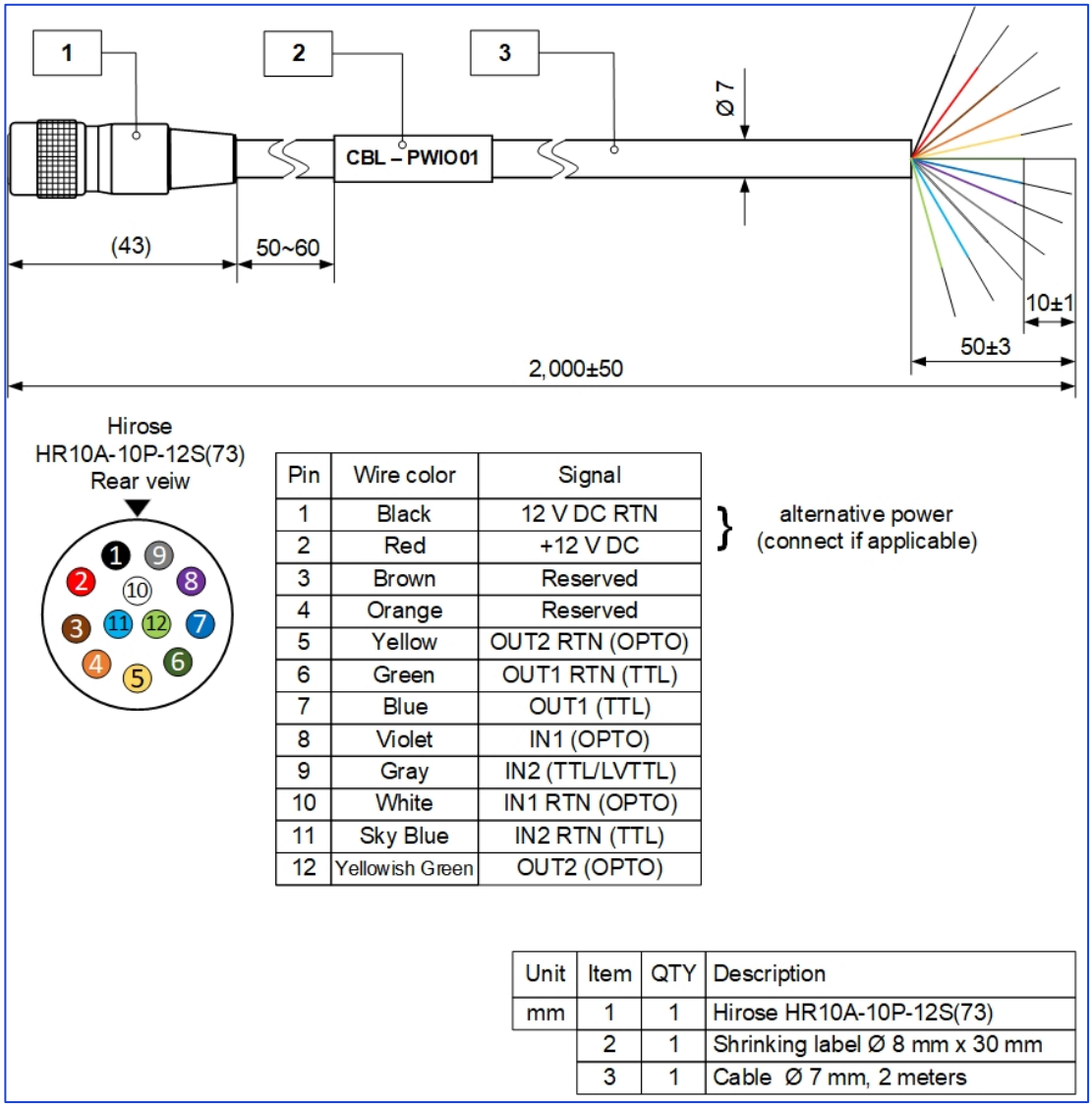
Pin	Wire color	Signal
1	White	+12 V DC
2	Black	IN1 (OPTO)
3	Red	IN1 RTN (OPTO)
4	Green	OUT1 (OPTO)
5	Yellow	OUT1 RTN (OPTO)
6	Blue	+12 V DC RTN

Unit	Item	QTY	Description
mm	1	1	Hirose HR10A-7P-6S(73)
	2	6	Shrinking tube Ø 1.5 mm x 8 mm
	3	1	Shrinking label Ø 6 mm x 30 mm
	4	1	Cable Ø 5.4 mm, 2 meters

Figure 11: CBL-COM01 cable for use with C2000 and C2400 cameras (ordered separately)

2.6.3 I/O Cable CBL-PWIO01

The optionally purchased CBL-PWIO01 cable is used with POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, POE-C4110YZ, POE-C4410, POE-C5410, and POE-C6410 cameras for transmitting external trigger and strobe signals when the camera is powered using Local Area Network power or an external POE injector. It terminates in a female HIROSE plug #HR10A-10P-12S(73) on one end and 12 loose wires on the opposing (see Figure 12).



Pin	Wire color	Signal
1	Black	12 V DC RTN
2	Red	+12 V DC
3	Brown	Reserved
4	Orange	Reserved
5	Yellow	OUT2 RTN (OPTO)
6	Green	OUT1 RTN (TTL)
7	Blue	OUT1 (TTL)
8	Violet	IN1 (OPTO)
9	Gray	IN2 (TTL/LVTTL)
10	White	IN1 RTN (OPTO)
11	Sky Blue	IN2 RTN (TTL)
12	Yellowish Green	OUT2 (OPTO)

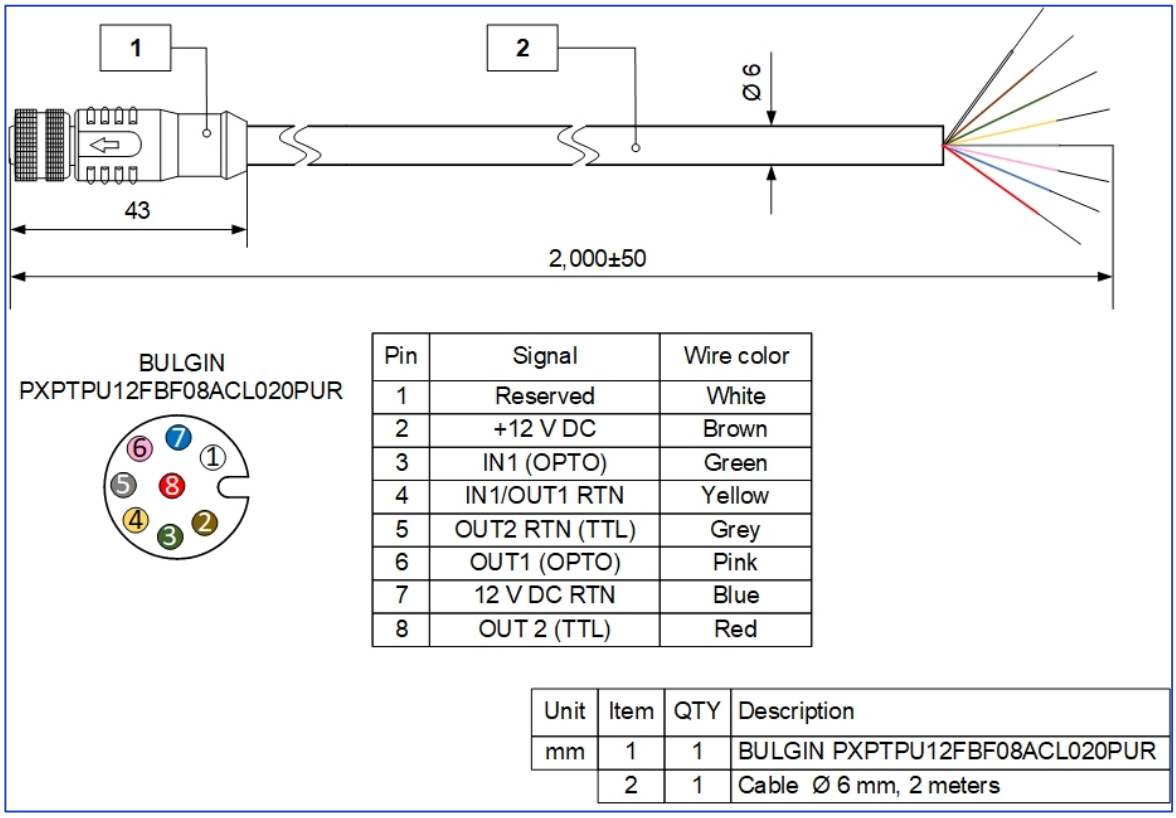
} alternative power (connect if applicable)

Unit	Item	QTY	Description
mm	1	1	Hirose HR10A-10P-12S(73)
	2	1	Shrinking label Ø 8 mm x 30 mm
	3	1	Cable Ø 7 mm, 2 meters

Figure 12: CBL-PWIO01 cable (ordered separately)

2.6.4 Power and I/O Cable CBL-IO08-0001

The optionally purchased CBL-IO08-0001 cable is used with the P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, P67-C4110 cameras for transmitting power, external trigger and strobe signals. It terminates in a female plug BULGIN PXPTPU12FBF08ACL020PUR on one end and 8 loose wires on the opposing (see **Figure 13**).



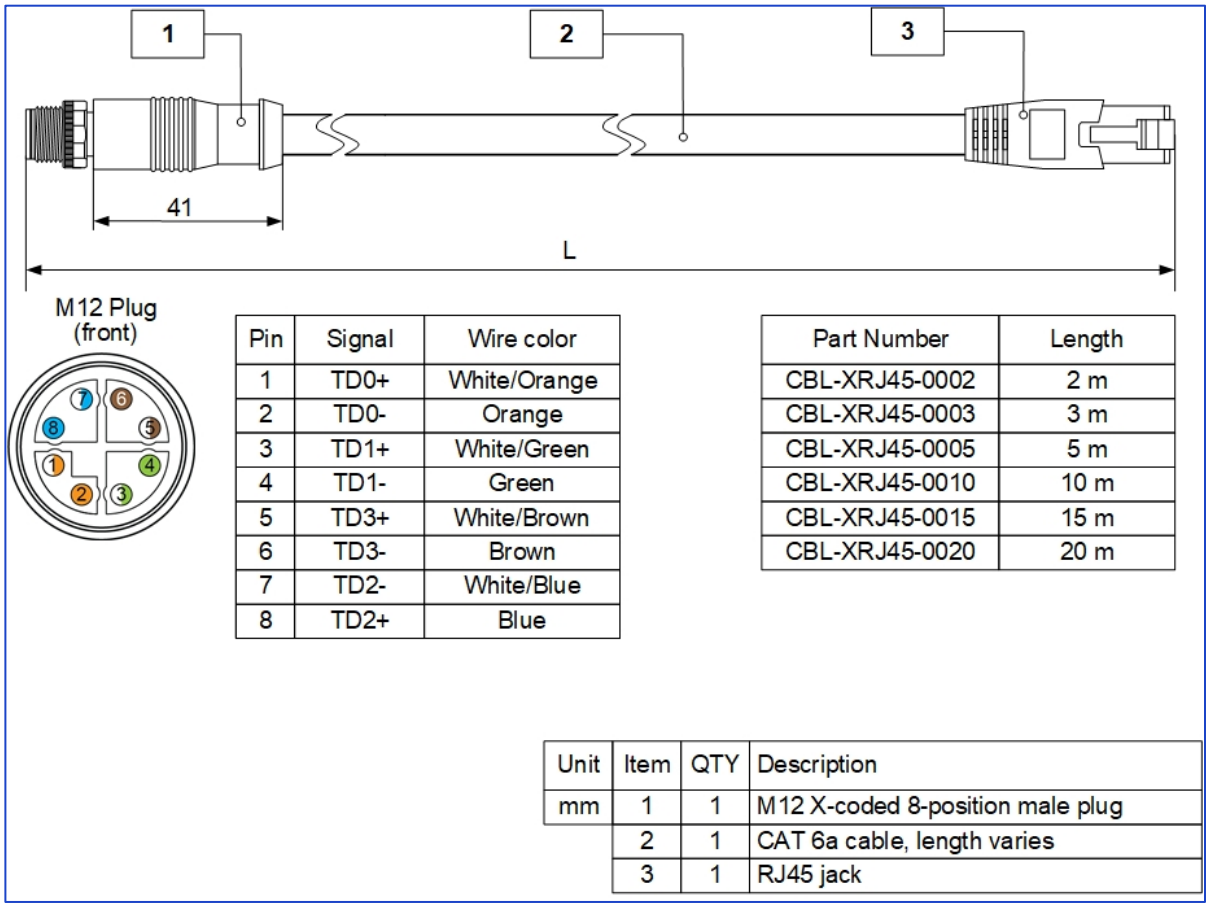
Pin	Signal	Wire color
1	Reserved	White
2	+12 V DC	Brown
3	IN1 (OPTO)	Green
4	IN1/OUT1 RTN	Yellow
5	OUT2 RTN (TTL)	Grey
6	OUT1 (OPTO)	Pink
7	12 V DC RTN	Blue
8	OUT 2 (TTL)	Red

Unit	Item	QTY	Description
mm	1	1	BULGIN PXPTPU12FBF08ACL020PUR
	2	1	Cable Ø 6 mm, 2 meters

Figure 13: CBL-IO08-0001 cable (ordered separately)

2.6.5 Gigabit Ethernet Cables CBL-XRJ45-00XX

The optionally purchased Gigabit Ethernet cable CBL-XRJ45-00XX meets EIA/TIA standards and is used with the P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, and P67-C4110 cameras. The cable terminates in an M12 8-pin male plug on one end and RJ45 straight connector on the opposing (Figure 14).



Pin	Signal	Wire color
1	TD0+	White/Orange
2	TD0-	Orange
3	TD1+	White/Green
4	TD1-	Green
5	TD3+	White/Brown
6	TD3-	Brown
7	TD2-	White/Blue
8	TD2+	Blue

Part Number	Length
CBL-XRJ45-0002	2 m
CBL-XRJ45-0003	3 m
CBL-XRJ45-0005	5 m
CBL-XRJ45-0010	10 m
CBL-XRJ45-0015	15 m
CBL-XRJ45-0020	20 m

Unit	Item	QTY	Description
mm	1	1	M12 X-coded 8-position male plug
	2	1	CAT 6a cable, length varies
	3	1	RJ45 jack

Figure 14: CBL-XRJ45-00XX cable (ordered separately)

2.6.6 Active Canon EF mount

The Canon EF lens mount provides active lens control for C4410, C5410, and C6410 cameras. The cameras provide communication and power to the mount through an internal connector on the front of the camera. The connector eliminates the need for a special power supply and external cable between the camera and the Canon EF mount.

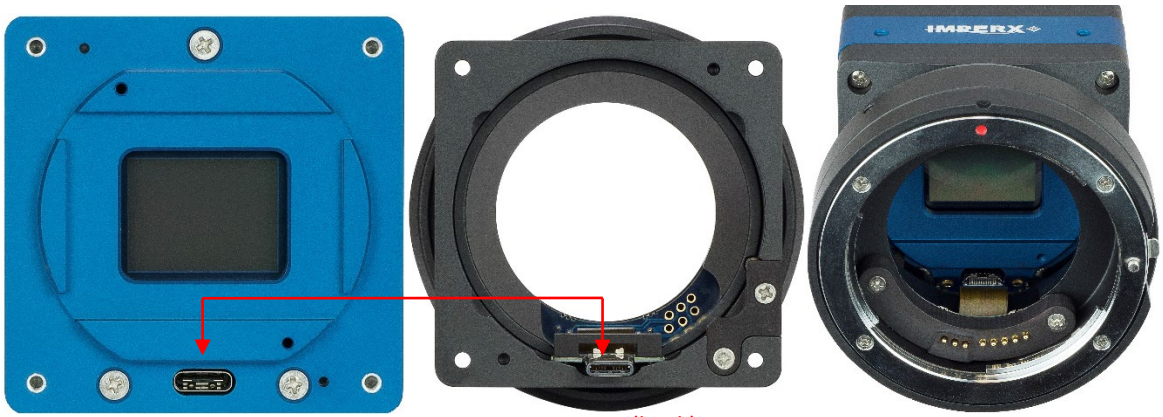


Figure 15: The camera (left) and Canon EF lens mount (center) connect internally

2.7 Electrical Connectivity

The number of external inputs and outputs vary between different Cheetah cameras. Depending on camera model, type of the available inputs or outputs (opto-isolated or TTL and opto-isolated) may differ as well. The following table shows what inputs and outputs are available for a particular camera model.

Table 19: Inputs and outputs of the Cheetah Cameras

Camera model	Inputs				Outputs			
	Opto-isolated		TTL/LVTTL		Opto-isolated		TTL	
	Name	Pin	Name	Pin	Name	Pin	Name	Pin
POE-C2000, POE-C2400	IN1 IN1 RTN	2 3	N/A	N/A	OUT1 OUT1 RTN	4 5	N/A	N/A
P67-C1911 P67-C2010, P67-C2410, P67-C3210, P67-C4010, P67-C4110	IN1 IN1 RTN	3 4	N/A	N/A	OUT1 OUT1 RTN	6 4	OUT2 OUT2 RTN	8 5
POE-C1911 POE-C2010, POE-C2410, POE-C3210, POE-C4010, POE-C4110, POE-C4410, POE-C5410, POE-C6410	IN1 IN1 RTN	8 10	IN2 IN2 RTN	9 11	OUT2 OUT2 RTN	5 12	OUT1 OUT1 RTN	7 6

The electrical connections of external inputs and outputs are similar for all Cheetah cameras. For more information see sections 2.7.1 Opto-isolated Input, 2.7.2 TTL/LVTTL Input, 2.7.3 TTL Output, and 2.7.4 Opto-isolated Output.

2.7.1 Opto-isolated Input

Input signals IN1 and IN1 RTN are optically isolated. The voltage difference between the two must be positive between 3.3 V and 24 V. The minimum input current is 3.3 mA.

Input IN1 pin numbers may vary for different camera models (see Table 19).

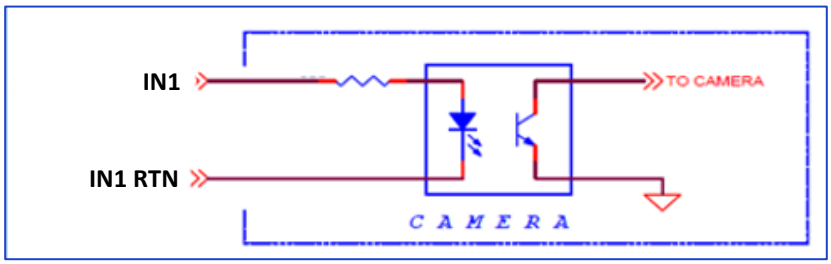


Figure 16: Opto-isolated input electrical schematic (simplified)

2.7.2 TTL/LVTTL Input

Input signals IN2 and IN2 RTN provide interfaces to a TTL or LVTTL input signal. The signal level (voltage difference between the inputs IN2 and IN2 RTN) must be LVTTL (3.3 V) or TTL (5.0 V). The total maximum input current must not exceed 2.0 mA.

Input IN2 pin numbers may vary for different camera models (see Table 19).

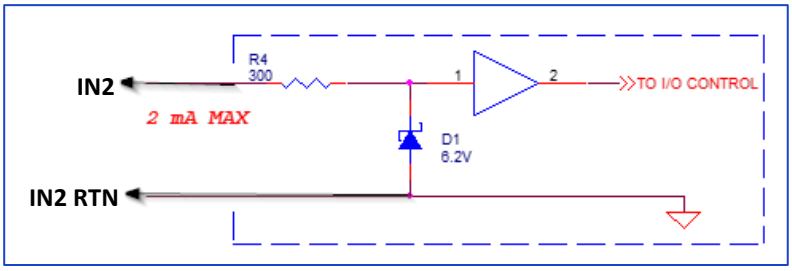


Figure 17: TTL input electrical schematic (simplified)

2.7.3 TTL Output

TTL output provides interface to a TTL compatible output signal. The signal level (voltage difference between the outputs OUT and OUT RTN) is TTL (5.0 V). The maximum output current must not exceed 8.0 mA.
Output name (OUT1 or OUT2) and a pin number may vary (see Table 19).

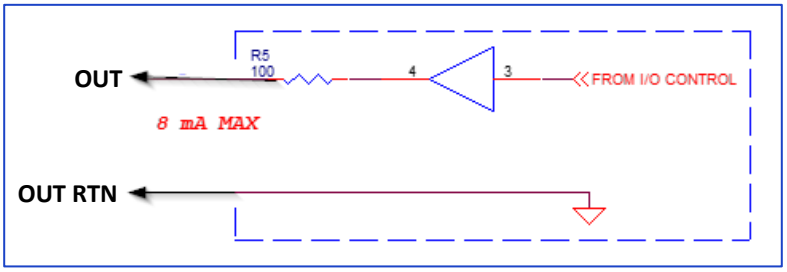


Figure 18: TTL output electrical schematic (simplified)

2.7.4 Opto-isolated Output

Opto-isolated output is an optically isolated switch. There is no pull-up voltage on either contact. An external pull-up voltage of up to 25 V is required for operation. Output is not polarity sensitive. AC or DC loads are possible. The voltage across Contact 1 and Contact 2 must not exceed 25 V and the current through the switch must not exceed 50 mA. 'On' resistance is less than 5 Ohms.

Output name (OUT1 or OUT2) and a pin number may vary (see Table 19).

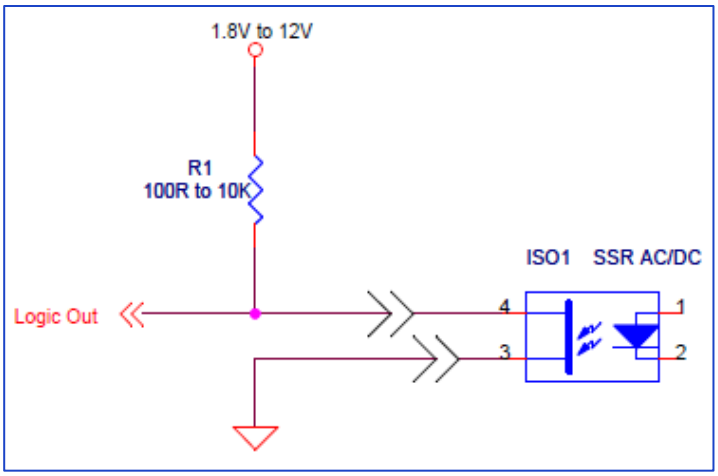


Figure 19: Out2 Open drain logic driver circuit

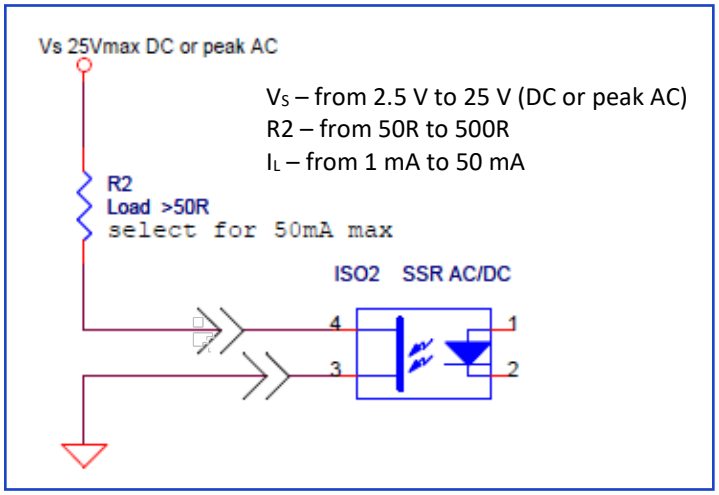


Figure 20: Out 2 Low side load driver circuit

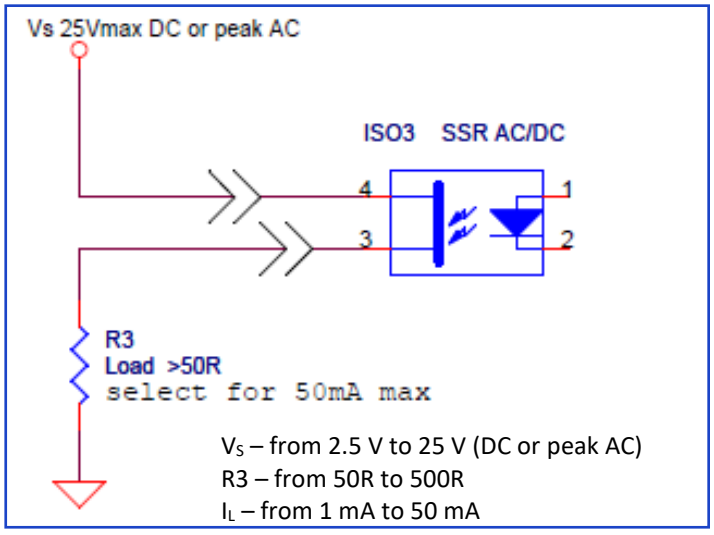


Figure 21: Out2 High side load driver circuit

2.8 Mechanical Drawings

2.8.1 C2000 and C2400 Cameras

The camera housing is made of precision-machined aluminum. For maximum flexibility, the camera has three M3X0.5mm mounting holes located on the bottom side. An additional mounting plate with ¼-20 UNC (tripod mount) and hardware ship with each camera.

Figure 22: C2000 and C2400 cameras

The following mechanical drawings show top, front, and back views of theC2000 and C2400 cameras.

Front View: **Back View:**

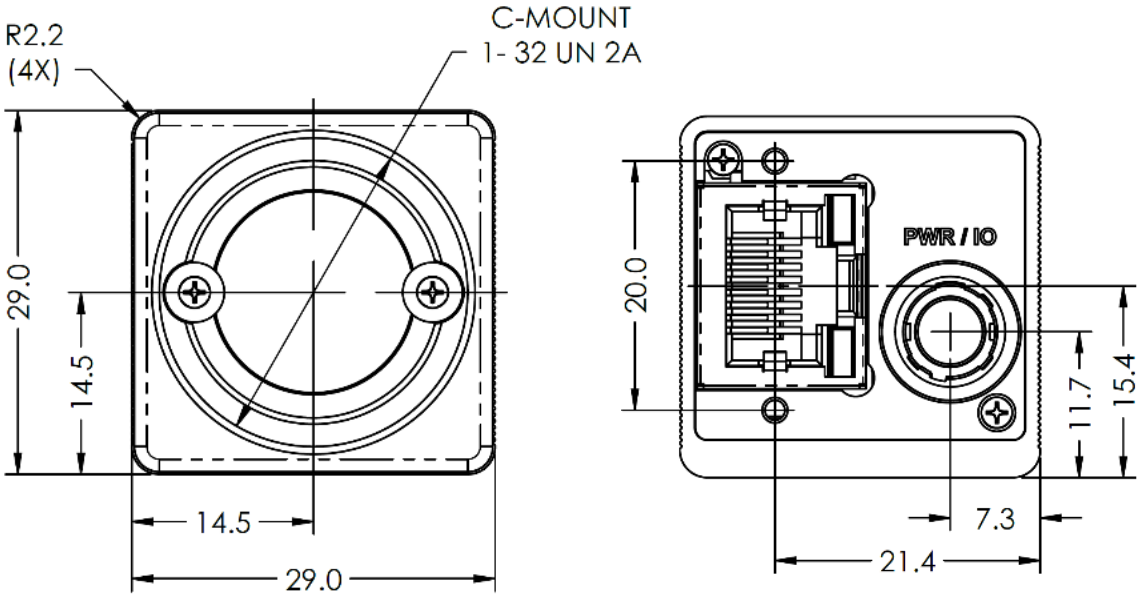
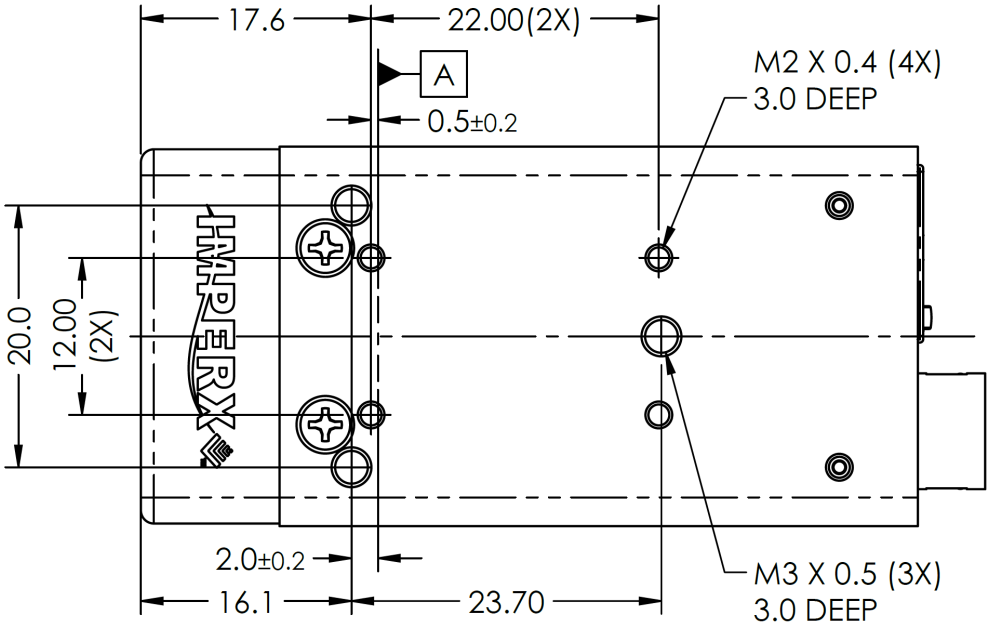


Figure 23: Front and Back Views of the C2000 and C2400 cameras

Bottom View:



Side View with Image Plane:

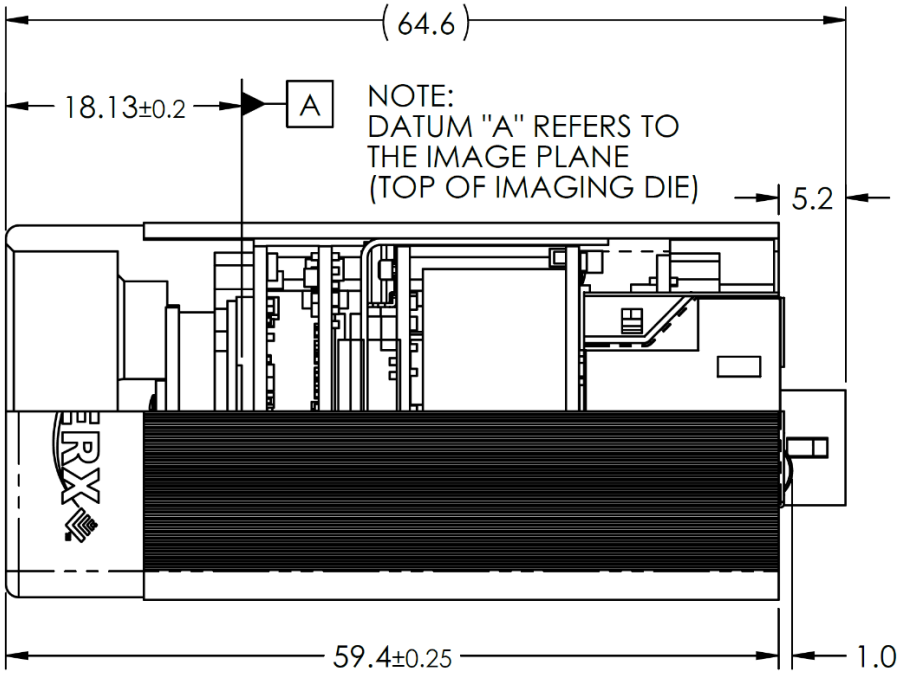


Figure 24: Bottom and Side views of the C2000 and C2400 cameras

2.8.1.1 C2000 and C2400 Cameras Mounting Plate

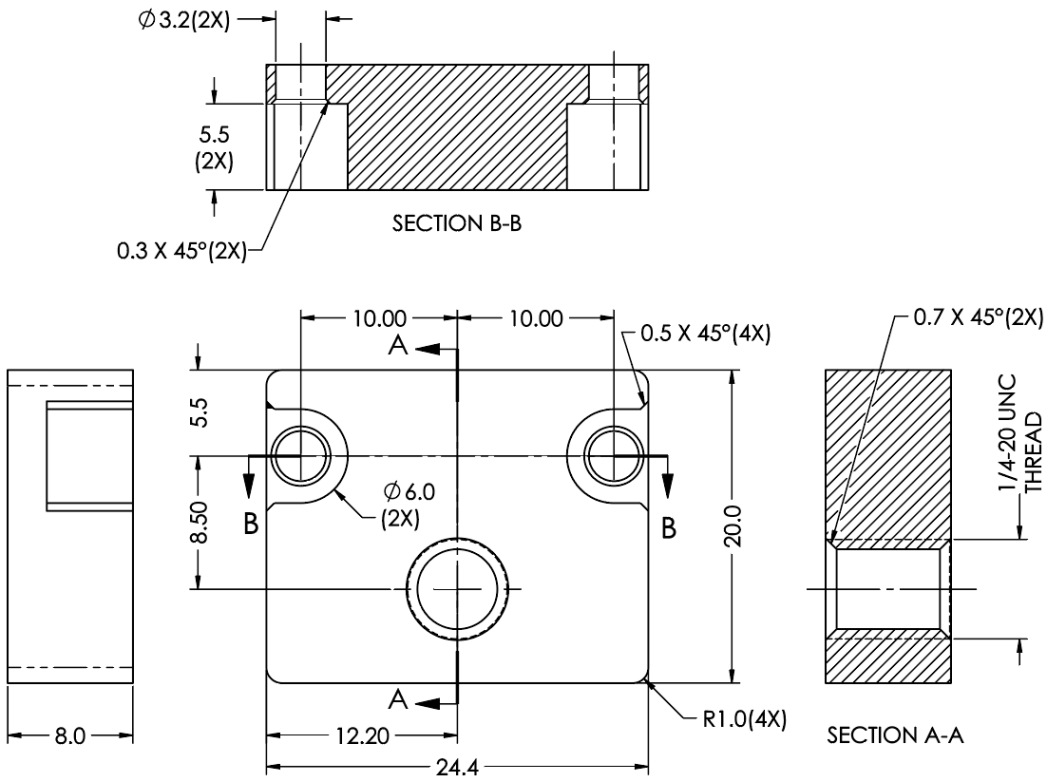


Figure 25: C2000 and C2400 Camera mounting plate

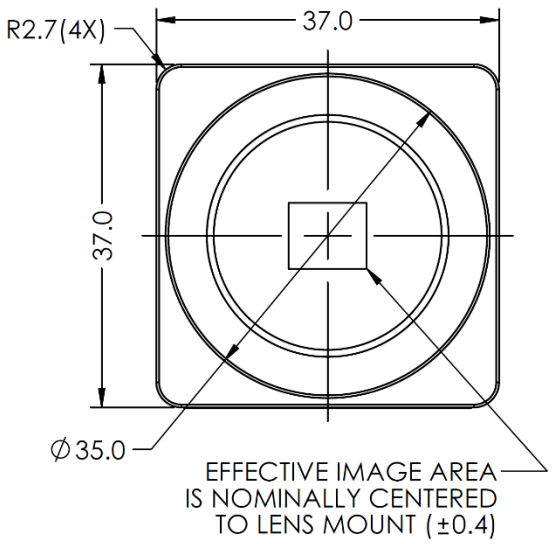
2.8.2 POE-C1911, POE-C2010, POE-C2410, POE-C3210, POE-C4010, and POE-C4110 Cameras

The camera housing is made of precision-machined aluminum. For maximum flexibility, the camera has eight M3X0.5mm mounting holes located towards the front of the camera on all four sides. An additional plate with ¼-20 UNC (tripod mount) and hardware ship with each camera.

Figure 26: POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, POE-C4110Y/Z camera

The following mechanical drawings show top, front, and back views of the POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, and C4110Y/Z cameras.

Front View:



Back View:

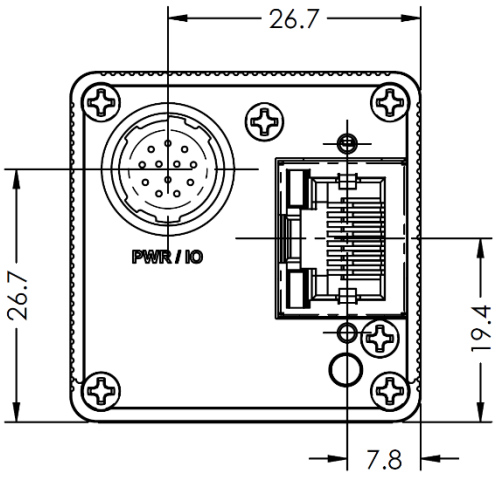
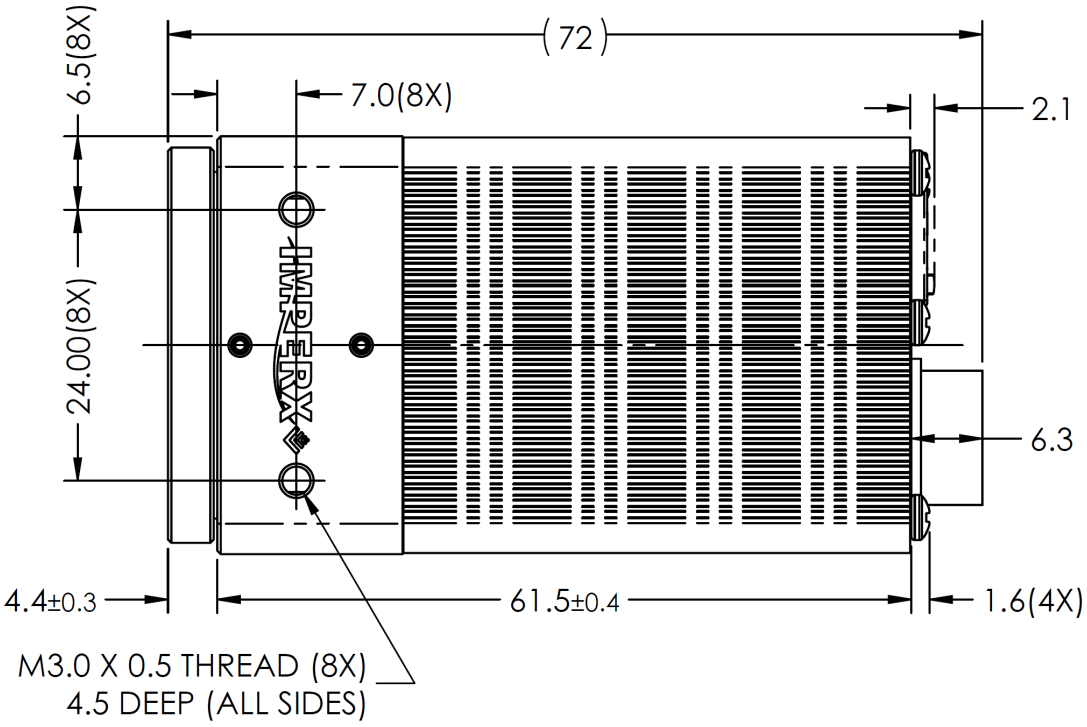


Figure 27: Front and Back Views of the POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, and POE-C4110Y/Z cameras

Top View:



Side View with Image Plane:

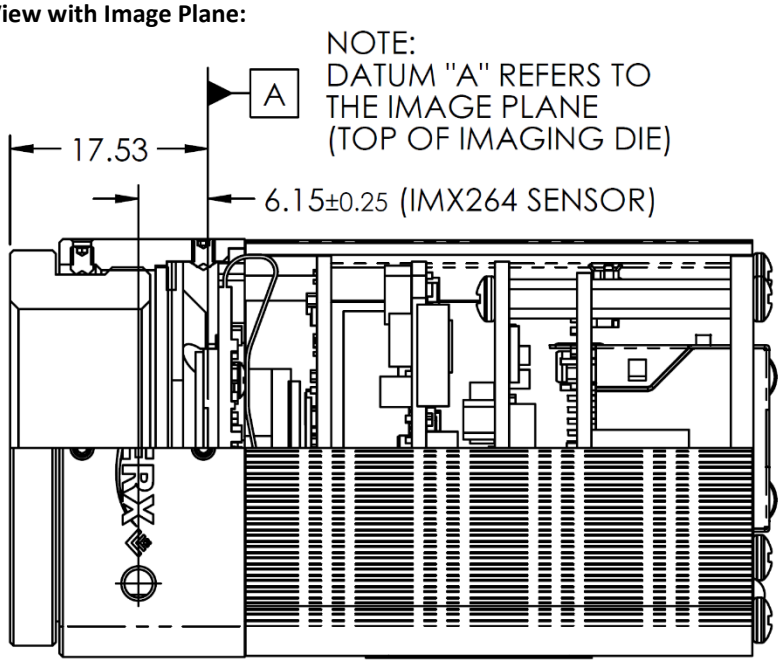


Figure 28: Top and Side views of the POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, and POE-C4110Y/Z cameras

2.8.2.1 POE-C1911, POE-C2010, POE-C2410, POE-C2410, POE-C3210, POE-C4010, and POE-C4110 Cameras Mounting Plate

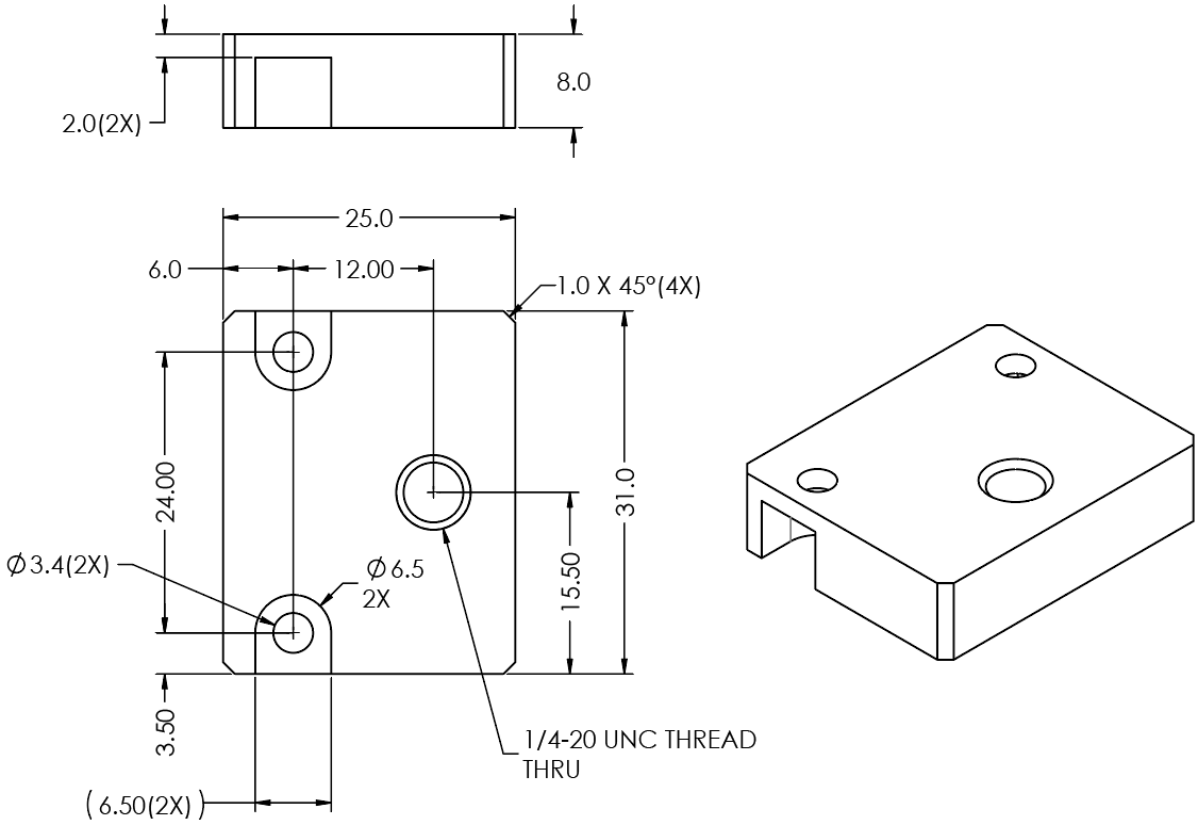


Figure 29: POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, and POE-C4110Y/Z cameras mounting plate

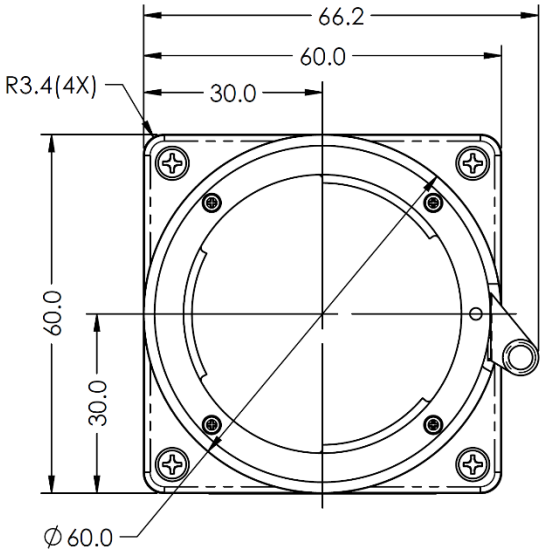
2.8.3 C4410, C5410, and C6410 Cameras

The camera housing is made of precision-machined aluminum. For maximum flexibility, the camera has eight M3X0.5mm mounting holes located towards the front of the camera on all four sides. An additional plate with ¼-20 UNC (tripod mount) and hardware ship with each camera.

Figure 30: C4410, C5410, C6410 cameras

The following mechanical drawings show top, front, and back views of the C4410, C5410, and C6410 cameras.

Front View:



Back View:

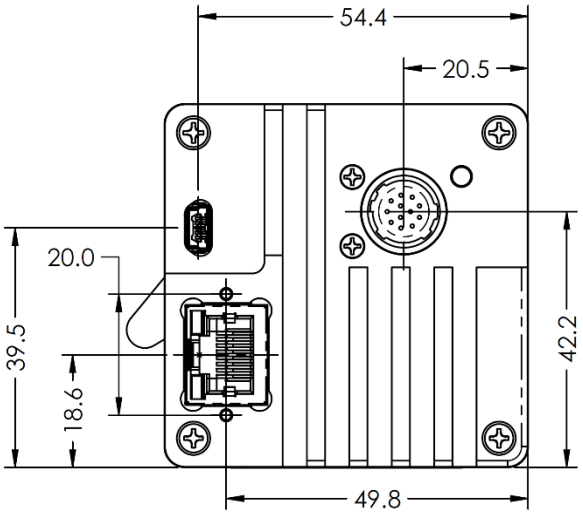
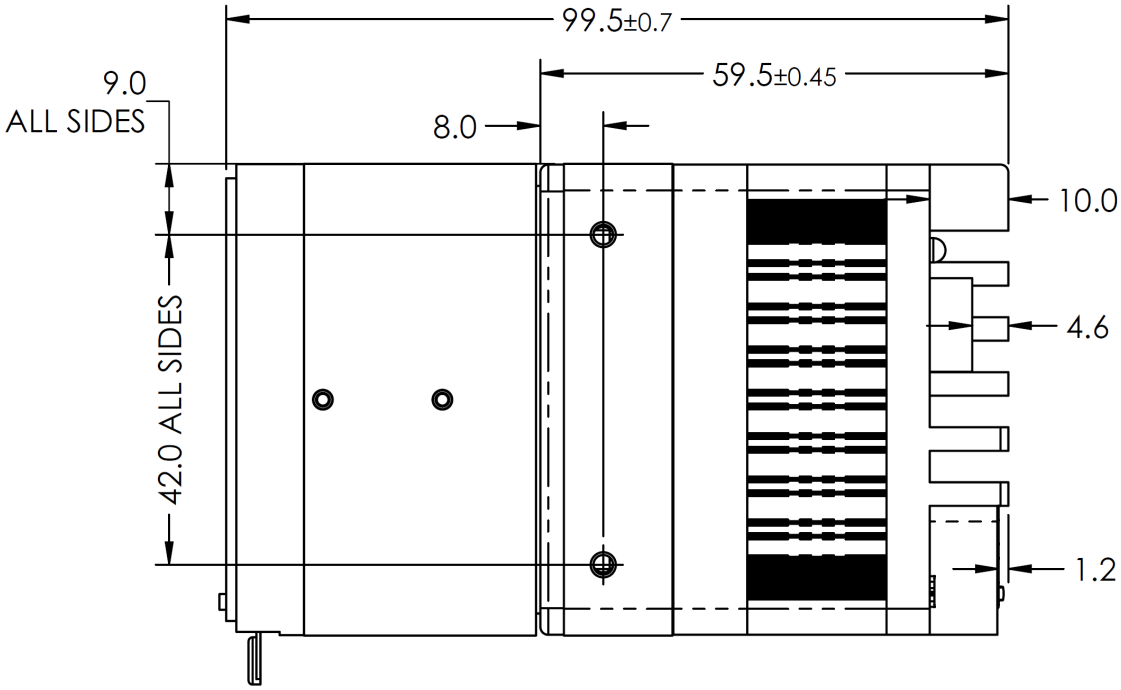


Figure 31: Front and Back views of the C4410, C5410, and C6410 cameras

Top View:



Side View with Image Plane:

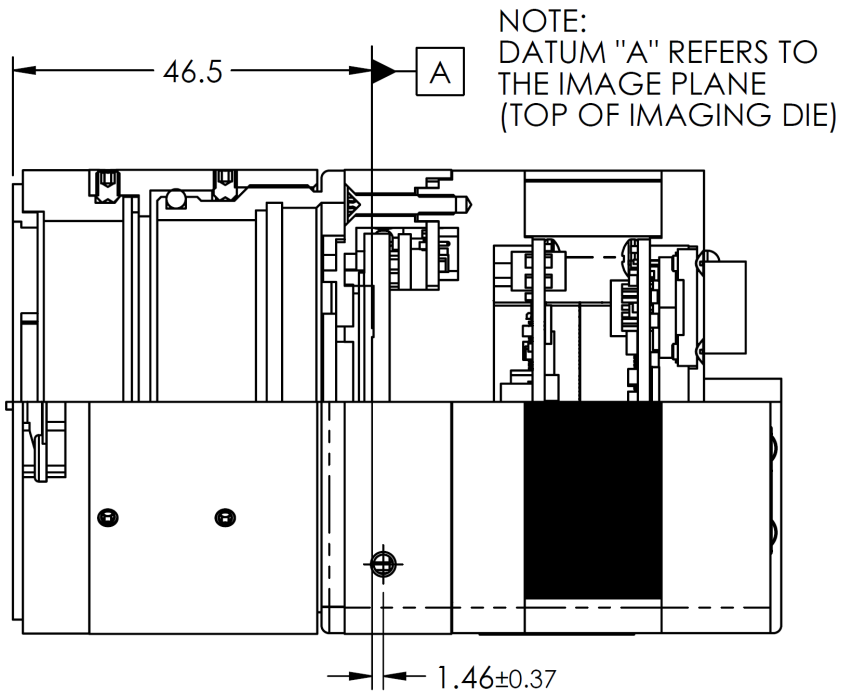


Figure 32: Top and Side views of the C4410, C5410, and C6410 cameras

2.8.3.1 C4410, C5410, and C6410 Cameras Mounting Plate

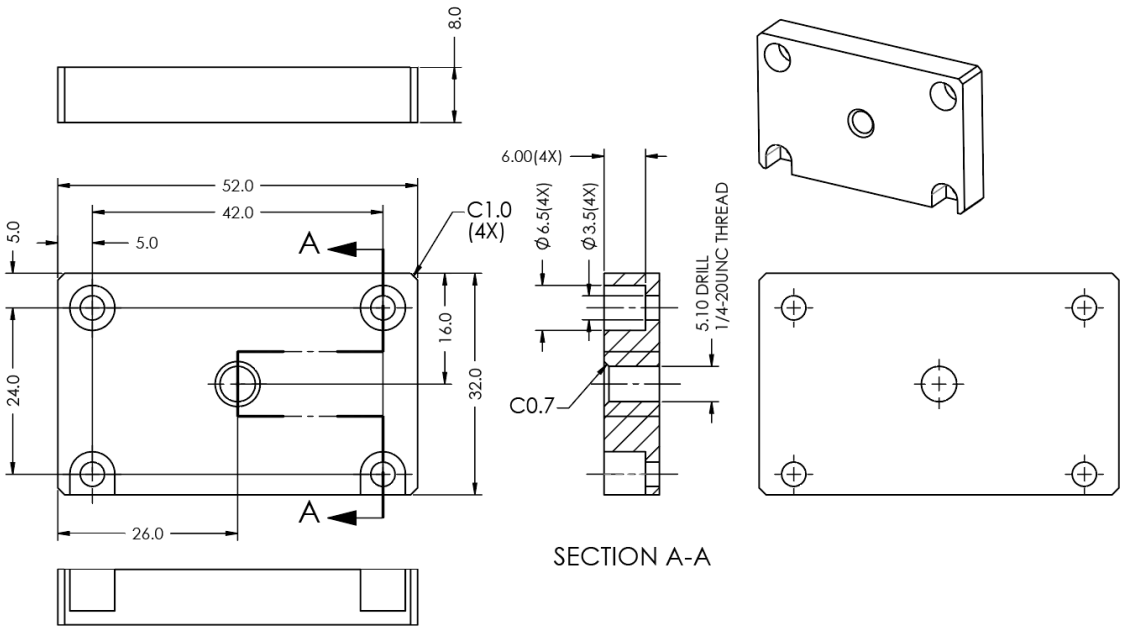


Figure 33: C4410, C5410, and C6410 Cameras Mounting Plate

2.8.4 P67 Cheetah Cameras

The camera housing is made of precision-machined aluminum. For maximum flexibility, the camera has four M3X0.5mm mounting holes located towards the front of the camera on the top and bottom sides. An additional plate with ¼-20 UNC (tripod mount) and hardware ship with each camera.

Figure 34: P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, P67-C4110 cameras

The following mechanical drawings show top, front, and back views of the P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, and P67-C4110 cameras.

Front View: **Back View:**

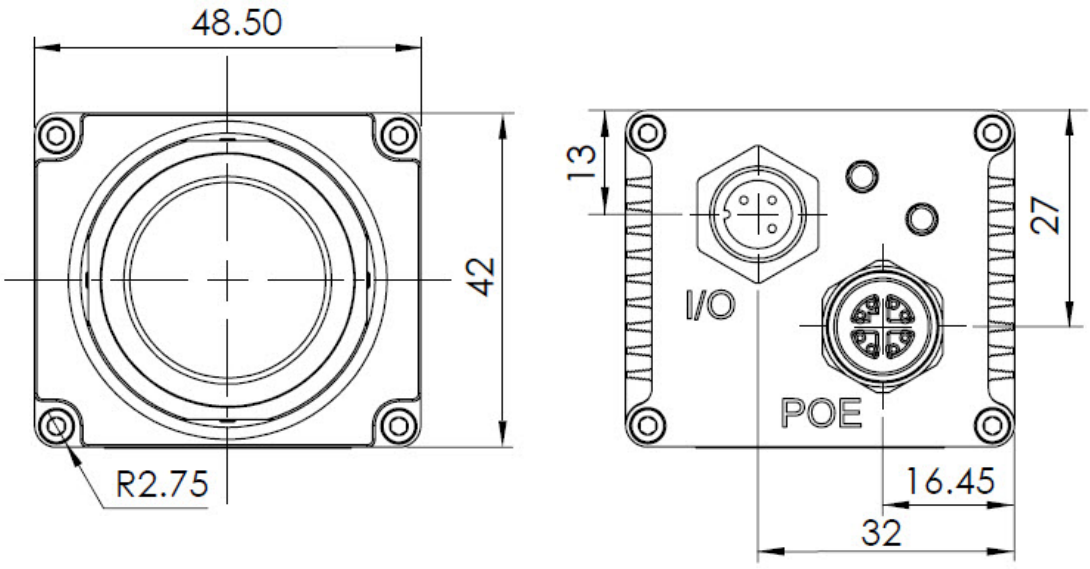
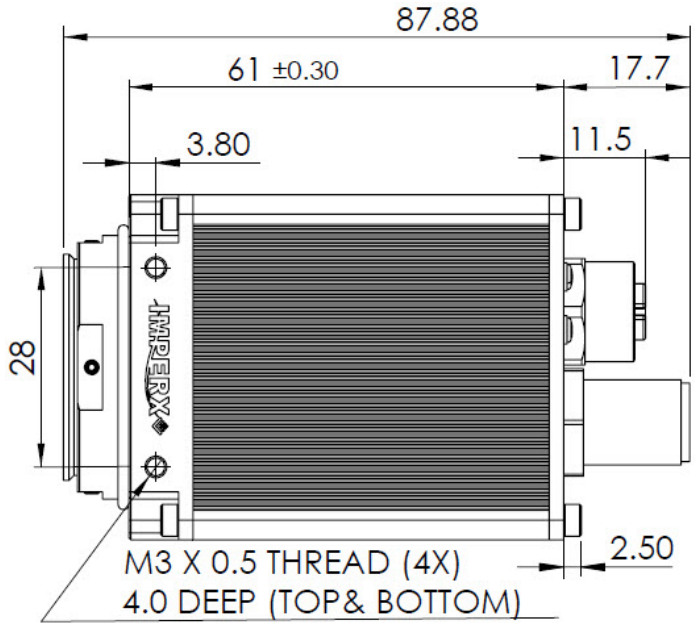


Figure 35: Front and Back views of the P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, P67-C4110 cameras

Top view:



Section A – A:

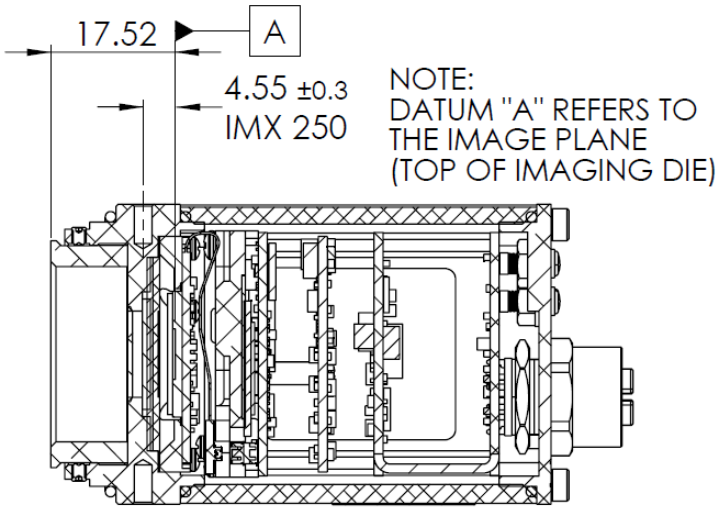
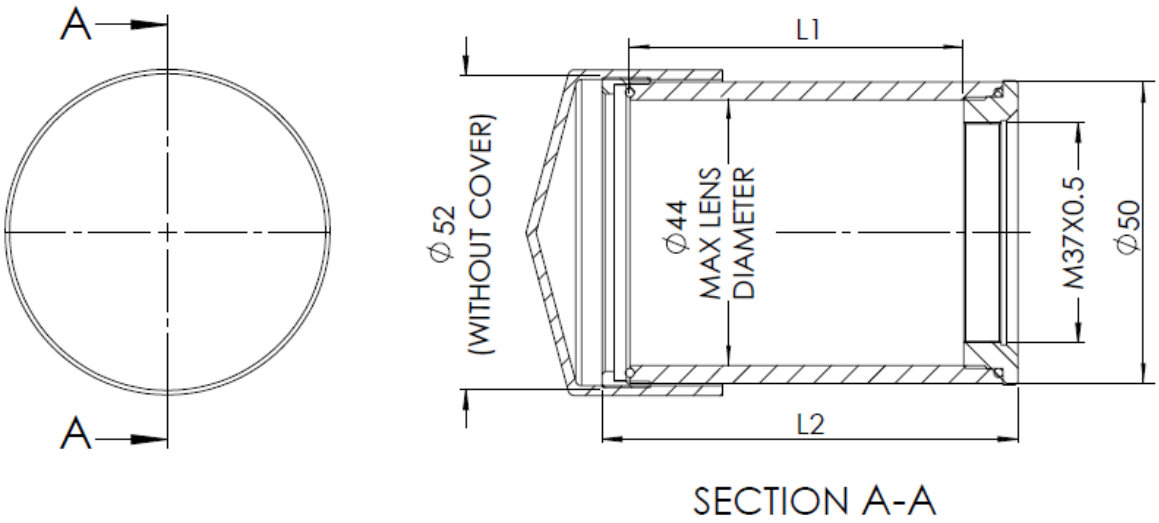


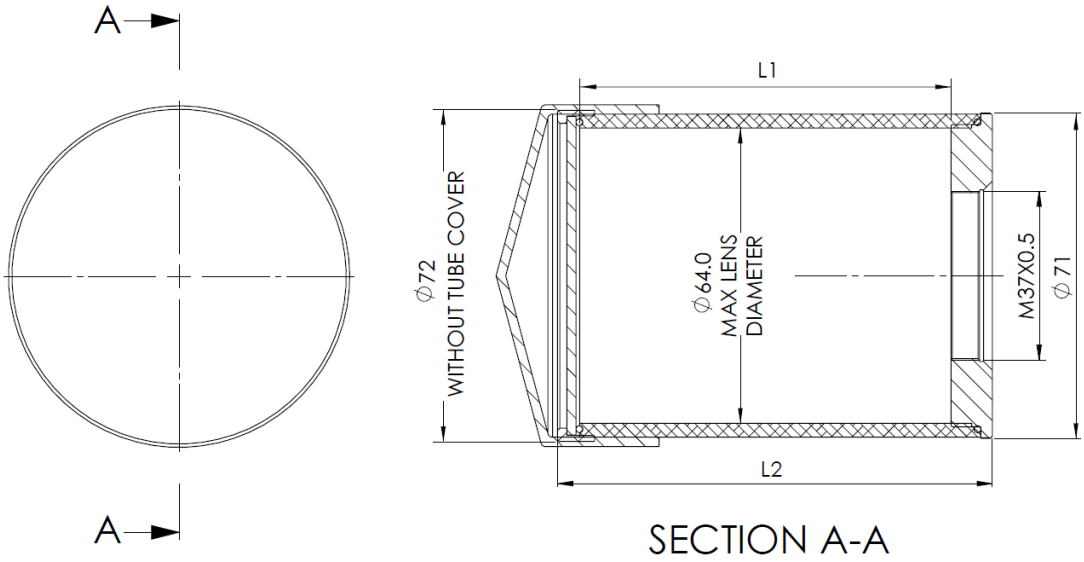
Figure 36: Mechanical drawings of the P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, P67-C4110 cameras



Part Number	Inner Length L1*	Outer Length L2
Tube-0044-0055 (default)	55 mm	69 mm

*Custom Tube Lengths are available, please contact your local distributor or Imperx sales

Figure 37: IP67 C-Mount Lens Tubes, inner diameter 44 mm



Part Number	Inner Length L1*	Outer Length L2
Tube-0064-0080 (default)	80 mm	95 mm

*Custom Tube Lengths are available, please contact your local distributor or Imperx sales

Figure 38: IP67 C-Mount Lens Tubes, inner diameter 64 mm

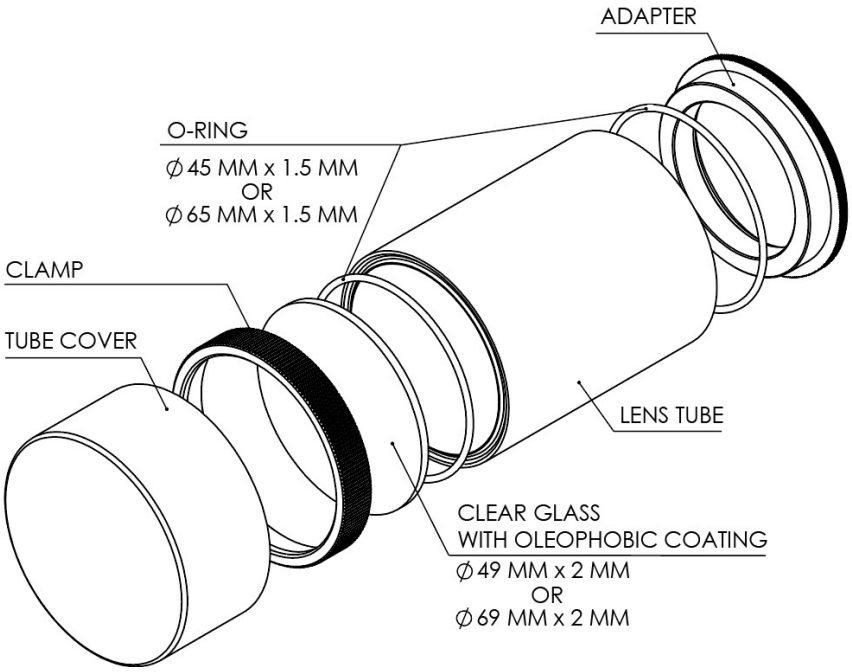


Figure 39: IP67 C-Mount Lens Tube, exploded drawing

⚠CAUTION

When assembling P67 camera:

- **Do not** hold the lens tube by the clamp when removing/attaching the tube as it may loosen the clamp.
- **Do not** remove the protective glass to install/adjust the lens. If the glass is fastened improperly, the IP67 rating will be lost. Always unscrew the tube at the adapter's end.
- To protect the camera sensor from dust and other contaminants, hold the camera pointing down while installing/removing the lens.

2.8.4.1 P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, P67-C4110 cameras mounting plate

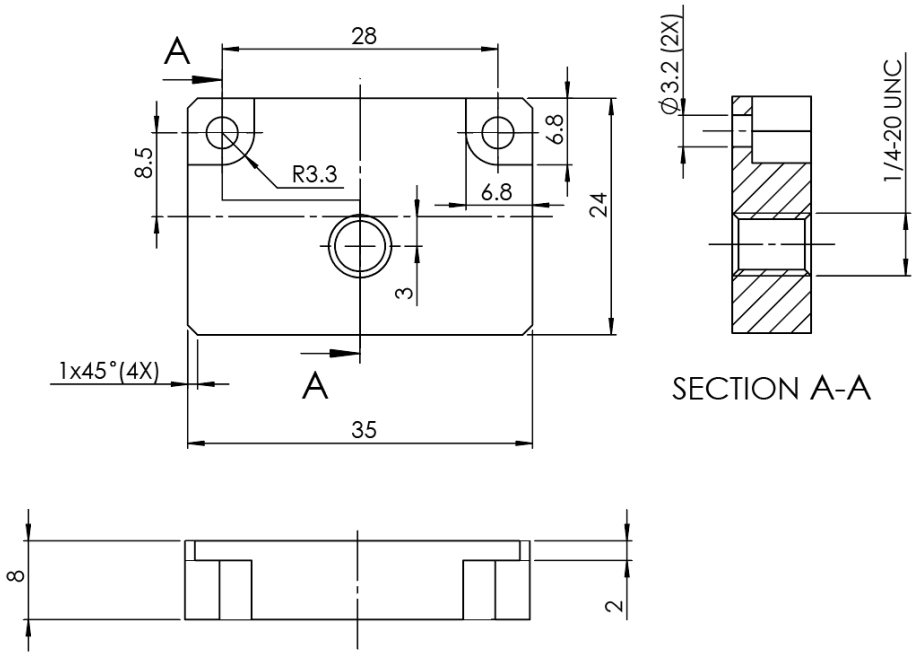


Figure 40: P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, P67-C4110 cameras mounting plate

2.9 Optical

The Cheetah cameras come with varying adapters for C-mount or F-mount lenses that have different back focal distances (see Table 20). You can use an F-mount lens with a C-mount camera using an F-mount–to-C-mount adapter (with POE-C1911, POE-C2010, POE-C2410, POE-C3210, POE-C4010, and POE-C4110 cameras only). You can purchase the adapter separately (refer to the Imperx web site www.imperx.com for more information).

Table 20: Cheetah Cameras' Adapters and Back Focal Distances

Camera model	Lens Mount (default)	Back focal distance
POE-C2000, POE-C2400	C-Mount	18.13 mm
POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, POE-C4110Y/Z	C-Mount	17.53 mm
P67-C1911, P67-C2010, P67-C2410, P67-C3210, P67-C4010, P67-C4110	C-Mount	17.53 mm
POE-C4410, POE-C5410, POE-C6410	F-Mount	46.50 mm

TIP

Camera performance and signal to noise ratio (SNR) depend on the illumination (amount of light) reaching the sensor and the exposure time. Always try to balance these two factors. Unnecessarily long exposures increase the amount of dark noise and thus decrease the signal to noise ratio.

The camera is highly sensitive in the infrared (IR) spectral region. All color cameras have an IR cut-off filter installed. Monochrome cameras do not have any optical filter. If necessary, the monochrome camera can accommodate an IR filter (1 mm thickness or less) inserted under the front lens bezel.

⚠CAUTION

1. Avoid direct exposure to a high intensity light source (such as a laser beam). This may damage the camera optical sensor!
2. Avoid foreign particles on the surface of the imager.

2.9.1 IP67 C-Mount Lens Tubes

Imperx offers IP67 C-mount Lens Tubes with 44 mm and 64 mm inner diameters to be used with varying lens sizes (see Table 21). The tube length can be customized to match your specific requirements. When ordering a P67 camera, please select the lens tube that matches the size of the lens used with the camera. Mechanical drawings of the lens tubes are shown in Figure 37, Figure 38 and Figure 39.

Table 21: Lens tube specifications

Specifications	**44 mm Lens Tube**	**64 mm Lens Tube**
Part number	Tube-0044-0055	Tube-0064-0080
Inner diameter	Ø 44 mm	Ø 64 mm
Outer diameter	Ø 50 mm	Ø 70 mm
Inner length (default)*	55 mm	80 mm
Outer length (default)	69 mm	95 mm
Protective glass	Clear Glass, Ø 49 mm x 2 mm, with oleophobic coating	Clear Glass, Ø 69 mm x 2 mm with oleophobic coating
Housing material	Aluminum	Aluminum

* Custom Tube Lengths are available, please contact your local distributor or Imperx sales at 1-561-989-0006 or sales@imperx.com

2.10 Environmental

Operate the POE cameras in a dry environment with temperatures between -30 °C and +75 °C (-30 °C and +70 °C for C2000 and C2400). Relative humidity should not exceed 90% non-condensing.

⚠CAUTION

1. **To maintain IP67 rating and warranty, the sealing caps MUST present when the connectors are not mated**
2. P67 cameras have an IP67 rating and when connected to appropriate IP67 cables (or when sealing caps are present on the camera connectors) can be submerged in water to 1-meter depth for 30 minutes. The P67 cameras should never be submerged or subjected to directed water spray unless sealing caps or IP67 cables are attached to the camera!

TIP

Always keep the camera within temperature specifications.

The camera should be stored in a dry environment with the temperature ranging from -40 °C to + 85 °C.

⚠CAUTION

1. For all cameras, except P67, avoid direct exposure to moisture and liquids. The camera housing is not hermetically sealed and any exposure to liquids may damage the camera electronics!
2. Avoid operating in an environment without any air circulation, in close proximity to an intensive heat source, strong magnetic or electric fields.
3. Avoid touching or cleaning the front surface of the optical sensor. If the sensor needs cleaning, use soft lint free cloth and an optical cleaning fluid.
   Do not use methylated alcohol!
   Please refer to the Sensor Cleaning Procedure document found on the camera's information USB stick or contact Imperx support for cleaning procedures.

3 GenICam™ API Module – Configuring the Camera

3.1 Overview

Imperx Cheetah cameras are highly programmable and flexible. They allow control of all the camera's resources. You communicate with the GEV camera from a simple GenICam™ compliant GigE graphical user interface (GUI). The GUI is bi-directional allowing you to issue commands to the camera and allowing the camera to issues responses (either status or information). You can configure and monitor all of the camera's features and resources.

The Cheetah camera ships with the Imperx Camera SDK software which includes the SDK and IpxPlayer application to control the camera and view/save images. Chapter 5 Software GUI provides information on Camera SDK software installing, IpxPlayer application interface and parameter windows.

3.2 Camera User Set Description

3.2.1 Startup Procedure

Upon powering up or receiving a 'DeviceReset' command, the camera performs the following steps:

1. Boot loader checks program flash memory for a valid firmware image and loads it into the field-programmable gate array (FPGA).
2. The camera reads the "Boot From" register from the parameter Flash and loads a workspace from one of the configuration spaces determined by the User Set Default Selector. The configuration spaces are: Factory Space (Default), User Space #1, #2, #3 or #4.
3. The camera runs the IP configuration according the GigE Vision standard, obtains the IP address, and is ready for device enumeration by host application.

3.3 GenApi Camera Configuration

The camera XML nodes are listed below with a description of the camera configuration parameters, the interface type, the range of control values, and the access mode for the parameter (RW: Read/Write, RO: Read Only, WO: Write Only).

While most configuration parameters are supported in all cameras, availability of some parameters may vary between different camera models. Those parameters are presented in Table 22.

Table 22: Parameters availability

Parameter	Camera model supporting the parameter
Slave AOI	All models except for POE-C2000 and POE-C2400
Line 2 in TriggerSource	POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, POE-C4110Y/Z, POE-C4410, POE-C5410, POE-C6410
AEC/AGC	All camera models except for POE-C2000 and POE-C2400
OUT2 and Strobe2	All camera models except for POE-C2000 and POE-C2400
IN2 in EventSelector	POE-C1911, POE-C2010, POE-C2410, POE-C2410Y/Z, POE-C3210, POE-C4010, POE-C4110, POE-C4110Y/Z, POE-C4410, POE-C5410, POE-C6410
OUT2 in EventSelector	All camera models except for POE-C2000 and POE-C2400
FFCEnable	All camera models except for POE-C2000, POE-C2010, P67-C2010, POE-C1911, and P67-C1911
Canon Lens Control	POE-C4410, POE-C5410, and POE-C6410

NOTE

In the following tables, parameter names underlined in *red italic* letters are changeable only if image acquisition is turned **off**. You cannot change these parameters if image acquisition is on.

3.3.1 Device Control

Device Control provides read-only information about the camera's XML file and enables camera reset functionality.

Table 23: Device Control parameters

Parameter Name	Type	Value	Access	Description
DeviceSFNCVersionMajor	Integer		RO	Major version of SFNC used for XML.
DeviceSFNCVersionMinor	Integer		RO	Minor version of SFNC used for XML.
DeviceSFNCVersionSubMinor	Integer		RO	Sub-minor version of SFNC used for XML.
DeviceReset	Command		WO	Resets camera to power-up state (resets both the GEV Engine and the camera head).
CameraHeadReset	Command		WO	Resets the camera circuitry. The GEV Engine doesn't reset. NOTE: After camera reset, issue a UserSetLoad command.

Table 23: Device Control parameters (continued)

Parameter Name	Type	Value	Access	Description
DeviceTemperatureSelector	Enumeration	**String** **Num.** "Sensor" 0	RW	Selects the location within the camera where the temperature will be measured.
DeviceTemperature	Float		RO	Camera temperature in degrees Celsius (C) measured at the location selected by DeviceTemperatureSelector.

3.3.2 Version Information

Version Information provides read-only information identifying the camera's firmware, hardware, software, image sensor, camera version, and so on. This information is programmed during the manufacturing process and stored in non-volatile memory.

Table 24: Version Information parameters

Parameter Name	Type	Value	Access	Description
SensorType	Enumeration	**String** **Num.** "Monochrome" 0 "Bayer" 1	RO	Returns the CMOS sensor type.
SensorModel	Enumeration	**String** **Num.** "Unknown" 0 "IMX250LQR" 0x00FA0000 "IMX250LLR" 0x04FA0000 "IMX252LQR" 0x00FC0000 "IMX252LLR" 0x04FAC000 "IMX264LQR" 0x01080000 "IMX264LLR" 0x05080000 "IMX265LQR" 0x01090000 "IMX265LLR" 0x05090000 "IMX267LQR" 0x010B0000 "IMX267LLR" 0x050B0000 "IMX304LQR" 0x01300000 "IMX304LLR" 0x05300000 "IMX342LQR" 0x01560000 "IMX342LLR" 0x05560000 "IMX367LQR" 0x016F0000 "IMX367LLR" 0x056F0000 "IMX387LQR" 0x01830000 "IMX387LLR" 0x05830000 "IMX420LQR" 0x01A40000 "IMX420LLR" 0x05C40000 "IMX428LQR" 0x01AC0000 "IMX428LLR" 0x05AC0000 "IMX429LQR" 0x01AD0000 "IMX429LLR" 0x05AD0000	RO	Returns the CMOS model name.
RgsID	Integer		RO	Returns RGS ID.

Table 24: Version Information parameters (continued)

Parameter Name	Type	Value	Access	Description
FpgaID	Integer		RO	Returns the FPGA ID (0=EP4C25, 1=EP4C40, 3=5CEFA4, 5=5CEFA5).
EpcsID	Integer		RO	Returns the EPCS ID (0=EPCS16, 1=EPCS64, 2=EPCS128).
FirmwareImage	Integer		RO	Returns the Firmware Image ID (F=Factory or A= Application).
CameraHeadFirmwareVersion	Integer		RO	Returns the Camera Head Firmware Version Number.
CameraHeadFirmwareBuild	Integer		RO	Returns Firmware build Number.
CustomerID	Integer		RO	Returns Customer ID for custom cameras (0=Imperx Standard camera).
FamilyID	Integer		RO	Returns Camera Family ID.
XMLVersion	Integer		RO	Returns XML Version.
GEVFirmwareSWVersion	Integer		RO	Shows software version of GigE Vision engine firmware.
GevFirmwareHwVersion	Integer		RO	Shows Hardware version for GigE Vision engine firmware.

3.3.3 Image Format Control

Image Format Control lets you change screen resolution, select pixel format, and more.

Table 25: Image Format Control parameters

Parameter Name	Type	Value		Access	Description
WidthMax	Integer			RO	Returns max. width of image in pixels.
HeightMax	Integer			RO	Returns max. height of image in pixels.
Width	Integer	Min: 8 Max: Depends on camera model		RW	AOI Width – Actual Image output width (in pixels).
Height	Integer	Min: 8 Max: Depends on camera model		RW	AOI Height – Actual image output height (in lines), multiple of 8
OffsetX	Integer	Min: 0 Max: Depends on Width		RW	AOI Horizontal offset from left side of image (in pixels).
OffsetY	Integer	Min: 0 Max: Depends on Height		RW	AOI Vertical offset from the top of the image (in pixels).
ConstantFrameRate	Boolean			RW	Enables Constant Frame Rate independent of AOI size.
PixelFormat	Enumeration	**String** "Mono8" "Mono10" "Mono10Packed" "Mono12" "Mono12Packed" "BayerRG8" "BayerRG10" "BayerRG12" "BayerRG10Packed" "BayerRG12Packed"	**Num.** 0x01080001 0x01100003 0x010C0004 0x01100005 0x010c0006 0x01080009 0x0110000D 0x01100011 0x010C0027 0x010C002B	RW	Sets Output Data Pixel format.
PixelSize	Enumeration	**String** "Bpp8" "Bpp10" "Bpp12" "Bpp14" "Bpp16" "Bpp24"	**Num.** 0 1 2 3 4 5	RO	Total size in bits of a pixel of the image.

Table 25: Image Format Control parameters (continued)

Parameter Name	Type	Value		Access	Description
PixelColorFilter	Enumeration	**String** "None" "BayerRG""	**Num.** 0 1	RO	Type of color filter that is applied to the image.
TestPattern	Enumeration	**String** **Num.** "Off" 0 "BwCheckerBoard" 1 "Grey" 2 "TapSegmented" 3 "GreyHorizontalRamp" 4 "GreyVerticalRamp" 5 "HorizontalAndVerticalRamp" 6 "HorizontalAndVerticalRampMoving" 7 "VerticalBars" 8 "Crosshair" 9 "IpxGevPattern" 16		RW	Selects type of test pattern generated by device replacing image source (refer to section 6.15 Test Image Pattern for more information).

3.3.3.1 Slave AOI

Slave AOI is supported by all cameras except for POE-C2000 and POE-C2400.

Table 26: Slave AOI parameters

Parameter Name	Type	Value		Access	Description
SAOI_Width	Integer			RW	Actual image width of the Slave AOI (in pixels).
SAOI_Height	Integer			RW	Actual image height of the Slave AOI (in pixels).
SAOI_OffsetX	Integer			RW	Horizontal offset from the origin to the Slave AOI (in pixels).
SAOI_OffsetY	Integer			RW	Vertical offset from the origin to the Slave AOI (in pixels).
SAOI_Mode	Enumeration	**String** "Disable" "Include" "Exclude" "AEC_AGC_Include" "AEC_AGC_Exclude" "AWB_Include" "AWB_Exclude" "LUT_Include" "LUT_Exclude"	**Num.** 0 1 2 3 4 5 6 7 8	RW	Sets Slave AOI mode. The Slave AOI might be used as AOI for AGC/AEC, AWB and LUT (refer to 6.11.3 Slave AOI for more information).

3.3.4 Acquisition Control

Acquisition Control lets you configure settings for image capture, exposure, frame rates, triggers, and so on. It also provides read-only information on frame and exposure time.

Table 27: Acquisition Control parameters

Parameter Name	Type	Value		Access	Description
AcquisitionMode	Enumeration	**String** "SingleFrame" "MultiFrame" "Continuous"	**Num.** 0 1 2	RW	Defines the number of frames to capture during acquisition and the way the acquisition stops (refer to 6.4 Acquisition Control section for more information).
AcquisitionStart	Command			WO	Starts device acquisition.
AcquisitionStop	Command			WO	Stops acquisition after current frame completes readout.
AcquisitionAbort	Command			WO	Stops acquisition immediately, but a partially transferred image will be completed.
AcquisitionFrameCount	Integer	Min: 1 Max: 65535		RW	Number of Frames to acquire in Multi-Frame Acquisition mode.
ExposureMode	Enumeration	**String** "Off" "TriggerWidth" "Timed"	**Num.** 0 1 2	RW	Sets exposure mode. "Off": exposure time equals frame time (refer to 6.1 Exposure Control for more information).
ExposureTime	Float			RW	Sets Timed Exposure in micro-seconds when ExposureMode is Timed and ExposureAuto is "Off".
AcquisitionFrameRateEnable	Boolean			RW	Controls if the AcquisitionFrameRate and AcquisitionFrameTime features are writable and used to control the acquisition rate. If "On", you can extend the actual frame time beyond the free-running frame time.
AcquisitionFrameTime	Integer			RW	Sets Frame Time in microseconds. 16 seconds maximum.

Table 27: Acquisition Control parameters (continued)

Parameter Name	Type	Value		Access	Description
AcquisitionFrameRate	Float			RW	Controls acquisition rate (in Hz) of frames captured.
CurrentExposureTime	Integer			RO	Returns current exposure time in microseconds.
CurrentFrameTime	Integer			RO	Returns current frame time in microseconds.
TriggerMode	Enumeration	String "Off" "On"	Num. 0 1	RW	Enables Trigger mode of operation. Not available if AcquisitionFrameRateEnable parameter is "On".
TriggerSoftware	Command			WO	Generates internal trigger. TriggerSource must be set to Software.
TriggerSource	Enumeration	**String** "Line1" "Line2" "PulseGenerator" "Software"	**Num.** 1 5 2 4	RW	Specifies internal signal or external Line as trigger source. TriggerMode must be set to "On" (refer to 6.9.2 Trigger Sources for more information).
TriggerActivation	Enumeration	**String** "RisingEdge" "FallingEdge"	**Num.** 0 1	RW	Specifies activation edge of trigger.
TriggerDebounceTime	Integer	Min: 0 Max: 65535		RW	Specifies time period (in microseconds) when a second trigger is not accepted.
TriggerFilterTime	Integer	Min: 0 Max: 65535		RW	Specifies the minimum Trigger signal pulse width. Any pulse shorter than the selected time is ignored.
TriggerOverlap	Enumeration	**String** "Off"	**Num.** 0	RO	Specifies the trigger overlap mode, if the camera receives a trigger pulse while the camera is still processing the previous trigger.

Table 27: Acquisition Control parameters (continued)

Parameter Name	Type	Value		Access	Description
TriggerType	Enumeration	**String** "Standard" "Fast"	**Num.** 0 1	RW	**Standard:** Exposure and readout sequential; **Fast:** Exposure and readout overlapped (see 6.9.1 Trigger Modes).
TriggerNumFrames	Integer	Min: 1 Max: 65531		RW	Number of Frames captured per Trigger. (Available in Standard Trigger mode only).
TriggerDelay	Integer	Min: 0 Max: 1000000		RW	Specifies delay between Trigger to start of exposure (in microseconds).

3.3.5 Gain Control

Gain Control provides parameters for setting analog/digital gain and black level.

Table 28: Gain Control parameters

Parameter Name	Type	Value		Access	Description
Gain	Float	Min: 0.0 Max: 48.0		RW	Sets analog/digital gain in dB. Increment is 0.1 dB.
BlackLevelAuto	Enumeration	**String** "Off" "Continuous"	**Num.** 0 1	RW	Sets the mode for Auto-Black Level Adjustment.
BlackLevel	Float	Min: 0 Max: 255		RW	Controls the analog black level as an absolute physical value. Adds a fixed analog offset to the video level.
DigitalGain	Float	Min: 1.00 Max: 4.00		RW	The pixel value is multiplied by the Digital Gain Factor. Increment is 0.01.
DigitalGainRaw	Integer	Min: 1024 Max: 4095		RW	Controls the raw value of Digital Gain from 1024 (1x) to 4095 (4x) in steps of 0.001x (Refer to section 6.5.1 Digital gain for more information on determining raw values).
DigitalOffset	Integer	Min: -512 Max: 511		RW	Adds a digital offset (+ or -) to the video data.
DigitalOffsetRaw	Integer	Min: 0 Max: 1023		RW	Controls the Digital Offset in RAW units.

3.3.6 Auto Exposure and Auto Gain Control (AEC/AGC)

You can set the camera to automatic exposure control (AEC) to keep the same image brightness during changing light conditions. You can enable both AEC and automatic gain control (AGC) independently or together. Auto gain and auto exposure controls let you control the range of exposure times and gain values used by placing minimum and maximum limits on these parameters. When both AEC and AGC are enabled together, exposure times are varied until the maximum exposure time limit is reached, then gain is applied.

NOTE

Auto Exposure and Auto Gain Control are supported by all cameras except for POE-C2000 and POE-C2400 models.

3.3.6.1 Control

Table 29: Auto Exposure and Auto Gain Control parameters

Parameter Name	Type	Value		Access	Description
GainAuto	Enumeration	**String** "Off" "Continuous"	**Num.** 0 1	RW	Enables automatic gain control (AGC) mode.
AgcGainMin	Float	Min: 0 Max: AgcGainMax		RW	Sets the minimum gain applied (in dB) when AGC is enabled. Increment is 0.1 dB.
AgcGainMinRaw	Integer	Min: 0 Max: AgcGainMax		RW	Sets the minimum Digital Gain value for the AGC mode in RAW units.
AgcGainMax	Float	Min: AgcGainMin Max: 48.000		RW	Sets the maximum gain applied (in dB) when AGC is enabled. Increment is 0.1 dB.
AgcGainMaxRaw	Integer	Min: AgcGainMinReg Max: 480		RW	Sets the maximum Digital Gain value for the AGC mode in RAW units.
ExposureAuto	Enumeration	**String** "Off" "Continuous"	**Num.** 0 1	RW	Enables automatic exposure control (AEC) mode.
AecExposureMin	Integer	Min: MinExposureTime Max: AecExposureMax		RW	Sets min. exposure time value for AEC in microseconds.
AecExposureMax	Integer	Min: AecExposureMin Max: IntExposureMax		RW	Sets max. exposure time value for AEC in microseconds.
AgcAecLuminanceLevel	Integer	Min: 1 Max: 4095		RW	Sets target luminance level for AGC/AEC up to 4095 counts.

Table29: Auto Exposure and Auto Gain Control parameters (continued)

Parameter Name	Type	Value		Access	Description
AgcAecLuminanceType	Enumeration	**String** "Average" "Peak"	**Num.** 0 1	RW	Sets how the luminance level in the scene is determined.
AgcAecSpeed	Enumeration	**String** "x1" "x2" "x3" "x4"	**Num.** 0 1 2 3	RW	Sets AEC/AGC tracking speed. 4x is fastest, 1x is slowest.

3.3.6.2 Status

Table 30: Status parameters

Parameter Name	Type	Value	Access	Description
AgcGainCurrentValue	Float	Min: 0.0 Max: 48.0	RO	Reports current value of gain in AGC mode in dB.
AgcGainCurrentValueRaw	Integer	Min: 0 Max:480	RO	Reports current value of gain in AGC mode in RAW units.
AgcMinLimitReached	Integer		RO	Returns whether or not the minimum gain limit was reached during AGC operation.
AgcMaxLimitReached	Integer		RO	Returns whether or not the maximum gain limit was reached during AGC operation.
AecExposureCurrentValue	Integer		RO	Reports current value of exposure in microseconds in AEC mode.
AecMinLimitReached	Integer		RO	Returns whether or not the minimum exposure limit was reached during AEC operation.
AecMaxLimitReached	Integer		RO	Returns whether or not the maximum exposure limit was reached during AEC operation.

Table 30: Status parameters (continued)

Parameter Name	Type	Value	Access	Description
CurrentAvgOrPeakLuminance	Integer		RO	Returns current average or peak luminance in counts.
AgcAecStatus	Integer		RO	Displays the value of AgcAecStatus register.

3.3.7 Data Correction

Data Correction parameters enable you to implement look-up tables and other techniques to improve image sensor performance.

Table 31: Data Correction parameters

Parameter Name	Type	Value		Access	Description
LUTEnable	Enumeration	**String** "Off" "LUT1" "LUT2" "LUT3" "LUT4"	**Num.** 0 1 2 3 4	RW	Selects and enables LUT to be used in processing image. (LUT1 and LUT3 are preprogrammed with Gamma 0.45, LUT 2 and LUT 4 – with negative LUT)
FFCEnable[1]	Enumeration	**String** "Off" "FFC1" "FFC2"	**Num.** 0 1 2	RW	Selects FFC to be used in processing image, if supported. Some cameras may not support FFC.
BadPixelCorrection	Enumeration	**String** "Off" "Factory" "Dynamic" "FactoryAndDynamic" "User" "UserAndDynamic"	**Num.** 0 1 2 3 4 5	RW	Enables bad pixel correction. You can upload your own bad pixel map. Dynamic Bad pixel correction supplements options 3 and 5.
BadPixelThreshold	Integer	Min: 0 Max: 4095		RW	Sets threshold for dynamic bad pixel correction algorithm.
NegativeImage	Boolean			RW	Inverts the image from positive to negative.
ReverseX	Boolean			RW	Flip horizontally the image sent by the camera. The AOI is applied after the flipping.
ReverseY	Boolean			RW	Flip vertically the image sent by the camera. The AOI is applied after the flipping.

Table 31: Data Correction parameters (continued)

Parameter Name	Type	Value		Access	Description
BitShift	Enumeration	**String** "NoShift" "OneBitRight" "TwoBitsRight" "ThreeBitsRight" "FourBitsRight" "FiveBitsRight" "SixBitsRight" "SevenBitsRight" "OneBitLeft" "TwoBitsLeft" "ThreeBitsLeft" "FourBitsLeft" "FiveBitsLeft" "SixBitsLeft" "SevenBitsLeft"	**Num.** 0 1 2 3 4 5 6 7 9 10 11 12 13 14 15	RW	Shifts the data output bits left or right.

[1]The POE-C2000, POE-C2010, P67-C2010, POE-C1911, and P67-C1911 cameras do not support **FFCEnable** parameter.

3.3.8 White Balance

White Balance parameters give you control over the individual red, green, and blue colors produced by the sensor in color cameras.

Table 32: White Balance parameters

Parameter Name	Type	Value		Access	Description
BalanceWhiteAuto	Enumeration	**String** "Off" "Once" "Continuous" "Manual"	**Num.** 0 1 2 3	RW	Controls the camera white balance. Options 1 and 2 calculate color coefficients automatically (see section 6.16 Color Control).
RedCoefficient	Integer	Min: 0 Max: 4095		RW	Manually sets white balance coefficient for red channel.
GreenCoefficient	Integer	Min: 0 Max: 4095		RW	Manually sets white balance coefficient for green channel.
BlueCoefficient	Integer	Min: 0 Max: 4095		RW	Manually sets adjusted white balance coefficient for blue channel.

3.3.9 Output and Strobe Signals

OUT2 and Strobe2 parameters are supported by all cameras except for POE-C2000 and POE-C2400 cameras.

Table 33: OUT1 parameters

Parameter Name	Type	Value		Access	Description
OUT1Polarity	Enumeration	**String** "ActiveLow" "ActiveHigh"	**Num.** 0 1	RW	Sets active logic level of OUT1 output.
OUT1Selector	Enumeration	**String** "None" "ExposureStart" "ExposureEnd" "MidExposure" "ExposureActive" "HSync" "VSync" "OddEvenFrame" "TriggerActual" "TriggerDelayed" "CameraReady" "PulseGenerator" "Strobe1" "Strobe2" "ToggleOut1"	**Num.** 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14	RW	Maps various internal signals to OUT1 output (refer to the section 6.10 Strobe and Synchronization Controls for more information on output signals).

Table 34: OUT2 parameters (some cameras may not support OUT2)

Parameter Name	Type	Value		Access	Description
OUT2Polarity	Enumeration	**String** "ActiveLow" "ActiveHigh"	**Num.** 0 1	RW	Sets active logic level of OUT2 output.
OUT2Selector	Enumeration	**String** "None" "ExposureStart" "ExposureEnd" "MidExposure" "ExposureActive" "HSync" "VSync" "OddEvenFrame" "TriggerActual" "TriggerDelayed" "CameraReady" "PulseGenerator" "Strobe1" "Strobe2" "ToggleOut2"	**Num.** 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14	RW	Maps various internal signals to OUT2 output (refer to the section 6.10 Strobe and Synchronization Controls for more information on output signals).

Table 35: Strobe 1 and Strobe2 parameters (some cameras may not support Strobe2)

Parameter Name	Type	Value		Access	Description
Strobe1Mode	Enumeration	**String** "Off" "EachFrame" "OddFrame" "EvenFrame"	**Num.** 0 1 2 3	RW	Sets the Strobe #1 mode of operation.
Strobe1Width	Integer	Min: 1 Max: Depends on CurrentFrameTime and Strobe1Delay		RW	Sets Strobe 1 pulse duration in microseconds.
Strobe1Delay	Integer	Min: 10 Max: Depends on CurrentFrameTime and Strobe1Width		RW	Sets Strobe 1 delay from the reference, in microseconds.
Strobe2Mode	Enumeration	**String** "Off" "EachFrame" "OddFrame" "EvenFrame"	**Num.** 0 1 2 3	RW	Sets the Strobe #2 mode of operation.
Strobe2Width	Integer	Min: 1 Max: Depends on CurrentFrameTime and Strobe2Delay		RW	Sets Strobe 2 pulse duration in microseconds.
Strobe2Delay	Integer	Min: 10 Max: Depends on CurrentFrameTime and Strobe2Width		RW	Sets Strobe 2 delay from the reference, in microseconds.

3.3.10 Pulse Generator

The camera provides an internal pulse generator for generating a trigger signal. You can program it to generate a discrete sequence or a continuous trail of pulse signals.

Table 36: Pulse Generator parameters

Parameter Name	Type	Value		Access	Description
PulseGenGranularity	Enumeration	**String** "x1uS" "x10uS" "x100uS" "x1000uS"	**Num.** 0 1 2 3	RW	Sets the multiplication factors of the Pulse Generator where x1 = 1 µS, x10=10 µS, etc.
PulseGenWidth	Integer			RW	Sets pulse width of Pulse Generator where each unit is equal to PulseGenGranularity.
PulseGenPeriod	Integer			RW	Sets pulse period of Pulse Generator where each unit is equal to PulseGenGranularity.

Table 36: Pulse Generator parameters (continued)

Parameter Name	Type	Value	Access	Description
PulseGenNumPulses	Integer	Min: 1 Max: 65535	RW	Sets number of pulses to be generated by Pulse Generator. To set Pulse Generator in continuous mode, set the parameter in 65536
PulseGenEnable	Boolean		RW	Enables Pulse Generator.

3.3.11 Canon Lens Control

Canon Lens Control is available in POE-C4410, POE-C5410, and POE-C6410 cameras.

Table 37: General Canon Lens Control parameters

Parameter Name	Type	Value	Access	Description
GetLensStatus	Command		WO	Requests value of Lens Status register.
LensStatus	Integer		RO	Returns status of Lens after GetLensStatus runs.

3.3.11.1 Controller Settings

Table 38: Controller Settings

Parameter Name	Type	Value		Access	Description
InitLens	Command			WO	This command initializes the Canon Lens, if one mounted to the camera.
StopLens	Command			WO	Removes the power from the Iris drive. Run InitLens command to resume the lens control.
LensControllerStatus	Enumeration	**String** "InitLens_Failed" "InitLens_Done"	**Num.** 0 1	RO	Shows status of Canon Lens initialization.
IrisRangeCheck	Enumeration	**String** "Off" "On"	**Num.** 0 1	RW	Enables internal checkout of Iris Position and Step.
LensPresenceCheck	Enumeration	**String** "Off" "On"	**Num.** 0 1	RW	Enables or disables check of lens presence.
LensClockPolarity	Enumeration	**String** "Negative" "Positive"	**Num.** 0 1	RW	Sets polarity of Lens Clock.

3.3.11.2 Focus

Table 39: Focus parameters

Parameter Name	Type	Value	Access	Description
NearFull	Command		WO	Drives the focus to the fully Near position.
FarFull	Command		WO	Drives the focus to the fully Far position.
FocusSetupValue	Integer	Min: 1 Max: 255	RW	Sets the focus step to be moved with NearStep and FarStep commands.
NearStep	Command		WO	Drives the focus to the Near direction by the amount defined in the FocusStepValue feature.
FarStep	Command		WO	Drives the focus to the Far direction by the amount defined in the FocusStepValue feature.
FocusStop	Command		WO	Stops the focus movement immediately.
GetFocusEncoderStatus	Command		WO	Requests the focus encoder position value
FocusEncoderStatus	Integer		RO	Returns the current focus encoder value after the GetFocusEncoderStatus command issued.
ResetFocusEncoder	Command		WO	Resets the Focus encoder.

3.3.11.3 Iris

Table 40: Iris parameters

Parameter Name	Type	Value	Access	Description
CurrentFNumber	Float		RO	Returns the current f-number value of the lens iris. Value of 0.0 signals about unknown iris position.
CloseIrisFull	Command		WO	Closes the iris to the fully closed position.
OpenIrisFull	Command		WO	Opens the iris to the fully opened position.
CloseIrisStep	Command		WO	Closes the iris by the amount defined in the IrisStepValue feature.
OpenIrisStep	Command		WO	Opens the iris by the amount defined in the IrisStepValue feature.
IrisStepValue	Integer	Min: 1 Max: 127	RW	Sets the iris step to be moved with OpenStep and CloseStep commands.
GetIrisRange	Command		WO	Sends the "Get Iris Range" command to the camera.
IrisMin	Integer		RO	Returns the minimum iris limit.
IrisMax	Integer		RO	Returns the maximium iris limit.
IrisRange	Integer		RO	Displays the Limit values of the iris, after the GetIrisRange command issued.

3.3.12 Transport Layer Information

The Transport Layer control provides a variety of configuration settings and read-only information for configuring communications between the camera with the GigE Vision interface.

Table 41: PayLoadSize parameter

Parameter Name	Type	Value	Access	Description
PayloadSize	Integer		RO	PayloadSize provides the number of bytes transferred for each image on the stream channel, including any end-of-line, end-of-frame statistics or other stamp data.

Table 42: GigE Vision parameters

Parameter Name	Type	Value	Access	Description
GevMACAddress	Integer		RO	Stores MAC address of network interface.
GevCurrentIPConfigurationLLA	Boolean		RW	Indicates if Link Local Address IP configuration scheme is activated on network interface.
GevCurrentIPConfigurationDHCP	Boolean		RW	Indicates if DHCP IP configuration scheme is activated on network interface.
GevCurrentIPConfigurationPersistentIP	Boolean		RW	Indicates if PersistentIP configuration scheme is activated on network interface.
GevCurrentIPAddress	Integer		RO	Reports IP address of network interface after configuring it.
GevCurrentSubnetMask	Integer		RO	Provides subnet mask of network interface.
GevCurrentDefaultGateway	Integer		RO	Indicates default gateway IP address to use on network interface.
GevPersistentIPAddress	Integer		RW	Indicates Persistent IP address of network interface.
GevPersistentSubnetMask	Integer		RW	Indicates Persistent subnet mask associated with Persistent IP address on network interface.

Table 42: GigE Vision parameters (continued)

Parameter Name	Type	Value		Access	Description
GevPersistentDefaultGateway	Integer			RW	Indicates Persistent gateway IP address to use on network interface.
GevLinkSpeed	Integer			RO	Indicates the speed of transmission negotiated by network interface in Mbps.
GevCCP	Enumeration	**String** "OpenAccess" "ExclusiveAccess" "ControlAccess"	**Num.** 0 1 2	RW	Grants privilege to an application.
GevPrimaryApplicationSocket	Integer			RO	Indicates the UDP source port of the primary application.
GevPrimaryApplicationIPAddress	Integer			RO	Indicates the address of the primary application.
GevMCPHostPort	Integer			RW	Controls the port to which the camera must send messages. Setting this value to 0 closes the message channel.
GevMCDA	Integer			RW	Controls the destination IP address for the message channel.
GevMCTT	Integer			RW	Provides the message channel transmission timeout value in milliseconds.
GevMCRC	Integer			RW	Controls the number of retransmissions allowed when a message channel message times out.
GevMCSP	Integer			RO	This feature indicates the source port for the message channel.
GevSCCFGUnconditionalStreaming	Boolean			(RW)	Enables the camera to continue to stream, for this stream channel, if its control channel is closed or regardless of the reception of any ICMP messages (such as destination unreachable messages).

Table 42: GigE Vision parameters (continued)

Parameter Name	Type	Value	Access	Description
GevSCPHostPort	Integer		RW	Indicates the port to which the device must send data stream.
GevSCPSFireTestPacket	Command		RW	When this bit is set, the device will fire one test packet.
GevSCPSDoNotFragment	Boolean		RW	This bit is copied into the "do not fragment" bit of IP header of each stream packet.
GevSCPD	Integer		RW	Indicates the delay (in timestamp counter unit) to insert between each packet for this stream channel.
GevSCDA	Integer		RW	indicates the destination IP address for this stream channel.
GevSCPSPacketSize	Integer	Min: 72 Max: 16260	RW	The stream packet size to send on this channel, except for data leader and data trailer; and the last data packet which might be of smaller size (since packet size is not necessarily a multiple of block size for stream channel).
GevHeartbeatTimeout	Integer	Min: 500 Max: 4294967295	RW	This feature indicates the current heartbeat timeout in milliseconds.
GevTimestampTickFrequency	Integer		RO	This 64-bit feature indicates the number of timestamp ticks during 1 second.
GevTimestampControlLatch	Command		WO	Latch current timestamp counter into "Timestamp value" register.
GevTimestampControlReset	Command		WO	Reset timestamp 64-bit counter to 0.
GevTimestampValue	Integer		RO	Reports the latched 64-bit value of the timestamp counter.

3.3.13 User Set Controls

User Set Control allows you to save custom settings and reload them into the camera as needed.

Table 43: User Set Controls parameters

Parameter Name	Type	Value		Access	Description
UserSetSelector	Enumeration	**String** "Default" "UserSet0" "UserSet1" "UserSet2" "UserSet3"	**Num.** 0 1 2 3 4	RW	Selects User Set to load, save, or configure. Default is defined by the Factory.
UserSetLoad	Command			WO	Loads User Set specified by 'UserSetSelector' from non-volatile memory into camera and makes it active.
UserSetSave	Command			WO	Saves User Set 0 ,1, 2 or 3 specified by 'UserSetSelector' to non-volatile memory.
UserSetDefault	Enumeration	**String** "Default" "UserSet0" "UserSet1" "UserSet2" "UserSet3"	**Num.** 0 1 2 3 4	RW	Selects User Set to load and activate when device is powered on or reset. Default is set by Factory.

3.3.14 Event Control

Event Control allows you to notify a host application (IpxPlayer or a third-party application) about the events occurred (start or end of the acquisition, dropped frames, rising edge of a signal on the camera's input or output).

Table 44: Event Control parameters

Parameter Name	Type	Value		Access	Description
EventSelector[1]	Enumeration	**String** "AcquisitionStart" "AcquisitionEnd" "Stream0TransferIntDrop" "MessageTransferOverflow" "IN1" "IN2" "OUT1" "OUT2"	**Num.** 0x9105 0x9106 0x9107 0x9108 0x9101 0x9102 0x9103 0x9104	RW	Selects which Event to signal to the host application.
EventNotification	Enumeration	**String** "Off" "On"	**Num.** 0 1	RW	Activate or deactivate the notification to the host application of the occurrence of the selected Event.

[1] **EventSelrctor** values:

- **AcquisitionStart** – Device just started the acquisition of one or many frames.
- **AcquisitionEnd** – Device just completed the acquisition of one or many frames.
- **Stream0TransferIntDrop** – Stream channel internal drop.
- **MessageTransferOverflow** – Message channel FIFO overflow.
- **IN1** – The event will be generated when a Rising Edge is detected on the Hardware Input Line GP IN 1 (TRIGGER 1)
- **IN2** – The event will be generated when a Rising Edge is detected on the Hardware Input Line GP IN 2(TRIGGER 2) (IN2 event is supported by the POE-C1911, POE-C2010, POE-C2410, POE-C3210, POE-C4010, POE-C4110, POE-C4410, POE-C5410, and POE-C6410 cameras).
- **OUT1** – The event will be generated when a Rising Edge is detected on the Hardware Output Line GP OUT 1 (STROBE 1).
- **OUT2** – The event will be generated when a Rising Edge is detected on the Hardware Output Line GP OUT 2 (STROBE 2) (OUT2 event is supported by all cameras except for POE-C2000 and POE-C2400 models).

4 Configuring an Ethernet Adapter

For the best system performance, Imperx recommends to configure the following parameters of your network interface card (NIC): Jumbo Packets (Jumbo Frames), Receive/Transmit Buffers, Interrupt Moderation Rate (see Table 45). You also might need to disable Firewall, turn off power saving plan, and configure IP addresses for multiple NICs on the host computer.

Table 45: Network Adapter Parameters

Parameter	Value
Jumbo Packets (or Jumbo Frames)	9000 (or 9 KB MTU)
Receive Buffers (or Receiver Descriptors)	Maximum
Transmit Buffers	Maximum
Interrupt Moderation	Enable
Interrupt Moderation Rate (or Interrupt Throttling)	Extreme

See section 4.4 Configuring Ethernet Adapter in Windows 10 for adjusting procedures.

NOTE

The parameter names and configuring procedures depend on the adapter model and manufacturer and may differ from the ones described in this chapter. When adjusting the adapter parameters, select the ones that relate to the parameters listed in Table 45. For more information, please refer to the NIC documentation.

4.1 Jumbo Packets

Jumbo Packet (or **Jumbo Frame**) parameter allows for payload larger than the standard maximum transmission unit (MTU) of 1,500 bytes and supports up to 9,000 bytes per packet. Jumbo Packet is used to reduce overhead load per packet, decrease CPU load, increase data transfer rate. As fewer packets are needed to transfer data, the amount of interrupts decreases resulting in lower overall CPU usage.

Please make sure that each piece of your network equipment (cameras, switches, routers, Network Interface Cards (NICs)) supports Jumbo Packet and is configured to use the same frame size. If some network devices do not support Jumbo Packet, fragmentation and packet drops will occur.

Most network adapters have Jumbo Packets disabled. To enable Jumbo Packet, please follow the steps in section 4.4 Configuring Ethernet Adapter in Windows 10.

TIP

Imperx recommends to connect Cheetah GigE Vision camera to a dedicated Ethernet port and use Ethernet adapter that supports Jumbo Packets.

4.2 Receive/Transmit Buffers

Receive Buffers (or **Receive Descriptors**) and **Transmit Buffer** parameters set the amount of system memory that can be used by the adapter driver when copying data to the memory. Typically, it is set to a low value by default (usually 256). The insufficient number of receive/transmit buffers leads to the dropped packets (older packets will be overwritten). For maximum performance, Imperx recommends that you set these parameters as high as possible.

The maximum setting supports more packets, improves stability, and can be configured on the most systems without causing the memory deficiency. However, please keep in mind that it can negatively affect the servers with limited system memory.

NOTE

Receive/Transmit Buffers settings do not affect your system's CPU usage.

TIP

The Receive Buffers can be set up to 2048 and depends on the RAM available. Please make sure that the Transmit Buffers setting is double the Receive Buffers. Experiment with the settings until you achieve the best value appropriate for your system.

4.3 Interrupt Moderation Rate

Interrupt Moderation Rate (or Interrupt Throttling) sets the number of interrupts to the CPU when processing the transmitted and received packets.

Minimizing the interval between interrupts reduces the latency on each packet but increases CPU usage and decreases throughput. To minimize CPU usage, larger interrupt intervals are required.

Some NIC support only Interrupt Moderation setting, while the others support both Interrupt Moderation and Interrupt Moderation Rate.

When Interrupt Moderation setting is disabled, the interrupt is created for every packet, reducing the latency on each packet. However, this significantly increases CPU usage. Enabling the Interrupt Moderation setting allows for the multiple packets to be processed for each interrupt and helps to achieve lower CPU usage.

TIP

1. The Interrupt Moderation Rate can be set at about 8,000 (or Extreme) interrupts per second to achieve lower latency.
2. If some latency is acceptable, the Interrupt Moderation Rate can be set at about 1,000 (or Low) interrupts per second to achieve lower CPU usage.
3. Experiment with your system to determine the optimal setting. You can try the following options as well:
   - Use the default value set by the manufacturer's drivers.
   - Set NIC to adaptive interrupt moderation mode. In this mode, the interval is dynamically changed according to packet size and throughput.

4.4 Configuring Ethernet Adapter in Windows 10

4.4.1 Adjusting Jumbo Packets, Receive/Transmit Buffers, Interrupt Moderation Rate in Windows

1. Click **Start** icon ⟶ **Windows System** ⟶ **Control Panel**.
2. Click **Hardware and Sound** ⟶ **Devices and Printers** ⟶ **Device Manager**.
3. Expand **Network Adapters** list⟶ Right-click the Ethernet adapter that works with your camera ⟶ **Properties**.

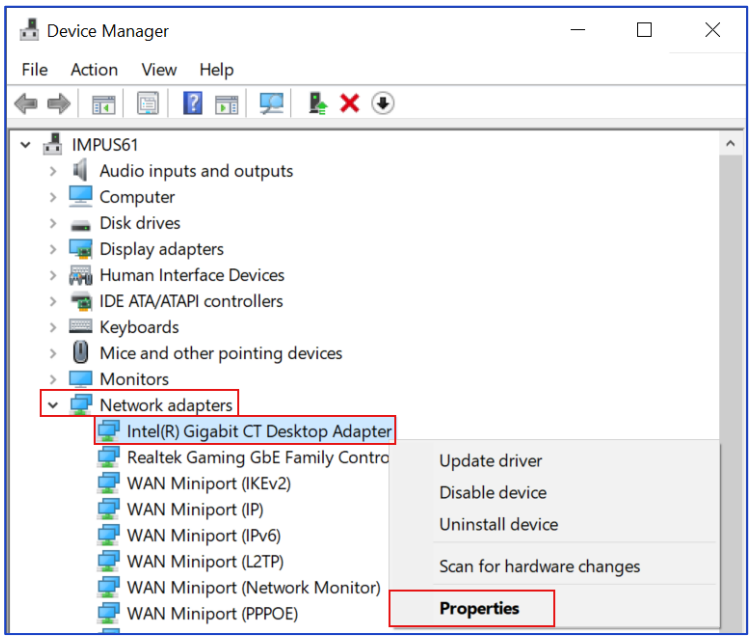


Figure 41: Selecting network adapter

4. On **Advanced** tab set the following parameters:
   - **Jumbo Packet** (or **Jumbo Frame**) ⟶ Set **Value** to *9014 Bytes* (or *9 KB MTU* – depends on NIC).
   - **Receive Buffers** (or **Receive Descriptors**) ⟶ Set to the maximum value possible.
   - **Transmit Buffers** ⟶ Set to the maximum value possible.
   - Interrupt Moderation ⟶ *Enable*.
   - **Interrupt Moderation Rate** (or **Interrupt Throttling**) ⟶ Set to *Extreme*.
     At higher data rates, the Extreme setting may improve system performance. At lower data rates, a Low setting is preferred, since delayed interrupts cause additional latency.

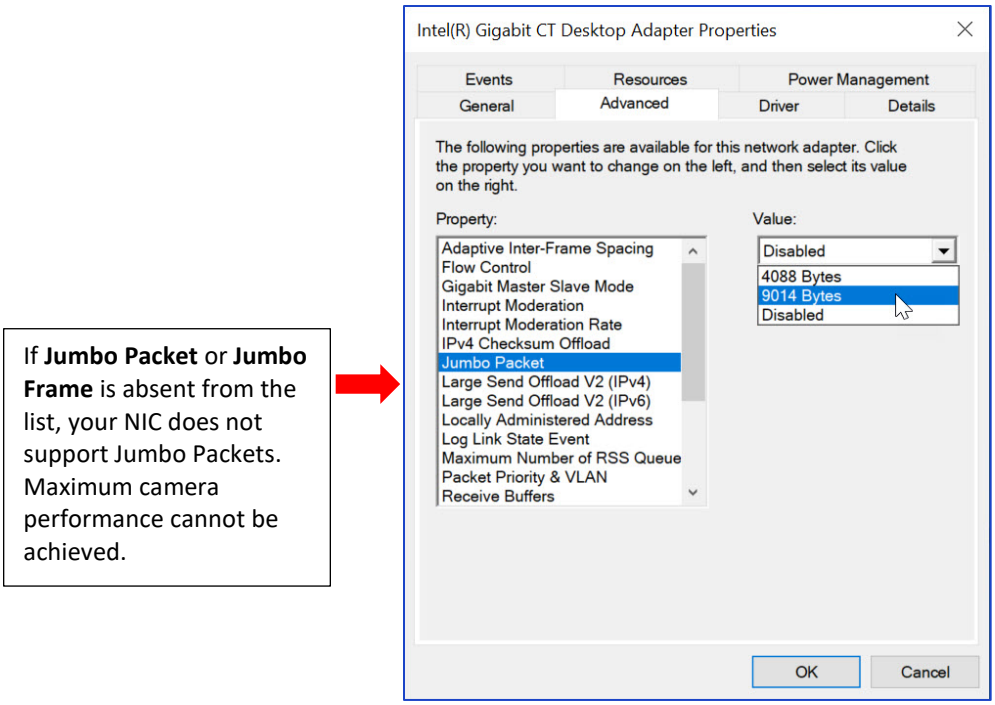


Figure 42: Adjusting network adapter properties

5. Click **OK**. The network connectivity may be lost for a couple of seconds.
6. Reboot your PC to ensure that new settings have been activated.

4.4.2 Disabling Windows Firewall

Firewalls can impact the efficiency of the systems with high bandwidth load. To test whether you are experiencing firewall issues, use the IpxPlayer application (See section 5.4 Connecting to Cameras).
In IpxPlayer, click the **Start** button to start streaming video from the camera. If the camera is connected, the Ethernet LEDs on the camera back panel and on your Ethernet switch are blinking. If you do not see images in IpxPlayer, you may be experiencing firewall issues.

To turn off Windows Firewall for all connections, follow the steps below.

1. Click **Start** icon → **Windows System** → **Control Panel**.
2. Click **System and Security** → **Windows Defender Firewall**
3. On the left panel, click **Turn Windows Defender Firewall on or off**. The **Customize settings** windows opens.
4. Select a network type that your camera is connected to, and click **Turn off Windows Defender Firewall (not recommended)**. Click **OK**.

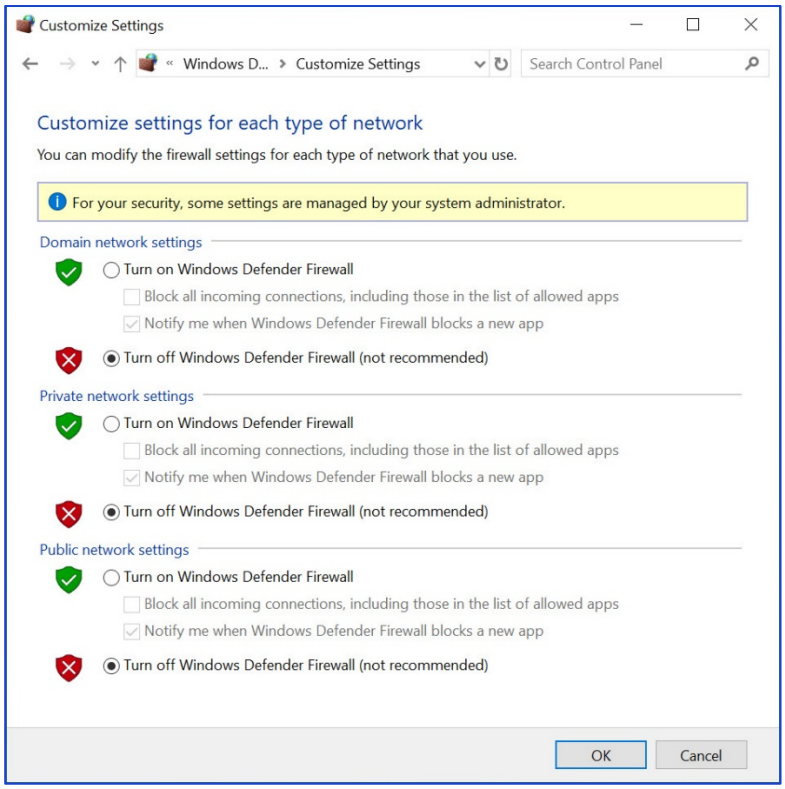


Figure 43: Customize Settings window

To turn off Windows Firewall for selected network adapters, follow the steps below.

1. Click **Start** icon → **Windows System** → **Control Panel**.
2. Click **System and Security** → **Windows Defender Firewall**.
3. On the left panel, click **Advanced settings**. The **Windows Defender with Advanced Security** windows opens.

4. Click **Windows Defender Firewall Properties**.

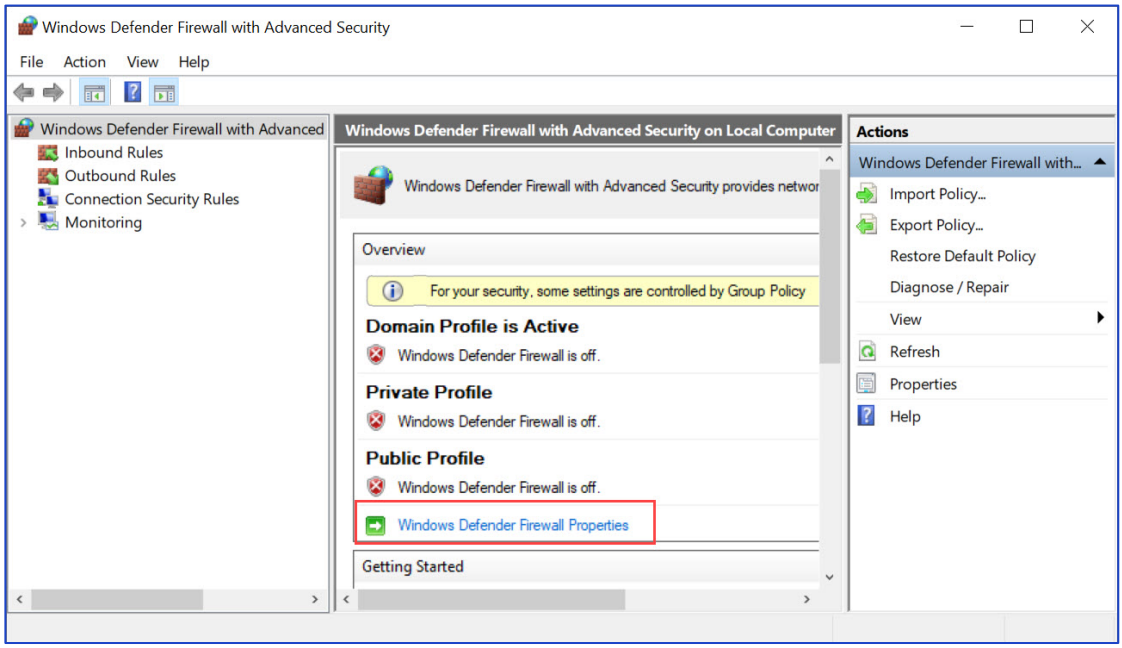


Figure 44: Windows Defender Firewall with Advanced Security

5. In the **Windows Firewall with Advanced Security on Local Computer Properties…** window, select the tab of the profile to turn off the firewall and click **Customize…** in the State section.

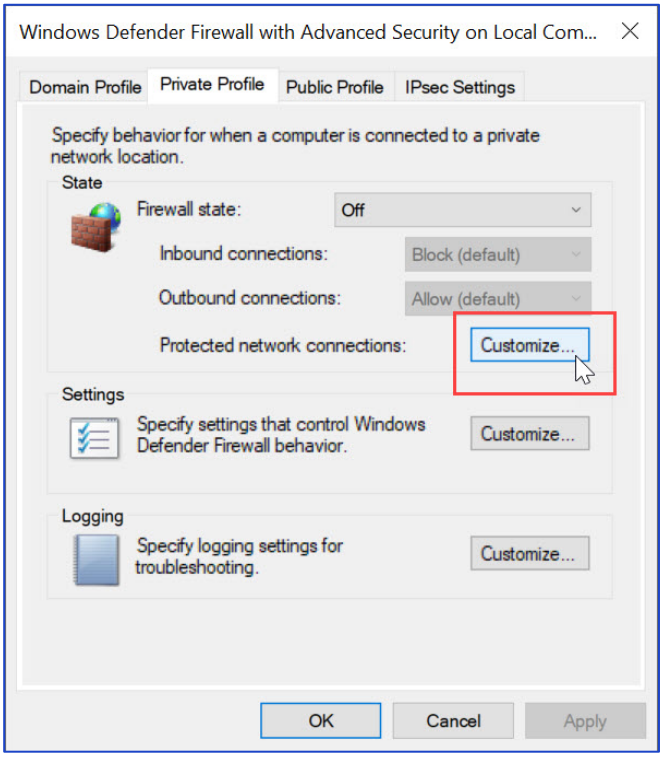


Figure 45: Customizing Private Profile

6. The **Protected Network Connections for the Private Profile** windows shows a list of the network connections with the firewall turned on. To disable firewall, uncheck those connections that contain your cameras. Click **OK.**

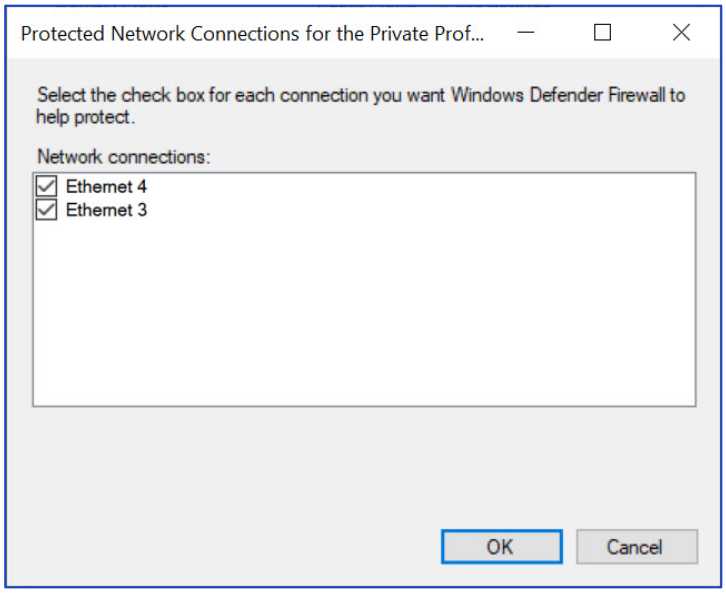


Figure 46: Protected Network Connections for the Private Profile

It is also recommended to turn off anti-virus scan and any third-party filter drivers, not to run Windows Performance Monitor (perfmon.exe) or Wireshark (use it solely for debugging purposes), and not to open the Networking tab in Windows Task Manager.

4.4.3 Multiple NICs in a Single Host PC

When several NICs installed in the same host PC, you must to assign a unique IP address to each NIC. You can use one of the following methods:

Method	When to use
1) Configure a dynamic IP address via DHCP	In networks with a DHCP server installed
2) Configure a static IP address	In networks without a DHCP server

TIP

1. Before assigning a dynamic IP address, please make sure that a DHCP server is installed in your network. The DHCP server assigns the IP address to each NIC with DHCP/Auto IP setting enabled.
2. If the DHCP server is not installed in the network, manually assign static IP addresses to each NICs and GigE Vision cameras.

4.4.3.1 Configuring a Static IP Address in Windows

To configure a static IP address:

1. Click **Start** icon → **Windows System** → **Control Panel**.
2. Click **Network and Internet** → **Network and Sharing Center**.
3. On the left panel, click **Change adapter settings**.
4. Right-click the Ethernet adapter that works with your camera → **Properties**.
5. Select Internet **Protocol Version 4 (TCP/IPv4)**, click **Properties**.

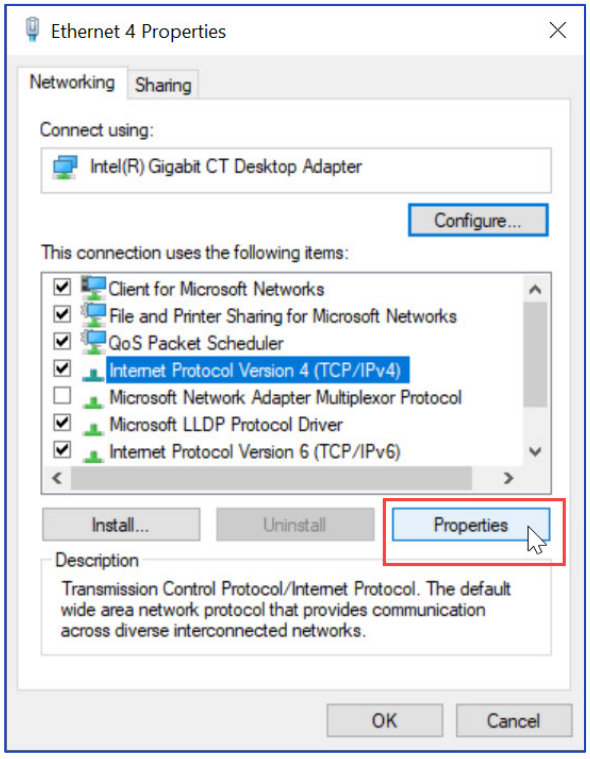


Figure 47: Ethernet adapter properties

6. Select **Use the following IP address** and assign an IP address to the network adapter. The **Default gateway** field should be blank.

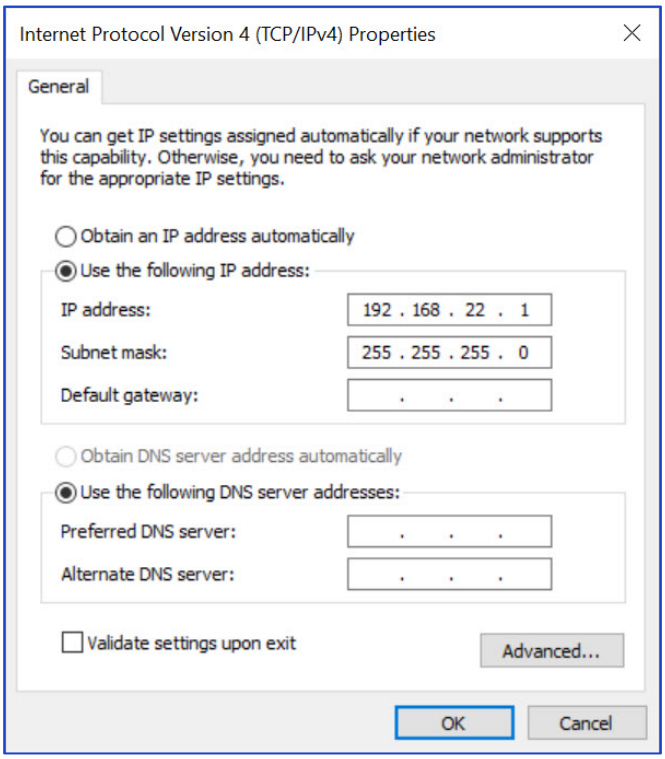


Figure 48: Assigning a static IP address

7. Click **OK**.
8. Repeat steps 4 – 6 for each NIC on your computer.

4.4.3.2 Configuring an IP Address Using DHCP in Windows

For a NIC to obtain an IP address automatically, follow the steps below.

1. Click **Start** icon → **Windows System** → **Control Panel**.
2. Click **Network and Internet** → **Network and Sharing Center**.
3. On the left panel, click **Change adapter settings**.
4. Right-click the Ethernet adapter that works with your camera → **Properties**.
5. Select Internet **Protocol Version 4 (TCP/IPv4)**, click **Properties**.

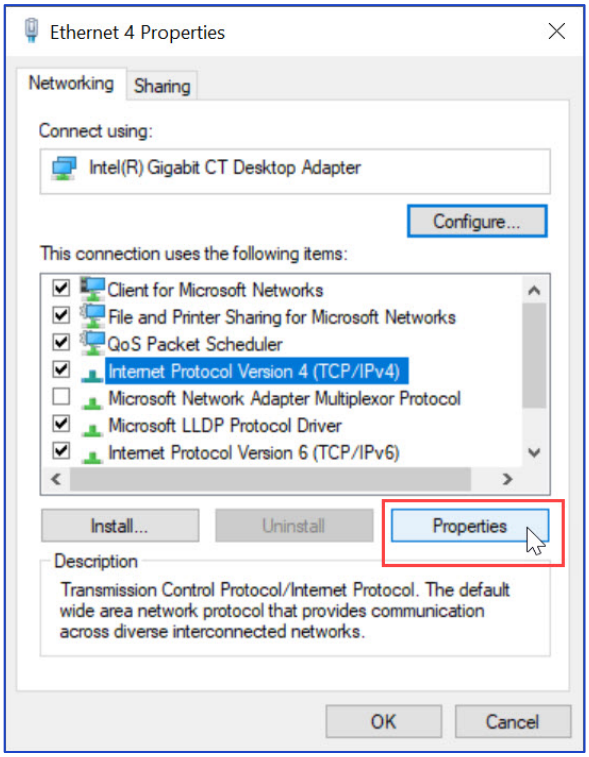


Figure 49: Ethernet adapter properties

6. Make sure that **Obtain an IP address automatically** is enabled.

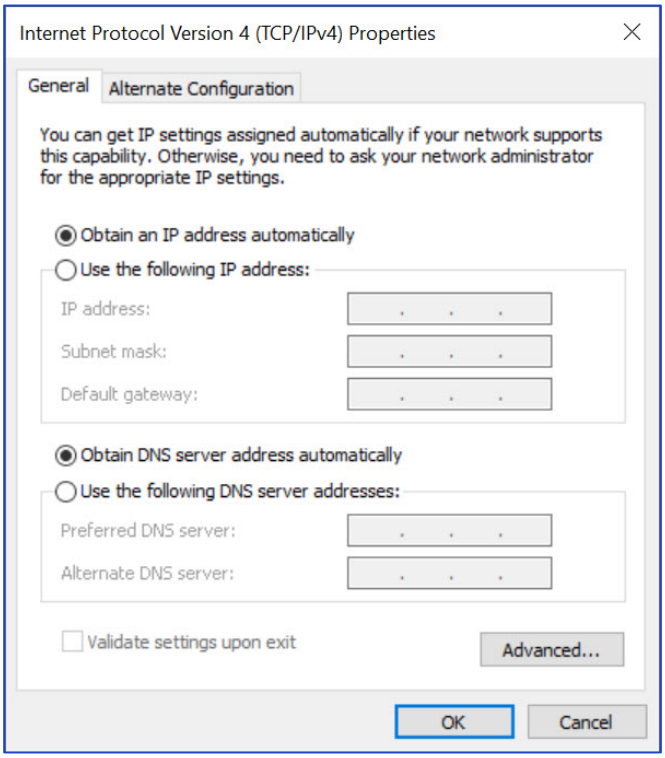


Figure 50: Configuring a dynamic IP address

NOTE

The DHPC server assigns a dynamic IP address to the NIC. If the server is not available, the IP address is assigned by the NIC itself. If more than one NIC have **Obtain an IP address automatically** setting enabled (set by default) and the DHPC server is not found, the IP addresses will not be assigned correctly which will lead to the lost connectivity with GigE Vision cameras.
If this is the case, re-configure the NICs to static IP addresses or install a DHPC server.

4.4.4 Configuring Power Management in Windows

For the applications with extended periods of image streaming, configuring power management is required. Typically, if there is no activity from the keyboard or mouse, the computer or NIC will go to sleep, and the image stream will be interrupted. To prevent Windows from powering down the NIC or computer, you need to change power plan settings.

To change power plan settings for the computer:

1. Click **Start** icon → **Windows System** → **Control Panel**.
2. Click **Hardware and Sound** → **Power Options**.
3. Next to the power plan, click **Change plan settings**.

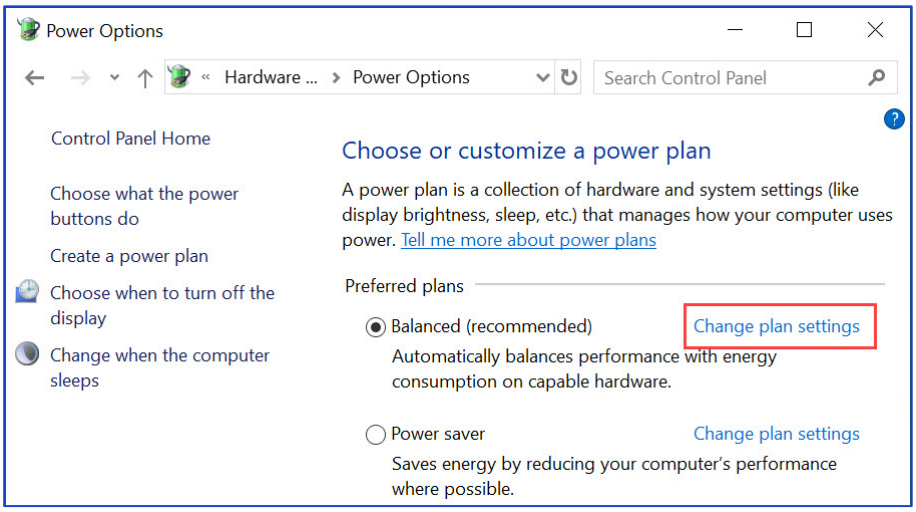


Figure 51: Power Options screen

4. In the **Put the computer to sleep** dropdown list select **Never** and click **Save changes**. **Turn off display** can be set to any value.

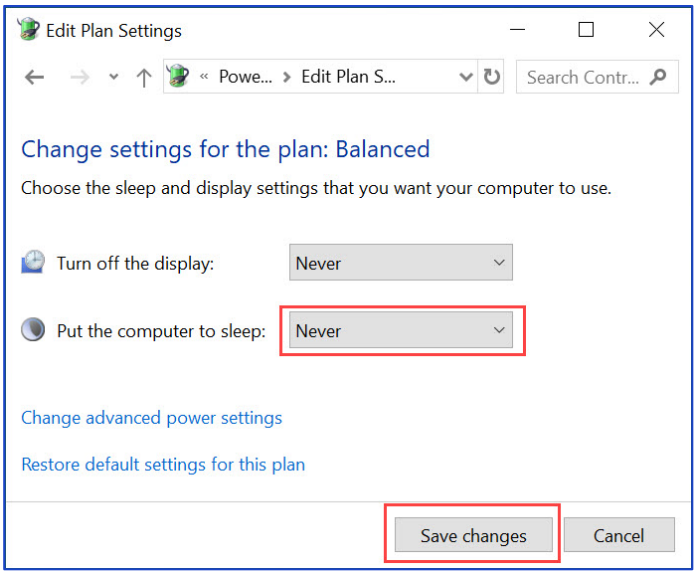


Figure 52: Configuring power plan settings

To change power plan settings for the NIC:

1. Click **Start** icon → **Windows System** → **Control Panel**.
2. Click **Network and Internet** → **Network and Sharing Center**.
3. On the left panel, click **Change adapter settings**.
4. Right-click the Ethernet adapter that works with your camera → **Properties**.
5. Click **Configure**. Adapter Properties window opens.
6. On the **Power Management** tab, uncheck the **Allow the computer to turn off this device to save power** option, click **OK**.
7. Repeat steps 4 – 6 for each NIC.

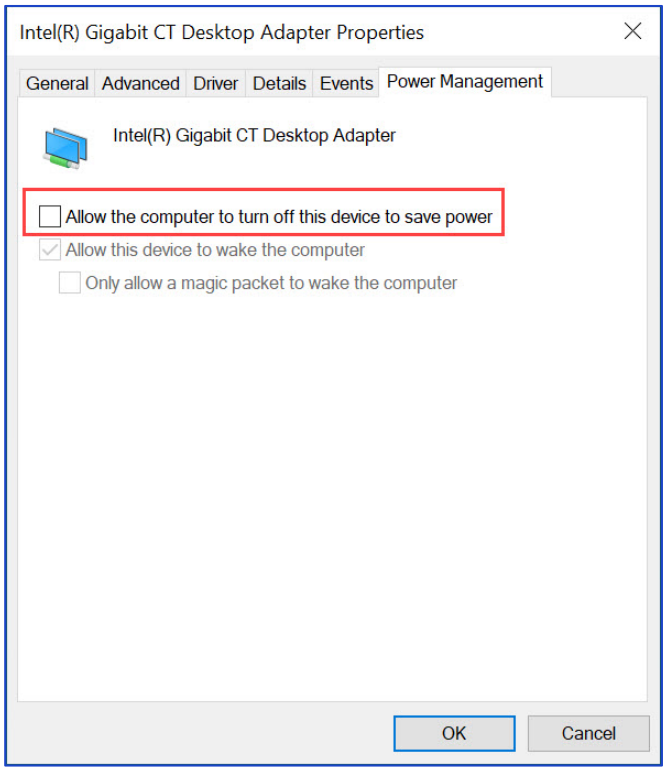


Figure 53: Configuring power management settings for the adapter

5 Software GUI

5.1 Overview

The IpxPlayer software application provides a graphical user interface (GUI) with functionality for controlling Imperx camera parameters, acquiring video, showing acquired video, and saving acquired images or video on the host computer.

The application also collects and displays statistical information on acquired images and generates a log of data transfers between the camera and the host computer.

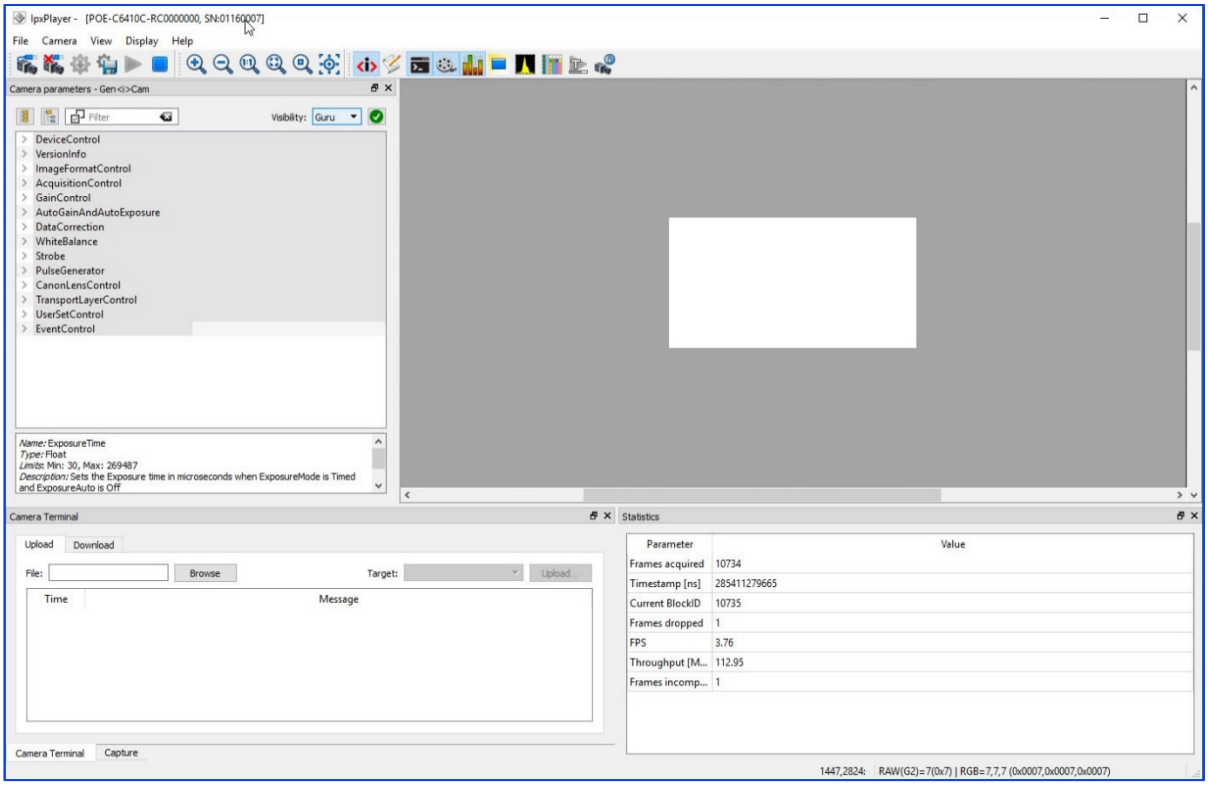


Figure 54: IpxPlayer graphical user interface

5.1.1 Supported Operating Systems

The IpxPlayer is compatible with the following operating systems:

- Windows 7, 32-bit and 64-bit
- Windows 8, 32-bit and 64-bit
- Windows 10, 32-bit and 64-bit
- Ubuntu Linux 16.04 64-bit
- Ubuntu Linux 16.04 64-bit, ARM CPU

5.1.2 Compatibility

The IpxPlayer is compatible with the Imperx GigE Vision cameras.

5.1.3 User Interface and Functionality

The IpxPlayer provides the following functionalities:

- Detects camera.
- Connects to the camera and will run multiple instances of applications.
- Controls camera parameters (gain, exposure, trigger, white balance, and so on) using the GenICam node tree GUI.
- Logs all protocol-related data (commands, images, events, and so on) transferred between the camera and host computer.
- Shows live video from the selected camera.
- Saves acquired video images or series of images to files.
- Saves and loads camera configuration files.

5.2 Installing the Software

Use the installation wizard to install the Imperx Camera SDK software supplied with your camera.

⚠CAUTION

If a previous version of the GUI software is installed on your computer, you must remove it before completing the installation. The installation wizard will do this for you during the installation process. Or, you can uninstall a previous version yourself.

To remove previous versions yourself:

1. Open **Control Panel** on your computer.
2. Select **Programs and Features**.
3. Select the software from the list.
4. Click **Uninstall**.

5.2.1 Installation

1. Locate the executable file (`IpxCameraSdk***.exe`) on the media that shipped with your camera.
2. Drag the file to your computer desktop. If a Security screen appears, click **OK**.

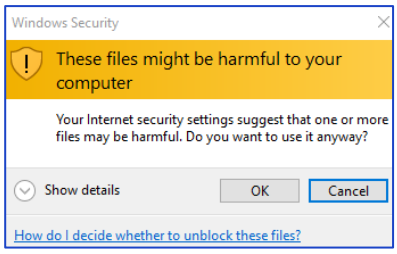


Figure 55: Security screen

3. Double click the executable file (`IpxCameraSdk***.exe`) on your desktop. The Welcome Setup screen opens. Note the recommendation to close other applications and then click **Next**.

Figure 56: Welcome Setup screen

4. When the License Agreement screen appears, read the agreement and click **I Agree**.

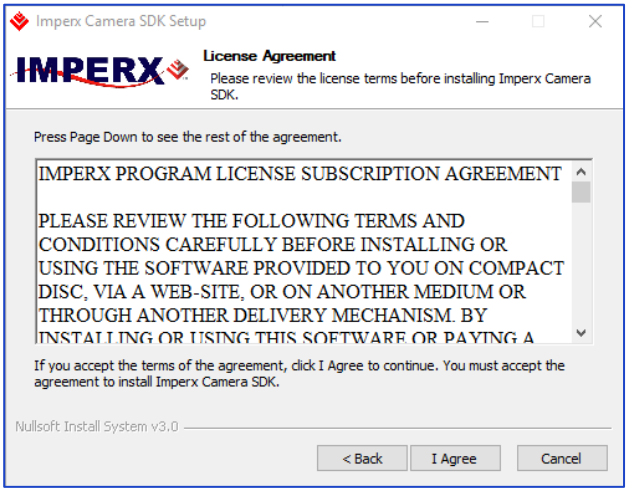


Figure 57: License Agreement screen

5. On the Choose Components screen, select all the Cheetah Camera SDK components and then click **Next**.

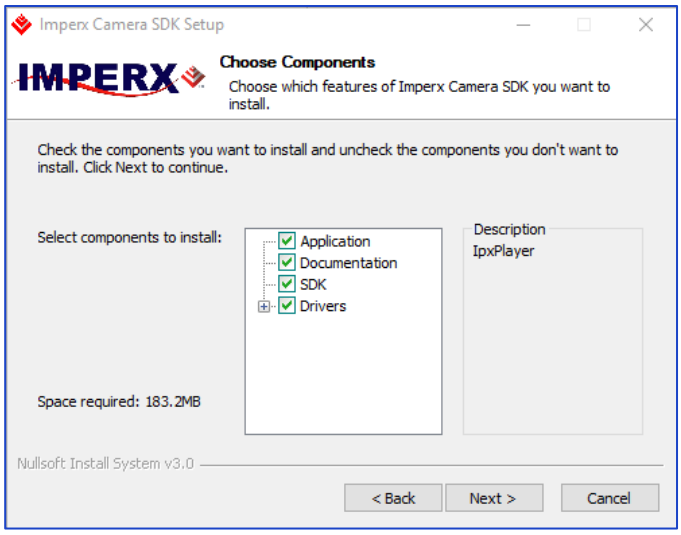


Figure 58: Choose Components screen

6. On the Choose Install Location screen, accept the default destination folder or click **Browse** and select a different location and then click **Next** and then **Install.** The installer prompts you to uninstall any existing versions of the software from your computer before continuing the installation.

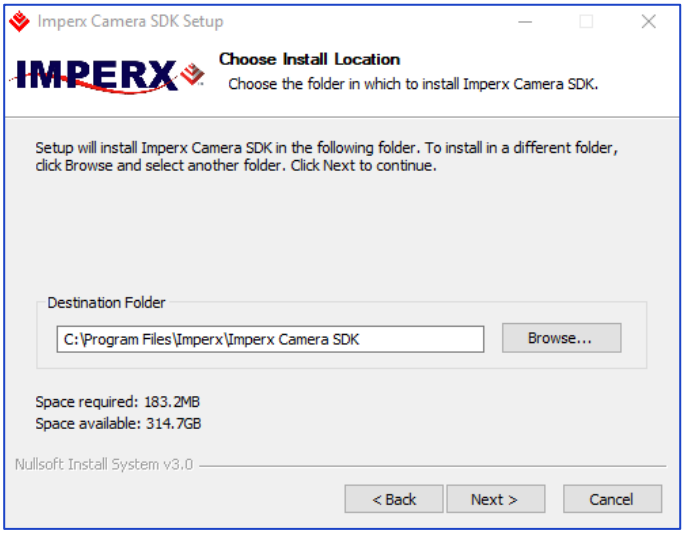


Figure 59 Choose Install Location screen

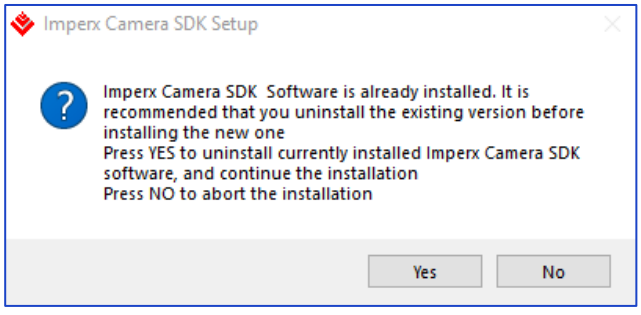


Figure 60: Uninstall any existing versions dialog

7. On the Installation Complete screen, select the check box to register your software and then click **Next**. When the Imperx website appears, complete the Subscriber Registration and click **Submit**.

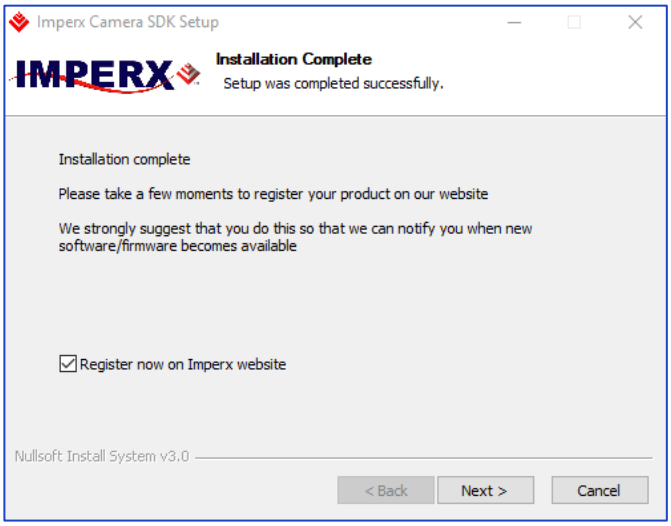


Figure 61: Installation Complete screen

8. On the Completing Imperx Camera SDK Setup screen, select Reboot now and click **Finish**. The Imperx IpxPlayer icon appears on your desktop.

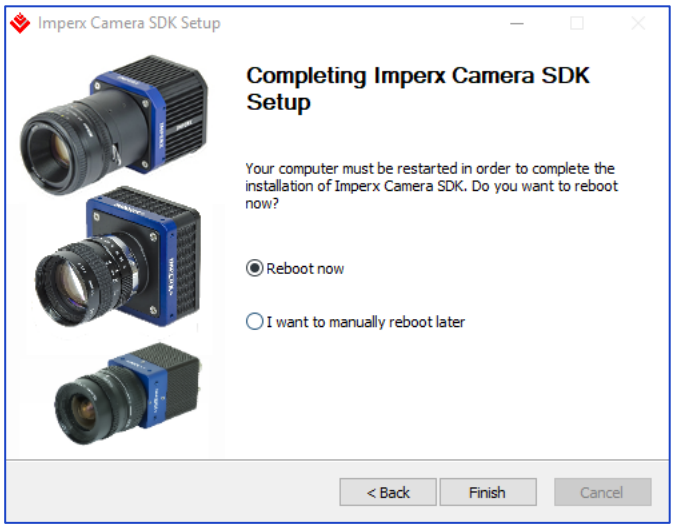


Figure 62: Completing Imperx Camera SDK Setup screen

Figure 63: IpxPlayer Icon

5.3 Camera SDK

The installation process places the Imperx camera SDK files on your computer's hard drive using following structure:

<InstallationFolder> – root SDK folder (usually, on the Windows OS, it is C:\Program Files\Imperx\Imperx Camera SDK\).

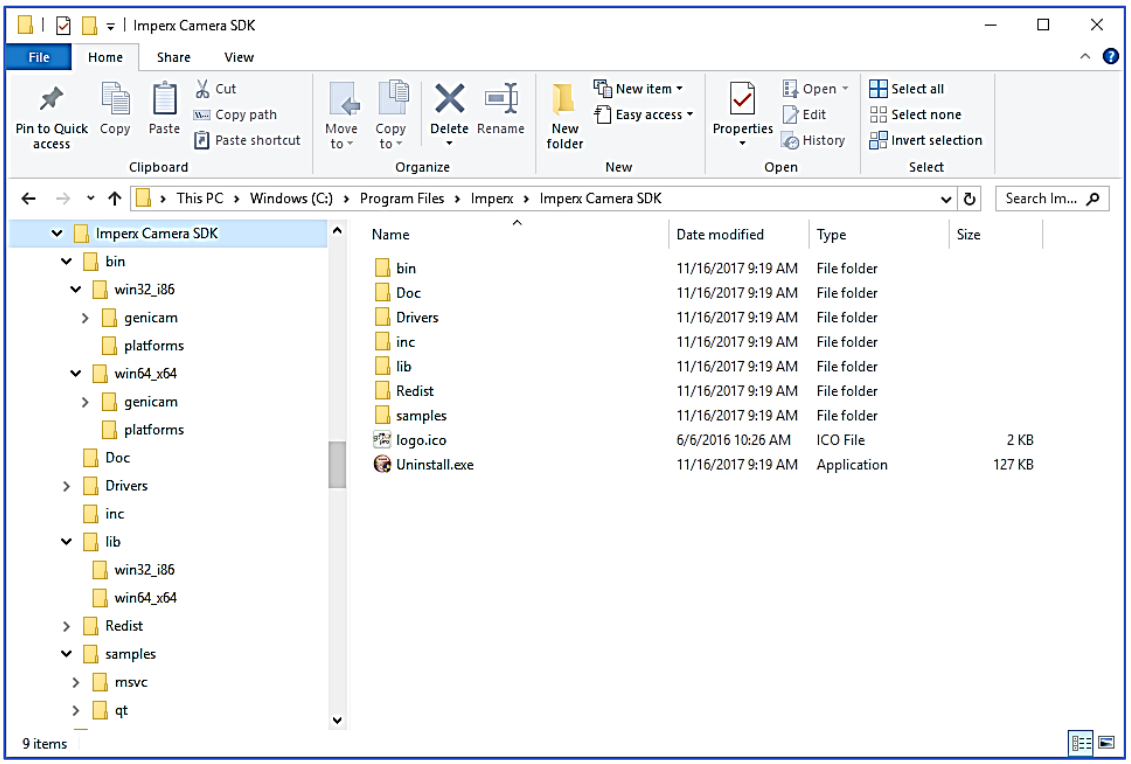


Figure 64: Imperx Camera SDK file locations on your computer

<InstallationFolder> **bin**\ – contains SDK binary executable files, including SDK dynamic libraries and IpxPlayer application executable
<InstallationFolder> **Doc**\ – contains SDK user manual files
<InstallationFolder> **inc**\ – contains SDK C++ header files
<InstallationFolder> **lib**\ – contains SDK C++ library files
<InstallationFolder> **samples**\ – contains SDK C++ samples
<InstallationFolder> **Drivers**\ – contains kernel drivers for Imperx USB3 cameras

5.4 Connecting to Cameras

The installation process places the IpxPlayer application shortcut on the computer desktop. Launch the application by double clicking the shortcut. The first task is to connect to a camera.

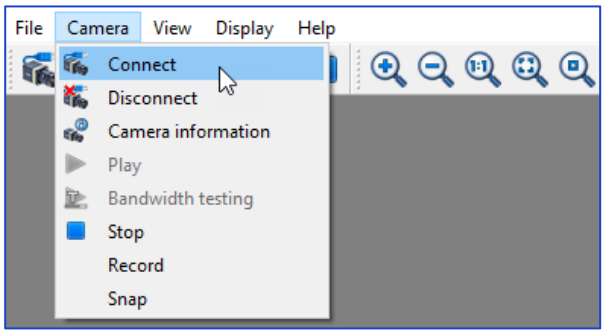


Figure 65: Connecting to a camera

To connect to a camera:

1. Locate and open the IpxPlayer from your desktop.
2. Click **Camera** menu and select **Connect** (or click the camera **icon** ).
   The Select Camera dialog appears. The dialog lists all connected cameras. The version number refers to the installed Imperx GUI driver.
3. Select a camera listed on the dialog. Camera information appears in the Device info section of the dialog.
4. Click **OK**. If needed, click **Rescan** to update the list of cameras.

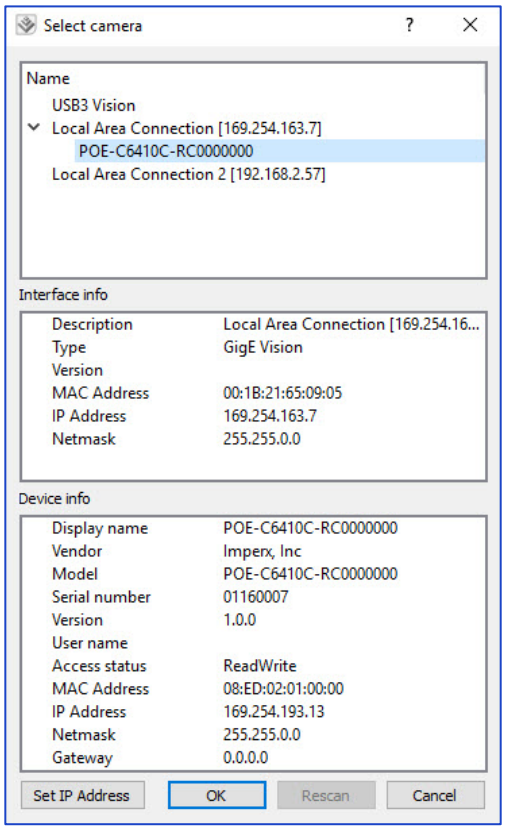


Figure 66: Select Camera dialogue

TIP

The first time you attempt to connect to the camera, you might need to set the IP address if IP Subnet Mismatch appears highlighted in red and the OK button is not available (as shown in the following figure).

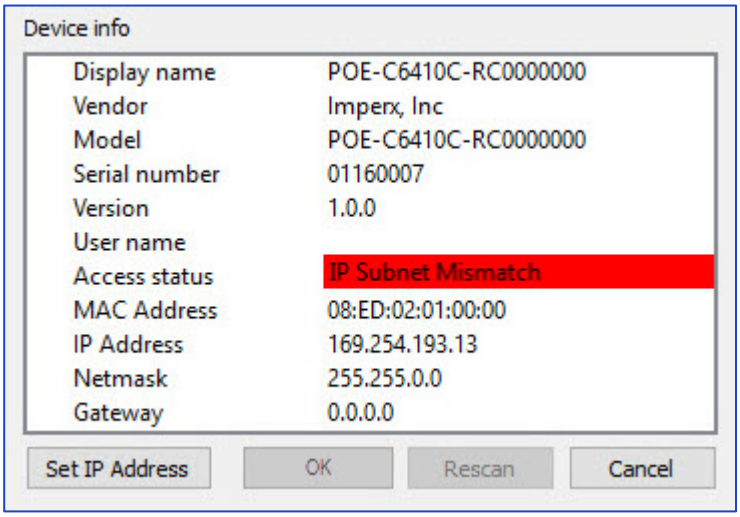


Figure 67: Access status showing IP Subnet Mismatch

To Set the IP Address:

1. Click **Set IP Address**.
2. When the Set IP Address screen appears, click **OK**.
3. On the Select Camera screen, click **OK**.

After the camera connects, click the play icon on the IpxPlayer to begin capturing and displaying images.

5.5 Using the IpxPlayer

The IpxPlayer displays and controls camera features and attributes based on an XML file stored in Flash memory inside the camera. The main window provides access to menus, shortcut icons, camera parameters, live images, capture options, a log, and camera statistics. You can customize the screen by closing, resizing, or hiding certain sections. Click **Log** at the bottom of the screen to see recent data transfers to or from the connected camera.

5.5.1 Menu Bar

The menu bar provides File, Camera, View, and Display options. Icons below the menu bar provide quick access to many of the menu bar functions. You can display an icon's function by rolling the computer cursor over it.

5.5.1.1 File Menu

Load Configuration		Opens the Open File dialog for loading a Camera Configuration file.
Save Configuration		Saves changes to an opened configuration file.
Save Configuration As		Opens the Save File dialog for saving the Camera Configuration file with a user-specified file name.
Exit		Closes the application.

5.5.1.2 Camera Menu

Connect		Opens the Connection dialog for connecting to a camera.
Disconnect		Disconnects the camera.
Camera Information		Displays Camera Information including model, version, sensor type, firmware version, XML version, and so on.
Play		Starts live video.
Bandwidth testing		Allows you to find the optimal Pixel Clock value for given interface bandwidth
Stop		Stops live video.
Record		Toggles video recording start/stop on the computer's hard drive.
Snap		Captures one image and saves it to the computer's hard drive.

5.5.1.3 View Menu

GenICam Tree		Shows/hides the camera control GenICam tree panel.
Log		Shows/hides the camera control Log panel (Control, Stream, Events).
Capture		Shows/hides the Capture panel.
Statistics		Shows/hides the Statistics panel.
Inspection View		Opens a window showing a portion of the image. Use Inspection View sliders to reposition the view of your image. Drag to reposition the window.

5.5.1.4 Display Menu

Zoom IN		Increases the zoom by 25 percent around the center of the image when clicked.
Zoom OUT		Decreases the zoom by 25 percent around the center of the image when clicked.
Actual Size (100%)		Sets zoom to 1:1 in the center of the image.
Fit to Window		Scales the image to fit within the window height while maintaining aspect ratio.
Spread to Window		Scales the image width to fit across the display window while maintaining the image aspect ratio.
Center Image		Moves the center of the image to the center of display window.

5.6 Saving and Loading Configurations

The File menu provides a **Save As** function for configuration changes made in the camera parameters section of the screen. Saved configurations on the host computer have a file extension of `.iccf`.

You can share these files with other users by email and other file transfer methods. You can load saved configurations into the IpxPlayer at any time.

To save a configuration:

1. Select the **File** menu.
2. Select **Save Configuration as**.
3. Navigate to location on your host computer.
4. Create a file name.
5. Click **Save**.

To load a configuration:

1. Select the **File** menu.
2. Select **Load Configuration**.
3. Navigate to the folder containing the file.
4. Click **Open.**

5.7 Camera Parameters Panel

The GenICam node tree displays the camera's available configuration parameters. Use the Visibility drop-down to select an access level of Basic, Expert, or Guru.

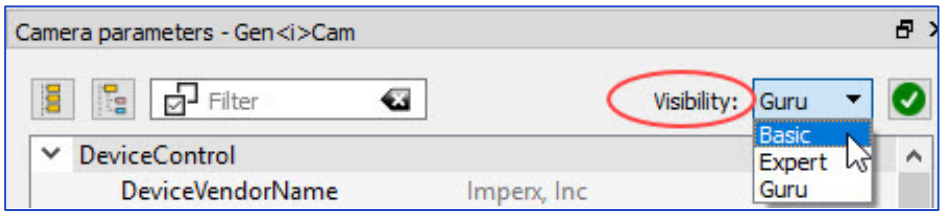


Figure 68: Select an access level

5.7.1 Device Control

The Device Controls parameters provide information about the camera:

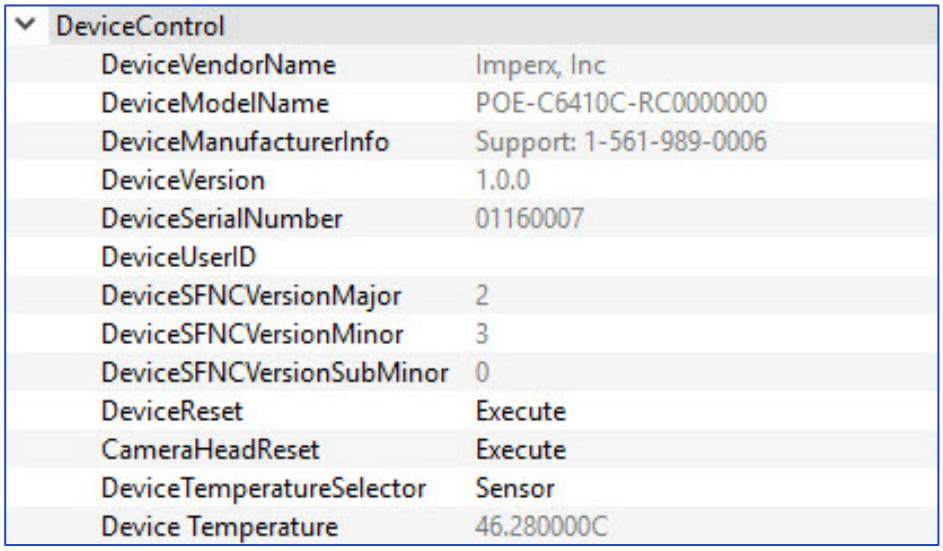


Figure 69: Device control parameters

DeviceVendorName	Imperx, Inc.
DeviceModelName	Full camera part number.
DeviceManufactureInfo	Imperx technical support: 561-989-0006
DeviceVersion	Camera Hardware version.
Device Serial Number	Camera serial number.
DeviceUserID	User-defined camera name.
Device SFNC Version Major	The major version number of the GenICam Standard Features Naming Convention.
Device SFNC Version Minor	The minor version number of the GenICam Standard Features Naming Convention.
Device SFNC Version Sub Minor	The sub major version number of the GenICam Standard Features Naming Convention.

DeviceReset	Resets the entire camera, including communications.
CameraHeadReset	Resets only the image sensor to default.
DeviceTemperatureSelector	Selects the location within the camera where the temperature will be measured.
Current Temperature	Returns the current camera temperature in degrees Celsius.

5.7.2 Version Info Controls

The camera contains non-volatile memory that stores manufacturing related information. The factory programs this information during the manufacturing process.

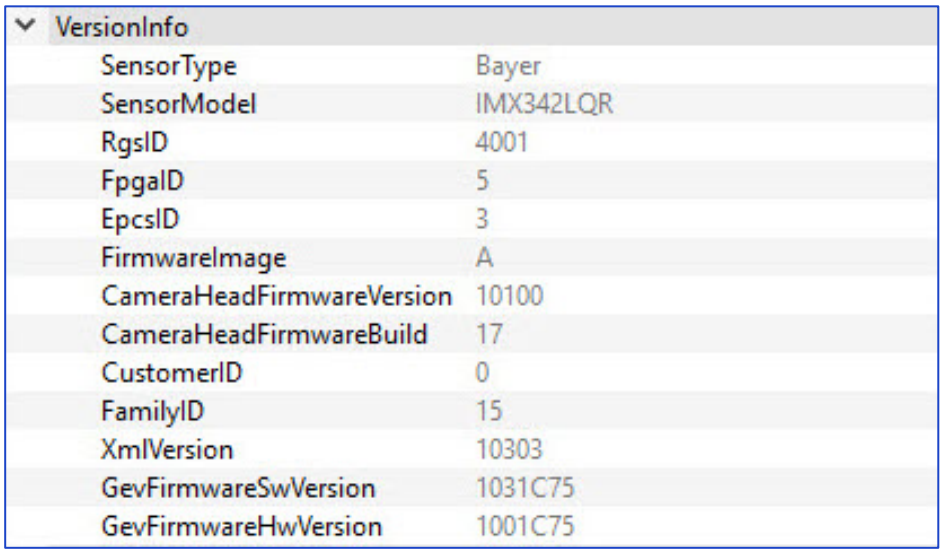


Figure 70: Version info parameters

SensorType	Returns the CMOS sensor type: Bayer Color or Monochrome
SensorModel	Returns the CMOS sensor model.
RgsID	The camera's register ID number.
FpgaID	Shows the field-programmable gate array (FPGA) ID (0=EP4C25, 1=EP4C40, 3=5CEFA4).
EpcsID	Shows the EPCS ID (0=EPCS16, 1=EPCS64, 2=EPCS128).
FirmwareImage	The Firmware Image ID (F=Factory or A=Application).
CameraHeadFirmwareVersion	The Firmware version number.
CameraHeadFirmwareBuild	The Firmware build number.
CustomerID	The Customer ID for custom firmware (0=Imperx standard firmware).
FamilyID	The Family ID.
XmlVersion	The version of the XML file.
GevFirmwareSwVersion	Displays the camera's firmware software version.
GevFirmwareHwVersion	Displays the camera's firmware hardware version.

5.7.3 Image Format Controls

Provides information on the camera base resolution and output resolution.

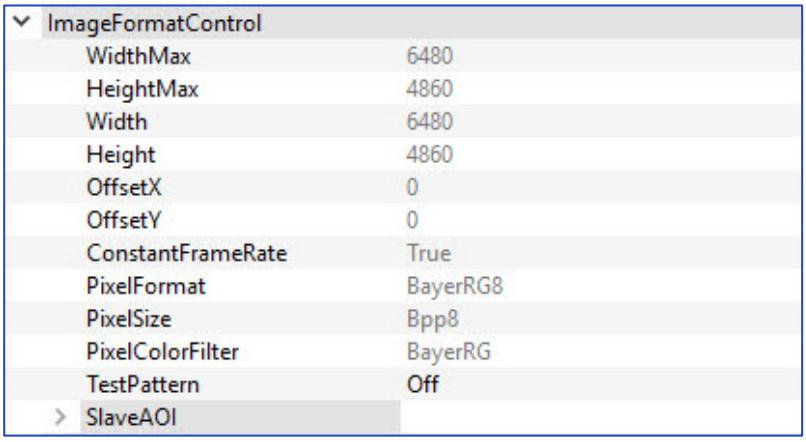


Figure 71: Image format control parameters

WidthMax Maximum width of the image in pixels calculated after horizontal binning, decimation, or any other functions change horizontal dimension of image.

HeightMax Maximum height of image in pixels calculated after vertical binning, decimation, or any other functions change vertical dimension of image.

Width Allows you to create an AOI: sets the output image width in number of pixels (multiples of 8).

Height Allows you to create an AOI: sets the output image height in number of lines (multiples of 2).

OffsetX AOI Offset in horizontal dimension: Enter the number of pixels to offset the image output from the left edge of the image. The number must be a multiple of 8.

OffsetY AOI Offset in the vertical dimension: Enter the number of pixels to offset the image output from the top of the image.

ConstantFrameRate Allows you to enable Constant Frame Rate independent of AOI size.

PixelFormat The number of bits of memory associated with each pixel. Options are: Mono8, Mono10, Mono10Packed, Mono12, Mono12Packed, BayerRG8, BayerRG10, RayerRG12, BayerRG10Packed, BayerRG12Packed.

PixelSize Number of bits per pixel in memory (8, 10, or 12 bits).

PixelColorFilter Shows the color filter pattern.

TestPattern Enables test patterns based on the following selections: BwCheckerBoard, Grey, TapSegmented, GreyHorizontalRamp, GreyVerticalRamp, HorizontalAndVerticalRamp, VerticalBars, HorizontalAndVerticalRampMoving, Crosshair, IpxGevPattern (refer to the section 6.15 Test Image Pattern for more information).

5.7.3.1 Slave AOI

Slave AOI is disabled in POE-C2000 and POE-C2400 cameras.

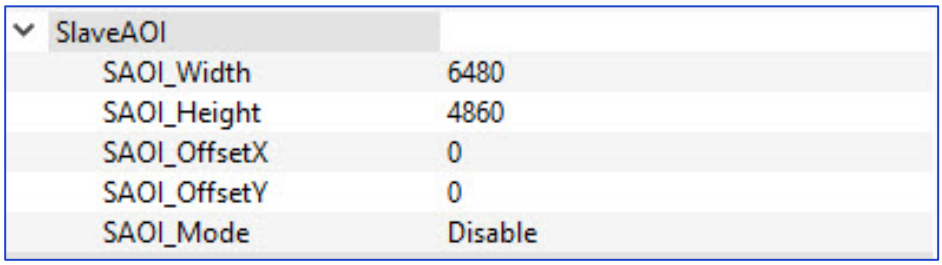


Figure 72: Slave AOI parameters

SAOI_Width Sets a SAOI width in number of pixels (multiples of 8).

SAOI_Height Sets a SAOI height in number of lines (multiples of 2).

SAOI_OffsetX Sets horizontal offset from the origin to the Slave AOI. The number must be a multiple of 8.

SAOI_OffsetY Sets vertical offset from the origin to the Slave AOI (in pixels).

SAOI_Mode Sets Slave AOI mode. Options are: Disable, Include, Exclude, AEC_AGC_Include, AEC_AGC_Exclude, AWB_Include, AWB_Exclude, LUT_Include, LUT_Exclude (refer to the section 6.11.3 Slave AOI for more information on SAOI mode).

5.7.4 Acquisition Control

Acquisition Control determines the data flow between the camera and the computer.

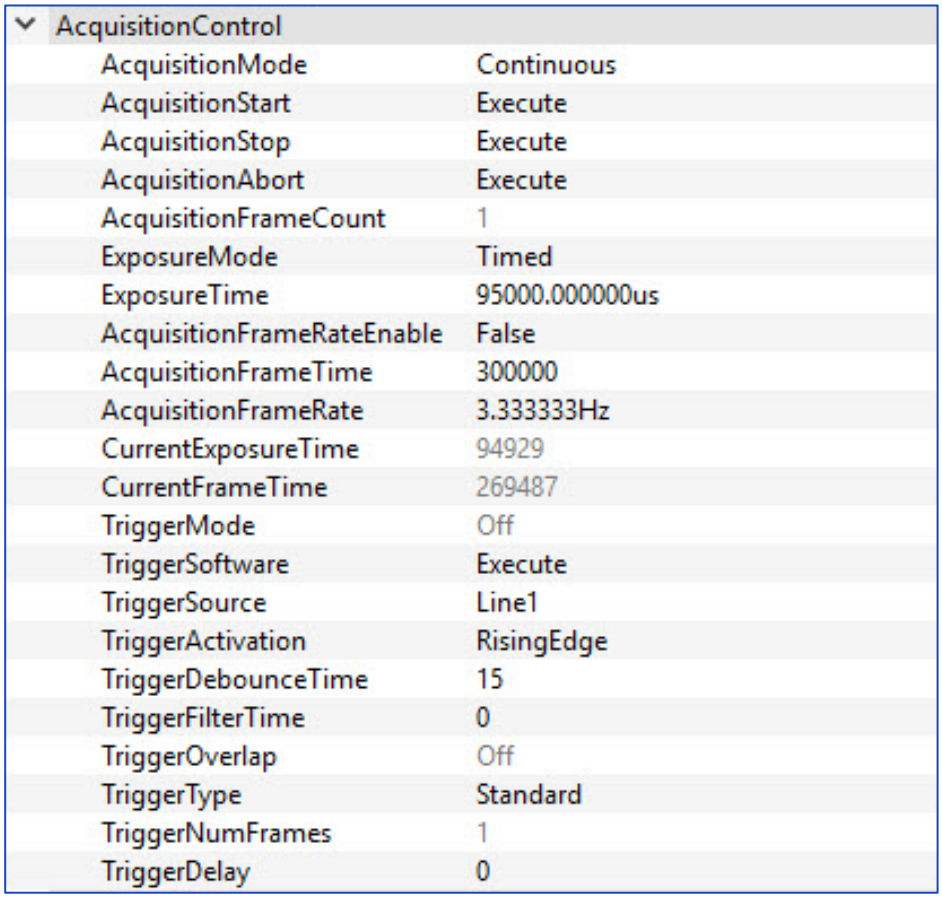


Figure 73: Acquisition control parameters

AcquisitionMode — Supports three modes of acquiring images: SingleFrame, MultiFrame, and Continuous (refer to the section 6.4 Acquisition Control for more information on acquisition control).

AcquisitionStart — Starts the acquisition of the device.

AcquisitionStop — Stops the acquisition of the device at the end of the current frame.

AcquisitionAbort — Aborts acquisition immediately, but a partially transferred image will be completed. If acquisition is not in progress, command is ignored.

AcquisitionFrameCount — Lets you enter the number of frames to acquire when using the MultiFrame Acquisition mode.

ExposureMode — Sets the operation mode of the exposure. Options are: Off, Triggerwidth, Timed (refer to the section 6.1 Exposure Control for more information on exposure modes).

ExposureTime — Sets the exposure time in microseconds when Exposure Mode is set to Timed and ExposureAuto is Off.

AcquisitionFrameRateEnable:	Controls the acquisition frame rate/frame time. If this mode is On, you can extend frame time beyond the free-running frame time.
AcquisitionFrameTime	Allows you to set the actual frame time in microseconds. Changes to Acquisition Frame Time affect the Acquisition Frame Rate setting.
AcquisitionFrameRate	Allows you to set the acquisition rate (in Hz with a precision of 0.01 Hz) at which the frames are captured. Changes to Acquisition Frame Rate affect the Acquisition Frame Time setting and vice versa.
CurrentExposureTime	This is a read-only feature providing a real-time monitor of the camera exposure time in micoseconds.
CurrentFrameTime	This is a read-only feature providing a real-time monitor of the camera output period in micoseconds.
TriggerMode	Enables or disables the triggering operation. A trigger initiates an exposure then readout sequence. Triggers received prior to completion of this sequence are ignored.
TriggerSoftware	The Start SW Trigger command instructs the camera to generate one short trigger pulse to capture and read out one frame when TriggerSource is set to Software.
TriggerSource	Specifies the internal signal or physical input line to use as trigger source. Options are Line1, Line2, PulseGenerator, and Software (Software is a single frame capture using internal exposure setting). Refer to the section 6.9.2 Trigger Sources for more information on trigger sources.
TriggerActivation	Sets the triggering edge to Rising or Falling.
TriggerDebounceTime	Sets the trigger signal de-bounce time. Subsequent trigger signals coming to the camera within the de-bounce time interval are ignored.
TriggerOverlap	Sets trigger overlap mode to Off (default). If the camera receives a trigger pulse while the previous trigger is still being processed, the camera ignores this pulse.
TriggerType	Sets the trigger to Standard or Fast. Fast trigger enables exposure and readout overlap. Standard trigger sets sequential exposure and readout.
TriggerNumFrames	Sets number of frames to capture per trigger. (Available in Standard Trigger mode only).
TriggerDelay	Sets the delay time in microseconds between the trigger pulse and the start of exposure.

5.7.5 Gain Controls

These parameters define analog and digital gain controls.

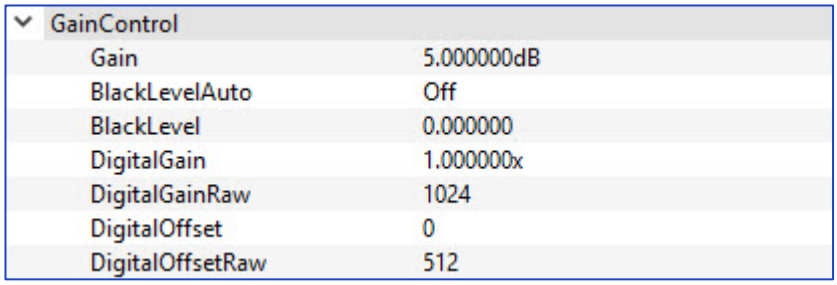


Figure 74: Gain Control

Gain Sets analog/digital gain from 0 to 48 dB with 0.1 dB step.

BlackLevelAuto Automatically adjusts the black level based on measurements of the dark reference lines at the start of each frame.

BlackLevel This represents a DC offset applied to the video signal. Values can range from 0 to 255.

DigitalGain Sets digital gain from 1x to 4x.

DigitalGainRaw Allows finer control of the DigitalGain. You can control the digital gain by 0.00097x per step from 1024 to 4095. Refer to section 6.5.1 Digital gain for more information on determining raw values.

DigitalOffset The offset is a digital count added or subtracted from each pixel's digital value. The range is -512 to +511 counts

DigitalOffsetRaw Controls the DigitalOffset in raw units.

5.7.6 Auto Gain and Auto Exposure

You can set the camera to automatic exposure control (AEC) to keep the same image brightness during changing light conditions. You can enable both AEC and automatic gain control (AGC) independently or together. Auto gain and auto exposure controls let you control the range of exposure times and gain values used by placing minimum and maximum limits on these parameters. When both AEC and AGC are enabled together, exposure times are varied until the maximum exposure time limit is reached, then gain is applied.

The POE-C2000 and POE-C2400 cameras do not support AGC and AEC.

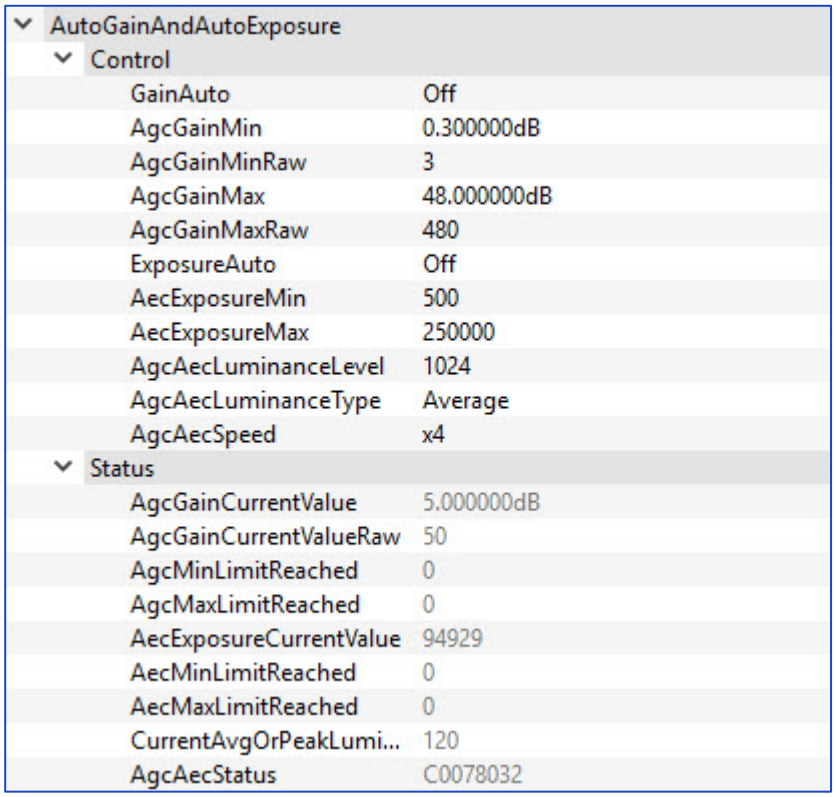


Figure 75: Auto Gain and Auto Exposure

5.7.6.1 Control Settings

GainAuto — Enables automatic gain control. After selecting Continuous, the camera constantly adjusts gain to achieve the luminance target level (AgcAecLuminanceLevel). When AGC is disabled, the gain defaults to the DigitalGain set in the Gain Control panel.

AgcGainMin — Sets the minimum gain when GainAuto is Continuous (step is 0.1 dB).

AgcGainMinRaw — Sets the minimum gain in RAW units.

AgcGainMax — Sets the maximum gain (up to 48 dB in 0.1 dB steps).

AgcGainMaxRaw — Sets the maximum gain in RAW units.

ExposureAuto — Enables automatic exposure control. After selecting Continuous, the camera constantly adjusts the exposure to achieve the luminance target level (AgcAecLuminanceLevel). When AEC is disabled, the

exposure defaults to the Exposure settings specified in the Acquisition control parameters panel.

AecExposureMin Sets the minimum exposure time value in microseconds.

AecExposureMax Sets the maximum exposure time value in microseconds.

AgcAecLuminanceLevel Sets the desired luminance level to be maintained during AGC or AEC or both assuming 12-bits per pixel.

AgcAecLuminanceType Sets how the luminance target is calculated in AGC or AEC. Options are Average or Peak.

AgcAecSpeed Sets speed AEC/AGC tracking speed. 4x is fastest, 1x is slowest.

5.7.6.2 Status Settings

AgcGainCurrentValue Shows current status of digital gain value calculated in AGC mode in dB.

AgcGainCurrentValueRaw Shows current status of digital gain value calculated in AGC mode in RAW units.

AgcMinLimitReached Shows status of whether minimum digital gain limit was reached while in AGC mode.

AgcMaxLimitReached Shows status of whether maximum digital gain limit was reached while in AGC mode.

AecExposureCurrentValue Shows status of exposure value in microseconds, calculated by the camera in AEC mode.

AecMinLimitReached Shows status of whether the minimum exposure limit was reached during AEC mode.

AecMaxLimitReached Shows status of whether the maximum exposure limit was reached during AEC mode.

CurrentAvgOrPeakLuminance Shows the current status of average or peak luminance.

AgcAecStatus Internal camera use.

5.7.7 Data Correction Controls

These parameters enable data correction and image improvements with Look-up tables and file corrections.

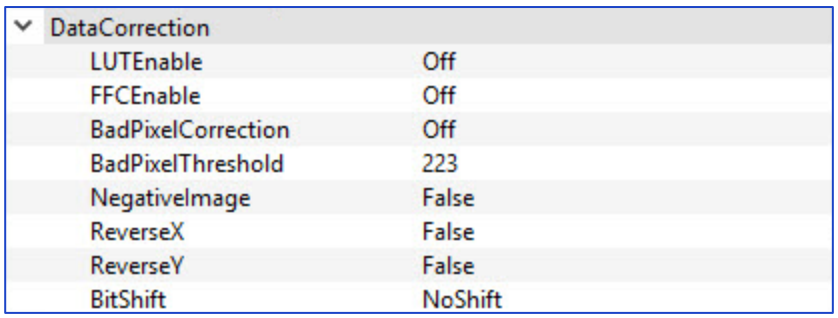


Figure 76: Data correction parameters

LUTEnable Selects LUT to be used in processing image (LUT1 – LUT4). LUT1 and LUT3 are pre-programmed with Gamma 0.45, LUT2 and LUT 4 are preprogrammed with negative LUT.

FFCEnable Selects FFC to be used in processing image. FFC1 has a factory preset correction. FFC2 can be created and loaded by the User.

BadPixelCorrection Provides the following correction modes: Factory, Dynamic, Factory and Dynamic, User, User and Dynamic.

BadPixelThreshold Sets the threshold for dynamic bad pixel correction. The sensitivity increases as the value decreases. You should set the BadPixelThreshold using the longest expected exposure time with the longest expected frame time at the maximum expected ambient temperature. The camera should be warmed up for 10 minutes prior to determining the desired threshold.

NegativeImage Inverts the image from positive to negative.

ReverseX Horizontally flips the image sent by the camera. The AOI is applied after the flipping.

ReverseY Vertically flips the image sent by the camera. The AOI is applied after the flipping.

BitShift Shifts the data output bits left or right. Options are: NoShift, OneBitRight, TwoBitsRight, ThreeBitsRight, FourBitsRight, FiveBitsRight, SixBitsRight, SevenBitsRight, OneBitLeft, TwoBitsLeft, ThreeBitsLeft, FourBitsLeft, FiveBitsLeft, SixBitsLeft, SevenBitsLeft.

5.7.8 White Balance Controls

White balance compensates for differences in the color temperature of light sources. The IpxPlayer enables color adjustments that preserve the original color so white objects appear white (also, see section 6.16 Color Control).

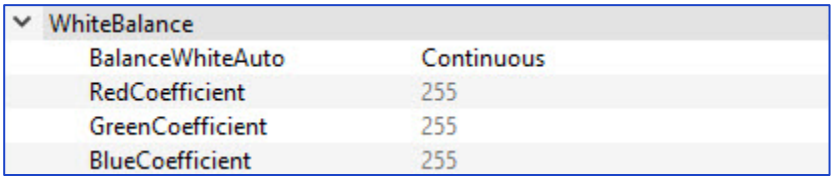


Figure 77: White balance parameters

BalanceWhiteAuto Selects the white balance mode with the following options: Off, Once, Continuous or Manual. In Once mode, the camera determines the red, green, and blue coefficients one time and applies them to subsequent frames. In Auto mode, the camera continuously computes the red, green, and blue coefficients to achieve good color reproduction. In manual mode, you define and manually enter the coefficients.

RedCoefficient This applies the white balance correction coefficients for Red used in manual mode. In manual mode, you enter the value. In Once or Auto modes, the camera returns the actual (calculated) coefficient. Coefficient values range from 0 to 4095.

GreenCoefficient This applies the white balance correction coefficients for Green in manual mode. In manual mode, you enter the value. In Once or Auto modes, the camera returns the actual (calculated) coefficient. Coefficient values range from 0 to 4095.

BlueCoefficient This applies the white balance correction coefficients for Blue in manual mode. In manual mode, you enter the value. In Once or Auto modes, the camera returns the actual (calculated) coefficient. Coefficient values range from 0 to 4095.

5.7.9 Strobe Controls

These registers enable and control the two available strobes. Strobe signals map to one or both of the available strobe outputs. Please remember that some cameras have only one output available (see Table 19).

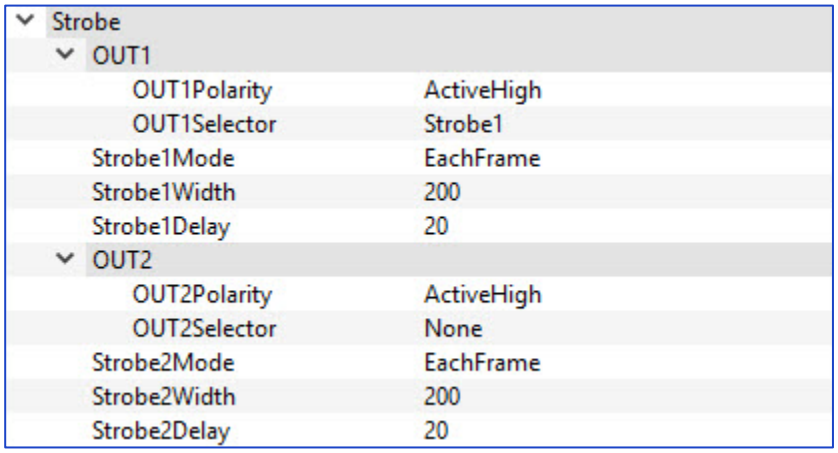


Figure 78: Strobe parameters

The following descriptions apply the same to either Output 1 (OUT1) or Output 2 (OUT2) and to either Strobe1 or Strobe2.

OUT1Polarity / OUT2Polarity Sets the OUT1 or OUT2 active logic level to either Active Low or Active High.

OUT1Selector / OUT2Selector Maps the camera's internal signals to the respective Output. The signals are: ExposureStart, ExposureEnd, MidExposure, ExposureActive, HSync, VSync, OddEvenFrame, TriggerActual, TriggerDelayed, CameraReady, PulseGenerator, Strobe1, Strobe2, ToggleOut1 (refer to the section 6.10 Strobe and Synchronization Controls for more information on output signals).

Strobe1Mode / Strobe2Mode Sets the Strobe 1 and Strobe 2mode of operation. The options are: Off, EachFrame, OddFrame, EvenFrame.

Strobe1Width / Strobe2Width Sets the strobe pulse duration in microseconds.

Strobe1Delay / Strobe2Delay Sets the strobe delay from reference, in microseconds.

5.7.10 Pulse Generator Controls

The Pulse Generator provides a signal generator for camera sourced trigger or control signals.

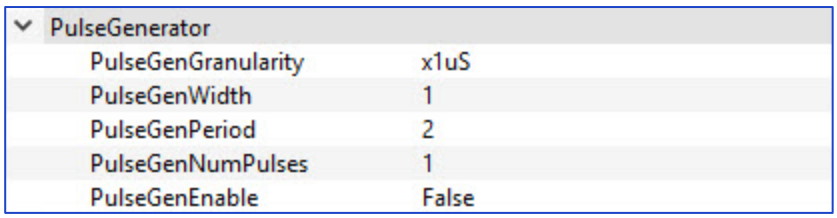


Figure 79: Pulse generator parameters

PulseGenGranularity Sets the Pulse Generator main timing resolution. The x1 resolution is in microseconds. The following four granularity steps are possible: x1, x10, x100, x1000 (x1000 is equal to 1ms timing resolution).

PulseGenWidth Sets the value of the pulse width in microseconds.

PulseGenPeriod Sets the value of the pulse period in microseconds.

PulseGenNumPulses Sets the number of pulses generated by the Pulse Generator. To set Pulse Generator in continuous mode, set the parameter in 65536.

PulseGenEnable Enables the Pulse Generator.

5.7.11 Canon Lens Control

The POE-C4410, POE-C5410, and POE-C6410 cameras support Canon EF Active lens mount. If using Canon lens control, the following parameters are available for controlling the lens or checking its status.

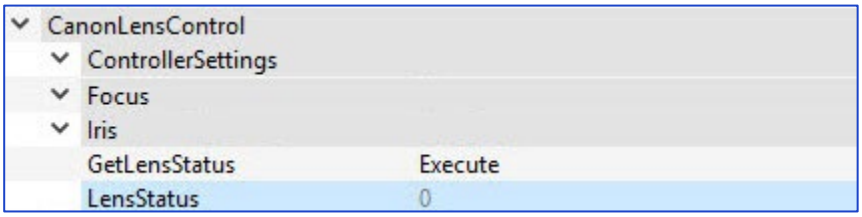


Figure 80: Canon lens control general parameters

GetLensStatus Request the value of the LensStatus register.

LensStatus Returns the status of the lens after the GetLensStatus runs.

5.7.11.1 Controller Settings

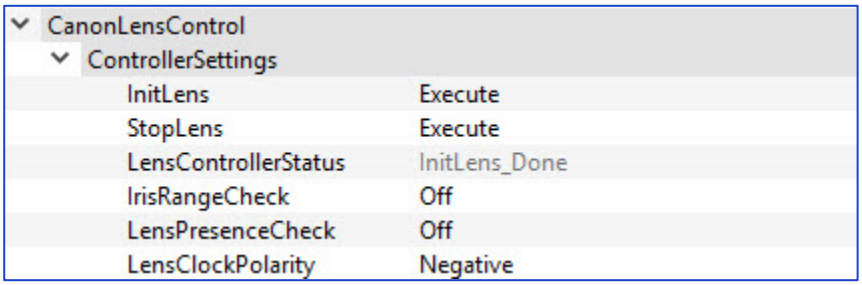


Figure 81: Canon lens control – Controller settings

InitLens Initializes the Canon Lens, if one is mounted to the camera. The InitLens command should always be applied after power up.

StopLens Removes the power from the Iris drive. Run InitLens command to resume the lens control

LensControllerStatus Shows the status of Canon Lens initialization.

IrisRangeCheck Enables internal checkout of Iris.

LensPresenceCheck Check for lens presence.

LensClockPolarity Sets the polarity of the Lens Clock.

5.7.11.2 Focus Settings

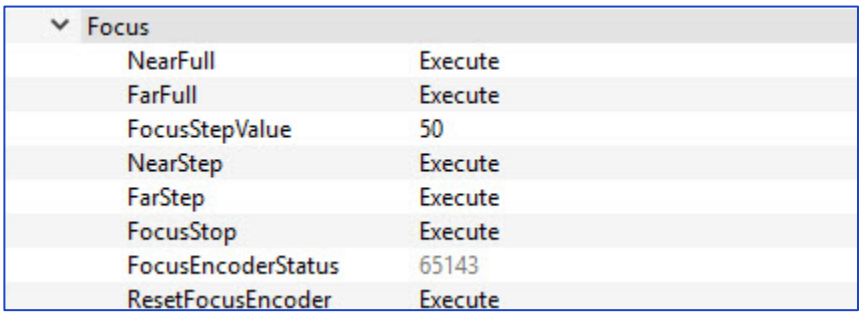


Figure 82: Canon lens control – Focus settings

NearFull Drives the focus to the fully Near position.

FarFull Drives the focus to the fully Far position.

FocusStepValue Sets the focus step size for NearStep and FarStep focus. A typical step size has a value of 4.

FarStep Drives the focus toward the Far direction based on amount defined in the FocusStepValue feature.

NearStep Drives the focus toward the Near direction based on the amount defined in the FocusStepValue feature.

FocusStop Stops focus movement.

FocusEncoderStatus Shows the current focus encoder value after issuing the GetFocusEncoderStatus command.

Reset Focus Encoder Resets the Focus encoder.

5.7.11.3 Iris Settings

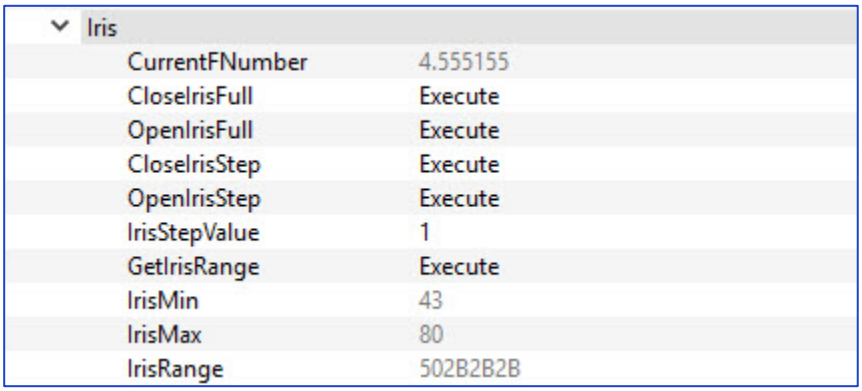


Figure 83: Canon lens control – Iris settings

CurrentFNumber f-number value of the lens iris. Value of 0.0 signals an unknown iris position.

CloseIrisFull Fully closes the iris.

OpenIrisFull Fully opens the iris.

CloseIrisStep Closes the iris based on amount entered in the IrisStepValue feature.

OpenIrisStep Opens the iris by the amount defined in the IrisStepValue feature.

IrisStepValue Sets the iris step size (between 1 and 127) when using the OpenIrisStep and CloseIrisStep commands.

GetIrisRange Determines the Iris Range. The values are read using the IrisRange Command.

IrisMin Returns the minimum iris limit.

IrisMax Returns the maximum iris limit.

IrisRange Shows the limit values of the iris after issuing the GetIrisRange command.

5.7.12 Transport Layer Control

The Transport Layer controls the exchange of data between the camera and the host computer.

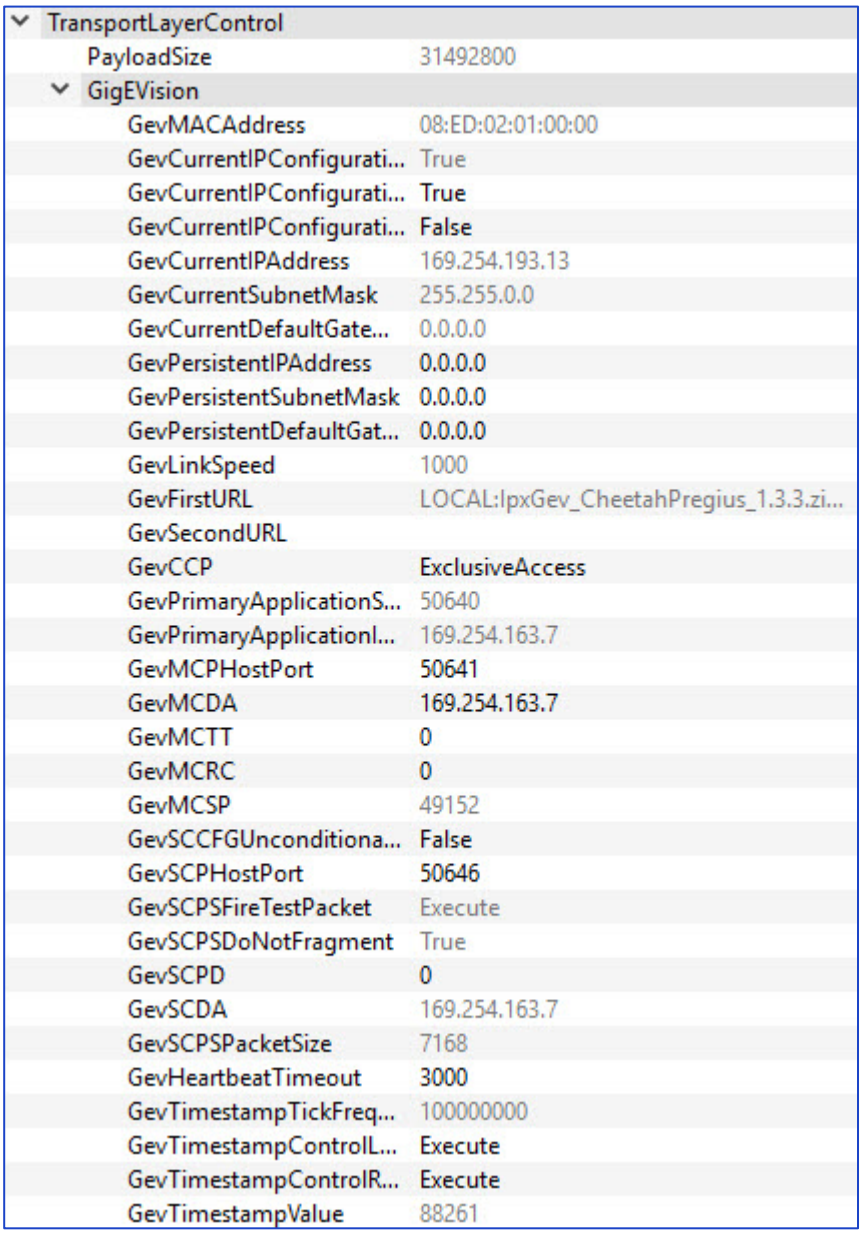


Figure 84: Transport layer control

PayloadSize Provides the number of bytes transferred for each image on the stream channel, including any end-of-line, end-of-frame statistics, or other stamp data.

GevMACAddress Displays the MAC address of the Ethernet network interface.

GevCurrentIPConfigurationLLA Indicates whether a Link Local Address IP configuration scheme is activated on the network interface.

GevCurrentIPConfigurationDHCP	Indicates whether a DHCP IP configuration scheme is activated on the network interface.
GevCurrentIPConfigurationPersistentIP	Indicates whether a Persistent IP configuration scheme is activated on the network interface. A persistent IP address is hard-coded in non-volatile memory.
GevCurrentIPAddress	Displays the host computer's network IP Address.
GevCurrentSubnetMask	Displays the subnet mask of the interface.
GevCurrentDefaultGateway	Displays the default gateway IP address to be used on the network interface.
GevPersistentIPAddress	Indicates the Persistent IP address for the network interface. The persistent IP address is re-used by the camera on power-up when Persistent IP is enabled.
GevPersistentSubnetMask	Indicates the Persistent subnet mask associated with the Persistent IP address on the network interface.
GevPersistentDefaultGateway	Indicates the Persistent default gateway for the network interface.
GevLinkSpeed	Indicates the speed of transmission negotiated by network interface in Mbps.
GevCCP	Enables granting privilege to an application. Options are open access, exclusive access, or control access.
GevPrimary Application Socket	Indicates the UDP source port of the primary application.
GevPrimary Application IP Address	Indicates the address of the primary application.
GevMCPHostPort	Controls the port to which the device must send messages. Setting this value to 0 closes the message channel.
GevMCDA	Controls the destination IP address for the message channel.
GevMCTT	Provides the message channel transmission timeout value in milliseconds.
GevMCRC	Controls the number of retransmissions allowed when a message channel message times out.
GevMCSP	Indicates the source port for the message channel.
GevSCCFG UnconditionalStreaming	Enables the camera to continue to stream for this stream channel if its control channel is closed or regardless of the reception of any ICMP messages (such as destination unreachable messages).
GevSCPHostPort	Indicates the port to which the device must send data stream.
GevSCPSFireTestPacket	When this bit is set, the device will fire one test packet.
GevSCPSDoNotFragment	This bit is copied into the "do not fragment" bit of IP header of each stream packet.

GevSCPD	Indicates the delay (in timestamp counter unit) to insert between each packet for this stream channel.
GevSCDA	Indicates the destination IP address for this stream channel.
GevSCPSPacketSize	The stream packet size to send on this channel, except for data leader and data trailer, and the last data packet that might be of smaller size (since packet size is not necessarily a multiple of block size for stream channel).
GevHeartbeatTimeout	Indicates the current heartbeat timeout in milliseconds.
GevTimestampTickFrequency	This 64-bit feature indicates the number of timestamp ticks during 1 second.
GevTimestampControlLatch	Latches current timestamp counter into "Timestamp value" register.
GevTimestampControlReset	Resets timestamp 64-bit counter to 0.
GevTimestampValue	Reports the latched 64-bit value of the timestamp counter

5.7.13 User Set Controls

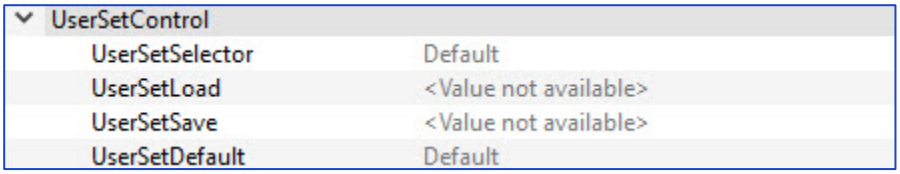


Figure 85: User set parameters

UserSetSelector	Points to User Configuration Set (Default, User Set 0…User Set 3) to load into the camera or save into the camera's non-volatile memory. Default is the Factory Default Settings.
UserSetLoad	Loads the User Set specified by UserSetSelector into the camera workspace (volatile).
UserSetSave	Saves the User Configuration Set 0 or 1 specified by UserSetSelector to the camera's non-volatile memory. The Default User Set is read only and cannot be modified by the user.
UserSetDefault	Points to User Configuration Set, which will be loaded and made active when the device is reset or after power is applied.

5.7.14 Event Control

Figure 86: Event Control parameters

EventSelector	Selects which Event to signal to the host application (see Table 44).
EventNotification	Activate or deactivate the notification to the host application of the occurrence of the selected Event

5.8 Capture Panel

The Capture panel provides options for recording images and video and saving them to the computer hard drive. Click the Capture tab at the bottom of the IpxPlayer screen to access the panel.

5.8.1 Recording Acquired Images

Use the Recording section of the Capture screen to record snapped images or video images. The screen displays real-time capture information during recording.

- **Snap**. Saves the current image to the hard drive.
- **Record**. Starts or stops saving video to the hard drive.
- **Statistics**. Shows the number of frames acquired, saved, and dropped during the current capture session. Dropped frames are frames received from the camera but not transferred due to a lack of host buffers.
- **Buffer Queue Filling**. Shows the current filling status of the capture frames queue.

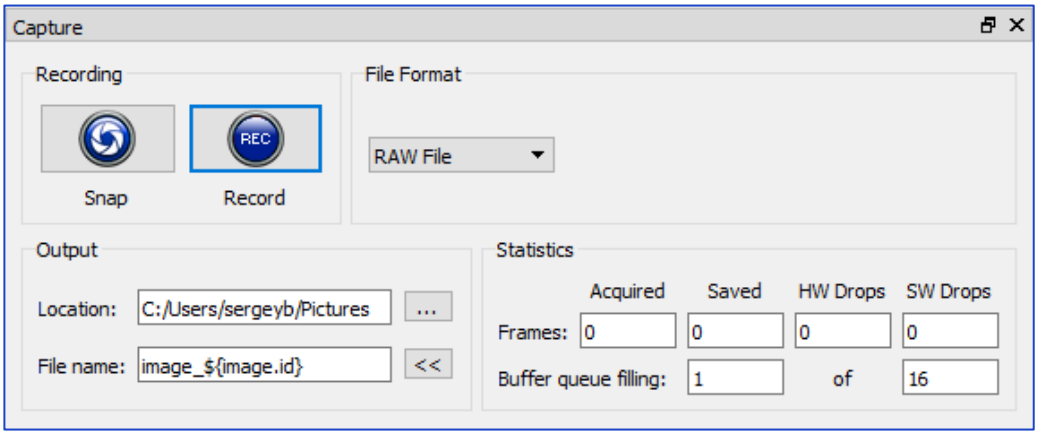


Figure 87: The Capture panel saves images and video

5.8.2 Saving Image Output

The Output section of the Capture screen lets you configure the location and format of saved images in the computer.

- **Output Location**. You determine where to save files on the computer.
- **File Name**. Defines the file name template.
- **File Format**. Allows you to specify the output file format from a drop-down list.
  - RAW File. This is an unprocessed file format.
  - BMP Image. (8bpp BMP for grayscale, 24bpp for Color images)
  - JPG Image. You can adjust the image quality. Default is 85%.
  - TIFF Image. Normalized option affects pixel intensity values.
  - AVI Movie. Options are – you can set the frames per second or get the current frames per second from the camera

5.9 Log Panel

The Log panel shows data transfers to or from the connected camera. Log information provides a numeric identifier assigned by the application, the transfer time, the control channel, and the message. Click the Log tab at the bottom of the IpxPlayer screen to access the panel.

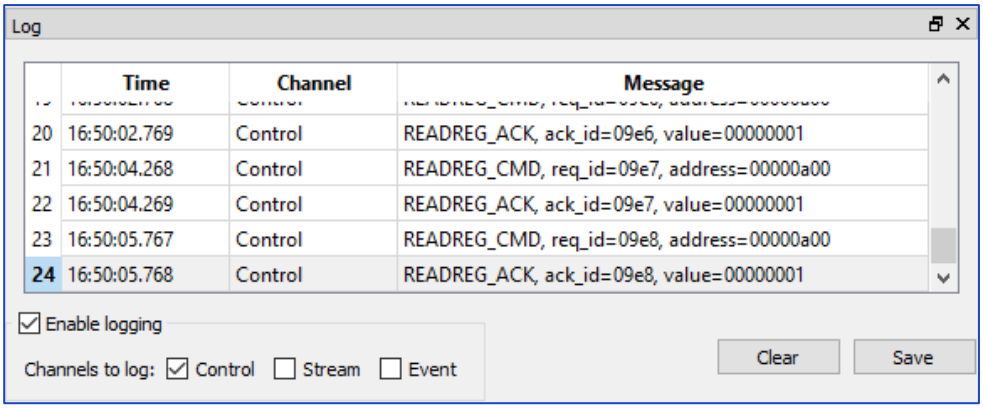


Figure 88: The Log panel records data transfers

5.9.1 Channels to Log

The Enable Logging check box initiates logging. You can save current log data to a TXT file (.txt) with space-separated fields.

You must select a channel to log. Channels are device channels linked to an appropriate camera interface. The following options are available:

- **Control Channel**. This is a data interface linked to the camera's Device Control Channel. The Control Channel is dedicated to camera parameters control. It sends and receives the data displayed on the Camera Parameters panel. The Control Channel is bi-directional, enabling data transfers from the host computer to the camera or from the camera to the host computer.

- **Stream Channel**. This links to the camera's Device Stream Channel. The Stream Channel is dedicated to transferring video data from the camera to the host computer.

- **Event Channel**. This links to the camera's Device Event Channel. The Event Channel notifies the host computer software about any events on the camera side. For example, the camera can notify the software that it received the trigger signal.

5.10 Statistics Panel

The Statistics panel displays camera performance and other information based on settings and parameters.

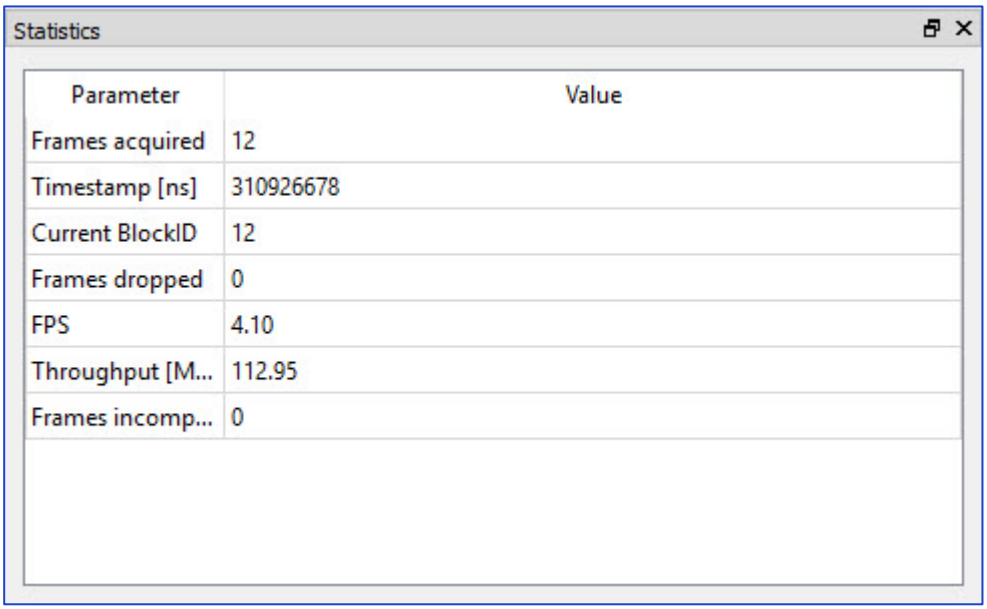


Figure 89: Statistics panel

Frames acquired: The number of frames acquired after you click the Play button.

Timestamp [ns]: The current value of the timestamp in the acquired image in nanoseconds.

Current Block ID: The current value of the block ID in the acquired image.

Frames dropped: The number of frames dropped by the camera (calculated from consequence block IDs).

FPS: The number of frames per second.

Throughput [MB/s]: The average throughput value of the camera interface in megabytes per second

6 Camera Features

6.1 Exposure Control

You can select one of the exposure control modes: Off, Timed, or Trigger Width. When exposure control is **Off**, the frame readout time determines the exposure time.

However, the camera's electronic exposure control can precisely control the image exposure time by selecting the cameras internal timer. The electronic exposure control does not affect the frame rate in free-running mode and Fast Trigger mode, because the exposure and readout operations are overlapped in time. In Standard Trigger mode, the maximum frame rate will be dependent upon the exposure time, because the exposure and readout occur sequentially (not overlapped).

In **Timed** mode, the camera controls the start of exposure. The maximum exposure is equal to the frame time. For longer exposure times, increase the frame period using the Acquisition Frame Time or Acquisition Frame Rate features.

In Free-run and Fast Trigger modes, the minimum exposure is equal to 14 microseconds for C2000, C2400, C2010, C2410, C4010, C4110 cameras, 5 microseconds for C1911 and C3210 camera, and 30 microseconds for C4410, C5410, C6410 cameras.

In Standard Trigger mode, the minimum exposure is equal to 1 line time. This value depends on camera model and some other parameters such as Pixel Format.

The camera exposure can also be controlled by the pulse width of the external trigger signal (**Trigger Width** mode). This mode is available in both Standard and Fast Trigger modes. Select Trigger Width under the Exposure Mode options and set Trigger Type to Standard or Fast. In Fast Trigger mode, ensure that Trigger Activation is set to Falling Edge.

6.1.1 Internal Exposure Control - Electronic Shutter

In global shutter mode, all pixels in the array reset at the same time, then collect signal during the exposure time, and finally transfer the image to a pixel memory region within each pixel. After transferring the image to the pixel memory region, the readout of the array begins. In this way, all pixels capture the image during the same period, which reduces any image artifacts due to motion within the scene. The maximum exposure is frame-time dependent, and the minimum exposure varies based on the image sensor.

The camera overlaps the exposure and read-out times in free-running and Fast trigger modes as shown in the following figure.

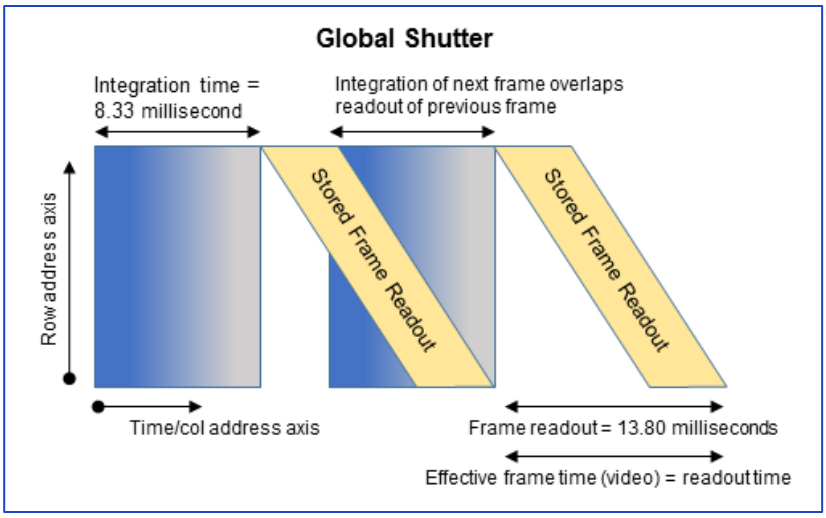


Figure 90: Global Shutter with 8.33mS exposure time

6.2 Automatic Exposure Control

You can set the camera to automatic exposure control (AEC) to keep the same image brightness during changing light conditions. You can enable both AEC and automatic gain control (AGC) independently or together.

In AEC mode, you can set the image luminance (brightness) target, and the camera adjusts the exposure accordingly. The luminance target is a 12-bit value. To determine the luminance target when using 8-bits per pixel, take the desired output in ADUs and multiply this value by 16. You can select the target luminance to be either the average luminance or peak luminance within the image.

The camera adjusts the exposure starting within the preset limit established by the user-specified minimum/maximum limits. When AEC and AGC are enabled, exposure is always varied first until the exposure reaches the maximum limit. The camera then indicates the exposure maximum limit has been reached and begins increasing the gain until either the luminance target is achieved or the maximum gain limit is reached.

You can preset the speed of convergence (how fast the camera stabilizes after an illumination change) using four possible rates. Slower convergence rates are more stable than faster convergence rates, if the illumination levels change quickly over a wide intensity range.

The camera displays the current luminance, current exposure, and current gain. For auto gain control, refer to 6.3 Automatic Gain Control.

NOTE

The POE-C2000 and POE-C2400 cameras do not support Automatic Exposure Control.

⚠CAUTION

In some rapidly changing and bright light conditions, an image brightness oscillation (image intensity flipping from bright to dark) could occur. To prevent this, increase the AEC minimum exposure setting, decrease the convergence speed, increase the target luminance level and/or decrease the lens iris.

6.3 Automatic Gain Control

Automatic gain control (AGC) enables the camera to maintain the same image brightness during changing light conditions. In AGC mode, you can set the image luminance (brightness), and the camera will adjust the gain accordingly. Luminance options are average or peak.

The camera starts by changing the gain within the specified min-max limits.

- If reaching one of the gain limits, the camera indicates the limit has been reached and maintains this value until the light condition change. You can set the speed of convergence from four possible options.
- If enabling AEC mode and AGC mode together, the camera starts by changing the exposure first within the specified min-max limits until the maximum exposure limit is reached.
- Upon reaching the maximum exposure limit, the camera adds gain and changes it within the specified min-max limits.

The AEC/AGC algorithm samples all pixels for the entire frame. The camera displays the current luminance within the frame, the current exposure, and the current gain.

NOTE

The POE-C2000 and POE-C2400 cameras do not support Automatic Gain Control.

6.4 Acquisition Control

You can control acquisition by selecting mode (see Table 46), number of frames to capture, acquisition frame time and frame rate. You can extend the actual frame time beyond the free-running frame time up to 16 s.

Table 46: Acquisition Control modes

Acquisition Control mode	Description
SingleFrame	acquires one image during the acquisition period
MultiFrame	acquires a specified number of images during the acquisition period
Continuous	acquires images continuously

6.5 Video Amplifier Gain and Offset

6.5.1 Digital gain

Digital gain can be varied from 1x (0 dB) to 4x (12 dB) with a precision of ~0.00097x using the raw (fine) gain control. There are 3,092 gain steps from 1x gain to 4x gain. Each step increases the gain by 0.000969932x or 1/1031 from 1024 (1.0x gain) to 4095 (4x gain). Digital Gain does not provide any improved contrast and should be used cautiously.

To determine the gain step when the gain value is known, use the following steps:

1. Subtract 1.0 from the desired gain multiplier (e.g. 2.5x gain).
2. Multiply the result by 1031.
3. Add 1024.

Or use this formula:

Gain coefficient = [[Desired gain – 1] *1031] +1024.

If the desired gain is in dB, use the following formula:

Gain coefficient = [[[anti-$\log_{10}$(Desired gain (dB)/20)]-1]*1031]+1024.

EXAMPLES:
1) Desired gain is 2.5x: [(2.5 – 1.0)*1031]+1024 = 2570.
Set coefficient to 2570.
2) Desired gain is 6 dB, then the code is 2050.
Minimum setting is 1024 corresponding to 1x gain. Below are other examples:

Gain (dB)	Multiplier	Coefficient
0 dB	1x	1024
3 dB	1.41254x	1449
6 dB	1.99526x	2050
12 dB	3.98107x	4097

6.5.2 Digital Offset

Digital offset is a digital count added or subtracted from each pixel. The range is - 512 to +511 counts.

6.5.3 Black Level Auto-calibration and Offset

The camera automatically adjusts black level based on measurements of the dark reference lines at the start of each frame. Imperx recommends leaving the BlackLevelAuto engaged (continuous). If auto-calibration is disabled, you can set the BlackLevel and adjust it from 0 to 255 counts. Black level will vary with temperature and gain settings

6.6 Data Output Format

6.6.1 Pixel Format

The image sensor digitization level is fixed at 12-bits, which enables 8-bit, 10-bit or 12-bit data format output. With 8-bit output, the camera uses the standard bit reduction process and truncates the least significant bits.

12-bit digitization

- If the camera is set to output 12-bit data, sensor data bits map directly to D0 (LSB) to D11 (MSB).
- If the camera is set to output 10-bit data, sensor most significant data bits (D2 to D11) map to D0 (LSB) to D9 (MSB)
- If the camera is set to output 8-bit data, sensor most significant data bits (D4 to D11) map to D0 (LSB) to D7 (MSB).

MSB				**Camera Output – 12 bits**							**LSB**
D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
P11	P10	P9	P8	P7	P6	P5	P4	P3	P2	P1	P0

MSB				**Camera Output – 10 bits**					**LSB**		
D9	D8	D7	D6	D5	D4	D3	D2	D1	D0		
P11	P10	P9	P8	P7	P6	P5	P4	P3	P2		

MSB				**Camera Output – 8 bits**			**LSB**				
D7	D6	D5	D4	D3	D2	D1	D0	-	-	-	-
P10	P10	P9	P8	P7	P6	P5	P4	P3	P2	P1	P0

Figure 91: 12-bit internal Digitization with 12-bit, 10-bit, and 8-bit outputs

6.7 Pulse Generator

The camera has a built-in pulse generator that you can program to generate a discrete sequence of pulses or a continuous sequence (Figure 92). You can use the pulse generator as a trigger signal or map it to one of the outputs. Set the discrete number of pulses from 1 to 65535 with a step of 1.

You can also set the following options:

- **Granularity** – Indicates the number of clock cycles used for each increment of the width and the period. Four possible options are available: x1, x10, x100, and x 1000.
- **Width** – Specifies the amount of time (determined by the granularity) the pulse remains at a high level before falling to a low level.
- **Period** – Indicates the amount of time (also determined by the granularity) between consecutive pulses.

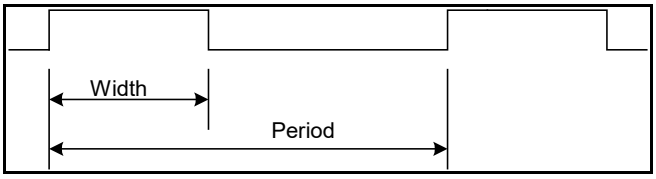


Figure 92: Internal pulse generator

6.8 Input / Output Control

Some camera models support two inputs and two outputs (one TTL and one opto-isolated output), others may have only one input and one output (both opto-isolated). Refer to the Table 19 for the inputs and outputs supported by different camera models.

You can map an external trigger signal to either input 1 or input 2 by setting Trigger Source parameter to “Line 1” or “Line 2” respectively (also see 6.9.2 Trigger Sources section). Also, you can select what edge (rising or falling) will be used for triggering.

The inputs have debounce and filter options to prevent false triggering. The Trigger filter option defines the input trigger signals minimum pulse width. By setting the Trigger filter setting to a value slightly less than the input signal’s pulse width, the camera will reject any noise with pulse widths less than the Trigger filter setting.

The debounce option defines the time period following a triggering event in which no additional triggers will be accepted by the camera.

You can map up to fourteen signals to either output 1 or input 2 by setting OutputSelector parameter to one of them (refer to the section 6.10 Strobe and Synchronization Controls). For each mapped signal you can select active High or active Low.

6.9 Camera Triggering

6.9.1 Trigger Modes

The camera supports Standard and Fast Trigger modes.

In **Standard trigger mode**, the camera first performs the exposure (using the internal timer or external pulse width) and then reads out the image. The minimum trigger period is equal to the maximum exposure time plus the camera readout time.

In **Fast trigger mode**, the exposure period and readout period are overlapped in a way that is similar to free-running (untriggered mode). Fast trigger mode depends upon a constant and stable trigger source so the camera can position the exposure period to conclude just as the previous frame readout ends. If the trigger period varies, the exposure will vary with the trigger period and uneven image illumination or wavering image brightness will result.

6.9.2 Trigger Sources

In the normal mode of operation, the camera is free running, which means the camera continually reads out the sensor. If using a trigger to initiate readout, trigger mode enables synchronizing the camera to a timing pulse.

The camera offers four sources for triggering: external Line1 or Line2, internal (pulse generator), and software. You can select the trigger input to a corresponding camera input.

- **Line 1** – hardware Input Line GP IN 1 (TRIGGER 1) is used as external source for the trigger signal.
- **Line 2** – hardware Input Line GP IN 2 (TRIGGER 2) is used as external source for the trigger signal (Line 2 is not available in C2000, C2400, and P67 cameras as they have only one input).
- **Pulse Generator** – trigger source is generated by camera's internal Pulse Generator.

- **Software** – the camera expects a computer to send a command to the camera for generating one short trigger pulse. You can trigger the camera by clicking the GUI Software Trigger button or by sending the GenICam™ Trigger Software command.

6.10 Strobe and Synchronization Controls

The camera allows you to synchronize your system from several references. You can synchronize with the trigger input, the start, middle or end of exposure, or the vertical/horizontal synchronization signals (see Table 47).

1) The camera provides signals indicating the start of exposure, mid-exposure, and end of exposure. These signals have a fixed duration of 2 microseconds. These signals can be delayed using the TriggerDelay feature in the Acquisition Control menu to also synchronize multiple cameras or light sources. If a longer pulse period is required, the strobe feature can be used.
2) The camera also provides a strobe that activate just as the readout period begins and can be activated on all frames or just even or odd frames . If using internal exposure control, you can position the strobe to occur when the exposure time starts by using the strobe delay feature. (The strobe delay should be set to the trigger period minus the exposure time in Standard trigger mode or Readout period minus exposure time in Fast trigger mode) You can position each strobe pulse within the entire frame-timing period with a precision of 1.0 microsecond. You can set the strobe position and duration from 1.0 microsecond to the maximum frame time with a precision of 1.0 microsecond.

Table 47: Output signals

Output Signal	Description
None	No signal
ExposureStart	A short pulse indicating the beginning of the camera exposure
ExposureEnd	A short pulse indicating the end of the camera exposure.
MidExposure	A short pulse indicating the middle of the camera exposure.
ExposureActive	The output signal is active for the duration of exposure time
HSync	Maps horizontal sync signal
VSync	Maps vertical sync signal
OddEvenFrame	Maps odd or even frame
TriggerActual	Maps the input trigger pulse to the output with no delay
TriggerDelayed	Maps the input trigger pulse to the output with trigger delay
CameraReady	Short signal indicating that a camera is ready to receive the next trigger
PulseGenerator	Maps the internal pulse generator waveform to the output
Strobe1	Maps the Strobe 1 signal to the corresponding external output
Strobe2	Maps the Strobe 2 signal to the corresponding external output
ToggleOut	Used to check Out1 or Out 2. Sets Out in “1” or “0”

6.11 Area of Interest

For some applications, you might not need the entire image, but only a portion of it. To accommodate this requirement, the Cheetah camera allows you to create one Region of Interest (ROI), also known as an Area of Interest (AOI).

6.11.1 Horizontal and Vertical Window

Set the starting and ending point for each AOI independently in the horizontal direction (Horizontal Window) and the vertical direction (Vertical Window) by setting the window (H & V) offset and (H & V) size. The horizontal dimension is limited to multiples of 8 pixels, and the vertical dimension is limited to multiples of 2 pixels. In normal operation, the AOI defines the number of columns and rows output. The maximum horizontal window size (H) and the vertical window size (V) are determined by the camera's image full resolution.

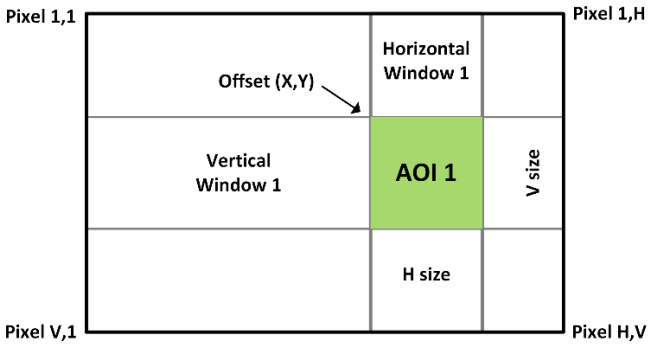


Figure 93: Horizontal and vertical window positioning

NOTE

For color version with AOI enabled, use an even number for Offset X and Offset Y to achieve proper color reconstruction and white balance.

6.11.2 Factors Impacting Frame Rate

The camera frame rate depends upon a number of variables including the exposure time, number of rows and columns in the AOI, and the bandwidth of the output interface.

AOI size: Camera frame rate increases by decreasing either the number of columns or number of rows read out. Changing the number of rows read out causes the largest change in frame rate.

Exposure Time: In free-running or Fast trigger mode, the camera overlaps the exposure time and image readout so frame rate has no dependence on exposure time. In Standard trigger mode, however, the exposure and readout time do not overlap, and long exposure times will decrease frame rate.

6.11.3 Slave AOI

A Slave AOI (SAOI) used to apply a look-up table (LUT) to a selected region of the image or to calculate white balance coefficients from a selected region within the image. The selected region can be within the SAOI or outside the SAOI ("Exclude" option). Alternatively, the SAOI can be used to further refine the camera output so that only the pixels within the SAOI are output or only pixels within the ROI, but outside the SAOI ("Exclude" option) are displayed (see Table 48). When SAOI is enabled with AEC/AGC, the auto gain and auto exposure corrections will use luminance values calculated from inside or outside the selected AOI and then apply the determined exposure and gain settings to the full image..

Table 48: Slave AOI modes

Test pattern	Description
Disable	Slave AOI disabled
Include	Slave AOI is included to the image, all the rest area is black
Exclude	Slave AOI is excluded from the image, all the rest area is included
AEC_AGC_Include	Slave AOI is included to AOI, used for Auto Gain Control (AGC) and/or Auto Exposure Control (AEC). Luminance calculated inside the selected AOI
AEC_AGC_Exclude	Slave AOI is excluded from AOI, used for Auto Gain Control (AGC) and/or Auto Exposure Control (AEC). Luminance calculated outside the selected AOI
AWB_Include	Slave AOI is included to AOI, used for Auto White Balance (AWB)
AWB_Exclude	Slave AOI is excluded from AOI, used for Auto White Balance (AWB)
LUT_Include	Slave AOI is included to AOI, used for Look Up Table (LUT)
LUT_Exclude	Slave AOI is excluded from AOI, used for Look Up Table (LUT)

6.12 Gamma Control

The camera's built-in processing engine enables adjustments to the luminance (brightness) of an image on the monitor. Using gamma correction, you can control, stretch, or compress the image luminance with one of four different LUTs. Two LUTs are pre-programmed at the factory with Gamma 0.45 (LUT1 and LUT3), but you can upload your own LUTs, if desired. (See section 6.17 Configuration Memory).

6.13 Bad Pixel Correction

A CMOS imager is composed of a two-dimensional array of light sensitive pixels. In general, the majority of the pixels have similar sensitivity. However, some pixels deviate from the average pixel sensitivity and are called "defective pixels" or "bad pixels" In most cases, bad pixels are responsive to light, and rarely is a pixel totally dark or totally bright. At the factory, final testing identifies and corrects up bad pixels using bad pixel correction.

6.13.1 Static Pixel Correction

Static pixel maps provide one method of correcting bad pixels. During factory testing, engineers identify the coordinates of bad pixels. They create a map file listing the pixel coordinates of these pixels by row and column, and the camera corrects the bad pixels found at these coordinates. The map file downloads into the camera's non-volatile memory.
When "Factory" or "User" correction is enabled, the camera compares each pixel's coordinates with entries in the pixel map. If a match is found, the camera corrects the defective pixel.

You can create your own Bad Pixel Map (BPM) file and upload it using the Imperx Upload Utility application.

6.13.2 Dynamic Pixel Correction

Dynamic pixel correction provides another method of correcting bad pixels. Dynamic correction works without preloaded pixel maps. Instead, you set a BadPixelThreshold value between zero and 4096 (12-bit) counts. The threshold determines how much a pixel's luminance can deviate from neighboring pixels. If the deviation between bright or dark is too great, the camera corrects the pixel.
Dynamic and Static corrections can be enabled independently or simultaneously (by setting BadPixelCorrection parameter to "Dynamic" or "FactoryAndDynamic"/ "UserAndDynamic").

6.14 Flat Field Correction

The camera uses a factory installed flat field correction (located in FFC1) algorithm to correct some of the image sensor's non-uniformity. You can upload your own FFC table to FFC2. While not recommended, you can disable the FFC. If two FFC correction tables are needed, you can also overwrite the factory installed FFC located in FFC1.

6.15 Test Image Pattern

The camera can output several test images to verify the camera's general performance and connectivity to the computer. This ensures that all the major modules in the hardware are working properly and the connection between your computer and camera is synchronized, that is, the image framing, output mode, communication rate, and so on are properly configured. Note that test image patterns do not exercise and verify the image sensor functionality. The following table show a list of test images available.

Table 49: Test patterns

Test pattern	Description
Off	Image is coming from the sensor
BwCheckerBoard	A black and white checkerboard pattern
Grey	A uniformly dark grey image. You can set the value
TapSegmented	Image segmented by each tap output
GreyHorizontalRamp	Image is filled horizontally with an image that goes from the darkest possible value to the brightest

Table 44: Test patterns (continued)

Test pattern	Description
GreyVerticalRamp	Image is filled vertically with an image that goes from the darkest possible value to the brightest
HorizontalAndVerticalRamp	A pair of horizontal and/or vertical lines positioned in the image at any pixel/line in the image
HorizontalAndVerticalRamp Moving	A moving horizontal and vertical ramp image
VerticalBars	A set of 8 vertical gray bars with different gray levels
Crosshair	Displays a cross-hair in the absolute center of the image. A live image is superimposed under the cross-hair pattern. Cross-hair has a thickness of two pixels
IpxGevPattern	Image is being generated by GEV engine Firmware

6.16 Color Control

The camera provides white balance options for controlling image color under different lighting conditions. White balance control options are Off, Once, Continuous, and Manual. You can load the camera with your preferred white balance coefficients or let the camera determine the color coefficients one time or continuously (auto).

Table 50: Automatic white balance modes

AWB Mode	Description
Off	No white balance correction performed.
Once	The camera analyzes one image frame, calculates only one set of coefficients, and corrects all subsequent frames with this set of coefficients.
Continuous	The camera analyzes every frame, derives a set of correction coefficients for each frame, and applies them to the next frame. You can select five tracking speeds.
Manual	The camera uses the correction coefficients you enter (0 is equal to 0.0x, 4095 is equal 4x gain). Also, see TIP below.

For best color reproduction when the source has a stable spectral output, Imperx suggests illuminating a uniformly grey card with the intended source then using the Once option to determine the coefficients and then saving these coefficients into the camera and saving this configuration to one of the User Spaces (see section 6.17 Configuration Memory).

TIP

To get the best white balance for the R, G, and B coefficients when the spectral source is constant:

1. Image a grey or white target over the camera's entire field of view using the intended lighting source.
2. Select **Once** mode for the **White Balance**. The R, G, and B coefficients appear in the RedCoefficient, GreenCoefficient, and BlueCoefficient areas respectively.

6.17 Configuration Memory

The camera has built-in configuration memory divided into four segments: Work Space, Factory Space (Default), User Space #1, #2, #3 or #4. The Work Space segment contains the current camera settings while the camera is powered up and operational. All camera registers are located in this space. You can program these registers and change the camera configuration through these registers.

The Work Space is RAM based. All camera registers clear upon camera power-down. The Factory Space (Default) segment is ROM based, write protected, and contains the default camera settings. This space is available for read operations only. User Space #1, #2, #3 and #4 are non-volatile, flash-based, and used to store up to four user defined configurations or User Sets. Upon power up or software reset, the camera firmware loads the Work Space registers from the Factory Space (Default), User Space #1, #2, #3 or #4 as determined by a User Set Default Selector setting. At any time, a user can instruct the camera to load its Work Space with the contents of the Factory Space, User Space #1, #2, #3 or #4 using the User Set Load command. Similarly, the user can instruct the camera to save the current Work Space settings into either User Space #1, #2, #3 or #4 using the User Set Save command.

The non-volatile parameter Flash memory also contains the Bad Pixel Map (BPM), Flat Field Correction (FFC) tables and LUT #1, #2, #3 and #4 which you can load to the camera's internal memory upon enabling the corresponding camera feature. You can create custom LUT tables using the Imperx IPX Toolkit utility and upload these tables to the parameter Flash using the Imperx Upload Utility. Both the IPX Toolkit and IPX Upload Utility are available from the Imperx website https://www.imperx.com/.Imperx also has an application note describing how to update or create custom Bad Pixel Maps (BPM) which can then be uploaded to the camera using the Imperx Upload Utility.

7 Image Sensor Technology

7.1 General Information

A CMOS camera is an electronic device for converting light into an electrical signal. The C2010, C2410, C4010, C4110, C4410, C5410, and C6410 cameras contain the 2nd Generation Sony Pregius CMOS (Complementary Metal-Oxide Semiconductor) image sensors with 3.45-micron square pixels while the C1911 and C3210 cameras contain 3rd generation Sony Pregius CMOS image sensors with 4.5-micron square pixels. The Pregius sensors have groundbreaking performance with sensitivity better than many traditional Charge Coupled Device (CCD) image sensors. The sensors have extremely low dark current and no visible fixed pattern noise, which has been the bane of traditional CMOS image sensors.

The Sony CMOS sensor consists of a two-dimensional array of sensitive elements called silicon photodiodes, also known as pixels. The photons falling on the CMOS surface create photoelectrons within the pixels. The number of photoelectrons is linearly proportional to the light level. Although the number of electrons collected in each pixel is linearly proportional to the light level and exposure time, the number of electrons created in the pixel during any fixed time period varies with the wavelength of the incident light.

When the camera reaches the desired exposure time, it shifts the charges from each pixel photodiode onto a storage register within the pixel, reads out one row at a time digitizing each pixel at 8, 10 or 12 bits as selected by the user. The user can also selectively output the most-significant 8, 10 or 12 bits from each pixel with an impact to camera's frame rate. Frame time, or read-out time, is the time interval required for all the pixels to be read out of the image sensor. In non-triggered or fast trigger mode, while reading out the image from the storage registers within each pixel, the camera captures the next image. The exposure ends just as the readout of the previous frame ends and the next frame begins.

Unlike traditional CCD image sensors, the Sony CMOS image sensor digitizes each pixel within a row simultaneously. This allows for more settling time, which lowers the overall noise floor and provides improved sensitivity. The low noise floor, combined with a reasonably large pixel charge capacity and extremely low dark current, translates into a large dynamic range of 71 dB (12-bits) or 12 F-stops for 3.45-micron pixels and 77 dB (13-bits) or 13 F-stops for 4.5-micron pixels.

The sensor allows you to apply up to 48 dB of gain to the image. The first 24 dB of gain is analog gain and some improvement in noise performance may result. The camera applies the last 24 dB of gain digitally, which affects both signal and noise equally. Digital Gain (up to 12 dB) can also be applied using the Digital Gain control.

7.2 Spectral Sensitivity

A set of color filters (red, green, and blue) arranged in a Bayer pattern over the pixels generates color images. The starting color is Red for SONY Pregius image sensors and follows the pattern: red, green, red, green, red, … on row 1 and green, blue, green, blue, green, … on row 2 and so on. The color and monochrome spectral responses of the sensors used in Cheetah cameras can be found in Appendix A.

7.3 Micro-polarized Cameras

Light travels in electromagnetic waves that vibrate in multiple, random directions. When these unpolarized light waves strike certain surfaces, they tend to reflect or refract light and obscure the imaging target. A polarizer filter integrated into the camera can block certain light waves from reaching the image sensor and thereby improve image quality.

The Sony IMX250MY/ZR and IMX253MY/ZR image sensors in the Cheetah POE-C2410Y/Z and POE-C4110Y/Z cameras include a micro-polarizer filter that blocks light waves based on a polarization angle. The filter consists of an array of four polarizers grouped in a 2x2 sub-array. As shown in the following illustration, each array covers a block of four pixels in the sensor with each polarizer absorbing light at one of four angles - 90 degrees, 45 degrees, 135 degrees, or 0 degrees.

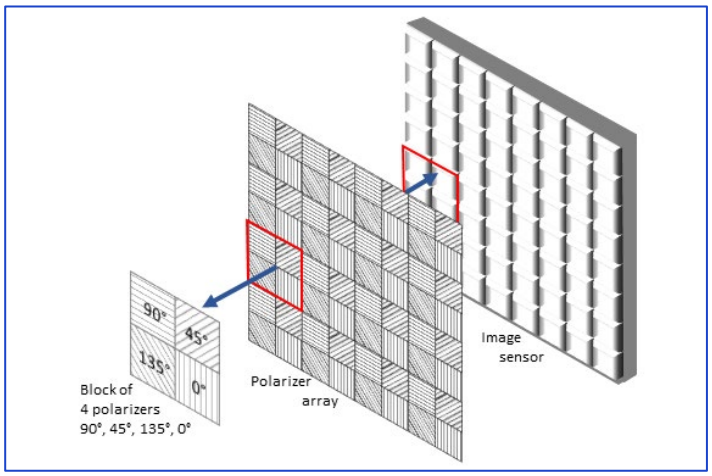


Figure 94: The POE-C2410Y/Z and POE-C4110Y/Z cameras micro-polarizer blocks image obscuring light waves from reaching the sensor

Appendix A – Spectral Response

A.1 Cheetah C1911 Spectral Response

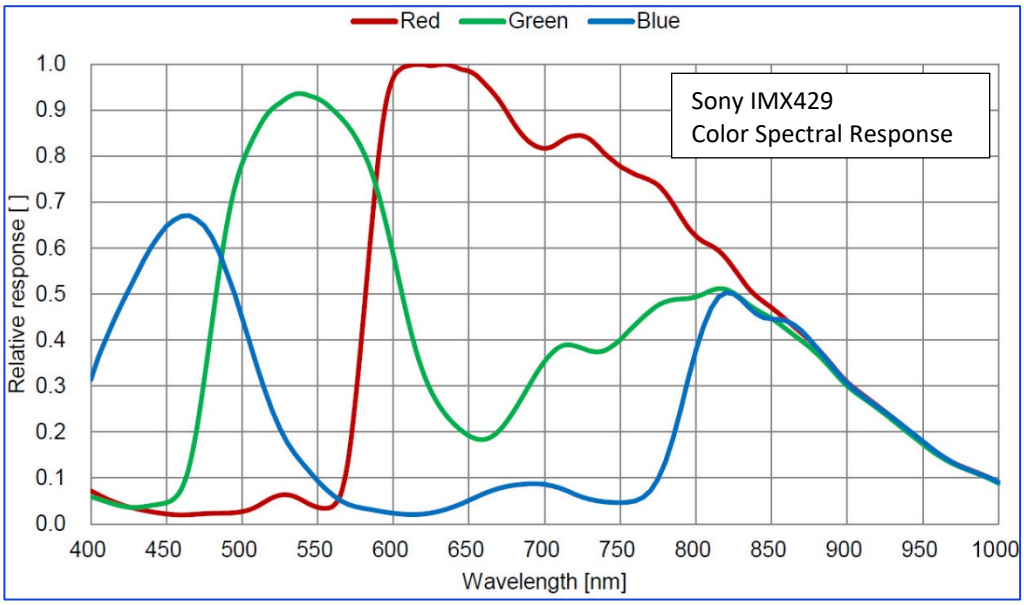


Figure 95: Cheetah C1911 Color Spectral Response

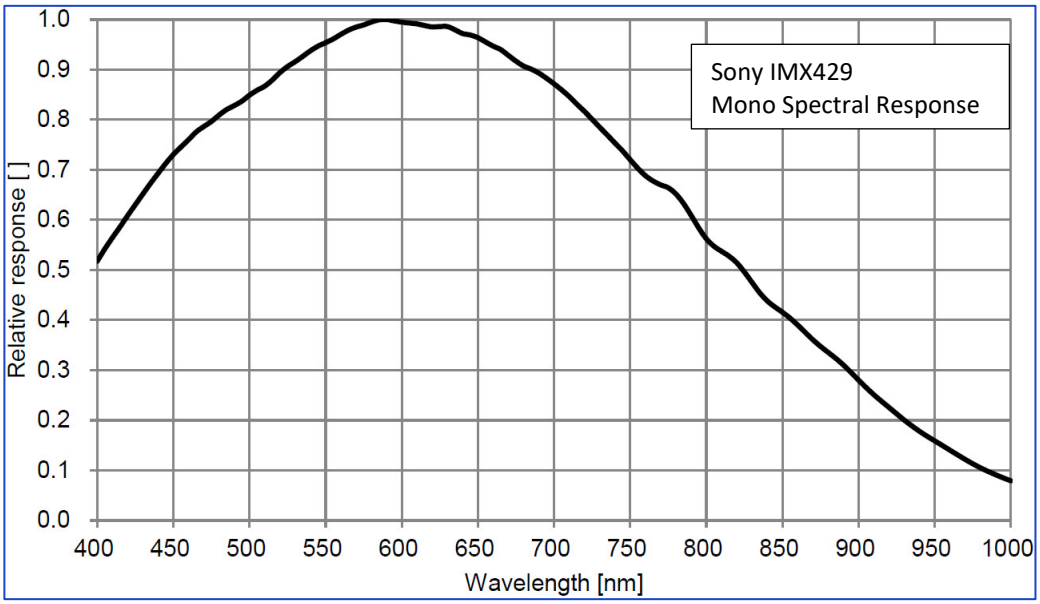


Figure 96: Cheetah C1911 Monochrome Spectral Response

A.2 Cheetah C2000 and C2010 Spectral Response

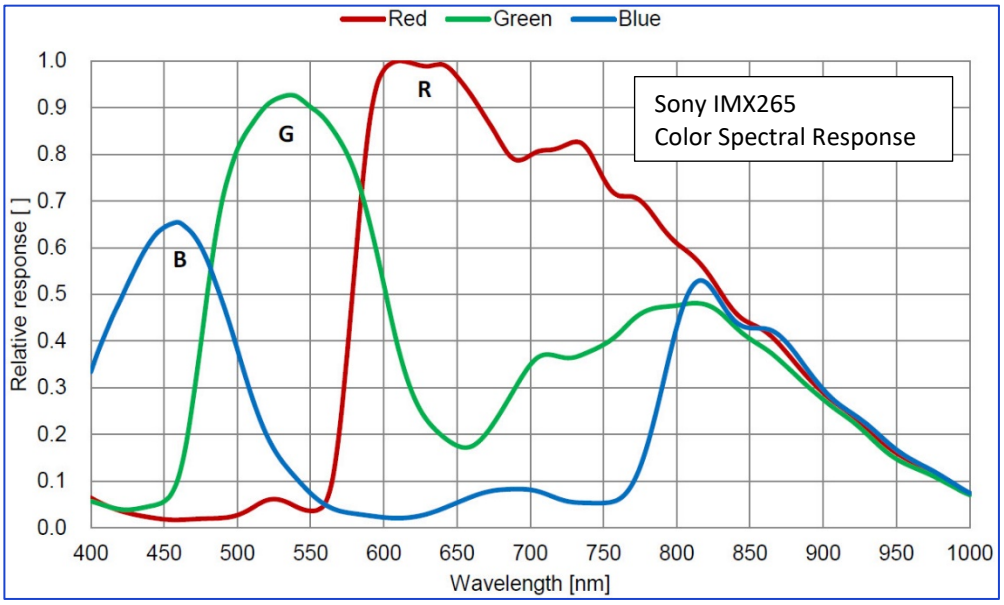


Figure 97: Cheetah C2000 and C2010 Color Spectral Response

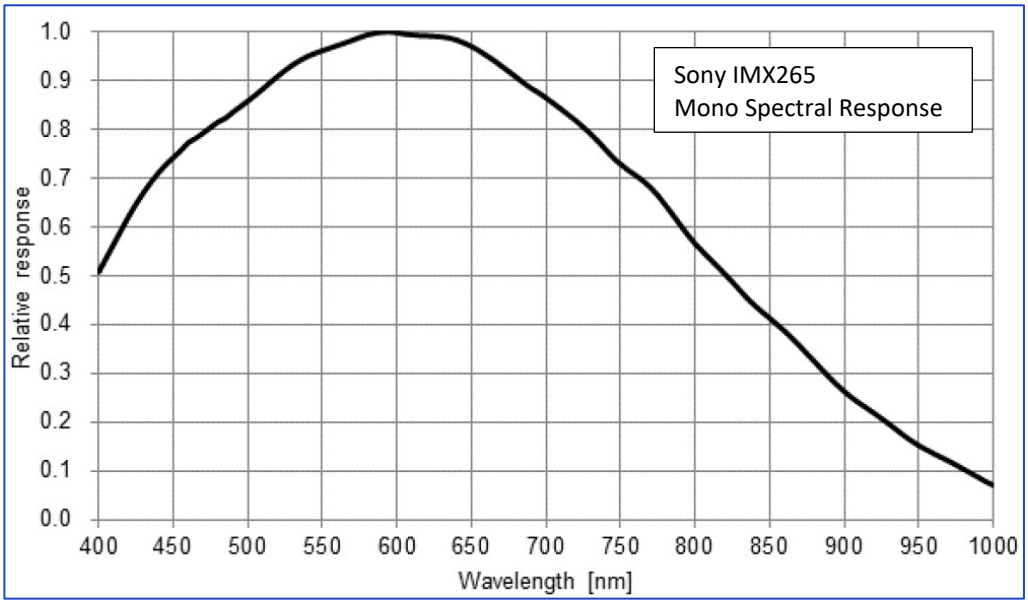


Figure 98: Cheetah C2000 and C2010 Monochrome Spectral Response

A.3 Cheetah C2400 and C2410 Spectral Response

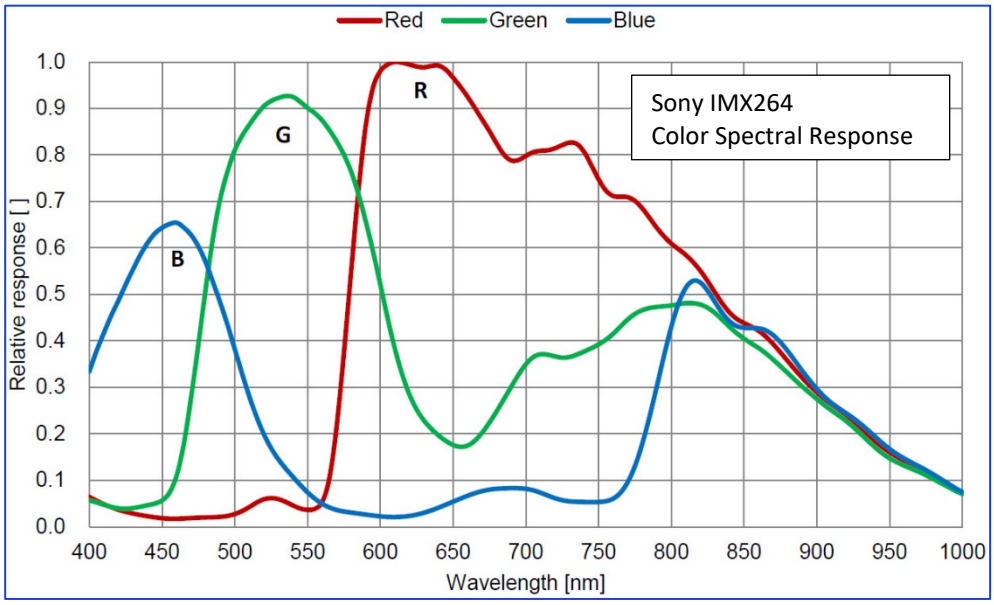


Figure 99: Cheetah C2400 and C2410 Color Spectral Response

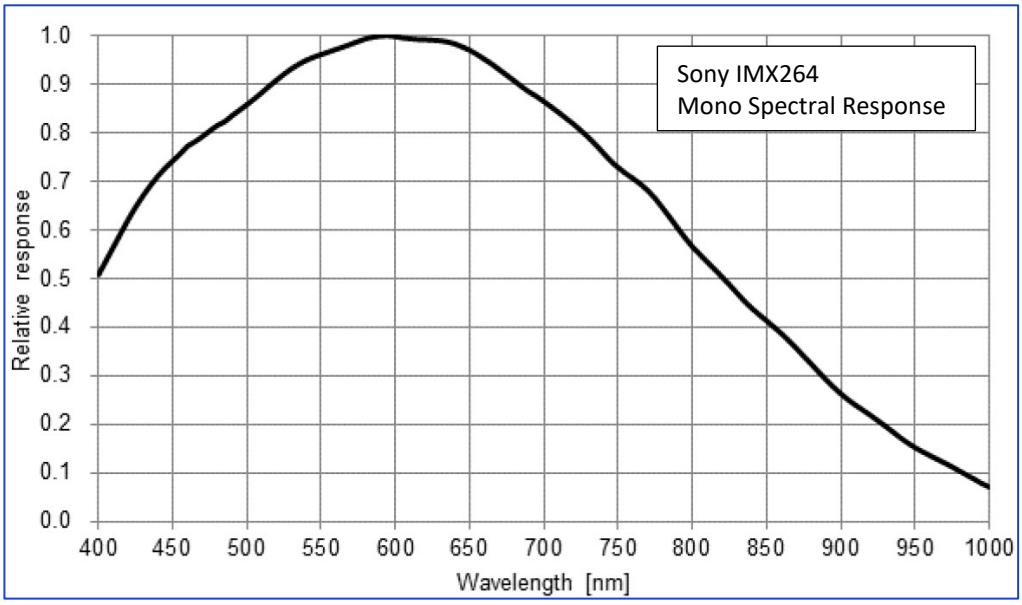


Figure 100: Cheetah C2400 and C2410 Monochrome Spectral Response

A.4 Cheetah C2410Y/Z Spectral Response

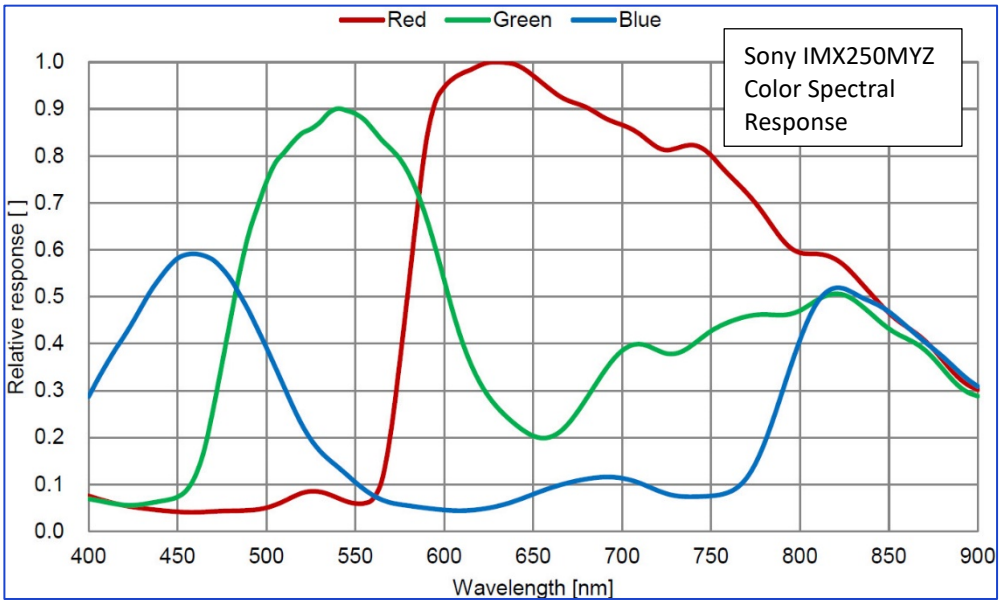


Figure 101: Cheetah C2410Y/Z Color Spectral Response

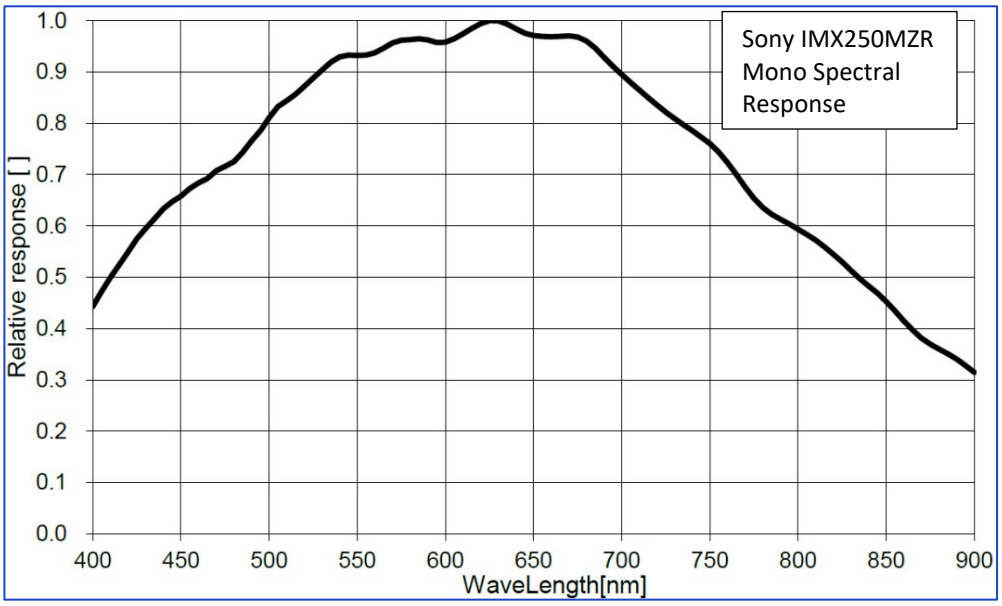


Figure 102: Cheetah C2410Y/Z Monochrome Spectral Response

A.5 Cheetah C3210 Spectral Response

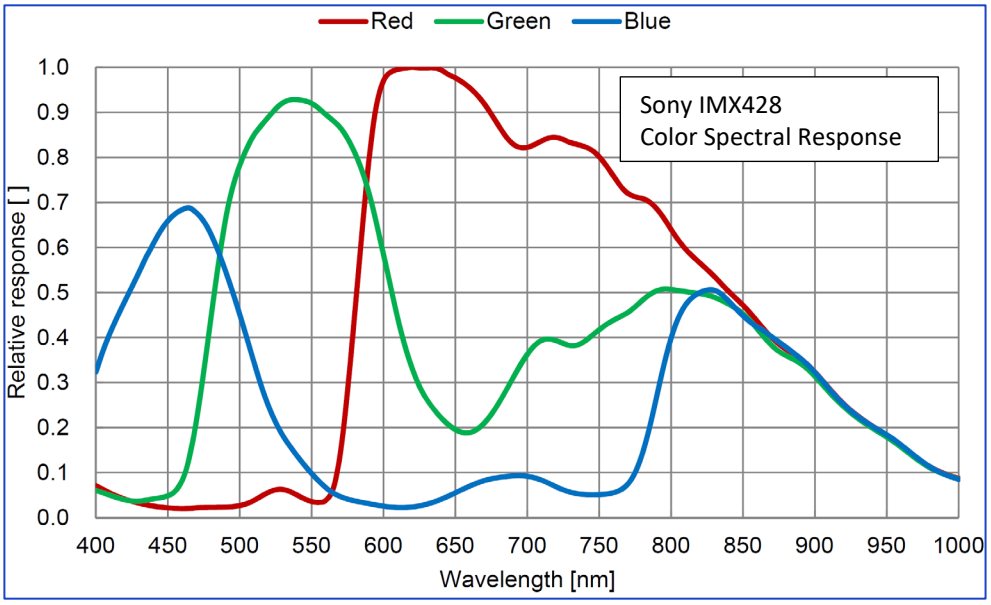


Figure 103: Cheetah C3210 Color Spectral Response

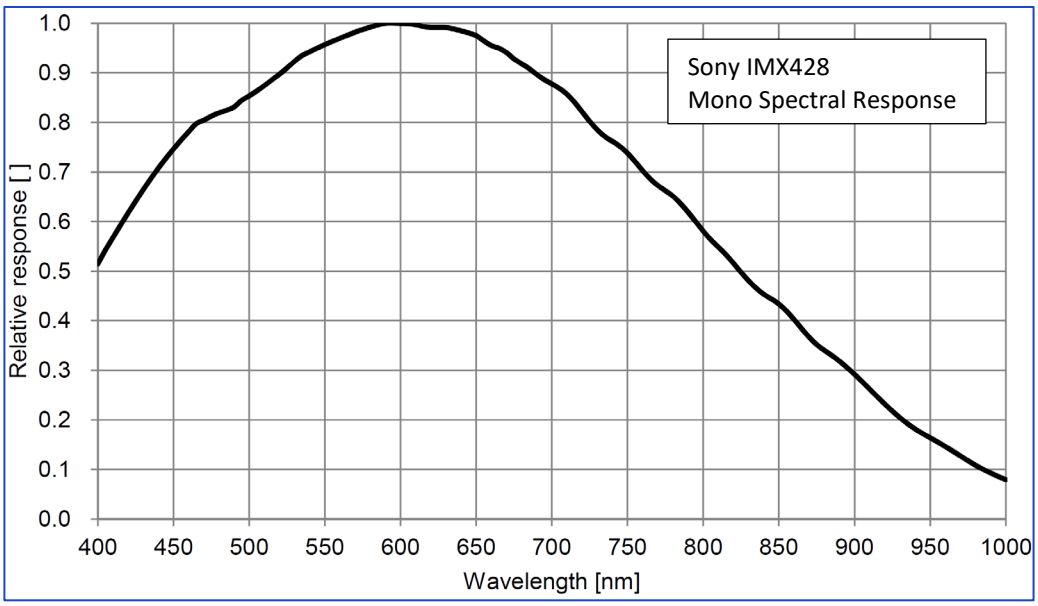


Figure 104: Cheetah C3210 Monochrome Spectral Response

A.6 Cheetah C4010 Spectral Response

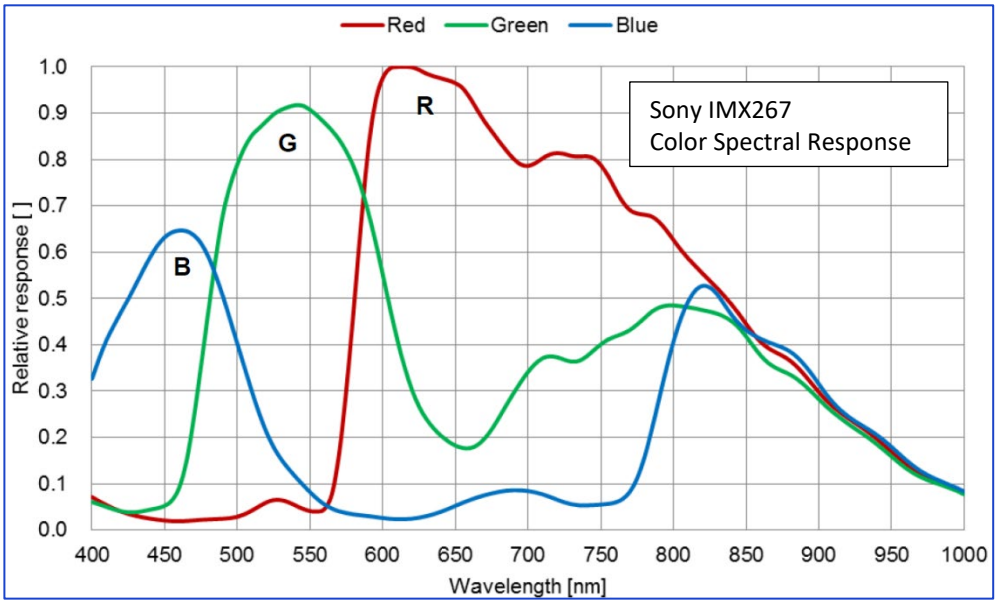


Figure 105: Cheetah C4010 Color Spectral Response

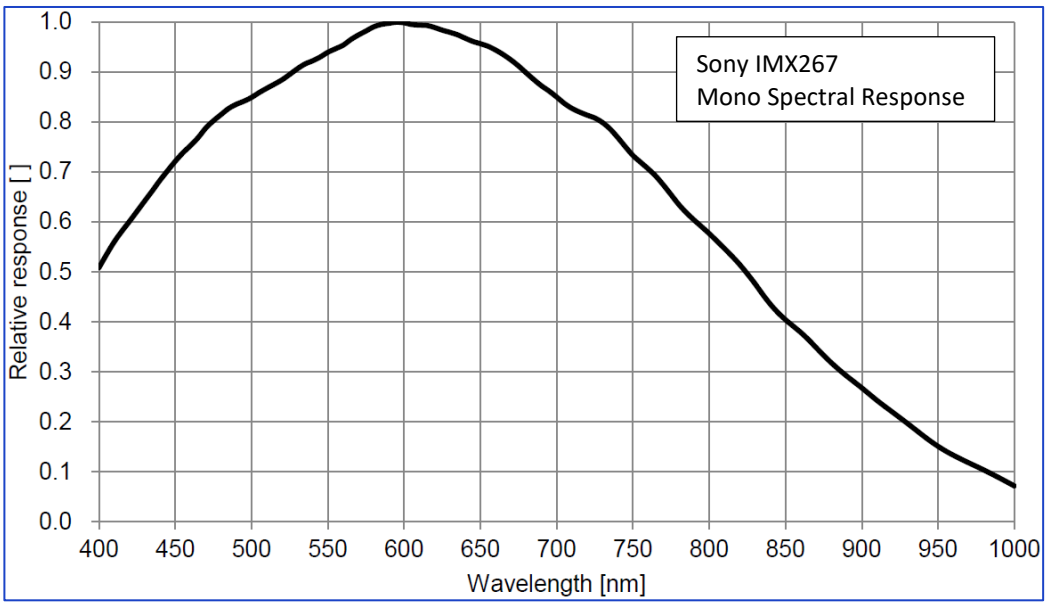


Figure 106: Cheetah C4010 Monochrome Spectral Response

A.7 Cheetah C4110 Spectral Response

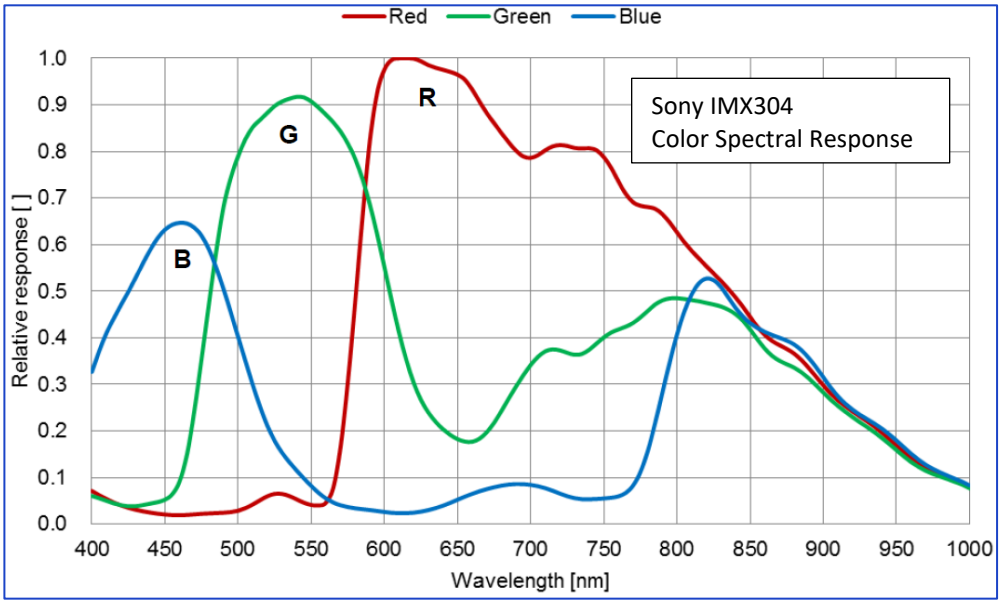


Figure 107: Cheetah C4110 Color Spectral Response

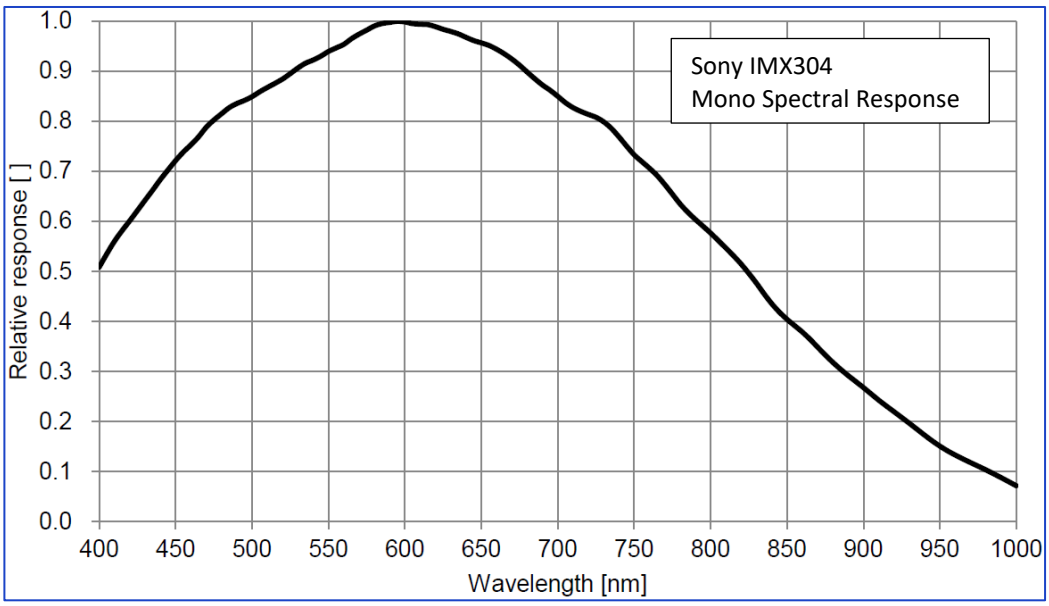


Figure 108: Cheetah C4110 Monochrome Spectral Response

A.8 Cheetah C4410 Spectral Response

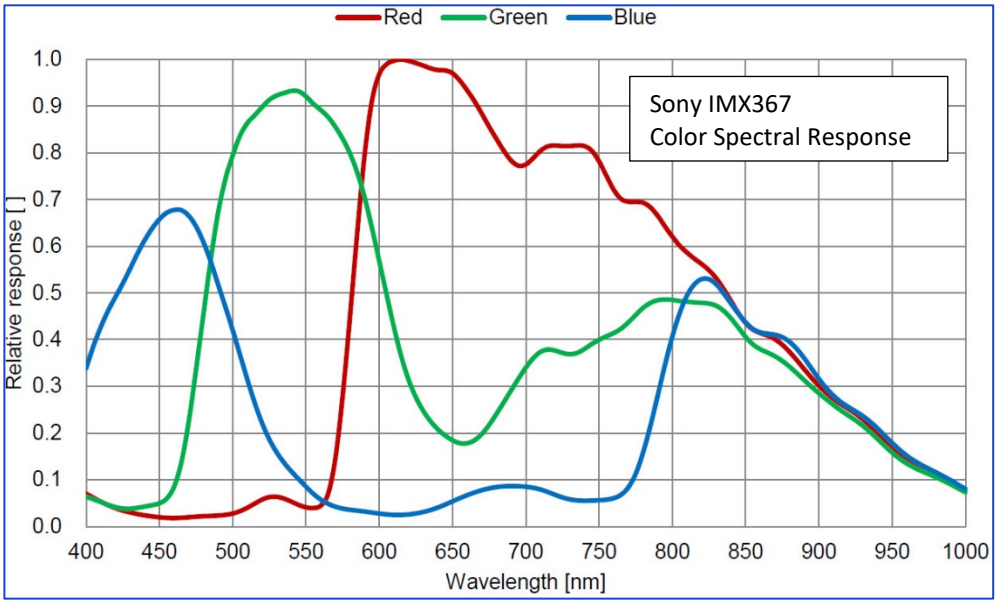


Figure 109: Cheetah C4410 Color Spectral Response

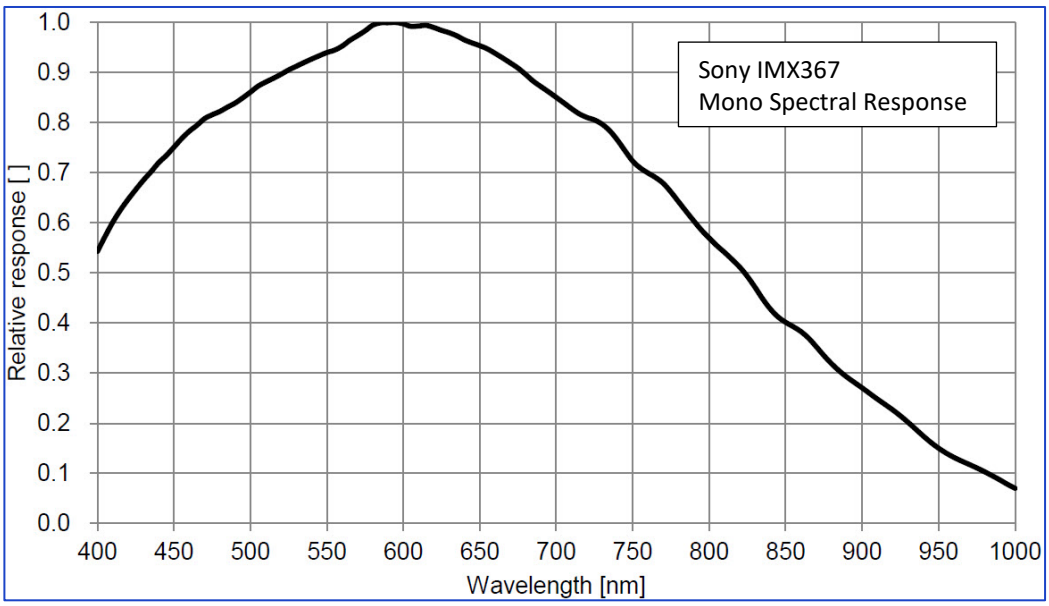


Figure 110: Cheetah C4410 Monochrome Spectral Response

A.9 Cheetah C5410 Spectral Response

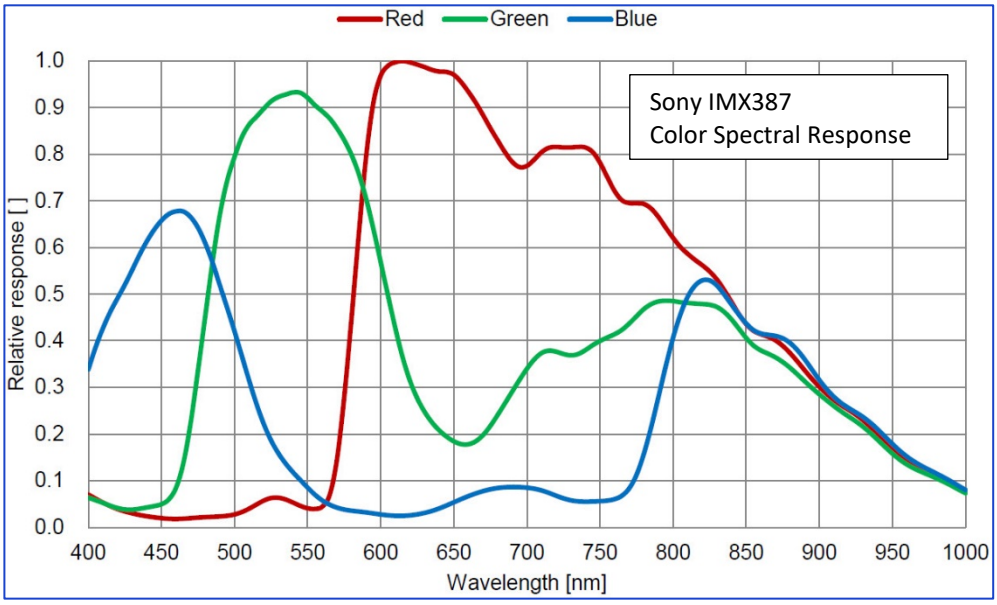


Figure 111: Cheetah C5410 Color Spectral Response

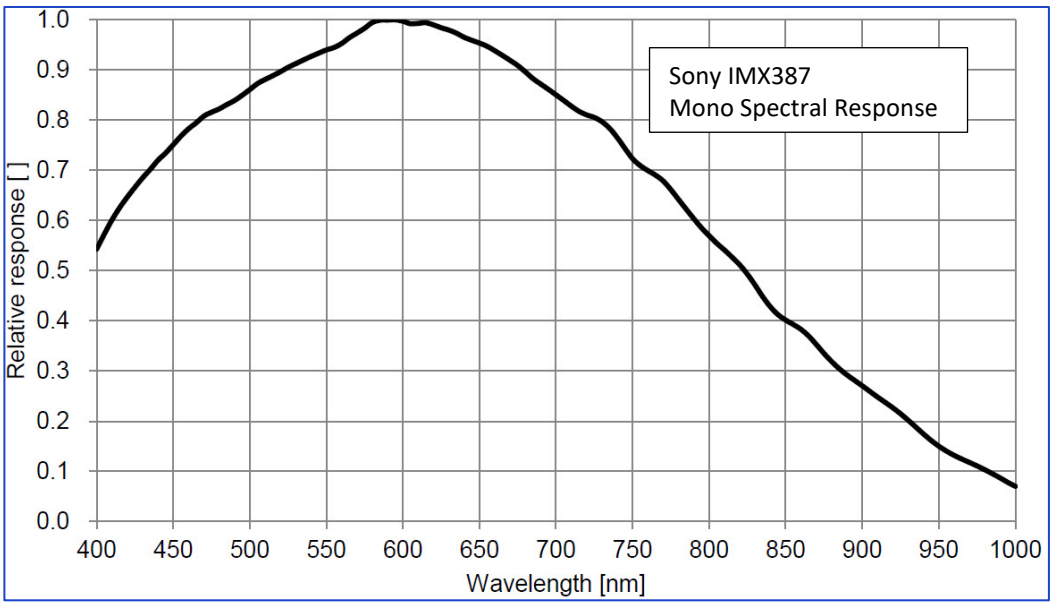


Figure 112: Cheetah C5410 Monochrome Spectral Response

A.10 Cheetah C6410 Spectral Response

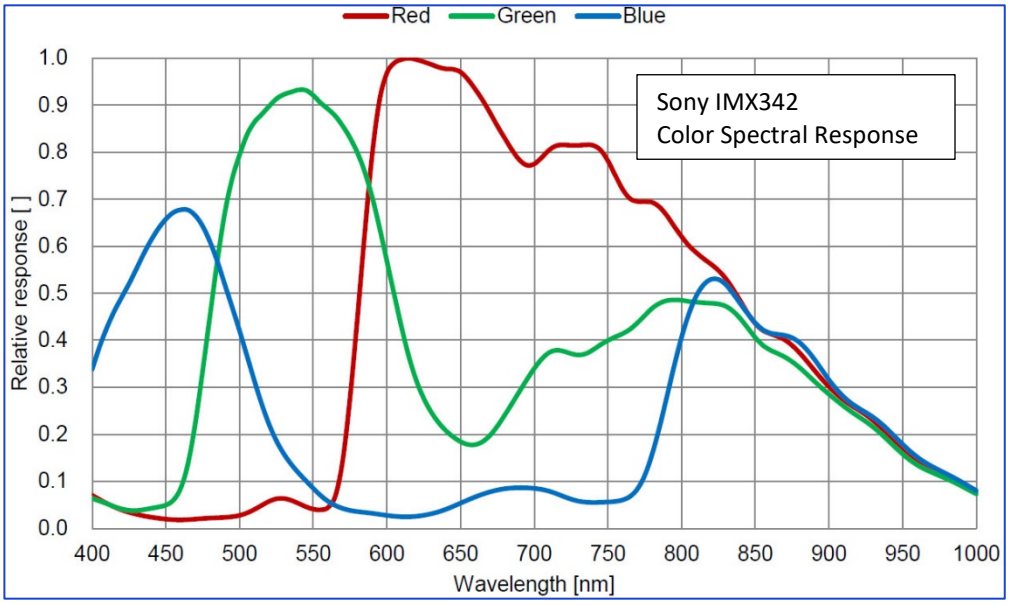


Figure 113: Cheetah C6410 Color Spectral Response

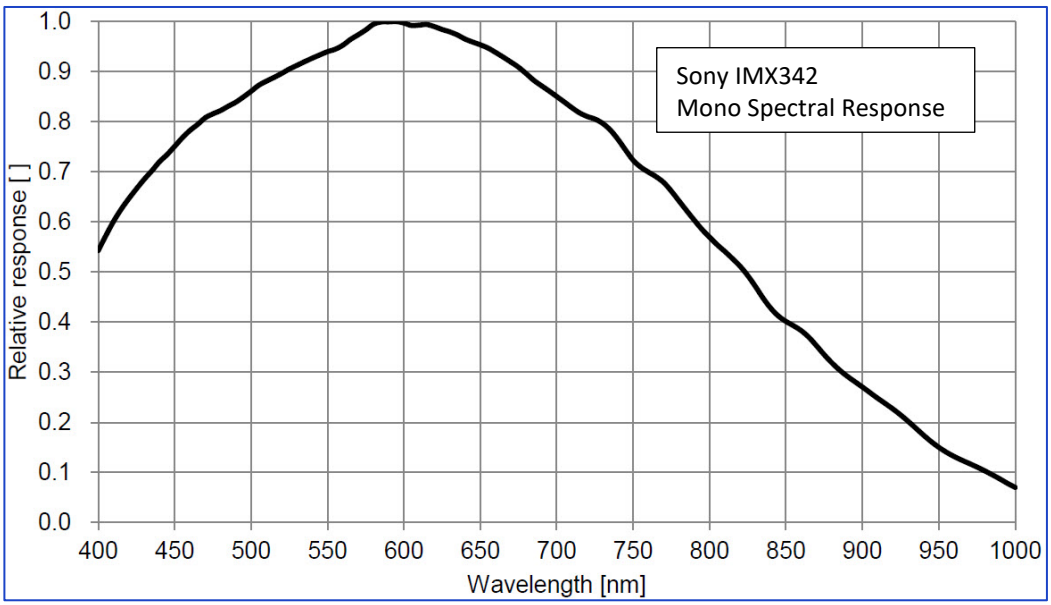


Figure 114: Cheetah C6410 Monochrome Spectral Response