

# *Digital Video Camera Module*

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## Technical Manual



**XCG-V60E**  
**XCG-SX97E**  
**XCG-SX99E**  
**XCG-U100E**  
**XCG-5005E**

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# Table of Contents

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## Overview

Features .....	3
Notes on Operation .....	4
Typical CCD Phenomena .....	4
System Components .....	5
Connection .....	6
Location and Function of Parts and Operation .....	7
Front/Top/Bottom .....	7
Rear .....	7
Using a Tripod .....	8
Connecting the Cables .....	8
Multi-Function Output Specifications .....	8
GPI Input Specifications .....	8
Trigger Input Specifications .....	9

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## Functions

Camera Drive System .....	10
Triggering .....	11
Trigger Polarity .....	11
Special Trigger Modes .....	11
Shutter .....	12
Trigger Inhibit .....	12
Trigger Delay .....	13
Multi-Function Outputs .....	13
General-Purpose Input (GPI) .....	13
Gain .....	13
Digital Pedestal .....	14
Digital Clamp (XCG-5005E only) .....	14
Digital Gain .....	14
Digital ON/OFF (XCG-5005E only) .....	14
Look-Up Table (LUT) .....	14
Switching Output Bit Length .....	14
Test Chart .....	14
Partial Scan .....	15
Binning Mode .....	15
Frame Rate Control .....	16
Image Acquisition Modes .....	16
Memory Channels and User Memories .....	16
Network Functions .....	16

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## Control Operations

Camera Control Registers .....	17
Memory Channel Registers .....	24
Default Value List .....	28
Max/Min Value List .....	31

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## Specifications

Specifications .....	33
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## Appendix

Spectral Sensitivity (Relative Response) Parameters .....	34
Dimensions .....	35

## Overview

The XCG-V60E/XCG-SX97E/XCG-SX99E/XCG-U100E/XCG-5005E is a monochrome digital video camera module that supports 1000BASE-T interface.

## Features

### GigE Vision-compliant

Conforming to GigE Vision version 1.0 standards, this unit is capable of transmitting uncompressed images at high efficiency.

### High image quality

Progressive-scan CCD produces high-precision, high-speed images.

The XCG-V60E equips a 330,000-pixel CCD that enables image output at 90 frames per second.

The XCG-SX97E equips a 1,450,000-pixel CCD that enables image output at 16 frames per second.

The XCG-SX99E equips a 1,450,000-pixel CCD that enables image output at 27 frames per second.

The XCG-U100E equips a 2,000,000-pixel CCD that enables image output at 15 frames per second.

The XCG-5005E equips a 5,000,000-pixel CCD that enables image output at 15 frames per second.

By adopting square pixels, images can be processed using the original aspect ratio without a converting procedure.

### Body fixing

The screw holes to install the camera module are located under the front and rear panels. Installing the camera module at these points minimizes deviation of the optical axis.

### Various mode settings

The following mode settings can be configured via controls from the host device.

- Gain
- Read mode: Normal/Binning
- Partial scan
- Shutter: Normal/Trigger shutter
- Shutter speed
- Gamma
- Switching an output Bit Length
- Binarization

### External trigger shutter function (2 to 1/100,000 sec.)

You can obtain still images by synchronizing with external trigger signals and operating the shutter at your own timing. This function is useful to shoot a fastmoving object clearly.

### Partial scan

The camera module can limit the number of effective video output lines to achieve high frame rates, enabling high-speed image processing.

### Frame rate control

You can change the frame rate while maintaining the shutter setting. This is useful when you want to reduce packet sizes per time by lowering the frame rate and reduce network traffic.

#### Note

Normal connection between the camera and the host system may not be established if the camera is turned on before system initialization is complete on the host device. Wait for completion of host device system initialization before turning on the camera.

## Notes on Operation

### Power supply

You can supply power via the DC IN connector using the power adapter.

Use DC-700/700CE which is the stable power source free from ripple or noise.

### Locations for operation and storage

Avoid operation or storage in the following places.

- Extremely hot or cold locations. Recommended temperature range for operation is 0 to 40 °C (32 to 104 °F).
- Locations subject to strong vibration or shock.
- Near generators of strong electromagnetic radiation such as TV or radio transmitters.

### Care

Use a blower to remove dust from the surface of the lens or optical filter. Clean the exterior with a soft, dry cloth. If the camera is very grimy, apply a cloth soaked in a mild detergent then wipe with a dry cloth. Do not apply organic solvents such as alcohol or benzene which may damage the finish.

#### Note on laser beams

Laser beams may damage a CCD. You are cautioned that the surface of a CCD should not be exposed to laser beam radiation in an environment where a laser beam device is used.

## Typical CCD Phenomena

The following effects on the monitor screen are characteristic of CCD cameras.

They do not indicate any fault with the camera module.

### Smear

This occurs when shooting a very bright object such as electric lighting, the sun, or a strong reflection.

This phenomenon is caused by an electric charge induced by infrared radiation deep in the photosensor. It appears as a vertical smear, since the CCD imaging element uses an interline transfer system.

### Vertical aliasing

When you shoot vertical stripes or lines, they may appear jagged.

### Blemishes

A CCD image sensor consists of an array of individual sensor elements (pixels). A malfunctioning sensor element will cause a single pixel blemish in the picture. (This is generally not a problem.)

### White speckles

While CCD image pickup device is made by an accurate technique, imperceptible speckles may rarely come up on the screen due to cosmic rays and so on. This is connected to the principle of CCD image pickup device, not a malfunction. And the white speckles are easy to come up in the following conditions.

- Using the camera in high temperature
- When turning up the gain

### Blooming

This is a phenomenon in which the light from very bright objects appears to overflow into neighboring areas in an image.

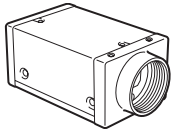
#### Note

If strong light enters a wide area of the screen, the screen may become dark.

This is not a malfunction. If this occurs, avoid strong light or adjust the lens iris to reduce the light amount.

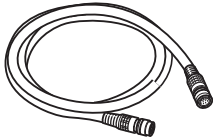
# System Components

The Camera Module system comprises the following optional products (sold separately from the Camera Module).



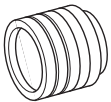
Camera Module

This is a small-size, high-resolution, video camera module using a progressive scan CCD image sensor.



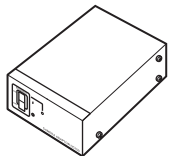
CCXC-12P02N (2 m, 6.6 ft)/  
05N (5 m, 16.4 ft)/10N (10 m,  
32.8 ft)/25N (25 m, 82 ft)  
camera cable

This is attached to the DC IN connector on the rear panel of the camera module and is used for power supply and exchange of trigger signals.



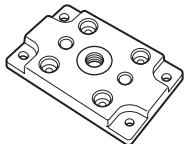
C-mount lens

For XCG-SX97E/SX99E/U100E/5005E, use a high-resolution lens.



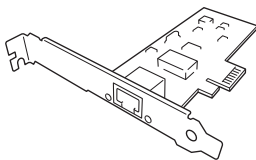
DC-700/700CE  
camera adaptor

This is connected to the camera module to enable power supply from ordinary AC power source.



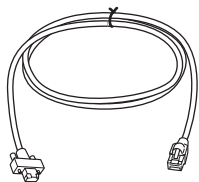
VCT-ST70I  
tripod adaptor

This attaches to the bottom of the camera module to fix the camera module to a tripod.



Network card  
(commercially available)

Install the board in the expansion slot of the host device (ex: computer). Select a card that is appropriate for your system and that supports 1000BASE-T and jumbo packets.

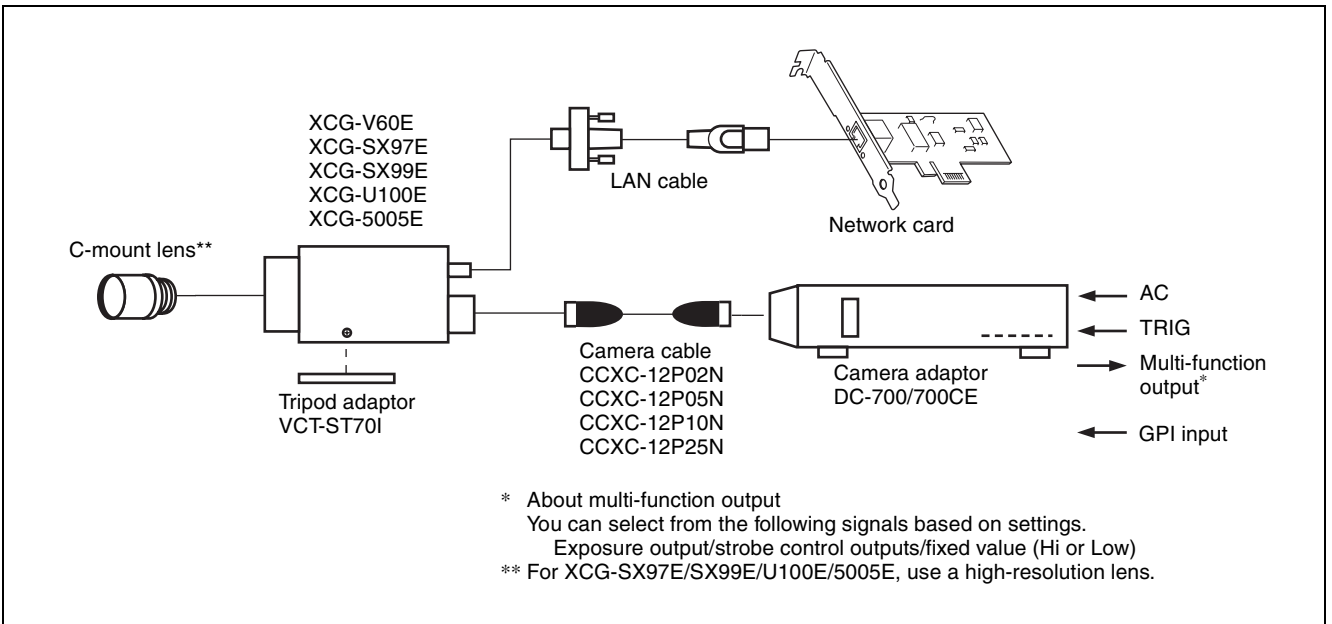


LAN cable  
(commercially available)

This cable connects to the RJ45 connector on the rear panel of the camera module. Image/control signals are transmitted via this cable. Select a LAN cable that supports 1000BASE-T (CAT5e or higher cable standard).

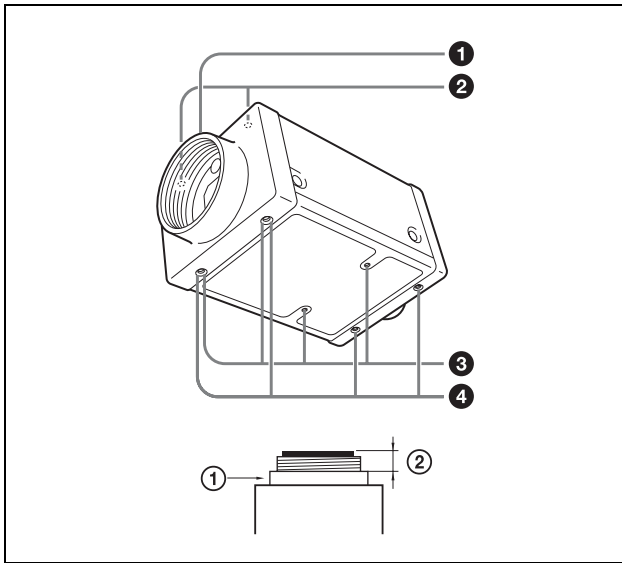
Depending on the attributes of the LAN cable, images may become less clear and the camera module may become unstable. Be sure to use a LAN cable that has sufficient noise reduction.

# Connection



# Location and Function of Parts and Operation

## Front/Top/Bottom



### 1 Lens mount (C-mount)

#### Note

The lens must not project more than 10 mm (13/32 inch) from the lens mount.

① Lens mount face    ② 10 mm (13/32 inch) or less

### 2 Guide screw holes (Top)

### 3 Guide screw holes/Tripod screw holes (bottom)

When using a tripod, use these four screw holes to attach a VCT-ST70I tripod adaptor.

#### Note

Use the screws (M2 × 6 (2); M3 × 8 (2)) supplied with the tripod adaptor when installing it on the camera module.

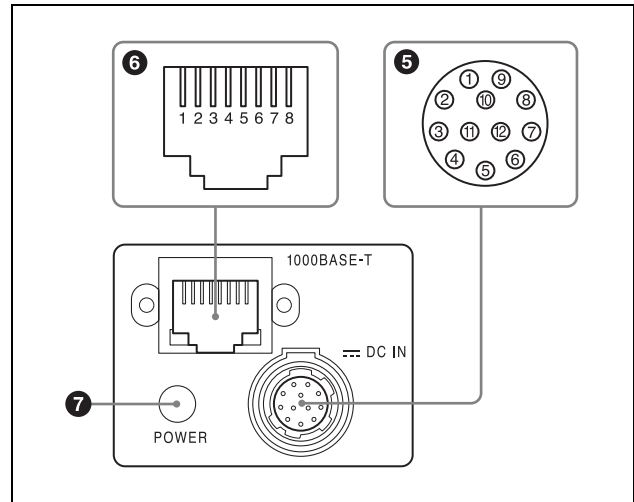
### 4 Reference screw holes (bottom)

These precision screw holes are for locking the camera module. Locking the camera module into these holes secures the optical axis alignment.

#### Note

Refer to XCG-V60E/XCG-SX97E/XCG-SX99E/XCG-U100E/XCG-5005E Dimensions in page 35 for about the position/size of the Guide hole and the Reference hole.

## Rear



### 5 DC IN (DC power input) connector (12-pin)

You can connect a camera cable CCXC-12P05N etc. to input the +12 V DC power supply. The pin configuration of this connector is as follows. For details on the pin arrangement, see the following table.

Pin No.	Signal	Pin No.	Signal
1	Ground	7	GPI input (ISO +)
2	+12 V DC	8	Ground
3	Ground	9	NC
4	Multi-function output* (TTL)	10	NC
5	Multi-function output* (ISO -)	11	Triger input
6	Multi-function output* (ISO +)	12	GPI input (ISO -)

#### \* About multi-function output

You can select from the following signals based on settings.

Exposure output/strobe control outputs/GPO (fixed value Hi or Low)

See page 8 for pin 4 TTL output level and pin 11 trigger input level specifications.

### 6 RJ45 connector

You can connect a LAN cable to this connector to control the camera module from a host device to output image to a host device.

Pin No.	Signal	Pin No.	Signal
1	TP1 +	5	TP3 -
2	TP1 -	6	TP2 -
3	TP2 +	7	TP4 +
4	TP3 +	8	TP4 -

## 7 POWER LED

Flashes or lights based on the internal status of the camera.

Flashing: Obtaining IP address.

Lit: IP address obtained.

## Using a Tripod

To use the tripod, install the tripod adaptor VCT-ST70I (not supplied) on the camera module.

Use a tripod screw with a protrusion ( $\ell$ ) extending from the installation surface, as follows, and tighten it, using a screwdriver.

4.5 to 5.5 mm

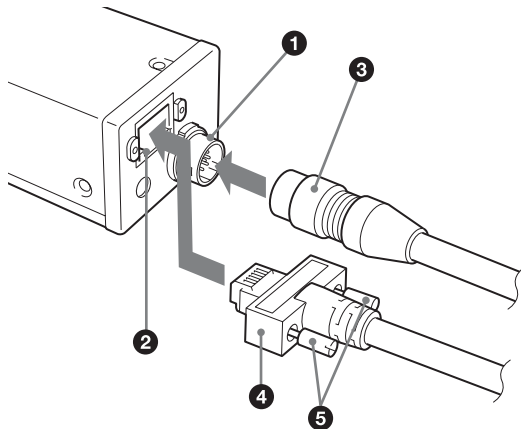
0.18 to 0.22 inches



### Note

If you install a tripod adapter (not supplied), use the screws provided.

## Connecting the Cables



Connect the camera cable to the DC IN connector and the LAN cable to the RJ45 connector respectively. When you connect the LAN cable, turn the two fastening screws on the connector to secure the cable tightly.

1 DC IN connector

2 RJ45 connector

3 Camera cable

4 LAN cable

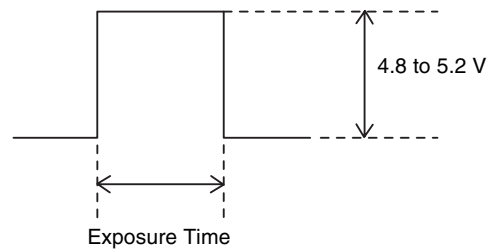
5 Fastening screws

Connect the other end of the camera cable to the DC-700/700CE and the other end of the LAN cable to the Network card.

## Multi-Function Output Specifications

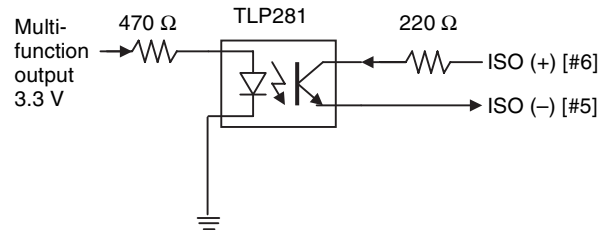
When exposure output is selected, signal output is valid during image sensor exposure. When strobe control output is selected, output signal timing and pulse width can be precisely set to control external devices such as strobes connected to the camera. Output signal polarity can be set for both exposure and strobe control outputs. TTL output termination impedance should be at least 10 k $\Omega$ .

Illustrations of positive-polarity multi-function TTL output.



When using ISO (+ or -), be sure to use an external power supply between +5 and +24 V DC in combination with resistance.

Refer to the following circuit diagram.



### Note

When GPO (fixed-value, general-purpose output) is selected, the fixed output varies depending on the register setting value.

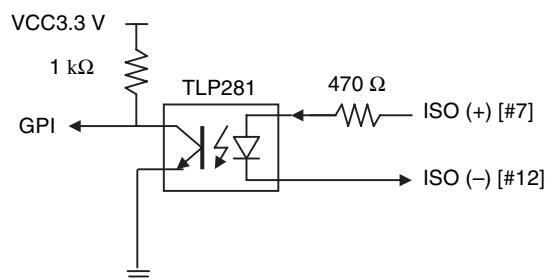
Register setting value 0: fixed Low

Register setting value 1: fixed Hi

## GPI Input Specifications

Be sure to use an external power supply between +5 and +24 V DC in combination with resistance.

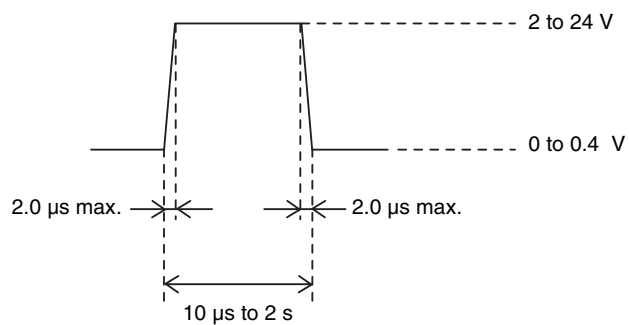
Refer to the following circuit diagram.



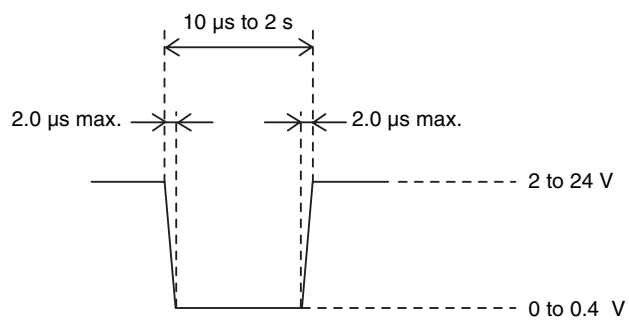


## Trigger Input Specifications

When trigger input polarity is positive



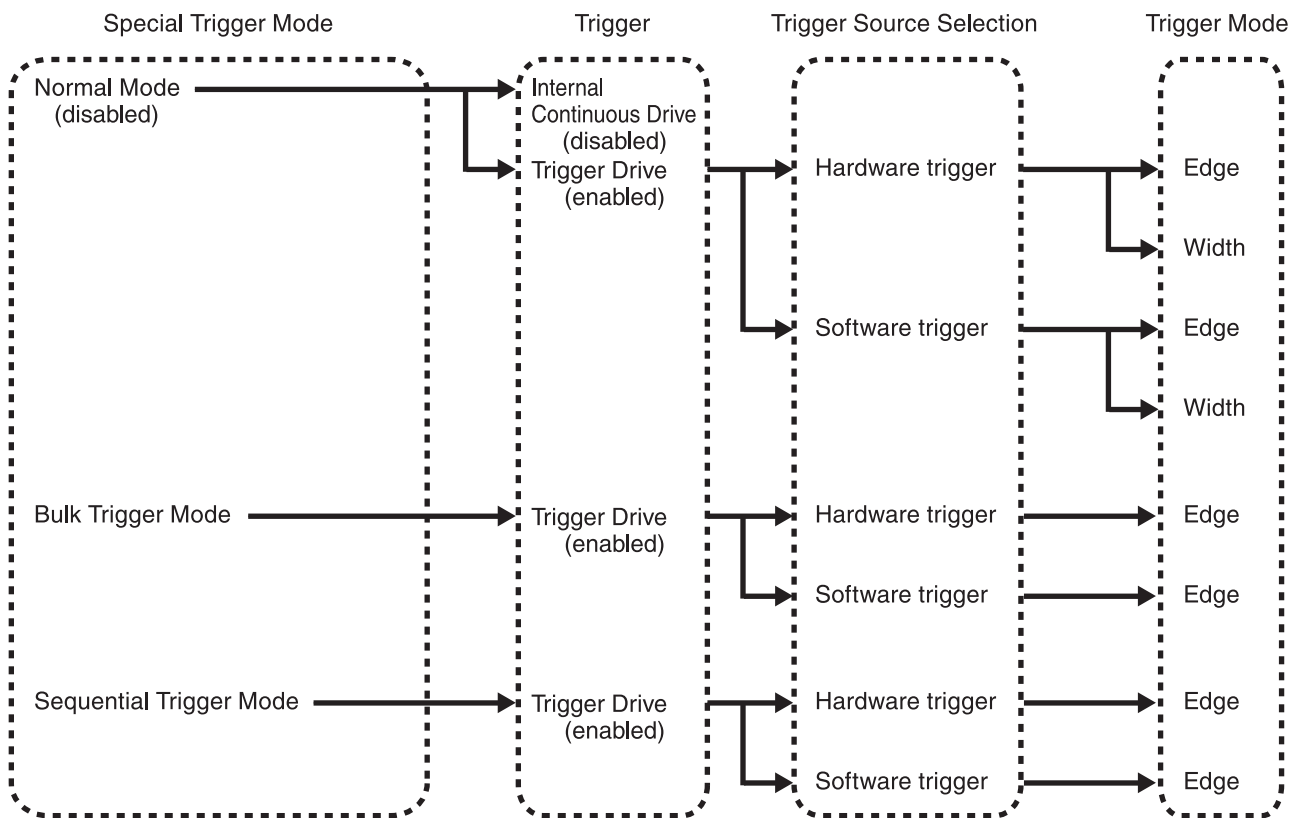
When trigger input polarity is negative



The voltage values described in the above diagram are the values when the terminating impedance is 10 kΩ or more.

# Camera Drive System

The camera drive system functions as follows.



## Triggering

The camera can be triggered by hardware or software triggering events.

### Hardware Triggering

Hardware triggering is performed by applying a signal to an input on the 12-pin connector. Exposure occurs according to the predetermined timing of the trigger signal, which serves as the drive signal for acquiring video images. An image is acquired whenever the drive signal is valid. This function is used for shooting simultaneous video with multiple cameras.

### Software Triggering

Software triggering is performed by an internal drive signal generated within the camera in response to network commands. Exposure occurs according to this trigger signal. This drive signal is useful for triggering when hardware triggering is not suitable.

## Trigger Polarity

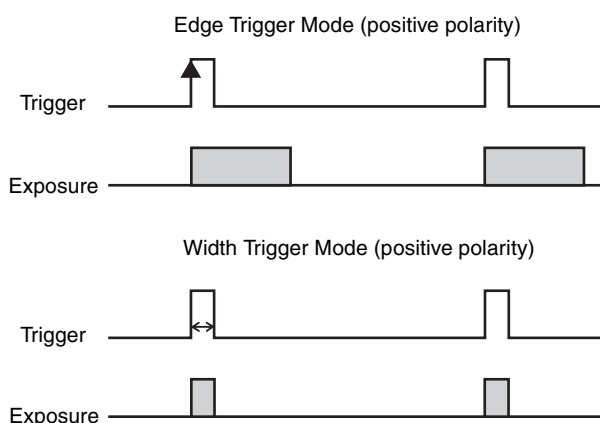
This is a function to select the polarity of the signal that enables triggering from positive or negative. Select the trigger polarity before using other trigger functions.

## Special Trigger Modes

The three special trigger modes are Normal, Bulk and Sequential triggering.

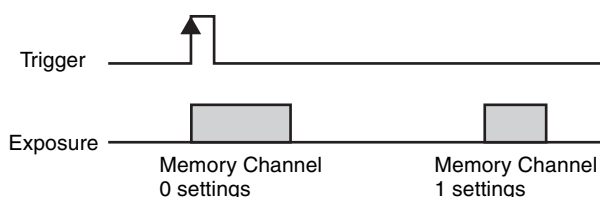
### Normal trigger mode (disabled)

The Normal mode outputs images continuously according to internal continuous drive. When trigger drive is enabled, the camera is driven by either hardware or software triggering. In this mode, the following two drive methods are available according to the trigger mode: Edge Trigger Mode (exposure begins at the rising edge of trigger pulses with duration based on the shutter settings) or Width Trigger Mode (exposure duration is the same as the trigger pulse width).



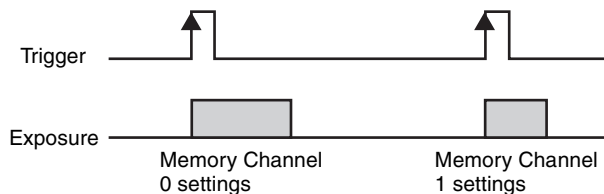
### Bulk trigger mode

Different camera setting configurations are stored in memory channels beforehand, with the different settings applied to acquire multiple video images at each trigger event. In the following diagram, two images are acquired in one cycle.



## Sequential trigger mode

Different camera setting configurations are stored in memory channels beforehand, with the different settings applied in sequence to acquire a different image with each trigger event. In the following diagram, two images with different exposure settings are acquired in one cycle.



The camera provides 16 memory channels, so up to 16 setting configurations can be assigned to each cycle. For bulk and sequential trigger modes, the following functions are read from each memory channel.

### Image parameters

- Image size (H) offset X
- Image size (V) offset Y

### Feature parameters

- Manual Gain (Gain L/R with XCG-5005E)
- Digital Clamp L/R (XCG-5005E only)
- Digital ON/OFF (XCG-5005E only)
- Digital Pedestal
- Digital Gain
- Shutter
- Look-Up Table (LUT)
- Binarization Threshold
- Multi-Function Output Mode
- Strobe Polarity
- Strobe Delay
- Strobe Pulse Width
- GPO
- User Memory

### Notes

- When using Bulk or Sequential trigger mode, be sure to allow sufficient trigger cycle time. Images are disrupted if the trigger period is shorter than the time required to output a frame.
- With the XCG-5005E, using Bulk or Sequential trigger mode with different gain values in different memory channels may result in different left and right video levels. In such cases, verify operation before use.
- When using Bulk or Sequential trigger mode, bear in mind that the following settings are ignored and have no effect.

## Image Parameters

- Image Size (H)
- Image Size (V)
- Pixel Format
- Binning
- Test Chart
- Auto Gain Detection Frame ON/OFF
- Auto Gain Detection Frame Area Setting
- Manual Frame Rate
- Auto Frame Rate
- Gamma Curve Coefficient
- Gamma Curve Reference Level

## Feature Parameters

- Auto Clamp ON/OFF (XCG-5005E only)
- Auto Gain ON/OFF
- Trigger ON/OFF (ON = fixed trigger drive)
- Trigger Mode (fixed edge)
- Trigger Polarity
- Trigger Inhibit
- Trigger Delay
- Software Trigger Pulse Output
- Trigger Source Select

When using the Bulk or Sequential special trigger mode, you must select the trigger type (hardware or software trigger) with the Special Trigger Source Select parameter, and select the polarity with the Special Trigger Polarity parameter.

## Shutter

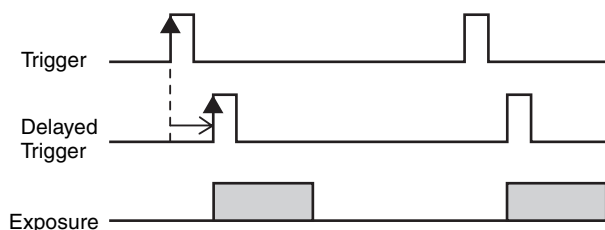
The camera supports manual shutter control. With Edge triggering, the exposure time can be set from 10  $\mu$ s to 2 s, in 1  $\mu$ s units.

## Trigger Inhibit

This function disables the camera's trigger input. When multiple cameras are connected, use this to disable triggering for only specified cameras at specific times.

## Trigger Delay

This function applies a trigger delay within the camera. Use it to synchronize trigger timing when the trigger signal is offset from the desired object exposure timing. Setting range is 0 to 4 sec. (in 1  $\mu$ s units).



### Note

To use trigger delay, the input trigger period must be longer than the trigger delay value. Otherwise, images cannot be output properly.

## Multi-Function Outputs

The multi-function output settings determine the function of the camera's output connector pins for GPO (general-purpose signal output), exposure signal output or strobe control signal output. These signal ports are used to control external devices. GPI ports are also provided for input signals.

### Exposure output

Signal output is valid during image sensor exposure. You can also configure the polarity.

### Strobe control outputs

Make precise adjustments to strobe control and control for other external devices connected to the camera by controlling the timing and width of signals. You can also configure the polarity.

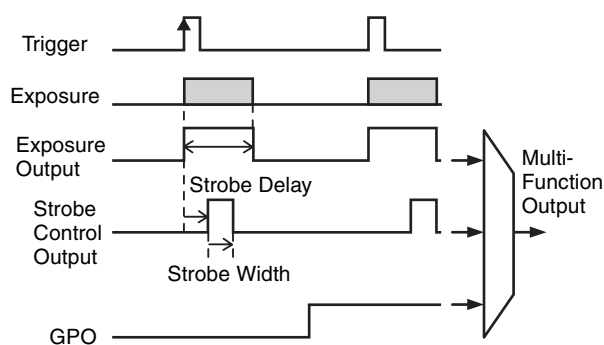
Setting ranges are:

Strobe delay: 0 to 4 msec. (in 1  $\mu$ s units)

Strobe width: 0 to 4 msec. (in 1  $\mu$ s units)

### GPO

Outputs can be High or Low active.



### Note

When using strobe control output, if the strobe delay or strobe width exceeds the exposure interval, proper strobe signals cannot be output. Set the strobe control output so that the delay and width are within the exposure time.

## General-Purpose Input (GPI)

The camera has two multi-function output ports and one GPI port.

## Gain

The camera provides both manual and automatic gain control.

### Manual gain control

Variable gain control in models XCG-V60E/XCG-SX97E/XCG-SX99E/XCG-U100E can be set from 0 to 18 dB in 0.0358 dB increments, or from 0 to 502 in 0.0358 dB steps.

In addition to the above, the XCG-5005E provides independent left and right controls (GainL and GainR). When left and right gain should be the same, set only the left level (GainL).

### Auto gain control

The camera provides the auto gain control function to automatically control image brightness according to a user-specified detection frame and image average level (variable from 0 to 16383 in 14 bit). The variable range is the same as for manual gain control.

Also, the auto gain control detection frame showing each area's image average level can be displayed and adjusted. The detection frame is defined by Offset X and Y, Width and Height percentage values (relative to the [100%] width and height of the output video image).

## Digital Pedestal

The camera provides the digital pedestal function to adjust image black level.

In the XCG-V60E/XCG-SX97E/XCG-SX99E/XCG-U100E, the level can be set from 0 to 2047.

In the XCG-5005E, the level can be set from each camera's lower limit value to 2047.

### Note

The digital pedestal setting is a 14-bit value. As such, 1/64 as many setting levels are available during 8-bit output, 1/16 are available during 10-bit output, and 1/4 are available during 12-bit output.

## Digital Clamp (XCG-5005E only)

The XCG-5005E provides the digital clamp function to correct black level difference between left and right images. The digital clamp has the following three modes.

### One-Shot Clamp

This mode corrects left-right black level difference once upon executing the command.

### Auto Clamp

This mode automatically corrects left-right black level difference.

### OFF

This mode allows you to manually correct left-right black level difference.

If the above One-Shot/Auto Clamp modes cannot adequately correct left-right black level difference, user adjustment is available from the OFF mode.

Set Digital ON/OFF to OFF, and adjust Clamp L/R values separately, from 0 to 1023. Left and right black level is freely user settable. However, in the OFF mode, Digital Pedestal and Digital Gain functions are disabled. User can also set left and right gain separately by GainL and GainR (0 to 502 steps or 0 to 18 dB). When setting Clamp L/R and GainL/R separately, set the left side first.

## Digital Gain

The camera provides a digital gain function. Gain values are from 1X to 2X (0 to 64, in 0.015625X increments).

### Note

When using digital gain, discontinuity may occur in the spacing between output levels. This occurs due to the lack of an image signal output that is equivalent to the output steps. This is not a malfunction.

## Digital ON/OFF (XCG-5005E only)

Use this function to set left-right image black levels independently. Setting range is 0 to 1023 for each.

### Note

The digital clamp L/R setting is a 14-bit value. Therefore, be careful when data is handled otherwise, e.g., as 12-bit output values (giving one quarter as many setting levels).

## Look-Up Table (LUT)

The camera's look-up table consists of 4,096 values, with 12-bit input and output. The look-up table allows setting an arbitrary gamma curve or binarization. Also, a gamma curve coefficient can be specified for the standard black level. For levels below the standard black level, set the gamma value to 1 to prevent burnt-out highlights in the black level.

Selectable from 0: Linear 1: Reverse 2: Binarization 3: Gamma Curve Coefficient 4: User Setting.

## Switching Output Bit Length

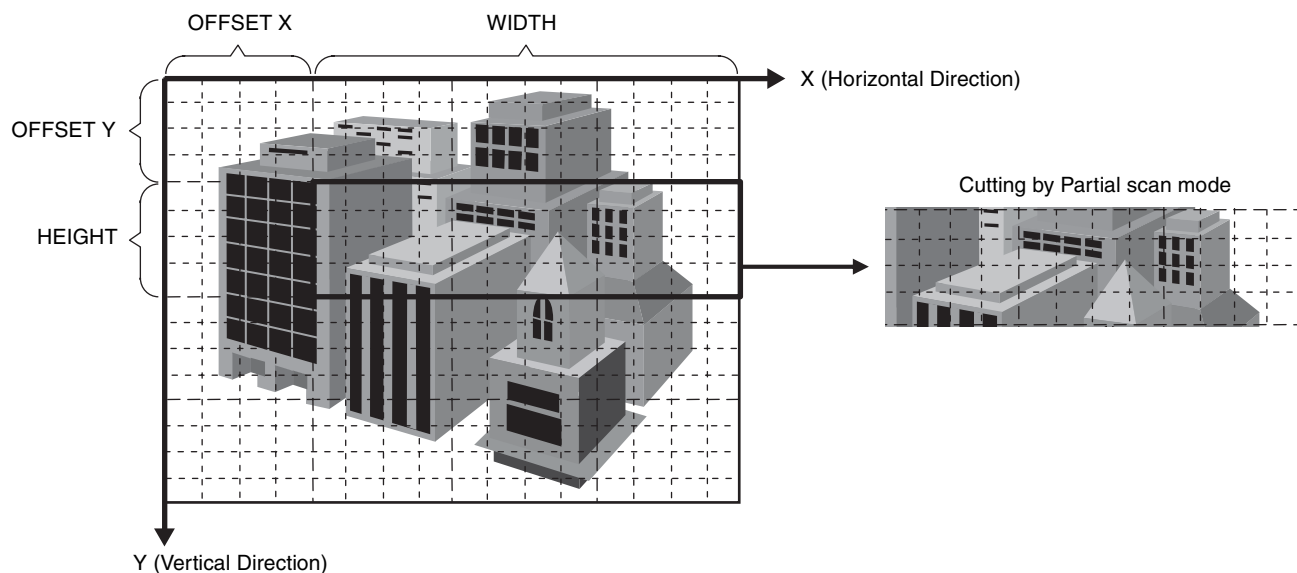
The camera provides a function to switch image output bit length between 8, 10 and 12 bits. Use it to adjust the relative priority of data quantity to image quality. The pixel formats are Mono8, Mono10, Mono10 Packed, Mono12 and Mono12 Packed in compliance with GigE Vision 1.0.

## Test Chart

The camera includes a grayscale chart for testing purposes.

# Partial Scan

The partial scan function outputs a user-defined region (Area Of Interest) within the overall image area. The cut-out region for partial scan is defined by Offset X and Offset Y (which indicate the start point for cutting), and Width and Height (which indicate the area). Contiguous blocks of minimum areas can be selected to define regions. However, the defined region must be a square or right rectangle. T- and L-shaped regions are invalid.



Minimum area sizes for partial scan are as follows:

- XCG-V60E 64 pixels × 48 lines
- XCG-SX97E 64 pixels × 100 lines
- XCG-SX99E 64 pixels × 100 lines
- XCG-U100E 64 pixels × 120 lines
- XCG-5005E 64 pixels × 480 lines

Cut-out position settings are specified with the following units:

- Horizontal: 8-pixel units
- Vertical: 4-scan line units

**Note**

Be aware that the frame rate increases for vertical cut-outs, while the frame rate remains unchanged for horizontal cut-outs.

# Binning Mode

This mode increases sensitivity and frame rate by combining vertically adjacent pixel data from the CCD.

**Note**

Binning mode approximately doubles sensitivity by combining vertical signals on alternate pairs of adjacent lines. However, because the frame rate is also doubled, available exposure time is consequently halved. Setting a shorter exposure time enhances the effect, and sensitivity is further increased. Consider the effect on exposure time when using the Binning mode.

## Frame Rate Control

The camera provides the following two methods for frame rate control during internal continuous drive operation.

### Auto Frame Rate setting

The fastest frame rate is configured automatically based on the current shutter setting and binning/partial scan setting. This is the default frame rate control setting for the camera.

To increase the frame rate, enable the binning mode or partial scan function. Depending on whether the exposure time is longer than the frame period, the frame rate will be reduced proportionally. Therefore, shorten the shutter time as necessary.

### Frame Rate setting

Configure the frame rate manually. However, you cannot increase the frame rate beyond the fastest setting. In addition, if the exposure time is longer than the configured frame period, the frame rate will be reduced in proportion to the exposure time.

When you want to minimize network traffic, use this setting to lower the frame rate while maintaining the same shutter setting.

The camera has a frame rate display function for verifying the frame rate obtained using the above settings. By using this function to confirm that an anticipated frame rate has been obtained, you can verify frame correspondence with hardware triggering. For width-mode hardware triggering, set the hardware trigger period to the displayed frame rate, and set the hardware trigger width to the displayed internal shutter value. For edge-mode hardware triggering, set only the trigger period to the displayed frame rate.

## Image Acquisition Modes

The following three image acquisition modes are available:

- Continuous image output
- Output a user-specified number of frames (from 1 to 255)
- Single frame output

## Memory Channels and User Memories

### Memory channels

Sixteen memory channels are provided for camera parameters that can be switched at each frame when using bulk and sequential trigger modes.

The memory channels can also be used to store user settings when the special trigger mode is set to Normal, to be applied when switching the camera state for particular situations.

### User Memories

Each memory channel provides 64 bytes of non-volatile read-write storage for users to store data freely.

Stored data is preserved even when the power is turned off.

## Network Functions

### Payload Size

Displays the data size of 1 frame in bytes. This is calculated from the image size (Width × Height) and pixel format.

Mono8: Width × Height

Mono10 Packed/Mono12 Packed: Width × Height × 1.5

Mono10/Mono12: Width × Height × 2.0

### IP Configuration

PersistentIP, DHCP, or LLA can be selected for IP configuration.

When DHCP or LLA is selected, the current IP address, current subnet mask, and current default gateway will be automatically assigned.

When PersistentIP is selected, IP address, subnet mask, and default gateway should be set.

### Packet Size

Sets the packet size in bytes. Set a value that is not more than the MTU defined for the network adapter.

#### Notes

- When setting the parameter (Width, Height, PixelFormat) for calculating PayloadSize, stop camera image output beforehand.
- When PacketSize is set, an error may occur depending on the image size or pixel format setting. If an error occurs, check whether the PacketSize setting condition ( $\text{PacketSize} \leq \text{PayloadSize}$ ) is satisfied.
- Any static IP address can be set, but the camera may become unable to be detected depending on the IP address setting. If that happens, use the tool for issuing ForceIP and set the static IP address again.



## Camera Control Registers

There is a diagonal line in the Address column of ReadOut registers for which there is a definition for XML only and there is no address definition.

Address	Register
0x00000000	Base Address
0x00000000 – 0x00009FFC	GigE Vision Bootstrap
0xA0000000	Camera Base Address
0xA0000000 – 0xA00020BC	Camera Control
0xA00020C0 – 0xA00020FC	User Memory
0xA0007000 – 0xA0007090	Camera Control Inq
0xA0010000 – 0xA0013FFC	LUT Control

### DeviceControl

Address	Name	Type	Data	Description
0x00000068	DeviceVendorName	R/O	1)	Displays the vendor name.
0x00000088	DeviceModelName	R/O	1)	Displays the model name.
0x000000A8	DeviceVersion	R/O	1)	Displays the version.
0x000000D8	DeviceManufacturerInfo	R/O	1)	Displays the manufacturer information.
0x000000D8	DeviceID	R/O	1)	Displays the serial number.
0x000000E8	DeviceUserID	R/W	1)	Sets the user ID.
/	DeviceScanType	R/O	1)	Displays the scan type.
0xA0000010	DeviceReset	W/O	1	Executes a device reset.

1) This value is unique to the model.

### ImageFormatControl

Address	Name	Type	Data	Description
0xA0000100	Width	R/W	1)	Sets the number of horizontal lines (H).
0xA0000104	Height	R/W	1)	Sets the number of vertical lines (V).
0xA0000108	OffsetX	R/W	0 - 100	Sets the offset of the number of horizontal lines (H).
0xA000010C	OffsetY	R/W	0 - 100	Sets the offset of the number of vertical lines (V).
0xA0000114	BinningVertical	R/W	0	Sets vertical binning to OFF.
			1	Sets vertical binning to vertical 2-line addition.
0xA0000110	PixelFormat	R/W	0x01080001	Sets 8-bit black and white (Mono8).
			0x01100003	Sets 10-bit black and white (Mono10).
			0x010C0004	Sets 10-bit black and white (Mono10 Packed).
			0x01100005	Sets 12-bit black and white (Mono12).
			0x010C0006	Sets 12-bit black and white (Mono12 Packed).

Address	Name	Type	Data	Description
	PixelSize	R/O	8	Configures with 8-bit pixels (Bpp8).
			10	Configures with 10-bit pixels (Bpp10).
			12	Configures with 12-bit pixels (Bpp12).

1) This value is unique to the model.

## AcquisitionControl

Address	Name	Type	Data	Description
0xA0000200	AcquisitionMode	R/W	1	Sets free run (Continuous).
			2	Sets multi frames (MultiFrame).
			3	Sets a single frame (SingleFrame).
0xA0000210	AcquisitionStart	W/O	1	Executes start of image transfer.
0xA0000214	AcquisitionStop	W/O	0	Executes stop of image transfer.
0xA0000204	AcquisitionFrameCount	R/W	2 - 255	Sets the frame count of multi frames.
0xA0000220	AcquisitionFrameRateAbs	R/W	$0.062500 \leq$	Sets the frame rate. [Fps]
0xA0000224	AcquisitionFrameRateAuto	R/W	0	Sets the auto frame rate to OFF.
			1	Sets the auto frame rate to ON.
0xA0000228	AcquisitionFrameRateActual	R/O		Displays the frame rate. [Fps]
0xA0000300	SpecialTriggerMode	R/W	0	Sets the special trigger to OFF.
			1	Sets the special trigger to bulk trigger mode.
			2	Sets the special trigger to sequential trigger mode.
0xA0000304	NumberOfMemoryForSpecialTriggerMode	R/W	1 - 16	Sets the frame count of the special trigger.
0xA00002F0	SpecialTriggerSource	R/W	0	Sets the trigger source of the special trigger to hardware.
			1	Sets the trigger source of the special trigger to software.
0xA00002F4	SpecialTriggerActivation	R/W	0	Sets the trigger of the special trigger to the edge of positive polarity.
			1	Sets the trigger of the special trigger to the edge of negative polarity.
	TriggerSelector	R/O		Displays the trigger type.
0xA0002044	TriggerMode	R/W	0	Sets the trigger to OFF.
			1	Sets the trigger to ON.
0xA00002F8	TriggerSoftware	W/O	1	Executes the software trigger.
0xA0002098	TriggerSource	R/W	0	Sets the trigger source to hardware.
			1	Sets the trigger source to software.
0xA0002050	TriggerInhibit	R/W	0	Sets trigger inhibit to OFF.
			1	Sets trigger inhibit to ON.
0xA0002048	TriggerActivation	R/W	0	Sets the trigger to edge.
			1	Sets the trigger to level.
			6	Sets the trigger to the edge of positive polarity.
			4	Sets the trigger to the edge of negative polarity.
			7	Sets the trigger to the level of positive polarity.
			5	Sets the trigger to the level of negative polarity.

Address	Name	Type	Data	Description
0xA0002054	TriggerOverlap	R/W	0	Sets the trigger overlap to OFF.
			1	Sets the trigger overlap to ReadOut.
0xA0002058	TriggerDelayRaw	R/W	0 - 4000000	Sets the trigger delay. [ms]
	ExposureMode	R/O	—	Displays the exposure mode.
0xA0002040	ExposureTimeRaw	R/W	10 - 2000000	Sets the exposure time. [us]

## AnalogControl

Address	Name	Type	Data	Description
0xA0000310	Gamma	R/W	0.00 - 1.00	Sets the gamma curve coefficient.
0xA0000314	GammaLevelLow	R/W	≤ 511	Sets the black level of the gamma curve coefficient.
0xA0002064	BinarizationThreshold	R/W	0 - 4095	Sets the threshold value to use for binarization.
0xA0002034	DigitalEnable	R/W	0	Sets digital control to OFF.
			1	Sets digital control to ON.
0xA0001100 Bit15 - Bit0 <sup>1)</sup>	GainSelector	R/W	0	Sets the gain to AnalogAll.
			1	Sets the gain to AnalogR.
			2	Sets the gain to DigitalAll.
0xA0002008	GainRaw <sup>2)</sup>	R/W	0 - 502	Sets the gain (L).
0xA000200C				Sets the gain (R).
0xA000203C			0 - 64	Sets the digital gain.
0xA0002010	GainAbs <sup>2)</sup>	R/W	0.0 - 18.0	Sets the gain (L) with an absolute value. [dB]
0xA0002014				Sets the gain (R) with an absolute value. [dB]
0xA000201C	GainAuto <sup>2)</sup>	R/W	0	Sets the auto gain to OFF.
			1	Sets the auto gain to Once.
			2	Sets the auto gain to Continuous.
0xA0002020	GainAutoLevel	R/W	0 - 16383	Sets the auto gain level.
0xA0001100 Bit31 - Bit16 <sup>1)</sup>	BlackLevelSelector	R/W	0	Sets the black level to AnalogAll.
			1	Sets the black level to AnalogR.
			2	Sets the black level to DigitalAll.
0xA0002038	BlackLevelRaw <sup>3)</sup>	R/W	0 - 2047	Sets the pedestal.
0xA0002000			0 - 1023	Sets the black level (L).
0xA0002004				Sets the black level (R).
0xA0002018	BlackLevelAuto <sup>3)</sup>	R/W	0	Sets the auto black level to OFF.
			1	Sets the auto black level to Once.
			2	Sets the auto black level to Continuous.
0xA0001104 Bit15 - Bit0 <sup>1)</sup>	LineSelector	R/W	0	Selects GPI.
			1	Selects GPO1
			2	Selects GPO2.
	LineMode <sup>4)</sup>	R/O		Displays the input/output of GPI and GPO.
0xA0002070	LineInverter <sup>4)</sup>	R/W	0	Sets the GPO inversion to OFF.
0xA0002084			1	Sets the GPO inversion to ON.
0xA0000400	LineStatus <sup>4)</sup>	R/O		Displays the GPI signal.

Address	Name	Type	Data	Description
0xA000206C	LineSource <sup>4)</sup>	R/W	0	Sets the Exposure signal.
			1	Sets the Strobe signal.
			2	Sets the GPO signal.
0xA0002080				
	LineFormat <sup>4)</sup>	R/O		Displays the signal format of GPI and GPO.
0xA0001104 Bit31 - Bit16 <sup>1)</sup>	UserOutputSelector	R/W	0	Selects UserOutput0.
			1	Selects UserOutput1.
0xA0002090	UserOutputValue <sup>5)</sup>	R/W	0 - 1	Sets the UserOutput signal.
0xA0002078	StrobeActiveTimeRaw <sup>4)</sup>	R/W	1 - 4000	Sets the pulse width of the Strobe1 signal. [us]
0xA000208C				Sets the pulse width of the Strobe2 signal. [us]
0xA0002074	StrobeActiveDelayRaw <sup>4)</sup>	R/W	0 - 4000	Sets the delay of the Strobe1 signal. [us]
0xA0002088				Sets the delay of the Strobe2 signal. [us]

- 1) The settings of GainSelector, BlackLevelSelector, LineSelector, and UserOutputSelector are deleted and unsaved when the power is turned OFF.
- 2) Select AnalogAll, AnalogR, and DigitalAll with GainSelector.
- 3) Select AnalogAll, AnalogR, and DigitalAll with BlackLevelSelector.
- 4) Select GPI, GPO1, and GPO2 with LineSelector.
- 5) Select UserOutput0 and UserOutput1 with UserOutputValue.

## LUTControl

Address	Name	Type	Data	Description
	LUTSelector	R/O		Displays the LUT control.
0xA000205C	LUTFormat	R/W	0	Sets linear.
			1	Sets reverse.
			2	Sets binarization.
			3	Sets gamma curve.
			4	Sets the user setting <sup>1)</sup> .
0xA0001108 Bit15 - Bit0 <sup>2)</sup>	LUTIndex	R/W	0 - 4095	Sets Index of LUT.
0xA0010000 - 0xA0013FFC	LUTValue	R/W	0 - 4095	Sets Value of LUT.
0xA0010000 - 0xA0013FFC	LUTValueAll	R/W	0 - 4095	Sets LUT with Streaming.

- 1) Set the user setting value with LUTIndex, LUTValue, and LUTValueAll.
- 2) The setting of LUTIndex is deleted and unsaved when the power is turned OFF.

## UserSetControl

Address	Name	Type	Data	Description
0xA0000130	TestImageSelector	R/W	0	Sets the test image to OFF.
			1	Sets the test image to ON.
0xA0000134	GainAutoAreaHighlight	R/W	0	Sets the auto gain detection frame to OFF.
			1	Sets the auto gain detection frame to ON.
0xA0000138	GainAutoAreaWidth	R/W	0 - 100	Sets the auto gain detection frame (H).
0xA000013C	GainAutoAreaHeight	R/W	0 - 100	Sets the auto gain detection frame (V).

Address	Name	Type	Data	Description
0xA0000140	GainAutoAreaOffsetX	R/W	0 - 100	Sets the offset of the auto gain detection frame (H).
0xA0000144	GainAutoAreaOffsetY	R/W	0 - 100	Sets the offset of the auto gain detection frame (V).
0xA0000000	UserSetSelector	R/W	1	Sets UserSet to the default value.
0xA0001000			0	Sets UserSet1 <sup>1)</sup> .
			15	Sets UserSet16 <sup>1)</sup> .
0xA0001008	UserSetLoad	R/W	3	Loads the setting value of UserSet <sup>2)</sup> .
0xA0001004	UserSetSave	R/W	3	Saves the setting value of UserSet <sup>2)</sup> .
	UserMemoryIndex	R/W	0 - 15	Sets Index of UserMemory.
0xA00020C0 - 0xA00020FC	UserMemoryValue	R/W		Sets Value of UserMemory.

- 1) UserSet1 - 16 can be directly set with a specific address. For details, see “Memory Channel Registers” (page 24).  
2) UserSet that was selected with UserSetSelector is applicable.

### TransportLayerControl

Address	Name	Type	Data	Description
0xA0000120	PayloadSize	R/O		Displays the payload size.
0x00000000	GevVersionMajor	R/O	1	Displays the version of GigE Vison.
	GevVersionMinor		0	
0x00000004	GevDeviceModeIsBigEndian	R/O	0	Displays the endian (Little Endian).
	GevDeviceModeCharacterSet		1	Displays the character set (UTF-8).
	GevInterfaceSelector	R/O	0	Displays the network interface.
0x00000008	GevMACAddress	R/O		Displays the MAC address.
0x00000010	GevSupportedIPConfigurationLLA	R/O	1	Displays the LLA support.
	GevSupportedIPConfigurationDHCP	R/O	1	Displays DHCP support.
	GevSupportedIPConfigurationPersistentIP	R/O	1	Displays PersistentIP support.
0xA0000194	GevIPConfigurationStatus	R/O	0	IPConfiguration is configured with None.
			1	IPConfiguration is configured with PersistentIP.
			2	IPConfiguration is configured with DHCP.
			3	IPConfiguration is configured with LLA.
			4	IPConfiguration is configured with ForceIP.
0x00000014	GevCurrentIPConfiguration	R/W	5	Sets IPConfiguration to PersistentIP.
			6	Sets IPConfiguration to DHCP.
			4	Sets IPConfiguration to LLA.
	GevCurrentIPConfigurationLLA	R/O	1	Displays ON of LLA.
	GevCurrentIPConfigurationDHCP	R/W	0	Sets DHCP to OFF.
			1	Sets DHCP to ON.
	GevCurrentIPConfigurationPersistentIP	R/W	0	Sets PersistentIP to OFF.
1			Sets PersistentIP to ON.	
0x00000024	GevCurrentIPAddress	R/O		Displays the IP address (IPv4).

Address	Name	Type	Data	Description
0x00000034	GevCurrentSubnetMask	R/O		Displays the subnet mask (IPv4).
0x00000044	GevCurrentDefaultGateway	R/O		Displays the default gateway (IPv4).
0x00000200	GevFirstURL	R/O		Displays the URL of the XML file (1st).
0x00000400	GevSecondURL	R/O		Displays the URL of the XML file (2nd).
0x00000600	GevNumberOfInterfaces	R/O	1	Displays the number of network interfaces.
0x0000064C	GevPersistentIPAddress	R/W		Sets the IP address of PersistentIP (IPv4).
0x0000065C	GevPersistentSubnetMask	R/W		Sets the subnet mask of PersistentIP (IPv4).
0x0000066C	GevPersistentDefaultGateway	R/W		Sets the default gateway of PersistentIP (IPv4).
0xA0000198	GevLinkSpeed	R/O	0 - 1000	Displays the link speed.
0x00000900	GevMessageChannelCount	R/O	0	Displays the message channel count support.
0x00000904	GevStreamChannelCount	R/O	1	Displays the stream channel count support.
0x00000934	GevSupportedOptionalCommandsUserDefineName	R/O	1	Displays the UserDefineName support.
	GevSupportedOptionalCommandsSerialNumber		1	Displays the SerialNumber support.
	GevSupportedOptionalHeartbeatDisable		1	Displays the HeartbeatDisable support.
	GevSupportedOptionalCommandsEVENTDATA		0	Displays the EVENTDATA support.
	GevSupportedOptionalCommandsEVENT		0	Displays the EVENT support.
	GevSupportedOptionalCommandsPACKETRESEND		1	Displays the PACKETRESEND support.
	GevSupportedOptionalCommandsWRITEMEM		1	Displays the WRITEMEM support.
	GevSupportedOptionalCommandsConcatenation		1	Displays the Concatination support.
0x00000938	GevHeartbeatTimeout	R/W	500 ≤	Sets the timeout value for the heartbeat.
0x0000093C	GevTimestampTickFrequency	R/O	83.333333	Displays the time stamp frequency.
0x00000944	GevTimestampControlLatch	W/O	1	Latches the time stamp value.
	GevTimestampControlReset		1	Resets the time stamp value.
0x00000948	GevTimestampValue	R/O		Displays the time stamp value.
0x0000094C				
0xA0000190	GevGVCPHeartbeatDisable	R/W	0	Disables the heartbeat.
			1	Enables streaming only.
			2	Enables the heartbeat.
0xA000019C	GevDiscoveryAckDelay	R/W	0 - 65535	Sets the delay of discovery acknowledgement. [ms]
0x00000A00	GevCCP	R/W	0	Sets the control privilege to uncontrolled.
			1	Sets the control privilege to control access privilege.
			2	Sets the control privilege to exclusive access privilege.
	GevStreamChannelSelector	R/O	0	Displays the stream channel.
0x00000D00	GevSCPInterfaceIndex	R/O	0	Display InterfaceIndex of the stream channel.
	GevSCPHostPort	R/W	0 - 65535	Displays HostPort of the stream channel.

Address	Name	Type	Data	Description
0x0000D04	GevSCPSFireTestPacket	R/W	1	Sends a test packet.
	GevSCPSDoNotFragment		0	Sets Do Not Fragment to OFF.
			1	Sets Do Not Fragment to ON.
	GevSCPSBigEndian	R/O	0	Displays the endian of GevSCPS (Packet Size).
0xA0000184	GevSCPSPacketSize	R/W	1476 - 10596	Sets GevSCPS (Packet Size).
0x0000D08	GevSCPD	R/W	32 - 65535	Sets GevSCPD (Packet Delay).
0x0000D18	GevSCDA	R/W		Sets GevSCDA (Channel Destination IP).



# Memory Channel Registers

## ImageFormatControl (UserSet0 to UserSet15)

### UserSet0

The same applies to UserSet1 to UserSet14.

Address	Name	Type	Data	Description
0xA0005000	Width	R/W	1)	Sets the number of horizontal lines (H).
0xA0005004	Height	R/W	1)	Sets the number of vertical lines (V).
0xA0005008	OffsetX	R/W	0 - 100	Sets the offset of the number of horizontal lines (H).
0xA000500C	OffsetY	R/W	0 - 100	Sets the offset of the number of vertical lines (V).
0xA0005010	BinningVertical	R/W	0, 1	Sets the vertical binning.
0xA0005014	PixelFormat	R/W	0x01080001	Sets the pixel format.

1) This value is unique to the model.

### UserSet15

Address	Name	Type	Data	Description
0xA0005F00	Width	R/W	1)	Sets the number of horizontal lines (H).
0xA0005F04	Height	R/W	1)	Sets the number of vertical lines (V).
0xA0005F08	OffsetX	R/W	0 - 100	Sets the offset of the number of horizontal lines (H).
0xA0005F0C	OffsetY	R/W	0 - 100	Sets the offset of the number of vertical lines (V).
0xA0005F10	BinningVertical	R/W	0, 1	Sets the vertical binning.
0xA0005F14	PixelFormat	R/W	0x01080001	Sets the pixel format.

1) This value is unique to the model.

## AcquisitionControl (UserSet0 to UserSet15)

### UserSet0

The same applies to UserSet1 to UserSet14.

Address	Name	Type	Data	Description
0xA0006000	AcquisitionFrameRateAbs	R/W	$0.062500 \leq$	Sets the frame rate. [Fps]
0xA0006004	AcquisitionFrameRateAuto	R/W	0, 1	Sets the auto frame rate.
0xA0008044	TriggerMode	R/W	0, 1	Sets the trigger.
0xA0008098	TriggerSource	R/W	0, 1	Sets the trigger source.
0xA0008050	TriggerInhibit	R/W	0, 1	Sets the trigger inhibit.
0xA0008048	TriggerActivation	R/W	0, 1, 4, 5, 6, 7	Sets the trigger.
0xA0008054	TriggerOverlap	R/W	0, 1	Sets the trigger overlap.
0xA0008058	TriggerDelayRaw	R/W	0 - 4000000	Sets the trigger delay. [ms]
0xA0008040	ExposureTimeRaw	R/W	10 - 2000000	Sets the exposure time. [us]



## UserSet15

Address	Name	Type	Data	Description
0xA0006F00	AcquisitionFrameRateAbs	R/W	0.062500 ≤	Sets the frame rate. [Fps]
0xA0006F04	AcquisitionFrameRateAuto	R/W	0, 1	Sets the auto frame rate.
0xA0008F44	TriggerMode	R/W	0, 1	Sets the trigger.
0xA0008F98	TriggerSource	R/W	0, 1	Sets the trigger source.
0xA0008F50	TriggerInhibit	R/W	0, 1	Sets trigger inhibit.
0xA0008F48	TriggerActivation	R/W	0, 1, 4, 5, 6, 7	Sets the trigger.
0xA0008F54	TriggerOverlap	R/W	0, 1	Sets the trigger overlap.
0xA0008F58	TriggerDelayRaw	R/W	0 - 4000000	Sets the trigger delay. [ms]
0xA0008F40	ExposureTimeRaw	R/W	10 - 2000000	Sets the exposure time. [us]

## AnalogControl (UserSet0 to UserSet15)

### UserSet0

The same applies to UserSet1 to UserSet14.

Address	Name	Type	Data	Description
0xA0008064	BinarizationThreshold	R/W	0 - 4095	Sets the threshold value to use for binarization.
0xA0008034	DigitalEnable	R/W	0, 1	Sets digital control.
0xA0008008	GainRaw <sup>1)</sup>	R/W	0 - 502	Sets the gain (L).
0xA000800C				Sets the gain (R).
0xA000803C			0 - 64	Sets the digital gain.
0xA0008010	GainAbs <sup>1)</sup>	R/W	0.0 - 18.0	Sets the gain (L) with an absolute value. [dB]
0xA0008014				Sets the gain (R) with an absolute value. [dB]
0xA000801C	GainAuto <sup>1)</sup>	R/W	0, 1, 2	Sets the auto gain.
0xA0008020	GainAutoLevel	R/W	0 - 16383	Sets the auto gain level.
0xA0008038	BlackLevelRaw <sup>2)</sup>	R/W	0 - 2047	Sets the pedestal.
0xA0008000			0 - 1023	Sets the black level (L).
0xA0008004				Sets the black level (R).
0xA0008018	BlackLevelAuto <sup>2)</sup>	R/W	0, 1, 2	Sets the auto black level.
0xA0008070	LineInverter <sup>3)</sup>	R/W	0, 1	Sets the GPO inversion .
0xA0008084				
0xA000806C	LineSource <sup>3)</sup>	R/W	0, 1, 2	Sets the GPO signal.
0xA0008080				
0xA0008090	UserOutputValue <sup>4)</sup>	R/W	0 - 1	Sets the UserOutput signal.
0xA0008078	StrobeActiveTimeRaw <sup>3)</sup>	R/W	1 - 4000	Sets the pulse width of the Strobe1 signal. [us]
0xA000808C				Sets the pulse width of the Strobe2 signal. [us]
0xA0008074	StrobeActiveDelayRaw <sup>3)</sup>	R/W	0 - 4000	Sets the delay of the Strobe1 signal. [us]
0xA0008088				Sets the delay of the Strobe2 signal. [us]

1) Select AnalogAll, AnalogR, and DigitalAll with GainSelector.

2) Select AnalogAll, AnalogR, and DigitalAll with BlackLevelSelector.

3) Select GPI, GPO1, and GPO2 with LineSelector.

4) Select UserOutput0 and UserOutput1 with UserOutputValue.

## UserSet15

Address	Name	Type	Data	Description
0xA0008F64	BinarizationThreshold	R/W	0 - 4095	Sets the threshold value to use for binarization.
0xA0008F34	DigitalEnable	R/W	0, 1	Sets digital control.
0xA0008F08	GainRaw <sup>1)</sup>	R/W	0 - 502	Sets the gain (L).
0xA0008F0C				Sets the gain (R).
0xA0008F3C			0 - 64	Sets the digital gain.
0xA0008F10	GainAbs <sup>1)</sup>	R/W	0.0 - 18.0	Sets the gain (L) with an absolute value. [dB]
0xA0008F14				Sets the gain (R) with an absolute value. [dB]
0xA0008F1C	GainAuto <sup>1)</sup>	R/W	0, 1, 2	Sets the auto gain.
0xA0008F20	GainAutoLevel	R/W	0 - 16383	Sets the auto gain level.
0xA0008F38	BlackLevelRaw <sup>2)</sup>	R/W	0 - 2047	Sets the pedestal.
0xA0008F00			0 - 1023	Sets the black level (L).
0xA0008F04				Sets the black level (R).
0xA0008F18	BlackLevelAuto <sup>2)</sup>	R/W	0, 1, 2	Sets the auto black level.
0xA0008F70	LineInverter <sup>3)</sup>	R/W	0, 1	Sets the GPO inversion .
0xA0008F84				
0xA0008F6C	LineSource <sup>3)</sup>	R/W	0, 1, 2	Sets the GPO signal.
0xA0008F80				
0xA0008F90	UserOutputValue <sup>4)</sup>	R/W	0 - 1	Sets the UserOutput signal.
0xA0008F78	StrobeActiveTimeRaw <sup>3)</sup>	R/W	1 - 4000	Sets the pulse width of the Strobe1 signal. [us]
0xA0008F8C				Sets the pulse width of the Strobe2 signal. [us]
0xA0008F74	StrobeActiveDelayRaw <sup>3)</sup>	R/W	1 - 4000	Sets the delay of the Strobe1 signal. [us]
0xA0008F88				Sets the delay of the Strobe2 signal. [us]

- 1) Select AnalogAll, AnalogR, and DigitalAll with GainSelector.
- 2) Select AnalogAll, AnalogR, and DigitalAll with BlackLevelSelector.
- 3) Select GPI, GPO1, and GPO2 with LineSelector.
- 4) Select UserOutput0 and UserOutput1 with UserOutputValue.

## LUTControl (UserSet0 to UserSet15)

### UserSet0

The same applies to UserSet1 to UserSet14.

Address	Name	Type	Data	Description
0xA000805C	LUTFormat	R/W	0 - 4	Sets LUTFormat.

### UserSet15

Address	Name	Type	Data	Description
0xA000805C	LUTFormat	R/W	0 - 4	Sets LUTFormat.

## UserSetControl (UserSet0 to UserSet15)

### UserSet0

The same applies to UserSet1 to UserSet14.

Address	Name	Type	Data	Description
0xA00080C0 – 0xA00080FC	UserMemoryValue	R/W		Sets Value of UserMemory.

### UserSet15

Address	Name	Type	Data	Description
0xA0008FC0 – 0xA0008FFC	UserMemoryValue	R/W		Sets Value of UserMemory.

# Default Value List

## ImageFormatControl - Default Value

Address	Name	Type	UserSet Default Value				
			V60E	SX97E	SX99E	U100E	5005E
0xA0000100	Width	R/W	640	1360	1360	1600	2448
0xA0000104	Height	R/W	480	1024	1024	1200	2048
0xA0000108	OffsetX	R/W	0				
0xA000010C	OffsetY	R/W	0				
0xA0000114	BinningVertical	R/W	0				
0xA0000110	PixelFormat	R/W	0x01080001				
	PixelSize	R/O	8				

## AcquisitionControl - Default Value

Address	Name	Type	UserSet Default Value				
			V60E	SX97E	SX99E	U100E	5005E
0xA0000200	AcquisitionMode	R/W	1				
0xA0000210	AcquisitionStart	W/O					
0xA0000214	AcquisitionStop	W/O					
0xA0000204	AcquisitionFrameCount	R/W	2				
0xA0000220	AcquisitionFrameRateAbs	R/W	90	16	27	15	15
0xA0000224	AcquisitionFrameRateAuto	R/W	1				
0xA0000228	AcquisitionFrameRateActual	R/O	90	16	27	15	15
0xA0000300	SpecialTriggerMode	R/W	0				
0xA0000304	NumberOfMemoryForSpecialTriggerMode	R/W	1				
0xA00002F0	SpecialTriggerSource	R/W	0				
0xA00002F4	SpecialTriggerActivation	R/W	0				
	TriggerSelector	R/O	FrameStart				
0xA0002044	TriggerMode	R/W	0				
0xA00002F8	TriggerSoftware	W/O					
0xA0002098	TriggerSource	R/W	0				
0xA0002050	TriggerInhibit	R/W	0				
0xA0002048	TriggerActivation	R/W	4				
0xA0002054	TriggerOverlap	R/W	1				
0xA0002058	TriggerDelayRaw	R/W	0				
	ExposureMode	R/O	Timed				
0xA0002040	ExposureTimeRaw	R/W	11046	62320	36931	65506	65570

## AnalogControl - Default Value

Address	Name	Type	UserSet Default Value					
			V60E	SX97E	SX99E	U100E	5005E	
0xA0000310	Gamma	R/W	0.70					
0xA0000314	GammaLevelLow	R/W	255					
0xA0002064	BinarizationThreshold	R/W	2047					
0xA0002034	DigitalEnable	R/W	1					
0xA0001100 Bit15 - Bit0 <sup>1)</sup>	GainSelector	R/W	0					
0xA0002008	GainRaw <sup>2)</sup>	R/W	0					
0xA000200C			0					
0xA000203C			0					
0xA0002010	GainAbs <sup>2)</sup>	R/W	0.0					
0xA0002014			0.0					
0xA000201C	GainAuto <sup>2)</sup>	R/W	0					
0xA0002020	GainAutoLevel	R/W	11264					
0xA0001100 Bit31 - Bit16 <sup>1)</sup>	BlackLevelSelector	R/W	2	2	2	2	0	
0xA0002038	BlackLevelRaw <sup>3)</sup>	R/W	1023	1023	1023	1023	960	
0xA0002000			/					3)
0xA0002004			/					3)
0xA0002018	BlackLevelAuto <sup>3)</sup>	R/W	/					2
0xA0001104 Bit15 - Bit0 <sup>1)</sup>	LineSelector	R/W	0					
/	LineMode <sup>4)</sup>	R/O	Input					
0xA0002070	LineInverter <sup>4)</sup>	R/W	0					
0xA0002084			0					
0xA0000400	LineStatus <sup>4)</sup>	R/O	0					
0xA000206C	LineSource <sup>4)</sup>	R/W	0					
0xA0002080								
/	LineFormat <sup>4)</sup>	R/O	OptoCoupled					
0xA0001104 Bit31 - Bit16 <sup>1)</sup>	UserOutputSelector	R/W	0					
0xA0002090	UserOutputValue <sup>5)</sup>	R/W	0					
0xA0002078	StrobeActiveTimeRaw <sup>4)</sup>	R/W	1					
0xA000208C			1					
0xA0002074	StrobeActiveDelayRaw <sup>4)</sup>	R/W	0					
0xA0002088			0					

- 1) The settings of GainSelector, BlackLevelSelector, LineSelector, and UserOutputSelector are deleted and unsaved when the power is turned OFF.
- 2) Select AnalogAll, AnalogR, and DigitalAll with GainSelector.
- 3) Select AnalogAll, AnalogR, and DigitalAll with BlackLevelSelector.
- 4) Select GPI, GPO1, and GPO2 with LineSelector.
- 5) Select UserOutput0 and UserOutput1 with UserOutputValue.

## LUTControl - Default Value

Address	Name	Type	UserSet Default Value				
			V60E	SX97E	SX99E	U100E	5005E
	LUTSelector	R/O	0				
0xA000205C	LUTFormat	R/W	0				
0xA0001108 Bit15 - Bit0 <sup>1)</sup>	LUTIndex	R/W	0				
0xA0010000 - 0xA0013FFC	LUTValue	R/W	0				
0xA0010000 - 0xA0013FFC	LUTValueAll	R/W	0				

1) The setting of LUTIndex is deleted and unsaved when the power is turned OFF.

# Max/Min Value List

## ImageFormatControllnq

Address	Name	Type	UserSet Default Value				
			V60E	SX97E	SX99E	U100E	5005E
0xA0007000	WidthMax	R/O	640	1360	1360	1600	2448
0xA0007004	WidthMin	R/O	64	64	64	64	64
0xA0007008	HeightMax	R/O	480	1024	1024	1200	2048
0xA000700C	HeightMin	R/O	48	100	100	120	480

## AcquisitionControllnq

Address	Name	Type	UserSet Default Value				
			V60E	SX97E	SX99E	U100E	5005E
0xA0007010	AcquisitionFrameRateMax	R/O	≤ 391.130035	≤ 77.952248	≤ 79.808334	≤ 73.818748	≤ 40.658424
0xA0007014	AcquisitionFrameRateMin	R/O	0.06525				
0xA0007060	TriggerDelayRawMax	R/O	4000000				
0xA0007064	TriggerDelayRawMin	R/O	0				
0xA0007058	ExposureTimeRawMax	R/O	2000000				
0xA000705C	ExposureTimeRawMin	R/O	10				

## AnalogControllnq

Address	Name	Type	UserSet Default Value				
			V60E	SX97E	SX99E	U100E	5005E
0xA0007068	GammaMax	R/O	1.00				
0xA000706C	GammaMin	R/O	0.00				
0xA0007070	BinarizationThresholdMax	R/O	4095				
0xA0007074	BinarizationThresholdMin	R/O	0				
0xA0007020	GainRawMax	R/O	502				
0xA0007024	GainRawMin	R/O	0				
0xA0007028	GainAbsMax	R/O	18.0				
0xA000702C	GainAbsMin	R/O	0.0				
0xA0007050	DigitalGainMax	R/O	64				
0xA0007054	DigitalGainMin	R/O	0				
0xA0007030	GainAutoLevelMax	R/O	16383				
0xA0007034	GainAutoLevelMin	R/O	0				
0xA0007048	BlackLevelRawMax	R/O	2047				
0xA000704C	BlackLevelRawMin	R/O	0				
0xA0007018	ClampMax	R/O	1023				
0xA000701C	ClampMin	R/O	0				

## DigitalIOControlInq

Address	Name	Type	UserSet Default Value				
			V60E	SX97E	SX99E	U100E	5005E
0xA0007080	StrobeActiveTimeRawMax	R/O	4000				
0xA0007084	StrobeActiveTimeRawMin	R/O	0				
0xA0007078	StrobeActiveDelayRawMax	R/O	4000				
0xA000707C	StrobeActiveDelayRawMin	R/O	0				

## LUTControlInq

Address	Name	Type	UserSet Default Value				
			V60E	SX97E	SX99E	U100E	5005E
0xA0007088	LUTMax	R/O	4095				
0xA000708C	LUTMin	R/O	0				

## UserSetControlInq

Address	Name	Type	UserSet Default Value				
			V60E	SX97E	SX99E	U100E	5005E
0xA0007038	GainAutoAreaMax	R/O	100				
0xA000703C	GainAutoAreaMin	R/O	0				
0xA0007040	GainAutoAreaOffsetMax	R/O	100				
0xA0007044	GainAutoAreaOffsetMin	R/O	0				
0xA0007090	UserMemorySize	R/O	64				



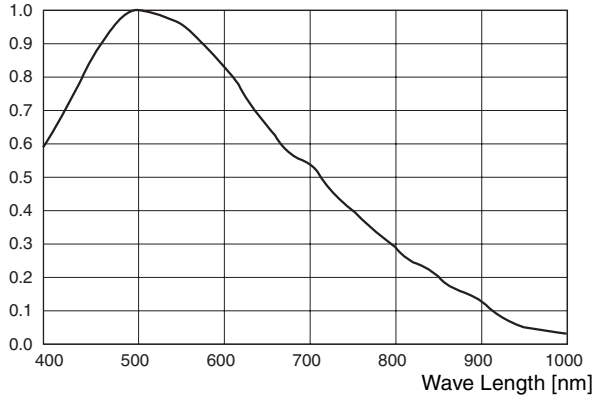
## Specifications

	XCG-V60E	XCG-SX97E	XCG-SX99E	XCG-U100E	XCG-5005E
Image sensor	1/3-type progressive scan IT transfer CCD	2/3-type progressive scan IT transfer CCD	2/3-type progressive scan IT transfer CCD	1/1.8-type progressive scan IT transfer CCD	2/3-type progressive scan IT transfer CCD
Cell size	7.4 (H) × 7.4 (V) μm	6.45 (H) × 6.45 (V) μm	6.45 (H) × 6.45 (V) μm	4.4 (H) × 4.4 (V) μm	3.45 (H) × 3.45 (V) μm
Chip size	5.79 (H) × 4.89 (V) mm	10.2 (H) × 8.3 (V) mm	10.2 (H) × 8.3 (V) mm	8.50 (H) × 6.80 (V) mm	9.93 (H) × 8.70 (V) mm
Number of effective pixels	Approx. 330,000 659 (H) × 494 (V)	Approx. 1,450,000 1392 (H) × 1040 (V)	Approx. 1,450,000 1392 (H) × 1040 (V)	Approx. 2,000,000 1628 (H) × 1236 (V)	Approx. 5,000,000 2456 (H) × 2058 (V)
Standard output pixels	640 (H) × 480 (V)	1360 (H) × 1024 (V)	1360 (H) × 1024 (V)	1600 (H) × 1200 (V)	2448 (H) × 2048 (V)
Frame rate	90 fps	16 fps	27 fps	15 fps	15 fps
Interface	1000BASE-T				
Transfer speed	1 Gbps				
Protocol	GigE Vision Version 1.0 Compliant				
Read method	Normal/Binning/Partial				
Image output bit length	Selectable, 12-/10-/8-bit				
Gain	Auto/Manual: 0 to 18 dB				
Gamma	Adjustable using the Lookup table				
Shutter speed	2 to 1/100,000 s				
External trigger shutter	Edge/width mode, software trigger (via 1000BASE-T), bulk trigger, sequential trigger, trigger inhibit, trigger/strobe delay				
Lens mount	C-mount				
Flange back	17.526 mm				
Minimum illumination	1 lx Iris: F1.4 Gain: +18 dB Shutter: 11,046 μs	0.2 lx Iris: F1.4 Gain: +18 dB Shutter: 62,320 μs	0.4 lx Iris: F1.4 Gain: +18 dB Shutter: 36,931 μs	1 lx Iris: F1.4 Gain: +18 dB Shutter: 66,506 μs	1 lx Iris: F1.4 Gain: +18 dB Shutter: 66,570 μs
Sensitivity	F5.6 (400 lx, 0 dB)	F11 (400 lx, 0 dB)	F8 (400 lx, 0 dB)	F5.6 (400 lx, 0 dB)	F5.6 (400 lx, 0 dB)
Power supply	DC +12 V (+10.5 to +15.0 V) (from 12-pin connector)				
Power consumption	3.1 W	3.1 W	3.6 W	3.1 W	4.3 W
Performance guaranty temperature	0 °C to 40 °C (32 °F to 104 °F)				
Operating temperature	-5 °C to +45 °C (23 °F to 113 °F)				
Storage temperature	-30 °C to +60 °C (-22 °F to +140 °F)				
Operating relative humidity	20 % to 80 % (No condensation)				
Storage relative humidity	20 % to 95 % (No condensation)				
Vibration resistance	10 G (20 Hz to 200 Hz, 20 minutes for each direction X, Y, Z)				
MTBF	Approx. 9.7 years	Approx. 9.9 years	Approx. 9.9 years	Approx. 9.9 years	Approx. 8.5 years
Shock resistance	70 G				
Dimensions	44 (W) × 33 (H) × 67.5 (D) mm, not including projecting parts (1 3/4 (W) × 1 5/16 (H) × 2 3/4 (D) inches)				
Mass	Approx. 145 g (5 oz)				

# Spectral Sensitivity (Relative Response) Parameters

## XCG-V60E

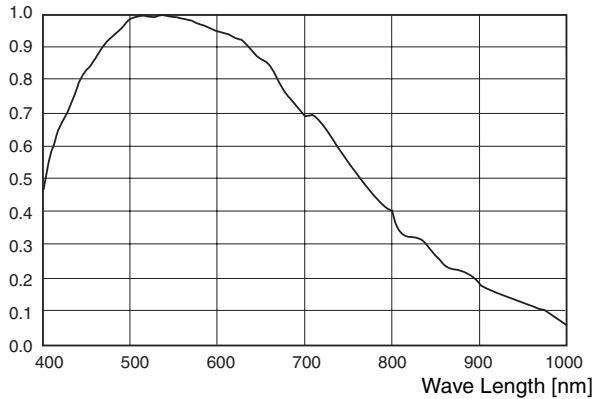
Camera Relative Response



(Without lens and light source parameters.)

## XCG-SX97E/XCG-SX99E

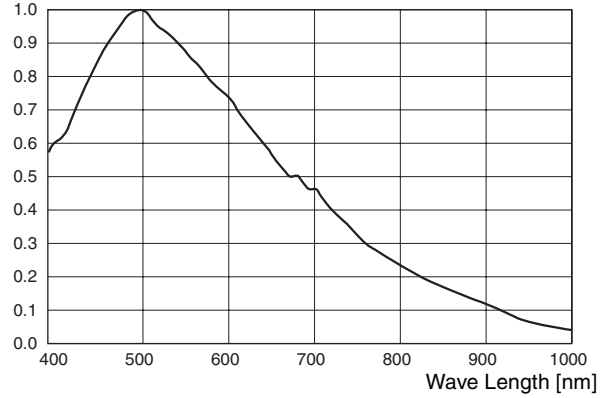
Camera Relative Response



(Without lens and light source parameters.)

## XCG-U100E

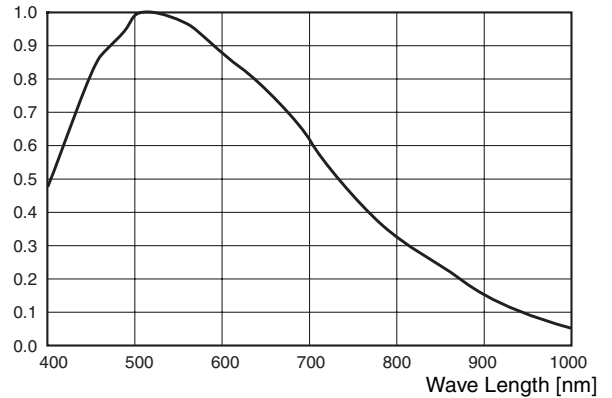
Camera Relative Response



(Without lens and light source parameters.)

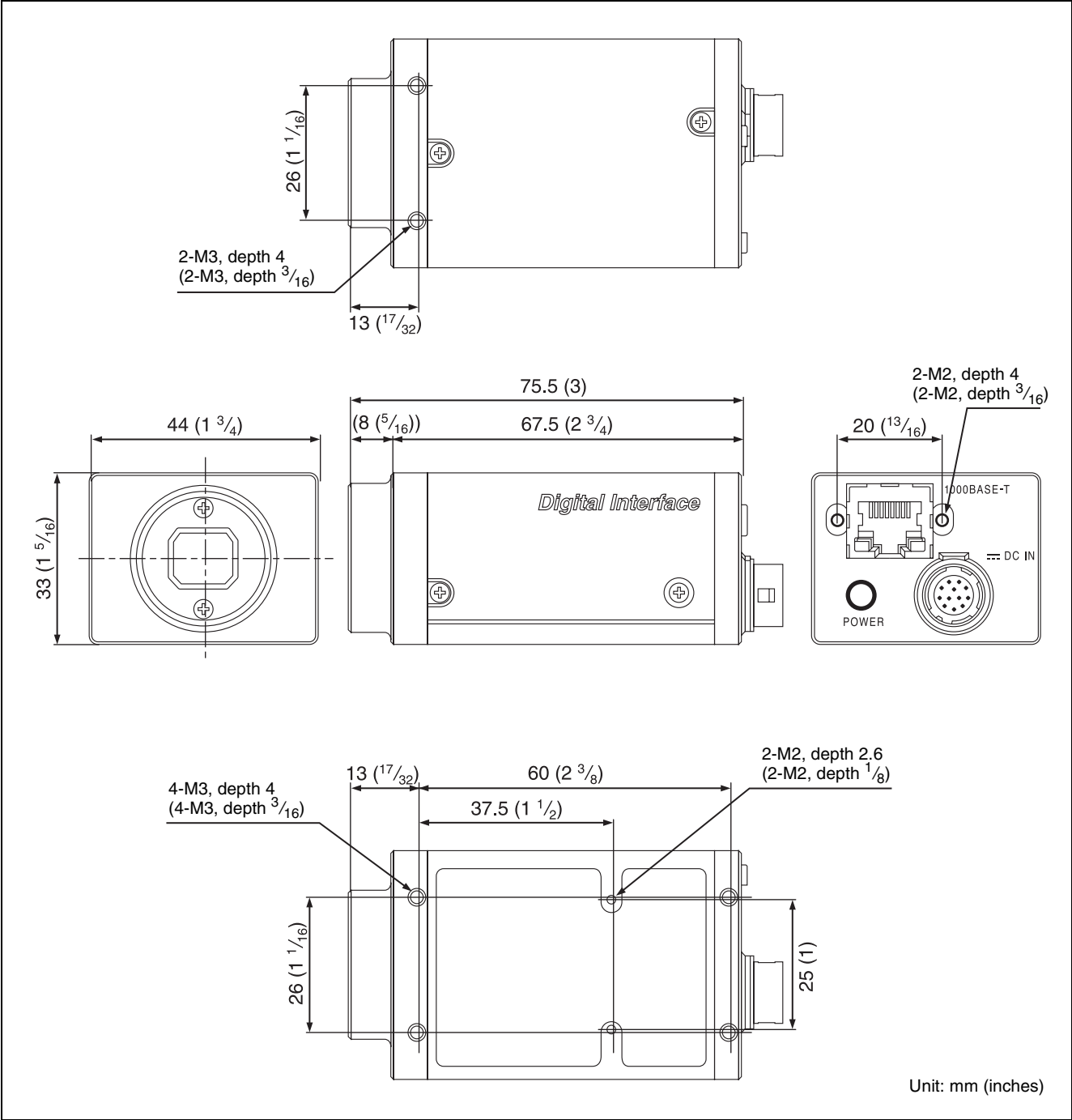
## XCG-5005E

Camera Relative Response



(Without lens and light source parameters.)

# Dimensions



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