

# ***Digital Video Camera Module***

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## **Technical Manual**

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

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## Overview

The XCG-V60E/XCG-SX97E/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-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 panel (the CCD reference plane).

Installing the camera module on the front panel 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.

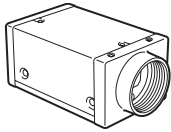
#### Note

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.

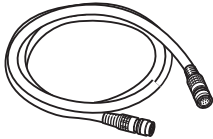
# System Components

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



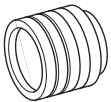
Camera Module

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



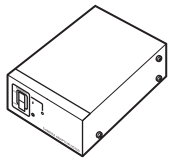
CCXC-12P02N (2 m, 6.6 ft)/  
05N (5 m, 16.4 ft)/10N (10 m,  
32.8 ft)/25N (25 m, 82 ft)  
camera cable

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



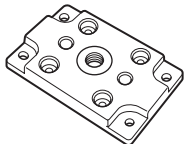
C-mount lens  
High-resolution lens

Use a high-resolution lens.



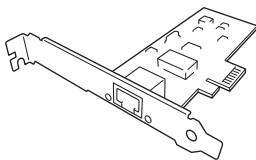
DC-700/700CE  
camera adaptor

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



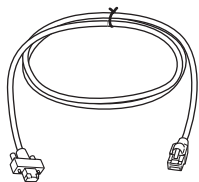
VCT-ST70I  
tripod adaptor

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.

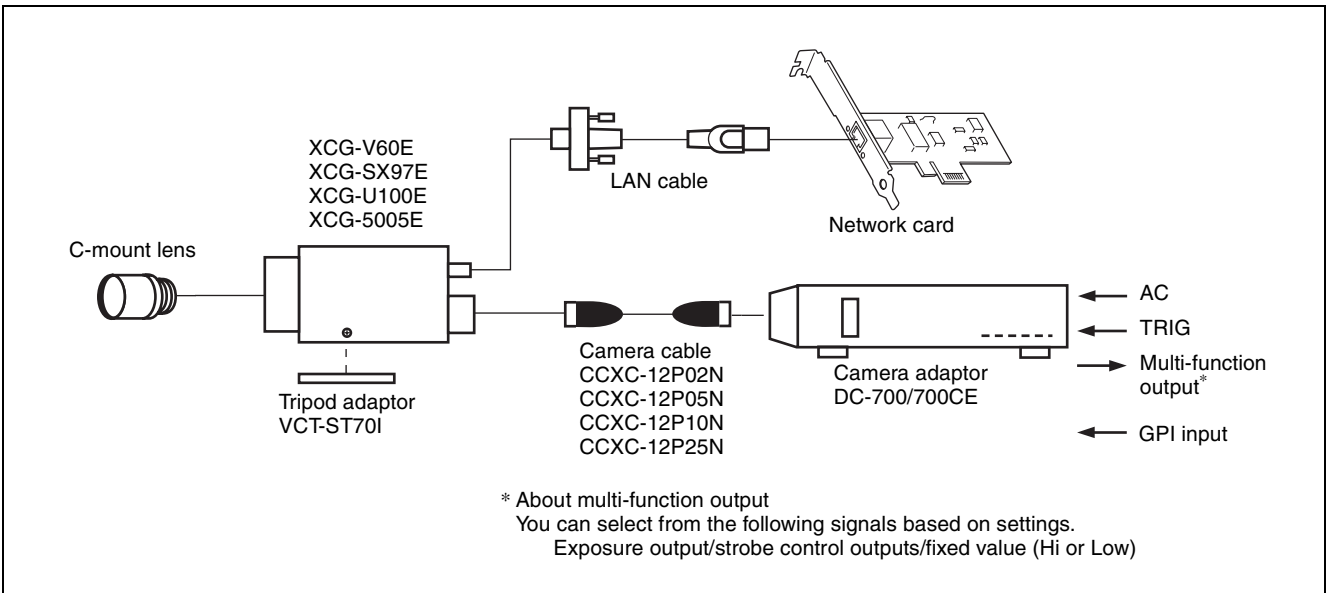


LAN cable  
(commercially available)

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).

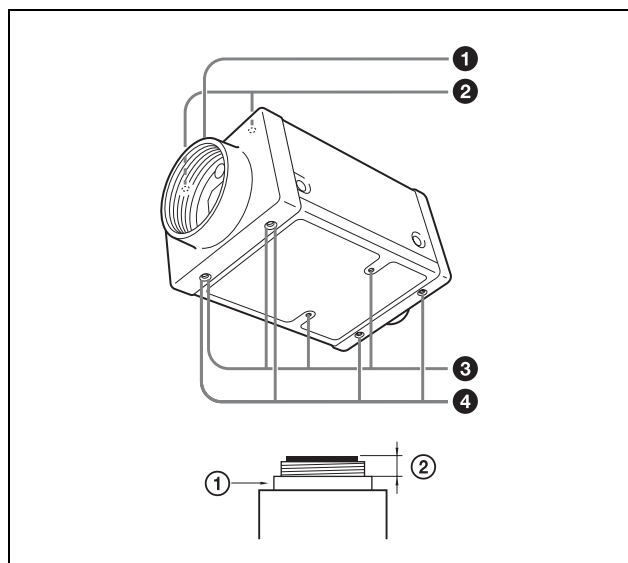
Depending on the attributes of the LAN cable, images may become less clear and the camera module may become unstable. Be sure to use a LAN cable that has sufficient noise reduction.

# 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.

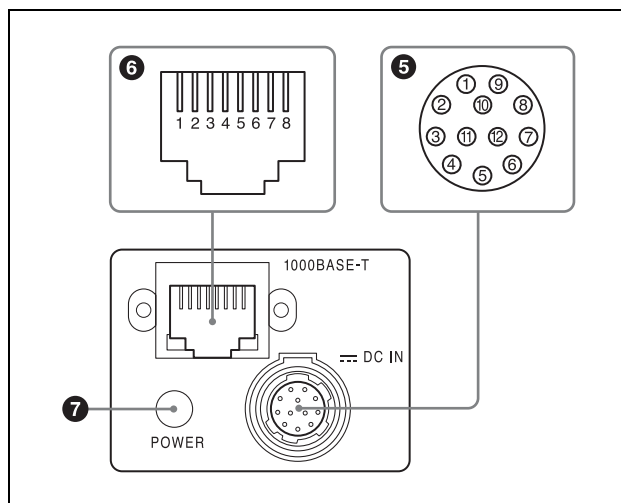
### 4 Reference screw holes (bottom)

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-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

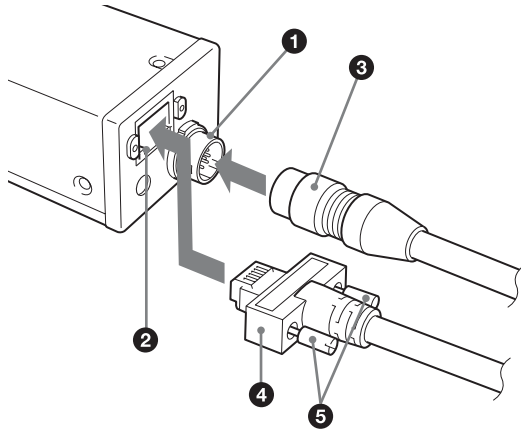
0.18 to 0.22 inches



### Note

If you install a tripod adaptor (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.

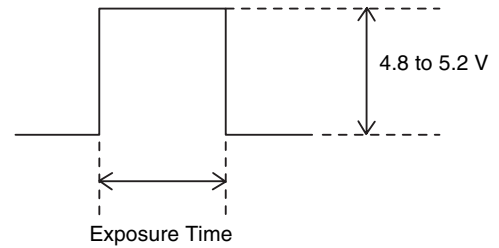
- 1 DC IN connector
- 2 RJ45 connector
- 3 Camera cable
- 4 LAN cable
- 5 Fastening screws

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.

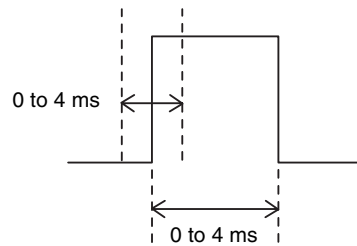
## Multi-Function Output Specifications

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.



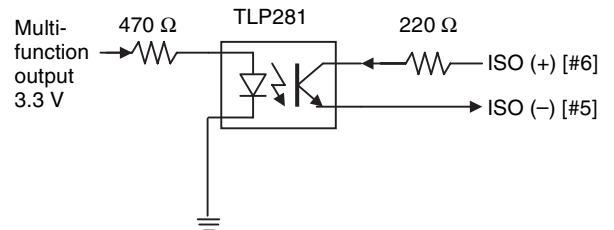
Strobe control pulse width setting (time)



Strobe control signal rise time and pulse width are settable

When using ISO (+ or -), be sure to use an external power supply between +5 and +24 Vdc 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.

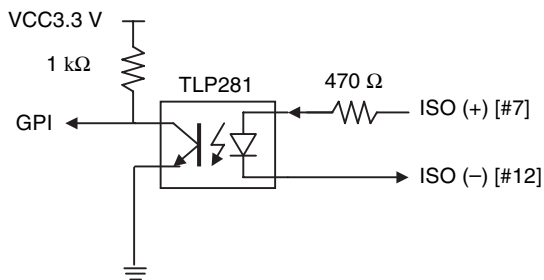
Register setting value 0: fixed Low

Register setting value 1: fixed Hi



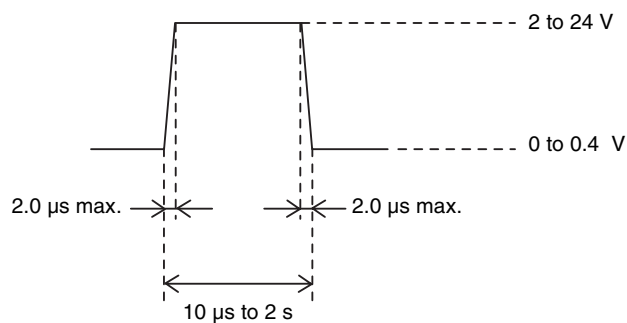
## GPI Input Specifications

Be sure to use an external power supply between +5 and +24 Vdc in combination with resistance.  
Refer to the following circuit diagram.

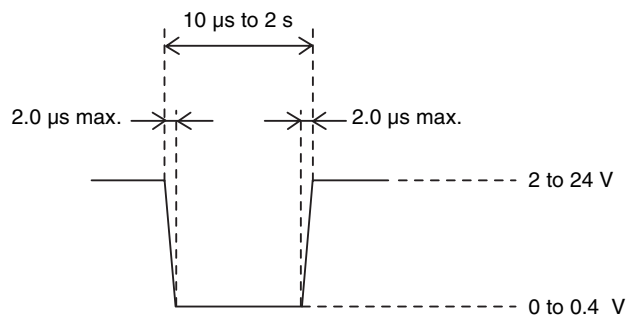


## Trigger Input Specifications

When trigger input polarity is positive

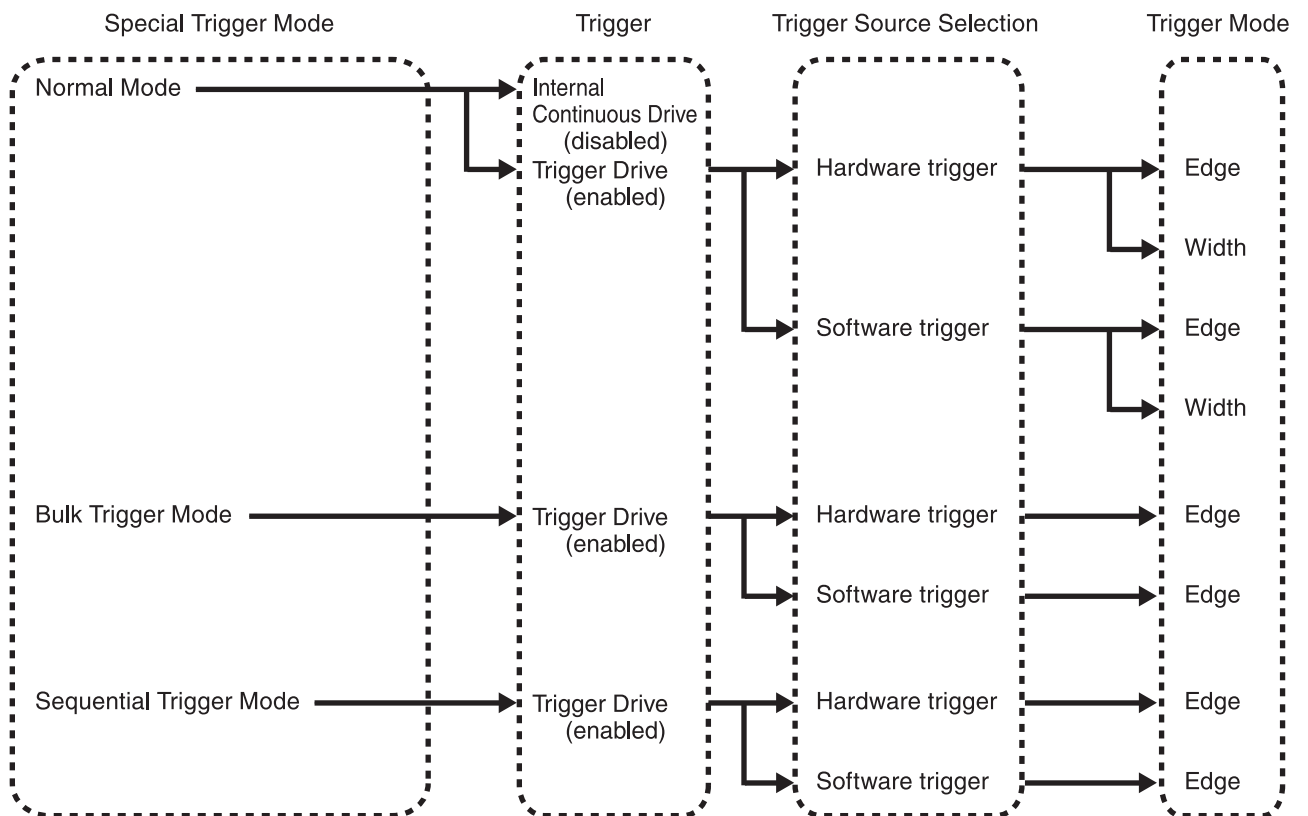


When trigger input polarity is negative



# 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

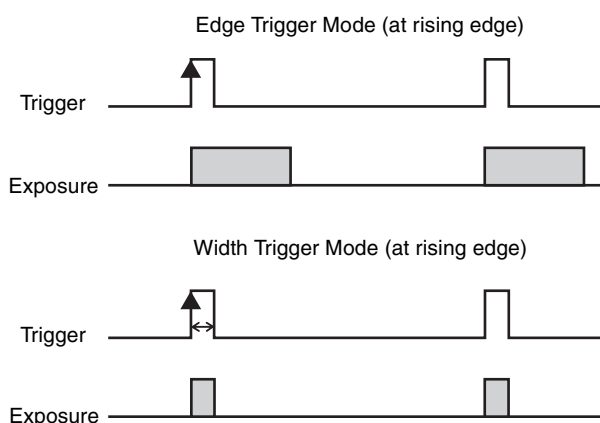
This function selects whether triggering occurs at the rising or falling edge of the trigger signal. Select the trigger polarity before using other trigger functions.

## Special Trigger Modes

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

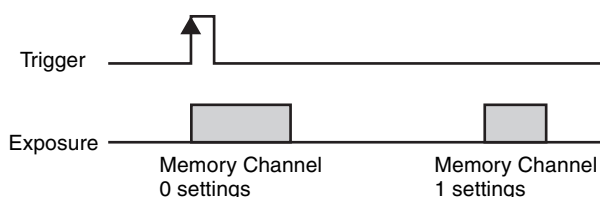
### Normal trigger mode

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 duration set for the trigger pulse width).



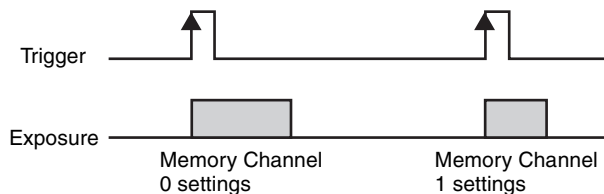
### Bulk trigger mode

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
- 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

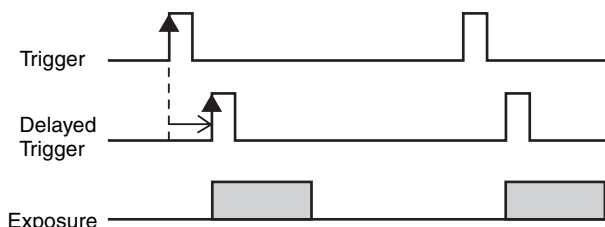
The camera supports manual shutter control. With Edge triggering, the exposure time can be set from 10  $\mu$ s to 2 s, in 1  $\mu$ s units.

## 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 4,000,000  $\mu$ s, 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/ GPs (general-purpose inputs)

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.

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

### 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.

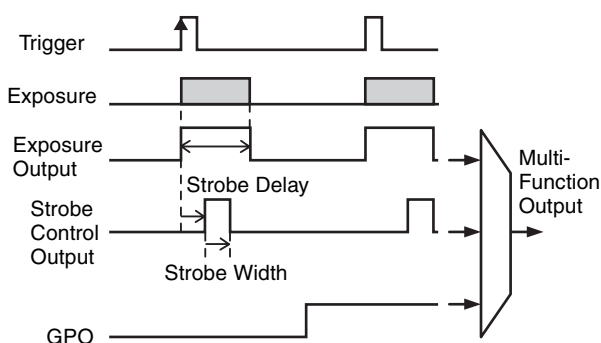
Setting ranges are:

Strobe delay: 0 to 4,000  $\mu$ s (in 1  $\mu$ s units)

Strobe width: 0 to 4,000  $\mu$ s (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.

## Gain

The camera provides both manual and automatic gain control.

### Manual gain control

Variable gain control in models XCG-V60E/XCG-SX97E/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-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

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

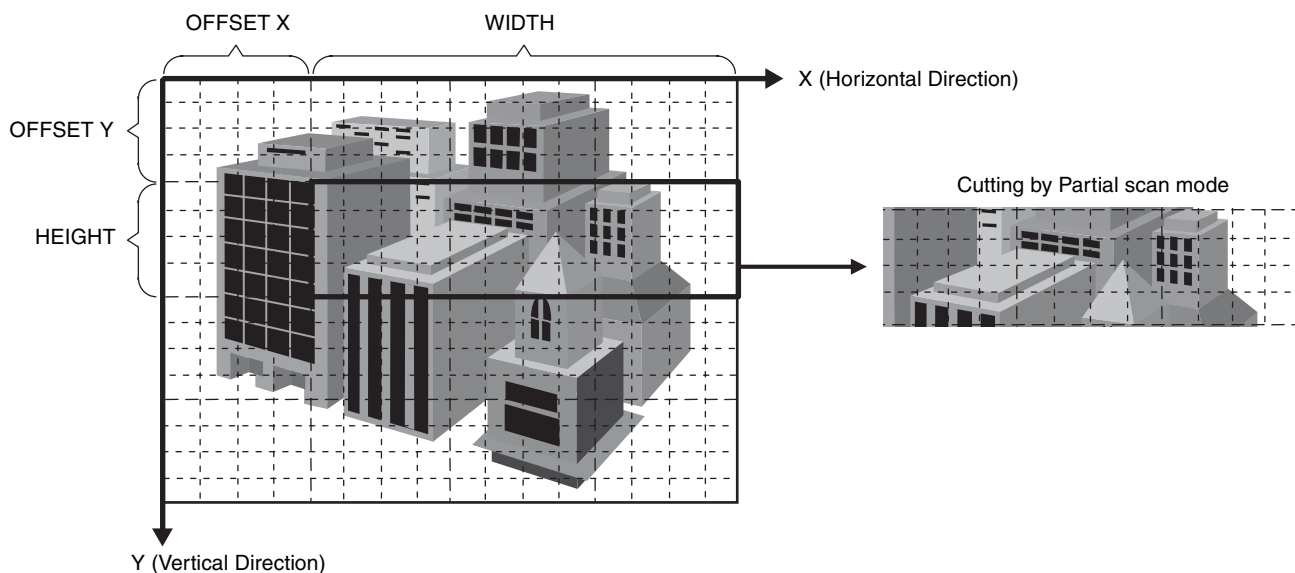
The camera provides a function to switch image output bit length between 8, 10 and 12 bits. Use it to adjust the relative priority of data quantity to image quality. The pixel formats are Mono8, Mono10 Packed and Mono12 Packed in compliance with GigE Vision 1.0.

## 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-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

The camera provides the following network functions.

### Payload Size

Acquires the data size of a single frame.

The value depends on the pixel format, as follows:

- Mono8: pixels \* lines
- Mono10 Packed and Mono12 Packed: pixels \* lines \* 1.5

### Packet Size

Specifies the packet size of image data, in bytes.

Use to reduce the MTU of the network used.

### Inter Packet Delay

Specifies a delay to be inserted between packets, in units of one tick (approximately 12 ns) of the Timestamp Tick Frequency.

This setting can be used as a simple flow control device for applications that cannot otherwise handle camera packets.

Setting range: 12 to 1,023

### DHCP Enable

Enable this when the camera's IP address is to be obtained from a DHCP server.

Enable: Obtain the IP address from a DHCP server.

Disable: Do not obtain the IP address from a DHCP server.



## Persistent IP Enable

Enable this when the camera uses a static IP address.

Enable: Use a static IP address.

(When this is enabled, DHCP Enable is disabled.)

Disable: Do not use a static IP address.

## Persistent IP Address

Specifies the camera's static IP address.

## Persistent IP Subnet Mask

Specifies the camera's subnet when using a static IP address.

## Heartbeat Mode

Enable or disable the Heartbeat mode.

Enable: When the heartbeat is enabled and interrupted, video image transfer is stopped and the network is initialized.

Disable: Heartbeat is ignored.

Streaming Only: When the heartbeat is enabled and interrupted, video image transfer is stopped.

## Heartbeat Timeout

Specifies the time allowed to reach heartbeat.

Setting range: 500 to 10,000 ms

## Timestamp Tick Frequency

Indicates the number of timestamp ticks per second.

The value is fixed at 83,333,333 ticks. This value is also the same as the timestamp frequency.

## Control Channel Privilege

This mode specifies the control method.

0: Ungoverned control (No control commands are accepted from any application.)

1: Exclusive access (One application has total control, and other applications cannot even read registers.)

2: Control access (One application has control, and other applications can only read registers.)

## Notes

- If the Payload Size is set to a value smaller than the Packet Size, images will not be output from the camera. This is not a malfunction.
- Before changing the Payload Size or Packet Size, stop image output from the camera. Changing either parameter without first stopping image output will result in loss of synchronization between the camera and the host, making normal image display impossible.
- When using a static IP address, it is recommended that the IP addresses on both the camera and the host device satisfy the following conditions.

IP Address: 169.254.A.B ( $1 \leq A \leq 255$ ,  $1 \leq B \leq 254$ )

Further, be sure to set different IP addresses on the camera and the host device.

Subnet Mask: 255.255.0.0

Saving an IP address other than as recommended above may prevent the camera from connecting normally when it is turned back on.

## Camera Control Registers

The camera complies with GigE Vision Version 1.0.

Address	Register
0x00000000	GigE Vision Boot Strap Register
0xA0000000	Camera Initialization Register
0xA0000100 - 0xA0000144	Image Control Registers
0xA0000180 - 0xA0000190	Network Control Registers
0xA0000200 - 0xA0000214	Acquisition Control Registers
0xA0000220 - 0xA0000400	Feature Control Registers
0xA0001000 - 0xA0001008	Memory Control Registers
0xA0002000 - 0xA0002098	Feature Control Registers
0xA00020C0 - 0xA00020FC	User Memory
0xA0007000 - 0xA0007090	Feature Control Inq
0xA0010000 - 0xA0013FFC	LUT (Look-Up Table) Control Register

## Camera Initialization Register

### Initialization Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000000h	Initialize Parameters	R/W	1				Initialize settings to factory defaults

#### Note

Network Control Registers, Acquisition Control Registers, LUT, Gamma Value, and Gamma Low Level will not be initialized.

## Image Control Registers

### Image Size Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000100h	Width	R/W					Horizontal image size
A0000104h	Height	R/W					Vertical image size
A0000108h	OffsetX	R/W					Horizontal image offset
A000010Ch	OffsetY	R/W					Vertical image offset

## Pixel Format Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000110h	Pixel Format	R/W	01080001h				8-bit black and white (Mono 8) format
			010C0004h				10-bit black and white (Mono 10 Packed) format
			010C0006h				12-bit black and white (Mono 12 Packed) format

## Binning Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000114h	Binning	R/W	0				Binning disable
			1				Binning enable

## Payload Size

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000120h	Payload Size	R/O					Read payload size

## Test Chart

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000130h	Display Test Chart	R/W	0				Hide grayscale chart
			1				Show grayscale chart

## Auto Gain Detection Frame

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000134h	Auto Gain Area High Light	R/W	0				Hide auto gain detection frame
			1				Show auto gain detection frame

## Auto Gain Detection Frame Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000138h	Auto Gain Area Width	R/W					Auto gain detection frame width (H)
A000013Ch	Auto Gain Area Height	R/W					Auto gain detection frame height (V)
A0000140h	Auto Gain Area Offset X	R/W					Auto gain detection frame horizontal offset X
A0000144h	Auto Gain Area Offset Y	R/W					Auto gain detection frame vertical offset Y

## Network Control Registers

### Packet Size Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000184h	Packet Size	R/W					Packet size

### DHCP Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000188h	DHCP Enable	R/W	0				DHCP disable
			1				DHCP enable

### Fixed IP Address Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A000018Ch	Persistent IP Enable	R/W	0				Do not use fixed IP address
			1				Use fixed IP address

### Heartbeat Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000190h	Heartbeat Mode	R/W	0				Heartbeat disable
			1				Heartbeat enable (stops video image)
			2				Heartbeat enable (stops video image and initialize network)

## Acquisition Control Registers

### Image Transfer Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000200h	Acquisition Mode	R/W	1				Continuous frame transfer mode
			2				Multi-frame transfer mode
			3				Single frame transfer mode

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000204h	Acquisition Frame Count	R/W	1 - 255				No. of frames for multi-frame transfer mode
A0000210h	Acquisition Start	R/W	1				Start image transfer
A0000218h	Acquisition Stop	R/W	0				Stop image transfer

## Memory Control Registers

### Memory channel

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0001000h	Memory Channel	R/W	0 - 15				Memory channel number select

### Save Setting Values

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0001004h	Save Parameters	R/W	1				Save camera parameters*
			2				Save common parameters**

\* Camera parameters are the contents of the Image Control and Feature Control registers.

\*\* Common parameters are the contents of the Network Control and Acquisition Control registers.

### Load Setting Values

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0001008h	Load Parameters	R/W	1				Load camera parameters*
			2				Load common parameters**

\* Camera parameters are the Image Control and Feature Control register contents.

\*\* Common parameters are the Network Control and Acquisition Control register contents.

## Feature Control Registers

### Frame Rate Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000220h	Frame Rate	R/W					Frame rate control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000224h	Auto Frame Rate	R/W	0				Manual
			1				Auto

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000228h	Current Frame Rate	R/O					Display current calculated value of frame rate

### Software Trigger Signal

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A00002F8h	Software Trigger Signal	R/W	0				Software trigger disable
			1				Software trigger enable

## Special trigger Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A00002F0h	Special Trigger Source Select	R/W	0				Sets the trigger source to “hardware” during special trigger mode
			1				Sets the trigger source to “software” during special trigger mode

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A00002F4h	Special Trigger Polarity	R/W	0				Sets the trigger polarity to “positive” during special trigger mode
			1				Sets the trigger polarity to “negative” during special trigger mode

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000300h	Special Trigger Mode	R/W	0				Normal Mode setting
			1				Bulk Mode setting
			2				Sequential Mode setting

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000304h	Number Of Frames For Special Trigger Mode	R/W	1 - 16				Number of frames for special trigger mode

## Gamma Curve Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000310h	Gamma Value	R/W					Gamma curve coefficient setting
A0000314h	Gamma Low Level	R/W					Sets the black level for the Gamma curve coefficient

## GPI Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0000400h	GPI	R/O					Read the GPI

## Feature Control Registers

### Clamp Control (Model XCG-5005E only)

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002000h	Clamp (L)	R/W					(L)eft black level
A0002004h	Clamp (R)	R/W					(R)ight black level

## Gain Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002008h	Gain (L)	R/W					Gain (L)
A000200Ch	Gain (R)	R/W					Gain (R)
A0002010h	Gain_dB (L)	R/W					Gain (L) absolute value
A0002014h	Gain_dB (R)	R/W					Gain (R) absolute value

## Auto Clamp Control (Model XCG-5005E only)

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002018h	Auto Clamp ON	R/W					Auto clamp disable
							Execute one-shot clamp setting
							Auto clamp enable

## Auto Gain Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A000201Ch	Auto Gain ON	R/W					Auto gain disable
							Execute one-shot gain setting
							Auto gain enable

## Auto Gain Level

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002020h	Auto Gain Level	R/W					Auto gain level setting

## Digital Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002034h	Digital	R/W					Digital Control* disable
							Digital Control* enable

\* Digital Control refers to Digital Gain and Pedestal controls.

## Pedestal Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002038h	Pedestal	R/W					Pedestal setting value

## Digital Gain Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A000203Ch	Digital Gain	R/W					Digital Gain setting value

## Shutter Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002040h	Shutter	R/W					Shutter setting value

## Trigger Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002044h	Trigger	R/W				0	External triggering disable
						1	External triggering enable

## Trigger Mode Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002048h	Trigger Mode	R/W				0	Edge-mode external trigger select
						1	Width-mode external trigger select

## Trigger Polarity

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A000204Ch	Trigger Polarity	R/W				0	Negative external trigger polarity
						1	Positive external trigger polarity

## Trigger Inhibit

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002050h	Trigger Inhibit	R/W				0	Permit external triggering
						1	Inhibit external triggering

## Trigger Delay Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002058h	Trigger Delay	R/W					Trigger Delay setting

## Gamma Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A000205Ch	Gamma	R/W				0	Gamma disable
						1	Reverse
						2	Binarization
						3	Gamma curve
						4	Optional* curve

\* Optional curves read by LUT control.



## Binarization Threshold

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002064h	Binarization Threshold	R/W					Binarization threshold setting value

## Multi-Function Output 1

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A000206Ch	Signal Output 1	R/W	0				Exposure signal select
			1				Strobe control signal select
			2				GPO signal select

## Strobe 1 Polarity

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002070h	Strobe 1 Polarity	R/W	0				Negative Strobe 1 polarity
			1				Positive Strobe 1 polarity

## Strobe 1 Delay Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002074h	Strobe 1 Delay	R/W					Strobe 1 delay setting

## Strobe 1 Pulse Width

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002078h	Strobe 1 Pulse Width	R/W					Strobe 1 pulse width setting

## Multi-Function Output 2

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002080h	Signal Output 2	R/W	0				Exposure signal select
			1				Strobe control signal select
			2				GPO signal select

## Strobe 2 Polarity

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002084h	Strobe 2 Polarity	R/W	0				Negative Strobe 2 polarity
			1				Positive Strobe 2 polarity

## Strobe 2 Delay Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002088h	Strobe 2 Delay	R/W					Strobe 2 delay setting

## Strobe 2 Pulse Width

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A000208Ch	Strobe 2 Pulse Width	R/W					Strobe 2 pulse width setting

## GPO Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002090h	GPO	R/W			Bit0		GPO 1 signal select
					Bit1		GPO 2 signal select

## Trigger Source Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0002098h	Trigger Source Select	R/W			0		Hardware trigger source select
					1		Software trigger source select

## User Memory Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A00020C0h – A00020FCh	User Memory	R/W					Memory available for user's storage purposes

## LUT Control Register

### LUT Control

Address	Name	Type	Bit assignment				
			31-24	23-16	15-8	7-0	
A0010000h	LUT Control 0	R/W					Data output when input is 0
A0010004h	LUT Control 1	R/W					Data output when input is 1
:	:	:					
A0013FFCh	LUT Control 4095	R/W					Data output when input is 4095

LUT Control allows selecting any LUT. The LUT is returned when the Optional Curve (Gamma Control) is selected.

# Memory Channel Registers

The default values for memory channels are the same as the values shown in the default value list on page 29.

## Image Control Registers

### Memory channel 0

Address	Name
A000500h	Width
A000504h	Height
A000508h	Offset X
A00050Ch	Offset Y
A000510h	Pixel Format
A000514h	Binning

### ... Memory channel 15

Address	Name
A0005F0h	Width
A0005F4h	Height
A0005F8h	Offset X
A0005FCh	Offset Y
A0005F10h	Pixel Format
A0005F14h	Binning

## Feature Control Registers

### Memory channel 0

Address	Name
A000600h	Frame Rate
A000604h	Auto Frame Rate

### ... Memory channel 15

Address	Name
A0006F0h	Frame Rate
A0006F04h	Auto Frame Rate

## Feature Control Registers

### Memory channel 0

Address	Name
A000800h	Clamp (L)
A000804h	Clamp (R)
A000808h	Gain (L)
A00080Ch	Gain (R)
A000810h	Gain_dB (L)
A000814h	Gain_dB (R)
A000818h	Auto Clamp ON
A00081Ch	Auto Gain ON
A000820h	Auto Gain Level
A000834h	Digital
A000838h	Pedestal
A00083Ch	Digital Gain
A000840h	Shutter
A000844h	Trigger ON
A000848h	Trigger Mode
A00084Ch	Trigger Polarity
A000850h	Trigger Inhibit
A000858h	Trigger Delay
A00085Ch	Gamma
A000864h	Binarization Threshold
A00086Ch	Signal Output 1
A000870h	Strobe 1 Polarity
A000874h	Strobe 1 Delay

### ... Memory channel 15

Address	Name
A0008F0h	Clamp (L)
A0008F04h	Clamp (R)
A0008F08h	Gain (L)
A0008F0Ch	Gain (R)
A0008F10h	Gain_dB (L)
A0008F14h	Gain_dB (R)
A0008F18h	Auto Clamp ON
A0008F1Ch	Auto Gain ON
A0008F20h	Auto Gain Level
A0008F34h	Digital
A0008F38h	Pedestal
A0008F3Ch	Digital Gain
A0008F40h	Shutter
A0008F44h	Trigger ON
A0008F48h	Trigger Mode
A0008F4Ch	Trigger Polarity
A0008F50h	Trigger Inhibit
A0008F58h	Trigger Delay
A0008F5Ch	Gamma
A0008F64h	Binarization Threshold
A0008F6Ch	Signal Output 1
A0008F70h	Strobe 1 Polarity
A0008F74h	Strobe 1 Delay

**Memory channel 0**

Address	Name
A0008078h	Strobe 1 Pulse Width
A0008080h	Signal Output 2
A0008084h	Strobe 2 Polarity
A0008088h	Strobe 2 Delay
A000808Ch	Strobe 2 Pulse Width
A0008090h	GPO Output
A0008094h	Software Trigger Signal
A0008098h	Trigger Source Select
A00080C0h – A00080FCh	User Memory

... **Memory channel 15**

Address	Name
A0008F78h	Strobe 1 Pulse Width
A0008F80h	Signal Output 2
A0008F84h	Strobe 2 Polarity
A0008F88h	Strobe 2 Delay
A0008F8Ch	Strobe 2 Pulse Width
A0008F90h	GPO Output
A0008F94h	Software Trigger Signal
A0008F98h	Trigger Source Select
A0008FC0h – A0008FFCh	User Memory

# Default Value List

## Camera Initialize Register

Address	Name	Type	Value			
			V60E	SX97E	U100E	5005E
0xA0000000	Initialize	R/W	0			

## Image Information

Address	Name	Type	Value			
			V60E	SX97E	U100E	5005E
0xA0000100	Width	R/W	640	1360	1600	2448
0xA0000104	Height	R/W	480	1024	1200	2048
0xA0000108	Offset X	R/W	0			
0xA000010C	Offset Y	R/W	0			
0xA0000110	Pixel Format	R/W	0x01080001			
0xA0000114	Binning	R/W	0			
0xA0000120	Payload Size	R/O	*			
0xA0000130	Test Chart	R/W	0			
0xA0000134	Auto Gain Area	R/W	0			
0xA0000138	Auto Gain Area Width	R/W	50			
0xA000013C	Auto Gain Area Height	R/W	50			
0xA0000140	Auto Gain Area Offset X	R/W	25			
0xA0000144	Auto Gain Area Offset Y	R/W	25			

## Network Information

Address	Name	Type	Value			
			V60E	SX97E	U100E	5005E
0xA0000180	Bandwidth MBps	R/W	50			
0xA0000184	Packet Size	R/W	6000			
0xA0000188	DHCP	R/W	1			
0xA000018C	Persistent IP Enable	R/W	0			
0xA0000190	Heartbeat Mode	R/W	2			

## Acquisition Control

Address	Name	Type	Value			
			V60E	SX97E	U100E	5005E
0xA0000200	Acquisition Mode	R/W	1			
0xA0000204	Acquisition Frame Count	R/W	2			
0xA0000210	Acquisition Start	R/W	0			
0xA0000214	Acquisition Stop	R/W	0			

## Feature Control

Address	Name	Type	Value			
			V60E	SX97E	U100E	5005E
0xA0000220	Frame Rate	R/W	90	16	15	15
0xA0000224	Auto Frame Rate	R/W	0			
0xA0000228	Actual Frame Rate	R/O	*			
0xA00002F0	Special Trigger Source Select	R/W	0			
0xA00002F4	Special Trigger Polarity	R/W	0			
0xA00002F8	Software Trigger Signal	R/W	0			
0xA0000300	Special Trigger Mode	R/W	0			
0xA0000304	Number Of Memory For Special Trigger Mode	R/W	1			
0xA0000310	Gamma Value	R/W	0.70			
0xA0000314	Gamma Low Level	R/W	255			
0xA0000400	GPO Input	R/O	-			

## Memory Control

Address	Name	Type	Value			
			V60E	SX97E	U100E	5005E
0xA0001000	Memory Channel	R/W	0			
0xA0001004	Save Parameters	R/W	0			
0xA0001008	Load Parameters	R/W	0			

## Feature Control

Address	Name	Type	Value			
			V60E	SX97E	U100E	5005E
0xA0002000	Clamp (L)	R/W	-	-	-	*
0xA0002004	Clamp (R)	R/W	-	-	-	*
0xA0002008	Gain (L)	R/W	0			
0xA000200C	Gain (R)	R/W	-	-	-	0
0xA0002010	Gain_dB (L)	R/W	0			
0xA0002014	Gain_dB (R)	R/W	-	-	-	0
0xA0002018	Auto Clamp ON	R/W	-	-	-	1
0xA000201C	Auto Gain ON	R/W	0			
0xA0002020	Auto Gain Level	R/W	11264			
0xA0002034	Digital	R/W	-	-	-	1
0xA0002038	Pedestal	R/W	1023	1023	1023	960
0xA000203C	Digital Gain	R/W	0			
0xA0002040	Shutter	R/W	11046	62320	66506	66570
0xA0002044	Trigger ON	R/W	0			
0xA0002048	Trigger Mode	R/W	0			
0xA000204C	Trigger Polarity	R/W	0			
0xA0002050	Trigger Inhibit	R/W	0			
0xA0002058	Trigger Delay	R/W	0			
0xA000205C	Gamma	R/W	0			
0xA0002064	Binalization Threshold	R/W	2047			
0xA000206C	Signal Output 1	R/W	0			
0xA0002070	Strobe 1 Polarity	R/W	0			

Address	Name	Type	Value			
			V60E	SX97E	U100E	5005E
0xA0002074	Strobe 1 Delay	R/W	0			
0xA0002078	Strobe 1 Pulse Width	R/W	0			
0xA0002080	Strobe 2 Mode	R/W	0			
0xA0002084	Strobe 2 Polarity	R/W	0			
0xA0002088	Strobe 2 Delay	R/W	0			
0xA000208C	Strobe 2 Pulse Width	R/W	0			
0xA0002090	GPO Output	R/W	0			
0xA0002098	Trigger Source Select	R/W	0			
0xA00020C0	User Memory	R/W	0			
0xA00020FC		R/W	0			

\* Camera-specific value.



# Feature Control Inq Registers

## Parameter range of feature

Address	Name	Type	Value			
			V60E	SX97E	U100E	5005E
A0007000h	Width Max	R/O	640	1360	1600	2448
A0007004h	Width Min	R/O	64	64	64	64
A0007008h	Height Max	R/O	480	1024	1200	2048
A000700Ch	Height Min	R/O	48	100	120	480
A0007010h	Frame Rate Max	R/O	depends on model			
A0007014h	Frame Rate Min	R/O	0.0625			
A0007018h	Clamp Max	R/O	1023			
A000701Ch	Clamp Min	R/O	0			
A0007020h	Gain Max	R/O	502			
A0007024h	Gain Min	R/O	0			
A0007028h	Gain Abs Max	R/O	18.0			
A000702Ch	Gain Abs Min	R/O	0.0			
A0007030h	Auto Gain Level Max	R/O	16383			
A0007034h	Auto Gain Level Min	R/O	0			
A0007038h	Auto Gain Area Max	R/O	100			
A000703Ch	Auto Gain Area Min	R/O	0			
A0007040h	Auto Gain Offset Max	R/O	100			
A0007044h	Auto Gain Offset Min	R/O	0			
A0007048h	Pedestal Max	R/O	2047			
A000704Ch	Pedestal Min	R/O	0			
A0007050h	Digital Gain Max	R/O	128			
A0007054h	Digital Gain Min	R/O	0			
A0007058h	Shutter Max	R/O	2000000			
A000705Ch	Shutter Min	R/O	10			
A0007060h	Trigger Delay Max	R/O	4000			
A0007064h	Trigger Delay Min	R/O	0			
A0007068h	Gamma Value Max	R/O	0			
A000706Ch	Gamma Value Min	R/O	0			
A0007070h	Binarization Threshold Max	R/O	4095			
A0007074h	Binarization Threshold Min	R/O	0			
A0007078h	Strobe Delay Max	R/O	4000			
A000707Ch	Strobe Delay Min	R/O	0			
A0007080h	Strobe Pulse Width Max	R/O	4000			
A0007084h	Strobe Pulse Width Min	R/O	1			
A0007088h	LUT Max	R/O	4095			
A000708Ch	LUT Min	R/O	0			
A0007090h	User Memory Size	R/O	64			



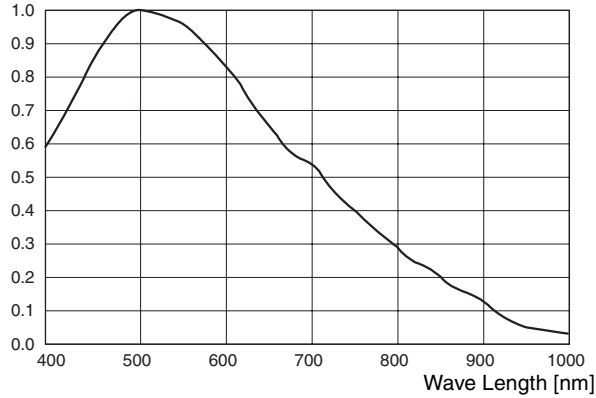
## Specifications

	XCG-V60E	XCG-SX97E	XCG-U100E	XCG-5005E
Image sensor	1/3-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	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	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. 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)	1600 (H) × 1200 (V)	2448 (H) × 2048 (V)
Frame rate	90 fps	16 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: 60,000 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)	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	3.1 W	4.3 W
Performance guaranty temperature	0 to +40 °C (32 to 104 °F)			
Operating temperature	-5 to +45 °C (23 to 113 °F)			
Storage temperature	-30 to +60 °C (-22 to +140 °F)			
Operating relative humidity	20 to 80 % (No condensation)			
Storage relative humidity	20 to 95 % (No condensation)			
Vibration resistance	10 G (20 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. 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

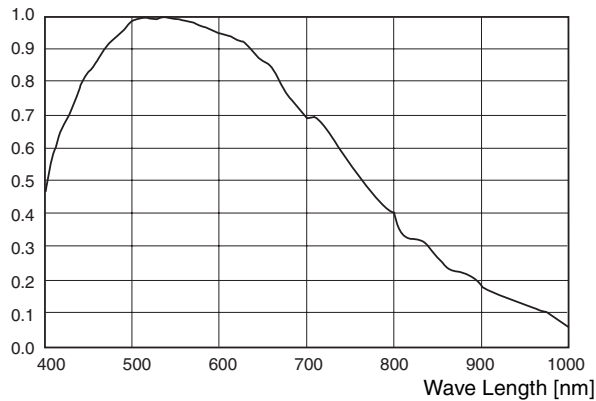
Camera Relative Response



(Without lens and light source parameters.)

## XCG-SX97E

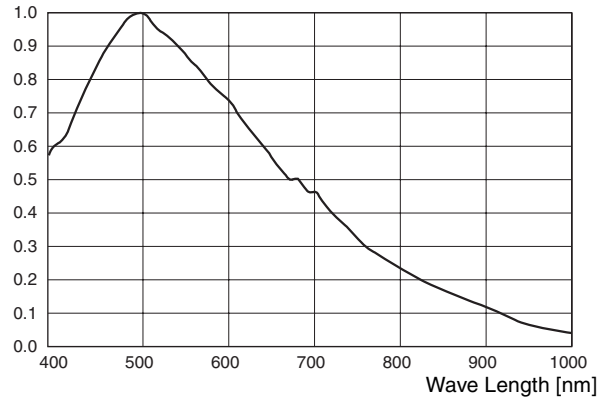
Camera Relative Response



(Without lens and light source parameters.)

## XCG-U100E

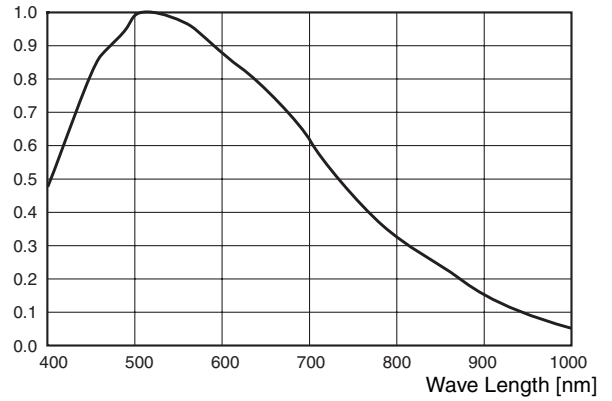
Camera Relative Response



(Without lens and light source parameters.)

## XCG-5005E

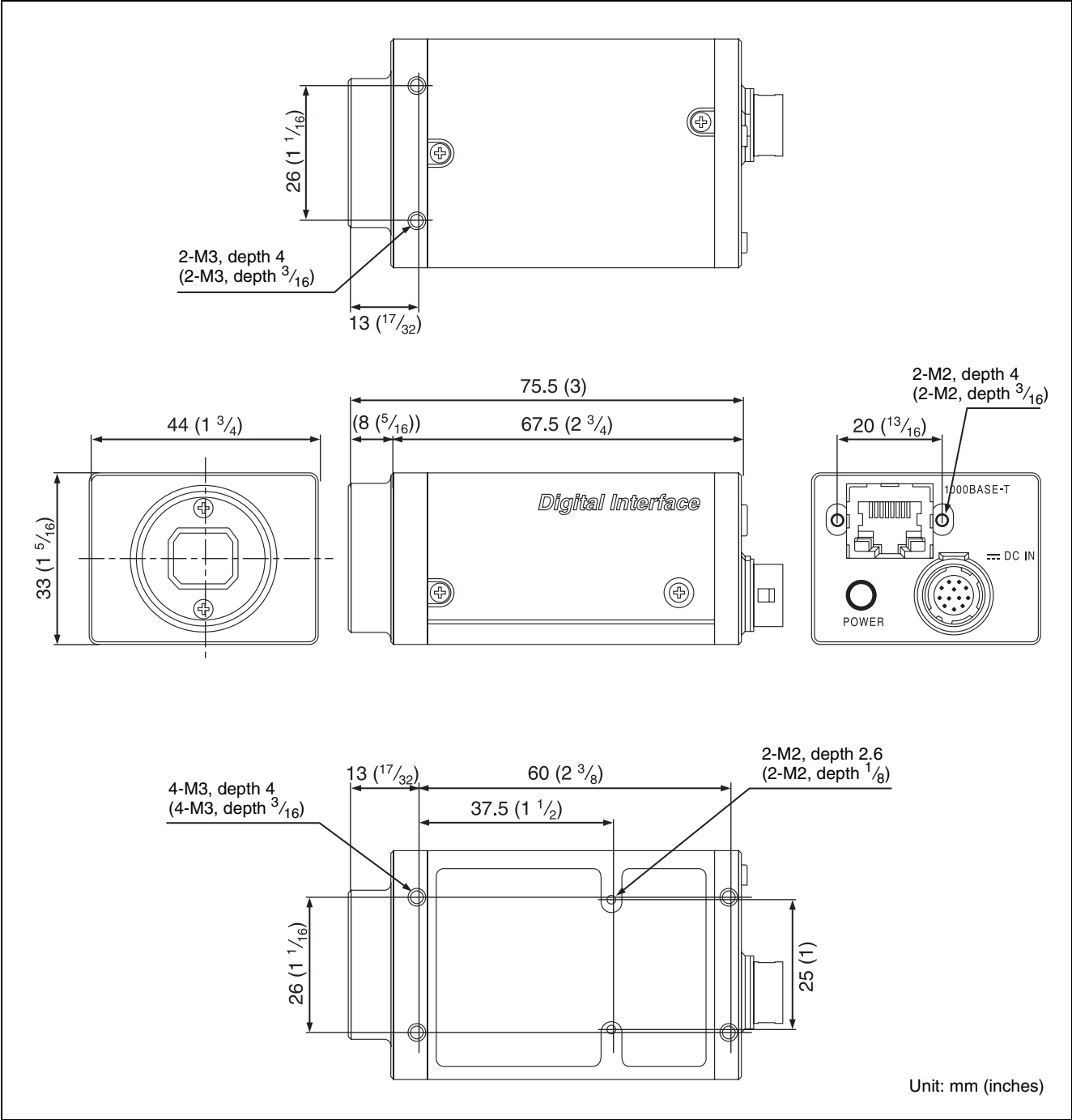
Camera Relative Response



(Without lens and light source parameters.)

Appendix

# Dimensions



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