Digital Video Camera

XCL
XCG
XCD

Analog Video Camera

XC (Non-TV Format)
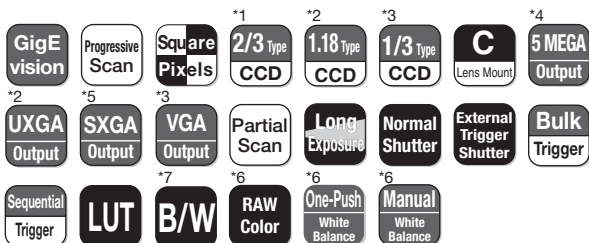
XC (TV Format)

Accessories

Color Camera Module

micro
FCB-HD
FCB-SD

XCG-5005E (B/W)
XCG-5005CR (RAW Color)
XCG-U100E (B/W)
XCG-U100CR (RAW Color)
XCG-SX99E (B/W)
XCG-V60E (RAW Color)

GigE vision	Progressive Scan	Square Pixels	2/3 Type *1 CCD	1.18 Type *2 CCD	1/3 Type *3 CCD	C Lens Mount	5 MEGA *4 Output
UXGA *2 Output	SXGA *5 Output	VGA *3 Output	Partial Scan	Long *6 Exposure	Normal Shutter	External Trigger Shutter	Bulk Trigger
Sequential Trigger	LUT	B/W *7	RAW Color *6	One-Push *6 White Balance	Manual *6 White Balance		

*1: XCG-5005E/XCG-5005CR/SX99E   *2: XCG-U100E/XCG-U100CR
*3: XCG-V60E   *4: XCG-5005E/XCG-5005CR
*5: XCG-SX99E   *6: XCG-5005CR/XCG-U100CR
*7: XCG-5005E/XCG-V100E/XCG-SX99E/XCG-V60E

Connection Diagram P47

Outline

The XCG Series incorporates the GigE Vision interface, which is specifically standardized for machine vision applications based on Gigabit Ethernet technology. The newly expanded XCG Series now consists of seven models – the XCG-5005E, the XCG-U100E, the XCG-SX99E, and the XCG-V60E. In addition, the XCG-SX99E, and XCG-5005E feature critical camera functions for security applications such as IR wavelength coverage (XCG-SX99E) and ultra-high 5-megapixel resolution (XCG-5005E).
The XCG camera series offers choice, flexibility, and high image quality options to match your specific inspection application requirements. By utilizing the features and benefits of the GigE Vision interface, the XCG Series expands the possibilities for factory automation and security applications, while also delivering the potential of significant cost savings.

Features

■ High image quality, high speed image output
  (B/W model)
  XCG-5005E equips a 5,000,000-pixel
    2/3-type CCD that enables image output at 15 fps.
  XCG-U100E equips a 2,000,000-pixel
    1/1.8-type CCD that enables image output at 15 fps.
  XCG-SX99E equips a 1,450,000-pixel
    2/3-type CCD that enables image output at 27 fps.
  XCG-V60E equips a 330,000-pixel
    1/3-type CCD that enables image output at 90 fps.

■ Near-infrared sensitivity: XCG-SX99E

■ GigE vision Interface: GigE vision® version 1.2

  * "GigE Vision" is a trademark of the AIA (Automated Imaging Association).
  * "GenIcam" is a trademark of EMVA (European Machine Vision Association).

■ Digital clamp XCG-5005E/XCG-5005CR
  The XCG-5005E and XCG-5005CR 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   • Auto Clamp   • OFF

■ External trigger shutter function (2 sec 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 fast-moving object clearly.

■ Trigger modes
  Free run/Special trigger mode
          (Bulk trigger/Sequential trigger)

■ 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 μs to 4,000,000 μs, in 1 μs units.

■ Partial scan
  The partial scan function outputs a user-defined region (Area of Interest) within the overall image area.
  Cut-out position settings are specified with the following units:
  • Vertical: 4-scan line units
  • Horizontal: 8-pixel units

■ Binning mode (B/W model only)
  This mode increases sensitivity and frame rate by combining vertically adjacent pixel data from the CCD.

■ 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.
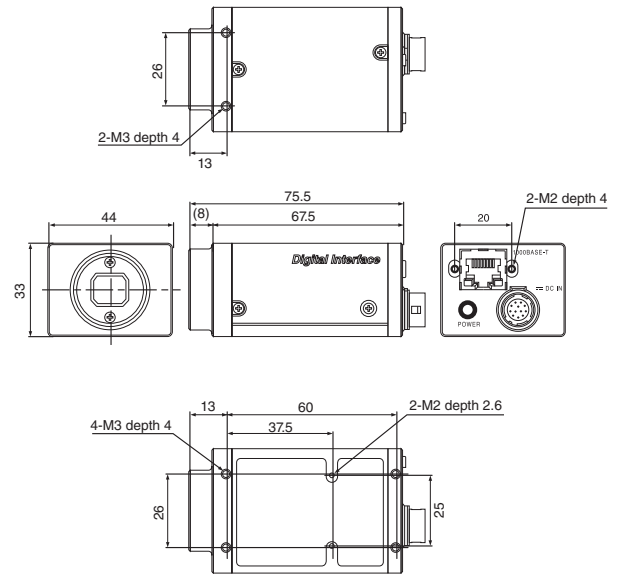
■ Strobe control outputs

■ 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.

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Color Camera Module
FCB-HD
FCB-SD

Accessories

- Compact camera adaptor
  - DC-700/700CE
- 12-pin camera cable (CE standard)
  - CCXC-12P02N (2 m)
  - CCXC-12P05N (5 m)
  - CCXC-12P10N (10 m)
  - CCXC-12P25N (25 m)
- Tripod adaptor
  - VCT-ST70I

Dimensions

Unit: mm

Specifications

	XCG-5005E	XCG-5005CR	XCG-U100E	XCG-U100CR	XCG-SX99E	XCG-V60E
Camera						
Image type	B/W	Color	B/W	Color	B/W	B/W
Image size	5 Mega	5 Mega	UXGA	UXGA	SXGA	VGA
Image sensor	2/3-type PS IT CCD	2/3-type PS IT CCD	1/1.8-type PS IT CCD	1/1.8-type PS IT CCD	2/3-type PS IT CCD (EXview HAD CCD)	1/3-type PS IT CCD
Number of effective pixels (H × V)	2456 × 2058	2456 × 2058	1628 × 1236	1628 × 1236	1392 × 1040	659 × 494
Cell size (H × V)	3.45 μm × 3.45 μm	3.45 μm × 3.45 μm	4.4 μm × 4.4 μm	4.4 μm × 4.4 μm	6.45 μm × 6.45 μm	7.4 μm × 7.4 μm
Standard output pixels (H × V)	2,448 × 2,048	2,448 × 2,048	1,600 × 1,200	1,600 × 1,200	1,360 × 1,024	640 × 480
Color filter	—	Color moxaic	—	Color moxaic	—	—
Frame rate	15 fps	15 fps	15 fps	27 fps	27 fps	90 fps
Minimum illumination	1 lx (Lens: F1.4, Gain: 18 dB, Shutter: 1/15 sec)	6 lx (Lens: F1.4, Gain: 18 dB, Shutter: 1/15 sec)	1 lx (Lens: F1.4, Gain: 18 dB, Shutter: 1/15 sec)	6 lx (Lens: F1.4, Gain: 18 dB, Shutter: 1/15 sec)	0.4 lx (Lens: F1.4, Gain: 18 dB, Shutter: 1/15 sec)	1 lx (Lens: F1.4, Gain: 18 dB, Shutter: 1/605 sec)
Sensitivity	F5.6 (400 lx, Gain 0 dB)	F8 (2,000 lx, Gain 0 dB)	F5.6 (400 lx, Gain 0 dB)	F5.6 (2,000 lx, Gain 0 dB)	F8 (400 lx, Gain 0 dB)	F5.6 (400 lx, Gain 0 dB)
SNR	1 step (Lens close, Gain: 0 dB, 8 bits)					
Gain	Auto/Manual: 0 to 18 dB					
Shutter speed	2 sec to 1/100,000 sec					
Mhite balance	—	Manual One push	—	Manual One push	—	—
Camera Features						
Readout modes	Normal/Binning (1 × 2) /Partial scan	Normal/Partial scan	Normal/Binning (1 × 2) /Partial scan	Normal/Partial scan	Normal/Binning (1 × 2) /Partial scan	Normal/Binning (1 × 2) /Partial scan
Readout features	Binarization, Gamma (arbitrary setting) Gray scale chart	Gamma (arbitrary setting), color bar pattern	Binarization, Gamma (arbitrary setting) Gray scale chart	Gamma (arbitrary setting), color bar pattern	Binarization, Gamma (arbitrary setting) Gray scale chart	Binarization, Gamma (arbitrary setting) Gray scale chart
Trigger modes	Edge/Width mode, Software trigger (1000BASE-T), Bulk trigger, Sequential trigger, Trigger inhibit, Trigger/Strobe delay					
User Set/Memory channel	16 channels					
User memory	16 bytes + 64 bytes × 16 channels	64 bytes × 16 channels	16 bytes + 64 bytes × 16 channels	64 bytes × 16 channels	16 bytes + 64 bytes × 16 channels	16 bytes + 64 bytes × 16 channels
Interface						
Video data output	digital Mono, 8, 10, 12-bit (default setting 8 bits)	digital Raw, 8, 10, 12-bit (default setting Raw 8 bits)	digital Mono, 8, 10, 12-bit (default setting 8 bits)	digital Raw, 8, 10, 12-bit (default setting Raw 8 bits)	digital Mono, 8, 10, 12-bit (default setting 8 bits)	digital Mono, 8, 10, 12-bit (default setting 8 bits)
Interface	Gigabit Ethernet (1000BASE-T)					
Camera specification	GigE Vision® Version 1.2 Compliant					
Digital I/O	ISO IN (x1), ISO OUT (x1), TTL OUT (x1)					
Others						
Lens mount	C-mount					
Flange focal length	17.526 mm					
Transfer rate	1 Gbps					
Power requirements	DC +12 V (10.5 V to 15.0 V) (from 12-pin connector)					
Power consumption	4.3 W	4.3 W	3.1 W	3.5 W	3.6 W	3.1 W
Operating temperature	–5°C to +45°C	–10°C to +45°C	–5°C to +45°C	–10°C to +45°C	–5°C to +45°C	–5°C to +45°C
Performance guarantee temperature	0°C to 40°C					
Storage temperature	–30°C to +60°C					
Operating humidity	20% to 80% (no condensation)					
Storage humidity	20% to 95% (no condensation)					
Vibration resistance	10 G (20 Hz to 200 Hz, 20 minutes for each direction-x, y, z)					
Shock resistance	70 G					
Dimensions (W × H × D)	44 × 33 × 67.5 mm (excluding protrusions)					
Mass	Approx. 145 g					
MTBF	Approx. 8.5 years	Approx. 8.5 years	Approx. 9.9 years	Approx. 9.9 years	Approx. 9.9 years	Approx. 9.7 years
Regulations	UL60950-1, CSA C22, 2 NO60950-1, FCC/IC: Class A, CE: EN61326-1, VCCI: Class A, AS/NZ: IEC61326-1, KC: KN22/KN24: Class A	UL2044, FCC Class A, CE: EN55022, AS/NZ: EN55022, VCCI: Class A, KC: KN22/KN24: Class A	UL60950-1, CSA C22, 2 NO60950-1, FCC/IC: Class A, CE: EN61326-1, VCCI: Class A, AS/NZ: IEC61326-1, KC: KN22/KN24: Class A	UL2044, FCC Class A, CE: EN55022, AS/NZ: EN55022, VCCI: Class A, KC: KN22/KN24: Class A	UL60950-1, CSA C22, 2 NO60950-1, FCC/IC: Class A, CE: EN61326-1, VCCI: Class A, AS/NZ: IEC61326-1, KC: KN22/KN24: Class A	UL60950-1, CSA C22, 2 NO60950-1, FCC/IC: Class A, CE: EN61326-1, VCCI: Class A, AS/NZ: IEC61326-1, KC: KN22/KN24: Class A
Supplied accessories	Lens mount cap (1), Operating Instructions (1)					

* "GigE Vision" is a trademark of the AIA (Automated Imaging Association).
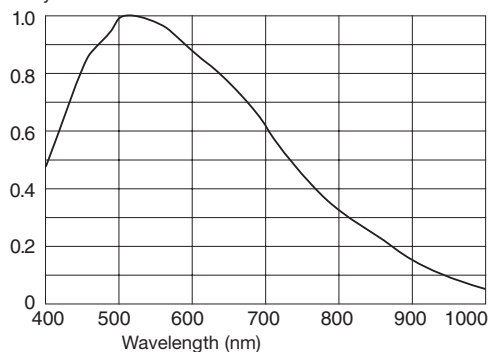* EXview HAD CCD II is a trademark of Sony Corporation.

B/W model

• XCG-5005E

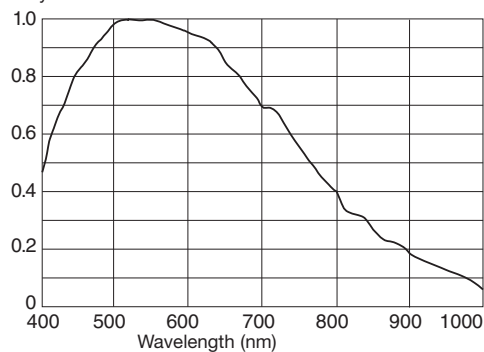(Lens characteristics and light source characteristics excluded.)

Relative sensitivity

Wavelength (nm)

• XCG-SX99E
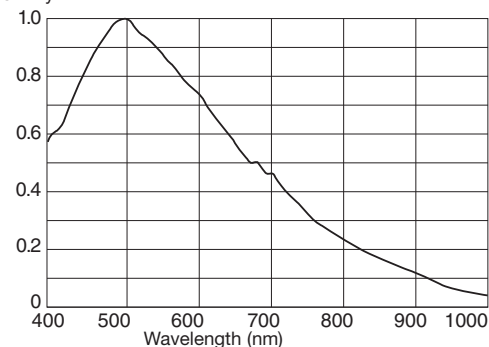
(Lens characteristics and light source characteristics excluded.)

Relative sensitivity

Wavelength (nm)

• XCG-U100E

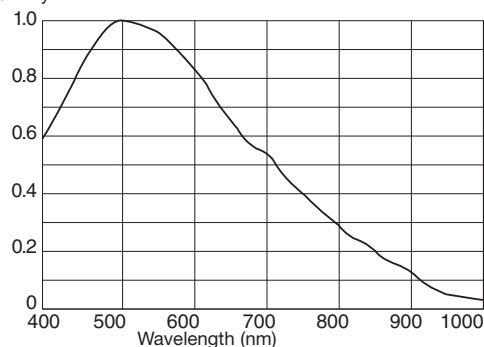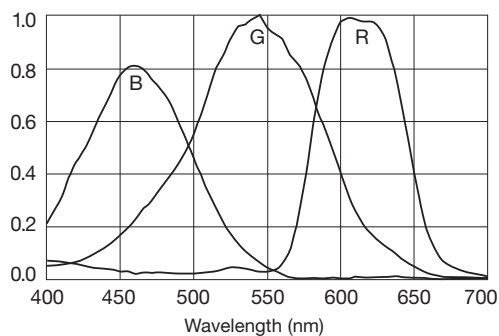(Lens characteristics and light source characteristics excluded.)

Relative sensitivity

Wavelength (nm)

• XCG-V60E

(Lens characteristics and light source characteristics excluded.)

Relative sensitivity

Wavelength (nm)

Color model

• XCG-5005CR

(Lens characteristics and light source characteristics excluded.)

Relative sensitivity

Wavelength (nm)

• XCG-U100CR

(Lens characteristics and light source characteristics excluded.)

Relative sensitivity

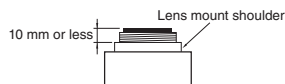Wavelength (nm)

XCG-5005E/5005CR/U100E/U100CR/SX99E/V60E
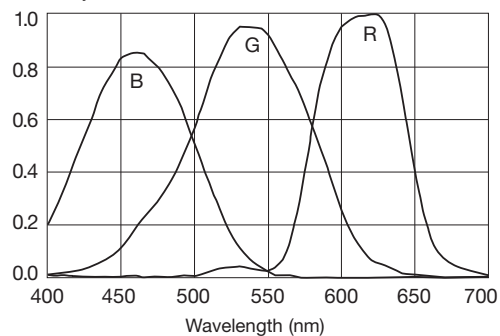
Location and Function of Parts and Controls
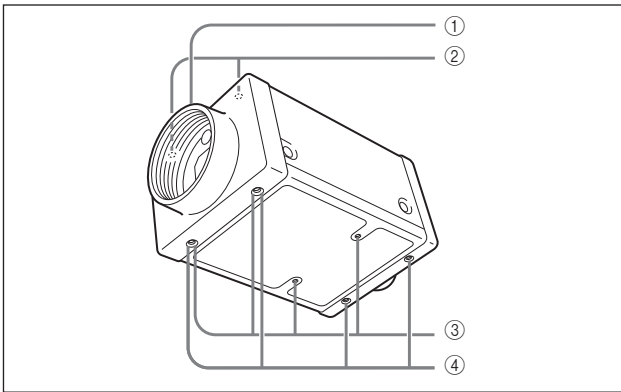
① Lens mount (C-mount)

Note

The lens must not project more than 10 mm from the lens mount.

Lens mount shoulder
10 mm or less

② Guide screw holes (at the top)
③ Guide screw holes/Tripod screw holes (at the bottom)
When using a tripod, use these four screw holes to attach a VCT-ST70I tripod adaptor.

④ Reference screw holes (at the bottom)
These precision screw holes are for locking the camera module. Locking the camera module into these holes secures the optical axis alignment.

Rear Panel/Pin Assignments
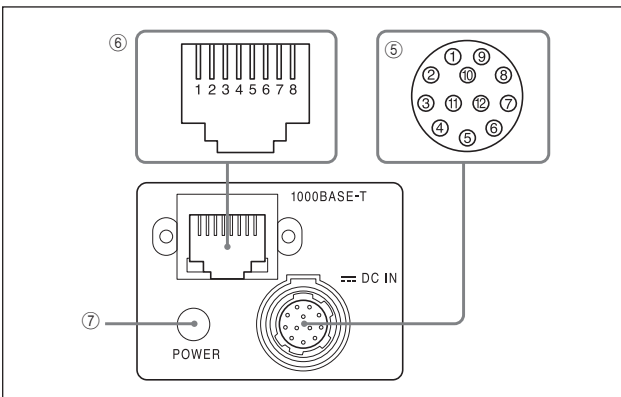
⑤ DC IN (DC power input) connector (12-pin)
You can connect a camera cable CCXC-12P05N etc. to input the +12 V DC power supply. The pin configuration of this connector is as follows. For details on the pin arrangement, see the following table.

Pin No.	Signal	Pin No.	Digital 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	Trigger 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 the Users Guide 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.

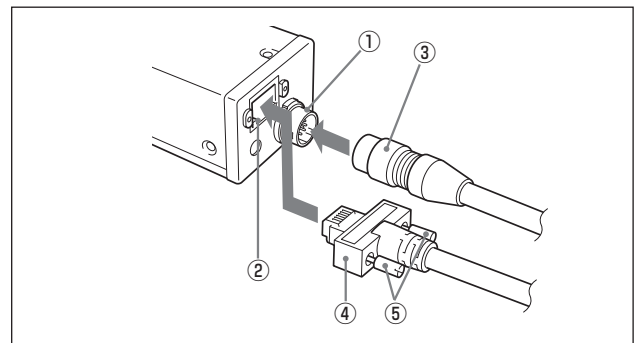| Pin No.	Signal	Pin No.	Signal
1	TP1 +	5	TP3 −
2	TP1 −	6	TP2 −
3	TP2 +	7	TP4 +
4	TP3 +	8	TP4 −

⑦ POWER LED
Flashes or lights based on the internal status of the camera.
Flashing: Obtaining IP address.
Lit: IP address obtained.

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

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.
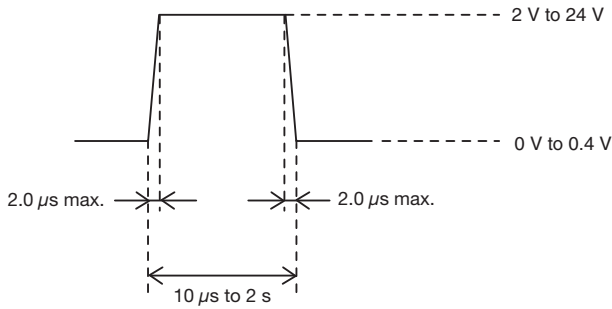Exposure occurs according to the predetermined timing of the trigger signal, which serves as the drive signal for acquiring video images. An image is acquired whenever the drive signal is valid. This function is used for shooting simultaneous video with multiple cameras.
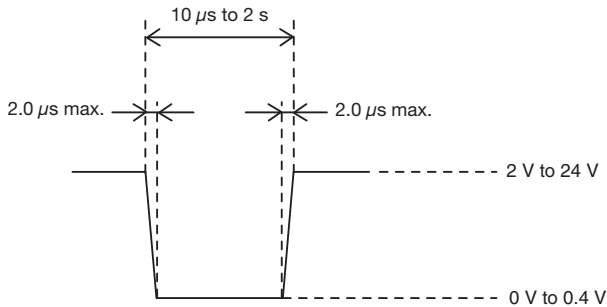
Software Triggering
Software triggering is performed by an internal drive signal generated within the camera in response to network commands. Exposure occurs according to this trigger signal. This drive signal is useful for triggering when hardware triggering is not suitable.

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Trigger Input Specifications

When trigger input polarity is positive

2 V to 24 V

0 V to 0.4 V

2.0 μs max. — — 2.0 μs max.

10 μs to 2 s

When trigger input polarity is negative

10 μs to 2 s

2.0 μs max. — — 2.0 μs max.

2 V to 24 V

0 V to 0.4 V

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

Note

When inputting a trigger signal to the camera using the DC-700/DC-700CE, use DC 5 V or less at the logical high level.

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).

Edge trigger mode (at rising edge)

Trigger

Exposure

Width trigger mode (at rising edge)

Trigger

Exposure
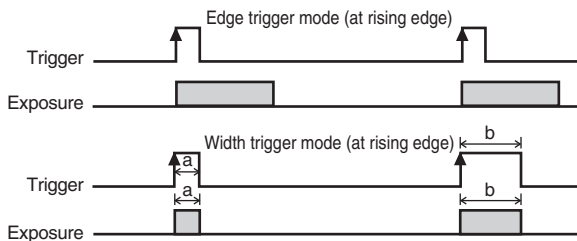
Bulk trigger mode

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.

Trigger

Exposure

Memory channel 0 settings

Memory channel 1 settings
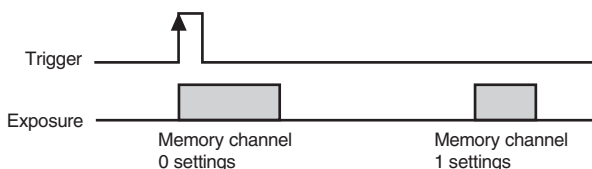
Sequential trigger mode

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.
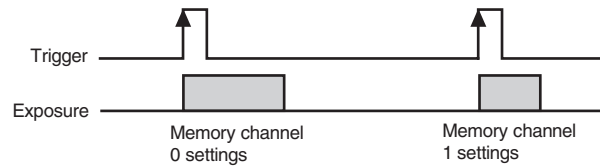
Trigger

Exposure

Memory channel 0 settings

Memory channel 1 settings

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 μs to 4,000,000 μs, in 1 μs units.

Trigger

Delayed Trigger
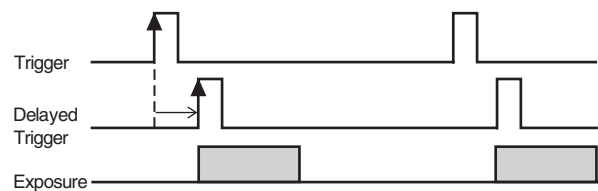
Exposure

Multi-Function Outputs/GPIs (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 μs to 4,000 μs (in 1 μs units)
Strobe width: 0 μs to 4,000 μs (in 1 μs units)

GPO

Outputs can be High or Low active.

Trigger

Exposure

Exposure output

Strobe delay

Strobe control output

Strobe width

GPO

Multi-function output
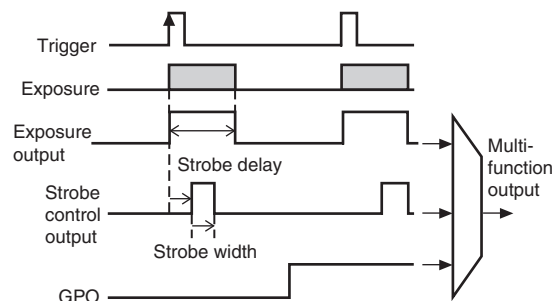
Network Functions

The camera provides the following network functions.

- Payload Size
- Inter Packet Delay
- Persistent IP Enable
- Persistent IP Subnet Mask
- Packet Size
- DHCP Enable
- Persistent IP Address

Gain

The camera provides both manual and automatic gain control.

Manual gain control

Variable gain control in models XCG-U100CR 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-5005CR 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).

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.
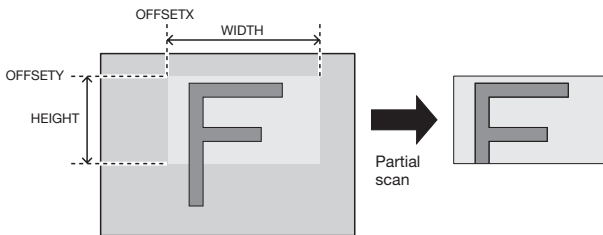
Note

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

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 partial scan setting. This is the default frame rate control setting for the camera.

To increase the frame rate, enable the 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.

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.
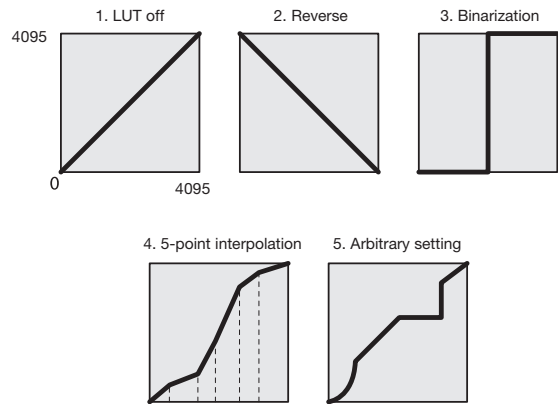
Digital Clamp (XCG-5005E/5005CR)

The XCG-5005E and XCG-5005CR provide 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.

Pixel Gain (XCG-5005CR/U100CR)

The camera provides a pixel gain function.
Gain values are from 1X to 16X (1024 to 16383, in 0.0009765625X increments).

Note

When using pixel 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.

White Balance (XCG-5005CR/U100CR)

The camera provides a white balance function.

One-Push White Balance

This mode adjusts the R- and B-level corresponding to the G-level for a user-specified detection frame once upon executing the command. The variable range is the same as for pixel gain.

Also, the white balance 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).

XCL
XCG
XCD
Digital Video Camera

XC (Non-TV Format)
XC (TV Format)
Analog Video Camera

Accessories

micro
FCB-HD
FCB-SD
Color Camera Module