D-020-100-**11** (2)

SONY

# *Digital Video Camera Module*

## Technical Manual

# XCU-CG160/CG160C

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## *Overview*

This unit is a digital video camera module that adopts a USB 3.0 interface for image output and camera control. The XCU-CG160 is a monochrome models, and the XCU-CG160C is a color model.
In this document, “Digital Video Camera Module” is referred to as the “unit”, “XCU-CG160” as “Monochrome camera”, and “XCU-CG160C” as “Color camera”.

# Features

### USB 3.0 interface

Image output and camera control are performed over a USB 3.0 interface.

### USB3 Vision adoption

The USB3 Vision standard is adopted to enable simple camera control.

### High image quality

This unit produces stable output images, by adopting the latest CMOS image sensors with a global shutter function. By adopting a square pixel image sensor, images can be processed using the original aspect ratio without a conversion procedure.

### Various settings

Various settings can be configured by sending a command from a host device.

### External trigger shutter function

By synchronizing with an external trigger signal, any shutter timing can be used.

### Partial scan

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

### Chassis mount

Screw holes for mounting the camera module are located under the front panel.
Mounting the camera module at this location minimizes the deviation of the optical axis.

### LUT (Look Up Table)

A LUT can be turned on/off.
When turned on, you can select from five preset values, such as inversion, binarization, configurable five-point approximations, etc.

### White balance control (color camera only)

You can adjust the R and B levels relative to the G level to adjust the white balance. This unit is also equipped with a one-push white balance function for automatic camera white balance adjustment.

### Area gain function

You can set the gain between 0 to 32 times for up to 16 arbitrary positions. If the set area is duplicated, the low-numbered area takes priority.

### Equipped with temperature sensor

The camera’s internal temperature can be read from a temperature sensor mounted on the module board. If the update interval of the temperature sensor value is set to other than 0, temperature information can be sent to a PC application as event data.

### Pixel defect correction function

This unit is equipped with a defective pixel correction function that reduces the effect of sensor defects. It can be switched on/off.

### Shading correction function

This unit is equipped with a function that corrects the shading caused by a light source or lens. It can be switched on/off.

### Binning function (XCU-CG160 only)

Adding two pixels in the vertical and horizontal directions achieves higher sensitivity and frame rate.

# Phenomena Specific to Image Sensors

**Note**

The following phenomena that may occur in images are specific to image sensors. They do not indicate a malfunction.

### White flecks

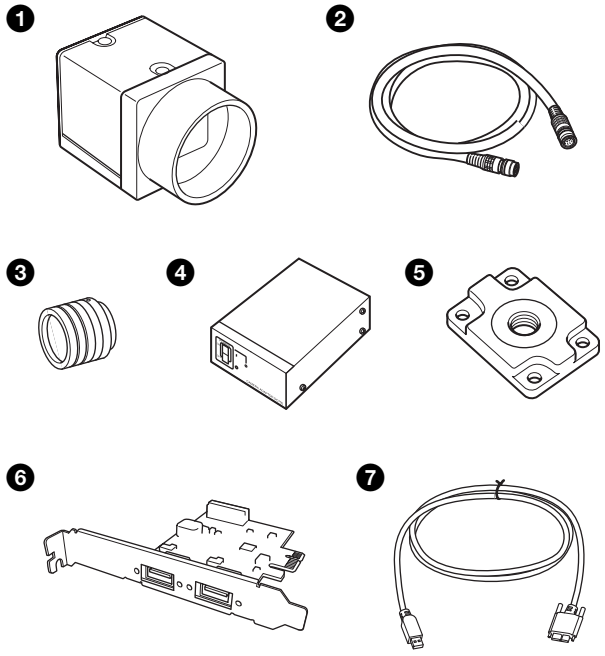
Although the image sensors are produced with high-precision technologies, fine white flecks may be generated on the screen in rare cases, caused by cosmic rays, etc.
This is related to the principle of image sensors and is not a malfunction.
The white flecks especially tend to be seen in the following cases:

- When operating at a high environmental temperature
- When you have raised the gain (sensitivity)
- When using the slow shutter

### Aliasing

When fine patterns, stripes, or lines are shot, they may appear jagged or flicker.

# System Components




A system centered on the unit can comprise the following components (available separately).

**❶ Video camera module (this unit)**
This is a small-size, high-resolution, camera that uses a CMOS image sensor with a global shutter function.

**❷ Camera cable**
This is attached to the DC power input connector of the unit and is used for the power supply and exchange of trigger signals. For details about purchasing a cable, consult a dealer.

**❸ C-mount lens**
Use a suitable lens to fit the camera pixel count.

**❹ DC-700/700CE Camera Adaptor**
This is connected to the unit to enable power supply from an ordinary AC power source.

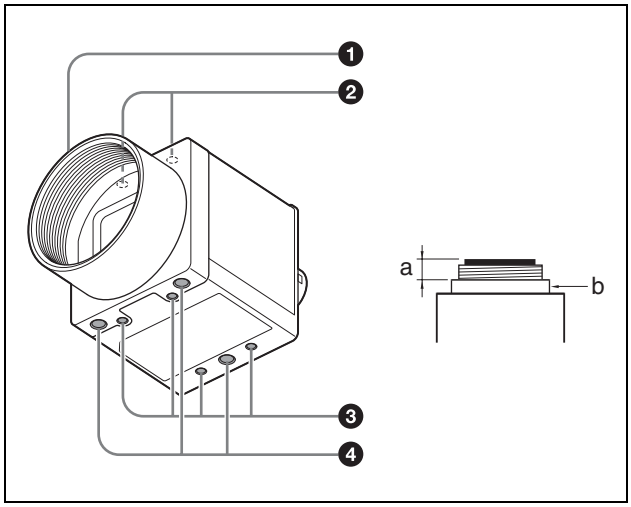
**❺ VCT-333I Tripod Adaptor**
This attaches to the bottom of the unit to mount the unit on a tripod.

**❻ USB 3.0 interface image input board**
Install the board in the expansion slot of the host device (computer or other device).
The camera can also be connected to a USB 3.0 port on a computer, but the use of the input board is recommended.
This document describes the case where the input board is used.

**❼ USB 3.0 cable**
Connect to the USB connector on the rear panel of the unit to send image signals and to receive control signals. Use a Standard USB A to USB Micro B, USB 3.0 cable that is compatible with the USB3 Vision standard.
For details about purchasing a cable, consult a dealer.

# Location and Function of Parts and Operation

## Front/top/bottom




**❶ Lens mount (C-mount)**
Attach any C-mount lens or other optical equipment.

**Note**

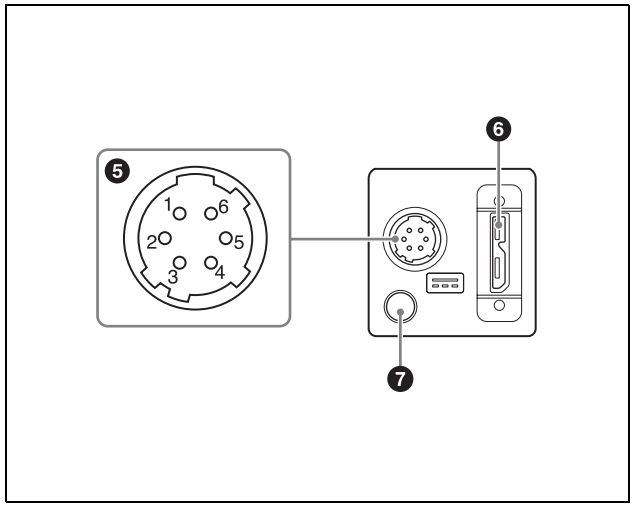
Use a C-mount lens where the protrusion (a) extending from the lens mount face (b) is 10 mm (13/32 inch) or less.
When attaching a lens to the camera, note that the resolution of the image that is output from the camera may vary depending on the performance of the lens. The performance of the same lens may also vary depending on the aperture value.
If the resolution is insufficient, adjust the aperture value.

**❷ Camera mount guide screw holes (top)**

**❸ Camera mount guide screw holes/Tripod attachment screw holes (bottom)**
When using a tripod, use these four screw holes to attach a VCT-333I Tripod Adaptor.
For details, see “Mounting on a tripod” (page 7).

**❹ Camera mount reference screw holes (bottom)**
These precision screw holes are for securing the camera module. Securing the unit with these holes minimizes any optical axis alignment offset.
For details about the size of and position of guide holes and reference holes, see “Dimensions” (page 44).

## Rear




**❺ ⎓ (DC power input) connector (6-pin)**
You can connect a camera cable to input a 12 V DC power supply. The pin configuration of this connector is as follows.
(Refer to part ❺ above for the pin assignment of the connector.)

| Pin No. | Signal | Pin No. | Signal |
|---|---|---|---|
| 1 | DC input (10.5 V to 15 V) | 4 | GPO3 (ISO +) |
| 2 | GPI1 (ISO +) | 5 | ISO – |
| 3 | GPI2/GPO2 | 6 | GND |

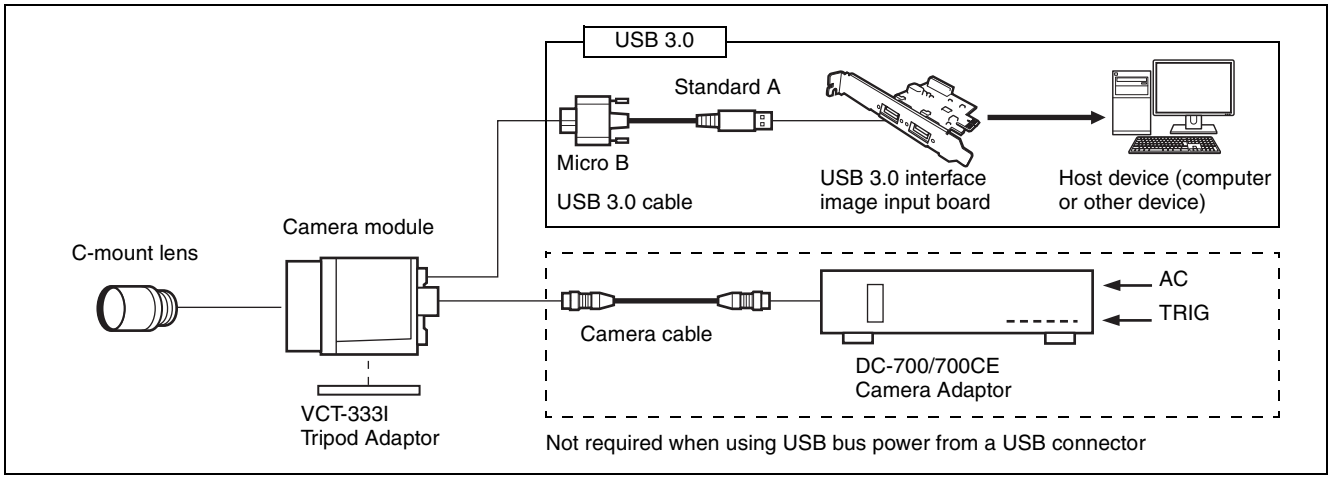
**❻ USB connector (Micro B type)**
Connect a USB 3.0 cable to control the camera module from a host device and to send image signals from the camera module. Power can be supplied from a USB 3.0 interface video input board or from a USB hub over the USB 3.0 cable.

**CAUTION**

- For safety, do not connect the connector for peripheral device wiring that might have excessive voltage to this port. Follow the instructions for this port.
- Use a Standard USB A to USB Micro B, USB 3.0 cable that is compatible with the USB3 Vision standard.
- USB 2.0 is not supported.

**❼ Status LED (green)**
Displays the unit status.
For details, see “Status LED” (page 30).

# Connections




## About the power supply

You can supply power to the unit using the following methods.

### Supplying power using the USB connector

Power supply, camera control, and image output are all supported using a single USB 3.0 cable.

### Supplying power using the DC power supply input connector

You can supply power via the DC power supply input connector using the power adaptor.
Use the DC-700/700CE, which provides a stable power source free from ripple or noise.

### Heat dissipation

Heat dissipation may be required, depending on the usage environment. For details, see “When mounting the camera” (page 7).

## USB 3.0 connection

**1** Insert the USB 3.0 interface image input board (not supplied) into an expansion slot of the host device.

**2** Connect the unit and host device using a USB 3.0 cable (not supplied). For details, see “Connecting the cables” (page 7).

**3** Check that the unit is successfully recognized on the screen of the host device, and click the model name. A viewer appears and displays the camera image.

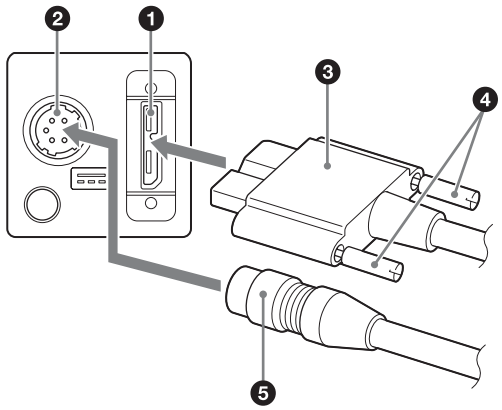
**Note**

The method of operation varies depending on the application used.

### About control of the camera module

To control the unit from a host device, USB 3.0 compatible software must be installed on the host device.
To use the Sony USB 3.0 Software Development Kit (SDK), download the software from the Sony website. For details about software operation, refer to the corresponding instruction manual.

## Connecting the cables

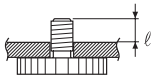



Connect the camera cable (❺) to the DC power supply input connector (❷), and connect a USB 3.0 cable (❸) to the USB connector (❶). If using a USB 3.0 interface image input board or a hub, you can operate the camera even if you do not connect the camera cable to the DC power supply input connector.
It you connect a USB 3.0 cable that has fastening screws, turn the two screws (❹) on the connector to secure the cable tightly.
Connect the other end of the USB 3.0 cable to the USB 3.0 interface image input board or a hub.

## Mounting on a tripod

To use a tripod, attach the VCT-333I Tripod Adaptor (not supplied) to the camera module.
Use a tripod screw that protrudes (ℓ) beyond the mounting surface, as follows, and tighten it using a screwdriver. Be sure that the protrusion (ℓ) does not exceed 5.5 mm (0.2 in.) in length.

ℓ: 4.5 mm to 5.5 mm




**Note**

When attaching the tripod adaptor (not supplied), use the screws provided with the tripod adaptor.

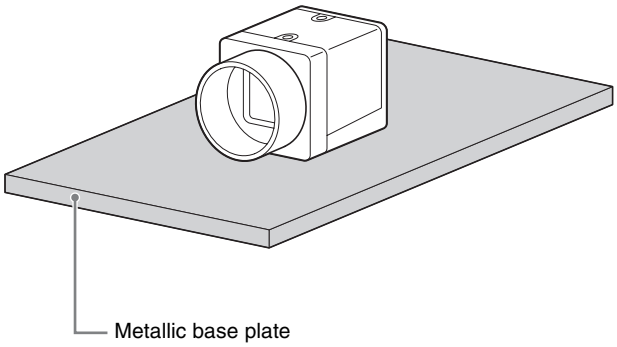
## When mounting the camera

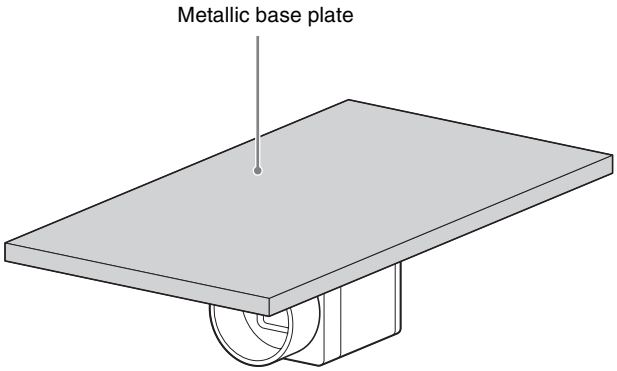
When the value read from temperature sensor is above 75 °C (167 °F), heat dissipation is required.
Use in environments where the difference with the ambient temperature is 32 °C (90 °F) or less.

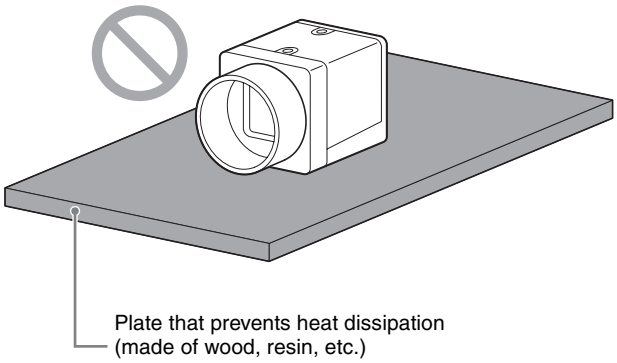
To facilitate heat dissipation from the unit and maintain performance, mount the camera to a metallic plate.

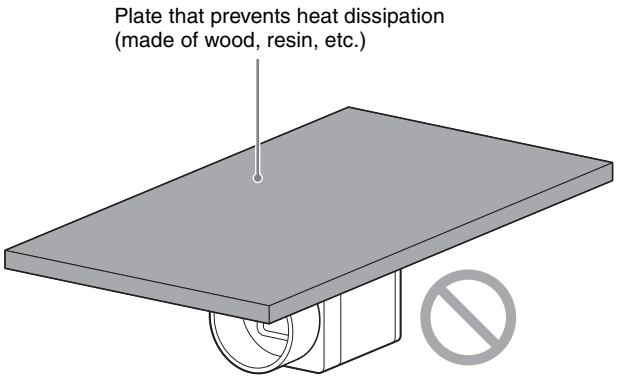
**Notes**

- When mounting the camera on the metallic plate, secure the camera by using the reference screw holes on the camera (page 5) and screws.
- Do not mount the camera on a plate made of a material, such as wood or resin, that prevents heat dissipation.



Default value for each item is underlined.

# Trigger Signal Input

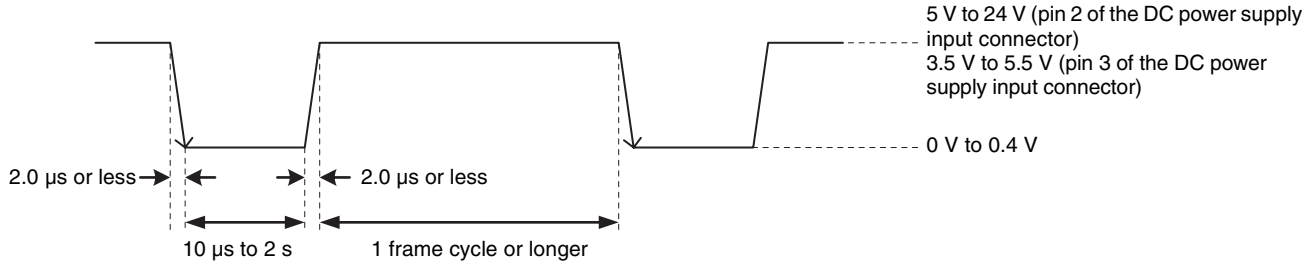
Trigger signals can be input via pins 2, 3, and 4 of the DC power supply input connector, or by software command. Switchover of the trigger signal can be changed using TriggerSource. For details, see “Trigger Control” (page 17).

## Trigger signal polarity

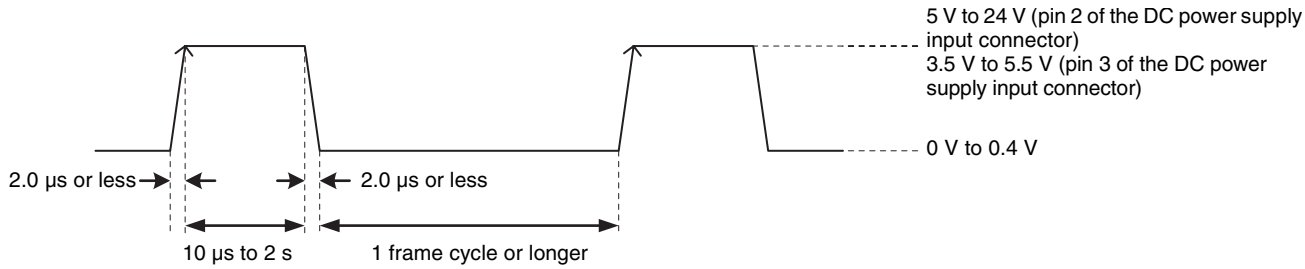
Positive polarity refers to a trigger signal activated by a Low to High rising edge, or High-level interval. Negative polarity refers to a trigger signal activated by a High to Low falling edge, or Low-level interval. The default value of the camera is negative polarity.

| Feature | Parameter | Setting |
|---|---|---|
| TriggerActivation | FallingEdge (0) | Negative |
| | RisingEdge (1) | Positive |

### DC power supply input connector specifications




Trigger input polarity = Negative




Trigger input polarity = Positive

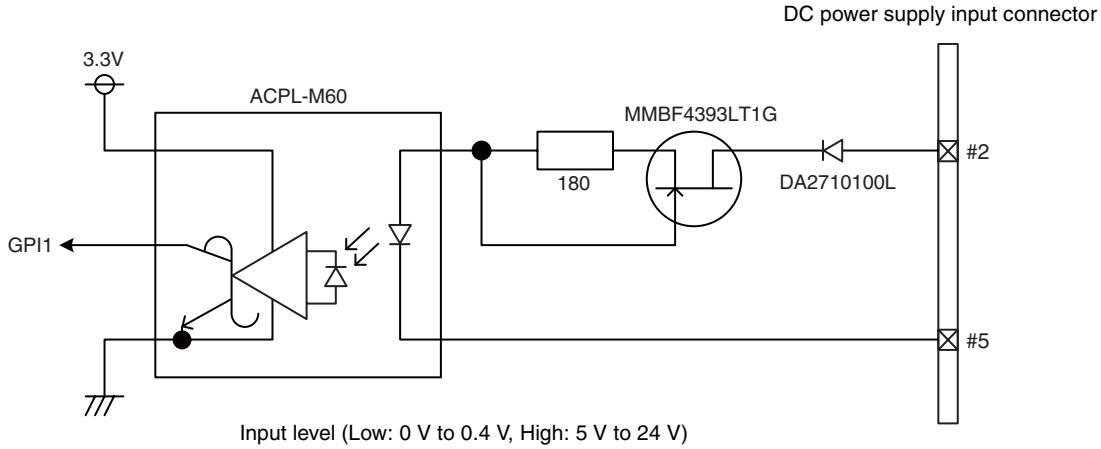
**Notes**

- When inputting a trigger signal to the camera using the DC-700/700CE, use 5 V DC or lower as the logical high level.
- Make sure to supply power to the unit and confirm that the unit is operating before inputting a trigger signal. If you input a trigger signal to the unit without the power supplied, this may cause a malfunction of the camera.

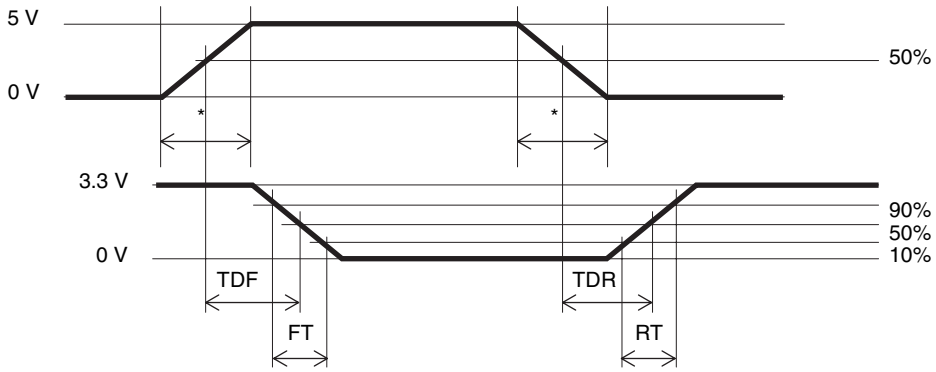
# GPIO Connector

Pin 2 of the DC power supply connector is a GPI connector, pin 3 can be set as either a GPI or GPO connector, and pin 4 is a GPO connector. The default trigger source is pin 2 of the DC power supply input connector (GPI1). If connecting an external device to the GPI or GPO connector, refer to the circuit specifications below.

## GPI circuit specifications




Input level (Low: 0 V to 0.4 V, High: 5 V to 24 V)

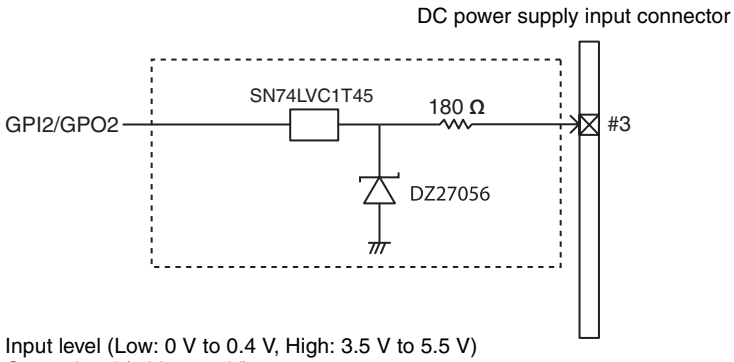



* Rising edge of the input signal should be as fast as possible.

### Example

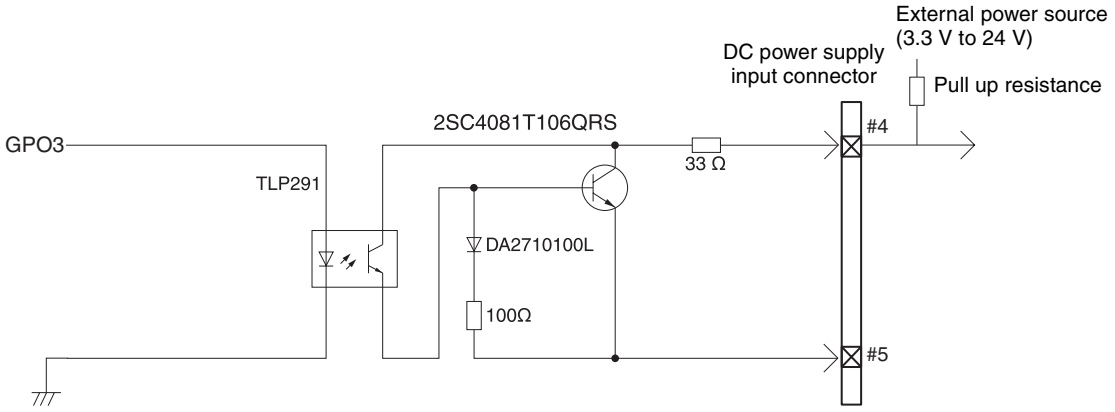
| Input voltage [V] | TDF [ns] | FT [ns] | TDR [ns] | RT [ns] |
|---|---|---|---|---|
| 5.0 | 167 | 297 | 192 | 358 |

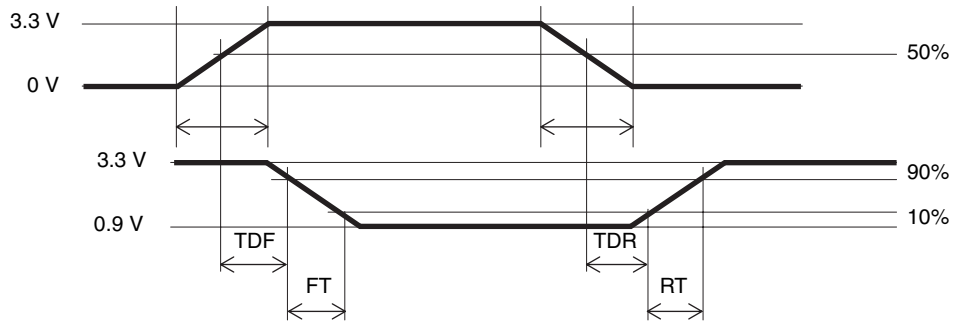
## GPIO circuit specifications




Input level (Low: 0 V to 0.4 V, High: 3.5 V to 5.5 V)
Output level (0 V to 3.3 V)

## GPO circuit specifications




### Example

When connecting to an external power supply, be sure to use a pull-up resistor to limit the current to 50 mA or less.

| | Supply voltage of the output [V] | Pull up resistance (Use 1/16 W) | Current [mA] | TDF [µs] | FT [µs] | TDR [µs] | RT [µs] | Output voltage [V] |
|---|---|---|---|---|---|---|---|---|
| Ambient temperature | 3.3 | 470 Ω | 5.07 | 0.75 | 0.49 | 24 | 35 | 0.916 |
| | 5.0 | 820 Ω | 4.98 | 0.73 | 0.63 | 28 | 46 | 0.909 |
| | 12.0 | Two 2200 Ω resistors in parallel | 9.87 | 0.71 | 1.05 | 36 | 64 | 1.112 |
| | 24.0 | Eight 8200 Ω resistors in parallel | 21.85 | 0.73 | 1.45 | 45 | 76 | 1.571 |

# Partial Scan

Only an area selected from the effective pixel area can be scanned. The area size is selected by Height and Width, and the read start point is selected by OffsetX and OffsetY. Reducing Height increases the frame rate, but changing Width does not change the frame rate. Partial scan can be set with or without a trigger.
OffsetX and OffsetY relate to Width and Height as follows:
OffsetX + Width ≤ Width (maximum value)
OffsetY + Height ≤ Height (maximum value)

**Note**

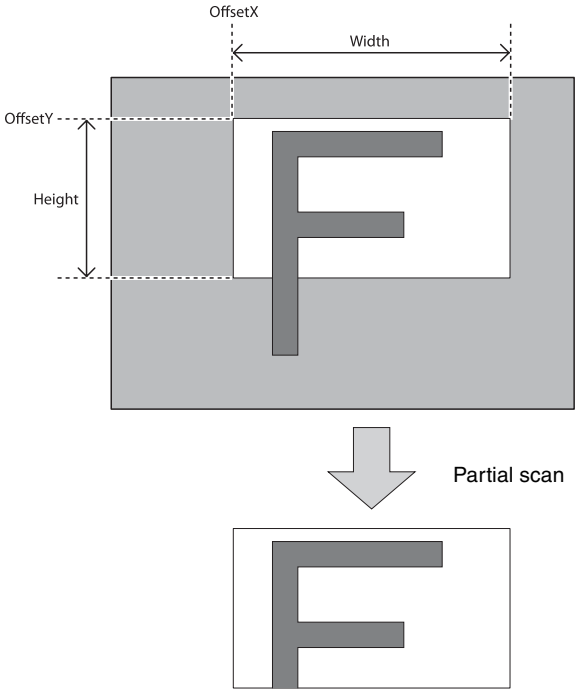
Since the shutter setting has priority, use a shutter speed high enough to enable partial scan at a higher frame rate.

### Configurable range

| Feature | Parameter |
|---|---|
| OffsetX | 0 to 8 to 1440 |
| OffsetY | 0 to 4 to 1072 |
| Width | 16 to 1440 to 1456 |
| Height | 16 to 1080 to 1088 |

### Configurable values

OffsetX, OffsetY, Width, Height: Increments of 4




# Binning (XCU-CG160 only)

Adding two pixels in the vertical and horizontal directions achieves higher sensitivity and frame rate.

| Feature | Parameter | Setting |
|---|---|---|
| BinningVertical | 1 | Vertical binning is off |
| | 2 | Vertical binning is on |
| BinningHorizontal | 1 | Horizontal binning is off |
| | 2 | Horizontal binning is on |

**Notes**

- To increase the frame rate for binning, use the shutter at a sufficiently high speed.
- When using binning, the configurable values for OffsetX, OffsetY, Width, and Height are halved and change in increments of 2.

# Camera Mode

“FAST” mode prioritizes the frame rate, and is set by default.
The frame rate upper limit of “FAST” mode is higher than for “NORMAL” mode, but the available functions are limited.
When correcting defects/shading in “FAST” mode, detect and save the defects/shading in “NORMAL” mode and then return to “FAST” mode.
Reboot the unit to apply the change in camera mode.

| Feature | Parameter | Setting |
|---|---|---|
| CameraModeSelector | FastMode (0) | FAST |
| | NormalMode (1) | NORMAL |

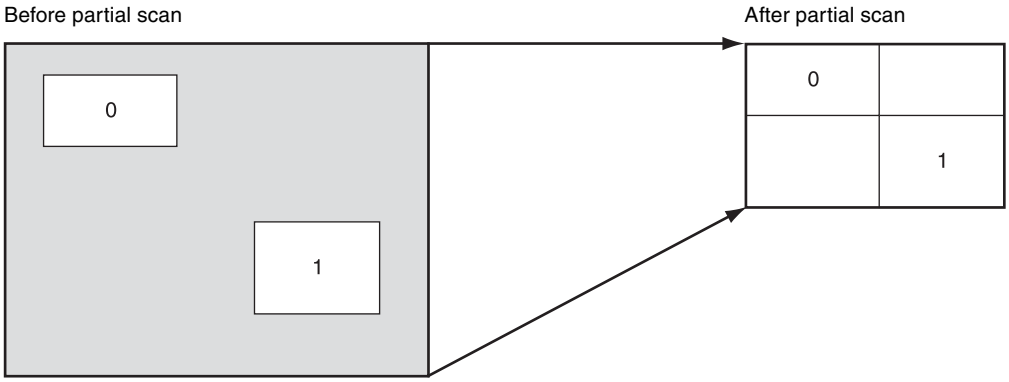
| Function | FAST | NORMAL |
|---|---|---|
| Maximum frame rate | 100 fps | 56 fps |
| Defect detection function (page 30) | – | ● |
| Defect correction function (page 30) | ● | ● |
| Shading detection function (page 31) | – | ● |
| Shading correction function (page 31) | ● | ● |
| Output format | See “Output Format” (page 14). | |

●: Available function, –: Unavailable function

# Multi ROI

You can set and read two arbitrary rectangular areas from the effective pixel area.
By reading only the required parts, you can shorten the time it takes to read.

| Feature | Parameter | Setting |
|---|---|---|
| MultiROIMode | Off (0) | All areas Off |
| | On (1) | All areas On |
| | Highlight (2) | Displays the specified region highlighted. |
| MultiROISelect | 0 to 1 | Designates the number of the area for which to change parameters. |
| MultiROIEnable | False (0) | The area designated in MultiROISelect is Off. |
| | True (1) | The area designated in MultiROISelect is On. |
| MultiROIWidth | 4 to 128 to 1456 | Horizontal size of the area |
| MultiROIHeight | 4 to 128 to 1088 | Vertical size of the area |
| MultiROIOffsetX | 0 to 128 to 1452 | Horizontal position of the area |
| MultiROIOffsetY | 0 to 128 to 1084 | Vertical position of the area |



# Output Format

The configurable pixel formats are as follows:

### XCU-CG160 (monochrome camera)

| Feature | Camera mode | ReverseX | ReverseY | Parameter | Setting |
|---|---|---|---|---|---|
| PixelFormat | FAST | False or True | False or True | 0x01080001 | Mono8 |
| | NORMAL | False or True | False or True | 0x01080001 | Mono8 |
| | | | | 0x010C0047 | Mono12p |

### XCU-CG160C (color camera)

| Feature | Camera mode | ReverseX | ReverseY | Parameter | Setting |
|---|---|---|---|---|---|
| PixelFormat | FAST | False or True | False or True | 0x01080001 | Mono8 *1 |
| | | False | False | 0x01080009 | BayerRG8 |
| | | False | True | 0x0108000A | BayerGB8 |
| | | True | False | 0x01080008 | BayerGR8 |
| | | True | True | 0x0108000B | BayerBG8 |
| | | False or True | False or True | 0x02180015 | BGR8 *2 |
| | NORMAL | False or True | False or True | 0x01080001 | Mono8 |
| | | False | False | 0x01080009 | BayerRG8 |
| | | | | 0x010C0059 | BayerRG12p |
| | | False | True | 0x0108000A | BayerGB8 |
| | | | | 0x010C0055 | BayerGB12p |
| | | True | False | 0x01080008 | BayerGR8 |
| | | | | 0x010C0057 | BayerGR12p |
| | | True | True | 0x0108000B | BayerBG8 |
| | | | | 0x010C0053 | BayerBG12p |
| | | False or True | False or True | 0x02180015 | BGR8 |
| | | | | 0x0218005B | YCbCr8 |
| | | | | 0x0210003B | YCbCr422_8 |

*1 Monochrome output due to binning.
*2 Image size is half of standard size.

# Image Flip

Flips an image vertically and horizontally.
Reboot the unit to reflect the changes of the setting.

| Feature | Parameter | Setting |
|---|---|---|
| ReverseX | False (0) | Off (no flip) |
| | True (1) | Flip horizontally |
| ReverseY | False (0) | Off (no flip) |
| | True (1) | Flip vertically |

# Gain

## Manual gain

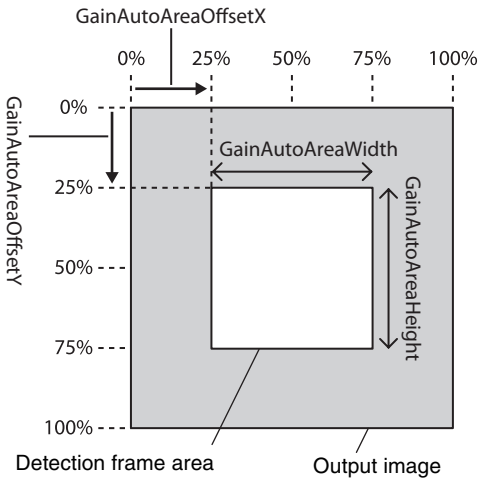
The manual gain can be finely set in 0.1 dB increments. Although the configurable lower/upper limit values of the gain are slightly different for each camera, the configurable values for the GainAnalog parameter are –1 dB or lower to +27 dB or higher.
The rage of the gain setting that guarantees image quality is 0 dB to 18 dB.

| Feature | Parameter | Setting |
|---|---|---|
| GainAnalog | –1 or lower to 0 to +27 or higher | Gain dB unit |

## Auto gain (AGC)

By setting auto gain, the gain is automatically adjusted according to the imaging environment. AGC operates so that the average level within a detection frame satisfies the GainAutoLevel setting. The AGC detection frame is set to the central region by default. The detection frame can be displayed and the detection area can be changed.

| Feature | Parameter | Setting |
|---|---|---|
| GainAuto | Off (0) | Manual gain |
| | Once (1) | One-push AGC |
| | Continuous (2) | Continuous AGC |
| GainAutoLevel | 0 to 11264 to 16383 | AGC target level (14 bits) |
| GainAutoSpeed | 1 to 192 to 256 | AGC convergence speed |
| GainAutoUpperLimit | –1 or lower to +18 to +27 or higher | AGC upper limit |
| GainAutoLowerLimit | –1 or lower to 0 to +27 or higher | AGC lower limit |
| GainAutoHighlight | False (0) | AGC detection frame is hidden |
| | True (1) | AGC detection frame is displayed |
| GainAutoAreaWidth | 1 to 50 to 100 | Horizontal size of AGC detection frame |
| GainAutoAreaHeight | 1 to 50 to 100 | Vertical size of AGC detection frame |
| GainAutoAreaOffsetX | 0 to 25 to 99 | Horizontal position of AGC detection frame |
| GainAutoAreaOffsetY | 0 to 25 to 99 | Vertical position of AGC detection frame |




## Area gain

A separate digital gain can be set for up to 16 rectangular areas.
If multiple rectangular areas are duplicated, the gain value of the low-numbered area takes priority.

| Feature | Parameter | Setting |
|---|---|---|
| AreaGainEnableAll | False (0) | Gain in all areas set to Off |
| | True (1) | Gain in all areas set to On |
| AreaGainSelect | 0 to 15 | Designates the number of the area for which to change parameters. |
| AreaGainEnable | False (0) | Gain of area specified by AreaGainSelect set to Off |
| | True (1) | Gain of area specified by AreaGainSelect set to On |
| AreaGainWidth | 0 to 128 to Width | Horizontal size of area* |
| AreaGainHeight | 0 to 128 to Height | Vertical size of area* |
| AreaGainOffsetX | OffsetX to 128 to Width | Horizontal position of area* |
| AreaGainOffsetY | OffsetY to 128 to Height | Vertical position of area* |

| Feature | Parameter | Setting |
|---|---|---|
| AreaGainValue | 0 to 256 (×1) to 8191 | Gain value of area |

* Specify the area size and position of the area gain in absolute coordinate values relative to the effective pixels. Therefore, the range of the area size and position needs to be set within the readout range.

# Shutter (Exposure)

## Configuration method

The setting is configured in μs units. The default shutter value is the value with the frame rate maximized. During free run operation, the frame rate is reduced by setting a value bigger than the default shutter value. If you do not prioritize the image quality, you can set it to a value of up to 60 seconds during operation. If the exposure time is long, it will be easier to see the pixel defects.

**Note**

The exposure times that can be set varies depending on the mode.
Check the actual value by reading out after completing settings.

| Feature | Parameter |
|---|---|
| ExposureTime | 1* to 9600 to 60000000 |

* The minimum value varies depending on the settings.

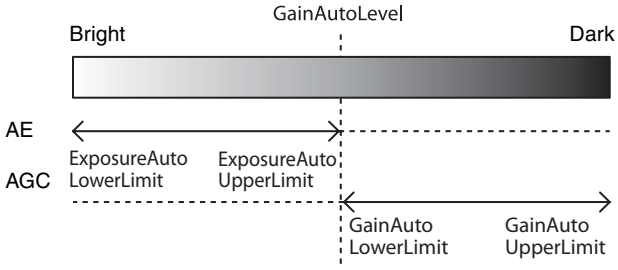
## Auto exposure (AE)

The shutter is set automatically by detecting the output level. The target level is the same as the value of GainAutoLevel. This can be performed in conjunction with auto gain.

| Feature | Parameter | Setting |
|---|---|---|
| ExposureAuto | Off (0) | Manual shutter |
| | Once (1) | One-push AE |
| | Continuous (2) | Continuous AE |
| ExposureAutoSpeed | 1 to 192 to 256 | AE convergence speed |
| ExposureAutoUpper-Limit | 1 to 9600 to 60000000 | AE upper limit |
| ExposureAutoLower-Limit | 1 to 10 to 60000000 | AE lower limit |

# Combination of Continuous AGC and Continuous AE

AGC and AE operate together to adjust the level automatically with GainAutoLevel as the target level. When the environment starts getting dark and AE reaches the upper limit, AGC starts to operate.



# Trigger Control

## Free run/trigger mode

### Free run

The camera operates without a trigger signal and performs image output operation continuously after the shutter (exposure) is finished. The horizontal and vertical timing signals are generated within the camera. During free-run operation, image pickup timing cannot be controlled. In free-run operation, adjustment is made automatically to achieve the maximum frame rate according to the shutter setting.

### Trigger mode

Exposure is started by detecting an external input trigger signal. When ExposureMode is set to Timed, exposure is started by detecting the rising or falling edge of the trigger signal (trigger edge detection performed based on the set shutter value). When ExposureMode is set to TriggerWidth, trigger width detection is performed (exposure during the trigger signal pulse width).

| Feature | Parameter | Setting |
|---|---|---|
| TriggerMode | Off (0) | Free run |
| | On (1) | Trigger mode |

## Trigger source

A trigger source can be input via the DC power supply input connector or via software command (TriggerSoftware).

| Feature | Parameter | Setting |
|---|---|---|
| TriggerSource | Line1 (0) | Pin 2 of the DC power supply input connector |
| | Line2 (1) | Pin 3 of the DC power supply input connector |
| | Software (4) | Software |

### In trigger mode (TriggerMode=On)

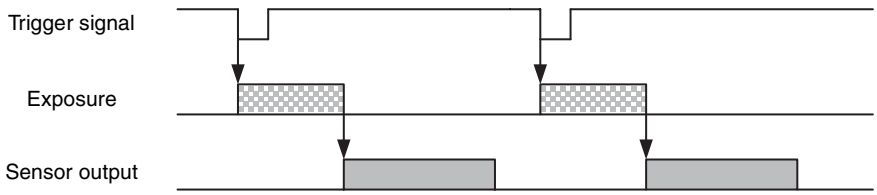
| Feature | Parameter | Setting |
|---|---|---|
| ExposureMode | Timed (0) | Trigger edge detection |
| | TriggerWidth (1) | Trigger width detection |

**Note**

A combination of TriggerSource Software setting and ExposureMode TriggerWidth setting is not supported.

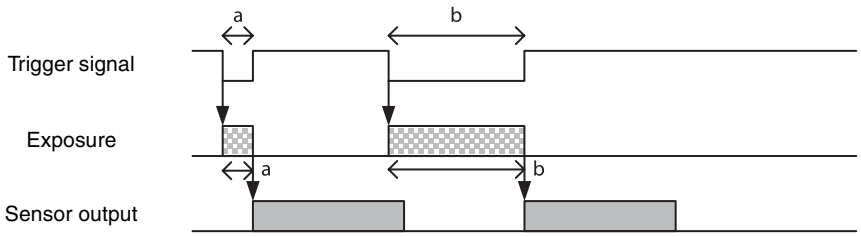
### Trigger edge detection

The figure shows trigger signal negative polarity (falling-edge detection).



### Trigger width detection

The figure shows trigger signal negative polarity (Low-level width detection).



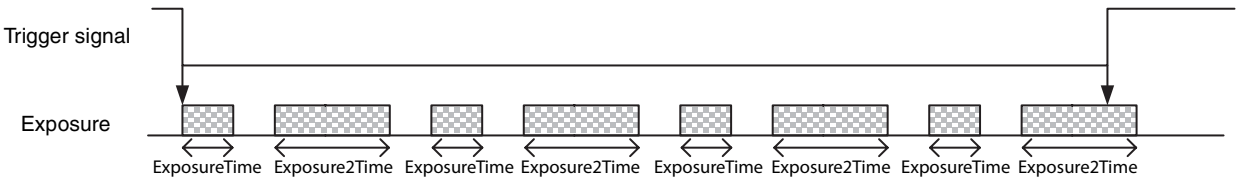

## Burst trigger

Exposure can be repeated with a single trigger signal. Two modes are available: a mode that repeats a single exposure time and a mode that alternately repeats two exposure times. You can specify the number of exposures and the interval between repeatedly setting the trigger signal on.

| Feature | Parameter | Setting | |
|---|---|---|---|
| BurstTriggerMode | Off (0) | | |
| | SingleExposureMode (1) | Upon trigger edge detection | Exposes for the period set in ExposureTime. |
| | | Upon trigger width detection | Exposes for the range of trigger width. |
| | DualExposureMode (2) | Upon trigger edge detection | Exposes for periods set in ExposureTime and ExposureTime2 alternatively. |
| | | Upon trigger width detection | Exposes for periods in trigger width and trigger width × Exposure2Ratio alternately. |
| BurstTriggerPeriod | FrameCount (0) | Exposes only the number of times set in BurstFrameCount. | |
| | TriggerDuration (1) | Performs burst exposure while the input trigger is on. However, burst exposure is terminated when it reaches BurstFrameCount.<br>Enabled when ExposureMode is in edge detection mode. Disabled in width detection mode. | |
| BurstFrameCount | 0 to 1 to 65533 | 0: Repeats continuously | |
| | | 1 or more: Exposure for designated number of times | |
| BurstForceStop | | Forced termination of repeated exposure | |
| Exposure2Time | 1 to 83998 to 60000000 | Second exposure time during trigger edge detection | |
| Exposure2Ratio | ×1 (1), ×2 (2), ×4 (4), ×8 (8), ×16 (16) | Value to determine the second exposure time of trigger width detection. The first exposure time (trigger width) multiplied by this value is the second exposure time. | |

### Trigger edge detection (ExposureMode = Timed)

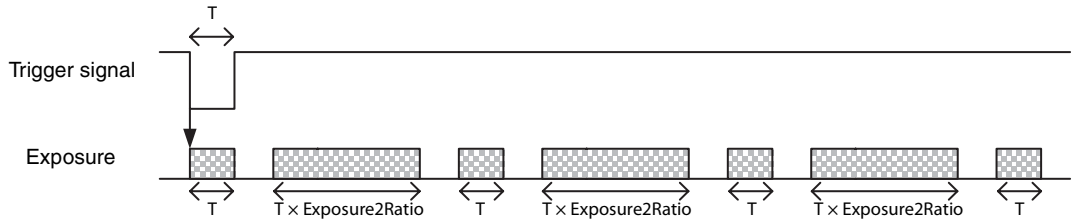
BurstTriggerPeriod=TriggerDuration
BurstTriggerMode=DualExposureMode



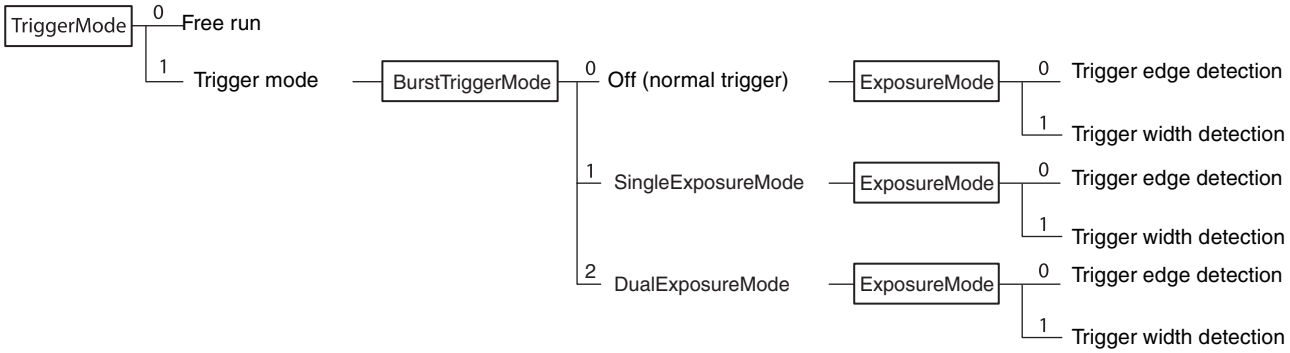

The continuous exposure ends when either one of the following conditions occurs.
- Trigger signal Off is detected
- The number of times of exposure reaches the number specified in BurstFrameCount

### Trigger width detection (ExposureMode = TriggerWidth)

BurstFrameCount = 7
BurstTriggerMode=DualExposureMode

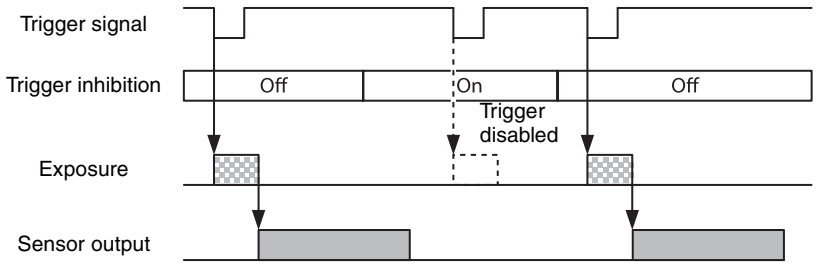



### Trigger states




## Trigger inhibit

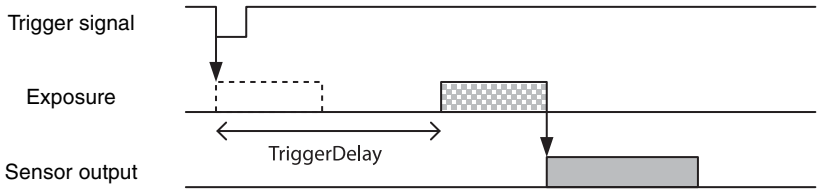
Trigger input can be disabled. This function is effective when disabling the trigger signal to a specific camera in an environment where multiple cameras are triggered by the same trigger signal, and when preventing false operations caused by noise on the trigger signal line (due to the installed environment).




| Feature | Parameter | Setting |
|---|---|---|
| TriggerInhibit | False (0) | Trigger is accepted |
| | True (1) | Trigger is not accepted |

## Trigger delay

The camera can delay the trigger signal.




| Feature | Parameter | Setting |
|---|---|---|
| TriggerDelay | 0 to 4000000 | Trigger delay [µs] |

## Trigger counter

This counts the number of accepted triggers. Triggers that have been removed because they exceed the trigger range limit and triggers input with invalid timing are not counted. The trigger counter returns to 0 when the upper limit (2147483647) is reached. The trigger counter can be reset to 0 by issuing TriggerCounterReset.

| Feature |
|---|
| TriggerCounter |
| TriggerCounterReset |

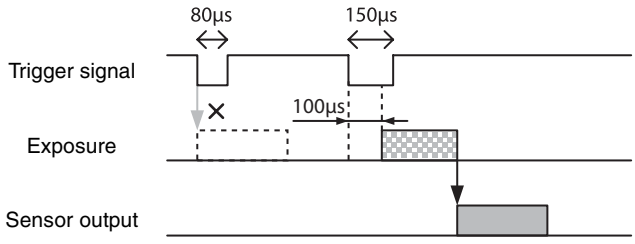
## Trigger range limit

Only signals in the set trigger width can be accepted as a trigger signal. This functions as a noise filter, which removes chattering or disturbance noise in the trigger signal line. When a trigger signal is input, exposure is started with a time lag set by the trigger range set value. No image is output outside the trigger signal width set range.

| Feature | Parameter | Setting |
|---|---|---|
| TriggerAcceptanceRangeEnable | False (0) | Trigger range off |
| | True (1) | Trigger range on |
| TriggerAcceptanceRangeLowerLimit | 1 to 2000000 | Trigger range lower limit [µs] |

### Trigger range operation example

ExposureTime=300, TriggerAcceptanceRangeLowerLimit=100 in the figure.



# Frame Rate

## Auto frame rate

The read cycle is set to allow the frame rate to be the maximum value automatically, according to the current shutter setting and the partial scan setting in free-run operation (shutter has priority). The next exposure is performed during image output, and the next image output is started immediately after finishing all image output. The frame rate is reduced by setting a shutter time longer than the image output time.

| Feature | Parameter | Setting |
|---|---|---|
| AcquisitionFrameRateAuto | False (0) | Auto frame rate off |
| | True (1) | Auto frame rate on |

## Specifying the frame rate

The frame rate of the image output can be specified in free-run operation. Enter the value of the frame rate [fps]. A frame rate faster than the fastest frame rate cannot be set.

| Feature | Parameter | Setting |
|---|---|---|
| AcquisitionFrameRate | 0.0625 to 100 to 4000 * | Frame rate [fps] |

* The upper limit varies depending on the partial scan setting.

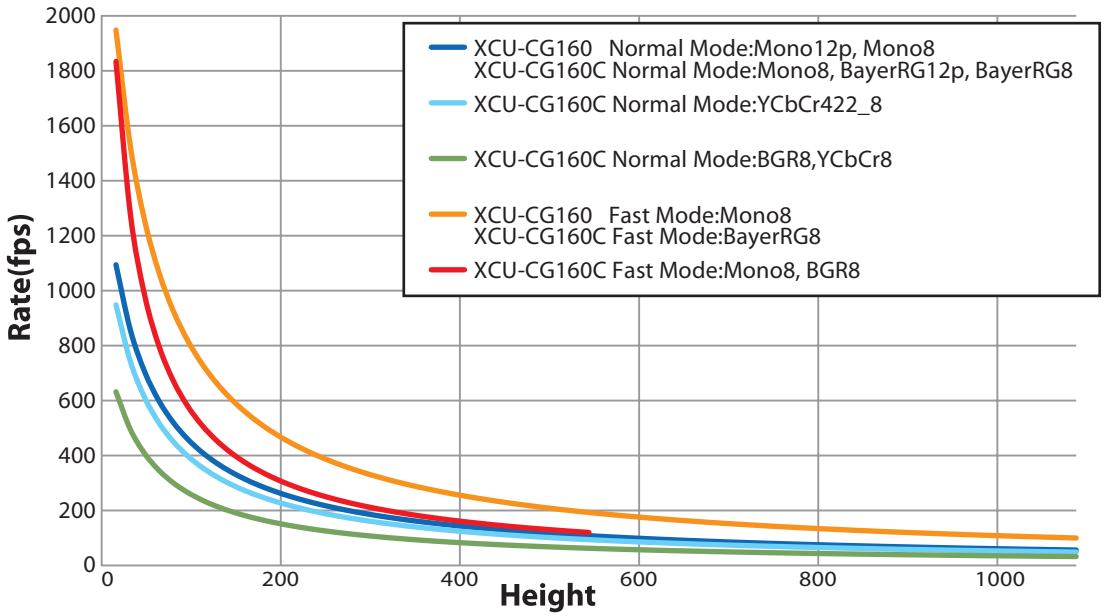
## Displaying the frame rate

The current frame rate during auto frame rate operation is displayed.

| Feature |
|---|
| AcquisitionFrameRateActual |

## Fastest frame rate for partial scanning

The fastest frame rate varies depending on the Height parameter for partial scanning.



# Frame Counter

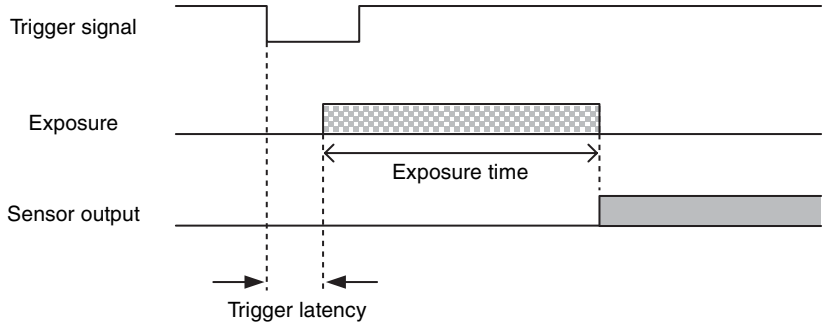
You can read out the number of frames captured by the camera.
The counter can be reset.

| Feature |
|---|
| FrameCounter |
| FrameCounterReset |

# Timing Chart

## Trigger latency/Exposure time

The values of trigger latency (time from trigger acceptance to exposure start) and exposure time are as follows.



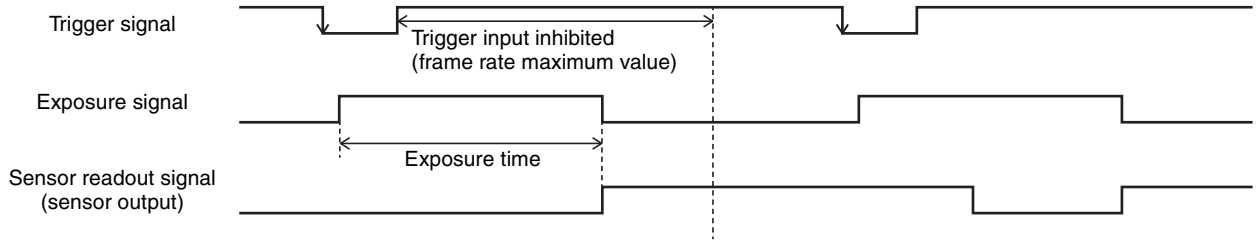

| Feature | Parameter | Trigger latency | Exposure time |
|---|---|---|---|
| TriggerFastMode | False (0) | Approx. 8 µs to approx. 82 µs | ExposureTime ± (approx. 0 µs to 27 µs) |
| | True (1) | Approx. 0.2 µs | ExposureTime ± (approx. 0 µs to 13 µs) |

The variation in trigger latency and exposure time varies depending on the output mode setting.

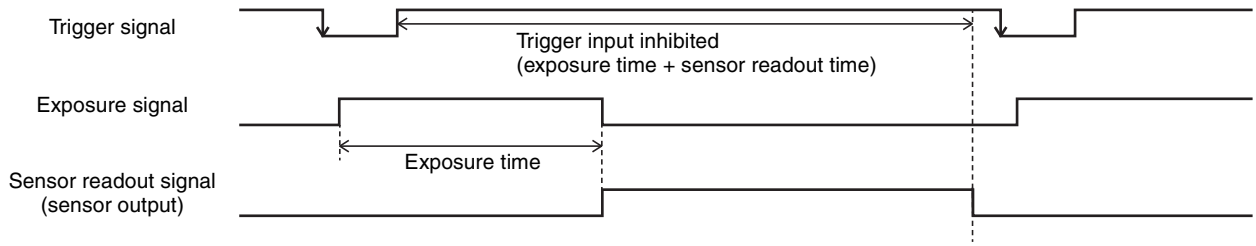
## Trigger overlap

Set TriggerFastMode to False.
Trigger signals can be accepted during the interval that sensor readout signals are asserted.
If the trigger cycle exceeds the maximum value of the frame rate, images are distorted.

### When trigger overlap is allowed (when TriggerFastMode is False)



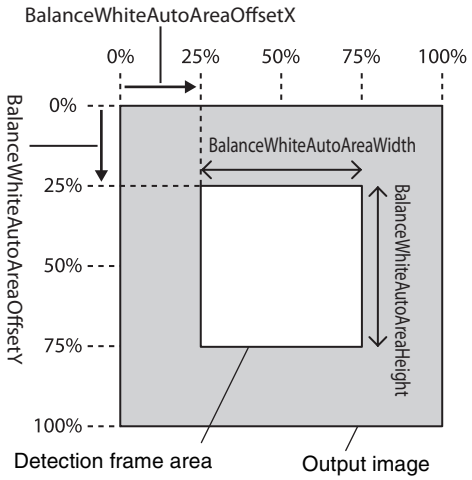

### When trigger overlap is inhibited (when TriggerFastMode is True)



# White Balance (Color Camera Only)

The white balance can be automatically adjusted by executing the BalanceWhiteAuto command. The detection area is set to the screen center by default. The detection area can also be displayed on the screen. The detection frame can be changed arbitrarily. For manual correction, change the GainDigital parameter.

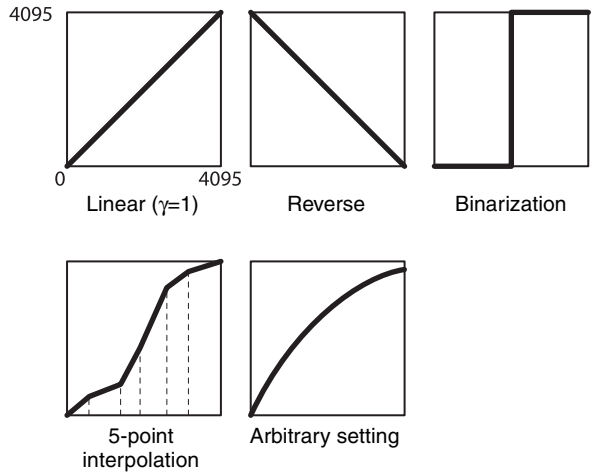
| Feature | Parameter | Setting |
|---|---|---|
| BalanceWhiteAuto | Off (0) | Manual correction |
| | Once (1) | One-push AWB |
| | Continuous (2) | Continuous AWB |
| GainDigitalRed | 256 (×1) to 4095 | Red gain |
| GainDigitalGreen | 256 (×1) to 4095 | Green gain |
| GainDigitalBlue | 256 (×1) to 4095 | Blue gain |
| BalanceWhiteHighlight | False (0) | AWB detection frame is hidden |
| | True (1) | AWB detection frame is displayed |
| BalanceWhiteAutoAreaWidth | 1 to 50 to 100 | Horizontal size of AWB detection frame |
| BalanceWhiteAutoAreaHeight | 1 to 50 to 100 | Vertical size of AWB detection frame |
| BalanceWhiteAutoAreaOffsetX | 0 to 25 to 99 | Horizontal position of AWB detection frame |
| BalanceWhiteAutoAreaOffsetY | 0 to 25 to 99 | Vertical position of AWB detection frame |



# LUT

Five types of presets are provided. Specify using a 12-bit value. Binarization, 5-point interpolation, and arbitrary setting can be changed.

| Feature | Parameter | Setting |
|---|---|---|
| LUTEnable | False (0) | LUT off (g=1) |
| | True (1) | LUT on |
| LUTFormat | Linear (0) | Linear (γ=1) |
| | Reverse (1) | Reverse |
| | Binarization (2) | Binarization |
| | LinearInterpolation (3) | 5-point interpolation |
| | UserSet (4) | Arbitrary setting |




## Binarization

The binarization threshold can be changed.

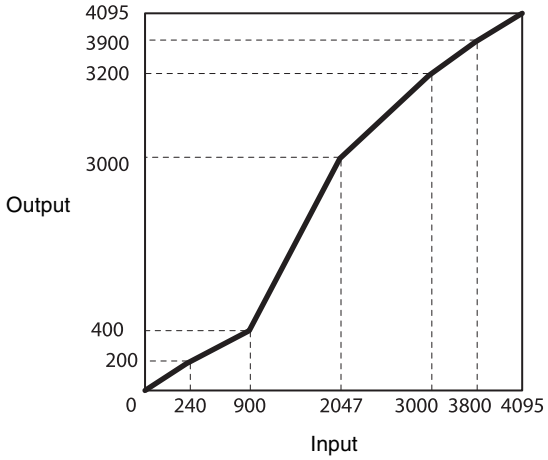
| Feature | Parameter |
|---|---|
| BinarizationThreshold | 0 to 2047 to 4095 |

## 5-point interpolation

The values of output points 1 through 5 that correspond to input points 1 through 5 can be changed. Linear interpolation is performed between interpolation points.

| Feature | Parameter | Setting |
|---|---|---|
| LinearInterpolationIndex | Index1 to Index5 | Select the interpolation points |
| LinearInterpolationInValue | 0 to 4095 | Input |
| LinearInterpolationOutValue | 0 to 4095 | Output |
| LinearInterpolationBuild | | Build LUT |

**Setting example:**




LinearInterpolationIndex = Index1
LinearInterpolationInValue = 240
LinearInterpolationOutValue = 200
LinearInterpolationIndex = Index2
LinearInterpolationInValue = 900
LinearInterpolationOutValue = 400
LinearInterpolationIndex = Index3
LinearInterpolationInValue = 2047
LinearInterpolationOutValue = 3000
LinearInterpolationIndex = Index4
LinearInterpolationInValue = 3000
LinearInterpolationOutValue = 3200
LinearInterpolationIndex = Index5
LinearInterpolationInValue = 3800
LinearInterpolationOutValue = 3900
LinearInterpolationBuild

## Arbitrary setting

The output values 0 through 4095 that correspond to input values 0 through 4095 can be changed.

| Feature | Parameter | Setting |
|---|---|---|
| LUTIndex | 0 to 4095 | Input |
| LUTValue | 0 to 4095 | Output |

**Setting example:**

LUTIndex = 0
LUTValue = 3
LUTIndex = 1
LUTValue = 10
…
LUTIndex = 4094
LUTValue = 4000
LUTIndex = 4095
LUTValue = 4010

## Saving a LUT

When you change the settings, save them using the LUTValueSave command.

| Feature | Parameter | Setting |
|---|---|---|
| LUTValueSave | | Save LUT |

# Color Matrix Conversion (Color Camera Only)

When the color camera is set to BGR8, YCbCr8, or YCbCr422_8 output, the following color matrix conversion can be applied. Specify using values between –8191 and +8191. 256 is ×1.

| Feature | Parameter | Setting |
|---|---|---|
| ColorTransformationEnable | False (0) | Conversion off |
| | True (1) | Conversion on |

| Feature | Parameter | Setting |
|---|---|---|
| ColorTransformationValue Selector | TopLeft, TopCenter, TopRight, CenterLeft, CenterCenter, CenterRight, BottomLeft, BottomCenter, BottomRight | Matrix position |
| ColorTransformationValue | –8191 to +256 to +8191 | Gain value |

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} TopLeft & TopCenter & TopRight \\ CenterLeft & CenterCenter & CenterRight \\ BottomLeft & BottomCenter & BottomRight \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

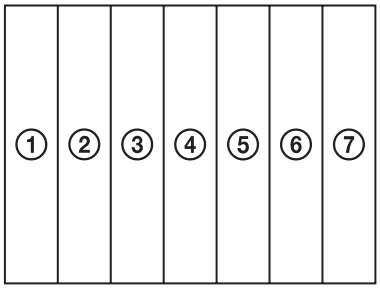
# Test Chart Output

For monochrome cameras, a monochrome chart can be set. For color cameras, a monochrome chart or a color chart can be set.

| Feature | Parameter | Setting |
|---|---|---|
| TestPattern | Off (0) | Off |
| | GreyScale (1) | Monochrome chart |
| | ColorBar (2) | Color chart |
| | GreyHorizontalRamp (3) | Monochrome horizontal ramp |
| | GreyVerticalRamp (4) | Monochrome vertical ramp |
| | GreyScaleMoving (5) | Monochrome chart (moving)* |
| | ColorBarMoving (6) | Color chart (moving)* |
| | GreyHorizontalRampMoving (7) | Monochrome horizontal ramp (moving)* |
| | GreyVerticalRampMoving (8) | Monochrome vertical ramp (moving)* |

* In a moving test pattern, the position to be drawn moves one pixel at a time for each frame.

## Monochrome chart/color chart

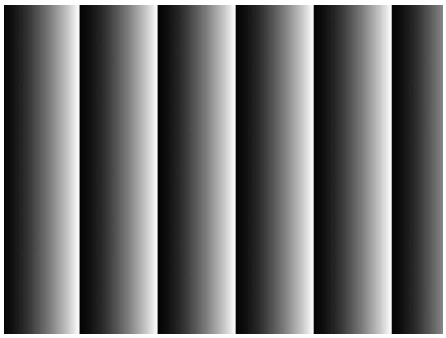



| | Monochrome | Color | | |
|---|---|---|---|---|
| | Raw/Mono | R | G | B |
| ① | 0xF30 | 0xFFF | 0xFFF | 0xFFF |
| ② | 0xDC0 | 0xFFF | 0xFFF | 0 |
| ③ | 0xC80 | 0 | 0xFFF | 0xFFF |
| ④ | 0xA00 | 0 | 0xFFF | 0 |
| ⑤ | 0x7A0 | 0xFFF | 0 | 0xFFF |
| ⑥ | 0x550 | 0xFFF | 0 | 0 |
| ⑦ | 0x340 | 0 | 0 | 0xFFF |

(12-bit notation)

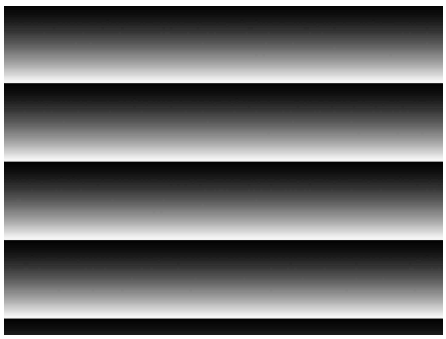
### Monochrome horizontal ramp

Bar pattern where the image level changes in the horizontal direction from step 0 by 1 pixel at a time.



### Monochrome vertical ramp

Bar pattern where the image level changes in the vertical direction from step 0 by 1 line at a time.



# 3 × 3 Filter

Monochrome cameras and color cameras perform 3 × 3 area filtering on RAW output. The brightness of a central pixel and the eight pixels around it, and the parameter of each pixel are multiplied and added together, The result is the brightness of the center pixel. Specify using values between –8191 and +8191. The parameter 256 is ×1. Depending on the patterns of coefficients, you can use filtering to reduce noise, enhance edges, and extract contours.

| Feature | Parameter | Setting |
|---|---|---|
| SpatialFilterEnable | False (0) | Filter off |
| | True (1) | Filter on |

| Feature | Parameter | Setting |
|---|---|---|
| SpatialFilterValue Selector | TopLeft, TopCenter, TopRight, CenterLeft, CenterCenter, CenterRight, BottomLeft, BottomCenter, BottomRight | Matrix position |
| SpatialFilterValue | –8191 to +8191 | Filter coefficient |

Select coefficients with SpatialFilterValueSelector and substitute values with SpatialFilterValue.
The rows with the entered coefficients are represented as follows.

$$\begin{bmatrix} TopLeft & TopCenter & TopRight \\ CenterLeft & CenterCenter & CenterRight \\ BottomLeft & BottomCenter & BottomRight \end{bmatrix}$$

Within any 9-pixel layout, shown below, where the data for each pixel is given by $Y_0$ to $Y_8$, the calculated filter result for $Y_4'$ is given by the following equation.

| | | |
|---|---|---|
| $Y_0$ | $Y_1$ | $Y_2$ |
| $Y_3$ | $Y_4$ | $Y_5$ |
| $Y_6$ | $Y_7$ | $Y_8$ |

$$Y_4' = TopLeft \times Y_0 + TopCenter \times Y_1 + TopRight \times Y_2 + CenterLeft \times Y_3 + CenterCenter \times Y_4 + CenterRight \times Y_5 + BottomLeft \times Y_6 + BottomCenter \times Y_7 + BottomRight \times Y_8$$

# GPIO

## GPI

The signal level which is input pin 2 and pin 3 of the DC power supply input connector can be detected. After selecting a connector using LineSelector, the signal level is acquired from LineStatus.

## GPO

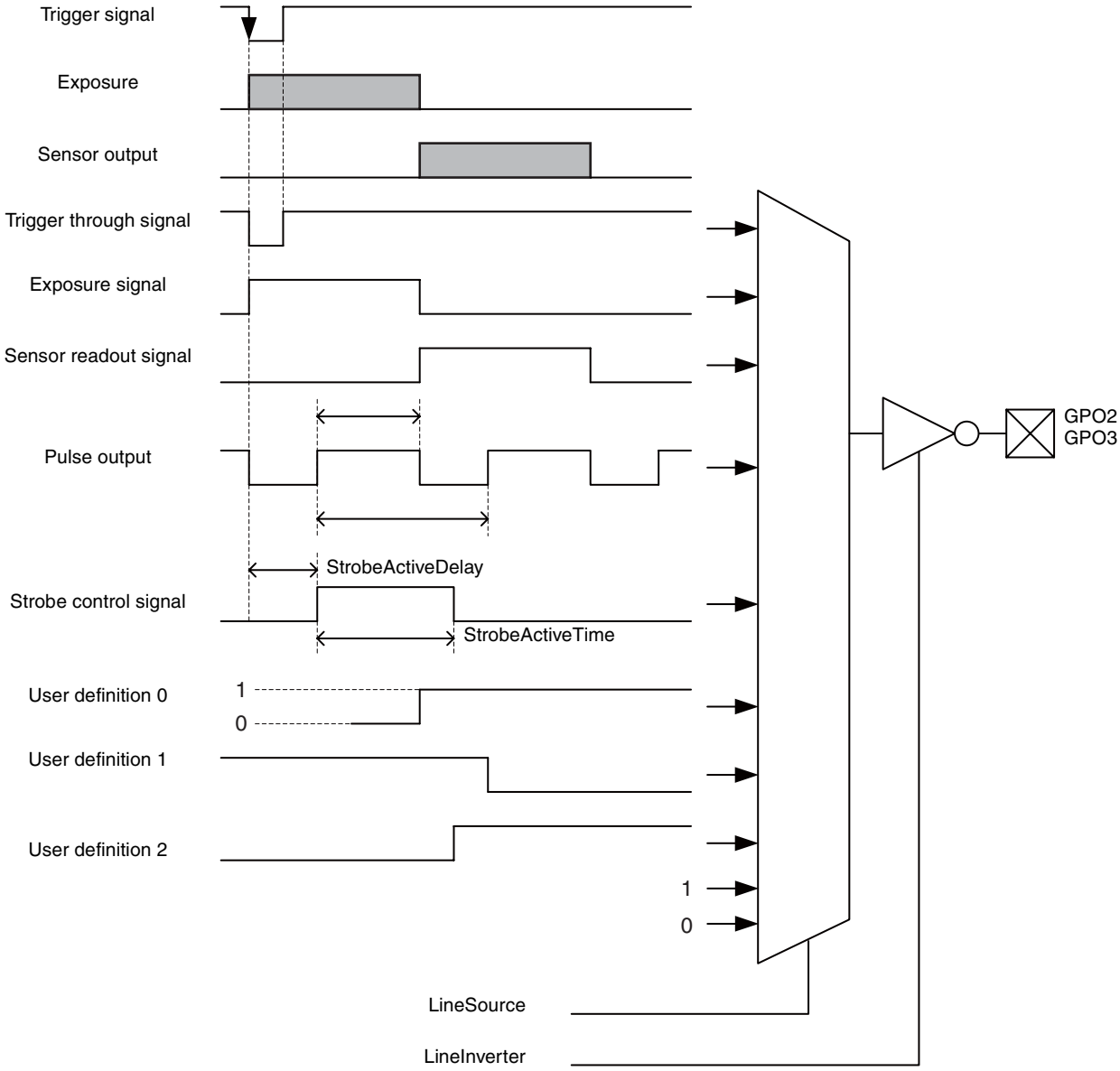
Various signals can be output from pin 3 and pin 4 of the DC power supply input connector. Select a connector using LineSelector, set LineMode to Output, and set LineSource. The output polarity is set by LineInverter.

| Feature | Parameter | Setting |
|---|---|---|
| LineSelector | Line1 (0) | Pin 2 of the DC power supply input connector |
| | Line2 (1) | Pin 3 of the DC power supply input connector |
| | Line3 (2) | Pin 4 of the DC power supply input connector |
| LineMode | Input (0) | Set to input |
| | Output (1) | Set to output |
| LineInverter | False (0) | Without output inversion |
| | True (1) | With output inversion |
| LineStatus | | Input signal level |
| LineSource | TriggerThrough (0) | Trigger through signal |
| | ExposureActive (1) | Exposure signal |
| | StrobeActive (2) | Strobe control signal |
| | SensorReadout (3) | Sensor readout signal |
| | UserOutput0 (4) | User definition 0 |
| | UserOutput1 (5) | User definition 1 |
| | UserOutput2 (6) | User definition 2 |
| | SignalTrue (7) | H level |
| | SignalFalse (8) | L level |
| | PulseGenerator (9) | Pulse generator signal |

**Setting example:**

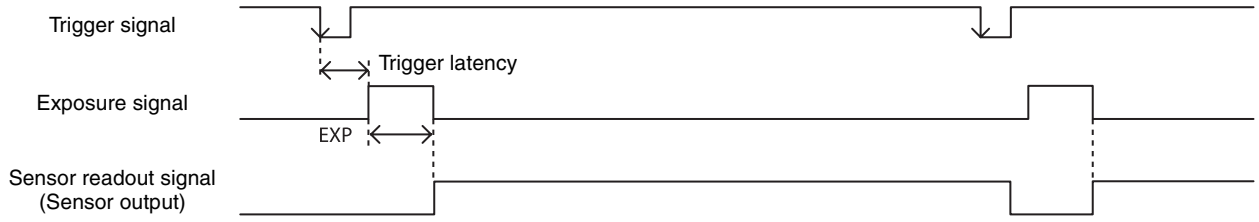
The strobe control signal is output on GPO2 (pin 3 of the DC power supply input connector, active-High).
LineSelector = Line2
LineMode = Output
LineInverter = False
LineSource = StrobeActive

### GPO output system diagram (example of GPO1)




## Sensor readout (Sensor output)

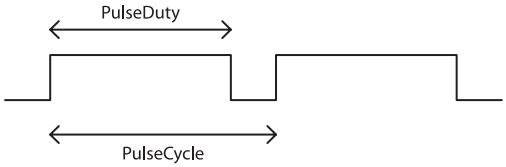
When exposure finishes, this signal indicates that the image sensor is in the image output sequence. Output is available from the GPO2/3 connectors. The sensor readout signal is asserted before the optical black (OB) and the effective pixel area are output.




## Pulse output

A pulse waveform can be output from the GPO2/3 connector. Available range is 0.5 Hz to 100 kHz.

| Feature | Parameter |
|---|---|
| PulseDuty | 1 to 500000 to 2000000 [µs] |
| PulseCycle | 10 to 1000000 to 2000000 [µs] |



# Status LED

The status indicated by the LED (lit, blinking, not lit) on the rear panel is as follows: You can change whether LEDs are lit or not with a user command.

| | |
|---|---|
| Lit | Power supply is applied. Ready for operation. |
| Blinking | Power supply is applied. Connected by USB 2.0. |
| Off | Power supply is not available, or the power supply is connected but not turned on. Or the LED was turned off by a user command. |

| Feature | Parameter | Setting |
|---|---|---|
| LEDMode | False (0) | Off |
| | True (1) | Lit |

# Temperature Readout Function

The camera's internal temperature can be read from a temperature sensor mounted on the module board. Its accuracy is ±2 °C. Use this value as a general guide.

| Feature | Parameter | Setting |
|---|---|---|
| DeviceTemperature | | Temperature sensor value |

# Defect Correction

This function corrects for white defect pixels and black defect pixels. A correction is applied for defective pixels by interpolating from the peripheral pixels surrounding the detected defect. The factory setting and user setting can be selected.

| Feature | Parameter | Setting |
|---|---|---|
| DefectCorrection | False (0) | Correction off |
| | True (1) | Correction on |

### Defect correction setup procedure

**1** Set conditions in which white defect points are easier to detect. Below is an example in which the gain is 18 dB and the shutter is 1 second. Prevent as much light as possible from entering by blocking light.

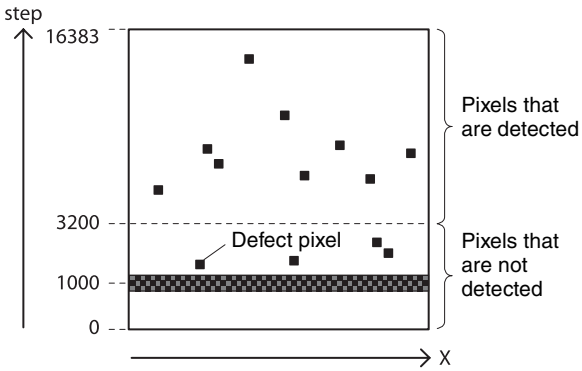
> Gain = 18
> ExposureTime = 1000000

**2** Set the threshold in units of 14 bits. White defect points are detected when this level is exceeded. Below is an example for 3200 steps/14 bits. Pixels in the range 3200 to 16383 are detected.

> DefectThreshold = 3200

**3** Execute white defect point detection. Detection takes four times the EXP time setting. The output levels for the same X coordinate are shown below. The display is uniformly black around step 1000 for an all-black image, but defect pixels (at high levels) are present in some locations. All pixels whose level exceed the step 3200 threshold set in step **2** are detected.

> DefectDetectionMode = DetectWhitePixels

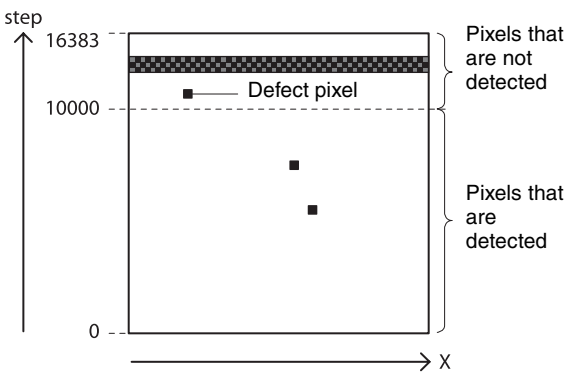



**4** Execute black defect point detection. Like the white defect point detection, set the image pickup conditions and the threshold in units of 14 bits. Below is an example for 10000 steps/14 bits. Pixels from step 0 to step 10000 are detected. If not setting black defect points, you can skip this step.

> DefectThreshold = 10000
> DefectDetectionMode = DetectBlackPixels

Read the status to determine whether the detection is finished.

> DefectDetectionMode (readout)
DetectBlackPixels (executing)
Off (exit)
The value Off is returned when finished.



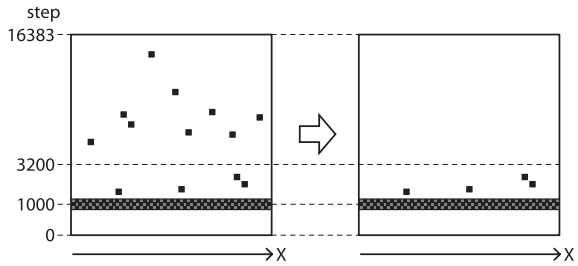
**5** Select the data for applying defect correction. To apply the pixels detected in steps **3** and **4**, select DefectPatternDetected. To apply factory settings, select DefectPatternFactory. To apply values that have been saved, select DefectPatternUser.

> DefectPatternLoad = DefectPatternDetected

| Feature | Parameter | Setting |
|---|---|---|
| DefectPatternLoad | DefectPattern Factory (0) | Factory setting |
| | DefectPattern User (1) | User setting |
| | DefectPattern Detected (2) | Data detected using DefectDetectionMode |

**6** Turn on defect correction.

> DefectCorrection = True




**7** Save the settings. To repeat defect detection without saving, repeat steps **1** to **6**.

> DefectPatternSave = True

Read the status to determine whether the save operation is finished.

> DefectPatternSave (readout)
True (executing)
False (exit)
The value False is returned when finished.

**Note**

The upper limit of defect detection points is 2047 for white and black defect points combined. Correction cannot be performed over the upper limit. The detected defect points can be confirmed using DefectDetectionResult. If the upper limit is exceeded, defect detection will fail or abnormal defect detection will occur, and the value of DefectDetectionResult will be set to –1. Defect detection should be performed with the camera mode set to NORMAL. For details, see "Camera Mode" (page 12).

# Shading Correction

Depending on the characteristics of the lens, shading caused by a drop in the amount of light around the lens, or light source variation, can be corrected. You can save up to 31 user-defined patterns.
There are two shading correction modes. In peak detection mode, you can adjust for the brightest level of the screen. In average detection mode, you can adjust for the average value of brightness for the whole screen.

| Feature | Parameter | Setting |
|---|---|---|
| ShadingDetection Mode | ShadingDetectionOff (0) | Check that the detection is completed |
| | ShadingDetectionBy PeakValue (1) | Start detection (peak detection) |
| | ShadingDetectionBy AverageValue (2) | Start detection (average detection) |

Set the camera mode to NORMAL. For details, see "Camera Mode" (page 12).

| Feature | Parameter | Setting |
|---|---|---|
| Shading Correction | False (0) | Correction off |
| | True (1) | Correction on |

| Feature | Parameter | Setting |
|---|---|---|
| ShadingPattern Select | 0 to 30 | Shading pattern selection |

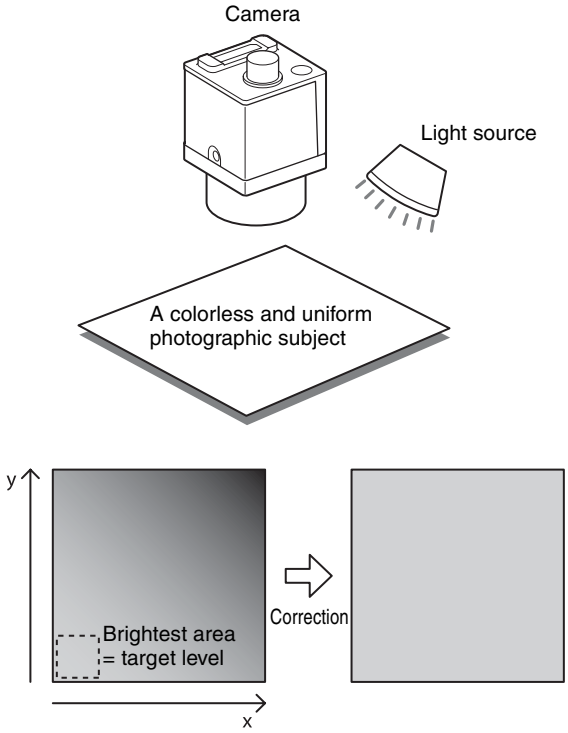
| Feature | Parameter | Setting |
|---|---|---|
| ShadingPattern Save | ShadingPatternSaveOff (0) | Check that shading pattern saving is finished |
| | ShadingPatternSaveOn (1) | Start shading pattern saving |

| Feature | Parameter | Setting |
|---|---|---|
| ShadingPattern Load | | Load shading pattern |

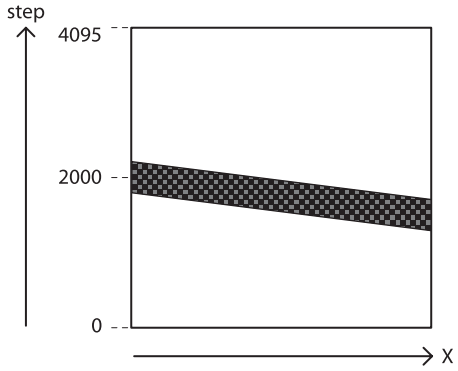
| Feature | Parameter | Setting |
|---|---|---|
| ShadingDetect Color | Red | Red |
| | Green | Green |
| | Blue | Blue |
| | Luminance | Luminance |

## Shading detection setup procedure

**1** As shown in the figure below, assume an environment in which the brightness is not uniform due to an uneven light source. In peak detection mode, shading correction adjusts the brightness level as the target level.
Fix the lens and lighting conditions.




**2** Adjust the exposure time and other parameters so that the target level is about 50%. On color cameras, adjust the white balance.




**3** Performs shading detection by selected mode.

> ShadingDetectionMode = ShadingDetectionByPeakValue or ShadingDetectionByAverageValue

Read the status to determine whether the calculation is finished.

> ShadingDetectionMode (readout)
ShadingDetectionByPeakValue or ShadingDetectionByAverageValue (executing)
ShadingDetectionOff (exit)
The value ShadingDetectionOff is returned when finished.

**4** Check the shading correction effect.

> ShadingPatternCheck

**5** Save the shading pattern.

>ShadingPatternSelect = 0
> ShadingPatternSave = ShadingPatternSaveOn

Read the status to determine whether the save operation is finished.

> ShadingPatternSave (readout)
ShadingPatternSaveOn (executing)
ShadingPatternSaveOff (exit)
The value ShadingPatternSaveOff is returned when finished.

**6** Read out the saved pattern.

>ShadingPatternSelect = 0
> ShadingPatternLoad

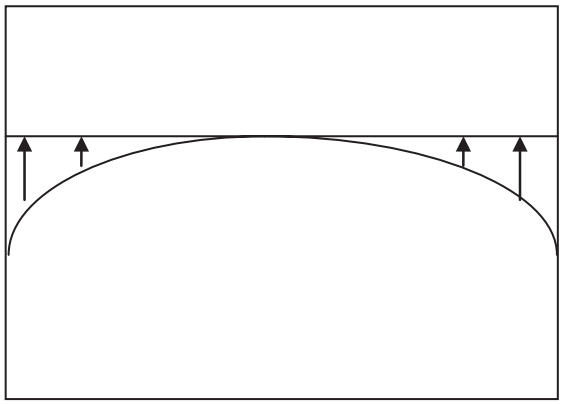
**Note**

Perform the shading detection with the trigger mode set to off.

### Peak detection mode

ShadingDetectionMode = ShadingDetectionByPeakValue

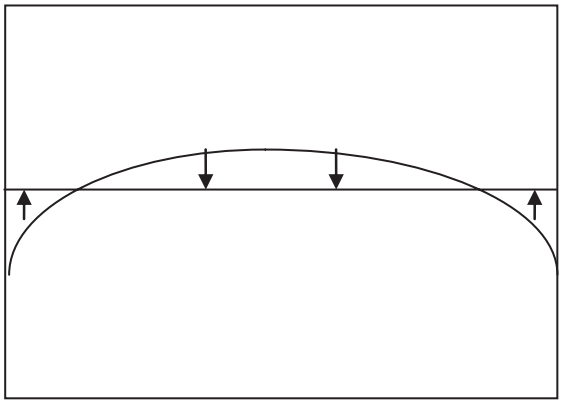
The subject appears brighter.



### Average value detection mode

ShadingDetectionMode = ShadingDetectionByAverageValue

Darker areas of the subject may appear darker.



# User Set

The main configuration values can be saved to channels 1 to 16 using UserSet. For details about items that are saved, see “Command List” (page 34).
Factory settings are saved to channel 0, and cannot be overwritten.

**Setting example ①:**

Shutter is 3 ms, Gain is 3 dB, Pulse signal is output to GPO3 connector (this setting is saved to channel 1).
ExposureTime = 3000
Gain = 3
LineSelector = Line3
LineMode = Output
LineSource = PulseGenerator
UserSetSelector = UserSet1
UserSetSave

**Setting example ②:**

The user set saved in the channel 2 is loaded.
UserSetSelector = UserSet2
UserSetLoad

## User set memory

A number is assigned to one item saved in each user set channel. Signed 32-bit numbers are assigned to slots 0 to 15.

# User ID

User IDs are unique names that can be assigned to cameras. A string that is 64 characters long can be assigned.

| Feature | Parameter |
|---|---|
| DeviceUserID | Arbitrary 64 characters |

# Saving and Startup

The startup settings can be determined using UserSetDefault. This is also used to check which user set settings are currently being used.

**Usage example:**

Startup with the setting saved in user set channel 3.
UserSetDefault = UserSet3
(Restart or DeviceReset command)

Check which user set settings are the current settings.
Read UserSetDefault

# Camera Information

The model name of a camera and its firmware information can be read out.

| Feature | Parameter |
|---|---|
| DeviceVendorName | Manufacturer (Sony) |
| DeviceModelName | Model name |
| DeviceVersion | Device version |
| DeviceSerialNumber | Serial number |
| DeviceManufacturerInfo | Data for manufacturer service |

# Restarting

The camera reboots 3 seconds after the reset command is sent. Exit the application software during this short interval.

| Feature |
|---|
| DeviceReset |

# Command List

| Category ( ) / Sub category ( ) Feature | Read/ Write*1 | Description | See page |
|---|---|---|---|
| **DeviceControl** | **RO** | **Category for device information and control features.** | **–** |
| DeviceType | RO | Returns the device type. | – |
| DeviceScanType | RO | Scan type of the sensor of the device. | – |
| DeviceVendorName | RO | Name of the manufacturer of the device (Sony). | 33 |
| DeviceModelName | RO | Model name of the device. | 33 |
| DeviceManufacturerInfo | RO | Manufacturer information about the device. | 33 |
| DeviceVersion | RO | Version of the device. | 33 |
| DeviceFirmwareVersion | RO | Version of the firmware in the device. | – |
| DeviceSerialNumber | RO | Serial number of the device. | 33 |
| DeviceUserID | RW | User-programmable device identifier. | 33 |
| DeviceSFNCVersionMajor | RO | Major version of the Standard Features Naming Convention that was used to create the device's GenICam XML. | – |
| DeviceSFNCVersionMinor | RO | Minor version of the Standard Features Naming Convention that was used to create the device's GenICam XML. | – |
| DeviceSFNCVersionSubMinor | RO | Sub minor version of the Standard Features Naming Convention that was used to create the device's GenICam XML. | – |
| DeviceManifestEntrySelector | RW | Selects the manifest entry to reference. | – |
| DeviceManifestXMLMajorVersion | RO | Indicates the major version number of the GenICam XML file of the selected manifest entry. | – |
| DeviceManifestXMLMinorVersion | RO | Indicates the minor version number of the GenICam XML file of the selected manifest entry. | – |
| DeviceManifestXMLSubMinorVersion | RO | Indicates the sub minor version number of the GenICam XML file of the selected manifest entry. | – |
| DeviceManifestSchemaMajorVersion | RO | Indicates the major version number of the schema file of the selected manifest entry. | – |
| DeviceManifestSchemaMinorVersion | RO | Indicates the minor version number of the schema file of the selected manifest entry. | – |
| DeviceTLType | RO | Transport Layer type of the device. | – |
| DeviceTLVersionMajor | RO | Major version of the Transport Layer of the device. | – |
| DeviceTLVersionMinor | RO | Minor version of the Transport Layer of the device. | – |
| DeviceTLVersionSubMinor | RO | Sub minor version of the Transport Layer of the device. | – |
| DeviceGenCPVersionMajor | RO | Major version of the GenCP protocol supported by the device. | – |
| DeviceGenCPVersionMinor | RO | Minor version of the GenCP protocol supported by the device. | – |
| DeviceConnectionSelector | RW | Selects which connection of the device to control. | – |
| DeviceConnectionSpeed | RO | Indicates the speed of transmission of the specified connection. | – |
| DeviceConnectionStatus | RO | Indicates the status of the specified connection. | – |
| DeviceLinkSelector | RW | Selects which link of the device to control. | – |
| DeviceLinkSpeed | RO | Indicates the speed of transmission negotiated on the specified link. | – |
| DeviceLinkThroughputLimitMode | RW | Controls if DeviceLinkThroughputLimit is active. | – |

*1 RO: Read only, WO: Write only, RW: Read/Write
*2 Color cameras are RO.
*3 Target models: Color cameras
*4 Enabled when color camera is set to BGR8, YCbCr8, or YCbCr422_8.
*5 Target camera mode: NORMAL

| Category ( ) / Sub category ( ) Feature | Read/ Write*1 | Description | See page |
|---|---|---|---|
| DeviceLinkThroughputLimit | RW | Limits the maximum bandwidth of the data that will be streamed out by the device on the selected link. | – |
| DeviceLinkConnectionCount | RO | Returns the number of physical connection of the device used by a particular link. | – |
| DeviceLinkCommandTimeout | RO | Indicates the command timeout of the specified link. | – |
| DeviceStreamChannelCount | RO | Indicates the number of streaming channels supported by the device. | – |
| DeviceStreamChannelSelector | RW | Selects the stream channel to control. | – |
| DeviceStreamChannelType | RO | Returns the type of the stream channel. | – |
| DeviceStreamChannelLink | RW | Index of device's link to use for streaming the specified stream channel. | – |
| DeviceStreamChannelEndianness | RO | Endianness of multi-byte pixel data for this stream. | – |
| DeviceEventChannelCount | RO | Indicates the number of event channels supported by the device. | – |
| DeviceCharacterSet | RO | Character set used by the strings of the device's bootstrap registers. | – |
| DeviceReset | WO | Resets the device to its power up state. | 33 |
| DeviceRegistersEndianness | RO | Endianness of the registers of the device. | – |
| DeviceTemperature | RO | Device temperature in degrees Celsius (°C). | 30 |
| TimestampLatch | WO | Latches the current timestamp counter into TimestampLatchValue. | – |
| TimestampLatchValue | RO | Returns the latched value of the timestamp counter. | – |
| FactoryDefault | RW | Restores all settings to the factory default. | – |
| **ImageFormatControl** | **RO** | **Category for image format control features.** | **–** |
| SensorWidth | RO | Effective width of the sensor (in pixels). | – |
| SensorHeight | RO | Effective height of the sensor (in pixels). | – |
| SensorUnitCellSizeH | RO | Horizontal pixel cell size. | – |
| SensorUnitCellSizeV | RO | Vertical pixel cell size. | – |
| WidthMax | RO | Maximum width of the image (in pixels). | – |
| HeightMax | RO | Maximum height of the image (in pixels). | – |
| Width | RW | Width of the image provided by the device (in pixels). | 11 |
| Height | RW | Height of the image provided by the device (in pixels). | 11 |
| OffsetX | RW | Horizontal offset from the origin to the region of interest (in pixels). | 11 |
| OffsetY | RW | Vertical offset from the origin to the region of interest (in pixels). | 11 |
| BinningHorizontal | RW *2 | Number of horizontal photo-sensitive cells to combine together. | 11 |
| BinningVertical | RW *2 | Number of vertical photo-sensitive cells to combine together. | 11 |
| ReverseX | RW | Flip horizontally the image sent by the device. | 15 |
| ReverseY | RW | Flip vertically the image sent by the device. | 15 |
| PixelFormat | RW | Format of the pixels provided by the device. | 14 |
| PixelSize | RO | Total size in bits of a pixel of the image. | – |
| TestPattern | RW | Selects the type of test pattern that is generated by the device as the image source. | 26 |

*1 RO: Read only, WO: Write only, RW: Read/Write
*2 Color cameras are RO.
*3 Target models: Color cameras
*4 Enabled when color camera is set to BGR8, YCbCr8, or YCbCr422_8.
*5 Target camera mode: NORMAL

| Category ( ) / Sub category ( ) Feature | Read/ Write*1 | Description | See page |
|---|---|---|---|
| **AcquisitionControl** | **RO** | **Category for the acquisition and trigger control features.** | **–** |
| AcquisitionMode | RW | Sets the acquisition mode of the device. | – |
| AcquisitionAbort | RW | Aborts the acquisition immediately. | – |
| AcquisitionFrameCount | RW | Number of frames to acquire in MultiFrame acquisition mode. | – |
| AcquisitionFrameRateAuto | RW | Automatically controls the maximum rate (in Hz) at which the line in a frame is captured when TriggerMode is Off. | 21 |
| AcquisitionFrameRate | RW | Controls the rate (in Hz) at which the line in a frame is captured when TriggerMode is Off for the frame trigger. | 21 |
| AcquisitionFrameRateActual | RO | Indicates the actual frame rate (in Hz). | 21 |
| TriggerMode | RW | Controls if the selected trigger is active. | 17 |
| TriggerSoftware | RW | Generates an internal trigger. | 17 |
| TriggerSource | RW | Specifies the internal signal or physical input line to use as the trigger source. | 17 |
| TriggerActivation | RW | Specifies the activation mode of the trigger. | 8 |
| TriggerDelay | RW | Specifies the delay in microseconds to apply after the trigger reception before activating it. | 20 |
| TriggerInhibit | RW | Specifies the activation of the trigger. | 19 |
| TriggerFastMode | RW | Sets the trigger mode of the image sensor. | 22 |
| TriggerCounter | RO | Gets the count of trigger. | 20 |
| TriggerCounterReset | WO | Resets the trigger counter. | 20 |
| TriggerAcceptanceRangeEnable | RW | Controls if the trigger acceptance range is enabled. | 20 |
| TriggerAcceptanceRangeLowerLimit | RW | Sets the lower limit of trigger acceptance range. | 20 |
| FrameCounter | RO | Gets the count of frames. | 22 |
| FrameCounterReset | WO | Resets the frame counter. | 22 |
| ExposureMode | RW | Sets the operation mode of the exposure. | 17 |
| ExposureTime | RW | Sets the exposure time when ExposureMode is Timed and ExposureAuto is Off. | 16 |
| ExposureAuto | RW | Sets the automatic exposure mode when ExposureMode is Timed. | 16 |
| ExposureAutoSpeed | RW | Sets the automatic exposure speed. | 16 |
| ExposureAutoLowerLimit | RW | Sets the lower limit for Exposure Auto mode. | 16 |
| ExposureAutoUpperLimit | RW | Sets the upper limit for Exposure Auto mode. | 16 |
| Exposure2Time | RW | Sets the second exposure time for burst trigger mode. | 18 |
| Exposure2Ratio | RW | Sets the exposure time ratio for burst trigger mode. | 18 |
| BurstFrameCount | RW | Sets the number of frames to acquire in burst trigger mode. | 18 |
| BurstTriggerMode | RW | Sets burst trigger mode. | 18 |
| BurstTriggerPeriod | RW | Sets the burst period type. | 18 |
| BurstForceStop | WO | Stops the acquisition of the device at the end of the current frame. | 18 |
| **AnalogControl** | **RO** | **Category that contains the analog control features.** | **–** |
| GainSelector | RW | Selects which gain is controlled by the various gain features. | – |
| Gain | RW | Controls the selected gain as an absolute physical value (in dB). | 15 |
| GainAnalog | RW | Controls the selected gain as an absolute physical value. | 15 |
| GainDigitalRed *3 | RW | Digital gain for the red channel. | 24 |

*1 RO: Read only, WO: Write only, RW: Read/Write
*2 Color cameras are RO.
*3 Target models: Color cameras
*4 Enabled when color camera is set to BGR8, YCbCr8, or YCbCr422_8.
*5 Target camera mode: NORMAL

| Category ( ) / Sub category ( ) Feature | Read/ Write*1 | Description | See page |
|---|---|---|---|
| GainDigitalGreen *3 | RW | Digital gain for the green channel. | 24 |
| GainDigitalBlue *3 | RW | Digital gain for the blue channel. | 24 |
| GainAuto | RW | Sets automatic gain control (AGC) mode. | 15 |
| GainAutoLevel | RW | Sets the target level for Gain Auto and Exposure Auto mode. | 15 |
| GainAutoSpeed | RW | Sets the automatic gain speed. | 15 |
| GainAutoLowerLimit | RW | Sets the lower limit for the gain auto control. | 15 |
| GainAutoUpperLimit | RW | Sets the upper limit for the gain auto control. | 15 |
| BlackLevel | RW | Controls the analog black level as an absolute physical value. | – |
| BalanceWhiteAuto *3 | RW | Controls the mode for automatic white balancing between the color channels. | 24 |
| SpatialFilterEnable | RW | Activates the 3×3 spatial filter. | 27 |
| SpatialFilterValueSelector | RW | Selects which physical line (or pin) of the external device connector to control. | 27 |
| SpatialFilterValue | RW | Controls the selected parameter for 3×3 spatial filter. 256 means ×1.0. | 27 |
| ColorTransformationEnable *4 | RW | Activates the color transformation filter. | 26 |
| ColorTransformationValueSelector *4 | RW | Selects which physical line (or pin) of the external device connector to control. | 26 |
| ColorTransformationValue *4 | RW | Controls the selected parameter for color transformation filter. 256 means ×1.0. | 26 |
| **LUTControl** | **RO** | **Category that includes LUT control features.** | **–** |
| LUTEnable | RW | Activates the selected LUT. | 25 |
| LUTFormat | RW | Selects which LUT format is controlled among the various LUT formats. | 25 |
| BinarizationThreshold | RW | Controls the binarization threshold (12 bits). | 25 |
| LinearInterpolationIndex | RW | Selects the index point to build a linear interpolation LUT. | 25 |
| LinearInterpolationInValue | RW | Specifies the In value of the point selected by LinearInterpolationIndex. | 25 |
| LinearInterpolationOutValue | RW | Specifies the Out value of the point selected by LinearInterpolationIndex. | 25 |
| LinearInterpolationBuild | WO | Builds a linear interpolation LUT. | 25 |
| LUTIndex | RW | Controls the index (offset) of the coefficient to access in the selected LUT. | 25 |
| LUTValue | RW | Returns the value at entry LUTIndex of the LUT selected by LUTSelector. | 25 |
| LUTValueSave | WO | Saves the value of the LUT to flash memory. | 26 |
| **DigitalIOControl** | **RO** | **Category that contains the digital input and output control features.** | **–** |
| LineSelector | RW | Selects the physical line (or pin) of the external device connector or the virtual line of the Transport Layer to configure. | 28 |
| LineMode | RW | Controls if the physical line is used to input or output a signal. | 28 |
| LineSource | RW | Selects which internal acquisition or I/O source signal to output on the selected line. | 28 |
| LineInverter | RW | Controls the inversion of the signal of the selected input or output line. | 28 |
| LineStatus | RO | Returns the current status of the selected input or output line. | 28 |

*1 RO: Read only, WO: Write only, RW: Read/Write
*2 Color cameras are RO.
*3 Target models: Color cameras
*4 Enabled when color camera is set to BGR8, YCbCr8, or YCbCr422_8.
*5 Target camera mode: NORMAL

| Category ( ) / Sub category ( ) Feature | Read/ Write*1 | Description | See page |
|---|---|---|---|
| StrobeControl | RO | Controls strobe signal output. | – |
| StrobeActiveTime2 | RW | Sets the strobe active time (in µs) for line 2. | – |
| StrobeActiveDelay2 | RW | Specifies the delay (in µs) to apply after StrobeActive before activating it. | – |
| StrobeActiveTime3 | RW | Sets the strobe active time (in µs) for line 3. | – |
| StrobeActiveDelay3 | RW | Specifies the delay (in µs) to apply after StrobeActive before activating it. | – |
| PulseWidthControl | RO | Controls the pulse output. | – |
| PulseCycle | RW | Controls the pulse cycle. | 29 |
| PulseDuty | RW | Controls the pulse duty. | 29 |
| UserOutputControl | RO | Controls the user output. | – |
| UserOutputSelector | RW | Selects which bit of the UserOutput register will be set by UserOutputValue. | – |
| UserOutputValue | RW | Sets the value of the bit selected by UserOutputSelector. | – |
| UserOutput0 | RW | Controls the value of User Output 0. | – |
| UserOutput1 | RW | Controls the value of User Output 1. | – |
| UserOutput2 | RW | Controls the value of User Output 2. | – |
| **EventControl** | **RO** | **Category that contains event control features.** | **–** |
| EventSelector | RW | Selects which event to signal to the host application. | – |
| EventNotification | RW | Activates or deactivates the notification to the host application of the occurrence of the selected event. | – |
| EventAcquisitionStartData | RO | Category that contains all the data features related to the acquisition start event. | – |
| EventAcquisitionStart | RO | Returns the unique identifier of the acquisition start type of the event. | – |
| EventAcquisitionStartTimestamp | RO | Returns the timestamp of the acquisition start event. | – |
| EventAcquisitionStartFrameID | RO | Returns the unique identifier of the frame (or image) that generated the acquisition start event. | – |
| EventAcquisitionEndData | RO | Category that contains all the data features related to the acquisition end event. | – |
| EventAcquisitionEnd | RO | Returns the unique identifier of the acquisition end type of the event. | – |
| EventAcquisitionEndTimestamp | RO | Returns the timestamp of the acquisition end event. | – |
| EventAcquisitionEndFrameID | RO | Returns the unique identifier of the frame (or image) that generated the acquisition end event. | – |
| EventAcquisitionErrorData | RO | Category that contains all the data features related to the acquisition error event. | – |
| EventAcquisitionError | RO | Returns the unique identifier of the acquisition error type of the event. | – |
| EventAcquisitionErrorTimestamp | RO | Returns the timestamp of the acquisition error event. | – |
| EventAcquisitionErrorFrameID | RO | Returns the unique identifier of the frame (or image) that generated the acquisition error event. | – |
| EventErrorData | RO | Category that contains all the data features related to the error event. | – |
| EventError | RO | Returns the unique identifier of the error type of the event. | – |
| EventErrorTimestamp | RO | Returns the timestamp of the error event. | – |
| EventErrorFrameID | RO | Returns the unique identifier of the frame (or image) that generated the error event, if applicable. | – |
| EventErrorCode | RO | Returns an error code for the error(s) that happened. | – |

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*5 Target camera mode: NORMAL

| Category ( ) / Sub category ( ) Feature | Read/ Write*1 | Description | See page |
|---|---|---|---|
| EventTestData | RO | Category that contains all the data features related to the event test generated using the TestEventGenerate command. | – |
| EventTest | RO | Returns the unique identifier of the event test type of event generated using the TestEventGenerate command. | – |
| EventTestTimestamp | RO | Returns the timestamp of the event test event. | – |
| **UserSetControl** | **RO** | **Category that contains the User Set control features.** | **33** |
| UserSetSelector | RW | Selects the feature User Set to load. | 33 |
| UserSetLoad | RW | Loads the User Set specified by UserSetSelector to the device and makes it active. | 33 |
| UserSetSave | RW | Saves the User Set specified by UserSetSelector to the non-volatile memory of the device. | 33 |
| UserSetDefault | RW | Selects the feature User Set to load and make active by default when the device is reset. | 33 |
| UsersetMemoryIndex | RW | Provides the index (offset) of the user-programmable identifier to access in the UserMemory. | – |
| UsersetMemoryValue | RW | Represents the value found at entry UserMemoryIndex. | – |
| **ChunkDataControl** | **RO** | **Category that contains the Chunk Data control features.** | **–** |
| ChunkModeActive | RW | Activates the inclusion of chunk data in the payload of the image. | – |
| ChunkSelector | RW | Selects which chunk to enable or control. | – |
| ChunkEnable | RW | Enables the inclusion of the selected chunk data in the payload of the image. | – |
| ChunkImage | RO | Returns the entire image data included in the payload. | – |
| ChunkOffsetX | RO | Returns the OffsetX value of the image included in the payload. | – |
| ChunkOffsetY | RO | Returns the OffsetY value of the image included in the payload. | – |
| ChunkWidth | RO | Returns the Width value of the image included in the payload. | – |
| ChunkHeight | RO | Returns the Height value of the image included in the payload. | – |
| ChunkPixelFormat | RO | Returns the PixelFormat value of the image included in the payload. | – |
| ChunkTimestampLatchValue | RO | Returns the last timestamp latched with the TimestampLatch command. | – |
| ChunkExposureTime | RO | Returns the exposure time used to capture the image. | – |
| ChunkGain | RO | Returns the analog gain used to capture the image. | – |
| ChunkGainDigitalRed *3 | RO | Returns the digital gain for the red channel used to capture the image. | – |
| ChunkGainDigitalGreen *3 | RO | Returns the digital gain for the green channel used to capture the image. | – |
| ChunkGainDigitalBlue *3 | RO | Returns the digital gain for the blue channel used to capture the image. | – |
| **TestControl** | **RO** | **Category for Test Control features.** | **–** |
| TestPendingAck | RW | Tests the device's pending acknowledge feature. | – |
| TestEventGenerate | RW | Generates a test event. | – |
| TriggerEventTest | WO | Generates the test event if the event channel is enabled. (Alternate command of TestEventGenerate) | – |

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| Category ( ) / Sub category ( ) Feature | Read/ Write*1 | Description | See page |
|---|---|---|---|
| **TransportLayerControl** | **RO** | **Category that contains the transport layer control features.** | **–** |
| PayloadSize | RO | Provides the number of bytes transferred for each image or chunk on the stream channel. | – |
| **SonySpecificControl** | **RO** | **Category that contains the Sony specific control features.** | **–** |
| CameraModeSelector | RW | Selects camera mode. | 12 |
| CameraModeCurrent | RO | Indicates the current camera mode. | – |
| LEDMode | RW | Controls the LED light. | 30 |
| GainAutoArea | RO | Category that contains detection area control for auto gain control and auto exposure feature. | 15 |
| GainAutoHighlight | RW | Performs highlight area for auto gain control and auto exposure feature. | 15 |
| GainAutoAreaWidth | RW | Indicates the percentage of the width for automatic gain's detection area. | 15 |
| GainAutoAreaHeight | RW | Indicates the percentage of the height for automatic gain's detection area. | 15 |
| GainAutoAreaOffsetX | RW | Indicates the percentage of the offset-X for automatic gain's detection area. | 15 |
| GainAutoAreaOffsetY | RW | Indicates the percentage of the offset-Y for automatic gain's detection area. | 15 |
| BalanceWhiteAutoArea *3 | RO | Category that contains detection area control for auto white balance feature. | 24 |
| BalanceWhiteHighlight *3 | RW | Performs highlight area for auto white balance control and auto exposure feature. | 24 |
| BalanceWhiteAutoAreaWidth *3 | RW | Indicates the percentage of the width for automatic white balance's detection area. | 24 |
| BalanceWhiteAutoAreaHeight *3 | RW | Indicates the percentage of the height for automatic white balance's detection area. | 24 |
| BalanceWhiteAutoAreaOffsetX *3 | RW | Indicates the percentage of the offset-X for automatic white balance's detection area. | 24 |
| BalanceWhiteAutoAreaOffsetY *3 | RW | Indicates the percentage of the offset-Y for automatic white balance's detection area. | 24 |
| Defect | RO | Category that contains defect detection and correction control features. | 30 |
| DefectThreshold *5 | RW | Sets the threshold level for defect detection. | 30 |
| DefectDetectionMode *5 | RW | Starts detection of defect pixels. | 30 |
| DefectDetectionResult *5 | RO | Gets the result of defect pixel detection. | 30 |
| DefectPatternSave *5 | RW | Saves the defect pixel coordinates in nonvolatile memory. | 30 |
| DefectPatternLoad | RW | Loads the defect pixel coordinates. | 30 |
| DefectCorrection | RW | Enables defect correction. | 30 |
| Shading | RO | Category that contains shading detection and correction control features. | 31 |
| ShadingDetectColor *3 *5 | RW | Specifies which color is used for shading detection. | 31 |
| ShadingDetectionMode *5 | RW | Performs shading detection by selected mode. | 31 |
| ShadingPatternCheck *5 | WO | Performs the current detected pattern. | 31 |
| ShadingPatternSelect | RW | Selects a shading pattern to load or save. | 31 |
| ShadingPatternSave *5 | RW | Saves the detected pattern specified by ShadingPatternSelect to the non-volatile memory of the device. | 31 |

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| Category ( ) / Sub category ( ) Feature | | | Read/ Write*1 | Description | See page |
|---|---|---|---|---|---|
| | | ShadingPatternLoad | WO | Loads the shading pattern specified by ShadingPatternSelect to the device. | 31 |
| | | ShadingCorrection | RW | Activates the shading correction by the selected pattern. | 31 |
| | AreaGain | | RO | Category that contains area gain control features. | 15 |
| | | AreaGainEnableAll | RW | Controls if all gain areas are enabled. | 15 |
| | | AreaGainSelect | RW | Selects a gain area of interest. | 15 |
| | | AreaGainEnable | RW | Controls if the selected area is enabled. | 15 |
| | | AreaGainWidth | RW | Width of the selected area (in pixels). | 15 |
| | | AreaGainHeight | RW | Height of the selected area (in pixels). | 15 |
| | | AreaGainOffsetX | RW | Horizontal offset from the origin to the region of interest (in pixels). | 15 |
| | | AreaGainOffsetY | RW | Vertical offset from the origin to the region of interest (in pixels). | 15 |
| | | AreaGainValue | RW | Gain value of the selected area (in pixels). | 15 |
| | MultiROI | | RO | Category that contains MultiROI control features. | 13 |
| | | MultiROIMode | RW | Controls if all MultiROI areas are enabled. | 13 |
| | | MultiROISelect | RW | Selects a MultiROI area of interest. | 13 |
| | | MultiROIEnable | RW | Controls if the selected area is enabled. | 13 |
| | | MultiROIWidth | RW | Width of the selected area (in pixels). | 13 |
| | | MultiROIHeight | RW | Height of the selected area (in pixels). | 13 |
| | | MultiROIOffsetX | RW | Horizontal offset from the origin to the region of interest (in pixels). | 13 |
| | | MultiROIOffsetY | RW | Vertical offset from the origin to the region of interest (in pixels). | 13 |

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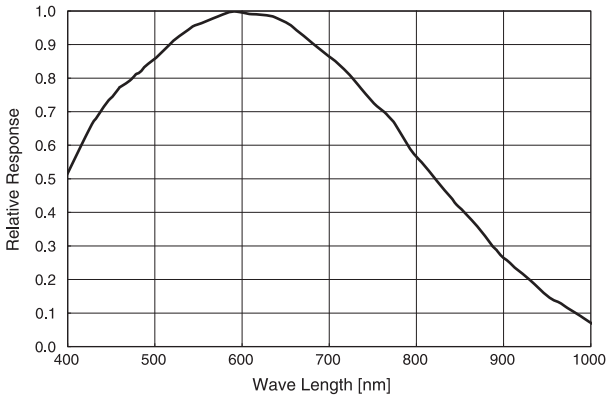
# Specifications

Imaging device 1/2.9 type CMOS image sensor with global shutter function
Standard video output size (horizontal/vertical)
1,440×1,080
Frame rate 100 fps
Lens mount C-mount
Flange focal length
17.526 mm
Video output signal
XCU-CG160:
Mono 8 bits (default setting)/12 bits
XCU-CG160C:
Raw 8 bits (default setting)/12 bits, BGR 24 bits, YCbCr 24 bits, YCbCr 16 bits
Reference video output level
235 steps (8 bits)/3,760 steps (12 bits)
Reference pedestal level
15 steps (8 bits)/240 steps (12 bits)
Range of color temperature for white balance
XCU-CG160C:
2,400 K to 9,000 K
Minimum illumination (gain control at +18 dB, F1.4, shutter speed at 1/30 sec)
XCU-CG160: 0.5 lx
XCU-CG160C: 12 lx
Sensitivity XCU-CG160:
F5.6 (gain control at 0 dB, 400 lx, shutter speed at 1/30 sec)
XCU-CG160C:
F5.6 (gain control at 0 dB, 2,000 lx, shutter speed at 1/30 sec)
Gain 0 dB to 18 dB, Auto gain
Shutter speed 1/100,000 sec to 60 sec, automatic shutter (image quality is retained for 2 seconds)
Gamma $\gamma = 1$ (Changeable by LUT)
Power requirements
USB bus power (DC 5V ± 5%): USB connector
DC 12 V (10.5 V to 15 V): DC power supply input connector
Power consumption
3.0 W (USB bus power)
3.5 W (DC)
Performance guarantee 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 80% (no condensation)
MTBF Approx. 7.7 years
Vibration resistance
10 G (20 Hz to 200 Hz)
Shock resistance
70 G
External dimensions (w/h/d)
29 × 29 × 30 mm
($1\ ^3/_{16} \times 1\ ^3/_{16} \times 1\ ^3/_{16}$ inches)
(excluding protrusions)
Mass Approx. 50 g (1.8 oz)
Accessories Lens mount cap (1)
Operating Instructions (1)

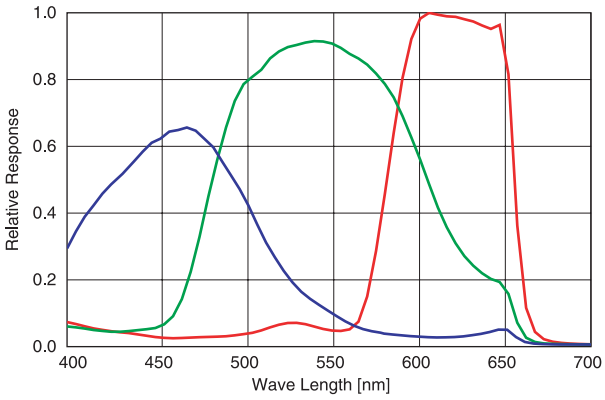
Design and specifications are subject to change without notice.

# Spectral Sensitivity Characteristics (Typical Values)

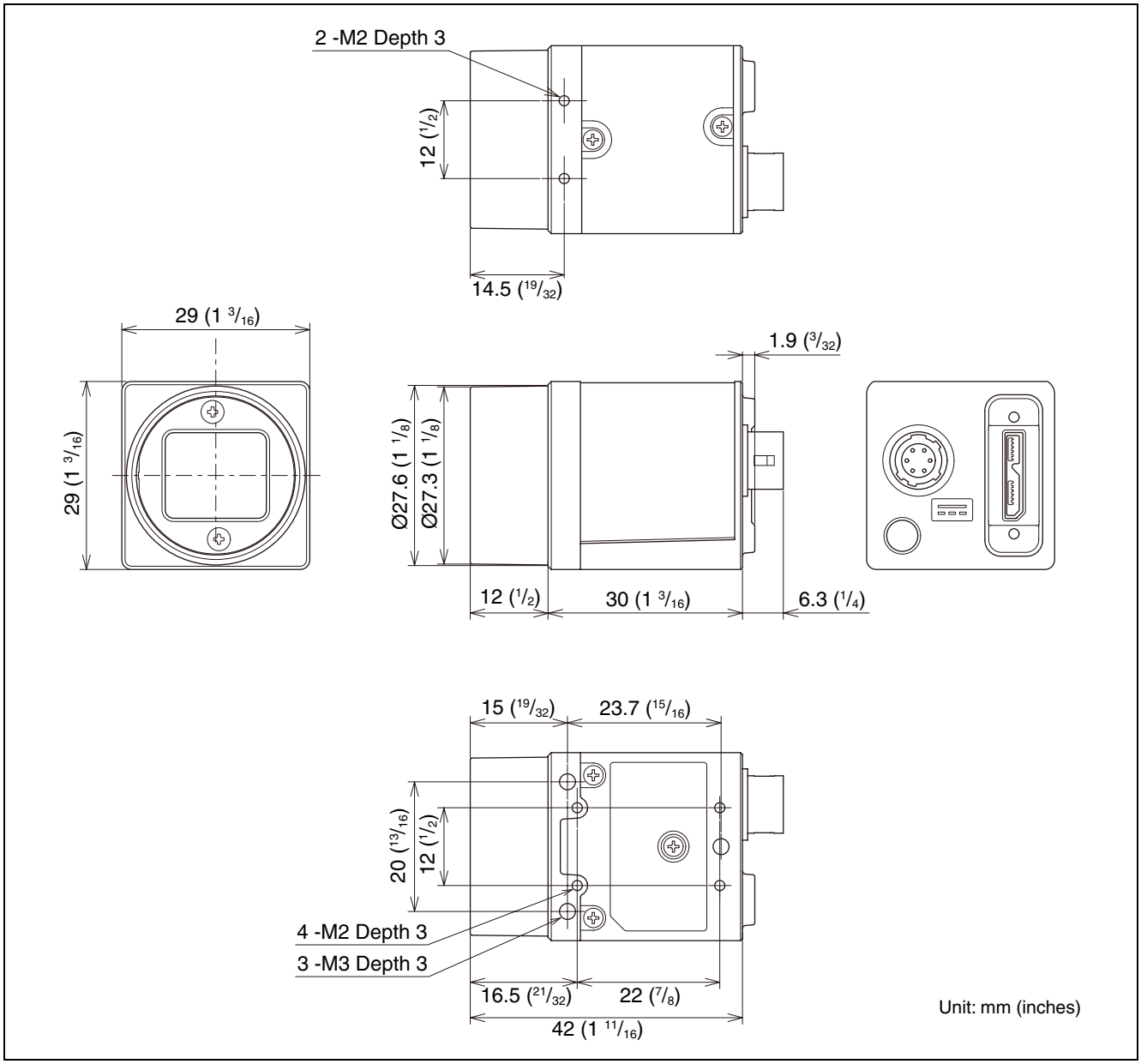
### XCU-CG160




### XCU-CG160C



# Dimensions


2 -M2 Depth 3
12 (1/2)
14.5 (19/32)
29 (1 3/16)
29 (1 3/16)
1.9 (3/32)
Ø27.6 (1 1/8)
Ø27.3 (1 1/8)
12 (1/2)
30 (1 3/16)
6.3 (1/4)
15 (19/32)
23.7 (15/16)
20 (13/16)
12 (1/2)
4 -M2 Depth 3
3 -M3 Depth 3
16.5 (21/32)
22 (7/8)
42 (1 11/16)
Unit: mm (inches)

http://www.sony.net/

Sony Corporation