

USB3 Vision

Monochrome / Color CMOS Camera

STC-MBS500U3V (5M, Monochrome)

STC-MCS500U3V (5M, Color)

STC-MBS312U3V (3.2M, Monochrome)

STC-MCS312U3V (3.2M, Color)

Product Specifications

Sentech Co., Ltd

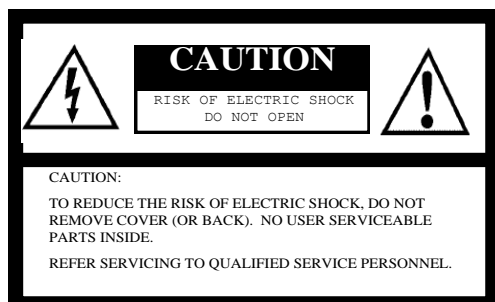
Table Contents

| | | |
|----------|--|-----------|
| 1 | OVERVIEW..... | 7 |
| 1.1 | Features | 7 |
| 1.2 | Item Numbers Naming Method..... | 7 |
| 2 | SPECIFICATIONS | 8 |
| 2.1 | Electronic Specifications..... | 8 |
| 2.1.1 | STC-MBS500U3V / STC-MCS500U3V..... | 8 |
| 2.1.2 | STC-MBS312U3V / STC-MCS312U3V..... | 10 |
| 2.2 | Spectral Sensitivity Characteristics | 13 |
| 2.2.1 | STC-MBS500U3V | 13 |
| 2.2.2 | STC-MCS500U3V (without IR cut filter) | 13 |
| 2.2.3 | STC-MBS312U3V | 14 |
| 2.2.4 | STC-MCS312U3V (without IR cut filter) | 14 |
| 2.3 | Mechanical Specifications..... | 15 |
| 2.3.1 | STC-MBS500U3V / STC-MCS500U3V..... | 15 |
| 2.3.2 | STC-MBS312U3V / STC-MCS312U3V..... | 15 |
| 2.4 | Environmental Specifications | 16 |
| 2.4.1 | STC-MBS500U3V / STC-MCS500U3V..... | 16 |
| 2.4.2 | STC-MBS312U3V / STC-MCS312U3V..... | 16 |
| 2.5 | External connector..... | 17 |
| 2.5.1 | USB 3.0 micro B..... | 17 |
| 2.5.2 | IO Connector..... | 18 |
| 2.5.3 | Reference Input Circuit | 19 |
| 2.5.4 | Reference Output Circuit | 21 |
| 3 | DIMENSIONS | 23 |
| 3.1 | STC-MBS500U3V / STC-MCS500U3V / STC-MBS312U3V / STC-MCS312U3V..... | 23 |
| 4 | SENSOR INFORMATION | 24 |
| 4.1 | Pixel Transferring Image..... | 24 |
| 5 | IMAGE ACQUISITION AND CAMERA OPERATIONAL MODES..... | 25 |
| 5.1 | Freerun..... | 25 |

| | | |
|------------|---|-----------|
| 5.2 | Trigger Mode..... | 26 |
| 5.2.1 | Frame Start Trigger (Edge Preset) | 27 |
| 5.2.2 | Frame Start Trigger (Pulse Width Trigger) | 28 |
| 5.2.3 | Exposure Start Trigger, Exposure End Trigger | 29 |
| 5.2.4 | Trigger Software | 29 |
| 6 | IO FUNCTION..... | 30 |
| 6.1 | Input Port Function | 30 |
| 6.1.1 | Trigger Input..... | 30 |
| 6.1.2 | Line Status | 30 |
| 6.1.3 | Line Debouncer..... | 31 |
| 6.1.4 | Trigger Delay..... | 31 |
| 6.2 | Output Port Function | 32 |
| 6.2.1 | Line Source | 32 |
| 6.2.1 | User Output..... | 34 |
| 6.2.2 | Line Status | 34 |
| 6.2.3 | Output signal duration setting and Pulse width setting..... | 34 |
| 6.3 | Hardware Reset | 34 |
| 7 | CAMERA OPERATION..... | 35 |
| 7.1 | ROI (Region of Interest) | 35 |
| 7.1.1 | ROI (One Region)..... | 35 |
| 7.1.2 | Multi ROI..... | 37 |
| 7.2 | Pixel Format..... | 39 |
| 7.3 | Binning..... | 39 |
| 7.4 | Decimation | 40 |
| 7.5 | Image Flip | 41 |
| 7.6 | Gain | 43 |
| 7.6.1 | Analog Gain | 43 |
| 7.6.2 | Digital Gain..... | 43 |
| 7.6.3 | White Balance Gain (Only available for the color cameras) | 43 |
| 7.7 | Black Level..... | 44 |
| 7.8 | ALC (Auto Light Control)..... | 45 |
| 7.8.1 | ALC Control Method | 45 |
| 7.8.2 | AGC (Auto Gain Control)..... | 45 |
| 7.8.3 | Auto Exposure | 45 |
| 7.8.4 | The procedure of ALC | 46 |

| | |
|---|-----------|
| 7.9 White Balance (Only available for the color cameras) | 47 |
| 7.9.1 White balance control methods | 47 |
| 7.9.2 Disable | 47 |
| 7.9.3 Manual (Off) | 47 |
| 7.9.4 Auto White Balance (Continuous) | 47 |
| 7.9.5 Push to Set White Balance (Once) | 47 |
| 7.10 Gamma Table | 48 |
| 7.11 Save and load the camera setting data | 49 |
| 7.11.1 Saving the Camera Settings | 49 |
| 7.11.2 The Camera Settings Loading | 50 |
| 7.11.3 The Camera Settings Loading When the Camera Power is on | 50 |
| 7.11.4 The Camera Settings Initialization | 50 |
| 7.12 Pixel Defect Correction | 51 |
| 7.13 Trigger | 51 |
| 7.13.1 Trigger Signal Process | 51 |
| 7.14 Device User ID | 52 |
| 7.15 Event Control (Only USB3 Vision protocol) | 52 |
| 7.15.1 The way to use Event | 52 |
| 7.15.2 Event Function | 52 |
| 7.16 Chunk Control (Only USB3 Vision protocol) | 53 |
| 7.16.1 The way to use Chunk | 53 |
| 7.16.2 Chunk Data | 53 |
| 7.17 GenICam command list | 54 |
| 7.17.1 DeviceControl | 54 |
| 7.17.2 ImageFormatControl | 55 |
| 7.17.3 AcquisitionControl | 56 |
| 7.17.4 TransportLayerControl | 56 |
| 7.17.5 DigitalIOControl | 56 |
| 7.17.6 CounterAndTimerControl | 57 |
| 7.17.7 EventControl | 57 |
| 7.17.8 EventExposureEndData | 57 |
| 7.17.9 EventExposureStartData | 57 |
| 7.17.10 EventTestData | 58 |
| 7.17.11 AnalogControl | 58 |
| 7.17.12 LUTControl | 58 |
| 7.17.13 UserSetControl | 58 |
| 7.17.14 ChunkDataControl | 58 |
| 7.17.15 TestControl | 59 |
| 8 REVISION HISTORY | 60 |

Safety / Product Precautions



For U.S.A.

Warning:

This equipment generates and uses radio frequency energy and if not installed and used properly, I.e., in strict accordance with the instruction manual, may cause harmful interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

For Canada

Warning:

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated \square dangerous voltage \square within the product \square enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

WARNING:

TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

Product Precautions

- **Handle the camera with care. Do not abuse the camera. Avoid striking or shaking it. Improper handling or storage could damage the camera.**
- **Do not pull or damage the camera cable.**
- **During camera use, do not wrap the unit in any material. This will cause the internal temperature of the unit to increase.**
- **Do not expose the camera to moisture, or do not try to operate it in wet areas.**
- **Do not operate the camera beyond its temperature, humidity and power source ratings.**
- **While the camera is not being used, keep the lens or lens cap on the camera to prevent dust or contamination from getting in the sensor or filter area and scratching or damaging this area.**
- **Do not keep the camera under the following conditions:**
 - **In wet, moist, and high humidity areas**
 - **Under hot direct sunlight**
 - **In high temperature areas**
 - **Near an object that releases a strong magnetic or electric field**
 - **Areas with strong vibrations**
- **Apply the power that satisfies the requirements specified in this document to the camera.**
- **Use a soft cloth to clean the camera. Use pressured air spray to clean the surface of the glass. DO not scratch the surface of the glass.**

- The camera is a general-purpose electronic device; using the camera for the equipment that may threaten human life or cause dangers to human bodies directly in case of failure or malfunction of the camera is not guaranteed. Use the camera for special purposes at your own risk.
- Defect pixels may appear due to the sensor characteristics.
- During camera use, do not plug or unplug other USB devices (USB storage, etc.). Plugging or unplugging other devices may result in a failure to recognize the USB camera.
- Increasing gain level may increase the noise level.
- When the camera is in Long Exposure mode, the noise level may increase.

1 Overview

This document describes the specification of the following cameras.

STC-MCS500U3V / STC-MBS500U3V

STC-MCS312U3V / STC-MBS312U3V

1.1 Features

- USB3 Vision
- Frame Rate (Full Scan) : 35.8fps@5.1M 8bit, 56.0fps@3.2M 8bit
- CMOS Global Shutter
- Up to 64 Pixel Defect Correction (Default: ON)
- 8bit, 10bit, 12bit output

1.2 Item Numbers Naming Method

Below is a description of the camera naming method:

STC-MxS500U3V

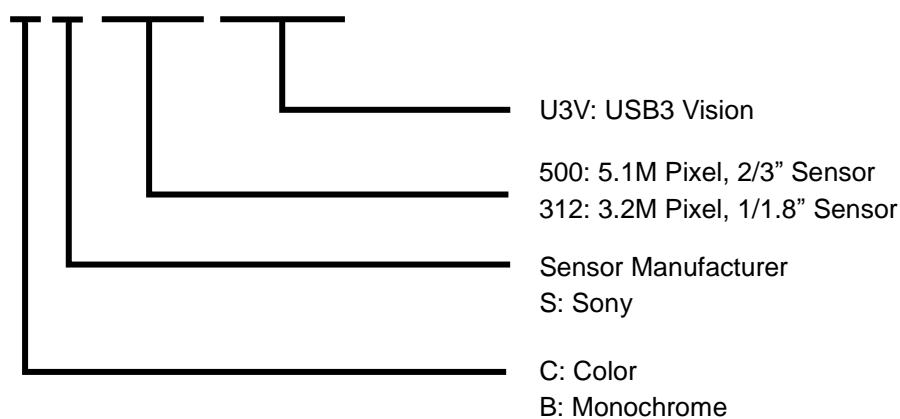


Figure 1: Naming Method

2 Specifications

2.1 Electronic Specifications

2.1.1 STC-MBS500U3V / STC-MCS500U3V

| Model Number | | STC-MBS500U3V | STC-MCS500U3V |
|--------------------------------|----------------------------|--|--|
| Image Sensor | | 2/3" 5.1M Progressive Monochrome CMOS (Sony: IMX264) | 2/3" 5.1M Progressive Color CMOS (Sony: IMX264) |
| Shutter Type | | Global | |
| Active Picture Elements | | 2448 (H) x 2048 (V) | |
| Cell Size | | 3.45 (H) x 3.45 (V) μ m | |
| Sync System | | Free run, External trigger(Hardware, Software) | |
| Maximum Frame Rate (Full Scan) | 8bit output | 35.8 fps | |
| | 10bit output | 35.8 fps | |
| | 10bit Packed output | 35.8 fps | |
| | 12bit output | 35.8 fps | |
| | 12bit Packed output | 35.8 fps | |
| ADC bit width | | 10bit / 12bit | |
| Video Format | | 8/10/12 bit output (Support packed on 10bit, 12bit) | 8/10/12 bit output (Support packed on 10bit, 12bit) |
| Noise Level | 8bit output | ≤ 3 LSBs (Gain 0 dB) | |
| | 10bit / 10bitPacked output | ≤ 12 LSBs (Gain 0 dB) | |
| | 12bit / 12bitPacked output | ≤ 48 LSBs (Gain 0 dB) | |
| Sensitivity | | 380 Lux | 1030 Lux |
| Exposure time | 8bit output | 27.2 μ seconds to 56 seconds | |
| | 10bit output | 27.2 μ seconds to 56 seconds | |
| | 10bit Packed output | 27.2 μ seconds to 56 seconds | |
| | 12bit output | 27.2 μ seconds to 56 seconds | |
| | 12bit Packed output | 27.2 μ seconds to 56 seconds | |
| Gain | Analog Gain | 0 to 20.8 dB | |
| | Digital Gain | 0 to 6 dB | |
| Black Level | 8bit output | 0 to 31 | |
| | 10bit / 10bitPacked output | 0 to 127 | |
| | 12bit / 12bitPacked output | 0 to 511 | |
| White Balance Gain | | N/A | -40dB to 12dB |
| ROI (AOI) | | Horizontal: 64 to 2448 (2432 on Packed) / Vertical: 32 to 2048 Adjustable Steps for offset: 16 pixels in horizontal direction (64 pixels on Packed) / 4 lines in vertical direction Adjustable Steps for offset: 4 pixels in horizontal direction / 4 lines in vertical direction | |
| Gamma | | Gamma Table =0.1 to 4.0, Default = 1.0 | |
| Binning | | Individual x2 Horizontal, Vertical Binning / OFF (Horizontal: Average, Vertical: Addition) *8 | N/A |
| Decimation | | Individual x2 Horizontal, Vertical Decimation | |
| Image Flip | | Horizontal / Vertical / Horizontal and Vertical / OFF | |
| Pixel Defect Correction | | Up to 64 points | |
| Auto | Auto Exposure | Support (Default: Fix 27.5 mseconds) | |

| | | | |
|----------------------|--------------------|--|------------------------------------|
| Image | Auto Gain | Support (Default: Fix x1) | |
| Control | Auto White Balance | N/A | Support (Default: Manual) |
| Operational Mode | | Free-run / Edge-preset Trigger / Pulse width Trigger / Start Stop Trigger | |
| User Setting Storage | | Support | |
| Communication | | Via USB3.0 bus | |
| Interface | | USB3.0 Super speed (USB3.0 Micro B) | |
| Protocol | | USB3 Vision® 1.0.1, GenICam Standard Version (SFNC 2.2, PFNC 2.0) compliant and Sentech's unique protocol (on Normal SDK, Trigger SDK) | |
| Input / Output | | Three GPIO, One Camera Hardware Reset | |
| Power | Input Voltage | +5V(typ.) (This conforms to the USB standard) | |
| | Consumption | Max: 3.4W, Typ: 2.8W | |

2.1.2 STC-MBS312U3V / STC-MCS312U3V

| Model Number | | STC-MBS312U3V | STC-MCS312U3V |
|--|-------------------------------|---|--|
| Image Sensor | | 1/1.8" 3.2M Progressive Monochrome CMOS (Sony: IMX265) | 1/1.8" 3.2M Progressive Color CMOS (Sony: IMX265) |
| Shutter Type | | Global | |
| Active Picture Elements | | 2048 (H) x 1536 (V) | |
| Cell Size | | 3.45 (H) x 3.45 (V) μ m | |
| Sync System | | Free run, External trigger(Hardware, Software) | |
| Maximum Frame Rate (Full Scan) | 8bit output | 56.0 fps | |
| | 10bit output | 56.0 fps | |
| | 10bit Packed output | 56.0 fps | |
| | 12bit output | 56.0 fps | |
| | 12bit Packed output | 56.0 fps | |
| ADC bit width | | 12bit | |
| Video Format | | 8/10/12 bit output (Support packed on 10bit, 12bit) | 8/10/12 bit output (Support packed on 10bit, 12bit) |
| Noise Level | 8bit output | ≤ 3 LSBs (Gain 0 dB) | |
| | 10bit / 10bitPacked output | ≤ 12 LSBs (Gain 0 dB) | |
| | 12bit / 12bitPacked output | ≤ 48 LSBs (Gain 0 dB) | |
| Sensitivity | | 370 Lux | 1020 Lux |
| Exposure time | 8bit output | 25.2 μ seconds to 47 seconds | |
| | 10bit output | 25.2 μ seconds to 47 seconds | |
| | 10bit Packed output | 25.2 μ seconds to 47 seconds | |
| | 12bit output | 25.2 μ seconds to 47 seconds | |
| | 12bit Packed output | 25.2 μ seconds to 47 seconds | |
| Gain | Analog Gain | 0 to 20.8 dB | |
| | Digital Gain | 0 to 6 dB | |
| Black Level | 8bit output | 0 to 31 | |
| | 10bit / 10bitPacked output | 0 to 127 | |
| | 12bit / 12bitPacked output | 0 to 511 | |
| White Balance Gain | | N/A | -40dB to 12dB |
| ROI (AOI) | | Horizontal: 64 to 2048 / Vertical: 32 to 1536 Adjustable Steps for offset: 16 pixels in horizontal direction (64 pixels on Packed) / 4 lines in vertical direction Adjustable Steps for offset: 4 pixels in horizontal direction / 4 lines in vertical direction | |
| Multi ROI | | 16 Regions (Horizontal 4 regions x Vertical 4 regions) | |
| Gamma | | Gamma Table =0.1 to 4.0, Default = 1.0 | |
| Binning | | Individual x2 Horizontal, Vertical Binning / OFF (Horizontal: Average, Vertical: Addition) *8 | N/A |
| Decimation | | Individual x2 Horizontal, Vertical Decimation / OFF | |
| Image Flip | | Horizontal / Vertical / Horizontal and Vertical / OFF | |
| Pixel Defect Correction | | Up to 64 points | |
| Auto Image Control | Auto Exposure | Support (Default: Fix 27.5 mseconds) | |
| | Auto Gain | Support (Default: Fix x1) | |
| | Auto White Balance | N/A | Support (Default: Manual) |

| | | |
|----------------------|---------------|---|
| Operational Mode | | Free-run / Edge-preset Trigger / Pulse width Trigger / Start Stop Trigger |
| User Setting Storage | | Support |
| Communication | | Via USB3.0 bus |
| Interface | | USB3.0 Super speed (USB3.0 Micro B) |
| Protocol | | USB3 Vision® 1.0 , GenICam Standard Version (SFNC 2.2, PFNC 2.0) compliant and Sentech's unique protocol (on Normal SDK, Trigger SDK) |
| Input / Output | | Three GPIO, One Camera Hardware Reset |
| Power | Input Voltage | +5V(typ.) (This conforms to the USB standard) |
| | Consumption | Max: 3.4W, Typ: 2.8W |

Precautions

*1 The procedure used to measure Sensitivity is as follows:

Measure the luminance when white level achieved 100% on F5.6

| Camera Setting | | Environment | |
|--------------------|-----------------|-------------------|------------------|
| Parameter | Setting | Parameter | Setting |
| Gain Up | 0 db | Light Source | Light Box(White) |
| AGC | OFF | Color temperature | 5100K |
| White Balance | Optimum | Exposure Time | 1/30 |
| Electrical Shutter | 1/30 | F on Lens | F 5.6 |
| Black Level | Optimum | Target Luminance | Illuminometer |
| Gamma | Factory Setting | | |

*2 Please refer to section ROI for further details on the ROI.

*3 Binning & Decimation cannot work simultaneously.

*4 The Binning & Decimation units do not change.

*5 The user should not input the trigger more frequently than the maximum frame rate.

If the trigger was input during the sensor ReadOut timing, ReadOut will be interrupted. This trigger will cause the exposure to end.

*6 Start/Stop trigger mode is only available for the software trigger.

*7 When using this camera with a USB 2.0 port, the user should take precautions in regards to power consumption due to this camera operating on the USB 3.0 standard.

*8 FrameRate can not increase on H,V Binning mode.

How to obtain full frame rate

This general guideline may help the user obtain the full frame rate from the camera.

To obtain the full frame rate, the data transfer speed on the USB bus depends on the capability of the host controller.

Renesas / Fresco Logic's host controller improved the data transfer speed drastically in the second generation. Intel's chipset increased the transfer speed 10% to 20%.

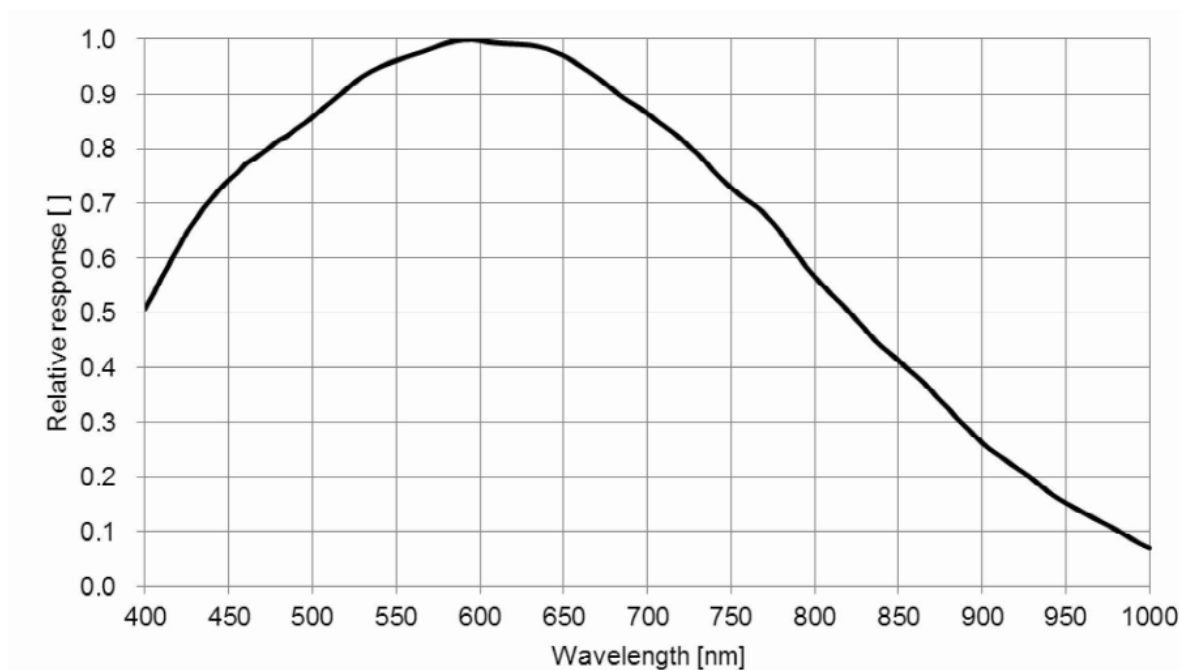
When PCIExpress board of USB3.0 interface is used, please insert the PCIExpress Gen2.0(5.0[GT/s]) slot. If non-PCIExpress Gen2.0(5.0[GT/s]) is used, data transfer speed could decrease by about 50%.

If an incapable host controller causes a lower frame rate, the camera frame rate should be set lower than the maximum to adjust for the incapable host controller spec. This may resolve the issue.

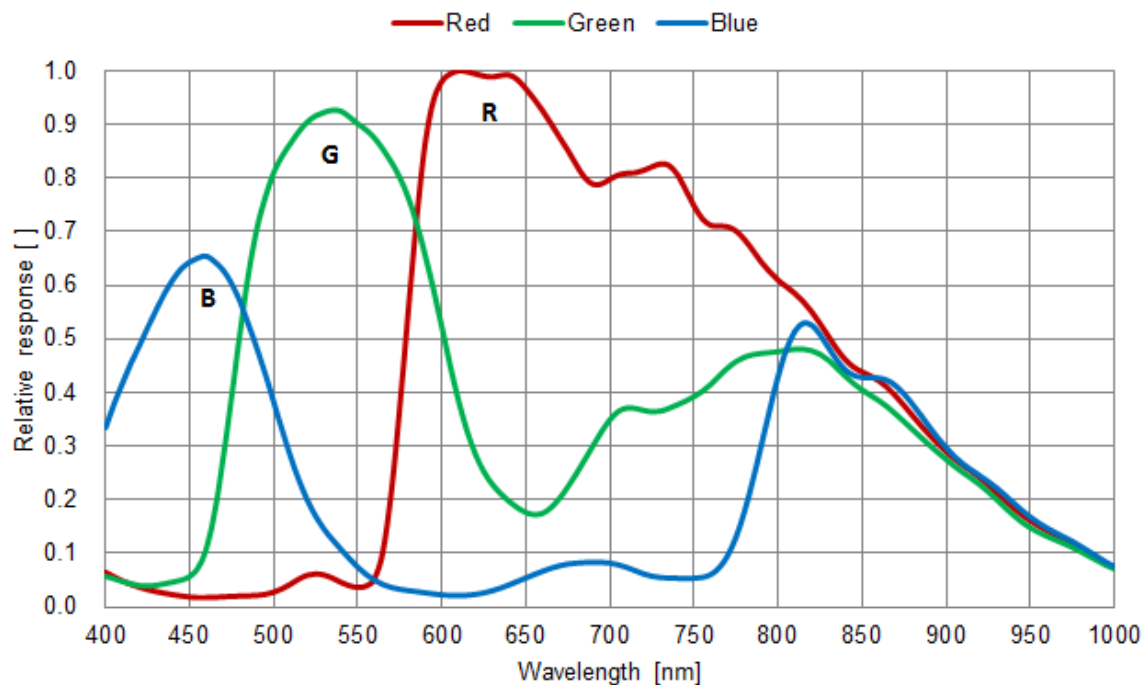
Due to the huge data transfer, PC resources may be consumed during the process. If this occurs, the frame rate of the camera may be effected.

2.2 Spectral Sensitivity Characteristics

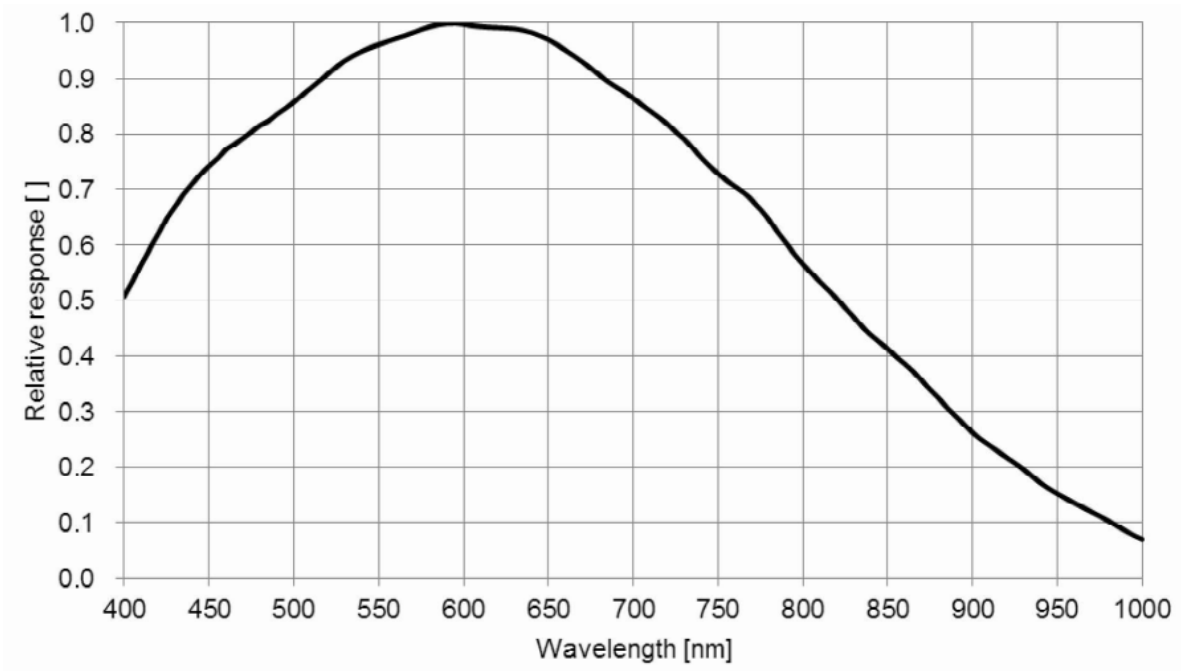
2.2.1 STC-MBS500U3V



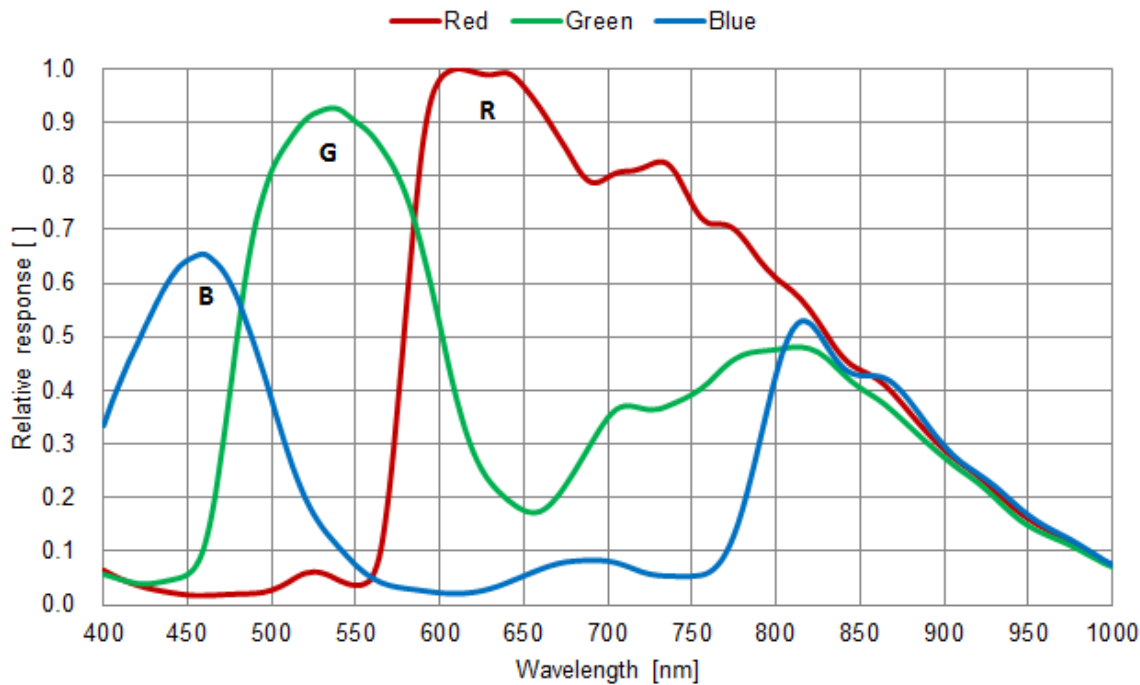
2.2.2 STC-MCS500U3V (without IR cut filter)



2.2.3 STC-MBS312U3V



2.2.4 STC-MCS312U3V (without IR cut filter)



2.3 Mechanical Specifications

2.3.1 STC-MBS500U3V / STC-MCS500U3V

| Model Number | STC-MBS500U3V | STC-MCS500U3V |
|-------------------------|--|---------------|
| Dimensions | C Mount: 28 (W) x 28 (H) x 40 (D) mm (*1) | |
| Optical Filter | No IR Cut Filter | IR Cut Filter |
| Optical Center Accuracy | Positional accuracy in Horizontal and Vertical directions: +/- 0.3 mm Rotational accuracy of Horizontal and Vertical: +/- 1.5 deg.° | |
| Material | Aluminum alloy | |
| Lens Mount | C Mount | |
| Interface Connectors | USB Connector: USB3.0 Micro B type I/O Connector: HR10A-7R-6PB (Hirose) or equivalent | |
| Weight | Approx. 48g | |

(*1) excluding the connectors

2.3.2 STC-MBS312U3V / STC-MCS312U3V

| Model Number | STC-MBS312U3V | STC-MCS312U3V |
|-------------------------|--|------------------|
| Dimensions | C Mount: 28 (W) x 28 (H) x 40 (D) mm (*1) | |
| Optical Filter | No IR Cut Filter | No IR Cut Filter |
| Optical Center Accuracy | Positional accuracy in Horizontal and Vertical directions: +/- 0.3 mm Rotational accuracy of Horizontal and Vertical: +/- 1.5 deg.° | |
| Material | Aluminum alloy | |
| Lens Mount | C Mount | |
| Interface Connectors | USB Connector: USB3.0 Micro B type I/O Connector: HR10A-7R-6PB (Hirose) or equivalent | |
| Weight | Approx. 48g | |

(*1) excluding the connectors

2.4 Environmental Specifications

2.4.1 STC-MBS500U3V / STC-MCS500U3V

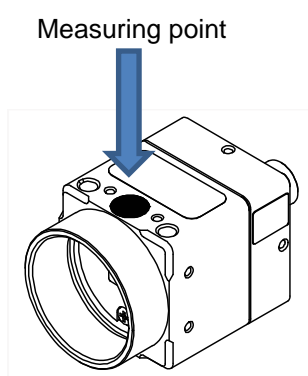
| Model Number | | STC-MBS500U3V / STC-MCS500U3V |
|-------------------------|---------|--|
| Operational Temperature | Minimum | Environmental Temperature: 0 deg. °C |
| | Maximum | Camera housing temperature (top plate) shall not exceed 58 deg. °C (*1) |
| Storage Temperature | | Environmental Temperature: -30 to +65 deg. C, Environmental Humidity: 0 to 85% |
| Vibration | | 20Hz to 200Hz to 20Hz (5min./cycle), acceleration 10G, XYZ 3 directions 30 min. each |
| Shock | | Acceleration 38G, half amplitude 6ms, XYZ 3 directions 3 times each |
| Standard Compliance | | EMS: EN61000-6-2, EMI: EN55011 |
| RoHS | | RoHS Compliant |

2.4.2 STC-MBS312U3V / STC-MCS312U3V

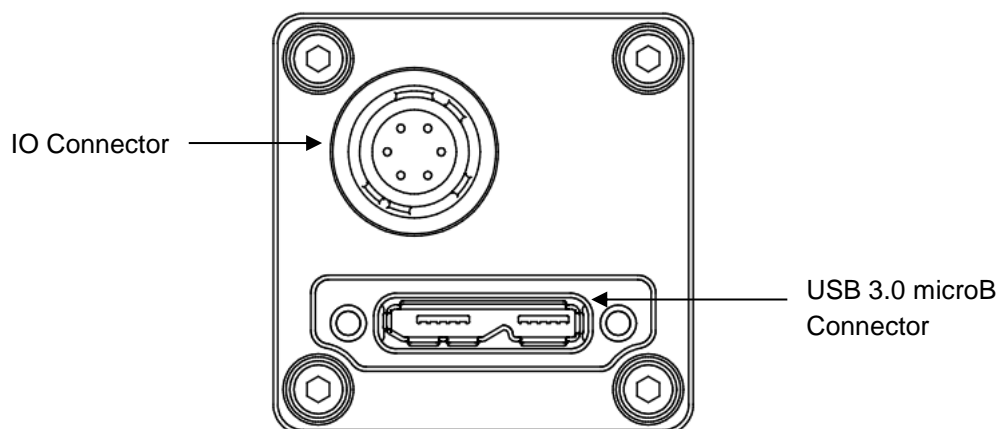
| Model Number | | STC-MBS312U3V / STC-MCS312U3V |
|-------------------------|---------|--|
| Operational Temperature | Minimum | Environmental Temperature: 0 deg. °C |
| | Maximum | Camera housing temperature (top plate) shall not exceed 58 deg. °C (*1) |
| Storage Temperature | | Environmental Temperature: -30 to +65 deg. C, Environmental Humidity: 0 to 85% |
| Vibration | | 20Hz to 200Hz to 20Hz (5min./cycle), acceleration 10G, XYZ 3 directions 30 min. each |
| Shock | | Acceleration 38G, half amplitude 6ms, XYZ 3 directions 3 times each |
| Standard Compliance | | EMS: EN61000-6-2, EMI: EN55011 |
| RoHS | | RoHS Compliant |

*1: Please insure the camera is installed with the appropriate heat dissipation. If camera has a mounted lens and a tripod with an aluminum plate, this could decrease the camera housing temperature for heat dissipation. When the internal temperature sensor on the camera shows less than 67 °C, the camera housing temperature (top plate) will be less than 58 °C.

Upper side of camera



2.5 External connector



2.5.1 USB 3.0 micro B

This connector is compatible with a USB 3.0 microB connector.
Connector size includes screw lock size and complies with USB3 Vision 1.0.1.

Pin assignment

| Pin No. | Signal Name | Description |
|---------|-------------|--|
| 1 | VBUS | Power |
| 2 | D- | USB 2.0 differential pair (D-) |
| 3 | D+ | USB 2.0 differential pair (D+) |
| 4 | USB OTG | USB OTG ID |
| 5 | GND | GND |
| 6 | SSTX- | SuperSpeed transmitter differential pair (-) |
| 7 | SSTX+ | SuperSpeed transmitter differential pair (+) |
| 8 | GND | GND |
| 9 | SSRX- | SuperSpeed receiver differential pair (-) |
| 10 | SSRX+ | SuperSpeed receiver differential pair (+) |

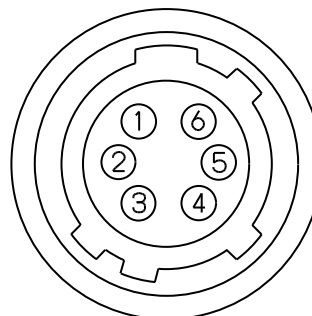


2.5.2 IO Connector

- HR10A-7R-6PB (Hirose) or equivalent.
- This connector is for input and output signals.
- The trigger input and sync input /output signals can be assigned through the camera setting communication.
As for the cable part (Female connector), HR10A-7P-6S (Hirose) or equivalent can be used.

Pin assignment

| Pin No. | Signal Name | IN/OUT |
|---------|-------------|--------|
| 1 | GPIO_GND | - |
| 2 | GPIO2 | IN/OUT |
| 3 | GPIO1 | IN/OUT |
| 4 | GPIO0 | IN/OUT |
| 5 | CAM_RESET | IN |
| 6 | N.C. | - |



*Possible Maximum Rated Voltage is +24V.on CAM_RESET, GPIO0, GPIO1 and GPIO2.

*Please set electrically "OPEN" on NC (Pin 6).

Input Output DC characteristics

| Pin No. | Signal Name | Function | IN/OUT | Voltage | | | Current | Reference |
|---------|-------------|------------------------------|--------|---------|------------------|-------------------|-----------------|-----------|
| | | | | | Low Voltage | High Voltage | | |
| 1 | IO_GND | GND | - | | | | - | - |
| 2 | GPIO2 | General Purpose Input Output | IN/OUT | IN | Less than+1.00V | +3.00 to +24V | 4uA(typ.)(*4) | 2 |
| | | | | OUT | 0 to +2.20V(*1) | +3.00 to +24V(*2) | 15mA (Max.)(*3) | 3,4 |
| 3 | GPIO1 | General Purpose Input Output | IN/OUT | IN | Less than+1.00V | +3.00 to +24V | 4uA(typ.)(*4) | 2 |
| | | | | OUT | 0 to +2.20V(*1) | +3.00 to +24V(*2) | 15mA (Max.)(*3) | 3,4 |
| 4 | GPIO0 | General Purpose Input Output | IN/OUT | IN | Less than+1.00V | +3.00 to +24V | 4uA(typ.)(*4) | 2 |
| | | | | OUT | 0 to +2.20V(*1) | +3.00 to +24V(*2) | 15mA (Max.)(*3) | 3,4 |
| 5 | CAM_RESET | Camera Hardware Reset | IN | IN | Less than +0.80V | +3.00 to +24V | 4uA(typ.)(*4) | 1 |
| 6 | N.C. | NC | - | - | | | - | - |

(*1): If the current on the IO port is at 15mA when using low voltage output, the output voltage could increase for the internal register.

(*2): This is the maximum charging voltage when the external IO port is connected. Equivalent VCCext is on Reference 4.

(*3): When the external IO port is connected, control the current less than 15mA on the IO port.

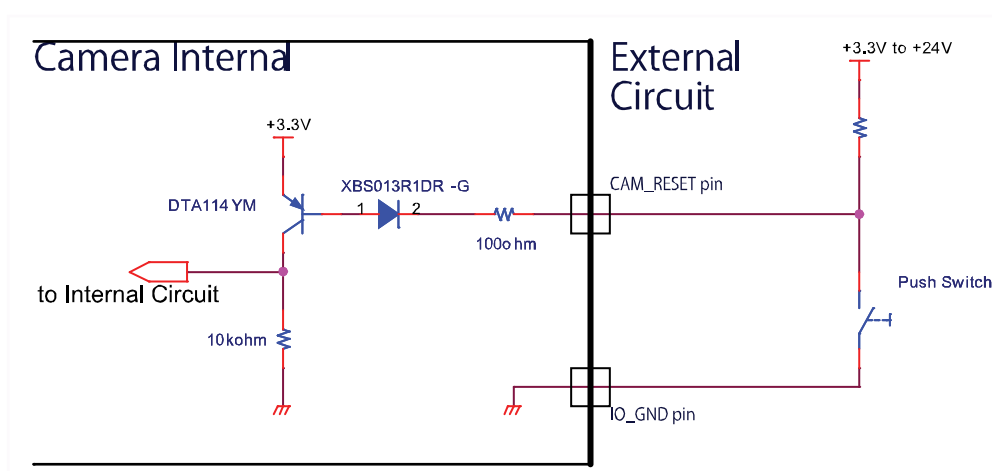
(*4): This value is the typical current value of the Input Port when High Voltage is input.

Default Setting of Input Output

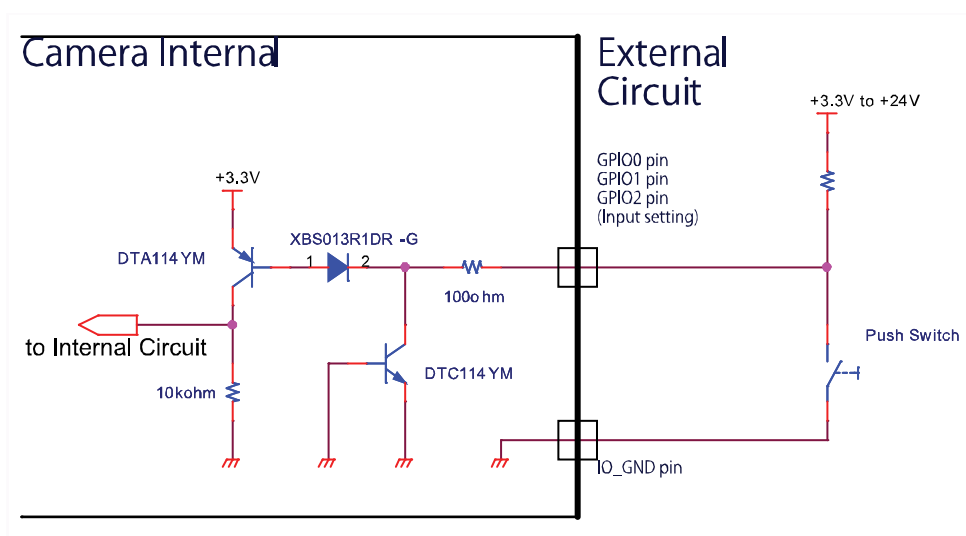
| Pin No. | Signal Name | Default | |
|---------|-------------|---------|---------|
| | | IN/OUT | Setting |
| 2 | GPIO2 | IN | Disable |
| 3 | GPIO1 | IN | Disable |
| 4 | GPIO0 | IN | Disable |

2.5.3 Reference Input Circuit

CAM_RESET (Reference 1)



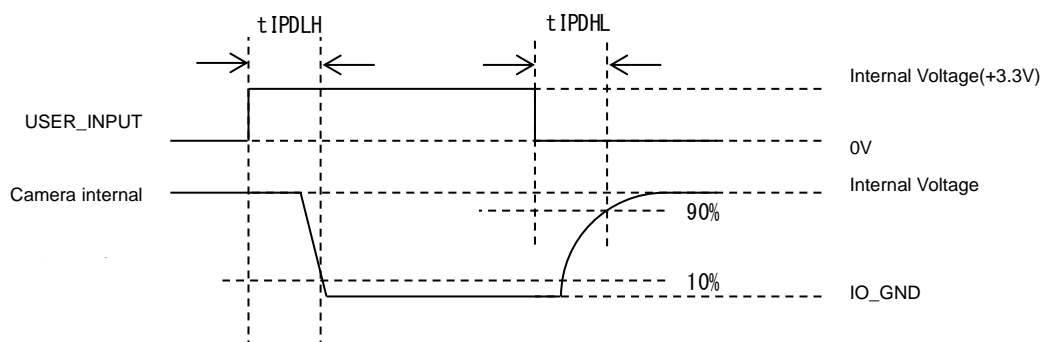
General Purpose Input (Reference 2)



Input Response Characteristics

Response characteristics of CAM_RESET (Reference1), General Purpose Input (Reference 2) are shown in the following diagrams

| | |
|--------|-----------|
| tIPDHL | 0.13 usec |
| tIPDLH | 6.54 usec |



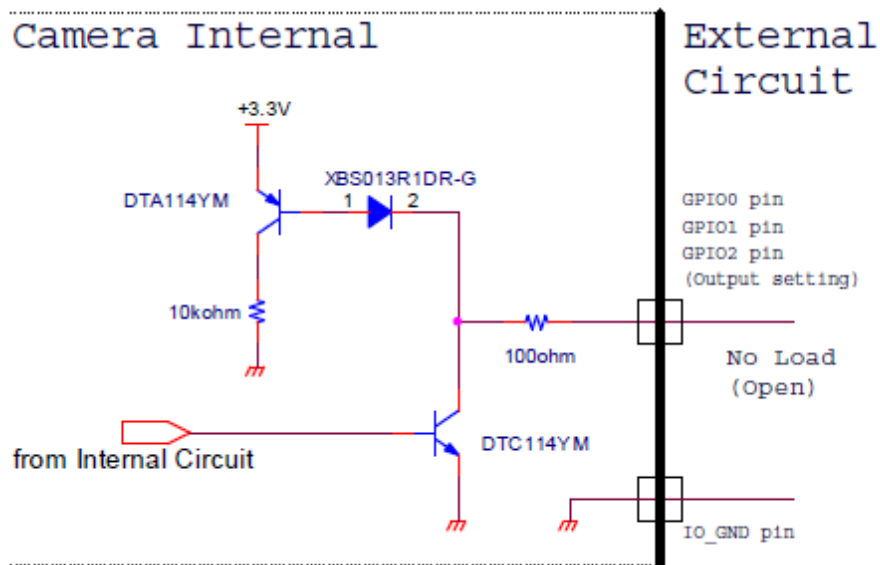
Capable input trigger's pulse width is

Positive Trigger: More than tIPDLH

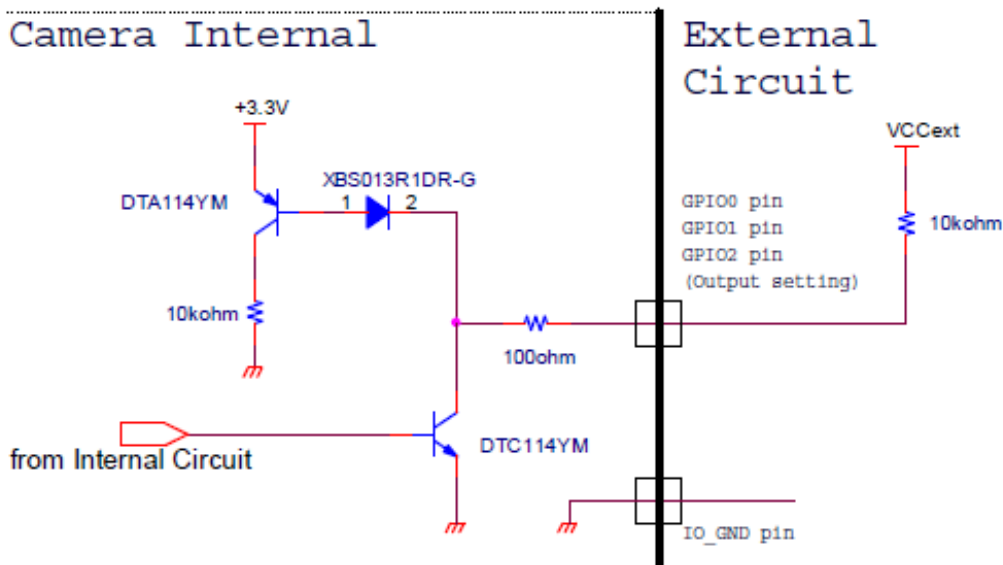
Negative Trigger: More than tIPDLH

2.5.4 Reference Output Circuit

General Purpose Output (Reference 3)



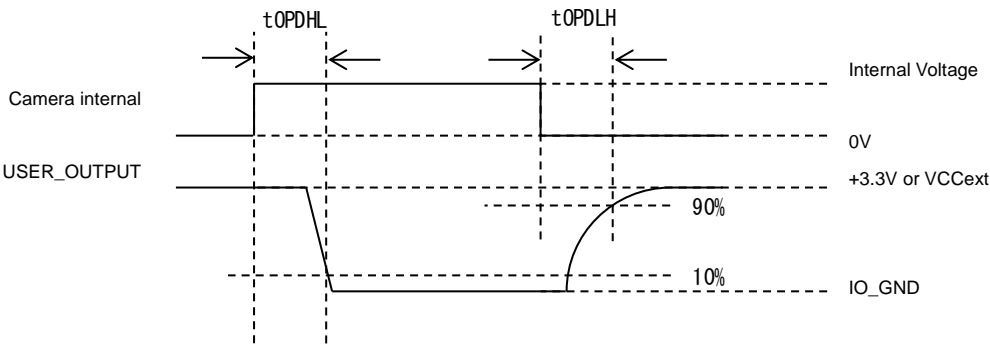
General Purpose Output (Reference 4)



Output Response Characteristics

Response characteristics of the General Purpose output (Reference 3), and General Purpose output (Reference 4) are shown in the diagram below. Pulse width is configurable through software.
Please refer to the following response timing table.

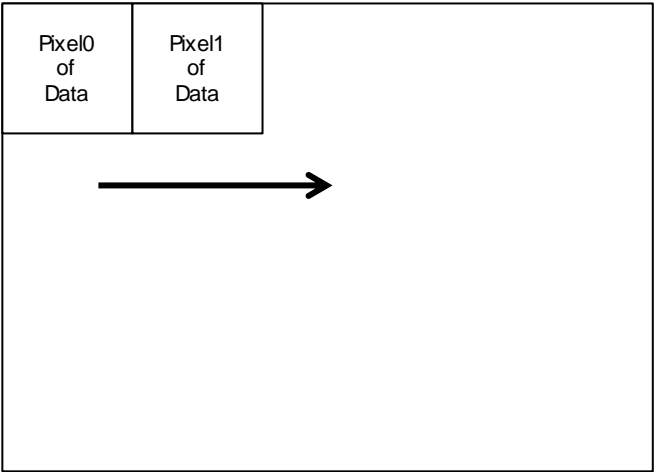
| | VCCext | | | |
|--------|------------|-----------|-----------|-----------|
| | OPEN(*1) | 5V (*2) | 12V (*2) | 24V (*2) |
| tOPDHL | 0.21 usec | 0.25 usec | 0.37 usec | 0.51 usec |
| tOPDLH | 10.40 usec | 2.69 usec | 2.68 usec | 2.61 usec |



(*1) Reference 3. Measured on +3.3V internal Voltage.
(*2) Reference 4

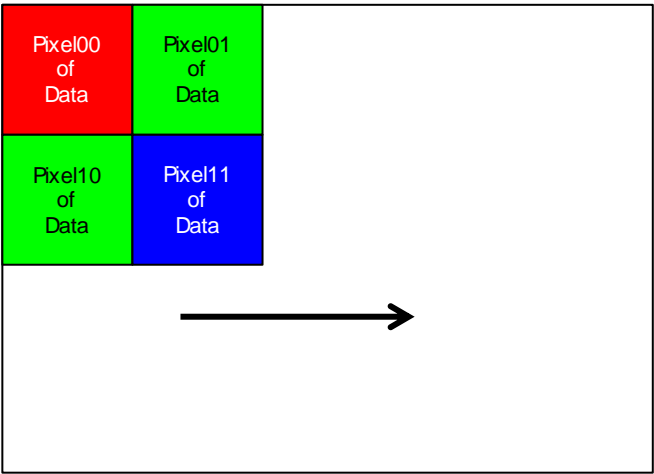
4 Sensor Information

4.1 Pixel Transferring Image
STC-MBS500U3V, STC-MBS312U3V (Monochrome)



Pixel (n) of Data: nth pixel being transferred

STC-MCS500U3V, STC-MCS312U3V (Color)



Pixel (m,n) of Data: nth pixel of the mth line being transferred

5 Image Acquisition and Camera Operational Modes

Please refer to [another chapter](#) for the method of switching Trigger.

GenICam Parameters

| | | |
|-----------------|-------------------|--|
| TriggerSelector | IEnumeration Type | Select Trigger function |
| TriggerMode | IEnumeration Type | Select ON/OFF which was selected function on TriggerSelector On: Trigger function ON, Off: Trigger function Off |
| TriggerSource | IEnumeration Type | Set Trigger Source which was selected function on TriggerSelector Software: Trigger control through TriggerSoftware command LineN: Trigger control through hardware trigger (N: Line number) |
| ExposureMode | IEnumeration Type | Select Exposure mode |

Please refer to IO function for the (*) Line.

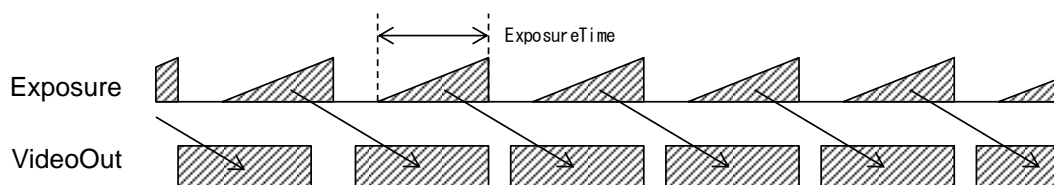
5.1 Freerun

Freerun mode outputs the camera video image continuously.

In order to run Freerun Mode, all trigger functions must be set to OFF via the Trigger mode.

Exposure time determines Exposure Mode. When Exposure Mode is turned off, the frame exposure will complete.

When Exposure Mode is set to Timed, the Exposure Time value will be set as the exposure time.



(*) The camera is set to Freerun mode as the default mode.

5.2 Trigger Mode

This trigger consists of Frame Start, Exposure Start and Exposure End.

1) Frame Start

This function has the capability to acquire an image from exposure through the trigger.

The Frame Start function can be enabled when "Frame Start" is selected on Trigger Selector and the Trigger mode is set to "On".

This function supports "Edge Preset" trigger and "Pulse Width" trigger with trigger signal. This function can control exposure through Exposure Mode.

2) Exposure Start, Exposure End

This function has the capability to acquire an image from Exposure Start to Exposure End. Exposure Start trigger is pair of Exposure End.

Exposure Start and Exposure End are selectable on Trigger Selector. Exposure Start function and Exposure End function can be enable through each Trigger Mode On.

This function is only enabled when Exposure Mode sets Trigger Controlled. If Exposure Mode did not set Triger Controlled, camera exposure and image acquisition don't work.

(*)Please do not apply the Trigger through maximum frame rate on Trigger Mode. When Trigger applies within sensor Readout as exposure end, camera interrupted Readout.

5.2.1 Frame Start Trigger (Edge Preset)

The exposure synchronizes trigger signal.

The value on Exposure Time is actual exposure time.

When the polarity on Line Inverter is positive (false), the Exposure starts on the rising edge of trigger.

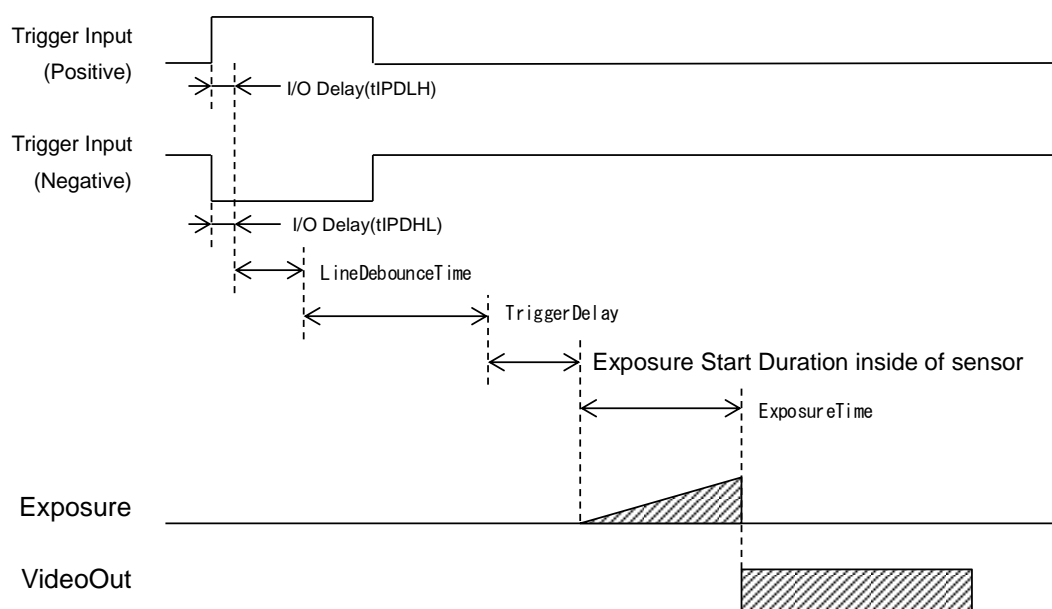
When the polarity on Line Inverter is negative (true), the Exposure starts on the falling edge of trigger.

To work the camera under this mode, as following setting have to be set.

- Exposure Mode: Timed
- Trigger Selector: Frame Start
- Trigger Mode: On

(*) On Trigger Mode except Frame Start should be set Off.

Timing



Delay time on exposure start timing in the sensor **Jitter** (unit: μ second)

| Video Output Format | STC-MCS500U3V STC-MBS500U3V | STC-MCS312U3V STC-MBS312U3V |
|---------------------|--------------------------------|--------------------------------|
| 8bit | 0 to 13.4 | 0 to 11.4 |
| 10bit | 0 to 13.4 | 0 to 11.4 |
| 10bit Packed | 0 to 13.4 | 0 to 11.4 |
| 12bit | 0 to 13.4 | 0 to 11.4 |
| 12bit Packed | 0 to 13.4 | 0 to 11.4 |

5.2.2 Frame Start Trigger (Pulse Width Trigger)

When operating in this mode, the exposure synchronizes the trigger signal.

The exposure time can be controlled by the pulse width of Frame Start trigger.

When the polarity on the Line Inverter is positive (false), the exposure can be controlled at a period of High level of input trigger signal.

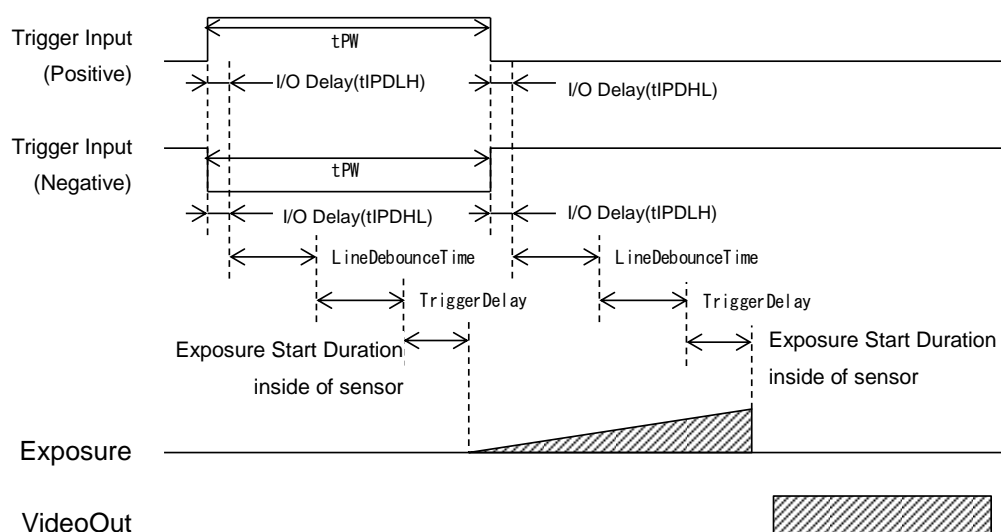
When the polarity on the Line Inverter is negative (true), the exposure can be controlled at a period of Low level of input trigger signal.

To operate the camera in this mode, the following settings have to be set.

- Exposure Mode: Trigger Width
- Trigger Selector: Frame Start
- Trigger Mode: On

(*) On Trigger Mode except Frame Start should be set Off.

Timing



Delay time on exposure start timing in the sensor **Jitter** (unit: μ second)

| Video Output Format | STC-MCS500U3V STC-MBS500U3V | STC-MCS312U3V STC-MBS312U3V |
|---------------------|--------------------------------|--------------------------------|
| 8bit | 0 to 13.4 | 0 to 11.4 |
| 10bit | 0 to 13.4 | 0 to 11.4 |
| 10bit Packed | 0 to 13.4 | 0 to 11.4 |
| 12bit | 0 to 13.4 | 0 to 11.4 |
| 12bit Packed | 0 to 13.4 | 0 to 11.4 |

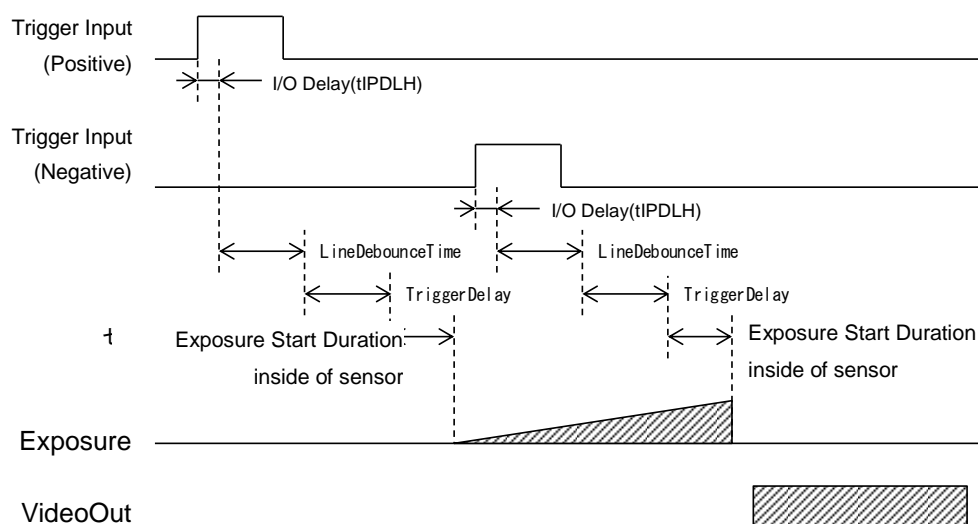
5.2.3 Exposure Start Trigger, Exposure End Trigger

Exposure Start trigger determines exposure start timing, Exposure End trigger determines exposure end timing.

To operate the camera under this mode, the following settings have to be set.

- Exposure Mode: Trigger Controlled
- Selects Trigger Selector: Exposure Start, and Trigger Mode: On
- Selects Trigger Selector: Exposure End, and Trigger Mode: On
- (*) On Trigger Mode except Frame Start should be set Off.

Timing



(*)When all of Trigger Mode (Frame Start trigger, Exposure Start trigger, Exposure End) are On, camera's behavior depends on Exposure Mode setting.

When the Exposure Mode sets the Trigger Control, this function works through Trigger Start/End Trigger. This function works through Frame Start trigger for the remainder of the Exposure Mode.

Delay time on exposure start timing in the sensor **Jitter** (unit: μ second)

| Video Output Format | STC-MCS500U3V STC-MBS500U3V | STC-MCS312U3V STC-MBS312U3V |
|---------------------|--------------------------------|--------------------------------|
| 8bit | 0 to 13.4 | 0 to 11.4 |
| 10bit | 0 to 13.4 | 0 to 11.4 |
| 10bit Packed | 0 to 13.4 | 0 to 11.4 |
| 12bit | 0 to 13.4 | 0 to 11.4 |
| 12bit Packed | 0 to 13.4 | 0 to 11.4 |

5.2.4 Trigger Software

This function can apply either external signal or a software command as the trigger.

The software trigger can be applied through the "execute Trigger Software" command when the trigger is selected on the Trigger Selector.

6 IO Function

This chapter describes the IO functions.

In this chapter the IO Port will be described as “Line”. The follow chart details the relationship of the Line and IO Port.

| IO Port Pin No. | Signal Name | Line number |
|--------------------|-------------|-------------|
| 2 | GPIO2 | Line2 |
| 3 | GPIO1 | Line1 |
| 4 | GPIO0 | Line0 |

GenICam Parameters

| | | |
|--------------------|-------------------|---|
| LineSelector | IEnumeration Type | Select Line |
| LineMode | IEnumeration Type | Switch input output direction into the Line that was selected on LineSelector. Input: set as input, Output: set as output |
| LineInverter | IBoolean Type | Switch polarity inversion ON/OFF into the Line that was selected on LineSelector. False: polarity inversion OFF (Active-H), True: polarity inversion ON (Active-L) |
| LineStatus | IBoolean Type | Line Status (High/Low) |
| LineSource | IEnumeration Type | Set function into the Line that was selected on LineSelector |
| UserOutputSelector | IEnumeration Type | Select UserOutput |
| UserOutputValue | IBoolean Type | Switch voltage level of UserOutput that was selected UserOutputSelector False: Low voltage level, True: High voltage level |

6.1 Input Port Function

This functions sets the input on Line Mode, then assigns Line as the input.

The following functions can be assigned as input.

6.1.1 Trigger Input

This sets the chosen port on the Trigger Source, then the input signal on the port can be assigned as Trigger.

The input signal can be switched to Active-Low(Line Inverter: true) or Active-High(Line Inverter: false) .

(*) When the Line polarity on Line Inverter is changed, this action will deal with the trigger input's transition inside of camera.

6.1.2 Line Status

This function monitors the signal status on the input port.

The High level (Line Status: true) or Low level (Line Status false) status can be seen through the software.

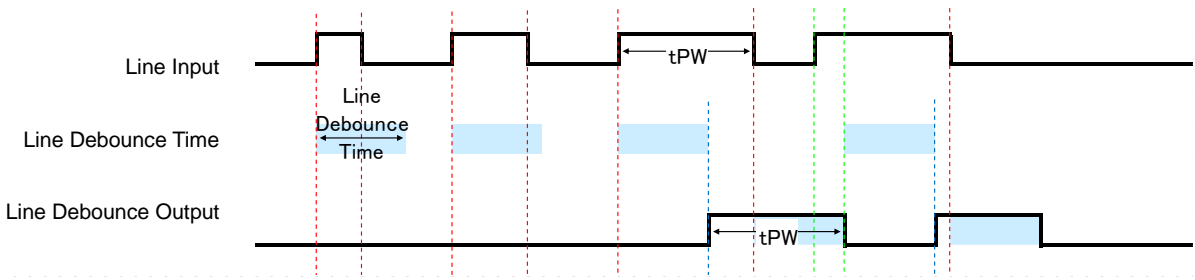
6.1.3 Line Debouncer

Line Debouncer can reduce the wrong signal detection inside of camera for filtering input signal(reduce the chattering and so on).

GenICamParameters

| | | |
|------------------|--------------|--|
| LineDebounceTime | Integer Type | Line Debounce Time Range: 0 to 10,000usec, Default: 1usec |
|------------------|--------------|--|

Timing



6.1.4 Trigger Delay

As was mentioned in the previous chapter, “Image acquisition and Camera Mode”, each trigger can add to the duration of the input signal

This Trigger Delay can add to the duration per usec uom.

GenICam Parameters

| | | |
|--------------|--------------|--|
| TriggerDelay | Integer Type | Trigger Delay Range: 0 to 262,143usec, Default: 0usec |
|--------------|--------------|--|

6.2 Output Port Function

This function sets the Output to Line Mode, then the Line is assigned as the input.

The following functions can be assigned when the IO port is used as the output

6.2.1 Line Source

The following list shows the configurable functions available through the Line Source.

The function that is described as “Enable” on Changeable Polarity is the configurable polarity on the Line Inverter(true, false).

| No. | Function Name | Changeable Polarity |
|-----|------------------|---------------------|
| 1) | Off (Default) | - |
| 2) | User Output | - |
| 3) | Trigger Out | Enable |
| 4) | Exposure End Out | Enable |
| 5) | Frame End Out | Enable |
| 6) | Transfer End Out | Enable |
| 7) | Strobe Out | Enable |
| 8) | Exposure Active | Enable |

1) Off (Disable)

Disable to output the signal.

2) User Output (General Output)

Output the High or Low level signal that was previously set on the software.

3) Trigger Out (Trigger Output)

This function outputs the signal added by the Trigger Out Delay(Output pulse duration) and the Trigger Out on Time (Output pulse width).

4) Exposure End Out (Exposure End)

This function outputs the signal added by the Trigger Out Delay(Output pulse duration) and the Trigger Out on Time (Output pulse width) after exposure has finished.

5) Frame End Out (Sensor Readout End)

This function outputs the signal added by the Trigger Out Delay(Output pulse duration) and the Trigger Out on Time (Output pulse width) when sensor read out is finished.

6) Transfer End Out (Transfer End Output)

This function outputs the signal added by the Trigger Out Delay(Output pulse duration) and the Trigger Out on Time (Output pulse width) when the single image frame transfer from camera is finished.

7) Strobe Out (Strobe Output)

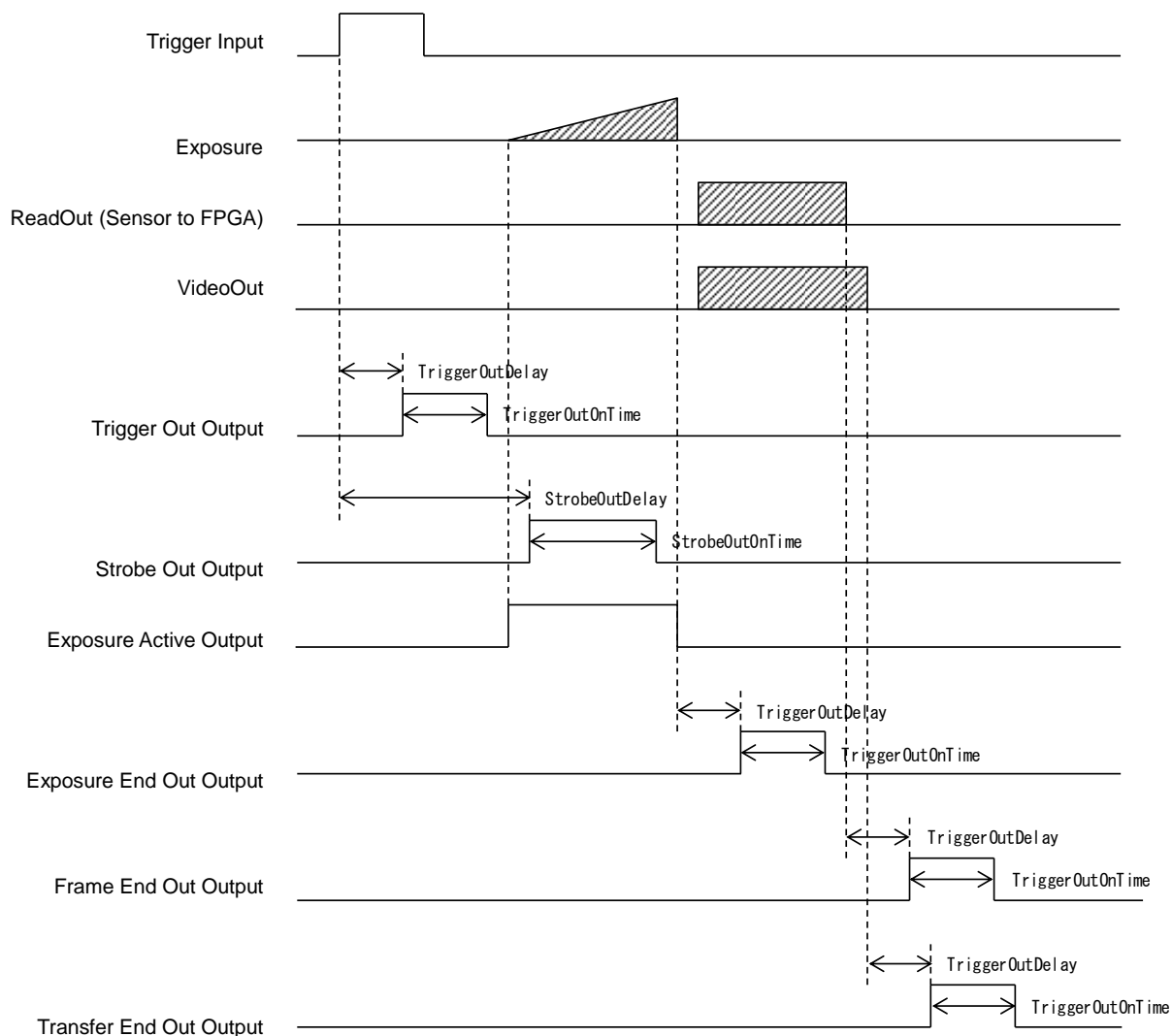
This function outputs the signal added by the Strobe Out Delay(Strobe output duration) and the Strobe Out on Time (Strobe output pulse width) when the trigger signal is received.

8) Exposure Active (In Exposure Period)

Outputs the exposure timing.

(*) Actual exposure period = Output signal pulse width + Minimum exposure time 13.73 usec

Line Source Timing



(*) This timing chart does not describe the duration on the IO circuit

(*) The trigger port in this chart describes Frame Start trigger as an example

(*) Trigger Out, Strobe Out output don't response with Exposure Start trigger, Exposure End trigger

6.2.1 User Output

The User Output outputs the High or Low level signal that was configured on the software.

Setting Procedure

Selects Line N(N: any number from 0,1,2)

- 1) **Sets the User Output N(N is Line number) as Line Source**
- 2) **Selects User Output N(N is same as selected Line number on User Output) on User Output Selector**
- 3) **Sets the value (True: High level, False: Low level) on User Output Value**

6.2.2 Line Status

Monitor the status on output port.

Monitor the output voltage level High (Line Status: true) or Low (Line Status: false) through the software.

6.2.3 Output signal duration setting and Pulse width setting

Some selectable functions can be modified in order to add to the duration or pulse width on Line Source.

The configurable parameters are shown in the chart below.

Please refer to Line Source for the applicable functions of Parameters.

GenICamParameters

| | | |
|------------------|--------------|---|
| TriggerOutDelay | Integer Type | Trigger Out Delay Range: 0 to 262,143usec, Default: 0usec |
| TriggerOutOnTime | Integer Type | Trigger Out On Time Range: 4 to 262,143usec, Default: 32usec |
| StrobeOutDelay | Integer Type | Strobe Out Delay Range: 0 to 262,143usec, Default: 30usec |
| StrobeOutOnTime | Integer Type | Strobe Out On Time Range: 4 to 262,143usec, Default: 32usec |

6.3 Hardware Reset

Hardware reset can be done through CAM_RESET port.

Sets on (Default : Off) on Line Device Reset Mode, and rest the camera to apply the Low voltage in 5 sec on CAM_RESET port.

7 Camera Operation

This chapter describes camera operation.

7.1 ROI (Region of Interest)

This sets the ROI in order to output the selected image.

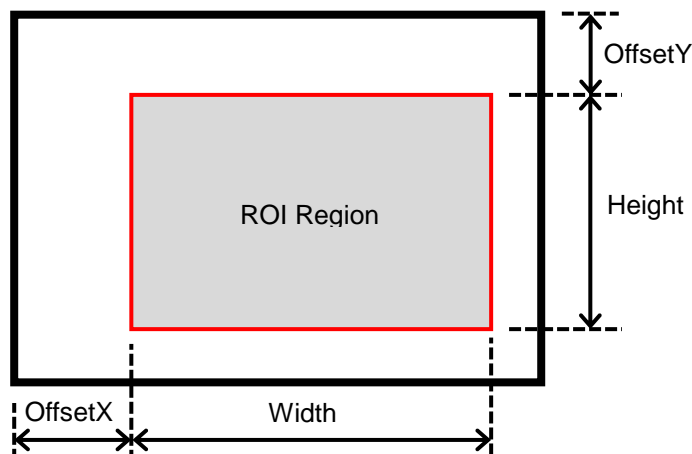
ROI will decrease the height of the image, while increasing the frame rate. This will also decrease the width of the image, but that does not affect the frame rate.

7.1.1 ROI (One Region)

GenICam Parameters

| | | |
|---------|--------------|--|
| Width | Integer Type | Horizontal(Pixel) size Sets the maximum value less than (Width + OffsetX) |
| Height | Integer Type | Vertical(Line) size Sets the maximum value less than (Height + OffsetY) |
| OffsetX | Integer Type | Horizontal(Pixel) offset Default: 0 Setting interval: 4 pixel unit |
| OffsetY | Integer Type | Vertical(Line) offset Default: 0 Setting interval: 4 line unit |

The parameters defines as following chart.



(*) Width, Height, OffsetX, OffsetY's setting interval is the same in Binning and Decimation.

Range: Width / Height setting range for each model

| | | STC-MBS500U3V STC-MCS500U3V | STC-MBS312U3V STC-MCS312U3V |
|--------|------------------|--|---|
| Width | Setting Range: | 64to2448 (*) Maximum value is up to 2432 on Packed output | 64to2048 |
| | Default: | 2448 | 2048 |
| | Setting Interval | 16 Pixel unit (*) 64 Pixel unit on Packed output | 16 Pixel unit (*) 64 Pixel unit on Packed output |
| Height | Setting Range: | 32to2048 | 32to1536 |
| | Default: | 2048 | 1536 |
| | Setting Interval | 4 Line unit | 4 Line unit |

7.1.2 Multi ROI

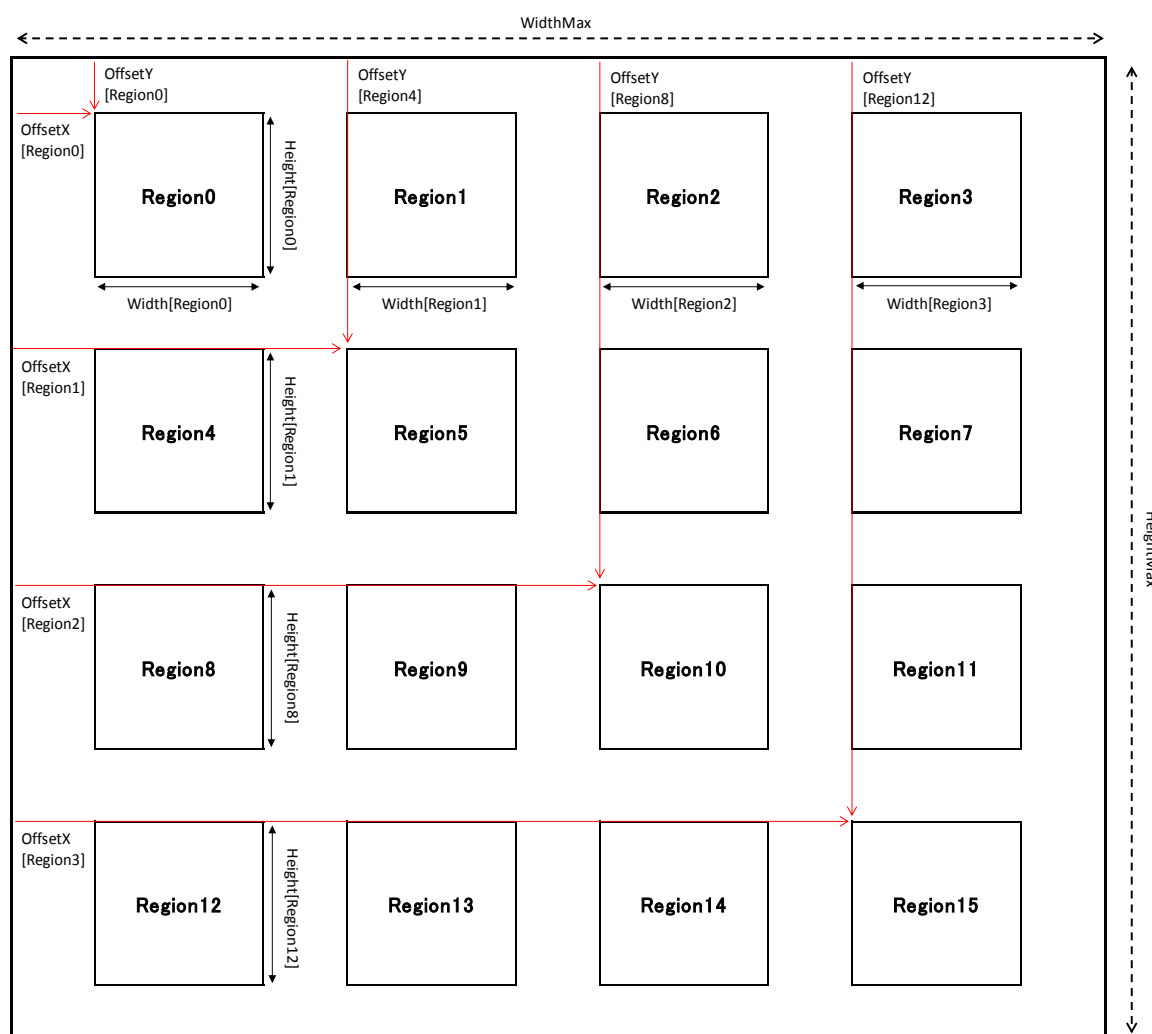
When utilizing the Multi-ROI function, please make note of the following:

This image format is Sentech original format, it does not comply with USB3Vision. Therefore this Multi ROI will not work on 3rd party applications that conform to USB3Vision.

To use Multi ROI, one of following application is required.

- The application that built on Sentech's SDK
- The application that built on Sentech's DirectShowFilter
- The application that built on Sentech's GenTL module (*1)

(*1) Sentech's original format data process has to be implemented into application



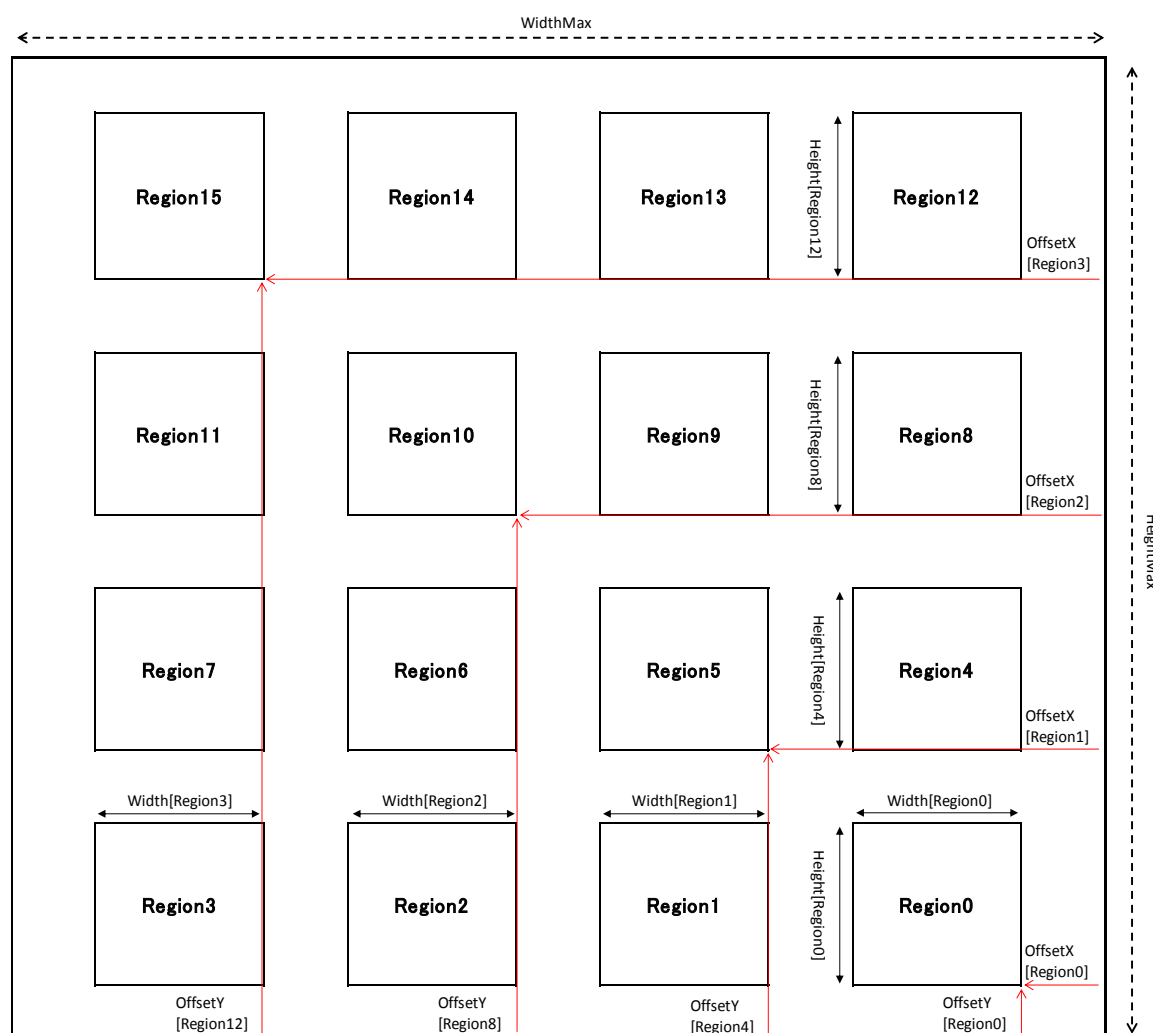
Multi ROI can be configure 16 regions as Region 0 to 15.

Restriction of ROI operation

- Region 0 is always ON
 - Region(X+Y) can be enable (ON) after sets ON Region(X) and Region(Y).
- (X, Y : Region number, X is any number from 1 to 3, Y is any number from 4,8,12)

- The following restriction exist to set region's Width, Height, OffsetX and OffsetY
 $Width[RegionN] = Width[Region(N+4)] = Width[Region(N+8)] = Width[Region(N+12)]$
 $Height[RegionN] = Height[Region(N+4)] = Height[Region(N+8)] = Height[Region(N+12)]$
 $OffsetX[RegionN] = OffsetX[Region(N+4)] = OffsetX[Region(N+8)] = OffsetX[Region(N+12)]$
 $OffsetY[RegionN] = OffsetY[Region(N+4)] = OffsetY[Region(N+8)] = OffsetY[Region(N+12)]$
(N: Region Number 0to3)
- Overlapped region setting is invalid
- When setting the Horizontal flip, Vertical flip, Horizontal Vertical flip, position of region 0 to 15 are changed. Please refer to the drawing that follows.
- All of selected data outputs as single image data.
- If Binning / Decimation is enable, obtained Width and Height values are as "Binning/Decimation" ed value.

Region number and position setting on Horizontal Vertical flip.



7.2 Pixel Format

The Camera output image data format can be set on the Pixel Format.

GenICam Parameters

| PixelFormat | IEnumeration Type | Pixel Format |
|-------------|-------------------|--------------|
|-------------|-------------------|--------------|

The following chart shows the available Pixel Formats on the camera:

| Output Bit | Pixel Format | |
|--------------|-------------------|--------------|
| | Monochrome Camera | Color Camera |
| 8bit | Mono8 | BayerRG8 |
| 10bit | Mono10 | BayerRG10 |
| 10bit Packed | Mono10p | BayerRG10p |
| 12bit | Mono12 | BayerRG12 |
| 12bit Packed | Mono12p | BayerRG12p |

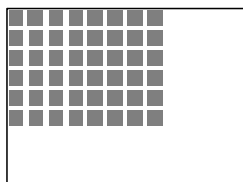
Each format is specified on GenIcam PFNC.

7.3 Binning

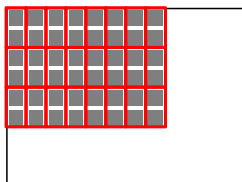
Binning can add and average beside of pixel data into one pixel.

The pixel data inside of red square add or average as one pixel.

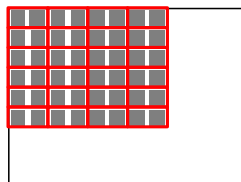
Binning X(Off), Y(Off)



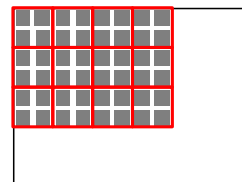
Binning X(Off), Y(On)



Binning X(On), Y(Off)



Binning X(On), Y(On)

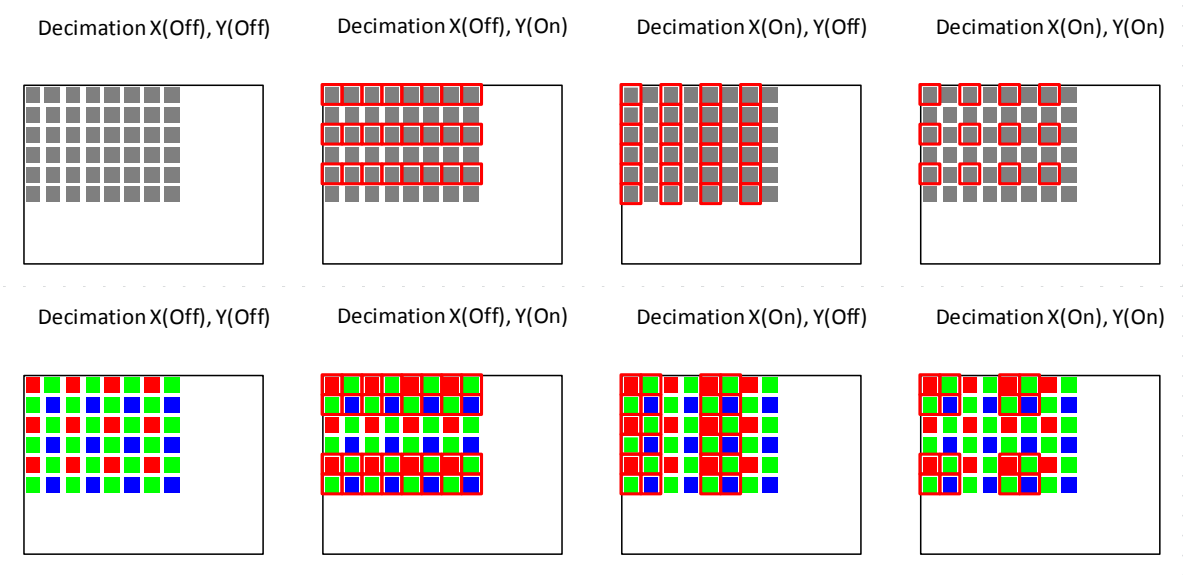


GenICamParameters

| | | |
|-------------------|--------------|---|
| BinningHorizontal | Integer Type | Sets Binning on Horizontal direction 1: Disable Binning 2: Binning 2 Pixel |
| BinningVertical | Integer Type | Sets Binning on Vertical direction 1: Disable Binning 2: Binning 2 Pixel |

7.4 Decimation

When using Decimation mode, the decimated image can be output.
The images below show the Decimated pixels (red squares) where they are output.



GenICam Parameters

| | | |
|----------------------|--------------|---|
| DecimationHorizontal | Integer Type | Sets decimation on horizontal direction 1: Decimation Off 2: 2Decimate one pixel |
| DecimationVertical | Integer Type | Sets decimation on vertical direction 1: Decimation Off 2: 2Decimate one pixel |

(*) Binning and Decimation cannot work simultaneously

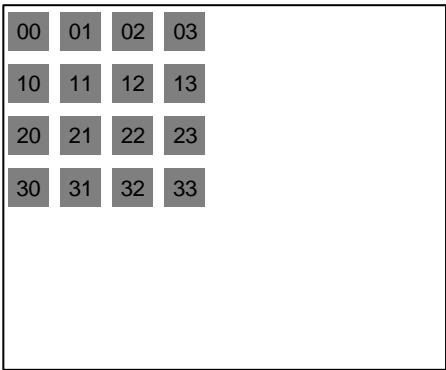
7.5 Image Flip

Mirror flip the image through ReverseX and ReverseY.

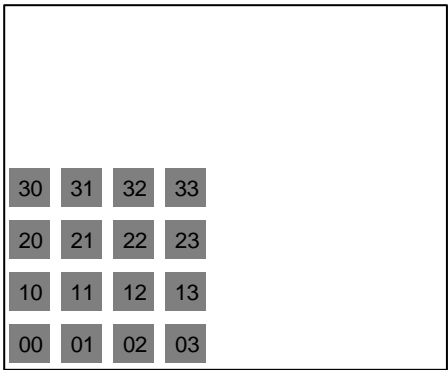
GenICam Parameters

| | | |
|----------|---------------|---|
| ReverseX | IBoolean Type | Switch ON/OFF on Horizontal False: Horizontal Flip Off, True: Horizontal Flip On. Default: False |
| ReverseY | IBoolean Type | Switch ON/OFF on Vertical False: Horizontal Flip Off, True: Horizontal Flip On. Default: False |

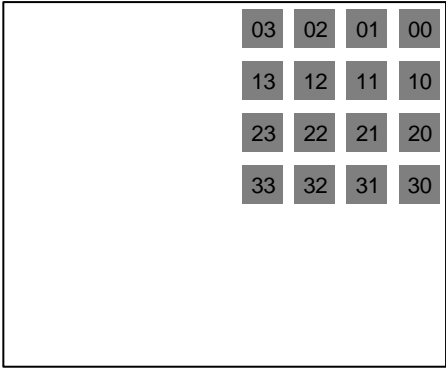
Reverse X(Off), Y(Off)



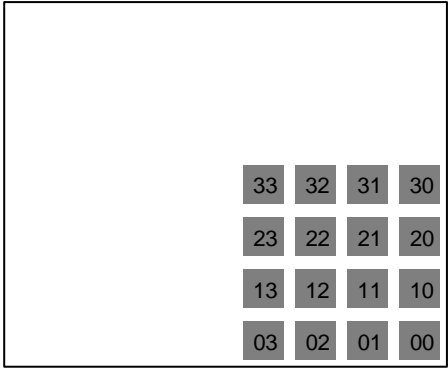
Reverse X(Off), Y(On)



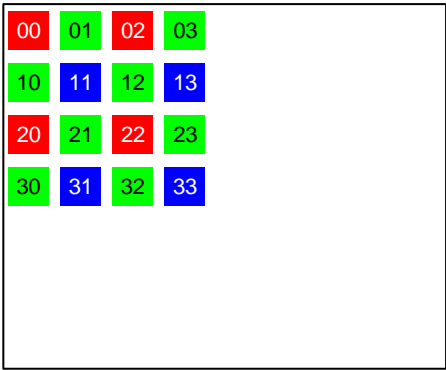
Reverse X(On), Y(Off)



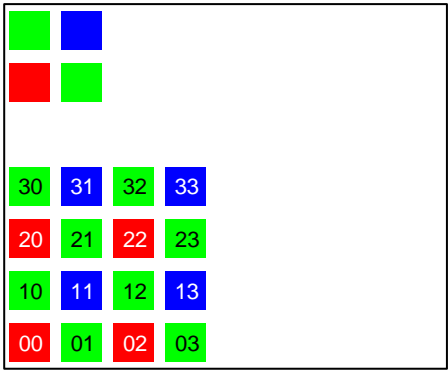
Reverse X(On), Y(On)



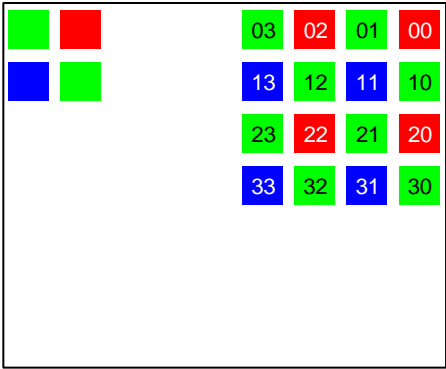
Reverse X(Off), Y(Off)



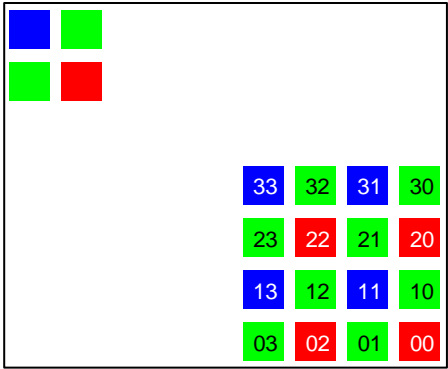
Reverse X(Off), Y(On)



Reverse X(On), Y(Off)



Reverse X(On), Y(On)



(*) When the image is flipped on the color camera, the pixel array is also inverted.

7.6 Gain

Gain has Analog Gain, Digital Gain and White Balance.

- (*) Increasing the gain level may increase the noise level. Please check the actual image on the actual environment when adjusting brightness.

7.6.1 Analog Gain

This parameter sets the analog gain.

Selects Analog ALL on Gain Selector, sets gain on Gain[gain Selector].

GenICam Parameters

| | | |
|------------------|----------------|--|
| Gain[Analog All] | IFloat Type | Analog Gain Range: 0to208, Default: 0 |
|------------------|----------------|--|

Analog Gain Formula

$$\text{Gain(dB)} = \text{Gain[Analog All]} / 10$$

7.6.2 Digital Gain

This parameter sets the digital gain.

Selects Digital ALL on Gain Selector, sets gain on Gain[gain Selector].

GenICam Parameters

| | | |
|-------------------|----------------|--|
| Gain[Digital All] | IFloat Type | Digital Gain Range: 0to64, Default: : 0 |
|-------------------|----------------|--|

Digital Gain Formula

$$\text{Gain(xtimes)} = 1 + (\text{Gain[Digital All]} \nearrow 64)$$

7.6.3 White Balance Gain (Only available for the color cameras)

This parameter sets the Bayer patter color gain.

Sets gain on Balance Ratio against selected color on Balance Ratio Selector.

As for the detail of manipulation, Auto White Balance”.

GenICam Parameters

| | | |
|------------------------------------|----------------|--|
| BalanceRatio[BalanceRatioSelector] | IFloat Type | White Balance Gain Range: 0 to 511, Default: Red: 229, Green: 128, Blue: 272 |
|------------------------------------|----------------|--|

White Balance Gain Formula

$$\text{Gain(xtimes)} = \text{BalanceRatio[BalanceRatioSelector]} \nearrow 128$$

7.7 Black Level

This parameter sets the black level (the clamp level for the black signal).
Sets the black level on Black Level[Black Leel Selector] against Node on Black Level Selector.
The bottom of the signal is clamped at this setting level. The signal does not become below this level.

(*) Black Level Selector support for Analog All

GenICam Parameters

| | | |
|----------------------------------|----------------|--|
| BlackLevel[Black Level Selector] | IFloat Type | Black Level Default: 7 (on 8bit output) Range: 8bit output 0 to 31 10bit output 0 to 127 (10bit Packed outputs same as this mode) 12bit output 0 to 511 (12bit Packed outputs same as this mode) |
|----------------------------------|----------------|--|

7.8 ALC (Auto Light Control)

ALC has AGC and Auto Exposure function, it can be set individually.

ALC sets the camera parameters to adjust the brightness automatically.

GenICam Parameters (for AGC and Auto Exposure)

| | | |
|-----------------|--------------|--|
| AutoLightTarget | Integer Type | Target Brightness Range: 0 to 255, Default: 127 |
|-----------------|--------------|--|

Target Brightness Formula (Auto Light Target)

8bit output : Target Brightness(Gradient) = Auto Light Target

10bit output : Target Brightness(Gradient) = Auto Light Target × 4

12bit output : Target Brightness(Gradient) = Auto Light Target × 16

7.8.1 ALC Control Method

AGC and Auto Exposure contribute to achieve Auto Light Target.

When AGC and Auto Exposure are ON, at first, Auto Exposure control have to be done, If AGC can not achieve Auto Light Target, AGC control take over the brightness control.

7.8.2 AGC (Auto Gain Control)

Adjust the gain to accommodate target brightness automatically.

When it was darker than target value, increase the gain up to Gain Auto Limit Max.

When it was brighter than target value, decrease the gain up to Gain Auto Limit Min.

GenICam Parameters

| | | |
|------------------|-------------------|---|
| GainAuto | IEnumeration Type | Switch ON/OFF on AGC Continuous: AGC ON, Off: AGC OFF. Default: Off |
| GainAutoLimitMax | IFloat Type | Sets the maximum gain on AGC Range: 0 to 208, Default: 127 This value sets as maximum value on AGC. |
| GainAutoLimitMin | IFloat Type | Sets the minimum gain on AGC Range: 0to127, Default: 0 This value sets as minimum value on AGC. |

7.8.3 Auto Exposure

Adjust the gain to accommodate target brightness automatically.

When it was darker than target value, extend exposure time up to Exposure Auto Limit Max.

When it was darker than target value, reduce exposure time up to Exposure Auto Limit Min.

GenICamParameters

| | | |
|----------------------|-------------------|--|
| ExposureAuto | IEnumeration Type | Switch ON/OFF on Auto Exposure Continuous: Auto Exposure ON, Off: Auto Exposure OFF. Default: Off |
| ExposureAutoLimitMax | IFloat Type | Sets the maximum exposure time on μ second unit Range: Same as Exposure Time Range for each PixelFormat |
| ExposureAutoLimitMin | IFloat Type | Sets the minimum exposure time on μ second unit Range: Same as Exposure Time Range for each PixelFormat |

7.8.4 The procedure of ALC

Please follow the procedure shown below.

Setting Procedure

1. Sets Timed on Exposure Mode (When Auto Exposure is applicable)
2. Sets Continuous on Exposure Auto (When Auto Exposure is applicable)
3. Sets Exposure Auto Limit Max (When Auto Exposure is applicable)
4. Sets Exposure Auto Limit Min (When Auto Exposure is applicable)
5. Sets Continuous on Gain Auto (When AGC is applicable)
6. Sets Gain Auto Limit Max (When AGC is applicable)
7. Sets Gain Auto Limit Min (When AGC is applicable)

7.9 White Balance (Only available for the color cameras)

The color compensates the gain adjustment for each individual color.

The gain for each color has to adjust with the flat white target to the each color has the same brightness.

The white balance control methods are the listed in the below:

- Disable
- Manual (Off)
- Auto White Balance (Continuous)
- Push to set white balance (Once)

7.9.1 White balance control methods

GenICam Parameters

| | | |
|----------------------|-------------------|---|
| BalanceWhiteAuto | IEnumeration Type | White balance control method selection. Default: : Off(Manual) |
| BalanceRatioSelector | IEnumeration Type | White balance control target color selection. |
| BalanceRatio | IFloat Type | Color gain setting for the color selects at BalanceRatioSelector |

7.9.2 Disable

Sets disable on White Balance Gain, each color gain set as x1.

Setting Procedure

1. Sets Disable on Balance White Auto

7.9.3 Manual (Off)

The optimized Balance Ratio(Red, Green, Blue) for the white balance.

Setting Procedure

1. Sets Red (when Red gain set) on Balance White Selector
2. Sets value on Balance Ratio
3. Sets Green on Balance White Selector
4. Sets value on Balance Ratio
5. Sets Blue (when Blue gain set) on Balance White Selector
6. Sets value on Balance Ratio
7. Sets Off on Balance White Auto

7.9.4 Auto White Balance (Continuous)

The optimized white balance gain calculates each frame for the auto white balance

Setting Procedure

1. Sets Continuous on Balance White Auto

7.9.5 Push to Set White Balance (Once)

The white balance gain adjusts once after selecting white balance then set to Balance White (Red, Green, Blue)

Sets OFF at Balance White Auto automatically after set White Balance Gain.

Setting Procedure

1. Sets the flat white target (To set right white balance)
2. Sets Once on Balance White Auto

7.10 Gamma Table

The gamma table inside of the camera corrects the gradient linearity.

GenICam Parameters

| | | |
|-------|-------------|---|
| Gamma | IFloat Type | Gamma Range: 0.1 to 4.0, Default: 1.0, Step: 0.1 |
|-------|-------------|---|

Gamma Formula

On 12bit

$$\text{Output Data} = 4096 \cdot \left(\frac{\text{Input Data}}{4096} \right)^\gamma$$

On 10bit

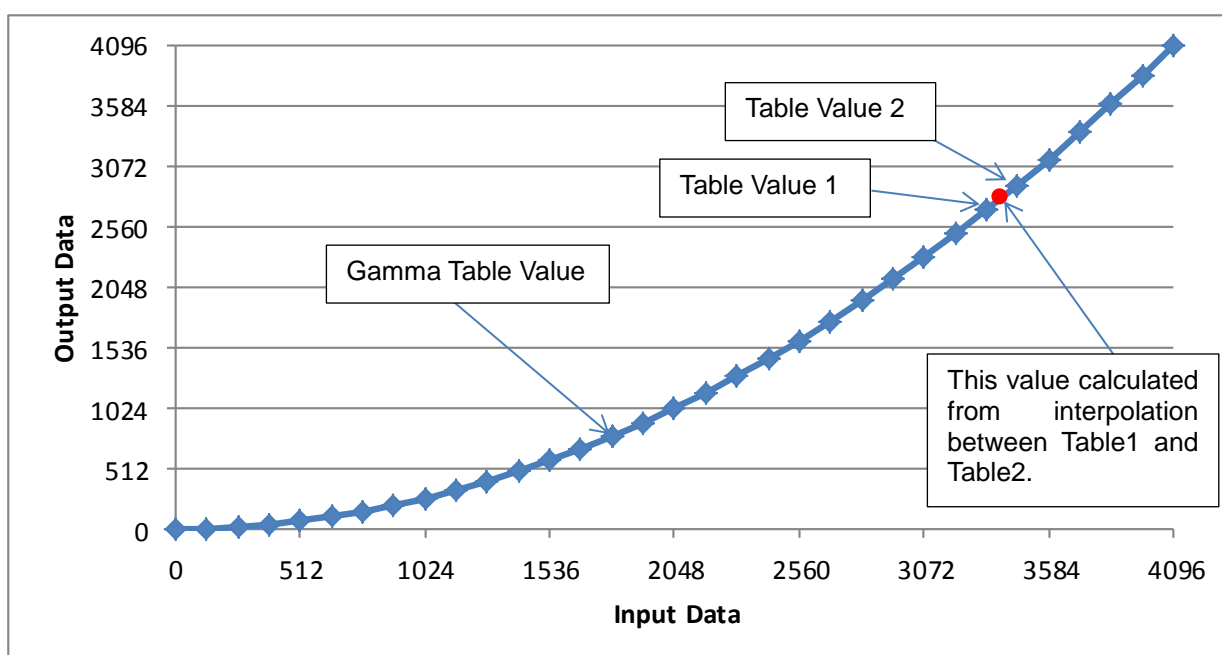
$$\text{Output Data} = 1024 \cdot \left(\frac{\text{Input Data}}{1024} \right)^\gamma$$

On 8bit

$$\text{Output Data} = 256 \cdot \left(\frac{\text{Input Data}}{256} \right)^\gamma$$

Input signal divided into 32, and set as 33 Gamma table values. When middle number between Table 1 to Table2 was inputted, linear Interpolated value would be outputted.

Case: 12bit Output (e.g. Gamma =2.0)



7.11 Save and load the camera setting data

The camera has the camera setting including the factory default, load function.

The camera has below two camera settings.

Default: The factory default data (This data cannot change)

User Set X: Changeable data (X: 0 to 7 any integer)

These camera settings load to the register in the RAM on the camera.

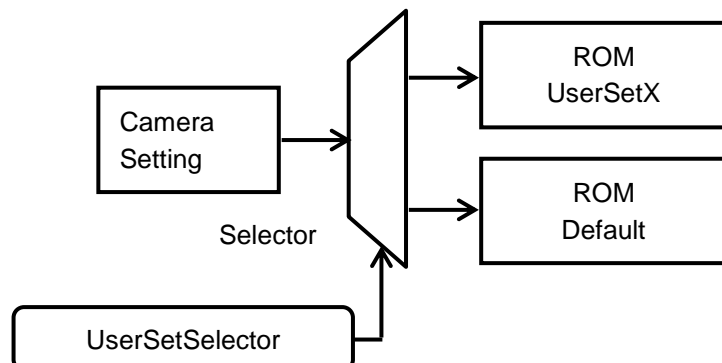
The camera settings saving and loading is controllable with Parameters (User Set Selector, User Set Default), and commands (UserSetLoad, UserSetSave) in UserSetControl category of GenICam.

The details of the parameters and the functions are in the table below:

GenICam Parameters

| | | |
|-----------------|-------------------|---|
| UserSetSelector | IEnumeration Type | Select "Default" or "UserSet1" UserSetLoad or UserSetSave process for the selected data. |
| UserSetLoad | ICommand Type | The camera settings load from ROM to the register in RAM. |
| UserSetSave | ICommand Type | The camera settings at the register in RAM save to ROM. |
| UserSetDefault | IEnumeration Type | Select which settings ("Default or UserSet X) load automatically when the camera power is on. Selection saves automatically. |

7.11.1 Saving the Camera Settings



When UserSetSave is executing, the camera settings in the RAM register are saved to the ROM that is selected at UserSetSelector.

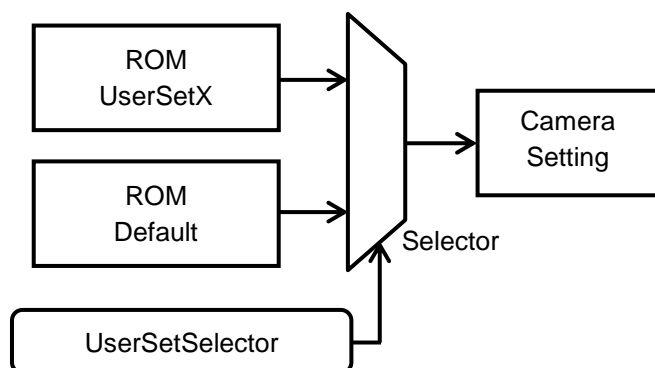
Caution:

User Set Save can't be executed when Default was selected on User Set Selector

Setting Procedure

1. Selects "UserSetX" at UserSetSelector
2. Execute User Set Save

7.11.2 The Camera Settings Loading

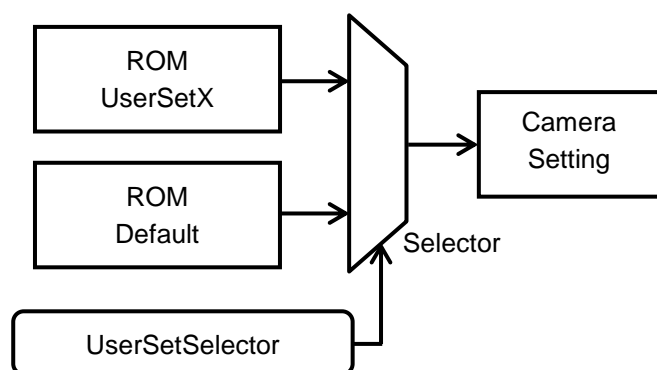


When UserSetLoad is executing, the camera settings load from the selected ROM that was assigned on User Set Selector to the register at RAM.

Setting Procedure

1. Select User Set X (or Default) at User Set Selector
2. Execute User Set Load

7.11.3 The Camera Settings Loading When the Camera Power is on



When the camera power is on, the camera settings load from the selected ROM that was assigned on User Set Default to the register at RAM.

Setting Procedure

1. Set User Set X or Default on User Set Default

7.11.4 The Camera Settings Initialization

Please follow the below procedure for the camera settings put back to the factory default.

Setting Procedure

1. Selects "Default" at UserSetSelector.
2. Executes UserSetLoad.

7.12 Pixel Defect Correction

Corrects the defect pixel, refer from horizontally beside pixel.

In the color camera, correct the defect pixel refer from horizontally beside same color pixel.

When consecutive defect pixels are selected, corrects up to 2pixels.

GenICamParameters

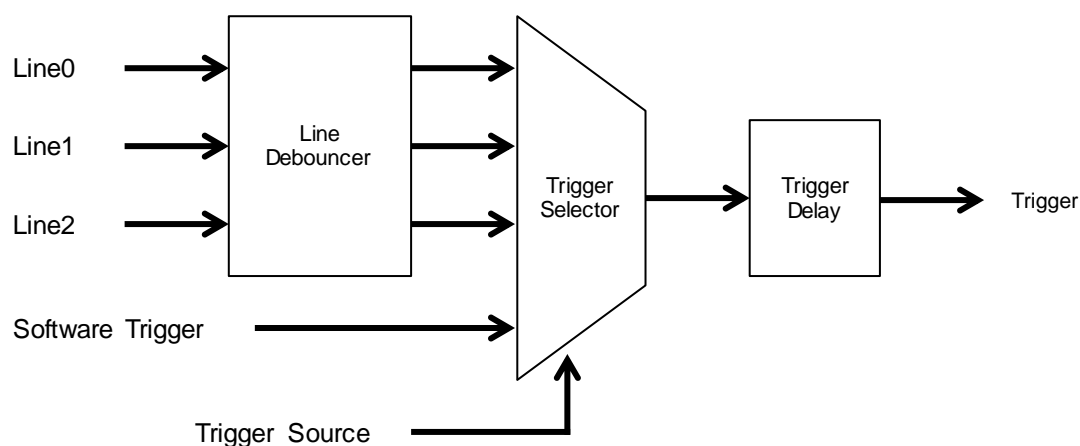
| | | |
|---------------------------|---------------|---|
| PixelCorrectionAllEnabled | IBoolean Type | Switch ON/OFF on Pixel Defect Correction True: ON, False: OFF |
| PixelCorrectionIndex | Integer Type | PixelCorrectionIndex |
| PixelCorrectionX | Integer Type | Defect position on X coordinate against Index was selected on PixelCorrectionIndex |
| PixelCorrectionY | Integer Type | Defect position on Y coordinate against Index was selected on PixelCorrectionIndex |
| PixelCorrectionEnabled | IBoolean Type | Switch ON/OFF on pixel defect correction against Index was selected on PixelCorrectionIndex True: ON, False: OFF |

7.13 Trigger

As for the decryption of Trigger Type and Characteristic, please refer to the chapter Image acquisition and Camera Mode.

7.13.1 Trigger Signal Process

When the external hardware or software signal is input, the following process should be done.



7.14 Device User ID

Device User ID provides the user access to the writable memory area.

Up to 64bytes data can be stored (The data still remains, even turned off the camera)

When the data is less than 64bytes, please add 0x00 at the end of character.

7.15 Event Control (Only USB3 Vision protocol)

The camera can inform the event inside of the camera to host.

GenICamParameters

| | | |
|-------------------|----------------------|--|
| EventSelector | IEnumeration Type | Select EventFunction |
| EventNotification | IEnumeration Type | Switch ON/OFF on Event function that was selected EventSelector. On: Event function ON, Off: Event function OFF |

7.15.1 The way to use Event

To be enable the Event Selector, please select to be available Event on Event Selector.

7.15.2 Event Function

The camera event functions are as follows.

- 1) Event Exposure Start
Inform exposure start timing inside of camera as Event.
Event ID is 0x9002.
- 2) Event Exposure End
Inform exposure end timing inside of camera as Event.
Event ID is 0x9001.

(*) Since Event and Stream (image data) share USB bus, when the Event came up frequently, Stream's data transfer rate would be decreased.

7.16 Chunk Control (Only USB3 Vision protocol)

This function has transferring additional data with image data.

For example, the exposure time and gain information aren't included in image data itself. However Chunk data transfers parameters when image was obtained with.

GenICam Parameters

| | | |
|-----------------|-------------------|--|
| ChunkModeActive | IBoolean Type | Enable transfer Chunk data on Payload True: Enable Chunk data transfer, False: Disable Chunk data transfer, |
| ChunkSelector | IEnumeration Type | Select the transfer Chunk data |
| ChunkEnable | IBoolean Type | Enable Chunk data that was selected ChunkSelector True: Enable Chunk data, False: Disable Chunk data |

7.16.1 The way to use Chunk

To enable Chunk, please Enable Chunk data after Chunk mode active.

Setting Procedure

1. To enable Chunk, set True on Chunk Mode Active
2. Select on Chunk data type (later) Chunk Selector
3. To enable Chunk Set True on Chunk Enable

7.16.2 Chunk Data

1) Chunk Counter Value

Transfer the value of Counter0 inside of camera as Chunk data.
Chunk ID is 0x00000001.

Frame Start, Frame End, Frame Trigger can be set as Counter Event Source. Execute Counter Reset to reset Counter.

2) Chunk Gain

Transfer the Gain when image was obtained as Chunk data.

Chunk Gain contains Analog All, Digital All, Red, Blue, and Green
Chunk ID is 0x00000002.

3) Chunk Black Level

Transfer the Black Level when image was obtained as Chunk data.

Chunk Black Level contains Analog All and Digital All.
Chunk ID is 0x00000003.

4) Chunk Exposure Time

Transfer the exposure time when image was obtained as Chunk data.
Chunk ID is 0x00000004.

5) Chunk Gamma

Transfer the Gamma when image was obtained as Chunk data.
Chunk ID is 0x00000005.

7.17 GenICam command list

7.17.1 DeviceControl

| Name | Description |
|----------------------------------|--|
| DeviceType | Returns the device type. |
| DeviceScanType | Scan type of the sensor of the device. |
| DeviceVendorName | Name of the manufacturer of the device. |
| DeviceModelName | Model of the device. |
| DeviceFamilyName | Identifier of the product family of the device. |
| DeviceManufacturerInfo | Manufacturer information about the device. |
| DeviceVersion | Version of the device. |
| DeviceFirmwareVersion | Version of the firmware in the device. |
| DeviceSerialNumber | Device's serial number. This string is a unique identifier of the device. |
| DeviceUserID | User-programmable device identifier. |
| DeviceSFNCVersionMajor | Major version of the Standard Features Naming Convention that was used to create the device's GenICam XML. |
| DeviceSFNCVersionMinor | Minor version of the Standard Features Naming Convention that was used to create the device's GenICam XML. |
| DeviceSFNCVersionSubMinor | Sub minor version of Standard Features Naming Convention that was used to create the device's GenICam XML. |
| DeviceManifestEntrySelector | Selects the manifest entry to reference. |
| DeviceManifestXMLMajorVersion | Indicates the major version number of the GenICam XML file of the selected manifest entry. |
| DeviceManifestXMLMinorVersion | Indicates the minor version number of the GenICam XML file of the selected manifest entry. |
| DeviceManifestXMLSubMinorVersion | Indicates the subminor version number of the GenICam XML file of the selected manifest entry. |
| DeviceManifestSchemaMajorVersion | Indicates the major version number of the schema file of the selected manifest entry. |
| DeviceManifestSchemaMinorVersion | Indicates the minor version number of the schema file of the selected manifest entry. |
| DeviceTLType | Transport Layer type of the device. |
| DeviceTLVersionMajor | Major version of the Transport Layer of the device. |
| DeviceTLVersionMinor | Minor version of the Transport Layer of the device. |
| DeviceTLVersionSubMinor | Sub minor version of the Transport Layer of the device. |
| DeviceGenCPVersionMajor | Major version of the GenCP protocol supported by the device. |
| DeviceGenCPVersionMinor | Minor version of the GenCP protocol supported by the device. |
| DeviceMaxThroughput | Maximum bandwidth of the data that can be streamed out of the device. This can be used to estimate if the connection can sustain transfer of free-running images from the camera at its maximum speed. |
| DeviceLinkSelector | Selects which Link of the device to control. |
| DeviceLinkThroughputLimitMode | Controls if the DeviceLinkThroughputLimit is active. When disabled, lower level TL specific features are expected to control the throughput. When enabled, DeviceLinkThroughputLimit controls the overall throughput. |
| DeviceLinkThroughputLimit | Limits the maximum bandwidth of the data that will be streamed out by the device on the selected Link. If necessary, delays will be uniformly inserted between transport layer packets in order to control the peak bandwidth. |
| DeviceLinkCommandTimeout | Indicates the command timeout of the specified Link. This corresponds to the maximum response time of the device for a command sent on that link. |
| DeviceCharacterSet | Character set used by the strings of the device's bootstrap registers. |
| DeviceReset | Resets the device to its power up state. |
| DeviceRegistersStreamingStart | Prepare the device for registers streaming without checking for consistency. |
| DeviceRegistersStreamingEnd | Announce the end of registers streaming. This will do a register set validation for consistency and activate it. |

| | |
|---------------------------|--|
| DeviceTemperatureSelector | Selects the location within the device, where the temperature will be measured. |
| DeviceTemperature | Device temperature in degrees Celsius (C). It is measured at the location selected by DeviceTemperatureSelector. |
| TimestampLatch | Latches the current timestamp counter into TimestampLatchValue. |
| TimestampLatchValue | Returns the latched value of the timestamp counter. |

7.17.2 ImageFormatControl

| Name | Description |
|-------------------------|--|
| SensorWidth | Effective width of the sensor in pixels. |
| SensorHeight | Effective height of the sensor in pixels. |
| SensorShutterMode | Sets the shutter mode of the device. |
| WidthMax | Maximum width of the image (in pixels). The dimension is calculated after horizontal binning, decimation or any other function changing the horizontal dimension of the image. |
| HeightMax | Maximum height of the image (in pixels). This dimension is calculated after vertical binning, decimation or any other function changing the vertical dimension of the image |
| BinningSelector | Selects which binning engine is controlled by the BinningHorizontal and BinningVertical features. |
| BinningHorizontalMode | Sets the mode to use to combine horizontal photo-sensitive cells together when BinningHorizontal is used. |
| BinningHorizontal | Number of horizontal photo-sensitive cells to combine together. This increases the intensity (or signal to noise ratio) of the pixels and reduces the horizontal resolution (width) of the image. |
| BinningVerticalMode | Sets the mode used to combine vertical photo-sensitive cells together when BinningVertical is used. |
| BinningVertical | Number of vertical photo-sensitive cells to combine together. This increases the intensity (or signal to noise ratio) of the pixels and reduces the vertical resolution (height) of the image. |
| DecimationHorizontal | Horizontal sub-sampling of the image. This reduces the horizontal resolution (width) of the image by the specified horizontal decimation factor. |
| DecimationVertical | Vertical sub-sampling of the image. This reduces the vertical resolution (height) of the image by the specified vertical decimation factor. |
| RegionSelector | Selects the Region of interest to control. The RegionSelector feature allows devices that are able to extract multiple regions out of an image, to configure the features of those individual regions independently. |
| RegionMode | Controls if the selected Region of interest is active and streaming. |
| ImageComponentSelector | Selects a component to activate data streaming from. |
| ImageComponentEnable | Controls if the selected component streaming is active. |
| Width | Width of the image provided by the device (in pixels). |
| Height | Height of the image provided by the device (in pixels). |
| OffsetX | Horizontal offset from the origin to the region of interest (in pixels). |
| OffsetY | Vertical offset from the origin to the region of interest (in pixels). |
| PixelFormat | Format of the pixels provided by the device. It represents all the information provided by PixelCoding, PixelSize, PixelColorFilter combined in a single feature. |
| PixelFormatInfoSelector | Select the pixel format for which the information will be returned. |
| PixelFormatInfoID | Returns the value used by the streaming channels to identify the selected pixel format. |
| PixelSize | Total size in bits of a pixel of the image. |
| PixelColorFilter | Type of color filter that is applied to the image. |
| ReverseX | This feature is used to flip horizontally the image sent by the device. The AOI is applied after the flipping. |
| ReverseY | This feature is used to flip vertically the image sent by the device. The AOI is applied after the flipping. |

| | |
|--------------------------|-----------------------------|
| MultiROIsInMultiPayloads | MultiROIs In MultiPayloads. |
|--------------------------|-----------------------------|

7.17.3 AcquisitionControl

| Name | Description |
|----------------------|---|
| AcquisitionMode | Sets the acquisition mode of the device. It defines mainly the number of frames to capture during an acquisition and the way the acquisition stops. |
| AcquisitionStart | Starts the Acquisition of the device. The number of frames captured is specified by AcquisitionMode. |
| AcquisitionStop | Stops the Acquisition of the device at the end of the current Frame. It is mainly used when AcquisitionMode is Continuous but can be used in any acquisition mode. |
| AcquisitionArm | Arms the device before an AcquisitionStart command. This optional command validates all the current features for consistency and prepares the device for a fast start of the Acquisition. |
| AcquisitionFrameRate | Controls the acquisition rate (in Hertz) at which the frames are captured. |
| TriggerSelector | Selects the type of trigger to configure. |
| TriggerMode | Controls if the selected trigger is active. |
| TriggerSoftware | Generates an internal trigger. TriggerSource must be set to Software. |
| TriggerSource | Specifies the internal signal or physical input Line to use as the trigger source. The selected trigger must have its TriggerMode set to On. |
| TriggerDelay | Specifies the delay in microseconds (us) to apply after the trigger reception before activating it. |
| ExposureMode | Sets the operation mode of the Exposure (or shutter). |
| ExposureTimeSelector | Selects which exposure time is controlled by the ExposureTime feature. This allows for independent control over the exposure components. |
| ExposureTime | Sets the Exposure time when ExposureMode is Timed and ExposureAuto is Off. This controls the duration where the photosensitive cells are exposed to light. |
| ExposureTimeAbs | Sets the Exposure time when ExposureMode is Timed and ExposureAuto is Off. This controls the duration where the photosensitive cells are exposed to light. |
| ExposureTimeRaw | Sets the Exposure time when ExposureMode is Timed and ExposureAuto is Off. This controls the duration where the photosensitive cells are exposed to light. |
| ExposureAuto | Sets the automatic exposure mode when ExposureMode is Timed. The exact algorithm used to implement this control is device-specific. |
| ExposureAutoLimitMax | Determine the upper limit of exposure time when ExposureAuto is set to Continuous. |
| ExposureAutoLimitMin | Determine the lower limit of exposure time when ExposureAuto is set to Continuous. |

7.17.4 TransportLayerControl

| Name | Description |
|-------------|--|
| PayloadSize | Provides the number of bytes transferred for each image or chunk on the stream channel. This includes any end-of-line, end-of-frame statistics or other stamp data. This is the total size of data payload for a data block. |

7.17.5 DigitalIOControl

| Name | Description |
|--------------|--|
| LineSelector | Selects the physical line (or pin) of the external device connector to configure. |
| LineMode | Controls if the physical Line is used to Input or Output a signal. |
| LineInverter | Controls the inversion of the signal of the selected input or output Line. |
| LineStatus | Returns the current status of the selected input or output Line. |
| LineSource | Selects which internal acquisition or I/O source signal to output on the selected Line. LineMode must be Output. |

| | |
|---------------------|---|
| UserOutputSelector | Selects which bit of the User Output register will be set by UserOutputValue. |
| UserOutputValue | Sets the value of the bit selected by UserOutputSelector. |
| StrobeOutDelay | Delay of StrobeOut signal when LineSource is set to StrobeOut(us). |
| StrobeOutOnTime | Duration of StrobeOut signal when LineSource is set to StrobeOut(us). |
| TriggerOutDelay | Delay of TriggerOut signal when LineSource is set to TriggerOut(us). |
| TriggerOutOnTime | Duration of TriggerOut signal when LineSource is set to TriggerOut(us). |
| LineDeviceResetMode | Sets the Line device reset mode. |
| LineDebounceTime | Sets the value of the input line debouncer time. |

7.17.6 CounterAndTimerControl

| Name | Description |
|--------------------------|---|
| CounterSelector | Selects which Counter to configure. |
| CounterEventSource | Select the events that will be the source to increment the Counter. |
| CounterEventActivation | Selects the Activation mode Event Source signal. |
| CounterResetSource | Selects the signals that will be the source to reset the Counter. |
| CounterResetActivation | Selects the Activation mode of the Counter Reset Source signal. |
| CounterReset | Does a software reset of the selected Counter and starts it. The counter starts counting events immediately after the reset unless a Counter trigger is active. CounterReset can be used to reset the Counter independently from the CounterResetSource. To disable the counter temporarily, set CounterEventSource to Off. |
| CounterValue | Reads or writes the current value of the selected Counter. |
| CounterValueAtReset | Reads the value of the selected Counter when it was reset by a trigger or by an explicit CounterReset command. |
| CounterDuration | Sets the duration (or number of events) before the CounterEnd event is generated. |
| CounterStatus | Returns the current status of the Counter. |
| CounterTriggerSource | Selects the source to start the Counter. |
| CounterTriggerActivation | Selects the activation mode of the trigger to start the Counter. |

7.17.7 EventControl

| Name | Description |
|-------------------|--|
| EventSelector | Selects which Event to signal to the host application. |
| EventNotification | Activate or deactivate the notification to the host application of the occurrence of the selected Event. |

7.17.8 EventExposureEndData

| Name | Description |
|---------------------------|---|
| EventExposureEnd | Returns the unique identifier of the ExposureEnd type of Event. This feature can be used to register a callback function to be notified of the event occurrence. Its value uniquely identifies the type of event that will be received. |
| EventExposureEndTimestamp | Returns the Timestamp of the ExposureEnd Event. It can be used to determine precisely when the event occurred. |

7.17.9 EventExposureStartData

| Name | Description |
|-----------------------------|--|
| EventExposureStart | Returns the unique Identifier of the Exposure Start type of Event. |
| EventExposureStartTimestamp | Returns the Timestamp of the Exposure Start Event. |

7.17.10 EventTestData

| Name | Description |
|--------------------|--|
| EventTest | Returns the unique identifier of the Test type of Event. This feature can be used to register a callback function to be notified of the event occurrence. Its value uniquely identifies the type of event that will be received. |
| EventTestTimestamp | Returns the timestamp of the Test event. |

7.17.11 AnalogControl

| Name | Description |
|----------------------|--|
| GainSelector | Selects which Gain is controlled by the various Gain features. |
| Gain | Controls the selected gain as an absolute physical value. This is an amplification factor applied to the video signal. |
| GainAuto | Sets the automatic gain control (AGC) mode. The exact algorithm used to implement AGC is device-specific. |
| GainAutoLimitMax | Determine the upper limit of gain when GainAuto is set to Continuous. |
| GainAutoLimitMin | Determine the lower limit of gain when GainAuto is set to Continuous. |
| AutoLightTarget | Determine the brightness target for GainAuto. |
| BlackLevelSelector | Selects which Black Level is controlled by the various Black Level features. |
| BlackLevel | Controls the black level as an absolute physical value. This represents a DC offset applied to the video signal. |
| BalanceRatioSelector | Selects which Balance ratio to control. |
| BalanceRatio | Controls ratio of the selected color component to a reference color component. It is used for white balancing. |
| BalanceWhiteAuto | Controls the mode for automatic white balancing between the color channels. The white balancing ratios are automatically adjusted. |

7.17.12 LUTControl

| Name | Description |
|---------------------------|--|
| PixelCorrectionAllEnabled | Enable pixel correction for all pixels. |
| PixelCorrectionIndex | Determine index of targeted pixel for pixel correction. |
| PixelCorrectionEnabled | Determine if targeted pixel is enabled for pixel correction. |
| PixelCorrectionX | Determine x-coordinate of targeted pixel for pixel correction. |
| PixelCorrectionY | Determine y-coordinate of targeted pixel for pixel correction. |

7.17.13 UserSetControl

| Name | Description |
|-----------------|---|
| UserSetSelector | Selects the feature User Set to load, save or configure. |
| UserSetLoad | Loads the User Set specified by UserSetSelector to the device and makes it active. |
| UserSetSave | Save the User Set specified by UserSetSelector to the non-volatile memory of the device. |
| UserSetDefault | Selects the feature User Set to load and make active by default when the device is reset. |

7.17.14 ChunkDataControl

| Name | Description |
|------|-------------|
|------|-------------|

| | |
|---------------------------|--|
| ChunkModeActive | Activates the inclusion of Chunk data in the payload of the image. |
| ChunkSelector | Selects which Chunk to enable or control. |
| ChunkEnable | Enables the inclusion of the selected Chunk data in the payload of the image. |
| ChunkCounterSelector | Selects which counter to retrieve data from. |
| ChunkCounterValue | Returns the value of the selected Chunk counter at the time of the FrameStart event. |
| ChunkGainSelector | Selects which Gain to return. |
| ChunkGain | Returns the gain used to capture the image. |
| ChunkBlackLevelSelector | Selects which Black Level to return. |
| ChunkBlackLevel | Returns the black level used to capture the image included in the payload. |
| ChunkExposureTimeSelector | Selects which exposure time is read by the ChunkExposureTime feature. |
| ChunkExposureTime | Returns the exposure time used to capture the image. |
| ChunkGamma | Returns the gamma used to capture the image. |

7.17.15 TestControl

| Name | Description |
|-------------------|---|
| TestPendingAck | Tests the device's pending acknowledge feature. When this feature is written, the device waits a time period corresponding to the value of TestPendingAck before acknowledging the write. |
| TestEventGenerate | Generates a Test Event. |

8 Revision History

| Rev | Date | Changes | Note |
|-----|------------|---|------|
| 00 | 2016/03/01 | ● New Document | |
| 01 | 2016/08/09 | ● Added Jitter information on | |
| 02 | 2016/11/28 | ● Revised Maximum Operational Temperature | |

Sentech Co., Ltd

7F, Harada center building
9-17, Naka cho 4 chome
Atsugi-city, Kanagawa
243-0018 Japan
TEL +81-46-295-7061 FAX +81-46-295-7066
URL <http://www.sentech.co.jp/>