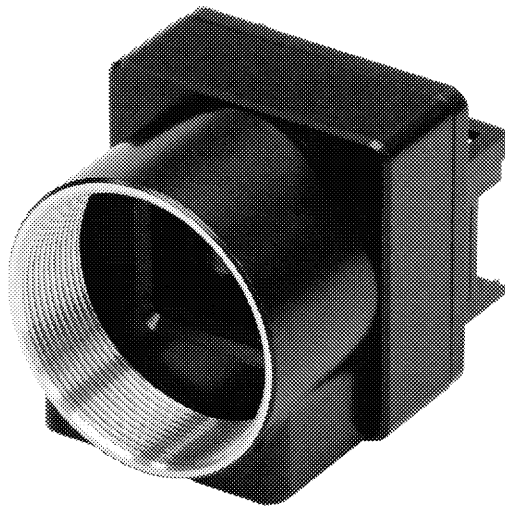# BU Series
CCD B/W Camera

Instruction Manual

Model
BU030 / BU031 / BU080 / BU130

Thank you for purchasing our product.

Before using this CCD camera, Please read through this instruction manual carefully in order to use this product correctly and safely.

After reading, keep this instruction manual handy so that you can refer to, whenever you need it.

TOSHIBA TELI CORPORATION

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Contents

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Safety Precautions

Before using this product, read these safety precautions carefully. Important information is shown in this Instruction Manual to protect users from bodily injuries and property damages, and to enable them to use the product safely and correctly.

Please be sure to thoroughly understand the meanings of the following signs and symbols before reading the main text that follow, and observe the instructions given herein.

[Definition of Safety Signs]

Safety Signs	Description
⚠ WARNING	Indicates a potentially hazardous situation that may result in death or serious injury (*1) in the event of improper handling.
⚠ CAUTION	Indicates a potentially hazardous situation that may result in light to moderate injuries (*2) or only in property damage (*3)in the event of improper handling.

Notes *1:"Serious injury" refers to cases of loss of eyesight, wounds, burns (high or low temperature), electric shock, broken bones, poisoning, etc., which leave after-effects or which require hospitalization or a long period of outpatient treatment of cure.

*2: "Light to moderate injuries" refers to injuries, burns, electric shock etc. that do not require hospitalization or long-term treatment.

*3: "Property damage" refers to cases of extensive damage involving damage to buildings, equipment, farm animals, pet animals and other belongings.

[Explanation of Safety Symbols]

Safety Symbols	Description
🚫 PROHIBITED	This sign indicates **PROHIBITION** (Do not). The content of prohibition is shown by a picture or words beside the symbol.
⬤ MANDATORY	This sign indicates **MANDATORY ACTION** (You are required to do). The content of action is shown by a picture or words beside the symbol.

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General Handing

⚠ WARNING

Unplug	● **Stop operation immediately when any abnormality or defect occurs.** If abnormal conditions are present, such as smoke, a burning smell, ingress of water or foreign matter, or if the equipment is dropped or malfunctions, fire or electric shock may result. Be always sure to disconnect the power cable from the wall socket at once and contact your dealer.
Do not get wet	● **Do not use the equipment in locations subject to water splashes.** Otherwise, fire or electric shock may result.
Never pull apart	● **Do not disassemble, repair, or modify the equipment.** Otherwise, fire or electric shock may result. For internal repair, inspection, or cleaning, contact your sales representative.
Avoid	● **Do not place anything on the equipment.** If metallic objects, liquid, or other foreign matter enters the equipment, fire or electric shock may result.
Avoid	● **Do not install the equipment in an unstable or inclined location or locations subject to vibration or impact.** Otherwise, the equipment may topple over and cause personal injury.
Do not touch	● **During an electrical storm, do not touch the power cable and the connection cable.** Otherwise, an electric shock may result.
Instruction	● **Use the specified voltage.** Use of an unspecified voltage may result in fire or electric shock.
Avoid	● **Do not be handled roughly, damaged, fabricated, bent forcefully, pulled, twisted, bundled, placed under heavy objects or heated the power cable and the connection cable.** Otherwise, fire or electric shock may result.

⚠ CAUTION

● Observe the following when installing the equipment:
Instruction
·Do not cover the equipment with a cloth, etc.
·Do not place the equipment in a narrow location where heat is likely to accumulate.
Otherwise, heat will accumulate inside the equipment, possibly resulting in a fire.

● Do not place the equipment in locations subject to high moisture, oil fumes, steam, or dust.
Avoid
Otherwise, fire or electric shock may result.

● Do not install the equipment in locations exposed to direct sunlight or humidity.
Avoid
Otherwise, the internal temperature of the equipment will rise, which may cause a fire.

● Use only specified the power cable and the connection cables.
Instruction
Otherwise, fire or electric shock may result.

● Do not give strong impact against the equipment.
Avoid
It may cause the trouble.

● When performing connection, turn off power.
Instruction
When connecting the power cable and the connection cable, turn off the equipment power.
Otherwise, fire or electric shock may result.

● Do not expose its camera head to any intensive light (such as direct sunlight).
Avoid
Otherwise, its inner image pickup device might get damaged.

● Avoid short-circuiting signal output.
Avoid
Otherwise, a malfunction may occur.

● Avoid giving a strong shock against the camera body.
Avoid
It might cause a breakdown or damage. If your camera is used in a system where its camera connector is subjected to strong repetitive shocks, its camera connector is possible to break down. If you intend to use your camera in such a situation, if possible, bundle and fix a camera cable in the place near the camera, and do not transmit a shock to the camera connector.

● Contact your sales representative to request periodic inspection and cleaning (every approx five years).
Instruction
Accumulation of dust inside the equipment may result in fire or electric shock.
For inspection and cleaning costs, contact your sales representative.

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CASES FOR INDEMNITY (LIMITED WARRANTY)

We shall be exempted from taking responsibility and held harmless for damage or losses incurred by the user in the following cases.

- In the case damage or losses are caused by natural disasters, such as an earthquake and thunder, fire, or other acts of God, acts by a third party, deliberate or accidental misuse by the user, or use under extreme operating conditions.

- In the case of indirect, additional, consequential damages (loss of business interests, suspension of business activities) are incurred as result of malfunction or non-function of the equipment, we shall be exempted from responsibility for such damages.

- In the case damage or losses are caused by failure to observe the information contained in the instructions in this instruction manual and specifications.

- In the case damage or losses are caused by use contrary to the instructions in this instruction manual and specifications.

- In the case damage or losses are caused by malfunction or other problems resulting from unintended use of equipment or software etc. that are not specified.

- In the case damage or losses are caused by repair or modification conducted by the customer or any unauthorized third party (such as an unauthorized service representative).

- Expenses we bear on this product shall be limited to the individual price of the product.

- The item that is not described in specifications of this product is out of the guarantee.

- The case of damages or losses which are caused by incorrect connection of the cable is out of the guarantee.

RESTRICTION FOR USE

● Should the equipment be used in the following conditions or environments, give consideration to safety measures and inform us of such usage:
   1. Use of the equipment in the conditions or environment contrary to those specified, or use outdoors.
   2. Use of the equipment in applications expected to cause potential hazard to people or property, which require special safety measures to be adopted.

● This product can be used under diverse operating conditions. Determination of applicability of equipment or devices concerned shall be determined after analysis or testing as necessary by the designer of such equipment or devices, or personnel related to the specifications. Such designer or personnel shall assure the performance and safety of the equipment or devices.

● This product is not designed or manufactured to be used for control of equipment directly concerned with human life (*1) or equipment relating to maintenance of public services/functions involving factors of safety (*2). Therefore, the product shall not be used for such applications.
   (*1): Equipment directly concerned with human life refers to.
      - Medical equipment such as life-support systems, equipment for operating theaters.
      - Exhaust control equipment for exhaust gases such as toxic fumes or smoke.
      - Equipment mandatory to be installed by various laws and regulations such as the Fire Act or Building Standard Law
      - Equipment related to the above
   (*2): Equipment relating to maintenance of public services/functions involving factors of safety refers to.
      - Traffic control systems for air transportation, railways, roads, or marine transportation
      - Equipment for nuclear power generation
      - Equipment related to the above

Notes on using this product

● Handle carefully

Do not drop the equipment or allow it to be subject to strong impact or vibration, as such action may cause malfunctions. Further, do not damage the connection cable, since this may cause wire breakage.

● Environmental operating conditions

Do not use the product in locations where the ambient temperature or humidity exceeds the specifications.

Otherwise, image quality may be degraded or internal components may be adversely affected. In particular, do not use the product in areas exposed to direct sunlight. Moreover, during shooting under high temperatures, vertical stripes or white spots (noise) may be produced, depending on the subject or camera conditions (such as increased gain). However, such phenomena are not malfunctions.

● Check a combination with the lens

Depending on the lens and lighting you use, an image is reflected as a ghost in the imaging area. However, this is not because of a fault of the camera.

In addition, depending on the lens you use, the performance of the camera may not be brought out fully due to deterioration in resolution and brightness in the peripheral area, aberration and others.

Be sure to check a combination with the camera by using the lens and lightning you actually use.

When installing a lens in the camera, make sure carefully that it is not tilted.

In addition, use a mounting screw free from defects and dirt. Otherwise, the camera may be unable to be removed.

Install a next lens; its dimension of protrusion from bottom of the screw is equal to or less than 10 mm. If a lens does not stand to this condition, it might not be installed to this camera.
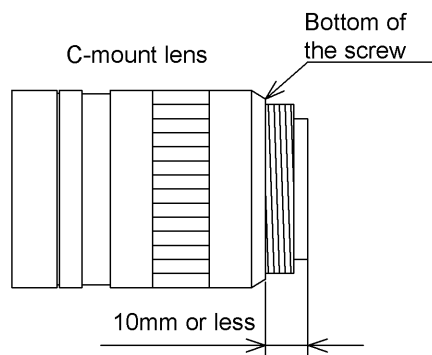
●Mounting to pedestal

When mounting this product to a pedestal, make sure carefully that lens doesn't touch with the pedestal.

● Do not shoot under intense light

Avoid intense light such as spot lights on part of the screen because it may cause blooming or smears. If intense light falls on the screen, vertical stripes may appear on the screen, but this is not a malfunction.

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●Do not expose the camera's image-pickup-plane to sunlight or other intense light directly

  Its inner CCD (charge-coupled device) might be damaged.

● Occurrence of moiré

  If you shoot thin stripe patterns, moiré patterns (interference fringes) may appear. This is not a malfunction.

● Occurrence of noise on the screen

  If an intense magnetic or electromagnetic field is generated near the camera or connection cable, noise may be generated on the screen. If this occurs, move the camera or the cable.

● Handling of the protective cap

  If the camera is not in use, attach the lens cap to the camera to protect the image pickup surface.

● If the equipment is not to be used for a long duration

  Turn off power to the camera for safety.

● Maintenance

  Turn off power to the equipment and wipe it with a dry cloth.

  If it becomes severely contaminated, gently wipe the affected areas with a soft cloth dampened with diluted neutral detergent. Never use alcohol, benzene, thinner, or other chemicals because such chemicals may damage or discolor the paint and indications.

  If the image pickup surface becomes dusty, contaminated, or scratched, consult your sales representative.

● Disposal

When disposing of the camera, it may be necessary to disassemble it into separate parts, in accordance with the laws and regulations of your country and/or municipality concerning environmental contamination.

This product is marked this symbol to subject to EU Waste Electrical & Electronic Equipment (WEEE) directive.

Following information is only for EU-member states:

The use of the symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about the take-back and recycling of this product, please contact your supplier where you purchased the product.

	"This symbol is applicable for EU member states only"
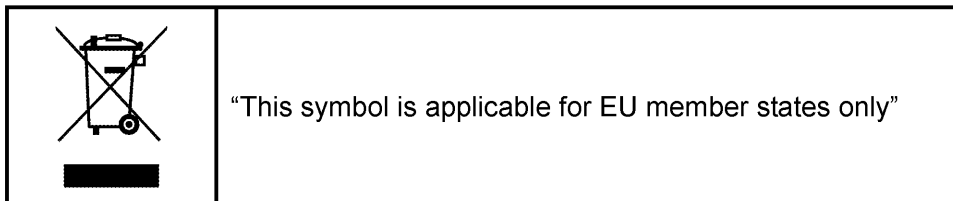
This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communication.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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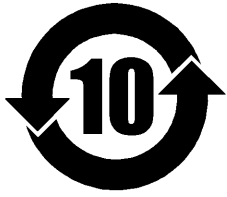
	环保使用期限标识，是根据电子信息产品污染控制管理办法以及，电子信息产品污染控制标识要求(SJ/T11364-2006)、电子信息产品环保使用期限通则，制定的适用于中国境内销售的电子信息产品的标识。 电子信息产品只要按照安全及使用说明内容，正常使用情况下，从生产月期算起，在此期限内，产品中含有的有毒有害物质不致发生外泄或突变，不致对环境造成严重污染或对其人身、财产造成严重损害。 产品正常使用后，要废弃在环保使用年限内或者刚到年限的产品时，请根据国家标准采取适当的方法进行处置。 另外，此期限不同于质量/功能的保证期限。 The Mark and Information are applicable for People's Republic of China only.
中华人民共和国 环保使用期限	

＜产品中有毒有害物质或元素的名称及含量＞

部件名称	有毒有害物质或元素					
	铅（Pb）	汞（Hg）	镉（Cd）	六价铬 （Cr(VI)）	多溴联苯 （PBB）	多溴二苯醚 （PBDE）
相机本体	×	○	○	○	○	○

○：表示该有毒有害物质在该部件所有均质材料中的含量均在电子信息产品中有毒有害物质的
限量要求标准规定的限量要求(SJ/T11363-2006)以下
×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出电子信息产品中有毒有害
物质的限量要求标准规定的限量要求(SJ/T11363-2006)
This information is applicable for People's Republic of China only.

リサイクルに関する情報（包装物）
有关再利用的信息(包装物)
Information on recycling of wrapping composition

箱 / 箱子 / Box
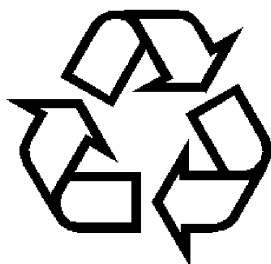
内部緩衝材料・袋
内部缓冲材料・袋
Internal buffer materials・Bag

ペーパーボード
纸板
Paper board

PE-LD

Installation

Before using this product, you shall install application software to display image and control registers of camera, and IP configuration tool for network setting.

You can download the SDK for our USB camera products (TeliU3vSDK) from the Service & Support section of our website.

User registration is necessary to use downloading service. Please make a user registration, or contact your dealer / distributor.

- TOSHIBA TELI CORPORATION Top Page
  http://www.toshiba-teli.co.jp/index.htm

- Service & Support
  https://www.toshiba-teli.co.jp/cgi/ss/en/service.cgi

Please refer to the TeliU3vSDK startup guide, about Operation environment, Installation, and Setup.

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Specifications

Overview

This BU B/W series is an integrated-(one-body)-type monochrome camera that adopts all pixel data readout inter line CCD. There are 4 models according to the sensor type. These are BU030 (VGA: 1/3 type), BU031 (VGA: 1/2 type), BU080 (XGA: 1/3 type), and BU130 (SXGA: 1/3 type). For video output and camera control, the USB 3.0 interface standard is adopted for high transfer rate, and it is easy to integrate into industrial equipment.

Features

● High frame rate and high resolution
Supported high frame rate BU030: 125fps / VGA (1/3 type), BU031: 125fps / VGA (1/2 type), BU080: 40fps / XGA (1/3 type), BU130: 30fps / SXGA (1/3 type).

● All pixel readout
All pixel signals (in the effective area) are output in one frame processing.

● Full frame shutter
Since all pixels are output even in Random Trigger Shutter operation, high resolution can be achieved, without deteriorating the vertical resolution.

● Square grids
The CCD pixels arrayed in square grids facilitates computation for image processing.

● USB*3 interface
Video output and camera control are performed via the USB 3.0 standard interface. Data transfer is up to 5Gbps (Maximum) that enables to output uncompressed video data at high frame rate.

- USB3 Vision* conformity

  This product is based on USB3 Vision Ver.1.0.

- GenICam* Ver 2.3 conformity

  This product is based on GenICam Generic Interface for Cameras Ver 2.3.

- IIDC2 Digital Camera Control Specification Ver.1.0.0 conformity

  This product is based on IIDC2 Digital Camera Control Specification Ver.1.0.0.

- e-CON* Connector adoption

  The e-CON connector adoption enables to assemble the cable easily without using special tools.

- Binning mode

  In this mode, pixel data is combined by vertical and horizontal. Vertical binning mode achieves high frame rate

- Random Trigger Shutter

  The Random Trigger Shutter function provides images in any timing by input of an external trigger signal. Trigger control from PC is available as well.

- Scalable

  Selectable video output area. This mode achieves higher frame rate by reducing vertical output area. And reduces occupied data rate of USB bus by reducing horizontal output area.

- Compact and lightweight

  This camera is compact and lightweight; it is easy to integrate into industrial equipment.

- EU RoHS & Chinese ROHS

* USB is a unified standard established by USB-IF(USB Implementers Forum).
* USB3 Vision is a unified standard established by AIA (Automated Imaging Association).
*GenICam is a registered trademark of EMVA (European Machine Vision Association).
* IIDC2 is a unified standard established by JIIA (Japan Industrial Association).
*e-CON (Easy & Economy connector) is a sensor connector that is normalized by the manufacturer of the sensor, FA equipment and connector.

Configuration

The system configuration of this camera series is as follows;

This camera does not include any accessories. Please prepare other equipments separately.

- Camera: This product. (BU)

- Camera mounting kit CPTBU (*1):   To fix a camera to a tripod; attach this to the bottom of the camera.

- USB3.0 Cable (*2):   This cable is used to connect the camera to host PC. Please use a USB3.0 cable of Standard A - Micro B. This product is able to connect a USB cable equipped with screw lock mechanism. Please use it as needed.

- USB3.0 Interface Card (*2):   This is the interface card to connect to the camera. Usually this card is installed to expansion slot of PC etc.

- e-CON Cable. (*2):   This cable is used to input external trigger signal and output GPIO signal.
    We recommend the use of shielded cable and ferrite core, because there is likely to be affected by the noise depending on the operating environment of the camera. In addition, when used a ferrite core, please attach close to the camera as possible.

*1: Optional part. Contact your dealer / distributor for details of option units.
*2: Commercial items.

Connection

Camera   USB3.0 Cable

◁ Control Packet   Stream Packet ▷

(Mirco B)   (Standard A)

e-CON Cable

(e-CON)

Camera mounting unit
CPTBU

- 1. N.C.
- 2. GPIO OUT
- 3. GND
- 4. TRIG IN

Interface Card   Host(PC etc.)
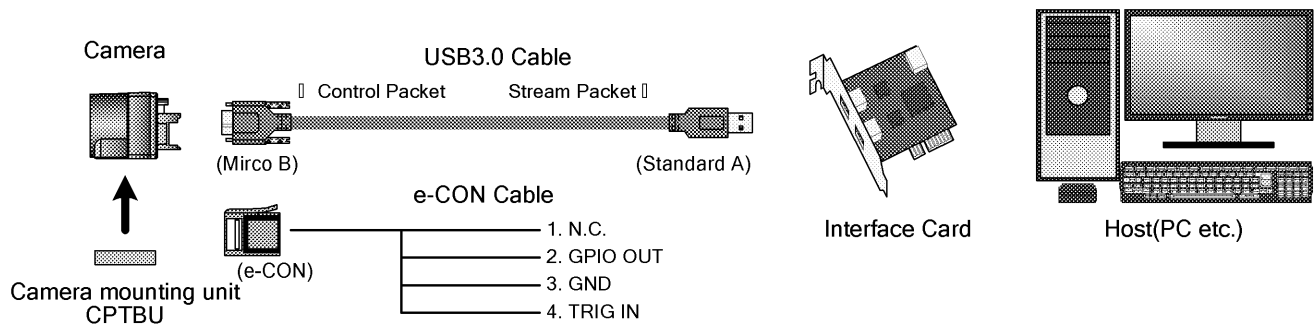
Notes on Connection:

- Please confirm the power supply of the camera off when plugging in or pulling out the I/O Connector. It causes the breakdown.

- If your camera is used in a system where its connectors are subjected to strong repetitive shocks, its connectors are possible to break down. If you use your camera in such a situation, use an USB3.0 cable with a lock screw, and secure the camera cable as close as possible to the camera body for avoid physical shock to the camera connector.

- About e-CON cable: In the case that electric-wire is long or thin, input and output voltage may not satisfy specifications of the camera or your system by voltage drop. Please confirm wires' specifications before use them.

- Lost packets may occur by an electrical characteristic of the transmission line of USB3.0. (USB3.0 Interface Card, USB3.0 Cable, and USB3.0 HUB).

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Connector Pin Assignment

Rear View
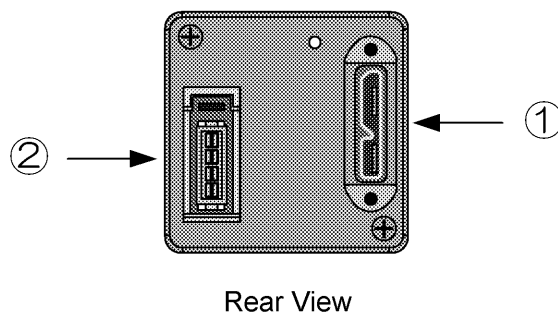
1. USB3.0 Interface Connector

Connector model: WMUR-10F6L1PH5N (WIN WIN PRECISION INDUSTRIAL)

Pin No.	I/O	Signal	Function
1	-	VBUS	Power
2	I/O	D-	USB2.0 differential pair
3	I/O	D+	
4	-	NC	Not connected
5	-	GND	Ground for power return
6	O	SSTX-	SuperSpeed transmitter differential pair
7	O	SSTX+	
8	-	GND_DRAN	Ground for SuperSpeed signal return
9	I	SSRX-	SuperSpeed receiver differential pair
10	I	SSRX+	

2. I/O Connector

Connector (Camera side)　　　　　　37204-62B3-004PL (Sumitomo 3M) or equivalent
Matching connector (Cable side)　　　Connectors which conformed to e-CON
　　　　　　　　　　　　　　　　　e.g. 37104 series (Sumitomo 3M), RITS 4P series (Tyco)
* Matching connector is not an accessory of this product.
Pin assignment
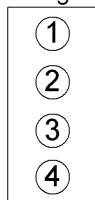
※ Above figure is connector view from insert side.

Pin No.	I/O	Signal	Function
1	-	NC	Not connected
2	O	GPIO_OUT	GPIO Output
3	-	GND	Ground
6	I	TRIG_IN	Trigger Input

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Outline Drawing

29 ±1

29 ±1

29 ±1

(16) 13 (10)

18

Cmount

2-M2
Depth 3.8

N.P.

4.5 9

20

3-M3
Depth 3
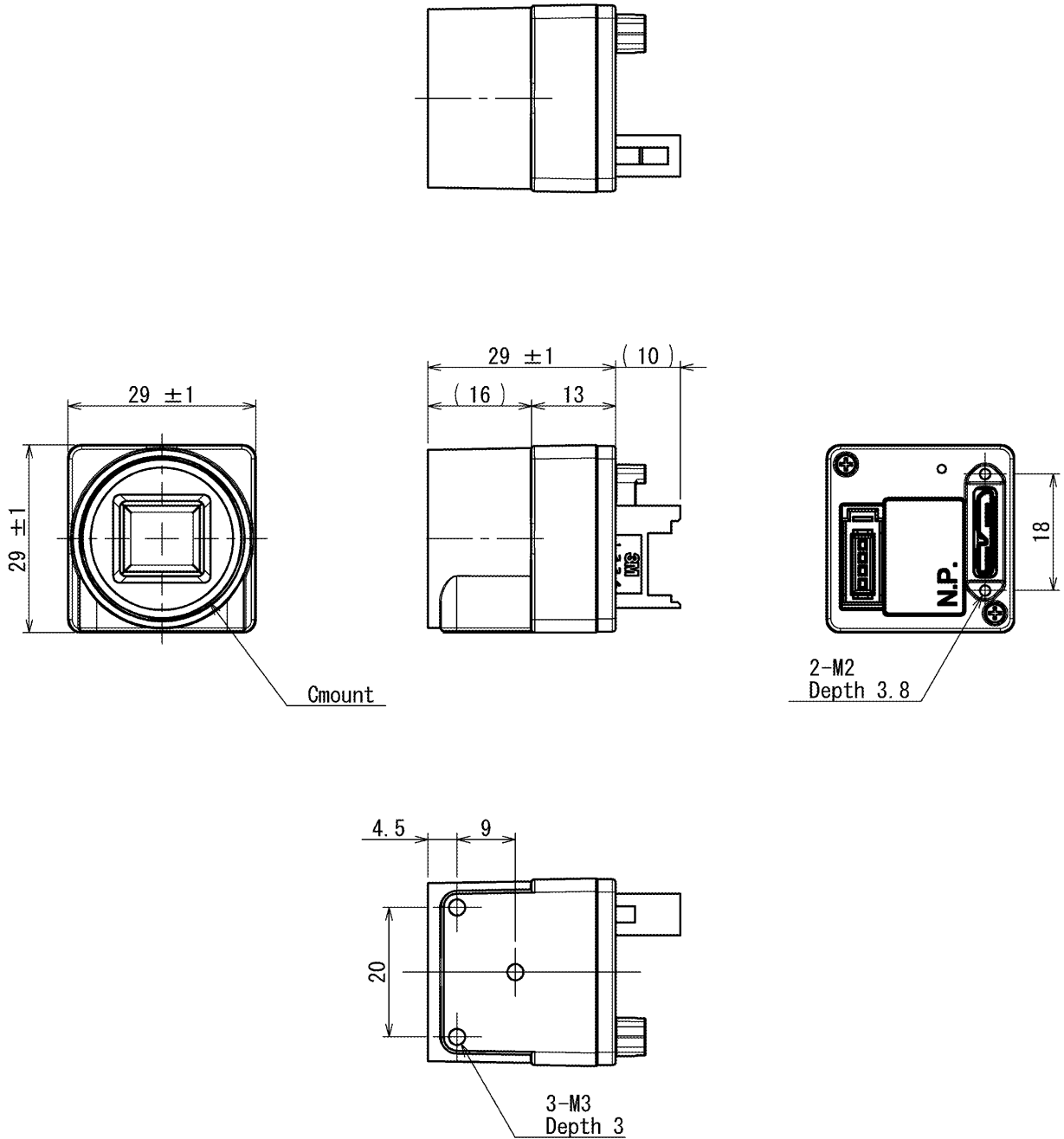
Specification
  Main material : Aluminum die-cast metal
  Processing   : Cation coating (black)

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General Specifications

Model Name	BU030	BU031	BU080	BU130
Imager	All-pixel-data-readout interline transfer CCD			
Number of total pixels (H) × (V)	692 × 504	692 × 504	1077 × 788	1348 × 976
Number of effective pixels (H) × (V)	659 × 494	659 × 494	1034 × 779	1296 × 966
Optical Size	1/3 type	1/2 type	1/3 type	1/3 type
Scanning area (H) × (V)[mm]	4.88 × 3.66	6.52 × 4.89	4.81 × 3.62	6.26 × 5.01
Pixel size (H) × (V)[μm]	7.4 × 7.4	9.9 × 9.9	4.65 × 4.65	3.75 × 3.75
Scan method	Non-interlace			
Electronic shutter method	Global shutter			
Aspect ratio	4: 3			
Standard subject illuminance	1700lx (F5.6, 1/125s)	1700lx (F5.6, 1/125s)	1700lx (F5.6, 1/40s)	1300lx (F8, 1/30s)
Minimum subject illuminance (*1)	7lx	7lx	7lx	3lx
Power supply	DC +5V±5% (from USB connector)			
Power consumption (*2)	2.5W (maximum)			
Base clock frequency	50.000MHz ±100ppm	50.000MHz ±100ppm	45.000MHz ±100ppm	50.000MHz ±100ppm
Interface	USB 3.0 (Only SuperSpeed is supported)			
Transmission speed	5Gbps (Maximum)			
Protocol	USB3 Vision			
Cable length	Up to 3.0 m			
Image format	Mono 8 bit			
Number of Video out pixels (H) × (V)	640 × 480	640 × 480	1024 × 768	1280 × 960
Maximum Frame rate (*2)	125 fps	125 fps	40 fps	30 fps
Dimensions	29 mm(W) x 29 mm (H) x 13 mm (D) (Not including protrusion)			
Mass	Approximately 27g			
Lens mount	C-mount			
Flange back	17.526mm			
Camera body grounding: insulation status	No conductive between circuit GND and camera body			

*1 F1.4, Gain: Maximum (+18dB), video level: 50%

*2 at the all pixel readout

Notes on combination of C-mount lens:

- Depending on the lens you use, the performance of the camera may not be brought out fully due to the deterioration in resolution and brightness in the peripheral area, occurrence of a ghost, aberration and others. When you check the combination between the lens and camera, be sure to use the lens you actually use.

- In addition, use a mounting screw free from defects and dirt. Otherwise, the camera may be unable to be removed.

- As for the C-mount lens used combining this camera, the projection distance from bottom of the screw should use 10mm or less.

C-mount lens

Bottom of the screw

10mm or less
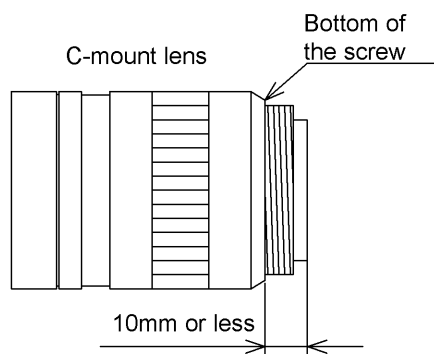
Notes on Dropping Frames:

Depends on your PC and USB3.0 interface card configurations, images may not be captured properly (e.g. dropping frames). In this case, change frame rate setting lower.

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LED status

Camera state	Lamp indication
No power	Off
Link detection in progress	Fast flash green (ON:20ms, OFF:60ms)
Connection Error	Flash alternate red / green
SuperSpeed connected, but no data being transferred	Flash green (ON: 200ms, OFF: 800ms)
SuperSpeed connected, waiting for trigger	Flash orange (ON: 200ms, OFF: 800ms)
HighSpeed connected, but no data being transferred	Slow flash green (ON: 400ms, OFF: 1600ms)
HighSpeed connected, waiting for trigger	Slow flash orange (ON: 400ms, OFF: 1600ms)
Data being transferred	Solid Green
Error during data transfer	Solid Red (Time period: 500ms)
Stand-by	Super slow flash orange (ON:200ms, OFF: 2800ms)

I/O Specification

● Signal Specification

- Trigger Input

Input Circuit	: LVTTL	
Level	: Low 0 ~ 0.5V, High 2.0 ~ 24.0V	
Polarity	: High active / Low active (initial factory setting: Low active)	
Pulse Width	: Minimum 50μs	

Notes of external trigger signal:

Depending on cable length, cable kinds and input current of trigger input line, Random Trigger Shutter operation may not satisfy timing specification or camera

- GPIO Output

Output Circuit	: LVTTL	
Polarity	: High active / Low active (initial factory setting: Low active)	
Signal Source	: TIMER0 ACTIVE	
	USER OUTPUT	
	EXPOSURE ACTIVE	
	FRAME ACTIVE	
	FRAME TRANSFER	
	FRAME TRIGGER WAIT	

● Circuit diagram

- Trigger Input

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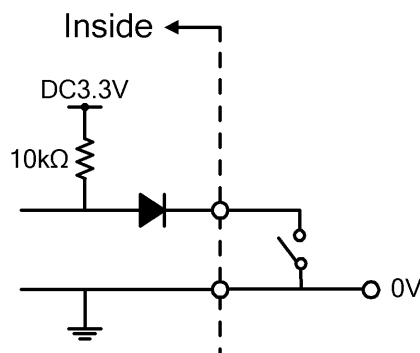
Timing Specification

Image data outputs are transferred with USB bulk transfer. Timing numerical value below is described by absolute prerequisite that camera can use transmission band without restriction of other device. When there is other device on the same bus, the value described below is not guaranteed.

● In normal shutter mode

Video format Mono 8, all pixels readout
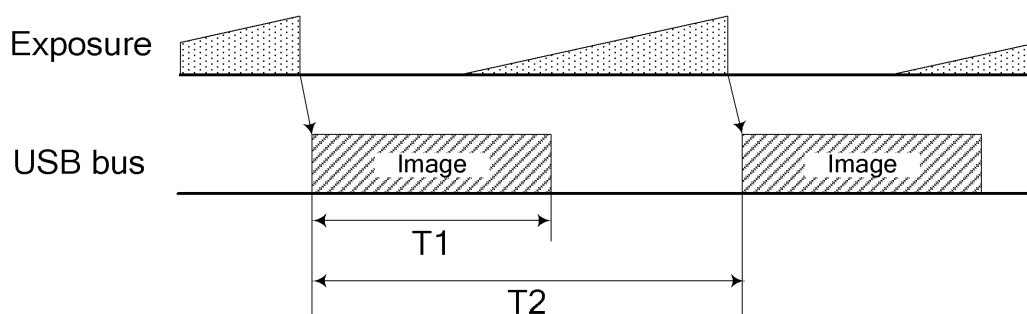
Model	T1 [ms]	T2 [ms]	Default Framerate [ms]
BU030	7.8	Frame Rate setting by the application.	8.0
BU031	7.8		8.0
BU080	25.0		25.0
BU130	33.3		33.3

* If the value of T2 is not set by the application, it will be the same as T1.

● In Random Trigger Shutter mode
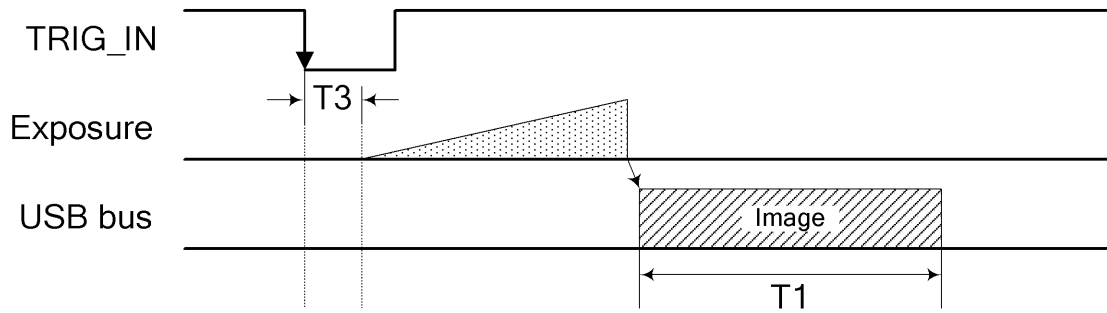
Edge mode (Image format: Mono 8, all pixels readout)
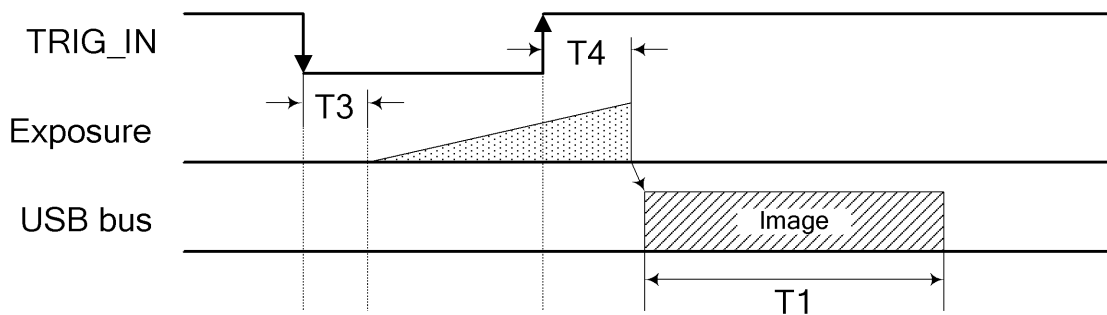
Level mode (Image format: Mono 8, all pixels readout)

Model	T3 [μs]	T4 [μs]
BU030	1.0	2.5
BU031	1.0	2.5
BU080	2.2	34.0
BU130	1.2	7.1

* T1 is the same value as the normal shutter mode.

* T3 and T4 are typical value.

Notes of random trigger shutter mode:

- In the period when FRAME_TRIGGER_WAIT (GPIO signal) is inactive, user must not input external trigger signal to this camera.

- When the interval of the input trigger signal is extremely short, or when the trigger signal is noisy, there is a possibility of causing the malfunction. In this case, please input a proper trigger signal.

Typical Spectral Response

* The lens characteristics and light source characteristics is not reflected in table.

● BU030

● BU031

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● BU080

● BU130

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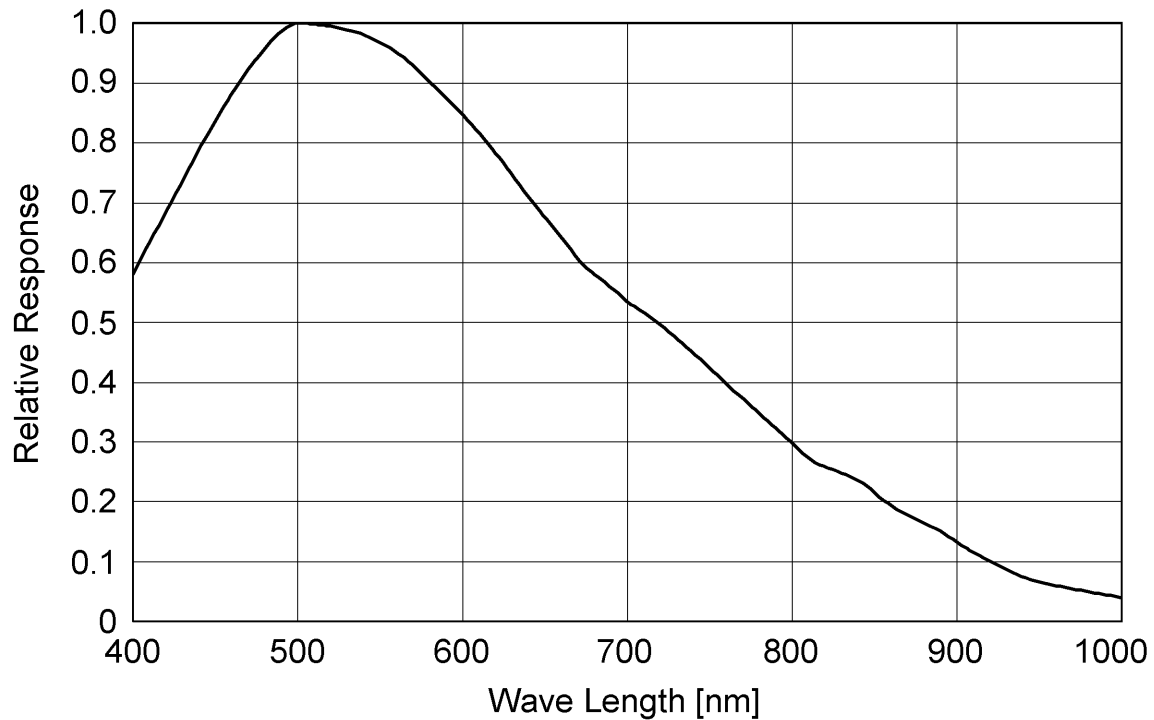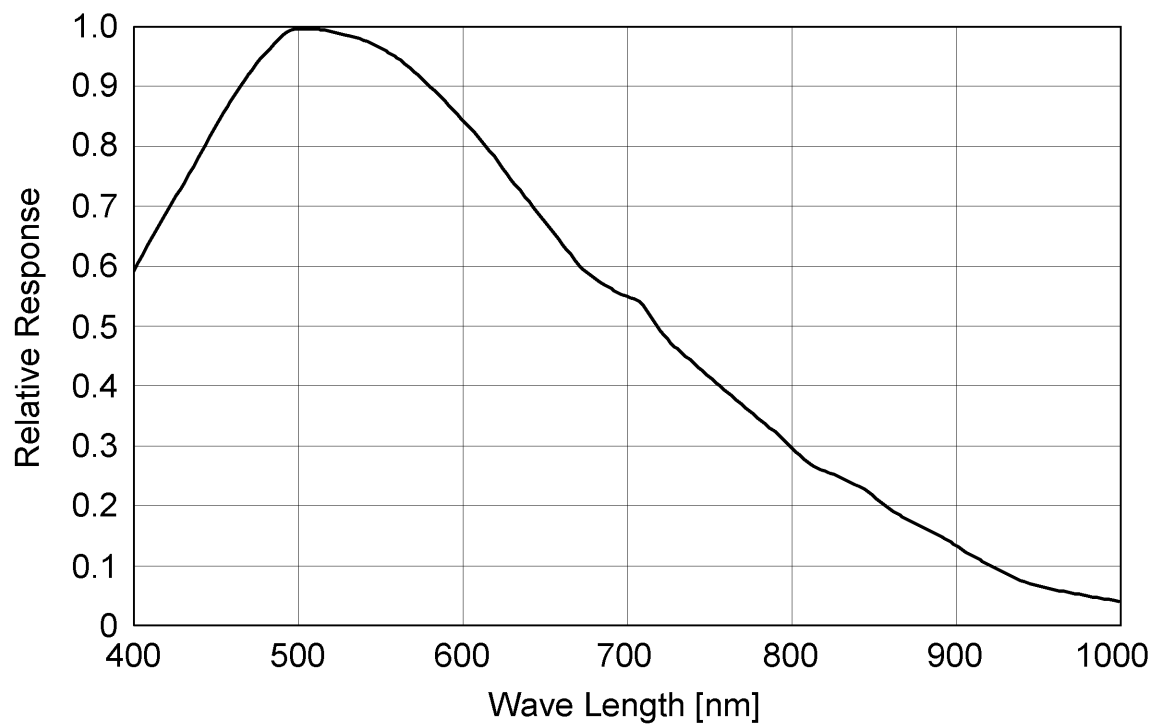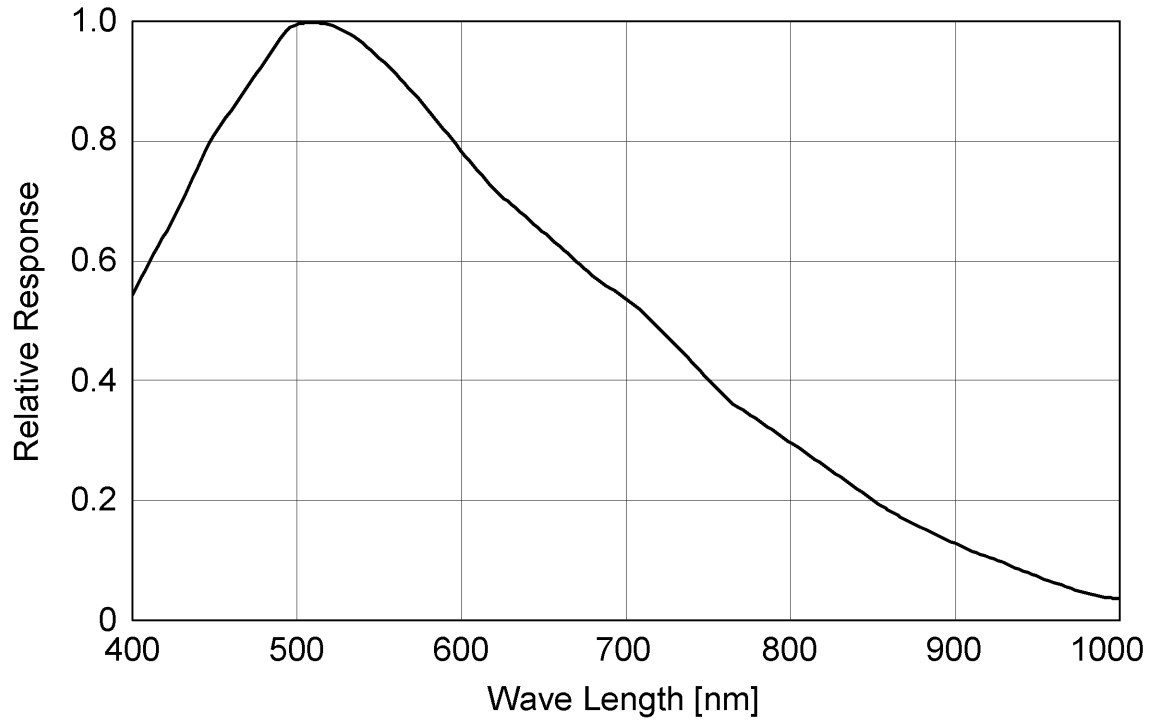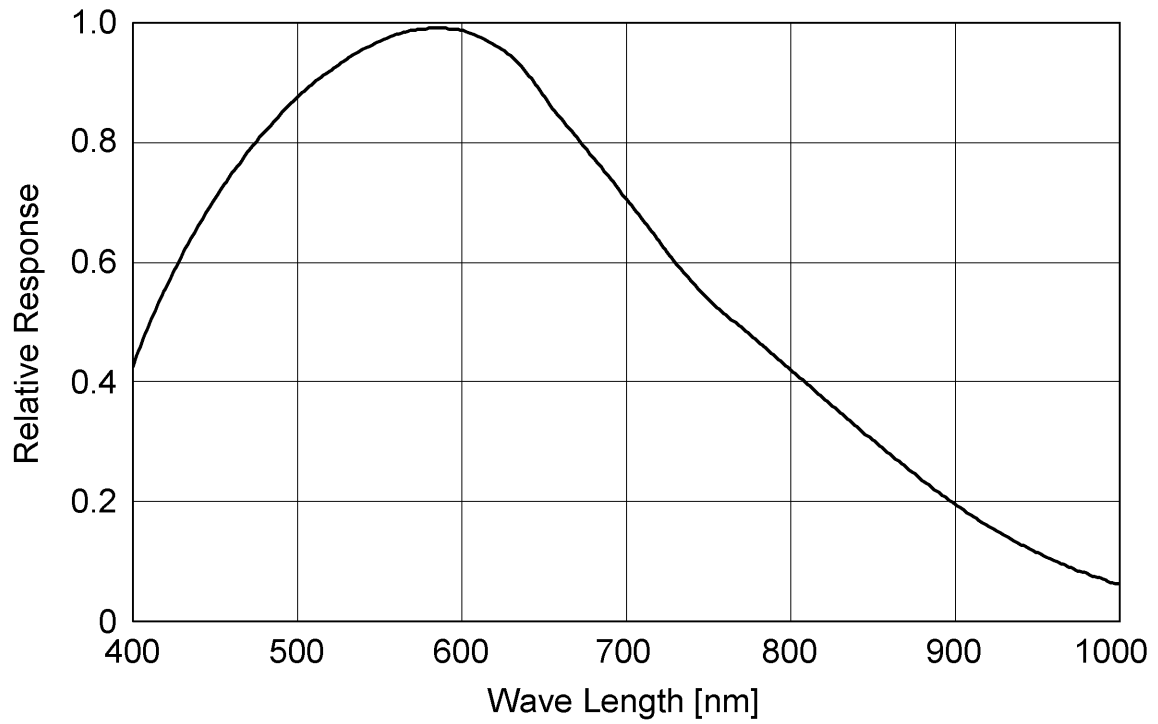
Operating Ambient Conditions

● Ambient conditions

   - Operating Assurance

        Temperature: 0°C ~ 40°C, Camera housing temperature: less than 50°C

        Humidity: 10% ~ 90% (no condensation)

   - Storage Assurance

        Temperature: -20°C ~ 60°C

        Humidity: 90% or less (no condensation)

Notes on Heat Radiation:

The temperature of camera housing must be kept less than 50 °C.

Please provide sufficient heat radiation depending on your installation.

● EMC Conditions

   - EMI (Electro-Magnetic Interference):   EN61000-6-4

                                             FCC Part 15 Subpart B Class A

   - EMS (Electro-Magnetic Susceptibility): EN61000-6-2

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Notes on Conformity of the EMC:

The adaptability of the safety standard of this camera is assured in the condition of combination with the following parts:

- USB Cable   USB3C-A/1-CS/1-C-0   (COMOSS Electronic Co., Ltd.)

- e-CON Cable   1.5m, Shield cable with ferrite core   (Fabricated parts)

Parts:

  - e-CON connector   XN2A-1470   (OMRON Corporation)

  - Ferrite core   ZCAT1730-0730A   (TDK Corporation)

  - Coaxial cable   3C-2VS   (Fujikura Ltd.)

Connection:
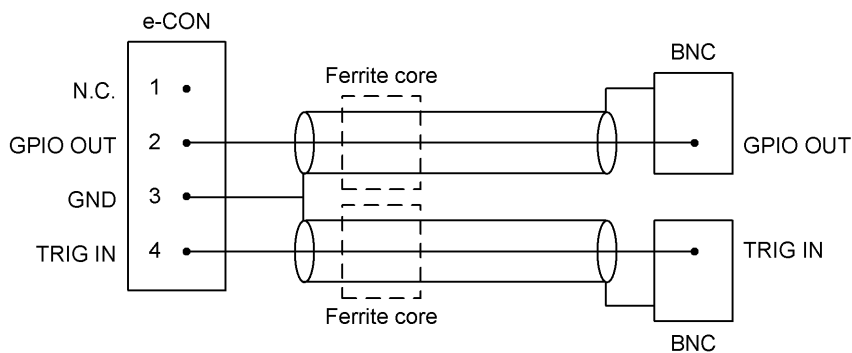
Please confirm the EMC adaptability when it combines with parts other than them.

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Functions

This section introduces standard functions of BU series. This camera series provides following functions.

Category	Function	
DeviceControl	DeviceControl	Device information
ImageFormatControl	ImageFormatSelector	Image format selection
	Scalable	Scalable control
	PixelFormat	Pixel format selection
AcquisitionControl	AcquisitionControl	Image stream start / stop
LuminanceControl	ExposureTime	Exposure time control
	BlackLevel	Black level control
	Gain	Gain control
	Gamma	Gamma control
TriggerControl	TriggerControl	Trigger control
DigitalIOControl	DigitalIOControl	GPIO signal control
TimerControl	TimerControl	Timer0Active signal control
VenderUniqueControl	LEDIndicatorLuminance	LED luminance control
	TestPattern	Test pattern control
	Binning	Binning control

* This camera doesn't have user settings memory control function.

DeviceControl

Registers of this category provide various information of the camera. And you can set the free user ID to the camera.

● Registers

Register	Visibility	Access	Description
DeviceReset	Expert	W	Resets the device.
DeviceVendorName	Beginner	R	Returns the vendor name.
DeviceModelName	Beginner	R	Returns the model name.
DeviceManufacturerInfo	Beginner	R	Returns the manufacturer information.
DeviceVersion	Beginner	R	Returns the device version.
DeviceID	Beginner	R	Returns the device ID (serial number).

ImageFormatControl

Registers of this category are related to image format control.

● Registers

Register	Visibility	Access	Description
ImageFormatSelector	Beginner	R/W	Selects an image format.

● Setting

- Select an image format.

    Set a following value to "ImageFormatSelector" register. Setting value is Enumeration type.

ImageFormatSelector	Function
Format0 (*)	Scalable Mode
Format1	Binning Mode

* initial factory setting

● Note

Changing "ImageFormatSelector" register value is invalid during image stream data output.

Binning function is disabled when the camera is running in Scalable mode.

Scalable function is disabled when the camera is running in Binning mode.

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Scalable

BU series provide the scalable mode that can read out defined area of the screen.

In the scalable mode, camera reads out only necessary area at the normal speed and reads out other area at high speed. The frame rate can be faster when the vertical height size is small. However, the frame rate cannot be faster only when the horizontal width size is small, due to the operation mechanism of the CCD sensor.

Only single rectangle is selectable. Concave or convex shape is not selectable.

- Window size: $\{A \times m \ (H)\} \times \{B \times n \ (V)\}$

A, B = minimum unit size

m, n = integer

The window size is equal or less than maximum image size.

- Start address: $\{32 \times i \ (H)\} \times \{24 \times j \ (V)\}$

i, j = integer

The window size is equal or less than maximum image size.
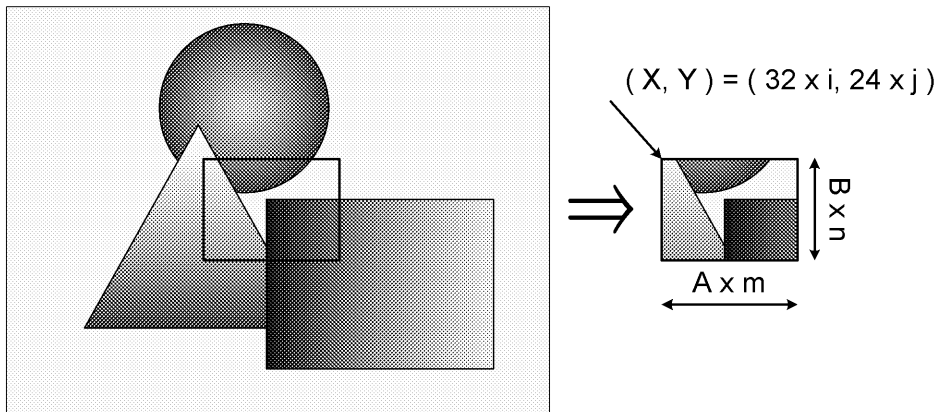
Fig. Scalable

● Registers

Register	Visibility	Access	Description
SensorWidth	Beginner	R	Returns effective width of the sensor in pixels.
SensorHeight	Beginner	R	Returns effective Height of the sensor in pixels.
WidthMax	Expert	R	Returns maximum width (in pixels) of the image.
HeightMax	Expert	R	Returns maximum Height (in pixels) of the image.
Width	Beginner	R/W	Sets width (in pixels) of the image data.
Height	Beginner	R/W	Sets Height (in pixels) of the image data.
OffsetX	Beginner	R/W	Sets horizontal offset (in pixels) from the origin to the region of interest.
OffsetY	Beginner	R/W	Sets vertical offset (in pixels) from the origin to the region of interest.

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● Setting

- Select an image format.

  Select "Fomat0" of "ImageFormatSelector" register.

- Set image size and image start position

  Set the following value to "Width", "Height", "OffsetX", "OffsetY" registers. Setting value is Integer type. "Width", "Height" registers are image size setting. "OffsetX", "OffsetY" registers are image start position setting.

Model	BU030	BU031	BU080	BU130
Width unit size	160	160	256	160
Height unit size	120	120	192	120
OffsetX unit size	32	32	32	32
OffsetY unit size	24	24	24	24
Minimum unit size	160×120	160×120	256×192	160×120
Maximum unit size (*)	640×480	640×480	1024×768	1280×960

* initial factory setting

● Note

Changing "Width", "Height", "OffsetX", "OffsetY" register value is invalid during image stream data output.

Notes on scalable mode:

White lines may occur in the upper portions of the screen when strong light exists in a wide area during the scalable mode. This is not a malfunction. If white lines occur, adjust the amount of incident light using the lens.

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PixelFormat

Select a pixel format of image stream data. BU B/W series provide Mono8 bit Pixel format.

● Registers

Register	Visibility	Access	Description
PixelCoding	Beginner	R	Returns a pixel coding. BU B/W series support Mono coding.
PixelSize	Beginner	R/W	Selects a bit size of image pixel.
PixelEndian	Beginner	R	Returns a pixel endian. BU series support Little endian.
PixelFormat	Beginner	R	Returns a selected pixel format. PixelFormat is conformed to AIA Pixel Format Naming Convention.

● Setting

- Select a pixel size

    Set a following value to "PixelSize" register. Setting value is Enumeration type.

PixelSize	Function
Bpp8 (*)	8 bits per pixel

* initial factory setting

● Note

Changing "PixelSize" register value is invalid during image stream data output.

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AcquisitionControl

Make a setting of image stream and control image stream output.

Camera starts image stream output by receiving AcquisitionStrat command. And there are some registers that require camera to stop image stream output to change values.

Acquisition frame rate is variable. Maximum acquisition frame rate depends on camera operation mode (scalable, binning, draft, etc.)

● Registers

Register	Visibility	Access	Description
AcquisitionMode	Beginner	R/W	Selects an acquisition mode.
AcquisitionStart	Beginner	W	Executes the image stream output start.
AcquisitionStop	Beginner	W	Executes the image stream output stop.
AcquisitionAbort	Beginner	W	Executes the image stream output abort.
AcquisitionFrameRateControl	Beginner	R/W	Activates frame rate setting.
AcquisitionFrameRate	Beginner	R/W	Sets frame rate of image stream.
AcquisitionFrameIntervalControl	Beginner	R/W	Activates frame interval setting.
AcquisitionFrameInterval	Beginner	R/W	Sets frame interval of image stream.

● Setting

- Select an acquisition mode

Set the following value to "AcquisitionMode" register. Setting value is Enumeration type.

AcquisitionMode	Function
Continuous (*)	Continuous image transfer
MultiFrame	Multi frame image transfer

* initial factory setting

- Set the number of frames to transfer (In MultiFrame mode)

Set the number of frames to transfer to "AcquisitionFrameCount". The setting value is Integer type.

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- Start image stream output

　　The camera starts image stream output by executing "AcquisitionStart" register command.

- Stop image stream output

　　The camera stops image stream output by executing "AcquisitionStop" register command.

　　The camera aborts image stream output by executing "AcquisitionAbort" register command.

- Set frame rate

　　Set the "AcquisitionFrameRateControl" register to "Manual".

　　And set the following value to "AcquisitionFrameRate" register. Setting value is Float type.

　　The range of register setting depends on camera model, and camera operation mode.

　　"AcquisitionFrameInterval" register is a reciprocal of "AcquisitionFrameRate".

AcquisitionFrameRateControl	Function
NoSpecify (*)	The frame rate is determined by giving priority to ExposureTime setting value.
Manual	The frame rate is determined by giving priority to AcquisitionFrameRate setting value.

* initial factory setting

AcquisitionFrameRate	Value
Minimum	0.5[Hz]
Maximum (*)	Depend on register setting of "Height", "Binning" and "Draft".

* initial factory setting

● **Note**

　　Changing "AcquisitionFrameRateControl", "AcquisitionFrameRate", "AcquisitionFrameIntervalControl", "AcquisitionFrameInterval" register value is invalid during image stream data output.

　　When exposure time setting is longer than frame rate setting, camera operation gives priority to exposure time setting.

Notes on Frame Drops of Image:

Depends on your PC or USB3.0 interface card configurations, images may not be captured normally (e.g. frame drops may occur). In this case, change to frame rate setting lower.

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ExposureTime

BU series are able to adjust exposure time by using electric shutter control.

BU USB series provide two kinds of exposure time control mode.

- Manual　　　　　　: The exposure time is determined by "ExposureTime" register setting value.
- NoSpecify　　　　: The exposure time is determined by "AcquisitionFrameRate" register setting value

● Registers

Register	Visibility	Access	Description
ExposureTimeControl	Beginner	R/W	Selects exposure time control mode.
ExposureTime	Beginner	R/W	Sets absolute exposure time.

● Setting

- Select exposure time control mode

　　Set the "ExposureTimeControl" register to "Manual".

　　Set the following value to "ExposureTime" register. Setting value is Float type.

AcquisitionFrameRateControl	Function
NoSpecify	The frame rate is determined by giving priority to AcquisitionFrameRate setting value.
Manual (*)	The frame rate is determined by giving priority to ExposureTime setting value.

* initial factory setting

Mode	BU030	BU031	BU080	BU130
ExposureTime (*)	8000 [µs]	8000 [µs]	25000 [µs]	33333 [µs]
ExposureTimeMin	10 [µs]	10 [µs]	30 [µs]	30 [µs]
ExposureTimeMax	16000000 [µs]			

* initial factory setting

● Note

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BlackLevel

This section describes BlackLevel control of LuminanceControl category of the BU series.

This control adjusts the black level of the image. It is adjustable from -5% to +25% as white saturation level is 100%. However, when BlackLevel is lower than 0[%], the image level may not be saturated.
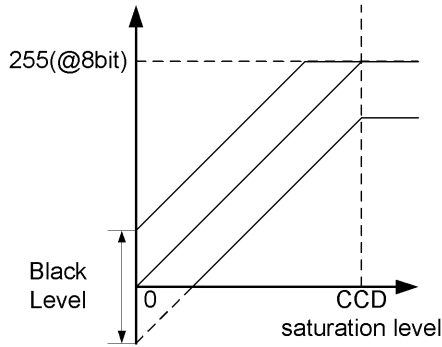

Fig. Black Level

● **Registers**

Register	Visibility	Access	Description
BlackLevel	Beginner	R/W	Sets the absolute Black Level.

● **Setting**

- Set Black Level

Set the following value to "BlackLevel" register. Setting value is Float type.

Black Level	Value
Minimum	-5.00[%]
Maximum	+25.00[%]

* initial factory setting = 0.00[%]

● **Note**

Gain

This section describes Gain control of LuminanceControl category of the BU series.
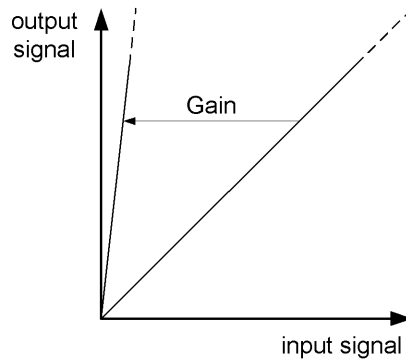This control adjusts the gain of the image.

Fig. Gain

● Registers

Register	Visibility	Access	Description
Gain	Beginner	R/W	Sets the absolute Gain.

● Setting

- Set Manual Gain

Set the following value to "Gain" register. Setting value is Float type. This setting value is valid only at Manual Gain mode setting.

Gain	Value
Minimum (*)	0.00 [dB]
Maximum	18.00 [dB]

* initial factory setting

The formula of Gain value is as follows;

$$\text{output signal} = \text{input signal} \times 10^{\frac{Gain}{20}}$$

● Note

Notes on gain setting:

Setting the gain value too high increases noises. When you adjust the brightness of the image, I ask you to have final image quality checked with your environment.

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Gamma

This section describes Gamma correction of AnalogControl category for the BU series.

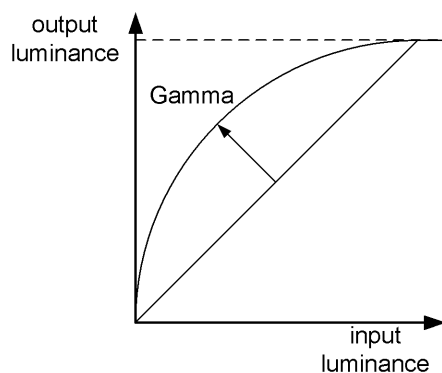This function allows you to apply a gamma correction to the output images.

Fig. Gamma correction

● Registers

Register	Visibility	Access	Description
Gamma	Beginner	R/W	Sets the Gamma correction.

● Setting

- Set Gamma correction

Set the following value to "Gamma" register. Setting value is Float type.

Gamma	Value
Minimum	0.45
Maximum (*)	1.00

* initial factory setting

● Note

TriggerControl

This section describes trigger control of TriggerControl category for the BU series.

This camera series provides two kinds of exposure synchronization.

1. Normal Shutter mode   : Free run operation (internal synchronization)
2. Random Trigger Shutter mode   : Synchronized with external trigger input

In Random Trigger Shutter mode, two kinds of trigger input are available.

1. Trigger signal via the I/O connector (HardwareTrigger)
2. Trigger command via the USB interface (SoftwareTrigger)

The following table shows the combination of operation mode of this camera series.

Table. Operation Mode

Trigger Mode	Synchronization	Exposure Control
Normal Shutter mode	Free run	"ExposureTime" register control
Random Trigger Shutter mode	HardwareTrigger	"ExposureTime" register control (Edge mode:TriggerSequence0)
		Trigger pulse width control (Level mode:TriggerSequence1)
	SoftwareTrigger	"ExposureTime" register control

* The camera operation not mentioned above is not guaranteed.

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When HardwareTrigger operation, you are able to control the exposure time by pulse width of external trigger input signal.

Trigger

ExposureTime

Exposure

USB bus   Image

Edge mode

Trigger

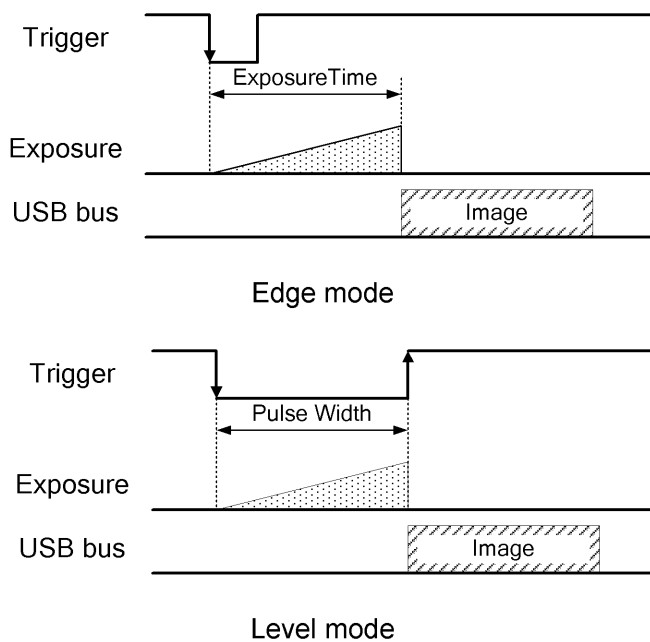Pulse Width

Exposure

USB bus   Image

Level mode
Fig. Trigger sequence

Operation point of HardwareTrigger is at the edge of trigger signal, and active edge polarity is able to change by register setting. And you can add delay time from trigger edge to exposure start by register setting.
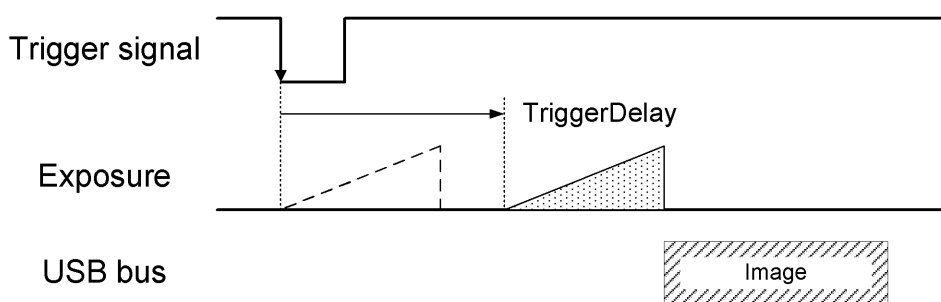
Trigger signal

TriggerDelay

Exposure

USB bus   Image

Fig. Trigger Delay

Details of Random Trigger Shutter operation, refer to "Timing" of "Specification".

● **Registers**

Register	Visibility	Access	Description
TriggerMode	Beginner	R/W	Selects Random Trigger Shutter mode.
TriggerSequence	Beginner	R/W	Selects trigger sequence.
TriggerSource	Beginner	R/W	Selects trigger source of Random Trigger Shutter.
TriggerDelay	Beginner	R/W	Sets trigger delay.
TriggerSoftware	Beginner	W	Executes software trigger.

● **Setting**

- Select trigger mode

Set the following value to "TriggerMode" register. Setting value is Enumeration type.

TriggerMode	Function
Off (*)	Normal Shutter Mode
On	Random Trigger Shutter mode

* initial factory setting

- Select trigger sequence

Set the following value to "TriggerSequence" register. Setting value is Enumeration type.

TriggerSequence	Function
TriggerSequence0 (*)	"ExposureTime" register control
TriggerSequence1	Trigger pulse width control

* initial factory setting

In Normal Shutter mode, the exposure time is determined by "ExposureTime" register value regardless of "TriggerSequence" register setting.

- Select trigger source

Set the following value to "TriggerSource" register. Setting value is Enumeration type.

TriggerSource	Function
Line0 (*)	Hardware trigger
TriggerSoftware	Software trigger

* initial factory setting

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- Set trigger delay (HardwareTrigger operation only)

Set the following value to "TriggerDelay" register. Setting value is Float type.

Adds delay time from trigger edge to exposure start.

TriggerDelay	Value
Minimum (*)	0.00[μs]
Maximum	4095.00[μs]

* initial factory setting

- Grabs image stream by software trigger

When executes "TriggerSoftware" register command, software trigger command is generated. And the camera starts exposure by receiving software trigger command in software trigger mode

● **Note**

When SoftwareTrigger operation, the period from execution of "TriggerSoftware" to grab image is an indefinite.

DigitalIOControl

This section describes DigitalIOControl category for the BU series.

This camera provides GPIO output selected by the register setting. And the polarity of the signal is able to switch by the register setting. The following chart shows the specifications of the selectable signals.
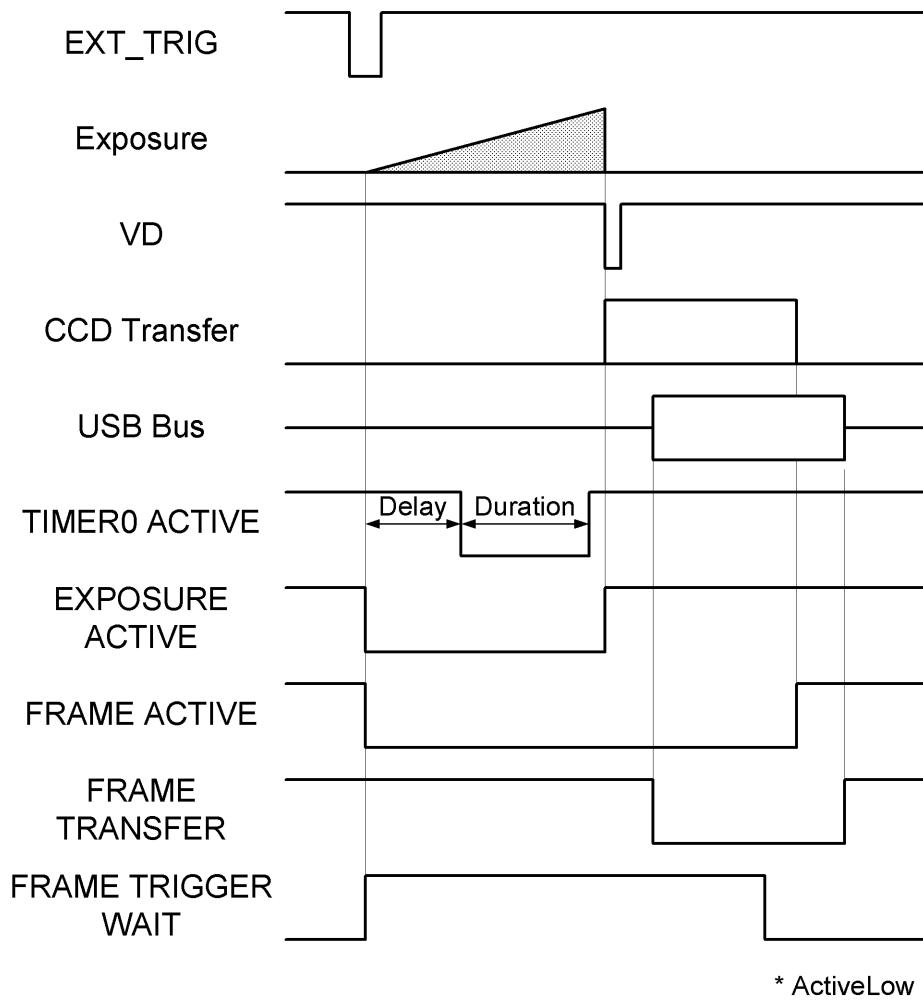

Fig. Selectable signals

● Registers

Register	Visibility	Access	Description
LineModeAll	Beginner	R	Returns the direction of each Line signal.
LineInverterAll	Beginner	R/W	Selects the polarity of each Line signal.
LineStatusAll	Beginner	R	Returns the status of each Line signal.
UserOutputValueAll	Beginner	R/W	Sets the user output value.
LineSelector	Beginner	R/W	Selects the Line of I/O connector.
LineSource	Beginner	R/W	Selects the source of the output signal.

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● Setting

- Select the Line of the I/O connector

Set the following value to "LineSelector" register. Select the line to output "LineSource" signal.

The setting value is Enumeration type.

LineSelector	I/O connector pin assignment	LineMode	Output circuit
Line1 (*)	2 pin: GPIO Output	Output	LVTTL

- Select the source of GPIO output signal

Set the following value to "LineSource" register to change GPIO output signal selected by "LineSelector".

Setting value is Enumeration type.

LineSource	Signal description
Off (*)	No output.
FrameTriggerWait	Indicating waiting a Random Trigger Shutter. An External trigger is input during this period, exposure starts immediately.
FrameActive	Period from exposure start to CCD transfer completion.
FrameTransfer	Period of transferring image data on Ethernet bus.
ExposureActive	Period from exposure start to exposure end.
UserOutput	Outputs the value set in "UserOutputValueAll".
Timer0Active	This signal can be used as strobe control signal. The delay time and pulse width of this signal are configurable.

- Set the UserOutput signal

Set the following value to "UserOutputValueAll" register. The setting value is Integer type.

Each bit corresponds to each Line (bit0=Line0, bit1=Line1).

Only Line1 is settable. Line0 is dedicated trigger input.

UserOutputValueAll	Function
0 (*)	Low level output
1	High level output

- Select the polarity of each signal

Set the following value to "LineInverterAll" register. The setting value is Integer type.

Each bit corresponds to each Line. Both Line0 and Line1 are settable.

Inverter is also inserted to UserOutputValue.

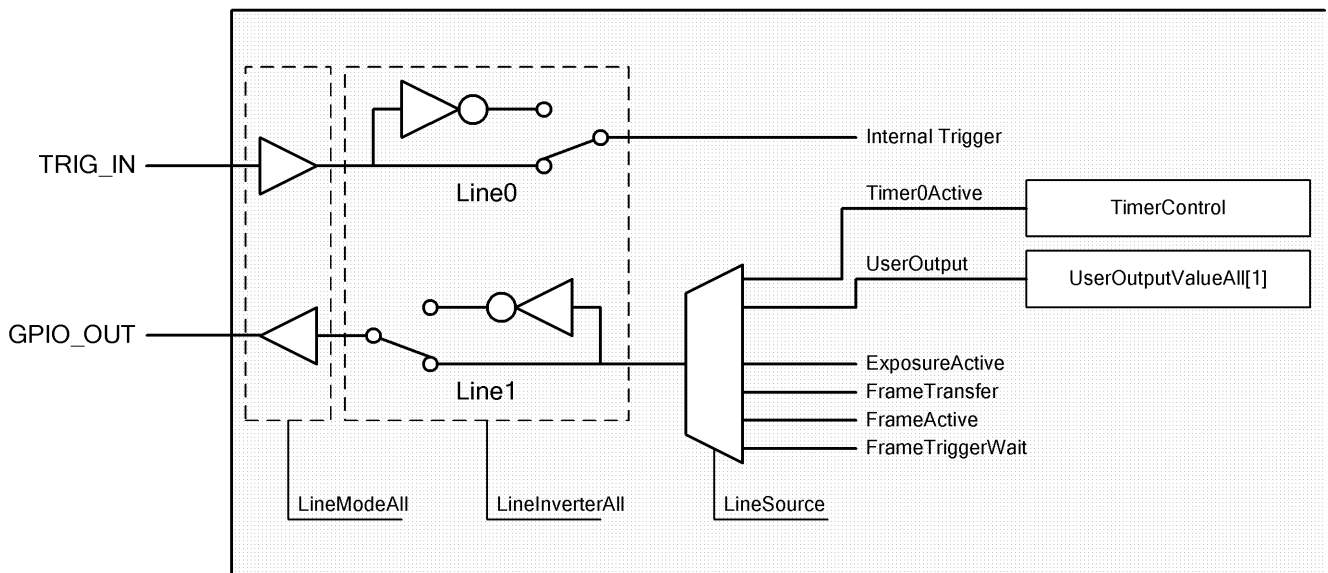| LineInverterAll	Function
0 (*)	non inverted
1	inverted

* initial factory setting

Fig. GPIO internal circuit diagram

● **Note**

About the details of Timer0Active signal, refer to "TimerControl" of "Functions".

TimerControl

This section describes TimerControl category for the BU series.

This camera series is able to generate Timer0Active signal, derived from exposure start, by register setting.

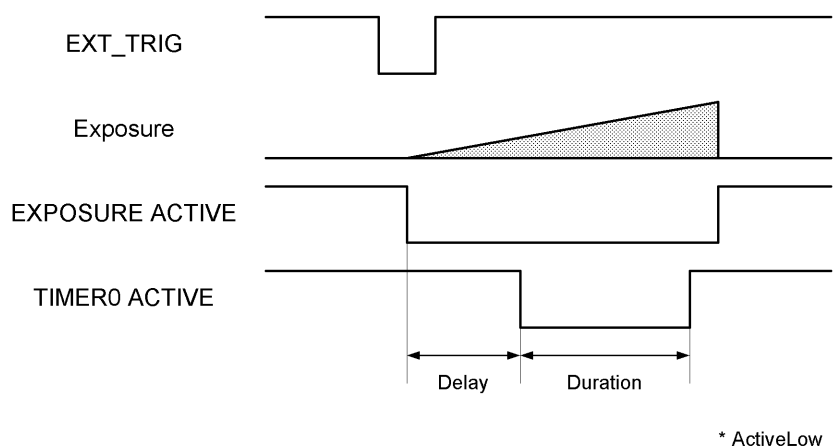This signal can be used as strobe control signal.

Fig. Timer0Active

● Registers

Register	Visibility	Access	Description
TimerSelector	Beginner	R	Returns the selected timer name.
TimerDuration	Beginner	R/W	Sets the width of Timer0Active signal.
TimerDelay	Beginner	R/W	Sets the delay of Timer0Active signal.

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● Setting

- Set the width of Timer0Active pulse

Set the following value to "TimerDuration" register. Setting value is Float type.

TimerDuration	Pulse width
Minimun (*)	0.00[μs]
Maximum	4095.00[μs]

* initial factory setting

- Set the delay of Timer0Active pulse

Set the following value to "TimerDelay" register. Setting value is Float type.

TimerDelay	Delay value
Minimun (*)	0.00[μs]
Maximum	4095.00[μs]

* initial factory setting

● Note

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LEDIndicatorLuminance

Adjusts LED indicator luminance.

● Registers

Register	Visibility	Access	Description
LEDIndicatorLuminance	Expert	R/W	Sets LED indicator luminance.

● Setting

- Set LED indicator luminance

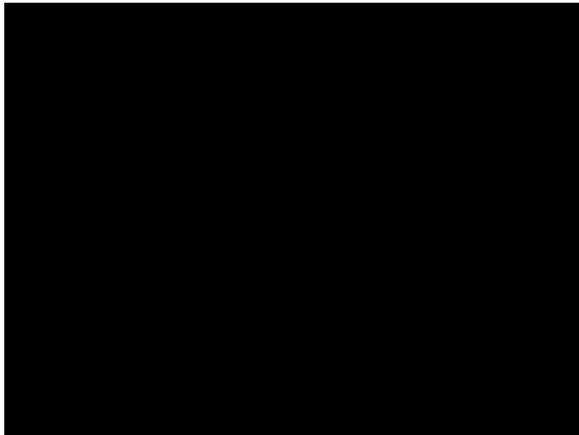Set the following value to "LEDIndicatorLuminance" register. Setting value is Float type.

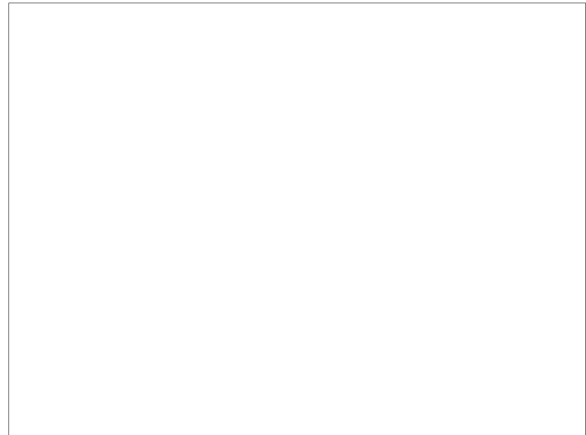| LEDIndicatorLuminance	Value
Minimum	0.00(%)
Maximum (*)	100.00(%)

* initial factory setting

● Note

TestPattern

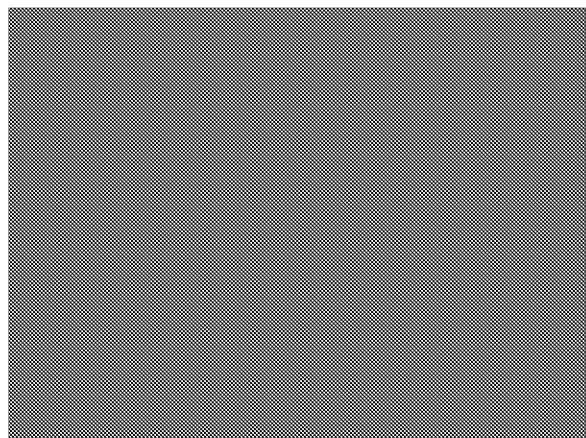BU series support test pattern data output. Camera provides following Test patterns;
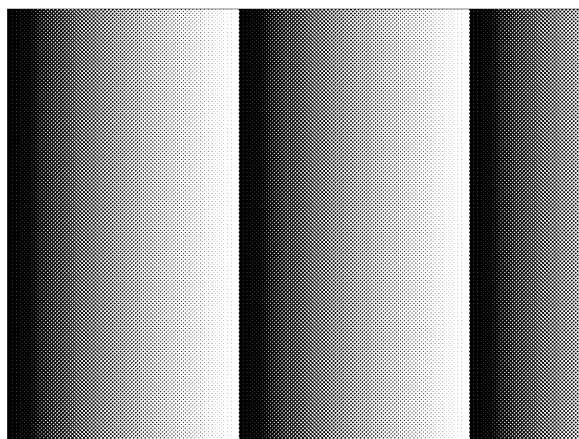
Black

White

GreyB

GreyA

Ramp

Fig. Test pattern

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● Registers

Register	Visibility	Access	Description
TestPattern	Beginner	R/W	Selects a test pattern.

● Setting

- Select a test pattern output

Set the following value to "TestPattern" register. Setting value is Enumeration type.

The camera generates a test pattern.

Setting value	function
Off (*)	Test pattern disable(Normal data output)
Black	All pixel = 0 LSB
White	All pixel = 255 @Mono8
GreyB	All pixel = 170 @Mono8
GreyA	All pixel = 85 @Mono8
Ramp	Horizontal Ramp

* initial factory setting

● Note

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Binning

In the binning mode, a pixel is added with the neighboring pixel(s). This increases the sensitivity of the image. It's alike scalable mode, the frame rate can be faster and Ethernet bandwidth occupation decrease.

Fig. Binning operation (e.g. VGA)
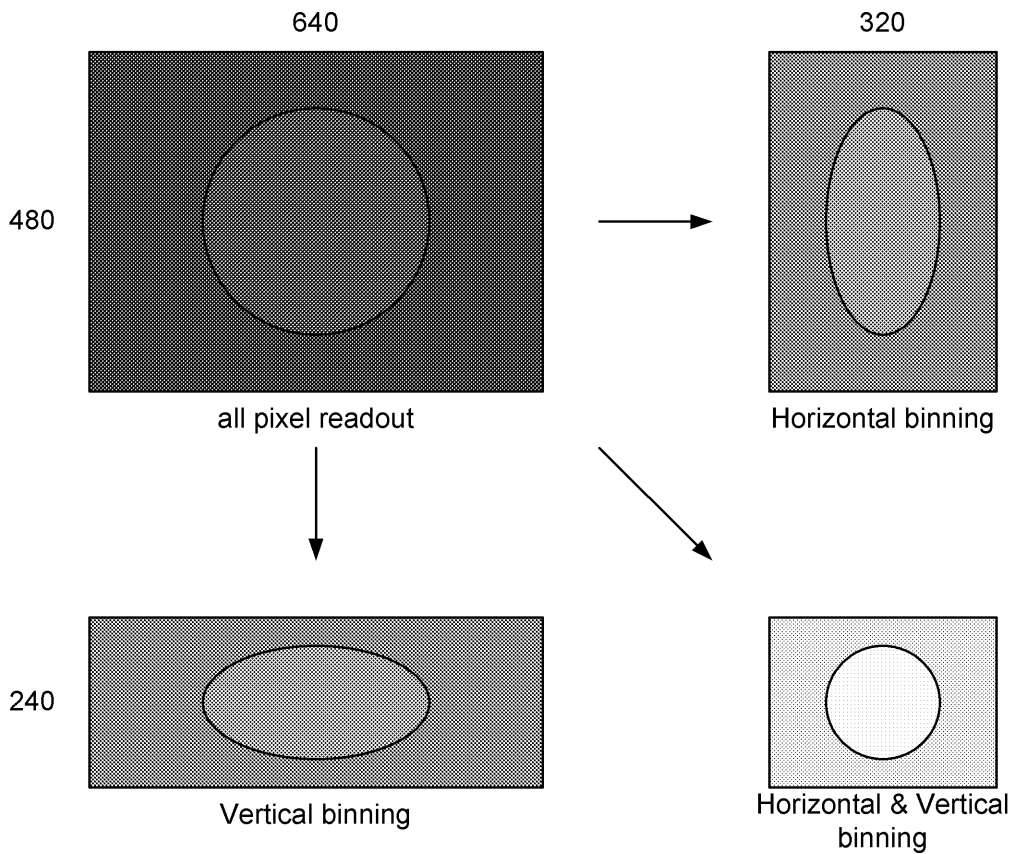
● Registers

Register	Visibility	Access	Description
BinningHorizontal	Beginner	R/W	Set horizontal binning.
BinningVertical	Beginner	R/W	Set vertical binning.

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● Setting

- Select an image format.

  Select "Fomat1" of "ImageFormatSelector" register.

- Set binning operation

  Set the following value to "BinningHorizontal", "BinningVertical" registers. Setting value is Integer type.

  "BinningHorizontal" is the number of horizontal pixel(s) to add. And "BinningVertical" is the number of vertical pixel(s) to add.

Model	BU030	BU051	BU080	BU130
Minimum (*)	1(H)×1(V)	1(H)×1(V)	1(H)×1(V)	1(H)×1(V)
Maximum	2(H)×2(V)	2(H)×2(V)	2(H)×2(V)	2(H)×2(V)

* initial factory setting

● Note

The range of register setting depends on camera model.

Binning function is disabled when the camera is running in Scalable mode.

Scalable function is disabled when the camera is running in Binning mode.

Changing "BinningHorizontal", "BinningVertical" register value is invalid during image stream data output.

Warranty rules

● **Warranty term**

Warranty term is 36 months after your purchase. We may assume the date of the purchase from our shipping date when the date is unidentified.

● **Limited Warranty**

Free warranty is not applicable for the troubles, damages or losses caused by the cases of the followings, even if it is during the warranty term.

1. Natural exhaust, wear or degradation of a component parts

2. Handling against the instructions and conditions described in the instruction manual

3. Remodeling, adjustment and the part exchange. (including the opening of the enclosure box and the alteration)

4. Using the accessories not included with the product or our non-designated optional articles

5. Damages caused during the transportation or deficiency of the handling such as drop or fall of the products after the products having been transferred to customers, leaving the products to corrosive environment such as sunlight, fire, sand, soil, heat, moisture, or an inappropriate storing method

6. A fire, an earthquake, a flood, a lightning, or other natural disasters, pollution and a short circuit, abnormal voltage, excessive physical pressure, theft, other accident

7. When connected to a product which is not recommended

8. When connected to the power supply which is not suitable

9. Forgery product, products which does not have proper serial number, products of which serial number is forged, damaged or deleted

10. All defects that happened after the expiration for a warranty term

Repair

● Repair methods

Exchange to a replacement or an equal function product.

● Repair request methods

On the occasion of a repair request, please return the defective product with the the failure situation report sheet to be filled out.

Please read the following instructions carefully.

1. Please return our product alone, taking out of your equipment in case that our product is installed to an equipment

2. We are unable to return the information such as your own serial numbers, control number, the identification seal, if it is attached to the returned products. Please keep record before you return the product.

3. As the data saved in the camera will not be kept after the repair, please take out data before return.

4. We are unable to accept the cancellation after the repair request by the customer's reason.

5. About the repair product shipping expenses, please bear the charges when you return the product to us. We bear the charges to you from us only for a warranty period.

6. We are unable to accept your request of a delivery date and time of the product return, or the delivery method.

7. We are unable to accept a trouble factor investigation, the request of the repair report.

8. We accept a repair of out of warranty product, if it is reparable.

9. The proprietary rights of the repair request products after the exchange repair belong to us.

10. The immunity from responsibility of the product is applied in the repair completion products.

* Please refer for the inquiry about the software to our homepage or sales personnel.

Failure situation report sheet　　　Ver.2.06　■Entry date

In order to grasp the details of failure,
please fill out the following information, and send us the defective product with this report sheet enclosed.

(1) Customer information

Company Name	Department	Your Name
Telephone number	E-Mail address	FAX number
Postal code number	Address	

(2) Return address　　　Please fill out this information, if the return addrrss is different from above address (1).

The offered personal information is not used for any purposes other than after-sale service, such as repair of a product and an inquiry, and the questionnaire of the improvement in customer satisfaction.
Moreover, except for the case where it commissions within limits required for the above-mentioned purpose achievement, it does not indicate to a third party without a visitor's consent.
We pay careful attention and manage a visitor's information.

(3) We suggest a possible solution before your repair request.
Please ensure your safety when you check following items.
Please handle power supply with proper procedure, and make sure it does not impede any operation.

a) Restart the power supply of this product.	Check → ☐ Tried　☐ Not Tried
Please turn off this product once, switch on a power supply again after passing for a while, and confirm operation.	

b) Exchange for other products.	Check → ☐ Tried　☐ Not Tried
Please exchange for other same products, and confirm operation.	

c) Connect to other PC systems.	Check → ☐ Tried　☐ Not Tried
Please connect this product to other PCs, and confirm operation.	

d) Check Specifications of this product.	Check → ☐ Tried　☐ Not Tried
Please confirm that specifications of this product conform to usage environment refering to following URL.	

URL:http://www.toshiba-teli.co.jp/index.htm　　　Please check our website for the latest information.

(4) Failure situation　　　■Accurual date

Model name	Serial No.	Your dealer
		Purchase date

Failure condition:　(Please fill out the phenomenon in detail.)

(5) From when
☐ Unknown　　　☐ From the beginning　　　☐ After a while
☐ After environment was changed.
(☐ Others _____)

(6) Occurrence frequency
☐ Unknown　　　☐ It certainly occurs.　　　☐ It sometimes occurs.
☐ It occurs, after time passes.
(☐ Others _____)

\<For dealer use\>

Reception date :　　　Receipt No. :　　　JOB No. :　　　Check :

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