CoaXPress Series

Instruction Manual

Version 1.5

Before using this product, be sure to read this instruction manual.

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*The contents of this document are subject to change without prior notice.

Revision history			
Rev.	Revision date	Revisions	Prepared by
1.0	2023.7.28	First edition	Kishimura
1.1	2023.9.26	Deletion of register table, layout modification, function descriptions changed due to changes in camera specifications	Shimada
1.2	2024.1.16	Added status LED description, and others	Shimada
1.3	2024.6.10	Addition of FCC certification and WEEE directive	Shimada
1.4	2024.6.20	Correction of errors	Shimada
1.5	2026.7.27	Address changed	Suzuki

Safety Precautions

Meaning of indication

⚠WARNING	**Indicates a hazardous situation which, if the precaution with this indication is not observed, could result in death or serious injury.**
⚠CAUTION	**Indicates a hazardous situation which, if the product is erroneously handled by ignoring the precaution with this indication, could result in bodily injury and/or property damage.**

Meaning of symbol

	Indicates a "prohibited action."
	Indicates a "matter to which you should pay attention."

⚠ WARNING	
	If an abnormality, such as smoke, strange odor, abnormal sound, or entry of water or foreign matter in the product, occurs, immediately stop using the product. Use of this product with an abnormality or failure may cause fire or electric shock.
	Do not disassemble or modify this product. Failure to follow this instruction may cause fire, electric shock, or failure.
	Securely fix this product. Failure to follow this instruction may cause it to fall.
	Make sure that water and foreign matter do not enter the product. Failure to follow this instruction may cause fire, electric shock, or failure.
	Use the specified power voltage. Connect and disconnect the connection cable with the power supply turned off. Failure to follow this instruction may cause fire, electric shock, or failure.
	Connect cables according to the instructions. Do not damage, forcefully bend, or pull cables. Failure to follow this instruction may cause fire, electric shock, or failure.

⚠ CAUTION	
	Do not use this product in an environment out of its operating environmental range. Failure to follow this instruction may cause the product to fail.
	Do not drop this product or give a strong shock to it. Failure to follow this instruction may cause the product to break or fail.

	Do not install this product at a location subject to direct sunlight or heat for a long period. Failure to follow this instruction may cause the product to fail.
	Do not short-circuit the signal output. Failure to follow this instruction may cause the product to fail.

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1. Applicable Cameras

Model name	Sensor		Pixels			Pixel Size [µm]	Frame rate [fps]
				H	V		
KC48XS1MX	B/W	PYTHON480	0.48MP	800	600	4.8µm(H)× 4.8µm(V)	100
KC130XC2MX	B/W	EV76C560	1.3MP	1280	1024	5.3µm(H)× 5.3µm(V)	55
KC130XC2CX	Color						
KC300XC3MX	B/W	IMX252	3MP	2064	1544	3.45µm(H)× 3.45µm(V)	149
KC300XC3CX	Color						
KC500XC3MX	B/W	IMX250	5MP	2464	2056	3.45µm(H)× 3.45µm(V)	95
KC500XC3CX	Color						

Depending on the model, the supported functions and setting values differ.

2. Overview on Specifications

This product is an industrial camera equipped with a global shutter CMOS image sensor. It connects directly to the customer's image processing device and outputs video signals. The camera can output 24 V power supply, contact signals, and PWM signal for strobe.

CoaXPress (*), an interface standard for general-purpose FA cameras, is used. Power supply, control, trigger signal transmission, and image transmission are performed with a single coaxial cable, so system costs can be reduced.

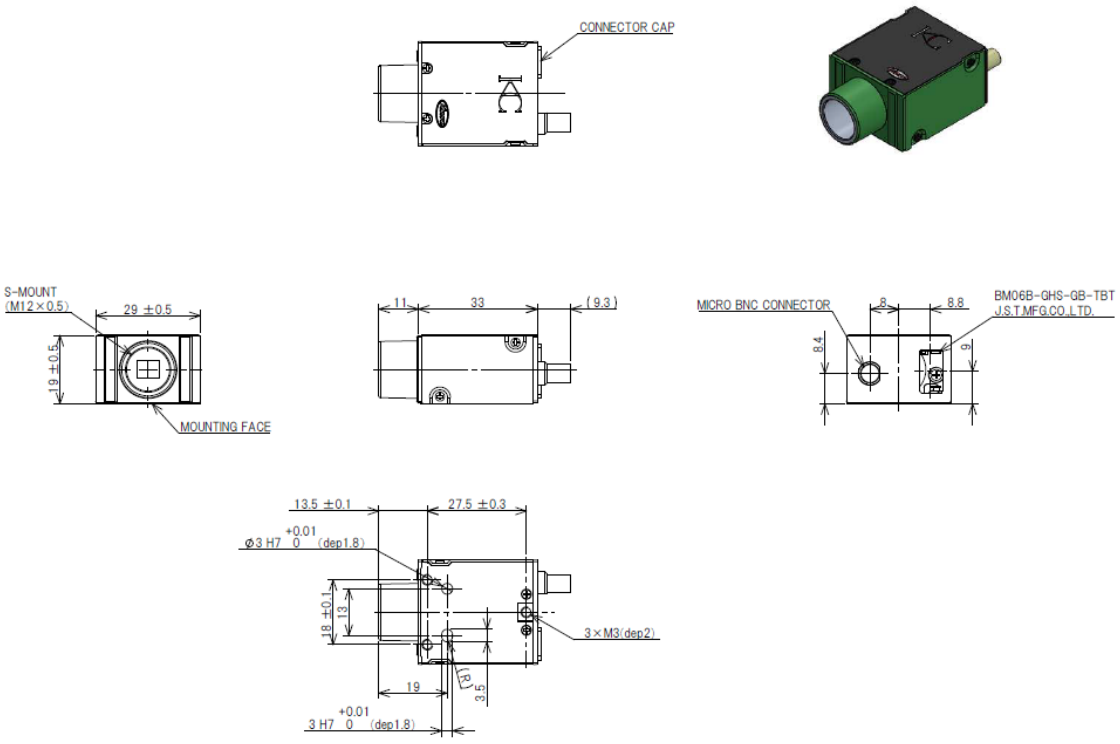
*CoaXPress is a trademark of JIIA.

3. Configuration

- Camera Body ····· 1
- Lens mount cap ····· 1
- 6-pin connector cap ····· 1

4. Appearance Drawing

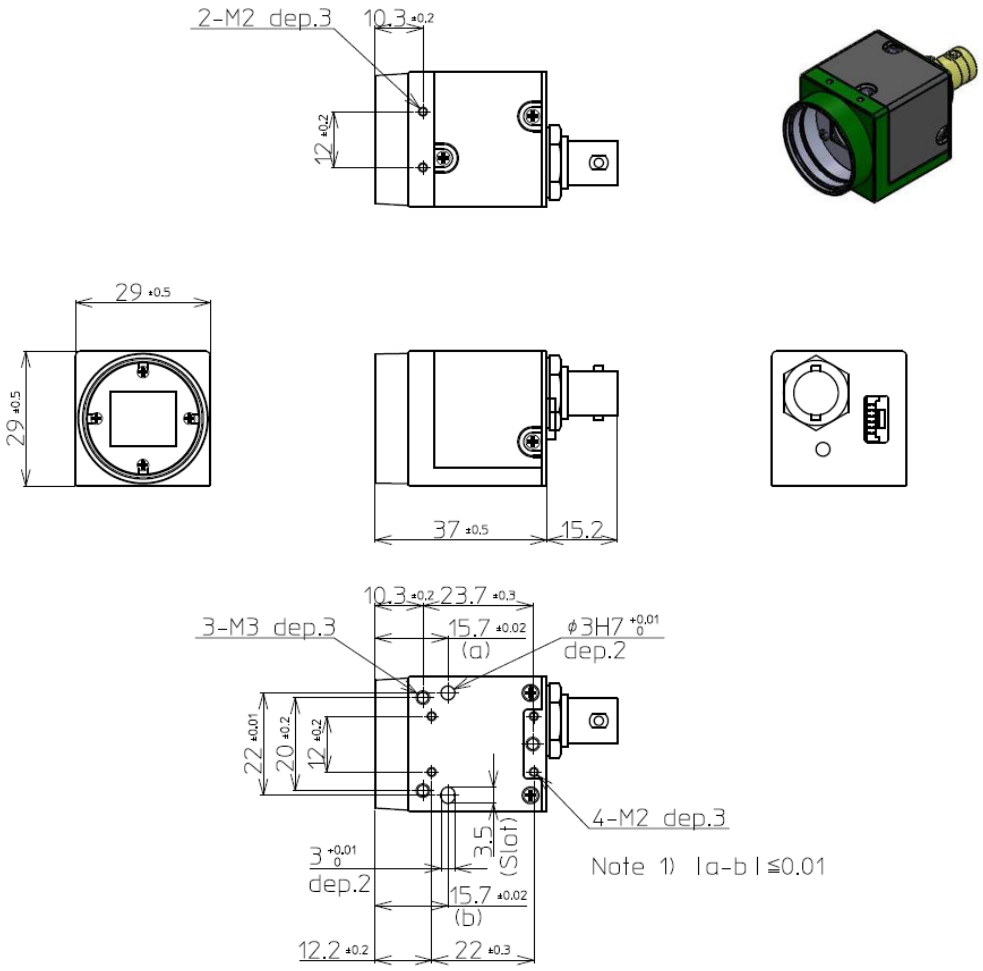
【KC48XS1MX】



(Unit: mm)

Fig. 1 Appearance Drawing (KC48XS1MX)

【KC130XC2MX/CX, KC300XC3MX/CX, KC500XC3MX/CX】



(Unit: mm)

Fig. 2 Appearance Drawing (KC130XC2MX/CX, KC300XC3MX/CX, KC500XC3MX/CX)

5. Location and Name of Each Part

5.1 Bottom Surface

【KC48XS1MX】

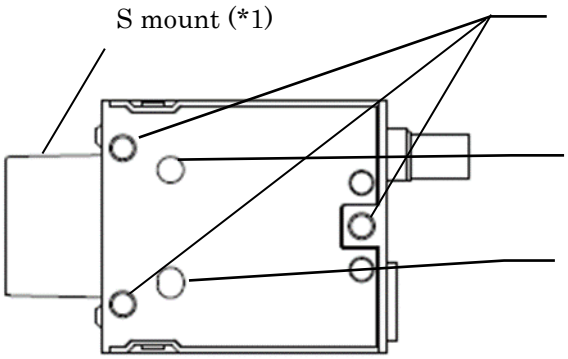


Fig. 3 Bottom

*1 The length from the tip of the lens mount on the chassis to the image sensor is 14.3 mm.

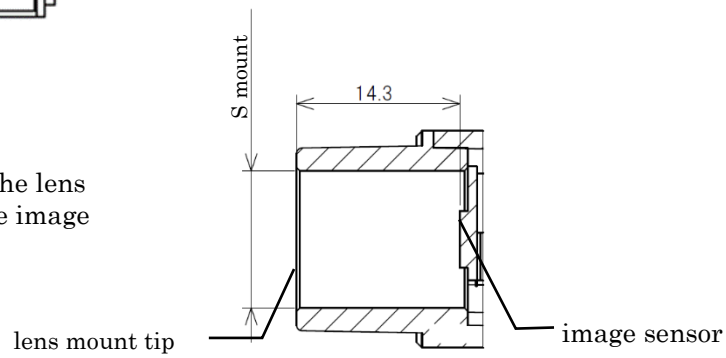


Fig. 4 S Mount Part

【KC130XC2MX/CX, KC300XC3MX/CX, KC500XC3MX/CX】

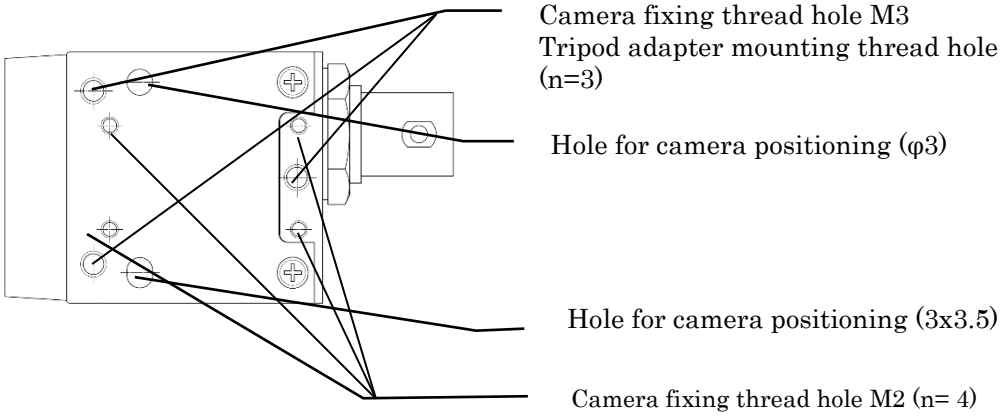


Fig. 5 Bottom Surface

5.2 Upper Surface

【KC130XC2MX/CX, KC300XC3MX/CX, KC500XC3MX/CX】

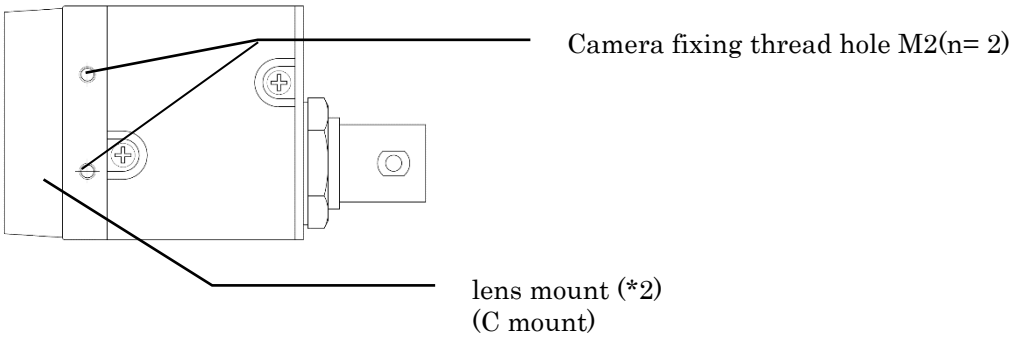


Fig. 6 Upper surface

*2 Use a lens with a protrusion from the lens mount flange surface of 10 mm or less.

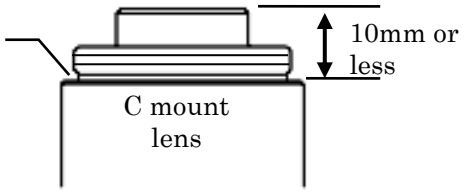


Fig. 7 C Mount Part

5.3 Back Surface

【KC48XS1MX】

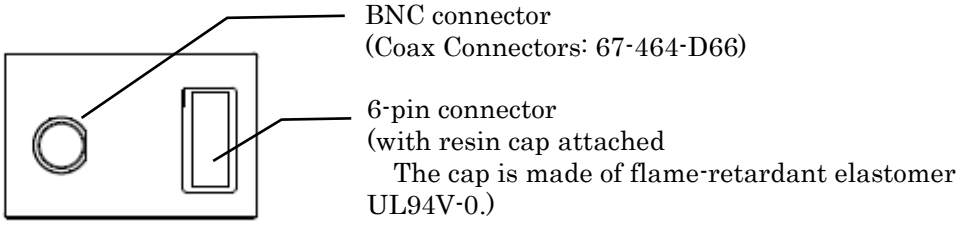


Fig. 8 Back Surface

【KC130XC2MX/CX, KC300XC3MX/CX, KC500XC3MX/CX】

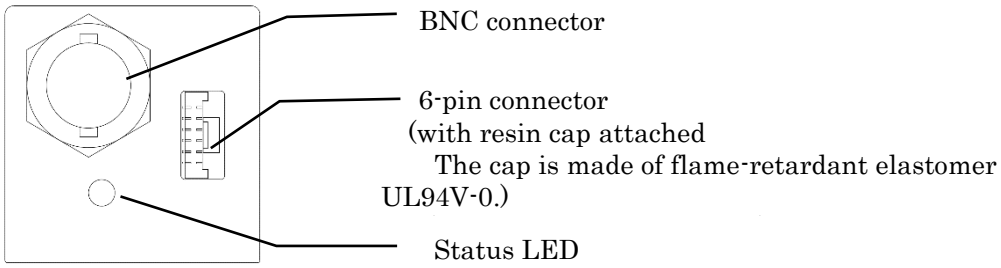
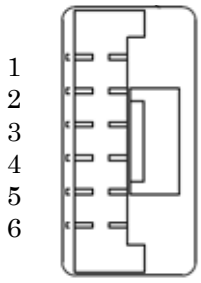


Fig. 9 Back Surface

5.4. 6-pin Connector

It is possible to output an external control signal from the GPO port. It is also possible to output a lighting control signal (PWM) and 24 V DC.

6-pin connector on the back surface
(J.S.T. BM06B-GHS-GB-TBT)



1 : GPO A
2 : GPO B
3 : GPO C
4 : PWM
5 : GND
6 : DC+24V

Compatible connector on the cable side
J.S.T. GHR-06V-S

Fig.10 6-pin Connector Pin Assignment

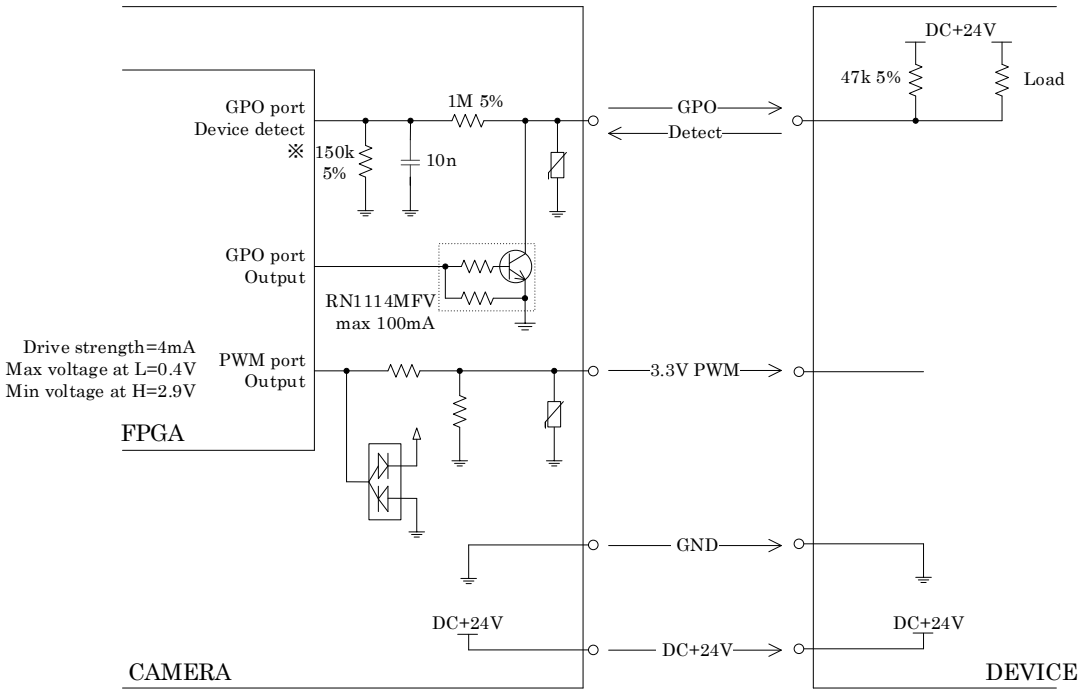


Fig. 11 Pattern Diagram of Electric Circuit on 6-pin Connector

It is possible to detect whether or not a device is connected to the GPO port of the camera. In order to detect device connection, the "Device detect" of the GPO port shall be H at the I/O standard LVTTL voltage level when this product is started. Output of GPO port is open at the start.

H: 2.0V or more

L: 0.8 V or less

For example, as shown in Fig. 11, when the load is turned on and off at the GPO port with DC +24 V as the power supply, connect a resistor in parallel with the load so that the combined resistance with the load is in the range of 270 Ω to 47 kΩ ±5%.

- When GPO is OFF, if the combined resistance is 47 kΩ or more, the device may not be detected when the power supply voltage is low.

  Minimum value of voltage detection level: 18 V × 150 kΩ / (150 kΩ + 1 MΩ + 47 kΩ) = 2.07 V

  (including resistance tolerance)

- When GPO is ON, if the combined resistance is 270 Ω or less, the maximum current of the transistor may be exceeded when the power supply voltage is high.

  Maximum value of current: 27 V / 270 Ω=100 mA

There is a DC resistance component of 400 mΩ from the power supply input to this product to the DC +24 V output of the 6-pin connector, excluding the contact resistance of the BNC connector and 6-pin connector. Please consider the voltage drop of the DC resistance component when using it.

5.5. Status LED

The status LED indicates the operating status of the camera. The following operating statuses can be determined based on the color of the LED.

Off : Camera is stopped.

Rapid blinking in orange and red : Camera is starting up.

Blinking in orange and green (at regular intervals) : Imaging is stopped.

Blinking in orange and green (with brief orange illumination) : Imaging is in progress.

Solid red: Error.

6. Connection

A camera connection example is shown in Fig. 12.

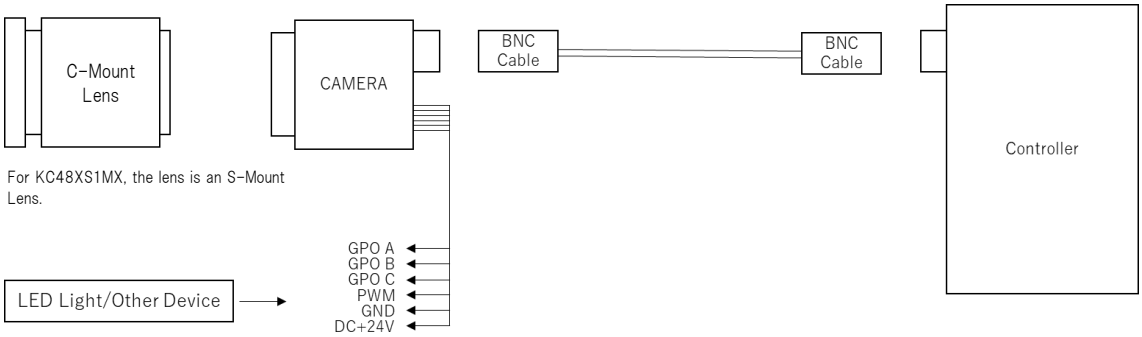


Fig. 12 Connection Example

⚠ As this product does not support hot swap, do not connect or disconnect the BNC connector with 24 V applied.

7. Major Camera Functions

The available functions and specification ranges partially differ depending on the model.

7.1. DeviceControl

It is possible to read information such as camera model name and serial number.

DeviceModelName
: This is the camera model name.
Example: KC500XC3MX

DeviceVersion
: This is the camera internal logic version.

DeviceFirmwareVersion
: This is the camera firmware version.

DeviceSerialNumber
: This is the camera manufacture number.
Example: 00000001

DeviceUserID
: The user can arbitrarily set a character string. Up to 16 alphanumeric characters can be used.
Use this information to identify the camera when multiple cameras are connected.
Setting example: “CAM1,” “Right”
The set character string is stored non-volatile memory even after the power supply to the camera is turned off.

SensorMode（KC300XC3MX/CX, KC500XC3MX/CX）
: This can change the sensor operation. In normal conditions, use the product with this setting left set to “MasterMode.”

FPGATemperature（KC48XS1MX, KC300XC3MX/CX, KC500XC3MX/CX）
: Indicates the temperature (°C) of FPGA.

ImageSensorTemperature（KC48XS1MX, KC300XC3MX/CX, KC500XC3MX/CX）
: Indicates the temperature (°C) of sensor.

7.2. ImageFormatControl

This is the parameter group related to image output format. By using this group, matters related to image including size, subsampling, and data format are specified. If a parameter explained in this section is changed, the size of the data to be transferred will be changed. Therefore, it is necessary to stop the ongoing image transfer and then change the parameter.

SensorWidth/SensorHeight

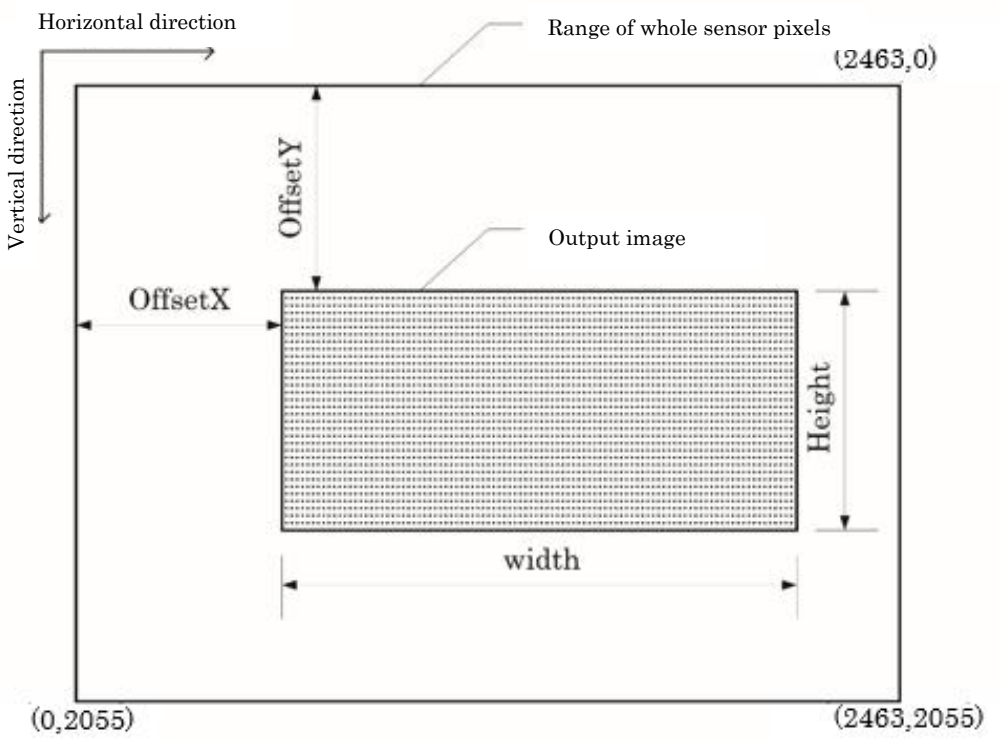
This is the maximum number of pixels that the sensor can output.

Width/Height/OffsetX/OffsetY

It is possible to set the cutout area (ROI) of an output image. Set and acquire the width and height of the area and the offsets in the horizontal and vertical directions. Figure 13 shows a schematic diagram of the ROI setting of this product. Set an output image area within the whole pixel range of the sensor.

Width：Area width [pixels]
Height：Area height [pixels
OffsetX：Left edge of area [pixels]
OffsetY：Upper edge of area [pixels]

* On a color camera, set the ROI area in 2×2 Bayer structure units.
* Use this product by setting the image size (Width×Height) to equal to or higher than StreamPacketSizeMax (default: 384).
*Please note that the number of pixels in the WOI area size within the image sensor and the image size output from the camera may not match due to binning or the subsampling specified.



* For KC500XC3

Fig. 13 Schematic Diagram on WOI Setting

PixelFormat

This is the format of an image to be output by the camera. Major formats include Mono8 (8 bits) for black-and-white cameras and Bayer BG8 (8 bits) for color cameras.

TestPattern

This function outputs a test pattern that is generated inside the camera, instead of an image acquisition by the sensor.

BinningType

With this function, as pixels adjacent in the vertical and horizontal directions are added, it is possible to increase the sensitivity. Unlike ROI, it is possible to decrease the resolution without changing the view angle.

The setting values are as follows (Varies depending on the camera model):

OFF
BINNING2X2
BINNING4X4

BinningDivider

With this function, an image whose brightness value is divided by the "BinningDivider" is output as image data.

The setting values are as follows (Varies depending on the camera model):

DIVIDE_1
DIVIDE_2
DIVIDE_4
DIVIDE_16

*If the pixels are added, specify DIVIDE_1. To return to the original brightness, specify an option in accordance with "BinningType."

* Performing binning decreases the image data size, but does not shorten the image transfer time. When using the binning function, specify the data size to be transferred to Width and Height, and for Offset X and Offset Y, specify an address on the sensor that does not take binning into consideration.

HorizontalSubsampling, VerticalSubsampling (KC48XS1MX, KC130XC2MX/CX)

This sets the steps for reducing the pixels in the horizontal and vertical directions.

The setting values are as follows (Varies depending on the camera model):

OFF
SUB_2
SUB_4
SUB_8

* In a sampling in the vertical direction, the image transfer time is shortened in proportion to the data amount. However, in a sampling in the horizontal direction, the image transfer time is not shortened. When using the subsampling function, set the size of the data to be transferred to Width and Height.

SensorDataClock (KC130XC2MX/CX)

This changes the sensor output clock of the camera.

Data	Freq[MHz]	Data	Freq[MHz]	Data	Freq[MHz]	Data	Freq[MHz]
9	9.6	12	12	14	14.3	16	16
19	19.1	22	22.9	24	24	28	28.7
38	38.2	48	48	57	57.3		

SensorLineWidth (KC48XS1MX, KC300XC3MX/CX, KC500XC3MX/CX)

This function changes the single output line width from the sensor (duration including blanking). When the value is increased, the image output from the sensor becomes slower.

Use the product with this setting set to the default value.

7.3. AcquisitionControl

This is the parameter group concerning image capturing.

AcquisitionFrameRate

This specifies the output frame rate [Hz] from the camera.
This parameter is enabled when AcquisitionFrameRateEnable is set to “True (ON).”

AcquisitionFrameRateEnable

This enables (True) or disables (False) the set AcquisitionFrameRate.
True (ON): Enables the AcquisitionFrameRate setting.
False (OFF): Disables the AcquisitionFrameRate setting. In this setting, the camera outputs images at the fastest frame rate for the output image size.
If the image size is decreased by using ROI, the frame rate will increase.

CurrentFrameRateMax (read only)

This is the maximum frame rate that can be output by the camera. This value varies depending on image acquisition parameters including ROI.

TriggerMode

This sets the mode of image acquisition trigger.
On: This is the mode for image acquisition by an external trigger.
Off: It is possible to perform image acquisition by an internal trigger (AcquisitionStart).

TriggerSource

This specifies the trigger signal source. To enable an external trigger, turn on TriggerMode.
CXP : Acquiring image by a trigger packet signal from host.
Software : Acquiring image by Software trigger command from host.

TriggerSoftware

This issues a software trigger command.
To enable the software trigger, configure the setting as follows.
TriggerMode:ON TriggerSource:Software

ExposureTime

Sets and acquires the exposure time.

ShutterDelay

Sets and acquires the delay of start of exposure.

7.4. AnalogControl

This is the parameter group concerning output level including camera gain.

Gain

Sets and acquires the gain value (magnification).

RedGain, Green1Gain, Green2Gain, BlueGain (only color)

Sets and acquires the gain values (magnifications) on color basis.

GammaValue

This parameter, referred to as "Gamma," changes the camera input/output characteristics, and sets the γ value in the formula below.

$Y=X^{(1/\gamma)}$

Off : $\gamma = 0$
Gamma_2 : $\gamma = 2.0$
Gamma_1_414 : $\gamma = 1.414$

CompressionKneePoint12bit (KC48XS1MX)

This register is a 16-byte register, and by setting the four parameters a, b, c, and e, sets the compression method from 12-bit data output from the sensor to 8-bit. The conversion method is as described below.

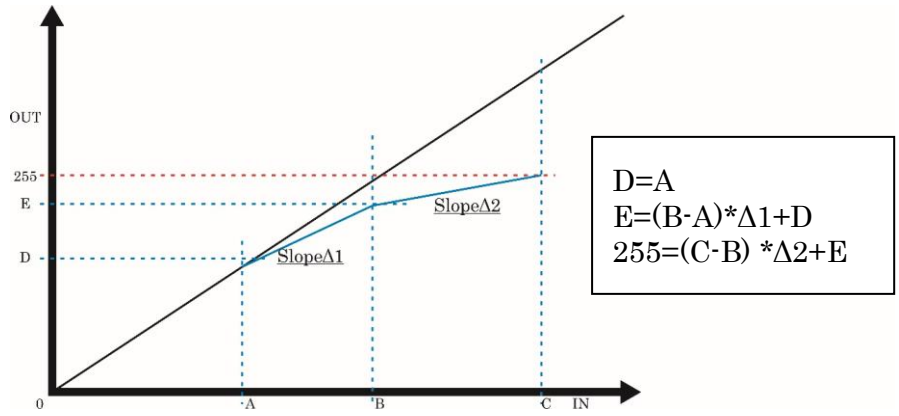


Fig. 14 Diagram of 12-to-8-bit compression

However, the restrictions described below apply.
A: It shall be in the range of 0 to 255.
B: It shall be in the range of 0 to 4095.
B-A shall be a factorial of 2 up to 2048.
C: It shall be in the range of 0 to 4095.
C-B shall be a factorial of 2 up to 2048.
D: It shall be the same value as A.
E: It shall be in the range of 0 to 255.
Example) A=50, B=1074, C=2098, E=200
In addition, specify the described below for the 16-byte (4WORD) structure.

WORD	bit31~24	bit23~16	bit15~8	bit7~0
0	0x000000			bit7~0:A
1	0x0000		bit11~0:B	
2	0x0000		bit11~0:C	
3	0x000000			bit7~0:E

CompressionKneePoint（KC130XC2MX/CX）

Sets and acquires the bending point of the 10-to-8-bit compression function. By setting this function, the luminance signal to be output is compressed with the following formula. Fig. 15 shows a diagram of this function.

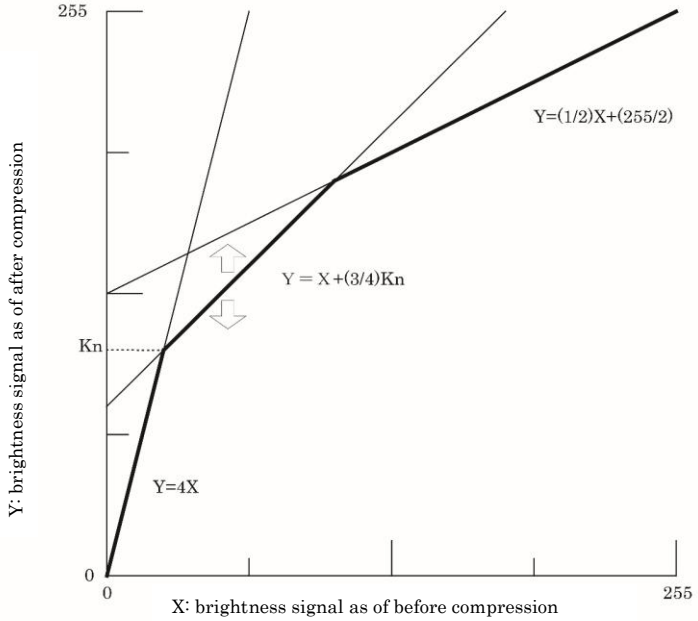


Fig. 15 Diagram of 10-to-8-bit compression

0 ≦X＜ (1/4)Kn : Y=4X
(1/4)Kn ≦X＜255~(3/2)Kn : Y=X+(3/4)Kn
255-(3/2)Kn≦X≦ 255 : Y=(1/2)X+(255/2)
Y: brightness signal as of after compression
X: brightness signal as of before compression
Kn: bending point

HDREnable（KC130XC2MX/CX）

When this function is set to ON, imaging is performed two times in a row per single trigger signal. The second imaging starts immediately after the output of the first image signal. Fig. 16 shows a diagram of this function. (0: OFF, 1: ON; the default setting is 0)

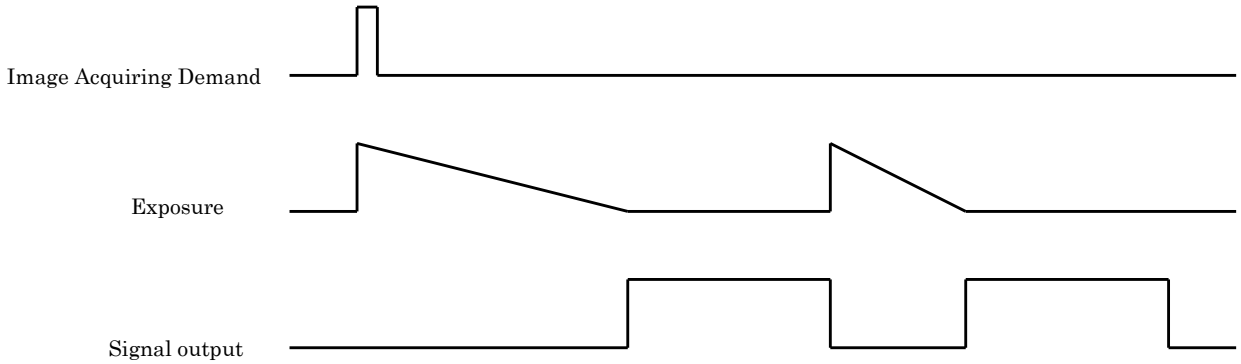


Fig. 16 HDR diagram

HDRExposureTime（KC130XC2MX/CX）

This sets and acquires the exposure time for the second imaging when the HDR function is set to ON.

7.5. DigitalIOControl

This is the parameter group for controlling the I/O output from the rear face of the camera.

CameraPortFunctionA/B/C

This changes the I/O signal output mode on the rear face of the camera.
GPO: It is possible to turn ON/OFF signal output.
Strobe: A pulse can be output in synchronization with the strobe trigger timing, making it possible to create the flash timing of the lighting.
To specify the pulse width, set “CameraStrobeSignalWidthA/B/C.” To specify the delay time from trigger, set “CameraStrobeSignalDelayA/B/C.”

CameraStrobeSignalDelayA/B/C

This sets the delay time [μs] of the pulse output for strobes from the trigger.

CameraStrobeSignalWidthA/B/C

This sets the output time [μs] of the pulse for strobes.

CameraGeneralPurposeOutputA/B/C

This can turn ON/OFF the signal output to Port A/B/C. To use this function, set CameraPortFunctionA/B/C to “GPO.” （True：ON, False：OFF）

CameraPWMFunction

This sets the function of the PWM signal output on the rear face of the camera.
GPO ：User mode (in accordance with the setting of CameraPWMOut)
Strobe: Strobe mode
This makes the lighting perform strobe flashing every time exposure occurs.
To specify the strobe flashing time, set “CameraPWMWidth.” To delay the flashing, set “CameraPWMDelay.”

CameraPWMDelay

This specifies the delay time [μs] from exposure start to output of the PWM pulse. This function is enabled when PWMFunction is set to “Strobe.”

CameraPWMWidth

This specifies the output duration of the PWM pulse [μs]. This function is enabled when PWMFunction is set to “Strobe.”

CameraPWMOut

This turns the PWM output ON/OFF. The PWM signal is output at 3.3 V (LVTTL).

CameraPWMDutyRate

This specifies the duty of the PWM pulse (0 to 15). When set to “0,” the lighting is at its dimmest. When set to “15,” the lighting is at its brightest.

CameraPortDeviceDetectedA/B/C

This register returns the presence or absence of a device (detection result) at the time when the camera is started. Please note that it does not change dynamically.
In order to detect device connection, the "Device detect" of the GPO port shall be H at the I/O standard LVTTL voltage level when this product is started.
Output of GPO port is open at the start. (H: 2.0 V or higher L: 0.8 V or below)

Lighting control procedures

To keep the lighting on from the camera, configure settings by following the steps below.

To keep the lighting on
Set CameraPWMFunction to “GPO.”
Set CameraPWMOut to “TRUE(ON).”
Set CameraPWMDutyRate to “0 (Min) to 15 (Max)” to adjust the lighting brightness.
To turn off the lighting, set CameraPWMOut to “FALSE(OFF).”

To perform strobe flashing (perform flashing for the set duration every time exposure occurs)
Set CameraPWMFunction to “Strobe.”
Set the flash duration [µs] (same as exposure time in normal conditions) to CameraPWMWidth.
Set the time [µs] from the start of exposure to the strobe flashing to CameraPWMDelay.
Set CameraPWMDutyRate to “0 (Min) to 15 (Max)” to adjust the lighting brightness.
When image acquisition is performed, the strobe flashes.

Note：
Set CameraPWMWidth and CameraPWMDelay in such a manner that the sum of those durations does not exceed the frame rate interval.
If CameraPWMFunction is set to “Strobe,” the value of CameraPWMOut does not affect the operation.

8. Disclaimer

・We do not take any responsibility for fires, earthquakes, floods, lightning strikes, acts by third parties, other accidents, customer intentional or negligence, misuse, or failures, damages, and losses (including items caused by third parties) caused by use under abnormal conditions.

・We are not responsible for any incidental damages (loss of business profit, interruption of business, change or loss of memory content, etc.) arising from the use of this product or inability to use this product.

・We are not responsible for any damage caused by not complying with the contents described in this specification.

・We are not responsible for any damage caused by malfunction, etc. due to combination with connected devices.

・The warranty period for this product is one year from the date of delivery.

・Do not disassemble or modify this product. Even within one year after delivery, the warranty will no longer be valid.

・We are not responsible for any failure or damage caused by maintenance, repair, etc. by the vendor from which you purchased this product or by anyone other than our company.

・Items not described in the specifications of this product are not covered by the warranty, and our company does not take any responsibility.

9. Federal Communications Commission

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: 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 communications.

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.

10. Environmental protection notice

At the end of its life span, this product may not be disposed as normal household waste. It must be disposed of at a collection center for recycling of electrical and electronic equipment or contact the manufacturer directly. The product label, inside the manual, or on the packing points to this information. The materials are recyclable according to their labelling. Through reusing, material recycling, or other forms of utilization of old devices you are making an important contribution to the protection of the environment. Please ask your local administrator for the responsible waste disposal center or contact the manufacturer.

11. Others

The product specifications are subject to change without prior notice for product improvement. The functions, designs, etc. provided in this instruction manual are subject to change without prior notice. We kindly ask for your understanding.

12. Product Specification List

	SVGA Camera	1.3MP Camera		3MP Camera	
Model	KC48XS1MX	KC130XC2MX	KC130XC2CX	KC300XC3MX	KC300XC3CX
Monochrome/Color	B/W	B/W	Color	B/W	Color
Interface	CXP-2 (BNC)			CXP-6 (BNC)	
Sensor Format	1/3.6"	1/1.8"		1/1.8"	
Resolution	0.48MP 800(H)×600(V)	1.3MP 1280(H)×1024(V)		3MP 2064(H)×1544(V)	
Pixel Size	4.8 μm(H)×4.8 μm (V)	5.3 μm(H)×5.3 μm (V)		3.45 μm (H)×3.45 μm (V)	
Shutter Type	Global Shutter				
Frame Rate	100fps	55fps		149fps	
Power Supply	PoCXP				
Power Consumption	2 W or less	1.5 W or less		3.6 W or less	
External Dimensions	29mm(W)×19mm(H)×33mm(D) (excluding protrusions)	29mm(W)×29mm(H)×37mm(D) (excluding protrusions)			
Mass	Approx. 30 g	Approx. 50 g			
Operating Temperature/Humidity	0℃ to +45℃ *(1) / 20% to 80%RH (state without condensation)			0℃ to +35℃ *(2)/ 20% to 80%RH (state without condensation)	
Storage Temperature/Humidity	−30℃ to +60℃ / 20% to 90%RH (no condensation)				
Vibration Resistance *(3)	10G				
Impact Resistance *(4)	75G				

	5MP Camera	
Model	KC500XC3MX	KC500XC3CX
Monochrome/Color	B/W	Color
Interface	CXP-6 (BNC)	
Sensor Format	2/3"	
Resolution	5MP 2464(H)×2056(V)	
Pixel Size	3.45 μm(H)×3.45 μm (V)	
Shutter Type	Global Shutter	
Frame Rate	95fps	
Power Supply	PoCXP	
Power Consumption	3.6 W or less	
External dimensions	29mm(W)×29mm(H)×37mm(D) (excluding protrusions)	
Mass	Approx. 50 g	
Operating Temperature/Humidity	0℃ to +35℃ *(2)/ 20% to 80%RH (state without condensation)	
Storage Temperature/Humidity	−30℃ to +60℃ / 20% to 90%RH (state without condensation)	
Vibration Resistance *(3)	10G	
Impact Resistance *(4)	75G	

*(1) Appropriate heat radiation is required. *(2) Use this product with its housing surface temperature at 55℃ or below. *(3) Complies with IEC 60068-2-6 (JIS C 60068-2-6). *(4) Complies with MIL-STD-810H.