September 11, 2025
Ver1.00

USB3.0 OUTPUT
HIGH RESOLUTION CAMERA
ARTCAM-5040-USB3
INSTRUCTION BOOKLET

ARTRAY CO., LTD.

Contents

1. Attention

■About this manual

1. Before using the camera, please read this manual thoroughly.
2. Please keep this manual reachable and always refer to the contents when needed.
3. Please contact us if the manual is lost or damaged. We will provide a replacement.
4. We do not guarantee the safety of the camera when used improperly.
5. For your safety, please follow the instructions in this manual.
6. All contents are subject to change.
7. Images in this manual may have been simplified for easier comprehension.
8. Please contact us if you find any unclear points or mistakes in this manual.
9. Quoting, copying or altering any or all parts of this manual without our permission is prohibited.
10. We are not responsible for any loss or damages to your profits due to the use of our products.
11. Please understand that our oversea branches do not provide maintenance or repair services.

■About the Icons

To ensure the safety of the user, other people and their property, please pay attention to the following icons.

Warning

If the user fails to follow the instruction, serious injury or death may occur.

Caution

If the user fails to follow the instruction, physical injury to humans or damage to hardware may occur.

■For Safe Use

Warning

●Under the following circumstances, please stop using the product and turn off the power immediately to prevent the risks of fire and electric shock. If the product is defective, please contact us for repair or replacement. For your safety, please do not disassemble, modify or repair the camera yourself.

Please stop using the product and turn off the power immediately if:

・The camera emits smoke, becomes abnormally hot, or produces unusual smells or sounds.

・Foreign objects or water have entered the camera.

・The camera was damaged due to impact.

●Do not place the product on unstable surfaces, as it may fall and cause injury

Caution

●Do not expose the product to steam or fumes as this may result in electric shock or fire.
●Do not place or store the product in high-temperature environments such as near open flames, inside vehicles or under direct sunlight. It may adversely affect internal components of the product and could potentially cause a fire.
●Do not cover the product with cloth or other materials. The product may overheat, which could deform its components or lead to a fire.
●Avoid dropping or subjecting the product to strong impact as this may cause damage.
●Do not touch the cable with wet hands as this may result in electric shock.
●Avoid prolonged contact with the surface of the camera while it is powered on. The surface may become hot and could cause low-temperature burns.

■Other Notices
●Please do not use the camera under strong lights such as sun light for a long period. Also, please do not expose the camera under strong lights even when the product is not being used because the sensor might be damaged.

■Maintenance
● Wipe any dirt from the camera with a soft cloth or tissue. Do not use alcohol, thinner or benzene to avoid discoloration or damage to the surface coating.

■Notice on Radio Interference
●Using the camera near a radio or television receiver may cause reception interference.

■Export Control
This product is a Catch-all Control item subject to the Foreign Exchange and Foreign Trade Act and its relevant legislations. Except for exports to the 27 white countries designated by Cabinet Order, export licenses are required if the products are intended for military use or if the end user of the product is related to all kinds of military activities. If your circumstances cause the need to apply export licenses, please notify us before you place orders. Also, please notify us in advance if the end users or purposes of use change after the purchase and thus cause the need to apply export licenses.

About the Japanese Security Export Controls, please refer to the webpage for Security Export Control Policy, the Ministry of Economy, Trade and Industry:
www.meti.go.jp/policy/anpo/englishpage.html

The above is based on the applicable laws and regulations in effect at the time of issuance of this document. Please ensure to check the latest laws and regulations before exporting this product.

■Guarantee
To support environmental sustainability, we do not issue printed warranty documents. Instead, all records of the warranty periods, delivery dates and the customer information are securely stored in our system.

For more details, please refer to the following link:
Hardware Warranty: http://www.artray.us/download/artray_warranty.pdf

●We do not guarantee that the functions of this product or the descriptions on this manual are suitable for the customer's intended use or marketability. Furthermore, we assume no liability for any direct or indirect damages arising from the use of this product.

●Please do not use this product in applications requiring high reliability. This product is not designed or intended for use in medical devices, nuclear facilities, aerospace equipment, transportation systems, or any other equipment critical to human safety. We are not held responsibility for any damages on the users' property, equipment or personal safety caused by this product.

■Disposal
●To dispose this product, please return the camera to us. If you decide to dispose the camera without returning it to us, please follow relevant regulations and ensure that it is treated as industrial waste.
Always keep records of the disposal and ensure that the disposed camera cannot be accessed or used by any third party.

2. Introduction

This manual elaborates the product specifications of the camera equipped with CMOS sensor and USB3.0 output, the color camera ARTCAM-5040-USB3, the RGB-IR camera ARTCAM-5040-RGBIR-USB3, and the monochrome camera ARTCAM-5040-BW-USB3.

3. Features

- RGB-IR Camera

An RGB-IR camera can capture both the visible and infrared spectral ranges without the use of a mechanical switch.

- Global Shutter Support

The CMOS sensor adopts a global shutter type, enabling the capture of sharp images without image smearing, even when photographing fast-moving subjects.

- USB3.0 Interface

It features a USB 3.0 interface, ensuring excellent compatibility with PCs and allowing direct image transfer without the need for a capture card or a host capture card.

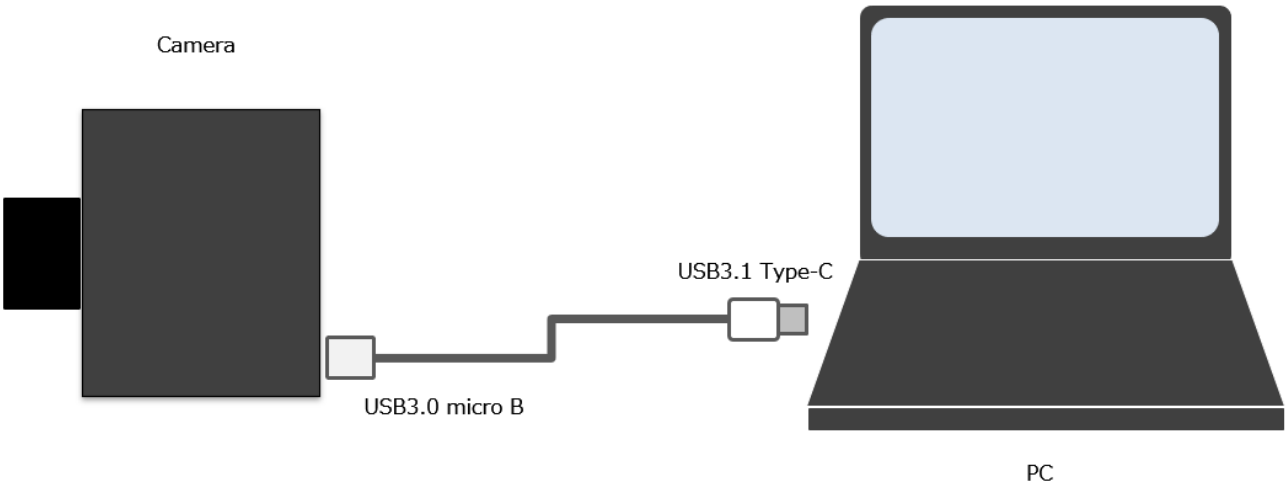
4. The Product

1) Camera
2) USB3.1 Gen1 cable TYPE C-micro B connector, approx. 2m
3) Viewer software and Device driver CD

<Optional>
1) C-mount lenses
2) Various lenses
3) Various filters
4) Cable for external IO/trigger input
5) USB3.0 cable TYPE A(dual)-micro B connector, approx. 3m

5. Connections

5.1. How to Connect a Camera (an example)



6. Specification

6.1. Specifications

Items	ARTCAM-5040-USB3	ARTCAM-5040-RGBIR-USB3	ARTCAM-5040-BW-USB3
Model	CANON RGB Sensor LI5040SAC	CANON RGB-IR Sensor LI5040SAI	CANON Monochrome Sensor LI5040SAM
Active Pixels	2592(W) x 2056(H)		
Effective Pixel	2592(W) x 2056(H)		
Pixel Size	3.4[μm] × 3.4[μm]		
Active Image Size	8.81[mm] x 6.99[mm] (2/3 inch)		
Spectral Range	350 ~ 850nm (QE>10%)		
Shutter	Global Shutter		
S/N Ratio (reference)	71.2dB (for reference only)		
Interface	USB3.0 Bulk Transfer		
A/D resolution	12bit		
Frame Rate	Max 30.0fps (12-bit mode) Max 60.0fps (8-bit mode)		
Exposure time	7.66μsec - 3sec		
Gain (analog/digital)	0 to 63 ※Default value is 32 (0 to 23.625dB, 0.375dB Step ※Default value is 12dB)		
ROI	ON/OFF ※Default value：OFF Supported (horizontal size must be a multiple of 24, and vertical size must be a multiple of 2)		
Mirroring	ON/OFF ※Default value：OFF Software processing only		
Synchronization Method	Internal Synchronization / External Trigger Synchronization (Optional)		
Lens mount	C mount		
Power-supply voltage	5.0V (±0.5V) USB Bus Power		
Power Consumption	MAX Approx. 5W		
Ambient Conditions	Operating Temperature / Humidity: 10 ~ 35°C / 10 ~ 80% （Non-water vapor condensation state） Storage Temperature / Humidity: 0 ~ 60°C / 10 ~ 95% （Non-water vapor condensation state）		
External Dimensions	80.0(W) × 65.0(H) × 36.8(D) mm ※Exclude lens, tripod mount and projections		
Weight	Approx. 250g		

6.2. Functions of camera

6.2.1. Shutter Speed

The exposure time of the camera (electronic shutter speed) can be set in 100 μsec increments.
※The actual setting is in 1H time units for less than 125.6 μsec
and in 1F time units for 125.6 μsec or more.
Since the sensor operation mode changes at the 125.6 μsec,
one or more frames with indefinite exposure time may be output when the exposure time is changed.

The exposure time can be calculated by the following formula:

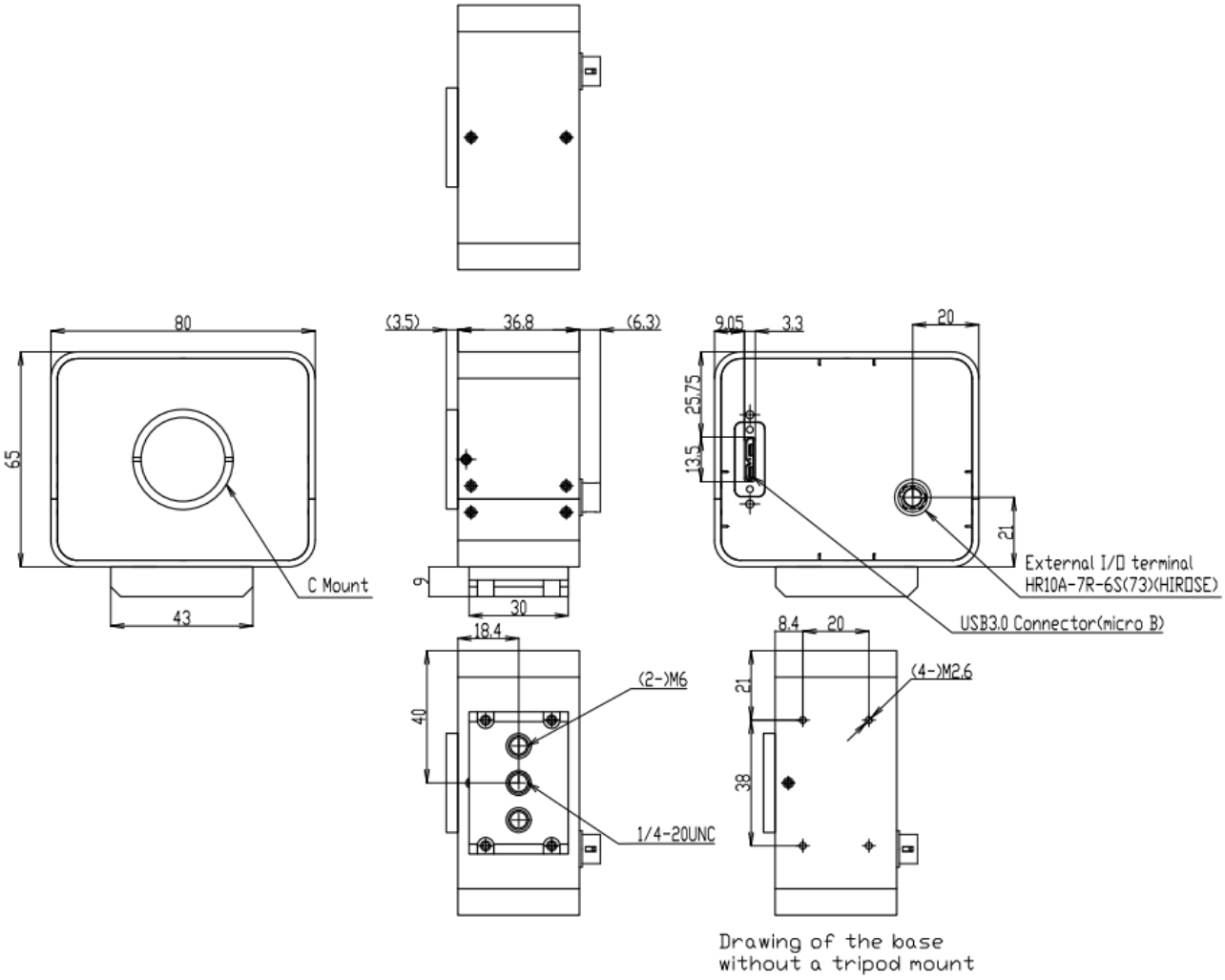
Exposure time = the setting value of the shutter speed * 100μsec (Setting range: 1~30000)

The formula for calculating 1H time is the same for both full pixel output (2592 x 2056)
and when using ROI setting, as shown below.
1H time = 276 x 1/36000000[sec] = 7.666[μsec]

The formula for 1F time is for full pixel output (2592 x 2056),
1F time = (2056 + 116) / 2 * 1H time = 8.326 [msec].

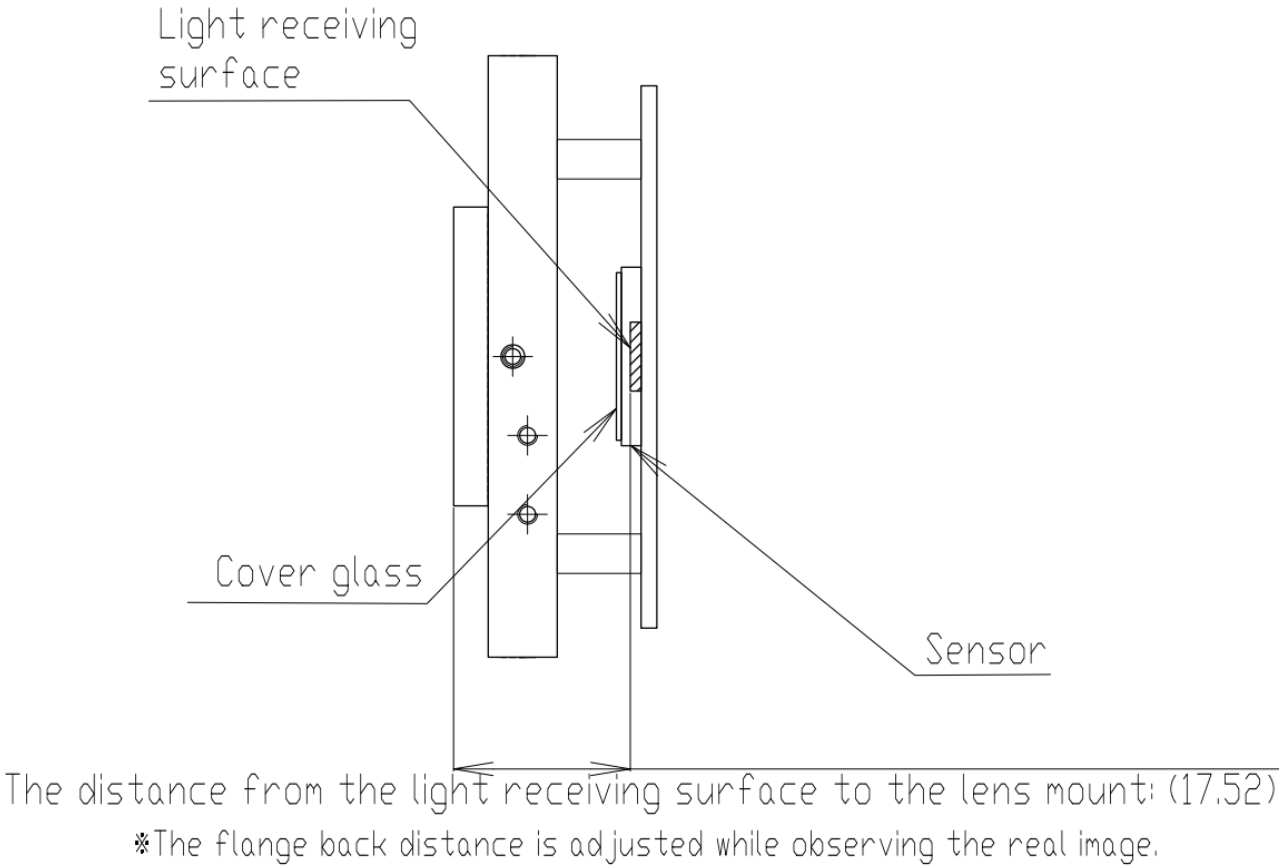
When ROI is set, the “2056” above is represents the number of vertical effective pixels.

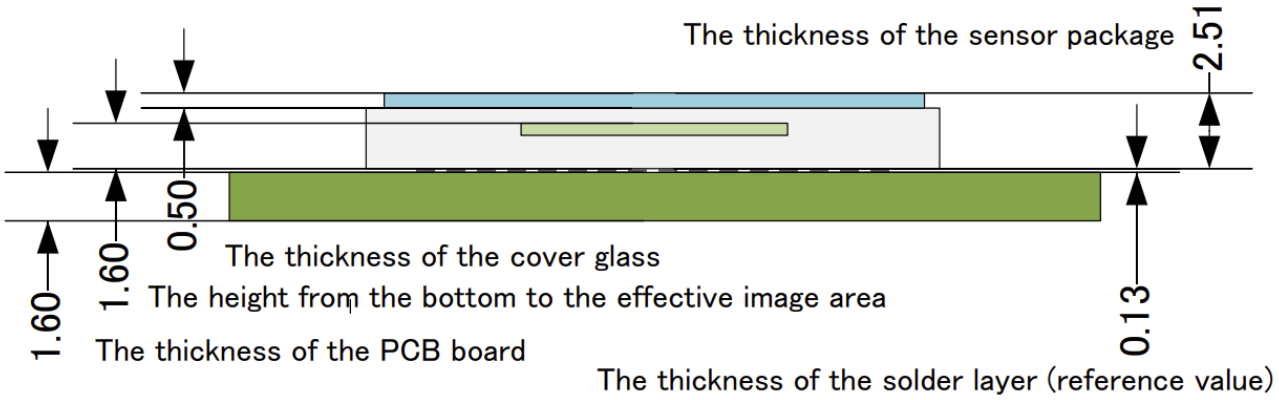
6.2.2. Dimensional Outline (External I/O terminals are only available for optional products.)



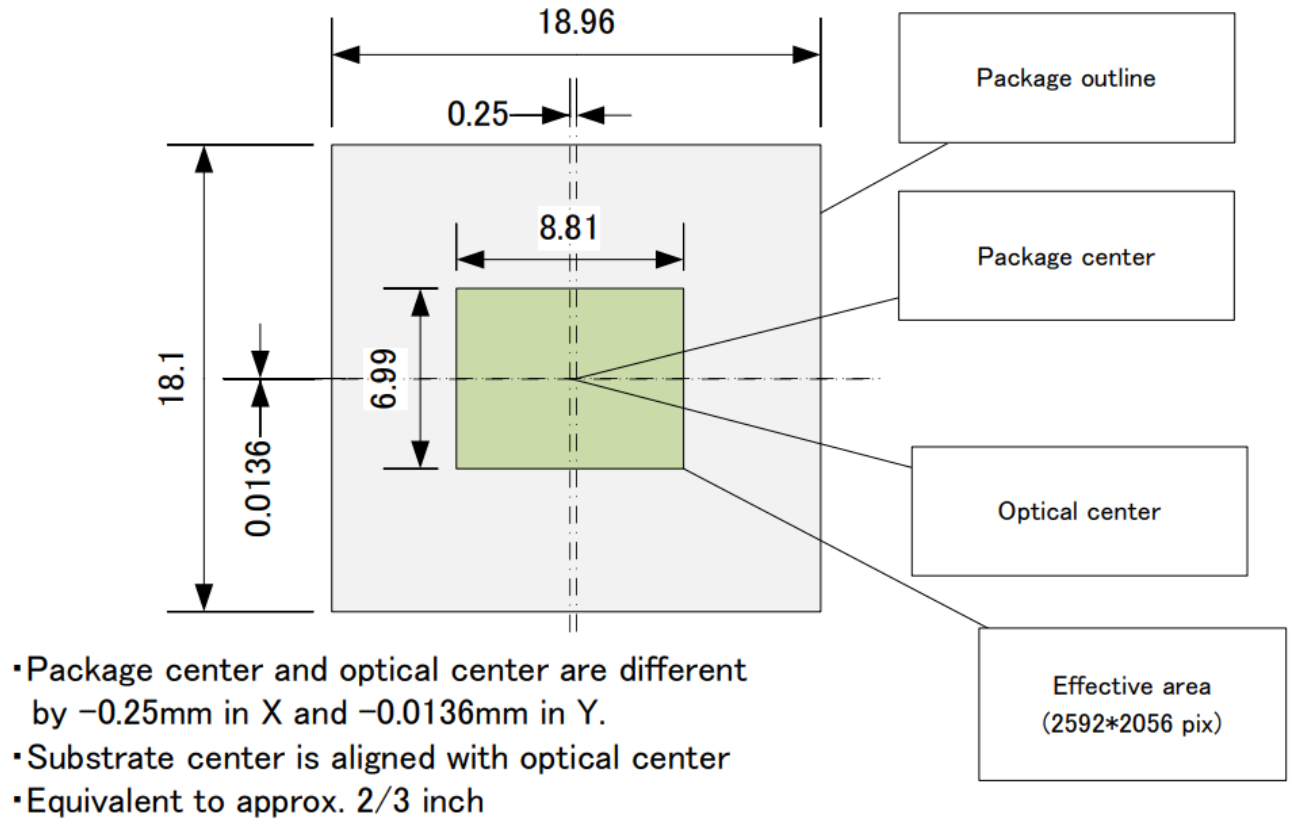
※The dimension might be changed.

6.2.3. Sensor Package Information



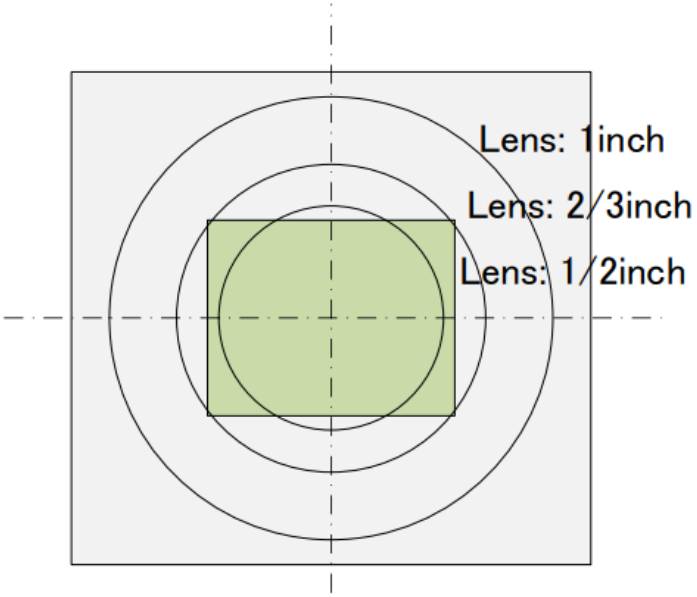


6.2.4. Position Relationship Diagram between the sensor package and the light receiving surface



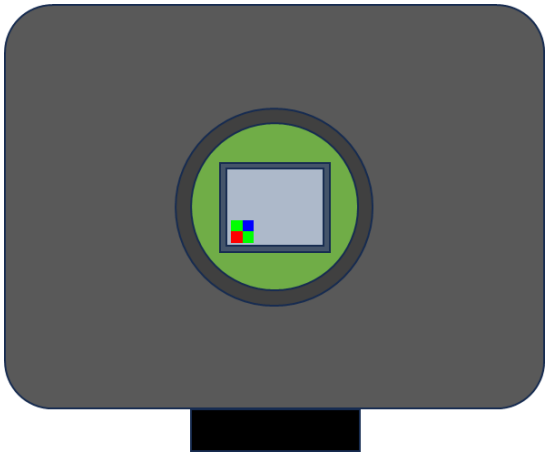
H = 3.4[μm] * 2592 = 8812.8[μm]
V = 3.4[μm] * 2056 = 6990.4[μm]

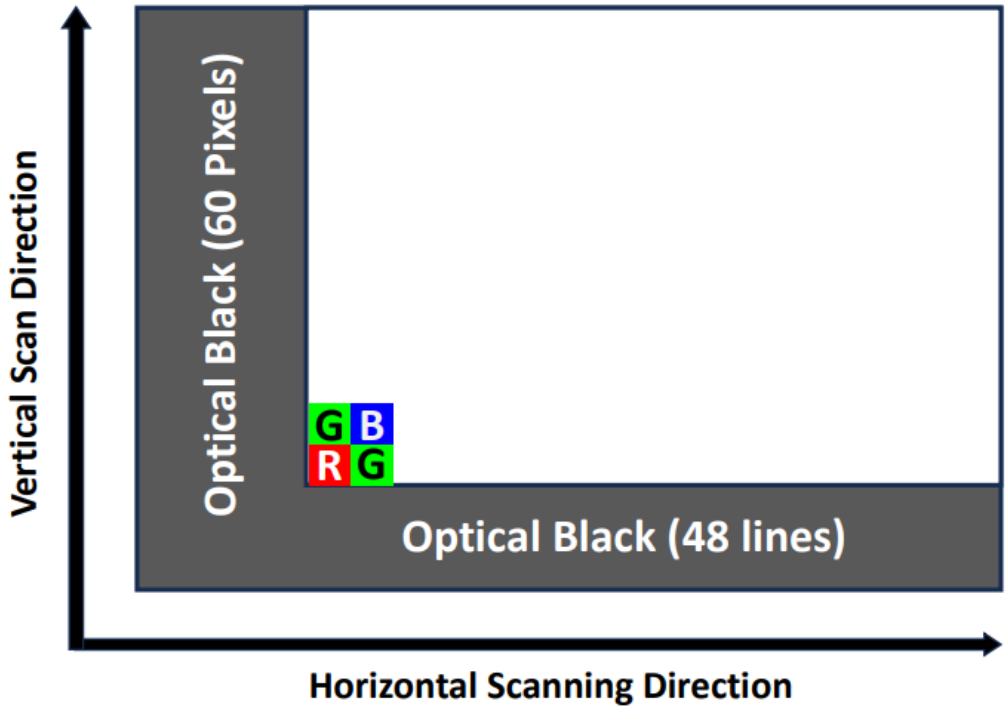
6.2.5. Lens vs. field of view range (reference)



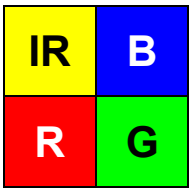
※The above figures are comparisons with sensor diagonals of φ 8 mm (1/2 inch), φ 11 mm (2/3 inch), and φ 15.8 mm (1 inch).
The actual field of view varies depending on the lens.

6.2.6. Sensor mounting orientation and Bayer pattern





※In the case of a RGB-IR sensor, the G pixels located on the same horizontal line as the B pixels are replaced with IR pixels.



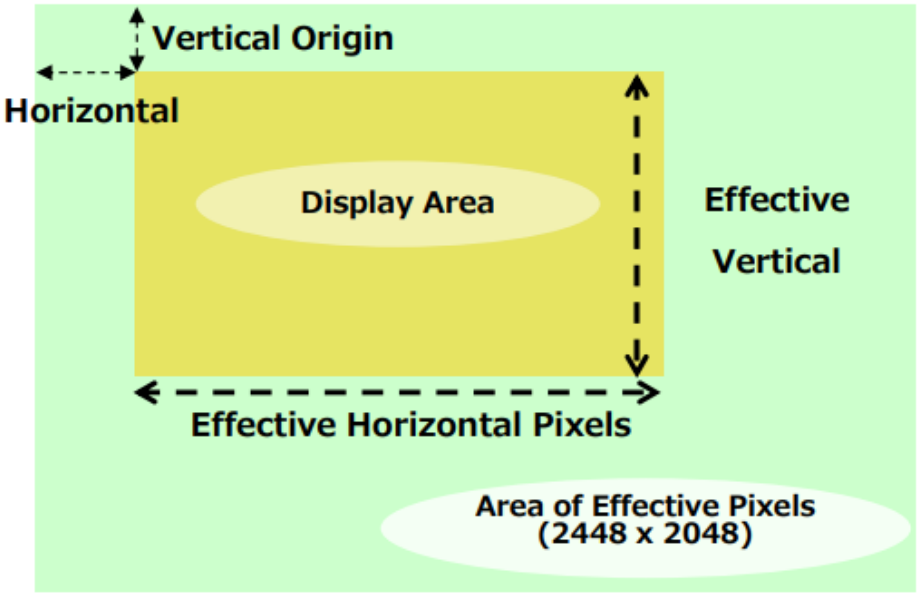
6.2.7. Region of Interest (ROI)

This function can reduce unnecessary data and improve the frame rate by cutting out any area within the effective pixels.
It is possible to cut out any area by setting the “origination” and “effective pixels”.

For "origination", please set the effective position of both "horizontal origination" and "vertical origination"
For "effective pixels", please enter the effective number of both "horizontal pixels" and "vertical pixels".

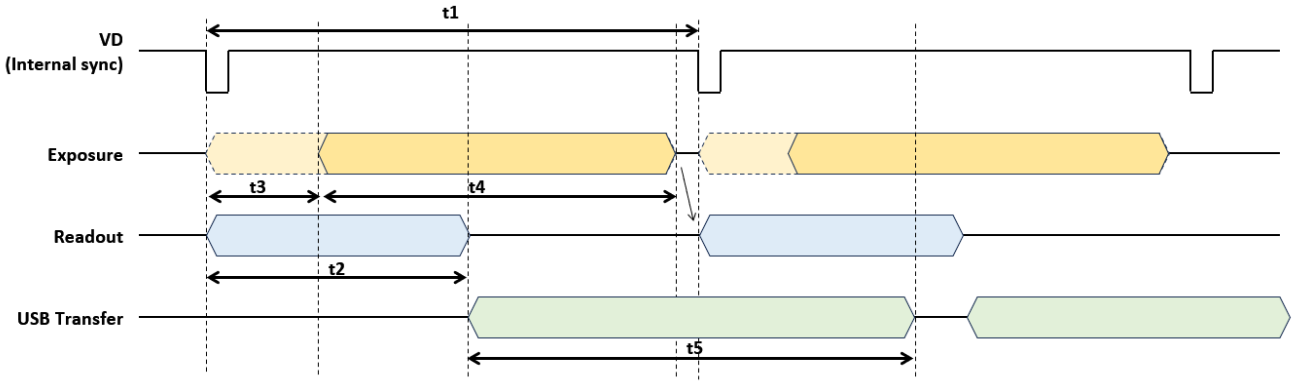
For "origination", the effective values of horizontal origination and horizontal pixels should be multiples of 24, and for "effective pixels", the effective values of vertical origination and vertical pixels should be multiples of 2.

The setting range available for each value is as follows.
effective horizontal pixels: 48 to 2592 (multiples of 24 only).
effective horizontal origination: 0 to 2568 (multiples of 24 only).
effective vertical pixels: 2 to 2056 (multiples of 2 only).
effective vertical origination: 0 to 2054 (multiples of 2 only).



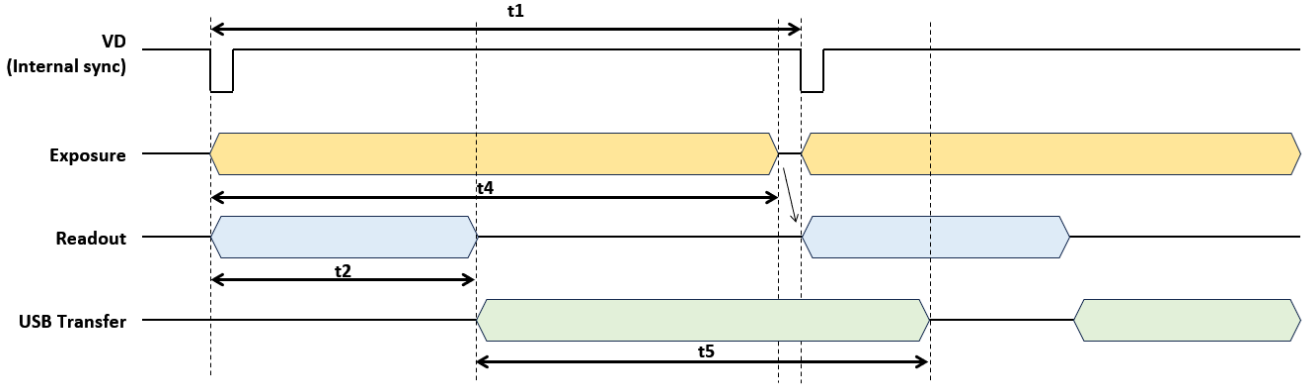
6.2.8. Timing chart

Full screen preview mode (2592x2056)
Exposure time: 16.6msec or less



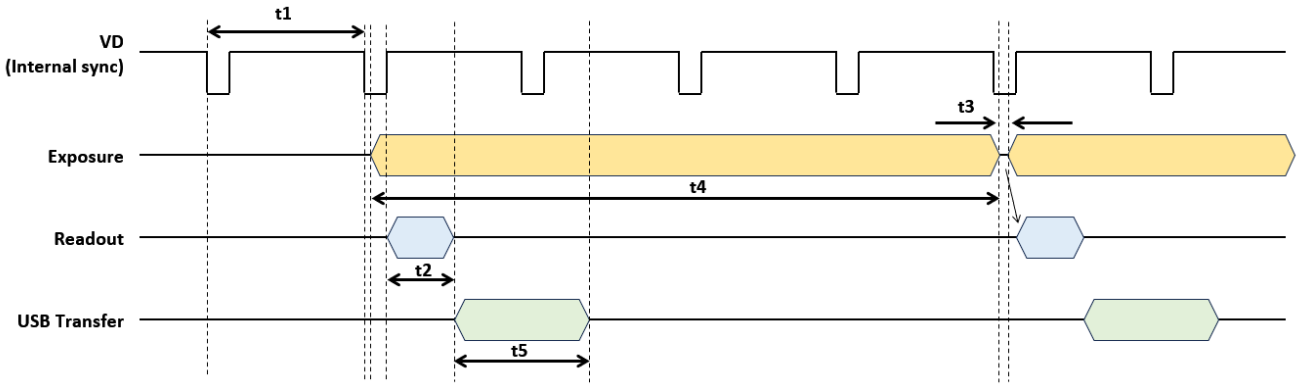
t1	1 frame time	1/60.0[sec] = 16.6666[msec]
t2	Charge readout period	(2056+116)/2 * 1H time = 8.326[msec]
t3	Charge sweep period	Sensor Exposure setting value * 1H time Closest sensor exposure setting to the value set by the software (rounded to the nearest integer)
t4	Exposure time	2 to 3 line time (1 line time = 3384 * 1/74.25 [μsec])
t5	USB transfer time	Approx. 13.23msec (8bit mode, theoretical value at USB3 transfer rate of 3Gbps)
	1H time (horizontal time)	276clk * 1/36000000[sec] = 7.66 [usec]

Full screen preview mode (2592x2058)
16.6[msec] < exposure time < 125.6[msec]



t1	1 frame time	1/([(1/([exposure time/1H time] +2) * 1H time)*10]+1)/10 The actual formula is complicated, but it is almost the reciprocal of the exposure time, so there is no problem in practical use.
t2	Charge readout period	(2056+116)/2 * 1H time = 8.326[msec]
t4	Exposure time	Sensor Exposure setpoint (<16382) * 1H time
t5	USB transfer time	Approx. 13.23msec (8bit mode, theoretical value at USB3 transfer rate of 3Gbps)
	1H time (horizontal time)	276clk * 1/36000000[sec] = 7.66 [usec]

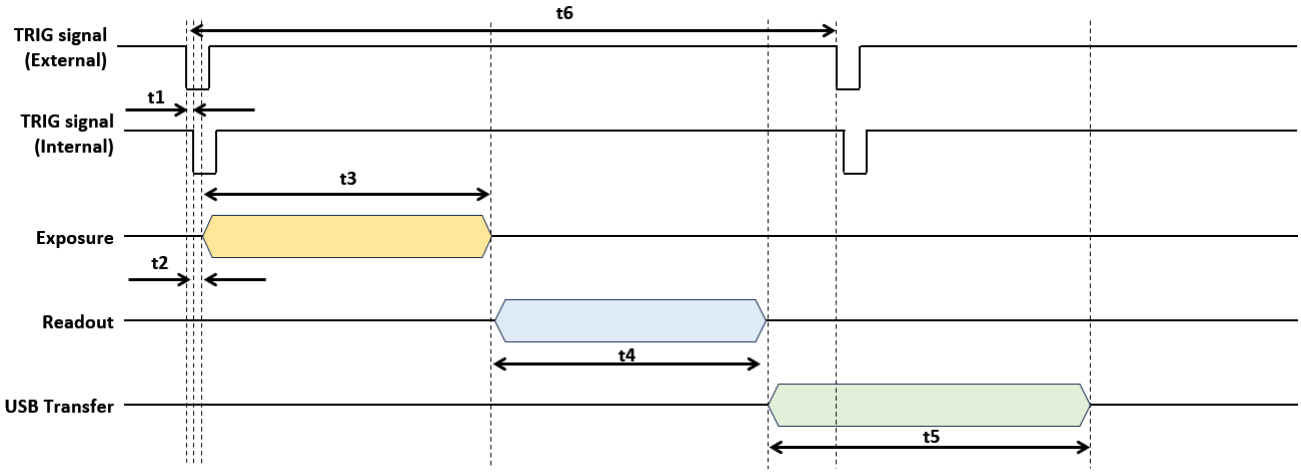
Full screen preview mode (2592x2056)
Exposure time 125.6[msec] or more (t1≧16383H hours)
※Long exposure mode



t1	1 frame time	(2056+116) * 1H time = 16.652[msec]
t2	Charge readout period	(2056+116)/2 * 1H time = 8.326[msec]
t3	Charge transfer + scavenging period	4 * 1H time = 30.666[usec]
t4	Exposure time	[(set exposure time + t3)/1F time] * 1F time - t3
t5	USB transfer time	Approx. 13.23msec (8bit mode, theoretical value at USB3 transfer rate of 3Gbps)
	1H time (horizontal time)	276clk * 1/36000000[sec] = 7.66 [usec]

※This is an operation mode in which a one-frame operation without readout is repeated for the specified number of frames, and readout is performed only after the final frame. Therefore, the exposure time setting is rounded to the nearest one-frame time unit.

Trigger mode (Optional)
Full screen mode (2592x2056)
Exposure time 7.666[usec]~125.6[msec]
*The upper limit of the trigger mode setting is 16383 * 1H time.



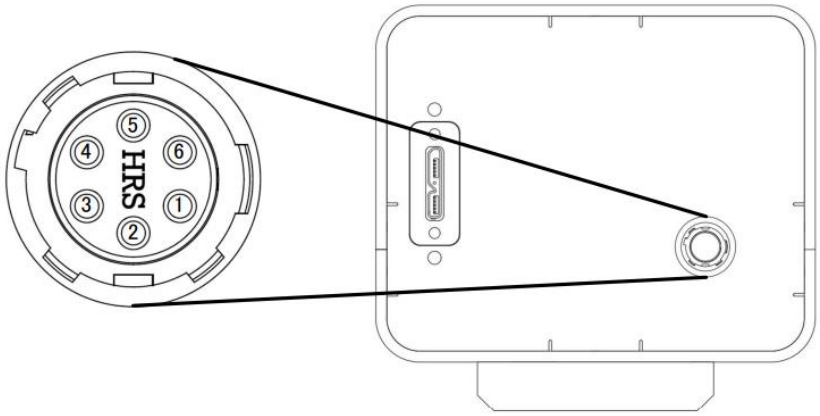
t1	Conversion Time from External Trigger Input to Internal Signal	Approx. 1 µsec or less
t2	From falling edge of internal trigger signal to start of exposure	270clk = 7.5µsec
t3	Charge sweep period	Sensor Exposure setting value * 1H time Closest to the value set by the software Sensor Exposure setting value (rounded to integer)
t4	Charge readout period	(2056+116+4)/2 * 1H time = 8.341[msec]
t5	USB transfer time	Approx. 13.23msec (Theoretical value for 8-bit mode and USB3 transfer rate of 3Gbps) The start of t5 depends on capture command reception timing from the software.
t6	Trigger input acceptance prohibited section	t1+t2+t3+t4
	1H time (horizontal time)	276clk * 1/36000000[sec] = 7.66 [usec]

※For stability, please set the actual trigger input interval to t6 plus approximately 1 to 2 msec.
If t5>t6, there is a possibility that the USB transfer may not complete in time, resulting in dropped frames.

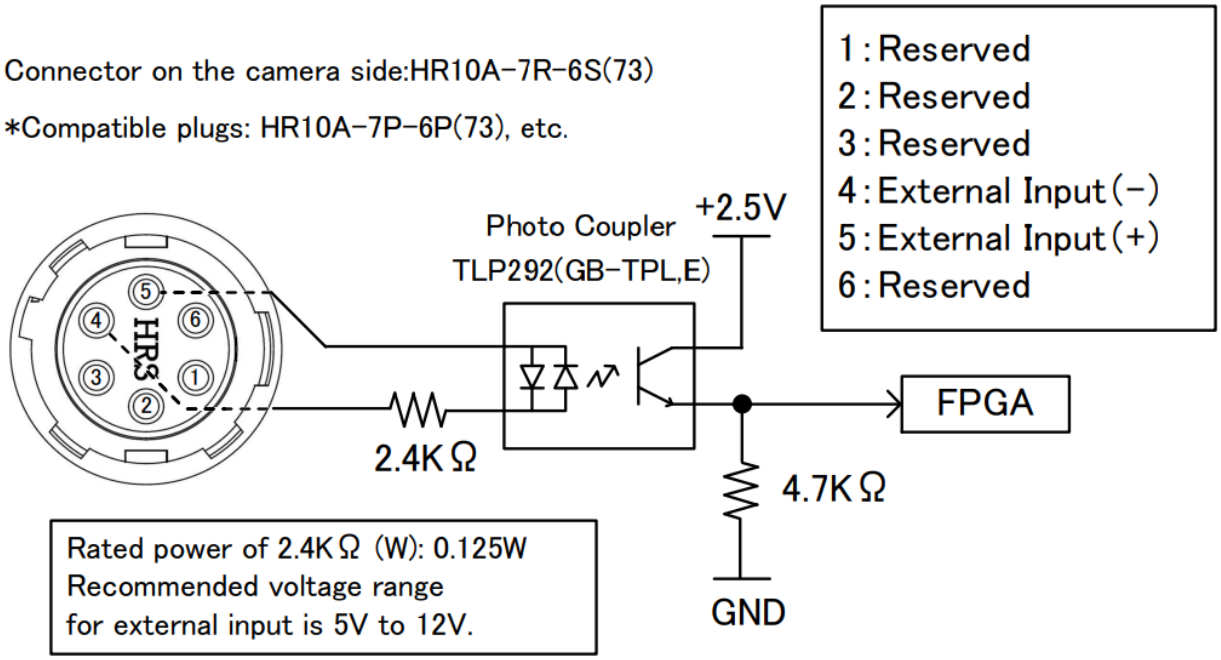
6.2.9. External Trigger Function (Optional)

This camera has an external trigger electronic circuit, which is insulated by a photocoupler, and thus enables synchronized shooting by the input signal received from the external circuit.

Connector on the camera side:HR10A-7R-6S(73)

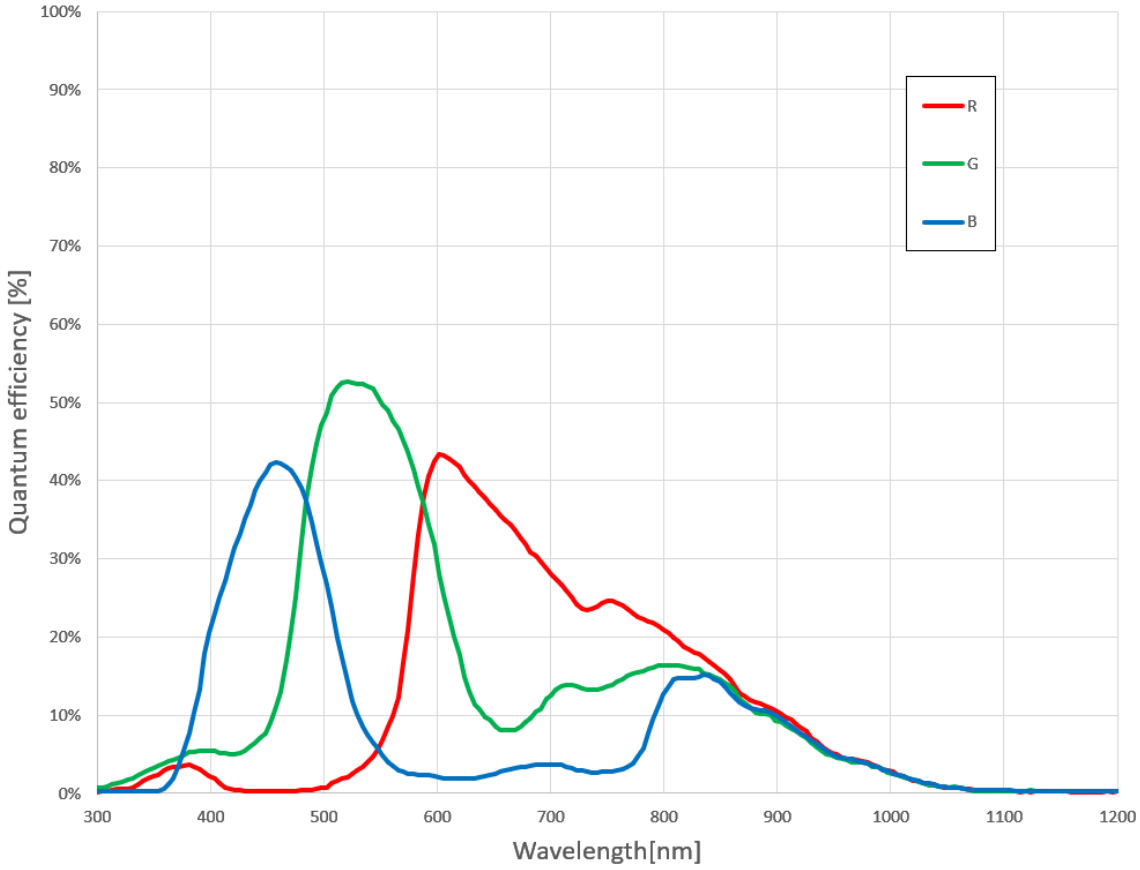


*Compatible plugs: HR10A-7P-6P(73), etc.

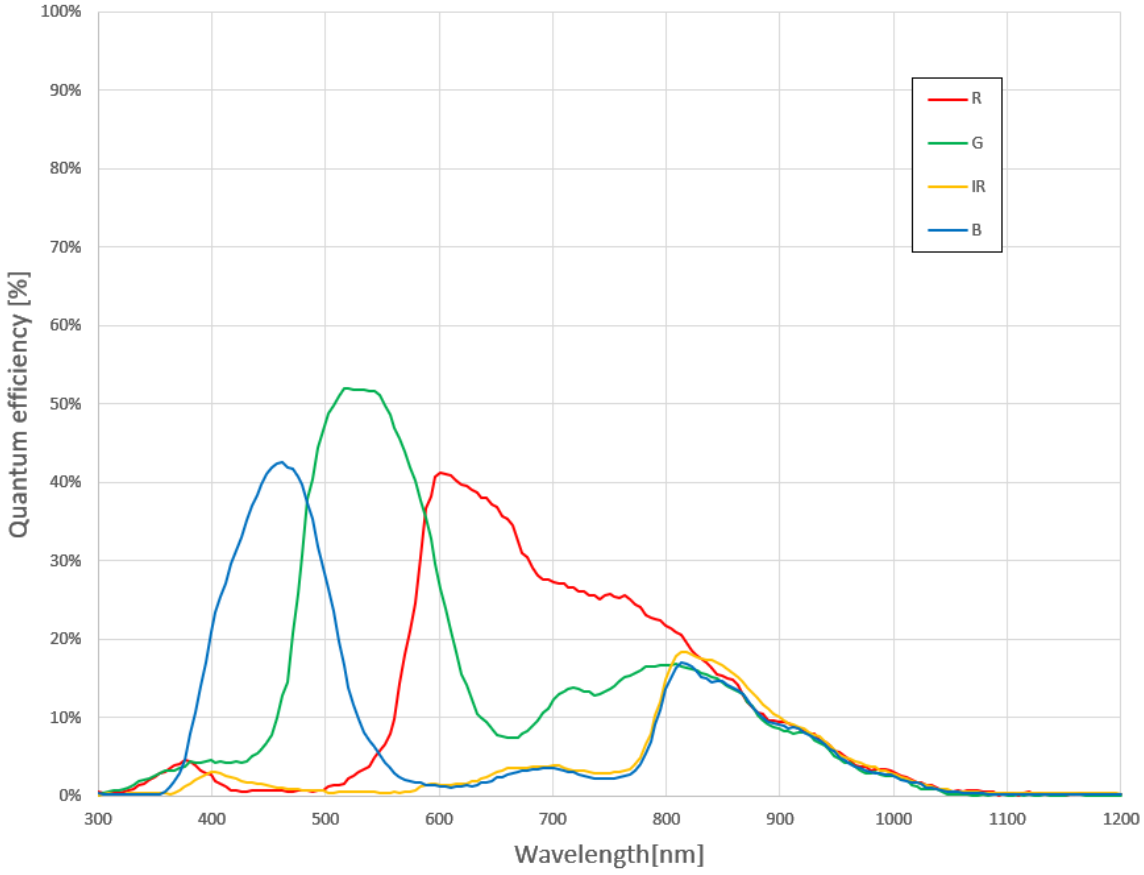


6.3. Spectral sensitivity characteristics (reference value)

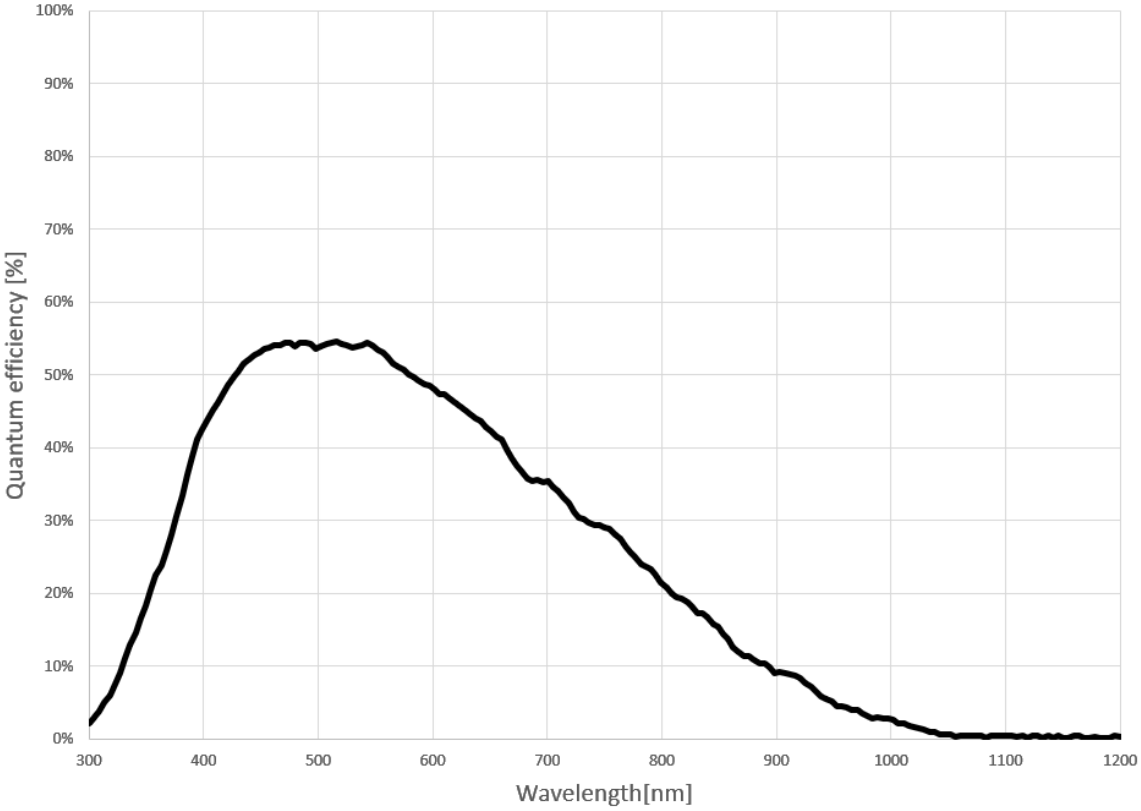
6.3.1. ARTCAM-5040-UBS3



6.3.2. ARTCAM-5040-RGBIR-UBS3



6.3.3. ARTCAM-5040-BW-UBS3



7. System Requirements

7.1. Recommended System Requirements

●Host Controller

This camera is applicable to USB3.0.

Connecting to USB2.0 host controller may cause low-speed or failure to function properly.

●CPU

The driver for this camera is compatible with computer architecture "x86" or "amd64."

The speed of the imaging process is directly affected by the CPU specification.

Therefore, it is highly recommended to use a high-end CPU if possible.

●Memory

In the viewer software, there is a data buffer which can store 4 to 8 frames.

Therefore, it is necessary to reserve at least 8 frames of memory for storing the image.

(For example, when using 1.3MP color camera, 1280 x 1024 x 3 x 8 [byte] = 30[MB] is required.)

It is highly recommended to keep enough memory space especially when using high resolution camera.

●OS

Please note that this camera is applicable only to the architecture of Windows NT (32bit/64bit).

Standard functions are confirmed with OS after Windows 10.

In addition, it is recommended to use Windows 11.

Caution

■Please refer the restrictions below when you use ARTCAM series.

(1) Recommended System Requirements

If the system specifications do not meet the requirements recommended above, it may be difficult to run at the maximum frame rate.

(2) Use of other USB3.0 Hardware

The data on our camera/converter is transferred in bulk mode. Therefore, when using our camera/converter, please refrain from using other bulk-transferred USB3.0 hardware, such as memory sticks, external hard drives, external DVD players, or CD-ROMs etc.

We recommend installing a PCI USB host card to the PC and connecting external USB hardware to this port only.

(3) USB3.0 Cable Extension

We cannot guarantee the functionality of the USB3.0 camera if the user adopts USB3.0 extension cables or repeaters which are not confirmed by us. The use of extension cables or repeaters can result in variations in bandwidth, potentially leading to malfunctions such as a low frame rate or failure in recognition by the camera.

One potential cause of the issue could be insufficient regulation of the power lines, which can result in a mismatch in data signal strength.

* For inquiries regarding the recommended extension cable, please contact our sales department.

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