



CCD Line Scan Camera CSL8000CL Specification

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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
-

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 fire, earthquake, 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 use of equipment or software that is 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.
 - About the item which does not have a publication in the specifications and manual of this product, it considers as the outside for a guarantee.
-

NOTES ON USING THIS PRODUCT

- **Handle carefully**

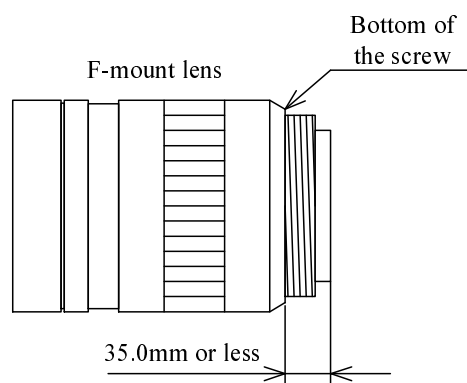
Do not drop the equipment or allow it to be subject to strong impact or vibration, as such action may cause malfunctions. Further, do not damage the connection cable, since this may cause wire breakage.

- **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.

- **About lens mount**

As for the F-mount lens used combining this camera, the projection distance from bottom of the screw should use 35.0mm or less.



- **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 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 lighting 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.

- **About camera cable**

The connector of the camera is in "Screw-coupling" lock structure. Improper cramping might cause image noise. Be sure to give it a good cramping to avoid noise.

- **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.

- **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.

● **Turn OFF the power in the case of connection**

Turn OFF the power in the case of connection of camera cable.

Otherwise, an electric shock or a malfunction may occur.

● **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.

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”

1. Overview

This product is CCD line scan camera of integrated type with Camera link interface. CCD of this product has three line color of RGB and the black and white of one line.

2. Features

- (1) Color and B/W can be output the same time

CCD of this product has three line color of RGB and the black and white of one line. RGB and B/W can be output at the same time. When only RGB output or the B/W output is selected, this camera can be output by a high line rate.

- (2) High resolution

This product uses the CCD line sensor of high resolution.

Effective pixel of B/W: 8160 pixels, effective pixel of RGB: 4080 pixels

- (3) Camera link interface

The interface of the image output and the camera control adopts the Camera Link standard.

When you use frame grabber board for the camera link, high-speed image transfer and various controls to PC are possible.

- (4) Random trigger shutter

By external trigger signal input, the shot image can be grabbed at an arbitrary timing.

- (5) FPN and PRNU correction

This Camera can correct FPN, and correct PRNU every one pixel.

- (6) Line delay function

This Camera can be output by adjusting the delay of each line of RGB.

3. Configuration

- (1) Camera body (Without lens) 1
- (2) Accessory
- Instruction Manual (Japanese) 1
- Instruction Manual (English) 1

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Oct. 23. 2008

Documents No. D4163203A

4. Optional parts

- (1) Camera link cable (2.0m, 3.0m, 5.0m, 10.0m) 14B26-SZLB-***-0LC
- (2) Camera adapter CPT8000CL
- (3) Camera power unit CA170
- (4) Power cable (2.0m) CPRC3700-02

***Conformity of EMC conditions**

When used combining parts other than specification of our company, Please check conformity of EMC with customer's machine and whole equipment.

5. Functions

- (1) Select of the video output

This camera can select the output of B/W and RGB simultaneous and the output of only B/W and the output of only RGB.

- (2) Select of the video output method

This camera can select the output of B/W with 8bit or 10bit.

- (3) Shutter mode

This camera can select the FIX mode or the PULSE mode.

Normal electronic shutter: Performs exposure control via the internal synchronization signal.

Random trigger shutter: Random trigger shutter can capture images at any timing using the external trigger signal.

·FIX mode: It depends on the shutter speed setting.

·Pulse mode: It depends on the width of an external synchronization pulse.

- (4) Trigger mode setting

The trigger mode can be set.

- (5) Shutter speed setting

The shutter speed can be set.

- (6) Analog and digital gain setting

Analog and digital gain can be set.

- (7) Analog and digital offset setting

Analog and digital offset can be set.

(8) FPN correction

This camera can correct FPN every one pixel. The correction value transmits the serial data from the outside.

(9) PRNU correction

This camera can correct PRNU every one pixel. The correction value transmits the serial data from the outside.

(10) Line delay adjustment

This camera can be output by adjusting the delay of each line of RGB. (Max: 32 lines)

(11) Reading of various camera information

Each information on CPU firmware version, the FPGA version, the Vendor information, the camera type name, and the serial number can be read.

(12) Memory setting

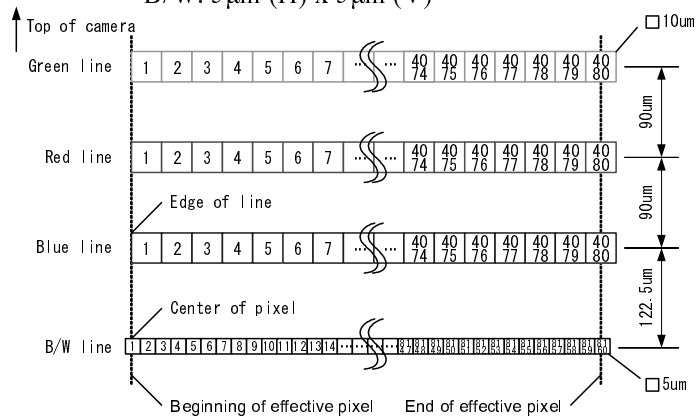
The setting when the camera starts can be preserved in the user's area. (Factory setting: bank 0)

6. Specifications

[Electrical specification]

- (1) Image sensor Line scan CCD
- Video output effective pixels RGB: 4080 pixels x 3
B/W: 8160 pixels x 1
- Scanning area RGB: 40.8mm x 10μm x 3
B/W: 40.8mm x 5μm x 1
- Unit sell size RGB: 10μm (H) x 10μm (V)
B/W: 5μm (H) x 5μm (V)

·Pixel array



※Optical center is center of B/W line.

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(2) Sync system	Internal sync
(3) Video output	
·Digital output	RGB 8bit (FIX) B/W (YA [Left]) 8 / 10bit (selectable) B/W (YB [Right]) 8 / 10bit (selectable)
·Analog output	G (Hi-Z) For confirmation of oscilloscope
(4) Standard Illumination	15.8Lv (7940nt), F2, 2856K (A light source) Output of RGB and B/W simultaneously Exposure time of B/W: 105.4 μ s Exposure time of RGB: 134.6 μ s
(5) Gain	The following setting is done by the communication command. Analog: 0 to 23 dB Digital: 0 to 12 dB
(6) Pedestal (Offset)	The following setting is done by the communication command. Analog: +/- 120 LSB (It is reflected in 12 bits of internal data.) Digital: +/- 120 LSB (It is reflected in 12 bits of internal data.)
(7) Power source	DC+12V +/-10% (Ripple voltage: 50 mV (p-p) or less)
(8) Power consumption	Approx. 18W (at +12VDC)

[Internal sync signal specification]

(1) Base clock frequency	At single operation	RGB: 40MHz B/W: 160MHz (80MHz x 2)
	At operation simultaneously	RGB: 20MHz B/W: 80MHz (40MHz x 2)
(2) H sync frequency	At single operation	RGB: 9.487kHz (105.4 μ s) B/W: 18.975kHz (52.7 μ s)
	At operation simultaneously	RGB: 4.743kHz (210.8 μ s) B/W: 9.487kHz (105.4 μ s)

[Notice]

The aging of 30 minutes or more is necessary for each mode of RGB single operation (40MHz) and B/W single operation (160MHz [80MHz x 2]). The aging of 30 minutes or more is necessary to stabilize the image output level.

[Trigger signal specification]

(1) Input level	LOW level: 0~0.5V (p-p) HIGH level: 2.0~5.0V (p-p)
(2) Input impedance	High impedance
(3) Polarity	Positive (Rising edge detection)/ Negative (Falling edge detection)
(4) Pulse width	At operation simultaneously B/W; 1 μ s – 3.27ms RGB; It synchronizes with the trigger signal of B/W. At single operation B/W; 1 μ s – 1.63ms At single operation RGB; 1 μ s – 3.27ms

[Notice]

- The external trigger signal can be input from both of camera link I/F (CC1) and DC IN connector.
- The external trigger signal polarity when the factory is shipped is a negative polarity.
- The signal of the trigger of RGB input is invalid for a simultaneous output mode of B/W and RGB.

[Electronic shutter signal specification]

(1) Normal shutter	Set via the Camera link interface
(2) Random shutter	Set via the Camera link interface
(3) Exposure time setting	1 μ s – 52.7 μ s / 105.4 μ s / 210.8 μ s (Maximum of scan rate) Setting range: 2040 steps

[Serial communication specification]

(1) Transmission speed	9600 / 19200 / 38400bps (Initial factory setting: 9600bps)
(2) Data bit	8 bit
(3) Polarity bit	None
(4) Stop bit	1 bit
(5) Handshake	None
(6) Communication connector	Connector of RGB or B/W is switched with DIP switch.

[Interface specification]

(1) Interface system	Camera Link Version 1.1 Base configuration
(2) Transmission speed	At single operation RGB: 40MHz B/W: 80MHz At operation simultaneously RGB: 20MHz B/W: 40MHz

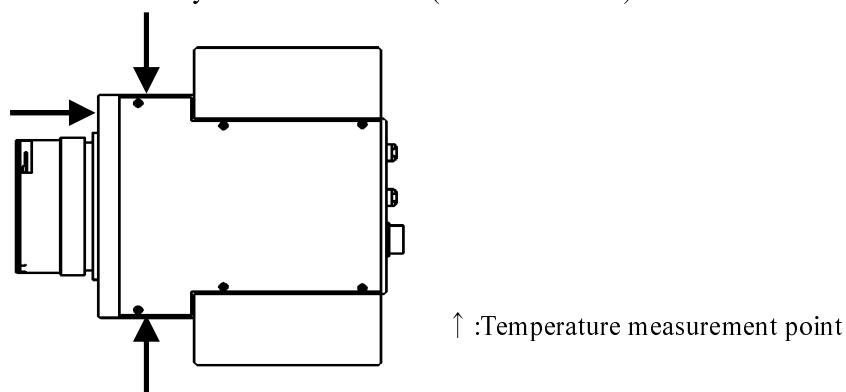
[Machine externals specification]

- (1) Dimensions 74 (W) x 130 (H) x 138.5 (D) [mm]
(Without heat sink: 74 (W) x 94 (H) x 138.5 (D) [mm])
- (2) Mass Approx. 1.2kg
- (3) Lens mount F mount
- (4) Flange focal distance Flange focal distance is can not be adjusted.
- (5) Camera body grounding Conductive between circuit GND and camera body
-insulation status

[Operating ambient conditions]

(1) Ambient conditions

Operating assurance	Temperature	+5 to 35 °C
	Humidity	20 to 80% (no condensation)



[Notice]

Please set the range of the operating temperature of the camera within the above-mentioned range.
Or, please do the system design so that the surface temperature may become 52 degrees or less with the temperature measurement point in the above figure.

Storage assurance	Temperature	-20 to 60 °C
	Humidity	10 to 90% (no condensation)

(2) EMC conditions

EMI (Electro-Magnetic interference)	EN61000-6-4 conformity
	FCC Sub part15 class A conformity
EMS (Electro-Magnetic susceptibility)	EN61000-6-2 conformity

***Conformity of EMC conditions**

When used combining parts other than specification of our company, Please check conformity of EMC with customer's machine and whole equipment.

[Connector pin assignment]

(1) Camera Link connector

Connector model: 10226-2210PL (Manufactured by 3M)

Pin assignment:

Pin No.	I/O	Function	Pin No.	I/O	Function
1	—	GND	14	—	GND
2	Out	Tx OUT 0-	15	Out	Tx OUT 0+
3	Out	Tx OUT 1-	16	Out	Tx OUT 1+
4	Out	Tx OUT 2-	17	Out	Tx OUT 2+
5	Out	Tx clk OUT-	18	Out	Tx clk OUT+
6	Out	Tx OUT 3-	19	Out	Tx OUT 3+
7	In	Ser TC(RxD)+	20	In	Ser TC(RxD)-
8	Out	Ser TFG(TxD)-	21	Out	Ser TFG(TxD)+
9	In	CC1-	22	In	CC1+
10	In	CC2+	23	In	CC2-
11	In	CC3-	24	In	CC3+
12	In	CC4+	25	In	CC4-
13	—	GND	26	—	GND

- Camera Link port assign for RGB

Port	I/O	Function
Port A[7 : 0]	Out	ROUT[7 : 0] (R Video output)
Port B[7 : 0]	Out	GOUT[7 : 0] (G Video output)
Port C[7 : 0]	Out	BOUT[7 : 0] (B Video output)
CC1	In	TRIG (Trigger signal input)
CC2	In	Reserved
CC3	In	Reserved
CC4	In	Reserved

- Camera Link port assign for B/W

Port	I/O	Function (8bit)	Function (10bit)
Port A[7 : 0]	Out	YA[7 : 0] (YA Video output)	
Port B0	Out	YB0 (YB Video output)	YA (YA Video output)
Port B1	Out	YB1 (YB Video output)	YA (YA Video output)
Port B2	Out	YB2 (YB Video output)	NC
Port B3	Out	YB3 (YB Video output)	NC
Port B4	Out	YB4 (YB Video output)	YB8 (YB Video output)
Port B5	Out	YB5 (YB Video output)	YB9 (YB Video output)
Port B6	Out	YB6 (YB Video output)	NC
Port B7	Out	YB7 (YB Video output)	NC
Port C0	Out		YB0 (YB Video output)
Port C1	Out		YB1 (YB Video output)
Port C2	Out		YB2 (YB Video output)
Port C3	Out		YB3 (YB Video output)
Port C4	Out		YB4 (YB Video output)
Port C5	Out		YB5 (YB Video output)
Port C6	Out		YB6 (YB Video output)
Port C7	Out		YB7 (YB Video output)
CC1	In	TRIG (Trigger signal input)	
CC2	In	Reserved	
CC3	In	Reserved	
CC4	In	Reserved	

- The assign of the signal is different because of the change of 8 bit and 10 bit.

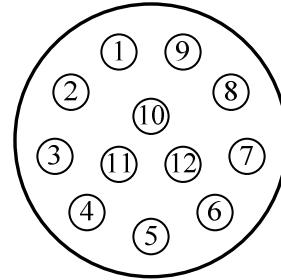
- YA: Left part 1 – 4080 pixels, YB: Right part 8160 – 4081 pixels

(2) Power and trigger connector

Connector model: HR10A-10R-12PB (Manufactured by HIROSE)

Pin assignment:

Pin No.	I/O	Function
1	—	GND
2	In	DC+12V IN
3	—	GND
4	Out	Analog OUT
5	—	GND
6	In	TRIG IN (RGB)
7	—	NC
8	—	GND
9	—	NC
10	—	NC
11	In	TRIG IN (B/W)
12	—	GND

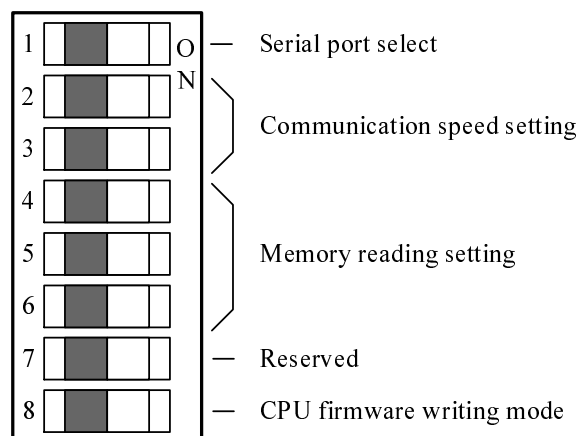


Rear view

[Notice]

- When combining with the I/F board, confirm and use the combination.
- When combining with the frame grabber board and the image processing device of each company, confirm and use the combination of hardware and software. Our company doesn't guarantee for the combination of the frame grabber board and the image processing device of each company.
- 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 Camera Link 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.

(3) DIP switch



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- Serial port select (1bit)

It is possible to communicate by selecting either the camera link connector for RGB or the camera link connector for B/W.

SW1	Connector for serial communication
OFF	Camera link connector for B/W
ON	Camera link connector for RGB

- Communication speed setting (2bit)

The serial communications speed by the camera link is set.

SW2	SW3	Communication speed
OFF	OFF	9600bps
ON	OFF	19200bps
OFF	ON	38400bps
ON	ON	(Reserved)

- Memory reading setting (3bit)

The memory numbers of various set values read when the power supply is started up are set. There are 8 bank memories.

SW4	SW5	SW6	Memory number
OFF	OFF	OFF	0
ON	OFF	OFF	1
OFF	ON	OFF	2
ON	ON	OFF	3
OFF	OFF	ON	4
ON	OFF	ON	5
OFF	ON	ON	6
ON	ON	ON	7

- Memory reading setting (1bit)

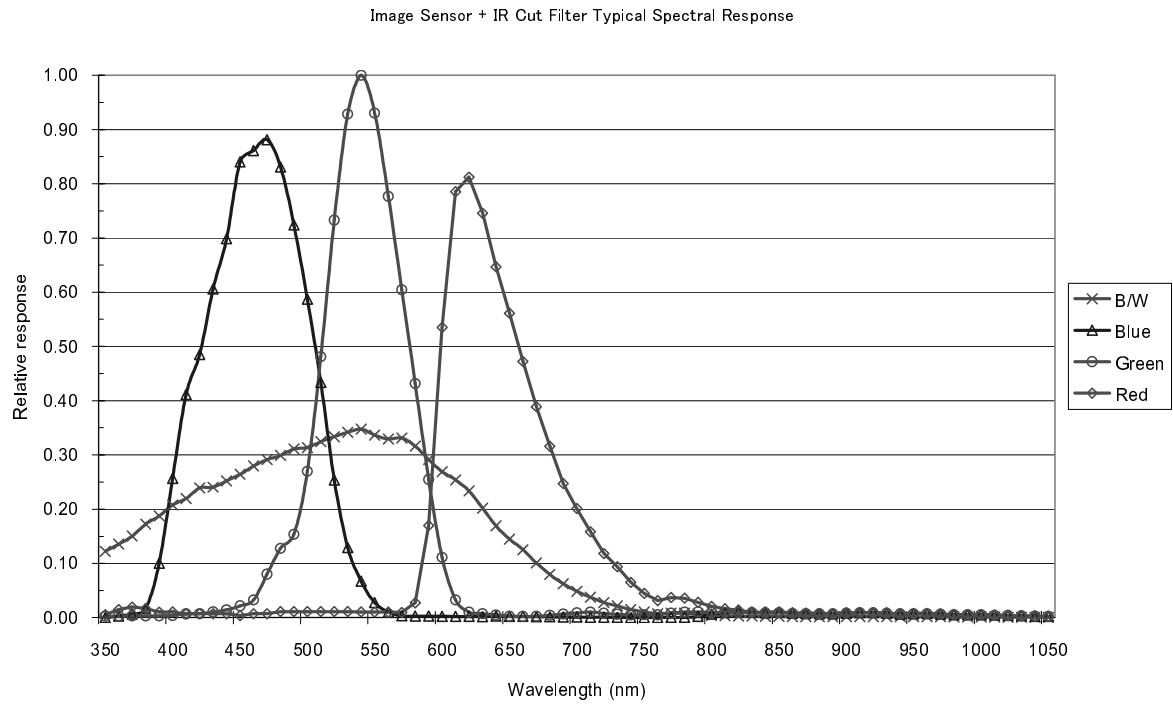
The state is usually set to OFF.

SW8	CPU MODE
ON	Writing
OFF	Normally

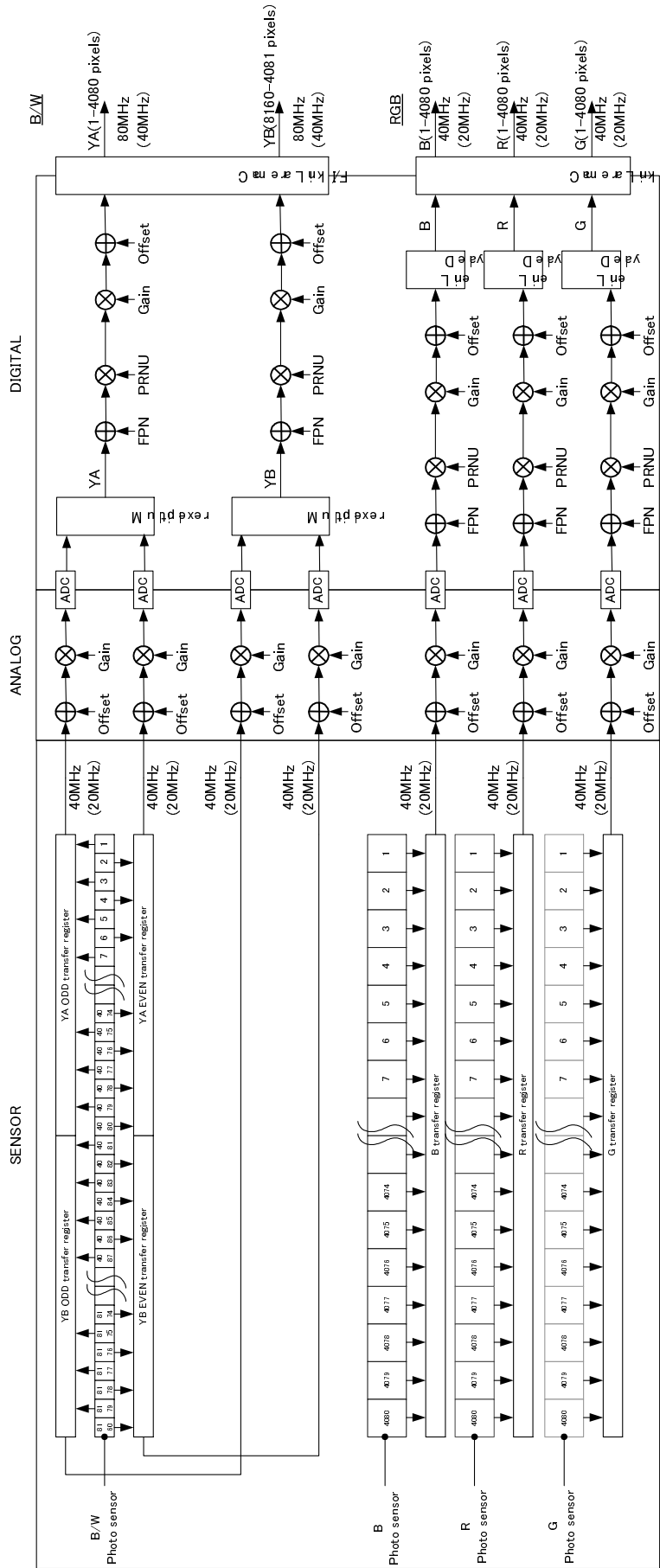
[Typical spectral response]

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

The IR cut filter characteristics is reflected in table.



[Block diagram]

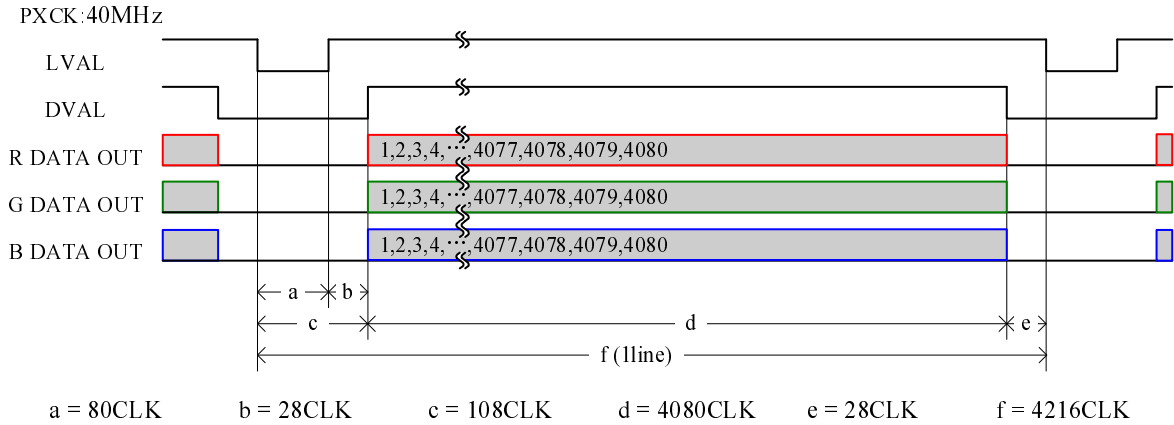


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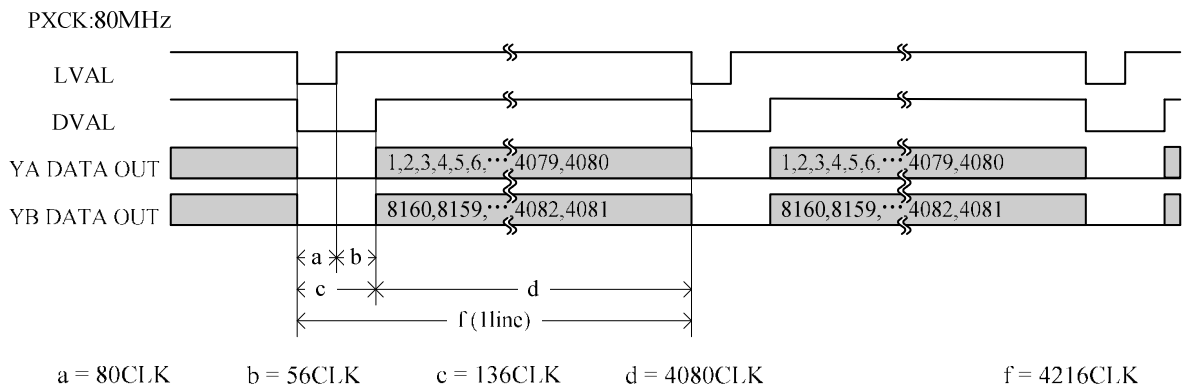
7. Timing chart

(1) Normal shutter

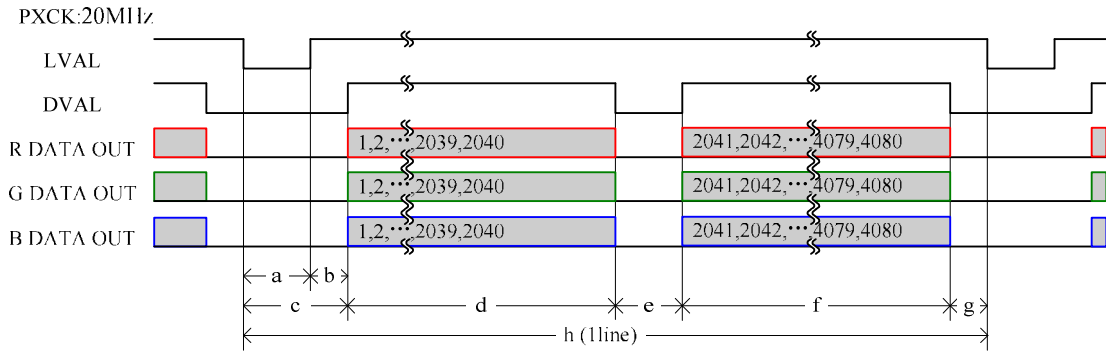
·RGB single output



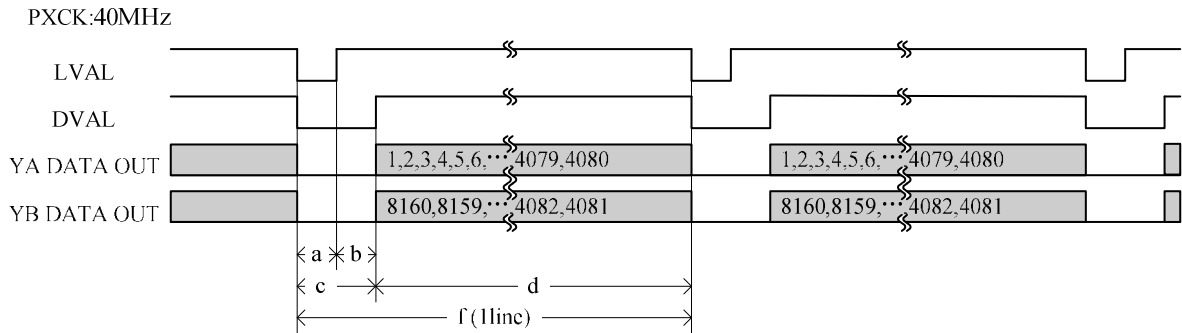
·B/W single output



·B/W & RGB operation simultaneously



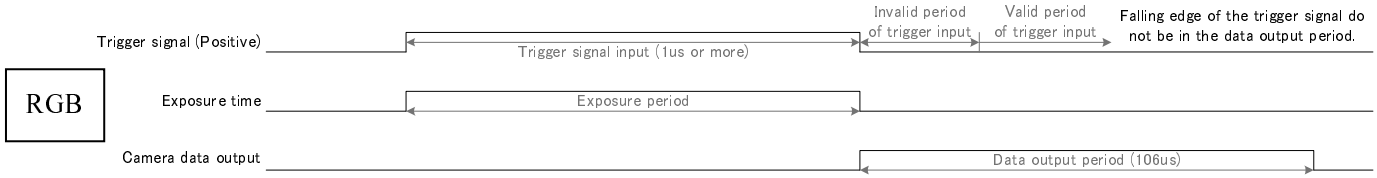
a = 40CLK b = 28CLK c = 68CLK d = 2040CLK e = 40CLK f = 2040CLK g = 28CLK h = 4216CLK



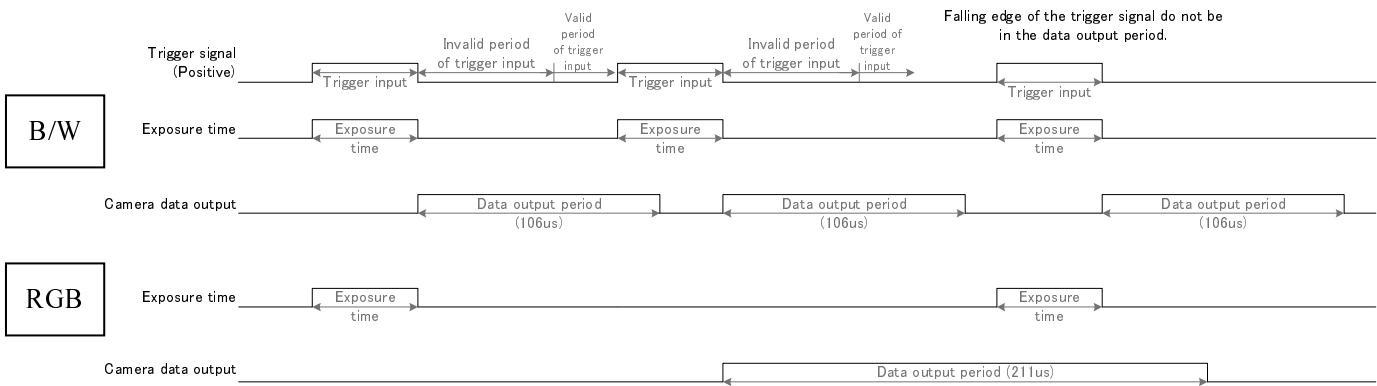
a = 80CLK b = 56CLK c = 136CLK d = 4080CLK f = 4216CLK

(2) Random trigger shutter

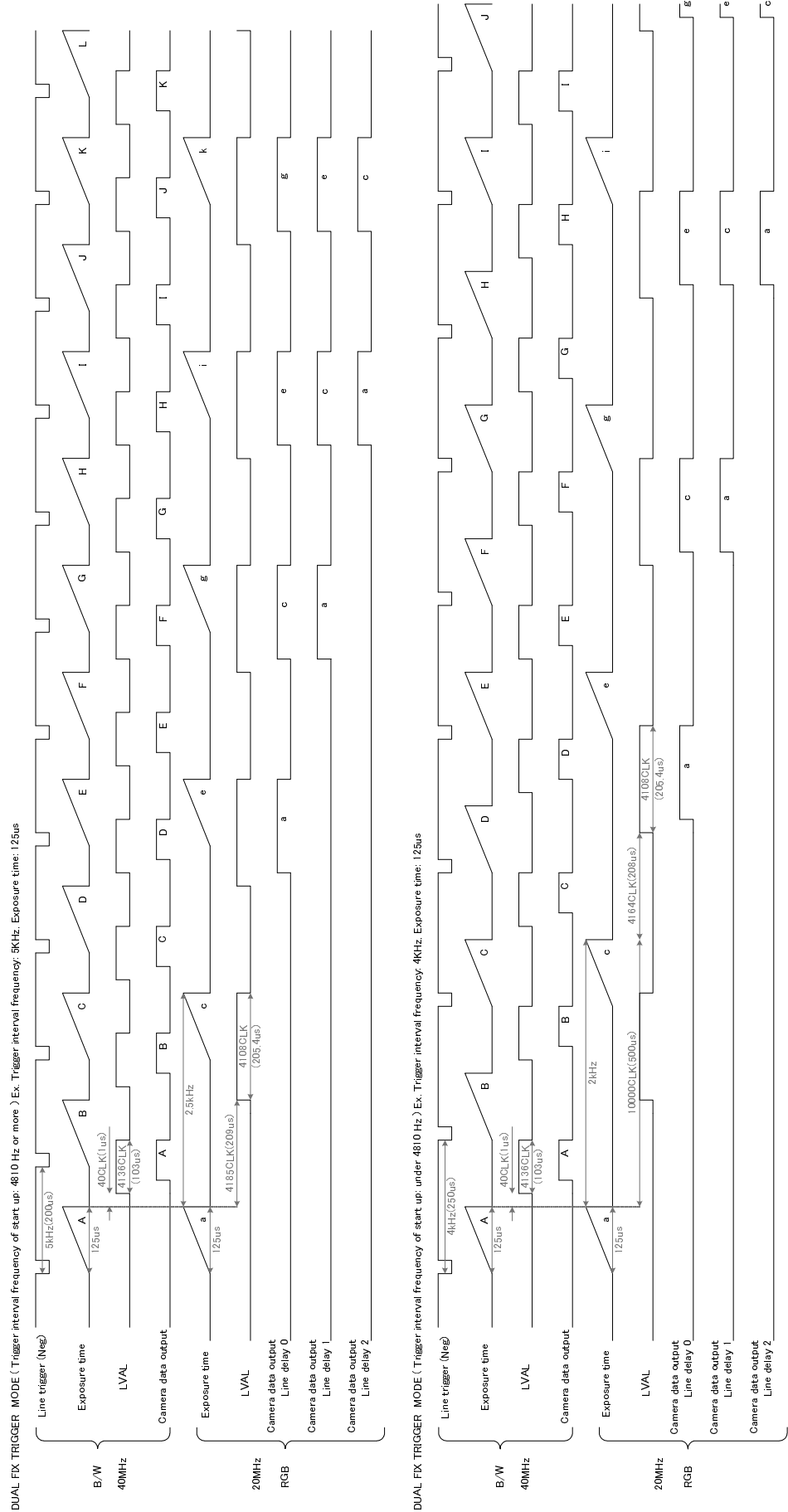
·Summary of pulse mode (RGB single output)



·Summary of pulse mode (B/W & RGB operation simultaneously)

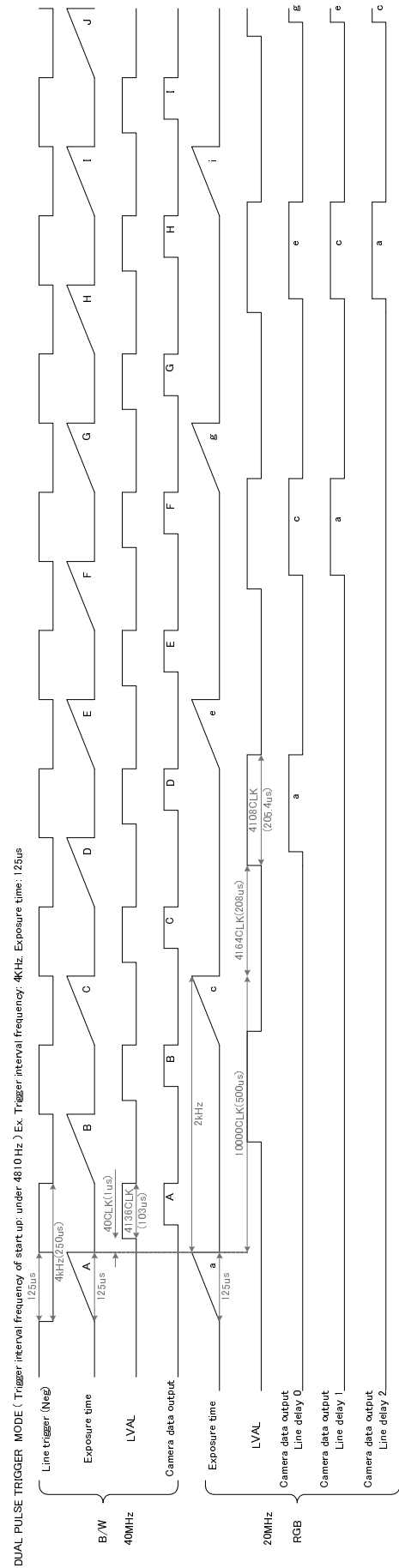
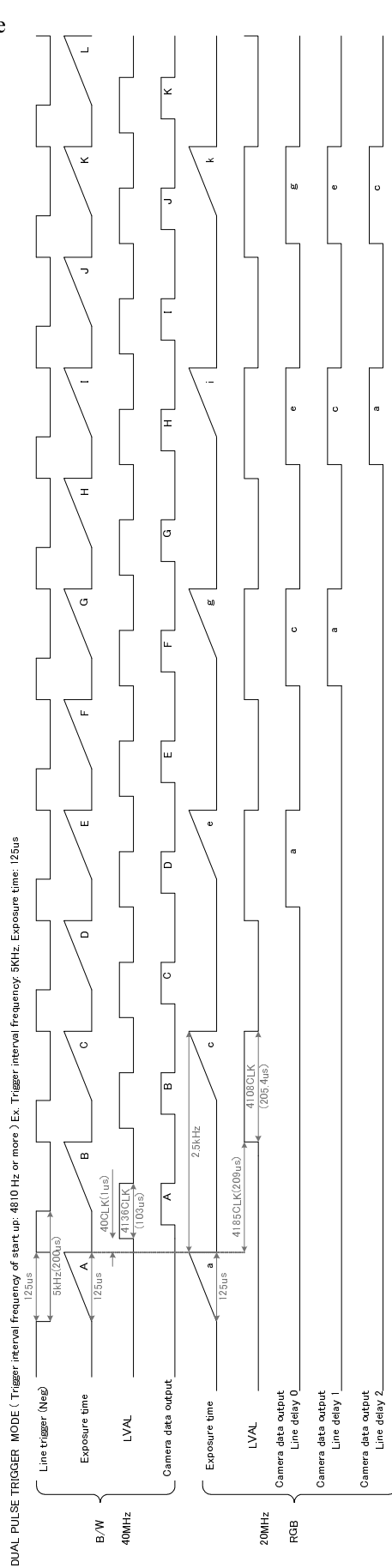


·Dual FIX mode



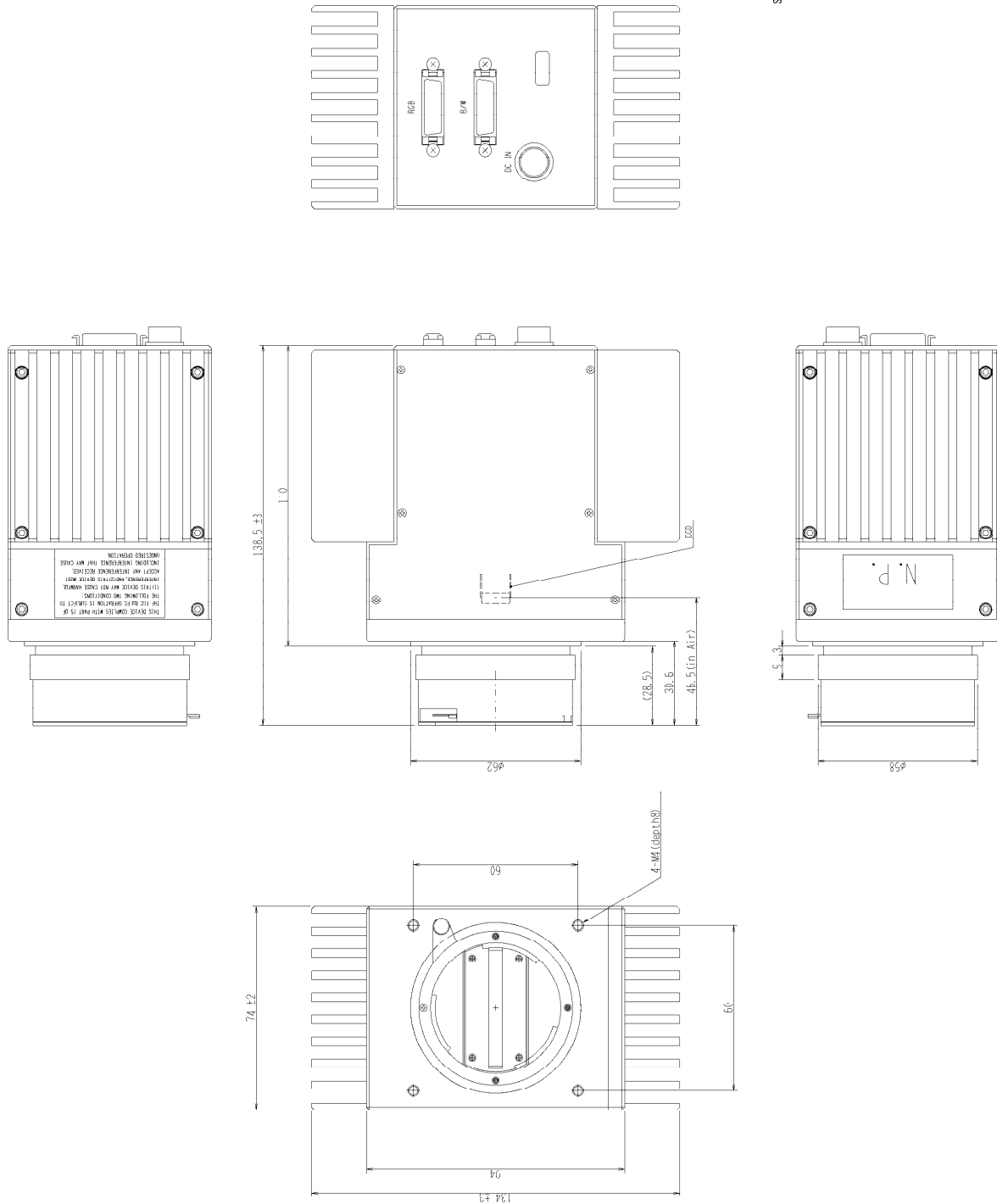
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·Dual pulse mode



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8. Outline Drawing



Specification
 Material: Aluminum alloy
 Processing: Anodize (Black)

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Distributor

- This product must be classified for disposal according to the laws of each country and municipal laws.
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