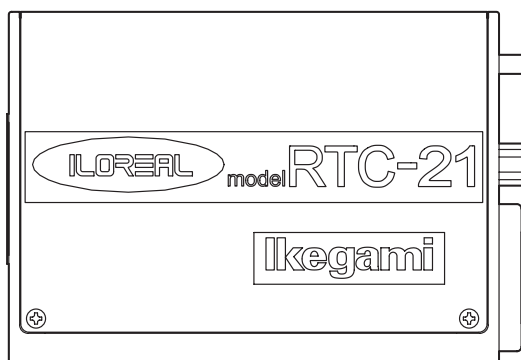


CE

Products conforming to RoHS directive



RTC-21 HD

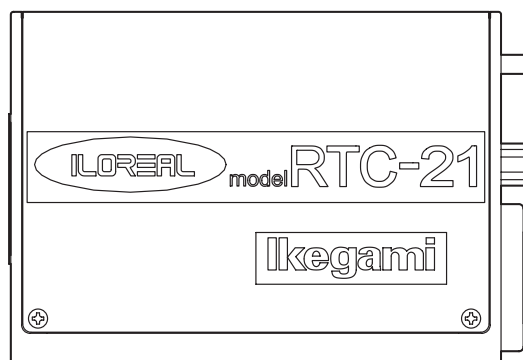
High Color Fidelity Camera

Operation Manual

Ikegami

CE

Products conforming to RoHS directive



RTC-21 HD

High Color Fidelity Camera

Operation Manual

1112 1st Edition (U) (E)

Ikegami

English

Instructions for Disposal of Electric and Electronic Equipment in Private Household



Disposal of used Electric and Electronic Equipment
(Applicable in the European Union and other European countries with separate collection systems)

This symbol on the product, or in the related documents in the package, indicates that this product shall not be treated as normal household waste. Instead, it should be taken to a proper applicable collection point or depot for the recycling of electric and electronic equipment.

By ensuring this product is disposed of correctly, you will help prevent possible negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. The recycling of materials will help to conserve natural resources.

For more detailed information about recycling of this product, please contact your local city authority, your household waste disposal service or the place where you purchased the product.

Deutsch

Vorschriften für die Entsorgung von elektrischen und elektronischen Geräten in Privathaushalten



Entsorgung von gebrauchten elektrischen und elektronischen Geräten
(In der Europäischen Union und anderen europäischen Ländern mit separaten Sammelsystemen anwendbar.)

Das auf dem Produkt angebrachte Symbol, bzw. die Symbole in den in der Packung beiliegenden Dokumenten, weisen darauf hin, dass dieses Produkt nicht als normaler Haushaltsmüll behandelt werden darf. Es muss deshalb an einer dafür vorgesehenen Sammelstelle abgeliefert werden, in der das Recycling von elektrischen und elektronischen Geräten durchgeführt wird.

Durch die ordnungsgemäße Entsorgung dieses Produkts tragen Sie dazu bei, dass unsere Umwelt und unsere Gesundheit nicht durch unsachgemäße Entsorgung negativ beeinflusst wird. Mit dem Recycling von Materialien tragen wir zur Bewahrung der natürlichen Ressourcen bei.

Für nähere Informationen hinsichtlich des Recyclings für dieses Produkt sprechen Sie bitte mit Ihrer zuständigen Behörde, Ihrer Hausmüll-Entsorgungsstelle oder dem Geschäft, wo Sie das Produkt gekauft haben.

Français

Consignes de mise au rebut des appareils électriques et électroniques dans les foyers privés



Mise au rebut des appareils électriques et électroniques
(Applicable dans l'Union Européenne et autres pays d'Europe ayant un système de récupération séparé)

Ce symbole apposé sur le produit ou dans les documents liés se trouvant dans l'emballage indique que ce produit ne doit pas être traité comme un déchet ménager normal. Il doit être porté à un point de récupération correct ou à un dépôt pour le recyclage des appareils électriques et électroniques.

En vous assurant que ce produit est correctement mis au rebut, vous aiderez à empêcher les conséquences possibles pouvant affecter l'environnement et la santé humaine, pouvant être causées par une mauvaise manipulation des déchets de ce produit. Le recyclage des matériaux favorise la conservation des ressources naturelles.

Pour des informations plus détaillées concernant le recyclage de ce produit, veuillez contacter les autorités locales, votre service de mise au rebut des déchets ménagers ou le lieu d'achat de votre produit.

Español

Instrucciones para eliminar equipos eléctricos y electrónicos de una casa privada



Eliminación de equipos eléctricos y electrónicos usados
(Normas aplicables en la Unión Europea y en otros países europeos con diferentes sistemas de recogida)

Este símbolo en el producto, o en los documentos relacionados, indica que este producto no deberá ser tratado como un residuo doméstico normal. En cambio, deberá ser llevado a un punto o lugar donde los equipos eléctricos y electrónicos sean recogidos para ser reciclados.

Asegurándose de que este producto sea eliminado correctamente, usted ayudará a impedir las posibles consecuencias negativas sobre el medio ambiente y la salud humana que podrían ser causadas por el manejo inapropiado de este producto como residuo doméstico. El reciclado de los materiales ayudará a conservar los recursos naturales.

Para conocer una información más detallada acerca del reciclado de este producto, póngase en contacto con las autoridades de su localidad, con su servicio de recogida de residuos domésticos o con el comercio donde adquirió el producto.

Conformance to RoHS Directive

The following product described in this manual conforms to the RoHS Directive:

RTC-21_{HD} XYZ Camera

* About the RoHS Directive

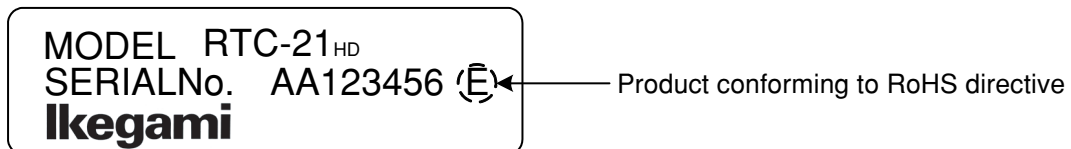
The RoHS Directive is an environmental directive established by the European Union concerning the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Maintenance of Products Conforming to RoHS Directive

Work with care about followings for maintenance of products conforming to RoHS directive.

1. Identification

- For products conforming to RoHS directive, the letter “E” is appended at the end of the serial number on the label. For models that the letter cannot be appended to the serial number, the letter “E” will be described in a distinguishable position on the label. A description example on a main label is shown below.



Label

- Print-circuit board of the products conforming to RoHS directive is manufactured by following methods.
 - [1] Blue resist ink is used for the print-circuit board. (The color of conventional print-circuit board is green.)
 - [2] Either one of the following marks is indicated by a serigraph or label.



Phase 3A



Phase 3

2. Soldering

Since the melting point of lead-free solder used for the products conforming to RoHS directive is 20 to 45 degrees Celsius higher than that of conventional solder with lead (Sn-Pb eutectic solder), a high temperature needs to be set to a soldering iron. Taking allowable temperature limit of the parts and stable work into consideration, use a soldering iron with excellent thermal recovery characteristics.

- Recommended solder composition is “Sn/3.0Ag/0.5Cu” or equivalent.
- Separate the soldering iron exclusively for RoHS products and the soldering iron for conventional use.
- Set the temperature of the soldering bit to 350 to 370 degrees Celsius.
- The temperature may need to be adjusted according to the size of the copper foil land on the print-circuit board and the tip width of the soldering bit.
- Finish by a lead-free solder looks dull or whitish compared to conventional solder with lead.
- If the customer mixed the lead-solder with the main body wiring or the circuit board, it becomes guarantee off the subject.

Ikegami doesn't guarantee to do the repair work. Because the solder polluted with lead cannot be removed.

3. Parts

Be sure to use parts conforming to RoHS directive.

Information for The User

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The CE mark means

The CE mark means that the following products will meet the Directives 2004/108/EC and standards EN55022, EN55024

- RTC-21_{HD} XYZ CAMERA

Handling Precautions

Be sure to read this operation manual thoroughly to make the best use of your camera. Also, although this camera has been designed with due consideration for safety, be sure to observe the safety precautions described below to prevent malfunction or accident through misuse.

- (1) This camera is a piece of precision equipment and should therefore not be subjected to strong impact force or handled roughly.
- (2) Avoid removing the camera lens.
If the lens must be removed for the purpose of replacement or repair, make sure that dirt or dust does not enter the camera's lens mount. Also, if you plan to leave the lens off the camera for a long period of time, be sure to attach the supplied lens mount cap to prevent the lens mount from becoming dusty.
If the optical elements of the camera do become dirty, carefully clean them by using a blower or with lens cleaning paper, making sure not to scratch the lens. Also be sure to clean the optical elements immediately if they are touched.
- (3) Do not let foreign matter enter the camera.
This camera uses precision parts. Foreign matter such as water or dirt entering the camera might lead to malfunction or accident.
- (4) When transporting the camera, be sure to wrap it in vibration dampening materials and place it in a cardboard box or other sturdy container.
- (5) Do not use the camera to film the sun or a strong spotlight for a long period of time. This might damage the CMOS elements.
- (6) Use the camera in favorable environments as much as possible, and avoid using or storing the camera in the following locations:
 - Places that are particularly hot (over 40°C) or cold (0° or lower)
Be careful not to leave the camera in a car or other enclosed environment subject to direct sunlight, especially in the summer.
 - Places that are excessively humid or dusty
The lens will fog up if the camera is brought into a warm room from outside on a cold day.
 - Places subject to rain or snow
 - Places subject to excessive vibration
 - Places subject to strong radio waves
 - Places subject to lightning strikes
 - Places subject to salt corrosion
 - Places subject to toxic gases



Contact an Ikegami service center if you think your camera might be malfunctioning. Do not attempt to disassemble or repair the camera yourself.

RTC-21_{HD}

Operation Manual

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1. Overview

This camera is a high-resolution 3CMOS progressive color camera that uses 1:2.8 CMOS sensors with 3.27 million pixels. The use of a special optical system enables a wide color gamut and accurate color reproduction.

2. Features

High-resolution CMOS sensor

The camera uses three 1:2.8 CMOS sensors with 3.27 million pixels in a square pixel array. Data with a resolution of 1,920 (horizontal) × 1,080 (vertical) pixels is output as X, Y, and Z values at a rate of 30 frames per second.

Wide color gamut

The camera uses a special optical system that improves the optical wavelength domain sensitivity and an original color matrix circuit that enables accurate color reproduction.

RS-232C communication

All settings in the camera can be remotely controlled by using RS-232C communication.

Digital output

The Camera Link (Medium configuration) protocol is used for the video output signal. X, Y, and Z values can all be output in 10 bits.

Compact and lightweight

The camera is much more compact and lightweight than previous models.

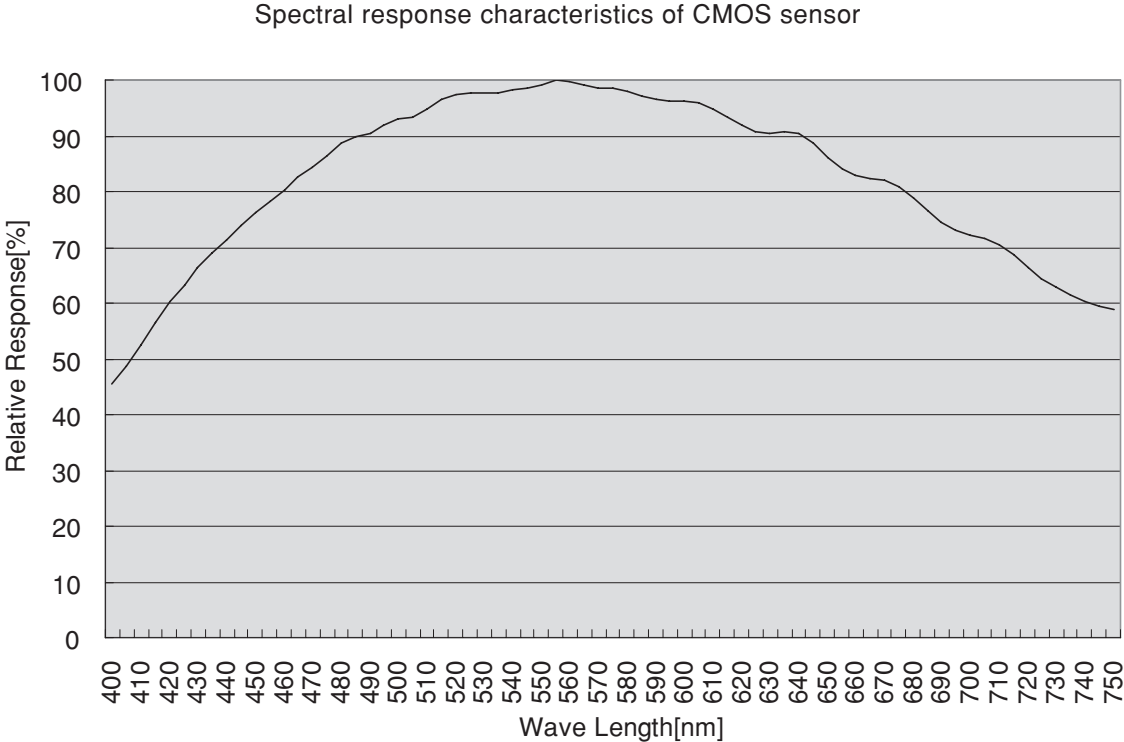
3. Contents of box

- Main camera unit 1
- Lens mount cap 1
- Operation manual (this document) 1

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4. Spectral response characteristics of CMOS sensor

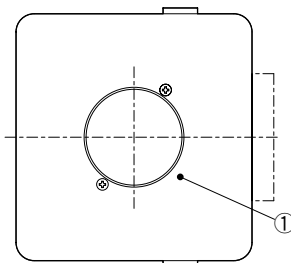
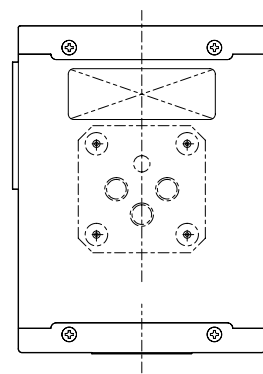
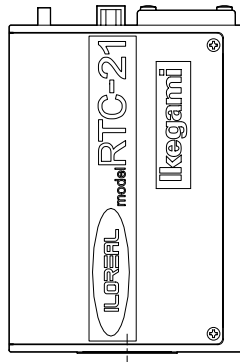
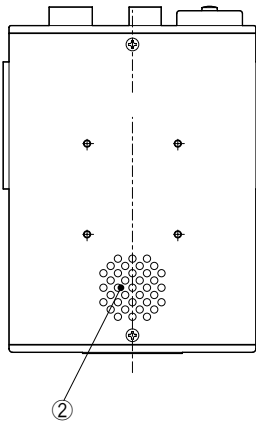
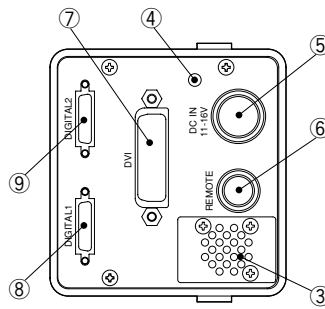
The spectral response characteristics of the CMOS sensors used in this camera are shown below.



Spectral response characteristics of CMOS sensor
Relative response (%)
Wave length (nm)

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5. Names and functions of parts



- | | |
|---------------------|----------------------|
| ① Lens mount | ⑥ REMOTE connector |
| ② Fan intake holes | ⑦ DVI connector |
| ③ Fan exhaust holes | ⑧ DIGITAL1 connector |
| ④ Power LED | ⑨ DIGITAL2 connector |
| ⑤ DC IN connector | |

5 - 2 5. Names and functions of parts

① Lens mount

The mount where the lens is attached (C mount).

② Fan intake holes

The air holes for the intake fan.

③ Fan exhaust holes

The holes for the exhaust fan.

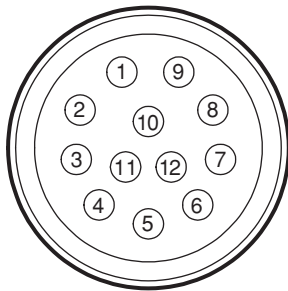
④ Power LED

This LED lights green when the power is on.

⑤ DC IN connector

This is an I/O connector for connecting a power supply or other signals.

The connector interface is described in the table below.



Connector on camera : HR10-10R-12PA (Hirose)

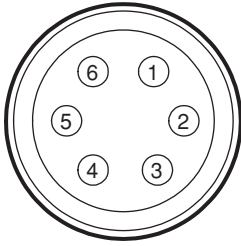
Plug on cable : HR10A-10P-12S (Hirose)

IN : Input OUT : Output

| Pin No. | Signal Name | IN/OUT |
|---------|----------------|--------|
| ① | +12V_RET (GND) | IN |
| ② | +12V | IN |
| ③ | GND | - |
| ④ | - | - |
| ⑤ | GND | - |
| ⑥ | - | - |
| ⑦ | - | - |
| ⑧ | GND | - |
| ⑨ | - | - |
| ⑩ | GND | - |
| ⑪ | - | - |
| ⑫ | GND | - |

⑥ REMOTE connector

This is a connector for RS-232C communication and lens control.



Connector on camera : HR10-7R-6SA (Hirose)

Plug on cable : HR10A-7P-6P (Hirose)

IN : Input OUT : Output

| Pin No. | Signal Name | Remarks | IN/OUT |
|---------|-------------|------------------|--------|
| ① | RD (RXD) | Received data | IN |
| ② | SG (GND) | GND | - |
| ③ | - | - | - |
| ④ | - | - | - |
| ⑤ | - | - | - |
| ⑥ | SD (TXD) | Transmitted data | OUT |

⑦ DVI connector

This is a connector for DVI-D output.

IN : Input OUT : Output

| Pin No. | Signal Name | IN/OUT | Pin No. | Signal Name | IN/OUT |
|---------|-------------|--------|---------|-------------|--------|
| ① | DATA2- | OUT | ⑬ | - | - |
| ② | DATA2+ | OUT | ⑭ | +5V | OUT |
| ③ | GND | - | ⑮ | GND | - |
| ④ | - | - | ⑯ | (H P DET) | - |
| ⑤ | - | - | ⑰ | DATA0- | OUT |
| ⑥ | (DDC CLK) | - | ⑱ | DATA0+ | OUT |
| ⑦ | (DDC DATA) | - | ⑲ | GND | - |
| ⑧ | - | - | ⑳ | - | - |
| ⑨ | DATA1- | OUT | ㉑ | - | - |
| ⑩ | DATA1+ | OUT | ㉒ | GND | - |
| ⑪ | GND | - | ㉓ | CLK+ | OUT |
| ⑫ | - | - | ㉔ | CLK- | OUT |

5 - 4 5. Names and functions of parts

⑧ DIGITAL1 connector

This is a connector for connecting a Camera Link cable.

IN : Input OUT : Output

| Pin No. | Signal Name | IN/OUT | Pin No. | Signal Name | IN/OUT |
|---------|-------------|--------|---------|-------------|--------|
| ① | GND | - | ⑭ | GND | - |
| ② | X0 - | OUT | ⑮ | X0 + | OUT |
| ③ | X1 - | OUT | ⑯ | X1 + | OUT |
| ④ | X2 - | OUT | ⑰ | X2 + | OUT |
| ⑤ | XCLK - | OUT | ⑱ | XCLK + | OUT |
| ⑥ | X3 - | OUT | ⑲ | X3 + | OUT |
| ⑦ | RD + | INPUT | ⑳ | RD - | INPUT |
| ⑧ | SD - | OUT | ㉑ | SD + | OUT |
| ⑨ | - | - | ㉒ | - | - |
| ⑩ | - | - | ㉓ | - | - |
| ⑪ | - | - | ㉔ | - | - |
| ⑫ | - | - | ㉕ | - | - |
| ⑬ | GND | - | ㉖ | GND | - |

⑨ DIGITAL2 connector

This is a connector for connecting a Camera Link cable.

IN : Input OUT : Output

| Pin No. | Signal Name | IN/OUT | Pin No. | Signal Name | IN/OUT |
|---------|-------------|--------|---------|-------------|--------|
| ① | GND | - | ⑭ | GND | - |
| ② | Y0 - | OUT | ⑮ | Y0 + | OUT |
| ③ | Y1 - | OUT | ⑯ | Y1 + | OUT |
| ④ | Y2 - | OUT | ⑰ | Y2 + | OUT |
| ⑤ | YCLK - | OUT | ⑱ | YCLK + | OUT |
| ⑥ | Y3 - | OUT | ⑲ | Y3 + | OUT |
| ⑦ | - | - | ⑳ | - | - |
| ⑧ | - | - | ㉑ | - | - |
| ⑨ | - | - | ㉒ | - | - |
| ⑩ | - | - | ㉓ | - | - |
| ⑪ | - | - | ㉔ | - | - |
| ⑫ | - | - | ㉕ | - | - |
| ⑬ | GND | - | ㉖ | GND | - |

6. Using the camera

- Do not turn on the power of connected devices until after they have been connected to the camera.
- Be sure to read the operation manual of the connected device before connecting it to the camera.

6.1 Connecting devices to the camera

DC IN connector

This connector connects an external DC power supply that supplies +12 V power.

Make sure that the rated power supply voltage of 12 V DC is supplied. Also make sure that any fluctuations in the voltage remain within a range of 11 V DC to 16 V DC.

- * The main camera unit does not contain a power on/off switch. Turn the camera's power on and off by using the external DC power supply. When the camera's power is on, the power LED on the rear of the camera lights green.

REMOTE connector

This is a connector for RS-232C communication. Connect an RS-232C cable to this connector.

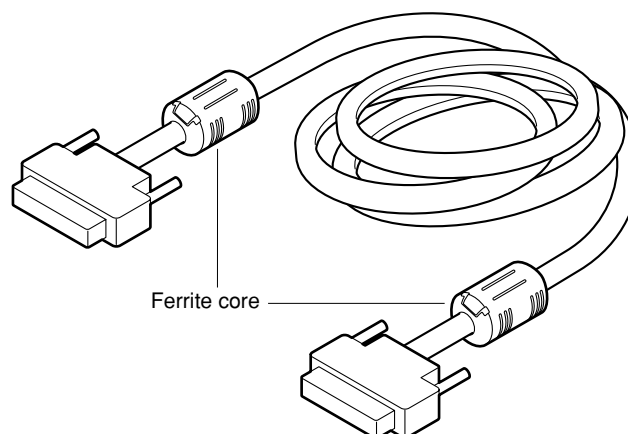
DIGITAL1/2 connector

This connector outputs a digital video signal (using the Camera Link (Medium configuration) protocol). Connect a Camera Link cable to this connector.

DVI connector

This connector outputs a digital video signal. Connect a DVI cable to this connector.

- * Use a DVI cable with a ferrite core at both ends. Contact Ikegami if you are unable to obtain such a cable.



6.2 Setting the camera's internal switches

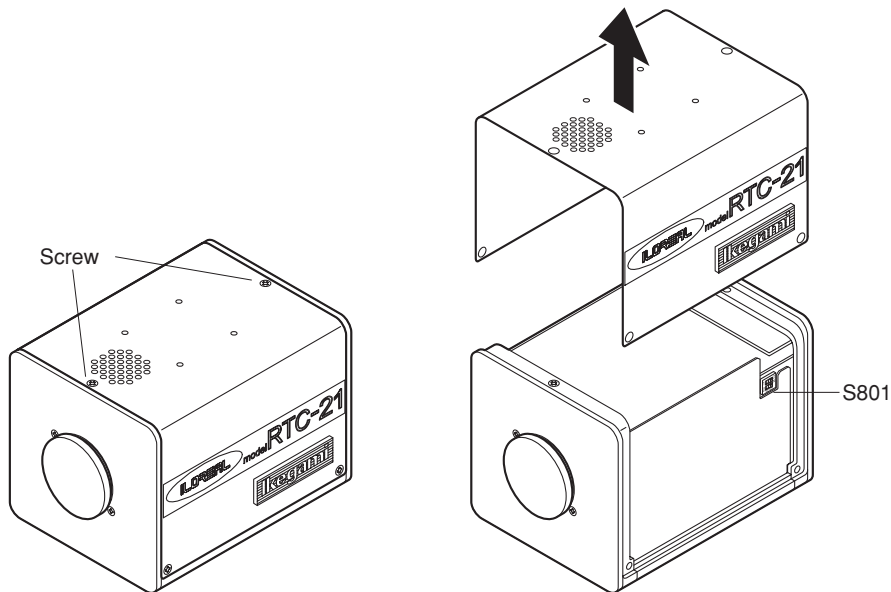
CAUTION

The top cover of the camera must be removed to set the camera's internal switches. Make sure that the camera's power is off before removing the top cover. Also make sure that no dirt or foreign objects enter the camera while the top cover is off.

Removing the camera's top cover

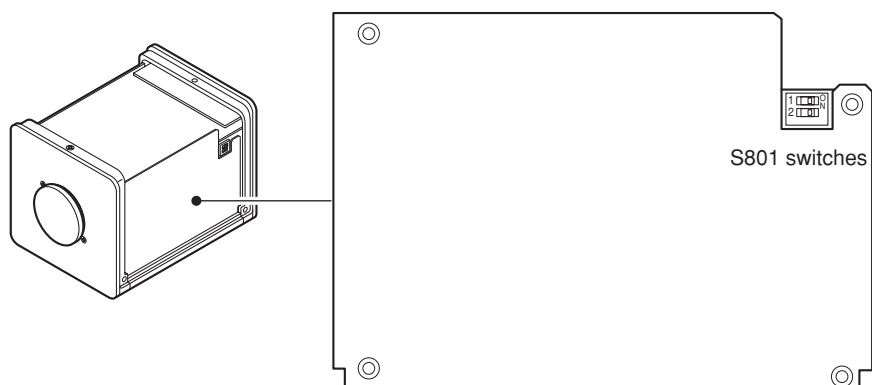
1. Remove the six screws anchoring the top cover (two on the top and two on each of the left and right sides) by using a Phillips screw driver. (Be careful not to lose these screws.)
2. Lift up and remove the top cover.

Reattach the top cover later by using the reverse procedure.



Description of switches

The S801 switches are located on the camera's internal circuit board as shown below.



S801-1: Remote control switch (Factory setting: ON)

This switch sets whether remote control is performed via the REMOTE connector or the DIGITAL1 connector.

OFF : REMOTE connector enabled

ON : DIGITAL1 connector enabled

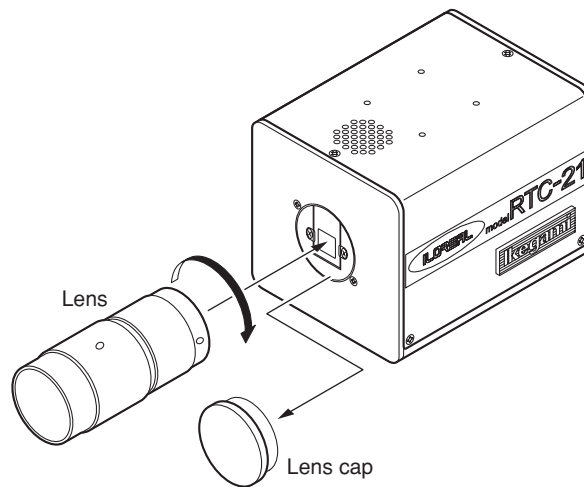
S801-2: Switch for testing (Factory setting: ON)

Do not change the factory setting of this switch.

6.3 Attaching the lens

Attach the lens as described below. Be sure to read the manual of the lens you are using before attaching it to the camera.

- 1) Remove the lens mount cap.
- 2) Insert the lens into the C mount and turn it until it fits into place.



6.4 Camera features

Auto shutter

Auto shutter is a function that automatically adjusts the shutter speed according to the amount of light in the image on the screen in order to maintain uniform brightness. This function is enabled by specifying auto shutter as the shutter mode.

Auto shutter adjusts the shutter speed in a range of 1/15 to about 1/4000 second.

When auto shutter is specified, the camera might “focus hunt” if the object to be photographed is particularly bright or there is a large difference in brightness in the image on the screen. If focus hunting occurs, reduce the amount of incident light entering the camera by taking measures such as narrowing the lens aperture or attaching an ND filter to the lens.

See 8-2 *Communication commands* for a list of camera commands.

White balance

In order to obtain a picture with the correct color balance, the white balance must be adjusted in accordance with the environment in which an object is being photographed. This environment is known as the *color temperature*, and is determined by the light source illuminating the object.

• Adjusting the white balance

1. Place a sheet of white paper (or a grayscale chart, etc.) in front of the object to be photographed and take a photograph with the paper taking up at least two-thirds of the screen.
2. Adjust the white balance by changing the settings of the S1 LEVEL, S2 LEVEL, and S3 LEVEL commands.

See 8-2 *Communication commands* for a list of camera commands.

To adjust the white balance accurately, it is necessary to adjust the monitor or other device used to display the images. For how to adjust the monitor, see the operation manual of the monitor you are using.

There are capture card and image capture software products available that can be used to display a histogram of a captured image. Using one of these products can help you adjust the white balance more accurately.

Master pedestal

This is a function that regulates the level of black in the output video signal. Similar to contrast adjustment, raising the level of black makes darker sections of the picture more visible, but whitens the picture as a whole; whereas lowering the black level darkens the picture as a whole.

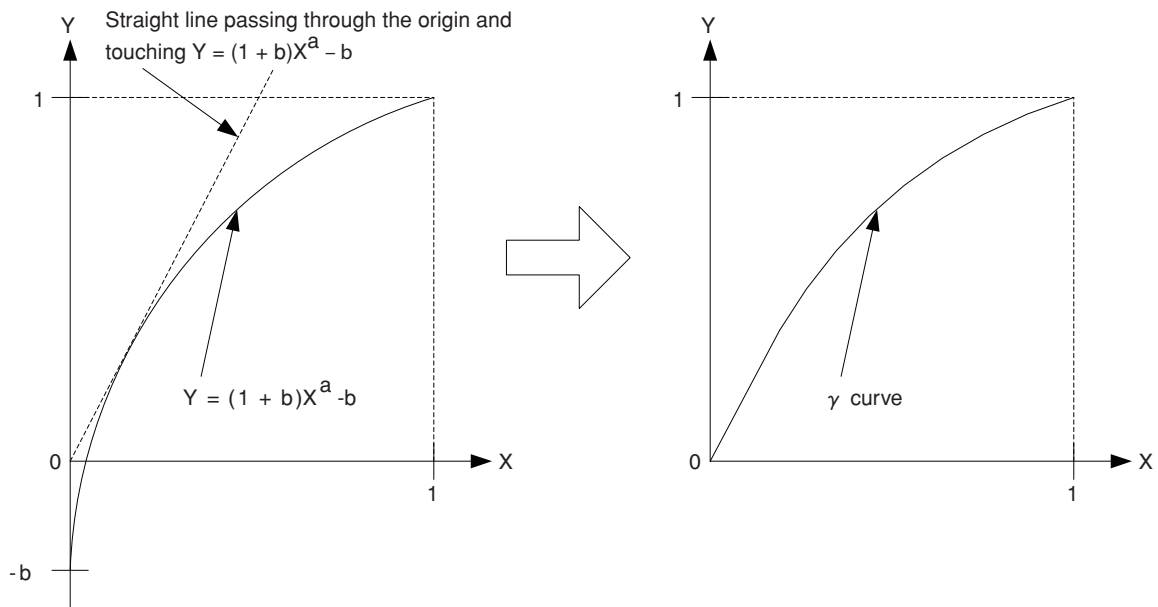
See 8-2 *Communication commands* for a list of camera commands.

Gamma

The tone response characteristics of an image are expressed by a value known as gamma (γ). In the case of a display, the brightness is not in direct proportion to the input voltage, but changes exponentially. Therefore, the change in brightness is more gradual when the input voltage is lower, and becomes more acute when the input voltage is larger. This relationship is illustrated on a normal 2.2 gamma curve ($\gamma = 2.2$).

When $\gamma = 1$, the curve is a straight line, so if the gamma value is set to $\gamma = 0.45$, which is the reciprocal of $\gamma = 2.2$ on the camera side, the gamma value on the display will be 1.

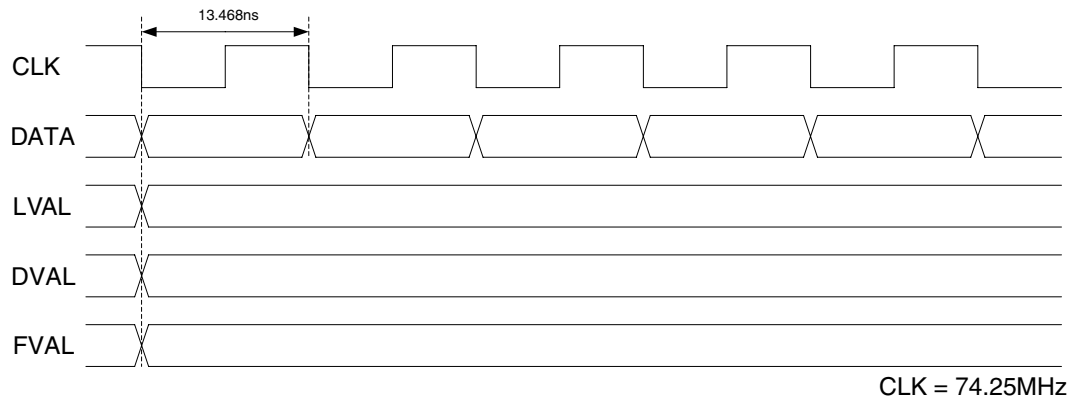
The camera's gamma curve can be specified based on the equation shown below.



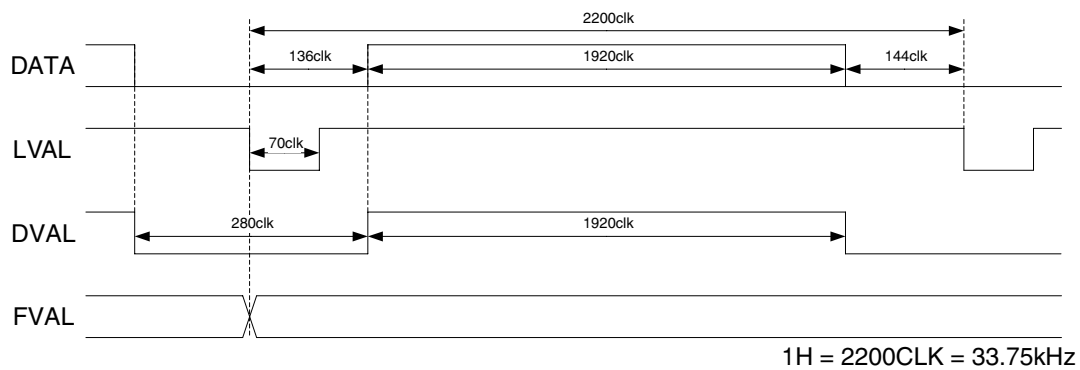
See 8-2 *Communication commands* for a list of camera commands.

7. Timing charts

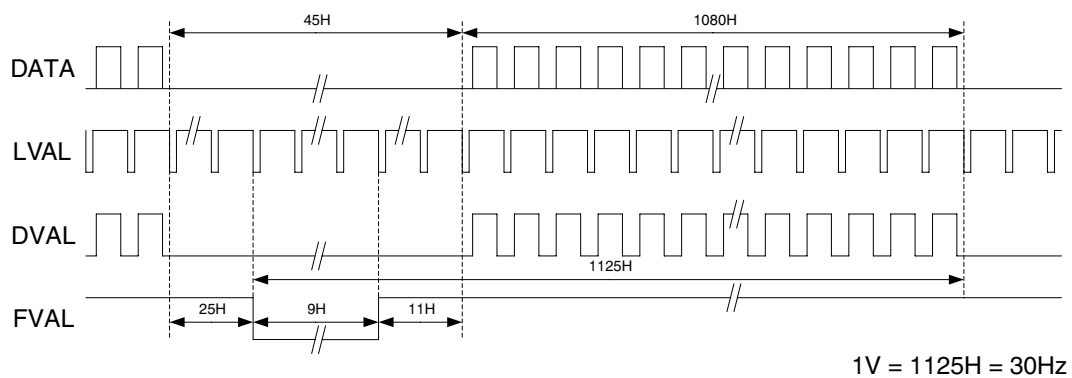
Pixel Clk Rate Timing



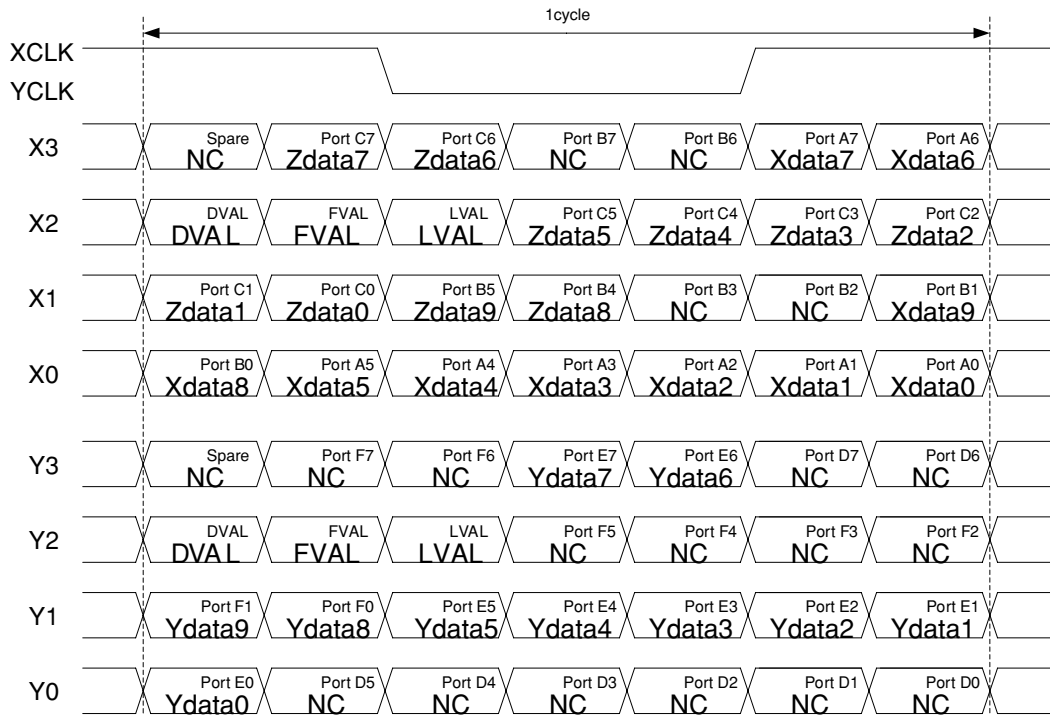
Line Rate Timing



Frame Rate Timing



Camera Link Medium Configuration



8. Using RS-232C communication

8.1 RS-232C communication specifications

- Communication method Duplex serial communication
- Synchronization method Asynchronous communication
- Data length 8 bits
- Stop bit 1 bit
- Parity None
- Transfer rate 9,600 bps

This camera can be controlled via either the REMOTE or DIGITAL1 connector by using RS-232C communication. The DIGITAL1 connector is selected as the default factory setting.

To enable control from the DIGITAL OUT1 connector, a switch on the camera's internal circuit board must be set. (See 6. *Using the camera* for how to set this switch.)

8.2 Communication commands

Command format

Commands are sent in the following format:

[STX][CODE1][CODE2][CODE3][CODE4][CODE5][ETX]

| Location | Field | Symbol | Meaning |
|-------------------|----------------|----------------|------------------|
| 1st field | Text start | STX | Start of command |
| 2nd to 7th fields | CODE1 to CODE5 | 0 to 9, A to F | Command |
| 8th field | Text end | ETX | End of command |

The text start symbol [STX] and the text end symbol [ETX] must be added to the start and end of a command.

Use uppercase letters for commands. Commands containing lowercase letters will not be recognized.

Commands are converted to ASCII code and sent and received as hexadecimal numbers.

If an incorrect command is sent or a communication error occurs, the camera returns the negative acknowledgment symbol [NAK].

List of communication commands

| No. | Command Name | Command | Initial Value | Meaning |
|-----|------------------------|---------|---------------|--|
| 1 | SOFT RESET | 01000 | - | Initialize all commands and restore factory settings. |
| 2 | SHUTTER MODE | 02000 | ○ | Preset shutter |
| | | 02001 | - | Variable shutter |
| | | 02002 | - | Auto shutter (AES) |
| | | 02003 | - | Slow shutter |
| | | R02 | - | Call setting. |
| 3 | VARIABLE SHUTTER SPEED | 030XX | XX = 00 | Variable shutter speed XX = 00 to FF (variable in 256 steps) |
| | | R03 | - | Call setting. |
| 4 | PRESET SHUTTER SPEED | 04000 | ○ | Preset shutter speed is 1/30 second |
| | | 04001 | - | Preset shutter speed is 1/60 second |
| | | 04002 | - | Preset shutter speed is 1/100 second |
| | | 04003 | - | Preset shutter speed is 1/120 second |
| | | 04004 | - | Preset shutter speed is 1/250 second |
| | | 04005 | - | Preset shutter speed is 1/500 second |
| | | 04006 | - | Preset shutter speed is 1/1000 second |
| | | 04007 | - | Preset shutter speed is 1/1500 second |
| | | 04008 | - | Preset shutter speed is 1/2000 second |
| | | 04009 | - | Preset shutter speed is 1/4000 second |
| | | 0400A | - | Preset shutter speed is 1/7000 second |
| | | 0400B | - | Preset shutter speed is 1/10000 second |
| | | 0400C | - | Preset shutter speed is 1/30 second |
| | | 0400D | - | Preset shutter speed is 1/30 second |
| | | 0400E | - | Preset shutter speed is 1/30 second |
| | | 0400F | - | Preset shutter speed is 1/30 second |
| | | R04 | - | Call setting. |
| 5 | SLOW SHUTTER SPEED | 05000 | ○ | Shutter speed is 1/30 second |
| | | 05001 | - | Shutter speed is 1/15 second |
| | | 05002 | - | Shutter speed is 1/7.5 second |
| | | 05003 | - | Shutter speed is 1/4 second |
| | | 05004 | - | Shutter speed is 1/2 second |
| | | 05005 | - | Shutter speed is 1 second |
| | | 05006 | - | Shutter speed is 2 seconds |
| | | 05007 | - | Shutter speed is 4 seconds |
| | | 05008 | - | Shutter speed is 1/30 second |
| | | 05009 | - | Shutter speed is 1/30 second |
| | | 0500A | - | Shutter speed is 1/30 second |
| | | 0500B | - | Shutter speed is 1/30 second |
| | | 0500C | - | Shutter speed is 1/30 second |
| | | 0500D | - | Shutter speed is 1/30 second |
| | | 0500E | - | Shutter speed is 1/30 second |
| | | 0500F | - | Shutter speed is 1/30 second |
| | | R05 | - | Call setting. |

| No. | Command Name | Command | Initial Value | Meaning |
|-----|-----------------------------|---------|---------------------------|---|
| 6 | S1 LEVEL | 06XXX | XXX = 400 | S1 video signal level, XXX = 000 to FFF (variable in 4096 steps) XXX = 000 (x0) to 400 (x1) to FFF (x4) |
| | | R06 | - | Call setting. |
| | S2 LEVEL | 07XXX | XXX = 400 | S2 video signal level, XXX = 000 to FFF (variable in 4096 steps) XXX = 000 (x0) to 400 (x1) to FFF (x4) |
| | | R07 | - | Call setting. |
| | S3 LEVEL | 08XXX | XXX = 400 | S3 video signal level, XXX = 000 to FFF (variable in 4096 steps) XXX = 000 (x0) to 400 (x1) to FFF (x4) |
| | | R08 | - | Call setting. |
| 7 | S1 BLACK | 09XXX | XXX = Adjustment value | S1 video signal black level, XXX = 000 to FFF (variable in 4096 steps) Negative variation: 800 to FFF, positive variation: 000 to 7FF |
| | | R09 | - | Call setting. |
| | S2 BLACK | 0AXXX | XXX = Adjustment value | S2 video signal black level, XX = 000 to FFF (variable in 4096 steps) Negative variation: 800 to FFF, positive variation: 000 to 7FF |
| | | R0A | - | Call setting. |
| | S3 BLACK | 0BXXX | XXX = Adjustment value | S3 video signal black level, XXX = 000 to FFF (variable in 4096 steps) Negative variation: 800 to FFF, positive variation: 000 to 7FF |
| | | R0B | - | Call setting. |
| 8 | MASTER PEDESTAL | 0CXXX | XXX = 000 | Set the RGB output video signal black levels simultaneously. XXX = 000 to FFF (variable in 4096 steps) Negative direction: 800 to FFF, positive direction: 000 to 7FF |
| | | R0C | - | Call setting. |
| 9 | AUTO WHITE BALANCE (AWB) | 0D000 | - | Execute auto white balance (auto stop). |
| | | 0D001 | - | Forcibly stop auto white balance. |
| 10 | AUTO BLACK BALANCE (ABB) | 0E000 | - | Execute auto black balance (auto stop). |
| | | 0E001 | - | Forcibly stop auto black balance. |
| 11 | DIGITAL OUTPUT | 0F000 | ○ | Camera Link XYZ 10-bit output |
| | | 0F001 | - | Camera Link RGB 10-bit output |
| | | 0F010 | - | Camera Link XYZ 12-bit output |
| | | 0F011 | - | Camera Link RGB 12-bit output |
| | | 0F020 | - | Camera Link XYZ 8-bit output |
| | | 0F021 | - | Camera Link RGB 8-bit output |
| | | R0F | - | Call setting. |

8 - 4 8. Using RS-232C communication

| No. | Command Name | Command | Initial Value | Meaning |
|-----|----------------|---------|---------------------------|---|
| 12 | XYZ MATRIX M10 | 11XXX | XXX = Adjustment value | XYZ matrix coefficient, row 1 column 1 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R11 | - | Call setting. |
| | XYZ MATRIX M11 | 12XXX | XXX = Adjustment value | XYZ matrix coefficient, row 1 column 2 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R12 | - | Call setting. |
| | XYZ MATRIX M12 | 13XXX | XXX = Adjustment value | XYZ matrix coefficient, row 1 column 3 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R13 | - | Call setting. |
| | XYZ MATRIX M20 | 21XXX | XXX = Adjustment value | XYZ matrix coefficient, row 2 column 1 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R21 | - | Call setting. |
| | XYZ MATRIX M21 | 22XXX | XXX = Adjustment value | XYZ matrix coefficient, row 2 column 2 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R22 | - | Call setting. |
| | XYZ MATRIX M22 | 23XXX | XXX = Adjustment value | XYZ matrix coefficient, row 2 column 3 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R23 | - | Call setting. |
| | XYZ MATRIX M30 | 31XXX | XXX = Adjustment value | XYZ matrix coefficient, row 3 column 1 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R31 | - | Call setting. |
| | XYZ MATRIX M31 | 32XXX | XXX = Adjustment value | XYZ matrix coefficient, row 3 column 2 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R32 | - | Call setting. |
| | XYZ MATRIX M32 | 33XXX | XXX = Adjustment value | XYZ matrix coefficient, row 3 column 3 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R33 | - | Call setting. |

| No. | Command Name | Command | Initial Value | Meaning |
|---------------|------------------|-----------|---|---|
| 13 | GAIN UP | 57000 | ○ | Increase digital sensitivity: OFF |
| | | 57001 | - | Increase digital sensitivity: +6 dB |
| | | 57002 | - | Increase digital sensitivity: +12 dB |
| | | 57003 | - | Increase digital sensitivity: +18 dB |
| | | R57 | - | Call setting. |
| 14 | VARIABLE GAIN UP | 58XXX | XXX = 000 | Increase variable sensitivity XXX = 000 to FFF (variable in 4096 steps) |
| | | R58 | - | Call setting. |
| 15 | RGB MATRIX N0 | 60XXX | XXX = 200 | RGB matrix coefficient, row 1 column 1 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R60 | - | Call setting. |
| | RGB MATRIX N1 | 61XXX | XXX = 000 | RGB matrix coefficient, row 1 column 2 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R61 | - | Call setting. |
| | RGB MATRIX N2 | 62XXX | XXX = 000 | RGB matrix coefficient, row 1 column 3 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R62 | - | Call setting. |
| | RGB MATRIX N3 | 63XXX | XXX = 000 | RGB matrix coefficient, row 2 column 1 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R63 | - | Call setting. |
| | RGB MATRIX N4 | 64XXX | XXX = 200 | RGB matrix coefficient, row 2 column 2 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R64 | - | Call setting. |
| | RGB MATRIX N5 | 65XXX | XXX = 000 | RGB matrix coefficient, row 2 column 3 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R65 | - | Call setting. |
| | RGB MATRIX N6 | 66XXX | XXX = 000 | RGB matrix coefficient, row 3 column 1 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R66 | - | Call setting. |
| | RGB MATRIX N7 | 67XXX | XXX = 000 | RGB matrix coefficient, row 3 column 2 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point |
| | | R67 | - | Call setting. |
| RGB MATRIX N8 | 68XXX | XXX = 200 | RGB matrix coefficient, row 3 column 3 XXX = 000 to FFF (variable in 4096 steps) Signed value, 9 bits after the decimal point | |
| | R68 | - | Call setting. | |

| No. | Command Name | Command | Initial Value | Meaning |
|-----|-----------------|---------|---------------|---|
| 16 | KNEE SEL | 73000 | ○ | KNEE function OFF |
| | | 73001 | - | KNEE function ON |
| | | R73 | - | Call setting. |
| 17 | GAMMA SEL | 80000 | ○ | GAMMA function OFF |
| | | 80001 | - | GAMMA function ON |
| | | R80 | - | Call setting. |
| 18 | S1 GAMMA | 810XX | XX = 69 | S1 gamma coefficient, initial value: $\gamma = 0.45$ XX = 00 to FF (variable in 256 steps) |
| | | R81 | - | Call setting. |
| | S2 GAMMA | 820XX | XX = 69 | S2 gamma coefficient, initial value: $\gamma = 0.45$ XX = 00 to FF (variable in 256 steps) |
| | | R82 | - | Call setting. |
| | S3 GAMMA | 830XX | XX = 69 | S3 gamma coefficient, initial value: $\gamma = 0.45$ XX = 00 to FF (variable in 256 steps) |
| | | R83 | - | Call setting. |
| 19 | S1 GAMMA OFFSET | 84XXX | XXX = 000 | S1 gamma offset coefficient XXX = 000 to FFF (variable in 4096 steps) |
| | | R84 | - | Call setting. |
| | S2 GAMMA OFFSET | 85XXX | XXX = 000 | S2 gamma offset coefficient XXX = 000 to FFF (variable in 4096 steps) |
| | | R85 | - | Call setting. |
| | S3 GAMMA OFFSET | 86XXX | XXX = 000 | S3 gamma offset coefficient XXX = 000 to FFF (variable in 4096 steps) |
| | | R86 | - | Call setting. |
| 20 | MARKER | A0000 | ○ | AWB/ABB/AES detection area marker OFF |
| | | A0001 | - | AWB/ABB detection area marker ON |
| | | A0002 | - | AES detection area marker ON |
| | | RA0 | - | Call setting. |
| 21 | DET1 HS | A1XXX | XXX = 000 | AWB/ABB detection area horizontal start position XXX = 000 to FFF |
| | | RA1 | - | Call setting. |
| | DET1 HE | A2XXX | XXX = 7FF | AWB/ABB detected area marker horizontal end position XXX = 000 to FFF |
| | | RA2 | - | Call setting. |
| | DET1 VS | A3XXX | XXX = 000 | AWB/ABB detection area vertical start position XXX = 000 to FFF |
| | | RA3 | - | Call setting. |
| | DET1 VE | A4XXX | XXX = 5FF | AWB/ABB detection area vertical end position XXX = 000 to FFF |
| | | RA4 | - | Call setting. |

| No. | Command Name | Command | Initial Value | Meaning |
|---------|-------------------------|-----------|--|---|
| 22 | DET2 HS | A5XXX | XXX = 000 | AES detection area horizontal start position XXX = 000 to FFF |
| | | RA5 | - | Call setting. |
| | DET2 HE | A6XXX | XXX = 7FF | AES detection area horizontal end position XXX = 000 to FFF |
| | | RA6 | - | Call setting. |
| | DET2 VS | A7XXX | XXX = 000 | AES detection area vertical start position XXX = 000 to FFF |
| | | RA7 | - | Call setting. |
| DET2 VE | A8XXX | XXX = 5FF | AES detection area vertical end position XXX = 000 to FFF | |
| | RA8 | - | Call setting. | |
| 23 | DYNAMIC | B0000 | ○ | Dynamic range = 100% |
| | | B0001 | - | Dynamic range = 200% |
| | | B0002 | - | Dynamic range = 400% |
| | | RB0 | - | Call setting. |
| 24 | MIRROR | B1000 | ○ | MIRROR function OFF |
| | | B1001 | - | MIRROR function ON (horizontal inversion) |
| | | B1002 | - | MIRROR function ON (vertical inversion) |
| | | B1003 | - | MIRROR function ON (horizontal-and-vertical inversion) |
| | | RB1 | - | Call setting. |
| 25 | AES LEVEL | B40XX | XX = 80 | Auto shutter reference level, XX = 00 to FF XX = 00 (-6 dB) to 80 (0 dB) to FF (+6 dB) |
| | | RB4 | - | Call setting. |
| 26 | AES RES | B500X | X = 0 | Auto shutter accumulated frames, X = 0 to F X = 0 (1 frame accumulated) to F (15 frames accumulated) |
| | | RB5 | - | Call setting. |
| 27 | S1 WHITE SHADING SEL | B8000 | ○ | S1 white shading OFF |
| | | B8001 | - | S1 white shading ON |
| | | RB8 | - | Call setting. |
| 28 | S1 WHITE SHADING | B9XXX | XXX = Adjustment value | S1 V-SAW shading correction coefficient XXX = 000 to 7FF (increase white vertically) XXX = 800 to FFF (decrease white vertically) |
| | | RB9 | - | Call setting. |
| 27 | S2 WHITE SHADING SEL | BA000 | ○ | S2 white shading OFF |
| | | BA001 | - | S2 white shading ON |
| | | RBA | - | Call setting. |
| 28 | S2 WHITE SHADING | BBXXX | XXX = Adjustment value | S2 V-SAW shading correction coefficient XXX = 000 to 7FF (increase white vertically) XXX = 800 to FFF (decrease white vertically) |
| | | RBB | - | Call setting. |

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| No. | Command Name | Command | Initial Value | Meaning |
|-----|-------------------------|---------|---------------------------|---|
| 27 | S3 WHITE SHADING SEL | BC000 | ○ | S3 white shading OFF |
| | | BC001 | - | S3 white shading ON |
| | | RBC | - | Call setting. |
| 28 | S3 WHITE SHADING | BDXXX | XXX = Adjustment value | S3 V-SAW shading correction coefficient XXX = 000 to 7FF (increase white vertically) XXX = 800 to FFF (decrease white vertically) |
| | | RBD | - | Call setting. |
| 29 | DATA SAVE | C000X | - | Save setting in camera. X = 0 to 7 (8 files) |
| | | RC0 | - | Call setting. |
| | DATA LOAD | C100X | - | Call setting in camera. X = 0 to 7 (8 files) |
| | | RC1 | - | Call setting. |
| 30 | WHITE BALANCE SAVE | C200X | - | Save white balance setting. X = 0 to 7 (8 files) |
| | | RC2 | - | Call setting. |
| | WHITE BALANCE LOAD | C300X | - | Call white balance setting. X = 0 to 7 (8 files) |
| | | RC3 | - | Call setting. |

8.3 Description of communication commands

1. SOFT RESET

This command returns all camera settings to their factory-set values.

2. SHUTTER MODE

This command specifies the method of exposure control used by the camera.

Preset shutter, variable shutter, auto shutter, or slow shutter can be selected.

3. VARIABLE SHUTTER SPEED

This command specifies the camera's exposure time. The time can be specified from between 1/15 and 1/10000 second, in 256 steps.

* This command can only be used when *variable shutter* is specified for SHUTTER MODE.

4. PRESET SHUTTER SPEED

This command specifies the camera's exposure time.

* This command can only be used when *preset shutter* is specified for SHUTTER MODE.

5. SLOW SHUTTER SPEED

This command specifies the camera's exposure time.

* This command can only be used when *slow shutter* is specified for SHUTTER MODE.

6. S1 LEVEL, S2 LEVEL, S3 LEVEL

These commands specify the level of the S1, S2, and S3 video signals.

Commands: [06XXX], [07XXX], and [08XXX]

XXX = 000 to FFF (variable in 4096 steps)

XXX = [000]: x0.0 to [400]: x1.0 (initial value) to [FFF]: x4.0

7. S1 BLACK, S2 BLACK, S3 BLACK

These commands specify the black level of the S1, S2, and S3 video signals.

Commands: [09XXX], [0AXXX], and [0BXXX]

XXX = 000 to FFF (variable in 4096 steps)

(Negative direction) (Positive direction)

(Minimum) [800] ←←← [FFF][000] →→→ [7FF] (Maximum)

8. MASTER PEDESTAL

This command specifies the black level of the S1, S2, and S3 video signals simultaneously.

Command: [0CXXX]

XXX = 000 to FFF (variable in 4096 steps)

(Negative direction) (Positive direction)

(Minimum) [800] ←←← [FFF] (Initial value) [000] →→→ [7FF] (Maximum)

S1 BLACK, S2 BLACK, and S3 BLACK are used to specify the black level balance of the S1, S2, and S3 video signals before video processing is performed in the camera.

MASTER PEDESTAL, on the other hand, is used to specify the output video signal contrast after video processing is performed in the camera.

If the black balance and black level are correctly specified by the S1 BLACK, S2 BLACK, and S3 BLACK commands, MASTER PEDESTAL can usually be used with the initial value.

With the factory settings, MASTER PEDESTAL only works on video signals output from the DVI connector. To use MASTER PEDESTAL for video signals output from the DIGITAL1 and DIGITAL2 connectors, it is necessary to switch to RGB output by using the DIGITAL OUTPUT command. If XYZ output is specified, the MASTER PEDESTAL command can be received but it will not work.

9. AUTO WHITE BALANCE

This command automatically adjusts the level of the S1, S2, and S3 video signals so that the levels are the same. This command works by varying the S1 LEVEL, S2 LEVEL, and S3 LEVEL values for all the output video signals or for the signals in the area marked by the AWB/ABB detection area marker so that the signal levels are the same.

The white balance might not be able to be accurately adjusted under some conditions. In this case, use the S1 LEVEL, S2 LEVEL, and S3 LEVEL commands to adjust the white balance. * See *White balance* on page 6-3 for details about white balance adjustment.

10. AUTO BLACK BALANCE

This command automatically adjusts the black level of the S1, S2, and S3 video signals so that the levels are the same. This command works by varying the S1 BLACK, S2 BLACK, and S3 BLACK values for all the output video signals or for the signals in the area marked by the AWB/ABB detection area marker so that the signal levels are the same.

When executing the AUTO BLACK BALANCE command, make sure that no incident light hits the image sensors by taking measures such as attaching the lens cap. The black balance might not be able to be accurately adjusted under some conditions. In this case, use the S1 BLACK, S2 BLACK, and S3 BLACK commands to adjust the black balance.

11. DIGITAL OUTPUT

This command switches the video signal output from the DIGITAL1 and DIGITAL2 connectors (Camera Link output). XYZ output (12 bits, 10 bit, 8 bits): The final output is the output from the XYZ MATRIX circuit. RGB output (12 bits, 10 bits, 8 bits): The circuits after the XYZ MATRIX circuit (the RGB MATRIX, KNEE, GAMMA, and MASTER PEDESTAL circuits) will operate.

* The video signal sensitivity differs between XYZ output and RGB output.

12. XYZ MATRIX M10 to M32

These commands specify the coefficients used when performing matrix calculations on the S1, S2, and S3 signals. The X, Y, and Z values after performing matrix-conversion on the S1, S2, and S3 signals are determined by the following formula:

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} M10 & M11 & M12 \\ M20 & M21 & M22 \\ M30 & M31 & M32 \end{bmatrix} \begin{bmatrix} S1 \\ S2 \\ S3 \end{bmatrix}$$

* M10 to M32: 12-bit signed value; 9 bits after the decimal point MIN: -3.998046875 to MAX: +3.998046875

| | | | | | | | | | | | |
|------|---------------|----|--------------------------------|----|----|----|----|----|----|----|----|
| B11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
| Sign | 2-bit integer | | 9 bits after the decimal point | | | | | | | | |

Sign [0]: Plus [1]: Minus
 Integer [00]: 0 to [11]: 3
 Bits after the decimal point [000000000]: 0.001953125 to [111111111]: 0.998046875

13. GAIN UP

This command increases the sensitivity of the video output. The gain can be selected from +6 dB, +12 dB, and +18 dB. Increasing the sensitivity also increases the noise element in the video signal.

14. VARIABLE GAIN UP

This command increases the sensitivity of the video output. The gain can be specified in 4096 steps up to +18 dB. Increasing the sensitivity also increases the noise element in

the video signal.

15. RGB MATRIX N0 to N8

These commands are used to convert the S1, S2, and S3 signals back to RGB after they have been converted to X, Y, Z by the MATRIX command.

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} N0 & N1 & N2 \\ N3 & N4 & N5 \\ N6 & N7 & N8 \end{bmatrix} \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$

* N0 to N8: 12-bit signed value; 9 bits after the decimal point MIN: -3.998046875 to MAX: +3.998046875

| | | | | | | | | | | | |
|------|---------------|----|--------------------------------|----|----|----|----|----|----|----|----|
| B11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
| Sign | 2-bit integer | | 9 bits after the decimal point | | | | | | | | |

Sign [0]: Plus [1]: Minus

Integer [00]: 0 to [11]: 3

Bits after the decimal point [000000000]: 0.001953125 to [111111111]: 0.998046875

* To use RGB MATRIX, it is necessary to switch to RGB output by using the DIGITAL OUTPUT command. If XYZ output is specified, the RGB MATRIX command can be received but it will not work.

- To specify Adobe RGB output:

Specify the following values for RGB MATRIX N0 to N8:

N0: 60413 N1: 61921 N2: 628B0

N3: 639F1 N4: 643C1 N5: 65015

N6: 66007 N7: 6783D N8: 68208

- To specify sRGB output:

Specify the following values for RGB MATRIX N0 to N8:

N0: 60676 N1: 61B10 N2: 628FE

N3: 639F1 N4: 643C1 N5: 65015

N6: 6601D N7: 67869 N8: 6821E

When specifying Adobe RGB output and sRGB output, set the following values for each GAMMA command:

S1 GAMMA: 81055

S2 GAMMA: 82055

S3 GAMMA: 83055

S1 GAMMA OFFSET: 840E1

S2 GAMMA OFFSET: 850E1

S3 GAMMA OFFSET: 860E1

With the factory settings, RGB MATRIX only works on video signals output from the DVI connector. To use RGB MATRIX for video signals output from the DIGITAL1 and DIGITAL2 connectors, it is necessary to switch to RGB output by using the DIGITAL OUTPUT command. If XYZ output is specified, the RGB MATRIX command can be received but it will not work.

16. KNEE SEL

This command turns the KNEE function on and off.

With the factory settings, KNEE SEL only works on video signals output from the DVI connector. To use the KNEE function for video signals output from the DIGITAL1 and DIGITAL2 connectors, it is necessary to switch to RGB output by using the DIGITAL OUTPUT command. If XYZ output is specified, the KNEE SEL command can be received but it will not work.

* KNEE SEL only works when DYNAMIC is set to 200% or more.

17. GAMMA SEL

This command turns the GAMMA function on and off.

With the factory settings, GAMMA SEL only works on video signals output from the DVI connector. To use the GAMMA function for video signals output from the DIGITAL1 and DIGITAL2 connectors, it is necessary to switch to RGB output by using the DIGITAL OUTPUT command. If XYZ output is specified, the GAMMA SEL command can be received but it will not work.

18. S1 GAMMA, S2 GAMMA, S3 GAMMA

These commands specify the value of a in the GAMMA curve equation $Y = (1 + b)X^a - b$.

[00]: 0.25 to [80]: 0.5 to [FF]: 0.748046875

19. S1 GAMMA OFFSET, S2 GAMMA OFFSET, S3 GAMMA OFFSET

These commands specify the value of b in the GAMMA curve equation $Y = (1 + b)X^a - b$.

[000]: 0 to [800]: 0.5 to [FFF]: 0.999755859375

20. MARKER

This command specifies markers that indicate the image detection area in which to execute auto white balance and auto black balance.

Each area can be changed by specifying values for DET1_HS, DET1_HE, DET1_VS, DET1_VE, DET2_HS, DET2_HE, DET2_VS, and DET2_VE.

21. DET1_HS, DET1_HE, DET1_VS, DET1_VE

These commands specify the image detection area used for auto white balance and auto black balance.

22. DET2_HS, DET2_HE, DET2_VS, DET2_VE

These commands specify the image detection area used for auto shutter.

23. DYNAMIC

This command specifies the dynamic range of the Camera Link output video signal.

100%: Signals with a level exceeding 100% are not output.

200%: Ensures a dynamic range of 200% for the image sensors. With this setting, the sensitivity is increased by 6 dB, but the noise element also increases.

400%: Ensures a dynamic range of 400% for the image sensors. With this setting, the sensitivity is increased by 12 dB, but the noise element also increases.

24. MIRROR

This command inverts the output video signal.

The type of inversion can be selected from horizontal, vertical, and horizontal-and-vertical.

25. AES LEVEL

This command specifies the auto shutter reference value.

* This command can only be used when *variable shutter* is specified for SHUTTER MODE.

26. AES RES

This command specifies the auto shutter response.

* This command can only be used when *auto shutter* is specified for SHUTTER MODE.

27. S1 to S3 WHITE SHADING SEL

These commands turn the white shading correction function on and off.

When white shading is on, shading generated by the lens, etc., is corrected vertically.

28. S1 to S3 WHITE SHADING

These commands specify the correction amount for white shading correction.

29. DATA SAVE, DATA LOAD

These commands save all the camera settings and call the set values (8 files).

When the power is turned on, the camera starts up with the settings saved in file 0.

30. WHITE BALANCE SAVE, WHITE BALANCE LOAD

These commands save the camera's white balance settings and call the set values (8 files).

When the power is turned on, the camera starts up with the settings saved in file 0.

8.4 Sending and receiving commands

At power on

When the power is turned on, the camera's internal settings are reset to the values saved in file 0 by the DATA SAVE command.

When a command sent from the terminal is received by the camera (normal operation)

After data has been received normally by the camera, it returns the received command with acknowledgment symbol [ACK] attached.

Example of sending a command to set PRESET SHUTTER SPEED to 1/30 second:

1. The terminal sends [STX 0 4 0 0 1 ETX] to the camera.
2. The camera's PRESET SHUTTER SPEED setting is changed to 1/30 second.
3. The camera returns [0 4 0 0 1 ACK] to the terminal.

When an incorrect command is sent from the terminal (a command not on the command list)

When an incorrect command is received by the camera, it returns the negative acknowledgment symbol [NAK].

If [EXT] is left off a received command, the camera does not acknowledge the command, but does not return [NAK].

Example of sending an incorrect PRESET SHUTTER SPEED command:

1. The command [STX 0 4 1 0 1 ETX], which is not on the command list, is sent from the terminal.
2. The camera setting does not change.
3. The camera returns [NAK] to the terminal.

Other errors

If any other type of communication error occurs, the command is not acknowledged and [NAK] is returned.

Note that the camera might not operate properly if a large amount of data is sent continuously.

| |
|--|
| If the camera stops operating properly, turn off the power and then turn it on again. |
|--|

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9. Optional accessories

The optional accessories are shown below.

| Name | Part Number | Remark |
|--------------|-------------|--|
| DC cable | PSC130-*A | (* = 3 m, 5 m, 10 m) For +12 V DC power supply |
| DC cable | PSC140-* | (* = 3 m, 5 m, 10 m) Loose end |
| Remote cable | RCC130-*D | (* = 3 m, 5 m, 10 m) |
| Tripod mount | SKC-TP1 | |

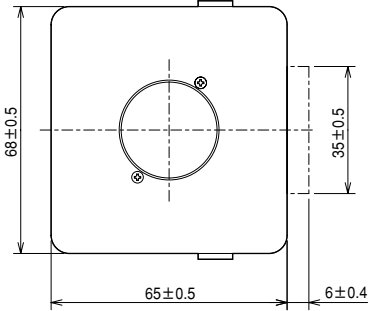
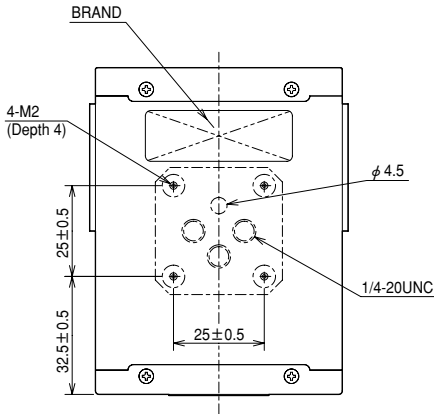
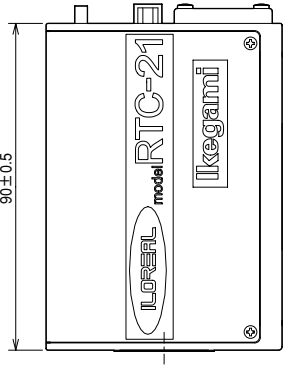
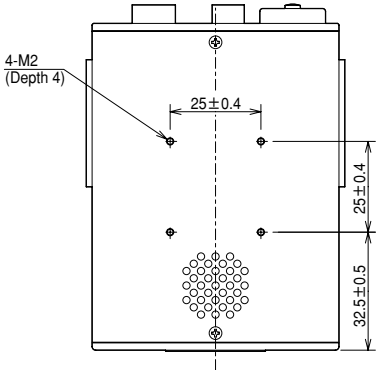
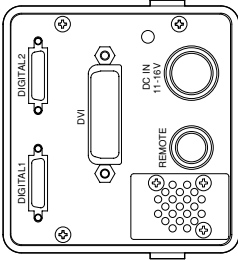
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10. Specifications

10.1 Ratings and performance

| Items | Rating |
|--|---|
| Image sensor | CMOS sensor |
| Optic size | 1:2.8 format (7.96 mm × 7.61 mm) |
| Effective pixels | S1, S2, S3: 2,048 (H) × 1,536 (V) |
| Pixel size | 2.5 (H) × 2.5 (V) μm |
| Pixel aspect ratio | 4 : 3 |
| Scanning method | Progressive, 30 frames per second |
| Scanning frequency | Horizontal: 33.75 kHz Vertical: 30 Hz |
| Pixel clock | 74.25 MHz |
| Lens mount | C mount |
| Optical filter | Infrared cut filter |
| Input signal | Serial control signal input RS-232C-compliant, 9,600 bps |
| Output signal | Digital video output: Complies with Camera Link protocol (Medium configuration) 10 bits for each of X, Y, and Z, LVAL, FVAL, DVAL, and CLK Digital video output: Complies with DVI-D standard 1,920 (H) × 1,080 (V) 60 Hz RGB 24 bits |
| Output signal pixels | X, Y, and Z: 1,920 (H) × 1,080 (V) |
| Quantization accuracy | 12 bits |
| Object brightness | Standard brightness: 2,000 Lx when using f2.8 lens, shutter off, 30 frames per second, illuminant D65 (6,500K) |
| Electronic shutter | Preset shutter 1/30, 1/60, 1/100, 1/120, 1/250, 1/500, 1/1000, 1/1500, 1/2000, 1/4000, 1/7500, 1/10000 second Slow shutter 1/30, 1/15, 1/7.5, 1/4, 1/2, 1, 2, 4 seconds Variable shutter 1/15 to 1/10000 second, in 256 steps |
| Power supply | 12 V DC (11 V to 16 V DC) |
| Power consumption | Approximately 10 W or less |
| Dimensions | Approximately 68 mm (W) × 65 mm (H) × 90 mm (D) (excluding protrusions) |
| Weight | Approximately 350 g |
| Operating ambient temperature/humidity | 0 to +40°C/30 to 75% RH (non condensing) |
| Storage ambient temperature/humidity | -20 to +60°C/30 to 85% RH (non condensing) |

10.2 Package drawing



RTC-21_{HD}
High Color Fidelity Camera

Operation Manual

First edition, December 2011

Published by Ikegami Tsushinki, Co., Ltd.

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