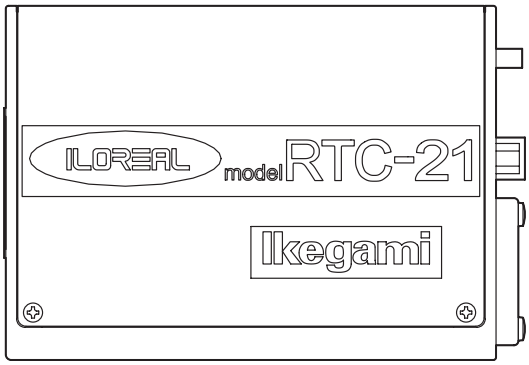
CE

Products conforming to RoHS directive



RTC-21 QX

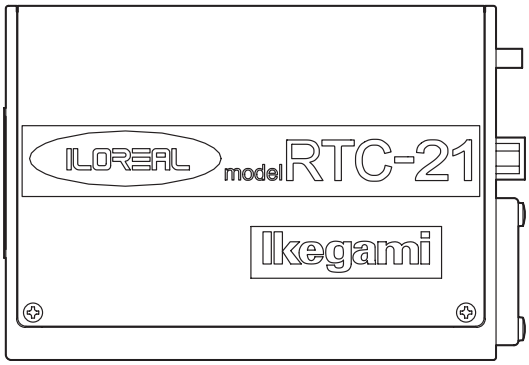
High Color Fidelity Camera

Operation Manual

Ikegami

CE

Products conforming to RoHS directive



RTC-21 QX

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$_{QX}$ XYZ Camera

* About the RoHS Directive

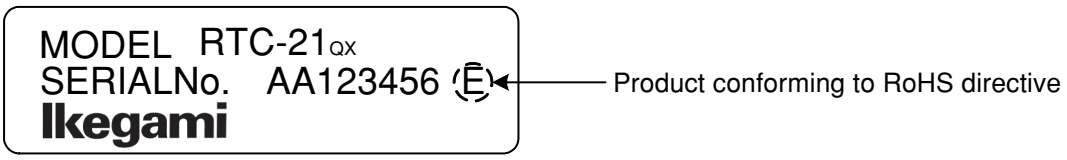
The RoHS Directive is an environmental directive established by the European Union concerning the restriction of the use of certain hazardous substances in electrical and electronic equipment.

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$_{QX}$ 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 lightening 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-21QX

Operation Manual

(Table of Contents)

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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 2,048 (horizontal) × 1,536 (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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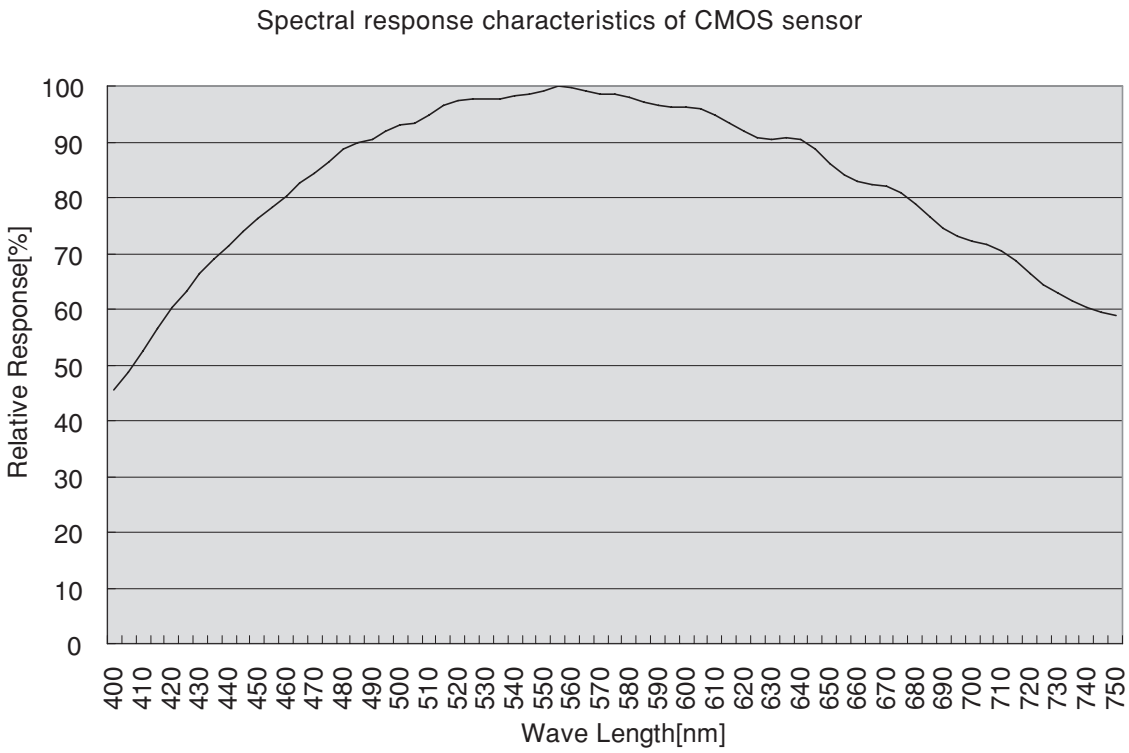
4. Spectral response characteristics of CMOS sensor

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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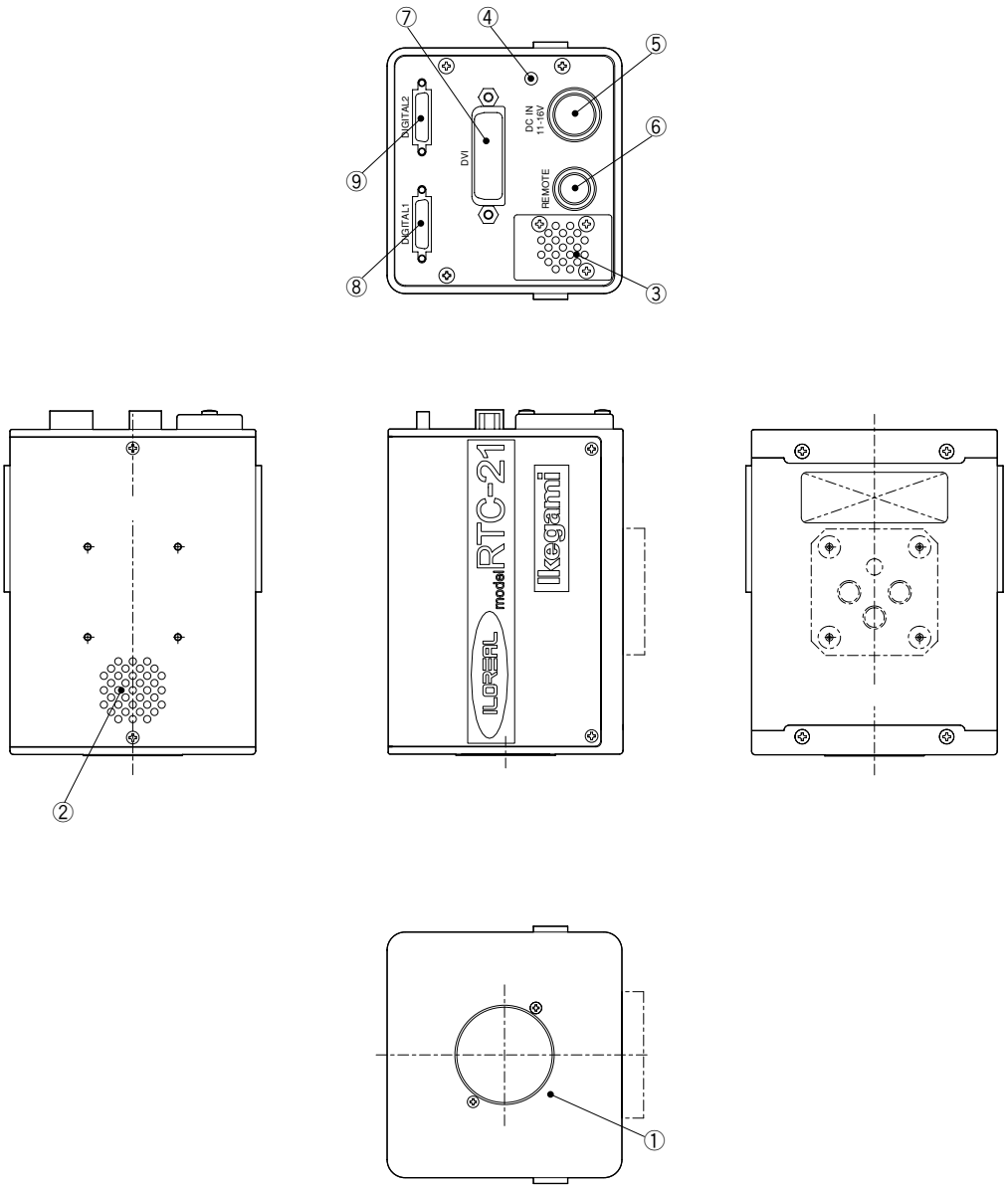
5. Names and functions of parts



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

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

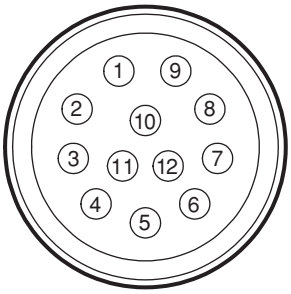
The holes for the exhaust fan.

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.



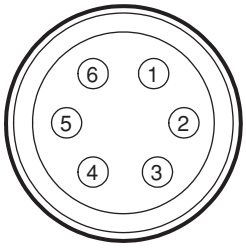
Connector on camera : HR10-10R-12PA (Hirose)
Plug on cable : HR10A-10P-12S (Hirose)

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

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.

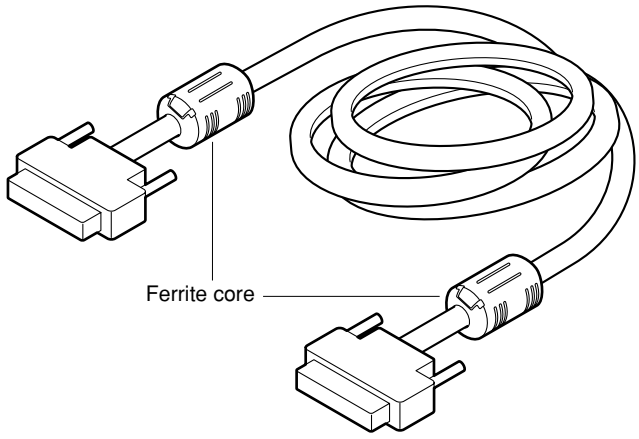
DIGITAL1/2 connector

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

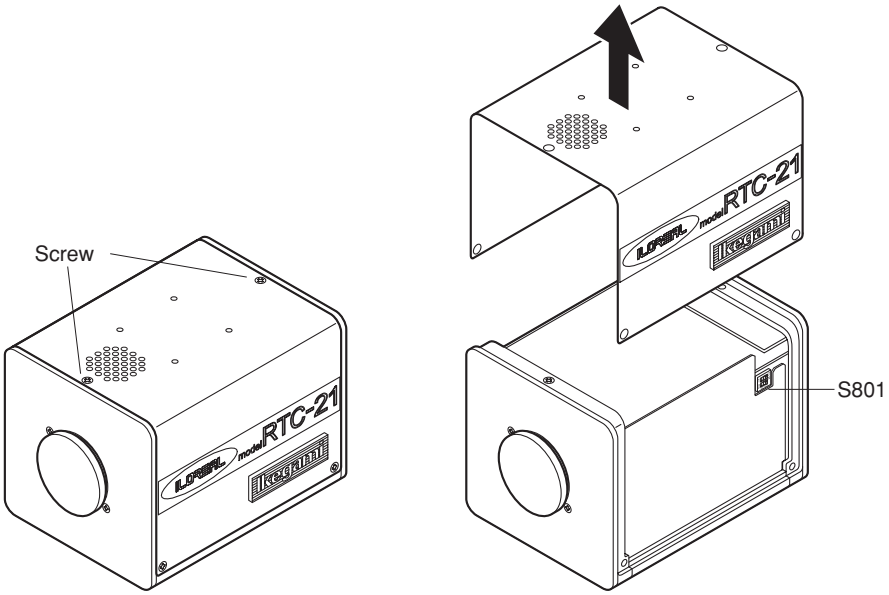
⚠ CAUTION

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

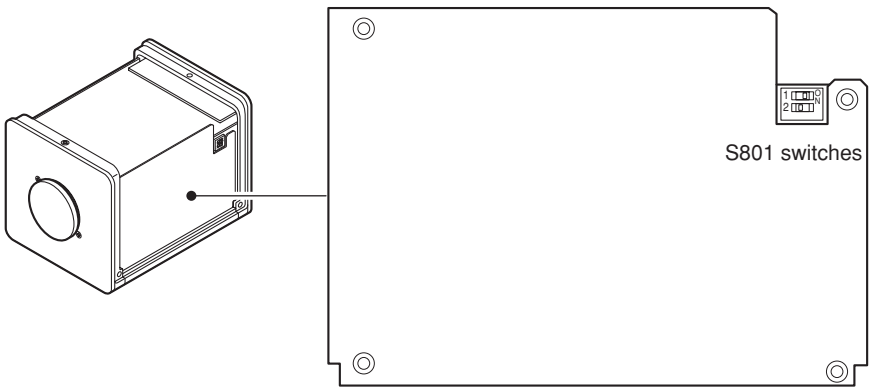
1. Remove the six screws anchoring the top cover (two on the top and two on each of the left and right sides) by using a Phillips screw driver. (Be careful not to lose these screws.)
2. Lift up and remove the top cover.

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: OFF)

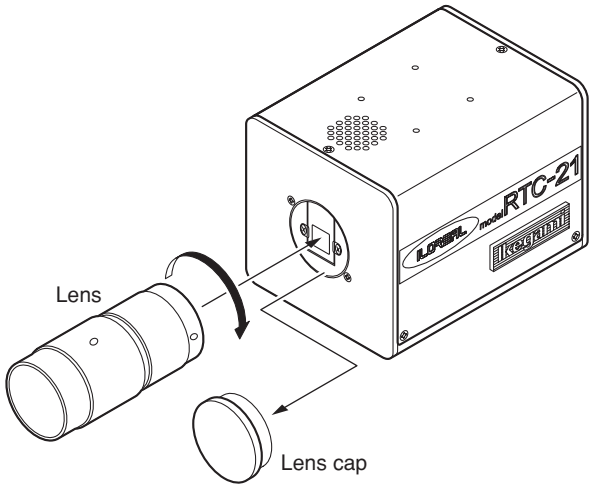
Do not change the factory setting of this switch.

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.

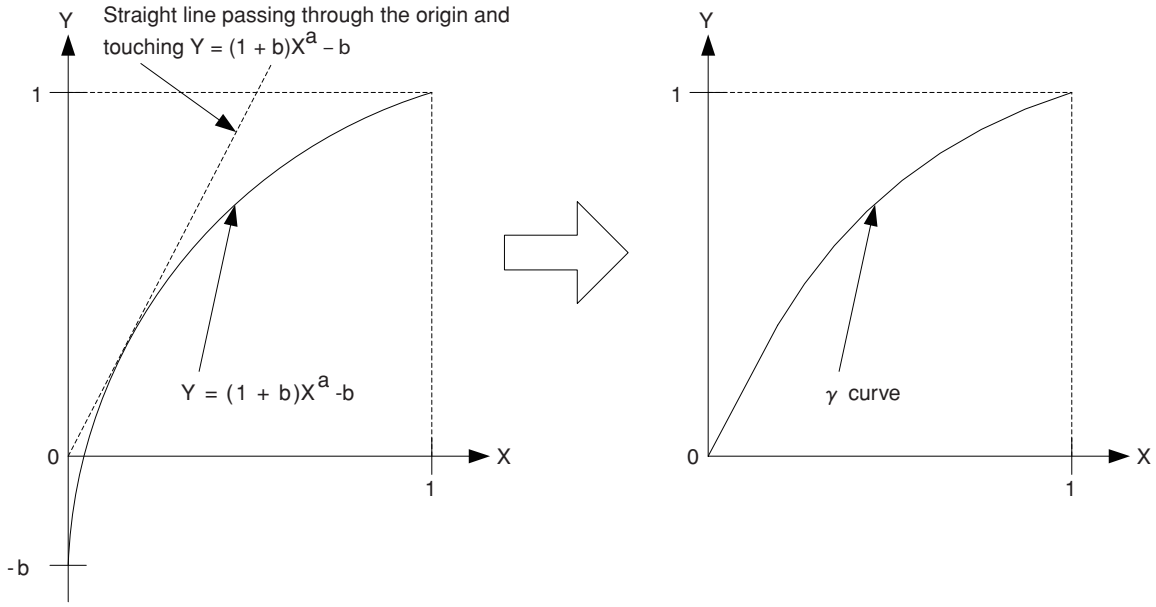
See *8-2 Communication commands* for a list of camera commands.

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.

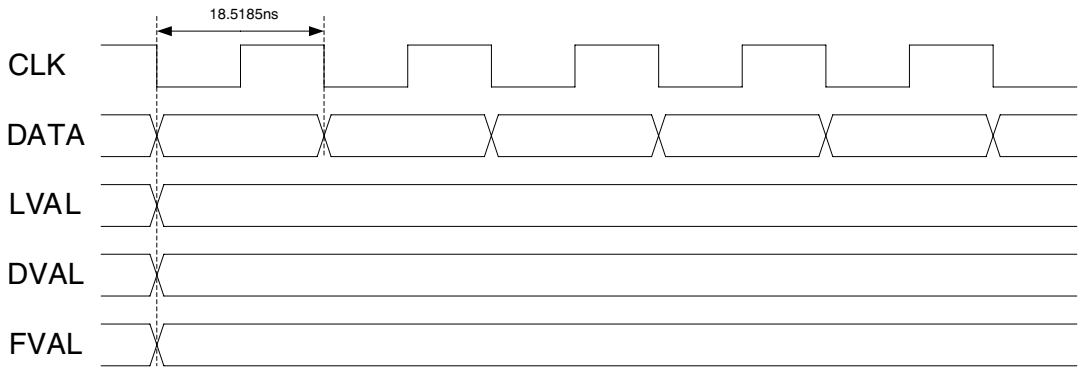
The camera's gamma curve can be specified based on the equation shown below.



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

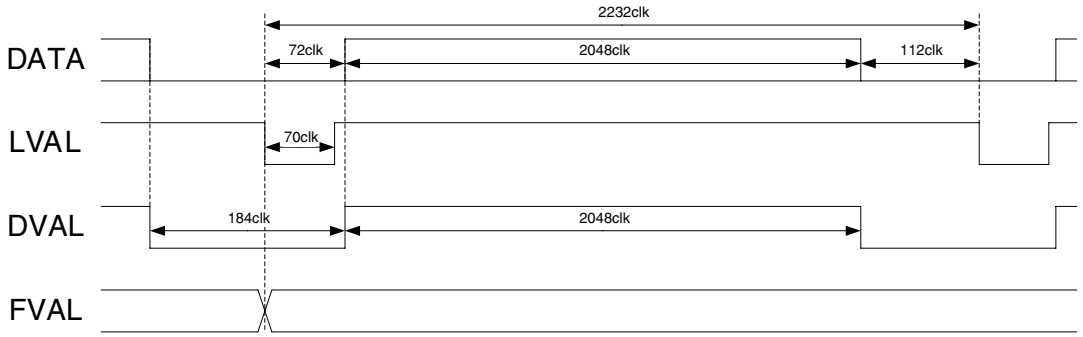
7. Timing charts

Pixel Clk Rate Timing



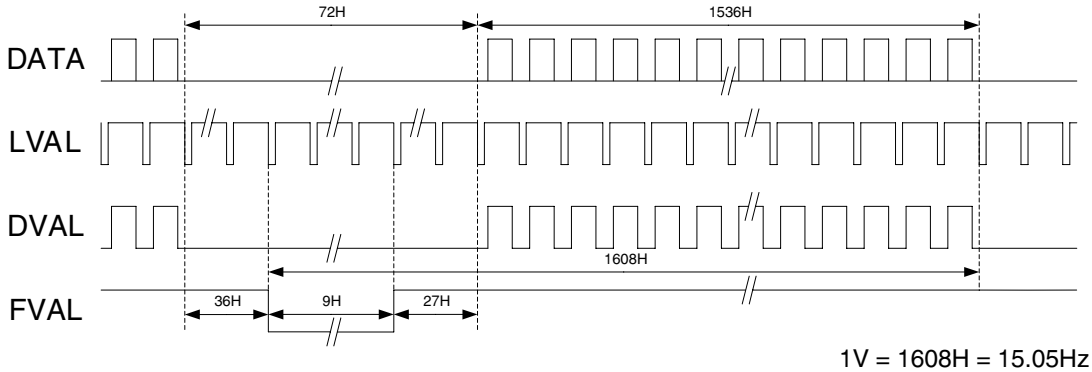
CLK = 54MHz

Line Rate Timing



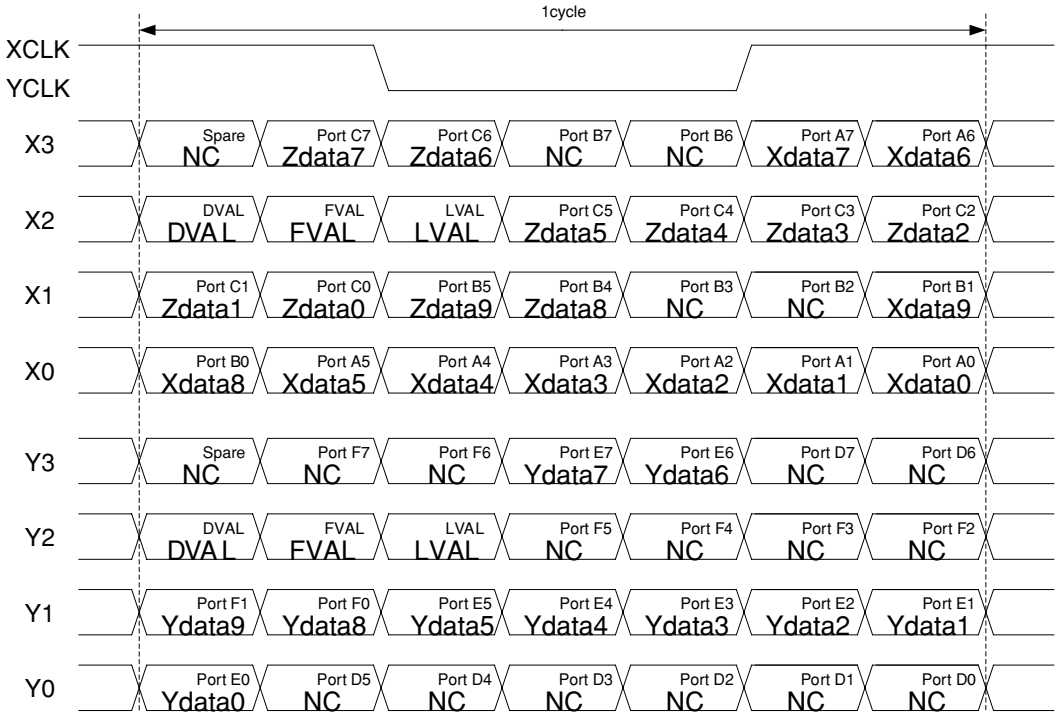
1H = 2232CLK = 24.193kHz

Frame Rate Timing



1V = 1608H = 15.05Hz

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 1/15 second
		04001	-	Preset shutter speed is 1/30 second
		04002	-	Preset shutter speed is 1/60 second
		04003	-	Preset shutter speed is 1/100 second
		04004	-	Preset shutter speed is 1/120 second
		04005	-	Preset shutter speed is 1/250 second
		04006	-	Preset shutter speed is 1/500 second
		04007	-	Preset shutter speed is 1/1000 second
		04008	-	Preset shutter speed is 1/1500 second
		04009	-	Preset shutter speed is 1/2000 second
		0400A	-	Preset shutter speed is 1/4000 second
		0400B	-	Preset shutter speed is 1/7000 second
		0400C	-	Preset shutter speed is 1/10000 second
		0400D	-	Preset shutter speed is 1/15 second
		0400E	-	Preset shutter speed is 1/15 second
		0400F	-	Preset shutter speed is 1/15 second
		R04	-	Call setting.
5	SLOW SHUTTER SPEED	05000	○	Shutter speed is 1/15 second
		05001	-	Shutter speed is 1/7.5 second
		05002	-	Shutter speed is 1/4 second
		05003	-	Shutter speed is 1/2 second
		05004	-	Shutter speed is 1 second
		05005	-	Shutter speed is 2 second
		05006	-	Shutter speed is 4 seconds
		05007	-	Shutter speed is 1/15 seconds
		05008	-	Shutter speed is 1/15 second
		05009	-	Shutter speed is 1/15 second
		0500A	-	Shutter speed is 1/15 second
		0500B	-	Shutter speed is 1/15 second
		0500C	-	Shutter speed is 1/15 second
		0500D	-	Shutter speed is 1/15 second
		0500E	-	Shutter speed is 1/15 second
		0500F	-	Shutter speed is 1/15 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.

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: γ = 0.45 XX = 00 to FF (variable in 256 steps)
		R81	-	Call setting.
	S2 GAMMA	820XX	XX = 69	S2 gamma coefficient, initial value: γ = 0.45 XX = 00 to FF (variable in 256 steps)
		R82	-	Call setting.
	S3 GAMMA	830XX	XX = 69	S3 gamma coefficient, initial value: γ = 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.

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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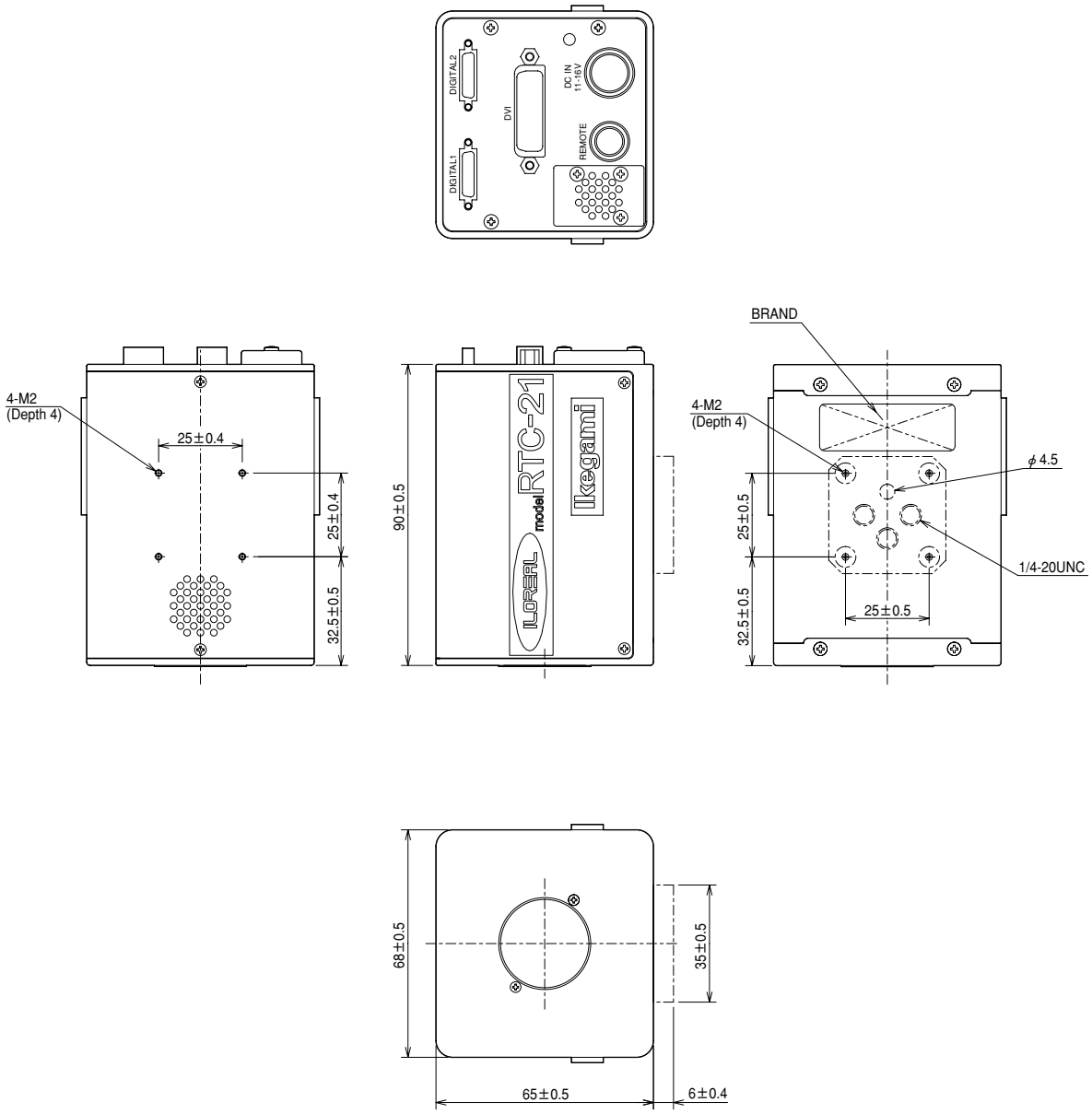
10. Specifications

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, 15 frames per second
Scanning frequency	Horizontal: 24.19 kHz Vertical: 15.05 Hz
Pixel clock	54 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 1,600 (H) × 1,200 (V) 60 Hz RGB 24 bits
Output signal pixels	X, Y, and Z: 2,048 (H) × 1,536 (V)
Quantization accuracy	12 bits
Object brightness	Standard brightness: 2,000 Lx when using f4 lens, shutter off, 15 frames per second, illuminant D65 (6,500K)
Electronic shutter	Preset shutter 1/15, 1/30, 1/60, 1/100, 1/120, 1/250, 1/500, 1/1000, 1/1500, 1/2000, 1/4000, 1/7000, 1/10000 second Slow shutter 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-21QX

High Color Fidelity Camera

Operation Manual

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