CCD Camera

Model CS8550DiF

Specification

Contents

Thank you for purchasing our CS8550DiF B/W CCD camera.
This operation manual includes some important information such as how to use this equipment correctly and safely. Please read through this manual carefully. After reading, keep this manual by the side of your equipment for your future reference.

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BEFORE USE – GENERAL SAFETY INSTRUCTIONS

This instruction manual contains important information for the operator (user) and/or people around him/her to avoid personal injuries, or property damages against him/her or people around him/her by using this product correctly.

- Prior to use, read this operation manual carefully to fully understand its instructions for correct use.
- After reading, keep this manual by the side of your equipment for your future reference.

WARNINGS & CAUTIONS

[Definition of markings]

The meaning of each mark used in this instruction manual is given below.

⚠ **DANGER**	This mark warns the user that improper use, indicated with this mark, may cause death or severe personal injuries against the user or people around him/her.
⚠ **CAUTION**	This mark warns the user that improper use, indicated with this mark, may cause personal injuries (*1) or material damages (*2) against the user or people around him/her.

Notes   *1: Personal injuries mean wounds, burns, electric shocks, and others for which the person injured need not to be hospitalized nor to be cared for the long term.

       *2: Material damages mean any direct or consequential damages related to property or material loss.

🚫	This mark indicates what the user **SHOULD NOT DO**. The details of things which the user should not do are described next to this mark.
●	This mark indicates what the user **MUST DO**. The details of things which the user must do are described next to this mark.
◇	This mark indicates that the user must be alert against a possible **DANGER**. The details of the danger which the user must be aware of are described next to this mark.
△	This mark indicates that the users are given a **CAUTION** against possible hazards. The details of the caution which the user must be aware of are described next to this mark.

Handling Precautions

⚠ **DANGER**	
Unplug	**If any overheating sign is observed, discontinue the use immediately.** In the event that smoke, smell, or any other overheating sign is observed, remove your plug from IEEE1394 connector. Do NOT try to continue to use this device. To do so in spite of clear signs of malfunction invites a fire, an electric shock hazard, or a serious damage. After checking that smoke stops coming out, contact us or our dealer /distributor from which you purchased this device for repair service.
Unplug	**If any malfunctioning sign is observed, discontinue the use immediately.** Do NOT try to use this device when it is obviously malfunctioning. (Example: No images on the monitor) In the event of malfunction, remove the pug from IEEE1394 connector. In such case, contact us or our dealer/distributor from which you purchased this device for repair service.

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Unplug	If any liquid gets into the device, discontinue the use immediately. In the event that water, or any other type of liquid gets into the body, Do NOT try to continue to use the device. To do so invites a fire or an electric shock hazard. In that case, turn its power switch OFF immediately; and then remove the plug from IEEE1394 connector. Then contact us or our dealer/distributor from which you purchased this device for repair service/technical advice.
NEVER pull apart	Do NOT disassemble this device. Do NOT attempt to pull apart, repair, or modify the device on your own. To do so might lead to a fire or an electric shock accident. Contact us or the dealer/distributor from which you purchased the device for repair/modification.
Avoid	Do NOT supply any power other than specified. Be sure to use specified power supply. This device is designed to work only under specified voltage (from DC8V to DC30V). Do NOT attempt to supply the device with power other than specified. Supplying the device with unspecified power invites a fire or an electric shock hazard.
Avoid	Do NOT use the camera in a high-humidity environment. Do NOT place the camera near a humidifier, or in other high-humidity environment. To do so many cause a fire or an electric shock accident.

⚠ CAUTION

Caution	If the camera is operated in the electromagnetic field, there may be cases where beat noises (vertical, horizontal, or oblique stripes) may appear in the video output. In that case, take preventive measures on the electromagnetic-wave generating source so that the camera does not receive the interference by the electromagnetic wave. Take extra precautions against electromagnetic-wave-interference if the camera is used with a servomotor, inverter, or other electromagnetic-wave-generating equipment.
Caution	Do NOT give a strong shock/impact against the camera-body. Avoid giving a strong shock against the camera body. It might cause a breakdown or damage. If your camera is used in a system where its camera head is subjected to strong repetitive shocks, its camera head is possible to break down. If you intend to use your camera in such a situation, secure the IEEE1394 cable as close as possible to the camera body for avoid physical shock to the IEEE1394 connector.
Caution	When the camera is not in use, put a lens or a lens-cap onto the camera head so that the image pickup plane of CCD is protected from dust, foreign object, or other flaw-causing object. If the glass plane (image pickup plane) gets dirty, clean it with a cotton swab. When it needs to be cleaned with a cleaner, be sure NOT to use any organic solvent other than ethyl alcohol. As a countermeasure against condensation, when the camera is moved from a warm place to a cold place, take appropriate precautions to prevent condensation from forming on the camera.
Caution	Do NOT pull/swing the cable forcefully. Do not pull strongly the IEEE1394 cable/camera-head nor swing it. The stress from pulling or swinging may cause damage in the coating of the cable, or breaks in the inside wires.
Caution	Do NOT short-circuit signal outputs. Avoid short-circuit of signal outputs. Otherwise it may cause damage to the camera. For inspection of inner parts/circuits, adjustment, maintenance, contact us or the dealer/distributor from which you purchased the camera.

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⚠ Caution	Do NOT expose the camera's image pickup-plane to sunlight or other intense light directly. Avoid intensive light. Doing so might cause a breakdown or malfunction, leading to an accident.
⚠ Caution	When mounting a lens, take extra caution so that the lens is not tilted, nor does flaw exist at the lens-mount-screw part. Also check to confirm that no dirt nor other foreign object is put inside. Improper mounting might cause the parts to become locked.
⚠ Caution	Do NOT connect/disconnect connectors before turning power off. Make sure to check the CCU power is OFF before connecting/disconnecting connectors. Otherwise, you might get an electric shock, or your camera might break down.

◈ **DANGER**	
🚫 Avoid	Do NOT use any optional until other than manufacturer-supplied one. [We declaim any responsibility for damages or losses incurred by user due to the use of unauthorized / unofficial option units supplied by a third-party]

RESTRICTION FOR USE

In case malfunction of this equipment (e.g. video output cut-off) can be expected to lead to significant accident, avoid using this equipment for such system integration use.

CASES FOR INDEMNITY (LIMITED WARRANTY)

We shall be exempted from taking responsibility and held harmless for damages or losses incurred by user in the following cases.

1. In case damages or losses are caused by fire, earthquake, or other acts of Gods, the act by third party, misuse by the user deliberately or erroneously, use under extreme operating conditions.
2. In case indirect, additional, consequential damages (loss of expected interest, suspension of business activities) are incurred as results of malfunction or non-function of the equipment, we shall be exempted from assuming responsibility for such damages.
3. In case damages or losses are caused by incorrect use which is not in line with the instructions in this instruction manual.
4. In case damages or losses are caused by malfunction resulting from bad connection with other equipment.
5. In case damages or losses are caused by repair or modification done by the user.

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Important Safety Instructions

(1)   Be sure to use the power supply from DC8V through DC20V.

(2)   This equipment is designed and guaranteed to work from 0 degrees to 40 degrees. Do not use this equipment beyond that limits.

(3)   Do not expose image pickup surface to sunlight or other intense light directly. (The heat of these lights may do damages to the imaging device.

(4)   Even when the equipment is not in use, make sure to put lens or lens-cap onto the camera head, so that sensitive image pickup surface is protected from fine dusts, surface flaws, stains.

(5)   Take care not to drop the equipment, nor give strong impact, as this may cause breakdown.

(6)   In case any abnormal conditions or breakdown should occur, remove the cable from IEEE1394 connector immediately, and request our distributor for after-sales service. The continual use of the equipment despite any abnormal conditions or breakdown may worsen the conditions, or may cause unexpected accident.

(7)   To clean the body of this equipment, make sure to remove the cable from IEEE1394 first. To remove stubborn stains, use soft cloth with diluted acid-free detergent. After that, clean with dry cloth. Avoid getting into liquids to the camera. To do so may cause a damage or an electric shock accident.

(8)   In case image pickup surface should be settled with fine dust, dirt, or scratched, ask our distributor for technical advice.

(9)   Waste of this product should be separated and discarded in compliance with the various national and local ordinances.

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1. Product Description

  Model CS8550DiF is a one-body type B/W CCD camera with all-pixel-data readout CCD. This model has twice greater driving frequency of conventional cameras to achieve fast-speed data processing. The model is suited for high-speed, high-resolution image processing use. The video output interface of CS8550DiF conforms to the serial digital bus standard IEEE1394.

2. Features

  (1) Double-speed scan
       This model reads out image-data twice as fast as conventional cameras do.
  (2) 1/3 type, progressive scan CCD
       In CS8550DiF, a square-grid-array, all-pixel-data-readout CCD is integrated. This model reads out image-data twice as fast as conventional cameras do.
  (3) Random trigger shutter function
       With a built-in RTS (Random Trigger Shutter), the inner CCD starts light-exposure in synchronization with external trigger signal inputs. This function enables this model to capture fast-moving subjects at constant position for precise image processing.
  (4) IEEE1394 video output
       The CS8550DiF outputs video signal via the serial digital bus standard IEEE1394. The data transfer is made in 400Mbps. Non-compressed VGA format video data (640 × 480) are output in 60fps.
  (5) PC control
       Basic operational parameters can be read and controlled via PC. The camera control interface conforms to IIDC1394 digital camera protocol standard

3. Configuration

  (1) Camera body · 1
  (2) Operation Manual·· 1

     NOTICE: As an interface at your PC side IEEE1394, host adopter card is necessary.
               Application software is not contained in camera standard components.

4. Specification

(1) Image sensor	All Pixel's Data Read-out Interline CCD
Total pixels	692(H) × 504(V)
Scanning area	4.88(H) × 3.66(V) mm (=Equivalent to 1/3" type)
Unit pixel size	7.4 μm (H) × 7.4 μm (V) (Square grid pattern)
(2) Video output pixels	640(H) × 480(V)
(3) Subject illumination	400 lx (F5.6)
(4) Minimum illumination	4 lx (F1.4) (GAIN MAX, Approx. 50% video output)
(5) Sensitivity setting	Setting is available as follows via communication command. Gain: ±6dB
(6) Gamma	Gamma = 1.0 (Fixed)
(7) Power supply	From DC+8V through DC+20V (IEEE 1394 cable power supply)
(8) Power consumption	3.2W (at +12V)

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(9) Interface   Conforms to IEEE Std.1394a-2000

         Transfer speed   400Mbps

(10) Video mode   Format_0 Mode_5 (60fps 640 x 480 Mono 8bit)

                                            60, 30, 15, 7.5, 3.75fps selectable

                                            Initial : 60fps,

                                            Format_7 Mode_5 (for scalable mode)

(11) Protocol   Conforms to 1394-based Digital Camera Specification ver. 1.3

(12) Input signal

       (Shutter Trigger) $V_L = 0$ to 0.5V (100kΩ)

                                            $V_H = 2$ to 5 V(100kΩ)

          Grabbing timing   Rising/Falling edge detection selectable

                                            Initial : Falling edge

         Pulse width   Minimum: 2 μs

                                            Maximum: 1 s

(13) Electronic shutter   Initial: Normal electronic shutter

        Normal   Setting via IEEE1394 interface

                                         Selection among 8 steps: 1/20000, 1/8000, 1/4000, 1/2000, 1/1000,

                                                                1/500, 1/200s, OFF (Initial: OFF)

        Random trigger shutter   Setting via IEEE1394 interface

                                         Selection among 9 steps: 1/20000, 1/8000, 1/4000, 1/2000, 1/1000

                                                            , 1/500, 1/200s, 1/60s , Pulse width mode

                                   *When the shutter mode is switched from Normal to Random trigger

                                     in OFF at electronic shutter speed, the exposure time is 1/60s.

(14) Ambient condition

         Performance guaranteed   Temperature: From 0 through 40 degrees

                                            Humidity: From 30 through 70 % (No condensing)

         Operation guaranteed   Temperature: From -5 through 45 degrees

                                            Humidity: From 30 through 90 % (No condensing)

         Storage   Temperature: From -20 through 60 degrees

                                            Humidity: From 10 through 90 % (No condensing)

(15) EMC conditions (Electro-Magnetic Compatibility)

    EMI   Electro-Magnetic Interference

                                 EN50081-2   Examination level   EN55011-A   Conformity

    EMS   Electro-Magnetic Susceptibility

                               EN61000-6 2 Conformity

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* Conformity of EMC conditions

    About the conformity of the EMC standard of this machine, it has guaranteed in the conditions combined with the recommanded parts.

    When used combining parts other than specification of our company, I ask you to have final EMC conformity checked of a visitor with a machine and the whole equipment.

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(16) Lens mount   C mount

C-mount lens   Bottom of
                                the screw

7.1mm or less
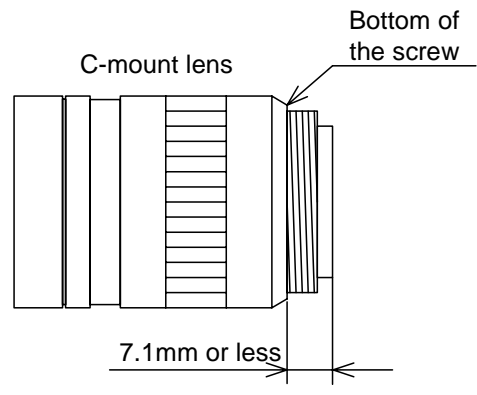
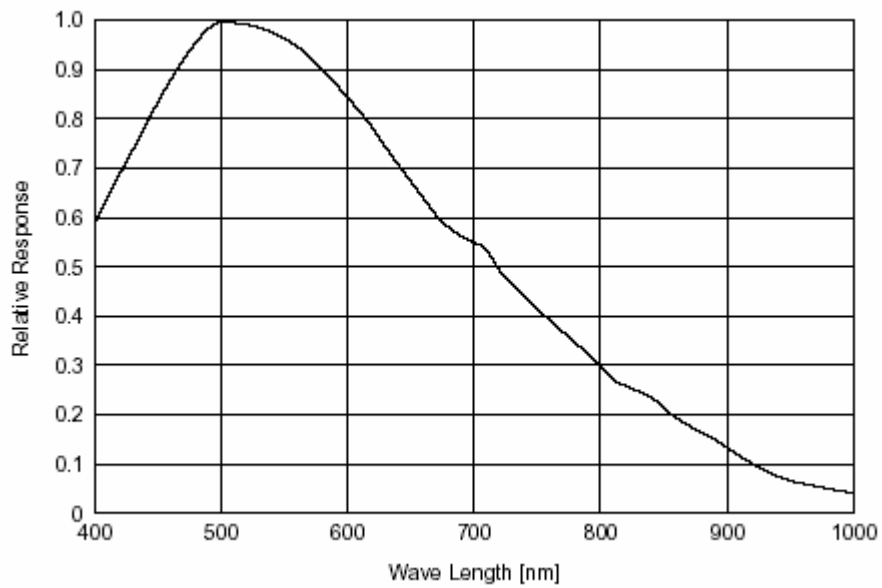(17) External dimension   Refer to the attached external-view drawing

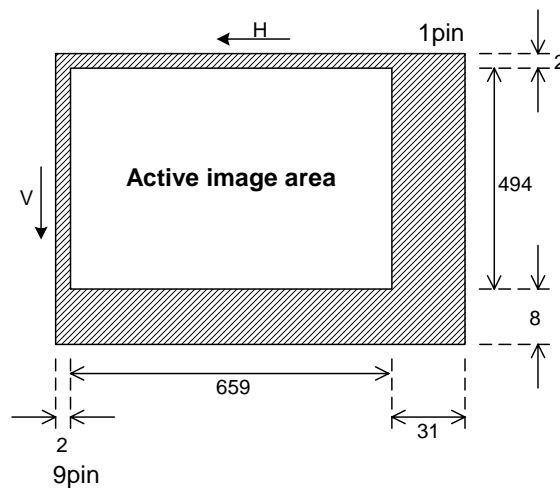(18) Weight   Approx. 170g

(19) Relative Spectrum Response
     *Including lens characteristics, Excluding light source characteristics

(19) Optical black

H   1pin

2

Active image area   494

V

8

659

31

2

9pin

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(20) IEEE1394 connector pin arrangement

IEEE1394 connector   : HSB-ARD62-SN15A (DDK Ltd.)
Recommended harness   : HSB-HC -A07   (DDK Ltd.)
Pin arrangement   : Refer to the table below.

Pin No.	Signal name	I/O	Remark
1	POWER	I	
2	POWER (GND)	I	
3	TPB–	I/O	
4	TPB+	I/O	
5	TPA–	I/O	
6	TPA+	I/O	

(21)TRIG pin connector

This connector is used for external trigger signal input.
Connector   : HR25-7TR-4PA (Hirose Electric Co., Ltd.)
Applicable connector   : HR25-7TP-4S (Hirose Electric Co., Ltd.)
            *Not attached to this product.
Pin arrangement   : Refer to the table below.

Pin No.	Signal name	I/O	Remark
1	TRIG	I	
2	TRIG GND	I	
3	NC	—	Used in open
4	NC	—	Used in open
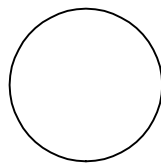
 * The figure above is the camera-side connector seen from the fitting (insert) side.

If your camera is used in a system where its connectors are subjected to strong repetitive shocks, its connectors are possible to break down. If you intend to use your camera in such a situation, secure the camera cable as close as possible to the camera body for avoid physical shock to the camera connector.

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5. Function

(1) GAIN
The gain of CS8550DiF is manually adjustable. The initial factory setting is in 0dB (= rated shooting condition). By manipulating the command status register setting value via IEEE1394 serial bus, you can change the gain value in 90 steps within the range from -6dB through +6dB. Due to the level variation characteristics of the gain control amplifier, incremental gain change amount per step is not uniform.

(2) Shutter mode selection
By manipulating the command status register setting value via IEEE1394 serial bus, you can change the shutter mode.

Normal Electronic shutter	Exposure control with internal sync signal High-speed shutter: From 1/20000s through OFF (in 8 steps)
Random trigger shutter	Under the RTS mode, the camera's inner CCD starts light-exposure in synchronization with external trigger signal inputs, so you can let the camera capture image at any user-defined timing. The RTS is effective in shooting any fast-moving object, or when you are operating more than one camera at the same capture timing.

(3) Exposure selection of Random trigger shutter
Model CS8550DiF supports both Trigger Mode 0 and Trigger Mode 1 of IIDC1394 digital camera protocol. By operation of command status register settings, the exposure mode of RTS mode can be changed.

* When the shutter mode is switched from Normal to Random trigger in OFF at electronic shutter speed, the exposure time is 1/60s.

Fix mode	Exposure-time control via IEEE1394 serial bus 1/60s, 1/200s, 1/500s, 1/1000s, 1/2000, 1/4000s, 1/8000s, 1/20000s
Pulse width mode	Exposure-time control via TRIG signal pulse width Pulse width: From 2 μs through 1 s

(4) Video output mode

1/60s Non-interlace mode	With its built-in all-pixel-data-readout CCD, this model can read out image-data just in approximately 1/60 sec.

Scalable function

Model CS8550DiF is equipped with the sixteen-way split scalable mode function. In this mode, the camera reads out only the user-selected segment of data (= block readout). A screen is composed of horizontal 4 lines and vertical 4 columns, and each unit cell has a 160 × 120 size. You can set the readout segment only in a rectangular block outline. No convex or concave outline selection is acceptable. The scalable mode works only under the RTS operation mode.

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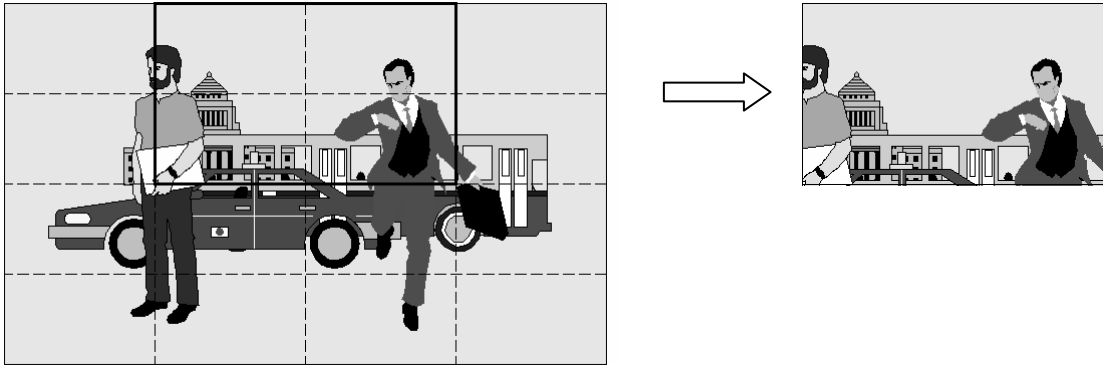
Under the scalable mode, only the user-selected necessary segment is read out at normal speed, while other unnecessary portion is skipped through at fast speed. If the vertical length of user-cutout segment is short, the trigger width is also short. In contrast, due to CCD operational characteristics, you can't shorten the trigger width even if you cut out the readout segment in a short horizontal length.

NOTICE:
It is not failure although white influence may occur in the upper part of screen when a strong light is carried into the large area of a screen. When white influence occurs, please adjust incidence of the light with a lens.
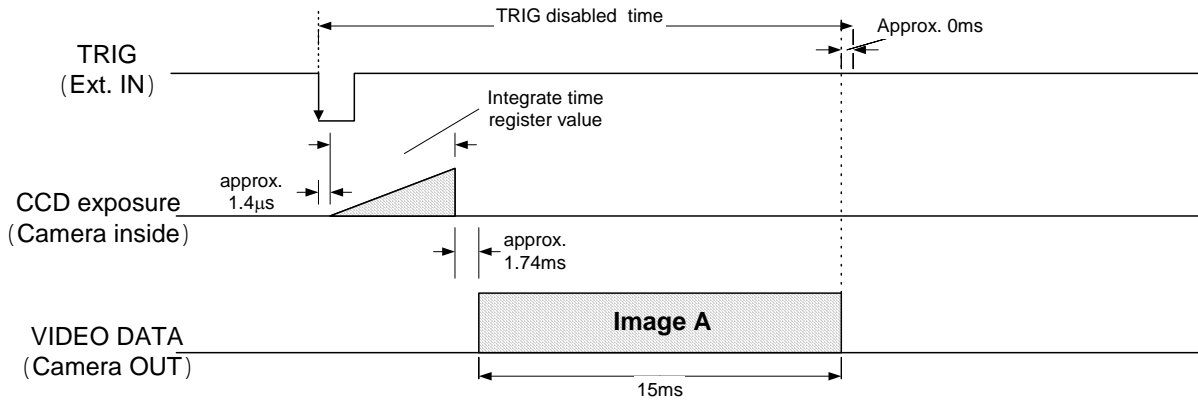
6. Timing Chart

Using Isochronous transmission of IEEE1394, the image data of CS8550DiF are output. It is necessary that CS8550DiF can use Isochronous zone without the restriction of other nodes. When the node, which is performing Isochronous transmission, is on IEEE1394 local bus simultaneously with CS8550DiF, it is not as follows.
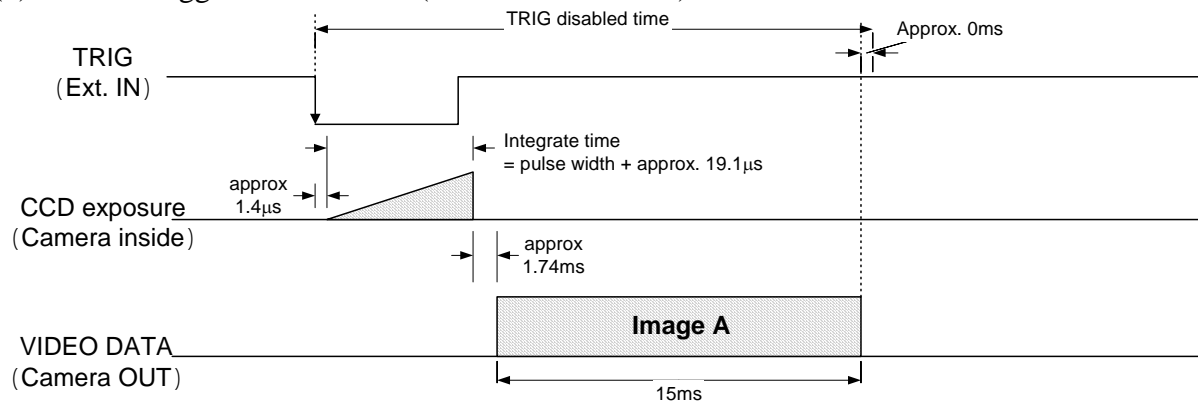
(1) Normal shutter mode

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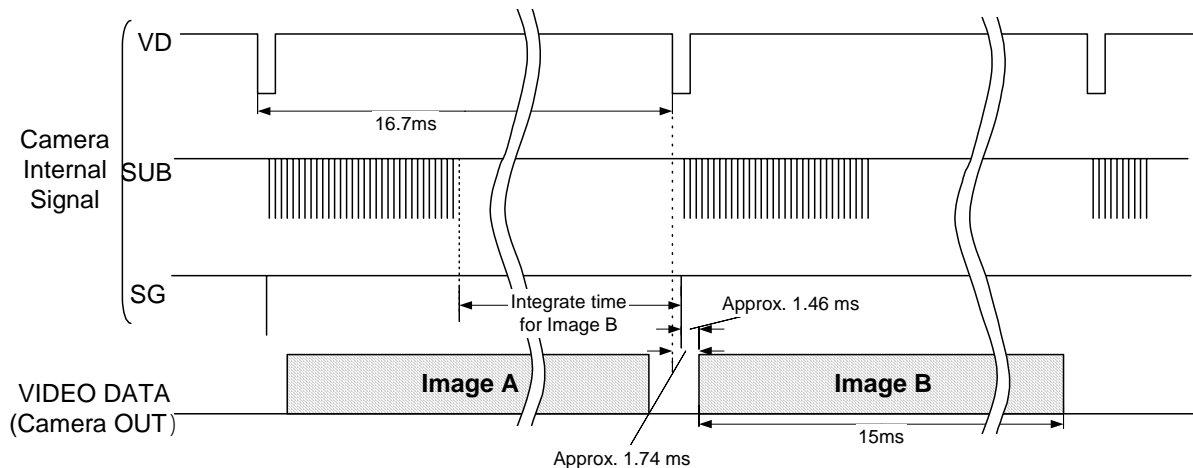
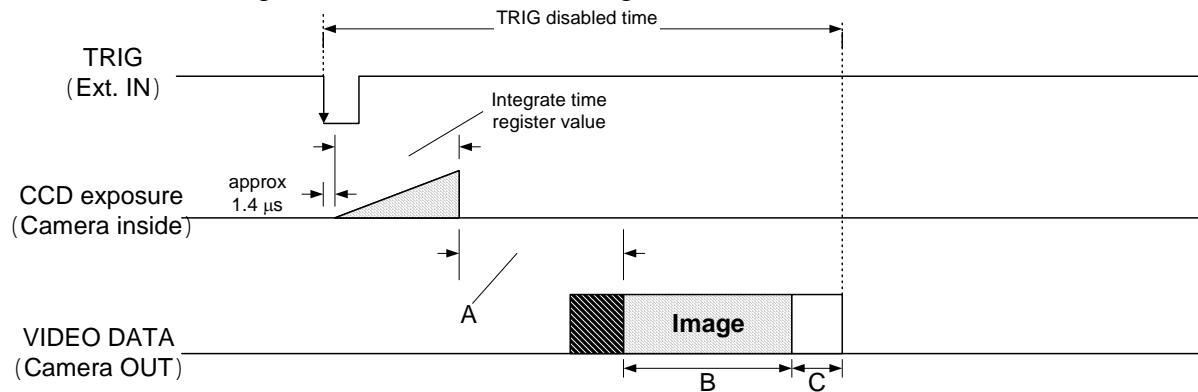(2) Random trigger shutter mode

(3) Random trigger shutter mode (Pulse width control)


(4) Scalable

Each of A, B, C time below is determined by the vertical user-selected cutout position and cutout length. Please refer to the timing chart below.

*The actual bus output data is B time only.

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(5) Scalable (Pulse width control)

Like (4) above, even when the exposure time is controlled through the width of pulse, A, B, C time each is determined by the vertical user-selected cutout position and cutout length. Each of A, B, C time is same as (4).
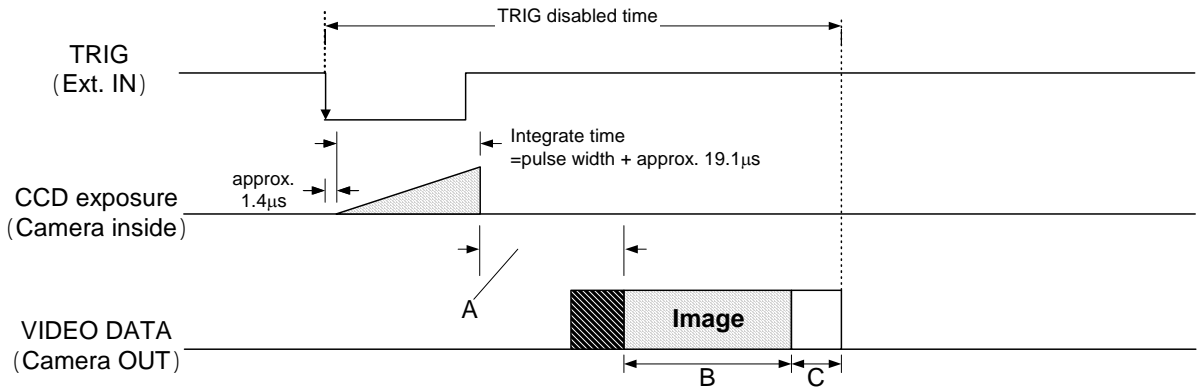
*The actual bus output data is B time only.
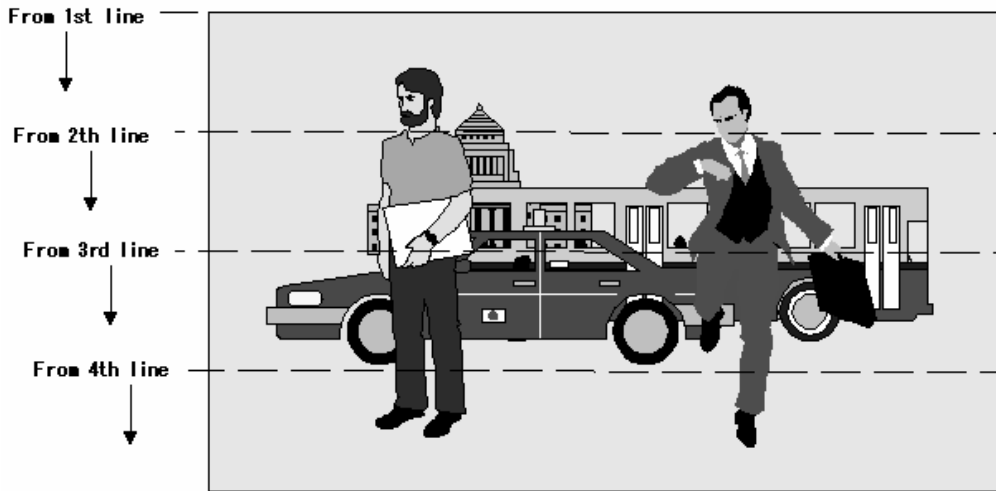
The interval A, which is the time from the completion of CCD exposure through image output, is determined by the readout start line above. The cutout length has no impact on this time.

Table 1: Time from the completion of CCD exposure through video output

From 1st line	From 2nd line	From 3rd line	From 4th line
Approx. 1.28 ms	Approx. 1.66 ms	Approx. 2.04 ms	Approx. 2.42 ms

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The interval B is determined by the cutout length. The cutout position has no impact on this time.

Table 2: Video output time

1st line	2nd line	3rd line
Approx. 3.75ms	Approx. 7.5ms	Approx. 11.25ms

Trigger disabled time (= No trigger signal input acceptable) after scalable is as shown in table 3 below. The cutout length has no impact on this time.

Table 3: Time from the completion of video output through trigger disabled

1st line	2nd line	3rd line
Approx. 0.74 ms	Approx. 0.44 ms	Approx. 0.11 ms

* Exposure time delay under RTS

When the RTS is active, both in FIX mode and PULSE width mode, there is a time delay of approximately 1.4 micro sec until the start of exposure after the rising edge of TRIG signal.

* Exposure time under Pulse width mode

Under RTS pulse mode, the exposure time is determined by the pulse width. More exactly, the actual time is the pulse width plus approximately 19.1 μ sec.

Delay time = approx. 1.4 μs
Integrate time = pulse width + approx. 19.1 μs

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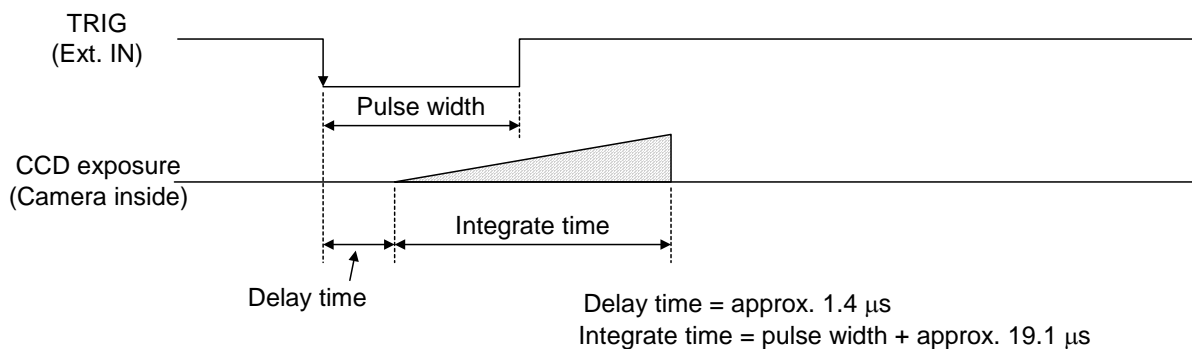
7. Model name

The model names of this camera are represented as follows (the details are changed when a model name changes).

(1) Camera internal register

The serial number and model name of the camera are controlled in the configuration ROM register installed in the camera in the following format.

Node Unique ID leaf

	Offset	0-7	8-15	16-23	24-31
Node unique ID leaf	0000h	0002h		CRC (CRC only for this leaf)	
	0004h	node_vendor_id			chip_id_hi
	0008h	chip_id_lo			

The details of Node unique ID leaf are described as follows:

Node_vendor_id   : Manufacturer (company) ID registered to IEEE is written. Manufacturer ID is H'000600 in hexadecimal notation.
chip_id_hi   : H'00 is written to identify the model.
chip_id_lo   : H'01 is written in the upper 1 byte to identify the model. The serial number to identify the individual unit is written in the lower 3 bytes. The possible values are 0 to 16,777,215, however, 7-digit values from 1 to 9,999,999 in decimal notation (H'1 to H'98967F in hexadecimal) are used as serial numbers.

The following results are obtained when Node unique ID leaf is referred to.

0000h   : 0002xxxx (xxxx varies for different units because of CRC.)
0004h   : 00060000
0008h   : 01yyyyyy (yyyyyy is the manufacturing number)

Vendor / Model Name Leaves

	Offset	0-7	8-15	16-23	24-31
Name leaf	0000h	leaf_length		CRC (CRC only for this leaf)	
	0004h	00	00	00	00
	0008h	00	00	00	00
	000Ch	char_0	char_1	char_2	char_3
	0010h	char_4	char_5	char_6	char_7
	0014h	char_8			
	n+6h				
	n+Ah	char_n-2	char_n-1	NUL	NUL

ASCII representation

The vendor name and mode name information is stored in ASCII code. For the offset of this leaf, each address must be obtained from vendor_name_leaf / model name leaf of Unit Depend Directory…

Vendor names are as shown below.

Vendor Name Leaf

	Offset	0-7	8-15	16-23	24-31
Vendor Name leaf	0000h	0003		CRC (CRC only for this leaf)	
	0004h	00	00	00	00
	0008h	00	00	00	00
	000Ch	'T'	'E'	'L'	'I'

ASCII representation

Model names are shown below.

Model Name Leaf

	Offset	0-7	8-15	16-23	24-31
Name leaf	0000h	leaf_length		CRC (CRC only for this leaf)	
	0004h	00	00	00	00
	0008h	00	00	00	00
	000Ch	'C'	'S'	'8'	'5'
	0010h	'5'	'0'	'D'	'i'
	0014h	'F'	SP(Ox20)	'V'	*
	0018h	'.'	*	NUL	

ASCII representation

* indicates the version of the firmware (ASCII representation: 0x30 to 0x39).

8. External-View Drawing

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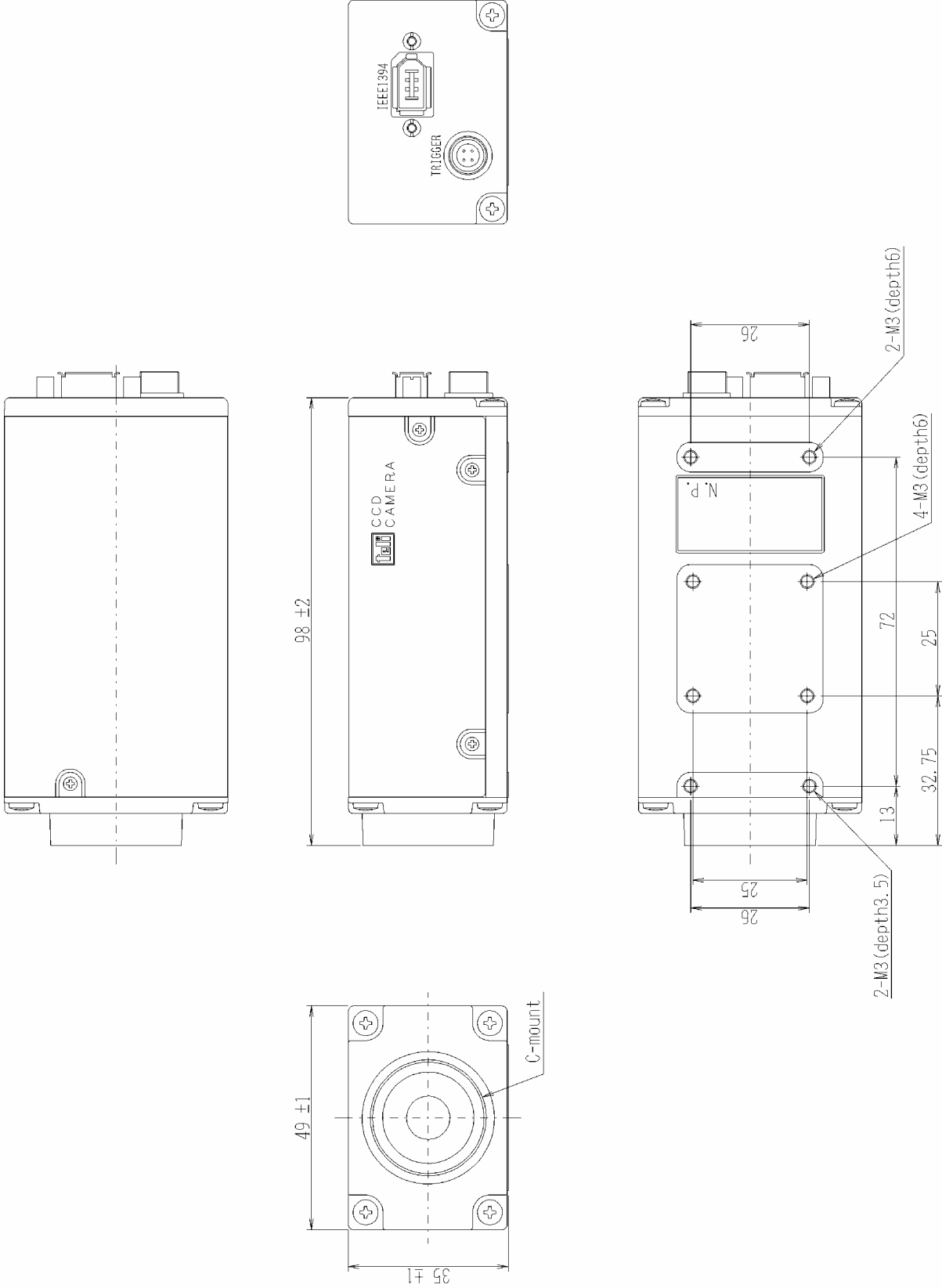
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