

# CMOS Camera

## Model CSB4000F-10

### Operation manual

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Thank you for purchasing our CSB4000F-10 CMOS 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.



**TOKYO ELECTRONIC INDUSTRY CO., LTD.**

D4123379B

Printed on recycled paper

## **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.





 <b>DANGER</b>	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.
 <b>CAUTION</b>	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 <b>SHOULD NOT DO</b> . The details of things which the user should not do are described next to this mark.
	This mark indicates what the user <b>MUST DO</b> . 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 <b>DANGER</b> . 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 <b>CAUTION</b> against possible hazards. The details of the caution which the user must be aware of are described next to this mark.



### Handling Precautions

 <b>DANGER</b>	
 Unplug	<p><u>If any overheating sign is observed, discontinue the use immediately.</u></p> <p>In the event that smoke, smell, or any other overheating sign is observed, remove camera cable from camera 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.</p>
 Unplug	<p><u>If any malfunctioning sign is observed, discontinue the use immediately.</u></p> <p>Do NOT try to use this device when it is obviously malfunctioning. (Example: No images on the monitor) In the event of malfunction, remove camera cable from camera connector. In such case, contact us or our dealer/distributor from which you purchased this device for repair service.</p>

 <p>Unplug</p>	<p><u>If any liquid gets into the device, discontinue the use immediately.</u></p> <p>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; remove the camera cable from camera connector. Then contact us or our dealer/distributor from which you purchased this device for repair service/technical advice.</p>
 <p>NEVER pull apart</p>	<p><u>Do NOT disassemble this device.</u></p> <p>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.</p>
 <p>Avoid</p>	<p><u>Do NOT supply any power other than specified.</u></p> <p>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.</p>
 <p>Avoid</p>	<p><u>Do NOT use the camera in a high-humidity environment.</u></p> <p>Do NOT place the camera near a humidifier, or in other high-humidity environment. To do so may cause a fire or an electric shock accident.</p>

 <h2 style="margin: 0;">CAUTION</h2>	
 <p>Caution</p>	<p>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.</p>
 <p>Caution</p>	<p><u>Do NOT give a strong shock/impact against the camera-body.</u></p> <p>Avoid giving a strong shock against the camera body. The camera-body might be damaged. If a camera is used in the system where its camera connector is subjected to strong repetitive shocks, the camera connector is possible to break down.</p>
 <p>Caution</p>	<p>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 device 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.</p>
 <p>Caution</p>	<p><u>Do NOT pull/swing the cable forcefully.</u></p> <p>Do not pull strongly the camera 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.</p>
 <p>Caution</p>	<p><u>Do NOT short-circuit signal outputs.</u></p> <p>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.</p>

 Caution	If too much amount of light, (= the incoming light amount of 100 times or greater in comparison with standard light) enters image pickup plane of device, video output might not be obtained. In such a case, take measures to reduce the amount of incoming light.
 Caution	<u>Do NOT expose the camera's image pickup-plane to sunlight or other intense light directly.</u> 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	<u>Do NOT connect/disconnect connectors before turning power off.</u> 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.

 <b>DANGER</b>	
 Avoid	<u>Do NOT use any optional until other than manufacturer-supplied one.</u> [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.

**Specific phenomenon of CMOS sensor**

• **Defective pixel**

CMOS image sensor has a square grid array on photo sensor pixels. If some photo sensors have a defect, as the image part is not displayed, white-or black-defect occurs on the screen.

The number and the brightness of defects more increase in high temperature condition rather than in normal temperature. Those also more increase in the case of the long exposure time rather than the short exposure time.

At the time, the defects look like noises. However, it is not failure but a characteristic of CMOS image sensor.

• **Image shading**

Under global shutter operation, the phenomenon that the brightness of the screen-upper part is difference from the under part might occur. However, it is not failure but a characteristic of CMOS image sensor.

This phenomenon occurs in the case of short exposure time besides the high illumination. In such a case, it is effective to reduce the illumination by setting the exposure time to be longer, or to adjust the lens aperture.

## **Important Safety Instructions**

- (1) Be sure to use the power supply from DC8V through DC30V.
- (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 the camera 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 the camera 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.

## 1. Production

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Model CSB4000F-10 is a CMOS camera developed specifically for FA and image measurement. High-speed image processing is available by a random access. The video output interface of CSB4000F-10 conforms to the serial digital bus standard IEEE1394.

## 2. Features

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(1) Ultra-high resolution

As CSB4000F-10 features High-pixel CMOS sensor (Total pixel counts: 4,190,000), high-density images reduced the moiré and beat extremely are obtained.

(2) Electronic shutter

As this model features a Global mode electronic shutter, clear images of fast-moving subject with little blurring are obtained.

(3) Random trigger shutter mode

Random trigger shutter, which starts light-exposure in synchronization with external trigger signal, is built in. This function enables the camera to capture images at any given timing.

(4) WOI (Window Of Interest)

WOI, which is suitable for high-speed image processing, is available.

Only arbitrary area can be read out by the designation of horizontal and vertical address.

(5) High-dynamic range

As this model can be achieved high-dynamic range featuring multi slope integrate mode, both of the high- and the low-intensity subject sharply contrasted can be shot at the same time.

(6) IEEE1394 video output

The CSB4000F-10 outputs video signal via the serial digital bus standard IEEE1394.

(7) 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

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- |                      |   |
|----------------------|---|
| (1) Camera body      | 1 |
| (2) Operation Manual | 1 |

## 4. Optional unit

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- |                         |                                     |
|-------------------------|-------------------------------------|
| (1) IEEE1394 Cable      | HSB-HCC-*** ( Manufactured by DDK ) |
| (2) Trigger Cable       | CTC4000-**                          |
| (3) Camera-mounting kit | CPT4000F                            |

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

## 5. Parts name

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- |              |                                   |
|--------------|-----------------------------------|
| (1) TRIGGER  | Connector for trigger input       |
| (2) IEEE1394 | Connector for IEEE1394 connection |

## 6. Function

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### 6-1. Electronic shutter

The shutter-speed of CSB4000F-10 is also manually adjustable. The initial factory setting is in 16msec. By manipulating the command status register setting value of CSB4000F-10 via IEEE1394 serial bus, you can change the shutter-speed from approx. 60 micro sec through 1 sec.

The actual shutter speed is calculated as follows.

(1) In case that the register setting value is 1 – 2048

You can set the shutter speed in 65.82usec step.

The actual shutter speed is calculated as follows.

(The setting value) x 65.82 – 5.16 [usec]

In the other word, you can adjust the shutter speed in 65.82usec step between 60.66usec – 1334.86002msec.

(2) In case that the register setting value is 2049 – 3941

You can set the shutter speed in 438.06usec ( 65.82usec x 7) step.

The actual shutter speed is calculated as follows.

(The setting value) x 65.82 x 7 + 134860.02 [usec]

In the other word, you can adjust the shutter speed in 438.06usec step between 135.32msec – 1.007sec.

## 6-2. Random trigger shutter

Under the RTS mode, the camera can capture image at any user-defined timing. The signal for input as a trigger signal under this mode is to be TTL signal. You can change the polarity of trigger pulse via IEEE1394 serial bus.

Model CSB4000F-10 supports both Trigger Mode 0 and Trigger Mode 1. In addition to the command status register settings as shown above, the RTS mode shutter-speed can be controlled via trigger signal pulse width as well. In this case, shutter speed is trigger pulse width – 5.16usec.

## 6-3. Image mode

### (1) Format 7 mode0

- Video transmission at 2008 x 2044 (Mono8bit)

### (2) Format 7 mode1

- Window of 100 x 100 pixels (mono8bit) per unit
- H: 100\*m, V: 100\*n (m/n = An integer: 1,2,3,4... 20)
- Selectable the video of 2000 x 2000 pixels (maximum)
- Placable the position freely except in lying off-screen
- Up to 1 window

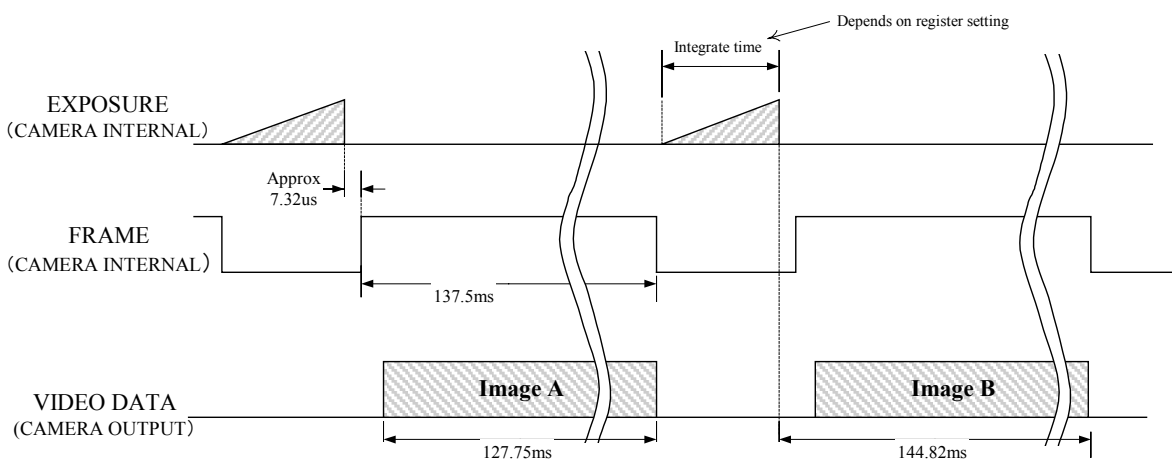
### (3) Format X

- Window of 100 x 100 (mono8bit) unit
- H: 100\*m, V: 100\*n (m/n = An integer: 1,2,3,4... 20)
- Selectable the video of 2000 x 2000 (maximum)
- Playable the position freely except in lying off-screen
- Selectable the window from 2 through 16 windows
- Overlaid windows setting is prohibited.

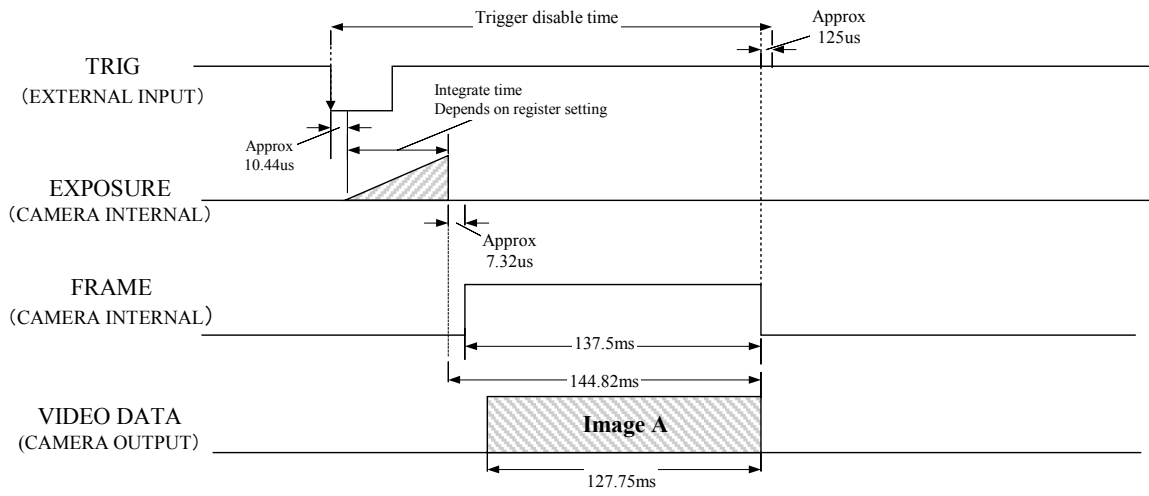
## 6-4 Timing chart

Using Isochronous transmission of IEEE1394, the image data of CSB4000F-10 are output. It is necessary that CSB4000F-10 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 CSB4000F-10, it is not as follows.

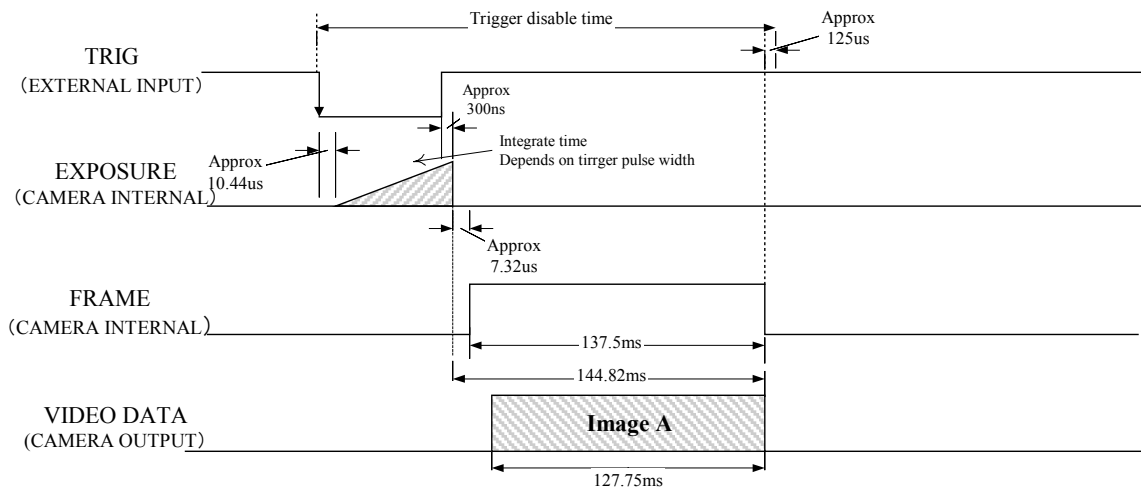
### (1) Normal shutter mode (Format7 mode0)



(2) Random trigger shutter mode (shutter speed preset) Format7 mode0

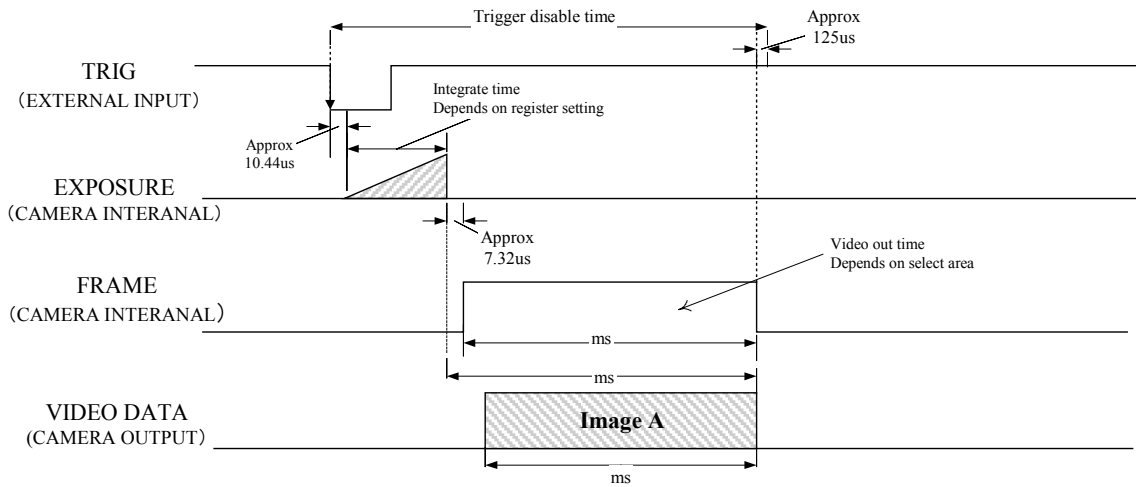


(3) Random trigger shutter mode (Shutter speed pulsed width control) Format7 Mode0



(4) Scalable (Shutter speed preset) Format7 Model1

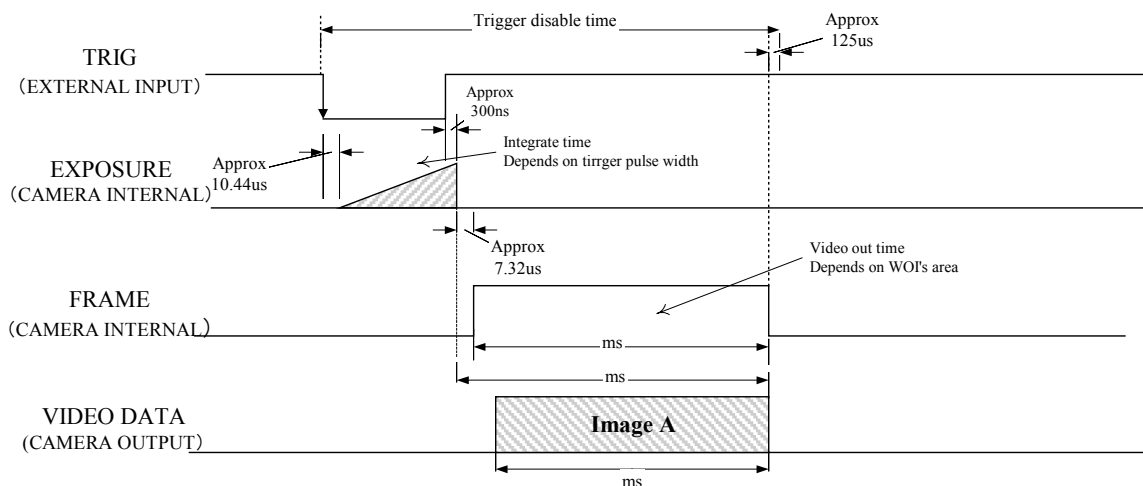
Video output time is changed depending on the setting of cutout position and cutout width.



\* Please refer to “CSB4000F-10 application manual” for calculation detailed timing of video output.

(5) Scalable (Shutter speed pulse width control) Format7 Model1

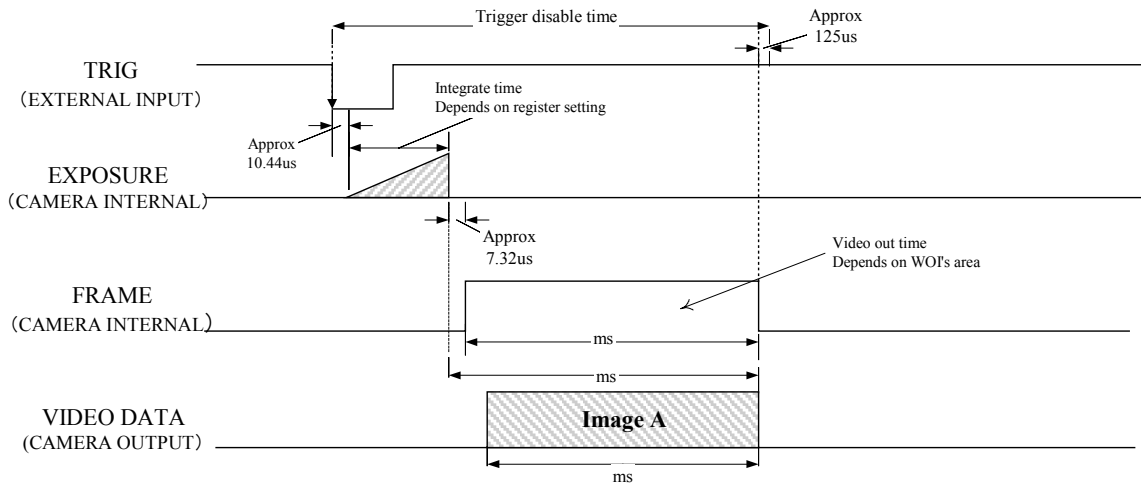
Video output time is changed depending on the setting of cutout position and cutout width.



\* Please refer to “CSB4000F-10 application manual” for calculation detailed timing of video output.

(6) WOI mode (Shutter speed preset) Format X

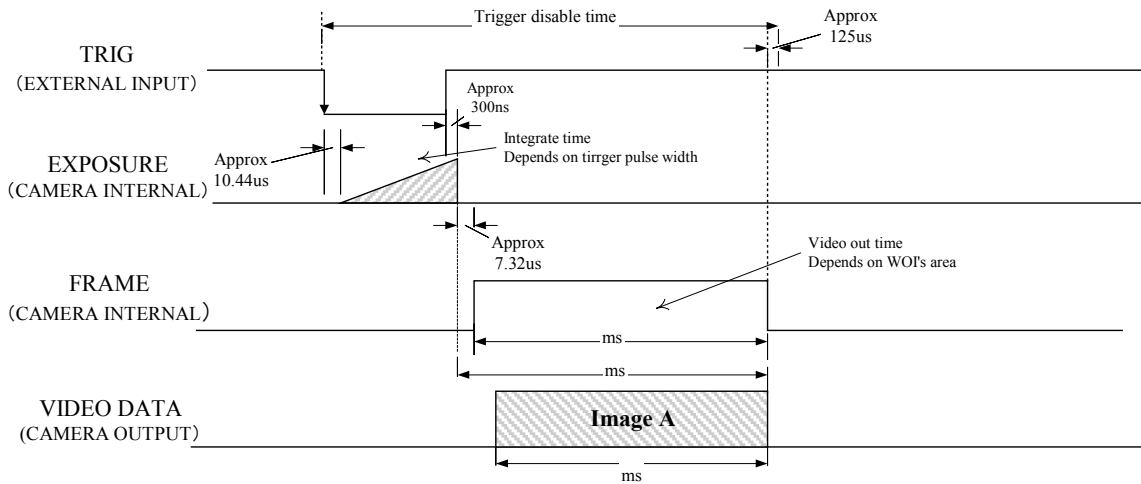
Video output time is changed depending on the setting of cutout position and cutout width.



\* Please refer to “CSB4000F-10 application manual” for calculation detailed timing of video output.

(7) WOI mode (Shutter speed pulse width control) Format X

Video output time is changed depending on the setting of cutout position and cutout width.



\* Please refer to “CSB4000F-10 application manual” for calculation detailed timing of video output.

## 7. Connection

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(1) IEEE1394

Recommendation harness : HSB-HCC-\*\*\* ( Manufactured by DDK ) ,or considerable article.  
It is not attached to this product.

Pin arrangement	
Pin No.	Signal name
1	POWER
2	POWER(GND)
3	TPB-
4	TPB+
5	TPA-
6	TPA+

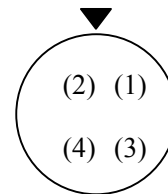
(2) Trigger connector specification

Be sure to use the following designated connector for trigger signal input for RTS.

Manufactured by HIROSE ELEC.

HR25-7TP-4S

Pin assignment	
Pin No.	Signal name
1	TRIG
2	S.G.
3	NC
4	S.G.



Connector view from insert side

Input signal of No.1 is for TTL level signal.

“NC” is a reserve pin for no-connection. Do NOT use this pin. To do so might cause a malfunction.

No.2 and No.4 is for signal ground signal. Those are not connected to camera body or connector shell.

## 8. Specification

Model	CSB4000F-10
Image sensor	CMOS image sensor
Total pixel	2048 (H) x 2048 (V)
Unit cell size	6.0 (H) x 6.0 (V) micro m
Scanning area	12.048 x 12.282 mm (Diagonal: 17.2 mm)
Driving frequency	33.3333MHz
Active pixel	2008 (H) x 2044 (V)
Scanning system	Progressive
Video output time	Approx. 140 ms (in all-pixel-data-readout mode) (Refer to “Timing chart”)
Sync system	Internal
Aspect ratio	1:1
Subject illumination	2000lx F4 (in exposure at approx. 16 ms)
Interface	Conforms to IEEE std. 1394a-2000
Transfer speed	400Mbps
Video format	Format7 / Special format (in WOI)
Protocol	Conforms to 1394-based Digital Camera Specification Ver. 1.3
Input signal	
TRIG (Shutter trigger)	TTL level
Gamma correction	Gamma = 1.0 (Fixed)
Electronic shutter	Shutter speed selection via communication command Selection from 1 through 3941 (Approx. 60 micros through 1 sec)
Random trigger shutter	RTS operation is available via external trigger input Mode 0: Shutter speed preset (depends on the electronic shutter setting) Mode 1: Shutter speed pulse width control is available. The camera starts light-exposure at the falling edge timing and ends it at the rising edge timing.
Power Supply	From DC+8V through +30V (IEEE1394 cable load)
Power Consumption	2.2W @+8V, 2.6W @+12V, 4.4W @+30V
Ambient condition	
Performance guaranteed	Temperature : From 0 through 40 degree Celsius Humidity : From 30 through 70 percent (No condensing)
Operation guaranteed	Temperature : From -5 through 45 degree Celsius Humidity : From 30 through 90 percent (No condensing)
Storage	Temperature: From -20 through 60 degrees Humidity: From 10 through 90 % (No condensing)
Lens mount	C-mount
Flange back	17.526mm
External-view	Refer to attached view drawing
Weight	Approx. 220g

EMC conditions(Electro-Magnetic Compatibility)

(1)EMI(Electro-Magnetic Interference) EN50081-2(Examination level EN55011-A)Conformity

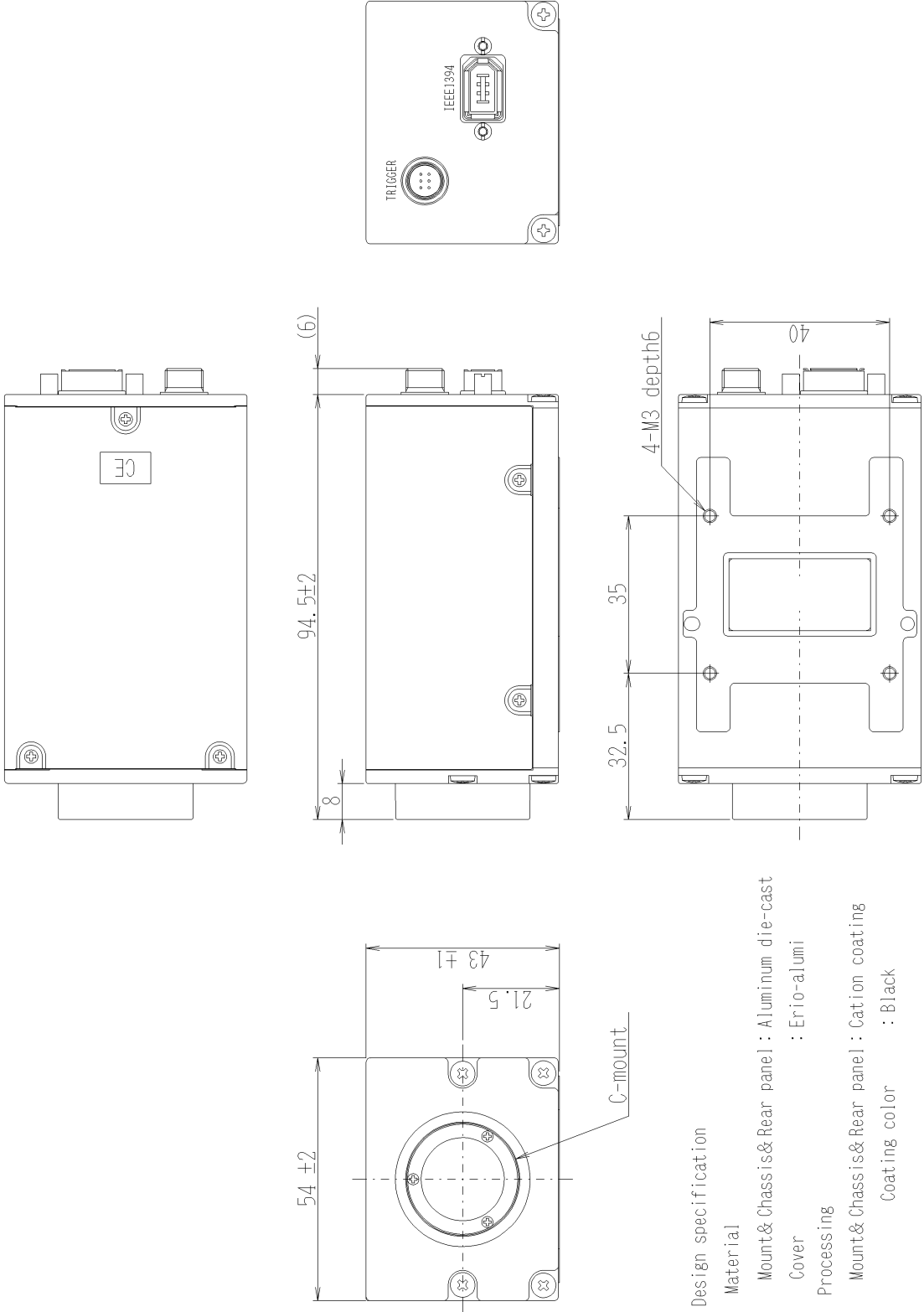
(2)EMS(Electro-Magnetic Susceptibility) EN61000-6-2 Conformity

\*Conformity of EMC conditions

About the conformity of the EMC standard of this machine, it has guaranteed in the conditions combined with the option part of the 4th clause.

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

# 9. External-View Drawing





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For more information, contact our sales department, branch, sales office, or your authorized distributor as follows;

Authorized distributors;

\*The design and specification subject to change without notice.

\*Wastes of this product should be separated and discarded in compliance with the various national and local ordinances.