



High-Resolution CCD Color Camera CleverDragon Series CSCU30CC18(-01)

Instruction Manual

Thank you for purchasing our product.

Before using this CCD color camera, please read through this instruction manual carefully in order to use this product correctly and safely.

After reading, keep this instruction manual handy so that you can refer to, whenever you need it.

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TOSHIBA TELI CORPORATION

Safety Precautions

Before using this product, read these safety precautions carefully. Important information is shown in this Instruction Manual to protect users from bodily injuries and property damages, and to enable them to use the product safely and correctly.

Please be sure to thoroughly understand the meanings of the following signs and symbols before reading the main text that follow, and observe the instructions given herein.

[Definition of Safety Signs]



Safety Signs	Description
 WARNING	Indicates a potentially hazardous situation that may result in death or serious injury (*1) in the event of improper handling.
 CAUTION	Indicates a potentially hazardous situation that may result in light to moderate injuries (*2) or only in property damage (*3) in the event of improper handling.

Notes *1: "Serious injury" refers to cases of loss of eyesight, wounds, burns (high or low temperature), electric shock, broken bones, poisoning, etc., which leave after-effects or which require hospitalization or a long period of outpatient treatment of cure.

*2: "Light to moderate injuries" refers to injuries, burns, electric shock etc. that do not require hospitalization or long-term treatment.

*3: "Property damage" refers to cases of extensive damage involving damage to buildings, equipment, farm animals, pet animals and other belongings.

[Explanation of Safety Symbols]

Safety Symbols	Description
 PROHIBITED	This sign indicates PROHIBITION (Do not). The content of prohibition is shown by a picture or words beside the symbol.
 MANDATORY	This sign indicates MANDATORY ACTION (You are required to do). The content of action is shown by a picture or words beside the symbol.

[General Handling]


WARNING



unplug

- **Immediately cease use of the equipment in the event of abnormality or malfunction.**

If abnormal conditions are present, such as smoke, a burning smell, ingress of water or foreign matter, or if the equipment is dropped or malfunctions, fire or electric shock may result.

If such abnormalities occur, disconnect the power plug from the outlet and contact your sales representative.



Do not get wet

- **Do not use the equipment in locations subject to water splashes.**

Otherwise, fire or electric shock may result.



Never pull apart

- **Do not disassemble, repair, or modify the equipment.**

Otherwise, fire or electric shock may result.

For internal repair, inspection, or cleaning, contact your sales representative.



Avoid

- **Do not place anything on the equipment.**

If metallic objects, liquid, or other foreign matter enters the equipment, fire or electric shock may result.



Avoid

- **Do not install the equipment in an unstable or inclined location or locations subject to vibration or impact.**

Otherwise, the equipment may topple over and cause personal injury.



Do not touch

- **During an electrical storm, do not touch the power cord or connection cable.**

Otherwise, an electric shock may result.



Instruction

- **Use the specified voltage.**

Use of an unspecified voltage may result in fire or electric shock.



Avoid

- **Do not be handled roughly, damaged, fabricated, bent forcefully, pulled, twisted, bundled, placed under heavy objects or heated the power cord, connection cable.**

Otherwise, fire or electric shock may result.

[General Handling]

 **CAUTION**



Instruction

● Observe the following when installing the equipment:

- Do not cover the equipment with a cloth, etc.
 - Do not place the equipment in a narrow location where heat is likely to accumulate. Otherwise, heat will accumulate inside the equipment, possibly resulting in a fire.
-



Avoid

- Do not place the equipment in locations subject to high moisture, oil fumes, steam, or dust.**
-
- Otherwise, fire or electric shock may result.
-



Avoid

- Do not install the equipment in locations exposed to direct sunlight or humidity.**
-
- Otherwise, the internal temperature of the equipment will rise, which may cause a fire.
-



Instruction

- Use only specified DC power cables and connection cables.**
-
- Otherwise, fire or electric shock may result.
-



Instruction

- When performing connection, turn off power.**
-
- When connecting the power cable or connection cable, turn off the equipment power. Otherwise, fire or electric shock may result.
-



Instruction

- Contact your sales representative to request periodic inspection and cleaning (every approx. five years).**
-
- Accumulation of dust inside the equipment may result in fire or electric shock.
-
- For inspection and cleaning costs, contact your sales representative.
-

CASES FOR INDEMNITY (LIMITED WARRANTY)

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

- In the case damage or losses are caused by fire, earthquake, or other acts of God, acts by a third party, deliberate or accidental misuse by the user, or use under extreme operating conditions.
 - In the case of indirect, additional, consequential damages (loss of business interests, suspension of business activities) are incurred as result of malfunction or non-function of the equipment, we shall be exempted from responsibility for such damages.
 - In the case damage or losses are caused by failure to observe the information contained in the instructions in this instruction manual and specifications.
 - In the case damage or losses are caused by use contrary to the instructions in this instruction manual and specifications.
 - In the case damage or losses are caused by malfunction or other problems resulting from use of equipment or software that is not specified.
 - In the case damage or losses are caused by repair or modification conducted by the customer or any unauthorized third party (such as an unauthorized service representative).
 - Expenses we bear on this product shall be limited to the individual price of the product.
-

RESTRICTION FOR USE

- Should the equipment be used in the following conditions or environments, give consideration to safety measures and inform us of such usage:
 1. Use of the equipment in the conditions or environment contrary to those specified, or use outdoors.
 2. Use of the equipment in applications expected to cause potential hazard to people or property, which require special safety measures to be adopted.
 - This product can be used under diverse operating conditions. Determination of applicability of equipment or devices concerned shall be determined after analysis or testing as necessary by the designer of such equipment or devices, or personnel related to the specifications. Such designer or personnel shall assure the performance and safety of the equipment or devices.
 - This product is not designed or manufactured to be used for control of equipment directly concerned with human life (*1) or equipment relating to maintenance of public services/functions involving factors of safety (*2). Therefore, the product shall not be used for such applications.
 - (*1): Equipment directly concerned with human life refers to.
 - Medical equipment such as life-support systems, equipment for operating theaters.
 - Exhaust control equipment for exhaust gases such as toxic fumes or smoke.
 - Equipment mandatory to be installed by various laws and regulations such as the Fire Act or Building Standard Law
 - Equipment related to the above
 - (*2) :Equipment relating to maintenance of public services/functions involving factors of safety refers to.
 - Traffic control systems for air transportation, railways, roads, or marine transportation
 - Equipment for nuclear power generation
 - Equipment related to the above
-

Notes on using this product

- **Handle carefully**

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

- **Environmental operating conditions**

Do not use the product in locations where the ambient temperature or humidity exceeds the specifications. Otherwise, image quality may be degraded or internal components may be adversely affected. In particular, do not use the product in areas exposed to direct sunlight. Moreover, during shooting under high temperatures, vertical stripes or white spots (noise) may be produced, depending on the subject or camera conditions (such as increased gain). However, such phenomena are not malfunctions.

- **Check a combination with the lens**

Depending on the lens and lighting you use, an image is reflected as a ghost in the imaging area. However, this is not because of a fault of the camera.

In addition, depending on the lens you use, the performance of the camera may not be brought out fully due to deterioration in resolution and brightness in the peripheral area, aberration and others.

Be sure to check a combination with the camera by using the lens and lightning you actually use.

When installing a lens in the camera, make sure carefully that it is not tilted.

In addition, use a mounting screw free from defects and dirt. Otherwise, the camera may be unable to be removed.

- **Do not shoot under intense light.**

Avoid intense light such as spot lights on part of the screen because it may cause blooming or smears. If intense light falls on the screen, vertical stripes may appear on the screen, but this is not a malfunction.

- **Occurrence of moiré**

If you shoot thin stripe patterns, moiré patterns (interference fringes) may appear. This is not a malfunction.

- **Occurrence of noise on the screen**

If an intense magnetic or electromagnetic field is generated near the camera or connection cable, noise may be generated on the screen. If this occurs, move the camera or the cable.

- **Handling of the protective cap**

If the camera is not in use, attach the lens cap to the camera to protect the image pickup surface.

- **If the equipment is not to be used for a long duration**

Turn off power to the camera for safety.

- **Maintenance**

Turn off power to the equipment and wipe it with a dry cloth.

If it becomes severely contaminated, gently wipe the affected areas with a soft cloth dampened with diluted neutral detergent. Never use alcohol, benzene, thinner, or other chemicals because such chemicals may damage or discolor the paint and indications.

If the image pickup surface becomes dusty, contaminated, or scratched, consult your sales representative.

● Disposal

When disposing of the camera, it may be necessary to disassemble it into separate parts, in accordance with the laws and regulations of your country and/or municipality concerning environmental contamination.

Following information is only for EU-member states:


The use of the symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about the take-back and recycling of this product, please contact your supplier where you purchased the product.



This equipment complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) This equipment may not cause harmful interference, and (2) This equipment must accept any interference received, including interference that may cause undesired operation.

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.

 <p>中华人民共和国 环保使用期限</p>	<p>环保使用期限标识，是根据电子信息产品污染控制管理办法以及，电子信息产品污染控制标识要求(SJ/T11364-2006)、电子信息产品环保使用期限通则，制定的适用于中国境内销售的电子信息产品的标识。</p> <p>电子信息产品只要按照安全及使用说明内容，正常使用情况下，从生产月期算起，在此期限内，产品中含有的有毒有害物质不致发生外泄或突变，不致对环境造成严重污染或对其人身、财产造成严重损害。</p> <p>产品正常使用后，要废弃在环保使用年限内或者刚到年限的产品时，请根据国家标准采取适当的方法进行处置。</p> <p>另外，此期限不同于质量/功能的保证期限。</p> <p>The Mark and Information are applicable for People's Republic of China only.</p>
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<产品中有毒有害物质或元素的名称及含量>



部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
相机本体	×	○	○	○	○	○

○：表示该有毒有害物质在该部件所有均质材料中的含量均在电子信息产品中有毒有害物质的限量要求标准规定的限量要求(SJ/T11363-2006)以下

×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出电子信息产品中有毒有害物质的限量要求标准规定的限量要求(SJ/T11363-2006)

This information is applicable for People's Republic of China only.

リサイクルに関する情報（包装物）
有关再利用的信息（包装物）
Information on recycling of wrapping composition

<p>箱／箱子／Box</p>  <p>段ボール 瓦楞纸板 Corrugated cardboard</p>	<p>内部緩衝材料・袋 内部缓冲材料・袋 Internal buffer materials・Bag</p>  <p>LDPE</p>
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1. Overview

This CCD color camera is a high-resolution color camera that features all pixel readout mode 1/1.8 CCD.

Model	Power Supply	Interface
CSCU30CC18	Camera Link Connector	PoCL (Power over Camera Link)
CSCU30CC18-01	I/O Connector	non-PoCL (Camera Link)

2. Features

- (1) High resolution
Bayer array high pixel density CCD (number of effective pixels 2.01 M, number of total pixels 2.11 M) is used.
- (2) Square grids
The CCD pixels arrayed in square grids facilitates computation for image processing.
- (3) Full-frame shutter
Since all pixels are output even by shutter operation, high resolution can be achieved, without deteriorating the vertical resolution.
- (4) Camera link interface (power supply type) PoCL
The interface for image output and camera control complies with the camera link standard.
By using a camera link frame grabber board for camera link of possible power supplies, the shot image can be transferred to PC at high speed, various camera controls can be performed from PC, and the power supply of the camera can be supplied with one cable. The camera link model that is not the power supply type is CSCU30BC18-01.
- (5) All-pixel readout mode (normal mode)
All pixel signals (in the effective area) are output in approximately 1/30 second.
- (6) Programmable partial scan mode
Partial scan within the range arbitrary from 50 lines to 1236 lines is possible.
- (7) High-speed draft readout mode
By reading 2 lines from every 8 lines, all signals in the effective area are output in approximately 1/89 second.
- (8) Random trigger shutter
By external trigger signal input, the shot image can be grabbed at an arbitrary timing.
- (9) Multiple-shutter
By external trigger signal input, the shot image can be grabbed at an arbitrary timing and the accumulated shot images can be output at an arbitrary timing.

3. Configuration

- (1) Camera body 1
- (2) Accessories
 - Instruction Manual (Japanese)..... 1
 - Instruction Manual (English)..... 1

4. Optional parts

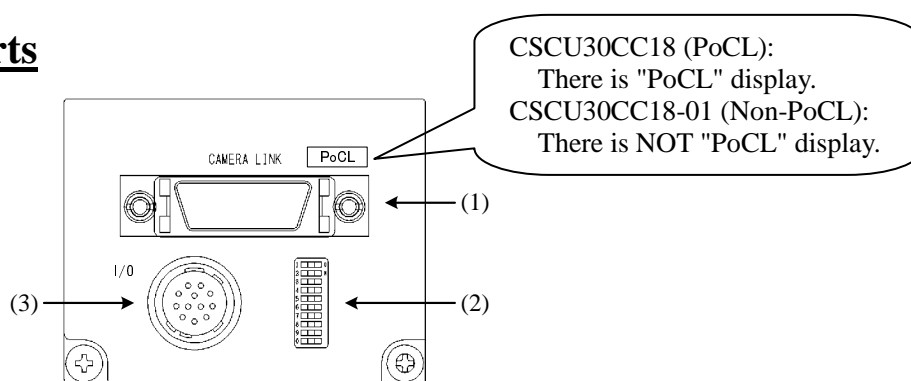
- | | |
|-------------------------|--|
| (1) Power cable | Model name: CPRC3700-** |
| (2) Camera Link cable | For the cable for PoCL, please contact the cable manufacturer. |
| (3) Camera mounting kit | Model name: CPT4000CL |
| (4) Camera adapter | Model name: CA130C |
- *NOTE: Application software is not supplied as a standard item.

Notes on optional parts and compliance with safety standard conditions:

We assure the compliance of this camera with the safety standard when it is used in combination with the optional parts listed above.

If you use the camera in combination with parts other than specified by our company, you are responsible for finally confirming the compliance with the safety standard by using the entire machine/equipment.

5. Name of Each Parts



- (1) Video output/controlling connector (Camera Link Base Configuration) CAMERA LINK
Outputs video signals and VALID, based on the camera link standard LVDS.
This connector is connected to the frame grabber board, image processing device and others.
• Connector model: DR 26-PIN connector 10226-2210PE (manufactured by 3M).

Pin No.	I/O	Signal Name	Pin No.	I/O	Signal Name
1	I(-)	+12V (GND)	14	-	GND
2	O	Tx OUT0-	15	O	Tx OUT0+
3	O	Tx OUT1-	16	O	Tx OUT1+
4	O	Tx OUT2-	17	O	Tx OUT2+
5	O	Tx CLK OUT-	18	O	Tx CLK OUT+
6	O	Tx OUT3-	19	O	Tx OUT3+
7	I	Ser TC (RxD) +	20	I	Ser TC (RxD) -
8	O	Ser TFG (TxD) -	21	O	Ser TFG (TxD) +
9	I	CC1 (TRIG) -	22	I	CC1 (TRIG) +
10	I	CC2 (MULTI) +	23	I	CC2 (MULTI) -
11	I	CC3-	24	I	CC3+
12	I	CC4+	25	I	CC4-
13	-	GND	26	I(-)	+12V (GND)

Please 1PIN and 26PIN must become power supplies, and match the camera link cable and grabber board for PoCL and use it. Please note that they become GND in camera link model.

(2) DIP switches

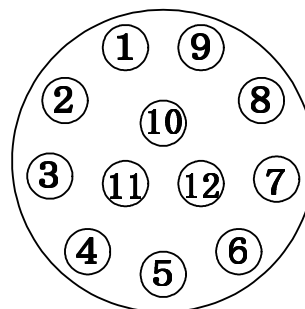
Used for various setting. For more information how to set the dip switches, see Chapter 8 "Dip Switch Setting" (on page 5).

(3) Connector for power supply and sync signal input/output I/O

This is a terminal used for power supply to the camera. This connector is connected to the power supply unit. In addition, this connector is used for sync signal (WEN signal) output and external trigger signal input.

- Connector (Camera side) : HR10A-10R-12PB (Manufactured by HIROSE DENKI)
- Plug (Cable side) : HR10A-10P-12S (Manufactured by HIROSE DENKI) or equivalents

Pin No.	I/O	Signal Name
1	-	GND
2	-(I)	N.C.(+12V)
3	-	GND
4	-	N.C.
5	-	GND
6	-	N.C.
7	-	N.C.
8	-	GND
9	-	N.C.
10	O	WEN
11	-	TRIG
12	-	GND

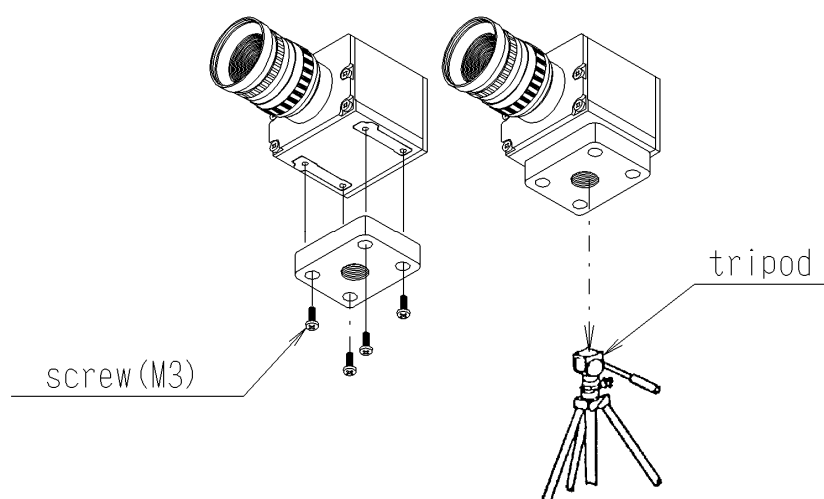


Rearview

Because the power supply is done from the camera link cable, 2PIN is opened. Please note that they become +12v in camera link model.

6. Installing the camera

- (1) When you fix the camera with a tripod stand screw (1/4-20UNC), use an optional mounting tab.

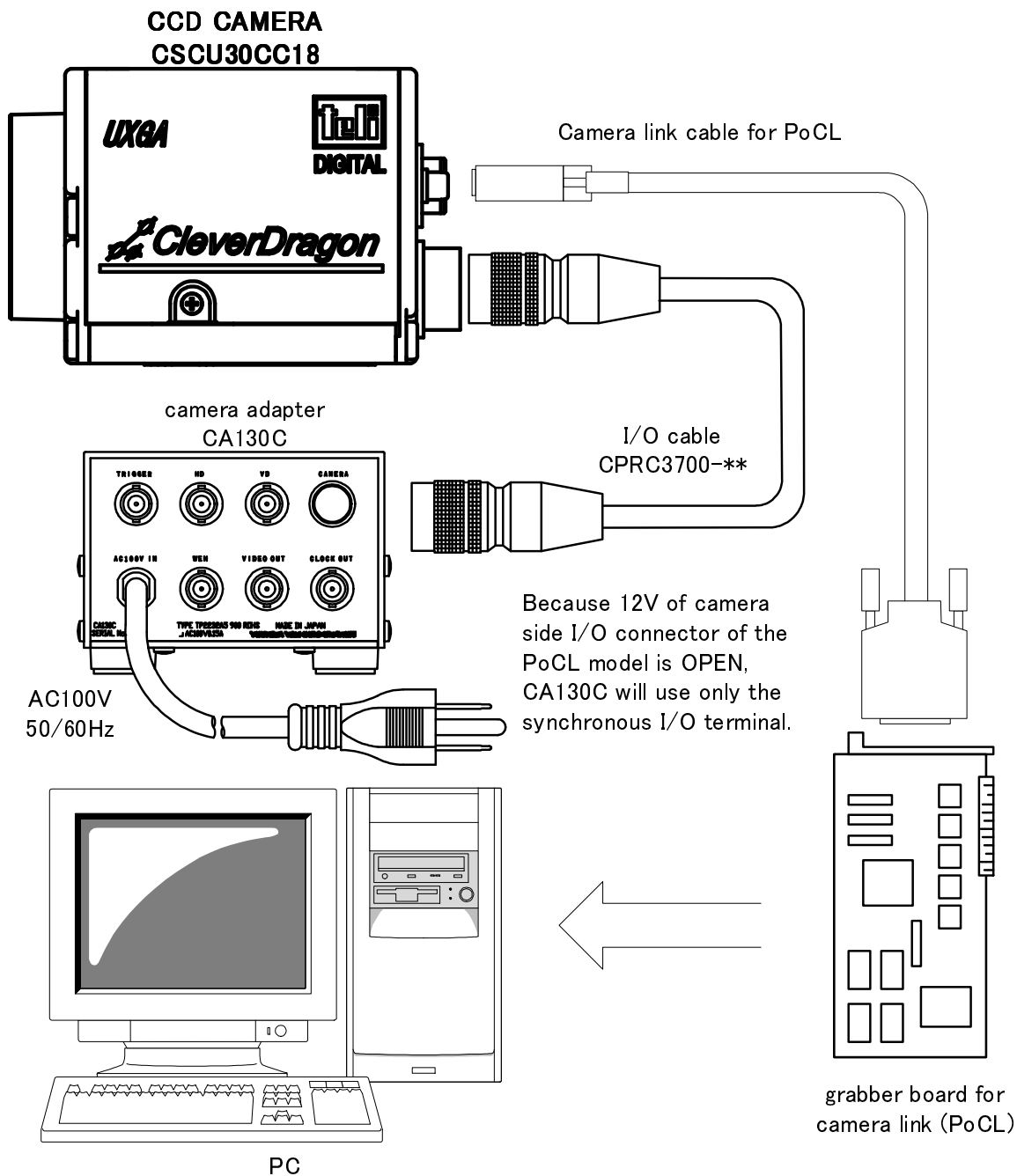


- (2) When you fix the camera by using the mounting screw hole on the camera body, use an M3 screw (6 mm or less for the portion to be inserted into the inside of the camera body).

7. Connection

Connect this camera as shown in the figure below.

(The figure below shows an example of connection. For details, contact our sales representative.)



Notes on frame grabber board:

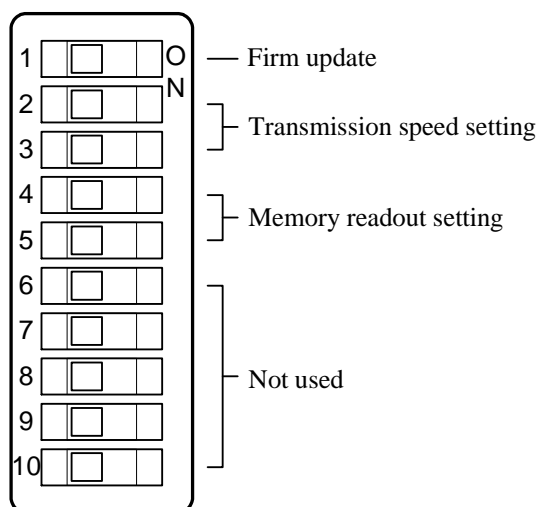
How to connect a frame grabber board with PC and how to set the frame grabber board differ depending on the frame grabber board you use.

For details, refer to the instruction manual of the relevant frame grabber board.

8. DIP switch setting

By using the DIP switches on the back surface of the camera body, you can set serial transmission speed and memory readout for when the power supply is turned on.

If you change the switch setting after the power supply is turned on, the change is not reflected.



(1) Transmission speed setting

You can set the speed of serial transmission by camera link.

SW2	SW3	Transmission speed
OFF	OFF	9600 bps
ON	OFF	19200 bps
OFF	ON	38400 bps

(2) Memory readout setting

You can set the number of the setting value saving memory bank to be called when the power supply is turned on.

The memory consists of 4 banks.

SW4	SW5	Memory number
OFF	OFF	0
ON	OFF	1
OFF	ON	2
ON	ON	3

(3) Firm update

It is a changeover switch for the CPU firm in the camera update. Please use it by turning off usually.

9. Functions

By accessing the camera register published on the camera link I/F, you can control/set each function.

Since access to the camera register is performed via the frame grabber board, the controlling and setting methods differ depending on the frame grabber board you use. For details, refer to the instruction manual of the relevant frame grabber board or contact our sales representative.

This instruction manual describes the specifications in the case where the camera register is directly connected by serial transmission over the camera link interface.

9.1 Explanation of Each Function

(1) Register setting value updating *Address:0x6E, Bit:0, Value:1*

The changed register setting value is reflected on the camera operation.

Only writing a value in each register does not cause the value to be reflected on the camera operation.

Register value updating must be executed before the changed setting value can be reflected on the camera action.

To save the setting value in memory, the register setting value must be updated beforehand. Otherwise, an execution error occurs and the setting value is unable to be saved in memory.

(2) Readout mode

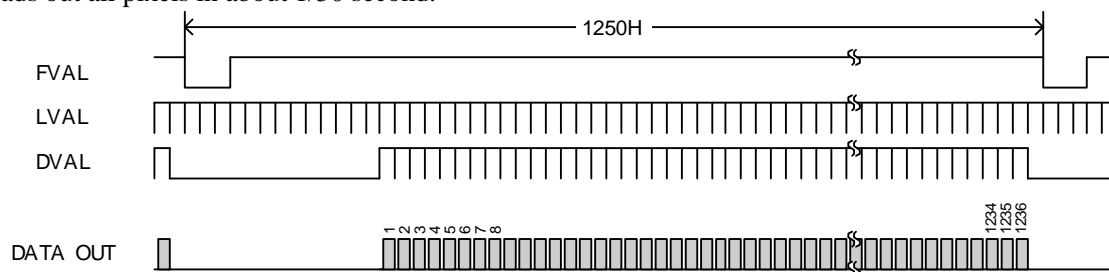
Video is output from the camera link connector. The output video can be grabbed by the frame grabber board.

The frame rate and resolution of output images that this model supports are as follows:

- 1) All pixel readout : Approximately 30 fps / 1628(H) x 1236(V)
- 2) Partial scan : Approximately 30 to 183 fps / 1628(H) x 552(V) to 1236(V)
- 3) High-speed draft readout : Approximately 89 fps / 1628(H) x 309(V)

1) All pixel readout *Address:0x70, Bit:0, Value:0 and Address:0x81, Bit:0, Value:0*

Reads out all pixels in about 1/30 second.



2) Programmable partial scan Address: 0x70, Bit: 0, Value: 0 and Address: 0x81, Bit: 0, Value: 1

A range arbitrary from 50 lines to 1236 lines can be read. The frame rate can be raised to 183fps or less by skipping it at high speed excluding an effective area.

When the frame rate of a partial scanning exceeds it when the shutter mode is switched from normality (internal synchronization) to the partial scanning mode, more high-speed than the setting of the speed of the shutter it is changed at the speed of the shutter matched to the frame rate.

- Starting position of effective line Address: 0x84, Bit: 0 to 7, and Address: 0x85, Bit: 0 to 2, Value: 0 to 1186
Starting position (Partial V Start) of an effective line can be set.
- Number of effective lines Address: 0x88, Bit: 0 to 7, and Address: 0x89, Bit: 0 to 2, Value: 50 to 1236
Number (Partial Height) of effective lines can be set.

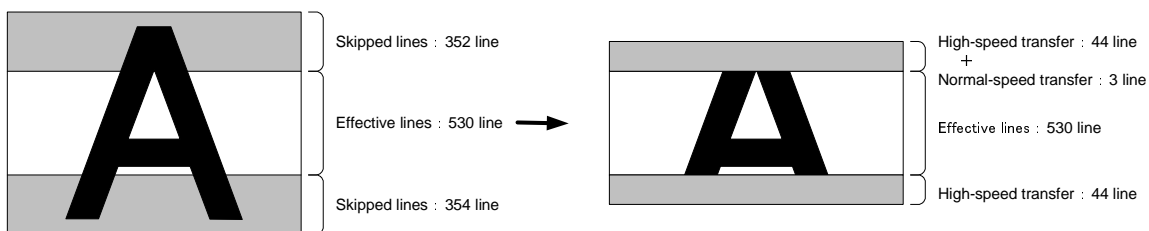
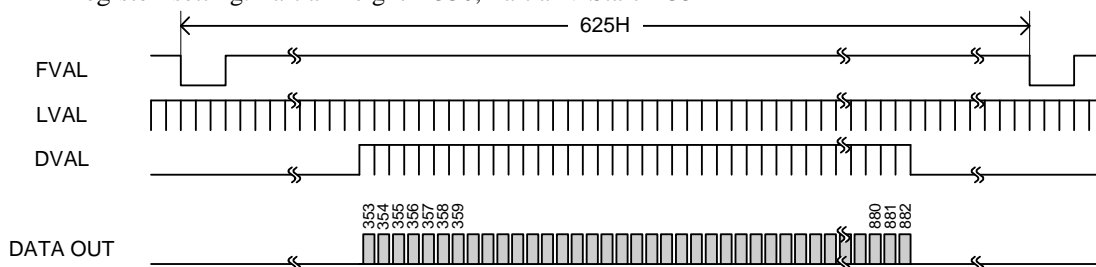
The frame rate is obtained in the following calculations.

$$FrameRate = \left[3 + \left\{ \left(\frac{Partial_V_Start + 15}{8} \right) + 2 \right\} + Partial_Height + \left\{ \frac{1236 - (Partial_V_Start + Partial_Height) + 13}{8} - 1 \right\} \right]^{-1} \times \frac{72 \times 10^6}{1920}$$

However, it assumes below the decimal point to be a round-down in {}.

Example: 530 effective lines (60fps) and start 353 line eyes (center partial)

Register setting: Partial Height = 530, Partial V Start = 352



< Example of calculating frame rate for the above-mentioned >

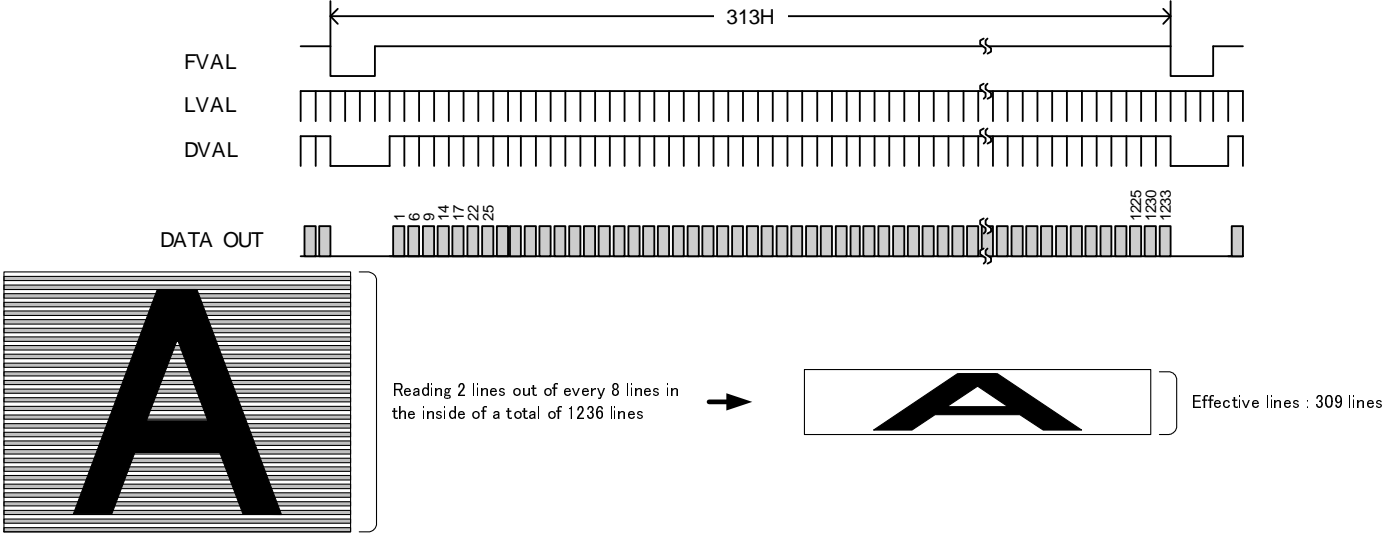
$$FrameRate = \left[3 + \left\{ \left(\frac{352 + 15}{8} \right) + 2 \right\} + 530 + \left\{ \frac{1236 - (352 + 530) + 13}{8} - 1 \right\} \right]^{-1} \times \frac{72 \times 10^6}{1920}$$

$$= \frac{72 \times 10^6}{[3 + \{47.875\} + 530 + \{44.875\}] \times 1920}$$

$$= \frac{72 \times 10^6}{[3 + 47 + 530 + 44] \times 1920} = \frac{72 \times 10^6}{624 \times 1920} = 60 \text{ fps}$$

3) High-speed draft readout *Address:0x70, Bit:0, Value:1 and Address:0x81, Bit:0, Value:0*

By reading 2 lines out of every 8 lines, reads out the whole valid area in approximately 1/89 seconds. Control and setting of functions can be done by accessing the cam. When the frame rate of a partial scanning exceeds it when the shutter mode is switched from normality (internal synchronization) or the partial scanning mode to the draft mode, more high-speed than the setting of the speed of the shutter it is changed at the speed of the shutter matched to the frame rate.



(3) Setup Address:0x62, Bit:0 to 7, Value:50 to 255

You can set a setup level (pedestal).

Output Format	Setup (calculated value)	Setting range	Calculation formula
RGB / RAW 8bit	0 ~ 31 LSB	0x00 ~ 0x1F (0 ~ 31)	Setup
RAW 10bit	0 ~ 124 LSB		4 x Setup
RAW 12bit	0 ~ 496 LSB		16 x Setup

* In the factory setting, the setup is set to about 264LSB.

(4) Gain Address:0x64, Bit:0 to 7, Value:0 to 150

You can set Gain (video gain).

Gain (calculated value)	Setting range	Calculation formula
0 ~ +7 dB	0x00 ~ 0x4B (0 ~ 75)	0.09375 x Gain

Notes on gain setting:

It is possible to set a maximum of +7 dB (Calculation value) but the warranty range for this product is 0 to +6 dB. When using this product, be sure to set a gain value within the warranty range.

And, Setting a too high gain value can increase noise. When you adjust the brightness of the shot image, you are responsible for finally confirming the image quality by using the entire machine/equipment.

(5) White balance

There are two types of white balancing mode. You can set white balancing mode, according to the subject and purpose.

1) OPWB (one-push auto white balance) Address:0x74, Bit:0, Value:1 and Address:0x77, Bit:0, Value:1

When you execute OPWB, the white balance is automatically adjusted. After automatic adjustment, the adjusted white balance is held. Execute OPWB, with a white subject picked up on the entire screen.

2) MANUAL (manual white balance)

Address:0x74, Bit:0, Value:0 and Address:0x75, Bit:0 to 7, Value:0 to 255

In the manual white balance mode, the white balance can be adjusted manually in two ways: by preset setting or by user setting (the user sets the R-gain and B-gain individually).

The preset setting can be selected from 6 fixed color temperatures (3000 K, 3700 K, 4000 K, 4500 K, 5500 K and 6500 K)

If you want to adjust the white balance more accurately, enter the user manual setting mode and set R-gain and B-gain individually.

R-gain setting Address:0x78 and 0x79, Bit:0 to 7 and 0 to 2, Value:0 to 1535

B-gain setting Address:0x7A and 0x7B, Bit:0 to 7 and 0 to 2, Value:0 to 1535

(6) Gamma Address:0x7D, Bit:0, Value:0 to 1

You can set gamma correction ON/OFF.

* When gamma correction is ON, the user cannot adjust the correction amount.

(7) Masking correction Address:0x7E, Bit:0, Value:0 to 1

You can set masking correction ON/OFF. When masking correction is ON, the hue of images is corrected so that it will be natural.

* When gamma correction is ON, the user cannot adjust the correction amount.

(8) Electronic shutter *Address:0x68, Bit:0 to 7, and Address:0x69, Bit:0 to 2, Value:0 to 2047*

You can set the shutter speed. The setting range differs depending on the output mode.

Readout mode	Shutter speed (calculated value)	Setting range	Calculation formula
All pixel readout	1/30 ~ 1/65,934 s	0x4E1 ~ 0x000 (1249 ~ 0)	(1092 CLK + 1920 CLK x Shutter Speed) / 72 MHz
Partial scan	1/30 ~ 1/65,934 s	0x4E1 ~ 0x000 (1249 ~ 0)	
High-speed draft readout	1/89 ~ 1/65,934 s	0x138 ~ 0x000 (312 ~ 0)	(1092 CLK + 2568 CLK x Shutter Speed) / 72 MHz

<For example, when you set shutter speed in 1/200 s (at All pixel readout, Partial scan)>

$$(1092 \text{ CLK} + 1920 \text{ CLK} \times \text{Shutter Speed}) / 72 \text{ MHz} = 1/200 \text{ s}$$

$$1092 + 1920 \times \text{Shutter speed} = 36 \times 10^6 / 200$$

$$1920 \times \text{Shutter speed} = 72 \times 10^6 / 200 - 1092$$

$$\therefore \text{Shutter speed} = (72 \times 10^6 / 200 - 1092) / 1920 = 186.931... \div 187 = 0x0BB$$

when you set shutter speed in 1/200 s, Please send a write command as follows.

(1) to write data 0xBB to address 0x68, to write data 0x00 to address 0x69.

(2) to write data 0x01 to address 0x6E

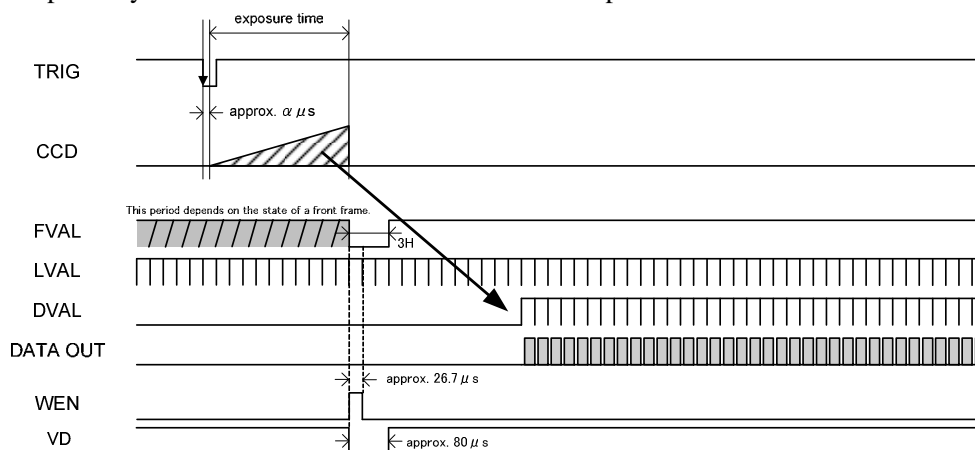
(9) Random trigger shutter *Address: 0x6A, Bit: 0, Value: 1*

In the random trigger shutter mode, you can shoot and grab an image at an arbitrary timing by trigger signal input from the external.

- External trigger signals can be input either from the camera link I/F CC1 or I/O connector.
- If polarity is set to negative polarity, exposure starts at the falling edge of the trigger. *Address: 0x6A, Bit: 1*
- The random trigger shutter of this camera can be operated in two types of mode: fixed mode and pulse width mode. How to determine the exposure time differs depending on the mode.

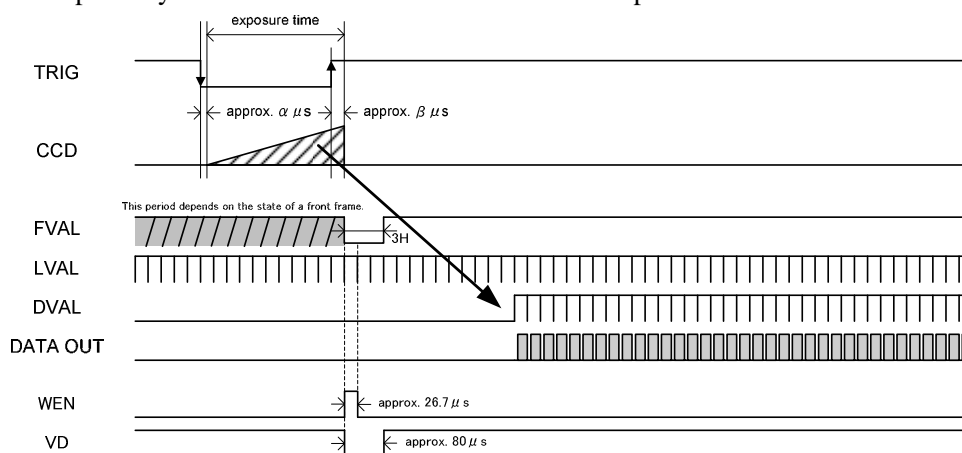
1) Fixed mode *Address: 0x6B, Bit: 0, Value: 0*

- The exposure time is determined by the setting value for the shutter speed.
- FVAL is output in sync with the first LVAL after the end of exposure time.



2) Pulse width mode *Address: 0x6B, Bit: 0, Value: 1*

- The exposure time is determined by the pulse width (exposure time = pulse width + approximately $14 \mu s$).
- Set a pulse width of 1H (approximately $26.7 \mu s$) or more.
- FVAL is output in sync with the first LVAL after the end of exposure time.



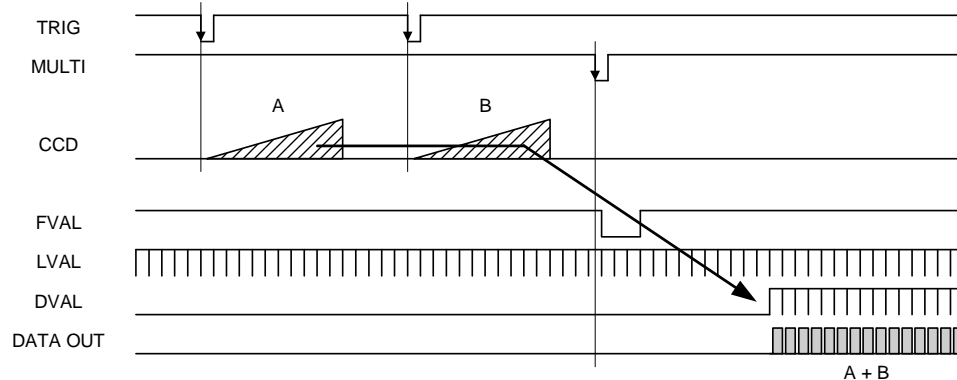
Notes of trigger mode:

When the interval of the input trigger signal is extremely short, or when the trigger signal is noisy, there is a possibility of causing the malfunction. In this case, please input a proper trigger signal.

(10) Multiple-shutter mode *Address: 0x66, Bit: 0, Value: 1*

In the multiple-shutter mode, video is output in sync with a MULTI signal from the external after the end of exposure time.

- Valid only when the random trigger shutter mode is ON.
- MULTI signals can be input from the camera link I/F CC2.
- If exposure is executed several times before MULTI signal input, the images are output superposed.
- The exposure time is determined by the random trigger shutter mode setting and its determination method.
- The pulse width must be set to negative polarity and 1H (approximately $26.7 \mu\text{s}$) to 10 ms.
- FVAL is output in sync with the first LVAL after the end of MULTI signal input.

**Notes on multiple-shutter:**

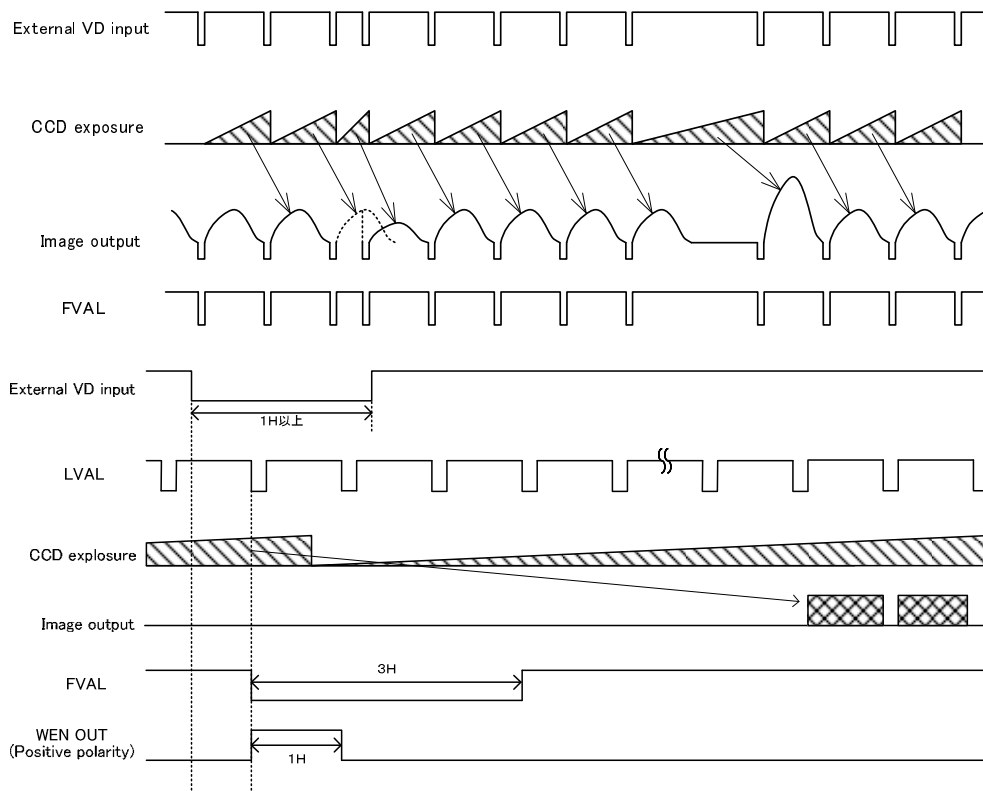
An image has been stored to CCD device until a MULTI signal is inputted and it begins to read out image after CCD is exposed. Therefore, an image may degenerate step by step when an image is stored to CCD device for a long time.

And, Electric charge is superimposed in CCD device when the multiplex exposure. Therefore, CCD will flood with electric charge when electric charge is over superimposed in CCD device. Consequently vertical stripes noise will appear. At that time please stop using spotlight and dimmer for example close the iris.

(11) Restart reset mode *Address: 0x6A, Bit: 4, Value: 1*

In the start reset mode, it takes a picture of the image according to arbitrary timing by the VD signal input from the outside, and it is possible to take it. A low-speed speed of the shutter can be easily set in this mode.

- External VD signal can be input from either camera link I/F CC1 or 11 I/O connector pins.
- The interval of external VD signal becomes the speed of the shutter (exposure time).
- Peculiar timing to internal makes horizontal, driving timing LVAL asynchronous from external VD signal.
- The image output is output to the input timing of external VD signal delaying 1.0H or less.



(12) Setting value memory

Each setting value can be saved in the memory inside the camera.

- The contents of the memory is held even after the power supply is turned off.
- The memory consists of 4 banks. For each table, you can save/readout the setting value independently, as well as reset the setting value to the initial factory setting.
- You can set the number of the memory bank to be read out when the power supply is turned on, by using the relevant dip switch on the back surface of the main body.

1) Memory save Address:0x51, Bit:0 to 1, Value:0 to 3

- When you write to the register the number of the memory bank to which the setting value is to be saved, the setting value of each register is saved in the internal memory.
- If you have not executed "Update" after changing the setting value (reset address 0x6E to 0x01), an execution error occurs and the setting value is not saved in the memory. Be sure to execute "Update" before saving the setting value.

2) Memory readout Address:0x52, Bit:0 to 1, Value:0 to 3

- When you write to the register the number of the memory bank from which the setting value is to be read out, the setting value is read out from the internal memory and set.

3) Memory reset Address:0x53, Bit:0 to 1, Value:0 to 3

- When you write to the register the number of the memory bank to be reset, the initial factory setting value is read out from the internal memory and set.

(13) RAW Output bit Address:0x90, Bit:0 to 1, Value:0 to 2

You can set gray scale per pixel. The initial factory setting is 12 bits.

(14) Output format Address:0x92, Bit:0, Value:0 to 1

You can set RGB(24bit) / RAW (12bit / 10bit / 8bit) output. The initial factory setting is RGB(24bit) output.

9.2 Communication protocol

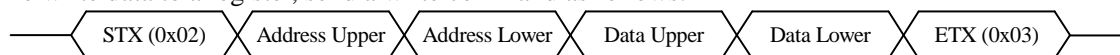
This camera uses the communication protocol of our standard method (where, parameters are set for the camera-internal registers).

In command transmission/receipt, the address and data in hexadecimal representation are converted to ASCII.

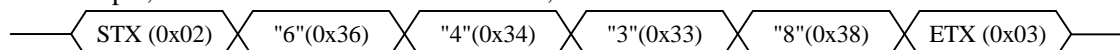
In addition, all alphabetical characters must be uppercase characters.

(1) Writing to the register

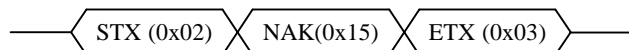
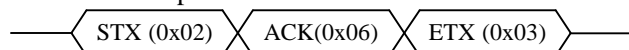
To write data to a register, send a write command as follows.



For example, to write data 0x38 to address 0x64, send a write command as follows.



The camera responds to the write command as follows.



*When you let camera operation reflect the changed register setting, Please you write in address 0x6E at 0x01 by all means, and update it.

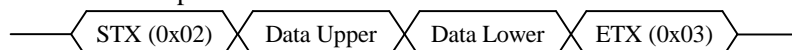
(2) Reading the register

To read data from the register, send "R" "Q" following the address.

For example, to read data from address 0x6A, send a read command as follows.



The camera responds to the read command as follows.



9.3 Register Map

	Adr	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
Base Registers	0x00 0x0F	Vendor Name (Read Only)	"TOSHIBA TELI"								←
	0x10 0x1F	Model Name (Read Only)	"CSCU30CC18"								←
	0x20 0x2F	Serial Number (Read Only)	Serial Number								←
	0x30 0x37	CPU Version (Read Only)	ex. "V1.01.01"								←
	0x38 0x3F	FPGA Version (Read Only)	ex. "V1.01.01"								←
Self Check Registers	0x40	Self Check (Read Only)	Self Check Result								0x00
	0x41	Status (Read Only)	Status Code								0x00
	0x42 0x4F	Reserved	Reserved								-
Memory Registers	0x50	Memory Information (Read Only)	Number of Memory Bank in This Camera (0x04)								0x04
	0x51	Memory Save (Write Only)	-	-	-	-	-	-	-	Save Bank Number (0x00 ~ 0x03)	-
	0x52	Memory Load (Write Only)	-	-	-	-	-	-	-	Load Bank Number (0x00 ~ 0x03)	-
	0x53	Memory Reset (Write Only)	-	-	-	-	-	-	-	Reset Bank Number (0x00 ~ 0x03)	-
	0x54 0x5F	Reserved	Reserved								-

	Adr	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default	
Base Function Registers	0x60	Reserved	Reserved								-	
	0x61	Reserved	Reserved								-	
	0x62	Setup	Setup (0x00 ~ 0x31)								0x10	
	0x63	Reserved	Reserved								-	
	0x64	Gain	Gain (0x00 ~ 0x4B)								0x00	
	0x65	Reserved	Reserved								-	
	0x66	Multiple Shutter	-	-	-	-	-	-	-	-	1:ON 0:OFF	0x00
	0x67	Reserved	Reserved								-	
	0x68	Shutter Speed(L)	Shutter Speed (0x000 ~ 0x7FF)								0x4E1	
	0x69	Shutter Speed(U)	-	-	-	-	-					
	0x6A	Shutter Mode	-	-	-	Restart Reset 1:ON 0:OFF	-	-	Polarity 1:POS 0:NEG	Random 1:ON 0:OFF	0x00	
	0x6B	Random Mode	-	-	-	-	-	-	-	-	1:PLS 0:FIX	0x00
	0x6C	Reserved	Reserved								-	
	0x6D	Reserved	Reserved								-	
	0x6E	Update (Write Only)	-	-	-	-	-	-	-	-	1:EXEC	-
	0x6F	Reserved	Reserved								-	
	0x70	Draft Mode	-	-	-	-	-	-	-	-	1:ON 0:OFF	0x00
0x71 0x73	Reserved	Reserved								-		

	Adr	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
Base Function Registers	0x74	WB Mode	-	-	-	-	-	-	-	1:OPWB 0:MAN U	0x00
	0x75	Manual WB Temp.	0x1E: 3000K 0x25: 3700K 0x28: 4000K 0x2D: 4500K 0x37: 5500K 0x41: 6500K 0xFF: User Manual WB								0xFF
	0x76	Reserved	Reserved								-
	0x77	OPWB (Write Only)	-	-	-	-	-	-	-	1:EXEC	-
	0x78	User Manual WB R Gain(L)	User Manual WB R Gain (0x000 ~ 0x5FF)								-
	0x79	User Manual WB R Gain(U)	-	-	-	-	-				-
	0x7A	User Manual WB B Gain(L)	User Manual WB B Gain (0x000 ~ 0x5FF)								-
	0x7B	User Manual WB B Gain(U)	-	-	-	-	-				-
	0x7C	Reserved	Reserved								-
	0x7D	Gamma	-	-	-	-	-	-	-	1:ON 0:OF F	0x01
	0x7E	Masking	-	-	-	-	-	-	-	1:ON 0:OF F	0x00
	0x7F	Reserved	Reserved								-

	Adr	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
Base Function Registers	0x80	Reserved	Reserved								-
	0x81	Partial Scan	-	-	-	-	-	-	-	1:ON 0:OFF	0x00
	0x82 0x83	Reserved	Reserved								-
	0x84	Partial V Start(L)	Partial V Start (0x000 ~ 0x4A2)								0x160
	0x85	Partial V Start(U)	-	-	-	-	-				
	0x86 0x87	Reserved	Reserved								-
	0x88	Partial Height(L)	Partial Height (0x1E ~ 0x4D4)								0x212
	0x89	Partial Height(U)	-	-	-	-	-				
	0x8A 0x8F	Reserved	Reserved								-
	0x90	Output Bit	-	-	-	-	-	-	0x00: 12bit 0x01: 10bit 0x02: 8bit	0x00	
	0x91	Reserved	Reserved								
	0x92	Output Format	-	-	-	-	-	-	1:RAW 0:RGB	0x00	
Expansion Registers	0x93 0x94	Reserved	Reserved								-
	0x95	Expansion Status (Read Only)	Expansion Status								0x00
	0x96 0xFF	Reserved	Reserved								-

9.4 Error status

If NAK is returned to the sent command, you can obtain detailed information on the error by accessing the status register.

Error type	Details of error	Status code	
		Status Code (Addr. 0x41)	Expansion Status (Addr. 0x95)
No Error	The previous communication was executed normally.	0x00	0x00
Status Register Accessed	An attempt was made to read the Status /Expansion Status register.	---	---
Communication Error	A communication error occurred.	0x01	0x00
Addressing Error	The reserved area was accessed.	0x10	0x00
	An attempt was made to write data to a write-protected area.	0x10	0x01
	An attempt was made to read data from a read-protected area.	0x10	0x02
Save Data Error	An attempt was made to perform Memory Save before performing Update processing.	0x11	0x00
Mode Setting Error	An attempt was made to write a mode setting value other than specified.	0x20	0x00
Configuration Error	An attempt was made to write a value that is out of the specified range.	0x30	0x00
Hardware Error	A hardware error was detected.	0xFF	0x00

10. Before determining it as being a fault

If any trouble occurs in use, check the following first.

If the trouble persists, contact your distributor or our sales representatives.

Phenomena	Check item
Cannot turn on power	- Check the connection of the camera adapter and power cable.
Shooting image is not displayed	- Check the connection of the camera link cable and camera cable. - Check that the camera register settings are correct. - Check that the dip switch settings are correct. - Check that lens aperture is not closed. - Check that the grabber board is installed and set up correctly.
Frame drop occurs on shooting image	- In the PCI bus system, a frame dropping may occur because the transfer rate is too slow for the amount of data to be transferred. Ensure that no frame dropping occurs with a grabber board and PC for PCI Express x4. - If more than one boards are installed in the PCI slots, remove the other boards.
Shooting image remains still	- Check that the camera is not in the random trigger mode. - Check the setting of the grabber board. - Check the connection of the camera link cable.
Cannot control camera from PC	- Check the connection of the camera link cable. - Check the dip switch setting (communication speed setting). - Check that the grabber board is installed and set up correctly.

11. Specifications

[Electrical specification]

- | | | | | | |
|----------------------------------|---|-----|-------|-------|------|
| (1) Imager | Interline CCD | | | | |
| · Number of total pixels | 1688 (H) x 1248 (V) | | | | |
| · Number of effective pixels | 1628 (H) x 1236 (V) | | | | |
| · Pixel size | 4.4μm (H) x 4.4μm (V) | | | | |
| · Optical size | 1/1.8 type | | | | |
| · Color filter | RGB primary color mosaic-on-tip color filter | | | | |
| (2) Scan method | Progressive | | | | |
| (3) Aspect ratio | 4:3 | | | | |
| (4) Synchronization method | Internal synchronization | | | | |
| (5) Standard subject illuminance | 2400 lx, F8, 5000 K (Gamma On) | | | | |
| (6) Minimum subject illuminance | 35 lx
(F1.4, GAIN MAX, all pixel readout, video level 50 %, Gamma On) | | | | |
| (7) Video output | Compliant with the camera link standard. | | | | |
| · Data | RGB 24bit / RAW 12bit / RAW 10bit / RAW 8bit switching
(initial factory setting: RGB) | | | | |
| | RAW pixel array | | | | |
| | <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding: 2px 10px;">Red</td> <td style="padding: 2px 10px;">Green</td> </tr> <tr> <td style="padding: 2px 10px;">Green</td> <td style="padding: 2px 10px;">Blue</td> </tr> </table> | Red | Green | Green | Blue |
| Red | Green | | | | |
| Green | Blue | | | | |
| · Readout mode | | | | | |
| All pixel readout | Approximately 30 fps / 1628(H) x 1236(V) | | | | |
| Partial scan | Approximately 30 fps to 183fps / 1628(H) x 50 to 1236(V) | | | | |
| High-speed draft readout | Approximately 89 fps / 1628(H) x 309(V) | | | | |
| (8) Gain | 0 to +6 dB (75 levels) (initial factory setting: 0 dB) | | | | |
| (9) Setup | 0 to 31 (32 levels) (initial factory setting: 16 LSB (calculated value)) | | | | |
| (10) White balance | OPWB/MANUAL switching (initial factory setting: MANUAL) | | | | |
| Effective range | 2500 K to 6500 K | | | | |
| · OPWB | | | | | |
| Effective area | Full screen | | | | |
| · MANUAL | | | | | |
| Preset value | 3000 K, 3700 K, 4000 K, 4500 K, 5500 K, 6500 K | | | | |
| User setting | R-gain and B-gain can be set independently. | | | | |
| (11) Gamma correction | ON(Gamma=0.65)/OFF(Gamma=1) switching (initial factory setting: ON) | | | | |
| (12) Masking correction | ON/OFF switching (initial factory setting: OFF) | | | | |
| (13) Power supply voltage | DC12 V (10.0 to 13.2V) (ripple 50 mV(p-p) or less) | | | | |
| (14) Power consumption | Typical: Approximately 4.0 W (initial factory setting: All pixel readout)
Max: Approximately 4.5 W (50lines partial scan) | | | | |

Notes on power consumption of PoCL:

Power consumption might exceed 4W in the partial scan mode. The PoCL model might not be able to be started according to the supplied electricity of frame grabber board or length of the camera link cable. I hope the examination to the non-PoCL model etc. in that case.

[Electronic shutter specification]

- (1) Shutter speed
- Readout mode
 - All pixel readout 1/30 to 1/65,934 s (1250 levels)
 - Partial scan 1/30 to 1/65,934 s (1250 levels)
 - High-speed draft readout 1/89 to 1/65,934 s (313 levels)
- (2) Random trigger shutter ON/OFF switching (initial factory setting: OFF)
- Fixed mode The exposure time depends on the shutter speed setting.
 - Pulse width mode The exposure time depends on the pulse width.
- ※When you input the following trigger signal to this camera for one frame period immediately after the trigger signal input (When you continuously output the image), the noise might be generated in the image output. The solution of the noise is not to input the following trigger for the image output period. The image output period can be recognized based on the WEN output or the VD output. Please refer to the timing chart for one frame period of each mode. Or, please refer to the FVAL signal.
- (3) Multiple-shutter ON/OFF switching (initial factory setting: OFF)
Exposure by TRIG input, readout by MULTI input
* Enabled when random trigger shutter is ON.
- (4) Restart reset ON/OFF switching (initial factory setting: OFF)

[Internal sync signal specification]

(1) Driving frequency	72.000 MHz
(2) Scanning frequency	
• Readout mode	
All pixel readout	Horizontal :37.500 kHz Vertical :30.000 Hz
Partial scan	Horizontal :37.500 kHz Vertical :30.193 Hz to 183.824Hz
High-speed draft readout	Horizontal :28.037 kHz Vertical :89.576 Hz

[Input signal specification]

(1) TRIG	Camera link I/F and I/O connector input
• Signal level (I/O input)	TTL level
• Polarity	Positive/Negative polarity switching possible (initial factory setting: Negative)
• Pulse width	26.7 μ s or more
(2) MULTI	Camera link I/F input
• Polarity	Negative polarity
• Pulse width	26.7 μ s to 10 ms

[Output signal specification]

(1) WEN	I/O connector output
• Signal level	4 V (p-p)
• Polarity	Positive polarity
• Pulse width	Approximately 26.7 μ s
(2) VD	I/O connector output
• Signal level	4 V (p-p)
• Polarity	Negative polarity
• Pulse width	Approximately 80 μ s

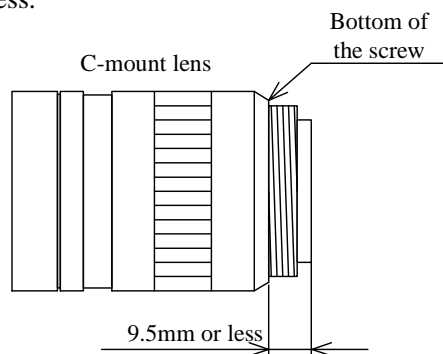
[Dimensions]

- (1) Lens mount C-mount

Notes on combination of C-mount lens:

Depending on the lens you use, the performance of the camera may not be brought out fully due to the deterioration in resolution and brightness in the peripheral area, occurrence of a ghost, aberration and others. When you check the combination between the lens and camera, be sure to use the lens you actually use.

As for the C-mount lens used combining this camera, the projection distance from bottom of the screw should use 9.5mm or less.



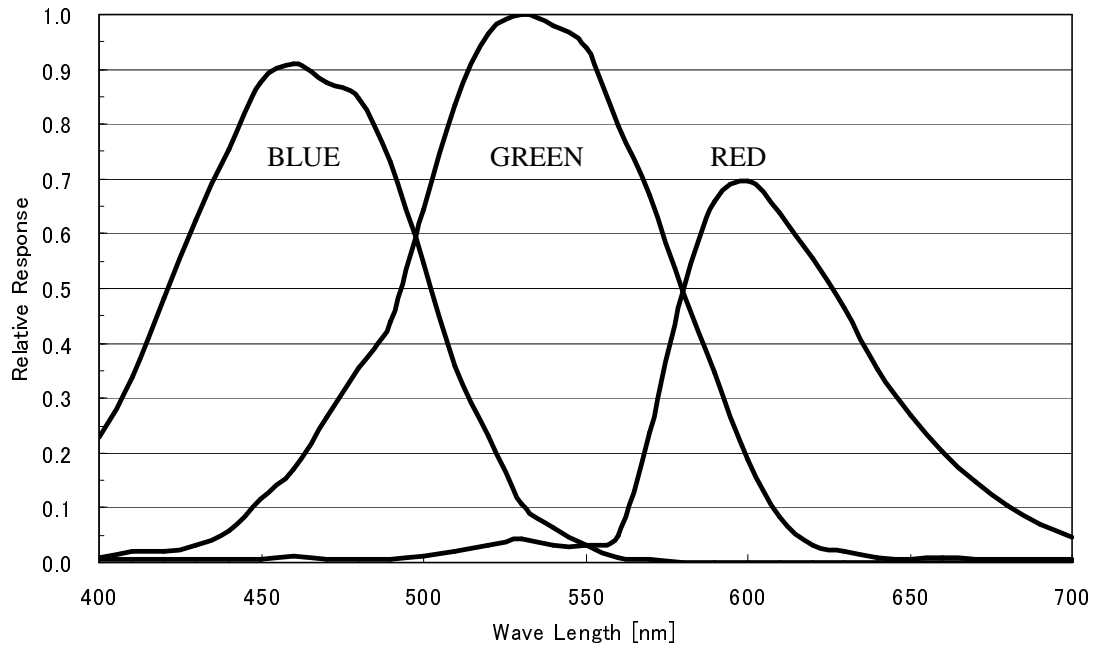
- (2) Flange back 17.526 mm
 (3) Dimensions 54 mm (W) x 43 mm (H) x 59 mm (D)
 (4) Mass Approximately 175 g
 (5) Camera body grounding: insulation status
 Conductive between circuit GND and camera body

[Operating ambient conditions]

- (1) Performance assurance Temperature : 0 to 40°C
 Humidity : 10 to 90% (no condensation)
 (2) Operating assurance Temperature : -5 to 45°C
 Humidity : 90% or less (no condensation)
 (3) Storage environment Temperature : -20 to 60°C
 Humidity : 10 to 90% (no condensation)

[Typical spectral response]

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

**[Applicable safety standards]**

- | | |
|--|--------------------------------|
| (1) EMC (Electro-Magnetic Compatibility) | |
| EMI (Electro-Magnetic Interference) | :EN61000-6-4 / 2001 |
| EMS (Electro-Magnetic Susceptibility) | :EN61000-6-2 / 2001 |
| (2) FCC | :FCC Part 15 Subpart B class A |

[Communication specification]

- | | |
|-------------------------|----------------------|
| (1) Communication speed | 9600/19200/38400 bps |
| (2) Data bit | 8 |
| (3) Parity bit | None |
| (4) Stop bit | 1 |
| (5) Handshake | None |

[Timing chart]

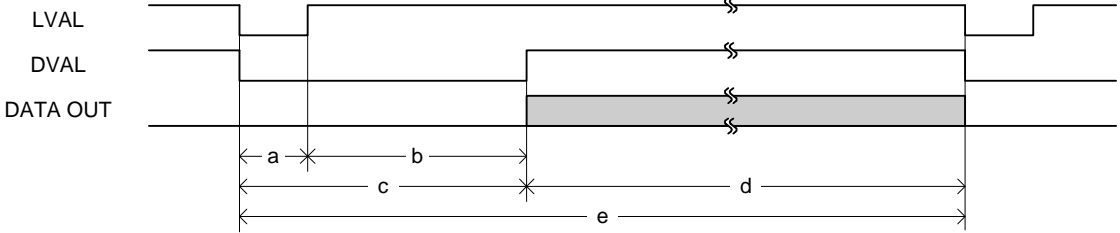
(1) Horizontal timing

1) All pixel readout, Partial scan



a = 185CLK b = 107CLK c = 292CLK d = 1628CLK e = 1920CLK

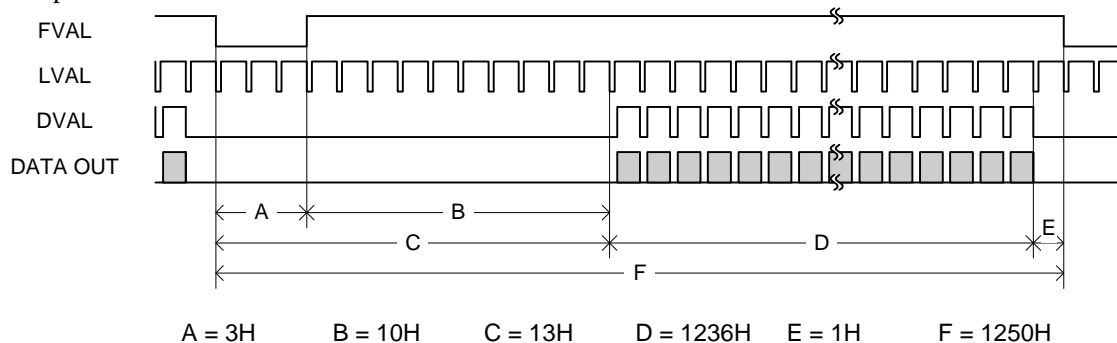
2) High-speed draft readout



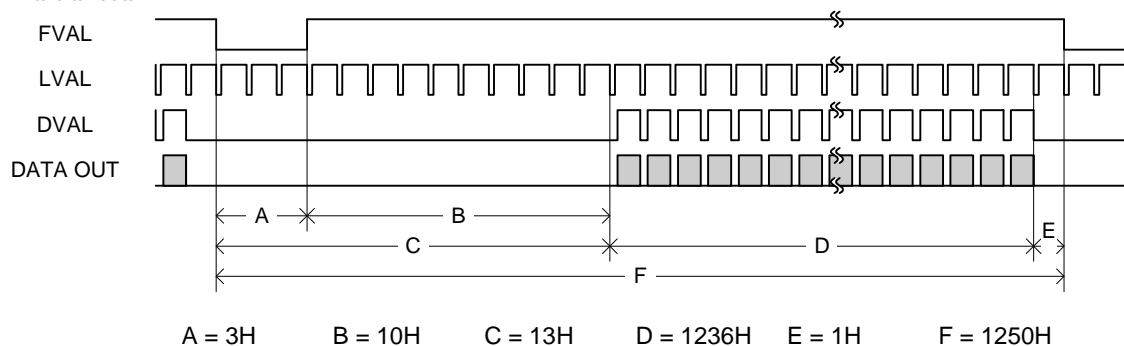
a = 185CLK b = 755CLK c = 940CLK d = 1628CLK e = 2568CLK

(2) Vertical timing

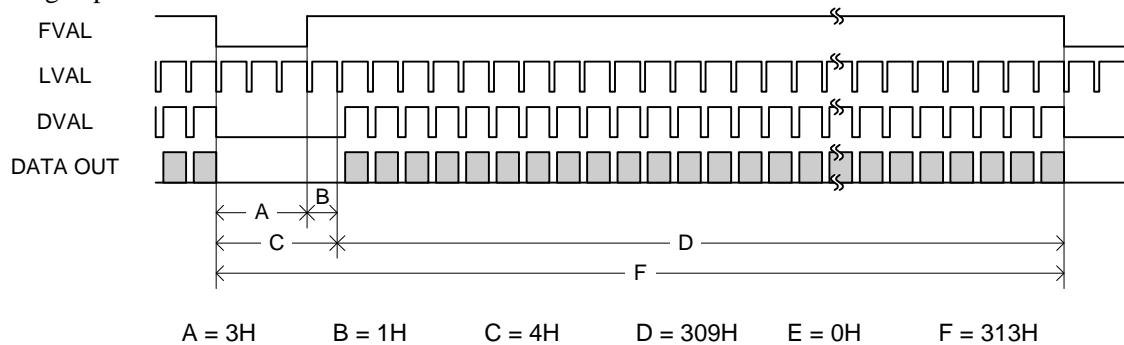
1) All pixel readout



2) Partial scan



3) High-speed draft readout



12. Guarantee

The term of a guarantee is one year after the product delivery.

If by any chance trouble by responsibility of our company occurs before an above period, TELI repairs it free of charge.

During terms of a guarantee, when the trouble cause is the case of below, TELI charges the repair costs.

- (1) Troubles and the damages that causes by misuse, unsuitable repair or remodeling.
- (2) Distribution hazards like drops and vibrations after purchase. Troubles and damages by transportation.
- (3) Troubles and damages by fire, natural calamity (earthquake, storm and flood damage, thunderbolt), damages from salty breeze, gas harm, abnormal voltage.

13. Repair

- (1) Condition for repair

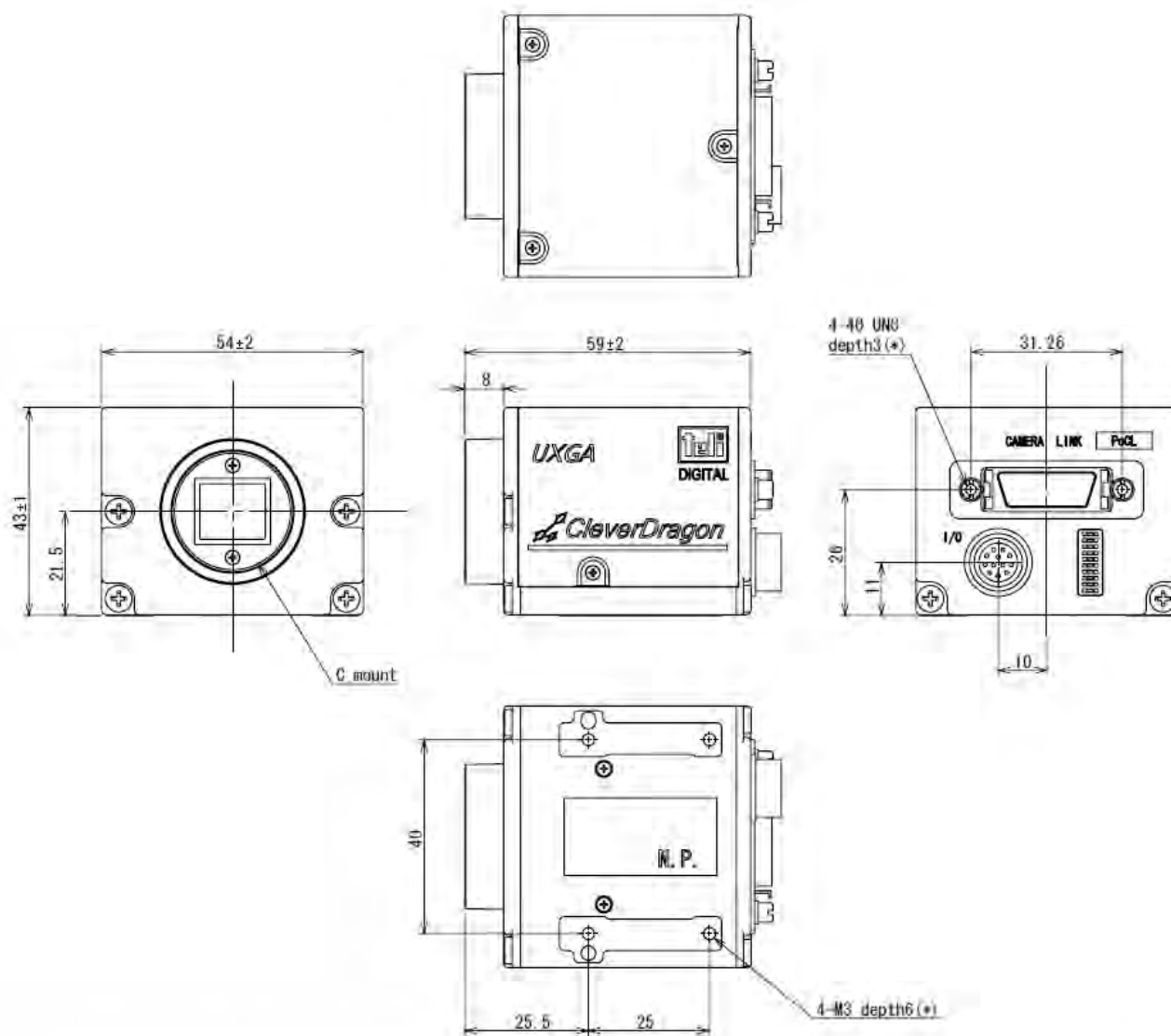
Basically, has to return it to our company when the user requests us to repair product.

Beside that, customer should pay these expenses (travel expenses, camera disassembly technology costs) of both customer and end user. Also customer should pay in themselves costs for return camera to us.

- (2) The period of repairing product

- Repair free of charge ... Refer to Clause 12.
- Charged repair Basically, repair period is 7 years after the last production end of products.

13. Outline Drawing



(*)Depth of screw that can be inserted

[UNIT] / mm



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Distributor

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