



High-Resolution CCD B/W Camera

CleverDragon series

CSCU30BC18

CSCU30BC18-01

Specification

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TOSHIBA TELI CORPORATION

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
-

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.
 - About the item which does not have a publication in the specifications and manual of this product, it considers as the outside for a guarantee.
-

NOTES ON USING THIS PRODUCT

- **Handle carefully**

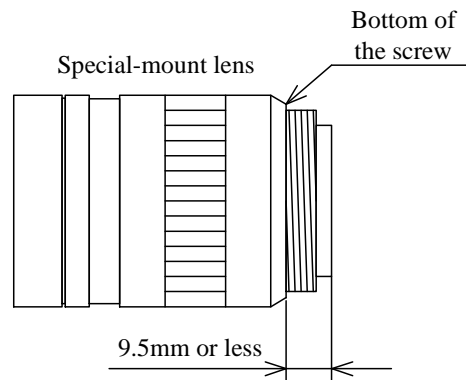
Do not drop the equipment or allow it to be subject to strong impact or vibration, as such action may cause malfunctions. Further, do not damage the connection cable, since this may cause wire breakage.

- **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.

- **About lens mount**

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



- **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 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 lighting 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.

- **About camera cable**

The connector of the camera is in "Screw-coupling" lock structure. Improper cramping might cause image noise. Be sure to give it a good cramping to avoid noise. 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.

- **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.

● **Turn OFF the power in the case of connection**

Turn OFF the power in the case of connection of connection camera cable.

Otherwise, an electric shock or a malfunction may occur.

● **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.

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 symbol is applicable for EU member states only”

1. Overview

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

| Model | Power supply | Interface |
|---------------|-----------------------|------------------------|
| CSCU30BC18 | Camera Link connector | Power over Camera Link |
| CSCU30BC18-01 | I/O Connector | Camera Link |

2. Features

(1) High resolution

High pixel density CCD (number of effective pixels 2.01M, number of total pixels 2.11M) is used.

(2) Square grids

The CCD pixels arrayed in square grids facilitates computation 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 of image output and the 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) Programming 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.

| |
|---|
| This specification subjects to change without notice. |
|---|

5. 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 specification describes the specifications in the case where the camera register is directly connected by serial transmission over the camera link interface.

5-1. Serial communication control

By Camera link serial communication interface, it is possible to control the following functions.

(1) Memory control

- Store
- Readout
- Reset

(2) Setup 104 - 530 LSB (206 steps)

(3) Gain 0 - +12 dB (150 steps)

(4) Shutter speed 1/30 – 1/65934 s, 1/89 - 1/65934 s

(5) Random shutter trigger ON / OFF

- Trigger polarity Positive / Negative

- Random trigger mode Pulse width mode / FIX mode

(6) Multiple shutter ON / OFF

* Random trigger shutter mode must be enabled.

(7) Restart reset ON / OFF

(8) High-speed draft readout ON / OFF

* Partial scan mode must be disabled.

(9) Partial scan ON / OFF

Start position of effective line

Number of effective line

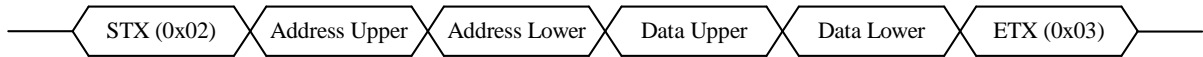
* High-speed draft readout mode must be disabled.

5-2. Command communication protocol

This camera uses the communication protocol of our standard method (where, parameters are set for the camera-initial 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

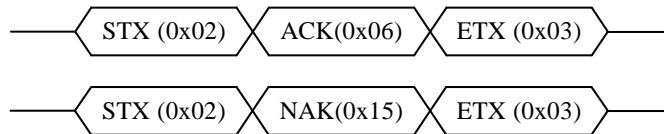
To write data to a register, send a write command as follows:



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.

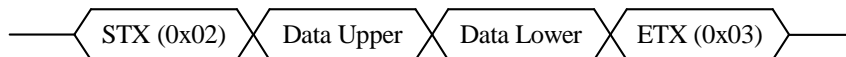
(2) Reading the register

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 follows:



5-3. 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) | "CSCU30BC18" | | | | | | | | ← |
| | 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) | | | | | | | | 0x00 |
| | 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 (0x32 ~ 0x FF) | | | | | | | | Adjustment value (0x7F) | |
| | 0x63 | Reserved | Reserved | | | | | | | | - | |
| | 0x64 | Gain | Gain (0x00 ~ 0x96) | | | | | | | | 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 | |
| | 0x6B | Random Mode | - | - | - | - | - | - | - | - | 1:PLS 0:FIX | |
| | 0x6C | Reserved | Reserved | | | | | | | | - | |
| | 0x6D | Reserved | Reserved | | | | | | | | - | |
| | 0x6E | Update (Write Only) | - | - | - | - | - | - | - | - | 1:EXEC | - |
| | 0x6F | Reserved | Reserved | | | | | | | | - | |
| | 0x70 | Draft Mode | - | - | - | - | - | - | - | - | 1:ON 0:OFF | 0x00 |
| | 0x71 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 | | |

This specification subjects to change without notice.

| | | | | | | | | | | |
|---------------------|-------------------|---------------------------------|-------------------------------|---|---|---|---|---|--|-------|
| | 0x85 | Partial V Start(U) | - | - | - | - | - | | | |
| | 0x86 0x87 | Reserved | Reserved | | | | | | | - |
| | 0x88 | Partial Height(L) | Partial Height (0x1E ~ 0x4D4) | | | | | | | 0x213 |
| | 0x89 | Partial Height(U) | - | - | - | - | - | | | |
| | 0x8A 0x8F | Reserved | Reserved | | | | | | | - |
| | 0x90 | Output Bit | - | - | - | - | - | - | 0x00: 12bit 0x01: 10bit 0x02: 8bit | 0x00 |
| Expansion Registers | 0x91 0x94 | Reserved | Reserved | | | | | | | - |
| | 0x95 | Expansion Status (Read Only) | Expansion Status | | | | | | | 0x00 |
| | 0x96 0xFF | Reserved | Reserved | | | | | | | - |

5-4. 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 |

5-5. 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.

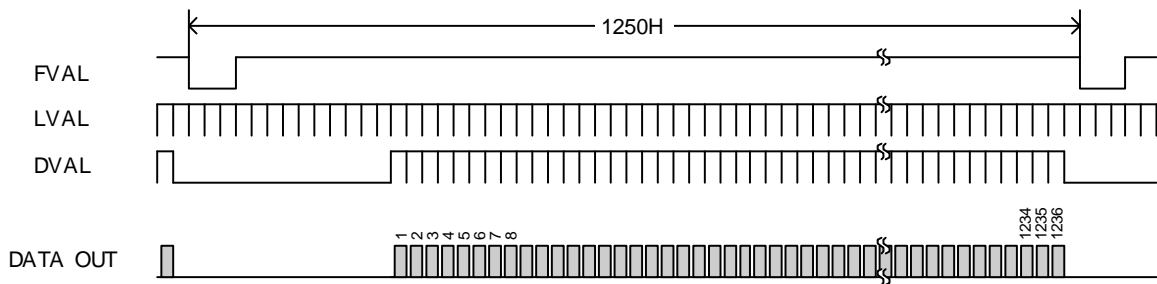
5-6. Readout mode

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:

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

- 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.



- 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 183 fps 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.

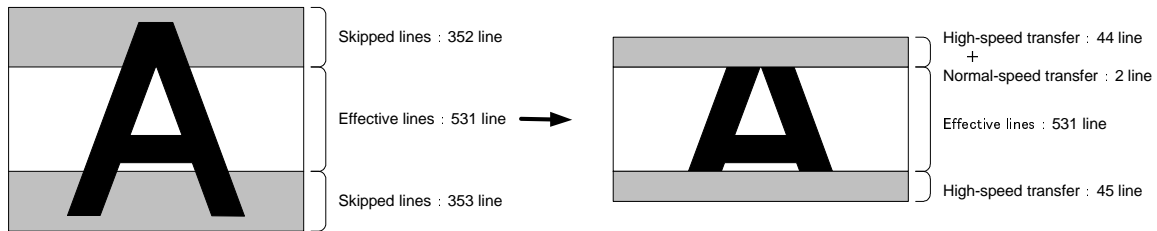
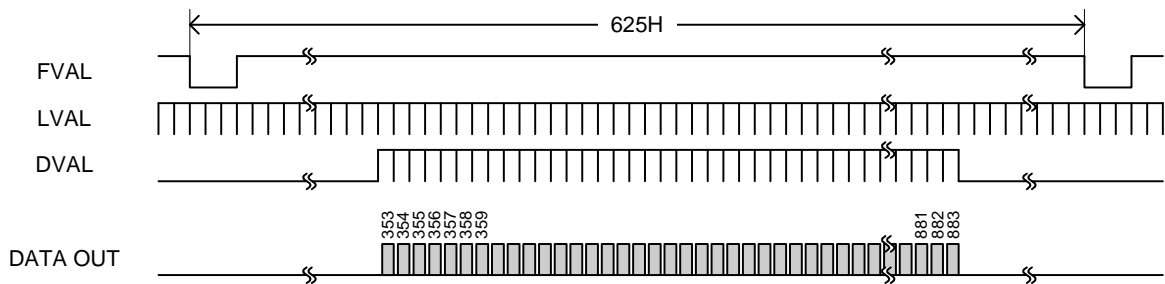
This specification subjects to change without notice.

The frame rate is obtained in the following calculations.

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

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

Example: 531 effective lines (60 fps) and start 353 line eyes (center partial)



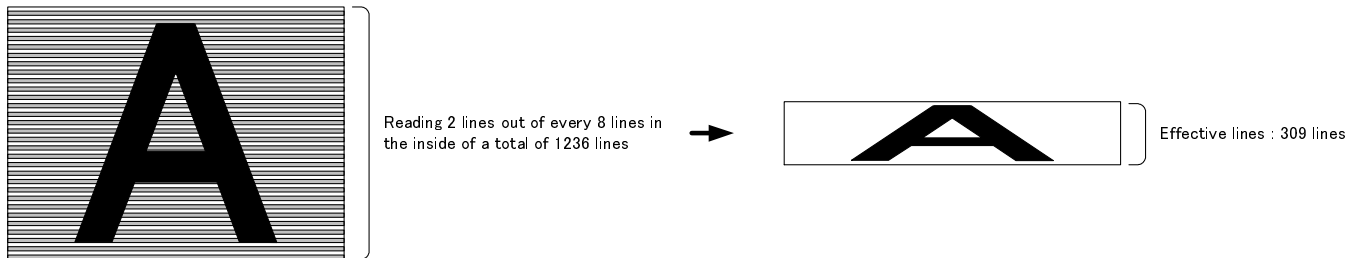
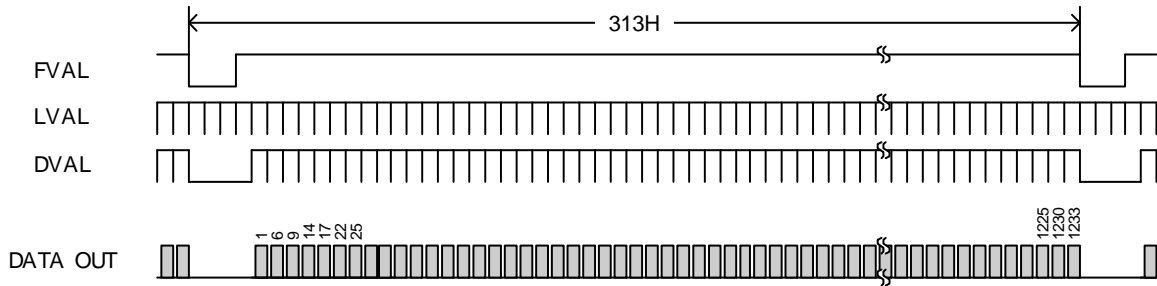
<Example of calculating frame rate for the above-mentioned>

$$FrameRate = \left[3 + \left\{ \left(\frac{352 + 15}{8} \right) + 1 \right\} + 531 + \left\{ \frac{1236 - (352 + 531) + 13}{8} \right\} \right]^{-1} \times \frac{72 \times 10^6}{1920}$$

$$= \frac{72 \times 10^6}{[3 + \{46.875\} + 531 + \{45.75\}] \times 1920}$$

$$= \frac{72 \times 10^6}{[3 + 46 + 531 + 45] \times 1920} = \frac{72 \times 10^6}{625 \times 1920} = 60 \text{ fps}$$

- 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.



5-7. Setup **Address: 0x62, Bit: 0 to 7, Value: 50 to 255**

You can set a level (pedestal).

| Setup (calculated value) | Setting range | Calculation formula |
|--------------------------|---------------------------|---------------------|
| 104 ~530 LSB | 0x32 ~ 0xFF (50 ~ 255) | 2.08 x Setup |

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

5-8. 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 ~ +14 dB | 0x00 ~ 0x96 (0 ~ 150) | 0.09375 x Gain |

Notes on gain setting:

It is possible to set a maximum of +14 dB (Calculation value) but the warranty range for this product is 0 to +12 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.

This specification subjects to change without notice.

5-9. 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

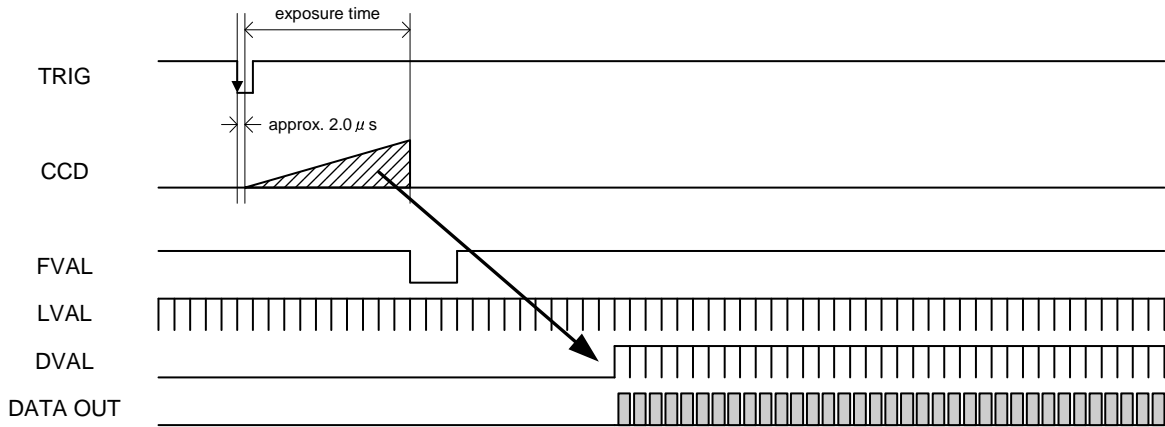
5-10. Random trigger shutter Address: 0x6A, Bit: 0, Value: 1

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.
- 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.

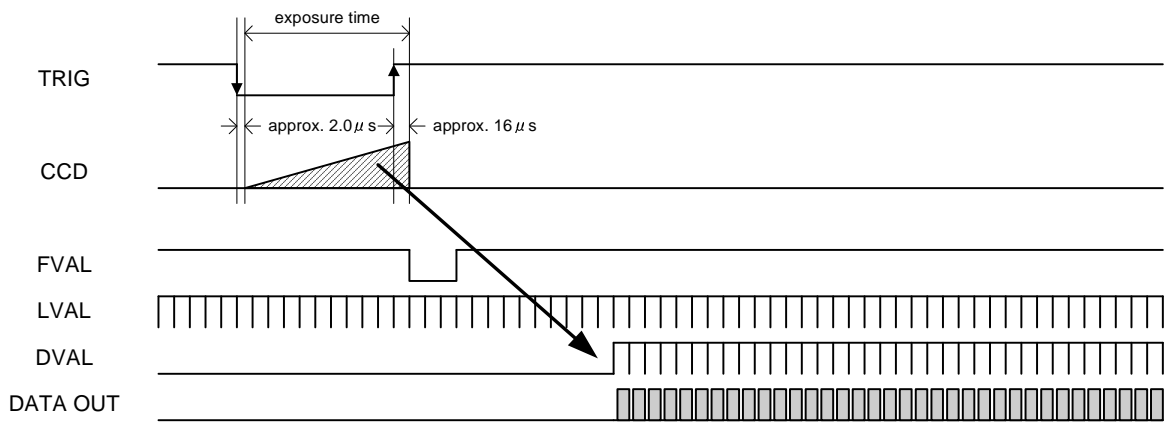
1) Fixed mode **Address: 0x6B, Bit: 0, Value: 0**

- 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**

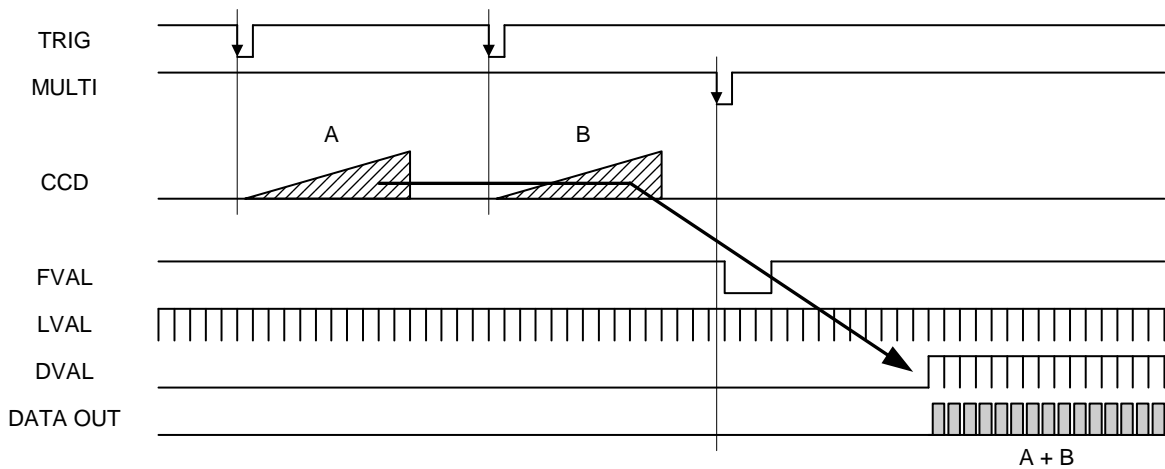
- The exposure time is determined by the pulse width.
- Exposure time = pulse width + approximately 14 μs
- Set a pulse width of 1H (approximately 26.7 μs) or more.
- FVAL is output in sync with the first LVAL after the end of exposure time.



5-11. Multiple shutter **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 extended 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 μ 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.

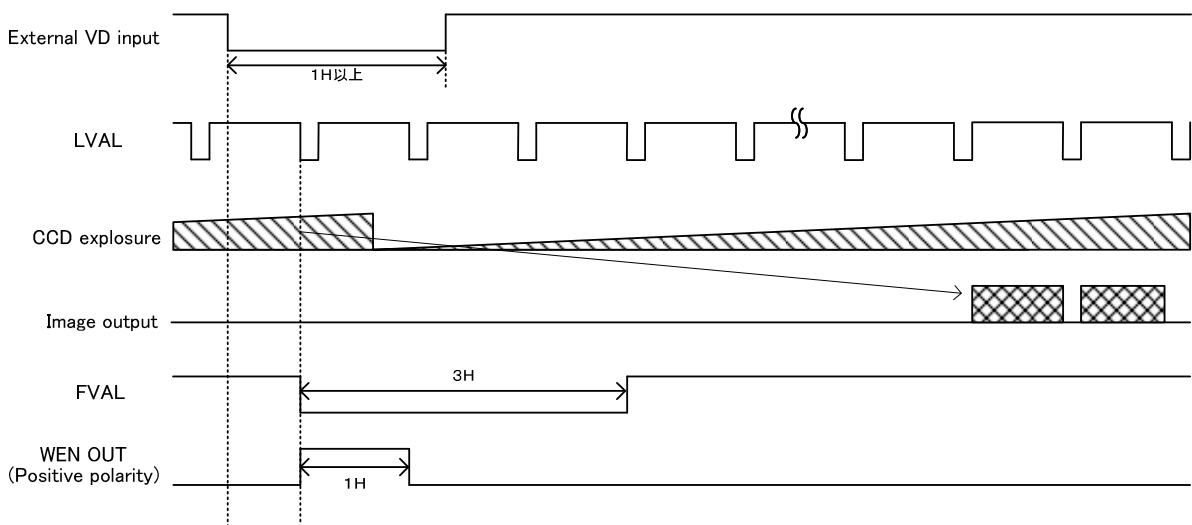
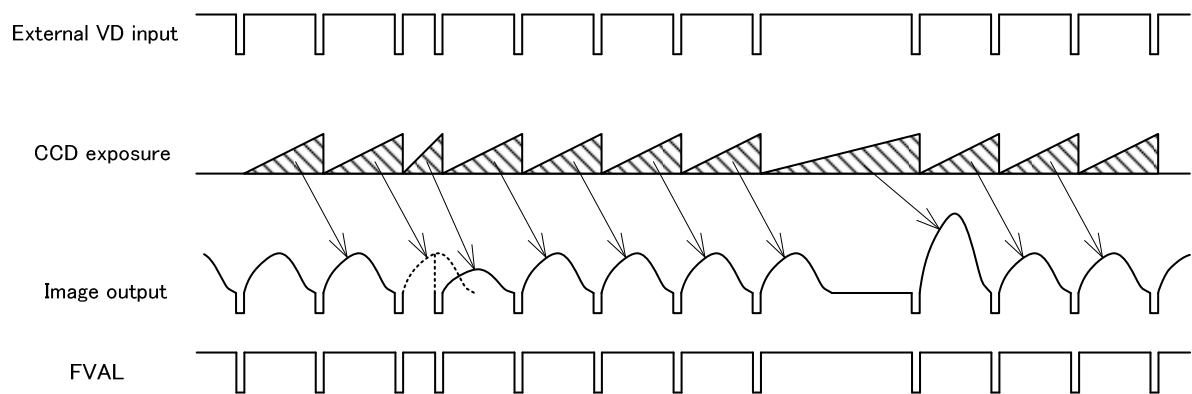
And, Electric charge is superimposed in CCD device when the multiplex exposure. Therefore, CCD will flood with electric charge when electric charge is over superimposed in CCD device. Consequently vertical stripes noise will appear. At that time please stop using spotlight and dimmer for example close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

This specification subjects to change without notice.

5-12. Restart reset mode **Address: 0x6A, Bit: 4, Value: 1**

In the restart reset mode, it take a picture of the image according to arbitrary timing by the VD signal input from the outside, and it possible to take it. A low-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.



5-13. Saving 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.

5-14. 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.

6. Specifications

[Electrical specification]

| | |
|-----------------------------------|---|
| (1) Image sensor | Interline CCD |
| ·Number of total pixels | 1688 (H) x 1248 (V) |
| ·Number of effective pixels | 1628 (H) x 1236 (V) |
| ·Pixel size | 4.4 μ m (H) x 4.4 μ m (V) |
| ·Optical size | 1/1.8 type |
| (2) Scan method | Progressive |
| (3) Aspect ratio | 4:3 |
| (4) Synchronization method | Internal synchronization |
| (5) Standard subject illumination | 600 lx, F5.6, 3000 K |
| (6) Minimum subject illumination | 6 lx (F1.4, Gain max, all pixel readout, video level 50%) |
| (7) Video output | Compliant with the camera link standard. |
| Data | 12 / 10 / 8 bit switching |
| 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 mode | Approximately 89 fps / 1628(H) x 309(V) |
| (8) Gain | 0 to +12 dB (150 levels)(initial factory setting: 0 dB) |
| (9) Setup | 104 to 530 LSB (206 levels) (initial factory setting: 264 LSB (calculated value)) |
| (10) Gamma correction | OFF($\gamma = 1.0$) fixed |
| (11) Power supply voltage | DC+12V (10.8 to 13.2 V)(ripple 50 mV(p-p) or less) |
| (12) Power consumption | Typical: Approximately 4.0 W (initial factory setting: All pixel readout) Max: Approximately 4.5 W (50 lines 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 standard according to 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 signal specification]

- (1) Shutter speed
 - Readout mode
 - All pixel readout 1/30 to 1/65934 s (1250 levels)
 - Partial scan 1/30 to 1/65934 s (1250 levels)
 - High-speed draft readout 1/89 to 1/65934 s (313 levels)
- (2) Random shutter trigger 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.
- (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 72.000MHz
- (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 183.824 Hz
 - 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 to 10 ms
- (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 |

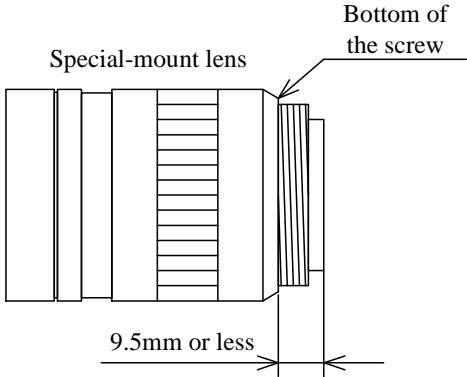
[Mechanical specification]

(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 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 170 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 guaranteed
 - 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)
- (4) EMC conditions
 - EMI (Electro-Magnetic Interference) EN61000-6-4
 - EMS (Electro-Magnetic Susceptibility) EN61000-6-2
- (5) FCC FCC Part 15 Subpart B class A

* About the conformity of EMC standard of this machine, it has guaranteed in the conditions combined with our system condition. When used combined 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.

This specification subjects to change without notice.

[Communication specification]

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

[Connector pin assignment]

- (1) Video output/controlling connector (Camera Link Base Configuration) CAMERA LINK

Output 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: MDR26-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.

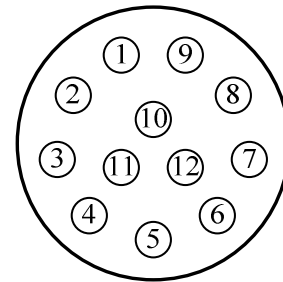
(2) Connector for power supply and sync signal input/output I/O

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)

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

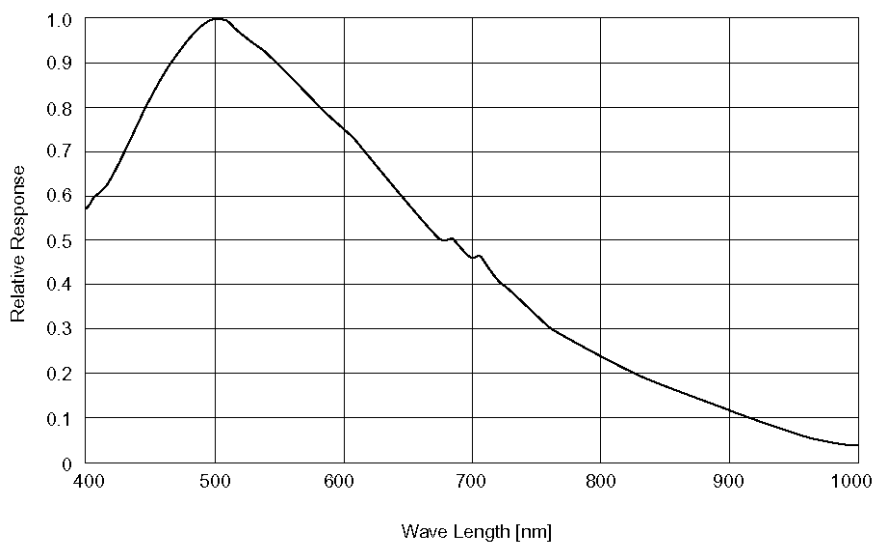


Rearview

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

[Typical spectral response]

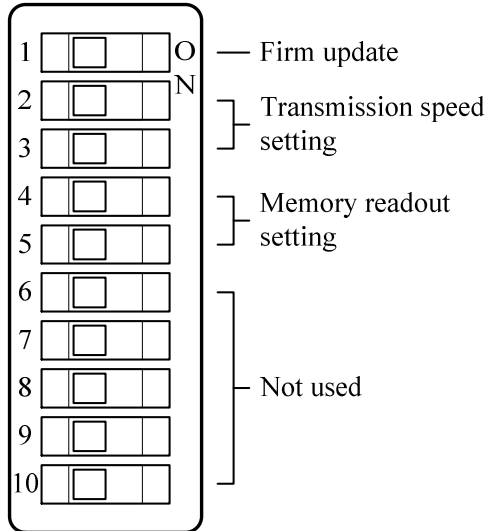
The lens characteristics and light source characteristics is not reflected in table.



This specification subjects to change without notice.

[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 setting the 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

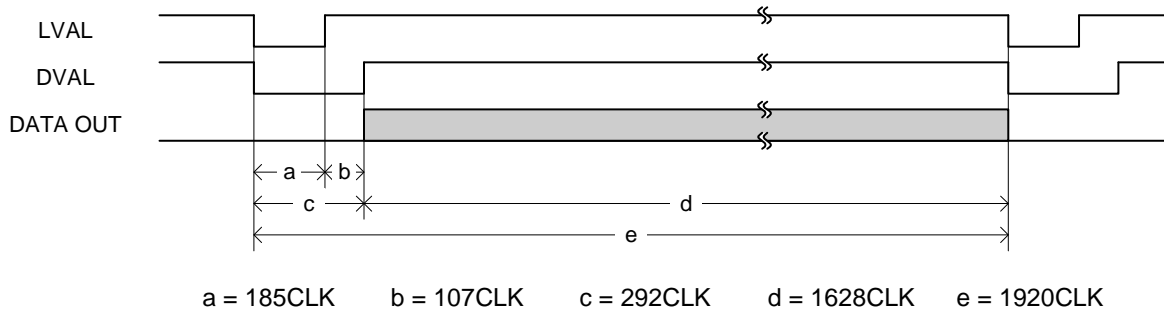
It is changeover switch for the CPU firm in the camera update. Please use it by turning off usually.

This specification subjects to change without notice.

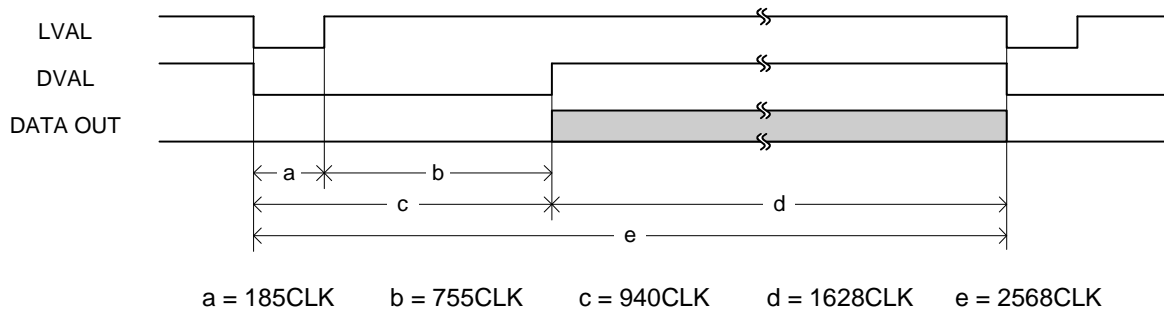
7. Timing chart

(1) Horizontal timing

1) All pixel readout, Partial scan

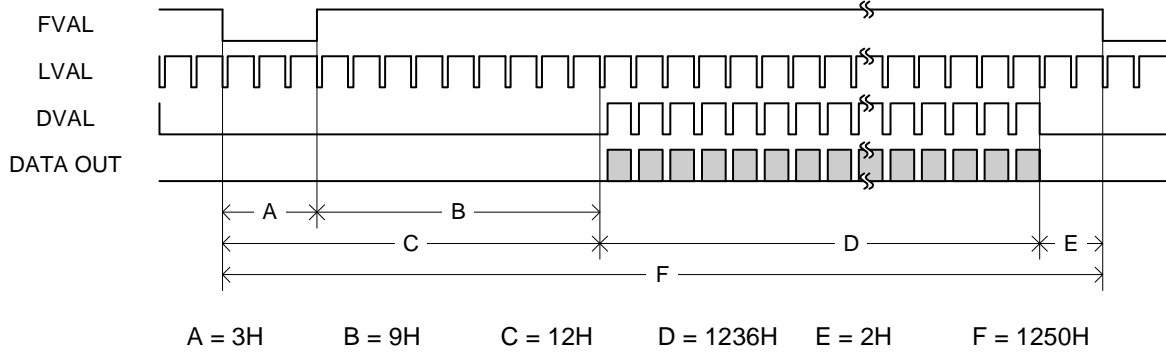


2) High-speed draft readout

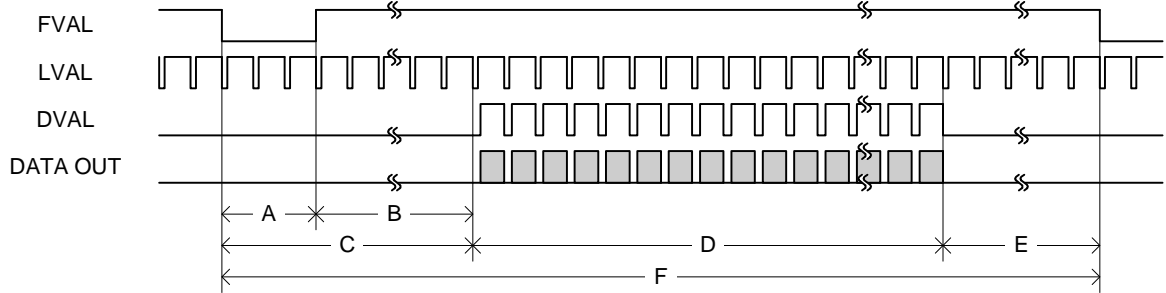


(2) Vertical timing

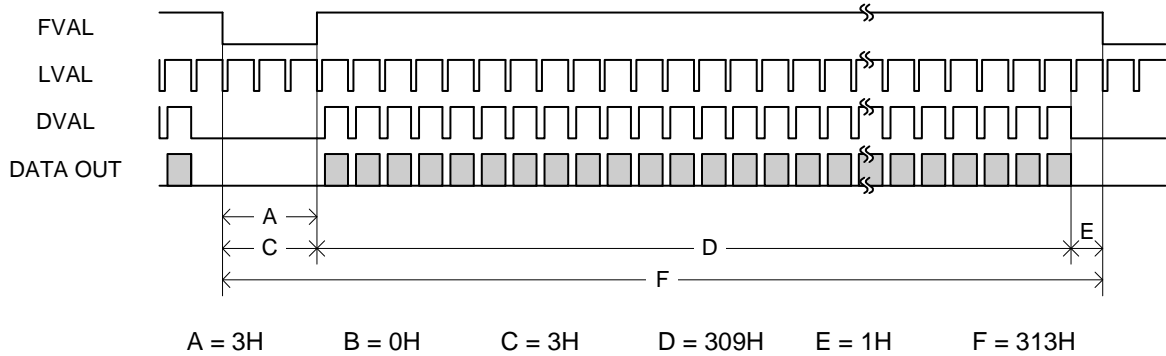
1) All pixel readout



2) Partial scan

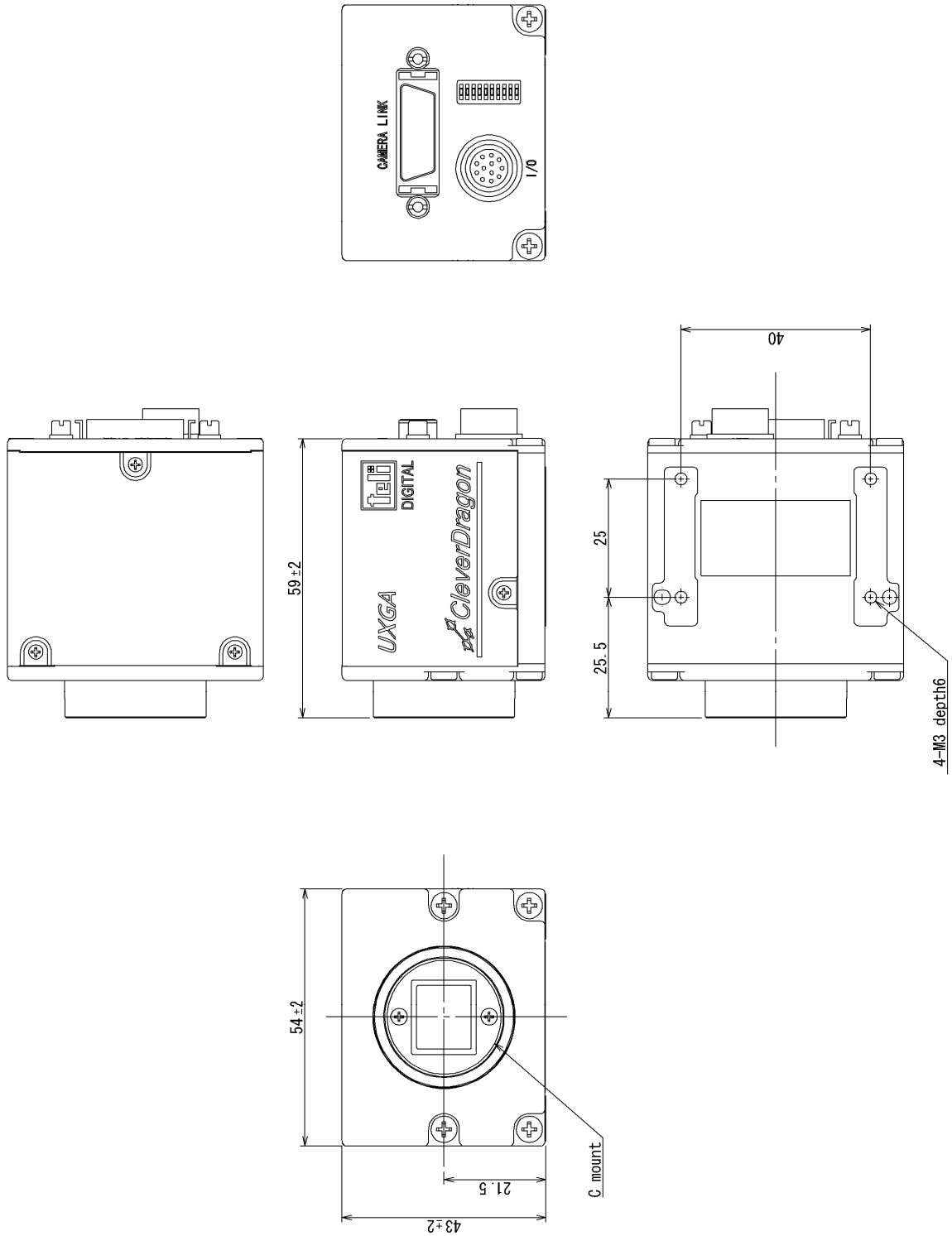


3) High-speed draft readout



This specification subjects to change without notice.

8. Outline Drawing



Sep. 07. 2009

This specification subjects to change without notice.

Documents No. D4167407A

9. 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.

10. 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 9.
- Charged repair Basically, repair period is 7 years after the last production end of products.



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