



High-Resolution CCD B/W Camera

Model CS3960DCL

Instruction Manual

Thank you for purchasing our product.

Before using this CCD B/W 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.

Contents

Safety Precautions

1. Overview	1
2. Features	1
3. Configuration	1
4. Optional parts	2
5. Name of Each Parts	2
6. Installing the camera	3
7. Connection	4
8. Functions	5
9. Before determining it as being a fault	13
10. Specifications	14
11. Recommended Frame Grabber Board - Input Module	19
12. Outline Drawing	20

TOSHIBA TELI CORPORATION

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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.

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.

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.

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 communication.

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.

1. Overview

This CCD B/W camera is a high-resolution camera that features all pixel readout mode 2/3 CCD.

2. Features

(1) High resolution

High pixel density CCD (number of effective pixels 1.45 M, number of total pixels 1.50 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

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, the shot image can be transferred to PC at high speed, and various camera controls can be performed from PC.

(5) All-pixel readout mode (normal mode)

All pixel signals (in the effective area) are output in approximately 1/30 second.

(6) Partial scan mode

Partial scanning of 400 lines in the center of the screen 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 in 1/100 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 | Model name: 14B26-SZLB-***-0LC |
| (3) Camera mounting kit | Model name: CPT4000CL |
| (4) Camera adapter | Model name: CA170 |

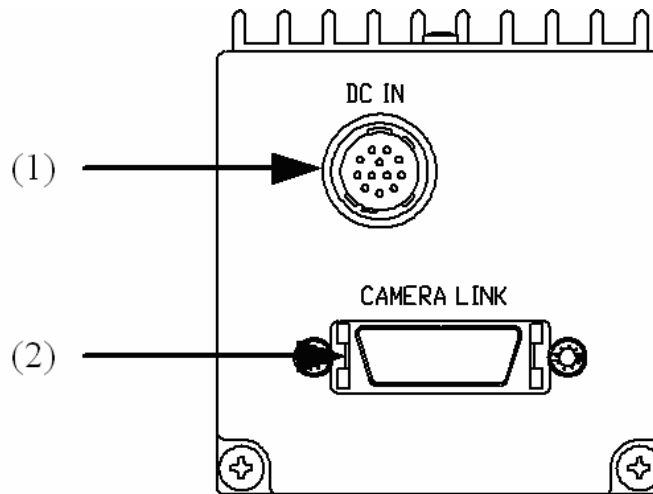
*NOTE: Application software is not supplied as a standard item.

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) Connector for power supply and sync signal input/output DC IN

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	+12V
3	-	GND
4	-	N.C.
5	-	GND
6	-	N.C.
7	-	N.C.
8	-	GND
9	-	N.C.
10	O	WEN
11	I	TRIG
12	-	GND

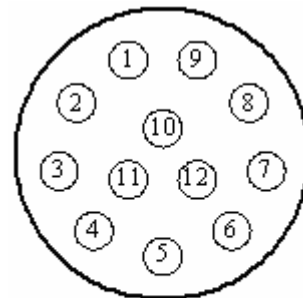


Figure seen from the back of main body

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

Outputs video signals and VALID, based on the camera link standard LVDS.

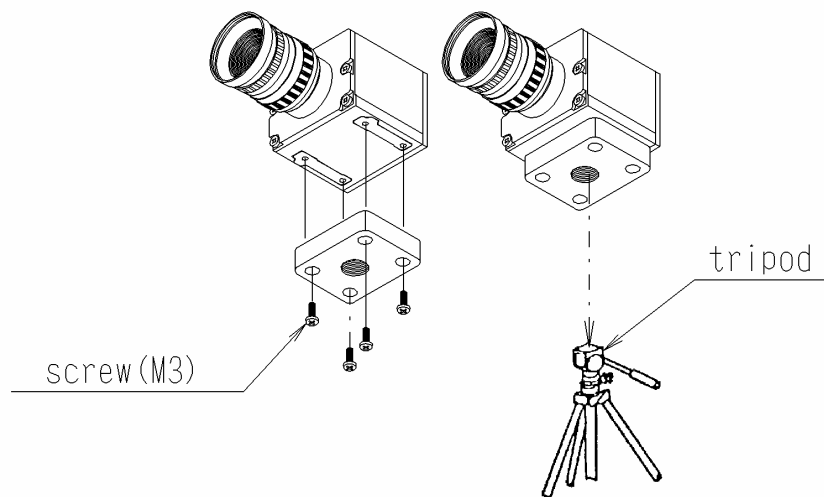
This connector is connected to the frame grabber board, image processing device and others.

- Connector model: DR 26-PIN connector 10226-2210VE (manufactured by 3M).

Pin No.	I/O	Signal Name	Pin No.	I/O	Signal Name
1	-	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	-	GND

6. Installing the camera

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

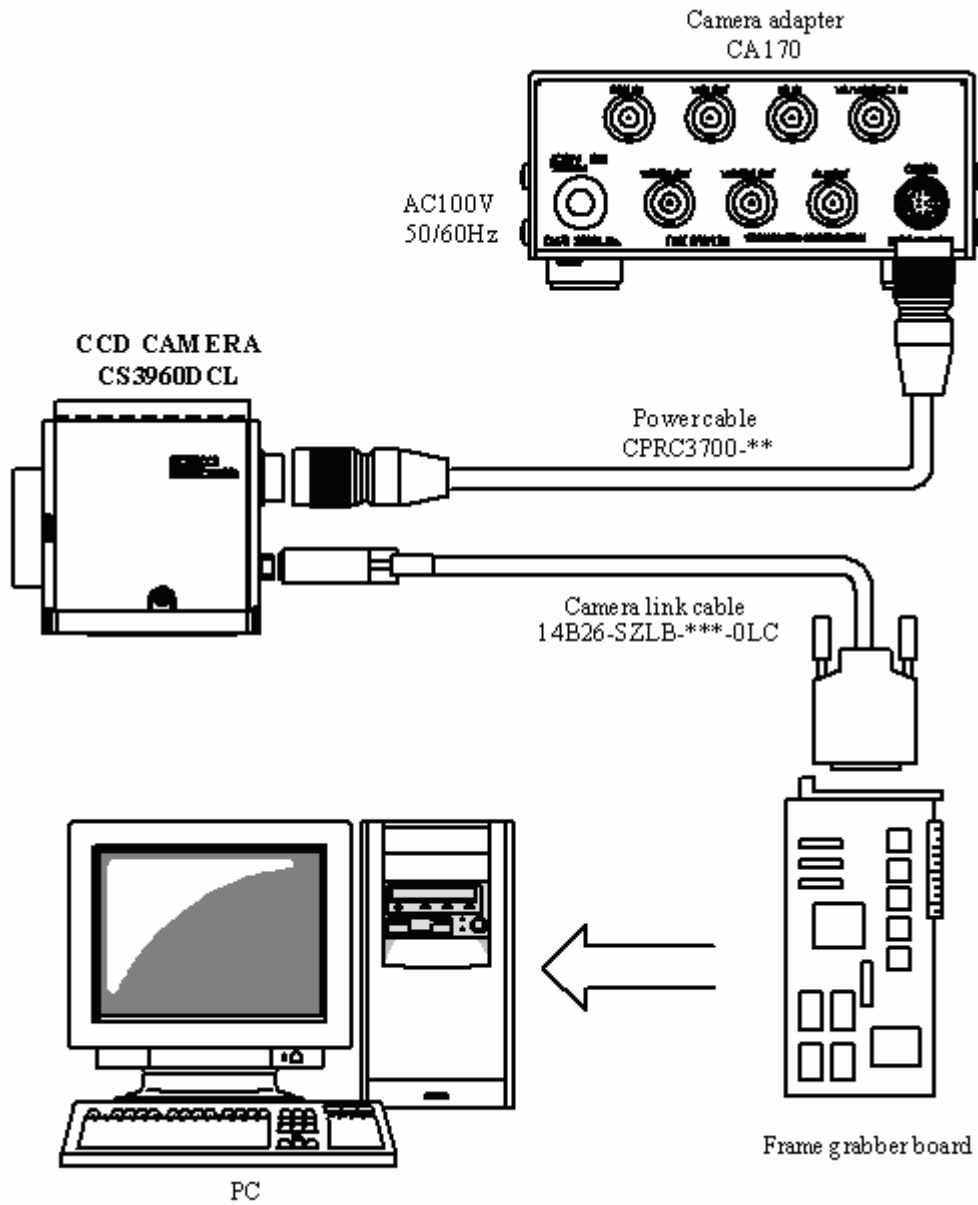


- (2) When you fix the camera by using the mounting screw hole on the camera body, use an M3 screw (6 [mm] or less for the portion to be inserted into the inside of the camera body).

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. 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.

8.1 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.

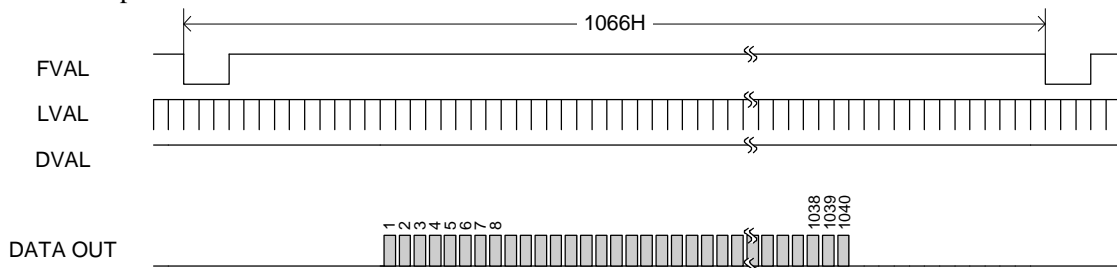
(2) Readout mode

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:

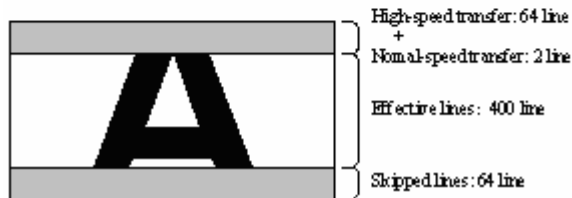
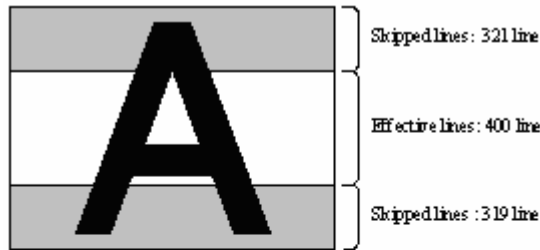
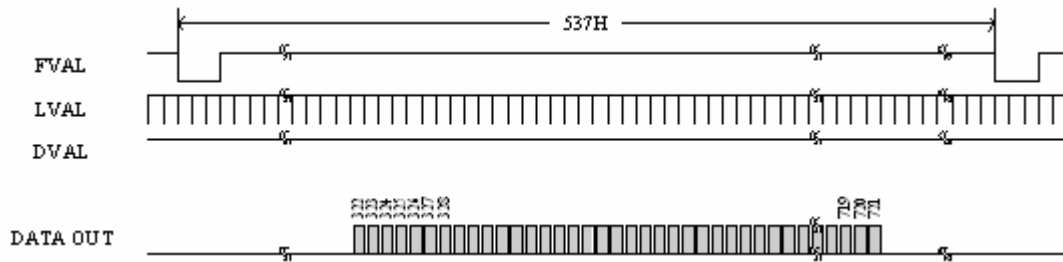
- 1) All pixel readout : Approximately 30 [fps] / 1392(H) x 1040(V)
- 2) Partial scan : Approximately 60 [fps] / 1392(H) x 400(V)
- 3) High-speed draft readout : Approximately 100 [fps] / 1392(H) x 260(V)

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

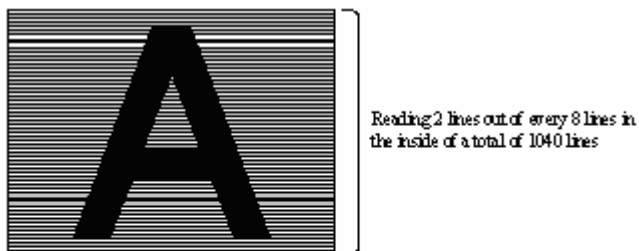
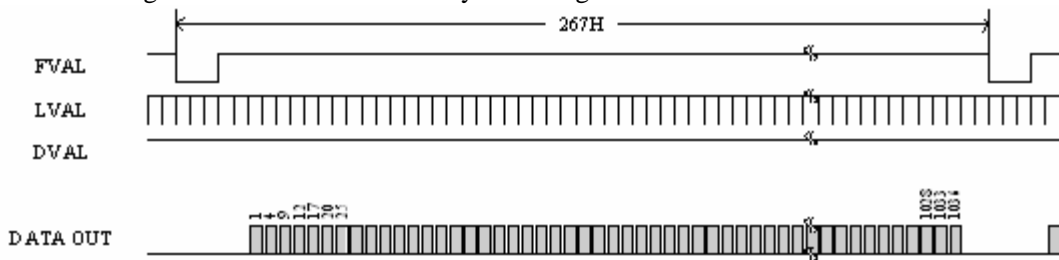
Reads out all pixels in about 1/30 second.



- 2) Partial scan Address:0x70, Bit:0, Value:0 and Address:0x81, Bit:0, Value:1
 Skips the top and bottom of the effective area and reads out 400 lines in the center area in approximately 1/60 second.



- 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 1/100 seconds.
 Control and setting of functions can be done by accessing the cam



(3) Setup Address:0x62, Bit:0 to 7 and Address:0x63, Bit:0 to 1 Value:-512 to 511

You can set a setup level (pedestal).

The setup level is internally preset to the plus direction.

Therefore, if you set the upper limit value of the camera register, the setup level may be unable to be changed further.

Setup (calculated value)	Setting range	Calculation formula
-248 ~ 264 ~ 511 LSB	0x200 ~ 0x000 ~ 0x1FF (-512 ~ 0 ~ 511)	264 + Setup LSB

(4) Gain Address:0x64, Bit:0 to 7, Value:0 to 255

You can set Gain (video gain).

Gain (calculated value)	Setting range	Calculation formula
0 ~ +12 dB	0x00 ~ 0xFF (0 ~ 255)	$20 \times \log\left(\frac{\text{Gain}}{255} \times 3 + 1\right)$ dB

Notes on gain setting:

- 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) Electronic shutter Address:0x68, Bit:0 to 7, Value:0 and Address:0x66, Bit:1, Value:1

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 to 1/10,000 s	0xFF to 0x00 (255 to 0)	_____
Partial scan	1/30 to 1/60 s	0xFF to 0xE0 (255 to 224)	Shutter off. The digital gain is applied at the camera side so that the equivalent setting value can be obtained with the same setting value as for the all pixel readout.
	1/60 to 1/10,000 s	0xDF to 0x00 (223 to 0)	_____
High-speed draft readout	1/100 s	0xFF to 0xBB (255 to 187)	Shutter off. The digital gain is applied at the camera side so that the equivalent setting value can be obtained with the same setting value as for the all pixel readout.
	1/100 to 1/10,000 s	0xBA to 0x00 (186 to 0)	To correct brightness difference due to the difference of the shutter speed from that for all pixel readout, a little bit digital gain is applied at the camera side. This enables you to achieve the equivalent brightness with the same setting value as for all pixel readout.

* To make the electronic shutter active, turn the camera register shutter to ON.

For the shutter speed for the setting value, see the electronic shutter table.

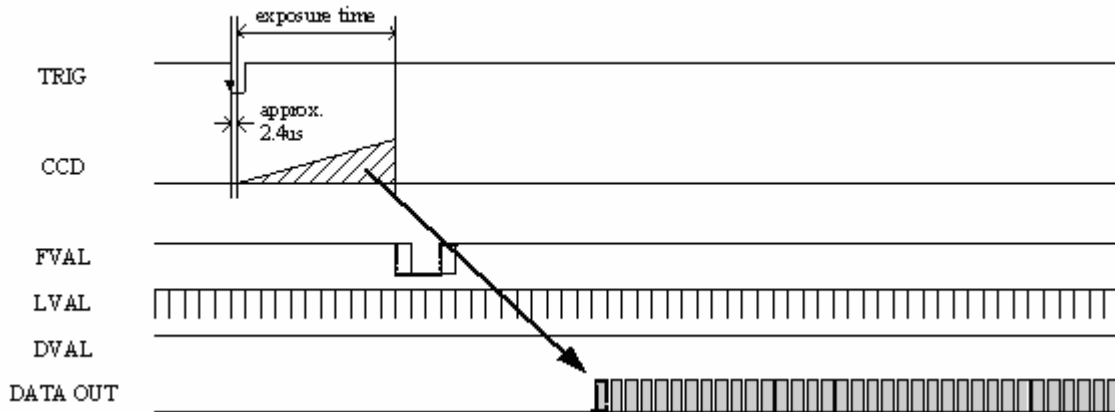
(6) Random trigger shutter Address:0x6A, Bit:0, Value:1

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 DC IN 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.
- * When AE is active, random trigger shutter setting is disabled.

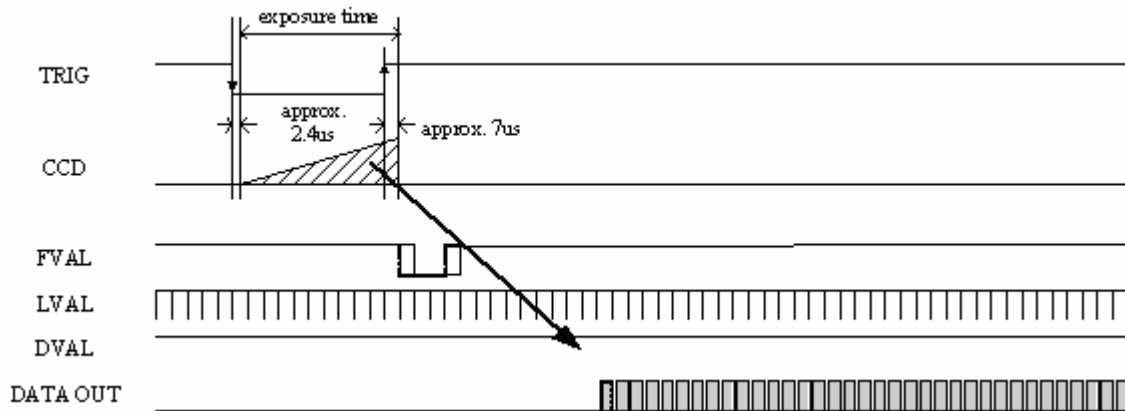
1) Fixed mode Address:0x6B, Bit:0, Value:0

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



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

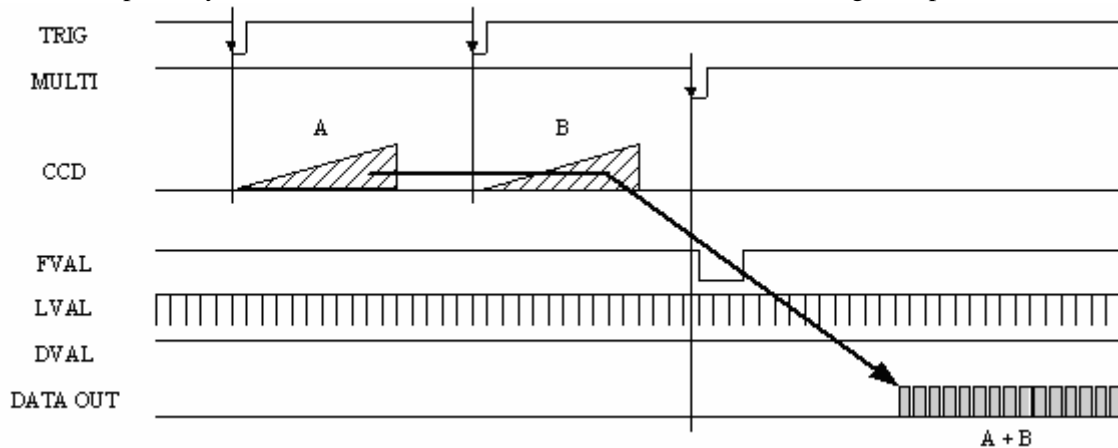
- The exposure time is determined by the pulse width (exposure time = pulse width + approximately 5µs).
- Set a pulse width of 1H (approximately 31.25µs) or more.
- FVAL is output in sync with the first or next LVAL after the end of exposure time.



(7) 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 31.25 μ s) to 10 ms.
- FVAL is output in sync with the first or next LVAL after the end of MULTI signal input.



(8) 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 tables. For each table, you can save/readout the setting value independently, as well as reset the setting value to the initial factory setting.
- The number of the memory bank to be read out when the power supply is turned on is fixed to Bank0.

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.

(9) Output bit

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

8.2 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

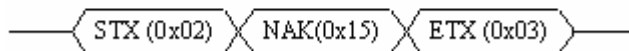
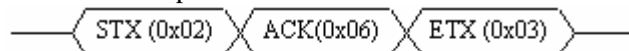
To write data to a register, send a write command as follows.



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



The camera responds to the write command as follows.



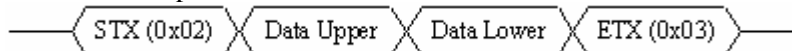
(2) Reading the register

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.



8.3 Register Map

	Adr	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Base Registers	0x00 0x0B	Vendor Name (Read Only)	"TOSHIBA TELP"							
	0x0C 0x0F	Reserved	Reserved							
	0x10 0x18	Model Name (Read Only)	"CS3960DCL"							
	0x19 0x1F	Reserved	Reserved							
	0x20 0x26	Serial Number (Read Only)	Serial Number							
	0x27 0x2F	Reserved	Reserved							
	0x30 0x3F	CPU Version (Read Only)	ex. "V01.01.01"							
Self Check Registers	0x40	Self Check (Read Only)	Self Check Result							
	0x41	Status (Read Only)	Status Code							
	0x42 0x4F	Reserved	Reserved							
Memory Registers	0x50	Memory Information (Read Only)	Number of Memory Bank in This Camera (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
Base Function Registers	0x60	Reserved	Reserved							
	0x61	Reserved	Reserved							
	0x62	Setup(L)	Setup (0x200(-512) ~ 0x000(0) ~ 0x1FF(+511))							
	0x63	Setup(U)	-	-	-	-	-	-		
	0x64	Gain(L)	Gain (0x00 ~ 0xFF)							
	0x65	Gain(U)	-	-	-	-	-	-	-	-
	0x66	Shutter/ Multiple	-	-	-	-	-	-	Shutter 1:ON 0:OFF	Multiple 1:ON 0:OFF
	0x67	Reserved	Reserved							
	0x68	Shutter Speed(L)	Shutter Speed (0x00 ~ 0xFF)							
	0x69	Shutter Speed(U)	-	-	-	-	-	-	-	-
	0x6A	Shutter Mode	-	-	-	-	-	-	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
	0x71 0x80	Reserved	Reserved							
	0x81	Partial Scan	-	-	-	-	-	-	-	1:ON 0:OFF
	0x82 0x8F	Reserved	Reserved							
0x90	Output Bit	-	-	-	-	-	-	-	0x00: 12bit 0x01: 10bit 0x02: 8bit	
Expansion Registers	0x91 0x94	Reserved	Reserved							
	0x95	Expansion Status(Read Only)	Expansion Status							
	0x96 0xFF	Reserved	Reserved							

8.4 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

9. 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 lens aperture is not closed. - Check that the grabber board is installed and set up correctly.
Frame drop occurs on shooting image	- 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 that the grabber board is installed and set up correctly.

10. Specifications

[Electrical specification]

(1) Imager	Interline CCD
· Number of total pixels	1434 (H) x 1050 (V)
· Number of effective pixels	1392 (H) x 1040 (V)
· Pixel size	6.45 μm (H) x 6.45 μm (V)
· Optical size	2/3 type
(2) Scan method	Progressive
(3) Aspect ratio	4:3
(4) Synchronization method	Internal synchronization
(5) Standard subject illuminance	400 lx, F5.6, 3000 K
(6) Minimum subject illuminance	4 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 / 1392(H) x 1040(V)
Partial scan	Approximately 60 fps / 1392(H) x 400(V)
High-speed draft readout	Approximately 100 fps / 1392(H) x 260(V)
(8) Gain	0 to +12 dB (256 levels)
(9) Setup	Approximately -248 to +511 LSB (1 LSB steps)
(10) Gamma correction	OFF($\gamma=1.0$) fixed
(11) Power supply voltage	DC12 V \pm 10% (ripple 50 mV(p-p) or less)
(12) Power consumption	Approximately 3.6 W

[Electronic shutter specification]

(1) Shutter speed	
· Readout mode	
All pixel readout	1/30 to 1/10,000 s
Partial scan	1/60 to 1/10,000 s
High-speed draft readout	1/100 to 1/10,000 s
(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.
(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.

[Internal sync signal specification]

(1) Driving frequency	57.28 MHz
(2) Scanning frequency	
· Readout mode	
All pixel readout	Horizontal 32.00 kHz
	Vertical 30.00 Hz
Partial scan	Horizontal 32.00 kHz
	Vertical 59.59 Hz
High-speed draft readout	Horizontal 26.92 kHz
	Vertical 100.81 Hz

[Input signal specification]

(1) TRIG	Camera link I/F and DC IN connector input
· Signal level (DC IN input)	TTL level
· Polarity	Positive/Negative polarity switching possible
· Pulse width	31.25 μ s or more
(2) MULTI	Camera link I/F input
· Polarity	Negative polarity
· Pulse width	31.25 μ s to 10 ms

[Output signal specification]

(1) WEN	DC IN connector output
· Signal level	4 V (p-p)
· Polarity	Positive polarity
· Pulse width	Approximately 31.25 μ s

[Dimensions]

(1) Lens mount

C-mount

*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.

(2) Flange back

17.526 mm

(3) Dimensions

55 mm (W) x 60 mm (H) x 63 mm (D)

(4) Mass

Approximately 190 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)

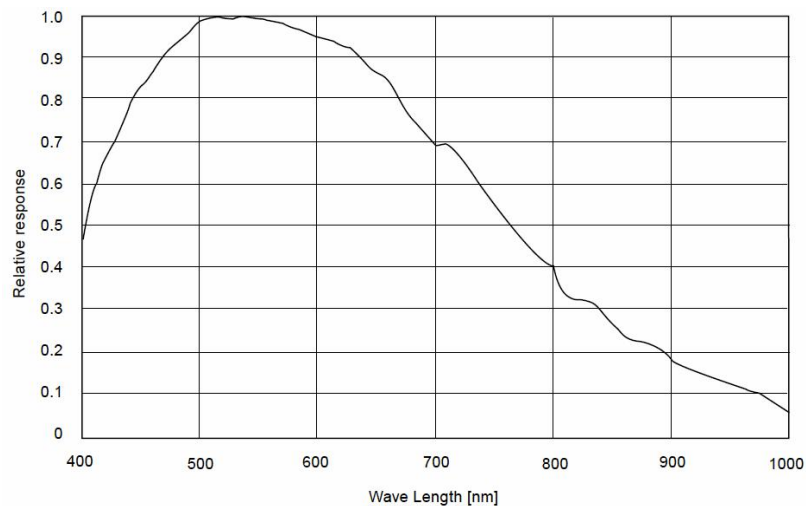
(2) Operating assurance

Temperature -5 to 45 °C

Humidity 90 % or less (no condensation)

[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

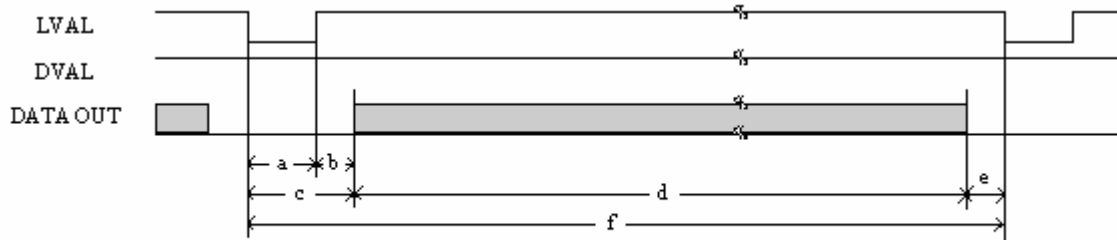
[Communication specification]

- (1) Communication speed 9600 bps
- (2) Data bit None
- (3) Parity 8
- (4) Stop bit 1
- (5) Parity bit None
- (6) Handshake None

[Timing chart]

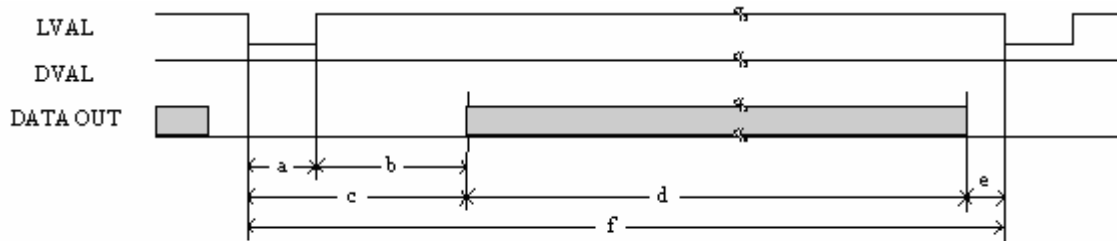
(1) Horizontal timing

1) All pixel readout, Partial scan



a = 276CLK b = 104CLK c = 380CLK d = 1392CLK e = 18CLK f = 1790CLK

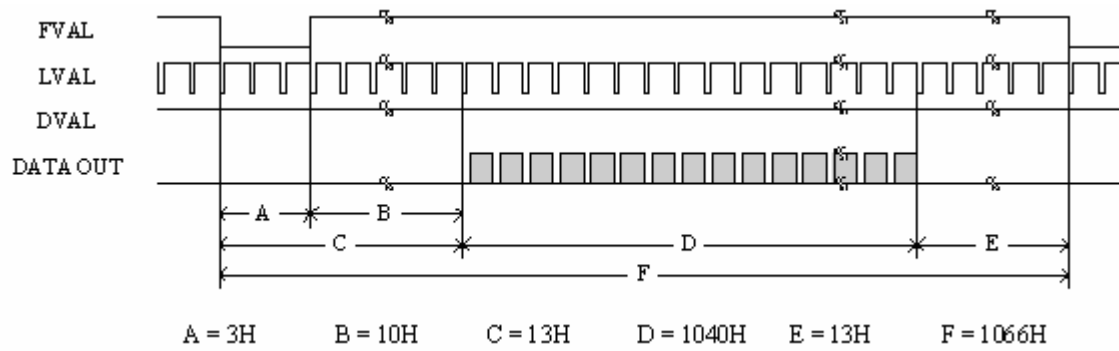
2) High-speed draft readout



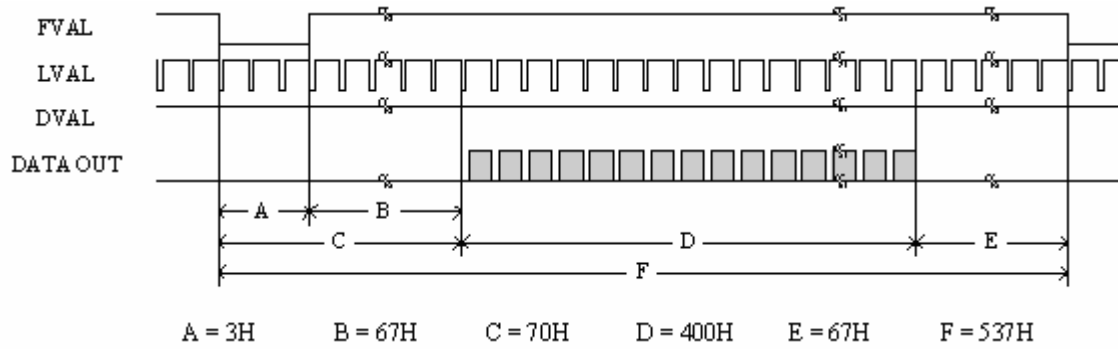
a = 276CLK b = 442CLK c = 718CLK d = 1392CLK e = 18CLK f = 2128CLK

(2) Vertical timing

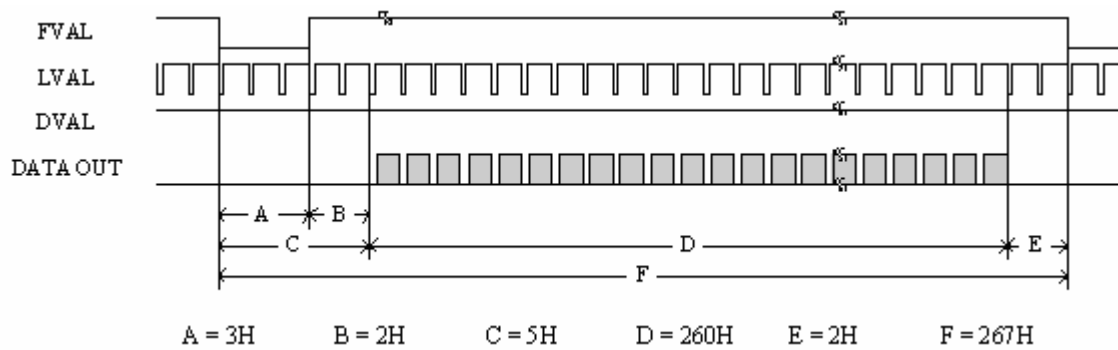
1) All pixel readout



2) Partial scan



3) High-speed draft readout



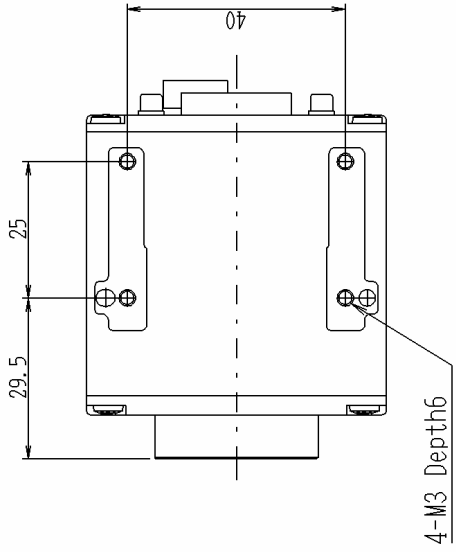
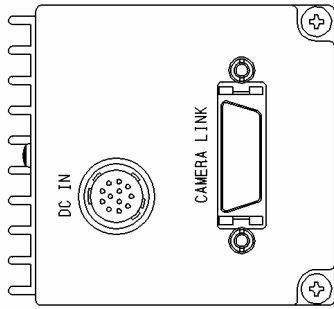
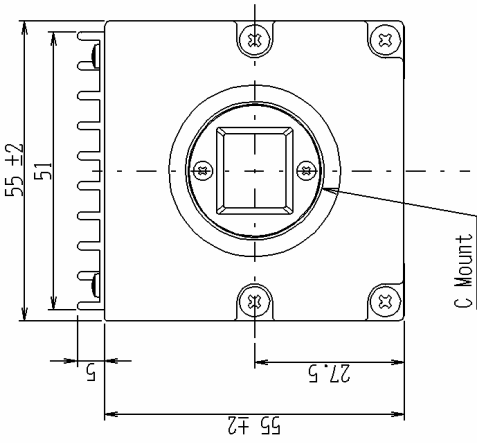
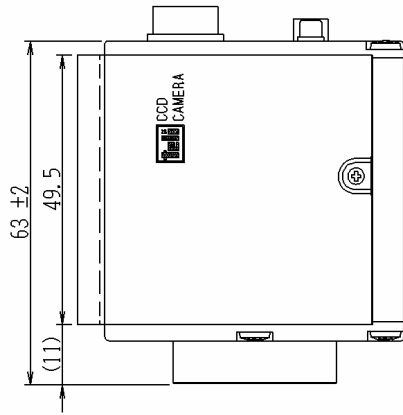
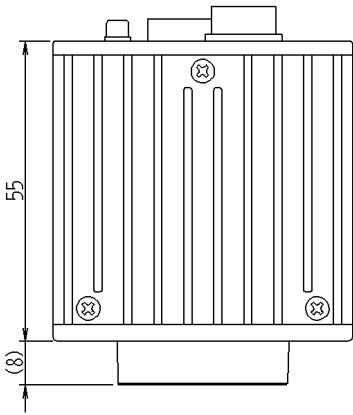
11. Recommended Frame Grabber Board - Input Module

Manufacturer Name	Model Name
CORECO Imaging	X64-CL
MATROX	Helios XCL
	Solios XCL
MICRO-TECHNICA	MTPCI-TL

* As of February, 2005

* Supported functions and control methods may vary depending on the board. For details, contact our sales representatives.

12. Outline Drawing



CS3960DCL External View



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Distributor

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