

# **B/W CCD Camera**

## **Model CS8541D series**

### **Operation Manual**

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**Thank you for purchasing our CS8541D series B/W CCD camera.**

**This operation manual includes some important information such as how to use this equipment correctly and safely. Please read through this manual carefully. After reading, keep this manual by the side of your equipment for your future reference.**



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

This Operation Manual is manufactured from recycled paper.

## **BEFORE USE - GENERAL SAFETY INSTRUCTIONS**



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

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

## **WARNINGS & CAUTIONS**





[Definition of markings]

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



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



### Notes

- \*1 : Personal injuries mean wounds, burns, electric shocks, and others for which the person injured need not to be hospitalized nor to be cared for the long term.
- \*2 : Material damages mean any direct or consequential damages related to property or material loss.

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

### ● Handling Precautions (Camera-head)

 <b>DANGER</b>	
 NEVER pull apart	<p><u>Do NOT disassemble this device.</u></p> Do NOT attempt to pull apart, repair, or modify the device on your own. To do so might lead to a fire or an electric shock accident. Contact us or the dealer/distributor from which you purchased the device for repair/modification.

 <b>CAUTION</b>	
 Avoid	<p><u>Do NOT connect/disconnect connectors before turning power off.</u></p> Make sure to check the CCU power is OFF before connecting/disconnecting connectors. Otherwise, you might get an electric shock, or your camera might break down.

## CAUTION



Avoid

Do NOT expose your device to direct sunlight, nor intensive heat.

Do NOT place this device where it is exposed to direct sunlight, or in a high temperature condition. To do so may cause the inner temperature of the device to go up, resulting in burning-down of inner parts, circuits or a fire accident.

### ● Handling Precautions (Camera Cable)

## DANGER



NEVER pull  
apart

Do NOT disassemble this device.

Do NOT attempt to pull apart, repair, or modify the device on your own. To do so might lead to a fire or an electric shock accident. Contact us or the dealer/distributor from which you purchased the device for repair/modification.

## CAUTION



Avoid

Do NOT connect/disconnect connectors before turning power off.

Make sure to check the CCU power is OFF before connecting/disconnecting connectors. Otherwise, you might get an electric shock, or your camera might break down.

### ● Handling Precautions (Camera Control Unit)

## DANGER



Unplug

If any overheating sign is observed, discontinue the use immediately.

In the event that smoke, smell, or any other overheating sign is observed, turn its power switch OFF immediately, and remove your plug from outlet. Do NOT try to continue to use this device. To do so in spite of clear signs of malfunction invites a fire, an electric shock hazard, or a serious damage. In such case, contact us or our dealer /distributor from which you purchased this device for repair service.



Unplug

If any malfunctioning sign is observed, discontinue the use immediately.

Do NOT try to use this device when it is obviously malfunctioning. (Example: No images on the monitor) In the event of malfunction, turn its power switch OFF immediately, and remove the plug from the outlet. In such case, contact us or our dealer/distributor from which you purchased this device for repair service.








Unplug




If any liquid gets into the device, discontinue the use immediately.

In the event that water, or any other type of liquid gets into the body, do NOT try to continue to use the device. To do so invites a fire or an electric shock hazard. In that case, turn its power switch OFF immediately, and then remove the plug from the outlet. After that, contact us or our dealer/distributor from which you purchased this device for repair service/technical advice.


## **DANGER**

 <p>Unplug</p>	<p><u>If any foreign object gets into the body, discontinue the use immediately.</u></p> <p>In the event that grits, small particles, or any other foreign objects get inside, do NOT try to continue to use the device. To do so invites a fire or an electric shock hazard. In that case, turn its power switch OFF immediately, and then remove the plug from the outlet. After that, contact us or our dealer/distributor from which you purchased this device for repair service/technical advice.</p>
 <p>Unplug</p>	<p><u>If any outer strong impact is given to this device, discontinue the use immediately.</u></p> <p>In the event that this device is dropped onto the ground, or its cabinet is damaged, turn its power switch OFF immediately, and remove the plug from the outlet. Do NOT try to continue to use the device. To do so invites a fire or an electric shock hazard. In such case, contact us or our dealer/distributor from which you purchased this device for repair service.</p>
 <p>NEVER pull apart</p>	<p><u>Do NOT disassemble this device.</u></p> <p>Do NOT attempt to pull apart, repair, or modify the device on your own. To do so might lead to a fire or an electric shock accident. Contact us or the dealer/distributor from which you purchased the device for repair/modification.</p>
 <p>Avoid</p>	<p><u>Do NOT supply any power other than specified.</u></p> <p>This device is designed to work only under specified voltage. Do NOT attempt to supply the device with power other than specified. Supplying the device with unspecified power invites a fire or an electric shock hazard.</p>
 <p>Avoid</p>	<p><u>Do NOT place the device unstably.</u></p> <p>Do NOT place the device on an unstable table, sloped ground, etc.. Make sure that the device do not fall nor roll over to prevent an accident.</p>









## **DANGER**

 <p>Avoid</p>	<p><u>Do NOT place any potentially-hazardous things on this device.</u></p> <p>Do NOT place any things on the device which may, if it gets into the inside of the body, damage the inner parts of the device (such as a flower pot, glass, cosmetics, a container filled with liquids or chemicals, as well as small metal parts, etc.). If tumbled, the liquids inside the bottle, etc. may get into the chassis, causing a fire or an electric shock accident.</p>
 <p>Avoid</p>	<p><u>Do NOT insert any foreign object through air-vent</u></p> <p>Avoid inserting any foreign object, especially metal part, combustible, through ventilation slits. To do so may cause a fire or an electric shock accident.</p>
 <p>Avoid</p>	<p><u>Do NOT damage the power cord.</u></p> <p>Do NOT damage, break, re-process, nor bend forcefully the power cord. Pulling forcefully/Twisting/Placing a heavy object on/Applying heat on the cord should also be avoided. Otherwise, the cord may be damaged, causing a fire or an electric shock accident. If the cord is damaged, contact us or our dealer/distributor from which you purchased this device for repair service.</p>

## **DANGER**

 Avoid	<p><u>Do NOT remove the protective cover</u></p> <p>Avoid removing its protective cover. If you touch the inner high-voltage part, you might get an electric shock. For inner part/circuit checkup, maintenance, or repair, contact us or the dealer/distributor from which you purchased this device.</p>
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## **CAUTION**

 Unplug	<p><u>Unplug the power-plug when the your device is not in use.</u></p> <p>For safety, make sure to unplug the power-plug before you give your device a cleanup, or when it is not used. Keeping the power-cord connected might invite a fire or an electric shock hazard.</p>
 Avoid	<p><u>Do NOT expose your device to direct sunlight, nor intensive heat.</u></p> <p>Do NOT place this device where it is exposed to direct sunlight, or in a high temperature condition. To do so may cause the inner temperature of the device to go up, resulting in burning-down of inner parts, circuits or a fire accident.</p>
 Avoid	<p><u>Do NOT attempt to make connection before turning power off</u></p> <p>Make sure to check the CCU power is OFF before connection. Otherwise, you might get an electric shock.</p>
 Avoid	<p><u>Do NOT pull the cord itself</u></p> <p>When disconnecting the power-plug out of the outlet, make sure to hold the plug, and then pull it out. Do NEVER try to pull the cord itself. Otherwise, the cord may be damaged or broken, leading to a fire or an electric shock accident.</p>
 Avoid	<p><u>Do NOT handle the power cord with your hand in an wet condition.</u></p> <p>Do NOT plug in/out the power cord with an wet hand. Otherwise, it may cause an electric shock accident.</p>
 Avoid	<p><u>Do NOT block ventilating slits.</u></p> <p>Blocking the ventilation slits prevents inner heat from escaping, which might lead to a fire accident.</p>
 Avoid	<p><u>Do NOT place your device too close to a heater.</u></p> <p>Do NOT place your device or its power cord too close to any heating appliance. Otherwise, the coating of its switch and/or power-cord may melt, leading to a fire or an electric shock accident.</p>
 Avoid	<p><u>Do NOT use chemical solvent for cleanup.</u></p> <p>When giving your camera a cleanup, avoid using a benzene, alcohol, and thinner. These chemicals might cause its coating or markings to come off or become degraded.</p>

## **RESTRICTION FOR USE**

### Avoid irregular signal interface.

Do not attempt irregular signal interface other than specified. Under signal interface other than recommended/specified in this instruction manual, the device might fail to exert the maximum performance. In much worse case, if you continue to use your device under incorrect signal interface, part(s) of inner circuits might burn down.

## **DISCRAMER (RIMITED WARRANTY)**

We disclaim any responsibility and shall be held harmless for damages or losses incurred by user(s) in either of the following cases.

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

## **OTHER INSTRUCTIONS**

### **Do NOT use power other than specified**

Be sure to use DC12V power supply. The camera is designed to work only under the specified voltage. Do NOT attempt to drive the camera with the power other than DC12V. Operating the camera under power other than DC12V invites a fire or an electric shock hazard.

### **Avoid intensive light**

Do NOT expose the camera's image-pickup-plane to sunlight or other intense light directly. If the part of CCD is exposed to spot-intensive light, you might get a picture problem like blooming and/or smear. Under the comparison at the same video output level, the faster the electronic shutter speed setting, the more smear is generated.

### **Use under right operation condition**

This equipment is designed and guaranteed to work under the temperature range of 0 to 40 degrees C and 30 through 90% humidity range. Avoid using the equipment beyond that limits.

### **Handle with care**

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

#### Do NOT tamper with switches

Read this operation guide thoroughly before you touch switches and adjusters on the rear or bottom panel. Do NEVER attempt to disassemble the camera and/or tamper with any inner switches, potentiometers, etc.

#### Avoid liquid

Avoid placing the camera where it is likely to be splashed with water or any other fluids. Operating the camera with its inner parts/circuits in an wet condition might cause a damage or an electric shock accident.

#### Camera cable connection/disconnection

Before connecting/disconnecting connectors, make sure to turn camera power OFF. Otherwise, your camera might break down.

#### CH / CCU serial number matching

Make sure to check the product serial number labeled on the camera-head matches with that of the camera control unit. Mismatch might cause the camera to fail to exert 100% performance.

#### Avoid placing near TV/radio

This camera might cause an interference (e.g. noise) if used around radio / TV set. In such a case, change the location of your camera (or radio / TV).

#### Abnormal operation

In the event that any abnormal condition is observed, turn the power switch OFF immediately. Do NOT try to continue to use the camera. To do so reckless of visible signs of malfunction invites a fire, an electric shock hazard, or any other serious damage to the camera. In such case, contact us or our dealer/distributor from which you purchased the camera for repair service.

#### Camera installation

For mounting this camera (M3.0, 3 places), use screws having inner depth (the portion which go inside the camera chassis side) shorter than 3.5mm. Longer screws contact and might damage inner boards/parts.

#### Waste treatment

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

## 1. Product Description

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Model CS8541D is a separate type B/W CCD camera with a VGA format all-pixel-data readout CCD. This model has twice greater driving frequency of conventional cameras to achieve fast-speed data-processing. The model is suited for high-speed, high-resolution image processing use. Camera head is compact, light-weight body is ideal for system integration.

## 2. Features

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(1) Double-speed scan

This model reads out image-data twice as fast as conventional cameras do.

(2) All pixel's data readout

With its built-in all-pixel-data-readout CCD, this model can read out image-data just in approximately 1/60 sec. A frame-shutter reads out all data even under RTS (Random Trigger Shutter) mode.

(3) High vertical resolution

As all pixel's data are read out even under RTS mode (in 1/60 sec.), images with no deterioration in vertical resolution are obtained.

(4) Square grid pattern CCD

Pixel's in CCD are aligned in square grid pattern. This makes it easier to perform computation correctly for image processing use.

(5) External Sync.

The camera is switched over to external synchronization operation automatically when external HD signal is input.

(6) Random trigger shutter function

With a built-in RTS, the camera's CCD starts light-exposure in synchronization with external trigger signals. This function enables the camera to capture fast-moving subjects at constant position for precise image processing.

(7) Restart / Reset

Under the restart / reset mode, this model can capture images at an arbitrary timing cued by external VD signal.

(8) Multiple shutter

With this shutter, this model capture images at an arbitrary timing cued by external trigger signal, and then outputs video at an arbitrary timing cued by external VD signal.

(9) Partial-scan

Under the partial scan mode, only 1/2 or 1/4 screen center portion of image information is read out, resulting in a faster operation.

### 3. Configuration

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- (1) Camera head (Camera cable: Direct fixing) ..... 1
  - (1-1) Cable fixing direction (viewed from rear)
    - (a) CS8541DV -\*\* V : Rear
    - (b) CS8541DW -\*\* W : Left
    - (c) CS8541DX -\*\* X : Down
    - (d) CS8541DY -\*\* Y : Right (Standard)
    - (e) CS8541DZ -\*\* Z : Up
  - (1-2) Camera cable length (Item(1-1)-\*\*)
    - (a) 01: 1m (Standard)
    - (b) 02: 2m
- (2) Camera control unit
- (3) Accessory
  - Operation Manual (Japanese) ..... 1
  - Operation Manual (English) ..... 1

### 4. Optional Accessories

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- (1) Dedicated lens (12-phi) f = 30mm, 17mm, 12mm, 6mm
- (2) Camera adapter [Model name: CA170]
- (3) DC IN / SYNC cable for CS8541D [Model name: CPRC8541P15-\*\*, \*\*:01(1m)-05(5m), \*Combination with (2)]
- (4) DC IN / SYNC conversion cable for CS8541D [Model name: CPRC8541J15-\*\*, \*\*:01(1m)-05(5m), \*Combination with CPRC3700-02,03,05]

\*Please contact your dealer / distributor for details of option units.

**\* Conformity of an option part and EMC conditions**

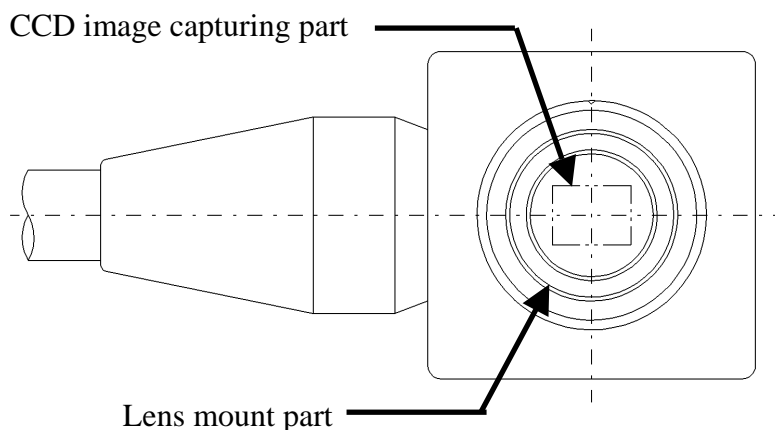
About the conformity of the EMC standard of this machine, it has guaranteed in the conditions combined with the above-mentioned option part.

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

### 5. Parts Name

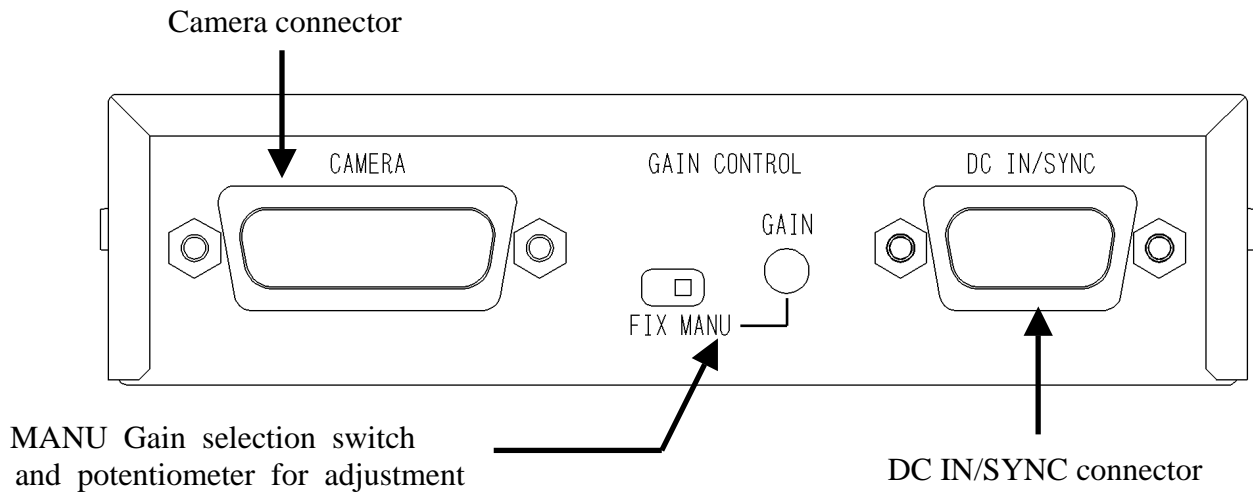
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#### 5.1 Camera head



## 5.2 Camera Control Unit

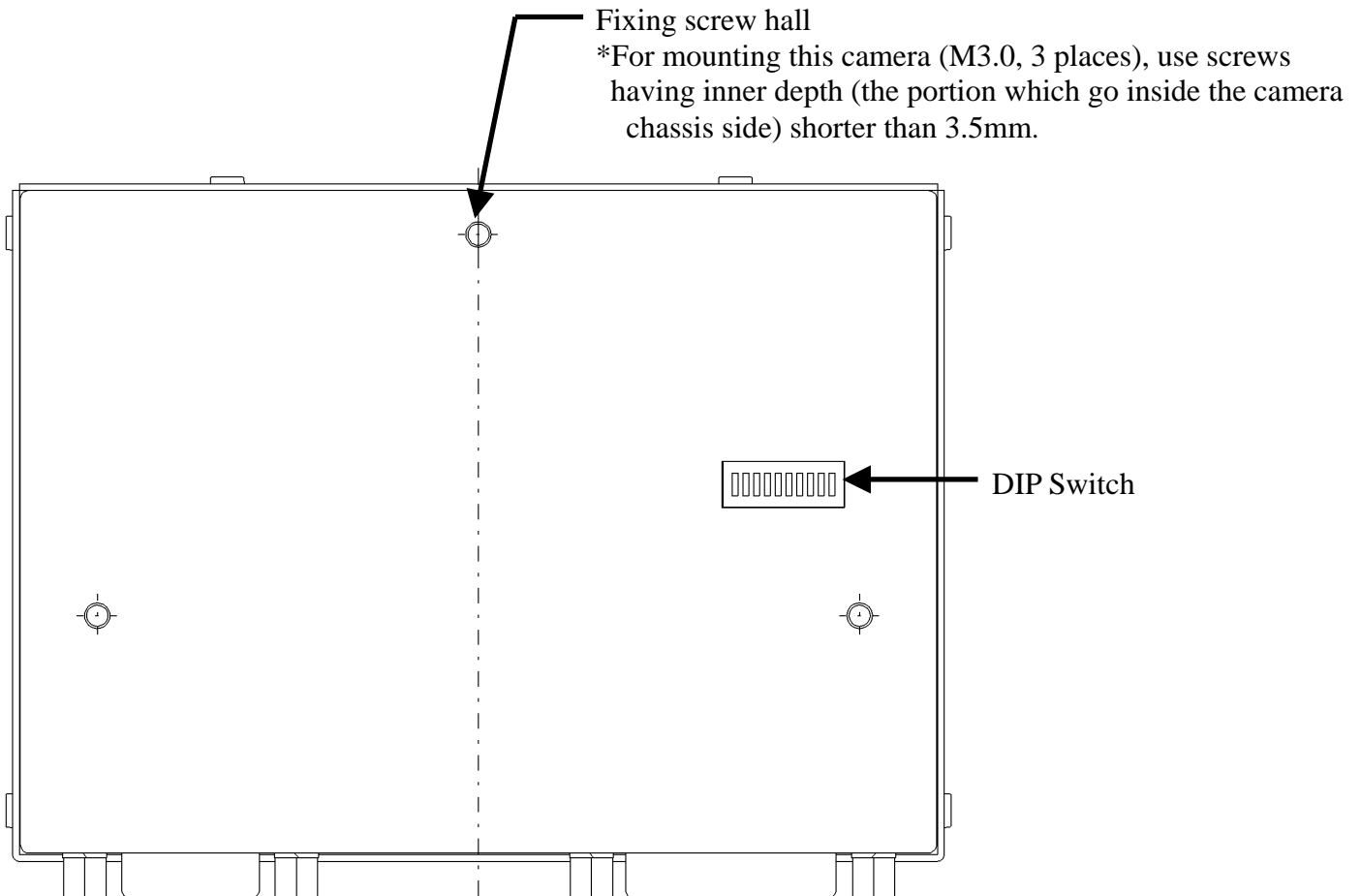
### (5-2-1) CCU rear



**Do NOT connect/disconnect connectors before turning power off.**

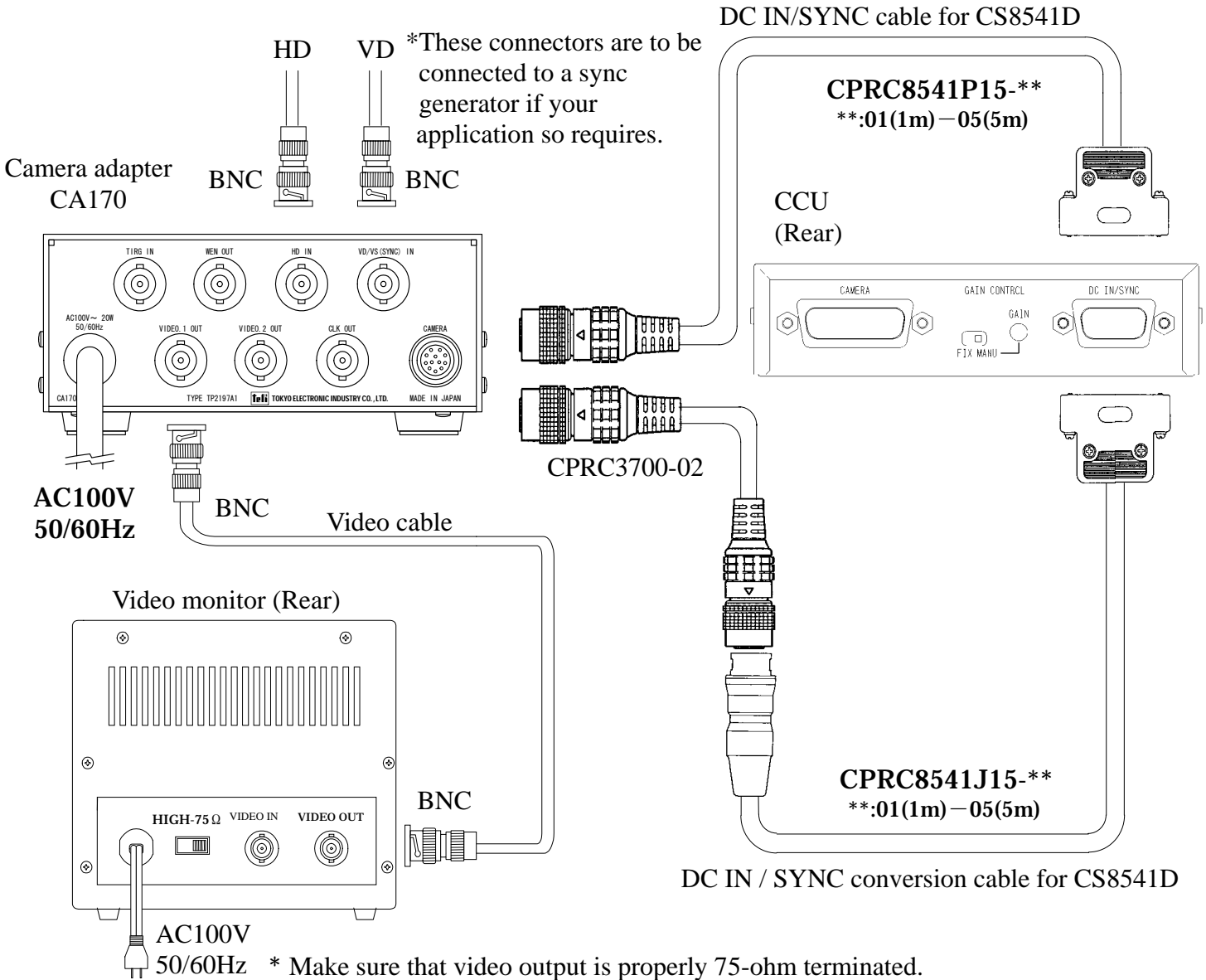
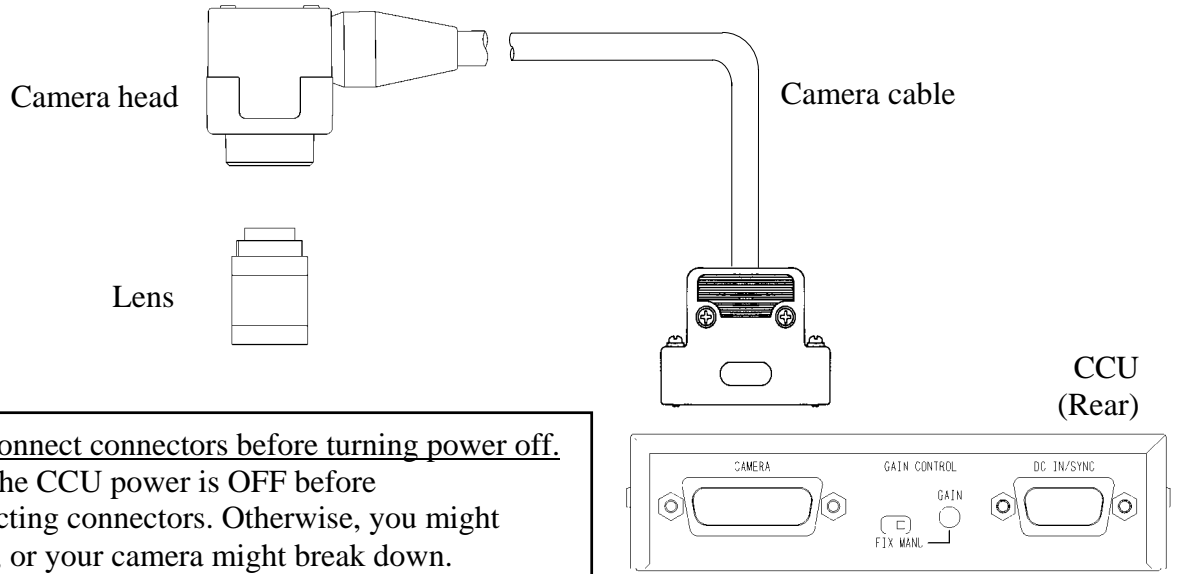
**Make sure to check the CCU power is OFF before connecting/disconnecting connectors. Otherwise, you might get an electric shock, or your camera might break down.**

### (5-2-2) CCU bottom



## 6. Connection

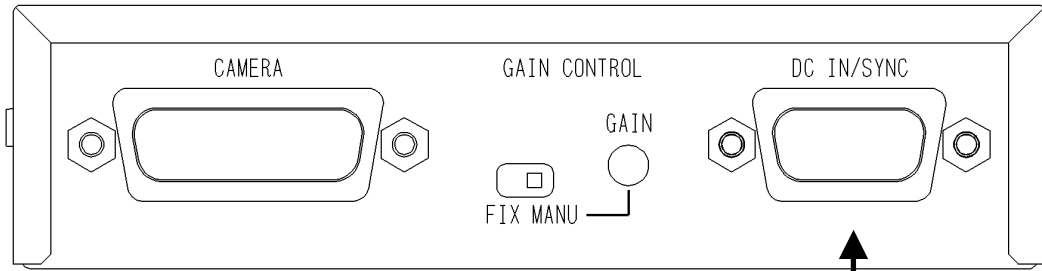
### 6.1 Connection examples



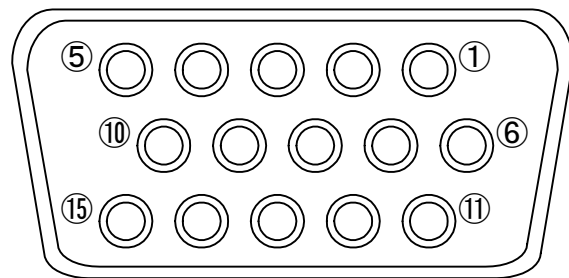
## 6.2 DC IN/SYNC Connector

(6-2-1) Compatible connector : D02-M15PG-N-F0 (Supplied by Japan Aviation Electronics Ind.) etc.

(6-2-2) Pin assignment : 15 conductor conforms to MIL-C-24308 standards



Pin No.	Signal Name
1	DC12V GND
2	DC12V
3	VIDEO GND
4	VIDEO OUT
5	GND
6	HD GND
7	HD IN
8	VD IN
9	VD GND
10	GND
11	N.C
12	TRIG IN
13	TRIG GND
14	WEN OUT
15	GND



Connector pin layout  
15 pin (Socket)



**CAUTION**

\*1: Make sure to confirm power is set is OFF before connecting/disconnecting connectors to avoid breakdown.

\*2: Under Partial scan mode **OPTION**, 11<sup>th</sup> pin is external partial IN.

[ Normal ]

Pin No.	Signal Name
11	N.C

→

[ Option ]

Pin No.	Signal Name
11	PARTIAL IN

\* The function/features noted as “option” or shown with the **OPTION** mark in this document is available as optional function/feature (= Production on order) and not provided as standard function. Please contact our sales staff for details.

\*3: Make sure to confirm the combination when this series is combined to other manufactures' board.

\*4: GND pins are grounded to the camera control unit chassis.

## 7. Camera Function and Settings

### 7.1 Camera function

#### (7-1-1) GAIN selection

Switches sensitivity setting

(1-1) FIX -----Factory-prefixed gain

(1-2) MANU-----Gain is adjustable via the manual gain potentiometer (GAIN)

#### (7-1-2) Video output mode selection

Switches video format

(2-1) 1/60N : 1/60s-----Non-interlace mode

As all pixels are read out in 1/60s, you will get images with the higher V resolution.

(2-2) 1/120I : 1/120s-----2:1 interlace MIX mode

As vertical pixels are added in readout, the sensitivity is same as that of 1/60s non-interlace mode during electronic shutter OFF. Twice greater sensitivity is obtained under shutter-speed range from 1/200 through 1/20000.

#### (7-1-3) TRIG selection

Switches TRIG input signal polarity used under RTS mode

(3-1) POSI -----Positive polarity (rising edge detection)

(3-2) NEGA-----Negative polarity (falling edge detection)

#### (7-1-4) RTS (Random Trigger Shutter) exposure selection

Switches light exposure mode under RTS mode

(4-1) FIX mode-----Bottom DIP SW Exposure-time control via bottom-panel DIP switch.

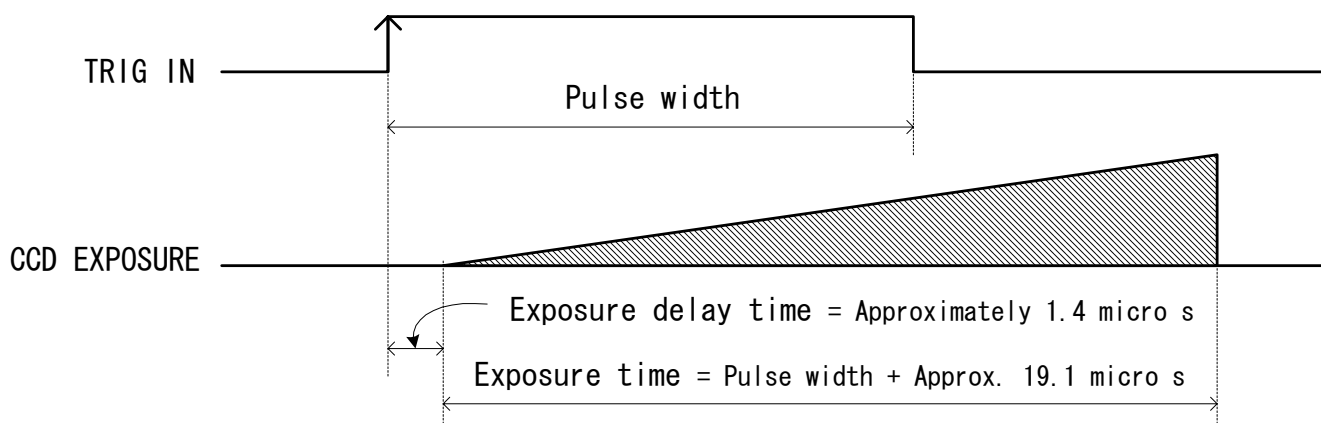
(4-2) PULSE W mode-----TRIG signal pulse width control Exposure-time control via TRIG signal pulse width.

#### <Exposure time delay under RTS>

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

#### <Exposure time under pulse width mode>

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



(7-1-5) E-shutter mode

Switches shutter modes / There are 4 shutter modes.

- (a) Normal -----Normal electronic shutter
  - Exposure control via internal sync signal
  - 8 positions, including OFF, 1/200s, 1/500s, 1/1000s, 1/2000s, 1/4000s, 1/8000s, 1/20000s
  
- (b) RTS-----Random trigger shutter
  - Exposure control via ex-trigger input
  - Non-reset or V-reset
  - Exposure-time: DIP SW or ex-trigger pulse width
    - (b-1) CCU bottom-panel DIP SW setting
      - Like normal shutter, shutter-speed (exposure-time) is selectable among 8 scales.
    - (b-2) TRIG signal pulse setting
      - TRIG signal pulse width control Exposure-time control via TRIG signal pulse width.
      - \* RDM selection is automatic with TRIG status
      - \*\* Neither under FIX nor PULSE W mode, RTS doesn't work if Electronic **shutter speed SW is set in OFF position.**
  
- (c) Multiple shutter ----Multiple shutter Multiple shutter operation is available by providing TRIG IN more than 1 time before ext. VD IN.  
Video, captured at arbitrary timing responsive to ext. TRIG signal, can be output at arbitrary timing responsive to ext. VD signal.
  
- (d) Restart/Reset -----The restart / reset function is available with the external VD signal. Users can get an arbitrary slower shutter speed than normal shutter and random trigger shutter.

(7-1-6) Partial-scan mode selection

Switches partial-scan mode / There are 2 partial scan modes

Note : Sometimes phenomenon called as “whiteout” occurs at the top of the screen when there is strong incident light entering in the wide area of a CCD, however, this is not a malfunction. If this occurs, reduce the amount of incoming rays.

- (a) 1/2 Partial-scan mode
- (b) 1/4 Partial-scan mode
- (c) Programmable partial-scan OPTION  
Only essential part can be readout with setting of the high transmission part by inputting the external PARTIAL signal.

**\* The function/features noted as “option” or shown with the OPTION mark in this document is available as optional function/feature (= Production on order) and not provided as standard function. Please contact our sales staff for details.**

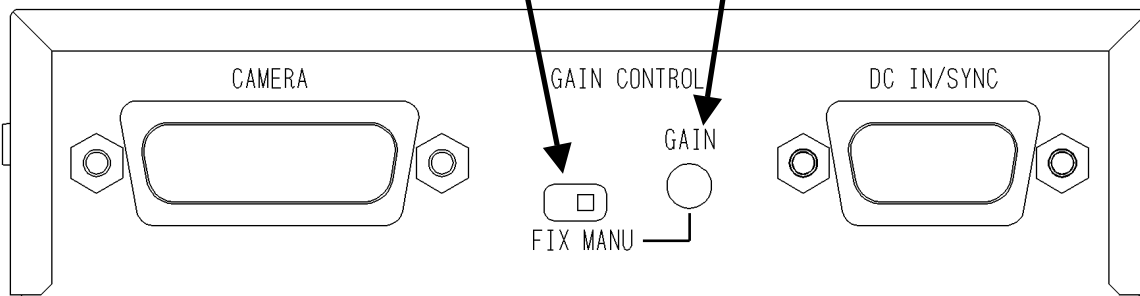
(7-1-7) Ex-sync impedance  
High-impedance / 75-ohm

(7-1-8) Ex-sync IN/OUT selection  
IN / OUT

(7-1-9) Video output coupling  
DC-coupling/AC-coupling

## 7.2 CCU rear slide SW and MANU GAIN VR (potentiometer) setting

- (1) MANU gain selection switch (2) MANU gain adjustment potentiometer



- (1) MANU gain selection switch

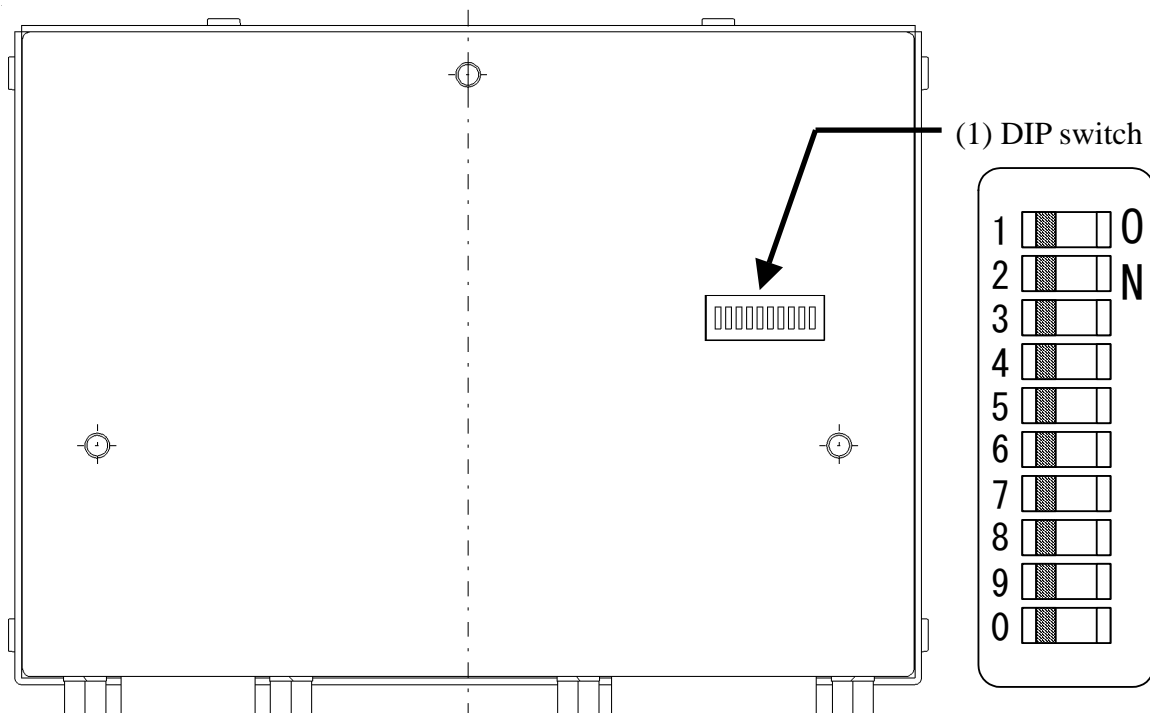
Camera sensitivity can be changed with MANU gain adjustment potentiometer by turning the switch to right.

Turn the switch to left to return the sensitivity at initial-factory setting.

- (2) MANU gain adjustment potentiometer

When you turn potentiometer clockwise to right, camera sensitivity level goes up. This potentiometer is enabled when (1) slide SW is in right position.

## 7-3 CCU bottom DIP SW



(1) CCU bottom-panel DIP SW

No.	Function	OFF	ON
1	E-shutter-speed	See shutter-speed table (Table 1)	
2			
3			
4	Video output	1/60s non-interlace	1/120s interlace
5	Shutter mode	See shutter-mode table (Table 3)	
6			
7	Partial scan	See partial-scan table (Table 2)	
8			
9	TRIG polarity	Positive (Rising edge)	Negative (Falling edge)
10	RTS Exposure	FIX mode	PULSE W mode

Notes : \* Initial factory setting: All OFF  
 \*\* Set No.9 OFF when TRIG IN OPEN.

(Table 1) Electronic shutter-speed

Shutter-speed	No.1	No.2	No.3
OFF	OFF	OFF	OFF
1/200s	ON	OFF	OFF
1/500s	OFF	ON	OFF
1/1000s	ON	ON	OFF
1/2000s	OFF	OFF	ON
1/4000s	ON	OFF	ON
1/8000s	OFF	ON	ON
1/20000s	ON	ON	ON

(Table 2) Partial-scan

Partial scan	No.7	No.8
OFF	OFF	OFF
Not acceptable	ON	OFF
1/2 partial	OFF	ON
1/4 partial	ON	ON

Note : \* Neither under FIX nor PULSE W mode, RTS doesn't work if  
 Electronic shutter speed SW is set in OFF position.

(Table 3) Shutter-mode

Shutter mode		No.5	No.6	SYNC	
Random trigger	V reset	OFF	OFF	Internal sync	
	SYNC reset	ON	OFF		
	Non-reset	OFF	ON		
Not acceptable		ON	ON		
Random trigger	Non-reset (Multiple shutter)	OFF	OFF	Single VD	Ext. sync HD IN
	Non-reset	ON	OFF	Consecutive VD	
	V-reset	OFF	ON	No VD	
Restart / Reset		ON	ON	Single VD	

Notes : \* Under normal shutter mode partial-scan, set No.5, 6 in OFF.  
 \*\* Under PULSE W mode, SYNC reset is disabled.

## 7.4 Camera CCU inner SW setting

### (7-4-1) Ex-sync IN impedance selection

To switch external-sync signal input impedance, open the CCU cover, and then switch the sliding SW (SW4) mounted on the circuit board.

No.	Function	SW Selection	Selected Function
1	Ex-sync IN Impedance selection	<b>High</b>	High-impedance
		75	75-ohm

\* The factory setting is shown with boldface underlined font.

### (7-4-2) External sync IN/OUT selection

To switch external-sync signal input impedance, open the CCU cover, and then switch the sliding SW (SW5) mounted on the circuit board.

No.	Function	SW Selection	Selected Function
1	Ex-sync IN/OUT selection	<b>IN</b>	IN (initial factory setting)
		OUT	OUT

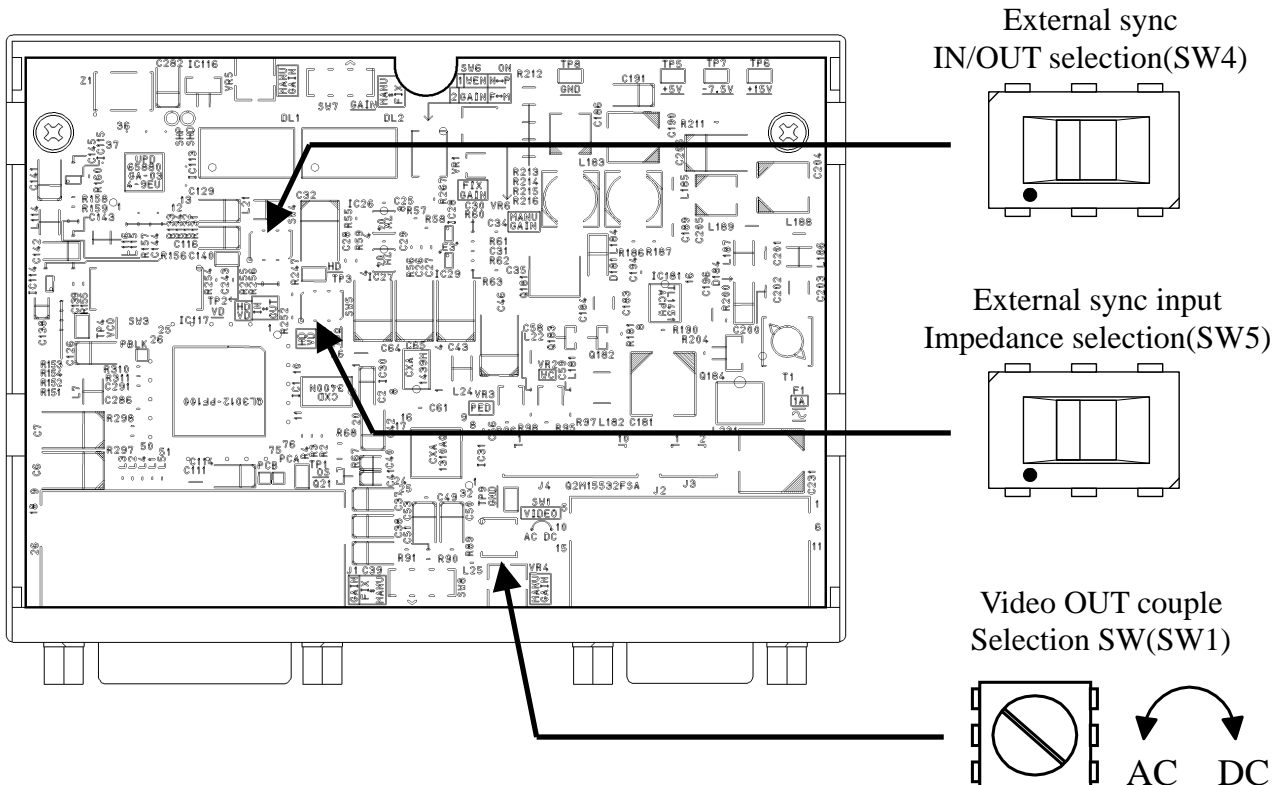
\* The factory setting is shown with boldface underlined font.

### (7-4-3) VIDEO OUT DC/AC couple selection

To switch external-sync signal input impedance, open the CCU cover, and then switch the sliding SW (SW1) mounted on the circuit board.

No.	Function	SW Selection	Selected Function
1	VIDEO OUT couple selection	<b>Clockwise</b>	DC coupled OUT (initial factory setting)
		Anticlockwise	AC coupled OUT

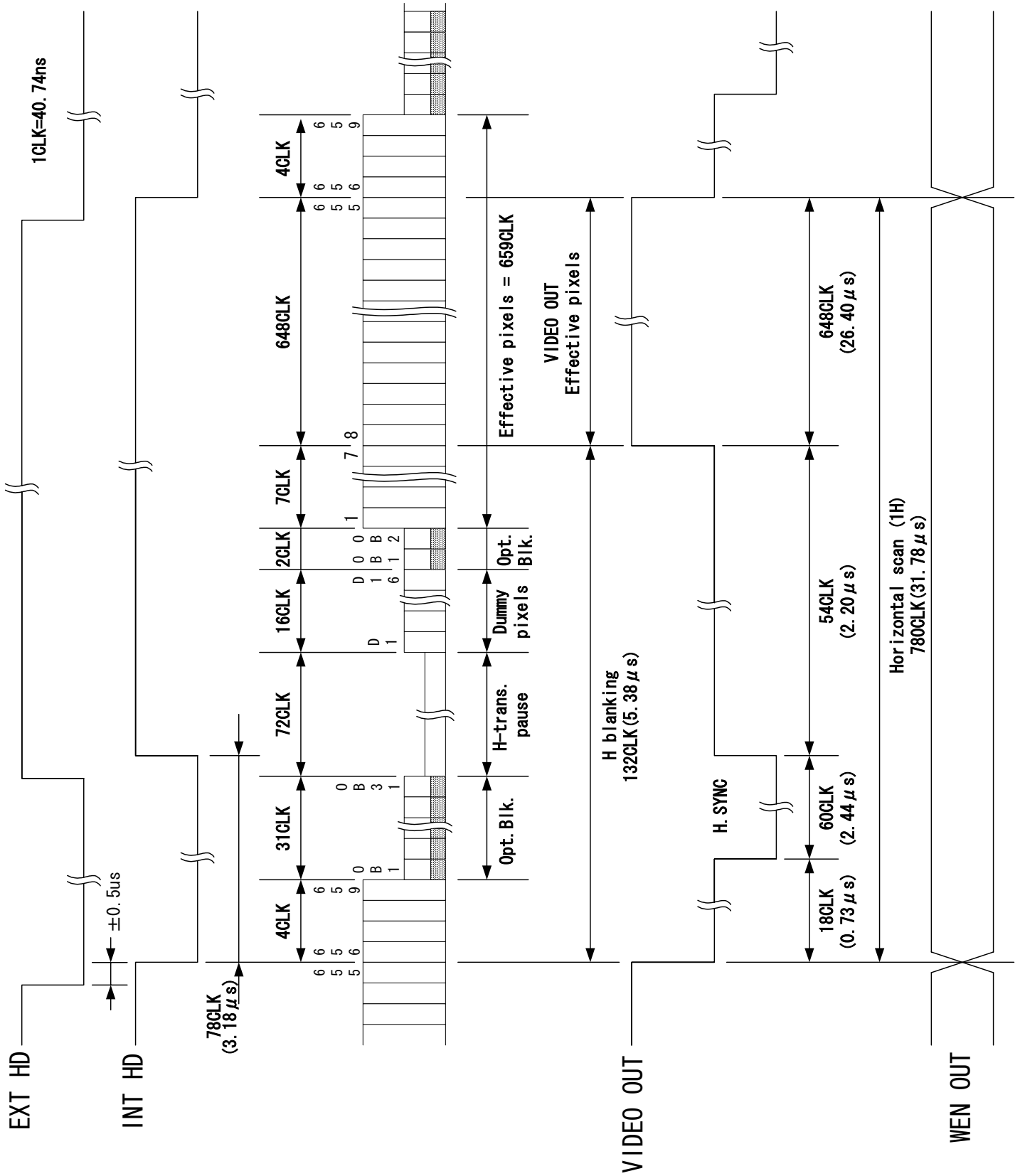
\* The factory setting is shown with boldface underlined font.



## 8. Timing Chart

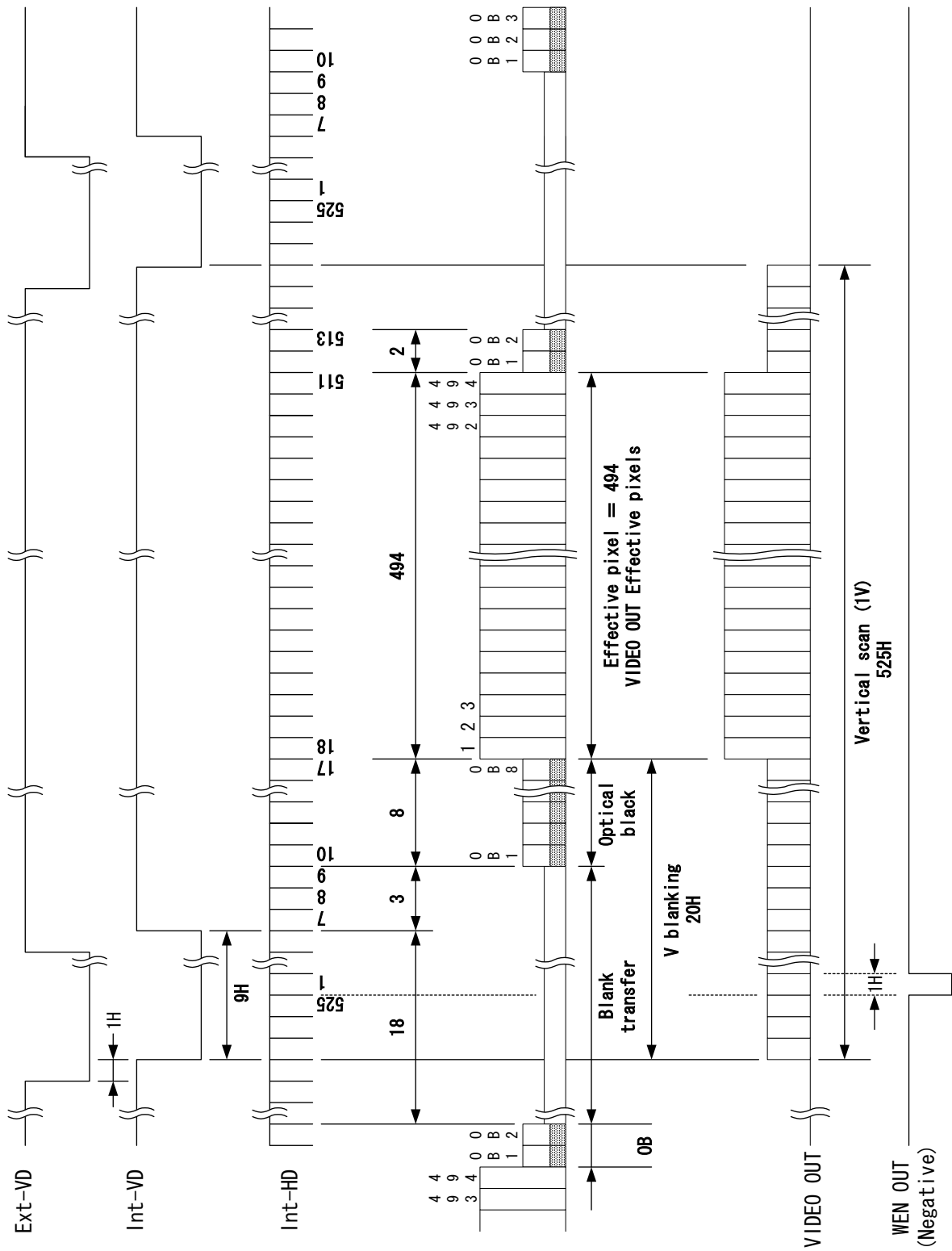
### 8.1 Output waveform timing chart

#### (1) Horizontal

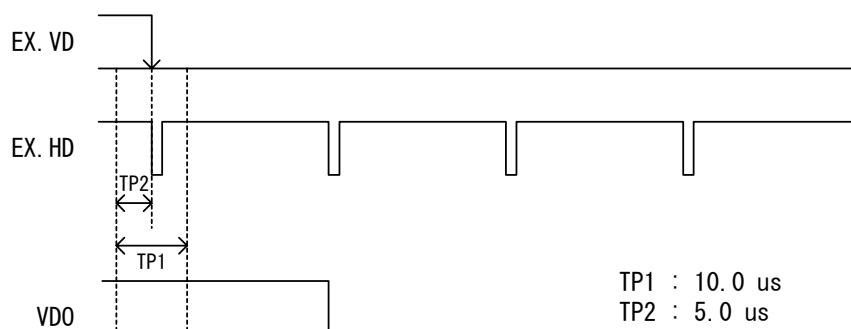


(2) Vertical

(2-a) 1/60s Non-interlace mode

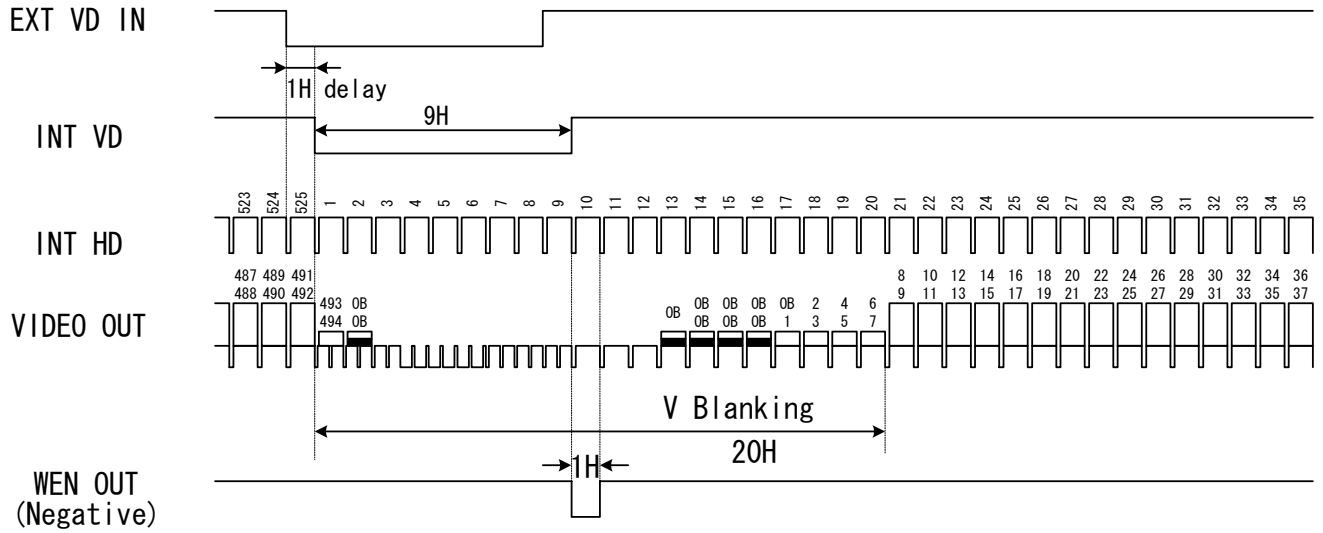


EXVD - EXHD phase difference

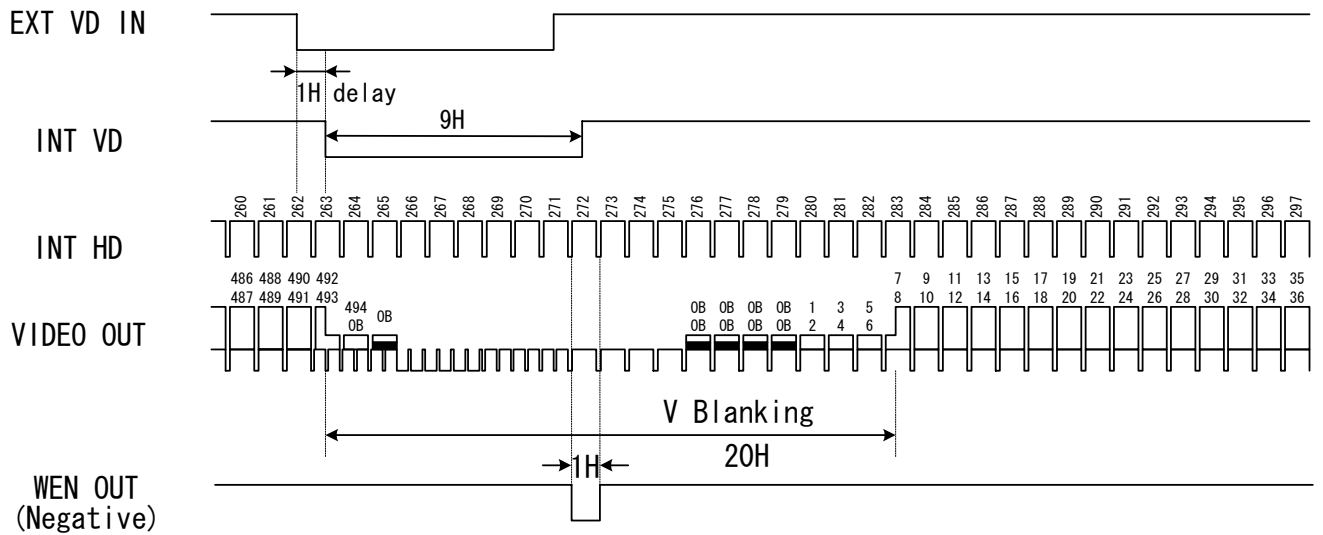


(2-b) 1/120s Interlace mode

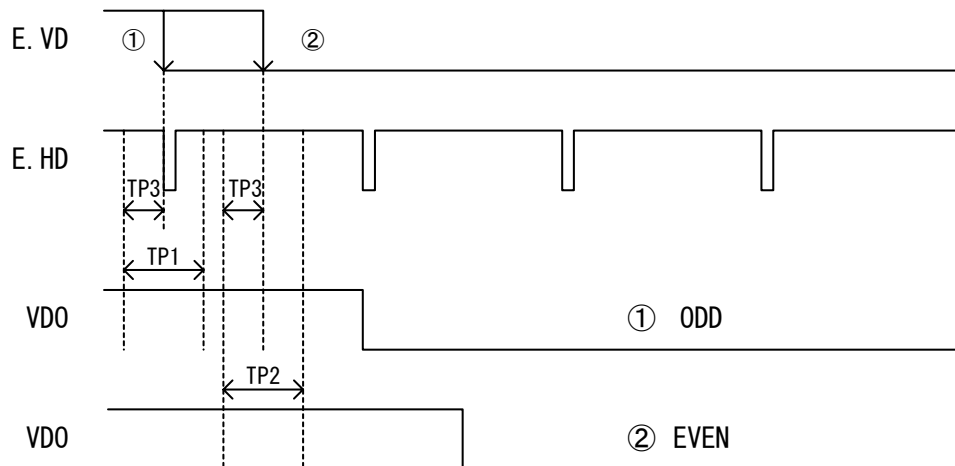
ODD (1st field)



EVEN (2nd field)



EXVD - EXHD phase difference

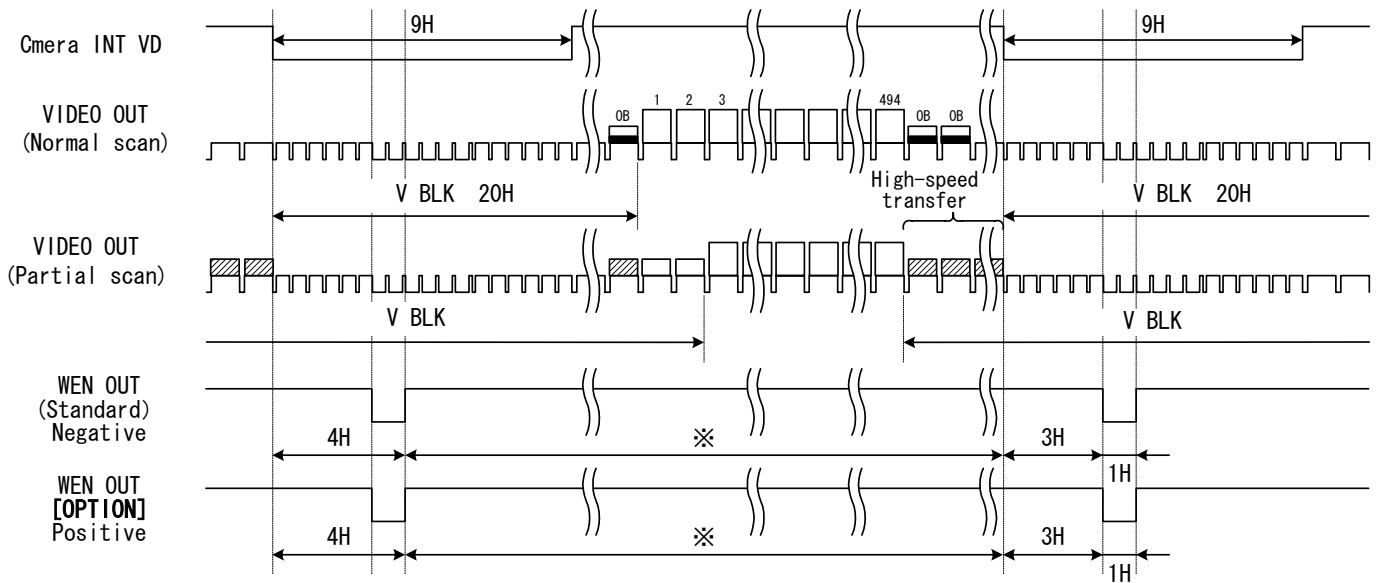


TP1 : ODD reset range      10.0 us  
 TP2 : EVEN reset range     10.0 us  
 TP3 : 5.0 us

(3) WEN timing

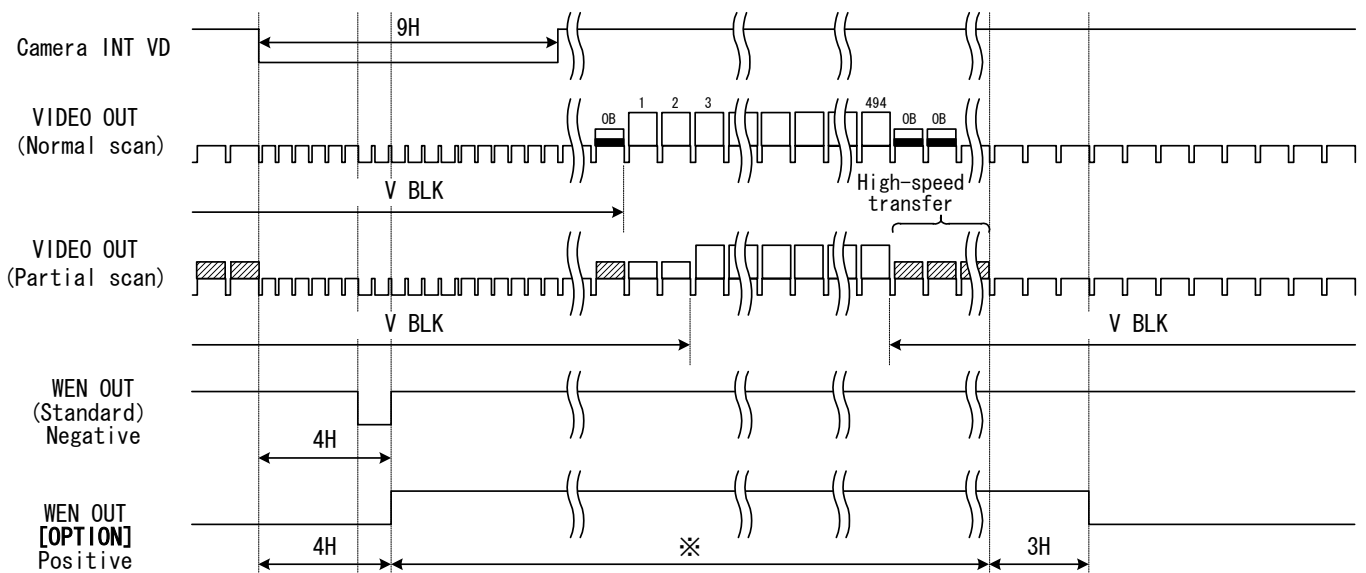
(3-a) 1/60s Non-interlace mode

★WEN(Under normal shutter mode)



※ Normal scan : 521H  
 1/2 Partial scan : 258H  
 1/4 Partial scan : 127H  
 Programmable partial scan : Arbitrary [OPTION]

★WEN(Under other shutter mode)



※As for WEN(Positive) of an option, Hi period changes with shutter modes of use.

- (1) 1/2 Partial scan : 258H
- 1/4 Partial scan : 127H

Programmable partial scan : Arbitrary [OPTION]

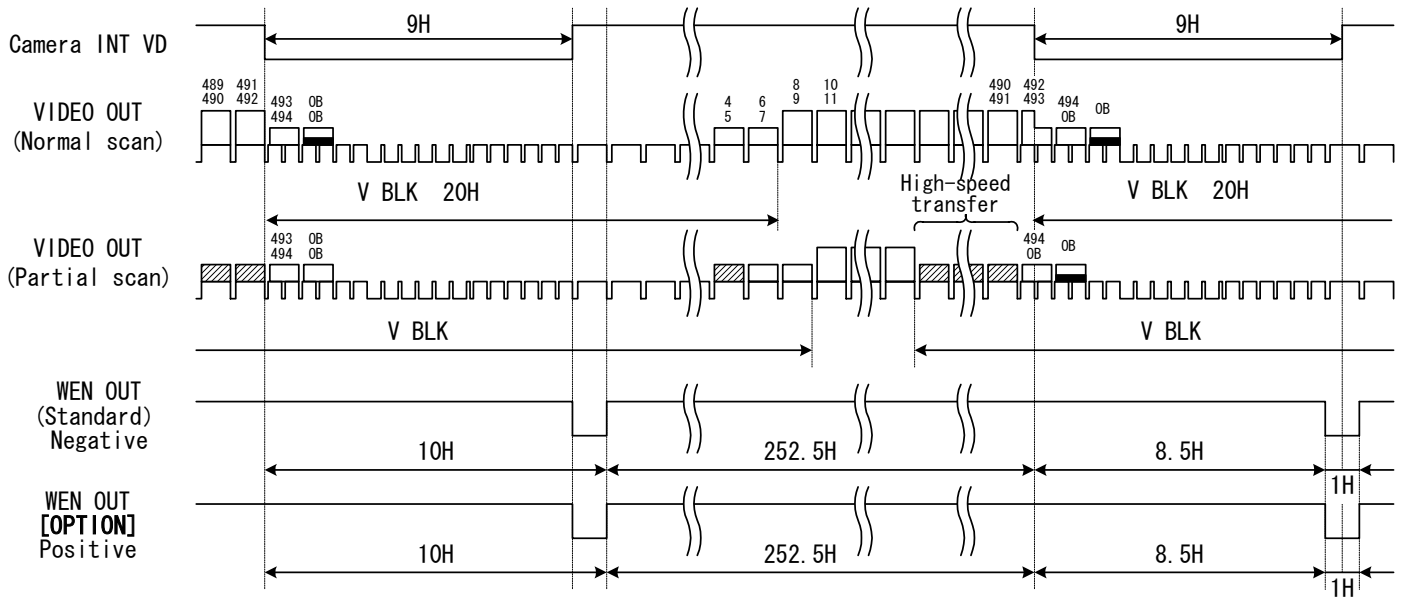
- RDM mode V-reset mode(Under internal sync)
- RDM mode SYNC reset mode(Under internal sync)
- RDM mode Non-reset mode(Under External sync --- Single VD IN)
- RDM mode V-reset mode(Under External sync)

- (2) 521H

- RDM mode Non-reset mode(Under internal sync)
- RDM mode Non-reset mode(Under External sync --- Consecutive VD IN)
- Restart / Reset

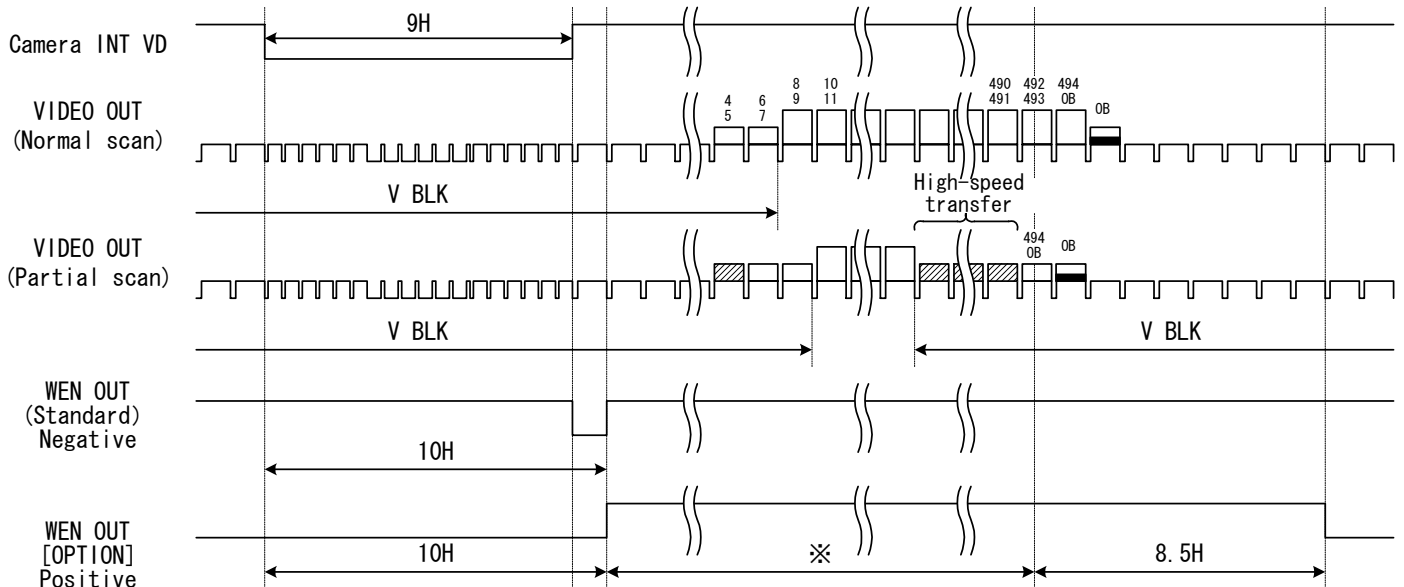
(3-b) 1/120s 2:1 Interlace mode [ODD field]

★WEN(Under normal shutter mode)



※ Normal scan : 252.5H  
 1/2 Partial scan : 121.5H  
 1/4 Partial scan : 55.5H  
 Programmable partial scan : Arbitrary [OPTION]

★WEN(Under other shutter mode)



※As for WEN(Positive) of an option, Hi period changes with shutter modes of use.

- (1) 1/2 Partial scan : 121.5H
- 1/4 Partial scan : 55.5H

Programmable partial scan : Arbitrary [OPTION]

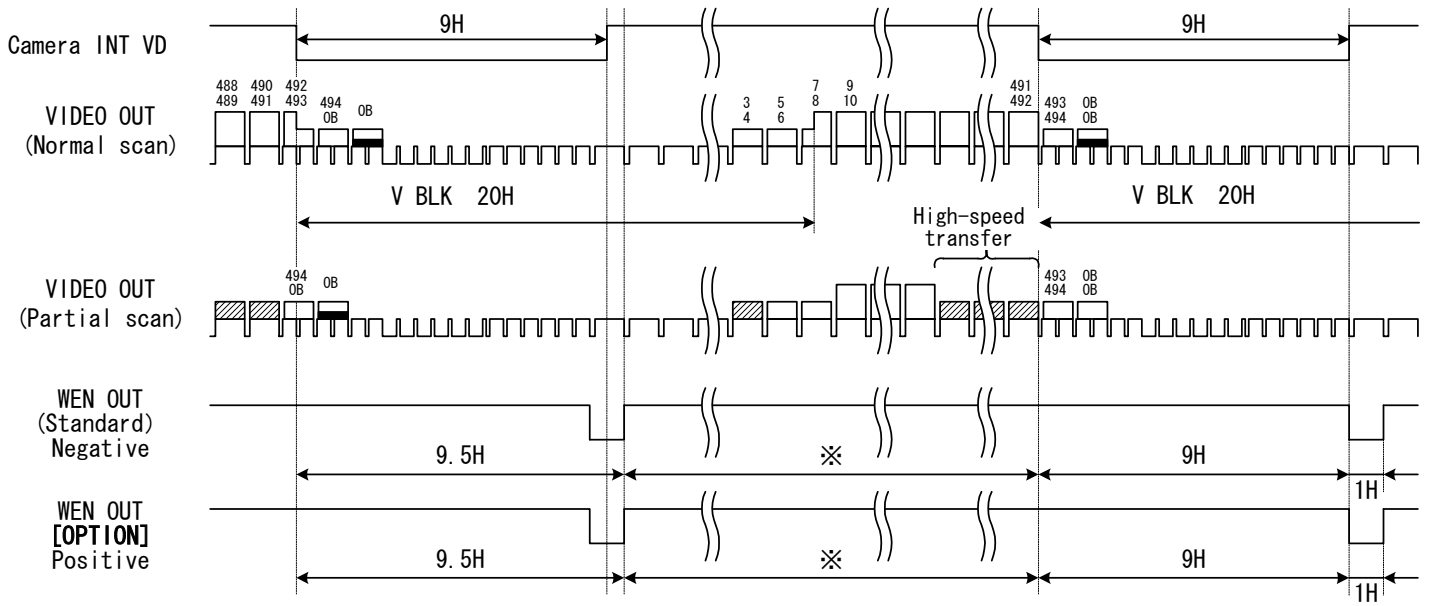
- RDM mode V-reset mode(Under internal sync)
- RDM mode SYNC reset mode(Under internal sync)
- RDM mode Non-reset mode(Under External sync --- Single VD IN)
- RDM mode V-reset mode(Under External sync)

- (2) 252.5H

- RDM mode Non-reset mode(Under internal sync)
- RDM mode Non-reset mode(Under External sync --- Consecutive VD IN)
- Restart / Reset

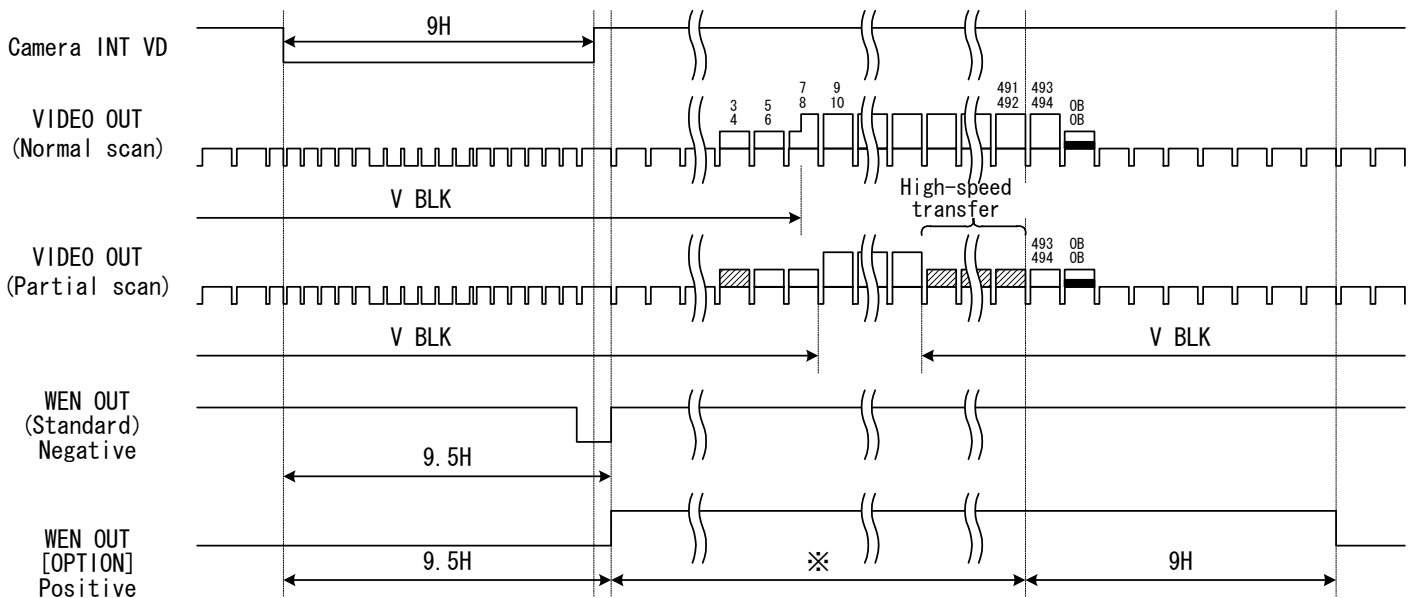
(3-c) 1/120s 2:1 Interlace mode [EVEN field]

★WEN(Under normal shutter mode )



※ Normal scan : 253H  
 1/2 Partial scan : 122H  
 1/4 Partial scan : 56H  
 Programmable partial scan : Arbitrary [OPTION]

★WEN(Under other shutter mode)



※As for WEN(Positive) of an option, Hi period changes with shutter modes of use.

- (1) 1/2 Partial scan : 122H  
 1/4 Partial scan : 56H  
 Programmable partial scan : Arbitrary [OPTION]
  - RDM mode Non-reset mode(Under External sync --- Single VD IN)
- (2) 253H
  - RDM mode Non-reset mode(Under internal sync)
  - RDM mode Non-reset mode(Under External sync --- Consecutive VD IN)
  - Restart / Reset

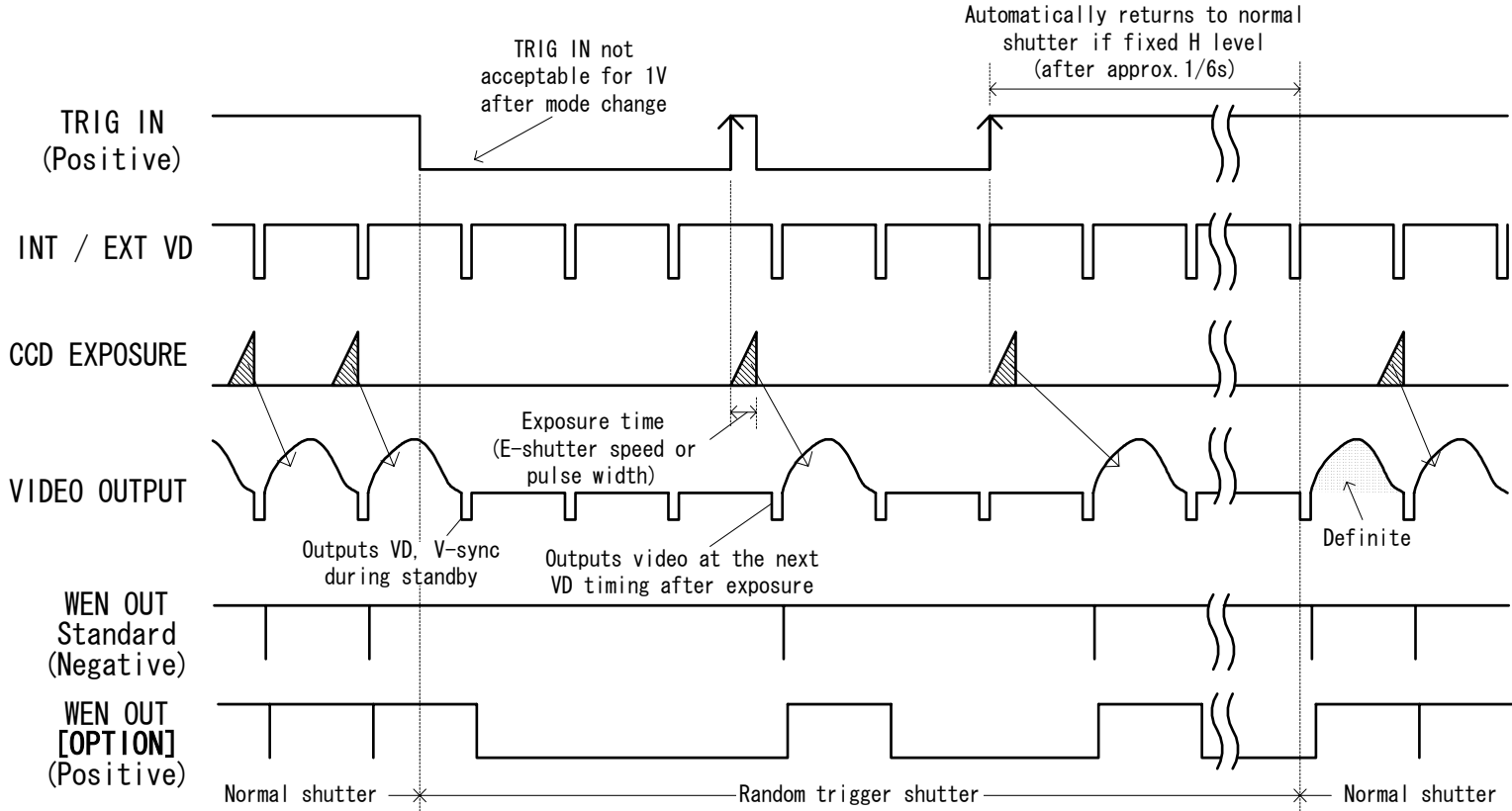
## 8.2 RTS Timing chart

TRIG signal capturing timing: Positive (Rising-edge detection)

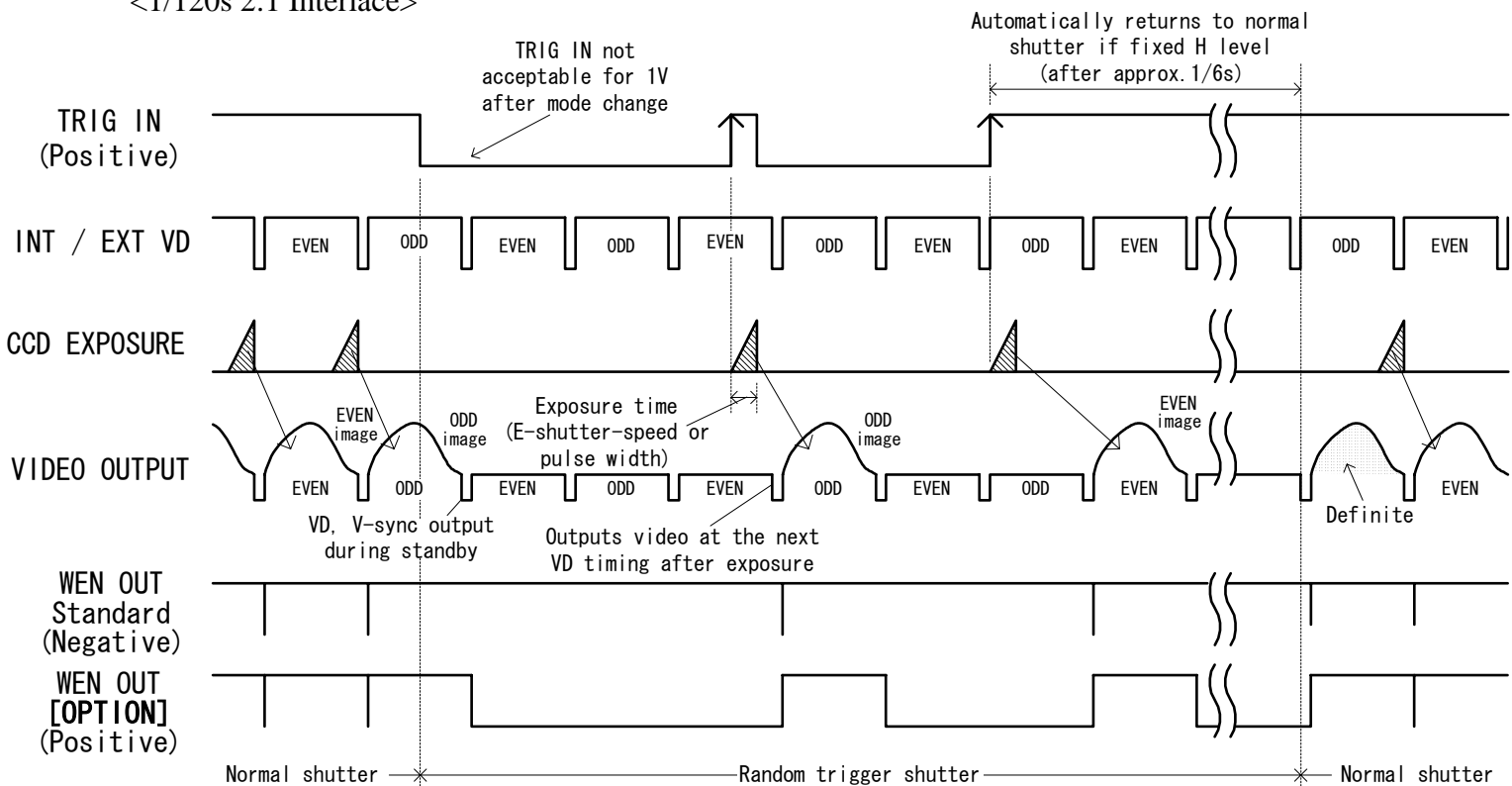
(a) Non-reset mode (Under internal-sync / external-sync --- Consecutive VD IN)

Exposure starts at the timing of TRIG signal IN. After each exposure is completed, the camera outputs video at each next VD IN timing.

<1/60s Non-interlace>



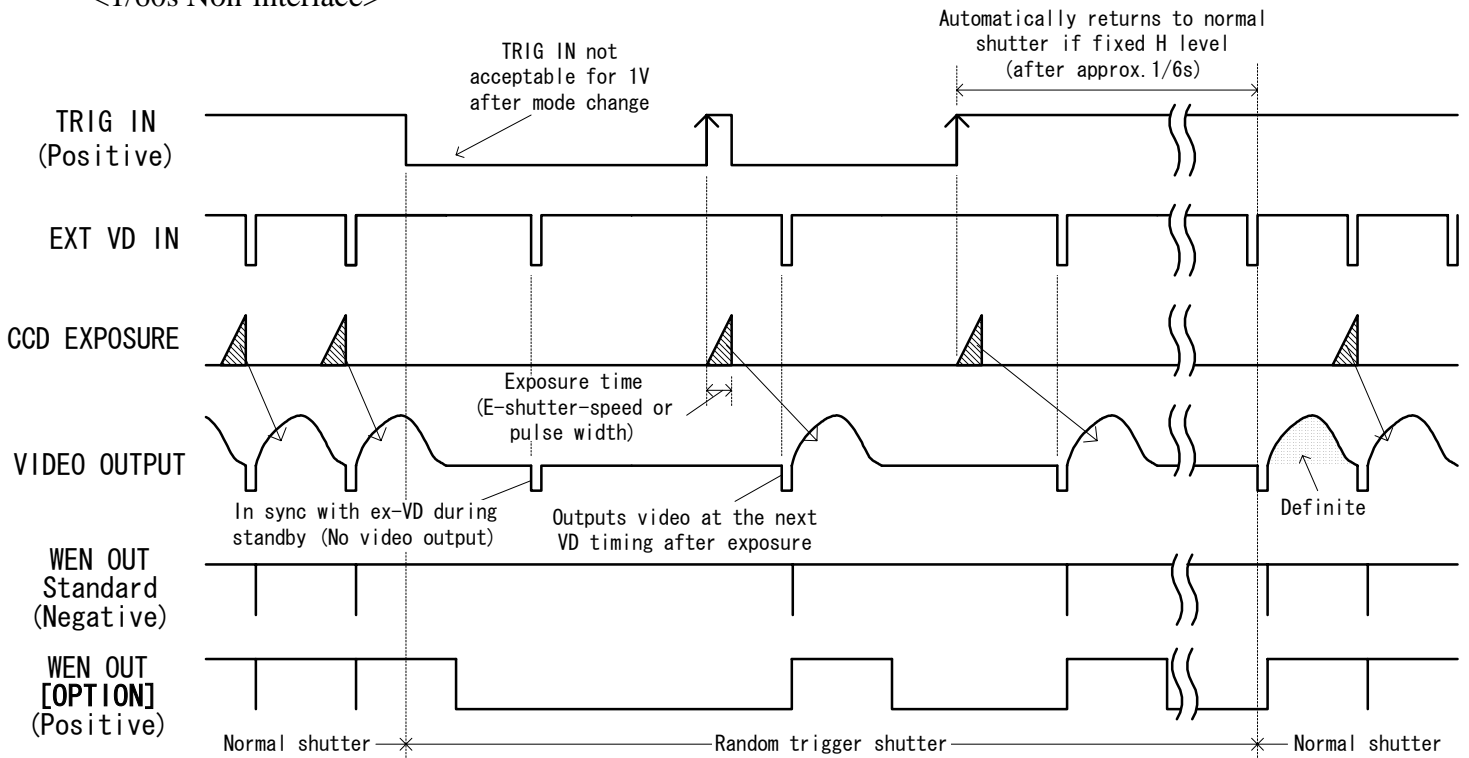
<1/120s 2:1 Interlace>



(b) Non-reset mode (Under external sync --- Single VD IN)

After TRIG IN and exposure, the camera goes into standby until next external VD IN.

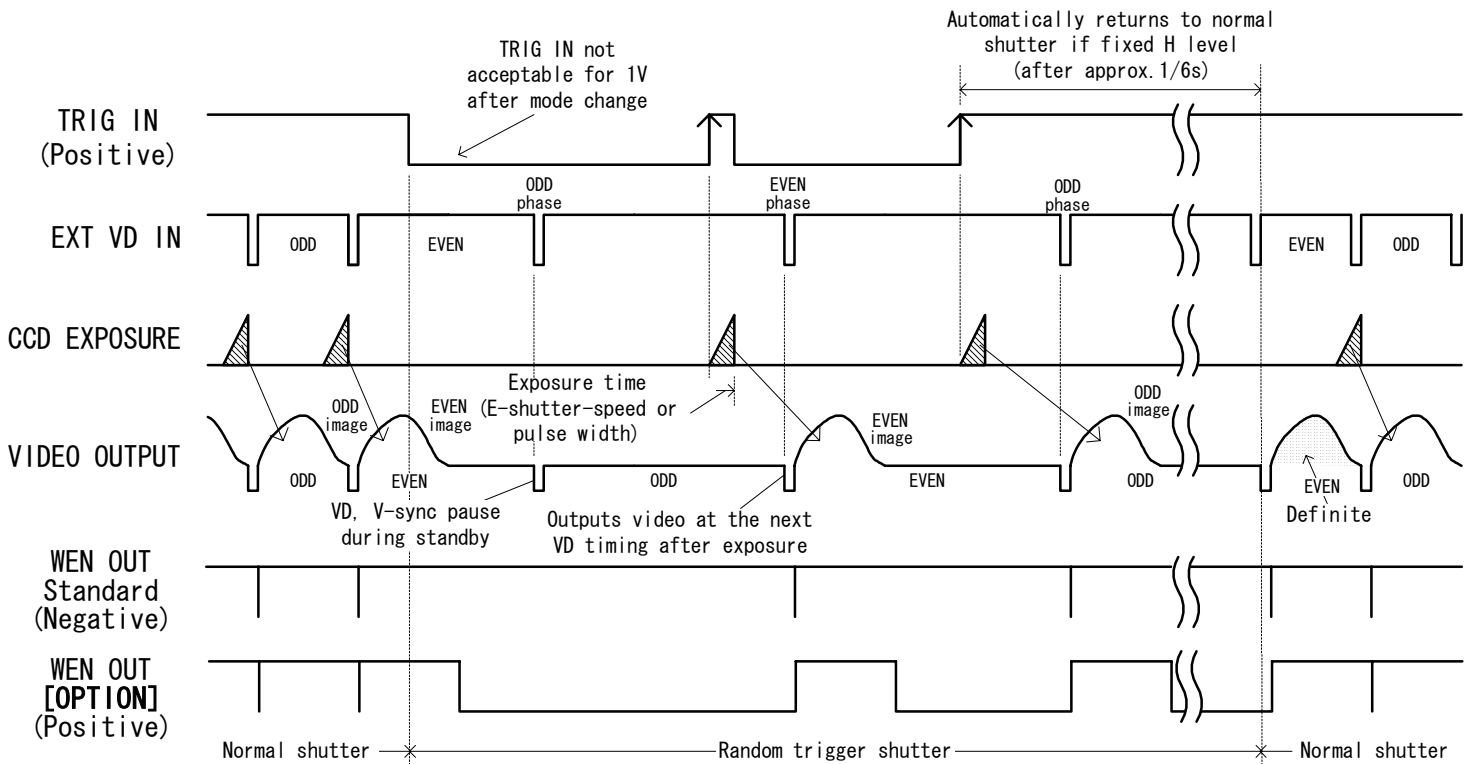
<1/60s Non-interlace>



- \* Don't provide ext. VD IN during exposure.
- \*\* After automatic return, fix ext. VD IN at Hi.

<1/120s 2:1 Interlace>

Video output field (ODD/EVEN) is determined by ext. VD falling edge and ext. HD phase.

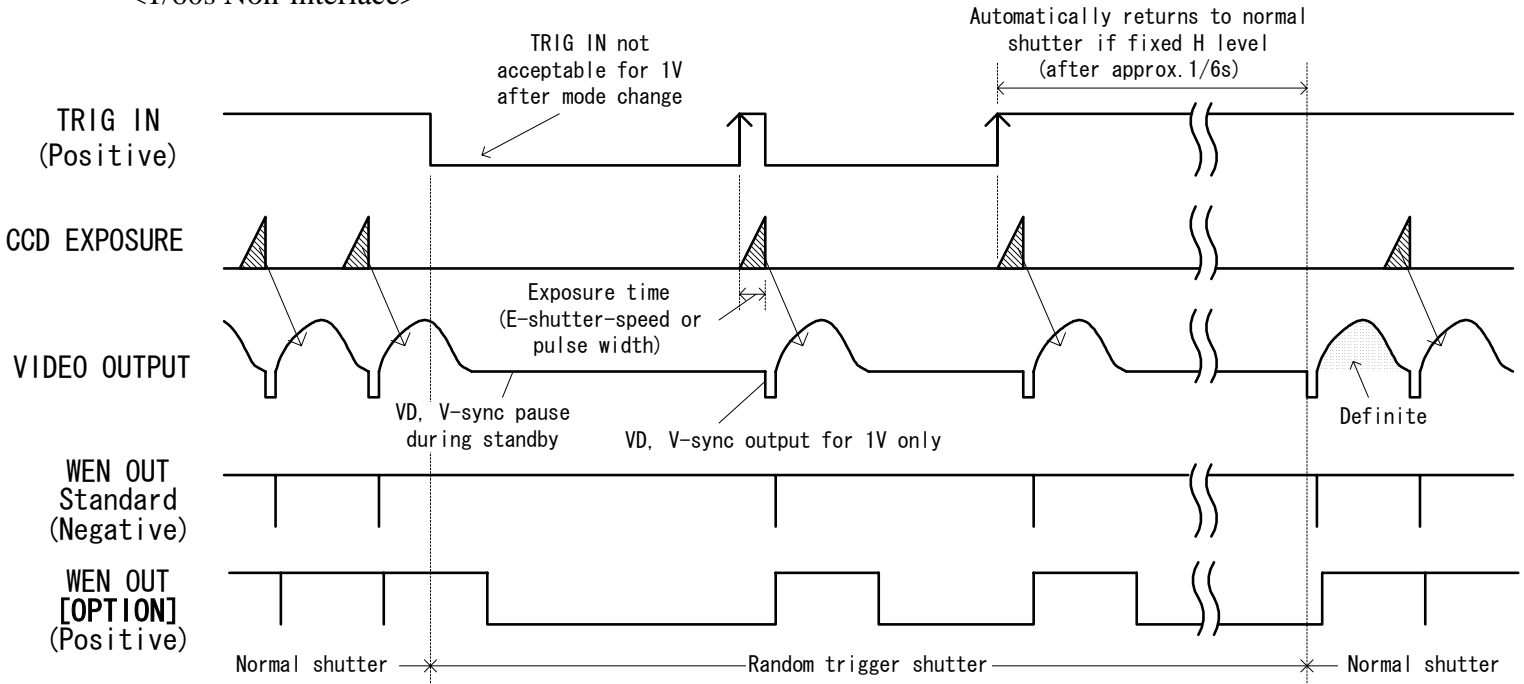


- \* Don't provide ext. VD IN during exposure.
- \*\* After automatic return, fix ext. VD IN at Hi.

(c) V-reset mode (Under internal / external-sync---without VD IN)

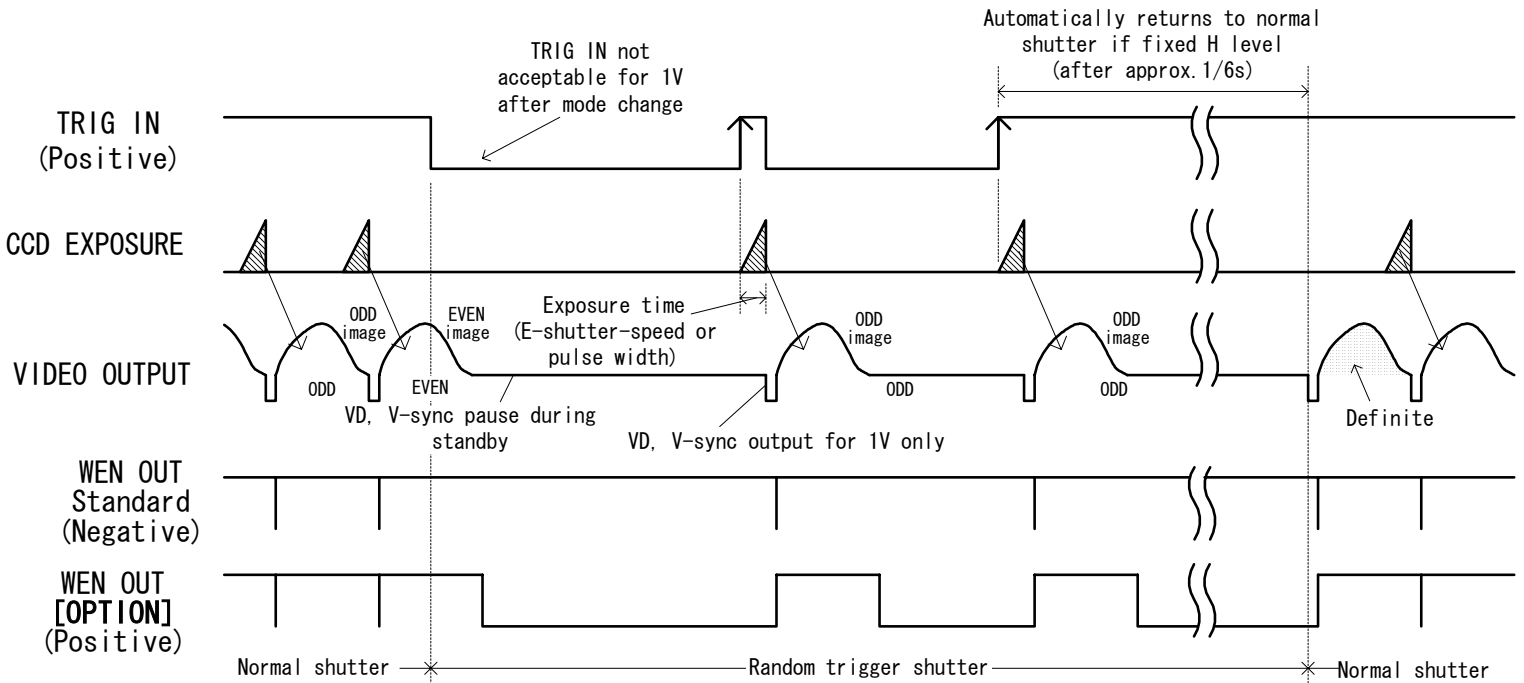
Exposure starts at the timing of TRIG signal IN. After each exposure is completed, the camera outputs video immediately by resetting VD. (HD is not reset)

<1/60s Non-interlace>



<1/120s 2:1 Interlace>

Irrespective of TRIG IN phase, the camera always outputs ODD field image.

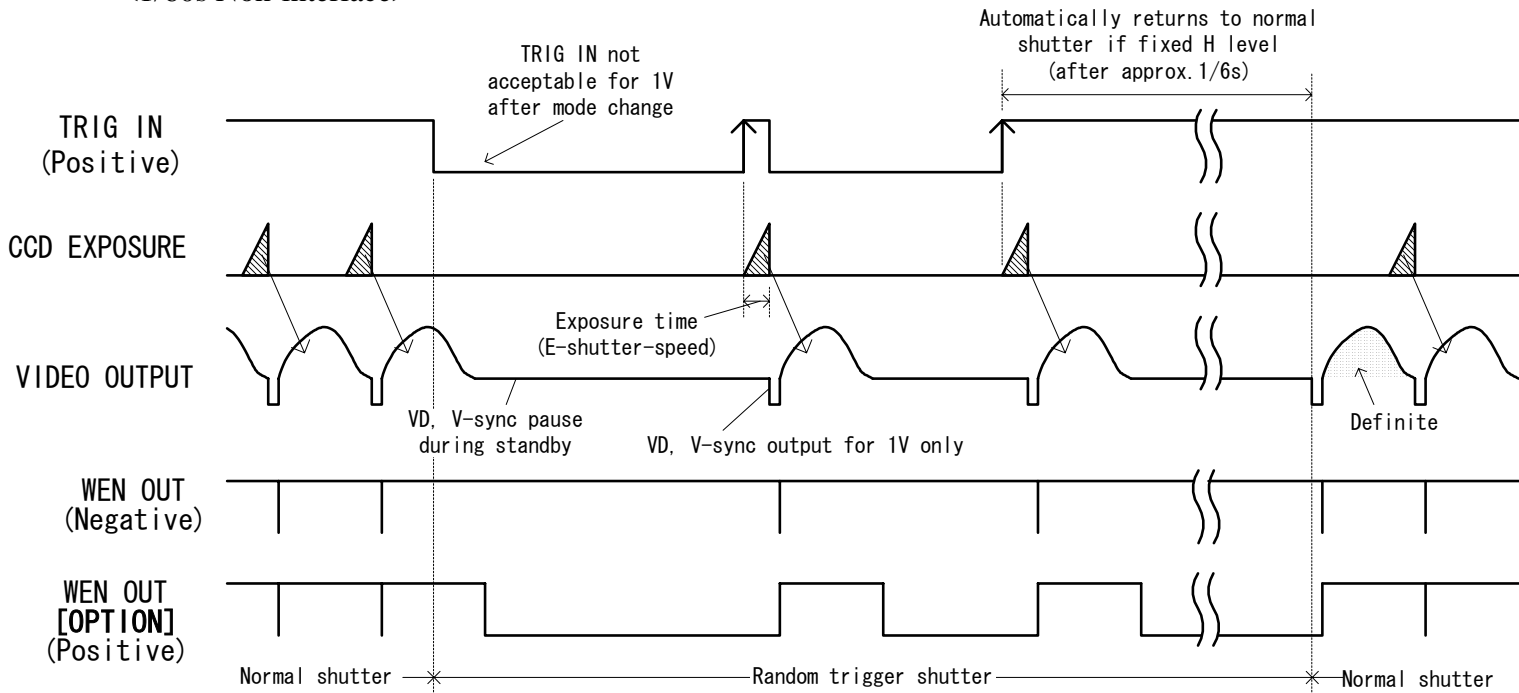


(d) SYNC reset mode (Under internal sync)

Exposure starts at TRIG signal input timing, resets HD, and outputs video immediately after exposure by resetting VD.

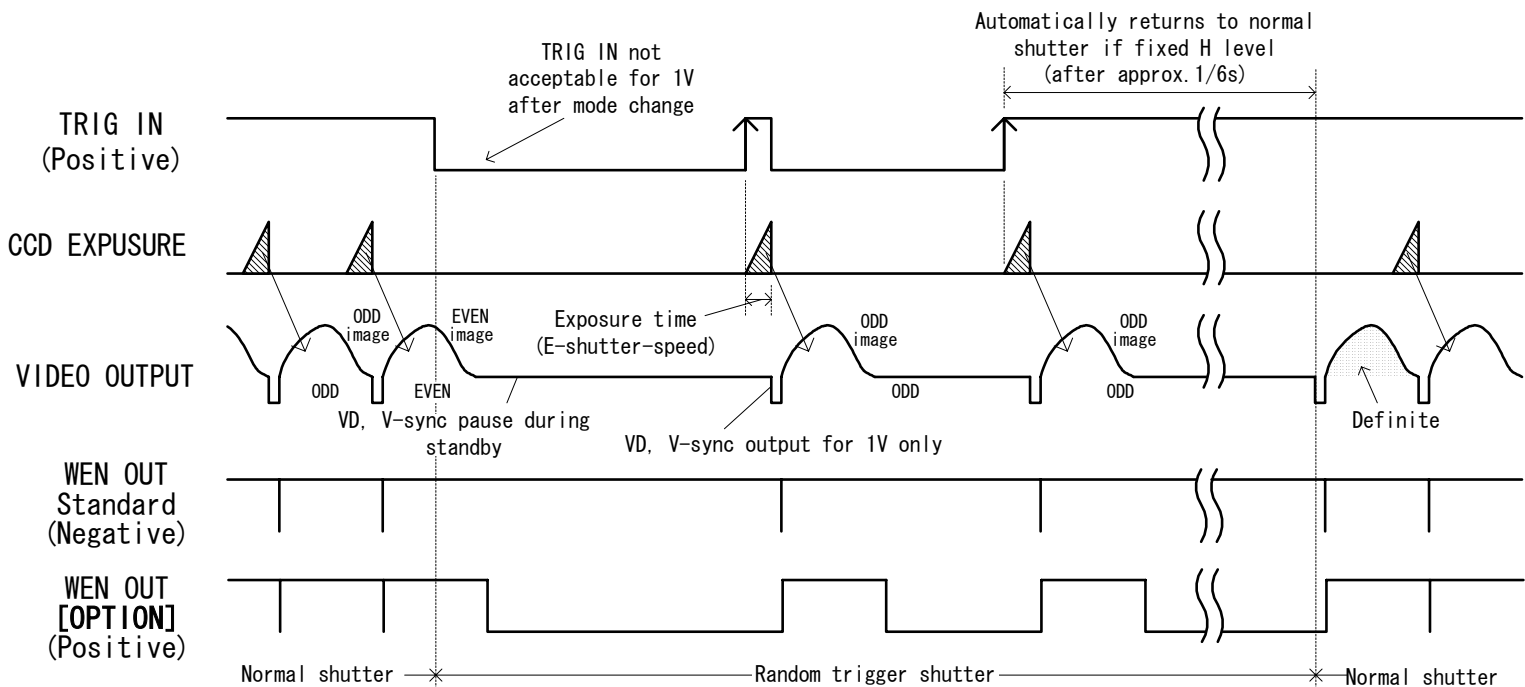
\* Available under FIX mode only.

<1/60s Non-interlace>



<1/120s 2:1 Interlace>

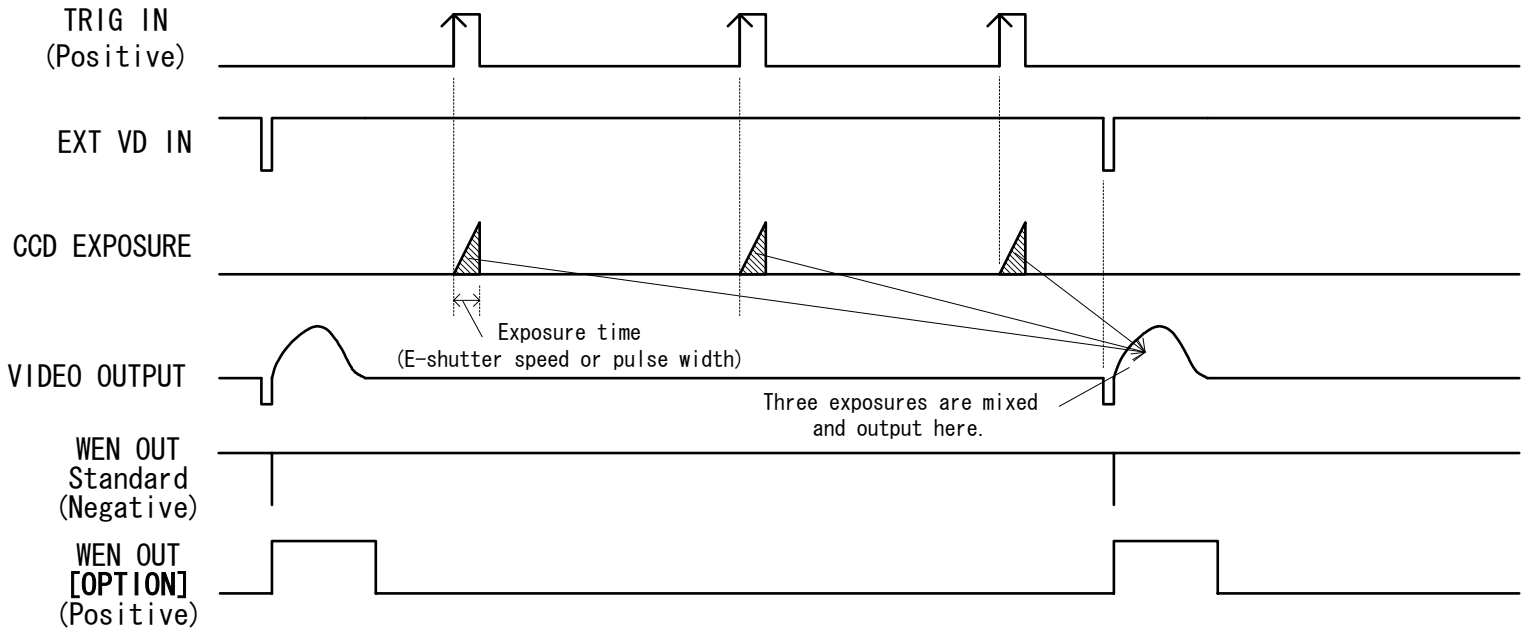
Irrespective of TRIG IN phase, the camera always outputs ODD field image.



### 8-3 MULTIPLE mode

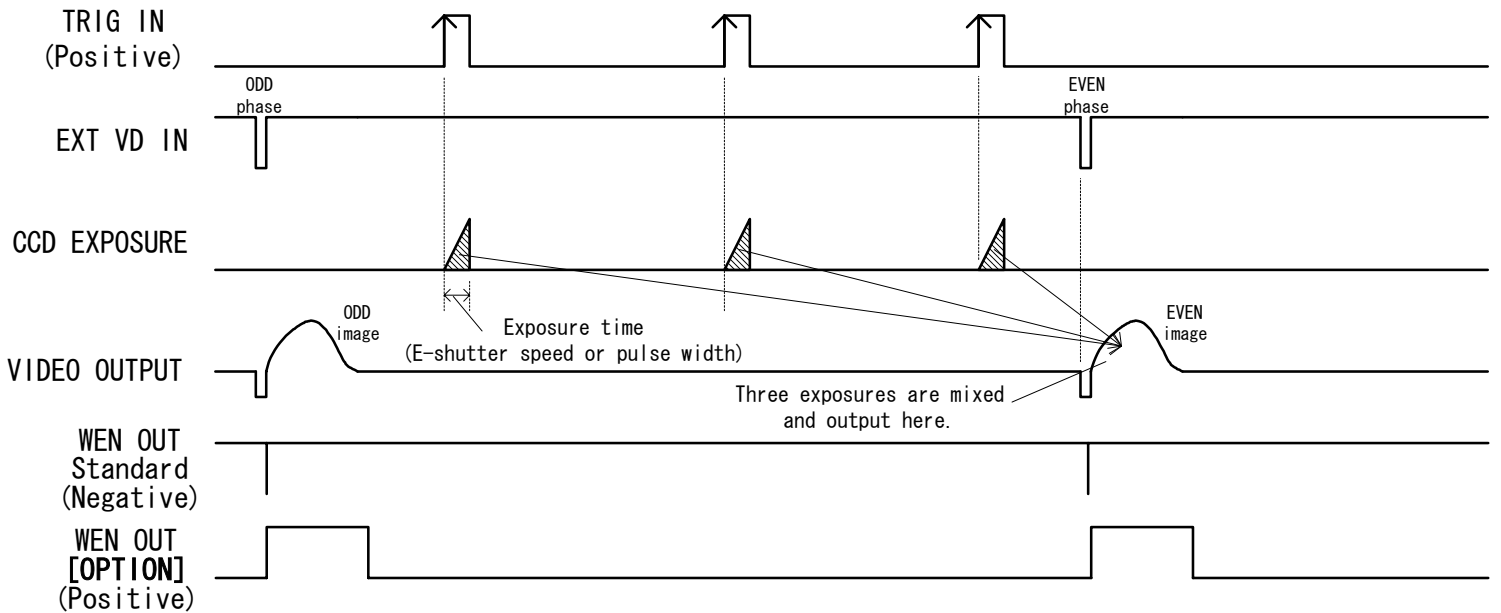
Multiple shutter operation is available by providing TRIG IN more than one time before ext. VD IN.  
 (Non-reset mode, single VD, consecutive VD IN)

<1/60s Non-interlace>



<1/120s 2:1 Interlace>

Video output field (ODD/EVEN) is determined by ext. VD falling edge and ext. HD phase.

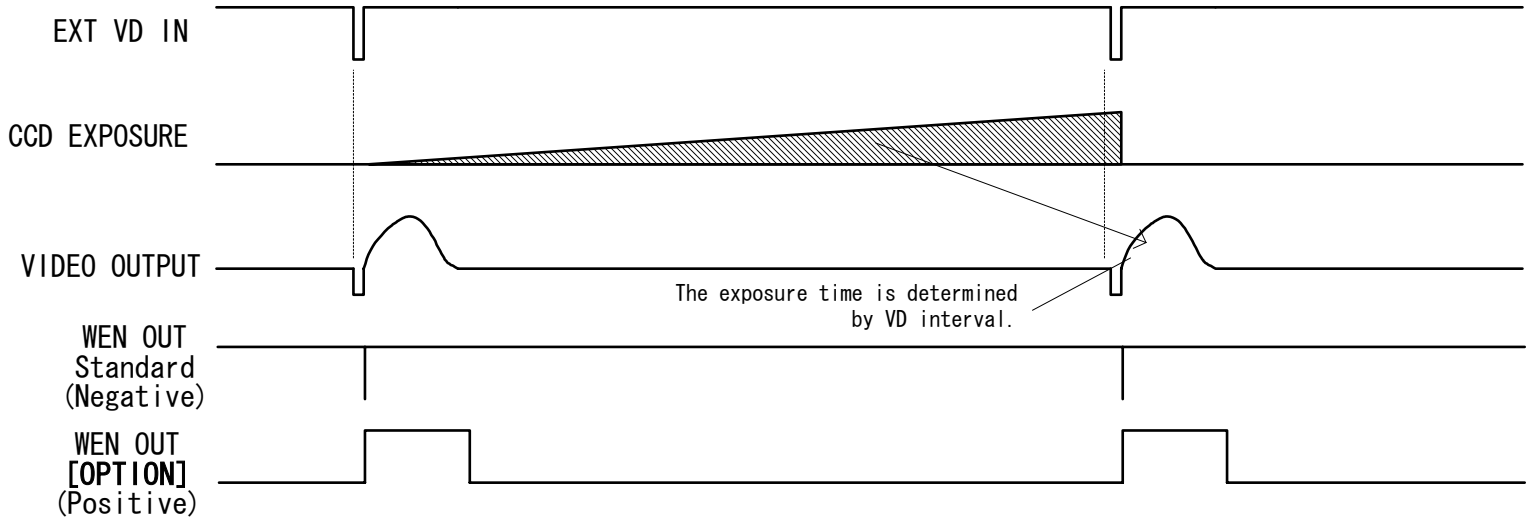


### 8-4 Restart / Reset

The restart / reset function is available with the ext. VD signal. You can get an arbitrary slower shutter speed than normal shutter and random trigger shutter.

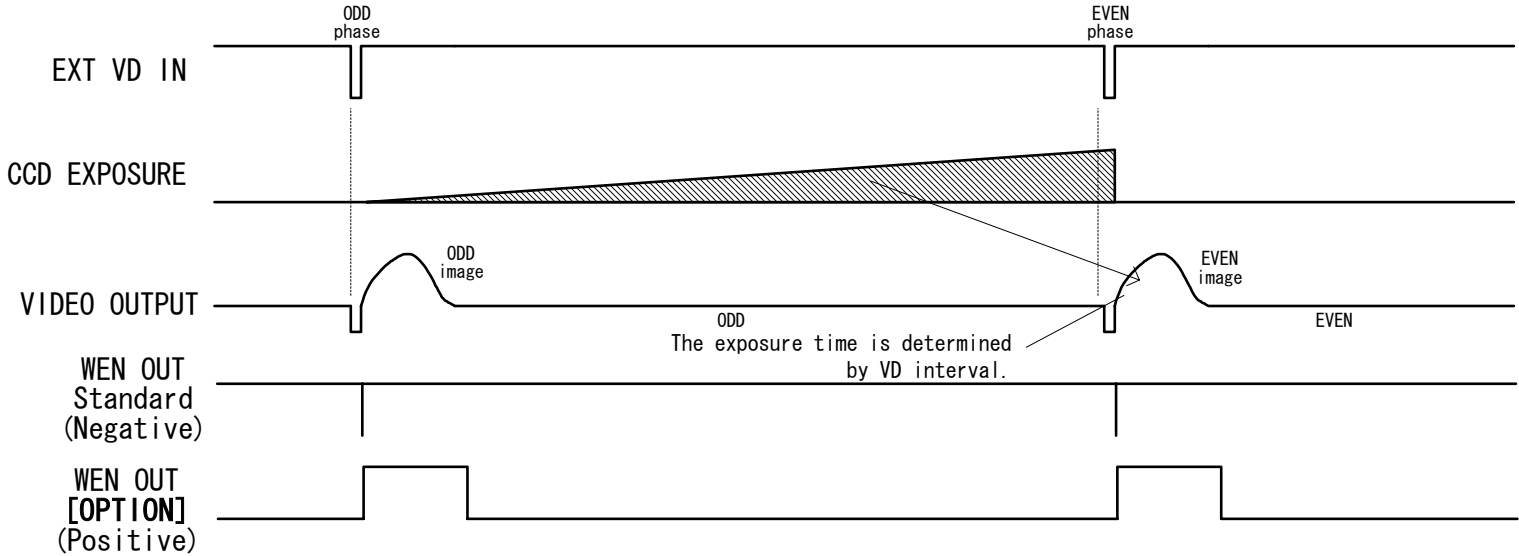
- \* The shutter speed (exposure time) is determined by ext. VD signal interval.
- \*\* This function is enabled when the bottom-panel shutter speed DIP SW is OFF.
- \*\*\* Supply consecutive VD.

<1/60s Non-interlace>



<1/120s 2:1 Interlace>

Video output field (ODD/EVEN) is determined by ext. VD falling edge and ext. HD phase.



### 8-5 Partial-scan mode selection (CCU bottom-panel DIP SW)

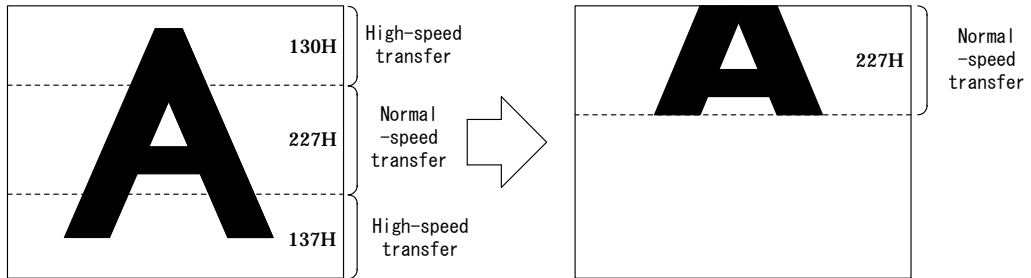
Switches partial-scan mode / There are 3 partial scan modes.

Note: Sometimes phenomenon called as “whiteout” occurs at the top of the screen when there is strong incident light entering in the wide area of a CCD, however, this is not a malfunction. If this occurs, reduce the amount of incoming rays.

#### (a) 1/2 Partial-scan ----- Screen center 1/2 readout

<1/60s Non-interlace>

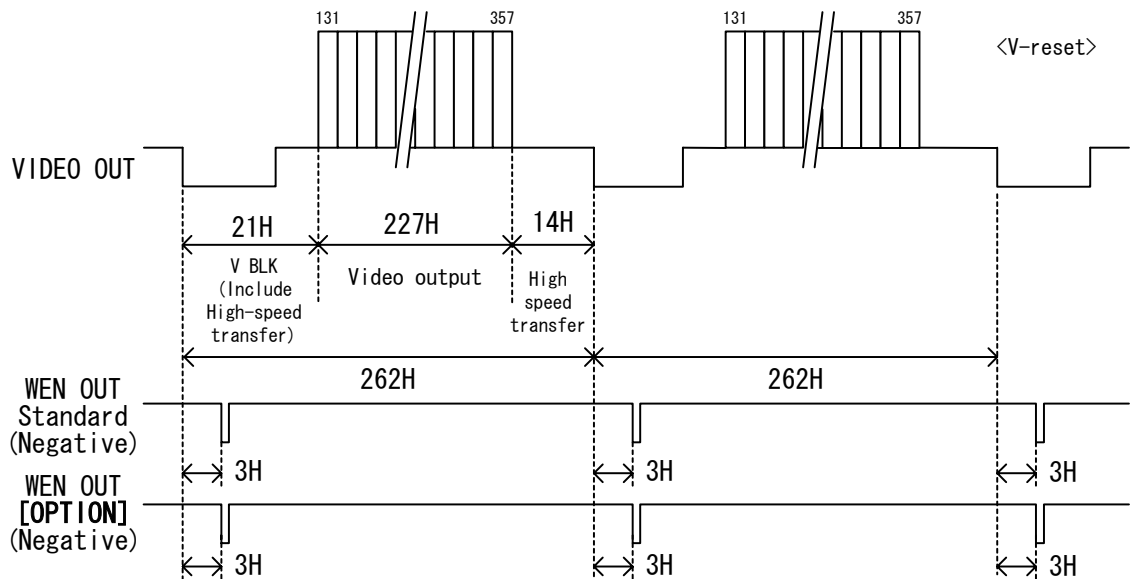
Under 1/60s non-interlace mode, only the center portion of 227H out of the total effective lines 494H (excluding BLK time) is read out. Available both under external / internal mode.



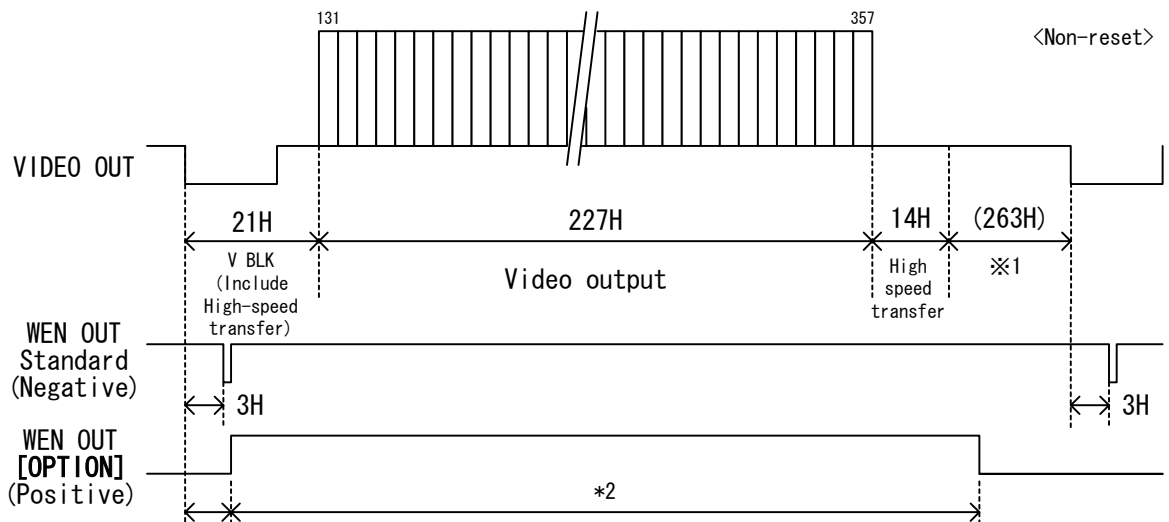
<Under normal shutter (Electronic shutter OFF)>

Notes: \* Under ext. sync, the ext. VD should be 1V = 262H.

\*\* Under normal shutter, set the bottom-panel DIP SW #5, #6 in OFF.



<Under other shutter modes>

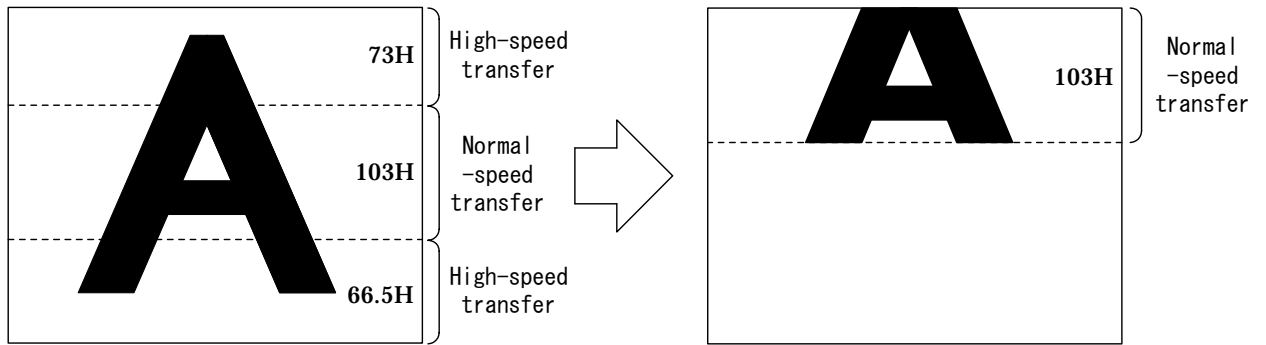


\*1:Arbitrary under ex-sync  
\*2:Please look at 7. (3) WEN timing.

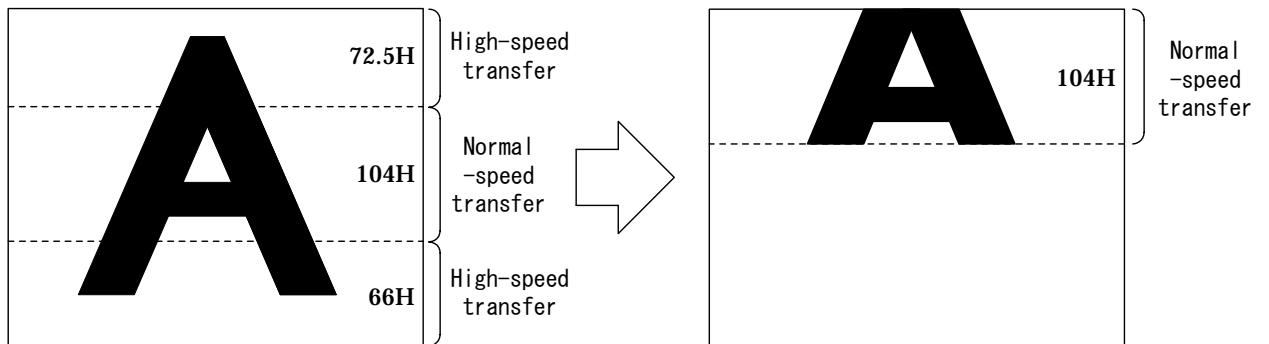
<1/120s 2:1 Interlace>

Under 1/120s interlace mode, only the center portion of 207H out of the total effective lines 485H (excluding BLK time) is read out. Available both under external / internal mode.

**ODD Field**



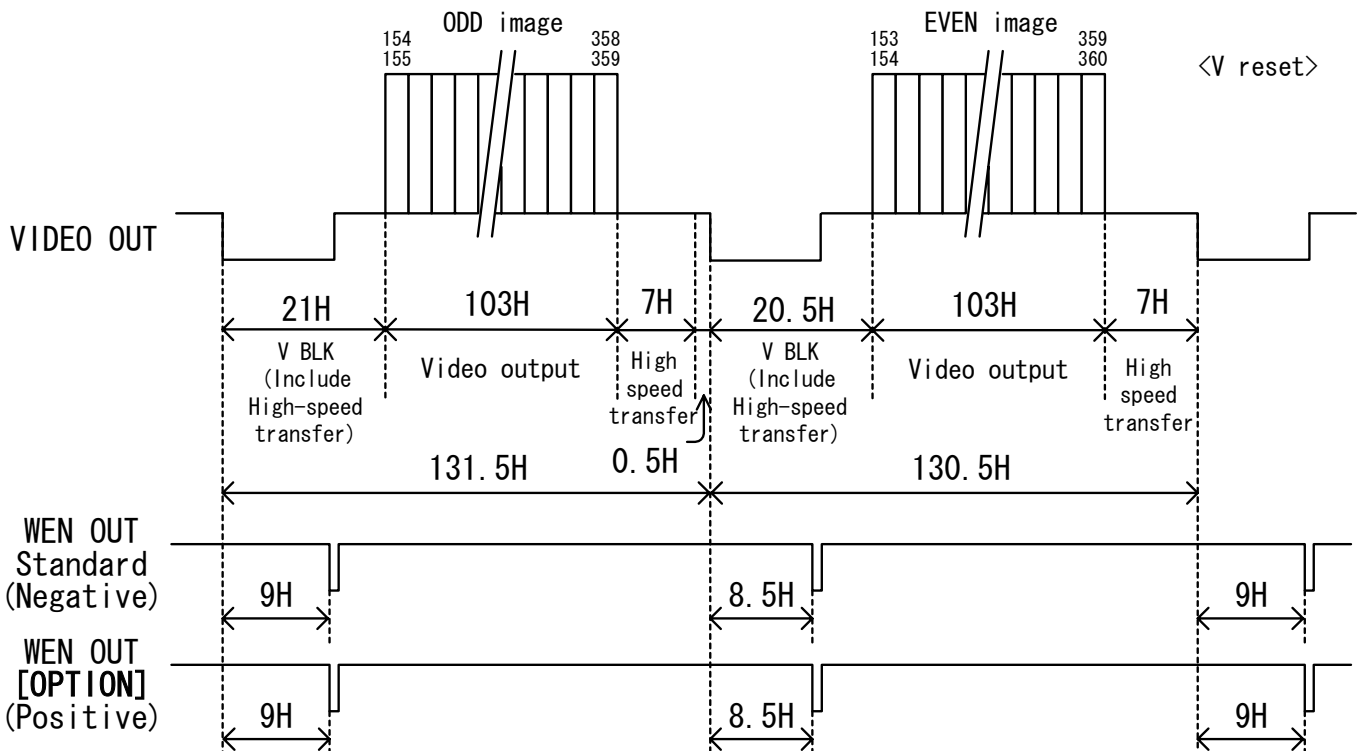
**EVEN Field**



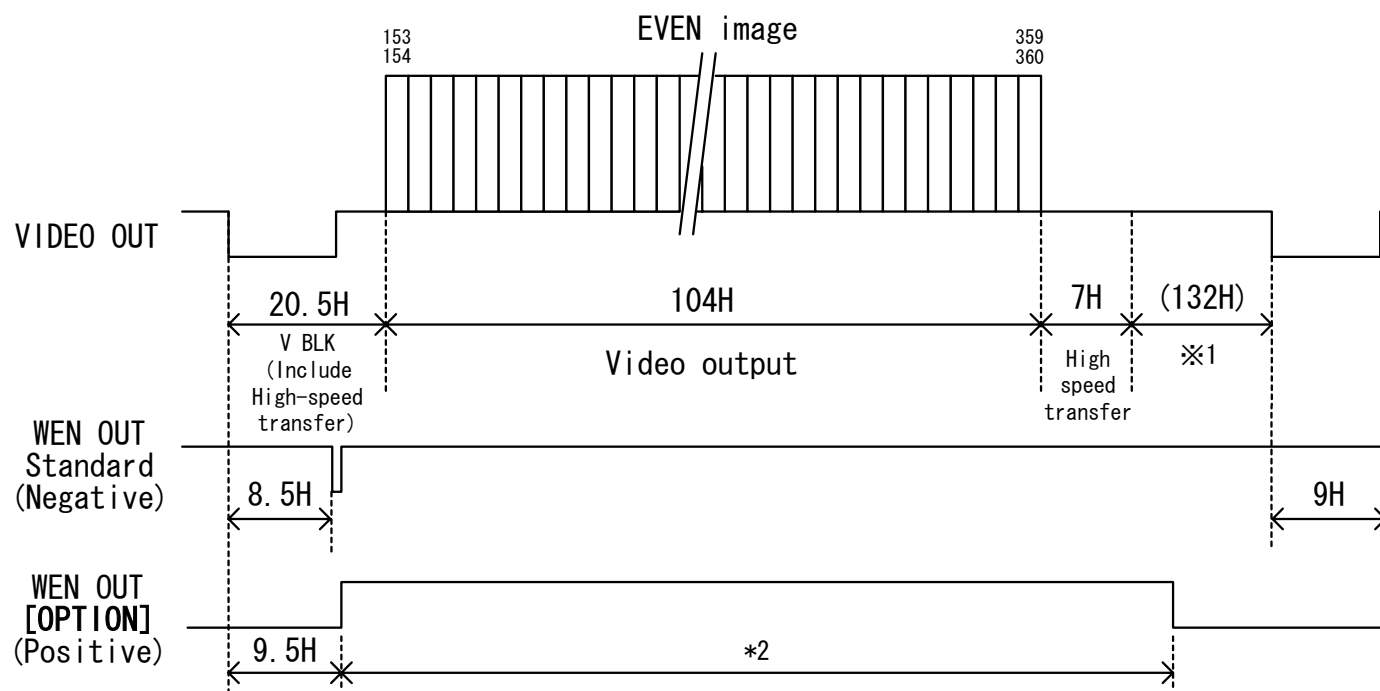
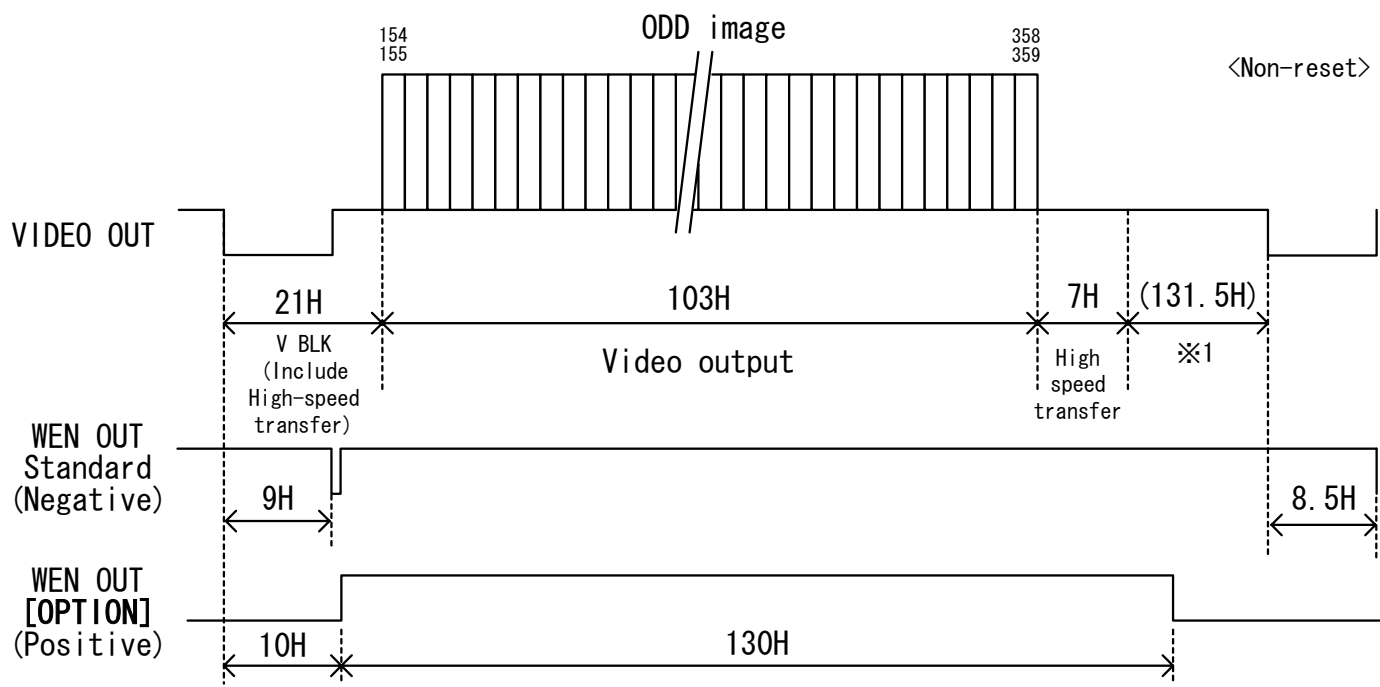
<Under normal shutter (Electronic shutter OFF)>

Notes: \* Under ext. sync, the ext. VD should be  $1V = 131.5H$ .

\*\* Under normal shutter, set the bottom-panel DIP SW #5, #6 in OFF.



<Under other shutter modes>

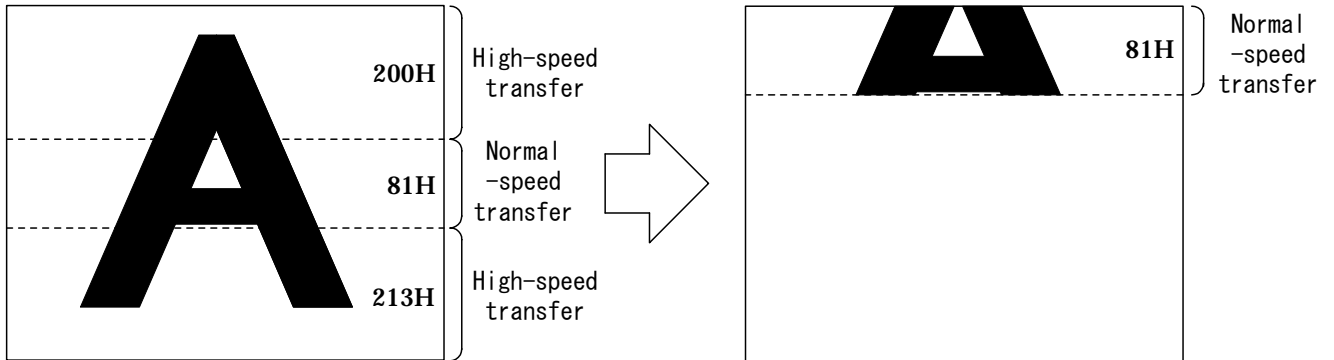


\*1:Arbitrary under ex-sync  
 \*2:Please look at 7. (3) WEN timing.

(b) 1/4 Partial-scan ----- Screen center 1/4 readout

<1/60s Non-interlace>

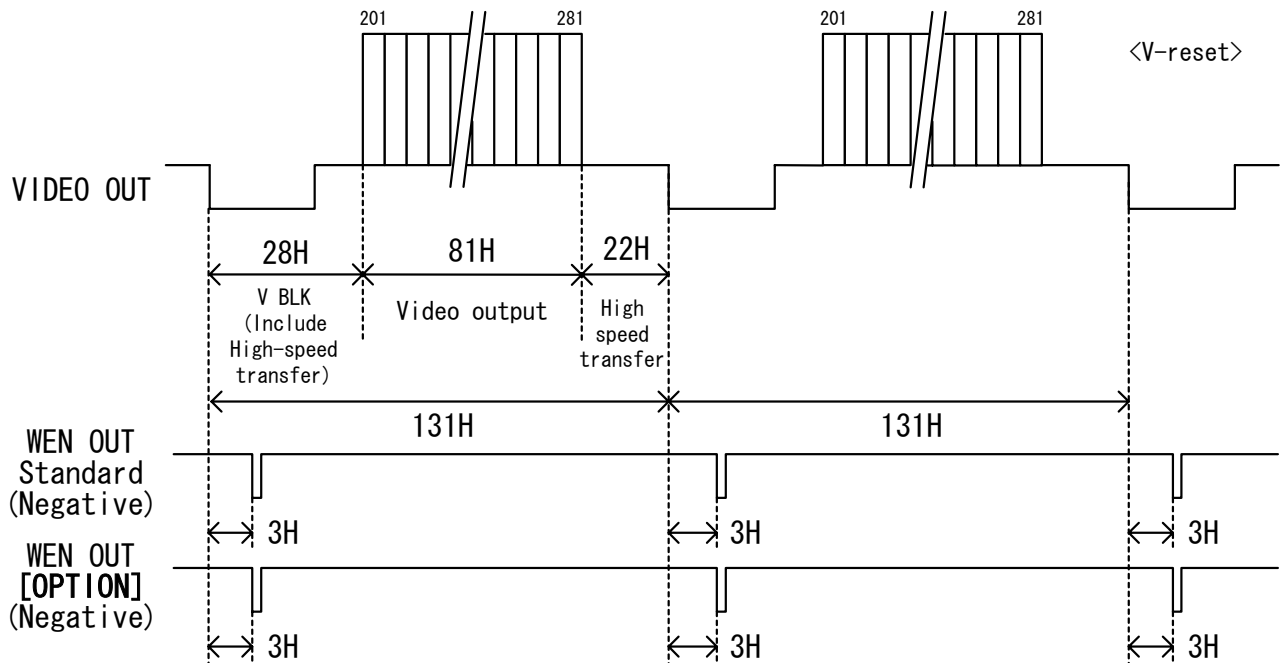
Under 1/60s non-interlace mode, only the center portion of 81H out of the total effective lines 494H (excluding BLK time) is read out. Available both under external / internal mode.



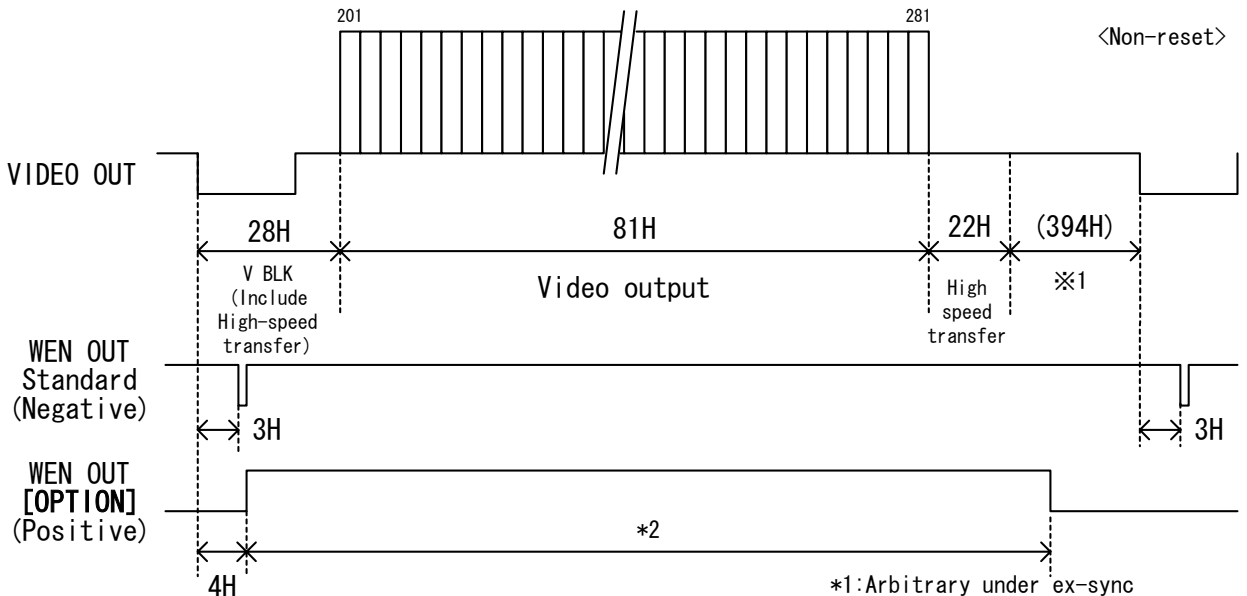
<Under normal shutter (Electronic shutter OFF)>

Notes: \* Under ext. sync, the ext. VD should be 1V = 131H.

\*\* Under normal shutter, set the bottom-panel DIP SW #5, #6 in OFF.



<Under other shutter modes>



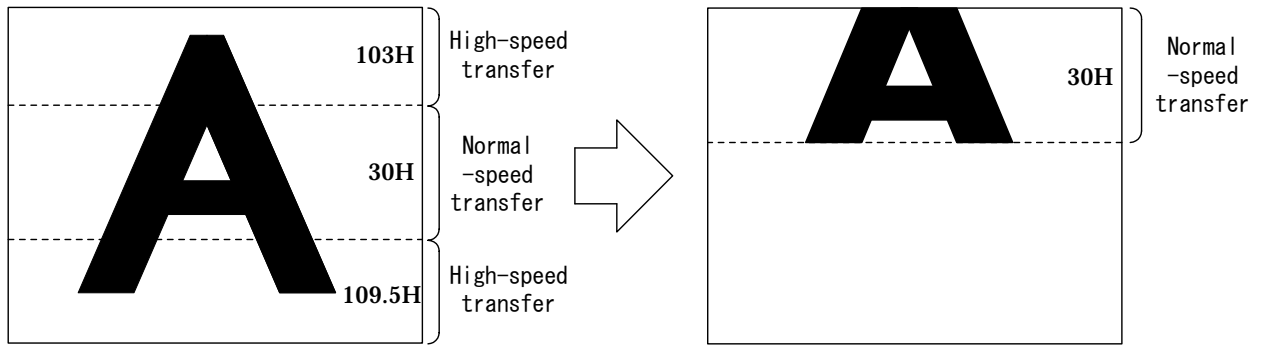
\*1:Arbitrary under ex-sync

\*2:Please look at 7. (3) WEN timing.

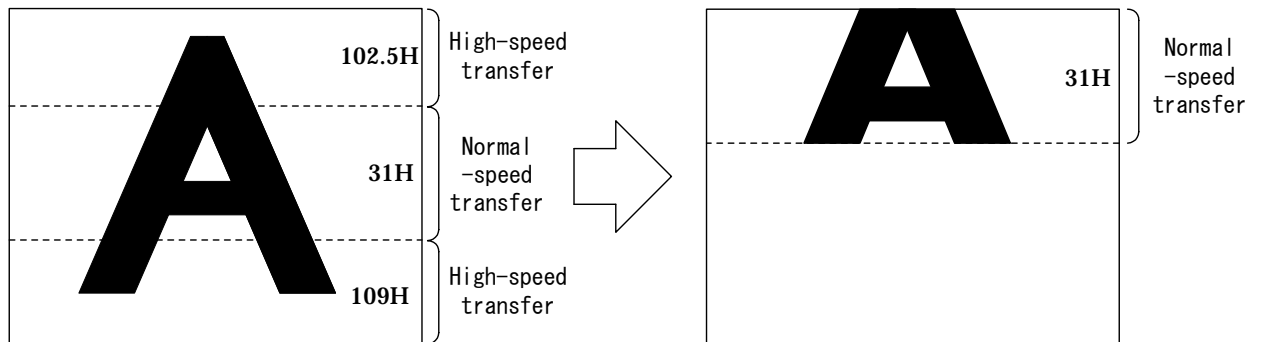
<1/120s 2:1 Interlace>

Under 1/120s interlace mode, only the center portion of 61H out of the total effective lines 485H (excluding BLK time) is read out. Available both under external / internal mode.

**ODD Field**



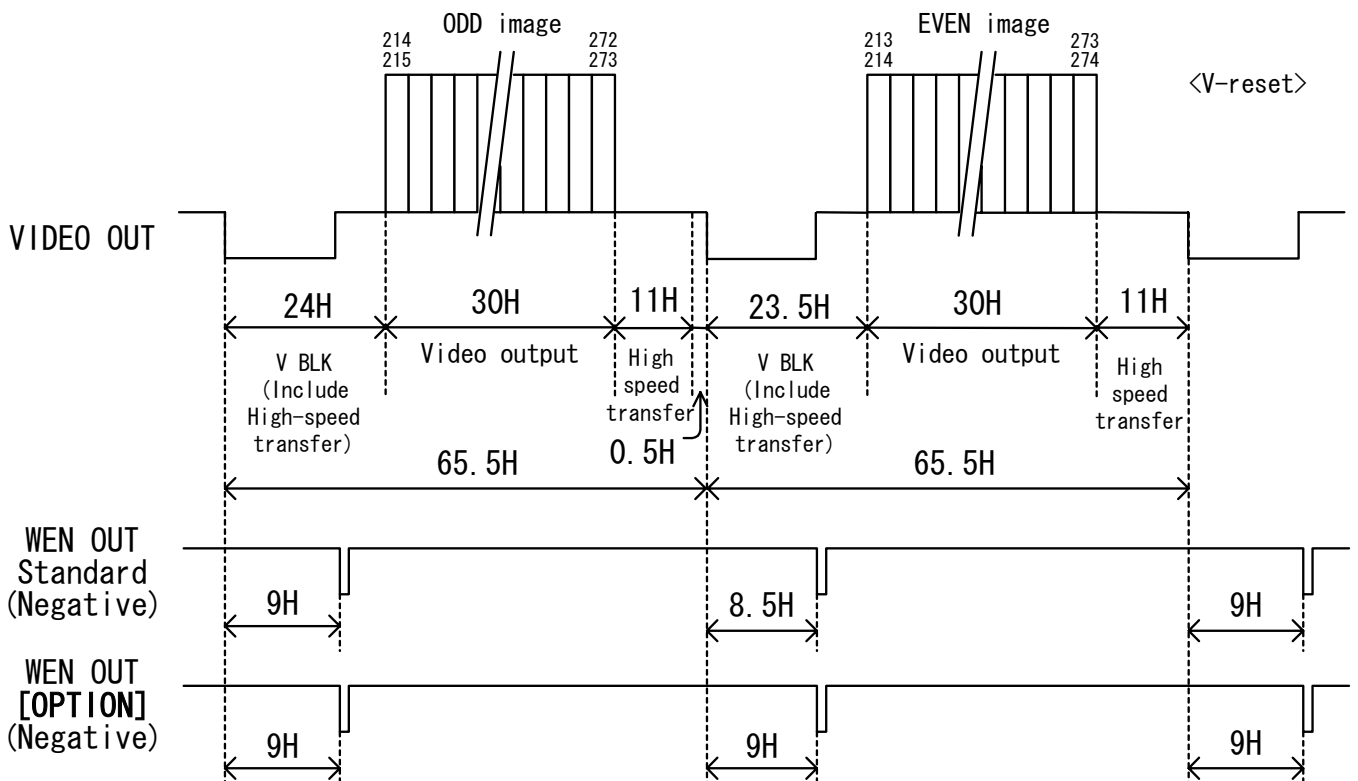
**EVEN Field**



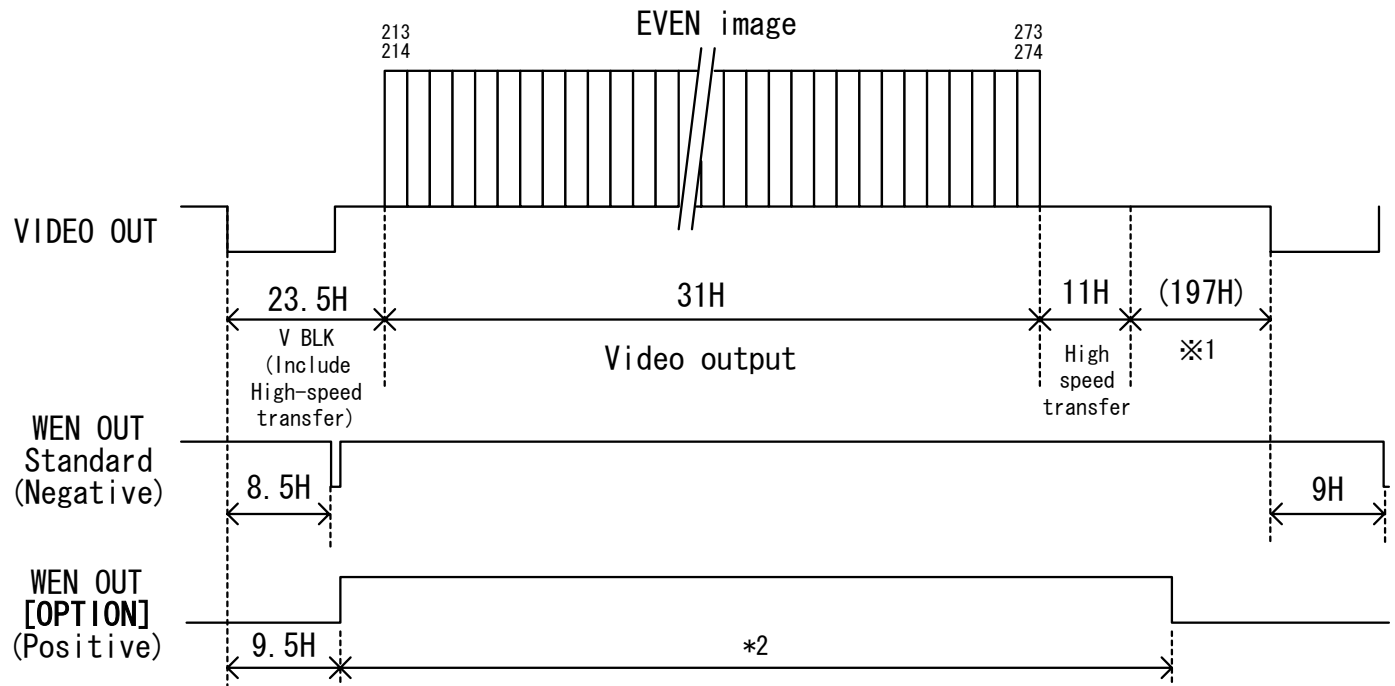
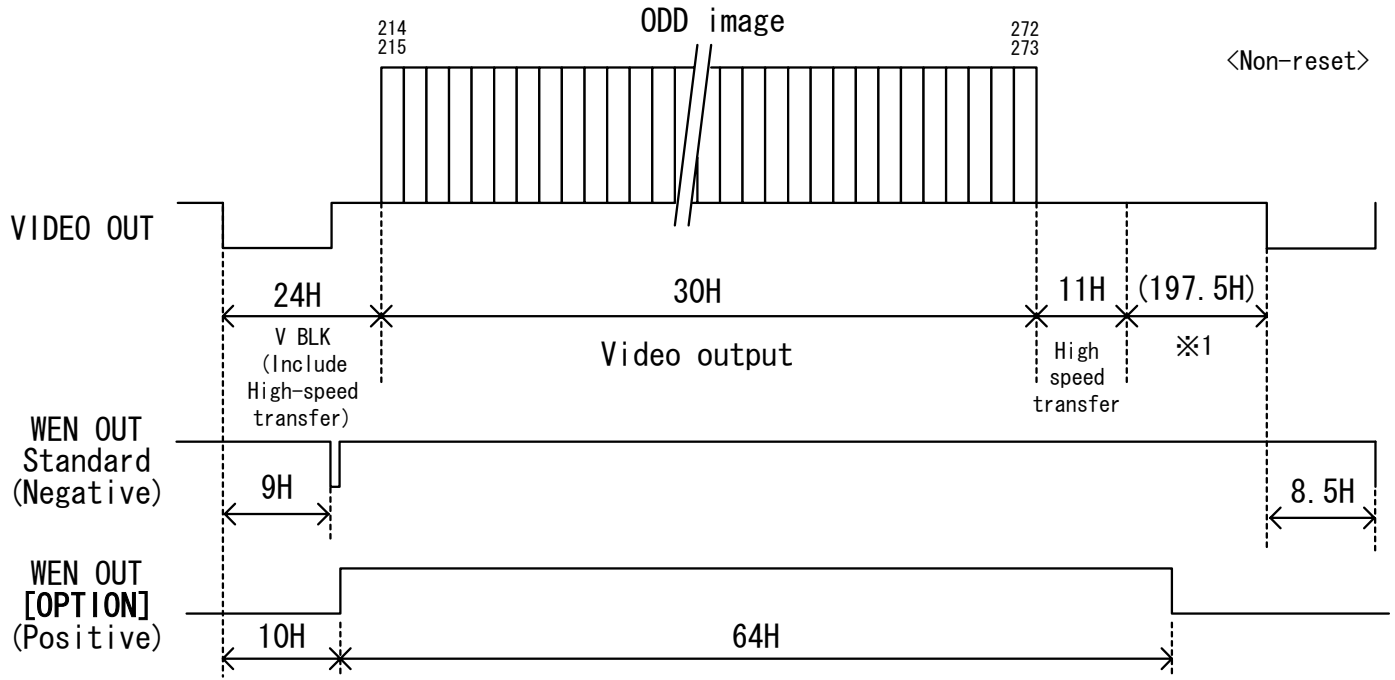
<Under normal shutter (Electronic shutter OFF)>

Notes: \* Under ext. sync, the ext. VD should be 1V = 65.5H.

\*\* Under normal shutter, set the bottom-panel DIP SW #5, #6 in OFF.



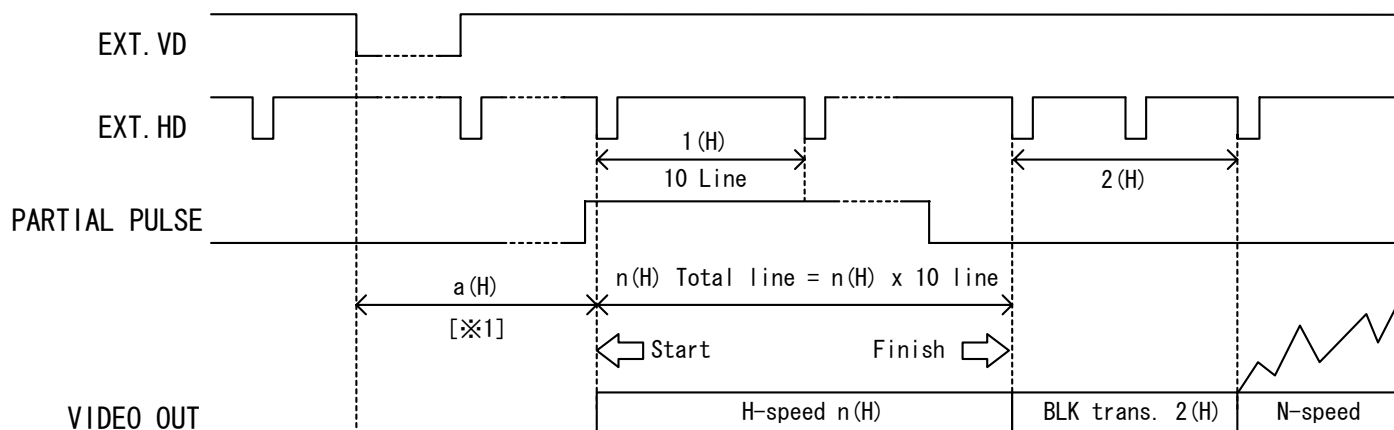
<Under other shutter modes>



\*1:Arbitrary under ex-sync  
 \*2:Please look at 7. (3) WEN timing.

(c) Programmable partial [Option]

By designating the high-speed transfer portion with external PARTIAL signal input, the camera read out only the portion of CCD area necessary for your application. This is available under ext. sync.



[※1]	1/60s non-interlace		1/120s Interlace	
			1st field	2nd field
a (H)	6.0		12.0	11.5

(Conditions)

- The starting point of external partial signal is [\*1] from the falling edge of ext. VD.
- The external partial signal is controlled at each ext. HD falling edge. Set the start / finish of the external partial signal in 1H increments.
- The number of 1H high-speed transfer line is 10 lines. The actual lines are determined by the external partial signal “hi” length. (Minimum: 2H = 20 lines)
- After high-speed transfer, 2H is allocated to blank transfer period. Normal transfer starts at the next line.
- VIDEO OUT vertical blanking is;  

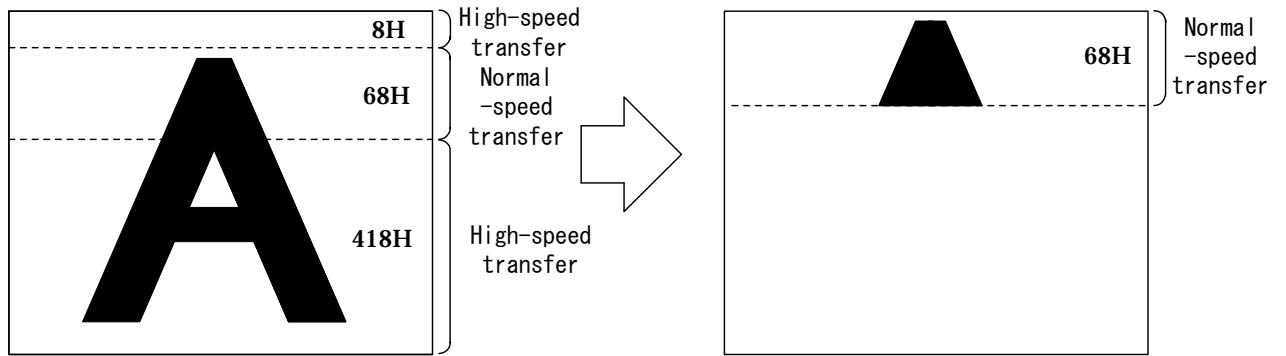
$$V. \text{ blanking} = [*1](H) + n(H) + \text{BLK transfer } [2(H)] - 1H$$

Example follows below.

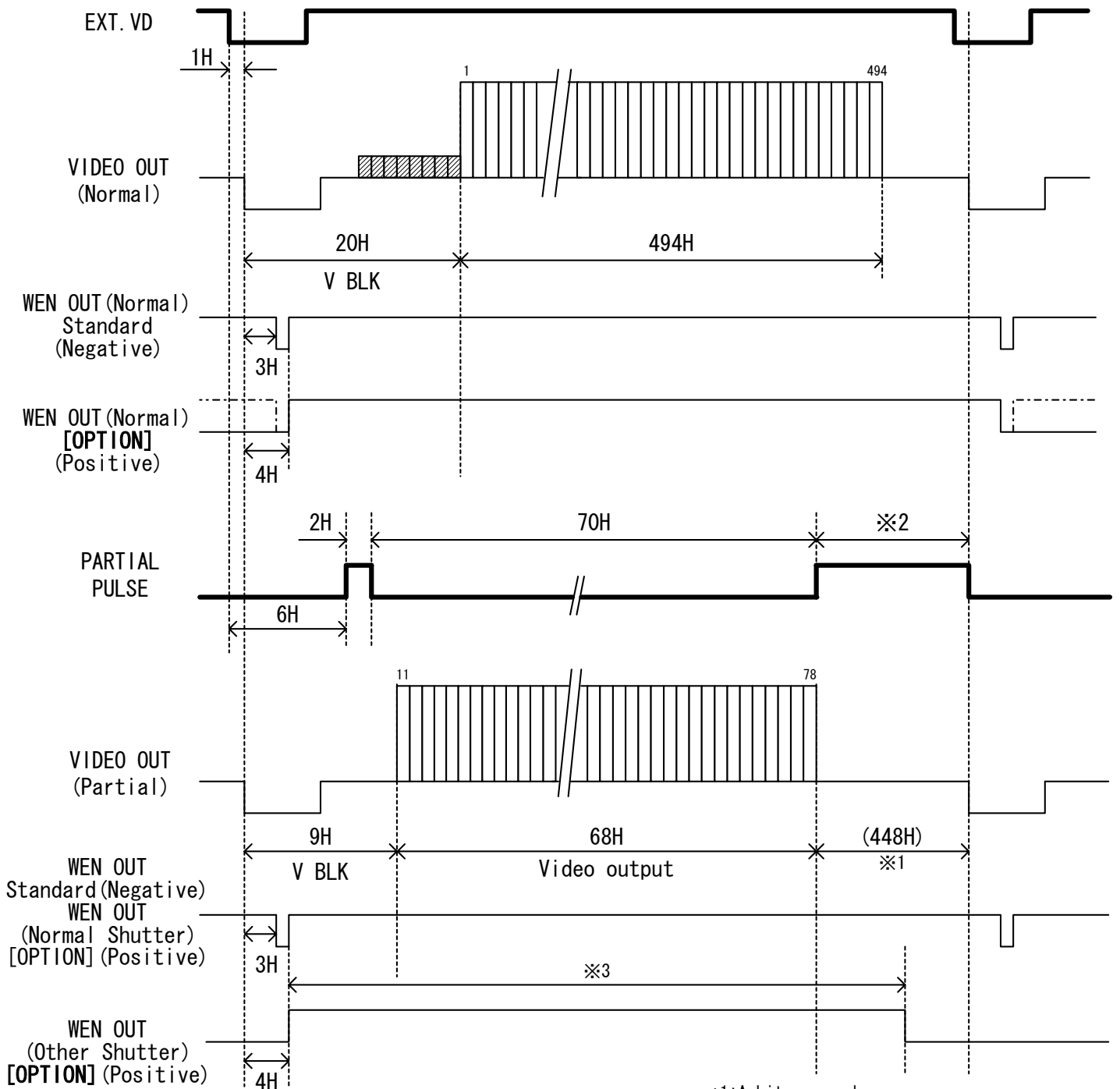
(High-speed minimum 2H = 20 lines, Normal-speed 70 lines + BLK 2H)

**Note: Items shown as [Option] in this document is not included in your purchase as standard components. Contact our dealer / distributor for details.**

<1/60s Non-interlace>

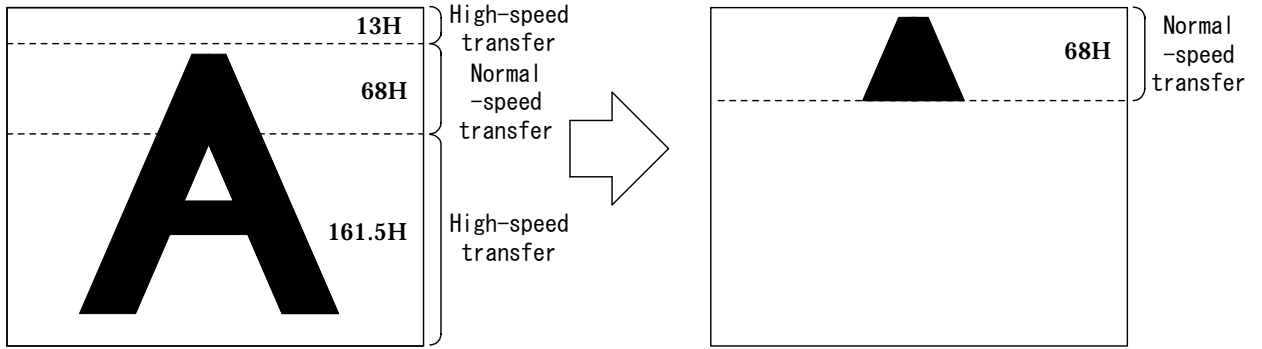


The timing is as follows;



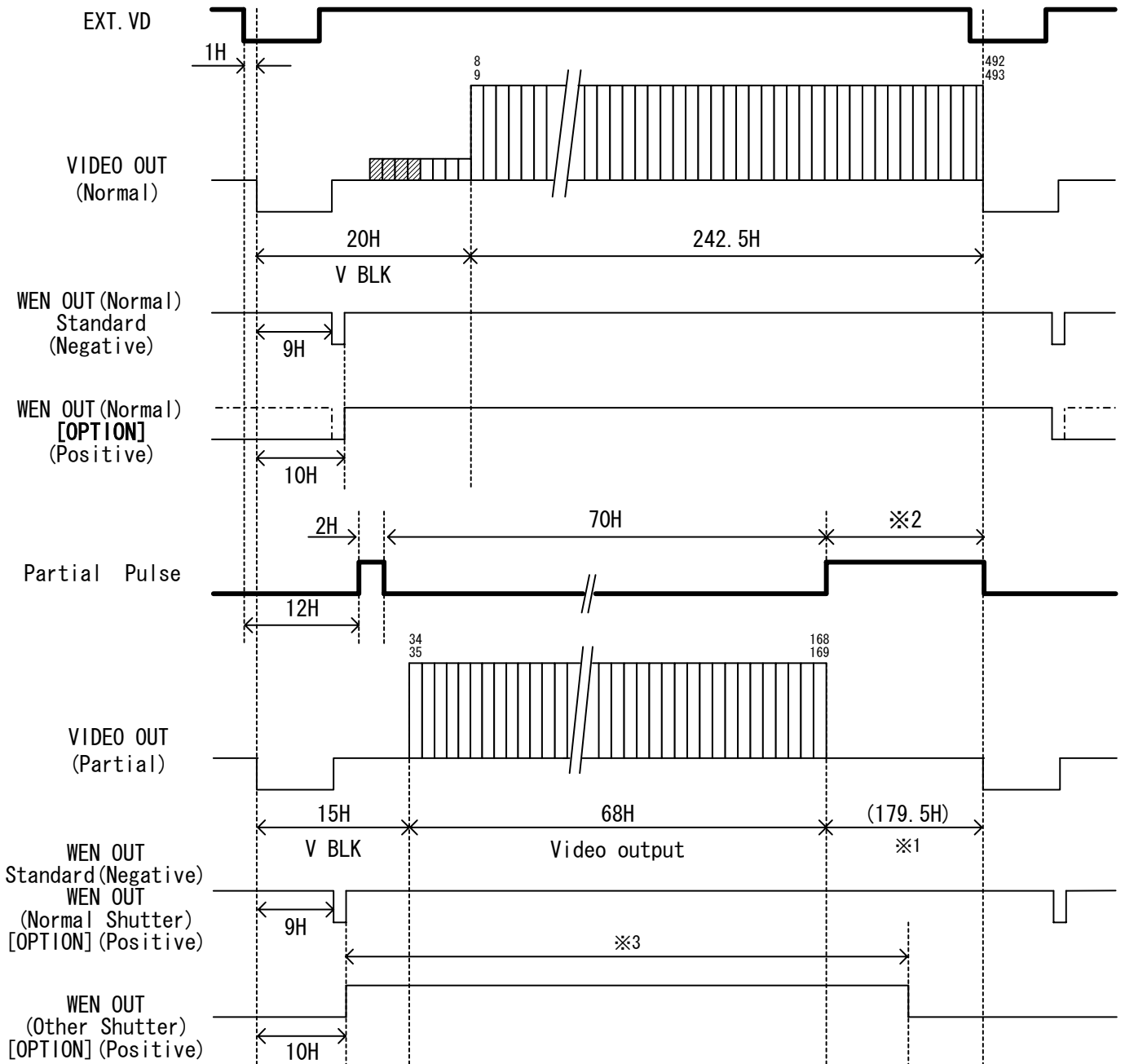
\*1:Arbitrary under ex-sync  
 \*2:Partial over actual video lines is OK  
 \*3:Please look at 7. (3) WEN timing.

<1/120s 2:1 Interlace, ODD field>



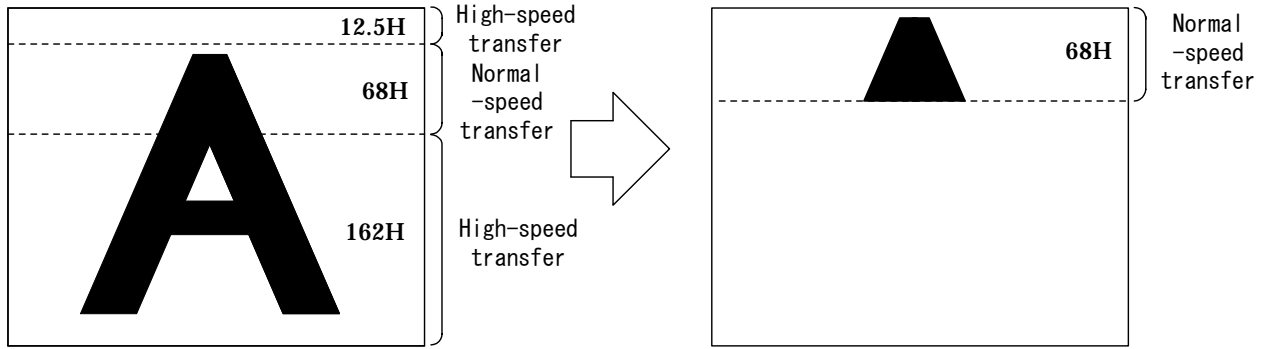
The timing is as follows;

**ODD field**



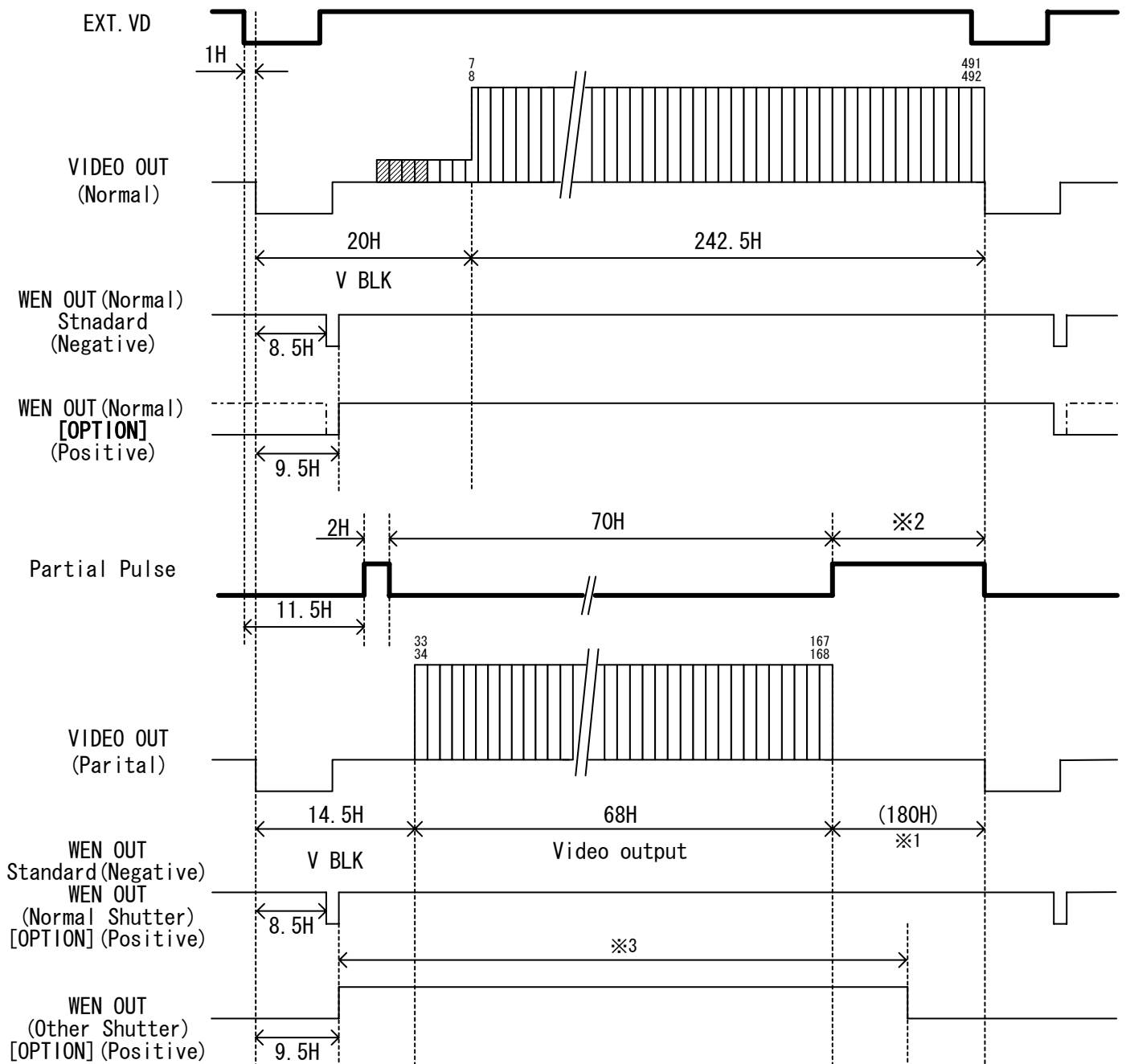
\*1:Arbitrary under ex-sync  
 \*2:Partial over actual video lines is OK  
 \*3:Please look at 7. (3) WEN timing.

<1/120s 2:1 Interlace, EVEN field>



The timing is as follows;

**EVEN field**



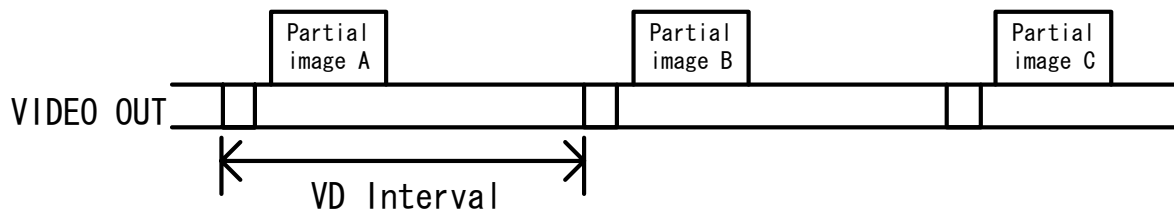
\*1:Arbitrary under ex-sync  
 \*2:Partial over actual video lines is OK  
 \*3:Please look at 7. (3) WEN timing.

(d) Partial-scan sync-signal reset

(d-1) Non-reset (Electronic shutter enabled)

VD doesn't get reset after video readout. The interval of VD signal is as follows.

	1/2 partial scan	1/4 partial scan
1/60s non-interlace	525H	525H
1/120s interlace	262.5H	262.5H

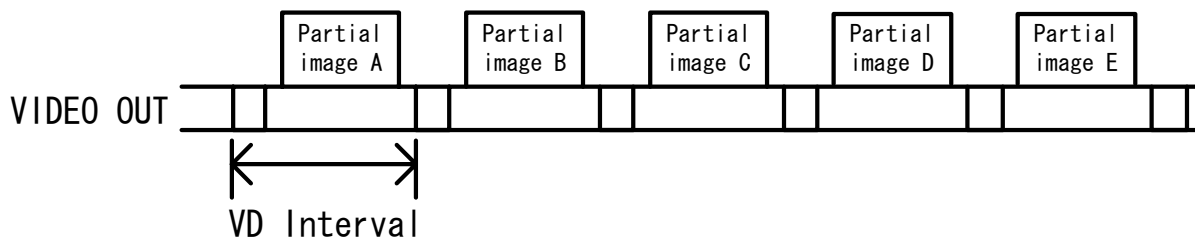


\* Under normal shutter mode, when partial scan is set to non-reset, the electronic shutter is enabled. However, when the input interval of external VD is shorter than that of the above mentioned, be sure that the exposure time becomes shorter than the set time.

(d-2) V-reset (Electronic shutter disabled)

VD does get reset after video readout. Under internal sync, the interval of VD signal is as follows.

	1/2 partial scan	1/4 partial scan
1/60s non-interlace	262H	131H
1/120s interlace	131.5H	65.5H



## 9. Specifications

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### [Basic spec]

(1) Image sensor	All Pixel's Data Read-out Interline CCD
Total pixels	692(H) x 504(V)
Active pixel	659(H) x 494(V)
Video output pixels	648(H) x 494(V) (Under non-interlace) 648(H) x 485(V) (Under interlace)
Scanning area	4.88(H) x 3.66(V) mm (=Equivalent to 1/3 type CCD size)
Unit cell size	7.4(H) x 7.4(V) $\mu$ m (Square-grid array)
(2) TV system	Special format (Non-conforming to EIA)
(3) Scanning lines	525 lines
(4) Interlace	1/60s Non-interlace mode 1/120s 2:1 Interlace mode (switching via bottom-panel DIP SW)
(5) Sync system	Internal/External automatic switch-over
(6) Aspect ratio	4:3
(7) Video output	VS 1.0V(p-p) / 75-ohm, DC coupled, 1 line DC/AC coupled [switching via internal SW]
(8) Resolution	485 TV lines (H) 485 lines (350 TV lines)(V)
(9) S/N	Standard: 52dB(p-p)/rms (Initial factory setting)
(10) Illumination	Standard 400 lx (F5.6) Minimum 4 lx (F1.4) (GAIN MAX, Approx. 50% video output)
(11) Gain	FIX (Fixed) gain: Factory-shipped preset level MANU (Manual) gain: Setting through GAIN VR FIX / MANU switching via rear-panel SW
(12) Gamma correction	Gamma = 1 (Fixed)
(13) White-clip level	Approx. 857mV(p-p) (Excluding SYNC)
(14) Power source	DC12V +/- 10% Ripple voltage: 50mV(p-p) or less
(15) Power consumption	Approx. 3.0W
(16) Camera cable	1m



\* Before connecting / disconnecting the connector, make sure the camera power is OFF to prevent a malfunction.

\*\* Do NOT use in combination with camera head and CCU having the different serial number.

**CAUTION**

To do so might cause not to make full use of the essential function of this camera.

### [Internal sync spec]

(1) Base clock frequency	24.545MHz (1CLK) +/- 200ppm
(2) H sync frequency	31.468kHz (1H = 780CLK)
(3) V sync frequency	59.94Hz (Under non-interlace) 119.88Hz (Under 2:1 interlace)

**[External sync spec]**

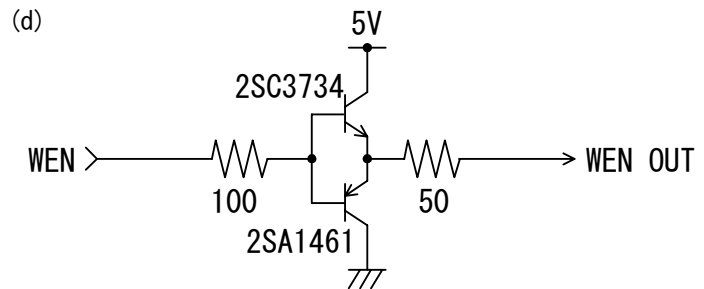
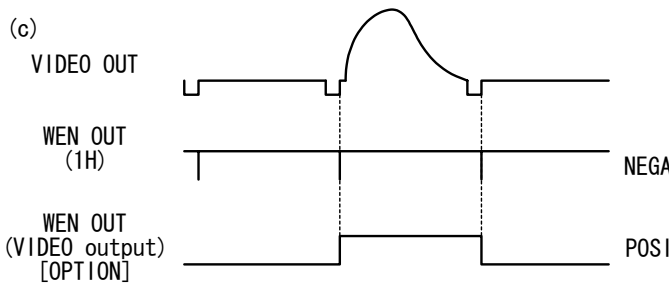
- (1) Ext. sync input signal      HD/VD
- (2) input level                      From 2 through 4V (p-p)/10k-ohm
- (3) Input impedance                75-ohm / High impedance (switching via internal SW)  
(Initial factory setting: High)
- (4) Interlace                         1/60s non-interlace or 1/120s 2:1 interlace
- (5) Polarity                            Negative
- (6) Pulse width                      HD: 3.2 +/- 1 micro s (LOW)  
VD: From 125 through 400 micro s (LOW)
- (7) Repeating frequency           $f_H = 31.468\text{kHz} \pm 1\%$   
 $f_V = f_H/262.5$  or  $f_H/525$
- (8) Phase difference                HD/VD: 0 +/- 5.0 micro s, 1/FH/2 +/- 5.0 micro s

**[Shutter trigger spec]**

- (1) Input level                        Exposure-starting-cue signal in random trigger shutter mode  
LOW level: From 0 through 0.5V(p-p)  
HIGH level: From 4 through 5V(p-p)
- (2) Input impedance                High impedance (10k-ohm)
- (3) Capture timing                 Rising edge detection (Positive) / Falling edge detection (Negative)  
(Switching via bottom-panel DIP SW)  
(Initial factory setting: Rising edge)
- (4) Pulse width                      Under DIP SW setting: Minimum 2 micro s, Maximum 1/6s  
Under PULSE W setting: Minimum 2 micro s, Maximum 1/8s

**[Sync signal spec]**

- (1) WEN (Readout timing pulse)
  - (a) Output signal level          More than 4V(p-p)
  - (b) Polarity                         Negative (Positive under VIDEO output mode [Option])
  - (c) Pulse width                    1H output (Available under VIDEO output mode [Option])
  - (d) Output circuit



- (2) HD·VD pulse (Switching via internal SW / Initial factory setting: Input)
  - (a) Output signal level          More than 4V(p-p)
  - (b) Interlace                         1/60s non-interlace or 1/120s 2:1 interlace
  - (c) Polarity                            Negative
  - (d) Pulse width                      HD : 3.18 ± 0.1 micro s (LOW)  
VD : 286 ± 1 micro s (LOW)

**Note: Items shown as [Option] in this document is not included in your purchase as standard components. Contact our dealer / distributor for details.**

**[Electronic shutter spec]**

(1) Normal shutter

Shutter-speed setting via bottom-panel SW (Initial: OFF)  
 8 steps selectable (= OFF, 1/200s, 1/500s, 1/1000s, 1/2000s, 1/4000s, 1/8000s, 1/20000s)

(2) RTS

(a) Operation mode

No.	Reset	Exposure	Sync
1	Non-reset	Bottom SW (FIX mode)	Internal
2			Consecutive HD / Consecutive VD IN
3			Consecutive HD / Single VD IN
4		TRIG pulse width (PULSE W mode)	Internal
5			Consecutive HD / Consecutive VD IN
6			Consecutive HD / Single VD IN
7	V-reset	Bottom SW (FIX mode)	Internal
8			Consecutive HD IN
9	SYNC reset		Internal
10	V reset	TRIG pulse width (PULSE W mode)	Internal
11			Consecutive HD IN

Notes : \* RTS mode automatically switches over through TRIG IN  
 \*\* Neither under FIX nor PULSE W mode, RTS doesn't work if Electronic shutter speed SW is set in OFF position.

(b) Multiple shutter

Multiple shutter via ext. trigger signal and ext. VD signal

Notes : \* Operation like No.3, 6 above

(3) Restart / Reset

Restart / reset available via ext. VD signal

(Switching via bottom panel DIP SW, Initial OFF)

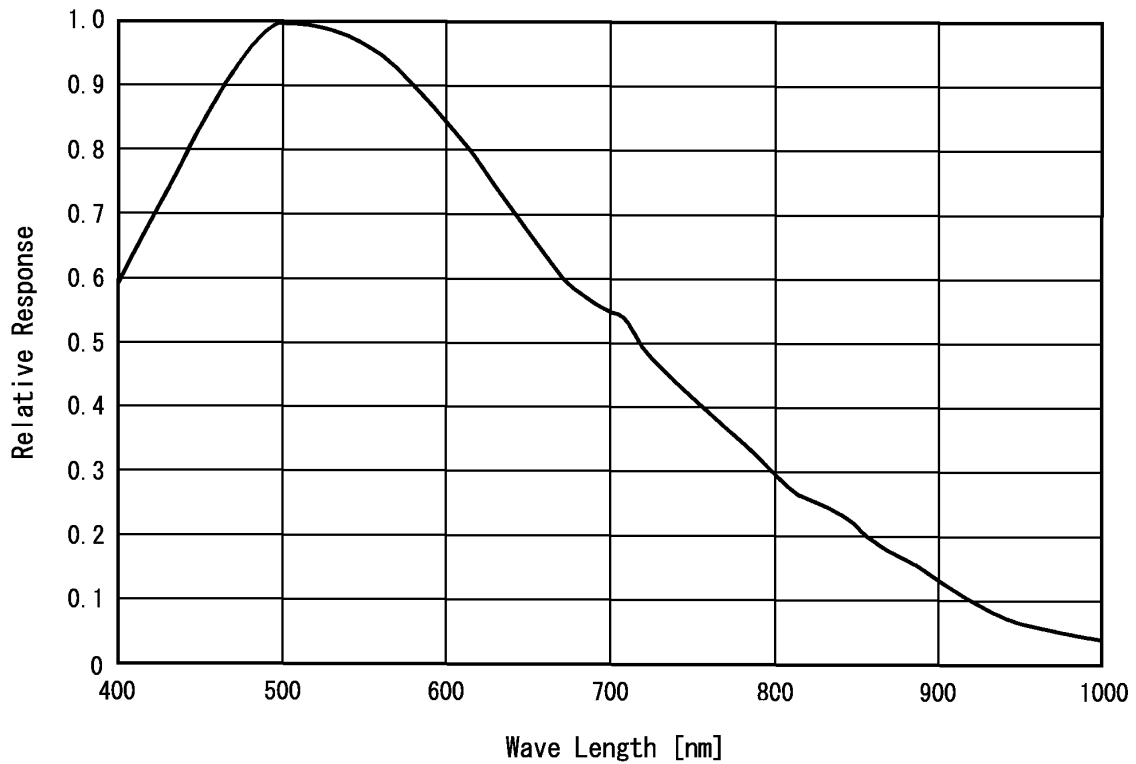
Notes : \* The exposure-time (shutter-speed) is determined by external VD interval.  
 \*\* Enabled when bottom-panel DIP SW OFF.  
 \*\*\* Provide Consecutive HD.



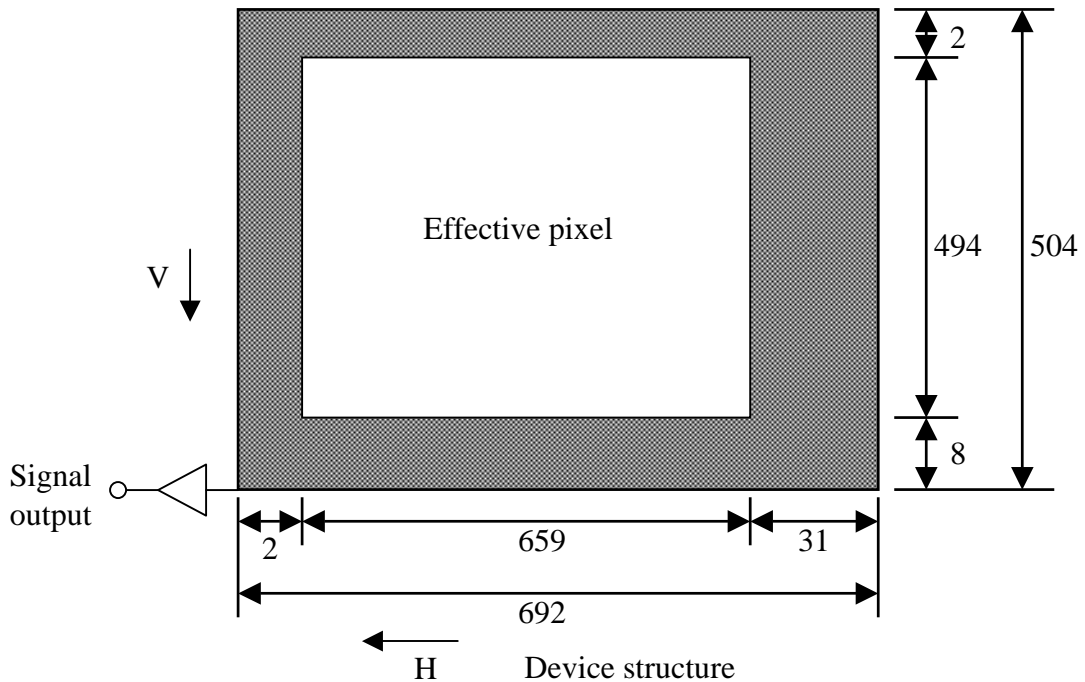
## 10. Attached drawing

### 10.1 Relative Spectrum Response

\*Including lens characteristics, Excluding light source characteristics



### 10.2 Optical black characteristics



Device structure

Total pixels : 692(H) x 504(V)

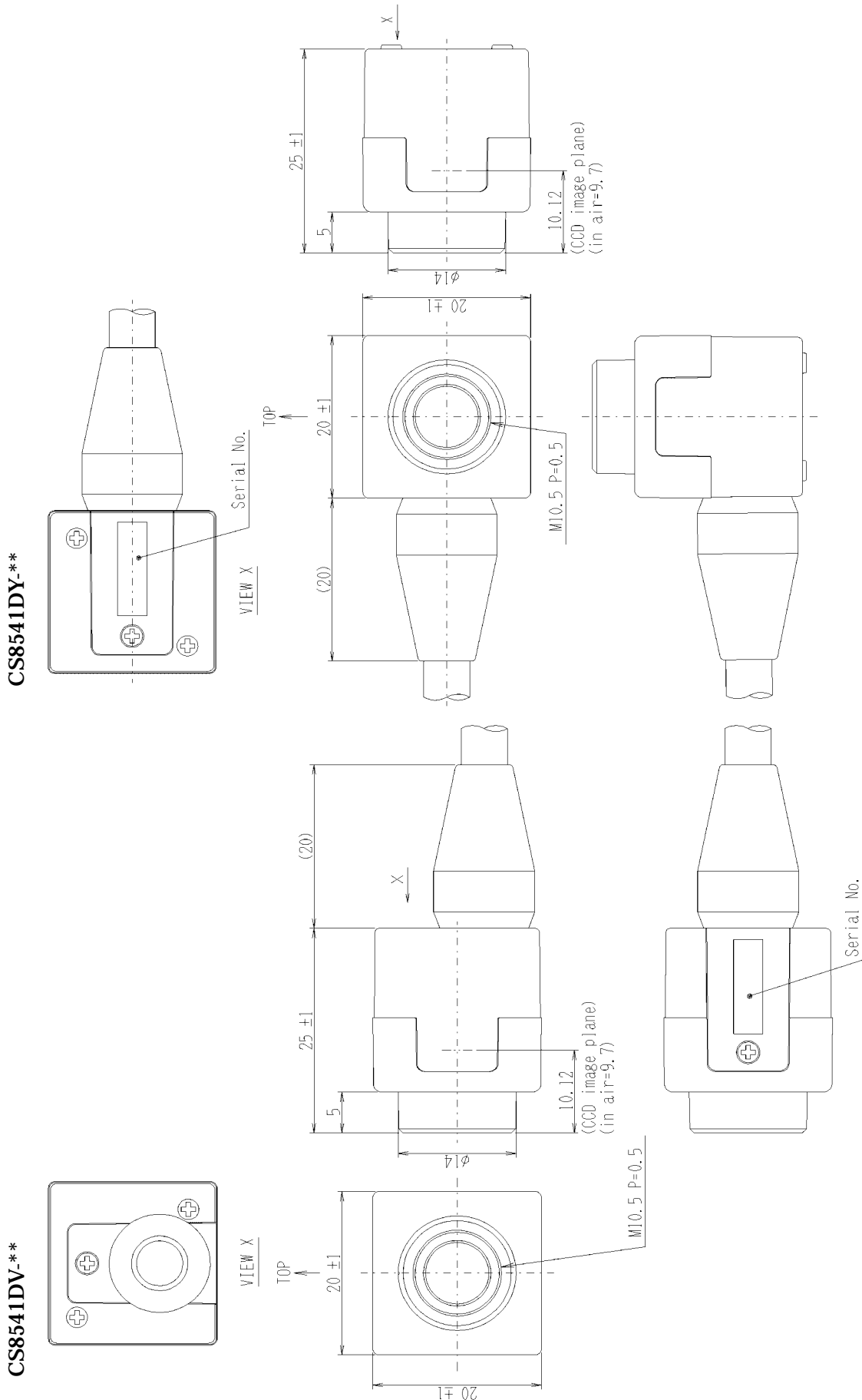
Effective pixels : 659(H) x 494(V)

Optical black:

Horizontal : 2 pixels, 31 pixels

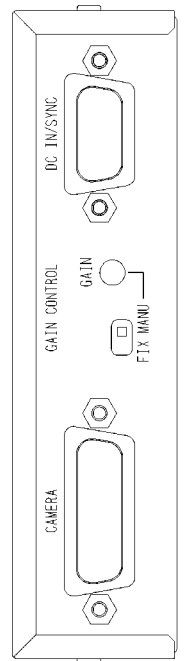
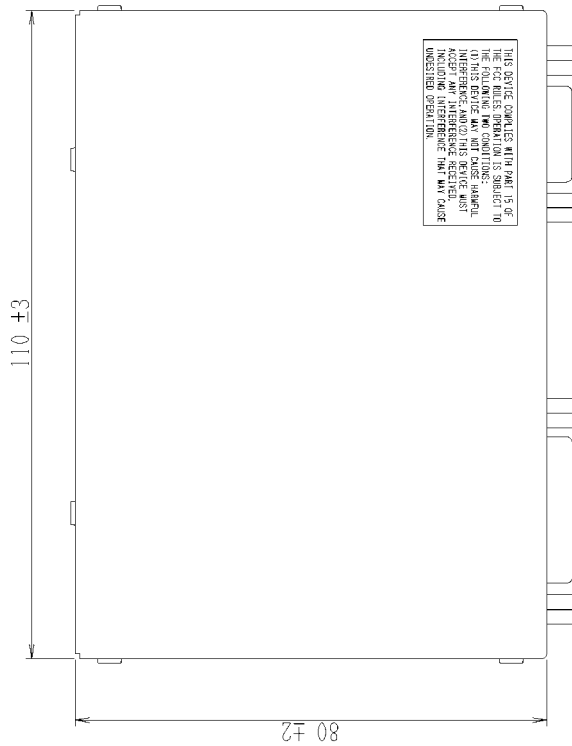
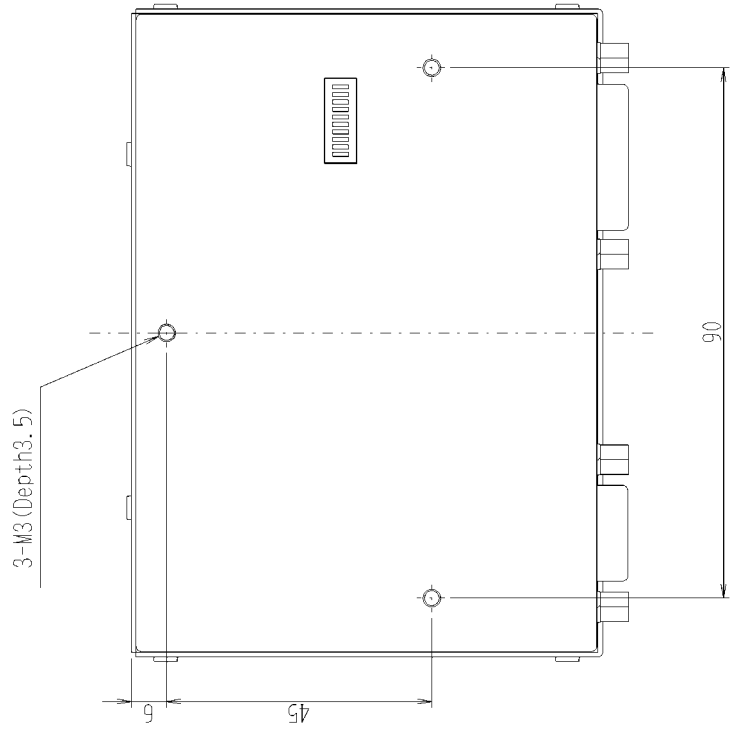
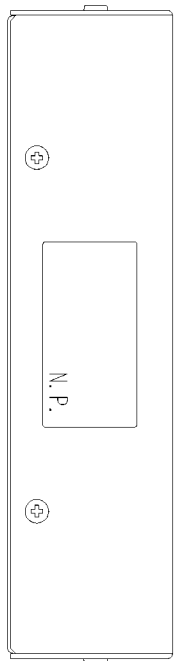
Vertical : 8 pixels, 2 pixels

### 10.3 Camera head external-view



\* Before connecting / disconnecting the connector, make sure the camera power is OFF to prevent a malfunction.

10.4 CCU external-view





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The design and specification is subject to change without notice.