SONY®

CCD Black-and-White Video Camera Module

Technical Manual

XC-HR90

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Overview

The XC-HR90 is a black-and-white video camera module using a CCD (Charge Coupled Device) image sensor.

Features

High image quality

The 1,300,000-pixel SXGA-compatible CCD image sensor delivers detailed images with the equivalent of SXGA resolution (1280 × 960 pixels). The CCD has square pixels, eliminating the need for aspect ratio conversion.

Various mode settings

Rear panel switches, or sending a command from the host device (e.g., PC) allow the following mode settings.
• Gain: Fixed/Manual
• Read mode (30 fps): Normal (30 fps)/Binning (54.1fps)
• Read mode (15 fps): Normal (15 fps)/Binning (30fps)
• Partial scan
• Synchronized input/output
• 75Ω termination
• Shutter modes: Normal/Trigger shutter
• Shutter speed

External synchronization

The camera module automatically detects HD (horizontal drive) and VD (vertical drive) signals input for external synchronization.

External sync signal output

You can output HD and VD signals from a 12-pin connector by changing the setting of a rear panel switch.

Electronic shutter

You can choose a shutter speed from a wide range of image speeds (1/100 to 1/100,000 s) for the best match to shooting conditions.

External trigger shutter function (1/4 to 1/100,000 s)

You can obtain a freeze picture by inputting an external trigger. This function is useful for shooting a fast-moving object at a precise moment.

Partial scan

By limiting the number of effective image output lines, you can obtain image output at high frame rates, suitable for high-speed image processing.

Binning function

Video signals combining vertically adjacent lines can be obtained at following frame rate.
In read mode (30 fps): 54.1 fps
In read mode (15 fps): 30 fps

Mounting holes

Mounting screw holes are provided on the reference plane on the lower surface of the body, allowing mounting for minimum deviation in the optical axis.
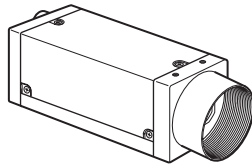
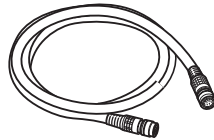## Compliant with EIAJ 12-pin connector pin assignments

The pin arrangement adds pin assignments for trigger pulses and WEN signals.

System Components

The XC-HR90 Video Camera Module system is comprised of the following components.

Video camera module
XC-HR90

Camera cables (not supplied)
CCXC-12P02N(2 m)
CCXC-12P05N(5 m)
CCXC-12P10N(10 m)
CCXC-12P25N(25 m)
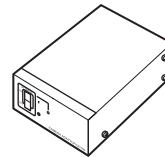
Camera adaptor (not supplied)
DC-700/700CE
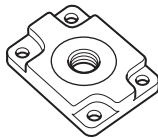
Tripod adaptor (not supplied)
VCT-55I
(Insulated type)
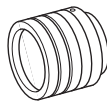
C-mount lens (not supplied)
(Our company does not handle the
C-mount lens for this camera.)

Connection Diagram

C-mount lens

XC-HR90

AC
VIDEO OUT
HD/VD
WEN
TRIG

Tripod adaptor
VCT-55I

Camera cables
CCXC-12P02N
CCXC-12P05N
CCXC-12P10N
CCXC-12P25N

Camera adaptor
DC-700/700CE
(Conforms to EIAJ 12-pin
assignments)

Location and Function of Parts and Controls

Front/Top/Bottom
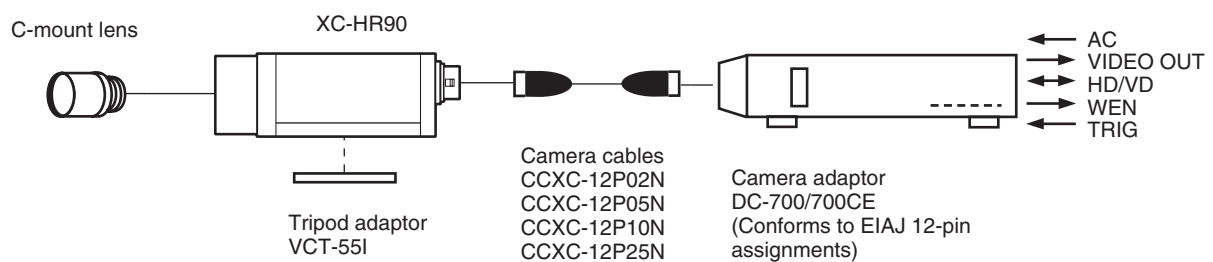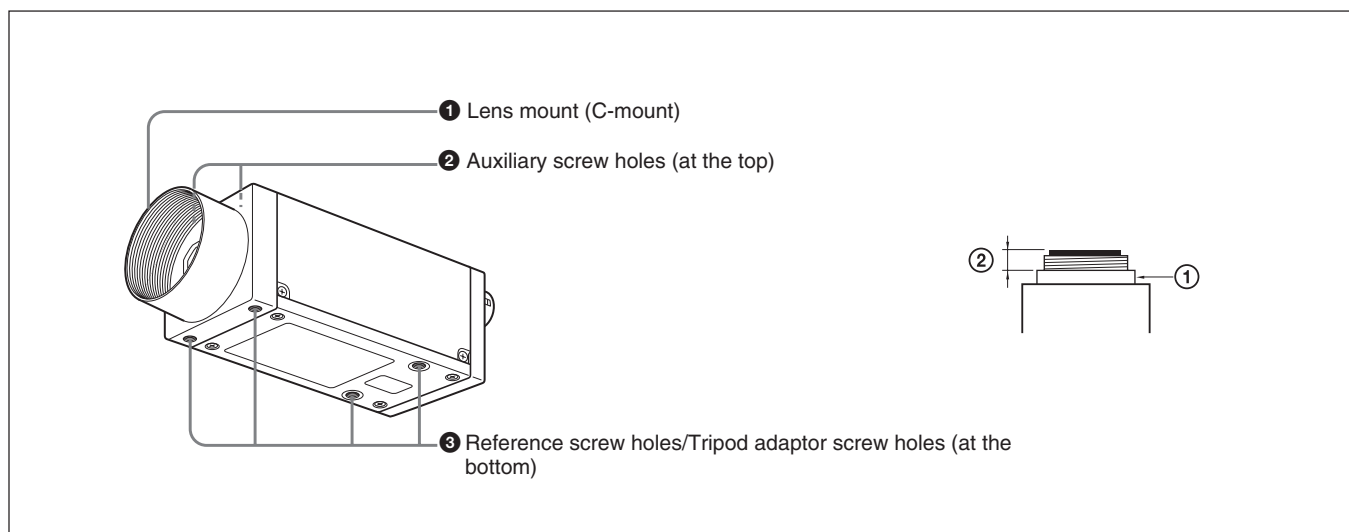

❶ Lens mount (C-mount)

❷ Auxiliary screw holes (at the top)

❸ Reference screw holes/Tripod adaptor screw holes (at the bottom)

❶ Lens mount (C-mount)

Attach any C-mount lens, which is suitable for SXGA for high resolution, or other optical equipment.

Note

The lens must not project more than 10 mm (13/32 inch) from the lens mount.

① Lens mount face

② 10 mm (13/32 inches) or less

❷ Auxiliary screw holes (at the top)
❸ Reference screw holes/Tripod adaptor screw holes (at the bottom)

These precision screw holes are for locking the camera module. Locking the camera module using these holes secures the optical axis alignment.

You can install the camera on a tripod. To install on a tripod, you will need to install the VCT-55I tripod adaptor using the reference holes on the bottom of the camera.

Rear Panel

❶ VIDEO OUT/DC IN/SYNC connector

❷ M Gain control knob

❸ Shutter speed / mode setting DIP switches

❹ Mode setting DIP switches
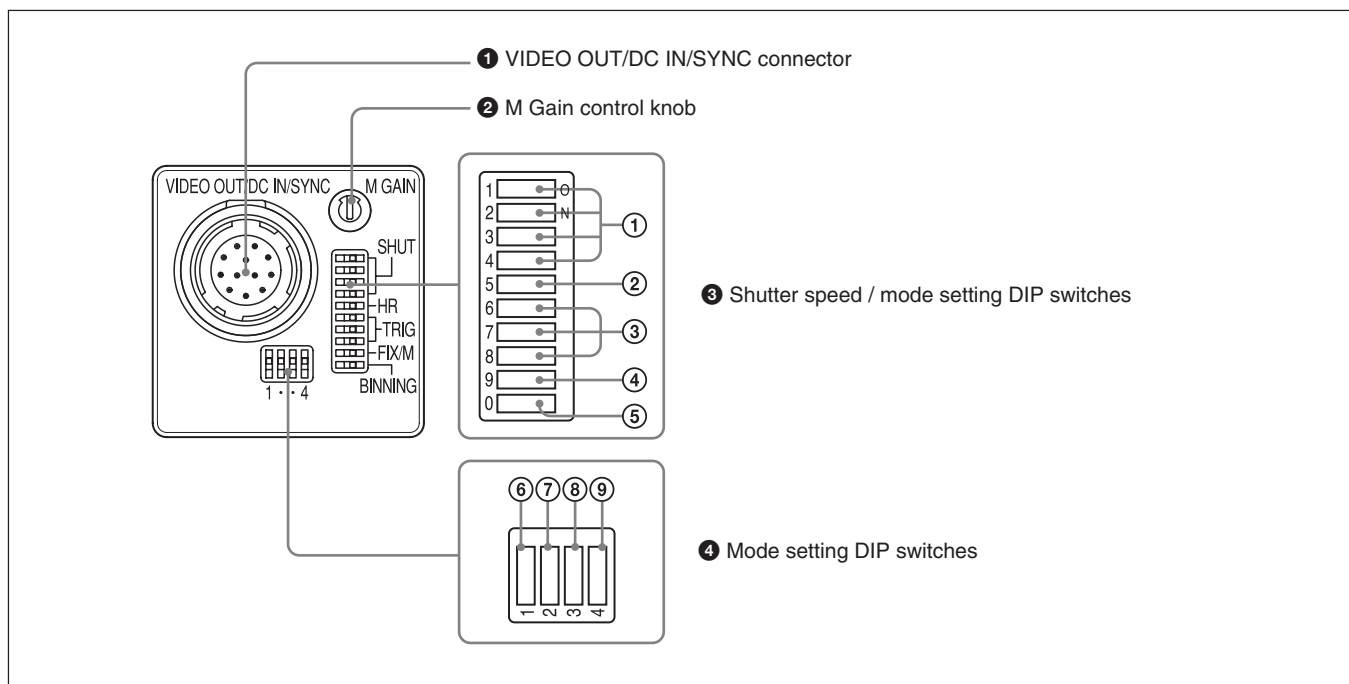
Note

Be sure to turn the power off before making switch settings.

❶ **VIDEO OUT/DC IN/SYNC (video output/DC power/sync input signal) connector (12-pin connector)**
Connect a CCXC-12P05N camera cable to this connector to obtain power from the +12V DC power supply and also to enable video signal output from the camera module. When a sync signal generator is connected to this connector, the camera module is synchronized with the external sync signals (HD/VD signals).

❷ **M GAIN (Manual Gain) control knob**
If you have selected MANUAL (manual adjustment) with DIP switch ④, this knob adjusts the gain.

❸ **Shutter speed/Mode setting DIP switches**
① **Shutter speed (Switches 1 to 4)**
Set an appropriate shutter speed (factory setting: OFF).

② **Partial scan mode switch (Switch 5)**
The factory setting of this switch is partial scan OFF.

For more information, see "Partial Scan Mode" (page 20).

③ **Restart reset/External trigger shutter mode switches (Switches 6 to 8)**
By inputting an external restart/reset signal, you can capture the information of single screens at arbitrary timing. By inputting an external trigger signal, you can capture imaging information on fast-moving objects at a precise moment in time. The factory settings for these switches are for normal operation.

For more information, see "Restart/Reset" (page 19) and "External Trigger Shutter" (page 22).

④ **Gain switch (Switch 9)**
This switch selects FIX (fixed) or MANUAL (manual adjustment) (factory setting: FIX (left side)).

⑤ **Binning mode switch (Switch 0)**
Switches the video signal output mode between binning OFF and binning ON (factory setting: OFF).

For more information, see "Video Output Modes" (page 14).

❹ **Mode setting DIP switches**
⑥ **75Ω termination switch**
Set this switch to the down position (OFF) when not terminating the external sync signal. Set this switch to the up position (ON) when terminating the external sync signal (factory setting).

② **HD/VD signal input/output switch**
Set this switch to the down position when an
HD/VD signal is output from the camera
module. Set this switch to the up position when
an HD/VD signal is input from an external unit
(factory setting).

Note

Even when the switch is set to the up position,
the camera module operates in internal
synchronization mode when no external HD
signal is input. In this case, however, the camera
module will not output internal sync signals.

⑧ **30 fps/15 fps switch**
This switch selects the frame rate.
30 fps: Set this switch to the down position
(factory setting).
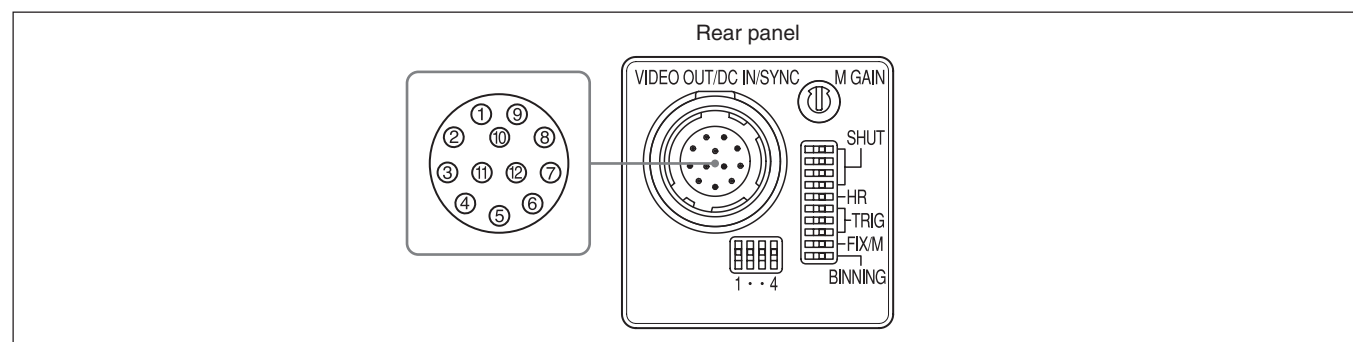**15 fps:** Set this switch to the up position.

⑨ **RS-232C ON/OFF switch**
This switch selects whether or not you control
the camera module via the RS-232C serial
interface.
RS-232C ON: Set this switch to the up
position.
RS-232C OFF: Set this switch to the down
position (factory setting).

## VIDEO OUT/DC IN/SYNC connector pin assignments

Rear panel

Pin No.	Camera sync output	External mode (HD/VD)	Restart/Reset	External trigger shutter
1	Ground	Ground	Ground	Ground
2	+12V DC	+12V DC	+12V DC	+12V DC
3	Video output (Ground)	Video output (Ground)	Video output (Ground)	Video output (Ground)
4	Video output (Signal)	Video output (Signal)	Video output (Signal)	Video output (Signal)
5	HD output (Ground)	HD input (Ground)	HD input (Ground)	HD input (Ground)
6	HD output (Signal)	HD input (Signal)	HD input (Signal)	HD input (Signal)
7	VD output (Signal)	VD input (Signal)	Reset (Signal)	VD input (Signal)
8	(RS-232C (Rx))*1	(RS-232C (Rx)) *1	(RS-232C (Rx)) *1	(RS-232C (Rx)) *1
9	(RS-232C (Tx))*1	(RS-232C (Tx)) *1	(RS-232C (Tx))*1	(RS-232C (Tx)) *1
10	—	—	—	WEN output (Signal)
11	—	—	—	Trigger pulse input (Signal)
12	VD output (Ground)	VD input (Ground)	Reset (Ground)	VD input (Ground)*2

*1 Controlling via the RS-232C interface
*2 Common ground for pins 7, 10, and 11

Factory mode settings of rear panel
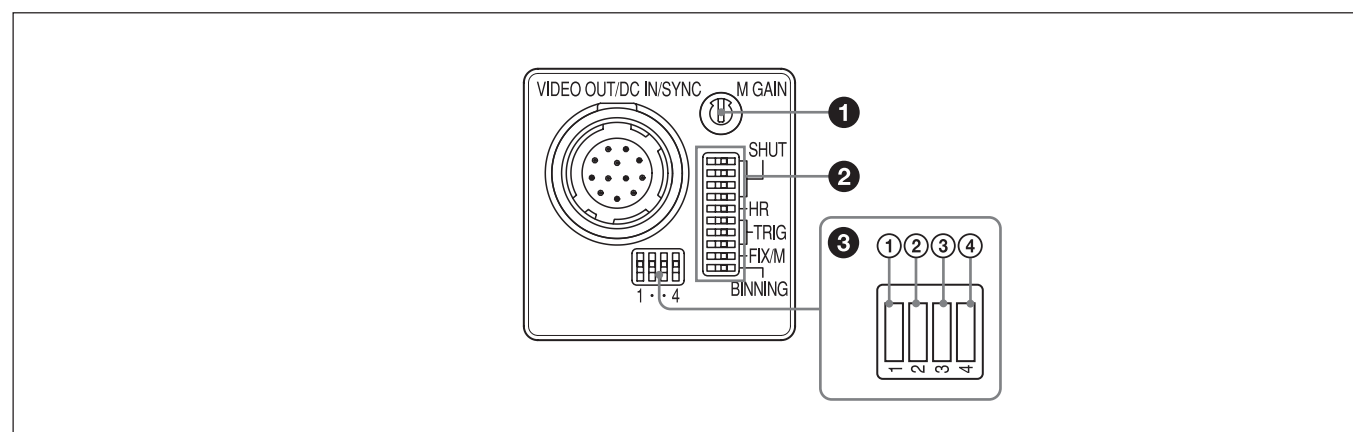
Number	Switch name		Factory mode setting
❶	M GAIN control knob		– *
❷	Shutter speed/mode setting DIP switches		All bits are OFF (left).
❸	Mode setting DIP switches		
	①	75Ω termination switch	ON (switch position: up)
	②	HD/VD signal input/output switch	HD/VD signal input (switch position: up)
	③	30 fps/15 fps switch	30 fps (switch position: down)
	④	RS-232C ON/OFF switch	OFF (switch position: down)

* This unit is shipped from the factory with the gain switch (DIP switch 9) being set to "FIX," so the M GAIN control knob is not operative unless the switch setting is changed. When the gain switch (DIP switch 9) is set to MANUAL, you can rotate this knob to adjust gain over the range 0 to 18 dB.

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Camera Control Method

You can control the camera module from host device such as a PC. The following table shows the control functions. You can send a command corresponding to the control items, with parameters for the desired setting, if necessary, from the host device to control the camera.

Control function	Description	
Operating mode	Normal/Restart reset/trigger mode 1/ trigger mode 2	
Shutter speed	Normal	30 fps mode: OFF (1/30) to 1/100000
		15 fps: OFF (1/15) to 1/50000
	Trigger	Internal setting: OFF (the same as above) to 1/100000
		Setting by trigger pulse width
Gain	0 to +18 dB	
Binning function	OFF/ON	
Partial Scan function	OFF/ON The area can be divided into 16 segments.	
HD/VD signal I/O signal input	External sync signal input/Internal sync	
75Ω termination	ON/OFF	
Frame rate	30 fps/15 fps	

Notes

- Make sure to supply power to the camera module and confirm that the camera module is operating before inputting a sync or trigger signal. If you input external signals to a camera module without the power supplied, this may cause malfunction of the camera module.
- Be sure to turn off the power of the camera before changing the settings of the RS-232C ON/OFF switch and the 30 fps/15 fps switch.

IMPORTANT

When you control the camera using both an external synchronous signal and the host device (e.g., a PC), be sure to use the camera within the specified frequency range. If the camera receives signals in frequencies other than the specified one, the camera cannot be controlled.

Mode Settings

It is recommended that you make a test under the conditions you will operate the camera before actually using it.

Input/Output Specifications

External HD/VD Input Specifications

Note that input outside the specified ranges can lead to internal reset instability and malfunction of the RS-232C communication.

However, when you input an external HD/VD phase signal in all modes, the video out signals are output about 1 H later than the external VD.

During normal operation (30 fps mode)
HD phase: 33.67 µ sec/37.32 µ sec (binning OFF/ON)
VD phase: 33.33 m sec/18.47 m sec (binning OFF/ON)
During normal operation (15 fps mode)
HD phase: 67.34 µ sec
VD phase: 66.66 m sec/33.33 m sec (binning OFF/ON) continuous
During restart/reset or external trigger shutter mode operation
HD phase: 33.67 µ sec (30 fps normal), 37.32 µ sec (30 fps binning), 67.34 µ sec (15 fps normal/binning) continuous
VD phase: VD (reset) only timing where the HD phase is within range shown above.

External HD/VD Output Specifications
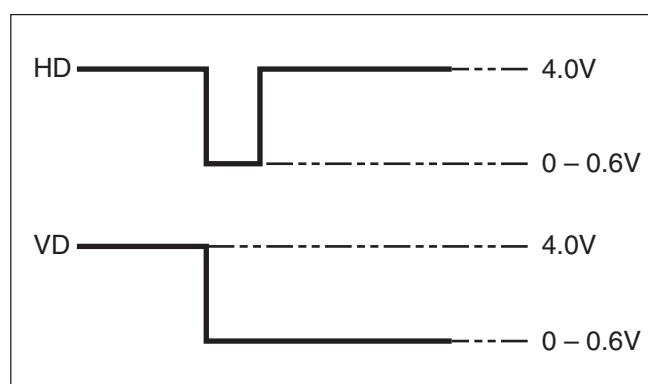
- The amplitude level is the typical value when terminated with 10 kΩ. External HD and VD can be output when you set the HD/VD signal input/output switch of the Mode setting DIP switches to INT (down position).
- The voltage and pulse width used are as measured at pin 6 (HD) and pin 7 (VD) of the 12-pin multi-connector on the rear panel.

WEN Output Specifications
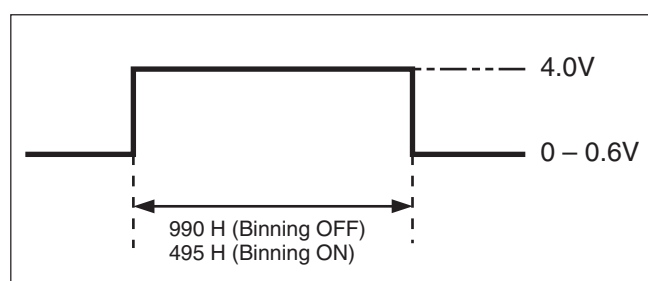
- The amplitude level is the typical value when terminated with 10 kΩ. The pulse width is undefined during partial scan mode, but WEN rising edge is always synchronized with internal VD at the start of image output.
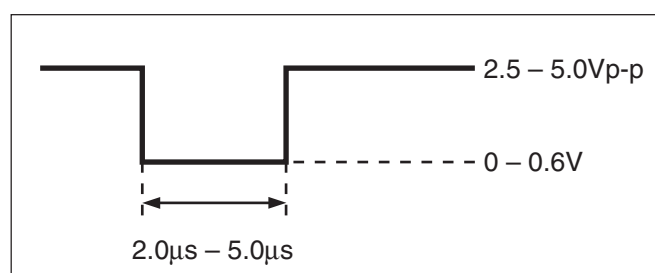
- The voltage and pulse width used are as measured at pin 10 of the 12-pin multi-connector on the rear panel.

VD Input Specifications
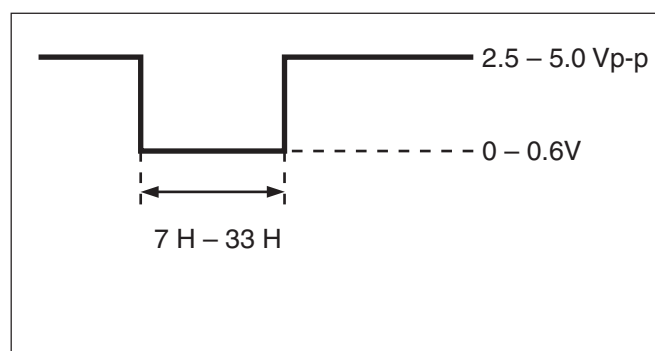
2.5 – 5.0 Vp-p

0 – 0.6V

7 H – 33 H

- Input impedance: 75 Ω or 10 kΩ or more.
- Input amplitude 2.5 to 5.0 Vp-p (for both 75 Ω termination ON and OFF).
- The voltage and pulse width used are as measured at pin 7 of the 12-pin multi-connector on the rear panel.
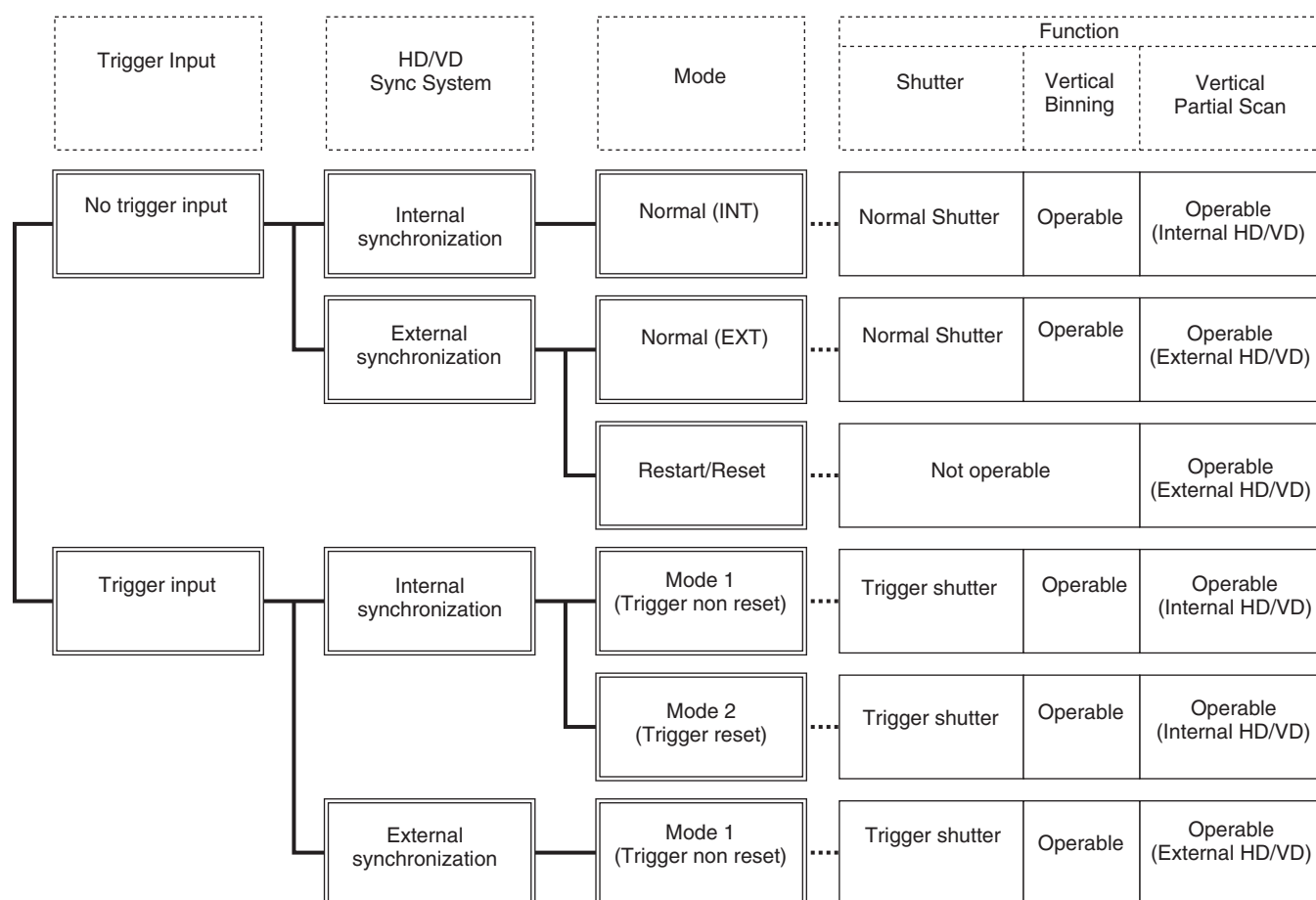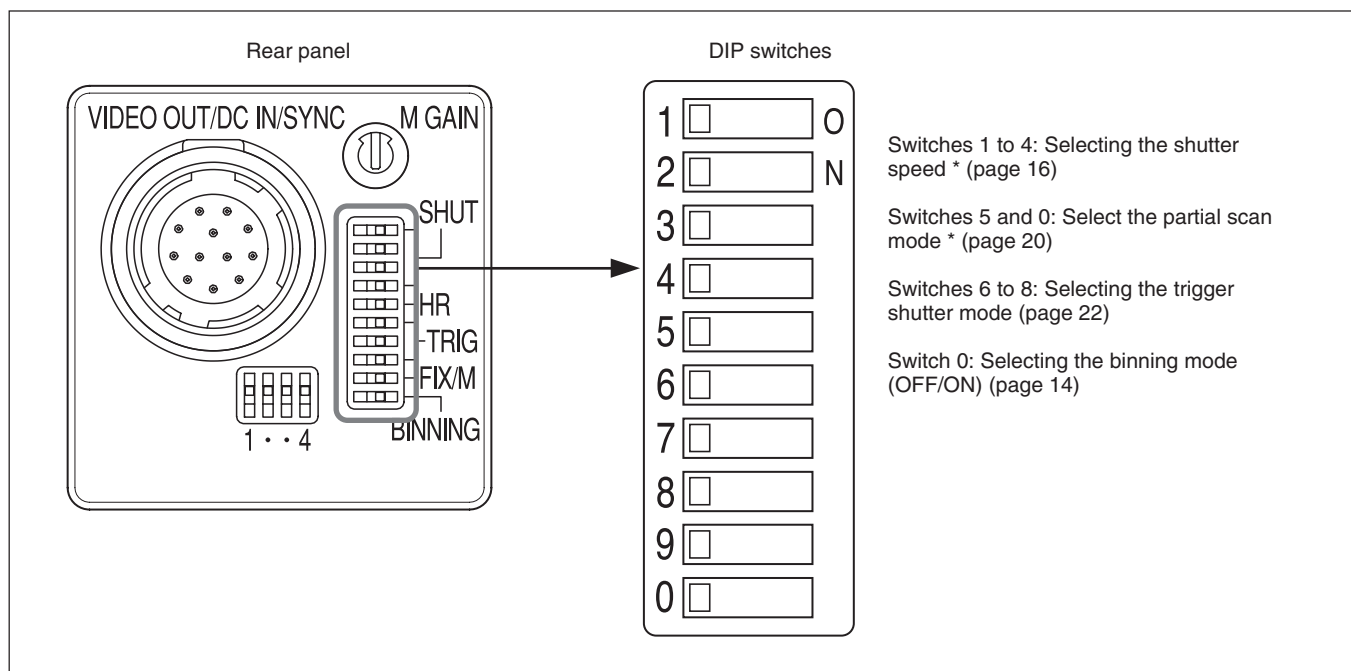
HD Input Specifications

2.5 – 5.0Vp-p

0 – 0.6V

2.0μs – 5.0μs

- Input impedance: 75 Ω or 10 kΩ or more.
- Input amplitude 2.5 to 5.0 Vp-p (for both 75 Ω termination ON and OFF)
- The voltage and pulse width used are as measured at pin 6 of the 12-pin multi-connector on the rear panel.

Trigger Pulse Specifications

2.5 – 5.0V

0 – 0.6V

2μs – 1/4s
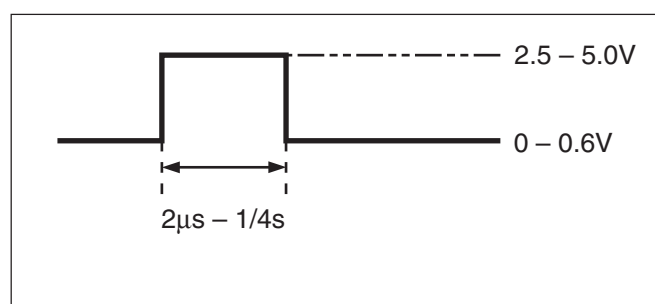
- Input impedance: 10 kΩ or more.
- The voltage and pulse width used are measured at pin 11 of the 12-pin multi-connector on the rear panel.

Mode System Diagram

Trigger Input	HD/VD Sync System	Mode	Function		
			Shutter	Vertical Binning	Vertical Partial Scan
No trigger input	Internal synchronization	Normal (INT)	Normal Shutter	Operable	Operable (Internal HD/VD)
	External synchronization	Normal (EXT)	Normal Shutter	Operable	Operable (External HD/VD)
		Restart/Reset	Not operable		Operable (External HD/VD)
Trigger input	Internal synchronization	Mode 1 (Trigger non reset)	Trigger shutter	Operable	Operable (Internal HD/VD)
		Mode 2 (Trigger reset)	Trigger shutter	Operable	Operable (Internal HD/VD)
	External synchronization	Mode 1 (Trigger non reset)	Trigger shutter	Operable	Operable (External HD/VD)

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Mode Setting DIP Switches

You can set the mode using the DIP switches located
on the rear of the camera.

Rear panel

DIP switches

VIDEO OUT/DC IN/SYNC   M GAIN

SHUT

HR
TRIG
FIX/M
BINNING

1 · · 4

1 O
2 N
3
4
5
6
7
8
9
0

Switches 1 to 4: Selecting the shutter
speed * (page 16)

Switches 5 and 0: Select the partial scan
mode * (page 20)

Switches 6 to 8: Selecting the trigger
shutter mode (page 22)

Switch 0: Selecting the binning mode
(OFF/ON) (page 14)

* The normal shutter cannot be used in partial scan mode. To control the
  exposure time in partial scan mode, set the mode to restart/reset mode or
  external trigger shutter mode (controlling the trigger pulse width).

Video Output Modes

This unit has two video signal output modes. Select the mode with the binning mode switch (DIP switch 0) on the rear panel.
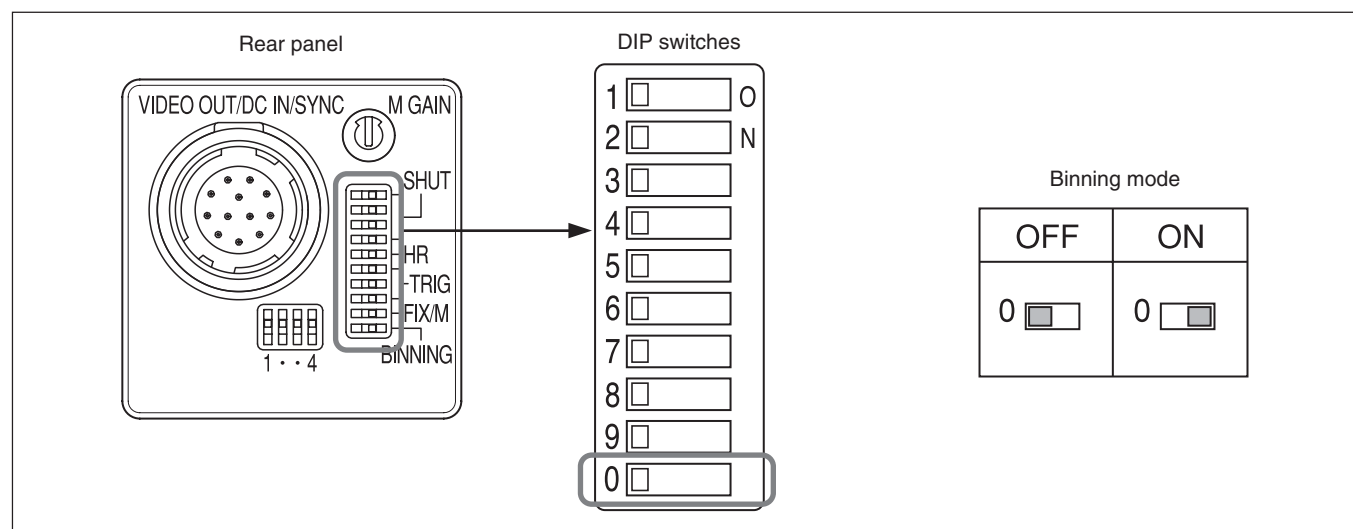
Binning OFF

30 fps mode: Signals for each independent pixel are output from the VIDEO OUT connector every 1/30 s (line sequential output).
External synchronization is possible by external HD/VD

15 fps mode: Signal for each independent pixel are output from the VIDEO OUT connector every 1/15 s (line sequential output).
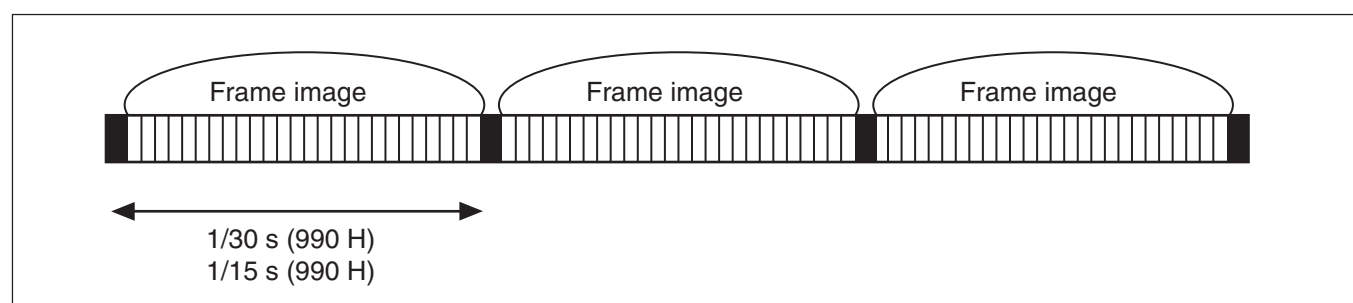
Binning ON

30 fps mode: Mixed signals for vertically adjacent pixels are output from the VIDEO OUT connector every 1/54.1 s.
External synchronization is possible by external HD/VD.

15 fps mode: Mixed signals for vertically adjacent pixels are output from the VIDEO OUT connector every 1/30 s.
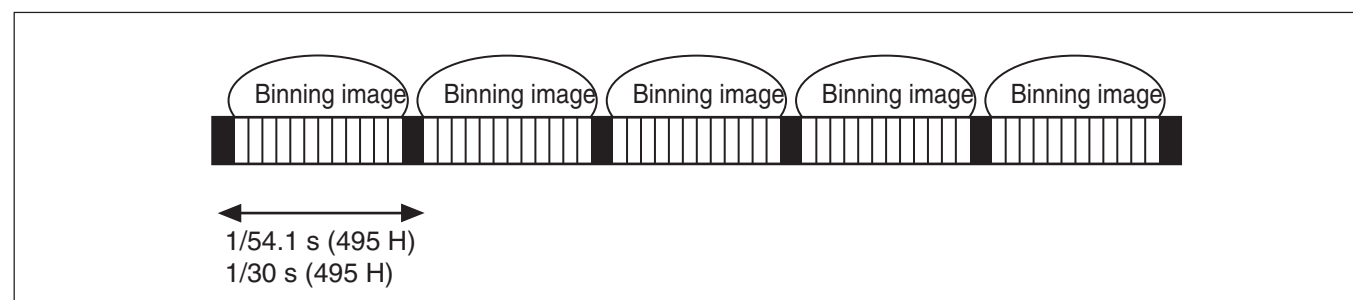
About the Electronic Shutter

There are two shutter types: normal shutter and external trigger shutter. Select them with the DIP switches on the rear panel.

Rear panel   DIP switches

VIDEO OUT/DC IN/SYNC   M GAIN

SHUT
HR
TRIG
FIX/M
BINNING
1 · · 4

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0

O
N

Switches 1 to 4: Selecting the shutter speed

Switches 6 to 8: Selecting the trigger shutter mode
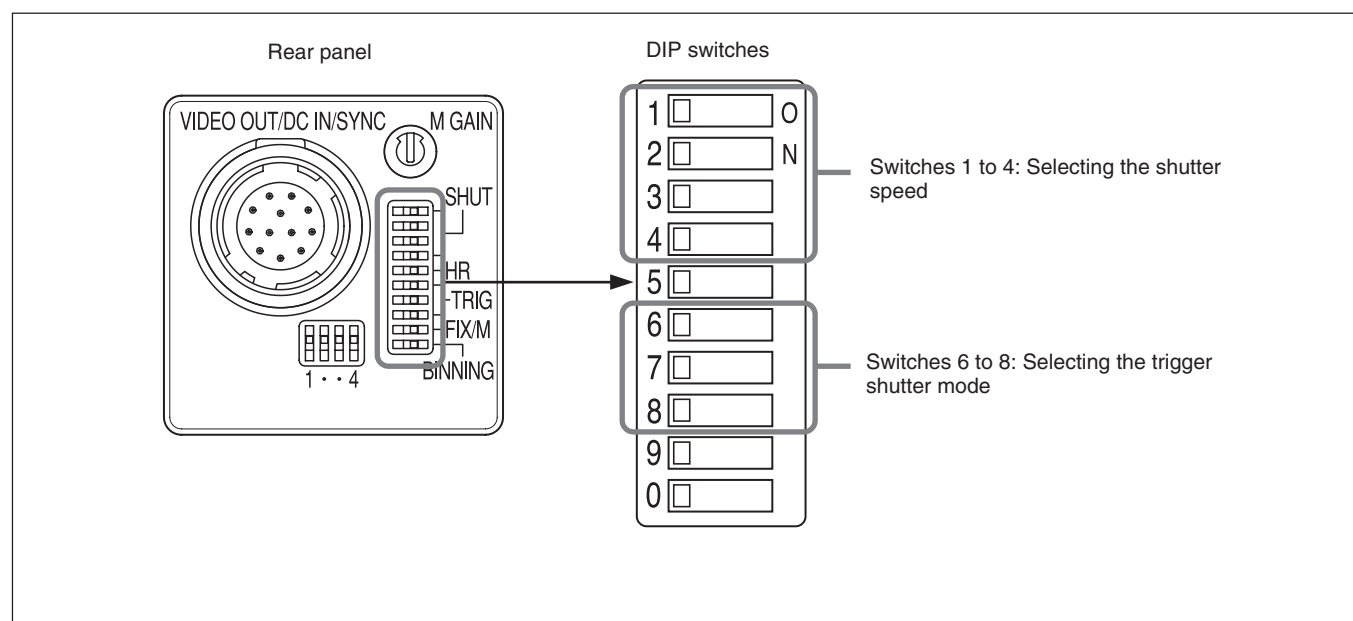
For detailed information on the normal shutter, see "Normal Shutter" on page 16, and for detailed information on the trigger shutter, see "External Trigger Shutter" on page 22.

Normal Shutter

This mode provides continuous video output with the electronic shutter selected by switches to capture a high-speed moving object clearly.

Rear panel

DIP switches

VIDEO OUT/DC IN/SYNC   M GAIN

SHUT

HR

TRIG

FIX/M

BINNING

1 · · 4

1 O
2 N
3
4
5
6
7
8
9
0
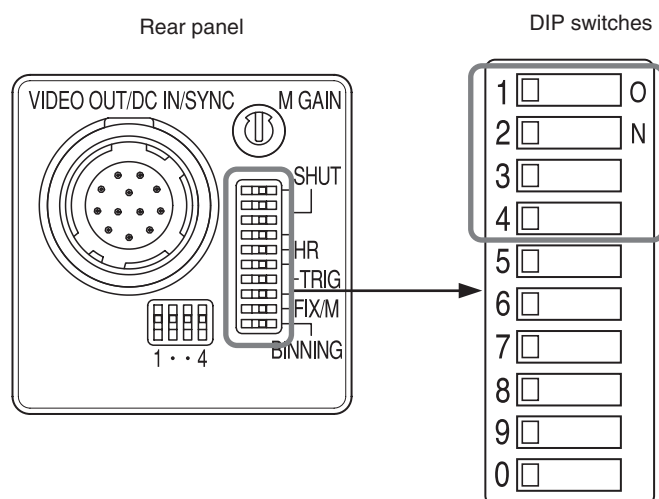
Note

Be sure to set the switch 8 to OFF (left side) as shown below when using the normal shutter.

Normal shutter	Other mode*
8	8

* "Other modes" refers to restart/reset mode and external trigger shutter mode.

30 fps Mode

Normal shutter speed settings

	1/125	1/250	1/500	1/1000
1	R	L	R	R
2	L	R	R	L
3	L	L	L	R
4	L	L	L	R

	1/2000	1/4000	1/10000	1/25000
1	R	L	L	R
2	L	R	R	R
3	R	R	R	R
4	L	L	L	R

	1/50000	1/100000	1/100	
1	L	L	L	
2	R	R	L	
3	L	R	L	
4	R	R	R	

(Unit: seconds)

The shutter will be OFF when the dip switches are set to each combination which mentioned below.

OFF	OFF	OFF	OFF	OFF
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4

15 fps Mode

Normal shutter speed settings

1/125	1/250	1/500	1/1000
1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■

1/2000	1/4000	1/10000	1/25000
1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■

1/50000	1/100
1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■

(Unit: seconds)

The shutter will be OFF when the dip switches are set
to each combination which mentioned below.

OFF	OFF	OFF	OFF	OFF	OFF
1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■	1 ■ 2 ■ 3 ■ 4 ■

Restart/Reset

Setting Restart/Reset Mode

The information on one screen can be extracted at any time by externally inputting restart/reset signals (HD/VD). To enter this mode, set the trigger shutter switches (6 to 8) on the rear panel of the camera as shown in the figure below.

To use restart/reset mode and partial scan mode simultaneously, set the partial scan mode switch (5) to ON (right side).
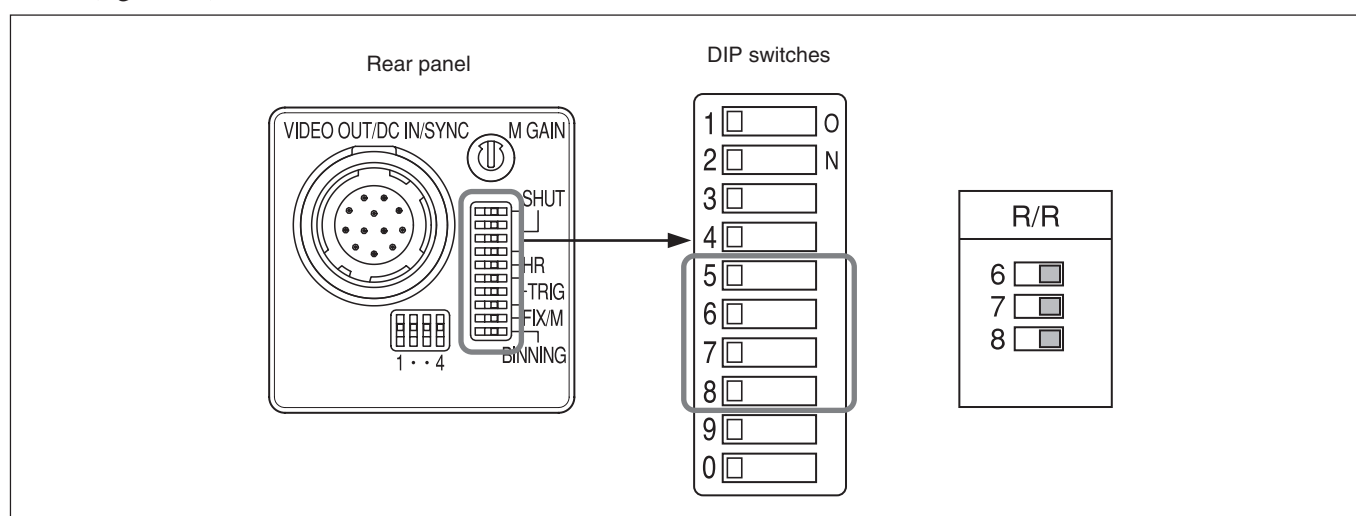
Long exposure

The Restart/Reset function extends the CCD accumulation time, resulting in highly sensitive image capture. This function is effective when you cannot gain satisfactory sensitivity under normal operating conditions, or when you want to observe the trail of a moving object. Extend the VD interval (T) between external VD pulses.
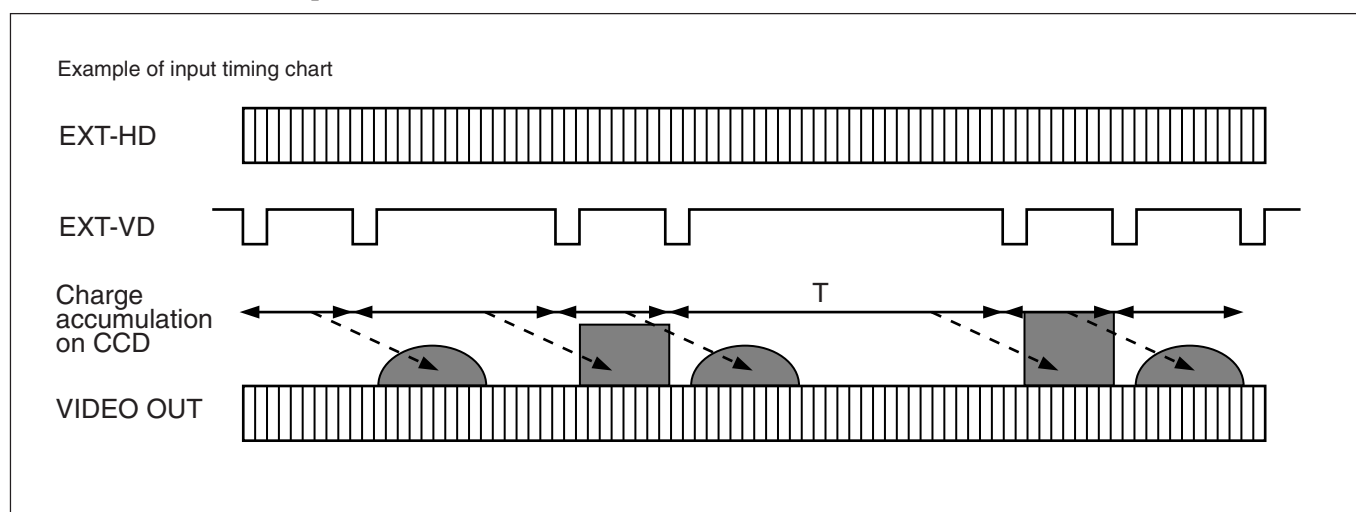
Partial Scan Mode

You can increase the frame rate by setting the upper high-speed transfer (FPS) and the lower high-speed transfer (RPS) via the RS-232C interface. When the RS-232C ON/OFF switch is set to OFF, you can set the 1/2 partial scan mode or 1/4 partial scan mode by a combination of switch 5 and switch 10 located on the rear panel.
The image is centered as shown below.
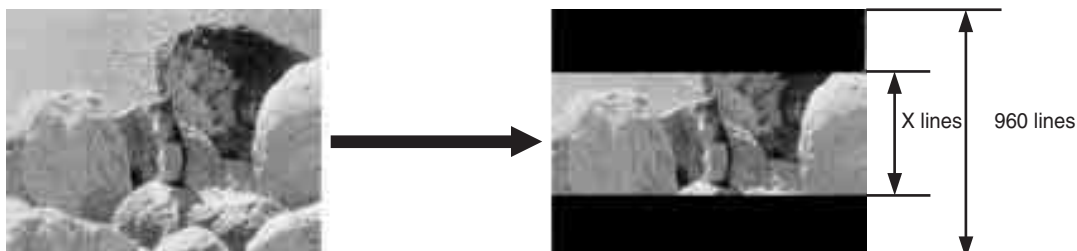
Notes

• In trigger shutter mode, video out signals are output about 1 H later than the external VD.
• In partial scan mode, image output and the WEN rising edge are always synchronized, but the WEN width becomes undefined.

Dip switch setting		Operating mode
Switch 5	**Switch 10**	
☐▣	▣☐	1/2 V partial scan
☐▣	☐▣	1/4 V partial scan

Timing Chart for Partial Scan Mode (Internal Synchronization)
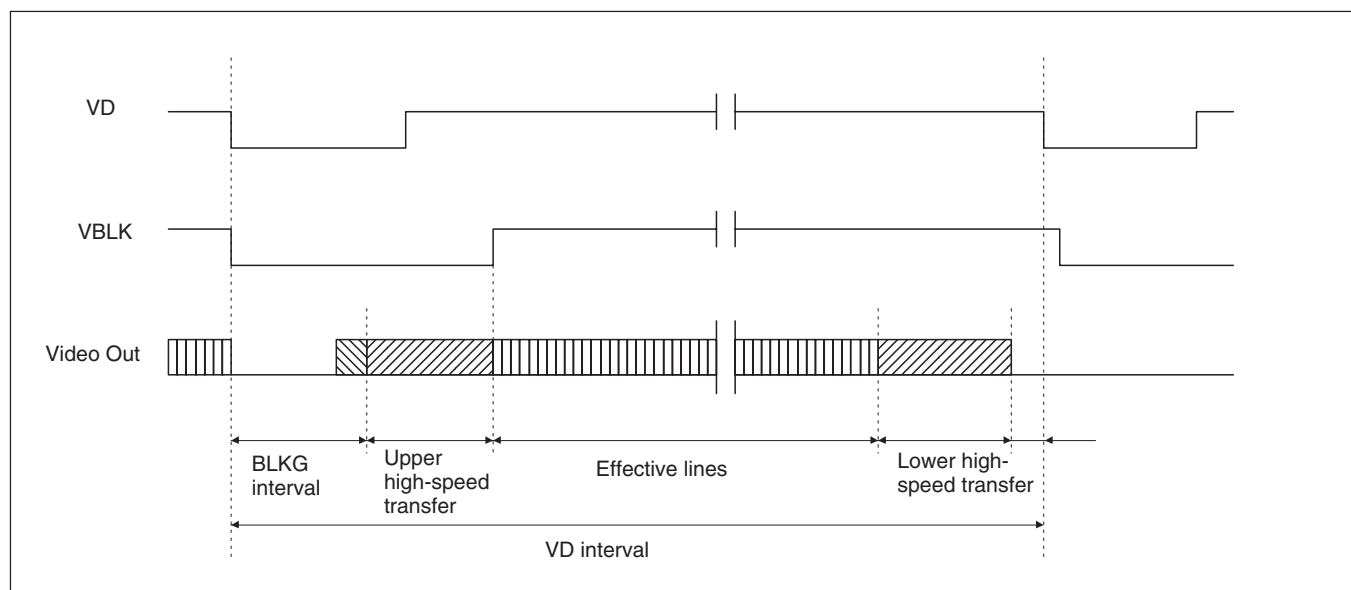
Setting of FPS and RPS, the number of output lines

RPS FPS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	960	900	840	780	720	660	600	540	480	420	360	300	240	180	120	60
1	900	840	780	720	660	600	540	480	420	360	300	240	180	120	60	—
2	840	780	720	660	600	540	480	420	360	300	240	180	120	60	—	—
3	780	720	660	600	540	480	420	360	300	240	180	120	60	—	—	—
4	720	660	600	540	480	420	360	300	240	180	120	60	—	—	—	—
5	660	600	540	480	420	360	300	240	180	120	60	—	—	—	—	—
6	600	540	480	420	360	300	240	180	120	60	—	—	—	—	—	—
7	540	480	420	360	300	240	180	120	60	—	—	—	—	—	—	—
8	480	420	360	300	240	180	120	60	—	—	—	—	—	—	—	—
9	420	360	300	240	180	120	60	—	—	—	—	—	—	—	—	—
A	360	300	240	180	120	60	—	—	—	—	—	—	—	—	—	—
B	300	240	180	120	60	—	—	—	—	—	—	—	—	—	—	—
C	240	180	120	60	—	—	—	—	—	—	—	—	—	—	—	—
D	180	120	60	—	—	—	—	—	—	—	—	—	—	—	—	—
E	120	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—

FPS: Upper high-speed transfer.
RPS: Lower high-speed transfer

Number of lines and frame rate

Number of lines	60	120	180	240	300	360	420	480
30 fps	204.83	148.5	116.47	95.81	81.37	70.72	62.53	56.04
15 fps	102.42	74.25	58.24	47.90	40.69	35.36	31.26	28.02

Number of lines and frame rate

Number of lines	540	600	660	720	780	840	900	960
30 fps	50.77	46.41	42.73	39.60	36.9	34.54	32.46	30.62
15 fps	25.39	23.20	21.37	19.80	18.45	17.27	16.23	15.31

External Trigger Shutter

Inputting an external trigger pulse enables the camera to capture fast-moving objects clearly with precise timing.
Set DIP switches 6, 7, and 8 on the rear panel to Mode 1 or Mode 2.

When you set the trigger pulse width to 1/4 of a second or more, the output signal changes to the normal VIDEO signal.
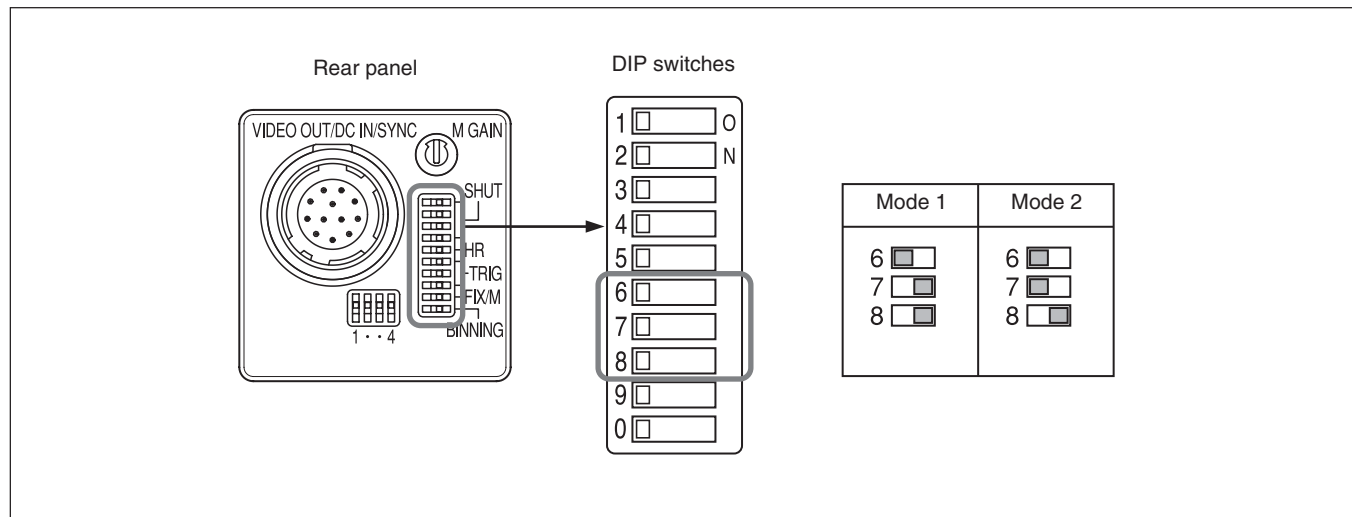
There are two modes for the timing in which video signals are obtained.

• **Mode 1 (Non-reset mode)**
 In this mode, a video signal synchronized with a VD signal is output after a trigger pulse is input.
 – The video signal is synchronized with the external VD signal when an external HD*/VD signal is input.
 – The video signal is synchronized with an internal VD signal when no external HD*/VD signal is input.
 * External or internal synchronization is selected automatically depending on the presence or absence of external HD input.

• **Mode 2 (Reset mode)**
 In this mode, an internal VD is reset, then a video signal is output a certain period of time after trigger pulse input.

Setting the External Trigger Shutter

There are two ways to set the shutter speed.

Using the DIP switches on the rear panel
For shutter speeds, see the following table.

Mode 1 (Non-reset mode)/Mode 2 (Reset mode)

1/125	1/250	1/500	1/1000
1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
1/2000	**1/4000**	**1/10000**	**1/25000**
1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
1/50000	**1/100000**	**1/100**	(Unit: Second)
1 2 3 4	1 2 3 4	1 2 3 4	

Using trigger pulse width
Set all DIP switches (1 to 4 on the rear panel) to OFF. You can obtain an arbitrary shutter speed by setting the trigger pulse width to the range of 2 μsec to 250 msec.

Mode 1 (Non-reset mode)   Mode 2 (Reset mode)

Mode 1	Mode 2
1 2 3 4	1 2 3 4
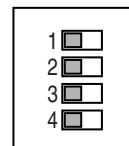
Note

An incorrect video signal will be output if you input a new trigger pulse before the video signal output for the previous trigger pulse is output completely.

Timing Chart

When set to Mode 1 (Non-reset mode)

Setting the shutter speed using trigger pulse width

◆ HD/VD input
• Continuous VD input
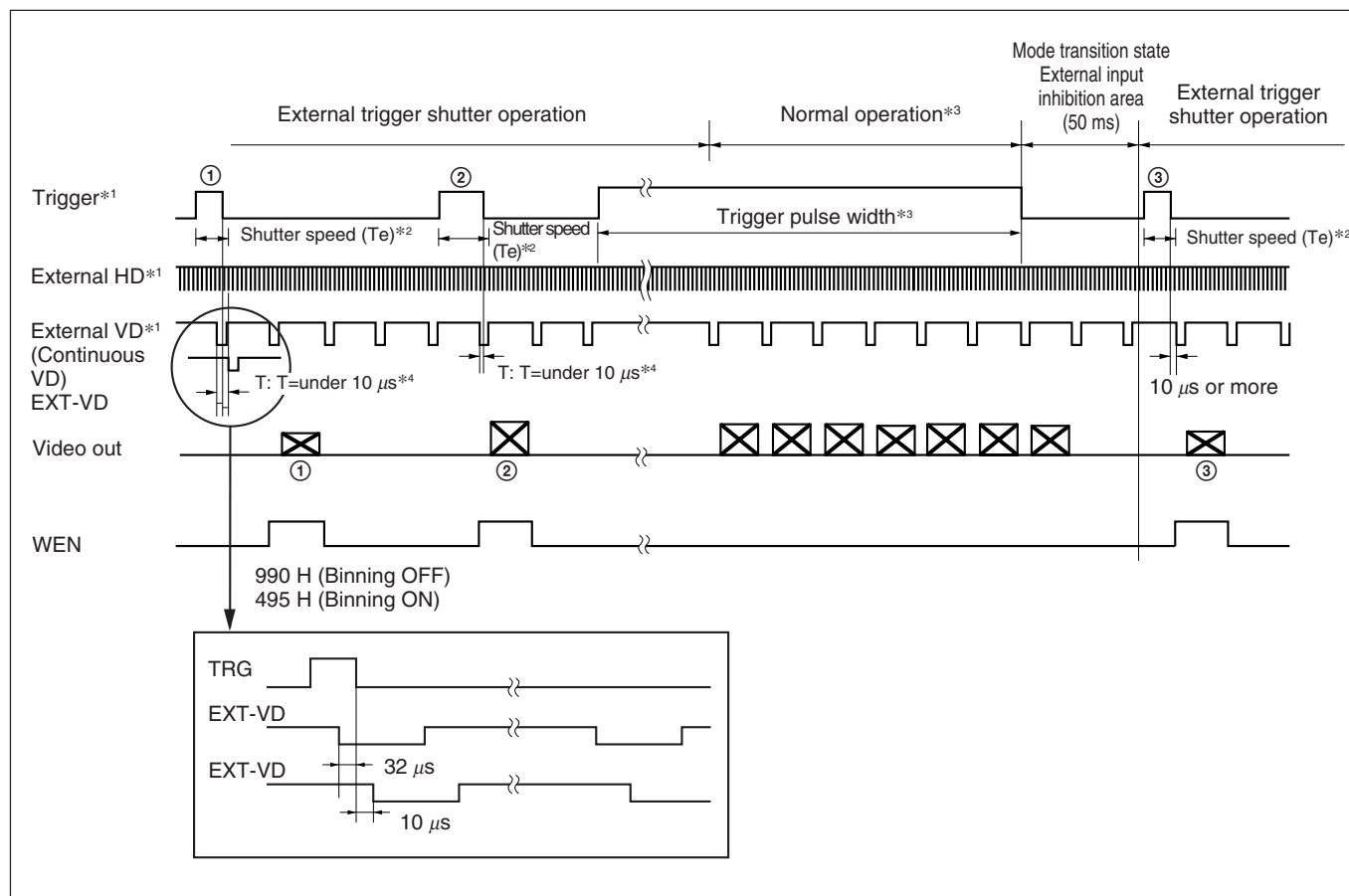
*1 This is an external input signal. Make sure to input both HD and VD signals.

*2 Shutter speed (Te)
Te = Trigger pulse width + 5 μsec
(The effective trigger pulse width for the external trigger shutter operation is between 2 μs and 1/4 s.)

*3 Normal operation is resumed when the trigger pulse width is 1/3 s or more. The trigger falling edge restores external trigger shutter operation. At this time, the 50 ms after the falling edge of the trigger pulse is an external trigger input inhibition area. There is no guarantee of operation for any trigger input in this period.

*4 If there is a falling edge on the external VD within a period of +10 μs from the falling trigger edge (① and ② in the figure), it is not defined whether the image is output for the external VD falling edge or the image is output for the next external VD falling edge. (① in the figure shows that the image is output for the next external VD. ② shows the image for the external VD.) In this case, see WEN since output of the image and WEN make up a pair. In any other case, the image is output for the external VD falling edge after the trigger falling edge (③ in the figure).

Note

An image is not output correctly when the next trigger is input before the image for the previous trigger has been output.

Setting the shutter speed using trigger pulse width

◆ **HD/VD input**
  • **Continuous HD input/Single VD input**
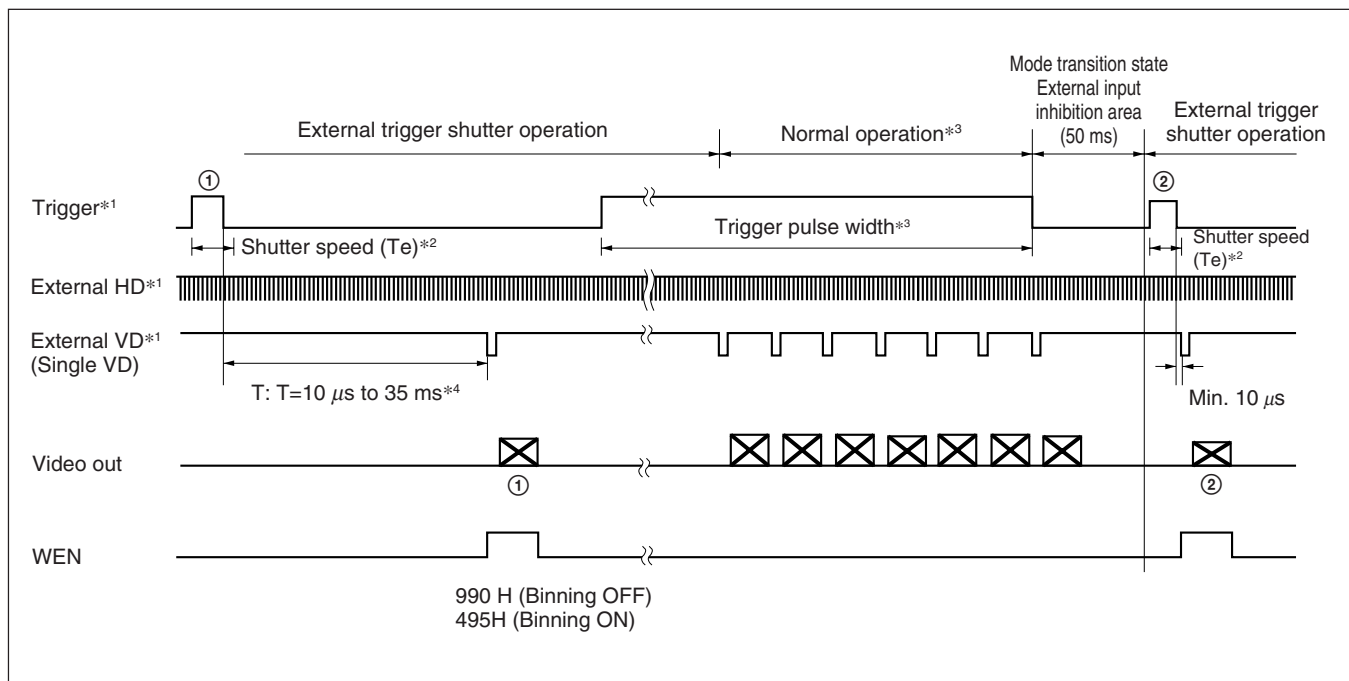
*1 This is an external input signal. Make sure to input both HD and VD signals in this case.
*2 Shutter speed (Te)
    Te = Trigger pulse width + 5 μsec
    (The effective trigger pulse width for the external trigger shutter operation is between 2 μs and 1/4 s.)
*3 Normal operation is resumed when the trigger pulse width is 1/3 s or more. The trigger falling edge restores external trigger shutter operation. At this time, the 50 ms after the falling edge of the trigger pulse is an external trigger input inhibition area. There is no guarantee of operation for any trigger input in this period.

*4 Input the external VD within the period of 10 μs to 35 ms after the trigger falling edge (① and ② in the figure). There is no guarantee of operation for any other input. If an invalid signal is input, the input is changed to a valid signal and, after several V signals, normal operation resumes.

Note

Make sure that the trigger signal and the VD signal make up a pair.
An image is not output correctly when the next trigger is input before the image for the previous trigger has been output.

Setting the shutter speed using trigger pulse width

◆ **No HD/VD input (Internal synchronization)**

*1 This is an external input signal.

*2 Shutter speed (Te)
Te = Trigger pulse width + 5 μs
(The effective trigger pulse width for the external trigger shutter operation is between 2 μs and 1/4 s.)

*3 Normal operation is resumed when the trigger pulse width is 1/3 s or more. The trigger falling edge restores external trigger shutter operation. At this time, the 50 ms after the falling edge of the trigger pulse is an external trigger input inhibition area. There is no guarantee of operation for any trigger input in this period.

*4 The internal VD signals are output as long as there is no external input and the HD/VD signal input/output switch of the mode setting DIP switch on the rear panel is set to set to INT (down position).

*5 In external trigger operation, the image is output for the internal VD falling edge after the trigger falling edge (① and ② in the figure). If the period from the trigger falling edge to the internal VD falling edge (T in the figure) is under 10 μs, it is not defined whether the image is output for the internal VD falling edge or the image is output for the next internal VD falling edge. (③ in the figure shows that the image is output for the next internal VD). In this case, see WEN since the image and WEN make up a pair.

Note

An image is not output correctly when the next trigger is input before the image for the previous trigger has been output.

Setting the shutter speed using DIP switches

◆ **HD/VD input**
  • **Continuous VD input**
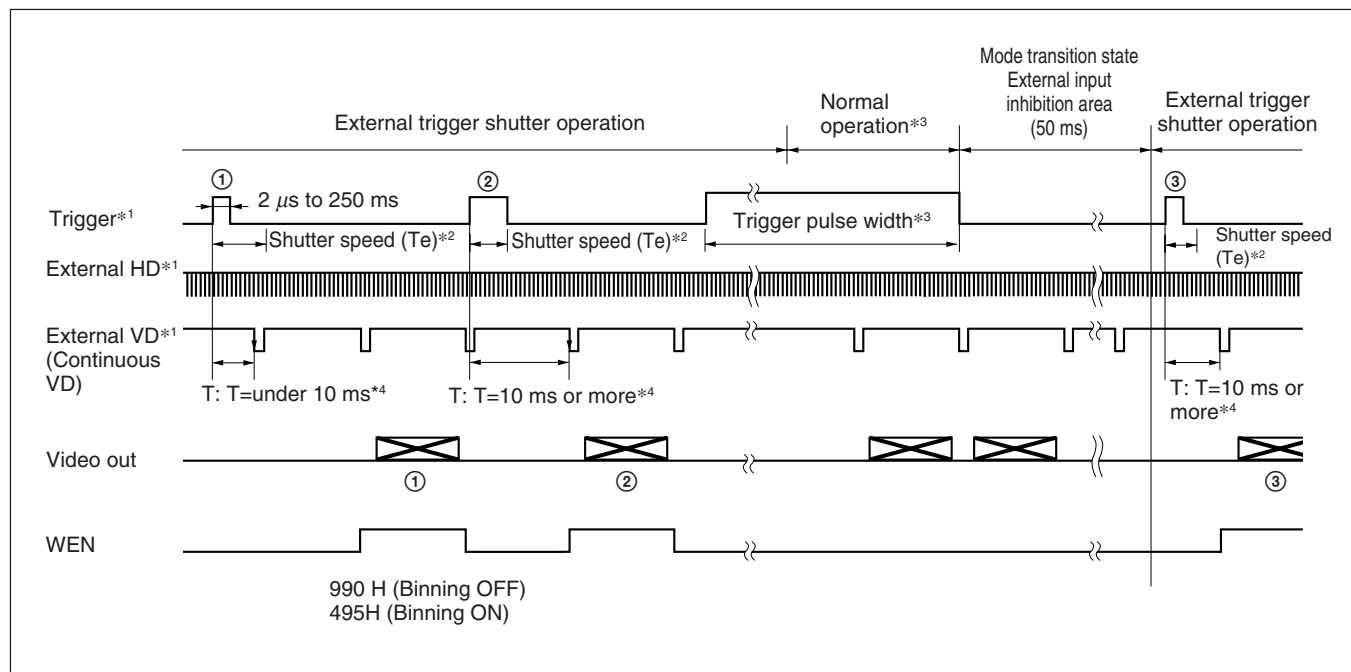
*1 This is an external input signal. Make sure to input both HD and VD signals.

*2 The shutter speed (Te) is determined by the setting of DIP switches.
  For details, see page 23.

*3 Normal operation is resumed when the trigger pulse width is 1/3 s or more. The trigger falling edge restores external trigger shutter operation. At this time, the 50 ms after the falling edge of the trigger pulse is an external trigger input inhibition area. There is no guarantee of operation for any trigger input in this period.

*4 An image is output when an external VD signal falls 10 ms or more after a trigger pulse rises (② and ③ in the figure). If the period from the trigger rising edge to the external VD falling edge (T in the figure) is under 10 ms, it is not defined whether the image is output for the external VD falling edge or the image is output for the next external VD falling edge. (① in the figure shows that the image is output for the next external VD). In this case, see WEN since the image and WEN make up a pair.

Note

An image is not output correctly when the next trigger is input before the image for the previous trigger has been output.

Setting the shutter speed using DIP switches

◆ **HD/VD input**
  • **Continuous HD input/Single VD input**
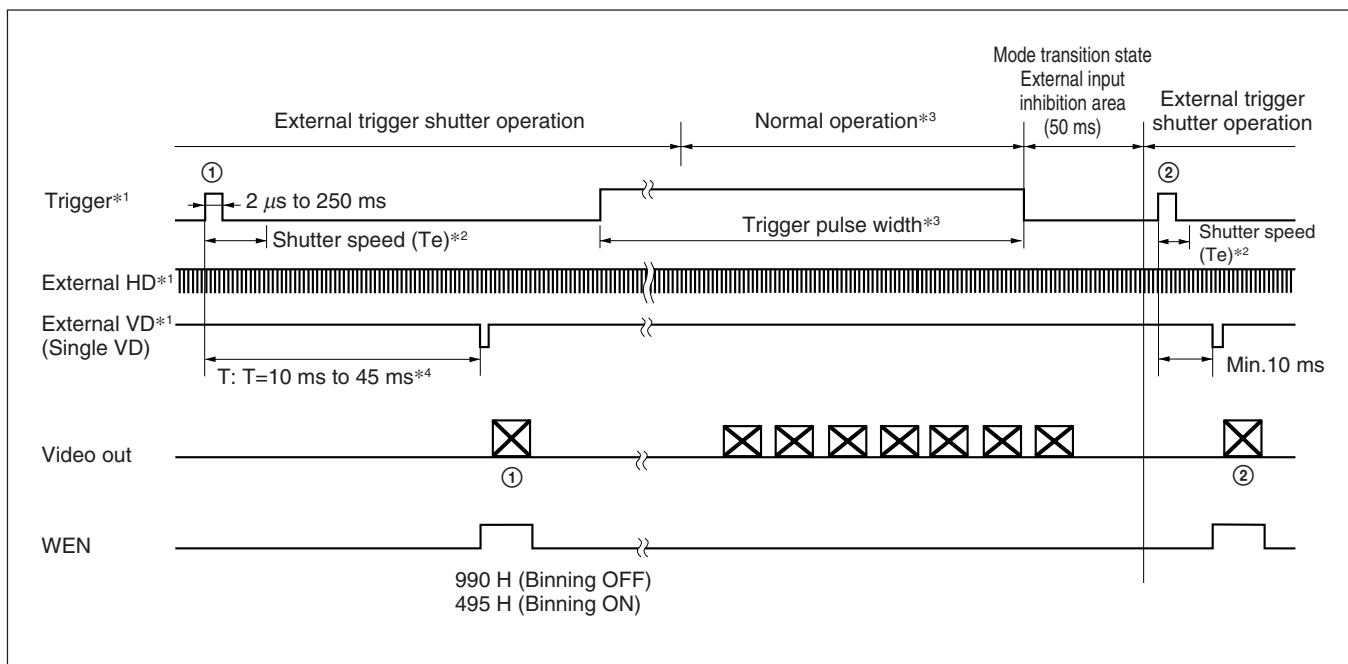
*1 This is an external input signal. Make sure to input both HD and VD signals in this case. Input the signal so that the VD phase aligns with the HD falling edge.

*2 The shutter speed (Te) is determined by the setting of the DIP switches.
    For details, see page 23.

*3 Normal operation is resumed when the trigger pulse width is 1/3 s or more. The trigger falling edge restores external trigger shutter operation. At this time, the 50 ms after the falling edge of the trigger pulse is an external trigger input inhibition area. There is no guarantee of operation for any trigger input in this period.

*4 Input the external VD within the period of 10 ms to 45 ms after the trigger rising edge (① and ② in the figure). There is no guarantee of operation for any other input. If an invalid signal is input, the input is changed to a valid signal, and after several V signals, normal operation resumes.

Note

Make sure that the trigger signal and the VD signal make up a pair.
An image is not output correctly when the next trigger is input before the image for the previous trigger has been output.

Setting the shutter speed using DIP switches

◆ No HD/VD input (Internal synchronization)
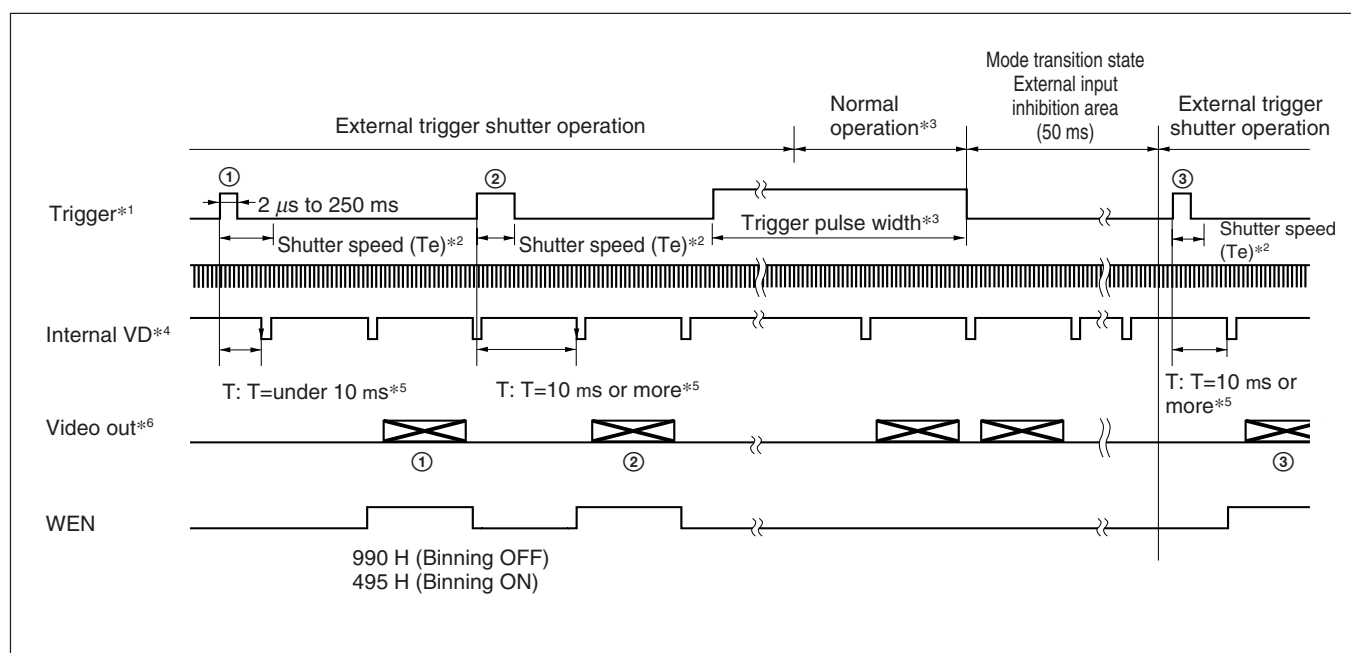
*1 This is an external input signal.
*2 The shutter speed (Te) is determined by the setting of the DIP switches.
For details, see page 23.
*3 Normal operation is resumed when the trigger pulse width is 1/3 s or more. The trigger falling edge restores external trigger shutter operation. At this time, the 50 ms after the falling edge of the trigger pulse is an external trigger input inhibition area. There is no guarantee of operation for any trigger input in this period.
*4 The internal VD signals are output as long as there is no external input and the HD/VD signal input/output switch of the mode setting DIP switch on the rear panel is set to the down position (INT).

*5 An image is output when an internal VD signal falls 10 ms or more after a trigger pulse rises (② and ③ in the figure). If the period from the trigger rising edge to the internal VD falling edge (T in the figure) is under 10 ms, it is not defined whether the image is output for the external VD falling edge or the image is output for the next external VD falling edge. (① in the figure shows that the image is output for the next internal VD). In this case, see WEN since the image and WEN make up a pair.

Note

An image is not output correctly when the next trigger is input before the image for the previous trigger has been output.

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When set to Mode 2 (Reset mode)

Setting the shutter speed using trigger pulse width
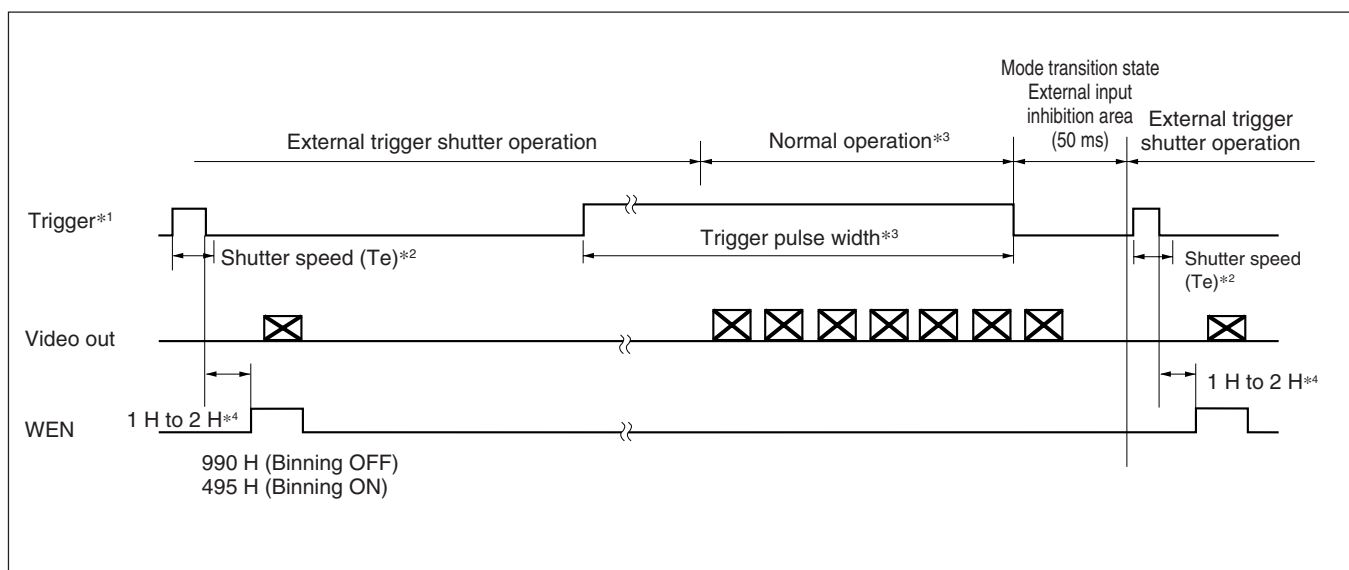
*1 This is an external input signal.

*2 Shutter speed (Te)
Te = Trigger pulse width + 5 μsec
(The effective trigger pulse width for the external trigger shutter operation is between 2 μs and 1/4 s.)

*3 Normal operation is resumed when the trigger pulse width is 1/3 s or more. The trigger falling edge restores external trigger shutter operation. At this time, the 50 ms after the falling edge of the trigger pulse is an external trigger input inhibition area. There is no guarantee of operation for any trigger input in this period.

*4 The video out is started after 1 H to 2 H from the trigger falling edge, then the image is output synchronized with the WEN pulse rising edge.

Note

An image is not output correctly when the next trigger is input before the image for the previous trigger has been output.

Setting the shutter speed using the DIP switches
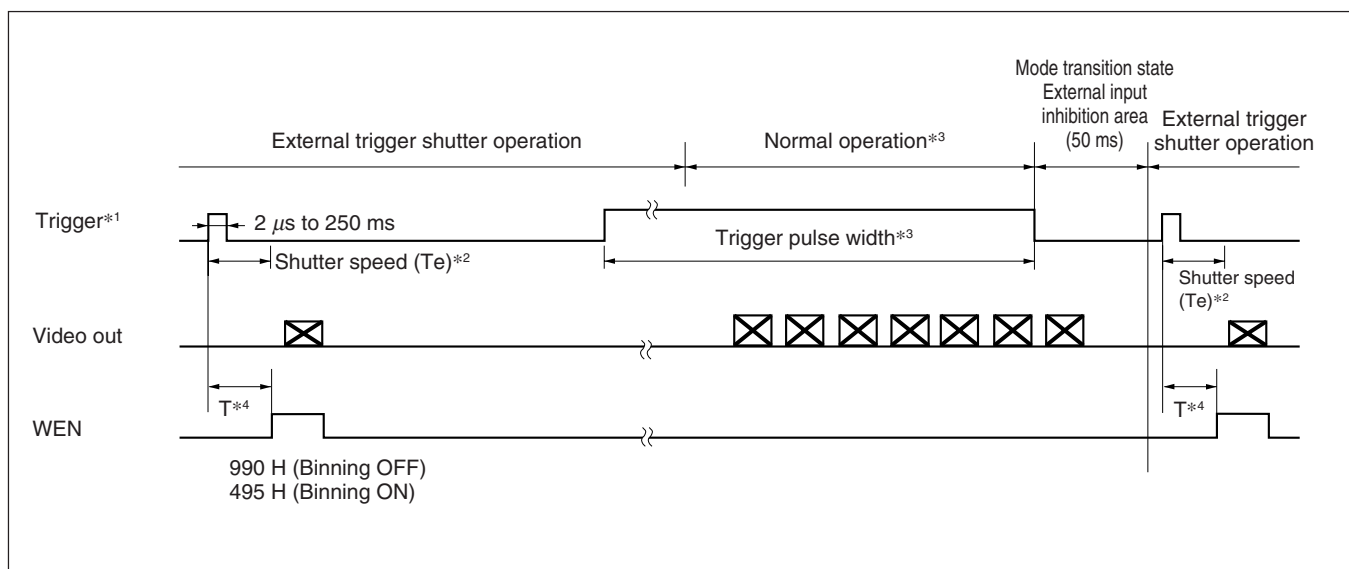
*1 This is an external input signal.
*2 The shutter speed (Te) is determined by the setting of the DIP switches.
    For details, see page 17.
*3 Normal operation is resumed when the trigger pulse width is 1/3 s or more. The trigger falling edge restores external trigger shutter operation. At this time, the 50 ms after the falling edge of the trigger pulse is an external trigger input inhibition area. There is no guarantee of operation for any trigger input in this period.

*4 The image is output at the shortest timing from the trigger rising edge according to the DIP switch setting. The image is output synchronized with the WEN pulse rising edge.

Note

An image is not output correctly when the next trigger is input before the image for the previous trigger has been output.

Camera Control Command

It is recommended that you make a test under the condition you will operate the camera before using the camera actually.

Overview

The XC-HR90 (Black and White Video Camera Module) can be controlled externally using serial communication.

Serial Communication Specifications

The serial communication system for the camera is an asynchronous method compliant with the RS-232C standard. The following table shows the transmission control specifications.
Command inputs are echoed back.

Baud rate	115200/4800 [bps]
	Default setting: 38400[bps]
Data bits	8
Parity	None
Stop bit	1
Flow control	None

Command Format

To input (send) a command, delimit a command name and parameters with spaces, and press the Carriage Return (CR) key.
The following shows the input format and an example:

> <Input format> command param1 param2 [CR]
> <Input example> PARTIAL 1 <CR>

Input characters are case-insensitive.
Use hexadecimal numbers for parameters.

Command Input and Response

When the camera receives commands from the host, it returns a response after each command is processed. Input commands are echoed back.

Note
To input multiple commands in sequence, input a command after the previous command returns its response.

Command response messages are as follows:
> OK : normal
> Error : syntax error
> Error : status error

■When command execution is completed normally, "OK[CR]" is returned.
Example:
> <Input> PARTIAL 1 <CR>
> <Output on screen> OK[CR]

■ If command execution is terminated abnormally, "Error[CR]" is returned.

■ When no parameter is input for a command requiring parameters, the current parameters of the command are returned.

Example:
> <Input> PARTIAL<CR>
> <Output on screen> 1[CR]

■ If an input value is out of parameter range or an invalid command name is input, the command is invalid and "Error[CR]" is returned.

> <Input> PARTIAL 5<CR>
> <Output on screen> Error [CR]

Command Specifications

This section describes the details of control
commands available for the XC-HR90.

User control commands

Command	Parameter range	Description
BRATE P[CR]	P: 0 to 6	Baud rate setting 0: 115200 1: 57600 2: 38400 3: 19200 4: 14400 5: 9600 6: 4800 The newly input baud rate is displayed and OK is displayed, and then the baud rate is changed to the newly set one.
BRATE[CR]	None	Displays the baud rate currently set
INIT[CR]	None	Resets the functions of the camera (shutter, gain, scan mode and trigger mode) to the factory settings
INITIAL[CR]	None	Resets the functions of the camera to the factory settings. Functions to be reset are those stored in the user memory in addition to the functions described above.
SHUTTER P[CR]	P: 0 to C (hexadecimal numbers)	Shutter setting 0: OFF 1: 1/100s 2: 1/125s 3: 1/250s 4: 1/500s 5: 1/1000s 6: 1/2000s 7: 1/4000s 8: 1/10000s 9: 1/25000s A: 1/50000s B: 1/100000s C: Trigger pulse width control
SHUTTER[CR]	None	Reads the shutter setting
GAIN PP[CR]	PP: 00 to FF (hexadecimal numbers)	Sets the gain
GAIN[CR]	None	Reads the gain setting
BINNING P[CR]	P: 0/1	Sets the binning mode 0: Binning OFF 1: Binning ON
BINNING[CR]	None	Reads the binning mode setting
PARTIAL P[CR]	P: 0/1	Sets the partial scan mode 0: Partial scan OFF 1: Partial scan ON

Command	Parameter range	Description
PARTIAL[CR]	None	Reads the partial scan mode setting
AREA FR[CR]	F: 0 to F (Hexadecimal numbers)	Sets the partial scan area
	R: 0 to F (Hexadecimal numbers)	The parameters are indicated by hexadecimal numbers. The number of blocks transferred at the upper high-speed is indicated by the first digit, and the number of blocks transferred at the lower high-speed is indicated by the second digit. Set the area within the range of F + R < 16.
AREA[CR]	None	Reads the partial scan area
MODE P[CR]	P: 0 to 3	Sets the trigger mode.
		0: OFF
		1: Restart/Reset
		2: Trigger Mode 1
		3: Trigger Mode 2
MODE[CR]	None	Reads the trigger mode
VERSION[CR]	None	Reads the version of the firmware of the camera
Maa,dd[CR]	aa: 00 to FF (Hexadecimal numbers)	Writes the data indicated by the parameter in the user memory
	dd: 00 to FF (hexadecimal numbers)	
Maa[CR]	aa:00 to FF (hexadecimal numbers)	Reads the user memory
FRATE P[CR]	P: 0 to 1	Sets the frame rate
		0: 30 fps
		1: 15 fps
FRATE[CR]	None	Reads the frame rate
INTEXT P[CR]	P: 0 to 1	Sets the synchronous mode
		0: INT
		1: EXT
INTEXT[CR]	None	Reads the synchronous mode
TERM P[CR]	P: 0 to 1	Sets the 75-ohm termination of the VD/HD input
		0: 75-ohm termination OFF
		1: 75-ohm termination ON
TERM[CR]	None	Reads the setting of the 75-ohm termination of the VD/HD input

Specifications

Main Specifications

Items without specific conditions indicated are the values set at the factory.

Image pickup system

Image pickup device

$^1/_3$ type interline transfer PS CCD

Number of effective pixels

1296 × 966 (H/V)

Optical black   52 pixels per horizontal scan line

CCD vertical driving frequency

At 30 fps: 29.7 kHz ±1%

At 15 fps: 14.85 kHz ±1%

CCD horizontal driving frequency

At 30 fps: 49.302 MHz

At 15 fps: 24.651 MHz

Cell size   3.75 × 3.75 μm (H/V)

Chip size   6.26 × 5.01 mm (H/V)

Optical and other systems

Lens mount   C-mount

Flange back   17.526 mm

Synchronization system

Internal/External (automatically switched according to input signal)

External synchronization input/output

HD/VD (HD/VD level: 2.5 to 5 Vp-p)

Allowable frequency deviation of external synchronization

±1% (in horizontal synchronous frequency)

H Jitter   Less than 20 ns

Scan lines   990-line/495-line (Normal mode/ Binning mode)

Scanning system   Non-interlace

Video output   1.0 Vp-p, sync negative, 75Ω, unbalanced

Output signal frequency

At 30 fps: 30 Hz/54.1 Hz (Normal mode/Binning mode)

At 15 fps: 15 Hz/30 Hz (Normal mode/Binning mode)

Effective lines   1280 × 960 (H/V)

Horizontal resolution

960 TV lines

Sensitivity   F5.6 (400 lx with FIX Gain)

Minimum illumination

1 lx (with gain manually adjusted to maximum, F1.4)

Video S/N ratio   56 dB (reference value)

Gain   Fixed/Manually adjustable

Gamma compensation

1 (fixed)

White clip   820 mV ±70 mV

Read mode   Normal mode/Binning mode

Shutter   External trigger shutter

Shutter speed   External trigger shutter: 1/4 to 1/100,000 s

Power requirements

+12 V DC (range: +10.5 to +15 V)

Power consumption

2.8 W

Operating temperature

−5 to +45 ˚C (23 to 113 ˚F)

Storage temperature

−30 to +60 ˚C (−22 to +140 ˚F)

Operating humidity

20 to 80% (no condensation)

Storage humidity   20 to 95% (no condensation)

Vibration resistance

10 G (20 to 200 Hz)

Shock resistance   70 G

External dimensions (w/h/d)

29 × 29 × 63.5 mm (1 $^3/_{16}$ × 1 $^3/_{16}$ × 2 $^1/_2$ inches)

Mass   80 g (2.8 oz)

MTBF   73880 hours (about 8.4 years)

Accessories   Lens mount cap (1)

Operating Instructions (1)

Design and specifications are subject to change without notice.

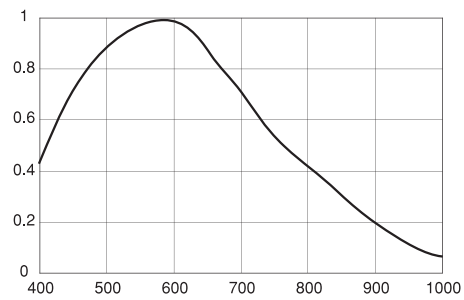**IMPORTANT**

The nameplate is located on the bottom.

Spectral Sensitivity Characteristics (Typical Values)

An example of spectral sensitivity characteristics (without taking the characteristics of the lens and the characteristics of the light source into consideration):

Horizontal Output Waveform Timing Chart

30 fps mode (Normal)

1 horizontal scan period 1660 (33.67 μs)

HD0

166 (3.36 μs)

20.28 ns

CCD output signal

40   308   4 12

8

Optical black

Horizontal transfer stop period

Effective total pixels 1296

Dummy bits   Optical black

Horizontal blanking period 380   Output video period 1280 (25.96 μs)

Camera video output signal (Typical value)

(7.70 μs)

76   HSYNC 235   69

(1.54 μs)   (4.76 μs)   (1.4 μs)

Values without units indicate the clock counts.

30 fps mode (Binning)

1 horizontal scan period 1840 (37.32 μs)

HD0

166 (3.36 μs)

20.28 ns

CCD output signal

40   488   4 12

8

Optical black

Horizontal transfer stop period

Effective total pixels 1296

Dummy bits   Optical black

Horizontal blanking period 560   Output video period 1280 (25.96 μs)

Camera video output signal (Typical value)

(11.35μs)

76   HSYNC 235   249

(1.54 μs)   (4.76 μs)   (5.05 μs)

Values without units indicate the clock counts.

15 fps mode (Normal)

1 horizontal scan period 1660 (67.34 μs)

HD0

166 (6.73 μs)

40.56 ns

CCD output signal

40   308   4   12

8

Optical black

Horizontal transfer stop period

8

Effective total pixels 1296

Dummy bits   Optical black

Horizontal blanking period 380

Output video period 1280 (51.92 μs)

(15.41 μs)

Camera video output signal (Typical value)

76   HSYNC 235   69

(3.08 μs)   (9.53 μs)   (2.8 μs)

Values without units indicate the clock counts.

15 fps mode (Binning)

1 horizontal scan period 1660 (67.34 μs)

HD0

166 (6.73 μs)

40.56 ns

CCD output signal

40   308   4   12

8

Optical black

Horizontal transfer stop period

8

Effective total pixels 1296

Dummy bits   Optical black

Horizontal blanking period 380

Output video period 1280 (51.92 μs)

(15.41 μs)

Camera video output signal (Typical value)

76   HSYNC 235   69

(3.08 μs)   (9.53 μs)   (2.8 μs)

Values without units indicate the clock counts.

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Vertical Output Waveform Timing Chart

30 fps mode (Normal)

*: The transfer stop period is included in the dummy bits.

30 fps mode (Binning)

*: The transfer stop period is included in the dummy bits.

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15 fps mode (Normal)

*: The transfer stop period is included in the dummy bits.

15 fps mode (Binning)

*: The transfer stop period is included in the dummy bits.

Dimensions

2-M2 depth 3 (0.118)

14.5 (0.571)

12 (0.472)

29 (1.142)

29 (1.142)

Ø27.6 (1.087)

Ø27.3 (1.075)

5.5 (0.217)

3 (0.118)

12 (0.472)

63.5 (2.500)

8 (0.315)

VIDEO OUT/DC IN/SYNC   M GAIN

SHUT

HR

TRIG

FIX/M

1 · · 4   BINNING

75.5 (2.972)

15 (0.591)

44.5 (1.752)

20 (0.787)

4-M3 depth 4 (0.157)

Unit: mm (inches)