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Monochrome Double Speed Camera

CV-M30

Operation Manual

Camera: Revision D
Manual: Version 1.1

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1. General

The CV-M30 camera revision D is an updated version with a new CCD sensor ICX-418ALL-6 with improved specifications. The revision D camera can only operate in double speed.
CV-M30 is a monochrome CCD video camera designed for industrial video sensing applications. The camera operates with double speed scanning, where the horizontal and vertical frequencies is doubled compared to a standard camera. The image-capturing speed is the double.
The CV-M30 also offers an attractive partial scanning mode for higher frame rates. The partial scanning is with full horizontal scanning and 50% or 33% in the vertical direction.
The camera is also equipped with a pulse width control mode, where the accumulation time is controlled by the low period of the external trigger pulse.

The latest version of this manual can be downloaded from: www.jai.com

For camera revision history, please contact your local JAI distributor.

2. Standard Composition

The standard camera composition consists of the camera main body.

3. Main Features

- High resolution image with 768(h) x 494(v) pixels
- Double speed scanning
- 60 interlaced frames per second
- 120 fields per second
- Partial scanning 1/2 or 1/3 for 240 or 360 fields per second
- Internal, external HD/VD or random trigger synchronization
- Asynchronous trigger for edge pre-select and pulse width controlled shutter
- Shutter speeds up to 1/20,000 second
- All function switches are accessible on the rear panel
- Compact housing with C-mount

4. Locations and Functions

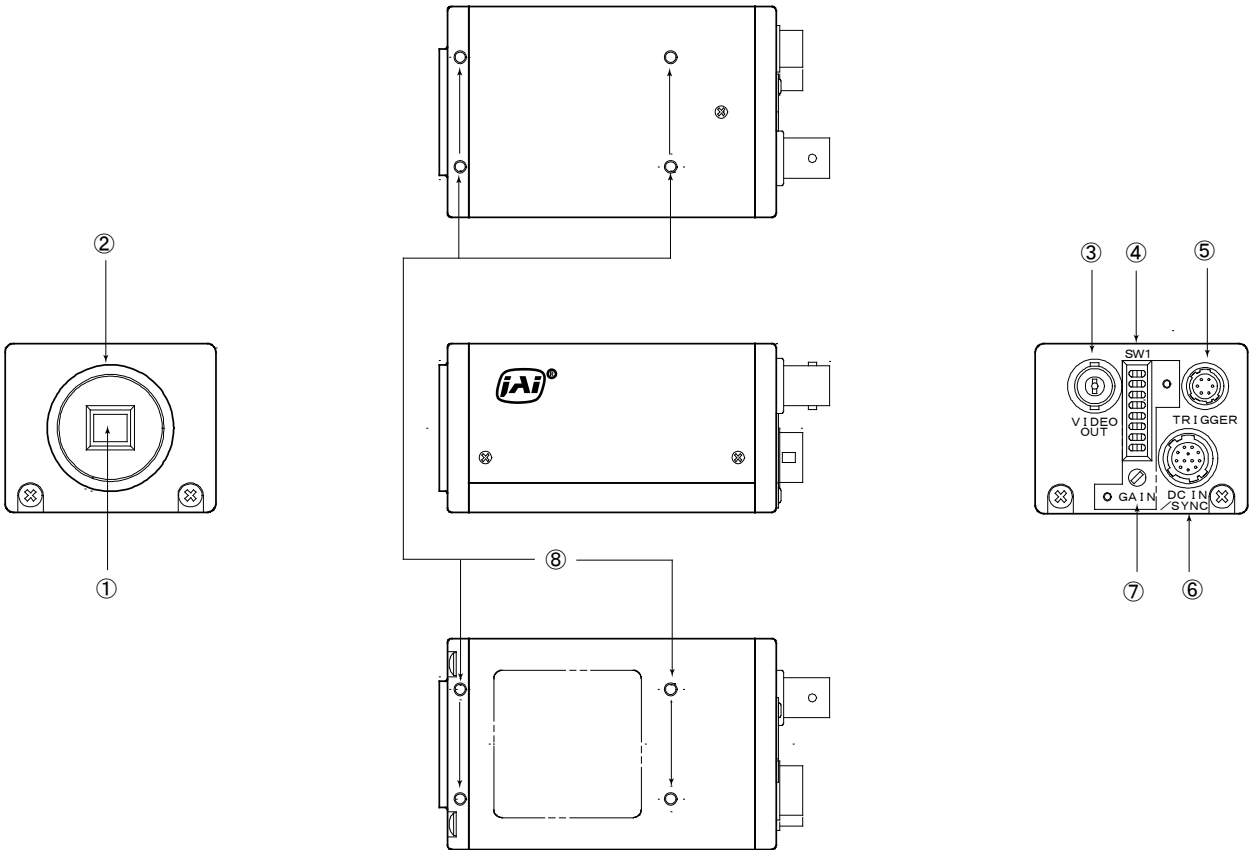


Fig. 1. Locations

1. 1/2” interline-transfer type CCD sensor
2. Lens mount for C-mount lenses. *1)
3. BNC connector for video output
4. Switch block SW1 for shutter speed and function mode setting
5. 6-Pin connector for Input/output of control signals
6. 12-Pin connector for 12V DC power and external sync signals
7. Gain potentiometer for manual gain adjustment
8. Screw holes for Tripod mount plate. (Screws 3.0 x 5mm)

Note *1): Rear protrusion on the C-mount lens must be less than 10mm (0.4 inches approx.). When IR-cut filter is used, it must be less than 7.0 mm (0.28 inches approx.).

The IR-cut filter is placed in the C-mount thread.
The C-mount IR-cut filter must be ordered separately.

5. Pin Assignment

5.1. 12-pin Multi-connector (DC-IN/VIDEO OUT, EXT.HD/VD IN)

Type: HR10A-10R-12PB-01 (Hirose) male
Seen from rear.

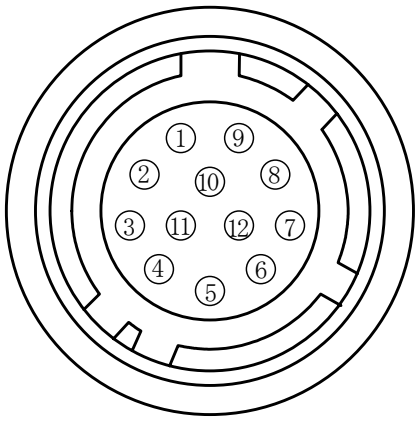


Fig. 2. 12 pin connector

Pin no	Signal	Remarks
1	GND	
2	+12 V DC input	
3	GND	
4	Video output	Parallel with the BNC connector. *1)
5	GND	
6	HD input	
7	VD/trig input	Parallel with pin 5 on 6 pin con. *2)
8	GND	
9	EEN output	Parallel with pin 2 on 6 pin con.
10	GND	
11	+12 V DC input	
12	GND	

Notes:
**1) The video signal on pin 4 is in parallel with the BNC connector. Avoid double termination*
**2) If external trigger pulse is input on either No.7 of 12 pin connector or No. 5 of 6 pin connector, no external VD signal should be input on the other.*

5.2. 6-pin Multi-connector (TRIGGER)

Type: HR10A-7R-6PB (Hirose) male
Seen from rear.

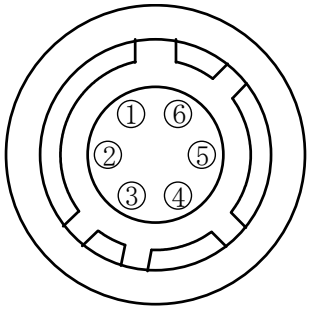


Fig. 3. 6 pin connector

Pin no.	Signal	Remarks
1	RM1	Normal/Double speed. (SW1-5)
2	EEN Output	Parallel with pin 9 on 12 pin con.
3	GND	
4	NC	
5	VD/trig input	Parallel with pin 7 on 12 pin con. *2)
6	WEN output	

5.3. Input and Output Diagram

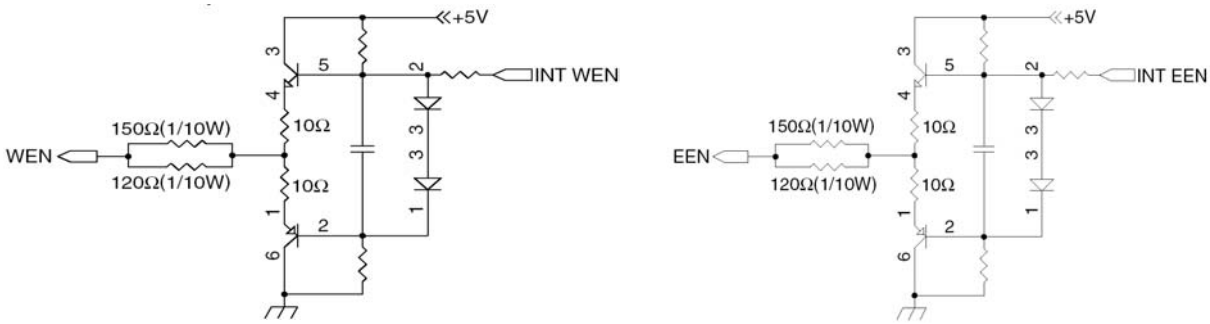


Fig. 4. WEN and EEN output

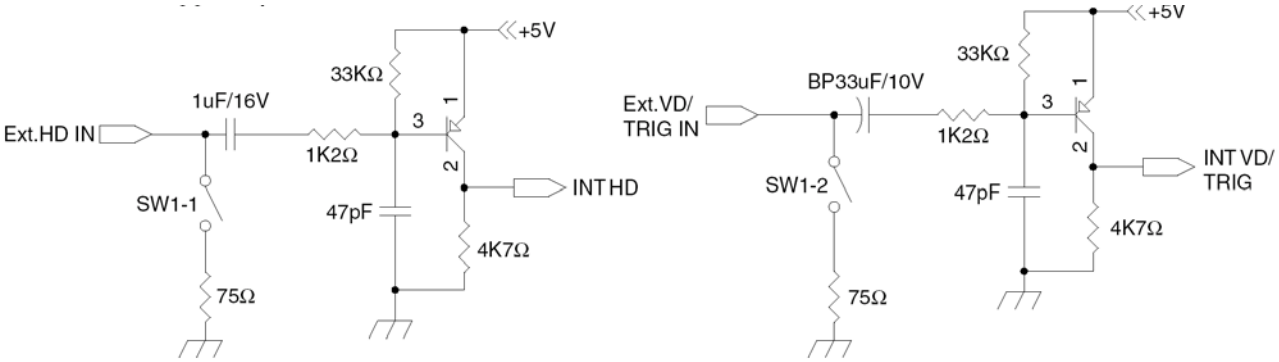


Fig. 5. HD and VD/Trigger input

6. Functions and Operations

6.1. Input of External HD/VD Signals

As factory setting the camera can be synchronized by external HD/VD signals. The external supplied HD/VD signal should follow the same standard as the camera setting for speed, scanning and interlace. The signal level must be 4.0 Vp-p ±2.0V with 75 Ohm termination on. The termination can be switched off with the internal switch SW1 on the PK8212 board.
The VD input terminal is used for external trigger signal input in the random trigger modes.
If no external HD is connected, the camera will switch to the internal HD.
If no external VD is connected, the camera will continue with its internal VD.
For settings, see "7. Mode Setting."

6.2. Continuous Operation

For applications that not require asynchronous trigger, but run in continuous mode, this mode is used. SW1-7 Trigger is set to Normal (OFF). The camera can operate in normal or double speed. It is set by with Sw1-5 or at pin 1 on 6 pin connector. The exposure time is selected with SW1-1 to SW1-3. The read out can be 2:1 interlaced, non-interlaced or partial scan. It can be set by SW1-4 and SW1-6. Partial scanning can only operate in non-interlaced mode. Maximum field rate with partial scan and double speed is 360 fields per second.

To use this mode

Set: SW1-7 to OFF for normal shutter
SW1-4 to and SW1-6 to interlaced, non interlaced.1/2 partial or 1/3 partial
SW1-1, SW1-2 and SW1-3 to shutter speed.

Input: If external synchronizing is used, input HD and VD.
Ext. VD to pin 5 on 6 pin connector or pin 7 on 12 pin connector..
Ext. HD to pin 6 on12-pin connector.
75 Ohm termination is done with SW1-1 (HD) and SW1-2 (VD) on PK8212 board.

Refer to "6.5.Timing Chart"
For settings, see "7. Mode Setting."

6.3. External Trigger Mode

This camera has two external trigger modes.

1. *Edge Pre-select Mode. (Asynchronous reset and exposure start by an external trigger.)*
2. *Pulse Width Control Mode. (Asynchronous reset and exposure controlled by the low period of the external trigger.)*

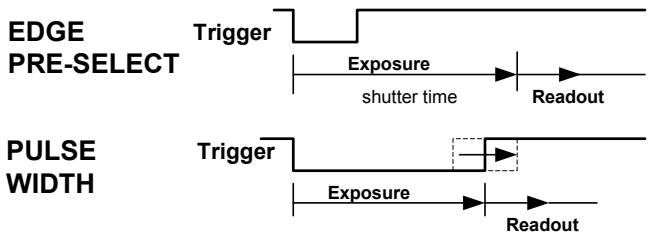


Fig. 6. External trigger modes

The trigger input is AC coupled, and the exposure will start at the first HD pulse after the trigger falling edge. The trigger pulse width should be > 1H to < 1000H.

6.3.1. Edge Pre-select Mode

The edge pre-select mode will work in non-interlaced and field accumulation mode with partial scanning and double speed. The CV-M30 starts the exposure (= accumulation of photoelectric charge) at the first HD pulse after the falling edge of the ext. trigger pulse. The exposure ends after the time set by the 3 shutter switches SW1-1 to SW1-3. The accumulated signal will be read out as a single field before a new trigger can be applied. The interval between trigger pulses must be longer than the time for 1 field + the shutter time. It is the limit for the field rate. For partial scanning the longest shutter time are not available.
In this mode, the EEN (Exposure ENable) pulse and WEN (Write ENable) pulses are generated and output from the camera. The EEN pulse indicates the exposure time and can be used to control the illumination such as strobe light. The WEN pulse indicates the time period of the effective video signal output, and is useful for the timing and interfacing of external devices such as frame grabbers.

To use this mode

Set: SW1-7 to ON for ext. trigger shutter
SW1-4 to OFF and SW1-6 to ON for non interlaced mode
SW2-1 on PK8212 board ton OFF for Edge Pre select mode
SW1-1, SW1-2 and SW1-3 to shutter speed

Input: Ext. trigger to pin 5 on 6 pin connector or pin 7 on 12 pin connector.
Ext. HD to pin 6 on12-pin connector. (If used).
75 Ohm termination is done with SW1-1 (HD) and SW1-2 (Trig) on PK8212 board.

Refer to "6.5.Timing Chart".
Detailed switch setting is described in "7. Mode Setting".
For connections see "5. Pin Assignment".

Cautions in the Edge Pre-select Mode.

1. Edge pre-select mode is effective in non-interlaced, field accumulation mode. Double speed and partial scan can be used.
2. The exposure start may delayed up to 1H max., when the falling edge of ext. trigger pulse is not synchronized with the falling edge of ext. HD signal. To avoid this 1H delay and jitter, the falling edge of the trigger pulse should be synchronized with the HD pulse as shown below. It can be the ext. HD input or the Internal HD output.

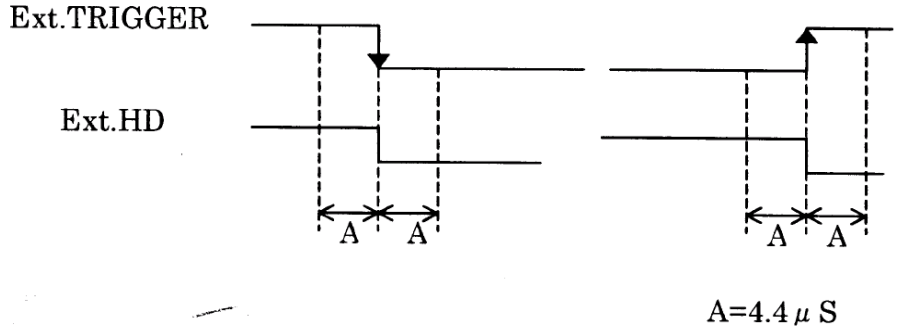


Fig. 7. External trigger and HD relations

3. The ext. trigger input is 75 Ohm terminated as factory setting. The voltage level of the ext. trigger has to be 4.0 Vp-p ± 2.0 V. The duration should be more than 1 H negative going. >32 µsec. and < 1000H. The input is AC coupled.
4. If the ext. HD input and ext. trigger input are from a TTL source, set SW1-1 (HD) to OFF and SW1-2 (ext. trigger) to OFF for non-terminated.

6.3.2. Pulse Width Control Mode

The pulse width control mode will only work in non-interlaced field accumulation mode.
The exposure is controlled by the low period of the ext. trigger pulse. The CV-M30 starts the exposure at the first HD pulse after the falling edge of the ext. trigger pulse. The exposure ends at the first HD pulse after the rising edge of the ext. trigger. The Shutter can be controlled to be within the range from >1H (>32 usec.) to <1000H. The AC coupling causes the upper limit.
The accumulated signal will be read out as a single field before a new trigger can be applied. The interval between trigger pulses must be longer than the time for 1 field + the trigger low time. It is the limit for the field rate.
In this mode, the EEN (Exposure ENable) pulse and WEN (Write ENable) pulses are generated and output from the camera. The EEN pulse indicates the exposure time and can be used to control the illumination such as strobe light. The WEN pulse indicates the time period of the effective video signal output, and is useful for the timing and interfacing of external devices such as frame grabbers.

To use this mode

Set: SW1-7 to ON for ext. trigger mode.
SW1-4 to OFF and SW1-6 to ON for non interlaced mode.
SW2-1 on PK8212 board ton ON for Pulse Width Control mode.

Input: Ext. trigger to pin 5 on 6 pin connector or pin 7 on 12 pin connector.
Ext. HD to pin 6 on12-pin connector. (If used).
75 Ohm termination is done with SW1-1 (HD) and SW1-2 (Trig) on PK8212 board.

Refer to "6.5.Timing Chart".
Detailed switch setting is described in "7. Mode Setting".
For connections see "5. Pin Assignment".

Cautions in the Pulse Width Control Mode.

1. Pulse width control mode is effective in non-interlaced, field accumulation mode. Double speed and partial scan can be used.
2. The exposure start may delayed up to 1H max., when the falling edge of ext. trigger pulse is not synchronized with the falling edge of ext. HD signal. To avoid this 1H delay and jitter, the falling edge of the trigger pulse should be synchronized with the HD pulse as shown below. It can be the ext. HD input or the Internal HD output.

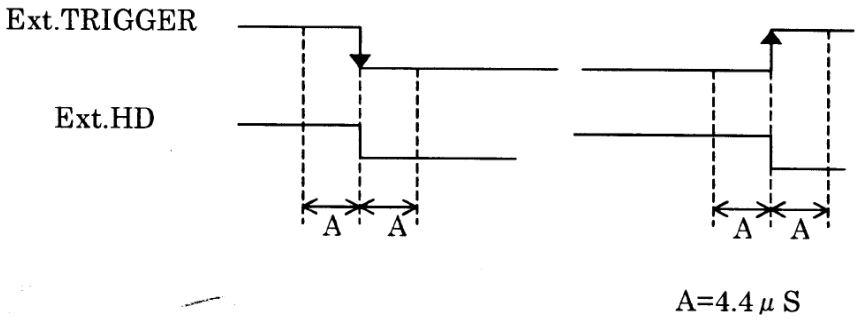


Fig. 8. External trigger and HD relations

3. The ext. trigger input is 75 Ohm terminated as factory setting. The voltage level of the ext. trigger has to be 4.0 Vp-p ± 2.0 V. The pulse width should be >1H (>32 usec.) to <1000H.
3. If the ext. HD input and ext. trigger input are from a TTL source, set SW1-1 (HD) to OFF and SW1-2 (ext. trigger) to OFF for non-terminated.

6.4. Other Functions

6.4.1. Double Speed Mode

The CV-M30 camera revision D operates only with double speed scanning.
Double speed is 120 fields per second. (V= 119.88Hz. H=31.468 kHz).

To use this mode.
Set:

6.4.2. Partial Scanning Mode

To obtain a higher frame rate, the partial scanning can be used. In this mode only the vertical center part of the CCD sensor is read out. Partial scan will only work in non-interlaced mode.
The useable image format is

Full non-interlaced	752(h) x 242(v) pixels (120 fields/second in continuous).
1/2 partial	752(h) x 111(v) pixels (240 fields/second in continuous).
1/3 partial	752(h) x 67(v) pixels (360 fields/second in continuous).

With external trigger and partial scan the maximum field rate is less then the above shown. The maximum field rate is given of the actual shutter time plus the readout time.

To use this mode.
Set: SW1-4 and SW1-6 on the rear panel as follows:

Full	SW1-4 OFF, SW1-6 OFF
1/2 partial	SW1-4 ON, SW1-6 OFF
1/3 partial	SW1-4 ON, SW1-6 ON

Note: In this mode, the shutter speed has limitation depending on the selected range.
Edge pre-select mode.
1/2 partial: Double speed 1/250 to 1/20,000s.
1/3 partial: Double speed 1/500 to 1/20,000s.

6.5. Timing Charts

6.5.1. Video Timing (H)

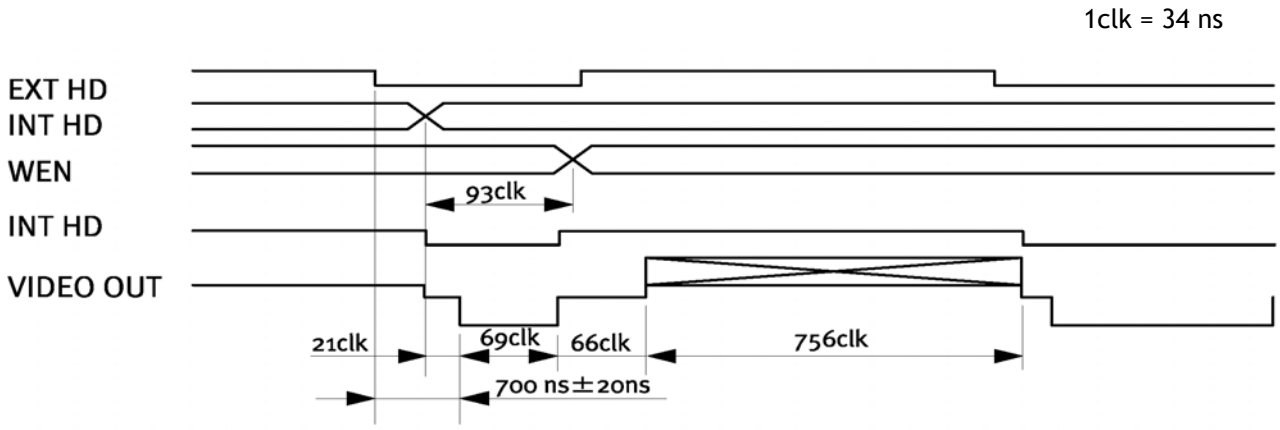


Fig. 9. Horizontal timing

6.5.2. External Sync Mode

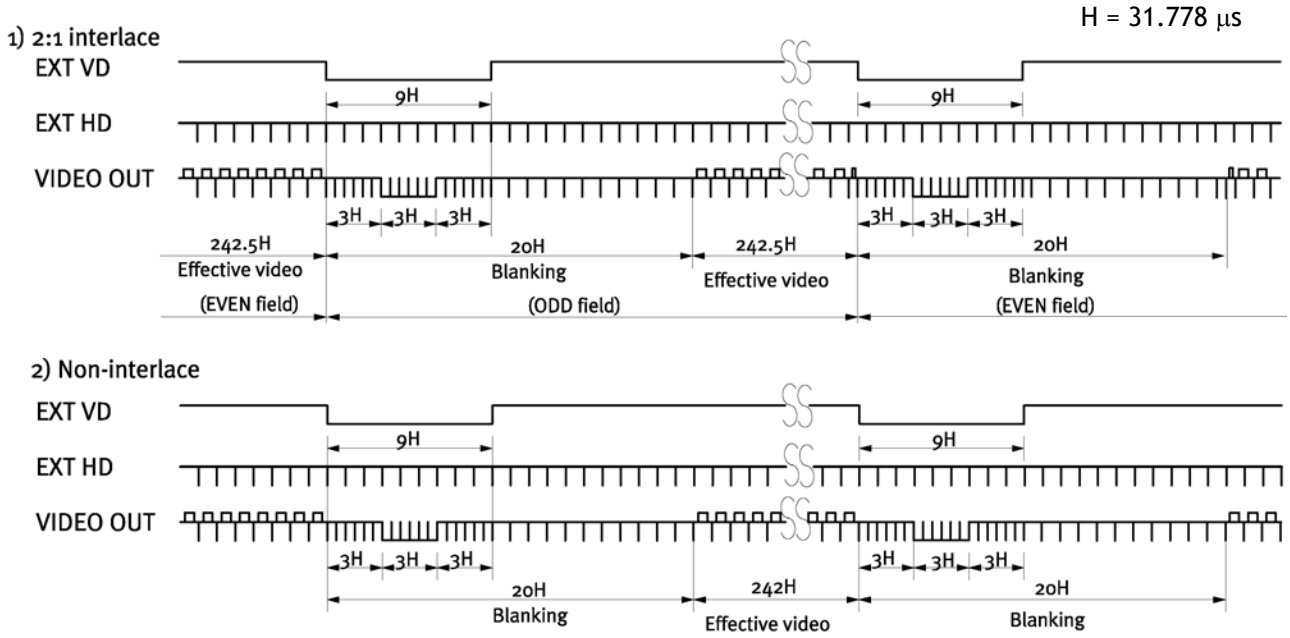


Fig. 10. Vertical timing with external sync

6.5.3. External Sync Mode. Partial Scan

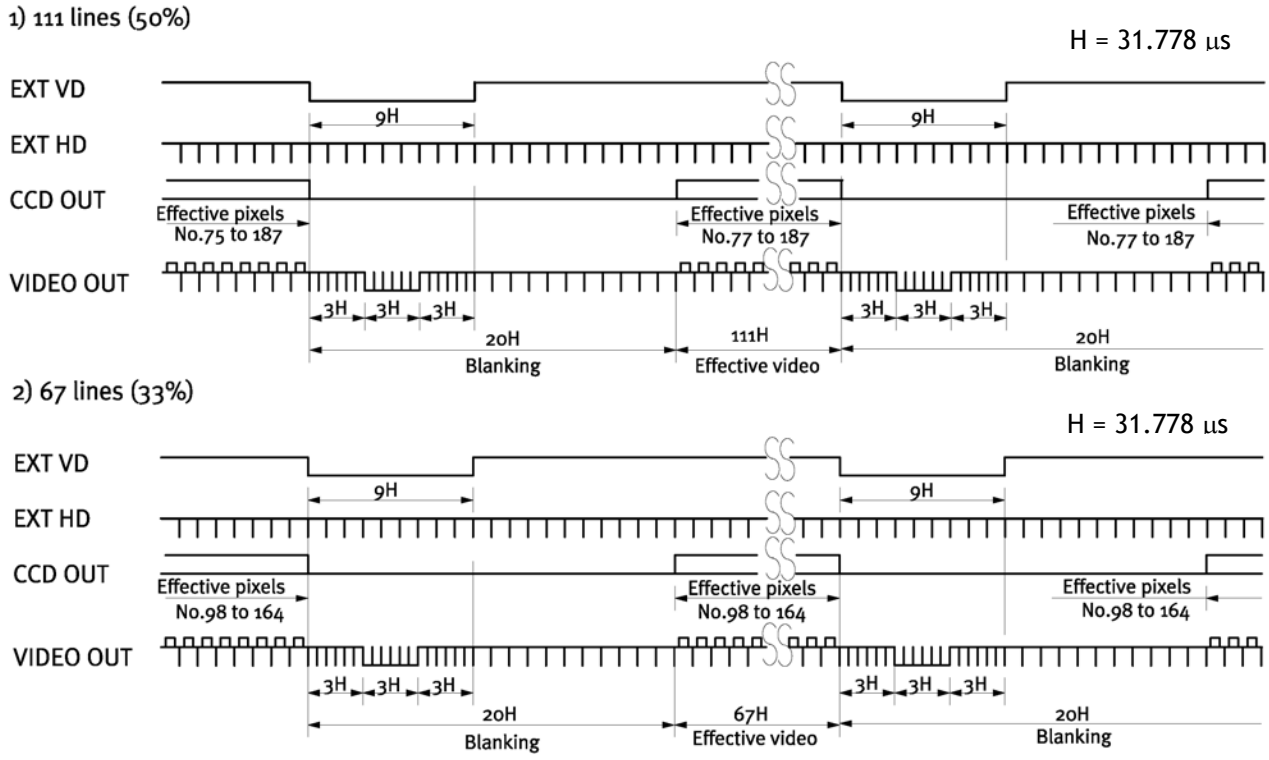


Fig. 11. Partial scanning vertical timing with external sync

6.5.4. Edge Pre-select

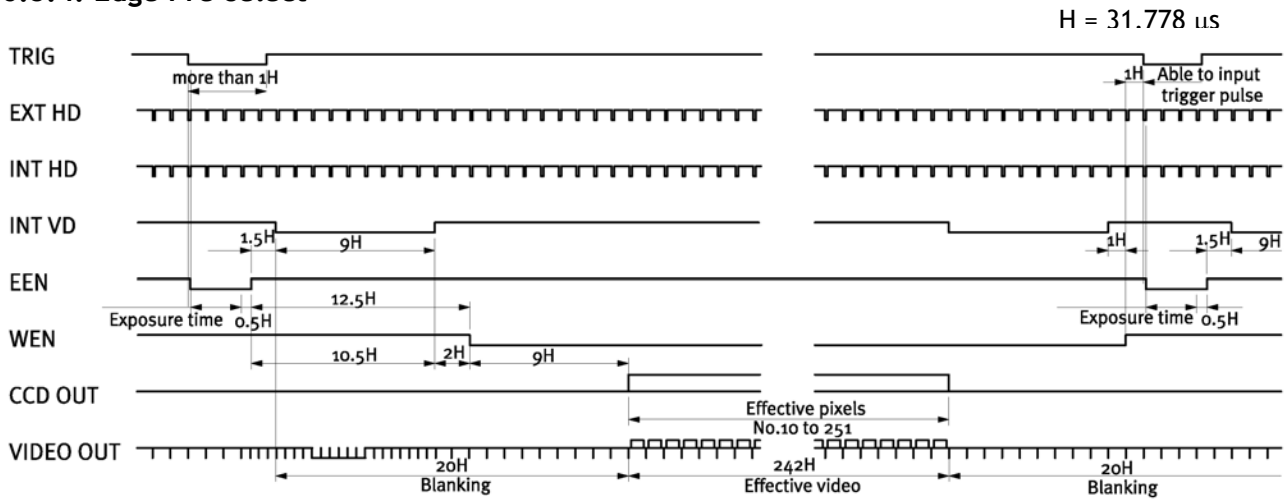


Fig. 12. Vertical timing for Edge pre-select

6.5.5. Edge Pre-select. Partial Scan

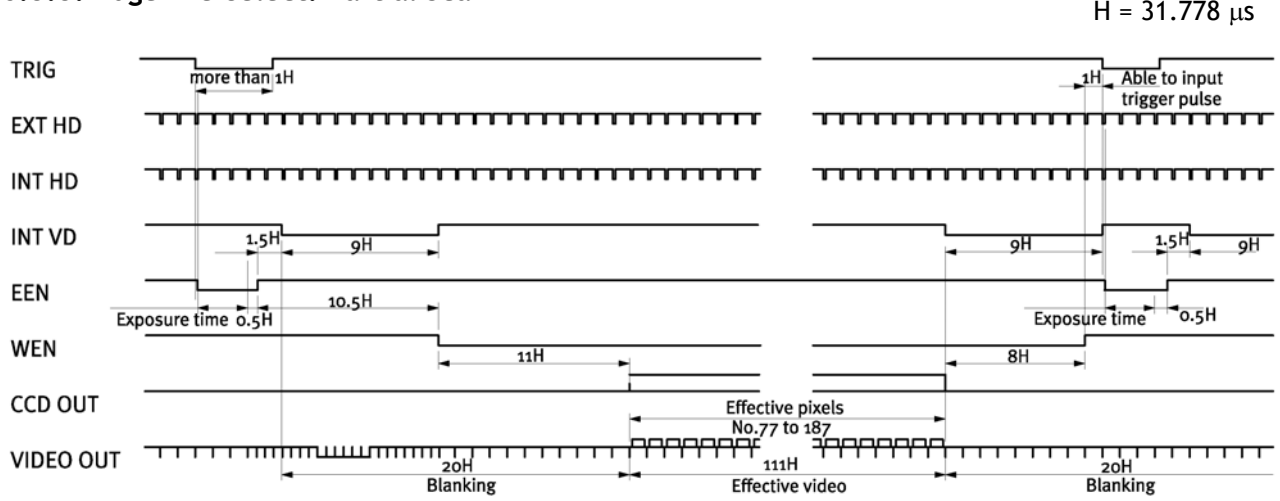


Fig. 13. Vertical timing for Edge pre-select 1/2 partial scanning

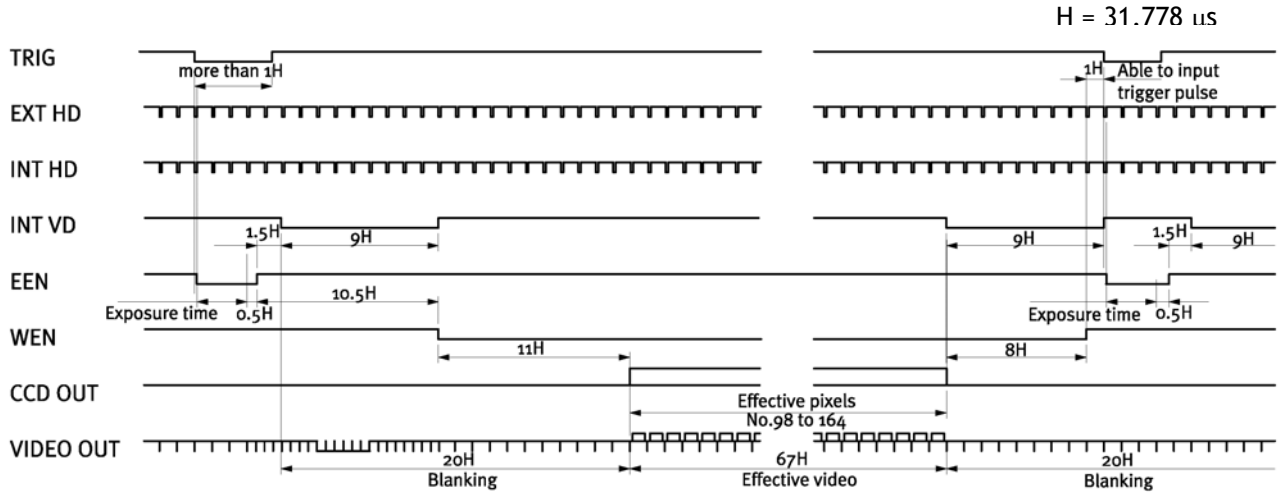


Fig. 14. Vertical timing for Edge pre-select 1/3 partial scanning

6.5.6. Pulse Width Control

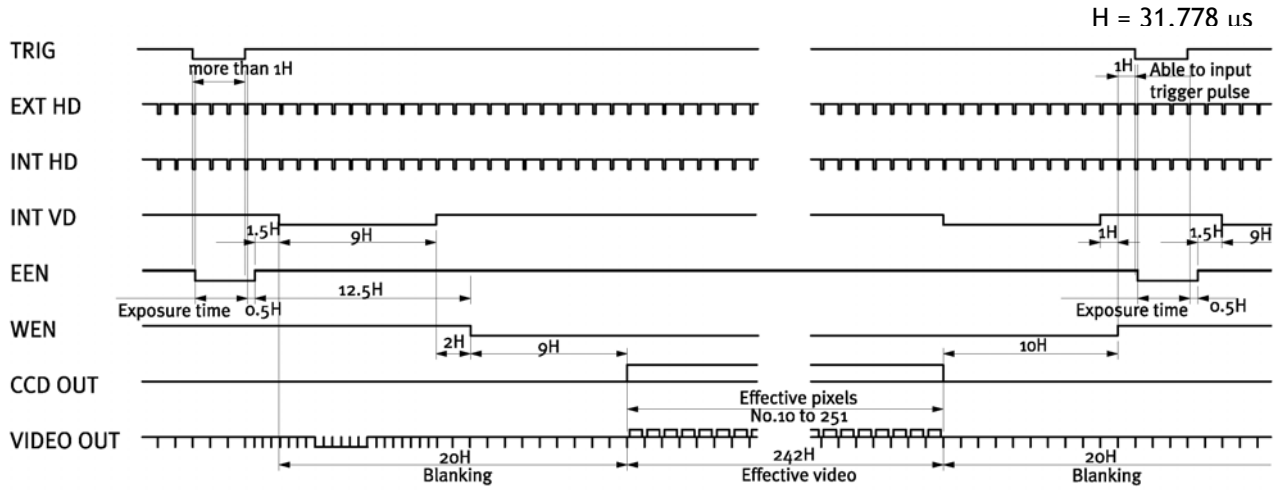


Fig. 15. Vertical timing for pulse width control

6.5.7. Pulse Width. Partial Scan

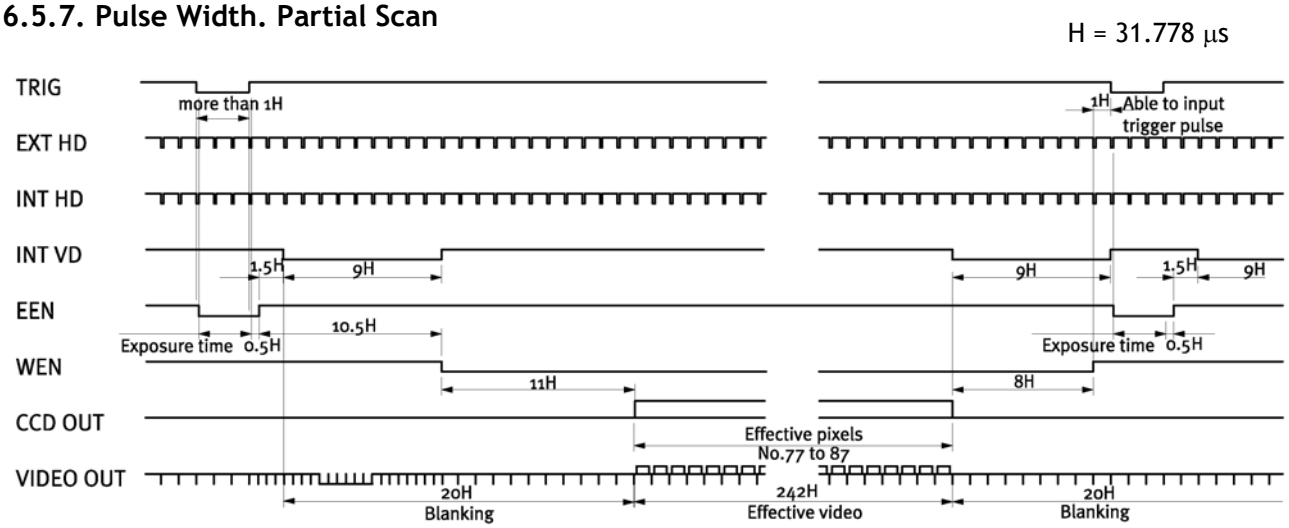


Fig. 16. Vertical timing for pulse width control 1/2 partial scanning

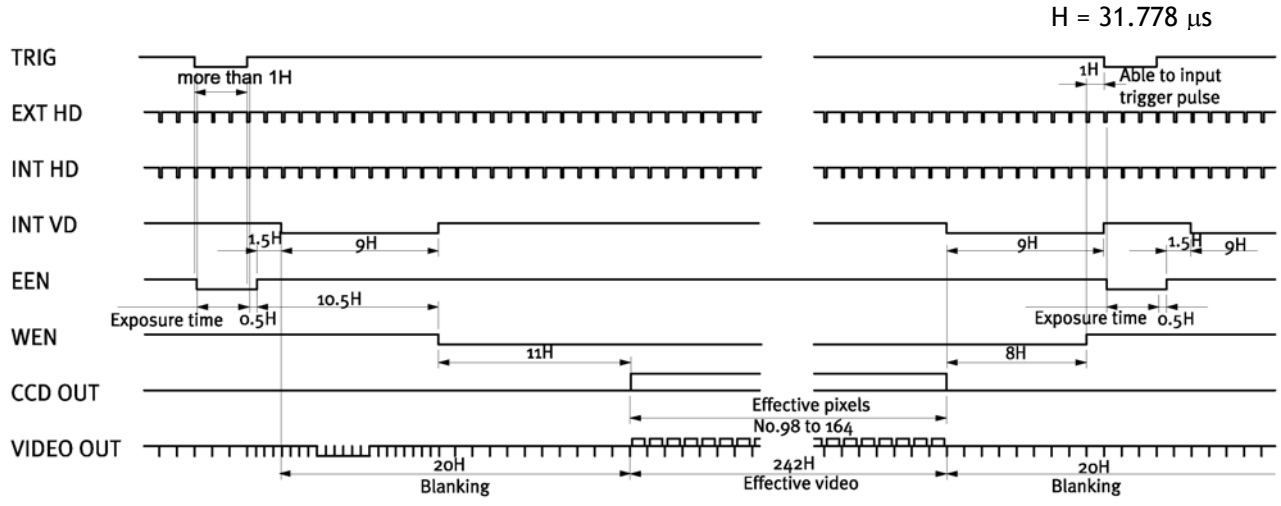


Fig. 17. Vertical timing for pulse width control 1/3 partial scanning

7. Mode Setting

7.1. Switch SW1 on Rear Panel

7.1.1. SW1 Lay-out

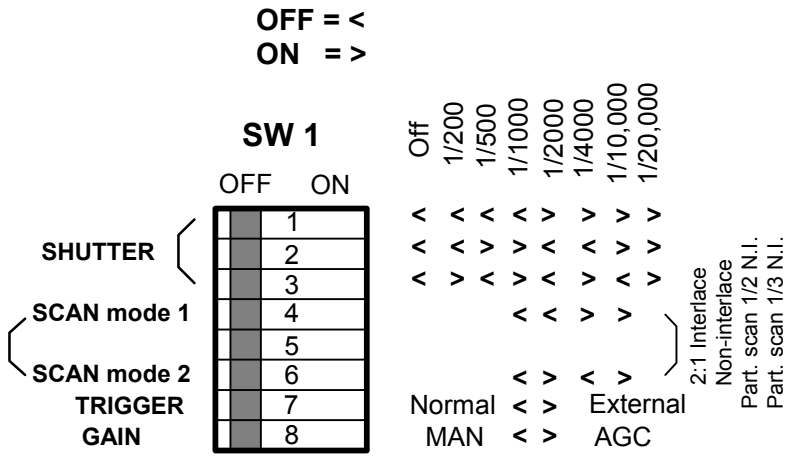


Fig. 18. Switch settings for switch on rear

7.1.2. Table for SW1 Setting

Switch no.	Switch function	Mode setting	
		OFF	ON
1	Shutter data MSB	For shutter speed select. Refer to shutter table 7.1.3.	
2	Shutter data		
3	Shutter data LSB		
4	Scan mode 1	Refer to mode table 7.1.4	
5	Read out	Double speed	Normal speed
6	Scan mode 2	Refer to mode table 7.1.4	
7	Trigger	Normal	External
8	Gain	Manual gain	AGC on

7.1.3. Table for Shutter Time

SW1-1, SW1-2 and SW1-3 is for shutter speed setting.
For 1/2 partial scan thel double speed range is 1/250 to 1/20,000. For 1/3 partial scan the range is from 1/500 to 1/20,000.

SW1-1 MSB	SW1-2	SW1-3 LSB	Shutter speed (sec.)	
			Double speed	
OFF	OFF	OFF	Off (1/120)	
OFF	OFF	ON	1/200	(1/250 with ext. trig.)
OFF	ON	OFF	1/500	
OFF	ON	ON	1/1000	
ON	OFF	OFF	1/2000	
ON	OFF	ON	1/4000	
ON	ON	OFF	1/10,000	
ON	ON	ON	1/20,000	

7.1.4. Scan Mode Settings

With SW1-4 and SW1-6 the scanning mode can be selected. The table shows the modes.

SW1-4	SW1-6	Function Mode	Remarks
OFF	OFF	2:1 Interlaced mode	In Normal trigger mode only. (Continuous).
ON	OFF	1/2 partial scan	Non-interlaced only
OFF	ON	Non-interlaced mode	
ON	ON	1/3 partial scan	Non-interlaced only

For detail, please refer to "6.2. Continuous Operation." and "6.4.2. Partial Scanning Mode."

7.1.5. Double Speed Mode

Vertical frequency 119.88Hz, and horizontal 31.468kHz.
For detail, please refer to "6.4.1. Double Speed Mode."

7.1.6. Trigger Mode

With SW1-7 the trigger mode can be changed between normal and external.
Off: for normal mode, which is internal trigger. In this mode the camera run continuously. It can be interlaced or non-interlaced. (For partial scan only non-interlaced with shutter off.)
On: for external trigger mode, which can be edge pre-select or pulse width control. It is non-interlaced and partial scan with shutter speed select.
For detail, please refer to "6.2. Continuous Operation." and "6.3. External Trigger Modes."

7.1.7. Gain Setting Switch

SW1-8 is for the gain select.
Off: is manual gain, which can be adjusted by the potentiometer on the rear panel.
On: is AGC mode. The AGC video level can be adjusted by an internal potentiometer VR1 on PK8210B board.
Please refer to "8. Internal Adjustments of Video Signal."

7.2. Internal Switch and Jumper Settings

Inside the camera there are switches for 75 termination of external trigger/VD and HD and for trigger mode select. There are also jumpers for gamma select.

7.2.1. Trigger/VD and HD Termination

On the PK8212 board switch SW1 for 75 Ohm termination of external trigger/VD and HD is found.
SW1-1 is for external HD termination.
SW1-2 is for external trigger or external VD termination.
ON is 75 Ohm termination. It is factory setting.
OFF is for TTL level.

7.2.2. Trigger Mode Select

On the PK8212 board switch SW2-1 for external trigger mode select is found.
SW2-1 OFF for edged pre-select. Factory setting.
SW2.1 ON for pulse width control.

7.2.3. Gamma Select

On the PK8210 board there are 2 jumpers for gamma select. The jumper is mounted as a 1KΩ resistor.

Gamma	JP31	JP36	Remarks
1.0	1KΩ	NC	Factory setting
0.45	NC	1KΩ	

7.2.4. Internal Switch Positions

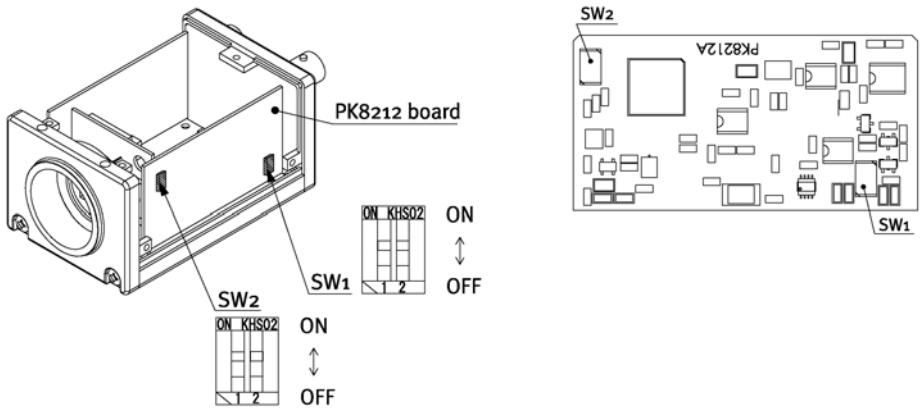


Fig. 19. Internal switch positions

7.2.5. Internal Jumper Positions

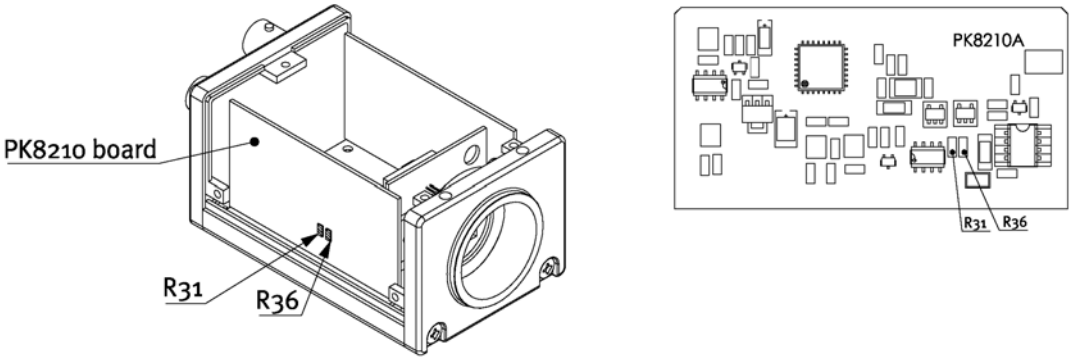


Fig. 20. Internal jumper positions

8. Internal Adjustments of Video Signal

For adjustment of the video output signal there are internal potentiometers on th PK 7987A board.
Adjustment should only be done in a setup with a standard test chart and controlled illumination
Do not touch these potentiometers unless you are familiar with camera adjustments.

VR 1 is for AGC level setting. Factory setting is 700 mVpp ±30 mV
VR2 is for black level set-up. Factory setting is 20 mVpp ±2 mV
VR3 is for white clip level. Factory setting is 800 mVpp ±30 mV
VR4 *is for factory adjustment only. Do not touch!*

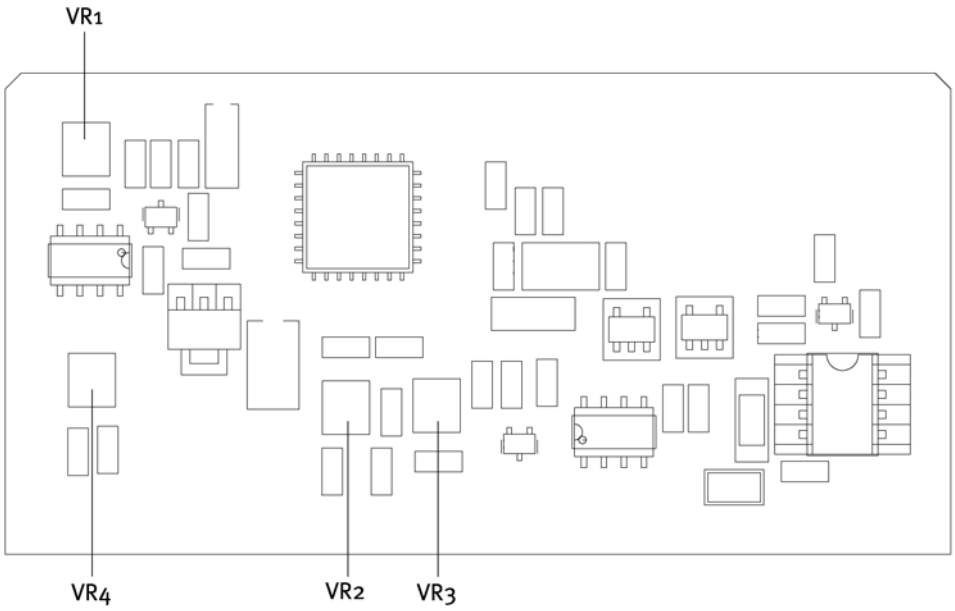


Fig. 21. Internal adjustments positions

9. External Appearance and Dimensions

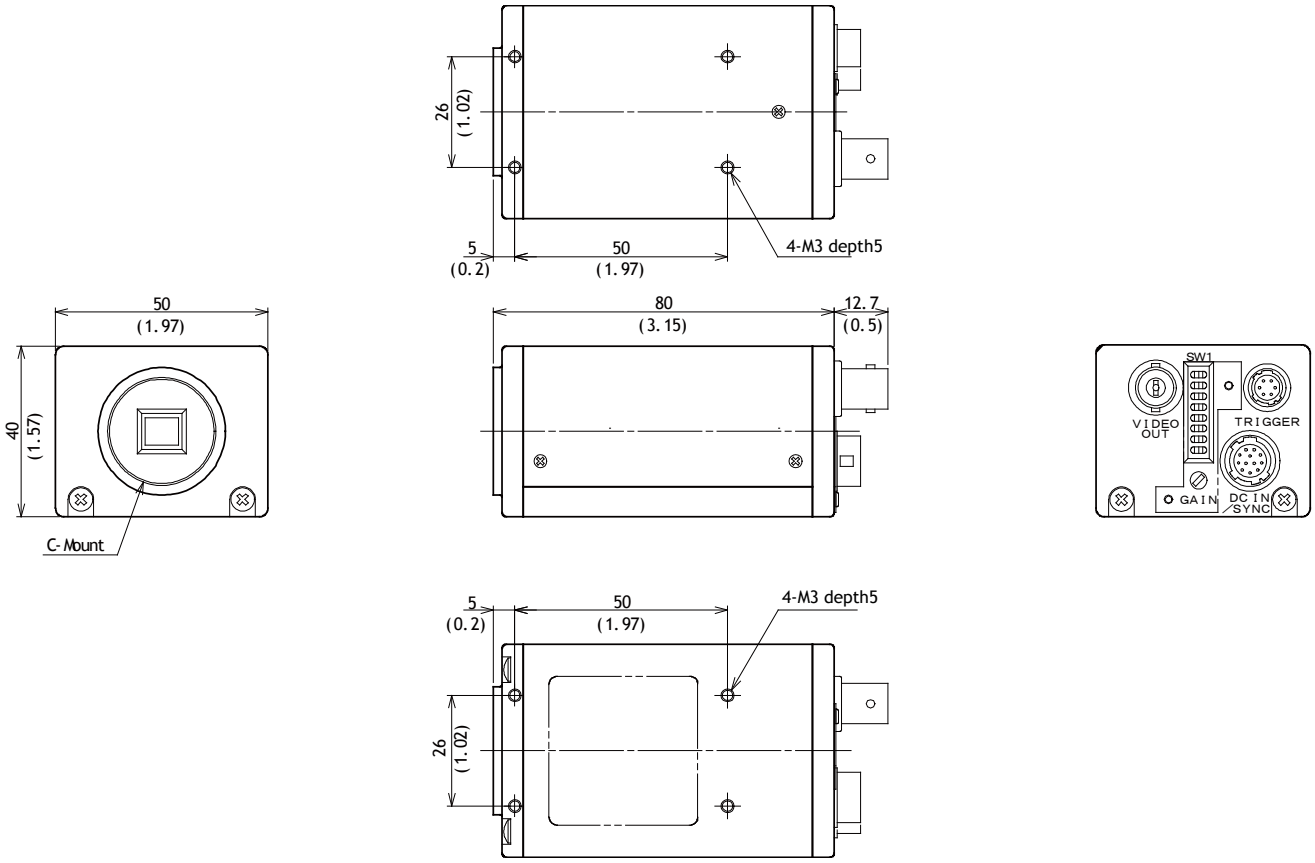


Fig. 22. Outline

10. Specifications

10.1. Specification table

Model	CV-M30
CCD Sensor	1/2"Monochrome IT CCD. Sony ICX-418ALL-6
Image Area	6.45mm (H) x 4.84mm (V)
Effective Pixels	768(H) x 494(V)
Cell Size	8.4 μ m(H) x 9.8 μm(V)
Pixels in video output Double Speed 2:1 interlaced Non-interlaced 1/2 partial 1/3 partial	 756(h) x 485(v) 60 frames/sec 756(h) x 242(v) 120 field/sec 756(h) x 111(v) 240 fields/sec 756(h) x 67(v) 360 fields/sec
Vertical Frequency	Double speed 119.88Hz
Horizontal Frequency	Double speed 31.468kHz
Pixel Clock Frequency	Double speed 28.7MHz
Pixel clocks per line	912
Synchronization	Int. X-tal, Ext. VD/HD, random trigger
S/N Ratio	>58dB
Sensitivity on sensor	0.1 lx (Max Gain, 50% video)
Ext. trigger mode	Continuous, Edge Pre-select, Pulse Width Control
Trigger Input	In edge pre-select >1H In pulse width >1H to <1000H
Electronic Shutter Double Speed	 Off (1/120), 1/200, 1/500, 1/1000, 1/2000, 1/4000, 1/10,000, 1/20,000 sec
Resolution	Horizontal 500 TV lines, Vertical 350 TV lines
Gamma	1.0/0.45
Gain Gain Range	Manual/Auto -3 to + 12dB
Video Output	Composite 1.0 Vp-p, 75Ω
Lens Mount	C-mount
Environment	-5°C to +45°C 20% to 80% (Non-condensed)
Power	DC+12V ±10%
Consumption	3W
Dimensions	50x40x80 (WxHxD) mm
Weight	240g

***Note**: Above specifications are subject to change without notice.*

10.2. Spectral Sensitivity

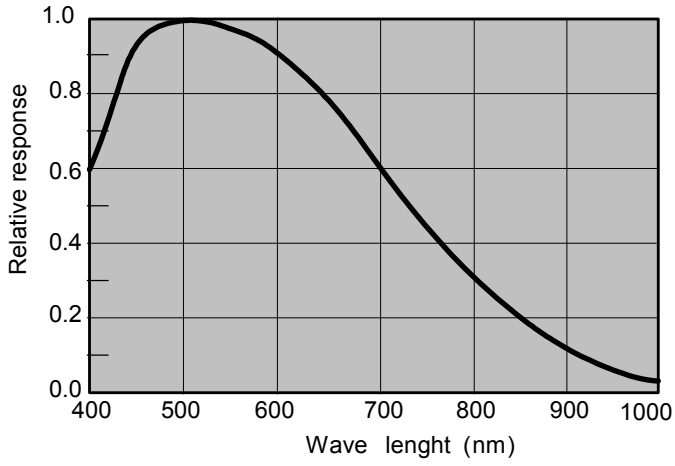


Fig. 23. Spectral sensitivity

11. Appendix

11.1. Precautions

Personnel not trained in dealing with similar electronic devices should not service this camera.

The camera contains components sensitive to electrostatic discharge. The handling of these devices should follow the requirements of electrostatic sensitive components.

Do not attempt to disassemble this camera.

Do not expose this camera to rain or moisture.

Do not face this camera towards the sun, extreme bright light or light reflecting objects.
When this camera is not in use, put the supplied lens cap on the lens mount.

Handle this camera with the maximum care.
Operate this camera only from the type of power source indicated on the camera.

Disconnect the power to the camera before modifications, such as changes of jumper and switch settings.

11.2. Typical CCD Characteristics

The following effects may be observed on the video monitor screen. They do not indicate any fault of the CCD camera, but do associate with typical CCD characteristics.

V. Smear

Due to an excessive bright object such as electric lighting, sun or strong reflection, vertical smear may be visible on the video monitor screen. This phenomenon is related to the characteristics of the Interline Transfer System employed in the CCD.

V. Aliasing

When the CCD camera captures stripes, straight lines or similar sharp patterns, jagged image on the monitor may appear.

Blemishes

Some pixel defects can occur, but this does not have en effect on the practical operation.

Patterned Noise

When the CCD camera captures a dark object at high temperature or is used for long time integration, fixed pattern noise (shown as white dots) may appear on the video monitor screen.

12. Users Record

Camera type: **CV-M30**

Revision: **(Revision D)**

Serial No. ……..

For camera revision history, please contact your local JAI distributor.

Users Mode Settings.

Users Modifications.

CE

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JAI A-S, Denmark
Phone +45 4457 8888
Fax +45 4491 8880
www.jai.com

JAI UK Ltd, England
Phone +44 0 1895 821 481
Fax +44 0 1895 824 466
www.jai.com

JAI Corporation, Japan
Phone +81 45 933 5400
Fax +81 45 931 6142
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