



*See the possibilities*

# *User's Manual*

## ***CV-A55 IR***

*1/2" Interlaced scan  
Near Infrared Camera*

Document Version: 1.0

Camera Revision: A

## Notice

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## Warranty

For information about the warranty, please contact your factory representative.

## Certifications

### CE compliance

As defined by the Directive 2004/108/EC of the European Parliament and of the Council, EMC (Electromagnetic compatibility), JAI Ltd., Japan declares that CV-A55 IR complies with the following provisions applying to its standards.

EN 61000-6-3 (Generic emission standard part 1 )

EN 61000-6-2 (Generic immunity standard part 1)

### FCC

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates , uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into a outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### Warning

Changes or modifications to this unit not expressly approved by the party responsible for FCC compliance could void the user's authority to operate the equipment.

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## 1. General

The CV-A55 IR is a 1/2 inch monochrome interlace scan CCD camera with EIA (RS-170) standard video output or with CCIR video standard output. The CV-A55 IR uses a CCD with 768(H) x 494(V) effective pixels for EIA version and 752(H) x 582(V) effective pixels for CCIR version. Both CCDs have an extended spectrum response in the Near Infrared (NIR) area.

The CV-A55 IR uses both external and internal DIP switches to configure the camera in various operating modes. Both cameras have three trigger modes, pre-select, pulse width and frame delay, and can be operated using internal or external synchronization. Both cameras also offer flange back adjustment.

These cameras are suitable for a wide range of applications within factory automation.

The latest version of this manual can be downloaded from: [www.jai.com](http://www.jai.com)

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

## 2. Camera Composition

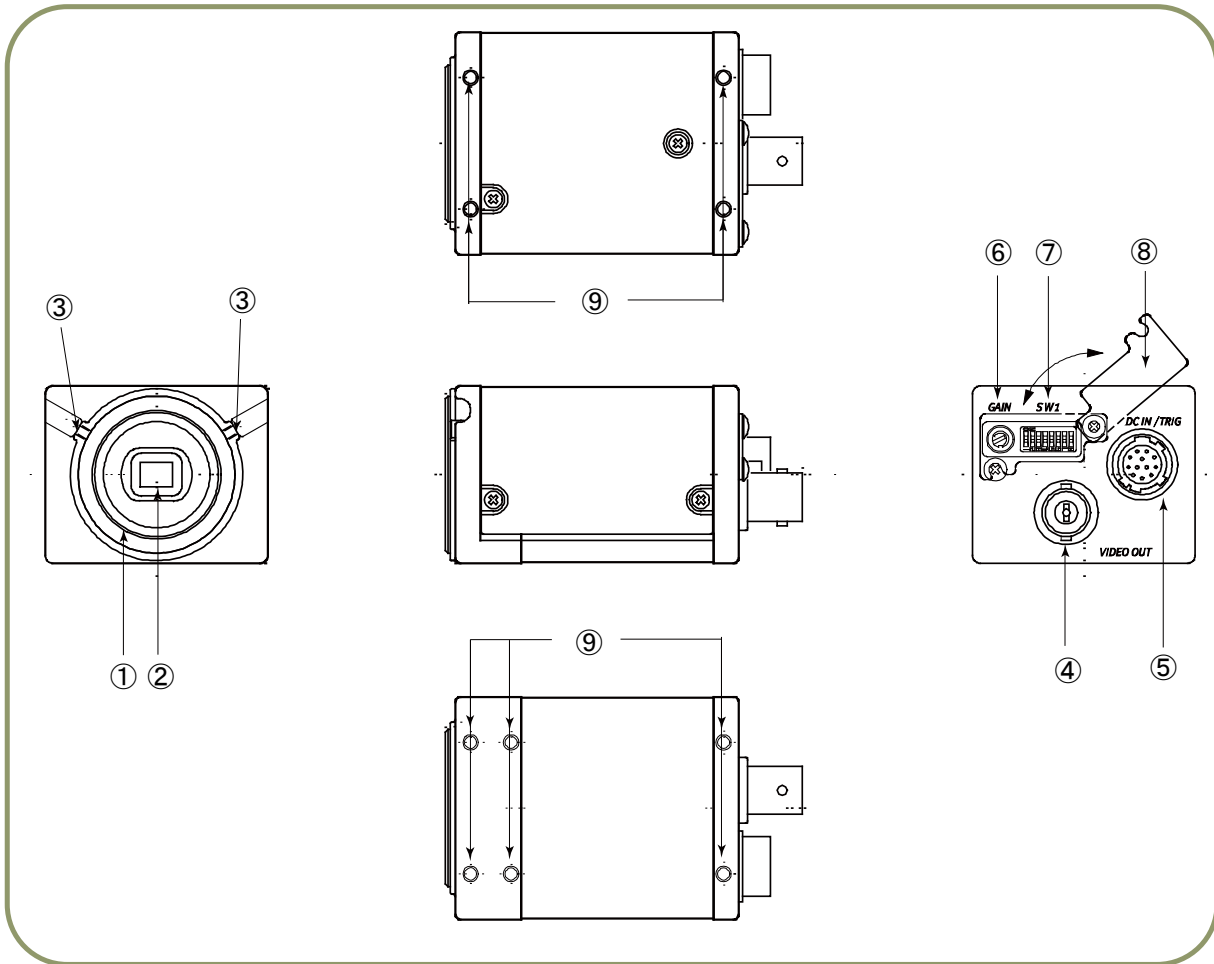
The standard camera composition consists of:

CV-A55 IR E Camera body(EIA version)	x 1
Or	
CV-A55 IR C Camera body(CCIR version)	x 1
C-mount protection cap	x 1
Options	
AC power adaptor	PD-12U series
Tripod plate	MP-40

## 3. Main Features

- 1/2 inch Interlaced CCD for EIA or CCIR video standard
- 768 (h) x 494 (v) for EIA and 752 (h) x 582 (v) for CCIR
- Extended spectrum response in Near Infrared (NIR)area
- High S/N ratio >56 dB
- 570 TV lines resolution
- Gain control range from - 3dB to +24 dB
- Shutter speeds from 1/100 to 1/10,000 second in 7 steps in continuous mode
- 1.0 or 0.45 gamma can be selected
- Internal or external synchronization using HD/VD
- Edge pre-select, pulse width control and frame delay trigger modes
- Field accumulation or frame accumulation can be selected
- Integration mode for long time exposure
- C-mount with adjustable back focus

4. Locations and Functions



- ① Lens mount
- ② CCD sensor
- ③ Flange back adjust pin
- ④ BNC connector
- ⑤ 12P connector
- ⑥ Gain control potentiometer
- ⑦ DIP switch
- ⑧ Protection cover
- ⑨ Camera mounting holes

- C-mount (Note \*1)
- 1/2 inch CCD sensor
- Fix these two screws after adjusting Flange back
- Video output
- DC+12V, trigger and pulses input
- Control video gain
- Configure the camera operation
- Protect DIP switch and Gain potentiometer
- 10 x M3 4mm depth holes for mounting tripod plate (Note\*2)

\*1) Note: Rear protrusion on C-mount lens must be less than 10.0mm.

\*2) Note: The tripod plate is MP40 (option).

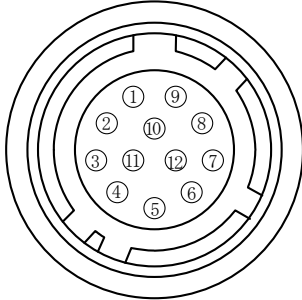
Fig. 1. Locations.

## 5. Pin Assignment

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

Type: HR10A-10R-12PB-01 (Hirose) male

Plugs for cable: HR10A-10P-12S



Seen from the rear

Fig. 2. 12-pin connector.

Pin no.	I/O	Signal	Remarks
1		GND	
2	I	+12 V DC input	
3		GND	
4	O	Video output	Note 1)
5		GND / NC	Note 2 )
6	I / O	VINIT / HD IN / SYNC OUT	Note 2 )
7	I / O	VD IN/ CLK OUT / VD OUT	Note 2 )
8		GND	
9	I / O	HD IN / VNIT / HD OUT	Note 2 )
10		NC	
11	I	NC / Integration	Note 2 )
12		GND / NC	Note 2 )

Note 1: This video output is parallel with BNC output

Note 2 : The selection of signals is done by internal switches. Refer to Chapter 7

The following table shows the factory default settings.

Pin no.	I/O	Signal
5		GND
6	I	VINIT
7	I	VD IN
9	I	HD IN
11	I	NC
12		GND

## 5.2. Input and Output Circuits

The following sections show the principles for the input and output circuits for video and timing.

### 5.2.1. Video output

The video output on the BNC connector is a  $75 \Omega$  DC coupled circuit. The video black DC level is 0.0 volt. Pin #4 on the 12-pin connector is in parallel with the BNC connector. Avoid double termination.

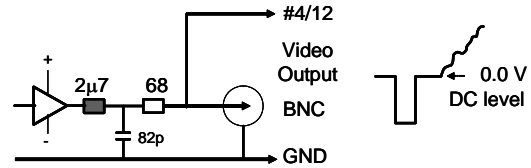


Fig. 3. Video output.

### 5.2.2. VINT, Integration input .

Trigger input level and Integration level are TTL, negative polarity. The trigger-input can be terminated by SW505.

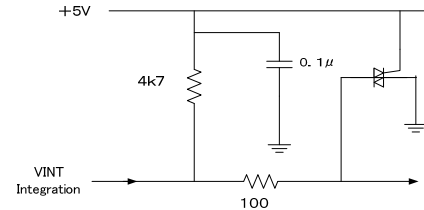


Fig. 4. Trigger input.

### 5.2.3. HD and VD input

The input circuit for external HD and VD signals are shown. It can be  $75 \Omega$  terminated by SW504. HD and VD input level is  $4 V \pm 2 V$ .

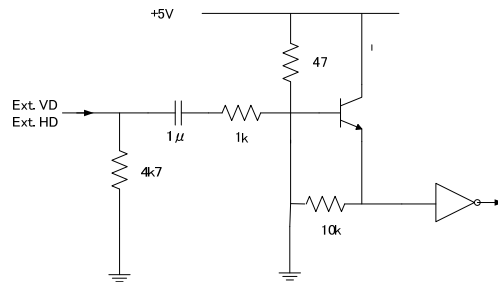


Fig. 5. HD and VD input.

### 5.2.4. HD, VD, PCLK, SYNC output

Output circuit for these signals are emitter followers. It will deliver a full TTL signal. Output level is 4 V and for PCLK, it is 3V.

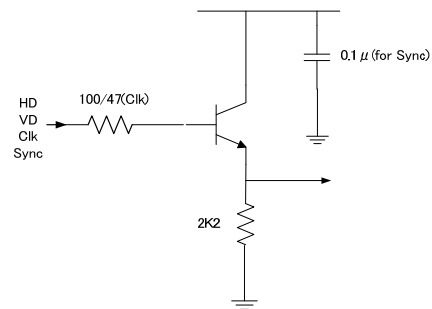


Fig. 6. HD, VD, PCLK, and SYNC output.



## 6. Functions and Operations

### 6.1. Basic functions

The CV-A55 IR camera is an interlaced scan camera. The video output is an analogue output complying with the EIA standard for CV-A55 IR E and CCIR standard for CV-A55 IR C.

The CV-A55 IR can be configured using external and internal DIP switches for various operating modes. For the details, refer to Chapter 7.

CV-A55 IR employs a preset shutter.

The steps for the shutter are:

CV-A55 IR E OFF(1/60), 1/100, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/10000

CV-A55 IR C OFF(1/50), 1/100, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/10000

Both cameras have field and frame accumulation.

Operation modes are:

1. Continuous mode
2. Edge pre-select trigger mode (EPS)
3. Pulse width control trigger mode (PWC)
4. Frame delay readout mode (FDR)
5. Integration mode

The details are described in the following chapters.

### 6.2. CCD accumulation

#### 6.2.1. Field accumulation

This is the default setting of the CV-A55 IR.

It scans two horizontal rows together and charges the pair at each interline scanning. This mode has an advantage when the shutter is often used, as the sensitivity of the CCD is doubled for one field of integration (for shutter, integration can not exceed one field) therefore, it can obtain the same sensitivity as the frame accumulation mode for half of the period.

Because the scanning alternates between two rows, Moiré is almost unnoticeable and even though the vertical resolution is not as good as in frame accumulation mode, it is sufficient to see the full vertical resolution of the TV format. Field mode cannot provide full frame resolution with a strobe lighting application.

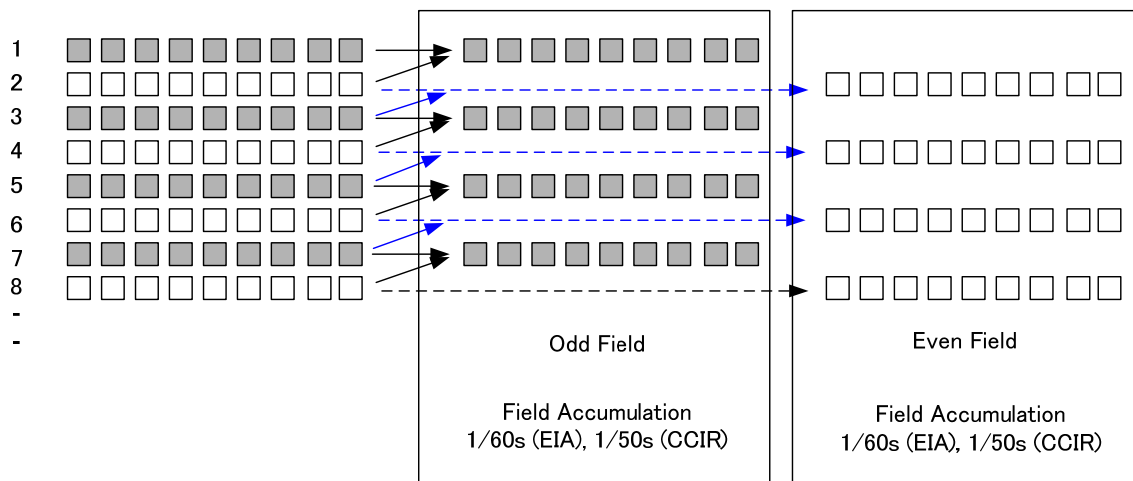


Fig.7. Field accumulation principle

6.2.2. Frame accumulation

Frame accumulation scans each horizontal row as in interlace scanning. During frame accumulation mode, integration of each pixel is one frame rate (1/30s=33ms for EIA, 1/25s=40ms for CCIR). Vertical pixel resolution is good and exact location is obtained. For strobe lighting, it is recommended to use frame accumulation in order to achieve full frame resolution.

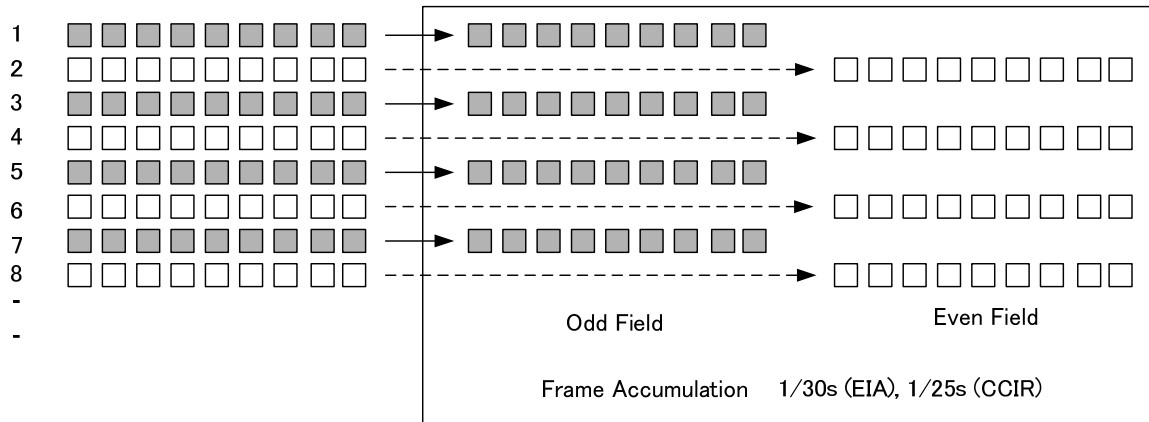


Fig.8. Frame accumulation principle

6.3. CCD sensor layout and full Image format

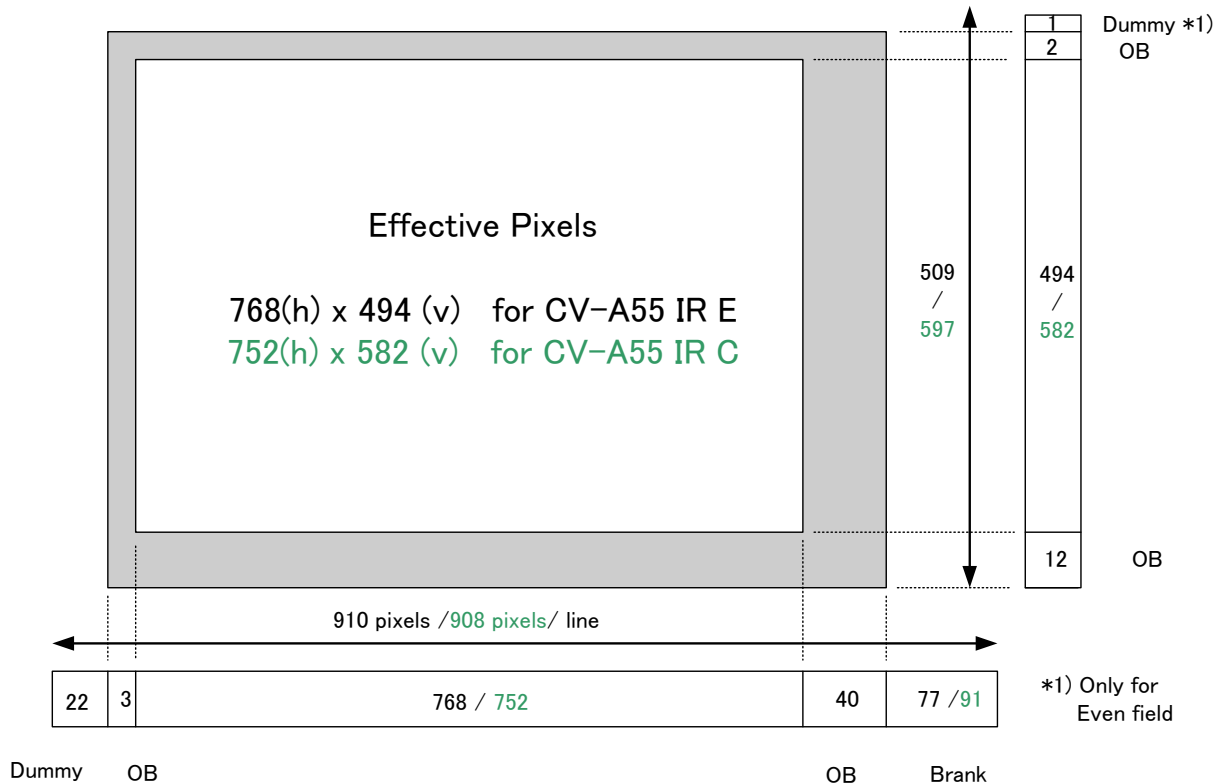


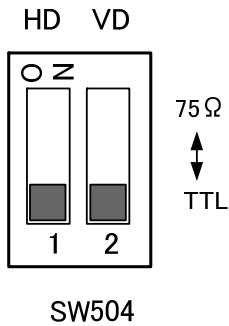
Fig. 9. CCD sensor layout

### 6.4. Input-output of HD/VD Signals

In the default setting the camera will accept external HD/VD signals on pin 7 and 9 of the 12 pin Hirose connector. If external HD/VD is applied, the camera will auto detect and synchronize to it. If no external sync signals are applied, the camera will operate with its internal x-tal controlled sync. The input is TTL level as factory setting. It can be 75 Ohm terminated by the internal switch SW504.

To output the internal HD/VD signals on pin 7 and 9 the internal switch SW501 and SW502 should be set ON. The output is TTL level from a 75-Ohm source.

7 pin	VD IN /CLK OUT /VD OUT	SW501	VD IN 	CLK OUT 	VD OUT 
9 pin	HD IN /VINT /HD OUT	SW502	HD IN 	VINT 	HD OUT 



**Important notes on using this mode**

- External sync system should follow the camera scanning.
- External HD and VD relationship should be followed as described below.

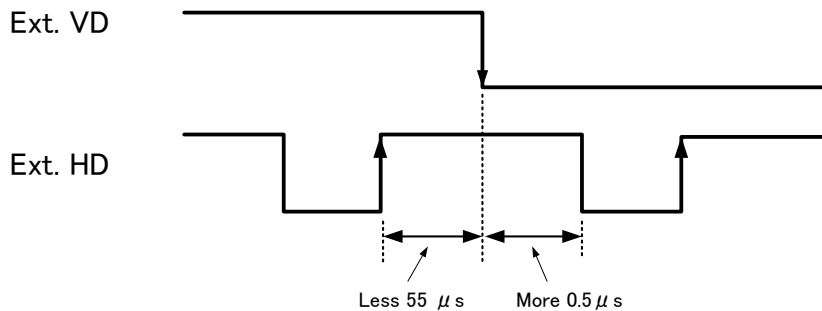


Fig. 10. Ext. HD and ext. VD phase conditions.

### 6.4. Continuous Operation (Non triggered)

The camera runs continuously at 1/60s (CV-A55 IR E) or 1/50s (CV-A55 IR C) to output continuous images. The CCD accumulation is available in either Field or Frame accumulation mode. This is suitable for any application which does not require a trigger for image capture. The shutter will work in all 8 steps up to 1/10,000 second.

#### Important notes on using this mode

- External sync system should follow the camera scanning system.

#### 6.4.1. Timing chart for EIA

##### 6.4.1a Horizontal timing

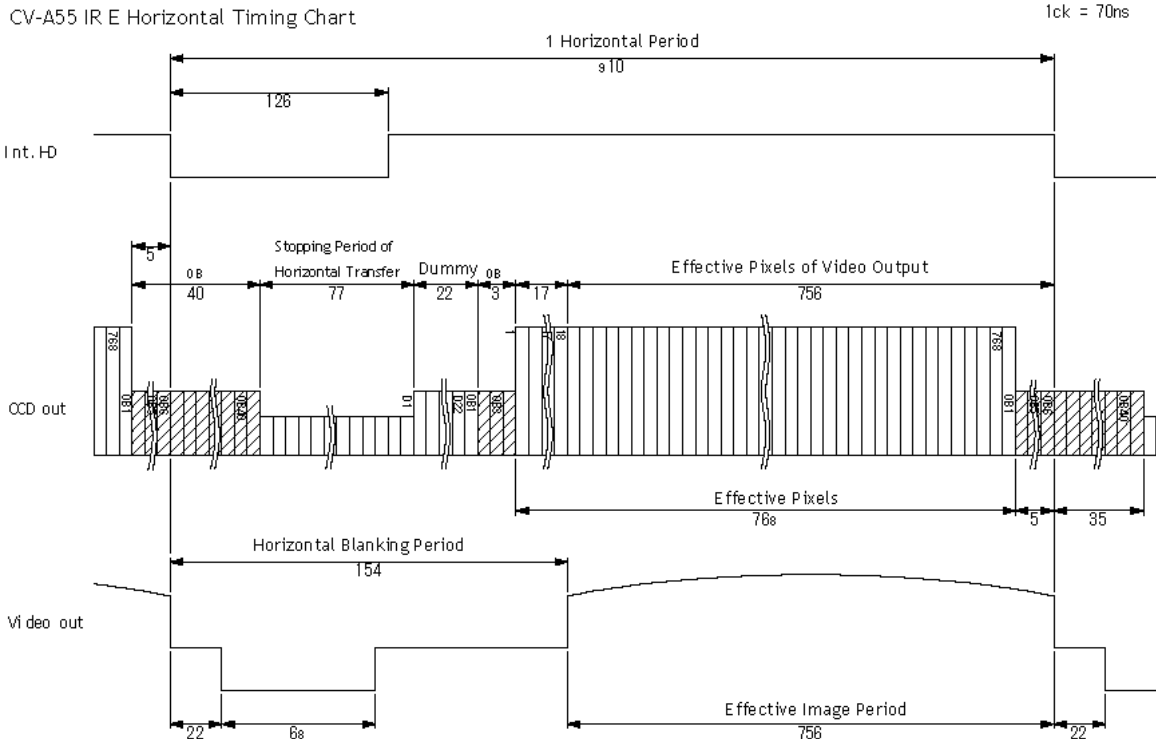


Fig. 11. Horizontal timing for EIA

6.4.1b Vertical Timing

CV-A55 IR EIA 2:1 Interlace Vertical Timing Chart

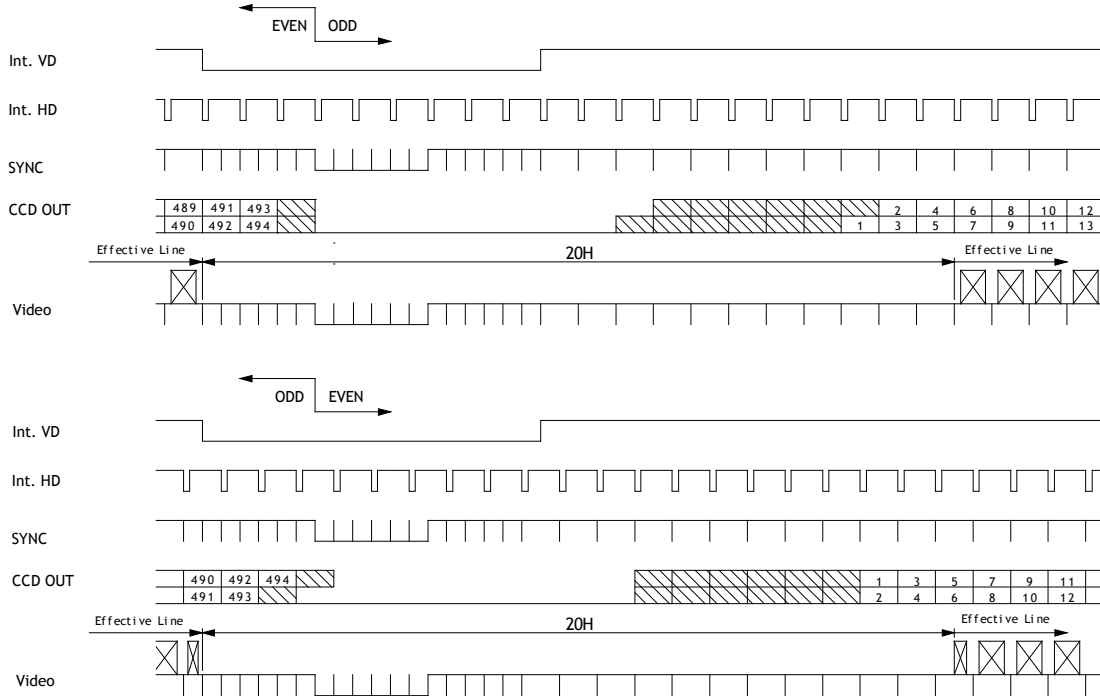


Fig. 12 Vertical timing for EIA

6.4.2. Timing chart for CCIR

6.4.2a Horizontal Timing

CV-A55 IR Horizontal Timing Chart

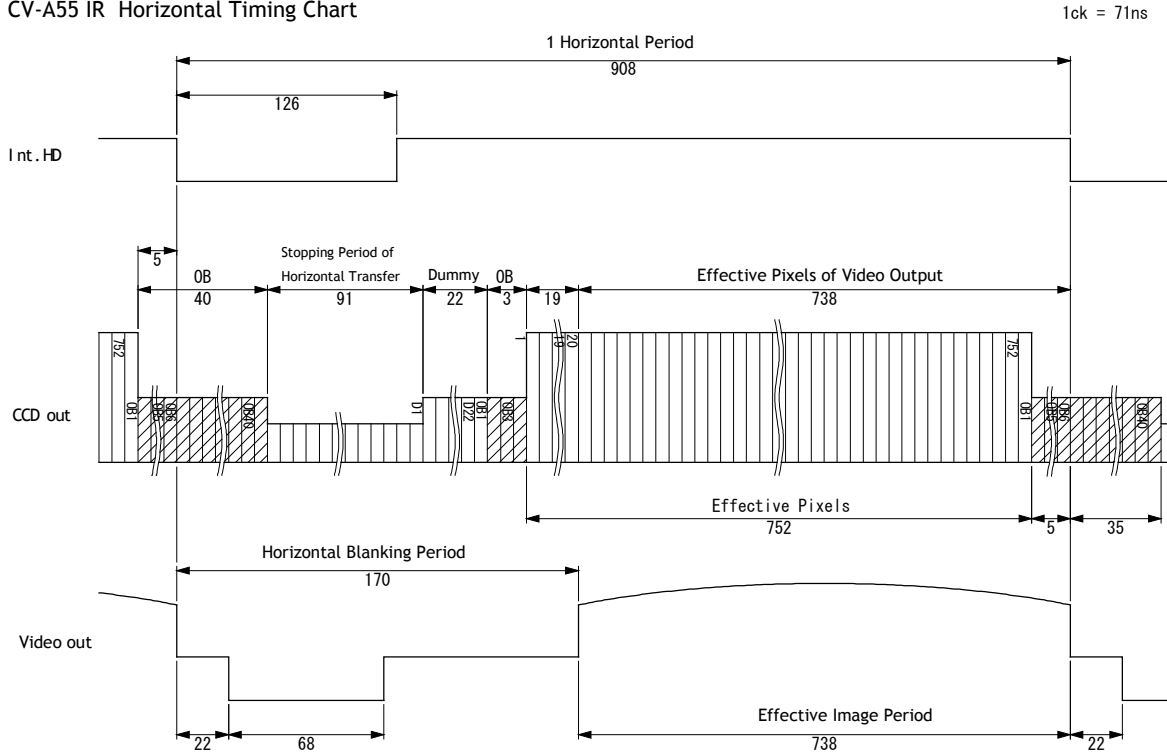


Fig. 13. Horizontal timing for CCIR

### 6.4.2b Vertical Timing

CV-A55 IR CCIR 2:1 Interlace Vertical Timing Chart

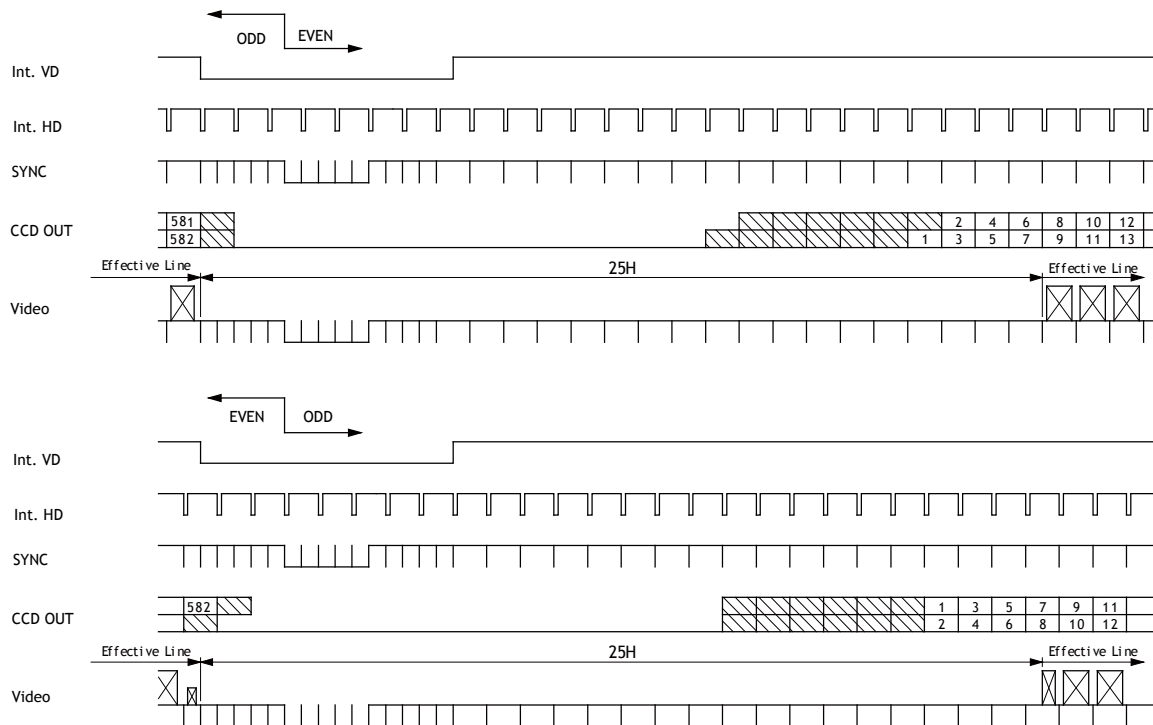


Fig. 14. Vertical timing for CCIR

### 6.5. External Trigger Modes

This camera has 4 external asynchronous trigger modes, which can be set by rear-panel switches.

- |                                     |   |
|-------------------------------------|---|
| 1. <i>Edge pre-select mode</i>      | Pre-selected exposure                     |
| 2. <i>Pulse width control mode</i>  | Pulse width controlled exposure.          |
| 3. <i>Frame delay read out mode</i> | PWC exposure read out by ext. VD.         |
| 4. <i>Integration mode</i>          | Integration time is set by 1 VD increment |

The accumulation is HD synchronous accumulation. The accumulation starts at the first HD after the trigger leading edge. To avoid the <1H jitter caused by this delay, synchronize the external trigger falling and rising edge to HD as shown in fig. 15 below. The trigger level translations should be placed inside a 2 x 4.4 μseconds region as shown.

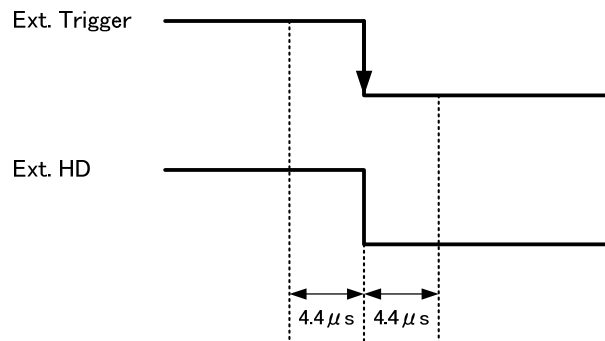


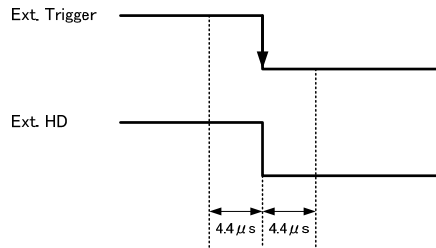
Fig.15. Ext. trigger and Ext. HD relation

### 6.5.1. Edge Pre-select Mode

The exposure starts at the first HD pulse after the trigger leading edge. It stops and is read out after the duration of the shutter time selected. It can be set to one of 8 steps. An EEN pulse will indicate the active accumulation time, and a WEN pulse indicates that the resulting video is being read out.

**Important notes on using this mode.**

- This trigger mode is available only for field accumulation mode.
- The start of exposure will start synchronized to the internal H signal. The start may be shifted max 1H. To avoid this shift (1 H jitter), synchronize the camera to an external HD and make sure that the trigger pulse aligns to the HD as shown below.



- The duration of the trigger should be  $\geq 1H$ .
- A new trigger must not be applied before WEN is high.

#### 6.5.1a. EIA

EIA : 1H = 63.5  $\mu$ s

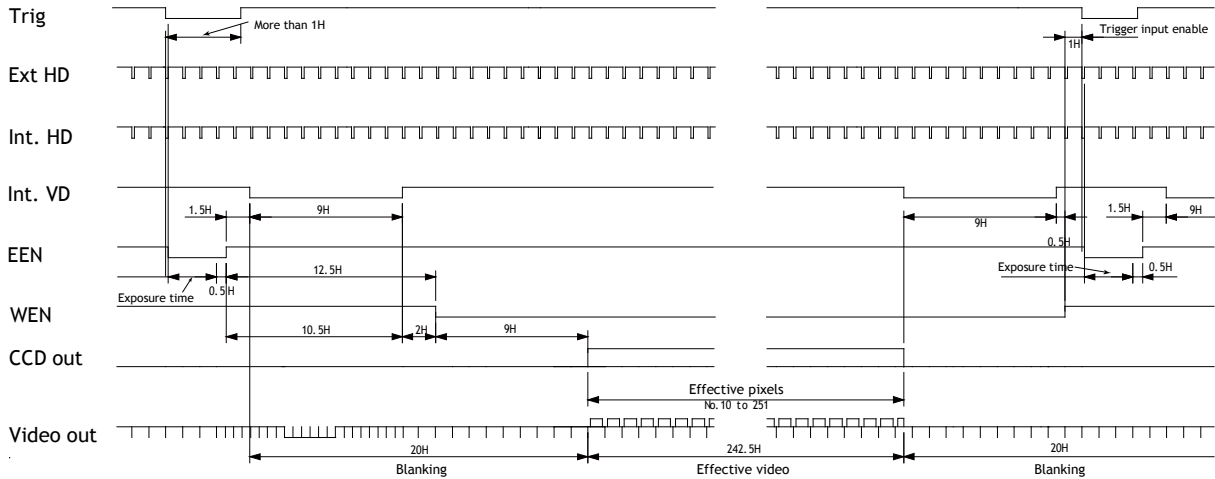


Fig.16. Timing for Edge Pre-select (EIA)

6.5.1b. CCIR

CCIR : 1H = 64μ s

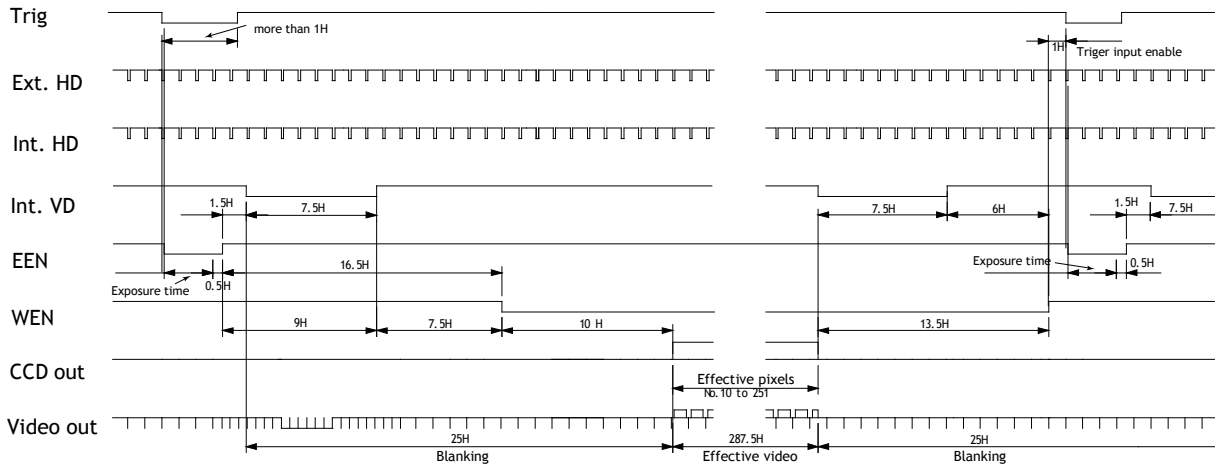


Fig. 17. Timing for Edge Pre-select (CCIR)

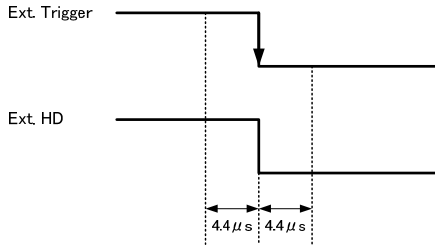


6.5.2. Pulse Width Control Mode

The leading edge of the trigger pulse initiates the exposure. The exposure time (accumulation time) is governed by the duration of the trigger pulse.  
The exposure time range is 1.5H to 2seconds.

**Important notes on using this mode.**

- This mode works only for field accumulation.
- The start of exposure will start synchronized to the internal H signal. The start may be shifted max 1H. To avoid this shift (1 H jitter), synchronize the camera to an external HD and make sure that the trigger pulse aligns to the HD as shown below.



- The duration of the trigger can be  $\geq 1.5H$  to  $\leq 2$ seconds.
- A new trigger must not be applied before WEN is high.
- *In trigger modes there is no continuous VD out, only after each trigger input.*

6.5.2a. EIA

EIA: 1H = 63.5μ s

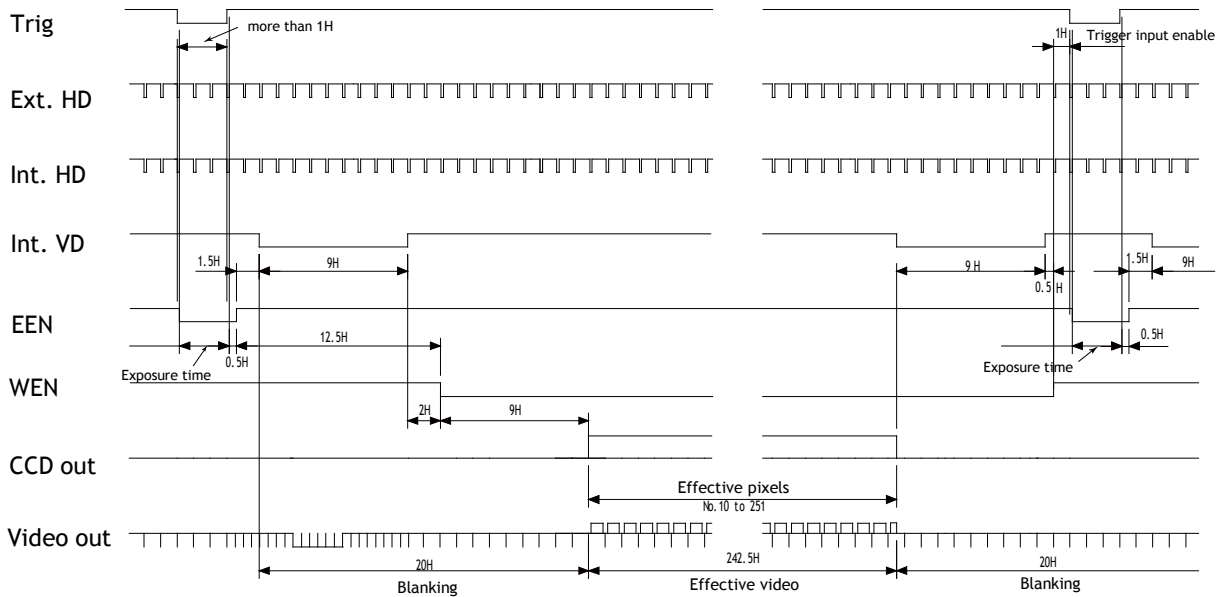


Fig. 18. Pulse Width Control trigger mode (EIA)

6.5.2b. CCIR

CCIR : 1H = 64μ s

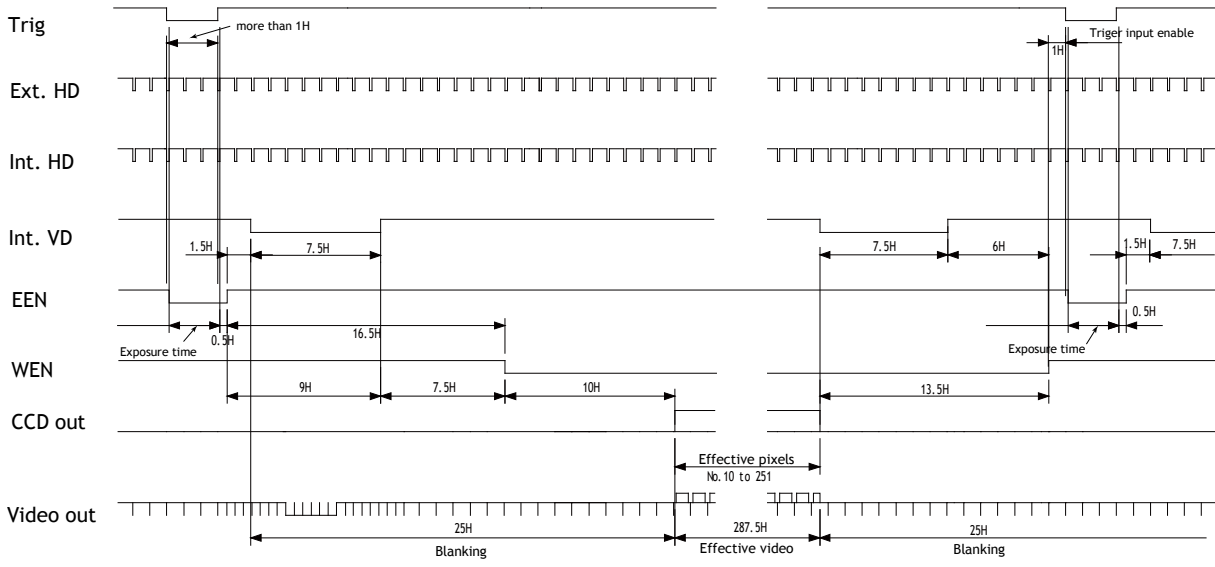


Fig. 19. Pulse Width Control trigger mode (CCIR)

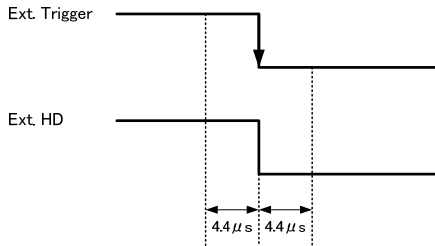
6.5.3. Frame-Delay read out Mode

In this mode the exposure starts from the leading edge of the trigger pulse. It stops at the trailing edge of the trigger pulse (in the same way as PWC mode.) The accumulation can be H synchronous. The accumulation starts at the first HD pulse after the leading edge of the trigger and it stops after the first HD after the trailing edge of the trigger. It can result in  $<1H$  jitter if the trigger is not synchronized to H.

The resulting video is read out after an external VD pulse is applied.

**Important notes on using this mode.**

- This mode works only for field accumulation mode.
- The exposure will start synchronized to the internal H signal, the start of exposure may be shifted max  $1H$ . To avoid this shift (jitter), synchronize the camera to an external HD and make sure that the trigger pulse aligns to the HD as the following.



- The duration of the exposure can be  $>1.5H$  to  $< 2$  seconds.
- A new trigger must not be applied before WEN is high.
- The duration of the external VD is  $\geq 2H$  to  $< 1$  field.

6.5.3a. EIA

EIA:  $1H = 63.5\mu s$

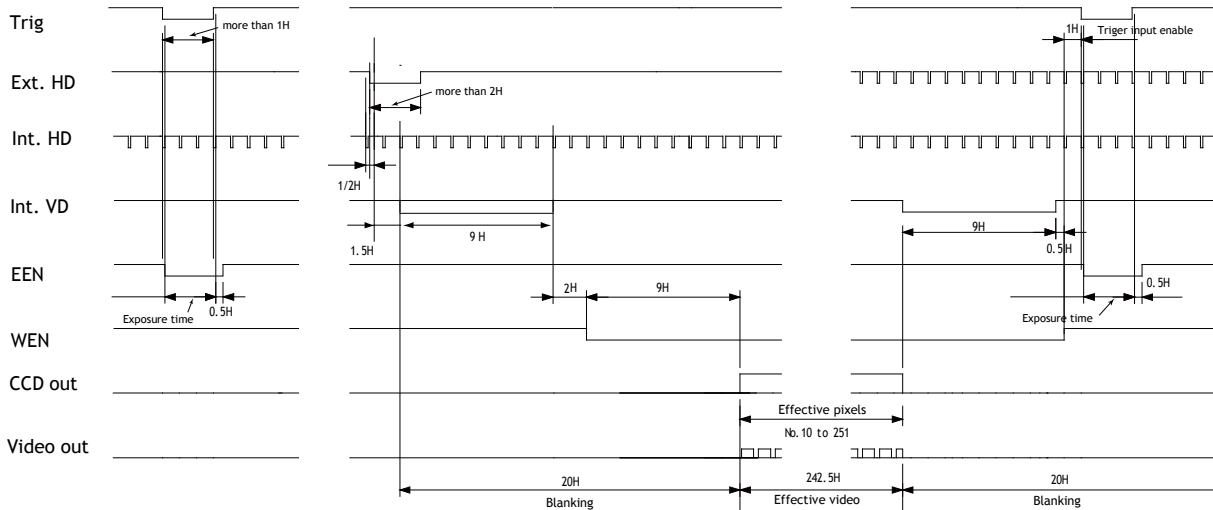


Fig. 20. Frame Delay read out mode (EIA)

6.5.3b. CCIR

CCIR : 1H=64μS

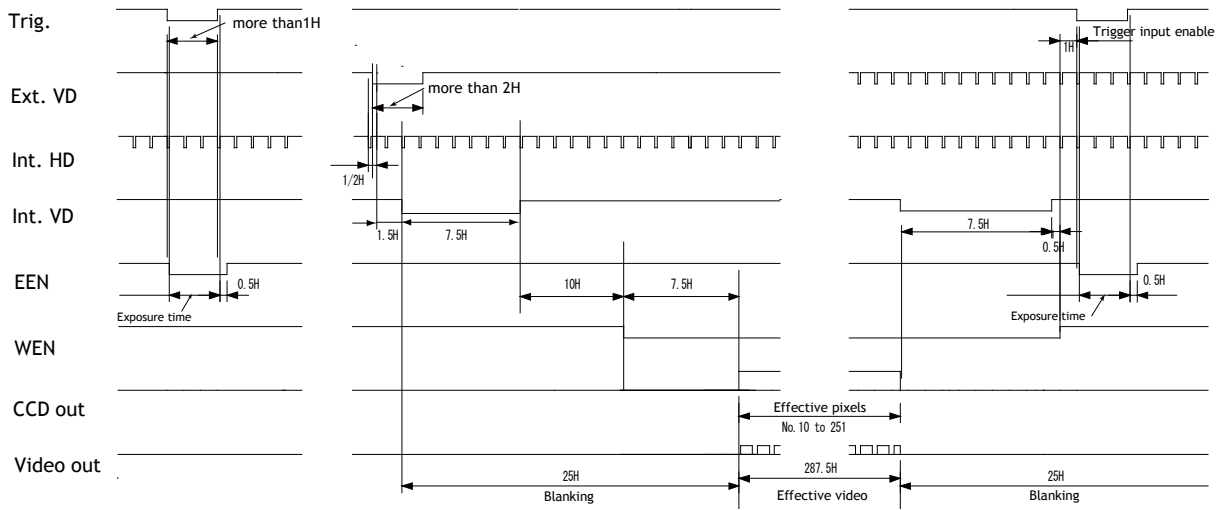


Fig. 21. Frame Delay read out mode (CCIR)

#### 6.5.4. Integration Mode

In this mode, the external integration pulse disables SG (Sensor Gate) pulses and as a result, the continuous exposure can be possible over multiple frames.

The integration pulse is applied through Hirose 12 P connector #11 pin. As the factory default, 11 pin is set at “NC “ and SW505 should be set at “UP”. Refer to the details in chapter 7.

#### Important notes on using this mode.

- The duration of the integration pulse is  $> 2VD$  to  $< 2$  seconds. This duration can be incremented every 1 VD..
- The exposure period is  $\geq 2VD$  to  $\leq 2$  seconds.

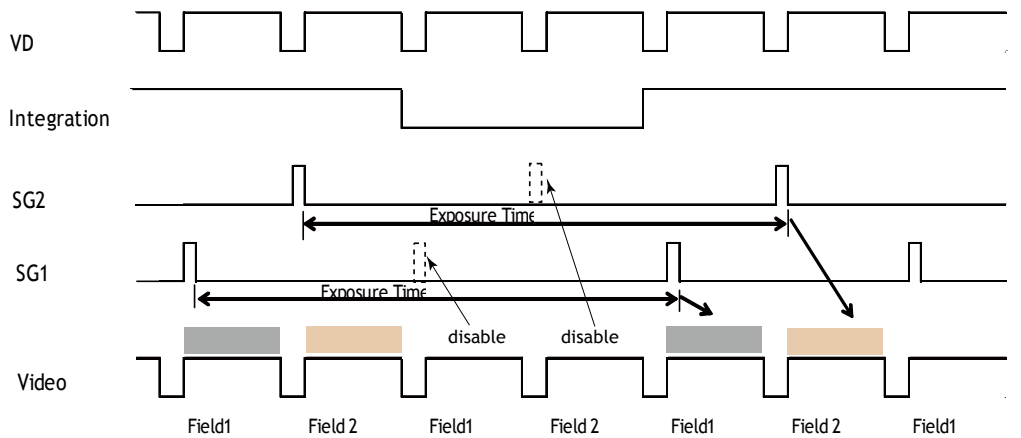


Fig. 22. Integration mode

## 7. Configuring the Camera

### 7.1. DIP switch locations

#### 7.1.1. Rear Switch.

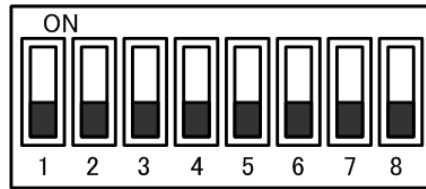


Fig.23. Rear DIP switch

#### 7.1.2. DIP switches inside

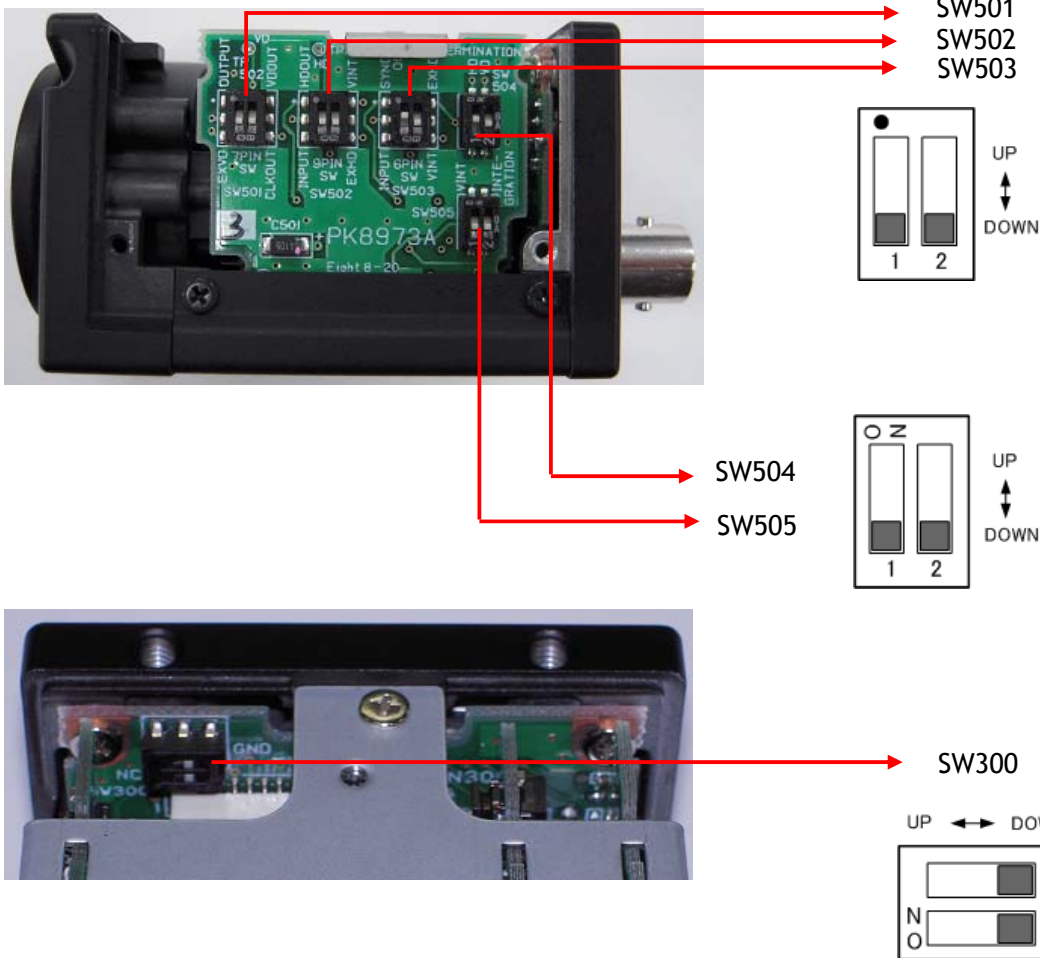


Fig.24. Inside DIP switch

7.2. Configuring the camera operation

7.2.1. Rear switch SW-1

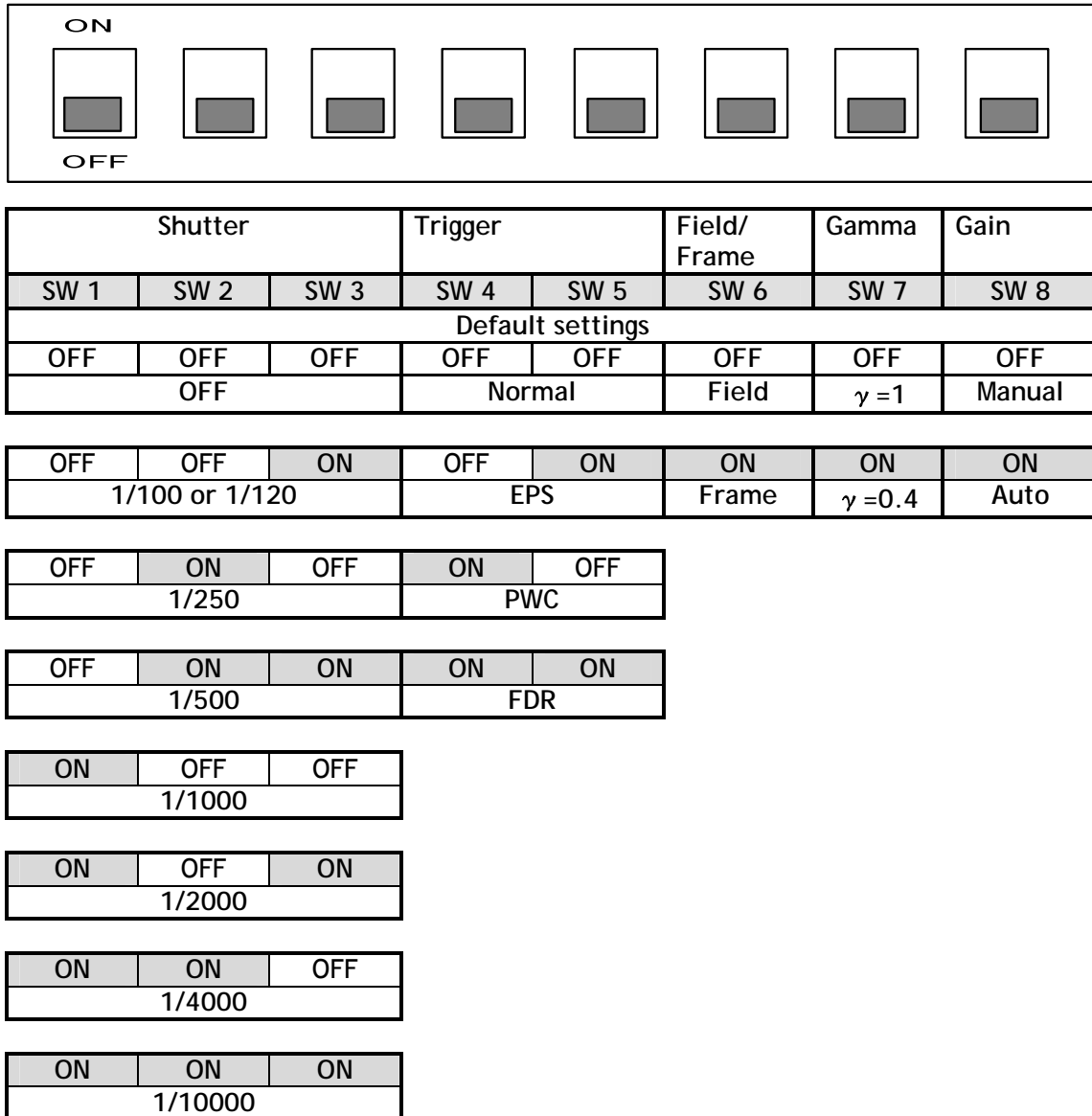


Fig.25. Rear DIP switch configuration

7.2.2. 12P connector configuration

12 pin No.	Items	Switch	Positioning		
			Default		
5 pin	GND / NC	SW300			
6 pin	VINT / HD IN / SYNC OUT	SW503			
7 pin	VD IN / CLK OUT / VD OUT	SW501			
9 pin	HD IN / VINT / HD OUT	SW502			
11 pin	NC / Integration	SW505			
12 pin	GND / NC	SW300			

Note: This does not depend on the position of the switch.

Fig.26. Inside DIP switch configuration

7.2.3. Termination setting for HD, VD and VINT

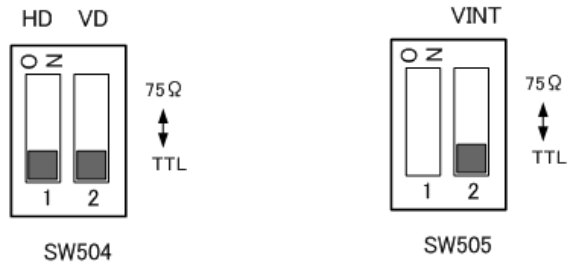


Fig. 27. Termination



### 8. External Appearance and Dimensions

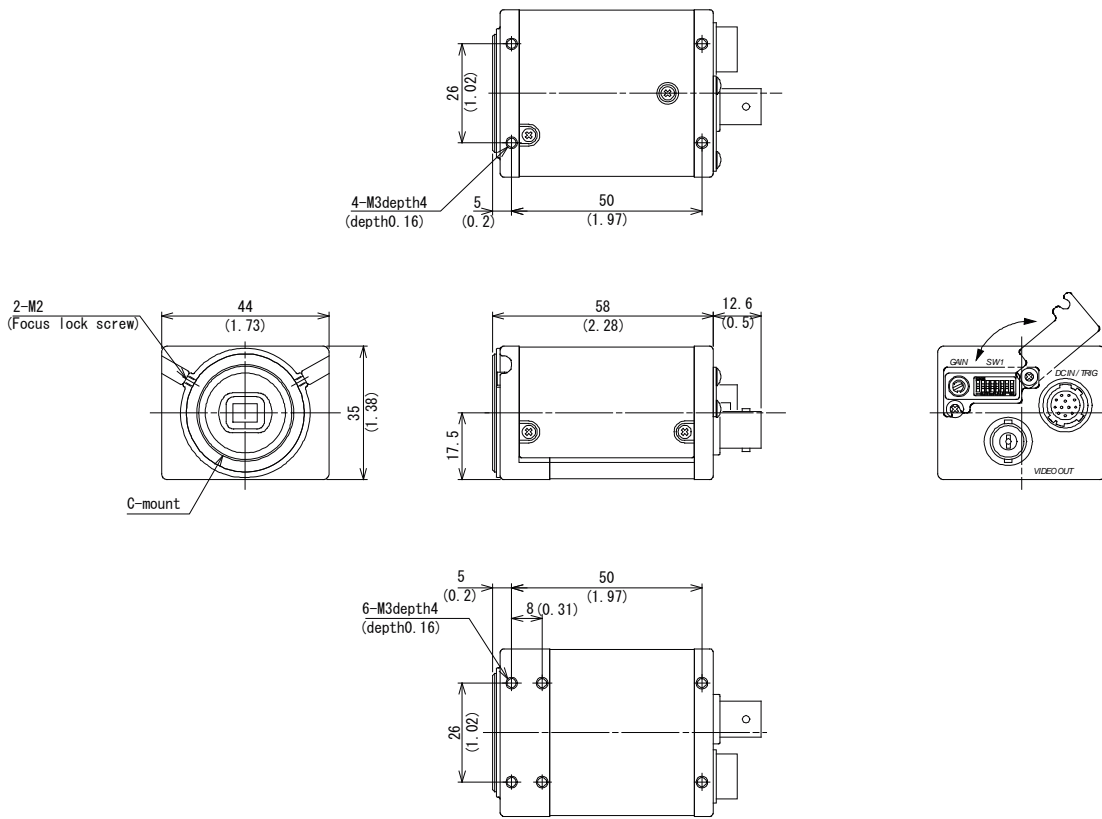


Fig. 28. Camera dimensions

## 9. Specifications

### 9.1 Specification table

Specifications	CV-A55 IR E	CV-A55 IR C
Video System	EIA	CCIR
Scanning system	2:1 Interlace scan	
CCD sensor	1/2". Monochrome ICX428ALL	1/2". Monochrome ICX429ALL
Sensing area	6.45 (h) x 4.84 (v) mm	6.47 (h) x 4.83(v) mm
Cell size	8.4 (h) x 9.8(v) $\mu$ m	8.6 (h) x 8.3(v) $\mu$ m
Active pixels	768 (h) x 494 (v)	752 (h) x 582 (v)
Pixel clock	14.318 MHz	14.1875 MHz
Line frequency	15.734 KHz	15.625 KHz
Vertical Frequency	59.94 Hz	50 Hz
Horizontal Resolution	570 TV lines	
Video output	1.0 V p-p , 75 ohm, VS ( DC coupled )	
Sensitivity on sensor (minimum)	0.01 Lux (Max. gain, Shutter OFF, 50% video )	
S/N ratio	More than 56 dB (0dB gain)	
Gain	Manual / AGC : -3 to +24 dB	
Gamma	1.0 / 0.45 Selectable	
Synchronization	Int. X-tal. / External ( Auto selection by HD input )	
Trigger input.	TTL	4 V $\pm$ 2 V. TTL
Trigger modes	Edge Pre-Select , Pulse Width Control and Frame Delay Readout	
Accumulation	HD synchronous	
Preset Shutter speed	8 fixed steps OFF to 1/10,000 second	
Pulse width control	1.5H to 2 seconds	
Interface	HD/VD input : 4.0 V p-p $\pm$ 2.0 V TTL ( 75 ohm by DIP SW) HD/VD output : 4.0 V p-p VINIT input : TTL Level ( 200 ohm termination by DIP SW ) Negative SYNC output : 4.0 V p-p Pixel clock output : 3.0 V p-p Integration input : TTL Level, Negative	
Operating temperature	-5°C to +45°C	
Humidity	20 - 90% non-condensing	
Storage temp/humidity	-25°C to +60°C/20% to 90% non-condensing	
Vibration	10G (20Hz to 200Hz, XYZ)	
Shock	70G	
Regulatory	CE (EN61000-6-2 and EN61000-6-3), FCC part 15 class B, RoHS	
Power	12V DC $\pm$ 10%. < 0.1A ( Normal Operation ) ,1.2 W	
Lens mount	C-mount (Flange back 17.526 mm -0.05mm)	
Dimensions	44 x 35 x 58 mm (WxHxD)	
Weight	125 g	

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

*Note: Approx. 30 minute pre-heat required to meet specifications.*

## 9.2. Spectral Sensitivity

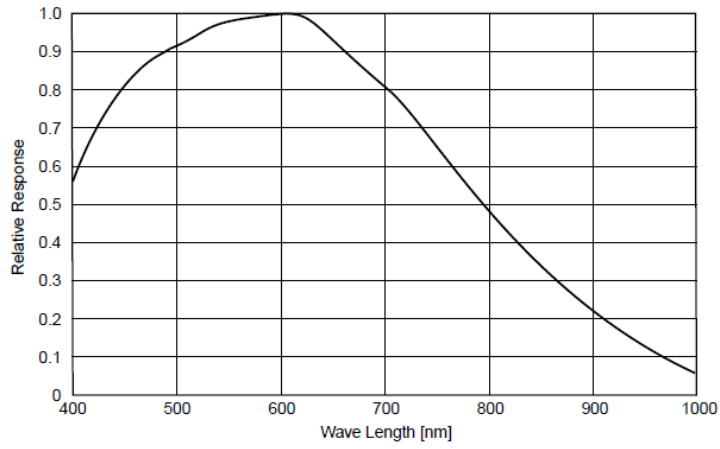


Fig. 29. Spectral sensitivity (EIA)

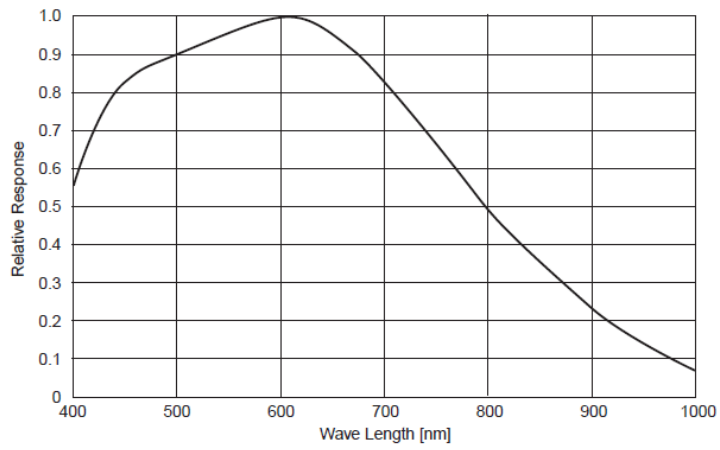


Fig.30. Spectral sensitivity (CCIR)

## 10. Appendix

### 10.1. 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, including laser sources.

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.

Remove power from the camera during any modification work, such as changes of jumper and switch settings.

### 10.2. Typical Sensor Characteristics

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

#### V. Aliasing

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

#### Blemishes

All cameras are shipped without visible image sensor blemishes.

Over time, some pixel defects can occur. This does not have a practical effect on the operation of the camera. These will show up as white spots (blemishes).

Exposure to cosmic rays can cause blemishes to appear on the image sensor. Please take care to avoid exposure to cosmic rays during transportation and storage. It is recommended using sea shipment instead of air flight in order to limit the influence of cosmic rays to camera.

Pixel defects/blemishes also may emerge due to prolonged operation at elevated ambient temperature, due to high gain setting or during long time exposure. It is therefore recommended to operate the camera within its specifications.

#### Patterned Noise

When the sensor captures a dark object at high temperature or is used for long time integration, fixed pattern noise may appear in the image.

### 10.3. Caution when mounting a lens on the camera

When mounting a lens on the camera dusts particles in the air may settle on the surface of the lens or the image sensor of the camera. It is therefore important to keep the protective caps on the lens and on the camera until the lens is mounted. Point the lens mount of the camera downward to prevent dust particles from landing on the optical surfaces of the camera. This work should be done in a dust free environment. Do not touch any of the optical surfaces of the camera or the lens.

### 10.4. Exportation

When exporting this product, please follow the export regulation of your own country.

### 10.5. References

1. This manual for CV-A55 IR E / CV-A55 IR C can be downloaded from [www.jai.com](http://www.jai.com)
2. Datasheet for CV-A555 IR E / CV-A55 IR C can be downloaded from [www.jai.com](http://www.jai.com)

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## 11. User's Record

Camera type: CV-A55 IR E / CV-A55 IR C  
Revision: .....  
Serial No. ....  
Firmware version. ....

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

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User's Mode Settings.

User's Modifications.

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