



*Compact Monochrome 2 Megapixel  
Progressive Scan Camera*

**CV-A2**

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# *Operation Manual*

*Camera: Revision A  
Manual: Version 1.0*

Table of Contents

1. General.....	2
2. Standard Composition .....	2
3. Main Features .....	2
4. Locations and Functions.....	3
5. Pin Assignment.....	4
5.1. 12-pin Multi-connector (DC-IN/VIDEO OUT, EXT.HD/VD IN) .....	4
5.2. 6-pin Multi-connector (TRIGGER).....	4
5.3. Input and Output Circuits .....	5
5.3.1. Video output .....	5
5.3.2. Trigger input .....	5
5.3.3. HD and VD input.....	5
5.3.4. HD, VD, PCLK, WEN and EEN output .....	5
5.4. CV-A2 Block Diagram .....	6
6. Functions and Operations .....	6
6.1. Basic functions .....	6
6.1.1. CCD sensor layout and full Image format .....	8
6.2. Input-output of HD/VD Signals .....	9
6.3. Continuous Operation (Non triggered) .....	10
6.4. External Trigger Modes .....	12
6.5. Edge Pre-select Mode .....	13
6.6. Pulse Width Control Mode .....	14
6.7. Frame-delay read out Mode.....	15
6.8. Long Time Exposure Mode.....	16
6.9. Start/Stop Mode .....	17
6.10. Smearless Mode.....	18
6.12. Sensor Gate Control.....	19
6.13. Other Functions.....	20
6.14. Request Functions.....	22
6.15. Save and Load Functions. ....	22
7. Configuring the Camera .....	24
7.1. RS-232C control. ....	24
7.2. CV-A2 RS-232C command list. ....	25
7.3. Camera Control Tool for CV-A2.....	26
7.3.1. Control Tool Windows .....	26
7.3.2. Camera Control Tool Interface .....	27
7.3.3. Using the Camera Control Tool .....	29
7.4. Internal Jumper Settings .....	30
8. External Appearance and Dimensions .....	30
9. Specifications .....	31
9.1. Specification table .....	31
9.2. Spectral Sensitivity .....	32
10. Appendix .....	33
10.1. Precautions.....	33
10.2. Typical CCD Characteristics .....	33
11. Users Record.....	34

### 1. General

The CV-A2 is a monochrome progressive scan 1/1.8" CCD camera with 2 Megapixel resolution. The CV-A2 camera is in the popular CV-A1 family. It is designed for automated inspection, featuring a small housing and a wide range of unique functions. The asynchronous trigger can be set to work in several modes, to allow such functions as pulse width controlled shutter, programmable shutter speed and long time integration. To obtain higher frame rates, the camera has partial scanning and vertical binning.

All modes and functions can be set via an RS-232C interface, greatly reducing the need for mechanical switches or jumpers.

CV-A2 Camera Control Tool for Windows 98/NT/2000/XP contains a camera control program and tools for making your own program.

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

The latest version of Camera Control Tool for CV-A2 can be downloaded from: [www.jai.com](http://www.jai.com)

### 2. Standard Composition

The standard camera composition consists of the camera main body.

### 3. Main Features

- Compact size 1/1.8" progressive scan monochrome CCD camera
- New 2 Megapixel camera in the popular CV-A1 family
- 15 full frames 1620(h) x 1220 (v) 4.4  $\mu\text{m}$  square pixels per second
- Up to 70 fps with 1/6 partial scan.
- Double speed and higher sensitivity with vertical 2:1 binning
- Iris video output for lens iris control
- Auto shutter and AGC for wide light range
- Internal, external HD/VD or random trigger synchronization
- Edge pre-select, programmable shutter and pulse width control trigger modes
- Start/stop mode (trigger/ext. VD) and long time exposure (ext. VD interval)
- Shutter speeds from 1/15 to 1/200,000 second in continuous mode
- Triggered shutter speed up to 1/12,000 second
- Programmable shutter speed from 1 H to 1250 H. (2047 H in EPS)
- Pulse width controlled shutter 1 H to 2 seconds
- Frame delay readout up to 2 second for pulse width controlled shutter
- Smear-less readout mode for edge pre-select and programmable shutter
- Sensor gate control for non triggered strobe flash applications
- Exposure enable EEN, write enable WEN and pixel clock output
- Short ASCII commands for fast mode set-up via serial port
- Set-up by Windows 98/NT/Win2000/XP software via RS 232C
- Compact housing with C-mount

4. Locations and Functions

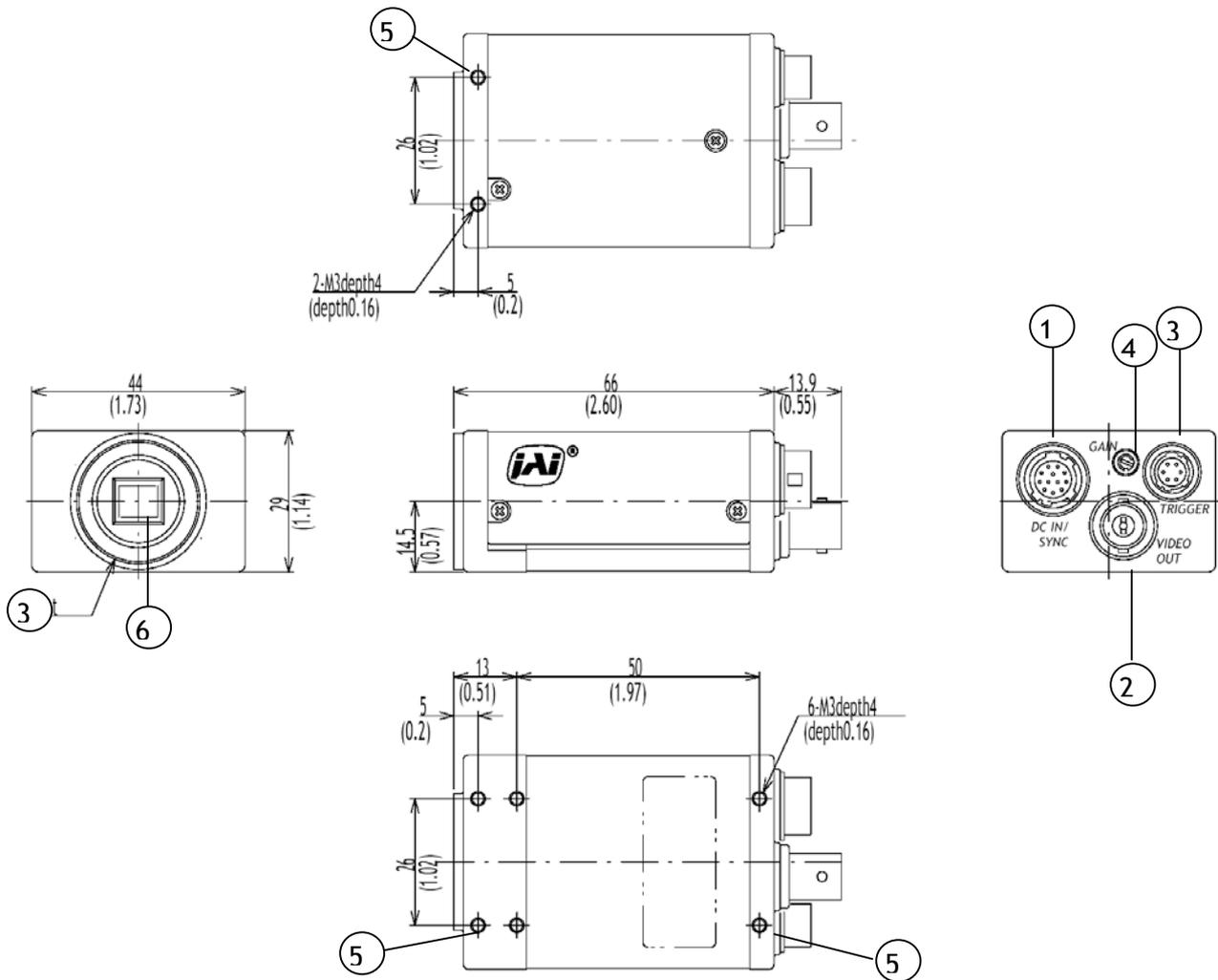


Fig. 1. Locations.

1. 12 pin Hirose connector for frame grabber interfacing and power (12V DC).
2. BNC connector for video output. VS 1.0 Vpp 75 Ohm.
3. 6 pin Hirose connector for trigger input and RS-232C control interface.
4. Gain potentiometer for manual gain setting.
5. Mounting holes, 8 x M3. For precision mounting use only the 4 holes located at the forward part of the bottom plate.
6. 1/2" interline-transfer type CCD sensor.
7. Lens mount for C-mount lenses. \*1)

Note: \*1) Rear protrusion on the C-mount lens must be less than 9 mm (0.4 inches approx.).  
When IR-cut filter is used, it must be less than 6.0 mm (0.24 inches approx.).

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

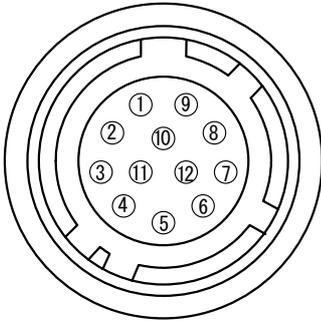
## 5. Pin Assignment

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

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

Seen from rear

Pin configuration is compatible with EIAJ standard



Pin no.	Signal	Remarks
1	GND	
2	+12 V DC input	
3	GND	
4	<b>Video/Iris video</b>	(IS=1 for iris video). 0.7 Vpp >1kΩ termination
5	GND	
6	<b>HD input/HD output</b>	*) SW502.3 on for 75Ω. SW501.1 on for HD out.
7	<b>VD input/VD output</b>	*) SW502.4 on for 75Ω. SW501.2 on for VD out.
8	GND	
9	Pixel clock output	PC=1 for pclk out. R615 short
10	<b>WEN output</b>	
11	<b>Trigger input</b>	
12	GND	

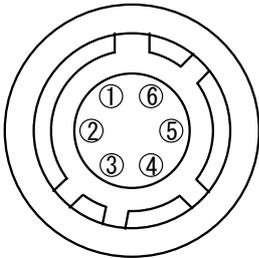
Fig. 2. 12-pin connector.

Plugs for cable: HR10A-10P-12S

### 5.2. 6-pin Multi-connector (TRIGGER)

Type: HR10A-7R-6PB (Hirose) male

Seen from rear.



Pin no.	Signal	Remarks
1	TXD out	
2	RXD in	
3	GND	
4	GND	
5	<b>Trigger input</b>	Parallel with pin 11 on 12 pin con
6	<b>EEN/WEN output</b>	*) *2). WEN output if EW=1

Fig. 3. 6-pin connector.

Plugs for cable: HR10A-7P-6S

Notes.

\*) Alternative signals can be placed on these pins by switch or jumper settings or RS-232C commands.  
Configurations shown in **Bold + italic** is factory setting.

\*2) EEN will be low all the time in normal continuous mode (TR=0), if the selected exposure time is longer than the frame readout time.

### 5.3. Input and Output Circuits

In the following the principle for the input and output circuits for video and timing signals are shown. Jumper settings are shown as for factory default.

#### 5.3.1. Video output

The video output on the BNC connector is a 75 Ω DC coupled circuit. The video level is shown with 75 Ω termination. The composite sync signal can be disabled. (SO=0).

Pin #4 on the 12-pin connector is an ac coupled video output. Termination should be >1kΩ. It can be change to iris video output for lens iris control. (IS=1).

Don't use pin #4 as primary video output.

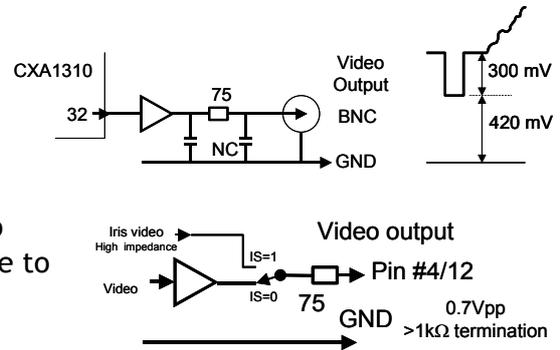


Fig. 4. Video output.

#### 5.3.2. Trigger input

The trigger input is AC coupled. To allow a long pulse width, the input circuit is a flip flop, which is toggled by the negative or positive differentiated spikes caused by the falling or rising trigger edges.

The trigger polarity can be changed.

Trigger input level 4 V ± 2 V.

The trigger-input impedance is 1 kΩ.

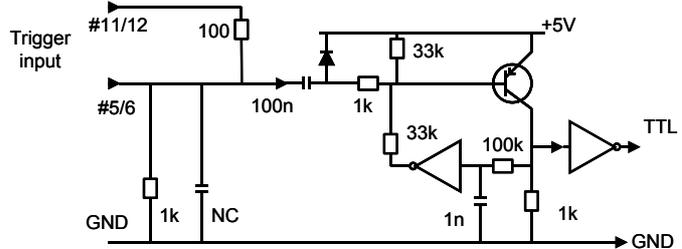


Fig. 5. Trigger input.

#### 5.3.3. HD and VD input

The input circuit for external HD and VD signals are shown. It can be 75 Ω terminated by closing SW502. SW501 will switch to output the internal HD and VD signal.

HD and VD input level is 4 V ± 2 V.

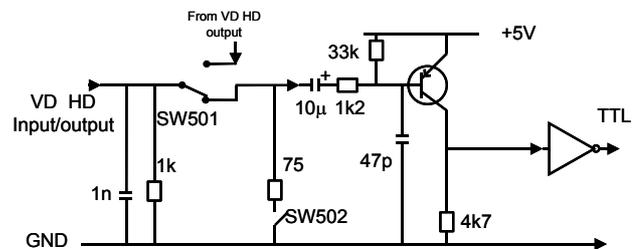


Fig. 6. HD and VD input.

#### 5.3.4. HD, VD, PCLK, WEN and EEN output

Output circuit for these signals are 75 Ω complementary emitter followers. It will deliver a full TTL signal. Output level ≥ 4 V from 75Ω. (No termination).

The WEN polarity can be changed.

EEN/WEN signal on pin #6/6 can be changed to WEN if EW=1.

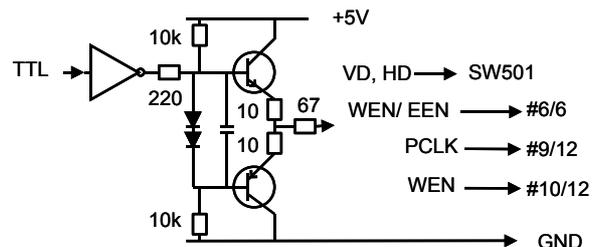


Fig. 7. HD, VD, PCLK, WEN and EEN output.

### 5.4. CV-A2 Block Diagram

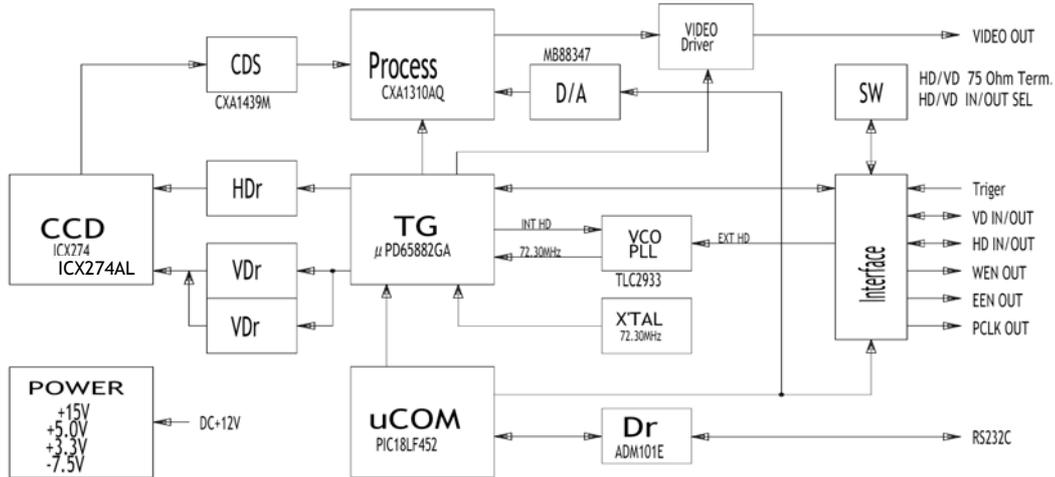


Fig. 8. Block diagram.

## 6. Functions and Operations

### 6.1. Basic functions

Some of the primary camera functions need a general introduction before the operation modes are described. The list below shows the primary functions from the command list.

SM	Shutter Mode	Normal shutter, Programmable Exposure, auto shutter.
SH	Shutter Speed	Off to 1/200,000 second
PE	Programmable Exposure	1H to 1250 H. ( 2047 in EPS modes.)
SC	Scanning Format	Full frame, 1/2 partial, 1/3, 1/6 partial
BI	Binning	Off, vertical
TR	Trigger Mode	Normal, Edge, PWC, frame delay PWC, Long time exposure, start-stop, smearless Edge and Sensor Gate control

The shutter **SM** can be set to normal (SM=0), where the exposure time is selected from 16 fixed steps with the command **SH**, or programmable exposure (SM=1). The command **PE** allows 1250 step with 1 line period resolution. (53.1 μs). PE=1 results in 1.44H.

Auto shutter (SM=2) will work in normal mode. (TR=0 ). Range Off - 1/12,000.

The CCD scanning format **SC** can be selected between full or partial scanning. With partial scanning, only the vertical central part of the CCD sensor is read out with a higher frame rate. The partial scan is done by a fast dump read out of the lines in the vertical ccd register down to the top of the partial image. The partial part of the image is read out with normal speed. The lines below the partial image are read out and dumped with a high speed.

Some signal distortion can be expected below highlighted areas, (saturated areas). It is caused by limitation in the vertical ccd register transfer efficiency at high speed.

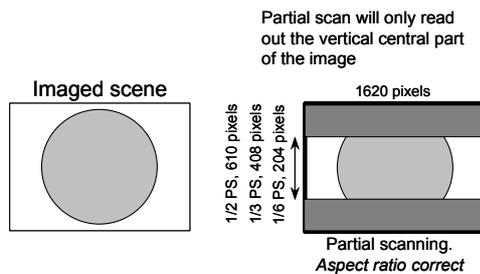


Fig. 9. Partial scanning.

## CV-A2

Binning mode **BI** is a function where the signal charge from 2 or more adjacent pixels are added together and read out as one pixel. A resulting full frame with lower resolution can be read out with a higher rate. By adding 2 pixels together, the sensitivity is doubled. The CV-A2 has only vertical binning. With V binning the pixel charge from 2 adjacent lines are added together in the horizontal ccd register. It is done by double pulses to the vertical ccd register.

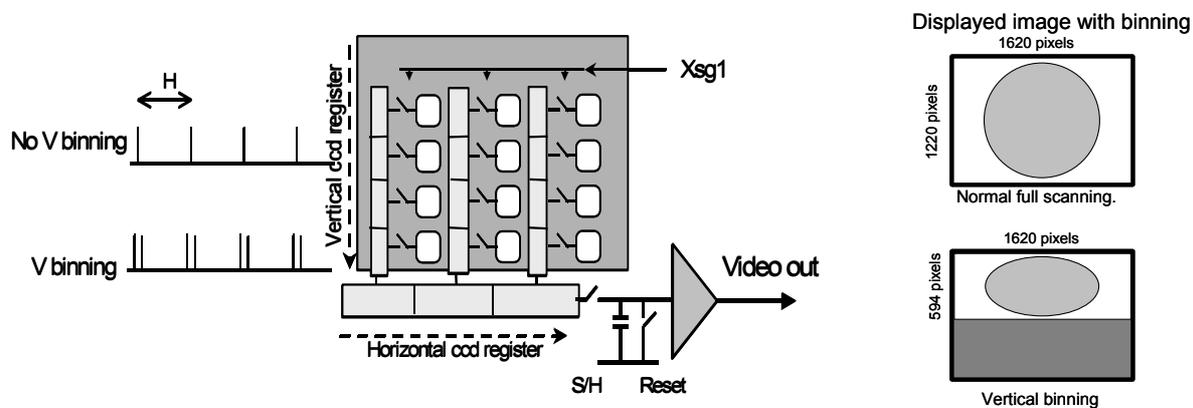


Fig. 10. Binning.

The following table shows the frame rates in normal continuous mode.

Scanning	Lines per frame [H]	Effective lines [H]	Frame rate [fps ]	Remarks
Full	1252	1220	15	
1/2 partial	676	610	28	
1/3 partial	474	408	40	
1/6 partial	270	204	70	
V binning	626	594	30	

The accumulation mode is normal H synchronous. In this mode it is possible to start a new exposure during the previous frame readout. The exposure should not be finished before the frame is read out.

In normal trigger mode (TR=0) shutter speed up to 1/200,000 sec. can be used. In all triggered shutter modes, the shortest shutter time is limited to  $\geq 1.44$  H. (1/12,000). In triggered shutter modes with partial scan or binning, the longest shutter speed is not limited by the frame readout time. It can be longer.

Trigger modes with possible scanning and binning combinations

TR=	Scanning	Full scan		Partial scan		Remarks
	Binning	norm.	V bin	Norm	V bin	
0	Normal	√	√	√	n	SM=0, SM=1, SM=3 active. AS=1 active. SG=1 active
1	Edge Pre-sel.	√	√	√	n	SM=0, SM=1 active
2	Pulse Width	√	√	√	n	
3	Fr. Delay r.o.	√	√	n	n	
4	Long Time int	√	n	n		
5	Start/Stop	√				
6	Smearless	√	√	√	n	SM=0, SM=1 active

√ Described mode  
n Non-described mode combination, which will work

**Note for mode setting.**

With RS232C commands it is possible to set up combinations of mode and functions, which has no meaning.

6.1.1. CCD sensor layout and full Image format

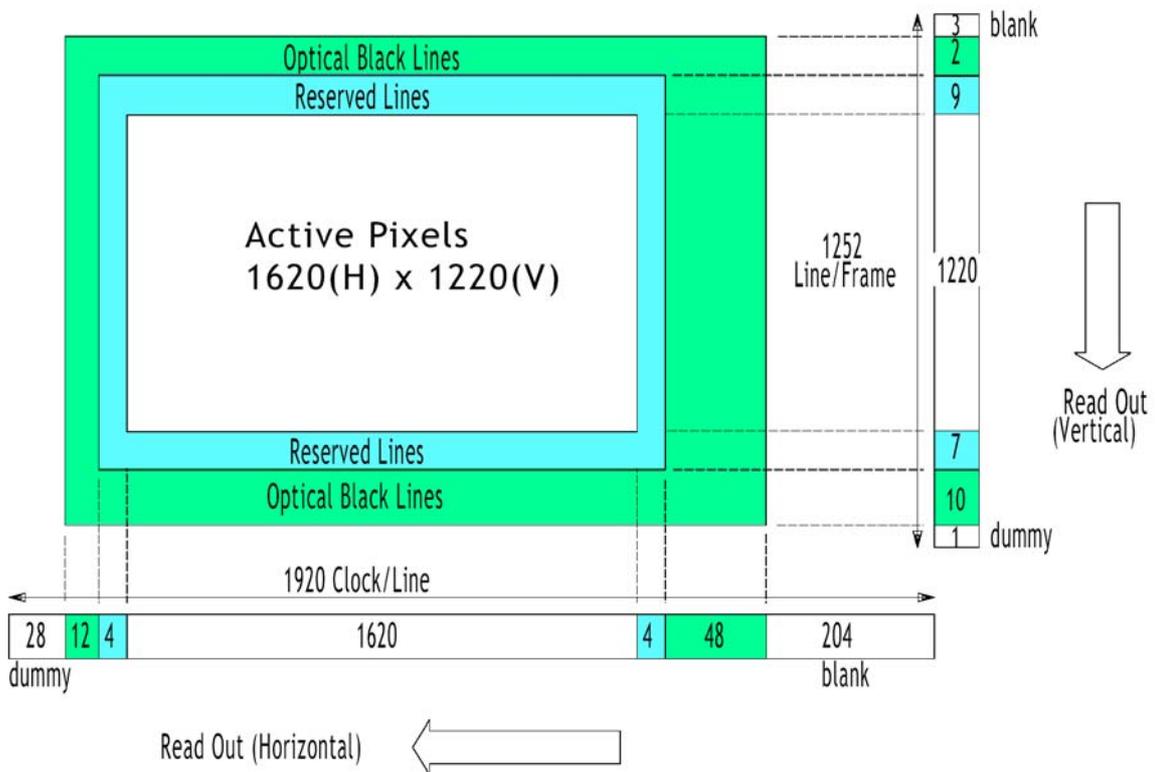


Fig. 11. CCD sensor layout

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

In the default setting the camera will accept external HD/VD signals on pin 6 and 7 of the 12 pin Hirose connector. If external HD/VD is applied, the camera will 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 on the PK8486A board. SW502-3 for HD and SW502-4 for VD. On for 75 Ohm termination.

To output the internal HD/VD signals on pin 6 and 7 the internal switch SW501-1 and 1-2 on the PK8486A board should be set ON. The output is TTL level from a 75-Ohm source.

To use this mode:

Set function:

SW 501 on PK8486A to **IN for ext. VD/HD input. (Factory default.)**

SW 502 on PK8486A to 75 Ω for termination of VD/HD.

SW 502 on PK8486A to **TTL for TTL level for VD/HD. (Factory default.)**

SW 501 on PK8486A to **OUT** for internal VD/HD output.

Input:

Ext. VD in or int. VD out on pin 7 on 12-pin connector.

Ext. HD in or int. HD out on pin 6 on 12-pin connector.

#### Important notes on using this mode

- External sync system should follow the camera scanning and binning system.
- In trigger modes there are no continuous VD out, only after each trigger input.
- With external HD/VD synchronizing in continuous partial scanning modes, a few pixel jitter can be expected in the first few lines. It can be avoided if a trigger mode is used.

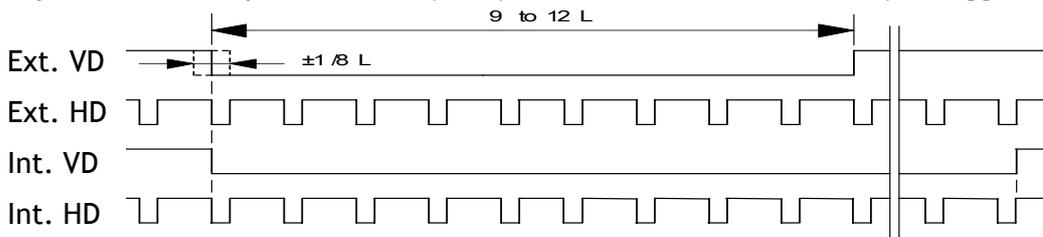
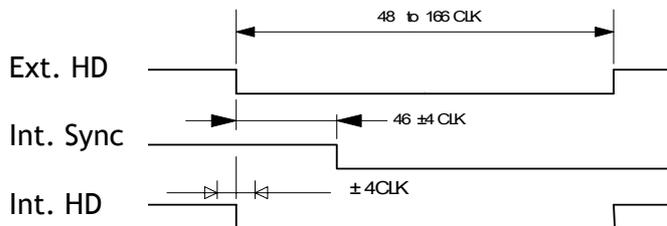
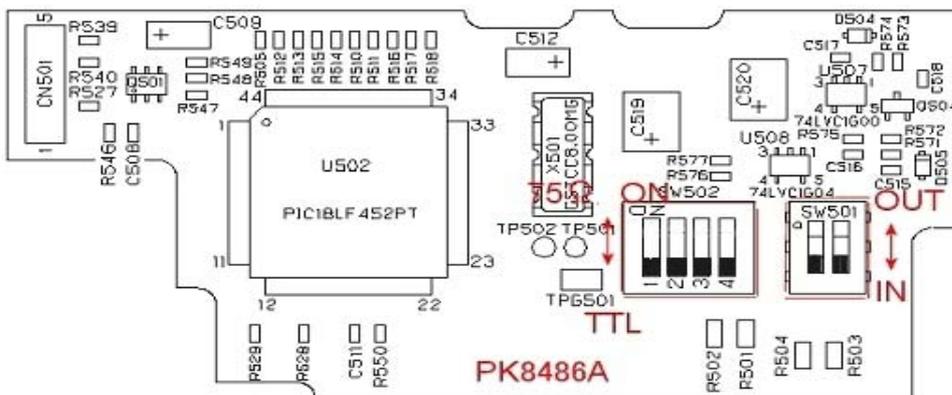


Fig. 12. Ext. HD and ext. VD phase conditions.



Ext. H = 18.828 kHz ±2%  
 L = 1H = 53.1 μs  
 1 CLK = 27.66 ns  
 (CLK = 36.15MHz)

Fig. 13. Ext. Int. HD timing details.



SW501-1. HD in/out  
 SW501-2. VD in/out  
  
 SW502-3. HD TTL/75  
 SW502-4. VD TTL/75

Fig. 14. Switch positions for int./ext. sync and termination.

### 6.3. Continuous Operation (Non triggered)

Trigger Mode Normal. TR=0. It is for applications where the camera is continuous running without external trigger. In normal mode the shutter mode can be normal, programmable or auto. (SM=0, SM=1, SM=2). The shutter will work in all 16 steps up to 1/200,000 second or with the programmable exposure in 1250 steps. In partial scanning and binning modes, shutter times longer than the actual frame time has no meaning. The exposure will be equal the frame time.

To use this mode:

Set function: Trigger mode "Normal" TR=0  
 Shutter mode "Normal", "Programmable", "Auto" SM=0, SM=1, SM=2  
 "Shutter Speed" SH=0 through 15  
 "Programmable exposure" PE=1 through 1250  
 Other functions

Input: Ext. VD on pin 7 on 12-pin connector. If used.  
 Ext. HD on pin 6 on 12-pin connector. If used.

#### Important notes on using this mode

- External sync system should follow the camera scanning and binning system.

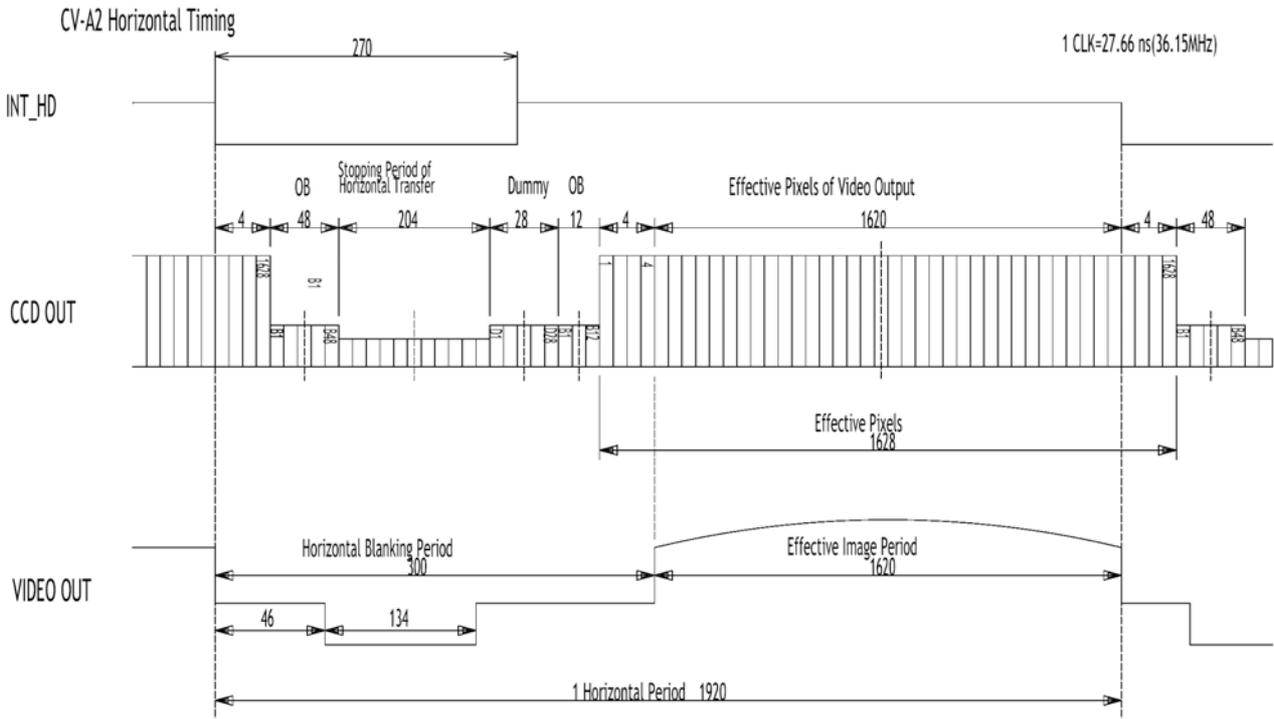
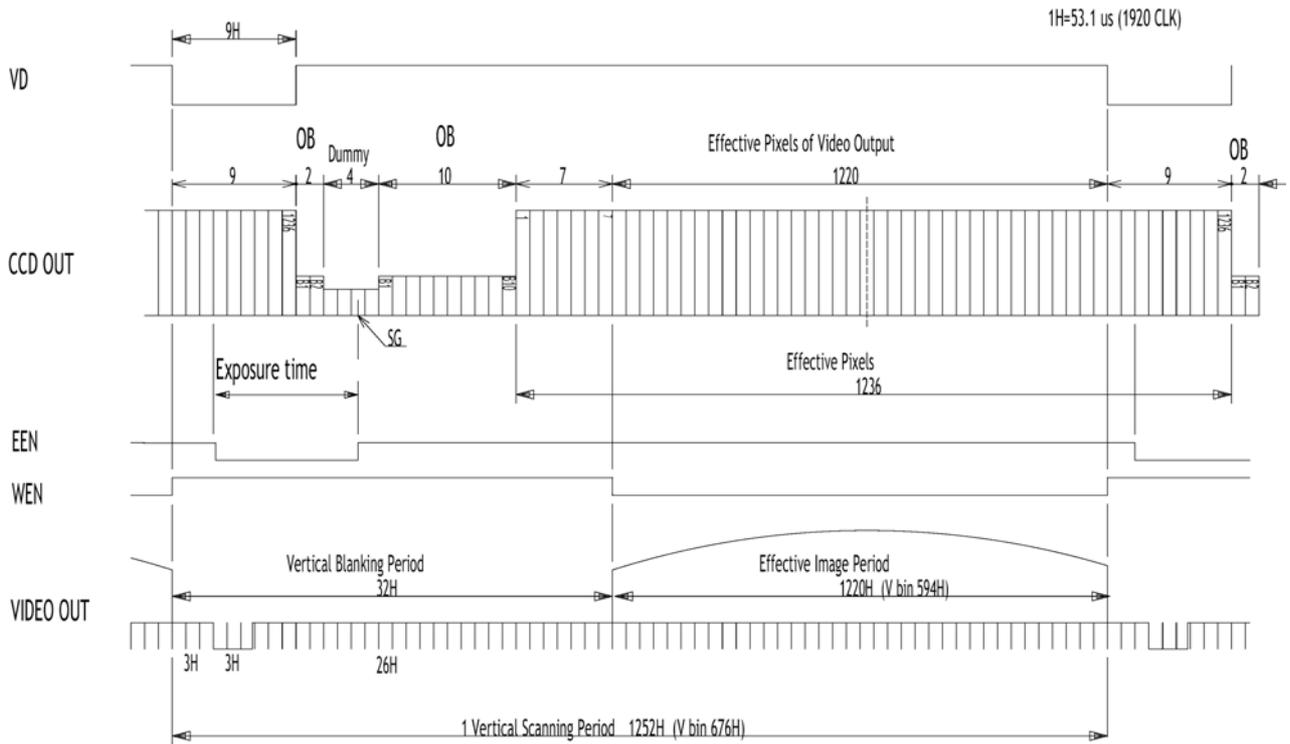


Fig. 15. Horizontal timing details and pixel numbering for the CCD array.

# CV-A2



\* Vertical blanking period at the partial scan differs from the full frame mode.

Fig. 16. Vertical timing details. Full (and V binning.).

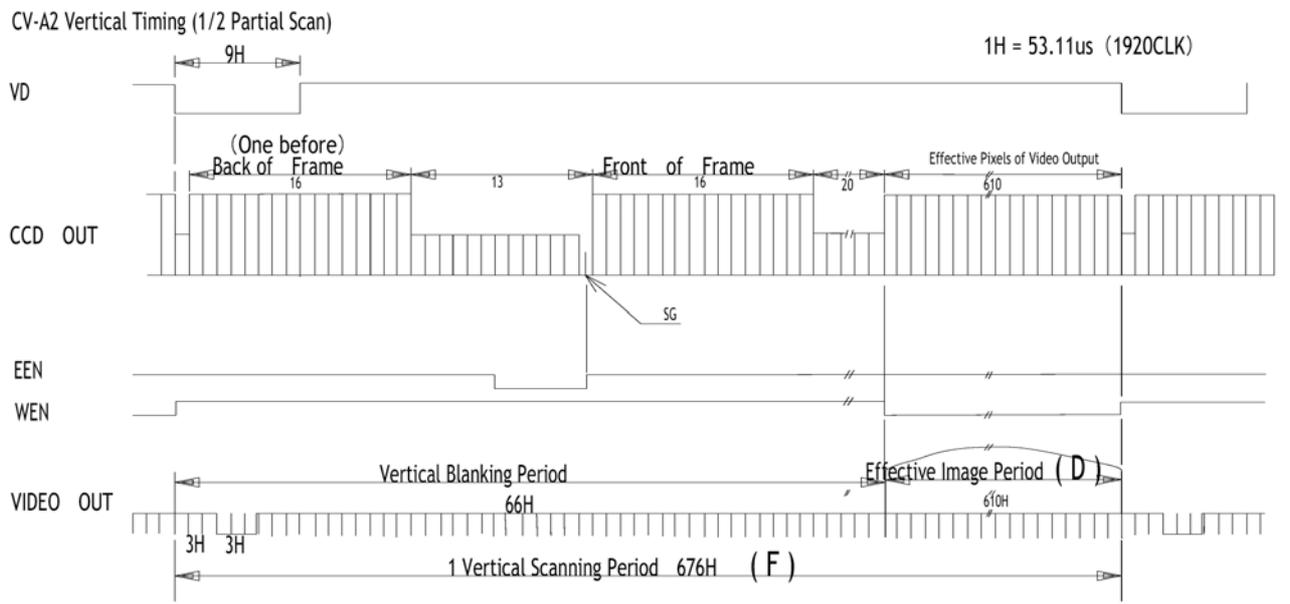


Table showing the figures for scanning

Scanning	D V period	F Effective video	Remarks
Full	1252H	1220H	
1/2 partial	676H	610H	Shown on timing diagram
1/3 partial	474H	408H	
1/6 partial	274H	204H	

Fig. 17. Vertical timing details for partial scan.

### 6.4. External Trigger Modes

This camera has 6 external asynchronous trigger modes, which can be set by RS-232C commands.

- |    |  |   |
|----|--|---|
| 1. | <i>Edge Pre-select Mode. TR=1</i>      | Pre-selected exposure. (SM=0, SM=1)             |
| 2. | <i>Pulse Width Control Mode. TR=2</i>  | Pulse width controlled exposure.                |
| 3. | <i>Frame Delay read out mode. TR=3</i> | PWC exposure read out by ext. VD.               |
| 4. | <i>Long Time Exposure Mode. TR=4</i>   | Exposure is interval between ext. VD.           |
| 5. | <i>Start/stop Mode. TR=5</i>           | Exposure start by trigger and stop by ext. VD   |
| 6. | <i>Smearless Read out mode. TR=6</i>   | Pre-sel. exp. after dummy readout. (SM=0, SM=1) |

The accumulation is HD synchronously 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. 18. below. The trigger level translations should be placed inside the 5.6 + 2.8 μseconds.

To obtain the highest triggered frame rate in EPS mode and PWC mode, it is possible to start a new exposure while the previous triggered exposure is read out. The exposure should not be finished before the previous frame is read out.

In Edge pre-select TR=1 and smearless TR=6, the shutter mode can be SM=0 or SM=1.

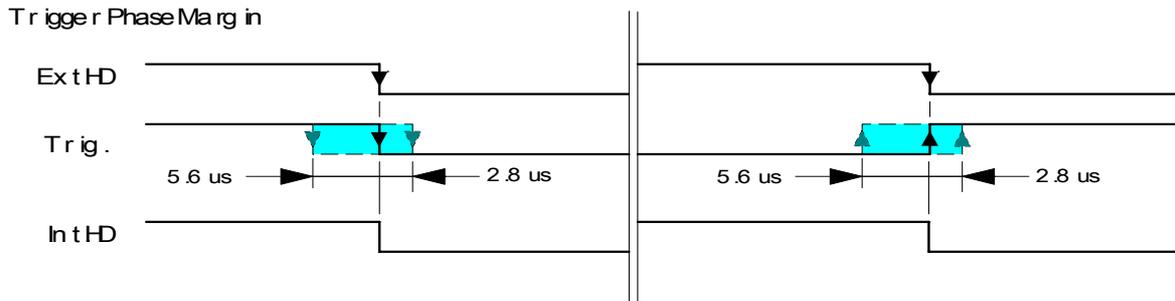


Fig. 18. Extern Trigger/HD Timing requirements.

### 6.5. 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 the first 10 steps in normal or 2047 steps in programmable shutter. SM=0 or SM=1. Shutter selections SH ≥10 will result in 1/12,000 sec. This mode will operate with full and partial scanning and with V binning modes. If partial scanning and binning is selected at the same time, partial scanning will have priority. An EEN pulse will indicate the active accumulation time, and a WEN pulse indicates that the resulting video is being read out.

To use this mode:

Set function: Trigger mode "Edge Pre-select" TR = 1  
 Shutter mode "Normal" or "Programmable" SM=0, SM=1  
 "Shutter Speed" SH=0 through 10  
 "Programmable exposure" PE=1 through 2047  
 Polarity and other functions

Input: Ext. trigger to pin 5 on 6 pin connector (or pin 11 on 12-pin connector).  
 Ext. HD to pin 6 on 12 pin connector. (If used).

**Important notes on using this 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 in fig. 18.
- The duration of the trigger should be >1H.
- A new trigger must not be applied before WEN is high.
- *In trigger modes there are no continuous VD out, only after each trigger input.*

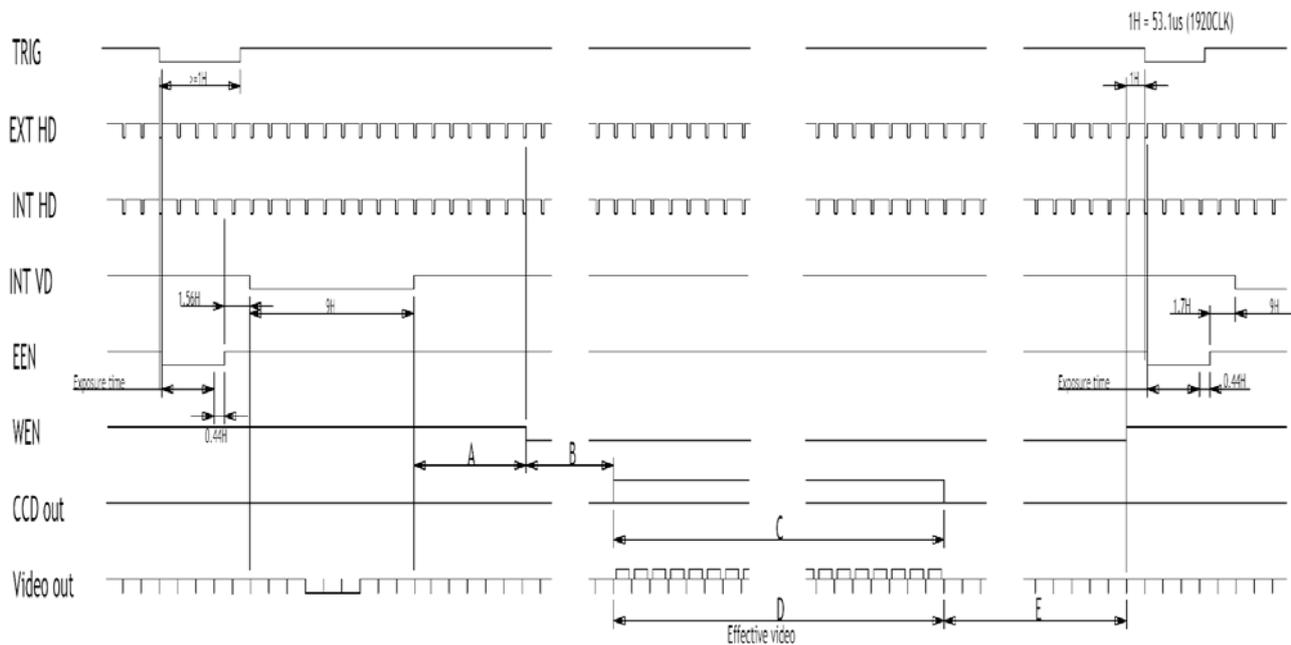


Table showing the figures for the different modes.

Scan mode	A	B	C CCD array line #	D Effective video	E	Max frame rate fps	Remarks
Full	3H	20H	8 to 1227	1220H	18H	15	
1/2 Partial	21H	36H	314 to 923	610H	29H	28	
1/3 Partial	21H	36H	415 to 822	408H	29H	40	
1/6 Partial	21H	36H	517 to 720	204H	29H	70	
V binning	3H	20H	26+27 to 1212+1213	594H	18H	30	

Fig. 19. Timing for Edge Pre-select with partial scanning and binning.

### 6.6. Pulse Width Control 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, and the resulting video is read out. The accumulation is H synchronous. The accumulation starts at the first HD pulse after the leading edge of the trigger, and it stops after the fist HD after the trailing edge of the trigger. It can result in <1H jitter if the trigger is not synchronized to H.

This mode will operate with full and partial scanning and with vertical binning modes. If partial scanning and binning is selected at the same time, partial scanning will have priority.

An EEN pulse will indicate the active accumulation time, and a WEN pulse indicates that the resulting video is being read out.

To use this mode:

Set function: Trigger mode "Pulse Width Controlled" TR = 2

Polarity and other functions

Input: Ext. trigger to pin 5 on 6 pin connector (or pin 11 on 12-pin connector).

Ext. HD to pin 6 on 12-pin connector. (If used).

**Important notes on using this mode.**

- With HC=0 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 in fig. 18. With HC=1 the exposure will start immediately.
- The duration of the trigger can be >1H to <2seconds.
- A new trigger must not be applied before WEN is high.
- *In trigger modes there are no continuous VD out, only after each trigger input.*

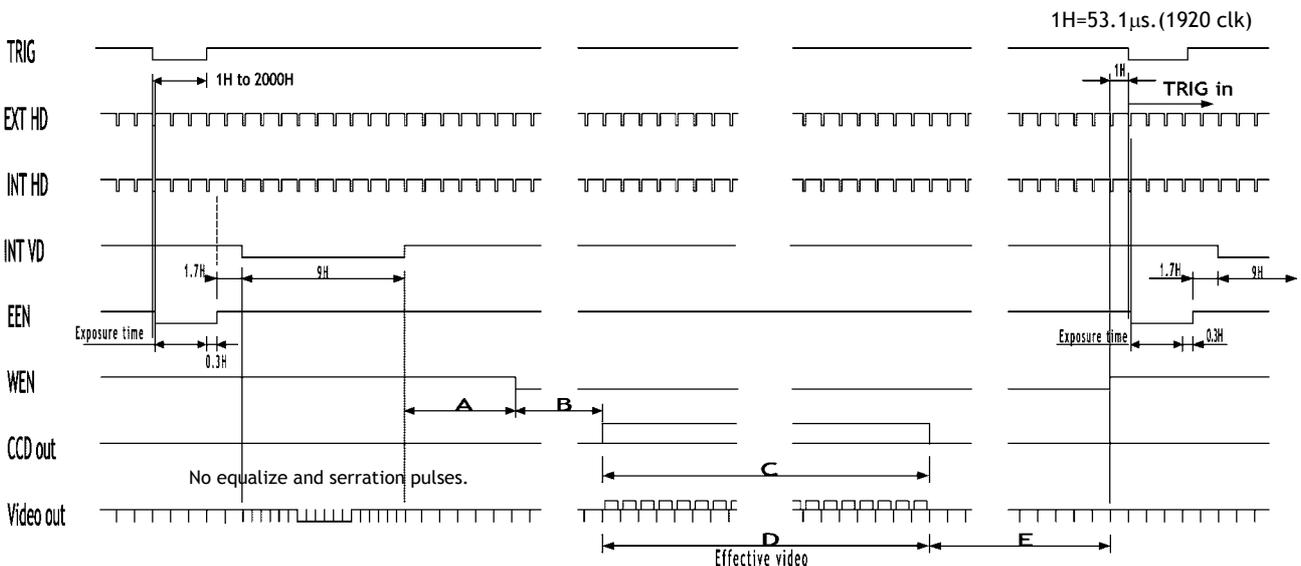


Table showing the figures for the different modes.

Scan mode	A	B	C CCD array line #	D Effective video	E	Max frame rate fps	Remarks
Full	3H	20H	8 to 1227	1220H	18H	15	
1/2 Partial	21H	36H	314 to 923	610H	29H	28	
1/3 Partial	21H	36H	415 to 822	408H	29H	40	
1/6 Partial	21H	36H	517 to 720	204H	29H	70	
V binning	3H	20H	26+27 to 1212+1213	594H	18H	30	

Fig. 20. Pulse Width Control trigger mode

### 6.7. 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. (Like PWC mode.) The accumulation is 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. (Delay < 2sec.)

This mode will operate with full and partial scanning and with vertical binning modes. If partial scanning and binning is selected at the same time, partial scanning will have priority.

An EEN pulse will indicate the active accumulation time, and a WEN pulse indicates that the resulting video is being read out.

To use this mode:

Set function: Trigger mode "Frame-delay read out" TR = 3  
Polarity and other functions

Input: Ext. trigger to pin 5 on 6 pin connector (or pin 11 on 12-pin connector).  
Ext. VD to pin 7 on 12-pin connector.  
Ext. HD to pin 6 on 12-pin connector. (If used).

**Important notes on using this 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 shown in fig. 18.
- The duration of the trigger can be >1H to <2000H.
- A new trigger must not be applied before WEN is high.
- *In trigger modes there are no continuous VD out, only after each trigger input.*

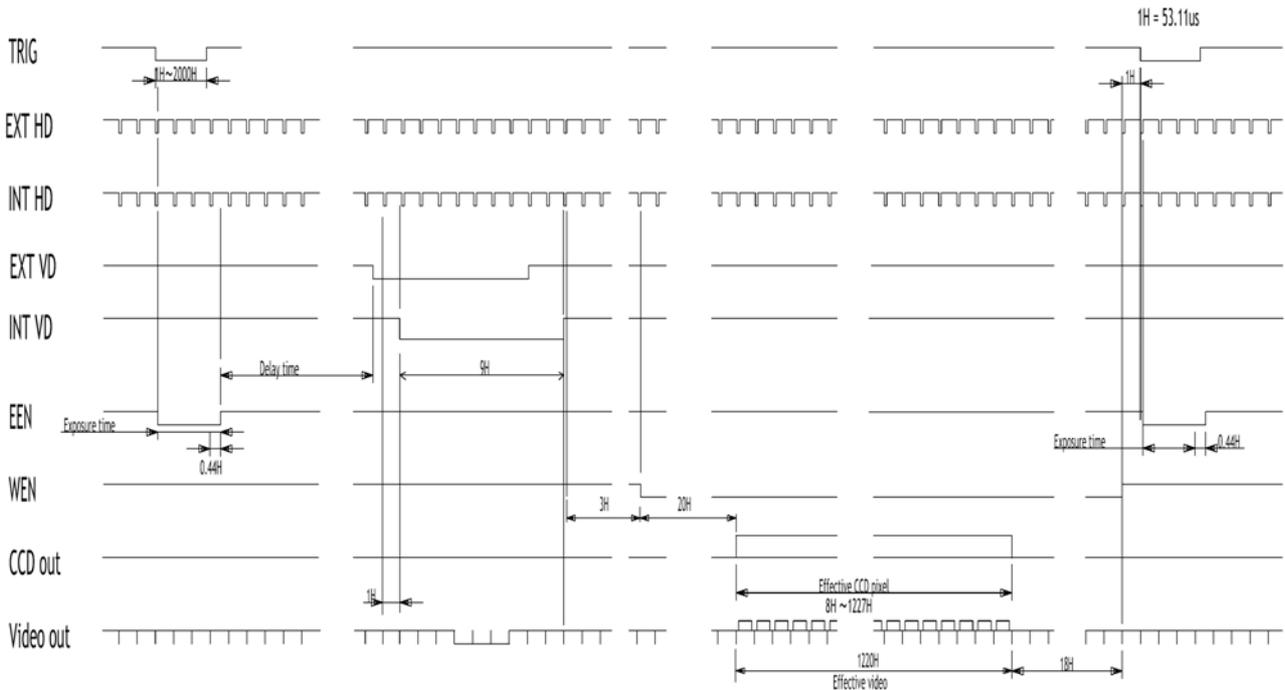


Table showing the figures for the different modes.

Binning	(CCD array line #)	Effective video lines
Normal	8 to 1227	1220H
V binning	26+27 to 1212+1213	594H

Fig. 21. Frame Delay read out mode

### 6.8. Long Time Exposure Mode

The exposure time is the interval between 2 external VD pulses sent to the VD input. The exposure starts after the input of a VD, and it ends after the next VD input, which again starts a new exposure. The interval between the external VD pulses (exposure time) can be from V to ∞. Thermal and dark current noise will increase by accumulation time, therefore the exposure time is not recommended to exceed 2 seconds (or 30 V periods). The external applied sync system should follow the camera scan system.

The long time exposure is a continuous process where each external VD pulse will synchronize the camera, stop an exposure, start a new exposure and read out the previous accumulated video signal.

A WEN pulse indicates that the resulting video is being read out.

To use this mode:

- Set function: Trigger mode "Long Time Exposure" TR = 4  
 Polarity and other functions
- Input: Ext. VD to pin 7 on 12-pin connector.  
 Ext. HD to pin 6 on 12-pin connector. (If used).

**Important notes on using this mode.**

- Depending of the temperature, it is not recommended to use integration time >2 sec.
- External sync system should follow the camera sync system.

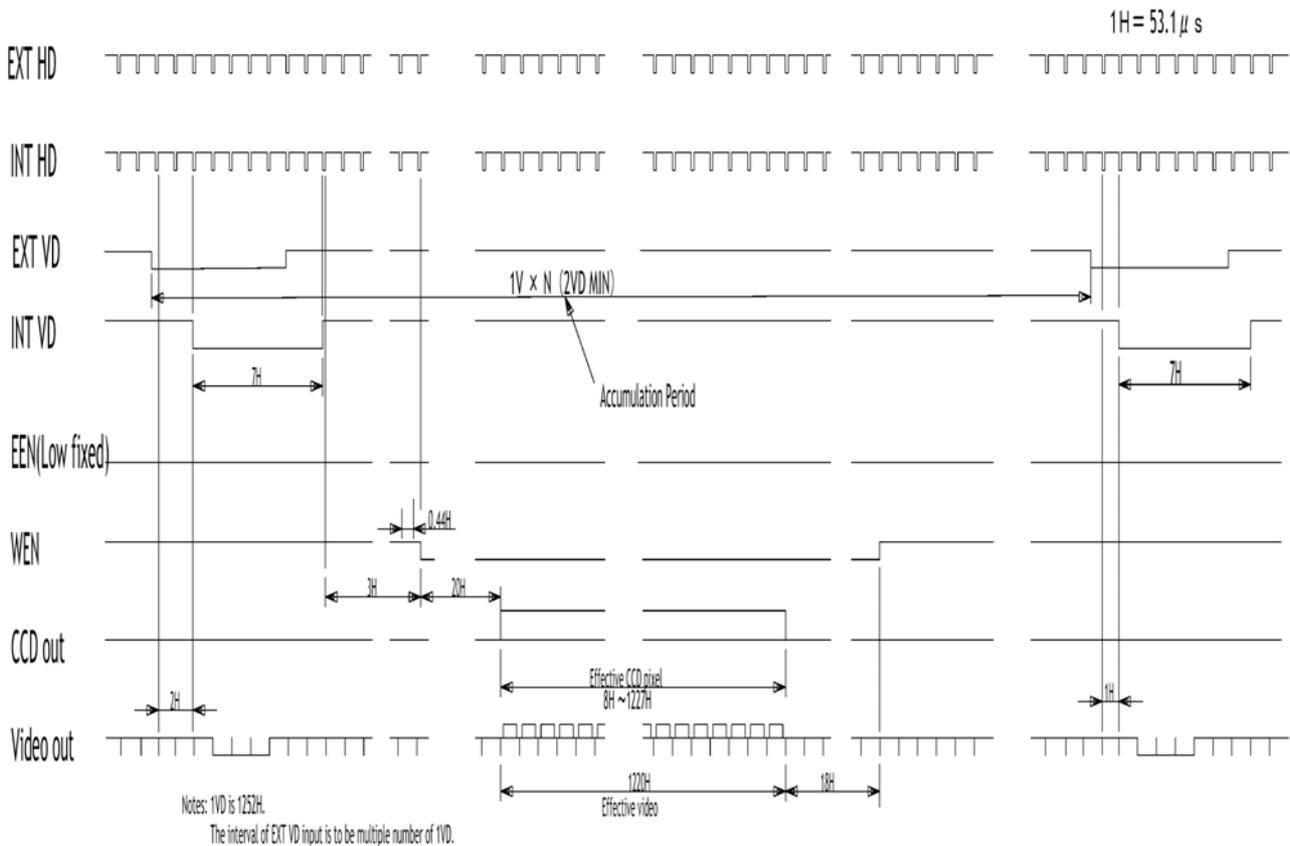


Fig. 22. Long time exposure

### 6.9. Start/Stop Mode

The exposure is controlled by the interval between the external trigger pulse and an external VD pulse. The exposure start at the first HD pulse after the trigger leading edge, and it stops after the rising edge of the VD. An EEN pulse will indicate the active accumulation time, and a WEN pulse indicates that the resulting video is being read out.

The shortest exposure time in this mode is >1.44H.

The longest exposure time is <2000 H.

To use this mode:

- Set function: Trigger mode "Start/Stop Mode" TR = 5  
 Polarity and other functions
- Input: Ext. trigger to pin 5 on 6-pin connector (or pin 11 on 12-pin con.).  
 Ext. VD to pin 7 on 12-pin connector.  
 Ext. HD to pin 6 on 12-pin connector. (If used).

**Important notes on using this 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 in fig. 18.
- The duration of the trigger should be >1H.
- External sync system should follow the camera sync system.
- A new trigger must not be applied before WEN is high.
- *In trigger modes there are no continuous VD out, only after each trigger input.*

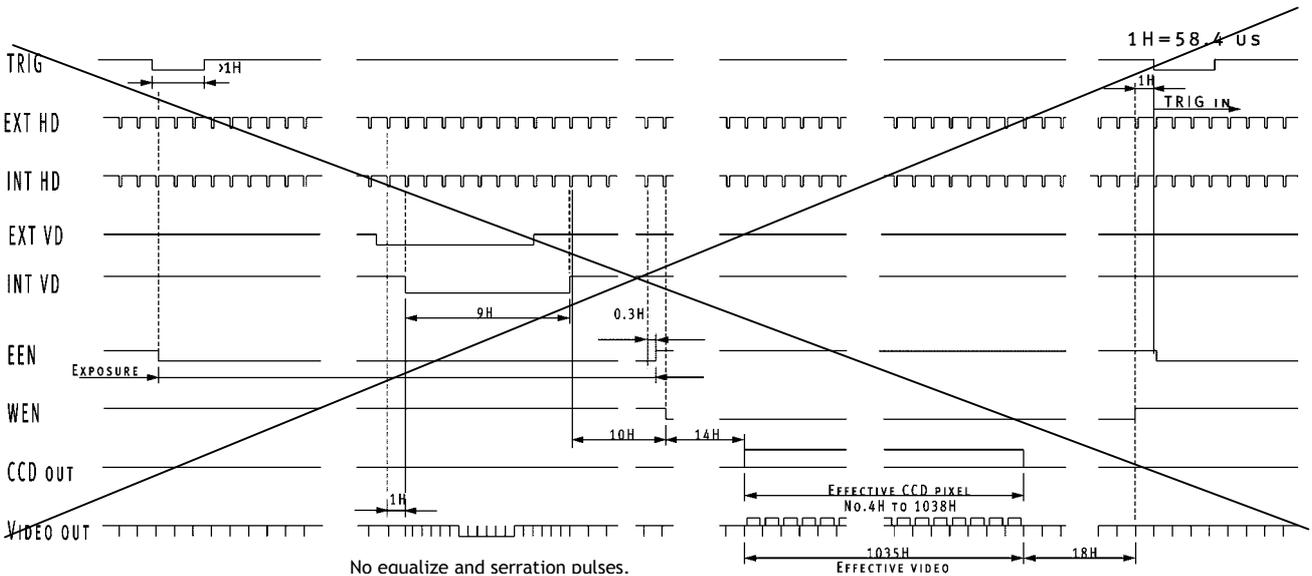


Fig. 23. Timing for Start/Stop mode

Timing shown for CV-A1.  
 A2 timing for start/stop under construction!

### 6.10. Smearless Mode

This mode will reduce the unwanted smear signal from a highlighted scene when a short exposure time is used. The trigger mode is like edge pre-select, but a dummy readout is performed before the active accumulation is started. It will remove the smear above the highlighted parts in the image, but there is still smear left below highlighted areas. The trigger leading edge will start the dummy readout. It takes 64 H before the exposure starts. The exposure stops and the resulting video signal is read out after the selected shutter time. It can be the 10 step normal or 2047 step programmable. SM=0 or SM=1. This mode will operate with full and partial scanning and with V binning modes. If partial scanning and binning is selected at the same time, partial scanning will have priority. An EEN pulse will indicate the active accumulation time, and a WEN pulse indicates that the resulting video is being read out.

To use this mode:

Set function: Trigger mode "Smearless read out" TR = 6  
 Shutter mode "Normal" or "Programmable" SM=0, SM=1  
 "Shutter Speed" SH=0 through 10  
 "Programmable exposure" PE=1 through 2047  
 Polarity and other functions

Input: Ext. trigger to pin 5 on 6 pin connector (or pin 11 on 12-pin connector).  
 Ext. HD to pin 6 on 12-pin connector. (If used).

**Important notes on using this 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 in fig. 18.
- The duration of the trigger should be >1H
- A new trigger must not be applied before WEN is high.
- *In trigger modes there are no continuous VD out, only after each trigger input.*

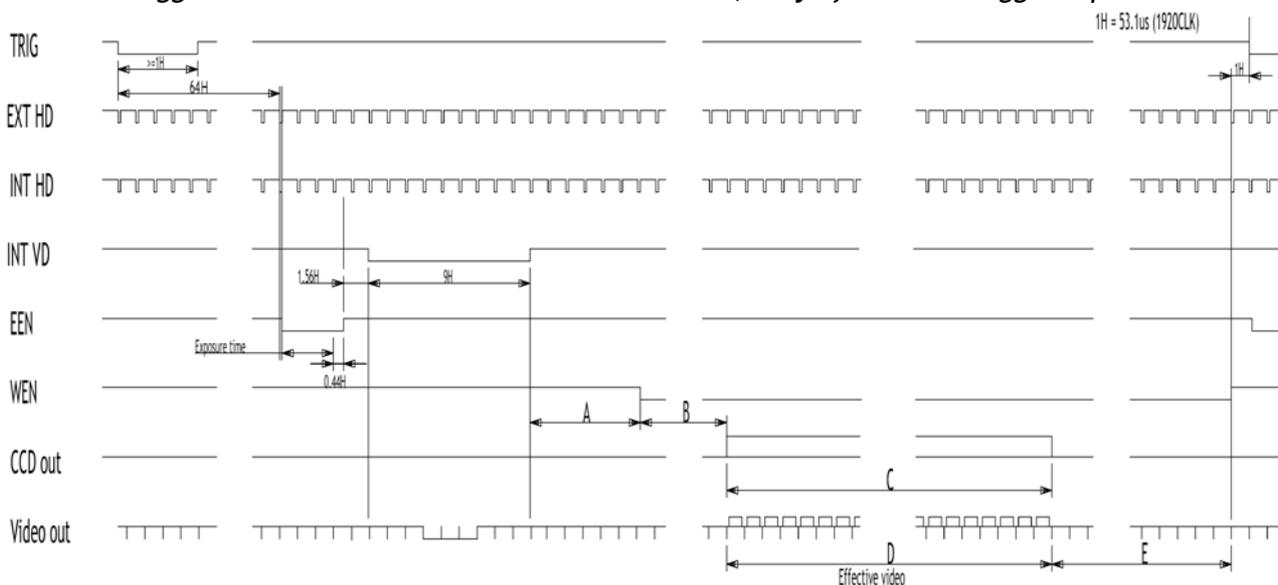


Table showing the figures for the different modes.

Scan mode	A	B	C CCD array line #	D Effective video	E	Max frame rate fps	Remarks
Full	3H	20H	8 to 1227	1220H	18H	15	
1/2 Partial	21H	36H	314 to 923	610H	29H	28	
1/3 Partial	21H	36H	415 to 822	408H	29H	40	
1/6 Partial	21H	36H	517 to 720	204H	29H	70	
V binning	3H	20H	26+27 to 1212+1213	594H	18H	30	

Fig. 24. Smearless Mode

### 6.12. Sensor Gate Control

This mode is for applications with strobe flash illuminations or long time accumulations up to several frames. In this mode the camera is running continuously with shutter off.

The internal Sensor Gate SG in line #14 after the falling VD edge stops the accumulation in the photo diode array, and transfer the accumulated charge the vertical ccd register for readout.

If this internal SG is disabled, the accumulation will continue during the next frame. The resulting video will be read out as a full frame after the first valid internal SG pulse.

To inhibit the internal SG pulse and continue the accumulation, the external sensor gate control signal should be low during line # 14 (after the falling VD edge). The sensor gate control signal can be synchronized by the VD signal.

For video out timing details, refer to fig. 15. - 16.

To use this mode:

Set function:	Trigger mode to "Normal".	TR=0
	Sensor Gate select to "sensor gate"	SG=1
	Scanning	SC=0
	Shutter	SH=0
	Other functions and settings	
Input:	Ext. SG control to pin 5 on 6 pin connector (or pin 11 on 12-pin connector).	
connector).	Ext. HD in on pin 6 on 12-pin connector.	(If used).
	Ext. VD in on pin 7 on 12-pin connector.	(If used).

**Important notes on using this mode**

- External sync system should follow the camera scanning system.
- 

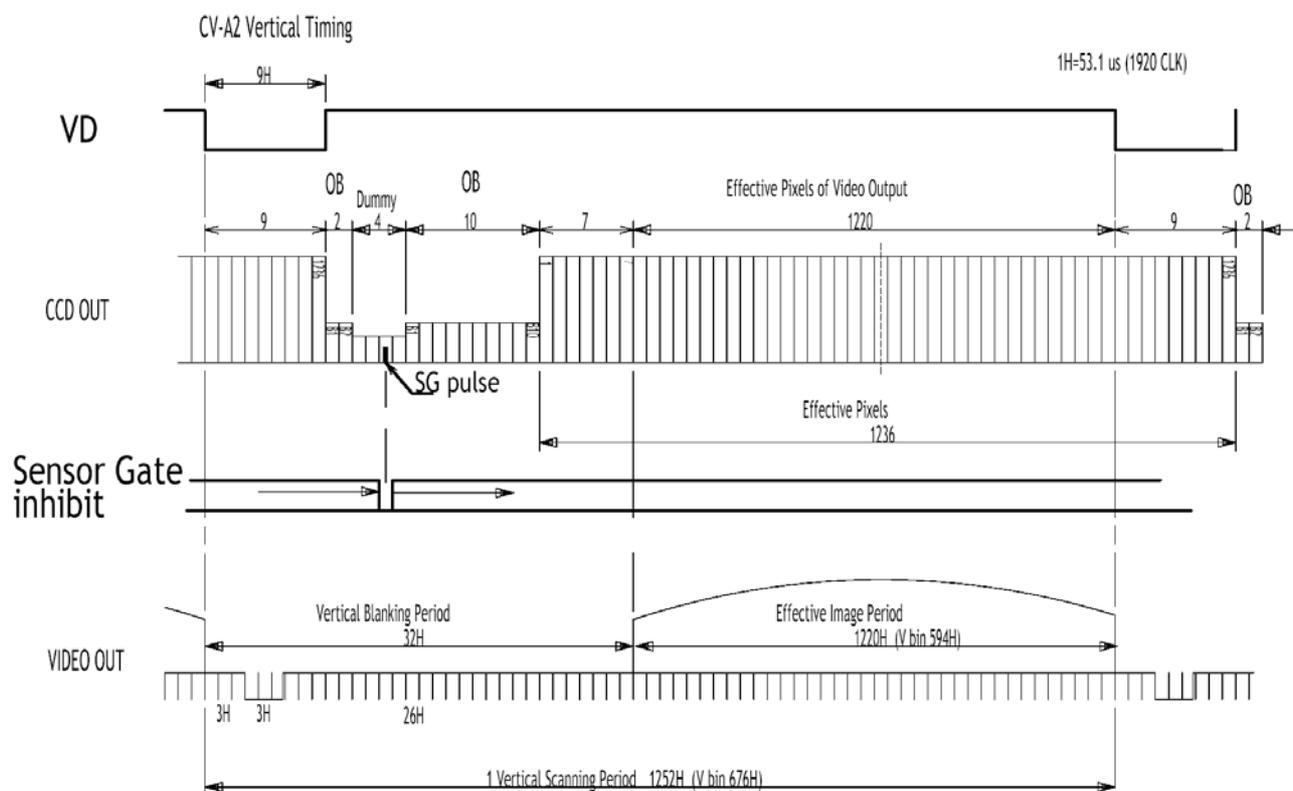


Fig. 25. Vertical timing for Sensor Gate Control

### 6.13. Other Functions.

Here a short description of functions not covered in the previous chapters.

#### **Scanning.** *SC=0 through 3.*

The CCD scanning format can be selected between full or partial scanning. With partial scanning only the vertical central part of the CCD sensor is read out with a higher frame rate. The partial scan is done by a fast dump read out of the lines in the vertical ccd register down to the top of the partial image. This central part of the image is read out with normal speed. The lines below the partial image is read out and dumped with a high speed. With partial scan in continuous and RCT mode, the shutter speed is limited to be shorter than the frame read out time. There is no limitation in trigger modes.

#### **Trigger mode.** *TR=0 through TR=6.*

#### **Smearless readout.** *TR=6.*

This function will reduce the unwanted smear signal from a highlighted scene when a short exposure time is used. It works like EPS modes, but a dummy readout is performed before the active accumulation is started. It will remove the smear above the highlighted parts in the image, but there is still smear left below highlighted areas.

The trigger leading edge will start the dummy readout. It takes 64 lines before the exposure starts. The exposure stops and the resulting video signal are read out.

#### **Shutter mode.** *SM=0, SM=1 and SM=2. SH=0 through SH=15 and PE=1 through PE=1250.*

With SM=0 this function selects the shutter from the 15 fixed steps (SH).

With SM=1 from programmable in 1250 steps (PE). (For EPS modes 2047 steps.)

SM=2 is auto shutter. The auto shutter range is from OFF to 1/12,000. The reference setting for auto shutter is common with the AGC reference. AG=0 through AG=1023. Together with the AGC function it will keep the video output constant over a wide range of illumination. The AGC gain is raised when the shutter has reached OFF. Manual gain can also be used in auto shutter mode. Auto shutter will work in continuous mode. (*TR=0*).

*Do not use auto iris lens together with the auto shutter function. The camera may be unstable.*

#### **Binning.** *BI=0 through BI=1.*

Binning mode is a function where the signal charge from 2 or more adjacent pixels are added together and read out as one pixel. A resulting full frame with lower spatial resolution can be read out with a higher rate, and higher sensitivity. (Refer to 6.1. Basic functions.)

Lowest shutter speed is reduced to be shorter than the frame read out time. There is no limitation in trigger modes.

Binning is only described for full frame modes. (*SC=0*).

#### **Sync signal.** *SO=0, SO=1.*

Off will remove the composite sync signal from the video signal. (BNC and pin #4/12)

#### **Pixel clock.** *PC=0, PC=1.*

Set to on if the pixel clock is used. To avoid interference, the pixel clock out should be off when not used.

#### **EEN/WEN output.** *EW=0, EW=1.*

Will select EEN or WEN signal to be output on pin #6 on 6-pin connector.

#### **Trigger polarity.** *TP=0, TP=1.*

The active trigger polarity is normal low (*TP=0*). It can be invert it to active high (*TP=1*).

#### **WEN polarity.** *WP=0, WP=1.*

## CV-A2

Will invert the WEN output signal. Normal WEN active is low.

### **Sensor Gate.** *SG=0, SG=1.*

The trigger input can also be used as sensor gate control in continuous mode with shutter off. SG=1, SM=0 and SH=0. The SG signal will inhibit the accumulated signal in the photo diode array to be transferred to the vertical register for read out. The accumulation will continue until the first VD after SG goes high. Normal is trigger mode SG=0.

### **Sensor Gate polarity.** *SGP=0, SGP=1.*

Will invert the sensor gate control function. SGP=1 is normal active low.

### **Iris select.** *IS=0, IS=1.*

This function select which signal should be output on pin #4 on the 12 pin connector. Note that this output is ac coupled. It should not be terminated with 75Ω.

If IS=0, the normal video signal is output with or without composite sync. It should not be used as primary video output. If IS=1 the iris video is output.

### **Iris video output.**

The iris video output in pin #4 on 12 pin HR is 700 mV for 100% video out at gain = 0. (>930 mV for saturation). The iris video signal is without sync. The iris video signal can be used for auto iris lens drive in continuous mode. TR=0.

**!! Do not use the auto shutter (CCD iris) function together with an auto iris lens. It may result in an unstable regulation !!**

### **Gain and analogue settings.**

**!! Do not adjust these settings unless you have knowledge to video adjustments!**

### **Gain settings.** *AS=0, AS=1.*

The video gain can be selected between manual gain (AS=0), or AGC (AS=1). Manual gain is set either by the gain level command (GA=-64 through GA=191) if RP=0, or the rear potentiometer if RP=1. The reference level for the AGC is set by the AGC reference level AG=0 through AG=1023. In AGC mode the video level is kept constant (normal 700 mVpp ±30 mV) by the automatic gain control circuit within a 12 dB range. Together with the auto shutter function (SM=2), it will keep the video output constant over a wide range of illumination. For continuous mode only.

### **Black level.** *BL=0 through BL=255.*

Black level (or set-up level) will set the video level for black. Normal 20 mVpp ±2 mv.

### **White clip level.** *WC=0 through WC=255.*

For adjusting the wanted white clip level. Normal 800 mVpp ±30 mv.

**Note! The clip level can be slightly reduced if GA is -64.**

### **Mode and function matrix.**

The following table shows which functions will work in the different modes for CV-A2.

Mode	Func. TR=	Shutter SM=			Part. s SC=	Binning BI= 1	Gain AS=		Ext sync		Iris video	Sensor Gate SG=1	Trig SG=0	Remarks
		0	1	2			0	1	VD	HD				
Cont.	0	√	√	√	√	√	√	√	√	√	√	√*	x	* SM=0. SH=0
EPS	1	√	√	x	√	√	√	x	x	√	-	x	√	
PWC	2	-	-	-	√	√	√	x	x	√	-	x	√	
FDRO	3	-	-	-	x	√	√	x	√	√	-	x	√	
LONG	4	-	x	x	x	√	√	x	√	√	-	x	x	
St/St	5	-	-	-	x	√	√	x	√	√	-	x	√	
SmLe	6	√	√	x	√	√	√	x	x	√	-	x	√	

√ = ok,    - = no function,    x = not allowed

## 6.14. Request Functions.

The following commands are for identification and help.

Fig. 26. shows some printout examples from a PC running terminal emulator software. (Hyper terminal). Status, version, camera ID, model name, user ID and the help list are shown.

Please refer to chapter 7.1. RS-232C control and chapter 7.2. CV-A2 Command List.

### **Echo Back. EB=1.**

If on, the camera will echo back the RS-232C transmission.

### **Status. ST.**

If received, the camera will send back its current setting for all functions. Refer to fig 35.

### **Help. HP.**

If received, the camera will send back a help list for all functions. Refer to fig 35.

### **Version Number. VN.**

If received, the camera will send back its firmware version number as a 3 digits number.

### **Camera ID. ID.**

If received, the camera will send back its ID, which is a manufacturing code.

### **Model Name. MD.**

If received, the camera will send back its model name.

### **User ID. UD.**

With this command, the user can program and store up to 16 characters for identification.

### **RS232C Baud Rate. BDRT=1 through 3.**

It is possible to change the communication speed from 9600 Baud to a higher speed. The new selected speed will be effective after next power up.

## 6.15. Save and Load Functions.

The following commands are for store and load camera settings in the camera EEPROM.

### **Load settings. LD.**

This command will load previous stored settings to the camera. 3 user settings can be stored in the camera EEPROM. 1 factory setting is also stored in the camera. The settings stored in the last used user area is used as default settings at power up.

### **Save Settings. SA.**

This command will store the actual camera settings to 1 of the 3 user area in the camera EEPROM.

### **EEPROM Area. EA.**

If received, the camera will return the last used user area number.

```

eb=1
COMPLETE
VN?
VN=7
id?
ID=
MD?
MD=CV-A2
UD?
UD=JPTA2nr13

st?
SM=0
SH=0
PE=1250
SC=0
BI=0
TR=0
SO=1
PC=0
EW=0
TP=0
WP=0
AS=0
AG=600
GA=0
RP=0
BL=106
WC=86
SGP=0
SG=0
IS=0

HP?
*** CV-A2 CV-A2 Camera Control Help List *****
EB(Echo Back): 0=off, 1=on
ST(Status Request): return the all settings
VN(Firmware Version): return the version no. of firmware
ID(camera ID): return the camera ID (10 characters)
MD(model name): return the model name (max 10 characters)
UD(camera UD): free text for user (max 16 characters)
SM(Shutter Mode): 0=normal shutter, 1=programmable exposure
                2=auto shutter
SH(Shutter Speed): 0=1/off, 1=1/30, 2=1/60, 3=1/100, 4=1/250
                  5=1/500, 6=1/1k, 7=1/2k, 8=1/4k, 9=1/8k
                  10=1/20k, 11=1/40k, 12=1/80k, 13=1/120k, 14=1/160k
                  15=1/200k
PE(Programmable Exposure): 0 - 1250
SC(Scanning Format): 0=full frame, 1=1/2 partial, 2=1/3, 3=1/6
BI(Binning): 0=off, 1=vertical,
TR(Trigger Mode): 0=normal, 1=edge, 2=PWC, 3=frame delay readout
                  4=long time exposure, 5=start-stop, 6=smeardless(edge)
SO(Sync Signal): 0=off, 1=on
PC(Pixel Clock): 0=off, 1=on
EW(EEN/WEN): 0=EEN, 1=WEN (connector HR6-pin6)
TP(Trigger Polarity): 0=active low, 1=active high
WP(WEN Polarity): 0=active low, 1=active high
AS(AGC Select): 0=AGC off(manual), 1=AGC on
AG(AGC Level): 0 - 1025
GA(Manual Gain Level): -64 - 191
RP(Rear Potentiometer): 0=off(remote), 1=on
BL(Black Level): 0 - 255
WC(White Clip Level): 0 - 255
SGP(Sensor Gate Invert): 0=normal, 1=invert
SG(Sensor Gate Select): 0=trig mode, 1=sensor gate control
IS(Iris Select): 0=video out, 1=iris video out
LD(Load settings from EEPROM): 0=factory, 1=user1, 2=user2, 3=user3
SA(Save settings into EEPROM): 1=user1, 2=user2, 3=user3
EA(Eeprom current area no.): return the current area no. of eeprom
*** Firmware Version 0.07 ***** Copyright(c) 2004 JAI Corporation *****

```

Fig. 26. Terminal printout of ID, status and Help for CV-A2.

## 7. Configuring the Camera

### 7.1. RS-232C control.

All configuration of the A2 camera is done via the RS-232C port. The camera can be set up from a PC running terminal emulator software, or using JAI's camera control software.

Below is the description of the ASCII based short command protocol.

#### Communication setting.

Baud Rate *)	9600 bps	RS 232C cable <b>CAMERA</b> TXD — 2 RXD RXD — 3 TXD GND — 5 GND 7 RTS 8 CTS 9 CI
Data Length	8 bit	
Start Bit	1 bit	
Stop Bit	1 bit	
Parity	None	
Xon/Xoff Control	None	

\*) Baud rates can be changed by RS232C commands. (9600bps to 38400 bps.)

#### Protocol.

Transmit setting to camera:

**NN=[Parameter]<CR><LF>** (NN is any kind of command. Capital or small letters.)

To have all communication visible on the emulator screen, start with:

**EB=1<CR><LF>**

The camera answers:

**COMPLETE<CR><LF>**

Transmit the following to have the actual parameter for a command:

**NN?<CR><LF>** (NN is any commands with parameters.)

The camera answers: **NN=[Parameter]**

Transmit the following to have the camera actual setting:

**ST?<CR><LF>**

The camera returns the actual parameter settings.

Transmit the following to have a command list:

**HP?<CR><LF>**

The camera returns a complete command list.

Invalid parameters send to camera: (99 is an invalid parameter)

**SH=99<CR><LF>**

The camera answers:

**02 Bad Parameters!!<CR><LF>**

To see firmware number.

**VN?<CR><LF>**

To see camera ID. It shows the manufacturing lot number.

**ID?<CR><LF>**

## 7.2. CV-A2 RS-232C command list.

	Command Name	Format	Parameter		Remarks
<b>A - General settings and useful commands</b>					
EB	Echo Back	EB=[Param.]<CR><LF>	0=Echo off	1=Echo on	Off at power up
ST	Camera Status request	ST?<CR><LF>			Actual setting
HP	Online Help request	HP?<CR><LF>			Command list
VN	Firmware version	VN?<CR><LF>			3 letter version
ID	Camera ID request	ID?<CR><LF>			10 characters
MD	Model name request	MD?<CR><LF>			≤10 characters
UD	User ID	UD=[Param.]<CR><LF>	Save and load user text		≤16 characters
BRDT	RS232C Baud Rate	BRDT=[Param.]<CR><LF>	0=9600 2=38400	1=19200	Rate will be active at next power up
<b>B - Timing and shutter related commands</b>					
SC	Scanning format	SC=[Param.]<CR><LF>	0=full frame 2=1/3 partial	1=1/2 partial 3=1/6 partial	SC=1-3 only with BI=0 and TR=0-2 and TR=6
TR	Trigger mode	TR=[Param.]<CR><LF>	0=normal 2=Pulse width 4=Long time 6=Smearless EPS	1=Edge 3=Frame delay 5=Start/stop	
SM	Shutter mode	SM=[Param.]<CR><LF>	0=Normal 2=Auto shutter	1=Programmabl	SM=0-1 only for TR=0, 1, 6 SM=2 only for TR=0
SH	Shutter speed	SH=[Param.]<CR><LF>	0=Off 2=1/60 4=1/250 6=1/1000 8=1/4000 10=1/20,000 12=1/80,000 14=1/160,000	1=1/30 3=1/100 5=1/500 7=1/2000 9=1/8000 11=1/40,000 13=1/120,000 15=1/200,000	All16 step is valid when TR=0. When TR=1, 6 and 7, shutter speeds higher than 9 will result in 1/12,000
PE	Programmable expos.	PE=[Param.]<CR><LF>	0=1.4 H	1250=1250.4 H	H= 53.1µsec 0-2047 for TR=1 and TR=6
BI	Binning	BI=[Param.]<CR><LF>	0=off	1=vertical	BI=1 only with SC=0
<b>C - Signals and polarity</b>					
SO	Sync signal	SO=[Param.]<CR><LF>	0=no sync	1=sync on video	
PC	Pixel clock	PC=[Param.]<CR><LF>	0=no clock out	1=clock out	Should be off when not used
EW	EEN/WEN	EW=[Param.]<CR><LF>	0= EEN out	1=WEN out	Pin #6 on 6 pin connector
TP	Trigger polarity	TP=[Param.]<CR><LF>	0= active low	1= active high	*1)
WP	WEN polarity	WP=[Param.]<CR><LF>	0=active low	1=active high	
SGP	Sensor Gate invert	SGP=[Param.]<CR><LF>	0=active low	1=active high	active low is normal
SG	Sensor Gate select	SG=[Param.]<CR><LF>	0=trig mode	1=sensor gate	SG=1 with TR=0, SM=0 and SH=0
IS	Iris select	IS=[Param.]<CR><LF>	0=video out	1=Iris video out	On pin #4 on 12 pin connector
<b>D - Gain and analogue signals setting</b>					
AS	AGC Switch	AS=[Param.]<CR><LF>	0=AGC off	1=AGC on	0= manual gain. RP=0 or RP=1
AG	AGC Level	AG=[Param.]<CR><LF>	0=low	1023=high	Reference for AGC and auto shutter. AS=1. SM=2
GA	Manual gain Level	GA=[Param.]<CR><LF>	-64=low	191=high	If RP=0. 0 is 0dB.
RP	Rear Potentiometer	RP=[Param.]<CR><LF>	0>manual gain	1=rear pot. on	
BL	Black Level	BL=[Param.]<CR><LF>	0=low	255=high	Range 0 to 255
WC	White clip Level	WC=[Param.]<CR><LF>	0=low	255=high	Range 0 to 255
<b>E - Saving and loading data in EEPROM</b>					
LD	Load settings from camera EEPROM	LD=[Param.]<CR><LF>	0=Factory data 2=User 2 area	1=User 1 area 3=User 3 area	Latest used data area becomes default at next power up
SA	Save settings to camera EEPROM	SA=[Param.]<CR><LF>	1=User 1 area 3=User 3 area	2=User 2 area	
EA	EEPROM area request	EA?<CR><LF>			Return latest used area #

\*1) If positive logic is used (TP=1), the first trigger pulse after power up will be ignored.

**Note for mode setting.**

- With RS232C commands it is possible to set up combinations of mode and functions, which has no meaning, or which can disturb the normal mode function.
- Refer to mode and function matrix on page 22.
- Do not try to use commands or parameters not shown in this list!

### 7.3. Camera Control Tool for CV-A2

From [www.jai.com](http://www.jai.com) Camera Control Tool for Windows 98/NT/2000 can be downloaded. The control tool contains a camera control program and tools for making your own program. For the integrator and experienced user, the Camera Control Tool is much more than a program with a window interface. It also provides an easy and efficient ActiveX interface built for MS Windows 98, ME, NT and 2000. The OCX interface has the ability to connect to the camera using the serial interface of the PC by reading and writing properties for the camera. This integration requires simple programming skills within Visual Basic, Visual C++ or similar languages in a Microsoft Windows environment.

#### 7.3.1. Control Tool Windows

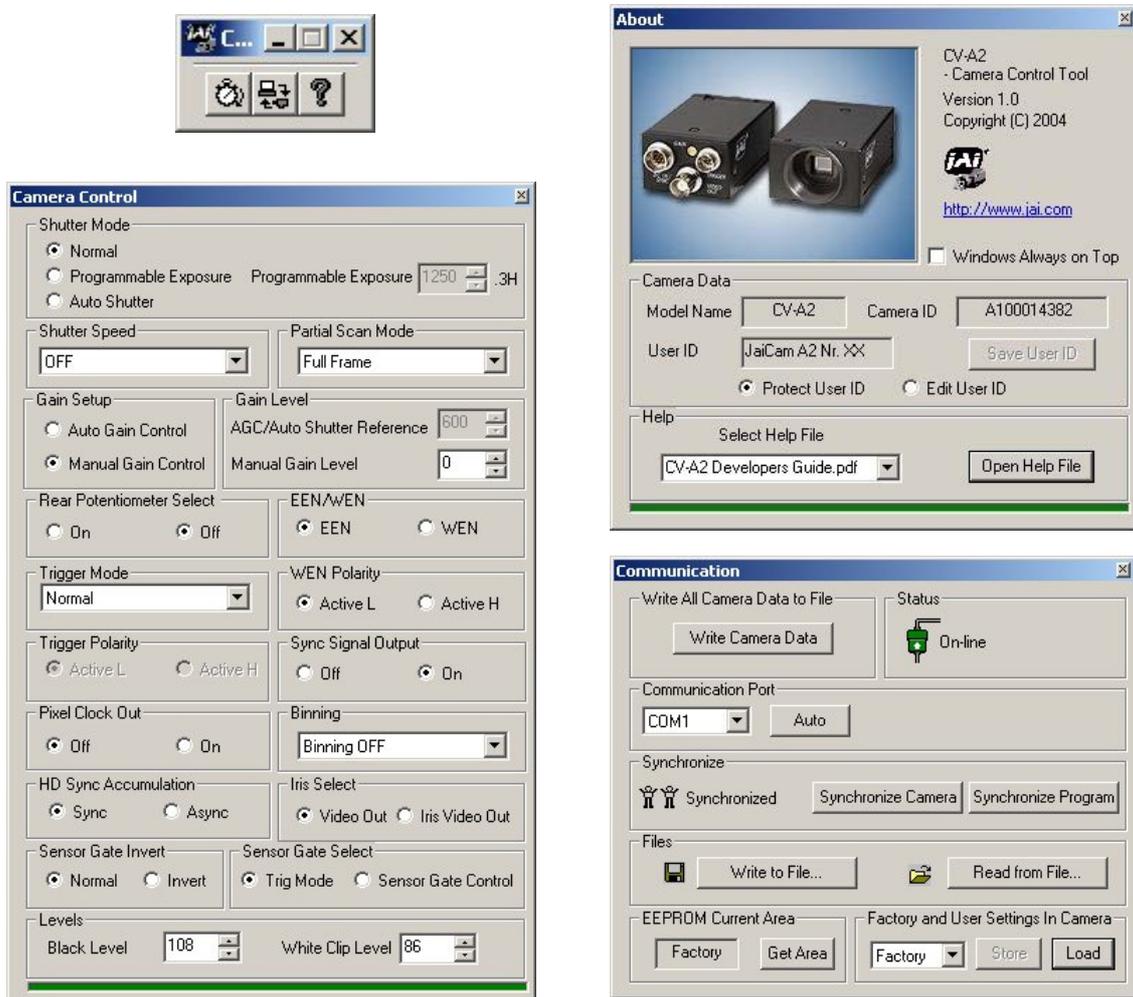


Fig. 27. Windows from Camera Tools.

### 7.3.2. Camera Control Tool Interface

The Camera Control Tool Software is based on a main Tool Bar and a number of associated Tool Windows. Each button in the Tool Bar pops up a separate Tool Window when pressed. The layout of the program can be adjusted by arranging the windows the way it is preferred. The program will store this information and recreate this layout, when the program is restarted.



All Camera Control Tools have a Communication Window and an About Window. The other window(s) contains camera control commands.

#### The About window

The about window contains a picture of the camera and information about the version of the program, Internet connection to JAI A/S and access to the help documents. The List box that contains the help documents will list all files, which have the extension .pdf and that are found in the program (default) folder

<C:\Program Files\JAI A-S\'Control Tool Name>

It is possible to download updated operation manuals from the jai website:

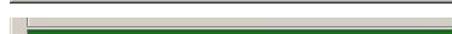
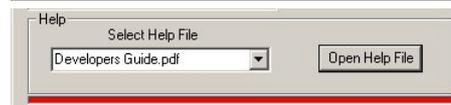
<http://www.jai.com/camera/manuals.asp/sprog=uk>

An updated manual can be saved in the folder address mentioned above and it will automatically be included in the list of help files.

For newer camera models the About Window also shows Model Name, camera ID and User ID. It is possible to edit and save free text in User ID.

At the bottom of the windows (all windows but the Communication Window is a coloured bar. The bar is green when the Camera Control Tool is connected to a camera and the camera is turned on.

The bar is red when the Camera Control Tool is not connected to a camera or when the camera is turned off.



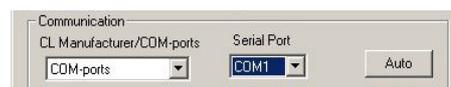
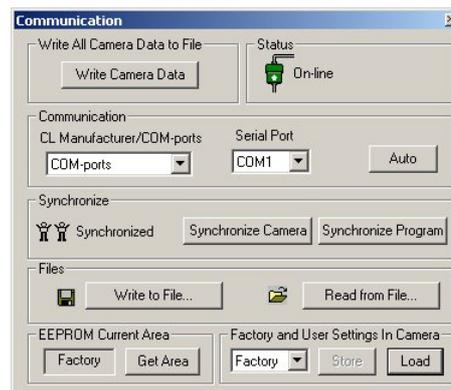
#### The Communication Window

The Communication Window is used to connect the Camera Control Tool with the JAI camera. Depending of camera there are 2 possible ways to communicate with a JAI camera. RS-232:

Select the communication port, where the serial cable is connected from the list box in the 'Communication Port' field, or click the 'Auto' button to search for a camera on communication port 1 to 16. The camera control program automatically sends a camera request on every communication port. The user is prompted to use a communication port if a camera answers the request.

RS-232 and Camera Link:

The Communication Window looks a bit different when it is possible to communicate with the camera using Camera Link and RS-232 com port. The Communication area contains 2 list boxes now.



RS-232 communication:

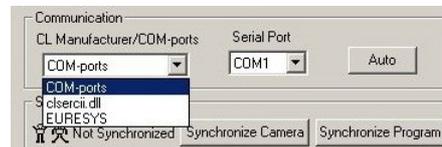
1. Select 'COM-ports' from the 'CL Manufacturer/COM-ports' list Box.
2. Select the communication port, where the serial cable is connected to the camera from the 'Serial Port' list box or click the 'Auto' button to search for a camera on communication port 1 to 16.



The Serial Port list box and the Auto search button are only active when COM-ports is selected.

Camera Link communication:

The 'CL Manufacturer/COM-ports' list box also contains DLL file names (or frame grabber names) for all Camera Link frame grabbers that are installed in the pc. This is done by using a DLL file called "clserial.dll" to upload all frame grabber DLLs that are found in the pc.



Just select the option for the frame grabber that is installed in the pc.

Auto search

Click the auto button to search for a camera on communication port 1 to 16. The camera control program automatically sends camera request on every communication port. The user is prompted to use a communication port if a camera answers the request.

This button is only used for RS-232 communication.

Off/On-line mode

The Camera Control Tool Application can run Offline (without a camera attached) and all functions are fully functional in offline mode.

Off line mode is indicated in The Communication Window, where a status field with graphic and text indicates the on/off-line status.



Changing the selected communication port (from the communication window)

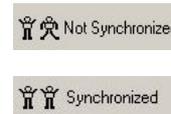
changes the online/off-line status. If a camera is found on the selected communication port the application runs online otherwise offline.

Changing the settings in the application will automatically update the camera settings when the application is online.

If the application loses connection with the camera it will automatically go to offline mode and it is indicated in the communication window.

Synchronize program and camera

The Camera Control software has the ability to synchronize either the camera or the program. Click Synchronize camera to write all settings from the program to the camera or click the Synchronize program to load all settings from the camera to the program.



**Files**

When clicking the Write to File or Read from File button, the user is prompted for a file using a standard file dialog. New files are created if they do not already exist.

Files for camera settings have the extension cam. Information about the communication port is not stored in the files. All settings are automatically sent to the camera when a file has been loaded (if the camera is online).

## Factory and User Settings

Use the Store button to store the current camera settings into the user settings area in EEPROM. Current camera settings are not saved when the camera is turned off. To save current camera settings you have to save them on the available user areas.

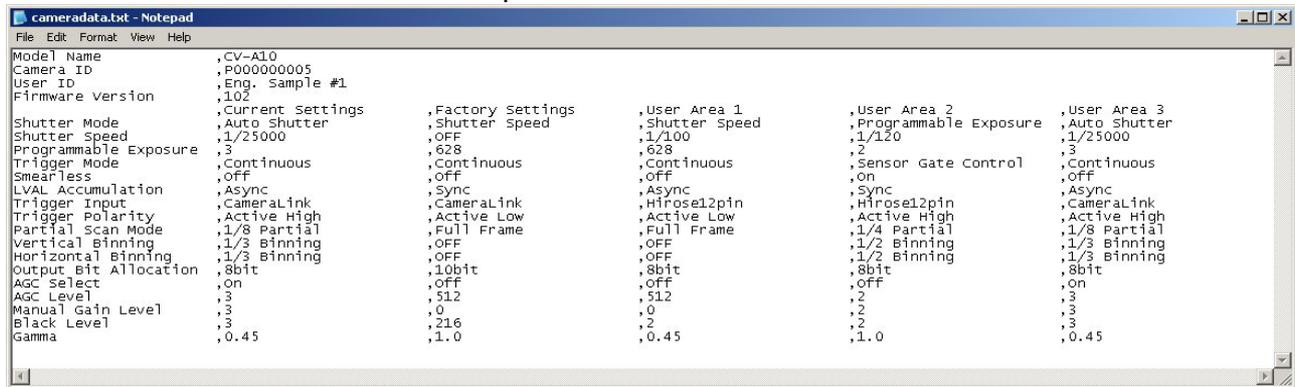
Use the Load button to restore previously saved camera settings from either the Factory or the User EEPROM area.

Write All Camera Data to File.

Click the "Write Camera Data" button to save all camera settings into a text file. The information that can be saved is:

Model Name, Camera ID, User ID, Firmware Version, Current Settings, Factory Settings and the available User Areas.

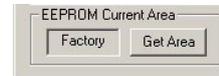
The file is formatted as shown in the picture below:



Note: The shown table is not for the actual camera.

EEPROM Current Area.

Click the 'Get Area' button to read the power up settings area number.



### 7.3.3. Using the Camera Control Tool

Here is some practical information about the Camera Control Tool:

1. The Camera Control Tool bar is always on top of other windows.
2. When you minimize the Camera Control Tool bar all open windows will close.
3. It is possible to work with the Camera Control Tool when the camera is online and when the camera is offline.
4. The newer JAI cameras always start up with the last used user area (but for some old models it will start up with the last saved user area.)
5. The Camera Control Tool saves the last used settings (not the user area), which don't have to be the same as for the last saved user area.
6. The setup file 'CameraName.ini' stores all information about camera settings. When the program is started the last settings for the program are loaded from the file 'CameraName.ini'
7. When you turn on the camera and the Camera Control Tool, it is possible that the Camera Control Tool does not show the actual camera settings (see 4. and 5.).
  - a. To obtain the camera settings click "Synchronize Program".
  - b. To send the settings that are saved in the Camera Control Tool (last used settings) to the camera click "Synchronize Camera".
  - c. To see which area the camera has started up in click "Get Area".

7.4. Internal Jumper Settings

Jumper for pixel clock out. R615. *Factory setting is short.*

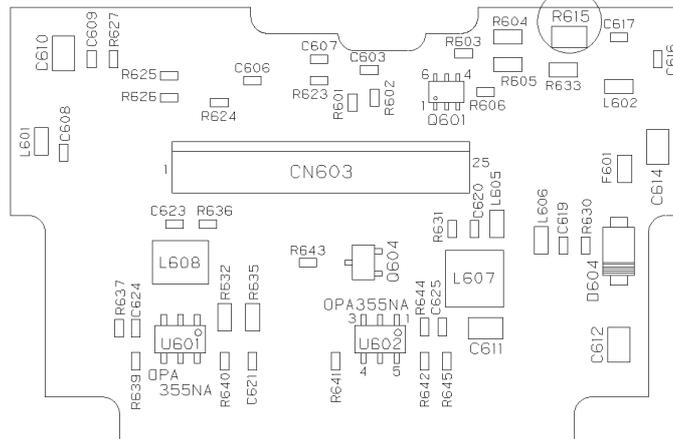


Fig. 28. Jumper position

8. External Appearance and Dimensions

Unit: mm(inch)

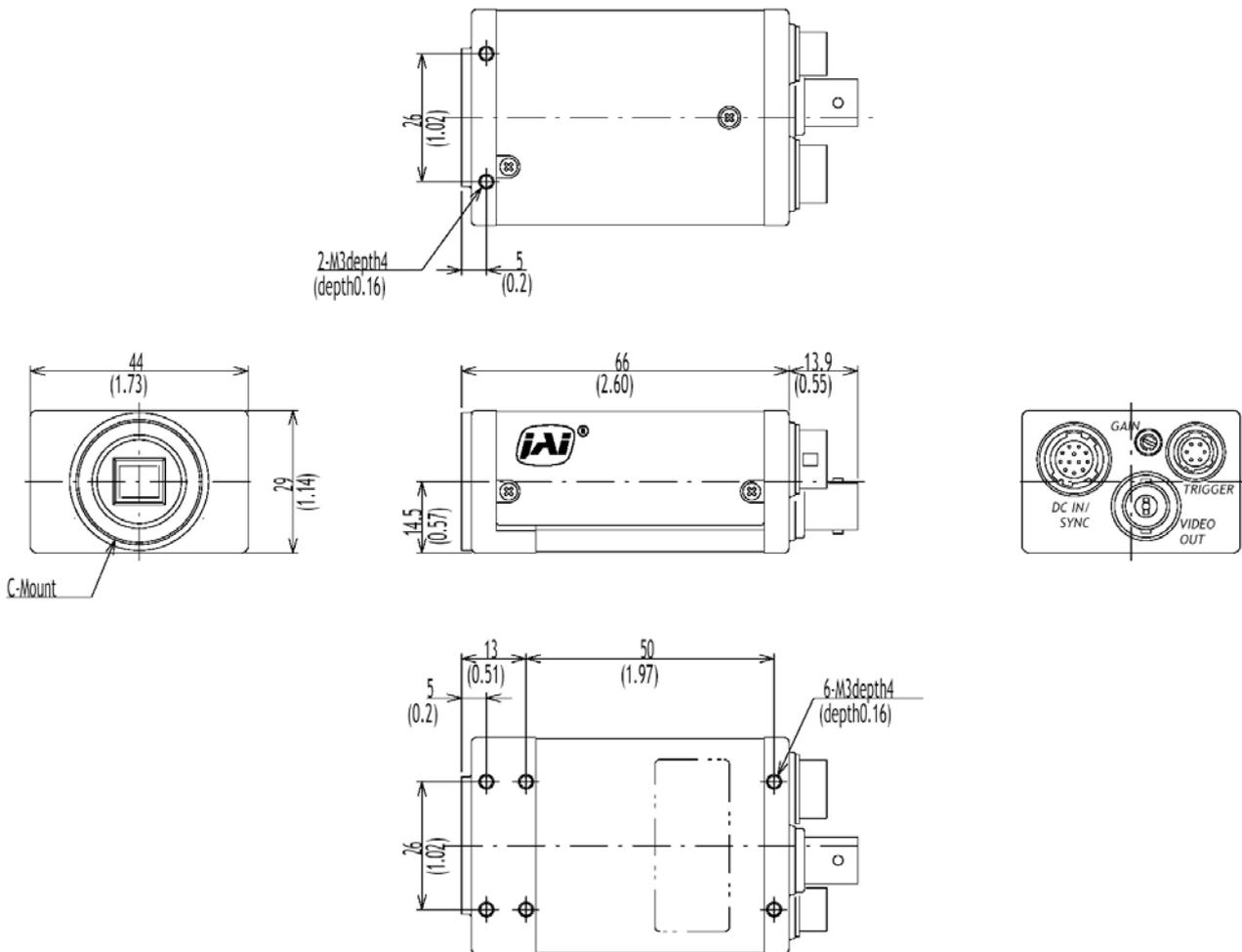


Fig. 29. Dimensions

## 9. Specifications

### 9.1. Specification table

Specifications	CV-A2
Scanning system	Progressive 1252 lines 15 frames/sec.
Pixel clock	36.15 MHz
Line frequency	18.828 kHz (1920 pixel clock/line)
Frame rate for full frame	15 frames/sec. (1252 lines/frame)
CCD sensor	1/1.8" progressive monochrome IT CCD. Sony ICX274
Sensing area for video out	7.13 (h) x 5.37 (v) mm
Effective pixels	1628 (h) x 1236 (v)
Pixels in video output	
Full:	1620 (h) x 1220 (v), 15 fps
Ver. binning:	1620 (h) x 594 (v), 30 fps
1/2 partial	1620 (h) x 610 (v), 15 fps
1/3 partial	1620 (h) x 408 (v), 40 fps
1/6 partial	1620 (h) x 204 (v), 70 fps
Cell size	4.40 (h) x 4.40 (v) $\mu$ m
Sensitivity on sensor	2.5 lux, min gain 100% video 0.3 Lux, Max gain, 50% video
S/N ratio	>50 dB
Video output	Composite VS signal, 1 Vpp, 75 $\Omega$ Video signal 0.7 Vpp (selectable) Iris video out 0.7Vpp
Gamma	1.0
Gain	Manual - Automatic
Gain range	Man. -3 to +12 dB. Aut. -3 to +12 dB
Synchronization	Int. X-tal. Ext. HD/VD or random trigger
External H	18.828 kHz $\pm$ 2%
HD sync. input/output	4 V $\pm$ 2 V, 75 $\Omega$
Trigger input	4 V $\pm$ 2 V, 1k $\Omega$ input impedance
WEN output (write enable)	4 V $\pm$ 2 V, 75 $\Omega$
EEN output (exposure enable)	4 V $\pm$ 2 V, 75 $\Omega$
Pixel clock output	4 V $\pm$ 2 V, 75 $\Omega$
Binning	Full, 2:1 V binning,
Partial scan vertical	Full, 1/2, 1/3, 1/6
Trigger	Continuous, Edge pre-select, Pulse width control, frame delay
Accumulation mode	H synchronized/ (H non synchronized. in PWC and frame delay only)
Shutter speed. Fixed (Full frame only)	1/15, 1/30, 1/60, 1/100, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/8000, 1/20,000, 1/40,000, 1/80,000, 1/120,000, 1/160,000, 1/200,000 second
Shutter speed in trigger modes	Max. 1/12,000 second. (1/12,000 for settings >1/20,000)
Programmable exposure	1.44 H to 1252.44 H in 1 H step
Pulse width control	1 H to 2047 H
Long time exposure	<2 sec. (Interval between ext. VD)
Start/stop exposure	1 H to - 2000 H. (Time from trigger to ext. VD)
Frame delay readout PWC	1 H to 2047 H
Delay	< 2 seconds (Time from PWC trigger input to ext. VD input.)
Smearless readout	For edge pre-select mode only
Functions controlled by internal DIP switches	VD input/output, HD input/output HD, VD 75 $\Omega$ termination on/off
Functions controlled by RS 232C short commands	Shutter speed, shutter mode, Trigger mode, Readout mode, polarity, Sync. on/off, Programmable exposure, Gain levels, timing signals and polarity
Communication Baud rate	9600, 19200, 38400 bps
Operating temperature	-5°C to +45°C
Humidity	20 - 80 % non-condensing
Storage temp./humidity	-25°C to +60°C/20 % -80 % non-condensing
Vibration	10G (20Hz to 200Hz XYZ)
Shock	70G
EMC	CE (EN50081-1 and 50082-2). FCC Part 15 Class B
Power	12V DC $\pm$ 10%. 2 W
Lens mount	C-mount
Dimensions	29 x 44 x 66 mm (HxWxD)
Weight	150g

## 9.2. Spectral Sensitivity

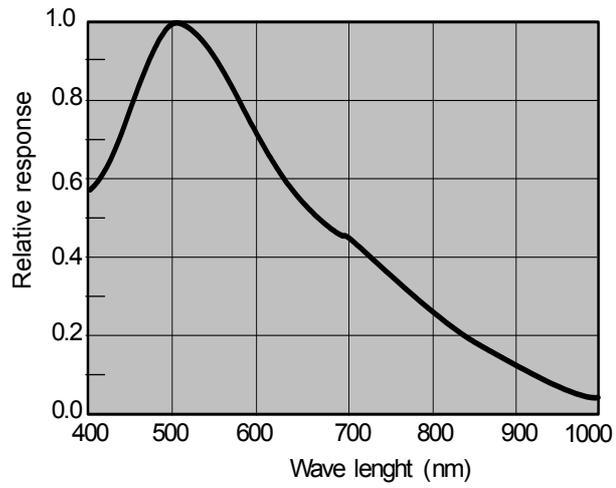


Fig. 30. Spectral sensitivity

## 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. 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.

Power off the camera during any modification such as changes of jumper and switch setting.

### 10.2. 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

All cameras produced are shipped in the condition that no blemished of CCD sensor are visible. In general, the CCD sensor can be affected by radiation, which makes photo diode defective and as the result, the CCD sensor will have blemishes. Be careful not to expose the camera by radiation during transportation and storage.

Since we learned that air shipment can cause blemishes by radiation, we recommend to use sea shipment instead.

Some pixel defects can occur, but this does not have an 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.

## 11. Users Record

Camera type: CV-A2  
Revision: (Revision A)  
Serial No. ....

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Users Mode Settings

Users Modifications



**DECLARATION OF CONFORMITY**  
AS DEFINED BY THE COUNCIL DIRECTIVE  
89/336/EEC  
EMC (ELECTROMAGNETIC COMPABILITY)  
WE HEREWITH DECLARE THAT THIS PRODUCT  
COMPLIES WITH THE FOLOWING PROVISIONS APPLYING TO IT.  
EN-50081-1  
EN-50082-1

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