



*Digital Monochrome and Color  
Progressive Scan Cameras*

***CV-A10 CL***

***CV-A70 CL***

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# ***Operation Manual***

*Camera: CV-A10CL Revision C*

*CV-A70CL Revision C*

*Manual: Version 1.3*

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### 1. General

***This manual will cover the digital monochrome progressive scan camera CV-A10 CL, and its color version, CV-A70 CL.***

The CV-A10CL is a Camera Link successor for the CV-M10BX/RS cameras. The progressive scanned CV-A10CL has a single digital video output as Camera Link. The frame rate for full frame is 60 fps. Functions like partial scanning and horizontal and vertical binning allows higher frame rates.

The color version CV-A70 CL is based on a CCD sensor with primary RGB Bayer mosaic filter. CV-A10 CL/A70 CL is a compact monochrome progressive scan camera designed for automated imaging applications. The 1/2" CCD with square pixels offers a superb image quality. The high-speed shutter function and asynchronous random trigger mode allows the camera to capture high quality images of fast moving objects.

CV-A10CL and CV-A70CL has been updated to revision B. Some boards have been redesigned. Revision C has updated circuits and construction for better performance.

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-A10 CL and CV-A70CL can be downloaded from: [www.jai.com](http://www.jai.com)

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

### 2. Standard Composition

The standard camera composition consists of the camera main body.

The camera is available in the following version:

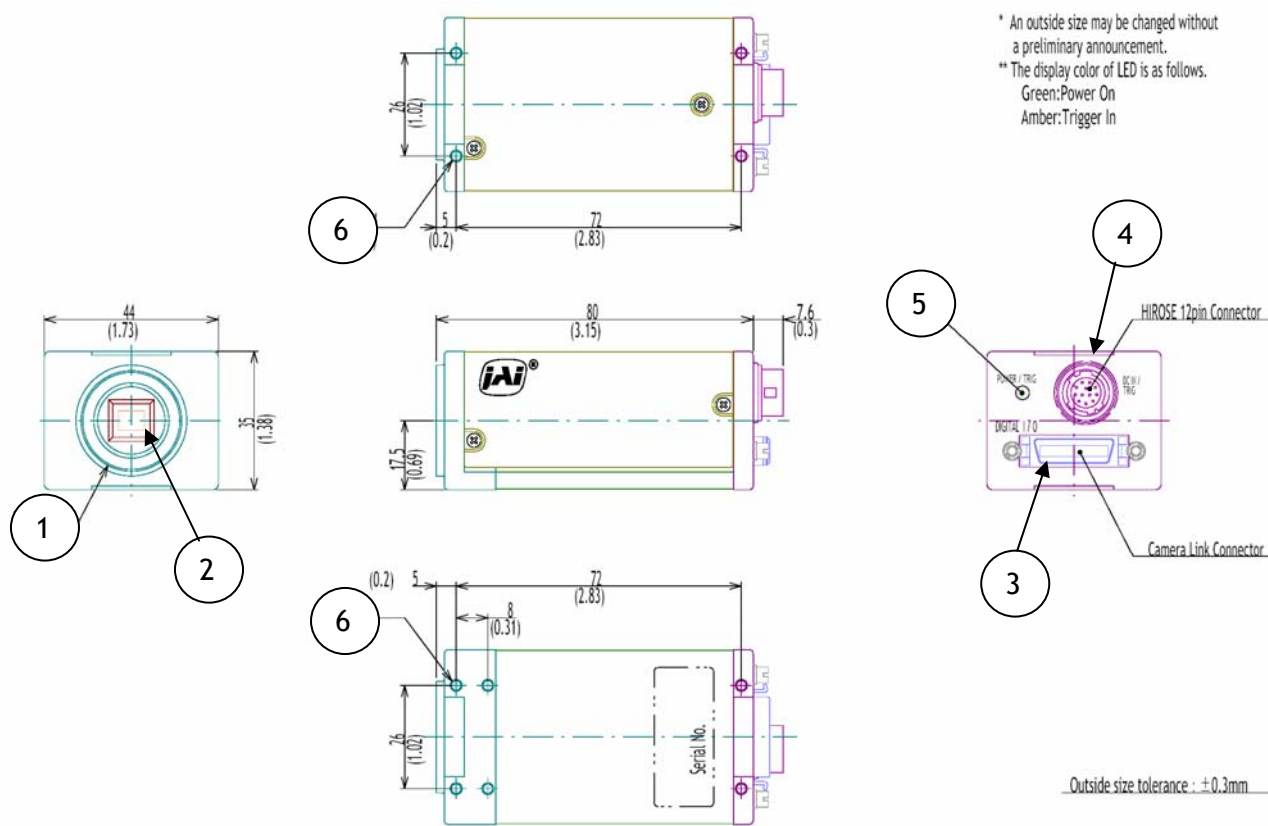
CV-A10 CL. Monochrome progressive scan camera.

CV-A70 CL. Color progressive scan camera.

### 3. Main Features

- 1/2" progressive scan monochrome and color camera
- Camera Link equivalent for the popular CV-M10
- 782 (h) x 582 (v) 8.3µm square pixels
- 60 fps 768 (h) x 576 (v) by single channel progressive read out
- 250 fps 768 (h) x 71 (v) with 1/8 partial scan
- Color version with Bayer RGB mosaic for host PC RGB color-coding. A70
- Vertical and horizontal binning for higher frame rates and sensitivity. A10
- High speed shutter from 1/60 to 1/300,000 second
- 8 or 10 bit output via Camera Link
- Edge pre-select, pulse width and sensor gate trigger modes
- Reset Continuous Trigger mode
- Programmable exposure, auto shutter (CCD iris) and smearless readout
- LVAL synchronous or asynchronous accumulation
- Iris video output for lens iris control
- Accepts standard C-mount lenses
- Setup via RS 232C interface or Camera Link
- Windows 98/NT/Win2000/XP control software

## 4. Locations and Functions



- 1 Lens mount of C-mount type. \*1)
- 2 Interline-transfer CCD sensor.
- 3 Camera Link connector
- 4 12 pin connector for DC +12V power external sync signals.
- 5 LED for power and trigger indication
- 6 Mounting holes 10 x M3deep4.

**\*1) Note:** Rear protrusion on C-mount lens must be less than 9.0mm.  
 When IR cut filter is used, it must be less than 6.0 mm.  
 The IR cut filter is placed in the C-mount thread.  
 The C-mount 25 mm IR cut filter must be ordered separately.

Fig. 1. Locations

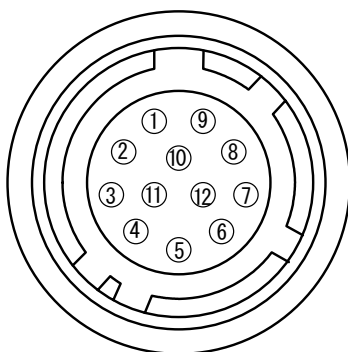
## 5. Pin Assignment

### 5.1. 12-pin Multi-connector (DC-IN/Trigger)

Type: HR10A-10R-12PB-01

(Hirose) male.

(Seen from rear of camera.)



Pin no.	Signal	Remarks
1	GND	
2	+12 V DC input	
3	GND	
4	Iris video	Only Contin. and RCT mode. TR=0, TR=10
5	GND	
6	HD input/ <b>RxD in</b>	SW301.2 ON for HD in. <b>OFF for RxD.</b> *1)
7	VD input/ <b>TxD out</b>	SW301.3 ON for VD in. <b>OFF for TxD.</b> *1) *2)
8	GND	
9	XEEN out	Low during exposure
10	Trigger in	TI=1. Or Camera Link (TI=0). *1)
11	Reserved	
12	GND	

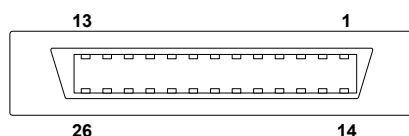
**Notes:** \*1) See "7.1. Switch Settings" for more information.

\*2) Do not input ext. VD in trigger modes.

Factory settings in **bold italic**.

Fig. 2. 12-pin connector.

### 5.2. Digital Output Connector for Camera Link



Type: 26 pin MRD connector

3M 10226-1A10JL

Fig. 3. Camera Link connector

The digital output signals follow the Camera Link standardized multiplexed signal output interface. Camera Link base configuration is used. The interface circuit is build around the NS type DS90CR285MTD.

The following signals are found on the Digital Output Connector:

SerTC	RxD serial data to camera	(SW301.1. <b>On for CL.</b> Off 12 pin HR)
SerTFG	TxD serial data to frame grabber	(SW301.1. <b>On for CL.</b> Off 12 pin HR)
CC1	Trigger input	(TI=0 for CL. TI=1 for 12 pin HR)
CC2	Factory use	
X0 to X3	Camera Link multiplexed data out	
Xclk	Camera Link clock. Used as pixel clock.	

In the Channel Link X0 to X3 multiplexed signals the following signals are encoded.

D0 - D9	8/10 bit video data out.
LVAL	Line VALid. Video line data is valid. High for valid line.
FVAL	Frame VALid. Video frame data is valid. High for valid frame.
DVAL	Data VALid. Effective video pixel data is valid. High for valid data.
EEN	Exposure ENable. High during exposure.

The polarity is positive and TRIG in negative as factory setting.  
For Camera Link interface principle diagram please check Fig. 8.

### 5.3. Input and output circuits

In the following schematic diagrams the input and output circuits for video and timing signals are shown.

#### 5.3.1. Iris video output

This signal can be used for lens iris control in Continuous and Reset Continuous Trigger mode. The signal is taken from the CCD sensor output before the gain circuit. The video output is without sync. The signal is 0.7 Vpp from  $<400\ \Omega$  ac coupled. *Do not use auto shutter (CCD iris) when auto iris lens is used.*

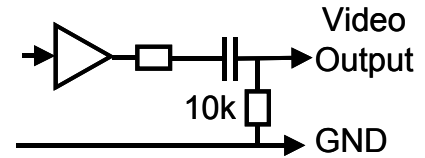


Fig. 4. Video output.

#### 5.3.2. HD and VD input/RXD TXD

Pin #6 and #7 on the 12 pin connector is used for HD/VD input or for the RS232C interface. If the camera control is done via Camera Link, the pins can be used for input of external HD and VD. SW301.2: ON for ext. HD in. **OFF for RS232C RxD.** SW301.3: ON for ext. VD in. **OFF for RS232C TxD.** SW302.3: ON for HD  $75\Omega$  termination. **OFF for TTL.** SW302.4: ON for VD  $75\Omega$  termination. **OFF for TTL.**

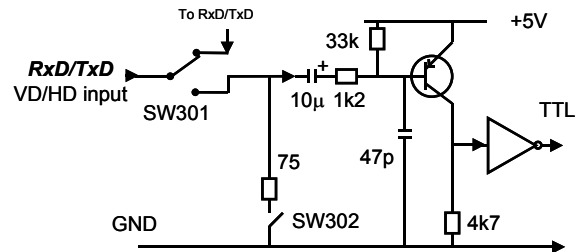


Fig. 5. HD/VD input, RS-232C

#### 5.3.3. Trigger input

With TI=1, the trigger input is on pin #10 12 pin connector. The 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 by TP=1. Trigger input level  $4\text{ V} \pm 2\text{ V}$ . It can be terminated by SW302.1: **ON for  $75\Omega$ .** OFF for TTL. The trigger inputs can be changed to Camera Link. (TI=0 for CL)

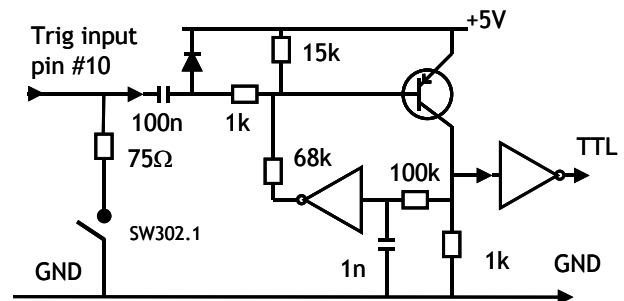


Fig. 6. Trigger input.

#### 5.3.4. XEEN output

On pin #9 on 12 pin HR connector XEEN is found. The output circuit is  $75\ \Omega$  complementary emitter follower. It will deliver a full 5 volt signal. Output level  $\geq 4\text{ V}$  from  $75\Omega$ . (No termination). EEN is also found in Camera Link.

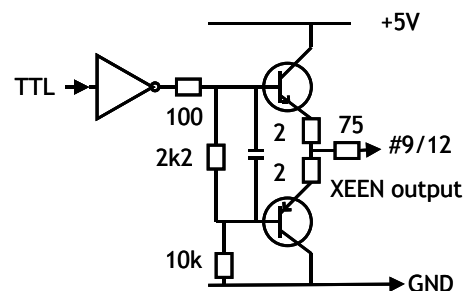


Fig. 7. EEN output

### 5.3.5. Camera Link interface

The video output is Camera Link with 10 or 8 bit video placed in a base configuration. The digital output signals follow the Camera Link standardized multiplexed signal output interface. The Camera Link output driver is NS type DS90CR285MTD.

The data bits from the digital video, FVAL, LVAL, DVAL and EEN are multiplexed into the twisted pairs, which are a part of the Camera Link. Trigger signals and the serial camera control are feed directly through its own pairs. The trigger input can also be TTL on the 12 pin connector. (TI=0 for CL. TI=1 for 12 pin HR). The serial camera control can be switches between the 12 pin connector or CL by the internal switch SW1.1.

The 26 pin MDR connector pin assignment follows the Camera Link base configuration.

For a detailed description of Camera Link specifications, please refer to the Camera Link standard specifications found on [www.jai.com](http://www.jai.com)

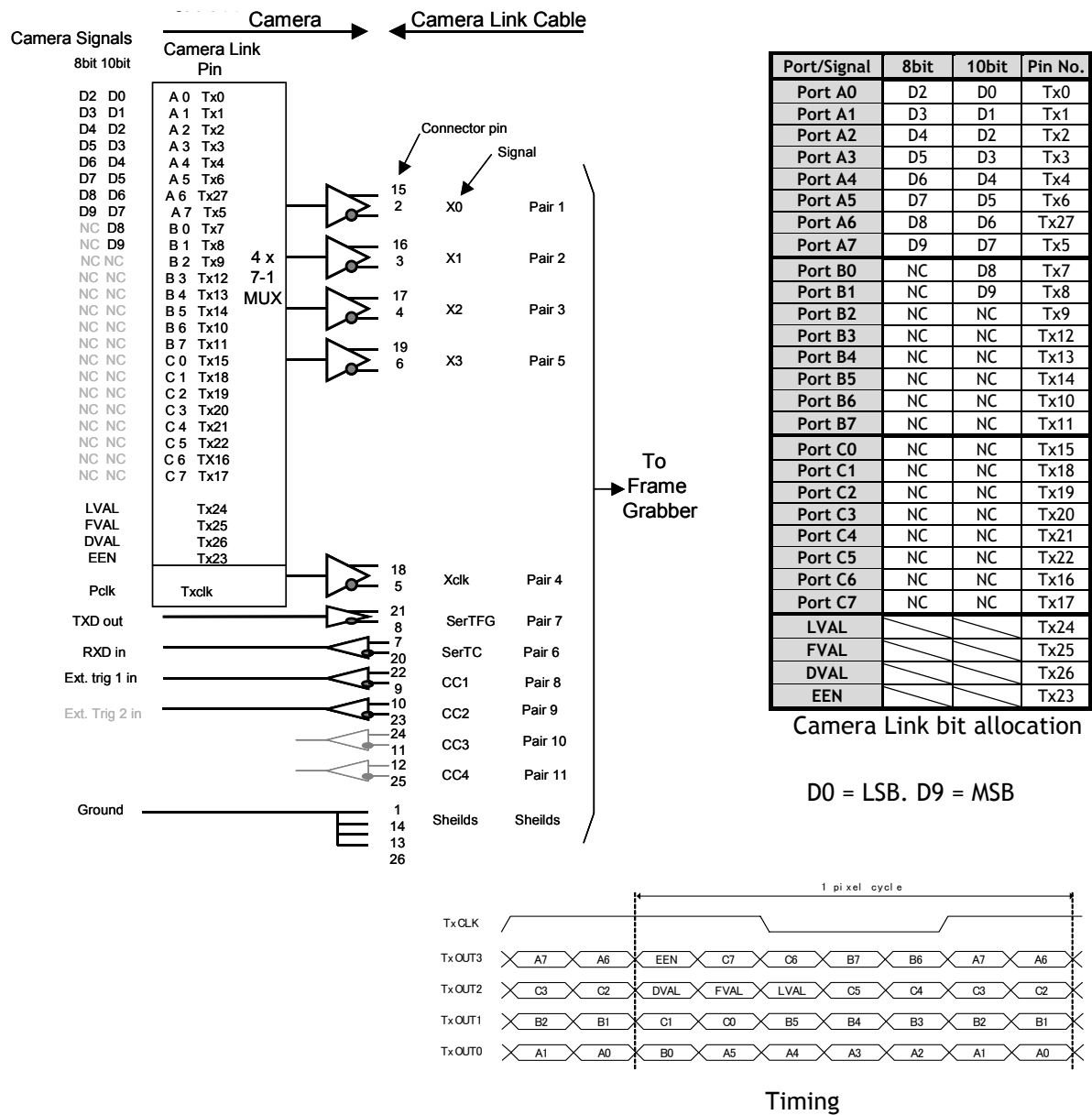


Fig. 8. Principle diagram for Camera Link base configuration interface

## 6. Functions and Operations

### 6.1. Basic functions

The A10CL-A70CL camera is a progressive scan camera with 10 or 8 bit video output in single channel Camera Link. An analogue iris video signal can be used for lens iris control. The camera has 1/2, 1/4 or 1/8 partial scanning for faster frame rates. Vertical and horizontal binning is possible. The H and V binning can operate separate or together. 2:1, 3:1 a 4:1 binning is available. If same H and V binning ratio is selected, the image aspect ratio is correct. With 4:1 V and H binning, the sensitivity is 16 times higher. Binning is only on CV-A10 CL.

There are 5 trigger modes. Normal continuous, edge pre-select, pulse width control, sensor gate control and reset continuous trigger. The accumulation can be LVAL synchronous or LVAL a-synchronous. For trigger modes using fast shutter times, smearless read out is possible.

In the following some of the functions are shown in details.

#### 6.1.1. Restart continuous trigger mode

The RCT mode makes it possible to use a lens with video controlled iris in triggered applications.

The camera is running continuously, and the iris is controlled from the iris video output. When a trigger pulse is applied, the scanning is reset and restarted, the previous signal is dumped with a fast dump readout, and the new triggered exposure is started. This fast dump readout has the same effect as "smearless readout". Smear over highlighted areas are reduced for the triggered frame.

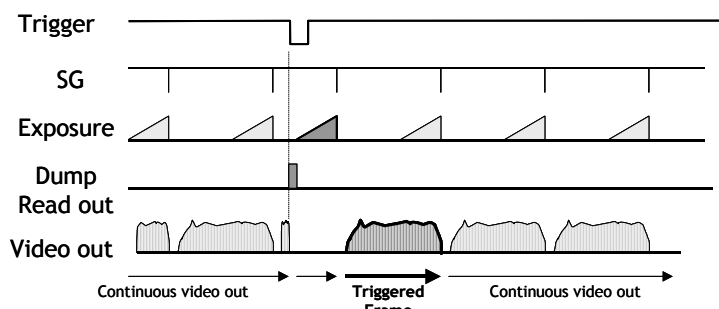


Fig. 9. Restart continuous trigger mode

#### 6.1.2. Sensor Gate Control

This function is for applications where a strobe flash is the only illumination, and where the exact time for the strobe firing is not known. The time window for the strobe firing can be up to several frames. The resulting video readout can also be delayed by this function. It makes the synchronization of the frame grabber more flexible.

The Sensor Gate Control signal will inhibit the internal SG signal so the accumulation can continue. The SG signal is an internal signal, which is low when the accumulated charge on the photo diode array is transferred to the vertical ccd registers for readout. When the Sensor Gate Control input is high, the internal SG pulse is inhibited, and the signal accumulation on the photo diode array can take place. When the strobe flash is fired, the Sensor Gate Control signal can be low. The resulting video is then read out after the first FVAL (or SG), following the falling edge of Sensor Gate Control signal.

The SG signal is placed in line #28.(fig.32.)

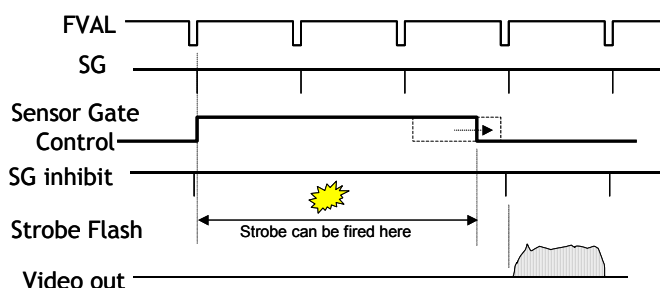


Fig. 10. Sensor Gate Control



### 6.1.3. CV-A10 CL. Binning

Binning is only on CV-A10 CL.

The binning functions can be used for higher frame rate or for higher sensitivity. The drawback is lower resolution.

Vertical binning is done by adding the charge from pixels in adjacent lines in the horizontal ccd register.

Horizontal binning is done by adding the charge from adjacent pixels in the sample/hold circuit capacitor.

In horizontal binning, the pixel clock will not change, so the grabber will over sample.

Vertical and horizontal binning can work together. If same factor is set for horizontal and vertical binning, and the sample rate is divided with same factor, the resulting image will have correct aspect ratio.

Upper right hand schematic shows the binning principle. Resolution and sensitivity for all combinations are shown below.

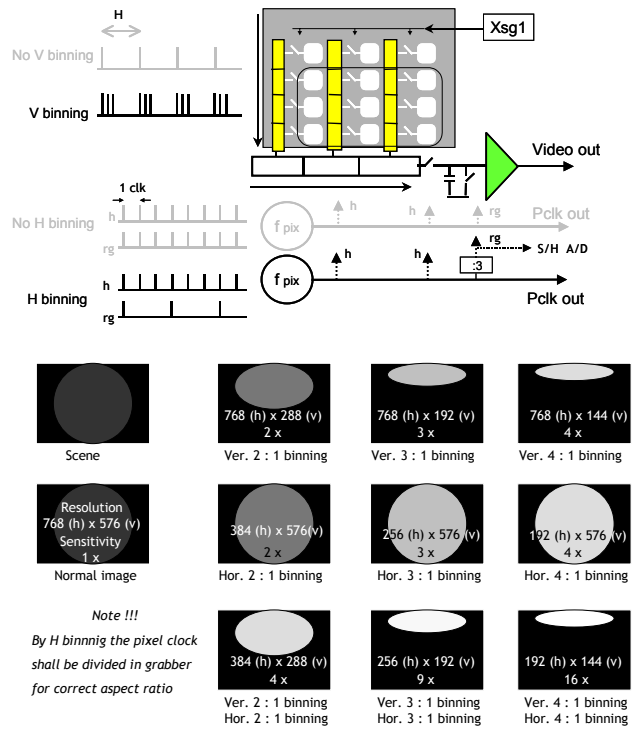


Fig. 11. CV-A10 CL binning.

### 6.1.4. CV-A70 CL. Bayer filter

CV-A70 CL is a color camera based on a CCD sensor with a Bayer RGB color mosaic.

The color image reconstruction is done in the host PC frame grabber.

The Color sequence in the video signal differ from full scanning to partial scanning. The right hand drawing shows the color sequence at the image start.

The start line # is shown from LVAL.

The start pixel is # 9 from LVAL. It is when DVAL rise.

The Bayer color sequence starts with:

GBG for even line numbers.

RGR for odd line numbers.

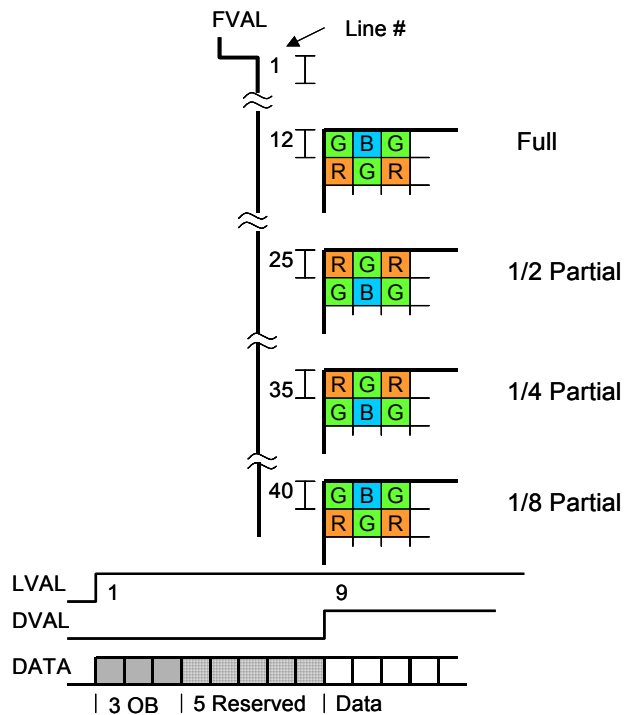


Fig. 12. CV-A70 CL Bayer RGB color sequence.

## 6.2. Sensor Layout and timing

### 6.2.1. CCD Sensor Layout

The CCD sensor layout with respect to pixels and lines used in the timing and video full frame read out is shown below.

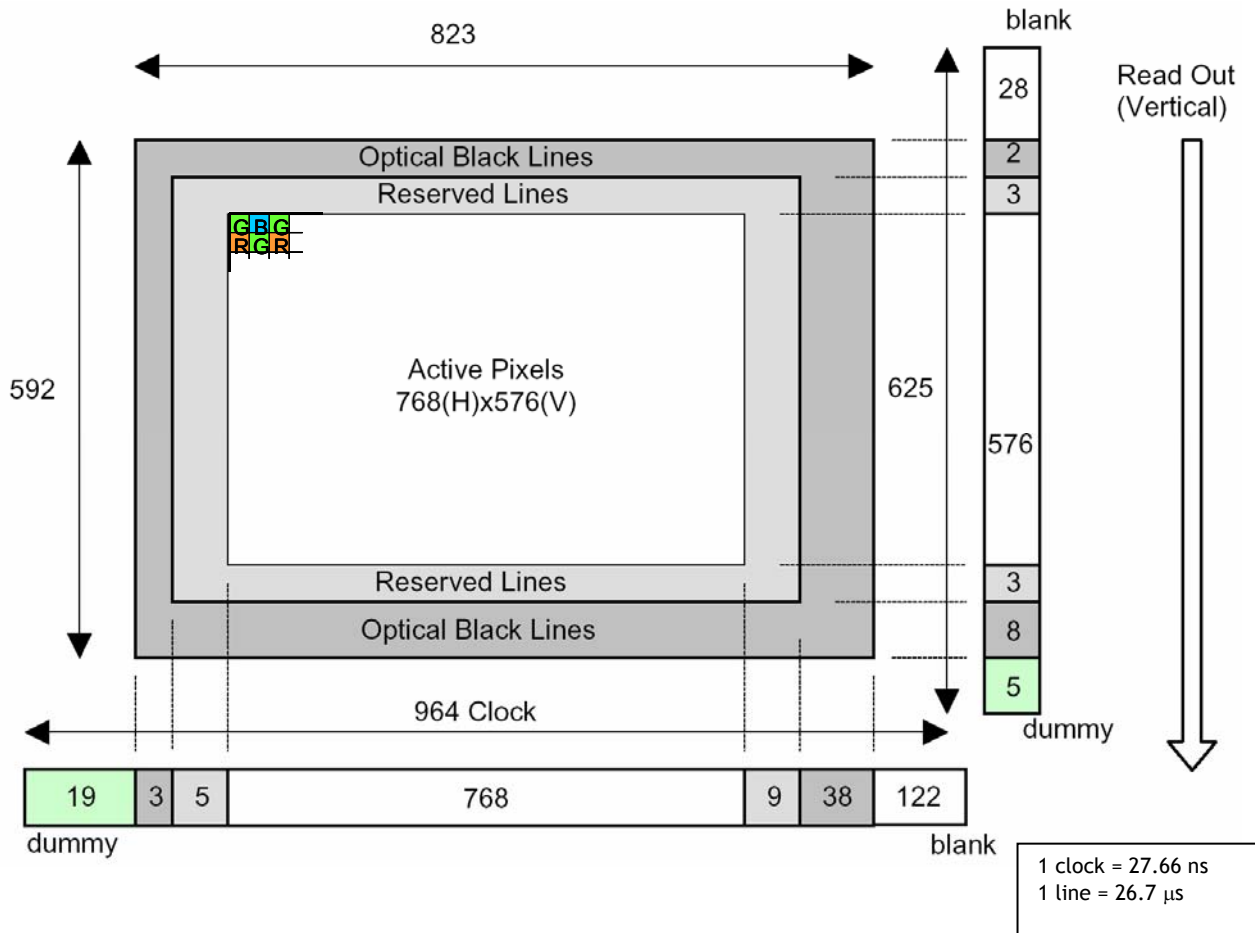


Fig. 13. CCD sensor layout

### 6.2.2. Horizontal timing

The LVAL period is shown for normal continuous mode.

1 clock = 27.66 ns

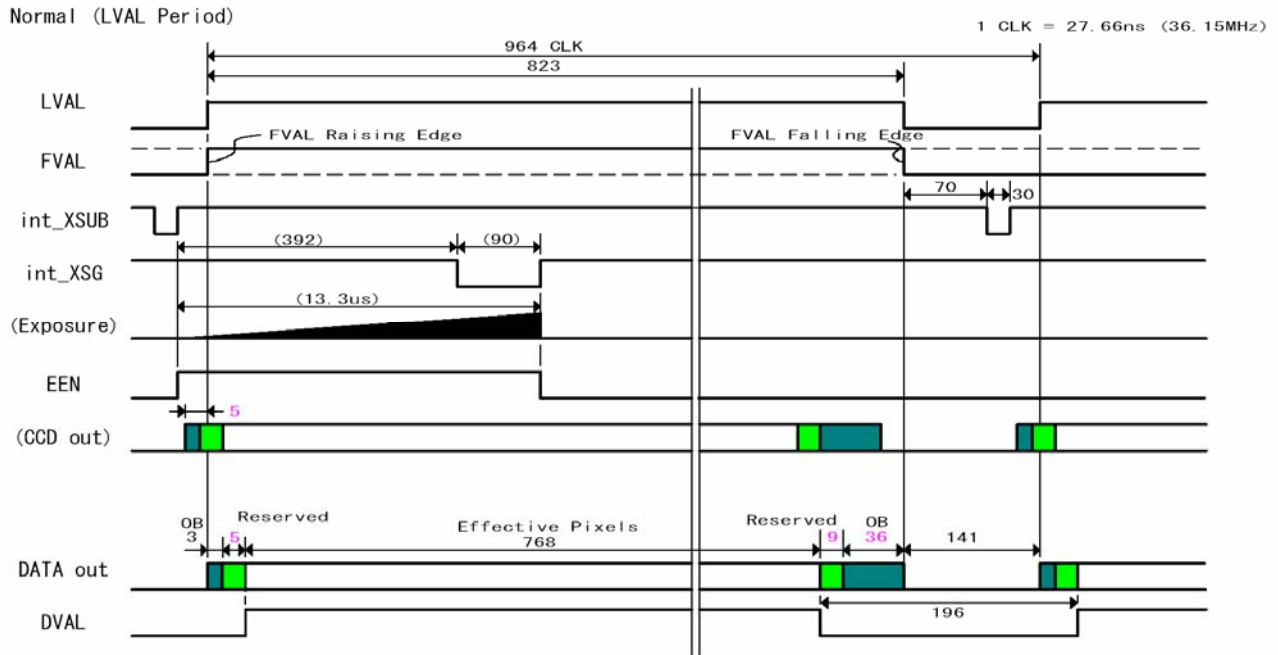


Fig. 14. Horizontal timing

### 6.2.3. Vertical timing

The FVAL period for normal continuous mode full scan is shown.

1 line = 26.7  $\mu$ s

Normal mode (Full Frame mode)

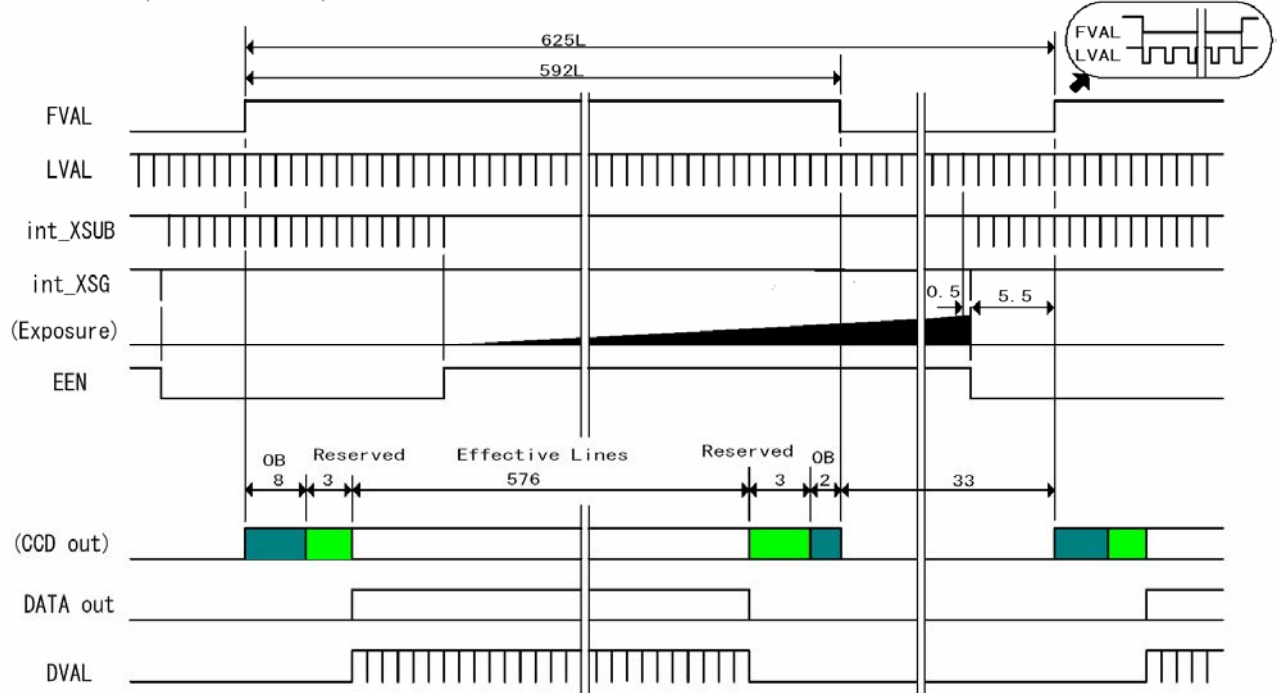
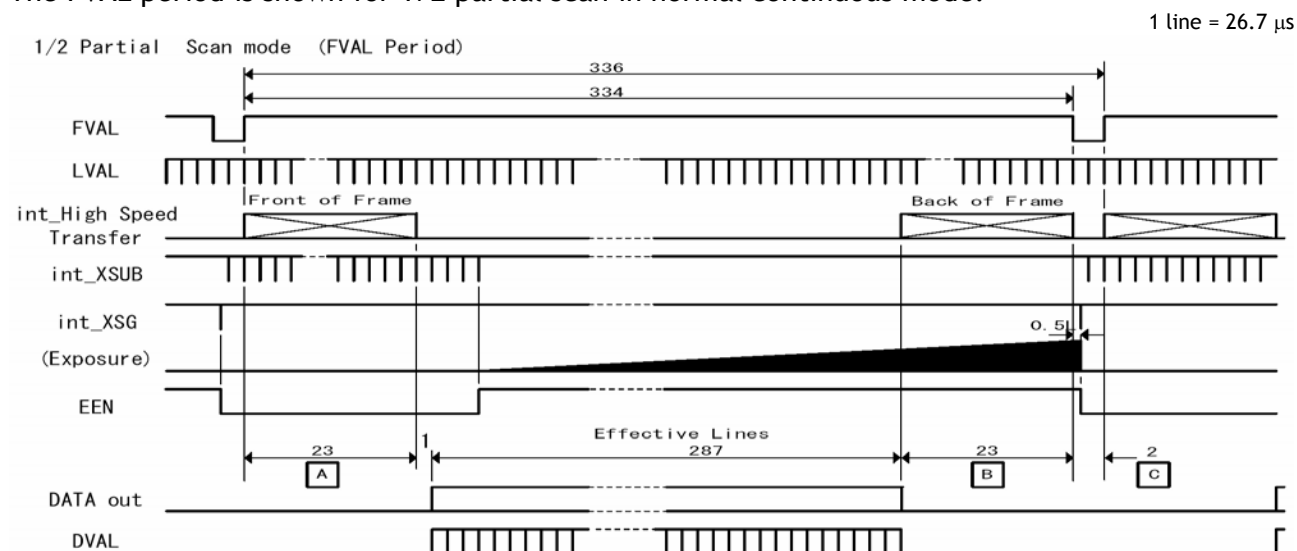


Fig. 15. Vertical timing for full scan

## 6.2.4. Partial Scanning

The FVAL period is shown for 1/2 partial scan in normal continuous mode.



Values for vertical timing in partial scan continuous mode.

Mode	Scanning	Start line #	Stop line #	A Front [LVAL]	Effect. video [LVAL]	B Back [LVAL]	C Blank [LVAL]	Lines per frame	Frame Rate [FPS]	Remarks
SC=0	Full	1	576	11	576	5	2	625	60	Full scan
SC=1	1/2 partial	146	432	23	287	23	2	336	112	Vertical centred
SC=2	1/4 partial	218	360	33	143	33	2	212	177	Vertical centred
SC=3	1/8 partial	254	324	38	71	38	2	150	250	Vertical centred

*Remark! The color sequence for CV-A70 CL differ in partial scan. Refer to chapter 6.1.4.*

Fig. 16 Vertical timing for partial scanning

## 6.2.5. Vertical binning

Values for the vertical timing with V binning in continuous mode.

Mode	Binning	Hor. freq. [KHz]	Effect. video [LVAL]	Lines per frame	Frame Rate [FPS]	Remarks
VB=0	Off	37.50	576	625	60	
VB=1	2:1 V binning	33.29	287	312	107	CV-A10 CL only
VB=2	3:1 V binning	29.92	191	208	144	CV-A10 CL only
VB=3	4:1 V binning	27.18	143	156	174	CV-A10 CL only

Fig. 17. Timing for vertical binning

## 6.2.6. Horizontal binning

Values for the horizontal timing with H binning in continuous mode.

Mode	Binning	Effect. pixels	Hor. freq. [KHz]	Pixel clock [MHz]	Clk per pixel	Remarks
HB=0	Off	768	37.50	36.15	1	
HB=1	2:1 H binning	384	37.50	36.15	2	CV-A10 CL only
HB=2	3:1 H binning	256	37.50	36.15	3	CV-A10 CL only
HB=3	4:1 H binning	193	37.50	36.15	4	CV-A10 CL only

*Remark that the pixel clock is not changed when horizontal binning is active!*

Fig. 18. Timing for horizontal binning

Vertical binning and horizontal binning can work together.

### 6.3. Input/Output of Timing Signals

For switch settings, please refer to chapter "7.1. Switch setting by internal switch."

#### 6.3.1. Input of External HD/VD signals

External synchronizing is only possible in full and partial scanning. For trigger mode only ext. HD can be input.

HD and VD input pins are shared with the RS-232C interface, which is factory default. SW301.2 (HD/RxD) and SW301.3 (VD/TxD). The video output is synchronized with external HD/VD signals if applied. If no ext. HD is connected, the camera will switch to the internal X-tal controlled HD sync. If no ext. VD is connected, the camera will continue with its internal VD.

The tracking range for H is 37.50 KHz  $\pm 1\%$

The external HD/VD signal should be 4.0 Vp-p  $\pm 2.0$  V from a 75  $\Omega$  source.

External HD/VD synchronizing can be used for full or partial scanning, but not in binning modes. Only external HD may be input in trigger modes.

Fig. 19 through fig. 22 shows timing details for external sync operations.

To use this mode:

Set function:

SW 301.2 and 301.3 to ON for external HD/VD input..

SW 302.3 and 302.4 to ON for 75  $\Omega$  termination of HD/VD.

SW 302.3 and 302.4 to OFF for TTL level for HD/VD.

Input:

Ext. HD in on pin 6 on 12-pin connector.

Ext. VD in on pin 7 on 12-pin connector.

#### Important notes on using this mode

External sync system should follow the camera scanning system.

The ext. HD/VD phase relations should follow the shown in fig. 21.

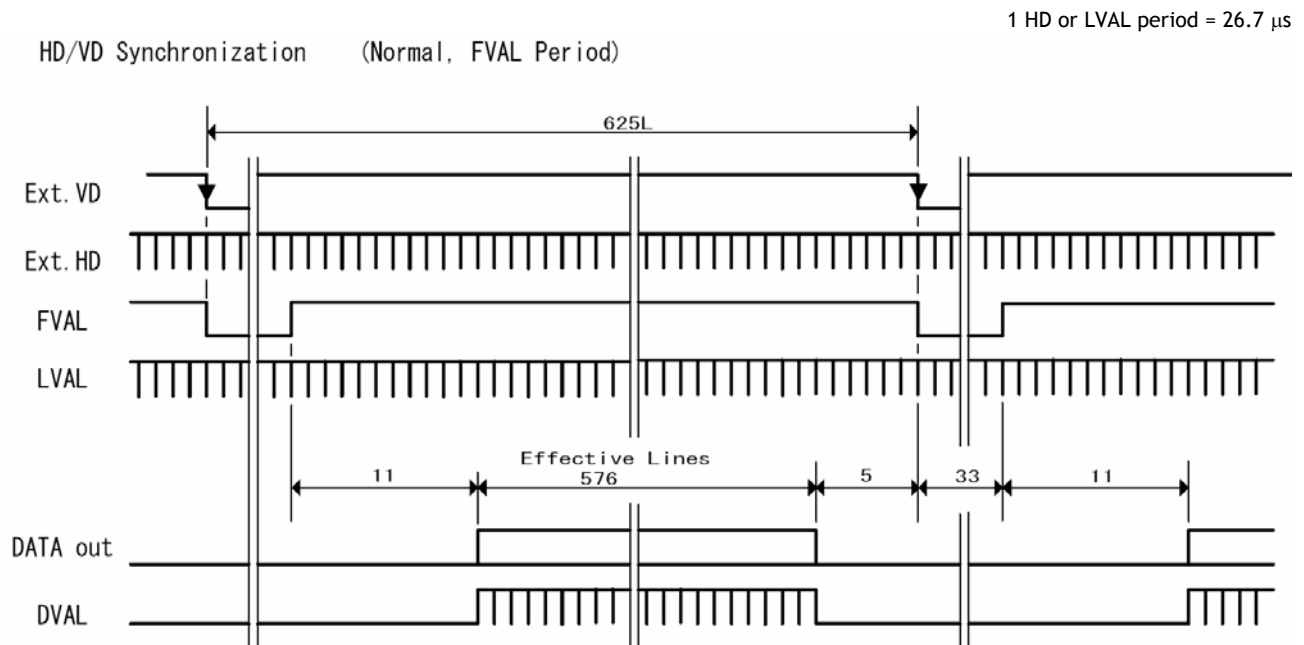


Fig. 19. VD timing for ext. synchronization

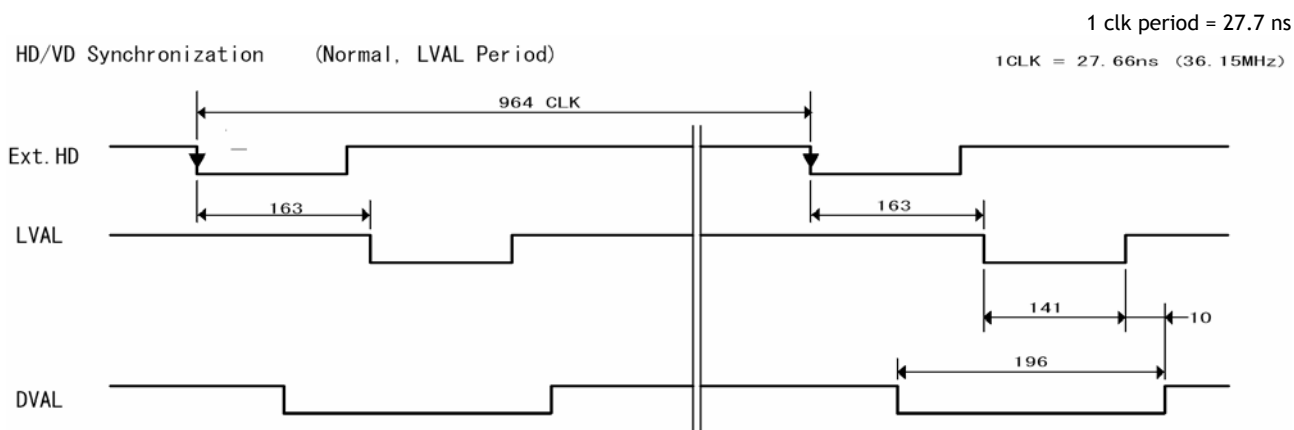


Fig. 20. HD to LVAL timing for ext. synchronization

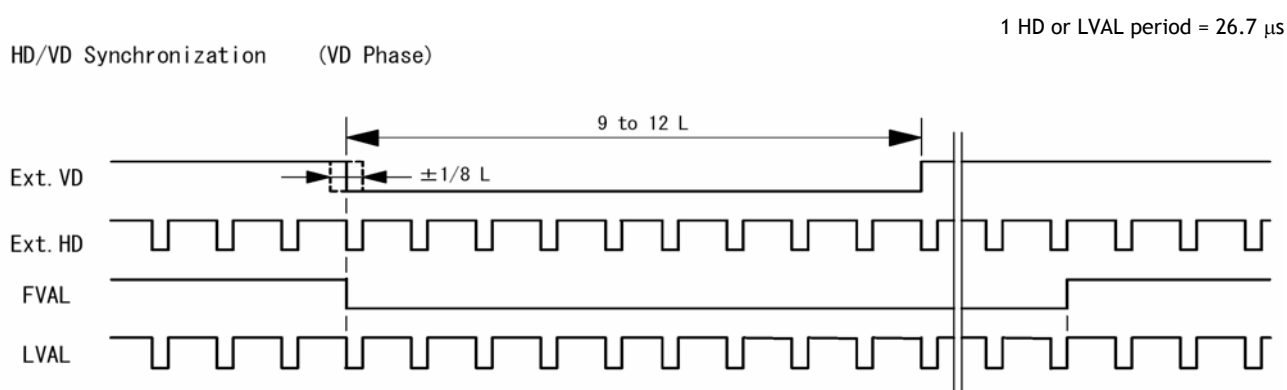


Fig. 21. Ext. VD/HD to int. FVAL/LVAL phase relations

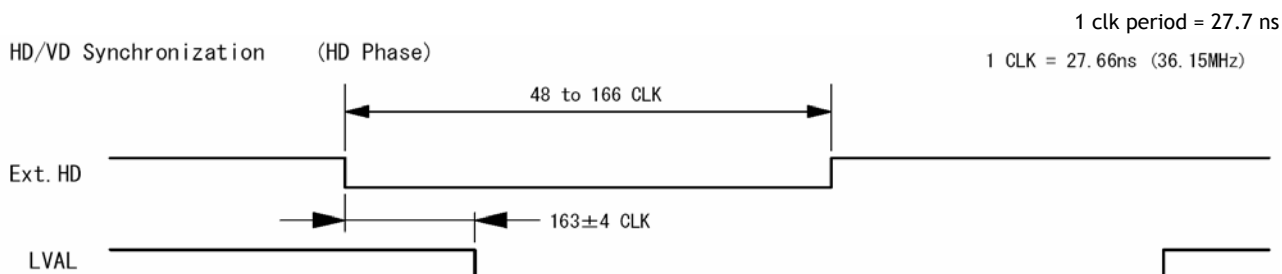


Fig. 22. Ext. HD to int. LVAL phase relations

## 6.3.2. Input of external trigger

The external trigger signal can be via Camera Link (TI=0), or pin 10 on 12 pin connector. (TI=1). Here it should be 4.0 Vp-p  $\pm$ 2.0 V from a 75  $\Omega$  source. Factory setting TTL. For 75  $\Omega$  termination SW302.1 should be ON.

## 6.3.3. Output of EEN

The EEN signal is 4.0 Vp-p from a 75  $\Omega$  source. The signal is also found in Camera Link.

### 6.4. Operation Modes

This camera can operate in 5 primary modes.

- |    |              |                                  |   |
|----|--------------|----------------------------------|---|
| 1. | <b>TR=0</b>  | <i>Normal continuous Mode.</i>   | Pre-selected exposure.                            |
| 2. | <b>TR=1</b>  | <i>Edge Pre-select Mode.</i>     | Pre-selected exposure.                            |
| 3. | <b>TR=2</b>  | <i>Pulse Width Control Mode.</i> | Pulse width controlled exposure.                  |
| 4. | <b>TR=3</b>  | <i>Sensor Gate Control</i>       | Strobe illuminated exposure with delayed read out |
| 5. | <b>TR=10</b> | <i>Reset Continuous Trigger</i>  | Pre-selected exposure.                            |

The triggered shutter in EPS, PWC and RTC mode can be LVAL synchronous or LVAL a-synchronous accumulation. Refer to chapter 6.4.1. and 6.4.2.

To avoid <1H time jitter in LVAL synchronous mode, it is recommended to synchronize the trigger to HD as shown in fig. 23. If trigger transitions are inside the shown limits, the accumulation jitter will be minimum.

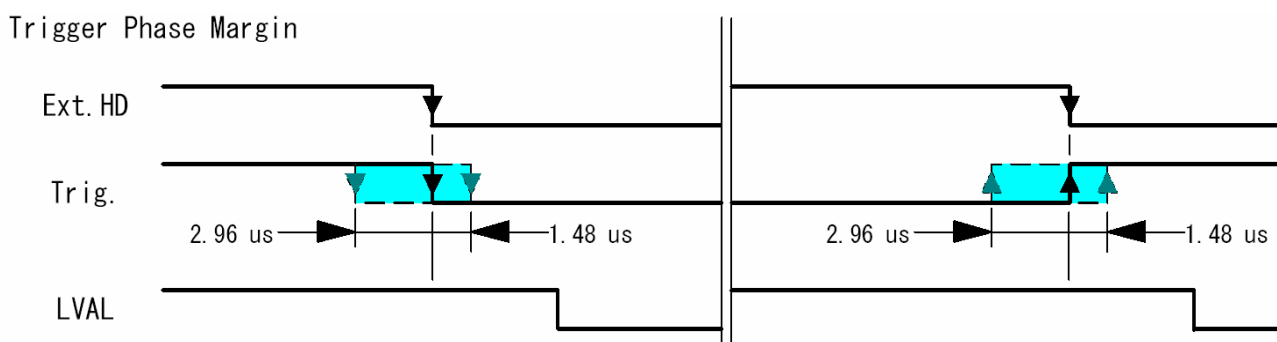


Fig. 23. Trigger to ext. HD phase relation

In the following chapters the different operation modes and functions will be covered.

### 6.4.1. LVAL synchronous accumulation

With LS=0, the accumulation will start synchronously with LVAL. The trigger pulse should be longer than 2 LVAL, and the accumulation will then start at the first LVAL after the trigger leading edge. The exposure start delay will be up to 1 line. (26.7  $\mu$ sec.).

In EPS mode the exposure stops 0.5 L after the selected shutter time, (in number of LVAL).

In PWC mode the exposure stops 0.5 L after the first LVAL after the trigger trailing edge. It results in up to 1 LVAL jitter.

*In trigger modes with LVAL synchronous accumulation, a new exposure can be started while the previous frame is read out. The new exposure should not finish before the frame is read out. FVAL shall be low for >2 LVAL. The maximum frame rate in trigger modes can then be close to the frame rate in continuous mode.*

#### Important notes on using this mode.

In LVAL synchronous trigger modes, exposure jitter up to 1 LVAL can be the result, if the trigger trailing edge is not synchronized to LVAL. Refer to fig. 23.

*The minimum trigger interval should be longer than (1 FVAL + 3 LVAL).*

Edge Pre-Select mode の例 (Full Frame)

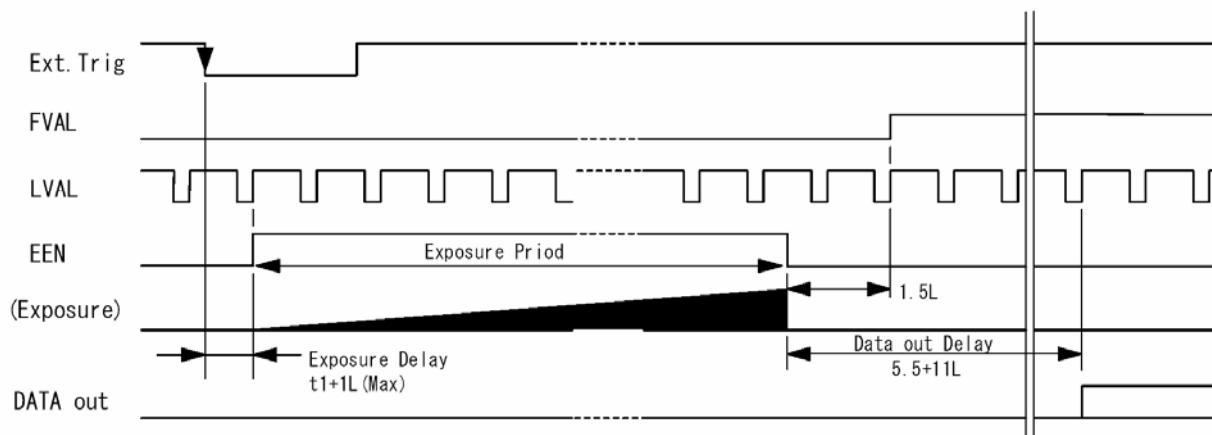


Fig. 24. LVAL synchronous accumulation in EPS mode

Pulse Width Control mode の例 (Full Frame)

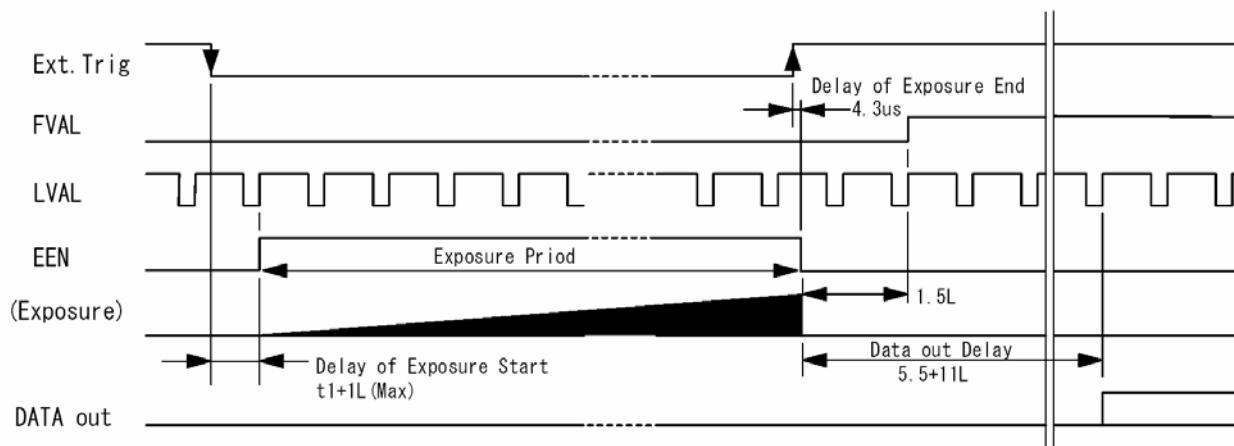


Fig. 25. LVAL synchronous accumulation in PWC mode



#### 6.4.2. LVAL a-synchronous accumulation

With LS=1, the accumulation will start immediately after the trigger leading edge.

The exposure start delay will be 4  $\mu$ sec. for shutter speeds up to 1/75,000.

In EPS mode the exposure stops 0.5 L after the selected shutter time, (in number of LVAL).

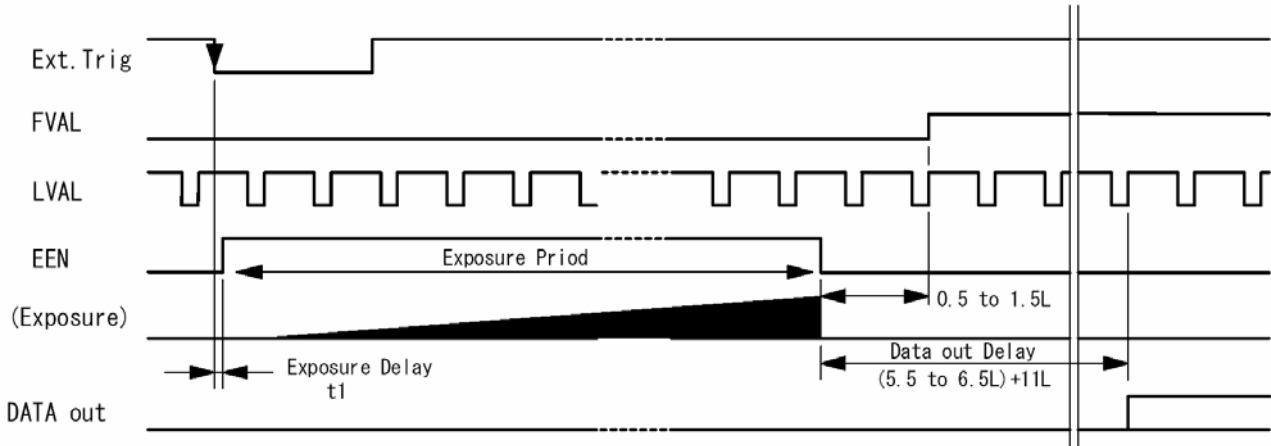
In PWC mode the exposure stops 0.5 L after the trigger trailing edge.

A new trigger must not be applied before the previous frame is read out. (FVAL is low).

The minimum trigger interval should be longer than (exposure time + 1 FVAL + 3 LVAL).

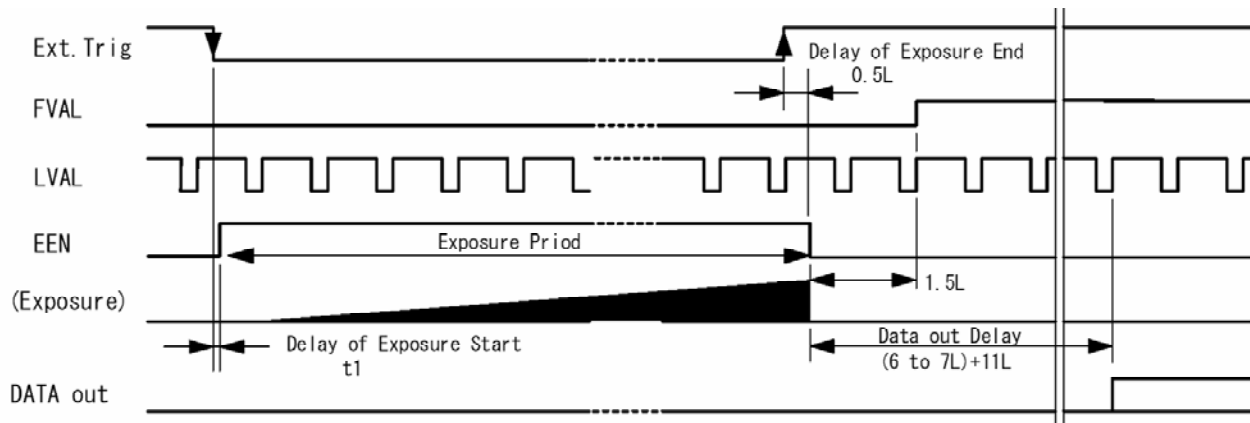
#### Important notes on using this mode.

In LVAL a-synchronous trigger modes, there is no exposure jitter.



t1. Exposure start delay			
$\leq 1/75,000$	1/100,000	1/150,000	1/300,000
4 $\mu$ sec.	7 $\mu$ sec.	11 $\mu$ sec.	14 $\mu$ sec.

Fig. 26. LVAL a-synchronous accumulation in EPS mode



t1. Exposure start delay			
$\leq 1/75,000$	1/100,000	1/150,000	1/300,000
4 $\mu$ sec.	7 $\mu$ sec.	11 $\mu$ sec.	14 $\mu$ sec.

Fig. 27. LVAL a-synchronous accumulation in PWC mode

### 6.4.3. Continuous operation

For applications not requiring asynchronous external trigger, but should run in continuous operation, this mode is used.

For timing details, refer to fig. 13. through fig. 17.

To use this mode:

Set function:	Trigger mode to "Continuous".	TR=0
	Scanning	SC=0 through 3
	Vertical binning. ( <i>CV-A10 CL only</i> )	VB=0 through 3
	Horizontal binning. ( <i>CV-A10 CL only</i> )	HB=0 through 3
	Shutter mode normal, programmable or auto	SM=0 through 2
	Shutter speed	SH=0 through 14
	Programmable exp.	PE=0 through 625
	Other functions and settings	
Input:	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.

The ext. HD/VD phase relations should follow the shown in fig. 21.

#### 6.4.4. Edge Pre-select Trigger Mode

An external trigger pulse initiates the capture, and the exposure time (accumulation time) is the fixed shutter speed set by SH or PE. The accumulation can be LVAL synchronous or LVAL a-synchronous. The resulting video signal will start to be read out after the selected shutter time. To avoid up to 1LVAL time jitter in LVAL synchronous accumulation it is recommended to synchronize the trigger to HD. (See fig. 23.).

Use LVAL synchronous accumulation (LS=0) for highest trigger rate. Here a new exposure can be started while the previous is read out. The selected shutter time should end >2 LVAL after FVAL goes low.

For timing details, refer to fig. 13. through fig. 17. and fig. 28.

To use this mode:

Set function:	Trigger mode to "Edge pre-select".	TR=1
	Scanning	SC=0 through 3
	Vertical binning. (CV-A10 CL only)	VB=0 through 3
	Horizontal binning. (CV-A10 CL only)	HB=0 through 3
	Shutter mode to normal or programmable	SM=0, SM=1
	Shutter speed	SH=0 through 14
	Programmable exp.	PE=0 through 625
	Accumulation LVAL synch. or a-synch.	LS=0, LS=1
	Other functions and settings	
Input:	Ext. trigger. Camera Link or 12 HiRose	TI=0, TI=1
	Ext. HD in on pin 6 on 12-pin connector.	(If used).

#### Important notes on using this mode

External sync system should follow the camera scanning system.

To avoid  $\leq 1$  LVAL jitter if LS=1, ext. HD/Trigger phase relations as shown in fig. 23.

Trigger pulse with  $>1$  LVAL to  $<1$  Frame

If LS=0, the minimum trigger interval  $>(1 \text{ FVAL} + 3 \text{ LVAL})$ .

If LS=1, the minimum trigger interval  $>(\text{exposure time} + 1 \text{ FVAL} + 2 \text{ LVAL})$ .

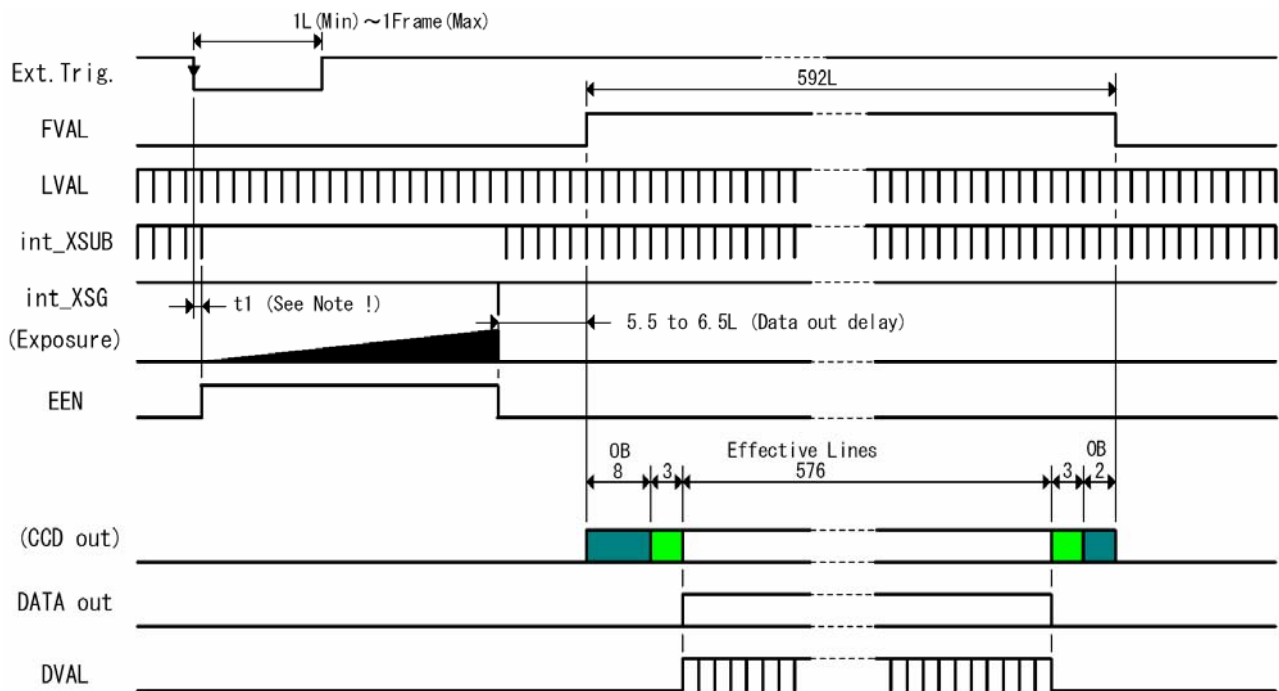


Fig. 28. Edge pre-select. LVAL synchronized.

#### 6.4.5. Pulse Width Control Trigger Mode

In this mode the accumulation time is equal the trigger pulse width. Here it is possible to have long time exposure. The maximum recommended time is <120 frames.

The accumulation can be LVAL synchronous or LVAL a-synchronous.

To avoid up to 1LVAL time jitter in LVAL synchronous accumulation it is recommended to synchronize the trigger to HD. (See fig. 23.).

Use LVAL synchronous accumulation (LS=0) for highest trigger rate. Here a new exposure can be started while the previous is read out. The trigger pulse should end >2 LVAL after FVAL goes low. The resulting video signal will start to be read out after the trigger rising edge.

For timing details, refer to fig. 13. through fig. 17. and fig. 29.

To use this mode:

Set function:	Trigger mode to "Pulse width control".	TR=2
	Scanning	SC=0 through 3
	Vertical binning. (CV-A10 CL only)	VB=0 through 3
	Horizontal binning. (CV-A10 CL only)	HB=0 through 3
	Accumulation LVAL synch. or a-synch.	LS=0, LS=1
	Other functions and settings	
Input:	Ext. trigger. Camera Link or 12 HiRose	TI=0, TI=1
	Ext. HD in on pin 6 on 12-pin connector.	(If used).

#### Important notes on using this mode

External sync system should follow the camera scanning system.

To avoid  $\leq 1$  LVAL jitter if LS=1, ext. HD/Trigger phase relations as shown in fig. 23.

Trigger pulse width >2 LVAL to <120 frames

If LS=0, the minimum trigger interval >(1 FVAL + 3 LVAL).

If LS=1, the minimum trigger interval >(trigger width + 1 FVAL + 2 LVAL).

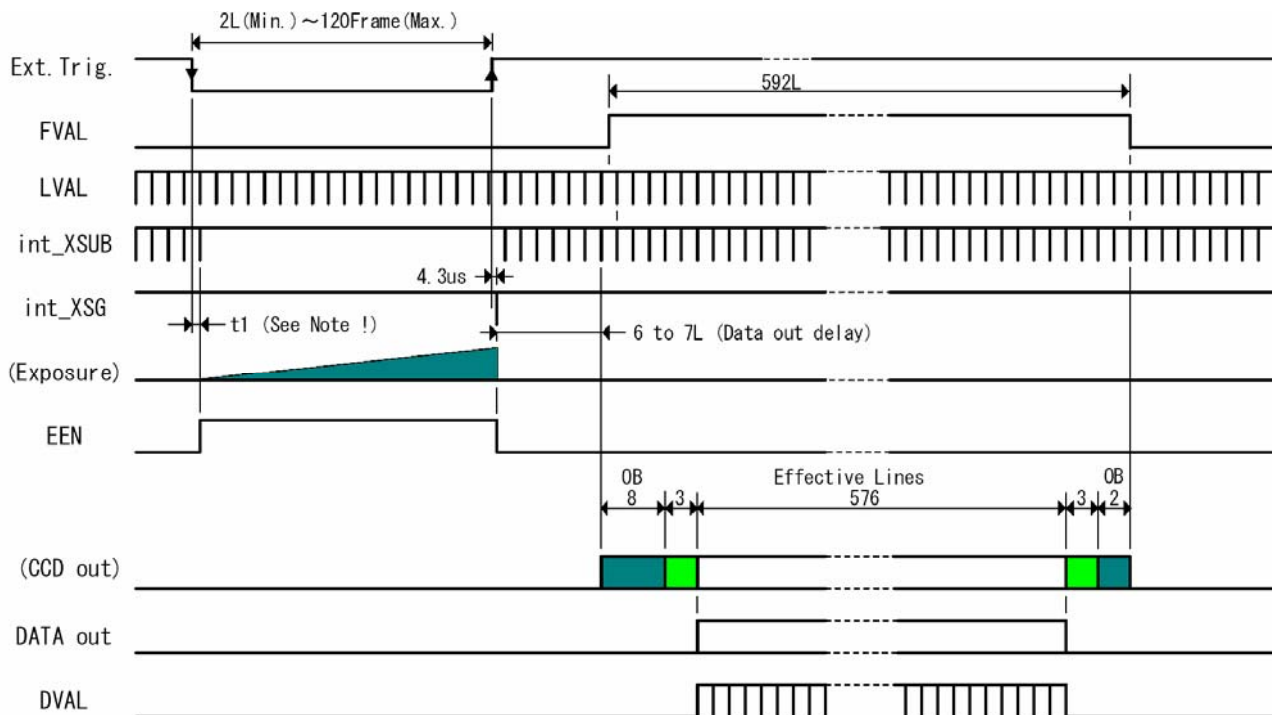


Fig. 29. Pulse width control. LVAL synchronized.

#### 6.4.6. Reset Continuous Trigger mode

The RCT mode is in principle the same as normal continuous mode. The difference is that an external trigger pulse will immediately stop the video read out and reset and restart the vertical timing. After a fast dump read out, which takes 86 LVAL, a new triggered exposure is started and read out as normal. If no further trigger pulses are applied, the camera will continue in normal mode. This fast dump read out has the same effect as "smearless read out". Smear over highlighted areas are reduced for the triggered frame.

The restart continuous trigger mode makes it possible to use a lens with video controlled iris in intelligent traffic surveillance applications.

For timing details, refer to fig. 13. through fig. 17. and fig. 30.

To use this mode:

Set function:	Trigger mode to "Reset continuous trigger".	TR=10
	Scanning	SC=0 through 3
	Vertical binning. (CV-A10 CL only)	VB=0 through 3
	Horizontal binning. (CV-A10 CL only)	HB=0 through 3
	Shutter mode normal, programmable or auto	SM=0 through 2
	Shutter speed	SH=0 through 14
	Programmable exp.	PE=0 through 625
	Accumulation LVAL synch. or a-synch.	LS=0, LS=1
	Other functions and settings	
Input:	Ext. trigger. Camera Link or 12 HiRose	TI=0, TI=1
	Ext. HD in on pin 6 on 12-pin connector.	(If used).

#### Important notes on using this mode

External sync system should follow the camera scanning system.

To avoid  $\leq 1$  LVAL jitter if LS=1, ext. HD/Trigger phase relations as shown in fig. 23.

Trigger pulse width  $> 2$  LVAL to  $< 1$  frame.

If LS=0, the minimum trigger interval  $> (1 \text{ FVAL} + 3 \text{ LVAL})$ .

If LS=1, the minimum trigger interval  $> (\text{trigger width} + 1 \text{ FVAL} + 2 \text{ LVAL})$ .

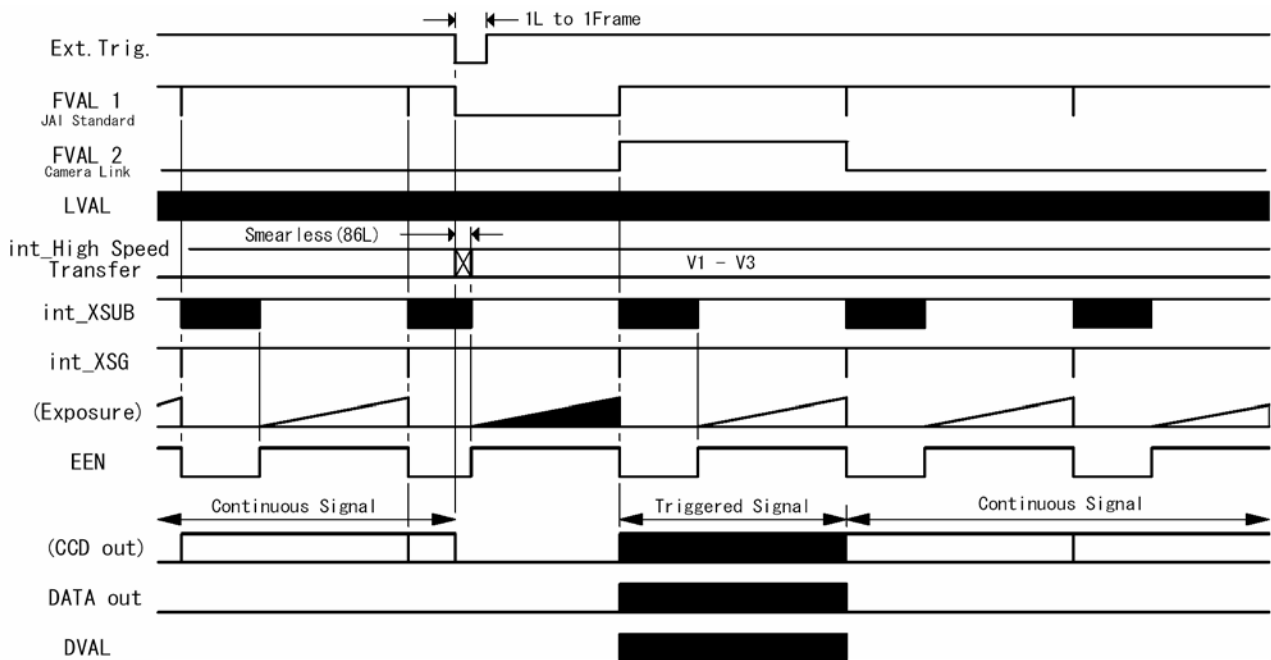


Fig. 30. Reset Continuous Trigger

## 6.4.7. 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. The external Sensor Gate control signal will disable the internal XSG pulse so the accumulation will continue during the next frame. The resulting video is read out after the first FVAL (or SG), following the trailing edge of the Sensor Gate Control signal.

To inhibit the internal XSG pulse and continue the accumulation, the external sensor gate control signal should be low during line 28, where the internal XSG is placed. Fig. 32.

The sensor gate control signal can be synchronized by the FVAL signal. Fig. 31. and fig. 32. For video out timing details, refer to fig. 13. - 14.

To use this mode:

Set function:	Trigger mode to "Sensor gate control".	TR=3
	Scanning	SC=0
	Vertical binning. (CV-A10 CL only)	VB=0
	Horizontal binning. (CV-A10 CL only)	HB=0
	Other functions and settings	
Input:	Ext. SG control to trigger input, CL or 12 pin HR	
	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.

The ext. HD/VD phase relations should follow the shown in fig. 23.

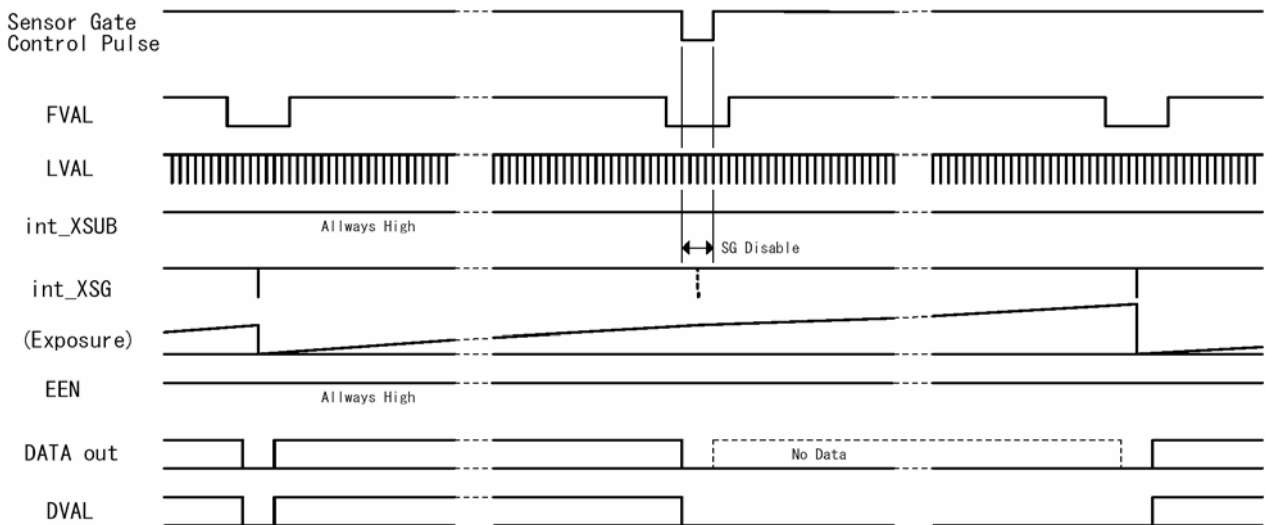


Fig. 31. Vertical timing for Sensor Gate Control

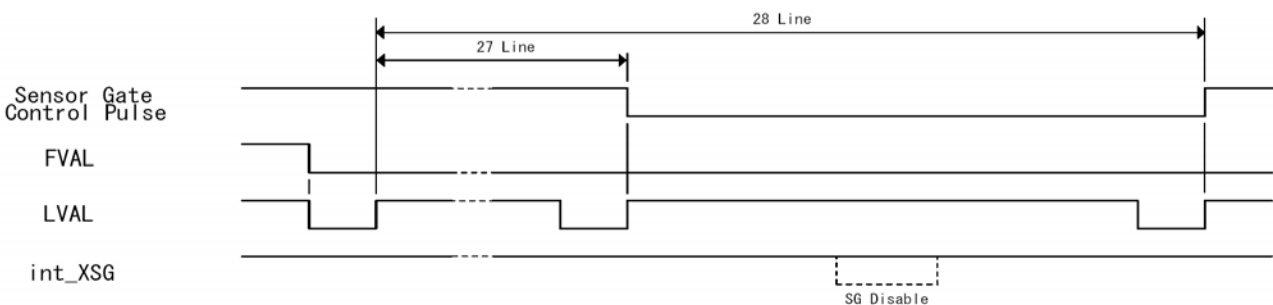


Fig. 32. Sensor Gate position in line number 28

### 6.5. Other Functions.

#### **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 the shutter speed is limited to be shorter than the frame read out time. There is no limitation in PWC mode.

Binning will not work in partial scanning modes. Partial scan has highest priority.

*Note: The color sequence for CV-A70 CL differ in partial scan modes. Refer to chapter 6.1.4.*

#### **Binning.** *VB=0 through VB=3 and HB=0 through HB=3.*

*(CV-A10 CL only).*

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. The CV-A10CL has vertical and horizontal binning 2:1, 3:1 and 4:1. H and V binning can work together. The aspect ratio is then correct if the pixel clock is divided in the frame grabber.

Vertical binning is done by adding the pixel charge from adjacent lines together in the horizontal ccd register. It is done by multiple pulses to the vertical ccd register.

Horizontal binning is done by adding the charge from adjacent pixels together in the sample/hold circuit on the CCD output.

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

Binning will only work in full frame modes. (*SC=0*).

#### **Smearless readout.** *SL=1.*

This function will reduce the unwanted smear signal from a highlighted scene when a short exposure time is used. It works in all trigger 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 86 lines before the exposure starts. The exposure stops and the resulting video signal is read out. This mode will operate with full and partial scanning and with all binning modes.

#### **Shutter mode.** *SM=0, SM=1 and SM=2. SH=0 through SH=14 and PE=0 through PE=625.*

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

With *SM=1* from programmable in 625 steps (*PE*).

*SM=2* is auto shutter (CCD iris). The range is from OFF to 1/25,000. The reference setting for auto shutter is done with the command *AH=*. Together with the AGC function it will keep the video output constant over a wide range of illumination. Auto shutter will work in continuous mode and reset continuous trigger mode. (*TR=0, TR=10*).

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

#### **Trigger input select.** *TI=0, TI=1.*

This function selects the trigger input to be through Camera Link (*TI=0*), or as TTL through the 12 pin Hirose connector (*TI=1*).

#### **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*).

#### **Gamma.** *GS=0, GS=1.*

For CV-A10CL, gamma can be set to 1.0, which is linear, or 0.45. (*GS=0*) or (*GS=1*).

For CV-A70CL gamma is 1.0.

## CV-A10 CL and CV-A70 CL

### 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 by the gain level command GA=. The reference level for the AGC is set by the AGC reference level AG=. In AGC mode the video level is kept constant by the automatic gain control circuit within a 15 dB range. For CV-A70CL 12 dB. Together with the auto shutter function it will keep the video output constant over a wide range of illumination. For continuous and RCT mode only.

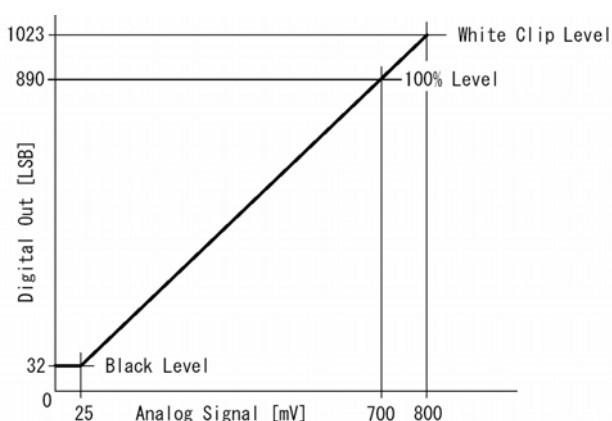
### Black level. BL=0 through BL=255.

Black level (or set-up level) will set the video level for black.

### Bit allocation. BA=0, BA=1.

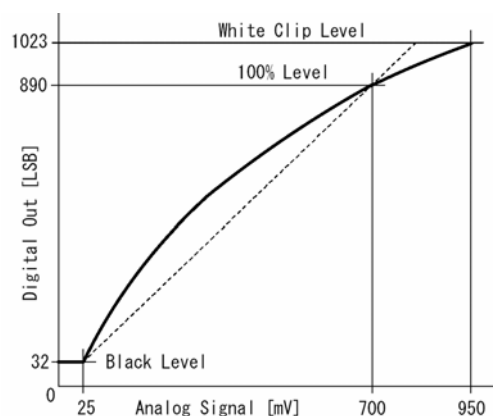
The video output in Camera Link can be selected to be 10 or 8 bits (BA=0, BA=1). For 8 bits only the 8 most significant bits are output.

The below figures shows the bit allocations for Gamma 1.0 and Gamma 0.45



Gamma 1.

CCD out	Analog Signal	Digital Out(10bit)	Digital Out(8bit)
Black	Setup 3.6% 25mV	32LSB	8LSB
200mV	700mV	890LSB	222LSB
230mV	800mV	1023LSB	255LSB



Gamma 0.45. CV-A10CL only.

CCD out	Analog Signal	Digital Out(10bit)	Digital Out(8bit)
Black	Setup 3.6% 25mV	32LSB	8LSB
200mV	700mV	890LSB	222LSB
270mV	950mV	1023LSB	255LSB

Fig. 33. Bit allocation.

### Iris video output.

The iris video output in pin #4 on 12 pin HR is 700 mv for 100% video out in Camera Link. The iris video signal is taken before the gain circuit. It is without sync.

The iris video signal can be used for auto iris lens drive in continuous and RCT mode.

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

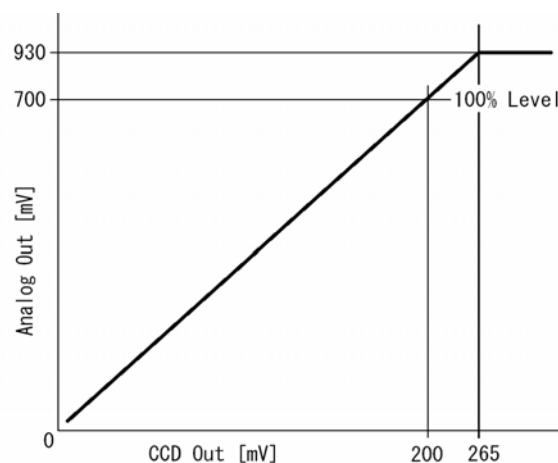


Fig. 34. Iris video output.



## CV-A10 CL and CV-A70 CL

### LED for power and trigger.

On the camera rear a Light Emitter Diode is found. The light will be green when power is connected. For trigger pulse input an amber flash will be seen.

### Mode and function matrix for CV-A10CL and A70CL.

The following table shows which functions will work in the different modes.

Func.		Shutter SM=			Part. s SC=	Binning VB= HB=*)		Smearl SL=	Accum LS=	Ext sync		Iris video out	Remarks
Mode	TR=	0	1	2						VD	HD		
Cont.	0	√	√	√	√	√	√	-	-	√	√	√	
EPS	1	√	√	-	√	√	√	√	√	-	√	-	
PWC	2	-	-	-	√	√	√	√	√	-	√	-	
RTC	10	√	√	√	√	√	√	√	√	√	√	√	
SG	3	-	-	-	-	-	-	-	-	√	√	-	

√ = ok, - = no function.

\*) Binning only for CV-A10 CL

The pixel clock is not changed in horizontal binning modes.

V binning has priority over partial scan.

Horizontal binning will work with partial scan.

## 6.6. Request Functions.

The following commands are for identification and help.

Fig. 35. 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 7.2. RS-232C control and chapter 7.3. CV-A10CL/A70CL 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.

### Help. HP.

If received, the camera will send back a help list for all functions.

### 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 4.

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.

### 6.7. 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.

```
ST?
SM=2
SH=10
PE=3
TR=0
SL=0
LS=1
TI=0
TP=1
SC=3
VB=2
HB=2
BA=1
AS=1
AG=3
GA=3
BL=3
GS=1

VN?
VN=102

ID?
ID=yyyyyyyyyy

MD?
MD=CV-A10

UD?
UD=Eng. Sample #5
```

```
HP?
*** CV-A10 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(user ID): free text for user (max 16 characters)
SM(shutter mode): 0=preset shutter, 1=programmable exposure
                  2=auto shutter
SH(preset shutter): 0=off, 1=1/100, 2=1/120, 3=1/250, 4=1/500, 5=1/1000
                   6=1/2000, 7=1/4000, 8=1/8000, 9=1/15000, 10=1/25000
                   11=1/75000, 12=1/100000, 13=1/150000, 14=1/300000
PE(programmable exposure): 0 - 628
TR(trigger mode): 0=normal(continuous), 1=edge pre-select
                  2=pulse width control, 3=sensor gate control
SL(smearless): 0=off, 1=on
LS(LVAL synchronous accumulation): 0=sync., 1=async.
TI(trigger input): 0=camera-link, 1=hirose 12pin-10p
TP(trigger polarity): 0=active low, 1=active high
SC(scanning format): 0=full frame, 1=1/2 partial, 2=1/4, 3=1/8
VB(vertical binning): 0=off, 1=1/2 binning, 2=1/3, 3=1/4
HB(horizontal binning): 0=off, 1=1/2 binning, 2=1/3, 3=1/4
BA(bit allocation: 0=10bit, 1=8bit
AS(AGC select): 0=off(manual gain control), 1=on
AG(AGC/auto shutter reference): 1 - 1023
GA(manual gain level): -50 - +150
BL(black level): 0 - 255
GS(gamma select): 0=1.0(off), 1=0.45
LD(Load settings from EEPROM): 0=factory, 1=user1, 2=user2, 3=user3
SA(Save settings into EEPROM): 1=user1, 2=user2, 3=user3
*** Firmware Version 1.02 ***** Copyright(c) 2003 JAI Corporation *****
```

Fig. 35. Terminal printout of status, ID and Help for CV-A10 CL.

## 7. Configuring the Camera

### 7.1. Switch setting by internal SW301 and SW302

SW 301 is used for communication port select and ext. HD/VD or RS232C on pin 6 and 7 12 pin. The switches are found inside the camera on the left hand board. (Seen from rear).

To access SW301 and SW302:

Remove camera cover.

The switches are located on left hand board.

SW301 is for communication and external HD/VD in.

No	Functions		
		ON	OFF
1	Communication port switch	<b>LVDS (CameraLink)</b>	RS232C (HIROSE 12pin)
2	HIROSE 12pin No. 6 switch	External HD in	<b>RS232C (RxD In)</b>
3	HIROSE 12pin No. 7 switch	External VD in	<b>RS232C (TxD Out)</b>
4			

SW 302 is for 75Ω termination of trigger and HD/VD input.

No	Functions		
		ON	OFF
1	Trigger In Termination switch	75Ω	<b>TTL</b>
2	Reserved	-	-
3	External Trigger HD in Termination	75Ω	<b>TTL</b>
4	External Trigger VD in Termination	75Ω	<b>TTL</b>

***Bold italic*** is factory setting

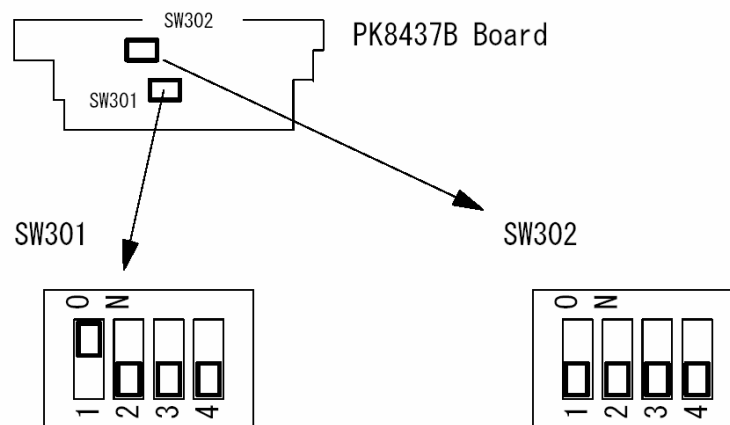


Fig. 36. Switch 301 and 302 positions on PK8437B

### 7.2. RS-232C control

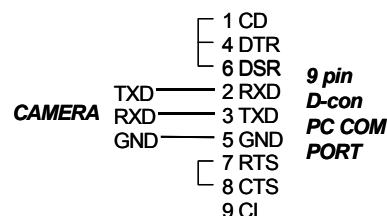
All configuration of the CV-A10 CL or CV-A70 CL camera is done via the RS-232C port on the 12 pin HR connector or via Camera Link. (Internal switch SW301.2 and 301.3 off for HR). The camera can be set up from a PC running terminal emulator software, or using JAI's camera control software.

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

#### Communication setting.

Baud Rate *)	9600 bps
Data Length	8 bit
Start Bit	1 bit
Stop Bit	1 bit
Parity	None
Xon/Xoff Control	None

RS 232C cable



\*) Baud rates can be changed by RS232C commands. (9600bps to 115200 bps.)

#### Protocol.

Transmit setting to camera:

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

The camera answers:

**COMPLETE<CR><LF>**

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

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

The camera answers:

**COMPLETE<CR><LF>**

Transmit request command to camera:

**NN?<CR><LF>** (NN is any kind of command.)

The camera answers:

**NN=[Parameter]<CR><LF>**

Transmit the following to have the camera actual setting:

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

The camera answers:

A complete list of the current settings

Transmit the following to have a command list:

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

The camera answers:

A list with all commands and possible settings

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>**

### 7.3. CV-A10CL/A70CL command list

	Command Name	Format	Parameter		Remarks
A - General settings and useful commands					
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 (Free text)	TR=[Param.]<CR><LF>	User can save and load free text		≤ 16 characters
BDRT	Baud rate	BDRT=[Param.]<CR><LF>	0=9600 bps 2=38400 bps 4=115200 bps	1=19200 bps 3=57600 bps	New rate will be activated at next power up.
B - Video Output					
BA	Output bit allocation	BA=[Param.]<CR><LF>	0=10 bit	1=8 bit	Camera Link
VB	Vertical binning	VB=[Param.]<CR><LF>	0=off 2=1/3 binning	1=1/2 binning 3=1/4 binning	CV-A10 CL only. Only when SC=0
HB	Horizontal binning	HB=[Param.]<CR><LF>	0=off 2=1/3 binning	1=1/2 binning 3=1/4 binning	CV-A10 CL only. Only when SC=0
C - Timing and shutter related commands					
SC	Scanning format	SC=[Param.]<CR><LF>	0=full 2=1/4 partial	1=1/2 partial 3=1/8 partial	
TR	Trigger mode	TR=[Param.]<CR><LF>	0=Continuous 2=Pulse width 10=RCT mode	1=Edge pre-sel 3=Sensor gate	
SL	Smearless readout	SL=[Param.]<CR><LF>	0=off	1=on	
SM	Shutter mode	SM=[Param.]<CR><LF>	0=Normal 2=auto shutter	1=Program. exp	Only for TR=0 and TR=1
SH	Shutter speed	SH=[Param.]<CR><LF>	0=Off (1/60) 2=1/120 4=1/500 6=1/2000 8=1/8000 10=1/25,000 12=1/100,000 14=1/300,000	1=1/100 3=1/250 5=1/1000 7=1/4000 9=1/15,000 11=1/75,000 13=1/150,000	When SM=0
PE	Programmable exposure	PE=[Param.]<CR><LF>	0 to 628 L 0=1/8L (3.3μs) 1=2/8L (6.7μs) 2=3/8L (10μs) 3=4/8L (13.3μs)	4=1.5L (40μs) 5=2.5L (66.7μs) .. 628=625L(16.7ms)	When SM=1 L = 26.7 μs  Shown time when VB=0 SC=0
D- Signals and polarity					
LS	LVAL accumulation	LS=[Param.]<CR><LF>	0= LVAL sync.	1= LVAL a-sync.	
TI	Trigger Input	TI=[Param.]<CR><LF>	0= CamerLink	1= 12 pin Hiror	
TP	Trigger polarity	TP=[Param.]<CR><LF>	0= active low	1= active high	*1)
E - Gain and analogue signals setting					
AS	Gain select	AS=[Param.]<CR><LF>	0>manual gain	1=AGC	
GA	Gain level	GA=[Param.]<CR><LF>	-50 to +150		-50=-3, 150=12dB
AG	AGC/auto shutter reference	AG=[Param.]<CR><LF>	1 to 1023		When AS =1
BL	Black level	BL=[Param.]<CR><LF>	0-255 (0=low 255=high)		
GS	Gamma select	GS=[Param.]<CR><LF>	0=gamma 1	(1=gamma 0.45)	0.45 only A10CL
F - Saving and loading data in EEPROM					
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	Data from latest used area default at power up
SA	Save settings to camera EEPROM	SA=[Param.]<CR><LF>	2=User 2 area	1=User 1 area 3=User 3 area	Parameter = 0 is not allowed
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. TTL only.

**!! Do not try to use commands not shown in this list.**

## 8. Camera Control Tool for CV-A10CL/A70CL

From [www.jai.com](http://www.jai.com) Camera Control Tool for Windows 98/NT/2000 can be downloaded. The control tool contents a camera control program and tools for making your own program. For the integrator and experienced user, the Camera Control Toll 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.

### 8.1. Control Tool Windows

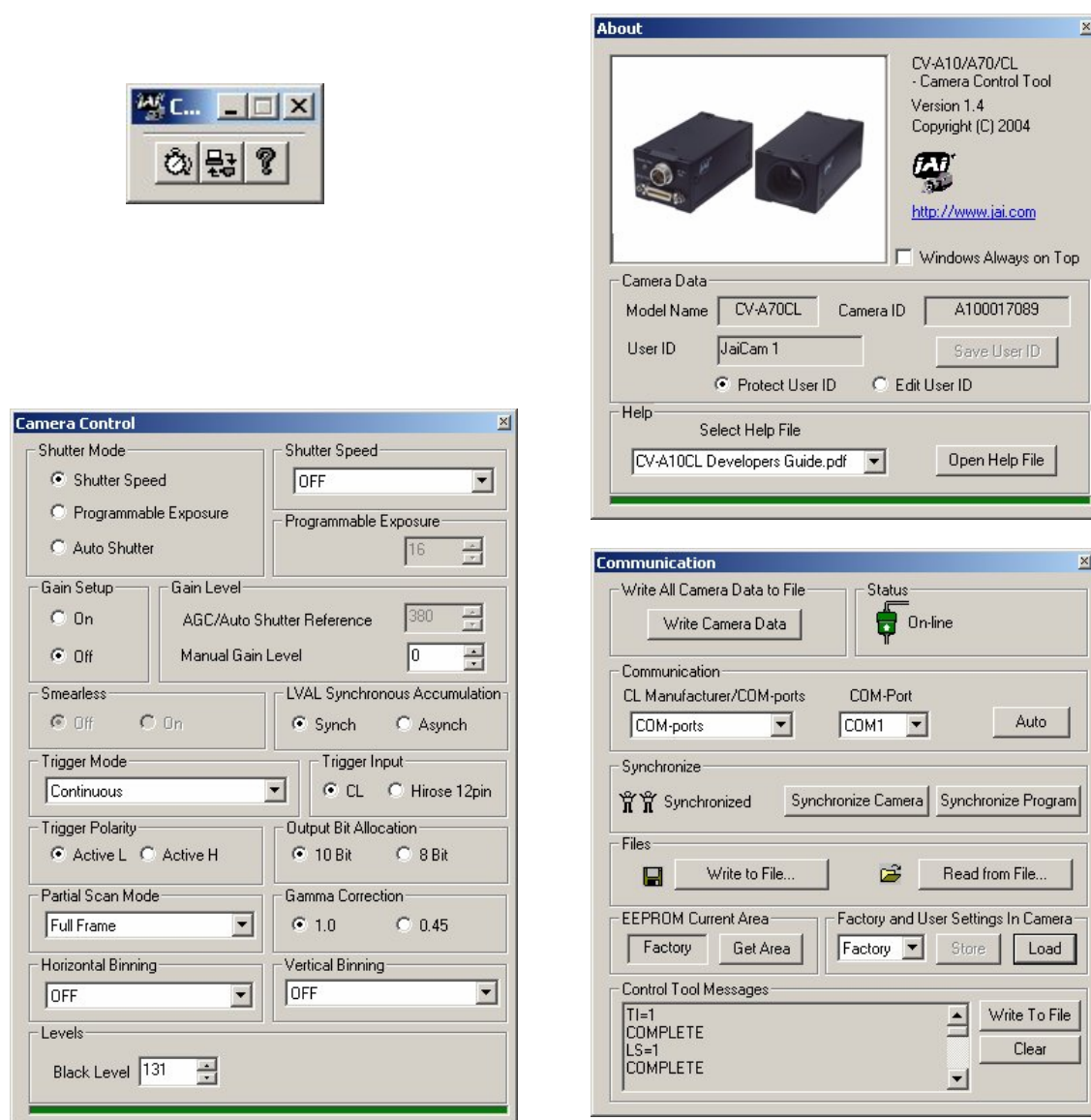


Fig. 37. CV-A10CL Camera control tool windows.

### 8.2. 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:

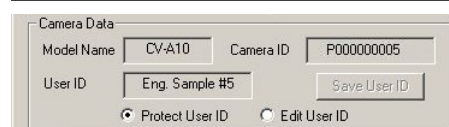
<http://www.jai.com/camera/manuals.asp/sprog=uk>

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

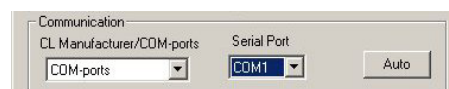
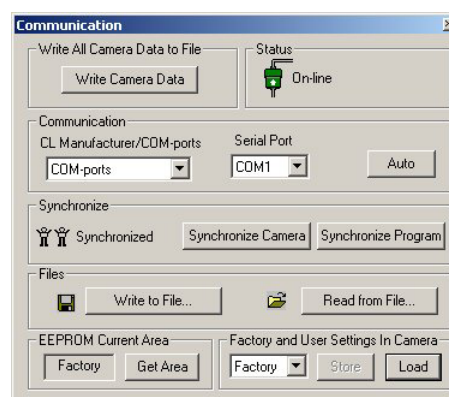
The Communication Window is used to connect the Camera Control Tool with the JAI camera. Depending of camera there are 2 possible ways to communicate with a JAI camera.

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:

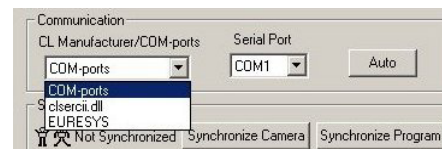
1. Select 'COM-ports' from the 'CL Manufacturer/COM-ports' list Box.
2. Select the communication port, where the serial cable is connected to the camera from the 'Serial Port' list box or click the 'Auto' button to search for a camera on communication port 1 to 16.



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.

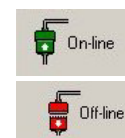
Off/On-line mode

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.

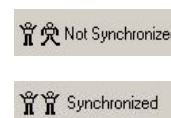


Changing the settings in the application will automatically update the camera settings when the application is online.

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.

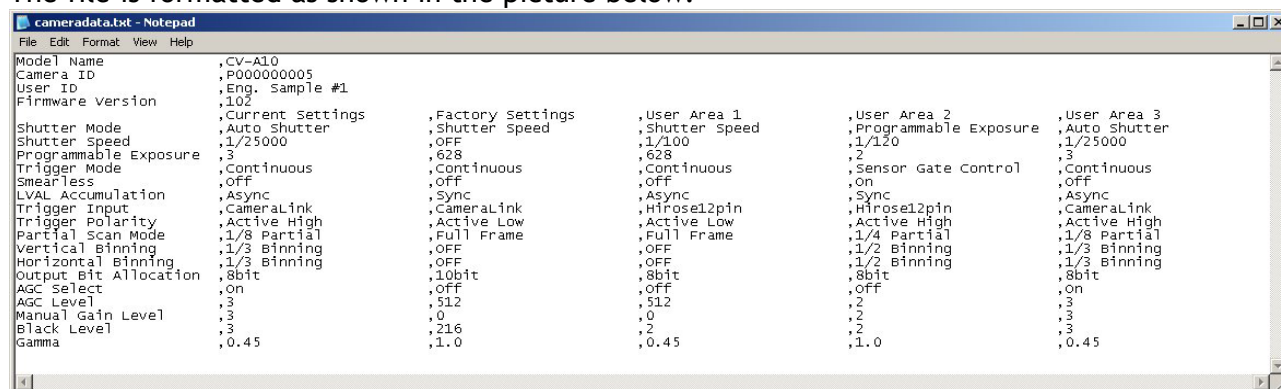
Use the Load button to restore previously saved camera settings from either the Factory or the User EEPROM area.

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:

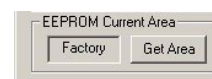
Model Name, Camera ID, User ID, Firmware Version, Current Settings, Factory Settings and the available User Areas.

The file is formatted as shown in the picture below:



EEPROM Current Area.

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



### 8.3. 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".

## 9. External Appearance and Dimensions

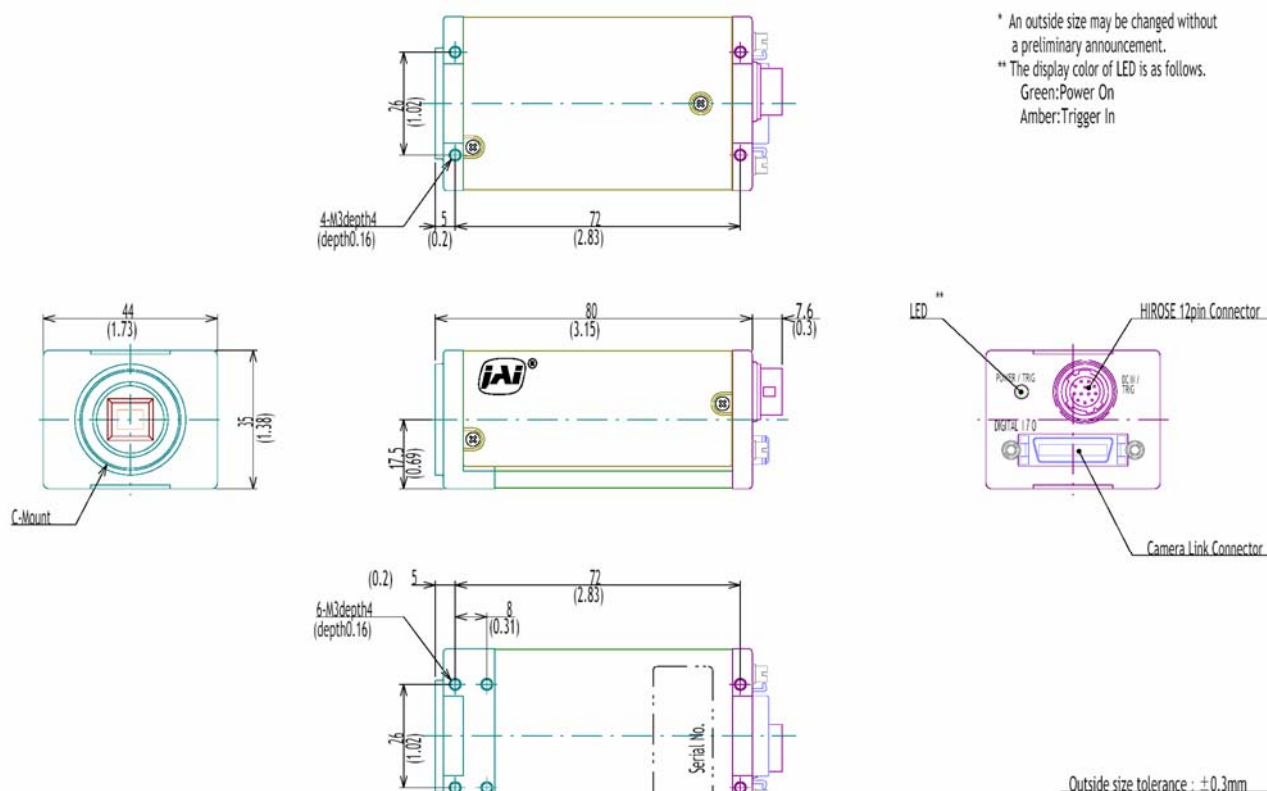


Fig. 38. Outline.

## 10. Specifications

### 10.1. Spectral sensitivity

CV-A70CL is with an IR stop and optical low-pass filter block in front of the CCD sensor.

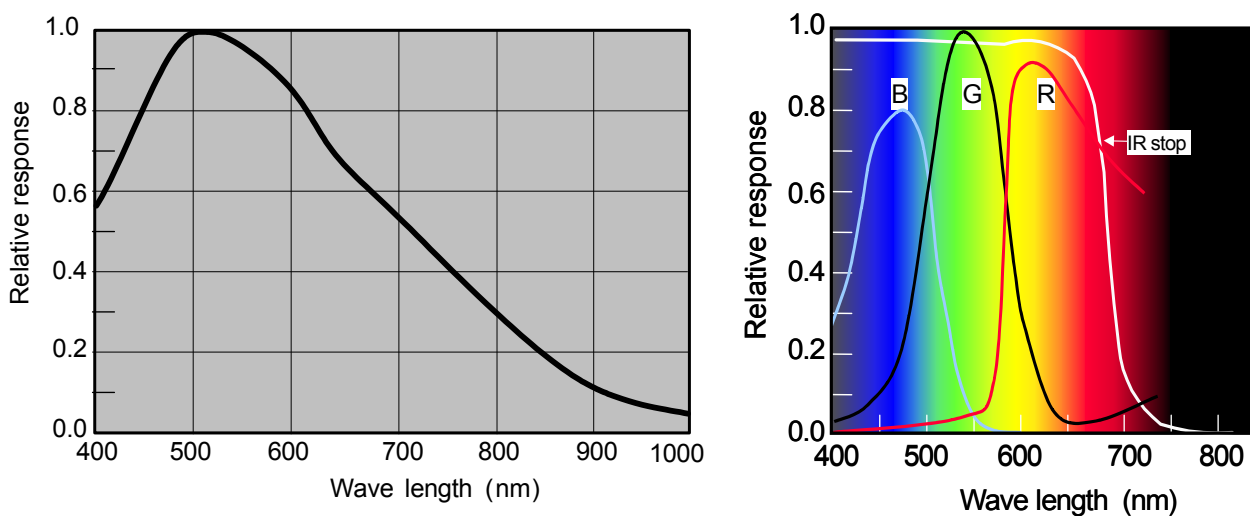


Fig. 39. Spectral sensitivity for CV-A10 CL and CV-A70 CL

## CV-A10 CL and CV-A70 CL

### 10.2. Specification table

Specifications	CV-A10 CL	CV-A70 CL
Scanning system	Progressive scan	
Frame rate full frame	60 frames/sec. Progressive (625 lines/frame)	
Pixel clock	36.15 MHz	
Line frequency	37.5 kHz (964 pixels clock/line)	
CCD sensor	1/2". Monochrome ICX-415AL	1/2". Color ICX-415AQ
Sensing area	6.4 (h) x 4.8 (v) mm	
Cell size	8.3 (h) x 8.3(v) $\mu$ m	
Effective pixels	782 (h) x 582 (v)	
Pixels in video output. Full 1/2 partial 1/4 partial 1/8 partial	768 (h) x 576 (v) 60 fps 768 (h) x 287(v) 112 fps 768 (h) x 143 (v) 177 fps 768 (h) x 71 (v) 250 fps	
Sensitivity on sensor	6 Lux (Min. gain, 100% video) 0.8 Lux (Max gain, 50% video)	14 Lux (Min. gain, 100% video) 1.3 Lux (Max. gain, 50% video)
S/N ratio	>55 dB	>54 dB (on Green)
Video output. Digital	8/10 bit Camera Link	
Iris video output. Analogue	0.7 Vpp	
Gain	Manual - automatic	Manual - automatic
Gain range	-3 to +12 dB	-3 to +12 dB. (-3 to +9 dB in aut.)
Gamma	0.45 - 1.0	1.0
Synchronization	Int. X-tal. Ext. HD/VD or random trigger	
Ext HD/VD in. (Not in binning modes)	4 V $\pm$ 2 V. TTL or 75 $\Omega$ terminated	
Tracking range for H	37.50 KHz $\pm$ 1%	
Trigger input. TTL Camera Link	4 V $\pm$ 2 V. TTL or 75 $\Omega$ terminated Via Camera Link	
EEN output	4 V from 75 $\Omega$ source	
Trigger modes	Continuous, Edge Pre-Select, Pulse Width Control, and Sensor Gate control	
Accumulation	LVAL synchronous or asynchronous	
Shutter speed EPS	1/60 to 1/300,000 second	
Programmable exposure	1/8 line to 625 lines. (3.3 $\mu$ s to 16.7 ms)	
Pulse width control	2 lines to 120 frames.	
Auto shutter range	1/60 to 1/25,000	
Readout modes	Partial scan. Full, 1/2, 1/4, 1/8 Vertical binning. Off, 1/2, 1/3, 1/4 Horizontal binning. Off, 1/2, 1/3, 1/4 Smearless	Partial scan. Full, 1/2, 1/4, 1/8 Smearless
Control interface	RS 232C or Camera Link	
Functions controlled by RS 232C	Shutter, Trigger, Scanning, Read out, Polarity, Black level, Gain, Gamma	
Operating temperature	-5°C to +45°C	
Humidity	20 - 80% non-condensing	
Storage temp/humidity	-25°C to +60°C/20% to 90%	
Vibration	10G (20Hz to 200Hz, XYZ)	
Shock	70G	
EMC	CE (EN50081-1 and EN50082-1), FCC part 15 class B	
Power	12V DC $\pm$ 10%. 4 W. (<0.33A)	
Lens mount	C-mount (Flange back 17.526 mm -0.05mm) Image centre $\pm$ 0.1mm from C-mount centre	
Dimensions	35 x 44 x 80 mm (HxWxD)	
Weight	150g	

Note: Above specifications are subject to change without notice

## 11. Appendix

### 11.1. Precautions

Personnel not trained in dealing with similar electronic devices should not service this camera. The camera contains components sensitive to electrostatic discharge. The handling of these devices should follow the requirements of electrostatic sensitive components.

Do not attempt to disassemble this camera.

Do not expose this camera to rain or moisture.

Do not face this camera towards the sun, extreme bright light or light reflecting objects.

When this camera is not in use, put the supplied lens cap on the lens mount.

Handle this camera with the maximum care.

Operate this camera only from the type of power source indicated on the camera.

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

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

#### Blemishes

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

#### Patterned Noise

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

### 11.3. References

1. This manual can for CV-A10 CL and CV-A70 CL can be downloaded from [www.jai.com](http://www.jai.com)
2. Datasheet for CV-A10 CL and CV-A70 CL can be downloaded from [www.jai.com](http://www.jai.com)
3. Camera control software can be downloaded from [www.jai.com](http://www.jai.com)
4. Specifications for the CCD sensor Sony ICX-415AL can be found on [www.jai.com](http://www.jai.com)
4. Specifications for the CCD sensor Sony ICX-415AQ can be found on [www.jai.com](http://www.jai.com)

## 12. Users Record

Camera type: CV-A10 CL/CV-A70 CL

Revision: (Revision C)

Serial No. ....

Firmware version. ....

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

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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  
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