



See the possibilities

User's Manual

AD-080CL

*Digital 2CCD Progressive Scan
Multi-Spectral Camera*

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Table of Contents

1.	General	3
2.	Camera nomenclature	3
3.	Main Features	4
4.	Locations and functions	5
5.	Pin configuration	6
5.1	12-pin multi connector (DC in / Trigger in)	6
5.2	Digital Output Connector (Camera Link™)	6
5.3	Input and output circuits	7
5.3.1	Iris Video output	7
5.3.2	Trigger input	7
5.3.3	XEEN (Exposure Enable) output	7
5.3.4	Camera Link Interface	7
6.	Third party products	9
6.1	Lens considerations	9
6.2	Frame grabber boards	9
7.	Functions and operation	10
7.1	Basic functions	10
7.1.1	2 CCD optical assembly	10
7.1.2	Continuous operation or triggered operation	11
7.1.3	Configuring the Camera Link interface	11
7.1.4	Digital Video output (Bit allocation)	12
7.1.5	Iris Video output	12
7.2	Auto-detect LVAL-sync / a-sync. accumulation	12
7.2.1	Partial scan and Color Pixels layout	13
7.2.2	Electronic shutter (Commands SM1 and SM2, SH1 and SH2, PE1 and PE2)	14
7.2.3	Shading correction (Commands SDM1 and SDM2, RS1 and RS2)	14
7.2.4	Knee compensation (Commands KN1 and KN2)	14
7.2.5	White balance (Commands WB1, GA1, GAR1, GAB1, AW1, WA1)	15
Rear Panel Indicator		15
7.2.6	Test Signal Generator (Commands: PBY1,PBY2)	16
7.2.7	Cross hair generator (Commands: CM1,CM2)	16
7.3	Modes and functions matrix	16
7.4	Sensor Layout and Timing	17
7.4.1	Sensor Layout	17
7.4.2	Horizontal Timing	18
7.4.3	Vertical Timing	19
7.4.4	Partial Scan	19
7.5	Operation Mode	23
7.5.1	Continuous mode	23
7.5.2	Pre-Select trigger mode	23
7.5.3	Pulse Width trigger mode	25
7.5.4	Smear-Less mode	27
8.	Configuring Camera	28
8.1	Serial communication	28
8.2	Setting functions	29
8.2.1	Output mode (Command IS)	29
8.2.2	Trigger input select (Command TI1 and TI2)	29
8.2.3	Trigger mode (Command TR1 and TR2)	29
8.2.4	Trigger polarity (Command TP1 and TP2)	29

8.2.5	Smear Less (Command SL1 and SL2).....	29
8.2.6	Scan Format (Command SC1 and SC2)	29
8.2.7	Gain Master level (Command GA1 and GA2)	29
8.2.8	AGC select (Command AGC1 and AGC2)	29
8.2.9	Setup-Y (Command BLY1 and BLY 2)	29
8.3	Load and Save functions	29
8.4	AD-080CL Command list	30
9.	AD-080CL Camera Control Tool	35
9.1	Camera Control Tool Interface.....	35
9.1.1	Camera Control Tool Bar	35
9.1.2	The About Window	35
9.1.3	Communication Window.....	36
9.1.4	Common Control window.....	37
9.1.5	Camera Control Window.....	37
9.2	Using the Camera Control Tool	38
10.	External Appearance and Dimensions.....	39
11.	Specifications	40
11.1	Spectral response	40
11.2	Specifications Table	41
12.	Appendix.....	43
12.1	Precautions.....	43
12.2	Typical Sensor Characteristics	43
12.3	Caution when mounting a lens on the camera	43
12.4	Exportation.....	44
12.5	References	44
13.	User's Record.....	46



1. General

AD-080CL is a unique prism based 2CCD multi-spectral camera, combining a visible color channel (Bayer mosaic CCD) and a Near-IR channel (monochrome CCD).

The major advantage of the AD-080CL is that it captures both channels simultaneously through the same optical path.

This camera can be used for solving inspection tasks, where images from the visible (color) and near-infrared spectrum are required in combination. Typical applications include print inspection, fruit, vegetable & produce inspection, surface quality control, to mention only few.

The AD-080 CL uses a standard Camera Link interface, whereby each channel can output images with 8 or 10-bit depth. The color channel can also output 24-bit RGB.

2. Camera nomenclature

The standard camera composition consists of the camera main body and Sensor protection cap.

The camera is available in the following version.

AD-080 CL

Where A stands for “Advanced family“ ,

D stands for “Dual CCD“,

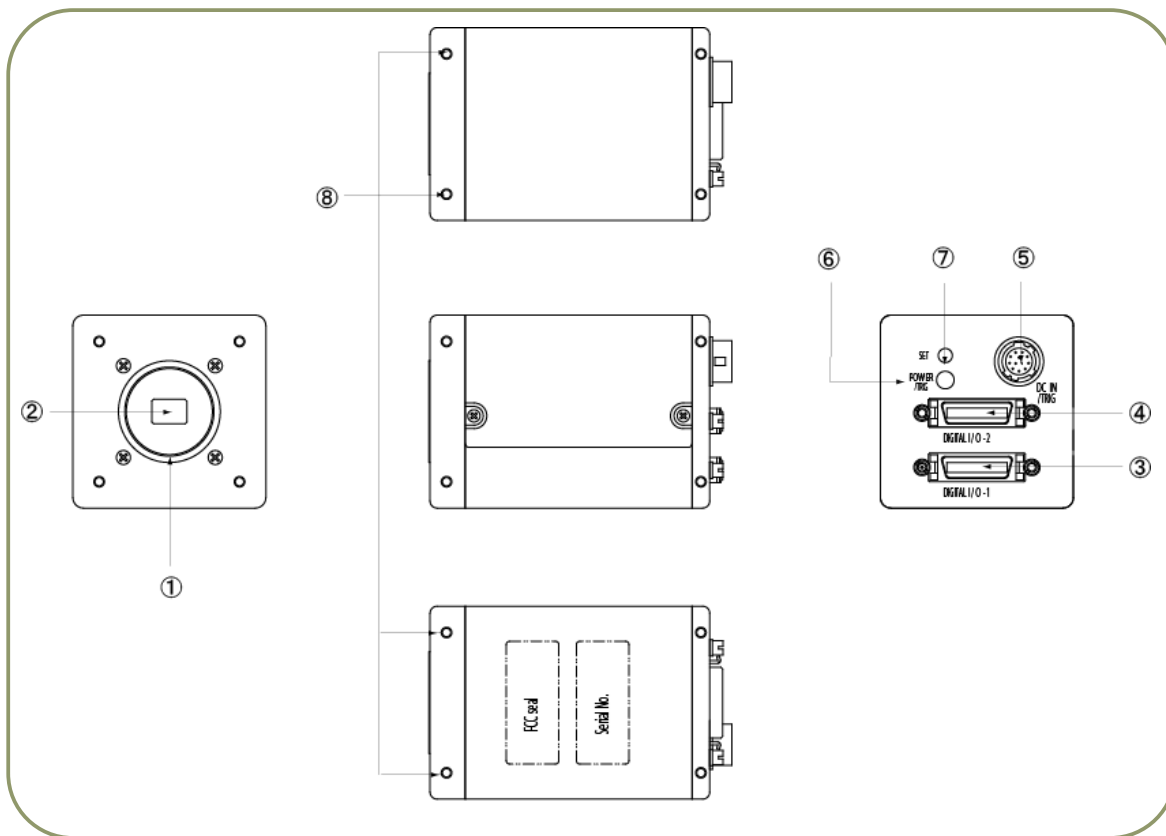
080 represents the resolution “ 800K pixels” and

CL stands for Camera Link™ Interface.

3. Main Features

- Multi-spectral 2-channel CCD camera
- Advanced series 2 x 1/3" progressive scan camera
- Simultaneously captures Visible and Near-IR through the same optical path
- 1024 (h) x 768 (v) active pixels per channel
- 4.65 μm square pixels
- 30 frames/second with full resolution
- Increased frame rate with partial scan
- Programmable exposure from 20 μs to 33ms
- Pre-select and Pulse width trigger modes
- LVAL Synchronous/-asynchronous operation (auto-detect)
- Auto-iris lens video output allows a wider range of light
- RGB 24-bit or Raw Bayer 10 or 8-bit output for visible
- 10 or 8-bit output for Near-IR
- Setup by Windows NT/2000/XP via serial communication

4. Locations and functions



- | | | |
|---|---------------------|----------------------------------|
| ① | Lens Mount | : C-mount (Note) |
| ② | CCD Sensor | : 1/3 inch CCD sensor |
| ③ | 26P Multi Connector | : Camera Link connector Output 1 |
| ④ | 26P Multi Connector | : Camera Link connector Output 2 |
| ⑤ | 12P Multi Connector | : DC+12V and Trigger Input |
| ⑥ | LED | : Power and Trigger indications |
| ⑦ | Push Button | : For Auto white balance |
| ⑧ | Mounting holes | : M3, max length 5mm |

(Note)

AD-080CL is based on a Dichroic Prism. For optimal performance, lenses designed for 3CCD cameras should be used with this camera.

Rear protrusion of the C-mount lens must be less than 4mm to avoid damage to the prism.

Fig.1. Locations

5. Pin configuration

5.1 12-pin multi connector (DC in / Trigger in)

Type: HR-10A-10R-12PB
(Hirose) male.
(Seen from rear of camera.)

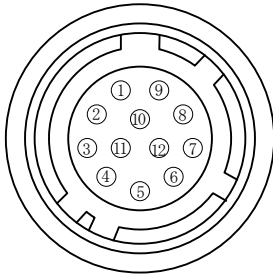


Fig.2. 12-pin connector

Pin No.	In / Out	Name	Remarks
1		GND	
2		DC (+12V) in	
3		GND	
4	O	Iris Video	For Auto-Iris lens
5		GND	
6	O	XEEN 1	Negative Logic
7	O	XEEN 2	
8		GND	
9			
10	I	Trigger 1	Channel 1
11	I	Trigger 2	Channel 2
12		GND	

5.2 Digital Output Connector (Camera Link™)

Type: 3M 10226-1A10JL

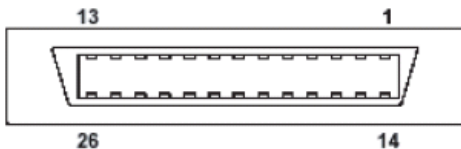


Fig.3. 26-pin CameraLink connector

Pin No	CameraLink Connector 1		CameraLink Connector 2		Remarks
	In/Out	Name	In/Out	Name	
1,14		Shield		Shield	GND
2(-),15(+)	O	TxOUT0	O	TxOUT0	Data output
3(-),16(+)	O	TxOUT1	O	TxOUT1	
4(-),17(+)	O	TxOUT2	O	TxOUT2	
5(-),18(+)	O	TxCk	O	TxCk	Clock for CL
6(-),19(+)	O	TxOUT3	O	TxOUT3	Data output
7(+),20(-)	I	SerTC (RxD)	I	SerTC (RxD)	LVDS serial control
8(-),21(+)	O	SerTFG (TxD)	O	SerTFG (TxD)	
9(-),22(+)	I	CC1 (Trigger)	I	CC1 (Trigger)	Ext.trigger IN
10(+),23(-)		N.C		N.C	
11,24		N.C		N.C	
12,25		N.C		N.C	
13,26		Shield		Shield	GND

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 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 V p-p from 75 Ω without termination.

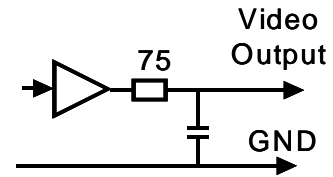


Fig.4. Iris video circuit

5.3.2 Trigger input

An external trigger input can be applied to pin 10 and 11 of 12-pin Hirose connector (when the command T11=1 or T12=1 has been set).

The input is AC coupled. To allow long pulses the input circuit is designed as a flip-flop circuit. The leading and trailing edges of the trigger pulse activate the circuit.

The trigger polarity can be changed by TP1/TP2=1.

Trigger input level 4 V \pm 2 V.

Trigger can also be applied through the Camera Link connector, when the command T11/T12=0 have been sent.

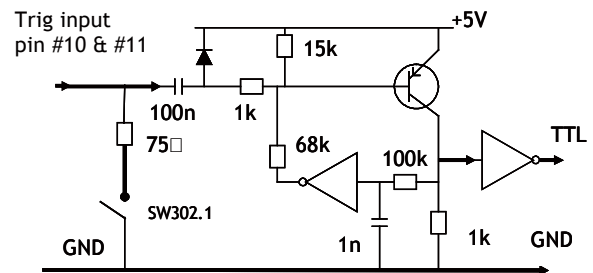


Fig.5. Trigger circuit

5.3.3 XEEN (Exposure Enable) output

XEEN is available on pins 6 and 7 of the 12-pin Hirose connector.

The output circuit is 75 Ω complementary emitter followers. It will deliver a full 5 volt signal.

Output level \geq 4 V from 75 Ω . (No termination).

EEN is also found in Camera Link.

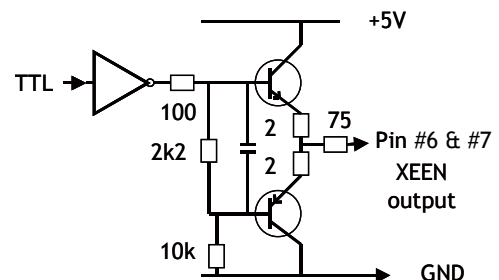


Fig.6. XEEN output circuit

5.3.4 Camera Link Interface

The video output can be configured as follows:

Visible (color) channel: 10/8-bit raw Bayer or 24 bit-RGB color

Near-IR channel: 10/8-bit for Near-IR channel.

They are both output via a standard Camera Link interface.

The pin configuration of 26-pin connector conforms to Camera Link BASE configuration. However, since AD-080CL camera can be set for various configurations, the Camera Link assignment will vary depending on specific settings. Please refer the below table for details.

Port/ Signal	Camera Link Output Connector 1					Camera Link Output Connector 2					Pin No.
	Bayer 10-bit	Bayer 8-bit	Bayer 10-bit / Near-IR 10-bit * Note	Bayer 8-bit / Near-IR 8-bit * Note	RGB 24-bit	Near-IR 10-bit	Near-IR 8-bit	Near-IR 10-bit/ Bayer 10-bit * Note	Near-IR 8-bit / Bayer 8-bit * Note	RGB 24-bit	
Port A0	D0	D0	D0	D0	RD0	NIR_D0	NIR_D0	NIR_D0	NIR_D0	RD0	Tx0
Port A1	D1	D1	D1	D1	RD1	NIR_D1	NIR_D1	NIR_D1	NIR_D1	RD1	Tx1
Port A2	D2	D2	D2	D2	RD2	NIR_D2	NIR_D2	NIR_D2	NIR_D2	RD2	Tx2
Port A3	D3	D3	D3	D3	RD3	NIR_D3	NIR_D3	NIR_D3	NIR_D3	RD3	Tx3
Port A4	D4	D4	D4	D4	RD4	NIR_D4	NIR_D4	NIR_D4	NIR_D4	RD4	Tx4
Port A5	D5	D5	D5	D5	RD5	NIR_D5	NIR_D5	NIR_D5	NIR_D5	RD5	Tx6
Port A6	D6	D6	D6	D6	RD6	NIR_D6	NIR_D6	NIR_D6	NIR_D6	RD6	Tx27
Port A7	D7	D7	D7	D7	RD7	NIR_D7	NIR_D7	NIR_D7	NIR_D7	RD7	Tx5
Port B0	D8	x	D8	NIR_D0	GD0	NIR_D8	x	NIR_D8	D0	GD0	Tx7
Port B1	D9	x	D9	NIR_D1	GD1	NIR_D9	x	NIR_D9	D1	GD1	Tx8
Port B2	x	x	x	NIR_D2	GD2	x	x	x	D2	GD2	Tx9
Port B3	x	x	x	NIR_D3	GD3	x	x	x	D3	GD3	Tx12
Port B4	x	x	NIR_D8	NIR_D4	GD4	x	x	D8	D4	GD4	Tx13
Port B5	x	x	NIR_D9	NIR_D5	GD5	x	x	D9	D5	GD5	Tx14
Port B6	x	x	x	NIR_D6	GD6	x	x	x	D6	GD6	Tx10
Port B7	x	x	x	NIR_D7	GD7	x	x	x	D7	GD7	Tx11
Port C0	x	x	NIR_D0	x	BD0	x	x	D0		BD0	Tx15
Port C1	x	x	NIR_D1	x	BD1	x	x	D1		BD1	Tx18
Port C2	x	x	NIR_D2	x	BD2	x	x	D2		BD2	Tx19
Port C3	x	x	NIR_D3	x	BD3	x	x	D3		BD3	Tx20
Port C4	x	x	NIR_D4	x	BD4	x	x	D4		BD4	Tx21
Port C5	x	x	NIR_D5	x	BD5	x	x	D5		BD5	Tx22
Port C6	x	x	NIR_D6	x	BD6	x	x	D6		BD6	Tx16
Port C7	x	x	NIR_D7	x	BD7	x	x	D7		BD7	Tx17
L V A L											Tx24
F V A L											Tx25
D V A L											Tx26
E E N											Tx23

***Note** When the output mode is set at “Separate” , only one channel signal is output.
 For instance, if “BAYER 10 bit/ IR 10 bit” is selected on channel 1, only “ Bayer 10 bit”
 is output when the output mode is set at “ Separate “.
 Command “IS” is related to this . IS=0 Synchronous and IS=1 Separate

6. Third party products

6.1 Lens considerations

The AD-080CL is based on a dichroic prism, allowing precise separation of the visible (color) and Near-Infrared parts of the spectrum. Thanks to the compact design of the prism C-mount lenses can be used with this camera. For optimal performance it is strongly advised to use lenses designed for 3CCD cameras with the AD-080CL.

These lenses have minimal chromatic aberration, thus allowing both the Visible and Near-IR images to be in focus.

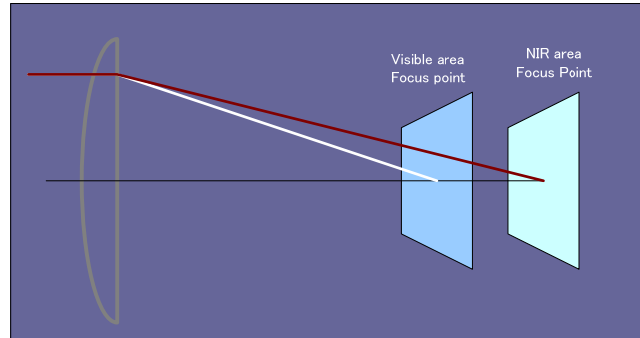


Fig 7. focal points for Visible and NIR lights

6.2 Frame grabber boards

AD-080CL has two Camera Link connectors. It is possible to operate the camera with just a single Camera Link connector when the camera is set to “Synchronous” mode. i.e. when both Channels are operating synchronously. In addition, the output from Channel 1 (Visible, color) must be set to raw Bayer 8- or 10-bit and Channel 2 (Near-IR) must be set to 8- or 10-bit. Chapter 7.1.2 describes how the Camera Link outputs can be configured.

If the two channels are set to operate “Separate”, the two channels act as two individual cameras. Therefore a frame grabber with Dual Base configuration must be used. Alternatively two separate frame grabbers must be use.

When Channel 1 is set to output RGB 24-bit images, a Dual Base frame grabber must also be used. In this case the RGB 24-bit image is normally configured to come of on Camera Link connector 1 and the Near-IR channel is set to come out on Camera Link connector 2.

7. Functions and operation

7.1 Basic functions

The AD-080CL is based on a dichroic prism, allowing precise separation of the visible (color) and Near-Infrared parts of the spectrum into two separate channels.

The Visible (color) channel is referred to as Channel 1 and the Near-Infrared channel is referred to as Channel 2.

Channel 1 and 2 can be configured to operate separately or synchronously. When operating separately each channel can be triggered and read out independently.

The AD-080CL can operate in Continuous (free-run) mode or in the Pre-Select (PS) and Pulse Width (PW) trigger modes.

The Partial Scan function, with 1/2, 1/4 or 1/8 image height, provides higher frame rate at lower vertical resolution.

7.1.1 2 CCD optical assembly

The dichroic prism incorporated in the AD-080CL separates the visible (color) part of the spectrum into a wavelength band from 400nm to 650nm (Channel 1) and the Near-IR part into a band ranging from 760 nm to 1000 nm (Channel 2).

The below figure shows the concept of the separation into Visible and Near-IR bands.

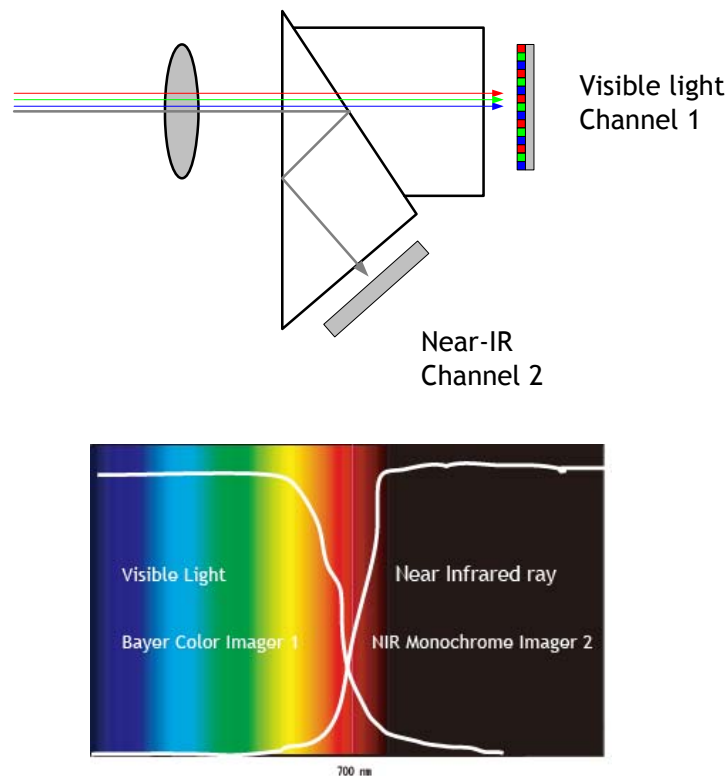


Fig 8. Conceptual diagram for 2CCD prism optics

7.1.2 Continuous operation or triggered operation

The camera can operate in continuous operation to support applications not requiring asynchronous external trigger. This mode permits the use of a lens with video controlled iris. The signal from Channel 1 is used for this purpose. The camera will operate at its maximum frame rate, 30 frames/seconds in this mode.

The command TR1=0 (Channel 1) and TR2=0 (Channel 2) are used to enable Continuous operation.

To use the camera with external asynchronous trigger signals the trigger mode must be set accordingly. Setting the Command TR1=1 or TR2=1 enables the Pre-Select (PS) trigger mode. Here the exposure time is pre-defined by the Preset Shutter (commands SH1 and SH2) or the Programmable Exposure (commands PE1 or PE2).

The command TR1=2 or TR2=2 enables the Pulse Width (PW) trigger mode, whereby the length of the trigger pulse controls the exposure time.

The external trigger signal can be applied to the 12-pin Hirose connector (pin 10 for Channel 1 and pin 11 for Channel 2) or via the Camera Link interface. The 12-pin Hirose input trigger input is factory default.

The input termination for the Hirose 12-pin trigger inputs can be changed from TTL (high impedance) to 75Ω by the internal switch SW802. The below diagram shows where the switch is located and how it is set.

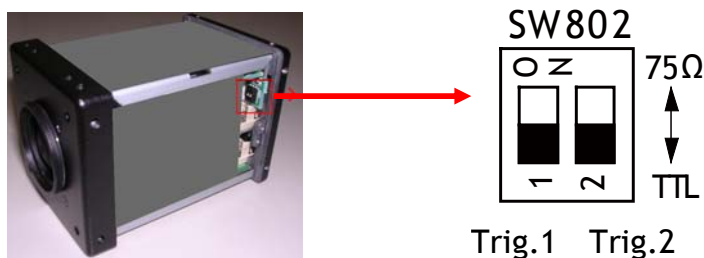


Fig.9. Switch SW802 location and setting

By using the command “TI” the trigger input can be configured to Camera Link. When this is selected, the trigger inputs of both Camera Link connectors can be used. The next chapter describes the configuration of inputs and outputs of the Camera Link interface.

7.1.3 Configuring the Camera Link interface

The AD-080CL has two Camera Link connectors. These two outputs can be synchronized or used separately by setting the command “IS”.

Each connector can output an individual channel or a combination of two channels as shown in the table below. In order to output two channels through one Camera Link connector, the output mode must be set to “synchronous”, command IS=0.

If the channels are to be output on individual channels the output mode must be set to “Separate”, command IS=1.

The command “OS” selects the output format of the two channels. Please note that not all combinations can operate in Separate mode.

Output mode IS=0 or 1	Camera Link 1			Camera Link 2		
	Cmd.	Output format	Default	Cmd.	Output format	Default
Sync/Separate	OS1=0	BAYER 10-bit		OS2=0	IR 10-bit	
Sync/Separate	OS1=1	BAYER 8-bit		OS2=1	IR 8-bit	
Sync	OS1=2	BAYER+NIR 10-bit	•	OS2=2	IR+BAYER 10-bit	
Sync	OS1=3	BAYER+IR 8-bit		OS2=3	IR+BAYER 8-bit	
Sync/Separate	OS1=4	RGB 24-bit		OS2=4	RGB 24-bit	•

In Synchronous mode (IS=0), Trigger 1 activates both channels (and Trigger 2 is not valid). Trigger signals can be input either via the Camera Link interface or as TTL signals at the 12-pin Hirose connector.

7.1.4 Digital Video output (Bit allocation)

The 10-bit digital output is set at 890 LSB as 100% video level when CCD output is 200mV.

The white clip level is set at 1023 LSB when CCD output is 230mV.

When using the 8-bit output, the equivalent settings are 222 LSB and 255 LSB respectively.

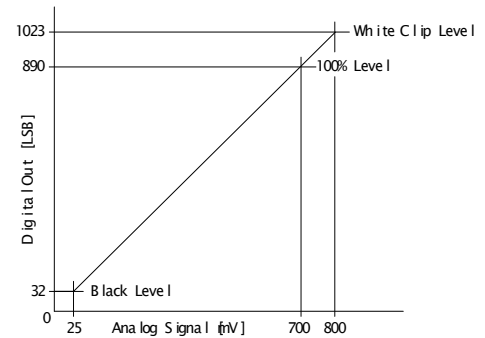


Fig.10. Digital Video Output

7.1.5 Iris Video output

The lens-iris video output level at pin 4 of the 12-pin Hirose connector is 700 mV for 100% video output level 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 mode.

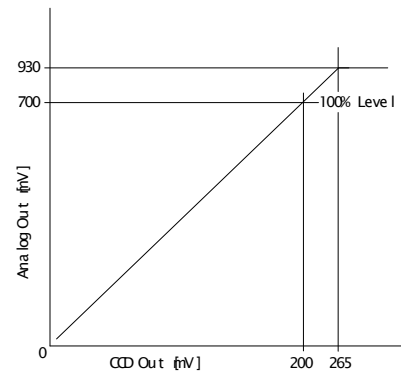


Fig.11. Iris Video output

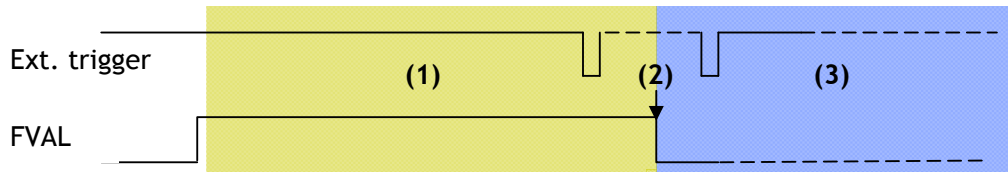
7.2 Auto-detect LVAL-sync / a-sync. accumulation

This function replaces the manual setting found in older JAI cameras. Whether accumulation is synchronous or a-synchronous in relationship to LVAL depends on the timing of the trigger input.

When a trigger is received while FVAL is high (during readout), the camera works in LVAL-synchronous mode, preventing reset feed-through in the video signal. There is a maximum jitter of one LVAL period from issuing a trigger to accumulation start.

When an external trigger is received during FVAL low, the camera works in LVAL-asynchronous (no delay) mode.

This applies to both Pre-Select (PS) trigger and Pulse Width trigger (PW) modes.

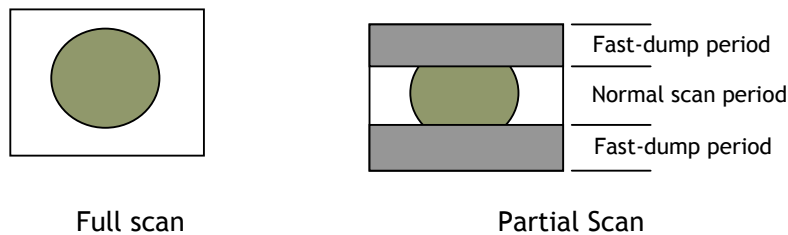


- (1) In this period camera executes trigger at next LVAL (prevents feed-through noise)
- (2) Avoid trigger at FVAL transition (+/- 1 LVAL period), as the function may randomly switch between "next LVAL" and "immediate".
- (3) In this period camera executes trigger immediately (no delay)

Fig. 12. Auto-detect LVAL sync /a-sync accumulation

7.2.1 Partial scan and Color Pixels layout

Partial scan allows higher frame rates by reading out a smaller center portion of the image, reducing vertical resolution. This is particularly useful when inspecting objects that do not fill the whole height of the image.



Channel 1 of the AD-080CL uses a Bayer mosaic color CCD sensor. The color image reconstruction is done in the host PC when the camera is configured for raw Bayer output.

The color sequence in the video signal is the same for all partial scan format, i.e. BG. The right hand drawing shows the color sequence at the image start. The starting line number is shown from FVAL. The first active pixel is offset 8 pixels from LVAL, when DVAL rises.

Channel 1 can also be configured to output 24-bit RGB video.

Even lines starts with GRG.

Odd lines starts with BGB.

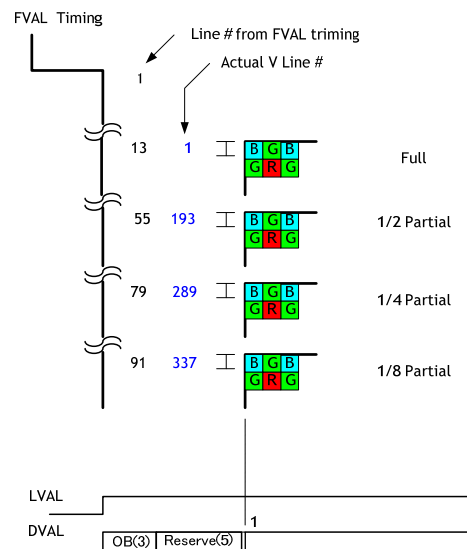


Fig.13. Bayer color mosaic

7.2.2 Electronic shutter

(Commands SM1 and SM2, SH1 and SH2, PE1 and PE2)

When Shutter Mode (SM) is set 1, the Pre-Select function is enabled. This allows a fixed shutter to be set either by the Pre-set shutter (SH) or by the Programmable Exposure (PE).

Pre-set Shutter (SH) The range of settings is from SH=0(OFF) to SH=11 (1/50,000)
 OFF(1/30); 1/60; 1/100; 1/120; 1/250; 1/500; 1/1000;
 1/2,000; 1/4,000; 1/10,000; 1/16,000; 1/50,000

Programmable Exposure (PE) Exposure time can be controlled in 1 LVAL unit (42.07µs).
 The range is from 0.5LVAL to 792LVAL. The actual shutter speed for each operation mode is shown below.

Mode	Read Out	Minimum shutter speed	Maximum shutter speed
Continuous, Pre-Select	Full, Partial	20µs at PE=0 (1/50,000)	1 Frame
Pulse Width	Full, Partial	42.07µs x 1L+42.07µs x 0.5L= 63.1µs (approx. 1/16,000s)	60 Frames (2 seconds)

Note: In Pulse Width mode, the minimum trigger pulse width must be >2LVAL.

7.2.3 Shading correction

(Commands SDM1 and SDM2, RS1 and RS2)

The AD-080CL features a shading correction circuit that can be used for reducing shading resulting from illumination, lens vignetting or prism shading caused by lenses with a wide output aperture.

The shading correction circuit divides the image up into 128 horizontal and 96 vertical fields, and adjusts these regions in relationship to the image center.

Each channel is treated handled separately by the commands SDM1 and SMD2 (turns shading correction on and off). To set (calibrate) the shading correction, the commands RS1 and RS2 are used.

The shading correction works with all output formats, raw Bayer color, Near-IR and 24-bit RGB.

7.2.4 Knee compensation (Commands KN1 and KN2)

The camera operates internally with 12-bit digitization, resulting in a dynamic range of 1335 LSB.

The output can be selected as 8- or 10-bit whereby the data over 1023 LSB is clipped to provide linear relationship between the input (CCD signal) and the output (Camera Link).

The Knee compensation circuit, featuring Knee Point and Knee Slope settings, makes it possible to map the data up to 1335 LSB into the 8-bit or 10-bit output.

The right drawing shows the characteristics for factory default.

The Knee compensation can be used together with the RGB 24-bit or Monochrome 8- or 10-bit

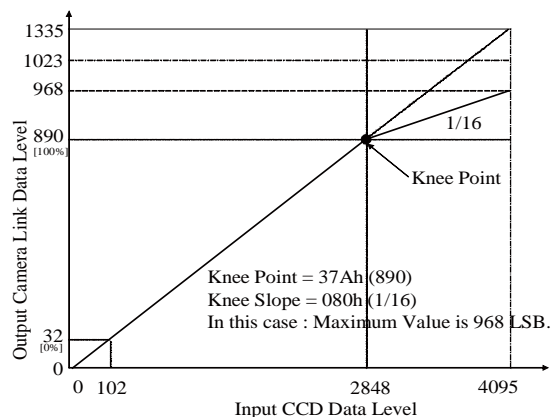


Fig. 14. Knee characteristics (Default setting)

output.

7.2.5 White balance
(Commands WB1, GA1, GAR1, GAB1, AW1, WA1)

When using the RGB 24-bit output mode, the white balance function is available. It can be used in 4 ways:

- 1) Continuous (tracking) Automatic White Balance, AWB
- 2) One-push AWB (rear panel push-button or command AW1=0)
- 3) Manual white balance setting, and
- 4) Pre-set white balance of 3,200K, 4000K, 4600K and 5600K.

Command:	WB1=0	Manual or One-push white balance
	WB1=1	Continuous (tracking) AWB
	WB1=2	4,000K
	WB1=3	4,600K
	WB1=4	5,600K
	WB1=5	3,200K

Manual white balance is achieved by optimizing the manual gain settings GA1, GAR1 and GAR2.

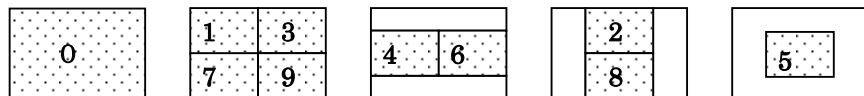
Items	Continuous (tracking) AWB ⁽¹⁾	One-push AWB ⁽²⁾	Manual WB
Adjusting range	-3dB to +6dB	-3dB to +6dB	-3dB to +6dB
Activated by the user on the camera	No	Yes	No
Possibility to store WB settings	No	Yes	Yes

Note 1: When using Continuous AWB, results depend on the surface properties of the object.
Note 2: One-push AWB may take up to 3 seconds to complete.

White Balance Measuring area

The user can select which part of the image is used for White Balance measurement. The command WA1 is used for this. The 9 different settings are as follows:

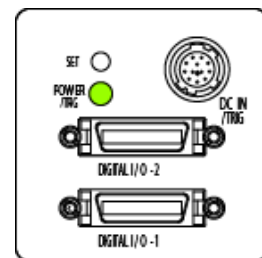
- 0 : Full area
- 1 : Upper Left
- 2 : Upper Center
- 3 : Upper Right
- 4 : Center Left
- 5 : Center
- 6 : Center Right
- 7 : Lower Left
- 8 : Lower Center
- 9 : Lower Right



Rear Panel Indicator

The rear panel mounted LED provides the following information:

- Amber : Power connected - initiating
- Steady green : Camera is operating in Continuous mode
- Flashing green : The camera is receiving external trigger



7.2.6 Test Signal Generator (Commands: PBY1,PBY2)

The AD-080CL has a built-in test pattern generator. The test patterns can be enabled by these commands:

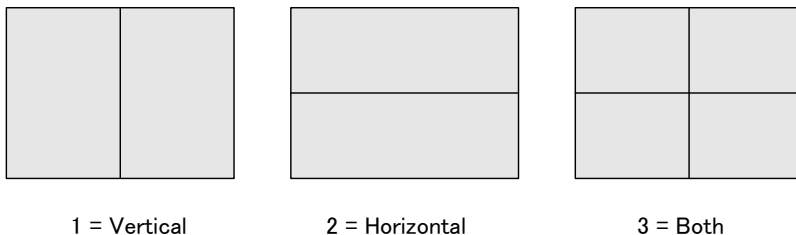
PBY1 for Visible (color) channel, imager 1: 0= Off, 1= Gradient, 2= Color Bar⁽¹⁾

PBY2 for Near-IR channel, imager 2: 0= Off, 1= Gradient, 2= 100% White

Note 1: This test signal is available only when the RGB 24-bit output is selected on the Visible (color channel).

7.2.7 Cross hair generator (Commands: CM1,CM2)

AD-080CL has a built-in cross hair generator for each channel. It can be configured to display a Vertical line, a Horizontal line or a combination of both lines.



7.3 Modes and functions matrix

AD-080CL has two output modes for each channel output. One is “Synchronous” mode and the other is “Separate” mode. On the Synchronous mode, two Camera Link output is synchronized each other and on the Separate mode, two Camera Link outputs are separately output. The following table shows modes and functions matrix.

Output mode, “IS”	Operation		Color Imager (Channel 1)				Near-IR imager (Channel 2)				Auto Iris
	TR	Mode	Trig. IN 1	Shutter	Partial	Smear Less	TRIG. IN 2	Shutter	Partial	Smear Less	
IS=0 Sync	0	Cont.	No	Yes	Yes	No	No	Yes	←	No	Yes ⁽¹⁾
	1	PS	Yes	Yes	Yes	Yes	No	Yes	←	←	
	2	PW	Yes	No	Yes	Yes	No	No	←	←	
IS=1 Separate	0	Cont.	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes ⁽¹⁾
	1	PS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	2	PW	Yes	No	Yes	Yes	Yes	No	Yes	Yes	

Legend:

← means that this channel (Channel 1) uses the Channel 1 settings

Note (1) The analogue output for Auto iris is the signal from the color imager.

7.4 Sensor Layout and Timing

7.4.1 Sensor Layout

The CCD sensor layout, with respect to vertical and horizontal pixels used in full frame read-out, is shown below. For Bayer color sequence, refer to chapter 7.2.1.

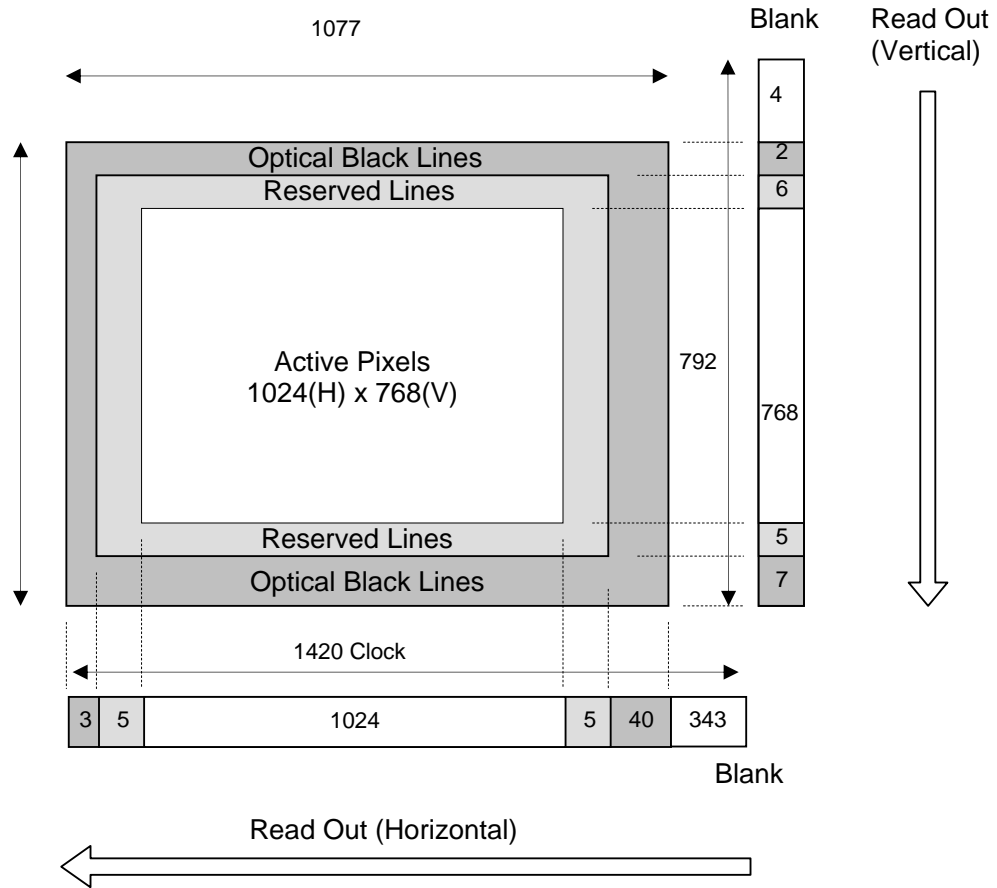
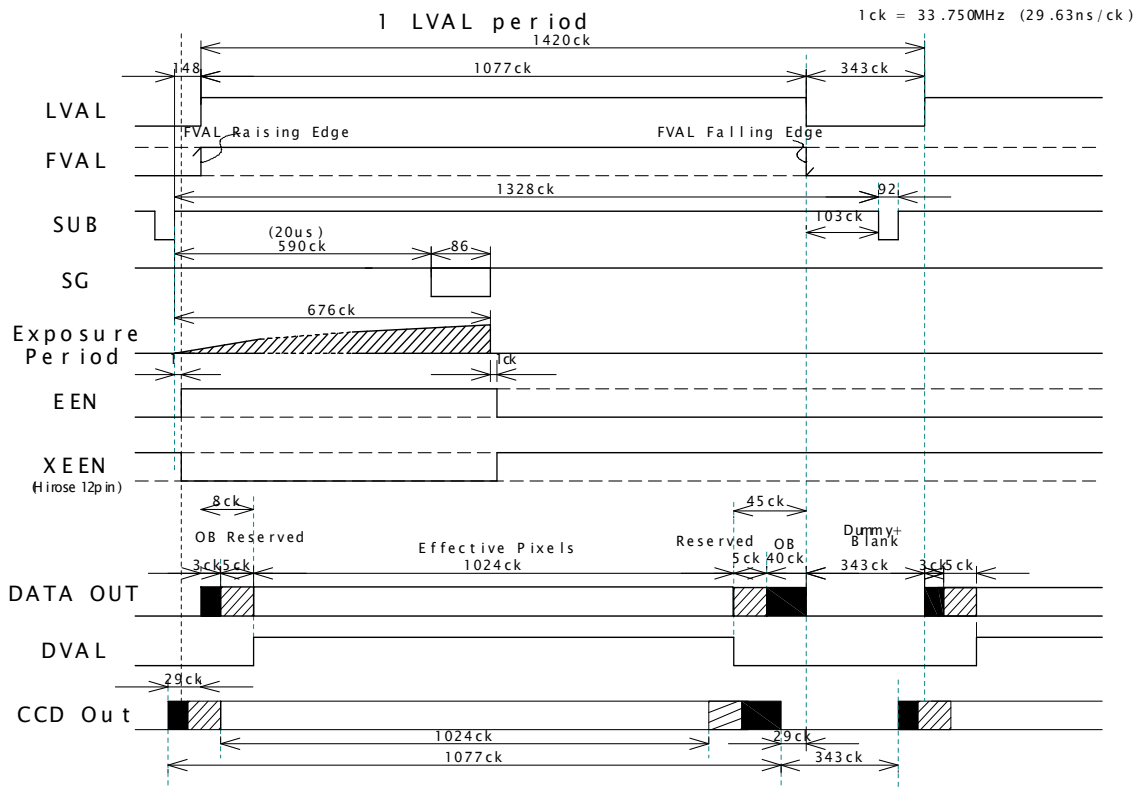


Fig.15. Sensor layout and video output image

7.4.2 Horizontal Timing

The horizontal timing for continuous mode, full frame and partial scan are shown below. This is the common for both Bayer color imager and Monochrome IR imager.

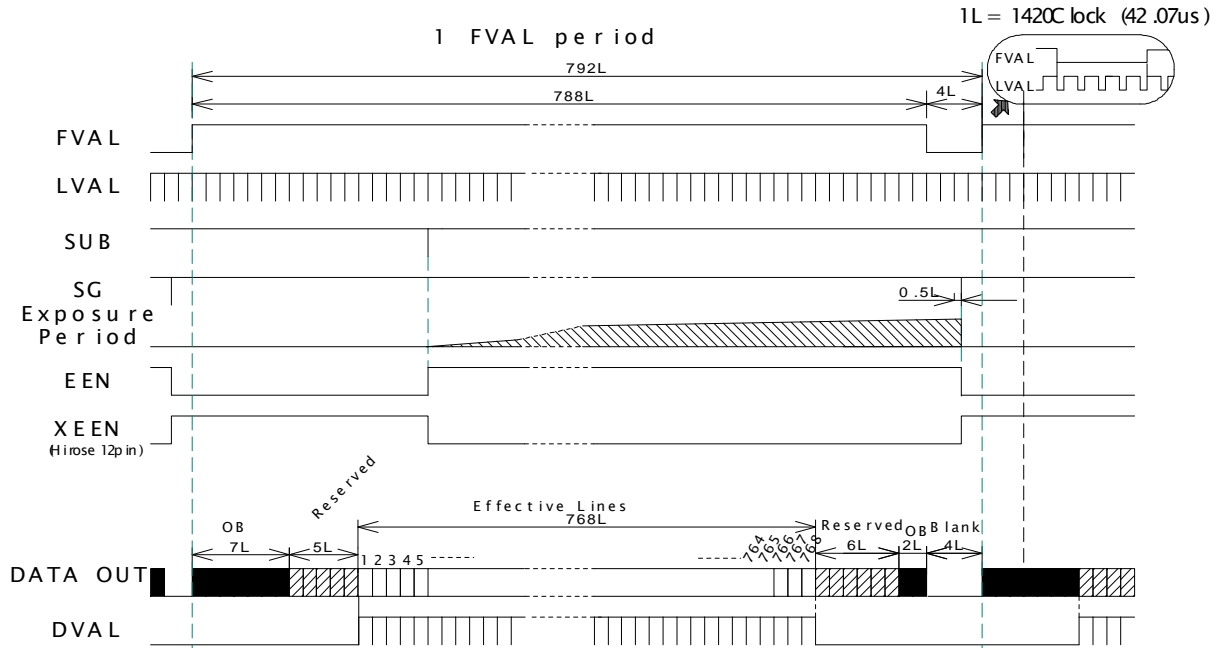


1CLK: 1 Pixel clock period OB: Optical black
 LVAL is HIGH in the period of optical black and effective video periods
 DVAL is HIGH in the effective video period

Fig.16. Horizontal Timing

7.4.3 Vertical Timing

The vertical timing for continuous mode and full frame scan are shown below. This is the common for both Bayer color imager and Monochrome IR imager.



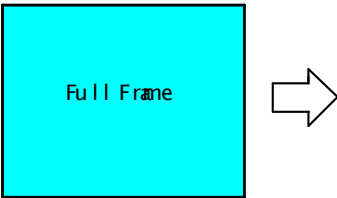
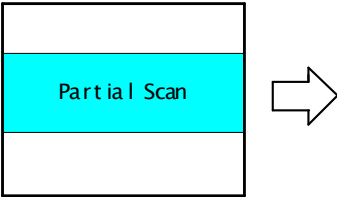
1L : 1 LVAL period OB: optical black
 FVAL is HIGH in the optical black and effective video periods
 LVAL is always output
 DVAL is output during the effective lines

Note: In case of the RGB24bit output, the output timing is delayed by 1 LVAL as comparing to Bayer and IR outputs.

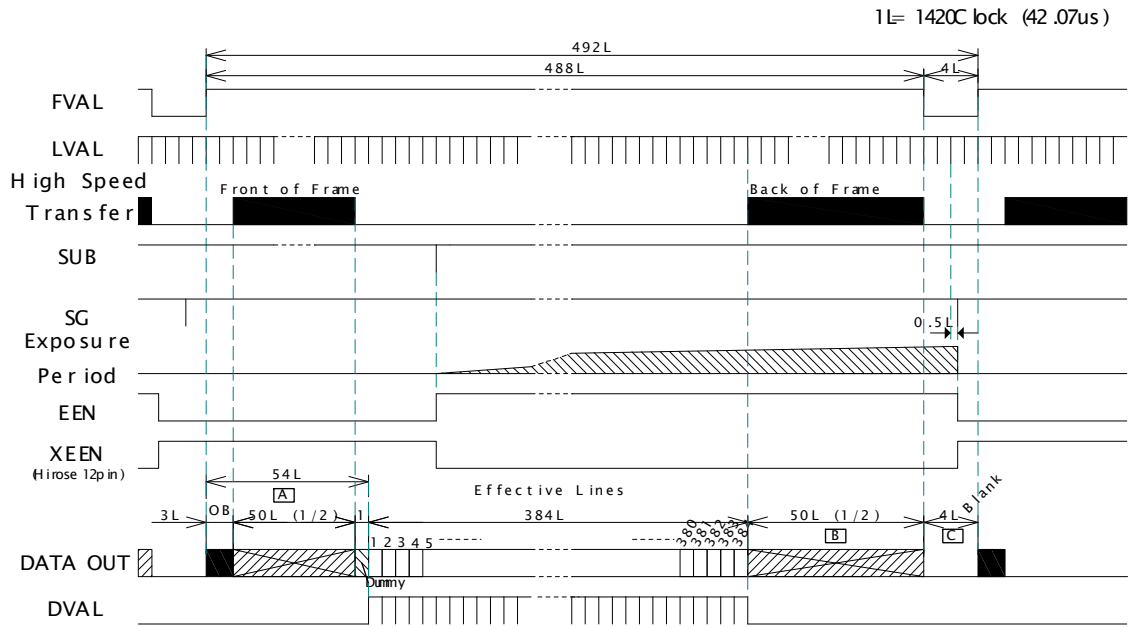
Fig.17. Vertical Timing

7.4.4 Partial Scan

The vertical timing for continuous mode and partial scan is shown below. The horizontal timing for partial scan is the same as full scan. This is the common for Channel 1 (Visible, color) and Channel 2 (Near-IR)

SC	Option	Start (Line)	End (Line)	Line No. (Lines)	Output Image	Front of Frame	Back of Frame	Blank of Frame
						-A-	-B-	-C-
0	Full Screen	1	768	768		12	8	4
1	1/2 Screen	193	576	384		54	50	4
2	1/4 Screen	289	480	192		78	74	4
3	1/8 Screen	337	432	96		90	86	4

Vertical Timing for 1/2 Partial scan



1L : 1LVAL period OB: Optical Black

Fig.18. Vertical Timing for 1/2 Partial scan

Vertical Timing for 1/4 Partial scan

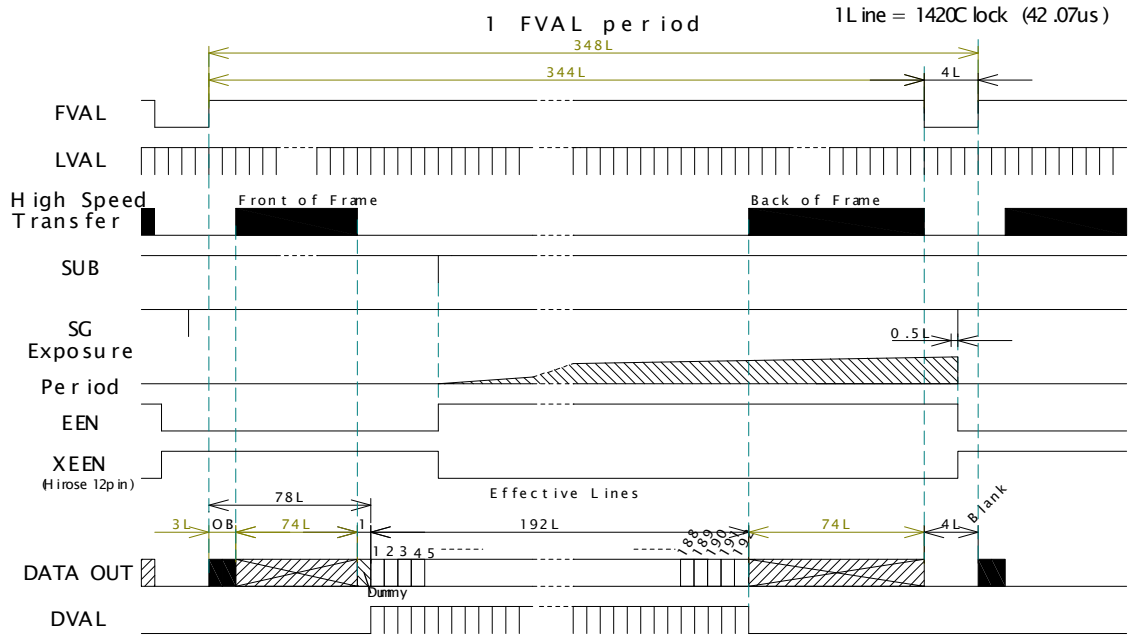


Fig.19. Vertical Timing for 1/4 partial scan

Vertical Timing for 1/8 Partial scan

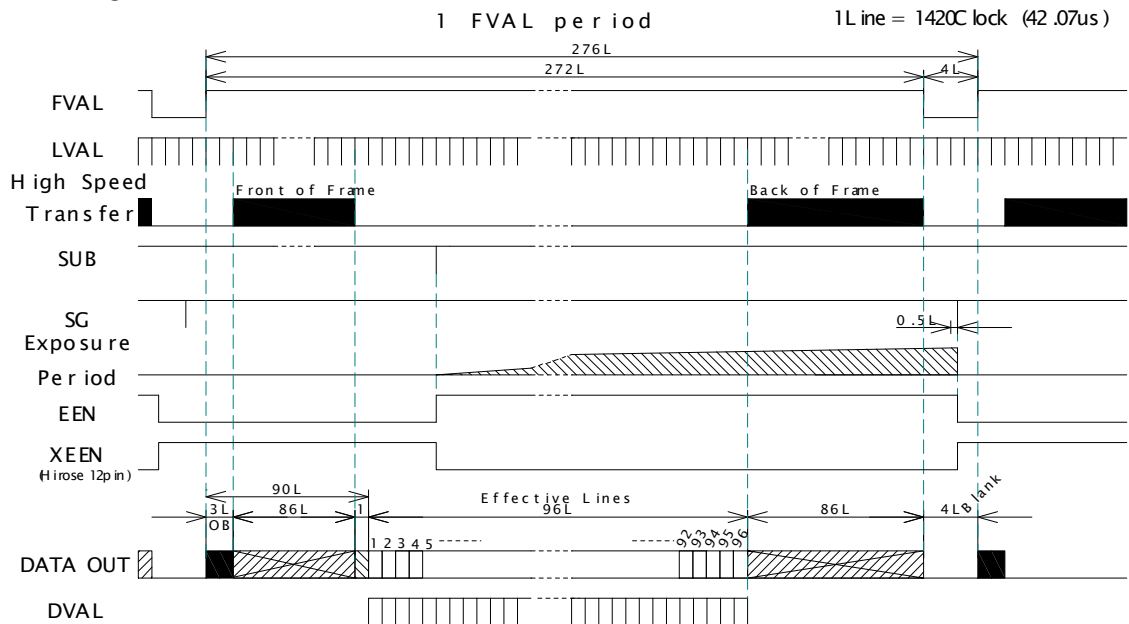


Fig.20. Vertical Timing for 1/8 Partial scan

Horizontal Timing (Common for Full and Partial Scans)

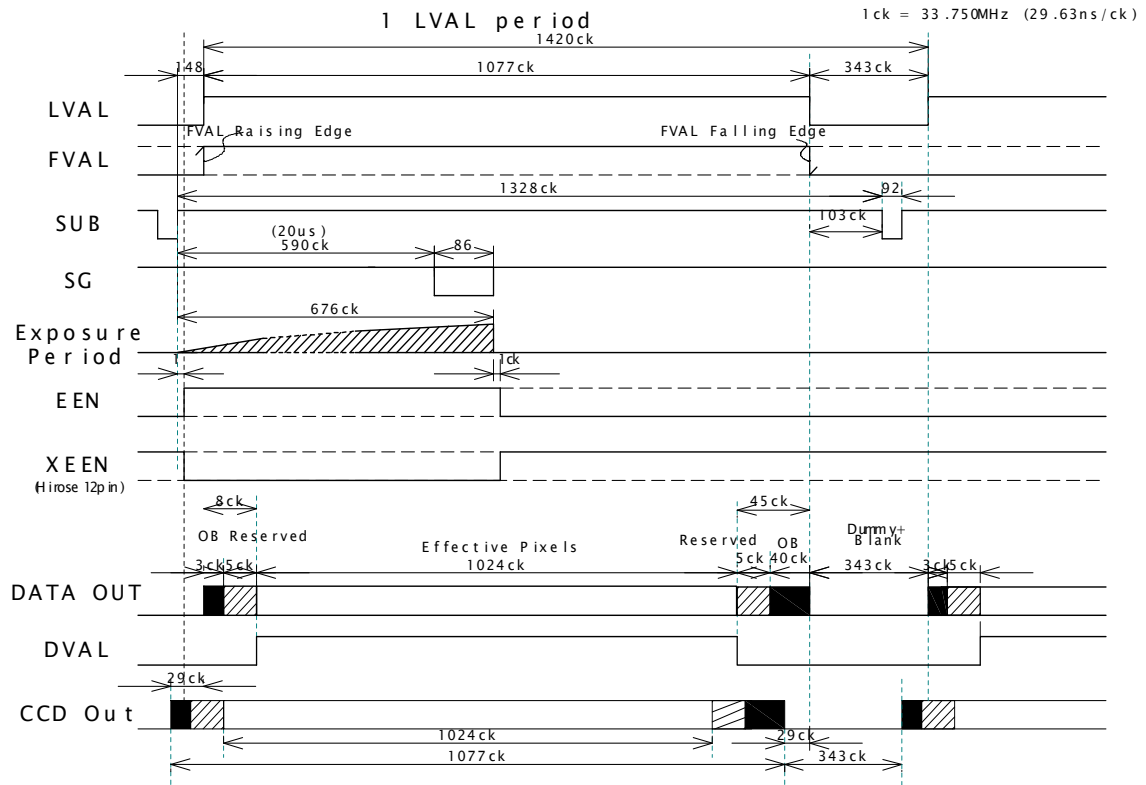


Fig.21. Horizontal Timing

7.5 Operation Mode

AD-080CL has three operation modes.

1	TR=0	Continuous	Pre-selected exposure
2	TR=1	Pre-Select Trigger	Pre-selected exposure
3	TR=2	Pulse Width Trigger	Pulse width controlled exposure

7.5.1 Continuous mode

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

For timing details, refer to fig. 16 through fig. 21.

To use this mode:

Mode	Setting	Command
Trigger	Continuous	TR1/TR2=0
Output mode	Sync/Separate	IS=0 (Sync), IS=1 (Separate)
Output Select	8-bit, 10-bit, Bayer, IR, Single Multiple, RGB 24-bit	OS1/OS2=0 to 4
Scanning	Full/Partial	SC1/SC2=0 to 3
Shutter	Preset / Programmable	SM1/SM2=0, 1
Preset Shutter	Shutter speed	SH1/SH2=0 to 10
Programmable Shutter	Shutter speed (1L unit)	PE1/PE2=0 to 792
Other functions		

7.5.2 Pre-Select trigger mode

An external trigger pulse initiates the capture, and the exposure time (accumulation time) is defined by the SH or PE commands.

The resulting video signal will start to be read out after the selected shutter time.

For timing details, refer to fig. 16 through fig. 22.

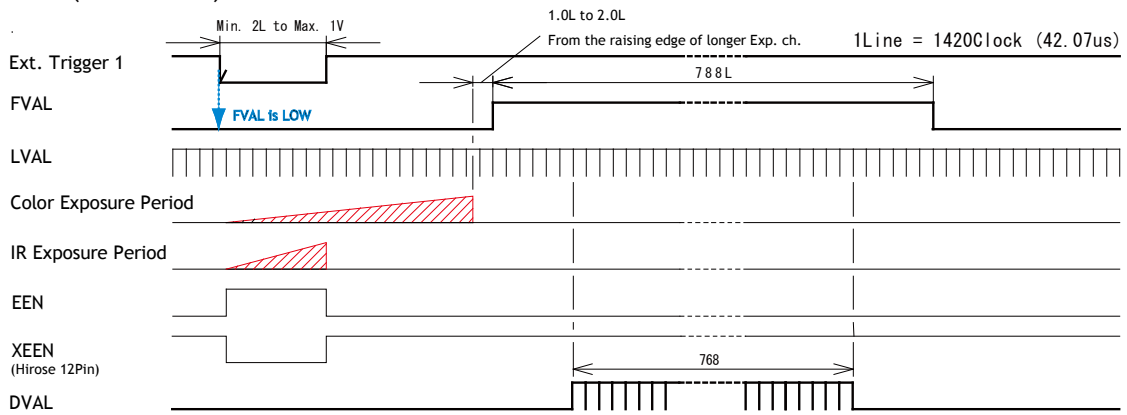
To use this mode:

Mode	Setting	Command
Trigger	Edge Pre-select (PS)	TR1/TR2=1
Output mode	Sync/Separate	IS=0 (Sync), IS=1 (Separate)
Output Select	8-bit, 10-bit, Bayer, IR, Single Multiple, RGB 24-bit	OS1/OS2=0 to 4
Scanning	Full/Partial	SC1/SC2 = 0 to 3
Shutter	Preset / Programmable	SM1/SM2=0, 1
Preset Shutter	Shutter speed	SH1/SH2=0 to 10
Programmable Shutter	Shutter speed (1L unit)	PE1/PE2=0 to 792
Other functions		
Trigger Input	Camera Link / Hirose 12-pin	TI1/TI2=0, 1

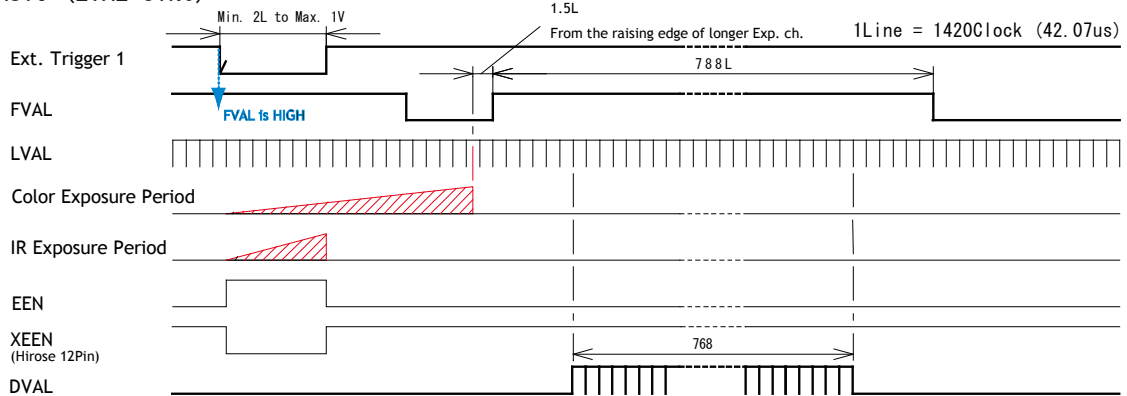
Important Note:

1	The minimum duration of the trigger is 2L. The minimum period of trigger is as follows.		
	Imager 1&2 Synchronized, IS=0	Smear-less OFF	FVAL(792L) + 3L
		Smear-less ON	Smear-less Time(198L)+1+ (longer exposure time between color and IR) + FVAL(792L) + 3L
	Image 1&2 Separate, IS=1	Smear-less OFF	FVAL(792L) + 3L
Smear-less ON		Smear-less Time(198L)+1+FVAL(792L)+3L	
FVAL(792L) is the FVAL period of continuous operation.			
2	In case that "Output mode" is set to "SYNC", the trigger input for Channel 1 is used for both channels. The exposure time can be set individually, but the output timing is synchronized with the rising edge of the longest exposure time.		

AUTO (LVAL ASYNC)



AUTO (LVAL SYNC)



1L: 1LVALPeriod OB : Optical Black

Note for setting Exposure Time

For instance, in case that the exposure time for color channel is 1/30 sec and that of Monochrome IR channel is 1/50,000 sec, the picture quality of the monochrome IR channel may not be acceptable due to CCD's operational principle. Accordingly, on EPS mode, each channel's exposure time should be set at the same. If it is necessary to set the different exposure time, please confirm the picture quality in advance of usage.

Fig.22. Edge Pre-select Trigger Mode Timing (Full scan)

7.5.3 Pulse Width 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 <60 frames.

For timing details, refer to fig. 16 through fig. 21 and fig. 23.

To use this mode:

Mode	Setting	Command
Trigger	Pulse Width Control (PWC)	TR1/TR2=2
Output mode	Sync/Separate	IS=0(Sync),IS=1(Separate)
Output Select	8bit, 10bit,Bayer, IR, Single Multiple, RGB24bit	OS1/OS2=0 to 4
Scanning	Full/Partial	SC1/SC2 = 0 to 3
Other functions		
Trigger Input	Camera Link / HIROSE 12-pin	T11/TI2=0, 1

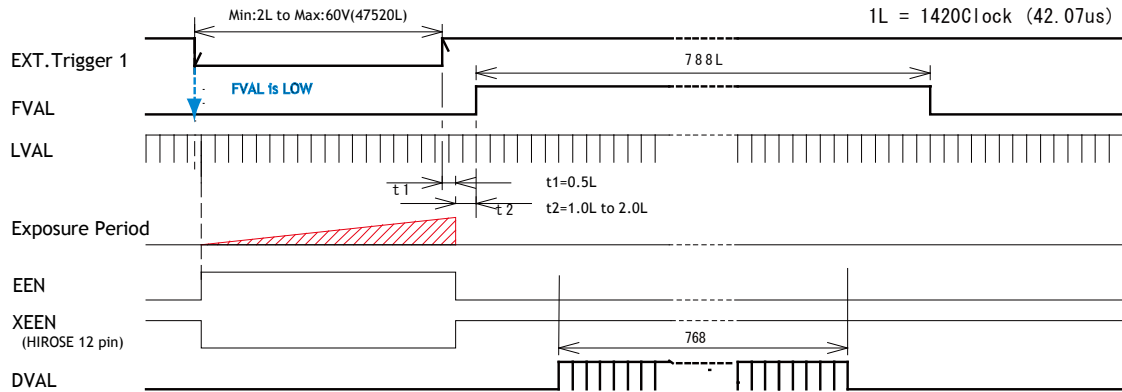
Important Note:

- The minimum duration of the trigger is 2L. The minimum period of trigger is as follows.

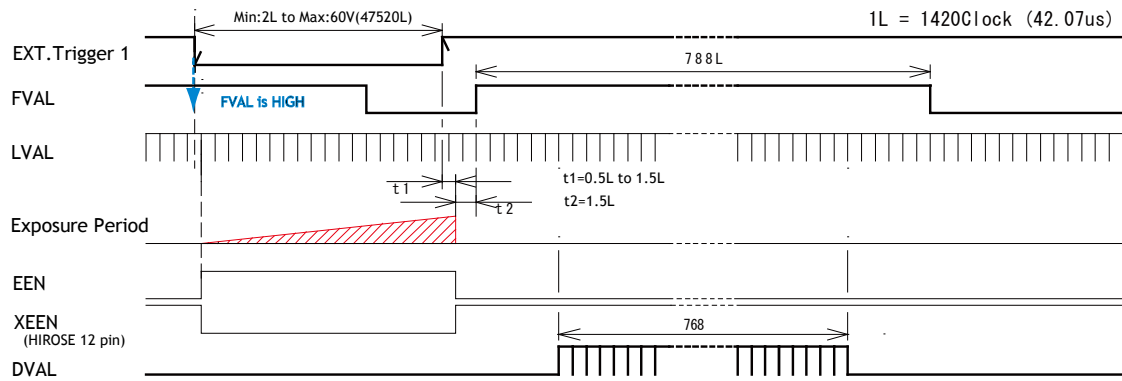
Imager 1&2 Synchro. IS=0 Sync & IS=1Separate	Smear-less OFF	<u>In case of Pulse width > FVAL(792L)</u> Exposure time - 792L + 3L <u>In case of Pulse width (Min:2L) ≤ 792L</u> 792L + 2L
	Smear-less ON	<u>In case of Pulse width > FVAL(792L)</u> Exposure time - 792L + 3L <u>In case of Pulse width (Min:199L+2L) ≤ 792L</u> 792L + 2L

FVAL(792L) is the FVAL period of continuous operation.

AUTO (LVAL ASYNC)



AUTO (LVAL SYNC)



On PWC mode, when “Smear Less ON” is selected, the actual accumulation time is (the trigger pulse width minus Smear Less active period (199L+2L)).
 If the trigger pulse width is shorter than 199L, the exposure is not active.

Fig.23. Pulse Width Control Trigger (Full Scan)

7.5.4 Smear-Less mode

This function can be used to reduce the smear coming from bright parts of the object. This is effective for both PS and PW trigger modes. Before the accumulation starts, charge that is stored in the pixel dumped by a high-speed transfer. This can reduce the smear at the upper part of the object but the lower part is affected.

At the falling edge of the trigger pulse the high speed transfer starts. This period is 198L. Thereafter the residual charge in horizontal CCD register is read out in 1L and the new exposure starts. This function is available for both full scan and partial scan.

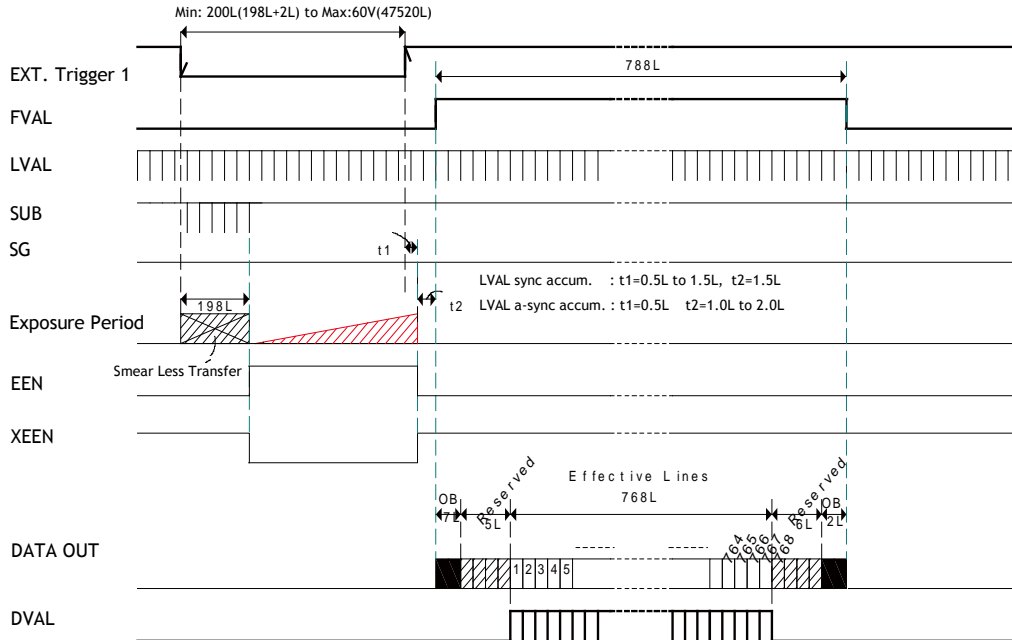


Fig 24. PWC timing chart with Smearless OFF (??)

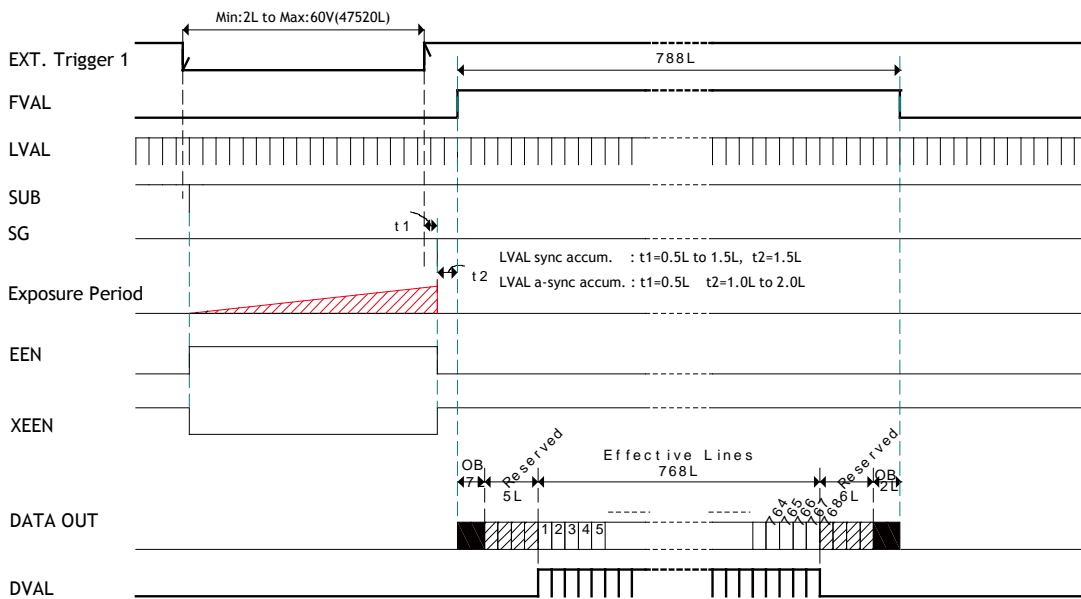


Fig 25. PWC timing chart with Smearless ON (??)

8. Configuring Camera

8.1 Serial communication

All configuration of the AD-080 CL camera is done by LVDS via Camera Link. Baud rate is 9600 bps. 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 Settings

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

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>

8.2 Setting functions

8.2.1 Output mode (Command IS)

AD-080CL has two imagers and this function selects synchronized output for both imagers, or individual output for each imager. This function should be set at first. IS=0 is synchronous output and IS=1 is separate output.

8.2.2 Trigger input select (Command TI1 and TI2)

This function selects the trigger input to be through Camera Link (TI1/TI2 =0), or as TTL through the 12 pin Hirose connector (TI1/TI2 =1).

8.2.3 Trigger mode (Command TR1 and TR2)

This can select continuous mode (0), EPS (1) and PWC (2).

8.2.4 Trigger polarity (Command TP1 and TP2)

The active trigger polarity is normal low (TP1/TP2 =0). It can be invert it to active high (TP1/TP2 =1).

8.2.5 Smear Less (Command SL1 and SL2)

This command selects Smear ON (1) or OFF (0).

8.2.6 Scan Format (Command SC1 and SC2)

4 Scan formats, full scan, 1/2 partial, 1/4 partial or 1/8 partial scan can be selected by this command.

8.2.7 Gain Master level (Command GA1 and GA2)

GA1/GA2 =0 is 0dB gain, which is normal working point. The range is from -3 dB to +12 dB.

8.2.8 AGC select (Command AGC1 and AGC2)

Select AGC ON (1) or OFF (0).

8.2.9 Setup-Y (Command BLY1 and BLY 2)

Valid range for settings is -128 to 256. The black level for 10 bit out put is set at 32 LSB and that for 8 bit output is set at 8 LSB.

8.3 Load and Save 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.

8.4 AD-080CL Command list

	Command	Format	Parameter	Remarks
A - General settings and utility commands				
1	Echo Back	EB=[Param.]<CR><LF> EB?<CR><LF>	0=Echo off 1=Echo on	Off at power up
2	Camera Status Request	ST?<CR><LF>		Actual setting
3	Online Help Request	HP?<CR><LF>		Command list
4	Firmware Version	VN?<CR><LF>		3 digits, (e.g.) 100 = Ver. 1.00
5	Camera ID Request	ID?<CR><LF>		Max 10 characters
6	Model Name Request	MD?<CR><LF>		Max 10 characters
7	User ID	UD=[Param.]<CR><LF> UD?<CR><LF>		User can save and load free text. (16 or less characters)
B - Shutter				
1	Shutter Mode	SM1=[Param.]<CR><LF> SM1?<CR><LF>	0=Preset Shutter 1=Programmable exposure	For Color
		SM2=[Param.]<CR><LF> SM2?<CR><LF>		For Monochrome IR
2	Preset Shutter	SH1=[Param.]<CR><LF> SH1?<CR><LF>	0=Off, 1=1/60, 2=1/100, 3=1/120, 4=1/250, 5=1/500, 6=1/1000, 7=1/2000, 8=1/4000, 9=1/8000 10=1/16000, 11=1/50000	Available when SM1=0
3	Preset Shutter	SH2=[Param.]<CR><LF> SH2?<CR><LF>	0=Off, 1=1/60, 2=1/100, 3=1/120, 4=1/250, 5=1/500, 6=1/1000, 7=1/2000, 8=1/4000, 9=1/8000	Available when SM2=0

			10=1/16000, 11=1/50000	
3	Programmable Exposure	PE1=[Param.]<CR><LF> PE1?<CR><LF>	0 to 792	Available when SM1=1
		PE2=[Param.]<CR><LF> PE2?<CR><LF>		Available when SM2=1
C - Trigger mode and Channel 1 & 2 synchronization settings				
1	Output mode	IS=[Param.]<CR><LF> IS?<CR><LF>	0=Sync 1=Separate	
2	Trigger Mode	TR1=[Param.]<CR><LF> TR1?<CR><LF>	0=Normal (Continuous) 1=EPS(Edge pre select) 2=PWC(Pulse width control)	For color
		TR2=[Param.]<CR><LF> TR2?<CR><LF>		For IR
	Command	Format	Parameter	Remarks
3	Trigger Polarity	TP1=[Param.]<CR><LF> TP1?<CR><LF>	0=Active Low 1=Active High	For Color
		TP2=[Param.]<CR><LF> TP2?<CR><LF>		For IR
4	Trigger Input	TI1=[Param.]<CR><LF> TI1? <CR><LF>	0=Camera Link 1=Hirose 12-pin	For Color
		TI2=[Param.]<CR><LF> TI2? <CR><LF>		For IR
5	Smear less	SL1=[Param.]<CR><LF> SL1? <CR><LF>	0=OFF 1=ON	Available when TR1=1 or 2
		SL2=[Param.]<CR><LF> SL2? <CR><LF>		Available when TR2=1 or 2
D - Image Format				
1	Scan Format	SC1=[Param.]<CR><LF> SC1? <CR><LF>	0=Full Frame 1=1/2 Partial 2=1/4 Partial 3=1/8 Partial	For Color
		SC2=[Param.]<CR><LF> SC2? <CR><LF>		For IR
2	Output Select	OS1=[Param.]<CR><LF> OS1? <CR><LF>	0=Bayer 10bit 1=Bayer 8bit 2=Bayer + IR 10bit 3=Bayer + IR 8bit 4=RGB 24 bit	For Color
		OS2=[Param.]<CR><LF> OS2? <CR><LF>		For IR
E - Gain, White Balance, Black				
1	Gain-master	GA1=[Param.]<CR><LF> GA1?<CR><LF>	-84 to 336	For Color
	Gain-master	GA2=[Param.]<CR><LF> GA2?<CR><LF>		For IR

2	White Balance mode	WB1 =[Param.]<CR><LF> WB1?<CR><LF>	0=Manual/One Push AWB 1=Continuous AWB 2=4000K, 3=4600K, 4=5600K 5=3200K	Available when RGB24bit output
3	Gain - Red	GAR1 =[Param.]<CR><LF> GAR1?<CR><LF>	-1023 to 1024	Available when RGB 24-bit output
4	Gain - Blue	GAB1 =[Param.]<CR><LF> GAB1?<CR><LF>	-1023 to 1024	Available when RGB 24-bit output
5	One Push AWB	AW1 =[Param.]<CR><LF>	0=activate one-push AWB	Available when RGB 24-bit output

	Command	Format	Parameter	Remarks
6	Inquiry the status after one push AWB	AWR1? <CR><LF>	0=AWB in process 1=Succeeded 2=Error1 G-ch too bright 3=Error2 G-ch too dark 4=Error3 Time out	Available when RGB 24-bit output
7	AWB area	WA1 =[Param.]<CR><LF> WA1?<CR><LF>	0=Full area 1=Upper left 2=Upper mid 3=Upper right 4=Middle left 5=Middle 6=Mid.right 7=Lower left 8=Lower mid.9=Lower right	Available when RGB 24-bit output
8	Setup level-Green	BL1 =[Param.]<CR><LF> BL1?<CR><LF>	-128 to 256	Available when RGB 24-bit output
9	Setup Level Y	BLY1 =[Param.]<CR><LF> BLY2?<CR><LF>	-128 to 256	For Color Bayer output
		BLY2 =[Param.]<CR><LF> BLY2?<CR><LF>		For IR
10	Setup level-red	BLR1 =[Param.]<CR><LF> BLR1?<CR><LF>	-128 to 256	Available when RGB 24-bit output
11	Setup Level-Blue	BLB1 =[Param.]<CR><LF> BLB1?<CR><LF>	-128 to 256	Available when RGB 24-bit output
12	AGC Select	AGC1 =[Param.]<CR><LF> AGC1?<CR><LF>	0=AGC OFF 1=AGC ON	For Color
		AGC2 =[Param.]<CR><LF> AGC2?<CR><LF>		For IR
13	AGC Reference	AGR1 =[Param.]<CR><LF> AGR1?<CR><LF>	0 to 1023	For Color
		AGR2 =[Param.]<CR><LF> AGR2?<CR><LF>		For IR



G - Knee function				
1	Knee ON/OFF	KN1=[Param.]<CR><LF> KN1?<CR><LF>	0=OFF 1=ON	For Color
		KN2=[Param.]<CR><LF> KN2?<CR><LF>		For IR
2	Knee Slope - Green	KSM1=[Param.]<CR><LF> KASM1?<CR><LF>	0 to 4095	Available when RGB 24-bit output
3	Knee Slope - Red	KSR1=[Param.]<CR><LF> KSR1?<CR><LF>	0 to 4095	Available when RGB 24-bit output
4	Knee Slope - Blue	KSB1=[Param.]<CR><LF> KSB1?<CR><LF>	0 to 4095	Available when RGB 24-bit output
5	Knee Slope Y	KSY1=[Param.]<CR><LF> KSY1?<CR><LF>	0 to 4095	For Color
		KSY2=[Param.]<CR><LF> KSY2?<CR><LF>		For IR

	Command	Format	Parameter	Remarks
6	Knee Point - Green	KPM1=[Param.]<CR><LF> KPM1?<CR><LF>	0 to 1023	Available when RGB 24-bit output
7	Knee Point - Red	KPR1=[Param.]<CR><LF> KPR1?<CR><LF>	0 to 1023	Available when RGB 24-bit output
8	Knee Pont - Blue	KPB1=[Param.]<CR><LF> KPB1?<CR><LF>	0 to 1023	Available when RGB 24-bit output
9	Knee Point Y	KPY1=[Param.]<CR><LF> KPY1?<CR><LF>	0 to 1023	For Color
		KPY2=[Param.]<CR><LF> KPY2?<CR><LF>		For IR
H - Shading Compensation				
1	Shading correction mode	SDM1=[Param.]<CR><LF> SDM1?<CR><LF>	0=OFF 1=Flat Shading	For Color
		SDM2=[Param.]<CR><LF> SDM2?<CR><LF>		For IR
2	Recalibrate Shading Corr.	RS1=[Param.]<CR><LF> RS1?<CR><LF>	Only 0 accepted	For Color
		RS2=[Param.]<CR><LF> RS2?<CR><LF>		For IR
3	Inquire the status after shading correction	RSS1=[Param.]<CR><LF> RSS1?<CR><LF>	0=Shading correction in process 1=Succeeded 2=Error 1- Image too bright 3=Error 2- Image too dark 4=Error 3- Time out	For Color
		RSS2=[Param.]<CR><LF> RSS2?<CR><LF>		For IR
F - Saving and loading setting for EEPROM				
1	Load Settings (from Camera EEPROM)	LD=[Param.]<CR><LF>	0=Factory area 1=User 1 area 2=User 2 area	Latest used DATA AREA will become default at next power up
2	Save Settings (to Camera EEPROM)	SA=[Param.]<CR><LF>	1=User 1 area 2=User 2 area	
3	EEPROM Current Area No Request.	EA?<CR><LF>	0=Factory area 1=User 1 area 2=User 2 area	The camera returns latest used DATA AREA

9. AD-080CL Camera Control Tool

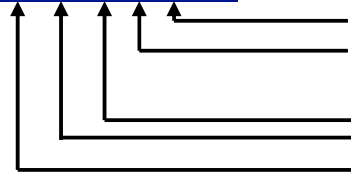
The Camera Control Tool for Windows 2000/XP can be downloaded from www.jai.com. The control tool contains a camera control program and a developer's kit for integrating the control tool in your own software. For the integrator and experienced user, the Camera Control Tool is much more than a program with a window interface. It also provides an easy and efficient ActiveX interface built for MS Windows 2000/XP. 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.

9.1 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.

9.1.1 Camera Control Tool Bar

This is a Camera Control Tool Bar and when the button of each window, each control GUI can be initiated.



About Window

Communication Window

Camera Control Window

① for Imager 1 (color) and ② for Imager 2 (IR)

Common Control Window

9.1.2 The About Window

The about window contains information about the version of the program, Internet connection to JAI A/S and access to the help documents.

The drop-down box labeled "Help File" 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, www.jai.com

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

At the bottom of the windows (all windows but the Communication Window is a



colored 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.

9.1.3 Communication Window

The Communication Window is used to connect the Camera Control Tool with the JAI camera.

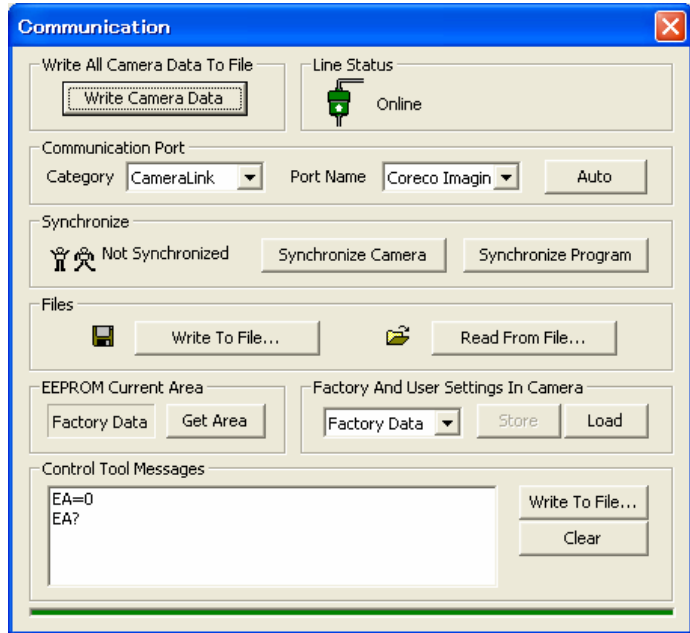
Camera Link communication:

Select “Camera Link” in the “Category” box. “Port Name” indicates 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.



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:

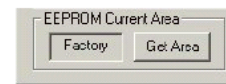
Model Name, Camera ID, User ID, Firmware Version, Current Settings, Factory Settings and the available User Areas.

The file is formatted as shown in the picture below:



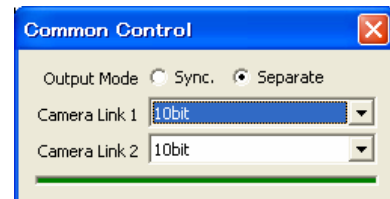
EEPROM Current Area.

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



9.1.4 Common Control window

On this window, the output mode can be selected, synchronous or separate. The output from Camera Link connector 1 and 2 is also selected on this window.

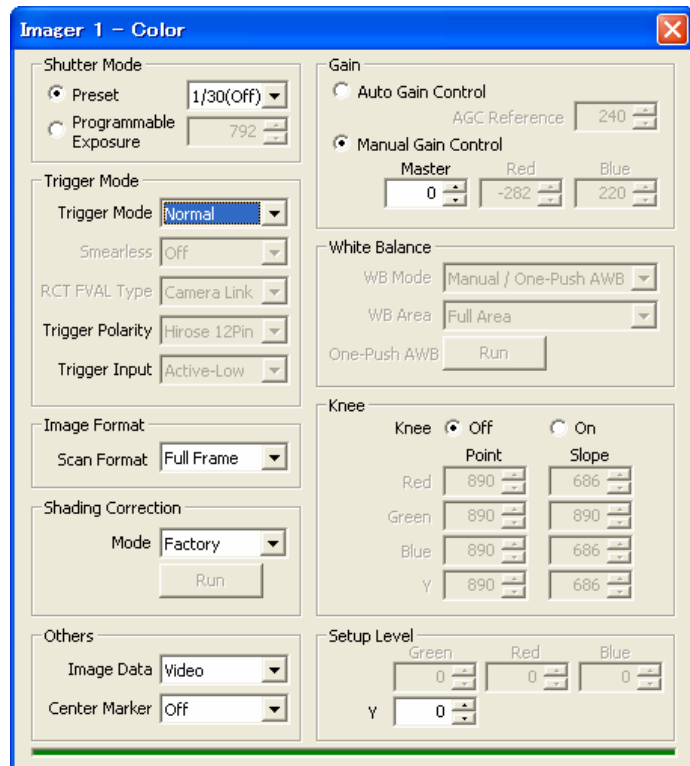


9.1.5 Camera Control Window

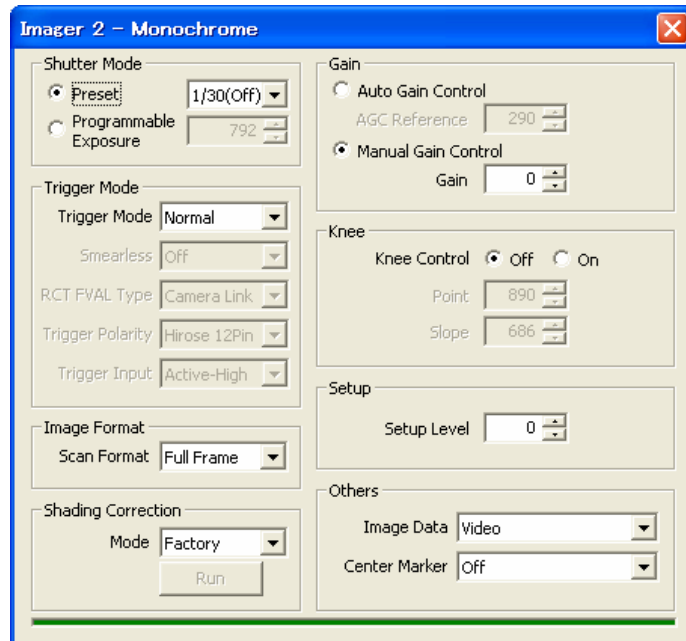
The Camera Control Window contains the fundamental camera setting functions.

It is possible to set the shutter mode, Trigger mode, image format, scan format, gain control and black setting.

AD-080CL has two camera control windows, one for Imager 1 and the other for Imager 2. The right hand side picture is for Imager 1, color.



This picture is for Imager 2,
Monochrome IR camera.



9.2 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".

10. External Appearance and Dimensions

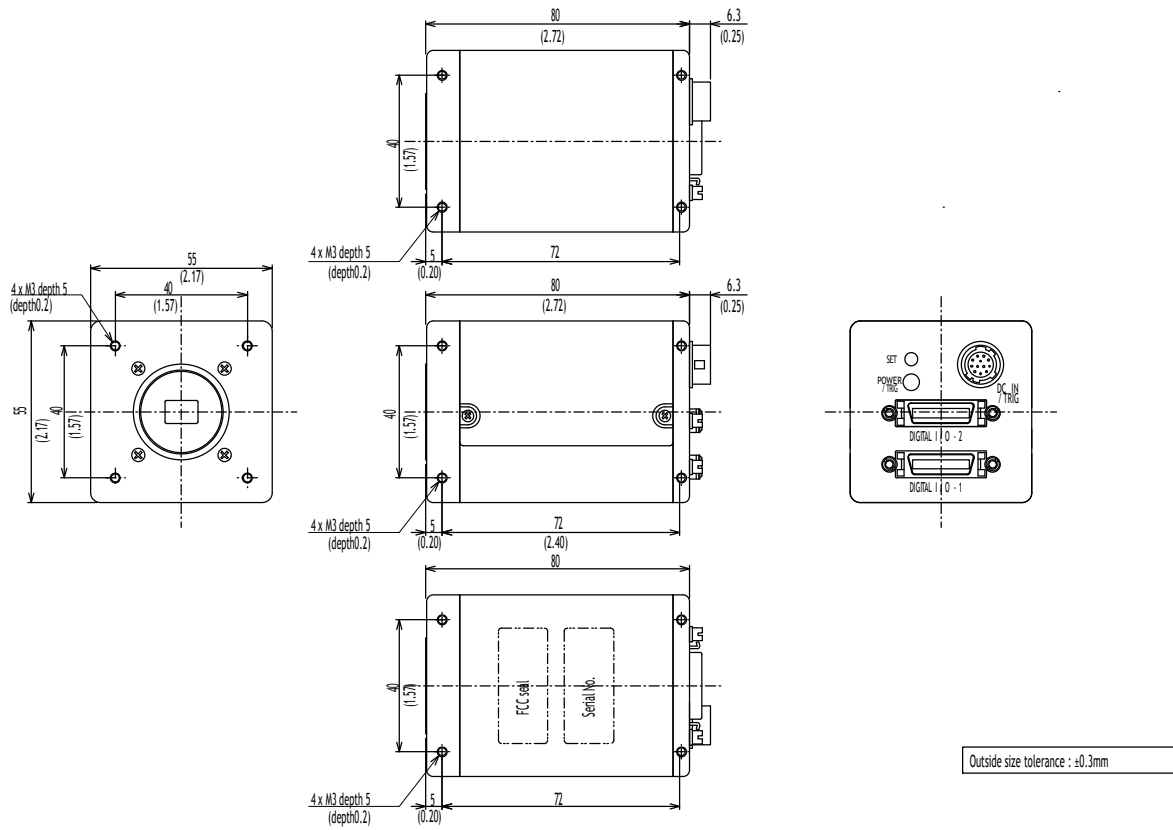


Fig. 26. Dimensions

11. Specifications

11.1 Spectral response

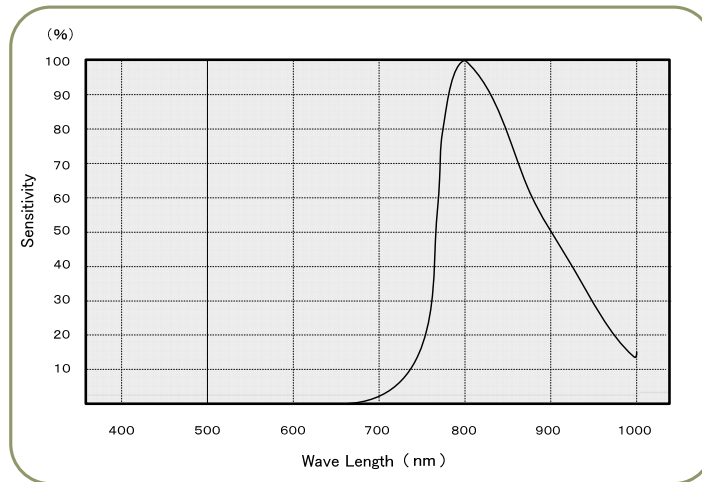


Fig. 27. Total spectral response including Prism and sensor (Monochrome IR)

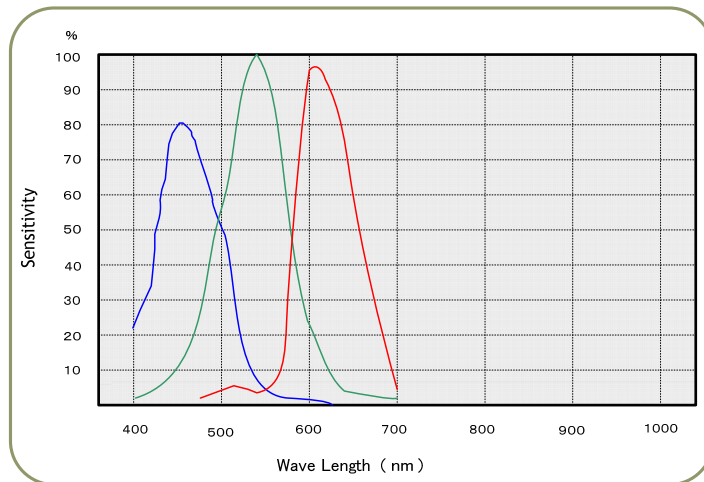


Fig. 28. Total Spectrum response including prism and sensor (Color)

11.2 Specifications Table

Specifications	AD-080CL	
	Color Imager channel	Monochrome Near-IR Imager ch.
Scanning system	Progressive scan	
Frame Rate Full scan	30 frames / sec. Progressive (768 lines/frame)	
Pixel clock	33.75MHz	
Line frequency	23.768 KHz (1420 pixel clocks / line)	
Image sensor	1/3 inch Bayer color IT CCD	1/3 inch Monochrome IR IT CCD
Sensing area	4.76 (H) x 3.57 (V) mm	
Cell size	4.65 (H) x 4.65 (V) μ m	
Active pixels	1024(H) x 768 (V)	
Pixels in Video output	Full 1024 (h) x 768 (v) 30fps. H = 23.768 kHz 1/2 Partial 1024 (h) x 384(v) 48fps. H = 23.768 kHz 1/4 Partial 1024 (h) x 192 (v) 68 fps. H = 23.768 kHz 1/8 Partial 1024 (h) x 96 (v) 86fps. H = 23.768Hz	
Sensitivity on sensor	1.4 lux	2.0 μ W / cm ² at 800nm
	Max. Gain, Shutter OFF, 50% Video Level	
S/N (dB)	More than 54dB (G-ch, 0dB)	More than 54 dB (0dB)
Iris video output, Analogue	0.7 V p-p (without Sync)	
Digital Video Output	Via Camera Link connector 1 Bayer 10bit / Bayer 8bit / Bayer+IR 10bit/Bayer+IR 8bit / RGB24bit	Via CameraLink connector 2 IR 10bit / IR 8bit / IR+Bayrer 10bit/ IR+Bayer 8bit / RGB24bit
White balance	Only for RGB24bit output Gain range: -3dB to +6dB Manual: 3000K to 6500K One-push: 3000K to 6500K	Not applicable
Input signals	Trigger (TTL/75 Ω) x2 via Camera Link or HIROSE 12-pin	
Output signals	Hirose 12-pin: XEEN (TTL/75 Ω) Camera Link: EEN, FVAL, LVAL, DVAL, PCLK (LVDS)	
Gain	Master Gain: -3dB to +12dB	
Knee compensation	For RGB 24-bit output Knee point, Knee slope	Knee point, Knee slope
Gamma	1.0	
Shading compensation	ON/OFF	
Synchronization	Int. X-tal	
Trigger mode	Edge Pre-select, Pulse width control	
Accumulation	LVAL synchronous or LVAL a-synchronous automatic selection	
Preset shutter speed	11steps: OFF(1/30), 1/60, 1/100, 1/120, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/10,000, 1/16,000, 1/50,000 sec.	
Programmable exposure	0.5L to 792L (1 LVAL unit)	
Pulse width control	1L to 60 frames	
Control interface	Camera Link Serial Communication (both CL connectors. Effective for the first established communication port)	
Lens Mount	C-Mount (Rear protrusion less than 4mm). Designed For 3CCD camera	
Operating temperature	-5°C to +45°C	
Operating humidity	20 to 80% (non-condensing)	
Storage temperature/humidity	-25°C to +60°C / 20% to 80% (non-condensing)	
Vibration	3G (15Hz to 200Hz XYZ)	
Shock	50G	
Regulatory	CE (EN61000-6-2, EN61000-6-3), FCC Part15 Class B, RoHS	
Power	DC +12V \pm 10%, 0.32A (Typical, normal operation)	

AD-080CL

Dimensions	55 (H) x55 (W) x80 (D) mm
Weight	400 g

Note: Above specifications are subject to change without notice.

Note: Approximately 30 minute pre heat requires to meet specifications.

12. Appendix

12.1 Precautions

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

Do not attempt to disassemble this camera.

Do not expose this camera to rain or moisture.

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

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

Handle this camera with the maximum care.

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

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

12.2 Typical Sensor Characteristics

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

V. Aliasing

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

Blemishes

All cameras are shipped without visible image sensor blemishes.

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

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

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

Patterned Noise

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

12.3 Caution when mounting a lens on the camera

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

12.4 Exportation

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

12.5 References

1. This manual for AD-080CL can be downloaded from www.jai.com
2. Datasheet for AD-080CL can be downloaded from www.jai.com
3. Camera control software can be downloaded from www.jai.com
4. Specifications for the CCD sensor Sony ICX-204AL and ICX-204AK can be found on www.jai.com

Index

A		K	
aberration.....	9	Knee	14, 15, 33, 34, 41
asynchronous	4, 11, 13, 23	L	
Auto-detect LVAL	12	LVDS	6, 28, 41
B		M	
Blemishes	43	multi-spectral.....	3
C		N	
Camera Control Tool	35, 36, 38	Near-IR.....	3, 4, 7, 8, 9, 10, 14, 16, 19, 41
CCD sensor	17, 44	O	
Continuous operation.....	11, 23	optical assembly.....	10
Cross hair generator	16	P	
D		Partial scan.....	13, 20, 21
Dichroic Prism	5	Pixels in video output.....	41
Digital Output	6	Preset Shutter	41
E		S	
Electronic shutter.....	14	Serial communication.....	28
external trigger	16, 23	Shading correction	14, 34
F		smear.....	27
frame grabber	9, 36	Synchronization.....	41
G		T	
Gain.....	29	Trigger input	29
Gamma	41	Trigger polarity	29
H		triggered operation	11
Hirose.....	6, 29	V	
I		visible	3, 4, 9, 10, 28, 43
internal switch	11	W	
Iris Video	6, 7, 12	White balance.....	15, 41

13. User's Record

Camera type: AD-080CL
Revision:
Serial No.
Firmware version.

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

User's Mode Settings.

User's 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.
EN61000-6-2
EN61000-6-3

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