



See the possibilities

User's Manual


AD-080CL

*Digital 2CCD Progressive Scan
Multi-Spectral Camera*

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Supplement

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| 部件名称 | 有毒有害物质或元素 | | | | | |
|--|-------------|-------------|-------------|-------------------|-----------------|-------------------|
| | 铅 (Pb) | 汞 (Hg) | 镉 (Cd) | 六价铬 (Cr(VI)) | 多溴联苯 (PPB) | 多溴二苯醚 (PBDE) |
| 棱镜 | × | ○ | ○ | ○ | ○ | ○ |
| 光学滤色镜 | × | ○ | × | ○ | ○ | ○ |
| | | | | | | |
| <p>○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006规定的限量要求以下。 ×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006规定的限量要求。 (企业可在此处、根据实际情况对上表中打“×”的技术原因进行进一步说明。)</p> | | | | | | |



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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.

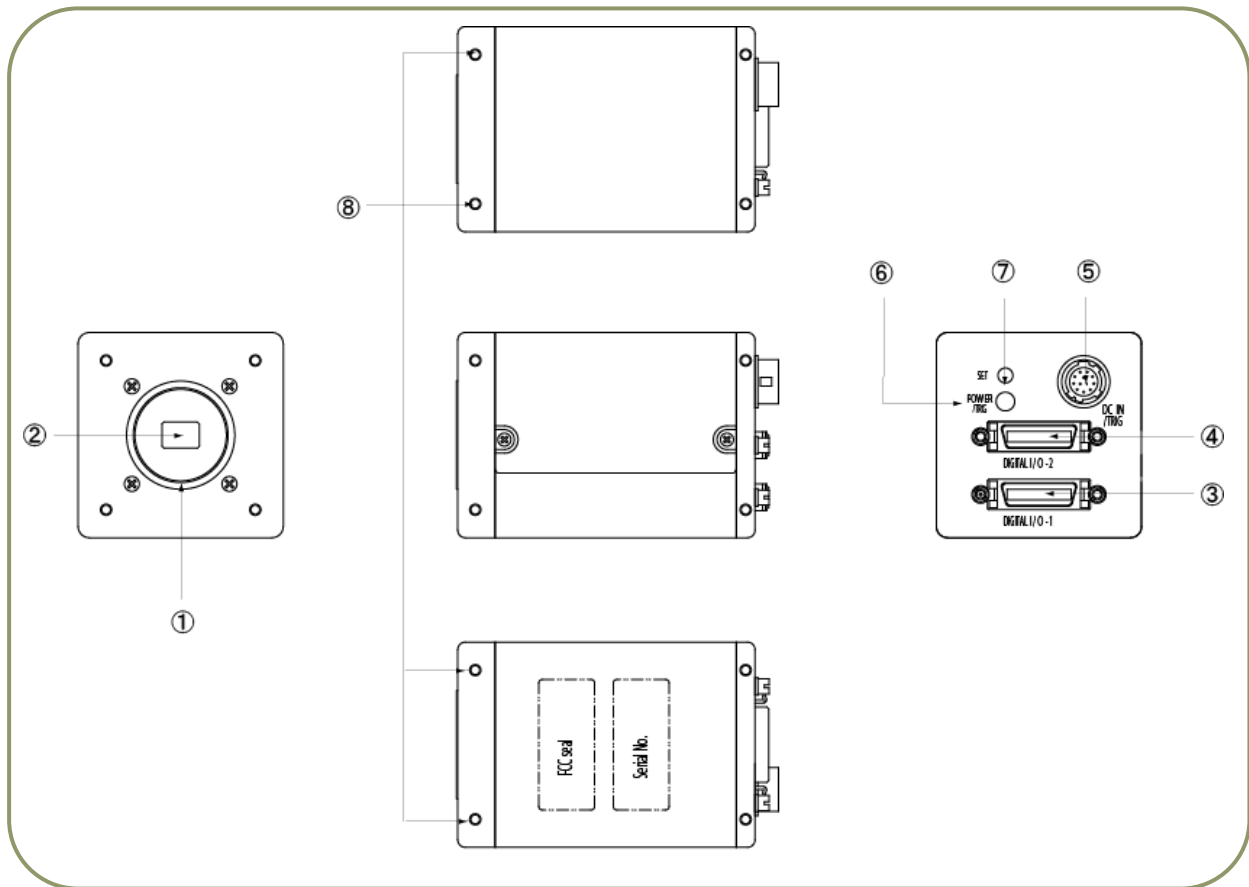
AD-080 CL

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.)

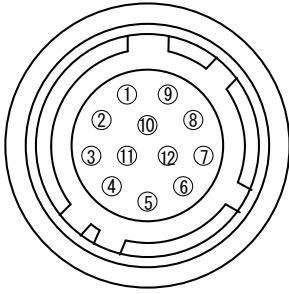


Fig.2. 12-pin connector

| 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

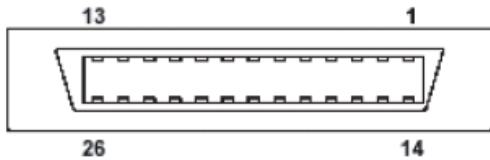


Fig.3. 26-pin CameraLink connector

| 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.

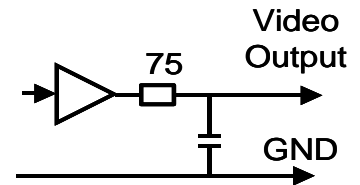


Fig.4. Iris video circuit

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 TI1=1 or TI2=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. The trigger input level 4 V \pm 2 V.

Trigger can also be applied through the Camera Link connector, when the command TI1/TI2=0 have been sent.

Trigger input level 4 V \pm 2 V.

Trigger can also be applied through the Camera Link connector, when the command TI1/TI2=0 have been sent.

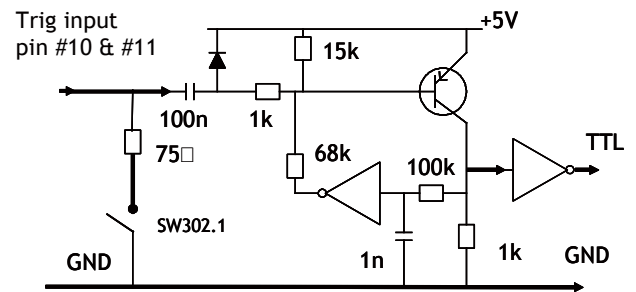


Fig.5. Trigger circuit

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.

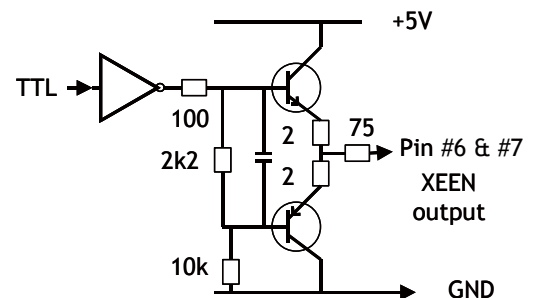


Fig.6. XEEN output circuit

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.

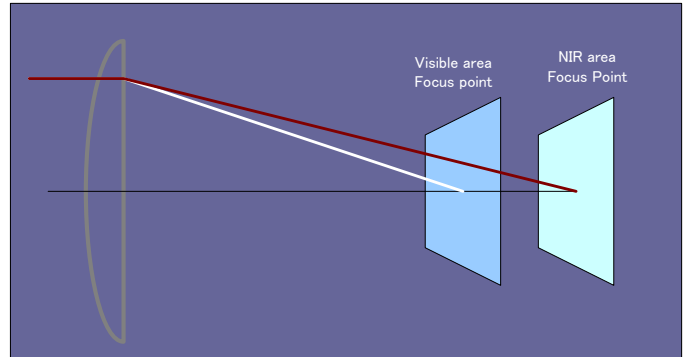


Fig 7. focal points for Visible and NIR lights

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.

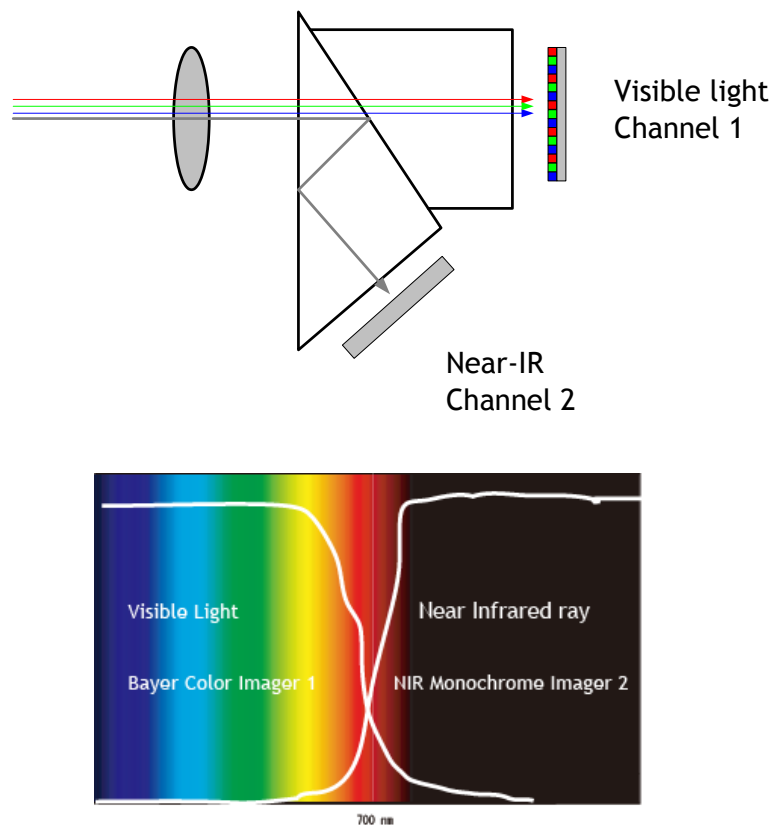


Fig 8. Conceptual diagram for 2CCD prism optics

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.

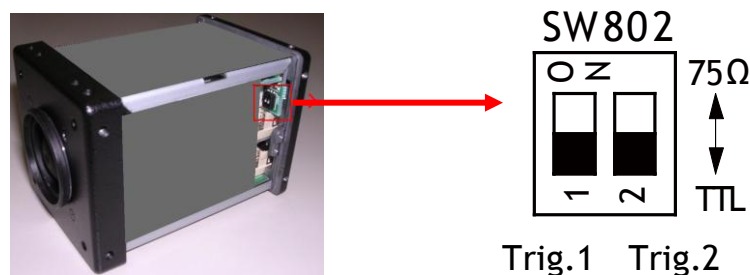


Fig.9. Switch SW802 location and setting

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.

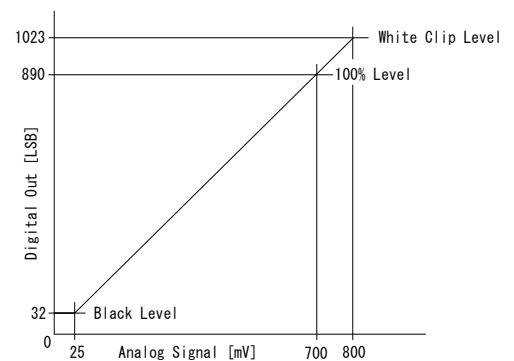


Fig.10. Digital Video Output

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.

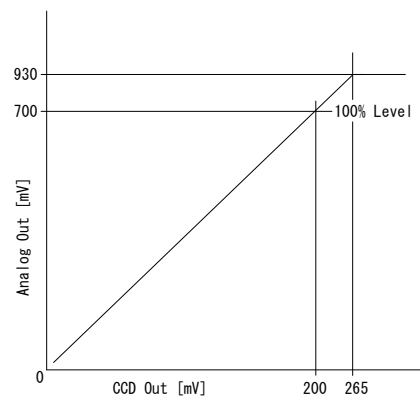


Fig.11. Iris Video output

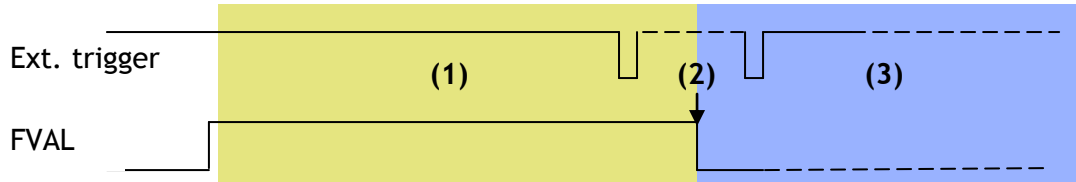
7.2 Auto-detect LVAL-sync / a-sync. accumulation

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.

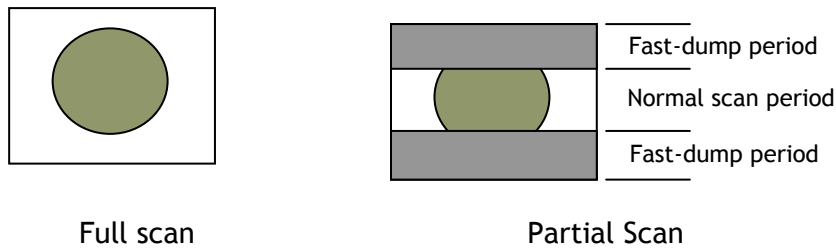
This applies to both Pre-Select (PS) trigger and Pulse Width trigger (PW) modes.



- (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)

7.2.1 Partial scan Fig. 12. Auto-detect LVAL sync /a-sync accumulation

Partial scan allows higher frame rates by reading out a smaller 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 start with GRG.

Odd lines start with BGB.

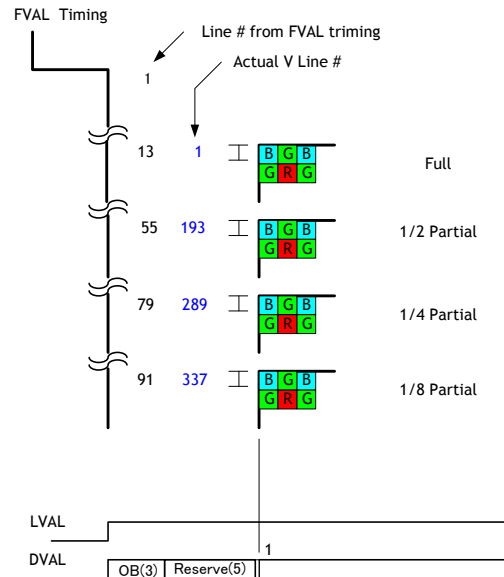


Fig.13. Bayer color mosaic

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 output.

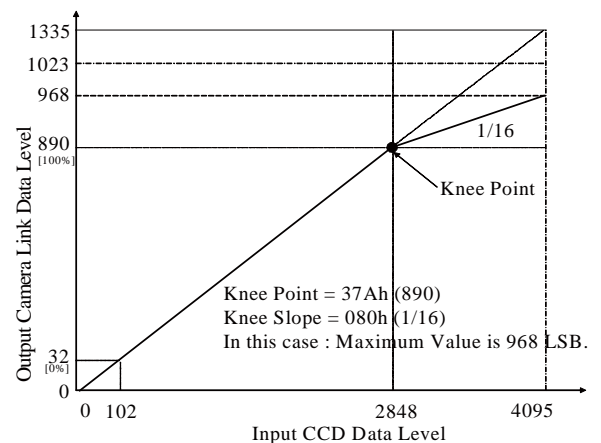


Fig. 14. Knee characteristics (Default setting)

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 |

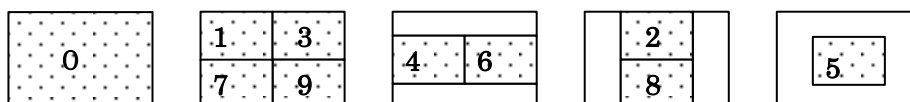
Note 1: When using Continuous AWB, results depend on the surface properties of the object.

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:

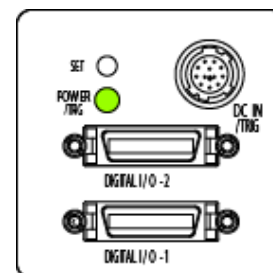
- 0 : Full area
- 1 : Upper Left
- 2 : Upper Center
- 3 : Upper Right
- 4 : Center Left
- 5 : Center
- 6 : Center Right
- 7 : Lower Left
- 8 : Lower Center
- 9 : Lower Right



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:

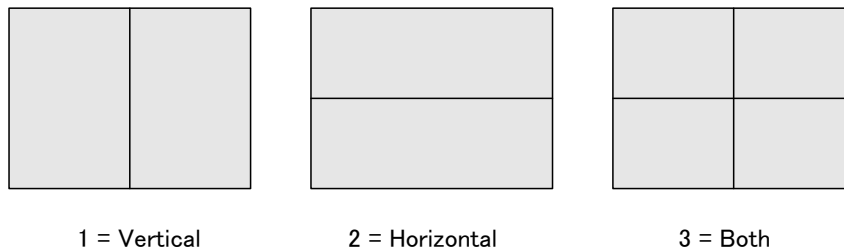
PBY1 for Visible (color) channel, imager 1: 0= Off, 1= Gradient, 2= Color Bar⁽¹⁾

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.

| | | | Color Imager (Channel 1) | | | | Near-IR imager (Channel 2) | | | | |
|-------------------|-----------|-------|--------------------------|---------|---------|------------|----------------------------|---------|---------|------------|--------------------|
| Output mode, “IS” | Operation | | Trig. IN 1 | Shutter | Partial | Smear Less | TRIG. IN 2 | Shutter | Partial | Smear Less | Auto Iris |
| | TR | Mode | | | | | | | | | |
| 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.

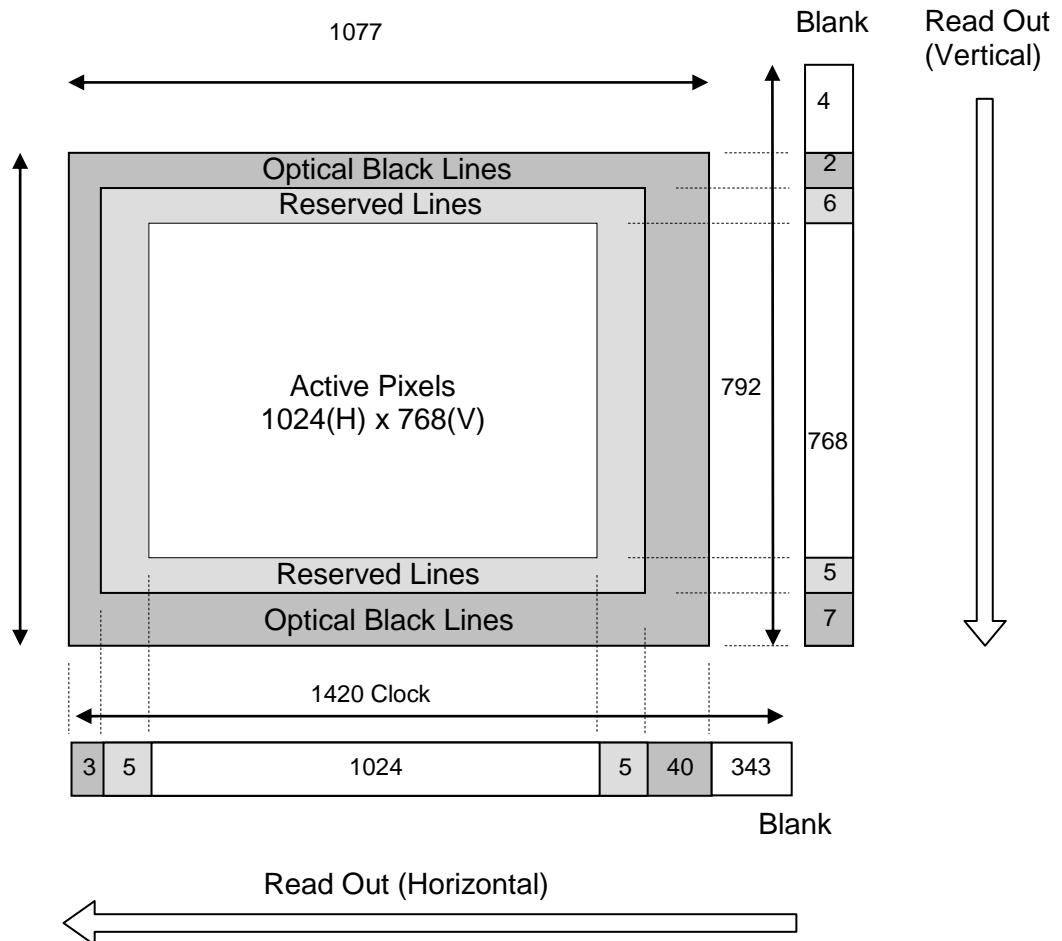
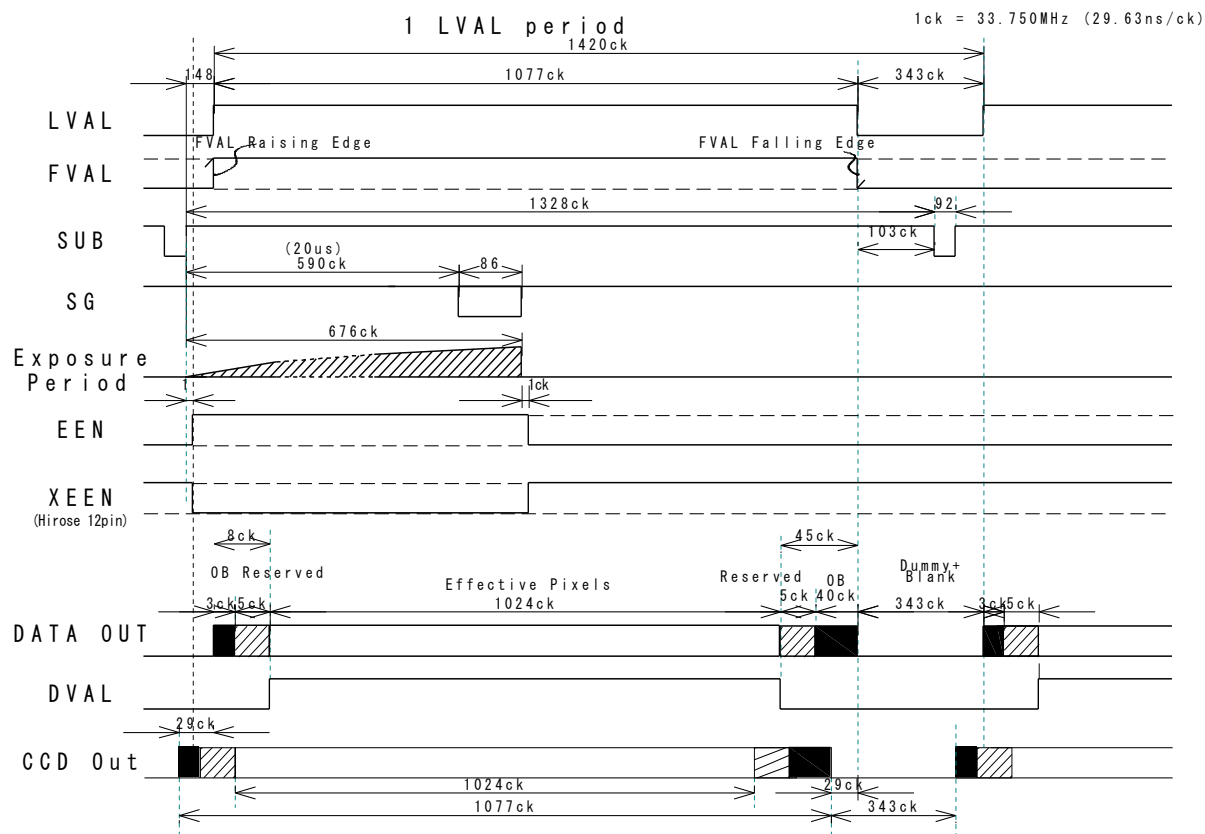


Fig.15. Sensor layout and video output image

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.

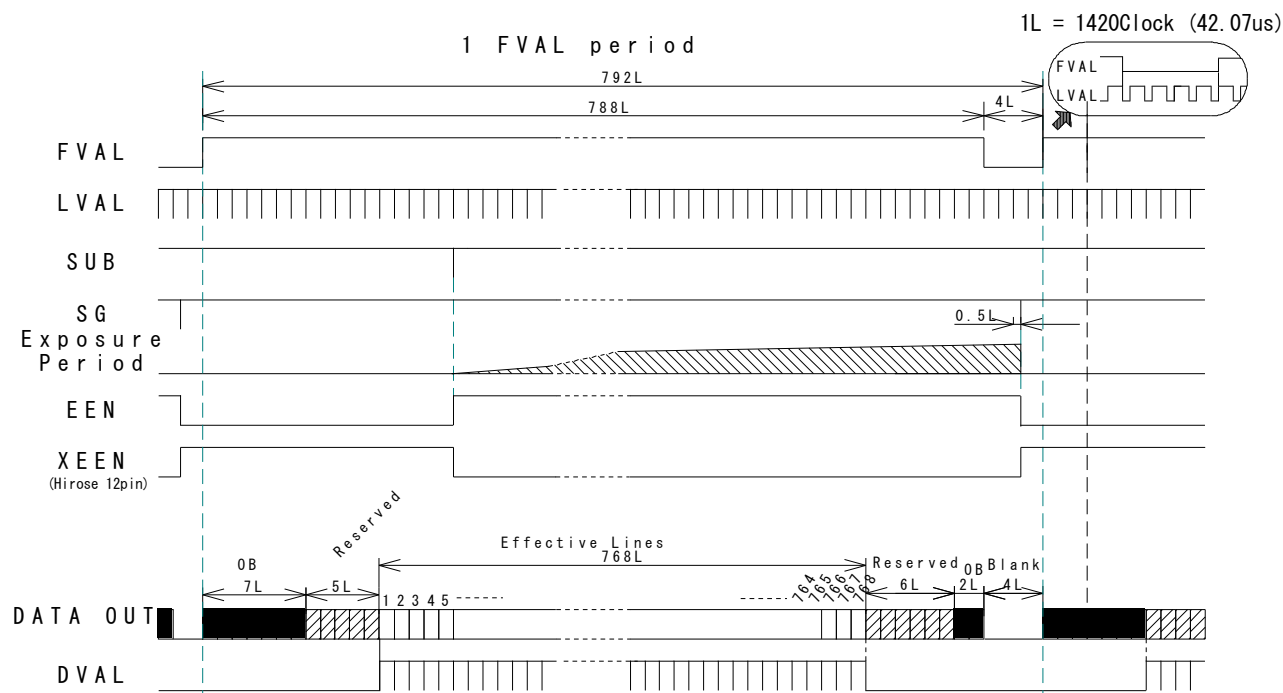


1CLK: 1 Pixel clock period OB: Optical black
 LVAL is HIGH in the period of optical black and effective video periods
 DVAL is HIGH in the effective video period

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.




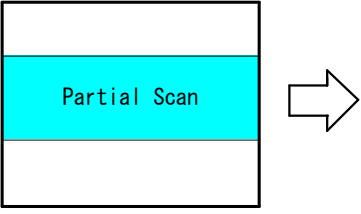
1L : 1 LVAL period OB: optical black
 FVAL is HIGH in the optical black and effective video periods
 LVAL is always output
 DVAL is output during the effective lines

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

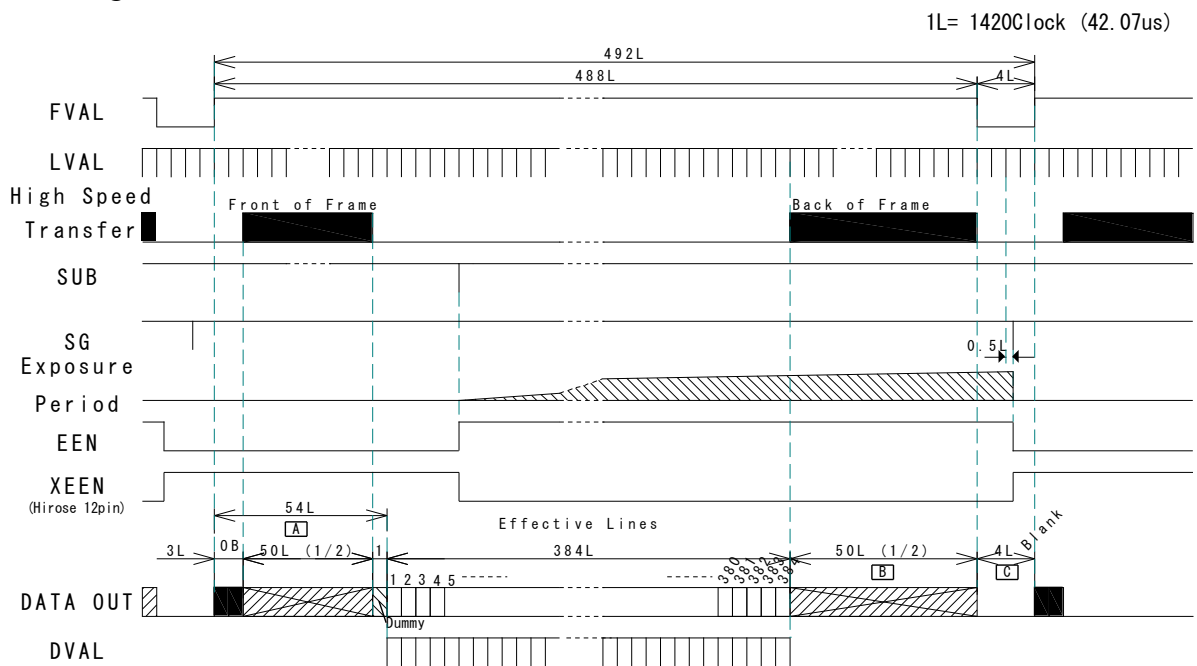
Fig.17. Vertical Timing

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 -A- | Back of Frame -B- | Blank of Frame -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

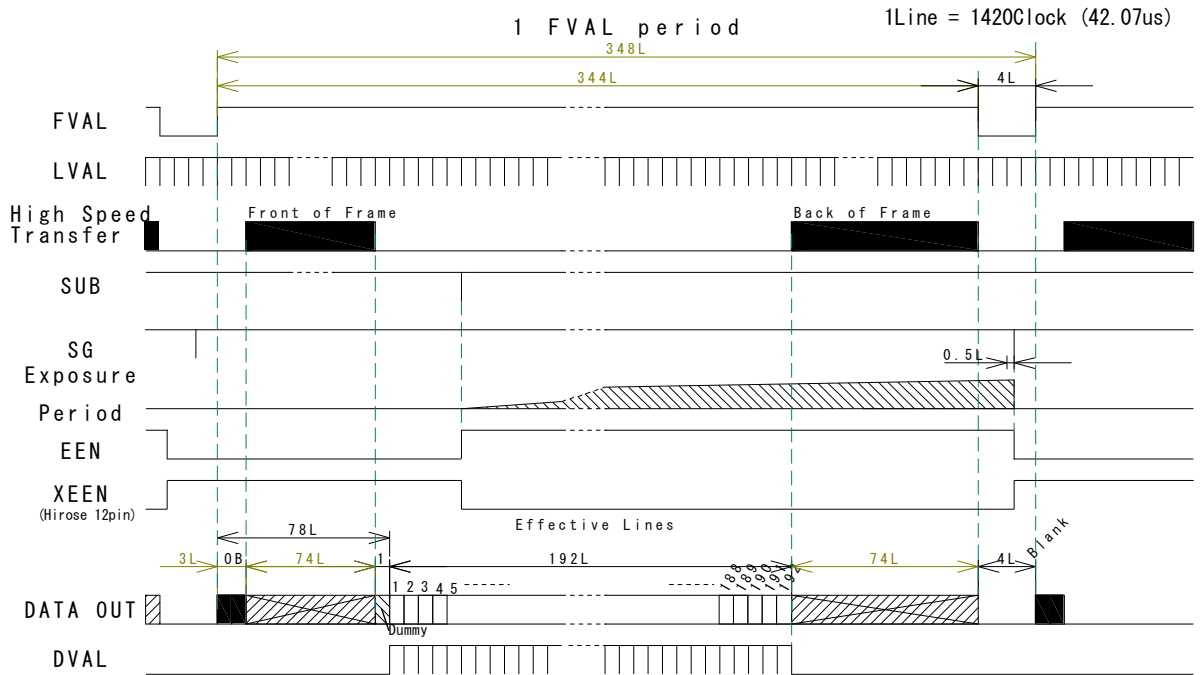


Fig.19. Vertical Timing for 1/4 partial scan

Vertical Timing for 1/8 Partial scan

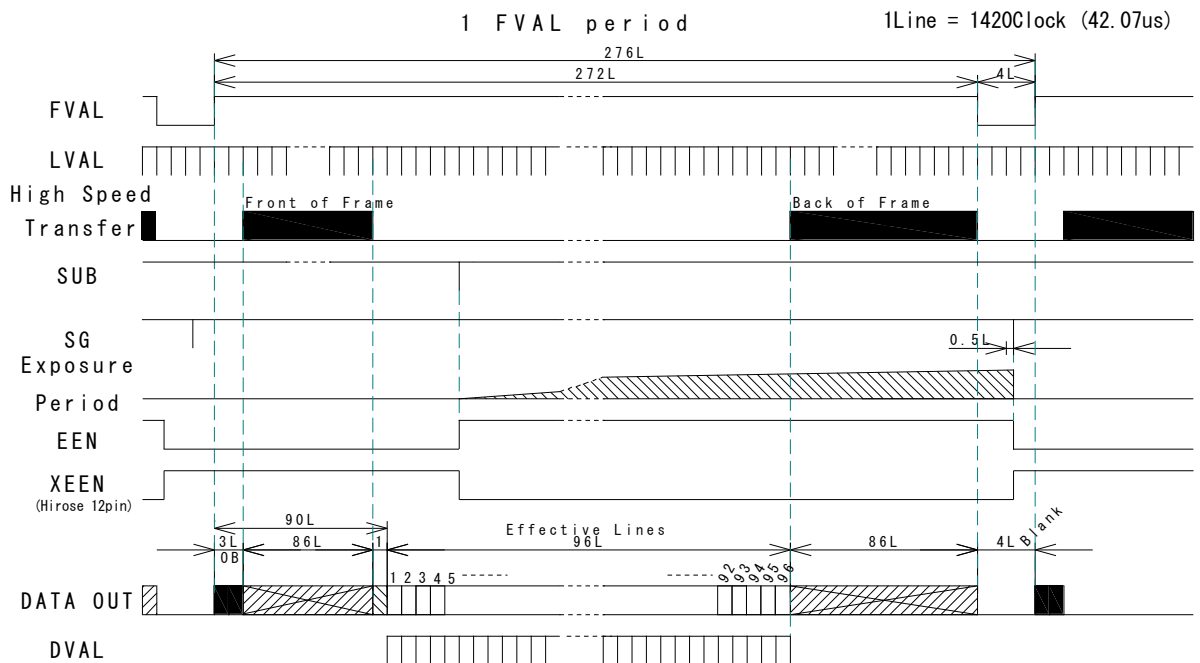


Fig.20. Vertical Timing for 1/8 Partial scan

Horizontal Timing (Common for Full and Partial Scans)

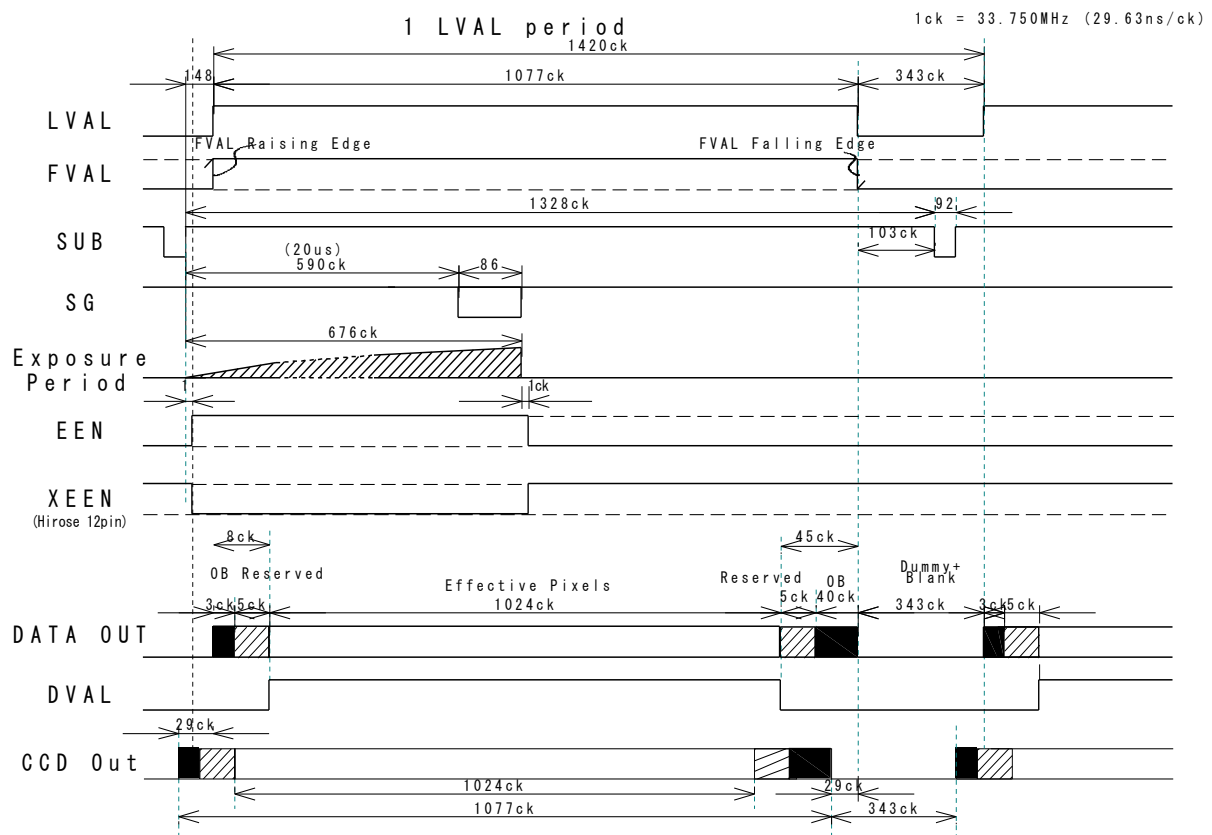


Fig.21. Horizontal Timing

7.5 Operation Mode

AD-080CL has three operation modes.

| | | | |
|---|-------------|----------------------------|---------------------------------|
| 1 | TR=0 | <i>Continuous</i> | Pre-selected exposure |
| 2 | TR=1 | <i>Pre-Select Trigger</i> | Pre-selected exposure |
| 3 | TR=2 | <i>Pulse Width Trigger</i> | 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.

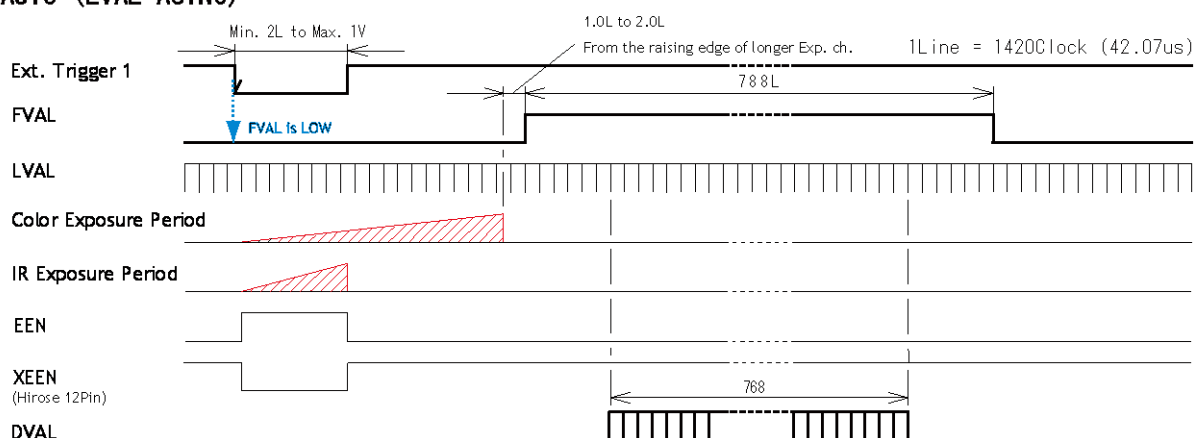
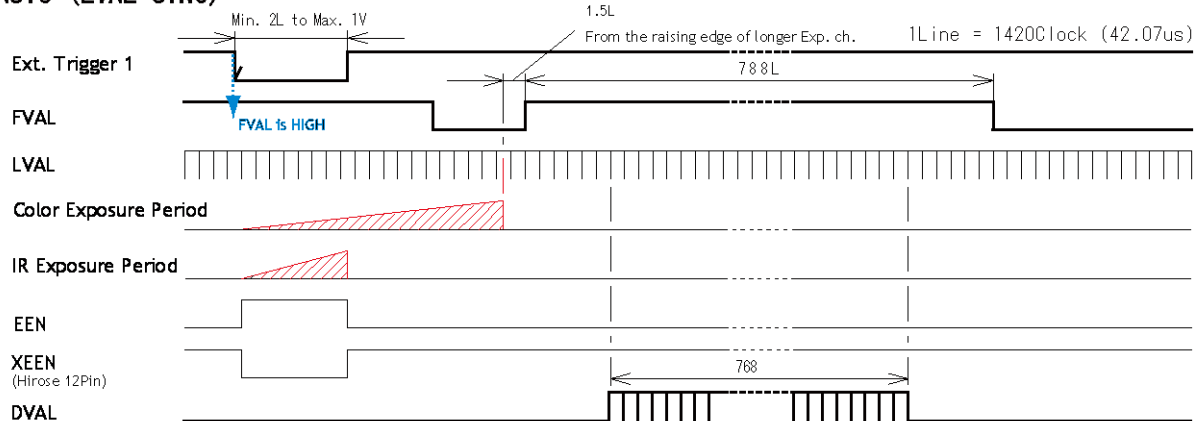
For timing details, refer to fig. 16 through fig. 22.

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:

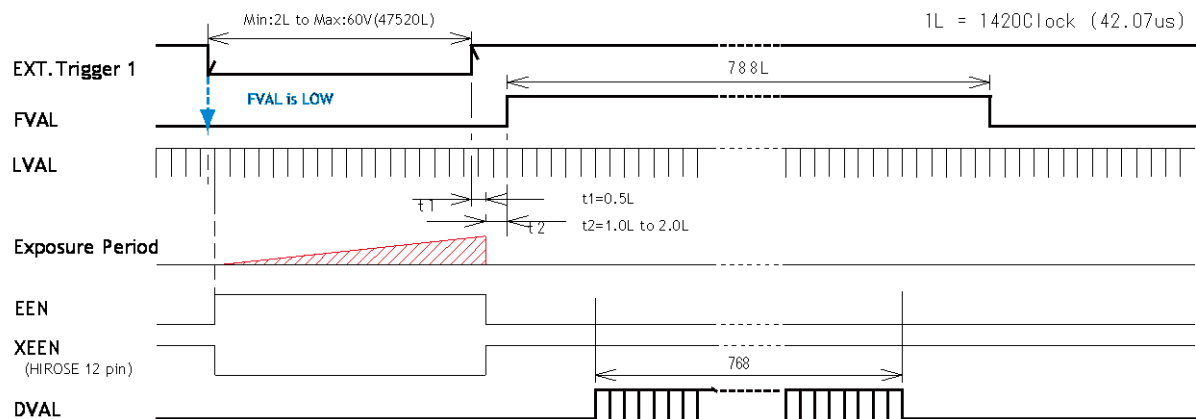
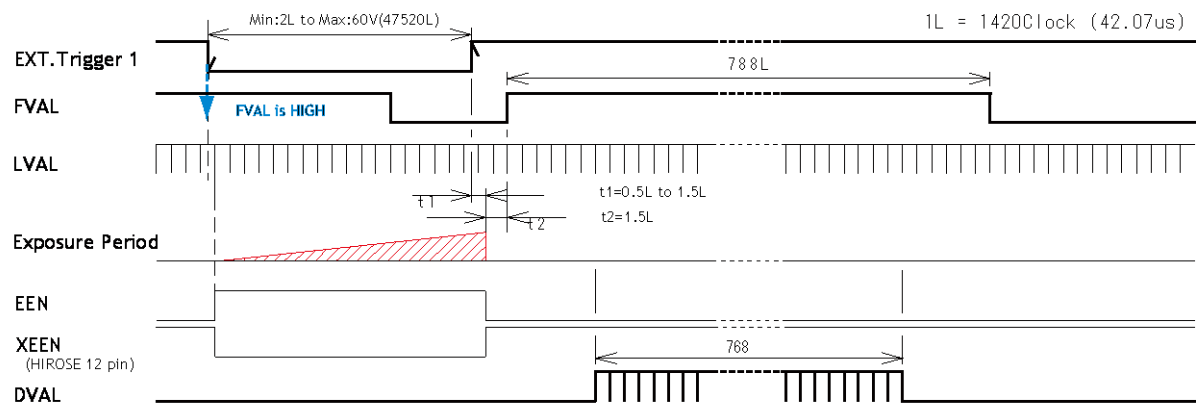
| Mode | Setting | Command |
|-----------------|---|----------------------------|
| Trigger | Pulse Width Control (PWC) | TR1/TR2=2 |
| Output mode | Sync/Separate | IS=0(Sync), IS=1(Separate) |
| Output Select | 8bit, 10bit, Bayer, IR, Single Multiple, RGB24bit | OS1/OS2=0 to 4 |
| Scanning | Full/Partial | SC1/SC2 = 0 to 3 |
| Other functions | | |
| Trigger Input | Camera Link / HIROSE 12-pin | TI1/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)

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**8.5**

| | 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> SM1?<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> | 0=IR 10bit 1=IR 8bit 2=IR + Bayer 10bit 3=IR + Bayer 8bit 4=RGB 24 bit | 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> | -84 to 336 | 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 | | | | |

AD-080CL

| | | | | |
|---|--------------------|---|---------------|-------------------------------------|
| 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

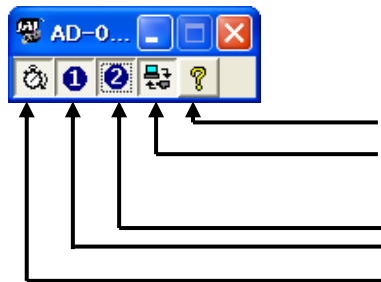
The Camera Control Tool for Windows 2000/XP can be downloaded from www.jai.com. The control tool contains a camera control program and a developer's kit for integrating the control tool in your own software. For the integrator and experienced user, the Camera Control Tool is much more than a program 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.

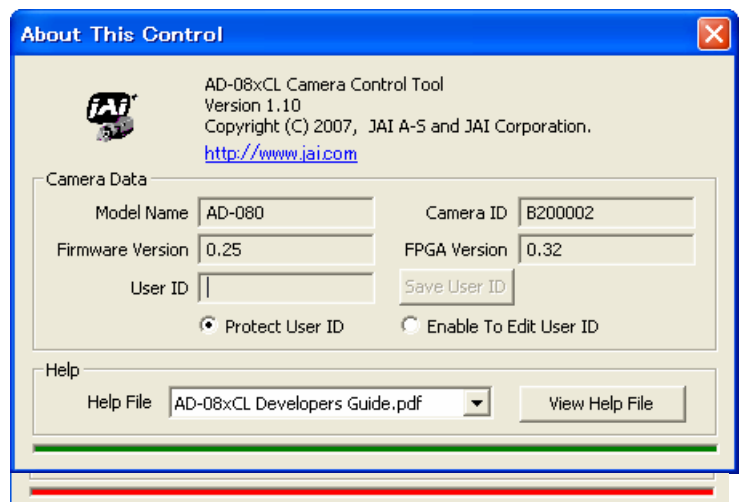
The drop-down box labeled "Help File" will list all files which have the extension .pdf and that are found in the program (default) folder.

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.

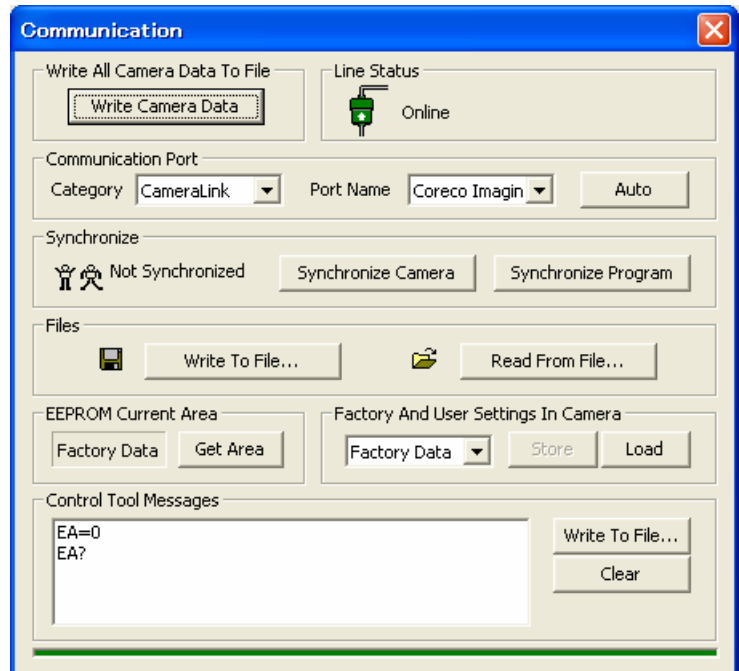
Camera Link communication:

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.

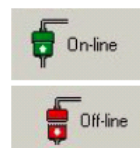


Off/On-line mode

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:

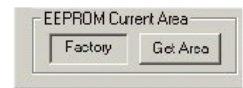
Model Name, Camera ID, User ID, Firmware Version, Current Settings, Factory Settings and the available User Areas.

The file is formatted as shown in the picture below:



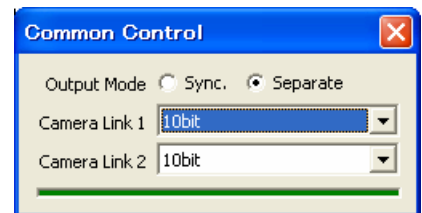
EEPROM Current Area.

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.

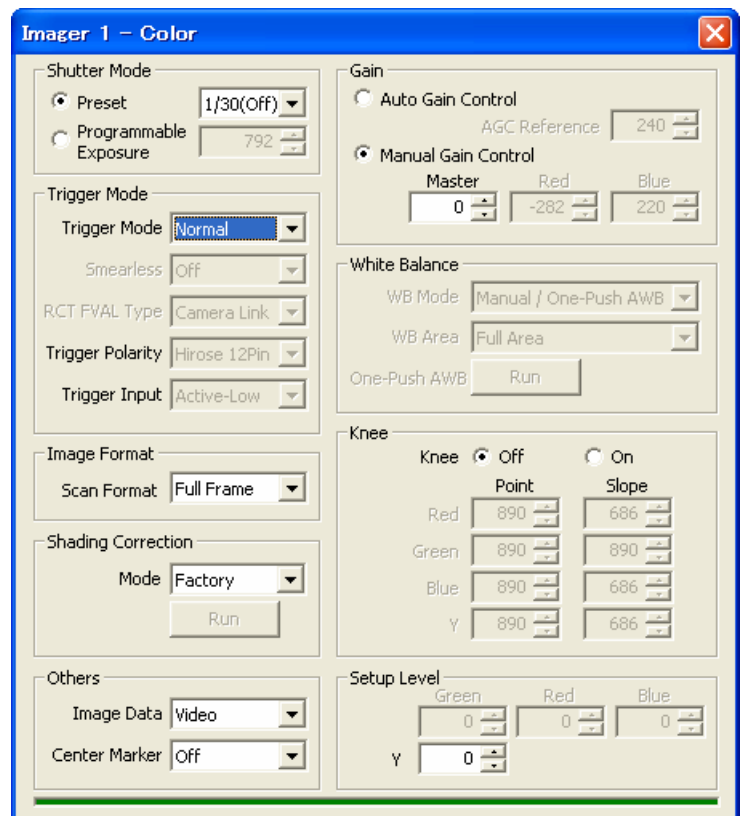


9.1.5 Camera Control Window

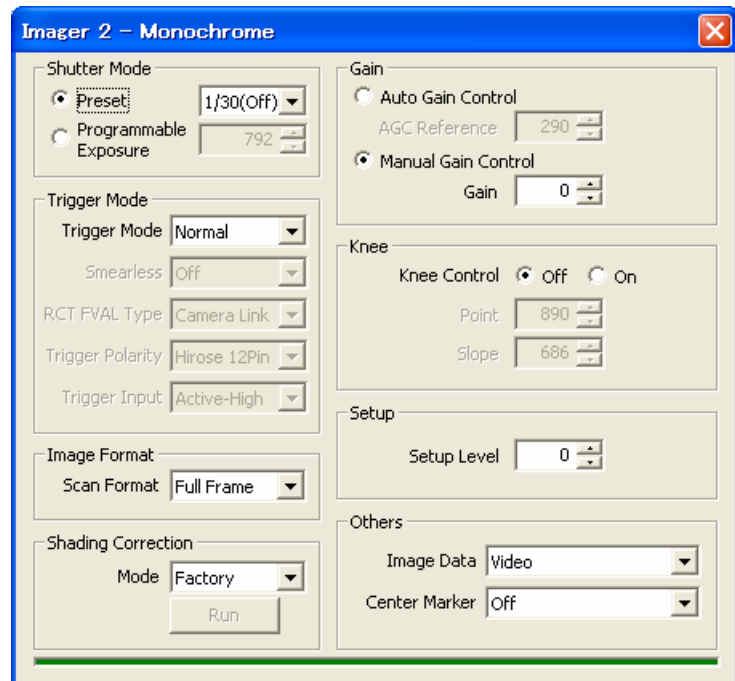
The Camera Control Window contains the fundamental camera setting functions.

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

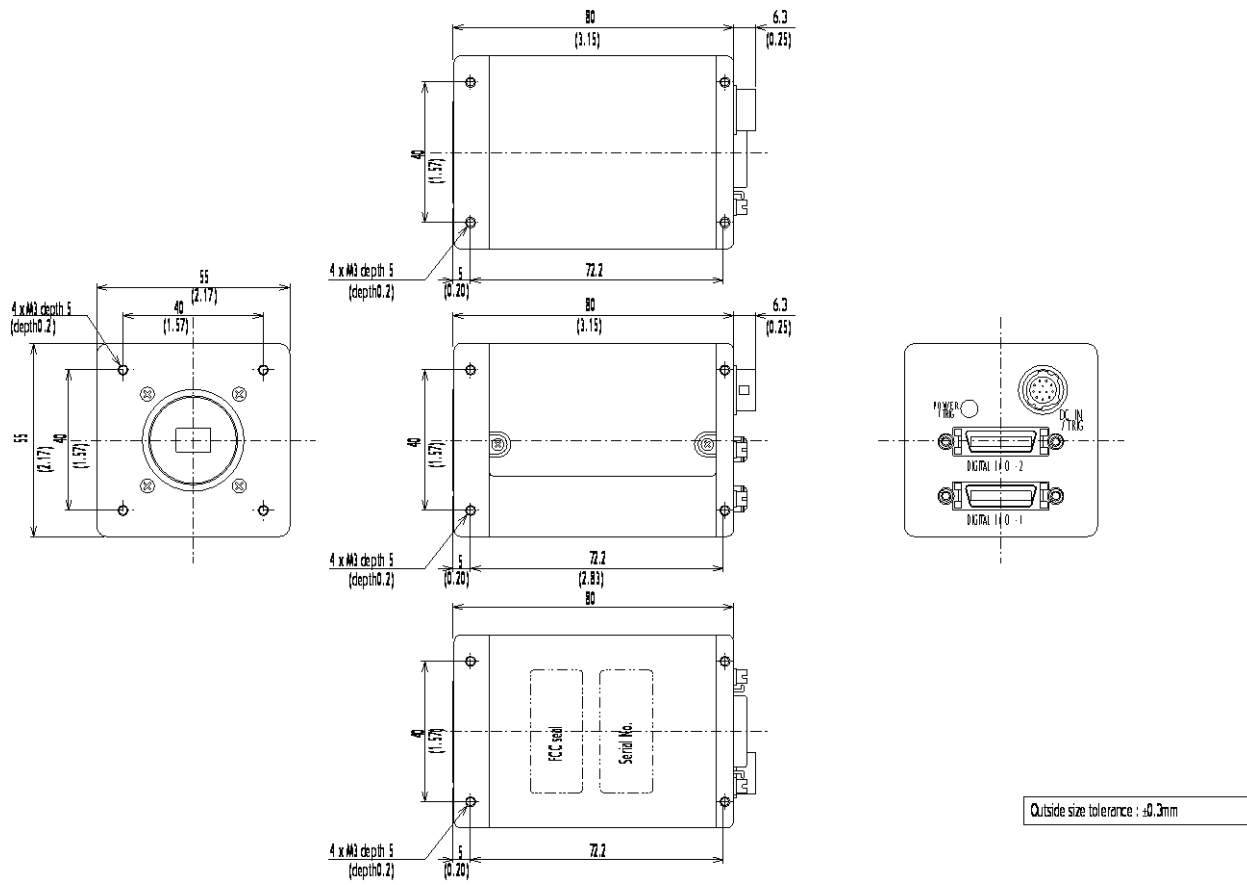


Fig. 26. Dimensions

11.Specifications

11.1 Spectral response

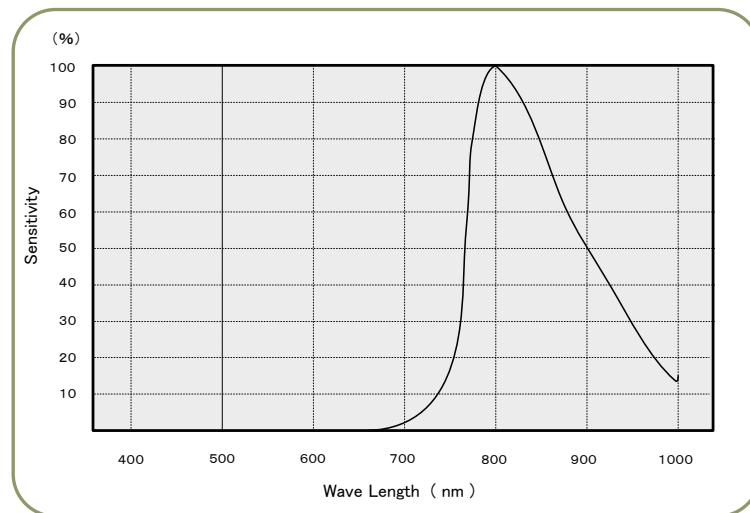


Fig. 27. Total spectral response including Prism and sensor (Monochrome IR)

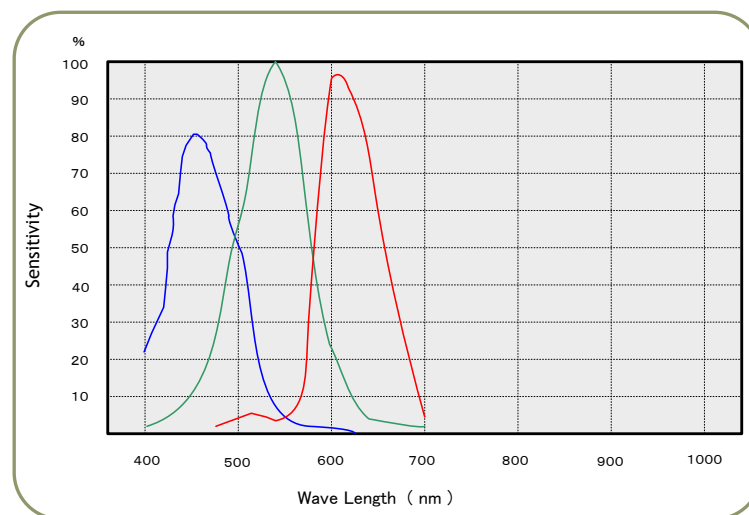


Fig. 28. Total Spectrum response including prism and sensor (Color)

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) μm | |
| Active pixels | 1024(H) x 768 (V) | |
| Pixels in Video output | Full 1/2 Partial 1/4 Partial 1/8 Partial | |
| | 1024 (h) x 768 (v) 30fps. H = 23.768 kHz 1024 (h) x 384(v) 48fps. H = 23.768 kHz 1024 (h) x 192 (v) 68 fps. H = 23.768 kHz 1024 (h) x 96 (v) 86fps. H = 23.768Hz | |
| Sensitivity on sensor | 1.4 lux | 0.1 μW / 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/75Ω) x2 via Camera Link or HIROSE 12-pin | |
| Output signals | Hirose 12-pin: XEEN (TTL/75Ω) 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) |
| 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

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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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