See the possibilities

User's Manual

AD-081GE

Digital 2CCD Progressive Scan
HDR / High Frame Rate Camera

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Notice

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Warranty

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

Certifications

CE compliance

As defined by the Directive 2004/108/EC of the European Parliament and of the Council, EMC (Electromagnetic compatibility), JAI Ltd., Japan declares that AD-081GE complies with the following provisions applying to its standards.
EN 61000-6-3 (Generic emission standard part 1)
EN 61000-6-2 (Generic immunity standard part 1)

FCC

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

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

Warning

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

Supplement

The following statement is related to the regulation on " Measures for the Administration of the control of Pollution by Electronic Information Products " , known as " China RoHS ". The table shows contained Hazardous Substances in this camera.

mark shows that the environment-friendly use period of contained Hazardous Substances is 15 years.

重要注意事项

有毒，有害物质或元素名称及含量表

根据中华人民共和国信息产业部『电子信息产品污染控制管理办法』，本产品《 有毒，有害物质或元素名称及含量表 》如下.

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)
螺丝固定座	×	○	○	○	○	○
.....	.....	.....	.....	.....	.....	.....

○: 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。）

环保使用期限

电子信息产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外泄或突变、电子信息产品用户使用该电子信息产品不会对环境造成严重污染或对基人身、财产造成严重损害的期限。

数字「15」为期限15年。

Table of Contents

1. General

This manual covers the digital 2-CCD progressive scan camera AD-081GE.

The AD-081GE is a GigE Vision® compliant camera, belonging to the JAI C3 Advanced family. The AD-081GE employs 2 monochrome CCDs utilizing prism optics in order to achieve higher dynamic range (maximum 118dB) or higher frame rate (60 fps). Incoming light is divided in half and transmitted to each sensor over the whole visible spectrum.

The AD-081GE provides a frame rate of 30 frames/second at full resolution at normal mode. Using partial scan, the camera can achieve faster frame rates up to 86 fps (1/8 partial scan). The AD-081GE also has a vertical binning mode.

The 1/3" CCDs with square pixels offer superb image quality. The high-speed shutter function and asynchronous random trigger mode allow the camera to capture high quality images of fast moving objects.

The camera features a built-in pre-processing function which includes blemish compensation, shading compensation, LUT/gamma correction and knee control.

The AD-081GE has two GigE Vision compliant interfaces, one for each sensor output.

The AD-081GE also complies with the GenICam™ standard and contains an internal XML file that is used to describe the functions/features of the camera. For further information about the GigE Vision Standard, please go to www.machinevisiononline.org and about GenICam, please go to www.genicam.org.

As an application programming interface, JAI provides an SDK (Software Development Kit). This SDK includes GigE Vision Filter Driver, JAI Control tool, software documentation and code examples.

The JAI SDK can be downloaded from www.jai.com.

The latest version of this manual can be downloaded from www.jai.com

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

2. Camera nomenclature

The standard camera composition consists of the camera main body and C-mount protection cap.

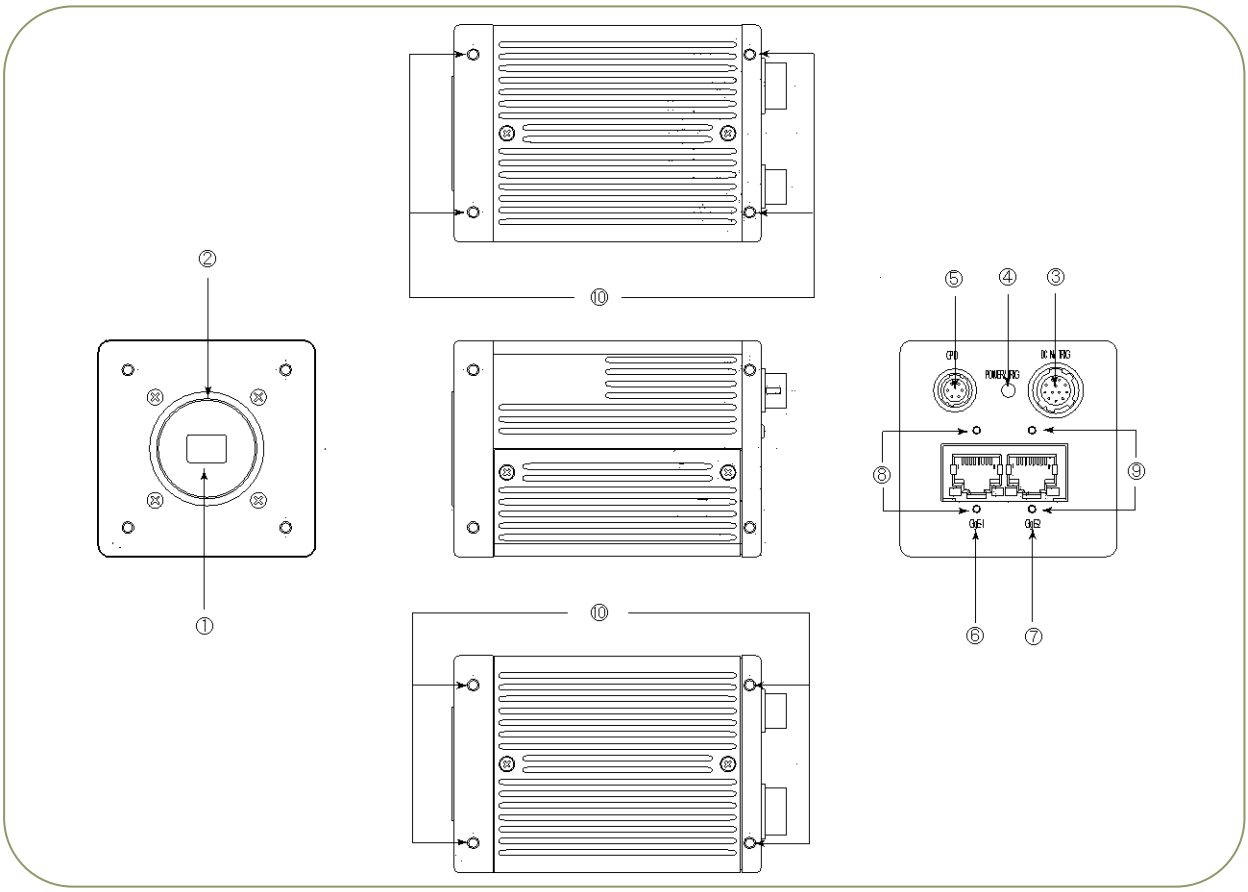
The camera is available in the following versions:

AD-081GE
Where **A** stands for "Advanced" family, **D** stands for "Dual CCD", **081** represents the resolution "800K pixels", **081** represents variation with the same resolution and **GE** stands for "GigE Vision" interface.

3. Main Features

- C3 Advanced series progressive scan camera
- GigE Vision, GenICam compliant
- 2-channel monochrome CCDs are employed by using prism optics
- Two RJ-45 connectors equipped for output from each CCD respectively
- 1/3" progressive scan IT CCDs with 1024 (h) x 768 (v) active pixels
- 4.65 µm square pixels
- 12- or 10- or 8-bit output
- 30 fps with full resolution at normal mode and 60 fps for high frame rate mode
- Variable partial scan is available with user-definable height and starting line
- Programmable exposure from 0.5L(20µs) to 792L(33ms)
- Edge Pre-select, Pulse Width Control ,Reset Continuous and PIV trigger modes
- Sequence trigger mode for on-the–fly change of gain, exposure and ROI
- Delayed readout mode for smooth transmission of multi-camera applications
- Smearless mode available
- Blemish compensation circuit built-in
- Shading compensation circuit built in
- LUT (Look Up Table) for various gamma corrections
- Knee point and Knee slope can be adjusted
- AGC (Automatic Gain Control) from -3dB to 21dB
- LVAL synchronous/asynchronous operation (auto-detect)
- Auto-iris lens video output for lens control
- Programmable GPIO with opto-isolated inputs and outputs
- Comprehensive software tools and SDK for Windows XP/Vista (32 bit "x86" and 64 bit "x64" JAI SDK Ver. 1.2.1 and after)

4. Locations and functions



①	CCD sensor	: 1/3 inch CCD sensor
②	Lens Mount	: C-mount (Note*1)
③	12P Multi Connector	: DC+12V and Trigger Input
④	LED	: Power and Trigger indications
⑤	6P Multi Connector	: LVDS IN and TTL IN and OUT
⑥	RJ-45 Connector(GigE-1)	: GigE Vision I/F w/ thumbscrews for BW1
⑦	RJ-45 Connector(GigE-2)	: GigE Vision I/F w/ thumbscrews for BW2
⑧	Holes for RJ-45 thumbscrews	: Vertical type (Note*2)
⑨	Holes for RJ-45 thumbscrews	: Vertical type (Note *2)
⑩	Mounting holes	: M3, max length 5mm (Note*3)

*1) : AD-081GE is based on a beam-splitting 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.

*2) : When an RJ-45 cable with thumbscrews is connected to the camera, please do not excessively tighten screws by using a screw driver. The RJ-45 receptacle on the camera might be damaged. For security, the strength to tighten screws is less than 0.147 Newton meter (Nm). Tightening by hand is sufficient in order to achieve this.

*3) : The tripod adapter plate MP-41 can be used with AD-081GE

Fig.1 Locations

5. Pin configuration

5.1. 12-pin Multi-connector (DC-in/GPIO/Iris Video)

Type: HR10A-10R-12PB
(Hirose) male.
(Seen from the rear of camera)

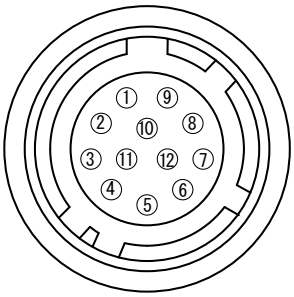


Fig. 2. 12-pin connector.

Pin no.	Signal	Remarks
1	GND	
2	+12 V DC input	
3	Opt IN 2 (-) / GND (*1)	GPIO IN / OUT
4	Opt IN 2 (+)/Iris Video out (*1)	
5	Opt IN 1 (-)	
6	Opt IN 1 (+)	
7	Opt Out 1 (-)	
8	Opt Out 1 (+)	
9	Opt Out 2 (-)	
10	Opt Out 2 (+)	
11	+ 12 V DC input	
12	GND	

*1: Iris Video output function can be set by the internal DIP switch (SW700).

5.2. Digital Output Connector for Gigabit Ethernet

Type: RJ-45 : HFJ11-1G02E-L21RL or equivalent

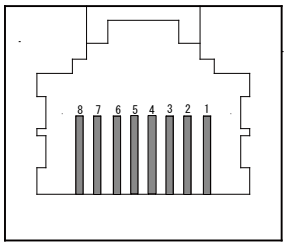


Fig. 3. Gigabit Ethernet connector

The digital output signals follow the Gigabit Ethernet interface using an RJ-45 conforming connector. To the right is a table with the pin assignment for Gigabit Ethernet connector.

Pin No	In/Out	Name
1	In/Out	MX1+ (DA+)
2	In/Out	MX1- (DA-)
3	In/Out	MX2+ (DB+)
4	In/Out	MX3+ (DC+)
5	In/Out	MX3- (DC-)
6	In/Out	MX2- (DB-)
7	In/Out	MX4+ (DD+)
8	In/Out	MX4- (DD-)

5.3. 6-pin Multi-connector (LVDS IN and TTL IN/OUT)

Type : HR-10A-7R-6PB

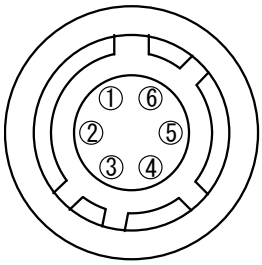


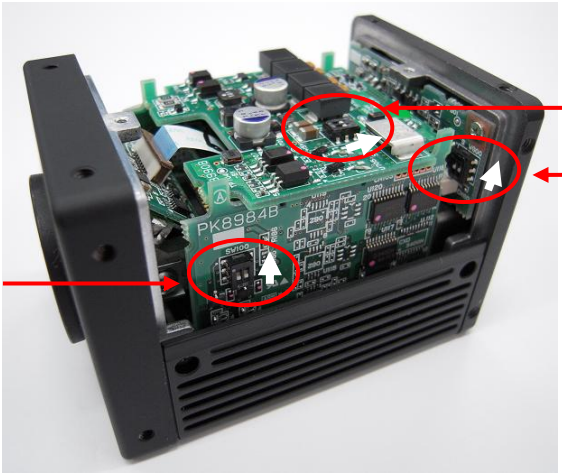
Fig.4 HIROSE 6-pin connector

No	I/O	Name	Note
1	I	LVDS In 1-	
2	I	LVDS In 1+	
3	I	TTL IN 1	75ohm Terminator (Note*1)
4	O	TTL Out 1	Note*2)
5	I	TTL IN 2	75ohm Terminator(Note*1)
6 注		GND	

*1:can be changed by DIP switches.
*2: Open collector or TTL level can be selected by an internal DIP switch. Factory default is TTL.

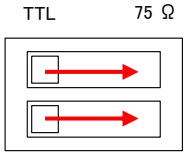
5.4. DIP switches

DIP switches are located inside the camera. When the top cover is removed, please pay careful attention so that the boards inside may not be damaged.



5.4.1 Trigger input 75 ohms termination

Trigger input can be terminated with 75 ohms if DIP switch SW600 is selected as described below. Factory default is TTL.

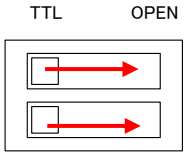


① TTL IN 1

② TTL IN 2

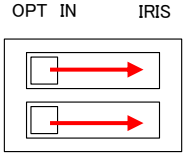
5.4.2 EEN output

EEN output through HIROSE 6-pin #4 can be selected TTL level or open collector level. The selection is activated by DIP switch SW100 described below. Factory default is TTL.



5.4.3 Video output for Auto iris lens

The output through HIROSE 12-pin #4 can be selected OPT IN 2 or Iris video output by DIP switch SW700 described below. Factory default is OPT IN 2.



6. Input and output circuits

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

6.1. Iris Video output

This signal can be used for lens iris control in Continuous mode. The signal is taken from the CCD sensor output through the process circuit but as the reverse compensation is applied, the signal is not influenced by the gain settings. The video output is without sync. The signal is 0.7 V p-p from 75 Ω without termination.
This signal is taken from sensor 1 but it can be changed by the register. In order to get this signal, DIP switch DSW700 should be changed. Refer to 5.4.3.

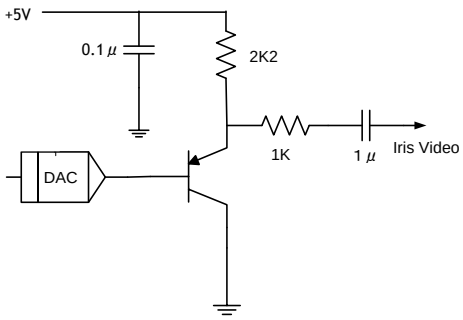


Fig.5 Iris video output

6.2. Trigger input

An external trigger input can be applied to pins 3 and 5 of the 6-pin Hirose connector.
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.
Trigger input level 4 V ±2 V.

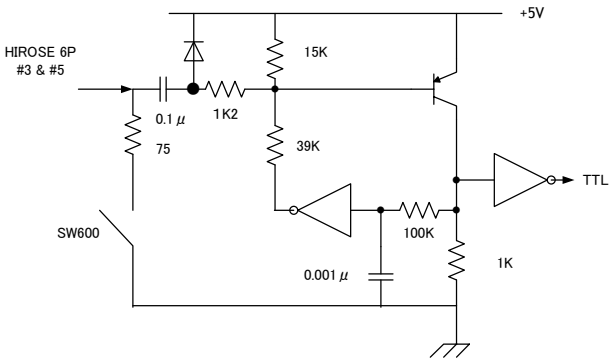


Fig.6 Trigger circuit

6.3. EEN (Exposure Enable) output

XEEN is available on pin 4 of the 6-pin Hirose connector.
The output can be selected as either open collector or TTL level.
The TTL output circuit is 75Ω complementary emitter followers. It will deliver a full 5 volt signal.
Output level ≥4 V from 75Ω. (No termination).
For the open collector, the maximum current is 120mA. But if current of more than 50mA is used, use thicker cable. The use of thinner cable may cause a malfunction due to its resistance.

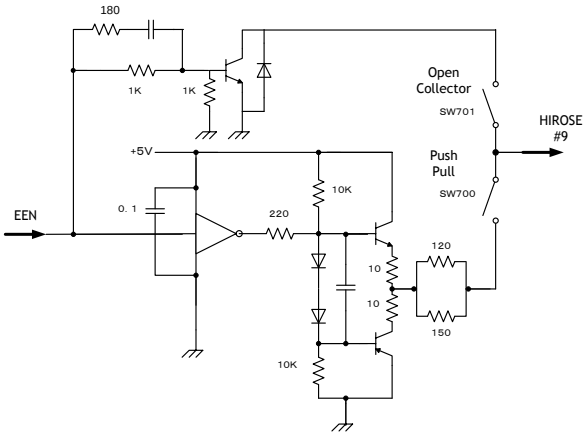


Fig.7 EEN output

7. System Configuration

7.1. System connection

When the AD-081GE is connected to a PC, there are two connection methods.
Method one is to use a dual or quad input Network Interface Card (NIC) or two separate network interface cards. The other way is to use a hub. Refer to the following drawings.

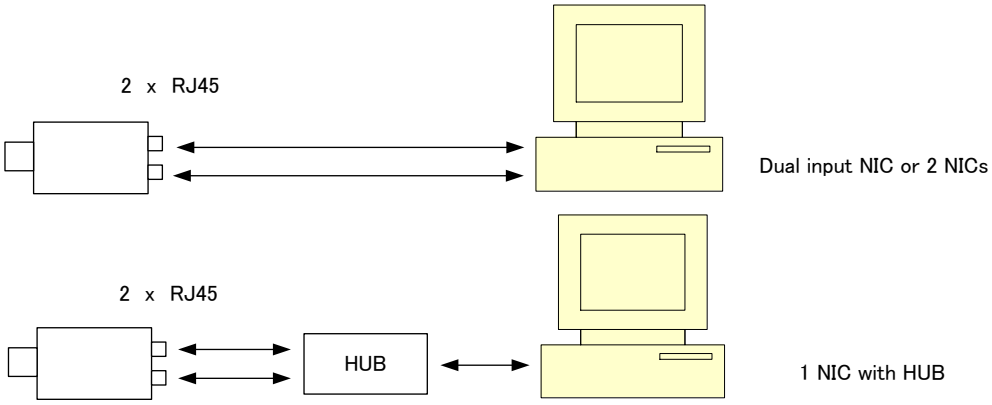


Fig.8 System configuration

It should be noted that the hub being used should comply with Gigabit Ethernet.
When JAI SDK control tool is executed, AD-081GE is recognized as like two cameras. #0 represents one of the imagers and #1 represents the other.
Each imager can be handled as an independent camera.

7.2. Lens considerations

The AD-081GE has a built-in a beam-splitter prism which separates transmitted and reflected light across the 400nm to 650nm visible wavelength range. 50% of the incoming light is reflected and goes to the BW2 sensor while the remaining 50% transmitted light goes to the BW1 sensor. 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-081GE.

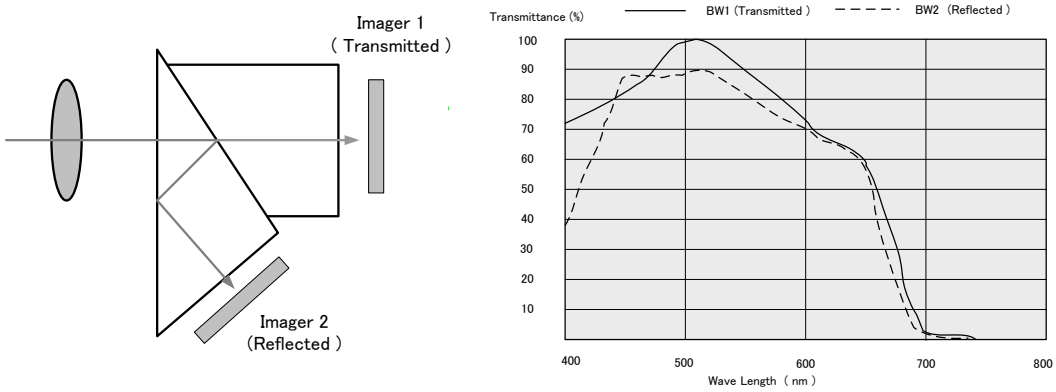
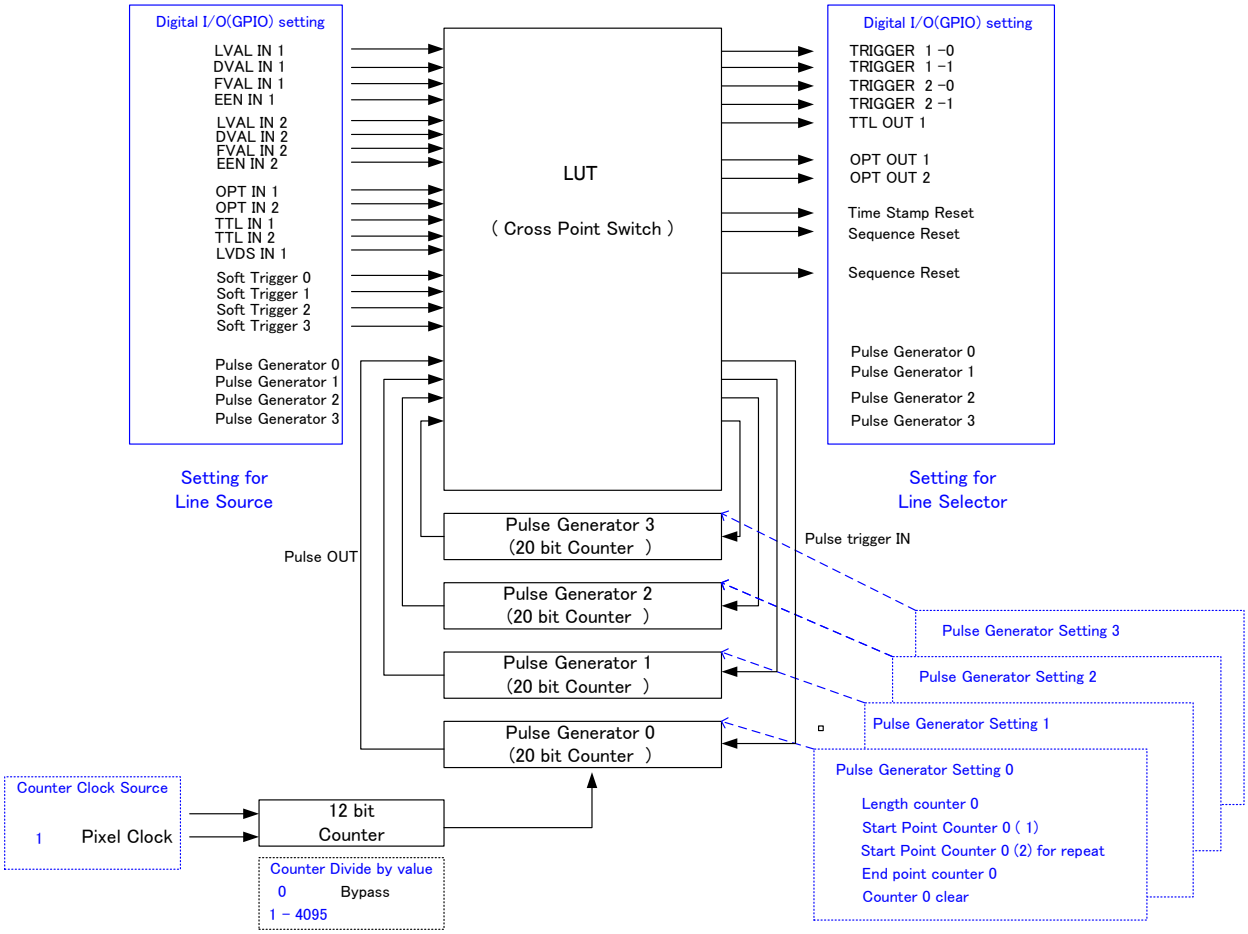


Fig 9 Focal points for Visible and NIR lights

8. GPIO (Inputs and outputs)

8.1. Overview

All input and output signals pass through the GPIO (General Purpose Input and Output) module. The GPIO module consists of a Look-Up Table (LUT – Cross-Point Switch), 2 Pulse Generators and a 12-bit counter. In the LUT, the relationship between inputs, counters and outputs is governed by internal register set-up.



Some of the descriptions in this diagram differ from those displayed in the camera control tool. The following table shows display names and descriptions.

Line Source		Line Selector	
Description	**Display Name**	Description	**Display Name**
OPT IN 1	Line 4	TTL OUT 1	Line 1
OPT IN 2	Line 5	OPT OUT 1	Line 2
TTL IN 1	Line 6	OPT OUT 2	Line 3
TTL IN 2	Line 7		
LVDS IN 1	Line 8		

On the above block diagram, Trigger 0 is used for Exposure and Trigger 1 is used for Delayed Readout. The Time Stamp Reset can reset the time stamp compliant with the GigE Vision standard. This is used for ensuring the same time stamp if multiple cameras are used.

The blocks shown in the above diagram have the following functionalities:

8.1.1 LUT (Cross Point Switch)

The LUT works as a cross-point switch which allows connecting inputs and outputs freely. The signals LVAL_IN, DVAL_IN, FVAL_IN and EEN_IN all originate from the camera timing circuit. On this diagram, Trigger 0 is used for exposure and Trigger 1 is used for Delayed Readout. The Time Stamp Reset signal can reset the time stamp specified in GigE Vision Format. This signal can be used when time stamps from several cameras connected are coincident with each other. The "Sequence reset" resets the sequential settings. Outputs from the LUT described on the right side show GPIO settings for LINE SELECTOR in the JAI Camera Control tool and inputs to the LUT on the left side show GPIO settings for LINE SOURCE in the JAI Camera Control tool. Refer to Chapter 8.2 GPIO inputs/Outputs table.

8.1.2 12-bit Counter

A camera pixel clock can be used as a source. The counter has a "Divide by N", where N has the range 1 through 4096, allowing a wide range of clock frequencies to be programmed. Setting value 0 is bypass, setting value 1 is 1/2 dividing, and setting value 4095 is 1/4096 dividing. As the pixel clocks for the AD-081GE are 33.75 MHz, the output frequency is varied from 33.75MHz to 23.768 KHz.

8.1.3 Pulse Generators (0 to 3)

Each pulse generator consists of a 20-bit counter. The behavior of these signals is defined by their pulse width, start point and end point.
The pulse generator signals can be set in either triggered or periodic mode.
In triggered mode, the pulse is triggered by the rising edge/falling edge/high level or low level of the input signal. In periodic mode, the trigger continuously generates a signal that is based on the configured pulse width, starting point and end point.
Each pulse generator operates at the frequency created in the 12-bit counter. As the pixel clock (33.75 MHz) is used as the main frequency, the frequency of pulse generator is 33.75 MHz to 8.24 KHz.

8.1.4 Opto-isolated Inputs/Outputs

The control interface of the C3 GigE Vision camera series has opto-isolated inputs and outputs, providing galvanic separation between the camera's inputs/outputs and peripheral equipment. In addition to galvanic separation, the opto-isolated inputs and outputs can cope with a wide range of voltages; the voltage range for inputs is +3.3V to +24V DC whereas outputs will handle +5V to +24V DC.

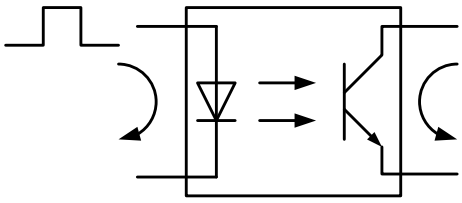


Fig.10 Photo coupler

8.1.5 Recommended External Input circuit diagram for customer

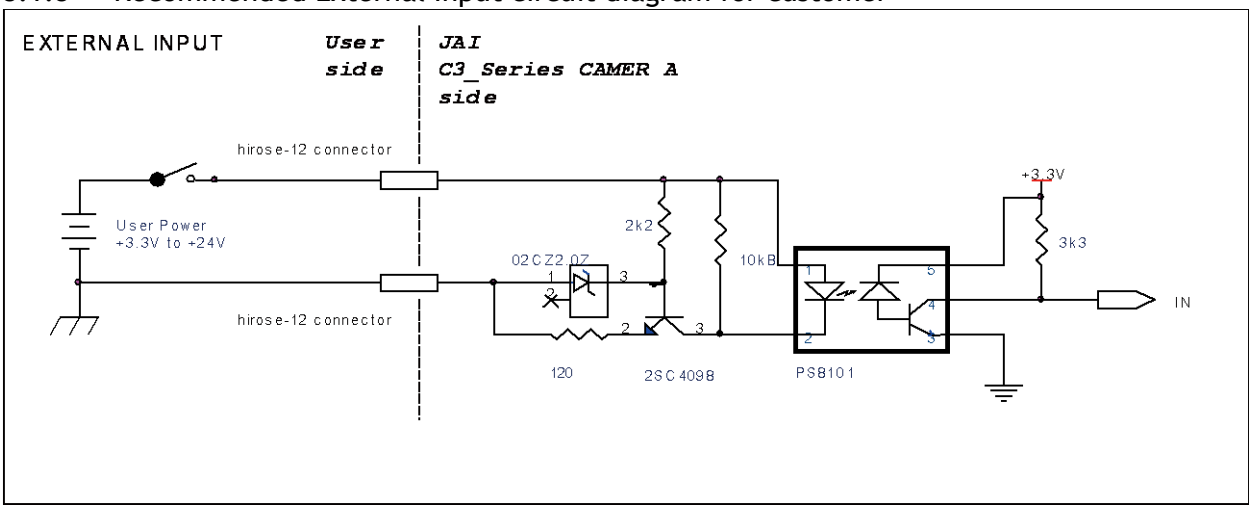


Fig.11 External Input Circuit、OPT IN 1 and 2

8.1.6 Recommended External Output circuit diagram for customer

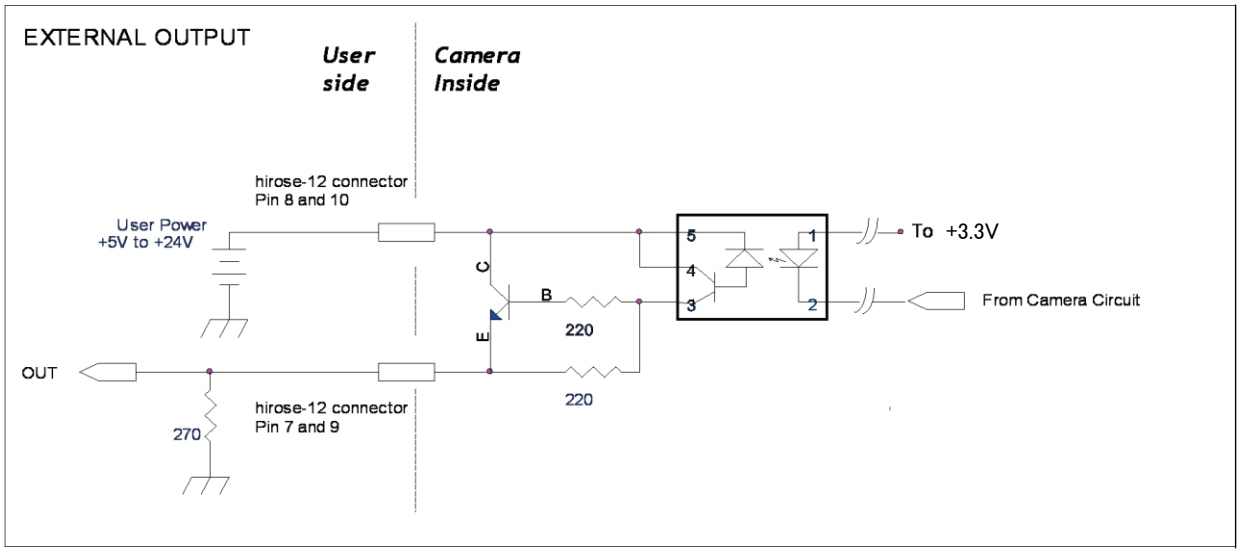
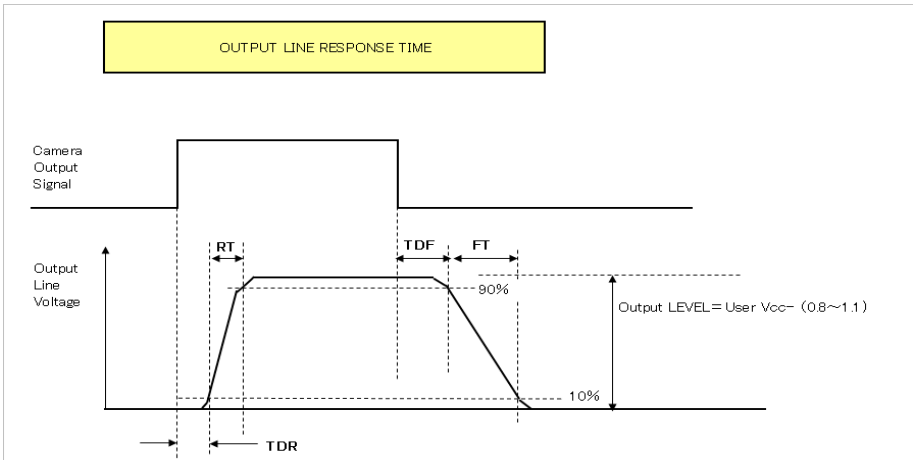


Fig.12 External Output Circuit, OPT OUT 1 and 2

8.1.7 Optical Interface Specifications

The relation of the input signal and the output signal through the optical interface is as follows.



Conditions for Input	
Input Line Voltage Range	+3.3V ～ +24V
Input Current	6mA ～ 30mA
Minimum Input Pulse Width to Turn ON	0.5μs

Output Specifications	
Output Load(Maximum Current)	100mA
Minimum Output Pulse Width	20μs
Time Delay Rise TDR	0.5μs ～ 0.7μs
Rise Time RT	1.2μs ～ 3.0μs
Time Delay Fall TDF	1.5μs ～ 3.0μs
Fall Time FT	4.0μs ～ 7.0μs

Fig.13 Optical Interface Performance

8.2. Inputs and outputs table

		Output Ports													
		Trig. 1-0	Trig. 1-1	Trig. 2-0	Trig. 2-1	OPT OUT1	OPT OUT2	TTL OUT1	Time Stamp Reset 1	Seq. Reset 1	Seq. Reset 2	Pulse Gen. 0	Pulse Gen. 1	Pulse Gen. 2	Pulse Gen. 3
Input Ports	LVAL IN 1	×	×			×	×	O	×	×		O	O	O	O
	DVAL IN 1	×	×			×	×	O	×	×		O	O	O	O
	FVAL IN 1	×	×			×	×	O	×	×		O	O	O	O
	EEN IN 1	×	×			O	O	O	×	×		O	O	O	O
	LVAL IN 2			×	×	×	×	O			×	O	O	O	O
	DVAL IN 2			×	×	×	×	O			×	O	O	O	O
	FVAL IN 2			×	×	×	×	O			×	O	O	O	O
	EEN IN 2			×	×	O	O	O			×	O	O	O	O
	OPT IN 1	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	OPT IN 2	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	TTL IN 1	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	TTL IN 2	O	O	O	O	O	O	O	O	O	O	O	O	O	
	LVDS IN	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	Soft Trigger 0	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	Soft Trigger 1	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	Soft Trigger 2	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	Soft Trigger 3	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	Pulse Gen. 0	O	O	O	O	O	O	O	O	O	O		O	O	O
	Pulse Gen.1	O	O	O	O	O	O	O	O	O	O	O		O	O
	Pulse Gen. 2	O	O	O	O	O	O	O	O	O	O	O	O		O
	Pulse Gen.3	O	O	O	O	O	O	O	O	O	O	O	O	O	

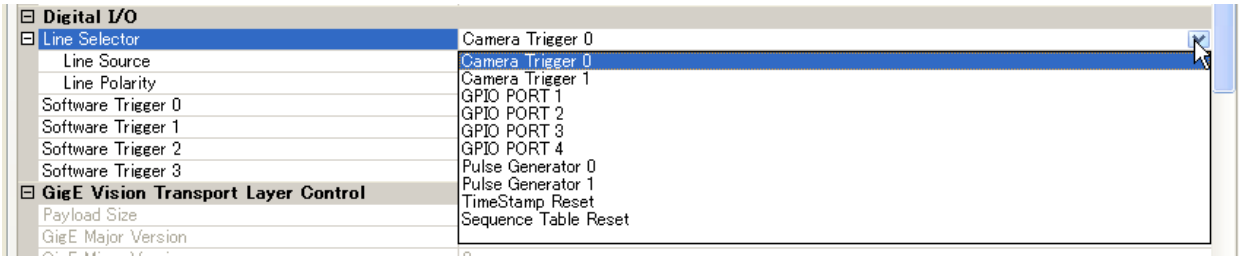
LEGEND: 0 = valid combination / x = Not valid (do not use this combination)
The shaded parts are for the interface to external equipment.

8.3. Configuring the GPIO module (register settings)

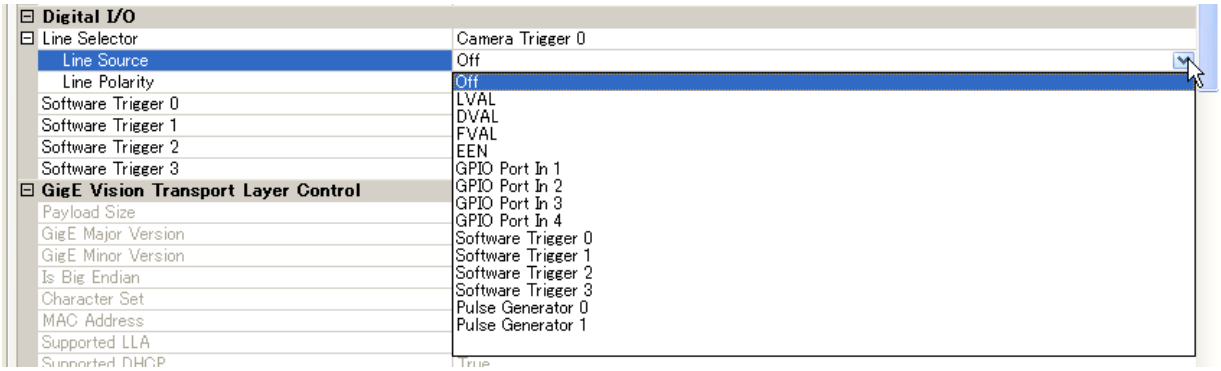
8.3.1 Input /Output Signal Selector

GPIO is used to determine which signal is assigned which terminal. For the details, please refer to Register Map, Digital I/O, Acquisition and Trigger Control, and Pulse Generator.

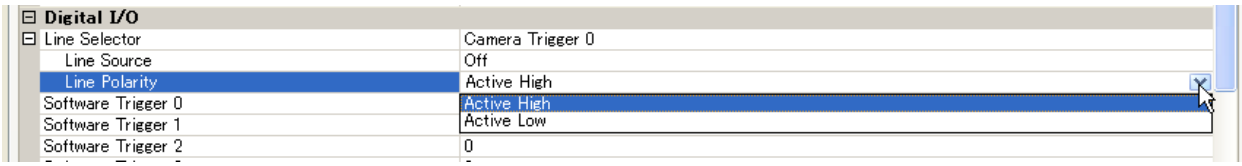
Line Selector



Line Source



Line Polarity

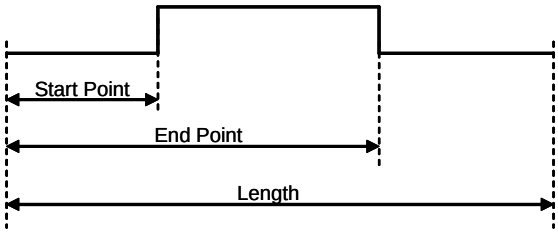


8.3.2 12bit counter

Address	Internal Name	GenICam Name	Access	Size	Value (Range)
0xB004	Counter Dividing Value	ClockPreScaler	R/W	4	0x000: Bypass 0x001: 1/2 Dividing 0x002: 1/3 Dividing | 0xFFF: 1/4096 Dividing

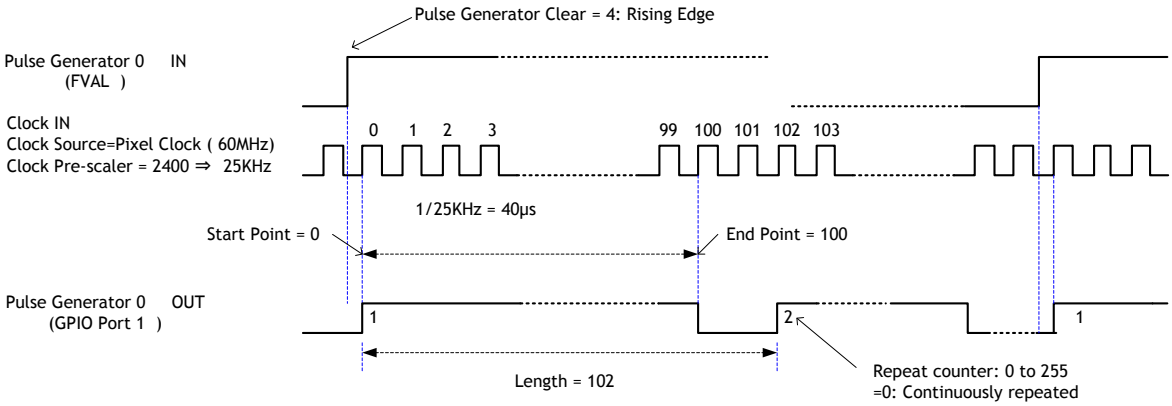
8.3.3 Pulse generators (20 bit x 4)

There are 4 pulse generators (designated 0 through 3) that can be used to create various timing scenarios by programming start point, endpoint, length and repeats.

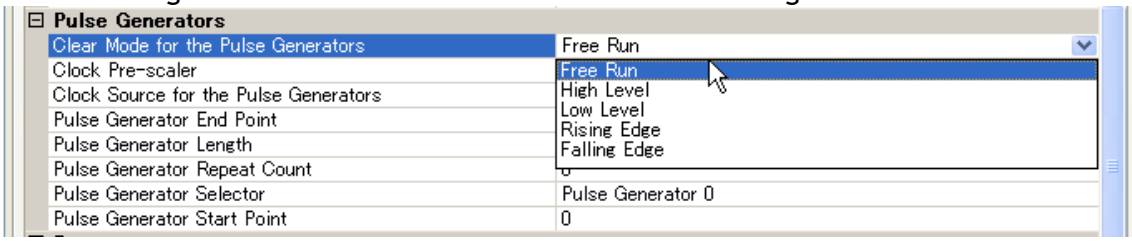


The following drawing is an example of settings.

FVAL is used for the input of a pulse generator 0 and the clock, after the rising edge of FVAL, counts 100 clocks for the high period of the pulse and 102 clocks for the pulse length.
As 2400 is for Clock Pre-scaler, the output of the 12 bit counter is 25 KHz, which is 40µs.
Thus, pulse generator 0 creates a 4 ms pulse.



The following shows JAI SDK Camera Control Tool for setting Pulse Generators.



8.4. GPIO programming examples

8.4.1 GPIO Plus PWC shutter

Example: 20μs unit pulse width exposure control (PWC). Pixel clock is 33.75MHz. 675 clocks (775-100) equal 20μs. These are the settings for Imager 1. For Imager 2, trigger 2-0 should be set in the same manner.

	Address	*Register*	*Value*
	0xA040	Trigger Mode	2 = PWC (Pulse Width Control)
①	0xB090	Pulse Generator 0 Selector	4 =OPT IN 1
②	0xB000	Clock Choice	1 = Pixel Clock (33.75MHz)
	0xB004	Counter Dividing Value	0 = Pass through
	0xB008	Length Counter 0	1000 Clocks
	0xB00C	Start point Counter 0(1)	100 Clocks
	0xB010	Start point Counter 0(2)	1
	0xB014	End point Counter 0	775 Clocks
	0xB018	Counter Clear 0	4 = Rising Edge Clear
③	0xB060	CAMERA TRIGGER Selector	16 = pulse generator 0
①	0xB090	Pulse Generator 0 Selector	4 =OPT IN 1

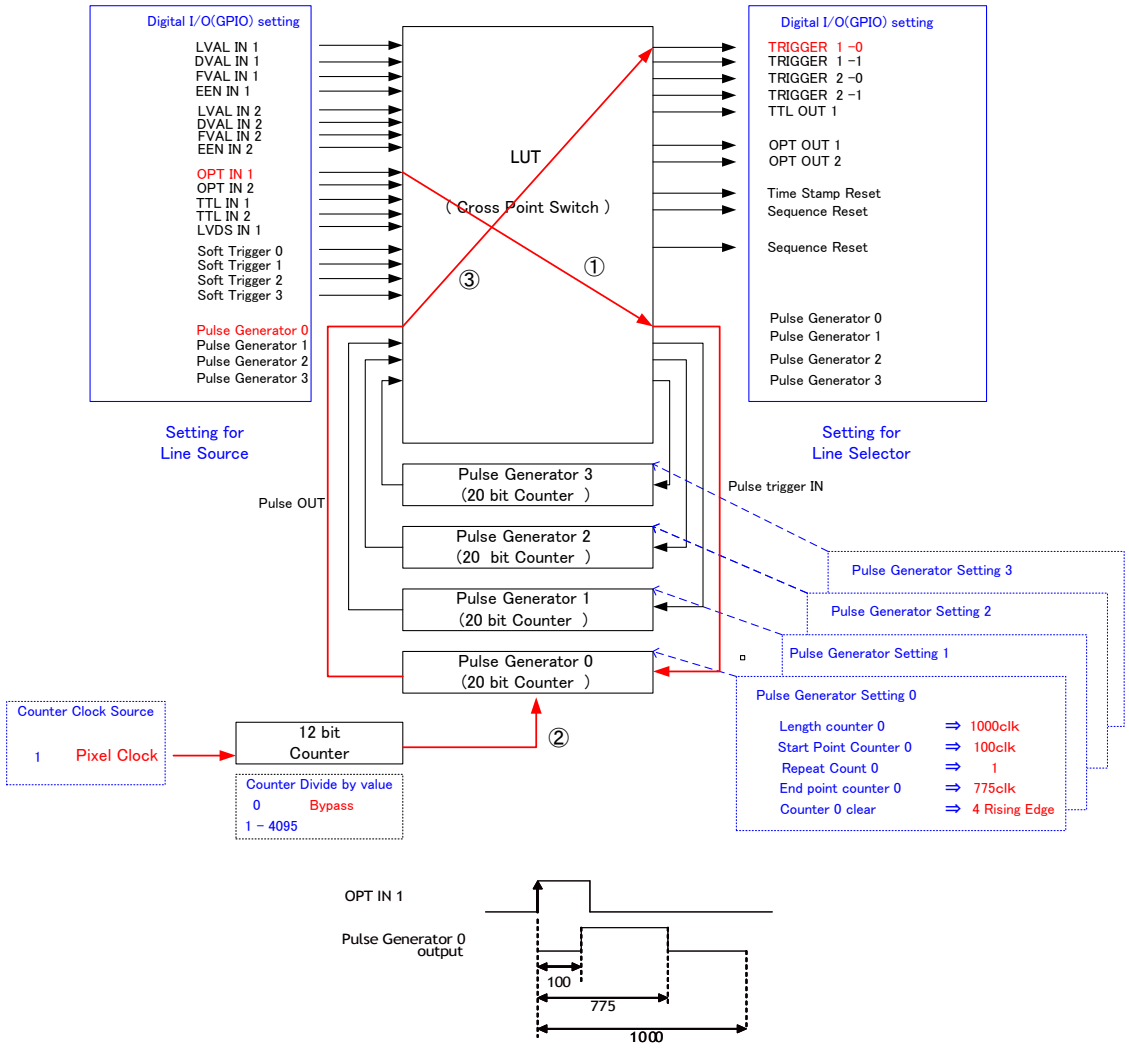


Fig.14 Pulse Generator Timing Example 1

8.4.2 Internal Trigger Generator

Example: Create a trigger signal and trigger the camera. These are the settings for Imager 1. For Imager 2, trigger 2-0 should be set in the same manner.

	Address	Register	Value
	0xA040	Trigger Mode	1 = EPS
①	0xB000	Clock Choice	1 = Pixel Clock
	0xB004	Counter Dividing Value	1419= 1/1420(Line Rate)
	0xB008	Length Counter 0	1000 Clocks
	0xB00C	Start point Counter 0 (1)	100 Clocks
	0xB010	Start point Counter 0 (2)	0 = Infinite
	0xB014	End point Counter 0	500 Clocks
	0xB018	Counter Clear 0	0 = Free Run
②	0xB060	CAMERA TRIGGER Selector	16 = pulse generator 0

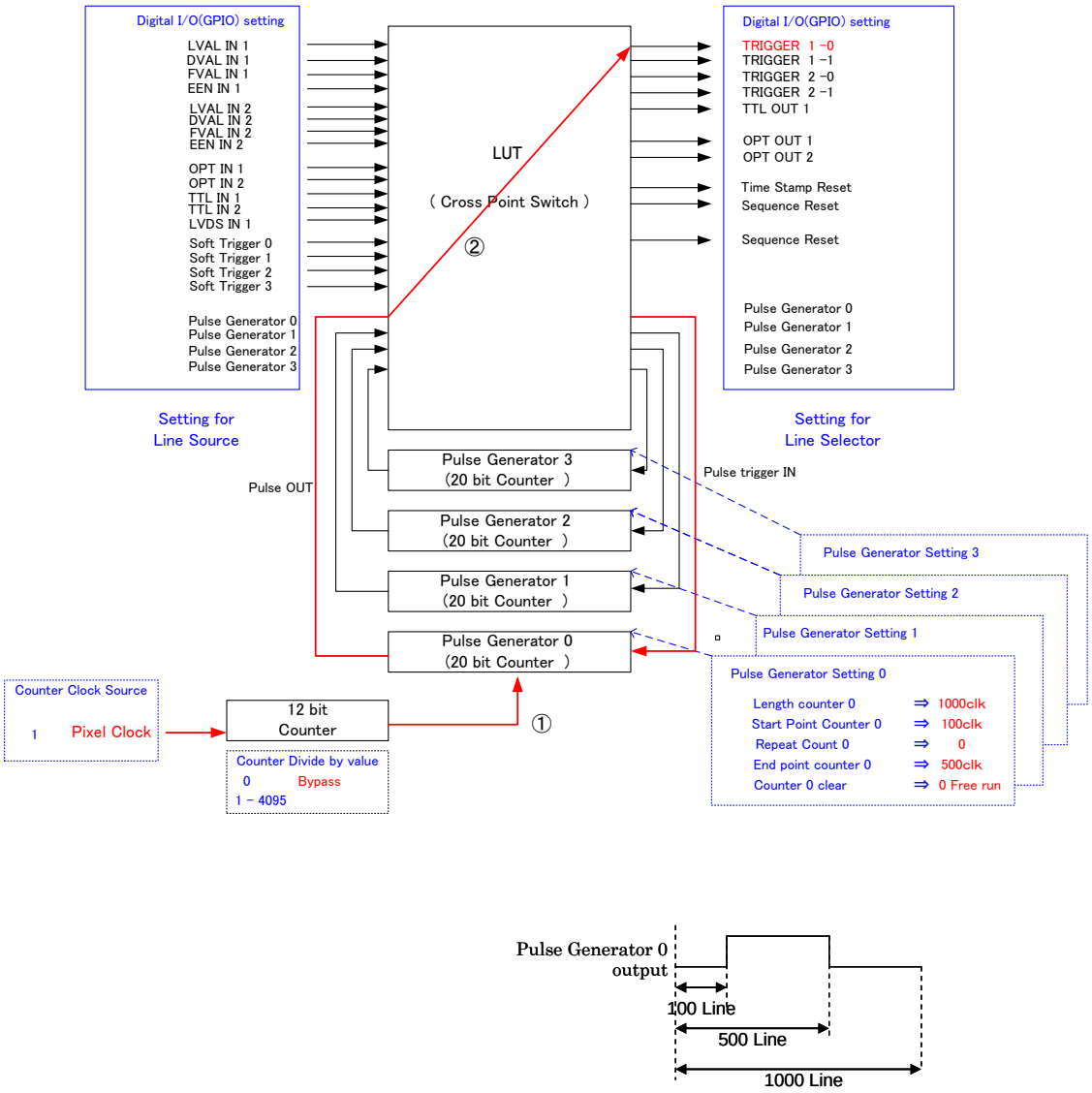


Fig.15 Pulse Generator 0 timing Example 2

9. GigE Vision® Streaming Protocol (GVSP)

9.1. Digital Video Output (Bit Allocation)

Although the AD-081GE is a digital camera, the image is generated by an analog component, the CCD sensor.
The table and diagram below show the relationship between the analog CCD output level and the digital output.

CCD out	Analog Signal *	Digital Out		
		8 bit	10 bit	12 bit
Black	Setup 3.6%, 25mV	8 LSB	32 LSB	128 LSB
200mV	700mV	222 LSB	890 LSB	3560 LSB
230mV	800mV	255 LSB	1023 LSB	4095 LSB

The standard setting for 10-bit video level is 890 LSB. A 200 mV CCD output level equals 100% video output.

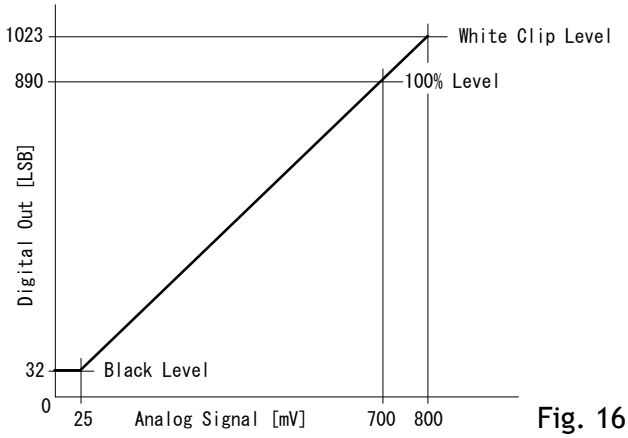


Fig. 16 Digital Output (10 bit output)

9.2. Bit Allocation (Pixel Format / Pixel Type)

In the GigE Vision Interface, GVSP (GigE Vision Streaming Protocol) is used for an application layer protocol relying on the UDP transport layer protocol. It allows an application to receive image data, image information and other information from a device.
In the AD-081GE, the following pixel types supported by GVSP are available.
With regard to the details of GVSP, please refer to the GigE Vision Specification available from the AIA (www.machinevisiononline.org).

9.2.1 GVSP_PIX_MONO8 (8bit)

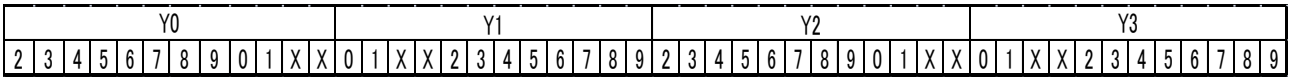
1 Byte								2 Byte								3 Byte							
Y0								Y1								Y2							
0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7

9.2.2 GVSP_PIX_MONO10 (10bit)

1 Byte								2 Byte								3 Byte								4 Byte							
Y0								Y0								Y1								Y1							
0	1	2	3	4	5	6	7	8	9	X	X	X	X	X	X	0	1	2	3	4	5	6	7	8	9	X	X	X	X	X	X

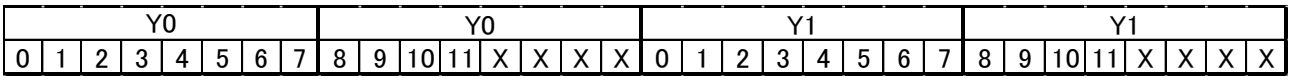
9.2.3 GVSP_PIX_MONO10_PACKED (10 bit)

1 Byte 2 Byte 3 Byte 4 Byte



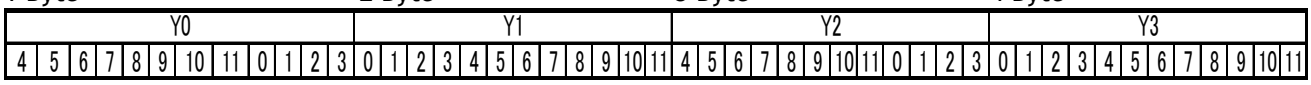
9.2.4 GVSP_PIX_MONO12 (12 bit)

1 Byte 2 Byte 3 Byte 4 Byte



9.2.5 GVSP_PIX_MONO12_PACKED (12 bit)

1 Byte 2 Byte 3 Byte 4 Byte



Address	Internal Name	Access	Size	Value
0xA410	Pixel Format type	R/W	4	0x01080001:Mono8 0x01100003:Mono10 0x010C0004:Mono10 Packed 0x01100005:Mono12 0x010C0006:Mono12 Packed

10. Functions and Operations

10.1. GigE Vision Standard Interface

The AD-081GE is designed in accordance with the GigE Vision standard. Digital images are transmitted over Cat5e or Cat6 Ethernet cables. All camera functions are also controlled via the GigE Vision interface.

The camera can operate in Continuous mode, providing an endless stream of images. For capturing individual images related to a specific event, the camera can also be triggered. For precise triggering, it is recommended to use a hardware trigger applied to the Hirose 12-pin connector or 6-pin connector. It is also possible to initiate a software trigger through the GigE Vision interface. However, when using a software trigger, certain latency inherent to the GigE interface must be expected. This latency, which manifests itself as jitter, greatly depends on the general conditions and traffic on the GigE connection. The frame rate described in this manual is for the ideal case and may deteriorate depending on conditions.

When using multiple cameras (going through a switch and/or a single path) or when operating in a system with limited transmission bandwidth the Delayed Readout Mode and Inter-Packet Delay functions can be useful.

10.2. Recommended Network Configurations

Although the AD-081GE conforms to Gigabit Ethernet (IEEE 802.3) not all combinations of network interface cards (NICs) and switches/routers are suitable for use with the GigE Vision compliant camera.
JAI will endeavor to continuously verify these combinations, in order to give users the widest choice of GigE components for their system design.

10.2.1 Verified Network Interface Cards (NICs)

At the time of publishing this document these combinations have been verified:

NIC manufacturer	Model	PCI Bus	PCI-X Bus	PCI-Express Bus
Intel	PRO/1000MT (PWLA8490MT)	√ (33MHz)	√(100MHz)	–
Intel	PRO/1000GT (PWLA8391GT)	√ (33MHz)	√ (33MHz)	–
Intel	PRO/1000PT (EXPI9300PT)	–	–	√ (x1)
Intel	Gigabit CT Desktop adaptor (EXPI9301CT)	–	–	√ (x1)
Intel	PRO/1000PT Quad port (EXPI9404PT)	–	–	√ (x4)
Intel	PRO/1000PT Dual port (EXPI9402PT)	–	–	√ (x4)

Minimum PC requirements are as follows in order to fulfill the above conditions:

- Intel Core 2 Duo , 2.4 GHz or better
- At least 2 GB memory
- Video Card with PCI Express Bus x 16, VRAM better than DDR2 with 256 MB or more, and display capability of 2560 x 1600
- Windows XP, SP2 (32bit)
- Functions such as screen saver and power save should not be used. Unnecessary applications such as Word, Excel or others should not be used.

Note: Pentium 4 type PC is not recommended due to dependency on chip set bus performance.

10.2.2 Video data rate (network bandwidth)

The video bit rate for the AD-081GE in Continuous mode is:

Model	Pixel Type	Packet data volume (assumes the packet size is 1428)
AD-081GE	MONO8	196 Mbit/s
	MONO10_PACKED MONO12_PACKED	294 Mbit/s
	MONO10 MONO12	392 Mbit/s

- In the case of using Jumbo Frames (16K), the packet data will be improved by 2 %.
- For AD-081GE, the jumbo frame size can be a maximum 16020 Bytes (factory setting is 1476 Bytes). The NIC must also be set to support Jumbo Frames (refer to section 10.2.4).
- Based on the Pixel Type, the packet size may be automatically adjusted inside the camera to its most suitable value .

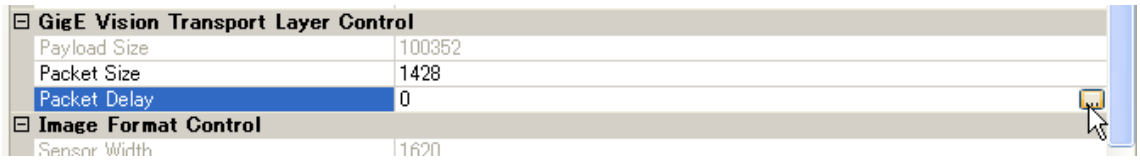
To ensure the integrity of packets transmitted from the camera, it is recommended to follow these simple guidelines:

1. Whenever possible use a peer-to-peer network.
2. When connecting several cameras going through a network switch, make sure it is capable of handling jumbo packets and that it has sufficient memory capacity.
3. Configure inter-packet delay to avoid congestion in network switches.
4. Disable screen saver and power save functions on computers.
5. Use high performance computers with multi-CPU, hyper-thread and 64-bit CPU, etc.
6. Only use Gigabit Ethernet equipment and components together with the camera.
7. Use at least Cat5e and preferably Cat6 Ethernet cables.
8. Whenever possible, limit the camera output to 8-bit.

- **Note for setting packet size**

  The packet size is set to 1428 as the factory default. Packet size can be modified in the GigE Vision Transport Layer Control section of the camera control tool (see below). For AD-081GE, users may enter any value for the packet size and the value will be internally adjusted to an appropriate, legal value that complies with the GenICam standard. Thus, the actual packet size may be different than the value entered by the user.

  Caution: do not set the packet size larger than the maximum setting available in the NIC or switch to which the camera is connected (see section 10.2.4). Doing so will cause output to be blocked.



Regarding data transfer rate, a larger packet size produces a slightly lower data transfer rate. AD-081GE can support a maximum of 16020 byte packets provided the NIC being used has a Jumbo Frames function with a setting of a 16020 bytes or larger.

◆ **Note for calculation of Data Transfer Rate**

Setting parameter

Item	Unit	Symbol
Image Width	[pixels]	A
Image Height	[pixels]	B
Bits per Pixel	[bits]	C
Frame Rate	[fps]	D
Packet Size	[Bytes]	E
Number of Packets (including Data Leader & Trailer Packet)	[packets]	G
DataTransfer Rate	[Mbit/s]	J

Fixed value

Item	Unit	value
Data Leader Packet Size	[Bytes]	90
Data Trailer Packet Size	[Bytes]	62

Formula to calculate Data Transfer Rate

J= {90+62+(E+18)*(G-2)} *8*D/1000000

Where,

G=ROUNDUP{A*B*C/8/(E-36)}+2

The following table shows Bits per Pixel which depends on the pixel format.

Pixel format	Bit
MONO8	8
MONO10	16
MONO10Packed	12
MONO12	16
MONO12Packed	12

Calculation example: AD-081GE Pixel type Mono8

Item	Unit	Symbol	Setting
Image Width	[pixels]	A	1024
Image Height	[pixels]	B	768
Bits per Pixel	[bits]	C	8
Frame Rate	[fps]	D	30.01
Packet Size	[Bytes]	E	1428
Number of Packets (including Data Leader & Trailer Packet)	[packets]	G	
Transfer Data Rate	[Mbit/s]	J	

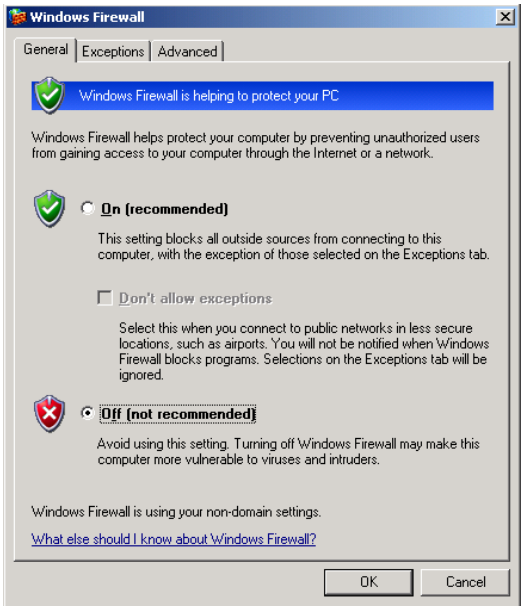
G=ROUNDUP {(1024 x 768 x 8 / 8 / (1428-36)) + 2 = 565+ 2 = 567

J={90+62+(1428+18)x(567-2)} x 8 x 30.12 / 1000000 = 196 Mbit/s

10.2.3 Disable Firewalls

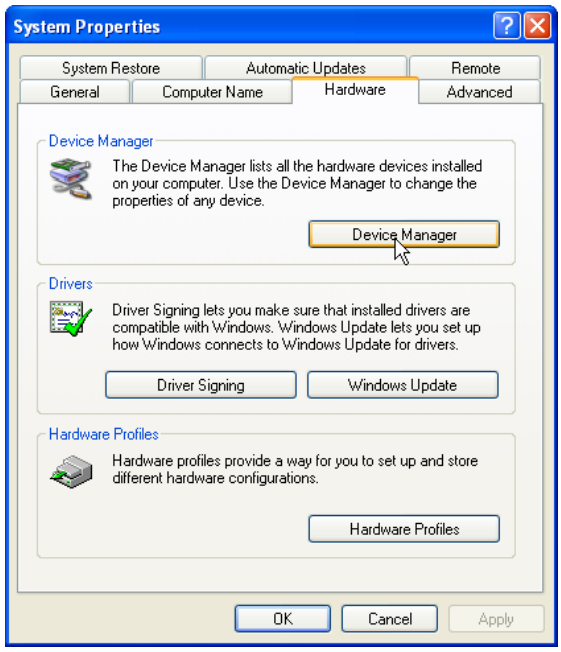
To ensure proper functions of the JAI SDK & Control Tool, all firewalls must be disabled. This also includes the Windows firewall.

Click [**Start**], [**Control Panel**] for accessing the Windows firewall configuration.

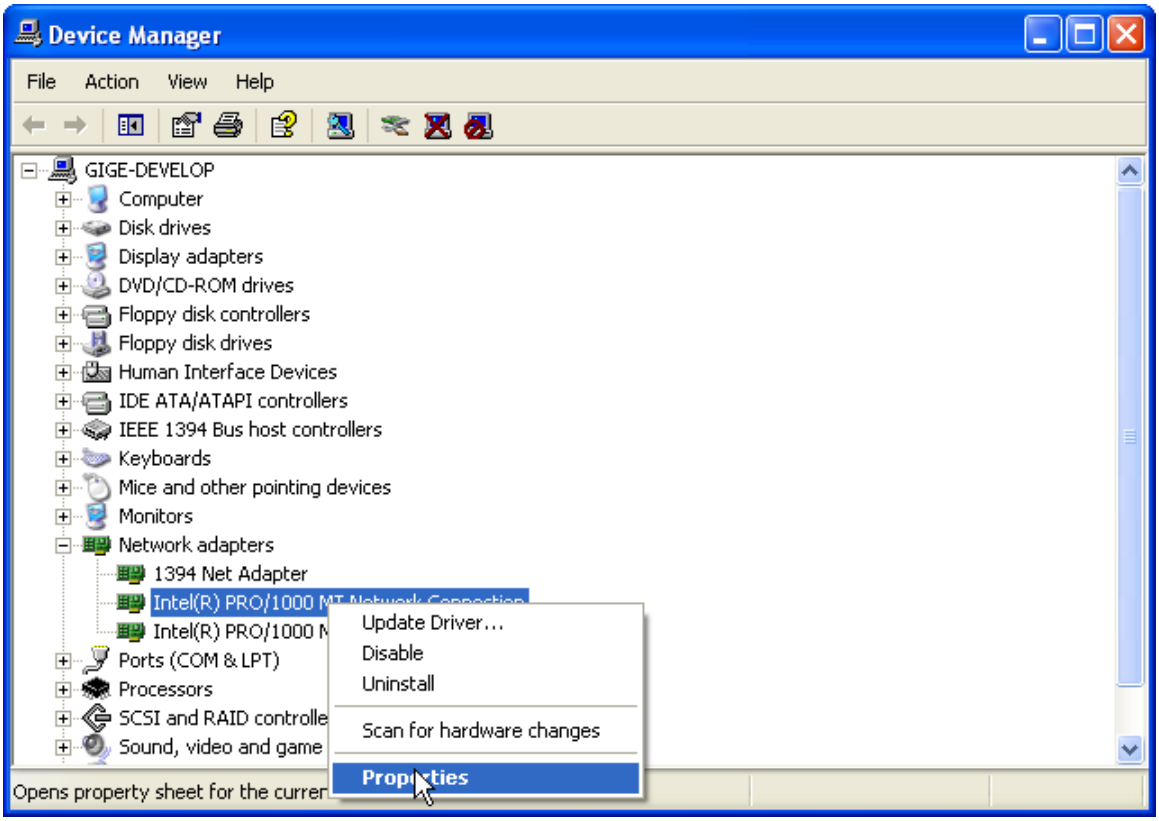


10.2.4 Enabling Jumbo Frames

(1) Click [**Start**] and click [**Control Panel**].
(2) Click [**Performance and Maintenance**].
(3) Click [**System**].
(4) Click [**Hardware**] tab.
(5) Click [**Device Manager**].



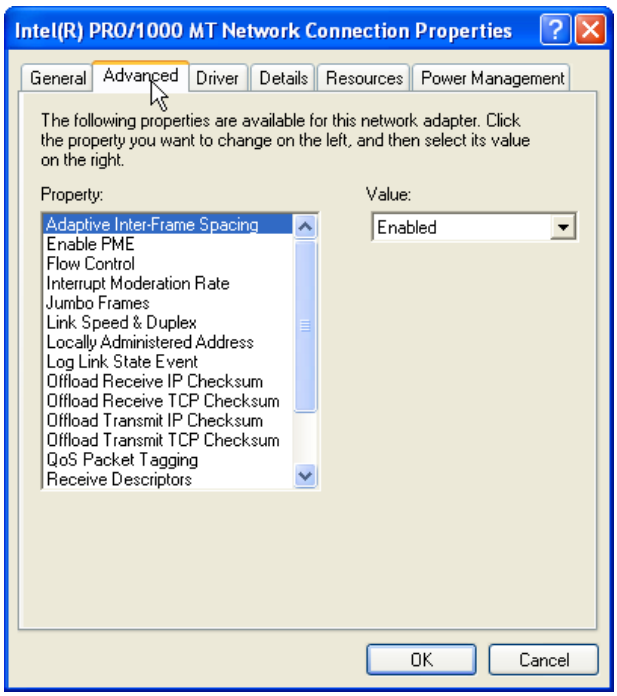
(6) Expand [**Network adapters**].
(7) Select target NIC, **right-click**, and click [**Properties**].



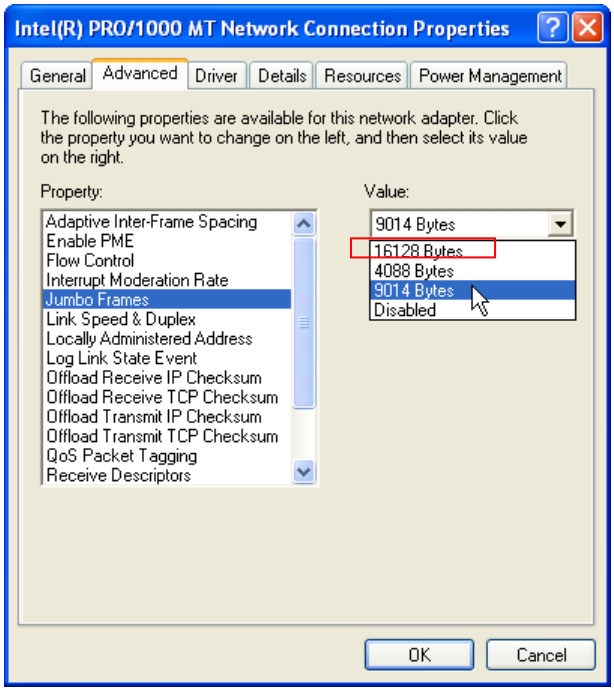
Note: Intel 1000 is used in this example.

If different NICs are used, the following setup tabs will likely be different. Follow the tabs associated with the specific NIC used.

(8)Click [**Advanced**] tab.



(9) Select **Jumbo Frames** property, and select **16128** under Value.

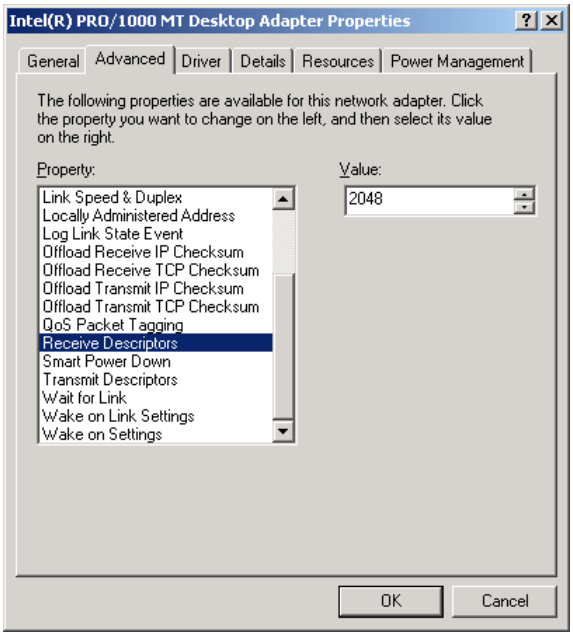


(10)Click [**OK**].
(11)Close [**Device Manager**].
(12)Close [**System Properties**] by clicking [**OK**].

10.2.5 Setting Receive Descriptors

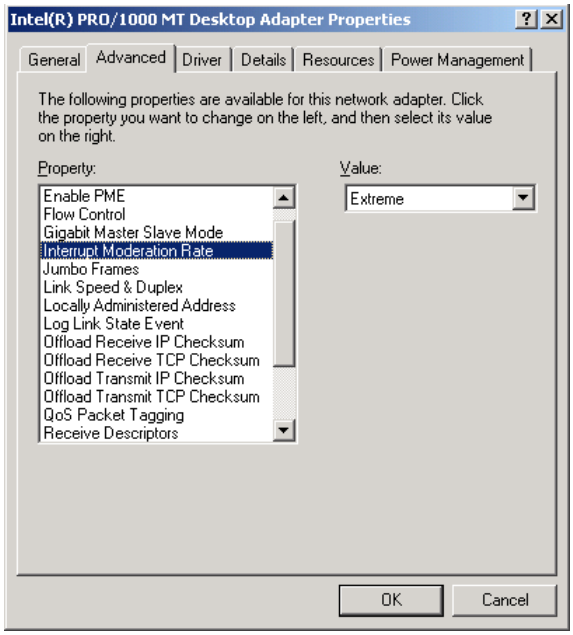
If the Network Connection Properties list contains a property called Receive Descriptors, then change its property to the maximum value supported by the NIC installed in the computer.

Click "OK" to save the property.



10.2.6 Interrupt Moderation rate

If the Network Connection Properties list contains a property called Interrupt Moderation Rate, then it is possible to set the preferred value. When it is changed from Minimal, to Medium, High and Extreme, the number of interruptions is decreased to get better performance. Set it to "Extreme".



Click "OK" to save the property.

10.2.7 Calculating and setting Inter-Packet Delay

When connecting several cameras to one network interface card via a switching hub, it is important to optimize the Inter-Packet Delay of the cameras to avoid congestion in the switch. A sure sign of congestion is the loss of packets.
Since increasing the inter-packet delay also adds overhead to the data transfer it is important to calculate the optimal setting in order to make best use of the video bandwidth.

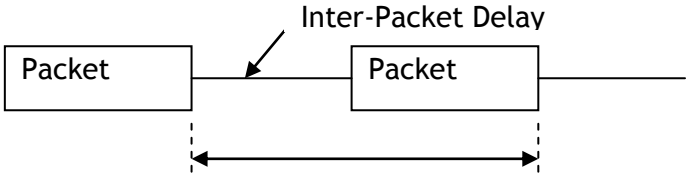
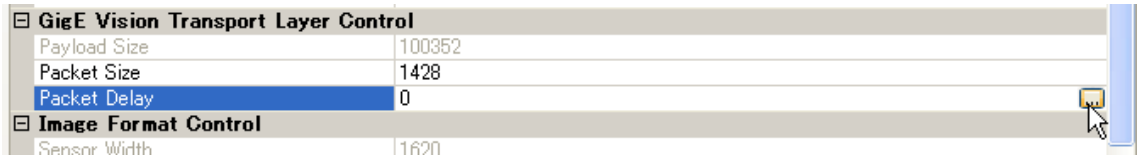
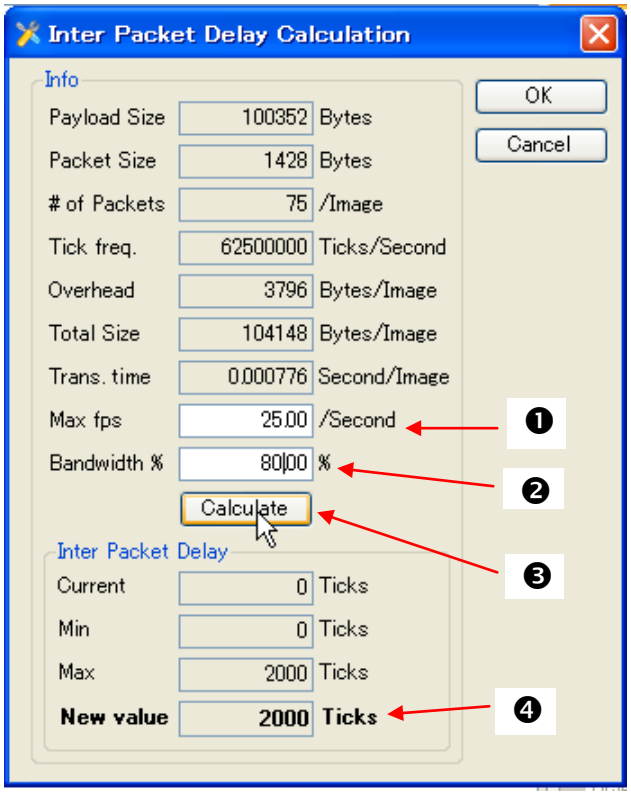


Fig.17 Duration of the entire packet, with delay

JAI Control Tool has a built in wizard for calculating Inter-Packet Delay.
When the Inter-Packet Delay function is activated, a button appears on the right hand side of the bar.
Click the button to open the calculation wizard window.

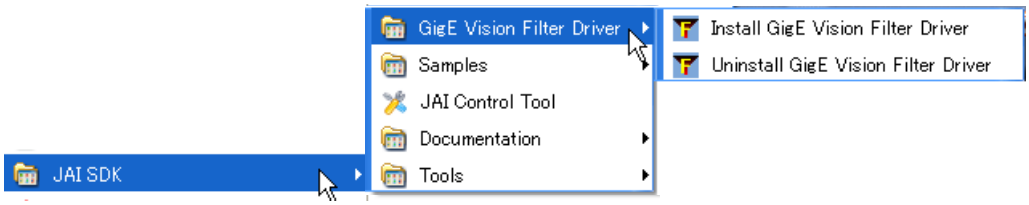




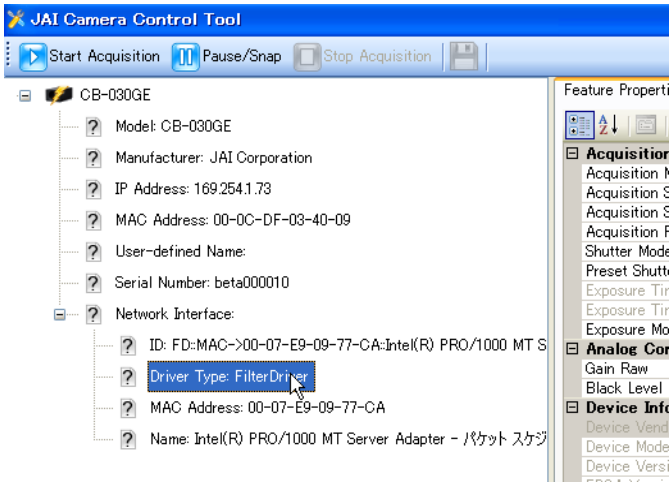
1. Type in the frame rate of the connected camera.
   AD-081GE operates at 30 fps.
2. Set the bandwidth at 80%.
3. Click the calculation tab.
4. New value is calculated.
5. Click OK. The value shown is automatically transferred to the Packet Delay column of the Control Tool.

10.2.8 Confirm the Filter Driver is used

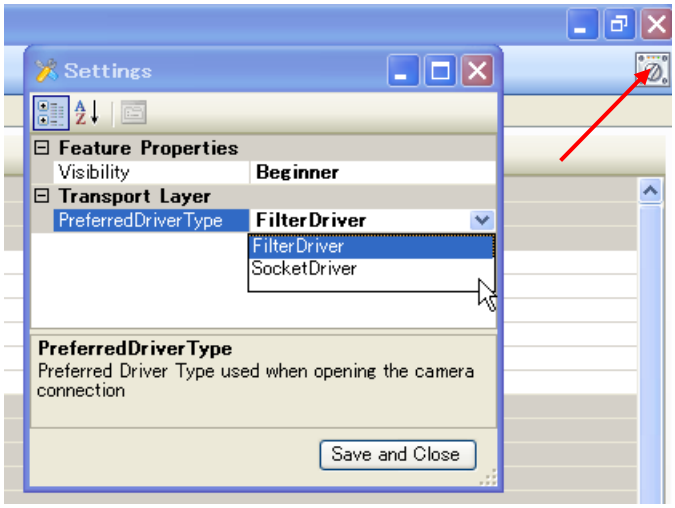
- The filter driver is installed as an optional function when JAI SDK is installed. If the filter driver is not installed at that time, it can be installed from, All Programs ⇒ JAI SDK ⇒ GigE Vision Filter Driver ⇒ Install GigE Vision Filter Driver.



- If the Filter Driver is installed properly, the Camera Control Tool indicates “Driver Type Filter Driver” in the Network Interface.



- If it is not shown, confirm the setting in the “Settings” window. Access the “Settings” window by clicking on the “Settings Tab” icon.



10.2.9 Others

- IF “Receive Descriptor” is set at its maximum value, picture disturbance may occur due to “Hyper Threading” mode. If this happens, check that “Hyper Threading” is set at OFF. This is set in BIOS.

- When the image is being captured, if the frame rate decreases, change the packet size. Each packet contains the header data and when the packet size is small, the total data including header information will increase. Depending on the performance of the computer used, the frame rate may be decreased. Confirm the packet size is increased. It can be set in the Camera Control Tool provided in JAI SDK.

10.2.10 Note for 100BASE-TX connection

- In order to use 100Mbps network, 100BASE-TX and Full Duplex are available. Half Duplex cannot be used.
- In the case of connecting on 100BASE-TX, the maximum packet size should be 1500 bytes.
- In the case the of connecting on 100BASE-TX, the specifications such as frame rate, trigger interval and so on described in this manual cannot be satisfied.

Pixel Type	Frame rate at Full Frame scan[fps]
MONO8	Approx. 12
MONO10_PACKED,MONO12_PACKED	Approx. 8
MONO10, MONO12	Approx. 6

Note: The above frame rates are based on total data of 70Mbps.

10.3. Basic functions

The AD-081GE is based on a beam-splitter prism, allowing precise separation into two separate monochrome channels. The transmitted light channel is referred to as BW1 and the reflected channel is referred to as BW2. BW 1 and 2 can be configured to operate separately or synchronously. When operating separately each channel can be triggered independently.

The AD-081GE can operate in Continuous (free-run) mode or in triggered modes.
The variable partial scan mode provides higher frame rates at lower vertical resolution.

10.3.1 RJ-45 outputs

The AD-081GE has two RJ-45 connectors, GigE-1 for BW1 and GigE-2 for BW2. These two signals can be set as synchronous or asynchronous, as well as high frame rate, high dynamic range, or high s/n mode, which are AD-081GE features. In high frame rate, high dynamic range, and high s/n modes, the synchronization of two sensors is automatically set at synchronous.

10.3.2 Sync mode (Register 0xA098)

Two image sensors can be operated either in SYNC mode or ASYNC mode as well as specific functions such as high frame rate, high dynamic range or high s/n mode.
This can be set by the “Sync mode command”.

<table>
<tr><th>Sync mode</th><th>Video output (Pixel format)</th><th>Trigger input</th><th>Readout (Partial,smearless)</th><th>Functions (Shutter etc)</th></tr>
<tr><td>Sync</td><td rowspan="6">Sensor 1, 2 can be independently set</td><td>Trigger to sensor 1 also triggers sensor 2</td><td>Settings for sensor 1 are applied to sensor 2</td><td rowspan="2">Sensor 1, 2 can be independently set</td></tr>
<tr><td>Async</td><td>Independent trigger to sensor 1 and 2</td><td>Sensor 1, 2 can be independently set</td></tr>
<tr><td>High Frame rate</td><td>—</td><td rowspan="3">Settings for sensor 1 are applied to sensor 2</td><td>Settings for sensor 1 are applied to sensor 2</td></tr>
<tr><td>High Dynamic Range</td><td rowspan="2">Trigger to sensor 1 also triggers sensor 2</td><td>Sensor 1, 2 can be independently set</td></tr>
<tr><td>High S/N</td><td>Settings for sensor 1 are applied to sensor 2</td></tr>
</table>

Functions	0 : SYNC		1 : ASYNC	
	RJ-45(GigE 1)	RJ-45(GigE 2)	RJ-45(GigE 1)	RJ-45(GigE 2)
Trigger input	○	← Triggered by GigE1	○	○
Output	BW1	BW2	BW1	BW2
Shutter	○	○	○	○
Partial scan	○	← Follow the setting of GigE 1	○	○
Smearless	○	← Follow the setting of GigE 1	○	○

In sync mode, the trigger to GigE 1 is also triggering BW2 sensor.
For details, refer to 10.6. Operation Mode and Functions matrix

10.3.3 High frame rate mode (Double speed)

In this mode, double speed readout (60fps) can be achieved by shifting the exposure timing for each sensor by 1/2 frame. Each signal with 1/2 frame offset is read out from each RJ-45 connector respectively.

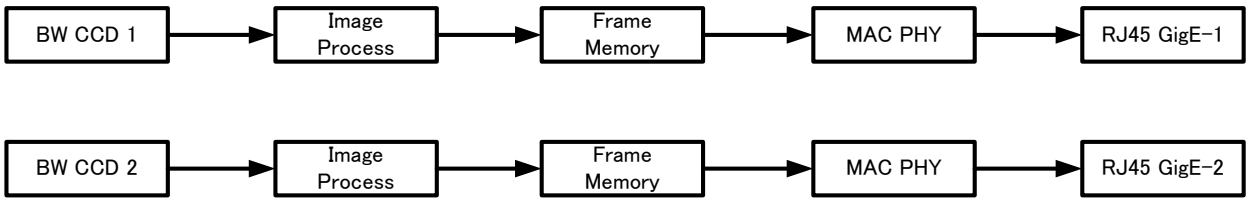


Fig. 18 High frame rate output

If this mode is used, the trigger mode should be set at "Continuous". The maximum shutter speed is 396L. The following table shows the frame rate.

Scan mode	Frame rate
Full pixels	60fps
Vertical binning	99fps

If trigger in/out is used, select "asynchronous" in the readout mode and input a trigger pulse to each sensor with 1/2 frame timing offset.

Sync mode	Synchronous	Shutter	Trigger mode	Output
2：High frame rate	Automatic	Same for BW1,2	Continuous	Individual
1： Sync (individual setting)	asynchronous	Same for BW1,2	EPS	Individual

10.3.4 High dynamic range mode

In this mode, high dynamic range can be achieved by setting a different exposure time for each sensor. To use this mode, set "Readout mode" to "High dynamic range".
The combining of the two signals uses the ratio of the shutter value for each sensor as the coefficient. As the composition process can be done regardless of signal levels, the composed signal is visibly smooth.
There are three built-in HDR modes, or users can choose to perform HDR image composition on an external host PC:

- **<u>High dynamic range (Sync Mode 3)</u>**
  In this mode, the composite output emphasizes the details captured by the high speed shutter sensor, while information from the sensor with the slower shutter appears only in the lowest (darkest) bits of the output.
  The formula for the composition process is;

$$\text{Output} = \frac{m}{n+m} \text{ x video 1} + \frac{n}{n+m} \text{ x video 2}$$

  where,
  1/m sec : shutter value of BW1
  1/n sec : shutter value of BW2

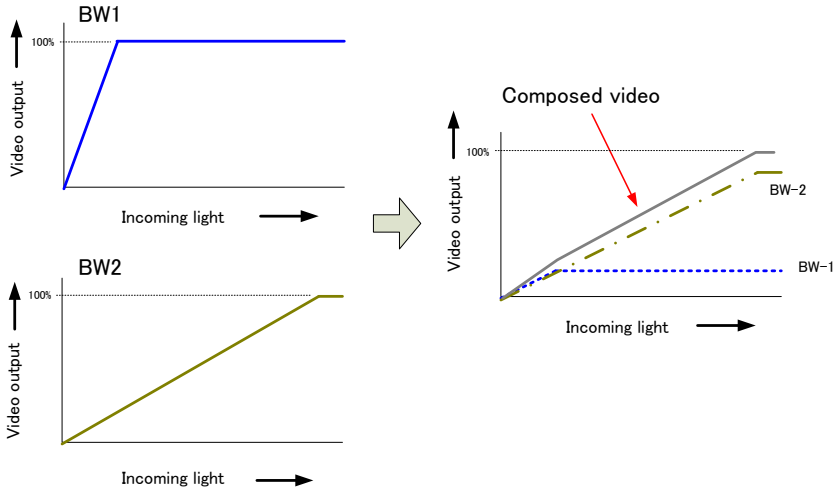


Fig.19 Composition of two images

- **High dynamic range (Sync Mode 5)**

  In this mode, 50% of each video level is added to make an output.
  The formula for the composition process is;

  $$\mathbf{Output = 0.5\ x\ Video\ 1 + 0.5\ x\ Video\ 2}$$

  where,
  1/m: shutter value of BW1
  1/n: shutter value of BW2

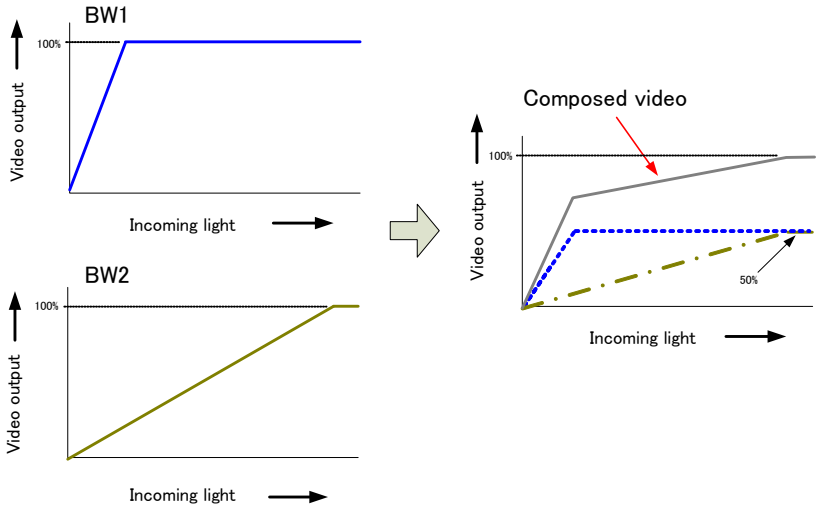


Fig.20 Composition of two images

♦ **High dynamic range (Sync Mode 6)**

In this mode, a roughly proportional approach is used which places an emphasis on the image from the slower shutter speed sensor, while confining the highlights from the sensor with the faster shutter to the highest (brightest) bits in the composite output.
The formula for the composition process is;

$$\text{Output} = \frac{n}{m+n} \text{ x Video 1} + \frac{m}{m+n} \text{ x Video 2}$$

where,
1/m: shutter value of BW1
1/n: shutter value of BW2

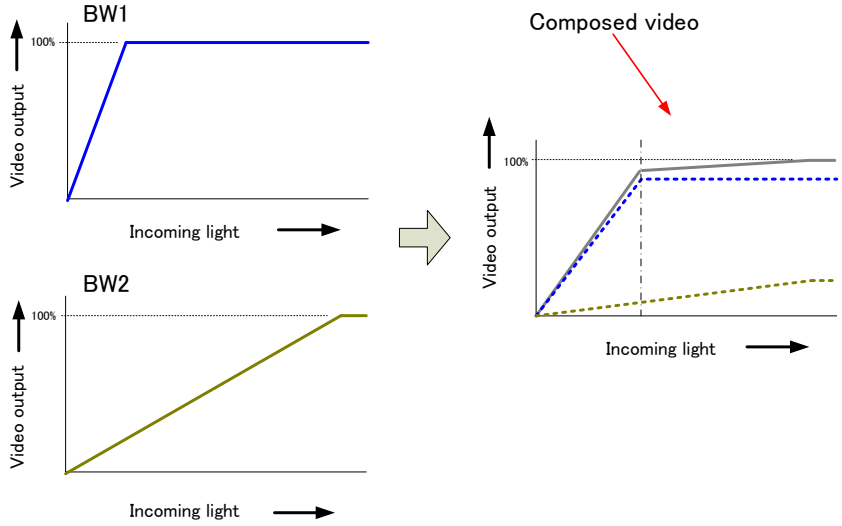


Fig.21 Composition of two images

Maximum dynamic range is:

Maximum dynamic range	118dB
Shutter setting : m	30 = 1/30 sec
Shutter setting : n	50,000 = 1/50,000 sec

When the high dynamic range mode is activated, the same composed output can be fed through both GigE-1 and GigE-2. Set the appropriate output port to capture the image.

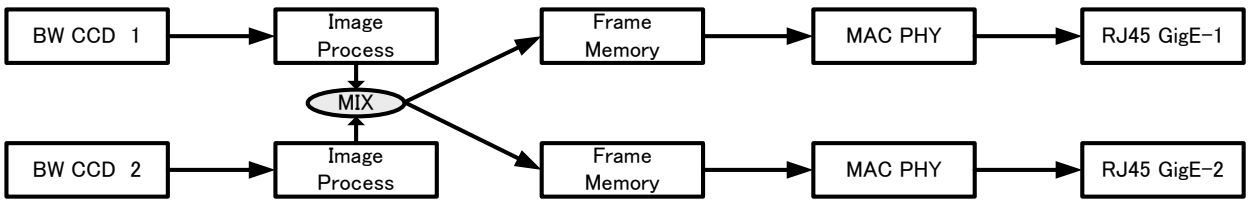


Fig.22 High dynamic range output

If the composition process is to be done on the host PC instead, set “Readout mode” to Sync and use individual output from BW1 and BW2 to compose a high dynamic range image.

Sync mode	Sync	Shutter	Trigger mode	Output
3:High dynamic	Auto	BW1,2 individual	Continuous	Composed out
0:SYNC	sync	BW1,2 individual	Continuous,EPS, PWC, RCT	Individual Process in PC

10.3.5 High S/N mode

In this mode, each sensor output is synchronized and has the same exposure time. The image average of the two signals is the output. The shutter and trigger settings for BW1 are applied to BW2. The same video output is fed through GigE-1 and GigE-2 and can be captured by setting the appropriate port.

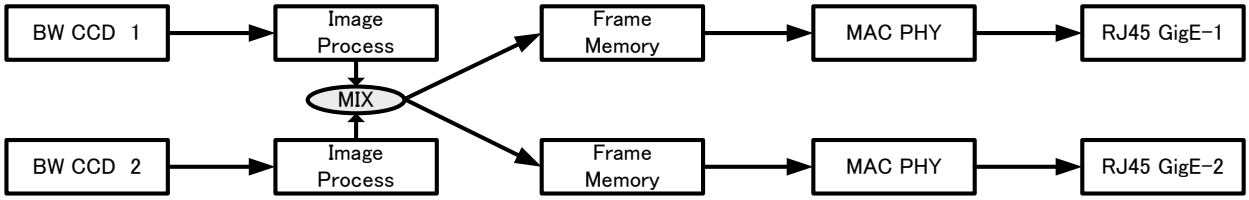


Fig.23 High S/N mode output

Sync mode	Sync	Shutter	Trigger mode	Output
4:High S/N	Auto	Same for BW1 /BW2	Continuous、EPS,PWC、RCT	Composed output
0:SYNC	Sync	Same for BW1/BW2	Continuous, EPS、PWC、RCT	Individual Process in PC

10.3.6 PIV (Particle Image Velocimetry) mode

The AD-081GE has a PIV (Particle Image Velocimetry) mode. This mode provides three (3) consecutive images by one trigger pulse. When the trigger is input, the first exposure on BW1 can be captured, followed quickly by an exposure on BW2. After the exposure on BW2 is completed, a second exposure on BW1 is made. Each exposure is executed by a strobe flash in very short interval period. The exposure time is preset at 4 µs, 6µs or 8µs by registers.

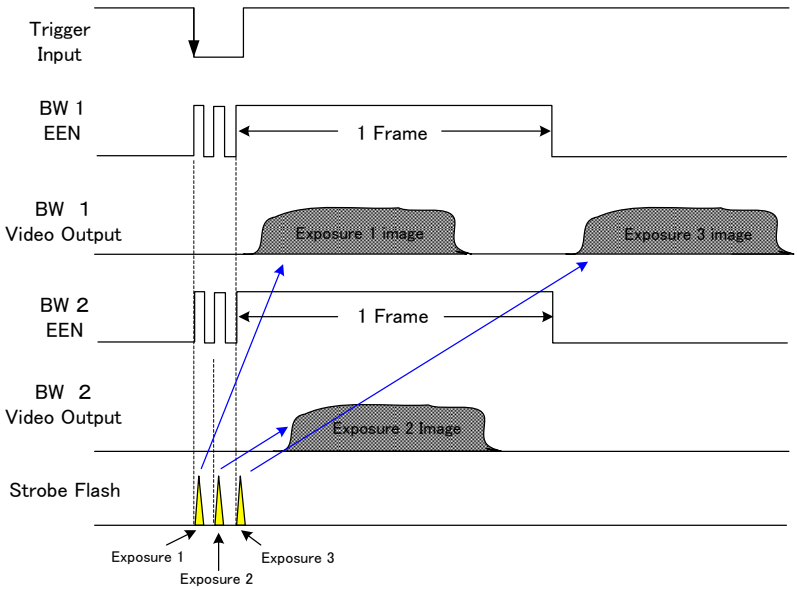


Fig.24 PIV conceptual drawing

10.3.7 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. The iris video signal is taken after the gain circuit. However, negative compensation is applied to the iris circuit, thus the gain setting has no influence for controlling auto iris lenses. It is without sync.

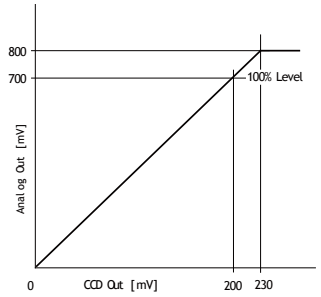
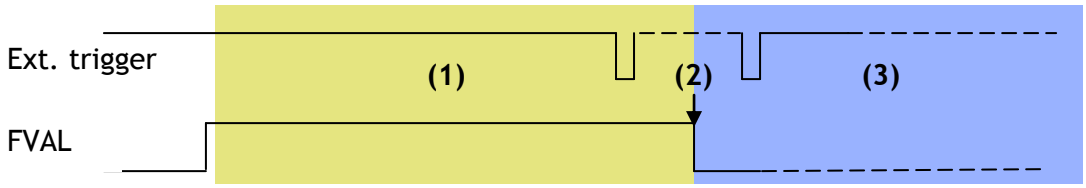


Fig.25 Iris Video output

10.3.8 Auto-detect LVAL-sync / async accumulation

This function replaces the manual setting found in older JAI cameras. Whether accumulation is synchronous or asynchronous 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.

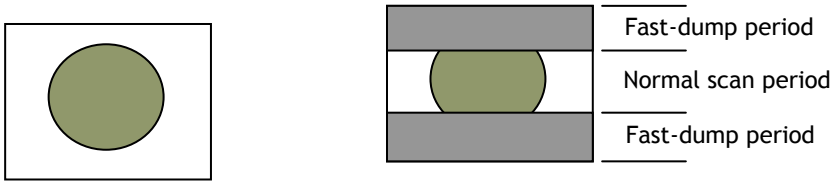


(1) In this period camera executes trigger at next LVAL (prevents feed-through noise)
(2) Avoid trigger at FVAL transition (+/- 1 LVAL period), as the function may randomly switch between "next LVAL" and "immediate".
(3) In this period camera executes trigger immediately (no delay)

Fig. 26 Auto-detect LVAL sync /async accumulation

10.3.9 Partial scan (Fast dump ON)

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. In order to activate this function, Fast Dump register should be ON.



Full scan Partial Scan
Fig.27 Conceptual drawing for partial scan

The partial scan mode for AD-081GE is variable. The first line and the last line to be read out can be set.

The variable scan readout is connected with the ROI settings.
1. If ROI is set, these settings are applied to the partial scan settings.
2. If the multi ROI is used, the smallest number of the line and the largest number of the line define the partial scan area.
3. In the case of sequence trigger, it is the same as for multi ROI. The smallest line and the largest line define the partial scan.

In order to execute the partial scan, the fast dump should be ON.

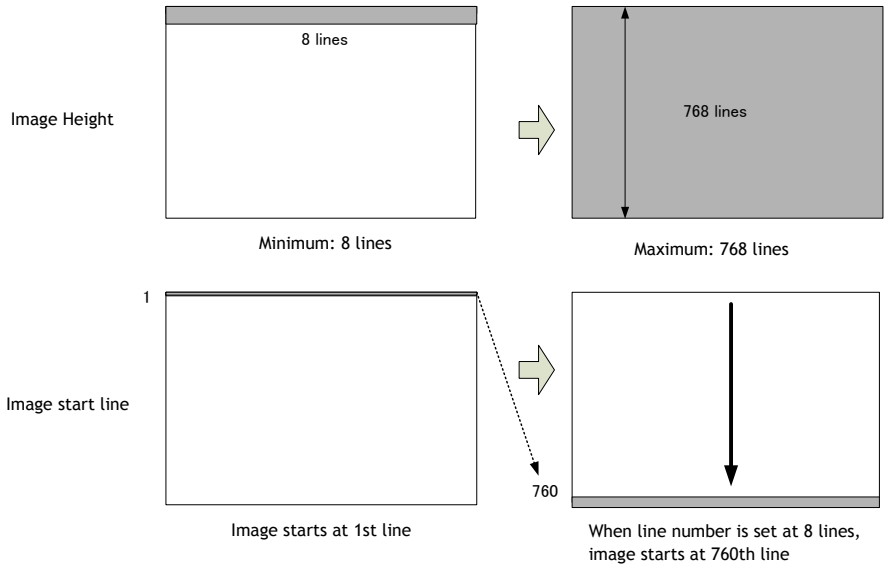


Fig.28 variable partial scan

How to calculate total line number and frame rate on variable partial scan mode

Variable partial scan The start line setting 1st line to 760th line
Readout height 8 lines to 768 lines

Total lines = ①OB period in the upper part of the frame (L) + ②Fast Dump period in the upper part of the frame (L) + ③Readout lines(L) + ④Fast dump period in the lower part of frame(L) +⑤Dummy transfer period
Where,

① OB period in the upper part of the frame= 3L

② Fast dump period for the upper part= $Round\ up\ \frac{4+3+(Start\ line\ No.-1)}{4}+1$

③ Readout lines = Effective lines + 4L

④ Fast dump period for the lower part= $Round\ up\ \frac{(768-End\ line\ No.)+3)}{4}+2$

⑤ Dummy transfer period = 4L

Frame rate (fps) = Horizontal Frequency / Total lines
where, Horizontal Frequency 23.768KHz

Calculation example
Readout: 1/2 partial at the center (384L), Start line (193), End line (576)

OB period in the upper part of the frame 3L
Fast dump period for the upper part = (4+3+193 -1) ÷4 +1 = 49.75 + 1 = 50.75 → 51
Readout lines = 384 + 4 = 388
Fast dump period for the lower part = (768 - 576 + 3) ÷4 +2 =50.75 → 51
Total lines = 3+51+388+50 + 4 =497
Frame rate = 23.768 ÷ 497 = 47.82 fps

10.3.10 Vertical Binning

The binning functions can be used to achieve higher frame rate or higher sensitivity. The drawback is lower resolution.
Vertical binning is done by adding the charge from pixels in adjacent lines in the horizontal CCD register. Fig.27 shows the vertical binning principle.

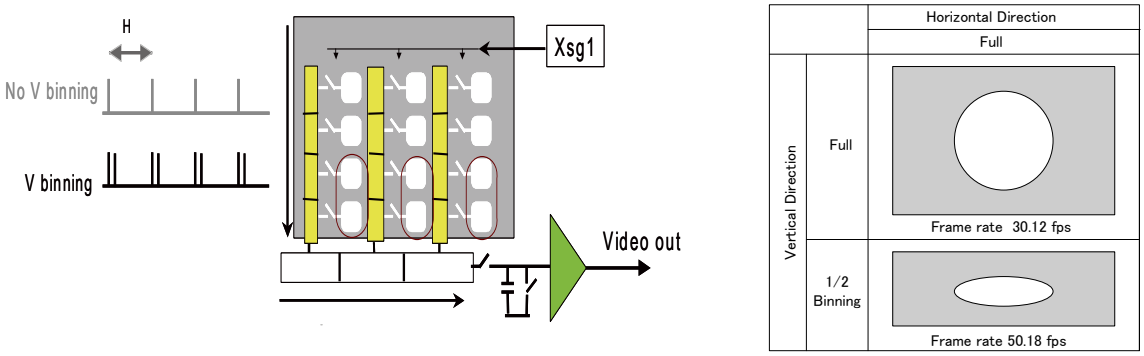


Fig.29 Conceptual drawing for vertical binning.

The AD-081GE has ON or OFF function for Vertical Binning:

Setting	Resolution	Frame rate
Off (no binning)	1024(h) x 768 (v) pixels	30 frames/sec.
2:1 binning	1024(h) x 384(v) pixels	49.30 frames /sec.

10.3.11 Electronic shutter

The AD-081GE has programmable exposure and the GenICam standard Exposure Time Abs.

◆ **Programmable Exposure**

Exposure time can be controlled in 1 L unit (42.07µs) from 0L to 792L. As the overhead of 0.5L is added, the actual shutter time is from 0.5L to 791.5L in the range from 0L to 791L. 792L is the shutter OFF. The actual shutter speed for each operation mode is shown below.

Mode	Readout	Minimum shutter speed	Maximum shutter speed
Continuous EPS, RCT	Full, Partial	20µs at PE=0 (1/50,000)	1 Frame
	V Binning	20µs at PE=0 (1/50,000)	
PWC	Full, Partial	42.07µs x 2L+20µs(0.5L)= 104.14µs (approx. 1/9,600s)	60 Frames (2 seconds)
	V Binning	50.96µs x 2L+ 30µs(0.5L)= 131.92µs (approx. 1/7,600s)	

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

◆ **Exposure Time Abs** (GenICam Standard)

This is a function specified in the GenICam standard.
The shutter speed can be entered as an absolute exposure time in microseconds (μs) in register address 0xA018. The entered absolute time (Time Abs) is then converted to programmable exposure (PE) value inside the camera.

The calculating formula below shows the relationship between the PE value used by the camera for the different readout modes and the value entered in register 0xA018.
Due to round down figure, some discrepancies may occur.

The relation between PE value and Time Abs
Normal readout PE= INT (Exposure time) μs / (1420/33750000)
(Note: INT means round down.)
Note:The minimum value in normal readout is 20μs.

◆ **Auto shutter**

Auto shutter works in the range of 1/30 to 1/10000 sec depending on the incoming light.

◆ **GPIO in combination with Pulse Width trigger**

More precise exposure time can be obtained by using GPIO in combination with Pulse Width mode. The clock generator and counter can be programmed in very fine increments.
For an example of the settings, refer to chapter 8.4.1.

The following table shows the approximate relationship among shutter modes.

Shutter speed (sec)	PE	Exposure Time Aps (μs)
1/50000	0	20
1/16000	1	62
1/10000	2	104
1/4000	5	230
1/2000	11	482
1/1000	23	987
1/500	47	1997
1/250	95	4017
1/120	127	5363
1/100	197	8308
1/60	395	16639
1/30	792	33333

10.3.12 Shading correction

The AD-081GE features a shading correction circuit that can be used for reducing shading resulting from illumination, lens or prism shading caused by lenses with a wide output aperture. The shading correction circuit divides the image into horizontal and vertical fields, and adjusts these regions in relationship to the image center. In the internal memory, factory data is stored. When the shading correction is ON, factory data is loaded. If it is OFF, the calibration can be activated and the result can be stored in the user area for reuse. Each channel is treated separately. The shading correction works with all pixel formats.

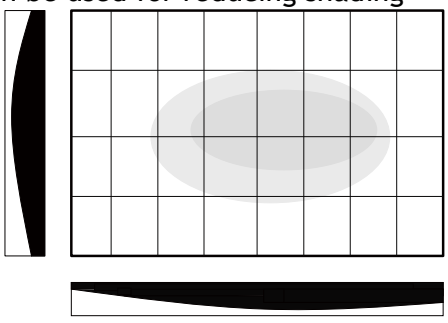


Fig.30 Conceptual drawing for calculating shading correction

10.3.13 Knee compensation

If the relation of input and output is linear (1:1), the output level will be clipped at a certain input level and cannot reproduce the details in the clipped area. The knee compensation circuit can keep the linear relation until the knee point, while after the knee point the input signal is compressed to reproduce the details. This compression area can be set by knee slope. The AD-081GE can compress up to 200% input video level. The factory default is OFF. Users may set the appropriate values for knee point and slope according to their applications.

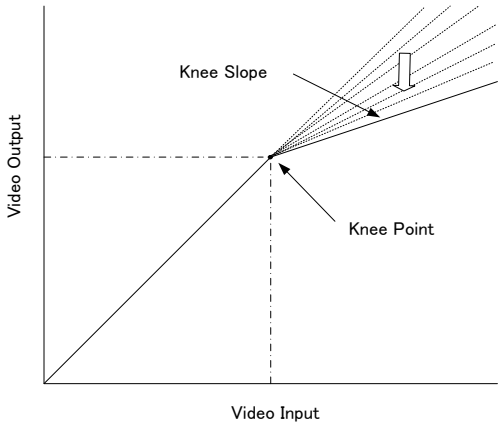


Fig.31 Knee characteristics

Funcrtion	Length	Setting range
Knee Point	10bit	0LSB ～ 1023LSB
Knee Slope	12bit	0(x0.0005) ～ 4095(x2.0000)

10.3.14 Blemish compensation

The AD-081GE has a blemish compensation function.
In the factory, the data for blemish compensation is stored in the factory data. When the blemish compensation is set to ON, the factory data is loaded. The user can store the compensation data in the user area (1 to 3). When executing a blemish calibration, it can be done for white and black blemishes. The user can also set the threshold of detecting blemishes.

Up to 32 blemishes can be compensated.

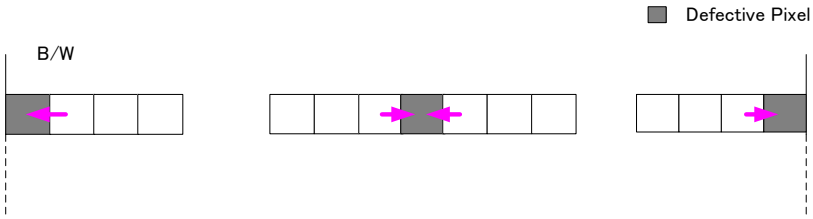


Fig.32 Conceptual drawing for blemish compensation

10.3.15 Digital gain

In high frame rate and high S/N modes, images from BW1 and BW2 are used interchangeably. Accordingly, the intensity level of BW1 and BW2 should be identical.
AD-081GE has a digital gain function for this purpose. Please note that if sync mode is set as Async, the settings of digital gain for BW1 are applied to BW2 settings.

10.3.16 Rear Panel Indicator

The rear panel mounted LED provides the following information:

Power LED:

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

LINK/ACT LED

- Steady green : Connecting 1000Base-T:Link
- Flashing green : Connecting 100Base-T/10Base-T:Link
- Amber : GigE Network:Act

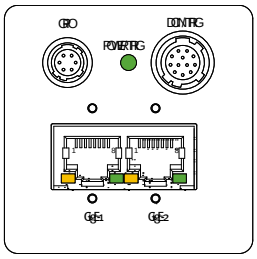


Fig.33 Rear Panel

Note: When the camera is connected to 10BASE-T, the system is not available.

10.3.17 Test signal generator

AD-081GE has a built-in test signal generator. The following options are available:

Address	Function	Read/Write	Size	Value
0xA13C	Test stream	RO	4	0=OFF 4=H Ramp scale 5=V Ramp scale 6=Moving Ramp scale

10.4. Sensor Layout and Timing

10.4.1 Sensor Layout

The CCD sensor layout, with respect to vertical and horizontal pixels used in full frame readout, is shown below.

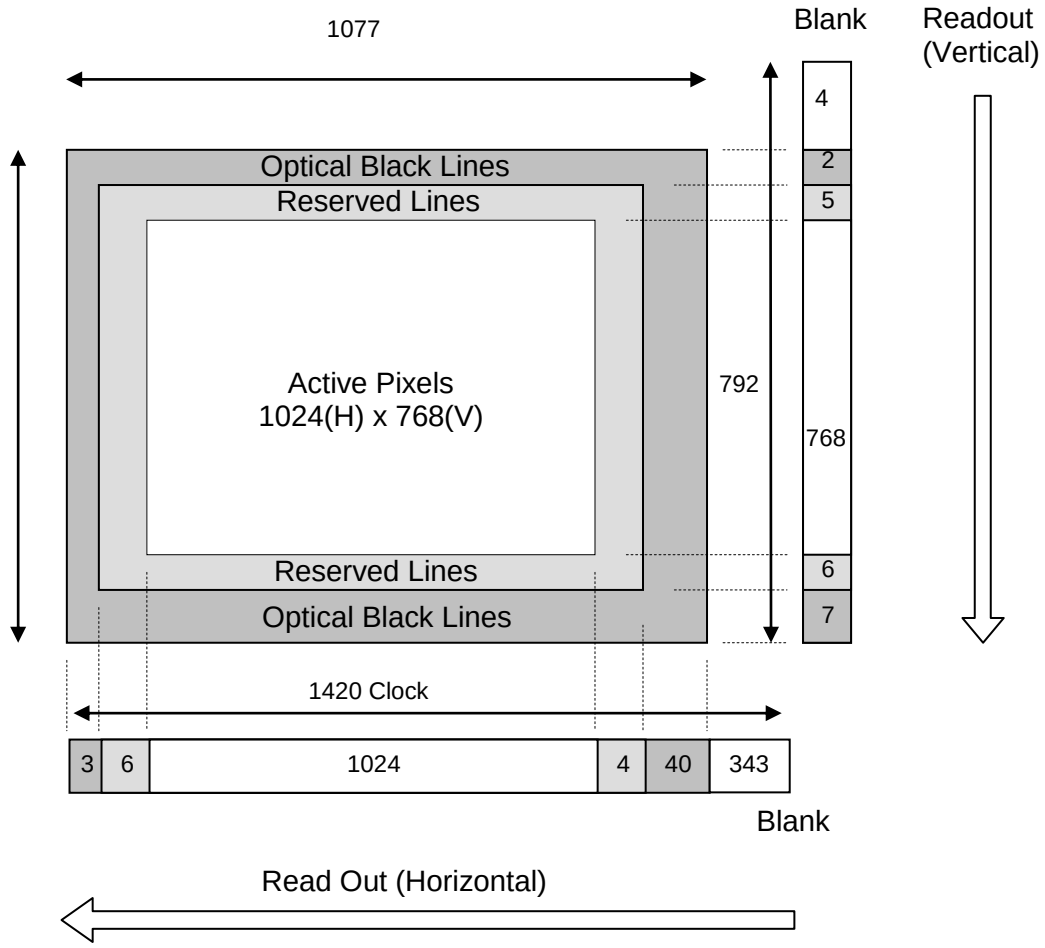
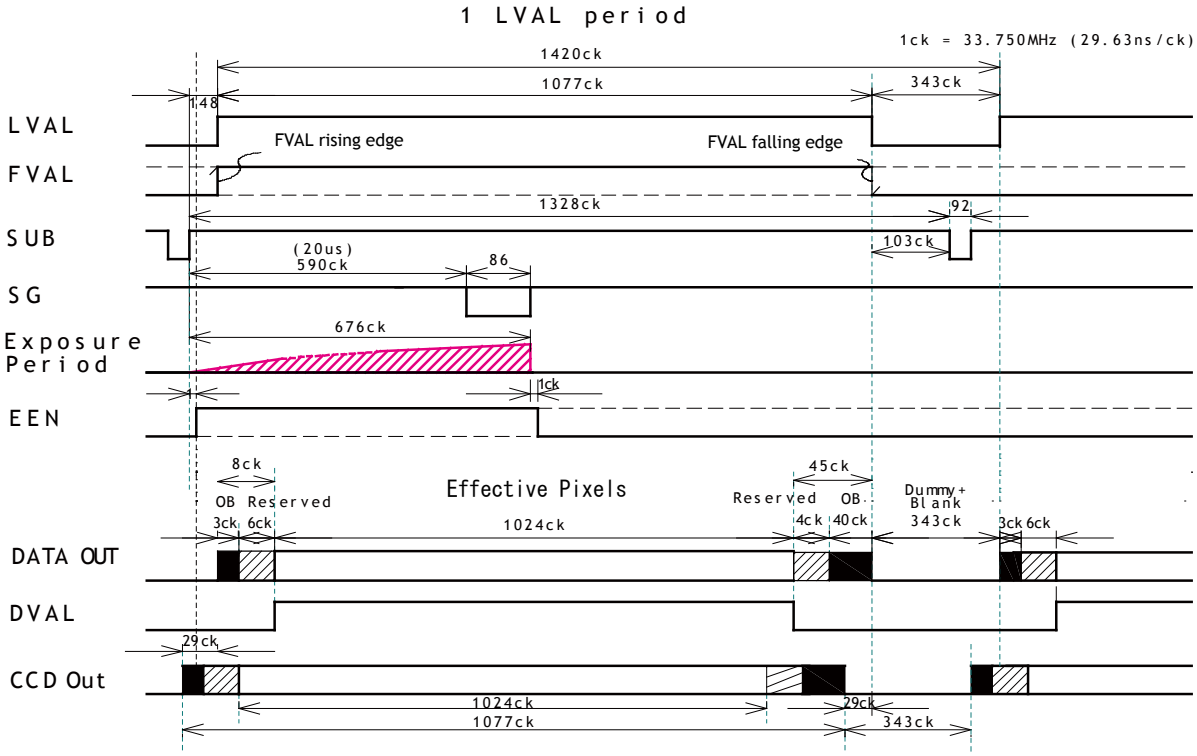


Fig.34 Sensor layout and video output image

10.4.2 Horizontal Timing

The horizontal timing for Continuous mode, full frame and partial scan is shown below.

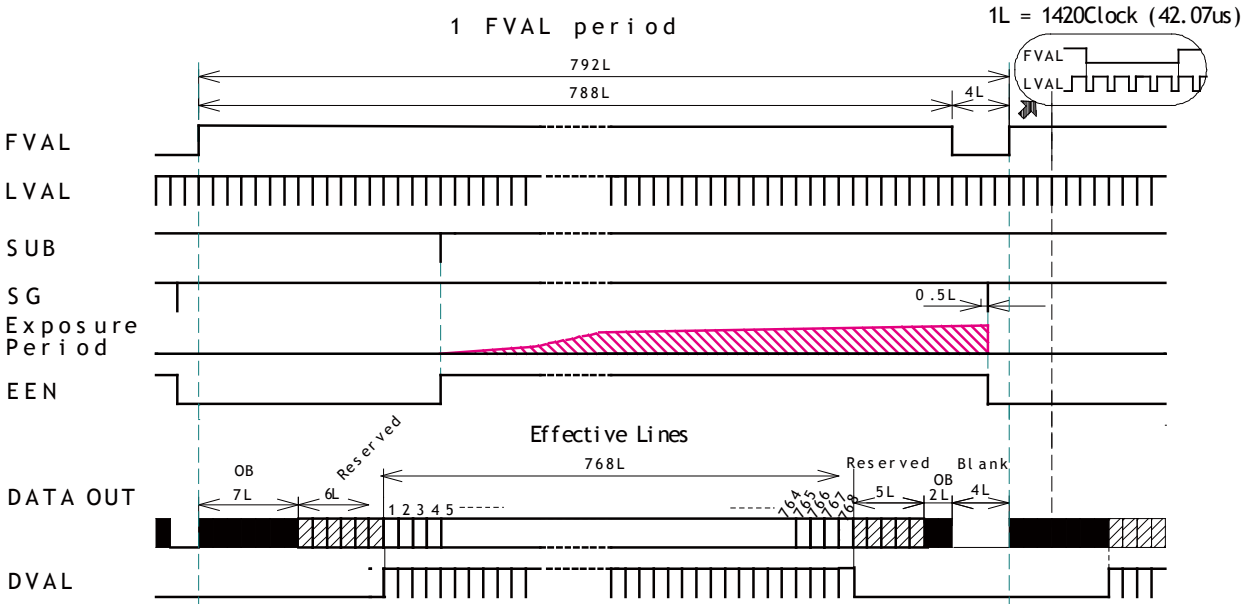


1CLK: 1 Pixel clock period OB: Optical black
LVAL is HIGH in the period of optical black and effective video periods
DVAL is HIGH in the effective video period

Fig.35 Horizontal Timing

10.4.3 Vertical Timing

The vertical timing for Continuous mode and full frame scan is shown below.



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

This timing chart shows camera timing. The output through GigE interface is only effective lines.

Fig.36 Vertical Timing

10.4.4 Partial Scan (when the start line is set at 193rd)

The following chart shows the vertical timing for 1/2 height partial scanning which starts at the 193rd line (384 lines). The horizontal timing for partial scan is the same as full scan.

Vertical

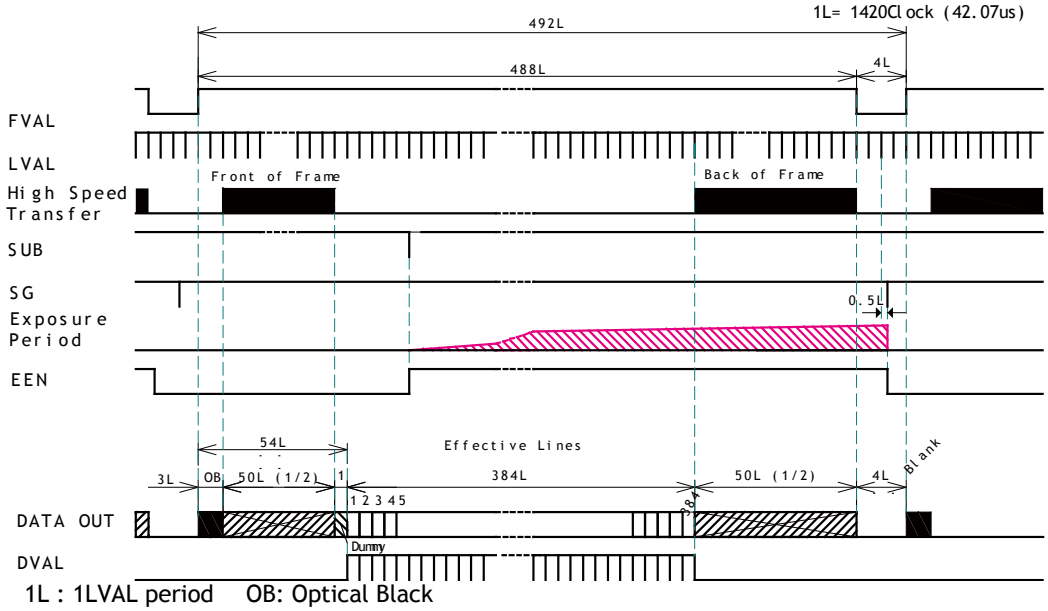
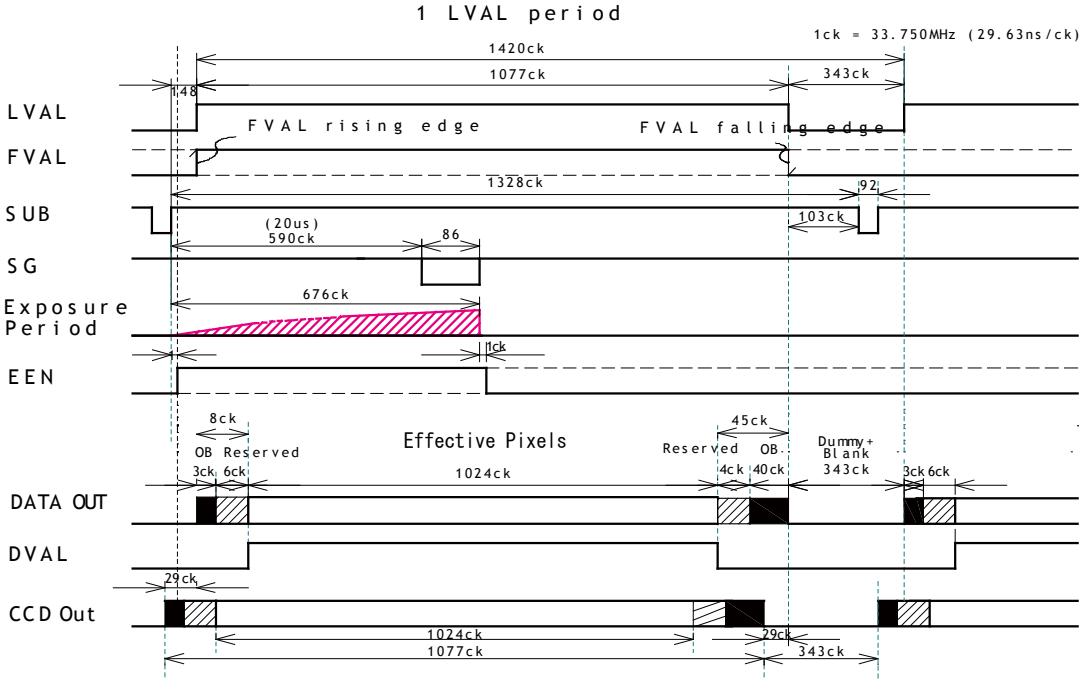


Fig.37 Vertical Timing in the case of 1/2 partial scan

Horizontal



LVAL is high during the period of optical black and effective pixels.
DVAL is high during effective pixels.

Fig.38 Horizontal Timing for partial scan

10.4.5 Vertical binning

Vertical binning combines charge from two adjacent lines, reducing the vertical resolution to half and at the same time increasing frame rate and sensitivity. By activating this function, the frame rate is increased to 50 fps.

Vertical timing

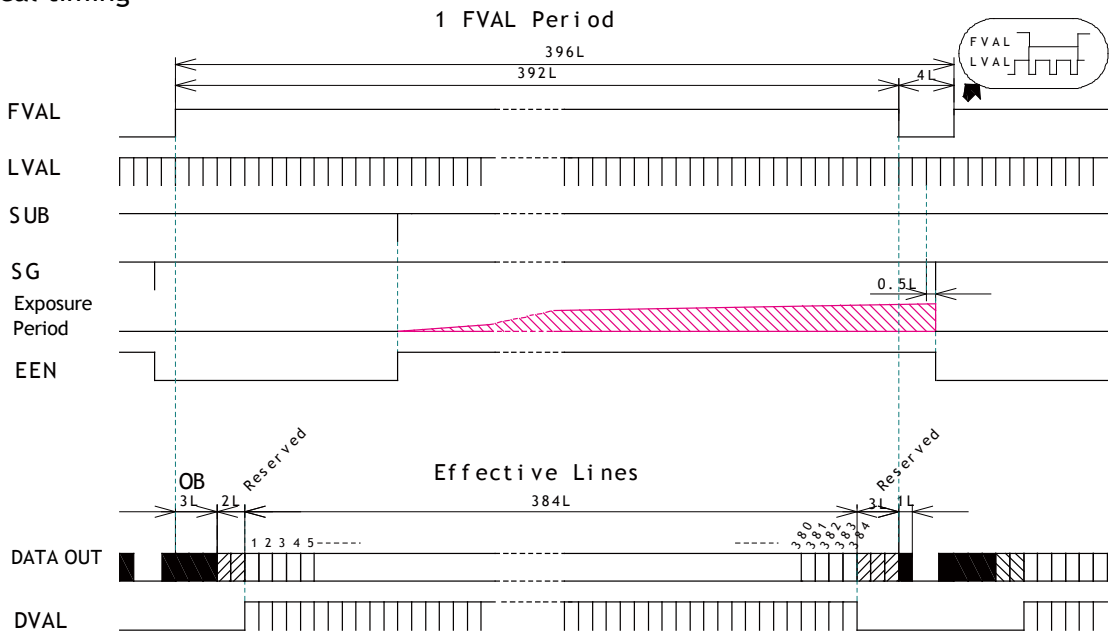


Fig.39 Vertical timing for vertical binning

Horizontal timing

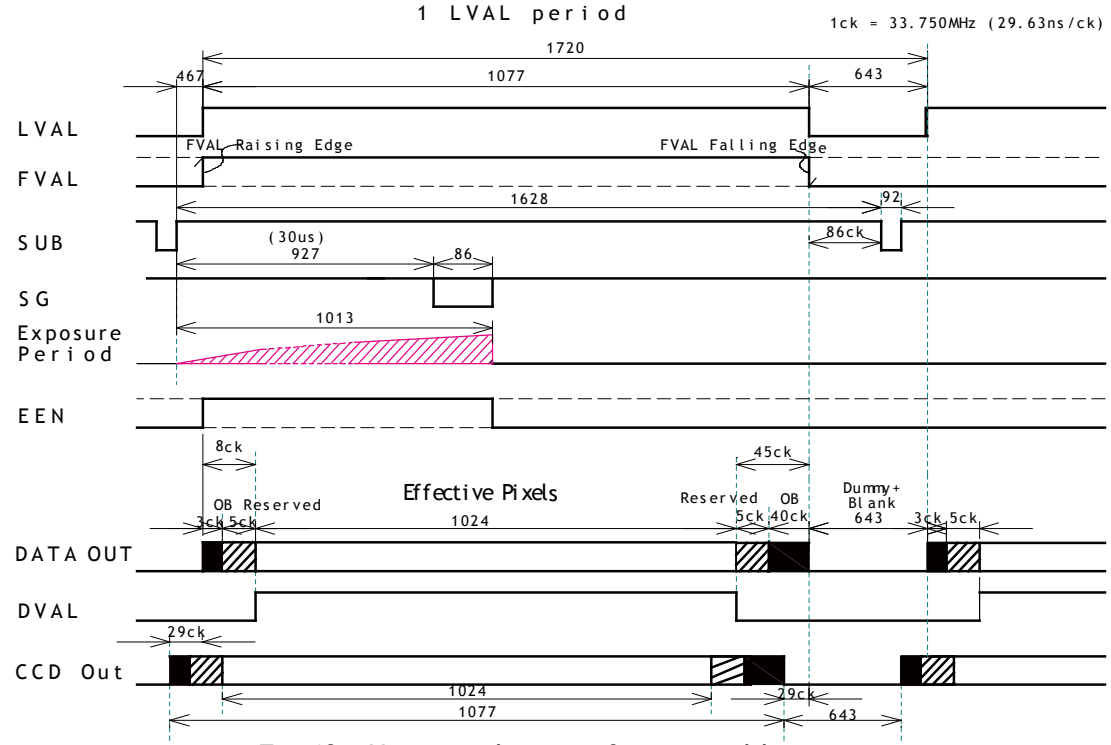


Fig.40 Horizontal timing for vertical binning

10.5. Operation Mode

AD-081GE has the following 8 operation modes and OB transfer and ROI modes.

1	*Continuous*	Pre-selected exposure
2	*Edge Pre-Select Trigger*	Pre-selected exposure
3	*Pulse Width Control Trigger*	Pulse width controlled exposure
4	*Reset Continuous Trigger*	Pre-selected exposure
5	*PIV (Particle Image Velocimetry)*	
6	*Sequence EPS*	Pre-selected exposure
7	*Delayed readout EPS*	Pre-selected exposure
8	*Delayed readout PWC*	Pulse controlled exposure
9	*Smearless*	Effective for EPS and PWC
10	*OB transfer mode*	
11	*ROI mode*	

10.5.1 Continuous mode

For applications not requiring asynchronous external triggering, this mode should be used for continuous operation.
For timing details, refer to fig. 33 through fig. 38.

To use this mode

Set function:	Trigger mode	Continuous
	Sync mode	Sync, async, High transfer rate, High dynamic range, High S/N
	Output Select	8-bit, 10-bit, 12-bit
	Scanning	Full/Partial
	Vertical binning	ON/OFF
	Shutter	Programmable, Exposure Time Abs, Auto shutter
	Programmable Shutter	0.5L to 792L (1L unit)
	Other functions	

10.5.2 Edge Pre-Select (EPS) trigger mode

An external trigger pulse initiates the capture, and the exposure time (accumulation time) is the fixed shutter speed set by registers. The accumulation can be LVAL synchronous or LVAL asynchronous. The resulting video signal will start to be read out after the selected shutter time.
For timing details, refer to fig. 35 through fig. 44.

To use this mode:

Set function:	Trigger mode	Edge Pre-select (EPS)
	Readout mode	Sync, async,
	Output Select	8-bit, 10-bit, 12-bit
	Scanning	Full/Partial
	Vertical binning	ON/OFF
	Shutter	Programmable, Exposure Time Abs
	Programmable Shutter	0.5 to 792 L (1L unit)
	Accumulation(Auto)	LVAL sync/LVAL async
	Other functions	
Input:	External Trigger	GigE I/F, Hirose 12-pin,Hirose 6-pin

Important Note:

1	The minimum duration of the trigger is 2L. The minimum period of trigger is as follows.		
	Sync mode: Sync	Smearless OFF	FVAL(792L) + 3L + (Difference shutter time between BW1 and BW2)
		Smearless ON	Smearless Time(198L)+1+ (longer exposure time between BW1 and BW2) + FVAL(792L) + 3L
	Sync mode: Async	Smearless OFF	FVAL(792L) + 3L
		Smearless ON	Smearless Time(198L)+1＋FVAL(792L)+3L
	FVAL(792L) is the FVAL period of continuous operation.		
2	In case that “Readout mode” is set to “SYNC”, the trigger input for BW1 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.		

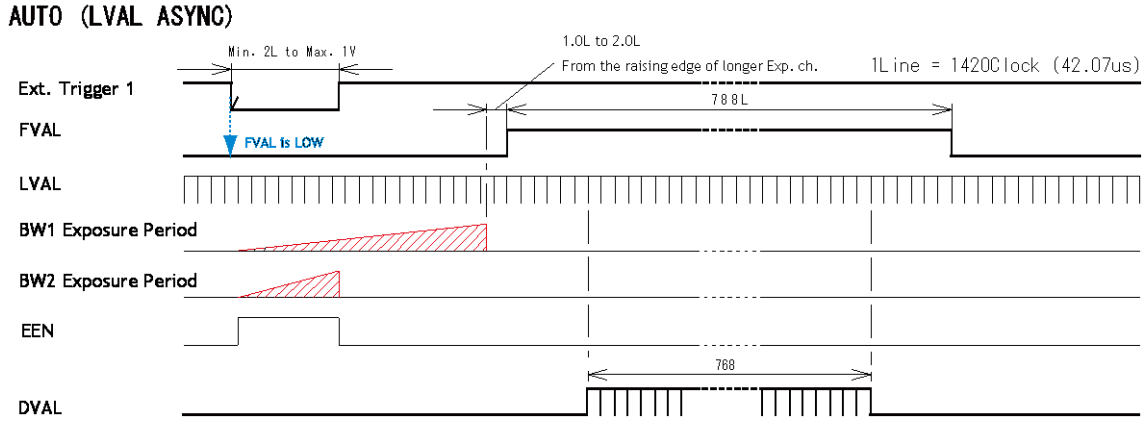


Fig.41 Edge Pre-select LVAL asynchronous

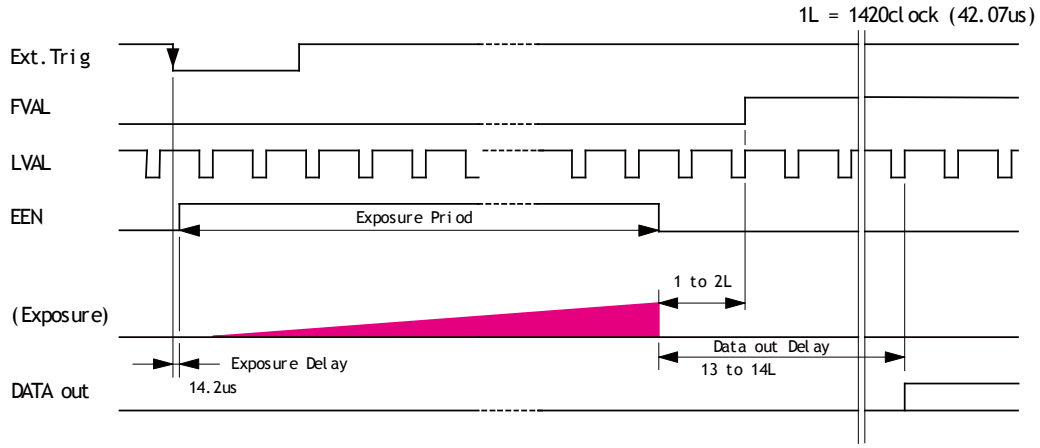


Fig.42 Edge Pre-select LVAL asynchronous details

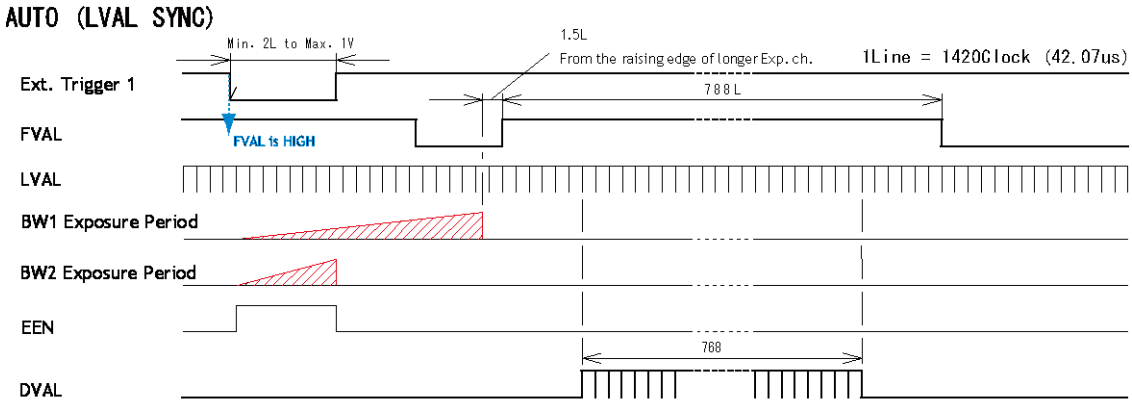


Fig.43 Edge Pre-select LVAL synchronous

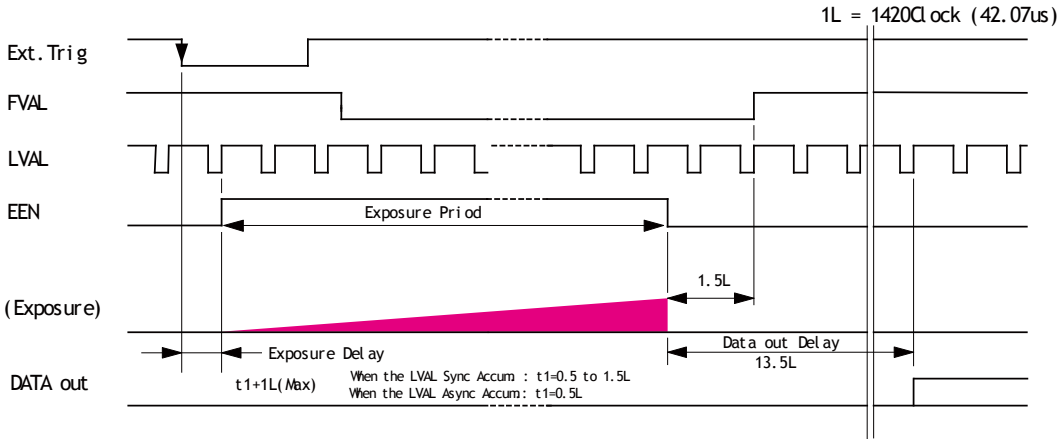


Fig.44 Edge Pre-select LVAL synchronous details

10.5.3 Pulse Width Control (PWC) trigger mode

In this mode the accumulation time is equal to the trigger pulse width. Here it is possible to have a long time exposure. The maximum recommended time is <60 frames.
The accumulation is only LVAL async.
For timing details, refer to fig. 35 through fig. 40 and fig. 45 through fig.46.

To use this mode:

Set function:	Trigger mode	Pulse Width Control (PWC)
	Readout mode	Sync, async,
	Output Select	8-bit, 10-bit, 12-bit
	Scanning	Full/Partial
	Vertical binning	ON/OFF
	Accumulation	LVAL async
	Other functions	
Input:	External Trigger	GigE I/F, Hirose 12-pin,Hirose 6-pin

Important Note:

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

Sync mode: Sync	Smearless OFF	Exposure time + 792L + 3L
	Smearless ON	Exposure time(Min:199L+2L) + 792L + 2L
Sync mode: Async	Smearless OFF	Exposure time + 792L + 3L
	Smearless ON	Exposure time(Min:199L+2L) + 792L + 3L

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

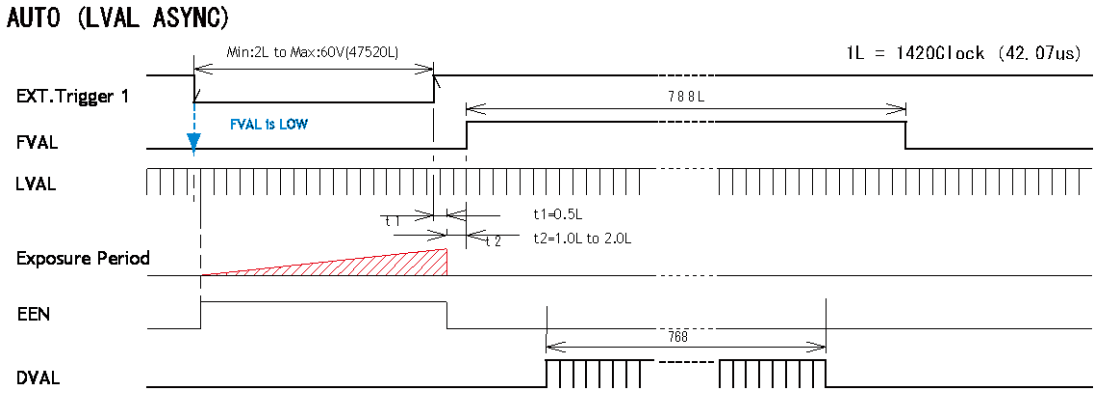


Fig.45 Pulse Width Control LVAL asynchronous

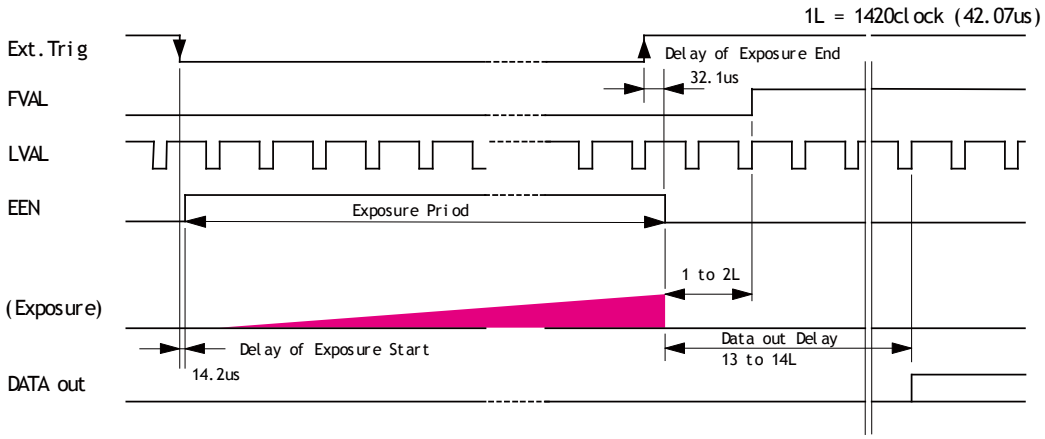


Fig.46 Pulse Width Control LVAL synchronous details

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

10.5.4 Reset Continuous Trigger (RCT) mode

The RCT mode operates like EPS (edge preselect) mode with smearless function. An external trigger pulse will immediately stop the video readout, reset and restart the exposure, then operate as normal mode until the next trigger. After the trigger pulse is input, a fast dump readout is performed. In the AD-081GE, this period is 8.32ms which is 198L. The exposure time is determined by the pre-set shutter speed. If no further trigger pulses are applied, the camera will continue in normal mode and the video signal is not output. The fast dump readout has the same effect as "smearless readout". Smear over highlight areas is reduced for the trigger frame. The reset continuous trigger mode makes it possible to use triggering in conjunction with a lens with video controlled iris.
The accumulation is LVAL Async only.

To use this mode:

Set function:	Trigger mode	Reset Continuous (RCT)
	Readout mode	Sync, async,
	Output Select	8-bit, 10-bit, 12-bit
	Scanning	Full/Partial
	Vertical binning	ON/OFF
	Shutter	Programmable, Exposure Time Abs
	Programmable Shutter	0.5L to 792 L (1L unit)
	Accumulation	LVAL async
	Other functions	
Input:	External Trigger	GigE I/F,Hirose 12-pin,Hirose 6-pin

Important notes on using this mode

- Trigger pulse >2 LVAL to <1 FVAL)
- The minimum trigger period is;

Sync mode: Sync	Smearless time(198L)+1+ (Longer exposure time between BW1 and BW2) + 792L + 3L
Sync mode: Async	Smearless time(198L)+1+ 792L + 3L

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

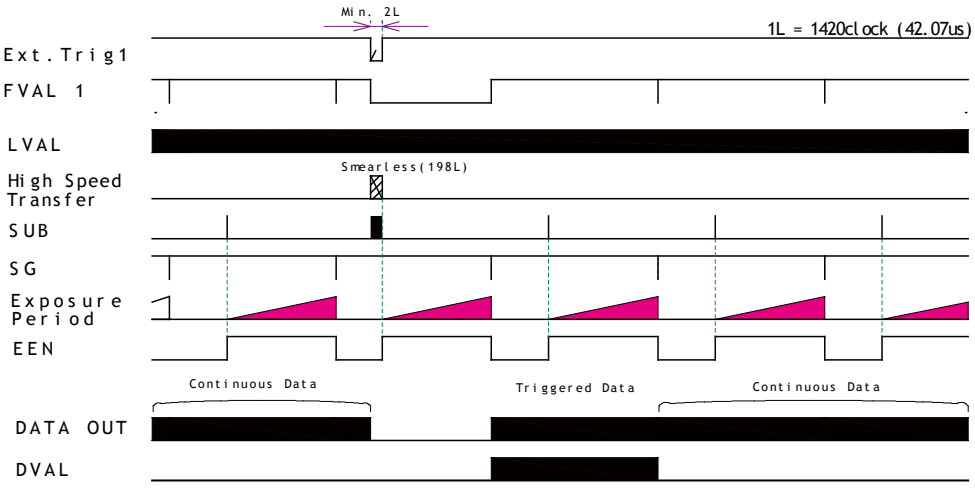


Fig.47 Reset Continuous Trigger

10.5.5 Particle Image Velocimetry

PIV mode is an independent function and is not to be combined with the High Frame Rate function, the High Dynamic Range function, or the normal output mode (Sync or Separate). In this mode, one trigger input provides three consecutive outputs. A strobe light is used for illumination. PIV has three preset modes.

PIV mode	Exposure time	Trigger Interval
PIV 1	4 µ	1.5 µ
PIV 2	6 µ	1.5 µ
PIV 3	8 µ	1.5 µ

Trigger width	2L(min.) to 1V (max.)

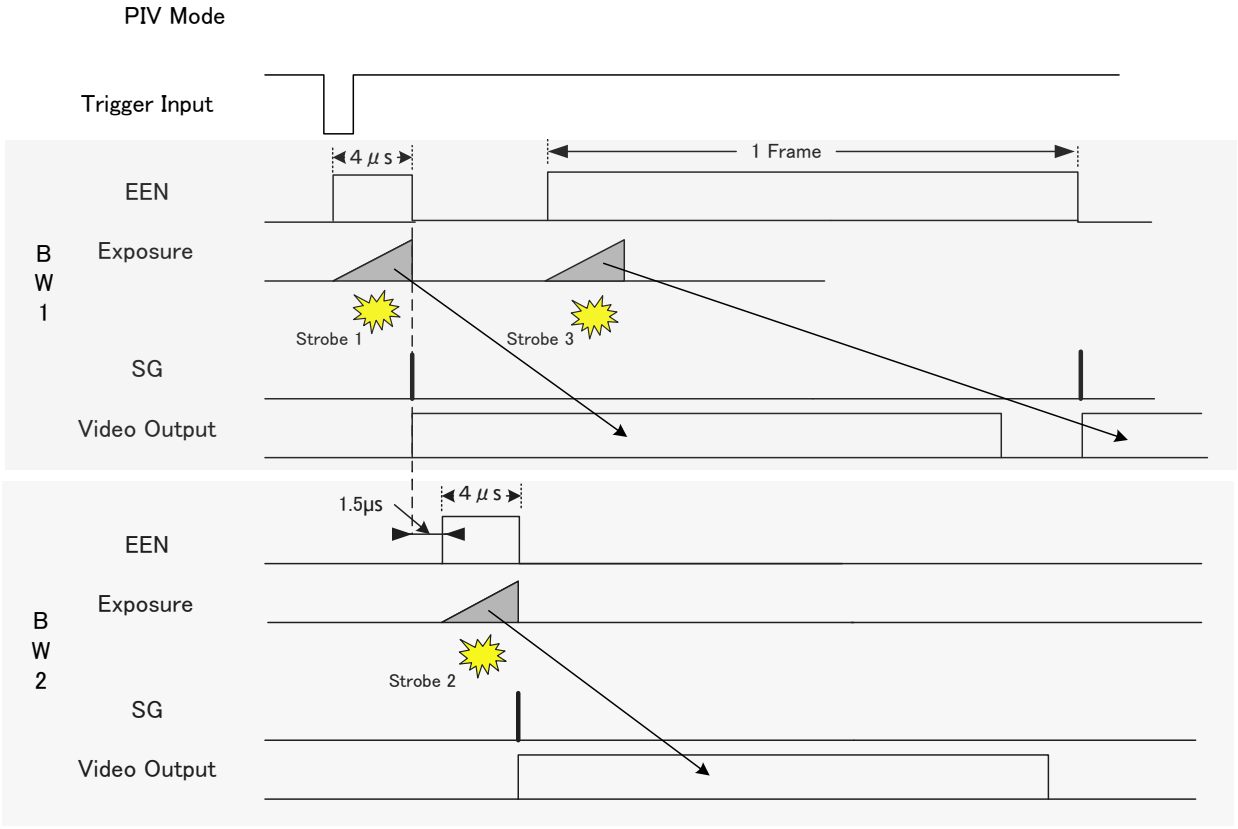


Fig. 48 PIV

10.5.6 Sequential Trigger Mode (EPS)

This mode allows the user to define a preset sequence of up to 10 images, each with its own ROI, Shutter and Gain values. As each trigger input is received, the image data with the preset sequence is output as described below.

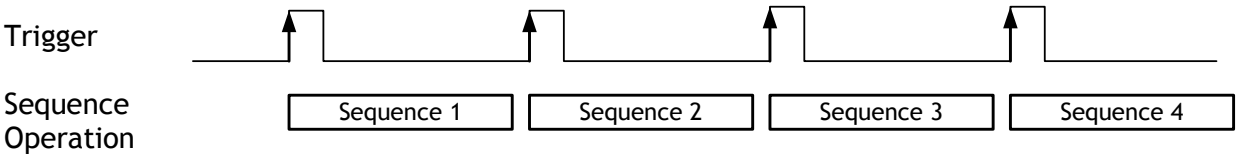


Fig.49 Sequential Trigger Mode

Signals added to a trigger can be selected by 0xB060 Camera Trigger Selector in the register map via GPIO. The camera will function on the rising edge of the trigger and Negative or Positive should be determined accordingly.

The following default settings can be modified by the user to define a sequence.
This table is common for both BW1 and BW2 sensors as default settings.

ID	ROI				Shutter	Gain	Repeat For each ID (1 to 50)
	Width	Height	Offset X	Offset Y			
1	1024	768	0	0	792	0	1
2	1024	768	0	0	792	0	1
3	1024	768	0	0	792	0	1
4	1024	768	0	0	792	0	1
5	1024	768	0	0	792	0	1
6	1024	768	0	0	792	0	1
7	1024	768	0	0	792	0	1
8	1024	768	0	0	792	0	1
9	1024	768	0	0	792	0	1
10	1024	768	0	0	792	0	1

The following registers are used to configure the sequence.

0xC0F4 Sequence Repetitions (Number of Repetitions – note: 0 = repeat indefinitely)
0xC0F8 Sequence Ending Position (Ending Position)
0xC0F0 Sequence Reset Command (1 only)
0xB060 Selection for camera trigger 0
0xA040 Trigger mode selection and 0x09 for Sequential PS mode

Example of settings

Setting: Repeat 5 times from ID 1 through ID 8

0xC0F4 Set to 0x05
0xC0F8 Set to 0x08
0xB060 For instance, 12p #6 for Optical IN 1
0xA040 Sequential PS (9)
0xA604 Set video sending flag to 1 for start
0xA604 Set video sending flag to 0 for stop
Please refer to the detailed register description on Camera Register Map which is included in the SDK.

Important Notes:

- When this mode is used, at first set the video sending flag to OFF (Acquisition end). Then set the trigger mode to “Continuous”. Then, set the shutter mode to “Sequential Trigger” mode. After setting those functions, set the video sending flag to ON (Acquisition start).
- If the changes are done while the trigger is input, the order of the sequence might be shifted. The trigger mode should be changed while the trigger is not input and after change the setting, execute the sequence reset to send 0xC0f0 command.
- In this mode, while the acquisition is ON, saving to user area 1 to 3 is not available. While this mode is in operation, the shutter mode (0xA000) should not be changed.

10.5.7 Delayed Readout EPS and PWC Modes (EPS and PWC)

This mode can be used to delay the transmission of a captured image. When several cameras are triggered simultaneously and connected to the same GigE interface, it allows the cameras to be read out in sequence, preventing congestion.

The image data is not transmitted directly by the trigger 0 and is stored in the memory located at the Ethernet Interface. By the falling edge of the soft trigger 1, the image data is output.

This mode can work in EPS mode and PWC mode.

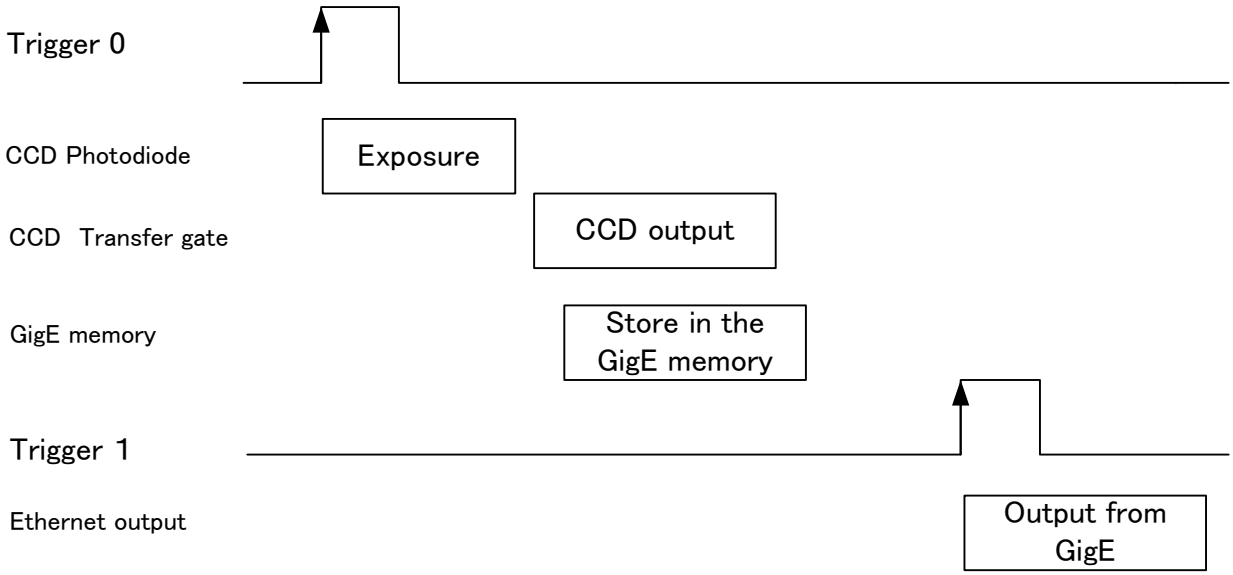


Fig.50 Delayed Readout Mode

Example of setting

0xA040 PS Delayed Readout (0x17)
0xB060 Trigger 0 select, e.g. 0x04 OPT IN 1
0xB-064 Trigger 1 select, e.g. 0x05 OPT IN 2

For the details of Registers, please refer to the Camera Register Map which is included in the SDK.

10.5.8 Smearless mode

This function can be used to reduce the smear coming from bright parts of the object. This is effective for both EPS and PWC trigger modes. Before the accumulation starts, any charge that is stored in the pixel is dumped by a high-speed transfer. This can reduce the smear at the upper part of the object but the lower part is unaffected.
At the falling edge of the trigger pulse the high speed transfer starts. This period is 8.32ms which is 198L. Thereafter the residual charge in the horizontal CCD register is read out in 1L and the new exposure starts. This function is available for both full scan and partial scan.

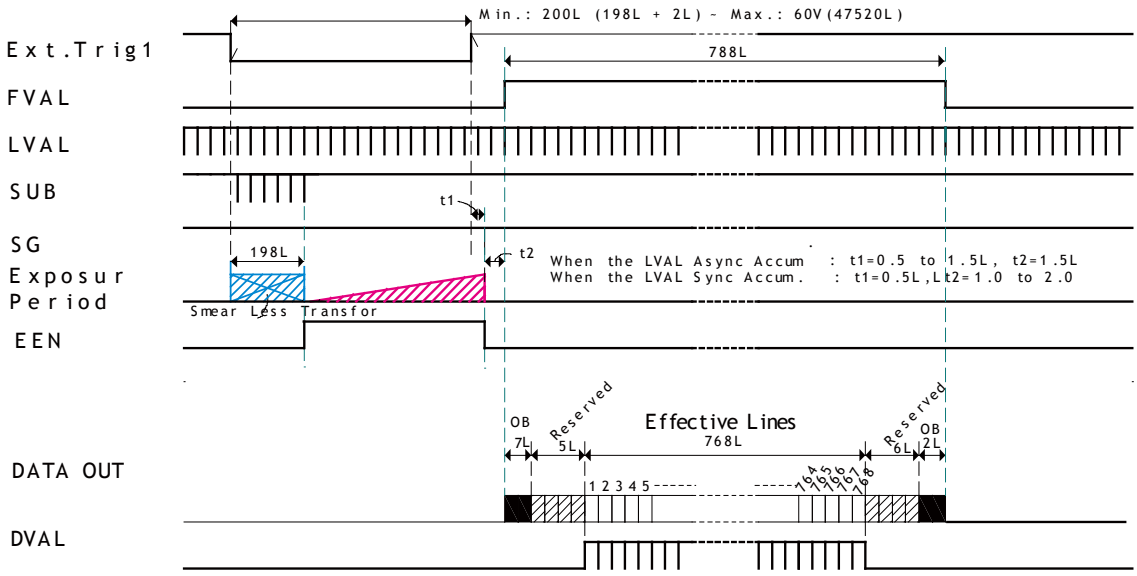
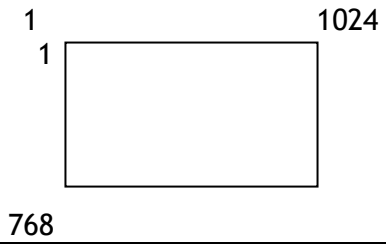
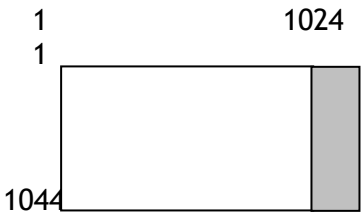
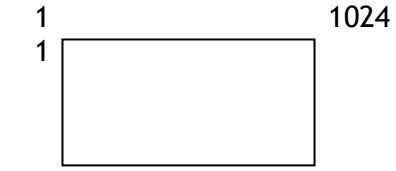
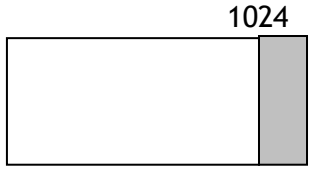
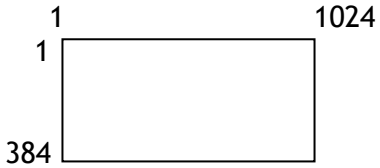
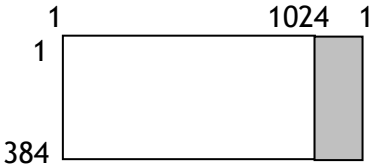


Fig 51 PWC timing chart with Smearless ON

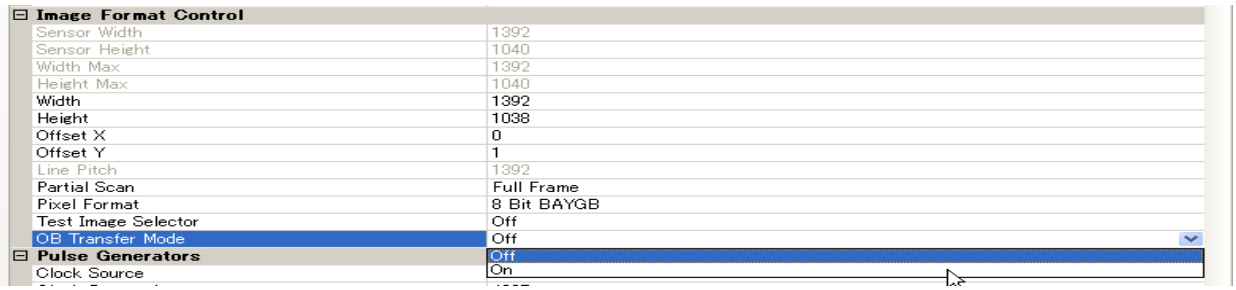
In PWC mode, when “Smearless ON ” is selected, the actual accumulation time is the trigger pulse width minus the Smearless active period (199L+2L).
If the trigger pulse width is shorter than 199L, the exposure is not active.

10.5.9 Optical Black transfer mode

It is possible for the user to decide whether the optical black (OB) portion of the image will be transferred or not. The optical black part can be used for black reference in the application software. Setting register 0xA41C turns the optical black transfer ON or OFF. The default condition is OFF.

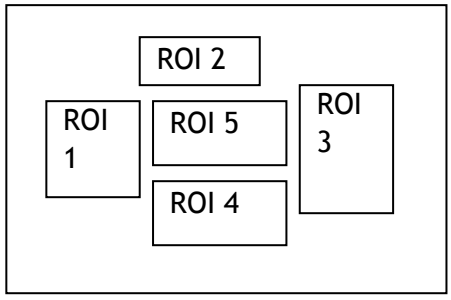
	OB Transfer Mode OFF	OB Transfer Mode ON
Normal Scan		
Fast Dump (Partial Scan)		
V Binning		

Note: The menu for ON or OFF of OB transfer mode is found on the Image Format Control of the JAI SDK Camera Control Tool.



10.5.10 Multi ROI mode (Multi Region of Interest)

In this trigger mode, up to 5 ROIs located on one image can be output by one trigger input. By using this mode, the data stream can be smaller.
Each ROI can be overlapped.
Please note that if the accumulated data size is bigger than the data size of 1 frame, the frame rate will be reduced.
Also note that these ROI settings are also used for partial scanning. In the diagram shown to the right, the start line of ROI2 and the end line of ROI4 would define the height for partial scan mode.



10.6. Operation Mode and Functions matrix

10.6.1 Readout Mode (0xA098) 0:SYNC

Sensor		BW-1			BW-2			Auto Iris output (Note2)
Trigger Inoput		Trigger 1 : Valid			Trigger 2 : Invalid			
ID Value	Mode	Shutter	Fast Dump ON	Smear less	Shutter	Fast Dump ON	Smear less	
00	Continuous	Yes	Yes	No	Yes	← (note1)	No	Yes
01	Edge Pre-select (EPS)	Yes	Yes	Yes	Yes	←	←	No
02	Pulse Width Control (PWC)	Not applicable	Yes	Yes	Not applicable	←	←	No
04	RCT	Yes	Yes	Automatically ON	Yes	←	Automatically ON	Yes
32	PIV 1	No	No	No	No	No	No	No
64	PIV 2	No	No	No	No	No	No	No
128	PIV 3	No	No	No	No	No	No	No
09	Sequential EPS	Yes	Yes	No	Yes	←	No	No
17	Delayed Readout EPS	Yes	Yes	Yes	Yse	←	←	No
18	Delayed Readout PWC	Not applicable	Yes	Yes	Not applicable	←	←	No

Note 1: "←" means that the setting depends on BW-1.
Note 2: Video signal for auto iris uses the signal from BW-1. It can be changed by register.

10.6.2 Readout mode (0xA098) 1:ASYNC

Sensor		BW-1			BW-2			Auto Iris output (note2)
Trigger Input		Trigger 1 : Valid			Trigger 2 : Valid			
ID Value	Mode	Shutter	Fast dump ON	Smear less	Shutter	Fast dump ON	Smear less	
00	Continuous	Yes	Yes	No	Yes	Yes	No	Yes
01	Edge Pre-select (EPS)	Yes	Yes	Yes	Yes	Yes	Yes	No
02	Pulse Width Control (PW)	Not applicable	Yes	Yes	Not applicable	Yes	Yes	No
04	RCT	Yes	Yes	Automatically ON	Yes	Yes	Automatically ON	Yes
32	PIV1	No	No	No	No	No	No	No
64	PIV2	No	No	No	No	No	No	No
128	PIV3	No	No	No	No	No	No	No
09	Sequential EPS	Yes	Yes	No	Yes	← (note1)	No	No
17	Delayed Readout EPS	Yes	Yes	Yes	Yes	←	←	No
18	Delayed Readout PWC	Not applicable	Yes	Yes	Not applicable	←	←	No

Note 1: "←" means that the setting depends on BW-1.
Note 2: Video signal for auto iris uses the signal from BW-1. It can be changed by register.

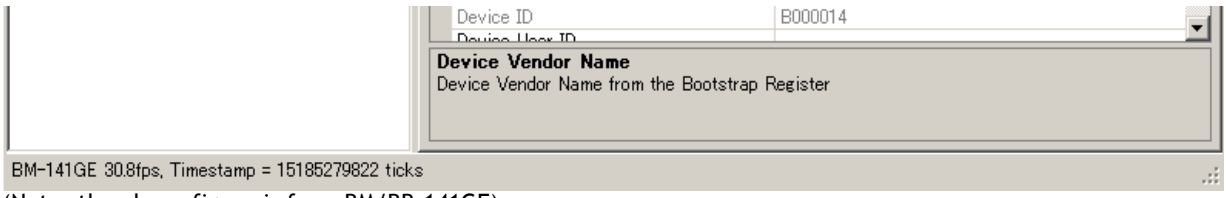
10.7. Special note for settings

10.7.1 When the image size is changed

When the image size needs to be changed while the image is being captured, you must stop image capturing by pressing “Stop Acquisition”. Then change the value. It is possible to set the shutter value and gain settings while watching the picture on the screen.

10.7.2 When the image is captured

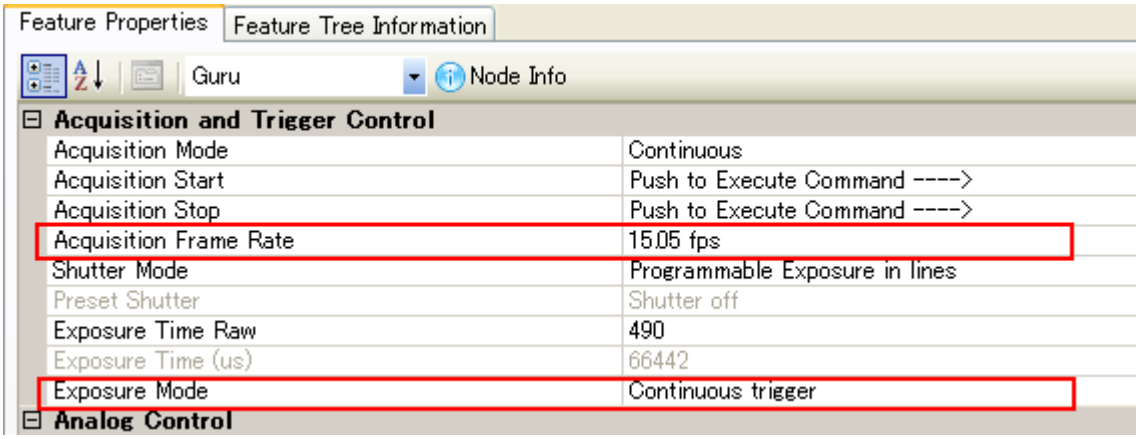
While capturing images, if the frame rate is decreased, please check packet size. Each packet contains header information. If the packet size is small, total data bandwidth is affected by all the headers that must be added to packets. Accordingly, the frame rate may be decreased. If so, it is recommended to set the packet size to a higher value. Please note that the packet size is not stored, and it is necessary to set it on every start up. The current frame rate is shown at the bottom of the camera control tool.



(Note: the above figure is from BM/BB-141GE)

10.7.3 Acquisition frame rate

Acquisition frame rate is a function to set the frame rate of image capturing. The frame rate can be set at full, 1/2, 1/4 and 1/8. This is only useful in “Continuous” mode. If a trigger mode is used, it is strongly recommended to use the full frame rate. Otherwise, the trigger frequency will also be divided according to the frame rate setting.



(Note: The above figure shows an example from a camera other than the AD-081GE.)

11. External Appearance and Dimensions

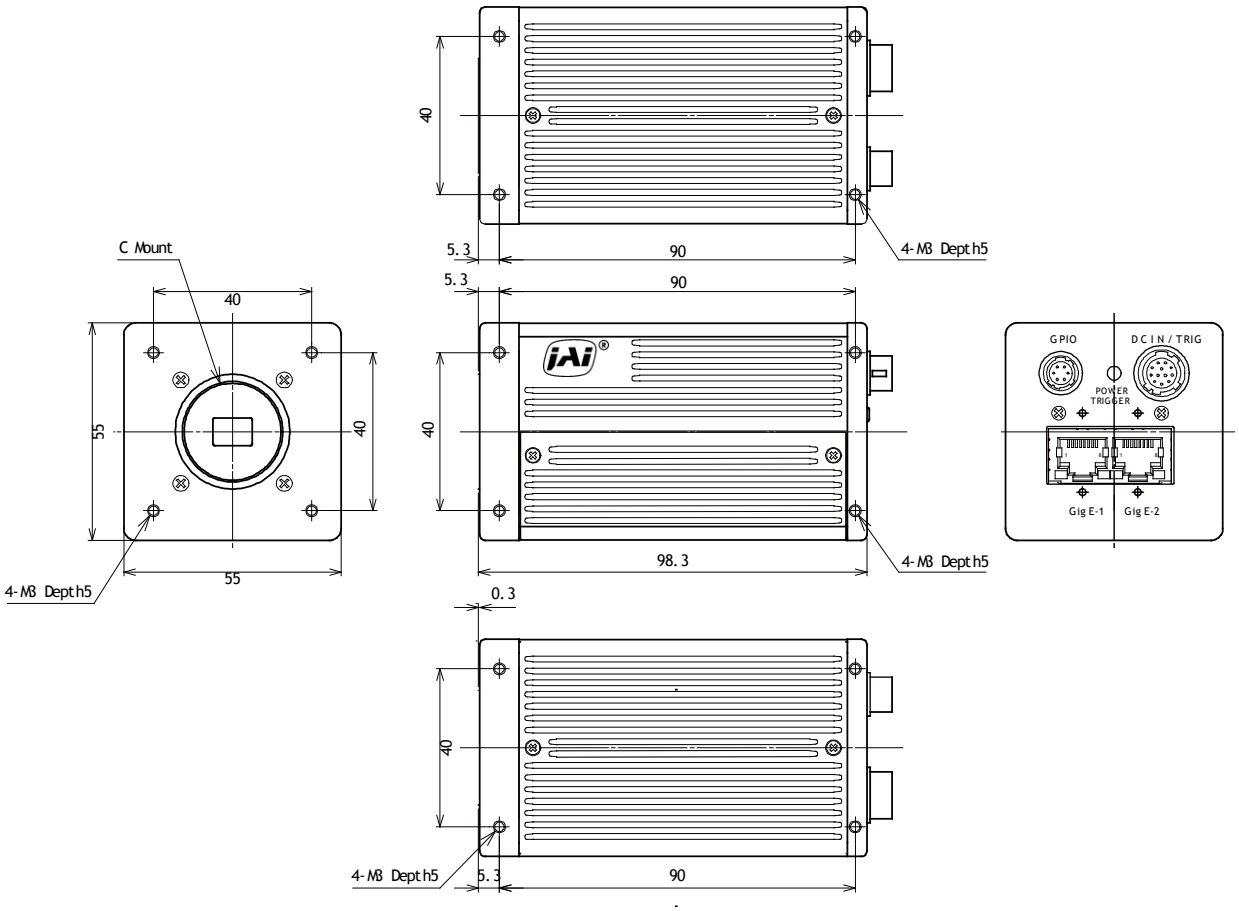


Fig. 52 Dimensions

12. Specifications

12.1. Spectral response

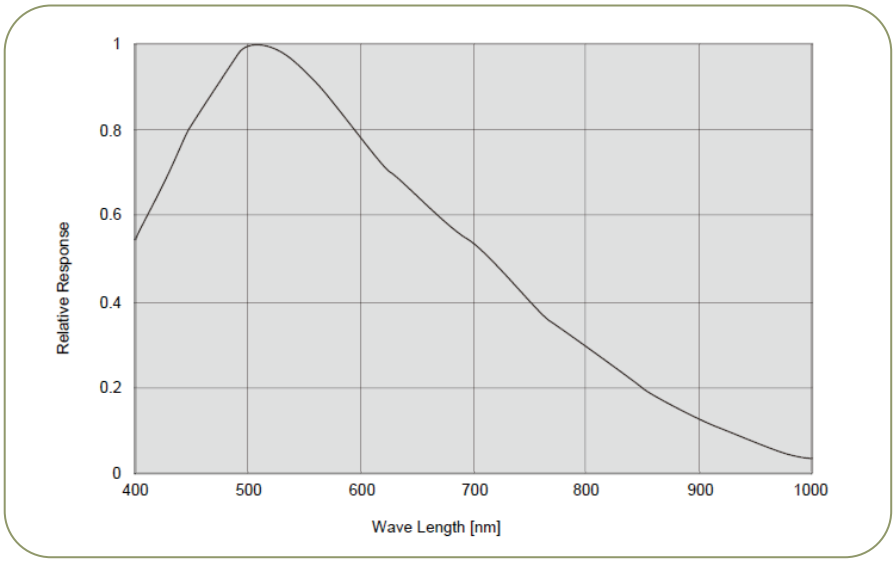


Fig. 53 Spectral response of monochrome sensor

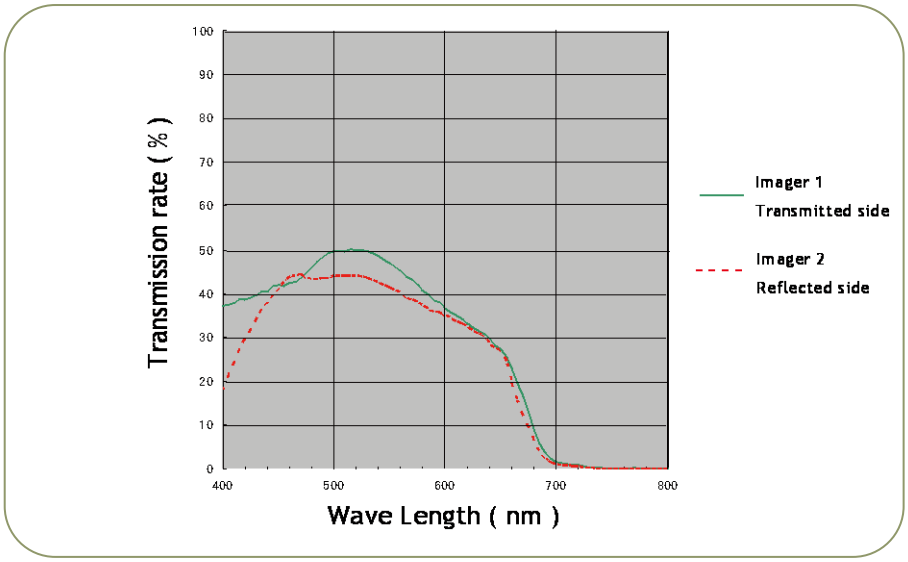


Fig. 54 Total spectral response including prism and sensor

12.2. Specifications Table

Specifications	AD-081GE
Scanning system	Progressive scan
Frame Rate Full scan	30.0 frames / sec. Progressive (768 lines/frame)
Pixel clock	33.75MHz
Line frequency	23.768 KHz (1420 pixel clocks / line)
Image sensor	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 Variable Partial Vertical binning	1024 (h) x 768 (v) 30.0 fps. H = 23.768 kHz Scan height 1 to 760 lines, Start line 8 to 768 1024(h) x 384(v), 49.30 fps (max.) H=19.62 KHz
Sensitivity on sensor	0.34 lux (Max. Gain, Shutter OFF, 50% Video Level)
S/N (dB)	More than 54 dB (0dB)
Iris video output, Analogue	0.7 V p-p (without Sync)
Digital Video Output	Via RJ-45 x 2 (GigE1 and GigE2) Mono8, Mono10, Mono10_Packed, Mono12_Packed, Mono12
Input signals	(TTL/75Ω) x2, LVDS x 1 HIROSE 6-pin OPT x2 HIROSE 12-pin
Output signals	TTL x 1 Hirose 6-pin OPT x 2 Hirose 12-pin
Gain	Manual Gain: -3dB to +21dB (o.35dB step) AGC: -3dB to +21dB
Knee compensation	Knee point and knee slope
LUT/Gamma	1.0/0.6/0.45/LUT
Shading compensation	ON/OFF
Synchronization	Int. X-tal
GPIO Module Input /Output switch Clock Generator(one) Pulse generator (Four)	 Configurable 21-in / 14-out switch 12 bit counter based on pixel clock 20-bit counter programmable for length, stat point, stop point , repeat
Hardware Trigger mode	Edge Pre-select, Pulse width control, RCT, PIV, Frame delay, Sequence
OB area transfer mode	ON / OFF
Event message	Exposure start, Exposure end, Trigger IN, Video start, Video end
Electronic Shutter Programmable Exposure Exposure Time Abs GPIO plus Pulse width Auto shutter	 20 µs to 792L(33.3ms) in 1L step µsec – user definable. Same range as PE Max. 2 sec (fine setting with GPIO and pulse width control) 1/30 to 1/10000 sec
Accumulation	LVAL synchronous or LVAL asynchronous automatic selection
Interface	Gigabit Ethernet (IEEE802.3, ATA GigE Vision Standard) 2 lines
Functions controlled via GigE Vision Interface	Shutter, Gain, Black Level, Trigger mode, Readout mode, GPIO setup, ROI (GenICam mandatory functions)
GigE Vision Streaming Control	Packet size, Delayed (Frame) readout, inter-packet delay Jumbo frame can be set at max. 16K (16020), Default packet size is 1476 Byte.
Indicators on rear panel	Power, Hardware trigger, GigE Link, GigE activity
Lens Mount	C-Mount (Rear protrusion less than 4mm). Designed For 3CCD camera
Flange back	17.526mm Tolerance 0 to – 0.05mm
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 to 24V) ±10%, 7.6W (Typical, normal operation,+12V)
Dimensions	55 (H) x55 (W) x 98.3 (D) mm
Weight	320 g

Note: Above specifications are subject to change without notice.

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

Register Map

The table below provides detailed information for the hardware registers used for controlling the camera and obtaining information on the status of the camera. The content of this register map is also found in the XML file, as stipulated by the GenICam standard.

Device Information

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0x0048	Device Vendor Name	DeviceVendoeName	R	32		Manufacture of this device	
0x0068	Device Model Name	DeviceModelName	R	32		Model Name of this device	
0x0088	Device Version	DeviceVersion	R	32		Version of this device	
0x00A8	Device Manufacturer Info	DeviceManufacturerInfo	R	48		Provides extended manufacturer information about the device.	
0x00D8	Device ID	DeviceID	R	16		Camera serial number	
0x00E8	Device User ID	DeviceUserID	RW	16		User assignable string (16 Byte)	
0xA714	FPGA version	DeviceFPGAVersion	R	4			
0xA034	Sensor Type	SensorType	R	4	2=AD-081GE Mono Sensor1(interface #0) 3=AD-081GE Mono Sensor2(Interface #1)		
0xA640	Device Reset	DeviceReset	W	4	Command=1		
0xA1FC	Temperature	Temperature	R	4	0.0625° step	-55 ℃ ～ 150 ℃	

Image Format Control

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0xA400	Width Max	WidthMax	R	4	1024	Width max	1024
0xA404	Height Max	HeightMax	R	4	768	Height max	768
0xA410	Pixel Format	PixelFormat	RW	4	Mono CCD(080/081) 0x01080001 0x010C0004 0x01100003 0x01100005 0x010C0006	Mono8 Mono10Packed Mono0 Mono12 Mono12Packed	**Mono8**
0xA500	ROI Mode	ROIMode	RW	4	1 to 5	1:ROI disable 2 to 5: Enable	1
0xA504	ROI 1 Width	Width	RW	4	8 - 1024	Width	W.Max
0xA508	ROI 1 Height	Height	RW	4	8 – 768	Height	H.Max
0xA50C	ROI 1 Offset X	OffsetX	RW	4	0 – 1016	Horizontal offset	0
0xA510	ROI 1 Offset Y	OffsetY	RW	4	0 – 760	Vertical offset	0
0xA514	ROI 2 Width	Width2	RW	4	8 - 1024	Width 2	W.Max
0xA518	ROI 2 Height	Height2	RW	4	8 – 768	Height 2	H.Max
0xA51C	ROI 2 Offset X	OffsetX2	RW	4	0 – 1016	Offset X2	0

0xA520	ROI 2 Offset Y	OffsetY2	RW	4	0 – 760	Offset Y2	0
0xA524	ROI 3 Width	Width3	RW	4	8 - 1024	Width 3	W.Max
0xA528	ROI 3 Height	Height3	RW	4	8 – 768	Height 3	H.Max
0xA52C	ROI 3 Offset X	OffsetX3	RW	4	0 – 1016	Offset X3	0
0xA530	ROI 3 Offset Y	OffsetY3	RW	4	0 – 760	Offset Y3	0
0xA534	ROI 4 Width	Width4	RW	4	8 - 1024	Width 4	W.Max
0xA538	ROI 4 Height	Height4	RW	4	8 – 768	Height 4	H.Max
0xA53C	ROI 4 Offset X	OffsetX4	RW	4	0 – 1016	Offset X4	0
0xA540	ROI 4 Offset Y	OffsetY4	RW	4	0 – 760	Offset Y4	0
0xA544	ROI 5 Width	Width5	RW	4	8 - 1024	Width 5	W.Max
0xA548	ROI 5 Height	Height5	RW	4	8 – 768	Height 2	H.Max
0xA54C	ROI 5 Offset X	OffsetX5	RW	4	0 – 1016	Offset X 5	0
0xA550	ROI 5 Offset Y	OffsetY5	RW	4	0 – 760	Offset Y 5	0
0xA080	Fast Dump	FastDumpEnable	RW	4		For enabling variable partial scan	
0xA084	Binning Vertical	BinningVertical	RW	4	1=Binning OFF 2=1/2 V Binning		1
0xA098	Sync Mode	SyncMode	RW	4	0=Sync 1=Async 2=High transfer Rate 3=High dynamic Range1 4=High S/N 5=High dynamic range 2 6=High dynamic range 3		
0xA13C	Test Image Selector	TestImageSeleector	RW	4	0=OFF 4=H Rmap Scale 5=V Ramp Scale 6= Moving Ramp Scale		0
0xA41C	OB Transfer Enable	OBTransferEnable	RW	4			

Acquisition and Trigger Control

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0xA604	Acquisition Mode	AcquisitionMode	RW	4	0=Stop 1=Start	Acquisition start and stop	0
0xA414	Acquisition frame rate	AcquisitionFrameRate	RW	4	0=Full speed 1=1/2 speed 2=1/4 speed 3=1/8 speed		0
0xA000	Shutter mode	ShutterMode	RW	4	1= Programmable exposure in line 2=Programmable exposure(us) 3=Auto Exposure Constantly	Sets exposure time for image capture.	1

0xA008	Exposure Time Raw	ExposureTimeRaw	RW	4	0 to 792 (OFF)	Flexible setting of exposure time ranging from 20 µs to 33.31 ms using the LVAL period (L) as increment. 1L is 42.071us.	792
0xA018	Exposure Time (us)	ExposureTimeAbs	RW	4	20 to 33333 (OFF)	Actual exposure time in microseconds, µs. The camera will round value off to match LVAL increments.	33333
0xA030	Auto exposure value	AutoExposureValue	R	4		Exposure time on Auto exposure mode	
0xA040	Exposure Mode	ExposureMode	RW	4	00=Continuous trigger 01=Edge pre-select 02=Pulse-width control 04=RCT mode 09=Sequential EPS trigger 17=Delayed readout EPS trigger 18=Delayed readout PWC trigger 32=PIV mode 1 64=PIV mode 2 128=PIV mode 3		0
0xB060	Camera Trigger 0	CameraTrigger0			Trigger Source Bit31 ~ Bit25 Bit24:Trigger Activation 0=Rising Edge(Active High) 1=Falling Edge(Active Low)	Trigger Source 127=OFF 9=Line4-OpticalIn 1 10=Line5-optical In 2 12=Line6-TTL In 1 13=Line7-TTL In 2 11=Line8-LVDS In 16=Pulse Generator0 17=Pulse Generator1 18=Pulse Generator2 19=Pulse Generator3 20=User Output 0 (Software trigger 0) 21=User Output1 (Software trigger10) 22=User Output 2 (software trigger 2) 23=User Output 3 (Software trigger 3) Add 0x80 makes「Active Low」	127
0xB064	Camera Trigger 1	CameraTrigger1					
0xB0A0	TimeStamp Rest Trigger	TimeStampReset					
0xB0A4	Sequence Table Reset Trigger	SequenceTableRest					
0xA04C	Smearless Enable	SmearlessEnable	RW	4	0:OFF 1:ON		

Video Control

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0xA0B0	Gain Auto	GainAuto	RW	4	0=OFF 1=continuous		0
0xA0B4	AGC Reference	AGCReference	RW	4	0 to 8191	Reference value for AGC as well as Auto shutter	0
0xA0C4	Analog All	AnalogAll	RW	4	-89 to 593	Analog all -89(−3dB) 593(+21dB) 1 step=0.0358dB Value 0=0dB	0

0xA0C8	Auto Gain Value	AutoGainValue	RO	4		See the gain raw value while AGC is being performed	
0xA71C	Digital Sensor 2	DigitalSensor2	RW	4	-1024 to 1023	Fine tuning on Digital sensor2	
0xA150	Black Level Selector(ALL)	BlackLevelRaw[DigitalALL]	R W	4	0 to 1023		
0xA718	Iris Signal Output Mode	IrisSignalOutputMode	RW	4	0=CCD1 1=CCD2		0

Digital Processing

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0xA0EC	Gamma Set(Mono/Bayer)	GammaSet[Mono_Bayer]	RW	4	0=OFF 1=0.9 2=0.8 3=0.75 4=0.6 5=0.55 6=0.5 7=0.45		0
0xA11C	Shading Correction Enable	ShadingCorrectionEnable	RW	4	0=OFF 1=On		0
0xA120	Shading Correction Mode	ShadingCorrectionMode	R	4	0=Flat shading		
0xA128	Blemish Reduction Enable	BlemishReductionEnable	RW	4	0=Disable 1=Black blemish 2=White blemish 3=Both blemish		0
0xA130	Perform Flat Shading Calibration	PerformFlatShadingCalibration	WO	4	Command=0		0
0x10000 | 0x10CE0	Shading Data Selector	ShadingDataSelector[Red_Mono]	R	4	0 ～ 65535	Index=0～824	
0xA138	Perform Black Blemish Reduction Calibration	PerformBlackBlemishCalibration	W	4	Command=0		
	Perform White Blemish Reduction Calibration	PerformWhiteBlemishCalibration			Command=1		
0x12700 | 0x127C	Blemish Data Selector (Black Blemish)	BlemishDataSelector[BlackBlemish]	R	4	0 ～ 0xFFFFFFFF	Index=0～31	0
0x12780 | 0x127FC	Blemish Data Selector (White Blemish)	BlemishDataSelector[WhiteBlemish]	R	4	0 ～ 0xFFFFFFFF	Index=0～31	0
0xA1A4	Knee Enable	KneeEnable	RW	4	0=OFF 1=ON		0
0xA1A8	Knee Slope	KneeSlope[Mono_Bayer]	RW	4	0 - 16383		2347
0xA1B8	Knee point	KneePoint[Mono_Bayer]	RW	4	0 - 32767		6864

Digital IO

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0xA600	User Output Selector	UserOutputSelector	RW	4	Bit31=User Output 0 Bit30:User Output 1 Bit29:User output 2 Bit28:User Output 3 0=Low 1=HIGH	This was called Software Trigger.	0
0xB070	Line Selector Line1-TTL Out 1	Line1	RW	4	Line Source Bit31 ~ Bit25	Line Source 127:OFF 1:LVAL 1	
0xB078	Line Selector Line2-Optical Out 1	Line2	RW	4			

0xB07C	Line Selector Line3-Optical Out 2	Line3	RW	4	Bit24:Line Inverter 0=False (Active High) 1=True(Active Low)	2:LVAL2 3:DVAL1 4:DVAL2 5:FVAL1 6:FVAL2 7:EEN1 8:EEN2 9:Line4-Ooptical In 1 10:Line5-Optical In 2 11:Line8-LVDS IN 12:Line6-TTL In 1 13:Line7-TTL In 2 16:Pulse Generator 0 17:Pulse Generator 1 18:Pulse Generator 2 19:Pulse Generator 3 20:User Output 0 21:User Output 1 22:User Output 2 23:User Output 3	
0xB080	Line Selector Line4-Optical In 1	Line4	RW	4			
0xB084	Line Selector Line5-Optical In2	Line5	RW	4			
0xB088	Line Selector Line6-TTL In 1	Line6	RW	4			
0xB08C	Line Selector Line7-TTL In 2	Line7	RW	4			
0xB090	Line Selector Line8-LVDS In	Line8	RW	4			
	Line Mode	LineMode			0=Input 1=Output		
	Line Format	LineFormat			0=Internal Logic Signal 1=TTL 2=LVDS 3=Opto-coupled		
0xB0B0	Line status		R	4		See the current input and output line	

Pulse Generator

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0xB004	Clock Pre-scaler	ClockPreScaler	RW	4	0x000 0x001 0x002 | 0xFFF	Bypass Divide by 2 Divide by 3 | Divide by 4096	0
0xB008	Pulse Generator Length 0	PulseGeneratorLength0	RW	4	1～1048575	Defines the length of the counter 0	1
0xB00C	Pulse Generator Start Point 0	PulseGeneratorStartPoint 0	RW	4	0～1048574	Defines the starting point of the counter 0	0
0xB010	Pulse Generator Repeat Count 0	PulseGeneratorRepeatCo unt0	RW	4	0 - 255	Defines the repeat count of the counter 0	0
0xB014	Pulse Generator End Point 0	PulseGeneratorEndPoint0	RW	4	1～1048575	Defines the end point of the counter 0	1
0xB018	Clear Mode for the Pulse Generator 0	PulseGeneratorClear0	RW	4	0 :Free Run 1:High Level 2: Low Level 4: Rising Edge 8: Falling Edge		0
0xB01C	Pulse Generator Length 1	PulseGeneratorLength1	RW	4	1～1048575	Defines the length of the counter 1	1
0xB020	Pulse Generator Start Point 1	PulseGeneratorStartPoint 1	RW	4	0～1048574	Defines the starting point of the counter 1	0
0xB024	Pulse Generator Repeat Count 1	PulseGeneratorRepeatCo unt1	RW	4	0 - 255	Defines the repeat count of the counter 1	0
0xB028	Pulse Generator End Point 1	PulseGeneratorEndPoint1	RW	4	1～1048575	Defines the end point of the counter 1	1

0xB02C	Clear Mode for the Pulse Generator 1	PulseGeneratorClear1	RW	4	0 :Free Run 1:High Level 2: Low Level 4: Rising Edge 8: Falling Edge		0
0xB030	Pulse Generator Length 2	PulseGeneratorLength2	RW	4	1～1048575	Defines the length of the counter 2	1
0xB034	Pulse Generator Start Point 2	PulseGeneratorStartPoint 2	RW	4	0～1048574	Defines the starting point of the counter 2	0
0xB038	Pulse Generator Repeat Count 2	PulseGeneratorRepeatCo unt2	RW	4	0 - 255	Defines the repeat count of the counter 2	0
0xB03C	Pulse Generator End Point 2	PulseGeneratorEndPoint2	RW	4	1～1048575	Defines the end point of the counter 2	1
0xB040	Clear Mode for the Pulse Generator 2	PulseGeneratorClear2	RW	4	0 :Free Run 1:High Level 2: Low Level 4: Rising Edge 8: Falling Edge		0
0xB044	Pulse Generator Length 3	PulseGeneratorLength3	RW	4	1～1048575	Defines the length of the counter 3	1
0xB048	Pulse Generator Start Point 3	PulseGeneratorStartPoint 3	RW	4	0～1048574	Defines the starting point of the counter 3	0
0xB04C	Pulse Generator Repeat Count 3	PulseGeneratorRepeatCo unt3	RW	4	0 - 255	Defines the repeat count of the counter 3	0
0xB050	Pulse Generator End Point 3	PulseGeneratorEndPoint3	RW	4	1～1048575	Defines the end point of the counter 3	1
0xB054	Clear Mode for the Pulse Generator 3	PulseGeneratorClear3	RW	4	0 :Free Run 1:High Level 2: Low Level 4: Rising Edge 8: Falling Edge		0
0xB090	Pulse Generator Selector Pulse Generator 0	PulseGenerator0	RW	4	Pulse Generator Source Bit 31 ～ 25 Bit24:Inverter 0:False (Active high) 1:True(Active Low)	Pulse Generator Source 127:OFF 1: LVAL IN 1 (I/F#0) 2:LVAL IN 2 (I/F#1) 3:DVAL IN 1 (I/F#0) 4:DVAL IN 2 (I/F#1) 5:FVAL IN 1 (I/F#0) 6:FVAL IN 2 (I/F#1) 7:EEN 1 (I/F#0) 8:EEN 2 (I/F#1) 9:LINE4(OPT IN 1) 10:LINE5(OPT IN 2) 11:LINE8(LVDS In) 12:LINE6(TTL IN 1) 13:LINE7(TTL IN 2) 16:Pulse Gen. 0 17:Pulse Gen.1 18*Pulse Gen.2 19:Pulse Gen.3 20:User Output 0 21: User Output 1 22: User Output 2 23: User Output 3	
0xB094	Pulse GeneratorSelector Pulse Generator 1	PulseGenerator1	RW	4			
0xB098	Pulse Generator Selector Pulse Generator 2	PulseGenerator2	RW	4			
0xB09C	Pulse Generator Selector Pulse Generator 2	PulseGenerator3	RW	4			

Sequence Acquisition Mode

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
	Sequence Selector	SequenceSelector			Sequence Selector Value 0=Sequence 1 1=Sequence 2 2=Sequence 3 3=Sequence 4 4=Sequence 5 5=Sequence 6 7=Sequence 8 8=Sequence 9 9=Sequence 10	Sequence Selector value is the INDEX for each sequence。	
0xC000	Sequence Exposure Time Raw	SequenceExposureTimeRaw	RW	4	0 - 792	Shutter value Base Address INDEX=0 to 9 (Base Address + Index *4)	792
0xC078	Sequence Master Gain Raw	SequenceMasterGain	RW	4	-89 to 593	Gain value Base Address INDEX=0 to 9 (Base Address + Index *4)	0
0xC0FC	Sequence ROI Size X	SequenceROISizeX	RW	4	8 - 1024	ROI width value Base Address INDEX=0 to 9 (Base Address + Index *4)	Width max
0xC124	Sequence ROI Size Y	SequenceROISizeY	RW	4	8 - 768	ROI Height value Base Address INDEX=0 to 9 (Base Address + Index *4)	Height Max
0xC14C	Sequence ROI Offset X	SequenceROIOffsetX	RW	4	0 - 1016	ROI H Offset value Base Address INDEX=0 to 9 (Base Address + Index *4)	0
0xC174	Sequence ROI Offset Y	SequenceROIOffsetY	RW	4	0 - 760	ROI V Offset value Base Address INDEX=0 to 9 (Base Address + Index *4)	0
0xC19C	Repeat Count in Each Step	SequenceRepeatCountInEachStep	RW	4	1 to 255	Sequence repeat count value Base Address INDEX=0 to 9 (Base Address + Index *4)	0
0xC0F0	Reset Sequence Settings	SequenceResetCommand	RW	4	1 only	Sequence3 reset	1
0xC0F4	Sequence Repetition Count	SequenceRepetitions	RW	4	0 to 255	Sequence repeat count	0
0xC0F8	Last Sequence	SequenceEndingPosition	RW	4	1 to 10	Last sequence number setting	1

GigE Transport Layer

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0xA418	Payload size	PayloadSize	R	4		Return image size of 1 frame	
0x0000	GigE Major Version	GevVersionMajor	R	4		Version of the GigE Standard to which the device is compliant.	0001
	GigE Minor Version	GevVersionMinor					0000
0x0004	Is Big Endian	GevDeviceModeIsBigEndian	R	4	0:Littel-endian 1:Big-endian	0:Little endian 1:Big endian 1:UTF-8	1
	Character set	GevDeviceModeCharacterSet			0:Unknown ,1:UTF-8		1
0x0008	MAC address	GevMacAddress	R	4		Upper 4 bytes of the MAC address	
0x000c	MAC address	GevMacAddress	R	4		Lower 4 bytes of the MAC address	
0x0010	Support LLA	GevSupportedIPConfigurationLLA	R	4	Bit 31: persistent Bit 30: DHCP	Bits can be OR-ed. All other bits are reserved and set to	All True

	Support DHCP	GevSupportedConfigurationDHCP			Bit 29: LLA	0. DHCP and LLA bits must be on.	
	Support Persistent IP	GevSupportedConfigurationPersistentIP					
0x0014	Current IP configuration LLA	GevCurrentIPConfigurationLLA	RW	4	Bit 31: persistent Bit 30: DHCP Bit 29: LLA	Bits can be OR-ed. LLA is always activated and is read only.	LLA is always true
	Current IP configuration DHCP	GevCurrentIPConfigurationDHCP					
	Current IP configuration Persistent IP	GevCurrentIPConfigurationPersistentIP					
0x0024	Current IP address	GevCurrentIPAddress	R	4			
0x0034	Current Subnet Mask	GevCurrentSubnetAddress	R	4			
0x0044	Current Default Gteway	GevCurrentDefaultGateway	R	4			
0x0200	First URL	GevFirstURL	R	512		File extension .XML indicates uncompressed text file. File extension .ZIP indicates compressed using ZIP.	
0x0400	Second URL	GevSecondURL	R	512			
0x0600	Number Of Interfaces	GevNumberOfInterfaces	R	4		Indicates the number of physical network interfaces on this device.	
0x064C	Persistent IP Address	GevPersistentIPAddress	RW	4		Valid if Persistent IP is enabled	
0x065C	Persistent Subnet Mask	GevPersistentSubnetMask	RW	4		Valid if Persistent IP is enabled	
0x066C	Persistent Default Gateway	GevPersistentDefaultGateway	RW	4		Valid if Persistent IP is enabled	
0x0900	Message Channel Count	GevMessageChannelCount	R	4		number of available message channel	
0x0904	Stream Channel Count	GevStreamChannelCount	R	4		number of available stream channel	
0x0934	Supported Optional Commands User-defined Name	GevSupportedOptionalCommandsUser-definedName	R	4	Bit 31:multiple read Bit 30:WRITEMEM Bit29: PACKETRESEND Bit 28:EVENT Bit 27:EVENTDATA Bit 1:Serial No. Bit 0:User defined name 0=false 1=True	This is a capability register indicating which one of the non-mandatory GVCP commands are supported by this device.	
	Supported Optional Commands Serial number	GevSupportedOptionalCommandsSerialnumber					
	Supported Optional Commands EVENTDATA	GevSupportedOptionalCommandsEVENTDATA					
	Supported Optional Commands EVENT	GevSupportedOptionalCommandsEVENT					
	Supported Optional Commands PACKET RESEND	GevSupportedOptionalCommandsPACKETRESEND					
	Supported Optional Commands WRITEMEM	GevSupportedOptionalCommandsWRITEMEM					
	Supported Optional Commands Concatenation	GevSupportedOptionalCommandsConcatenation					
0x0938	Heartbeat Timeout	GevHeartbeatTimeout	RW	4	0 ～4294967295		0
0x093C	Timestamp Tick Frequency	GevTimestampTickFrequency	R	4	Timestamp tick frequency is 0 if timestamp is not supported.	In milliseconds. Internally, the heartbeat is rounded according to the clock used for heartbeat.	
0x0940		GevTimestampTickFrequency	R	4		64-bit value indicating the number of timestamp clock ticks in 1 second. This register holds the most significant bytes.	

0x0944	Timestamp control Latch	GevTimestampcontrolLatch	W	4	Command 2	This register holds the least significant bytes. Used to latch the current timestamp value. No need to clear to 0.	
	Timestamp control Reset	GevTimestampcontrolReset			Command 1		
0x0948	Timestamp Tick Value	GevTimeStampValue	R	4	High	Latched value of the timestamp (most significant bytes)	
0x094C		GevTimeStampValue	R	4	Low	Latched value of the timestamp (least significant bytes)	
0x0A00	Control Channel Privilege Feature	GevCCP	R	4	0:Open Access 1:Exclusive 2:Control 3:Exclusive Control	control channel privilege register	0
0x0B00	Message Channel Port	GevMCPHostPort	R	4		message channel port register	0
0x0B10	Message Channel Destination Address	GevMCDA	R	4		message channel destination address register	
0x0B14	Message Channel Transmission Timeout	GevMCTT	R	4		message channel transfer timeout: ms	300
0x0B18	Message Channel Retry Count	GevMCRC	R	4		message channel retry count	2
0x0D00	Stream Channel Port	GevSCPHostPort	R	4		primary stream port register	
0xD04	Fire Test Packet	GevSCPSFireTestPacket	RW	4	1	The device will fire one test packet of size specified by the packet size. The don't fragment bit of IP header must be set for this test packet.	
0x0D04	Packet Size	GevSCPSPacketSize	RW	4	1476 ～16020	primary stream channel packet size register/ packet size includes IP, UDP&GVSP Header	1476
	Do Not Fragment	GevSCPSDoNotFragment			0=False 1=True	This bit is copied into the "don't fragment Ebit of IP header of each stream packet. It can be used by the application to prevent IP fragmentation of packets on the stream channel.	1
0x0D08	Packet Delay	GevSCPD	RW	4	0 ～ 125000	Set the delay in between packets	0
0x0D18	Strem Channel Destination Address	GevSCDA	R	4		primary stream channel destination address register	

LUT Controls

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0xA200	LUT Enable	LUTEnable	R W	4			
0xD800 | 0xDFFC	LUT Value	LUTValue	R W	4	0 ～ 65535		0

Event Generation

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0xA610	Event Selector Acquisition Trigger	GevEventtreigger	RW	4	Selector Value 0	Event message ON/OFF	0
	Exposure Start	GevEventStartOfExposure			1		0
	Exposure End	GevEventEndOfExposure			2		0
	Frame Transfer Start	GevEventStartOfTransfer			3		0
	Frame Transfer End	GevEventEndOfTransfer			4		0
	Any Lines Any Edges	AnyLineAynyEdge			17		0
	Updated All Features	UpdatedAllFeatures			18		1
	Processing Done	ProcessingDone			19		1
	Video Parameters Changed	VideoParamsChanged			20		1
	Opposite Channel Parameters changed	DioTrigParamsChanged			21		1
	Device Reset	DeviceReset			31		1
	Event Notification	EventNotification			0=Disable 1=Enable		

User Sets

Address	Display Name (JAI Control Tool)	GenICam name	Read / Write	Size	Value / Range of value	Description	Default value
0xA300	UserSet Save	UserSetSave	W	4	1=User area1	Allows use to save all camera settings. Last used area number becomes new default.	1
0xA304	UserSet Load	UserSetLoad	W	4	0=Factory area 1=User area1	Allow the user to recall all camera settings.	0
0xA308	UserSet Selector	UserSetSelector	RW	4	Whenreceiving following commands,store the parameters 0xA300 0xA304	Check the used data, 0=Factory or1=User	0

Appendix

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.

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 that sea shipment instead of air flight be used in order to limit the influence of cosmic rays on the 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.

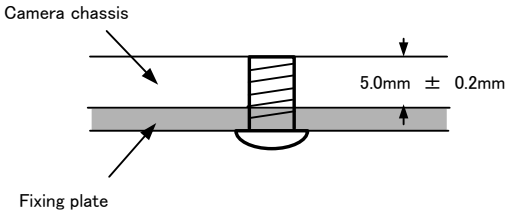
Patterned Noise
When the sensor captures a dark object at high temperature or is used for long time integration, fixed pattern noise may appear in the image.

3. Caution when mounting a lens on the camera

When mounting a lens on the camera dust 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.

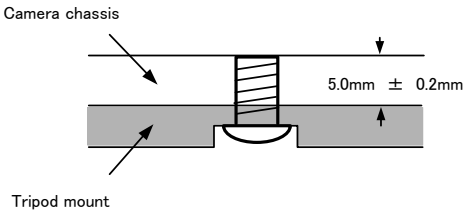
4. Caution when mounting the camera

When you mount the camera on your system, please make sure to use screws of the recommended length described in the following drawing. Longer screws may cause serious damage to the PCB inside the camera.



Mounting the camera to fixing plate

If you mount the tripod mounting plate, please use the provided screws.



Attaching the tripod mount

5. Exportation

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

6. References

1. This manual for AD-081GE can be downloaded from www.jai.com
2. Datasheet for AD-081GE can be downloaded from www.jai.com
3. JAI SDK software can be downloaded from www.jai.com

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Change History

Month/Year	Revision	Changes
Oct 2009	1.0	New release
Dec 2009	1.1	Add functions, high dynamic range mode 5 and 6.
		Modify the register map exclusively for AD-081GE

User's Record

Camera type: **AD-081GE**

Revision: ……..

Serial No. ……..

Firmware version. ……..

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

User's Mode Settings.

User's Modifications.

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