See the possibilities

# User Manual

# AT-030MCL

## Digital 3CCD Progressive Scan RGB Color Camera

**Document Version: Ver.1.1**
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1042E-1210

## 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 AT-030MCL complies with the following provisions applying to its standards.
EN 61000-6-3 (Generic emission standard part 1)
EN 61000-6-2 (immunity)

### FCC

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment I a residential area may cause harmful interference, in which case the user will be required to correct the interference at his own expense.

## 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.

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## 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<br>( Pb ) | 汞<br>( Hg ) | 镉<br>( Cd ) | 六价铬<br>( Cr(Ⅵ) ) | 多溴联苯<br>( PPB ) | 多溴二苯醚<br>( PBDE ) |
| 棱镜 | × | ○ | ○ | ○ | ○ | ○ |
| 光学滤色镜 | × | ○ | × | ○ | ○ | ○ |
| ..... | ..... | ..... | ..... | ..... | ..... | ..... |

○: 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。）

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数字「15」为期限15年。

## Table of Contents

# 1. General

The AT-030MCL is a digital 3CCD progressive scan RGB color camera. It employs three 1/3-inch 659 (h) x 494 (v), 320K pixel CCDs and it runs at the high speed of 120 frames per second in full resolution mode. The AT-030MCL has a Camera Link® interface and its output can be either 8-bit through a Camera Link Base configuration, or 10-bit or 12-bit through a Camera Link Medium configuration. JAI developed an upgraded 1/3-inch compact F2.0 prism optical system and, in combination with a linear color matrix circuit, the AT-030MCL provides a higher fidelity of color reproduction than in earlier 1/3-inch models. The AT-030MCL also incorporates a shading circuit, gamma correction circuit and knee correction circuit to provide high picture quality. Functions like partial scanning and vertical binning allow higher frame rates.

The latest version of this manual can be downloaded from: www.jai.com
The latest version of Camera Control Tool for AT-030MCL can be downloaded from: www.jai.com

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

# 2. Camera nomenclature

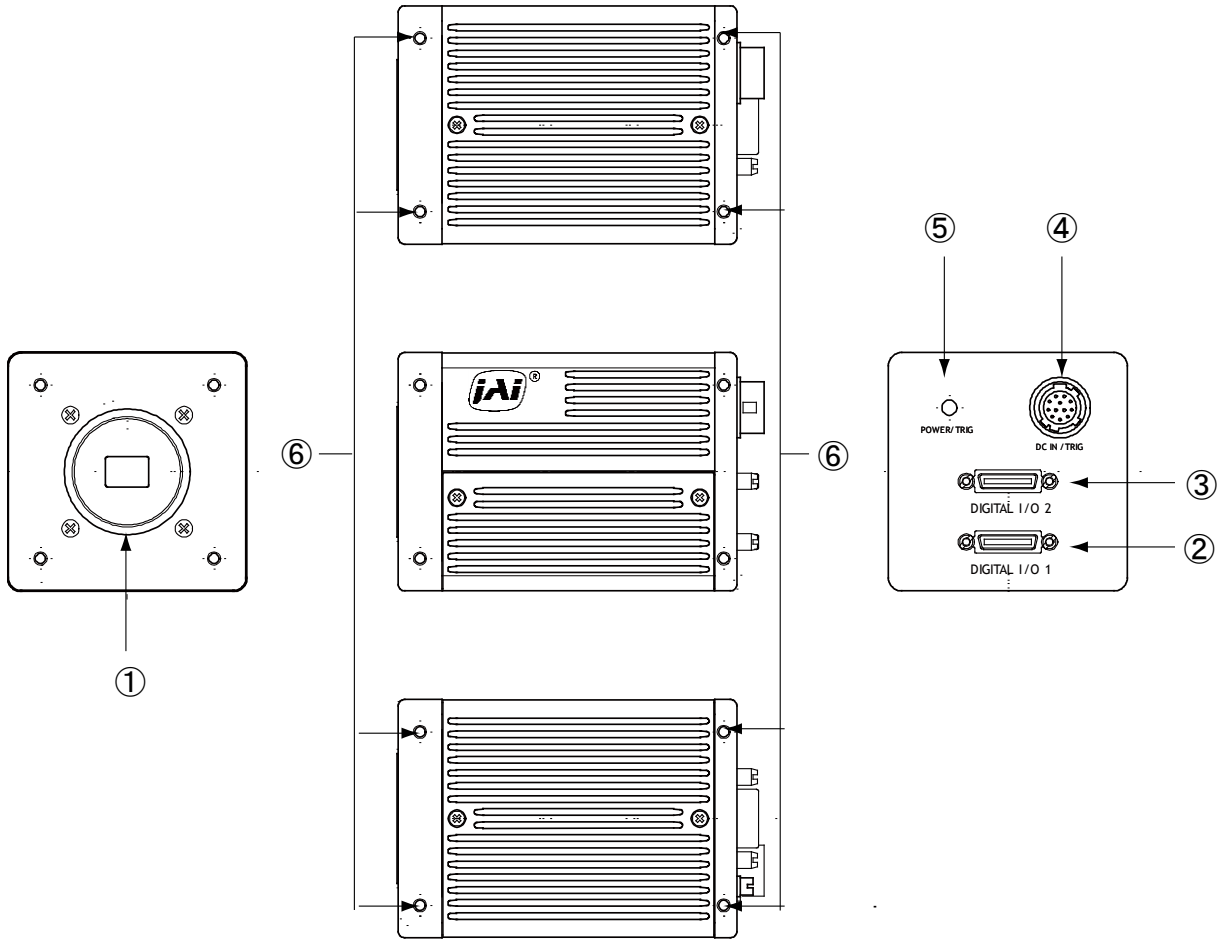
The standard camera composition consists of the camera main body and C-mount protection cap.

The camera is available in the following versions:
**AT-030MCL**
Where A stands for "Advanced" family, T stands for "3 CCD", 030 represents the resolution "320 thousand pixels" , and **CL** stands for "Camera Link" interface.

## 3. Main Features

- 3 x 1/3" CCD progressive scan RGB color camera for vision applications
- 3 x 659(h) x 494 (v) 7.4μm effective square pixels
- Compact RGB prism for C-mount lenses
- Shading reduction permits wider choice of lenses
- 120.49 frames per second with 659 (h) x 494 (v) pixels
- 436.68 fps with 659 (h) x 60(v) pixels in 1/8 partial scan
- In addition to fixed rate partial scan, variable partial scan is available
- Vertical binning for higher sensitivity and frame rate of 193.89 fps as the maximum
- 8-bit RGB output via single port Camera Link. 10-bit or 12-bit via dual port
- Gamma is selectable for 0.45 or 0.6 or LUT
- Linear matrix circuit with sRGB or Adobe RGB pre-setting
- Knee function available for knee point and knee slope settings.
- Noise reduction circuit (ON/OFF, level settings)
- Smearless mode available in EPS and PWC
- Edge Pre-select, Pulse Width Control , Fast PWC and Reset Continuous Trigger modes
- Pre-set shutter in the range from OFF(1/120) and 1/250 to 1/130,000, 10 steps
- Common or individual programmable exposure for RGB
- Auto exposure capability
- Manual, continuous, one push or pre-set white balance
- Analog iris video output for lens iris control

## 4. Locations and Functions




| | |
|---|---|
| 1. Lens mount | Lens mount of C-mount type. *1) |
| 2. Connector | Mini Camera Link base connector 1 *2) |
| 3. Connector | Mini Camera Link medium connector 2 *2) |
| 4. 12 pin connector | for DC power and trigger |
| 5. LED | Power and trigger indication |
| 6. Mounting holes | 8 x M3 depth 4.5mm for tripod mount plate or direct installation *3) |

*1) Note: Applicable C-mount lens should be designed for 3-CCD cameras. Rear protrusion on C-mount lens must be less than 4mm.
Be advised: when using a lens with the iris diaphragm fully open, vignetting on corners may occur.

*2) Note: When a Camera Link® cable is connected to the camera, please do not excessively tighten screws by using a driver. The Camera Link® 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) Note: The tripod adapter plate MP-41 can be used.

Fig. 1. Locations

# 5. Pin Assignment

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

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

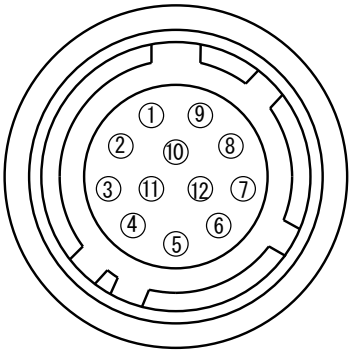



Fig. 2. 12-pin connector.

| Pin no. | Signal | Remarks |
|---|---|---|
| 1 | GND | |
| 2 | +12 V DC input | |
| 3 | GND | |
| 4 | Iris video | Continuous and RCT modes only |
| 5 | GND | |
| 6 | - | |
| 7 | - | |
| 8 | GND | |
| 9 | XEEN out | Negative logic |
| 10 | Trigger in | *1) |
| 11 | - | |
| 12 | GND | |

*1) 75 ohm termination can be selected by DIP SW600.
Note: If the trigger of Active High is input through 10pin, dummy pulses must be applied more than one time when the camera is activated.

## 5.2. Digital Output Connector for Camera Link

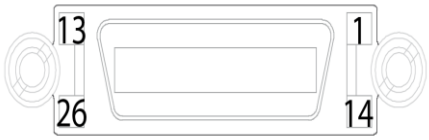



Fig.3. 26-pin connector

Type: 26 pin Mini Camera Link connector
Honda HDR-EA26LFYPG1+

The digital output signals follow the Camera Link standardized multiplexed signal output interface. Camera Link base configuration is used for 3 x 8-bit RGB signal and medium configuration is used for 3 x10-bit or 3 x12-bit. The interface circuit is built around the NS type DS90CR285MTD.

Port 1 (Used for 24bits, 30 bits, 36 bits)

| Pin No | In/Out | Name | Note |
|---|---|---|---|
| 1,26 | | Shield | DC GND |
| 2(-),15(+) | O | TxOUT0 | Data out |
| 3(-),16(+) | O | TxOUT1 | |
| 4(-),17(+) | O | TxOUT2 | |
| 5(-),18(+) | O | TxClk | Clock for CL |
| 6(-),19(+) | O | TxOUT3 | Data out |
| 7(+),20(-) | I | SerTC (RxD) | Serial Communication |
| 8(-),21(+) | O | SerTFG (TxD) | |
| 9(-),22(+) | I | CC1 (Trigger) | External trigger |
| 10(+),23(-) | I | CC2 (Reserved) | |
| 13,14 | | Shield | DC GND |

Port2 (Used for 30bits, 36bits)

| Pin No | In/Out | Name | Note |
|---|---|---|---|
| 1,26 | | Shield | DC GND |
| 2(-),15(+) | O | TxOUT0 | Data out |
| 3(-),16(+) | O | TxOUT1 | |
| 4(-),17(+) | O | TxOUT2 | |
| 5(-),18(+) | O | TxClk | Clock for CL |
| 6(-),19(+) | O | TxOUT3 | Data out |
| 7(+),20(-) | | NC | |
| 8(-),21(+) | | NC | |
| 9(-),22(+) | | NC | |
| 10(+),23(-) | | Reserved | |
| 13,14 | | Shield | DC GND |

## 5.3. DIP switch SW-600

This switch can select ON or OFF of 75 ohm termination for trigger input.
The factory default setting is OFF which is TTL level.
SW-600 is located in the rear board.

| No | Functions | Setting | |
|---|---|---|---|
| | | ON | OFF |
| **1** | **Trigger input termination** | **75 Ω** | **TTL** |
| **2** | **NC** | **-** | **-** |

## 5.4. Rear Panel indication

The rear panel mounted LED provides the following information:

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

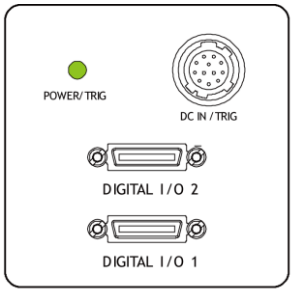



Fig.4. rear panel

# 6. Input and output circuits

This chapter introduces the basic diagram and bit allocation of digital output.

## 6.1. Iris video output

This signal can be used for lens iris control In Continuous and RCT modes. The signal is NUM luminance signal and passes through the gain circuit. However, due to reversed compensation applied, the gain settings do not influence this signal. The iris video output is 0.7 V p-p from 75 Ω and without sync. This signal is always output except EPS and PWC modes.

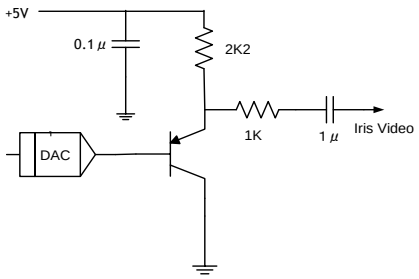



Fig. 5. Iris video output.

## 6.2. Trigger input

When TI=1, the trigger input is on pin #10 on the 12-pin connector. The input is AC coupled. To allow a long pulse width, the input circuit is a flip-flop, which is toggled by the negative or positive differentiated spikes caused by the falling or rising trigger edges. The trigger polarity can be changed by TP=1. Trigger input level is 4 V ±2 V. It can be terminated by SW600 : ON for 75Ω. OFF for TTL. The trigger inputs can be changed to Camera Link. (TI=0 for CL)

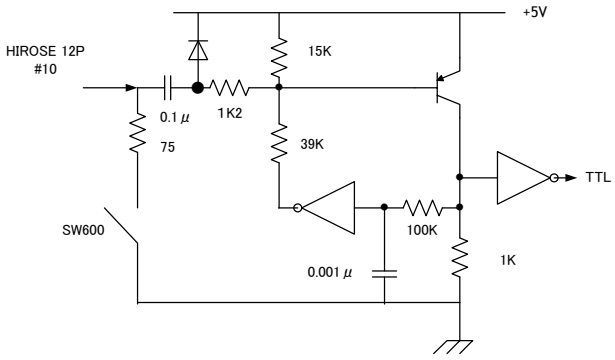



Fig. 6. Trigger input.

## 6.3. Digital output interface (Camera Link® interface)

The video output is Camera Link with 3 x 8 bits RGB video placed in a base configuration, or 3 x 10 bits or 3 x 12 bits RGB placed in a Camera Link medium configuration. The digital output signals follow the Camera Link standardized multiplexed signal output interface. The Camera Link output driver is NS type DS90CR285MTD.
The data bits from the digital video, FVAL, LVAL, DVAL and EEN are multiplexed into the twisted pairs, which are a part of Camera Link. Trigger signals and the serial camera control are fed directly through its own pairs. The trigger input can also be TTL on the 12-pin connector.
For details of the Camera Link® standard, visit the AIA web site www.machinevisiononline.org.

### 6.3.1 Camera Link® bit allocation

The AT-030MCL outputs an RGB signal via Camera Link. A 3 x 8-bit signal is allocated via a Base configuration through port 1, while a 3 x 10-bit or 3 x 12-bit signal is allocated via a Medium configuration through both port 1 and port 2.

On the next page, there is bit allocation table.
RD9～RD0 : R Channel Camera Data(RD9=MSB, RD0=LSB)
GD9～GD0 : G Channel Camera Data(GD9=MSB, GD0=LSB)
BD9～BD0 : B Channel Camera Data(BD9=MSB, BD0=LSB)

× : Not in use

| Port/Signal | 24 bits output | 30 bits output | 36 bits output | Connector | Pin No. |
|---|---|---|---|---|---|
| Port A0 | RD0 | RD0 | RD0 | Port 1 | Tx0 |
| Port A1 | RD1 | RD1 | RD1 | Port 1 | Tx1 |
| Port A2 | RD2 | RD2 | RD2 | Port 1 | Tx2 |
| Port A3 | RD3 | RD3 | RD3 | Port 1 | Tx3 |
| Port A4 | RD4 | RD4 | RD4 | Port 1 | Tx4 |
| Port A5 | RD5 | RD5 | RD5 | Port 1 | Tx6 |
| Port A6 | RD6 | RD6 | RD6 | Port 1 | Tx27 |
| Port A7 | RD7 | RD7 | RD7 | Port 1 | Tx5 |
| Port B0 | GD0 | RD8 | RD8 | Port 1 | Tx7 |
| Port B1 | GD1 | RD9 | RD9 | Port 1 | Tx8 |
| Port B2 | GD2 | × | RD10 | Port 1 | Tx9 |
| Port B3 | GD3 | × | RD11 | Port 1 | Tx12 |
| Port B4 | GD4 | BD8 | BD8 | Port 1 | Tx13 |
| Port B5 | GD5 | BD9 | BD9 | Port 1 | Tx14 |
| Port B6 | GD6 | × | BD10 | Port 1 | Tx10 |
| Port B7 | GD7 | × | BD11 | Port 1 | Tx11 |
| Port C0 | BD0 | BD0 | BD0 | Port 1 | Tx15 |
| Port C1 | BD1 | BD1 | BD1 | Port 1 | Tx18 |
| Port C2 | BD2 | BD2 | BD2 | Port 1 | Tx19 |
| Port C3 | BD3 | BD3 | BD3 | Port 1 | Tx20 |
| Port C4 | BD4 | BD4 | BD4 | Port 1 | Tx21 |
| Port C5 | BD5 | BD5 | BD5 | Port 1 | Tx22 |
| Port C6 | BD6 | BD6 | BD6 | Port 1 | Tx16 |
| Port C7 | BD7 | BD7 | BD7 | Port 1 | Tx17 |
| Port D0 | × | × | | Port 2 | Tx0 |
| Port D1 | × | × | | Port 2 | Tx1 |
| Port D2 | × | × | | Port 2 | Tx2 |
| Port D3 | × | × | | Port 2 | Tx3 |
| Port D4 | × | × | | Port 2 | Tx4 |
| Port D5 | × | × | | Port 2 | Tx6 |
| Port D6 | × | × | | Port 2 | Tx27 |
| Port D7 | × | × | | Port 2 | Tx5 |
| Port E0 | × | GD0 | GD0 | Port 2 | Tx7 |
| Port E1 | × | GD1 | GD1 | Port 2 | Tx8 |
| Port E2 | × | GD2 | GD2 | Port 2 | Tx9 |
| Port E3 | × | GD3 | GD3 | Port 2 | Tx12 |
| Port E4 | × | GD4 | GD4 | Port 2 | Tx13 |
| Port E5 | × | GD5 | GD5 | Port 2 | Tx14 |
| Port E6 | × | GD6 | GD6 | Port 2 | Tx10 |
| Port E7 | × | GD7 | GD7 | Port 2 | Tx11 |
| Port F0 | × | GD8 | GD8 | Port 2 | Tx15 |
| Port F1 | × | GD9 | GD9 | Port 2 | Tx18 |
| Port F2 | × | × | GD10 | Port 2 | Tx19 |
| Port F3 | × | × | GD11 | Port 2 | Tx20 |
| Port F4 | × | × | | Port 2 | Tx21 |
| Port F5 | × | × | | Port 2 | Tx22 |
| Port F6 | × | × | | Port 2 | Tx16 |
| Port F7 | × | × | | Port 2 | Tx17 |
| LVAL | | | | Port 1/2 | Tx24 |
| FVAL | | | | Port 1/2 | Tx25 |
| DVAL | | | | Port 1/2 | Tx26 |
| EEN | | | | Port 1/2 | Tx23 |

### 6.3.2 Digital Output (Bit allocation)

| CCD out | Analog Signal | Digital Out(24bit) | Digital Out(30bit) | Digital Out(36bit) |
|---|---|---|---|---|
| Black | Setup 3.6%, 25mV | 8LSB | 32LSB | 128LSB |
| 200mV | 700mV | 222LSB | 890LSB | 3560LSB |
| 230mV ↑ | 800mV | 255LSB | 1023LSB | 4095LSB |

Note: The above data is for the case when gamma is OFF.

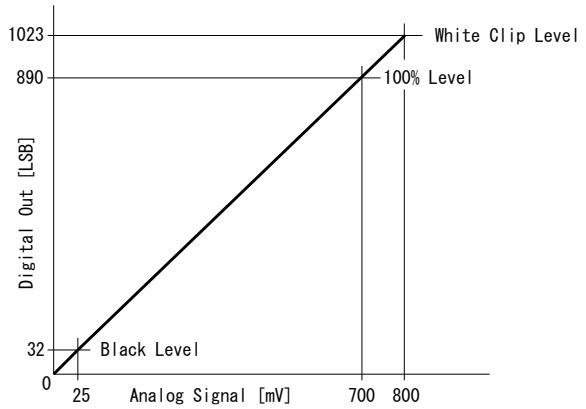



Fig.7. Digital output (10-bit output)

## 6.4. Auto iris video output level

This video output signal is NUM luminance signal and does not have SYNC. It is available only in Continuous mode and RCT mode. In the trigger mode, it is not available and also not available in partial scan mode.
This signal is not affected by the gain control.

| CCD out | Analog Out |
|---|---|
| 200mV | 700mV |
| 230mV ↑ | 800mV |

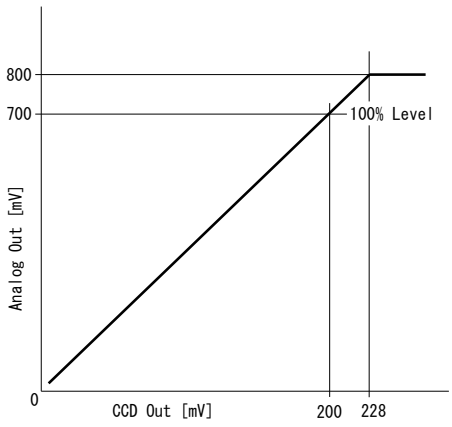



Fig.8. Iris video output

# 7. Functions and Operations

## 7.1. Basic construction

A 32-bit microprocessor controls all functions in the AT-030MCL camera. The CCD sensor output is normalized in CDS and preamplifiers. The signals are then digitized to 14 bits. Digital gain control, color matrix, look-up tables and setup can do signal processing in 14 bits before the signal is converted to a 12-, 10- or 8-bit Camera Link signal.

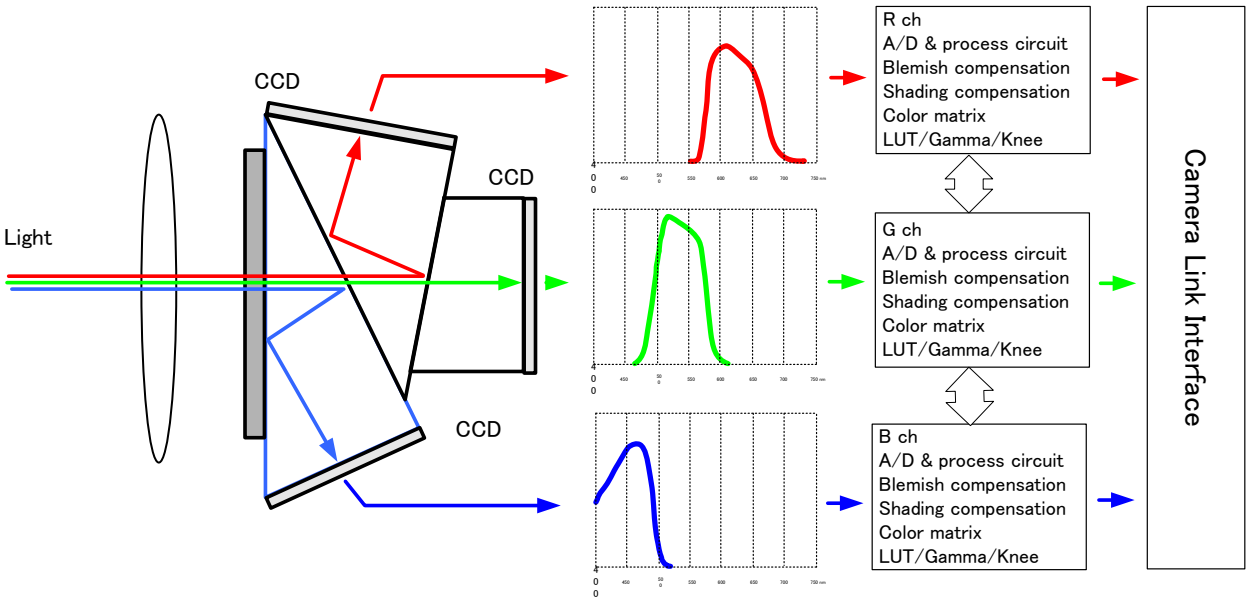
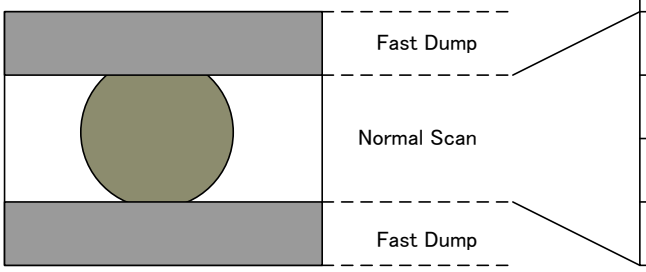



Fig. 9. Principle diagram for signal processing

## 7.2. Main functions

### 7.2.1 Partial scan (SC)

The partial scanning function uses the middle of the image vertically to achieve faster frame rates. This is very useful when capturing and inspecting an image which does not require the full height. The AT-030MCL has 4 types of pre-set partial scan modes: 2/3, 1/2, 1/4 and 1/8.




Example

| Mode | Start line | End line | Frame Rate |
|---|---|---|---|
| 2/3 | 84 | 411 | 168.69 fps |
| 1/2 | 124 | 369 | 208.01 fps |
| 1/4 | 186 | 307 | 319.03 fps |
| 1/8 | 217 | 276 | 436.68 fps |

Fig.10 Partial scan (pre-set)

In addition to pre-set partial scan modes, the AT-030MCL has a variable partial scan mode. The offset line can be set from the 1st line to 493th line and the height can also be set from 2 lines to 494 lines. In actual use, the offset line plus height must be within total lines.

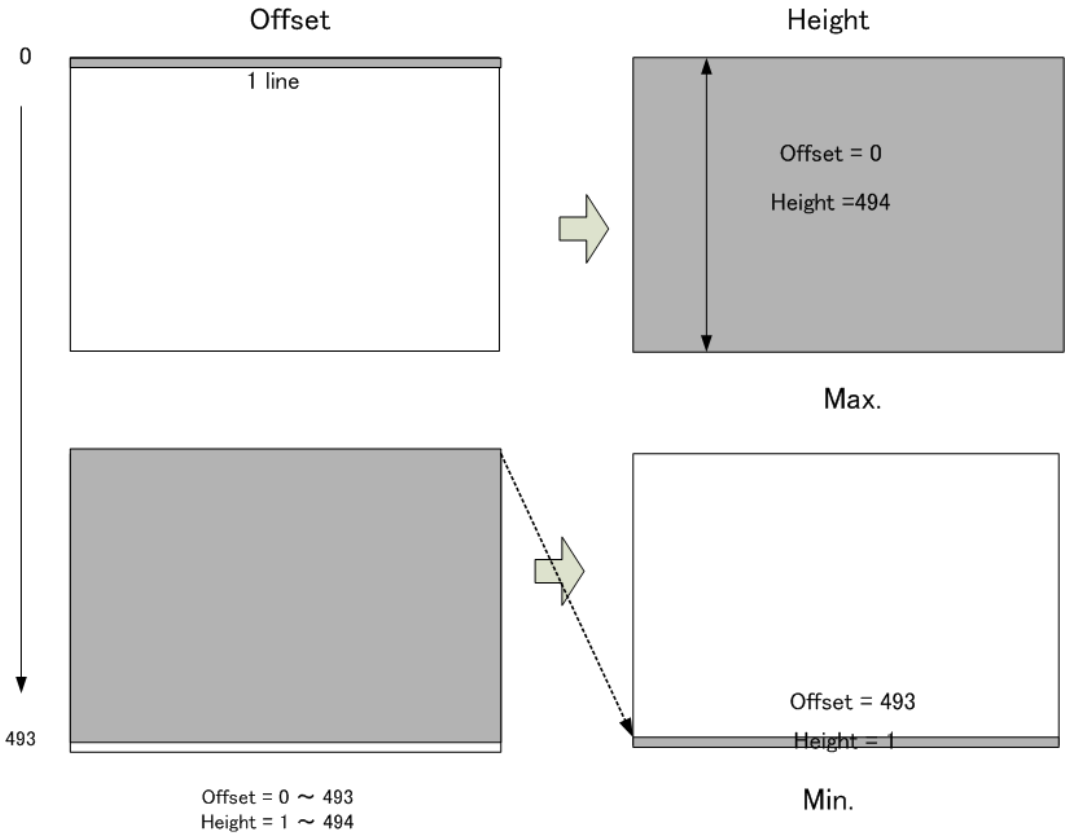



Fig.11. Variable Partial scan

◆ **How to calculate total line number and frame rate in variable partial scan mode**

Frame rate (fps) = Horizontal frequency(61571Hz) / Total lines

Total lines = Blanking period + Fast Dump period in the upper part of the frame (L) + Effective image period (L) + Fast dump period in the lower part of frame (L)

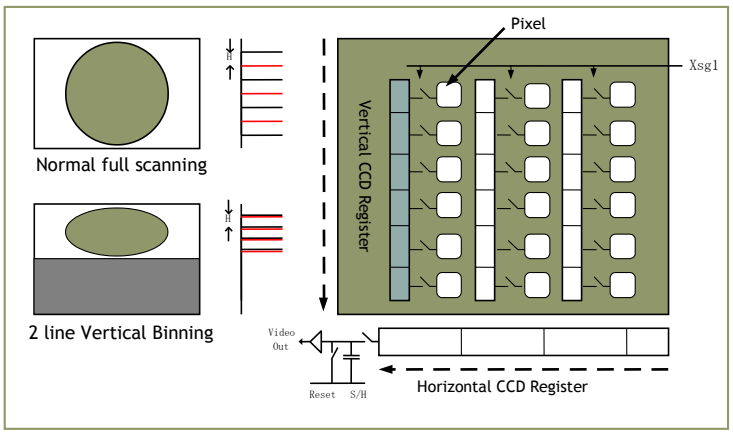
Where,
Blanking period = 4L (Fixed)
Fast dump period for the upper part = $\text{Round up}\left(\frac{\text{Offset}+9}{6}\right) + 2$
Effective image period = Height
Fast dump period for the lower part = $\text{Roud up}\left(\frac{494-(\text{Offset}+\text{Height})+2}{6}\right)$

Calculation example
Read out: 1/2 partial at the center , Height(246), Offset(123)

Blanking period =4L
Fast dump period for the upper part = (123 + 9) ÷6 +2=24
Effective image period = 246
Fast dump period for the lower part = (494-(123+246) + 2) ÷ 6 =21.1 → 22
Total lines = 4+24+246+22=296
Frame rate = 61571/296 =208.1 fps

### 7.2.2 Vertical Binning (VB)

Vertical Binning mode is a function where the signal charges from 2 adjacent (vertical) pixels are added together and read out as one pixel. Binning results in half vertical resolution but higher frame rate and sensitivity. The charge accumulated in 2 adjacent lines is added together in the horizontal CCD register. This is done by providing two pulses to the vertical CCD register for each line read out. Vertical binning cannot be used together with partial scanning.



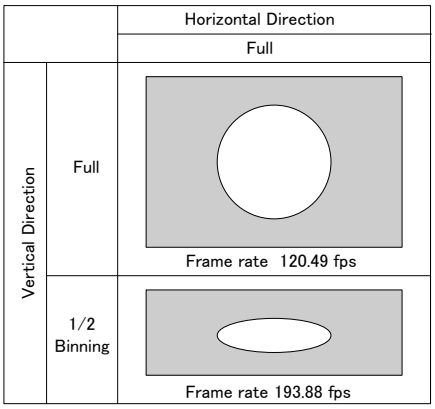




Fig. 12. Vertical Binning

| Setting | Effective/total | Horizontal Frequency | Frame rate |
|---|---|---|---|
| Off (No V Binning)) | 494/511 | 61.571 KHz | 120.49 frames/sec. |
| 2:1 V Binning | 247/257 | 49.828 KHz | 193.89 frames /sec. |

### 7.2.3 Electronic shutter (SM)

The AT-030MCL has the following shutter modes.

◆ **Pre-set shutter(SM-0)**

The setting command is from SH=0(OFF) to SH=10（1/130,000）
OFF(1/120),1/250,1/500,1/1000,1/2000,1/4000,1/8000,1/18,000,1/25,000,1/40,000 and 1/130,000s

Note: The actual exposure uses the programmable exposure (PE) method. When the camera receives a pre-set shutter value, it is converted to a programmable value inside the camera. So, the actual exposure might be slightly different from the pre-set value.

◆ **Programmable Exposure (PE) (RGB Common and RGB Individual)**

The setting command is PE and the exposure time can be controlled from 0L to 511L in 1 LVAL units (16.24μs). Calculating actual shutter speed requires adding 0.5L to the setting value. This is because there is 0.5L overhead.
The resulting range is from 0.5LVAL to 511LVAL. Setting 511L is Shutter OFF.
The programmable exposure can be set for R, G and B together (SM=1) or individually (SM=2) in EPS and RCT modes.

The shutter speed for each operation mode is shown below.

| Mode | Read Out | Minimum shutter speed | Maximum shutter speed |
|---|---|---|---|
| Continuous Edge Pre-select | Full Partial | 8.3850 µs at PE=0(1/130,000s) | 16.24µs x 511L=1 Frame (8.298 ms) (Note1) |
| | V binning | 8.4500 µs at PE=0(1/130,000s) | |
| Pulse Width | Full Partial | 16.24 µs x 2L+8.412( 0.5L)= 40.890 µs （≒1/24,456s） (Note2) | 240 Frames ( 2 seconds ) |
| | V Binning | 20.07 µs x 2L + 8.460µs(0.5L)= 46.0504µs （≒1/20,574s） (Note2) | |
| Fast PWC | Full Partial | 2.3 µs (1/434,900s) | 69 µs |
| | V Binning | 8.7 µs (1/119,000s) | |

Note1: If V-Binning and partial scan modes are used, the maximum shutter speed is limited by the programmable exposure value of total line numbers in one frame.
Note2: In Pulse Width mode, the minimum trigger pulse width requires more than 2LVAL.

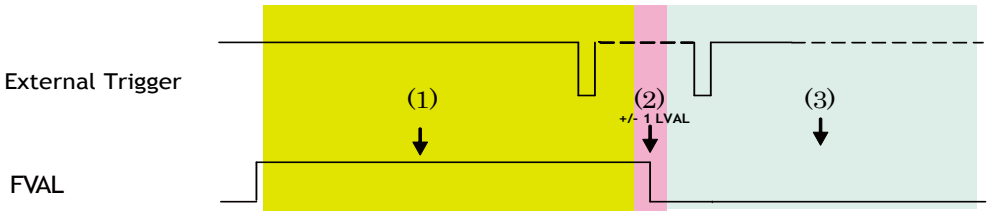
◆ Auto exposure

AT-030MCL has an automatic shutter function which sets the video at an appropriate level depending on illumination.

### 7.2.4 Auto-detect LVAL-sync / a-sync accumulation

This function replaces the manual setting found in older JAI cameras. Whether accumulation is synchronous or asynchronous in relation 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 and accumulation start.
When a trigger is received during FVAL low, the camera works in LVAL-asynchronous mode (no delay) mode.

This applies to both Edge Pre-select (EPS) trigger mode and Pulse Width Control (PWC) trigger mode.




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

Fig.13. Auto-detect LVAL sync/async accumulation

### 7.2.5 Shading compensation (SDM)

The AT-030MCL implements a digital shading compensation circuit for the white shading which could be caused in the prism or optical system. The whole image is divided horizontally and vertically and uses the center level as the reference. The circuit will compensate the difference between the center and each divided area. The range for compensation is a maximum of 30%.

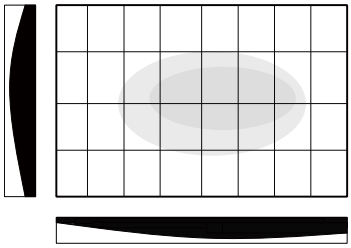


Fig.14 Shading compensation

Shading correction mode: SDM
0:OFF, 1:Factory shading, 2:User 1, 3:User2
These are used to load the stored data.

In order to calibrate the shading, use RS command, Recalibrate Shading correction. Param. 1 is used to store the calibration data in 0 for User 1 and 1 for User 2. User 1 and User 2 can store only one data set for either color shading or flat shading. Param. 2 can be set to 0 for Flat or 1 for Color and executes the shading correction and the storing of data.

Note: Conditions for lens used with AT-030MCL

In order to get an appropriate picture, it is recommended to use 1/3 inch or larger, 3CCD lenses. Shading is dependent on F value and focal length. Using a wide angle lens or using the lens fully open, will cause the shading characteristics to deteriorate.

AT-030MCL has two shading compensation circuits.

1. Color shading compensation
   In this mode, the shading is compensated using the G channel as the reference. Adjust R and B channels to match the characteristics of the G channel. Use white balance to match R, G and B levels.

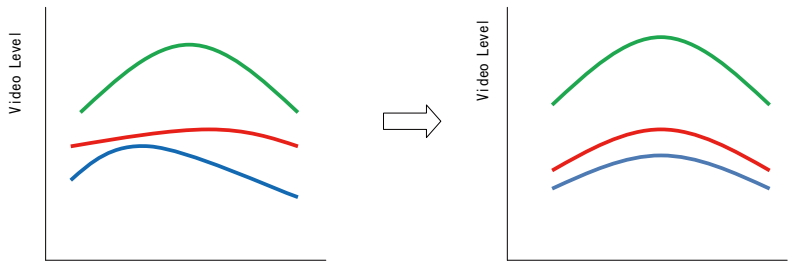



Fig.15 Conceptual drawing for color shading compensation

2. Flat shading compensation
   In this mode, each channel can be adjusted to achieve flat characteristics.

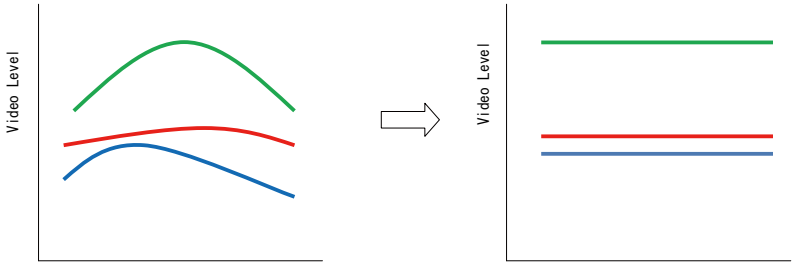



Fig.16 Conceptual drawing for flat shading compensation

### 7.2.6 White balance (WB)

The AT-030MCL has 4 white balance modes: manual balance, one push auto white balance, continuous auto white balance, and pre-set white balance.
The pre-set white balance can be set to 4000K, 4600K or 5600K.
The white balance of AT-030MCL is set under 4600K lighting in factory. When the camera is started up the first time, it is 4600K white balanced and R and B gain settings are 0.

For executing the white balance, the entire image is
divided into 64 areas, 8 for horizontal and 8 for vertical.
The following drawing is an example of using a 2 x 2 area in the image center.

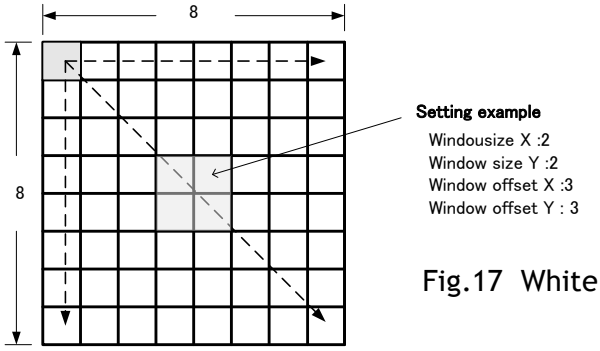



Fig.17 White balance measuring area

| | Continuous | One push | Manual |
|---|---|---|---|
| Tracking range | 3200K to 9,000K | 3200K to 9,000K | 3200K to 9,000K |
| Adjustable range | -7dB ～ +10dB | -7dB ～ +10dB | 7dB ～ +10dB |
| Store the setting value | No | Yes | Yes |

Note: In continuous mode, if the white part is not enough to make an adjustment, the white balance may not achieve a proper white color.
Note: The completion of one push auto white requires a maximum of 5 seconds to complete.

**Important Note:**
The range for setting white balance is -7dB to +10dB, if the master gain is set at 0dB. However, this range varies depending on the master gain setting.

For example:
If the master gain is set at -3dB (Command value is 92), the adjusting range for R channel is -5dB to +10dB. (Color temperature is more than 4600K)

If the master gain is set at +21dB (command value is 587), the adjusting range is -7dB to 0dB. (color temperature is more than 3200K)

### 7.2.7 Linear matrix (CMTX)

The AT-030MCL incorporates a linear color matrix circuit to improve color reproduction.
As this circuit processes signals in the linear stage, before the gamma correction circuit, the gamma circuit does not affect color reproduction.

This circuit has:
1. Linear OFF
2. sRGB Standard which HP and Microsoft specify for printer and monitor. This preset is based on this standard.
3. Adobe RGB Standard which Adobe systems specify. This preset is based on this standard.
4. User User can manipulate R, G and B color relationships based on applications. Set the gain for R-R, R-G, R-B, G-R, G-G, G-B, B-R, B-G, B-B to adjust.

**Important Note:**

If sRGB or Adobe RGB is used, please note the following procedure.

1) Achieve the white balance under the condition of D65 (6500K) illumination.
2) Gamma should be set at 0.45 and set the linear matrix at either sRGB or Adobe RGB.
3) Monitor should comply with sRGB or Adobe RGB color reproduction capability.

### 7.2.8 Gamma setting (LUTC)

The AT-030MCL has various gamma settings including LUT (Look Up Table). Gamma can be set OFF (1.0), 0.6, 0.45, or to exhibit characteristics set using LUT.
The drawing in the right shows the typical characteristics in the case of gamma ON (0.6/0.45).

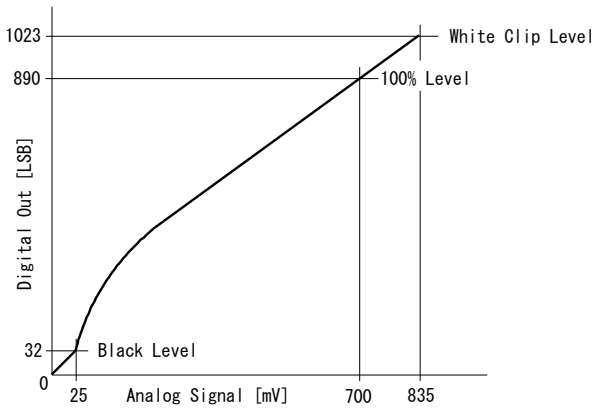



Fig.18. Gamma setting

| CCD out | Analog Signal | Digital Out(36bit) | Digital Out(30bit) | Digital Out(24bit) |
|---|---|---|---|---|
| Black | Setup 3.6%, 25mV | 128LSB | 32LSB | 8LSB |
| 200mV | 700mV | 3560LSB | 890LSB | 222LSB |
| 230mV ↑ | 800mV | 4095LSB | 1023LSB | 255LSB |

### 7.2.9 Knee compensation (KN)

If the relation of input and output is linear (1:1), the output signal is saturated at a certain level of the input signal and details cannot be reproduced in the saturated area. The knee compensation circuit maintains linear output up to a knee point and compresses the level after the knee point. This is set by a knee slope function. AT-030MCL supports up to 200% signal compression by knee slope. Factory default is OFF.

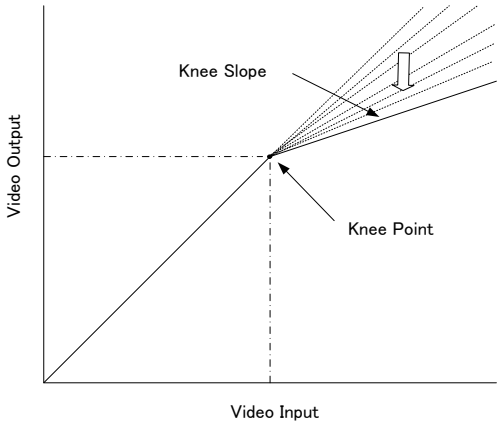



Fig.19. Example of Knee characteristics

| Functions | Data length | Setting range | Initial setting |
|---|---|---|---|
| Knee Point | 12bit | 0LSB ～ 4095LSB | 3434 |
| Knee Slope | 16bit | 0(x0.0) ～ 16383(x0.99999) | 8000 |

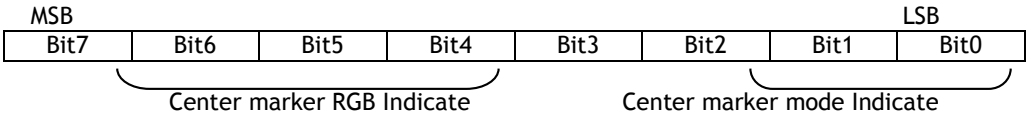
### 7.2.10 Test pattern generator

The AT-030MCL has an internal test pattern generator. These signals are output as the last process of the digital signal processing circuit and can be used for adjustment of the related system. The AT-030MCL has a total of 15 test pattern types.

### 7.2.11 Center marker

AT-030MCL is equipped with a center marker generator. The center marker can be configured by command CM. For the details, please refer to the chapter 10.3.

Bit construction




Center marker color setting
Bit6 : Indication for R channel (Effective if both or either of Bit0 and Bit1)
Bit5 : Indication for G channel (Effective if both or either of Bit0 and Bit1)
Bit4 : Indication for B channel (Effective if both or either of Bit0 and Bit1)

Indication settings for vertical and horizontal lines
Bit1 : Horizontal bar ON/OFF
Bit0 : Vertical bar ON/OFF

| CM Command Operation | Parameter | | CM Command Operation | Parameter | |
|---|---|---|---|---|---|
| | Hex | Decimal | | Hex | Decimal |
| OFF | 00H | 0 | | | |
| B ch Vertical | 11H | 17 | B+G ch Vertical | 31H | 49 |
| B ch Horizontal | 12H | 18 | B+G ch Horizontal | 32H | 50 |
| B ch Both | 13H | 19 | B+G ch Both | 33H | 51 |
| G ch Vertical | 21H | 33 | B+R ch Vertical | 51H | 81 |
| G ch Horizontal | 22H | 34 | B+R ch Horizontal | 52H | 82 |
| G ch Both | 23H | 35 | B+R ch Both | 53H | 83 |
| R ch Vertical | 41H | 65 | G+R ch Vertical | 61H | 97 |
| R ch Horizontal | 42H | 66 | G+R ch Horizontal | 62H | 98 |
| R ch Both | 43H | 67 | G+R ch Both | 63H | 99 |
| | | | B+G+R ch Vertical | 71H | 113 |
| | | | B+G+R ch Horizontal | 72H | 114 |
| | | | B+G+R ch Both | 73H | 115 |

As the Parameter, the above settings are set in Decimal.

# 8. Sensor Layout and timing

## 8.1. CCD Sensor Layout

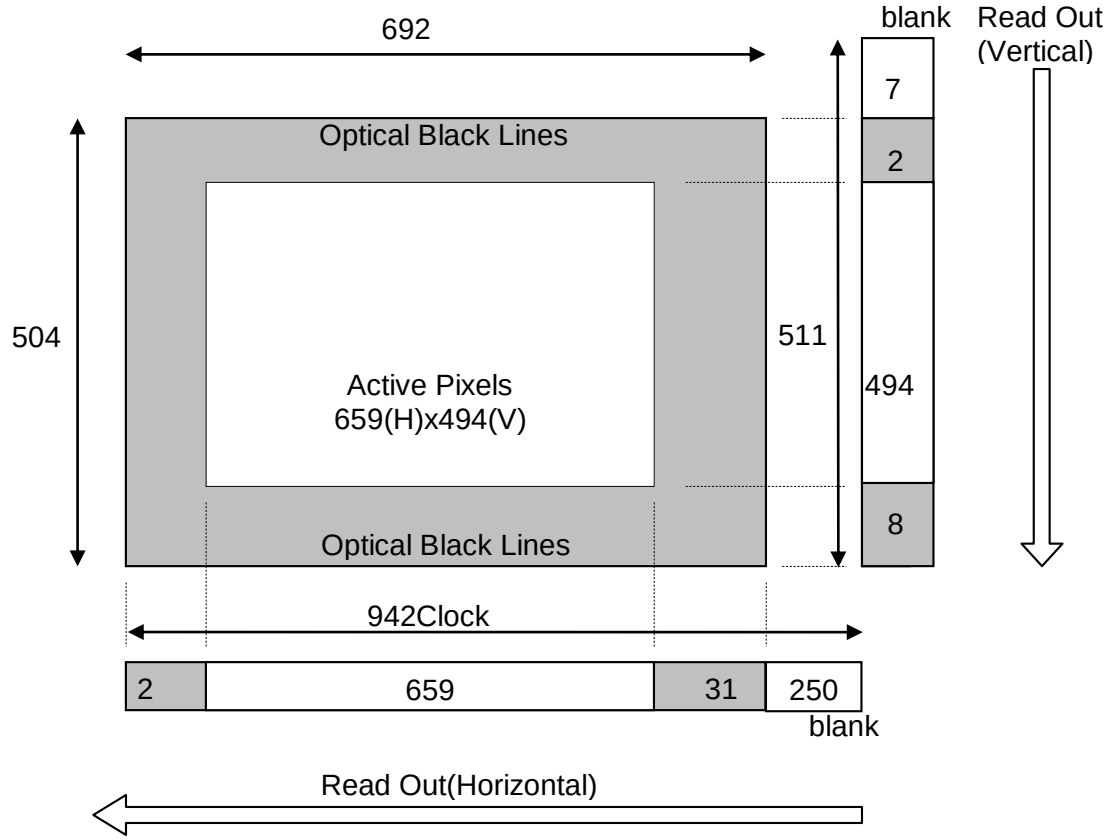



Fig. 20. CCD sensor layout

## 8.2. Normal continuous mode timing

### 8.2.1 Horizontal timing

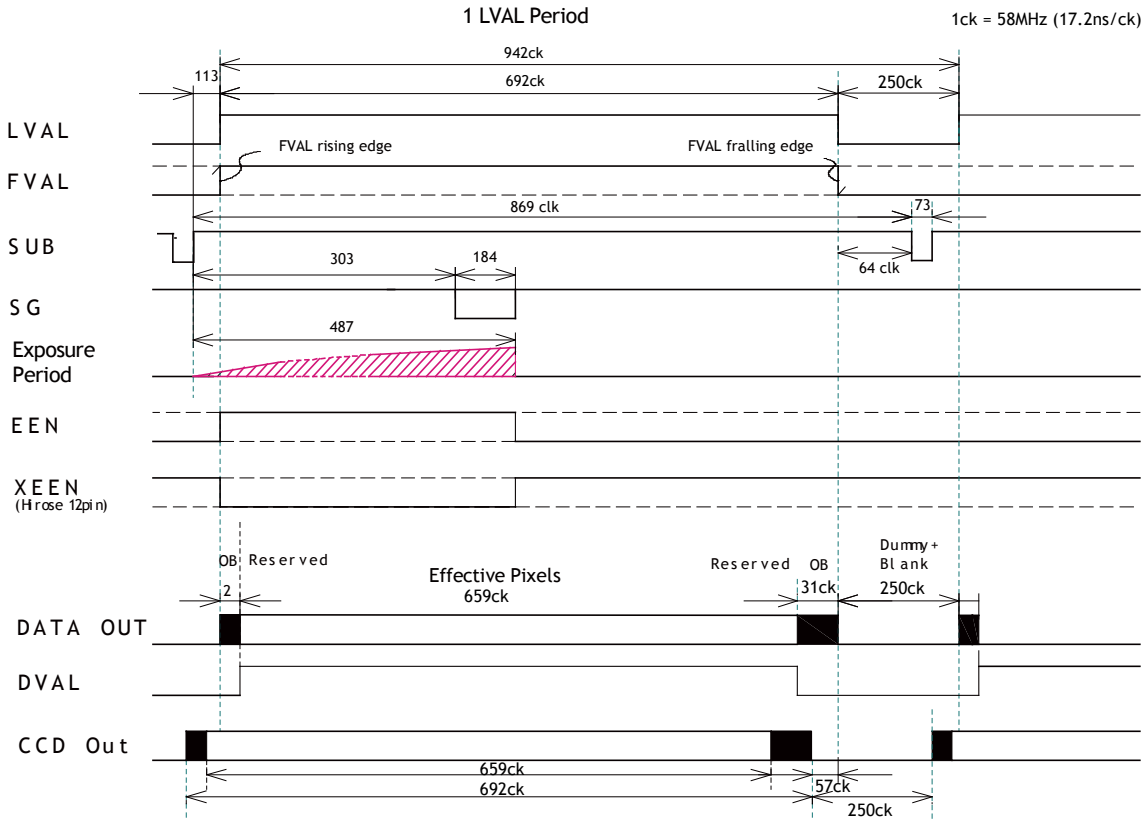



Fig. 21. Horizontal timing

### 8.2.2 Vertical timing

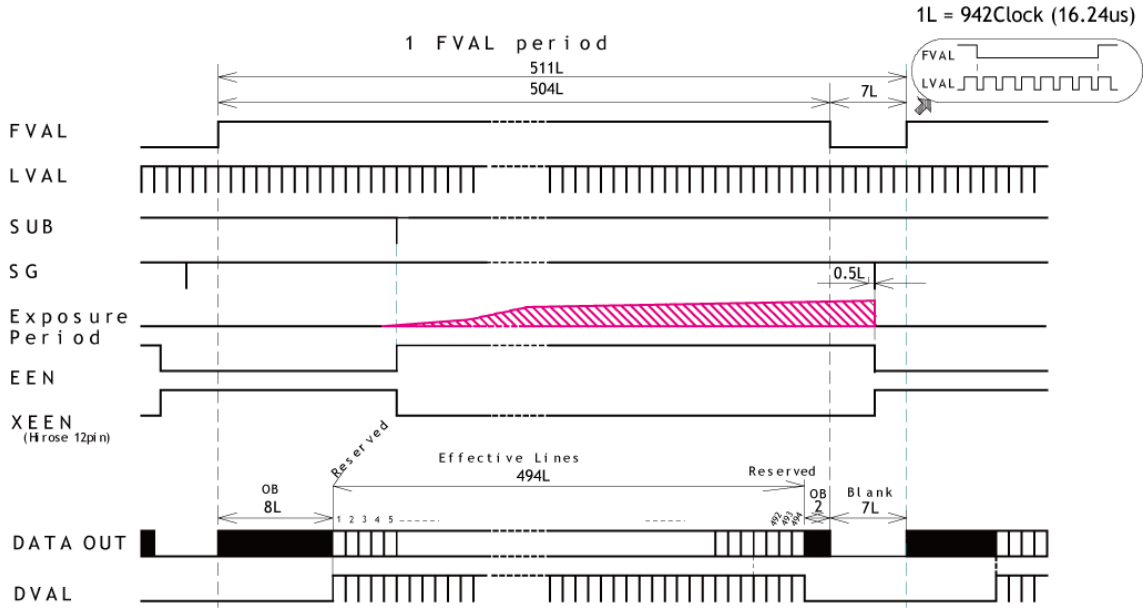



Fig. 22. Vertical timing for full scan

## 8.3. Partial scan timing

### 8.3.1 Horizontal timing

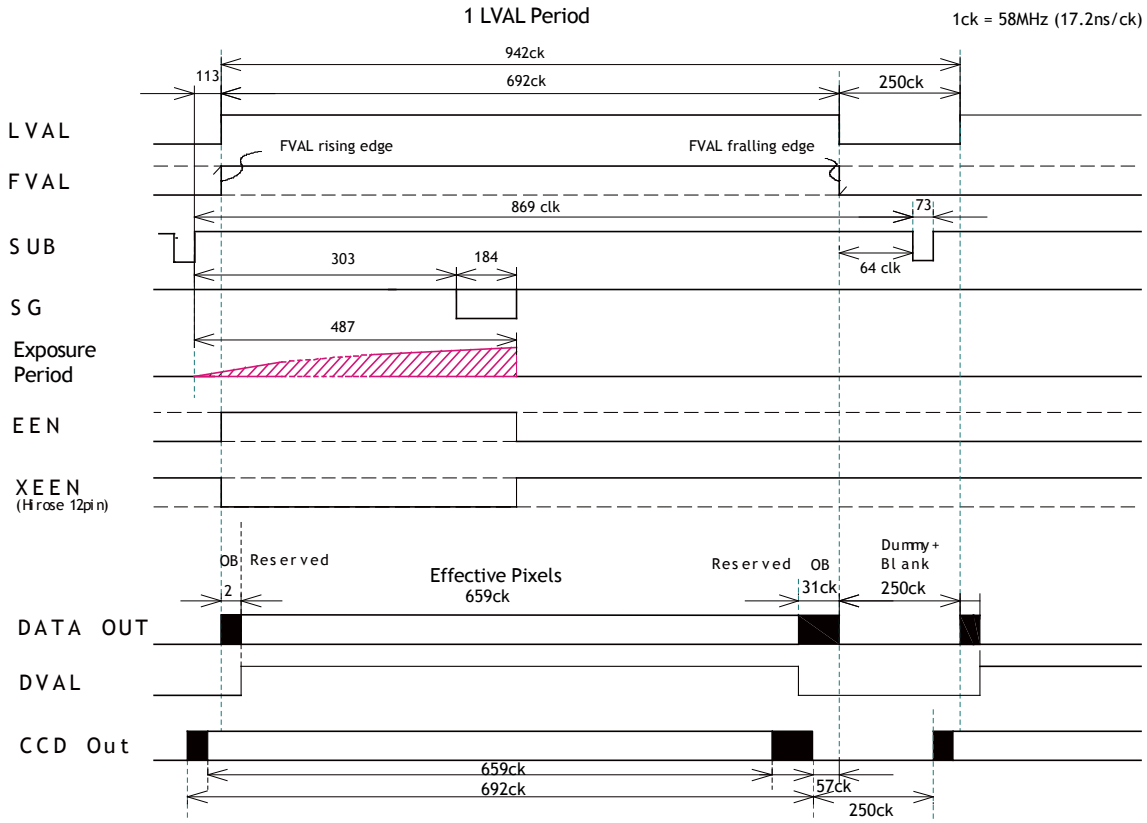



Fig.23 Horizontal timing ( Partial scan, the same as normal continuous)

### 8.3.2 Vertical timing

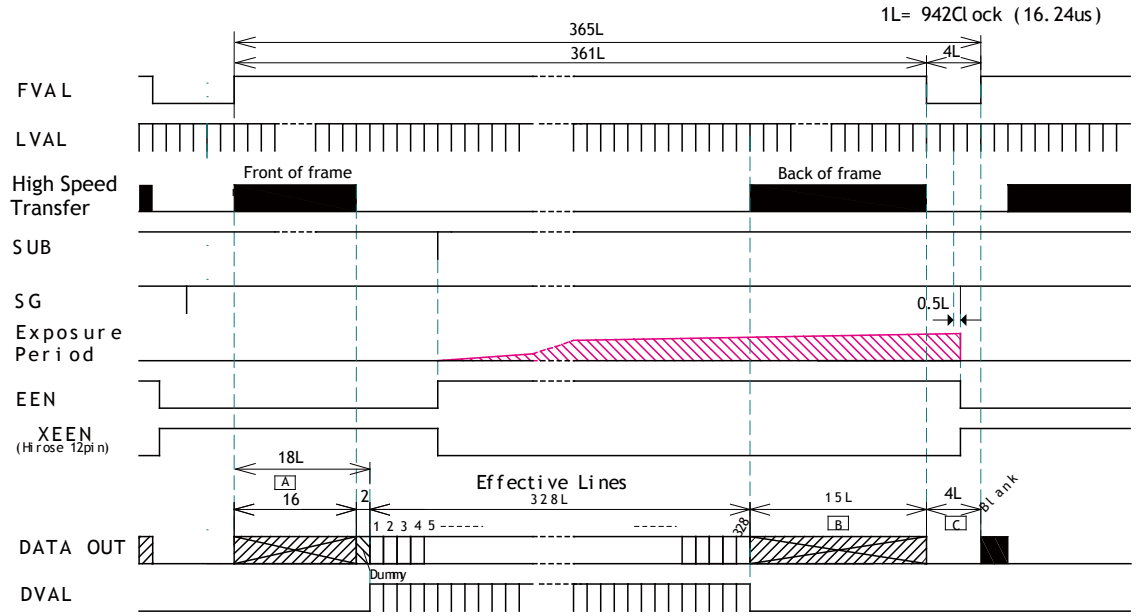
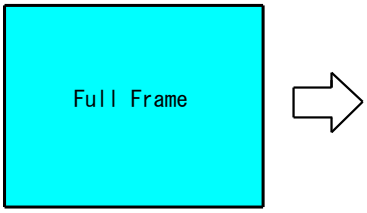
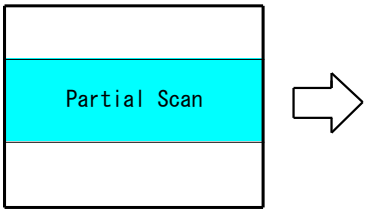



Fig. 24 Vertical timing ( 2/3 partial scan)

| | Option | Offset (Line) | Height (Line) | Start line | End line | Output image | Front of Frame -A- | Back of Frame -B- | Blank Of Frame -C- |
|---|---|---|---|---|---|---|---|---|---|
| 0 | Full screen | 0 ~ 493 | 494 ~ 1 | Offset + 1 | Offset + Height |   | 4 ~ 86 | 1 ~ 1 | 4 ~ 4 |
| 1 | 2/3 screen | 83 | 328 | 84 | 411 |   | 18 | 15 | 4 |
| 2 | 1/2 screen | 123 | 246 | 124 | 369 | | 24 | 22 | 4 |
| 3 | 1/4 screen | 185 | 122 | 186 | 307 | | 35 | 32 | 4 |
| 4 | 1/8 screen | 216 | 60 | 217 | 276 | | 40 | 37 | 4 |

## 8.4. Vertical binning

### 8.4.1 Vertical timing

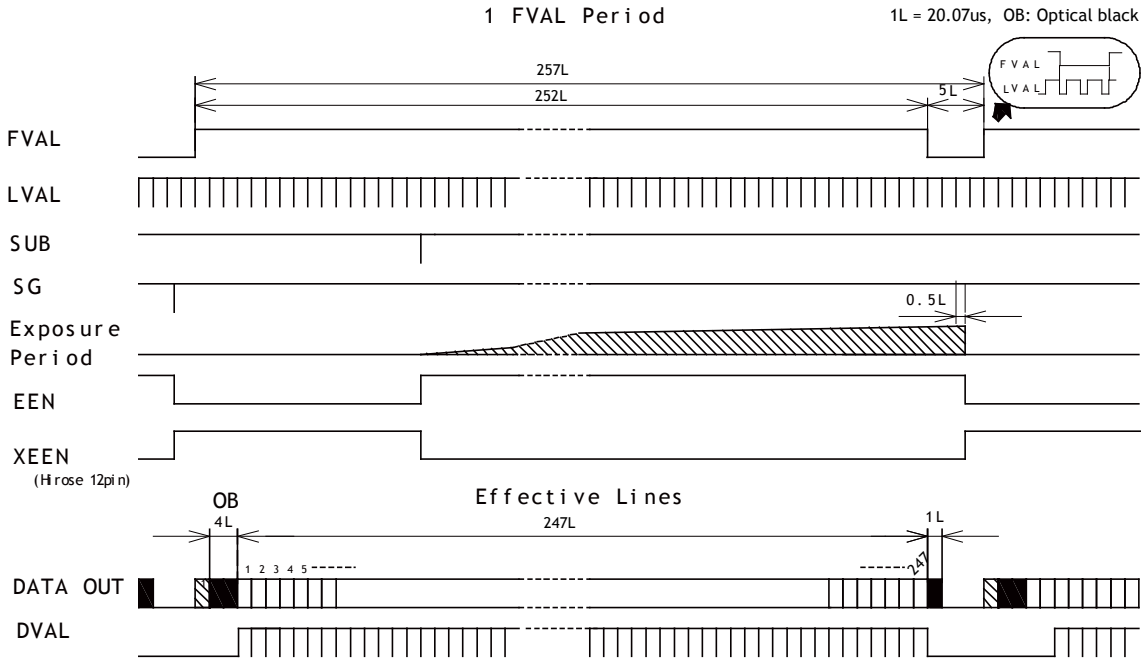



Fig.25. Vertical timing for V binning.

### 8.4.2 Horizontal timing

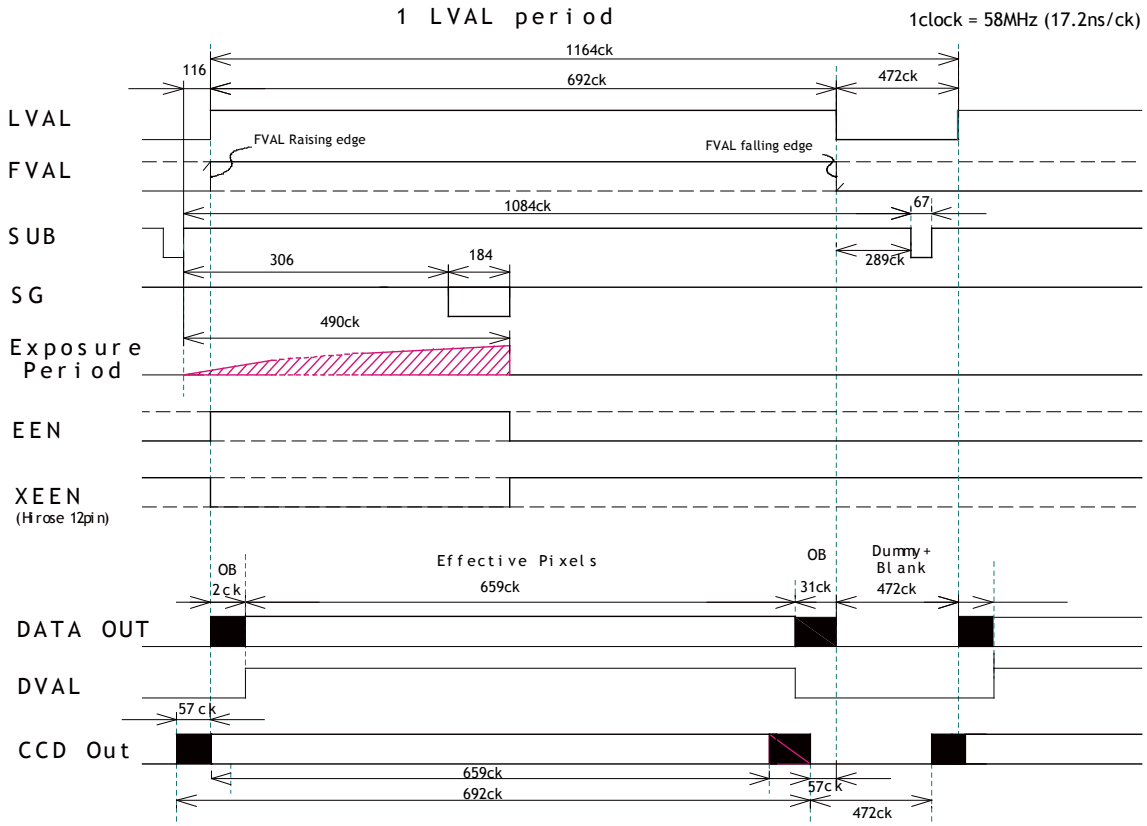



Fig. 26 Horizontal timing for V binning.

# 9. Operation Modes

This camera can operate in 5 primary modes.

| | | | | |
|---|---|---|---|---|
| *1.* | *TR=0* | *Con* | *Normal continuous Mode* | Pre-selected exposure. |
| *2.* | *TR=1* | *EPS* | *Edge Pre-select Mode* | Pre-selected exposure. |
| *3.* | *TR=2* | *PWC* | *Pulse Width Control Mode* | Pulse width controlled exposure. |
| *4.* | *TR=3* | *RCT* | *Reset Continuous Mode* | Pre-select exposure |
| *5.* | *SL* | | *Smearless Mode* | |

## 9.1. Continuous operation

For applications not requiring asynchronous external triggering, this mode should be used. In this mode it possible to use a lens with video controlled iris.

To use this mode:

| | | |
|---|---|---|
| Set function: | Trigger mode to “Continuous” | TR=0 |
| | Scanning | SC=0, 1 |
| | Vertical binning | VB=0, 1 |
| | Shutter mode normal, programmable | SM=0 ,1,3 |
| | Shutter speed | SH=0 through 10 |
| | Programmable exp. | PE=0 through 511 |
| | Other functions and settings | |

## 9.2. Edge Pre-select Trigger Mode

An external trigger pulse initiates the capture, and the exposure time (accumulation time) is the fixed shutter speed set by SH or PE. The accumulation can be automatically set either LVAL synchronous or LVAL asynchronous in relation to FVAL and trigger timing.
Refer to chaper 7.2.4
The resulting video signal will start to be read out after the selected shutter time.

To use this mode:

| | | |
|---|---|---|
| Set function: | Trigger mode to “Edge Pre-select” | TR=1 |
| | Scanning | SC=0, 1 |
| | Vertical binning | VB=0, 1 |
| | Shutter mode to normal or programmable | SM=0 through 2 |
| | Shutter speed | SH=0 through 10 |
| | Programmable exp. | PE=0 through 511 |
| | Other functions and settings | |
| Input: | Ext. trigger. Camera Link or 12 HiRose | TI=0, TI=1 |

Important notes on using this mode

- Active Trigger pulse >2 LVAL to <1 FVAL
- Minimum Trigger interval is shown in the following table.

### 9.2.1 EPS Timing (Programmable exposure common)

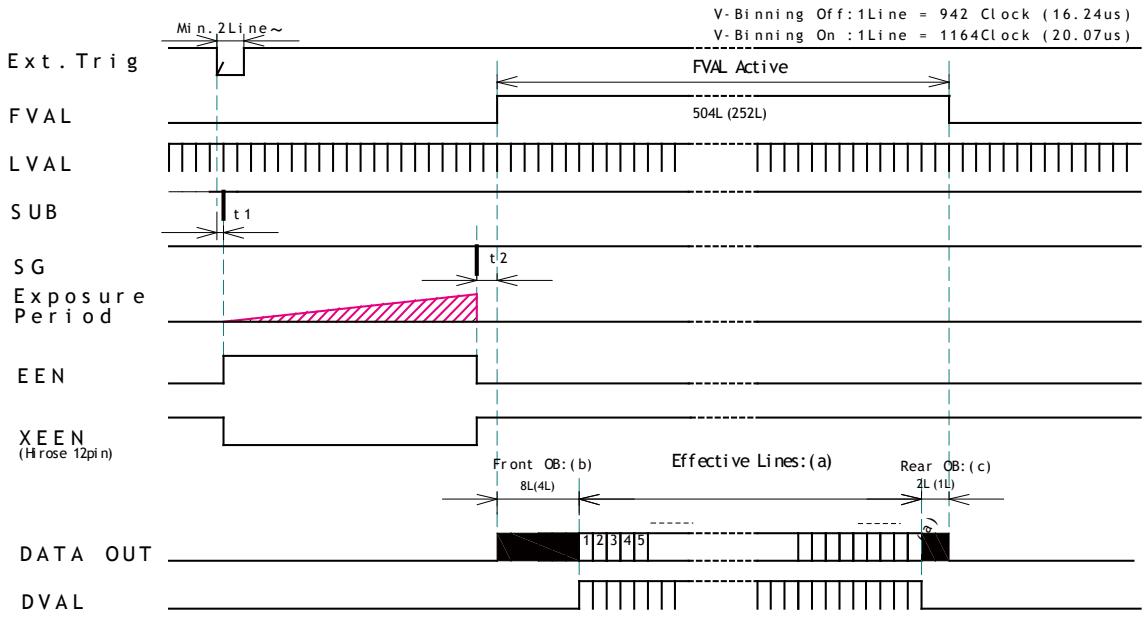
If the shutter mode is set at SM=1(Programmable Exposure (Common),

Minimum Trigger Interval

| Smear Less | Mode | Minimum trigger interval V-Binning OFF : 1L=16.24μs<br>V-Binning ON : 1L=20.07μs |
|---|---|---|
| OFF | LVAL Sync | 511L + 3L<br>◆Range for programmable exposure: 7L to 511L (Note1) |
| | LVAL Async | Programmable Exposure time + 511L + 3L |
| ON | LVAL Async | Smearless time(87L) + Programmable exposure time +511L + 3L |

On the above table, 511L is FVAL interval on normal continuous mode
1) In partial scan and the vertical binning modes, if programmable exposure value is larger than 511L, the programmable exposure value is used in this formula.
511L + 5L + (programmable exposure value – 511L) = programmable exposure value + 5L
2) In vertical binning mode, 1L is different from normal scanning. So, the minimum trigger interval will be different.

Note: If the trigger of Active High is input through 10pin, dummy pulses must be applied more than one time when the camera is activated.




Note: The value in ( ) is for V-Binning OB.

| LVAL Accumulation | V-Binning | t1 | t2 |
|---|---|---|---|
| LVAL Async | OFF | 7.7μs ~7.7μs + 1L | 5.6L ~6.6L |
| | ON | 15.7μs ~15.7μs + 1L | 3.6L ~4.6L |
| LVAL Sync | OFF | 4.2μs ~4.2μs + 1L | 5.6L |
| | ON | 8.0μs ~8.0μs + 1L | 3.6L |

Fig.27. Edge Pre-select.

### 9.2.2 EPS Timing (Programmable Exposure Individual)

If the shutter mode is set at SM=2 (Programmable Exposure(Individual)),

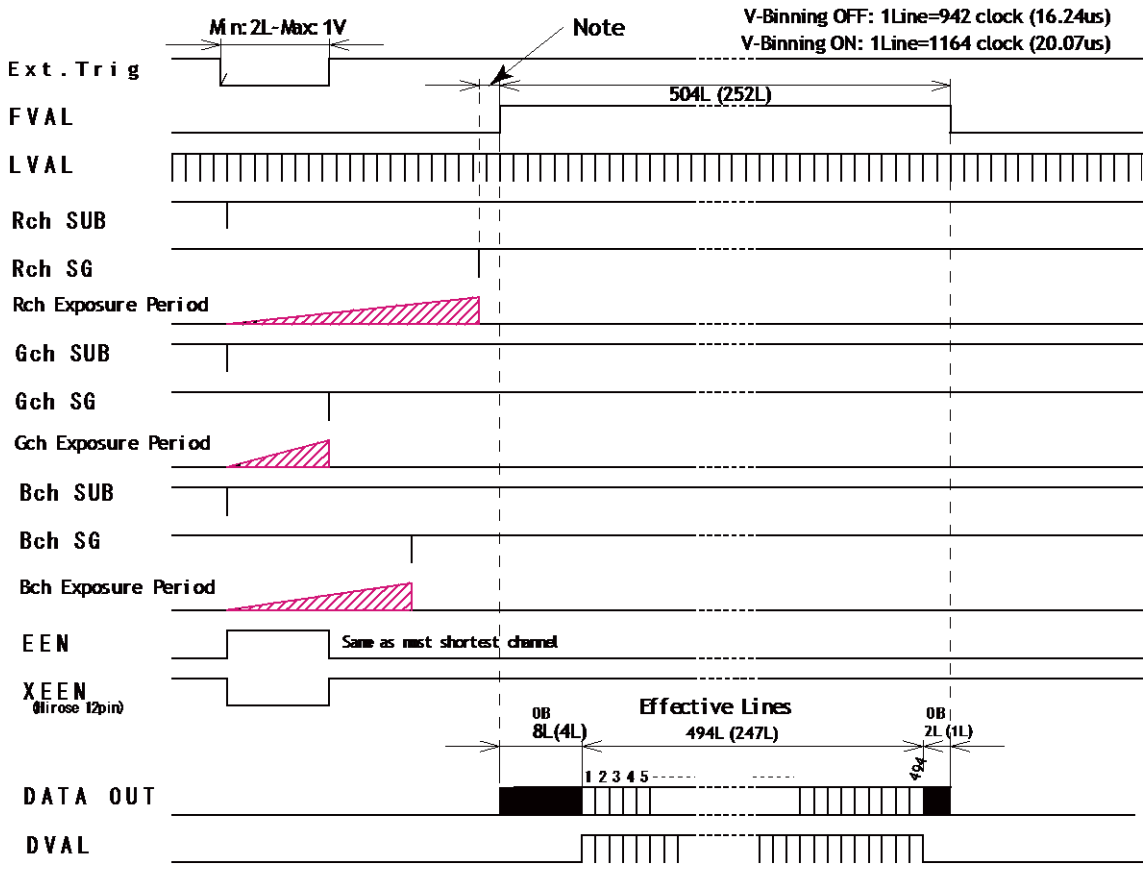
In the EPS trigger mode, if the programmable exposure is set at Individual, each exposure for R, G and B channels is executed when the trigger is input.
Each exposure is activated as it is set. The signal output for the channel with the smaller exposure time is held until the longest exposure is completed and then, all channels are read out.

**Minimum trigger interval**

| Smear less | Mode | Minimum trigger interval (Line) **Vertical Binning =Off、1L=16.24us** **Vertical Binning =On 、1L=20.07us** |
|---|---|---|
| **Off** | **LVAL Async** | **511L + [Maximum Programmable Exposure value among R,G and B channels] + 4L** |
| | **LVAL Sync** | **511L + [Maximum Programmable Exposure value among R,G and B channels] - [Minimum Programmable Exposure value among R,G and B channels]+ 5 L** ◆ **The range of Programmable Exposure: 7L to 511L (Note 1)** |
| **On** | **LVAL Async** | **(Smear less[87L] ) +[Maximum value of Programmable Exposure among R,G and B channels] ] + 511L + 3L (Note:2)** |

Note 1: In partial scan or V-binning mode, EPS programmable exposure value must be within total lines of 1 frame in continuous mode on each scan format.
Note 2: In partial scan or V-Binning mode, EPS programmable exposure value can be set at maximum 511L.

Note: If the trigger of Active High is input through 10pin, dummy pulses must be applied more than one time when the camera is activated.

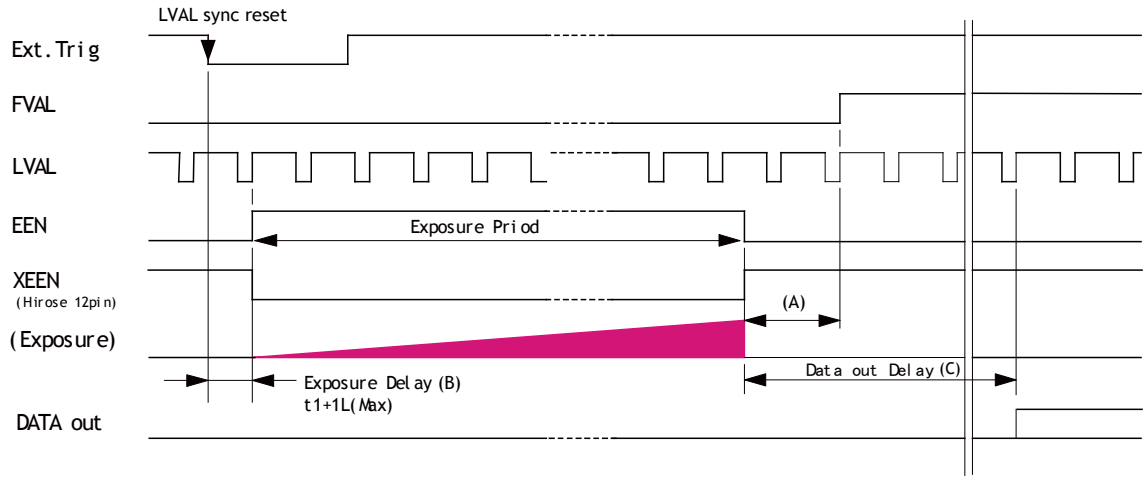



Note: The figure in ( ) is for V-Binning ON.

| | | |
|---|---|---|
| LVAL Async | V-Binning OFF | 5.6L ～ 6.6L |
| | V-Binning ON | 3.6L ～ 4.6L |
| LVAL Sync | V-Binning OFF | 5.6L |
| | V-Binning ON | 3.7L |

Fig.28 Edge Pre-select (Programmable Exposure Individual )

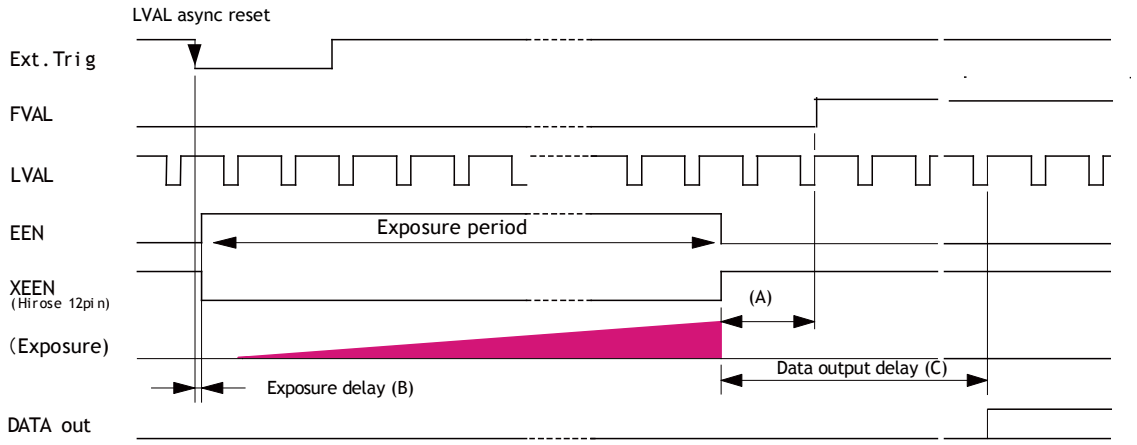
### 9.2.3 EPS timing LVAL sync details




| V-Binning | A | B | C |
|---|---|---|---|
| OFF | 5.6L | t1(4.2μs) + 1L (max) | 13.6L |
| ON | 3.6L | t1(8.0μs) + 1L(max) | 7.6L |

Fig.29 Edge Pre-select LVAL SYNC details

### 9.2.4 EPS timing LVAL async details




| V-Binning | A | B | C |
|---|---|---|---|
| OFF | 5.6L ～6.6L | 7.7μs) | 13.6L ～14.6L |
| ON | 3.6L ～4.6L | 15.7μs | 7.6L ～8.6L |

Fig.30 Edge Pre-select LVAL ASYNC details

## 9.3 Pulse Width Control 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 accumulation can be automatically set either LVAL synchronous or LVAL asynchronous in relation to FVAL and trigger timing. Refer to chapter 7.2.4. The maximum recommended exposure time is <2 seconds.
The resulting video signal will start to be read out after the trigger's rising edge.

To use this mode:

| | | |
|---|---|---|
| Set function: | Trigger mode to "Pulse width control". | TR=2 |
| | Scanning | SC=0 ,1 |
| | Vertical binning | VB=0, 1 |
| | Other functions and settings | |
| Input: | Ext. trigger. Camera Link or 12 Hirose | TI=0, TI=1 |

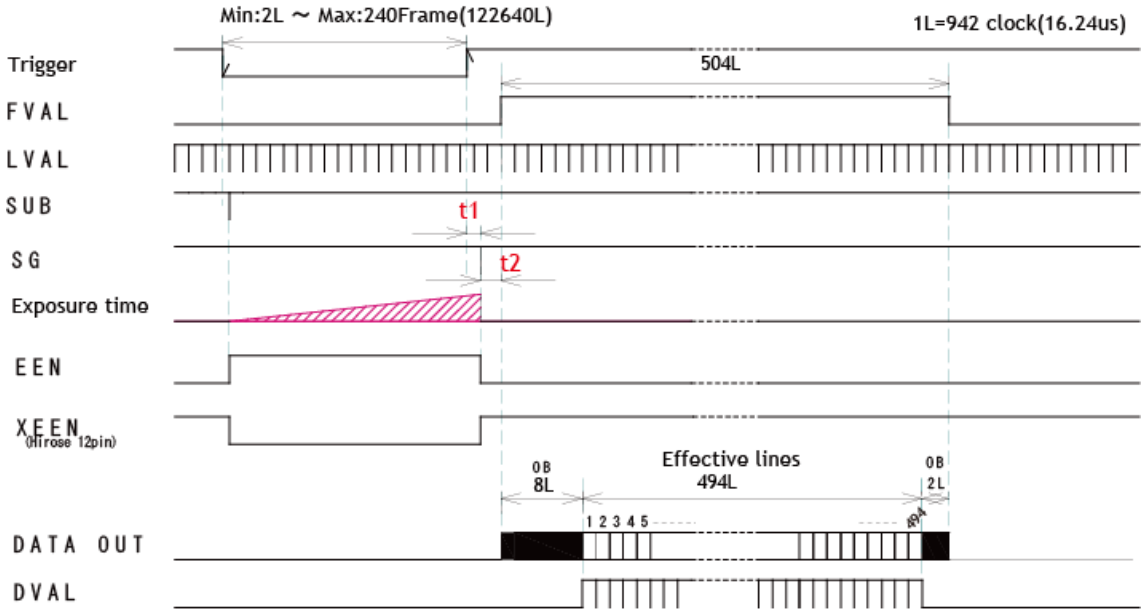
Important notes on using this mode

- Trigger pulse width >2 LVAL to <2 seconds.
- Minimum trigger interval is shown in the following table.

| **Smear Less** | **Mode** | **Minimum trigger interval** V-Binning OFF : 1L=16.24μs<br>V-Binning ON : 1L=20.07μs |
|---|---|---|
| OFF | LVAL Sync | 1.If the trigger pulse width < 511L, then 511L + 3L<br>2.If the trigger pulse width ≥ 511L, then pulse width +2L |
| | LVAL Async | Trigger pulse width (min. 2L) + 511L + 3L |
| ON | LVAL Async | Trigger pulse width(Min. 89L) + 511L + 5L<br>◆Trigger pulse width = Smear Less time (87L) + Exposure (Min. 2L) |
| Note: 1) On the above table, 511L is FVAL interval on normal continuous mode<br>2) In the vertical binning mode, 1L is different from the normal scanning. So, the minimum trigger interval will be different. | | |

Note: If the trigger of Active High is input through 10pin, dummy pulses must be applied more than one time when the camera is activated.

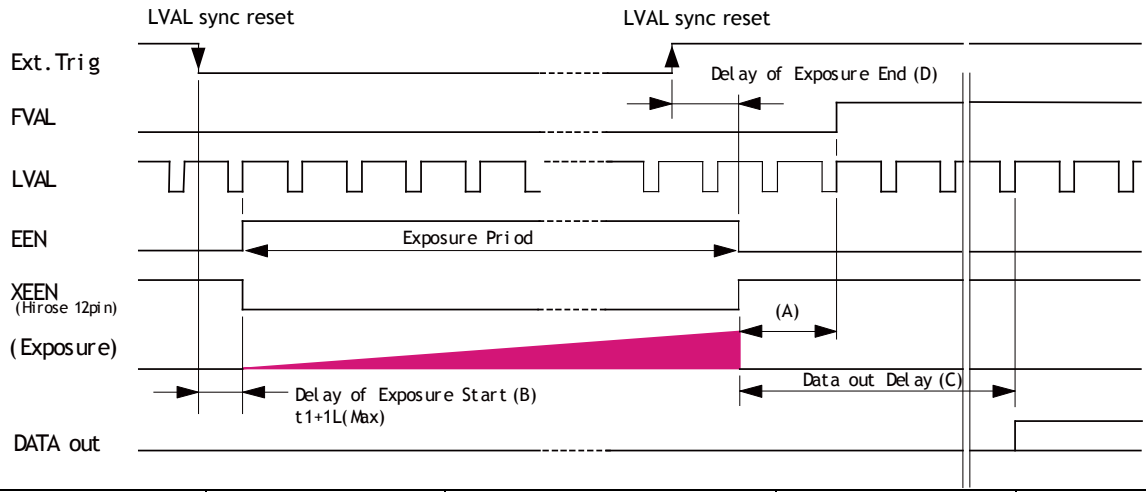
### 9.3.1 PWC timing




| V-Binning | LVAL Accumulation | t1 | t2 |
|---|---|---|---|
| OFF | LVAL Sync | 16.1µs | 5.6L ~ 6.6L |
| | LVAL Async | 16.1µs | 5.6L ~ 6.6L |
| ON | LVAL Sync | 24.1µs | 3.6L ~ 4.6L |
| | LVAL Async | 24.1µs | 3.6L ~ 4.6L |

Fig. 31. Pulse width control.

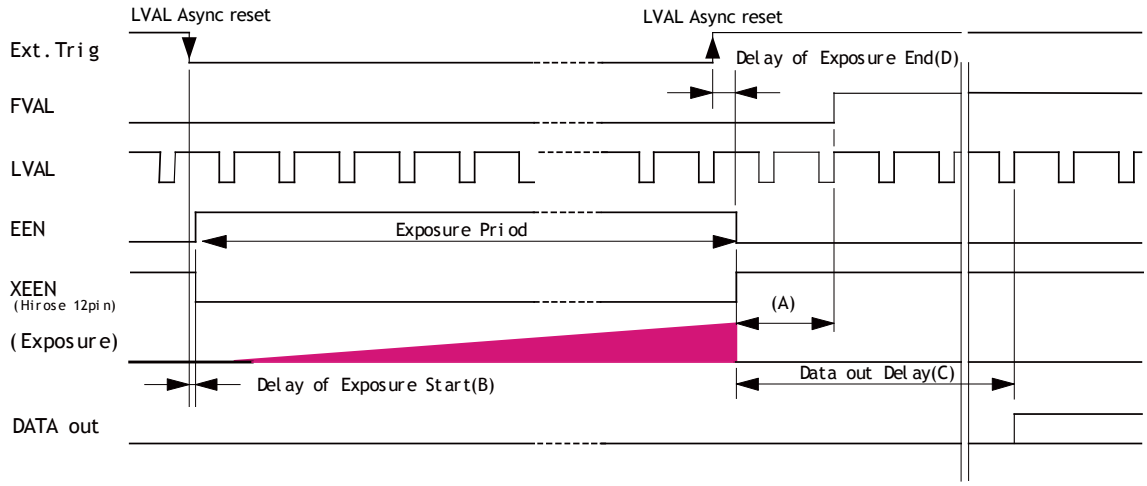
### 9.3.2 PWC timing - LVAL sync details




| V-Binning | A | B | C | D |
|---|---|---|---|---|
| OFF | 5.6L ~6.6L | t1(4.2µs) + 1L(max.) | 13.6L ~14.6L | 16.1µs |
| ON | 3.6L~4.6L | t1(8.0µs) + 1L (max) | 7.6L~8.6L | 24.1µs |

Fig.32 Pulse Width Control LVAL SYNC details

### 9.3.3 PWC timing - LVAL async details




| V-Binning | A | B | C | D |
|---|---|---|---|---|
| OFF | 5.6L ～6.6L | 7.7µs | 13.6L ～14.6L | 16.1µs |
| ON | 3.6L ～4.6L | 15.7µs | 7.6L ～8.6L | 24.1µs |

Fig.33 Pulse Width Control LVAL ASYNC Details

## 9.4. Reset Continuous Trigger (RCT)

The RCT mode operates like EPS (Edge Pre-select) 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 AT-030MCL, this period is 1.4ms which is 87L. 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.
RCT mode is available only in LVAL asynchronous.

To use this mode:

| | | |
|---|---|---|
| Set function: | Trigger mode | TR=3 |
| | Scanning | SC=0, 1 |
| | Vertical binning | VB=0, 1 |
| | Shutter | SM=0 through 2 |
| | Programmable Shutter | 1 to 511 L |
| | Accumulation(Auto) | LVAL async |
| | Other functions | |
| Input: | External Trigger , Camera link or Hirose 12P | TI=0, 1 |

Important notes on using this mode

- Active Trigger pulse >2 LVAL to <1 FVAL

◆ Minimum Trigger interval is shown in the following table.

If the shutter mode is set at Programmable Exposure (common)

| **Mode** | **Minimum trigger interval** |
|---|---|
| LVAL Async | Smearless time(87L) + Programmable exposure time +511L + 3L |
| Note: 1) On the above table, 511L is FVAL interval on normal continuous mode<br>2) In partial scan mode, the maximum programmable exposure values must be set within 511L. | |

If the shutter mode is set at Programmable Exposure (individual)

| **Mode** | **Minimum trigger interval** |
|---|---|
| LVAL Async | Smearless time(87) + Maximum programmable exposure time among R,G and B channels +511L + 3L |
| **Note: 1) On the above table, 511L is FVAL interval on normal continuous mode<br>2) In partial scan or vertical binning mode, the exposure time can be set up to 511L.** | |

Note: If the trigger of Active High is input through 10pin, dummy pulses must be applied more than one time when the camera is activated.

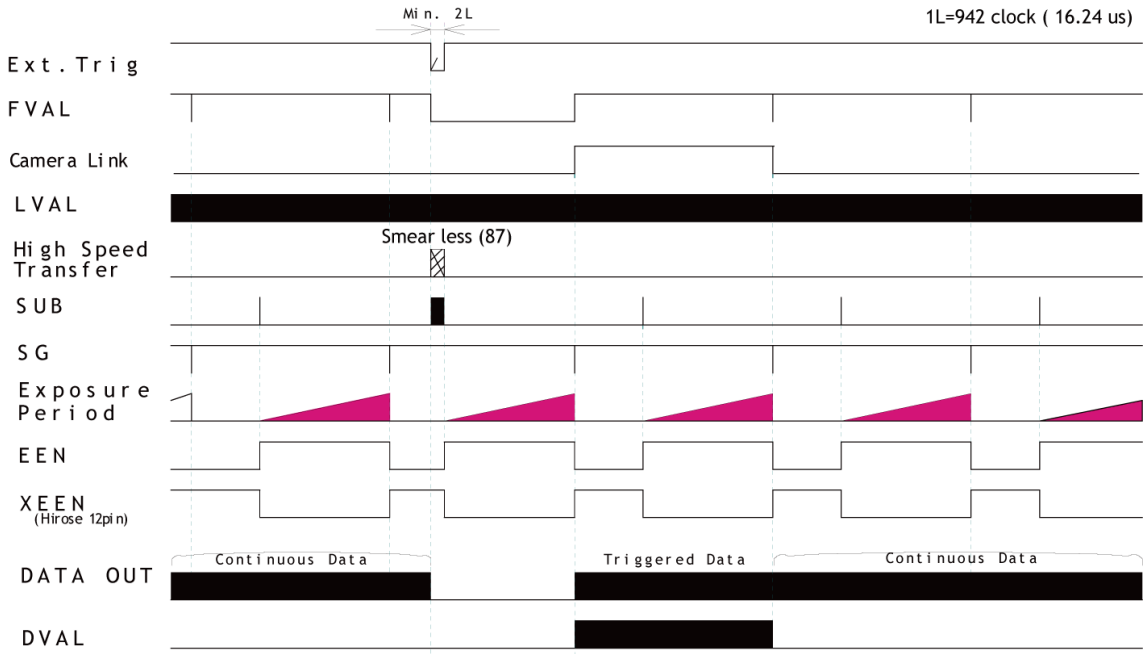



Fig.34 RCT mode

Note: In this mode, if the next trigger is input while the data is read out, the data can be immediately dumped by the high speed transfer. The minimum trigger interval should be kept.

## 9.5. Fast PWC mode

In this mode, the pulse width is available for high speed shutter. This can be activated by selecting FastPWC in the trigger mode.

Conditions to use this function;
1. It works only in LVAL Async mode.
2. Smearless mode must be OFF.
3. The maximum trigger width is 69μs.
   If a longer pulse than 69μs is input, it is fixed at 69μs.

**Exposure time control**

| **Vertical Binning** | **The range of exposure time control (Note 1)** | | **Vertical Binning =Off、1L=16.241us<br>Vertical Binning =On 、1L=20.069us** |
|---|---|---|---|
| Off | Trigger receiving time | Exposure start | 7.70 us |
| | | Exposure end | 7.68 us |
| | Possible Trigger Pulse width | | 2.3us ～ 69 us |
| | The difference between Trigger Pulse Width and actual exposure time : | | The exposure time is apprx. 20 ns shorter than the pulse width. |
| On | Trigger receiving time | Exposure start | 15.6 us |
| | | Exposure end | 11.89 us |
| | Possible Trigger Pulse width | | 8.4us～ 69 us (Note 2) |
| | The difference between Trigger Pulse Width and actual exposure time : | | The exposure time is apprx. 3.8μs shorter than the pulse width. |

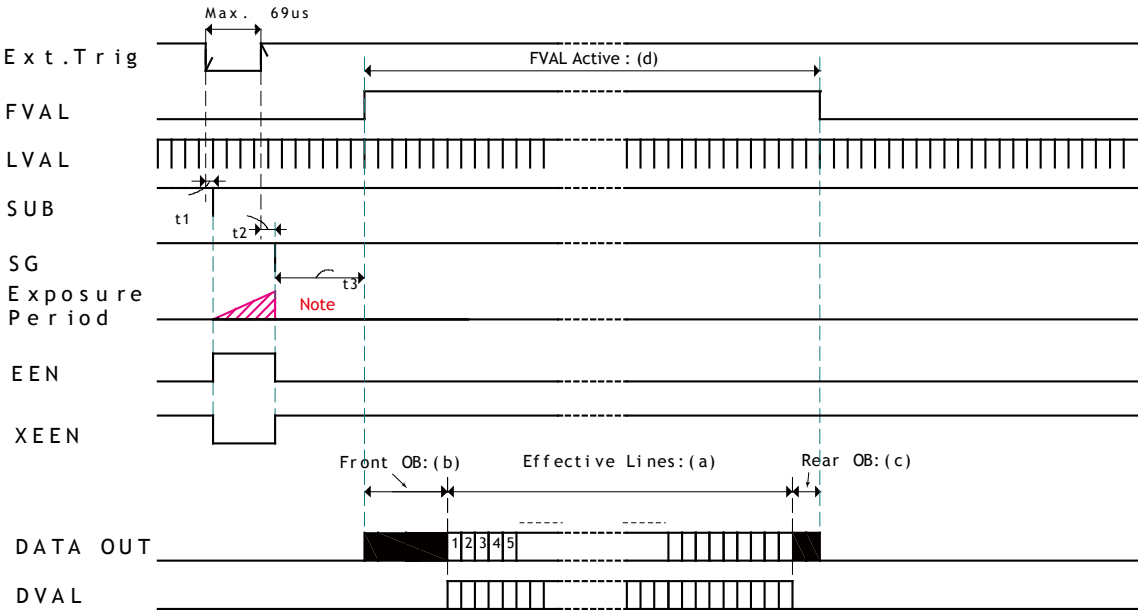
Note 1: The above value is if the trigger is input through Camera Link CC1(Trigger In) .
Note 2: If V-binning is ON, the trigger width must be longer than 8.4μs.

**FAST PWC Mode Minimum trigger interval**

| Smear less | Auto Accumulation | Minimum Trigger interval (Line) | **Vertical Binning =Off、1L=16.24us<br>Vertical Binning =On 、1L=20.07us** |
|---|---|---|---|
| - | LVAL Async | [Trigger Pulse width] ＋ (511L) ＋ 5L | |

Note: 511L is FVAL interval in continuous mode with full frame

### 9.5.1 Timing



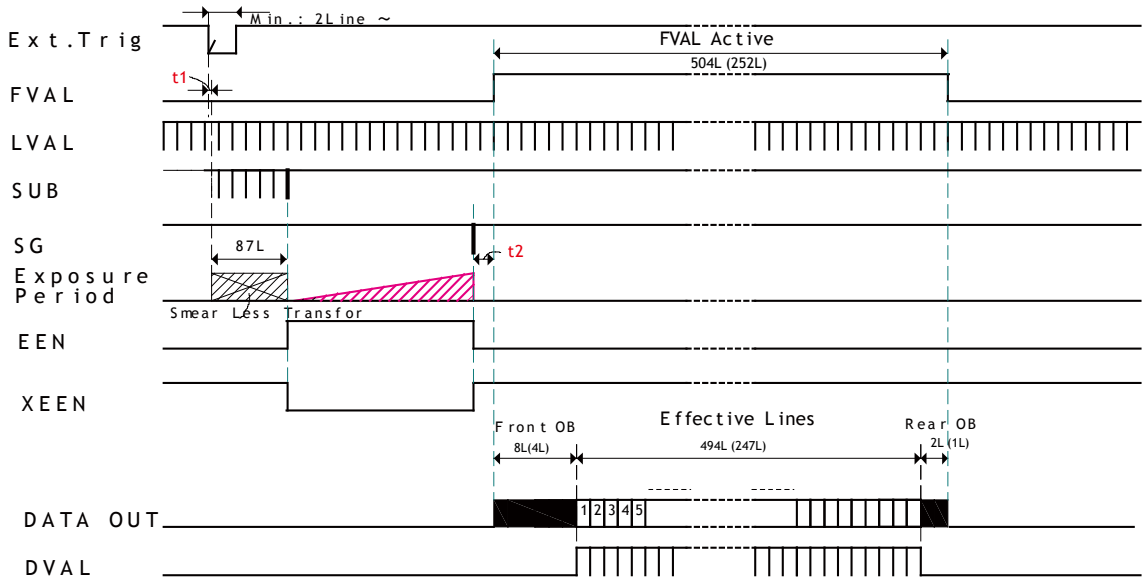

| V-Binning | a | b | c | d |
|---|---|---|---|---|
| OFF | 494L | 8L | 2L | 504L |
| ON | 247L | 4L | 1L | 252L |

Fig. 35 Fast PWC mode

## 9.6. 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, 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 1.4ms which is 87L. 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.

### 9.6.1 Smeraless mode (EPS)




Note: The figure in ( ) is for V-Binning mode.

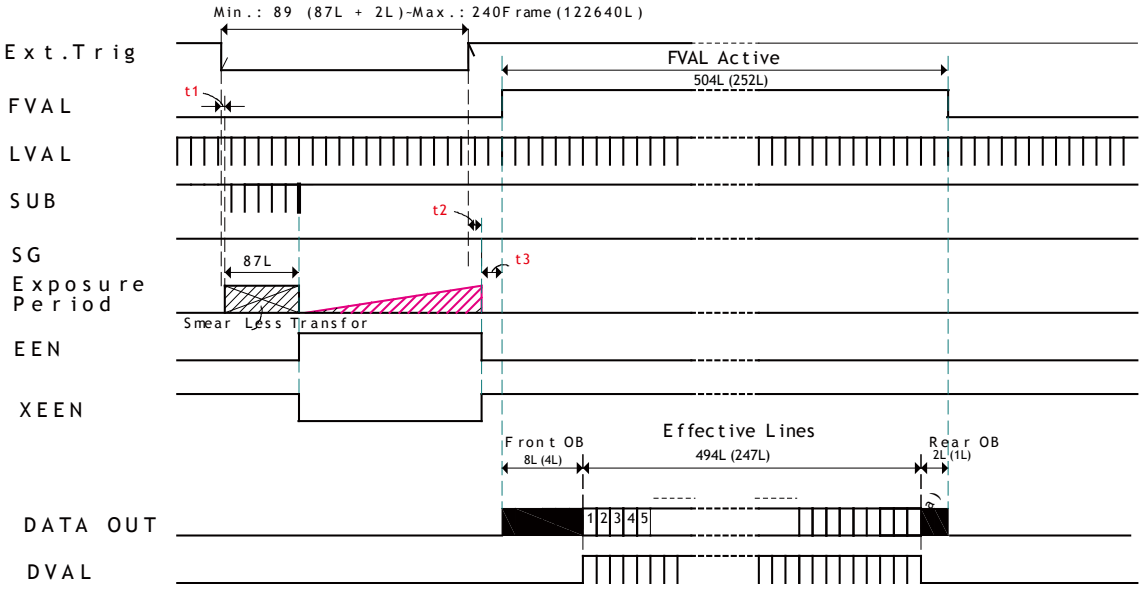
| LVAL Accumulation | V-Binning | t1 | t2 |
|---|---|---|---|
| LVAL Async | OFF | 4.35µs | 5.6L ～6.6L |
| | ON | 8.65µs | 3.6L ～4.6L |

Fig.36 Smeraless mode (EPS)

If Smearless mode (EPS) is ON, the programmable exposure individual is available. In this case, the minimum trigger interval is as follows.

| Auto Accumulation | Minimum Trigger Interval（Line） Vertical Binning =Off 時、1L=16.24us Vertical Binning =On 時、1L=20.07us |
|---|---|
| LVAL Async | Smear lesstime[87L] + Programmable Exposure value + 511L＋3L |

### 9.6.2 Smearless mode (PWC)




Note: The figure in ( ) is for V-Binning mode.

| LVAL Accumulation | V-Binning | t1 | t2 | t3 |
|---|---|---|---|---|
| LVAL Async | OFF | 4.35μs | 16.1μs | 5.6L ～6.6L |
| | ON | 8.65μs | 24.1μs | 3.6L ～4.6L |

Fig.37 Smearless mode (PWC)

## 9.7. Mode and functions matrix

| | Mode | Shutter Preset / Programmable | V Binning | Partial scan | Smear less | LVAL Sync/ Async | Auto Iris output | Auto Exposure /AGC | Continuous AWB |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Continuous | ○ | ○ | ○ | × | --- | ○ | ○ | ○ |
| 2 | EPS | ○ | ○ | ○ | × | Auto | × | × | × |
| | | | | | ○ | Async | | | |
| 3 | PWC | --- | ○ | ○ | × | Auto | × | × | × |
| | | | | | ○ | Async | | | |
| 4 | RCT | ○ | ○ | ○ | ○ | Async only | ○ | × | × |
| 5 | Fast PWC | × | ○ | ○ | × | Async only | × | × | × |

# 10. Configuring the Camera

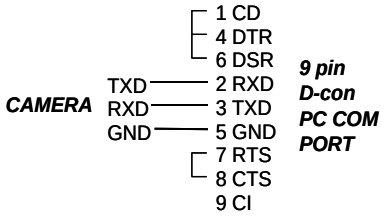
## 10.1. RS-232C control

All configuration of the AT-030MCL camera is done via Camera Link. The camera can be set up from a PC running terminal emulator software, or using JAI´s camera control software. Below is the description of the ASCII based short command protocol.

## 10.2. Communication setting.

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

RS 232C cable




**Protocol.**

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

The camera answers:
**COMPLETE<CR><LF>**
Note: Some commands can only be requested.

To have all communication visible on the emulator screen, start with:
**EB=1<CR><LF>**
The camera answers:
**COMPLETE<CR><LF>**

Transmit request command to camera:
**NN?<CR><LF>** (NN is any kind of command.)
The camera answers:
**NN=[Parameter]<CR><LF>**

Transmit the following to have the camera's actual settings:
**ST?<CR><LF>**
The camera answers:
A complete list of the current settings

Transmit the following to have a command list:
**HP?<CR><LF>**
The camera answers:
A list with all commands and possible settings

Invalid parameters sent to camera: (99 is an invalid parameter)
**SH=99<CR><LF>**
The camera answers:
**02 Bad Parameters!!<CR><LF>**

To see firmware number.
**VN?<CR><LF>**
To see camera ID. It shows the manufacturing lot number.
ID?<CR><LF>

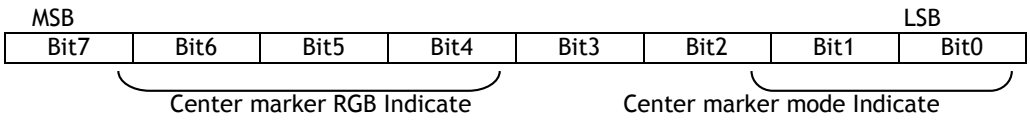
## 10.3. AT-030MCL command list

| | Command Name | Format | Parameter | Remarks |
|---|---|---|---|---|
| **A - General settings and useful commands** | | | | |
| **EB** | Echo Back | EB=[Param.]<CR><LF> | 0=echo off 1=echo on | Off at power up |
| **ST** | Camera Status request | ST?<CR><LF> | | Actual setting |
| **HP** | Online Help request | HP?<CR><LF> | | Command list |
| **VN** | Firmware version | VN?<CR><LF> | | 3 digits version |
| **ID** | Camera ID request | ID?<CR><LF> | | 12 characters |
| **MD** | Model Name request | MD?<CR><LF> | | ≤ 12 characters |
| **UD** | User ID (Free text) | UD=[Param.]<CR><LF><br>UD?<CR><LF> | User can save and load free text | ≤ 12 characters |
| **B - Shutter** | | | | |
| **SM** | Shutter Mode | SM=[Param.]<CR><LF><br>SM?<CR><LF> | 0=Preset Shutter<br>1=Programmable exposure (RGB common)<br>2=Programmable exposure (RGB individual)<br>3=Auto exposure | |
| **SH** | Preset Shutter | SH=[Param.]<CR><LF><br>SH?<CR><LF> | 0=Off, 1=1/250, 2=1/500,3=1/100, 4=1/2000, 5=1/4000, 6=1/8000, 7=1/18000, 8=1/25000, 9=1/40000, 10=1/130000 | |
| **PE** | Programmable Exposure (RGB common set) | PE=[Param.]<CR><LF><br>PE?<CR><LF> | 0 to 511 | SM=1 |
| **PER** | Programmable Exposure(R) | PER=[Param]<CR><LF><br>PER?<CR><LF> | 0 to 511 | SM=2 |
| **PEG** | Programmable Exposure(G) | PEG=[Param]<CR><LF><br>PEG?<CR><LF> | 0 to 511 | SM=2 |
| **PEB** | Programmable Exposure(B) | PEB=[Param]<CR><LF><br>PEB?<CR><LF> | 0 to 511 | SM=2 |
| **C - Trigger mode** | | | | |
| **TR** | Trigger mode | TR=[Param.]<CR><LF><br>TR?=<CR><LF> | 0=Continuous 1=EPS 2=PWC 3=RCT | |
| **TP** | Trigger polarity | TP=[Param.]<CR><LF><br>TR?=<CR><LF> | 0= active low 1= active high | |
| **TI** | Trigger Input | TI=[Param.]<CR><LF><br>TI?=<CR><LF> | 0= Camera Link 1=Hirose12P | |
| **SL** | Smear less | SL=[Param.]<CR><LF><br>SL? <CR><LF> | 0=OFF 1=ON | |
| **D - Image format** | | | | |
| **BA** | Bit Allocation | BA=[Param.]<CR><LF><br>BA?<CR><LF> | 0=8-bit 1=10-bit 2=12-bit | |
| **SC** | Scan Format | SC=[Param.]<CR><LF><br>SC? <CR><LF> | 0=Full Frame 1=Partial | |
| **PRGP** | Programmable partial | PRGP=[Param]<CR><LF><br>PRGP? <CR><LF> | 0=Programmable 1=2/3 Partial<br>2=1/2 Partial 3=1/4 Partial<br>4=1/8 Partial | Set at SC=1 |
| **OFL** | Offset Line | OFL=[Param.]<CR><LF><br>VB?<CR><LF> | 0 to 493 | Offset Line + Height Line < Total Line |

| | | | | |
|---|---|---|---|---|
| **HTL** | Height Line | HTL=[Param.]<CR><LF><br>VB?<CR><LF> | 1 to 494 | Offset Line + Height Line < Total Line |
| **VB** | V-Binning | VB=[Param.]<CR><LF><br>VB?<CR><LF> | 0=OFF<br>1=On | Set at SC=o |
| **E- Gain ,Knee ,Black and signal settings** | | | | |
| **GA** | Master Gain | GA=[Param.]<CR><LF><br>GA?<CR><LF> | -92 ～ 347 (-3dB ～ +12dB ,0.0358dB step) | |
| **GAR** | R Gain | GAR=[Param.]<CR><LF><br>GAR?<CR><LF> | -200 ～ 200(-7dB ～ +10.5dB,0.0358dB step) | |
| **GAB** | B Gain | GAB=[Param.]<CR><LF><br>GAB?<CR><LF> | -200 ～ 300 (-7dB～+10.5dB,0.0358dB step) | |
| **AGC** | Gain Mode | AGC=[Param.]<CR><LF><br>AGC?<CR><LF> | 0=Manual Gain Control<br>1=Auto Gain Control | |
| **AASX** | AGC<br>Window Size X | AASX=[Param.]<CR><LF><br>AASX?<CR><LF> | 1 to 8 | |
| **AASY** | AGC<br>Window Size Y | AASY=[Param.]<CR><LF><br>AASY?<CR><LF> | 1 to 8 | |
| **AAOX** | AGC<br>Window offset X | AAOX=[Para.]<CR><LF><br>AAOX?<CR><LF> | 0 to 7 | |
| **AAOY** | AGC<br>Window offset Y | AAOY=[Para.]<CR><LF><br>AAOY?<CR><LF> | 0 to 7 | |
| **AGCS** | AGC Speed | AGCS=[Param]<CR><LF><br>AGCS?<CR><LF> | 0=slow 1=standard 2=fast | AGC tracking speed setting Default=standard |
| **AGCF** | AGC Reference | AGCF=[Para.]<CR><LF><br>AGCF?<CR><LF> | 512 to 14240 | AGC Reference Level at 14bit |
| **SDM** | Shading Correction Mode | SDM=[Param.]<CR><LF><br>SDM?<CR><LF> | 0=Off, 1=Factory Shading.<br>2=User1, 3=User2 | |
| **RS** | Recalibrate Shading Correction | RS=[Param1],[Param2]<CR><LF> | Param1：0=User1,1=User2<br>Param2：0=Flat, 1=Color | |
| **SDTH** | Shading Threshold | SDTH=[Param.]<CR><LF>SDTH?<CR><LF> | 16384 to 65535 | |
| **KN** | Knee On/Off | KN=[Param.]<CR><LF><br>KN?<CR><LF> | 0=Off, 1=On | |
| **KSR** | Knee Slope - Red | KSR=[Param]<CR><LF><br>KSR?<CR><LF> | 0 to 16383 | X1 at 16383 |
| **KSM** | Knee Slope - Green | KSM=[Param]<CR><LF><br>KSM?<CR><LF> | 0 to 16383 | X1 at 16383 |
| **KSB** | Knee Slope - Blue | KSB=[Param]<CR><LF><br>KSB?<CR><LF> | 0 to 16383 | X1 at 16383 |
| **KPR** | Knee Point - Red | KPR=[Param]<CR><LF><br>KPR?<CR><LF> | 0 to 4095 | |

| | | | | |
|---|---|---|---|---|
| **KPM** | Knee Point - Green | KPM=[Param]<CR><LF><br>KPM?<CR><LF> | 0 to 4095 | |
| **KPB** | Knee Point - Blue | KPB=[Param.]<CR><LF><br>KPB?<CR><LF> | 0 to 4095 | |
| **SP00** | Setup -Green | SP00=[Param.]<CR><LF><br>SP00?<CR><LF> | ±128 | |
| **SPR0** | Setup -Red | SPR0=[Param.]<CR><LF><br>SPR0?<CR><LF> | ±128 | |
| **SPB0** | Setup -Blue | SPB0=[Param.]<CR><LF><br>SPB0?<CR><LF> | ±128 | |
| **F - AWB,LUT and other** | | | | |
| **WB** | White Balance Mode | WB=[Param.]<CR><LF><br>WB?<CR><LF> | 0=Manual/One push AWB<br>1=Continuous<br>2=4000K 3=4600K 4=5600K | |
| **AW** | One-push AWB | AW=[Param.]<CR><LF> | 1=Activates one-push AWB | |
| **WASX** | White Balance Window Size X | WASX=[Param.]<CR><LF><br>WASX?<CR><LF> | 1 to 8 | |
| **WASY** | White Balance Window Size Y | WASY=[Param.]<CR><LF><br>WASY?<CR><LF> | 1 to 8 | |
| **WAOX** | White Balance Window offset X | WAOX=[Param.]<CR><LF><br>WAOX?<CR><LF> | 0 to 7 | |
| **WAOY** | White Balance Window offset Y | WAOY=[Param.]<CR><LF><br>WAOY?<CR><LF> | 0 to 7 | |
| **AWRS** | Request the Result of One Push AWB | AWRS?<CR><LF> | 0=Complete. 1=Too Bright. 2=Too dark. 3=Timeout Error.<br>4=Busy 5=Limit.<br>6= Trig is not set as Normal. | |
| **LUTC** | LUT Control | LUTC=[Param.]<CR><LF><br>LUTC?<CR><LF> | 0=off, 1=0.45 $\gamma$ ,2=0.6 $\gamma$ ,3=LUT | |
| **LUTR** | LUT data communication (For Red) | LUTR=[Param.]<CR><LF><br>LUTR?<CR><LF> | transfer by a serial method.<br>The number of the data is 512.<br>Param: 0 to 8191 | |
| **LUTG** | LUT data communication (For Green) | LUTG=[Param.]<CR><LF><br>LUTG?<CR><LF> | transfer by a serial method.<br>The number of the data is 512.<br>Param: 0 to 8191 | |
| **LUTB** | LUT data communication (For Blue) | LUTB=[Param.]<CR><LF><br>LUTB?<CR><LF> | transfer by a serial method.<br>The number of the data is 512.<br>Param: 0 to 8191 | |
| **TPN** | Test pattern | TPN=[Param.]<CR><LF><br>TPN?<CR><LF> | 0=OFF<br>1 to 15 pattern | |
| **RF** | RCT FVAL Type | RF=[Param.]<CR><LF><br>RF?<CR><LF> | 0=Camera Link Standard<br>1=JAI Standard | |
| **CM** | Center Marker | CM=[Param.]<CR><LF><br>CM?<CR><LF> | Upper 4bit<br>Center marker RGB Indicate<br>Bit6 bit5 bit4<br>R-Ch G-Ch B-Ch<br>1:on 1:on 1:on<br>0:off 0:off 0:off<br>Lower 4bit | |

| | | | | |
|---|---|---|---|---|
| | | | 0=Normal Mode, 1=Vertical Bar<br>2=Horizontal Bar ,3=Both<br><br>Refer to the following table | |




| CM Command Operation | Parameter | | CM Command Operation | Parameter | |
|---|---|---|---|---|---|
| | Hex | Decimal | | Hex | Decimal |
| OFF | 00H | 0 | | | |
| B ch Vertical | 11H | 17 | B+G ch Vertical | 31H | 49 |
| B ch Horizontal | 12H | 18 | B+G ch Horizontal | 32H | 50 |
| B ch Both | 13H | 19 | B+G ch Both | 33H | 51 |
| G ch Vertical | 21H | 33 | B+R ch Vertical | 51H | 81 |
| G ch Horizontal | 22H | 34 | B+R ch Horizontal | 52H | 82 |
| G ch Both | 23H | 35 | B+R ch Both | 53H | 83 |
| R ch Vertical | 41H | 65 | G+R ch Vertical | 61H | 97 |
| R ch Horizontal | 42H | 66 | G+R ch Horizontal | 62H | 98 |
| R ch Both | 43H | 67 | G+R ch Both | 63H | 99 |
| | | | B+G+R ch Vertical | 71H | 113 |
| | | | B+G+R ch Horizontal | 72H | 114 |
| | | | B+G+R ch Both | 73H | 115 |

As the Parameter, the above settings are set in Decimal.

| | | | | |
|---|---|---|---|---|
| **CMTX** | Color Matrix | CMTX=[Param.]<CR><LF><br>CMTX?<CR><LF> | 0=Linear 1=sRGB<br>2=Adobe RGB 3=User | |
| **BLM** | Blemish Control | BLM=[Param]<CR><LF><br>BLM?<CR><LF> | 0=off, 1=Black, 2=White, 3=Both | |
| **MGRR3** | R_R_MATRIX_GAIN | MGRR3=,[Param.]<CR><LF><br>MGRR3?<CR><LF> | -2048 to 2047 | User color matrix gain |
| **MGRG3** | R_G_MATRIX_GAIN | MGRG3=[Param.]<CR><LF><br>MGRG3?<CR><LF> | -2048 to 2047 | User color matrix gain |
| **MGRB3** | R_B_MATRIX_GAIN | MGRB3=[Param.]<CR><LF><br>MGRB3?<CR><LF> | -2048 to 2047 | User color matrix gain |
| **MGGR3** | G_R_MATRIX_GAIN | MGGR3=[Param.]<CR><LF><br>MGGR3?<CR><LF> | -2048 to 2047 | User color matrix gain |
| **MGGG3** | G_G_MATRIX_GAIN | MGGG3=[Param.]<CR><LF><br>MGGG3?<CR><LF> | -2048 to 2047 | User color matrix gain |
| **MGGB3** | G_B_MATRIX_GAIN | MGGB3=[Param.]<CR><LF><br>MGGB3?<CR><LF> | -2048 to 2047 | User color matrix gain |
| **MGBR3** | B_R_MATRIX_GAIN | MGBR3=[Param.]<CR><LF><br>MGBR3?<CR><LF> | -2048 to 2047 | User color matrix gain |
| **MGBG3** | B_G_MATRIX_GAIN | MGBG3=[Param.]<CR><LF><br>MGBG3?<CR><LF> | -2048 to 2047 | User color matrix gain |
| **MGBB3** | B_B_MATRIX_GAIN | MGBB3=[Param.]<CR><LF> | -2048 to 2047 | User color matrix gain |

| | | | | |
|---|---|---|---|---|
| | | MGBB3?<CR><LF> | | |
| **NRC** | Noise reduction | NRC=[Param.]<CR><LF><br>NRC?<CR><LF> | 0=FF 1=ON | |
| **NRS** | Noise reduction threshold | NRS=[Param.]<CR><LF><br>NRS?<CR><LF> | 0 to 255 | 0=FF, 255=max |
| **TMS** | Temperature sensor | TMS?<CR><LF> | -880 to 2400 | /16 -= ℃<br>(-55 to 150℃) |
| **G – Saving and loading data in EEPROM** | | | | |
| **LD** | Load settings from camera EEPROM | LD=[Param.]<CR><LF> | 0=Factory data 1=User 1 area<br>2=User 2 area 3=User 3 area | Latest used data defa. at power up |
| **SA** | Save settings to camera EEPROM | SA=[Param.]<CR><LF> | 2=User 2 area 1=User 1 area<br>3=User 3 area | Parameter = 0 is not allowed |
| **EA** | EEPROM area request | EA?<CR><LF> | 0=Factory data 1=User 1 area<br>2=User 2 area 3=User 3 area | Return latest used area |

Note: Do not try to use commands not shown in this list.

# 11. Camera Control Tool for AT-030MCL

A Camera Control Tool for AT-030MCL can be downloaded from the JAI web site www.jai.com
This control tool is based on the Windows XP operating system.

## 11.1. Software install

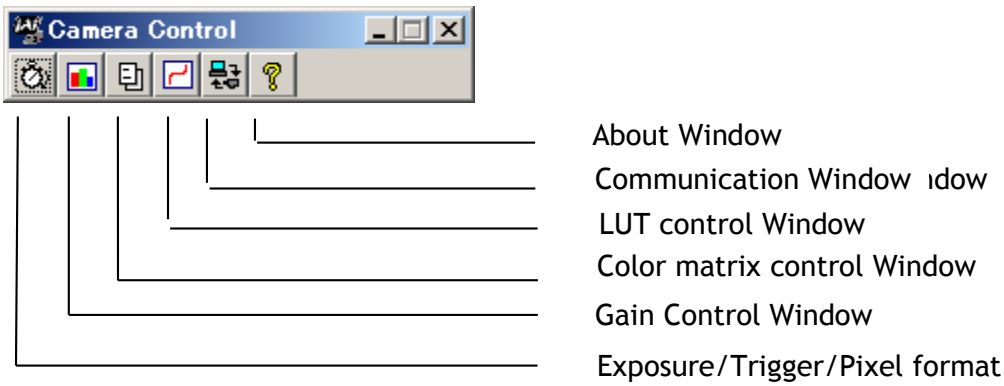
Execute AT030MCL.exe in the file downloaded. As the setup program is activated, install the control software.

## 11.2. Camera Control Tool Interface

The Camera Control Tool Software is based on a main Tool Bar and a number of associated Tool Windows. Each button in the Tool Bar pops up a separate Tool Window when pressed. The layout of the program can be adjusted by arranging the windows the way it is preferred. The program will store this information and recreate this layout, when the program is restarted. All Camera Control Tools have a Communication Window and an About Window. The other window(s) contains camera control commands.

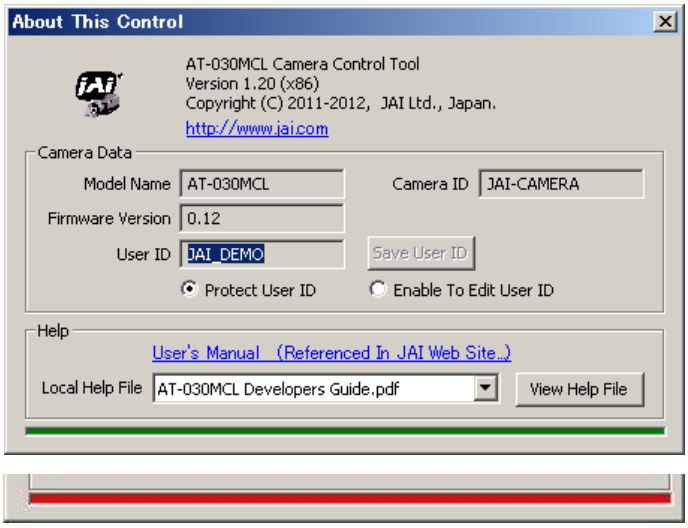
### 11.2.1 Camera Control Tool Bar

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

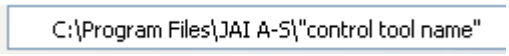



### 11.2.2 The About Window

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




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



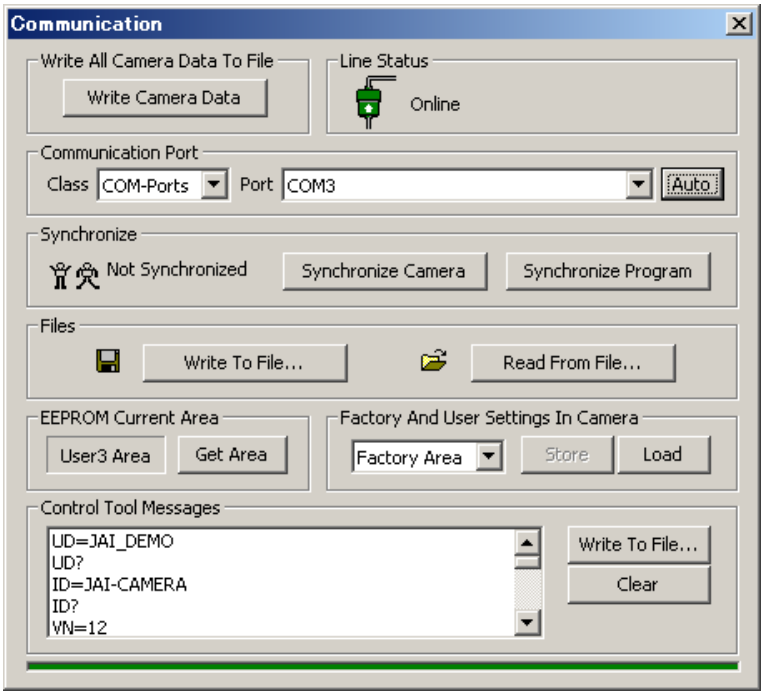

It is possible to download updated operation manuals from the JAI website:

At the bottom of the windows (all windows but the Communication Window is a colored bar. The bar is green when the Camera Control

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

### 11.2.3 Communication Window

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




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

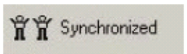
**Auto search**
Click the auto button to search for a camera on communication port 1 to 16. The camera control program automatically sends camera request on every communication port. The user is prompted to use a communication port if a camera answers the request.
This button is only used for RS-232 communication.

**Off/On-line mode**
The Camera Control Tool Application can run Offline (without a camera attached) and all functions are fully functional in offline mode.
Off line mode is indicated in The Communication Window, where a status field with graphic and text indicates the on/off-line status.
Changing the selected communication port (from the communication window) changes the online/off-line status. If a camera is found on the selected communication port the application runs online otherwise offline.



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

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

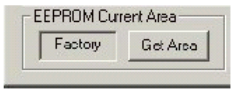



**Files**
When clicking the Write to File or Read from File button, the user is prompted for a file using a standard file dialog. New files are created if they do not already exist.
Files for camera settings have the extension cam. Information about the communication port is not stored in the files. All settings are automatically sent to the camera when a file has been loaded (if the camera is online).

**Factory and User Settings**
Use the Store button to store the current camera settings into the user settings area in EEPROM. Current camera settings are not saved when the camera is turned off. To save current camera settings you have to save them on the available user areas.
Use the Load button to restore previously saved camera settings from either the Factory or the User EEPROM area.

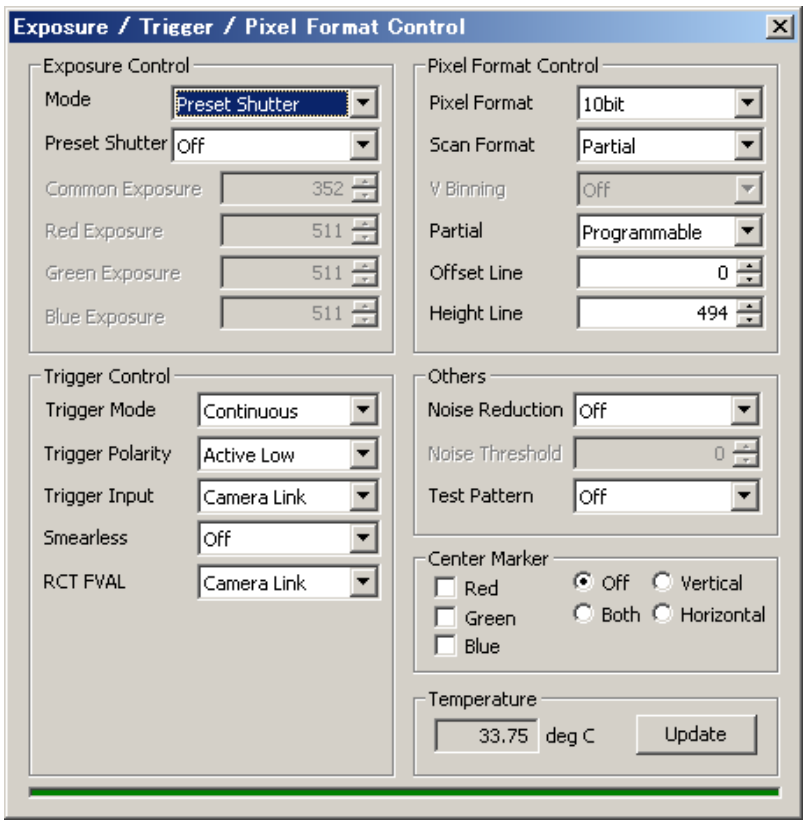
**Write All Camera Data to File.**
Click the "Write Camera Data" button to save all camera settings into a text file. The information that can be saved is:
Model Name, Camera ID, User ID, Firmware Version, Current Settings, Factory Settings and the available User Areas.
The file is formatted as shown in the picture below:


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



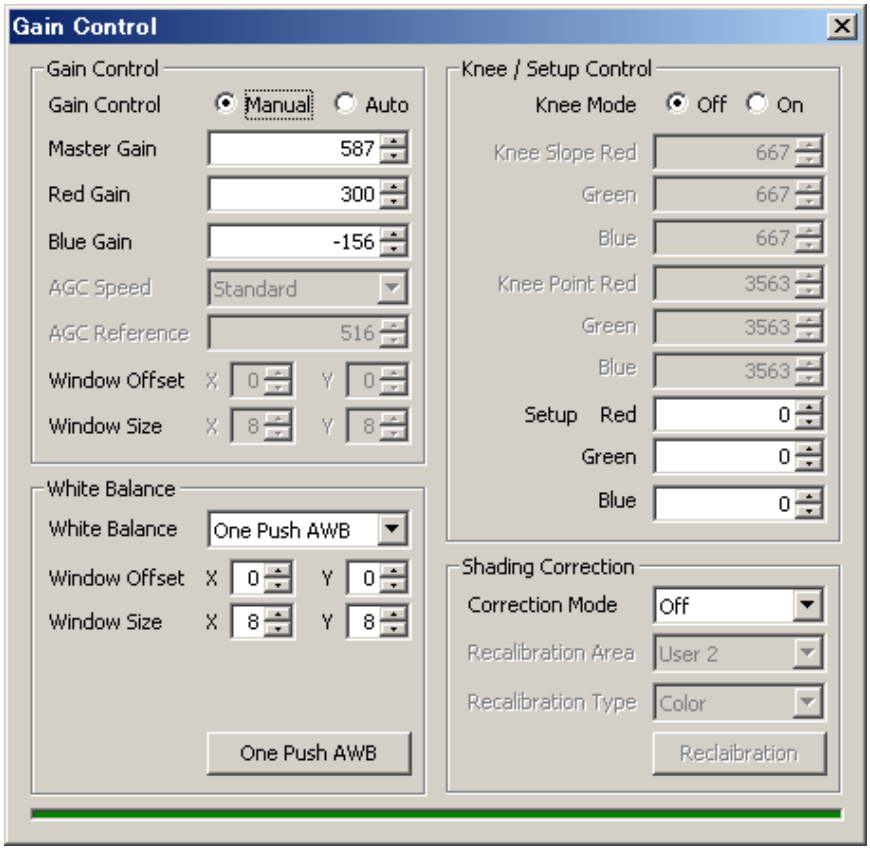

### 11.2.4 Camera Control Window

The Camera Control Window contains the fundamental camera setting functions.
It is possible to set the shutter mode, Trigger mode, image format, scan format, gain control and black setting.



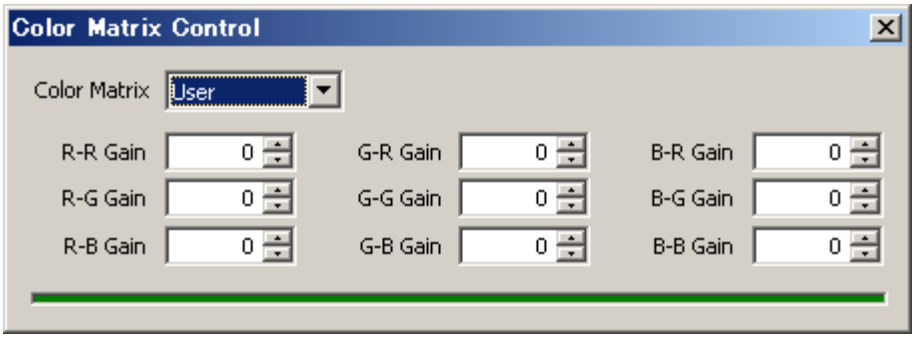
### 11.2.5 Gain Control Window

In this window, Gain, White Balance, Knee, Set up and Shading Compensation can be controlled.

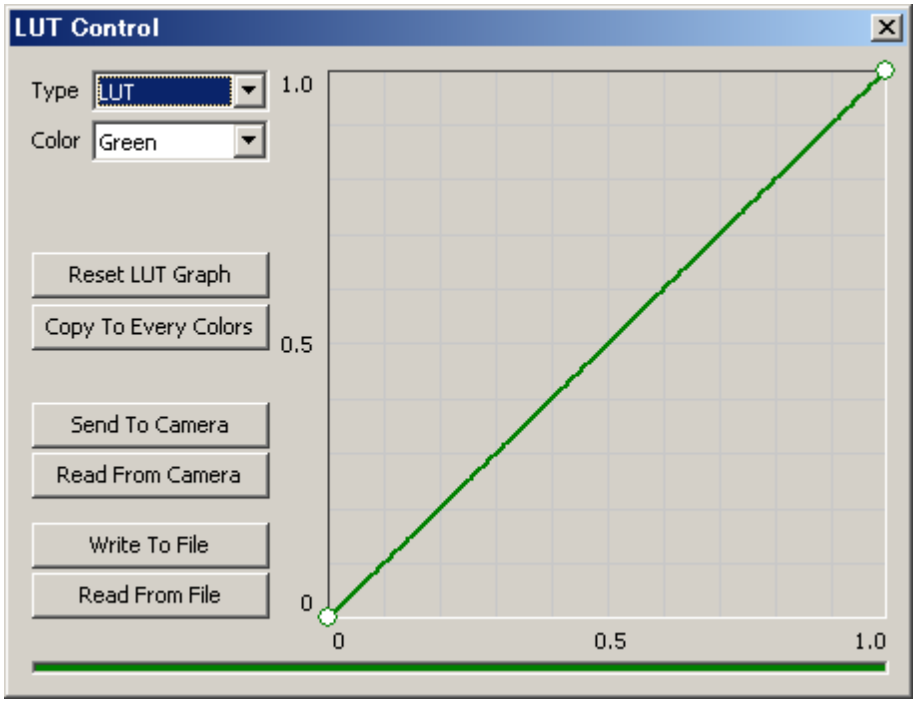



### 11.2.6 Color Matrix Window

This is for Color Matrix Control.



### 11.2.7 LUT Control Window

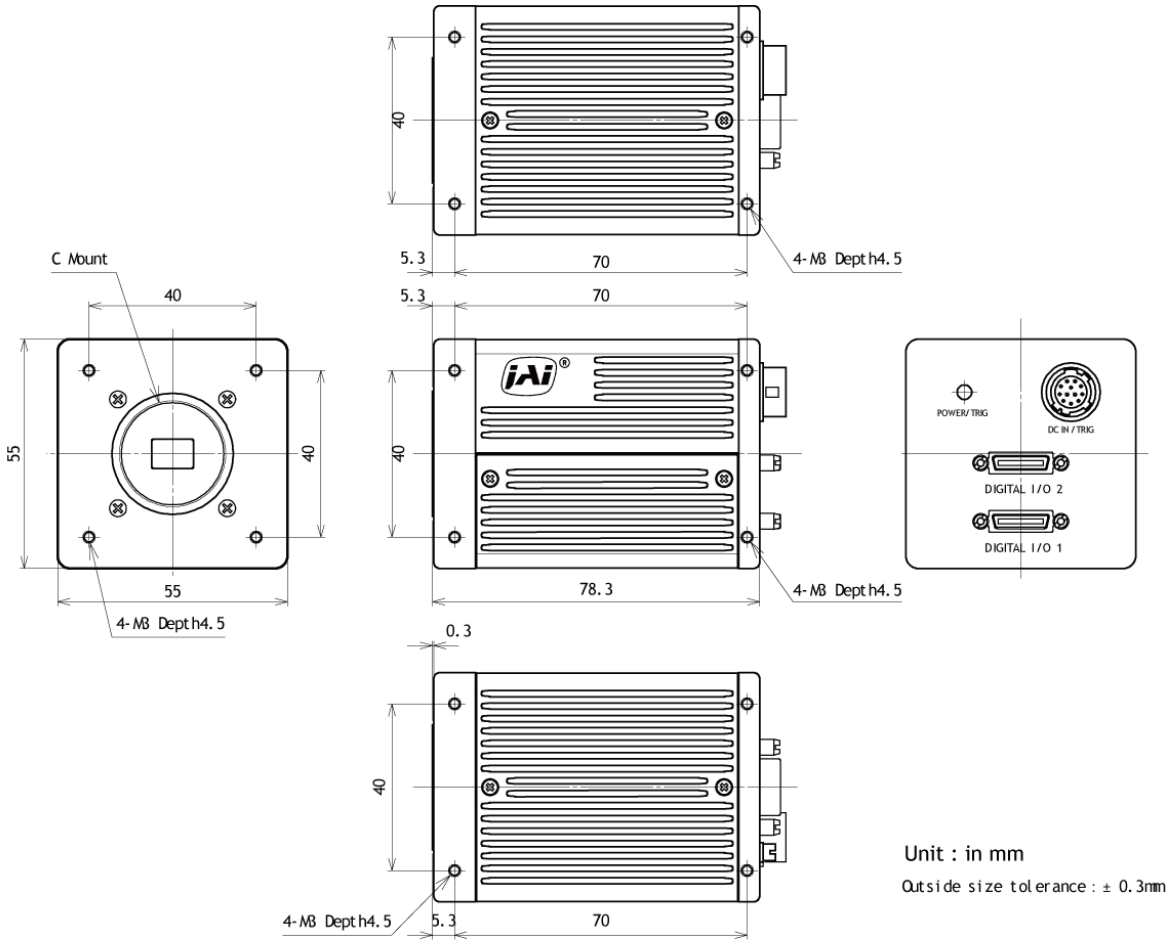



### 11.2.8 Using the Camera Control Tool

Here is some practical information about the Camera Control Tool:

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

## 12. External Appearance and Dimensions




***Note**: Rear protrusion on C-mount lens must be less than 4.0mm*

Fig. 35. Outline.

# 13. Specifications

## 13.1. Spectral sensitivity for sensor

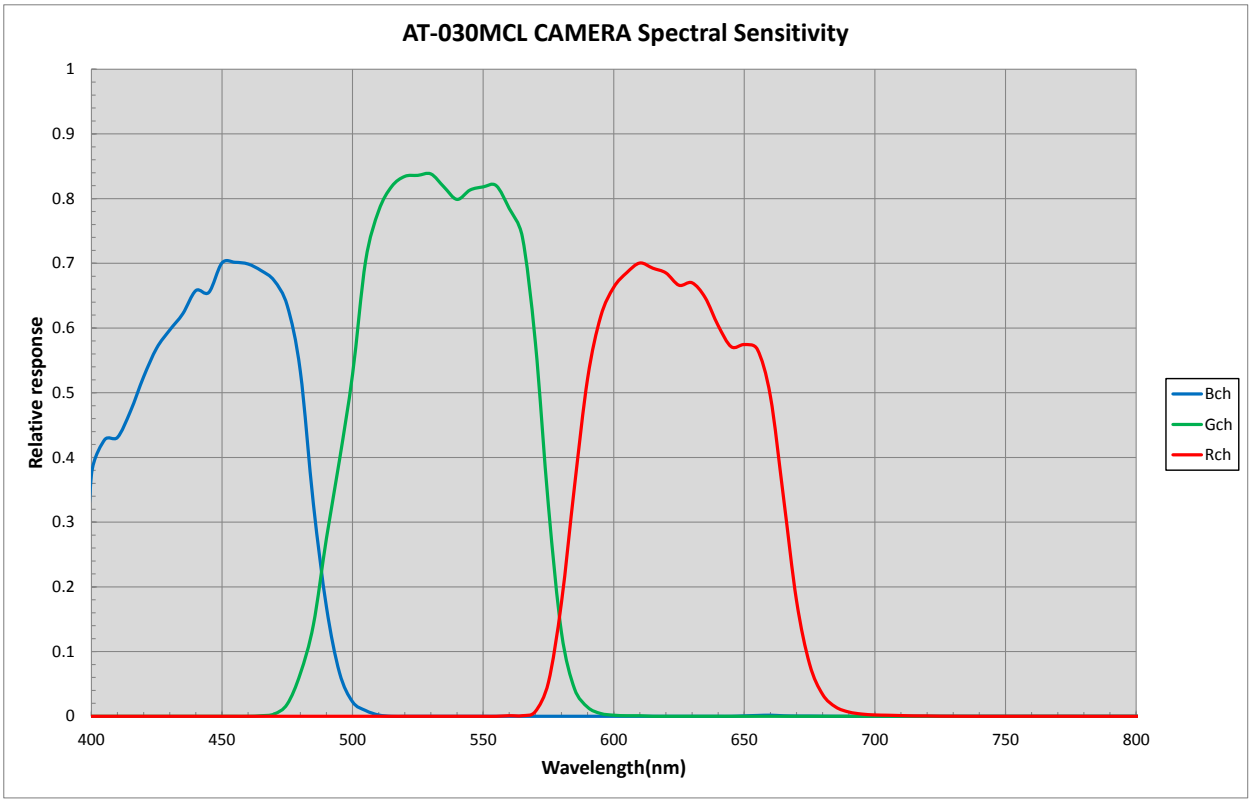



Fig. 36. Spectral sensitivity for AT-030MCL sensor

## 13.2. Specification table

| Specifications | AT-030MCL |
|---|---|
| Optical system | 1/3 inch F4.0 prism |
| Scanning system | Progressive |
| Frame rate full frame | 120.49 frames/second (511 lines per frame) |
| Pixel clock | 58 MHz |
| Line frequency<br>V binning | 61.571 kHz (942 clk per line)<br>49.828 kHz (1164 clk per line) |
| CCD sensors | 3 x 1/3" IT CCD on prism. Sony ICX424AL |
| Sensing area | 4.88 (h) x 3.66 (v) mm 1/3 inch diagonal |
| Cell size | 7.4 (h) x 7.4 (v) μm |
| Active pixels | 659 (h) x 494 (v) |
| Pixels in video output full<br>2/3 partial<br>1/2 partial<br>1/4 partial<br>1/8 partial<br>Variable partial<br>V binning | 659 (h) x 494 (v) 120.49 fps. (511 lines per frame)<br>659 (h) x328 (v) 169.62 fps (363 lines per frame)<br>659 (h) x 246 (v) 208.72 fps. (295 lines per frame)<br>659 (h) x 122 (v) 322.36 fps. (191 lines per frame)<br>659 (h) x 60 (v) 422.96 fps. (139 lines per frame)<br>Programmable start line and height, start line 1 to 493, height 2 to 494<br>659 (h) x 247 (v) 193.88 fps. (257 lines per frame) (Maximum) |
| Sensitivity (on sensor)<br>(minimum) | 0.34 Lux, max gain, 50% video |
| S/N ratio | >50 dB. (On Green) |
| Digital Video outputs. | 3 x 8-bit RGB via single port Camera Link base configuration or<br>3 x 10-bit RGB via dual port Camera Link medium configuration or<br>3 x 12-bit RGB via dual port Camera Link medium configuration |
| Iris video output | 0.7 V p-p, 75 Ω NUM luminance signal w/o Sync |
| Inputs TTL<br>Camera Link | Ext. trigger 4 Vp-p ±2 V. (TTL or 75 Ω)<br>Ext. trigger (LVDS) |
| Outputs TTL<br>Camera Link | XEEN output 4 V p-p from 75 Ω source (TTL)<br>RGB 8/10/12-bit video output. D0 – D9<br>Pixel clock, DVAL, LVAL, FVAL and EEN (LVDS) |
| White balance<br>Tracking range | Manual/one push, continuous, preset(4000K, 4600K,5600K)<br>-7 to +10 dB. (3200K to 9000K)<br>White balance setting in factory:4600K (R and B gain settings=0) |
| Gain<br>Gain range | Manual for all 3 colors<br>Master -3 to +21 dB. R and B -7 to +10 dB (0.036dB/Step) |
| Gamma | 1.0 (OFF) , 0.6, 0.45 or LUT (Look Up Table) |
| Knee correction | Knee point and knee slope for R, G and B channel |
| Shading Compensation | ON/OFF |
| Linear Matrix | Linear/Preset (sRGB, Adobe RGB)/User |
| Blemish compensation | ON(use factory preset data)/OFF |
| Noise reduction | ON / OFF |
| Synchronization | Int. X-tal |
| Trigger modes | Continuous, Edge Pre-select, Pulse Width Control, Fast PWC,Reset continuous |
| Trigger function | LVAL synchronous or LVAL asynchronous auto detect |
| Shutter speed (Preset) | OFF,1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/8000, 1/18000, 1/2500, 1/40000, and 1/130,000 sec. R, G and B can be set individually |
| Programmable exposure | 0L to 511L |
| Auto shutter | Yes |
| Pulse Width Control | 2L to 122640 L |
| LVAL accumulation | SYNC/ASYNC auto detect |
| Smear less mode | Available for EPS and PWC |
| Control interface | EIA-644 LVDS |
| Operating temperature | -5°C to +45°C |
| Humidity | 20 - 80% non-condensing |
| Storage temp./humidity | -25°C to 60°C/20% - 80 % non-condensing |
| Vibration | 3 G (15 Hz – 200 Hz in XYZ) |

| Specifications | AT-030MCL |
|---|---|
| Shock | 50 G |
| Regulations | CE (EN 61000-6-2, EN 61000-6-3), FCC part 15 class A, RoHS |
| Power | 10.8V to 26.4V DC. 6W (Typical , Full frame ,12V input)<br>7.2W (Typical ,1/8 partial, +12V input) |
| Lens mount | C-mount (Rear protrusion on C mount must be less than 4mm)<br>The lens used should be designed for 3CCD cameras. |
| Flange back | 17.526mm, Tolerance +0 –0.05mm |
| Optical axis | Center ±0.1mm |
| Dimensions | 55 x 55 x 78.3 mm (HxWxD) |
| Weight | 290 g |

Note: Above specifications are subject to change without notice
Specifications are valid after a 30 min. warm up period.

# 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.
When this camera is not in use, put the supplied lens cap on the lens mount.
Handle this camera with the maximum care.
Operate this camera only from the type of power source indicated on the camera.
Power off the camera during any modification such as changes of jumper and switch setting.

## 2. Typical Sensor Characteristics

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

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

**Blemishes**
All cameras are shipped without visible image sensor blemishes.
Over time some pixel defects can occur. This does not have a practical effect on the operation of the camera. These will show up as white spots (blemishes).
Exposure to cosmic rays can cause blemishes to appear on the image sensor. Please take care to avoid exposure to cosmic rays during transportation and storage. It is recommended using sea shipment instead of air flight in order to limit the influence of cosmic rays 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.

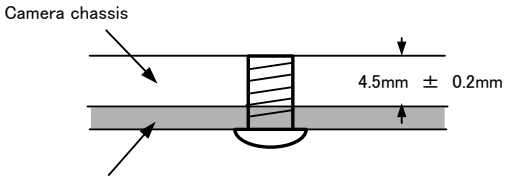
**Patterned Noise**
When the sensor captures a dark object at high temperature or is used for long time integration, fixed pattern noise may appear on the video monitor screen.

## 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.

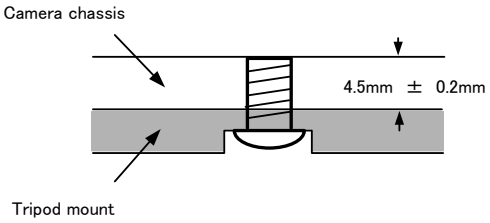
## 4. Caution when mounting the camera

**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 can and datasheet for AT-030MCL can be downloaded from www.jai.com
2. Camera control software can be downloaded from www.jai.com

## Revisions

| Date | Revision | Changes |
|---|---|---|
| Oct. 2012 | 1.0 | New issue |
| Jan. 2015 | 1.1 | White balance factory setting standard color temperature is corrected to 4600K from 7800K |
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## User's Record

**Camera type:** **AT-030MCL**

**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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