



See the possibilities

User Manual

Sweep+ Series - Camera Link Interface

SW-4000T-MCL



3CMOS Prism Line Scan Camera

Document Version: 2.4

Date: 2026-08-10

Thank you for purchasing this product.

 Be sure to read this documentation before use.

This documentation includes important safety precautions and instructions on how to operate the unit. Be sure to read this documentation to ensure proper operation.

The contents of this documentation are subject to change without notice for the purpose of improvement.

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About Technical Note



Some additional technical information is provided on the JAI website as Technical Notes. In this manual, if a technical note is available for a particular topic, the above icon is shown. Please refer to the following URL for Technical notes.

<https://www.jai.com/support-software/technical-notes>

Notice/Warranty

Notice

The material contained in this manual consists of information that is proprietary to JAI Ltd., Japan, and may only be used by the purchasers of the product. JAI Ltd., Japan makes no warranty for the use of its product and assumes no responsibility for any errors which may appear or for damages resulting from the use of the information contained herein. JAI Ltd., Japan reserves the right to make changes without notice.

Company and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.

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 SW-4000T-MCL complies with the following provisions applying to their standards.

EN61000-6-2

EN61000-6-3

FCC

Note: FCC compliance for this model varies depending on the hardware revision number. You can identify the hardware revision number by the last letter of your camera's serial number.

Model	Hardware Rev.	FCC Compliance
SW-4000T-MCL-F	A - C	FCC Part 15, Class B
SW-4000T-MCL-M52	A - B	
SW-4000T-MCL-F	D or later	FCC Part 15, Class A
SW-4000T-MCL-M52	C or later	

FCC Part 15, Class A

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 in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Part 15, Class B

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.

KC

	상 호:	JAI Ltd. Japan
	기자재명칭:	Industrial Camera
	모 델 명:	SW-4000T-MCL-F
	제조사 및 제조국가:	JAI Ltd., Japan / JAPAN
R-R-JAI-SW-4000T-MCL-F		

	상 호:	JAI Ltd. Japan
	기자재명칭:	Industrial Camera
	모 델 명:	SW-4000T-MCL-M52
	제조사 및 제조국가:	JAI Ltd., Japan / JAPAN
R-R-JAI-SW-4000T-MCL-F		

제조년월은 제품상자의 라벨을 참조하십시오.

China RoHS

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《电器电子产品有害物质限制使用管理办法》，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 (PBB)	多溴二苯醚 (PBDE)
SW-4000T-MCL	×	○	○	○	○	○
○: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 GB/T 26572-2011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 GB/T 26572-2011规定的限量要求。						

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 或对其人身、财产造成严重损害的期限。

数字「15」为期限15年。

Usage Precautions

Notes on Cable Configurations

The presence of lighting equipment and television receivers nearby may result in video noise. In such cases, change the cable configurations or placement.

Notes on Attaching the Lens



Technical Notes

How to Clean a Sensor

Avoiding Dust Particles

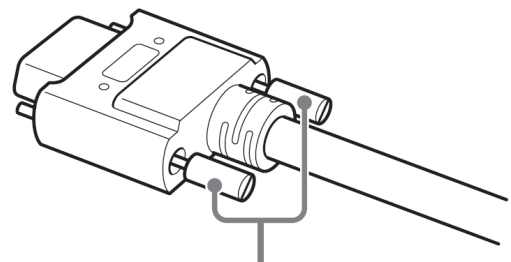
When attaching the lens to the camera, stray dust and other particles may adhere to the sensor surface and rear surface of the lens. Be careful of the following when attaching the lens.

- Work in a clean environment.
- Do not remove the caps from the camera and lens until immediately before you attach the lens.
- To prevent dust from adhering to surfaces, point the camera and lens downward and do not allow the lens surface to come into contact with your hands or other objects.
- Always use a blower brush to remove any dust that adheres.
- Never use your hands or cloth, blow with your mouth, or use other methods to remove dust.

Notes on Camera Link Cable Connections

Secure the locking screws on the connector manually, and do not use a driver. Do not secure the screws too tightly. Doing so may wear down the screw threads on the camera. (Tightening torque: 0.15 N·m or less)

Caution: Secure manually. Do not secure too tightly.



Phenomena Specific to CMOS Image Sensors

The following phenomena are known to occur on cameras equipped with CMOS image sensors. These do not indicate malfunctions.

- **Aliasing:** When shooting straight lines, stripes, and similar patterns, vertical aliasing (zigzag distortion) may appear on the monitor.
- **Blooming:** When strong light enters the camera, some pixels on the CMOS image sensor may receive much more light than they are designed to hold, causing the accumulated signal charge to overflow into surrounding pixels. This “blooming” phenomenon can be seen in the image but does not affect the operation of the camera.
- **Fixed pattern noise:** When shooting dark objects in high-temperature conditions, fixed pattern noise may occur throughout the entire video monitor screen.
- **Defective pixels:** Defective pixels (white and black pixels) of the CMOS image sensor are minimized at the factory according to shipping standards. However, as this phenomenon can be affected by the ambient temperature, camera settings (e.g., high sensitivity and long exposure), and other factors, be sure to operate within the camera’s specified operating environment.

Notes on Exportation

When exporting this product, please follow the export regulations of your country or region.

Features

The SW-4000T-MCL is a 3CMOS line scan camera using three 4096 pixel line sensors mounted on a prism, for the R, G and B channels.

The camera has a Camera Link pixel clock of 85 MHz and is capable of high-speed scanning at up to 67.7 kHz (Line Rate). 8-bit and 10-bit video output is possible via Camera Link. Camera and external trigger settings are configured via the Camera Link interface or the 12-pin connector.

■ Features Overview

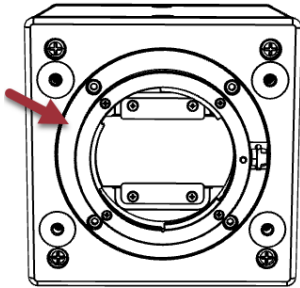
- The Camera Link interface can be used for video output and trigger input.
- Prism technology for superior color quality and better color differentiation.
- Two Pixel sizes - 7.5 μm x 7.5 μm or 7.5 μm x 10.5 μm
- Supports vertical dual-line binning, 2x horizontal binning, or both.
- HSI, sRGB, Adobe RGB and XYZ color space conversion.
- Support for connection of rotary encoders.
- Excellent shock and vibration resistance.
- GenICam compliant.

Parts Identification

This section describes the lens mount, connectors, LEDs, and mounting holes of this camera.

Lens Mount (M52-Mount or F-Mount)

Mount an M52-mount lens or F-mount lens here.



- Back flange distance (both F- and M52-mount): 46.5 mm

Note: Before mounting a lens, be sure to refer to [① Lens](#) and confirm the precautions for attaching a lens and the supported lens types.

Connectors

This section displays the pin assignments for each connector.

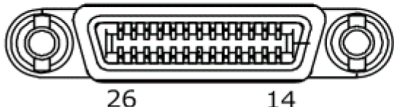
Digital I/O-1 and Digital I/O-2 Video Output Connectors

Connect a Cable Link compatible cable here.

Note: The cable length at which communication will be possible will be limited when using a cable that is not compatible with Camera Link, a small diameter type cable, or a high flex type cable.

Camera Link Connector 1

DIGITAL I/O - 1



Base (RGB8)

Medium (RGB8, RGB10)

Full (RGB8)

80bit[Deca] (RGB8)

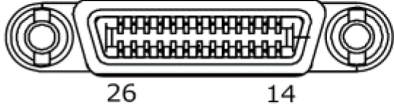
Camera Side: HDR-EC26FYTG2-SL+
(HONDA)

Cable: SDR Connector Cable

Pin	Input Output	Signal	Description
1, 26		Shield	GND
2 (-), 15 (+)	Out	TxOUT0	Data output
3 (-), 16 (+)	Out	TxOUT1	Data output
4 (-), 17 (+)	Out	TxOUT2	Data output
5 (-), 18 (+)	Out	TxCk	CL Clock
6 (-), 19 (+)	Out	TxOUT3	Data output
7 (+), 20 (-)	In	SerTC (RxD)	LVDS Serial Control
8 (-), 21 (+)	Out	SerTFG (TxD)	
9 (-), 22 (+)	In	CC1	Trigger
10 (-), 23 (+)		CC2	Reserved
11, 24		N.C	
12, 25		N.C	
13, 14		Shield	GND

Camera Link Connector 2

DIGITAL I/O - 2



Medium (RGB8, RGB10)

Full (RGB8)

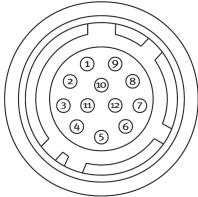
80bit[Deca] (RGB8)

Pin	Input Output	Signal	Description
1, 26		Shield	GND
2 (-), 15 (+)	Out	TxOUT0	Data output
3 (-), 16 (+)	Out	TxOUT1	Data output
4 (-), 17 (+)	Out	TxOUT2	Data output
5 (-), 18 (+)	Out	TxCk	CL Clock
6 (-), 19 (+)	Out	TxOUT3	Data output
7 (+), 20 (-)		Reserved	
8 (-), 21 (+)	Out	TxOUT0	Data output
9 (-), 22 (+)	Out	TxOUT1	Data output
10 (+), 23 (-)	Out	TxOUT2	Data output
11 (-), 24 (+)	Out	TxCk	CL Clock
12 (+), 25 (-)	Out	TxOUT3	Data output
13, 14		Shield	GND

DC IN/TRIG Connector (12-Pin Round)

Related Setting Items: [DigitalIOControl](#)

Connect the cable for a power supply or for DC IN / Trigger IN here.

 Camera side: 12-pin circular connector equivalent to Hirose HR10A-10R-12PB(71) (gold-plated pins) Cable side: Hirose HR10A-10P-12S(73) (Plug) or equivalent	Pin No.	Input/Output	Signal	Description
	1		GND	
	2	Power In	DC In	DC 12V to 24V $\pm$ 10%
	3		GND	
	4		Reserved	External connection not possible
	5	In	OPT IN1 -	Line 5
	6	In	OPT IN1 +	
	7	Out	TTL OUT 4	Line 12
	8		NC	
	9	Out	TTL OUT 1	Line 1
	10	In	TTL IN 1	Line 4
	11	Power In	DC In	+12 V ~ 24 V $\pm$ 10%
	12		GND	

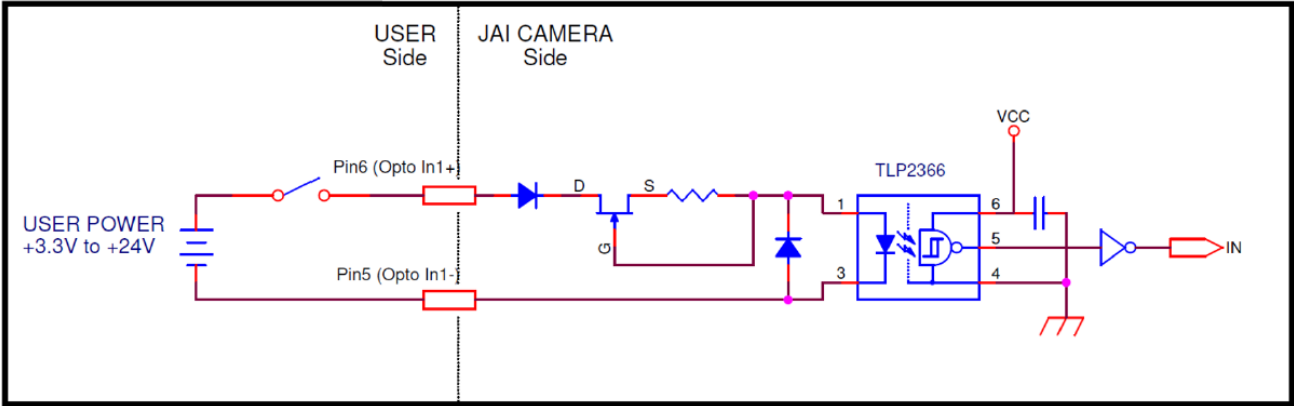
Caution: The DC IN / TRIG IN connector, AUX connector, or the CC1 of the DIGITAL I/O-1 video output connector will be used for external trigger inputs. You can switch which of these is used via a command.

TTL Signal specification

TTL out signal specification (Typ.)	Output voltage: Low 0.0V, High 5.0V Input/Output current: +/-32mA
TTL in signal specification (Typ.)	Input voltage: Low 0.0 ~ 0.8V, High 2.0 ~ 5.5V

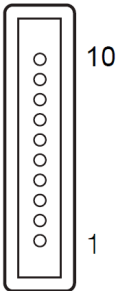
Caution: About Opto In: Check the recommended external input circuit diagram (reference example) and connect correctly. If you connect Opto In 1 and Opto In 2 in reverse, camera may be damaged.

Recommended External Input Circuit Diagram (Reference Example)



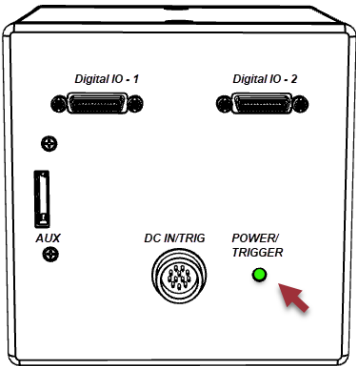
AUX Connector (10-pin)

Connect the cable for DC IN / trigger IN here.

 Camera side: Hirose 3260-10S3(55) Cable side: Hirose 3240-10P-C(50)	Pin No.	Attribute	Name	Description
	1	Out	TTL OUT2	Line 8
	2	Out	TTL OUT3	Line 9
	3	IN	TTL_IN2	Line 10
	4		N.C	
	5	GND	GND	
	6	IN	TTL_IN3	Line 13
	7		N.C	
	8		N.C	
	9	GND	GND	
	10	GND	GND	

LED

Indicates the power or trigger input status.



LED		Status
	Lit amber	Camera initializing.
	Lit green	Camera in operation
	Blinking green	During operation in trigger mode, trigger signals are being input. Note: The blinking interval is not related to the actual input interval of the external trigger.

Mounting Holes

Use these holes when mounting the camera directly to a wall or other structural system.

Location	Description
Bottom	M4, Depth 6mm
Front	M4, Depth 5mm
Top	M4, Depth 6mm

Note: Refer to "[Dimensions](#)" for the location of the mounting holes.

Preparation

Read this section to learn how the camera connects to devices and accessories. The preparation process is described below.

Note: eBUS Player for SDK does not support this camera.

1	<u>Step 1: Connect Devices</u> Connect the lens, Camera Link cable, AC adapter, computer, and other devices.
2	<u>Step 2: Verify Camera Operation</u> Verify whether the camera is turned on and ready for use.
3	<u>Step 3: Verify the Connection Between the Camera and PC</u> Verify whether the camera is properly recognized.
4	<u>Step 4: Configure Basic Settings for the Camera</u> Configure the camera output formats, trigger, exposure, and line rate settings.
5	<u>Step 5: Adjust the Image Quality</u> Perform DSNU, PRNU and other basic settings for image quality.
6	<u>Step 6: Save the Settings</u> Save the current setting configurations in user memory.

Short ASCII Commands

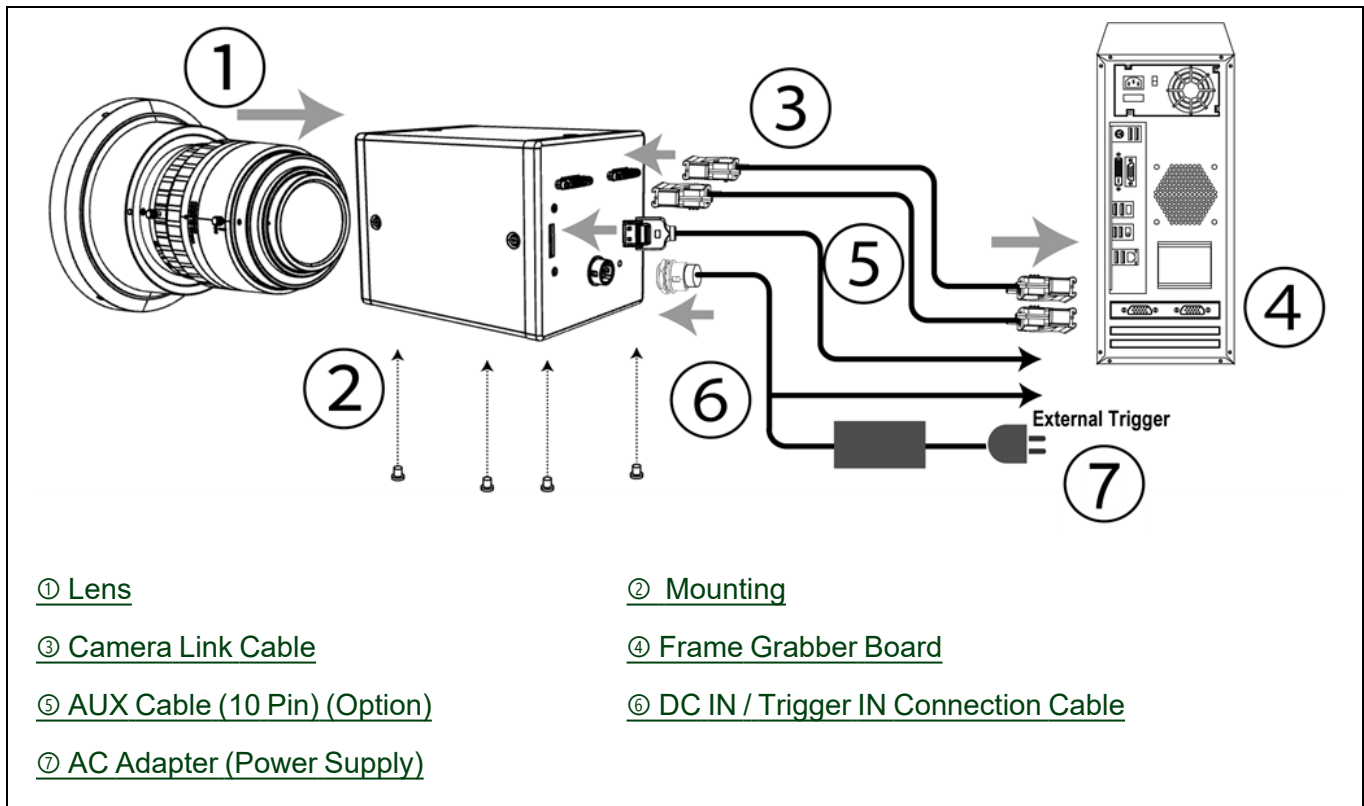
The most universal method for controlling a Camera Link camera such as SW-4000T-MCL is by the use of short ASCII commands sent via serial communications. All Camera Link frame grabber boards support the use of these short ASCII commands. SDKs that utilize these ASCII commands for developing machine vision applications are typically available from the grabber manufacturer, as well as from third-party vendors.

This section describes how to configure various camera settings using serial communication and specific short ASCII commands. See "[Short ASCII Command List](#)" for a complete list of all available ASCII commands for this camera.

Later sections of the manual refer to GenICam nomenclature for various features/functions and includes a complete list of all camera settings ([Setting List](#)).

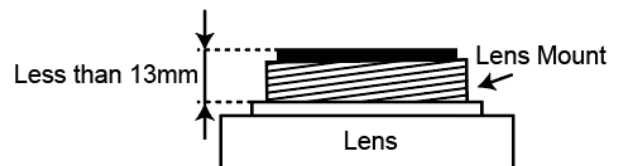
The SW-4000T-MCL fully supports applications written using GenICam-based SDKs. The advantage of this is that programs written using GenICam names can be applied with little or no modification to control cameras with other GenICam-compliant interfaces and even GenICam-compliant cameras from different vendors.

Step 1: Connect Devices



① Lens

F-mount or M-52 mount lenses with lens mount protrusions of 13 mm or less can be attached.



Caution: The maximum performance of the camera may not be realized depending on the lens.

Notes:

The following formula can be used to estimate the focal length: **Focal length = WD / (1 + W/w)**

WD: Working distance (distance between lens and object)

W: Width of object

w: Width of sensor (30.72mm)

② Mounting

When mounting the camera directly to a wall or other device, use screws that match the mounting holes on the camera. ([Mounting Holes](#))

Caution: For heavy lenses, be sure to support the lens itself. Do not use configurations in which its weight is supported by the camera.

③ Camera Link Cable

Connect the Camera Link cables to the DIGITAL I/O-1 and DIGITAL I/O-2 video output connectors.

- Use Cable Link compatible cables.
- Refer to the specifications of the cable for details on its bend radius.

Caution: Refer to [Notes on Camera Link Cable Connections](#) when connecting the cables to the connectors.

Note: The maximum Camera Link cable length is 10 m. The maximum length of cable you can use will also vary depending on type and maker. If the **CableEmphasis** setting of [TransportLayerControl](#) is changed from Normal to **Medium** or **Strong**, it may be possible to lengthen the Camera Link cable.

④ Frame Grabber Board

Refer to the operating instructions of the frame grabber board and configure settings on the computer as necessary. (Use a computer that meets the requirements of your frame grabber board).

⑤ AUX Cable (10 Pin) (Option)

Performs external I/O such as trigger input.

⑥ DC IN / Trigger IN Connection Cable

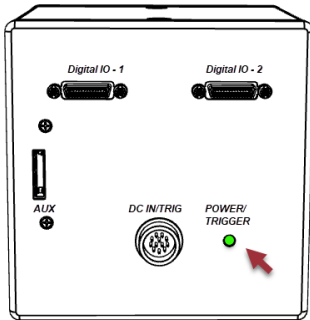
Performs external I/O such as power supply and trigger input.

⑦ AC Adapter (Power Supply)

Connect the AC adapter and the round connector of the connection cable to the DC IN / Trigger IN connector on the camera.

Step 2: Verify Camera Operation

When power is supplied to the camera while the necessary equipment is connected, the POWER/TRIG LED at the rear of the camera lights amber, and initialization of the camera starts. When initialization is complete, the POWER/TRIG LED lights green.



Verify whether power is being supplied to the camera by checking the rear LED. When properly turned on, the power LED is lit green.

For details on how to read the LEDs, see the [Connectors](#) section.

Note: If the POWER/TRIG LED does not switch to green within minutes of supplying power, check the DC IN/TRIG cable, the Camera Link cable and other connections.

Step 3: Verify the Connection Between the Camera and PC

Use a short ASCII command to verify whether the camera is properly recognized in your setup.

1. Install terminal emulator software capable of serial communication to the PC connected to the camera via the frame grabber board.

Set the following serial communication.

Baud Rate: 9600 (Default)

Data Length: 8bit

Start Bit: 1bit

Stop Bit: 1 bit

Parity: None

Xon/Xoff Control: None

2. Enter the command **DVN? <CR><LF>** from the terminal emulator software.

If correctly connected, response **DVN = JAI Ltd., Japan** will be displayed.

Item	Short ASCII Command	Description
DeviceVendorName	DVN	DVN? <CR><LF> Display the device vendor name: "JAI Ltd., Japan"

Step 4: Configure Basic Settings for the Camera

Configure the Camera Output Formats

Configure the pixel formats of the image output.

1. To check the current pixel format setting, enter the command **BA?<CR><LF>** from the terminal emulator software. The default setting is RGB8 (BA=0).
2. To change the pixel format setting to RGB10, enter **BA=1<CR><LF>**.

Note: For the details on the short ASCII commands required to configure the Output format settings, see "[Image Format Control](#)".

Configure Trigger, Exposure, and Line Rate Settings

Related Setting Items: [AcquisitionControl](#)

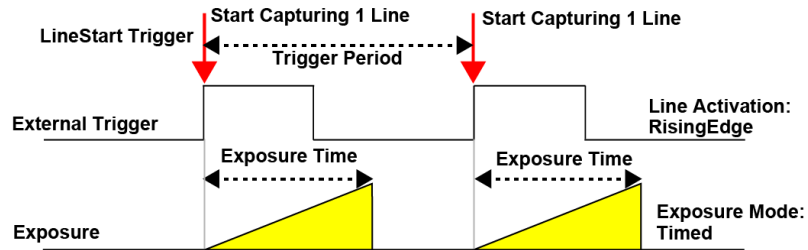
This section describes five scenarios for controlling the trigger, exposure, and line rate.

Notes:

- This section is intended to explain the basic relationship between the trigger, exposure, and line rate.
- This section is intended to explain the basic relationship between the trigger, exposure, and line rate. For the detailed timings, see "[Timing Chart](#)".
- For the details on the short ASCII commands required to configure the Trigger, Exposure and Line Rate settings, see "[Acquisition Control](#)".

Trigger Mode	Exposure Mode	Example
ON	Timed	Control via External Triggers with the Specified Exposure Time
	OFF	Control via External Triggers without Specifying the ExposureTime
	TriggerWidth	Control via External Triggers with Exposure Time Set to TriggerWidth
OFF	ON	Control without External Triggers with the Specified Exposure Time
	OFF	Control without External Triggers without Specifying the Exposure Time

Control via External Triggers with the Specified Exposure Time

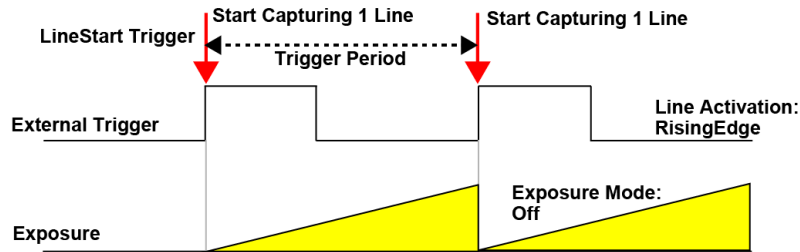


Notes:

- When using external triggers, the line rate is determined by the trigger period.
- The ExposureTime value cannot be longer than the trigger period.
- For details on internal delays, see "[ExposureMode = Timed](#)".

Item	Setting Value / Selectable Range
Trigger Mode	On
Trigger Source	Any
Trigger Activation	RisingEdge (rising edge of input signal) or FallingEdge (falling edge of input signal)
Exposure Mode	Timed (control via exposure time)
Exposure Time	Varies depending on settings.

Control via External Triggers without Specifying the ExposureTime

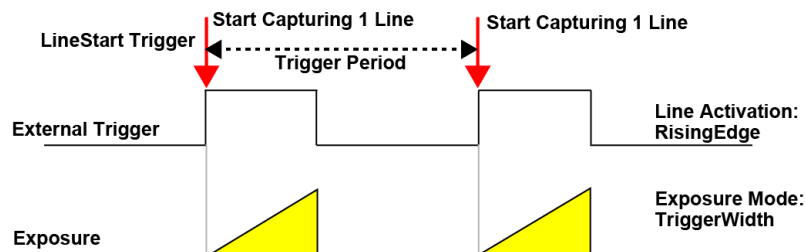


Notes:

- When using external triggers, the line rate is determined by the trigger period.
- The exposure is performed with an exposure time calculated from $1 / (\text{line rate})$.
- For details on internal delays, see "[ExposureMode = Off](#)".

Item	Setting Value / Selectable Range
Trigger Mode	On
Trigger Source	Any
Trigger Activation	RisingEdge (rising edge of input signal) or FallingEdge (falling edge of input signal)
Exposure Mode	Off

Control via External Triggers with Exposure Time Set to TriggerWidth



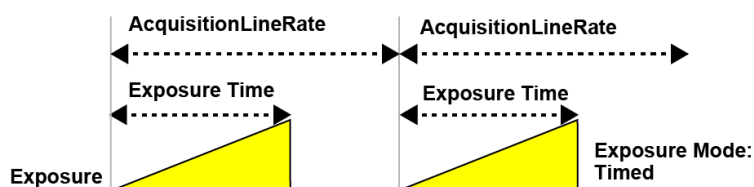
Notes:

- When using external triggers, the line rate is determined by the trigger period.
- For details on internal delays, see "[ExposureMode = TriggerWidth](#)".

Item	Setting Value / Selectable Range
Trigger Mode	On
Trigger Source	Any
Trigger Activation	LevelHigh (high-level duration) or LevelLow (low-level duration)
Exposure Mode	TriggerWidth (control via trigger width)

Control without External Triggers with the Specified Exposure Time

Configure the settings as follows.



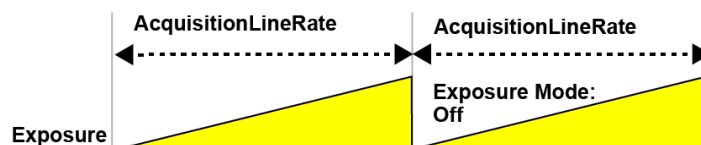
Notes:

- The line rate can be set up to 1 line cycle to match the speed of the object or to lengthen the accumulation time to increase sensitivity.
- The ExposureTime value cannot be longer than the line period.

Item	Setting Value / Selectable Range
Trigger Mode	Off
Exposure Mode	Timed (control via exposure time)
Exposure Time	Varies depending on settings.
Acquisition Line Rate	Varies depending on the PixelFormat and Link speed.

Control without External Triggers without Specifying the Exposure Time

Configure the settings as follows.



Notes:

- The line rate can be set up to 1 line cycle to match the speed of the object or to lengthen the accumulation time to increase sensitivity.
- The exposure will be performed with an exposure time equal to 1 / line rate.

Item	Setting Value / Selectable Range
Trigger Mode	Off
Exposure Mode	Off
Acquisition Line Rate	Varies depending on the PixelFormat and Link speed.

Step 5: Adjust the Image Quality

Related Setting Items: [AnalogControl](#)

Note: For the details on the short ASCII commands required to configure the image quality settings, see "[Analog Control](#)".

To maximize the performance of the camera, configure its basic function in the following order.

1. [DSNU Correction \(Pixel Black Correct\)](#)
2. [PRNU Correction \(Pixel Gain Correct\)](#)
3. [Adjust the Black Level](#)
4. [Adjust the White Balance](#)

DSNU Correction (Pixel Black Correct)

Related Setting Items: [JAI Custom Control Pixel Correction](#)

DSNU (dark signal non-uniformity) is a variation between pixels in the dark areas generated by the sensor. If the line rate is slowed or a long exposure time is set, the dark current in the sensor may change and the state of the DSNU may change.



1. Place the sensor protection cap on the camera.
2. Start image acquisitions with AcquisitionStart [[AcquisitionControl](#)].
3. Specify the user area (User1 ~ User3) to save the black level correction value with **PixelBlackCorrectionMode** ([JAI Custom Control Pixel Correction](#)).

Note: You cannot perform calibration when **Off** or **Default** is selected.

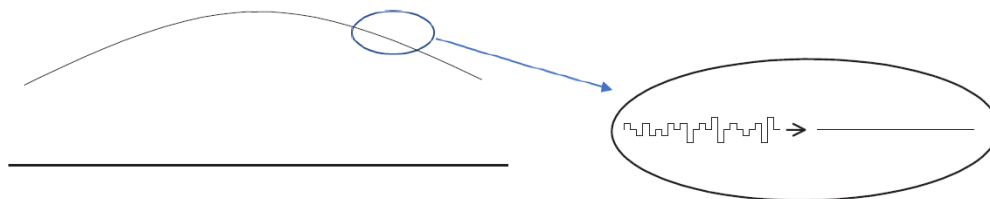
4. Black level correction data is automatically generated by **PerformPixelBlackCalibration** and saved in the user area specified in step 1.
5. You can check the execution result of black level correction by **PixelBlackDetectResult**.

Result	Description
Succeeded	The correction has been successfully completed. The correction data has been saved to the user area specified in PixelBlackCorrection.
Image too bright	Correction failed. The image was too bright.
Image too dark	Correction failed. The image was too dark.
Timeout-error	Correction failed. Timeout error has occurred.

PRNU Correction (Pixel Gain Correct)

Related Setting Items: [JAI Custom Control Pixel Correction](#)

PRNU (photo response non-uniformity) is a variation between pixels generated by the sensor under bright conditions. If the line rate is slowed or a long exposure time is set, the dark current in the sensor may change and the state of the PRNU may change.



How to Execute

Notes:

- The video level should be between 70% and 90% of the saturation level.
- The lens should be defocused.
- The subject should be a white, flat surface (such as a sheet of white paper).

1. Specify the user area (User1 ~ User3) to save the gain correction value with **PixelGainCorrectionMode** ([JAI Custom Control Pixel Correction](#)).

Note: Default saves the correction data set at the factory. You cannot overwrite this data.

2. Execute **PerformPixelGainCalibration** and correct the image. Gain correction data is automatically generated and saved in the area specified in **PixelGainCorrectionMode**.
3. You can check the execution result of gain correction by **PixelGainDetectResult**.

Result	Description
Succeeded	The correction has been successfully completed. The correction data has been saved to the user area specified in PixelGainCorrectionMode.
Image too bright	Correction failed. The image was too bright.
Image too dark	Correction failed. The image was too dark.
Timeout-error	Correction failed. Timeout error has occurred.

Caution: This camera may take several minutes or more to complete PRNU correction.

Adjust the Black Level

Related Setting Items: [AnalogControl](#)

Black level correction is a function for adjusting the setup level. When this function is used, the following is performed for the gain mode setting.

1. Select the black level you want to configure in **BlackLevelSelector**. (DigitalAll, DigitalRed, DigitalBlue)
2. Specify the adjustment value in **BlackLevel**. (All: -133 ~ 255; Red/Blue: -64 ~ 64)

Adjust the White Balance

Related Setting Items: [AnalogControl](#)

Adjust the white balance using the automatic adjustment function.

Automatic White Balance Adjustment

1. Place a white sheet of paper or similar object under the same lighting conditions as the intended subject, and zoom in to capture the white. White objects near the subject, such as a white cloth or wall, can also be used. Be sure to prevent the high-intensity spot lights from entering the screen.
2. If necessary, use **BalanceWhiteAutoWidth** and **BalanceWhiteAutoOffsetX** to configure the white balance adjustment area.
3. Select **Once** or **ExposureOnce** from **BalanceWhiteAuto**.

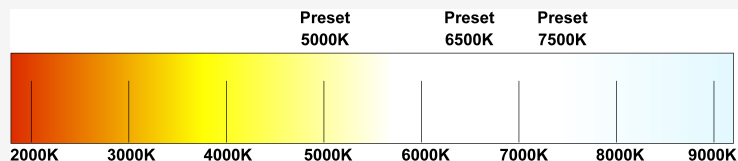
- **Once:** The white balance is automatically adjusted by calculating Red / Blue of the Gain control ([AnalogControl](#)). When **IndividualGainMode = Off**, the white balance is adjusted based on **DigitalAll** of the Gain setting, and when **IndividualGainMode = On**, it is adjusted based on **DigitalGreen** of the **Gain** setting. (Control range: 3000K ~ 9000K)
- **ExposureOnce:** The white balance is automatically adjusted by calculating Red / Blue of the ExposureTime setting based on the Green ExposureTime setting ([AcquisitionControl](#)).

Note: To use the **ExposureOnce** option, **ExposureTimeMode** ([AcquisitionControl](#)) must be set to **Individual**.

- The white balance is automatically adjusted. After the adjustment, "**Succeeded**" is displayed in **AWBOnceStatus** (when BalanceWhiteAuto = Once) or **AWBExposureOnceStatus** (when BalanceWhiteAuto = ExposureOnce). Once the adjustment is completed, BalanceWhiteAuto returns to Off.
- The table below shows a list of the adjustment result:

Result	Description
Succeeded	Adjustment was completed successfully. After the adjustment, BalanceWhiteAuto returns to Off.
Error1 - G image was too bright	Adjustment failed. The Green level was too high compared to the Red or Blue level.
Error2 - G image was too dark	Adjustment failed. The Green level was too low compared to the Red or Blue level.
Error3 - Timeout	Adjustment failed. Adjustment was repeated for 10 seconds without success.

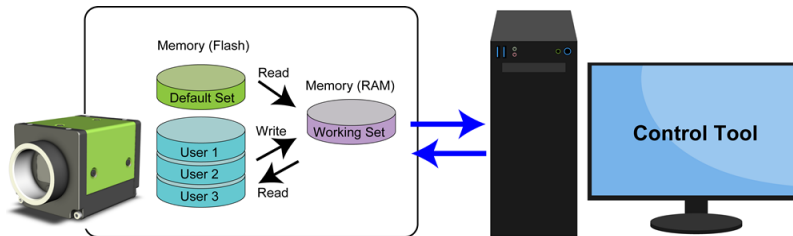
Note: On this camera, the white balance can also be set to "Color Temperature" (**Preset5000K**, **Preset6500K**, **Preset7500K**). When using the Color Temperature option, **IndividualGainMode** ([AnalogControl](#)) must be set to **Off**.



Step 6: Save the Settings

Related Setting Items: [UserSetControl](#)

The configured setting values will be deleted when the camera is turned off. By saving current setting values to user memory, you can load and recall them whenever necessary. You can save up to three sets of user settings in the camera. (User Set1 to 3)



Notes:

- Settings will not be saved on the PC.
- For the details on the short ASCII commands required to configure the save/load settings, see [User Set Control](#).

Save the User Settings

1. Stop image acquisition. Settings can only be saved when image acquisition on the camera is stopped.
2. Specify the storage location (UserSet1 - UserSet3) using the **UserSetSave** command and save the current camera settings.

Load the User Settings

1. Stop image acquisition. User settings can only be loaded when image capture on the camera is stopped.
2. Specify the storage location (UserSet1 - UserSet3) using the **UserSetLoad** command and read the settings of the camera.

Note: When selecting **Default** for UserSetSelector, the factory settings are loaded.

Main Functions

This chapter describes the camera's main functions.

Basic Function Matrix

The following signals can be used as sources for each output destination (TriggerSelector, LineSelector, PulseGeneratorSelector). The combinations of source signals and output destinations are indicated in the following.

Line Selector

	Output Destination					
	Line1 TTLOut1	Line8 TTLOut2	Line9 TTLOut3	Line12 TTLOut4	NANDO0	NANDO1
LOW	• (Default)	• (Default)	• (Default)	• (Default)	• (Default)	• (Default)
High	•	•	•	•	•	•
Line4 TTLIn1	•	•	•	•	•	•
Line5 OptoIn1	•	•	•	•	•	•
Line7 CL-CC1	•	•	•	•	•	•
Line10 TTLIn2	•	•	•	•	•	•
Line13 TTLIn3	•	•	•	•	•	•
Encoder Trigger	•	•	•	•	•	•
UserOutput 1 ~ 3	•	•	•	•	•	•
PulseGenerator 1 ~ 3	•	•	•	•	•	•
NANDO Out	•	•	•	•		•
NAND1 Out	•	•	•	•	•	
Exposure Active	•	•	•	•	•	•
LVAL	•	•	•	•	•	•
EncoderDetection	•	•	•	•	•	•

LineStart Trigger, PulseGenerator Selector

	Output Destination				
	LineStart Trigger	Pulse Generator0	Pulse Generator1	Pulse Generator2	Pulse Generator3
LOW	•	• (Default)	• (Default)	• (Default)	• (Default)
High	•	•	•	•	•
Line4 TTLIn1	• (Default)	•	•	•	•
Line5 OptoIn1	•	•	•	•	•
Line7 CL-CC1	•	•	•	•	•
Line10 TTLIn2	•	•	•	•	•
Line13 TTLIn3	•	•	•	•	•
Encoder Trigger	•	•	•	•	•
UserOutput 1 ~ 3	•	•	•	•	•
PulseGenerator 1 ~ 3	•				
NAND0 Out	•	•	•	•	•
NAND1 Out	•	•	•	•	•
Exposure Active		•	•	•	•
LVAL		•	•	•	•
EncoderDetection		•	•	•	•

ROI (Regional Scanning Function)

Related Setting Items: [ImageFormatControl](#)

The ROI (region of interest) function allows you to output images by specifying the area to scan.

ROI Settings

Specify the area to scan by specifying the Width and Horizontal Offset values ([ImageFormatControl](#)).

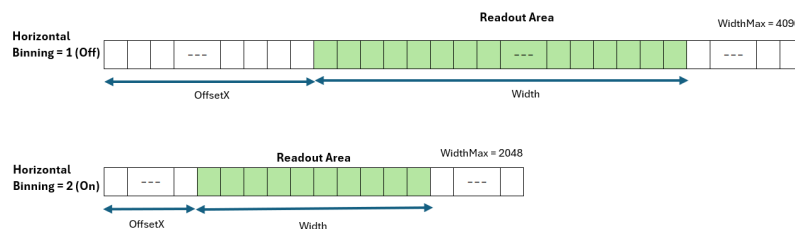
Notes:

- On this camera, **Height** is fixed to 1.
- For the relationship between this function and the line rate, see "[Number of Pixels per Line and Line Rate](#)".

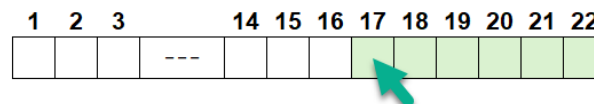
The setting ranges for the ROI function's readable area based on the Binning setting are as follows.

BinningHorizontal	Width (Pixel)	Offset X (Pixel)
1 (Off)	16 ~ 4096, Step 16	0 ~ 4080, Step 16
2 (On)	8 ~ 2048, Step 8	0 ~ 2040, Step 8

Example



For example, when **OffsetX** is set to 16, the first readout pixel is the 17th pixel.



Binning

Related Setting Items: [ImageFormatControl](#)

In this mode, a camera combines the charge collected in two adjacent pixels. This halves the effective resolution to 2048 pixels, but doubles the sensitivity (= Sum). On this camera, the line rate is not affected by Binning.

Binning = 1 (Off)	Binning = 2 (ON): Sum Mode
	

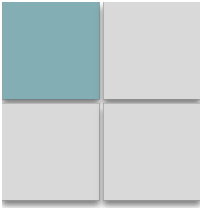
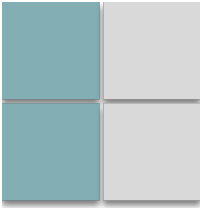
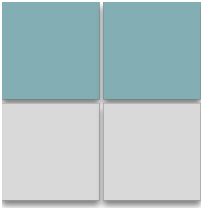
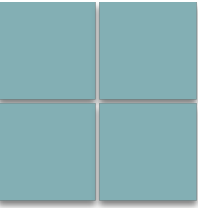
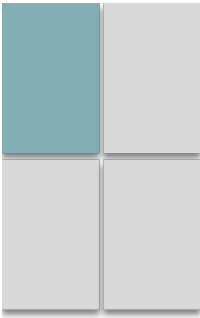
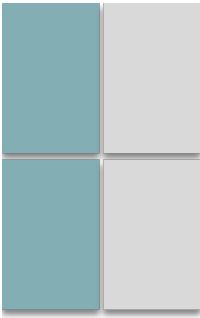
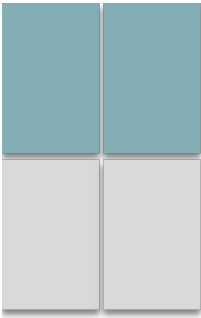
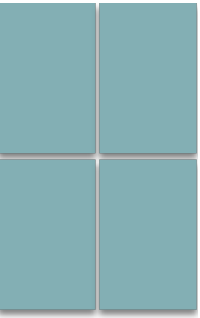
This camera supports BinningHorizontal and BinningVertical.

	Process Method	Mode
BinningHorizontal	Digital (FPGA)	Sum
BinningVertical	Analog (Sensor)	Sum

Notes:

- On this camera, the line rate is not affected by Binning.
- Refer to JAI's blog "[Using pixel binning to increase image quality under low light conditions](#)" on how to use the Binning function.

Setting Examples

Sensor Type	Binning Off	1 x 2	2 x 1	2 x 2
Type A				
	7.5 μm x 7.5 μm 4096 pixels	7.5 μm x 15.0 μm 4096 pixels	15.0 μm x 7.5 μm 2048 pixels	15.0 μm x 15.0 μm 2048 pixels
Type B				
	7.5 μm x 10.5 μm 4096 pixels	7.5 μm x 21.0 μm 4096 pixels	15.0 μm x 10.5 μm 2048 pixels	15.0 μm x 21.0 μm 2048 pixels

Note: Sensor Type can be configured in SensorType [\[ImageFormatControl\]](#).

Pixel Format

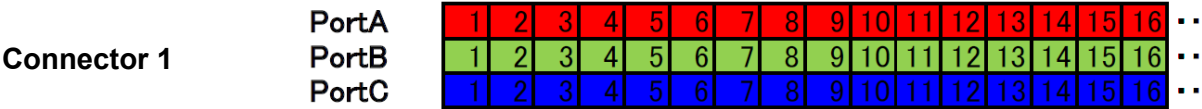
Related Setting Items: [ImageFormatControl](#)

This camera supports two output formats (RGB8 and RGB10). The selectable PixelFormat depends on the CIConfiguration ([TransportLayerControl](#)) setting (see below).

CIConfiguration	PixelFormat
Base	RGB8
Medium	RGB8, RGB10
Full	RGB8
80bit (Deca)	RGB8

Note: The CIConfiguration and PixelFormat settings on the camera side and the frame grabber board side must match. For details on frame grabber board settings, refer to the instruction manual of the board.

CIConfiguration Base - PixelFormat RGB8



Connector 1

Port / Bit	24-bit RGB
Port A0	R0
Port A1	R1
Port A2	R2
Port A3	R3
Port A4	R4
Port A5	R5
Port A6	R6
Port A7	R7
Port B0	G0
Port B1	G1
Port B2	G2
Port B3	G3
Port B4	G4
Port B5	G5
Port B6	G6
Port B7	G7
Port C0	B0
Port C1	B1
Port C2	B2
Port C3	B3
Port C4	B4
Port C5	B5
Port C6	B6
Port C7	B7

CIConfiguration Medium - PixelFormat RGB8

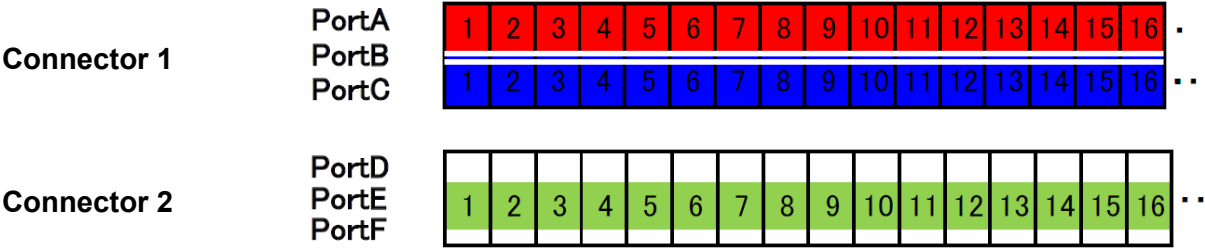
Connector 1	PortA	1 3 5 7 9 11 13 15 ..
	PortB	1 3 5 7 9 11 13 15 ..
	PortC	1 3 5 7 9 11 13 15 ..
Connector 2	PortD	2 4 6 8 10 12 14 16 ..
	PortE	2 4 6 8 10 12 14 16 ..
	PortF	2 4 6 8 10 12 14 16 ..

Connector 1

Connector 2

Port / bit	Custom	Port / bit	Custom
Port A0	R0	Port D0	R0
Port A1	R1	Port D1	R1
Port A2	R2	Port D2	R2
Port A3	R3	Port D3	R3
Port A4	R4	Port D4	R4
Port A5	R5	Port D5	R5
Port A6	R6	Port D6	R6
Port A7	R7	Port D7	R7
Port B0	G0	Port E0	G0
Port B1	G1	Port E1	G1
Port B2	G2	Port E2	G2
Port B3	G3	Port E3	G3
Port B4	G4	Port E4	G4
Port B5	G5	Port E5	G5
Port B6	G6	Port E6	G6
Port B7	G7	Port E7	G7
Port C0	B0	Port F0	B0
Port C1	B1	Port F1	B1
Port C2	B2	Port F2	B2
Port C3	B3	Port F3	B3
Port C4	B4	Port F4	B4
Port C5	B5	Port F5	B5
Port C6	B6	Port F6	B6
Port C7	B7	Port F7	B7

CIConfiguration Medium - PixelFormat RGB10



Connector 1		Connector 2	
Port / bit	30-bit RGB	Port / bit	30-bit RGB
Port A0	R0	Port D0	-
Port A1	R1	Port D1	-
Port A2	R2	Port D2	-
Port A3	R3	Port D3	-
Port A4	R4	Port D4	-
Port A5	R5	Port D5	-
Port A6	R6	Port D6	-
Port A7	R7	Port D7	-
Port B0	R8	Port E0	G0
Port B1	R9	Port E1	G1
Port B2	-	Port E2	G2
Port B3	-	Port E3	G3
Port B4	B8	Port E4	G4
Port B5	B9	Port E5	G5
Port B6	-	Port E6	G6
Port B7	-	Port E7	G7
Port C0	B0	Port F0	G8
Port C1	B1	Port F1	G9
Port C2	B2	Port F2	-
Port C3	B3	Port F3	-
Port C4	B4	Port F4	-
Port C5	B5	Port F5	-
Port C6	B6	Port F6	-
Port C7	B7	Port F7	-

CIConfiguration Full - PixelFormat RGB8

Connector 1	PortA	1 3 6 9 11 14	..
	PortB	1 4 6 9 12 14	..
	PortC	1 4 7 9 12 15	..
Connector 2	PortD	2 4 7 10 12 15	..
	PortE	2 5 7 10 13 15	..
	PortF	2 5 8 10 13 16	..
	PortG	3 5 8 11 13 16	..
	PortH	3 6 8 11 14 16	..

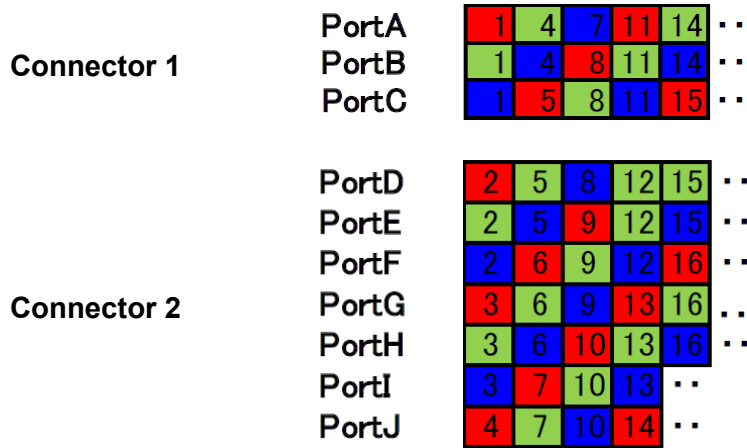
Connector 1

Port / bit	24-bit RGB
Port A0	R0
Port A1	R1
Port A2	R2
Port A3	R3
Port A4	R4
Port A5	R5
Port A6	R6
Port A7	R7
Port B0	G0
Port B1	G1
Port B2	G2
Port B3	G3
Port B4	G4
Port B5	G5
Port B6	G6
Port B7	G7
Port C0	B0
Port C1	B1
Port C2	B2
Port C3	B3
Port C4	B4
Port C5	B5
Port C6	B6
Port C7	B7

Connector 2

Port / bit	24bit-RGB	Port / bit	24-bit RGB
Port D0	R0	Port G0	R0
Port D1	R1	Port G1	R1
Port D2	R2	Port G2	R2
Port D3	R3	Port G3	R3
Port D4	R4	Port G4	R4
Port D5	R5	Port G5	R5
Port D6	R6	Port G6	R6
Port D7	R7	Port G7	R7
Port E0	G0	Port H0	G0
Port E1	G1	Port H1	G1
Port E2	G2	Port H2	G2
Port E3	G3	Port H3	G3
Port E4	G4	Port H4	G4
Port E5	G5	Port H5	G5
Port E6	G6	Port H6	G6
Port E7	G7	Port H7	G7
Port F0	B0		
Port F1	B1		
Port F2	B2		
Port F3	B3		
Port F4	B4		
Port F5	B5		
Port F6	B6		
Port F7	B7		

CIConfiguration EightyBit - PixelFormat RGB8



Connector 1

Port / bit	24-bit RGB
Port A0	R0
Port A1	R1
Port A2	R2
Port A3	R3
Port A4	R4
Port A5	R5
Port A6	R6
Port A7	R7
Port B0	G0
Port B1	G1
Port B2	G2
Port B3	G3
Port B4	G4
Port B5	G5
Port B6	G6
Port B7	G7
Port C0	B0
Port C1	B1
Port C2	B2
Port C3	B3
Port C4	B4
Port C5	B5
Port C6	B6
Port C7	B7

Connector 2

Port / bit	24-bit RGB	Port / bit	24-bit RGB	Port / bit	24-bit RGB
Port D0	R0	Port G0	R0	Port J0	R0
Port D1	R1	Port G1	R1	Port J1	R1
Port D2	R2	Port G2	R2	Port J2	R2
Port D3	R3	Port G3	R3	Port J3	R3
Port D4	R4	Port G4	R4	Port J4	R4
Port D5	R5	Port G5	R5	Port J5	R5
Port D6	R6	Port G6	R6	Port J6	R6
Port D7	R7	Port G7	R7	Port J7	R7
Port E0	G0	Port H0	G0		
Port E1	G1	Port H1	G1		
Port E2	G2	Port H2	G2		
Port E3	G3	Port H3	G3		
Port E4	G4	Port H4	G4		
Port E5	G5	Port H5	G5		
Port E6	G6	Port H6	G6		
Port E7	G7	Port H7	G7		
Port F0	B0	Port I0	B0		
Port F1	B1	Port I1	B1		
Port F2	B2	Port I2	B2		
Port F3	B3	Port I3	B3		
Port F4	B4	Port I4	B4		
Port F5	B5	Port I5	B5		
Port F6	B6	Port I6	B6		
Port F7	B7	Port I7	B7		

Change the Line Rate

Related Setting Items: [AcquisitionControl](#)

When TriggerMode is set to Off, you can set the line rate using AcquisitionLineRate. This function can be used to match the scanning speed of the camera to the feeding speed of the object or to lengthen the accumulation time to increase sensitivity. (Variable Range: 66 Hz to 67.7 kHz when Width = 4096; step: 0.1Hz)

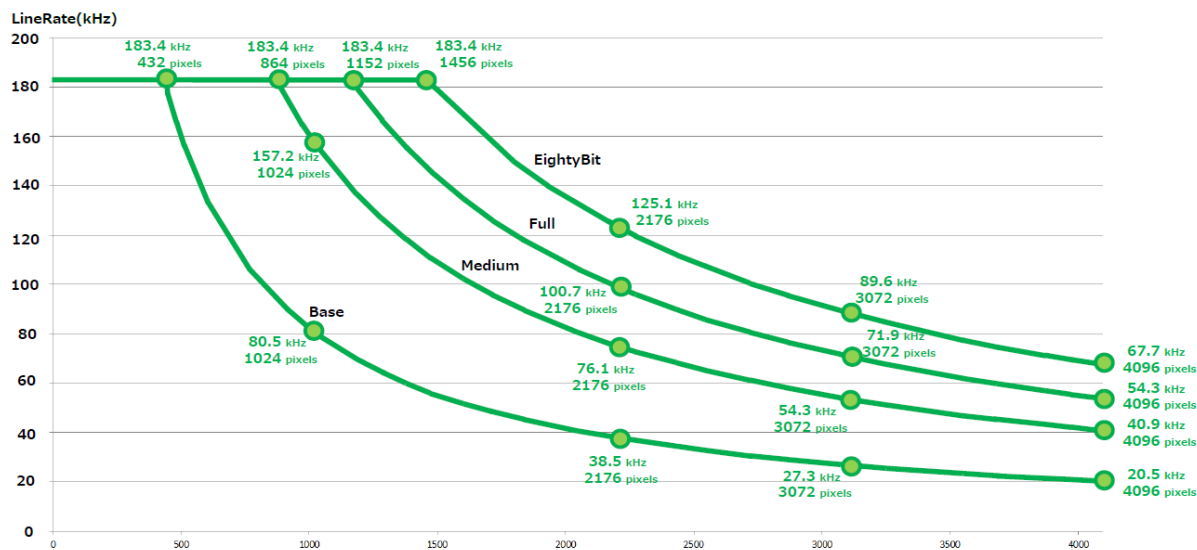
Notes:

- You can also save the setting, and have it applied whenever the power is subsequently turned on, but this requires addition operations. ([Step 6: Save the Settings](#))
- Switching and settings storage for this function is performed via serial communication.
- The black level will change depending on the line rate, so be sure to readjust the black level after changing the line rate or trigger period.

Number of Pixels per Line and Line Rate

You can increase the line rate by decreasing the number of pixels per line. Use Width (ASCII = WTC) to set the line width. Line rate can be increased to a maximum of 183.4 kHz for each configuration.

The relationship between the number of pixels per line and the line rate for each CL configuration is shown below. Widths smaller than the minimums shown will also run at 183.4 kHz.



Note: The line rate in the case of CameralinkClockFrequency 85MHz, PixelFormat RGB8, ExposureMode Off. The maximum line rate varies depending on operating conditions.

Trigger Control

Related Setting Items: [AcquisitionControl](#)

The camera allows Line Start trigger controls to be performed via external trigger signals. The Line Start trigger allows exposure control via the trigger signal inputs.

Supported Operation Mode

TriggerMode	ExposureMode	Example
On	Timed	Control via External Triggers with the Specified Exposure Time
On	Off	Control via External Triggers without Specifying the ExposureTime
On	TriggerWidth	Control via External Triggers with Exposure Time Set to TriggerWidth

Note: The minimum Trigger Pulse Width is 3 μ s for Camera Link, and 50ns for TTL In.

Exposure Mode

Related Setting Items: [AcquisitionControl](#)

This function allows exposure at a preset accumulation time regardless of the line rate. The setting range is 3.0 μ s ~ 15.149ms.

This camera supports the following exposure modes:

Exposure Mode	Description	Setting Example
Off	Exposure control is not performed (free-running operation).	Control via External Triggers without Specifying the ExposureTime
		Control without External Triggers without Specifying the Exposure Time
Timed	Mode in which control is performed using ExposureTime. Acquire images using an exposure time configured beforehand on an external trigger.	Control via External Triggers with the Specified Exposure Time
		Control without External Triggers with the Specified Exposure Time
TriggerWidth	Mode in which control of the exposure time is performed using the pulse width of the trigger input signal. The exposure time will be the same as the pulse width of the trigger input signal.	Control via External Triggers with Exposure Time Set to TriggerWidth

Note: When **ExposureMode** is set to **Timed** or **TriggerWidth**, the actual exposure time will consist of the image sensor's offset duration subtracted from the ExposureTime setting configured on the camera or the Width of the trigger signal to the camera. For more information, see "[Actual Exposure Time](#)".

ExposureTimeMode

Exposure Time Mode	Description
Common	Set the common exposure time for Red, Green, and Blue (the RGB channels will have the same exposure time).
Individual	Set the exposure times for Red, Green, and Blue individually. To set the exposure time individually for Red, set ExposureTimeSelector to Red, and configure the exposure time for Red in ExposureTime. Similarly, configure the exposure times individually for Green and Blue.

Notes:

- When ExposureMode is set other than Timed, ExposureTimeMode is fixed to Common.
- The **RBExposureInterlocked** function is available when Individual is selected. This function changes the exposure time while maintaining the Red / Blue exposure time ratio (G:R and G:B ratio before the change) with respect to Green.

For example, if R: 20 μ s / G: 10 μ s / B: 15 μ s and G is changed to 30 μ s, R will automatically change to 60 μ s (= 20 * 30 / 10) and B will automatically change to 45 μ s (= 15 * 30 / 10).

Actual Exposure Time

Related Setting Items: [AcquisitionControl](#)

The actual exposure time will consist of the image sensor's offset duration ($0.85\mu\text{s}$) subtracted from the ExposureTime setting configured on the camera or the Width of the trigger signal to the camera.

- Exposure Offset Time: $-0.85\mu\text{s}$

The minimum ExposureTime setting is $3\mu\text{s}$ (setting unit: 10ns), and the maximum Exposure setting depends on other settings (see Exposure Mode on "[Specifications](#)").

Note: The exposure time setting unit for this camera is 10ns. For example, to set ExposureTime to $3\mu\text{s}$, enter 300 in ExposureTime ($1\mu\text{s} = 100$).

■ ExposureMode = Timed

When ExposureTime is set to $3\mu\text{s}$, the actual exposure time will be $2.15\mu\text{s}$ ($= 3\mu\text{s} - 0.85\mu\text{s}$).

■ ExposureMode = TriggerWidth

The actual exposure time will consist of the image sensor's offset duration added to the Width of the trigger signal to the camera. If the needed ExposureTime is $2.15\mu\text{s}$, the width of the Trigger Signal to the camera will be $3\mu\text{s}$ ($= 2.15\mu\text{s} + 0.85\mu\text{s}$).

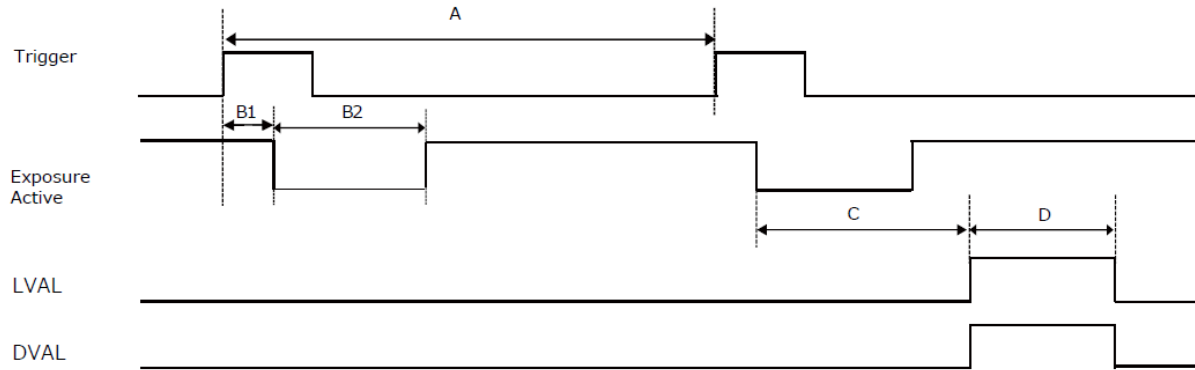
Timing Chart

Related Setting Items: [AcquisitionControl](#)

This section shows timing charts for the following exposure modes when TriggerMode = On.

- [ExposureMode = Off](#)
- [ExposureMode = Timed](#)
- [ExposureMode = TriggerWidth](#)

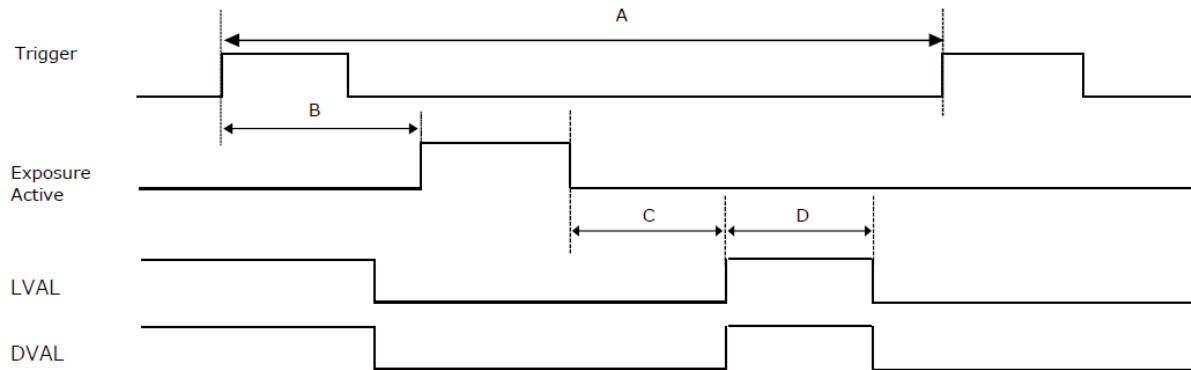
ExposureMode = Off



A	Trigger Period (μs)
B1	Delay Time from Trigger to Exposure Active (ns)
B2	Exposure Active Non Active (μs)
C	Period from Exposure Active Falling to LVAL Rising (μs)
D	LVAL ACTIVE (μs)

CL Configuration	PixelFormat	CL Clock (MHz)	[A]	[B1]	[B2]	[C]	[D]
Base	RGB8	42.5	97.58	224 ~ 245	3.23 ~ 3.25	47	96.8
		63.75	65.06	224 ~ 245	3.23 ~ 3.25	47	64.5
		85	48.8	224 ~ 246	3.23 ~ 3.25	47	48.4
Medium	RGB8	42.5	48.8	224 ~ 245	3.23 ~ 3.25	47	48.4
		63.75	32.54	224 ~ 245	3.23 ~ 3.25	47	32.2
		85	24.41	224 ~ 246	3.23 ~ 3.25	47	24.2
	RGB10	42.5	97.58	224 ~ 245	3.23 ~ 3.25	47	96.8
		63.75	65.06	224 ~ 245	3.23 ~ 3.25	47	64.5
		85	48.8	224 ~ 246	3.23 ~ 3.25	47	48.4
Full	RGB8	42.5	36.64	224 ~ 245	3.23 ~ 3.25	47	36.3
		63.75	24.43	224 ~ 245	3.23 ~ 3.25	47	24.2
		85	18.33	224 ~ 246	3.23 ~ 3.25	47	18.1
Eighty Bit	RGB8	42.5	29.32	224 ~ 246	3.23 ~ 3.25	47	29.0
		63.75	19.55	224 ~ 246	3.23 ~ 3.25	47	19.4
		85	14.67	224 ~ 246	3.23 ~ 3.25	47	14.5

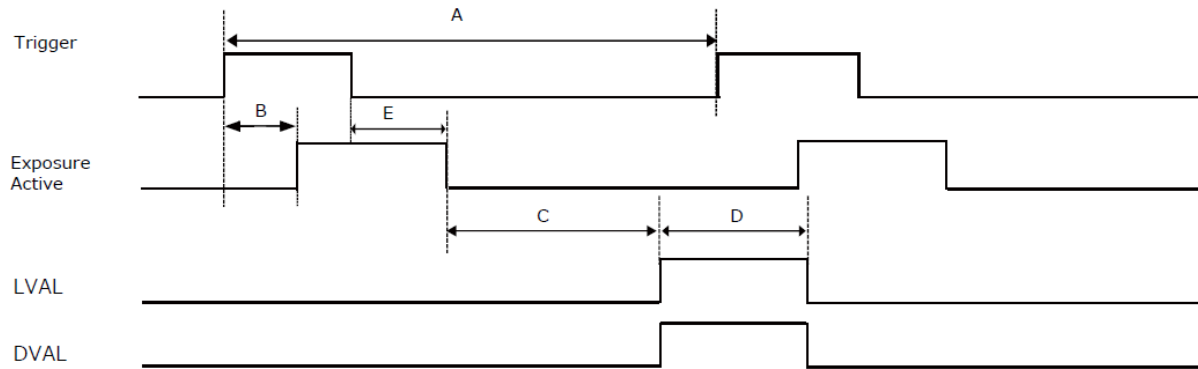
ExposureMode = Timed



A	Trigger Period (μs)
B	Delay Time from Trigger to Exposure Active (ns)
C	Period from Exposure Active Falling to LVAL Rising (μs)
D	LVAL ACTIVE (μs)

CL Configuration	PixelFormat	CL Clock (MHz)	[A]	[B]	[C]	[D]
Base	RGB8	42.5	97.1	165 ~ 186	47	96.8
		63.75	64.74	165 ~ 186	47	64.5
		85	48.56	165 ~ 186	47	48.4
Medium	RGB8	42.5	48.86	165 ~ 186	47	48.4
		63.75	32.58	165 ~ 186	47	32.2
		85	24.44	165 ~ 186	47	24.2
	RGB10	42.5	97.1	165 ~ 186	47	96.8
		63.75	64.74	165 ~ 186	47	64.5
		85	48.56	165 ~ 186	47	48.4
Full	RGB8	42.5	36.80	165 ~ 186	47	36.3
		63.75	24.54	165 ~ 186	47	24.2
		85	18.41	165 ~ 186	47	18.1
Eighty Bit	RGB8	42.5	29.52	165 ~ 186	47	29.0
		63.75	19.70	165 ~ 186	47	19.4
		85	14.77	165 ~ 186	47	14.5

ExposureMode = TriggerWidth



A	Trigger Period (μs)
B	Delay Time from Trigger to Exposure Active (ns)
E	Exposure Active Non Active (ns)
C	Period from Exposure Active Falling to LVAL Rising (μs)
D	LVAL ACTIVE (μs)

CL Configuration	PixelFormat	CL Clock (MHz)	[A]	[B]	[E]	[C]	[D]
Base	RGB8	42.5	97.58	165 ~ 186	225 ~ 247	47 ~ 48	96.8
		63.75	65.06	165 ~ 186	225 ~ 247	47	64.5
		85	48.8	165 ~ 186	225 ~ 247	47	48.4
Medium	RGB8	42.5	48.8	165 ~ 186	225 ~ 247	47 ~ 48	48.4
		63.75	32.54	165 ~ 186	225 ~ 247	47	32.2
		85	24.41	165 ~ 186	225 ~ 247	47	24.2
	RGB10	42.5	97.58	165 ~ 186	225 ~ 247	47 ~ 50	96.8
		63.75	65.06	165 ~ 186	225 ~ 247	47	64.5
		85	48.8	165 ~ 186	225 ~ 247	47	48.4
Full	RGB8	42.5	36.64	165 ~ 186	225 ~ 246	47 ~ 48	36.3
		63.75	24.43	165 ~ 186	225 ~ 246	47	24.2
		85	18.33	165 ~ 186	225 ~ 246	47	18.1
Eighty Bit	RGB8	42.5	29.32	165 ~ 186	225 ~ 246	47 ~ 48	29
		63.75	19.55	165 ~ 186	225 ~ 247	47	19.4
		85	14.67	165 ~ 186	225 ~ 246	47	14.5

Gain Control

Related Setting Items: [AnalogControl](#)

Gain can be controlled manually or automatically on this camera.

Manual Adjustment

- **Digital Gain:** Configure Gain in Master Mode or Individual Gain Mode. For more information, see "[Individual Gain Mode](#)".
- **Analog Gain:** This setting is applied to the analog video signal output from the sensor. The gain steps can be configured to one of three levels (0 dB, 6 dB, 12 dB).

Note: The following two gain values are added together for the total gain value: Total Gain = AnalogGain (dB) + DigitalGain (dB)

Automatic Adjustment

This camera can automatically adjust the gain.

1. Set **IndividualGainMode** to **On**.
2. Configure **AGCReference** to set the convergence level.
3. Set **GainAuto** to **Once**.
4. The Gain value is automatically adjusted. After the adjustment, **GainAuto** returns to **Off**.
5. The adjustment status can be checked in AGCOnceStatus.

Notes:

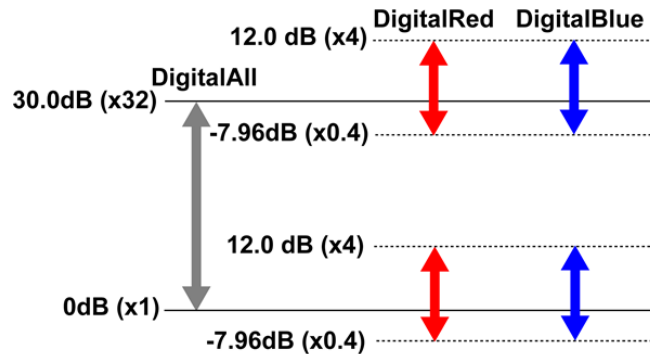
- The following two gain values are added together for the total gain value.
Total Gain = AnalogBaseGain (dB) + DigitalGain (dB)
- In the IndividualGainMode, BalanceWhiteAuto cannot be set automatically.

Individual Gain Mode

Configure DigitalGain using this mode. The available options are as follows:

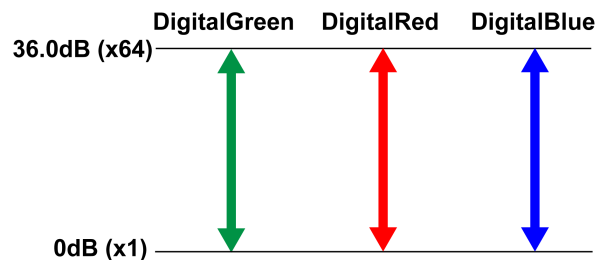
Note: The Gain setting is configured in multipliers. For more information, see "[Comparison of the Decibel Display and Multiplier Display](#)."

Individual Gain Mode = Off (Master Mode)



Adjust the **DigitalAll** (master gain) setting first, and then adjust the **DigitalRed** and **DigitalBlue** setting values to perform fine adjustment.

Individual Gain Mode = On



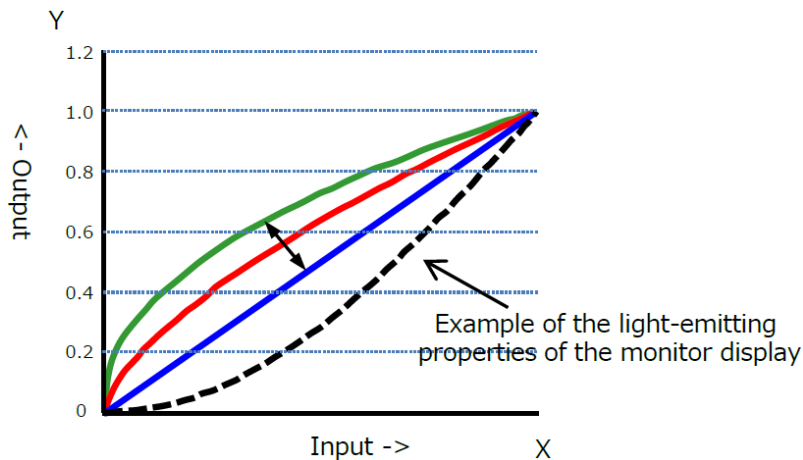
Adjust the **DigitalGreen**, **DigitalRed**, and **DigitalBlue** setting values to adjust the gain. This mode allows a wider range of adjustment by the user when compared to Master Mode.

Gamma Function

Related Setting Items: [AnalogControl](#),

The Gamma function corrects the output signals from the camera beforehand (reverse correction), taking into consideration the light-emitting properties of the monitor display. As the light-emitting properties of the monitor are not linear, the entire image may be darker or the gradation in the dark areas may be less noticeable when camera outputs are displayed without processing.

The Gamma function can be used to correct the camera signals with an opposite-direction curve and produce a display that is close to linear.



To Use the Gamma Function

1. Select the correction value from **Gamma**. The selectable values are as follows: 0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0
2. Select **Gamma** from **LUTMode**.

Note: You can use the LUT function to configure a curve with more detailed points. For details, see [LUT \(LUT \(Lookup Table\)\)](#).

LUT (Lookup Table)

Related Setting Items: [LUTControl](#)

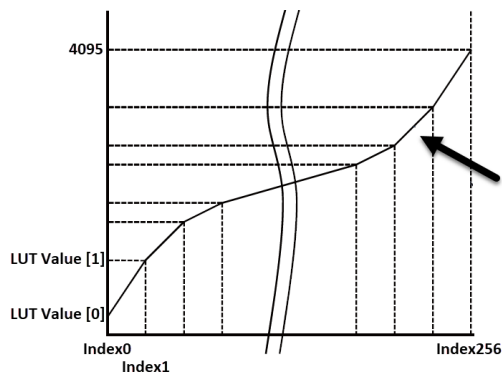
The LUT function is used to generate a non-linear mapping between signal values captured on the sensor and those that are output from the camera. On this camera, you can specify the output curve using 257 setting points (indexes).

How to Configure

1. Select **LUT** from **LUTMode** ([AnalogControl](#)).
2. Select the LUT channel you want to control from **LUTSelector** ([LUTControl](#)). (Red, Green, or Blue)
3. Select the LUT Index from **LUTIndex** (0 ~ 256). Indexes represent the possible pixel values captured on the sensor, from the lowest value (Index 0) to the highest (Index 256). For example, Index 0 represents a full black pixel and Index 256 represents a full white pixel.
4. Set the LUT output value for the selected index in **LUTValue** (0 ~ 4095).

LUT Values

LUT values range from 0 at the lowest to 4095 at the highest. Linear interpolation is used to calculate LUT values between the index points.

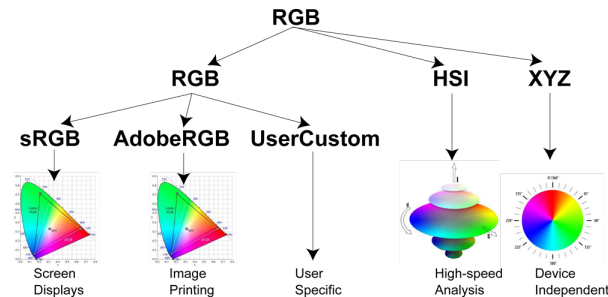


Interpolation using the average values of data to the left and right is used to determine values between points.

Color Space Conversion (Color Transformation Control)

Related Setting Items: [ColorTransformationControl](#)

This camera allows you to convert the standard color space (RGB) that is used to produce colors into other color spaces.

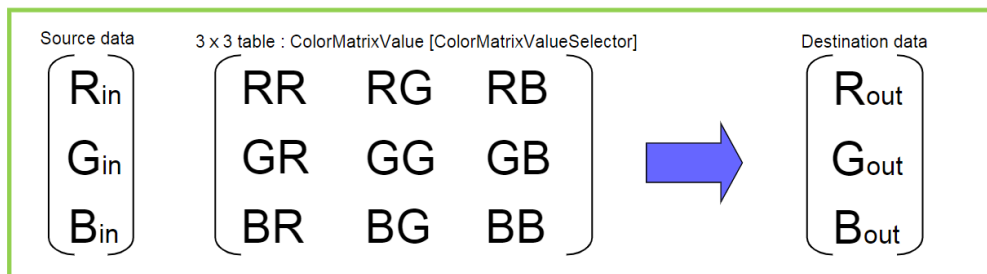


How to Configure

1. Select the color space (**RGB**, **HSI**, or **XYZ**) you want to use from **ColorTransformationMode** ([ColorTransformationControl](#)).
2. When **RGB** is selected, select the details (sRGB, AdobeRGB, UserCustom) from **ColorTransformationRGBMode**.

Note: If you select other than RGB, ColorTransformationRGBMode is fixed to Off.

3. When **UserCustom** is selected,
 - a. Select the item you want to configure in **ColorMatrixValueSelector**.
 - b. Configure the value (-2 to +2) in **ColorMatrixValue**.



Caution: If you set the color space to XYZ or HSI, Control Tool will not display the images captured by the camera properly. To display them properly, XYZ- or HSI-compatible image processing must be performed on the computer side.

About Color Space HSI

- Hue Value: 0° to 360° can be specified as follows.

Output	Description
8bit	Can be specified in 2° increments - 0°(00000000) ~ 360°(10110100)
10bit	Can be specified in 0.5°increments- 0°(0000000000) ~ 360°(1011010000)
12bit	Can be specified in 0.125°increments- 0°(000000000000) ~ 360°(101101000000)

- Saturation value, Intensity value: 0 ~ 100% can be specified as follows.

Output	Description
8bit	0% (00000000) ~ 100% (11111111)
10bit	0% (00000000) ~ 100% (1111111111)
12bit	0% (00000000) ~ 100% (111111111111)

GPIO (Digital Input/Output Settings)

Related Setting Items: [DigitalIOControl](#)

The camera is equipped with GPIO (general-purpose input/output) functions for generating and using combinations of triggers and other necessary signals within the camera and of signals output from the camera to the system such as those used for lighting equipment control.

These signals can be used as triggers and other necessary signals within the camera or as signals output from the camera to the system, such as those used for lighting equipment control.

Note: See "[DC IN/TRIG Connector \(12-Pin Round\)](#)" for recommended external circuit examples.

LineSelector	LineMode	LineFormat	LineInverter	LineStatusAll	Line Source
TTL OUT 1 (Line 1)	Output	TTL	True/False	bit0	User-Specified
TTL OUT 4 (Line 12)			True/False	bit11	User-Specified
TTL OUT2 (Line 8)			True/False	bit7	User-Specified
TTL OUT3 (Line 9)			True/False	bit8	User-Specified
OPT IN1 - (Line 5)	Input	OptoCoupled	False (Fixed)	bit4	-
OPT IN1 + (Line 5)			False (Fixed)	bit4	-
TTL IN 1 (Line 4)		TTL	False (Fixed)	bit3	-
TTL IN2 (Line 10)			False (Fixed)	bit9	-
TTL IN3 (Line 13)			False (Fixed)	bit12	-
Nand0In1		Internal Signal	True/False	bit13	-
Nand0In2			True/False	bit14	-
Nand1In1			True/False	bit15	-
Nand1In2			True/False	bit16	-

Notes:

- Line Status: "Low" signal level is indicated by **False**, and "High" signal level is indicated by **True**.
- Line Status All: The current status of the Line signal is indicated by the above bit field.
- Line Source: Selectable items are listed in "[LineSource Items](#)".

LineSource Items

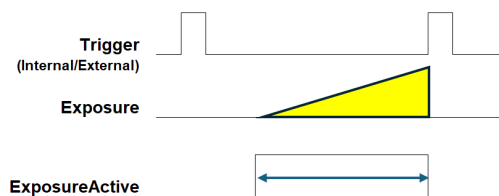
This section describes items that can be selected in **LineSource**.

LineSource	Description
Low	Low signal
High	High signal
ExposureActive	Camera is doing the exposure. See " ExposureActive Signal " for reference.
LVAL	Image data (line) from the sensor is being read.
PulseGenerator0 ~ 3	PulseGenerator output. For more information, see the following technical note: https://www.jai.com/uploads/documents/Technical-notes/English/TNE-0005-2015XII11-000-TechNote-PulseGenerator-tips.pdf
UserOutput0 ~ 3	Allows you to toggle UserOutput's On / Off on the software. Select the User Output 0 ~ 3 you want to use from UserOutputSelector , and then set the UserOutputValue (High or Low).
Line4 TTL In1	TTL In1
Line5 Opt In1	Opt In1
Line7 CC1	LVDS (CC1)
Line10 TTL In2	TTL In2
NAND0 Out	Output of the NAND gate inside the camera. The input to the NAND gate can be set by Nand0In1 or 2 and Nand1In1 or 2.
NAND1 Out	
Line13: TTL In3	TTL In3
EncoderTrigger	Encoder output. See " Connecting Rotary Encoders " for reference.
Encoder Direction	Direction of encoder rotation. See " Rotation Direction " for reference.

ExposureActive Signal

Perform external output for the timing at which video is accumulated to the sensor. The signal is output to the DC IN / TRIG IN connector (12-pin round) or AUX connector.

Note: ExposureActive includes the exposure offset time. For more information see "[Actual Exposure Time](#)".



Counter and Timer Control Function

Related Setting Items: [CounterAndTimerControl](#)

Note: This camera supports only the counter function.

The counter function counts up change points in the camera's internal signals using the camera's internal counter and reads that information from the host side. This function is useful for verifying error conditions via the count value using internal camera operations.

When a problem occurs in a system that includes this camera, comparing the values from multiple counters allows you to verify the extent of normal operability and can be useful when investigating the cause of the problem.

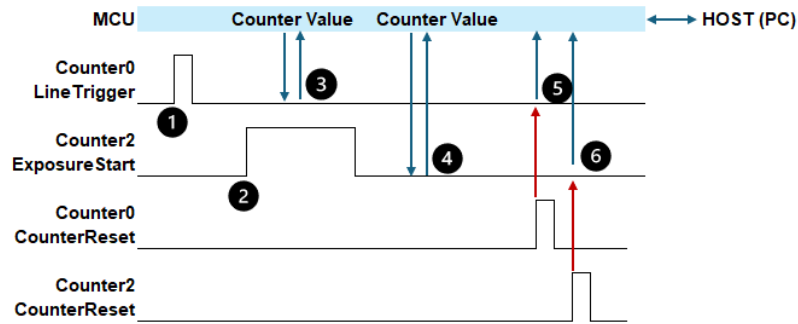
The following counters are available on this camera. The functions that can be counted are fixed for each counter.

Counter	Description	Counter Event Activation
Counter0	Count the number of Line Trigger instances.	Rising Edge (Fixed)
Counter1	Count the number of Line Start instances.	Rising Edge (Fixed)
Counter2	Count the number of Exposure Start instances.	Rising Edge (Fixed)
Counter3	Count the number of Line Transfer End instances.	Rising Edge (Fixed)

How to Configure

1. Select the counter you want to use from CounterSelector.
2. Enable the counter by selecting the event source in **ConterEventSource** (Default = Off).
3. **CounterEventActivation** displays the timing for counting for the selected counter (RisingEdge).
4. You can reset and refresh the selected counter's counter value by executing **CounterReset** and **CounterRefresh**, respectively. The selected counter's value and status are displayed in **CounterValue** and **CounterStatus**, respectively.

Counter Occurrence Diagram (Example)



1. A LineTrigger Event occurs. Counter0 counts up.
2. An Exposure Start Event occurs. Counter 2 counts up.
3. The camera's internal MCU requests and reads the Counter0's counter value.
4. The camera's internal MCU requests and reads the Counter2's counter value.
5. Reset the Counter0's counter value to 0 by a CounterReset command or a CounterResetSource signal.
6. Reset the Counter2's counter value to 0 by a CounterReset command or a CounterResetSource signal.

Pulse Generator

Related Setting Items: [PulseGenerator](#)

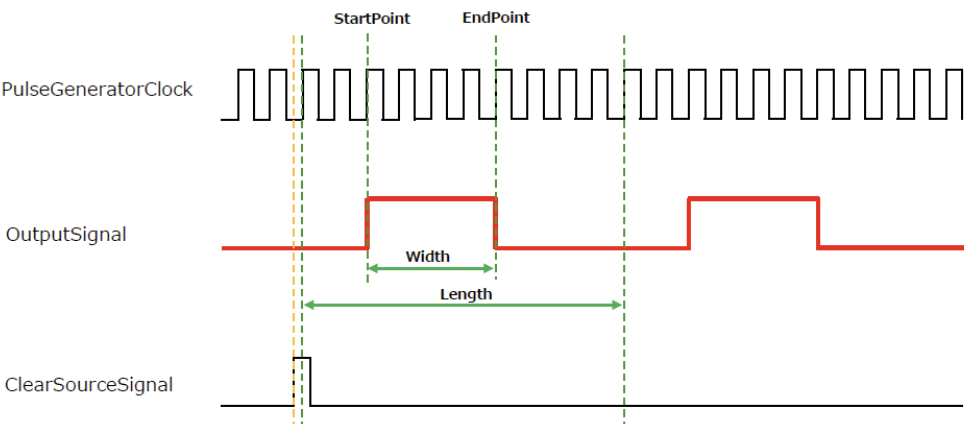
 Technical Notes

Tips for using the Pulse Generator

By using this function, any signal can be generated inside the camera.
The following is an example of signal generation.

Settings

PulseGeneratorStartPoint = 2
PulseGeneratorEndPoint = 6
PulseGeneratorLength = 10
PulseGeneratorPulseWidth = 4
PulseGeneratorClearSyncMode = AsyncMode



The table below shows the PulseGeneratorClearSource signals that can be set.

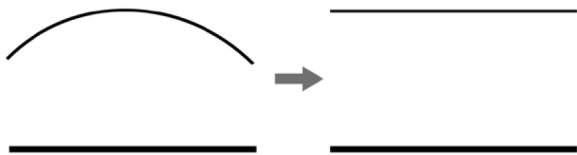
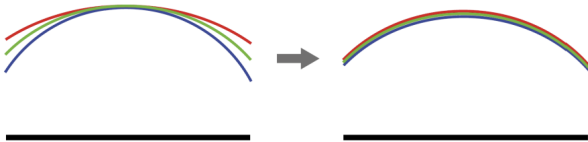
- Low, High, ExposureActive, LVAL, PulseGenerator0-3*, UserOutput0-3, Line4 TTL In1, Line5 Opt In1, Line7 CC1, Line10 TTL In2, NAND0 Out, NAND1 Out, Line13 TTL In3, EncoderTrigger, EncoderDirection

Note: *PulseGenerator0-3: You cannot select the same Pulse Generator that is currently selected. For example, if Pulse Generator 0 is selected, you cannot select Pulse Generator 0 as the Clear source.

Shading Correction

Related Setting Items: [JAI Custom Control Shading](#)

The ShadingCorrection function corrects non-uniformity (i.e., shading) in the amount of light generated by the lens and lighting equipment. The following shading correction modes are available on the camera.

FlatShading	ColorShading
	
The highest brightness level is used as a reference, and other areas are corrected to match that brightness level.	R-channel and B-channel properties are adjusted by using the G-channel shading properties as a reference.

Notes:

- FlatShading: The correction range is within $\pm 30\%$ of the highest signal level on a line.
- Complete correction may not be possible depending on the optical system and light source you are using.
- Data based on corrections performed under factory conditions is stored for this function.

Shading Correction Blocks

The camera makes adjustments in blocks (4 pixels/block). The block Index number (ShadingDataIndex) can be used to view and change the settings per block (ShadingData). For more information, see "How to Configure the Shading Correction Function".

How to Configure the Shading Correction Function

This section explains how to configure the Shading Correction function.

1. Select the Shading Correction Mode (Flat Shading or Color Shading) from **ShadingCorrectionMode**.
2. Select the user area (User1 ~ 3) where you save the shading correction data from **ShadingMode**.
3. Display a white chart under a uniform light and execute **PerformShadingCalibration**.

Note: PerformShadingCalibration cannot be executed when the image is not output, **TestPattern** [[ImageFormatControl](#)] is set to anything other than Off, or **ShadingMoe** is set to Off.

4. Once the shading correction is successfully completed, the shading correction values are automatically saved to the area specified in **ShadingMode**. Also, the calibration result "Succeeded" is displayed in **ShadingDetectResult**.

Note: Condition Error is displayed when a timeout occurs if the correction cannot be completed.

5. Optionally, you can view or change the setting of each correction block.
 1. Select a color channel (Red, Green, or Blue) from **ShadingDataSelector** and an Index number (block number) from **ShadingDataIndex**.
 2. The setting selected by ShadingDataSelector and ShadingDataIndex is displayed in ShadingData. To change the setting, overwrite the value (0x4000 = 1x).
 3. Execute **ShadingDataSave**. The currently set ShadingData will be overwritten and save to the area specified in ShadingMode.

Note: The setting is immediately reflected in the image, but is not saved until ShadingDataSave is executed. If ShadingMode is changed without executing ShadingDataSave, the setting will be discarded.

Pixel Sensitivity Correction

Related Topic: [JAI Custom Control Pixel Correction](#)

Correct variations between the sensor's pixels.

Calibration must be performed within the camera and correction data must be created beforehand. DSNU (PixelBlackCorrect) / PRNU (PixelGainCorrect) can be reduced using that correction data.

We recommend performing calibration and creating correction data whenever the line rate setting or Analog base gain setting or vertical binning setting are changed significantly.

Refer to the following topics on how to perform the calibration.

- [DSNU Correction \(Pixel Black Correct\)](#)
- [PRNU Correction \(Pixel Gain Correct\)](#)

Notes:

- Correction data is saved for DSNU (PixelBlackCorrect) / PRNU (PixelGainCorrect) according to the conditions adjusted at the factory.
- We recommend performing DSNU and PRNU calibration again whenever the line rate setting is changed significantly.
- A single correction data entry can be saved on the camera for each user. When calibration is performed, the correction data is saved to the non-volatile ROM at the same time.

Noise Reduction Filter Functions

Related Setting Items: [JAI Custom Control Pixel Correction](#)

The camera has noise reduction functions. The noise reduction methods vary depending on the channel. Three filters are available:

- **MEDIAN Filter:** Apply 1x3 MEDIAN filter

Select the target to apply the filter from Red, Green, Blue, and set the **Median Filter Mode**. When set to **On**, this function is enabled. (Default = Off)

- **FIR Filter:** Apply the FIR (Finite Impulse Response) filter

Select the target to apply the filter from Red, Green, Blue, and set the **FIR Filter Mode**. When set to **On**, this function is enabled (Default = Off). In FIR Filter, the coefficients of the three signals (left, center, right) can be set in the range of -2 to 2. The correction value through the FIR Filter is:

- Left pixel read value x Left pixel coefficient +
 - Center pixel read value x Center pixel coefficient +
 - Right pixel read value x Right pixel coefficient.
- **Noise Reduction:** Apply the noise filter using JAI's own algorithm.

Set the noise reduction intensity in 4 levels. Level1 = weak, Level4 = strong.

Any of the above filters can improve SNR, but it affects the sense of resolution and sensitivity. An imaging test should be performed before deciding to use this feature.

Horizontal Image Mirroring

Related Setting Items: [JAI Custom Control Image Setup](#)

The HorizontalImageMirroring function allows you to flip an image horizontally.

HorizontalImageMirroring = Off	HorizontalImageMirroring = On
	

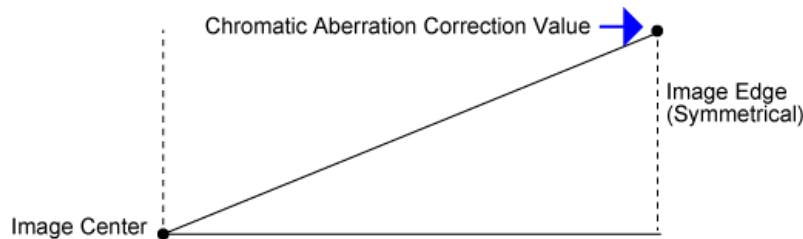
Note: The **Width** and **OffsetX** settings are not affected by this function because the image is flipped after the image acquisition.

Chromatic Aberration Correction

Related Setting Items: [JAI Custom Control Video Process](#)

This function corrects for the chromatic aberration of magnification caused by the lens (i.e., when the size of the image differs at the focal point for each color (RGB)). You can save correction data for three types of lenses.

Specify the number of pixels to delay or advance the R channel and B channel using the G channel as a reference.



Note: This function assumes that the amount of deviation between the left and right is identical. If the amount of deviation between the left and right is not identical, correction will not be performed properly.

How to Configure

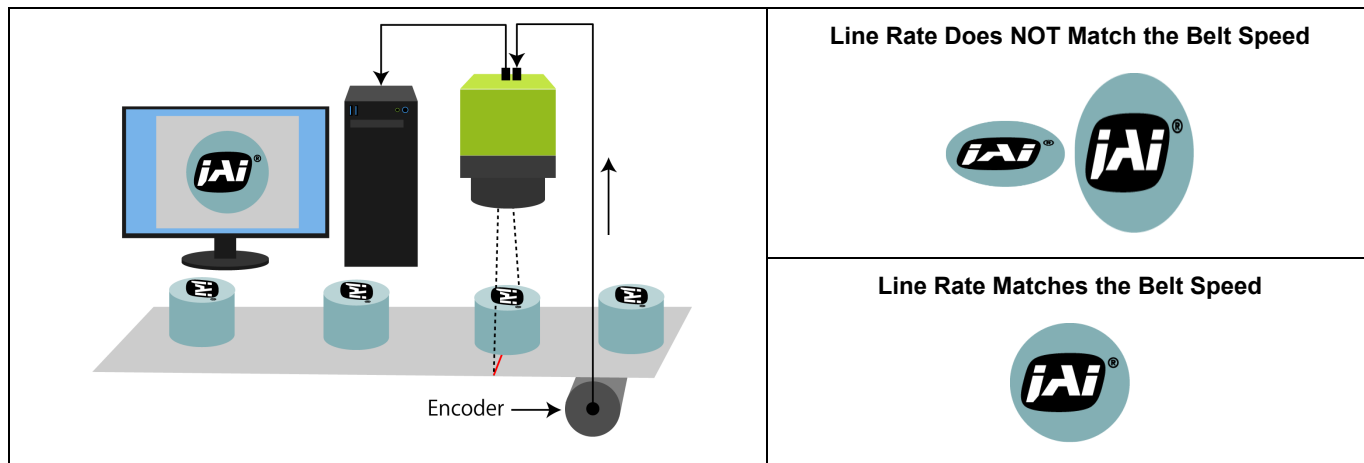
1. Select the area to apply or save the correction value in **ChromaticAberrationCorrectionMode** (Lens1 ~ 3).
2. Correct the **R channel**. Set **ChromaticAberrationCorrectionSelector** to **RChannel**. Specify the amount of correction in **ChromaticAberrationCorrectionLens1,2,3** (-4.0 to +4.0 in steps of 0.1).
3. Select **B Channel** from **ChromaticAberrationCorrectionSelector**, and configure the correction settings as R Channel.

Connecting Rotary Encoders

Related Setting Items: [EncoderControl](#)

Encoders are useful in line scan applications where line triggers need to be tied to motion, such as applications using conveyors with varying belt speeds.

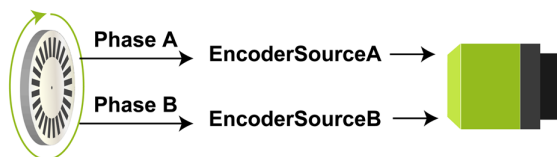
If the object is moving at a constant speed, a fixed line rate can be set. In most cases, however, the speed of the belt speed is not always constant and must be triggered by an encoder to ensure that the speed of the object and the image acquisition are always synchronized. If the line rate and the belt speed do not match, the image of the object will appear stretched or shrunk (see images below).



Note: JAI tests the encoder-related functions with a 2-Phase (Phase A and Phase B) incremental encoder.

How to Configure

1. Connect the two signals (Phase A and Phase B) from the rotary encoder to the camera's inputs (**EncoderSourceA** and **EncoderSourceB**).



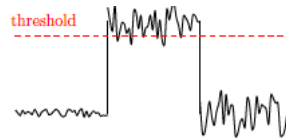
Note: On this camera, PhaseB is used only to detect the rotation direction.

2. Specify the number of triggers to generate as a ratio ($65536 / \text{EncodeDivider value}$) in **EncoderDivider**. For more information, see "[EncoderDivider](#)".

Note: On this camera, input pulses are generated on the rising edge of the Phase A signal.

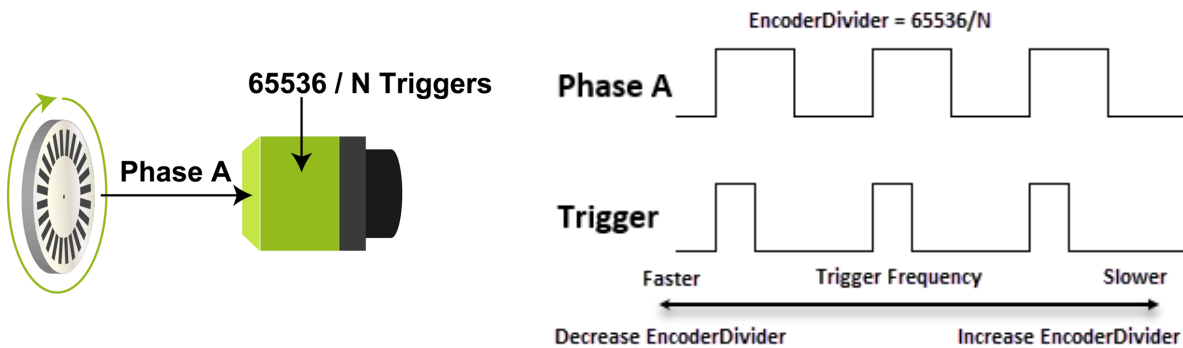
3. If necessary, configure the following settings.

- **EncoderAveragingInterval:** When **EncoderDivider** is not set to an integer multiple of 65536, use this setting if the reliability of the interval of the signal output from the rotary encoder is low (some signal interval is extremely long or short; the encoder's jitter is large). When this function is enabled, internal processing is performed by averaging the interval of several previous signals.
- **EncoderStrobe:** Specify the strobe length of the generated signal (10 ~ 2550 ns).
- **EncoderFilter:** Enable the low-pass filter for the signal to prevent unintended operations due to signal noise from the rotary encoder. Specify the number of cycles from a range of 0 to 150 ns.



EncoderDivider

The **EncoderDivider** trigger option allows you to specify the number of triggers to generate as a ratio ($65536 / N$).



Notes:

- Input pulses are generated on the rising edge of PhaseA.
- **When N is an integer multiple of 65536:** The camera's internal trigger is generated by the decimation of the output trigger of a rotary encoder.
- **When N is not an integer multiple of 65536:** Using the time interval of the output trigger of the rotary encoder, the camera's internal trigger is generated so that the set division ratio is obtained. For example, if the encoder frequency is 10kHz, but you need a line rate of 12kHz to get a proper image, then the EncoderDivider option can be used to set this 1:1.2 ratio, which will be maintained even if the encoder frequency changes.

- If the time interval of the output of the rotary encoder fluctuates greatly, the output of the camera's internal trigger generated may also fluctuate greatly. In this case, by setting **EncoderAveragingInterval**, it is possible to perform internal processing with the value obtained by averaging the time intervals of the specified number of signals.

EncoderDivider Examples

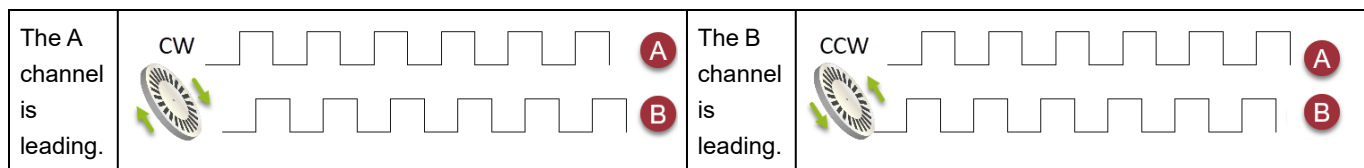
EncoderDivider Setting	Encoder Input : Encoder Trigger Ratio	Number of Triggers (Output Pulse No.)	Timing Chart
32768	1 : 2	2 (= 65536/32768) The camera generates "two" triggers per a PhaseA input pulse signal.	
65536 (Default)	1 : 1	1 (= 65536/65536) The camera generates "one" trigger per a PhaseA input pulse signal.	
131072	2 : 1	0.5 (= 65536/131072) The camera generates "one" trigger per "two" PhaseA input pulse signals.	

Rotation Direction

Incremental encoders typically have two channels (A and B), and the channels operate in a square logical pattern. In one cycle, an encoder outputs a number of pulses on each channel which is called the resolution.

Because the A and B channels are phase shifted, it is possible to determine which direction the rotation is based on which channel is leading (see below).

Note: On this camera, PhaseB is used only to detect the rotation direction.



Setting List

This camera complies with GenICam. Each setting item name conforms to GenICam SFNC (Standard Features Naming Convention). (There are some JAI-specific setting items).

Each setting item is an integer type (Integer), a real type (Float), an element enumeration type (Enumeration), a character string (String), a logical type (Boolean), and a category type (Category) or a command type (Command) for executing the function.

Beginner: For beginner users.

Expert: For users with deep knowledge of camera functions.

Guru: For advanced users who make settings, including advanced features that can cause the camera to malfunction if not set correctly.

Note: See the [Short ASCII Command List](#) chapter for details on the ASCII commands required to configure the settings.

Selector

A Selector is used to index which instance of the feature is accessed in situations where multiple instances of a feature exist.

Instance Example:

Each Line-related item (LineSource, LineInverter, etc.) has LineSelector-LineX instances, which can be set or referenced as an index.

Selectors are a feature of element enumeration type (Enumeration) or an integer type (Integer). However, unlike normal configuration items, it is only used to select the instance in the following configuration item.

It does not change the behavior of the camera by changing the value of the selector. Also, the selector may have only one selectable value. In this case, use the selector function only for information purposes. In this document, it is described as SelectedFeature[Selector] according to the description method of GenICam.

In the case of Line Selector with a specific I/O line selected, the description could be as follows.

```
LineSource[LineSelector-LineX] = High
LineInverter[LineSelector-LineX] = False
LineMode[LineSelector-LineX] = Input
LineFormat[LineSelector-LineX] = TTL
```

Generally, selectors only apply to a single category of features. (Example: TriggerSelector only applies to trigger related functions.)

DeviceControl

Display/configure information related to the device.

Device Control Item	Setting Range	Default	Description
DeviceScanType		1: Linescan (Fixed)	Display the scan type.
DeviceVendorName	-	"JAI Corporation"	Display the manufacturer name.
DeviceModelName	-	"SW-4000T- MCL"	Display the model name.
DeviceManufacturerInfo	-	"See the possibilities"	Display the manufacturer information.
DeviceVersion	-	-	Display the hardware version.
DeviceFirmwareVersion	-	-	Display the firmware version.
DeviceFpgaVersion			Display the FPGA version.
DeviceSerialNumber	-	-	Display the device ID.
DeviceUserID	Any	-	Set the user ID (16bytes) for the camera.
DeviceSFNCVersionMajor	-	2	Display the SFNC Major version.
DeviceSFNCVersionMinor	-	3	Display the SFNC Minor version.
DeviceSFNCVersionSubMinor	-	0	Display the SFNC Sub Minor version.
DeviceManifestEntrySelector	-	XML1	Display information on valid XML file.
DeviceManifestXMLMajorVersion	0 ~ 32bit max		Indicates the major version number of the XML file of the selected manifest entry.
DeviceManifestXMLMinorVersion	0 ~ 32bit max		Indicates the minor version number of the XML file of the selected manifest entry.
DeviceManifestXMLSubMinorVersion	0 ~ 32bit max		Indicates the subminor version number of the XML file of the selected manifest entry.
DeviceManifestSchemaMajorVersion	0 ~ 32bit max	1	Indicates the major version number of the schema file of the selected manifest entry.
DeviceManifestSchemaMinorVersion	0 ~ 32bit max	1	Indicates the minor version number of the schema file of the selected manifest entry.
DeviceTemperatureSelector	-	Mainboard	Select the area of the camera's interior for which to display the temperature sensor's reading. (fixed Mainboard)

Device Control Item	Setting Range	Default	Description
DeviceTemperature	-55 ~ +125	-	Display the internal temperature (°C) of the camera.
DeviceSerialPortSelector	-	CameraLink (Fixed)	Selects which serial port of the device to control.
DeviceSerialPortBaudRate	0: Baud9600 1: Baud19200 2: Baud38400 3: Baud57600 4: Baud115200		Display the baudrate of the serial port.
DeviceReset	-	-	Reset the device. (After the camera receives this command, it returns an ACK response. Then, execute reset.)

ImageFormatControl

Configure image format settings.

Image Format Control Item	Setting Range	Default	Description										
Width Related Topic: ROI (Regional Scanning Function)	-	4096	Set the image width. Max: 4096 (2048)* - OffsetX Min,Step: 16 (8)* Note: (): BinningHorizontal=2										
Height	1 (Fixed))		Display the image height.										
OffsetX	0 ~ [4096 (2048)* - Width]	0	Set the horizontal offset. Max: WidthMax - Width Step: 16 (8)* Note: (): BinningHorizontal=2										
BinningHorizontal Related Topic: Binning	1: Binning Off 2: Binning On	1 (Off)	Set the number of pixels in the horizontal direction for which to perform binning (in Sum Mode).										
BinningVertical	1: Binning Off 2: Binning On	1 (Off)	Set the number of pixels in the vertical direction for which to perform binning (in Sum Mode).										
PixelFormat Related Topic: Pixel Format	0: RGB8 1: RGB10	0: RGB8	Set the Pixel Format. Depending on the CICConfiguration setting, the selectable PixelFormat is different. See the table below for details. <table><tr><th>CICConfiguration</th><th>PixelFormat</th></tr><tr><td>Base</td><td>RGB8</td></tr><tr><td>Medium</td><td>RGB8, RGB10</td></tr><tr><td>Full</td><td>RGB8</td></tr><tr><td>80bit (Deca)</td><td>RGB8</td></tr></table>	CICConfiguration	PixelFormat	Base	RGB8	Medium	RGB8, RGB10	Full	RGB8	80bit (Deca)	RGB8
CICConfiguration	PixelFormat												
Base	RGB8												
Medium	RGB8, RGB10												
Full	RGB8												
80bit (Deca)	RGB8												
TestPattern	0: Off (Default) 1: White 2: GreyPattern1 (Ramp) 3: GreyPattern2 (Stripe) 4: ColorBar		Select the test image. Note: This function cannot be saved as the camera's default.										
SensorType	0:TypeA 1:TypeB	0:TypeA	Select the size of pixel. TypeA: 7.5um x 7.5um TypeB: 7.5um x 10.5um										

AcquisitionControl

Configure image capture settings.

Acquisition Control Item	Setting Range	Default	Description							
AcquisitionLineRate (Hz)	66 ~	66	Set the AcquisitionLineRate in Hz (step: 0.1). The maximum value varies depending on the settings.							
Related Topic: Change the Line Rate										
TriggerMode	0: Off 1: On	0: Off	Select the trigger mode. When ExposureMode is set to TriggerWldth, TriggerMode is forced to set to On.							
TriggerSource	0: Low 1: High 10-13: PulseGenerator0-3 14-17: UserOutput0-3 20: Line4 TTL In1 (Default) 21: Line5 Opt In1 23: Line7 CC1 24: Line10 TTL In2 26: NAND0 Out 27: NAND1 Out 28: Line13 TTL In3 29: EncoderTrigger		Select the trigger signal source.							
TriggerActivation	0: Rising Edge 1: Falling Edge (Default) 3: Level High 4: Level Low		Select the polarity of the trigger signal (i.e., the location of the signal to which trigger is applied). Selectable TriggerActivation item depends on the ExposureMode setting. <table><tr><th>ExposureMode</th><th>TriggerActivation</th></tr><tr><td>Off</td><td rowspan="2">RisingEdge or FallingEdge</td></tr><tr><td>Timed</td></tr><tr><td>TriggerWidth</td><td>LevelHigh or LevelLow</td></tr></table>	ExposureMode	TriggerActivation	Off	RisingEdge or FallingEdge	Timed	TriggerWidth	LevelHigh or LevelLow
ExposureMode	TriggerActivation									
Off	RisingEdge or FallingEdge									
Timed										
TriggerWidth	LevelHigh or LevelLow									
ExposureMode	0: Off 1: Timed (Default) 2: TriggerWidth		Select the exposure mode.							
Related Topic: Exposure Mode										

Acquisition Control Item	Setting Range	Default	Description
ExposureTimeMode	0: Common (Default) 1: Individual		Select the exposure time mode. Select "Common" to set the common value for all three sensors, and "Individual" to set the individual value for each channel. Note: This setting is available only when ExposureMode is set to Timed.
ExposureTimeSelector	0: Common (Default) 1: Red 2: Green 3: Blue		Select the sensor to set ExposureTime. To set the common setting values for all three sensors, select Common. Note: This setting is available only when ExposureMode is set to Timed.
ExposureTime (10ns) Related Topic: Actual Exposure Time	300 ~1514907	-	Set the exposure time (in 10ns) for the setting selected from ExposureTimeSelector . Note: Exposure Offset Time: -0.85μs
AutoResetMode	0: Off 1: On	0: Off	After trigger input is interrupted for a prolonged period (52 msec or more) when ExposureMode is set to Off and TriggerMode is set to On, the over-exposed image exposed during the interruption is output after the first trigger input after resumption. When AutoReset mode is enabled, LVAL and DVAL images are not output during interruption, and LVAL and DVAL image output is resumed after the second trigger input. This function is enabled only when ExposureMode is set to Off and TriggerMode is set to On.
RBExposureInterlocked	0: Off 1: On	0: Off	When set to On, changes the exposure time while maintaining the Red / Blue exposure time ratio (G:R and G:B ratio before the change) with respect to Green.

AnalogControl

Configure analog control settings.

Analog Control Item	Setting Range	Default	Description
IndividualGainMode Related Topic: Individual Gain Mode	0:Off 1:On	0:Off	When Off (=Master Mode), the overall gain is set by DigitalAll (master gain), and then the gain is fine-tuned by changing the DigitalRed and DigitalBlue settings. When On (= Individual Gain Mode), RGB can be configured individually for the entire gain adjustment range of the sensor.
GainSelector Related Topic: Gain Control	0:Digital All* 1:Digital Green** 2:Digital Red 3:Digital Blue *IndividualGainMode=OFF Only **IndividualGainMode=ON Only		Select the gain to configure.
Gain	-	1.0	Set the gain value for the gain setting selected in GainSelector. IndividualGainMode = OFF - Digital All: x1.0 ~ x32.0 - Digital Red/Blue: x0.4 ~ x4.0 IndividualGainMode = ON - DigitalGreen/Red/Blue: x1.0 ~ x64.0
GainAuto	0: Off 1: Once	0: Off	Enable/disable gain auto adjustment. Note: Once is available only when IndividualGainMode is set to On. Once automatically changes to Off when the signal level converges once.
AGCReference (%)	30~95	50	Set the target level for GainAuto.
AGCOnceStatus	1: Succeeded. 2: Error1 - Timeout-error occurred. 3: Abort1 - Contro lLimit 4: Idle (Default)		Allows confirmation of the current status during gain auto adjustment.
AnalogBaseGainSelector	1: Analog Green (Default) 2: Analog Red 3: Analog Blue		Select the analog gain to configure.

Analog Control Item	Setting Range	Default	Description
AnalogBaseGain	0: 0dB (Default) 1: 6dB 2: 12dB		Set the gain value for the analog gain setting selected in Analog Gain Selector.
BalanceWhiteAuto	0: Off (Default) 2: Once 4: Exposure Once 6: Preset 5000K 7: Preset 6500K 8: Preset 7500K		Enable/disable auto white balance. Once automatically changes to Off when the signal level converges once. • When IndividualGainMode = On; PresetXXXX cannot be selected. • When ExposureTimeMode = Common: ExposureOnce cannot be selected.
AWBAreaWidth	Min: 16(8) Max: 4096 (2048) - AWBAreaOffsetX Default: 4096 (2048) Step: 16(8) (): BinningHorizontal = 2		Set the area for adjusting white balance when BalanceWhiteAuto is set to Once .
AWBAreaOffsetX	Min: 0 (Default) Max: 4096 (2068) - AWBAreaWidth Step: 16(8) (): BinningHorizontal = 2		Set the area for adjusting white balance when BalanceWhiteAuto is set to Once .
AWBOnceStatus	1: Succeeded 2: Error1- G image was too bright 3: Error2 - G image was too dark 4: Error3 - Timeout error occurred 5: Idle(Default)		Display the result when BalanceWhiteAuto = Once .
AWBExposureOnce Status	1: Succeeded 2: Error1- G image was too bright 3: Error2 - G image was too dark 4: Error3 - Timeout error occurred 5: Idle(Default)		Display the result when BalanceWhiteAuto = ExposureOnce .
BlackLevelSelector	0: DigitalAll (Default) 1: DigitalRed 2: DigitalBlue		Select the black level to configure.
BlackLevel	DigitalAll: -133 ~ 255 DigitalRed/Blue: -64 ~ 64 Default: 0		Select the black level to configure.

Related Topic: [Adjust the Black Level](#)

Analog Control Item	Setting Range	Default	Description
Gamma	0.45 (Default), 0.50, 0.55, 0.60, 0.65, 0.75, 0.80, 0.90, 1.00		Set the gamma value.
Related Topic: Gamma Function			
LUTMode	0: Off (Default) 1: Gamma 2: LUT		Select the LUT mode.

LUTControl

Configure LUT settings.

Related Topic: [LUT \(Lookup Table\)](#)

LUT Control Item	Setting Range	Default	Description
LUTSelector	0: Red (Default) 1: Green 2: Blue		Select the LUT channel to control.
LUTIndex	0~256	0	Set the LUT index table number.
LUTValue	0~4095	Gamma= 1.0	Set the LUT index table number.

ColorTransformationControl

Configure color transformation settings.

Related Topic: [Color Space Conversion \(Color Transformation Control\)](#)

ColorTransportation Control Item	Setting Range	Default	Description
ColorTransformationMode	0:RGB (Default) 1: HSI 2: XYZ		Set the output image format.
ColorTransformationRGBMode	0: OFF (Default) 1: sRGB 2: AdobeRGB 3: UserCustom		Set the detailed mode when RGB is selected for the color space.
ColorMatrixValueSelector	0: R-R (Default) 1: R-G 2: R-B 3: G-R 4: G-G 5: G-B 6: B-R 7 :B-G 8: B-B		Select the ColorMatrix setting component.
ColorMatrixValue	-2.0 ~ 2.0	-	Set the Color Matrix value. (step = 0.1) (Default): R-R, G-G, B-B: 1.0 Other than above: 0.0

DigitalIOControl

Configure settings for digital input/output.

Related Topic: [GPIO \(Digital Input/Output Settings\)](#)

Digital IO Control Item	Setting Range	Default	Description
LineSelector	12-pin	Line5: Opt In1	Select the input/output to configure.
		Line4: TTL In1	
		Line1: TTL Out1 (Default)	
		Line12: TTL Out4	
	AUX	Line10: TTL In2	
		Line13: TTL In3	
		Line8: TTL Out2	
		Line9: TTL Out3	
	NAND	NAND Gate 0 In 1	
		NAND Gate 1 In 1	
		NAND Gate 0 In 2	
		NAND Gate 1 In 2	
	LineMode	0: Input 1: Output	
LineInverter	0: False 1: True	0: False	Enable/disable polarity inversion for the selected input signal or output signal.
LineStatus	0: False (Low) 1: True (High)	0: False	Display the status of the input signal or output signal (True: High, False: Low).
LineSource	0: Low (Default) 1: High 7: ExposureActive 9: LVAL 10 ~ 13: PulseGenerator0 ~ 3 14 ~ 17: UserOutput0 ~ 3 20: Line4: TTL In1 21: Line5: Opt In1 23: Line7 - CC1 24: Line10: TTL In2 26: NAND0 Out 27: NAND1 Out 28: Line13: TTL In3 29: EncoderTriger 30: EncoderDirection		Select the line source signal for the item selected in Line Selector.

Digital IO Control Item	Setting Range	Default	Description
LineFormat	2: TTL 5: Opto Coupled 7: Internal Signal		Display the signal format.
LineStatusAll	bit0: Line1 TTLOut1 bit1 ~ 2: Unused bit3: Line4 TTLInput 1 bit4: Line5 OptIn1 bit5 ~ 6: Unused bit7: Line8 TTLOut2 bit8: Line9 TTLOut3 bit9: Line10 TTLIn2 bit10: Unused bit11: Line12 TTLOut4 bit12: Line13 TTLIn3 bit13: NAND0A bit14: NAND0B bit15: NAND1A bit16: NAND1B		Display the input/output signal status. The state is shown with 16 bits.
OptInFilterSelector	0: Off (Default) 1: 0.1 us 2: 1 us 3: 5 us 4: 10 us 5: 50 us 6: 100 us		Remove noise from the OptIn input signal of Digital I/O.
UserOutputSelector	0: User Output 0 (Default) 1: User Output 1 2: User Output 2 3: User Output 3		Set the UserOutput signal.
UserOutputValue	0: False 1: True	0: False	Set the value for the UserOutput selected in UserOutputSelector.

CounterAndTimerControl

Configure counter settings.

Note: This camera only supports counter functions

Related Topic: [Counter and Timer Control Function](#)

CounterAndTimer Control Item	Setting Range	Default	Description
CounterSelector	0: Counter0 (Default) 1: Counter1 2: Counter2 3: Counter3		Select the counter.
CounterEventSource	Counter0: LineTrigger Counter1: LineStart Counter2: ExposureStart Counter3: LineTransferEnd		Assign the counter event signal for which you want to read the count value to a dedicated counter, and read the value.
CounterEventActivation	0: Rising Edge (Fixed)		Set the count timing.
CounterReset	-	-	Reset the counter.
CounterRefresh	-	-	Refresh the counter value.
CounterValue	0 ~ 4294967295	0	Display the count value.
CounterStatus	0: CounterIdle (Default) 2: CounterActive 4: CounterOverflow		Display the counter status.

UserSetControl

Configure user settings.

Related Topic: [Step 6: Save the Settings](#)

User Set Control Item	Setting Range	Default	Description
UserSetSelector	0: Default (Default) 1: User1 2: User2 3: User3		Select the user settings.
UserSetLoad	-	-	Read the user settings specified in UserSetSelector. When selecting Default for UserSetSelector, the factory settings are loaded.
UserSetSave	-	-	Overwrite the current setting values with the user settings specified in UserSetSelector. Invalid when UserSetSelector is set to Default.

TransportLayerControl

Display information on transport layer control.

Transport Layer Control Item	Setting Range	Default Value	Description
CIConfiguration	0: Base (Default) 1: Medium 2: Full 4: EightyBit		Set the Camera Link configuration.
CameraLinkClockFrequency	0: 85MHz (Default) 1: 63.75MHz 2: 42.5MH		Set Camera Link clock frequency.
SwapBandR	0: Off 1: On	0: Off	Specify whether to swap Blue and Red to enable support for connecting a particular grabber board.
AdditionalInformation	0: Off 1: On	1: On	When On, LineCounter, TimeStamp, and CRC information are placed on the DVAL LOW - LVAL High interval.
CableEmphasis	0: Normal 1: Medium (Default) 2: Strong		Set CableEmphasis. When set to Medium or Strong, you may be able to extend the camera link cable length.

Related Topic: [③ Camera Link Cable](#)

PulseGenerator

Configure pulse generator settings.

Pulse Generator Item	Setting Range	Default Value	Description
ClockPreScaler	1 ~ 4096	1	Set the division value for the prescaler (12 bit) using PixelClock as the base clock.
PulseGeneratorClock (MHz)	0.0244 ~ 100	-	Set the clock used for the pulse generator. This value is calculated using the [ClockPreScaler] value as a base. PulseGeneratorClock = 100 / ClockPreScaler
PulseGeneratorSelector	0: PulseGenerator0 (Default) 1: PulseGenerator1 2: PulseGenerator2 3: PulseGenerator3		Select the pulse generator.
PulseGeneratorLength	1 ~ 1048575	1000000	Set the maximum count-up value as a clock count.
PulseGeneratorLength(ms)	-	66.6667	Set the maximum count-up value in milliseconds. Min: 1 / PulseGeneratorClock (MHz) Max: 1048575 / PulseGeneratorClock (MHz)
PulseGeneratorFrequency (Hz)	-	15	Set the maximum count-up value as a frequency. Min: ((PulseGeneratorClock (MHz)) ÷ 1048575) x 1000000 Max: (PulseGeneratorClock (MHz) x 1000000)
PulseGeneratorStartPoint	0~1048575	0	Set the start point of the High interval as a clock count. When the counter reaches this value, the output will be 1.
PulseGeneratorStartPoint (ms)	0 ~ (1048575 / PulseGeneratorClock (MHz))	0	Set the start point of the High interval in milliseconds. When the counter reaches this value, the output will be 1.
PulseGeneratorEndPoint	1~1048575	500000	Set the start point of the Low interval as a clock count. When the counter reaches this value, the output will be 0.
PulseGeneratorEndPoint (ms)	-	33.3333	Set the start point of the Low interval in milliseconds. When the counter reaches this value, the output will be 0. Min: (1 / PulseGeneratorClock (MHz)) Max: (1048575 / PulseGeneratorClock(MHz))

Pulse Generator Item	Setting Range	Default Value	Description
PulseGeneratorPulseWidth (ms)	-	33.3333	Display the High interval width of the pulse in milliseconds. The duration between the Start Point and End Point is calculated. PulseGeneratorPulseWidth (ms) = PulseGeneratorStartPointPulseGeneratorEndPoint(ms) - PulseGeneratorStartPoint(ms)
PulseGeneratorRepeat Count	0~255	0	Set the repeat count for the counter. When this is set to 0, a free counter is enabled with no repeat limit.
PulseGeneratorClear Activation	0: Off (Default) 1: Level High 2: Level Low 4: Rising Edge 8: Falling Edge		Set the clear signal condition for the count clear input of the pulse generator.
PulseGeneratorClear Source	0: Low (Default) 1: High 7: ExposureActive 9: LVAL 10-13: PulseGenerator0-3* 14-17: UserOutput0-3 20: Line4: TTL In1 21: Line5: Opt In1 23: Line7 - CC1 24: Line10: TTL In2 26: NAND0 Out 27: NAND1 Out 28: Line13: TTL In3 29: EncoderTriger 30: EncoderDirection		Select the count clear input signal source. Note: *Disabled if the PulseGenerator is selected in PulseGeneratorSelector.
PulseGeneratorClearInverter	0: False 1: True	0:False	Controls if the pulse generator clear signal is inverted. False means "Active High" and True for "Active Low".
PulseGeneratorClear SyncMode	0: Async Mode (Default) 1: Sync Mode		Select the sync mode for the count clear input signal.

JAI Custom Control Shading

Configure shading correction settings.

Related Topic: [Shading Correction](#)

ShadingControl Item	Setting Range	Default Value	Description
ShadingCorrectionMode	0: Flat Shading (Default) 1: Color Shading		Select the shading correction method.
ShadingMode	0: Off (Default) 1: User1 2: User2 3: User3		Set the area to which to save shading correction data. When this is set to Off , PerformShadingCalibration will not be executed.
PerformShadingCalibration	-	-	Execute shading correction. Note: This command cannot be executed under the following conditions: when outputting no image, when outputting TestPattern, or ShadingMode is Off.
ShadingDetectResult	0: Condition Error 1: Too Dark 2: Too Bright 3: Correction Limit 4: Complete (Default)		Display the shading correction results.
ShadingDataSelector	0: Green (Default) 1: Red 2: Blue		Read the shading correction data and select the sensor to be changed.
ShadingDataIndex	1~1024	1	Set the index table number for shading correction.
ShadingData	0~32767	-	Display the result of shading correction. Note: 0x4000= x1
ShadingDataUpdate	-	-	Update the shading correction data.
ShadingDataSave	-	-	Save the shading correction data.

JAI Custom Control Pixel Correction

Configure settings related to image correction.

Correction Control Item	Setting Range	Default Value	Description
PixelBlackCorrectionMode Related Topic: DSNU Correction (Pixel Black Correct)	0: Off 1: Default (Default) 2: User1 3: User2 4: User3		(DSNU) Select the user area to which to save the black level correction value. Note: Default stores correction data with factory settings.
PerformPixelBlackCalibration	-	-	(DSNU) Generate black level correction data automatically from the captured image. Caution: When PixelBlackCorrectionMode is set to Off or Default and a test pattern is being output instead of an image, this command cannot be executed.
PixelBlackDetectResult	1: Succeeded (Default) 2: Image too bright 3: Image too dark 4: Timeout error		(DSNU) Display the results of PerformPixelGainBlackCalibration execution.
PixelGainCorrectionMode Related Topic: PRNU Correction (Pixel Gain Correct)	0: Off 1: Default (Default) 2: User1 3: User2 4: User3		(PRNU) Select the user area to which to save the gain correction value. Note: Default stores correction data with factory settings.
PerformPixelGainCalibration	-	-	(PRNU) Generate gain correction data automatically from the captured image. Caution: When PixelGainCorrectionMode is set to Off or Default and a test pattern is being output instead of an image, this command cannot be executed.
PixelGainDetectResult	1: Succeeded (Default) 2: Image too bright 3: Image too dark 4: Timeout error		(PRNU) Display the results of PerformPixelGainCalibration execution.

Correction Control Item	Setting Range	Default Value	Description
FIRFilterSelector Related Topic: Noise Reduction Filter Functions	0: Red (Default) 1: Green 2: Blue		Select the target to apply FIR Filter from Red, Green, Blue.
FIRFilterMode	0: Off 1: On	0: Off	Enable / Disable FIR Filter.
FIRFilterLeftRatio	-2~2	0	Set the coefficient of the left pixel when FIR Filter is applied.
FIRFilterCenterRatio	-2~2	1	Set the coefficient of the center pixel when FIR Filter is applied.
FIRFilterRightRatio	-2~2	0	Set the coefficient of the right pixel when FIR Filter is applied.
MEDIANFilterSelector	0: Red (Default) 1: Green 2: Blue		Select the target to apply MEDIAN Filter from Red, Green, Blue.
MEDIANFilterMode	0: Off 1: On	0: Off	Enable / Disable MEDIAN Filter.
NoiseReduction	0: Off (Default) 1: Level1 2: Level2 3: Level3 4: Level4		Set the noise reduction intensity in 4 levels. Level1 = weak, Level4 = strong.

JAI Custom Control Image Setup

Configure the Horizontal Image Mirroring setting.

Related Topic: [Horizontal Image Mirroring](#)

Custom Image SetupControl Item	Setting Range	Default	Description
HorizontallImageMirroring	0: Off 1: On	0: Off	Specify whether to mirror the image horizontally.

JAI Custom Control Video Process

Configure the chromatic Aberration Correction settings.

Related Topic: [Chromatic Aberration Correction](#)

Video Process Control Item	Setting Range	Default Value	Description
ChromaticAberration CorrectionMode	0: Off (Default) 1: Lens1 2: Lens2 3: Lens3		Correct the color aberration that occurs at the left and right edges due to lens characteristics.
ChromaticAberration CorrectionSelector	0: R Channel (Default) 1: B Channel		Specify the channel for which to perform ChromaticAberrationCorrectionLens1,2,3.
ChromaticAberration CorrectionLens1 (pixel)	-4.0 ~ 4.0 (Step: 0.1)	0	Set the amount of correction for ChromaticAberrationCorrectionLens1.
ChromaticAberration CorrectionLens2 (pixel)	-4.0 ~ 4.0 (Step: 0.1)	0	Set the amount of correction for ChromaticAberrationCorrectionLens2.
ChromaticAberration CorrectionLens3 (pixel)	-4.0 ~ 4.0 (Step: 0.1)	0	Set the amount of correction for ChromaticAberrationCorrectionLens3.

EncoderControl

Configure the rotary encoder related settings.

Related Topic: [Connecting Rotary Encoders](#)

ShadingControl Item	Setting Range	Default Value	Description
EncoderSourceA EncoderSourceB	0: Line5 Opt In1 (Default) 1: Line4 TTL In1 2: Line10 TTL In2 3: Line13 TTL In3		Select where to input the signal from the rotary encoder.
EncoderDivider	1~4294967295	65536	Set the number of triggers to be generated as a ratio 65536 / (set value).
EncoderAveragingInterval	0: none (Default) 1: 2 pulses 2: 4 pulses 3: 8 pulses 4: 16 pulses 5: 32 pulses		Perform the internal processing by averaging the time interval of the specified number of signals.
EncoderFilter (cycle)	0~15	0	Apply a low-pass filter to prevent noise on the signal from the rotary encoder and stabilize the signal for the specified number of cycles. Note: 10ns/cycle
EncoderStrobe (ns)	1~ 256	1	Set the strobe length of the Trigger signal generated from the rotary encoder by the number of cycles.

Short ASCII Command List

All configuration of the camera is done via the RS-232C port. The camera can be set up from a PC running terminal emulator software.

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

■ Communication Setting

Baud Rate: 9600 (Default)

Data Length: 8bit

Start Bit: 1bit

Stop Bit: 1 bit

Parity: None

Xon/Xoff Control: None

Protocol (Short ASCII Command)

■ Transmit the setting command to camera

NN is any kind of the command.

NN=[Param.]<CR><LF>

Send to camera: GA=0 <CR><LF>

Camera response: COMPLETE<CR><LF>

When camera receives a valid command, camera will return 'COMPLETE'. If camera receives an invalid command, camera will return following:

Send to camera: GAX=0 <CR><LF>

Camera response: 01 Unknown Command!!<CR><LF>

Send to camera: GA=1000 <CR><LF>

Camera response: 02 Bad Parameters!!<CR><LF>

■ Transmit the request command to camera

The status of camera's settings can be queried by transmitting NN?<CR><LF>, where NN is any valid command.

The camera will return the current setting data.

Send to camera: GA? <CR><LF>

Camera response: GA=100<CR><LF>

■ Switching baud rate between PC and camera

Camera always starts up with 9600bps. This can be switched to higher baud rates after a communication has been established. When switching to other baud rate the procedure is as follows.

e.g. Change baud rate to 115200bps

1. Confirm baud rates camera supported

Send to camera: SBDRT? <CR><LF>

Camera response: SBDRT=31(0x1F)<CR><LF>

2. Request new baud rate 115200bps

Send to camera: CBDRT=16(0x10) <CR><LF>

Camera response: COMPLETE<CR><LF>

3. Rewrite new baud rate again with new baud rate (Confirmation command)

Send to camera: CBDRT=16(0x10) <CR><LF>

Camera response: COMPLETE<CR><LF>

In case the camera does not receive the confirming command with new baud rate within 250ms after sending the acknowledge it falls back to the original baud rate (9600bps).

Device Control

Display/configure information related to the device.

Note: Descriptions of each command can also be found in "[DeviceControl](#)" (Setting List).

Device Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
DeviceVendorName (R)	DVN	"JAI Corporation"	-	DVN?<CR><LF> Display the manufacture name.
DeviceModelName (R)	MD	"SW-4000T-MCL"	-	MD?<CR><LF> Display the model name.
DeviceVersion (R)	DV	Indicate device version (e.g. "0.1.0.0")	-	DV?<CR><LF> Display the camera version.
DeviceFirmwareVersion (R)	VN	"*.*.*"	-	VN?<CR><LF> Display the version of firmware.
DeviceFpgaVersion (R)	FPVN	"*.*.*"	-	FPVN?<CR><LF> Display the version of FPGA.
DeviceSerialNumber (R)	ID	Serial Number	-	ID?<CR><LF> Display device's serial number.
DeviceUserID (R/W)	UD	User can save and load free text. (64 or less characters)	-	UD=[Param.]<CR><LF> UD?<CR><LF> Set the user ID for the camera
DeviceTemperature (R)	TMP0	-	-	TMP0?<CR><LF> Display the temperature of the device in Celsius (C).
DeviceReset (W)	CRS00	1	-	CRS00=1<CR><LF> Reset the device.
Access: (R) = Read Only; (R/W) = Read and Write; (W) = Write Only.				

Technology Specific Bootstrap Register

Name (Access)	Short ASCII	Values	Description
SupportedBaud rates (R)	SBDRT	Indicate Support/Non-support status for each baud rate (0x01 ~ 0xFF) bit0: 9600bps (Default) bit1: 19200bps bit2: 38400bps bit3: 57600bps bit4: 115200bps	SBDRT?<CR><LF> Display the supported transmission baud rate as bit fields. This camera supports 9600bps, 19200bps, 38400bps, 57600bps, and 115200bps.
CurrentBaudrate (R/W)	CBDRT	READ: Indicate current baud rate. (0x01 ~ 0x80) WRITE: Set any bit of baud rate. bit0: 9600bps (Default) bit1: 19200bps bit2: 38400bps bit3: 57600bps bit4: 115200bps	CBDRT=[Param.]<CR><LF> CBDRT?<CR><LF> In case of WRITE execution (change baud rate), it needs to control in the proper sequence between Host and Camera. Display the currently configured transmission baud rate. To change the transmission baud rate, use this command (configuration steps).
Access: (R) = Read Only; (R/W) = Read and Write			

Image Format Control

Configure image format settings.

Note: Descriptions of each command can also be found in "[ImageFormatControl](#)" (Setting List).

Image Format Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
Width (R/W)	WTC	Min / Step: 16 (8)* Max: 4096 (2048)* - OffsetX Default: 4096		WTC=[Param.]<CR><LF> WTC?<CR><LF> Set the image width. Note: () = BinningHorizontal = 2 (ON)
OffsetX (R/W)	OFC	Min: 0 Max: 4096 (2048)* - Width Step: 16 (8)* Default: 0		OFC=[Param.]<CR><LF> OFC?<CR><LF> Set the horizontal offset. Note: () = BinningHorizontal = 2 (ON)
BinningHorizontal (R/W)	HB	1: Off 2: On	1	HB=[Param.]<CR><LF> HB?<CR><LF> Set the number of pixels in the horizontal direction for which to perform binning.
BinningVertical (R/W)	VB	1: Off 2: On	1	VB=[Param.]<CR><LF> VB?<CR><LF> Set the number of pixels in the vertical direction for which to perform binning.
PixelFormat (R/W)	BA	0: RGB8 1: RGB10	0	BA=[Param.]<CR><LF> BA?<CR><LF> Set the pixel format.
TestPattern (R/W)	TPN	0:Off (Default) 1:White 2:GreyPattern1 (Ramp) 3:GreyPattern2 (Stripe) 4:ColorBar		TPN=[Param.]<CR><LF> TPN?<CR><LF> Select the test image.
SensorType (R/W)	STP	0:TypeA (7.5um x 7.5 um) (Default) 1:TypeB (7.5um x 10.5um)		STP=[Param.]<CR><LF> STP?<CR><LF> Set the sensor type.
Access: (R/W) = Read and Write				

Acquisition Control

Configure image capture settings.

Note: Descriptions of each command can also be found in "[AcquisitionControl](#)" (Setting List).

Acquisition Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
AcquisitionLineRate (R/W)	LR	1466 ~ 1515152 Unit: 0.01us	1515152	LR=[Param.]<CR><LF> LR?<CR><LF> Use this command to set the line rate of the camera by specifying the line period. The unit value is 1/100 μ s. Example: If you need 68212 Hz = 1466 (14.66 μ s line period).
TriggerMode (R/W)	TM	0:Off 1:On	0	TM=[Param.]<CR><LF> TM?<CR><LF> Enable/disable the Trigger mode.
TriggerSource (R/W)	TI	0: Low 1: High 10-13: PulseGenerator0-3 14-17: UserOutput0-3 20: Line4 TTL In1 (Default) 21: Line5 Opt In1 23: Line7 CC1 24: Line10 TTL In2 26: NAND0 Out 27: NAND1 Out 28: Line13 TTL In3 29: EncoderTrigger		TI=[Param.]<CR><LF> TI?<CR><LF> Select the trigger signal source.
TriggerActivation (R/W)	TA	0:Rising Edge 1:Falling Edge 2: LevelHigh 3: LevelLow	1	TA=[Param.]<CR><LF> TA?<CR><LF> Select the polarity of the trigger signal (i.e., location of signal at which trigger is applied).
ExposureMode (R/W)	TR	0:Off 1:Timed 2: TriggerWidth	1	TR=[Param.]<CR><LF> TR?<CR><LF> Select the exposure mode.

Acquisition Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
ExposureTimeMode (R/W)	ETM	0:Common 1:Individual	0	ETM=[Param.]<CR><LF> ETM?<CR><LF> Select the exposure time mode. Common: Set the common value for R, G and B channels. Individual: Set the values for the R, G, and B channels individually
ExposureTime [Common] (R/W)	PE	300 ~ 1514908 Unit: 10ns (100 = 1us)	27847	PE=[Param.]<CR><LF> PE?<CR><LF> When ExposureTimeMode is set to Common, set the exposure time in Common mode.
ExposureTime [Red] (R/W)	PER	300 ~ 1514908 Unit: 10ns (100 = 1us)	27847	PER=[Param.]<CR><LF> PER?<CR><LF> Set the exposure time for the Red channel. Note: ExposureTimeMode must be set to Common .
ExposureTime [Green] (R/W)	PEG	300 ~ 1514908 Unit: 10ns (100 = 1us)	27847	PEG=[Param.]<CR><LF> PEG?<CR><LF> Set the exposure time for the Green channel. Note: ExposureTimeMode must be set to Common .
ExposureTime [Blue] (R/W)	PEB	300 ~ 1514908 Unit: 10ns (100 = 1us)	27847	PEB=[Param.]<CR><LF> PEB?<CR><LF> Set the exposure time for the Blue channel. Note: ExposureTimeMode must be set to Common .
AutoReset (R/W)	ARS	0: Off 1: On	0	ARS=[Param.]<CR><LF> ARS?<CR><LF> Set the AutoReset. (When auto reset mode is enabled, LVAL, DVAL, and video are not output while the trigger input is interrupted. When resuming trigger input, output of LVAL, DVAL, and video is resumed.)

Acquisition Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
RBExposureInterlocked (R/W)	EI	0:Off 1:On	0	EI=[Param.]<CR><LF> EI?<CR><LF> Adjust exposure time of the R and B channels automatically in conjunction with exposure time of the G channel.
ExposureTimeMin (R/W)	PEMIN	-	-	PEMIN?<CR><LF> Display the minimum exposure time.
ExposureTimMax (R/W)	PEMAX	-	-	PEMAX?<CR><LF> Display the maximum exposure time.
Access: (R/W) = Read and Write				

Analog Control

Configure the analog control setting.

Note: Descriptions of each command can also be found in "[AnalogControl](#)" (Setting List).

Analog Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
IndividualGainMode (R/W)	GM	0:Off 1:On	0	GM=[Param.]<CR><LF> GM?<CR><LF> Configure Gain individually when set to On.
GainInt[DigitalAll] (R/W)	GA	100 ~ 3200 Setting value 100 = x1	100	GA=[Param.]<CR><LF> GA?<CR><LF> Set Gain [DigitalAll], when IndividualGainMode is Off .
GainInt[DigitalRed] (R/W)	GAR	IndividualGainMode = Off: 40 ~ 400 IndividualGainMode = On: 100 ~ 6400 Default: 100 (= x1)		GAR=[Param.]<CR><LF> GAR?<CR><LF> Set Gain[DigitalRed]. The setting range varies depending on the IndividualGainMode setting.
GainInt[DigitalGreen] (R/W)	GAG	IndividualGainMode = On: 100 ~ 6400 Default: 100 (= x1)		GAG=[Param.]<CR><LF> GAG?<CR><LF> Set Gain[DigitalGreen].

Analog Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
GainInt[DigitalBlue] (R/W)	GAB	IndividualGainMode = Off: 40 ~ 400 IndividualGainMode = On: 100 ~ 6400 Default: 100 (= x1)		GAB=[Param.]<CR><LF> GAB?<CR><LF> Set Gain[DigitalBlue]. The setting range varies depending on the IndividualGainMode setting.
AnalogBaseGain [AnalogGreen] (R/W)	SGG	0:0dB 1:6dB 2:12dB	0	SGG=[Param.]<CR><LF> SGG?<CR><LF> Set AnalogBaseGain[AnalogGreen].
AnalogBaseGain [AnalogRed] (R/W)	SGR	0:0dB 1:6dB 2:12dB	0	SGR=[Param.]<CR><LF> SGR?<CR><LF> Set AnalogBaseGain[AnalogRed].
AnalogBaseGain [AnalogBlue] (R/W)	SGB	0:0dB 1:6dB 2:12dB	0	SGB=[Param.]<CR><LF> SGB?<CR><LF> Set AnalogBaseGain[AnalogBlue].
BalanceWhiteAuto (R/W)	AWB	0:Off (Default) 2:Once 4:Exposure Once 5:Preset 5000K 6:Preset 6500K 7:Preset 7500K	0	AWB=[Param.]<CR><LF> AWB?<CR><LF> Set BalanceWhiteAuto. When set to Once , the automatic adjustment will be performed only once, and then automatically switched to Off. Note: When set to IndividualGainMode , only Off can be selected.
AWBAreaWidth (R/W)	AWBW	Min / Step: 16(8)* Max: 4096 (2048)* - AWBOffsetX Default: 0 Note: *() = BinningHorizontal = 2		AWBW=[Param.]<CR><LF> AWBW?<CR><LF> Specify the width of the referenced area when BalanceWhiteAuto is set to Once ,
AWBAreaOffsetX (R/W)	AWBO	Min: 0 Max: 4096 (2048)* - AWBWidth Default: 0 Step: 16(8)* Note: *() = BinningHorizontal = 2		AWBO=[Param.]<CR><LF> AWBO?<CR><LF> Specify the offset of the referenced area when BalanceWhiteAuto is set to Once ,

Analog Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
AWBExposureOnce Status (R)	AHRS	1=Succeeded. 2=Error1 - G image was too bright. 3=Error2 - G image was too dark. 4=Error3 - Timeout-error occurred. 5=IDLE		AWHS?<CR><LF> Displays the status at the time of execution (BalanceWhiteAuto = ExposureOnce).
AWBOnceStatus (R)	AWRS			AWBS?<CR><LF> Displays the status at the time of execution (BalanceWhiteAuto = Once).
BlackLevel [DigitalAll] (R/W)	BL	-133 ~ 255	0	BL=[Param.]<CR><LF> BL?<CR><LF> Controls the analog black level as an absolute physical value. This represents a DC offset applied to the video signal.
BlackLevel [DigitalRed] (R/W)	BLR	-64 ~ 64	0	BLR=[Param.]<CR><LF> BLR?<CR><LF> Set BlackLevel[Red].
BlackLevel [DigitalBlue] (R/W)	BLB	-64 ~ 64	0	BLB=[Param.]<CR><LF> BLB?<CR><LF> Set BlackLevel[Blue].
GainAuto (R/W)	AGC	0:Off 1:Once	0	AGC=[Param.]<CR><LF> AGC?<CR><LF> Enable/disable gain auto adjustment. Once automatically changes to Off when the signal level converges once.
AGCReference (R/W)	AGCR	30 ~ 95 Unit: %	50	AGCF=[Param.]<CR><LF> AGCF?<CR><LF> Set the target level for AGC.
AGCOnceStatus (R)	AGCS	1: Succeeded. 2: Error1 - Timeout-error occurred. 3: Abort1 - Control Limit 4: Idle (Default)		AGCS?<CR><LF> Display the status when GainAuto is set to Once.
Gamma (R/W)	GMA	40 ~ 100	45	GMA=[Param.]<CR><LF> GMA?<CR><LF> Controls the gamma correction of pixel intensity. This is typically used to compensate for non-linearity of the display system (such as CRT).
LUTMode (R/W)	LUN	0: Off 1: Gamma 2: LUT	0	LUN=[Param.]<CR><LF> LUN?<CR><LF> Select the LUT mode.
Access: (R) = Read Only; (R/W) = Read and Write				

LUT Control

Configure LUT settings.

Note: Descriptions of each command can also be found in "[LUTControl](#)" (Setting List).

Lut Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
LUTIndex [Red] (R/W)	LUTIR	0 ~ 256	0	LUTIR=[Param.]<CR><LF> LUTIR?<CR><LF> Set the LUT index table number for the Red channel.
LUTIndex [Green] (R/W)	LUTIG	0 ~ 256	0	LUTIG=[Param.]<CR><LF> LUTIG?<CR><LF> Set the LUT index table number for the Green channel.
LUTIndex [Blue] (R/W)	LUTIB	0 ~ 256	0	LUTIB=[Param.]<CR><LF> LUTIB?<CR><LF> Set the LUT index table number for the Blue channel.
LUTValue [Red] (R/W)	LUTR	0 ~ 4095		LUTR=[Param.]<CR><LF> LUTR?<CR><LF> Set the LUT value for the Red channel.
LUTValue [Green] (R/W)	LUTG	0 ~ 4095		LUTG=[Param.]<CR><LF> LUTG?<CR><LF> Set the LUT value for the Green channel.
LUTValue [Blue] (R/W)	LUTB	0 ~ 4095		LUTB=[Param.]<CR><LF> LUTB?<CR><LF> Set the LUT value for the Blue channel.
Access: (R/W) = Read and Write				

Color Transformation Control

Configure color transformation settings.

Note: Descriptions of each command can also be found in "[ColorTransformationControl](#)" (Setting List).

Color Transformation Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
ColorTransformationMode (R/W)	CTM	0: RGB 1: HSI 2: XYZ	0	CTM=[Param.]<CR><LF> CTM?<CR><LF> Select the color space.
ColorTransformation RGBMode (R/W)	CTRM	0: Off 1: sRGB 2: AdobeRGB 3: UserCustom	0	CTRM=[Param.]<CR><LF> CTRM?<CR><LF> Set the detailed mode when RGB is selected for the color space.
*ColorMatrixValueInt [R-R] (R/W)	CMVRR	-20000 ~ 20000 Step: 1000	10000	CMVRR=[Param.]<CR><LF> CMVRR?<CR><LF> Specify the User Custom ColorMatrix value.
*ColorMatrixValueInt [R-G] (R/W)	CMVRG	-20000 ~ 20000 Step: 1000	0	CMVRG=[Param.]<CR><LF> CMVRG?<CR><LF> Specify the User Custom ColorMatrix value.
*ColorMatrixValueInt [R-B] (R/W)	CMVRB	-20000 ~ 20000 Step: 1000	0	CMVRB=[Param.]<CR><LF> CMVRB?<CR><LF> Specify the User Custom ColorMatrix value.
*ColorMatrixValueInt [G-R] (R/W)	CMVGR	-20000 ~ 20000 Step: 1000	0	CMVGR=[Param.]<CR><LF> CMVGR?<CR><LF> Specify the User Custom ColorMatrix value.
*ColorMatrixValueInt [G-G] (R/W)	CMVGG	-20000 ~ 20000 Step: 1000	10000	CMVGG=[Param.]<CR><LF> CMVGG?<CR><LF> Specify the User Custom ColorMatrix value.
*ColorMatrixValueInt [G-B] (R/W)	CMVGB	-20000 ~ 20000 Step: 1000	0	CMVGB=[Param.]<CR><LF> CMVGB?<CR><LF> Specify the User Custom ColorMatrix value.
*ColorMatrixValueInt [B-R] (R/W)	CMVBR	-20000 ~ 20000 Step: 1000	0	CMVBR=[Param.]<CR><LF> CMVBR?<CR><LF> Specify the User Custom ColorMatrix value.

Color Transformation Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
*ColorMatrixValueInt [B-G] (R/W)	CMVBG	-20000 ~ 20000 Step: 1000	0	CMVBG=[Param.]<CR><LF> CMVBG?<CR><LF> Specify the User Custom ColorMatrix value.
*ColorMatrixValueInt [B-B] (R/W)	CMVBB	-20000 ~ 20000 Step: 1000	10000	CMVBB=[Param.]<CR><LF> CMVBB?<CR><LF> Specify the User Custom ColorMatrix value.
Access: (R/W) = Read and Write				

Note: *ColorMatrixValueInt: These settings can be configured only when **ColorTransformationMode** is **RGB** and **ColorTransformationRGBMode** is set to **UserCustom**.

Digital IO Control

Configure settings for digital input/output.

Notes:

- Descriptions of each command can also be found in "[DigitalIOControl](#)" (Setting List).
- The following signals cannot be inverted (LineInverter fixed to 0): TTL In1 (Line4/12-pin), Opt In1 (Line 5/12-pin), TTL In2 (Line 10/AUX), TTL In3 (Line 13/AUX).

Digital IO Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
LineInverter [TTL Out1] (R/W)	LI0	0: False 1: True	0	LI0=[Param.]<CR><LF> LI0?<CR><LF> Invert the polarity of the signal (TTLOut1 = Line 1 [12-pin]).
LineInverter [TTL Out2] (R/W)	LI1	0: False 1: True	0	LI1=[Param.]<CR><LF> LI1?<CR><LF> Invert the polarity of the signal (TTLOut2 [AUX]).
LineInverter [TTL Out3] (R/W)	LI2	0: False 1: True	0	LI2=[Param.]<CR><LF> LI2?<CR><LF> Invert the polarity of the signal (TTLOut3 [AUX]).
LineInverter [TTL Out4] (R/W)	LI3	0: False 1: True	0	LI3=[Param.]<CR><LF> LI3?<CR><LF> Invert the polarity of the signal (TTLOut4 [12-pin]).

Digital IO Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
LineInverter [NANDGate0In1] (R/W)	ND0INV1	0: False 1: True	0	ND0INV1=[Param.]<CR><LF> ND0INV1?<CR><LF> Invert the polarity of the signal (NANDGate0In1).
LineInverter [NANDGate0In2] (R/W)	ND0INV2	0: False 1: True	0	ND0INV2=[Param.]<CR><LF> ND0INV2?<CR><LF> Invert the polarity of the signal (NANDGate0In1).
LineInverter [NANDGate1In1] (R/W)	ND1INV1	0: False 1: True	0	ND1INV1=[Param.]<CR><LF> ND1INV1?<CR><LF> Invert the polarity of the signal (NANDGate1In1).
LineInverter [NANDGate1In2] (R/W)	ND1INV2	0: False 1: True	0	ND1INV2=[Param.]<CR><LF> ND1INV2?<CR><LF> Invert the polarity of the signal (NANDGate1In2).
LineSource [TTL Out1] (R/W)	LS0	0: Low (Default) 1: High 7: ExposureActive 9: LVAL 10 - 13: PulseGenerator0 - 3 14 - 17: UserOutput0 - 3 20: Line4: TTL In1 21: Line5: Opt In1 23: Line7 - CC1 24: Line10: TTL In2 26: NAND0 Out 27: NAND1 Out 28: Line13: TTL In3 29: EncoderTriger 30: EncoderDirection		LS0=[Param.]<CR><LF> LS0?<CR><LF> Select signal to be passed to the Line 1 (TTL Out1 [12-pin]).
LineSource [TTL Out2] (R/W)	LS1	Same as LS0	0	LS1=[Param.]<CR><LF> LS1?<CR><LF> Select signal to be passed to the Line 8 (TTL Out2 [AUX]).
LineSource [TTL Out3] (R/W)	LS2	Same as LS0	0	LS2=[Param.]<CR><LF> LS2?<CR><LF> Select signal to be passed to the Line 9 (TTL Out3 [AUX]).
LineSource [TTL Out4] (R/W)	LS3	Same as LS0	0	LS3=[Param.]<CR><LF> LS3?<CR><LF> Select signal to be passed to the Line 12 [12-pin].

Digital IO Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
LineSource [NANDGate0In1] (R/W)	ND0IN1	Same as LS0	0	ND0IN1=[Param.]<CR><LF> ND0IN1?<CR><LF> Select signal to be passed to the Line NANDGate0In1.
LineSource [NANDGate0In2] (R/W)	ND0IN2	Same as LS0	0	ND0IN2=[Param.]<CR><LF> ND0IN2?<CR><LF> Select signal to be passed to the Line NANDGate0In2.
LineSource [NANDGate1In1] (R/W)	ND1IN1	Same as LS0	0	ND1IN1=[Param.]<CR><LF> ND1IN1 ?<CR><LF> Select signal to be passed to the Line NANDGate1In1.
LineSource [NANDGate1In2] (R/W)	ND1IN2	Same as LS0	0	ND1IN2=[Param.]<CR><LF> ND1IN2 ?<CR><LF> Select signal to be passed to the Line NANDGate1In2.
OptInFilterSelector (R/W)	OPTFL	0: Off 1: 0.1 us 2: 1 us 3: 5 us 4: 10 us 5: 50 us 6: 100 us	0	OPTFL=[Param.]<CR><LF> OPTFL?<CR><LF> Set the noise elimination level of OptIO input signal of DigitalIO.
UserOutputValue [UserOutput0] (R/W)	USC0	0: False 1: True	0	USC0=[Param.]<CR><LF> USC0 ?<CR><LF> Set the value (False or True) for the UserOutput0.
UserOutputValue [UserOutput1] (R/W)	USC1	0: False 1: True	0	USC1=[Param.]<CR><LF> USC1 ?<CR><LF> Set the value (False or True) for the UserOutput1.
UserOutputValue [UserOutput2] (R/W)	USC2	0: False 1: True	0	USC2=[Param.]<CR><LF> USC2 ?<CR><LF> Set the value (False or True) for the UserOutput2.
UserOutputValue [UserOutput3] (R/W)	USC3	0: False 1: True	0	USC3=[Param.]<CR><LF> USC3 ?<CR><LF> Set the value (False or True) for the UserOutput3.
Access: (R/W) = Read and Write				

Counter and Timer Control

Configure counter settings.

Notes:

- This camera only supports the counter functions.
- Descriptions of each command can also be found in "[CounterAndTimerControl](#)" (Setting List).

Counter and Timer Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
CounterEventSource [Counter0] (R/W)	CE0	0: Off (Stop the counter) (Default) 1: Line Trigger (Count the number of LineTrigger)		CE0=[Param.]<CR><LF> CE0?<CR><LF> Select the events that will be the source to increment the Counter.
CounterEventSource [Counter1] (R/W)	CE1	0: Off (Stop the counter) (Default) 1: Line Start (Count the number of LineStart)		CE1=[Param.]<CR><LF> CE1?<CR><LF> Select the events that will be the source to increment the Counter.
CounterEventSource [Counter2] (R/W)	CE2	0: Off (Stop the counter) (Default) 1: Exposure Start (Count the number of Exposure Start)		CE2=[Param.]<CR><LF> CE2?<CR><LF> Select the events that will be the source to increment the Counter.
CounterEventSource [Counter3] (R/W)	CE3	0: Off (Stop the counter) (Default) 1: Line Transfer End (Count the number of LineTransfer End)		CE3=[Param.]<CR><LF> CE3?<CR><LF> Select the events that will be the source to increment the Counter.
CounterReset [Counter0] (W)	CR0	-	-	CR0=0<CR><LF> Reset the Counter0 (software reset).
CounterReset [Counter1] (W)	CR1	-	-	CR1=0<CR><LF> Reset the Counter0 (software reset).
CounterReset [Counter2] (W)	CR2	-	-	CR2=0<CR><LF> Reset the Counter0 (software reset).
CounterReset [Counter3] (W)	CR3	-	-	CR3=0<CR><LF> Reset the Counter0 (software reset).
CounterValue [Counter0] (R)	CV0	0 ~ 4294967295	-	CV0?<CR><LF> Display the Counter0's value.

Counter and Timer Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
CounterValue [Counter1] (R)	CV1	0 ~ 4294967295	-	CV1?<CR><LF> Display the Counter1's value.
CounterValue [Counter2] (R)	CV2	0 ~ 4294967295	-	CV2?<CR><LF> Display the Counter2's value.
CounterValue [Counter3] (R)	CV3	0 ~ 4294967295	-	CV3?<CR><LF> Display the Counter3's value.
Access: (R) = Read Only; (R/W) = Read and Write; (W) = Write Only.				

User Set Control

Configure user settings.

Note: Descriptions of each command can also be found in "[UserSetControl](#)" (Setting List).

User Set Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
UserSetLoad (R/W)	LD	0: Default 1: User1 2: User2 3: User3	-	LD=[Param.]<CR><LF> LD?<CR><LF> Read the user settings. When selecting 0 (Default) , the factory settings are loaded.
UserSetSaveAscii (R/W)	SA	1: User1 2: User2 3: User3	-	SA=[Param.]<CR><LF> SA?<CR><LF> Save the current setting values as user settings.
Access: (R/W) = Read and Write				

Transport Layer Control

Display information on transport layer control.

Note: Descriptions of each command can also be found in "[TransportLayerControl](#)" (Setting List).

Transport Layer Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
ClConfiguration (R/W)	CLCFG	0: Base 1: Medium 2: Full 4: Eighty Bit	0	CLCFG=[Param.]<CR><LF> CLCFG?<CR><LF> Set the Camera Link configuration.
CameraLinkClockFrequency (R/W)	CLCF	0: 85MHz 1: 63.75MHz 2: 42.5MH	0	CLCF=[Param.]<CR><LF> CLCF?<CR><LF> Set Camera Link clock frequency.
SwapBandR (R/W)	SWBR	0: Off 1: On	0	SWBR=[Param.]<CR><LF> SWBR?<CR><LF> Swap the output of B, R.
AdditionalInformation (R/W)	ADDI	0: Off 1: On	1	ADDI=[Param.]<CR><LF> ADDI?<CR><LF> Add additional information during LVAL Low period.
CableEmphasis (R/W)	SCB	0: Normal 1: Medium 2: Strong	1	SCB=[Param.]<CR><LF> SCB?<CR><LF> Set cableEmphasis. When set to Medium or Strong, you may be able to extend the camera link cable length.
Access: (R/W) = Read and Write				

Pulse Generator

Configure pulse generator settings.

Note: Descriptions of each command can also be found in "[PulseGenerator](#)" (Setting List).

Pulse Generator Name (Access)	Short ASCII	Values	Default Value	Example / Description
ClockPreScaler (R/W)	PGDEV	1 ~ 4096	1	PGDEV=[Param.]<CR><LF> PGDEV?<CR><LF> Set the division value for the prescaler (12 bit) using PixelClock as the base clock.
PulseGeneratorLength [PulseGenerator0] (R/W)	PGL0	1 ~ 1048575	1000000	PGL0=[Param.]<CR><LF> PGL0?<CR><LF> Set the maximum count-up value as a clock count for PulseGenerator0.
PulseGeneratorLength [PulseGenerator1] (R/W)	PGL1	1 ~ 1048575	1000000	PGL1=[Param.]<CR><LF> PGL1?<CR><LF> Set the maximum count-up value as a clock count for PulseGenerator1.
PulseGeneratorLength [PulseGenerator2] (R/W)	PGL2	1 ~ 1048575	1000000	PGL2=[Param.]<CR><LF> PGL2?<CR><LF> Set the maximum count-up value as a clock count for PulseGenerator2.
PulseGeneratorLength [PulseGenerator3] (R/W)	PGL3	1 ~ 1048575	1000000	PGL2=[Param.]<CR><LF> PGL2?<CR><LF> Set the maximum count-up value as a clock count for PulseGenerator3.
PulseGeneratorStartPoint [PulseGenerator0] (R/W)	PGST0	0 ~ 1048575	0	PGST0=[Param.]<CR><LF> PGST0?<CR><LF> Set the start point of the High interval as a clock count for PulseGenerator0. When the counter reaches this value, the output will be 1
PulseGeneratorStartPoint [PulseGenerator1] (R/W)	PGST1	0 ~ 1048575	0	PGST1=[Param.]<CR><LF> PGST1?<CR><LF> Set the start point of the High interval as a clock count for PulseGenerator1. When the counter reaches this value, the output will be 1.

Pulse Generator Name (Access)	Short ASCII	Values	Default Value	Example / Description
PulseGeneratorStartPoint [PulseGenerator2] (R/W)	PGST2	0 ~ 1048575	0	PGST2=[Param.]<CR><LF> PGST2?<CR><LF> Set the start point of the High interval as a clock count for PulseGenerator2. When the counter reaches this value, the output will be 1.
PulseGeneratorStartPoint [PulseGenerator3] (R/W)	PGST3	0 ~ 1048575	0	PGST3=[Param.]<CR><LF> PGST3?<CR><LF> Set the start point of the High interval as a clock count for PulseGenerator3. When the counter reaches this value, the output will be 1.
PulseGeneratorEndPoint [PulseGenerator0] (R/W)	PGEN0	0 ~ 1048575	0	PGEN0=[Param.]<CR><LF> PGEN0?<CR><LF> Set the start point of the Low interval as a clock count for PulseGenerator0. When the counter reaches this value, the output will be 0.
PulseGeneratorEndPoint [PulseGenerator1] (R/W)	PGEN1	0 ~ 1048575	0	PGEN1=[Param.]<CR><LF> PGEN1?<CR><LF> Set the start point of the Low interval as a clock count for PulseGenerator1. When the counter reaches this value, the output will be 0.
PulseGeneratorEndPoint [PulseGenerator2] (R/W)	PGEN2	0 ~ 1048575	0	PGEN2=[Param.]<CR><LF> PGEN2?<CR><LF> Set the start point of the Low interval as a clock count for PulseGenerator2. When the counter reaches this value, the output will be 0.
PulseGeneratorEndPoint [PulseGenerator3] (R/W)	PGEN3	0 ~ 1048575	0	PGEN3=[Param.]<CR><LF> PGEN3?<CR><LF> Set the start point of the Low interval as a clock count for PulseGenerator3. When the counter reaches this value, the output will be 0.
PulseGeneratorRepeatCount [PulseGenerator0] (R/W)	PGRPT0	0 ~ 255	0	PGRPT0=[Param.]<CR><LF> PGRPT0?<CR><LF> Set the repeat count for the counter for PulseGenerator0. When this is set to 0, a free counter is enabled with no repeat limit.

Pulse Generator Name (Access)	Short ASCII	Values	Default Value	Example / Description
PulseGeneratorRepeatCount [PulseGenerator1] (R/W)	PGRPT1	0 ~ 255	0	PGRPT1=[Param.]<CR><LF> PGRPT1?<CR><LF> Set the repeat count for the counter for PulseGenerator1. When this is set to 0, a free counter is enabled with no repeat limit.
PulseGeneratorRepeatCount [PulseGenerator2] (R/W)	PGRPT2	0 ~ 255	0	PGRPT2=[Param.]<CR><LF> PGRPT2?<CR><LF> Set the repeat count for the counter for PulseGenerator2. When this is set to 0, a free counter is enabled with no repeat limit.
PulseGeneratorRepeatCount [PulseGenerator3] (R/W)	PGRPT3	0 ~ 255	0	PGRPT3=[Param.]<CR><LF> PGRPT3?<CR><LF> Set the repeat count for the counter for PulseGenerator3. When this is set to 0, a free counter is enabled with no repeat limit.
PulseGeneratorClearActivation [PulseGenerator0] (R/W)	PGCM0	0: Off 1: Level High 2: Level Low 4: Rising Edge 8: Falling Edge	0	PGCM0 =[Param.]<CR><LF> PGCM0 ?<CR><LF> Set the clear signal condition for the count clear input of PulseGenerator0.
PulseGeneratorClearActivation [PulseGenerator1] (R/W)	PGCM1	0: Off 1: Level High 2: Level Low 4: Rising Edge 8: Falling Edge	0	PGCM1 =[Param.]<CR><LF> PGCM1 ?<CR><LF> Set the clear signal condition for the count clear input of PulseGenerator1.
PulseGeneratorClearActivation [PulseGenerator2] (R/W)	PGCM2	0: Off 1: Level High 2: Level Low 4: Rising Edge 8: Falling Edge	0	PGCM2 =[Param.]<CR><LF> PGCM2 ?<CR><LF> Set the clear signal condition for the count clear input of PulseGenerator2.
PulseGeneratorClearActivation [PulseGenerator3] (R/W)	PGCM3	0: Off 1: Level High 2: Level Low 4: Rising Edge 8: Falling Edge	0	PGCM3 =[Param.]<CR><LF> PGCM3 ?<CR><LF> Set the clear signal condition for the count clear input of PulseGenerator3.

Pulse Generator Name (Access)	Short ASCII	Values	Default Value	Example / Description
PulseGeneratorClearSource [PulseGenerator0] (R/W)	PGIN0	0: Low (Default) 1: High 7: ExposureActive 9: LVAL 10-13: PulseGenerator0-3 14-17: UserOutput0-3 20: Line4: TTL In1 21: Line5: Opt In1 23: Line7 - CC1 24: Line10: TTL In2 26: NAND0 Out 27: NAND1 Out 28: Line13: TTL In3 29: EncoderTriger 30: EncoderDirection		PGIN0=[Param.]<CR><LF> PGIN0?<CR><LF> Select the count clear input signal source for PulseGenerator0. Note: 10: PulseGenerator0 cannot be selected.
PulseGeneratorClearSource [PulseGenerator1] (R/W)	PGIN1	Same as PGIN0 Note: 11: PulseGenerator1 cannot be selected.	0	PGIN1=[Param.]<CR><LF> PGIN1?<CR><LF> Select the count clear input signal source for PulseGenerator1.
PulseGeneratorClearSource [PulseGenerator2] (R/W)	PGIN2	Same as PGIN0 Note: 12: PulseGenerator2 cannot be selected.	0	PGIN2=[Param.]<CR><LF> PGIN2?<CR><LF> Select the count clear input signal source for PulseGenerator2.
PulseGeneratorClearSource [PulseGenerator3] (R/W)	PGIN3	Same as PGIN0 Note: 13: PulseGenerator3 cannot be selected.	0	PGIN3=[Param.]<CR><LF> PGIN3?<CR><LF> Select the count clear input signal source for PulseGenerator3.
PulseGeneratorClearInverter [PulseGenerator0] (R/W)	PGINV0	0:False 1:True	0	PGINV0=[Param.]<CR><LF> PGINV0?<CR><LF> Controls if the pulse generator clear signal is inverted. False means "Active High" and True for "Active Low".

Pulse Generator Name (Access)	Short ASCII	Values	Default Value	Example / Description
PulseGeneratorClearInverter [PulseGenerator1] (R/W)	PGINV1	0:False 1:True	0	PGINV1=[Param.]<CR><LF> PGINV1?<CR><LF> Controls if the pulse generator clear signal is inverted. False means "Active High" and True for "Active Low".
PulseGeneratorClearInverter [PulseGenerator2] (R/W)	PGINV2	0:False 1:True	0	PGINV2=[Param.]<CR><LF> PGINV2?<CR><LF> Controls if the pulse generator clear signal is inverted. False means "Active High" and True for "Active Low".
PulseGeneratorClearInverter [PulseGenerator3] (R/W)	PGINV3	0:False 1:True	0	PGINV3=[Param.]<CR><LF> PGINV3?<CR><LF> Controls if the pulse generator clear signal is inverted. False means "Active High" and True for "Active Low".
PulseGeneratorClearSyncMode [PulseGenerator0] (R/W)	PGSM0	0:Async Mode 1:Sync Mode	0	PGSM0=[Param.]<CR><LF> PGSM0?<CR><LF> Selects the sync mode of the input to clear PulseGenerator0.
PulseGeneratorClearSyncMode [PulseGenerator1] (R/W)	PGSM1	0:Async Mode 1:Sync Mode	0	PGSM1=[Param.]<CR><LF> PGSM1?<CR><LF> Selects the sync mode of the input to clear PulseGenerator1.
PulseGeneratorClearSyncMode [PulseGenerator2] (R/W)	PGSM2	0:Async Mode 1:Sync Mode	0	PGSM2=[Param.]<CR><LF> PGSM2?<CR><LF> Selects the sync mode of the input to clear PulseGenerator2.
PulseGeneratorClearSyncMode [PulseGenerator3] (R/W)	PGSM3	0:Async Mode 1:Sync Mode	0	PGSM3=[Param.]<CR><LF> PGSM3?<CR><LF> Selects the sync mode of the input to clear PulseGenerator3.
Access: (R/W) = Read and Write				

JAI Custom Control Shading

Configure shading correction settings.

Note: Descriptions of each command can also be found in "[JAI Custom Control Shading](#)" (Setting List).

Shading Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
ShadingCorrectionMode (R/W)	SDCM	0: Flat Shading 1: Color Shading	0	SDCM=[Param.]<CR><LF> SDCM?<CR><LF> Select the shading correction method.
ShadingMode (R/W)	SDM	0: Off 1: User1 2: User2 3: User3	0	SDM=[Param.]<CR><LF> SDM?<CR><LF> Set the area to which to save shading correction data. When this is set to Off, PerformShadingCalibration will not be executed.
PerformShadingCalibration (W)	RS	-	-	RS=0<CR><LF> Execute shading correction. Note: This command cannot be executed under the following conditions: when outputting no image, when outputting TestPattern, or ShadingMode is Off.
ShadingDetectResult (R)	SDRS	0: Condition Error 1: Too Dark 2: Too Bright 3: Correction Limit 4: Complete	0	SDRS?<CR><LF> Display the shading correction results.
ShadingDataSelector (R/W)	SDDS	0: Green 1: Red 2: Blue	0	SDDS=[Param.]<CR><LF> SDDS?<CR><LF> Read the shading correction data, and set the target sensor for modification.
ShadingDataIndex (R/W)	SDDI	1 ~ 1024	1	SDDI=[Param.]<CR><LF> SDDI?<CR><LF> Set the number of shading correction index tables.
ShadingData (R/W)	SDD	0 ~ 32767 Note: 0x4000= x1	-	SDD=[Param.]<CR><LF> SDD?<CR><LF> Display or set the shading correction data.

Shading Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
ShadingDataUpdate (W)	SDDU	1: Update	-	SDDU=[Param.]<CR><LF> Make shading data reflect on video.
ShadingDataSave (W)	SDDA	1: Save	-	SDDA=[Param.]<CR><LF> Save data to be stored in Flash in the area specified by ShadingCorrectionMode.
Access: (R) = Read Only; (R/W) = Read and Write; (W) = Write Only.				

JAI Custom Control Pixel Correction

Configure settings related to the correction function for nonuniformity in black levels and gain between pixels.

Note: Descriptions of each command can also be found in "[JAI Custom Control Pixel Correction](#)" (Setting List).

Correction Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
PixelBlackCorrectionMode (R/W)	PBC	0: Off 1: Default 2: User1 3: User2 4: User3	1	PBC=[Param.]<CR><LF> PBC?<CR><LF> (DSNU) Select the user area to which to save the black level correction value.
PerformPixelBlackCalibration (W)	PBR	-	-	PBR=0<CR><LF> (DSNU) Generate black level correction data automatically from the captured image. Caution: When PixelBlackCorrectionMode is set to Off or Default and a test pattern is being output instead of an image, this command cannot be executed.
PixelBlackDetectResult (R)	PBS	1: Succeeded 2: Image too bright 3: Image too dark 4: Timeout error	1	PBS?<CR><LF> (DSNU) Display the results of PerformPixelGainBlackCalibration execution.
PixelGainCorrectionMode (R/W)	PGC	0: Off 1: Default 2: User1 3: User2 4: User3	1	PGC=[Param.]<CR><LF> PGC?<CR><LF> (PRNU) Select the user area to which to save the gain correction value.

Correction Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
PerformPixelGainCalibration (W)	PGR	-	-	PGR=0<CR><LF> (PRNU) Generate gain correction data automatically from the captured image. Caution: When PixelGainCorrectionMode is set to Off or Default and a test pattern is being output instead of an image, this command cannot be executed.
PixelGainDetectResult (R)	PGS	1: Succeeded 2: Image too bright 3: Image too dark 4: Timeout error	1	PGS?<CR><LF> (PRNU) Display the results of PerformPixelGainCalibration execution.
FIRFilterMode [Red] (R/W)	FFR	0: Off 1: On	0	FFR=[Param.]<CR><LF> FFR?<CR><LF> Enable / Disable FIR Filter for Red.
FIRFilterMode [Green] (R/W)	FFG	0: Off 1: On	0	FFG=[Param.]<CR><LF> FFG?<CR><LF> Enable / Disable FIR Filter for Green.
FIRFilterMode [Blue] (R/W)	FFB	0: Off 1: On	0	FFB=[Param.]<CR><LF> FFB?<CR><LF> Enable / Disable FIR Filter for Blue.
FIRFilterLeftRatio [Red] (R/W)	FFLRR	-200 ~ 200	0	FFLRR=[Param.]<CR><LF> FFLRR?<CR><LF> Set the coefficient of the left pixel when FIR Filter for Red is applied.
FIRFilterLeftRatio [Green] (R/W)	FFLRG	-200 ~ 200	0	FFLRG=[Param.]<CR><LF> FFLRG?<CR><LF> Set the coefficient of the left pixel when FIR Filter for Green is applied.
FIRFilterLeftRatio [Blue] (R/W)	FFLRB	-200 ~ 200	0	FFLRB=[Param.]<CR><LF> FFLRB?<CR><LF> Set the coefficient of the left pixel when FIR Filter for Blue is applied.
FIRFilterCenterRatio[Red] (R/W)	FFCRR	-200 ~ 200	0	FFCRR=[Param.]<CR><LF> FFCRR?<CR><LF> Set the coefficient of the center pixel when FIR Filter for Red is applied.

Correction Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
FIRFilterCenterRatio [Green] (R/W)	FFCRG	-200 ~ 200	0	FFCRG=[Param.]<CR><LF> FFCRG?<CR><LF> Set the coefficient of the center pixel when FIR Filter for Green is applied.
FIRFilterCenterRatio [Blue] (R/W)	FFCRB	-200 ~ 200	0	FFCRB=[Param.]<CR><LF> FFCRB?<CR><LF> Set the coefficient of the center pixel when FIR Filter for Blue is applied.
FIRFilterRightRatioInt [Red] (R/W)	FFRRR	-200 ~ 200	0	FFRRR=[Param.]<CR><LF> FFRRR?<CR><LF> Set the coefficient of the right pixel when FIR Filter for Red is applied.
FIRFilterRightRatioI [Green] (R/W)	FFRRG	-200 ~ 200	0	FFRRG=[Param.]<CR><LF> FFRRG?<CR><LF> Set the coefficient of the right pixel when FIR Filter for Green is applied.
FIRFilterRightRatio [Blue] (R/W)	FFRRB	-200 ~ 200	0	FFRRB=[Param.]<CR><LF> FFRRB?<CR><LF> Set the coefficient of the right pixel when FIR Filter for Blue is applied.
MEDIANFilterMode [Red] (R/W)	MFR	0: Off 1: On	0	MFR=[Param.]<CR><LF> MFR?<CR><LF> Enable / Disable MEDIAN Filter for Red.
MEDIANFilterMode [Green] (R/W)	MFG	0: Off 1: On	0	MFG=[Param.]<CR><LF> MFG?<CR><LF> Enable / Disable MEDIAN Filter for Green.
MEDIANFilterMode [Blue] (R/W)	MFB	0: Off 1: On	0	MFB=[Param.]<CR><LF> MFB?<CR><LF> Enable / Disable MEDIAN Filter for Blue.
NoiseReduction (R/W)	NR	0: Off 1: Level1 2: Level2 3: Level3 4: Level4	0	NR=[Param.]<CR><LF> NR?<CR><LF> Set the noise reduction intensity in 4 levels. Level1 = weak, Level4 = strong.
Access: (R) = Read Only; (R/W) = Read and Write; (W) = Write Only.				

JAI Custom Control Image Setup

Configure the Horizontal Image Mirroring setting.

Note: Descriptions of each command can also be found in "[JAI Custom Control Image Setup](#)" (Setting List).

Image Setup Name (Access)	Short ASCII	Values	Default Value	Example / Description
HorizontalImageMirroring (R/W)	HIM	0: Off 1: On	1	HIM=[Param.]<CR><LF> HIM?<CR><LF> Specify whether to mirror the image horizontally.
Access: (R/W) = Read and Write				

JAI Custom Control Video Process

Configure the chromatic Aberration Correction settings.

Note: Descriptions of each command can also be found in "[JAI Custom Control Video Process](#)" (Setting List).

Video Process Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
ChromaticAberration CorrectionMode (R/W)	CACM	0: Off 1: Lens1 2: Lens2 3: Lens3	0	CACM=[Param.]<CR><LF> CACM?<CR><LF> Correct the color aberration that occurs at the left and right edges due to lens characteristics.
ChromaticAberration CorrectionLens [Lens1, R channel] (R/W)	CACR1	-40 ~ 40 Unit: 0.1 pixel	0	CACR1=[Param.]<CR><LF> CACR1?<CR><LF> Set the amount of correction for the Lens1/R channel.
ChromaticAberration CorrectionLens [Lens1, B channel] (R/W)	CACB1	-40 ~ 40 Unit: 0.1 pixel	0	CACB1=[Param.]<CR><LF> CACB1?<CR><LF> Set the amount of correction for the Lens1/B channel.
ChromaticAberration CorrectionLens [Lens2, R channel] (R/W)	CACR2	-40 ~ 40 Unit: 0.1 pixel	0	CACR2=[Param.]<CR><LF> CACR2?<CR><LF> Set the amount of correction for the Lens2/R channel.

Video Process Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
ChromaticAberration CorrectionLens [Lens2, B channel] (R/W)	CACB2	-40 ~ 40 Unit: 0.1 pixel	0	CACB2=[Param.]<CR><LF> CACB2?<CR><LF> Set the amount of correction for the Lens2/B channel.
ChromaticAberration CorrectionLens [Lens3, R channel] (R/W)	CACR3	-40 ~ 40 Unit: 0.1 pixel	0	CACR3=[Param.]<CR><LF> CACR3?<CR><LF> Set the amount of correction for the Lens3/R channel.
ChromaticAberrationCorrectionLens [Lens3, B channel] (R/W)	CACB3	-40 ~ 40 Unit: 0.1 pixel	0	CACB3=[Param.]<CR><LF> CACB3?<CR><LF> Set the amount of correction for the Lens3/B channel.
Access: (R/W) = Read and Write				

Encoder Control

Configure Encoder settings.

Note: Descriptions of each command can also be found in "[EncoderControl](#)" (Setting List).

Encoder Control Name (Access)	Short ASCII	Values	Default Value	Example / Description
EncoderSourceA (R/W)	ENCSA	0: Line5 Opt In1 1: Line4 TTL In1 2: Line10 TTL In2 3: Line13 TTL In3	0	ENCSA=[Param.]<CR><LF> ENCSA?<CR><LF> Select where to input the signal from the rotary encoder.
EncoderSourceB (R/W)	ENCSB	0: Line5 Opt In1 1: Line4 TTL In1 2: Line10 TTL In2 3: Line13 TTL In3	0	ENCSB=[Param.]<CR><LF> ENCSB?<CR><LF> Select where to input the signal from the rotary encoder.
EncoderDivider (R/W)	ENCDIV	1 ~ 4294967295	65536	ENCDIV=[Param.]<CR><LF> ENCDIV?<CR><LF> Set the number of triggers to be generated during one pitch of the rotary encoder. The number of triggers is 65536 / (set value).
EncoderFilter (R/W)	ENFIL	0 ~ 15 (cycle) Note: 10ns/cycle	0	ENFIL=[Param.]<CR><LF> ENFIL?<CR><LF> Apply a low-pass filter to prevent noise on the signal from the rotary encoder and stabilize the signal for the specified number of cycles.
EncoderStrobe (R/W)	ENSTR	1 ~ 256 (1 = 10ns)	1	ENSTR=[Param.]<CR><LF> ENSTR?<CR><LF> Set the strobe length of the Trigger signal generated from the rotary encoder by the number of cycles.
EncoderAveragingInterval (R/W)	ENAVE	0: none 1: 2 pulses 2: 4 pulses 3: 8 pulses 4: 16 pulses 5: 32 pulses	0	ENAVE=[Param.]<CR><LF> ENAVE?<CR><LF> Perform the internal processing by averaging the time interval of the specified number of signals.
Access: (R/W) = Read and Write				

Miscellaneous

Troubleshooting

Check the following before requesting help. If the problem persists, contact your local JAI distributor.

Power Supply and Connections

Issue: The POWER/TRIG LED remains lit amber and does not turn green, even after power is supplied to the camera.

Cause and Solution: Camera initialization may not be complete due to lack of power. Check the Camera Link cable or 6-pin power cable connection.

Image Display

Issue: Gradation in dark areas is not noticeable.

Cause and Solution: Use the gamma function to correct the display. As the light-emitting properties of the monitor are not linear, the entire image may be darker or the gradation in the dark areas may be less noticeable when camera outputs are displayed without processing. Using the gamma function performs correction to produce a display that is close to linear. For details, see [Gamma Function](#).

Settings and Operations

Issue: Settings cannot be saved to user memory.

Cause and Solution: You cannot save to user memory while images are being acquired by the camera. Stop image acquisition before performing the save operation.

Issue: I want to restore the factory default settings.

Cause and Solution: Load Default under User Set Selector in the Feature Properties tab to restore the factory default settings.

Specifications

Item	Specifications																						
Image Sensor	4K line scan CMOS image sensor × 3 Effective Pixels: 4096 × 3 (R, G, B) Pixel Size: Type A: 7.5 μm x 7.5 μm, Type B: 7.5 μm x 10.5 μm																						
Synchronization	Internal																						
CameraLink PixelClock	42.5 / 63.75 / 85 MHz																						
Lline Rate (Width = 4096)	<table><tr><th>CIConfiguration</th><th>PixelFormat</th><th>Line Rate</th></tr><tr><td>Base</td><td>RGB8</td><td>66Hz ~ 20kHz</td></tr><tr><td rowspan="2">Medium</td><td>RGB10</td><td>66Hz ~ 20kHz</td></tr><tr><td>RGB8</td><td>66Hz ~ 40kHz</td></tr><tr><td>Full</td><td>RGB8</td><td>66Hz ~ 54kHz</td></tr><tr><td>80Bit (Deca)</td><td>RGB8</td><td>66Hz ~ 67kHz</td></tr></table>			CIConfiguration	PixelFormat	Line Rate	Base	RGB8	66Hz ~ 20kHz	Medium	RGB10	66Hz ~ 20kHz	RGB8	66Hz ~ 40kHz	Full	RGB8	66Hz ~ 54kHz	80Bit (Deca)	RGB8	66Hz ~ 67kHz			
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80Bit (Deca)	RGB8	66Hz ~ 67kHz																					
Dark SN (DR) DarkLevel @ 10bit	<table><tr><th>Channel</th><th>Individual Gain</th><th>SN</th></tr><tr><td>R</td><td rowspan="3">Off*</td><td>TypeA/B 58 dB (Typ)</td></tr><tr><td>G</td><td>TypeA/B 57 dB (Typ)</td></tr><tr><td>B</td><td>TypeA/B 56 dB (Typ)</td></tr><tr><td>R</td><td rowspan="3">On**</td><td>TypeA/B >60 dB (Typ)</td></tr><tr><td>G</td><td>TypeA/B >60 dB (Typ)</td></tr><tr><td>B</td><td>TypeA/B >60 dB (Typ)</td></tr><tr><td colspan="3">*DSNU Correction = ON; Gain All/Red/Blue = 0dB **DSNU Correction = ON; Gain Green/Red/Blue = 0dB</td></tr></table>			Channel	Individual Gain	SN	R	Off*	TypeA/B 58 dB (Typ)	G	TypeA/B 57 dB (Typ)	B	TypeA/B 56 dB (Typ)	R	On**	TypeA/B >60 dB (Typ)	G	TypeA/B >60 dB (Typ)	B	TypeA/B >60 dB (Typ)	*DSNU Correction = ON; Gain All/Red/Blue = 0dB **DSNU Correction = ON; Gain Green/Red/Blue = 0dB		
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	Bright SNR 890LSB @ 10bit	<table><tr><th>Channel</th><th>Individual Gain</th><th>SN</th></tr><tr><td>R</td><td rowspan="3">Off*</td><td>TypeA 37 dB (Typ); TypeB 40 dB (Typ)</td></tr><tr><td>G</td><td>TypeA 36 dB (Typ); TypeB 39 dB (Typ)</td></tr><tr><td>B</td><td>TypeA 36 dB (Typ); TypeB 39 dB (Typ)</td></tr><tr><td>R</td><td rowspan="3">On**</td><td>TypeA 40 dB (Typ) ; TypeB 43 dB (Typ)</td></tr><tr><td>G</td><td>TypeA 40 dB (Typ) ; TypeB 43 dB (Typ)</td></tr><tr><td>B</td><td>TypeA 40 dB (Typ) ; TypeB 43 dB (Typ)</td></tr><tr><td colspan="3">*PRNU/DSNU Correction = ON; Gain All/Red/Blue = 0dB *PRNU/*DSNU Correction = ON; Gain Green/Red/Blue = 0dB</td></tr></table>			Channel	Individual Gain	SN	R	Off*	TypeA 37 dB (Typ); TypeB 40 dB (Typ)	G	TypeA 36 dB (Typ); TypeB 39 dB (Typ)	B	TypeA 36 dB (Typ); TypeB 39 dB (Typ)	R	On**	TypeA 40 dB (Typ) ; TypeB 43 dB (Typ)	G	TypeA 40 dB (Typ) ; TypeB 43 dB (Typ)	B	TypeA 40 dB (Typ) ; TypeB 43 dB (Typ)	*PRNU/DSNU Correction = ON; Gain All/Red/Blue = 0dB *PRNU/*DSNU Correction = ON; Gain Green/Red/Blue = 0dB	
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Item	Specifications	
Digital Image Output Format		Setting Range
	Width	16 (8) ~ 4096 (2048), 16 (8) pixels/step
	OffsetX	0 ~ 4096 (2048), 16 (8) pixels/step
	Height	1 (Fixed)
	PixelFormat	RGB8, RGB10
	() = BinningHorizontal = 2	
Exposure Mode	Exposure Mode	ExposureTime (step: 0.01μs)
	Off	Line Period - 3.29us + 0.85us
	Timed (Trigger Off)	3.0μs ~ 15.149ms
	Timed (Trigger On)	3.0μs ~ 15.149ms
	TriggerWidth	TriggerWidth + 0.85μs (1.8μs ~ 1s)
	Exposure Offset: -0.85 μs	
Trigger Inputs	12pin (DC IN/TRIG): TTL, Opt Input; 10-pin: TTL In Camera Link: LVDS (CC1) Positive / negative logic switchable. Minimum trigger width: 50ns or more	
Synchronous output (when the terminal is open)	Camera Link: LVAL (Camera Link Tx24, DVAL (Camera LinkTx25), ExposureActive (Camera Link Tx26) 12-pin: Exposure Active or LVAL 10-pin: Exposure Activeor LVAL	
Gain	Mode	Gain Setting Range
	AnalogBaseGain	0dB / 6dB / 12dB
	Individual Gain Mode*	DigitalG/R/B: 0 ~ 36.0dB (x1.0 ~ x64.0)
	Master Mode**	DigitalAll: 0 ~ 30.0dB (x1.0 ~ x32.0)
Digital R/B: -7.96 ~ +12.0dB (x0.4 ~ x4.0)		
Black Level	DigitalAll: -133 ~ 255 DigitalRed/Blue: -64 ~ 64	
Test Pattern	White, GreyPattern1(Ramp), GreyPattern2(Stripe), ColorBar	
Image Processing	Pixel Sensitivity Correction: Pixel Correction (DSNU、PRNU) Shading Correction (ColorShading, FlatShading) LUT: Off : y =1.0, ON: 257 points can be set. Gamma : 0.45 to 1.0 (9 steps available) Noise Reduction Filter (MEDIAN, FIR, NoiseReduction)	
Communication interface	EIA-644: Camera Link (SerTFG, SerTC) Communication Rate: 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps	
Field Update	Supported	

Item	Specifications	
Power Supply Voltage (12-pin)	Input Range	DC +12 ~ +24V $\pm$ 10%
	Consumption	9.3 W (at 12 V input, full pixel, Default setting, Environmental temperature 25°C) (Typical), 14.5W (Maximum)
Lens mount	M52 Mount, F mount	
Back flange distance	M52 mount: 46.5 mm (in air), tolerance: 0 mm to -0.05 mm F mount: 46.5 mm, tolerance: 0 mm to -0.05 mm	
Verified Performance Temperature/Humidity	-5°C ~ +45°C (20 to 80%, non-condensing) Note: It may change depending on the installation environment. Please refer to the Caution in this chapter.	
Storage Temperature/Humidity	-25°C ~ +60°C (20 to 80%, non-condensing)	
Vibration Resistance	3G (20 Hz~ 200 Hz X-Y-Z direction)	
Shock Resistance	50G	
Regulations	You can identify the hardware revision number by the last letter of your camera's serial number.	
	Model	Hardware Rev.
	SW-4000T-MCL-F	A - C
	SW-4000T-MCL-M52	A - B
	SW-4000T-MCL-F	D or later
	SW-4000T-MCL-M52	C or later
Dimensions (Housing)	90mm x 90mm x 90mm (WHD, excluding connectors)	
Weight	765g	
Connectors / LEDs	Mini Camera Link	Model: HDR-EC26FYTG2-SLt $\times$ 2 Function: video output / communication / external trigger / ExposureActive *Positive polarity for ExposureActive (polarity switching not possible)
	12-pin	Model: HR10A-10R-12PB(71) (or equivalent) Function: power supply input / communication / external trigger / ExposureActive *Negative polarity for ExposureActive (polarity switching not possible)
	10-pin	Model: Camera side: 3260-10S3 (55) (Equivalent to Hirose Electronic), Cable side: 3240-10P-C(50) (Equivalent to Hirose Electronic) Function: communication
	LED	Function: Power on, trigger input indicator

Notes:

- Design and specifications are subject to change without notice.
- Approximately 30 minutes of warm-up are required to achieve these specifications.

Caution: About the verified performance temperature

Make sure the following temperature conditions are met when operating the unit.

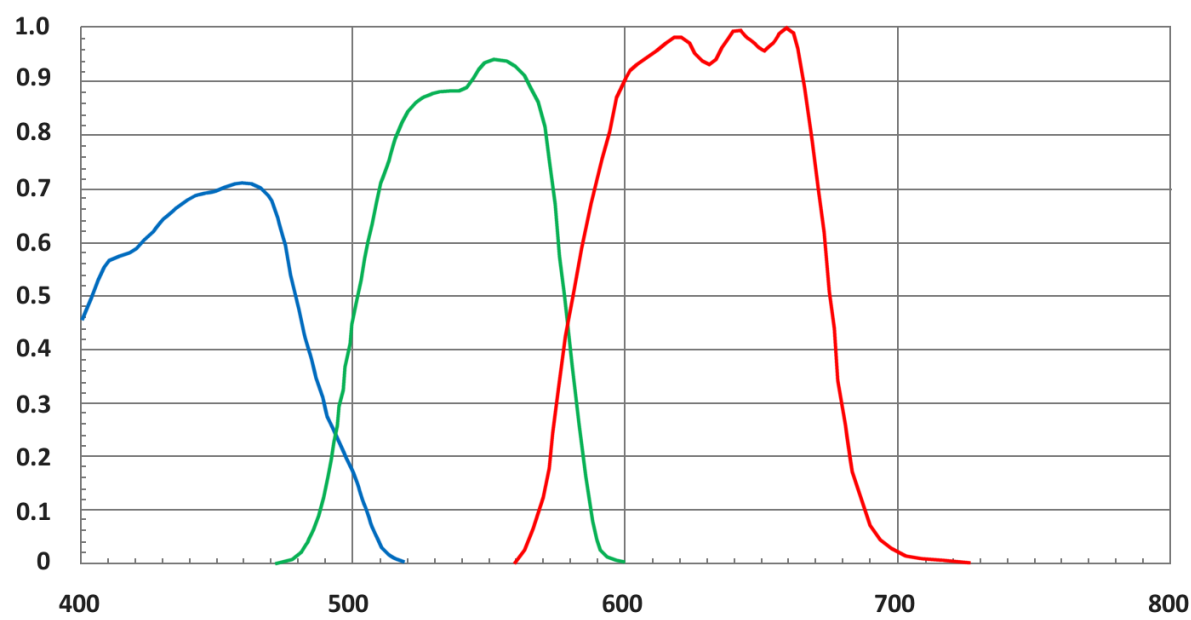
- 1) The camera's internal temperature sensor detects temperatures of 67 °C or less during operation.
- 2) The top surface of the camera's casing is 57 °C or less.

If the above temperature conditions are exceeded, take measures to dissipate heat according to your installation environment and conditions.

Package Contents

- Camera body (1)
- Sensor protection cap (1)
- Dear Customer (sheet) (1)

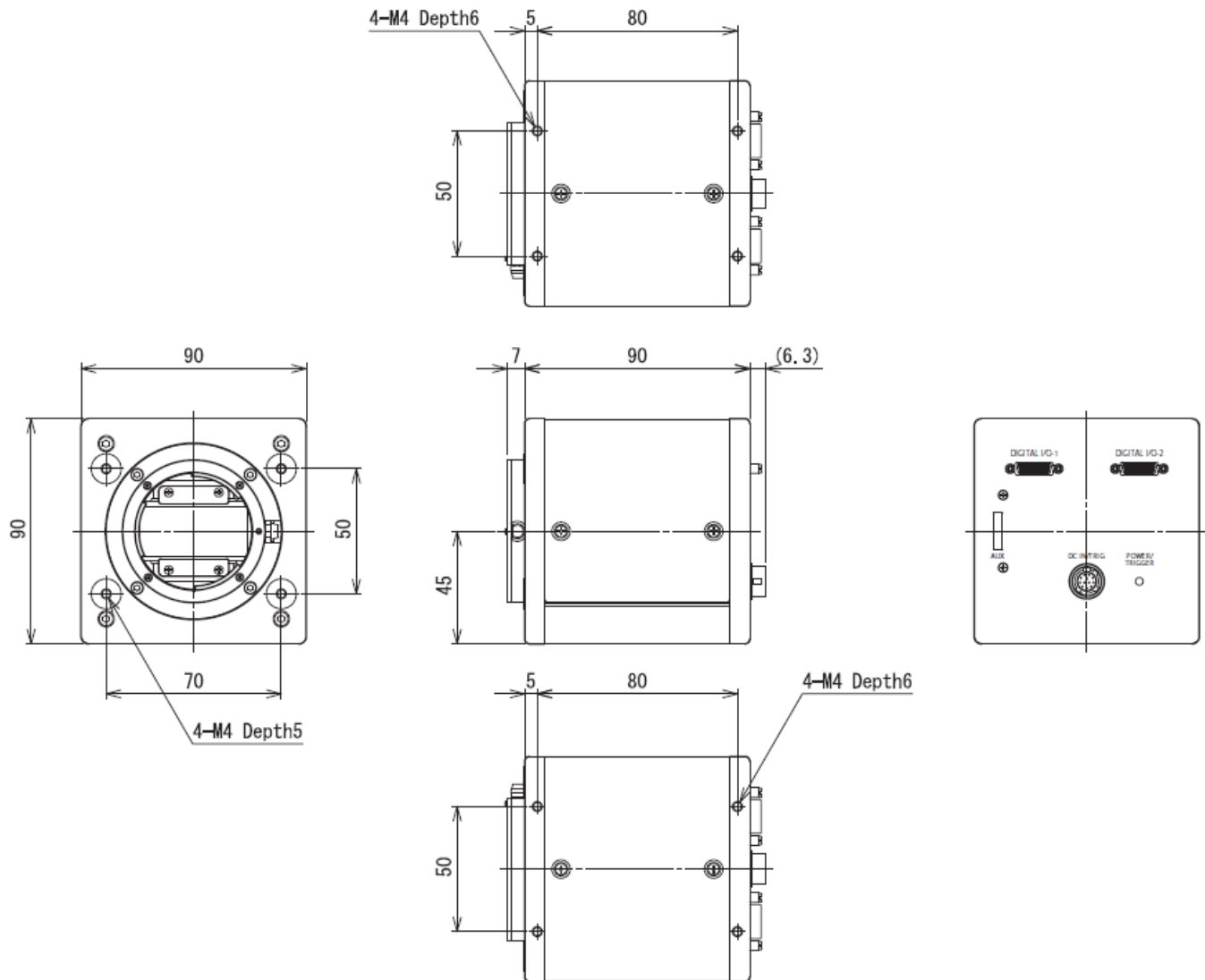
Spectral Response



Dimensions

This section shows the dimensional drawings of each camera model.

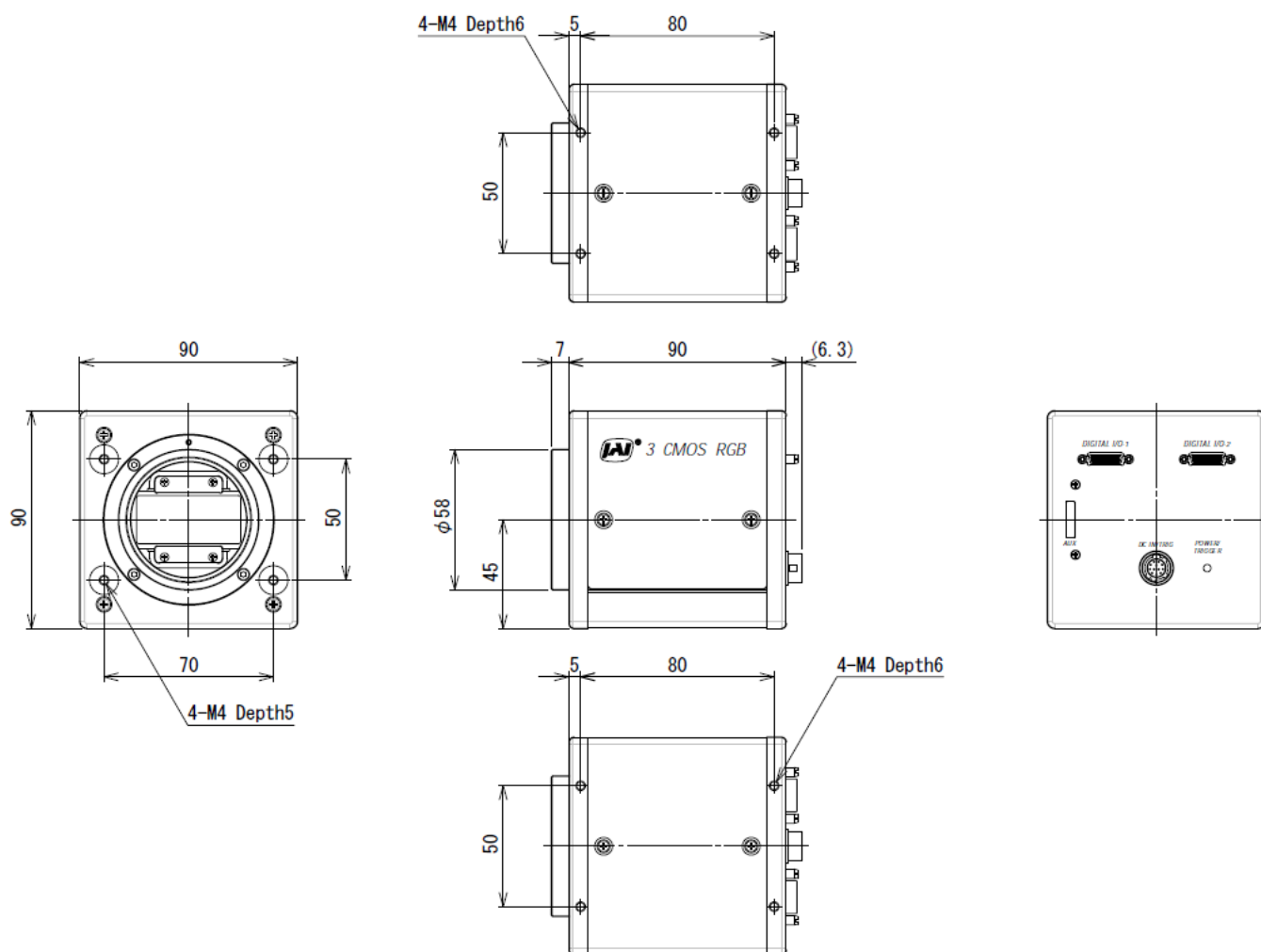
Dimensions (F-Mount)



Notes:

- Dimensional Tolerance: $\pm 0.3\text{mm}$
- Unit: mm

Dimensions (M52-Mount)



Notes:

- Dimensional Tolerance: $\pm 0.3\text{mm}$
- Unit: mm

Comparison of the Decibel Display and Multiplier Display

Decibels [dB]	Multipliers [X]	Remarks
-6	0.501	
-5	0.562	
-4	0.631	
-3	0.708	
-2	0.794	
-1	0.891	
0	1	
1	1.122	
2	1.259	
3	1.413	
4	1.585	
5	1.778	
6	1.995	
7	2.239	
8	2.512	
9	2.818	
10	3.162	
11	3.548	
12	3.981	
13	4.467	
14	5.012	
15	5.623	
16	6.31	
17	7.079	
18	7.943	
19	8.913	
20	10	
21	11.22	
22	12.589	
23	14.125	
24	15.849	
25	17.783	
26	19.953	
27	22.387	
28	25.119	
29	28.184	
30	31.623	
31	35.481	
32	39.811	
33	44.668	

Decibels [dB]	Multipliers [X]	Remarks
34	50.119	
35	56.234	
36	63.096	

User's Record

Model name: SW-4000T-MCL

Revision:

Serial No:

Firmware version:

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

Revision History

Revision	Date	Device Version	Changes
2.4	2026/08/10	DV0113	Updated the DC IN/TRIG Connector (12-Pin Round) topic.
2.3	2026/07/30	DV0113	Update the FCC Compliance. (Certifications) Updated " Spectral Response ".
2.2	2025/10/03	DV0113	Corrected the examples of ICommand items in ASCII short command list (Counter and Timer Control , JAI Custom Control Image Setup , JAI Custom Control Pixel Correction).
2.1	2025/04/04	DV0113	Added the following topics: " ROI (Regional Scanning Function) ", " Pulse Generator ", " LineSource Items " Significant additions and corrections have been made to the following topics: " Exposure Mode ", " Gain Control ", " Connecting Rotary Encoders "
2.0	2024/10/29	DV0113	Redesigned the user manual and updated/corrected topics. Added the Command List (Short ASCII Command List). Added Encoder Max Trigger Period (DeviceControl). Added a caution and notes to PRNU Correction (Pixel Gain Correct) . Updated China RoHS .

Camera User Manual Revision History (1.x versions)

Revision	Date	Changes
1.4	June 2023	Added the lens mount protrusion information (13mm or less)
1.3	July 2022	Corrected China RoHS, added the Non-Volatile Flash Memory topic.
1.2	Dec 2018	Add Noise reduction digital filter function, etc.
1.0	June 2018	First version

Command List Revision History (1.x versions)

Revision	Date	Changes
1.2	June 2023	Corrected the setting ranges for the ChromaticAberrationCorrectionLens commands (JAI Custom Control Video Process). Added NoiseReduction (JAI Custom Control Pixel Correction).
1.1	Dec. 2019	-
1.0	2018	First Release

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