

VIEWWORKS

VL Series User Manual

VL-2K7C-M200I-2 / VL-4K7C-M200I-2 / VL-2K7C-C100I-2 / VL-4K7C-C100I-2

VL-4K7C-M120I-1 / VL-4K7C-C60I-2



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Preface

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Before Using This Product

Thank you for choosing VL-2K/4K series™.

- Make sure to read this manual before using the product.
- Make sure to check whatever a professional engineer has finished installation and configuration.
- Make sure to keep this manual at hand as a reference while using the product.
- This manual assumes that you have expertise in how to use an industrial camera.

The Series

This manual is intended for users of the following products:

- VL-2K7C-M200I-2
- VL-2K7C-C100I-2
- VL-4K7C-M200I-2
- VL-4K7C-C100I-2
- VL-4K7C-M120I-1
- VL-4K7C-C60I-2

About This Manual

This manual is intended for VL-2K/4K series™ camera users. It is recommended to refer to the Frame Grabber's User Manual of yours, with this manual.

Convention in This Manual

For better understanding, the following conventions are used throughout the manual.

Names and Fonts

The names and fonts of user interfaces are used as follows:

- The menu and icon names in this manual are used as displayed in the product.
- The menu and icon names are marked in **this font**.
- Button or keyboard key names are marked in this font.

Warning, Caution, and Note

This manual shows warnings, cautions, and notes with the following figures:

**Warning! (English)**

This indicates that you need to follow this message for your safety and to prevent the product from damage.

Avertissement! (Français)

Cela indique que vous devez suivre ce message pour votre sécurité et pour éviter que le produit ne soit endommagé.

**Caution! (English)**

This indicates that you need to follow this message to prevent data from being lost or corrupted.

Prudence! (Français)

Cela indique que vous devez suivre ce message pour éviter la perte ou la corruption des données.

**Note: (English)**

This indicates that this message provides additional information.

Note: (Français)

Cela indique que ce message fournit des informations supplémentaires.

Definition of Terms

For clarity, this manual defines some terms as follows:

Term	Definition
Preface	The introductory part preceding the Table of Contents in this manual
Application	A program that performs a particular task or set of tasks
Configurator	A sample application offered by Vieworks to control the cameras of the VL-2K/4K series

Revision History

This document has the revision history as follows:

Version	Date	Description
1.0	2021-09-01	Initial Release
1.1	2021-12-03	<ul style="list-style-type: none">• Added description for the Binning function• Added a note for a CC1 trigger signal and for an external trigger signal
	2021-12-20	<ul style="list-style-type: none">• Fixed errors on Command List
1.2	2022-07-20	<ul style="list-style-type: none">• Added description for the feature to correct FPN in acquired images• Modified description for temperature information on camera's housing• Modified numeric information on resolutions in the specification tables
	2022-12-09	Added information on UKCA certification
1.3	2023-02-15	Added some contents related to UL certification
1.4	2023-10-10	<ul style="list-style-type: none">• Added description for VL-4K7C-M120I, VL-4K7C-C60I-2
		<ul style="list-style-type: none">• [English only] Added all the warnings/cautions/notes texts in French for UL certification.
1.5	2024-02-26	<ul style="list-style-type: none">• Removed information about trigger signal in chapter 8.2.

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Chapter 1. Precautions

General



English

- Do not drop, disassemble, repair or alter the device. Doing so may damage the camera electronics and cause an electric shock.
- Do not let children touch the device without supervision.
- Stop using the device and contact the nearest dealer or manufacturer for technical assistance if liquid such as water, drinks or chemicals gets into the device.
- Do not touch the device with wet hands. Doing so may cause an electric shock.
- Make sure that the temperature of the camera does not exceed the temperature range specified in 5.2 Specifications. Otherwise, the device may be damaged by extreme temperature.

Français

- Ne laissez pas tomber, démontez, réparez ou modifiez l'appareil. Cela pourrait endommager les composants électroniques de l'appareil photo et provoquer un choc électrique.
 - Ne laissez pas les enfants toucher l'appareil sans surveillance.
 - Arrêtez d'utiliser l'appareil et contactez le revendeur ou le fabricant le plus proche pour obtenir une assistance technique si un liquide tel que de l'eau, des boissons ou des produits chimiques pénètre dans l'appareil.
 - Ne touchez pas l'appareil avec les mains mouillées. Cela pourrait provoquer un choc électrique.
 - Assurez-vous que la température de la caméra ne dépasse pas la plage de température spécifiée dans 5.2 Specifications. Sinon, l'appareil pourrait être endommagé par des températures extrêmes.
-

Installation and Maintenance



English

- Do not install in dusty or dirty areas - or near an air conditioner or heater to reduce the risk of damage to the device.
- Avoid installing and operating in an extreme environment where vibration, heat, humidity, dust, strong magnetic fields, explosive/corrosive mists or gases are present.
- Do not apply excessive vibration and shock to the device. This may damage the device.
- Avoid direct exposure to a high intensity light source. This may damage the image sensor.
- Do not install the device under unstable lighting conditions. Severe lighting change will affect the quality of the image produced by the device.
- Do not use solvents or thinners to clean the surface of the device. This can damage the surface finish.

Français

- Ne pas installer dans des endroits poussiéreux ou sales – ou à proximité d'un climatiseur ou d'un chauffage pour réduire le risque d'endommagement de l'appareil.
 - Évitez d'installer et d'utiliser dans un environnement extrême où des vibrations, de la chaleur, de l'humidité, de la poussière, des champs magnétiques puissants, des brouillards ou des gaz explosifs/corrosifs sont présents.
 - N'appliquez pas de vibrations ni de chocs excessifs à l'appareil. Cela pourrait endommager l'appareil.
 - Évitez l'exposition directe à une source de lumière de haute intensité. Cela pourrait endommager le capteur d'image.
 - N'installez pas l'appareil dans des conditions d'éclairage instables. Un changement d'éclairage important affectera la qualité de l'image produite par l'appareil.
 - N'utilisez pas de solvants ou de diluants pour nettoyer la surface de l'appareil. Cela peut endommager la finition de la surface.
-

Power Supply



English

- Applying incorrect power can damage the camera. If the voltage applied to the camera is greater or less than the camera's nominal voltage, the camera may be damaged or operate erratically. Please refer to 5.2 Specifications for the camera's nominal voltage.
 - ※ Vieworks Co., Ltd. does NOT provide power supplies with the devices.
When using a Power Supply device, use a device below PS2 certified as UL 62368-1.
- Make sure the power is turned off before connecting the power cord to the camera. Otherwise, damage to the camera may result.

Français

- Une alimentation incorrecte peut endommager la caméra. Si la tension appliquée à la caméra est supérieure ou inférieure à la tension nominale de la caméra, la caméra peut être endommagée ou fonctionner de manière irrégulière. Veuillez vous référer à 5.2 Spécifications pour la tension nominale de la caméra.
 - ※ Vieworks Co., Ltd. ne fournit PAS d'alimentation électrique avec les appareils.
Lorsque vous utilisez un périphérique d'alimentation, utilisez un périphérique inférieur à PS2 certifié UL 62368-1.
 - Assurez-vous que l'alimentation est coupée avant de connecter le cordon d'alimentation à l'appareil photo. Sinon, cela pourrait endommager l'appareil photo.
-

Cleaning the Sensor Surface

Avoid cleaning the surface of the camera's sensor if possible. If you have dust or foreign matter on the sensor surface that will not blow off, use a soft lint free cotton bud dampened with a small quantity of high-quality lens cleaner. Because electrostatic discharge (ESD) can damage the sensor, you must use a cloth (e.g. cotton) that will not generate static during cleaning.



Avoid dust or foreign matter on the sensor surface. (English)

The camera is shipped with a protective plastic seal on the camera front. To prevent collecting dust or foreign matter on the camera sensor, make sure that you always put the protective seal in place when there is no lens mounted on the camera. In addition, make sure to always point the camera downward when there is no protective seal on the camera front or no lens mounted.

Évitez la poussière ou les corps étrangers sur la surface du capteur. (Français)

La caméra est livrée avec un sceau de protection en plastique sur le devant de la caméra. Pour éviter toute accumulation de poussière ou de corps étrangers sur le capteur de l'appareil photo, assurez-vous de toujours mettre le joint de protection en place lorsqu'aucun objectif n'est monté sur l'appareil photo. De plus, veillez à toujours pointer l'appareil photo vers le bas lorsqu'il n'y a pas de joint de protection sur le devant de l'appareil photo ou qu'aucun objectif n'est monté.

Procedures for Cleaning the Sensor

If you have dust or foreign matter on the sensor surface, follow the procedures below to wipe off.

1. Remove a contaminant by using an ionizing air gun.
If this step does not remove the contaminant, proceed to the next step.
2. Clean the contaminant on the sensor using one drop of lens cleaner on a non-fluffy cotton bud.
3. Wipe the cotton bud gently in only one direction (either left to right or right to left). Avoid wiping back and forth with the same cotton bud in order to ensure that the contaminants are removed and not simply transferred to a new location on the sensor surface.
4. Mount a lens, set the lens at a smaller aperture (e.g. F8), and then acquire images under bright lighting conditions. Check the images on the monitor for dark spots or stripes caused by the contaminant. Repeat the steps above until there is no contaminant present.



Caution! (English)

If the sensor is damaged due to electrostatic discharge or the sensor surface is scratched during cleaning, the warranty is void.

Prudence! (Français)

Si le capteur est endommagé en raison d'une décharge électrostatique ou si la surface du capteur est rayée lors du nettoyage, la garantie est annulée.

Chapter 2. Warranty

Do not open the housing of the camera. The warranty becomes void if the housing is opened. For information about the warranty, please contact your local dealer or factory representative.

Chapter 3. Compliance & Certifications

3.1 FCC Compliance

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 expenses.

3.2 CE

EMC Directive 2014/30/EU
EN 55032:2012 (Class A), EN 55024:2010
Class A

3.3 UKCA



The UKCA marking is the product marking used for products being placed on the market in Great Britain (England, Scotland and Wales). The UKCA marking applies to most products previously subject to the CE marking.* Therefore, this device is eligible for the UKCA marking.

*Source: [Using the UKCA marking at GOV.UK](https://www.gov.uk/guidance/using-the-ukca-marking)

3.4 UL



This is the Canadian / US safety compliance mark applies to electric shock, fire and mechanical hazards.

In accordance with UL 62368-1.

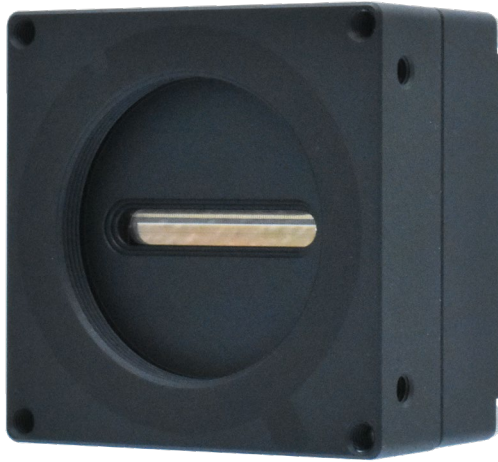
3.5 KC

KCC Statement

Type	Description
Class A (Broadcasting Communication Device for Office Use)	This device obtained EMC registration for office use (Class A), and may be used in places other than home. Sellers and/or users need to take note of this.

Chapter 4. Package Components

Package Components



VL Camera with M72 × 0.75 mount

Chapter 5. Product Specifications

5.1 Overview

VL-2K/4K series, which is a line scan camera equipped with a CMOS sensor, provides much faster line rate and higher resolution than legacy line-scan cameras. With its compact size, it realizes high reliability and high performance required in the machine vision systems. The VL-4K7C-M200I-2 model acquires images in the speed of maximum 200 kHz Line Rate on the 4096 x 2 resolution, moreover, it acquires 4k resolution images with double sensitivity on the TDI mode. In addition, the VL-2K/4K series includes the following features required by various line scan applications:

Main Features

- CMOS Line Scan
- Camera Link Full Interface
- Max. 4 k Pixel Resolution
- Dual Integration Mode
- Exposure Control
- PoCL Compliant
- GenICam Compatible -XML based Control

Applications

- Flat Panel Display Inspection
- Printed Circuit Board Inspection
- Parcel Sorting
- Document Scanning
- High Throughput Screening
- Printing/Packaging System

5.2 Specifications

Technical specifications for the mono cameras in the VL-2K/4K series are as follows.

Item	VL-2K7C-M200I-2	VL-4K7C-M200I-2	VL-4K7C-M120I-1
Active Image (H × V)	2048 × 2	4096 × 2	
Sensor	Vieworks	Gpixel GL0402	
Pixel Size	7.0 μm × 7.0 μm		
Max. Line Rate	2 Tap	82.36 kHz	41.34 kHz
	3 Tap	123.06 kHz	61.89 kHz
	4 Tap	163.46 kHz	82.36 kHz
	8 Tap	200.00 kHz	163.46 kHz
	10 Tap	200.00 kHz	200.00 kHz
Camera Link Pixel Clock	45 / 65 / 85 MHz		50 MHz
Data Output Mode	8 bit(2/3/4/8/10 Tap), 10 bit(2/3/4 Tap) or 12 bit(2/3/4 Tap)		8 bit(2/3/4/8/10 Tap), 10 bit(2/3/4/8 Tap)
Pixel Data Format	Mono 8/10/12		Mono 8/10
Image Direction	CC3 or Programmable		
Dual Integration Mode	Supported		
Trigger Mode	Free-Run, Hardware Trigger, CC1		
Exposure Time	1.00 – 1000.00 μs		
Black Level	from -4096 to 4095 LSB at 12 bits		from -256 to 255 at 10 bit
Gain Control	Analog Gain	×1.25, ×1.75, ×2, ×3, ×4	
	Digital Gain	×1.00 – ×32.00	
Camera Interface	Camera Link (Base / Medium / Full / 10 Tap)		
External Trigger	External, 3.3 V – 5.0 V		
Power	External	10 – 30 VDC	
	Dissipation	Typ. 6.8 W	Typ. 5.1 W
Environmental	Ambient Operating: 0°C~40°C (Housing: 10°C~50°C) Storage: 40°C~70°C		
Mechanical	60 mm × 60 mm × 37.1 mm, 224 g		
[Optional] Lens Mount	M42 × 1.0 mm		
[Optional] Sensor to Camera Front	Sensor to Camera Front: 10.1 mm		

Table 5-1 Specifications of VL-2K7C-M200I-2, VL-4K7C-M200I-2 and VL-4K7C-M120I-1

Technical specifications for the color cameras in the VL-2K/4K series are as follows.

Item		VL-2K7C-C100I-2	VL-4K7C-C100I-2	VL-4K7C-C60I-2
Active Image (H × V)		2048 × 2	4096 × 2	
Sensor		Vieworks	Gpixel GL0402	
Pixel Size		7.0 μm × 7.0 μm		
Max. Line Rate	2 Tap	41.34 kHz	20.71 kHz	13.81 kHz
	3 Tap	61.89 kHz	31.03 kHz	20.71 kHz
	4 Tap	82.36 kHz	41.34 kHz	27.59 kHz
	6 Tap	101.06 kHz	61.89 kHz	41.34 kHz
	8 Tap	101.06 kHz	82.36 kHz	55.05 kHz
	10 Tap	101.06 kHz	100.52 kHz	61.72 kHz
Camera Link Pixel Clock		45 / 65 / 85 MHz		50 MHz
Data Output Mode		8 bit(2 / 3 / 4 / 6 / 8 / 10 Tap), 10 bit(2 / 3 / 4 Tap) or 12 bit(2 / 3 / 4 Tap)		8bit(2/3/4/6/8/10Tap), 10bit(2/3/4/8Tap)
Pixel Data Format		Mono 8/10/12 BiColor RGBG 8/10/12 RGB 8/10/12 BGR 8/10/12		Mono 8/10 BiColor RGBG 8/10 RGB 8/10 BGR 8/10
Dual	Mono	Supported		
Integration Mode	Color	N/A		
Trigger Mode		Free-Run, Hardware Trigger, CC1		
Exposure Time		1.00 – 1000.00 μs		
Black Level		from -4096 to 4095 LSB at 12 bit		-from 256 to 255 at 10 bit
Gain Control	Analog Gain	×1.25, ×1.75, ×2, ×3, ×4		
	Digital Gain	×1.00 - ×32.00		
Camera Interface		Camera Link (Base / Medium / Full / 10 Tap)		
External Trigger		External, 3.3 V – 5.0 V		
Power	External	10 – 30 VDC		
	Dissipation	Typ. 6.8 W		Typ. 5.1 W
Environmental		Ambient Operating: 0°C~40°C (Housing: 10°C~50°C) Storage: 40°C~70°C		
Mechanical		60 mm × 60 mm × 37.1 mm, 224 g		
[Optional] Lens Mount		M42 × 1.0 mm		
[Optional] Sensor to Camera Front		Sensor to Camera Front: 10.1 mm		

Table 5-2 Specifications of VL-2K7C-C100I-2, VL-4K7C-C100I-2 and VL-4K7C-C60I-2

5.3 Camera Block Diagram

VL series consists of three printed circuit boards (PCB), and its block diagram is shown below.

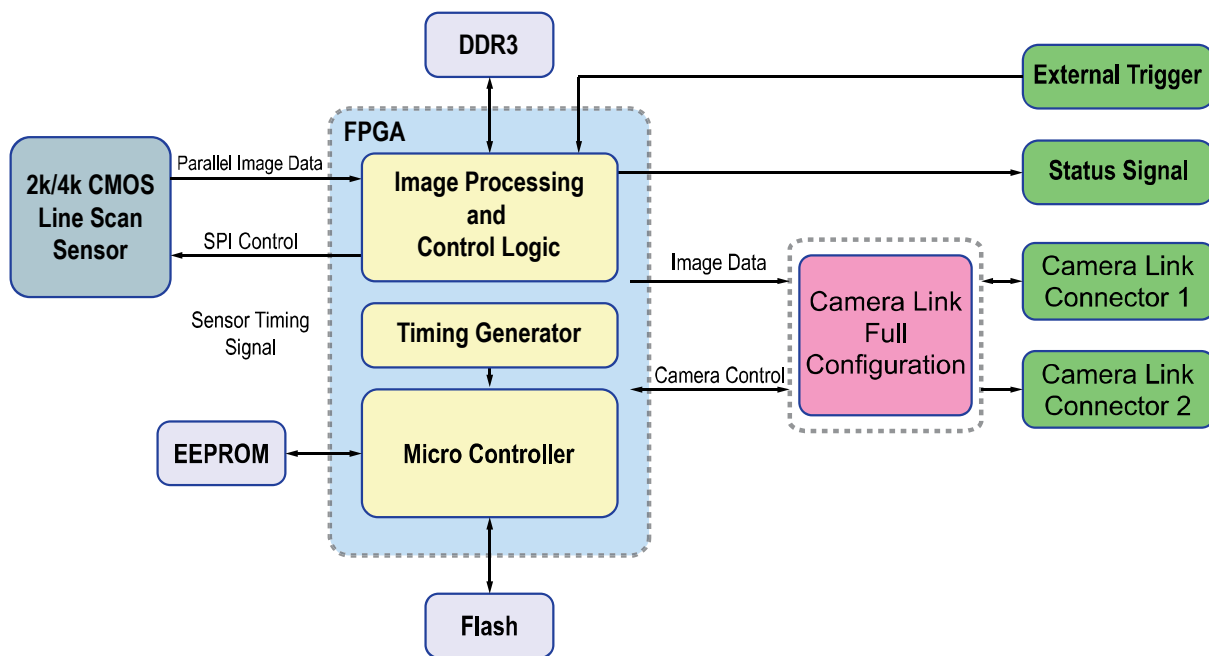


Figure 5-1 Camera Block Diagram

5.4 Quantum Efficiency

The following graphs show the quantum efficiency for the VL-2K/4K series.

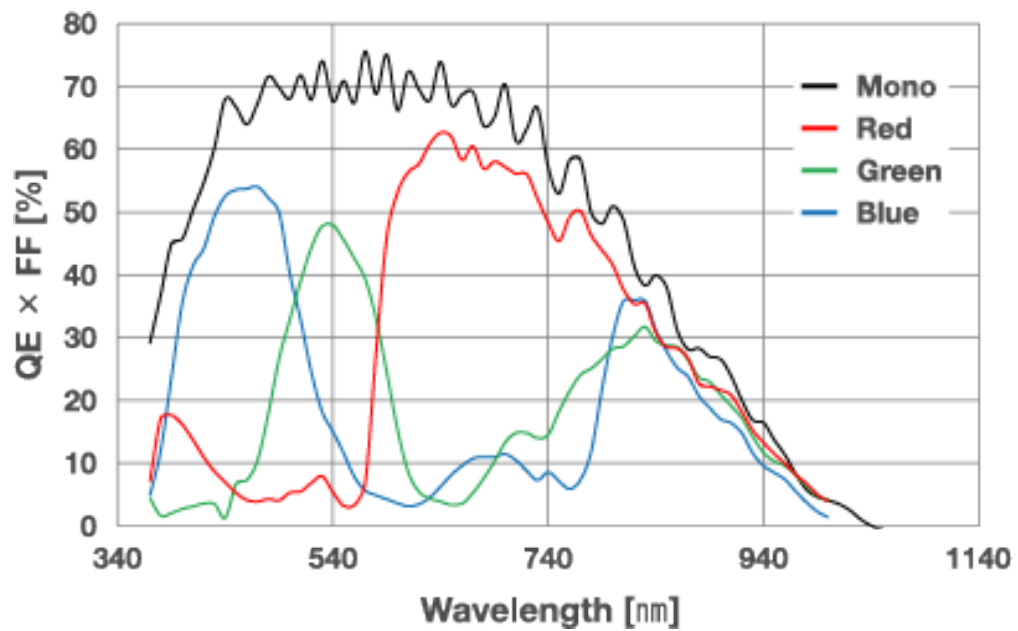


Figure 5-2 Quantum Efficiency

5.5 Mechanical Specification

The camera dimensions in millimeters are shown in the following figure.

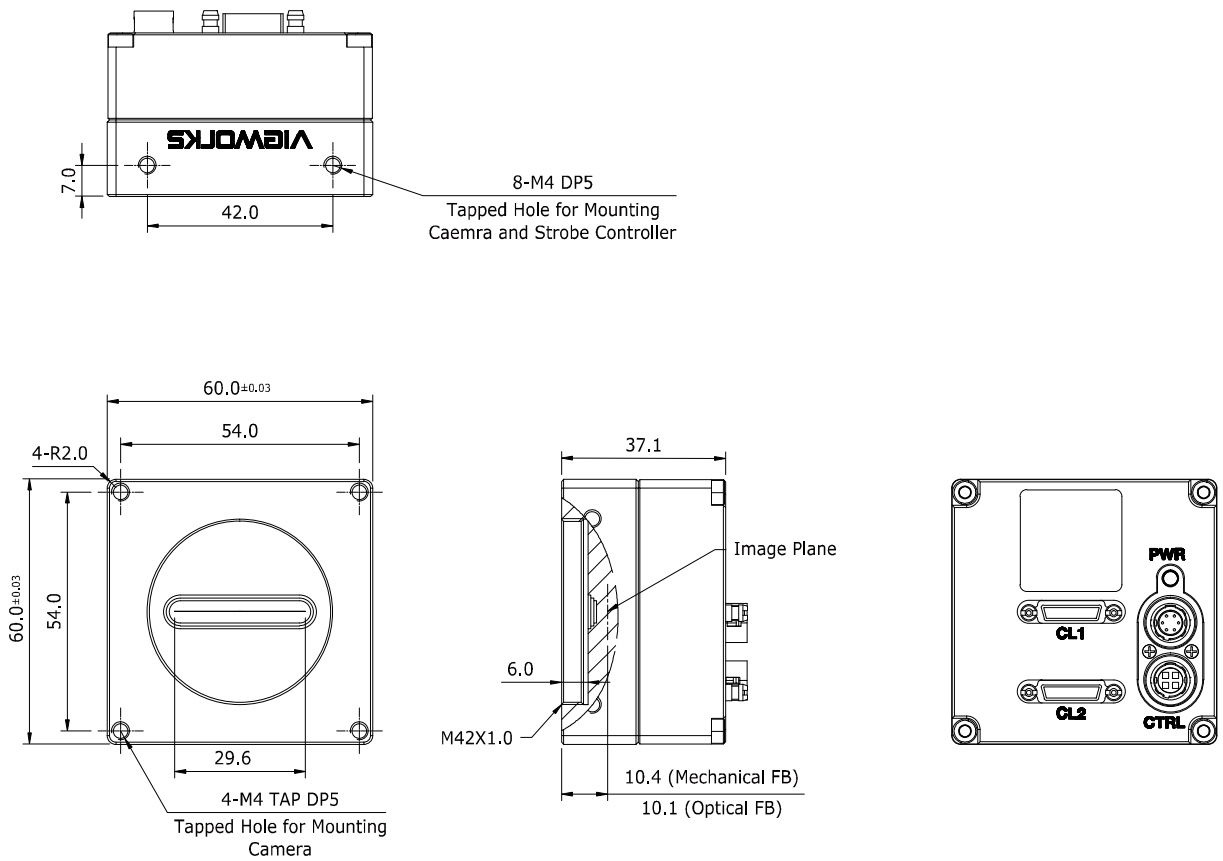


Figure 5-3 VL Series Mechanical Dimension

5.5.1 Camera Mounting and Heat Dissipation

You must mount the camera on a heat dissipation structure to maintain the temperature of the camera housing at 50°C or less. Given the low power consumption of the VL series camera, its housing temperature during operation will generally stay within the specified limits. However, overheating can occur if heat dissipation is restricted or if the camera is mounted on a severe environment. It is recommended to follow the general guidelines below when you mount the camera.

- In all cases, you should monitor the temperature of the camera housing and make sure that the temperature does not exceed 50°C. You can monitor the internal temperature of the camera by using the 'gct' command.
- If your camera is mounted on a metal component in your system, this may provide sufficient heat dissipation.

5.5.2 Fixing the Camera

If needed, it enables to fix the VL-2K/4K series product firmly to use. When doing this, the sections available to be used for tightening by the setscrews are 8 parts marked with the dashed lines in the following figure:

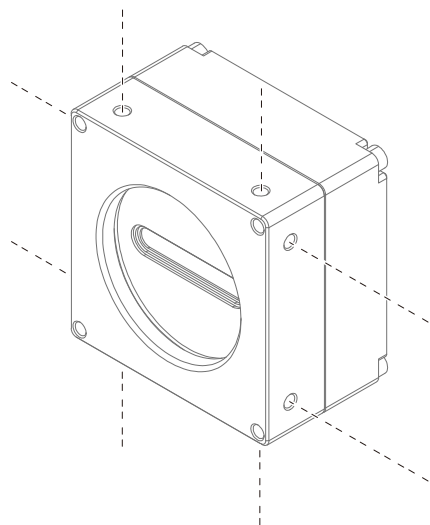


Figure 5-4 Locations available to Tighten the Setscrews when Mounting the Product

At least one of the four surfaces must be fixed, and at this time, all two setscrews must be fastened on one surface. For this product, the type of the fixing setscrew is M4, and this setscrew must be screwed into the camera by at least 4 mm.

Chapter 6. Connecting the Camera

The following instructions assume that you have installed a Camera Link frame grabber in your PC including related software. For more information, refer to your Camera Link frame grabber User Manual.

To connect the camera to your PC, follow the steps below.

1. Make sure that the power supply is not connected to the camera and your PC is turned off.



English

In the following step, you will be removing the protective plastic seal from the camera front. To prevent collecting dust or foreign matter on the camera sensor, make sure that the camera is pointing down when you remove the seal.

Français

À l'étape suivante, vous retirerez le joint de protection en plastique de l'avant de la caméra. Pour éviter toute accumulation de poussière ou de corps étrangers sur le capteur de la caméra, assurez-vous que la caméra pointe vers le bas lorsque vous retirez le sceau.

2. Remove the protective seal from the camera front and mount a lens on the camera.
3. Plug one end of a Camera Link cable into the Camera Link connector on the camera and the other end of the Camera Link cable into the Camera Link frame grabber in your PC.
4. Connect the plug of the power adaptor to the power input receptacle on the camera.
5. Plug the power adaptor into a working electrical outlet.
6. Verify all the cable connections are secure.

6.1 Precaution to Center the Image Sensor

- Users do not need to center the image sensor as it is adjusted as factory default settings.
- When you need to adjust the center of the image sensor, please contact your local dealer or the manufacturer for technical assistance.

6.2 Controlling the Camera

- You can control the camera by executing the Configurator.exe file.
- You can download the latest Configurator at <http://vision.viewworks.com>.
- Please refer to your Camera Link frame grabber user manual.

Chapter 7. Camera Interface

7.1 General Description

As shown in the following figure, four types of connectors and a status indicator LED are located on the back of the camera and have the functions as follows:

- ① 26-pin SDR Connector 1 (Camera Link Base): transmits video data and controls the camera.
- ② 26-pin SDR Connector 2 (Camera Link Medium/Full): transmits video data.
- ③ Status LED: displays power status and operation mode.
- ④ 6-pin Power Input Receptacle: supplies power to the camera.
- ⑤ 4-pin Control Receptacle: inputs external trigger signals and outputs strobe signals.

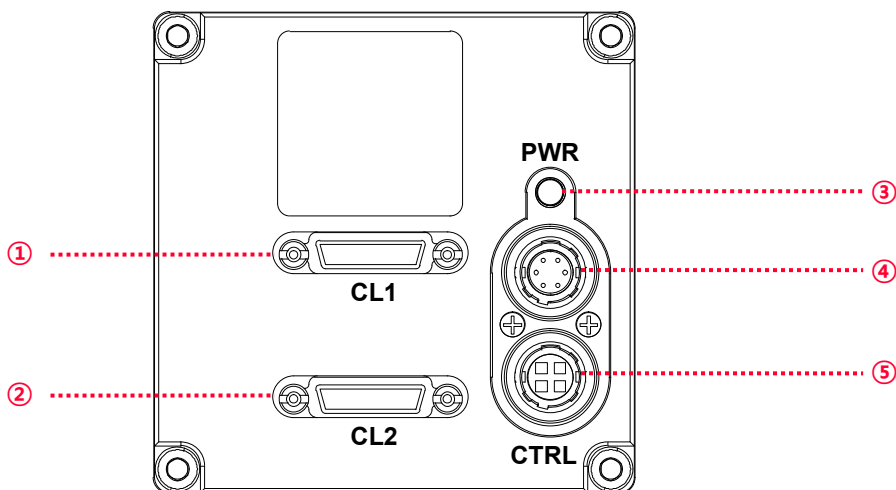


Figure 7-1 VL-2K/4K series Back Panel

7.2 Camera Link SDR Connector

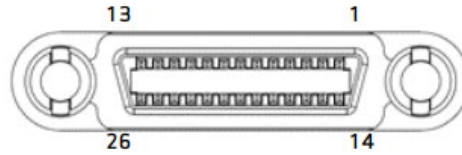


Figure 7-2 26-pin Camera Link SDR Connector

The Camera Link connectors on the camera comply with Camera Link standard and the following table shows the pin assignments.

PAIR List	Pin	Signal Name	Type	Description
PAIR 0	1	PoCL_1	PoCL	Cable Shield
	14	Ground	Ground	Cable Shield
PAIR 1	2	-X0	LVDS - Out	Camera Link Transmitter
	15	+X0	LVDS - Out	Camera Link Transmitter
PAIR 2	3	-X1	LVDS - Out	Camera Link Transmitter
	16	+X1	LVDS - Out	Camera Link Transmitter
PAIR 3	4	-X2	LVDS - Out	Camera Link Transmitter
	17	+X2	LVDS - Out	Camera Link Transmitter
PAIR 4	5	-XCLK	LVDS - Out	Camera Link Transmitter
	18	+XCLK	LVDS - Out	Camera Link Transmitter
PAIR 5	6	-X3	LVDS - Out	Camera Link Transmitter
	19	+X3	LVDS - Out	Camera Link Transmitter
PAIR 6	7	+ SerTC	LVDS - In	Serial Data Receiver
	20	- SerTC	LVDS - In	Serial Data Receiver
PAIR 7	8	- SerTFG	LVDS - Out	Serial Data Transmitter
	21	+ SerTFG	LVDS - Out	Serial Data Transmitter
PAIR 8	9	- CC 1	LVDS - In	Software External Trigger
	22	+ CC 1	LVDS - In	Software External Trigger
PAIR 9	10	- CC 2	LVDS - In	N/A
	23	+ CC 2	LVDS - In	N/A
PAIR 10	11	- CC 3	LVDS - In	Image Direction
	24	+ CC 3	LVDS - In	Image Direction
PAIR 11	12	- CC 4	LVDS - In	N/A
	25	+ CC 4	LVDS - In	N/A
PAIR 12	13	Ground	Ground	Cable Shield
	26	PoCL_1	PoCL	Cable Shield

Table 7-1 Pin Assignments for Camera Link Connector 1

PAIR List	Pin	Signal Name	Type	Description
PAIR 0	1	PoCL_2	PoCL	Cable Shield
	14	Ground	Ground	Cable Shield
PAIR 1	2	-Y0	LVDS - Out	Camera Link Transmitter
	15	+Y0	LVDS - Out	Camera Link Transmitter
PAIR 2	3	-Y1	LVDS - Out	Camera Link Transmitter
	16	+Y1	LVDS - Out	Camera Link Transmitter
PAIR 3	4	-Y2	LVDS - Out	Camera Link Transmitter
	17	+Y2	LVDS - Out	Camera Link Transmitter
PAIR 4	5	-YCLK	LVDS - Out	Camera Link Transmitter
	18	+YCLK	LVDS - Out	Camera Link Clock Tx
PAIR 5	6	-Y3	LVDS - Out	Camera Link Channel Tx
	19	+Y3	LVDS - Out	Camera Link Channel Tx
PAIR 6	7	-	Not Used	Connected with 100 ohm
	20	-	Not Used	
PAIR 7	8	-Z0	LVDS - Out	Camera Link Transmitter
	21	+Z0	LVDS - Out	Camera Link Transmitter
PAIR 8	9	-Z1	LVDS - Out	Camera Link Transmitter
	22	+Z1	LVDS - Out	Camera Link Transmitter
PAIR 9	10	-Z2	LVDS - Out	Camera Link Transmitter
	23	+Z2	LVDS - Out	Camera Link Transmitter
PAIR 10	11	-ZCLK	LVDS - Out	Camera Link Transmitter
	24	+ZCLK	LVDS - Out	Camera Link Clock Tx
PAIR 11	12	-Z3	LVDS - Out	Camera Link Channel Tx
	25	+Z3	LVDS - Out	Camera Link Channel Tx
PAIR 12	13	Ground	Ground	Cable Shield
	26	PoCL_2	PoCL	Cable Shield

Table 7-2 Pin Assignments for Camera Link 2 Connector



English

Camera Link cables of up to 10 meters length can be used for the VL series camera generally, in the case of 45MHz. However, the maximum usable cable length may be decreased depending on the quality of the Camera Link cables.

Français

Des câbles Camera Link d'une longueur maximale de 10 mètres peuvent être utilisés pour la caméra de la série VL en général, dans le cas de 45MHz. Cependant, la longueur maximale de câble utilisable peut être réduite en fonction de la qualité des câbles Camera Link.

7.3 Power Input Receptacle

The power input receptacle is a Hirose 6-pin connector (part # HR10A-7R-6PB). The pin assignments and configurations are as follows:

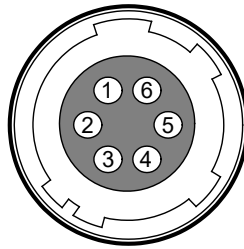


Figure 7-3 Pin Assignments for Power Input Receptacle

Pin Number	Signal	Type	Description
1, 2, 3	+ 12 VDC	Input	DC Power Input
4, 5, 6	DC Ground	Input	DC Ground

Table 7-3 Pin Configurations for Power Input Receptacle



English

- A recommended mating connector for the Hirose 6-pin connector is the Hirose 6-pin plug (part # HR10A-7P-6S) or the equivalent.
- It is recommended that you use the power adapter, which has at least 3 A current output at 12 VDC \pm 10% voltage output.
(You need to purchase a power adapter separately. When using a Power Supply device, use a device below PS2 certified as UL 62368-1.)

Français

- Un connecteur homologue recommandé pour le connecteur Hirose à 6 broches est la fiche Hirose à 6 broches (référence HR10A-7P-6S) ou l'équivalent.
- Il est recommandé d'utiliser l'adaptateur secteur doté d'une sortie de courant d'au moins 3 A à une tension de sortie de 12 V CC \pm 10 %.
(Vous devez acheter un adaptateur secteur séparément. Lorsque vous utilisez un périphérique d'alimentation, utilisez un périphérique inférieur à PS2 certifié UL 62368-1.)

Precaution for Power Input



English

- Make sure the power is turned off before connecting the power cord to the camera. Otherwise, damage to the camera may result.
- If the voltage applied to the camera is greater than specified in the specifications, damage to the camera may result.
- Make sure not to use the PoCL and the power adapter together.

Français

- Assurez-vous que l'alimentation est coupée avant de connecter le cordon d'alimentation à l'appareil photo. Sinon, cela pourrait endommager l'appareil photo.
 - Si la tension appliquée à la caméra est supérieure à celle spécifiée dans les spécifications, la caméra risque d'être endommagée.
 - Assurez-vous de ne pas utiliser le PoCL et l'adaptateur secteur ensemble.
-

7.4 Control Receptacle

The control receptacle is a Hirose 4-pin connector (part # HR10A-7R-4S) and consists of an external trigger signal input and strobe output ports. The pin assignments and configurations are as follows:

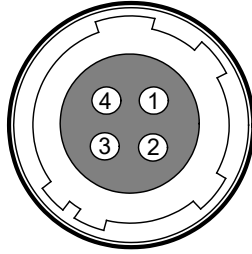


Figure 7-4 Pin Assignments for Control Receptacle

Pin Number	Signal	Type	Description
1	Trigger Input	Input	3.3 V – 5.0 V TTL input Input resistance: 1 k Ω
2	-	-	-
3	DC Ground	-	DC Ground
4	Strobe Out	Output	3.3 V TTL Output Output resistance: 47 Ω

Table 7-4 Pin Configurations for Control Receptacle



English

A recommended mating connector for the Hirose 4-pin connector is the Hirose 4-pin plug (part # HR10A-7P-4P) or the equivalent.

Français

Un connecteur homologue recommandé pour le connecteur Hirose à 4 broches est la fiche Hirose à 4 broches (référence HR10A-7P-4P) ou l'équivalent.

7.5 Trigger/Direction Input Circuit

The following figure shows trigger signal input and strobe output signal circuit of the 4-pin connector. Transmitted trigger signal is applied to the internal circuit through a CMOS buffer with a good noise margin. The minimum trigger width that can be recognized by the camera is $1 \mu\text{s}$. If transmitted trigger signal is less than $1 \mu\text{s}$, the camera will ignore the trigger signal.

The strobe output signal comes out through a 3.3 V output level of Line Driver IC. The pulse width of signal is synchronized with the exposure signal (shutter) of the camera.

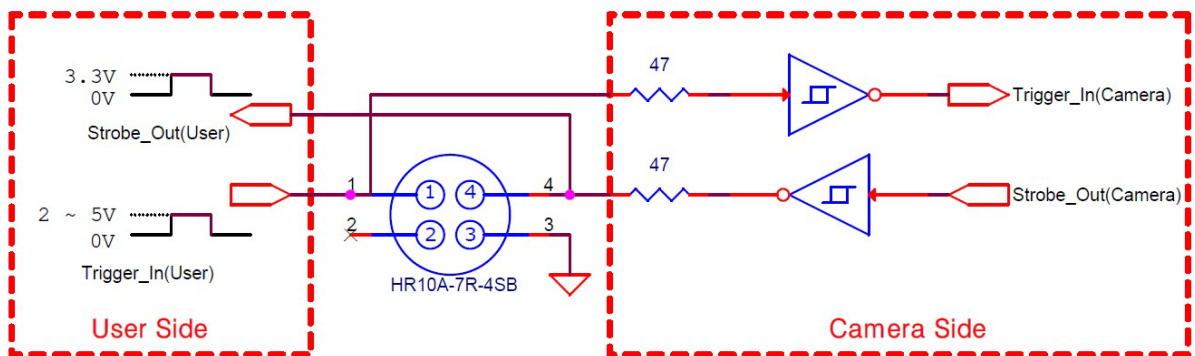


Figure 7-5 Trigger/Direction Input Schematic

Chapter 8. Acquisition Control

This chapter provides detailed information about the following elements involved with the image acquisition.

- Acquisition Start/Stop commands and Acquisition Mode parameter
- Line Start trigger
- Line Rate control
- Exposure Mode

8.1 Acquisition Start/Stop Commands and Acquisition Mode

The **Acquisition Start** command prepares the camera to acquire images. The camera cannot acquire images unless an **Acquisition Start** command has first been executed.

Executing an **Acquisition Stop** command terminates the camera's ability to acquire images.

A parameter called the **Acquisition Mode** has a direct bearing on how the **Acquisition Start** command operates. The VL-2K/4K series cameras only support **Continuous** for the **Acquisition Mode** parameter.

The **Acquisition Start** command will remain in effect until you execute the **Acquisition Stop** command. Once an **Acquisition Stop** command has been executed, the camera will not be able to acquire images until a new **Acquisition Start** command is executed.

8.2 Line Start Trigger

The **Trigger Selector** parameter is used to select a type of trigger and only the Line Start trigger is available on the VL-2K/4K series cameras. The Line Start trigger is used to begin line acquisition.

Line Start trigger signals can be generated within the camera or may be applied externally by setting the **Trigger Source** parameter to **Line0** or **CC1**. If a line start trigger signal is applied to the camera, the camera will begin to acquire images.

8.2.1 Trigger Mode

The main parameter associated with the line start trigger is the **Trigger Mode** parameter. The **Trigger Mode** parameter for the line start trigger has two available settings: **Off** and **On**.

Trigger Mode = Off

When the **Trigger Mode** parameter is set to **Off**, the camera will generate all required line start trigger signals internally, and you do not need to apply line start trigger signals to the camera. With the **Trigger Mode** set to **Off**, the camera will automatically generate a line start trigger signal whenever it receives an **Acquisition Start** command. The camera will automatically do this until executing an **Acquisition Stop** command.



Free-Run (English)

When you set the **Trigger Mode** parameter to **Off**, the camera will generate all required trigger signals internally. When the camera is set this way, it will constantly acquire images without any need for triggering by the user. This use case is commonly known as "Free-Run".

Free-Run (Français)

Lorsque vous réglez le paramètre **Trigger Mode** sur **Off**, la caméra génère tous les signaux de déclenchement requis en interne. Lorsque la caméra est réglée de cette façon, elle acquiert constamment des images sans aucun déclenchement de la part de l'utilisateur. Ce cas d'utilisation est communément appelé « Free-Run ».

The rate at which the line start trigger signals are generated may be determined by the camera's Acquisition Line Rate parameter.

- If the parameter is set to a value less than the maximum allowed line rate with the current camera settings, the camera will acquire images at the rate specified by the parameter setting.
- If the parameter is set to a value greater than the maximum allowed line rate with the current camera settings, the camera will acquire images at the maximum allowed line rate.

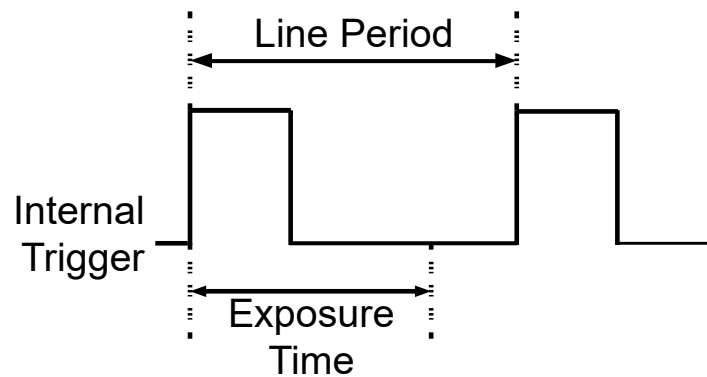


Figure 8-1 Trigger Mode = Off

Trigger Mode = On

When the **Trigger Mode** parameter is set to **On**, you must apply a line start trigger signal to the camera each time you want to begin an image acquisition. The **Trigger Source** parameter specifies the source signal that will act as the line start trigger signal.

The available settings for the **Trigger Source** parameter are:

- **Line0:** You can apply a line start trigger signal to the camera by injecting an externally generated electrical signal (commonly referred to as a hardware or external trigger signal) into the Control I/O Receptacle on the camera. Refer to 7.5 Trigger/Direction Input Circuit for more information.
- **CC1:** You can apply a line start trigger signal via Camera Link Frame Grabber. For more information, refer to your Camera Link Frame Grabber User Manual.

If the **Trigger Source** parameter is set, you must also set the **Trigger Activation** parameter.

The available settings for the **Trigger Activation** parameter are:

- **Rising Edge:** Specifies that a rising edge of the electrical signal will act as the line start trigger.
- **Falling Edge:** Specifies that a falling edge of the electrical signal will act as the line start trigger.
- **Any Edge:** Specifies that both rising and falling edges of the electrical signal will act as the line start trigger.

When the **Trigger Mode** parameter is set to **On**, the camera's line rate can be controlled by manipulating the external trigger signal. At this point, it is important that you do not attempt to trigger images at a rate that is greater than the maximum allowed.

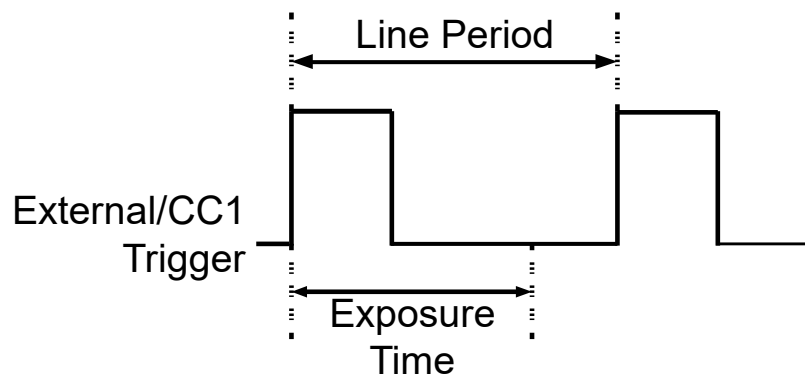


Figure 8-2 Trigger Mode = On

8.2.2 Using CC1 Trigger Signal

If the **Trigger Mode** parameter is set to **On** and the **Trigger Source** parameter is set to **CC1**, you must apply a CC1 trigger signal to the camera to begin each frame acquisition. A CC1 trigger signal will act as the exposure start trigger signal for the camera. For more information, refer to your Camera Link frame grabber user manual.

A rising edge or falling edge of the CC1 signal can be used to trigger frame acquisition. The **Trigger Activation** parameter is used to select rising edge or falling edge triggering. Assuming that the camera is in a waiting for exposure start trigger acquisition status, frame acquisition will start whenever the appropriate edge transition is received by the camera.

When the camera is operating under control of a CC1 signal, the period of the CC1 trigger signal will determine the rate at which the camera is acquiring lines:

$$\frac{1}{\text{CC1 signal period in seconds}} = \text{Line Rate}$$

For example, if you are operating a camera with a CC1 trigger signal period of 1 μs (0.001 s):
So in this case, the line rate is 1 kHz.



English

Apply 50% duty cycle to your external trigger when using AnyEdge in the TriggerActivation parameter. By doing this, you will be able to avoid malfunction originated from the different widths of the trigger because of the incorrect setting of the duty cycle. Additionally, it is recommended to use either RisingEdge or FallingEdge rather than AnyEdge in the TriggerRescaler parameter.

Français

Appliquez un cycle de service de 50 % à votre déclencheur externe lorsque vous utilisez AnyEdge dans le paramètre TriggerActivation. En faisant cela, vous pourrez éviter des dysfonctionnements provenant des différentes largeurs de la gâchette en raison d'un réglage incorrect du rapport cyclique. De plus, il est recommandé d'utiliser RisingEdge ou FallingEdge plutôt que AnyEdge dans le paramètre TriggerRescaler.

8.2.3 Using an External Trigger Signal

If the **Trigger Mode** parameter is set to **On** and the **Trigger Source** parameter is set to **Line0**, an externally generated electrical signal injected into the Control I/O Receptacle will act as the exposure start trigger signal for the camera. This type of trigger signal is generally referred to as a hardware trigger signal.

A rising edge or a falling edge of the external signal can be used to trigger frame acquisition. The **Trigger Activation** parameter is used to select rising edge or falling edge triggering.

Assuming that the camera is in a waiting for exposure start trigger acquisition status, frame acquisition will start whenever the appropriate edge transition is received by the camera.

When the camera is operating under control of an external signal, the period of the external trigger signal will determine the rate at which the camera is acquiring lines:

$$\frac{1}{\text{External signal period in seconds}} = \text{Line Rate}$$

For example, if you are operating a camera with an external trigger signal period of 1 μs (0.001 s):
So in this case, the line rate is 1 kHz.



English

Apply 50% duty cycle to your external trigger when using **AnyEdge** in the **TriggerActivation** parameter. By doing this, you will be able to avoid malfunction originated from the different widths of the trigger because of the incorrect setting of the duty cycle. Additionally, it is recommended to use either **RisingEdge** or **FallingEdge** rather than **AnyEdge** in the **TriggerRescaler** parameter.

Français

Appliquez un cycle de service de 50 % à votre déclencheur externe lorsque vous utilisez **AnyEdge** dans le paramètre **TriggerActivation**. En faisant cela, vous pourrez éviter des dysfonctionnements provenant des différentes largeurs de la gâchette en raison d'un réglage incorrect du rapport cyclique. De plus, il est recommandé d'utiliser **RisingEdge** ou **FallingEdge** plutôt que **AnyEdge** dans le paramètre **TriggerRescaler**.

8.2.4 Trigger Multiplier/Divider

With the **Trigger Multiplier** or **Trigger Divider**, you can modulate the period of the external trigger signal as desired. For example, if you supply the external trigger signal into the camera’s I/O receptacle using the conveyor’s encoder, the number of output pulses per revolution of the encoder is fixed. In this situation, you can modulate the period of the trigger signal received from the camera on the **Trigger Multiplier** or the **Trigger Divider** in the following manner, to match the pitch of the image in vertical direction.

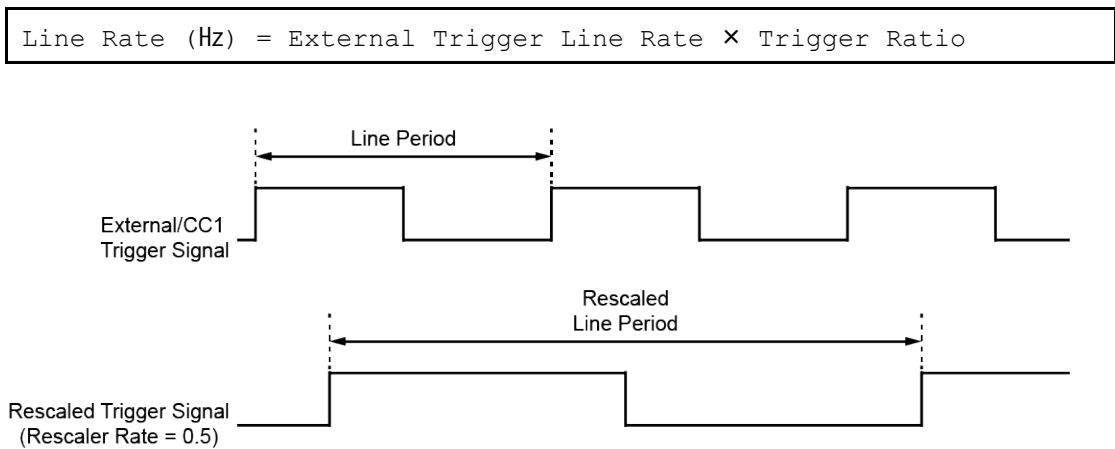


Figure 8-3 Trigger Ratio = 0.5

The XML parameters related to **Trigger Multiplier** or **Trigger Divider** are as follows.

XML Parameters	Value	Description
Acquisition Control		
Trigger Multiplier	1 - 1024	Sets the trigger rescaler rate for converting trigger signals.
Trigger Divider	1 - 1024	Sets the trigger rescaler rate for converting trigger signals.
Trigger Ratio	0.000977 - 1024	Sets the trigger rescaler rate for converting trigger signals.
TriggerRescalerFilter		Sets the rescaler filter factor to decrease the jitter of the external trigger signals.
	SIZE16	Sets the rescaler filter factor to 16.
	SIZE32	Sets the rescaler filter factor to 32.
	SIZE64	Sets the rescaler filter factor to 64.
	SIZE128	Sets the rescaler filter factor to 128.
	SIZE256	Sets the rescaler filter factor to 256.
	SIZE512	Sets the rescaler filter factor to 512.

Table 8-1 XML Parameters related to Trigger Multiplier/Divider Mode

8.2.5 Exposure Mode

If you are triggering the start of frame acquisition with an externally generated trigger signal, two exposure modes are available: **Timed** and **Trigger Width**.

Timed Exposure Mode

When the **Timed** mode is selected, the exposure time for each frame acquisition is determined by the value of the camera's **Exposure Time** parameter. If the camera is set for rising edge triggering, the exposure time starts when the external trigger signal rises. If the camera is set for falling edge triggering, the exposure time starts when the external trigger signal falls. The following figure illustrates **Timed** exposure with the camera set for rising edge triggering.

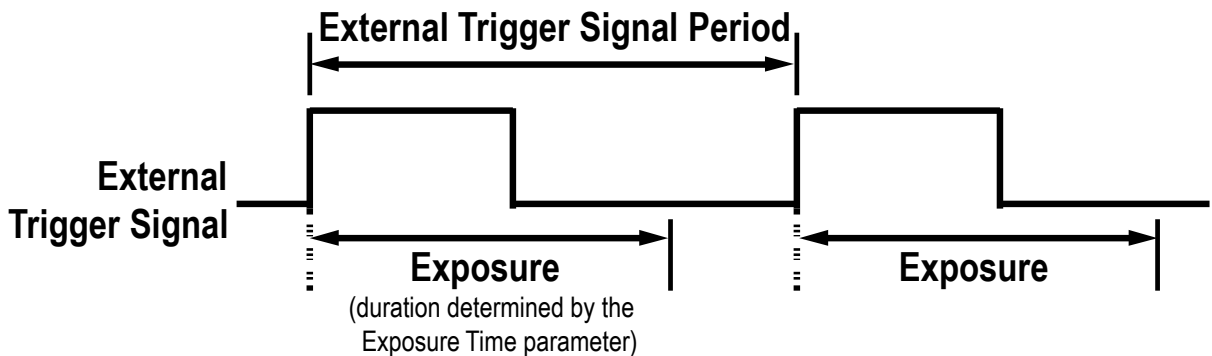


Figure 8-4 Timed Exposure Mode

Trigger Width Exposure Mode

When the **Trigger Width** exposure mode is selected, the length of the exposure for each frame acquisition will be directly controlled by the external trigger signal. If the camera is set for rising edge triggering, the exposure time begins when the external trigger signal rises and continues until the external trigger signal falls. If the camera is set for falling edge triggering, the exposure time begins when the external trigger signal falls and continuous until the external trigger signal rises. The following figure illustrates **Trigger Width** exposure with the camera set for rising edge triggering.

Trigger Width exposure is especially useful if you intend to vary the length of the exposure time for each frame.

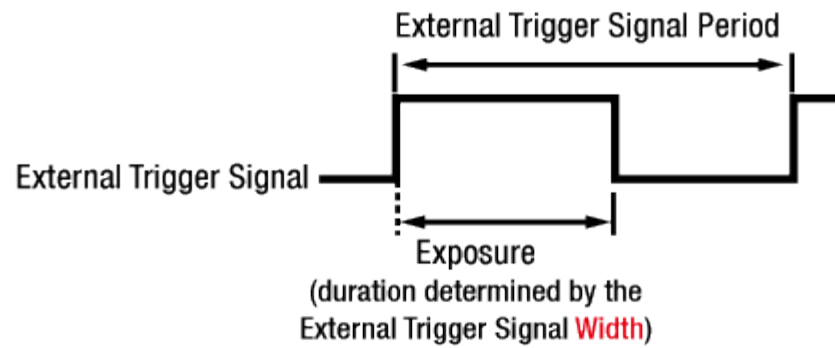


Figure 8-5 Trigger Width Exposure Mode

8.3 Maximum Allowed Line Rate

In general, the maximum allowed acquisition line rate on the camera may be limited by the following factor:

- Camera Link Tap Configuration (Tap Mode) Settings.
When the camera is set for a Tap Mode that uses more taps, it will take less time to transfer acquired images from the camera to the Camera Link frame grabber in your computer. For example, if the camera is set to 8 Tap (Camera Link Full Configuration), it can typically transfer data out of the camera two times faster than when the camera is set to 4 Tap (Camera Link Medium).
- The horizontal size of an image. The smaller you apply the width value of a camera, the more you can acquire lines per a second.
- The exposure time for acquired lines. If you use very long exposure time, you can acquire fewer lines per second.

On the Pixel Clock 85 MHz for each models of CL cameras supporting a M42 mount, the maximum allowed line rates of the VL-2K/4K series cameras are as follows(at 8 bit). However, for the VL-4K7C-M120I-1 or VL-4K7C-C60I-2 product, it is available to use 50 MHz only:

Tap Mode	VL-2K7C-M200I-2	VL-4K7C-M200I-2	VL-4K7C-M120I-1
2 Tap	82.3 kHz	41.3 kHz	41.3 kHz
3 Tap	123.0 kHz	61.8 kHz	61.8 kHz
4 Tap	163.4 kHz	82.3 kHz	82.3 kHz
6 Tap	N/A	N/A	N/A
8 Tap	200.0 kHz	163.4 kHz	122.8 kHz
10 Tap	200.0 kHz	200.0 kHz	122.8 kHz

Tap Mode	VL-2K7C-C100I-2			VL-4K7C-C100I-2			VL-4K7C-C60I-2		
	MONO 8	RGB 8	BiColor RGBG 8	MONO 8	RGB 8	BiColor RGBG 8	MONO 8	RGB 8	BiColor RGBG 8
2 Tap	82.3 kHz	27.5 kHz	41.3 kHz	41.3 kHz	13.8 kHz	20.7 kHz	24.3 kHz	8.1 kHz	12.1 kHz
3 Tap	123.0 kHz	41.3 kHz	61.8 kHz	61.8 kHz	20.7 kHz	31.0 kHz	36.4 kHz	12.1 kHz	18.2 kHz
4 Tap	163.4 kHz	55.0 kHz	82.3 kHz	82.3 kHz	27.5 kHz	41.3 kHz	48.4 kHz	16.2 kHz	24.3 kHz
6 Tap	200.0 kHz	82.3 kHz	100.5 kHz	123.0 kHz	41.3 kHz	61.8 kHz	72.3 kHz	24.3 kHz	36.4 kHz
8 Tap	200.0 kHz	100.5 kHz	100.5 kHz	163.4 kHz	55.0 kHz	82.3 kHz	96.1 kHz	32.3 kHz	48.4 kHz
10 Tap	200.0 kHz	100.5 kHz	100.5 kHz	200.0 kHz	68.7 kHz	100.5 kHz	119.7 kHz	40.4 kHz	60.4 kHz

†: When the camera is set for 4 / 6 Tap Mode (CL Medium), 8 Tap or 10 Tap Mode(CL Full), you must connect the camera to the Camera Link frame grabber using two Camera Link cables.

Table 8-2 Maximum Allowed Line Rates of the cameras supporting a 42 mount

8.4 Setting the Exposure Time

This section describes how the exposure time can be adjusted manually by setting the value of the Exposure Time parameter. If you are operating the camera in any one of the following ways, you must specify an exposure time by setting the camera's **Exposure Time** parameter.

- the Trigger Mode is set to Off.
- the Trigger Mode is set to On, the Trigger Source is set to CC1 or Line0, and the Exposure Mode is set to Timed.

The **Exposure Offset** value which is necessary for exposure function is $2.46 \mu\text{s}$, and the VL-2K/4K series cameras add this value automatically to the exposure time determined by the **Exposure Time** parameter. The **Exposure Time** parameter sets the exposure time in microseconds (μs). The minimum and maximum exposure time settings for the cameras are shown in the following table.

Camera Model	Minimum Exposure Time	Maximum Exposure Time [†]
VL-2K/4K	$1 \mu\text{s}$	$1,000 \mu\text{s}$

[†]: When the **Exposure Mode** is set to **Trigger Width**, the exposure time is controlled by the external trigger signal and has no maximum limit.

Table 8-3 Minimum and Maximum Exposure Time Setting

Chapter 9. Camera Features

9.1 Device Scan Type (Monochrome Only)

The VL-2K/4K series cameras have two different operation modes: **Areascan** and **Linescan**.

If the **DeviceControl** parameter is set to **Areascan**, the camera will operate as an area scan camera using two array of pixels. This mode is useful for aligning the camera to your target object. If the **DeviceControl** parameter is set to **Linescan**, the camera will operate as a line scan camera.

The commands related to the **DeviceControl** are as follows.

XML Parameters		Value	Description
DeviceControl	DeviceScanType	Areascan	Operates the camera in the Areascan Mode. (Not supported for VL-4K7C-M120I-1)
		Linescan	Operates the camera in the Linescan mode.

Table 9-1 XML Parameters related to Device Scan Type

On the **Areascan** mode, the XML parameters related to a height size of an images are as follows.

XML Parameters		Value	Description
ImageFormatControl	Height	2 – 16384	Sets the Height value in the Areascan mode.

Table 9-2 XML Parameters related to Device Scan Type

9.2 TDI Stages(Monochrome Only)

In the **Linescan** mode, the **TDI Stages** parameter is used to determine the number of integration stages used by the camera. For example, if the TDI Stages parameter is set to 2, the camera will acquire images with 2× higher sensitivity.

The XML parameter related to TDI Stages is as follows.

XML Parameters	Value	Description
ImageFormatControl TDI Stages	1	Sets the number of TDI Stages to 1.
	2	Sets the number of TDI Stages to 2.

Table 9-3 XML Parameters related to TDI Stages

The number of available TDI Stages for each camera model is as follows.

Camera Model	The number of available TDI Stages
VL-2K/4K7C-M200I-2	1 / 2
VL-2K/4K7C-C100I-2, VL-4K7C-M120I-1, VL-4K7C-C60I-2	1

Table 9-4 The number of available TDI Stages for each camera model

9.3 Output Formats from Color Cameras

The sensors for color cameras of the VL-2K/4K series has the Bilinear pixel structure as follows.

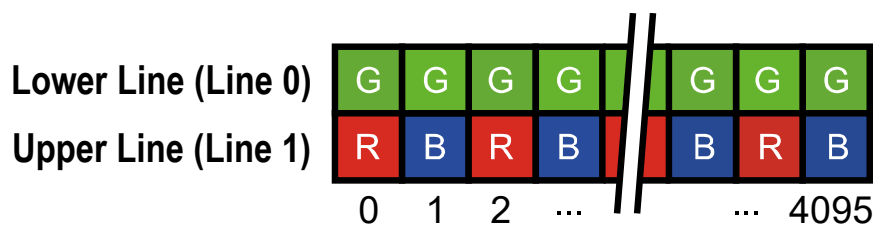


Figure 9-1 Structure of the Bilinear Pixel (Color Sensor)

The Camera Link data, which is output finally by a camera, will be converted into the format such as Mono, RGB, BGR, RGBG, depending on the Pixel Format set by user's choice. The camera will output the value corresponding to the Green pixel if setting Mono as Pixel Format. In the case of RGB or BGR, it will output the value by interpolating near pixels. And it will be able to output the data in the faster speed by doing it as the format of the Bilinear pixel without interpolation when setting BiColor.

About maximum allowed Line Rates, refer to 8.3 Maximum Allowed Line Rate.

9.4 Scan Direction

In the Linescan mode, the **Scan Direction** parameter is used to select the image sensor’s scan direction. You need to set the **Scan Direction** parameter to **Forward** if the object being imaged will pass the top of the camera, and then pass the bottom of the camera. On the contrary, you need to set the **Scan Direction** parameter to **Backward** if the object being imaged will pass the bottom of the camera, and then pass the top of the camera.

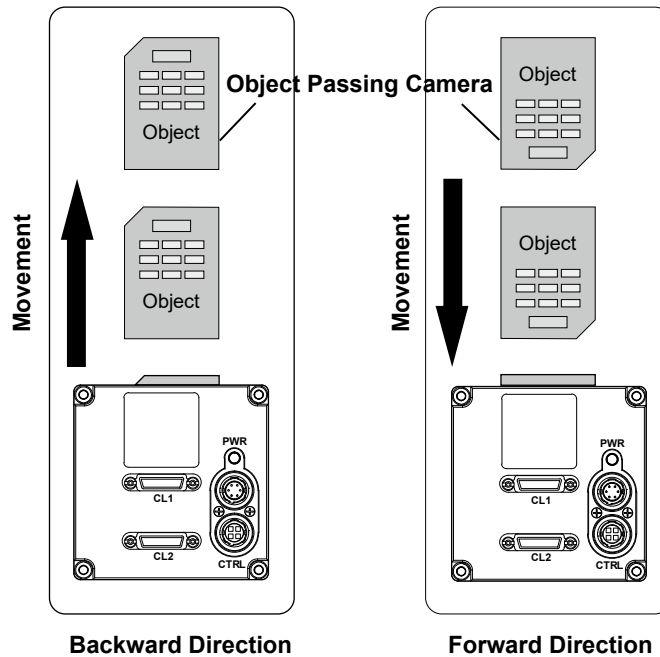


Figure 9-2 Scan Direction

XML Parameters	Value	Description
ImageFormatControl Scan Direction	Forward	Scans images in the forward direction.
	Backward	Scans images in the backward direction.

Table 9-5 XML Parameters related to Scan Direction

When you set the **Scan Direction** parameter to **Backward** in the **Area** mode, you can acquire vertically flipped images.

9.5 Region of Interest

The Region of Interest (ROI) feature allows you to specify a portion of the sensor lines. During operation, only the pixel information from the specified portion of the lines are read out of the sensor and transmitted from the camera to the frame grabber.

The ROI is referenced to the left end of the sensor array. The location and size of the ROI is defined by declaring the **Offset X** and **Width** settings. For example, suppose that you set the Offset X parameter to 24 and the Width parameter to 160 as shown in the figure below. With these settings, the camera will read out and transmit pixel values for pixels 24 through 184.

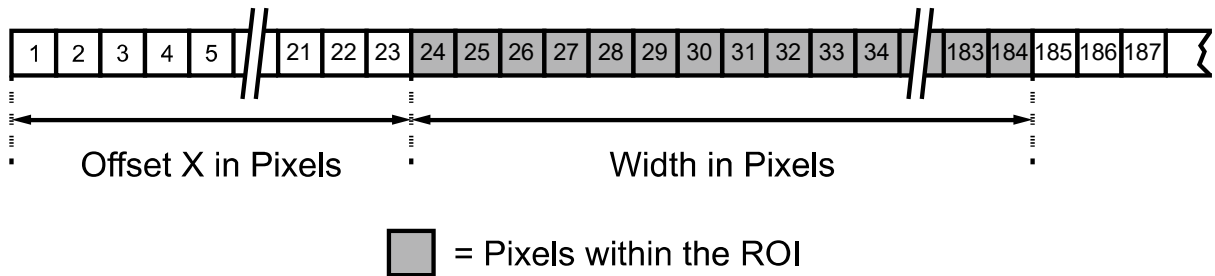


Figure 9-3 Region of Interest

The XML parameters related to ROI on the Linescan mode are as follows.

XML Parameters		Value†	Description
ImageFormatControl	Width	-	Sets the Width of the Image ROI.
	OffsetX	-	Sets the horizontal offset from the origin to the Image ROI.
	OffsetY	0	Sets the vertical offset from the origin to the Image ROI.

†: The unit for all parameters in this table is pixel.

Table 9-6 XML Parameters related to ROI

You can change the size of ROI by setting the **Width** parameters in the **Image Format Control** category. You can also change the position of the ROI origin by setting the **Offset X** parameter. Make sure that the **Width + Offset X** value is less than the **Width Max** value. You must set the size of the ROI first, and then set the Offset values since the **Width** parameter is set to its maximum value by default.

- The Width parameter must be set to a multiple of 8.
- The minimum allowed setting values for the ROI Width is 24.



Caution! (English)

When you change the Image ROI settings after executing the Acquisition Start command, the camera may acquire abnormal images. Change the Image ROI settings after executing the Acquisition Stop command.

Prudence! (Français)

Lorsque vous modifiez les paramètres Image ROI après avoir exécuté la commande Acquisition Start, la caméra peut acquérir des images anormales. Modifiez les paramètres Image ROI après avoir exécuté la commande Acquisition Stop.

9.6 Binning

The Binning has the effects of increasing the level value and decreasing resolution by summing the values of the adjacent pixels and sending them as one pixel. The XML parameters related to Binning are as follows.

XML Parameters	Value	Description
Image Format Control	BinningSelector	Sensor Selects the Sensor for the binning engine. Applies the Binning in analog by the image sensor. (Not supported for VL-4K7C-M120I-1, VL-4K7C-C60I-2)
		Logic Selects the Logic for the binning engine. Applies the Binning in digital by the logic.
BinningHorizontal Mode	Sum	Adds pixel values from the adjacent pixels as specified in the Binning Horizontal, and then sends them as one pixel.
	Average	Adds pixel values from the adjacent pixels as specified in the Binning Horizontal, and calculates average of those, and then sends them as one pixel.
BinningHorizontal	×1, ×2	The number of horizontal pixels to combine together.
BinningVertical Mode	Sum	Adds pixel values from the adjacent pixels as specified in the Binning Vertical, and then sends them as one pixel.
	Average	Adds pixel values from the adjacent pixels as specified in the Binning Vertical, and calculates average of those, and then sends them as one pixel.
BinningVertical	×1, ×2	The number of vertical pixels to combine together.

Table 9-7 XML Parameters related to Binning

For example, if you set 2×2 binning, the responsivity of the camera is quadrupled, the resolution of the width is reduced to $1/2$, and the MTF of the height's resolution decreases, because 2×2 pixel is recognized as one single pixel in the case of the dual integration mode. The **Width** and **Offset X** parameter, indicating the maximum allowed resolution of the image with the current camera settings, will be updated depending on the binning settings, and you can verify the current resolution through the **Width** parameter.

9.6.1 Sensor Binning(Monochrome Only)

You can acquire images of approximately quadruple sensitivity with simultaneous use of Horizontal Binning and Vertical Binning in the case of setting the Sensor Binning mode. The 2 x 2 binning function is supported when using the dual integration mode of monochrome cameras.

XML Parameters	Value	Description	
ImageFormat Control	BinningSelector	Sensor	Selects the Sensor for the binning engine. Applies the Binning in analog by the image sensor.
	BinningHorizontal Mode	Sum	Adds pixel values from the adjacent pixels as specified in the Binning Horizontal, and then sends them as one pixel.
		Average	N/A
	BinningHorizontal	×1, ×2	The number of horizontal pixels to combine together.
	BinningVertical Mode	Sum	Adds pixel values from the adjacent pixels as specified in the Binning Vertical, and then sends them as one pixel.
		Average	N/A
BinningVertical	×1, ×2	The number of vertical pixels to combine together.	

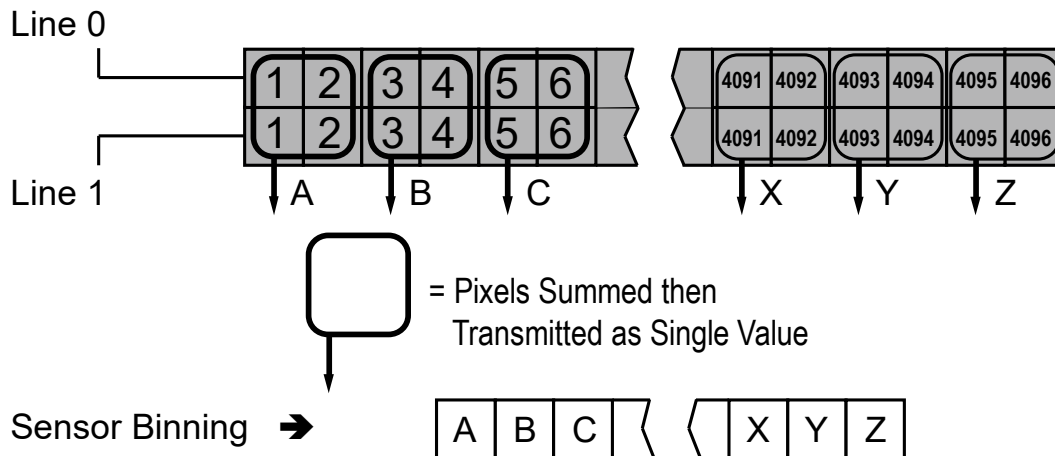


Figure 9-4 Sensor Binning

9.6.2 Logic Binning

In the case of using the monochrome cameras or the color cameras in the monochrome mode, it exposures only Line 1 whenever the trigger to acquire the line image is supported, if setting the Logic Binning mode. The values of near pixels will be added on the sensor's line after the exposure is complete, as the follow figure explains. After that, it calculates the average value by dividing the accumulated value into 2, and then, it will transfer such average value as if it is a value of one single pixel. The resolution of the sensor will be half on the Horizontal Binning mode, effective resolution will be 2048 pixels if the product is VL-4K7C-M200I-2.

In the case of using the color cameras in the color mode, you can acquire images of approximately double sensitivity with the use of sum in the Logic Binning mode. And the SNR(Signal to Noise Ratio) is improved 1.4 times approximately if using avg in the Logic Binning mode.

XML Parameters	Value	Description	
BinningSelector	Logic	Selects the Logic for the binning engine. Applies the Binning in digital by the logic.	
Image Format Control	BinningHorizontal Mode	Sum	Adds pixel values from the adjacent pixels as specified in the Binning Horizontal, and then sends them as one pixel.
		Average	Adds pixel values from the adjacent pixels as specified in the Binning Horizontal, and calculates average of those, and then sends them as one pixel.
BinningHorizontal	×1, ×2	The number of horizontal pixels to combine together.	
BinningVertical Mode	Sum	N/A	
	Average	N/A	
BinningVertical	×1, ×2	N/A	

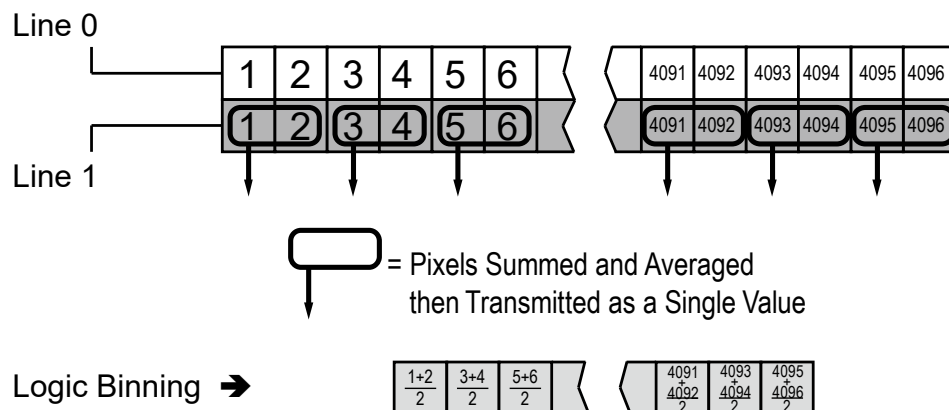


Figure 9-5 Logic Binning(Average) in the monochrome mode

9.7 Pixel Format

You can determine the pixel format (8 bits, 10 bits or 12 bits) of image data transmitted from the camera by using the **Pixel Format** parameter.

The XML parameter related to Pixel Format is as follows.

XML Parameter		Description
ImageFormatControl	PixelFormat	Sets the pixel format supported by the device.

Table 9-8 XML Parameter related to Pixel Format

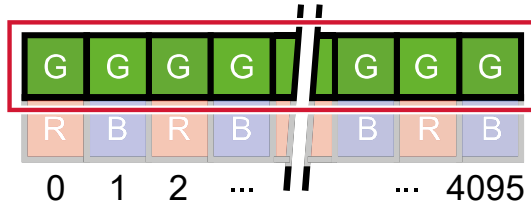
The available pixel formats on the monochrome and color cameras are as follows.

VL-2K/4K7C-M200I-2	VL-4K7C-M120I-1	VL-2K/4K7C-C100I-2	VL-4K7C-C60I-2
Mono 8/10/12	Mono 8/10	Mono 8/10/12	Mono 8/10
		RGB 8/10/12	RGB 8/10
		BGR 8/10/12	BGR 8/10
		BiColor RGBG 8/10/12	BiColor RGBG 8/10

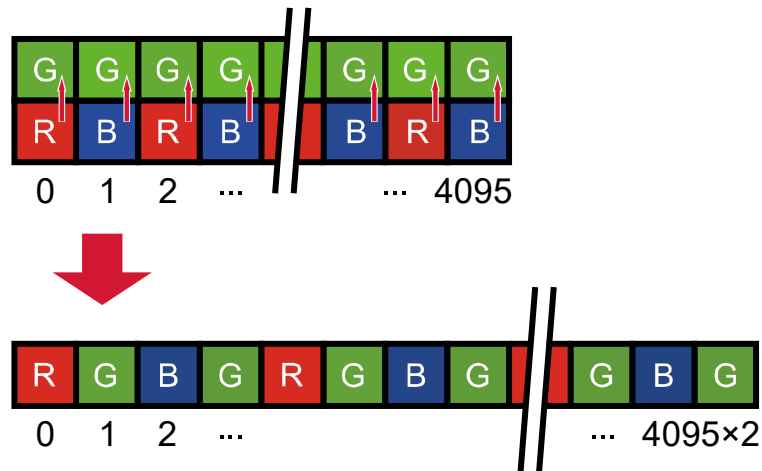
Table 9-9 Pixel Format Values

The way to output a pixel on each mode of a camera in the VL-2K/4K series are described as follows.

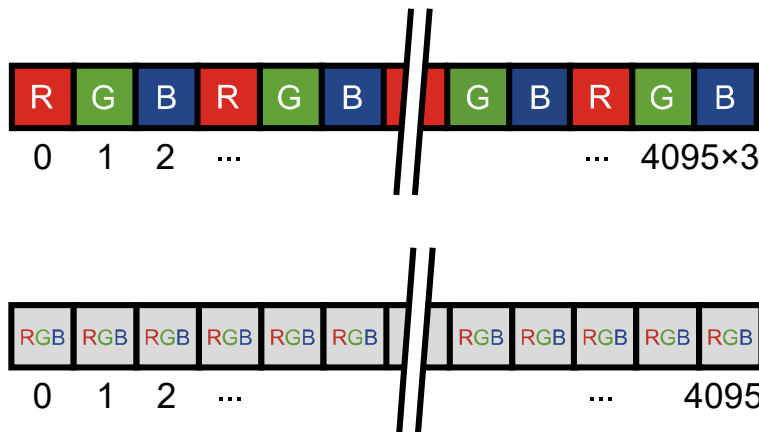
- Case Mono 8/10/12: Outputs green pixels on the Line0.



- Case BiRGB: Outputs pixels in sequence of RGBGRGBG... as the figure below describes. Its width increases 2 times, maximum allowed line rate decreases by half of those of the Mono mode.



- Case RGB/BGR: Outputs pixels in sequence of RGB/BGR via Bayer Interpolation inside of a camera. The width increases 3 times, maximum allowed line rate decreases by one third of the Mono mode. When outputting the true-color on the camera of 3/6 Tap, the data size increases 3 times than the case of the Mono mode, the Width is the same as the Mono case, and the maximum allowed line rate decreases by one third of the Mono mode.



Except for the 3/6 Tap

The 3/6 Tap

9.8 Device Tap Geometry

The VL-2K7C-M200I-2, VL-4K7C-M200I-2 and VL-4K7C-M120I-1 cameras support 2 Tap, 3 Tap, 4 Tap, 8 Tap and 10 Tap Device Tap Geometry, the VL-2K7C-C100I-2, VL-4K7C-C100I-2 and VL-4K7C-C60I-2 cameras support 2 Tap, 3 Tap, 4 Tap, 6 Tap, 8 Tap and 10 Tap Device Tap Geometry. The number of taps represents the number of pixel data that will be output on each cycle of the Camera Link Pixel Clock. The maximum allowed line rate will be changed according to the Device Tap Geometry settings.

The image data is transmitted in the interleaved order as shown in the figure below.

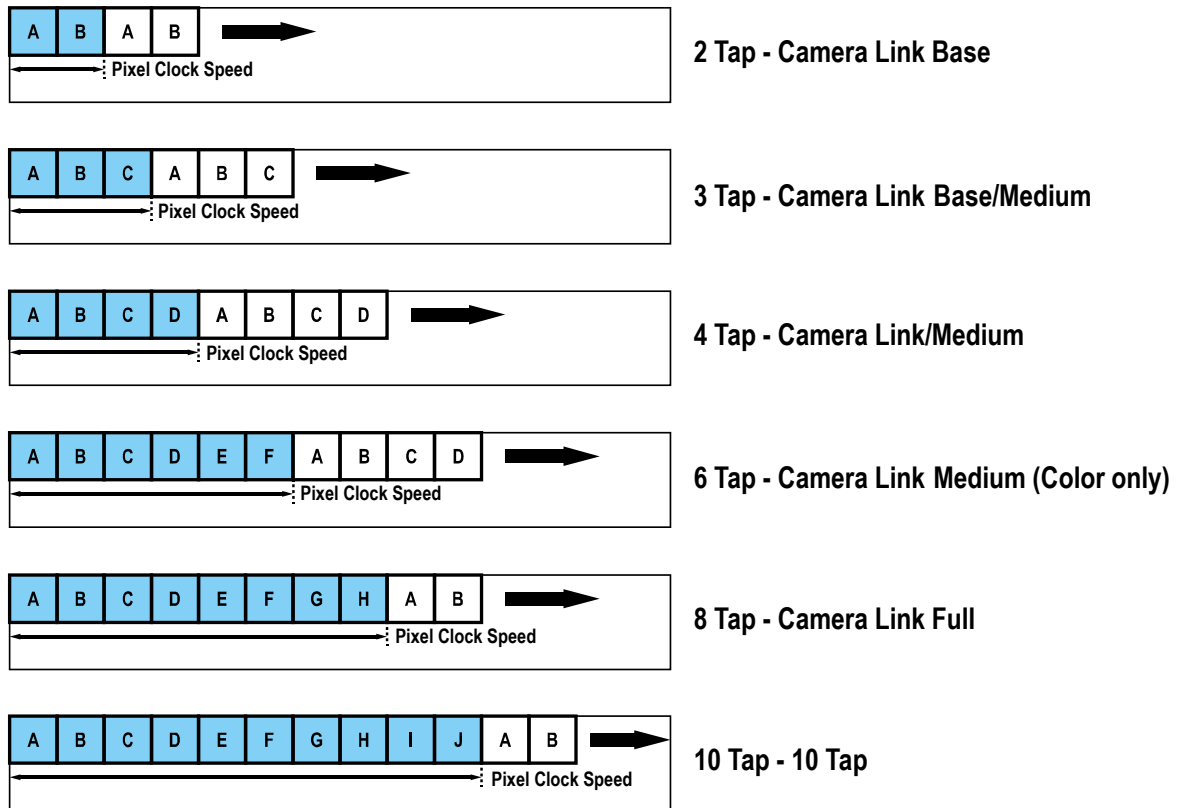


Figure 9-6 Device Tap Geometry

The XML parameter related to Device Tap Geometry is as follows.

XML Parameter		Value	Description
Transport Layer Control	DeviceTap Geometry	Geometry_1X2_1Y	Sets the Device Tap Geometry to 2 Tap.
		Geometry_1X3_1Y	Sets the Device Tap Geometry to 3 Tap.
		Geometry_1X4_1Y	Sets the Device Tap Geometry to 4 Tap.
		Geometry_1X6_1Y (Color Model Only)	Sets the Device Tap Geometry to 6 Tap.
		Geometry_1X8_1Y	Sets the Device Tap Geometry to 8 Tap.
		Geometry_1X10_1Y	Sets the Device Tap Geometry to 10 Tap.

Table 9-10 XML Parameter related to Device Tap Geometry



English

To output a true-color image of the RGB or BGR format on the Viewer, Tap of the camera and the frame grabber need to be set in accordance with the Camera Link standard as follows:

- To set 3 Tap for the camera, set the Grabber 1 Tap.
- To set 6 Tap for the camera, set the Grabber 2 Tap.

Français

Pour produire une image en vraies couleurs au format RVB ou BGR sur la visionneuse, le toucher de la caméra et la capture d'écran doivent être définis conformément à la norme Camera Link comme suit:

- Pour définir 3 Tap pour la caméra, réglez le Grabber 1 Tap.
- Pour définir 6 Tap pour la caméra, réglez le Grabber 2 Tap.



Caution! (English)

The Device Tap Geometry is unable to be changed after executing the Acquisition Start command. Therefore, it is recommended to execute the Acquisition Stop command before changing the Device Tap Geometry parameter.

Prudence! (Français)

La Device Tap Geometry ne peut pas être modifiée après l'exécution de la commande Acquisition Start. Par conséquent, il est recommandé d'exécuter la commande Acquisition Stop avant de modifier le paramètre Device Tap Geometry.

9.9 Camera Link Clock

The VL-2K/4K series cameras provide selectable Camera Link Pixel Clock speeds. The Pixel Clock speed determines that the rate at which pixel data will be transmitted from the camera to the frame grabber in your computer via the Camera Link interface. Setting the camera for a higher Pixel Clock speed will increase the rate at which image data is transferred from the camera to the frame grabber. Before setting the camera's Pixel Clock speed, make sure you determine the maximum Pixel Clock speed supported by your frame grabber. Then, you should not attempt to set the camera's Pixel Clock speed that exceeds the maximum Pixel Clock speed for your frame grabber.

The XML parameters related to Camera Link Clock speed are as follows.

XML Parameters		Value	Description
CameraLink	CameraLinkClock	Clock0	Sets the Camera Link Clock speed to 85 MHz.
		Clock1	Sets the Camera Link Clock speed to 65 MHz.
		Clock2	Sets the Camera Link Clock speed to 45 MHz.
	CameraLinkClockFrequency	-	Displays the current Camera Link Clock speed in MHz.

Table 9-11 XML Parameters related to Camera Link Clock Speed

9.10 Data ROI (Color Camera)

The White Balance Auto feature provided by the color camera uses the pixel data from a Data Region of Interest (ROI) to adjust the related parameters.

The XML parameters related to Data ROI are as follows.

XML Parameters	Value	Description
DataRoiControl	RoiSelector	WhiteBalanceAuto
		Selects a Data ROI used for White Balance Auto. Only available on color cameras
	RoiOffsetX	-
		X coordinate of start point ROI
	RoiWidth	-
		Width of ROI
	RoiHeight	-
		Height of ROI

Table 9-12 XML Parameters related to Data ROI

Only the pixel data from the area of overlap between the Data ROI by your settings and the Image ROI will be effective if you use the Image ROI and Data ROI at the same time. You can specify the numbers of lines to generate correction data by inputting the value in the Height parameter. A camera acquires images in the internal buffer as many as the specified number of lines and uses them for image correction.

The effective ROI is determined as shown in the figure below.

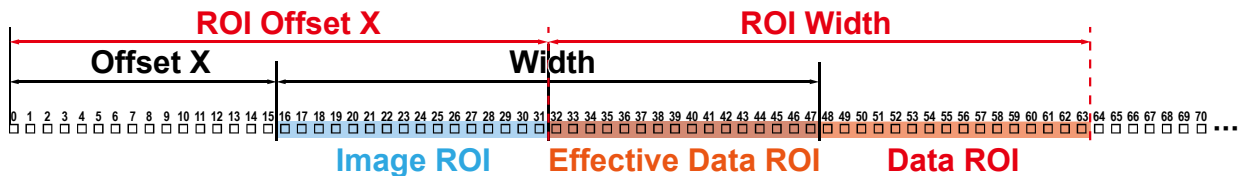


Figure 9-7 Effective Data ROI

9.11 White Balance (Color Camera)

The color camera includes the white balance capability to adjust the color balance of the images acquired from the image sensor. With the white balancing scheme used on the VL-2K7C-C100I-2 and VL-4K7C-C100I-2 cameras, the Red, Green and Blue intensities can be adjusted individually. You can set the intensity of each color by using the **Balance Ratio** parameter. The **Balance Ratio** value can range from 1.0 to 4.0. If the **Balance Ratio** parameter is set to 1.0 for a color, the intensity of the color will be unaffected by the white balance mechanism. If the **Balance Ratio** parameter is set to greater than 1.0, the intensity of the color will be proportionally increased to the ratio. For example, if the Balance Ratio is set to 1.5, the intensity of that color will be increased by 50%.

The XML parameters related to White Balance are as follows.

XML Parameters		Value	Description
Analog Control	BalanceRatio Selector	Red	A Balance Ratio value will be applied to red pixels.
		Green	A Balance Ratio value will be applied to green pixels.
		Blue	A Balance Ratio value will be applied to blue pixels.
	BalanceRatio	1.0× - 4.0×	Adjusts the ratio of the selected color.

Table 9-13 XML Parameters related to White Balance

9.11.1 Balance White Auto

The Balance White Auto feature is implemented on the color camera. It will control the white balance of the image acquired from the color camera according to the GreyWorld algorithm. Before using the Balance White Auto feature, you need to set the Data ROI. If you do not set the Data ROI, the pixel data from the Image ROI will be used to control the white balance. As soon as the **Balance White Auto** parameter is set to **Once**, the Balance Ratio values for Red and Blue will be automatically adjusted to adjust the white balance by referring to Green.

The XML parameter related to Balance White Auto is as follows.

XML Parameter		Value	Description
AnalogControl	BalanceWhiteAuto	Off	Balance White Auto Off
		Once	White Balance is adjusted once and then Off.

Table 9-14 XML Parameter related to Balance White Auto

9.12 Gain and Black Level

Increasing the **Gain** parameter increases all pixel values of the image. This results in a higher grey value output from the camera for a given amount of output from the image sensor.

1. Selects the Gain Control (**Analog All** or **Digital All** are available) to be adjusted by using the **Gain Selector** parameter.
2. Sets the **Gain** parameter to the desired value.

Adjusting the **Black Level** parameter will result in an offset to the pixel values output from the camera.

1. Selects the Black Level Control (**Digital All** is only available) to be adjusted by using the **Black Level Selector** parameter.
2. Sets the **Black Level** parameter to the desired value. The available setting range varies depending on the **Pixel Format** settings.

The XML parameters related to Gain and Black Level are as follows.

XML Parameters	Value	Description
Analog Control	Analog All	Applies the Gain value to all analog channels.
	Digital All	Applies the Gain value to all digital channels.
Gain	1.25x - 4x	Sets an analog gain value. (1.25x, 1.75x, 2x, 3x, 4x)
	1.0x - 32.0x	Sets a digital gain value.
BlackLevelSelector	Digital All	Applies the Black Level value to all digital channels.
BlackLevel	from -4096 to 4095	Sets a black level value. (The setting range is based on the 12-bit pixel format.)
	from -265 to 255	Sets a black level value. (The setting range is based on the 10-bit pixel format, for VL-4K7C-M120I-1 and VL-4K7C-C60I-2)

Table 9-15 XML Parameters related to Gain and Black Level

9.13 Optical Black Clamp

The Optical Black Clamp function allows to correct changes of pixel values due to changes of sensor temperature. With this function, the VL-2K/4K series camera minimizes changes of pixel's level by temperature through removing offsets from temperature differences in real time.

The XML parameters related to Optical Black Clamp are as follows.

XML Parameters		Value	Description
AnalogControl	OpticalBlack	Off	Deactivates the Optical Black Clamp function.
	Clamp	On	Activates the Optical Black Clamp function.

Table 9-16 XML Parameters related to Optical Black Clamp

9.14 Dark Signal Non-uniformity Correction

In theory, when a digital camera acquires images in complete darkness, all of the pixel values in the image should be near zero and they should be equal. In practice, however, slight variations in the performance of the pixels in the sensor will cause some variations in the pixel values output from the camera when the camera is acquiring in darkness. This variation is known as Dark Signal Non-uniformity (DSNU). The VL-2K/4K series cameras provide the DSNU Correction feature.

The XML parameters related to DSNU are as follows.

XML Parameters		Value	Description
DSNU	DSNUGenerate	-	Generates the DSNU data.
	DSNUSave	-	Saves the generated DSNU data in the non-volatile memory. The generated data by executing the DSNUGenerate parameter are saved in the volatile memory so that the data are lost if the camera is reset or if power is turned off. To use the data after the camera is powered on or reset, save them in the non-volatile memory.
	DSNULoad	-	Loads the DSNU data from the non-volatile memory into the volatile memory.

Table 9-17 XML Parameters related to DSNU

9.14.1 Generating and Saving User DSNU Correction Values

To generate and save user DSNU correction values, use the following procedure.



English

For optimum DSNU correction results, we recommend that you generate DSNU data after the temperature of the camera housing has been stabilized.

Français

Pour des résultats de correction DSNU optimaux, nous vous recommandons de générer des données DSNU une fois que la température du boîtier de la caméra a été stabilisée.

1. The camera will use the entire sensor when generating DSNU correction values. The DSNU correction value refers to the current setting values of the **OffsetX** and the **Width** range, therefore, we recommend to check setting of these values in advance.
2. Ensure that the camera will be acquiring line images in complete darkness by covering the camera lens, closing the iris in the lens, or darkening the room.
3. Begin acquiring line images either by setting the camera for the Free-Run mode or by supplying external trigger signals to trigger line acquisitions.
4. Generate DSNU correction values.
5. If you execute the **DSNU Generate** command,
 - a. The camera generates DSNU data according to the current Analog Gain setting value. The camera must acquire at least 1024 line images to create a set of DSNU correction values.
 - b. After completing 1024 line acquisitions, the generated DSNU correction values will be activated and saved in the camera's volatile memory.
 - c. To save the generated DSNU correction values in the camera's flash(non-volatile) memory, execute the **DSNU Save** command. The previous DSNU values for the current **Analog Gain** setting value saved in the memory will be overwritten.
6. If you change the **Analog Gain** setting value or want to load the existing values in the flash memory, execute the **DSNU Load** command.

9.15 Photo Response Non-uniformity Correction

In theory, when a line scan camera acquires images with the camera viewing a uniform light-colored target in bright light, all of the pixel values in the image should be near the maximum grey value and they should be equal. In practice, however, slight variations in the performance of the pixels in the sensor, variations in the optics, and variations in the lighting will cause some variations in the pixel values output from the camera. This variation is known as Photo Response Non-uniformity (PRNU). The VL-2K/4K series cameras provide the PRNU Correction feature and eight storage locations for PRNU correction values.

The XML parameters related to PRNU are as follows.

XML Parameters	Value	Description
PRNU PRNUMode	Off	Disables the PRNU Correction feature.
	On	Enables the PRNU Correction feature.
PRNU Selector	0 - 7	Selects a location to save PRNU data to or load PRNU data from.
TargetLevelAUTO	-	Select to set the PRNU Target Level automatically.
PRNUTargetLevel	0 - 255	Sets the PRNU Target Level (@ 8 bit pixel format).
PRNU Generate	-	Generates the PRNU data.
PRNUSave	-	Saves the generated PRNU data in the non-volatile memory. The generated data by executing the PRNUGenerate parameter are saved in the volatile memory so that the data are lost if the camera is reset or if power is turned off. To use the data after the camera is powered on or reset, save them in the non-volatile memory.
PRNULoad	-	Loads the PRNU data from the non-volatile memory into the volatile memory.

Table 9-18 XML Parameters related to PRNU

9.15.1 Generating and Saving User PRNU Correction Values

To generate and save user PRNU correction values, use the following procedure.



English

- We strongly recommend that you generate new PRNU correction values whenever you make a change to the optics or lighting or if you change the camera's line rate.
- For optimum PRNU correction results, we recommend that you generate DSNU correction values first before generating PRNU correction values.

Français

- Nous vous recommandons fortement de générer de nouvelles valeurs de correction PRNU chaque fois que vous modifiez l'optique ou l'éclairage ou si vous modifiez le débit linéaire de la caméra.
- Pour des résultats de correction PRNU optimaux, nous vous recommandons de générer d'abord les valeurs de correction DSNU avant de générer les valeurs de correction PRNU.

1. The camera will use the entire sensor when generating PRNU correction values. The PRNU correction value refers to the current setting values of the **OffsetX** and the **Width** range, therefore, we recommend to check setting of these values in advance.
2. Place a uniform white target in the field of view of the camera. Adjust the optics, lighting and line rate as you would for normal operation. We recommend that you make adjustments to achieve the digital output level in a range from 100 to 200 (Gain: 1.00 at 8 bit).
3. Begin acquiring line images either by setting the camera for the Free-Run mode or by supplying external trigger signals to trigger line acquisition.
4. Set the Target Level.
To set the Target Level automatically, select the **Target Level AUTO** check box.
To set the Target Level manually, deselect the **Target Level AUTO** check box and input the target level in a range from 0 to 255.
5. Execute the **PRNU Generate** command to generate PRNU correction values.
6. The camera must acquire at least 1024 line images to create a set of PRNU correction values.
7. After completing 1024 line acquisitions, the generated PRNU correction values will be activated and saved in the camera's volatile memory.
8. To save the generated PRNU correction values in the camera's Flash (non-volatile) memory, specify a location to save by using the **PRNU Selector** parameter and execute the **PRNU Save** command. The existing values in the memory will be overwritten.

To ignore the generated PRNU correction values and load the existing values in the Flash memory, specify a location to load from by using the **PRNU Selector** parameter and execute the **PRNU Load** command.

9.16 FPN Coefficients Control

The FPN Coefficients Control feature provides function to correct Fixed Pattern Noise for acquired images. The VL-2K/4K series camera provides the feature to correct images after acquiring those, by adding Black Level to the value of the DSNU correction, or by multiplying Gain by the value of the PRNU correction.

The XML parameters related to FPN Coefficients Control are as follows.

XML Parameters		Value	Description
FPN Coefficients Control	DSNUCoefficient	-	Sets a value of Black Level to add to current value of the DSNU correction.
	DSNUCoefficientApply		Sets a value of Black Level to add to current value of the DSNU correction.
	PRNUCoefficient	-	Sets a Gain value to multiply by current value of the PRNU correction.
	PRNUCoefficientApply	-	Applies the value above to the value of the PRNU correction.

Table 9-19 XML Parameters related to FPN Coefficients Control

9.17 Digital I/O Control

The Control I/O receptacle of the camera can be operated in various modes.

The XML parameters related to Digital I/O Control are as follows.

XML Parameters	Value	Description	
DigitalIOControl	LineSelector	Line0	Selects the number 1 pin of the camera's Control I/O receptacle as an input line.
		Line1	Selects the number 4 pin of the camera's Control I/O receptacle as an output line.
		Output	Sets the Line Mode of the selected physical line (4) to Output.
LineInverter	FALSE	Disables inversion on the output signal of the line.	
	TRUE	Enables inversion on the output signal of the line.	
LineSource	Off	Disables the line output.	
	High	High output.	
	FrameActive	Outputs pulse signals indicating a frame readout time.	
	LineActive	Outputs pulse signals indicating the current line time.	
	ExposureActive	Outputs pulse signals indicating the current exposure time.	
	UserOutput0	Outputs pulse signals set by User Output Value.	
	Timer0Active	Outputs user-defined Timer signals as pulse signals.	
UserOutput Value	FALSE	Sets the bit state of the line to Low.	
	TRUE	Sets the bit state of the line to High.	

Table 9-20 XML Parameters related to Digital I/O Control

Outputs pulse signals indicating the current exposure time.

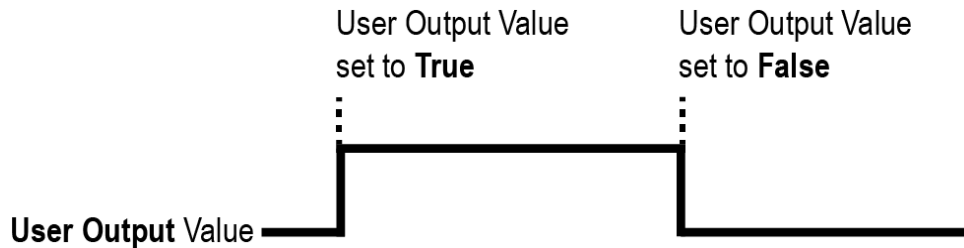


Figure 9-8 User Output

The camera can provide an Exposure Active output signal. The signal goes high when the exposure time for each frame acquisition begins and goes low when the exposure time ends as shown in the figure below. This signal can be used as a flash trigger and is also useful when you are operating a system where either the camera or the object being imaged is movable. Typically, you do not want the camera to move during exposure. You can monitor the Exposure Active signal to know when exposure is taking place and thus know when to avoid moving the camera.

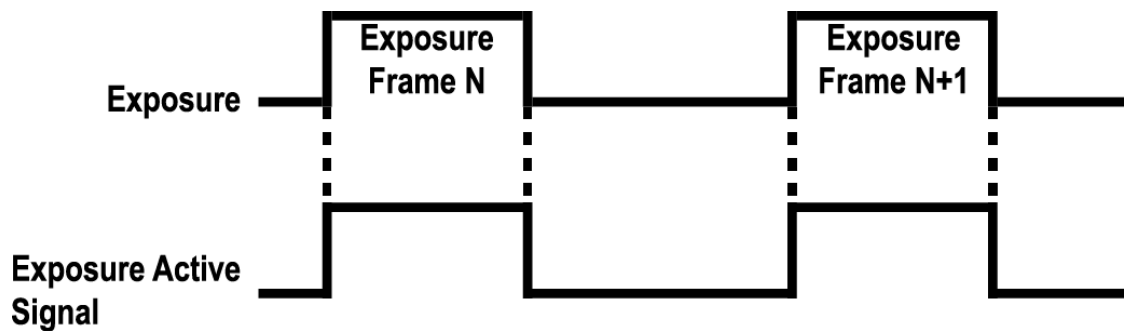


Figure 9-9 Exposure Active Signal

9.18 Debounce

The Debounce feature of the VL-2K/4K series cameras allows to supply only valid signals to the camera by discriminating between valid and invalid input signals. The Debounce Time parameter specifies the minimum time that an input signal must remain High or Low in order to be considered as a valid input signal. When you use the Debounce feature, be aware that there is a delay between the point where the valid input signal arrives and the point where the signal becomes effective. The duration of the delay is determined by the Debounce Time parameter setting value.

When you set the Debounce Time parameter, High and Low signals shorter than the setting value are considered invalid and ignored as shown in the figure below.

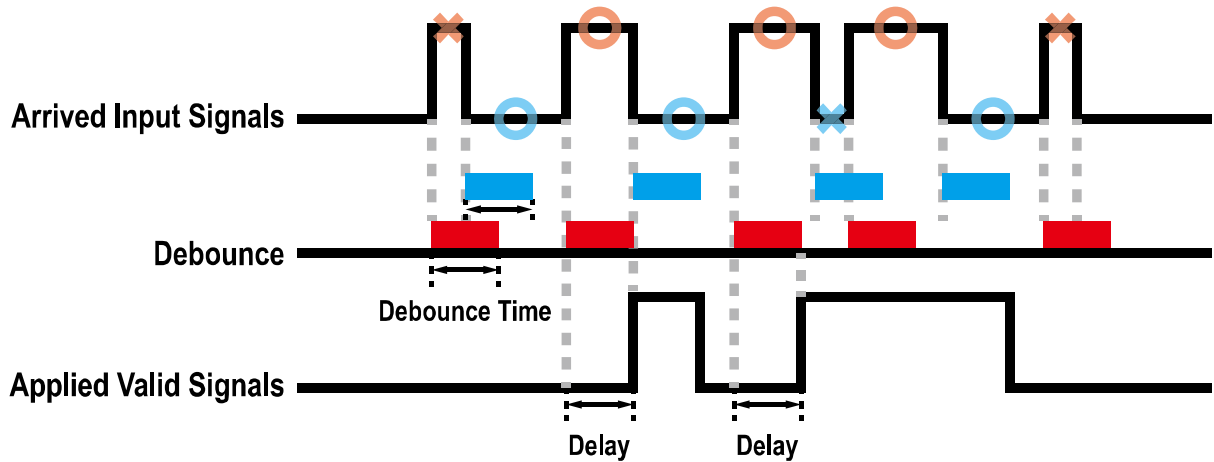


Figure 9-10 Debounce

9.19 Temperature Monitor

The camera has an embedded sensor chip to monitor the internal temperature.

The XML parameters related to Device Temperature are as follows.

XML Parameters	Value	Description
DeviceControl DeviceTemperature Selector	Mainboard	Sets a temperature measuring spot to the mainboard.
DeviceTemperature	-	Displays device temperature in Celsius.

Table 9-21 XML Parameters related to Device Temperature

9.20 Status LED

A LED is installed on the rear panel of the camera to inform the operation status of the camera.

LED status and corresponding camera status are as follows:

Status LED	Description
Steady Red	The camera is not initialized.
Fast Flashing Green	The camera is transmitting image data.

Table 9-22 Status LED

9.21 Test Pattern

To check whether the camera operates normally or not, it can be set to output test patterns generated in the camera, instead of image data from the image sensor. Four types of test patterns are available; images with different values in horizontal direction (Grey Horizontal Ramp), images with different values in diagonal direction (Grey Diagonal Ramp), moving images with different values in diagonal direction (Grey Diagonal Ramp Moving) and images with different values in horizontal direction output from the image sensor (Sensor Specific).

The XML parameter related to Test Pattern is as follows.

XML Parameter	Value	Description
ImageFormatControl	TestPattern	Off
		GreyHorizontalRamp
		GreyDiagonalRamp
		GreyDiagonalRampMoving
		SensorSpecific
		Disables the Test Pattern feature.
		Sets to Grey Horizontal Ramp.
		Sets to Grey Diagonal Ramp.
		Sets to Grey Diagonal Ramp Moving.
		Sets to the Test Pattern generated by the image sensor.

Table 9-23 XML Parameter related to Test Pattern



Figure 9-11 Grey Horizontal Ramp

9.22 Reverse X

The Reverse X feature lets you flip images horizontally. This feature is available in almost all of operation modes of the camera, except for the **Test Image** mode.

XML Parameter		Value	Description
ImageFormatControl	ReverseX	FALSE	Disables the Reverse X feature.
		TRUE	Flips images horizontally.

Table 9-24 XML Parameter related to Reverse X



Figure 9-12 Original Image



Figure 9-13 Reverse X Image

9.23 Counter Control

The VL-2K/4K series camera provides the Counter feature to count certain camera events. For example, you can verify the number of external trigger signals applied to the camera.

The XML parameters related to Counter Control are as follows.

XML Parameters		Value	Description
CounterAnd TimerControl	CounterSelector	Counter0	Selects a Counter to configure.
	CounterEvent Source	Off	Stops the Counter.
FrameActive		Counts the number of FrameActive signals.	
LineActive		Counts the number of Line Active signals.	
Exposure Active		Counts the number of Exposure Active signals.	
CC1		Counts the number of CC1 signals.	
Line0		Counter the number of external trigger signals.	
CounterEvent Activation	RisingEdge	Counts on the rising edge of the selected Event Source signal.	
	FallingEdge	Counts on the falling edge of the selected Event Source signal.	
CounterResetSource	Off	Disables the Counter Reset trigger.	
	Frame Active	Uses the Frame Active signal as Reset Source.	
	Exposure Active	Uses the Exposure Active signal as Reset Source.	
	Acquisition Active	Uses the Acquisition Active signal as Reset Source.	
	Line0	Uses the Line0 signal as Reset Source.	
CounterReset Activation	RisingEdge	Resets Counter on the rising edge of the selected Reset Source signal.	
	FallingEdge	Resets Counter on the falling edge of the selected Reset Source signal.	
	AnyEdge	Resets Counter on the rising/falling edge of the selected Reset Source signal.	
	LevelHigh	Resets the Counter if the level of the selected Reset Source signal is High.	
	LevelLow	Resets the Counter if the level of the selected Reset Source signal is Low.	
CounterReset	-	Resets the selected Counter and restarts.	
CounterValue	-	Displays the current value of the selected Counter.	
CounterValue AtReset	-	Displays the value of the Counter when it was reset by the Counter Reset command.	

Table 9-25 XML Parameters related to Counter Control (1)

XML Parameters		Value	Description	
CounterAnd TimerControl	CounterDuration	-	Sets the duration or number of events to count before the Counter ends.	
	CounterStatus	-	Displays the current status of the Counter.	
	CounterTrigger Source	Off	Off	Disables the Counter Trigger Source function.
		Exposure Active	Exposure Active	Uses the Exposure Active signal as Trigger Source of Counter.
		Frame Active	Frame Active	Uses the Frame Active signal as Trigger Source of Counter.
		CC1	CC1	Uses the CC1 signal as Trigger Source of Counter.
		Line0	Line0	Uses the Line0 signal as Trigger Source of Counter.
	CounterTrigger Activation	RisingEdge	RisingEdge	Starts Counter on the rising edge of the selected Counter Trigger Source signal.
		FallingEdge	FallingEdge	Starts Counter on the falling edge of the selected Counter Trigger Source signal.
		AnyEdge	AnyEdge	Starts Counter on the rising/falling edge of the selected Counter Trigger Source signal.
		LevelHigh	LevelHigh	Resets the Counter if the level of the selected Counter Trigger Source signal is High.
		LevelLow	LevelLow	Resets the Counter if the level of the selected Counter Trigger Source signal is Counter.

Table 9-26 XML Parameters related to Counter Control (2)

9.24 Timer Control

When the Sector parameter is set to Line1 and the Line Source parameter to Timer(Timer0Active), the camera can provide output signals by using the Timer. On the VL-2K/4K series camera, the Exposure Active, Frame Active, CC1, or external trigger signal is available as Timer source signal.

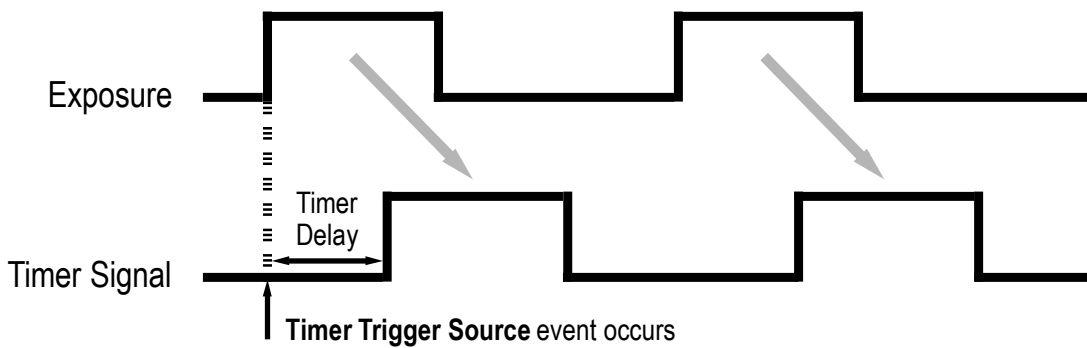
The XML parameters related to Timer Control are as follows.

XML Parameters		Value	Description
CounterAnd TimerControl	TimerSelector	Timer0	Selects a Timer to configure.
	TimerDuration	1 - 60,000,000 μ S	Sets the duration of the Timer output signal to be used when Timer Trigger Activation is set to Rising / Falling Edge.
	TimerDelay	0 - 60,000,000 μ S	Sets the delay time to be applied before starting the Timer.
	TimerReset	-	Resets the Timer and starts it again.
	TimerTrigger Source	Off	Disables the Timer trigger.
		ExposureActive	Sets the Timer to use the current exposure time as the source signal.
		FrameActive	Sets the Timer to use a frame readout time as the source signal.
		CC1	Sets the CC1 signal to use as the source signal of the Timer output signal.
		Line0	Sets the Timer to use the external trigger signal as the source signal.
	TimerTrigger Activation	RisingEdge	Specifies that a rising edge of the selected trigger signal will act as the Timer trigger.
		FallingEdge	Specifies that a falling edge of the selected trigger signal will act as the Timer trigger.
		LevelHigh	Specifies that the Timer output signal will be valid as long as the selected trigger signal is High.
		LevelLow	Specifies that the Timer output signal will be valid as long as the selected trigger signal is Low.

Table 9-27 XML Parameters related to Timer Control

For example, when the Timer Trigger Source is set to Exposure Active and the Timer Trigger Activation is set to Level High, the Timer will act as follows.

1. When the source signals set by the Timer Trigger Source parameter are applied, the Timer will start operations.
2. The delay set by the Timer Delay parameter begins to expire.
3. When the delay expires, the Timer signal goes high as long as the source signal is high.



* Timer Trigger Activation is set to Level High.

Figure 9-14 Timer Signal

9.25 Device User ID

You can input user-defined information up to 16 bytes.

The XML parameter related to Device User ID is as follows.

XML Parameter	Description
DeviceControl DeviceUserID	Input user-defined information (16 bytes).

Table 9-28 XML Parameter related to Device User ID

9.26 Device Reset

Resets the camera physically to power off and on.

The XML parameter related to Device Reset is as follows.

XML Parameter	Description
DeviceControl Device Reset	Resets the camera physically.

Table 9-29 XML Parameter related to Device Reset

9.27 Field Upgrade

The camera provides a feature to upgrade the Firmware and FPGA logic through the Camera Link interface without disassembling the camera in the field. Refer to **Appendix A** for more details about how to upgrade.

9.28 User Set Control

You can save the current camera settings to the camera's internal Flash memory. You can also load the camera settings from the camera's internal Flash memory. The camera provides two setups to save and three setups to load settings.

The XML parameters related to User Set Control are as follows.

XML Parameters	Value	Description	
UserSetControl	UserSetSelector	Default	Selects the Factory Default settings.
		UserSet1	Selects the User Set1 settings.
		UserSet2	Selects the User Set2 settings.
UserSetLoad	-	Loads the User Set specified by User Set Selector to the camera.	
UserSetSave	-	Saves the current settings to the User Set specified by User Set Selector. The Default is a Factory Default settings and allowed to load only.	
UserSetDefault	Default	Applies the Factory Default settings when reset.	
	User Set1	Applies the User Set1 settings when reset.	
	User Set2	Applies the User Set2 settings when reset.	

Table 9-30 XML Parameters related to User Set Control

The camera settings stored in the Default can be loaded into the camera's workspace but cannot be changed. The settings set in the workspace will be lost if the camera is reset or powered off. To use the current setting values in the workspace after a reset, you must save the settings to one of the user spaces.

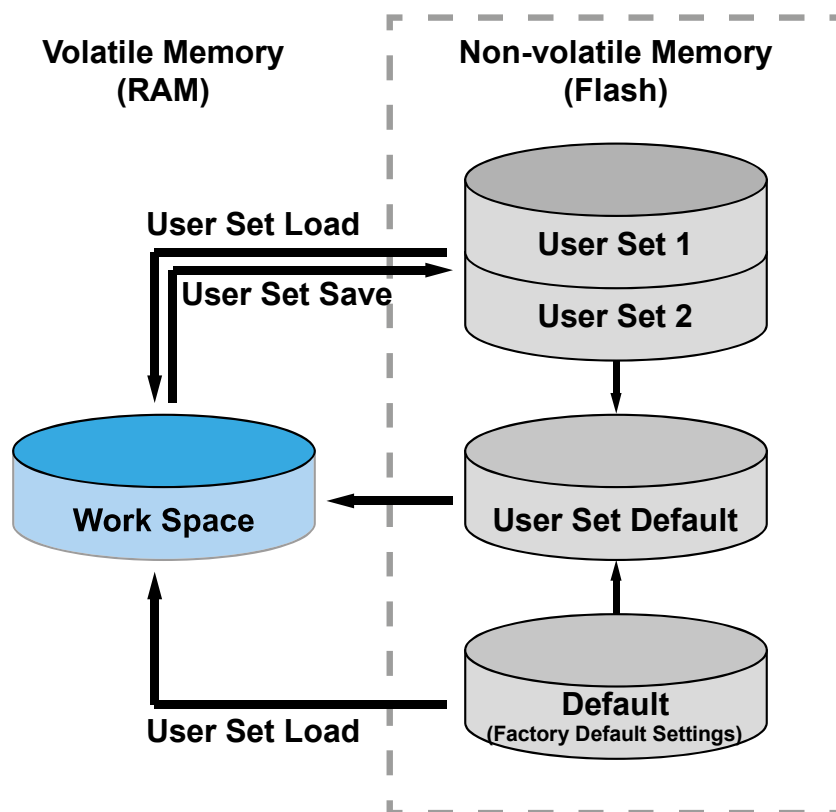


Figure 9-15 User Set Control

Chapter 10. Camera Configuration

10.1 Serial Communication

You can configure all camera settings via RS-644 serial communication of the Camera Link interface. When you want to control the camera by using a terminal or access directly to the camera by using your application, you need to set your network as follows:

- Baud Rate: 115200 bps
- Data Bit: 8 bit
- Parity Bit: No parity
- Stop Bit: 1 stop bit
- Flow Control: None

10.2 Actual Runtime of Parameters

When you set a parameter, the actual runtime of the parameter varies depending on the type of the parameter and the operating status of the camera. All parameters except the Exposure Time parameter are applied to change the camera settings as illustrated below, on the rising edge of a REQ_Frame signal before starting the readout process. When you change the Exposure Time parameter, the exposure time setting will be changed and applied at the starting of the exposure.

If you operate the camera with the **Trigger Mode** parameter set to **On**, you must change parameters before applying the trigger signals in order to synchronize image outputs with the parameters. If you change a parameter in the Free-Run mode, you may acquire up to two lines that are not affected by the parameter change. This is true because it is hard to verify the current operating status of the camera in the Free-Run mode.

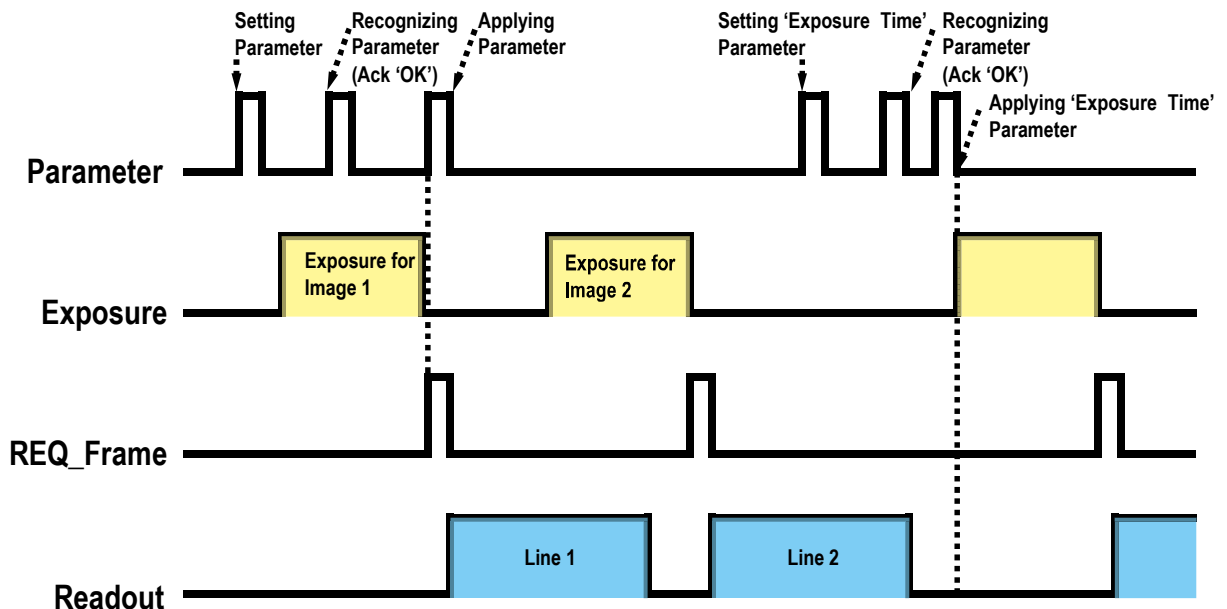


Figure 10-1 Actual Runtime of Parameters

10.3 Configurator

The Configurator, a sample application, is provided to control Vieworks Camera Link cameras. The Configurator allows you to change the camera's parameters and control the camera.

10.3.1 Starting the Configurator

After connecting the camera to your computer (refer to [Chapter 6 Connecting the Camera](#)), you can run the Configurator by following the procedure below.

1. Execute the **Configurator.exe** file after the camera is powered on. The **Camera Scan** window appears.
2. The **Configurator** probes if a camera is connected to your computer and then displays the model name of the connected camera in the **Camera Scan** window.
3. Right-click the model name of the camera, and then click the **Add to List** menu. By adding a Vieworks Camera Link camera which supports XML-based control to the list, you can configure the camera with a newer version of the **Configurator**.

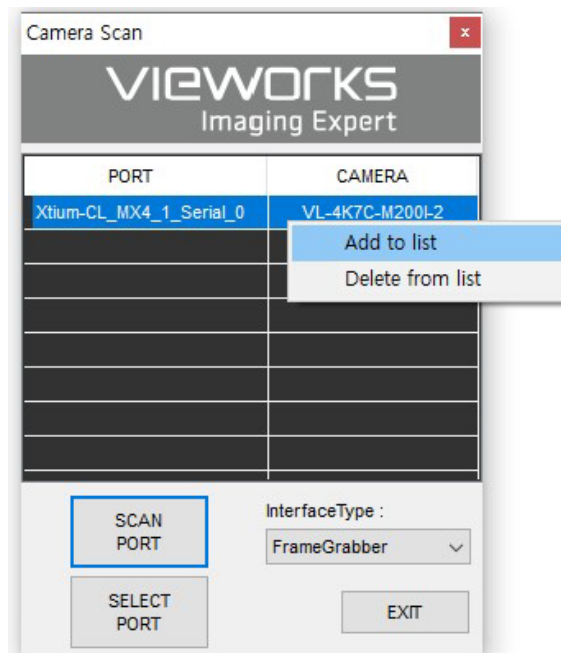


Figure 10-2 Add to list in the Camera Scan window

4. Double-click the model name of the camera. The DeviceProperty and Configurator Plus windows appear.

The DeviceProperty window displays controls for setting camera parameters.

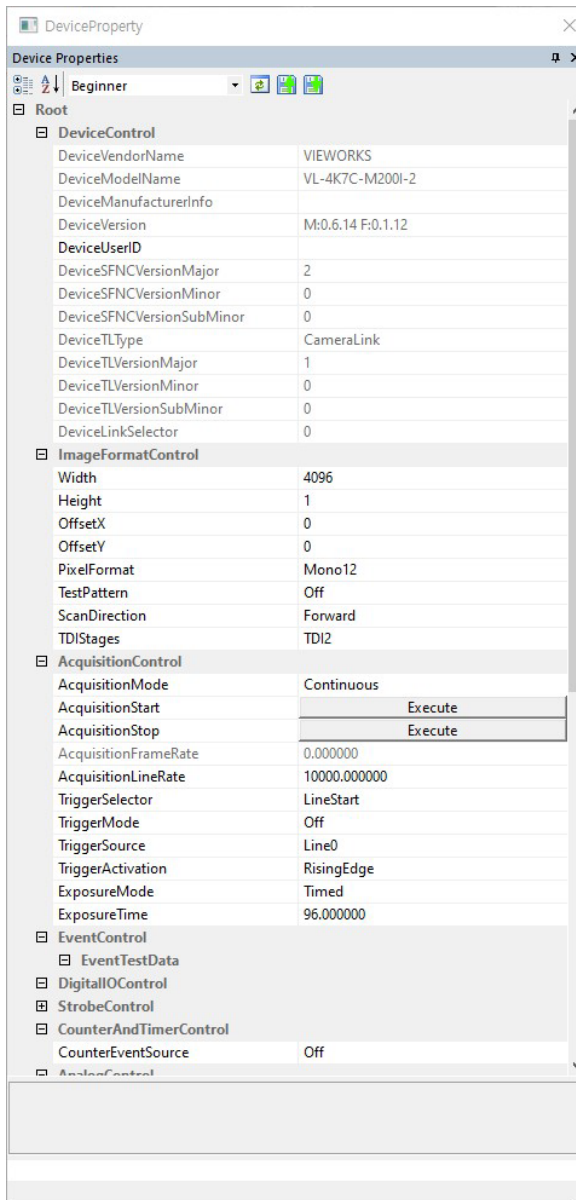


Figure 10-3 Device Property

In the **Configurator Plus** window, you can display the **Device Property** and/or **Device Maintenance** windows. In the **Device Maintenance** window, you can download a Defective Pixel Map or upgrade camera's MCU, FPGA and XML files.

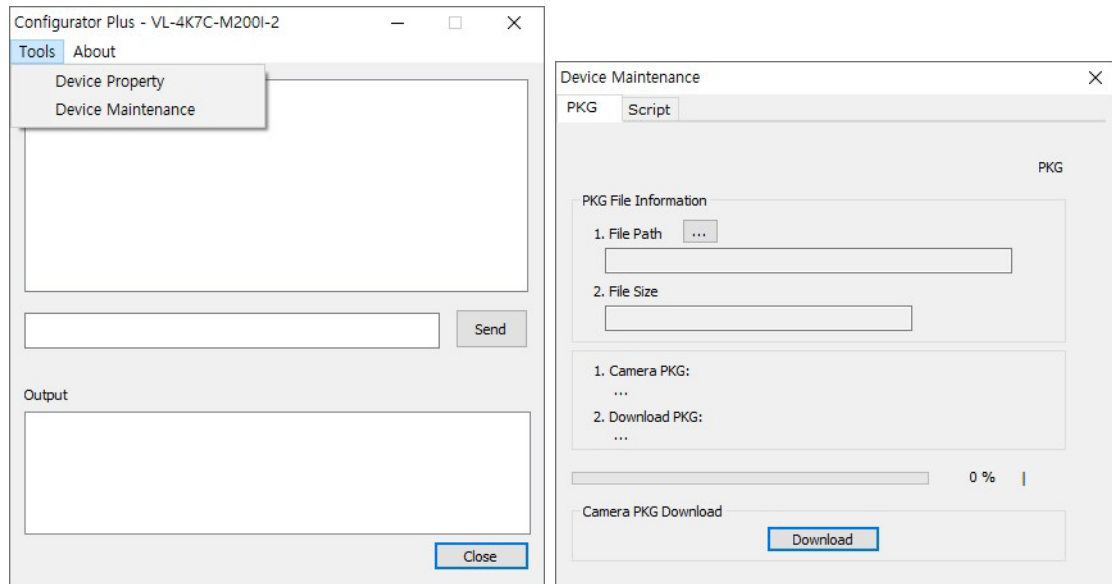


Figure 10-4 Configurator Plus and Device Maintenance

10.4 Command List

You can also set all features provided by the VL-2K/4K series cameras by using the following commands.

Command	Syntax	Return Value	Description
Set DeviceScanType Get DeviceScanType	sdst 0 1 gdst	OK 0 1	Sets an operation mode. 0: Areascan mode 1: Linescan mode
Set Image Width Get Image Width	siw n giw	OK n	Sets the ROI width n: value of the width
Set Offset X Get Offset X	sox n gox	OK n	X coordinate of start point ROI. n: X axis offset
Set Binning Selector Get Binning Selector	sbns 0 1 gbns	OK n	Selects a type of binning. 0: Sensor Binning 1: Logic Binning
Set Binning Horizontal Get Binning Horizontal	sbh 1 2 gbh	OK 1 2	Sets for the horizontal binning. 1: ×1 binning horizontal (No binning) 2: ×2 binning horizontal
Set Binning Horizontal Mode Get Binning Horizontal Mode	sbhm 0 1 gbhm	OK 0 1	Changes automatically depending on the Binning Horizontal Mode. 0: Sum 1: Average
Set Binning Vertical Get Binning Vertical	sbv 1 2 gbv	OK 1 2	Sets for the vertical binning. 1: ×1 binning vertical (No binning) 2: ×2 binning vertical
Set Binning Vertical Mode Get Binning Vertical Mode	sbvm 0 1 gbvm	OK 0 1	Sets a binning mode to apply to Binning Vertical. 0: Sum 1: Average
Set Reverse X Get Reverse X	shf 0 1 ghf	OK 0 1	Sets Reverse X. 0: deactivates Reverse X 1: activates Reverse X

Table 10-1 Command List #1

Command	Syntax	Return Value	Description
Set Pixel Format Get Pixel Format	sdb 8 10 12 gdb	OK 8 10 12	Sets Pixel Format. 8: 8 bit output 10: 10 bit output 12: 12 bit output
Set Test Image Get Test Image	sti 0 1 2 3 16 gti	OK 0 1 2 3 16	Sets Test Image. 0: deactivates Test Image 1: chooses Grey Horizontal Ramp 2: chooses Grey Diagonal Ramp 3: chooses Grey Diagonal Ramp Moving 16: chooses Test Image from a sensor
Set Scan Direction Get Scan Direction	ssd 0 1 2 gsd	OK 0 1	Sets scan direction. 0: Forward 1: Backward
Set TDI Stage Get TDI Stage	std 1 2 gtd	OK 1 2	Sets a number of the TDI Stage 1: 1 Stage 2: 2 Stage
Acquisition Start	ast	OK	Starts acquiring an image.
Acquisition Stop	asp	OK	Stops acquiring an image.
Get Acquisition Status	gast	OK	Checks if the current camera is acquiring images or not. 0: indicates the camera is not acquiring images 1: indicates the camera is acquiring images
Set Line Rate Get Line Rate	slr f glr	OK f	Sets Line Rate of a camera. f: Line rate (Hz)
Set Trigger Mode Get Trigger Mode	stm 0 1 gtm	OK 0 1	Sets a Trigger Mode. 0: Trigger Mode Off (Free-Run mode) 1: Trigger Mode On
Set Trigger Source Get Trigger Source	sts 14 22 gts	OK 14 22	Sets a source signal in the Trigger Mode On 14: CC1 22: Line0
Set Trigger Activation Get Trigger Activation	sta 0 1 4 gta	OK 0 1 4	Sets an electrical signal in the Trigger Mode On 0: Falling 1: Rising 4: AnyEdge

Table 10-2 Command List #2

Command	Syntax	Return Value	Description
Set Trigger Multiplier	stml n	OK	Sets the Trigger Multiplier rate.

Get Trigger Multiplier	gtml	n	n: 1 - 1024
Set Trigger Divider	stdv n	OK	Sets the Trigger Divider rate.
Get Trigger Divider	gtdv	n	n: 1 - 1024
Get Trigger Ratio	grr	n	Displays the Trigger Ratio
Set Trigger Rescaler Filter Size	srf 0 1 2 3 4 5	OK	Sets the Trigger Rescaler Filter Size
Get Trigger Rescaler Filter Size	grf	0 1 2 3 4 5	0: SIZE16 1: SIZE32 2: SIZE64 3: SIZE 128 4: SIZE 256 5: SIZE512
Set Exposure Mode	sem 0 1	OK	Sets an exposure mode.
Get Exposure Mode	gem	0 1	0: Timed 1: TriggerWidth
Set Exposure Time	set n	OK	Sets exposure time.
Get Exposure Time	get	n	n: exposure time in microseconds(μ s).
Set Line Selector	slns 0 1	OK	Sets the Line Selector.
Get Line Selector	glns	0 1	0: Line0 1: Line1
Set Line Inverter	slni 0 1	OK	Sets the Line Inverter.
Get Line Inverter	glni	0 1	0: deactivates the Line Inverter. 1: activates the Line Inverter.
Set Line Source	slnc n	OK	Sets the Line Inverter.
Get Line Source	glnc	n	0: Off 2: High 4: FrameActive 5: LineActive 6: ExposureActive 10: UserOutput0 18: Timer0Active

Table 10-3 Command List #3

Command	Syntax	Return Value	Description
Set Debounce Time Get Debounce Time	sdbt n gdbt	OK n	Sets the Debounce time on the Line0. n: Debounce time in microseconds (μ s, 0 – 1,000,000 μ s)
Set Counter Event Source Get Counter Event Source	sces n gces	OK n	Sets the Counter Event Source. 0: Off 4: FrameActive 5: LineActive 6: ExposureActive 14: CC1 22: Line0
Set Counter Event Activation Get Counter Event Activation	stts n gtts	OK n	Sets the Counter Event Activation. 0: FallingEdge 1: RisingEdge
Set Counter Reset Source Get Counter Reset Source	scrs n gcrs	OK n	Sets the Counter Reset Source. 0: Off 4: FrameActive 6: ExposureActive 7: AcquisitionActive 22: Line0
Set Counter Reset Activation Get Counter Reset Activation	scra n gcra	OK n	Sets the Counter Reset Activation. 0: Falling Edge 1: Rising Edge 2: LevelLow 3: LevelHigh 4: AnyEdge
Set Counter Duration Get Counter Duration	scls n gcls	OK n	Sets the Counter Duration.
Set Counter Trigger Source Get Counter Trigger Source	scfts n gcfts	OK n	Sets the Counter Trigger Source. 0: Off 4: FrameActive 6: ExposureActive 7: AcquisitionActive 22: Line0

Table 10-4 Command List #4

Command	Syntax	Return Value	Description
Set Counter Trigger Activation Get Counter Trigger Activation	scta n gcta	OK n	Sets the Counter Trigger Activation. 0: FallingEdge 1: RisingEdge 2: LevelLow 3: LevelHigh 4: AnyEdge
Set Timer Duration Get Timer Duration	stdu f gtdu	OK f	Sets the Timer Duration between 1 and 60,000,000.
Set Timer Delay Get Timer Delay	stdl f gtdl	OK f	Sets Timer Delay between 0 and 60,000,000.
Set Timer Trigger Source Get Timer Trigger Source	stts n gtts	OK n	Sets the Timer Trigger Source. 0: Off 4: FrameActive 6: ExposureActive 14: CC1 22: Line0
Set Timer Trigger Activation Get Timer Trigger Activation	stta n gtta	OK n	Sets the Timer Trigger Activation. 0: FallingEdge 1: RisingEdge 2: LevelLow 3: LevelHigh 4: AnyEdge
Set Analog Gain Get Analog Gain	sag f gag	OK f	Sets a value of an analog value. f: 1.25×, 1.75×, 2×, 3×, 4×
Set Digital Gain Get Digital Gain	sdg f gdg	OK f	Sets a value of a digital gain. f: a gain value (Setting range: 1× – 32×)
Set Black Level Get Black Level	sbl n gbl	OK n	Sets the value of Black Level. n: Black level (Setting Range: from -255 to 255)
Set RGB Gain Get RGB Gain	srg r g b n grg r g b	OK n	Sets intensity for a color pixel. r g b: Red / Green / Blue pixel n: a gain value (1.0× – 4.0×)

Table 10-5 Command List #5

Command	Syntax	Return Value	Description
Auto White Balance	arg	OK	Execute Auto White Balance once.
Set Optical Black Clamp	sob 0 1	OK	Sets Optical Black Clamp.
Get Optical Black Clamp	gob	0 1	0: deactivates Optical Black Clmap. 1: activates Optical Black Clmap.
Set Color Transformation Enable	scte 0 1	OK	Sets Color Transformation Enable.
Get Color Transformation Enable	gcte	0 1	0: deactivates Color Transformation Enable. 1: activates Color Transformation Enable.
Set Color Transformation Value	sccm n f	OK	Sets Color Transformation Value.
Get Color Transformation Value	gccm	f	n: the Matrix value (0: Gain00, 1: Gain01, ..., 8: Gain22)
Set Data ROI Width	sdrw n	OK	Sets a width of data ROI.
Get Data ROI Width	gdrw	n	
Set Data ROI Height	sdrh n	OK	Sets a height of data ROI.
Get Data ROI Height	gdrh	n	
Set Data ROI Offset X	sdrx n	OK	Sets the horizontal offset from the origin to the data ROI.
Get Data ROI Offset X	gdrx	n	
Set Data ROI Offset Y	sdry n	OK	Sets the vertical offset from the origin to the data ROI.
Get Data ROI Offset Y	gdry	n	
Generate DSNU Data	gdd	OK	Generates the DSNU data depending on the current value of the analog gain.
Save DSNU Data	sdd	OK	Saves the DSNU data in the non-volatile memory.
Load DSNU Data	ldd	OK	Loads the DSNU data from the non-volatile memory into the volatile memory.
Generate PRNU Data	gpd n	OK	Generates PRNU data. n: Target level (Setting range: 1 – 255, 0: automatic setting)
Set PRNU Mode	sprnu 0 1	OK	Sets the PRNU Correction function.
Get PRNU Mode	gprnu	0 1	0: deactivates the function. 1: activates the function.
Save PRNU Data	spd	OK	Saves the PRNU data in the non-volatile memory.

Table 10-6 Command List #6

Command	Syntax	Return Value	Description
Load PRNU Data	lpd	OK	Loads the PRNU data from the non-volatile memory into the volatile memory.
PRNU Selector	spi n gpi	OK n	Saves the PRNU data, or Sets the workspace to load the data. n: workspace to save the PRNU data (0 – 7).
Set Camera Link Clock Speed Get Camera Link Clock Speed	sccs 0 1 2 gccs	OK 0 1 2	Sets Camera Link Pixel Clock. 0: 85 MHz 1: 65 MHz 2: 45 MHz
Set Camera Link mode Get Camera Link mode	stg n gtg	OK n	Sets the Camera Link Output mode. 2: 2 Tap 3: 3 Tap 4: 4 Tap 6: 6 Tap (Color Model Only) 8: 8 Tap 10: 10 Tap
Load Config From	lcf 0 1 2	OK	Loads the setting value of the camera. 0: loads from the Factory workspace. 1: loads from the User 1 workspace. 2: loads from the User 2 workspace.
Save Config To	sct 1 2	OK	Saves the setting values of the camera 1: saves in the User 1 workspace. 2: saves in the User 2 workspace.
Set Config Initialization Get Config Initialization	sci 0 1 2 gci	OK 0 1 2	Chooses the setting value to apply when reset. 0: Applies the Factory Default settings when reset. 1: Applies the User Set1 settings when reset. 2: Applies the User Set2 settings when reset.
Get MCU Version	gmv	String	Displays the version of the camera's MCU.
Get FPGA Version	gfv	String	Displays the version of the camera's FPGA.
Get Model Number	gmn	String	Displays the model name of the camera.
Get Serial Number	gsn piece	String	Displays the serial number of the camera.
Get Current Temperature Reset Hardware	gct rst	String -	Displays the temperature in Celsius. Resets a camera physically.

Table 10-7 Command List #7

Chapter 11. Troubleshooting

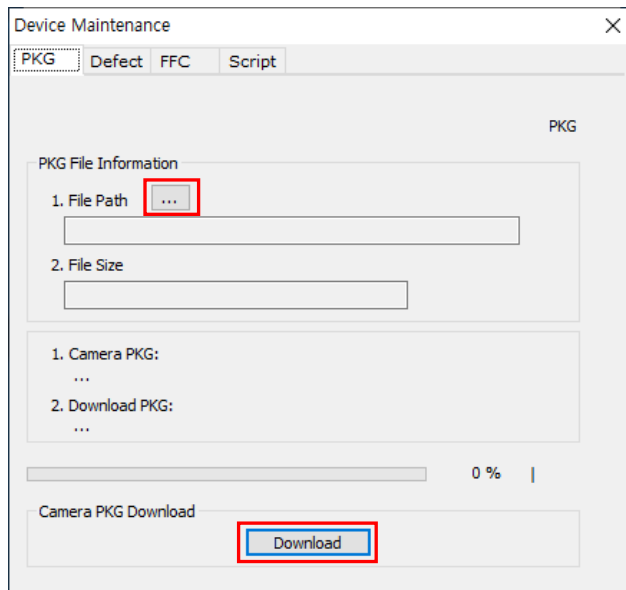
When you have a problem with a Vieworks camera, please check the followings:

- If no image is displayed on your computer,
 - Ensure that all cable connections are secure.
 - Ensure that the power supply is properly connected.
 - Ensure that trigger signals are applied correctly when you operate the camera with trigger signals.
- If images are not clear,
 - Ensure the camera lens or glass is clean.
 - Check the lens aperture is adjusted properly.
- If images are dark,
 - Ensure the camera lens is not blocked.
 - Check the exposure time is set properly.
- If you identify abnormal operation or overheating sign,
 - Ensure the power supply is properly connected.
 - Stop using the camera when you notice smoke or abnormal overheating.
- If the Trigger Mode is not working correctly,
 - Ensure that the CC1 settings on the frame grabber are configured correctly when you use CC1 triggering.
 - Ensure that cable connections are secure when you use external triggering.
- If there is a communication failure between the camera and user's computer,
 - Ensure that the Camera Link cable connections are secure.
 - Ensure that you have configured a frame grabber in your computer and the camera is connected to the frame grabber correctly.

Appendix A. Field Upgrade

You can upgrade the MCU, FPGA and XML file of the camera by following the procedure below.

1. Run the Configurator and then click the Configurator Plus window > Tools > Device Maintenance to open the Device Maintenance window.
2. Select the PKG tab, click the button of the File Path item's left, select the MCU, FPGA or XML upgrade file, and then click the button.



3. The camera begins downloading the upgrade file and the downloading status is displayed at the bottom of the window.
4. After completing the download, click the button to close the confirmation.

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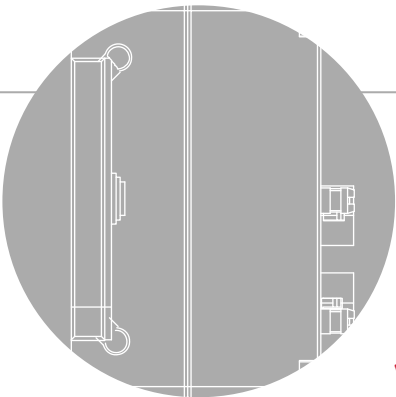
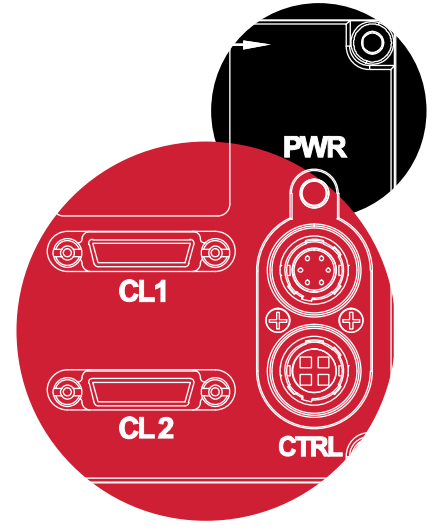
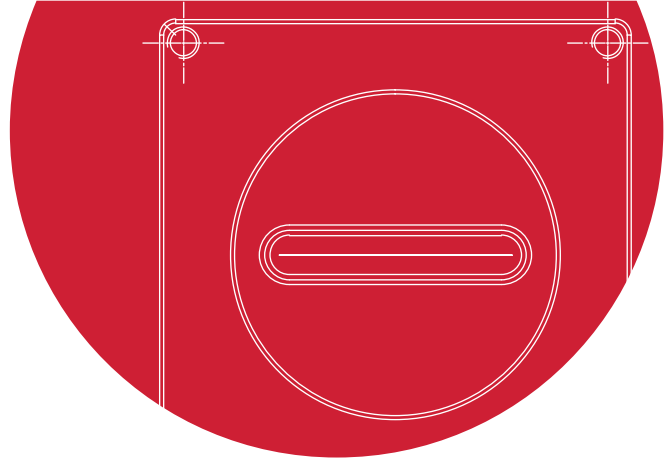
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