

# VL series

## User Manual

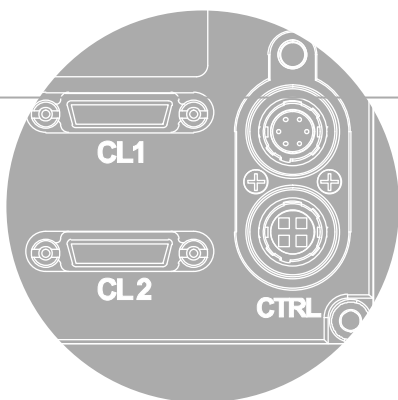
English

VL-2K7C-M200I-2

VL-4K7C-M200I-2

VL-2K7C-C100I-2

VL-4K7C-C100I-2



# VIEWWORKS



## **Preface**

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Although Vieworks made every effort to ensure the accuracy of this document, it assumes no responsibility for errors or omissions that may appear herein. The figures in this manual may differ depending on the version of the product or operating system, or the way how it runs. Information in this manual is subject to change without notice.



## 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-M200 I2
- VL-2k7C-C100 I2
- VL-4k7C-M200 I2
- VL-4k7C-C100 I2

## 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!

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



#### Caution!

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



#### Note:

This indicates that this message provides additional information.

## Definition of Terms

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"><li>• Added description for the Binning function</li><li>• Added a note for a CC1 trigger signal and for an external trigger signal</li></ul>
	2021-12-20	<ul style="list-style-type: none"><li>• Fixed errors on Command List</li></ul>





## Contents

<b>Chapter 1. Precautions .....</b>	<b>15</b>
<b>Chapter 2. Warranty .....</b>	<b>17</b>
<b>Chapter 3. Compliance &amp; Certifications .....</b>	<b>18</b>
3.1    FCC Compliance.....	18
3.2    CE : DoC.....	18
3.3    KC .....	18
<b>Chapter 4. Package Components.....</b>	<b>19</b>
<b>Chapter 5. Product Specifications.....</b>	<b>20</b>
5.1    Overview.....	20
5.2    Specifications .....	21
5.3    Camera Block Diagram .....	23
5.4    Quantum Efficiency.....	24
5.5    Mechanical Specification .....	25
5.5.1    Camera Mounting and Heat Dissipation .....	25
<b>Chapter 6. Connecting the Camera.....</b>	<b>26</b>
6.1    Precaution to Center the Image Sensor .....	26
6.2    Controlling the Camera .....	26
<b>Chapter 7. Camera Interface.....</b>	<b>27</b>
7.1    General Description.....	27
7.2    Camera Link SDR Connector.....	28
7.3    Power Input Receptacle.....	30
7.4    Control Receptacle.....	31
7.5    Trigger/Direction Input Circuit .....	32
<b>Chapter 8. Acquisition Control.....</b>	<b>33</b>
8.1    Acquisition Start/Stop Commands and Acquisition Mode.....	33
8.2    Line Start Trigger .....	34
8.2.1    Trigger Mode .....	34
8.2.2    Using CC1 Trigger Signal .....	37

8.2.3	Using an External Trigger Signal .....	38
8.2.4	Trigger Multiplier/Divider.....	39
8.2.5	Exposure Mode .....	40
8.3	Maximum Allowed Line Rate.....	42
8.4	Setting the Exposure Time .....	43
<b>Chapter 9. Camera Features.....</b>		<b>44</b>
9.1	Device Scan Type(Monochrome Only) .....	44
9.2	TDI Stages(Monochrome Only) .....	45
9.3	Output Formats from Color Cameras.....	46
9.4	Scan Direction .....	47
9.5	Region of Interest .....	48
9.6	Binning.....	49
9.6.1	Sensor Binning(Monochrome Only) .....	50
9.6.2	Logic Binning .....	51
9.7	Pixel Format.....	52
9.8	Device Tap Geometry.....	54
9.9	Camera Link Clock .....	56
9.10	Data ROI (Color Camera).....	57
9.11	White Balance (Color Camera) .....	58
9.11.1	Balance White Auto .....	58
9.12	Gain and Black Level .....	59
9.13	Optical Black Clamp .....	59
9.14	Dark Signal Non-uniformity Correction.....	60
9.14.1	Generating and Saving User DSNU Correction Values .....	60
9.15	Photo Response Non-uniformity Correction .....	61
9.15.1	Generating and Saving User PRNU Correction Values .....	62
9.16	Digital I/O Control .....	63
9.17	Debounce.....	65
9.18	Temperature Monitor.....	65
9.19	Status LED.....	66

---

9.20	Test Pattern .....	66
9.21	Reverse X.....	67
9.22	Counter Control .....	68
9.23	Timer Control .....	70
9.24	Device User ID .....	71
9.25	Device Reset .....	71
9.26	Field Upgrade.....	72
9.27	User Set Control.....	72
<b>Chapter 10. Camera Configuration .....</b>		<b>74</b>
10.1	Serial Communication.....	74
10.2	Actual Runtime of Parameters .....	74
10.3	Configurator .....	76
	10.3.1 Starting the Configurator .....	76
10.4	Command List .....	79
<b>Chapter 11. Troubleshooting .....</b>		<b>86</b>
<b>Appendix A. Field Upgrade.....</b>		<b>87</b>
<b>Appendix B. Index .....</b>		<b>88</b>

## Tables

Table 5-1	Specifications of VL-2K7C-M200I-2 and VL-4K7C-M200I-2.....	21
Table 5-2	Specifications of VL-2K7C-C100I-2 and VL-4K7C-C100I-2.....	22
Table 7-1	Pin Assignments for Camera Link Connector 1.....	28
Table 7-2	Pin Assignments for Camera Link 2 Connector.....	29
Table 7-3	Pin Configurations for Power Input Receptacle .....	30
Table 7-4	Pin Configurations for Control Receptacle .....	31
Table 8-1	XML Parameters related to Trigger Multiplier/Divider Mode .....	39
Table 8-2	Maximum Allowed Line Rates of the cameras supporting a 42 mount .....	42
Table 8-3	Minimum and Maximum Exposure Time Setting.....	43
Table 9-1	XML Parameters related to Device Scan Type .....	44
Table 9-2	XML Parameters related to Device Scan Type .....	44
Table 9-3	XML Parameters related to TDI Stages.....	45
Table 9-4	The number of available TDI Stages for each camera model .....	45
Table 9-5	XML Parameters related to Scan Direction .....	47
Table 9-6	XML Parameters related to ROI .....	48
Table 9-7	XML Parameters related to Binning.....	49
Table 9-8	XML Parameter related to Pixel Format .....	52
Table 9-9	Pixel Format Values .....	52
Table 9-10	XML Parameter related to Device Tap Geometry .....	55
Table 9-11	XML Parameters related to Camera Link Clock Speed.....	56
Table 9-12	XML Parameters related to Data ROI.....	57
Table 9-13	XML Parameters related to White Balance .....	58
Table 9-14	XML Parameter related to Balance White Auto.....	58
Table 9-15	XML Parameters related to Gain and Black Level .....	59

Table 9-16	XML Parameters related to Optical Black Clamp .....	59
Table 9-17	XML Parameters related to DSNU .....	60
Table 9-18	XML Parameters related to PRNU .....	61
Table 9-19	XML Parameters related to Digital I/O Control .....	63
Table 9-20	XML Parameters related to Device Temperature.....	65
Table 9-21	Status LED .....	66
Table 9-22	XML Parameter related to Test Pattern.....	66
Table 9-23	XML Parameter related to Reverse X.....	67
Table 9-24	XML Parameters related to Counter Control .....	69
Table 9-26	XML Parameters related to Timer Control.....	70
Table 9-25	XML Parameter related to Device User ID.....	71
Table 9-27	XML Parameter related to Device Reset.....	71
Table 9-28	XML Parameters related to User Set Control .....	72
Table 10-1	Command List #1 .....	79
Table 10-2	Command List #2 .....	80
Table 10-3	Command List #3 .....	81
Table 10-4	Command List #4 .....	82
Table 10-5	Command List #5 .....	83
Table 10-6	Command List #6 .....	84
Table 10-7	Command List #7 .....	85

## Figures

Figure 5-1	Camera Block Diagram.....	23
Figure 5-2	Quantum Efficiency .....	24
Figure 5-3	VL Series Mechanical Dimension.....	25
Figure 7-1	VL-2K/4K series Back Panel.....	27
Figure 7-2	26-pin Camera Link SDR Connector .....	28
Figure 7-3	Pin Assignments for Power Input Receptacle .....	30
Figure 7-4	Pin Assignments for Control Receptacle .....	31
Figure 7-5	Trigger/Direction Input Schematic .....	32
Figure 8-1	Trigger Mode = Off .....	35
Figure 8-2	Trigger Mode = On .....	36
Figure 8-3	Trigger Ratio = 0.5 .....	39
Figure 8-4	Timed Exposure Mode .....	40
Figure 8-5	Trigger Overlapped with Timed Exposure Mode .....	40
Figure 8-6	Trigger Width Exposure Mode .....	41
Figure 9-1	Structure of the Bilinear Pixel (Color Sensor) .....	46
Figure 9-3	Scan Direction.....	47
Figure 9-4	Region of Interest.....	48
Figure 9-5	Sensor Binning .....	50
Figure 9-6	Logic Binning(Average) .....	52
Figure 9-7	Device Tap Geometry .....	54
Figure 9-8	Effective Data ROI.....	57
Figure 9-9	User Output .....	63
Figure 9-10	Exposure Active Signal.....	64
Figure 9-11	Debounce .....	65

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Figure 9-12	Grey Horizontal Ramp .....	66
Figure 9-13	Original Image .....	67
Figure 9-14	Reverse X Image.....	67
Figure 9-15	Timer Signal.....	71
Figure 9-16	User Set Control.....	73
Figure 10-1	Actual Runtime of Parameters .....	75
Figure 10-2	Add to list in the Camera Scan window.....	76
Figure 10-3	Device Property .....	77
Figure 10-4	Configurator Plus and Device Maintenance.....	78





## Chapter 1. Precautions

### General



- 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.

### Installation and Maintenance



- 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.

### Power Supply



- 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.
- Make sure the power is turned off before connecting the power cord to the camera. Otherwise, damage to the camera may result.

## 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.

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.

---

## 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!

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

---

## 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 : DoC

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

### 3.3 KC

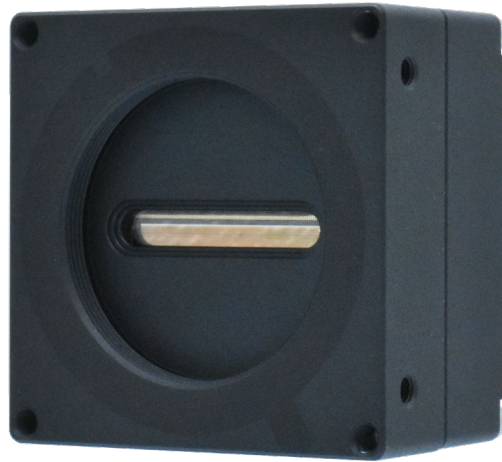
#### KCC Statement

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

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Package Components



VL Camera with M72 × 0.75 mount

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## 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	
Active Image (H × V)	2024 × 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		
Data Output Mode	8 bit(2 / 3 / 4 / 8 / 10 Tap), 10 bit(2 / 3 / 4 Tap) or 12 bit(2 / 3 / 4 Tap)		
Pixel Data Format	Pixel Data Format Mono8 / Mono10 / Mono12		
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		
Gain	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 V DC	
	Dissipation	Typ. 6.8 W	
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 and VL-4K7C-M200I-2

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

Item		VL-2K7C-C100I-2	VL-4K7C-C100I-2
Active Image (H × V)		2024 × 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
	3 Tap	61.89 kHz	31.03 kHz
	4 Tap	82.36 kHz	41.34 kHz
	6 Tap	101.06 kHz	61.89 kHz
	8 Tap	101.06 kHz	82.36 kHz
	10 Tap	101.06 kHz	100.52 kHz
Camera Link Pixel Clock		45 / 65 / 85 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)	
Pixel Data Format		Mono8 / Mono10 / Mono12 BiColor RGBG 8 / 10 / 12 RGB 8 / 10 / 12 BGR 8 / 10 / 12	
Dual Integration Mode	Mono	Supported	
	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 bits	
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 V DC	
	Dissipation	Typ. 6.8 W	
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 and VL-4K7C-C100I-2



### 5.3 Camera Block Diagram

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

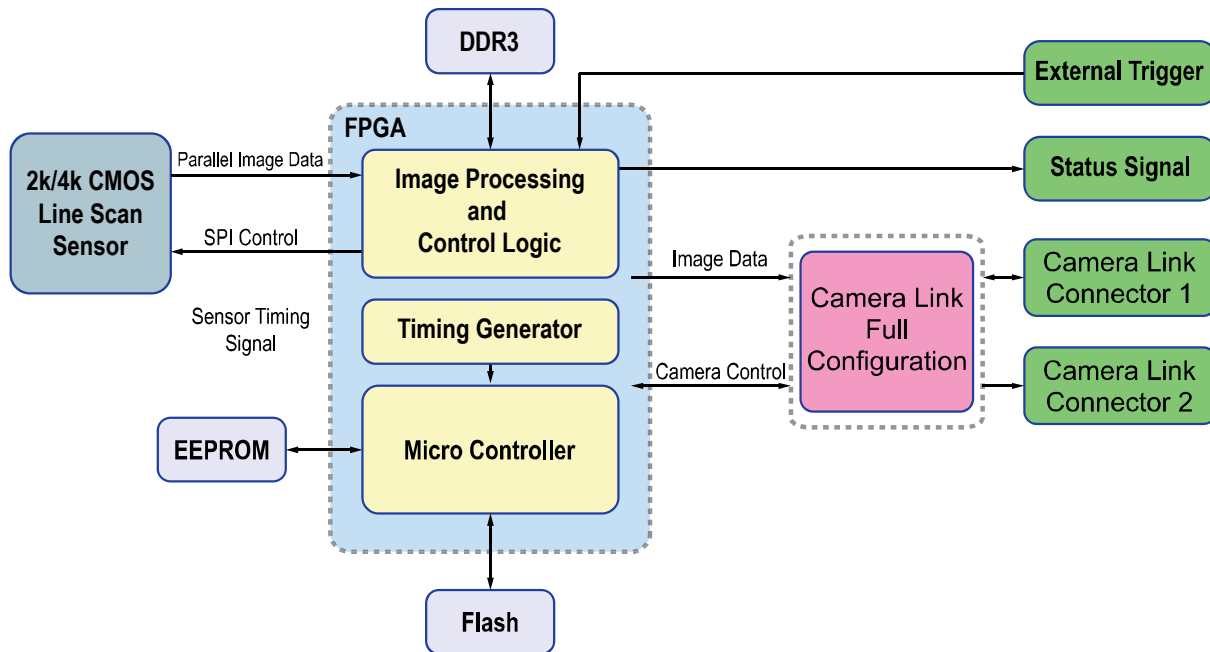


Figure 5-1 Camera Block Diagram

## 5.4 Quantum Efficiency

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

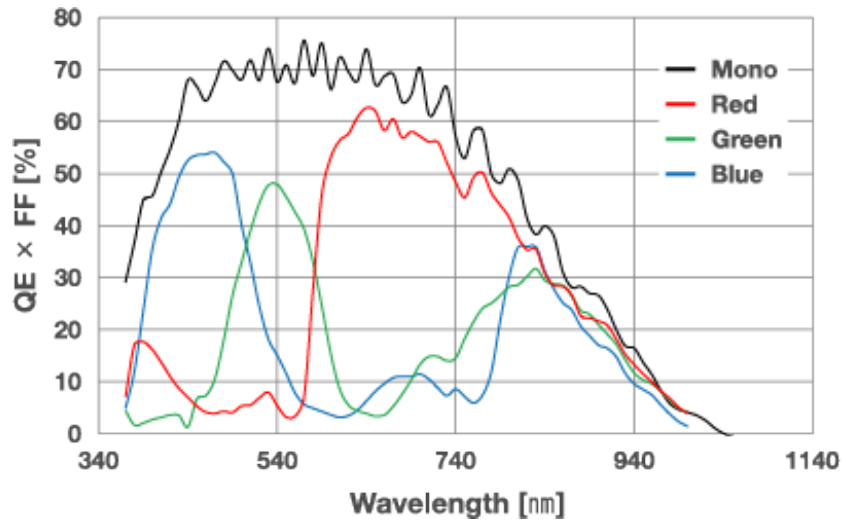


Figure 5-2 Quantum Efficiency

## 5.5 Mechanical Specification

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

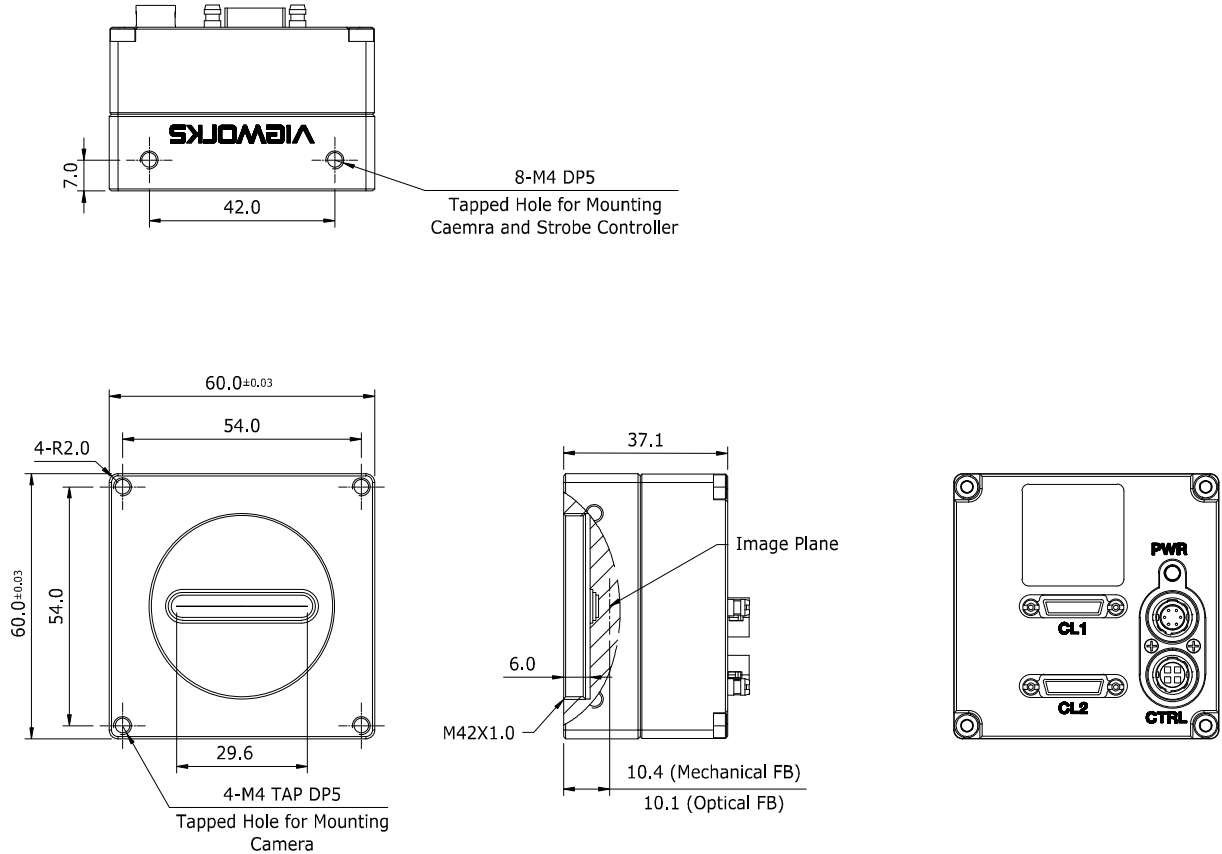


Figure 5-3 VL Series Mechanical Dimension

### 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 60°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 40°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.

## 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.

---

**Note:**



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.

---

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://www.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.

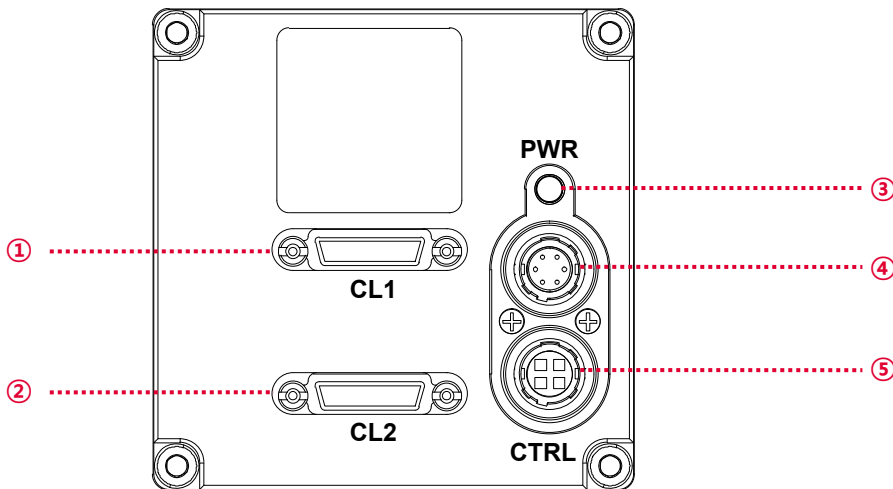


Figure 7-1 VL-2K/4K series Back Panel

## 7.2 Camera Link SDR Connector

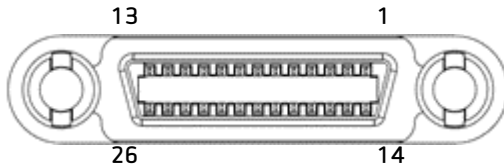


Figure 7-2 26-pin Camera Link SDR Connector

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

**Note:**

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.

### 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:

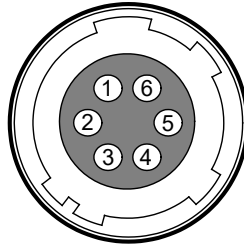


Figure 7-3 Pin Assignments for Power Input Receptacle

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

Table 7-3 Pin Configurations for Power Input Receptacle



**Note:**

- 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 V DC  $\pm 10\%$  voltage output (You need to purchase a power adapter separately.).

#### Precaution for Power Input



**Caution!**

- 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.



## 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:

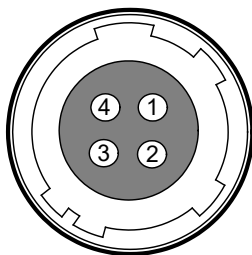


Figure 7-4 Pin Assignments for Control Receptacle

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

Table 7-4 Pin Configurations for Control Receptacle



**Note:**

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

## 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.

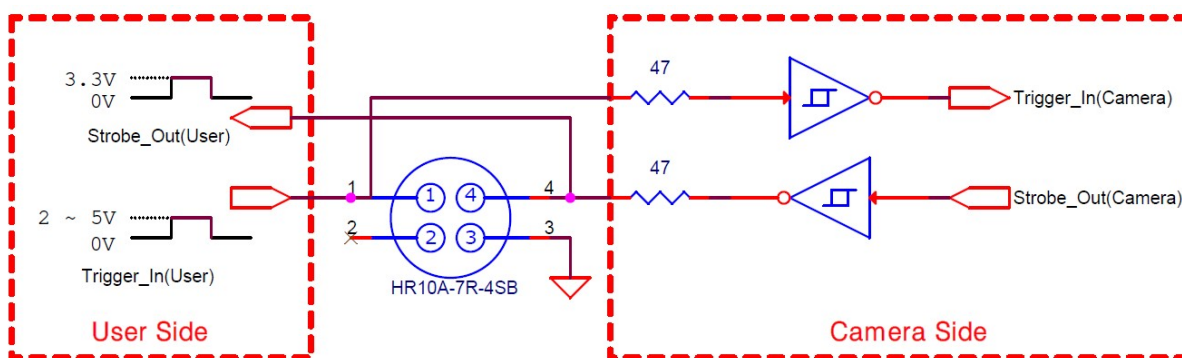


Figure 7-5 Trigger/Direction Input Schematic

## 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



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".

---

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.

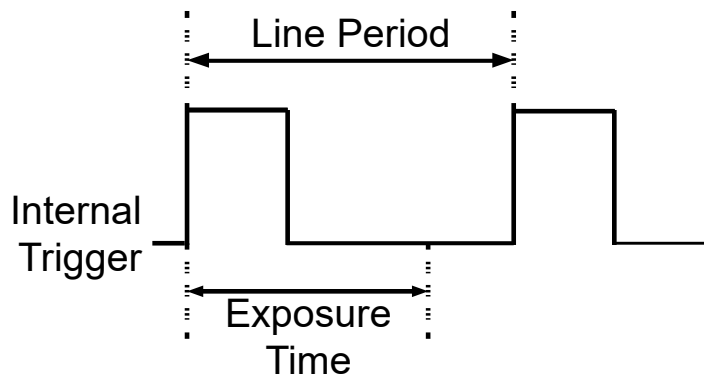


Figure 8-1 Trigger Mode = Off

### 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.

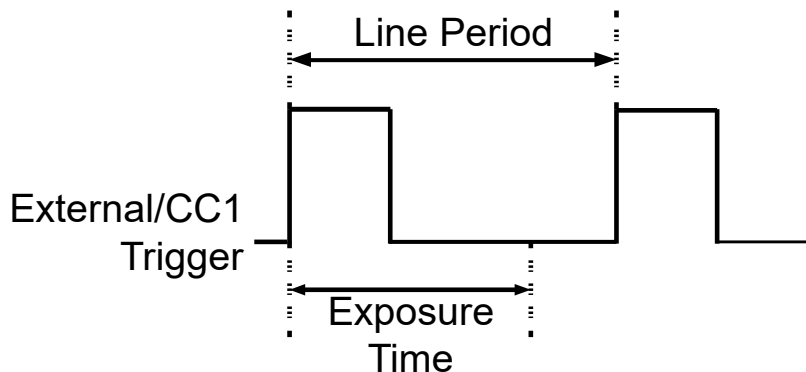


Figure 8-2 Trigger Mode = On

### 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.

The camera starts the exposure after receiving a CC1 trigger signal, however, additional new CC1 trigger signal would be ignored while the previous exposure is still in progress. 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  $\mu\text{s}$  (0.001 s):  
So in this case, the line rate is 1 kHz.

---

**Note:**

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.

---

### 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. The camera starts the exposure after receiving an external trigger signal, however, additional new external trigger signal would be ignored while the previous exposure is still in progress.

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  $\mu\text{s}$  (0.001 s):  
So in this case, the line rate is 1 kHz.

---

**Note:**

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.

---



### 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.

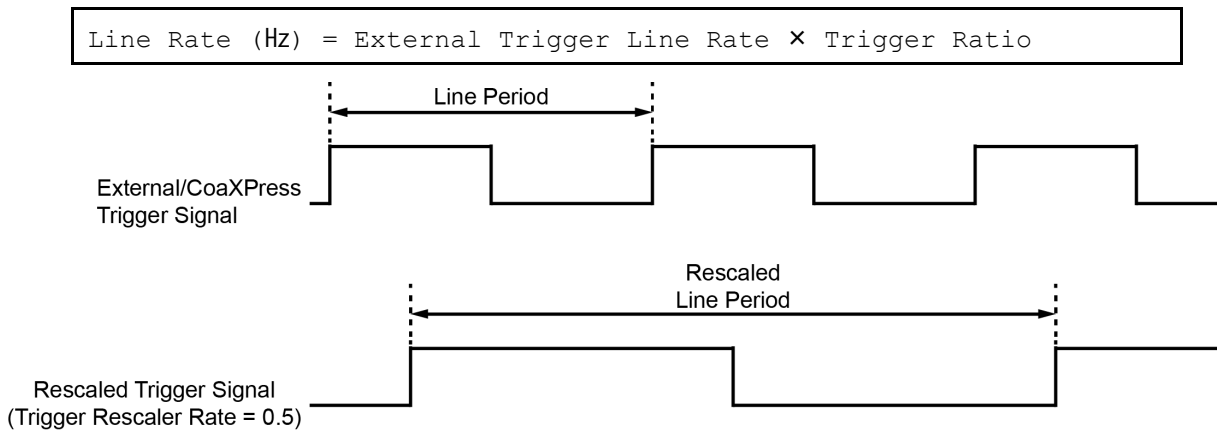


Figure 8-3 Trigger Ratio = 0.5

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.

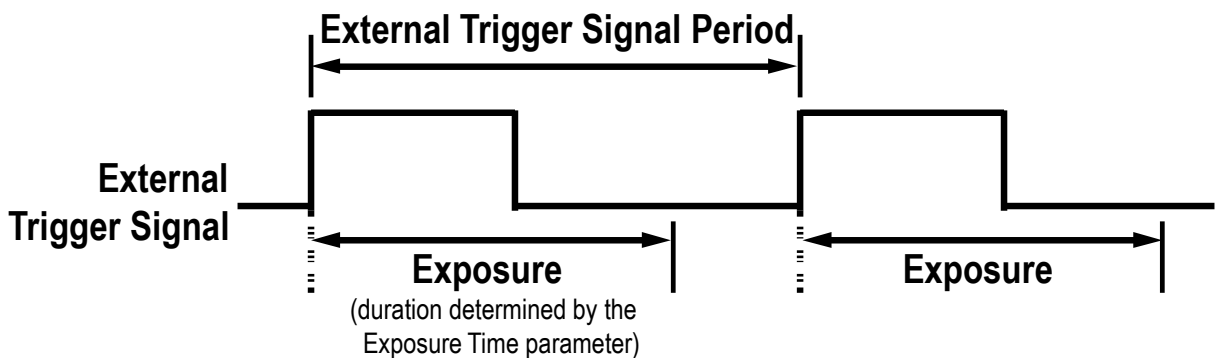


Figure 8-4 Timed Exposure Mode

Note that if you attempt to trigger a new exposure start while the previous exposure is still in progress, the trigger signal will be ignored.

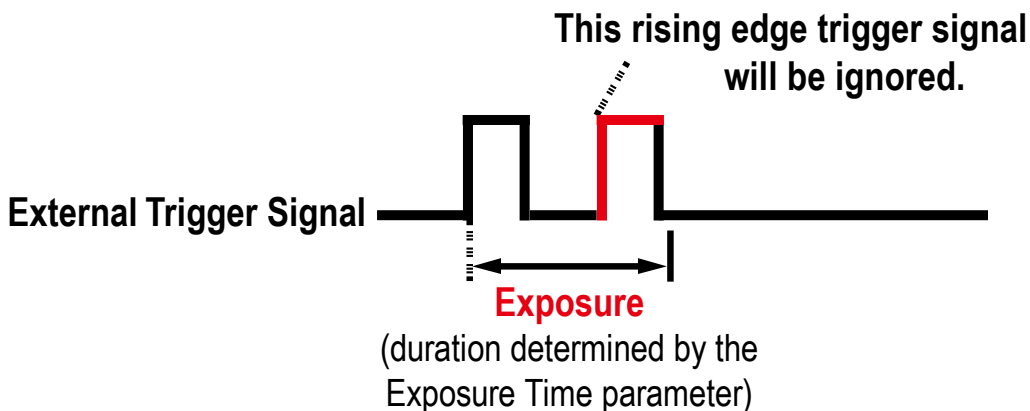


Figure 8-5 Trigger Overlapped with Timed Exposure Mode

### 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 continues 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.

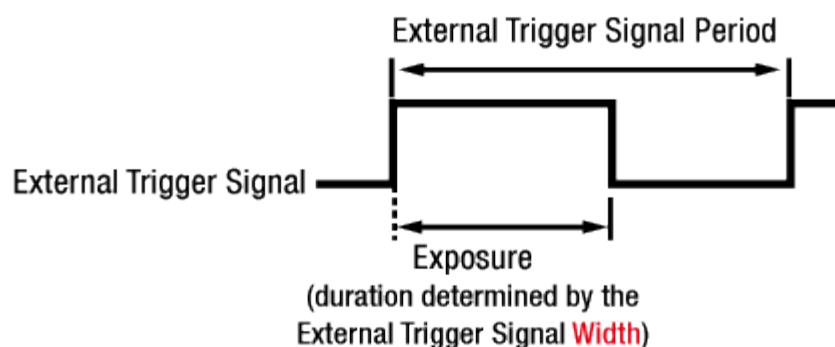


Figure 8-6 Trigger Width Exposure Mode

### 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:

Tap Mode †	VL-2K7C-M200I-2	VL-4K7C-M200I-2	VL-2K7C-C100I-2	VL-4K7C-C100I-2
2 Tap	82.36 kHz	41.34 kHz	41.34 kHz	20.71 kHz
3 Tap	123.06 kHz	61.89 kHz	61.89 kHz	31.03 kHz
4 Tap	163.46 kHz	82.36 kHz	82.36 kHz	41.34 kHz
6 Tap	N/A	N/A	101.06 kHz	61.89 kHz
8 Tap	200.00 kHz	163.46 kHz	101.06 kHz	82.36 kHz
10 Tap	200.00 kHz	200.00 kHz	101.06 kHz	100.52 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  $2.46 \mu s$ , 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 ( $\mu s$ ). 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	$1 \mu s$	$1,000 \mu s$

†: 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.
	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	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.

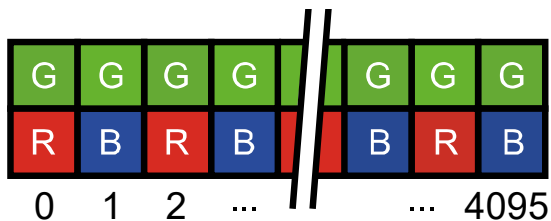


Figure 9-1 Structure of the Bilinear Pixel (Color Sensor)

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.

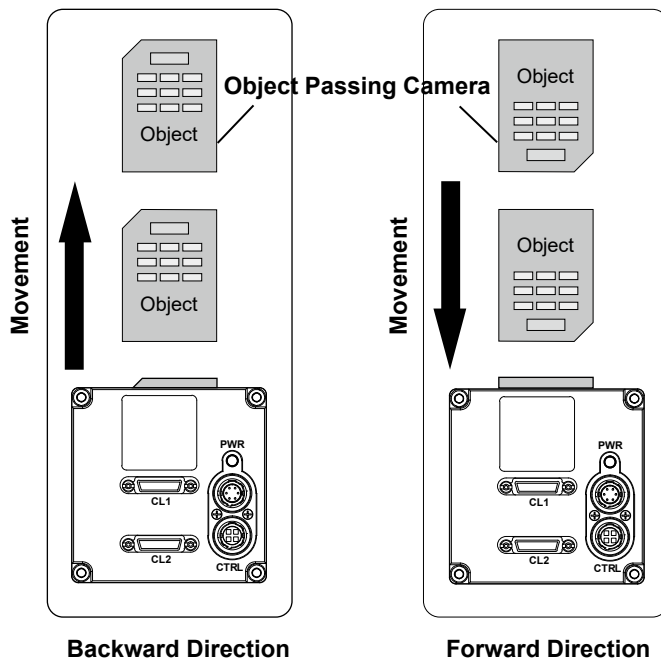


Figure 9-2 Scan Direction

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.

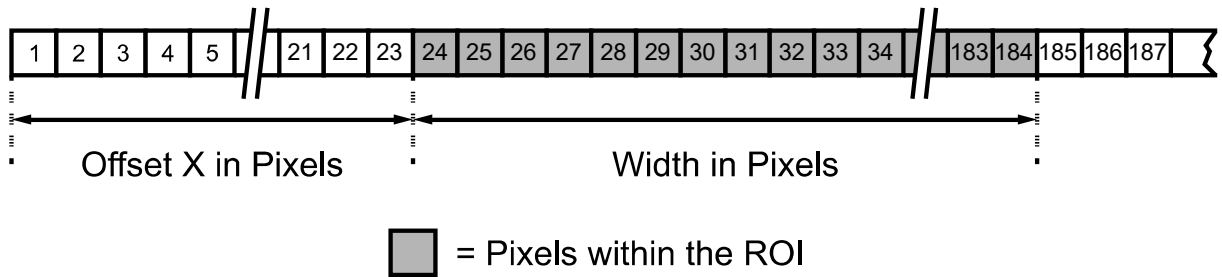


Figure 9-3 Region of Interest

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!

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.

## 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
ImageFormatControl BinningSelector	Sensor	Selects the Sensor for the binning engine. Applies the Binning in analog by the image sensor.
	Logic	Selects the Logic for the binning engine. Applies the Binning in digital by the logic.
BinningHorizontalMode	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.
BinningVerticalMode	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  $2 \times 2$  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  $2 \times 2$  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  $2 \times 2$  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.
	BinningHorizontalMode	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	$\times 1, \times 2$ The number of horizontal pixels to combine together.
	BinningVerticalMode	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	$\times 1, \times 2$ The number of vertical pixels to combine together.

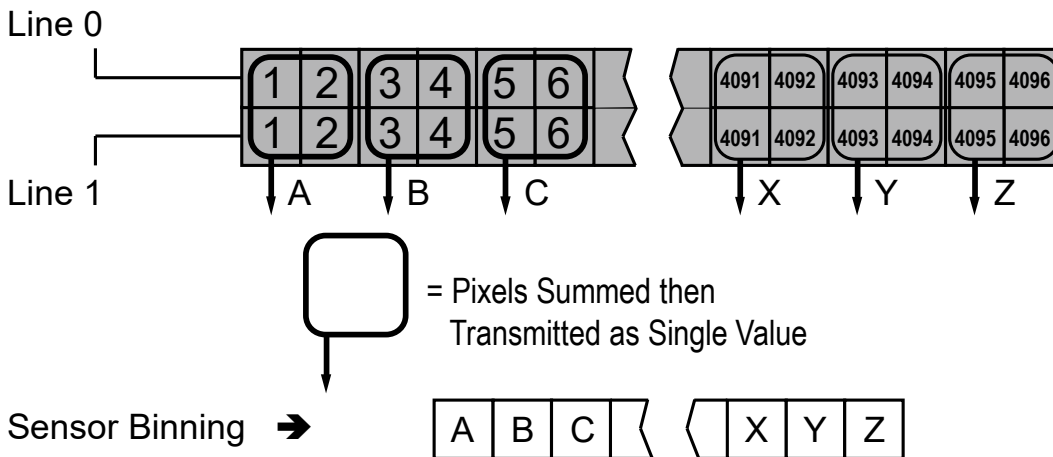


Figure 9-4 Sensor Binning

## 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	
ImageFormatControl	BinningSelector	Logic	Selects the Logic for the binning engine. Applies the Binning in digital by the logic.
	BinningHorizontalMode	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.
	BinningVerticalMode	Sum	N/A
		Average	
	BinningVertical	×1, ×2	N/A

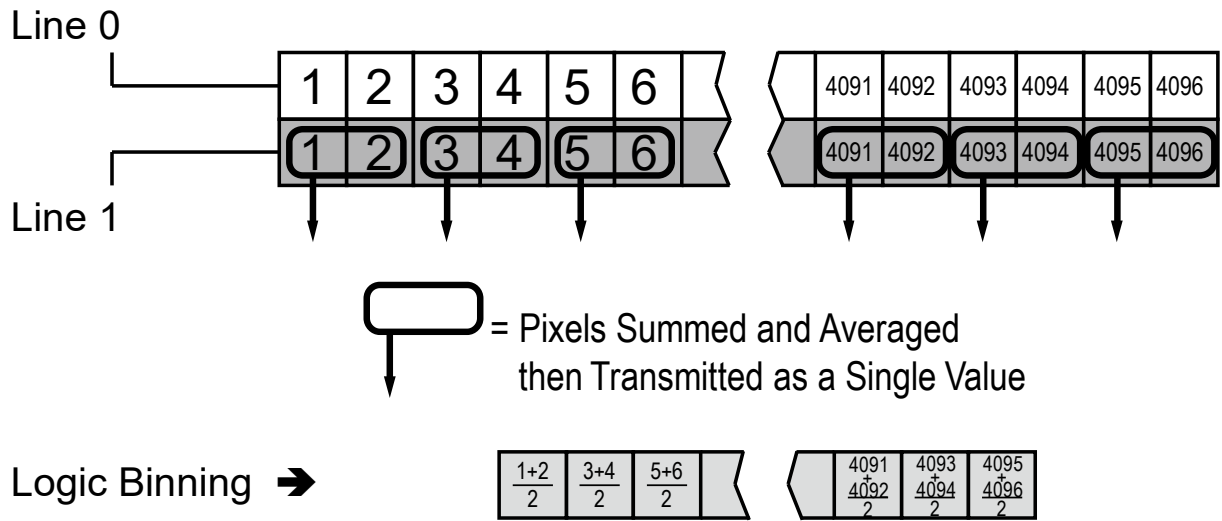


Figure 9-5 Logic Binning(Average) in the monochrome mode

## 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

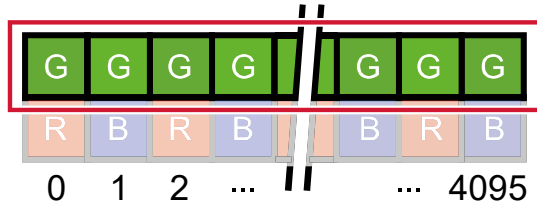
The available pixel formats on the monochrome and color cameras are as follows.

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

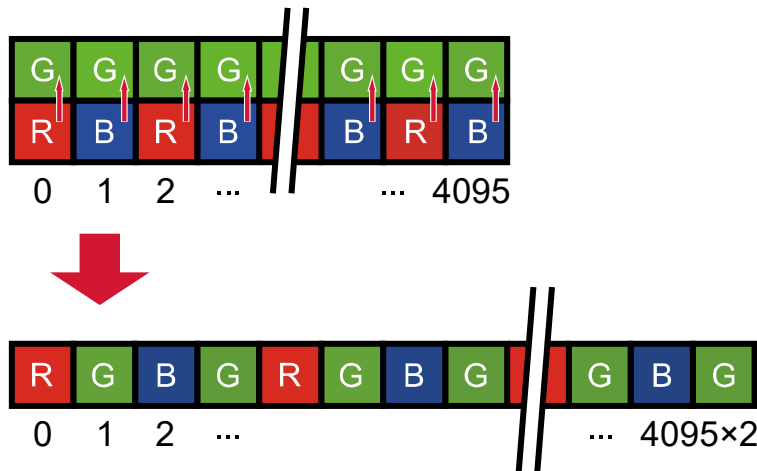
Table 9-9 Pixel Format Values

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

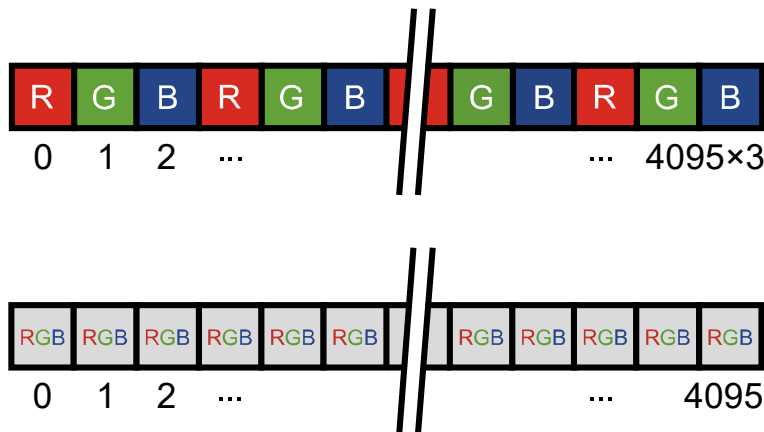
- Case **Mono 8/10/12**: Outputs green pixels on the Line0.



- 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 and VL-4K7C-M200I-2 cameras support 2 Tap, 3 Tap, 4 Tap, 8 Tap and 10 Tap Device Tap Geometry, the VL-2K7C-C100I-2 and VL-4K7C-C100I-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.

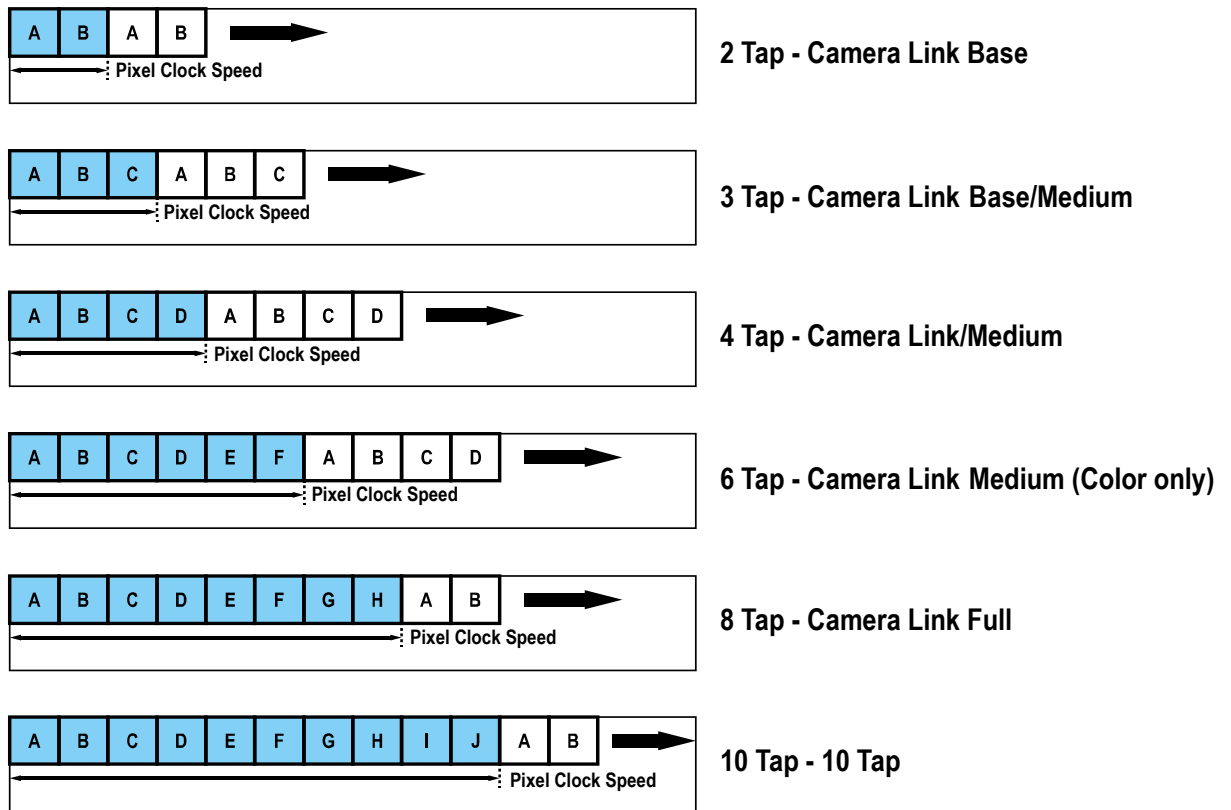


Figure 9-6 Device Tap Geometry



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

XML Parameter	Value	Description
TransportLayer DeviceTapGeometry Control	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

**Note:**



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.

**Caution!**



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.

## 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.

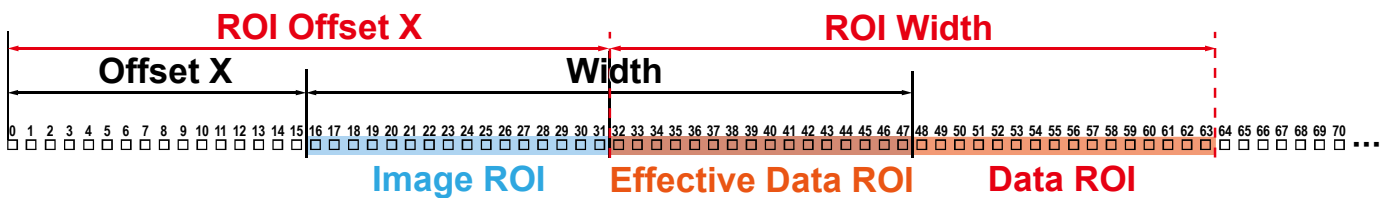


Figure 9-7 Effective Data ROI

## 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
AnalogControl    BalanceRatioSelector	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	GainSelector	Analog All
		Digital All
Gain		1.25x – 4x
		1.0x – 32.0x
BlackLevelSelector	Digital All	
BlackLevel	from -4096 to 4095	

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	OpticalBlackClamp	Off
		On

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 <b>DSNUGenerate</b> 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.



**Note:**

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

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.

**Note:**



- 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.

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 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
DigitalIIOControl	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.
UserOutputValue	FALSE	Sets the bit state of the line to Low.	
	TRUE	Sets the bit state of the line to High.	

Table 9-19 XML Parameters related to Digital I/O Control

Outputs pulse signals indicating the current exposure time.

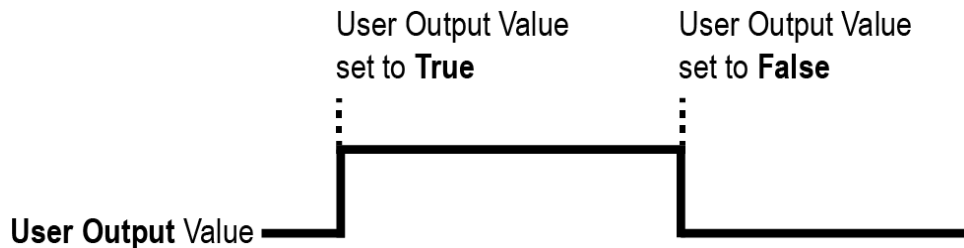


Figure 9-8 User Output

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.

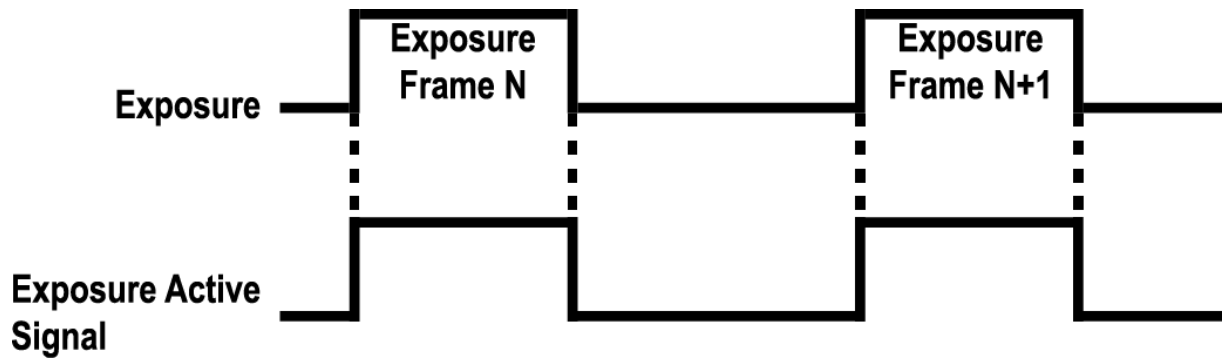


Figure 9-9 Exposure Active Signal

### 9.17 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.

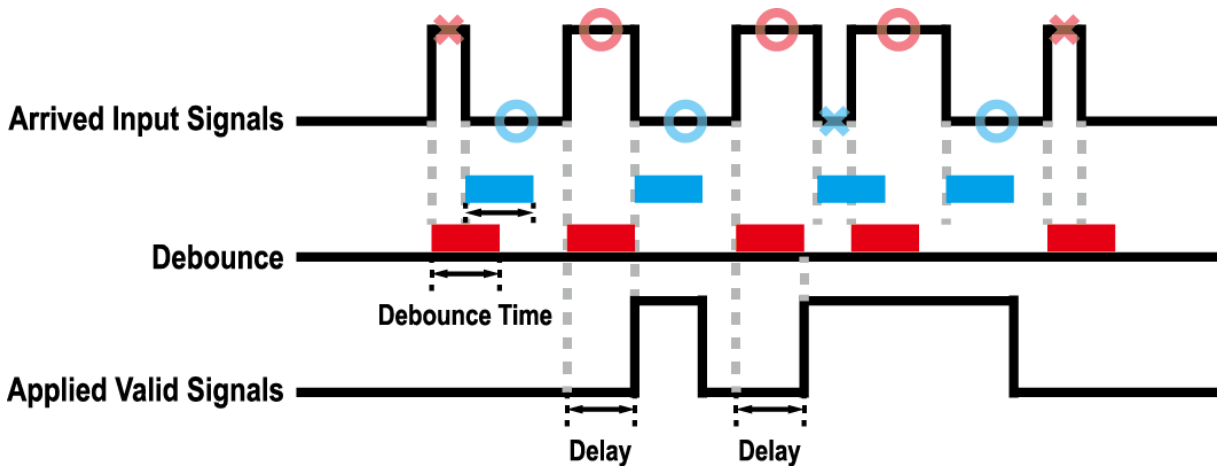


Figure 9-10 Debounce

### 9.18 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 DeviceTemperatureSelector	Mainboard	Sets a temperature measuring spot to the mainboard.
DeviceTemperature	-	Displays device temperature in Celsius.

Table 9-20 XML Parameters related to Device Temperature

### 9.19 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 9-21 Status LED

### 9.20 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	Disables the Test Pattern feature.
	GreyHorizontalRamp	Sets to Grey Horizontal Ramp.
	GreyDiagonalRamp	Sets to Grey Diagonal Ramp.
	GreyDiagonalRampMoving	Sets to Grey Diagonal Ramp Moving.
	SensorSpecific	Sets to the Test Pattern generated by the image sensor.

Table 9-22 XML Parameter related to Test Pattern



Figure 9-11 Grey Horizontal Ramp

## 9.21 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 9-23 XML Parameter related to Reverse X



Figure 9-12 Original Image



Figure 9-13 Reverse X Image

## 9.22 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.
	CounterEventSource	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.
	CounterEventActivation	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.
	CounterResetActivation	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.
	CounterValueAtReset	-	Displays the value of the Counter when it was reset by the Counter Reset command.

XML Parameters	Value	Description	
CounterAnd TimerControl	CounterDuration	1 –	Sets the duration or number of events to count before the Counter ends.
	CounterStatus	-	Displays the current status of the Counter.
	CounterTriggerSource	Off	Disables the Counter Trigger Source function.
		Exposure Active	Uses the Exposure Active signal as Trigger Source of Counter.
		Frame Active	Uses the Frame Active signal as Trigger Source of Counter.
		CC1	Uses the CC1 signal as Trigger Source of Counter.
		Line0	Uses the Line0 signal as Trigger Source of Counter.
	CounterTriggerActivation	RisingEdge	Starts Counter on the rising edge of the selected Counter Trigger Source signal.
		FallingEdge	Starts Counter on the falling edge of the selected Counter Trigger Source signal.
		AnyEdge	Starts Counter on the rising/falling edge of the selected Counter Trigger Source signal.
LevelHigh		Resets the Counter if the level of the selected Counter Trigger Source signal is High.	
LevelLow		Resets the Counter if the level of the selected Counter Trigger Source signal is Counter.	

Table 9-24 XML Parameters related to Counter Control

## 9.23 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.

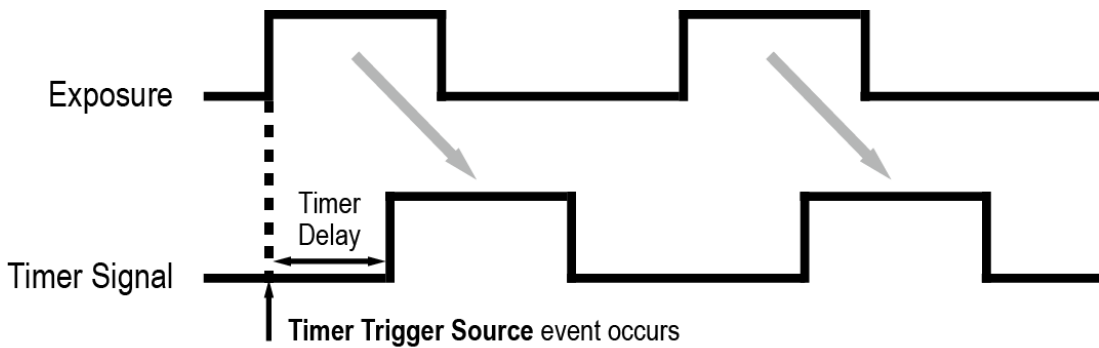
XML Parameters	Value	Description	
CounterAnd TimerControl	TimerSelector	Timer0	Selects a Timer to configure.
	TimerDuration	1 - 60,000,000 $\mu$ s	Sets the duration of the Timer output signal to be used when Timer Trigger Activation is set to Rising / Falling Edge.
	TimerDelay	0 - 60,000,000 $\mu$ s	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 9-25 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

### 9.24 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 9-26 XML Parameter related to Device User ID

### 9.25 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 9-27 XML Parameter related to Device Reset

## 9.26 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.

## 9.27 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 9-28 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.

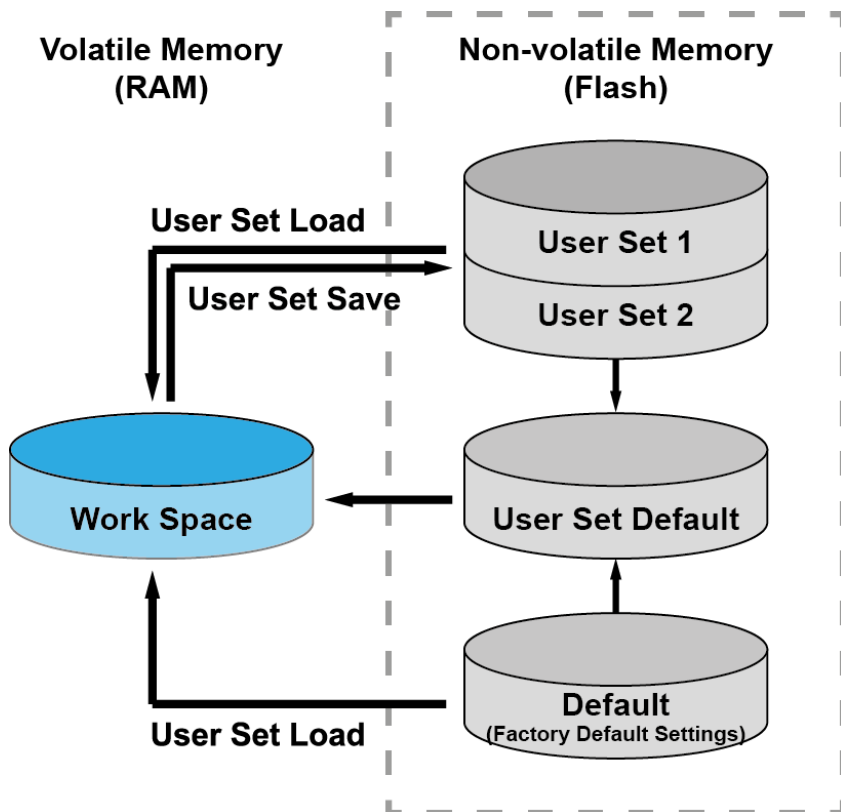


Figure 9-15 User Set Control

## 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.

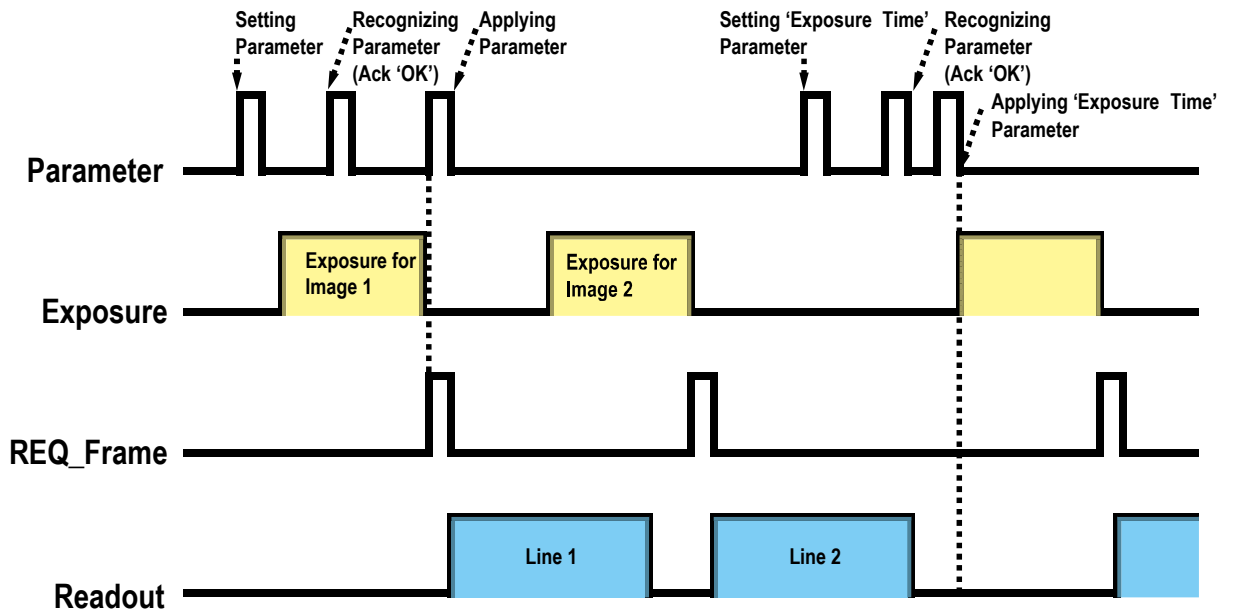


Figure 10-1 Actual Runtime of Parameters

## 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](#).

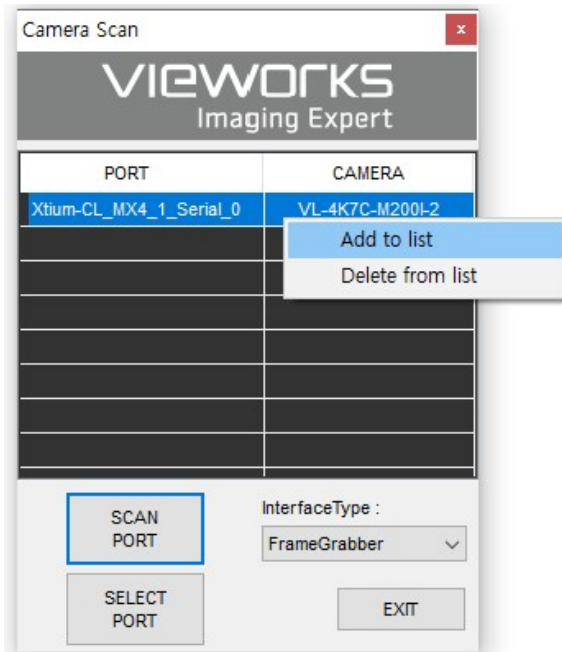


Figure 10-2 Add to list in the Camera Scan window

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.

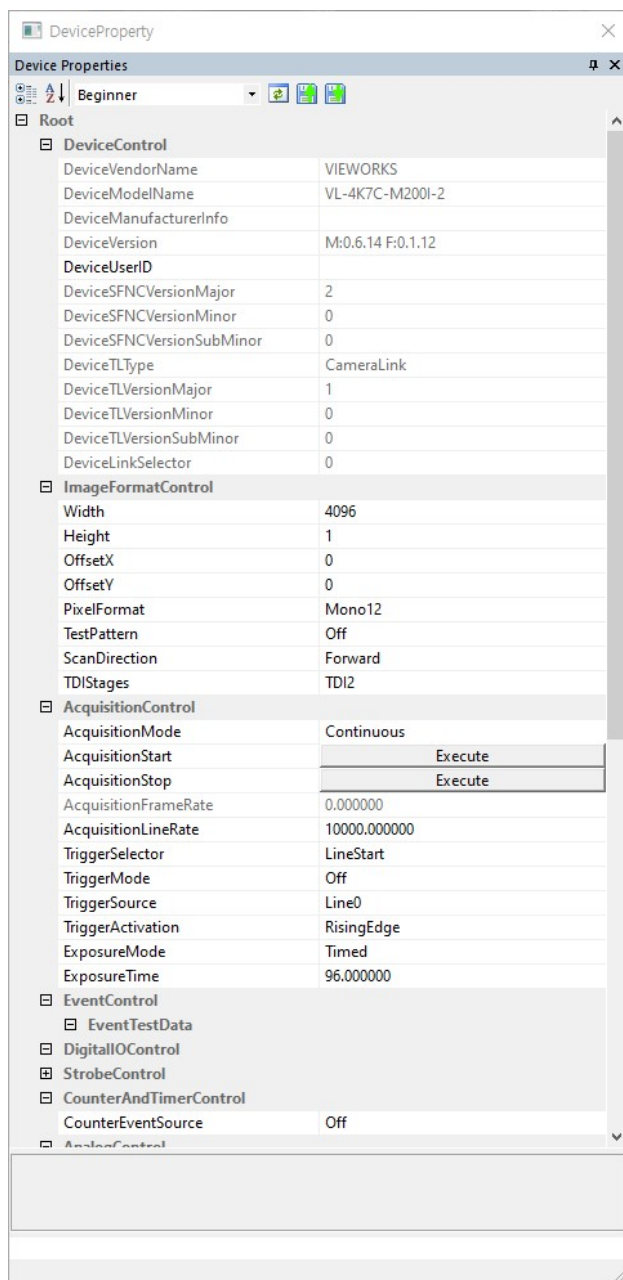


Figure 10-3 Device Property

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.

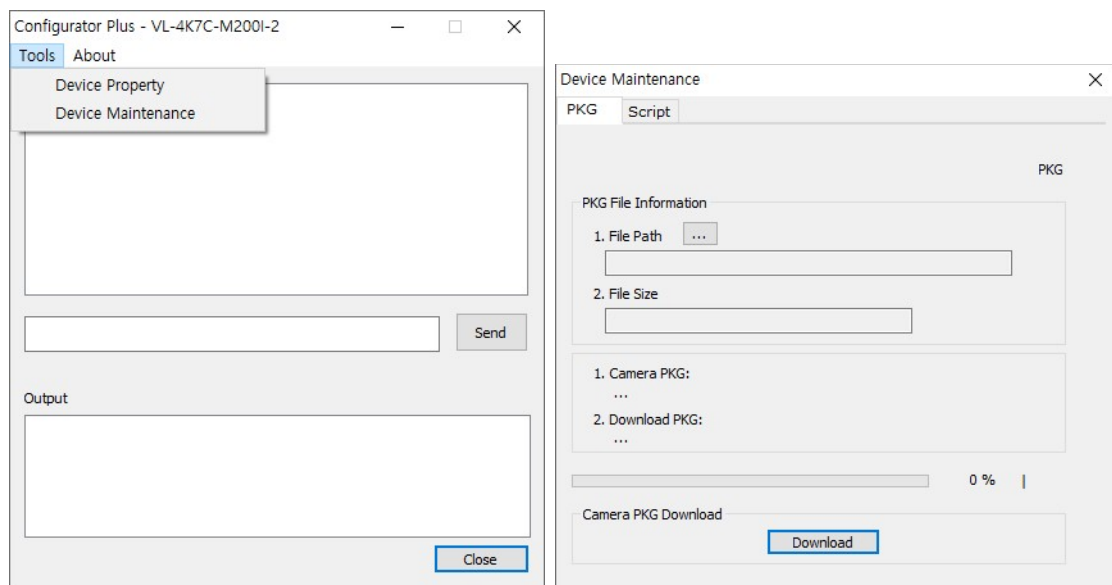


Figure 10-4 Configurator Plus and Device Maintenance



## 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 Get Trigger Multiplier	stml n gtml	OK n	Sets the Trigger Multiplier rate. n: 1 - 1024
Set Trigger Divider Get Trigger Divider	stdv n gtdv	OK n	Sets the Trigger Divider rate. n: 1 - 1024
Get Trigger Ratio	grr	n	Displays the Trigger Ratio
Set Trigger Rescaler Filter Size Get Trigger Rescaler Filter Size	srf 0 1 2 3 4 5 grf	OK 0 1 2 3 4 5	Sets the Trigger Rescaler Filter Size 0: SIZE16 1: SIZE32 2: SIZE64 3: SIZE 128 4: SIZE 256 5: SIZE512
Set Exposure Mode Get Exposure Mode	sem 0 1 gem	OK 0 1	Sets an exposure mode. 0: Timed 1: TriggerWidth
Set Exposure Time Get Exposure Time	set n get	OK n	Sets exposure time. n: exposure time in microseconds( $\mu$ s).
Set Line Selector Get Line Selector	slns 0 1 glns	OK 0 1	Sets the Line Selector. 0: Line0 1: Line1
Set Line Inverter Get Line Inverter	slni 0 1 glni	OK 0 1	Sets the Line Inverter. 0: deactivates the Line Inverter. 1: activates the Line Inverter.
Set Line Source Get Line Source	slnc n glnc	OK n	Sets the Line Inverter. 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( $\mu s$ , 0 – 1,000,000 $\mu s$ )
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	sctl n gctl	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	gct	String	Displays the temperature in Celsius.
Reset Hardware	rst	-	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:

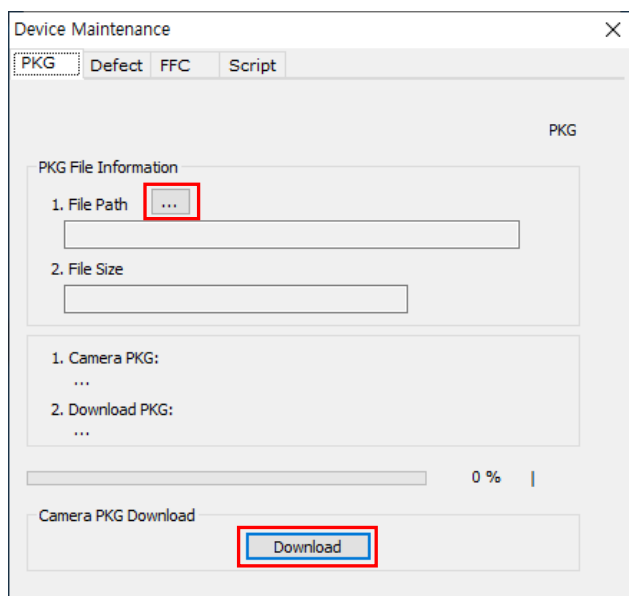
- If no image is displayed on your computer,
  - Ensure that all cable connections are secure.
  - Ensure that the power supply is properly connected.
  - Ensure that trigger signals are applied correctly when you operate the camera with trigger signals.
  
- If images are not clear,
  - Ensure the camera 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 **Download** 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 **OK** button to close the confirmation.

## Appendix B. Index

### 4

4-pin connector.....31

### 6

6-pin connector.....30

### A

acquisition control.....33

Acquisition Mode parameter .....33

Acquisition Start command .....33

Acquisition Stop command.....33

any edge.....36

application.....6

Areascan mode .....44

### B

back panel.....27

Backward parameter .....47

BGR mode, way to output pixel formats ..... 53

BGR, way to output pixel formats..... 53

bilinear pixel .....46

BiRGB mode, way to output pixel formats..... 53

BiRGB, way to output pixel formats ..... 53

block diagram.....23

**C**

camera control .....	76
camera ON&OFF .....	71
Camera Scan window .....	76
camera's temperature, parameters.....	65
CC1 Trigger .....	37
CC1 trigger signal.....	34
color camera's pixel formats.....	52
color sensor pixel .....	46
communication setting .....	74
Configurator .....	6
Configurator execution.....	76
Configurator Plus window .....	78
connecting a camera.....	26
controlling cameras.....	76
controlling parameters .....	76

**D**

Defective Pixel Map download.....	78
Device Maintenance window.....	78
DeviceProperty window.....	77
dimension.....	25
direction input .....	32
DSNU data, generation.....	60

**E**

Effective Data ROI, determination.....	57
Exposure Offset .....	43
external trigger signal.....	38

**F**

falling edge .....	36
Forward parameter .....	47
FPGA file upgrade .....	78
Free-Run .....	34

**G**

gain value, setting.....	59
generating line start trigger signals.....	34

**H**

heat dissipation.....	25
Hirose .....	30, 31
Hirose 4-pin connector .....	31
Hirose 6-pin connector .....	30
housing .....	25

**I**

inputting information of user's choice .....	71
--	----

**L**

LED status.....66

line rate for each model .....42

Line0 signal.....34

Linescan mode..... 44, 45

**M**

M42 mount .....42

MCU file upgrade.....78

Mono 8/10/12, way to output pixel formats.....53

Mono mode, way to output pixel formats .....53

monochrome camera’s pixel formats.....52

mounting.....25

**N**

number of Integration Stage .....45

number of TDI Stage.....45

**O**

offset to pixel..... 59

offset value, setting ..... 59

output of pixel format, BGR ..... 53

output of pixel format, BiRGB ..... 53

output of pixel format, Mono 8/10/12 ..... 53

output of pixel format, Mono mode..... 53

output of pixel format, RGB ..... 53

**P**

parameter control..... 76

Pixel Format setting

    RGB.....46

Pixel Format setting

    Mono.....46

Pixel Format setting

    BGR.....46

Pixel Format setting

    RGBG .....46

preface.....3, 6

PRNU .....61

product ..... 6

**Q**

quantum efficiency..... 24

**R**

reset physically .....	71
RGB intensities, adjusting .....	58
RGB mode, way to output pixel formats .....	53
RGB, way to output pixel formats .....	53
rising edge .....	36

**S**

scan direction of an image sensor .....	47
schematic diagram .....	32
SDR connector .....	27, 28
serial communication setting .....	74
signal period of trigger .....	39
specification .....	21
strobe output .....	32

**T**

Target Level AUTO .....	62
TDI Stages parameter .....	45
Timed .....	40
Timed exposure mode .....	40
Trigger Activation parameter .....	36
trigger input .....	32
Trigger Mode parameter .....	34
Trigger Selector parameter .....	34
Trigger Source parameter .....	36

**U**

upgrading FPGA files .....	78
upgrading MCU files .....	78
upgrading XML files .....	78
upgrading files .....	78

**V**

VL-2K7C-C100I-2 specification .....	22
VL-2K7C-M200I-2 .....	44
VL-2K7C-M200I-2 specification .....	21
VL-4K7C-C100I-2 specification .....	22
VL-4K7C-M200I-2 .....	44
VL-4K7C-M200I-2 specification .....	21

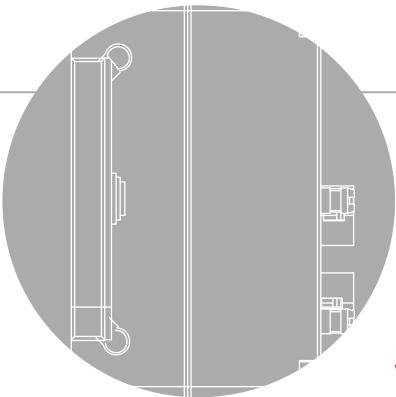
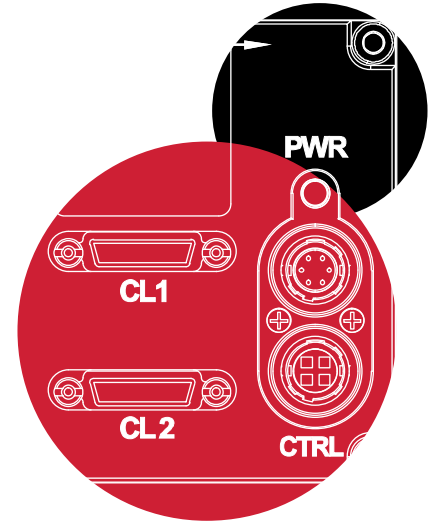
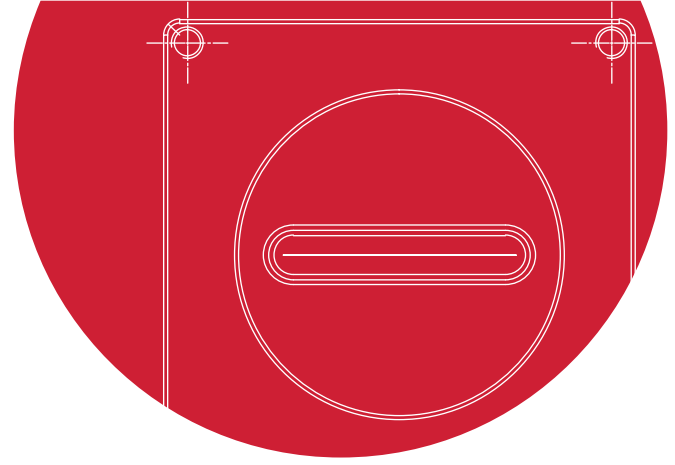
## X

XML file upgrade .....	78	LineActive.....	63
XML parameter		LineActive, (CounterEventSource) .....	69
BalanceRatio .....	58	LineInverter .....	63
BalanceRatioSelector .....	58	LineSelector .....	63
BalanceWhiteAuto.....	58, 59	LineSource .....	63
BinningHorizontal .....	49, 50, 51	LineTrigger0 .....	69
BinningHorizontalMode .....	49, 50, 51	Mainboard .....	65
BinningSelector.....	49, 50, 51	OffsetX.....	48
BinningVertical.....	49, 50, 51	OffsetY.....	48
BinningVerticalMode .....	49, 50, 51	Once of BalanceWhiteAuto.....	58
CameraLink .....	56	OpticalBlackClamp .....	59
CameraLinkClock .....	56	PixelFormat.....	52
CameraLinkClockFrequency.....	56	PRNU Generate.....	61
CounterAndTimeControl.....	69, 70	PRNU Selector.....	61
CounterDuration .....	69	PRNU Load .....	61
CounterEventActivation .....	69	PRNUMode .....	61
CounterEventSource .....	69	PRNUSave .....	61
CounterReset.....	69	PRNUTargetLevel.....	61
CounterResetSource.....	69	ReverseX.....	67
CounterSelector.....	69	RisingEdge .....	69
CounterStatus.....	69	ROI setting .....	48
CounterValue.....	69	Scan Direction.....	47
CounterValueAtReset .....	69	SensorSpecific.....	66
Device Reset.....	71	TargetLevelAUTO.....	61
DeviceScanType .....	44	TDI Stages .....	45
DeviceTapGeometry.....	55	TestPattern .....	66
DeviceTemperature .....	65	Timer0Active .....	63
DeviceTemperatureSelector.....	65	TimerDelay .....	70
DeviceUserID.....	71	TimerDuration.....	70
DigitalIOControl .....	63	TimerReset .....	70
DSNUGenerate.....	60	TimerSelector .....	70
DSNULoad .....	60	TimerTriggerActivation.....	70
DSNUSave .....	60	TimerTriggerSource.....	70
FallingEdge .....	69	Trigger Ratio .....	39
FrameActive.....	63	TriggerRescalerFilter .....	39
GreyDiagonalRamp .....	66	UserDefault .....	72
GreyDiagonalRampMoving.....	66	UserOutput0.....	63
GreyHorizontalRamp .....	66	UserOutputValue .....	63
Line 0 .....	63	UserSet1 .....	72
Line 1 .....	63	UserSet2.....	72
		UserSetControl.....	72
		UserSetLoad .....	72
		UserSetSave.....	72
		UserSetSelector.....	72
		WhiteBalanceAuto .....	57









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