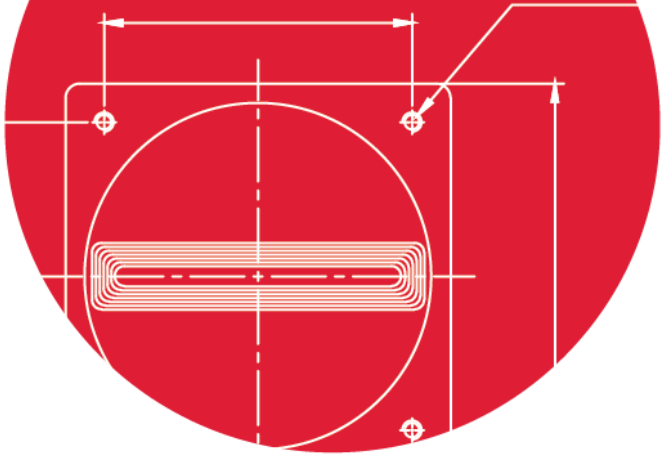


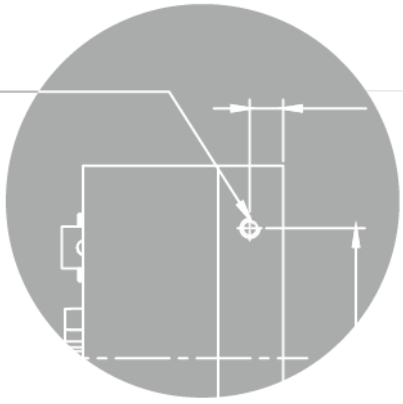
VL series

User Manual

English

VL-8K7C-C80F-2

CAMERA Link



vieworks

Revision History

Version	Date	Description
1.0	2021-04-30	Initial release

Contents

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 temperatures.

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, 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.

Procedure for Cleaning the Sensor

If you have dust or foreign matter on the sensor surface, follow the procedure 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.

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

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.

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.

4 Package Components

Package Components

VL-8K7C-C80F-2 with M72 × 0.75 mount

5 Product Specifications

5.1 Overview

The VL-8K7C-C80F-2 is Vieworks' first CMOS color line scan camera which offers color images based on a dual line 7 ㎛ × 7 ㎛ architecture with RGB Bayer filter arrayed pixels. The VL-8K7C-C80F-2 camera delivers a maximum line rate of 80 ㎑ at 8k resolution. This camera features exposure control with 100× anti-blooming and is available with the Camera Link interface. Featuring high sensitivity and high speed, this camera is ideal for wide range of demanding applications such as flat panel display inspection, printed circuit board inspection, and high-performance document scanning.

Main Features

- CMOS Line Scan
- Max. 8 k Pixel Resolution
- 100% Fill Factor
- Exposure Control
- 100× Anti-blooming
- Camera Link Interface (Base / Medium / Full Configuration)
- Programmable User Setting Commands
- Pre-emphasis (up to 10 meters at 85 ㎒ Pixel Clock)
- Field Update Firmware by Configuration Tool
- DSNU/PRNU Correction
- Adjustable Gain and Offset
- Test Pattern

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 VL-8K7C-C80F-2 camera are as follows.

Specification		VL-8K7C-C80F-2
Active Image (H × V)		8192 × 2
Sensor (AMS)		Dragster DR-2x8k-7 RGB Linear CMOS
Pixel Size		7.0 μm × 7.0 μm
Max. Line Rate	2 Tap	20.37 kHz
	3 Tap	29.41 kHz
	4 Tap	40.03 kHz
	8 Tap	80.32 kHz
Camera Link Pixel Clock		50 / 60 / 70 / 85 MHz
Video Output		2, 3, 4 or 8 Tap Output
Data Format		8 bit (2 / 3 / 4 / 8 Tap), 10 bit (2 / 4 Tap) or 12 bit (2 / 4 Tap)
Dynamic Range		56 dB
Max. SNR		37 dB
Dark Noise		14 e-
Image Direction		CC3 or Programmable
Trigger Mode		Free-Run, External Sync, External Sync Converter
Trigger Source		External or CC1
Exposure Time		2.00 ~ 10000.00 μs (0.01 μs step)
Line Period	2 Tap	49.09 ~ 10000.00 μs
	3 Tap	34.00 ~ 10000.00 μs
	4 Tap	24.98 ~ 10000.00 μs
	8 Tap	12.45 ~ 10000.00 μs
Black Level		0 ~ 2048 LSB at 12 bits
Gain Control		Digital Gain: 1.00× ~ 32.00×
Camera Interface		Camera Link (Base/Medium/Full)
Max. Cable Length		10 m (@ 85 MHz, Standard Camera Link Cable)
External Trigger		External, 3.3 V – 5.0 V
Software Trigger		Camera Link CC1, Programmable Exposure

Table 5.1 Specifications of VL-8K7C-C80F-2 (continuous)

Specification		VL-8K7C-C80F-2
Lens Mount		M72 × 0.75 ㎜ (Sensor to Camera Front: 12 ㎜)
Power	External	8 ~ 28 V DC
	Dissipation	Typ. 9.0 W
Environmental		Ambient Operating: 0℃ ~ 40℃ (Housing: 0℃ ~ 60℃), Storage: -40℃ ~ 70℃
Mechanical		80 ㎜ × 80 ㎜ × 54 ㎜, 420 g

Table 5.2 Specifications of VL-8K7C-C80F-2

5.3 Camera Block Diagram

The VL-8K7C-C80F-2 camera consists of three printed circuit boards (PCB), and its block diagram is shown below.

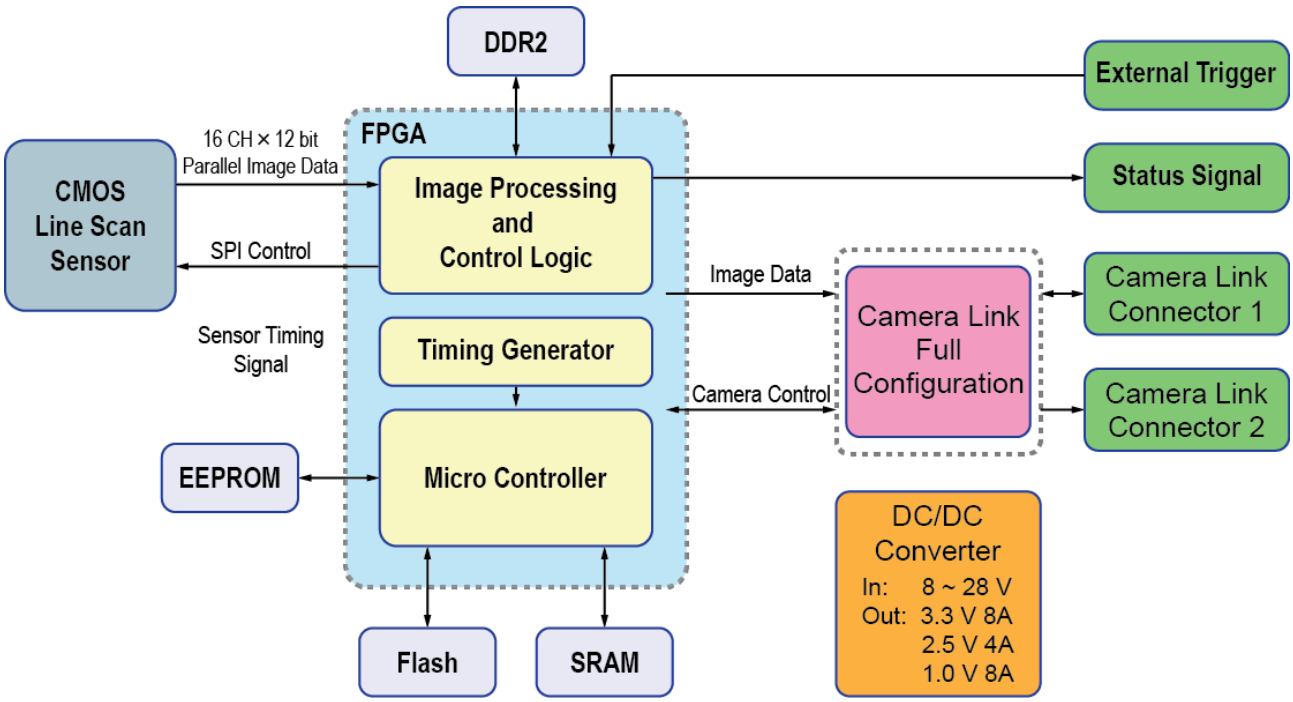


Figure 5.1 Camera Block Diagram

5.4 Spectral Transmission

The following graphs show the spectral response of the VL-8K7C-C80F-2 camera.

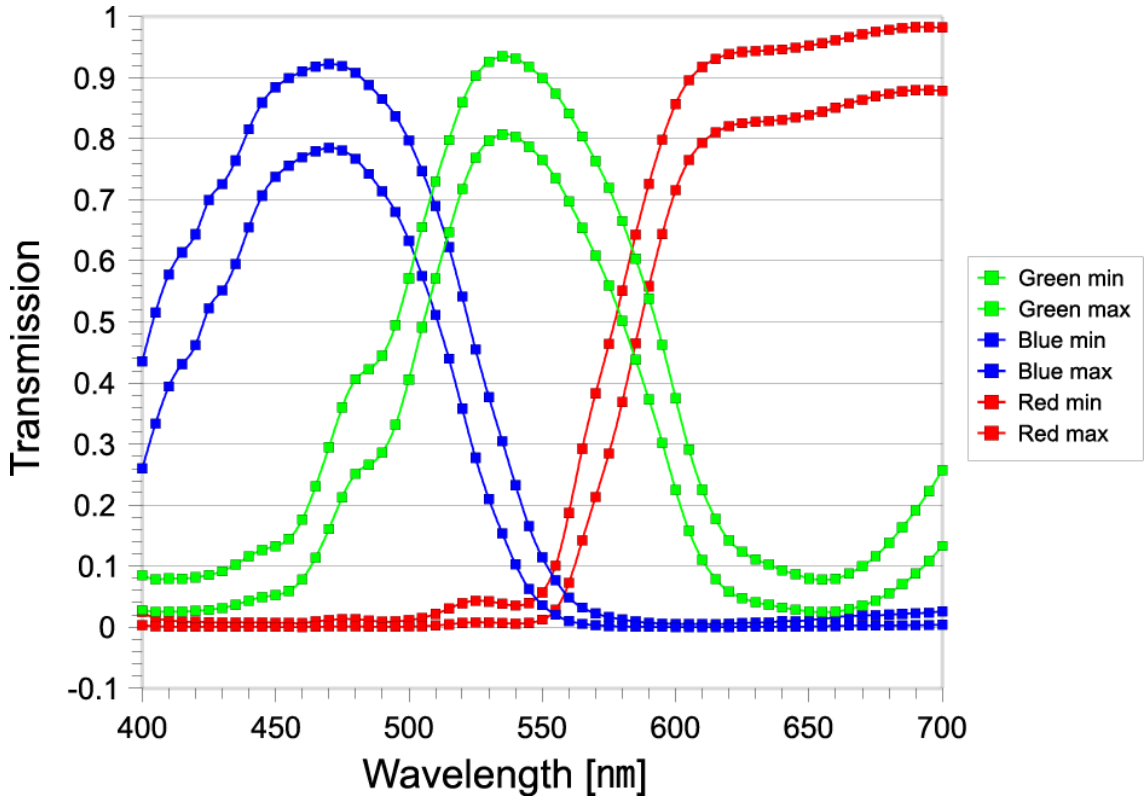


Figure 5.2 Spectral Transmission

5.5 Mechanical Specification

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

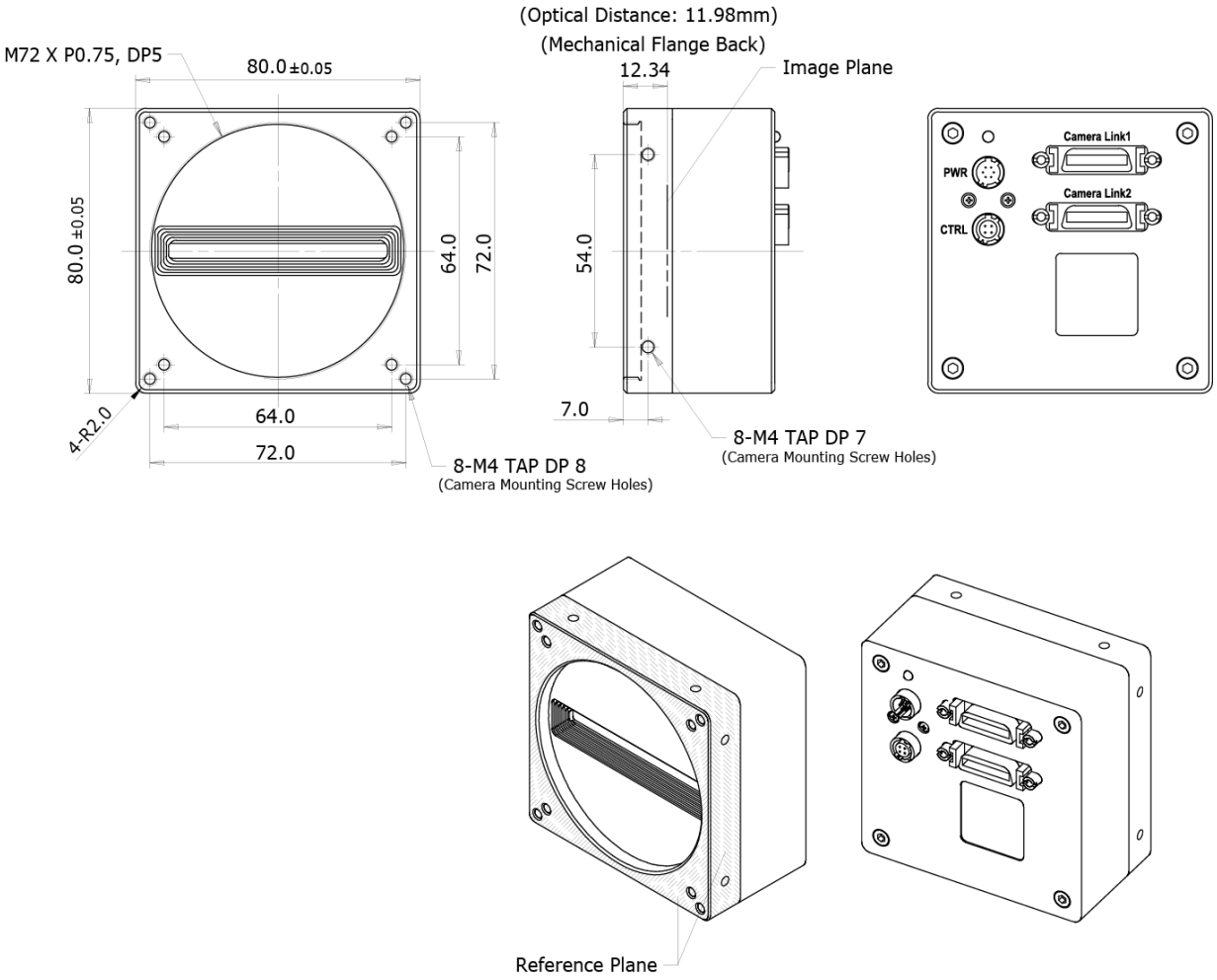


Figure 5.3 VL-8K7C-C80F-2 Mechanical Dimension

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℃ or less. Given the low power consumption of the VL 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. We strongly recommend that you 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℃. 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.

6 Connecting the Camera

The following instructions assume that you have installed a Camera Link frame grabber in your computer 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 computer is turned off.

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 Link1 connector on the camera and the other end of the Camera Link cable into the Base connector on the Camera Link frame grabber.

4. Plug one end of a Camera Link cable into the Camera Link2 connector on the camera and the other end of the Camera Link cable into the Medium/Full connector on the Camera Link frame grabber.

5. Connect the plug of the power adaptor to the power input receptacle on the camera.

6. Plug the power adaptor into a working electrical outlet.

7. Verify all the cable connections are secure.

The VL-8K7C-C80F-2 camera supports Camera Link Base, Medium and Full configurations. To operate the camera in the medium or full Camera Link configuration, you must connect the camera to the Camera Link frame grabber using two Camera Link cables. Make sure that you connect both Camera Link1 (Base) and Camera Link2 (Medium/Full) connectors on the camera to their respective connectors on the Camera Link frame grabber.

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 using Configurator.
- You can download the latest Configurator at http://www.vieworks.com.
- Please refer to your Camera Link frame grabber user manual.

7 Camera Interface

7.1 General Description

As shown in the figure below, 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 MDR Connector 1 (Camera Link Base): transmits video data and controls the camera.
- ② 26-pin MDR 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 I/O Receptacle: provides access to the camera's I/O lines.

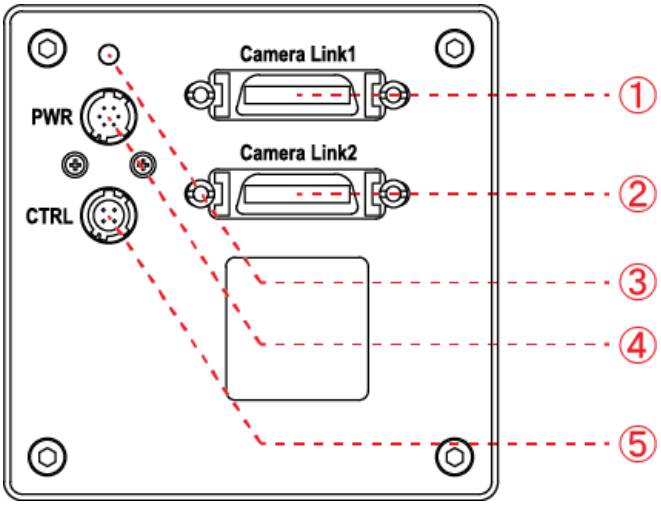


Figure 7.1 VL-8K7C-C80F-2 Back Panel

7.2 Camera Link MDR Connector

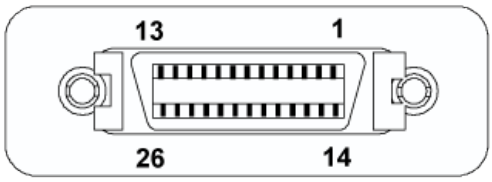


Figure 7.2 26-pin Camera Link MDR Connector

The Camera Link connectors on the camera comply with the Camera Link standard and the following lists show the pin assignments of the connectors.

PAIR List	Pin	Signal Name	Type	Description
PAIR 0	1	Ground	Ground	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	Ground	Ground	Cable Shield

Table 7.1 Pin Assignments for Camera Link Connector 1

PAIR List	Pin	Signal Name	Type	Description
PAIR 0	1	Ground	Ground	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	Ground	Ground	Cable Shield

Table 7.2 Pin Assignments for Camera Link Connector 2

Generally, Camera Link cables of up to 10 meters length can be used for the VL camera. 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:

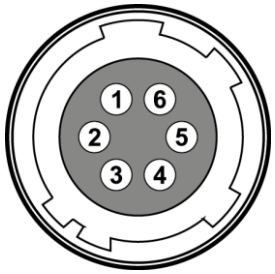


Figure 7.3 Pin Assignments for Power Input Receptacle

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

- 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 8 ~ 28 V 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.

7.4 Control I/O Receptacle

The control I/O 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:

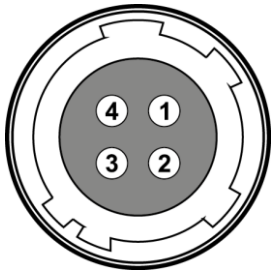


Figure 7.4 Pin Assignments for Control I/O Receptacle

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

Table 7.4 Pin Configurations for Control I/O Receptacle

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 Input Circuit

The following figure shows a trigger signal input circuit of the 4-pin connector. Transmitted trigger signal is applied to the internal circuit through a photo coupler. The minimum trigger width that can be recognized by the camera is 1 μs. If transmitted trigger signal is less than 1 μs, the camera will ignore the trigger signal.
An external trigger circuit example is shown below.

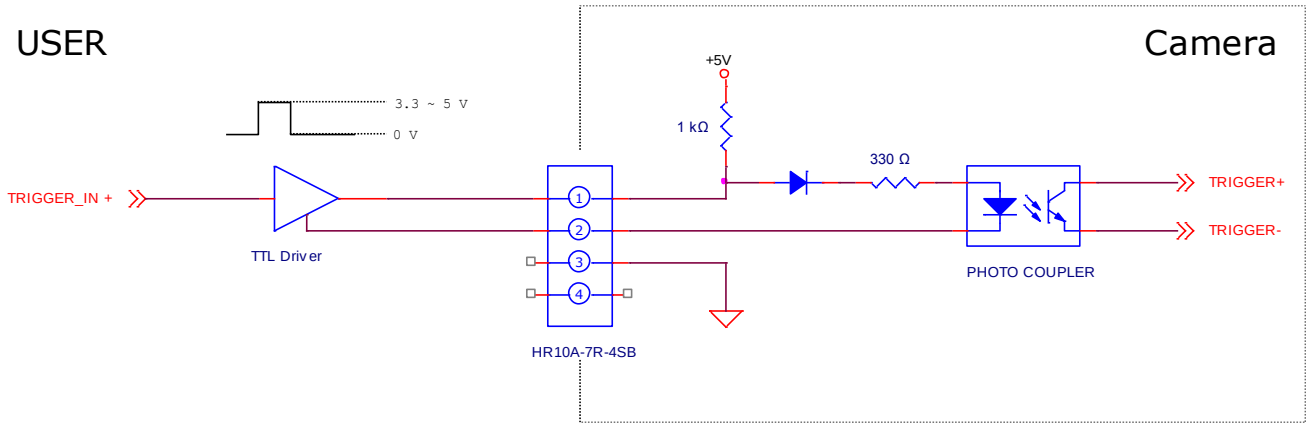


Figure 7.5 Trigger Input Schematic

7.6 Strobe Output Circuit

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

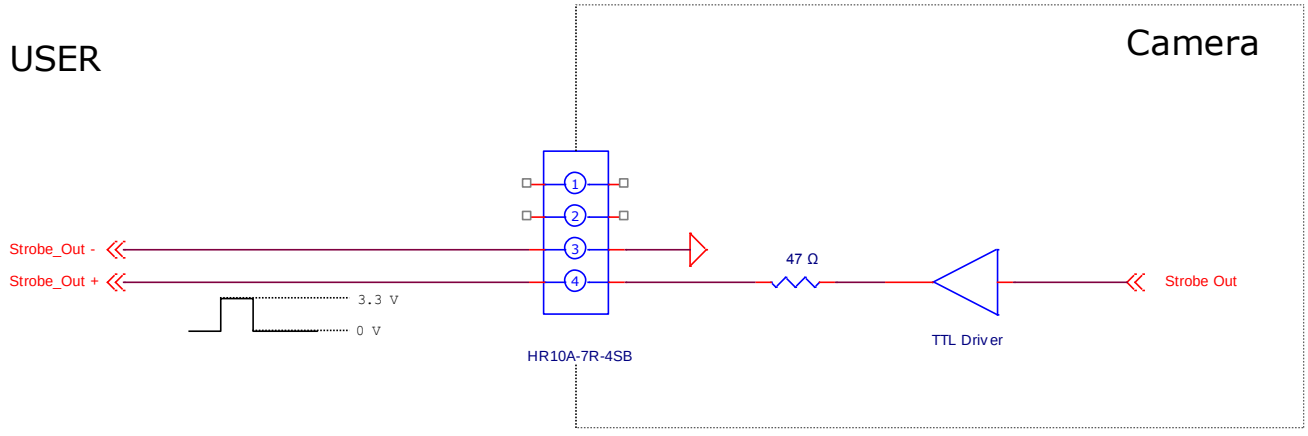


Figure 7.6 Strobe Output Schematic

8 Camera Features

8.1 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 is 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 value to 16 and the Width value to 160 as shown in the figure below. With these settings, the camera will read out and transmit pixel values for pixels 16 through 175.

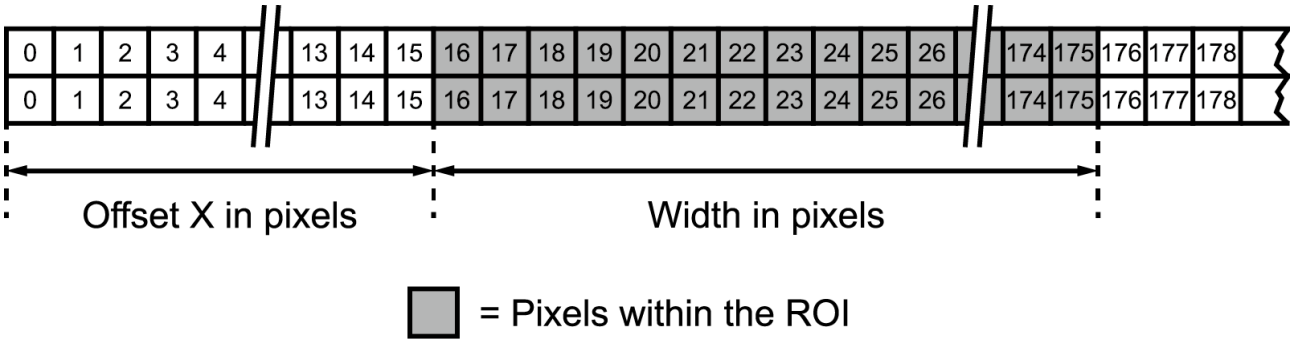


Figure 8.1 Region of Interest

The commands related to ROI are as follows.

Configurator Parameter	Command	Value	Description
Offset X	sio	-	Sets the horizontal offset from the origin to the ROI.
Width	siw	-	Sets the Width of the ROI.

Table 8.1 Commands related to ROI

8.1.1 Setting the ROI

By default, the ROI is set to use the full resolution of the camera's image sensor. You can change the size and location of the ROI by changing the Offset X and Width settings.

When you are setting the camera's region of interest, you must consider the following guidelines:

- The sum of the Offset X and Width setting values must not exceed the width of the camera's image sensor. For example, on the VL-8K7C-C80F-2 camera, the sum of the Offset X and Width settings values must not exceed 8192.
- The Offset X setting value can be set to 0 and can be increased in increments of 16. The Width setting values must be a minimum of 160 and can be set to a multiple of 16.

Your Camera Link frame grabber may place additional restrictions on how the ROI location and size must be set. Refer to your Camera Link frame grabber user manual for more information.

8.2 Bayer Filter Arrangement

The sensor used in the VL-8K7C-C80F-2 camera is equipped with a Bayer filter. With the Bayer filter, each individual pixel is covered by one of three color filters (red, green and blue) that allows only one color to strike the pixel. The pattern of the Bayer filter used in the camera is shown in the figure below.

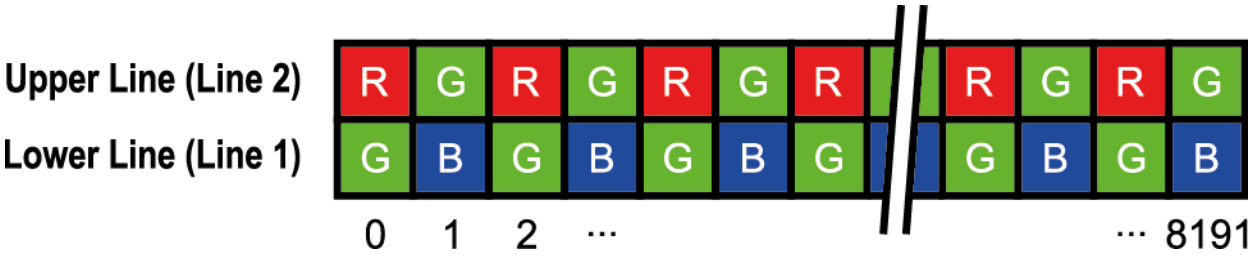


Figure 8.2 Bayer Filter Arrangement

8.3 Image Direction

By using the **Image Direction** feature, you need to specify a scan direction of the camera according to the direction of the object being imaged. You should set the **Image Direction** parameter to **Forward** if the object being imaged will pass Line 1(the bottom of the camera) first, and then pass Line 2 (the top of the camera). On the contrary, you should set the **Image Direction** parameter to **Backward** if the object being imaged will pass Line 2 first, and then pass Line 1.

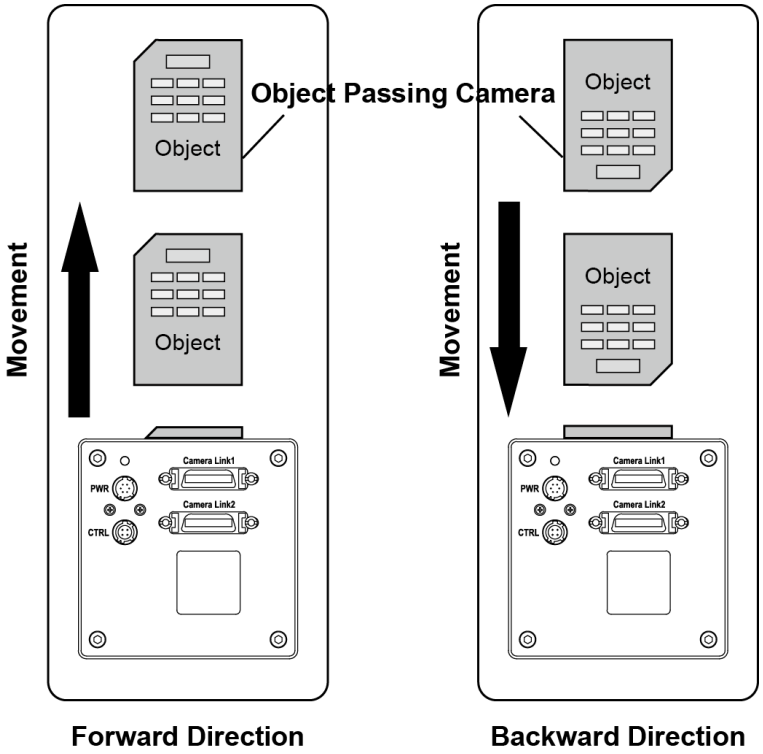


Figure 8.3 Image Direction

You can also set the Image Direction through the Camera Link CC3 (Control Port 3) port. To set the Image Direction to Forward, CC3 must be low. To set the Image Direction to Backward, CC3 must be high.
The command related to Image Direction is as follows.

Configurator Parameter	Command	Value	Description
Image Direction	sid	0: Forward	Scans images in the forward direction.
		1: Backward	Scans images in the backward direction.
		2: CC3	Specifies the scan direction using the CC3 port.

Table 8.2 Command related to Image Direction

8.4 Acquisition Start and Stop Commands

The **Acquisition Start** command (‘ast’) 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 (‘asp’) terminates the camera’s ability to acquire images.

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 received.

When the camera is powered on or reset and operating in the Free-Run mode, it is hard to verify which line is transmitted first between line 1 and line 2. If this is the case, you must execute the **Acquisition Stop** command and then execute the **Acquisition Start** command.

8.5 Trigger Mode

The trigger mode of the camera is divided into Trigger synchronous mode and Trigger asynchronous mode (hereinafter 'Free-Run' mode) depending on its synchronization with trigger input. The trigger synchronous mode is divided into External Sync mode and External Sync Converter mode.

The commands related to Trigger Mode and Exposure are as follows.

Configurator Parameter	Command	Value	Description
Trigger Mode	stm	0: Free-Run	Sets the Trigger Mode to Free-Run.
		1: External Sync	Sets the Trigger Mode to External Sync.
		2: External Sync Converter	Adjusts the period of external trigger signals by using the Frequency Rate.
Frequency Rate	stc	0.10 ~ 100.00	Conversion rate of external trigger signals
Exposure	ses	0: Program	The exposure time is determined by the Exposure Time parameter.
		1: Pulse Width	The exposure time is determined by the pulse width of trigger signals.
		2: Edge	The exposure time is determined by the period of trigger signals.
Source	sts	1: CC1	Sets the input port of external trigger signal to the Camera Link CC1.
		2: External	Sets the input port of external trigger signal to the Control I/O receptacle.
Polarity	stp	0: Active Low	Sets the camera to begin line acquisition when the trigger signal falls.
		1: Active High	Sets the camera to begin line acquisition when the trigger signal rises.
Exp. Time	set	2.00 ~ 10,000.00	Sets the exposure time when Exposure is set to Program.
Line Period	slr	49.09 ~ 10,000.00 @ 2 Tap 34.00 ~ 10,000.00 @ 3 Tap 34.98 ~ 10,000.00 @ 4 Tap 12.45 ~ 10,000.00 @ 8 Tap	Sets the line period.

Table 8.3 Commands related to Trigger Mode and Exposure

8.5.1 Free-Run

In the Free-Run mode, an external trigger signal is not required. The camera generates trigger signals internally according to the Line Period and Exposure Time settings. In the Free-Run mode, the camera exposes and transmits lines continuously and the Line Period settings will determine the camera's line rate as follows:

$$\text{Line Rate (Hz)} = \frac{1}{\text{Line Period}}$$

In the Free-Run mode, line acquisition begins on the falling edge of the internal trigger signal as shown in the figure below. The pixels are exposed and charge is accumulated when the internal trigger signal is 'High'. Then, the pixel values are read out of the sensor on the falling edge of the internal trigger signal. The Exposure Time setting determines how long the internal trigger signal will be high and thus determines the exposure time. The exposure time can be set in a range from 2 μs up to Line Period. The exposure time may be restricted by the Line Period setting. If this is the case, you must first increase the Line Period setting to increase the exposure time.

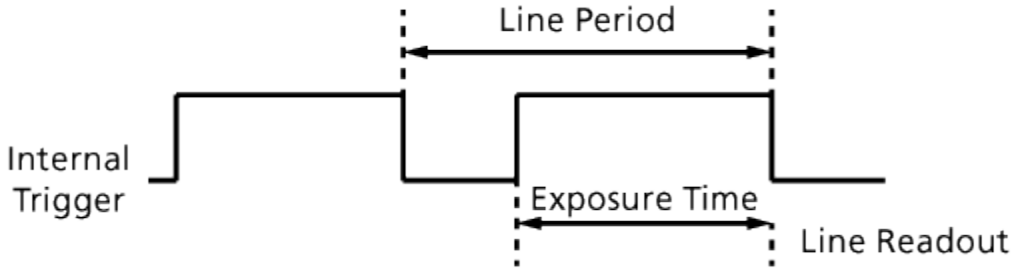


Figure 8.4 Free-Run Mode

8.5.2 External Sync

In the External Sync mode, the camera's line rate and exposure time are controlled by an external trigger signal. The external trigger signal is typically supplied to the camera by a frame grabber (CC1 Port) via the Camera Link cable or by injecting an externally generated electrical signal into the Control I/O receptacle (External).
When you operate the camera in the External Sync mode, the length of the external trigger signal period determines the camera's line rate as follows:

$$\text{Line Rate (Hz)} = \frac{1}{\text{External Trigger Period}}$$

When the camera is operating with an external trigger signal, three Exposure modes are available: Program, Pulse Width and Edge.
You can also set the Source and Polarity for the external trigger signal.

- **Source**: selects an input port of the external trigger signal between **CC1** and **External**.
- **Polarity:** selects the polarity of the external trigger signal between **Active High** and **Active Low**.

The following instructions assume that you have set the **Polarity** setting to **Active High**.

8.5.2.1 External Sync Program

When the **Exposure** setting is set to **Program**, line acquisition begins on the rising edge of the external trigger signal. The exposure starts when the external trigger signal rises, and continues as long as specified by the **Exposure Time** setting. Then, the pixel values are read out of the sensor at the end of the pre-programmed period.

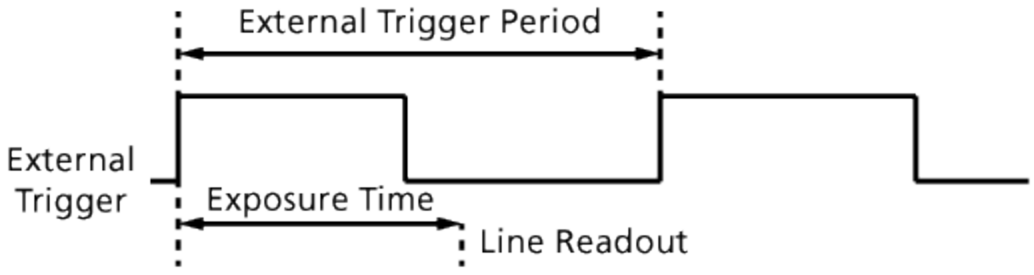


Figure 8.5 External Sync Program Mode

8.5.2.2 External Sync Pulse Width

When the **Exposure** setting is set to **Pulse Width**, line acquisition begins on the rising edge of the external trigger signal. The exposure time is determined by the time interval between the point where an external trigger signal rises and the point where the external trigger signal falls. The pixels are exposed only when the external trigger signal is High. Then, the pixel values are read out of the sensor on the falling edge of the external trigger signal as shown in the figure below.

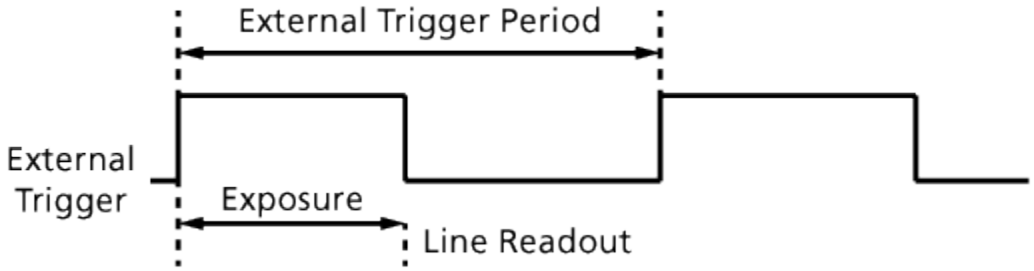


Figure 8.6 External Sync Pulse Width Mode

8.5.2.3 External Sync Edge

When the **Exposure** setting is set to **Edge**, line acquisition begins on the rising edge of the external trigger signal. The pixels are exposed and charge is accumulated over the full period of the external trigger signal (rising edge ➔ rising edge). Then, the pixel values are read out of the sensor on the rising edge of the external trigger signal as shown in the figure below.

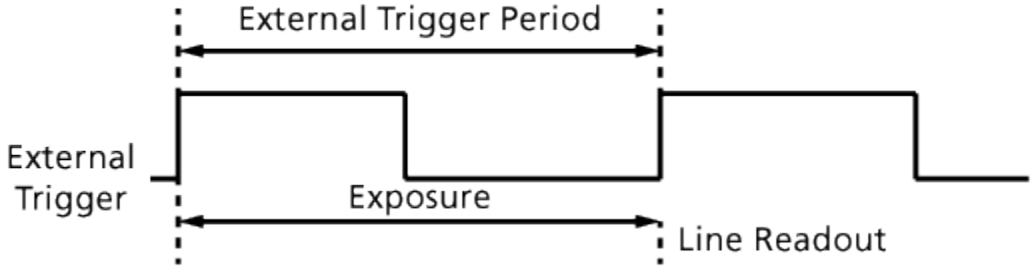


Figure 8.7 External Sync Edge Mode

8.5.3 External Sync Converter

Operation in the External Sync Converter mode is similar to the External Sync mode. In the External Sync Converter mode, however, you can adjust the period of the external trigger signal at a desired rate.
For example, if you supply the external trigger signal into the camera's Control 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 in the following manner to match the pitch of the image in vertical direction.

```
Line Rate (Hz) = External Trigger Line Rate × Trigger Converter Ratio
```

You can set the **Frequency Rate** (Trigger Converter Ratio) from 0.02 to 100.00 in increments of 0.01 by using Configurator or the 'stc' command.
In the External Sync Converter mode, two exposure modes are available: **Program** and **Edge**.

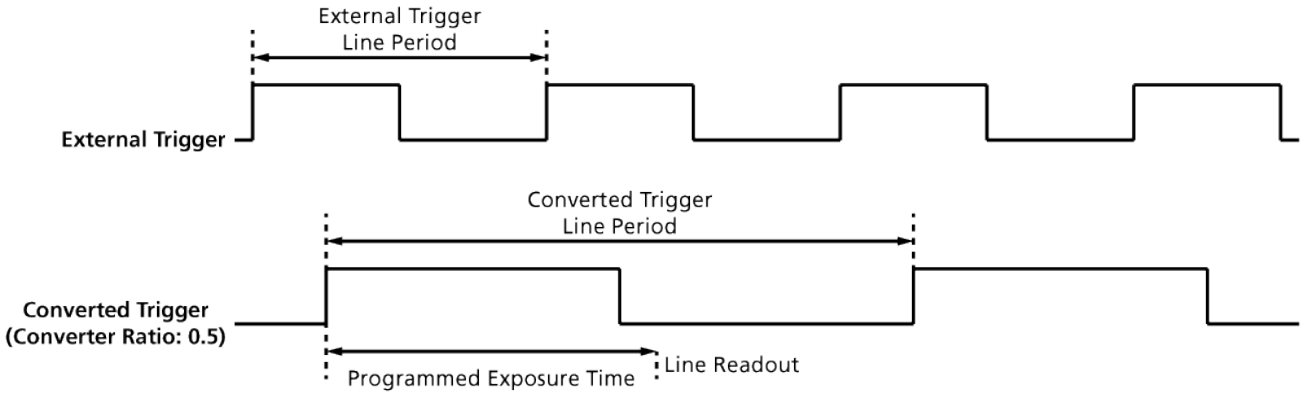


Figure 8.8 External Sync Converter

8.6 Camera Link Tap Mode

The VL-8K7C-C80F-2 camera supports 2 Tap, 3 Tap, 4 Tap and 8 Tap Camera Link Tap modes. 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 Camera Link Tap modes. The line data is transmitted in the interleaved order as shown in the figure below.

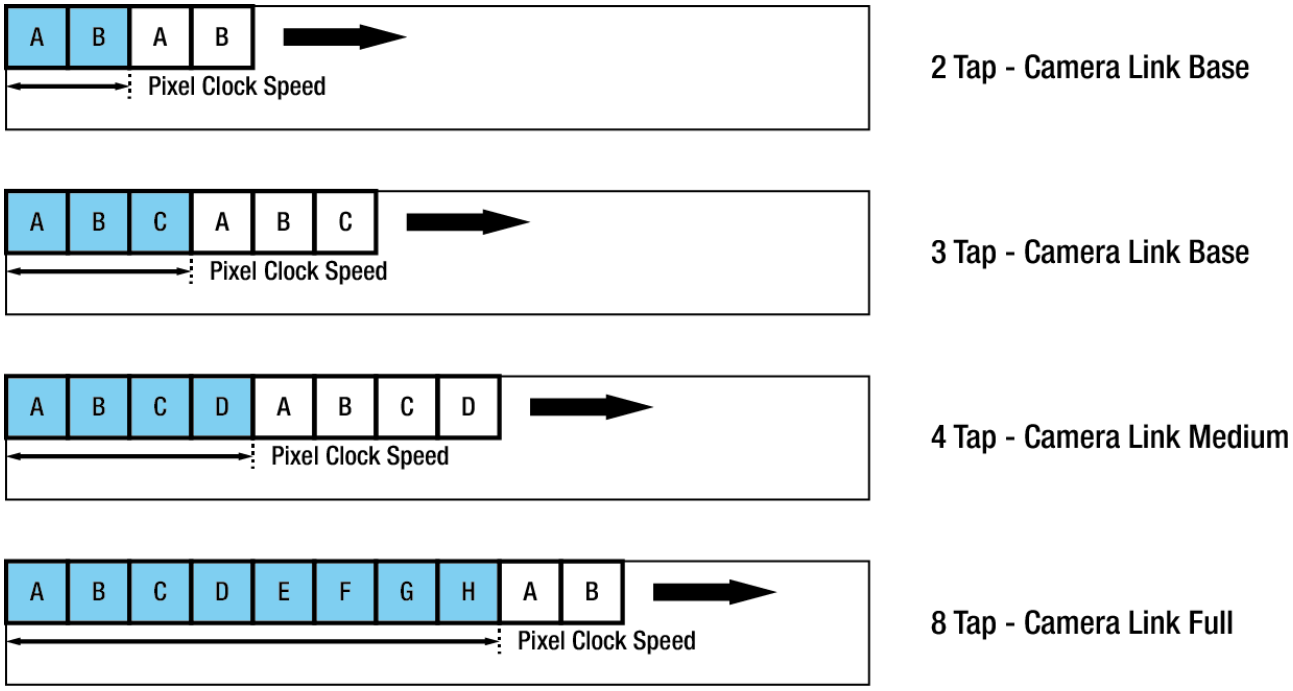


Figure 8.9 Camera Link Tap Mode

The command related to Image Direction is as follows.

Configurator Parameter	Command	Value	Description
Tap Mode	scl	0: 2 Tap	Sets the Tap Mode to 2 Tap.
		1: 4 Tap	Sets the Tap Mode to 4 Tap.
		2: 8 Tap	Sets the Tap Mode to 8 Tap.
		4: 3 Tap	Sets the Tap Mode to 3 Tap.

Table 8.4 Command related to Camera Link Tap Mode

8.7 Camera Link Pixel Clock

The VL-8K7C-C80F-2 camera provides 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 command related to Camera Link Pixel Clock is as follows.

Configurator Parameter	Command	Value	Description
N/A	sccs	0: 50 ㎒	Sets the Camera Link Pixel Clock to 50 ㎒.
		1: 60 ㎒	Sets the Camera Link Pixel Clock to 60 ㎒.
		2: 70 ㎒	Sets the Camera Link Pixel Clock to 70 ㎒.
		3: 85 ㎒	Sets the Camera Link Pixel Clock to 85 ㎒.

Table 8.5 Command related to Camera Link Pixel Clock

8.8 Data Bit

The camera processes image data in the unit of 12 bit. You can determine the pixel format (8 bits, 10 bits or 12 bits) of image data transmitted form the camera by using the Data Bit parameter. When the camera is set for 8-bit or 10-bit pixel format, the four or two least significant bits will be dropped from the overall 12 bits. You can set the 8-bit, 10-bit or 12-bit pixel format with 2 Tap and 4 Tap Camera Link Tap modes, but only the 8-bit pixel format is available with the 3 Tap and 8 Tap Camera Link Tap modes.

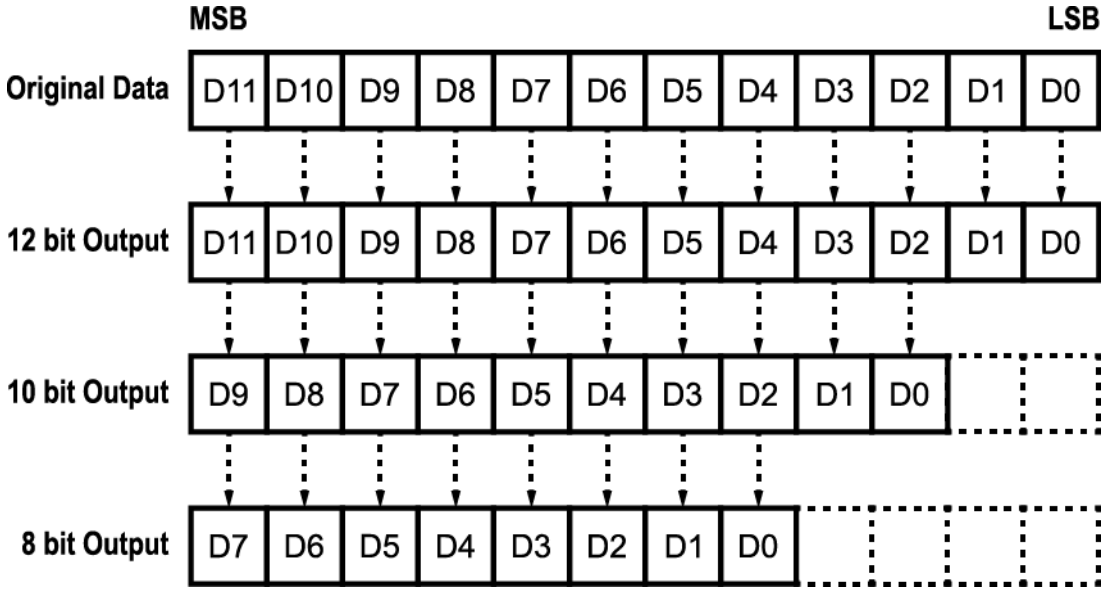


Figure 8.10 Pixel Format

The command related to Data Bit is as follows.

Configurator Parameter	Command	Value	Description
Data Bit	sdb	8	Sets the pixel format to 8 bit.
		10	Sets the pixel format to 10 bit.
		12	Sets the pixel format to 12 bit.

Table 8.6 Command related to Data Bit

8.9 Gain and Offset

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

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

The commands related to Gain and Offset are as follows.

Configurator Parameter	Command	Value	Description
Gain	sdg	1.0× ~ 32.0×	Sets a digital gain value.
Offset	sdo	0 ~ 128 @ 8 bit 0 ~ 512 @ 10 bit 0 ~ 2048 @ 12 bit	Sets a digital offset value.

Table 8.7 Commands related to Gain and Offset

8.10 Test Image

To check whether the camera operates normally or not, it can be set to output test images generated in the camera instead of the image data from the image sensor. Three types of test images are available, images with different values in horizontal direction (Test #1), images with different values in diagonal direction (Test #2), and moving images with different values in diagonal direction (Test #3).

The command related to Test Image is as follows.

Configurator Parameter	Command	Value	Description
Test Image	sti	0: None	Disables the Test Image feature.
		1: Test #1	Sets to Test #1.
		2: Test #2	Sets to Test #2.
		3: Test #3	Sets to Test #3.

Table 8.8 Command related to Test Image

Figure 8.11 Test #1

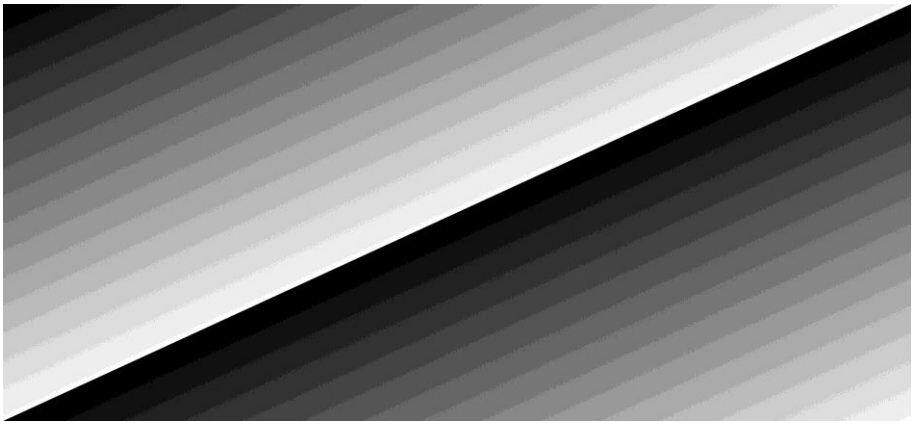


Figure 8.12 Test #2

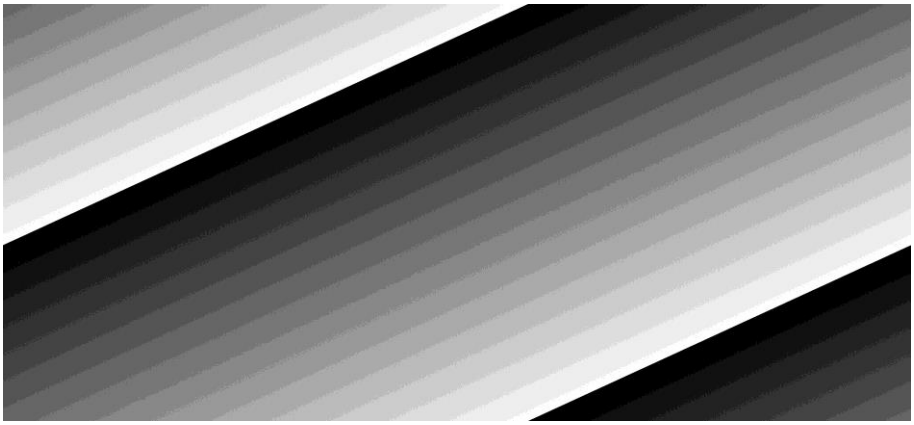


Figure 8.13 Test #3

The test image may look different because the region of the test image may vary depending on the camera's resolution.

8.11 Dark Signal Non-uniformity Correction

In theory, when a line scan 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-8K7C-C80F-2 camera provides the DSNU Correction feature and contains DSNU correction values in the Flash memory. These values are generated during the camera's factory setup procedure and they serve as default correction values until you change them.

The commands related to DSNU are as follows.

Configurator Parameter	Command	Value	Description
Generate	gdd	-	Generates DSNU correction data.
Save to Flash	sdd	-	Saves the generated DSNU correction data in the non-volatile memory.
Load from Flash	ldd	-	Loads the DSNU correction data from the non-volatile memory into the volatile memory.

Table 8.9 Commands related to DSNU

8.11.1 Generating and Saving User DSNU Correction Values

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

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. Therefore, we recommend that you set the ROI settings to use the entire width of the sensor.
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. In Configurator, click the **Generate** button to generate DSNU correction values.
5. The camera must acquire at least 1024 line images to create a set of DSNU correction values.
6. After completing 1024 line acquisitions, the generated DSNU correction values will be activated and saved in the camera's volatile memory.
7. To save the generated DSNU correction values in the camera's Flash (non-volatile) memory, click the **Save to Flash** button. The previous DSNU values saved in the memory will be overwritten.
   To disregard the generated DSNU correction values and load the previous values in the Flash memory, click the **Load from Flash** button.

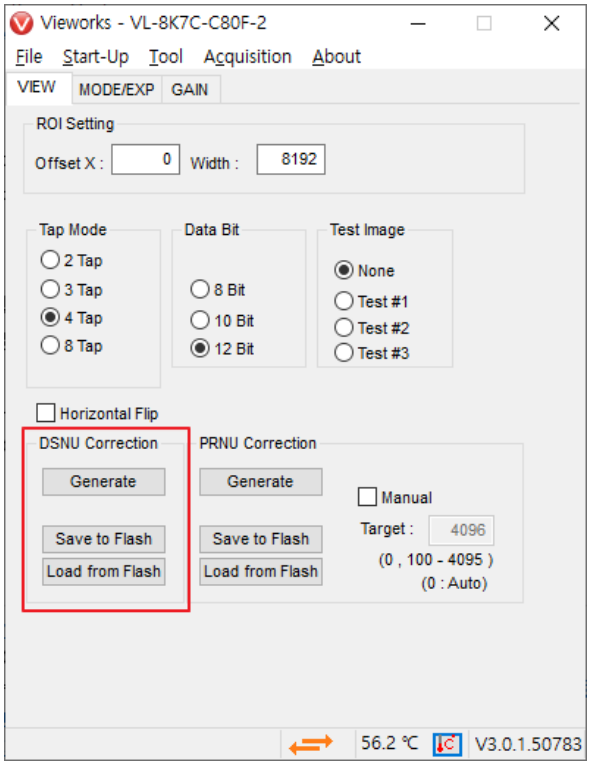


Figure 8.14 DSNU Correction

8.12 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 gray 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-8K7C-C80F-2 camera provides the PRNU Correction feature and contains PRNU correction values in the Flash memory. These values are generated during the camera's factory setup procedure and they serve as default correction values until you change them. The commands related to PRNU are as follows.

Configurator Parameter	Command	Value	Description
Generate	gpd	0	Generates PRNU correction data automatically.
		100 ~ 4095	Generates PRNU correction data by specifying the target level manually.
Save to Flash	spd	-	Saves the generated PRNU correction data in the non-volatile memory.
Load from Flash	lpd	-	Loads the PRNU correction data from the non-volatile memory into the volatile memory.

Table 8.10 Commands related to PRNU

8.12.1 Generating and Saving User PRNU Correction Values

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

- 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 exposure mode or exposure time.
- 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. Therefore, we recommend that you set the ROI setting to use the entire width of the sensor.
2. Place a uniform white target in the field of view of the camera. Adjust the optics, lighting, exposure mode and exposure time as you would for normal operation. We recommend that you make adjustments to achieve the digital output level in a range from 200 to 3000 (Data Bit: 12 bit, Gain: 1.00).

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. In Configurator, set the target level.
   - To set the target level automatically, select the **Manual** check box and then input '0', or deselect the **Manual** check box.
   - To set the target level manually, select the **Manual** check box and input the target level in a range from 100 to 4095.
5. In Configurator, click the **Generate** button 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, click the **Save to Flash** button. The previous PRNU values in the memory will be overwritten.
   To disregard the generated PRNU correction values and load the previous values in the Flash memory, click the **Load from Flash** button.

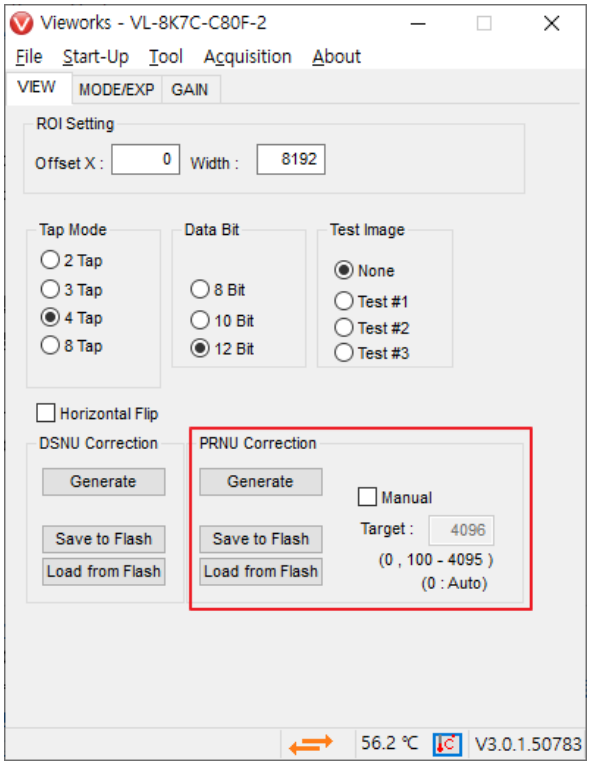


Figure 8.15 PRNU Correction

8.13 Temperature Monitor

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

The command related to the device temperature is as follows.

Command	Description
gct	Displays device temperature in Celsius.

Table 8.11 Command related to Device Temperature

8.14 Status LED

A green LED is installed on the back panel of the camera to inform the operation status of the camera. LED status and corresponding camera status are as follows.

Status LED	Descriptions
Continuous On	The camera operates in the Free-Run mode.
Repeat On for 0.5 second, Off for 0.5 second	The camera operates under the control of external sync signals.
Repeat On for 1 second, Off for 1 second	The camera outputs test images.
Repeat On for 0.25 second, Off for 0.25 second	The camera operates under the control of external sync signals and outputs test images.

Table 8.12 Status LED

8.15 Horizontal Flip

The Horizontal Flip feature let you flip the image horizontally. This feature is available in all camera operation modes except the Test Image mode. The command related to Horizontal Flip is as follows.

Configurator Parameter	Command	Value	Description
Horizontal Flip	shf	0	Disables the Horizontal Flip feature.
		1	Flips images horizontally.

Table 8.13 Command related to Horizontal Flip

Figure 8.16 Original Image

Figure 8.17 Horizontally Flipped Image

8.16 Strobe Out

The camera can output Strobe Out signals. The signal goes high when the exposure time for each line 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 to check whether the camera is in an exposure status.

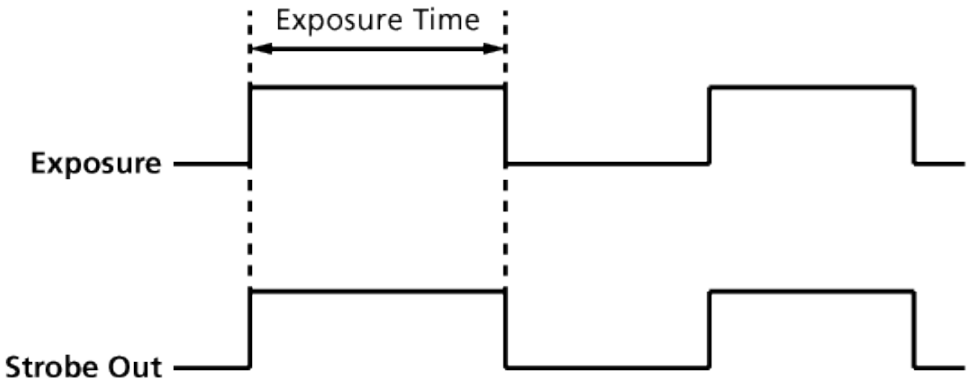


Figure 8.18 Strobe Out Signal

8.17 Field Upgrade

The camera provides a feature to upgrade the camera's firmware and FPGA logic through the Camera Link interface rather than disassemble the camera in the field. Refer to Appendix A for more details about how to upgrade.

8.18 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 commands related to User Set Control are as follows.

Configurator Menus	Command	Value	Description
Load Setting	lcf	0: Factory Space	Loads the Factory Default Settings to the camera.
		1: User 1 Space	Loads the User 1 Settings to the camera.
		2: User 2 Space	Loads the User 2 Settings to the camera.
Save Setting	sct	1: User 1 Space	Saves the current settings to User 1 Setting.
		2: User 2 Space	Saves the current settings to User 2 Setting.
Start-Up	sci	0: Factory Setting	Applies the Factory Default Settings when reset.
		1: User 1 Setting	Applies the User 1 Settings when reset.
		2: User 2 Setting	Applies the User 2 Settings when reset.

Table 8.14 Commands 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.

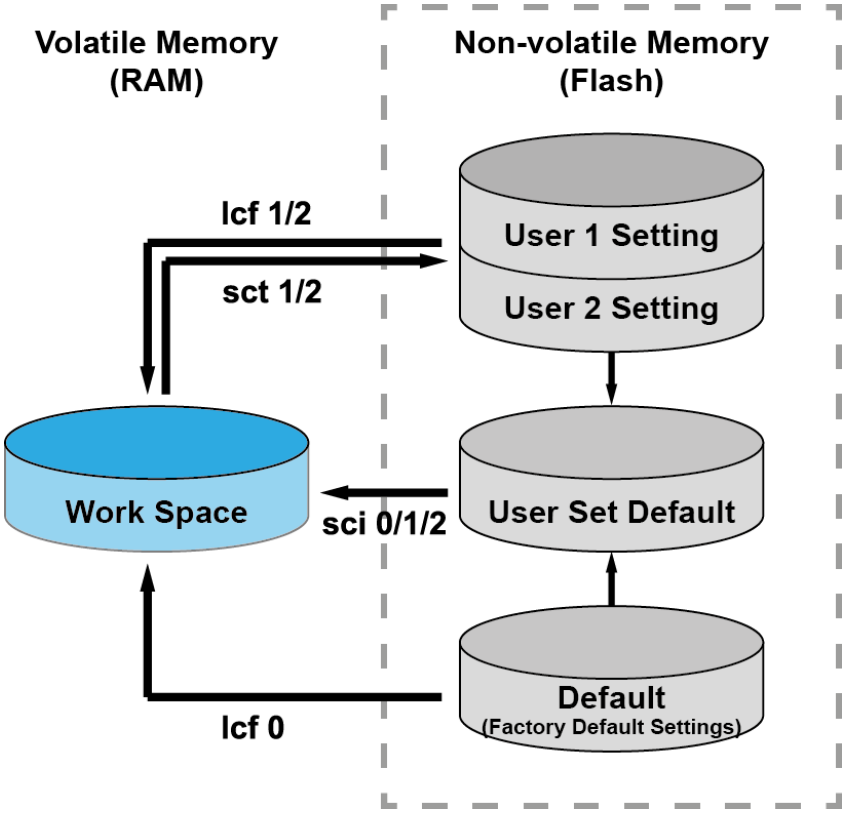


Figure 8.19 User Set Control

9 Camera Configuration

9.1 Setting Commands

You can configure all camera settings via RS-644 serial interface of the Camera Link. When you want to control the camera using a terminal or access to the camera at 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

All camera setting commands are transmitted in the ASCII command type except a command for transmitting a large file such as firmware download. All camera setting commands are transmitted from the user application and then the camera returns a response (“OK”, “Error” or information) for a command. When you execute a write command, the camera returns a response to inform whether the command has been successfully executed. When you execute a read command, the camera returns an error or information.

```
Command format:
<command> <parameter1> <parameter2> <cr>
0 -2 parameters follow the command.
Response:
If a write command is successfully executed
OK <cr> <lf>
```

ex) Write command

```
In response to a “set 100” command the camera will return (in hex value)
Command:   73 65 74 20 31 30 30 0D
           set 100<cr>
Response:  73 65 74 20 31 30 30 0D 0A   4F 4B 0D 0A   3E
           set 100<cr><lf>              OK<cr><lf>    >
           Echo                         result        prompt
```

```
If a read command is successfully executed
<parameter1> <cr> <lf>
```

ex) Read command

```
In response to a "get" command the camera will return (in hex value)
Command:    67 65 74 0D
            get <cr>
Response:   67 65 74 0D 0A   31 30 30 0D 0A   3E
            get<cr><lf>      100<cr><lf>      >
            Echo             response         prompt
```

```
If a command is not executed successfully
Error: <Error Code> <cr> <lf>
```

```
Prompt:
A prompt always follows after the response. '>' is used as prompt.

Types of Error Code
0x80000481: values of parameter is not valid
0x80000482: the number of parameters is not matched
0x80000484: command does not exist
0x80000486: no permission to execute
```

9.2 Command List

Command	Syntax	Return Value	Description
Set Image Offset Get Image Offset	sio n gio	OK n	X coordinate of start point ROI n: X axis offset
Set Image Width Get Image Width	siw n giw	OK n	Width of ROI, n: Width value • Setting range: 160 ~ 8192
Set Line Period Get Line Period	slr f glr	OK f	Sets the camera's line period. f: Line period (μs) <Float> • Setting range: Refer to Line Period in the Specifications.
Set Exposure Time Get Exposure Time	set f get	OK f	Sets the camera's exposure time. f: Exposure time (μs) <Float> • Setting range: 2.00 ~ 10,000.00 μs
Set Test Image Get Test Image	sti 0|1|2|3 gti	OK 0|1|2|3	Sets the Test Image. 0: Test Image Off 1/2: Fixed pattern image 3: Moving pattern image
Set Data Bit Get Data Bit	sdb 8|10|12 gdb	OK 8|10|12	Sets the Pixel Format. 8: 8 bit output 10: 10 bit output 12: 12 bit output
Set Camera-Link Mode Get Camera-Link Mode	scl 0|1|2|4 gcl	OK 0|1|2|4	Sets the Camera Link Tap mode. 0: 2 Tap (BASE) 1: 4 Tap (MEDIUM) 2: 8 Tap (FULL) 3: 3 Tap (BASE)
Set Camera Link Clock Speed Get Camera Link Clock Speed	sccs 0|1|2|3 gccs	OK 0|1|2|3	Sets the Camera Link Pixel Clock. 0: 50 MHz 1: 60 MHz 2: 70 MHz 3: 85 MHz
Acquisition Start	ast	OK	Starts image acquisitions.
Acquisition Stop	asp	OK	Stops image acquisitions.

Table 9.1 Command List #1

Command	Syntax	Return Value	Description
Set Horizontal Flip Get Horizontal Flip	shf 0|1 ghf	OK 0|1	Sets the Horizontal Flip features. 0: Disables the Horizontal Flip feature. 1: Enables the Horizontal Flip feature.
Set Digital Gain Get Digital Gain	sdg f gdg	OK f	Sets the Digital Gain. f: Digital gain <Float> • Setting range: 0.0 ~ 32.0
Set Digital Offset Get Digital Offset	sdo n gdo	OK n	Sets the Digital Offset. n: Digital offset • Setting range: 0 ~ 2048 @ 12 bit
Set Trigger Mode Get Trigger Mode	stm 0|1|2 gtm	OK 0|1|2	Sets the Trigger Mode. 0: Free-Run mode 1: External Sync mode 2: External Sync Converter mode
Set Exposure Source Get Exposure Source	ses 0|1|2 ges	OK 0|1|2	Sets the exposure control mode. 0: Program (by camera) 1: Pulse Width (by external trigger signal) 2: Edge (by external trigger signal)
Set Trigger Source Get Trigger Source	sts 1|2 gts	OK 1|2	Specifies the trigger source when using external trigger signals. 1: CC1 (Camera Link) 2: External (Control I/O Receptacle)
Set Trigger Polarity Get Trigger Polarity	stp 0|1 gtp	OK 0|1	Specifies a polarity of trigger signals. 0: Active Low 1: Active High
Set Trigger Converter Get Trigger Converter	stc f gtc	OK f	Sets a conversion rate of external trigger signals. f: Trigger converter ratio <Float> • Setting rate: 0.10 ~ 100.00
Generate DSNU Data	gdd	OK	Generates the DSNU correction data.
Save DSNU Data	sdd	OK	Saves the generated DSNU correction data in the non-volatile memory.
Load DSNU Data	ldd	OK	Loads the DSNU correction data from the non-volatile memory into the volatile memory.

Table 9.2 Command List #2

Command	Syntax	Return Value	Description
Generate PRNU Data	gpd n	OK	Generates the PRNU correction data. n: Target level • Setting range: 0 <Auto> 100 ~ 4095 <Manual>
Save PRNU Data	spd	OK	Saves the PRNU correction data in the non-volatile memory.
Load PRNU Data	lpd	OK	Loads the PRNU correction data from the non-volatile memory into the volatile memory.
Load Config From	lcf 0|1|2	OK	Loads camera setting values to the camera's workspace. 0: Loads from Factory Space 1: Loads from User 1 Space 2: Loads from User 2 Space
Save Config To	sct 1|2	OK	Saves the current camera setting values. 1: Saves to User 1 Space 2: Saves to User 2 Space
Set Config Initialization Get Config Initialization	sci 0|1|2 gci	OK 0|1|2	Specifies setting values to be loaded when reset. 0: Applies Factory default settings when reset. 1: Applies User 1 Settings when reset. 2: Applies User 2 Settings when reset.
Get MCU Version	gmv	String	Displays the version of camera MCU.
Get Model Number	gmn	String	Displays camera model name.
Get FPGA Version	gfv	String	Displays the version of camera FPGA.
Get Serial Number	gsn piece	String	Displays the serial number of the camera.
Get Current Temperature	gct	String	Displays device temperature in Celsius.
Reset	rst	-	Resets the camera.

Table 9.3 Command List #3

10 Configurator GUI

Configurator, a sample application, is provided to control the VL-8K7C-C80F-2 camera. Configurator provides easy-to-use Graphic User Interface (GUI) that allows users to view and change the camera's settings mentioned in the previous chapters.

10.1 Camera Scan

When you execute the Configurator.exe file while the camera is powered on, the Camera Scan window appears as shown in the figure below. At this time, the Configurator checks serial ports of your computer and DLL provided by the Camera Link to scan whether a camera is connected. If the Configurator finds a connected camera, it displays the model name of the camera on the Camera Scan window. If the camera is not displayed on the window, check the cable connections and power of the camera, and then press the **refresh** button. Double-clicking the model name of the camera displayed on the window will launch the Configurator and display the current parameter settings of the camera connected.

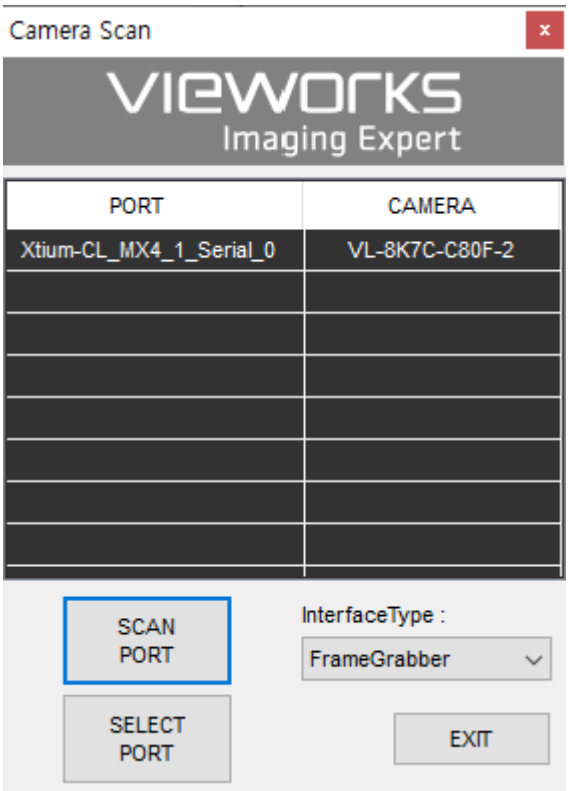


Figure 10.1 Camera Scan Window

10.2 Menu

The menu bar of the Configurator provides the File, Start-Up, Tool and About menus.

10.2.1 File

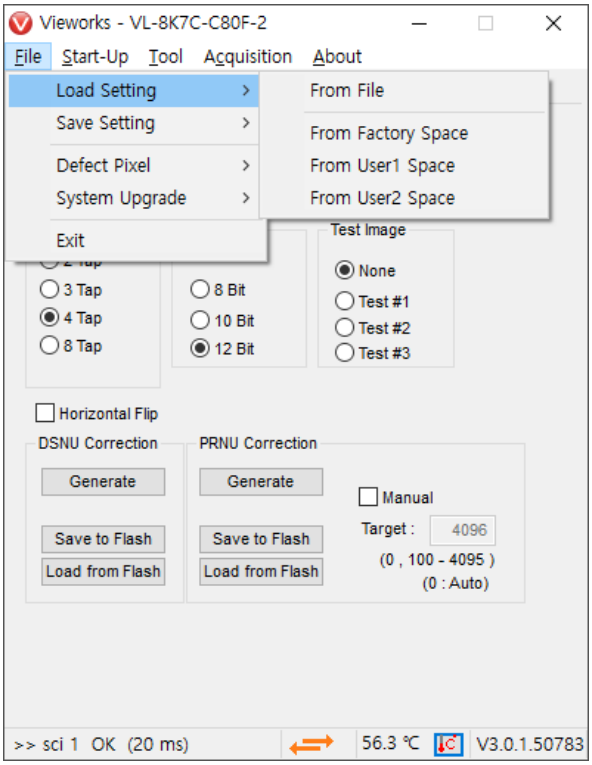


Figure 10.2 File menu

- **Load Setting:** Loads the camera setting values from the camera memory (Factory, User1 or User2) or user's computer (From File).
- **Save Setting:** Saves the camera setting values to the camera memory (User1 or User2) or user's computer (To File).
- **Defect Pixel:** Not supported on the VL-8K7C-C80F-2 camera.
- **System Upgrade:** Upgrades the MCU or FPGA logic.
- **Exit:** Exits the Configurator.

10.2.2 Start-Up

The Start-Up menu allows you to select the camera setting values to be loaded when the camera is powered on.

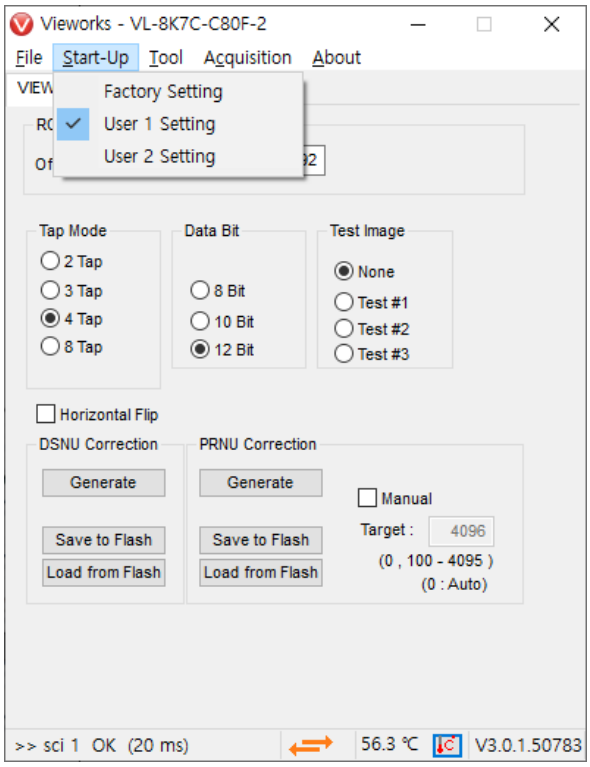


Figure 10.3 Start-Up menu

- **Factory Setting:** Loads the camera setting values from the Factory Space when the camera is powered on.
- **User 1 Setting:** Loads the camera setting values from the User 1 Space when the camera is powered on.
- **User 2 Setting:** Loads the camera setting values from the User 2 Space when the camera is powered on.

10.2.3 Tool

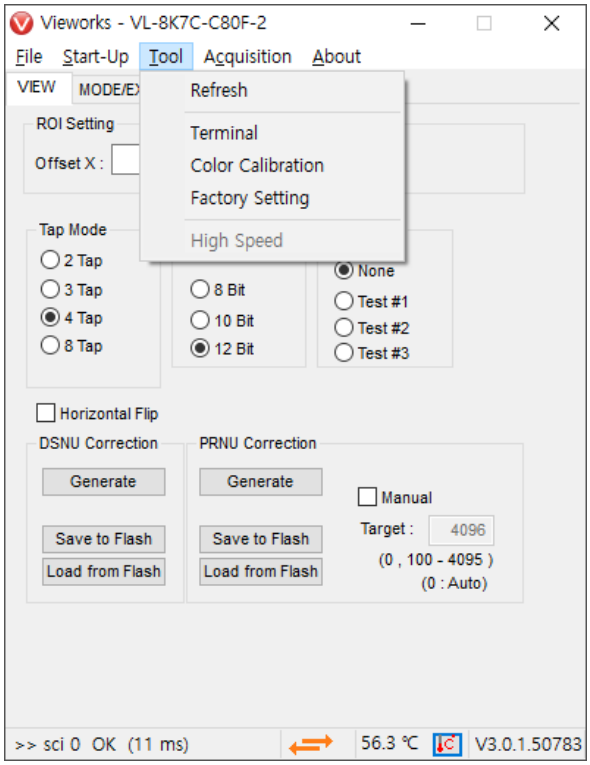


Figure 10.4 Tool menu

- **Refresh:** Loads and displays the current camera setting values on the Configurator.
- **Terminal:** Displays the Terminal window. The Terminal window displays a user command for the feature that you have set on the Configurator. To hide the Terminal window, uncheck Terminal by clicking it again.
- **Color Calibration:** Not supported on the VL-8K7C-C80F-2 camera.
- **Factory Setting:** Not supported for users.
- **High Speed:** Not supported on the VL-8K7C-C80F-2 camera.

10.2.4 Acquisition

The Acquisition menu allows you to execute the Acquisition Start and Acquisition Stop commands directly.

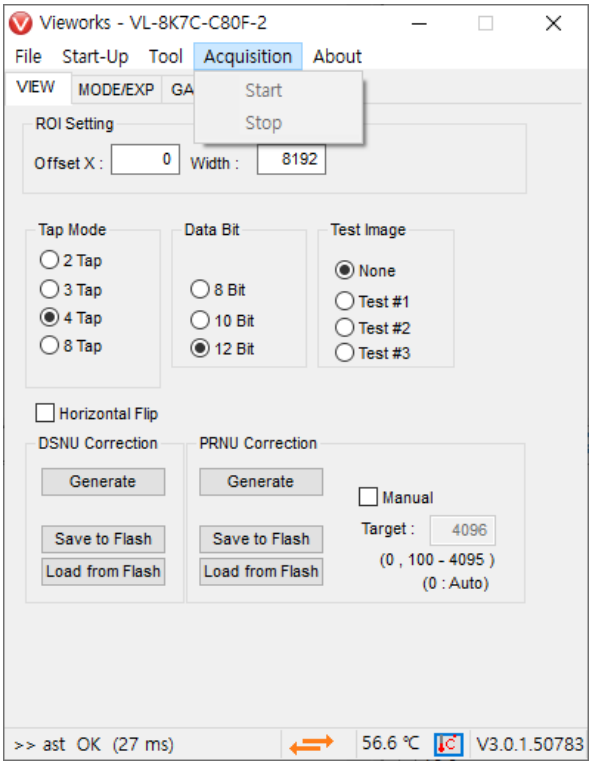


Figure 10.5 Acquisition menu

- **Start:** Executes the Acquisition Start command to begin image acquisitions.
- **Stop:** Executes the Acquisition Stop command to stop image acquisitions.

10.2.5 About

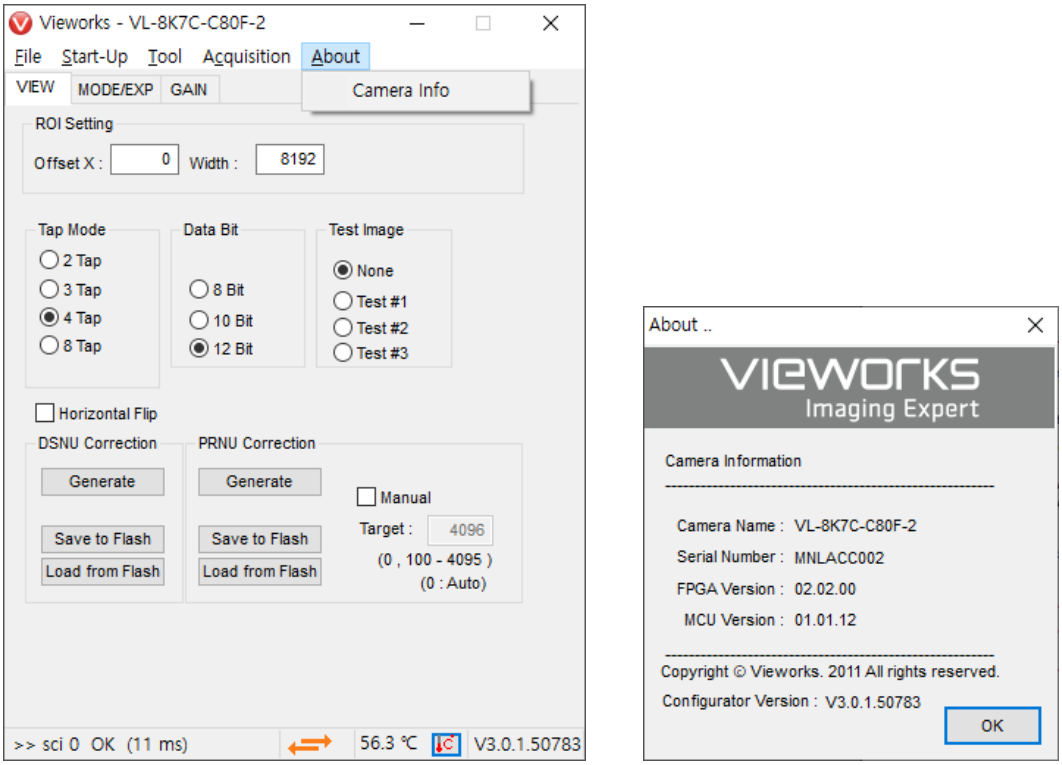


Figure 10.6 About menu

- **Camera Info:** Displays camera information (model name, serial number, version, etc.).

10.3 Tab

10.3.1 VIEW Tab

The VIEW tab allows you to set the camera's region of interest (ROI), Camera Link Tap mode, Data Bit, Test Image, and Correction features.

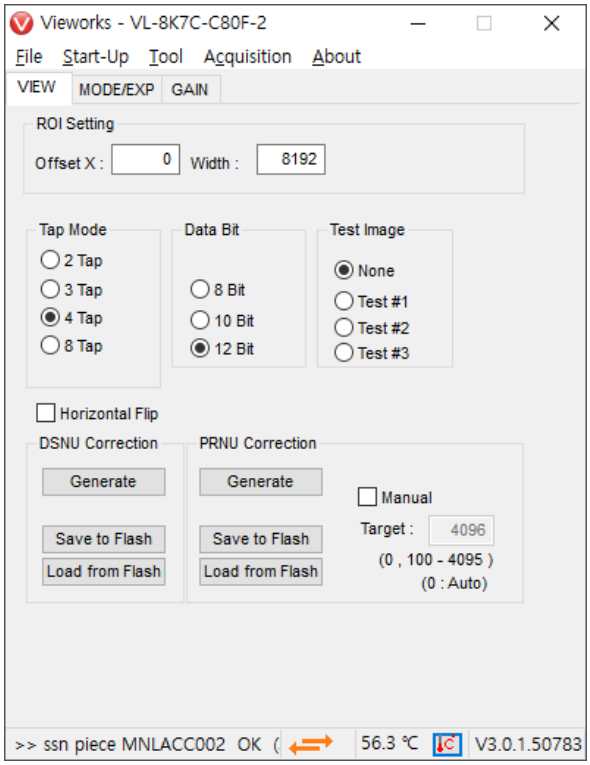


Figure 10.7 VIEW Tab

- **ROI Setting:** Sets the camera's ROI by using the Offset X and Width input boxes.
- **Tap Mode:** Selects a Camera Link Tap mode.
- **Data Bit:** Selects a data bit depth.
- **Test Image:** Enables or disables the test image feature and selects the type of test image.
- **Horizontal Flip:** Sets the Horizontal Flip feature to On or Off.
- **DSNU Correction:** Sets the DSNU Correction feature.
- **PRNU Correction:** Sets the PRNU Correction feature.

10.3.2 MODE/EXP Tab

The MODE/EXP tab allows you to configure the camera's Trigger Mode, exposure time, Line Period and Image Direction.

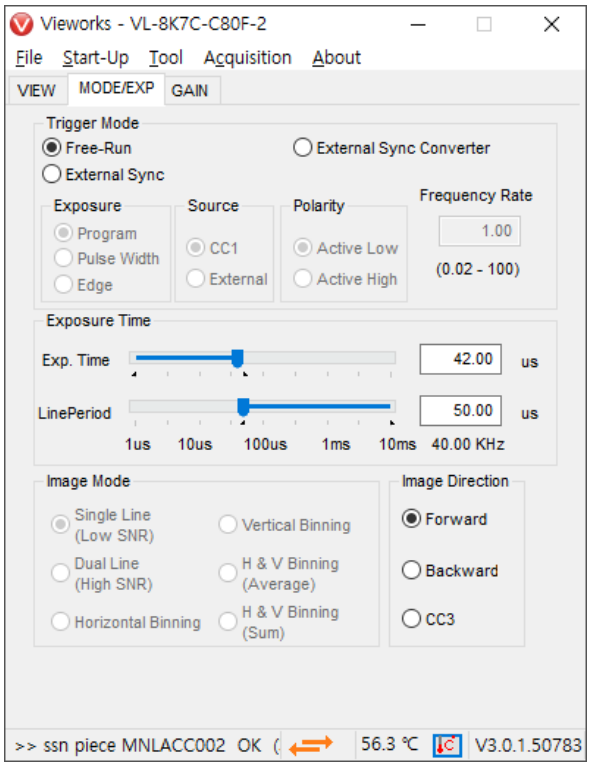


Figure 10.8 MODE/EXP Tab

- **Trigger Mode:** Sets the trigger mode. Once a mode has been selected, related options for the mode will be activated.
- **Exposure:** Sets the exposure control mode.
- **Source:** Specifies the trigger source when using external trigger signals.
- **Polarity:** Specifies a polarity of trigger signals.
- **Frequency Rate:** Sets a conversion rate of external signals when **Trigger Mode** is set to **External Sync Converter**.
- **Exposure Time/Line Period:** Sets the camera's exposure time and line period when **Exposure** is set to **Program** or **Trigger Mode** is set to **Free-Run**.
- **Image Direction:** Sets the scan direction of the camera.

10.3.3 GAIN Tab

The GAIN tab allows you to set the Gain and Offset values of the image. All scroll bars are controllable with the mouse wheel scroll.

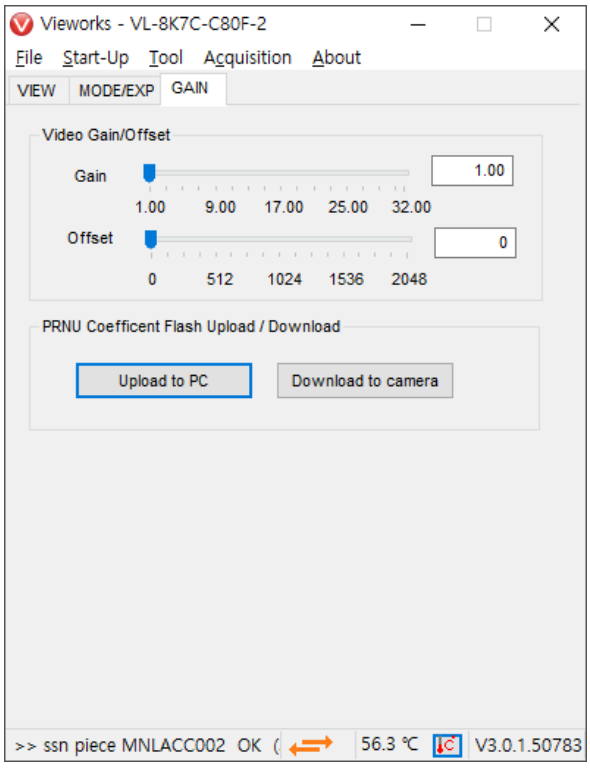


Figure 10.9 GAIN Tab

- **Gain:** Sets a digital gain value.
- **Offset:** Sets a digital offset value.
- **PRNU Coefficient Flash Upload/Download:** Uploads PRNU data stored in the camera's Flash memory to your computer or downloads PRNU data stored in your computer to the camera.

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.
  - Check the aperture is opened properly.
  - Check the digital gain value is not set to small.

- 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.

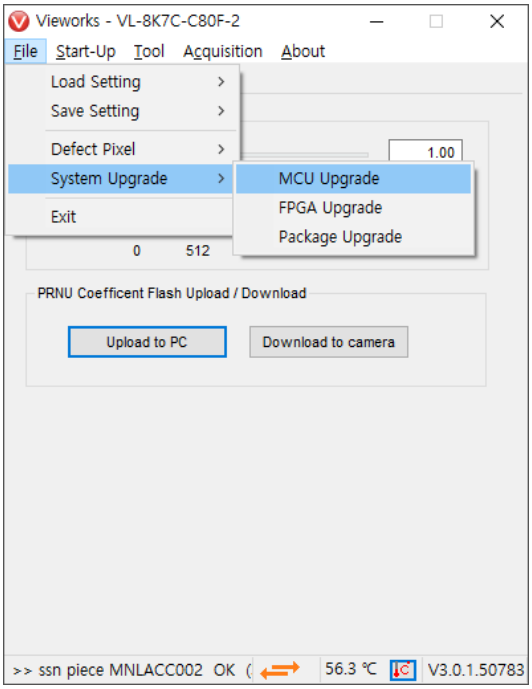
- If you have a problem using the Trigger Mode,
  - Ensure that the CC1 settings on your frame grabber are configured correctly when you use CC1 triggering.
  - Ensure that cable connections are secure when you use external triggering.

- 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.

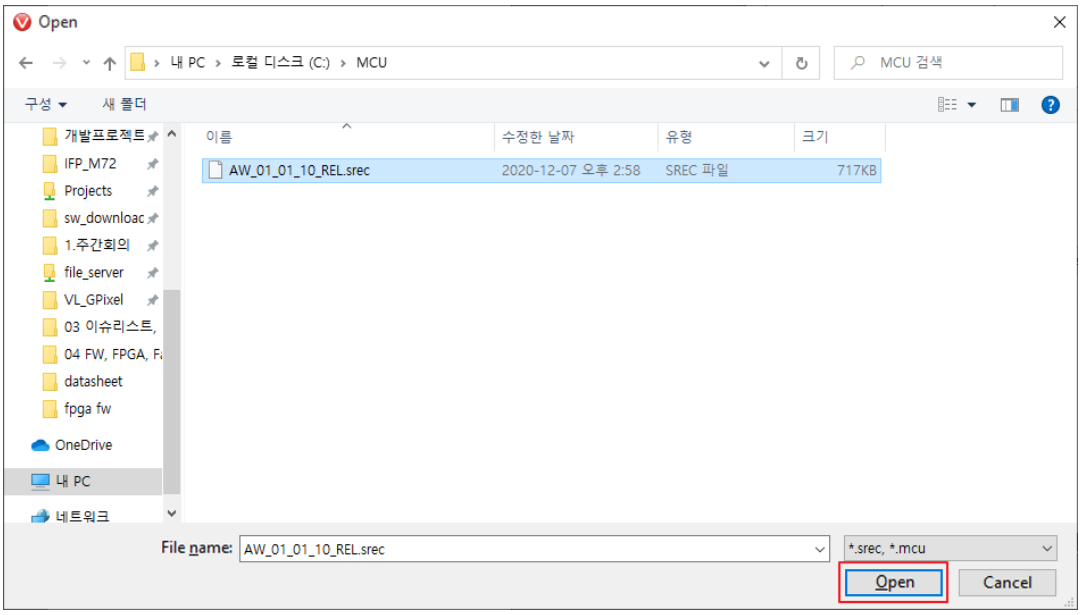
Appendix A Field Upgrade

A.1 MCU

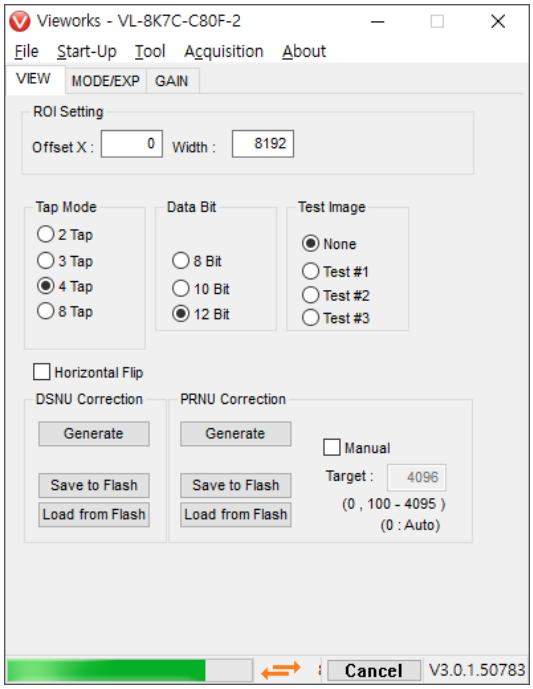
1. Select **File** > **System Upgrade** -> **MCU Upgrade** in the Configurator.



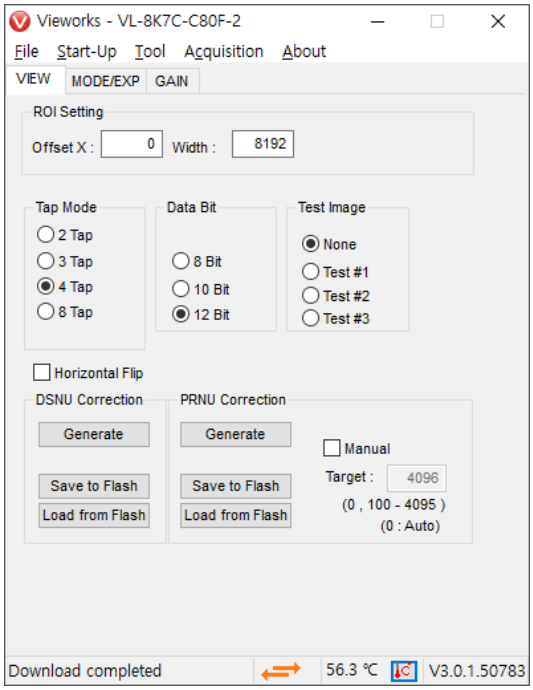
2. Search and select the provided MCU upgrade file (*.srec) and click the **Open** button.



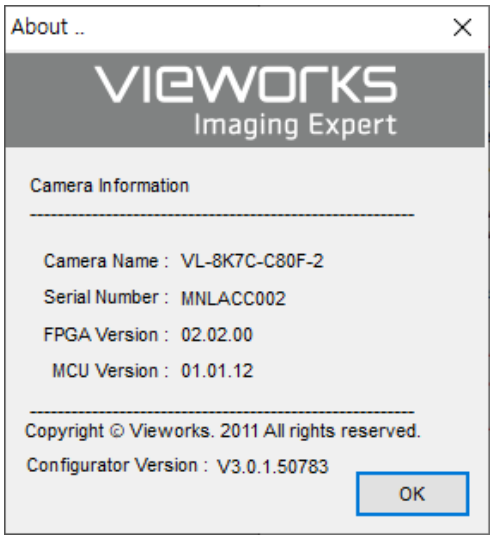
3. The Configurator starts downloading the MCU upgrade file to the camera and the download status is displayed at the bottom of the window. This process may require several minutes to complete. If you want to cancel the upgrade process, click the **Cancel** button.



4. Once the download is complete, the saving process will begin. If a power failure occurs during the saving process, the camera cannot be restored. Make sure that the power connection is secure.

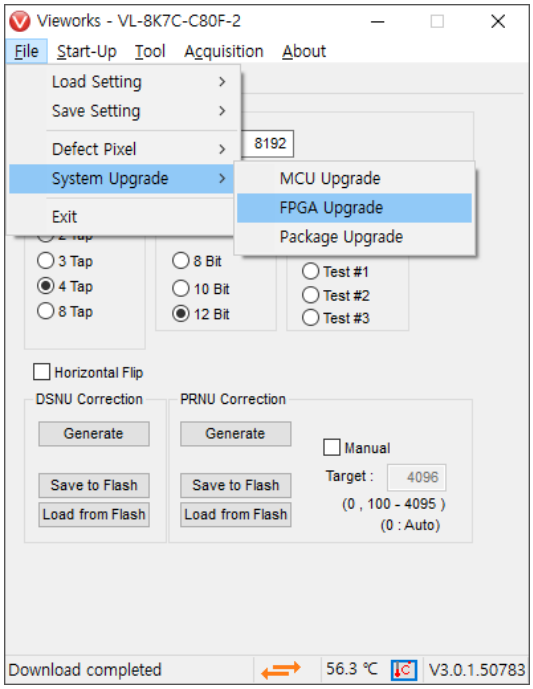


5. Once all the processes are complete, turn the camera power off and turn it back on again. Select **Tool** > **Terminal** and enter the ‘gmv' command to confirm the version. Or select **About** > **Camera Info** to confirm the MCU version.

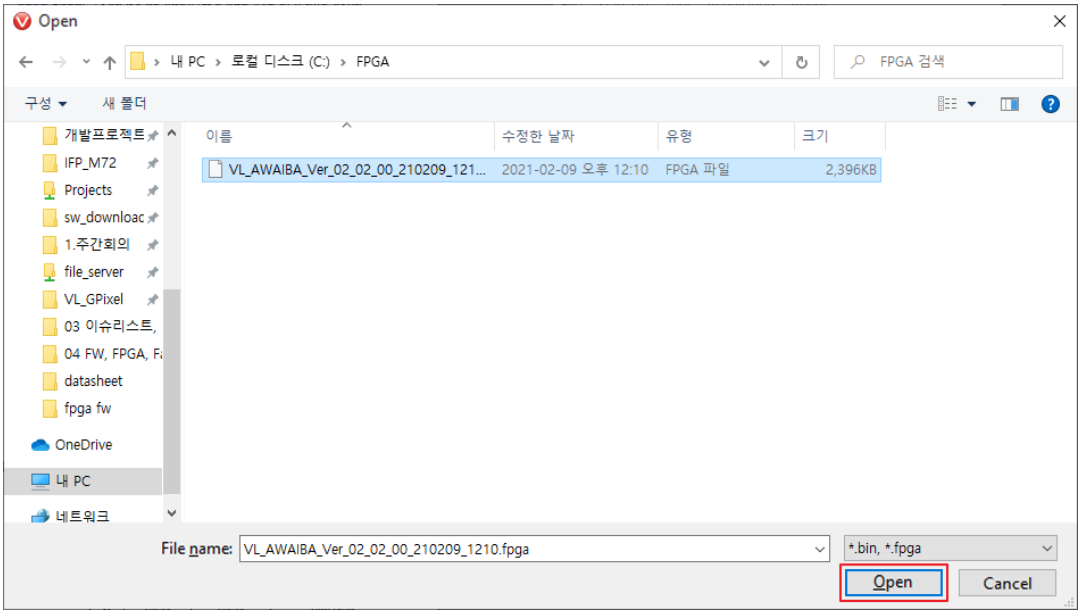


A.2 FPGA

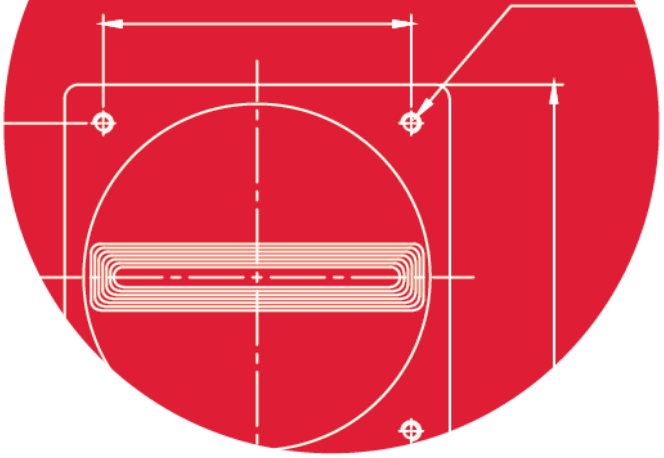
1. Select **File** > **System Upgrade** > **FPGA Upgrade** in the Configurator.

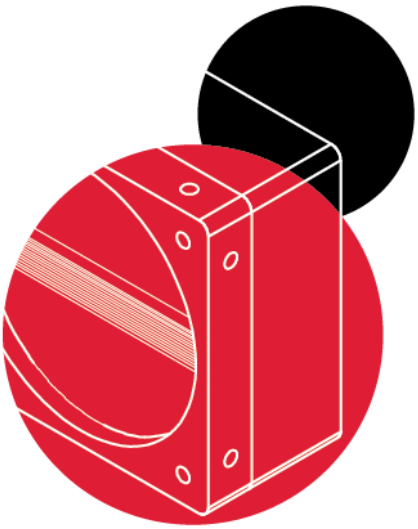


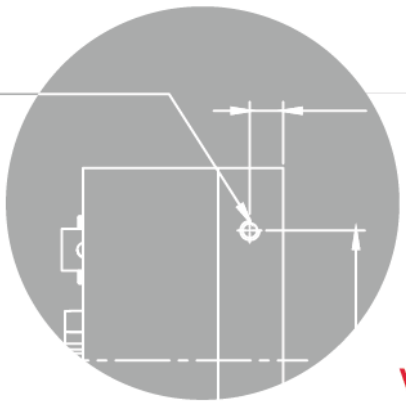
2. Search and select the provided FPGA upgrade file (*.bin) and click the **Open** button.



3. The subsequent processes are identical to those of MCU upgrade.







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