Vieworks

VCS Series User Manual

VCS-14MX2-M/C340I, VCS-14MX2-M/C340I-HS

CoaXPress®

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1. Instruction

This section gives basic information about this manual and safe product use.

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1.1 Document Guide

1.1.1 Target Audience

This manual is intended for users who have purchased the following product. It is also recommended to refer to the manual for the frame grabber used in conjunction with this manual.

- VCS-14MX2-M/C340I
- VCS-14MX2-M/C340I-HS

1.1.2 Symbols

This product should be operated under the safety instructions with the warning or caution symbol in this manual. It is important for you to read and understand the contents to operate the products safely.

Warning

	• This symbol provides information that the user must follow to ensure personal safety or prevent product damage.

Caution

	• This symbol provides information that the user must follow to prevent data loss or damage.

Information

	• This symbol provides additional information.

1.2 Terminology

The terminologies defined in the manual are as follows:

Terminology	Definition
Vieworks Imaging Solution (VIS)	This refers to the software provided by Vieworks for controlling the camera.

1.3 Precautions

General

- Do not drop, disassemble, repair or alter the device. Doing so may damage the camera electronics and cause an electric shock.
- For safety, do not store the product where it can be accessed by children or pets.
- 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 indicated in <2.2 Product Specification>. 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.
- The shipped product has a pre-aligned sensor center, so no further adjustment is necessary. If adjustment is unavoidable, please contact the manufacturer or distributor.
- The shipped product is pre-adjusted for tilt, so no further adjustment is necessary. If adjustment is unavoidable, please contact the manufacturer or distributor.

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 <2.2 Product Specification> 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.

1.4 Product Use

1.4.1 Warranty Coverage

The following cases are excluded from the warranty coverage:

- The manufacturer is not responsible for equipment failures caused by services or modifications performed by unauthorized manufacturers, agents, or technicians.
  - The manufacturer is not liable for the loss or damage of data due to operator error.
  - Warranty coverage is void if the product is used for purposes other than its intended use, subjected to excessive use, or damaged due to negligence.
  - The manufacturer is not responsible if the power is used under conditions other than those specified in the user manual.
- Natural disasters, such as lightning, earthquakes, fires, and floods, are not covered under the warranty.
- If components or software of the equipment are replaced or modified without authorization, any resulting issues are not covered by the warranty.

For product-related inquiries or service needs, please contact the distributor or manufacturer.
The warranty period is as stated on the warranty card provided at the time of sale and takes effect from the date the equipment is shipped.

1.4.2 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.

1.4.3 Camera Mounting and Heat Dissipation

Recommended Camera Mounting for Vibration Prevention

If the camera is poorly mounted, fan vibrations can be amplified, leading to blurry images. To prevent or reduce vibration from the camera's fan, follow these guidelines:

- Secure the front or side of the camera using four or more screws.
- Ensure no foreign objects enter the contact surface between the camera and the system.
- Keep the center of gravity of the camera as close as possible to the center of gravity of the system.
- If the size or weight of the lens is larger or heavier than the camera, use a suitable support to mount the lens.
- Be careful to prevent foreign objects from entering the fan, as this can damage the fan blades.

Recommended Camera Mounting for Effective Heat Dissipation

- Ensure that the fan's air intake and exhaust are not blocked.
- If a fan cannot be used, allow sufficient space around the heat sink for effective natural convection.

- If a fan cannot be used, mount the camera on a metal structure with high thermal conductivity (e.g., aluminum) to help dissipate the heat generated by the camera.
- Mount the camera so that at least 30% of the front block is in contact with the mounting surface.

1.5 Revision History

Version	Date	Description
1.0	2025-04-18	Initial release

2. Product

This section gives an instruction about the product components and their specifications.

Product Components

Product Specification

2.1 Product Components

Package Components	
	
VCS-14MX2-M/C340I	VCS-14MX2-M/C340I-HS

2.2 Product Specifications

The VCS-14MX2-M/C340I camera is a 14-megapixel CoaXPress model newly added to the proven VC series for industrial applications, featuring Gpixel's latest BSI CMOS image sensor technology (GSPRINT5514).

This camera can capture images at a resolution of 4608 × 3072 at up to 338 fps. Using the next-generation CoaXPress 2.0 (CXP-12) interface with four coaxial cables, it can transfer image data at up to 50 Gbps. This combination of advanced CMOS sensor technology and CoaXPress 2.0 sets a new standard for digital imaging in industrial, scientific, and surveillance applications. The VCS-14MX2-M/C340I camera provides uniform imaging along with high-speed image processing capabilities. With its high resolution and excellent image uniformity, this camera is ideal for demanding applications such as FPD, PCB, and semiconductor inspection.
To diversify its range of use, Vieworks offers this product in two versions: Fan-type and Heat Sink-type, both of which have the same specifications.

Main Features

- High Speed 14 Megapixel CMOS Image Sensor
- BSI (Backside Illuminated) CMOS Image Sensor
- CoaXPress 2.0 Interface up to 338 fps at 50 Gbps using 4 CH
- Global Shutter CMOS Technology
- DSNU and PRNU Correction
- Flat Field Correction
- Defective Pixel Correction
- GenICam Compatible – XML based Control
- HDR: Low-gain and high-gain composite image

Applications

- FPD and Electronics Inspection
- Semiconductor Inspection
- Research and Scientific Imaging
- Document / Film Scanning

The specifications of the VCS-14MX2-M/C340I cameras are as follows:

Specification		VCS-14MX2-M/C340I	VCS-14MX2-M/C340I-HS
Resolution (H × V)		4,608 X 3,072	
Sensor Type		GSPRINT5514	
Optical Format (Diagonal)		25.34 mm x 16.90 mm (30.5mm)	
Sensor Type		High Speed CMOS Image Sensor	
Pixel Size		5.5 μm × 5.5 μm	
Interface		CoaXPress 2.0 (CXP-12)	
Max. Line Rate (8 bit)	CXP12 × 1	84 fps	
	CXP12 × 2	169 fps	
	CXP12 × 4	338 fps	
Exposure Time		4 μs to 60 s	
Partial Scan (Max. speed)		21037fps at 32Lines, CXP-12	
Pixel Data Format	Mono	Mono 8/10/12	
	Color	RG Bayer 8/10/12	
Electronic Shutter		Global Shutter	
Gain Control	Analog Gain	1.0×, 1.55×, 2.17×, 2.77×, and 5.0x	
	Digital Gain	1× to 32×	
Black Level Control		0 to 255 LSB at 12 bit	
Trigger Synchronization		Free-Run, Hardware Trigger, Software Trigger, or CXP	
External Trigger		3.3 V to 24.0 V, 10 mA, Logical Level Input, Optically Isolated	
Software Trigger		Asynchronous, Programmable via Camera API	
Dynamic Range		Typ. 66 dB at 12 bit	
Dimension(W×H×L)/Weight		68 x 68 x 109 mm / 530 g	68 x 68 x 112.5 mm / 540 g
Temperature		Operating: 0℃ to 40℃, Storage: -40℃ to 70℃	
Lens Mount		F-mount, Custom mount available upon request	
Power	Adapter	11 to 24 VDC	
	Dissipation	Typ. 19 W	
	PoCXP	24 VDC, Minimum of two PoCXP cables required	
Compliance		CE, FCC, and KC	

Table 2-1 The specifications of VCS-14MX2-M/C340I(-HS)

- It is recommended to update the frame grabber's driver to the latest version before use.

2.2.1 Camera Block Diagram

The block diagram of the VCS-14MX2-M/C340I camera is as shown below:

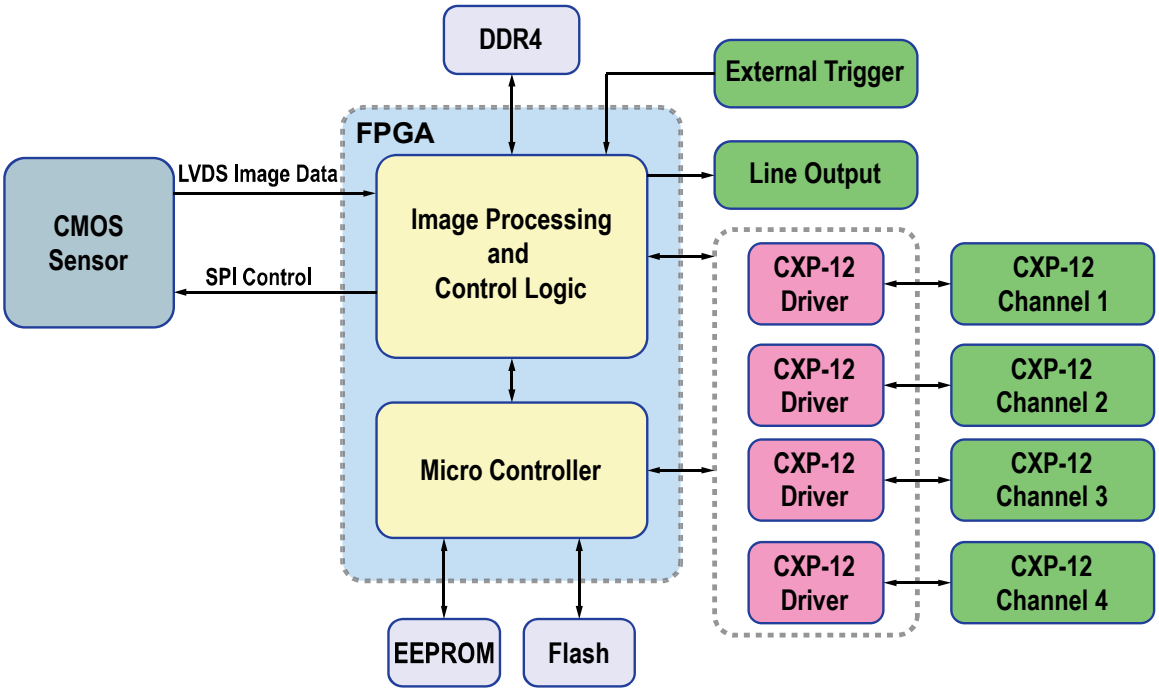


Figure 2-1 Camera Block Diagram

All camera controls and data processing are handled within a single FPGA chip. The FPGA consists of a 32-bit RISC microprocessor in Softcore form and processing & control logic. The microprocessor receives commands from the user via the CoaXPress 2.0 interface and processes them accordingly.

The processing & control logic handles image data received from the CMOS sensor, outputs it through the CoaXPress 2.0 interface, and manages time-sensitive trigger input and output signals. Additionally, outside the FPGA, there are a Flash memory for microcontroller operation and DDR4 memory for image processing.

2.2.2 Spectral Response

The below graph represents the spectral response of the VCS-14MX2-M/C340I camera.

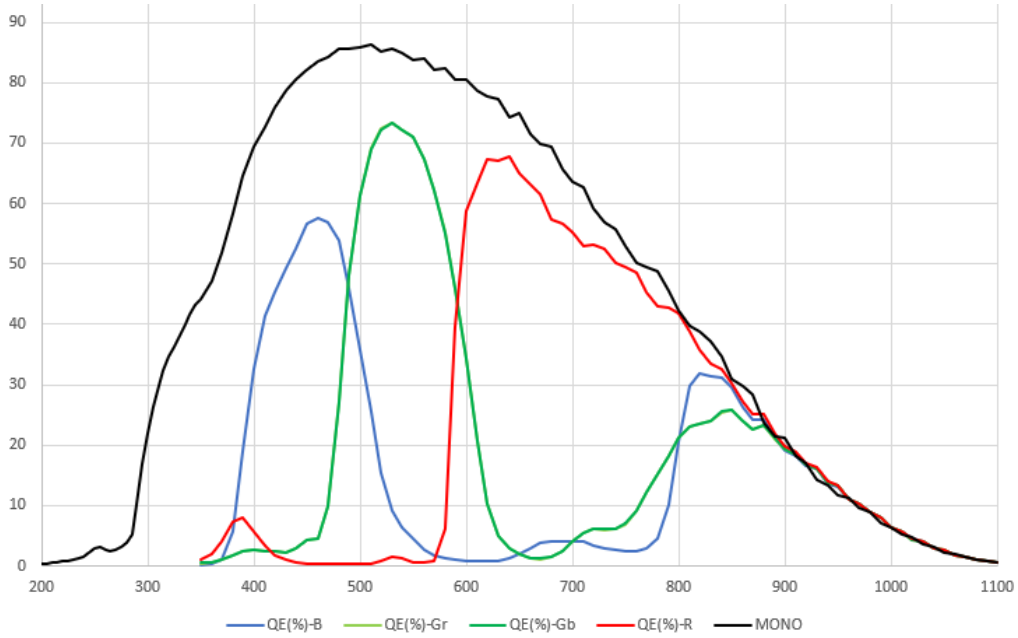


Figure 2-2 Spectral Response

2.2.3 Drawings

Unit: mm

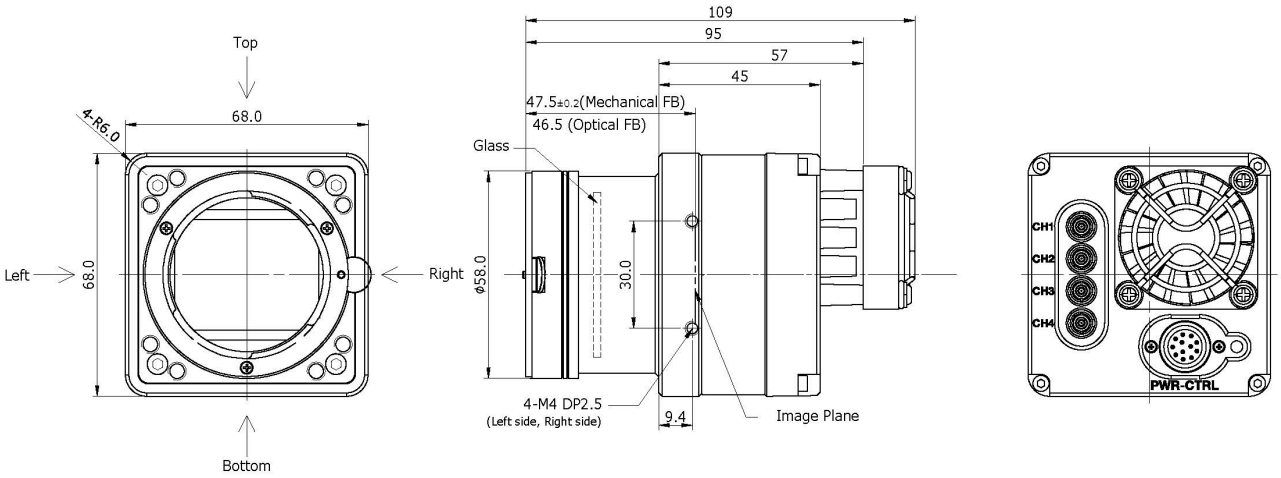


Figure 2-3 VCS-14MX2-M/C340I Drawing

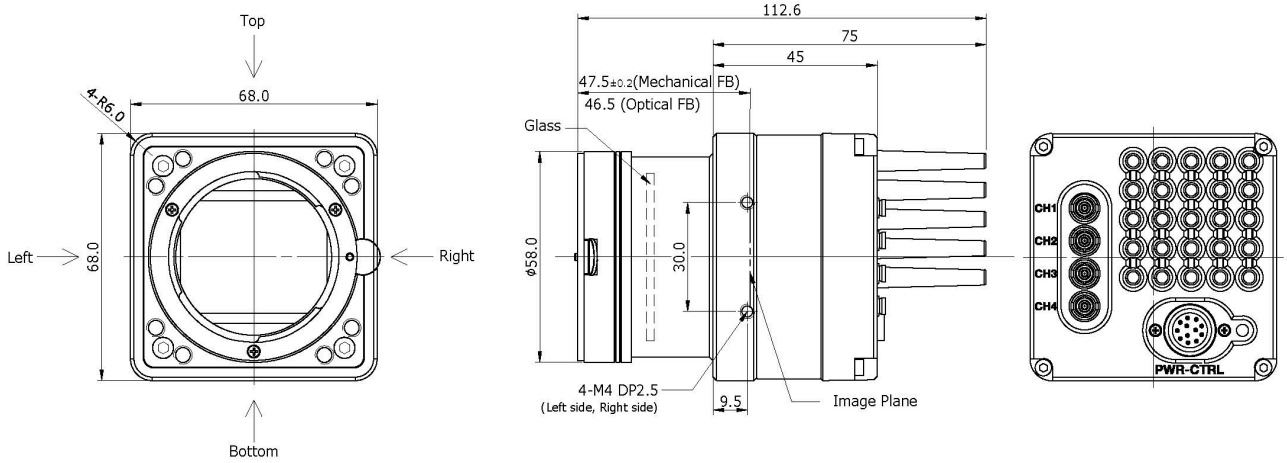


Figure 2-4 VCS-14MX2-M/C340I-HS Drawing

3. Installation

This section explains how to install and connect the camera.

Camera Connection

Camera Interface

3.1 Camera Connection

This section explains the connection procedure, assuming that 1) the CoaXPress 2.0 frame grabber (hereafter referred to as the "CXP-12 frame grabber") software is installed on the user's PC, and 2) the camera is connected to the CXP-12 frame grabber using four coaxial cables.

Follow these steps to connect the camera to the user's PC:

1 Ensure the camera is disconnected from the power supply and the PC is powered off.
2 Connect one end of a coaxial cable to the camera's CXP connector CH1 and the other end to the CXP-12 frame grabber CH1 in the PC. Then, use three additional coaxial cables to connect the camera's CXP connectors CH2, CH3, and CH4 to the corresponding CXP-12 frame grabber ports CH2, CH3, and CH4.
   ▫ Connect the power adapter to the camera's power input terminal.
   ▫ Plug the power adapter into an electrical outlet.
3 Verify that all cables are securely connected.

Installation of Vieworks Imaging Solution

You can download the Vieworks Imaging Solution at http://www.vieworks.com. You should perform the software installation first and then the hardware installation.

3.2 Camera Interface

The rear panel of the camera has two types of connectors and a status indicator LED, each with the following functions.

No.	Item	Description
1	Status LED	Power Status and Operating Mode Indicators
2	12-pins power input and control I/O receptors	Camera Power Input • If PoCXP is not used, configure through the camera's input/output lines.
3	CoaXPress connector	Transmits video data and controls the camera.

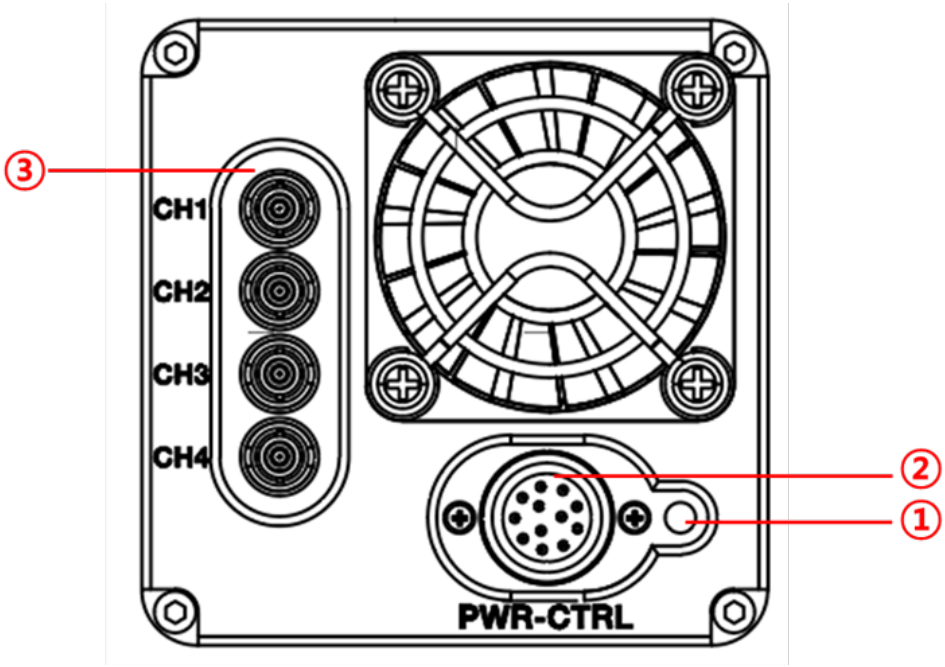


Figure 3-1 VCS-14MX2-M/C340I Back Panel

• The VCS-14MX2-M/C340I-HS interface is also the same as described above.

3.2.1 CoaXPress Connector

The CoaXPress protocol includes an automatic link discovery mechanism (Plug and Play) that accurately detects the connection from the camera to the CXP-12 frame grabber. The connection between the camera and the CXP-12 frame grabber uses coaxial cables, each capable of transmitting data at up to 12.5 Gbps.

Micro-BNC Connector

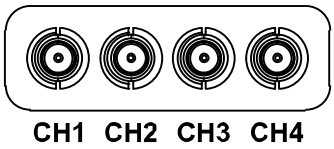


Figure 3-2 The Rear Pannel of VCS-14MX2-M/C340I

The Micro-BNC connector of the VCS-14MX2-M/C340I camera complies with the CoaXPress 2.0 Standard, and the channel configuration of the connector is as shown in the below table:

Channel	Max. Bit Rate per Coax	Type	PoCXP Compliant
CH1	12.5 Gbps	Master Connection	Yes
CH2	12.5 Gbps	Extension Connection	Yes
CH3	12.5 Gbps	Extension Connection	No
CH4	12.5 Gbps	Extension Connection	No

Table 3-1 Micro-BNC Connector Pin Configuration

- When connecting the CXP-12 frame grabber and the camera using coaxial cables (also referred to as "coax cables"), be careful to match the connection points correctly. If the camera's CXP connector CH1 is not properly connected to the CXP-12 frame grabber CH1, the camera's images may not be output correctly, or communication between the PC and the camera may not function properly.

3.2.2 Power Input Receptacle

The power input receptacle is a Hirose 12-pin connector(part # HR10A-10R-12PB). The pin assignments and configurations are as follows:

Figure 3-3 Pin Assignments for Power Input Receptacle

Pin Number	Signal	Type	Description
1	DC Ground	Ground	Camera Power Ground
2	11 to 24 VDC	Power	Camera Power 11 to 24 VDC
3	Output -	Ground	Output Common Ground
5	Trigger IN-	Input	-
6	Trigger IN+	Input	-
4,7,8,9,10,11	Output1+ Output2+ Output3+ Output4+ Output5+ Output6+	Output	3.3 V TTL Output
12	NC	-	Not connected

Table 3-2 Pin Arrangements for Power Input Receptacle

- A recommended mating connector for the Hirose 12-pin connector is Hirose 12-pin plug ((part # HR10A-10P-12S) or the equivalent connector.
- It is recommended to use an external power supply adapter with a voltage output of 11 to 24 VDC and a current output of at least 3A.

  ※ Note: The camera manufacturer, Vieworks, does not provide a power adapter.

CAUTION

- Before connecting the power wiring for the camera, ensure that the camera's power input is turned off. Failure to do so may result in camera damage.
- Supplying voltage beyond the camera's input voltage range can damage the internal circuits of the camera.

3.2.3 Trigger Input Circuit

The below diagram illustrates the trigger signal input of the 12-pin connector. The trigger input signal is transmitted to the internal circuit through a photo coupler. The debounce function allows you to specify the pulse width of an input signal that the camera will recognize as a valid input. External trigger signals can be supplied as shown in the circuit diagram below.

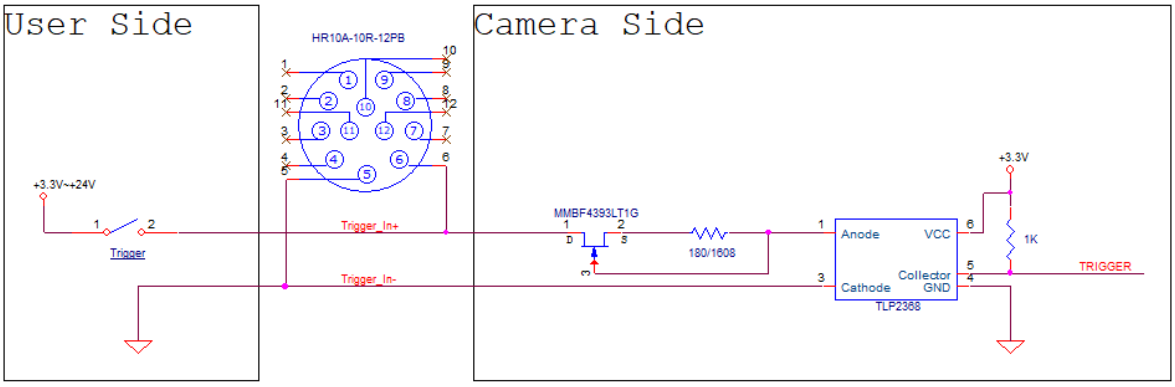


Figure 3-4 Trigger Input Schematic

3.2.4 Strobe Output Circuit

The diagram below shows the output circuit of the 12-pin connector. Users can configure the output settings through the Digital I/O Control settings. Refer to <5.16 Digital I/O Control>.

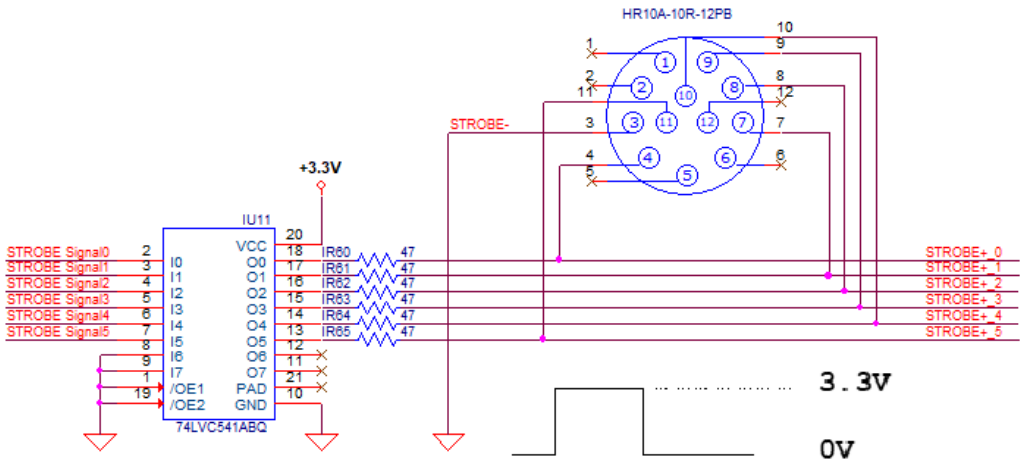


Figure 3-5 Strobe Output Schematic

4. Image Acquisition Control

This section provides information on image acquisition control.

Acquisition Start/Stop Command and Acquisition Mode

Exposure Start Trigger

Exposure Time Setting

Overlap of Exposure and Readout

Global Shutter

Maximum Configurable Frame Rate

This section provides detailed information on the following items required for image acquisition:

- Image acquisition trigger methods
- Exposure time settings
- Frame rate control
- Maximum frame rate variation based on camera settings

The key factors required to control image acquisition are as follows:

- Acquisition Start/Stop Command and Acquisition Mode
- Exposure Start Trigger
- Exposure Time Setting
- Overlap of Exposure and Readout
- Global Shutter
- Maximum Configurable Frame Rate

- In this section, the term "frame" generally refers to a single captured image.

4.1 Acquisition Start/Stop Command and Acquisition Mode

The Acquisition Start/Stop command is directly affected by the Acquisition Mode parameters. There are 3 types available for selection in this parameter:

- Continuous:
  Once the Acquisition Start command is executed, images will continue to be acquired until the Acquisition Stop command is executed.
- SingleFrame:
  Once the Acquisition Start command is executed, it automatically executes Acquisition Stop after acquiring a single image.
- MultiFrame:
  Once the Acquisition Start command is executed, it automatically executes Acquisition Stop after acquiring as many images as specified in the AcquisitionFrameCount parameter.

- The Acquisition Start command remains active until the Acquisition Stop command is executed. Once the Acquisition Stop command is executed, the camera will not be able to acquire images until a new Acquisition Start command is issued. If a user executes Acquisition Stop while the camera is in the process of acquiring images, the current image acquisition will be completed before the process stops.

4.2 Exposure Start Trigger

The camera deactivates the standby status when receiving the Exposure Start trigger to start exposure and readout the frame. The camera will return to the standby status once it is ready to receive the next Exposure Start trigger signal. When a new Exposure Start trigger signal is supplied to the camera in this state, the camera will begin the next exposure.

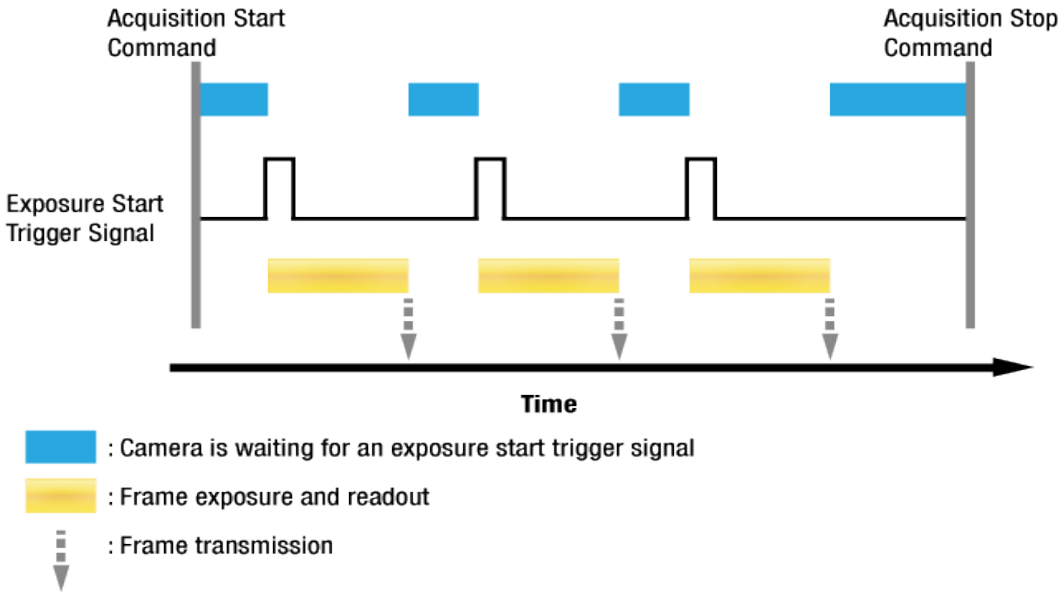


Figure 4-1 Exposure Start Trigger

4.2.1 Trigger Signal Supply

Exposure Start trigger can either generates signal internally or supply signals externally using one of the following 5 methods:

- Software
- UserOutput0
- LinkTrigger0
- Timer0 Active
- Line0 (or Hardware)

Software

To supply a trigger signal with Software, the Trigger Source parameter should be set to Software. Then the Exposure Start trigger is supplied to the camera every time the Trigger Software command is executed.

UserOutput0

To supply a user-defined (User Output) Exposure Start trigger signal to the camera, set the Trigger Source parameter to UserOutput0. Then, you can provide the Exposure Start trigger signal to the camera by toggling the User Output Value parameter to On (rising edge) or Off (falling edge).

LinkTrigger0

To supply a trigger signal via CH1 channel of the frame grabber, the Trigger Source parameter should be set to LinkTrigger0. Then, you can use the API provided by the CXP-12 frame grabber manufacturer to supply the CoaXPress trigger signal to the camera as an Exposure Start trigger signal. For more details, refer to the CXP-12 frame grabber user manual.

Timer0Actice

To supply a trigger signal using the user-defined Timer function, set the Trigger Source parameter to Timer0 Active. If you set the Timer Trigger Source parameter to Line0 in the Counter and Timer Control category, you can use the Timer with Line0 as the source signal to provide the Exposure Start trigger signal to the camera.

Line0 (or Hardware)

To supply a trigger signal through hardware, set the **Trigger Source** parameter to **Line0**.
Then, provide an appropriate electrical signal to the camera, and the generated Exposure Start trigger signal will be recognized by the camera.

4.2.2 Trigger Mode

The critical parameter to the Exposure Start Trigger is Trigger Mode. This mode is configurable in 2 ways:

a) Trigger Mode = Off

When the Trigger Mode parameter is set to Off, all required Exposure Start trigger signals are generated internally by the camera, eliminating the need for the user to supply Exposure Start trigger signals to the camera. The rate at which the camera generates these signals and captures images is determined by the settings of the frame rate-related parameters.

After setting Trigger Mode to Off and executing the Acquisition Start command, the camera will automatically generate Exposure Start trigger signals. It will continue to do so until the Acquisition Stop command is executed.

- When the Trigger Mode parameter is set to Off, the camera generates all the required trigger signals internally. With this configuration, the camera continuously captures images without the need for external trigger signals. This mode is commonly referred to as **Free-Run**.

The rate at which the camera generates **Exposure Start** trigger signals can be determined by the **Acquisition Frame Rate** parameter.

- If this parameter is set to a value lower than the maximum frame rate allowed by the current camera settings, the camera will generate Exposure Start trigger signals at the specified frame rate.

- If this parameter is set to a value higher than the maximum frame rate allowed by the current camera settings, the camera will generate Exposure Start trigger signals at the maximum allowable frame rate.

When **Trigger Mode is set to Off**, the exposure time is determined by the Exposure Time parameter. For more details, refer to <4.3 Exposure Time Settings>.

b) Trigger Mode = On

When the **Trigger Mode** parameter is set to **On**, the user must supply an **Exposure Start** trigger signal to the camera each time an image is to be acquired. The **Trigger Source** parameter specifies the source signal that will act as the **Exposure Start** trigger signal. In this mode, trigger signals must not be supplied at a rate faster than the maximum frame rate specified at the end of this section. If a trigger signal is supplied when the camera is not in a ready state, that signal will be ignored.

When **Trigger Mode** is **On** and the **Trigger Source** parameter is set to **Software**, the exposure time for each image acquisition will depend on the specific trigger settings.

a) When LinkTrigger0 or Line0 is selected:

- Exposure Mode = Timed: Exposure time is controlled by the Exposure Time parameter.
- Exposure Mode = TriggerWidth: Exposure time can be adjusted by controlling an external trigger signal.

b) When Timer0Active is selected:

- Exposure Mode = Timed: Exposure time is controlled by the Exposure Time parameter.
- Exposure Mode = TriggerWidth: Exposure time is controlled by the Time Duration parameter when the Timer Trigger Activation parameter is set to Rising or Falling Edge, while it is controlled by the external trigger signal when the Timer Trigger Activation parameter is set to Level High or Level Low

c) When UserOutput0 is selected:

- Exposure Mode = Timed: Exposure time is controlled by the Exposure Time parameter.
- Exposure Mode = TriggerWidth: Exposure time is controlled by the activation of the User Output Value parameter.

After setting the **Trigger Source** parameter, you also need to select the **Trigger Activation** parameter from the following options:

- **Falling Edge**: Specifies that the falling edge of the electrical signal will act as the **Exposure Start** trigger.
- **Rising Edge**: Specifies that the rising edge of the electrical signal will act as the **Exposure Start** trigger.

4.2.3 Exposure Time Control

Image acquisition starts as the camera receives the Exposure Start trigger. An important factor in the image acquisition process is the amount of time that the camera sensor's pixels are exposed to light.
When the camera's Trigger Source is set to Software, the exposure time for each image is determined by the Exposure Time parameter. If the Trigger Source is set to UserOutput0, LinkTrigger0, Timer0 Active, or Line0, the Exposure Mode can be configured using either the Timed or TriggerWidth method.

- When set to **Timed,** the exposure time for each image is determined by the Exposure Time parameter.
- When set to **TriggerWidth**, the exposure time is determined by the rising and falling edges of **User Output**, **CoaXPress**, **Timer**, or **Hardware** signals controlled by the user. This mode is useful when different exposure times are required for each image.

4.2.4 Software Trigger Signal

To start image acquisition, set the Trigger Mode parameter to **On** and the Trigger Source parameter to **Software** to supply the software trigger signal, exposure start, to the camera. When the camera in ready mode receives the Exposure Start trigger, exposure begins as shown in the below image. However, a new Exposure Start trigger cannot be received during the exposure. Signals can only be received when the camera is in the ready state. The exposure time for each image is determined by the **Exposure Time** parameter.

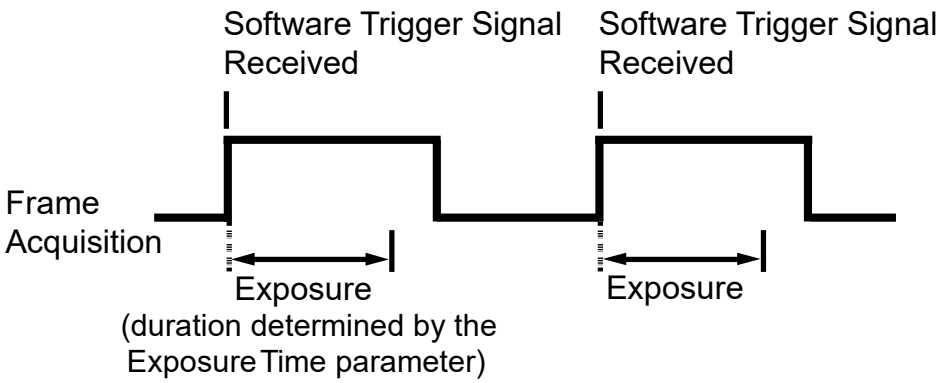


Figure 4-2 Image Acquisition with the Software Trigger Signal

The frame rate is determined by the frequency at which the user supplies software trigger signals to the camera. Trigger signals should not be supplied at a rate exceeding the maximum frame rate specified at the end of this section. The camera will not receive trigger signals if it is not in the ready state.

4.2.5 CoaXPress Trigger Signal

When the Trigger Mode parameter is set to On and the Trigger Source parameter is set to LinkTrigger0, a CoaXPress trigger signal (Exposure Start) must be supplied to the camera in order to capture images. The CoaXPress trigger signal acts as the Exposure Start trigger for the camera. For more details, refer to the CXP-12 Frame Grabber User Manual.

The **Trigger Activation** parameter allows you to use the rising edge or falling edge of the **CoaXPress** signal as the image acquisition trigger. When the camera, which is waiting for a trigger, receives the signal, it will begin exposure. However, while the camera is exposed, it cannot receive a new **Exposure Start** trigger signal. The camera can only receive triggers when in the ready state. The formula for calculating the frame rate is as follows. For example, if the camera operates with a **CXP trigger signal** with a period of 50 ms (0.05 seconds), the resulting frame rate would be 20 fps.

$$\frac{1}{\text{CoaXPress signal period in seconds}} = \text{Frame Rate}$$

4.2.6 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 external trigger input terminal 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.

In the **Trigger Activation** parameter, the rising edge or falling edge of the external signal can be used as the trigger for image acquisition. When the camera, in its idle state, receives the signal, exposure starts. However, a new **Exposure Start** trigger signal cannot be received while the camera is exposed to light. The camera can only receive the signal when it is in the idle state. The formula for determining the **frame rate** is as follows: For instance, if the camera is operated with an external trigger signal that has a period of 50 ms (0.05 seconds), the resulting frame rate will be 20 fps.

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

Delay Time Setting

When the **Trigger Source** parameter is set to **Timer0Active**, you can configure a delay between the moment the camera receives the hardware trigger signal and when it is actually applied. The method for setting the delay time is as follows:

1 In the Counter and Timer Control category, set the Timer Trigger Source parameter to Line0.
2 Use the Timer Delay parameter to set the delay time.
3 In the Acquisition Control category, set the Trigger Source parameter to Timer0Active.
4 Click Acquisition Start to initiate image acquisition after the specified delay time.

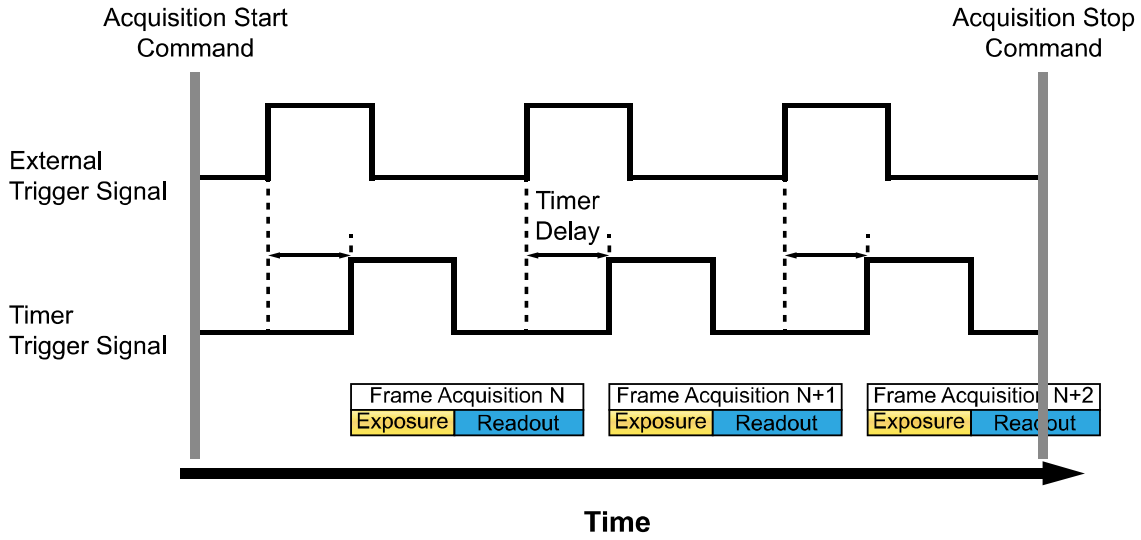


Figure 4-3 Delay Time Settings for External Trigger

Timed Exposure Mode

When using external trigger signals, such as CoaXPress or External, as the Exposure trigger, two modes are available: **Timed** and **TriggerWidth**.

Timed Exposure Mode

When **Timed Mode** is selected, the exposure time required for image acquisition is determined by the **Exposure Time** parameter.

- If set to a **rising edge** trigger, the exposure time starts when the external trigger signal rises (transitions from low to high).
- If set to a **falling edge** trigger, the exposure time starts when the external trigger signal falls (transitions from high to low).

The diagram below illustrates the **Timed exposure mode** set with a **rising edge trigger**, where the exposure begins as the external trigger signal rises.

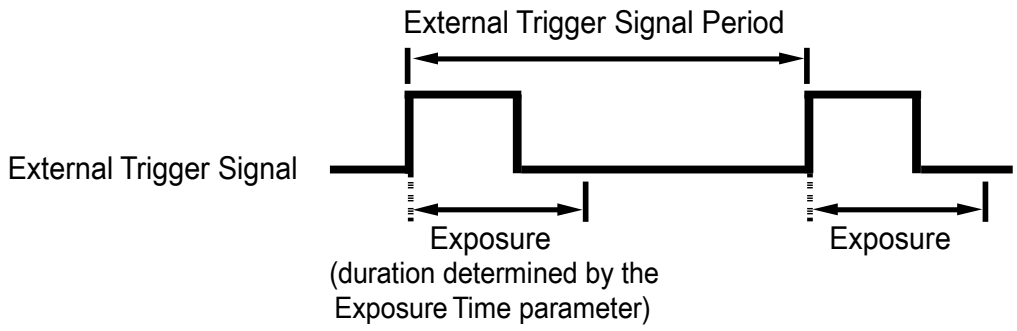


Figure 4-4 Timed Mode

If a new **Exposure Start trigger** signal is supplied while exposure is ongoing, that trigger signal will be ignored.

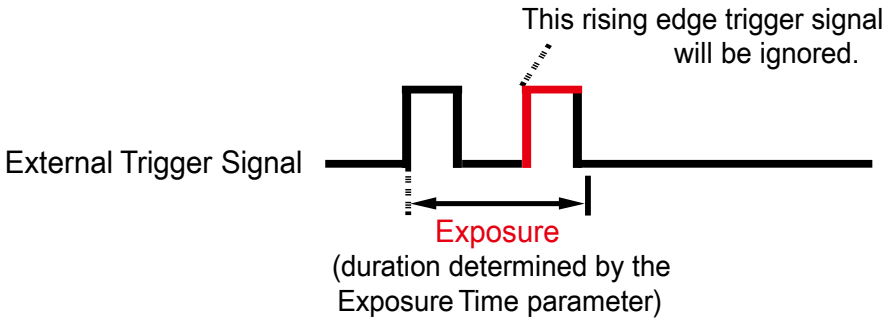


Figure 4-5 Timed Exposure mode and Overlapping Triggers

TriggerWidth Mode

If you select the TriggerWidth exposure mode, you can directly control the exposure period for each image acquisition using the external trigger signal (CoaXPress or External).

- When set to a rising edge trigger, exposure starts when the external trigger signal rises, and the exposure period continues until the signal falls.
- When set to a falling edge trigger, exposure starts when the external trigger signal falls, and the exposure period continues until the signal rises.

The following illustration shows the TriggerWidth exposure mode set with a rising edge trigger. TriggerWidth exposure is useful when applying different exposure periods for each image.

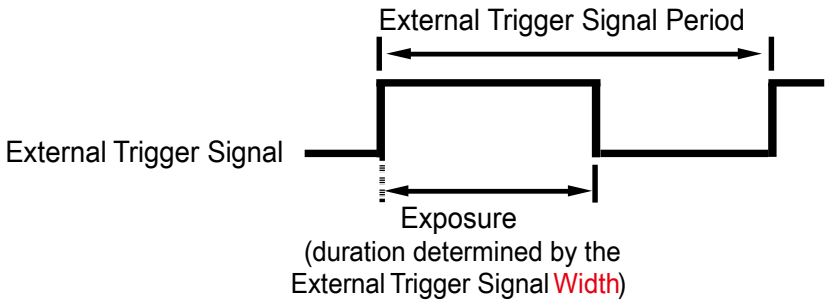


Figure 4-6 TriggerWidth Exposure Mode

4.3 Exposure Time Setting

This explains how to adjust the exposure time by setting the Exposure Time parameter. When the camera operates in the following ways, you need to set the Exposure Time parameter to specify the exposure duration.

- Set Trigger Mode to Off.
- Set Trigger Mode to On, and Trigger Source to Software.
- Set Trigger Mode to On, Trigger Source to UserOutput0, LinkTrigger0, Timer0 Active, or Line0, and set Exposure Mode to Timed.

The Exposure Time parameter should not be set below the allowable minimum value. The Exposure Time parameter sets the exposure time in microseconds (*μs*). The camera's allowable minimum and maximum exposure times are as follows:

Number of Channels	Minimum Exposure Time†	Maximum Exposure Time††
1/2/4	4 *μs*	60,000,000 *μs*

†: The actual exposure time is the same as the exposure time set by the user (Timed, TriggerWidth).

††: When the Exposure Mode is set to **TriggerWidth**, the exposure time is determined by the duration of the trigger signal, and there is no maximum limit.

Table 4-1 The Minimum and Maximum Exposure Time Settings

4.4 Overlap of Exposure and Readout

The image is acquired through two processes. The first is the exposure of the pixels on the image sensor. Once the exposure process is completed, the second process begins, which is the readout of the pixel values from the sensor. The VCS-14MX2-M/C340I camera operates in the Overlapped exposure mode by default, allowing the overlap of the exposure and readout processes.

While the pixel values from the previous image are being read out, if a trigger signal is supplied to the camera, exposure for the new image will begin. The image below illustrates the case where the Trigger Mode parameter is set to "On," the Trigger Source parameter is set to "Line0," and the Exposure Mode parameter is set to "TriggerWidth."

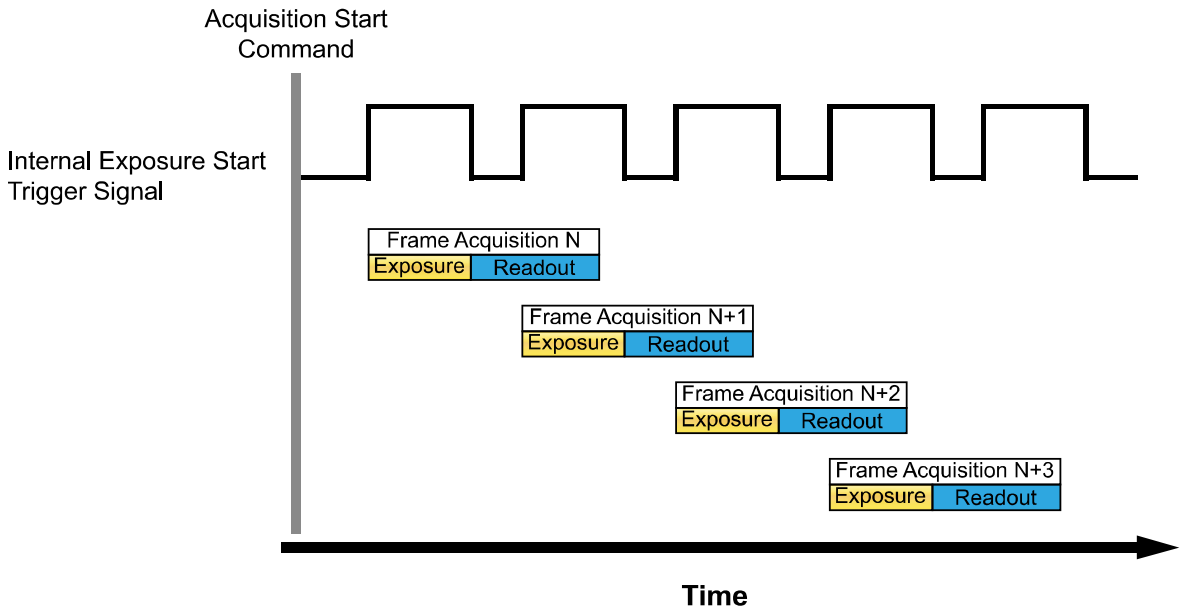


Figure 4-7 Overlapped Exposure and Readout

The overlap of the camera's exposure and readout processes is not determined by commands or settings; it is determined by the way the camera operates. If we define the "Frame Period" as the interval from the start point of the exposure for one image to the start point of the exposure for the next image, it is as follows:

Overlapped: Frame Period ≤ Exposure Time + Readout Time

Guideline for Overlapped Exposure

Since the VCS-14MX2-M/C340I camera operates with Overlapped Exposure, the following must be strictly adhered to:

- Do not start a new frame exposure while the exposure for the previous frame is still ongoing.
- Do not end the exposure for the current frame until the readout for the previous frame is complete.

When using Overlapped Exposure and external trigger signals to capture images, the camera's exposure time parameters and timing formulas can be used to calculate the optimal timing for the new capture.

4.5 Global Shutter

The VCS-14MX2-M/C340I camera uses a sensor equipped with an electronic global shutter. When an Exposure Start trigger is supplied to a camera with a global shutter, the exposure begins across all lines of the sensor, as shown in the diagram below. The exposure process continues in the following two cases:
1) When using TriggerWidth exposure mode, the exposure continues until the Exposure Start trigger signal ends the set exposure.
2) Alternatively, it continues until the set exposure time finishes.

Once the exposure ends, the pixel data is immediately read out.

The main feature of a global shutter is that all pixels of the sensor simultaneously start and stop exposure when capturing an image. This ensures that the brightness of the captured image remains uniform, minimizing issues that may arise when capturing images of moving objects. The Exposure Active output signal provided by the camera rises when the exposure time begins and ends when the exposure is finished.

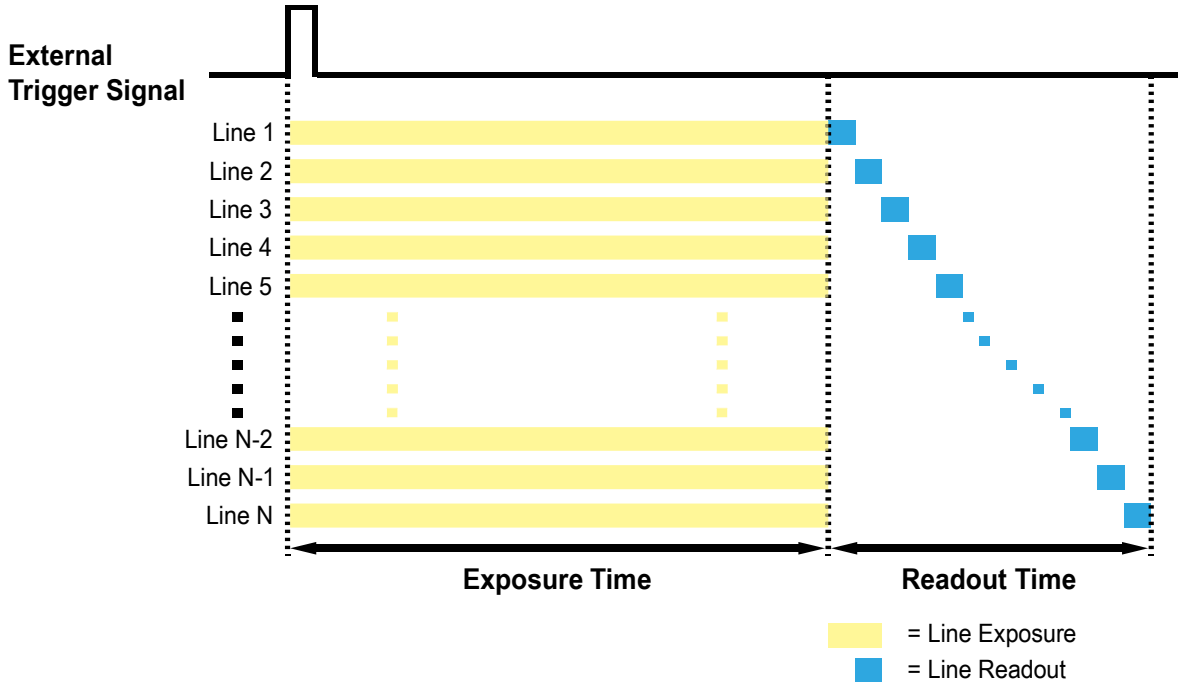


Figure 4-8 Global Shutter

4.6 Maximum Configurable Frame Rate

The factors that limit the camera's maximum frame rate are as follows:

- **Transmission time to the user's computer**: The transmission time is determined by the bandwidth allocated to the camera.
- **Time taken to transfer data from the image sensor to the camera's frame buffer after readout**: This time is determined by the ROI (Region of Interest) settings. A smaller image size results in a shorter readout time.
- **CXP Link Configuration**: Using more channels in the CXP Link Configuration allows for faster image acquisition compared to using fewer channels.
- **Exposure time**: Using very long exposure times reduces the number of images that can be acquired per second.

4.6.1 Increasing the Maximum Allowed Frame Rate

To capture images at a faster rate than the maximum allowed frame rate for the camera's current settings, adjust one or more of the following factors that affect the maximum frame rate and verify if the speed has increased.

- The time it takes to transmit images from the camera is a critical factor that limits the frame rate. Using the ROI (Region of Interest) function can reduce the image transmission time (which increases the maximum frame rate).
  - Reducing the size of the image can increase the allowable maximum frame rate. If possible, reduce the Height and Width settings of the image ROI.
- If using a CXP Link Configuration with fewer channels, switch to one with more channels. This generally increases the maximum frame rate.
- If the camera is set to capture images at maximum resolution with a normal exposure time, the exposure time does not limit the frame rate. However, when using long exposure times, the exposure time can limit the maximum frame rate. When using long exposure times, reduce the exposure time and check if the maximum frame rate increases. In this case, you may need to adjust the settings by using a bright light source or opening the lens aperture to allow more light in.

- Using extremely long exposure times can significantly limit the maximum frame rate. For example, if the exposure time is set to 1 second, it takes at least 1 second to capture one image, so the camera can capture only one image per second at most.

5. Camera Features

This section provides information on each camera feature.

5.1 Image Processing Sequence

The VCS-14MX2-M/C340I camera processes signals in the following sequence to efficiently capture high-quality images.

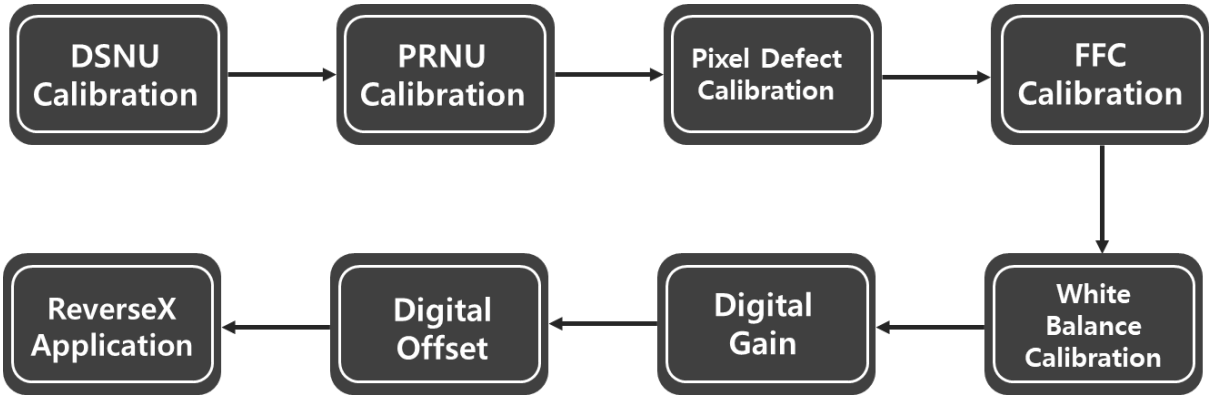


Figure 5-1 Image Processing Sequence for Image Acquisition

5.2 Region of Interest

Users can designate a Region of Interest (ROI) in the image for analysis, allowing them to capture images at a faster frame rate with the same quality as capturing the entire area. In this case, reducing the Width and Height parameters increases the maximum allowable frame rate.

When an ROI is specified, the Offset X and Offset Y values are set automatically. The VCS-14MX2-M/C340I camera automatically centers the ROI at the midpoint of the sensor's X and Y axes.

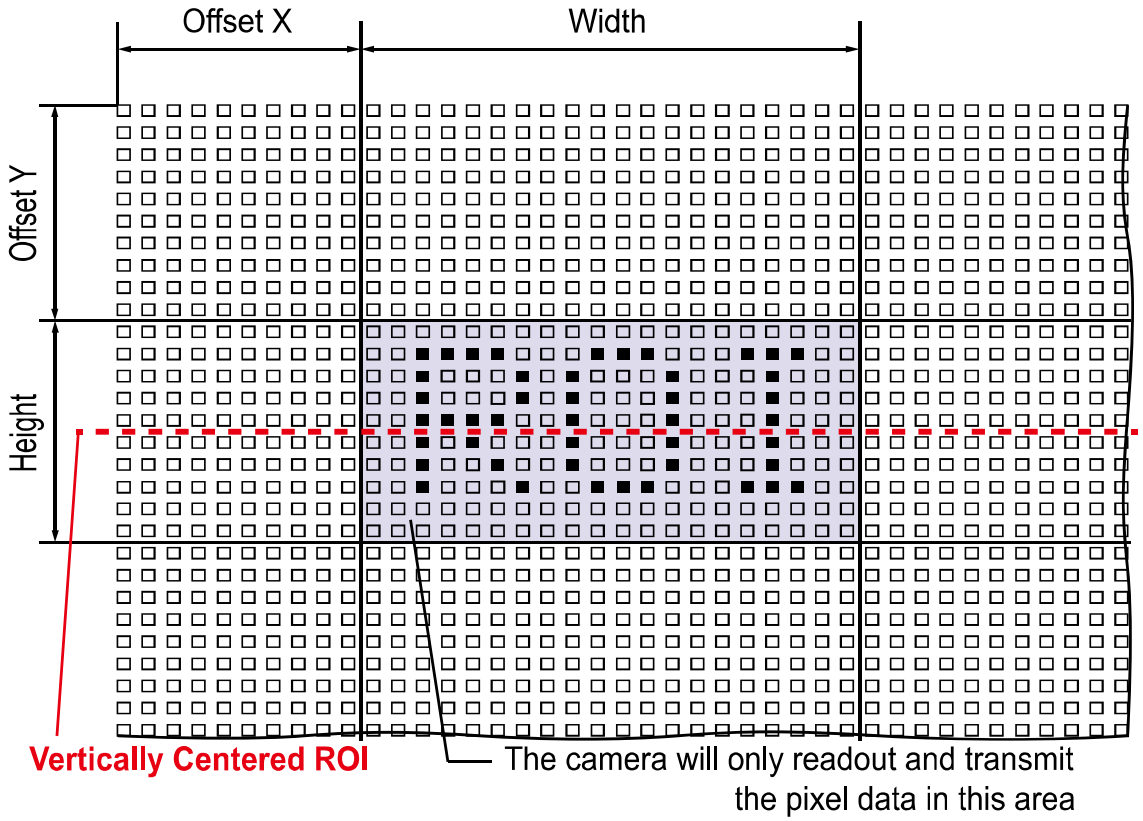


Figure 5-2 Region of Interest

The XML parameters related to ROI settings are as follows. The units for all parameters in this table are in pixels.

XML Parameters		Value	Description
ImageFormatControl	SensorWidth[a]	-	Effective width of the sensor
	SensorHeight[a]	-	Effective height of the sensor
	WidthMax	-	Maximum allowed width of the image with the current camera settings
	HeightMax	-	Maximum allowed height of the image with the current camera settings
	Width[b]	-	Sets the Width of the Image ROI.
	Height[b]	-	Sets the Height of the Image ROI.
	OffsetX[a]	-	Sets the horizontal offset from the origin to the Image ROI.

	OffsetY[a]	-	Sets the vertical offset from the origin to the Image ROI.

a: Read only. User cannot change the value.

B: User Menu for Setting ROI size

Table 5-1 XML Parameters for ROI

For this product, the ROI center is always aligned with the vertical center of the sensor due to its characteristics. Therefore, the Width and Height values set for the desired ROI size are automatically adjusted to center the ROI in the image.

- For the VCS-14MX2-M/C340I camera, both the Width and Height parameters must be set in multiples of 32.

The minimum allowed setting values for the ROI Width and Height are shown below:

Camera Model	Minimum Width Settings	Minimum Height Settings
VCS-14MX2-M/C340I	576	32

Table 5-2 Minimum ROI Width and Height Settings

The maximum frame rates for horizontal and vertical ROI changes in the VCS-14MX2-M/C340I camera are as shown below. The maximum frame rates listed below are calculated based on 8-bit settings. If you change from 8-bit to 10-bit, the speed generally decreases by approximately 20%. The frame rates shown in the table are the values output from the camera and may vary depending on the specifications of the user's computer.

ROI Size (H x V)	1 Channel	2 Channels	4 Channels
4608 x 3072	84.5 fps	168.8 fps	337.4 fps
4608 x 1984	129.5 fps	258.8 fps	516.9 fps
4608 x 992	251.9 fps	503.1 fps	1003.8 fps
4608 x 32	2955.9 fps	5819.5 fps	11286.7 fps
3008 x 3072	128.6 fps	257.1 fps	513.6 fps
3008 x 1984	197.2 fps	394.1 fps	786.2 fps
3008 x 992	383.5 fps	765.5 fps	1525.2 fps
3008 x 32	4466.3 fps	8723.5 fps	16666.7 fps
1984 x 3072	193.6 fps	386.7 fps	659.3 fps
1984 x 1984	296.6 fps	592.4 fps	1009.1 fps
1984 x 992	576.6 fps	1149.9 fps	1954.9 fps
1984 x 32	6641.5 fps	12825.9 fps	21037.9 fps

Table 5-3 Maximum Frame Rate by VCS-14MX2-M/C340I ROI Sizes_CXP-12

- When using ROI mode, the applicable ROI values (H × V) may vary depending on the specifications of the frame grabber. For detailed information, please refer to the CXP-12 frame grabber user manual.

- The maximum ROI area size changes when Binning is applied. For logic Binning, the maximum size is halved (2304x1536), while for sensor Binning, the maximum size is 4608×1536. For information regarding the changes in ROI size and speed when sensor Binning is applied, refer to <5.3 Binning>.

5.3 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:

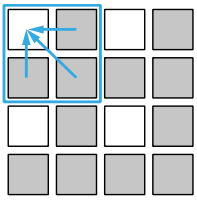
XML Parameters		Value	Description
ImageFormatControl	BinningSelector	Sensor	Binning is applied to the sensor in analog (supported only in Mono).
		Logic	Binning is applied digitally through logic.
	BinningHorizontalMode	Sum	Outputs a single pixel value by summing the values of adjacent pixels according to the Binning Horizontal setting.
		Average	Outputs a single pixel value by summing the values of adjacent pixels according to the Binning Horizontal setting and then dividing by the number of summed pixels. (Only supported for Logic Binning)
	BinningHorizontal	1×, 2×	Number of pixels to be summed in the horizontal direction (Only supported for Logic Binning)
	BinningVerticalMode	Sum	Outputs a single pixel value by summing the values of adjacent pixels according to the Binning Vertical setting.
		Average	Outputs a single pixel value by summing the values of adjacent pixels according to the Binning Vertical setting and then dividing by the number of summed pixels. (Only supported for Logic Binning)
	BinningVertical	1×, 2×	Number of pixels to be summed in the vertical direction.

Table 5-4 XML Parameters for Binning

When 2x2 binning is enabled, the camera's resolution is reduced to one-quarter of its original size.

- When Binning Mode is set to **Sum**, it reduces both the horizontal and vertical resolution of the image by half, resulting in a fourfold increase in brightness.
- When Binning Mode is set to **Average**, it reduces both the horizontal and vertical resolution by half while remaining the brightness and reducing temporal noise.
- Sensor Binning only supports vertical binning, which reduces vertical resolution by half while remaining the brightness and reducing temporal noise. The maximum frame speed does not increase.

The Width Max and Height Max XML parameters, which indicate the current maximum output resolution, are automatically updated based on the binning settings. In addition, the Width, Height, Offset X, and Offset Y parameters are adjusted accordingly, allowing you to check the current camera resolution.



2 × 2 Binning

Figure 5-3 2x2 Binning

- In color mode, binning is performed by combining adjacent pixels of the same color into a single pixel.

5.4 Multi-ROI

The VCS-14MX2-M/C340I camera's Multi-ROI feature allows you to specify up to 8 ROIs within the entire sensor area. When Multi-ROI is enabled, the camera reads out pixel data only from the specified regions during image acquisition. It then combines the data from these regions into a single image before transmitting it. The XML parameters related to Multi-ROI configuration are listed below, with all values in pixels.

XML Parameters		Value	Description
MultiROIControl	MultiROISelector	-	Selects the ROI to set.
	MultiROIMode	On/Off	Enables / Disables the selected ROI.
	MultiROIWidth	-	Width setting for the selected ROI
	MultiROIHeight	-	Height setting for the selected ROI
	MultiROIOffsetX[b]	-	Horizontal offset from the origin to the selected ROI
	MultiROIOffsetY	-	Vertical offset from the origin to the selected ROI
	MultiROIValid[a]	-	Verifies the validation of the Multi-ROI setting values.
	MultiROIStatus	Active/Inactive	Displays the status of the Multi ROI feature. • Active: The Multi-ROI feature is in use. • Inactive: The Multi-ROI feature is not in use.

a: If the setting values for the Multi-ROI feature are valid, 'True' will be returned or the check box will be selected.

b: Read only. User cannot change the values.

Table 5-5 XML Parameter for Multi-ROI

When configuring multiple ROIs, the Multi-ROI Width parameter is applied uniformly to all ROIs, so it is recommended to set this parameter first. After that, you can configure each ROI individually. You can define up to 8 ROIs, numbered from 0 to 7. First, select the desired ROI number using the Multi-ROI Selector parameter, then enable or disable it using the Multi-ROI Mode parameter. Finally, adjust the Multi-ROI Offset Y and Multi-ROI Height parameters for each selected ROI. The figure below provides an example of configuring two ROIs.

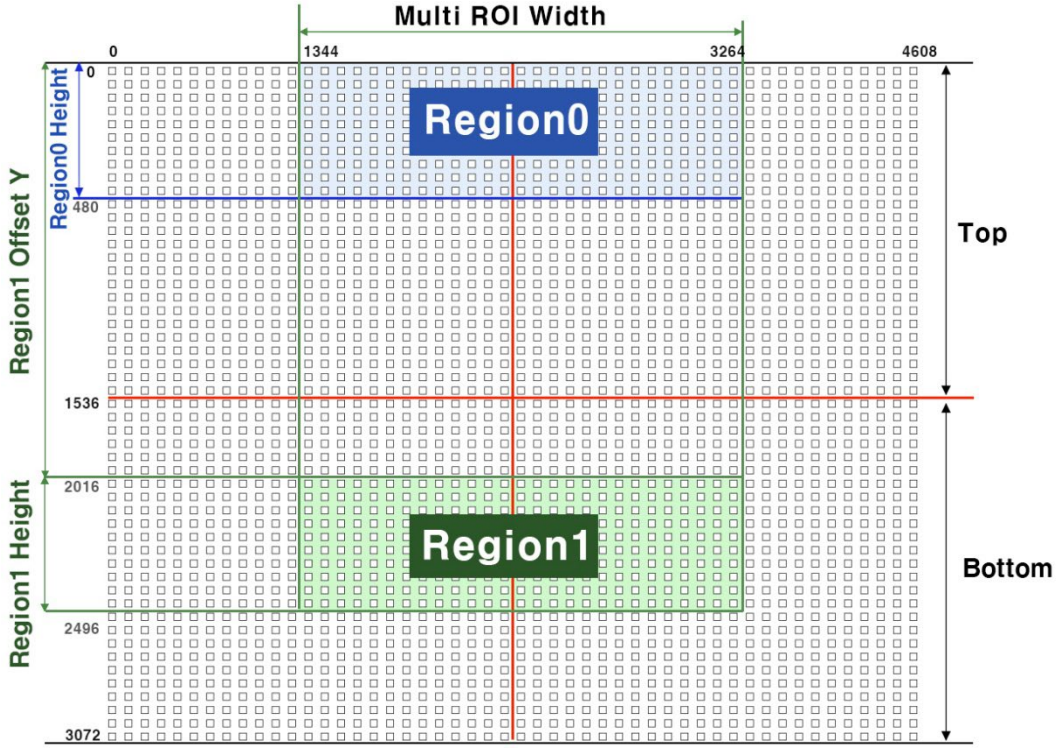


Figure 5-4 Multi-ROI

When setting the Multi-ROI mode on the VCS-14MX2-M/C340I camera, keep the following considerations in mind.

- The sum of the Multi-ROI Offset X value and the Multi-ROI Width value cannot exceed the Width value of the camera's sensor
- The sum of the Multi-ROI Offset Y value and the Multi-ROI Height value cannot exceed the Height value of the camera's sensor.
- The Width and Height settings for Multi-ROI are the same as those in the <5.2 Region of Interest> configuration.
- To use Multi-ROI, at least one ROI must be set for both the top and bottom.
- You can save Multi-ROI settings as a User Set and reload them whenever needed. For more details, refer to <5.28 User Set Control>.

5.5 CXP Link Configuration

The VCS-14MX2-M/C340I camera must be connected to a CXP-12 Frame Grabber of CXP 2.0 interface. CoaXPress 2.0 interface allows you to connect a camera to a Frame Grabber supporting CXP 2.0 by using simple coax cabling and allows up to 12.5 Gbps data rate per cable. The VCS-14MX2-M/C340 camera supports one master connection and up to three extension connections to configure a link. In compliance with the CoaXPress standard, the camera includes an automatic link detection mechanism (Plug and Play) to correctly detect the camera to CXP-12 Frame Grabber connections.

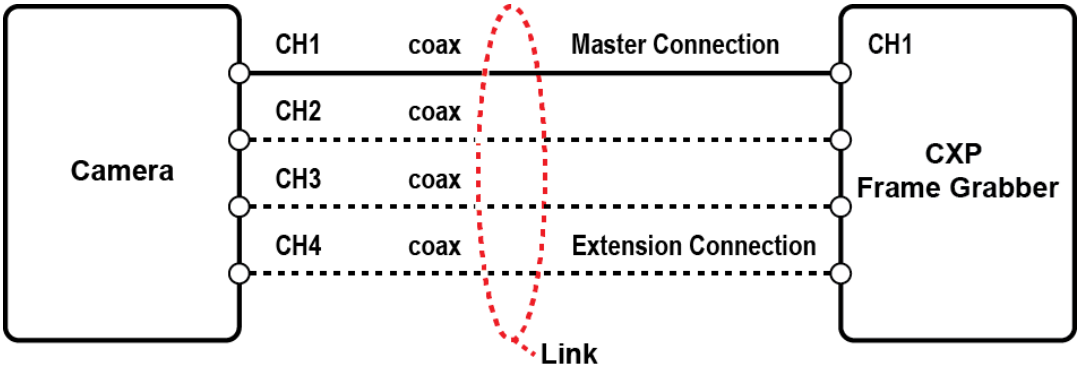


Figure 5-5 CXP Link Configuration

The XML parameters related to the link configuration between the camera and CXP-12 Frame Grabber are as follows:

XML Parameters		Value	Description
CoaXPress	CxpLinkConfiguration Preferred	Read Only	• Displays bit rate and the number of connections to be set for the link configuration between the camera and Host (Frame Grabber) while discovering devices. • Saves the current CxpLinkConfiguration values as the CxpLinkConfigurationPreferred value when you execute the User Set Save parameter.
	CxpLinkConfiguration	CXP6_X1 CXP6_X2 CXP6_X4 CXP10_X1 CXP10_X2 CXP10_X4 CXP12_X1 CXP12_X2 CXP12_X4	Sets bit rate and the number of connections for the link configuration. e.g. CXP12_X4: Four connections running at a maximum of CXP12 speed (12.5 Gbps)

Table 5-6 XML Parameter for CXP Link Configuration

5.6 Pixel Format

You can determine the pixel format (8 bits, 10 bits, and 12 bits) of these image data transmitted from the camera by selecting 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 5-7 XML Parameter for Pixel Format

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

Mono Sensor	Color Sensor
Mono 8 Mono 10 Mono 12	Mono 8 Mono 10 Mono 12 Bayer RG 8 Bayer RG 10 Bayer RG 12

Table 5-8 Pixel Format Values

5.7 Data ROI (Color Only)

The Balance White 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	DataRoiSelector	BalanceWhiteAuto	Selects a Data ROI used for Balance White Auto. Only available on the color camera
	DataRoiOffsetX	-	X coordinate of start point ROI
	DataRoiOffsetY	-	Y coordinate of start point ROI
	DataRoiWidth	32 to 4608	Width of ROI
	DataRoiHeight	2 to 3072	Height of ROI

Table 5-9 XML Parameter for Data ROI

When using both Image ROI and Data ROI simultaneously, only the pixel data within the overlapping area of the defined Data ROI and Image ROI is valid. The valid area is determined as shown in the figure below.

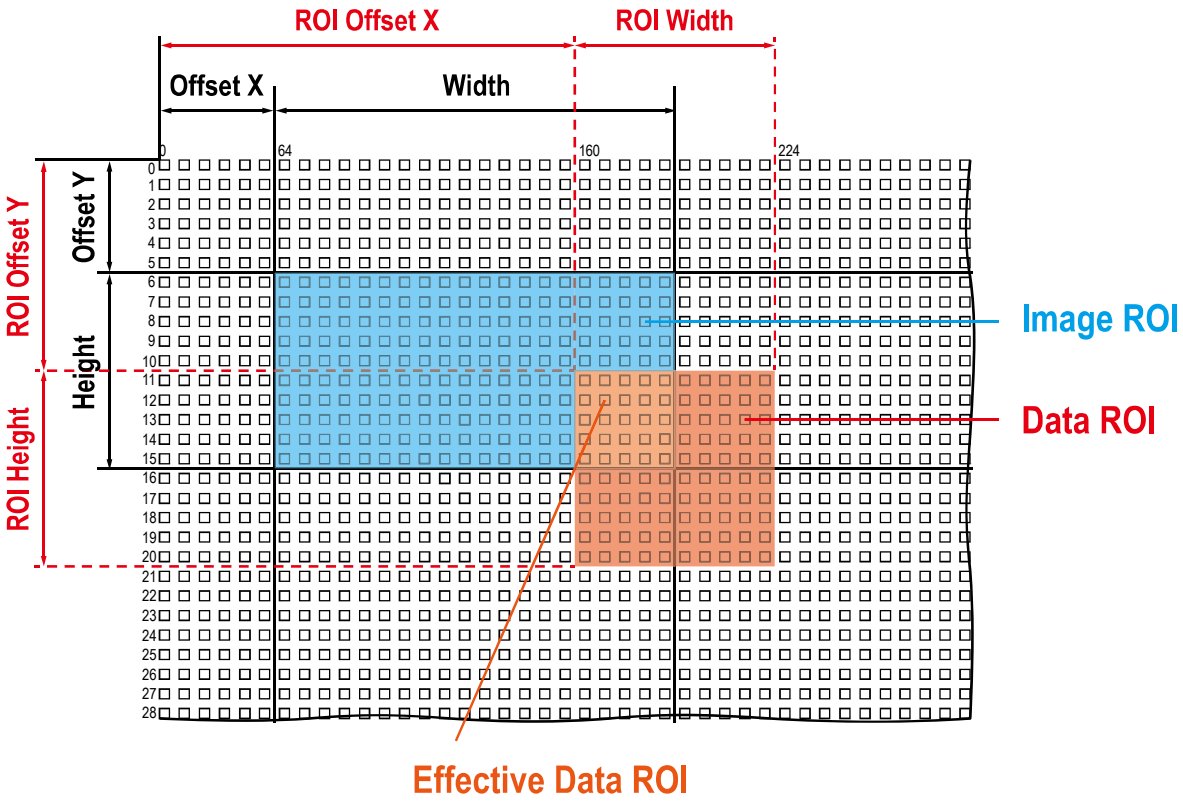


Figure 5-6 Effective Data ROI

5.8 White Balance (Color Only)

The color camera includes the white balance capability to adjust the color balance of the images transmitted from the camera. The White Balance function on the VCS-14MX2-M/C340I camera allows you to individually adjust the intensity of Red, Green, and Blue channels. Use the Balance Ratio parameter to set the intensity for each color. The Balance Ratio can be set between 1.0 and 4.0. If the Balance Ratio is set to 1.0, the intensity of that color will not be affected by the White Balance mechanism. If the Balance Ratio is set to a value greater than 1.0, the intensity of that color will increase proportionally. For example, setting the Balance Ratio to 1.5 increases the intensity of that color 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	x1.0 to x4.0	Adjusts the ratio of the selected color.

Table 5-10 XML Parameter for White Balance

5.8.1 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 for Balance White Auto. If you do not set the related 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 parameters related to Balance White Auto are as follows:

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

Table 5-11 XML Parameter for Balance White Auto

5.9 Gain and Black Level

Increasing the Gain parameter value can amplify the pixel values of the entire image. As a result, the camera can output Grey values higher than those generated by the sensor.

1 Select the Gain Control (Analog All, Digital All) to be adjusted by using the Gain Selector parameter.
2 Set 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 Select the Black Level Control (Analog All, Digital All) to be adjusted by using the Black Level Selector parameter.
2 Set the Black Level parameter to the desired value.

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

XML Parameters		Value	Description
AnalogControl	GainSelector	Analog All	Applies the Gain value to all analog channels.
		Digital All	Applies the Gain value to all digital channels.
	Gain	x1, x1.55, x2.17, x2.77, and x5.0	Sets an analog gain value.
		x1, x1.67, x2.14, x2.93, and x4.4	Sets a digital gain value.
		1.0× to 32.0×	Applies the Black Level value to all digital channels.
	BlackLevelSelector	DigitalAll	Sets a black level value.
	BlackLevel	8 bit: 0 to 15.93 10 bit: 0 to 63.75 12 bit: 0 to 255.00	Applies the Gain value to all analog channels.

Table 5-12 XML Parameter for 0Gain and Black Level

5.10 Defective Pixel Correction

The CMOS sensor may have defect pixels which cannot properly react to the light. Correction is required since it may deteriorate the quality of output image. Defect pixel information of CMOS used for each camera is entered into the camera during the manufacturing process. If you want to add defect pixel information, it is required to enter coordinate of new defect pixel into the camera. For more information, refer to <7.1 Appendix A – Defective Pixel Map Download>.

5.10.1 Calibration Method

A calibration value for a defect pixel is calculated based on the valid pixel value adjacent in the same line.

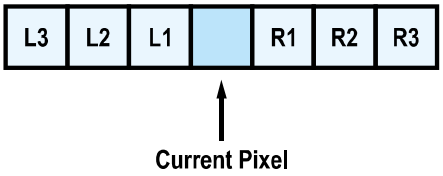


Figure 5-7 Location of Defect Pixel to Be Calibrated

If the Current Pixel is a defect pixel as shown in the figure above, the calibration value for this pixel is obtained as shown in the following table depending on whether surrounding pixels are defect pixels or not.

Adjacent Defect Pixel	Calibration Value of Current Pixel
None	(L1 + R1) / 2
L1	R1
R1	L1
L1, R1	(L2 + R2) / 2
L1, R1, R2	L2
L2, L1, R1	R2
L2, L1, R1, R2	(L3 + R3) / 2
L2, L1, R1, R2, R3	L3
L3, L2, L1, R1, R2	R3

Table 5-13 Calculation of Defect Pixel Calibration Value

5.11 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 VCS-14MX2-M/C340I camera provides the DSNU Correction feature.

The XML parameters related to DSNU are as follows:

XML Parameters		Value	Description
DSNU	DSNUDataSelector	Default	Selects Default as a non-volatile memory location to load DSNU data from.
		Space1 to 7	Selects a user defined location as a non-volatile memory location to save DSNU data to or load DSNU data from.
	DSNUDataGenerate	-	Generates the DSNU data for the current camera settings.
	DSNUDataSave	-	Saves the generated DSNU data in the non-volatile memory. The generated data by executing the **DSNUDataGenerate** command 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.
	DSNUDataLoad	-	Loads the DSNU data from the non-volatile memory into the volatile memory.
	DSNUDataDefault	Default	Selects the DSNU data region to use as the initial value from the data stored as the default value.
		Space1 to 7	Selects the DSNU data region to use as the initial value.

Table 5-14 XML Parmaters for DSNU

5.11.1 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.
- Before generating DSNU data, set the FFC feature to Off.

1 To obtain the optimum DSNU correction values, set the ROI to the actual settings you will be using during normal operation.
2 Ensure that the camera will be acquiring images in complete darkness by covering the camera lens, closing the iris in the lens, or darkening the room.
3 Begin acquiring images by setting the camera for the Free-Run mode.
4 Execute the DSNU Data Generate command to generate DSNU data for the current camera settings.
5 The generated DSNU correction values will be activated and saved in the camera's volatile memory.
6 To save the generated DSNU correction values in the camera's Flash (non-volatile) memory, use the DSNU Data Selector parameter to specify a location to save the DSNU correction values, and then execute the DSNU Data Save command. The previous DSNU values saved in the memory will be overwritten.

To disregard the generated DSNU correction values and load the existing values in the Flash memory, use the DSNU Data Selector parameter to select a desired DSNU correction values, and then execute the DSNU Data Load command.

5.12 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 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 VCS-14MX2-M/C340I camera provides the PRNU Correction feature.

The XML parameters related to PRNU are as follows:

XML Parameters		Value	Description
PRNU	PRNUDataSelector	Default	Selects Default as a non-volatile memory location to load PRNU data from.
		Space1 - 7	Selects a user defined location as a non-volatile memory location to save PRNU data to or load PRNU data from.
	PRNUDataGenerate	-	Generates the PRNU data for the current camera settings.
	PRNUDataSave	-	Saves the generated PRNU data in the non-volatile memory. The generated data by executing the **PRNUDataGenerate** command 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.
	PRNUDataLoad	-	Loads the PRNU data from the non-volatile memory into the volatile memory.
	PRNUDataDefault	Default	Selects the PRNU data region to use as the initial value from the data stored as the default value.
		Space1 - 7	Selects the PRNU data region to use as the initial value.

Table 5-15 XML Parameters for PRNU

5.12.1 Generating and Saving User PRNU Correction Values

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

To generate the optimum PRNU data,

- Generating DSNU correction values first before generating PRNU correction values is recommended.
- Set the FFC feature to Off before generating PRNU correction values.
- The grey reference image must be acquired at uniform illumination. We strongly recommend that you use a high-quality light source to deliver uniform illumination. Standard illumination may not be appropriate.

The PRNU correction values stored in Default are optimized for use in typical situations and will provide good camera performance in most cases. Use of the values stored in Default is recommended.

1 To generate PRNU correction values suitable for your operating conditions, set the ROI to the actual settings you will be using during normal operation. We strongly recommend that you use the Default PRNU correction values stored in Default, if you cannot set up the uniform illumination.
2 Without mounting a lens on the camera, place a uniform illumination (e.g. backlight) in the field of view of the camera. Set up the camera as you would for normal operation. We recommend that you make adjustments to achieve the digital output level in a range from 150 to 200 (Gain: 1.00 at 8 bit).
3 Begin acquiring images by setting the camera for the Free-Run mode.
4 Execute the PRNU Data Generate command to generate PRNU correction values for the current camera settings.
5 The generated PRNU correction values will be activated and saved in the camera's volatile memory.
6 To save the generated PRNU correction values in the camera's Flash (non-volatile) memory, use the PRNU Data Selector parameter to specify a location to save the PRNU correction values, and then execute the PRNU Data Save command. The previous PRNU values saved in the memory will be overwritten.

To disregard the generated PRNU correction values and load the existing values in the Flash memory, use the PRNU Data Selector parameter to select a desired PRNU correction values, and then execute the PRNU Data Load command.

5.13 Flat Field Correction

The Flat Field Correction feature improves the image uniformity when you acquire a non-uniformity image due to external conditions. The feature of Flat Field Correction can be simplified by the following equation:

```
IC = IR / IF

IC:     Level value of corrected image
IR:     Level value of original image
IF:     Level value of Flat Field data
```

In actual use conditions, generate a Flat Field correction data and then save the data into the non-volatile memory of the camera by following the procedure below.

1 Execute the Flat Field Data Generate parameter. After executing the Flat Field Data Generate parameter, you must acquire one image to generate the scaled down Flat Field correction data.

2 Use the Flat Field Data Selector parameter to specify a location to save the generated Flat Field correction data.

3 Execute the Flat Field Data Save parameter to save the generated Flat Field data into the non-volatile memory. When the scaled down Flat Field data are used for correction, they are expanded and applied with a Bilinear Interpolation as shown in the <Figure 5-10 Bilinear Interpolated Magnification>. To disregard the generated Flat Field correction data and load the existing Flat Field correction data, execute the Flat Field Data Load parameter before executing the Flat Field Data Save parameter.

4 Set the Flat Field Correction parameter to On to apply the Flat Field data to the camera.

- It is recommended that you enable the Defective Pixel Correction feature before executing the Flat Field Data Generate parameter.
- Before executing the Flat Field Data Generate parameter, you must set the camera as follows:
  - OffsetX, Y: 0
  - Width, Height: Maximum values
- After executing the Acquisition Start command, you need to operate the camera with the free-run mode or apply a trigger signal to acquire an image.

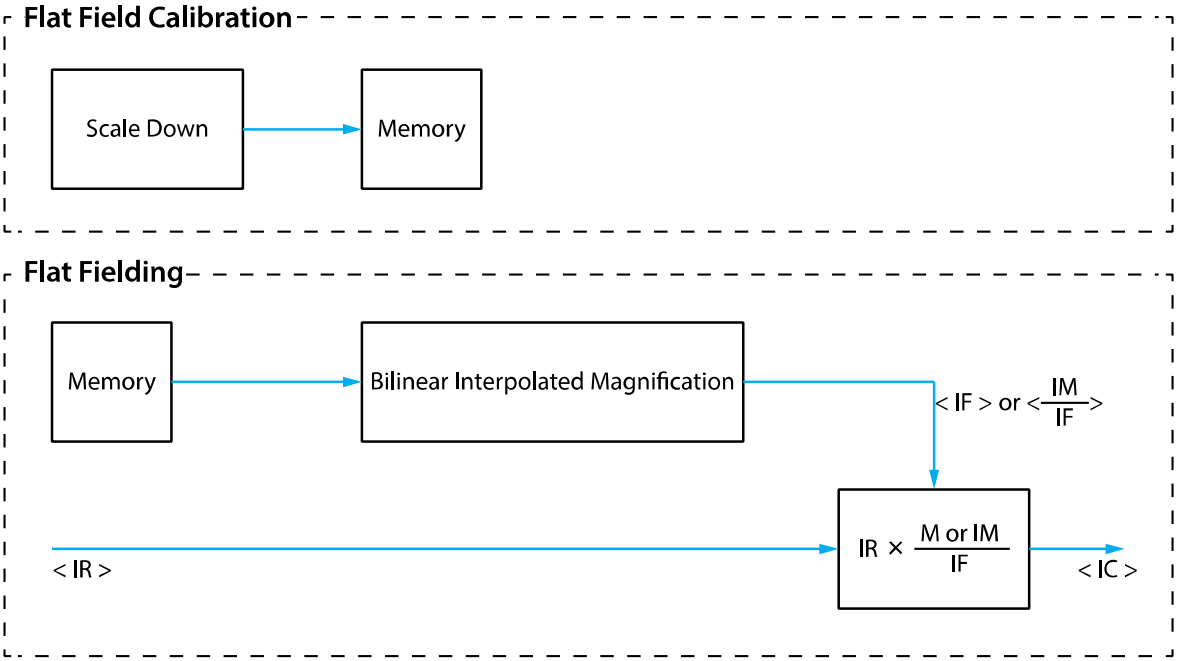


Figure 5-8 Generation and Application of Flat Field Data

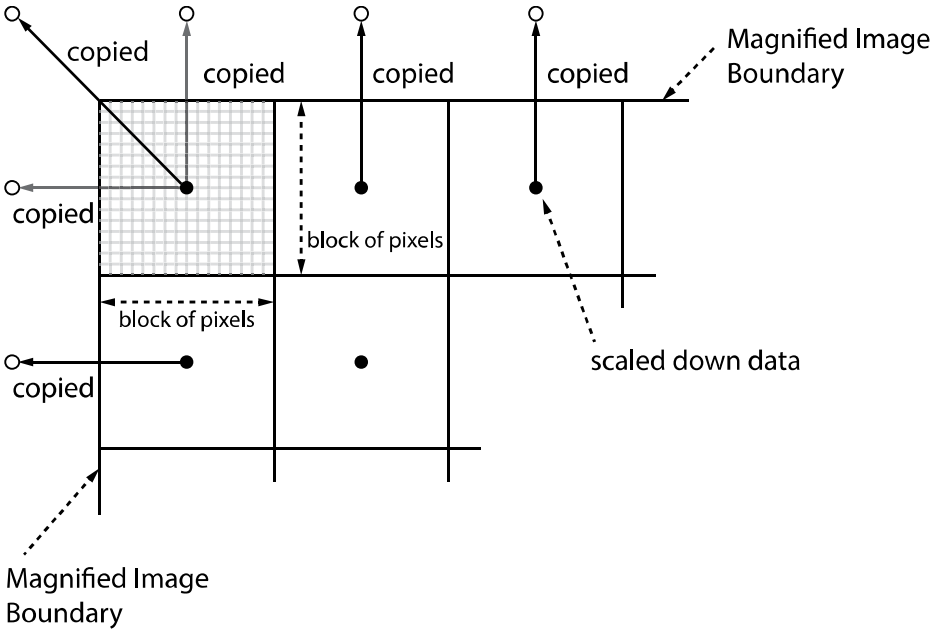


Figure 5-9 Bilinear Interpolated Magnification

The XML parameters related to Flat Field Correction are as follows:

XML Parameters		Value	Description
FlatFieldControl	FlatFieldCorrection	Off	Disables the Flat Field Correction feature.
		On	Enables the Flat Field Correction feature.
	FlatFieldDataSelector	Space0 to Space7	Selects a location to save or import Flat Field data. Space0 to Space7: User defined location
	FlatFieldDataGenerate	-	Creates Flat Field data
	FlatFieldDataSave	-	Saves the generated Flat Field correction data in the non-volatile memory. The data generated by executing the Flat Field Data Generate parameter is saved in the volatile memory so that the data is 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.
	FlatFieldDataLoad	-	Loads the Flat Field data from the non-volatile memory into volatile memory.
	FlatFieldDataDefault	Space0 to Space7	• Selects a space to use Flat Field data as an initial value. • Selects a space to load the Flat Field data to the current window. Space0 to Space7: User defined location

Table 5-16 XML Parameters for Flat Field Correction

5.13.1 Flat Field Data Selector

As mentioned above, the generated Flat Field correction data are stored in the camera's volatile memory and the data are lost if the camera is reset or powered off. To use the generated Flat Field correction data after the camera is powered on or reset, you need to save them in the camera's non-volatile memory. The VCS-14MX2-M/C340I camera provides thirty-two reserved locations in the camera's non-volatile memory available for saving and loading the Flat Field correction data. You can use the Flat Field Data Selector parameter to select a location as desired.

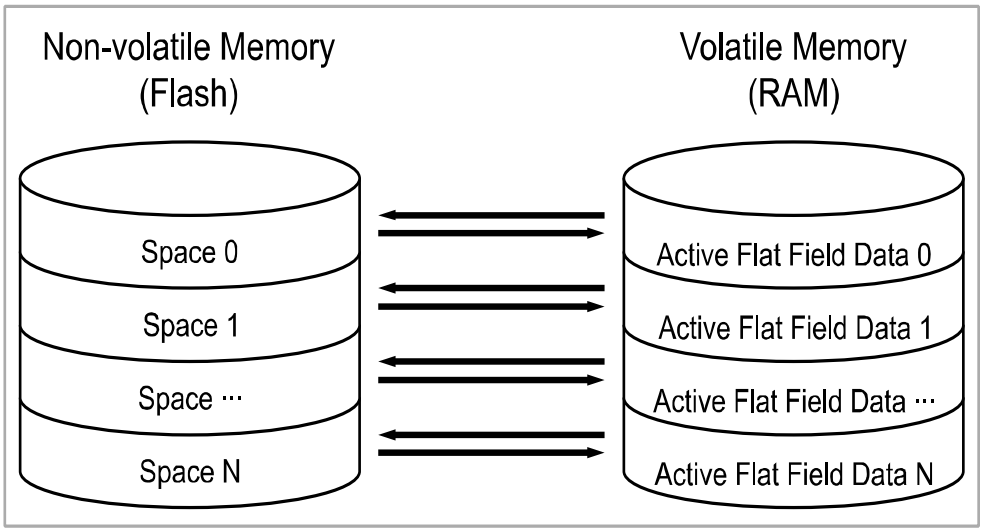


Figure 5-10 Flat Field Data Selector

Saving Flat Field Data

In order to save the active Flat Field data into a reserved location in the camera's Flash memory, follow the procedure below.

1 Use the Flat Field Data Selector parameter to specify a location to save the active Flat Field data.
2 Execute the Flat Field Data Save parameter to save the active Flat Field data to the selected location.

Importing Flat Field Data

If you saved Flat Field correction data into the camera's non-volatile memory, you could load the saved Flat Field correction data from the camera's non-volatile memory into the camera's active Flat Field data location.

1 Use the Flat Field Data Selector parameter to specify a reserved location whose Flat Field correction data will be loaded into the camera's active Flat Field data location.
2 Execute the Flat Field Data Load parameter to load the selected Flat Field correction data into the active Flat Field data location.

5.14 Timestamp

The VCS-14MX2-M/C340I camera provides the Timestamp feature.

The XML parameters related to Timestamp are as follows:

XML Parameters		Description
DeviceControl	Timestamp	Indicates the current Timestamp value of the connected device.
	TimestampIncrement	Indicates the increment of Timestamp.
	TimestampReset	Changes the current Timestamp value into 0 and restarts counting.
	TimestampResetValue	Designates time to reset Timestamp as 0, by the form in the numeric value.
	TimestampLatch	Latches the current value of Timestamp.
	TimestampLatchValue	Indicates prior value before resetting the Timestamp value.

Table 5-17 XML Parameters for Timestamp

5.15 Event Control

The VCS-14MX2-M/C340I camera provides an Event Notification feature. With the Event Notification feature, the camera can generate an event and transmit a related event message to the PC whenever a specific situation has occurred. It can generate and transmit events when the TestEventGenerate parameters is executed.

The XML parameters related to Event Control are as follows:

XML Parameters		Value	Description
EventControl	EventSelector	Test	Transfers the Test event generated from the execution of the TestEventGenerate parameter.
	EventNotification	On	Enables the selected event notification.
		Off	Disables the selected event notification.
TestControl	TestPendingAck	-	Sets time to wait before writing the device's pending acknowledge feature.
	TestEventGenerate	-	Generates a Test event.

Table 5-18 The XML parameters for Event Control

5.16 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
DigitalIOControl	LineSelector	Line0	Selects pin 1 as the input among the 12-pin connectors for camera power input and control I/O, and configure the related settings.
		Line1 to Line6	Configures each of pins 4, 7, 8, 9, 10, and 11 among the 12-pin connectors for camera power input and control I/O.
	LineMode	Input	Items displayed when Line0 is selected
		Output	Items displayed when Line1 to Line6 are selected
	LineInverter	FALSE	Line output signal not inverted
		TRUE	Line output signal inverted
	LineSource	Off	Line output disabled
		FrameActive	Outputs a pulse for the readout period of a single frame
		LineActive	Outputs a pulse for the current Line time
		ExposureActive	Outputs a pulse for the current exposure time
		UserOutput0	Outputs a pulse based on the UserOutputValue setting
		Timer0Active	Outputs a pulse for the user-configured Timer signal
		Count0Active	Outputs a pulse for the user-configured counter signal
	UserOutput Selector	UserOutput0	Outputs a pulse based on the UserOutputValue setting
	UserOutput Value	FALSE	Sets the Bit to Low
		TRUE	Sets the Bit to High
	Debounce Time	0 to 1,000,000	Sets the debounce time in microseconds (Default: 0.5 μs)

Table 5-19 XML Parameters for Digital I/O Control

If the Line Source is set to UserOutput0, the user-configured value can be used as the output signal.

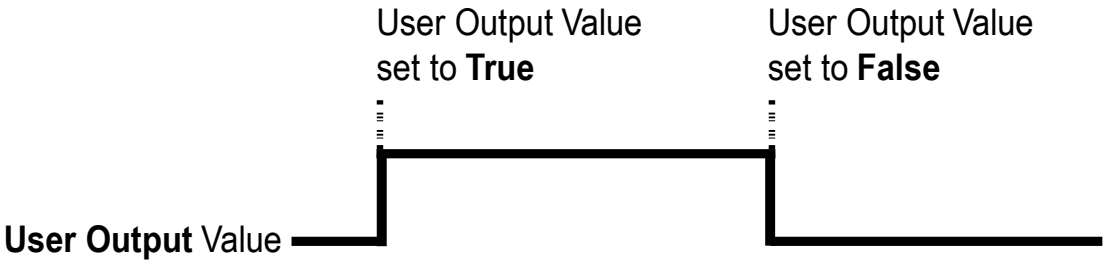


Figure 5-11 User Output

The camera can provide an Exposure Active output signal. This 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. It can be used as a flash trigger and is also useful in systems where either the camera or the object being imaged is movable. Typically, you want to avoid moving the camera during exposure. By monitoring the Exposure Active signal, you can determine when exposure is in progress and prevent unwanted movement.

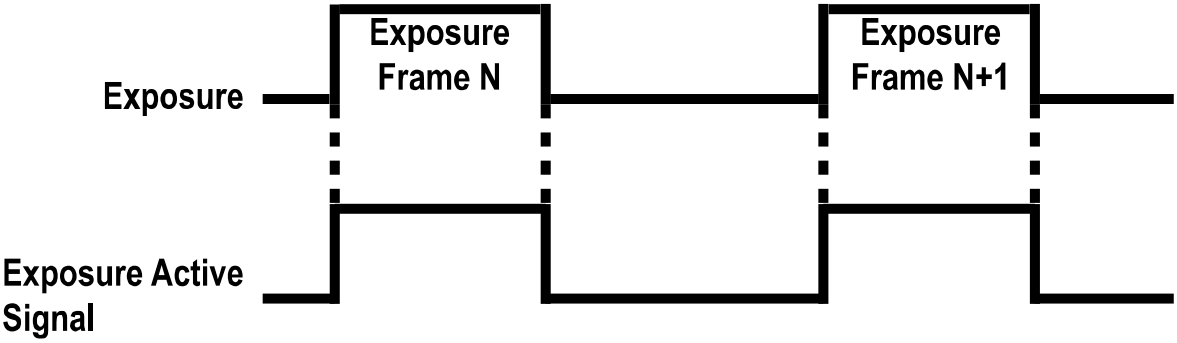


Figure 5-12 Exposure Active Signal

5.17 Debounce

The Debounce feature enables the VCS-14MX2-M/C340I camera to receive only valid signal by distinguishing the 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:

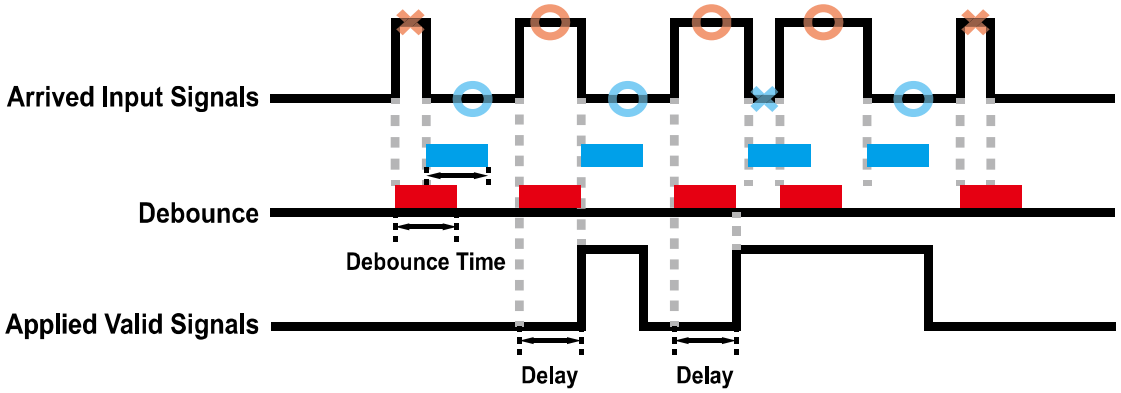


Figure 5-13 Debounce

The XML parameter related to Debounce Time is as follows:

XML Parameters		Value	Description
DigitalIOControl	Debounce Time	0 to 1,000,000 μs	Sets a Debounce Time in microseconds (Default: 0 μs)

Table 5-20 XML Parameter for Debounce Time

5.18 Timer Control

When the Line Source parameter is set to Timer0Active, the camera can provide output signals by using the Timer. On the VCS-14MX2-M/C340I camera, the Frame Active, Exposure Active event or external trigger signal is available as Timer source signal.

The XML parameters related to Timer are as follows:

XML Parameters		Value	Description
CounterAnd TimerControl	TimerSelector	Timer0	Selects the Timer to configure.
	TimerDuration	1 to 85,899,344 μs	Sets the duration of the Timer output signal to be used when Timer Trigger Activation is set to Rising/Falling Edge.
	TimerDelay	0 to 85,899,344 μs	Sets the delay time to be applied before starting the Timer.
	TimerReset	-	Resets the Timer and starts it again.
	TimerValue	-	Displays the current value of the selected Timer.
	TimerStatus	TimerIdle	Indicates that the Timer is in a standby state.
		TimerTriggerWait	Indicates that the Timer is waiting for a trigger signal.
		TimerActive	Indicates that the Timer is active.
	TimerTriggerSource	Off	Disables the Timer output signal.
		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.
		Line 0	Sets the Timer to use the external trigger signal as the source signal.
		Counter0Start	설정해 둔 Counter0를 Timer 출력 신호의 소스 신호로 사용
	TimerTriggerActivation	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.
		AnyEdge	Specifies the selected trigger signal's rising and falling edges to operate as the Timer output signal 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.

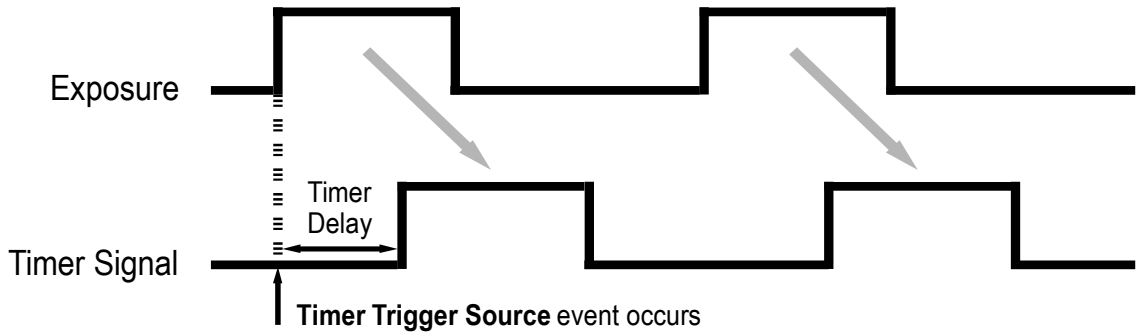
Table 5-21 XML Parameters for Timer Control

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 5-14 Timer Signal

5.19 Cooling Control

A fan is installed on the rear panel of the camera to radiate heat. You can set the fan to turn on or off. You can also set the fan to turn on when a specified internal temperature is reached.

The XML parameters related to Cooling Control are as follows:

XML Parameters		Value	Description
CoolingControl	TargetTemperature	-10℃ to 80℃	Turns on the fan automatically when the temperature set in this parameter.
	FanOperationMode	Off	Turns off the fan.
		On	Turns on the fan.
		Temperature	The fan operates when the temperature reaches or exceeds the value set in the TargetTemperature parameter.
	FanSpeed	-	Displays the current Fan RPM.

Table 5-22 XML Parameters for Cooling Control

5.20 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 5-23 XML Parameters for Device Temperature

.

What is Partial Shutdown?

To ensure stable operation, maintain the front panel temperature of the camera below +55°C and the internal temperature below +65°C. In environments where cooling tools like fans are not available, the camera temperature may rise along with increased ambient convection.

If the internal temperature of the camera exceeds +75°C ± 2, the device will enter a partial shutdown mode to protect itself. In this mode, commands can still be sent to the camera, but video capture will be disabled, and power consumption will be reduced to approximately 70% of normal operating levels.

To recover from partial shutdown mode, turn off the camera, allow sufficient time for it to cool down, and then restart it.

5.21 Status LED

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.
Slow Flashing Red	A CXP Link is not configured.
Fast Flashing Red	Partial operational shutdown due to camera exceeding recommended temperature limits.
Fast Flashing Orange	The camera is checking a CXP Link configuration.
Steady Green	A CXP Link is configured.
Fast Flashing Green	The camera is transmitting image data.

Table 5-24 Status LED

5.22 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 Parameters		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 5-25 XML Parameter for Test Pattern

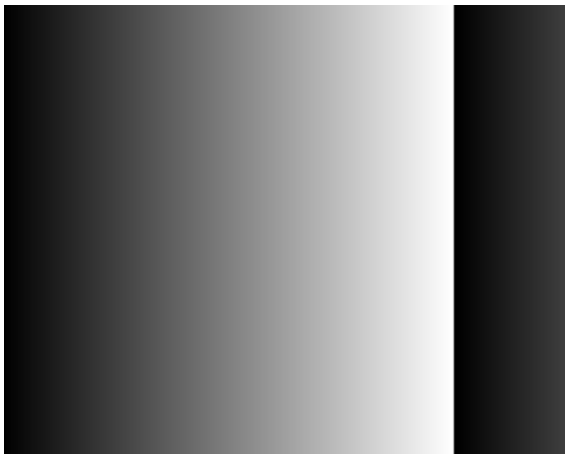


Figure 5-15 Grey Horizontal Ramp

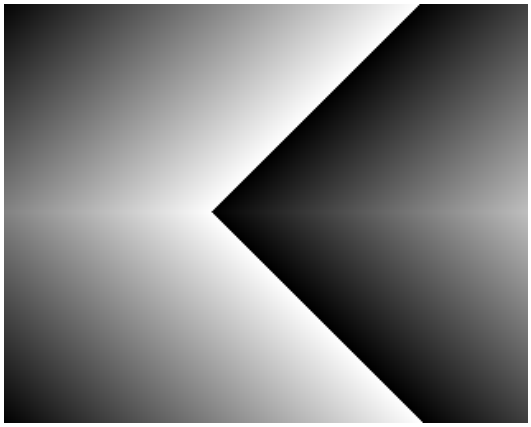


Figure 5-16 Grey Diagonal Ramp

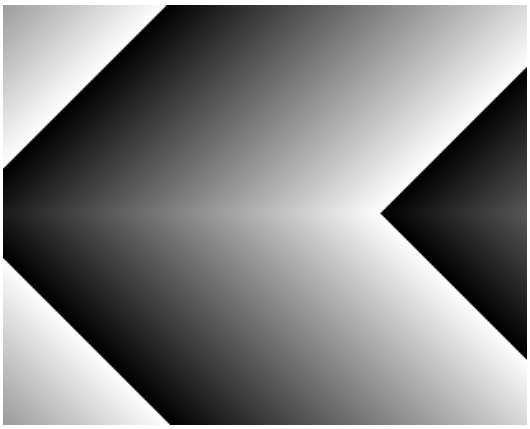


Figure 5-17 Grey Diagonal Ramp Moving

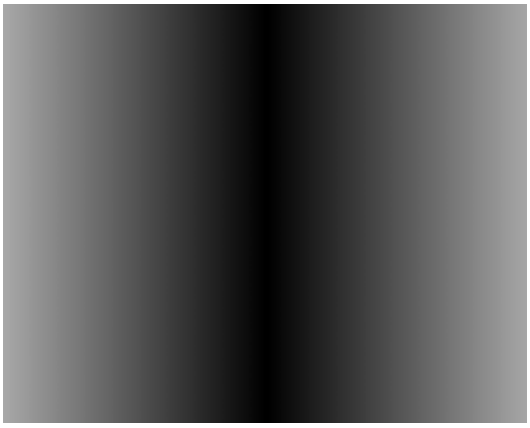


Figure 5-18 Sensor Specific

CAUTION

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

5.23 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 Parameters		Value	Description
ImageFormatControl	ReverseX	FALSE	Disables the Reverse X feature.
		TRUE	Flips images horizontally.

Table 5-26 XML parameter for Reverse X

Figure 5-19 Image without Reverse X applied

Figure 5-20 Image with Reverse X applied

5.24 Device Link Throughput Limit

The Device Link Throughput Limit feature allows you to limit the maximum available bandwidth for data transmission to your computer.

The XML parameter related to Device Link Throughput Limit is as follows:

XML Parameters		Description
DeviceControl	DeviceLinkThroughputLimit	Limits the maximum available bandwidth (bps).

Table 5-27 XML Parameter for Device Link Throughput Limit

- To ensure good image quality, we recommend setting the Device Link Throughput Limit parameter to the maximum value. the maximum value of the VCS-14MX2-M/C340I is 8000.

5.25 Device User ID

You can input user-defined information up to 32 bytes .

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

XML Parameters		Description
DeviceControl	DeviceUserID	Input user-defined information (32 bytes).

Table 5-28 XML Parameter for Device User ID

5.26 Device Reset

Resets the camera physically to power off and on.

The XML parameter related to Device Reset is as follows:

XML Parameters		Description
DeviceControl	Device Reset	Resets the camera.

Table 5-29 XML Parameter for Device Reset

5.27 Field Upgrade

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

5.28 User Set Control

You can save the camera settings into the internal flash memory and load it when needed. The camera provides 2 settings for saving and 3 settings for loading.

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 UserSet1 settings.
		UserSet2	Selects the UserSet2 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.
		UserSet1	Applies the UserSet1 when reset.
		UserSet2	Applies the UserSet2 when reset.

Table 5-30 XML Parameters for User Set Control

The setting values stored in the Default can be loaded to the camera's workspace but cannot be changed. The determined values are removed when the camera is reset or powered off. To use the currently-configured setting values after the reset, it should be stored to one of the user spaces.

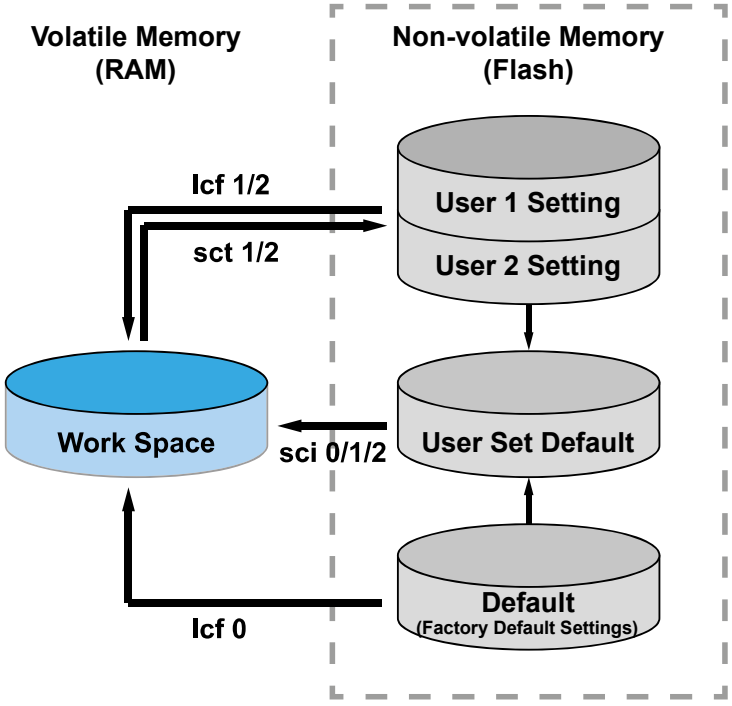


Figure 5-21 User Set Control

5.29 Sequencer Control

The Sequencer Control provided by the VCS-14MX2-M/C340I camera allows you to apply different parameter settings, called **Sequencer Sets,** for continuous image acquisition. When capturing images, the camera applies one Sequencer Set first, then switches to another, enabling quick adaptation to changing acquisition conditions.
For example, if you need to apply different **Exposure Times** for each shot, you can pre-configure these settings using Sequencer Sets. The camera will then automatically adjust the **Exposure Time** for each shot according to the predefined settings.

With the **User Set Control** function, you can save configured **Sequencer Sets** to the camera's non-volatile memory. This allows you to use the Sequencer Sets according to the **User Set Default** settings even after the camera is powered off or reset.
Each **Sequencer Set** is identified by an index number ranging from 0 to 63, allowing you to specify up to 64 different Sequencer Sets.

XML Parameters		Value	Description
Sequencer Control	SequencerMode	Off	Disables the Sequencer.
		On	Enables the Sequencer.
	Sequencer ConfigurationMode	Off	Disables the Sequencer Configuration Mode.
		On	Enables the Sequencer Configuration Mode.
	Sequencer FeatureSelector	FlatFieldData Default	Applies the Flat Field data stored in the region specified in FlatFieldDataDefault to the selected Sequencer Set.
		GainDigitalAll	Applies the value set for Gain in DigitalAll to the selected Sequencer Set.
		ExposureTime	Applies the value set for ExposureTime to the selected Sequencer Set.
	Sequencer FeatureEnable	False	Disables the feature selected in SequencerFeatureSelector and clears it from all Sequencer Sets.
		True	Enables the feature selected in SequencerFeatureSelector and applies it to all Sequencer Sets.
	SequencerSetSelector	0 – 63	Selects the Sequencer Set to configure.
	SequencerSetSave	-	Saves the current camera settings to the Sequencer Set selected in SequencerSetSelector.
	SequencerSetLoad	-	Loads the Sequencer Set selected in SequencerSetSelector and applies it to the current camera.
	SequencerSetActive	-	Displays the index number of the currently active Sequencer Set (0 to 63).

	SequencerSetStart	0 - 63	Indicates the Sequencer Set that will operate as the initial default or serves as the basis for configuration.
	SequencerPathSelector	0 - 1	Selects the path of the currently configured or active Sequencer Set. The path chosen here determines the next Sequencer Set to be executed, with the index number (0-1) indicating the identifier of each path.
	SequencerSetNext	0 - 63	Specifies which Sequencer Set to execute next when the path selected in SequencerPathSelector (Path 0 or Path 1) is active.
	Sequencer TriggerSource	Off	Does not use a Sequencer Trigger.
		ExposureActive	Uses the ExposureActive signal as the Sequencer Trigger.
		FrameActive	Uses the FrameActive signal as the Sequencer Trigger.
	SequencerTrigger Activation	FallingEdge	Operates on the falling edge of the signal used as the Sequencer Trigger.

Table 5-31 XML Parameters for Sequence Control

Use Case

Application of Four Different Sets of Flat Field Correction Data, Gain and Exposure Time Settings to Sequencer Sets

For example, assume that four different sets of Flat Field correction data, Gain and Exposure settings optimized for White, Green, Red and Blue pixels are applied to four different Sequencer Sets to inspect LCD panels.

1 Set the Sequencer Mode parameter to Off.

2 Select a feature to be applied to Sequencer Sets by using the Sequencer Feature Selector parameter.

- You must select features to be applied to Sequencer Sets prior to entering the Sequencer Configuration Mode.
- Set the SequencerFeatureSelector parameter to FlatFieldDataDefault, and then set the SequencerFeatureEnable parameter to On.
- Set the SequencerFeatureSelector parameter to GainDigitalAll, and then set the SequencerFeatureEnable parameter to On.
- Set the SequencerFeatureSelector parameter to ExposureTime, and then set the SequencerFeatureEnable parameter to On.

3 Set the Sequencer Configuration Mode parameter to On.

4 Set the Sequencer Set 0 first.

- SequencerSetSelector parameter: 0
- FlatFieldControl category's FlatFieldDataDefault parameter: Space0
- AnalogControl category's DigitalALL Gain parameter: 1
- AcquisitionControl category's ExposureTime parameter: 10000

- SequencerSetNext parameter: 1
- SequencerPathSelector para,eter: 0
- SequencerTriggerSource parameter: FrameActive
- SequencerTriggerActivation parameter: FallingEdge
- SequencerPathSelector parameter: 1
- SequencerTriggerSource parameter: Off

5 To set up **Sequencer Set 1, 2, and 3** using the information from **Step 4**, follow the procedure outlined in Step 4 for each set:

Sequence	Parameter	Sequencer Set 1	Sequencer Set 2	Sequencer Set 3
1	SequencerSetSelector	1	2	3
2	FlatFieldDataDefault	Space1	Space2	Space3
3	DigitalALL, Gain	2	3	4
4	ExposureTime	20000	30000	40000
5	SequencerSetNext	2	3	0
6	SequencerPathSelector	0	0	0
7	SequencerTriggerSource	FrameActive	FrameActive	FrameActive
8	SequencerTriggerActivation	FallingEdge	FallingEdge	FallingEdge
9	PathSelector	1	1	1
10	SequencerTriggerSource	Off	Off	Off

6 Set the Sequencer Configuration Mode parameter to Off, and then set the Sequencer Mode parameter to On.

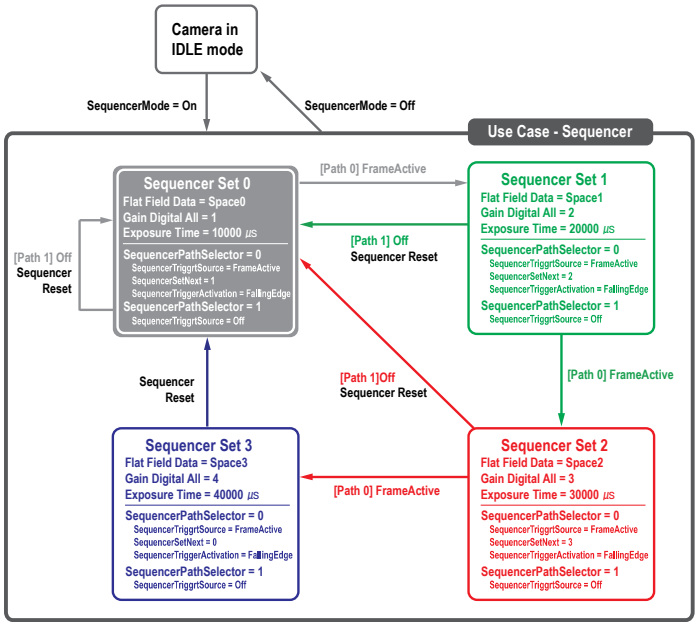


Figure 5-22 Sequencer Diagram (Use Case)

- To use the configured Sequencer Set later, save it to the nonvolatile memory using the User Set Control function. For more information on the function, refer to <5.28 User Set Control>.

6. Troubleshooting

This section explains the troubleshooting steps to follow in case of a product malfunction.

6.1 Troubleshooting

Check the followings when the product is not working:

- 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 the screen is not clear,
  - Ensure the camera lens or glass is clean.
  - Check the lens aperture is adjusted properly.

- If an image is dark,
  - Ensure the camera lens is not blocked.
    Check the exposure time is set properly.

- If the camera operation is abnormal or the camera becomes hot,
  - 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,
  - Check if the **Software trigger input** settings are configured correctly.
  - For **LinkTrigger0** trigger mode, verify that the trigger settings on the **CXP-12 frame grabber** are correctly configured.
  - If using an external trigger, ensure that the cables are properly connected.

- If there is communication fails,
  - Check if the coaxial cable is properly connected.
  - Verify that the camera is correctly connected to the CXP-12 frame grabber installed on the computer and that the settings are properly configured.

Warranty Certificate

Product Name				Warranty Period
Model Name				
Date of Purchase	Date	Month	Year	
Warranty Expiration Date	Date	Month	Year	

Customer address	Name	
	Contact Info	
Retailer:	Name	
	Contact Info	

When Requesting A/S

Please check the user manual again. If you determine that it is a malfunction, clearly record and provide the malfunction status and product information. Depending on the nature of the malfunction, it may be either a paid or free service. The following causes of malfunction are subject to paid service:

- Malfunction due to user mishandling
- Connecting power sources other than the rated power supply
- Unauthorized disassembly or repair by the user
- Malfunction caused by disasters (fire, flooding, lightning, etc.)

Malfunction Details

7. Appendix

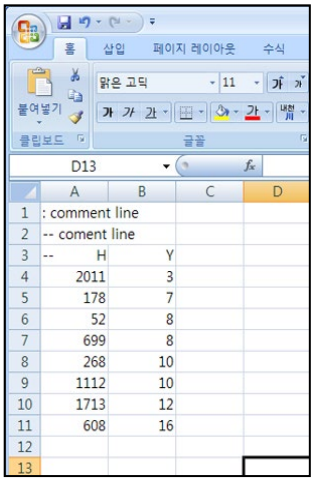
Appendix A

Appendix B

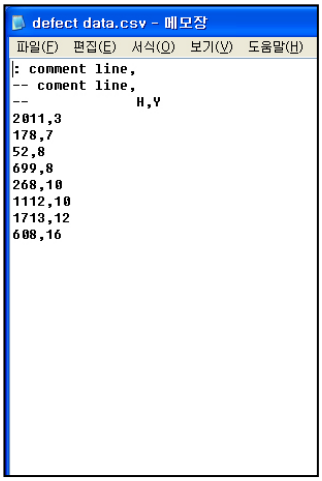
7.1 Appendix A – Defective Pixel Map Download

1 Create the Defective Pixel Map data in Microsoft Excel format as shown in the left picture below and save as a CSV file (*.csv). The picture in the right shows the created Excel file opened in Notepad. The following rules need to be applied when creating the file.

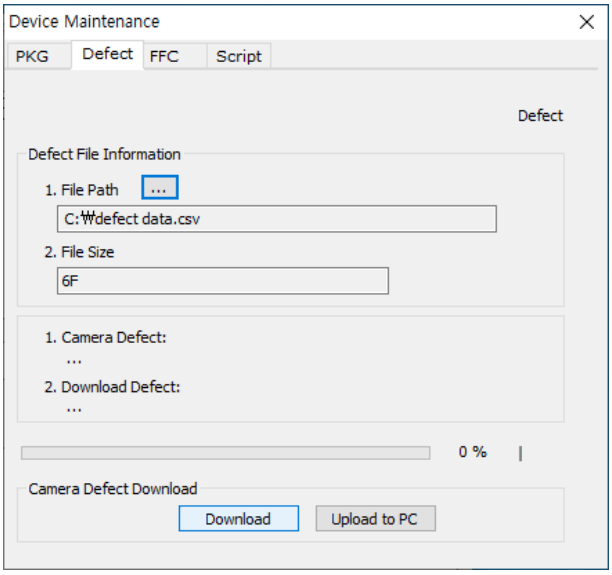
- Lines beginning with ':' or '—' are treated as notes.
- You must enter the horizontal value first and then the vertical value for coordinates of each defect pixel.
- Coordinate values for each pixel can be placed in any order.



	A	B	C	D
1	: comment line			
2	-- coment line			
3	--	H	Y	
4		2011	3	
5		178	7	
6		52	8	
7		699	8	
8		268	10	
9		1112	10	
10		1713	12	
11		608	16	
12				
13				



2 Run Vieworks Imaging Solution 7.X and click the Configure button to display the window as shown below. Select the Defect tab, click the File Path item, search and select the defective pixel map (*.csv), and then click the Download button.

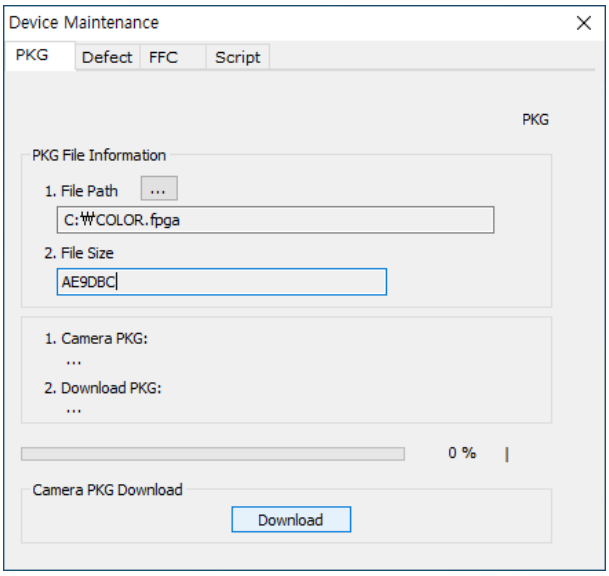


7.2 Appendix B – Field Upgrade

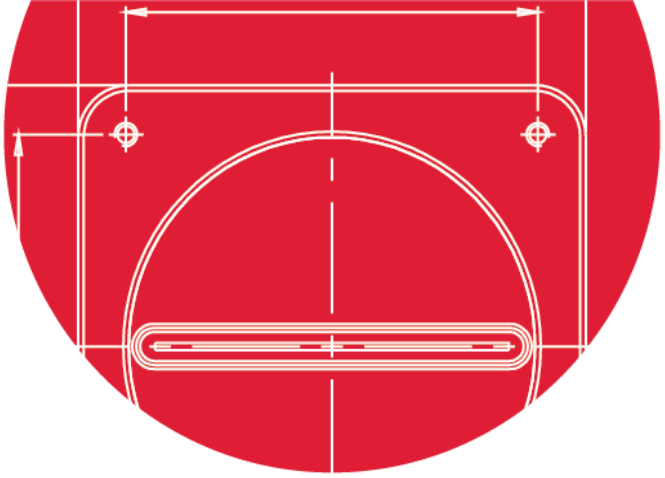
You can upgrade the MCU, FPGA and XML file of the camera by following the procedure below.

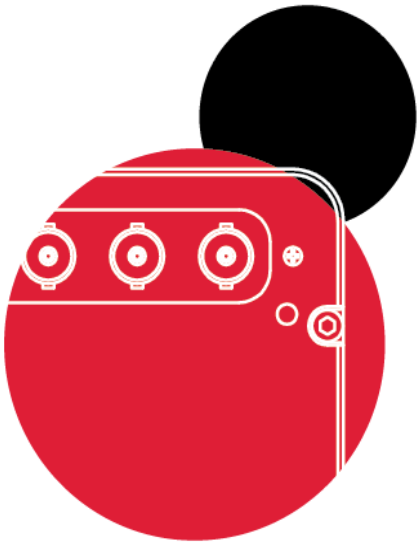
1 Run Vieworks Imaging Solution 7.X and click the Configure button to display the window as shown below.

2 Select the PKG tab, click the button next to File Path, search and 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 .





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