# VC series
## User Manual

VC-12MX-M65H
VC-12MX-C65H
VC-12MX-M65H-RA
VC-12MX-C65H-RA

**CoaXPress**®

CH2
CH1

PWR

**VIEWORKS**

# Preface

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

# Before Using This Product

Thank you for choosing a camera in the VC-12MX-M/C65H™.

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

## The Series

This manual is intended for users of the following products:

- VC-12MX-M65H (straight type)
- VC-12MX-C65H (straight type)
- VC-12MX-M65H (right-angle type)
- VC-12MX-C65H (right-angel type)

# About This Manual

This manual is intended for VC-12MX-M/C65H™ camera users. It is recommended to refer to the Frame Grabber's User Manual of yours, with this manual.

# Convention in This Manual

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

## Names and Fonts

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

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

## Warning, Caution, and Note

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

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

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

**Note:**
This indicates that this message provides additional information.

# Definition of Terms

For clarity, this manual defines some terms as follows:

| Term | Definition |
|---|---|
| Preface | The introductory part preceding the Table of Contents in this manual |
| Vieworks Imaging Solution | Indicates the control application provided with the product together by Vieworks |

# Revision History

This document has the revision history as follows:

| Version | Date | Description |
|---|---|---|
| 1.0 | 2022-05-13 | Initial Release |

# Contents

# Tables

# Figures

# Chapter 1. Precautions

## General

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

## Installation and Maintenance

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

## Power Supply

- Applying incorrect power can damage the camera. If the voltage applied to the camera is greater or less than the camera's nominal voltage, the camera may be damaged or operate erratically. Please refer to 5.2 Specifications for the camera's nominal voltage.
  ※ Vieworks Co., Ltd. does NOT provide power supplies with the devices.
- Make sure the power is turned off before connecting the power cord to the camera. Otherwise, damage to the camera may result.

## Cleaning the Sensor Surface

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

⚠️ **Avoid dust or foreign matter on the sensor surface.**

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

## Procedures for Cleaning the Sensor

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

1. Remove a contaminant by using an ionizing air gun.

   If this step does not remove the contaminant, proceed to the next step.

2. Clean the contaminant on the sensor using one drop of lens cleaner on a non-fluffy cotton bud.

3. Wipe the cotton bud gently in only one direction (either left to right or right to left). Avoid wiping back and forth with the same cotton bud in order to ensure that the contaminants are removed and not simply transferred to a new location on the sensor surface.

4. Mount a lens, set the lens at a smaller aperture (e.g. F8), and then acquire images under bright lighting conditions. Check the images on the monitor for dark spots or stripes caused by the contaminant. Repeat the steps above until there is no contaminant present.

⚠️ **Caution!**

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

# Chapter 2. Warranty

Do not open the housing of the camera. The warranty becomes void if the housing is opened.

For information about the warranty, please contact your local dealer or factory representative.

# Chapter 3. Compliance & Certifications

## 3.1 FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expenses.

## 3.2 CE : DoC

EMC Directive 2014/30/EU

EN 55032:2012 (Class A), EN 55024:2010

Class A

## 3.3 KC

### KCC Statement

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

# Chapter 4. Package Components

The VC-12MX-M/C65H camera has straight type and right-angle type, and the appearance of each type is as follows. One type of a camera is provided depending on the type of purchase.

Package Components



VC-12MX-M/C65H camera
(straight type)

VC-12MX-M/C65H camera
(right-angle type)

# Chapter 5. Product Specifications

## 5.1 Overview

The VC-12MX-M/C65H cameras, the latest model of the industrial proven VC series, are new 12-megapixel CoaXPress cameras and based on the CMOS global shutter image sensor technology (IMX253) from Sony. In the case of the VC-12MX-M/C65H camera, it offers up to 64.6 frames per second at 4,096 × 3,000 resolution. The camera comes with the next generation CoaXPress 1.0 (CXP-6) interface delivering up to 12.5 Gigabits per second over two coaxial cables. These combinations of the CMOS sensor technology and CoaXPress 1.0 interface set a new standard for industrial, scientific and surveillance digital imaging applications. Customers in the industrial market can take advantage of simple coax cabling to transmit images at rates and distance above and beyond previous standards. The high-speed and high-resolution camera is ideal for wide range of demanding applications such as FPD, PCB and semiconductor inspections. For efficiency, Vieworks provides this amazing product in two different types, the straight type and the right-angle type, with the same specification.

### Main Features

- High Speed 12 Megapixel CMOS Image Sensor
- Minimizing the Number of Hot Pixels with TEC
- CoaXPress 1.0 Interface up to 64.6 fps at 12.5 Gbps using 2 Channels
- Output Channel: CXP-6 × 1/2ch
- Electronic Exposure Time Control (Global Shutter)
- Output Pixel Format: 8 bit
- Line Output
- Defective Pixel Correction
- Gain / Black Level Control
- Test Pattern
- Temperature Monitor
- Field Upgrade
- Flat Field Correction
- GenICam Compatible – XML based Control

## 5.2    Specifications

Technical specifications for the VC-12MX-M/C65H cameras are as follows.

| Specifications | | VC-12MX-M/C65H |
|---|---|---|
| Resolution (H × V) | | 4096 × 3000 |
| Sensor | | Sony IMX253 |
| Sensor Size (diagonal) | | 17.6 ㎜ |
| Sensor Type | | High-speed CMOS Image Sensor |
| Pixel size | | 3.45 ㎛ × 3.45 ㎛ |
| Interface | | CXP-6 × 2 (Micro-BNC) |
| Max. Frame Rate(CXP6 2ch) | | 64.6 fps |
| Exposure Time(1 ㎲ step) | | 1.5 ㎲ ~ 60 s |
| Partial Scan(Max. Speed) | | 3413.7 fps at 4 Lines |
| Pixel Data Format | | Mono 8 bit, Color GB Bayer 8 bit |
| Electronic Shutter | | Global Shutter |
| Gain | Analog | ×1 ~×8 |
| | Digital | ×1 ~×32 |
| Digital Black Level | | 0 ~ 15 LSB in 8 bit Sensor Resolution |
| Exposure Mode | | Free-Run, Timed, Trigger Width |
| External Trigger | | 3.3 ~ 24.0 V, 10 ㎃, Logical Level Input Optically Isolated |
| Software Trigger | | Asynchronous, Programmable via Camera API |
| Digital I/O | | FrameActive, LineActive, ExposureActive, UserOutput0, Timer0Active, Count0Active |
| Dynamic Range | | 65 ㏈ |
| Mechanical (W × H × L) | | Right-angle: 50×50×45 ㎜, Straight: 50×50×44 ㎜ |
| Environmental | | Operating: 0℃ ~ 40℃, Storage: -40℃ ~ 70℃ |
| Lens Mount | | C-mount |
| Power | External | 11 ~ 24 V DC |
| | Dissipation | Typical: 6.5 W, Maximum: 7 W |
| Compliance | | CE, FCC, KC |

Table 5-1    Specifications VC-12MX-M/C65H

## 5.3    Camera Block Diagram

The block diagram of VC-12MX-M/C65H is shown below.

All controls and data processing of the camera are carried out in one FPGA chip. The FPGA generally consists of a 32-bit RISC Micro-Controller and Processing & Control logic. The Micro-Controller receives commands from the user through the CoaXPress 1.0 interface and then processes them.

The Processing & Control logic processes the image data received from the CMOS image sensor and then transmits data through the CoaXPress 1.0 interface. The Processing & Control logic also controls time-sensitive trigger inputs and output signals. Furthermore, Flash and DDR3 are installed outside FPGA. The DDR3 is used to process images and the Flash stores the firmware to operate the Micro-Controller.

## 5.4 Spectral Response

The following graphs show each spectral response for the VC-12MX-M/C65H cameras.



Figure 5-2   Spectral Response (Monochrome)



Figure 5-3   Spectral Response (Color)

## 5.5    Mechanical Specification

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

17.526(Optical Distance)
18.45±0.2(Mechanical FB)
44
50.0±0.05
7.0
4-R4.0
50.0±0.05
ø44.2
7.0
30.0
CH2
CH1
PWR
M25.4×P0.794
(C-mount Thread)
Glass
Image Plane
8-M5 TAP DP5
Camera Mounting Screw Holes

Figure 5-4    Mechanical Dimension of Straight Type

17.526(Optical Distance)
18.45±0.2(Mechanical FB)
45
50.0±0.05
10.3
7.0
4-R4.0
50.0±0.05
ø44.2
7.0
30.0
CH2
CH1
PWR
M25.4×P0.794
(C-mount Thread)
Glass
Image Plane
8-M5 TAP DP5
Camera Mounting Screw Holes

Figure 5-5    Mechanical Dimension of Right-angle Type

# Chapter 6. Connecting the Camera

The following instructions assume that you have installed a CoaXPress 1.0 Frame Grabber (hereinafter 'CXP-6 Frame Grabber') in your computer including related software. The procedure below also assumes that you may attempt to configure a link between a camera and CXP-6 Frame Grabber by using two coax cables. For more detailed information, refer to your CXP-6 Frame Grabber User Manual.

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

1. Make sure that the power supply is not connected to the camera and your computer is turned off.
2. Plug one end of a coax cable into the CH1 of the CXP connector on the camera and the other end of the coax cable into the CH1 of the CXP-6 Frame Grabber in your computer. Then, connect the CH2 of the CXP connector on the camera to the CH2 of the CXP-6 Frame Grabber respectively using the other three coax cables.

   • Connect the plug of the power adapter to the power input receptacle on the camera.
   • Plug the power adapter into a working electrical outlet.

3. Verify all the cable connections are secure.

## 6.1    Precaution about Blurring Compared to the Center

• Users do not need to adjust the tilt as it is adjusted as factory default settings.
• If the tilt settings need to be adjusted inevitably, please contact your local dealer or factory representative for technical support.

## 6.2    Controlling the Camera

• You can control the camera by executing the Vieworks Imaging Solution application.
• You can download the latest Vieworks Imaging Solution application at http://vision.vieworks.com.
• Please refer to your Camera Link frame grabber user manual.

# Chapter 7. Camera Interface

## 7.1    General Description

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

① Status LED:                                                    displays power status

and operation mode.

② 6-pin Power Input and Control I/O Receptacle:    supplies power to the camera

and can be set to operate

as an input and output line.

③ CoaXPress Connector:                                     transmits video data

and controls the camera.



&lt;Back panel of straight type&gt;                                    &lt;Back panel of right-angle type&gt;

Figure 7-1    VC-12MX-M/C65H Back Panel

## 7.2    CoaXPress Connector

CoaXPress protocol includes an automatic link detection mechanism (Plug and Play) to correctly detect the camera to the CXP-6 Frame Grabber connection. The connection between the camera and CXP-6 Frame Grabber uses a coax (also known as 'coaxial') cable and provides up to 6.25 Gbps bit rate per cable.

### 7.2.1    Micro-BNC Connector



**CH1    CH2**

Figure 7-2   Micro-BNC Connector

The CoaXPress connectors on the VC-12MX-M/C65H camera comply with the CoaXPress 1.0 standard and the following table shows the channel assignments.

| Channel | Max. Bit Rate per Coax | Type |
| --- | --- | --- |
| CH1 | 6.25 Gbps | Master Connection |
| CH2 | 6.25 Gbps | Extension Connection |

Table 7-1   Channel Assignments for Micro-BNC Connector

ⓘ   **Note:**

When you connect a camera to a CXP-6 Frame Grabber using coax cables, make sure to connect the cables to their correct channels. If you connect the CH1 of the CXP connector on the camera to a channel other than CH1 of the CXP-6 Frame Grabber, the camera may not transmit images properly or the communication between the computer and camera may fail.

## 7.3 Power Input and Control I/O Receptacle

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



Figure 7-3   Pin Assignments for Power Input and Control I/O Receptacle

| Pin Number | Signal | Type | Description |
|---|---|---|---|
| 1 | + 12V DC | Input | DC Power Input |
| 2 | Trigger Input + | Input | - |
| 3 | Trigger Input - | Input | - |
| 4 | I/O Output+ | Output | - |
| 5 | I/O Output- | Output | - |
| 6 | DC Ground | Input | DC Ground |

Table 7-2   Pin Configurations for Power Input Receptacle

**Note:**
- A recommended mating connector for the Hirose 6-pin connector is the Hirose 6-pin plug (part # HR10A-7P-6S) or the equivalent.
- It is recommended that you use the power adapter, which has at least 3 A current output at 12 V DC ±10% voltage output (You need to purchase a power adapter separately.).

## Precaution for Power Input

**Caution!**
- Make sure the power is turned off before connecting the power cord to the camera. Otherwise, damage to the camera may result.
- If the voltage applied to the camera is greater than specified in the specifications, damage to the camera may result.

## 7.4 Trigger Input Circuit

The following figure shows trigger signal input circuit of the 6-pin connector. Transmitted trigger signal is applied to the internal circuit through a photo coupler. With the Debounce feature, you can specify the width of input signal to be considered as a valid input signal. An external trigger circuit example is shown below.



Figure 7-4　Trigger Input Schematic

## 7.5 Strobe Output Circuit

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



Figure 7-5　Strobe Output Schematic

# Chapter 8. Acquisition Control

This chapter provides detailed information about controlling image acquisition.

- Triggering image acquisition
- Setting the exposure time
- Controlling the camera's image acquisition rate
- Variation of the camera's maximum allowed image acquisition rate according to the camera settings

## 8.1    Overview

This section presents an overview of the elements involved with controlling the acquisition of images.

The followings are involved in controlling the acquisition of images:

- Acquisition Start and Acquisition Stop commands and the Acquisition Mode parameter
- Exposure start trigger
- Exposure time control
- Frame acquisition process on the camera
- Global shutter
- Maximum Allowed Frame Rate

ⓘ **Note:**

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

## 8.2 Acquisition Start/Stop Commands and Acquisition Mode

This section describes function available to use via the followings:

- Acquisition Start/Stop commands
- Acquisition Mode

The details about each item above is described in the order from the following section.

### 8.2.1 Acquisition Start/Stop Commands

The Acquisition Start command prepares the camera to acquire images. The camera cannot acquire images unless an Acquisition Start command has first been executed. Executing an Acquisition Stop command terminates the camera's ability to acquire images.

### 8.2.2 Acquisition Mode

The Acquisition Mode parameter affects directly how the Acquisition Start command works. There are three of types available to select in this parameter as follows:

- Continuous:
  Acquires frames continuously once the Acquisition Start command is called until the Acquisition Stop command is called.

- SingleFrame:
  Acquires one single frame after the Acquisition Start command is called, and then, finishes acquiring images with calling the Acquisition Stop command automatically.

- MultiFrame:
  Acquires frames as many as the numbers designated on the AcqusitionFrameCount parameter after the Acquisition Start command is called, and then, finishes acquiring images with calling the Acquisition Stop command automatically.

---

ⓘ **Note:**

The Acquisition Start command will remain in effect until you execute an Acquisition Stop command. Once an Acquisition Stop command has been executed, the camera will not be able to acquire frames until a new Acquisition Start command is executed. If a user calls an Acquisition Stop command on the way of image acquisition, the work will finish after finishing the ongoing acquisition all.

---

### 8.2.3   Exposure Start Trigger

Applying an exposure start trigger signal to the camera will exit the camera from the waiting for exposure start trigger acquisition status and will begin the process of exposing and reading out a frame (see Figure 8-1). As soon as the camera is ready to accept another exposure start trigger signal, it will return to the waiting for exposure start trigger acquisition status. A new exposure start trigger signal can then be applied to the camera to begin another frame exposure. The exposure start trigger has two modes: off and on.

If the Trigger Mode parameter is set to Off, the camera will generate all required exposure start trigger signals internally, and you do not need to apply exposure start trigger signals to the camera. The rate at which the camera will generate the signals and acquire frames will be determined by the way that you set several frame rate related parameters.

If the Trigger Mode parameter is set to On, you must trigger exposure start by applying exposure start trigger signals to the camera. Each time a trigger signal is applied, the camera will begin a frame exposure. When exposure start is being triggered in this manner, it is important that you do not attempt to trigger frames at a rate that is greater than the maximum allowed (There is a detailed explanation about the maximum allowed frame rate at the end of this chapter.). Exposure start trigger signals applied to the camera when it is not in a waiting for exposure start trigger acquisition status will be ignored.



Figure 8-1   Exposure Start Triggering

## 8.2.4   Applying Trigger Signals

The paragraphs above mention "applying a trigger signal". There are five ways to apply an exposure start trigger signal to the camera: via Software, via User Output0, via LinkTrigger0, via Timer0 Active or via Line0 (commonly referred to a hardware).

- To apply trigger signals via Software, you must set the Trigger Source parameter to Software. At that point, each time a Trigger Software command is executed, the exposure start trigger signal will be applied to the camera.

- To apply trigger signals via User Output0, you must set the Trigger Source parameter to User Output0. At that point, you can apply an exposure start trigger signal to the camera by switching the User Output Value parameter between On (rise) and Off (fall).

- To apply trigger signals via CH1 of the CXP-6 Frame Grabber, you must set the Trigger Source parameter to LinkTrigger0. At that point, each time a proper CoaXPress trigger signal is applied to the camera by using the APIs provided by a CXP-6 Frame Grabber manufacturer, the exposure start trigger signal will be applied to the camera. For more information, refer to your CXP-6 Frame Grabber User Manual.

- To apply trigger signals via the user-defined Timer feature, you must set the Trigger Source parameter to Timer0 Active. When you set the Timer Trigger Source parameter to Line0 in the Counter And Timer Control category, you can apply an exposure start trigger signal to the camera by using a Timer that uses the Line0 signal as the source signal.

- To apply trigger signals via hardware (external), you must set the Trigger Source parameter to Line0. At that point, each time a proper electrical signal is applied to the camera, an occurrence of the exposure start trigger signal will be recognized by the camera.

### 8.2.5　Exposure Time Control

When an exposure start trigger signal is applied to the camera, the camera will begin to acquire a frame.

A critical aspect of frame acquisition is how long the pixels in the camera's sensor will be exposed to light during the frame acquisition.

If the Trigger Source parameter is set to Software, the Exposure Time parameter will determine the exposure time for each frame.

If the Trigger Source parameter is set to User Output0, LinkTrigger0, Timer0 Active or Line0, there are two modes of operation: Timed and Trigger Width.

With the Timed mode, the Exposure Time parameter will determine the exposure time for each frame.

With the Trigger Width mode, the way that you manipulate the rise and fall of the User Output, CoaXPress, Timer or hardware (external) signal will determine the exposure time. The Trigger Width mode is especially useful if you want to change the exposure time from frame to frame.


## 8.3　Exposure Start Trigger

The Trigger Selector parameter is used to select a type of trigger and only the Exposure Start trigger is available on the VC-12MX-M/C65H camera. The Exposure Start trigger is used to begin frame acquisition. Exposure start trigger signals can be generated within the camera or may be applied externally by setting the Trigger Source parameter to Software, User Output0, LinkTrigger0, Timer0 Active or Line0. If an exposure start trigger signal is applied to the camera, the camera will begin to expose a frame.


### 8.3.1　Trigger Mode

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

## Trigger Mode = Off

When the Trigger Mode parameter is set to Off, the camera will generate all required exposure start trigger signals internally, and you do not need to apply exposure start trigger signals to the camera.

If the Trigger Mode parameter is set to Off, the camera will automatically begin generating exposure start trigger signals when it receives an Acquisition Start command. The camera will continue to generate exposure start trigger signals until it receives an Acquisition Stop command.

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ⓘ **Free-Run**

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

---

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

- If the parameter is set to a value less than the maximum allowed frame rate with the current camera settings, the camera will generate exposure start trigger signals at the rate specified by the parameter setting.

- If the parameter is set to a value greater than the maximum allowed frame rate with the current camera settings, the camera will generate exposure start trigger signals at the maximum allowed frame rate.

## Exposure Time Control with Trigger Mode = Off

When the Trigger Mode parameter is set to Off, the exposure time for each frame acquisition is determined by the value of the camera's Exposure Time parameter. For more information about the Exposure Time parameter, see 8.4 Setting the Exposure Time.

### Trigger Mode = On

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

The available settings for the Trigger Source parameter are:

- Software: You can apply an exposure start trigger signal to the camera by executing a Trigger Software command for the exposure start trigger on your computer.

- User Output0: You can apply an exposure start trigger signal to the camera by switching the User Output Value parameter between On and Off on your computer.

- LinkTrigger0: You can apply an exposure start trigger signal via CH1 of the CXP-6 Frame Grabber. For more information, refer to your CXP-6 Frame Grabber User Manual.

- Timer0Active: You can apply an exposure start trigger signal to the camera using a user defined Timer signal. When you set the Timer Trigger Source parameter to Line0 in the Counter And Timer Control category, you can specify a delay for the Line0 signal by using the Timer Delay parameter. For more information, refer to 9.12 Timer Control.

- Line0: You can apply an exposure start trigger signal to the camera by injecting an externally generated electrical signal (commonly referred to as a hardware or external trigger signal) into the Control I/O receptacle on the camera. Refer to 7.4 Trigger Input Circuit for more information.


You must also set the Trigger Activation parameter after setting the Trigger Source parameter. The available settings for the Trigger Activation parameter are:

- Falling Edge: Specifies that a falling edge of the electrical signal will act as the exposure start trigger.
- Rising Edge: Specifies that a rising edge of the electrical signal will act as the exposure start trigger.

## Exposure Time Control with Trigger Mode = On

When the Trigger Mode parameter is set to On and the Trigger Source parameter is set to Software, the exposure time for each frame acquisition is determined by the value of the camera's Exposure Time parameter.

When the Trigger Mode parameter is set to On and the Trigger Source parameter is set to LinkTrigger0 or Line0, the exposure time for each frame acquisition will be determined by the Exposure Mode parameter settings as follows:

- Exposure Mode = Timed: Exposure time can be controlled with the Exposure Time parameter.
- Exposure Mode = Trigger Width: Exposure time can be controlled by manipulating the external trigger signal.

When the Trigger Mode parameter is set to On and the Trigger Source parameter is set to Timer0 Active, the exposure time for each frame acquisition will be determined by the Exposure Mode parameter settings as follows:

- Exposure Mode = Timed: Exposure time can be controlled with the Exposure Time parameter.
- Exposure Mode = Trigger Width: When you set the Timer Trigger Activation parameter to Rising/Falling Edge, the exposure time is controlled with the Timer Duration parameter.

When the Trigger Mode parameter is set to On and the Trigger Source parameter is set to User Output0, the exposure time for each frame acquisition will be determined by the Exposure Mode parameter settings as follows:

- Exposure Mode = Timed: Exposure time can be controlled with the Exposure Time parameter.
- Exposure Mode = Trigger Width: Exposure time can be controlled by switching the User Output Value parameter between On and Off.

### 8.3.2  Using a Software Trigger Signal

If the Trigger Mode parameter is set to On and the Trigger Source parameter is set to Software, you must apply a software trigger signal (exposure start) to the camera to begin each frame acquisition. Assuming that the camera is in a waiting for exposure start trigger acquisition status, frame exposure will start when the software trigger signal is received by the camera. Figure 8-2 illustrates frame acquisition with a software trigger signal.

When the camera receives a software trigger signal and begins exposure, it will exit the waiting for exposure start trigger acquisition status because at that point, it cannot react to a new exposure start trigger signal. As soon as the camera is capable of reacting to a new exposure start trigger signal, it will automatically return to the waiting for exposure start trigger acquisition status.

The exposure time for each acquired frame will be determined by the value of the camera's Exposure Time parameter.

Software Trigger Signal Received        Software Trigger Signal Received

Frame Acquisition

Exposure (duration determined by the Exposure Time parameter)        Exposure

Figure 8-2   Frame Acquisition with Software Trigger Signal

When you are using a software trigger signal to start each frame acquisition, the frame rate will be determined by how often you apply a software trigger signal to the camera, and you should not attempt to trigger frame acquisition at a rate that exceeds the maximum allowed for the current camera settings (There is a detailed explanation about the maximum allowed frame rate at the end of this chapter.). Software trigger signals that are applied to the camera when it is not ready to receive them will be ignored.

### 8.3.3 Using a CoaXPress Trigger Signal

If the Trigger Mode parameter is set to On and the Trigger Source parameter is set to LinkTrigger0, you must apply a CoaXPress trigger signal to the camera to begin each frame acquisition. A CoaXPress trigger signal will act as the exposure start trigger signal for the camera. For more information, refer to your CXP-6 Frame Grabber User Manual.

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

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

When the camera receives a CoaXPress trigger signal and begins exposure, it will exit the *waiting for exposure start trigger* acquisition status because at that point, it cannot react to a new exposure start trigger signal.

As soon as the camera is capable of reacting to a new exposure start trigger signal, it will automatically return to the *waiting for exposure start trigger* acquisition status.

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

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

For example, if you are operating a camera with a CoaXPress trigger signal period of 50 ㎳(0.05 s): So in this case, the frame rate is 20 fps.

### 8.3.4    Using an External Trigger Signal

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

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

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

When the camera receives an external trigger signal and begins exposure, it will exit the *waiting for exposure start trigger* acquisition status because at that point, it cannot react to a new exposure start trigger signal.

As soon as the camera is capable of reacting to a new exposure start trigger signal, it will automatically return to the *waiting for exposure start trigger* acquisition status.

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

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

For example,

if you are operating a camera with an External trigger signal period of 50 ㎳ (0.05 s):

So in this case, the frame rate is 20 fps.

### External Trigger Delay

When you set the Trigger Source parameter to TimerOActive, you can specify a delay between the receipt of a hardware trigger signal and when the trigger becomes effective.

1. Set the Timer Trigger Source parameter in the Counter And Timer Control category to LineO.
2. Set the Timer Delay parameter to the desired Timer delay in microseconds.
3. Set the Trigger Source parameter in the Acquisition Control category to TimerOActive.
4. Execute the Acquisition Start command and inject an externally generated electrical signal into the Control I/O receptacle. Then, the delay set by the Timer Delay parameter expires and the exposure for image acquisition begins.
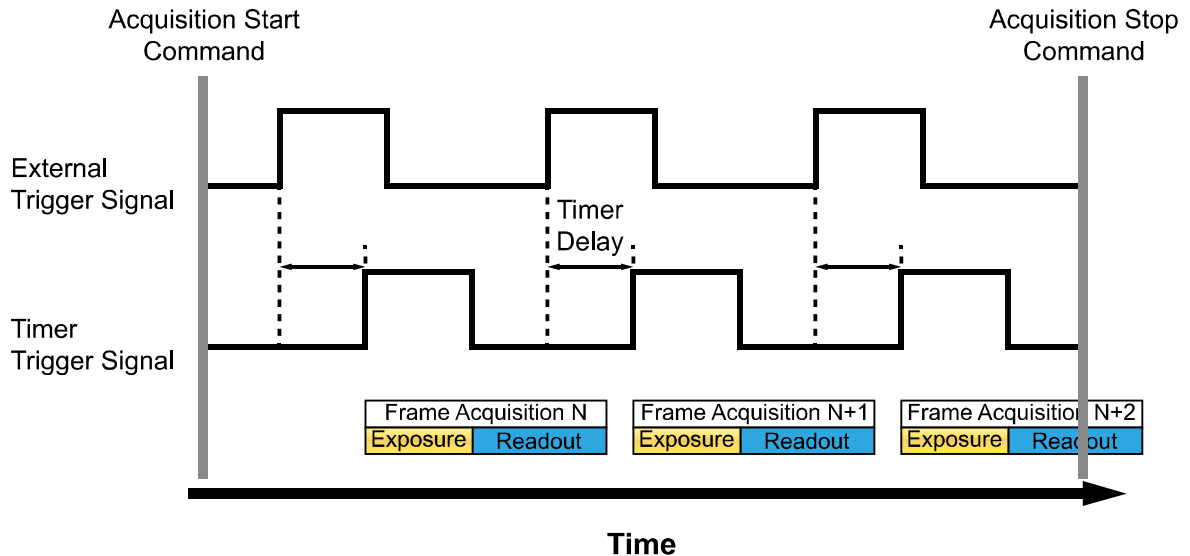


Figure 8-3   External Trigger Delay

### 8.3.5 Exposure Mode

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

#### Timed Exposure Mode

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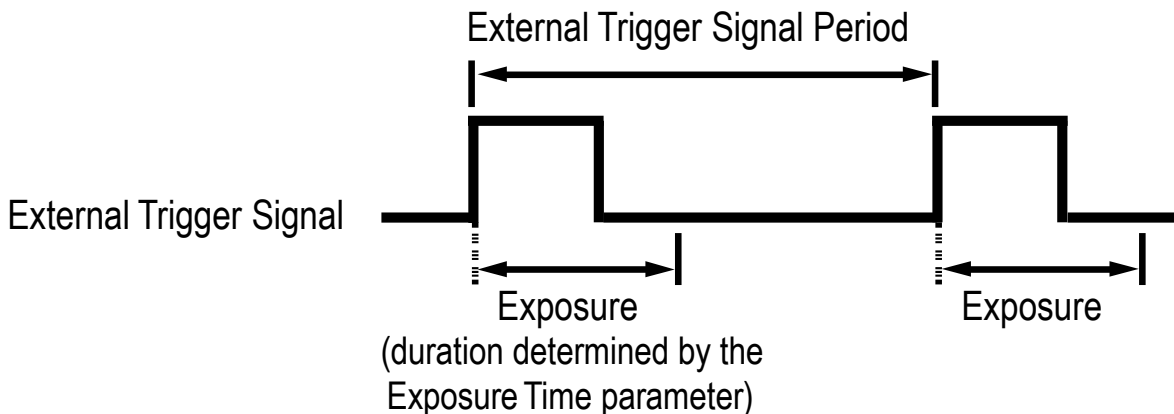


Figure 8-4   Timed Exposure Mode

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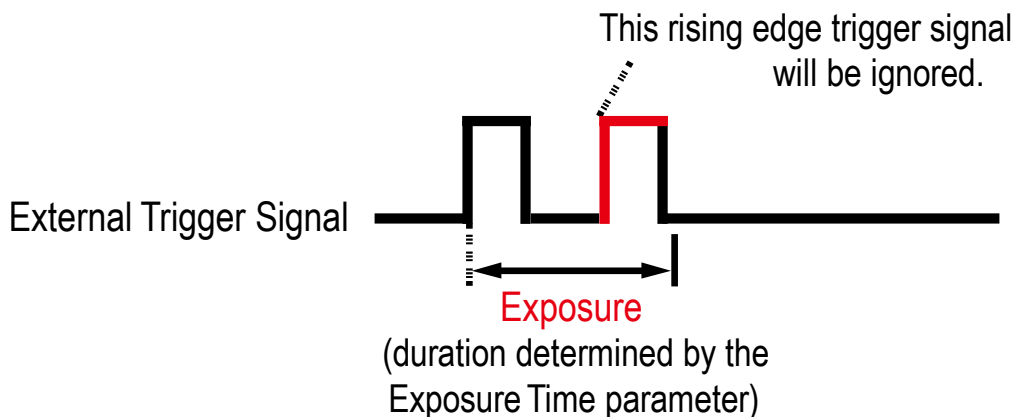


Figure 8-5   Trigger Overlapped with Timed Exposure Mode

## Trigger Width Exposure Mode

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

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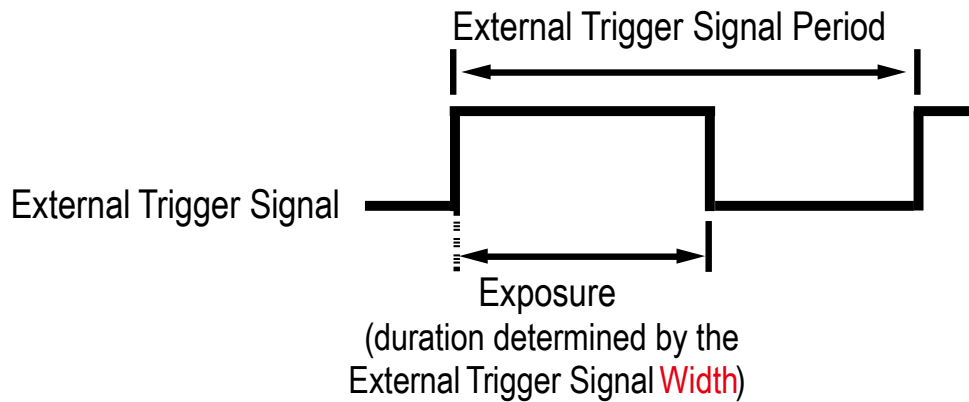


Figure 8-6　Trigger Width Exposure Mode

## 8.4 Setting the Exposure Time

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

- the Trigger Mode is set to Off.
- the Trigger Mode is set to On and the Trigger Source is set to Software.
- the Trigger Mode is set to On, the Trigger Source is set to User Output0, LinkTrigger0, Timer0 Active or Line0, and the Exposure Mode is set to Timed.


The Exposure Time parameter must not be set below a minimum specified value. The Exposure Time parameter sets the exposure time in microseconds (µs). The minimum and maximum exposure time settings for the VC-12MX-M/C65H camera are shown in the following table.

| Camera Model | Number of Channels | Minimum Exposure Time † | Maximum Exposure Time † † |
| --- | --- | --- | --- |
| VC-12MX-M/C65H | 1 / 2 Channel | 1.51 µs | 60,000,000 µs |

†: The actual exposure time is determined by adding the **Exposure Time** value in the **Timed** or **Trigger Width** items to the **Exposure Offset** value of user's choice.
††: When the **Exposure Mode** is set to **Trigger Width**, the exposure time is controlled by the external trigger signal and has no maximum limit.

Table 8-1   Minimum and Maximum Exposure Time Setting

## 8.5 Overlapping Exposure with Sensor Readout

The frame acquisition process on the camera includes two distinct parts. The first part is the exposure of the pixels in the image sensor. Once exposure is complete, the second part of the process – readout of the pixel values from the sensor – takes place. In regard to this frame acquisition process, the VC-12MX-M/C65H camera basically operates with 'overlapped' exposure so that the exposure for a new frame can be overlapped with the sensor readout for the previous frame.

When a new trigger signal is applied to the camera while reading out the previous frame, the camera begins the process of exposing a new frame. This situation is illustrated in the following figure with the Trigger Mode set to On, the Trigger Source set to Line0 and the Exposure Mode set to Trigger Width.
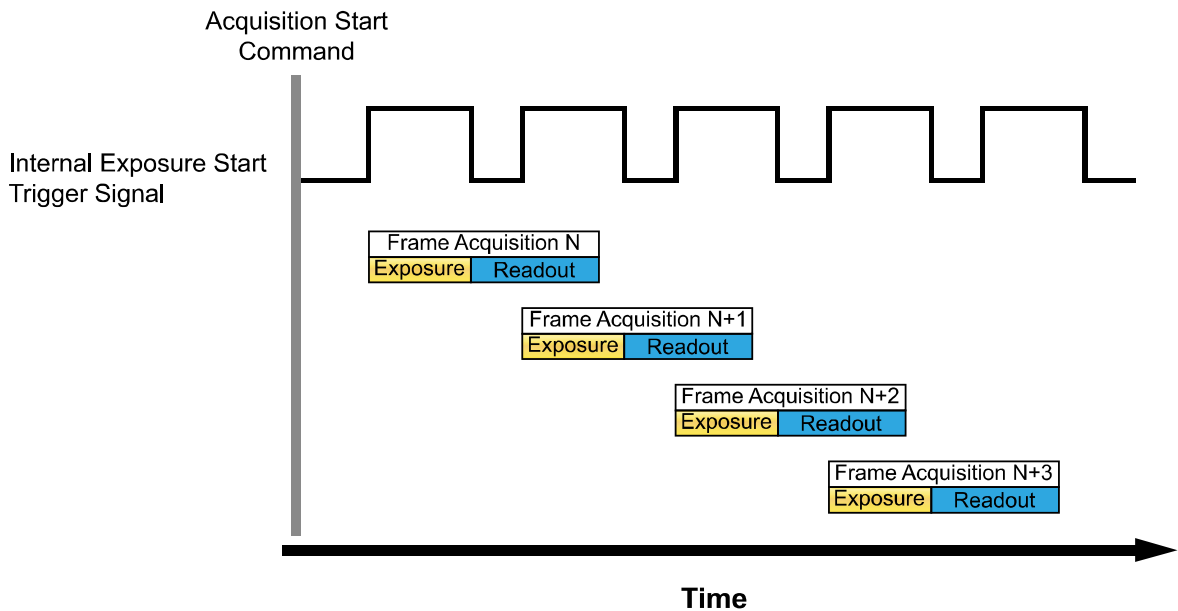


Figure 8-7 Overlapped Exposure and Readout

Determining whether your camera is operating with overlapped exposure and readout is not a matter of issuing a command or changing a setting. Rather a way that you operate the camera will determine whether the exposures and readouts are overlapped or not. If we define the "Frame Period" as the time from the start of exposure for one frame acquisition to the start of exposure for the next frame acquisition, then:

• Overlapped: Frame Period ≤ Exposure Time + Readout Time

### Guidelines for Overlapped Exposure

Since the VC-12MX-M/C65H camera operates with overlapped exposure, you must keep in mind two important guidelines:

- You must not begin the exposure for a new frame while the exposure for the previous frame is in progress.
- You must not end the exposure for the current frame until the readout for the previous frame is complete.


When you are operating the camera with overlapped exposure and using an external trigger signal to trigger image acquisition, you could use the camera's Exposure Time parameter settings and timing formula to calculate when it is safe to begin each new acquisition.

## 8.6    Global Shutter

The VC-12MX-M/C65H camera is equipped with an image sensor that has an electronic global shutter. When an exposure start trigger signal is applied to the camera equipped with a global shutter, exposure begins for all lines in the sensor as shown in the figure below. Exposure continues for all lines in the sensor until the programmed exposure time ends or when the exposure start trigger signal ends the exposure time if the camera is using the trigger width exposure mode. At the end of the exposure time, exposure ends for all lines in the sensor. Immediately after the end of exposure, pixel data readout begins and proceeds line by line until all pixel data is read out of the sensor. A main characteristic of a global shutter is that for each frame acquisition, all of the pixels in the sensor start exposing at the same time and all end exposing at the same time. This means that image brightness tends to be more uniform over the entire area of each acquired image, and it helps to minimize problems with acquiring images of object in motion.

The camera can provide an Exposure Active output signal that will go high when the exposure time for a frame acquisition begins and will go low when the exposure time ends.
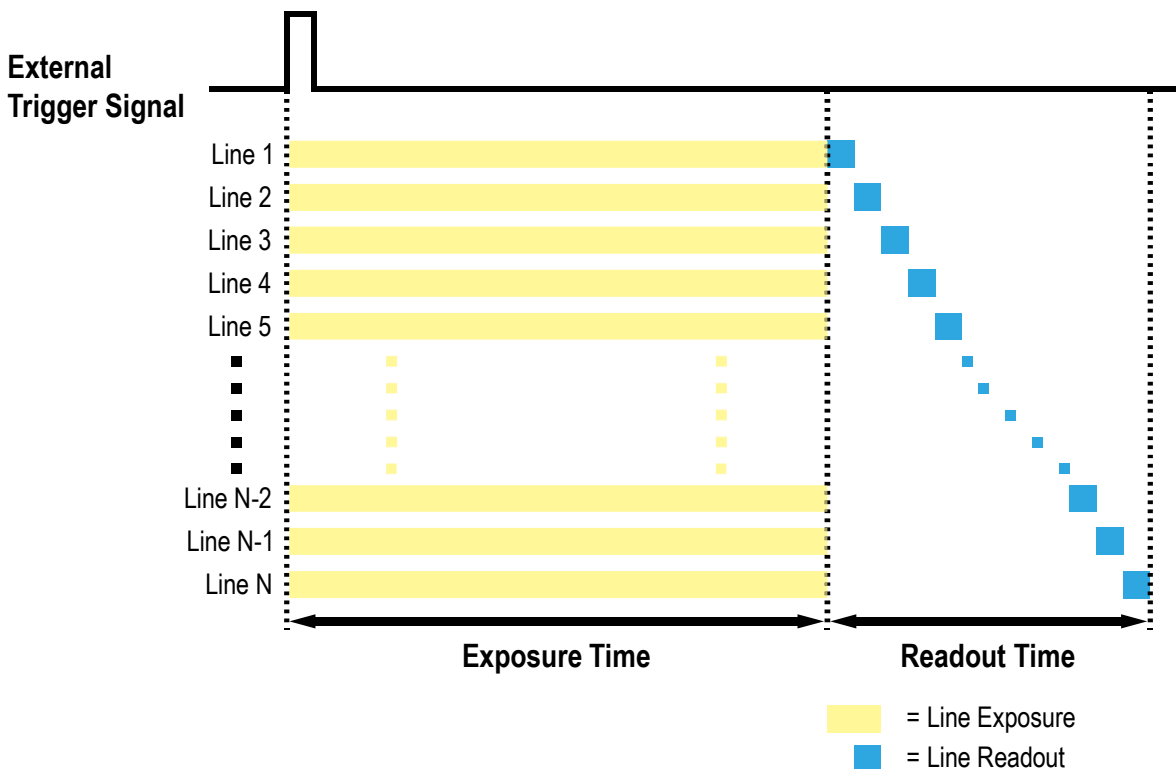


Figure 8-8    Global Shutter

## 8.7　Maximum Allowed Frame Rate

In general, the maximum allowed acquisition frame rate on the camera may be limited by several factors:

- The amount of time that it takes to transmit an acquired frame from the camera to your computer. The amount of time needed to transmit a frame depends on the bandwidth assigned to the camera.

- The amount of time it takes to read an acquired frame out of the image sensor and into the camera's frame buffer. This time varies depending on the setting for ROI. Frames with a smaller height and/or width take less time to read out of the sensor. The frame height and width are determined by the camera's Height and Width settings in the Image Format Control category.

- The CXP Link Configuration. When the camera is set for a CXP Link Configuration that uses more channels, it can typically transfer data out of the camera faster than when it is set for a CXP Link Configuration that uses less channels.

- The exposure time for acquired frames. If you use very long exposure time, you can acquire fewer frames per second.

## 8.7.1 Increasing the Maximum Allowed Frame Rate

You may find that you would like to acquire frames at a rate higher than the maximum allowed with the camera's current settings. In this case, you must adjust one or more of the factors that can influence the maximum allowed frame rate and then check to see if the maximum allowed frame rate has increased.

- The time that it takes to transmit a frame out of the camera is the main limiting factor on the frame rate. You can decrease the frame transmission time (and thus increase the maximum allowed frame rate) by using the ROI feature. Decreasing the size of the Image ROI may increase the maximum allowed frame rate. If possible, decrease the height and/or width of the Image ROI.

- If you are using a CXP Link Configuration with a low number of channels, consider using a CXP Link Configuration with a high number of channels. This will usually increase the maximum allowed frame rate.

- If you are using normal exposure times and you are using the camera at its maximum resolution, your exposure time will not normally restrict the frame rate. However, if you are using long exposure time, it is possible that your exposure time is limiting the maximum allowed frame rate. If you are using a long exposure time, try using a shorter exposure time and see if the maximum allowed frame rate increases (You may need to compensate for a lower exposure time by using a brighter light source or increasing the opening of your lens aperture.).

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ⓘ **Note:**

A very long exposure time severely limits the camera's maximum allowed frame rate. As an example, assume that your camera is set to use a 1 second exposure time. In this case, because each frame acquisition will take at least 1 second to be completed, the camera will only be able to acquire a maximum of one frame per second.

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# Chapter 9. Camera Features

## 9.1    Region of Interest

The Image Region of Interest (ROI) feature allows you to specify a portion of the sensor array. You can acquire only the frame data from the specified portion of the sensor array while preserving the same quality as you acquire a frame from the entire sensor array.

With the ROI feature, you can increase the maximum allowed frame rate by decreasing the Width and/or Height parameters. The ROI is referenced to the top left corner [origin (0, 0)] of the sensor array as shown below.



Figure 9-1    Region of Interest

The XML parameters related to ROI settings are as follows.

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

The unit for all parameters in this table is pixel.
a: Read only. User cannot change the value.
b: User configurable parameters for setting ROI
c: User configurable parameters for setting the origin of the ROI

Table 9-1   XML Parameters related to ROI

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

• On the VC-12MX-M/C65H camera, the Width parameter must be set to a multiple of 16, and the Height parameter must be set to a multiple of 4.

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

| Camera Model | Minimum Width Settings | Minimum Height Settings |
|---|---|---|
| VC-12MX-M/C65H | 272 | 4 |

Table 9-2   Minimum ROI Width and Height Settings

On the VC-12MX-M/C65H camera, the maximum allowed frame rates depending on Horizontal and Vertical ROI changes are shown below.

| Interface | ROI Size (H×V) | 1 Channel | 2 Channels |
|---|---|---|---|
| CXP1 | 4096×4 | 504.0 fps | 1017.6 fps |
| | 4096×1000 | 27.8 fps | 56.3 fps |
| | 4096×2000 | 14.3 fps | 28.9 fps |
| | 4096×3000 | 9.6 fps | 19.4 fps |
| | 272×3000 | 64.8 fps | 64.8 fps |
| | 1280×3000 | 30.6 fps | 61.8 fps |
| | 2560×3000 | 15.3 fps | 31.0 fps |
| | 3840×3000 | 10.2 fps | 20.7 fps |
| CXP2 | 4096×4 | 1008.0 fps | 2035.2 fps |
| | 4096×1000 | 55.7 fps | 112.7 fps |
| | 4096×2000 | 28.6 fps | 57.8 fps |
| | 4096×3000 | 19.2 fps | 38.8 fps |
| | 272×3000 | 64.8 fps | 64.8 fps |
| | 1280×3000 | 61.2 fps | 64.8 fps |
| | 2560×3000 | 30.7 fps | 100.3 fps |
| | 3840×3000 | 20.5 fps | 102.5 fps |
| CXP3 | 4096×4 | 1260.0 fps | 2540.0 fps |
| | 4096×1000 | 69.7 fps | 140.8 fps |
| | 4096×2000 | 35.7 fps | 72.2 fps |
| | 4096×3000 | 24.0 fps | 48.6 fps |
| | 272×3000 | 64.8 fps | 64.8 fps |
| | 1280×3000 | 64.8 fps | 64.8 fps |
| | 2560×3000 | 38.4 fps | 101.0 fps |
| | 3840×3000 | 25.6 fps | 51.8 fps |
| CXP5 | 4096×4 | 2016.0 fps | 3413.7 fps |
| | 4096×1000 | 111.4 fps | 187.8 fps |
| | 4096×2000 | 57.1 fps | 96.3 fps |
| | 4096×3000 | 38.4 fps | 64.8 fps |
| | 272×3000 | 64.8 fps | 64.8 fps |
| | 1280×3000 | 64.8 fps | 64.8 fps |
| | 2560×3000 | 61.5 fps | 64.8 fps |
| | 3840×3000 | 41.0 fps | 64.8 fps |
| CXP6 | 4096×4 | 2520.0 fps | 3413.7 fps |
| | 4096×1000 | 139.4 fps | 187.8 fps |
| | 4096×2000 | 71.5 fps | 96.3 fps |
| | 4096×3000 | 48.1 fps | 64.8 fps |
| | 272×3000 | 64.8 fps | 64.8 fps |
| | 1280×3000 | 64.8 fps | 64.8 fps |
| | 2560×3000 | 64.8 fps | 64.8 fps |
| | 3840×3000 | 51.2 fps | 64.8 fps |

Table 9-3   Maximum Frame Rates by ROI Changes

⚠ **Caution!**

Your CXP-6 Frame Grabber may place additional restrictions on how the ROI location and size must be set. Refer to your CXP-6 Frame Grabber user manual for more information.

## 9.2    Multi-ROI

The VC-12MX-M/C65H camera provides the Multi-ROI feature which allows you to define up to 8 regions of the sensor array. When an image is acquired, only the pixel information from the defined regions will be readout of the sensor. The pixel data read out of the regions will then be combined together and will be transmitted from the camera as a single image.

The XML parameters related to Multi-ROI are as follows.

| XML Parameters | | Value | Description |
|---|---|---|---|
| MultiRoiControl | MultiRoiSelector | Region0 – Region7 | Selects the ROI to set |
| | MultiRoiMode | On/Off | Enables / Disables the selected ROI |
| | MultiRoiWidth | 64 - 4096 | Width setting for the selected ROI |
| | MultiRoiHeight | 4 - 3000 | Height setting for the selected ROI |
| | MultiRoiOffsetX | 0 - 4096 | Horizontal offset from the origin to the selected ROI |
| | MultiRoiOffsetY | 0 - 3000 | 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<br>Active: The Multi-ROI feature is in use<br>Inactive: The Multi-ROI feature is not in use |

The unit for all parameters in this table is pixel.
a: If the setting values for the Multi-ROI feature are valid, 'True' will be returned or the check box will be selected.

Table 9-4   XML parameters related to Multi-ROI

It is recommended that you first set the MultiRoiWidth parameter, since all of the regions must be the same width. The next step in the setup process is to define each individual region as desired. Up to 8 regions can be set up ranging from 0 through 7. Use the MultiRoiSelector parameter to select which ROI to set and then set the ROI to On/Off by using the MultiRoiMode parameter. Then, set the MultiRoiOffsetX, MultiRoiOffsetY and MultiRoiHeight parameters to define each region.

In the figure below, for example, three regions have been set. With these settings, the camera would output an image as follows:

- MultiRoiWidth × the total height of the three regions (Region0 Height + Region1 Height + Region2 Height)
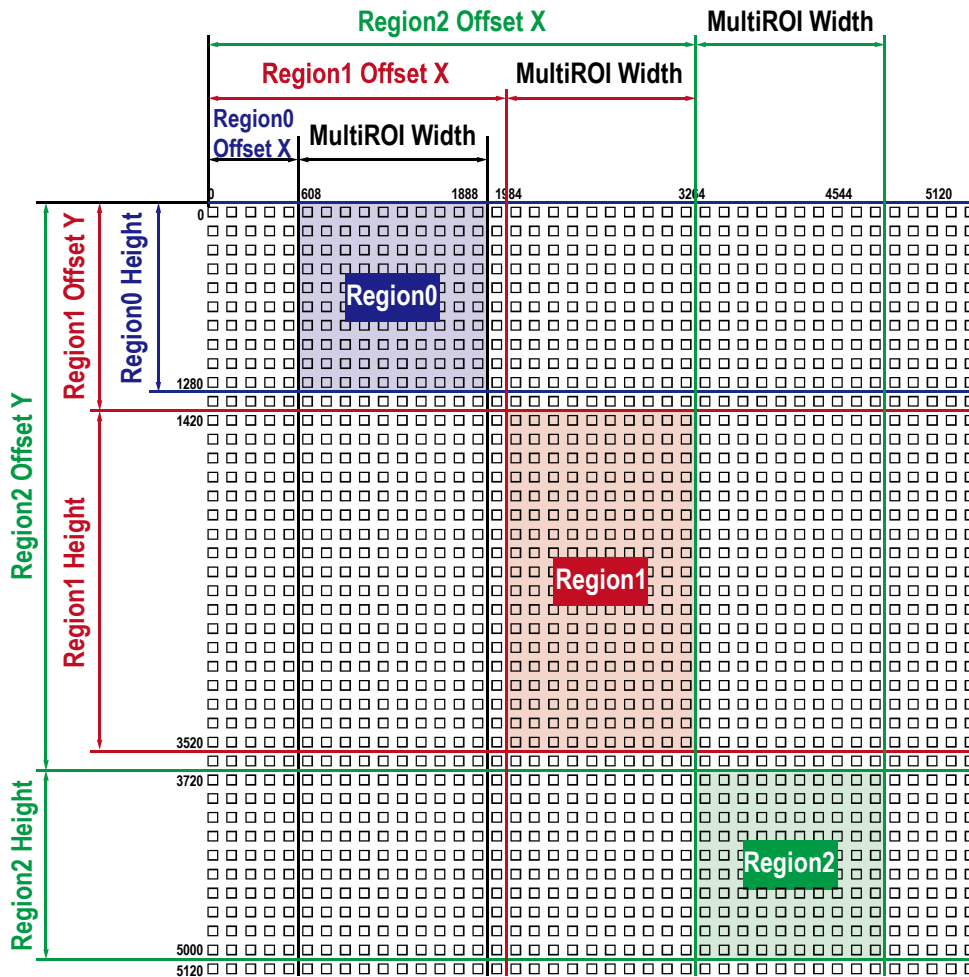


Figure 9-2    Multi-ROI

There are several things to keep in mind when setting the Multi-ROI feature on the VC-12MX-M/C65H camera:

- The sum of the MultiRoiOffsetX value plus the MultiRoiWidth value must not exceed the width of the camera's sensor.

- The sum of the MultiRoiOffsetY value plus the MultiRoiHeight value must not exceed the height of the camera's sensor.

- The MultiRoiOffsetX and MultiRoiWidth value must be a multiple of 16.

- The Multi-RoiOffsetY and MultiRoiHeight value must be a multiple of 4.

- The MultiRoiWidth values are equal, so the widths of the Region 0, Region 1, and Region 2 are the same in the figure above.

- You can save the Multi-ROI setting values as a User Set and then load the values to the camera when desired. For more information, refer to 9.23 User Set Control.

## 9.3    CXP Link Configuration

The VC-12MX-M/C65H camera must be connected to a CXP-6 Frame Grabber installed in your computer via CoaXPress 1.0 interface. CoaXPress 1.0 interface allows you to connect a camera to a CXP-6 Frame Grabber by using simple coax cabling and allows up to 6.25 Gbps data rate per cable. The VC-12MX-M/C65H camera supports one master connection and up to one more extension connection 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-6 Frame Grabber connections.



Figure 9-3    CXP Link Configuration

The XML parameters related to the link configuration between the camera and CXP-6 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 | CXP1_X1 CXP2_X1 CXP3_X1 CXP5_X1 CXP6_X1 CXP1_X2 CXP2_X2 CXP3_X2 CXP5_X2 CXP6_X2 | Sets bit rate and the number of connections for the link configuration. e.g. CXP6_X2: Two connections running at a maximum of CXP-6 speed (6.25 Gbps) |

Table 9-5    XML Parameters related to CXP Link Configuration

## 9.4    Pixel Format

The VC-12MX-M/C65H camera processes image data in the unit of 8 bit. The pixel format of the image data is available to be chosen with the Pixel Format parameter.

The XML parameter related to Pixel Format is as follows.

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

Table 9-6   XML Parameter related to Pixel Format

The available pixel formats on the VC-12MX-M/C65H camera are as follows:

- Mono8: both mono sensors and color sensors
- BayerRG8: color sensors only

## 9.5    Data ROI (Color Camera)

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 | RoiSelector | WhiteBalanceAuto | Selects a Data ROI used for Balance White Auto. Only available on the color camera. |
| | RoiOffsetX | - | X coordinate of start point ROI |
| | RoiOffsetY | - | Y coordinate of start point ROI |
| | RoiWidth | - | Width of ROI |
| | RoiHeight | - | Height of ROI |

Table 9-7    XML Parameters related to Data ROI

Only the pixel data from the area of overlap between the Data ROI and the Image ROI by your settings will be effective if you use the Image ROI and Data ROI at the same time. The effective ROI is determined as shown in the figure below.



Figure 9-4    Effective Data ROI

## 9.6 White Balance (Color Camera)

The color camera includes the white balance capability to adjust the color balance of the images transmitted from the camera. With the white balancing scheme used on the VC-12MX-M/C65H camera, the Red, Green and Blue intensities can be adjusted individually. You can set the intensity of each color by using the Balance Ratio parameter. The Balance Ratio value can range from 1.0 to 4.0. If the Balance Ratio parameter is set to 1.0 for a color, the intensity of the color will be unaffected by the white balance mechanism. If the Balance Ratio parameter is set to greater than 1.0, the intensity of the color will be proportionally increased to the ratio. For example, if the Balance Ratio is set to 1.5, the intensity of that color will be increased by 50%.

The XML parameters related to White Balance are as follows.

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

Table 9-8   XML Parameters related to White Balance

### 9.6.1 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 Parameter | | Value | Description |
|---|---|---|---|
| AnalogControl | BalanceWhite Auto | Off | Balance White Auto Off |
| | | Once | White Balance is adjusted once and then Off. |

Table 9-9   XML Parameter related to Balance White Auto

## 9.7    Gain and Black Level

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

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

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

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

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

| XML Parameters | | Value | Description |
|---|---|---|---|
| Analog Control | GainSelector | Analog All | Applies the Gain value to all analog channels. |
| | | Digital All | Applies the Gain value to all digital channels. |
| | Gain | 1.0× — 8.0× | Sets an analog gain value. |
| | | 1.0× — 32.0× | Sets a digital gain value. |
| | BlackLevel Selector | Digital All | Applies the Black Level value to all digital channels. |
| | BlackLevel | 0 ~ 15.75 | Sets a black level value |

Table 9-10   XML Parameters related to Gain and Black Level

## 9.8    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 Appendix A.

### 9.8.1    Correction Method

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

| L3 | L2 | L1 | | R1 | R2 | R3 |
|----|----|----|----|----|----|----|

**Current Pixel**

Figure 9-5    Location of Defect Pixel to be corrected

If the Current Pixel is a defect pixel as shown in the figure above, the correction 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 | Correction 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 9-11    Calculation of Defect Pixel Correction Value

## 9.9    Flat Field Correction

The Flat Field Correction feature improves the image uniformity when you acquire a non-uniformity image due to external conditions. The Flat Field Correction feature of the VC-12MX-M/C65H camera can be summarized 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 9-7.

    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.

---

⚠ **Caution!**

- 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.

---

> ⓘ **FFC for the color camera:**
>
> When you set the Pixel Format parameter to a Bayer pattern (Bayer RG 8/10/12/14/16) and enable the Flat Field Correction feature on the color camera, the FFC will be performed for each color pixel (red, green1, green2 and blue) separately. This significantly removes image artifacts to improve pixel to pixel color uniformity.

**Flat Field Calibration**

Scale Down → Memory

**Flat Fielding**

Memory → Bilinear Interpolated Magnification

$< IF >$ or $<\dfrac{IM}{IF}>$

$< IR >$

$IR \times \dfrac{M \text{ or } IM}{IF}$

$< IC >$

Figure 9-6　Generation and Application of Flat Field Data

Figure 9-7    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. |
| | FlatFieldData Selector | Space0 ~ Space15 | Selects a location to save Flat Field data to or load Flat Field data from. Space0~Space15: User defined location |
| | FlatFieldData Generate | - | Generates the 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 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. |
| | FlatFieldDataLoad | - | Loads the Flat Field data from the non-volatile memory into volatile memory. |

Table 9-12    XML Parameters related to Flat Field Correction

### 9.9.1 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 VC-12MX-M/C65H camera provides sixteen 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 9-8   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.


## Loading 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.

## 9.10    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 | Configures the items related to the pins of No.2 and No.3 among 6 of the pins |
| | | Line1 | Configures the items related to the pin No.4 among 6 of the pins |
| | LineMode | Input | Appears under Line0 is chosen |
| | | Output | Appears under Line1 is chosen |
| | LineInverter | FALSE | Disables inversion on the output signal of the line |
| | | TRUE | Enables inversion on the output signal of the line |
| | LineSource | Off | Disables the line output |
| | | Frame Active | Outputs pulse signals indicating a frame readout time |
| | | LineActive | Outputs pulse signals indicating a line readout time |
| | | Exposure Active | Outputs pulse signals indicating the current exposure time |
| | | UserOutput0 | Outputs pulse signals set by User Output Value |
| | | Timer0 Active | Outputs user-defined Timer signals as pulse signals |
| | | Count0 Active | Outputs user-defined Counter signals as pulse signals |
| | UserOutput Selector | UserOutput0 | Outputs pulse signals set by User Output Value. |
| | UserOutput Value | FALSE | Sets the bit state of the line to Low |
| | | TRUE | Sets the bit state of the line to High |
| | Debounce Time | 0 ~ 1,000,000 | Sets a Debounce Time in microseconds (Default: 0.5 $\mu$s) |

Table 9-13   XML Parameters related to Digital I/O Control

When you set the Line Source to User Output0, you can use the user setting values as output signals.

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



Figure 9-10   Exposure Active Signal

## 9.11 Debounce

The Debounce feature of the VC-12MX-M/C65H cameras allows to supply only valid signals to the camera by discriminating between valid and invalid input signals. The Debounce Time parameter specifies the minimum time that an input signal must remain High or Low in order to be considered as a valid input signal. When you use the Debounce feature, be aware that there is a delay between the point where the valid input signal arrives and the point where the signal becomes effective. The duration of the delay is determined by the Debounce Time parameter setting value.

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



Figure 9-11    Debounce

The XML parameter related to Debounce Time is as follows.

| XML Parameters | | Value | Description |
|---|---|---|---|
| DigitalIOControl | Debounce Time | 0 – 1,000,000 μs | Sets a Debounce Time in microseconds (Default: 0.5 μs). |

Table 9-14    XML Parameter related to Debounce Time

## 9.12 Timer Control

When the Line Source parameter is set to Timer0Active, the camera can provide output signals by using the Timer. On the VC-12MX-M/C65H 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 | TimerDuration | 1 ~ 60,000,000 μs | Sets the duration of the Timer output signal to be used when Timer Trigger Activation is set to Rising/Falling Edge. |
| | TimerDelay | 0 ~ 60,000,000 μs | Sets the delay time to be applied before starting the Timer. |
| | TimerReset | - | Resets the Timer and starts it again. |
| | TimerTrigger Source | Off | Disables the Timer trigger. |
| | | ExposureActive | Sets the Timer to use the current exposure time as the source signal. |
| | | FrameActive | Sets the Timer to use a frame readout time as the source signal. |
| | | Line0 | Sets the Timer to use the external trigger signal as the source signal. |
| | | Counter0Start | Sets the Timer to use the Counter0 signal as the source signal. |
| | TimerTrigger Activation | RisingEdge | Specifies that a rising edge of the selected trigger signal will act as the Timer trigger. |
| | | FallingEdge | Specifies that a falling edge of the selected trigger signal will act as the Timer trigger. |
| | | AnyEdge | Specifies that a rising edge or a falling edge of the selected trigger signal will act as the Timer trigger. |
| | | LevelHigh | Specifies that the Timer output signal will be valid as long as the selected trigger signal is High. |
| | | LevelLow | Specifies that the Timer output signal will be valid as long as the selected trigger signal is Low. |

Table 9-15   XML Parameters related to Timer Control

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

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



* **Timer Trigger Activation** is set to **Level High**.

Figure 9-12   Timer Signal

## 9.13 Counter Control

The VC-12MX-M/C65H camera provides the Counter feature to count certain camera events. For example, you can verify the number of external trigger signals applied to the camera.

The XML parameters related to Counter Control are as follows.

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

| XML Parameters | | Value | Description |
|---|---|---|---|
| CounterAnd TimerControl | CounterDuration | 1 – 4294967295 | Sets the duration or number of events to count before the Counter ends. |
| | CounterStatus | - | Displays the current status of the Counter. |
| | CounterTriggerSource | Off | Disables the Counter Trigger Source function. |
| | | Frame Active | Uses the Frame Active signal as Trigger Source of Counter. |
| | | Exposure Active | Uses the Exposure Active signal as Trigger Source of Counter. |
| | | Acquisition Active | Uses the Acquisition Active signal as Trigger Source of Counter. |
| | | Line0 | Uses the Line0 signal as Trigger Source of Counter. |
| | CounterTriggerActivation | RisingEdge | Starts Counter on the rising edge of the selected Counter Trigger Source signal. |
| | | FallingEdge | Starts Counter on the falling edge of the selected Counter Trigger Source signal. |
| | | AnyEdge | Starts Counter on the rising/falling edge of the selected Counter Trigger Source signal. |
| | | LevelHigh | Resets the Counter if the level of the selected Counter Trigger Source signal is High. |
| | | LevelLow | Resets the Counter if the level of the selected Counter Trigger Source signal is Counter. |

Table 9-16   XML Parameters related to Counter Control

## 9.14   Temperature Monitor

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

The XML parameters related to Device Temperature are as follows.

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

Table 9-17   XML Parameters related to Device Temperature

## 9.15   Status LED

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

LED status and corresponding camera status are as follows:

| Status LED | Description |
| --- | --- |
| Steady Red | The camera is not initialized. |
| Slow Flashing Red | A CXP Link is not configured. |
| 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 9-18   Status LED

## 9.16 Test Pattern

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

The XML parameter related to Test Pattern is as follows.

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

Table 9-19    XML Parameter related to Test Pattern



Figure 9-13    Grey Horizontal Ramp

Figure 9-14   Grey Diagonal Ramp



Figure 9-15   Grey Diagonal Ramp Moving



Figure 9-16   Sensor Specific

## Caution!

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

## 9.17    Reverse X

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

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

Table 9-20    XML Parameter related to Reverse X



Figure 9-17    Original Image



Figure 9-18    Reverse X Image

## 9.18  Reverse Y

The Reverse Y feature lets you flip images vertically. This feature is available in all operation modes of the camera. The XML parameter related to Reverse Y is as follows.

| XML Parameters | | Value | Description |
|---|---|---|---|
| ImageFormatControl | ReverseY | FALSE | Disables the Reverse Y feature. |
| | | TRUE | Flips images vertically. |

Table 9-21    XML Parameter related to Reverse Y



Figure 9-19    Original Image



Figure 9-20    Reverse Y Image

⚠ **Caution!**

- After using the Reverse Y feature, you must generate the camera's correction data (FFC) again, from the beginning.
- To apply the new color filter array to the color cameras in the series, it is recommended to execute the Reverse Y feature after choosing Bayer on the Pixel Format parameter.

## 9.19 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 9-22   XML Parameter related to Device Link Throughput Limit

⚠ **Caution!**

To ensure good image quality, we recommend that you set the Device Link Throughput Limit parameter to the maximum value. Otherwise, the image quality can decrease. In case of the VC-12MX-M/C65H, its maximum value is 1000.

## 9.20 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 Parameter | | Description |
| --- | --- | --- |
| DeviceControl | DeviceUserID | Input user-defined information (32 bytes). |

Table 9-23   XML Parameter related to Device User ID

## 9.21 Device Reset

Resets the camera physically to power off and on.

The XML parameter related to Device Reset is as follows.

| XML Parameter | | Description |
| --- | --- | --- |
| DeviceControl | Device Reset | Resets the camera physically. |

Table 9-24   XML Parameter related to Device Reset

## 9.22 Field Upgrade

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

## 9.23 User Set Control

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

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

| XML Parameters | | Value | Description |
| --- | --- | --- | --- |
| UserSetControl | UserSetSelector | Default | Selects the Factory Default settings. |
| | | UserSet1 | Selects the 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.<br>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 9-25   XML Parameters related to User Set Control

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



Figure 9-21    User Set Control

# Chapter 10. Troubleshooting

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

- If no image is displayed on your computer,

  − Ensure that all cable connections are secure.
  − Ensure that the power supply is properly connected.
  − Ensure that trigger signals are applied correctly when you operate the camera with trigger signals.

- If images are not clear,

  − Ensure the camera lens or glass is clean.
  − Check the lens aperture is adjusted properly.

- If images are dark,

  − Ensure the camera lens is not blocked.
  − Check the exposure time is set properly.

- If you identify abnormal operation or overheating sign,

  − Ensure the power supply is properly connected.
  − Stop using the camera when you notice smoke or abnormal overheating.

- If the Trigger Mode is not working correctly,

  − Ensure that the CC1 settings on the frame grabber are configured correctly when you use CC1 triggering.
  − Ensure that cable connections are secure when you use external triggering.

- If there is a communication failure between the camera and user's computer,

  − Ensure that the Camera Link cable connections are secure.
  − Ensure that you have configured a frame grabber in your computer and the camera is connected to the frame grabber correctly.

# **Appendix A.** 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.



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.

# 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.

# Appendix C. Index

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