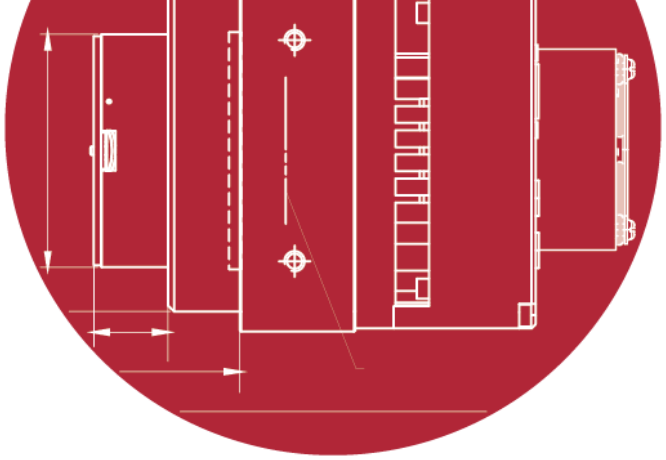


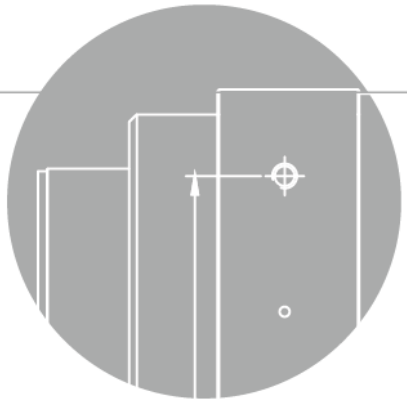
VP-25MC

User Manual

English

VP-25MC-30

CAMERA Link®



vieworks

Imaging Expert

Revision History

Revision	Date	Description
1.0	2017-09-29	Initial Release

Contents

1 Precautions

General

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

Installation and Maintenance

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

Power Supply

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

2 Warranty

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

3 Compliance & Certifications

3.1 FCC Declaration

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 own expenses.

3.2 CE: DoC

EMC Directive 2014/30/EU

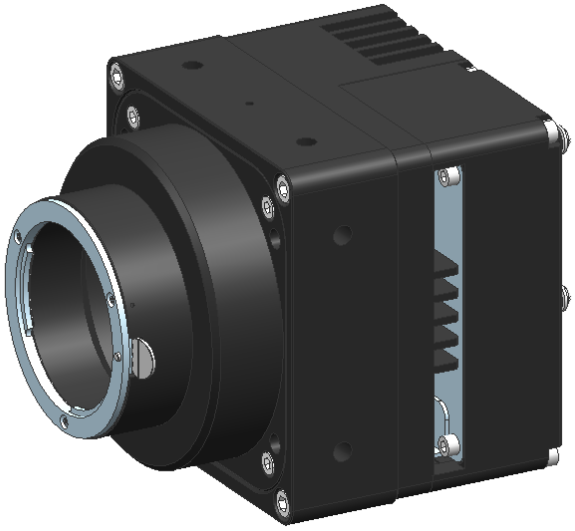
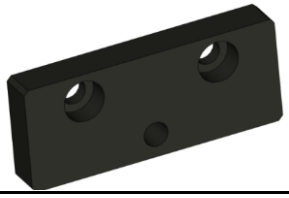
EN 55032:2012 (Class A), EN 55024:2010

Class A

3.2.1 KCC Statement

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

4 Package Components

Package Components

VP-25MC <F-mount>

Mount Plate (Optional)

M5 Set Screws for Tilt Adjustment (Provided only with F-mount camera)

CAUTION	• You can adjust the tilt using the M5 set screws, however it is not recommended since 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.

5 Product Specifications

5.1 Overview

The VP-25MC camera, the latest member of the industrial proven VP series, is a 25 megapixel resolution CMOS camera with Camera Link interface. It features 25 megapixel resolutions with frame rate up to 30 fps. This camera uses thermo-electric Peltier (TEC) cooling technology developed for, and used by, many demanding medical market customers. The TEC maintains the operating temperature of the CMOS image sensor at up to about 17 degrees below ambient temperature. This camera provides a stable operating condition or the ability to expose for a long period of time to increase camera sensitivity. Featured with the stable operating capability and high resolution, this camera is ideal for demanding applications such as FPD, PCB and semiconductor inspections.

Main Features

- High speed 25 megapixel CMOS image sensor
- Thermoelectric Peltier Cooling – about 17 degrees below ambient temperature
- Minimizing the number of hot pixels with TEC (up to 99%)
- Electronic exposure time control (global shutter)
- Output Pixel Format: 8 / 10 bit
- Strobe Output
- Defective Pixel Correction
- Camera Link Full Interface
- Camera Link Output Mode: 8 Tap, 10 Tap
- Gain/Offset Control
- Test Image
- LVDS (RS-644) serial communication by Camera Link interface
- Temperature monitor
- Field upgrade
- Flat Field Correction

5.2 Specifications

The technical specifications of the VP-25MC are as follows.

Specifications	VP-25MC-30
Resolution (H x V)	5120 × 5120
Sensor	On Semiconductor VITA-25K
Sensor Size (㎟)	23.04 × 23.04 (Diagonal: 32.5 ㎜)
Sensor Type	High Speed Progressive Scan CMOS Image Sensor
Pixel size	4.5 ㎛ × 4.5 ㎛
Interface	Camera Link
Electronic Shutter	Global Shutter
Max. Frame Rate	8 Tap: 25.0 fps
	10 Tap: 30.9 fps
Transfer Time	8 Tap: 40.00 ㎳
	10 Tap: 32.36 ㎳
Pixel Data Format	8 bit (8/10 Tap), 10 bit (8 Tap)
Camera Link Pixel Clock	85 ㎒
Exposure Time	1/100000 ~ 7 sec (10 ㎲ step)
Cable Length	< 5 m (Camera Link Cable at 85 ㎒)
Black Offset	0 ~ 63 LSB, 64 step
Video Gain	0 ~ 12 ㏈, 64 step
Trigger Mode	Free-Run, Trigger Programmable Exposure Time and Trigger Polarity
External Trigger	External, 3.3 V ~ 24.0 V Logical level input, Optically isolated
Software Trigger	Camera Link CC1
Dynamic Range	54 ㏈
Lens Mount	F-mount
Cooling Method	Thermoelectric Peltier Cooling
Cooling Performance	17℃ below ambient temperature / Standard cooling with a fan
Power	10 ~ 24 V DC, Typ. 22 W
Environmental	Operating: -5℃ ~ 40℃, Storage: -40℃ ~ 70℃
Mechanical	90 ㎜ × 90 ㎜ × 134 ㎜, 1,500 g (with F-mount)
Configuration SW	Configurator

Table 5.1 Specifications of VP-25MC

5.3 Camera Block Diagram

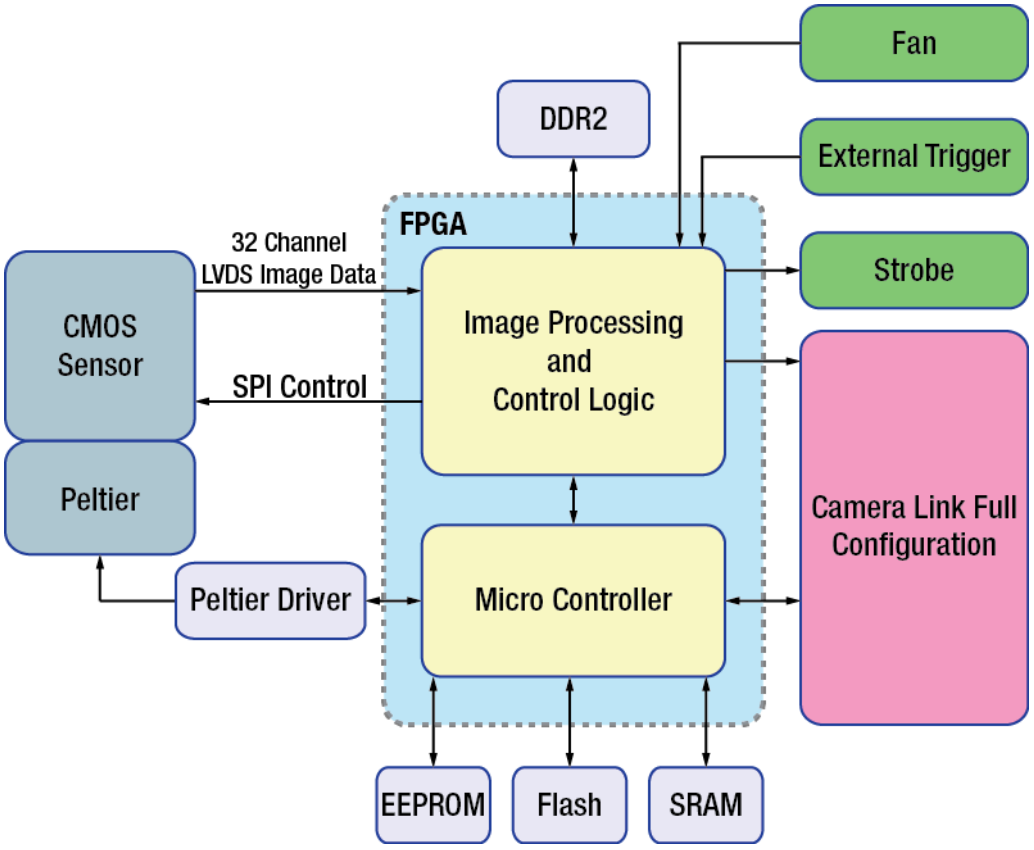


Figure 5.1 Camera Block Diagram

All controls and data processing of the VP-25MC 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 Camera Link 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 Camera Link interface. The Processing & Control logic also controls the trigger inputs and strobe outputs which are sensitive to time. Furthermore, FLASH and DDR2 are installed outside FPGA. DDR2 is used to process image data and FLASH stores the firmware to operate the Micro-Controller. And a Peltier Driver is applied to control a Thermoelectric Peltier Cooling unit.

5.4 Sensor Information

The following graphs show the quantum efficiency of the VP-25MC monochrome and color cameras.

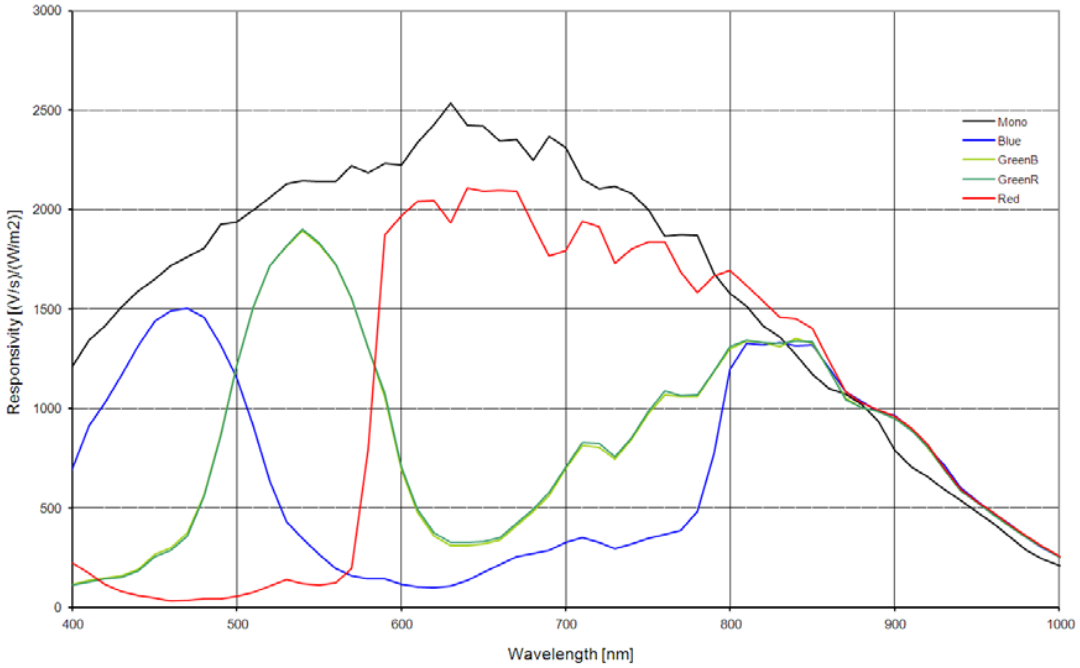


Figure 5.2 Mono and Color Spectral Response for VP-25MC

5.5 Mechanical Specification

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

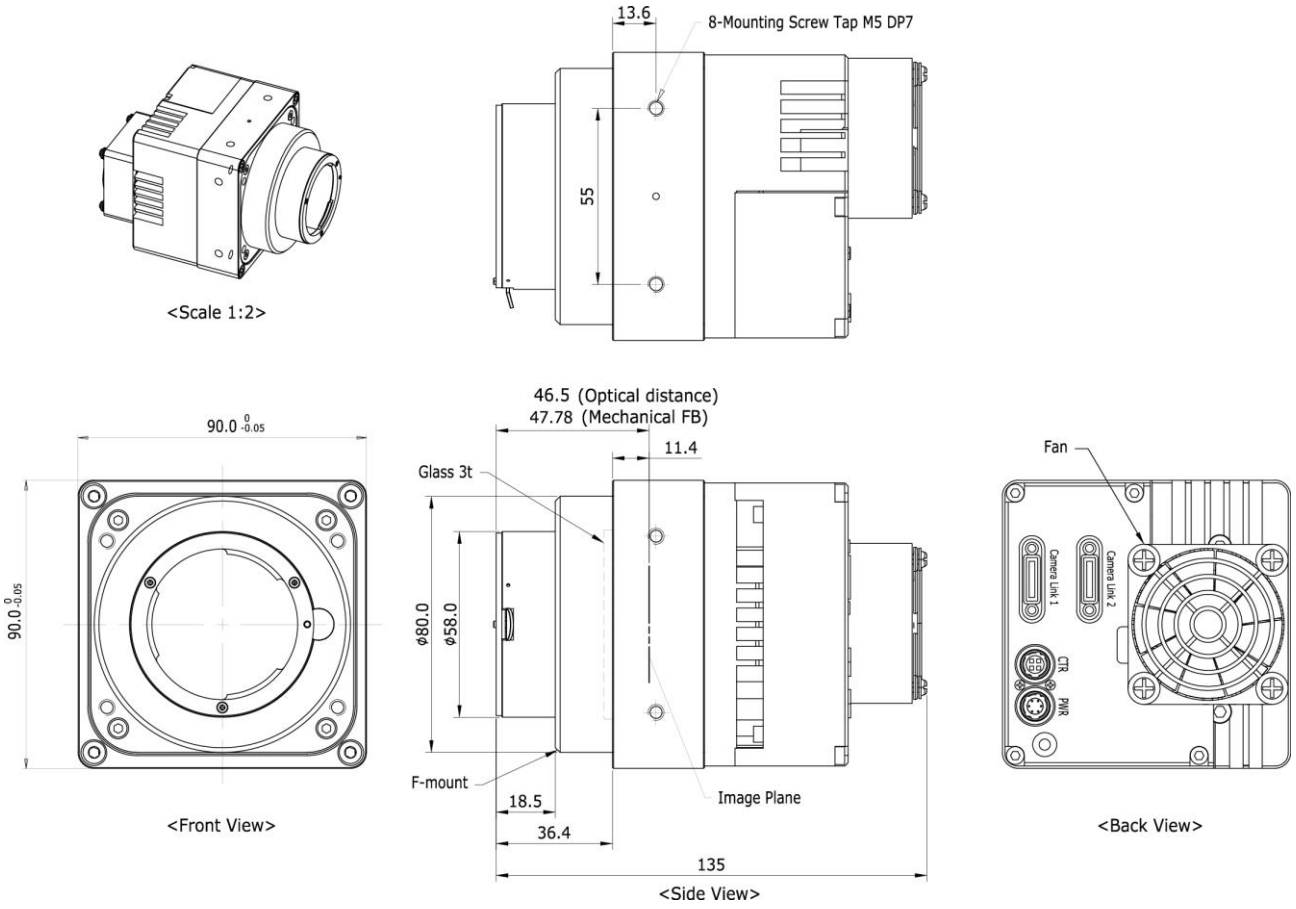


Figure 5.3 VP-25MC Camera Link F-mount Mechanical Dimension

6 Connecting the Camera

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

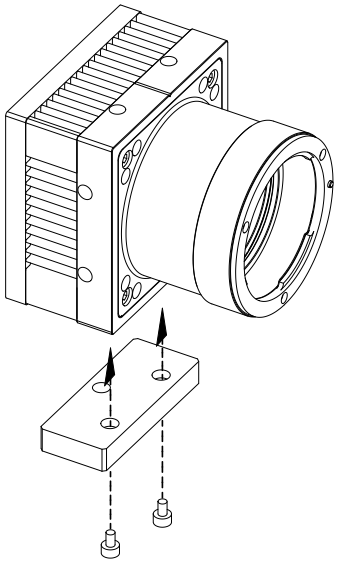
To connect the camera to your computer, follow the steps below:

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 Camera Link cable into the Camera Link1 connector on the camera and the other end of the Camera Link cable into the Base connector on the Camera Link frame grabber.
3. Plug one end of a Camera Link cable into the Camera Link2 connector on the camera and the other end of the Camera Link cable into the Medium/Full connector on the Camera Link frame grabber.
4. Connect the plug of the power adaptor to the power input receptacle on the camera.
5. Plug the power adaptor into a working electrical outlet.
6. Verify all the cable connections are secure.

Precautions for using Camera Link Full Configuration

	The VP-25MC camera supports Camera Link Full configuration. To operate the camera in the full configuration, you must connect the camera to the Camera Link frame grabber using two Camera Link cables. At this time, you must connect both Camera Link1 (Base) and Camera Link2 (Full) connectors on the camera to their respective connectors on the Camera Link frame grabbers.

6.1 Mount Plate



- The mount plate is provided as an optional item.
- The camera can be installed without using this mount plate.

6.2 Precaution to center the image sensor

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

6.3 Precaution about blurring compared to the center

- User does 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.

6.4 Controlling the Camera

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

7 Camera Interface

7.1 General Description

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

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

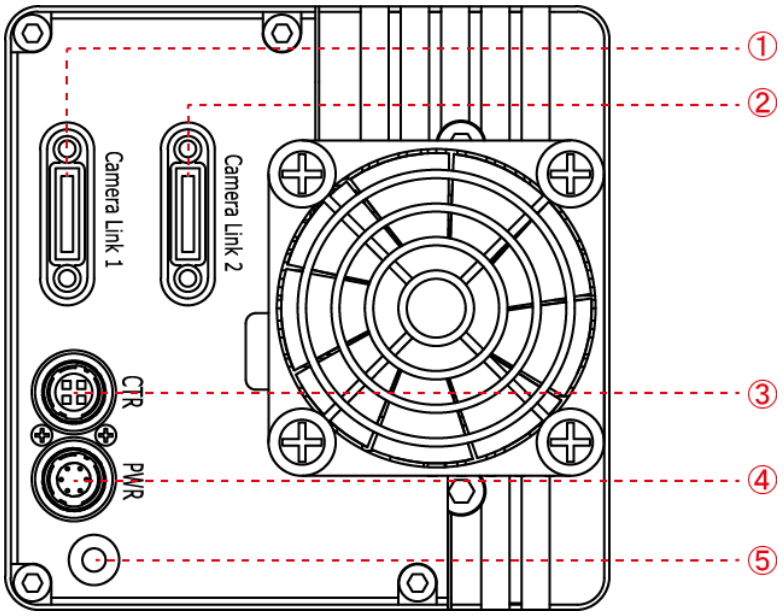


Figure 7.1 VP-25MC Camera Back Panel

7.2 Camera Link Connector

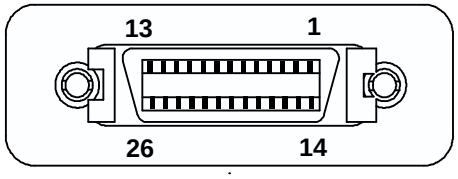


Figure 7.2 Camera Link Connector

Camera Link connectors comply with Camera Link Standard and the following list shows the pin assignments of the connector.

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

Table 7.1 Pin Assignments for Camera Link Connector 1

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

Table 7.2 Pin Assignments for Camera Link Connector 2

Model	Camera Link Output Mode	CL Configuration	CL Connector 1	CL Connector 2
VP-25MC-30	8 Tap	FULL	O	O
	10 Tap	FULL	O	O

Table 7.3 Connector Arrangement for the Camera Link Output Modes

When you connect a Frame Grabber to Camera Link connectors on the camera using Camera Link cables, make sure you connect to the correct Camera Link connector. Incorrect connection of the Connector 1 and Connector 2 may cause malfunction of the camera or communication problems between your computer and the camera.

7.3 Power Input Receptacle

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

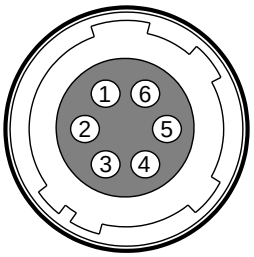


Figure 7.3 Pin Configurations for Power Input Receptacle

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

Table 7.4 Pin Configurations for Power Input Receptacle

The mating connector is a Hirose 6 pin plug (part # HR10A-7P-6S) or the equivalent connectors. The power adapter is recommended to have at least 1 A current output at 12 V DC ±10% voltage output (Users need to purchase the power adapter separately).

Precaution for Power Input

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

7.4 Control I/O Receptacle

The Control I/O Receptacle is a Hirose 4 pin connector (part # HR10A-7R-4S) and consists of an external trigger signal input and strobe output port. The pin assignments and configurations are as follows:

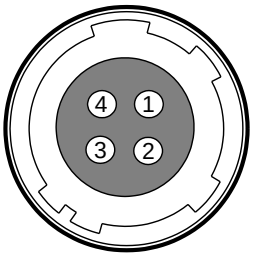


Figure 7.4 Pin Assignments for Control I/O Receptacle

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

Table 7.5 Pin Configurations for Control I/O Receptacle

The mating connector is a Hirose 4 pin plug (part # HR10A-7P-4P) or the equivalent connectors.

7.5 Trigger Input Circuit

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

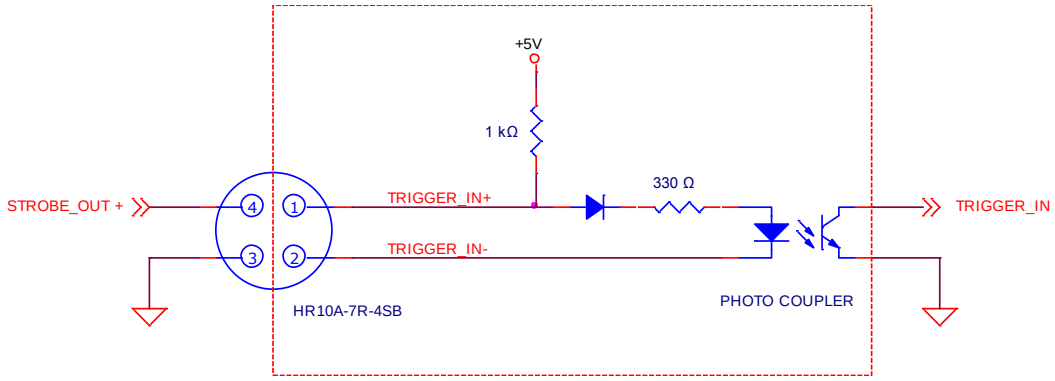


Figure 7.5 Trigger Input Schematic

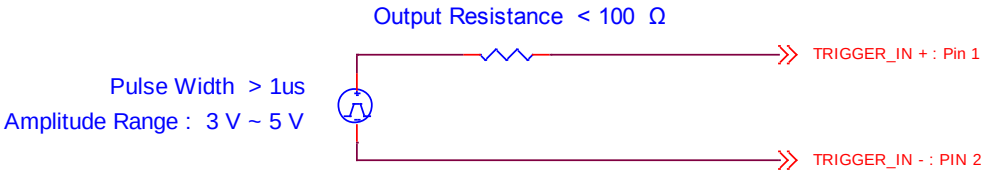


Figure 7.6 Recommended Pulse Trigger Driver Input

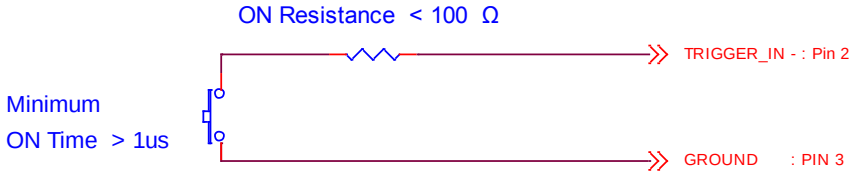


Figure 7.7 Recommended Contact Trigger Input

7.6 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.

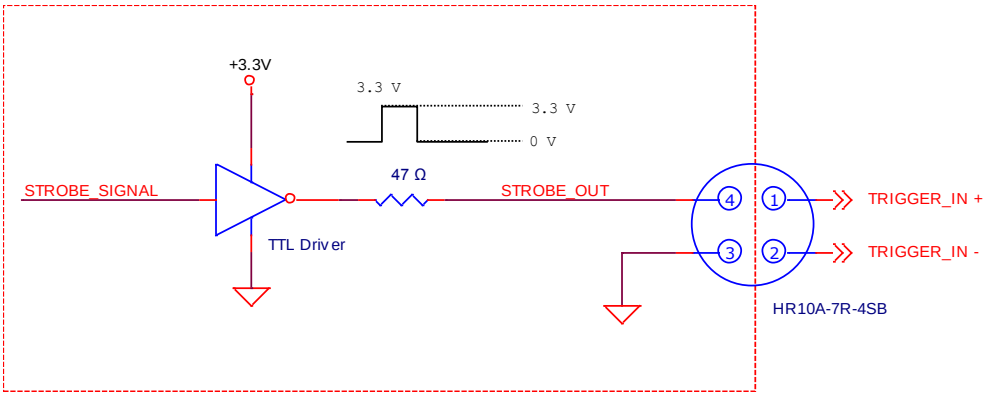


Figure 7.8 Strobe Output Schematic

8 Camera Features

8.1 Region Of Interest (ROI)

The 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.

On the VP-25MC camera, decreasing the Height and Width of the ROI can increase the camera's maximum allowed frame rate. The ROI is referenced to the top left corner [origin (0, 0)] of the sensor array as shown below.

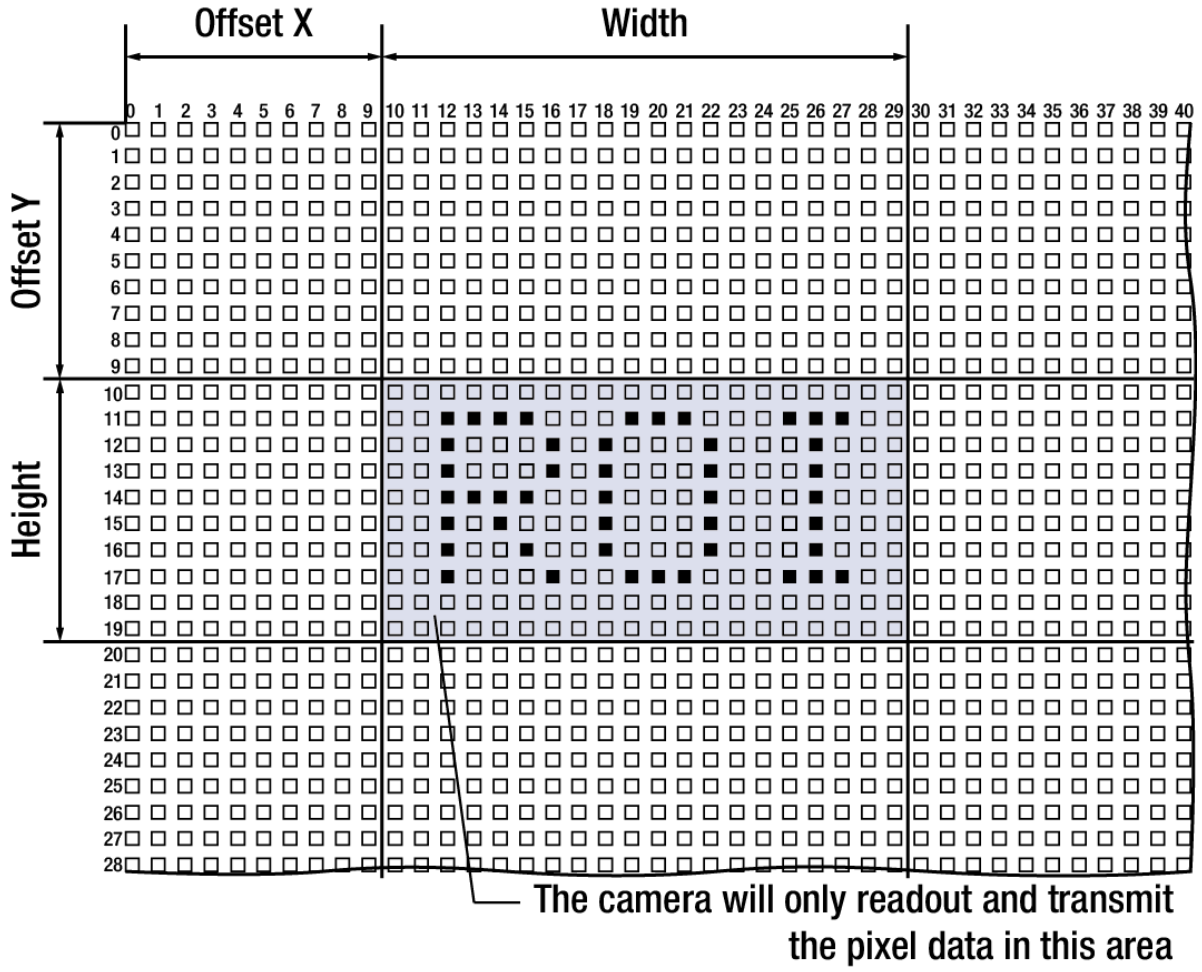


Figure 8.1 Region of Interest

On the VP-25MC, the maximum allowed frame rate depending on Horizontal ROI and Vertical ROI changes are shown below.

ROI Size (H × V)	VP-25MC	
	8 Tap	10 Tap
3000 × 3000	56.4 fps	69.8 fps
4000 × 3000	48.8 fps	60.4 fps
4000 × 4000	36.7 fps	45.4 fps
5120 × 5120	25.0 fps	30.9 fps

Table 8.1 Maximum Frame Rate by VP-25MC ROI Changes

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

8.2 Multi-ROI

The VP-25MC camera provide the Multi-ROI feature which allows you to define up to thirty two regions on 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.

8.2.1 Multi-ROI on VP-25MC

It is recommended that you first set the **Width** 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 32 regions can be set up ranging from 0 through 31. Set the each region to ON/OFF and then set the **Offset X**, **Offset Y** and **Height** (the height of the region) values to define each region. In figure 8.2, for example, three regions have been set. With these settings, the camera would output an image with 1280 (width) × 4660 (the total height of the three regions) size.

- Width = 1280
- ROI_0
  - Offset X = 600, Offset Y = 0, Height = 1280
- ROI_1
  - Offset X = 1984, Offset Y = 1420, Height = 2100
- ROI_2
  - Offset X = 3264, Offset Y = 3720, Height = 1280

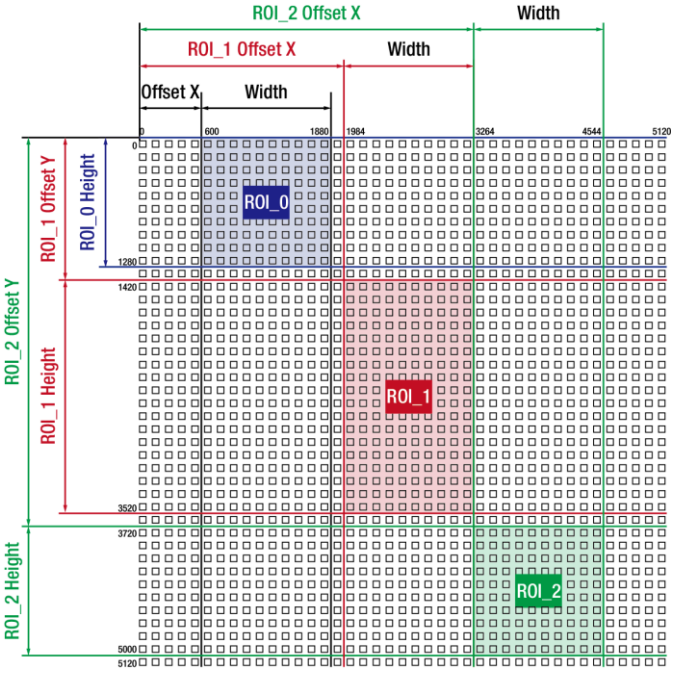


Figure 8.2 Multi-ROI

There are several things to keep in mind when setting the Multi-ROI feature on the VP-25MC camera:

- The sum of the Offset X value plus the Width value must not exceed the width (5120 on the VP-25MC) of the camera's sensor.
- The sum of the Offset Y value plus the Height value must not exceed the height (5120 on the VP-25MC) of the camera's sensor.
- The Offset X value must be a multiple of 64.
- The Width value must be a multiple of 64 ranging from 256 to 5120.
- You can save (**Configurator** > **File** > **Save Setting** > **User 1** or **User 2**) the setting values for Multi-ROI to parameter storage space and then load (**Configurator** > **File** > **Load Setting** > **From User 1 Space** or **From User 2 Space**) the values to the camera when desired.
- If you make changes to the Multi-ROI settings, you must execute the 'ast' command (Update Multi-ROI) to apply the changes.
- If you attempt to set the Multi-ROI settings with invalid values, the camera will not acquire images.
- Refer to Table 9.1 Command List for the commands related to Multi-ROI.

8.3 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 VP-25MC camera provides two binning factors (×1 and ×2) that you can apply both horizontally and vertically. With the 2 × 2 binning, four pixels are reported out of the camera as a single pixel as shown in the figure below. For example, if you set 2 × 2 binning as shown in the figure below, the camera's resolution is reduced to 1/2. Using the binning feature reduces the resolution of the camera's output image in half, however, it results in double signal to noise ratio with the same brightness as an original image. You can use the binning feature and the ROI feature at the same time. To set the binning feature, use the 'sbf' command.

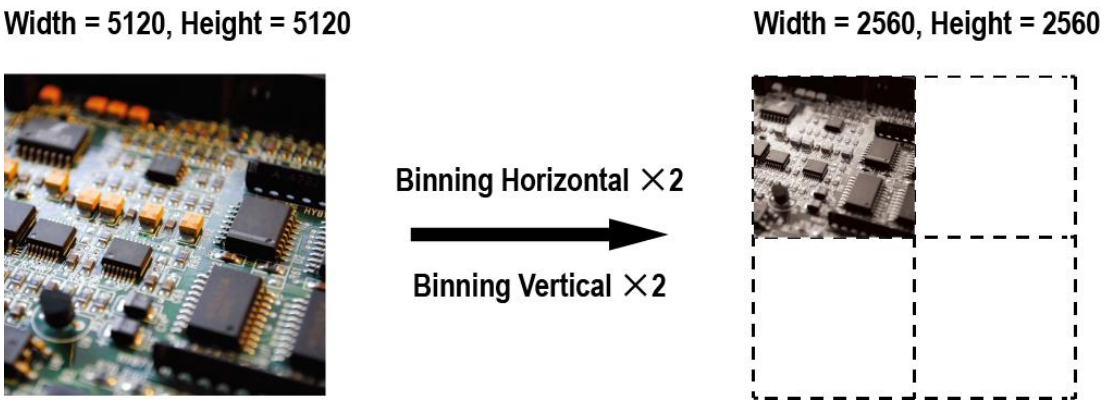


Figure 8.3 Binning

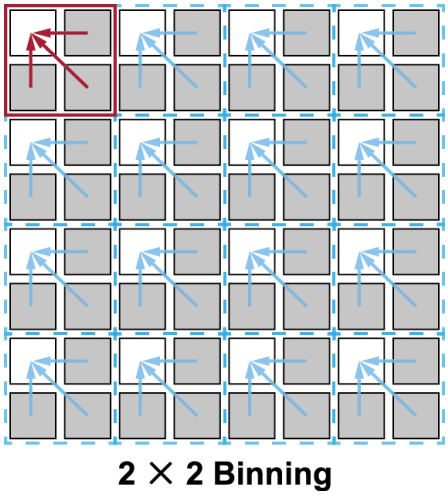


Figure 8.4 2 × 2 Binning

8.4 Trigger Mode

When the **Trigger Mode** is set to **Free-Run**, the camera will generate all required trigger signals internally, and you do not need to apply trigger signal to the camera.

When the **Trigger Mode** is set to **External Sync**, you must apply a trigger signal to the camera each time you want to begin a frame acquisition. The **Source** parameter specifies the source signal that will act as the trigger signal. The available settings for the **Source** parameter are:

- **CC1 port**: You can apply a trigger signal to the camera via Camera Link CC1 port. For more information, refer to your Camera Link frame grabber user manual.
- **External port**: You can apply a trigger signal to the camera by injecting an externally generated electrical signal (commonly referred to as a hardware trigger signal) into the Control I/O receptacle on the camera.

If the **Source** parameter is set to **CC1 port** or **External port**, you must also set the **Polarity** parameter.
The available settings for the **Polarity** parameter are:

- **Active Low**: Specifies that a falling edge of the electrical signal will act as the trigger signal.
- **Active High**: Specifies that a rising edge of the electrical signal will act as the trigger signal.

8.4.1 Free-Run Mode

When the **Trigger Mode** is set to **Free-Run**, the camera will generate all required trigger signals internally. When the camera is set this way, the exposure time for each frame acquisition is determined by the value of the camera's **Exposure Time** parameter. The camera will constantly acquire images (repeat exposure and readout) without any need for triggering by the user.

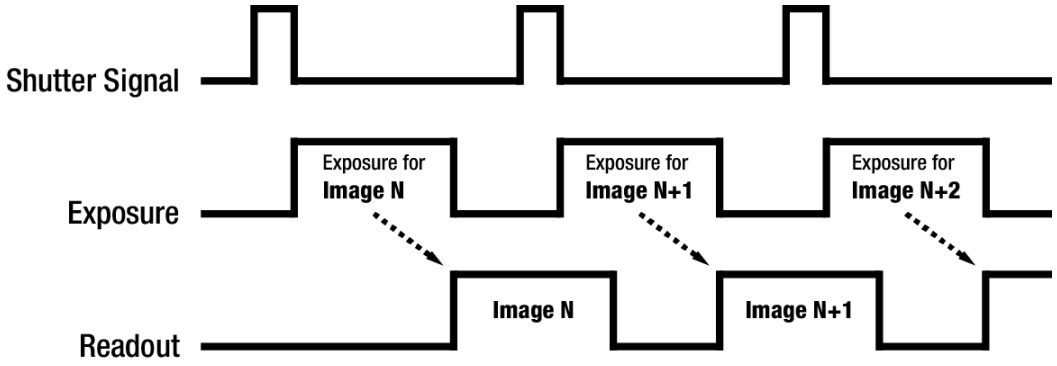


Figure 8.5 Free-Run Mode

With the Trigger Mode set to Free-Run, the exposure for a new frame will overlap the readout for the previous frame. The operation of the camera may differ depending on the length of the exposure time and readout time.

If the exposure time is shorter than the readout time, a shutter signal will be generated while reading out the sensor data for the previously acquired frame. Then, the camera will begin reading out the sensor data for a new frame as soon as it finishes reading out the sensor data for the previous frame. In this case, the frame speed will be constant regardless of changes in the exposure time.

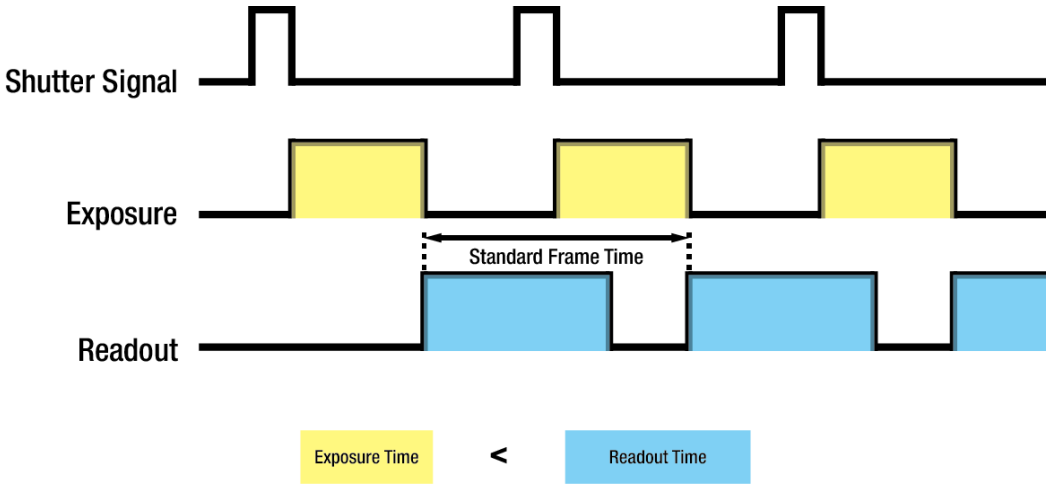


Figure 8.6 Exposure Time is shorter than Readout Time

If the exposure time is longer than the readout time, the camera will begin the process of reading out a frame each time a shutter signal is generated. After completing the process of reading out the frame, the camera will not begin the process of reading out a new frame until the camera completes the process of exposing a new frame. In this case, the frame speed becomes slower as you increase the exposure time value.

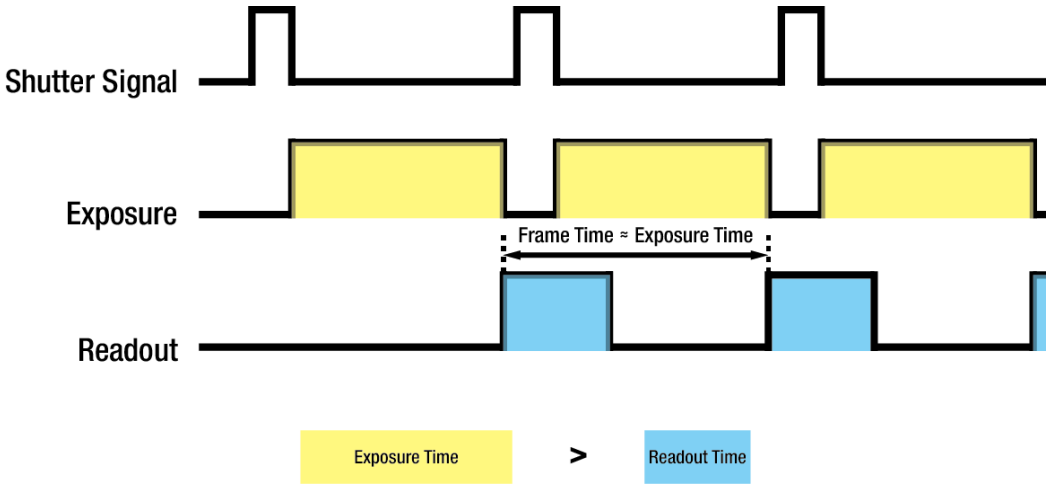


Figure 8.7 Exposure Time is longer than Readout Time

8.4.2 External Sync Mode

When the **Trigger Mode** is set to **External Sync**, you must trigger exposure start by applying trigger signals to the camera. Applying a trigger signal to the camera will exit the camera from the waiting for trigger signal acquisition status and will begin the process of exposing and reading out a frame. After the readout for the frame is complete and the camera is ready to accept another trigger signal, it will return to the waiting for trigger signal acquisition status. Trigger signals applied to the camera when it is not in a waiting for trigger signal acquisition status will be ignored.

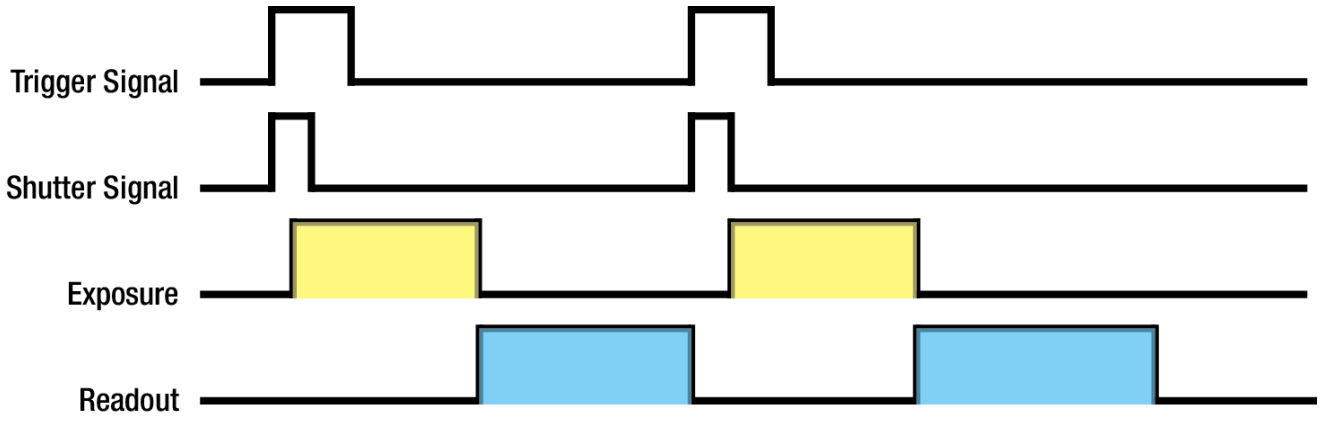


Figure 8.8 External Sync Mode

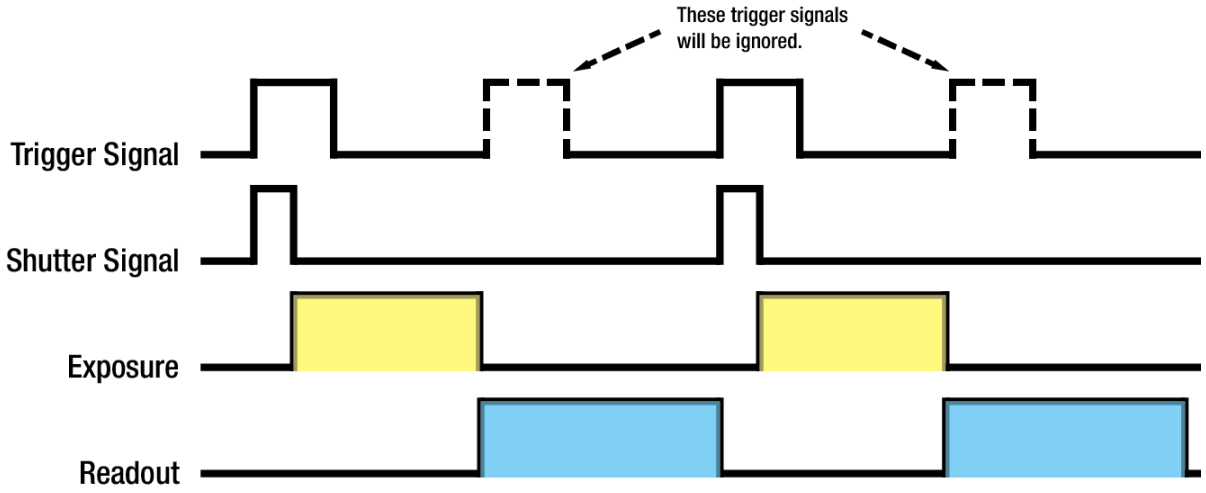


Figure 8.9 Trigger Ignored

8.4.3 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 VP-25MC 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 **External Sync**, the **Exposure** set to **Pulse Width** and the **Source** set to **External port**.

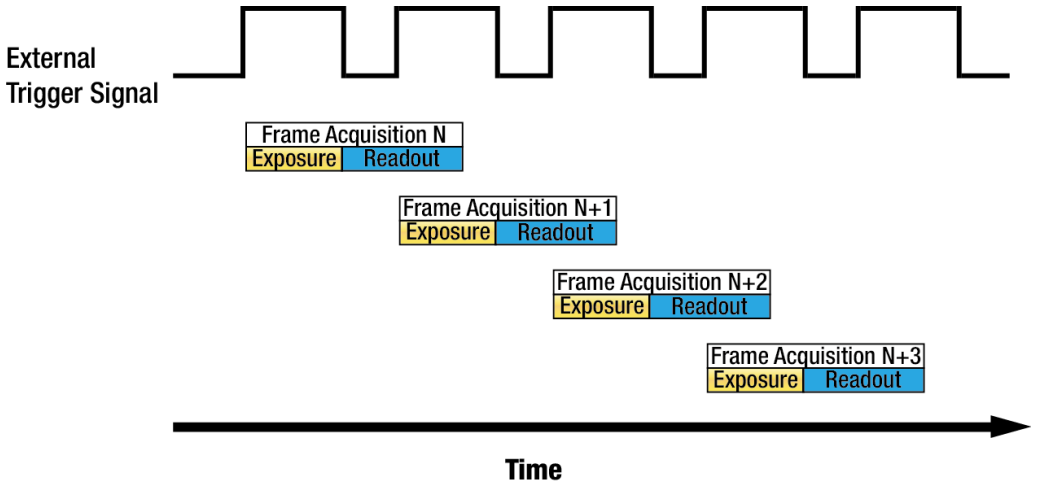


Figure 8.10 Overlapped Exposure and Readout

Determining whether your camera is operating with overlapped exposure and readout is not a matter of 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 Operation: Frame Period $\leq$ Exposure Time + Readout Time

Guidelines for Overlapped Exposure

If you are operating the camera in a way that exposure and readout will be overlapped, there are two important guidelines to keep in mind:

- 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.

8.5 Setting the Exposure Time

This section describes how the exposure time can be adjusted manually by setting the **Exposure Time** ('set' command) 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 **Free-Run**
- the **Trigger Mode** is set to **External Sync** and the **Exposure** is set to **Program**

When you set the Exposure Time below to a minimum specified value, it will be set to the minimum specified value automatically. The Exposure Time parameter sets the exposure time in microseconds (*μs*). The minimum and maximum allowed exposure time settings for the camera are shown in the following table.

Camera Model	Minimum Exposure Time	Maximum Exposure Time†
VP-25MC	10 *μs*	7,000,000 *μs*

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

Table 8.2 Minimum and Maximum Exposure Time Setting

8.6 Electronic Shutter Operation

The VP-25MC camera is equipped with an image sensor that has an electronic shutter. There are two types of electronic shutters, i.e. global and rolling. The VP-25MC camera uses a sensor with a global shutter.

8.6.1 Global Shutter

When a 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 trigger signal ends the exposure time if the camera is using the Pulse 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 a **Strobe Out** output signal that will go high when the exposure time for a frame acquisition begins and will go down when the exposure time ends.

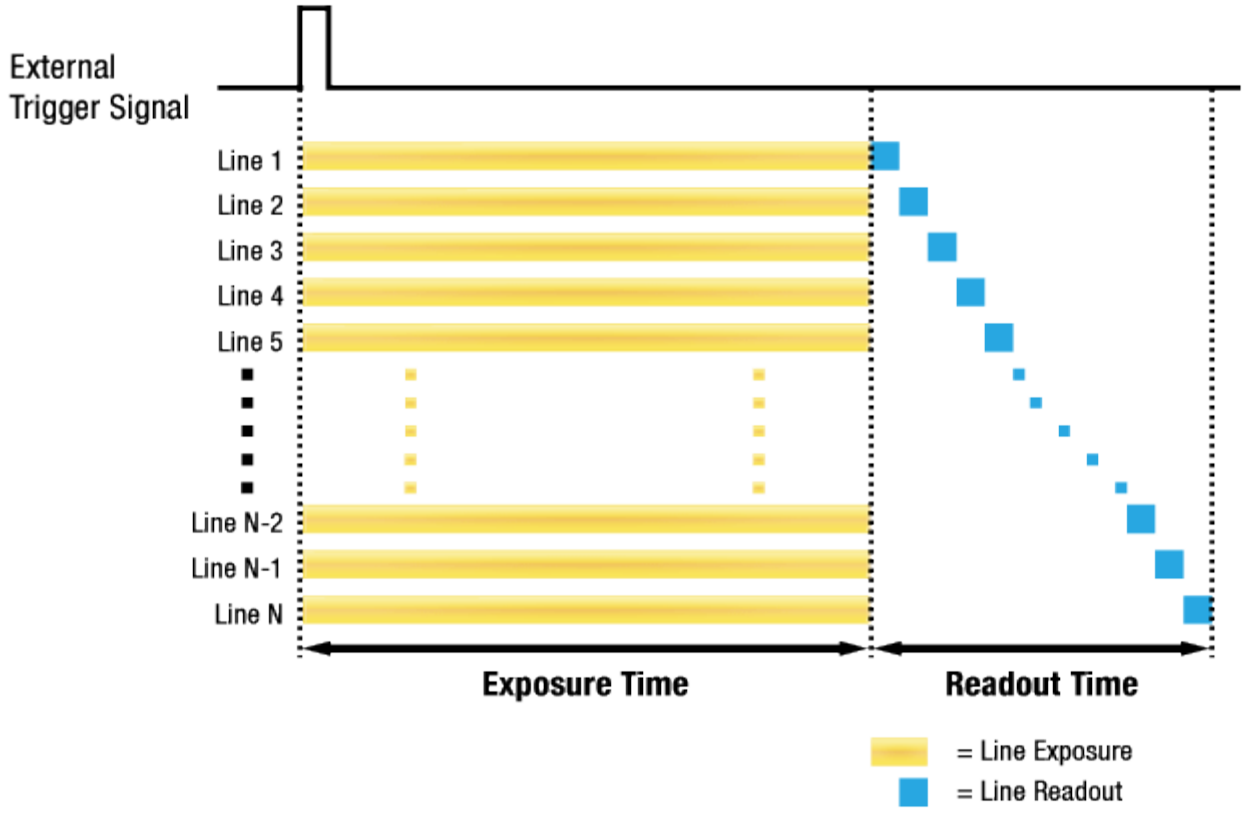


Figure 8.11 Global Shutter

8.7 Camera Link Output

The VP-25MC camera supports 8 Tap and 10 Tap Camera Link output modes. The number of taps represents the number of pixel data that will be output on each cycle of the Camera Link Pixel Clock. The maximum allowed frame rate will be changed according to the tap settings. The image data is transmitted in the interleaved order as shown in the figure below. You can set the Camera Link Output parameter by using the ‘scl’ command.

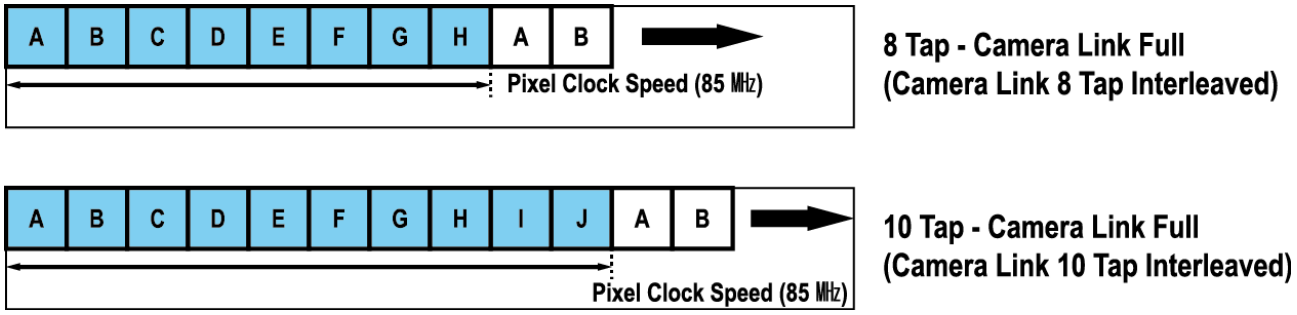


Figure 8.12 Camera Link Output Mode

8.8 Gain and Offset

Increasing the **Gain** setting value increases the slope of the camera's response curve as shown in the figure below. This results in a higher grey value output from the camera for a given amount of output from the image sensor. The Gain can be set in a range from 0 to 12 dB with 64 steps. If you know the current setting value for the Gain, you can use the formula below to calculate the actual Gain in dB.

```
Gain(dB) = (setting value) × 0.19 dB
```

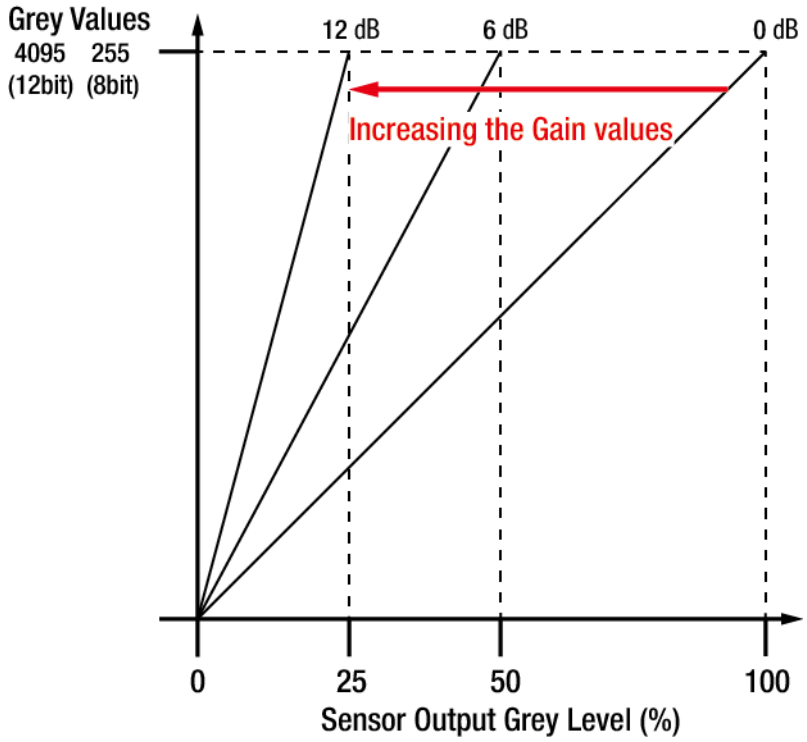


Figure 8.13 Setting the Gain

Adjusting the Offset setting value will result in an offset to the pixel values output from the camera. The Offset can be set in a range from 0 to 63 (LSB) with 64 steps based on 12 bit data format.

8.9 Defective Pixel Correction

The CMOS sensor may have Defect Pixels which cannot properly respond to the light. The VP-25MC camera provides a feature to correct the defect pixels to enhance the quality of output images. Defect Pixel information of the CMOS used for each camera is saved in the camera during the manufacturing process in the factory. 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. You can determine whether to use the Defective Pixel Correction feature by using the 'sdc' command.

8.9.1 Correction Method

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

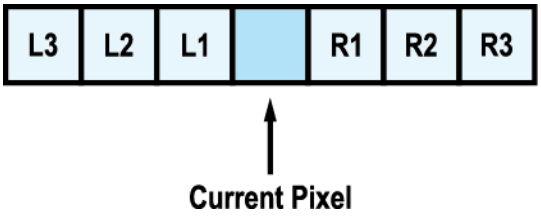


Figure 8.14 Location of Defect Pixel to be corrected

If the current pixel is a defect pixel as shown in the figure above, a correction value for this pixel is obtained as shown in the following table depending on whether adjacent pixels are defect pixel or not.

Adjacent Defect Pixel (s)	Correction Value of Current Pixel
없음	(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 8.3 Calculation of Defect Pixel Correction Value

8.10 White Pixel

If you use the VP-25MC camera under the condition of high ambient temperature, white pixels (also known as ‘hot pixels’) may be appeared due to the characteristics of the high resolution CMOS image sensor.
White pixels are caused by accumulated current leakage in the charge storage region inside the image sensor’s active pixel. If the temperature of the camera is increased by seven degrees, it is getting worse with double white pixels. To effectively reduce white pixels, maintain the operating temperature as low as possible and mount the camera on a substantial metal component in your system to provide sufficient heat dissipation. You can also use the defective pixel correction feature to remove white pixels. Add a defect pixel to the defect pixel map or modify the defect pixel map stored in the camera.

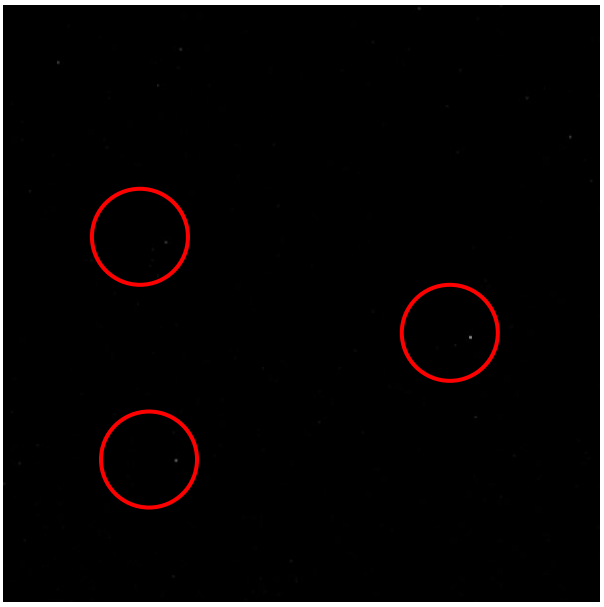


Figure 8.15 White Pixel

8.11 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 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
```

Under actual use conditions, generate a Flat Field data (IF) and enable the Flat Field Correction feature according to the following procedures.

1. Execute the Flat Field Generator by using the ‘gfd’ command. The Flat Field Generator will average series of frames and scale down to 1/32 pixel to generate the Flat Field data. The Flat Field data will be saved in the external frame buffer (volatile memory).
2. Enable the Flat Field Correction feature by using the ‘sfc’ command. The Flat Field data will be enlarged via Bilinear Interpolation as shown in the Figure 8.17.
3. Save the generated Flat Field data in the non-volatile memory by using the ‘sfd’ command for future use.

CAUTION	• It is recommended that you enable the Defective Pixel Correction feature before executing the Flat Field Generator. • Executing the Flat Field Generator will temporarily set the camera’s ROI to its full resolution. After completing the Flat Field data generation, the previous camera settings will be restored. • You need to operate the camera with the Free-Run mode or apply a trigger signal to acquire an image.

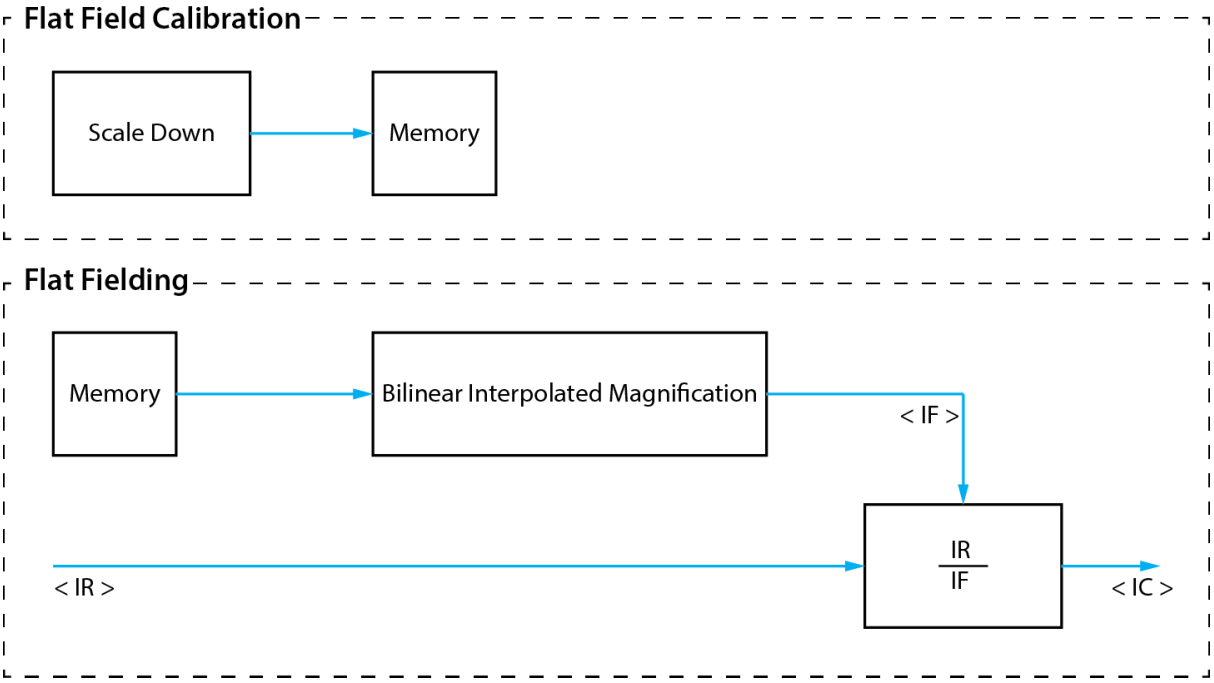


Figure 8.16 Generation and Application of Flat Field Data

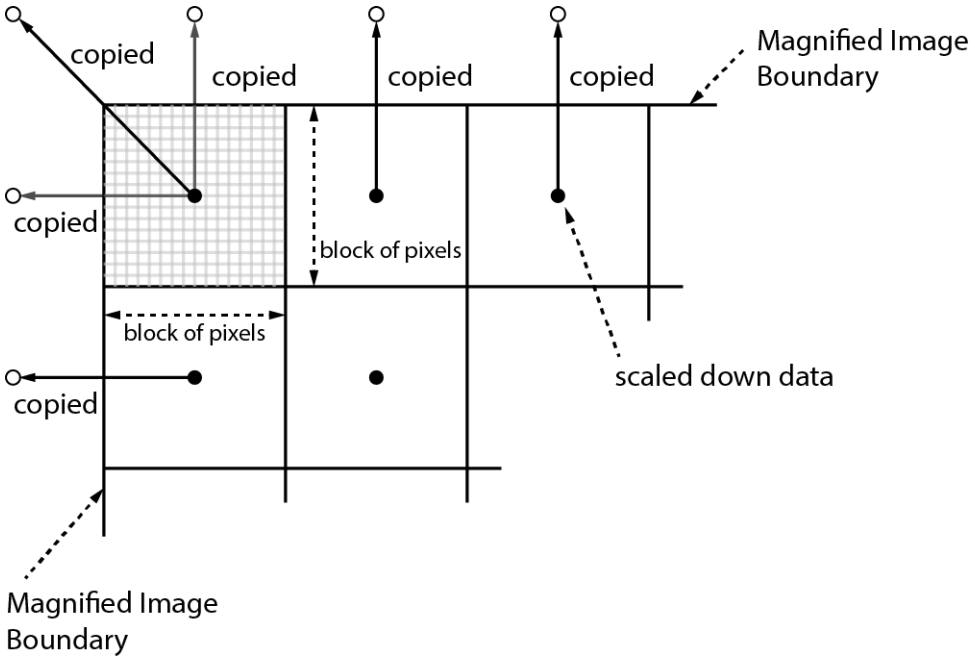


Figure 8.17 Bilinear Interpolated Magnification

8.11.1 Flat Field Selector

As mentioned above, the active Flat Field data is stored in the camera's volatile memory and the data is lost if the camera is reset or powered off. To use the active or generated Flat Field data after the camera is powered on or reset, you need to save them in the camera's non-volatile memory. The VP-25MC camera provides four reserved areas in the camera's non-volatile memory available for saving Flat Field data. You can use the **Flat Field Selector** feature to select one of the four reserved areas.

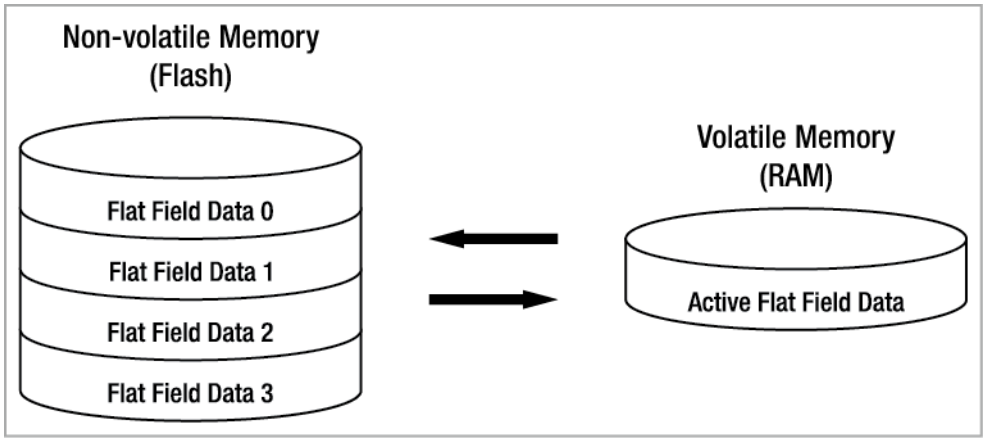


Figure 8.18 Flat Field Selector

Saving Flat Field Data

To save the current active Flat Field data into a reserved area in the camera's flash memory,

1. Use the 'sfs 0/1/2/3' command to specify a reserved area where the current active Flat Field data will be stored.
2. Use the 'sfd' command or click the **Save to Flash** button in Configurator to save the active Flat Field data to the selected reserved area.

Loading Flat Field Data

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

1. Use the 'sfs 0/1/2/3' command to specify a reserved area whose Flat Field data will be loaded into the camera's active Flat Field data.
2. Use the 'lfd' command or click the **Load from Flash** button to load the selected Flat Field data into the active Flat Filed data.

8.12 Temperature Monitor

The VP-25MC camera has an embedded sensor chip to monitor the internal temperature. To check the temperature of the camera, use the ‘gct’ command.

8.13 Status LED

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

- Continuous On: operates in the Free-Run mode.
- Repeat On for 0.5 second, Off for 0.5 second: operates in the External Sync mode.
- Repeat On for 1 second, Off for 1 second: outputs Test Image.
- Repeat On for 0.25 second, Off for 0.25 second: operates in the External Sync and outputs Test Image.

8.14 Data Format

The VP-25MC camera processes image data in the unit of 10 bit. You can determine the Data Format (8 bit or 10 bit) of image data transmitted from the camera by using the ‘sdb’ command. When the camera is set for 8 bit data format, the 2 least significant bits will be dropped from overall 10 bits.

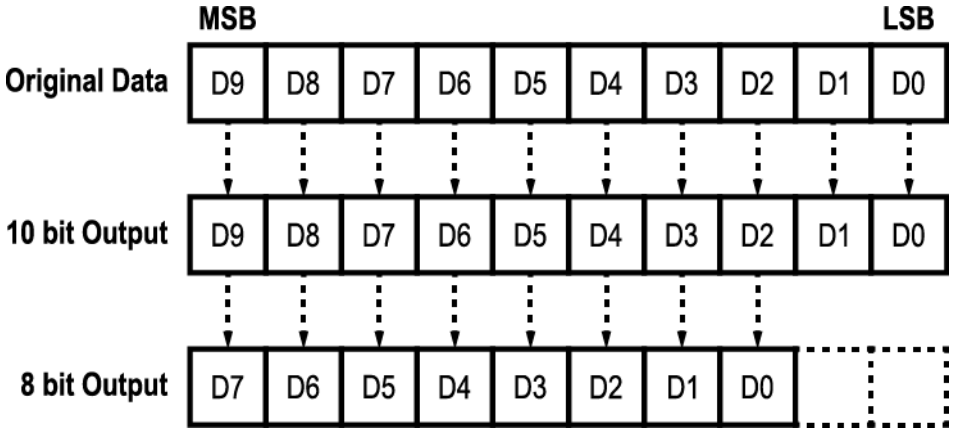


Figure 8.19 Data Format

8.15 Test Image

To check whether the camera operates normally or not, it can be set to output test images generated in the camera, instead of the image data from the image sensor. Three types of test images are available; image with different value in horizontal direction (Test Image 1), image with different value in diagonal direction (Test Image 2), and moving image with different value in diagonal direction (Test Image 3). The Test Image feature is available in all operation modes of the camera. You can set the Test Image feature by using the ‘sti’ command.

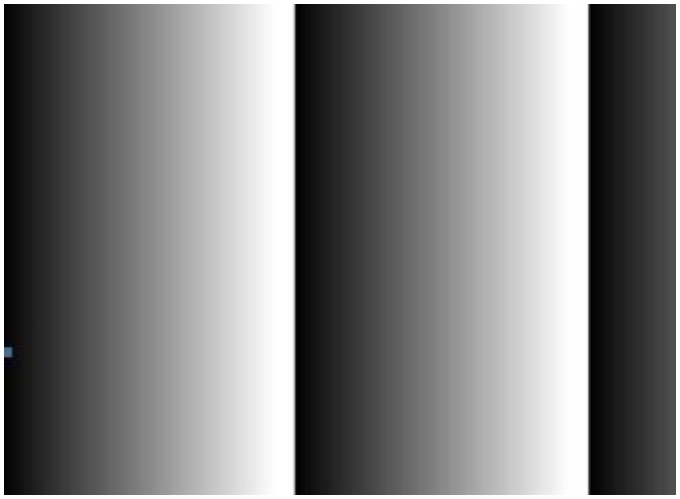


Figure 8.20 Test Image 1

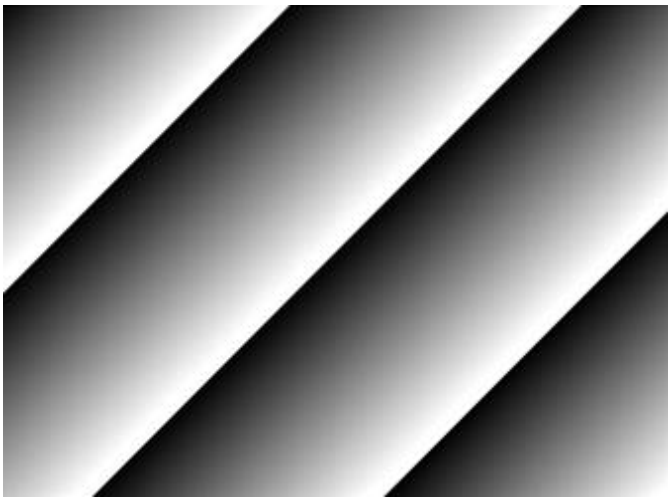


Figure 8.21 Test Image 2

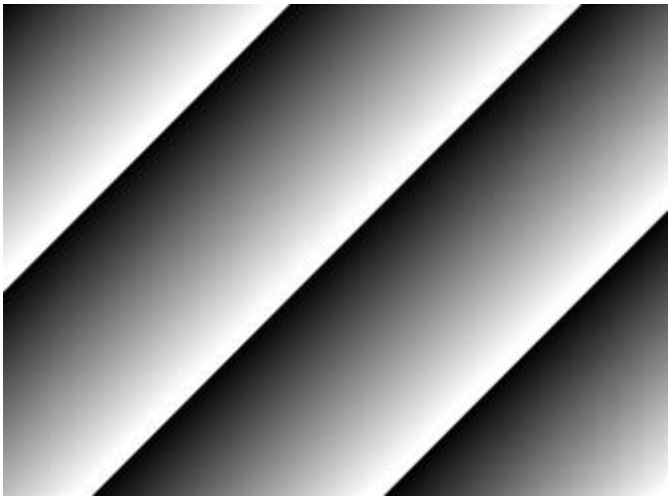


Figure 8.22 Test Image 3

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

8.16 Strobe

The Strobe signal goes high when the exposure time for each frame acquisition begins and goes low when the exposure time ends. 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 Strobe signal to know when exposure is taking place and thus know when to avoid moving the camera.

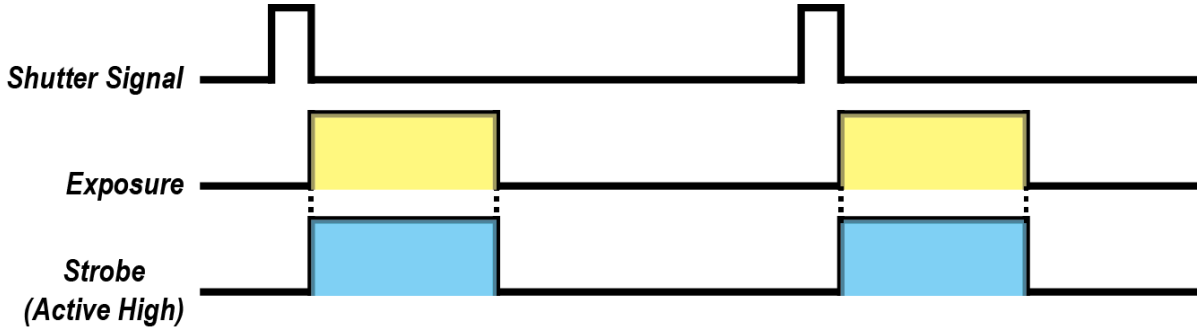


Figure 8.23 Strobe Output

8.16.1 Strobe Polarity

The Strobe Polarity is used to select Active High or Active Low triggering. You can set the polarity of the strobe signal by using the ‘ssp' command.

8.17 Field Upgrade

The camera provides a feature to upgrade Firmware and FPGA logic through the Camera Link interface rather than disassemble the camera in the field. Refer to Appendix B for more details on how to upgrade.

9 Camera Configuration

9.1 Setup Command

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

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

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

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

ex) Write command

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

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

ex) Read command

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

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

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

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

9.2 Actual Time of Command Application

When you execute a command, the actual runtime of the command varies depending on the type of the command and the operating status of the camera.

All commands except the Set Exposure Time (‘set’) command are applied to change the settings as illustrated below, on the rising edge of a VCCD signal before starting the readout process. When you execute the ‘set’ command, the exposure time setting will be changed and applied at the starting of the exposure.

If you operate the camera with CC1 or external trigger signals, you must execute commands before applying the trigger signals in order to synchronize image outputs with the commands.

If you execute a command in the Free-Run mode, you may acquire up to two images that are not affected by the command execution. This is true because it is hard to verify the current operating status of the camera in the Free-Run mode.

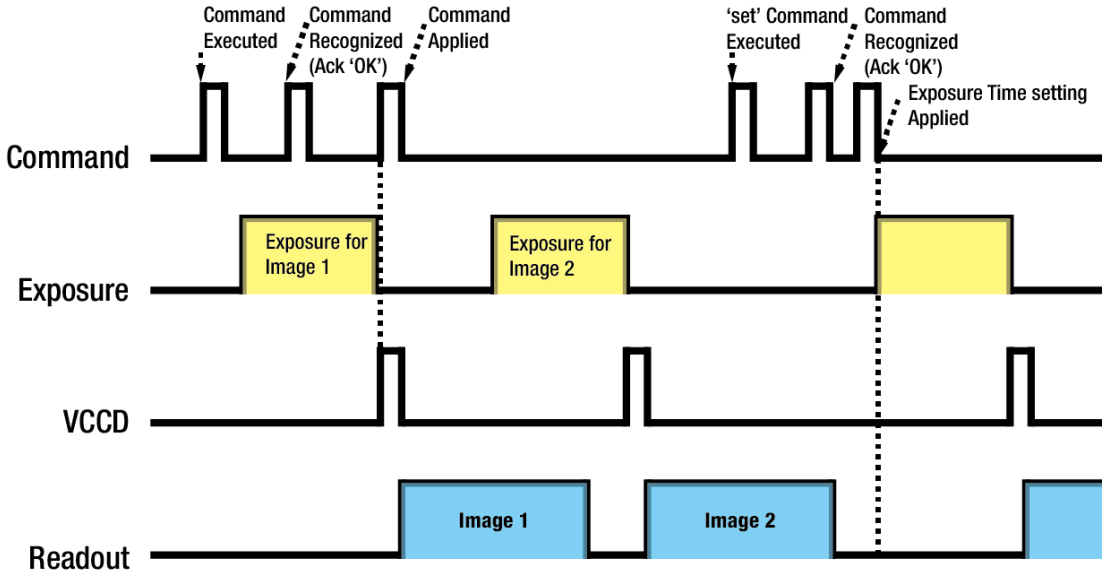


Figure 9.1 Actual Time of Command Application

9.3 User Set Control

The VP-25MC camera provides three non-volatile spaces (Flash) for storing parameter settings and one work space (RAM) for operating the camera. Non-volatile spaces are divided into a Factory space (Factory Setting) that contains default setting values entered during the manufacturing, and two User spaces (User 1 Setting and User 2 Setting) that are available for saving user-defined setting values.

You can save the current camera settings to a user space or you can load the settings stored in one of the non-volatile spaces into the camera's work space. The default setting values stored in the factory space can be loaded into the camera's work space, but cannot be changed.

The setting values in the camera's volatile memory will be lost if the camera is reset or powered off.

To use the current setting values in the work space after a reset, you must save the settings to one of the user spaces.

By default, the Factory Setting will be loaded into the camera when the camera is reset or powered on. You can change the Configuration Initialization value to select which setting values will be loaded when the camera is reset or powered on.

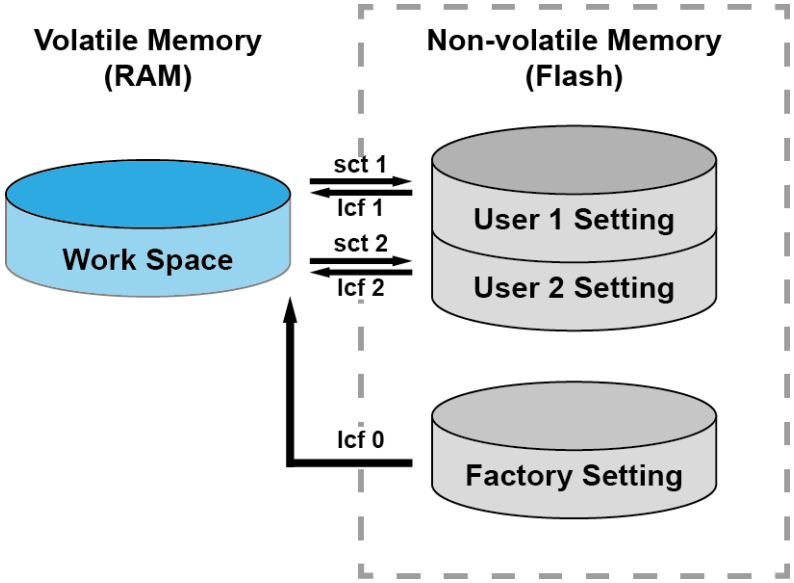


Figure 9.2 User Set Control

9.4 Command List

You can set all features provided by the VP-25MC camera by using the following commands.

Command	Syntax	Return Value	Description
Help	h	String	Displays a list of all commands
Set Region Select Get Region Select	srs n grs	OK n	Selects a ROI when setting the Multi-ROI n: ROI number (0 - 31)
Set Region Mode(current region) Get Region Mode(current region)	src 0|1 grc	OK 0|1	Enables the selected ROI when setting the Multi-ROI 0: Disable the ROI 1: Enable the ROI
Set Offset X Get Offset X	sox n gox	OK n	X coordinate of start point ROI n: X axis offset
Set Offset Y(current region) Get Offset Y(current region)	soy n goy	OK n	Y coordinate of start point ROI n: Y axis offset
Set Width Get Width	siw n giw	OK n	Sets a width of a ROI n: Width value
Set Height(current region) Get Height(current region)	sih n gih	OK n	Sets a height of a ROI n: Height value
Update Multi-ROI	ast	OK	Updates setting values of the Multi-ROI
Set Trigger Mode Get Trigger Mode	stm 0|1 gtm	OK 0|1	Sets the Trigger Mode 0: Free Run mode 1: External Sync mode
Set Trigger Source Get Trigger Source	sts 1|2 gts	OK 1|2	Specifies a source signal in External Sync 1: CC1 port 2: External port
Set Trigger Polarity Get Trigger Polarity	stp 0|1 gtp	OK 0|1	Specifies a polarity of triggers in External Sync 0: Active Low 1: Active High
Set Exposure Source Get Exposure Source	ses 0|1 ges	OK 0|1	Sets the Exposure Mode 0: Program – Exposure Time parameter 1: Pulse Width – width of signal
Set Exposure Time Get Exposure Time	set n get	OK n	Sets an exposure time(Free-Run and Program) n: exposure time in microseconds (μs)

Table 9.1 Command List #1

Command	Syntax	Return Value	Description
Set Analog Gain Get Analog Gain	sag n gag	OK n	Sets the Digital Video Gain n: Gain value (Setting Range: 0 ~ 63)
Set Analog Offset Get Analog Offset	sao n gao	OK n	Sets the Digital Video Offset n: Offset value (Setting Range: 0 ~ 63)
Set RGB Gain Get RGB Gain	srg r|g|b f grg r|g|b	OK f	Sets the Gain on color cameras f: Gain value
Auto generation RGB Gain	arg	OK	Executes the Auto White Balance feature on color cameras
Set Test Image Get Test Image	sti 0|1|2|3 gti	OK 0|1|2|3	Sets the Test Image 0: Test Image Off 1, 2: Fixed pattern images 3: Moving pattern images
Set Data Bit Get Data Bit	sdb 8|10 gdb	OK 8|10	Sets the Data Format 8: 8 Bit 10: 10 Bit
Set Camera-Link Mode Get Camera-Link Mode	scl 2|3 gcl	OK 2|3	Sets the Camera Link Output mode 2: 8 Tap 3: 10 Tap
Set Strobe Polarity Get Strobe Polarity	ssp 0|1 gsp	OK 0|1	Sets a polarity of strobe signals 0: Active Low 1: Active High
Set Binning Factor Get Binning Factor	sbf 1|2 gbf	OK 1|2	Sets the Binning 1: Disables the Binning 2: Enables the 2 × 2 Binning

Table 9.2 Command List #2

Command	Syntax	Return Value	Description
Set Defect Correction Get Defect Correction	sdc 0|1 gdc	OK 0|1	Enables the Defective Pixel Correction feature 0: Disable the Defective Pixel Correction 1: Enable Defective Pixel Correction
Generate Flat Field Data	gfd	OK	Executes the Flat Field Generator
Set Flat-Field Selector Get Flat-Field Selector	sfs 0|1|2|3 gfs	OK n	Selects a Flat Field data 0: Select Flat Field data 0 1: Select Flat Field data 1 2: Select Flat Field data 2 3: Select Flat Field data 3
Save Flat Field Data	sfd	OK	Saves the generated Flat Field data in the non-volatile memory
Load Flat Field Data	lfd	OK	Loads the Flat Field data from the non-volatile memory into the volatile memory
Set Flat Field Correction Get Flat Field Correction	sfc 0|1 gfc	OK 0|1	Enables the Flat Field Correction feature 0: Disable the Flat Field Correction 1: Enable the Flat Field Correction
Save Config. To	sct 1|2	OK	Saves the current camera setting values 1: Save to User 1 space 2: Save to User 2 space
Load Config. From	lcf 0|1|2	OK	Loads camera setting values 0: Load from Factory space 1: Load from User 1 space 2: Load from User 2 space
Set Config Initialization Get Config Initialization	sci 0|1|2 gci	OK 0|1|2	Specifies setting values to be loaded when reset 0: Load Factory default settings when reset 1: Load User 1 settings when reset 2: Load User 2 settings when reset

Table 9.3 Command List #3

Command	Syntax	Return Value	Description
Get Model Name	gmn	String	Displays camera model name
Get MCU Version	gmv	String	Displays the version of camera MCU
Get FPGA Version	gfv	String	Displays the version of camera FPGA
Get Serial Number	gsn piece	String	Displays the serial number of the camera
Get Current Temperature	gct	String	Displays device temperature in Celsius
Set Fan Control Get Fan Status	sft 0|1 gft	OK 0|1	Turns the Fan On or Off 0: Fan Off 1: Fan On
Set Peltier Control Get Peltier Control	stc 0|1 gtc	OK 0|1	Turns the Peltier On or Off 0: Peltier Off 1: Peltier On

Table 9.4 Command List #4

10 Configurator GUI

Configurator, a sample application, is provided to control the VP-25MC camera. Configurator provides easy-to-use Graphic User Interface (GUI) that allows users to view and change the camera's settings mentioned in the previous chapters.

10.1 Camera Scan

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

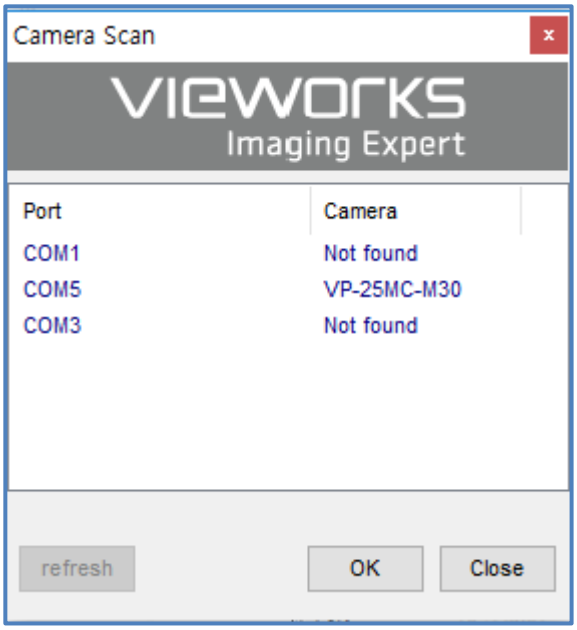


Figure 10.1 Configurator Loading Window

10.2 Menu

10.2.1 File

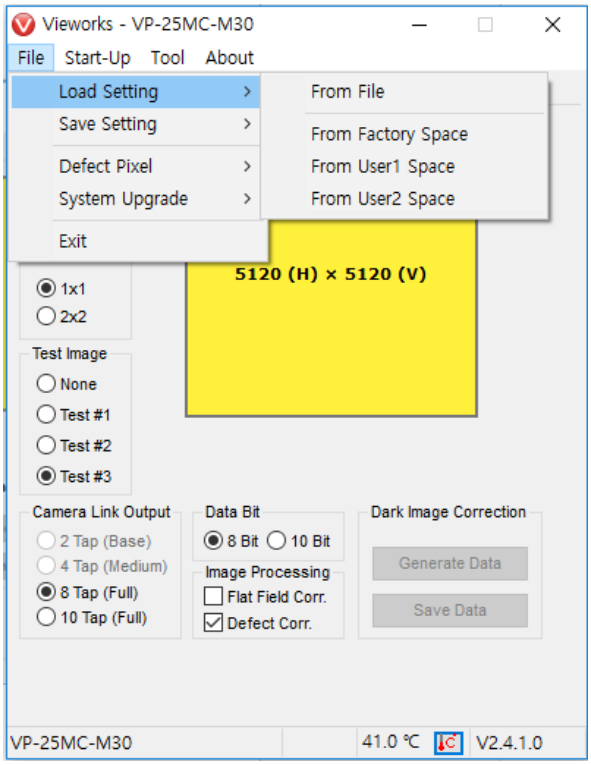


Figure 10.2 File Menu

- **Load Setting:** Loads the camera setting values from the camera memory (Factory, User1 or User2) or user's computer (From File).
- **Save Setting:** Saves the camera setting values to the camera memory (User1 or User2) or user's computer (To File).
- **Defect Pixel:** Downloads defect information to the camera (Download to Camera) or uploads defect information stored in the camera to user's computer (Upload to PC).
- **System Upgrade:** Upgrades MCU or FPGA logic.
- **Exit:** Exits Configurator.

10.2.2 Start-Up

You can select the camera setting values to load when the camera is powered on.

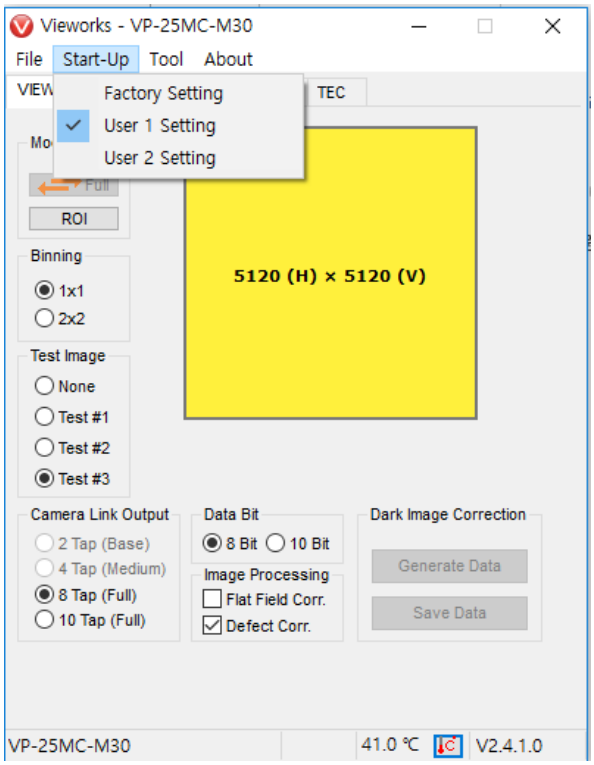


Figure 10.3 Start-Up Menu

- **Factory Setting:** Loads the camera setting values from Factory Space when the camera is powered on.
- **User1 Setting:** Loads the camera setting values from User1 Space when the camera is powered on.
- **User2 Setting:** Loads the camera setting values from User2 Space when the camera is powered on.

10.2.3 Tool

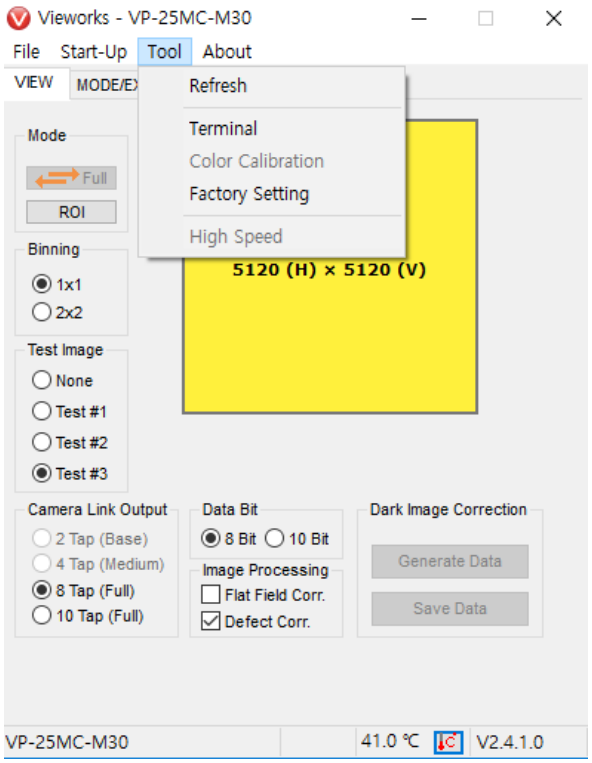


Figure 10.4 Tool Menu

- **Refresh:** Loads and displays the current camera setting values on Configurator.
- **Terminal:** Displays the Terminal window which displays a user command of the feature that you have set. To hide the Terminal window, uncheck Terminal by clicking again.
- **Color Calibration:** Displays the Color Calibration window for Bayer sensor color temperature calibration. When you click the **Auto White Balance** button, white balance is automatically adjusted once and then Off.

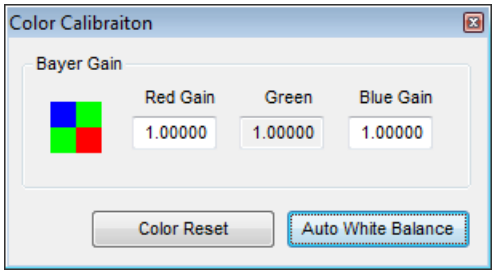
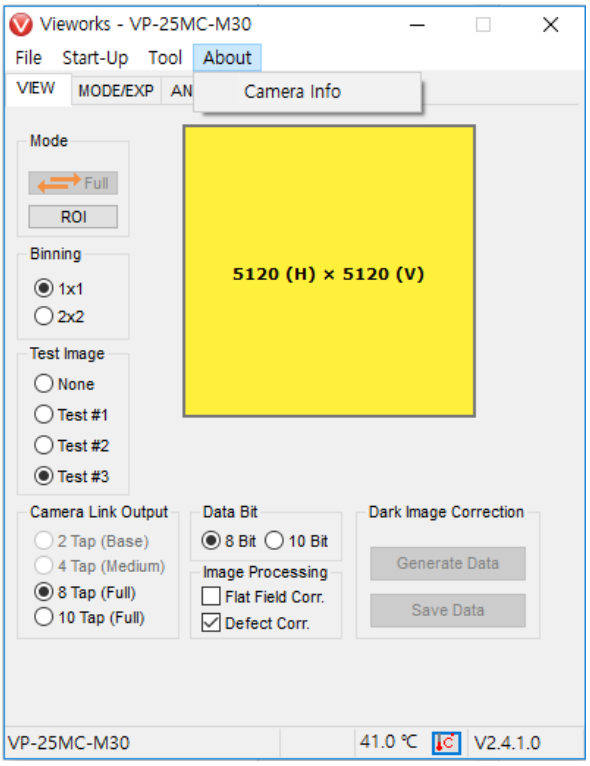


Figure 10.5 Color Calibration (Color Camera Only)

- **Factory Setting:** Not supported for users.
- **High Speed:** Not supported on the VP-25MC.

10.2.4 About



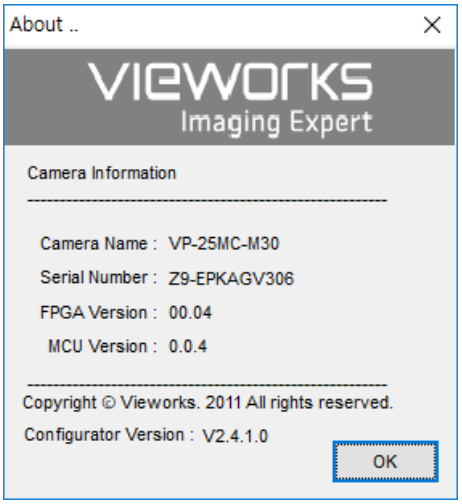


Figure 10.6 About Menu

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

10.3 Tab

10.3.1 VIEW Tab

The VIEW tab allows you to set the camera's region of interest (ROI), binning, test image mode, data bit, Camera Link output, image processing, etc.

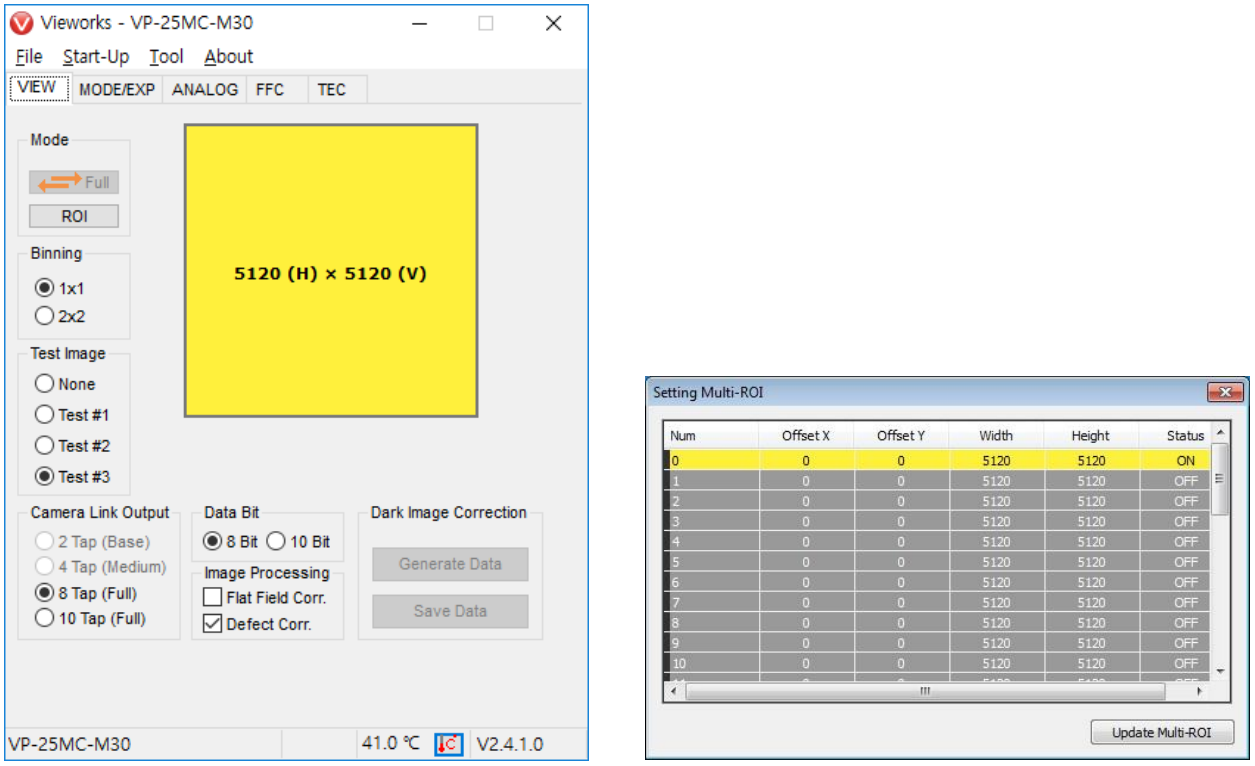


Figure 10.7 VIEW Tab

- **Full:** Disables the Multi-ROI feature and set to its full resolution.
- **ROI:** Displays the **Setting Multi-ROI** window for setting Multi-ROI.
- **Binning:** Sets the camera's binning mode.
- **Test Image:** Selects whether to apply test image and a type of test image.
- **Camera Link Output:** Selects a Camera Link output mode.
- **Data Bit:** Selects a bit depth of data output.
- **Image Processing:** Sets the Flat Field Correction and Defect Correction features to On or Off.
- **Dark Image Correction:** Not supported on the VP-25MC.

10.3.2 MODE/EXP Tab

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

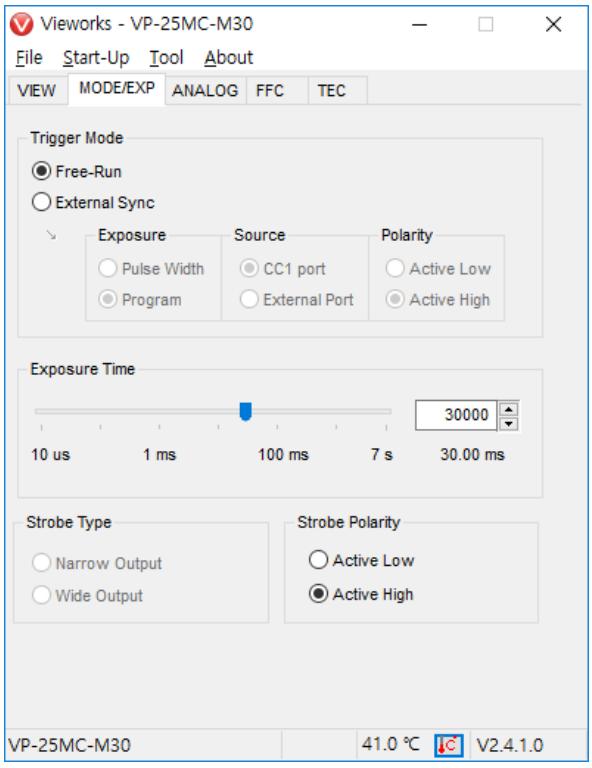


Figure 10.8 MODE/EXP Tab

- **Trigger Mode:** Selects a Trigger Mode. Once you select the External Sync mode, options related with the External Sync will be activated.
- **Exposure:** Selects an exposure source.
- **Source:** Selects a source signal for exposure triggering.
- **Polarity:** Selects a polarity of the trigger signal.
- **Exposure Time:** Sets an exposure time when the Trigger Mode is set to Free-Run or when Exposure is set to Program.
- **Strobe Type:** Not supported on the VP-25MC.
- **Strobe Polarity:** Selects a polarity of the Strobe Output signal.

10.3.3 ANALOG Tab

The ANALOG tab allows you to adjust the camera's gain and offset settings.

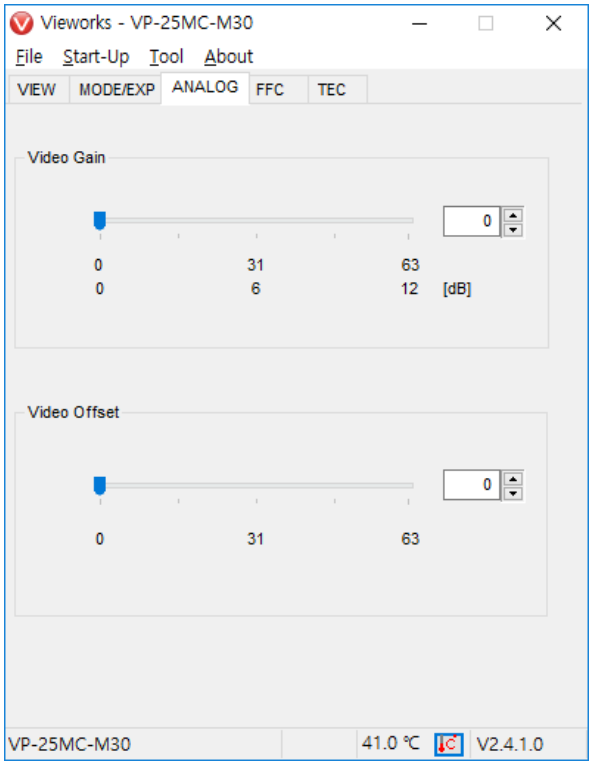


Figure 10.9 ANALOG Tab

- **Video Gain:** Sets a gain value.
- **Video Offset:** Sets an offset value.

10.3.4 FFC Tab

The FFC Tab allows you to set the Flat Field Correction feature.

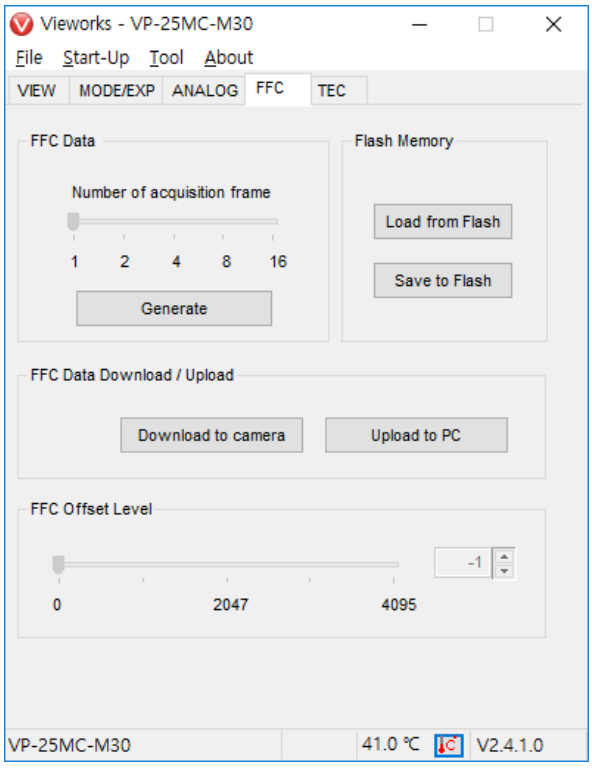


Figure 10.10 FFC Tab

- **FFC Data:** Clicking the **Generate** button will generate Flat Field Correction data.
- **Flash Memory:** Saves the generated FFC data in the Flash memory for future use (Save to Flash) or loads the FFC data stored in the Flash memory (Load from Flash).
- **FFC Data Download / Upload:** Downloads the FFC data stored in user's computer to the camera (Download to camera) or uploads the FFC data stored in the camera to user's computer (Upload to PC).
- **FFC Offset Level:** Not supported on the VP-25MC.

10.3.5 TEC Tab

The TEC Tab allows you to control target temperature of the image sensor.

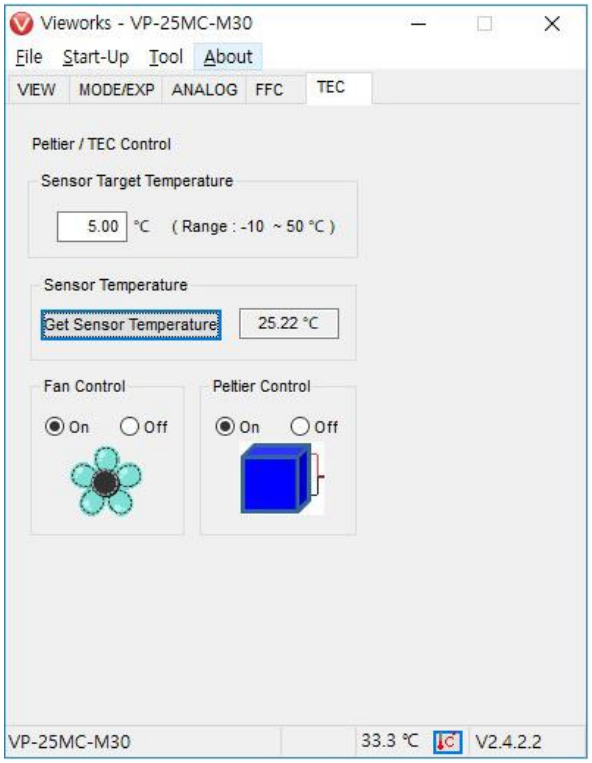


Figure 10.11 TEC Tab

- **Sensor Target Temperature:** Sets target temperature of the image sensor.
- **Sensor Temperature:** Displays the current image sensor's temperature.
- **Fan Control:** Turns the fan On or Off.
- **Peltier Control:** Turns the Peltier On or Off.

11 Troubleshooting

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

- If no image is displayed on your computer,
  - Ensure that all cable connections are secure.
  - Ensure that the power supply is properly connected.
  - Ensure that trigger signals are applied correctly when you operate the camera with trigger signals.

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

- If images are dark,
  - Ensure the camera lens is not blocked.
  - Check the exposure time is set properly.
  - Check the aperture is opened properly.
  - Check the Video Gain value is not set to small.

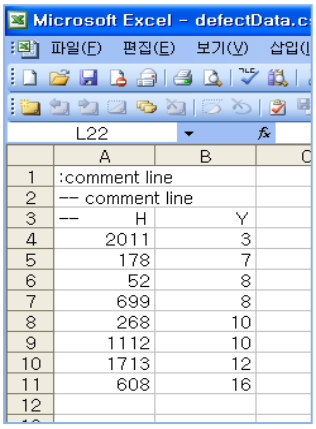
- If you identify abnormal operation or overheating sign,
  - Ensure the power supply is properly connected.
  - Stop using the camera when you notice smoke or abnormal overheating.

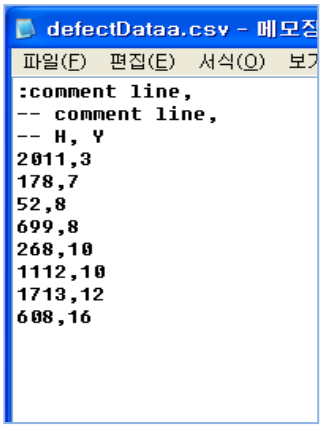
- If the External Sync mode is not working correctly,
  - Ensure that the CC1 settings on the frame grabber are configured correctly when you use CC1 triggering.
  - Ensure that cable connections are secure when you use external triggering.

- 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.

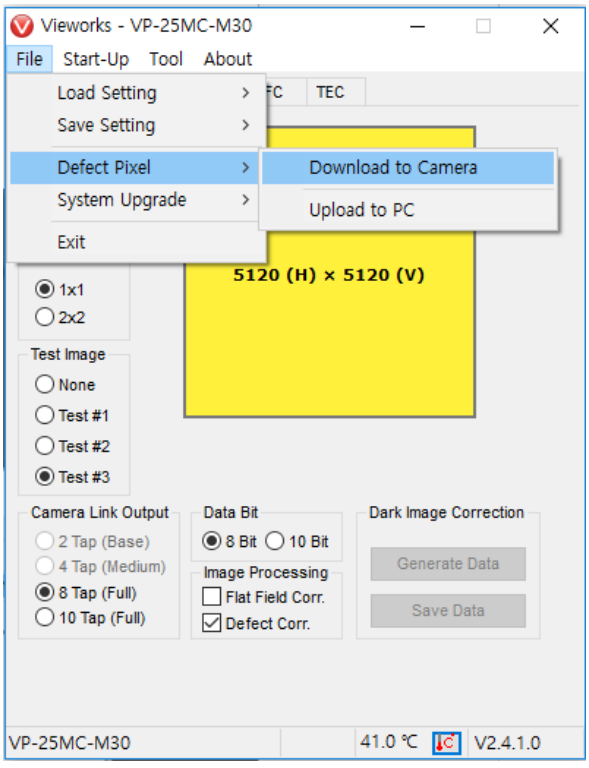
Appendix A Defective Pixel Map Download

1. Create a Defective Pixel Map in Microsoft Excel format as shown in the left picture below and save as a CSV (*.csv). The picture in the right shows the created Excel file opened with 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 coordinate of each defect pixel.
   - Coordinate values for each pixel can be placed in any order.

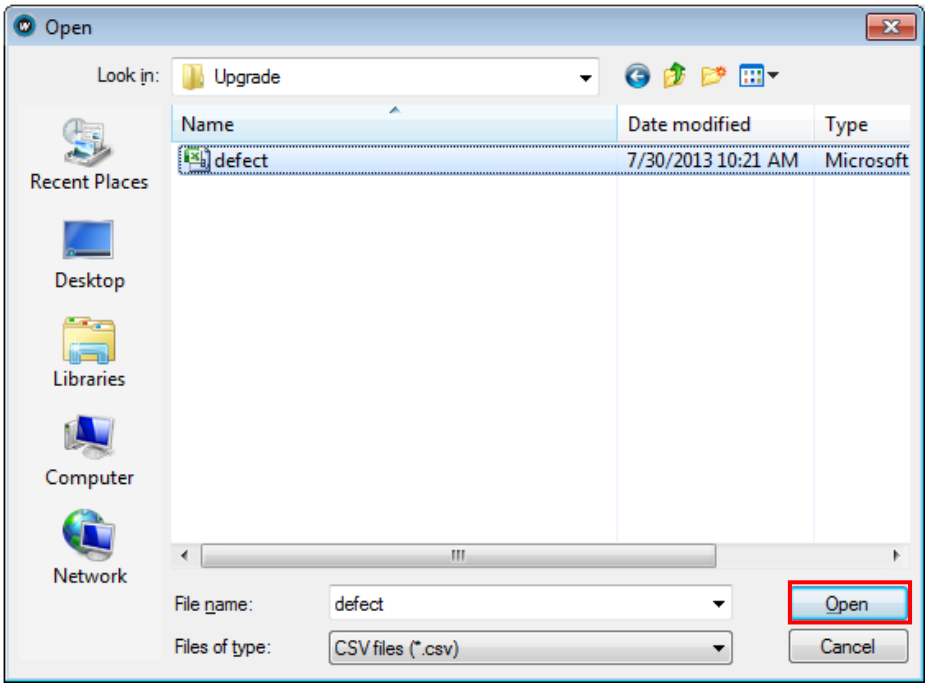




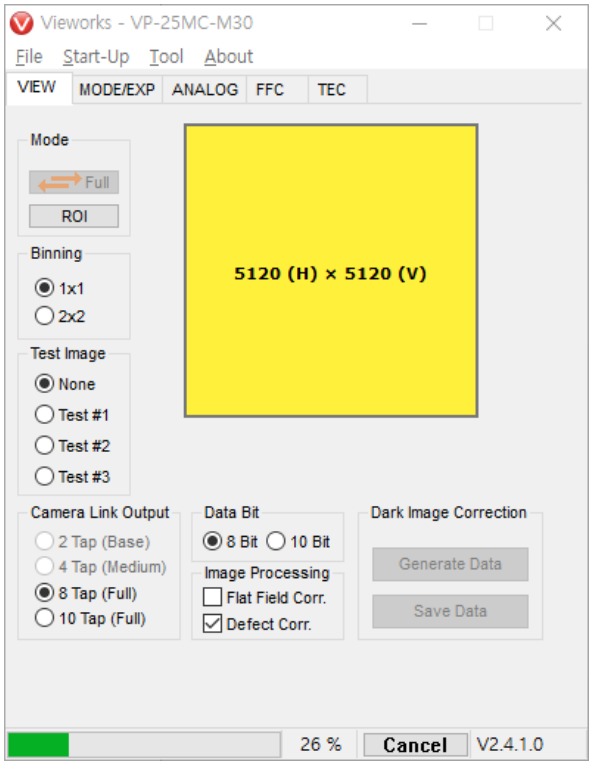
2. Select **File** > **Defect Pixel** > **Download to Camera** in the Configurator.



3. Search and select the created file and click **Open**.

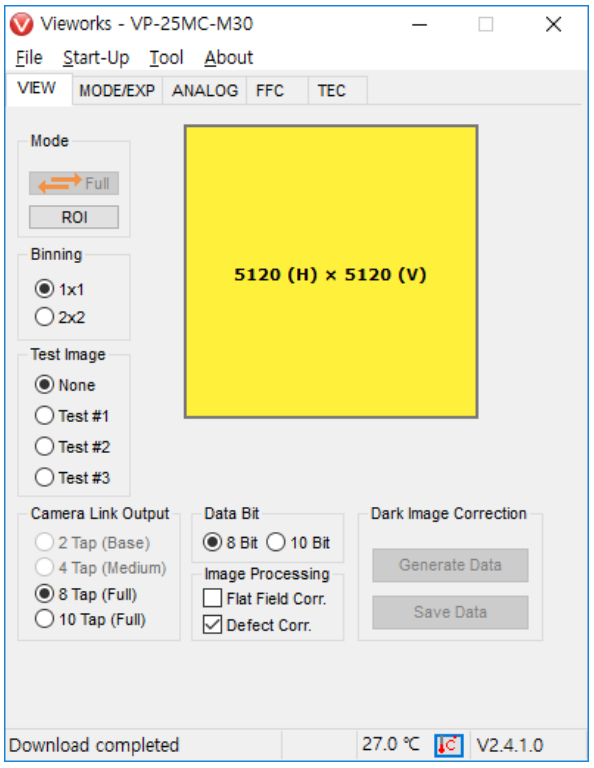


4. The Configurator starts downloading Defective Pixel Map to the camera and the downloading status is displayed at the bottom of the window.



5. Once the download is complete, the saving process will begin. During the saving process, make sure not to disconnect the power cord.

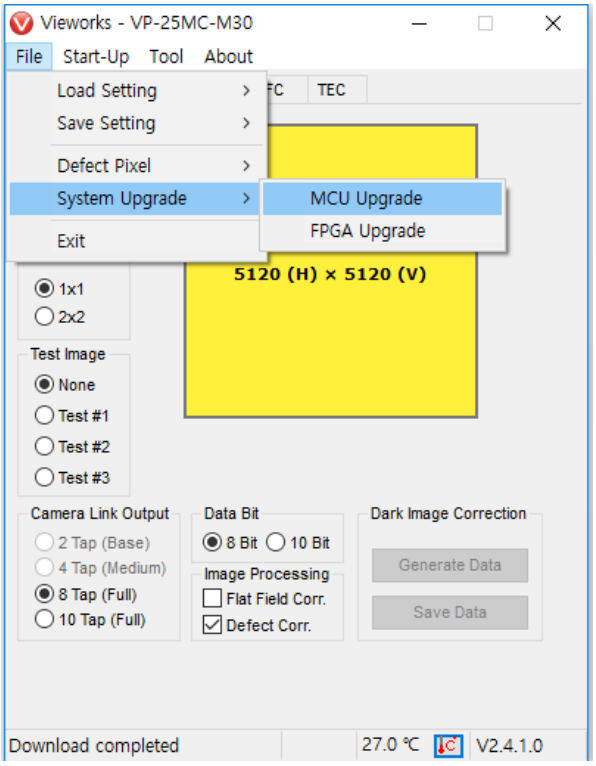
6. Once all the processes are complete, **Download completed** message will appear at the bottom of the window.



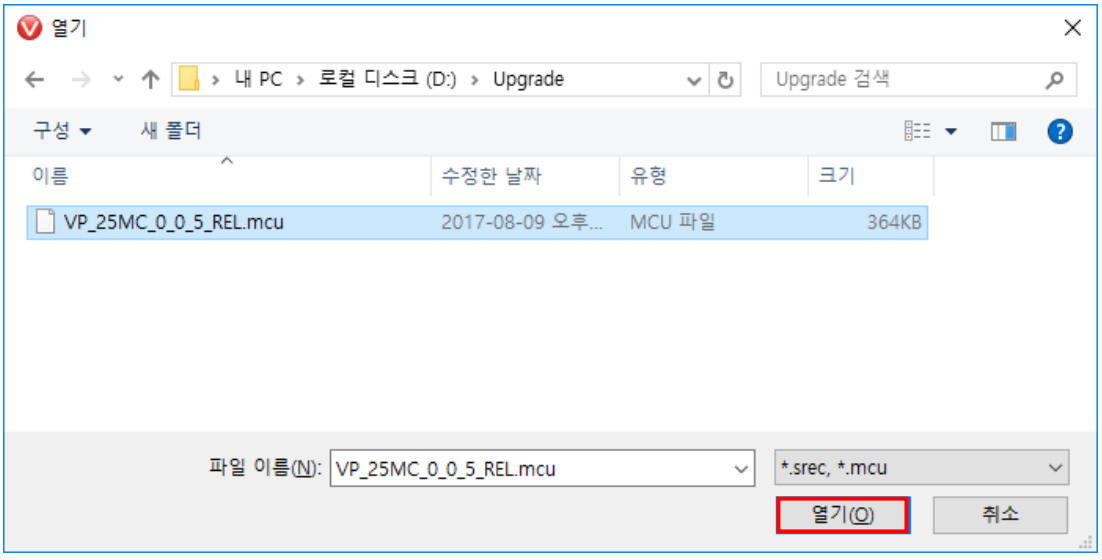
Appendix B Field Upgrade

B.1 MCU

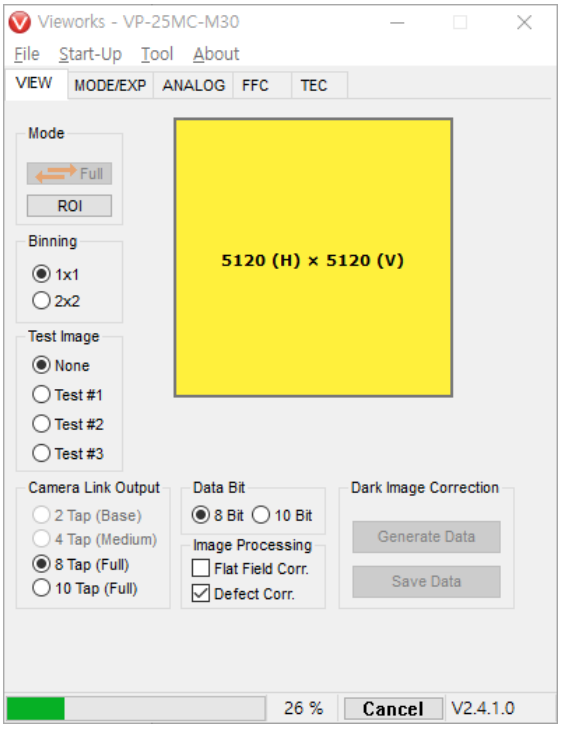
1. Select **File** > **System Upgrade** > **MCU Upgrade** in the Configurator.



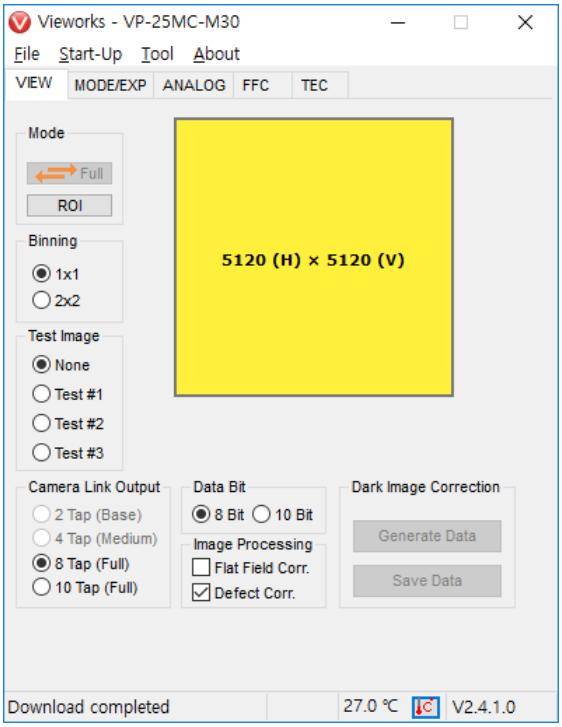
2. Search and select the provided MCU file (*.mcu) and then click **Open**.



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



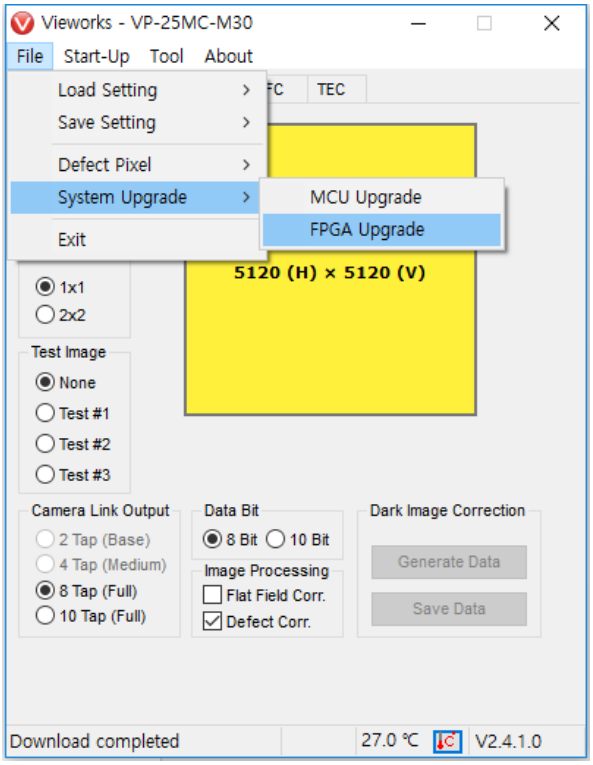
4. Once the download is complete, the saving process will begin. If a power failure occurs during the saving process, the camera cannot be restored. Make sure that the power connection is secure.



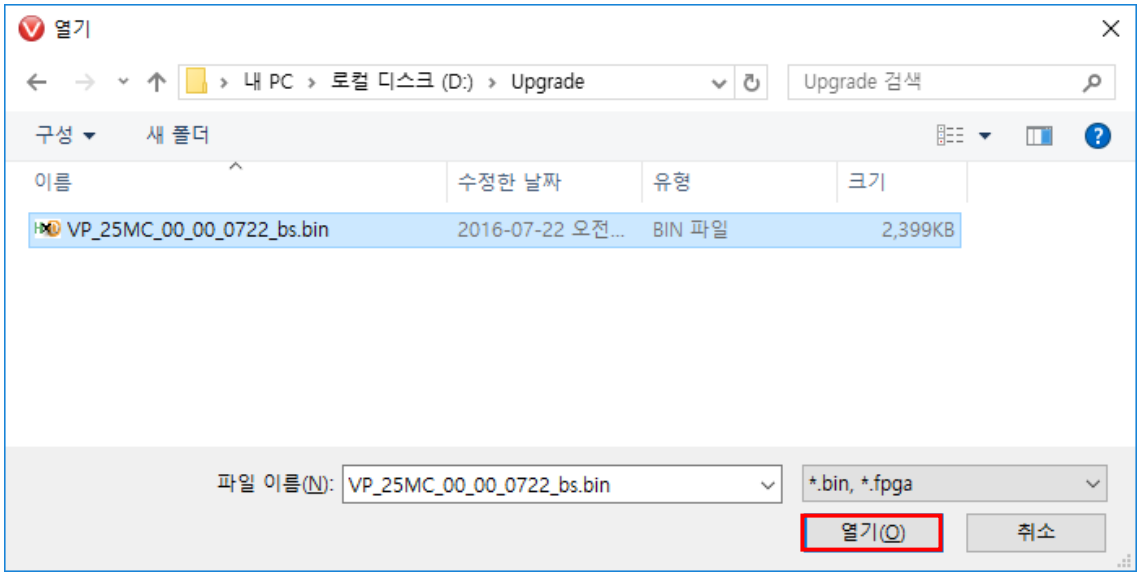
5. Once all the processes are complete, turn the camera power off and turn it back on again. Select **Tool** > **Terminal** and enter the ‘gmv' command to confirm the version. Or, select **About** > **Camera Info** to confirm the MCU version.

B.2 FPGA

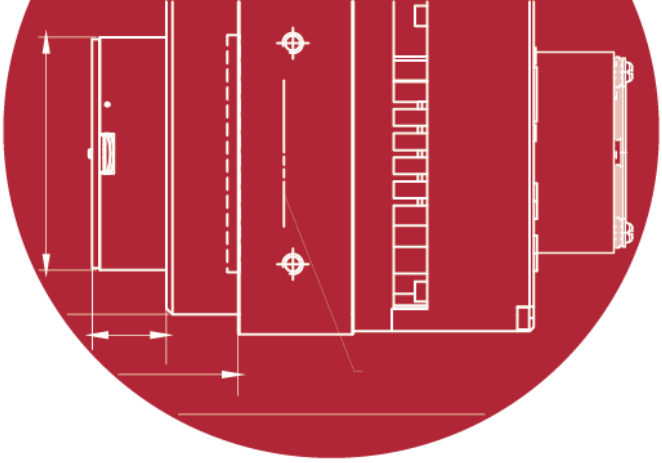
1. Select **File** > **System Upgrade** > **FPGA Upgrade** in the Configurator.

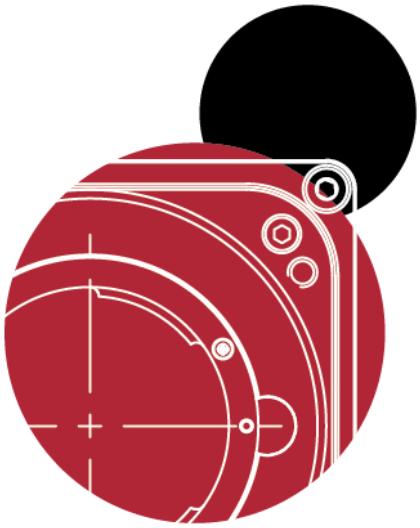


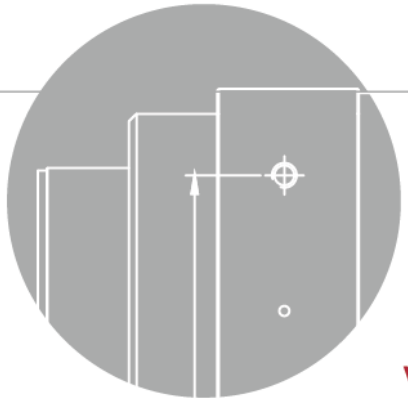
2. Search and select the provided FPGA upgrade file (*.bin) and click **Open**.



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







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