MityCAM-120MXS EVK

User's Manual

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1 Introduction

The purpose of this document is to detail features of the MityCAM-120MXS Evaluation Kit (EVK).

1.1 Additional Documentation

In addition to this document, the following documents are also useful / pertinent to the use and operation of the MityCAM-120MXS cameras.

Table 1: Reference Documentation

Title	Description
120MXSM, 120MXSX, 120MXSI Datasheet	Sensor Datasheet 120MXS_DS https://canon-cmos-sensors.com/
120MXSM, 120MXSX, 120MXSI Application Note	Sensor Application Note 120MXS_AN https://canon-cmos-sensors.com/
MityCAM-120MXS datasheet	Complete specification for MityCAM-120MXS.
USB3 Vision Standard 1.0.1	See https://www.visiononline.org/vision-standards-details.cfm?type=11
GenTL Viewer User's Manual	Users guide for the Critical Link Supplied GenTL Viewer PC software. https://support.criticallink.com/files/GenTLViewer/GenTLViewer%20Manual.pdf

2 Interfaces

2.1 AIA USB 3 Vision

The MityCAM-120MXS includes a USB 3.1 Gen 1 interface that is compliant with the AIA USB 3.0 Vision standard (USB3 Vision). This is the main control and data interface to the camera system. A list of the GenICam registers available for control of the system included in Section 10 of this document.

Critical Link supplies a free PC application that may be used to control, capture and save images generated by the evaluation kit. However, this kit should also be compatible with any third-party software that is compliant with the USB3 Vision standard, such as the National Instruments Vision Acquisition Software, HALCON, etc. Figures in this document are captured using the Critical Link provided software. This Software can be downloaded from https://support.criticallink.com/files/GenTLViewer/GenTLViewer_latest_setup.exe

2.2 Power Interface

The MityCAM-120MXS kit requires a +12 V input voltage supply. A minimum of 1.0 amps is required. See the datasheet for details on the connector.

2.3 USB 2.0 RNDIS Debug

The USB 2.0 port on the MityCAM-120MXS kit provides an RNDIS (Ethernet) connection to an attached HOST PC. The port is configured to run a DHCP server and present an Ethernet IP address of 10.1.47.2/8 for the camera and assign an address of 10.1.47.2/8 to the attached HOST PC. The camera supports accessing the embedded Linux shell on the device using the ssh protocol. Using this protocol it is also possible to transfer files onto the camera subsystem. There is also a simple web-server running on the camera to support firmware upgrades.

3 Frame Interval and Exposure Time

Control of the Frame Interval and Exposure Time can be performed both internally and externally on the kit using the GenICam control registers and (for the case of external control) the GPIO IO pins on J201. The block diagram shows how the kit interfaces with the 120MXS sensor.

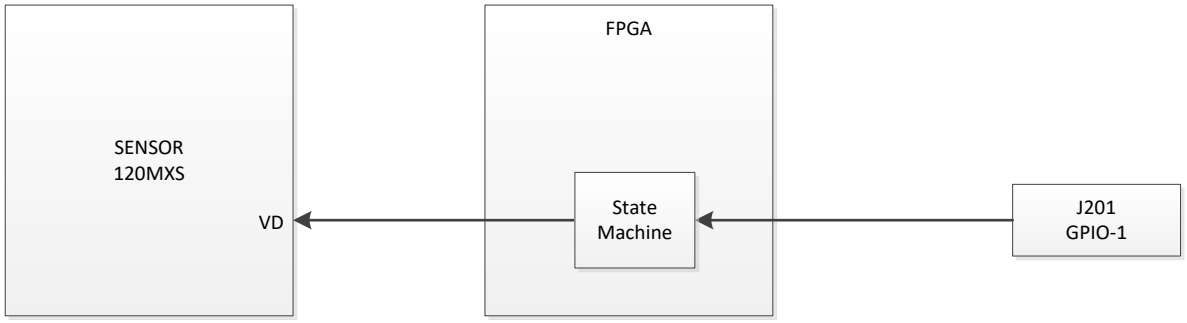

Figure 1 Sensor Connections Relating to Frame Exposure and Timing Control

3.1 External Frame Rate and Internal Exposure

This mode uses the Trigger Event mode of the 120MXS as described by section 4.6 in the sensor application note. In this mode GPIO IO 0 (pin 1) of the P201 cable interface is used as the TRIGGER signal. To configure this mode, the following GenICAM registers of the camera should be configured:

GenICam Register	Setting
TriggerMode	On
ExposureTime	User Required Exposure Time
LineSelector	Line0
LineMode	Input

Note, instead of the GPIO IO 0, the optical input pins may be used with the following GenICAM settings:

GenICam Register	Setting
TriggerMode	On
ExposureTime	User Required Exposure Time
LineSelector	Line0
LineMode	OptoInput

3.2 Internal Frame Rate and Internal Exposure

This mode uses Slit Rolling Sequence mode of the 120MXS as described by the section 4.2 of the sensor application note. To configure this mode, the following GenICAM registers of the camera should be configured:

GenICam Register	Setting
TriggerMode	Off
ExposureTime	User Required Exposure Time
AcquisitionFrameRate or AcquisitionFramePeriod	User Required Sensor Frame Rate

3.3 Notes on Frame Interval

The maximum frame interval time is defined in the 120MXS datasheet. For a full ROI, up to 9.4 Hz may be achieved. For ROIs that are smaller in height, higher frame rates out of the sensor are possible. However, the USB 3.1 Gen 1 interface is limited to approximately 320 MB/sec. So, for a full ROI image at 8 bits per pixel, the maximum continuous framerate achievable is limited to approximately 2 Hz. For continuous operation, if the requested frame rate is higher than can be achieved, frames will be periodically dropped on the USB output interface.

4 Continuous Operation

4.1 USB Output

When the GenICam AcquisitionMode register is set to Continuous and acquisition is started, the camera will configure the sensor to operate at the requested Frame Rate and start transmitting data to the USB 3.1 Gen 1 interface. If the requested data rate exceeds the capability of the USB 3.1 Gen 1 link, the camera will periodically drop incoming frames prior to transmission to the host PC in order to reduce the latency of the data shown on a host PC display.

5 Burst Mode Operation

5.1 USB 3 Output

The camera has a section of RAM dedicated as a circular image buffer. When the AcquisitionMode GenICam register is set to Single or Multi-Frame, data will be streamed at the configured rate into the image buffer and streamed out at the maximum achievable rate on the USB 3.1 Gen 1 interface, which is approximately 320 MB/sec.

6 Configurable Region of Interest

The MityCAM-120MXS currently supports a single ROI. The ROI can be adjusted using the GenICam OffsetX, OffsetY, Width, and Height settings.

6.1 USB3 Vision

The base ROI captured from the Sensor and transmitted via the USB3 Vision interfaces is configured using the GenICam defined Width, Height, OffsetX, and OffsetY registers while the camera is IDLE.

7 Color Processing

The MityCAM-120MXSC (or MityCAM-120MXSI) currently outputs the RAW Bayer RGB (or RGBIR) data and does not perform demosaicing. The GenTL viewing software does support demosaicing the data and white balance operations to support color presentation. A plugin is also provided to extract the IR information and present a proper color image for RGBIR Bayer data.

8 GPIO Interface

The EVK comes with a breakout cable for the GPIO interface harness. The pin connections are listed in Table 2. P1 is the 12-Pin GPIO connector interface. P2 is the USB Type A interface for Host PC insertion. P3 is the 9 Pin receptacle (female) cable end. P4 is the 9 pin plug (male) cable end.

Table 2: GPIO Break Out Cable Pin Assignments

GPIO Port (P1)	Break Out Cable Port-Pin	Description
1	P3-6	FPGA IO 0 – 1.8V CMOS Logic Level
2	P3-7	FPGA IO 1 – 1.8V CMOS Logic Level
3	P3-8	FPGA IO 2 – 1.8V CMOS Logic Level
4	P3-9	FPGA IO 3 – 1.8V CMOS Logic Level
5	P3-4	Camera shutdown, short to GND to turn off camera, otherwise leave unconnected.
6	P3-5	Ground
7	USB-A Connector, P2	1.8V Serial Console Output
8	USB-A Connector, P2	1.8V Serial Console Input
9	P4-5	Reference / Return for Isolated input currents.
10	P4-6	Opto-isolated Input 0
11	P4-7	Opto-isolated Input 1
12	P4-8	Opto-isolated Input 2

The available modes of operation for the 4 GPIO pins are listed in Table 3.

Table 3: GPIO Modes

#	Mode
1.	Input for reading
2.	Output driven low
3.	Output driven high
4.	Input for external trigger (FPGA IO 0 only)

The following sections will cover Modes 1, 2 and 3. Mode 4 is covered in separate sections.

The Opto-Isolated Input pins may be used as inputs for reading. Input 0 may be used as an optional trigger source in the same way as GPIO 0.

8.1 Input

In the input mode of operation, the pin can be queried for its current logical value (High or Low).

8.2 Output

In output mode, the pin can be driven high or low. This can be used to toggle a light source or some other operation.

9 Firmware Upgrade

The MityCAM-120MXS allows upgrading the firmware via the network interface. Details for acquiring the firmware and downloading the firmware to the camera are available on the Critical Link MityCAM Support Site.

10 MityCAM120MXS GenICam Features

This section presents a summary of the Generic Interface for Cameras (GenICam) available features provided by the camera. Many of the listed features, identified by the SFNC=Y field, are defined by the European Machine Vision Association (EMVA) Standard Features Naming Convention.

10.1 Device Control Group

Feature	Type	SFNC?	Description
DeviceReset	Command	Y	This command is used to reset the device and to put it in its power up state.
DeviceVendorName	StringReg	Y	Name of camera vendor
DeviceModelName	StringReg	Y	Name of the camera model
DeviceManufacturerInfo	StringReg	Y	Manufacturer Info
DeviceVersion	StringReg	Y	Device Version
DeviceSerialNumber	StringReg	Y	Displays the factory set camera serial number.
DeviceFirmwareVersion	StringReg	Y	Firmware Version
DeviceSFNCVersionMajor	Integer	Y	Major version of the Standard Features Naming Convention that was used to create GenICam XML
DeviceSFNCVersionMinor	Integer	Y	Minor version of the Standard Features Naming Convention that was used to create GenICam XML
DeviceSFNCVersionSubMinor	Integer	Y	Sub-Minor version of the Standard Features Naming Convention that was used to create GenICam XML
SoftwareBuildDate	StringReg	N	Build date of the camera software.
FpgaVersion	IntReg	N	Version information of the FPGA.
Fx3Version	StringReg	N	Version information for the FX3.

10.2 Image Format Control Group

Feature	Type	SFNC?	Description
OffsetX	Integer	Y	Horizontal offset from the origin to the region of interest (in pixels). **Min Value:**0 **Increment:**8
OffsetY	Integer	Y	Vertical offset from the origin to the region of interest (in pixels). **Min Value:**0 **Increment:**4
Width	Integer	Y	Width of the image provided by the device (in pixels). **Min Value:**32 **Increment:**8

Height	Integer	Y	Height of the image provided by the device (in pixels). **Min Value:**4 **Increment:**4
PixelFormat	Enumeration	Y	Format of the pixels provided by the device. It represents all the information provided by PixelSize, PixelColorFilter combined in a single feature. **Allowed Values :** • Mono12p • Mono8 • BayerRG8 • BayerRG8IR • BayerRG12p • BayerRG12pIR
BadPixelReplacementEnable	Enumeration	N	This control allows the user to enable or disable the replacement of pixels marked as bad by the system. **Allowed Values :** • On • Off
BadPixelReplacementMap	Enumeration	N	When on, marked bad pixels are set to 0 and non-marked pixels are set to maximum value during image transmission. **Allowed Values :** • On • Off
TestPattern	Enumeration	N	This control allows the user to enable Canon provided test pattern That provides a grid of values 0,120 and 240 scaled for 8 and 12 bits per pixel. Bias subtraction is turned off. **Allowed Values :** • SensorData • CanonGridTestPattern

PGAGain	Enumeration	N	Sensor PGA setting **Allowed Values :** • x_half • x1 • x2 • x4 • x8

10.3 Acquisition Control Group

Feature	Type	SFNC?	Description
AcquisitionMode	Enumeration	Y	Sets the acquisition mode of the device. It defines mainly the number of frames to capture during an acquisition and the way the acquisition stops. **Allowed Values :** • Continuous • SingleFrame • MultiFrame
AcquisitionStart	Command	Y	Starts the Acquisition of the device. The number of frames captured is specified by AcquisitionMode.
AcquisitionStop	Command	Y	Stops the Acquisition of the device at the end of the current Frame. It is mainly used when AcquisitionMode is Continuous but can be used in any acquisition mode.
ExposureTime	Float	Y	Exposure duration, in microseconds. **Min Value:**30.0 **Max Value:**1000000
AcquisitionFrameRate	Converter	Y	Controls the acquisition rate (in Hertz) at which the frames are captured.
AcquisitionFramePeriod	Integer	Y	Period between frames, in microseconds. **Max Value:**5000000
AcquisitionFrameCount	Integer	Y	Number of frames to aquire in MultiFrame Acquisition mode. **Min Value:**1 **Increment:**1

FrameCountMax	IntSwissKnife	Y	Maximum AcquisitionFrameCount possible given current payload size
TriggerSelector	Enumeration	Y	Selects the type of trigger to configure. **Allowed Values :** • FrameStart
TriggerMode	Enumeration	N	Controls if the selected trigger is active. **Allowed Values :** • Off • On
TriggerActivation	Enumeration	N	Specifies the activation mode of the trigger. **Allowed Values :** • RisingEdge

10.4 Sensor Peek/Poke Group

Feature	Type	SFNC?	Description
RegAddress	Integer	N	Register address of the Peek/Poke **Min Value:**0 **Max Value:**2047 **Increment:**1
RegValue	Integer	N	Value of the address peeked or to be written when poked **Min Value:**0 **Max Value:**268435455 **Increment:**1
ExecRead	Command	N	Command reads and invalidates/replaces the RegValue register with the setting read back from the sensor.
ExecWrite	Command	N	Command writes the value stored in the RegValue register to the sensor at the specified RegAddress location.

10.5 Digital IO Control Group

Feature	Type	SFNC?	Description
LineSelector	Enumeration	Y	Selects the physical line (or pin) of the external device connector or the virtual line of the Transport Layer to configure. When a Line is selected, all the other Line features will be applied to its associated I/O control block and will condition the resulting input or output signal. For this case, Line0-3 correspond to High Speed FPGA IO numbers 1-4 on the GPIO connector interface. **Allowed Values :** • Line0 • Line1 • Line2 • Line3
LineMode	Enumeration	Y	Controls if the physical Line is used to Input or Output a signal. When a Line supports input and output mode, the default state is Input to avoid possible electrical contention. **Allowed Values :** • Input • Output • OptoInput
LineSource	Enumeration	Y	Selects which internal acquisition or I/O source signal to output on the selected Line. LineMode must be Output. **Allowed Values :** • Off • ExposureActive • UserOutput0 • UserOutput1
UserOutputSelector	Enumeration	Y	Selects which bit of the User Output register will be set by UserOutputValue. **Allowed Values :** • UserOutput0 • UserOutput1

UserOutputValue	Boolean	Y	Sets the value of the bit selected by UserOutputSelector.
LineStatus	Boolean	Y	Returns the current status of the selected input or output Line. The status of the signal is taken after the input Line inverter of the I/O control block.

10.6 Transport Layer Control Group

Feature	Type	SFNC?	Description
PayloadSize	Integer	Y	Size of payload, in bytes **Min Value:**16 **Max Value:**243927040 **Increment:**1

11 Revision History

Revision	Date	Author	Description
1B	11/18/2019	Mike Williamson	Initial Release