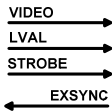


Matrox Radiant eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

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Basics about the camera	Camera Descriptions ▪ Trilinear color line scan camera (trilinear CCD line scan sensor) ▪ Effective resolution: Up to 4096 pixels/line @ up to 50.8k line per second. ▪ Camera Link FULL interface (2, 3, 6, 8, 10 taps and 8, 10, 12-bit). ▪ External and internal sync. ▪ Internal exposure control. ▪ 61.8, 75.5, 85 MHz pixel clock rate.
Mode of operations as per Matrox Imaging (in parentheses as per camera manufacturer)	Interface Mode ▪ Fixed line scan rate¹ ▪ Variable line scan rate² ▪ Variable line scan rate using the Rotary Encoder^{2,3} ▪ Fixed line scan rate with frame trigger¹ ▪ Variable line scan rate with frame trigger² ▪ Variable line scan rate using the Rotary Encoder with frame trigger^{2,3} ▪ Fixed line scan rate with variable frame size¹ ▪ Variable line scan rate with variable frame size² ▪ Variable line scan rate using the Rotary Encoder with frame size^{2,3}
Basics about the interface modes	Camera Interface Briefs <i>Mode 1: Fixed line scan rate</i> ▪ 4096 pixels/line. ▪ Camera Link FULL interface (up to ten 8-bit taps). ▪ DCF configured for 1000 lines per virtual frame. ▪ Matrox Radiant eV-CL sending periodic EXPOSURE1 (EXSYNC) signal to camera. ▪ Matrox Radiant eV-CL receiving LVAL, PIXEL CLOCK (@ 85 MHz) and video data from camera. ▪ DCF used: allPIXA_pro_4k_8bit_10tap_RGB_Fls.DCF  Chromasens allPIXA pro  VIDEO LVAL STROBE EXSYNC  Matrox Radiant eV-CL

¹ EXSYNC, level-controlled or Free Run programmable

¹ EXSYNC, level-controlled.

¹ LVDS line trigger for rotary encoder is 5V tolerant.

Matrox Radient eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

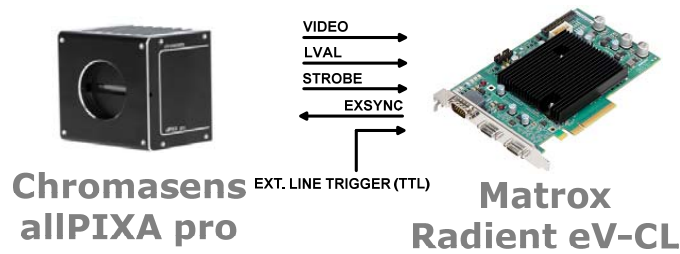
February 19, 2016

Basics about the interface modes

Camera Interface Briefs (cont.)

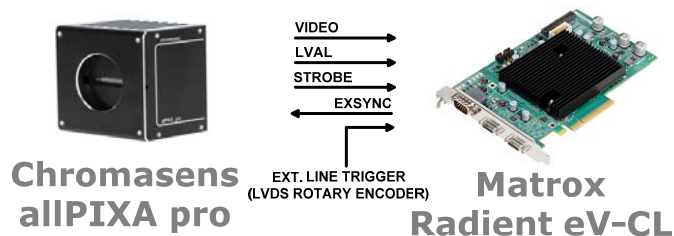
Mode 2: Variable line scan rate

- 4096 pixels/line.
- Camera Link FULL interface (up to ten 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Radient eV-CL receiving external TTL line trigger signal.
- Matrox Radient eV-CL sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Radient eV-CL receiving LVAL, PIXEL CLOCK (@ 85 MHz) and video data from camera.
- DCF used: [allPIXA_pro_4k_8bit_10tap_RGB_Vls.DCF](#)



Mode 3: Variable line scan rate with rotary encoder

- 4096 pixels/line.
- Camera Link FULL interface (up to ten 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Radient eV-CL receiving external LVDS line trigger (ROTARY ENCODER) signal.
- Matrox Radient eV-CL sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Radient eV-CL receiving LVAL, PIXEL CLOCK (@ 85 MHz) and video data from camera.
- DCF used: [allPIXA_pro_4k_8bit_10tap_RGB_VlsRe.DCF](#)



Matrox Radient eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

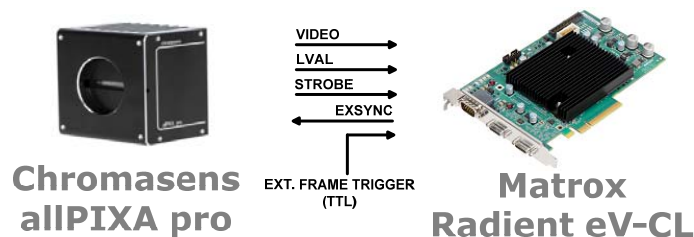
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Basics about the interface modes

Camera Interface Briefs (cont.)

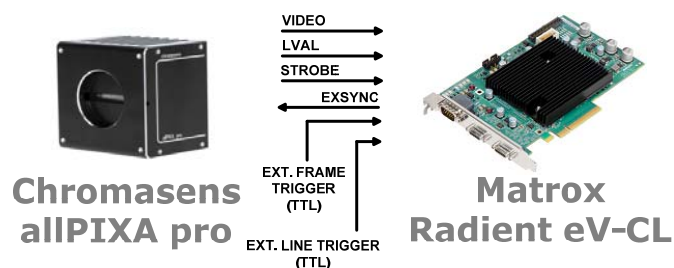
Mode 4: Fixed line scan rate with frame trigger

- 4096 pixels/line.
- Camera Link FULL interface (up to ten 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Radient eV-CL receiving external TTL frame (virtual) trigger signal.
- Matrox Radient eV-CL sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Radient eV-CL receiving LVAL, PIXEL CLOCK (@ 85 MHz) and video data from camera.
- DCF used: [allPIXA_pro_4k_8bit_10tap_RGB_Flsft.DCF](#)



Mode 5: Variable line scan rate with frame trigger

- 4096 pixels/line.
- Camera Link FULL interface (up to ten 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Radient eV-CL receiving external TTL frame (virtual) and line trigger signals.
- Matrox Radient eV-CL sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Radient eV-CL receiving LVAL, PIXEL CLOCK (@ 85 MHz) and video data from camera.
- DCF used: [allPIXA_pro_4k_8bit_10tap_RGB_Vlsft.DCF](#)



Matrox Radiant eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

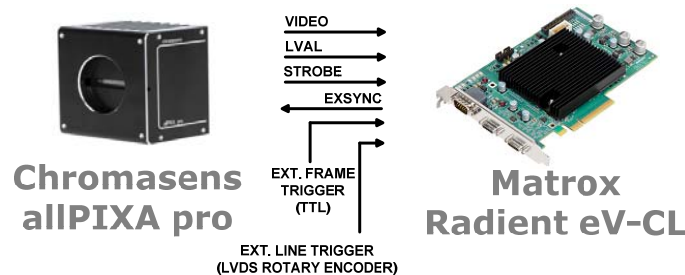
February 19, 2016

Basics about the interface modes

Camera Interface Briefs (cont.)

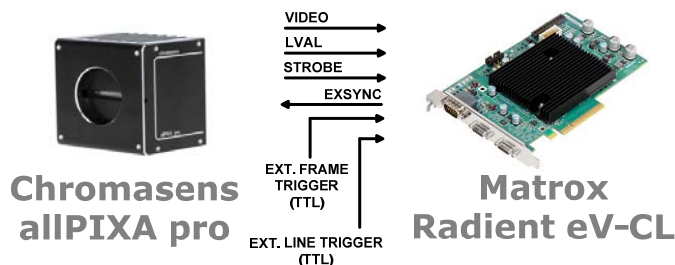
Mode 6: Variable line scan rate with rotary encoder and frame trigger

- 4096 pixels/line.
- Camera Link FULL interface (up to ten 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Radiant eV-CL receiving external TTL frame (virtual) and external LVDS line trigger (ROTARY ENCODER) signals.
- Matrox Radiant eV-CL sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Radiant eV-CL receiving LVAL, PIXEL CLOCK (@ 85 MHz) and video data from camera.
- DCF used: [allPIXA_pro_4k_8bit_10tap_RGB_VlsftRe.DCF](#)



Mode 7: Fixed line scan rate with variable frame size

- 4096 pixels/line.
- Camera Link FULL interface (up to ten 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Radiant eV-CL receiving external TTL frame (virtual) trigger signal.
- Matrox Radiant eV-CL sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Radiant eV-CL receiving LVAL, PIXEL CLOCK (@ 85 MHz) and video data from camera.
- DCF used: [allPIXA_pro_4k_8bit_10tap_RGB_Flsvf.DCF](#)



Matrox Radiant eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

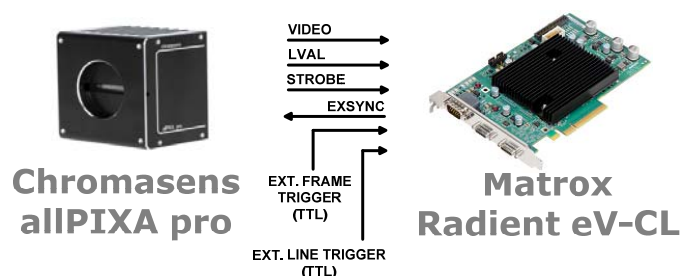
February 19, 2016

Basics about the interface modes

Camera Interface Briefs (cont.)

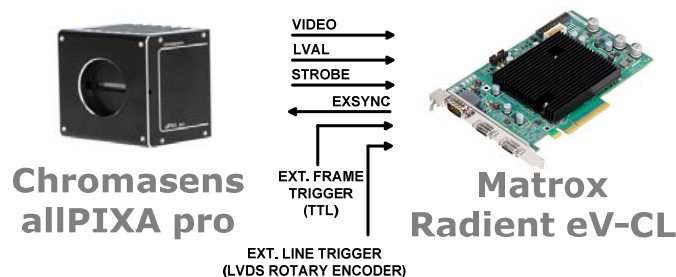
Mode 8: Variable line scan rate with variable frame size

- 4096 pixels/line.
- Camera Link FULL interface (up to ten 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Radiant eV-CL receiving external TTL frame (virtual) and line trigger signals.
- Matrox Radiant eV-CL sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Radiant eV-CL receiving LVAL, PIXEL CLOCK (@ 85 MHz) and video data from camera.
- DCF used: [allPIXA_pro_4k_8bit_10tap_RGB_Vlsvf.DCF](#)



Mode 9: Variable line scan rate with rotary encoder and variable frame size

- 4096 pixels/line.
- Camera Link FULL interface (up to ten 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Radiant eV-CL receiving external TTL frame (virtual) and external LVDS line trigger (ROTARY ENCODER) signals.
- Matrox Radiant eV-CL sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Radiant eV-CL receiving LVAL, PIXEL CLOCK (@ 85 MHz) and video data from camera.
- DCF used: [allPIXA_pro_4k_8bit_10tap_RGB_VlsvfRe.DCF](#)



Matrox Radiant eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

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Specifics about the interface modes

Camera Interface Details

Mode 1: Fixed line scan rate

- **Line rate:** The frequency of the periodic EXPOSURE1 (CC1) signal determines the camera's line rate. The maximum line rate for this camera equals **50.8 kHz**. Refer to the camera manual for more information.
- **Exposure time:** Exposure time is set in the camera by using the **Camera Setup Tool (i.e. CST)**. In the manual, in the **Calculating the integration time** section, you will obtain the formula about the relationship between the line frequency and the integration time. Consult the respective manual for more information.
- **Camera communication:** This DCF will work with all **Free Run** and **External Trigger** modes however **External Trigger Mode** is the recommended mode to control the camera from the frame grabber with this DCF. When the camera is in the **Free-running** mode, the camera will ignore the CC1 signal from the board. Refer to the camera manual for additional information. Please set the mode using the **Chromasens Camera Setup Tool (CST)** and set the recommended parameters as follow from the default configuration:

Edit settings

- Camera parameter/Integration time
Integration Time in us -> as desired
Line period time in us -> as desired
- Image parameter/Synchronization
Triggered frame scan -> Free running
- Image parameter/Output format
Video output mode -> Color image (3*8 Bit parallel)
CameraLink Connection speed -> High speed (85 Mhz)
Type of CameraLink interface -> Full80_10Tx8Bit 1X Raw

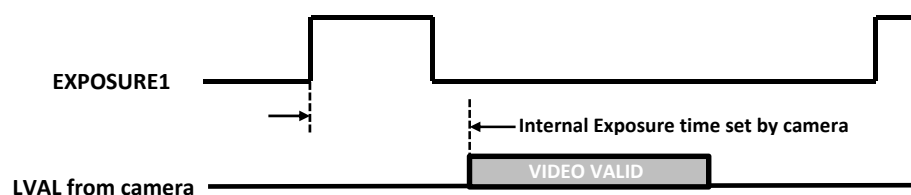
IO-configuration

- Encoder Ch 0/Incr 0/line trigger -> CL1-CC1
- Encode Ch 1 /Incr 1/line trigger ->---
- Enable Encoder -> ---

Encoder setup

- Enable encoder -> check box
- Synchronisation mode -> Line trigger mode (Const. Int. Time)

▪ Timing diagram:



Matrox Radiant eV-CL

Camera Interface Application Note

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Specifics about the interface modes

Camera Interface Details (cont.)

Mode 2: Variable line scan rate

- **Line rate:** The line rate is controlled by the frequency of the external TTL line trigger signal. The external line trigger signal period must be larger than the total duration of the exposure time (Exposure time is set in the camera), the internal delay of the camera or slower than the maximum line rate.
- **Exposure time:** Refer to Mode 1: Fixed line scan rate section.
- **Camera communication:** This DCF will work with the **External Trigger** mode (in the **Chromasens Camera Setup Tool**) to control the line rate from the frame grabber. Refer to the camera manual for additional information. Please set the mode using the **Chromasens Camera Setup Tool** and set the recommended parameters as follow from the default configuration:

Edit settings

- Camera parameter/Integration time
Integration Time in us -> as desired
Line period time in us -> as desired
- Image parameter/Synchronization
Triggered frame scan -> Free running
- Image parameter/Output format
Video output mode -> Color image (3*8 Bit parallel)
CameraLink Connection speed -> High speed (85 Mhz)
Type of CameraLink interface -> Full80_10Tx8Bit 1X Raw

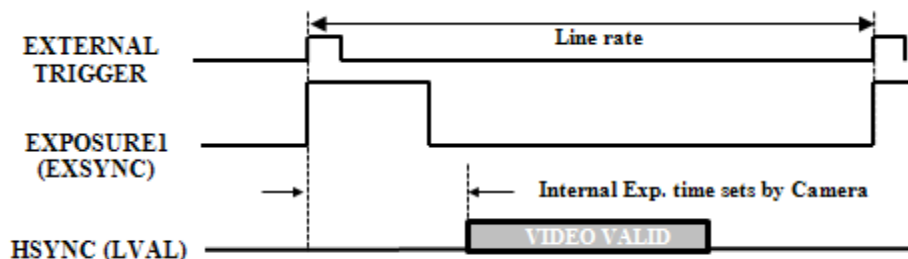
IO-configuration

- Encoder Ch 0/Incr 0/line trigger -> CL1-CC1
- Encode Ch 1 /Incr 1/line trigger ->---
- Enable Encoder -> ---

Encoder setup

- Enable encoder -> check box
- Synchronisation mode -> Line trigger mode (Const. Int. Time)

- **Timing diagram:**



Matrox Radient eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

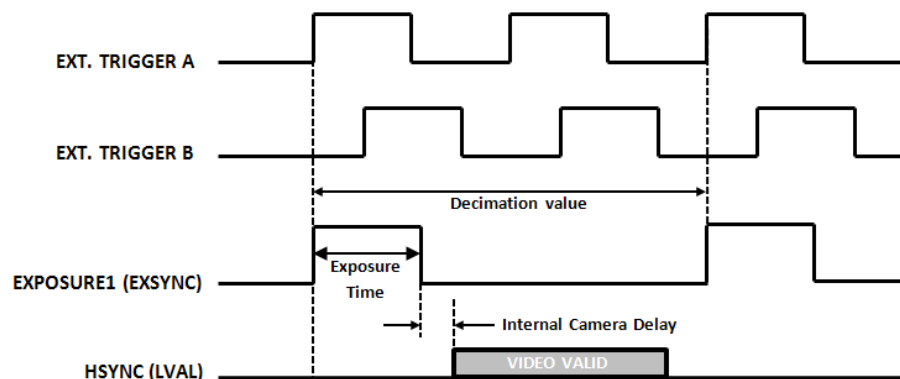
February 19, 2016

Specifics about the interface modes

Camera Interface Details (cont.)

Mode 3: Variable line scan rate with rotary encoder

- **Line/frame rate:** The line rate is controlled by the frequency of the external LVDS line trigger signal with a Rotary Encoder format. With the Rotary Encoder approach, it is possible to force a certain decimation value to grab a line every x number of pulses from the line trigger (combination of the A and B signals). The line trigger signal controlled by the decimation value must be larger than the total duration of the exposure time (set in the camera), the internal delay of the camera or slower than the maximum line rate of the camera. The DCF is done for a forward direction from the Rotary Encoder.
- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate.
- **Timing diagram:**



Mode 4: Fixed line scan rate with frame trigger

- **Line/frame rate:** The line rate is fixed and controlled by the frequency of EXPOSURE1 (i.e. CC1) signal. The virtual frame rate is variable and controlled by the period of the external frame trigger signal, however the external frame trigger period must always be greater than the total time of the number of lines captured. The number of lines per virtual frame (maximum of 1000 for this DCF) is fixed and controlled by the vertical timing of the DCF. Capture of the lines will start with the rising edge of the frame trigger signal.
- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 1: Fixed line scan rate.

Continued...

Matrox Radiant eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

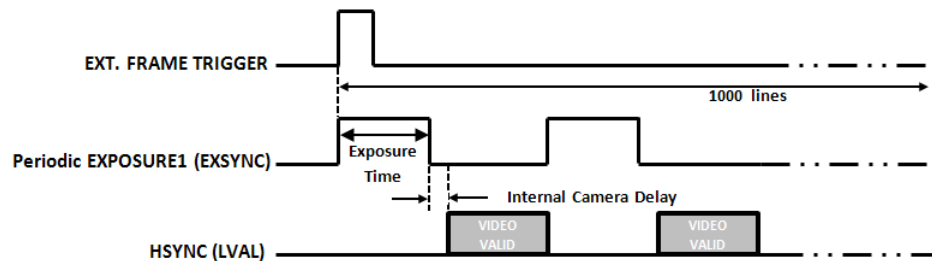
February 19, 2016

Specifics about the interface modes

Camera Interface Details (cont.)

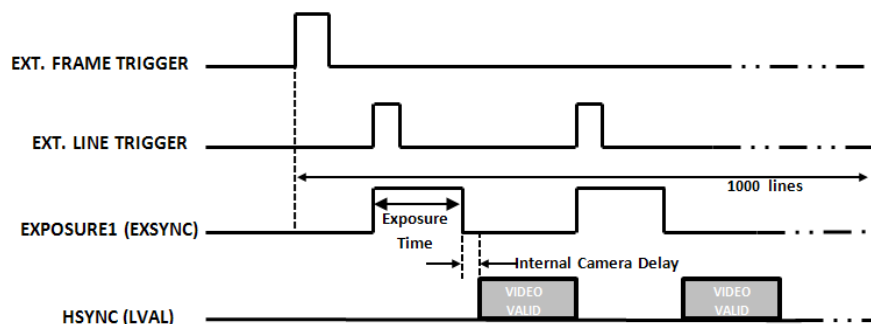
Mode 4: Fixed line scan rate with frame trigger

- **Timing diagram:**



Mode 5: Variable line scan rate with frame trigger

- **Line/frame rate:** The line rate is controlled by the frequency of the external TTL line trigger signal. The line trigger signal period must be larger than the total duration of the exposure time (set in the camera), the internal delay of the camera or slower than the maximum line rate of the camera. The virtual frame rate is variable and controlled by the period of the external frame trigger signal, however the external trigger period must always be greater than the total time of the number of lines captured. The number of lines per virtual frame (1000 for this DCF) is fixed and controlled by the vertical timing of the DCF. Capture of the lines will start with the rising edge of the frame trigger signal.
- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate
- **Timing diagram:**



Matrox Radiant eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

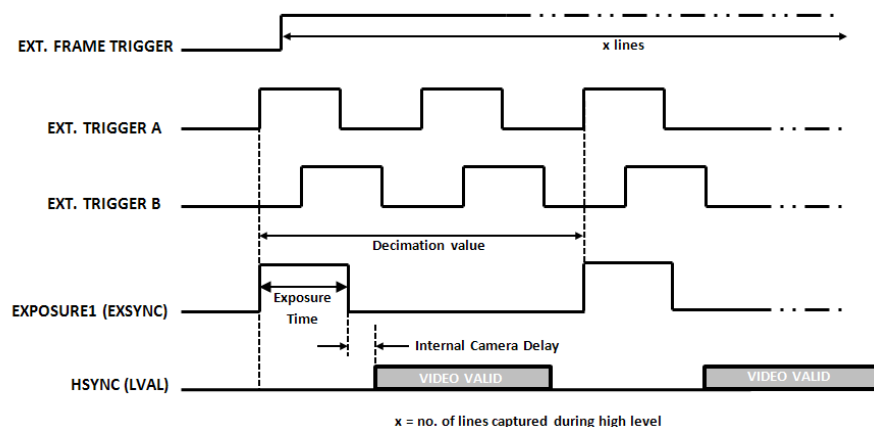
February 19, 2016

Specifics about the interface modes

Camera Interface Details (cont.)

Mode 6: Variable line scan rate with rotary encoder and frame trigger

- **Line/frame rate:** The line rate is controlled by the frequency of the external LVDS line trigger signal with a Rotary Encoder format. With the Rotary Encoder approach, it is possible to force a certain decimation value to grab a line every x number of pulses from the line trigger (combination of the A and B signals). The line trigger signal controlled by the decimation value must be larger than the total duration of the exposure time (set in the camera), the internal delay of the camera or slower than the maximum line rate of the camera. The DCF is done for a forward direction from the Rotary Encoder. The number of lines per virtual frame (maximum of 1000 for this DCF) is variable and controlled by the frame trigger signal. Matrox Radiant eV-CL captures lines during the high level of the frame trigger signal. To modify the maximum amount of lines captured, change the active vertical timing period in the DCF. Capture of the lines will start with the rising edge of the frame trigger signal.
- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 1: Fixed line scan rate
- **Timing diagram:**



Mode 7: Fixed line scan rate with variable frame size

- **Line/frame rate:** The line rate is fixed and controlled by the frequency of EXPOSURE1 (i.e. CC1) signal. The number of lines per virtual frame (maximum of 1000 for this DCF) is variable and controlled by the frame trigger signal. Matrox Radiant eV-CL captures lines during the high level of the frame trigger signal. To modify the maximum amount of lines captured, change the active vertical timing period in the DCF. Capture of the lines will start with the rising edge of the frame trigger signal.

Matrox Radiant eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

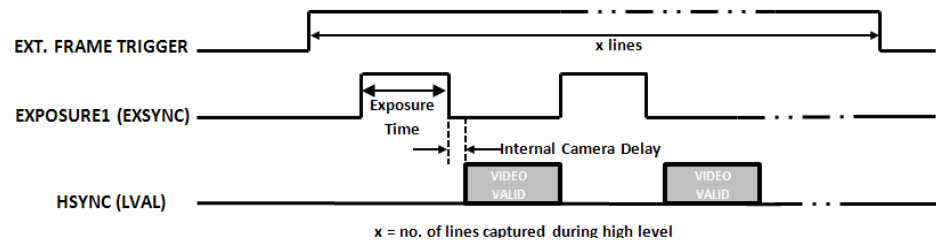
February 19, 2016

Specifics about the interface modes

Camera Interface Details (cont.)

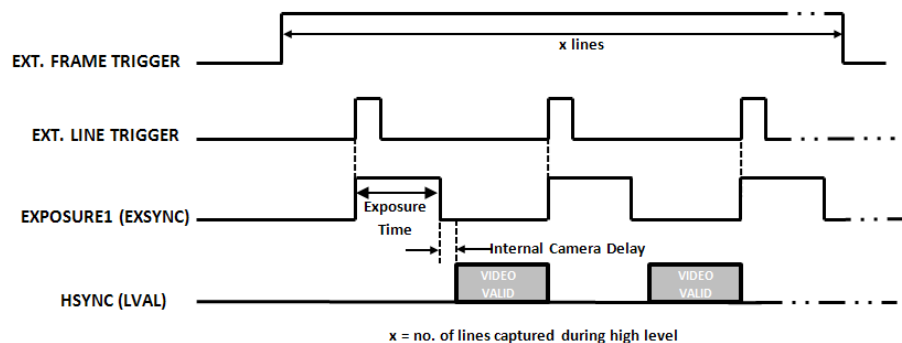
Mode 7: Fixed line scan rate with variable frame size

- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 1: Fixed line scan rate
- **Timing diagram:**



Mode 8: Variable line scan rate with variable frame size

- **Line/frame rate:** The line rate is variable and controlled by the external line trigger frequency. The line trigger signal period must be larger than the total duration of the exposure time (set in the camera), the internal delay of the camera or slower than the maximum line rate of the camera. The number of lines per virtual frame (maximum of 1000 for this DCF) is variable and controlled by the frame trigger signal. Matrox Radiant eV-CL captures lines during the high level of the frame trigger signal. To modify the maximum amount of lines captured, change the active vertical timing period in the DCF. Capture of the lines will start with the rising edge of the frame trigger signal.
- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 1: Fixed line scan rate
- **Timing diagram:**



Matrox Radient eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

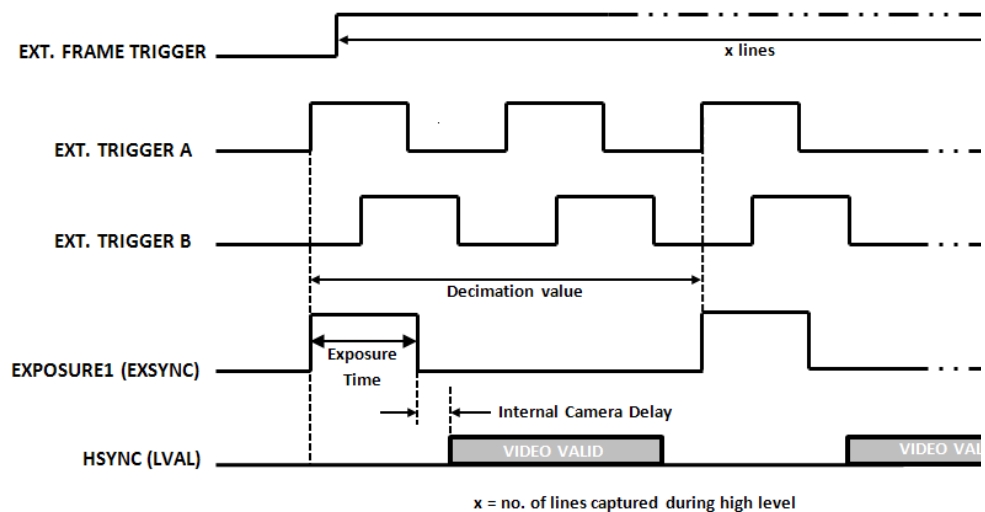
February 19, 2016

Specifics about the interface modes

Camera Interface Details (cont.)

Mode 9: Variable line scan rate with rotary encoder and variable frame size

- **Line/frame rate:** The line rate is controlled by the frequency of the external LVDS line trigger signal with a Rotary Encoder format. With the Rotary Encoder approach, it is possible to force a certain decimation value to grab a line every x number of pulses from the line trigger (combination of the A and B signals). The line trigger signal controlled by the decimation value must be larger than the total duration of the exposure time (set in the camera), the internal delay of the camera or slower than the maximum line rate of the camera. The DCF is done for a forward direction from the Rotary Encoder. The number of lines per virtual frame (maximum of 1000 for this DCF) is variable and controlled by the frame trigger signal. Matrox Radient eV-CL captures lines during the high level of the frame trigger signal. To modify the maximum amount of lines captured, change the active vertical timing period in the DCF. Capture of the lines will start with the rising edge of the frame trigger signal.
- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate
- **Timing diagram:**



Matrox Radient eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

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Cabling details for the interface moc

Cabling Requirements

Mode 1: Fixed line scan rate

- **Cable and Connection:** Standard Camera Link cable.

Mode 2: Variable line scan rate

- **Cable and Connection:** Standard Camera Link cable.
- **External trigger:** External line trigger should be connected to the external auxiliary I/O (connector A on the Matrox Radient eV-CL bracket)

EXTERNAL AUX. I/O (connector A)

External Trigger Source

PIN NAME	PIN NO.		PIN NAME
OPTO_AUX_IN0 +	15	←	LINE TRIGGER (TTL FORMAT)
OPTO_AUX_IN0 -	09	←	LINE TRIGGER (GROUND)

Mode 3: Variable line scan rate with rotary encoder

- **Cable and Connection:** Standard Camera Link cable.
- **External trigger:** External line trigger should be connected to the external auxiliary I/O (connector A on the Matrox Radient eV-CL bracket)

EXTERNAL AUX. I/O (connector A)

External Trigger Source

PIN NAME	PIN NO.		PIN NAME
LVDS_AUX_IN2 +	04	←	LINE TRIGGER A + (LVDS FORMAT)
LVDS_AUX_IN2 -	05	←	LINE TRIGGER A - (LVDS FORMAT)
LVDS_AUX_IN3 +	06	←	LINE TRIGGER B + (LVDS FORMAT)
LVDS_AUX_IN3 -	08	←	LINE TRIGGER B - (LVDS FORMAT)

Mode 4: Fixed line scan rate with frame trigger

- **Cable and Connection:** Standard Camera Link cable.
- **External trigger:** External line trigger should be connected to the external auxiliary I/O (connector A on the Matrox Radient eV-CL bracket)

EXTERNAL AUX. I/O (connector A)

External Trigger Source

PIN NAME	PIN NO.		PIN NAME
OPTO_AUX_IN1 +	12	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN1 -	11	←	FRAME TRIGGER (GROUND)

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Camera Interface Application Note

Chromasens allPIXA pro 4K

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Cabling details for the interface
modes

Cabling Requirements (cont.)

Mode 5: Variable line scan rate with frame trigger

- **Cable and Connection:** Standard Camera Link cable.
- **External trigger:** External line trigger should be connected to the external auxiliary I/O (connector A on the Matrox Radiant eV-CL bracket)

EXTERNAL AUX.

I/O

(connector A)

External Trigger Source

PIN NAME	PIN NO.		PIN NAME
OPTO_AUX_IN1 +	12	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN1 -	11	←	FRAME TRIGGER (GROUND)
OPTO_AUX_IN0 +	15	←	LINE TRIGGER (TTL FORMAT)
OPTO_AUX_IN0 -	09	←	LINE TRIGGER (GROUND)

Mode 6: Variable line scan rate with rotary encoder and frame trigger

- **Cable and Connection:** Standard Camera Link cable.
- **External trigger:** External line trigger should be connected to the external auxiliary I/O (connector A on the Matrox Radiant eV-CL bracket)

EXTERNAL AUX.

I/O

(connector A)

External Trigger Source

PIN NAME	PIN NO.		PIN NAME
OPTO_AUX_IN1 +	12	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN1 -	11	←	FRAME TRIGGER (GROUND)
LVDS_AUX_IN2 +	04	←	LINE TRIGGER A + (LVDS FORMAT)
LVDS_AUX_IN2 -	05	←	LINE TRIGGER A - (LVDS FORMAT)
LVDS_AUX_IN3 +	06	←	LINE TRIGGER B + (LVDS FORMAT)
LVDS_AUX_IN3 -	08	←	LINE TRIGGER B - (LVDS FORMAT)

Mode 7: Fixed line scan rate with variable frame size

- **Cable and Connection:** Standard Camera Link cable.
- **External trigger:** External line trigger should be connected to the external auxiliary I/O (connector A on the Matrox Radiant eV-CL bracket)

EXTERNAL AUX.

I/O

(connector A)

External Trigger Source

PIN NAME	PIN NO.		PIN NAME
OPTO_AUX_IN1 +	12	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN -	11	←	FRAME TRIGGER (GROUND)

Matrox Radiant eV-CL

Camera Interface Application Note

Chromasens allPIXA pro 4K

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Cabling details for the interface modes

Cabling Requirements (cont.)

Mode 8: Variable line scan rate with variable frame size

- **Cable and Connection:** Standard Camera Link cable.
- **External trigger:** External line trigger should be connected to the external auxiliary I/O (connector A on the Matrox Radiant eV-CL bracket)

EXTERNAL AUX. I/O (connector A)

PIN NAME	PIN NO.
OPTO_AUX_IN1 +	12
OPTO_AUX_IN1 -	11
OPTO_AUX_IN0 +	15
OPTO_AUX_IN0 -	09

External Trigger Source

PIN NAME
FRAME TRIGGER (TTL FORMAT)
FRAME TRIGGER (GROUND)
LINE TRIGGER (TTL FORMAT)
LINE TRIGGER (GROUND)

Mode 9: Variable line scan rate with rotary encoder and variable frame size

- **Cable and Connection:** Standard Camera Link cable.
- **External trigger:** External line trigger should be connected to the external auxiliary I/O (connector A on the Matrox Radiant eV-CL bracket)

EXTERNAL AUX. I/O (connector A)

PIN NAME	PIN NO.
OPTO_AUX_IN1 +	12
OPTO_AUX_IN1 -	11
LVDS_AUX_IN2 +	04
LVDS_AUX_IN2 -	05
LVDS_AUX_IN3 +	06
LVDS_AUX_IN3 -	08

External Trigger Source

PIN NAME
FRAME TRIGGER (TTL FORMAT)
FRAME TRIGGER (GROUND)
LINE TRIGGER A + (LVDS FORMAT)
LINE TRIGGER A - (LVDS FORMAT)
LINE TRIGGER B + (LVDS FORMAT)
LINE TRIGGER B - (LVDS FORMAT)

The DCFs mentioned in this application note are also attached (embedded) to this PDF file – use the Adobe Reader's View File Attachment to access the DCF files. The information furnished by Matrox Electronics System, Ltd. is believed to be accurate and reliable. Please verify all interface connections with camera documentation or manual. Contact your local sales representative or Matrox Sales office or Matrox Imaging Applications at 514-822-6061 for assistance. © Matrox Electronic Systems Ltd, 2016.

Matrox Electronic Systems Ltd.
1055 St. Regis Blvd.
Dorval, Quebec H9P 2T4
Canada
Tel: (514) 685-2630
Fax: (514) 822-6273