

Matrox Helios eCL/XCL

Camera Interface Application Note

TVI XIIMUS 2048CT-40

October 20, 2006

Basics about the
camera

Mode of operations as
per Matrox Imaging (in
parentheses as per
camera manufacturer)

Basics about the
interface modes

Camera Descriptions

- Effective resolution: up to 2048 pixels/line @ 18.5k line per second.
- Camera Link BASE or MEDIUM interface (8 or 12-bit RGB).
- External and internal sync.
- External or internal exposure control.
- 40 MHz pixel clock rate.

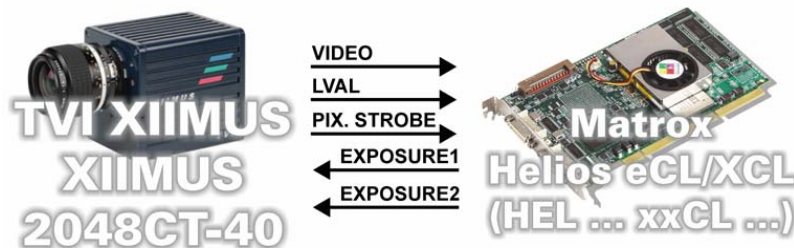
Interface Mode

- Fixed line scan rate (Free Run mode)
- Variable line scan rate (Encoder Input Driven mode)
- Fixed line scan rate with frame trigger (Encoder Input Driven mode)
- Variable line scan rate with frame trigger (Encoder Input Driven mode)
- Fixed line scan rate with variable frame size (Encoder Input Driven mode)
- Variable line scan rate with variable frame size (Encoder Input Driven mode)

Camera Interface Briefs

Mode 1: Fixed line scan rate

- Up to 2048 pixels/line.
- Camera Link BASE or MEDIUM interface (8 or 12-bit RGB).
- DCF configured for 1000 lines per virtual frame.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (EXP CTL-CC2) and EXPOSURE2 (New Line-CC1) signals to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (PIXEL STROBE @ 40 MHz) and video data from camera.
- DCF used: [XIIMUS_2048CT-40_2048_12bitRBGFLS.DCF](#) (MEDIUM)
- DCF used: [XIIMUS_2048CT-40_2048_8bitRBGFLS.DCF](#) (BASE)



Matrox Helios eCL/XCL

Camera Interface Application Note

TVI XIIMUS 2048CT-40

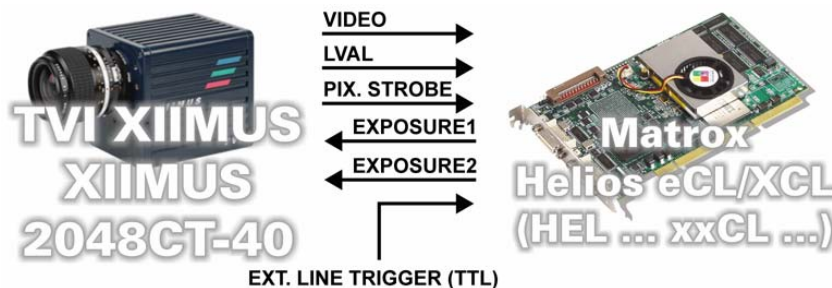
October 20, 2006

Basics about the
interface modes

Camera Interface Briefs (cont.)

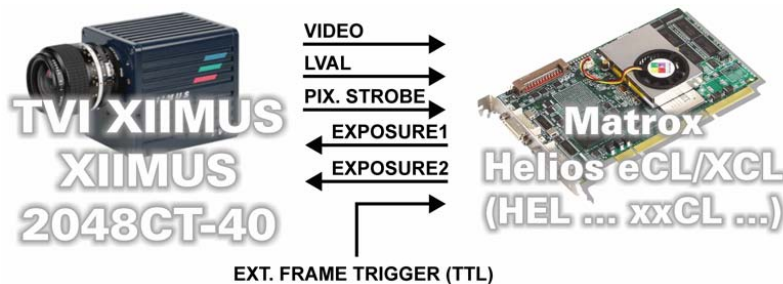
Mode 2: Variable line scan rate

- Up to 2048 pixels/line.
- Camera Link BASE or MEDIUM interface (8 or 12-bit RGB).
- DCF configured for 1000 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL line trigger signal.
- Matrox Helios eCL/XCL sending EXPOSURE1 (EXP CTL-CC2) and EXPOSURE2 (New Line-CC1) signals to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (PIXEL STROBE @ 40 MHz) and video data from camera.
- DCF used: [XIIMUS_2048CT-40_2048_12bitRBGVLS.DCF](#) (MEDIUM)
- DCF used: [XIIMUS_2048CT-40_2048_8bitRBGVLS.DCF](#) (BASE)



Mode 3: Fixed line scan rate with frame trigger

- Up to 2048 pixels/line.
- Camera Link BASE or MEDIUM interface (8 or 12-bit RGB).
- DCF configured for 1000 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL frame (virtual) trigger signal.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (EXP CTL-CC2) and EXPOSURE2 (New Line-CC1) signals to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (PIXEL STROBE @ 40 MHz) and video data from camera.
- DCF used: [XIIMUS_2048CT-40_2048_12bitRBGFLSFT.DCF](#) (MEDIUM)
- DCF used: [XIIMUS_2048CT-40_2048_12bitRBGFLSFT.DCF](#) (BASE)



Matrox Helios eCL/XCL

Camera Interface Application Note

TVI XIIMUS 2048CT-40

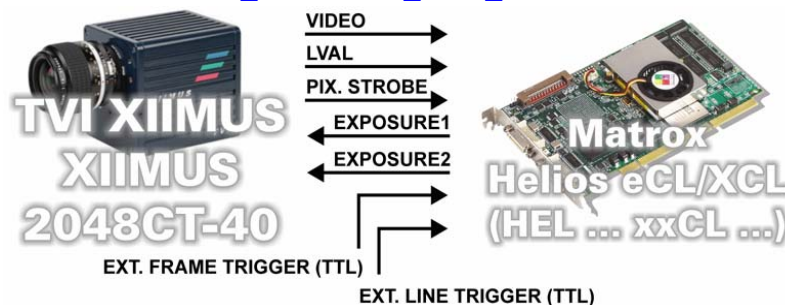
October 20, 2006

Basics about the
interface modes

Camera Interface Briefs (cont.)

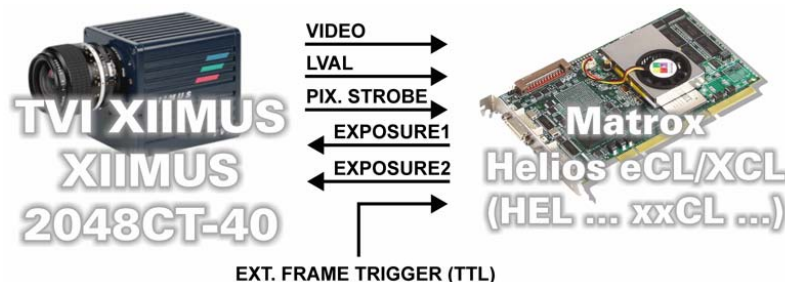
Mode 4: Variable line scan rate with frame trigger

- Up to 2048 pixels/line.
- Camera Link BASE or MEDIUM interface (8 or 12-bit RGB).
- DCF configured for 1000 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL frame (virtual) and line trigger signals.
- Matrox Helios eCL/XCL sending EXPOSURE1 (EXP CTL-CC2) and EXPOSURE2 (New Line-CC1) signals to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (PIXEL STROBE @ 40 MHz) and video data from camera.
- DCF used: [XIIMUS_2048CT-40_2048_12bitRBGVLSFT.DCF](#) (MEDIUM)
- DCF used: [XIIMUS_2048CT-40_2048_8bitRBGVLSFT.DCF](#) (BASE)



Mode 5: Fixed line scan rate with variable frame size

- Up to 2048 pixels/line.
- Camera Link BASE or MEDIUM interface (8 or 12-bit RGB).
- DCF configured for 1000 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL frame (virtual) trigger signal.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (EXP CTL-CC2) and EXPOSURE2 (New Line-CC1) signals to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (PIXEL STROBE @ 40 MHz) and video data from camera.
- DCF used: [XIIMUS_2048CT-40_2048_12bitRBGFLSVF.DCF](#) (MEDIUM)
- DCF used: [XIIMUS_2048CT-40_2048_8bitRBGFLSVF.DCF](#) (BASE)



Matrox Helios eCL/XCL

Camera Interface Application Note

TVI XIIMUS 2048CT-40

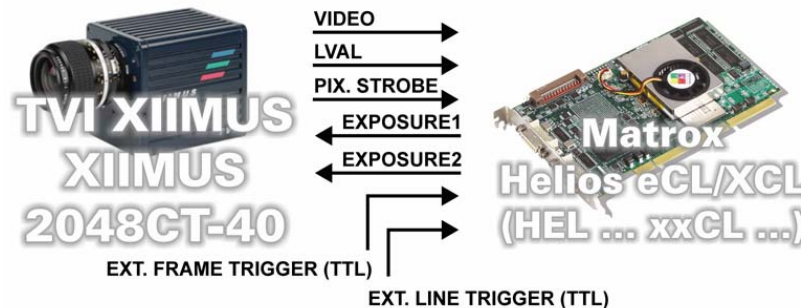
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Basics about the
interface modes

Camera Interface Briefs (cont.)

Mode 6: Variable line scan rate with variable frame size

- Up to 2048 pixels/line.
- Camera Link BASE or MEDIUM interface (8 or 12-bit RGB).
- DCF configured for 1000 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL frame (virtual) and line trigger signals.
- Matrox Helios eCL/XCL sending EXPOSURE1 (EXP CTL-CC2) and EXPOSURE2 (New Line-CC1) signals to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (PIXEL STROBE @ 40 MHz) and video data from camera.
- DCF used: [XIIMUS_2048CT-40_2048_12bitRBGVLSVF.DCF](#) (MEDIUM)
- DCF used: [XIIMUS_2048CT-40_2048_8bitRBGVLSVF.DCF](#) (BASE)



Specifics about the
interface modes

Camera Interface Details

Mode 1: Fixed line scan rate

- **Line rate:** The frequency of the periodic EXPOSURE1 (EXP CTL-CC2) signal determines the camera's line rate. The maximum line rate for this camera equals **18.5 kHz**.
- **Exposure time:** The exposure time is the period from the rising edge of EXPOSURE1 (EXP CTL-CC2) to the rising edge of the EXPOSURE2 (New Line-CC1) signal plus an internal delay of **550 ns**. The minimum exposure time can be set to **1.5 μs**. The exposure time can be modified in the DCF using Matrox Intellicam or with the MIL MdigControl() function. Consult the respective manual for more information.
- **Camera communication:** This DCF will work with **Free Run** and **Encoder Input Driven** modes. Set the mode to **MEDIUM 36** and **RGB** for the 12-bit MEDIUM interface DCF, and set the mode to **BASE 24** and **RGB** for the 8-bit BASE interface DCF via the XIICONF Configuration utility. Refer to the camera manual for additional information.

Matrox Helios eCL/XCL

Camera Interface Application Note

TVI XIIMUS 2048CT-40

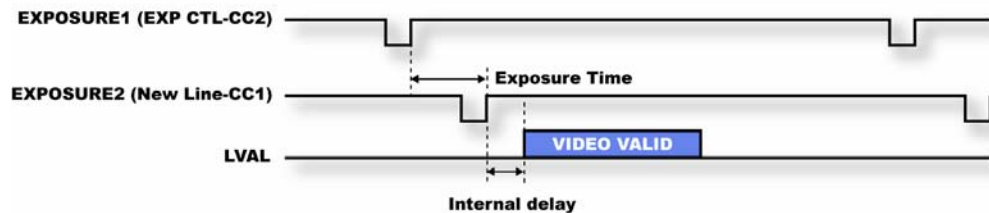
October 20, 2006

Specifics about the
interface modes

Camera Interface Details (cont.)

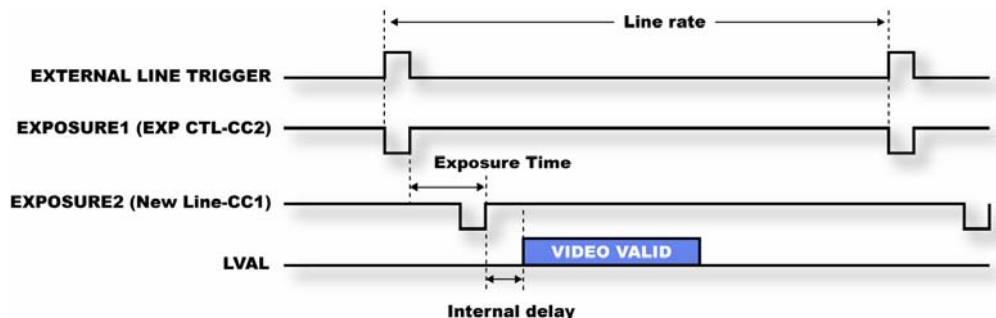
Mode 1: Fixed line scan rate

▪ Timing diagram:



Mode 2: Variable line scan rate

- **Line 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, the camera readout rate and the internal delay of the camera ($\approx 54 \mu\text{s}$).
- **Exposure time:** Exposure time is determined by the period between the rising edge of the EXPOSURE1 (EXP CTL-CC2) signal and the rising edge of the EXPOSURE2 (New Line-CC1) signal. The exposure time can be modified in the DCF using Matrox Intellicam or with the MIL MdigControl() function. Consult the respective manual for more information.
- **Camera communication:** Refer to Mode 1: Fixed line scan rate.
- **Timing diagram:**



Mode 3: Fixed line scan rate with frame trigger

- **Line/frame rate:** The line rate is fixed and controlled by the period of the EXPOSURE1 (EXP CTL-CC2) signal. 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 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.

Cont....

Matrox Helios eCL/XCL

Camera Interface Application Note

TVI XIIMUS 2048CT-40

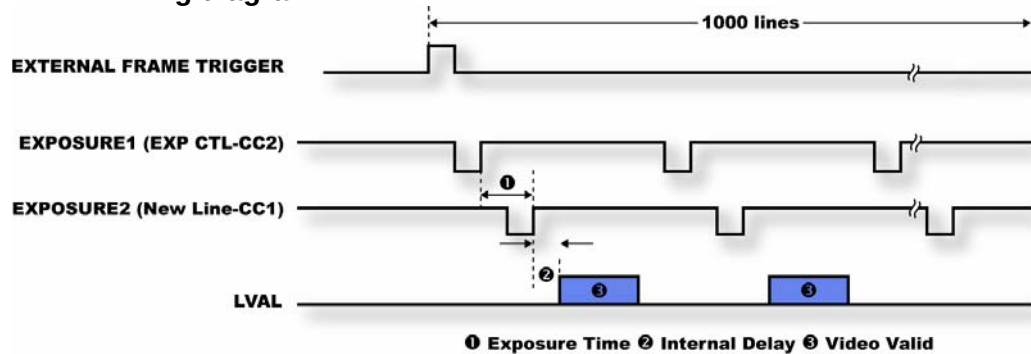
October 20, 2006

Specifics about the
interface modes

Camera Interface Details (cont.)

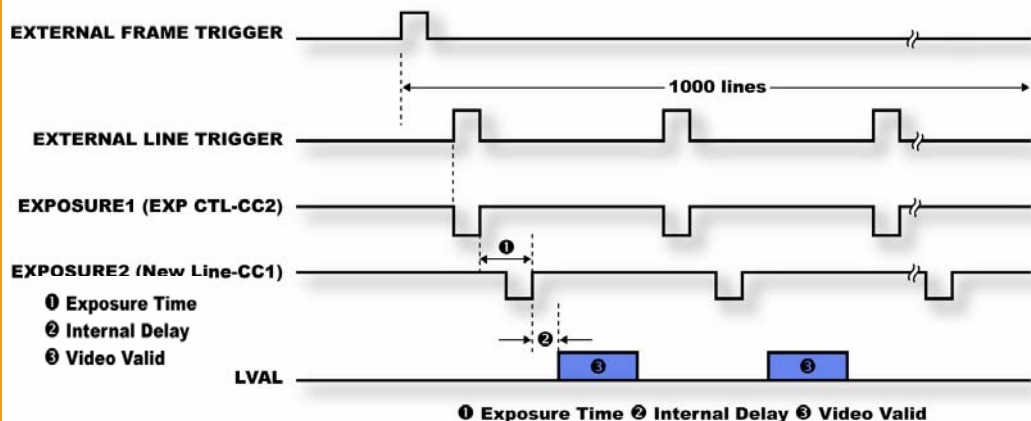
Mode 3: Fixed line scan rate with frame trigger

- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate.
- **Timing diagram:**



Mode 4: 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, plus the internal delay of the camera ($\approx 54 \mu\text{s}$). 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 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 2: Variable line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate.
- **Timing diagram:**



Matrox Helios eCL/XCL

Camera Interface Application Note

TVI XIIMUS 2048CT-40

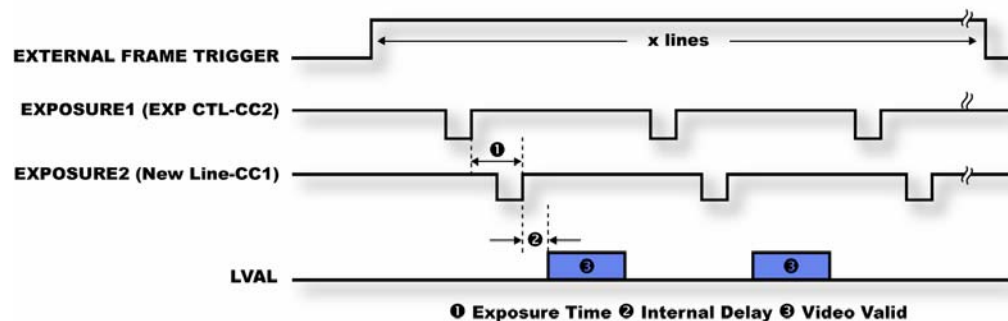
October 20, 2006

Specifics about the
interface modes

Camera Interface Details (cont.)

Mode 5: Fixed line scan rate with variable frame size

- **Line/frame rate:** The frequency of the periodic EXPOSURE1 (EXP CTL-CC2) signal determines the camera's line rate. The maximum line rate for this camera equals **18.5 kHz**. The number of lines per virtual frame is variable and controlled by the frame trigger signal. Matrox Helios eCL/XCL 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 and end with the rising edge and falling edge (respectively) 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:**



Mode 6: 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, plus the internal delay of the camera ($\approx 54 \mu\text{s}$). The number of lines per virtual frame is variable and controlled by the frame trigger signal. Matrox Helios eCL/XCL 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 and end with the rising edge and falling edge (respectively) 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.

Cont....

Matrox Helios eCL/XCL

Camera Interface Application Note

TVI XIIMUS 2048CT-40

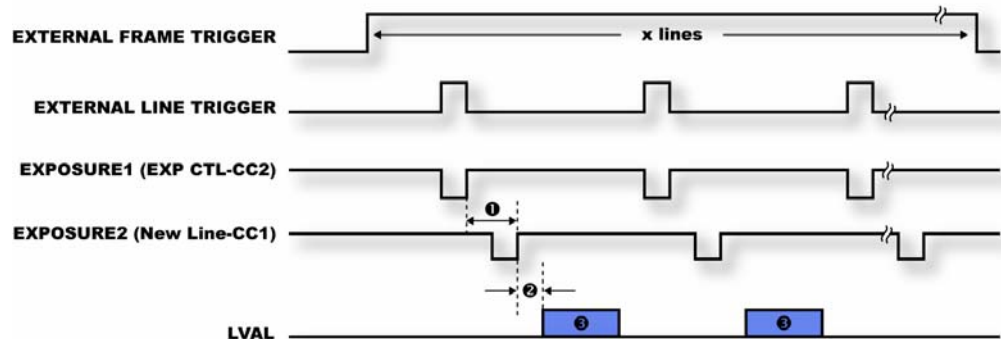
October 20, 2006

Specifics about the
interface modes

Camera Interface Details (cont.)

Mode 6: Variable line scan rate with variable frame size

▪ Timing diagram:



Cabling details for the
interface modes

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.
- **External trigger:** External line trigger should be connected to the OPTO TRIG input of the 9-pin connector (pins 7 and 2) on the External I/O adapter bracket:

EXTERNAL I/O BRACKET

(9-pin connector)

Pin Name	Pin no.		External Trigger Source
OPTO_AUX_IN0 +	07	←	LINE TRIGGER (TTL FORMAT)
OPTO_AUX_IN0 -	02	←	LINE TRIGGER (GROUND)

Mode 3: Fixed line scan rate with frame trigger

- **Cable and Connection:** Standard Camera Link.
- **External trigger:** External line trigger should be connected to the OPTO TRIG input of the 9-pin connector (pins 4 and 5) on the External I/O adapter bracket:

EXTERNAL I/O BRACKET

(9-pin connector)

Pin Name	Pin no.		External Trigger Source
OPTO_AUX_IN1 +	04	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN1 -	05	←	FRAME TRIGGER (GROUND)

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Cabling details for the
interface modes

Cabling Requirements

Mode 4: Variable line scan rate with frame trigger

- **Cable and Connection:** Standard Camera Link.
- **External trigger:** External frame and line triggers should be connected to the OPTO TRIG inputs of the 9-pin connector on the External I/O adapter bracket:

EXTERNAL I/O BRACKET (9-pin connector)

Pin name	Pin no.		External Trigger Sources Pin name
OPTO_AUX_IN1 +	04	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN1 -	05	←	FRAME TRIGGER (GROUND)
OPTO_AUX_IN0 +	07	←	LINE TRIGGER (TTL FORMAT)
OPTO_AUX_IN0 -	02	←	LINE TRIGGER (GROUND)

Mode 5: Fixed line scan rate with variable frame size

- **Cable and Connection:** Standard Camera Link.
- **External trigger:** External trigger should be connected to the OPTO TRIG input (pins 4 and 5) of the 9-pin connector on the External I/O adapter bracket:

EXTERNAL I/O BRACKET (9-pin connector)

Pin name	Pin no.		External Trigger Sources Pin name
OPTO_AUX_IN1 +	04	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN1 -	05	←	FRAME TRIGGER (GROUND)

Mode 6: Variable line scan rate with variable frame size

- **Cable and Connection:** Standard Camera Link.
- **External trigger:** External frame and line triggers should be connected to the OPTO TRIG inputs of the 9-pin connector on the External I/O adapter bracket:

EXTERNAL I/O BRACKET (9-pin connector)

Pin name	Pin no.		External Trigger Sources Pin name
OPTO_AUX_IN1 +	04	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN1 -	05	←	FRAME TRIGGER (GROUND)
OPTO_AUX_IN0 +	07	←	LINE TRIGGER (TTL FORMAT)
OPTO_AUX_IN0 -	02	←	LINE TRIGGER (GROUND)

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, 2007-2011.

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