

Matrox Helios eCL/XCL

Camera Interface Application Note

LORD Ingénierie DVL2048T

July 13, 2006

Basics about the camera

Camera Descriptions

- Effective resolution: Up to 2048 pixels/line @ up to 9.26k line per second.
- Camera Link BASE interface (single 8 or 16-bit tap).
- External and internal sync.
- External or internal exposure control.
- 20 MHz pixel clock rate.

Interface Mode

- Fixed line scan rate (continuous)
- Variable line scan rate (continuous)
- Fixed line scan rate with frame trigger (continuous)
- Variable line scan rate with frame trigger (continuous)
- Fixed line scan rate with variable frame size (continuous)
- Variable line scan rate with variable frame size (continuous)

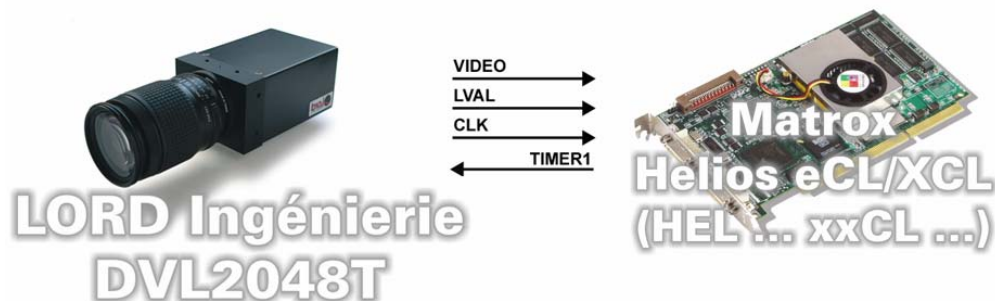
Camera Interface Briefs

Mode 1: Fixed line scan rate

- 2048 pixels/line.
- Camera Link BASE interface (single 16-bit tap).
- DCF configured for 1000 lines per virtual frame.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (CIEXT) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 20 MHz) and video data from camera.
- DCF used: [DVL2048T_2048_16bit1tapFLS.DCF](#)

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

Basics about the interface modes



Matrox Helios eCL/XCL

Camera Interface Application Note

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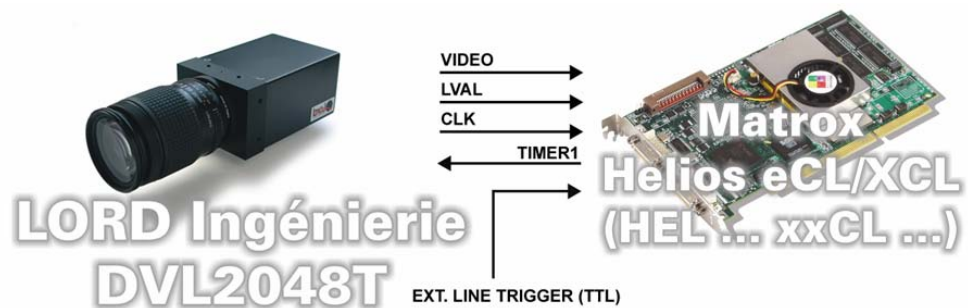
July 13, 2006

Basics about the
interface modes

Camera Interface Briefs (cont.)

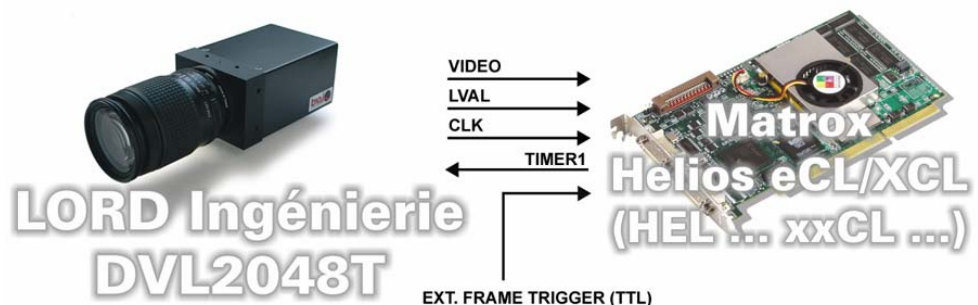
Mode 2: Variable line scan rate

- 2048 pixels/line.
- Camera Link BASE interface (single 16-bit tap).
- DCF configured for 1000 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL line trigger signal.
- Matrox Helios eCL/XCL sending EXPOSURE1 (CIEXT) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 20 MHz) and video data from camera.
- DCF used: [DVL2048T_2048_16bit1tapVLS.DCF](#)



Mode 3: Fixed line scan rate with frame trigger

- 2048 pixels/line.
- Camera Link BASE interface (single 16-bit tap).
- 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 (CIEXT) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 20 MHz) and video data from camera.
- DCF used: [DVL2048T_2048_16bit1tapFLSFT.DCF](#)



Matrox Helios eCL/XCL

Camera Interface Application Note

LORD Ingénierie DVL2048T

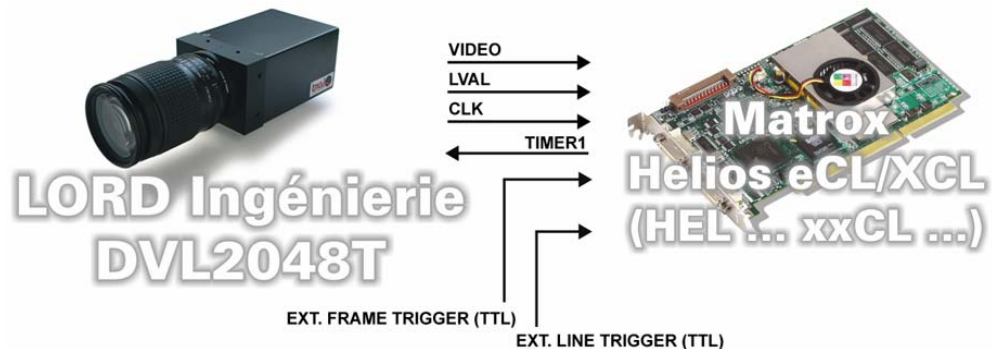
July 13, 2006

Basics about the
interface modes

Camera Interface Briefs (cont.)

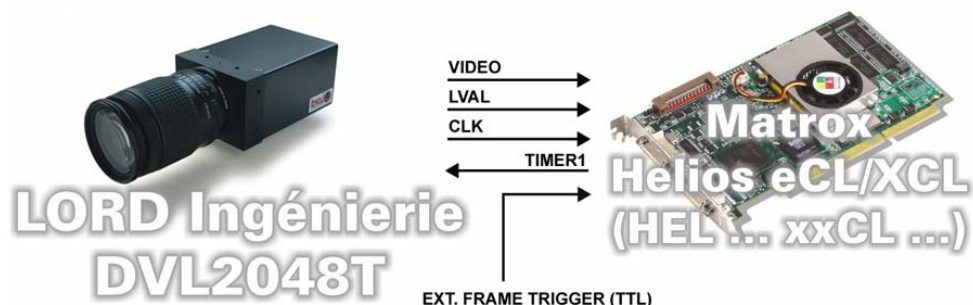
Mode 4: Variable line scan rate with frame trigger

- 2048 pixels/line.
- Camera Link BASE interface (single 16-bit tap).
- 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 (CIEXT) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 20 MHz) and video data from camera.
- DCF used: [DVL2048T_2048_16bit1tapVLSFT.DCF](#)



Mode 5: Fixed line scan rate with variable frame size

- 2048 pixels/line.
- Camera Link BASE interface (single 16-bit tap).
- 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 (CIEXT) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 20 MHz) and video data from camera.
- DCF used: [DVL2048T_2048_16bit1tapFLSVF.DCF](#)



Matrox Helios eCL/XCL

Camera Interface Application Note

LORD Ingénierie DVL2048T

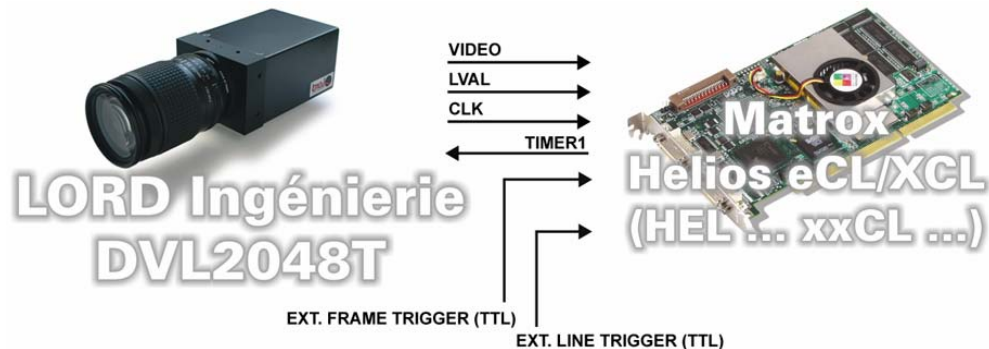
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Basics about the
interface modes

Camera Interface Briefs (cont.)

Mode 6: Variable line scan rate with variable frame size

- 2048 pixels/line.
- Camera Link BASE interface (single 16-bit tap).
- 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 (CIEXT) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 20 MHz) and video data from camera.
- DCF used: [DVL2048T_2048_16bit1tapVLSVF.DCF](#)



Specifics about the
interface modes

Camera Interface Details

Mode 1: Fixed line scan rate

- **Line rate:** The frequency of the periodic EXPOSURE1 (CIEXT) signal determines the camera's line rate. The maximum line rate for this camera equals **9.26 kHz**.
- **Exposure time:** For **continuous** mode the exposure time is between the rising edges of the EXPOSURE1 (CIEXT) signal. The default exposure time for this DCF is **115 µs**. Maximum/minimum exposure time per line for this DCF is **839 ms** and **50 ns** respectively. 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 the **continuous** and **continuous** modes. Set the mode via the Camera Link communication. Refer to the camera manual for additional information.

Menu	Cmd	Value	Function
User settings	U	00	Continuous mode
User settings	C	0	16 bits

Matrox Helios eCL/XCL

Camera Interface Application Note

LORD Ingénierie DVL2048T

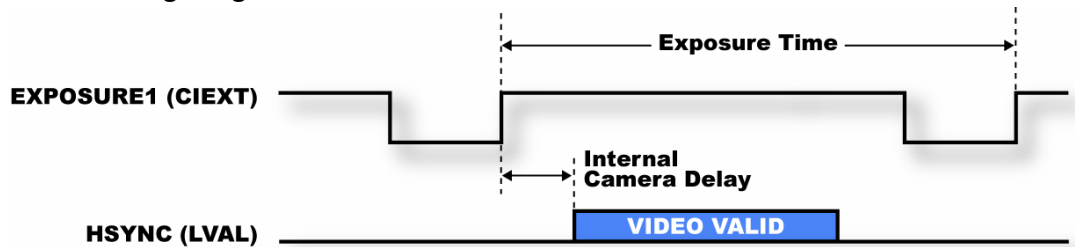
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Specifics about the
interface modes

Camera Interface Details (cont.)

Mode 1: Fixed line scan rate (cont.)

▪ Timing diagram:

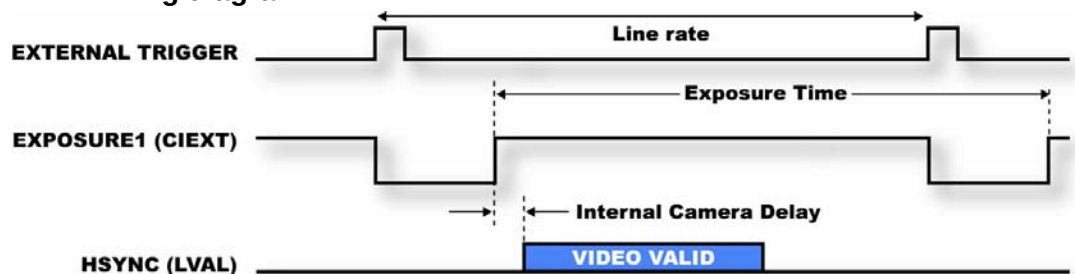


Mode 2: Variable line scan rate

- **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 low level duration of the timer and the internal delay of the camera ($\approx 4.4 \mu\text{s}$). However, the line trigger cannot be faster than the maximum line rate output by the camera (**9.26 kHz**).
- **Exposure time:** For **continuous** mode the exposure time is between the rising edges of the EXPOSURE1 (CIEXT) signal. In this case, the exposure time will be equal to the external line trigger rate. Therefore it is important to send a constant line trigger in order to have a similar exposure time for every line. If the external trigger signals vary, there will be a varying intensity for each line. Consult the respective manual for more information.
- **Camera communication:** This DCF will work with **continuous** mode only. Set the mode via the Camera Link communication. Refer to the camera manual for additional information.

Menu	Cmd	Value	Function
User settings	U	00	Continuous mode
User settings	C	0	16 bits

▪ Timing diagram:



Matrox Helios eCL/XCL

Camera Interface Application Note

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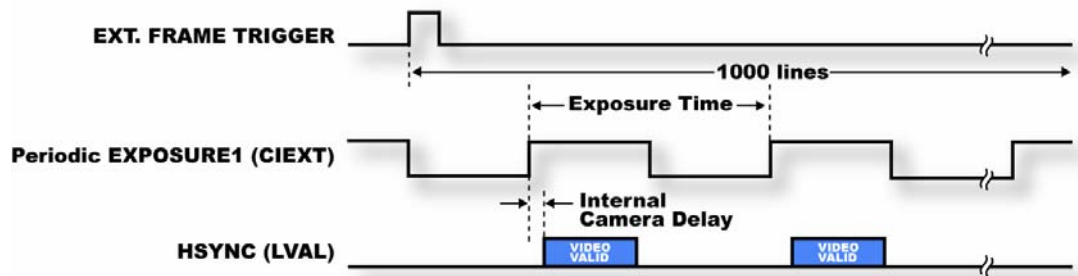
July 13, 2006

Specifics about the
interface modes

Camera Interface Details (cont.)

Mode 3: Fixed line scan rate with frame trigger

- **Line/frame rate:** The line rate is fixed and controlled by the frequency of EXPOSURE1 (CIEXT) signal. The default exposure time for this DCF is **115 μ s** (for continuous mode). 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.
- **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 low level duration of the timer and the internal delay of the camera ($\approx 4.4 \mu$ s). However, the line trigger cannot be faster than the maximum line rate output by the camera (**9.26 kHz**). 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 2: Variable line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate.

Continued....

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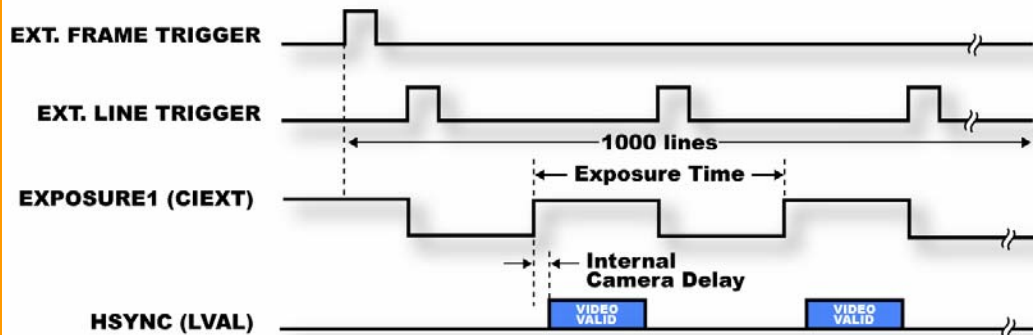
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Specifics about the
interface modes

Camera Interface Details (cont.)

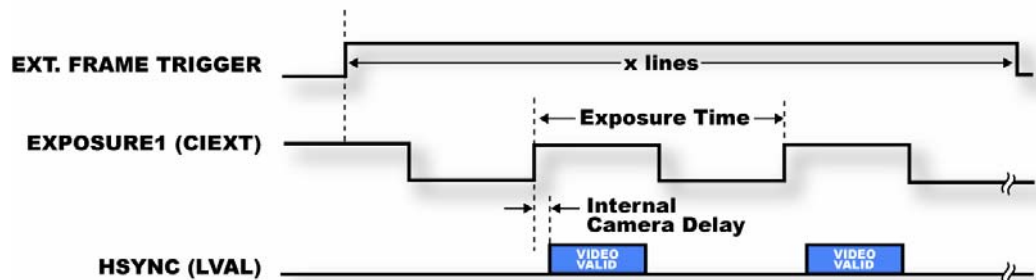
Mode 4: Variable line scan rate with frame trigger

- Timing diagram:



Mode 5: Fixed line scan rate with variable frame size

- **Line/frame rate:** The line rate is fixed and controlled by the frequency of EXPOSURE1 (CIEXT) signal. The default exposure time for this DCF is **115 μ s** (for continuous mode). The number of lines per virtual frame (maximum of 1000 for this DCF) 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 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 Helios eCL/XCL

Camera Interface Application Note

LORD Ingénierie DVL2048T

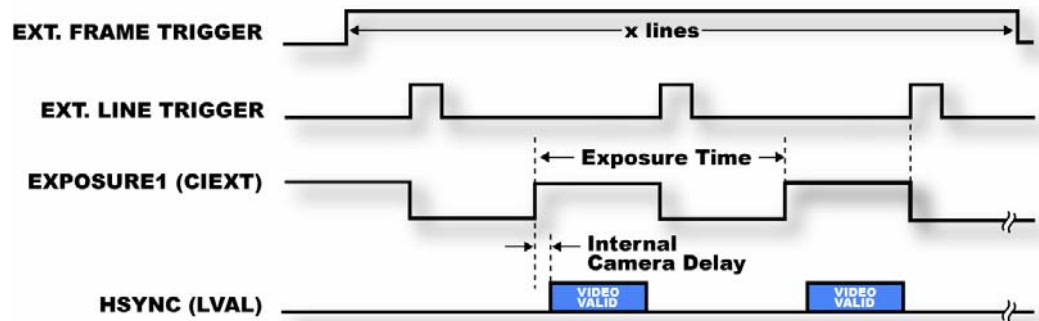
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Specifics about the
interface modes

Camera Interface Details (cont.)

Mode 6: Variable line scan rate with variable frame size

- **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 low level duration of the timer and the internal delay of the camera ($\approx 4.4 \mu\text{s}$). However, the line trigger cannot be faster than the maximum line rate output by the camera (**9.26 kHz**). The number of lines per virtual frame (maximum of 1000 for this DCF) 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 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:**



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 Pin Name
OPTO_AUX_IN0 +	07	←	LINE TRIGGER (TTL FORMAT)
OPTO_AUX_IN0 -	02	←	LINE TRIGGER (GROUND)

Matrox Helios eCL/XCL

Camera Interface Application Note

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July 13, 2006

Specifics about the
interface modes

Cabling Requirements

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 Pin Name
OPTO_AUX_IN1 +	04	←	FRAME TRIGGER (TTL FORMAT)
OPTO_AUX_IN1 -	05	←	FRAME TRIGGER (GROUND)

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)

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Cabling details for the
interface modes

Cabling Requirements

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, 2006-2011.

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