Matrox Helios eCL/XCL

Camera Interface Application Note

LORD Ingénierie DVL7500T2 July 13, 2006

Basics about the camera

Camera Descriptions

- Effective resolution: Up to 7500 pixels/line @ up to 5.2k line per second.
- Camera Link BASE interface (single 8 or 16-bit tap).
- External and internal sync.
- External or internal exposure control.
- 40 MHz pixel clock rate.

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

Interface Mode

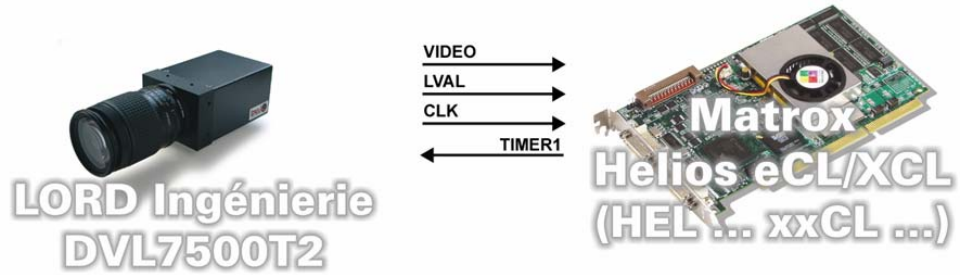
- Fixed line scan rate (continuous)
- Variable line scan rate (Exposure Control)
- Fixed line scan rate with frame trigger (continuous)
- Variable line scan rate with frame trigger (Exposure Control)
- Fixed line scan rate with variable frame size (continuous)
- Variable line scan rate with variable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

Basics about the interface modes

Camera Interface Briefs

Mode 1: Fixed line scan rate

- 7500 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 @ 40 MHz) and video data from camera.
- DCF used: DVL7500T2_7500_16bit1tapFLS.DCF



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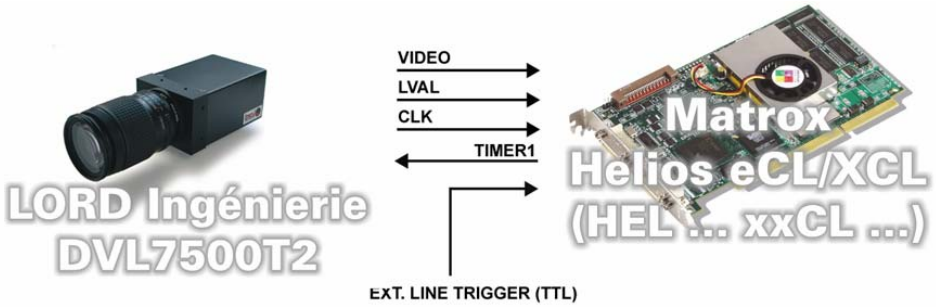
Basics about the interface modes

Camera Interface Briefs (cont.)

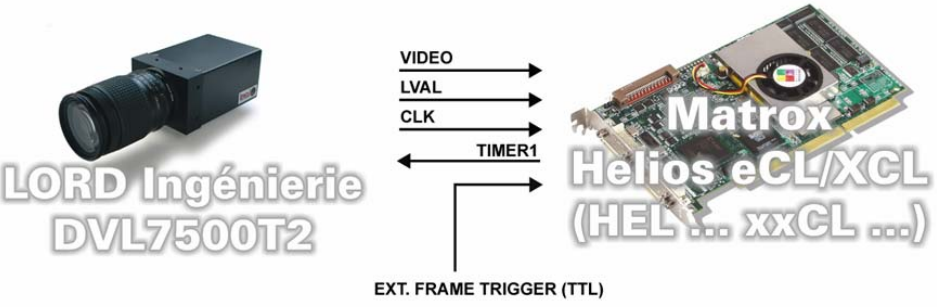
Mode 2: Variable line scan rate

- 7500 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 @ 40 MHz) and video data from camera.
- DCF used: DVL7500T2_7500_16bit1tapVLS.DCF



Mode 3: Fixed line scan rate with frame trigger

- 7500 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 @ 40 MHz) and video data from camera.
- DCF used: DVL7500T2_7500_16bit1tapFLSFT.DCF



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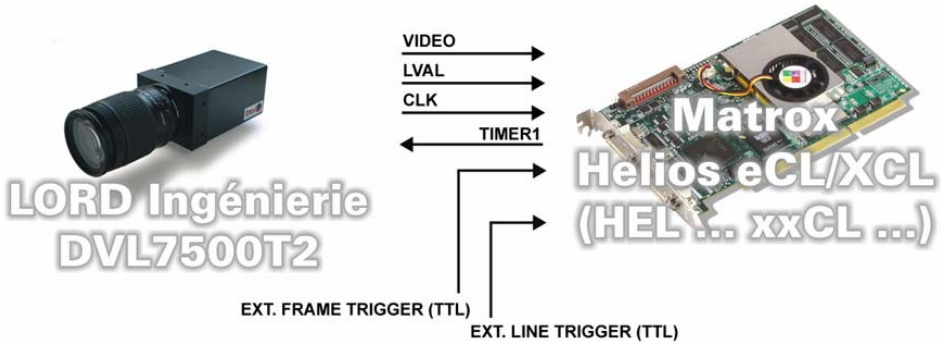
Basics about the interface modes

Camera Interface Briefs (cont.)

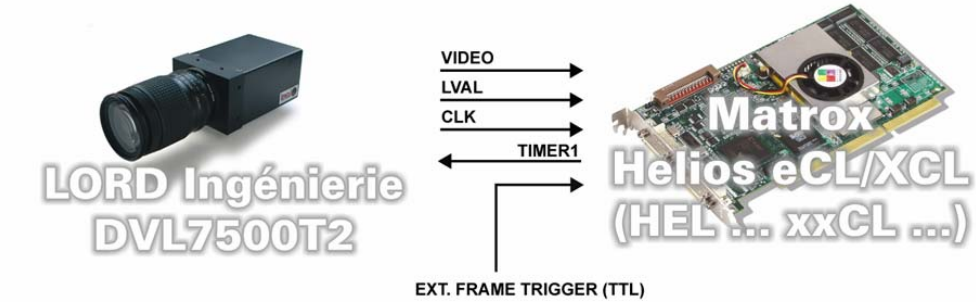
Mode 4: Variable line scan rate with frame trigger

- 7500 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 @ 40 MHz) and video data from camera.
- DCF used: DVL7500T2_7500_16bit1tapVLSFT.DCF



Mode 5: Fixed line scan rate with variable frame size

- 7500 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 @ 40 MHz) and video data from camera.
- DCF used: DVL7500T2_7500_16bit1tapFLSVF.DCF



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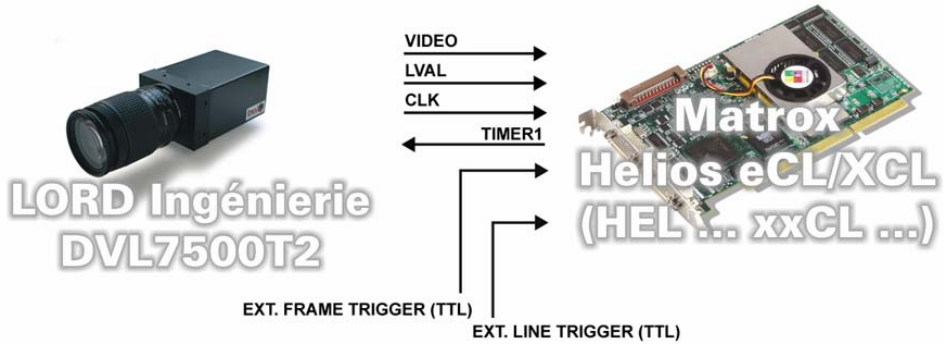
Basics about the interface modes

Camera Interface Briefs (cont.)

Mode 6: Variable line scan rate with variable frame size

- 7500 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 @ 40 MHz) and video data from camera.
- DCF used: DVL7500T2_7500_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 **5.2 kHz**.
- **Exposure time:** For **continuous** mode the exposure time is the period between the rising edges of the EXPOSURE1 (CIEXT) signal. The default exposure time for this DCF is **198 µs**. Maximum/minimum exposure time per line for this DCF is **419 ms** and **25 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 only with the **continuous** mode. Set the mode via the Camera Link communication. Refer to the camera manual for additional information.

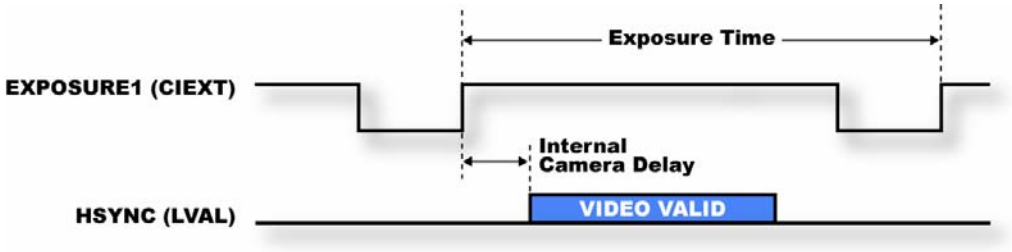
Menu	Cmd	Value	Function
User settings	U	00	Continuous mode
User settings	C	0	16 bits

Specifics about the interface modes

Camera Interface Details (cont.)

Mode 1: Fixed line scan rate (cont.)

- **Timing diagram:**

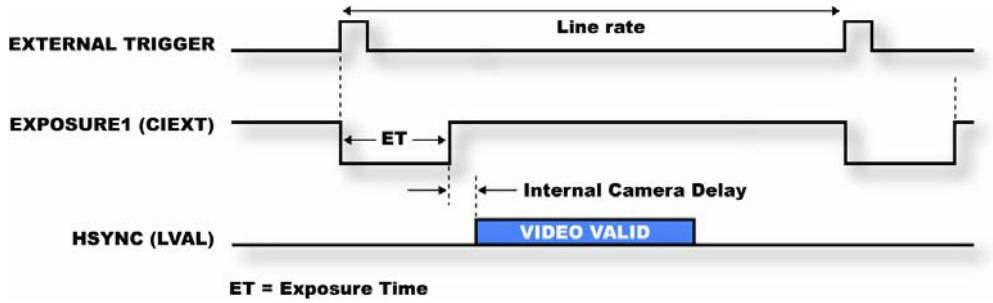


Mode 2: Variable line scan rate

- **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 total duration of the exposure time (low level duration of the timer) and the internal delay of the camera (**≈4.4 µs**). However the line trigger cannot be faster than the camera's maximum line rate (**5.2 KHz**).
- **Exposure time:** For **exposure control** mode (Emulated Shutter mode) the exposure time is the inactive (low level) period between the falling and rising edges of the EXPOSURE1 (CIEXT) signal. The default exposure time for this DCF is **200 µs**. Note that with this mode, the camera must have an exposure time longer than the readout time (minimum exposure time = readout + delay = **193 µs**) The maximum/minimum exposure time per line for this DCF is **419 ms** and **25 ns** respectively. The exposure time can be modified in the DCF using Matrox Intellicam, ONL imCamControl() or imDigControl() function, or with the MIL MdigControl() function. Consult the respective manual for more information.
- **Camera communication:** This DCF will work with **exposure control** 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	20	Exposure control mode
User settings	C	0	16 bits

- **Timing diagram:**

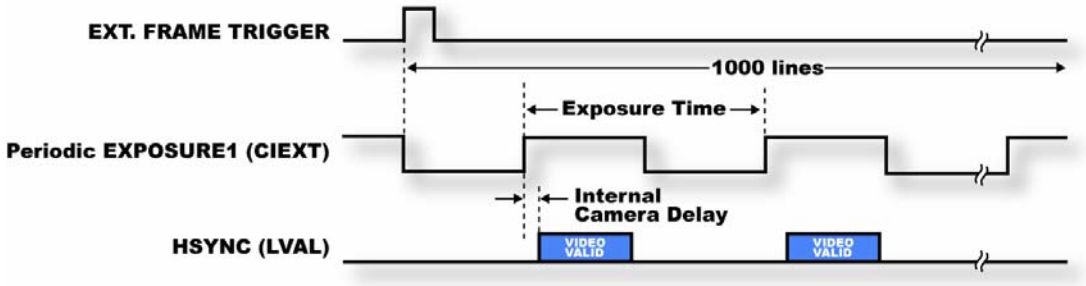


Specifics about the interface modes

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 **198 µs** (for exposure control 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 total duration of the exposure time (low level duration of the timer) and the internal delay of the camera (**≈4.4 µs**). However the line trigger cannot be faster than the camera's maximum line rate (**5.2 KHz**). The default exposure time for this DCF is **200 µs**. 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.

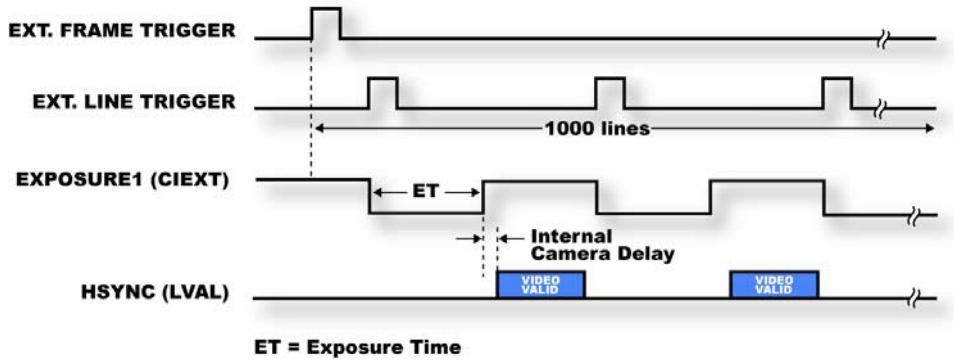
Continued....

Specifics about the interface modes

Camera Interface Details (cont.)

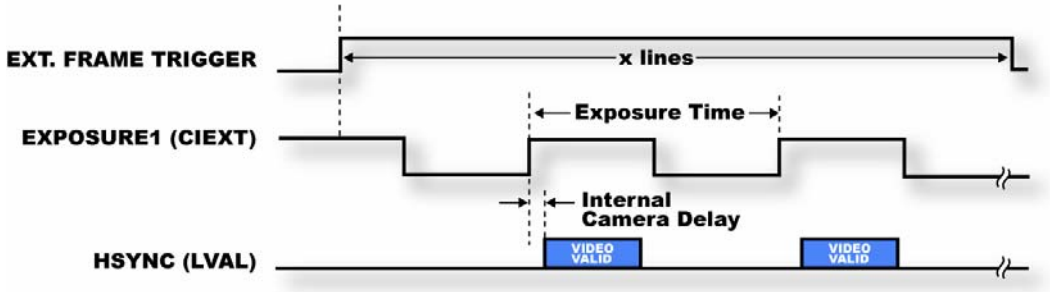
Mode 4: Variable line scan rate with frame trigger

- **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 **198 µs** (for exposure control 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:**



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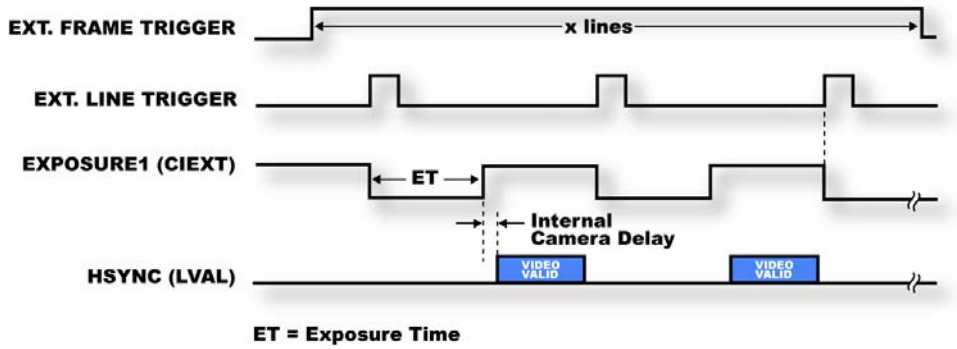
Specifics about the interface modes

Camera Interface Details (cont.)

Mode 6: Variable line scan rate with variable frame size

- **Line/frame rate**: The line rate is variable and controlled by the external line trigger frequency. The default exposure time for this DCF is **200 µs**. 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:**



ET = Exposure Time

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

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)			**External Trigger Source**
Pin Name	**Pin no.**		**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)			**External Trigger Sources**
Pin name	**Pin no.**		**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)			**External Trigger Sources**
Pin name	**Pin no.**		**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)			External Trigger Sources
Pin name	**Pin no.**		**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)

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