Matrox Odyssey Xpro

Camera Interface Application Note

Fairchild Imaging OWL* April 16, 2008

Basics about the camera

Camera Descriptions

- Effective resolution: 2048 pixels/line @ 38k line per second (RDI).
- Camera Link BASE interface (two 12-bit taps).
- External or internal sync.
- External or internal exposure control.
- 40 MHz pixel clock rate.

*(CAM/CMOS-2K.LS)

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

Interface Mode

- Fixed line scan rate (ExSync Synchronization with Electronic Shutter Control or Free Running)
- Variable line scan rate (*)
- Fixed line scan rate with frame trigger (*)
- Variable line scan rate with frame trigger (*)
- Fixed line scan rate with variable frame size (*)
- Variable line scan rate with variable frame size (*)

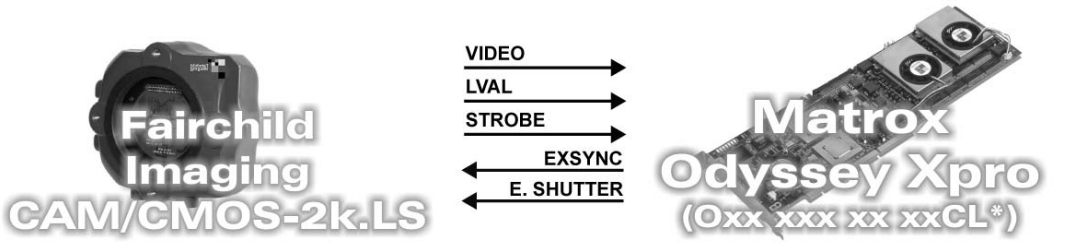
*ExSync Synchronization with Electronic Shutter Control

Basics about the interface modes

Camera Interface Briefs

Mode 1: Fixed line scan rate

- 2048 pixels/line.
- Camera Link BASE interface (two 12-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (40 MHz) and video data from camera.
- DCF used: CAM2KCMOS_2048_12bit2tapsFLS.DCF



***Matrox Odyssey Xpro main board with Camera Link grab module**

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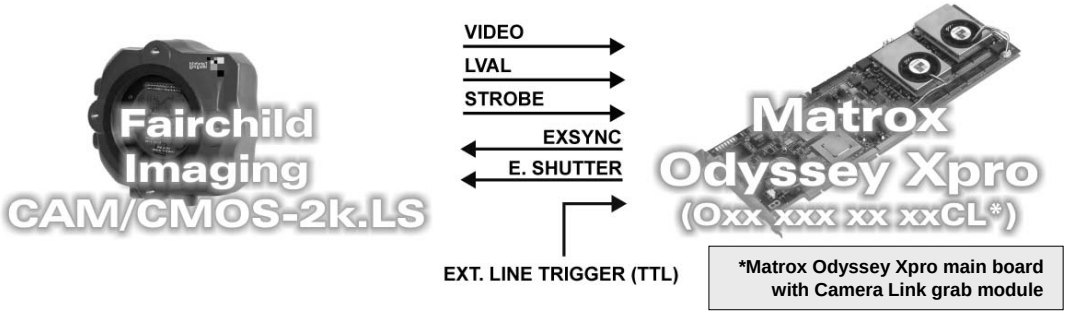
Basics about the interface modes

Camera Interface Briefs (cont.)

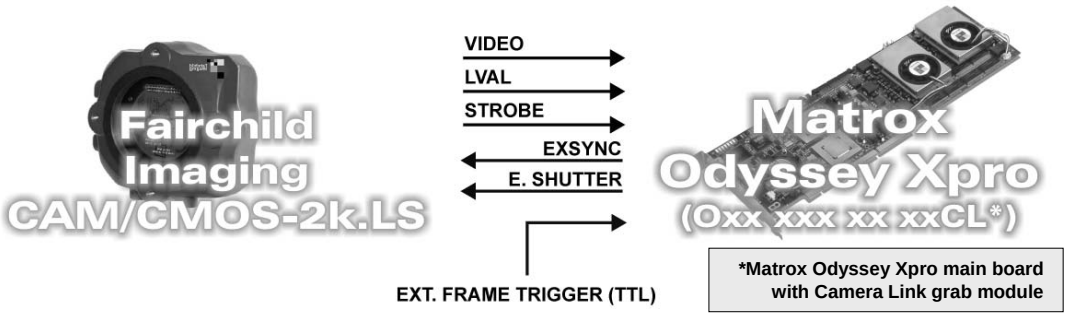
Mode 2: Variable line scan rate

- 2048 pixels/line.
- Camera Link BASE interface (two 12-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro receiving external TTL line trigger signal.
- Matrox Odyssey Xpro sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (40 MHz) and video data from camera.
- DCF used: CAM2KCMOS_2048_12bit2tapsVLS.DCF



Mode 3: Fixed line scan rate with frame trigger

- 2048 pixels/line.
- Camera Link BASE interface (two 12-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro receiving external TTL frame (virtual) trigger signal.
- Matrox Odyssey Xpro sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (40 MHz) and video data from camera.
- DCF used: CAM2KCMOS_2048_12bit2tapsFLSFT.DCF

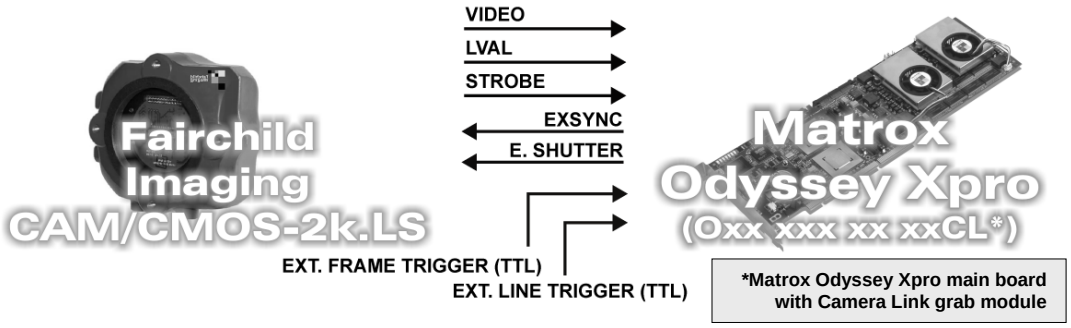


Basics about the interface modes

Camera Interface Briefs (cont.)

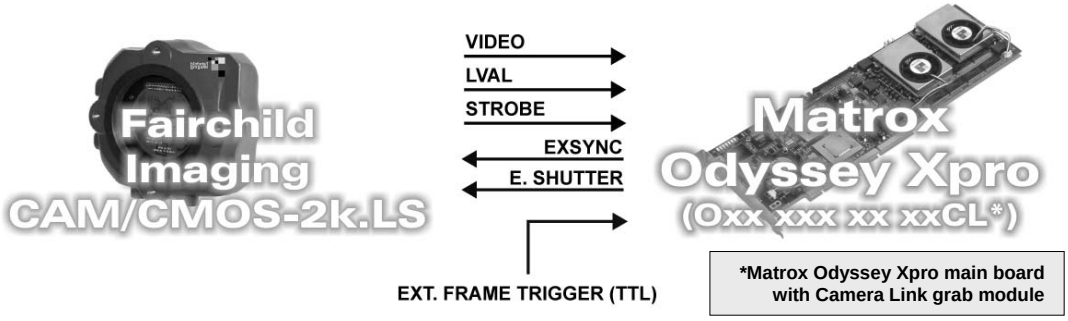
Mode 4: Variable line scan rate with frame trigger

- 2048 pixels/line.
- Camera Link BASE interface (two 12-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro receiving external TTL frame (virtual) and line trigger signals.
- Matrox Odyssey Xpro sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (40 MHz) and video data from camera.
- DCF used: CAM2KCMOS_2048_12bit2tapsVLSFT.DCF



Mode 5: Fixed line scan rate with variable frame size

- 2048 pixels/line.
- Camera Link BASE interface (two 12-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro receiving external TTL frame (virtual) trigger signal.
- Matrox Odyssey Xpro sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (40 MHz) and video data from camera.
- DCF used: CAM2KCMOS_2048_12bit2tapsFLSVF.DCF



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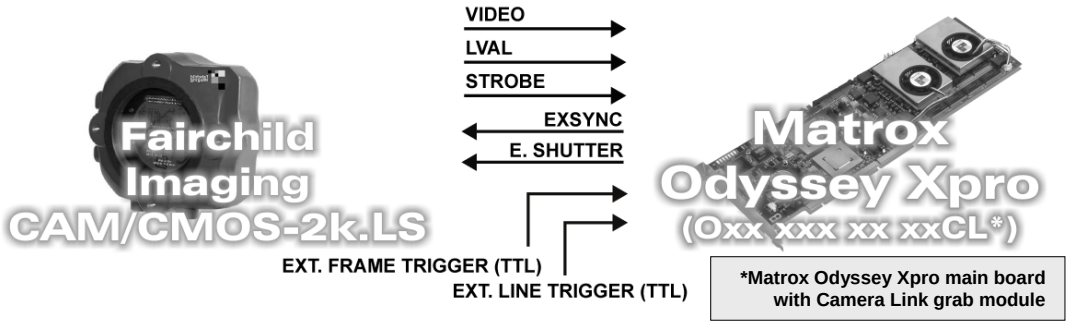
Basics about the interface modes

Camera Interface Briefs (cont.)

Mode 6: Variable line scan rate with variable frame size

- 2048 pixels/line.
- Camera Link BASE interface (two 12-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey Xpro receiving external TTL frame (virtual) and line trigger signals.
- Matrox Odyssey Xpro sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey Xpro receiving HSYNC (LVAL), PIXEL CLOCK (40 MHz) and video data from camera.
- DCF used: CAM2KCMOS_2048_12bit2tapsVLSVF.DCF



Specifics about the interface modes

Camera Interface Details

Mode 1: Fixed line scan rate

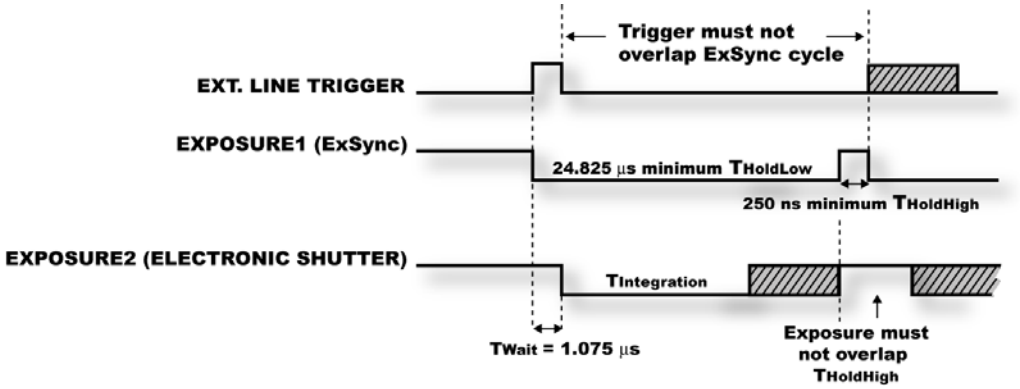
- **Line rate:** The frequency of the periodic EXPOSURE1 (EXSYNC) signal determines the camera's line rate. The EXPOSURE1 (EXSYNC) signal period is set in the DCF to **26.25 µs** which translates into a **38 kHz** line rate. The maximum line rate for this camera equals **38 kHz**.
- **Exposure time:** For **ExSync Synchronization with Electronic Shutter Control** mode the exposure time is the pulse (low level) period between the falling and rising edges of the EXPOSURE2 (Electronic Shutter) signal. The default exposure time for this DCF equals **24.8 µs**. Maximum/minimum exposure time per line for this DCF is **24.8 ms** to **0.2s** 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.

Specifics about the interface modes

Camera Interface Details (cont.)

Mode 1: Fixed line scan rate

- **Timing diagram:**

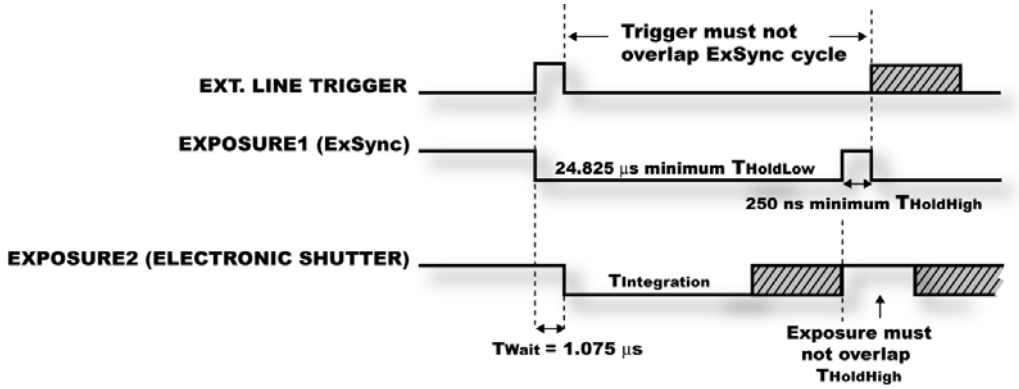


- **Camera communication:** This DCF will work with **Free Running** and **ExSync Synchronization with Electronic Shutter Control** modes. Set the mode using Windows HyperTerminal and one of the following commands:

Command	Description
SSM 1	Set Sync Mode to **Free run mode**
SSM 4	Set Sync Mode to **External Sync, electronic shutter**

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 1 time (low level duration of the timer), the internal delay of the camera (**0.88 µs**) and the line read out (**25.6 µs**).
- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Timing diagram:**



Specifics about the interface modes

Camera Interface Details (cont.)

Mode 2: Variable line scan rate

- **Camera communication:** This DCF will work with **ExSync Synchronization with Electronic Shutter Control** mode. Set the mode using Windows HyperTerminal and the following command:

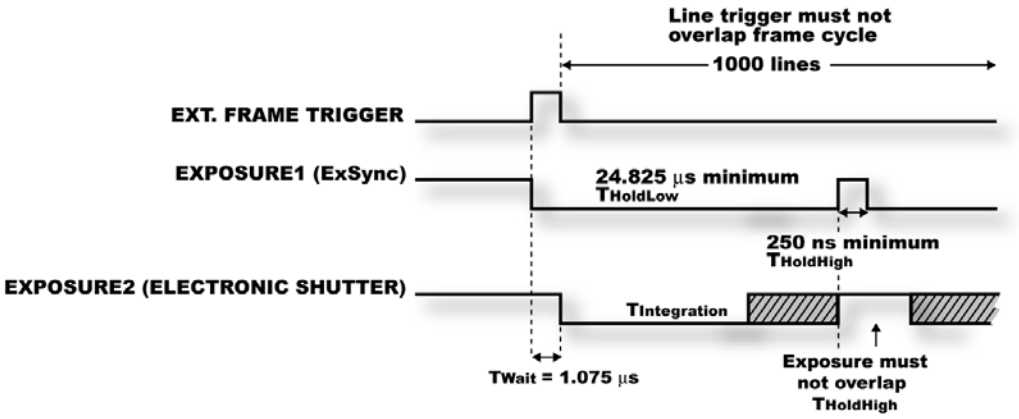
Command	Description
SSM 4	Set Sync Mode to **External Sync, electronic shutter**

Mode 3: Fixed line scan rate with frame trigger

- **Line/frame rate**: The line rate is fixed and controlled by the period of EXPOSURE1 (EXSYNC) 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 (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:** This DCF will work with **ExSync Synchronization** modes (see below). Set the mode using Windows HyperTerminal and one of the following commands:

Command	Description
SSM 2	Set Sync Mode to **External Sync**
SSM 3	Set Sync Mode to **External Sync, fixed integration**
SSM 4	Set Sync Mode to **External Sync, electronic shutter**

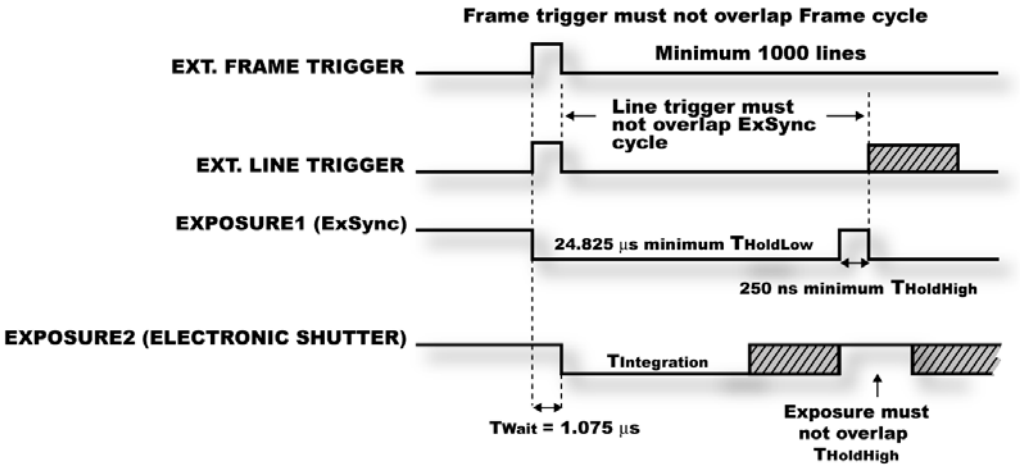
- **Timing diagram:**



Specifics about the interface modes

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), the internal delay of the camera (**0.88 µs**) and the line read out (**25.6 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 (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 2: Variable line scan rate.
- **Timing diagram:**



Mode 5: Fixed line scan rate with variable frame size

- **Line/frame rate**: The line rate is fixed and controlled by the period of EXPOSURE1 (EXSYNC) signal. The number of lines per virtual frame (maximum of 1000 for this DCF) is variable and controlled by the frame trigger signal. Matrox Odyssey Xpro 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 3: Fixed line scan rate with frame trigger.

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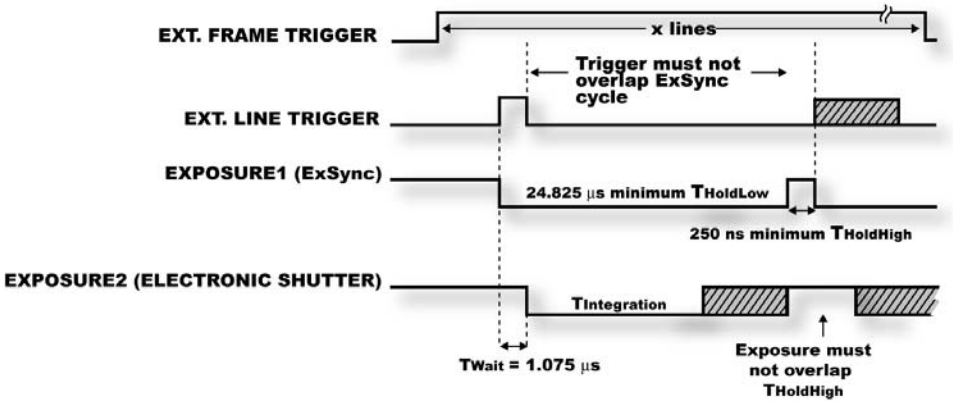
Specifics about the interface modes

Camera Interface Details (cont.)

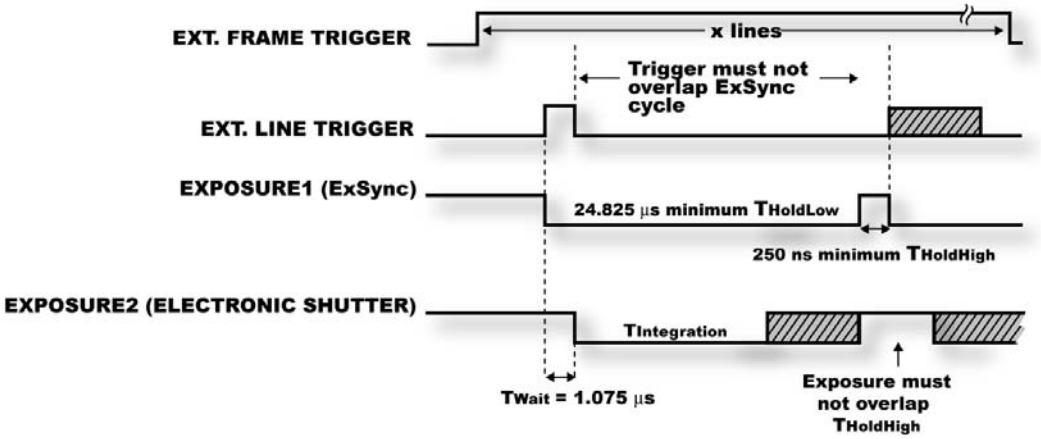
Mode 5: Fixed line scan rate with variable frame size

- **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 number of lines per virtual frame (maximum of 1000 for this DCF) is variable and controlled by the frame trigger signal. Matrox Odyssey Xpro 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:**



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)

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)

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Cabling details for the interface modes

Cabling Requirements

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)

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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