

Matrox Odyssey eCL/XCL

Camera Interface Application Note

DALSA Piranha3 (P3-8x-12k40)

March 18, 2009

Basics about the camera

Camera Descriptions

- Effective resolution: up to 12288 pixels/line @ 23.5k line per second.
- Camera Link FULL or MEDIUM interface (four 12-bit taps and eight 8-bit taps).
- External and internal sync.
- External or internal exposure control.
- 40 or 80 MHz pixel clock rate.

Interface Mode

- Fixed line scan rate (Smart EXSYNC¹)
- Variable line scan rate (Smart EXSYNC mode)
- Fixed line scan rate with frame trigger (Smart EXSYNC mode¹)
- Variable line scan rate with frame trigger (Smart EXSYNC mode)
- Fixed line scan rate with variable frame size (Smart EXSYNC mode¹)
- Variable line scan rate with variable frame size (Smart EXSYNC mode)

Camera Interface Briefs

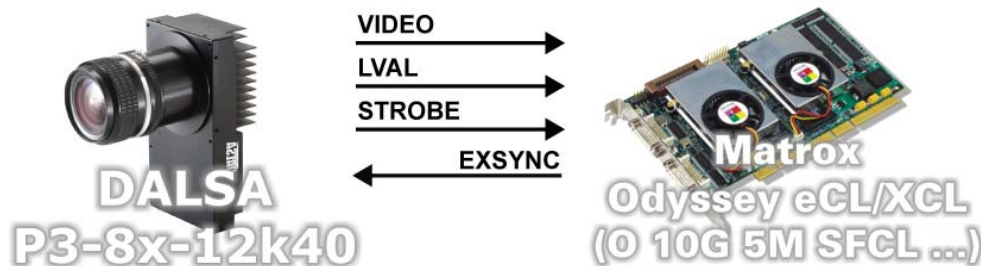
1. or Free Run mode

Mode 1: Fixed line scan rate

- Up to 12288 pixels/line.
- Camera Link FULL or MEDIUM interface (four 12-bit taps and eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey eCL/XCL sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey eCL/XCL receiving HSYNC (LVAL), PIXEL CLOCK (four 12-bit taps: STROBE @ 80 MHz and eight 8-bit taps: STROBE @ 40 MHz) and video data from camera.
- DCF used: [P38x12k40_12288_8bit8tapsFLS.DCF](#)
- DCF used: [P38x12k40_12288_12bit4tapsFLS.DCF](#)

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

Basics about the interface modes



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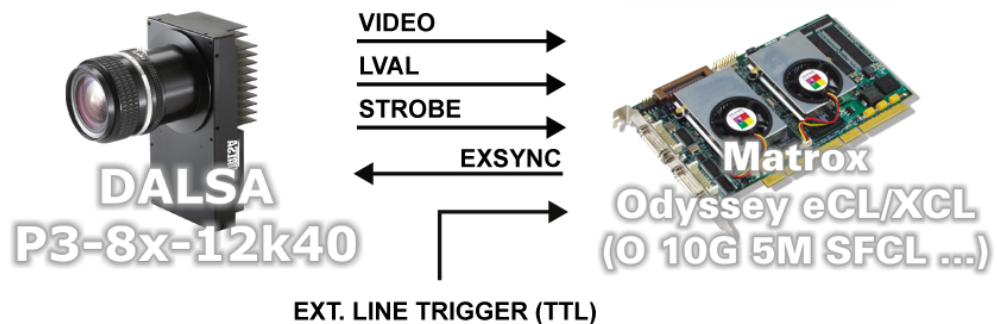
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Basics about the
interface modes

Camera Interface Briefs (cont.)

Mode 2: Variable line scan rate

- Up to 12288 pixels/line.
- Camera Link FULL or MEDIUM interface (four 12-bit taps and eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey eCL/XCL receiving external TTL line trigger signal.
- Matrox Odyssey eCL/XCL sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey eCL/XCL receiving HSYNC (LVAL), PIXEL CLOCK (four 12-bit taps: STROBE @ 80 MHz and eight 8-bit taps: STROBE @ 40 MHz) and video data from camera.
- DCF used: [P38x12k40_12288_8bit8tapsVLS.DCF](#)
- DCF used: [P38x12k40_12288_12bit4tapsVLS.DCF](#)



Mode 3: Fixed line scan rate with frame trigger

- Up to 12288 pixels/line.
- Camera Link FULL or MEDIUM interface (four 12-bit taps and eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey eCL/XCL receiving external TTL frame (virtual) trigger signal.
- Matrox Odyssey eCL/XCL sending periodic EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey eCL/XCL receiving HSYNC (LVAL), PIXEL CLOCK (four 12-bit taps: STROBE @ 80 MHz and eight 8-bit taps: STROBE @ 40 MHz) and video data from camera.
- DCF used: [P38x12k40_12288_8bit8tapsFLSFT.DCF](#)
- DCF used: [P38x12k40_12288_12bit4tapsFLSFT.DCF](#)

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Camera Interface Application Note

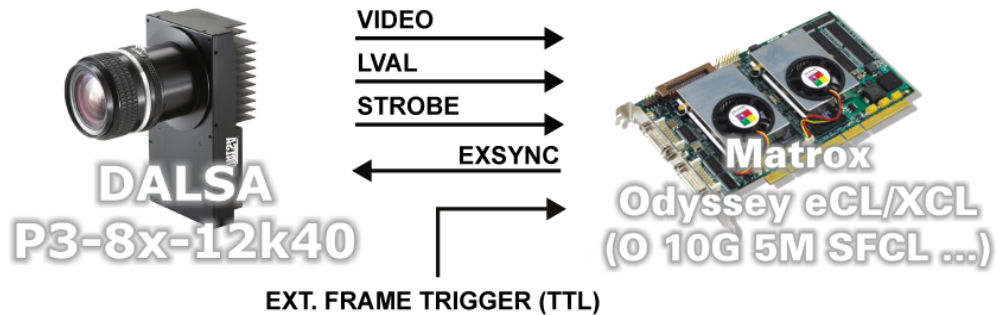
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Basics about the
interface modes

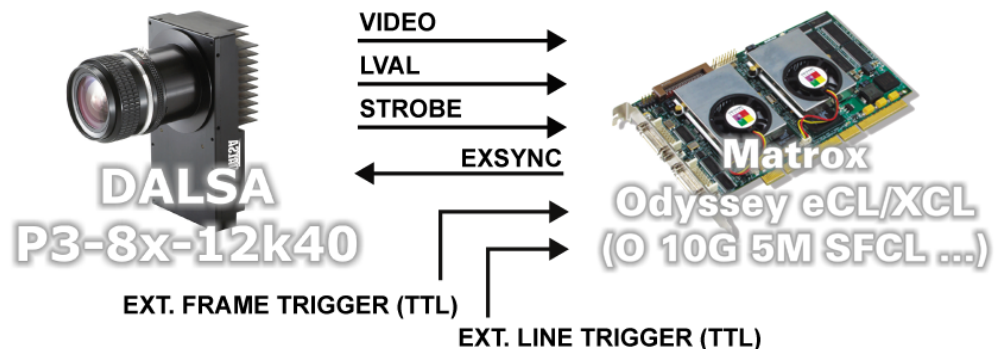
Camera Interface Briefs (cont.)

Mode 3: Fixed line scan rate with frame trigger



Mode 4: Variable line scan rate with frame trigger

- Up to 12288 pixels/line.
- Camera Link FULL or MEDIUM interface (four 12-bit taps and eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey eCL/XCL receiving external TTL frame (virtual) and line trigger signals.
- Matrox Odyssey eCL/XCL sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey eCL/XCL receiving HSYNC (LVAL), PIXEL CLOCK (four 12-bit taps: STROBE @ 80 MHz and eight 8-bit taps: STROBE @ 40 MHz) and video data from camera.
- DCF used: [P38x12k40_12288_8bit8tapsVLSFT.DCF](#)
- DCF used: [P38x12k40_12288_12bit4tapsVLSFT.DCF](#)



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Camera Interface Application Note

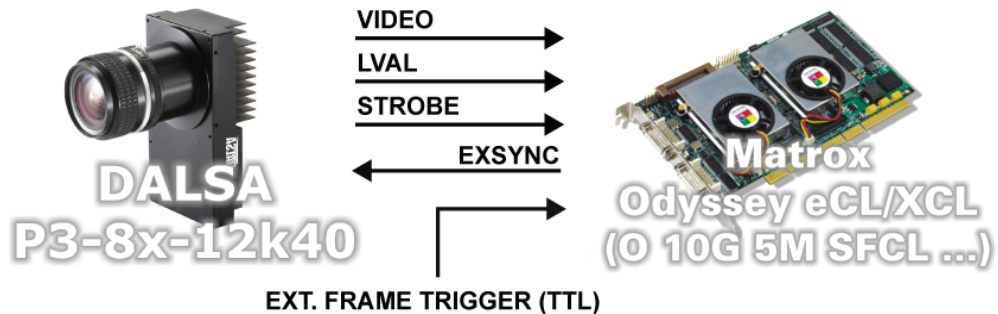
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Camera Interface Briefs (cont.)

Mode 5: Fixed line scan rate with variable frame size

- Up to 12288 pixels/line.
- Camera Link FULL or MEDIUM interface (four 12-bit taps and eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey eCL/XCL receiving external TTL frame (virtual) signal.
- Matrox Odyssey eCL/XCL sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey eCL/XCL receiving HSYNC (LVAL), PIXEL CLOCK (four 12-bit taps: STROBE @ 80 MHz and eight 8-bit taps: STROBE @ 40 MHz) and video data from camera.
- DCF used: [P38x12k40_12288_8bit8tapsFLSVF.DCF](#)
- DCF used: [P38x12k40_12288_12bit4tapsFLSVF.DCF](#)



Basics about the interface modes

Mode 6: Variable line scan rate with variable frame size

- Up to 12288 pixels/line.
- Camera Link FULL or MEDIUM interface (four 12-bit taps and eight 8-bit taps).
- DCF configured for 1000 lines per virtual frame.
- Matrox Odyssey eCL/XCL receiving external TTL frame (virtual) and line trigger signals.
- Matrox Odyssey eCL/XCL sending EXPOSURE1 (EXSYNC) signal to camera.
- Matrox Odyssey eCL/XCL receiving HSYNC (LVAL), PIXEL CLOCK (four 12-bit taps: STROBE @ 80 MHz and eight 8-bit taps: STROBE @ 40 MHz) and video data from camera.
- DCF used: [P38x12k40_12288_8bit8tapsVLSVF.DCF](#)
- DCF used: [P38x12k40_12288_12bit4tapsVLSVF.DCF](#)

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Camera Interface Application Note

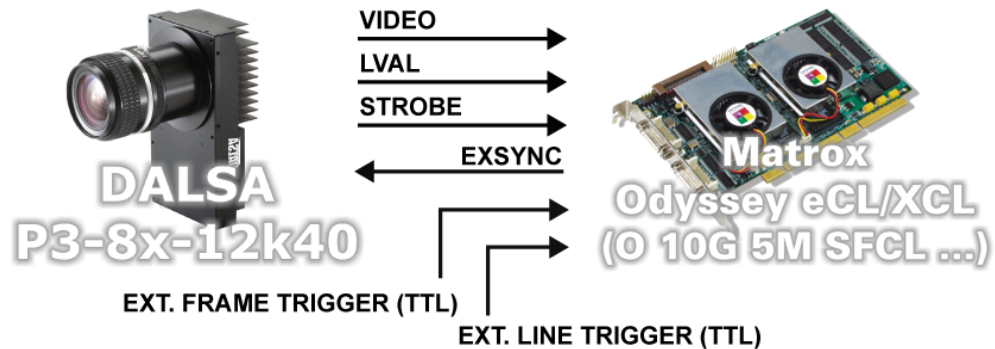
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Basics about the
interface modes

Camera Interface Briefs (cont.)

Mode 6: Variable line scan rate with variable frame size



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. For the eight tap/8-bit DCF used for the **Smart EXSYNC** mode, the EXPOSURE1 (EXSYNC) signal period is set to **170 μ s** which translates into a **5.88 kHz** line rate. The maximum line rate for this camera equals **23.5 kHz**.
- **Exposure time:** The exposure time is the inactive (high level) period between the rising and falling edges of the EXPOSURE1 (EXSYNC) signal. The default exposure time for the eight tap/8-bit DCF used for **Smart EXSYNC** mode equals **130 μ s**. Maximum/minimum exposure time per line for this DCF is **420 ms** and **50 ns** respectively. The exposure time can be modified in the DCFs using Matrox Intellicam, ONL imCamControl() or imDigControl() function, or with the MIL MdigControl() function. Consult the respective manual for more information.
- **Inverted tap output:** The camera's tap output configuration features mirrored taps of which two taps will need to be inverted. Matrox Odyssey Xpro supports hardware tap inversion, which has been enabled in the DCF.
- **Camera communication:** These DCFs will work with **Free Run** and **Smart EXSYNC** modes. Set the mode (as shown in table below) via the Camera Link communication. Refer to the camera manual for additional information.

Command	Short Form	Parameter	Description
Set_exposure_mode	sem	1 or 2	Free Run
Set_exposure_mode	sem	4	Smart EXSYNC mode
Camera_link_mode	clm	16	Medium configuration 4 taps, 12 bit output
Camera_link_mode	clm	21	Full configuration 8 taps, 8 bit output

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Specifics about the
interface modes

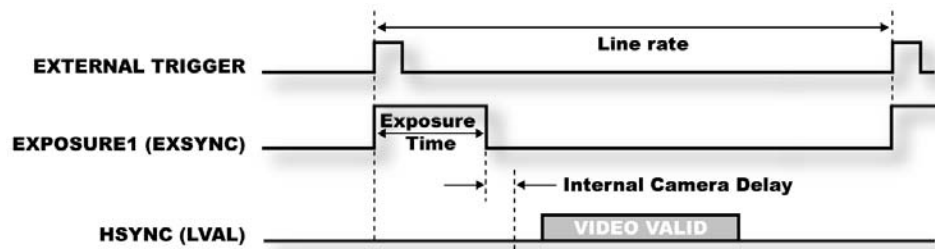
Camera Interface Details (cont.)

Mode 2: Variable line scan rate

- **Line rate:** The line rate is controlled by the frequency of the external TTL line trigger signal. The line trigger signal period must be larger than the total duration of the exposure time (high level duration of the timer), the internal delay of the camera ($\approx 1.50 \mu\text{s}$) and the line read out ($38.4 \mu\text{s}$).
- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Inverted tap output:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Set the mode (as shown in table below) via the Camera Link communication. Refer to the camera manual for additional information.

Command	Short Form	Parameter	Description
Set_exposure_mode	sem	4	Smart EXSYNC mode
Camera_link_mode	clm	16	Medium configuration 4 taps, 12 bit output
Camera_link_mode	clm	21	Full configuration 8 taps, 8 bit output

▪ 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 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.

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Camera Interface Application Note

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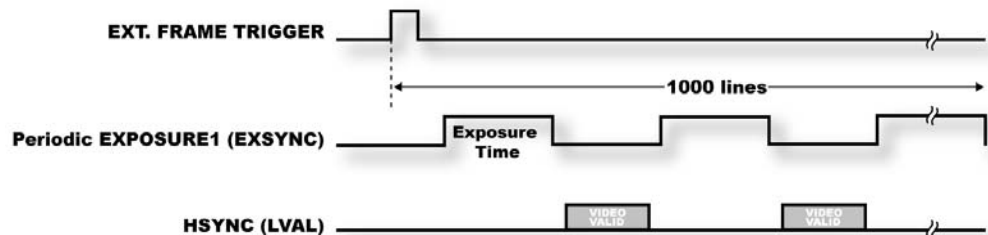
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Specifics about the
interface modes

Camera Interface Details (cont.)

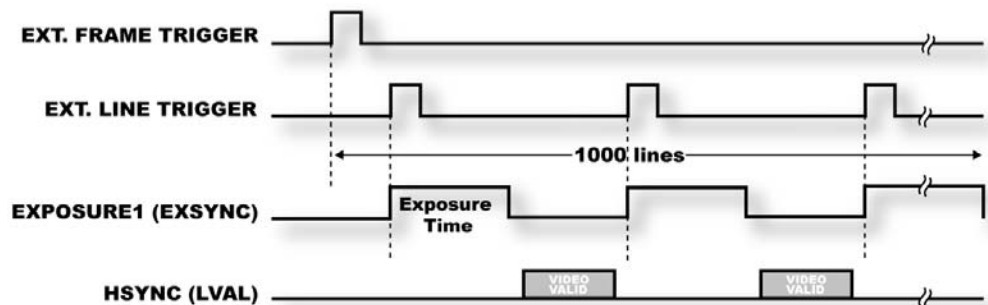
Mode 3: Fixed line scan rate with frame trigger

- **Exposure time:** Refer to Mode 1: Fixed line scan rate.
- **Inverted tap output:** 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 (high level duration of the timer), the internal delay of the camera ($\approx 1.50 \mu\text{s}$) and the line rate ($38.4 \mu\text{s}$). 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 (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.
- **Inverted tap output:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate.
- **Timing diagram:**



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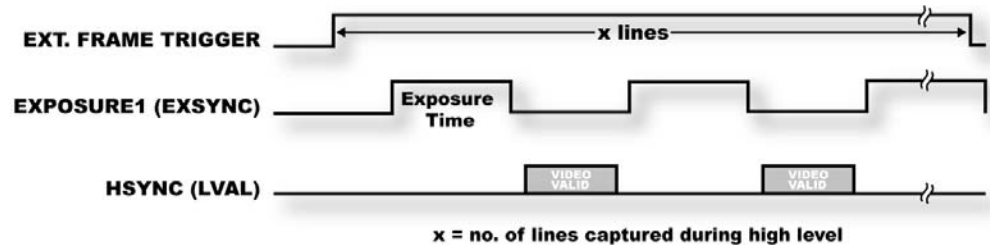
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Specifics about the
interface modes

Camera Interface Details (cont.)

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 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.
- **Inverted tap output:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 1: Fixed 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 number of lines per virtual frame (maximum of 1000 for this DCF) is variable and controlled by the frame trigger signal. Matrox Odyssey 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.
- **Inverted tap output:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate.

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Camera Interface Application Note

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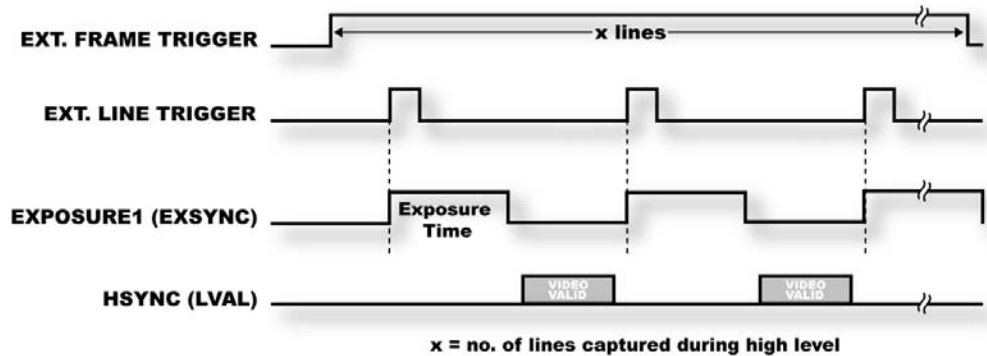
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Specifics about the
interface modes

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, 2009-2011.

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