Matrox Odyssey Xpro
Camera Interface Application Note
DALSA Piranha HS-4x-02k30 June 20, 2005

Basics about the camera

Camera Descriptions

- Effective resolution: up to 2048 pixels/line @ 52k line per second.
- Camera Link MEDIUM or dual BASE interface (four 8-/10-bit taps).
- External and internal sync.
- External or internal exposure control.
- 30 MHz pixel clock rate (60 MHz with Time Multiplexing mode).

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

Interface Mode

- Fixed line scan rate (External Sync Mode[1])
- Variable line scan rate (External Sync Mode)
- Fixed line scan rate with frame trigger (External Sync Mode[1])
- Variable line scan rate with frame trigger (External Sync Mode)
- Fixed line scan rate with variable frame size (External Sync Mode[1])
- Variable line scan rate with variable frame size (External Sync Mode)
- Fixed line scan rate (Area scan mode)

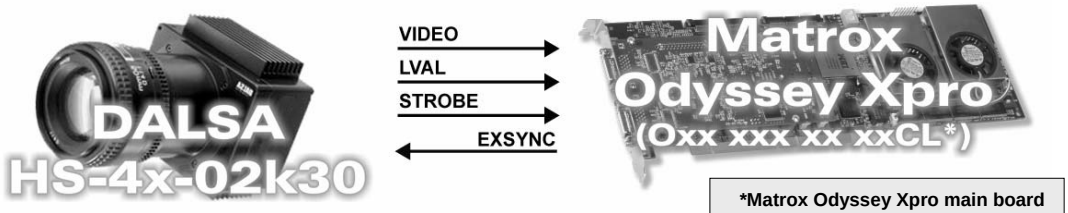
1. or Internal Programmable Sync Mode

Basics about the interface modes

Camera Interface Briefs

Mode 1: Fixed line scan rate

- Up to 2048 pixels/line.
- Camera Link MEDIUM or dual BASE interface (four 8-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 (STROBE @ 30/60 MHz) and video data from camera.
- DCF used: HS4x02k30_2048_8bit4tapsFLS.DCF (Single FULL board only)
- DCF used: HS4x02k30_2048_8bit4tapsTMFLS.DCF (Time Multiplexing – Dual BASE or Single FULL board)



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

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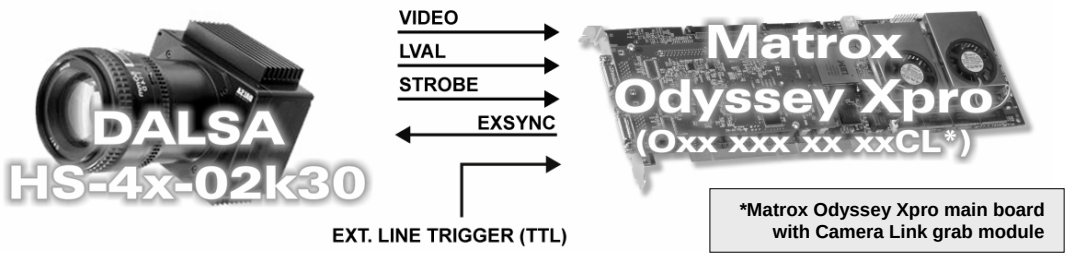
Basics about the interface modes

Camera Interface Briefs (continued)

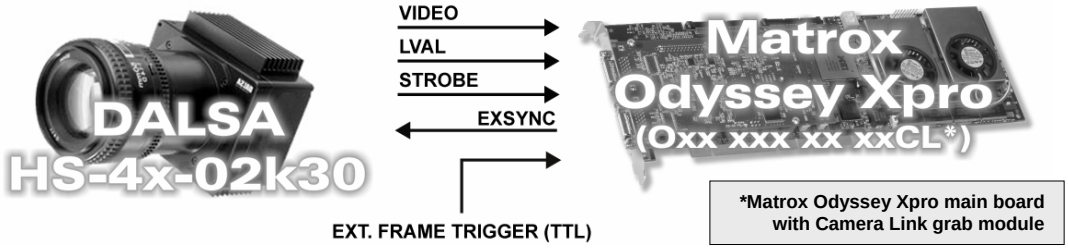
Mode 2: Variable line scan rate

- Up to 2048 pixels/line.
- Camera Link MEDIUM or dual BASE interface (four 8-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 (STROBE @ 30/60 MHz) and video data from camera.
- DCF used: HS4x02k30_2048_8bit4tapsVLS.DCF (Single FULL board only)
- DCF used: HS4x02k30_2048_8bit4tapsTMVLS. DCF (Time Multiplexing – Dual BASE or Single FULL board)



Mode 3: Fixed line scan rate with frame trigger

- Up to 2048 pixels/line.
- Camera Link MEDIUM or dual BASE interface (four 8-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 (STROBE @ 30/60 MHz) and video data from camera.
- DCF used: HS4x02k30_2048_8bit4tapsFLSFT.DCF (Single FULL board only)
- DCF used: HS4x02k30_2048_8bit4tapsTMFLSFT. DCF (Time Multiplexing – DualBASE or Single FULL board)



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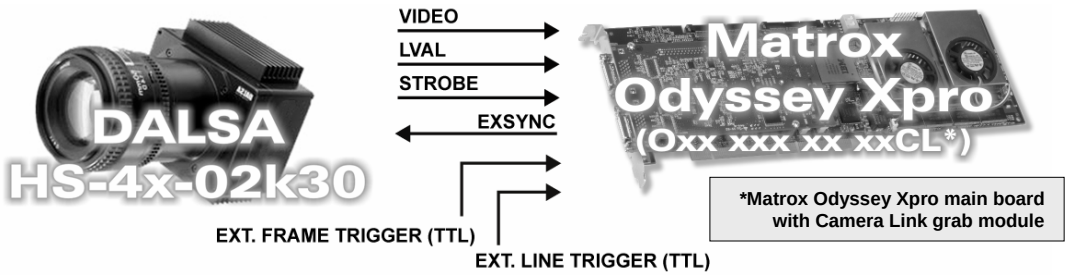
Basics about the interface modes

Camera Interface Briefs (continued)

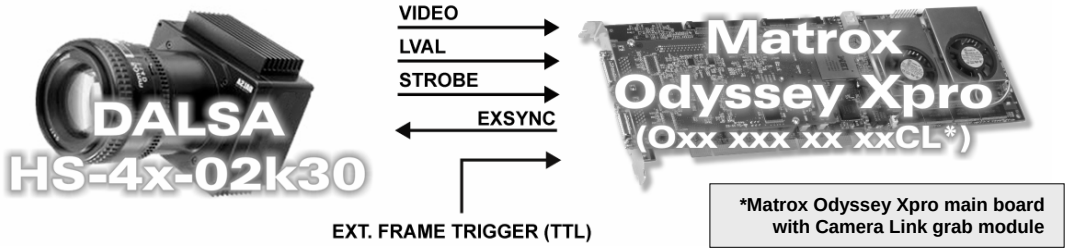
Mode 4: Variable line scan rate with frame trigger

- Up to 2048 pixels/line.
- Camera Link MEDIUM or dual BASE interface (four 8-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 (STROBE @ 30/60 MHz) and video data from camera.
- DCF used: HS4x02k30_2048_8bit4tapsVLSFT.DCF (Single FULL board only)
- DCF used: HS4x02k30_2048_8bit4tapsTMVLSFT. DCF (Time Multiplexing – DualBASE or Single FULL board)



Mode 5: Fixed line scan rate with variable frame size

- Up to 2048 pixels/line.
- Camera Link MEDIUM or dual BASE interface (four 8-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 (STROBE @ 30/60 MHz) and video data from camera.
- DCF used: HS4x02k30_2048_8bit4tapsFLSVF.DCF (Single FULL board only)
- DCF used: HS4x02k30_2048_8bit4tapsTMFLSVF. DCF (Time Multiplexing – DualBASE or Single FULL board)

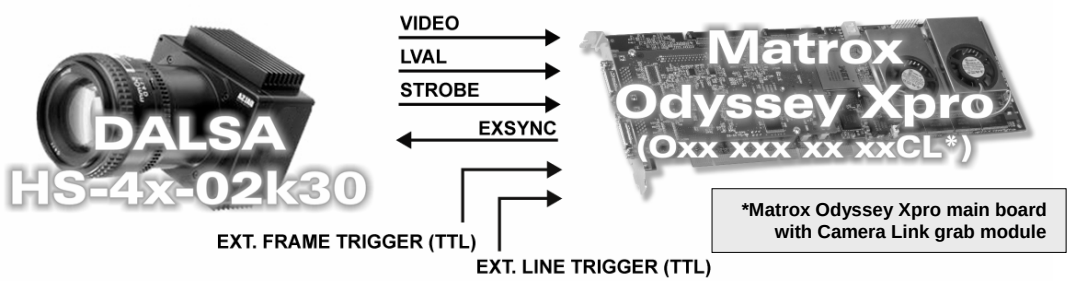


Basics about the interface modes

Camera Interface Briefs (continued)

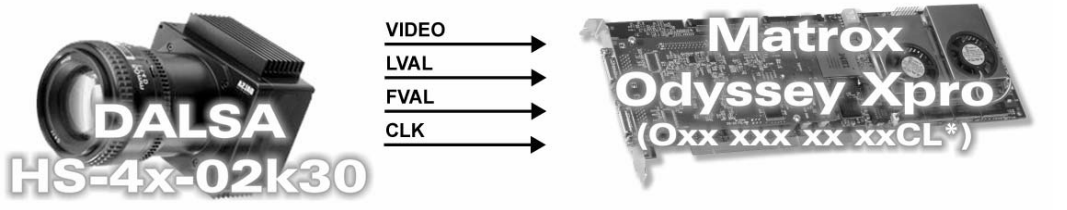
Mode 6: Variable line scan rate with variable frame size

- Up to 2048 pixels/line.
- Camera Link MEDIUM or dual BASE interface (four 8-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 (STROBE @ 30/60 MHz) and video data from camera.
- DCF used: HS4x02k30_2048_8bit4tapsVLSVF.DCF (Single FULL board only)
- DCF used: HS4x02k30_2048_8bit4tapsTMVLSVF. DCF (Time Multiplexing – Dual BASE or Single FULL board)



Mode 7: Fixed line scan rate (Area scan mode)

- 2048 x 64 (full resolution).
- Camera Link MEDIUM or dual BASE interface (four 8-bit taps).
- Matrox Odyssey Xpro receiving VSYNC (FVAL), HSYNC (LVAL), PIXEL CLOCK (STROBE @ 30/60 MHz) and video data from camera.
- DCF used: HS4x02k30_2048x64_8bit4tapsAM_con.DCF



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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 DCFs to **150 µs** (**75 µs** for Time Multiplexing) which translates into a **6.52 kHz** (**13.3 kHz** for Time Multiplexing) line rate. The maximum line rate for this camera equals **52 kHz** (same for Time Multiplexing).
- **Exposure time:** Since the camera used a TDI sensor, the exposure time is the period between the falling edges of the EXPOSURE1 (EXSYNC) signals, and is equal to the line rate. The default exposure time for the DCFs equals **150 µs** (**75 µs** for Time Multiplexing). The maximum and minimum exposure times per line for the DCFs are **560 ms** and **19.2 µs** respectively (same for Time Mulplexing). 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.
- **Time multiplexing mode:** Time multiplexing requires only a BASE configuration (2 taps x 60 MHz). While the clock rate is doubled in this mode, the line rate is the same. This mode can be used with the Dual BASE board (DBCL) with 1 or 2 cameras, or the Single FULL board (SFCL) with 1 camera only. To learn more about time multiplexing, refer to the camera manual.
- **Inverted tap output:** The camera's tap output configuration features mirrored taps of which one tap will need to be inverted. Matrox Odyssey Xpro supports hardware tap inversion, which has been enabled in the DCFs.
- **Camera communication:** The DCFs will work with the **Internal Programmable Sync Mode** and **External Sync Mode**. 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	7	Internal Programmable Sync Mode
Set_exposure_mode	sem	3	External Sync Mode

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 (**1.50 µs**) and the line read out (**17.07 µs**).

Continued...

Specifics about the interface modes

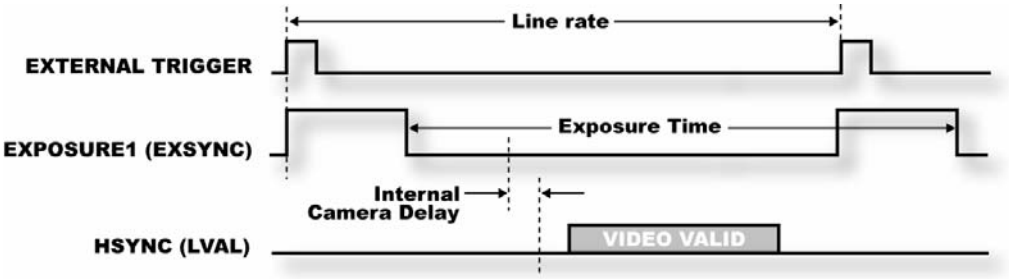
Camera Interface Details (continued)

Mode 2: Variable line scan rate

- **Exposure time:** The exposure time is the period between the falling edges of the EXPOSURE1 (EXSYNC) signals (see Timing Diagram below) and controlled by the period of the external line trigger signal. **NOTE** that the frequency of the external line trigger signal must be consistent otherwise the intensity of the individual lines will be affected. Moreover, if a line trigger signal arrives before the end of the camera read-out period, the camera will ignore the EXSYNC signal for this line.
- **Time multiplexing mode** and **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	3	External Sync Mode

- **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 the DCFs) is fixed and controlled by the vertical timing of the DCFs. 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.
- **Time multiplexing mode** and **Inverted tap output:** Refer to Mode 1: Fixed line scan rate.

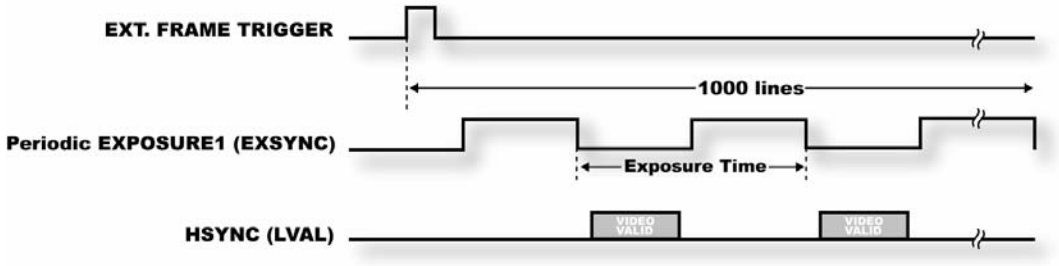
Continued...

Specifics about the interface modes

Camera Interface Details (continued)

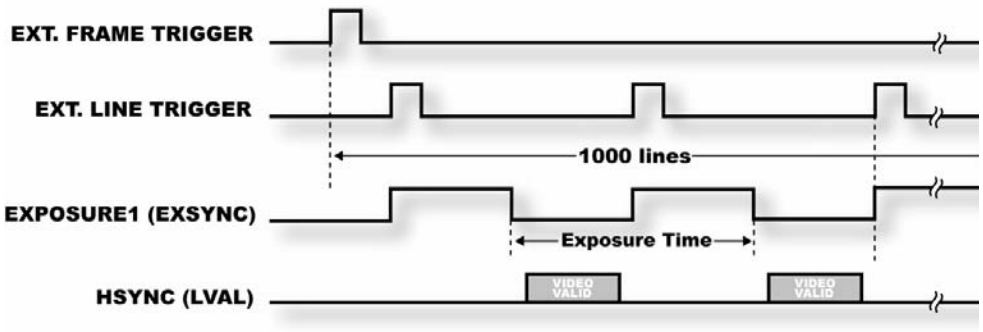
Mode 3: Fixed line scan rate with frame trigger

- **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 (**1.50 µs**) and the line rate (**17.07 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 the DCFs) is fixed and controlled by the vertical timing of the DCFs. 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.
- **Time multiplexing mode** and **Inverted tap output:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate.
- **Timing diagram:**

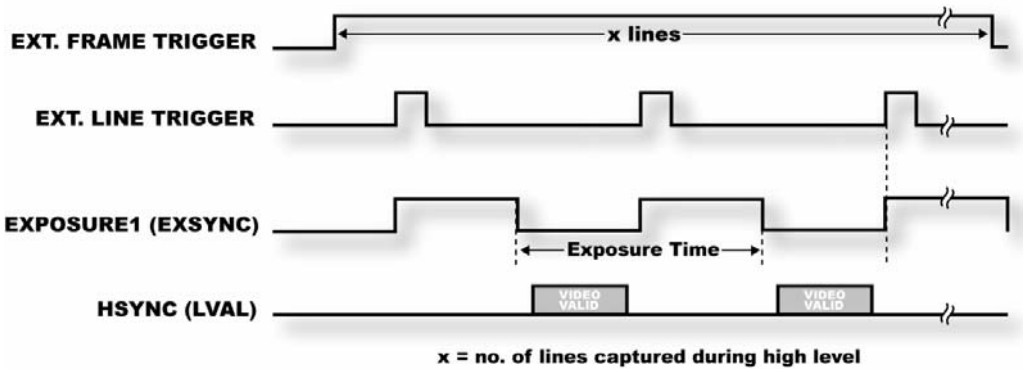


Specifics about the interface modes

Camera Interface Details (continued)

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 the DCFs) 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 DCFs. 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.
- **Time multiplexing mode** and **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

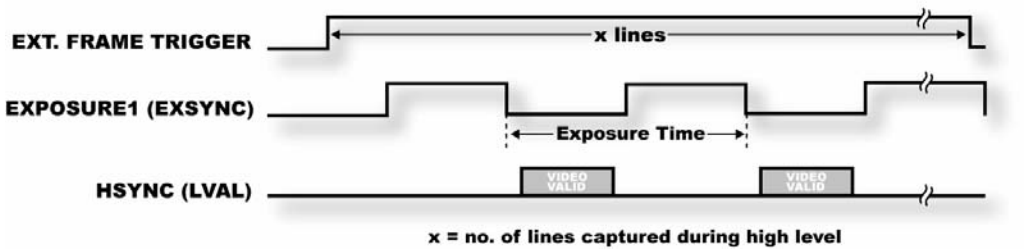
- **Line/frame rate**: The line rate is variable and controlled by the external line trigger frequency. The number of lines per virtual frame (maximum of 1000 for the DCFs) is variable and controlled by the frame trigger signal. Matrox Odyssey Xpro captures lines during the high level of the frame trigger signal. To modify the maximum amount of lines captured, change the active vertical timing period in the DCFs. 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.
- **Time multiplexing mode** and **Inverted tap output:** Refer to Mode 1: Fixed line scan rate.
- **Camera communication:** Refer to Mode 2: Variable line scan rate.

Specifics about the interface modes

Camera Interface Details (continued)

Mode 6: Variable line scan rate with variable frame size

- **Timing diagram:**



Mode 7: Fixed line scan rate (Pseudo-area scan mode)

- **Frame rate**: Matrox Odyssey Xpro receives the continuous video from the camera (Full resolution). The frame rate is controlled by the camera, refer to the camera manual for more information.
- **Exposure time:** The exposure time is controlled by the camera, refer to the camera manual for more information.
- **Time multiplexing mode** and **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	7	Internal Programmable Sync Mode
Set_tdi_mode	tdi	1	Area mode

Cabling details for the interface modes

Cabling Requirements

Mode 1: Fixed line scan rate

- **Cable and Connection:** Standard Camera Link cable.

Cabling details for the interface modes

Cabling Requirements

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)

Mode 7: Fixed line scan rate (Pseudo-area scan mode)

- **Cable and Connection:** Standard Camera Link.

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