

Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

October 6, 2006

Basics about the
camera

Camera Descriptions

- Effective Resolution: $1536 \times 512 \times 8\text{-bit}$ @ approximately 27 fps.
- Camera Link BASE interface (8-bit, 2 taps).
- Progressive scan (image) and line scan (measurement).
- Internal sync.
- Internal exposure control.
- 66 MHz pixel clock rate.

Interface Modes

- Continuous (Image mode)
- Pseudo-continuous (Image mode with CC1 trigger)
- Asynchronous reset (Image mode with CC1 trigger)
- Fixed line scan rate (Free running Measure Mode)
- Variable line scan rate (Measure Mode with CC1 trigger)
- Fixed line scan rate with frame trigger (Measure Mode with CC1 trigger)
- Variable line scan rate with frame trigger (Measure Mode with CC1 trigger)
- Fixed line scan rate with variable frame size (Measure Mode with CC1 trigger)
- Variable line scan rate with variable frame size (Measure Mode with CC1 trigger)

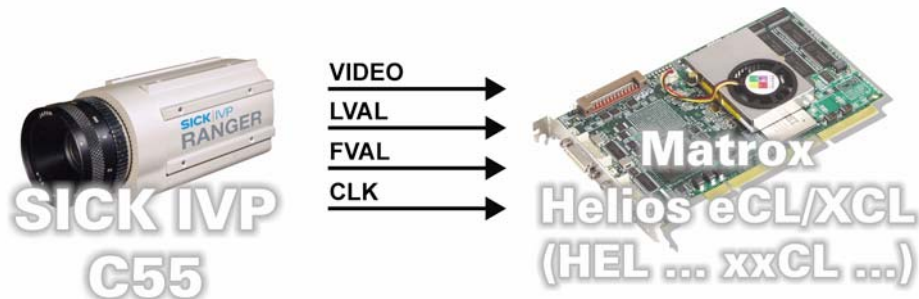
Mode of operations as
per Matrox Imaging (in
parentheses as per
camera manufacturer)

Basics about the
interface modes

Camera Interface Briefs

Mode 1: Continuous (Image mode)

- $1536 \times 512 \times 8\text{-bit}$ @ approximately 27 fps.
- Camera Link BASE interface (8-bit, 2 taps).
- Progressive scan.
- Matrox Helios eCL/XCL receiving LVAL, FVAL, PIXEL CLOCK (CLK @ 66 MHz) and video signals from camera.
- DCF: [SICKIVPC55_1536x512_8bit2tapCon.DCF](#)



Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

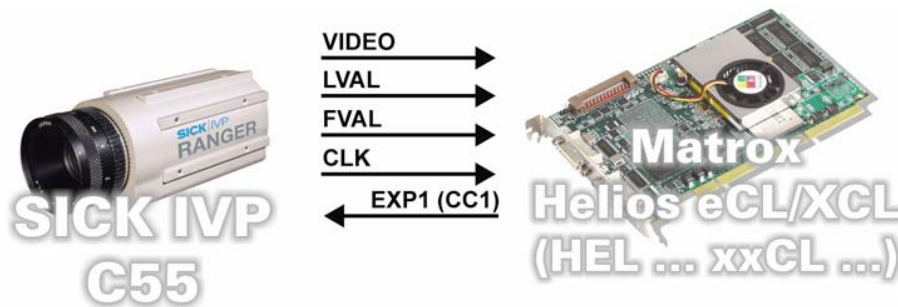
October 6, 2006

Basics about the
interface modes

Camera Interface Briefs (cont.)

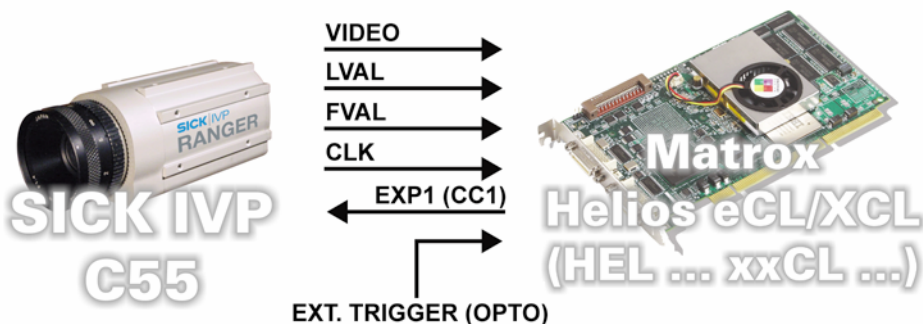
Mode 2: Pseudo-continuous

- $1536 \times 512 \times 8$ -bit.
- Camera Link BASE interface (8-bit, 2 taps).
- Progressive scan.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (CC1) signal to camera to initiate exposure time.
- Matrox Helios eCL/XCL receiving LVAL, FVAL, PIXEL CLOCK (CLK @ 66 MHz) and video signals from camera.
- DCF: [SICKIVPC55_1536x512_8bit2tapPcon.DCF](#)



Mode 3: Asynchronous reset

- $1536 \times 512 \times 8$ -bit.
- Camera Link BASE interface (8-bit, 2 taps).
- Progressive scan.
- Matrox Helios eCL/XCL receiving external OPTO trigger signal.
- Matrox Helios eCL/XCL sending EXPOSURE1 (CC1) signal to camera to initiate exposure time.
- Matrox Helios eCL/XCL receiving LVAL, FVAL, PIXEL CLOCK (CLK @ 66 MHz) and video signals from camera.
- DCF used: [SICKIVPC55_1536x512_8bit2tapAsync.DCF](#)



Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

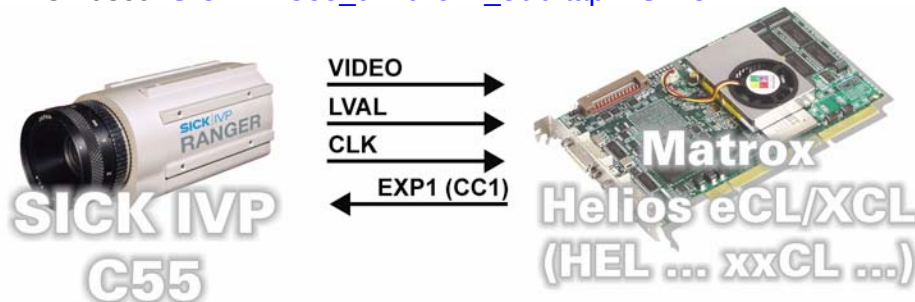
October 6, 2006

Basics about the
interface modes

Camera Interface Briefs (cont.)

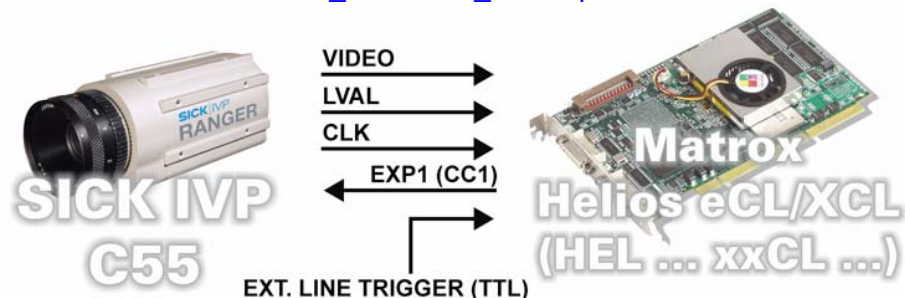
Mode 4: Fixed line scan rate

- 9216 × 8-bit.
- Camera Link BASE interface (8-bit, 2 taps).
- DCF configured for 512 lines per virtual frame.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (CC1) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 66 MHz) and video signals from camera.
- DCF used: [SICKIVPC55_9216x512_8bit2tapFLS.DCF](#)



Mode 5: Variable line scan rate

- 9216 × 8-bit.
- Camera Link BASE interface (8-bit, 2 taps).
- DCF configured for 512 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL line trigger signal.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (CC1) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 66 MHz) and video signals from camera.
- DCF used: [SICKIVPC55_9216x512_8bit2tapVLS.DCF](#)



Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

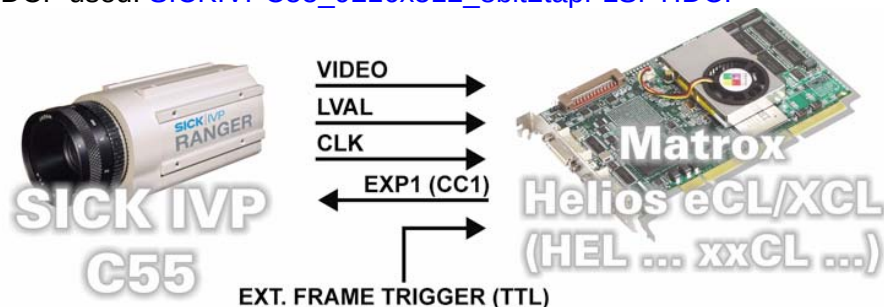
October 6, 2006

Basics about the
interface modes

Camera Interface Briefs (cont.)

Mode 6: Fixed line scan rate with frame trigger

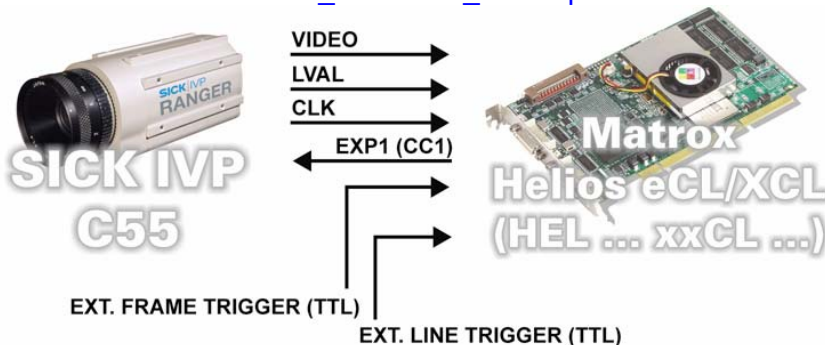
- 9216 × 8-bit.
- Camera Link BASE interface (8-bit, 2 taps).
- DCF configured for 512 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL frame (virtual) trigger signal.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (CC1) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 66 MHz) and video signals from camera.
- DCF used: [SICKIVPC55_9216x512_8bit2tapFLSFT.DCF](#)



Basics about the
interface modes

Mode 7: Variable line scan rate with frame trigger

- 9216 × 8-bit.
- Camera Link BASE interface (8-bit, 2 taps).
- DCF configured for 512 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL frame (virtual) and line trigger signals.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (CC1) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 66 MHz) and video signals from camera.
- DCF used: [SICKIVPC55_9216x512_8bit2tapVLSFT.DCF](#)



Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

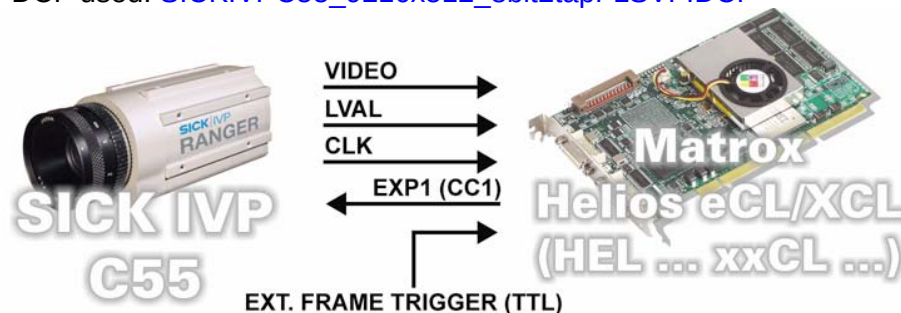
October 6, 2006

Basics about the
interface modes

Camera Interface Briefs (cont.)

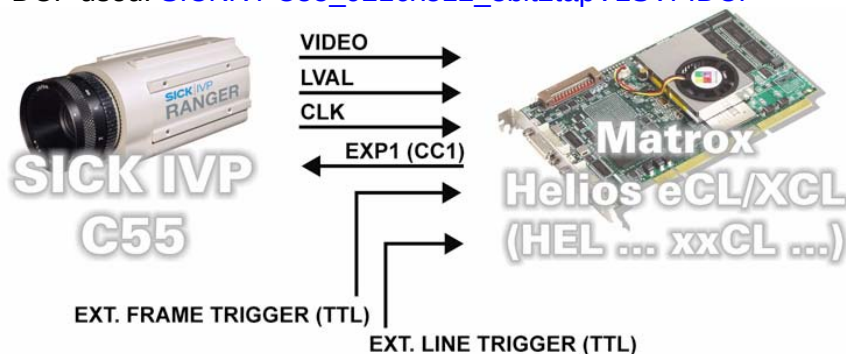
Mode 8: Fixed line scan rate with variable frame size

- 9216 × 8-bit.
- Camera Link BASE interface (8-bit, 2 taps).
- DCF configured for 512 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL frame (virtual) trigger signal.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (CC1) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 66 MHz) and video signals from camera.
- DCF used: [SICKIVPC55_9216x512_8bit2tapFLSVF.DCF](#)



Mode 9: Variable line scan rate with variable frame size

- 9216 × 8-bit.
- Camera Link BASE interface (8-bit, 2 taps).
- DCF configured for 512 lines per virtual frame.
- Matrox Helios eCL/XCL receiving external TTL frame (virtual) and line trigger signals.
- Matrox Helios eCL/XCL sending periodic EXPOSURE1 (CC1) signal to camera.
- Matrox Helios eCL/XCL receiving LVAL, PIXEL CLOCK (CLK @ 66 MHz) and video signals from camera.
- DCF used: [SICKIVPC55_9216x512_8bit2tapVLSVF.DCF](#)



Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

October 6, 2006

Specifics about the
interface modes

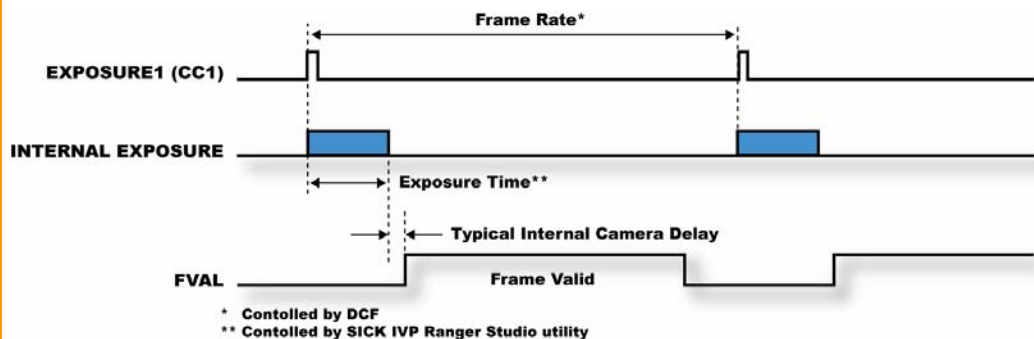
Camera Interface Details

Mode 1: Continuous (Image mode)

- **Frame rate:** Matrox Helios eCL/XCL receives the continuous video from the camera at 27 frames per second.
- **Exposure time:** Exposure time is determined by the exposure time setting in the SICK IVP Ranger Studio utility. Refer to the camera manual for more information.
- **Camera control:** Set the camera mode to **Image mode** using the SICK IVP Ranger Studio utility. Refer to the camera manual for more information.

Mode 2: Pseudo-continuous

- **Frame rate:** Matrox Helios eCL/XCL receives the pseudo-continuous video from the camera. Frame rate is controlled by the frequency of the EXPOSURE1 (CC1) signal.
- **Exposure time:** Exposure time is controlled by exposure time setting in the SICK IVP Ranger Studio utility. If the exposure time is modified, increase or decrease EXPOSURE1 (CC1) inactive duration, which will respectively decrease or increase the frame rate. The frame rate is determined by the frequency of the EXPOSURE1 (CC1) signal.
- **Camera control:** Set the camera mode to **Image mode** and **Trigger mode = 1** using the SICK IVP Ranger Studio utility. Refer to the camera manual for the more information.



Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

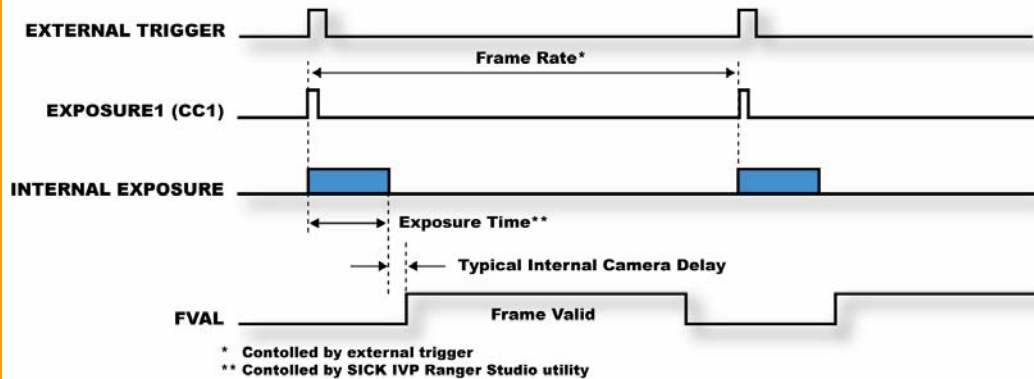
October 6, 2006

Specifics about the
interface modes

Camera Interface Details (cont.)

Mode 3: Asynchronous Reset

- **Frame rate:** The frame rate is determined by the frequency of the external trigger signal. The period between external trigger signals must be larger than the total duration of one frame.
- **Exposure time:** Exposure time is determined by the exposure time setting in the SICK IVP Ranger Studio utility. Refer to the camera manual for the more information.
- **Camera control:** Set the camera mode to **Image mode** and **Trigger mode = 1** using the SICK IVP Ranger Studio utility. Refer to the camera manual for the more information.



Mode 4: Fixed line scan rate

- **Line rate:** Line rate is determined by the camera's output and is inversely proportionate to the exposure setting in the SICK IVP Ranger Studio utility. Refer to the camera manual for the more information.
- **Line and virtual frame size:** Line size and virtual frame size can be modified in Matrox Intellicam (video timing image size X, Y) or with MIL MdigControl() function. Refer to the respective manual for more information.
- **Exposure time:** Exposure time is determined by the exposure time setting in the SICK IVP Ranger Studio utility. Refer to the camera manual for the more information.
- **Camera control:** Set the camera mode to **Measurement mode** using the SICK IVP Ranger Studio utility. Refer to the camera manual for more information.

Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

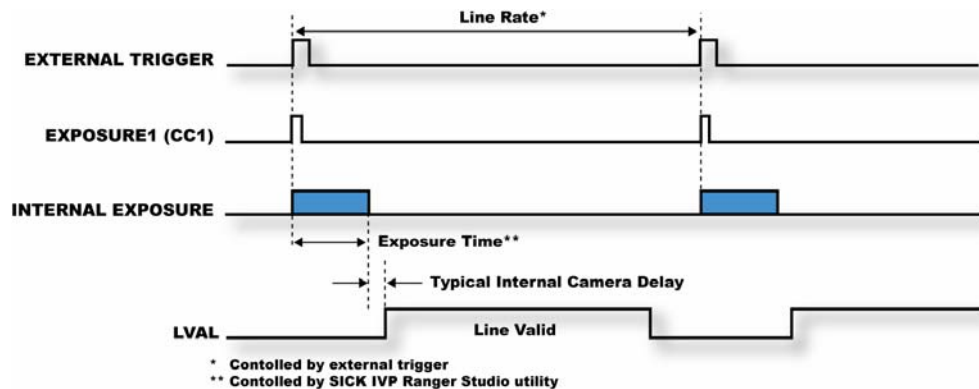
October 6, 2006

Specifics about
the interface modes

Camera Interface Details (cont.)

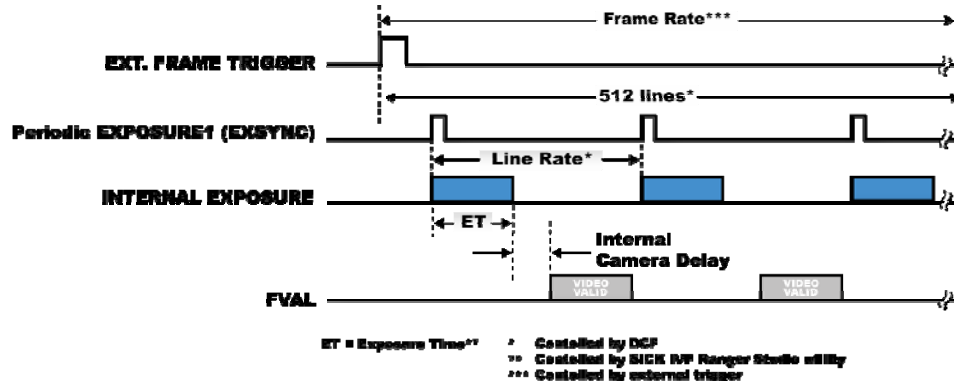
Mode 5: Variable line scan rate

- **Line rate:** Line rate is controlled by the frequency of the external TTL line trigger signal. The line trigger period must be larger than the internal exposure time, the internal delay of the camera ($190 \mu s^1$) and the line readout period ($100 \mu s^1$).
- **Line and virtual frame size:** Refer to Mode 4: Fixed line scan rate.
- **Exposure time:** Refer to Mode 4: Fixed line scan rate.
- **Camera control:** Set the camera mode to **Measurement mode** and **Trigger mode = 1** using the SICK IVP Ranger Studio utility. Refer to the camera manual for more information.



Mode 6: Fixed line scan rate with frame trigger

- **Line rate:** Line rate is fixed and controlled by the period of the EXPOSURE1 (EXSYNC) signal. The virtual frame rate is variable and controlled by the external frame trigger signal, however the external frame trigger period must always be greater than the total frame duration. The number of lines per virtual frame (512) 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.
- **Line and virtual frame size:** Refer to Mode 4: Fixed line scan rate.
- **Exposure time:** Refer to Mode 4: Fixed line scan rate.
- **Camera control:** Refer to Mode 5: Variable line scan rate.



1. Actual values may vary depending on the application.

Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

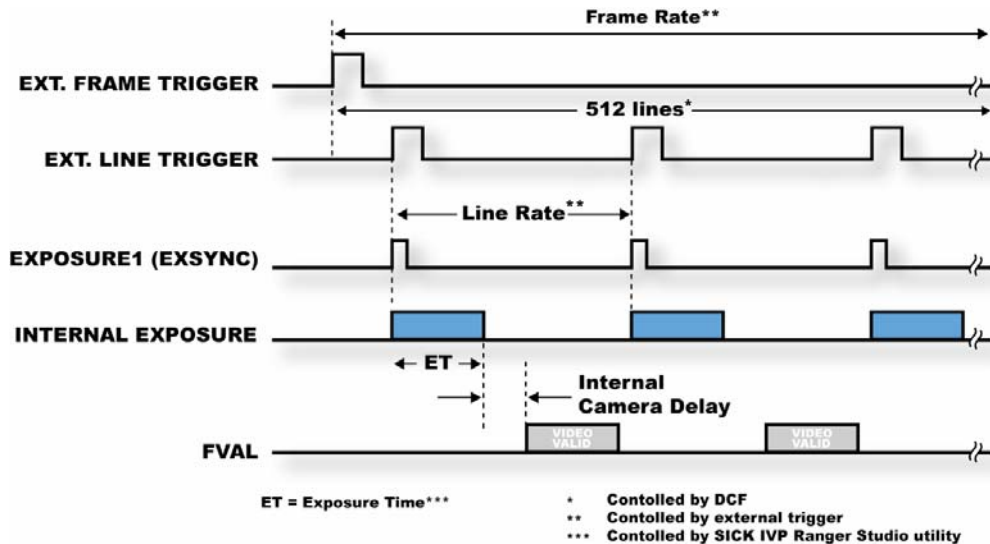
October 6, 2006

Specifics about
the interface modes

Camera Interface Details (cont.)

Mode 7: Variable line scan rate with frame trigger

- **Line rate:** Line rate is controlled by the frequency of the external TTL line trigger signal. The line trigger period must be larger than the internal exposure time, the internal delay of the camera ($190 \mu s^1$) and the line readout period ($100 \mu s^1$). The virtual frame rate is variable and controlled by the external frame trigger signal, however the external frame trigger period must always be greater than the total frame duration. The number of lines per virtual frame (512) 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.
- **Line and virtual frame size:** Refer to Mode 4: Fixed line scan rate.
- **Exposure time:** Refer to Mode 4: Fixed line scan rate.
- **Camera control:** Refer to Mode 5: Variable line scan rate.



Mode 8: Fixed line scan rate with variable frame size

- **Line rate:** Line rate is fixed and controlled by the period of the EXPOSURE1 (EXSYNC) signal. The virtual frame rate is variable and controlled by the external frame trigger signal, however the external frame trigger period must always be greater than the total frame duration. The number of lines per virtual frame (512) 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.
- **Line and virtual frame size:** Refer to Mode 4: Fixed line scan rate.
- **Exposure time:** Refer to Mode 4: Fixed line scan rate.
- **Camera control:** Refer to Mode 5: Variable line scan rate.

Continued...

1. Actual values may vary depending on the application.

Matrox Helios eCL/XCL

Camera Interface Application Note

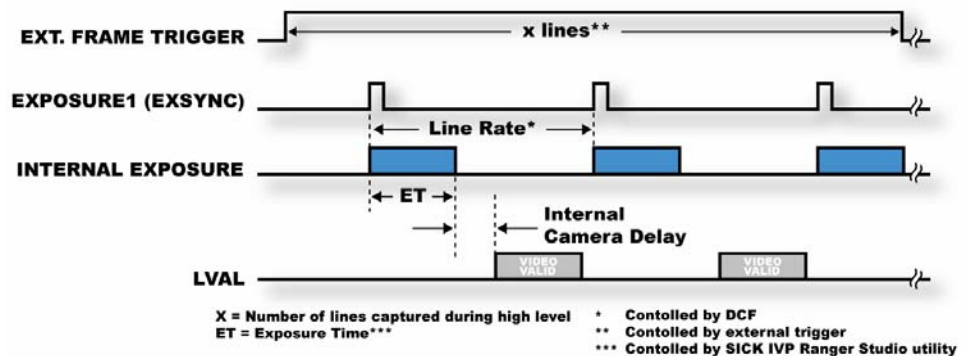
SICK IVP C55

October 6, 2006

Specifics about the
interface modes

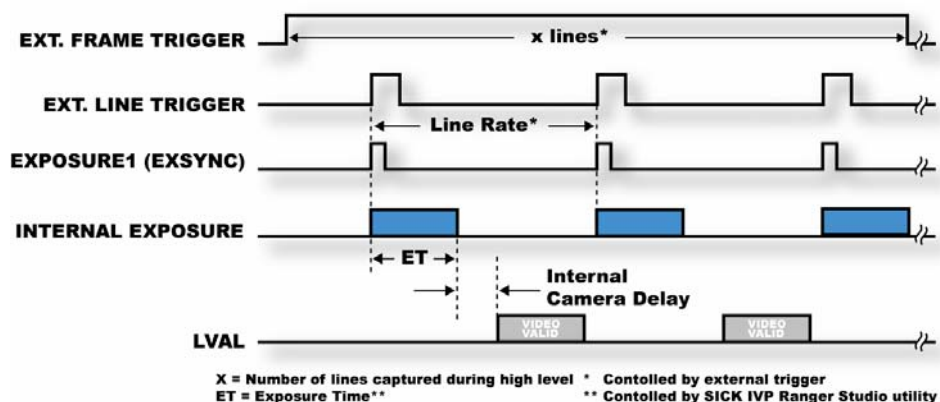
Camera Interface Details (cont.)

Mode 8: Fixed line scan rate with variable frame size



Mode 9: Variable line scan rate with variable frame size

- **Line rate:** Line rate is variable and controlled by the frequency of the external TTL line trigger signal. The line trigger period must be larger than the internal exposure time, the internal delay of the camera ($190 \mu s$) and the line readout period ($100 \mu s$). The number of lines per virtual frame (512) 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 value of the timing period in the DCF. Capture of lines will start with the rising edge of the frame trigger signal.
- **Line and virtual frame size:** Refer to Mode 4: Fixed line scan rate.
- **Exposure time:** Refer to Mode 4: Fixed line scan rate.
- **Camera control:** Refer to Mode 5: Variable line scan rate.



Cabling details for the
interface modes

Cabling Requirements

Mode 1, 2 and 4: Continuous, Pseudo-continuous, and Fixed line scan rate

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

1. Actual values may vary depending on the application.

Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

October 6, 2006

Cabling details for the
interface modes

Cabling Requirements (cont.)

Mode 3: Asynchronous reset

- **Cable and Connection:** Standard Camera Link.
- **External trigger:** External trigger should be connected to the OPTO TRIG input of the 9-pin connector (pins 7 and 2) on the Expanded I/O adapter bracket.

EXPANDED I/O BRACKET (9-pin connector)

		External Trigger Source	
Pin Name	Pin no.	Pin Name	Pin no.
OPTOTRIG +	07	SIGNAL	--
OPTOTRIG -	02	GROUND	--

Mode 5: 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	Pin no.
OPTO_AUX_IN0 +	07	LINE TRIGGER (TTL FORMAT)	--
OPTO_AUX_IN0 -	02	LINE TRIGGER (GROUND)	--

Mode 6: 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	Pin no.
OPTO_AUX_IN1 +	04	FRAME TRIGGER (TTL FORMAT)	--
OPTO_AUX_IN1 -	05	FRAME TRIGGER (GROUND)	--

Mode 7: 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	Pin no.
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)	--

Matrox Helios eCL/XCL

Camera Interface Application Note

SICK IVP C55

October 6, 2006

Cabling details for the
interface modes

Cabling Requirements (cont.)

Mode 8: 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 9: 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.

Matrox Electronic Systems Ltd.

1055 St. Regis Blvd.
Dorval, Quebec H9P 2T4
Canada
Tel: (514) 685-2630
Fax: (514) 822-6273
HEL-CID-070

