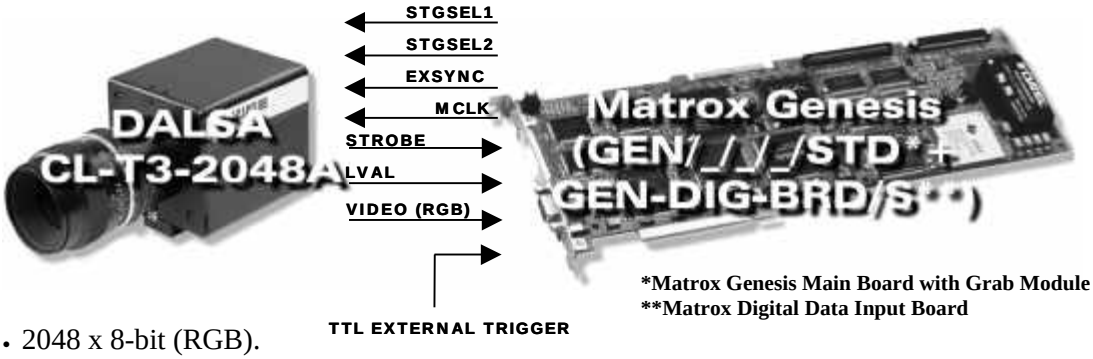
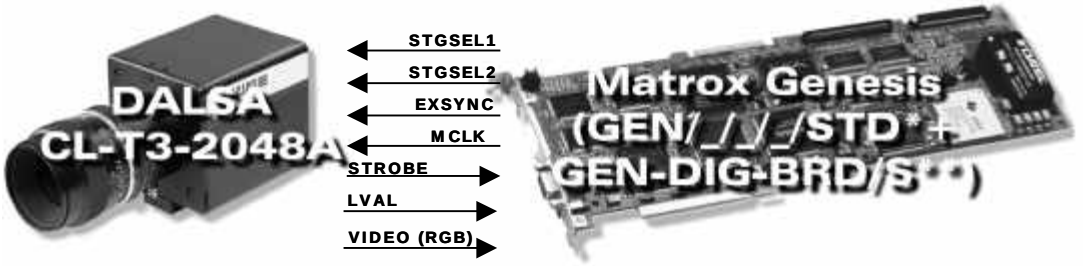
Application Note:
Interfacing non-standard cameras to Matrox Genesis

MATROX GENESIS

DALSA CL-T3-2048A

June 12, 1998

Camera Descriptions	• 2048 x 8-bit (RGB). • 3-channels RS-422 digital video output. • Maximum data rate per output: 15MHz.
Interface Modes	• Variable, fixed line scan rate, and fixed line scan rate and variable frame size mode
Camera Interface Briefs	**Mode 1: Variable line scan rate mode**  ***Matrox Genesis Main Board with Grab Module** ****Matrox Digital Data Input Board** • 2048 x 8-bit (RGB). • 3-channels RS-422 digital video output. • DCF configured for 480 lines per virtual frame (640 minus the 160 unusable lines). • Line scan rate is variable and controlled by external trigger. • Matrox Genesis receiving TTL external trigger. • Matrox Genesis sending RS-422 EXPOSURE1 (EXSYNC), RS-422 user output (STGSEL) and RS-422 reference clock (MCLK @ 30MHz) signals to camera: the EXPOSURE1 (EXSYNC) signal initiates line readout. • Matrox Genesis receiving RS-422 pixel clock (STROBE @ 15MHz) and RS-422 hsync (LVAL) signals from camera. • DCF used: CLT3DT1.DCF **Mode 2: Fixed line scan rate mode**  ***Matrox Genesis Main Board with Grab Module** ****Matrox Digital Data Input Board** • 2048 x 8-bit (RGB). • 3-channels RS-422 digital video output. • DCF configured for 480 lines per virtual frame (640 minus the 160 unusable lines). • Line scan rate is programmable and controlled through Matrox Intellicam. • Matrox Genesis sending RS-422 EXPOSURE1 (EXSYNC), RS-422 user output (STGSEL) and RS-422 reference clock (MCLK @ 30MHz) signals to camera: the EXPOSURE1 (EXSYNC) signal initiates line readout. • Matrox Genesis receiving RS-422 pixel clock (STROBE @ 15MHz) and RS-422 hsync (LVAL) signals from camera. • DCF used: CLT3DT2.DCF

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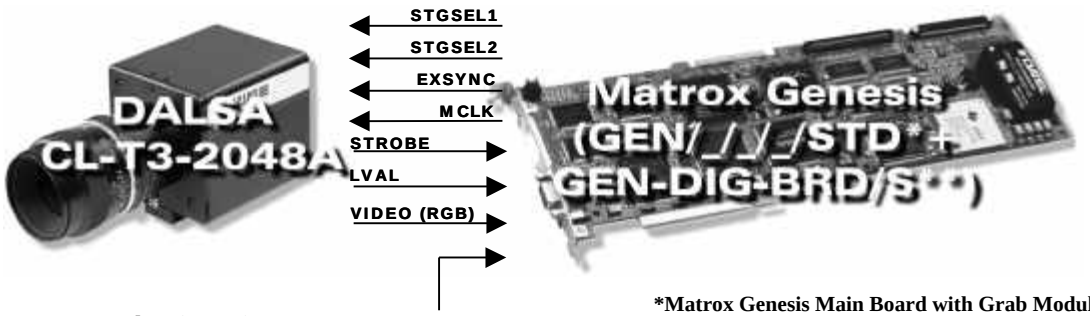
Camera Interface Briefs (continued)

Mode 3: Fixed line scan rate and variable frame size mode



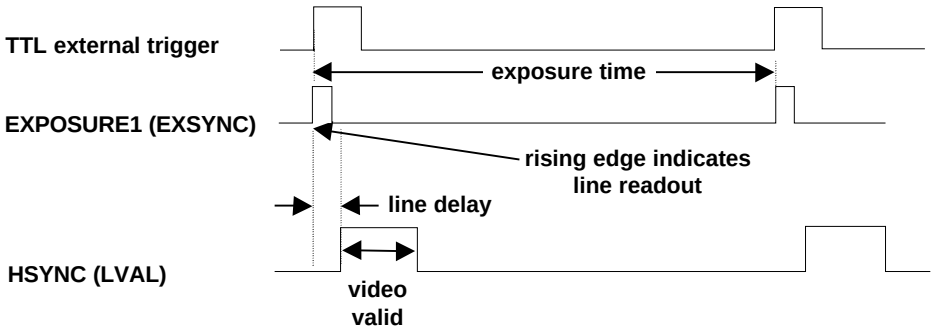
*Matrox Genesis Main Board with Grab Module
**Matrox Digital Data Input Board

- 2048 x 8-bit (RGB).
- 3-channels RS-422 digital video output.
- DCF configured for 480 lines per virtual frame (640 minus the 160 unusable lines).
- Line scan rate is fixed and controlled through Matrox Intellicam.
- Matrox Genesis receiving TTL external trigger.
- Matrox Genesis sending RS-422 EXPOSURE1 (EXSYNC), RS-422 user output (STGSEL) and RS-422 reference clock (MCLK @ 30MHz) signals to camera: the EXPOSURE1 (EXSYNC) signal initiates line readout.
- Matrox Genesis receiving RS-422 pixel clock (STROBE @ 15MHz) and RS-422 hsync (LVAL) signals from camera.
- DCF used: CLT3MOD1.DCF

Camera Interface Details

Mode 1: Variable line scan rate

- The line scan rate is variable and controlled by the external trigger signal.
- The external trigger is input on the Matrox Genesis via the analog video input connector trigger pin.
- Once an external trigger is received, the Matrox Genesis generates a pulse on EXPOSURE1 (EXSYNC) which in turns initiates line readout. A delay period exists between the rising edge of EXPOSURE1 and the rising edge of the valid video period (LVAL).
- The exposure time is defined as the period between the EXSYNC pulses; therefore changing the external trigger frequency can modify the exposure time. Increasing the period between the external trigger pulses (and in affect between the EXSYNC pulses) will lengthen the exposure time and vice versa will shorten the exposure time.
  The pixel clock, supplied by the camera, is half the master clock (MCLK). The master clock can be adjusted using Matrox Intellicam.



Camera Interface Details (continued)

Maximum line scan rate: the maximum trigger frequency, or the maximum line scan rate for this DCF is equal to the sum of the video valid (LVAL) and the maximum line delay or **136.6 µs + 4.9µs**. This maximum line scan rate is for a MCLK frequency of 30 MHz. The MCLK frequency can be reduced by a user through Matrox Intellicam, thereby changing the maximum line scan rate.

Maximum line delay: the maximum line delay (the period between the rising edge of EXPOSURE1 and the rising edge of HSYNC) is an inherent characteristic of the camera and determined to equal 4µs + 11MCLK + 4MCLK + 400ns

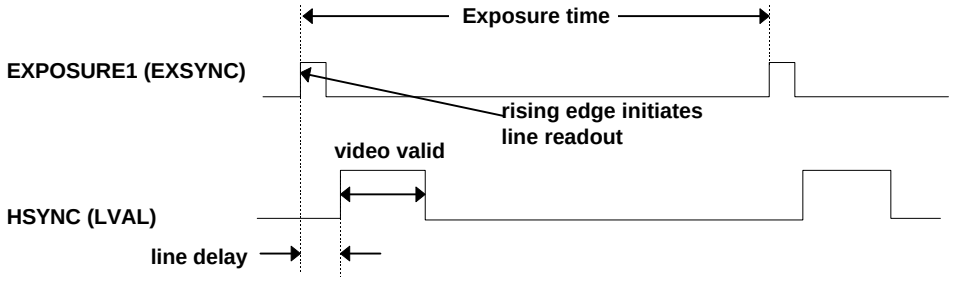
= 4µs + 0.37µs + 0.13µs + 400ns = **4.9µs**

Camera and Object set-up: As discussed in the camera manual, it is important to note that the object must pass in front of the lens parallel to the direction of the TDI stage shifts. And that while passing between the blue scan area and the red scan area the object should not move in a lateral direction any more than 1 pixel.

The number of TDI stages can be selected by controlling the user bits of the Genesis (STGSEL bit on camera) either via Matrox Intellicam, Genesis Native Library or MIL digitizer control, or by adjusting the rotary switches (JU1 and stage selection switch) located on the camera. See the camera manual for more information.

Mode 2: Fixed line scan rate mode

- The line scan rate is programmable and controlled by changing the Timer1 setting in the EXPOSURE SIGNAL menu in Matrox Intellicam.
- The exposure time is the period between the rising edges of the EXPOSURE1 (EXSYNC) pulses.
- The default exposure time for this DCF is ≅ 165 µs.



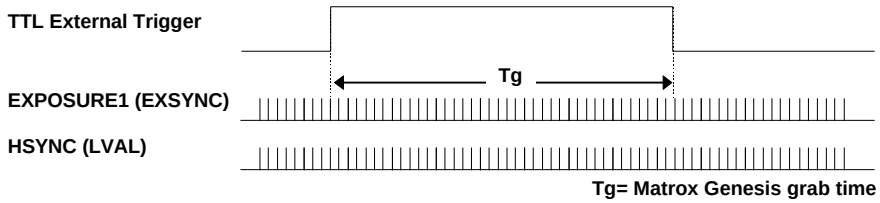
- To modify the exposure time, reduce or increase the inactive period of the EXPOSURE1. **Note**, it is important that the period of EXPOSURE1 signal be longer than the video valid output + the video valid output time. The exposure pulses can be easily changed with either Matrox Intellicam, Genesis Native Library function **imCamControl()** or with the MIL digitizer control function **MdigControl()**. Refer to the appropriate manual or user guide for additional information.

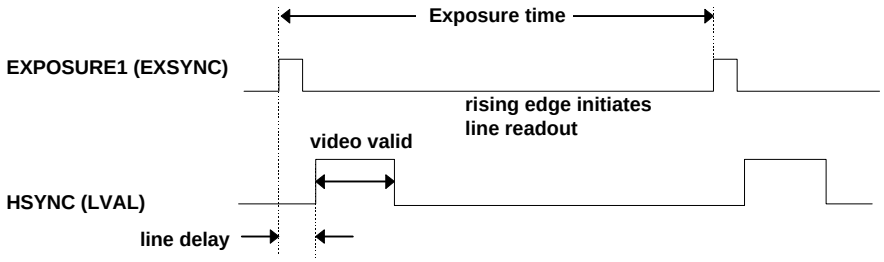
Camera Interface Details (continued)

Maximum line rate, Max. line delay, and Camera & Object set-up: are the same as for *Mode 1: Variable line scan rate mode*

Mode 3: Fixed line scan rate and variable frame size mode

- Number of lines per virtual frame is determined by external trigger period (lines are grabbed only when trigger is active). To change the number of lines per virtual frame, reduce or increase the active period of the TTL external signal; lines are grabbed only when trigger is active. Virtual frame size is 640 lines maximum (minus the 160 unusable lines) for this DCF and is dependent upon the trigger active (high) period.
- The line scan rate is fixed and controlled through Matrox Intellicam (Timer1 setting in EXPOSURE SIGNAL), Genesis Native Library function **imCamControl()** or MIL Digitizer control function **MdigControl()**. Refer to the Intellicam, Genesis Native Library or MIL command reference for additional information.
- The exposure time is the period between both rising edges of the EXPOSURE1 (EXSYNC).
- The default exposure time for this DCF is ≅ 165µs.
- To modify the exposure time, reduce or increase the inactive of Timer1 setting within the EXPOSURE menu of Matrox Intellicam. Note, it is important that the period of the EXPOSURE1 (EXSYNC) signal be longer than the video valid output delay + the video valid output time. Increasing the exposure time will decrease the total number of lines grabbed.
- The pixel clock supplied by the camera is 15 MHz.
- The TTL external trigger is input on the Matrox Genesis via the analog video input connector trigger pin.





Cabling Requirements

Mode 1: Variable line scan rate

- IMG-7W2-TO-5BNC cable required for TTL external trigger source and GEN-DIG-BRD/S required for digital data, syncs and control signals in RS-422.
- TTL external trigger source should be connected to the TTL trigger input of the IMG-7W2-TO-5BNC cable.
- Connections between the connector of the camera and the 100-pin connector of the GEN-DIG-BRD/S are as follows:

DALSA CL-T3-2048A (Red 20-pin dual row connector)			**GEN-DIG-BRD/S (GEN/CBL/OPEN connector)**	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
D7	01	→	DATA, INPUT, 7+	15
D7B	02	→	DATA, INPUT, 7-	16
D6	03	→	DATA, INPUT, 6+	13
D6B	04	→	DATA, INPUT, 6-	14
D5	05	→	DATA, INPUT, 5+	11
D5B	06	→	DATA, INPUT, 5-	12
D4	07	→	DATA, INPUT, 4+	09
D4B	08	→	DATA, INPUT, 4-	10
D3	09	→	DATA, INPUT, 3+	07
D3B	10	→	DATA, INPUT, 3-	08
D2	11	→	DATA, INPUT, 2+	05
D2B	12	→	DATA, INPUT, 2-	06
D1	13	→	DATA, INPUT, 1+	03
D1B	14	→	DATA, INPUT, 1-	04
D0	15	→	DATA, INPUT, 0+	01
D0B	16	→	DATA, INPUT, 0-	02
STROBE	17	→	CLOCK, INPUT, -	40
STROBE B	18	→	CLOCK, INPUT,+	39
LVAL	19	→	HSYNC, INPUT, +	33
LVALB	20	→	HSYNC, INPUT, -	34

DALSA CL-T3-2048A (Green 20-pin dual row connector)			**GEN-DIG-BRD/S (GEN/CBL/OPEN connector)**	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
D7	01	→	DATA, INPUT, 15+	31
D7B	02	→	DATA, INPUT, 15-	32
D6	03	→	DATA, INPUT, 14+	29
D6B	04	→	DATA, INPUT, 14-	30
D5	05	→	DATA, INPUT, 13+	27
D5B	06	→	DATA, INPUT, 13-	28
D4	07	→	DATA, INPUT, 12+	25
D4B	08	→	DATA, INPUT, 12-	26
D3	09	→	DATA, INPUT, 11+	23
D3B	10	→	DATA, INPUT, 11-	24
D2	11	→	DATA, INPUT, 10+	21
D2B	12	→	DATA, INPUT, 10-	22

(Pin-out continued)

Cabling Requirements (continued)

D1	13	→	DATA, INPUT, 9+	19
D1B	14	→	DATA, INPUT, 9-	20
D0	15	→	DATA, INPUT, 8+	17
D0B	16	→	DATA, INPUT, 8-	18
------	17		not connected	
------	18		not connected	
USER_EN	19	←	CAMERA CONTROL BIT0	49
USER_ENB	20	←	GROUND	50

DALSA CL-T3-2048A (Blue 20-pin dual row connector)			**GEN-DIG-BRD/S (GEN/CBL/OPEN connector)**	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
D7	01	→	DATA, INPUT, 23+	65
D7B	02	→	DATA, INPUT, 23-	66
D6	03	→	DATA, INPUT, 22+	63
D6B	04	→	DATA, INPUT, 22-	64
D5	05	→	DATA, INPUT, 21+	61
D5B	06	→	DATA, INPUT, 21-	62
D4	07	→	DATA, INPUT, 20+	59
D4B	08	→	DATA, INPUT, 20-	60
D3	09	→	DATA, INPUT, 19+	57
D3B	10	→	DATA, INPUT, 19-	58
D2	11	→	DATA, INPUT, 18+	55
D2B	12	→	DATA, INPUT, 18-	56
D1	13	→	DATA, INPUT, 17+	53
D1B	14	→	DATA, INPUT, 17-	54
D0	15	→	DATA, INPUT, 16+	51
D0B	16	→	DATA, INPUT, 16-	52
------	17		not connected	
------	18		not connected	
USER_EN	19	←	CAMERA CONTROL BIT1	99
USER_ENB	20	←	GROUND	50

DALSA CL-T3-2048A (DB-25 male connector)			**GEN-DIG-BRD/S (GEN/CBL/OPEN connector)**	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
MCLK	06	←	CLOCK, OUTPUT+	89
MCLKB	19	←	CLOCK, OUTPUT -	90
EXSYNC	17	←	EXPOSURE1, OUTPUT, +	95
EXSYNCB	04	←	EXPOSURE1, OUTPUT, -	96
STGSEL1	05	←	USER, OUTPUT, 0+	91
STGSEL1B	18	←	USER, OUTPUT, 0-	92
STGSEL2	23	←	USER, OUTPUT, 1+	93
STGSEL2B	10	←	USER, OUTPUT, 1-	94
GROUND	20		GROUND	50

Application Note:
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DALSA CL-T3-2048A

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Cabling Requirements (continued)

DALSA CL-T3-2048A (DB-25 male connector) *Pin name*	*Pin no.*		POWER SUPPLY *Pin name*
+15V	09	←	+15V
-5V	12	←	-5V
+5V	13	←	+5V
+15V	21	←	+15V
-5V	22	←	-5V
-15V	25	←	-15V
+5V	08	←	+5V
GROUND	07		GROUND
GROUND	11		GROUND
GROUND	24		GROUND

NOTE: it is very important that all the GROUNDs of the camera be connected together to the POWER SUPPLY GROUND, and to the GROUND of the Matrox Genesis. Do not use the cable shield as a ground, instead always use the ground pin of the power supply.

Mode 2: Fixed line scan rate mode

- All connections, except IMG-7W2-TO-5BNC cable (no TTL external trigger), are as in Mode 1: *variable line scan rate.*

Mode 3: Fixed line scan rate and variable frame size mode

- All connections are as in Mode 1: *variable line scan rate.*

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