Application Note:
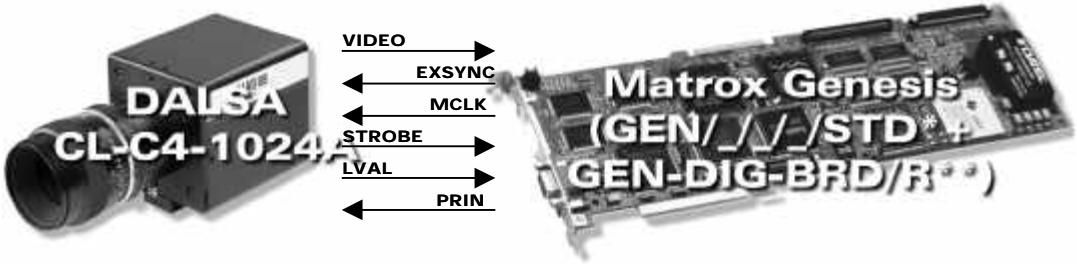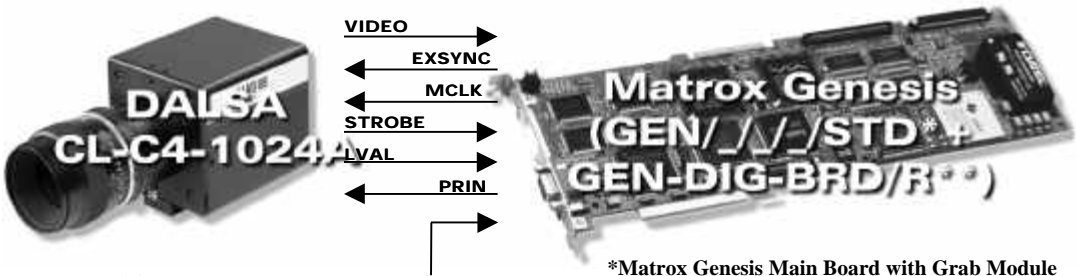## Interfacing non-standard cameras to Matrox Genesis

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DALSA CL-C4-1024A

August 24, 1998

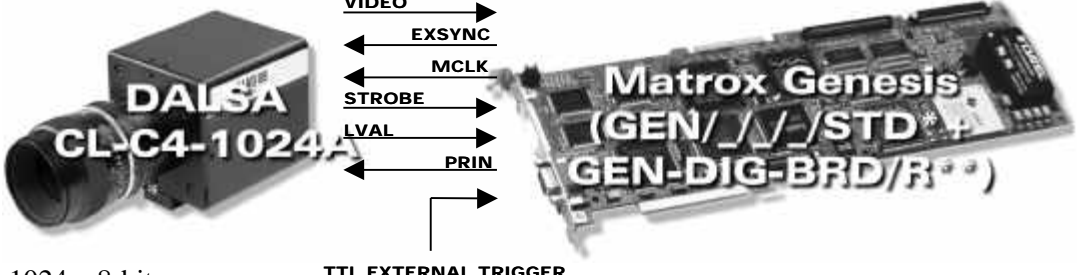|	
Camera Descriptions	• 1024 x 8-bit. • Dual channel RS-422 digital video output. • Exposure control. • Maximum data rate per output: 7.5MHz.
Interface Modes	• Fixed, variable line scan rate, and fixed line scan rate with variable frame size.
Camera Interface Briefs	**Mode 1: Fixed line scan rate** *Matrox Genesis Main Board with Grab Module **Matrox RS-422 Digital Data Input Board • 1024 x 8-bit. • Dual channel RS-422 digital video output. • DCF configured for 400 lines per virtual frame. • Line scan rate is fixed and determined by the frequency of the EXSYNC signal. • Matrox Genesis sending EXPOSURE2 (PRIN), RS-422 EXPOSURE1 (EXSYNC) and RS-422 reference clock (MCLK@ 15 MHz) signals to camera; the EXPOSURE1 (EXSYNC) signal initiates line readout. • Matrox Genesis receiving RS-422 pixel clock (STROBE @ 7.5 MHz), RS-422 HSYNC (LVAL) and video signals from camera. • DCF used: CLC4DBE2.DCF **Mode 2: Variable line scan rate** *Matrox Genesis Main Board with Grab Module **Matrox RS-422 Digital Data Input Board • 1024 x 8-bit. • Dual channel RS-422 digital video output. • DCF configured for 400 lines per virtual frame. • Line scan rate is variable and controlled by external trigger signal. • Matrox Genesis receiving TTL external trigger. • Matrox Genesis sending RS-422 EXPOSURE2 (PRIN), EXPOSURE1 (EXSYNC) and RS-422 reference clock (MCLK@ 15 MHz) signals to camera; the EXPOSURE1 (EXSYNC) signal initiates line readout. • Matrox Genesis receiving RS-422 pixel clock (STROBE @ 7.5 MHz), RS-422 HSYNC (LVAL) and video signals from camera. • DCF used: CLC4DBE1.DCF

Application Note:
Interfacing non-standard cameras to Matrox Genesis

M A T R O X
GENESIS

DALSA CL-C4-1024A

August 24, 1998

Camera Interface Briefs (continued)	**Mode 3: Fixed line scan rate with variable frame size** - 1024 x 8-bit. - Dual channel RS-422 digital video output. - Number of lines per virtual frame is determined by external trigger period (lines are grabbed when trigger is active). - Matrox Genesis receiving TTL external trigger. - Matrox Genesis sending RS-422 EXPOSURE2 (PRIN), EXPOSURE1 (EXSYNC) and RS-422 reference clock (MCLK@ 15 MHz) signals to camera; the EXPOSURE1 (EXSYNC) signal initiates line readout. - Matrox Genesis receiving RS-422 pixel clock (STROBE @ 7.5 MHz), RS-422 HSYNC (LVAL) and video signals from camera. - DCF used: CLC4DBE3.DCF
Camera Interface Details	**Mode 1: Fixed line scan rate** - Matrox Genesis sends the EXPOSURE1 (EXSYNC) signal to the camera; the camera awaits the rising edge of the EXPOSURE1 (EXSYNC) signal and after a short (constant) delay initiates line readout. - **Line rate**: The EXPOSURE1 (EXSYNC) period in the DCF specifies the line rate of the camera. The EXPOSURE1 (EXSYNC) period is currently set to **7500 pixels**. With a **7.5 MHz** pixel clock this translates to a **1 kHz** line rate. - **Exposure time**: The time between the rising edge of the EXPOSURE2 (PRIN) to the EXPOSURE1 (EXSYNC) signal is the exposure time. The default exposure time for this DCF is **900 μs**. In order to select the exposure time, the width and deployment time of EXPOSURE2 (PRIN) and EXPOSURE1 (EXSYNC) must be set in Matrox Intellicam. The exposure time of the camera can be modified in the DCF using 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. - **Maximum/minimum exposure time:** Since the Matrox Genesis timer is 16-bit wide, the maximum exposure time is calculated to be 65536-30/7.5 MHz = **8.73 ms**. The maximum line rate of the camera is **25.34 kHz**, therefore the minimum exposure time is **10.6 ns**. - **Smallest exposure time increment**: The pixel clock is the reference clock that the exposure time is being set by. The smallest increment of the exposure time is **133 ns**.

EXPOSURE2 (PRIN) — CCD charge

EXPOSURE1 (EXSYNC) — exposure time — rising edge initiates line readout

HSYNC (LVAL) — Line Delay — 68µs — video valid

Mode 2 : Variable line scan rate

- Once it has received the external signal to trigger, Matrox Genesis sends the EXPOSURE1 (EXSYNC) signal to the camera. A short (variable) delay will follow after receiving the EXPOSURE1 (EXSYNC), followed by the camera sending the HSYNC (LVAL) signal to the Matrox Genesis to initiate line readout.
- **Line rate**: The Line rate is variable and controlled by the frequency of the external trigger signal.
- **Exposure time**: Since the EXPOSURE1 (EXSYNC) signal is controlled by the external trigger signal, the time between the rising edges of the external trigger signal is the exposure time.
- **Maximum/minimum exposure time:** The maximum exposure time is equal to the maximum delay between rising edges of the external trigger signal. The minimum exposure time is **10.6 ns**.
- **Smallest exposure time increment**: same as in Mode 1

TTL external trigger

EXPOSURE 2 (PRIN) — CCD charge (1ms)

0.9ms

EXPOSURE 1 (EXSYNC) — 1.6µs

exposure time — rising edge initiates line readout

HSYNC (LVAL) — Line Delay — 68µs — video valid

Mode 2 : Fixed line scan rate with variable frame size

- **Line rate, Exposure time, Maximum/minimum exposure time and Smallest exposure time increment**: same as in Mode 1

TTL external trigger

EXPOSURE2 (PRIN) — CCD charge

EXPOSURE1 (EXSYNC) — exposure time

HSYNC (LVAL) — video valid

Cabling Requirements	**Mode 1: Fixed line scan rate**

- GEN-DIG-BRD/R required for digital data, syncs and control signals in RS-422 format.

- Matrox cable kit (GEN-TO-DALSA/32) is available for this mode as an alternative to custom cable development based on the pin-outs listing below.

- Connections between the 20-pin dual row connector (labeled **OS1** and **OS2**) of the camera and the 100-pin connector of the GEN-DIG-BRD/R are as follows:

DALSA CA-C4-1024A/B   **GEN-DIG-BRD/R**

(20-pin dual row connector-OS1)   **(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, +	39
STROBEB	18	→	CLOCK, INPUT, -	40
LVAL	19	→	Not connected	
LVALB	20	→	Not connected	

Cabling Requirements (continued)	

- Connections between the 20-pin dual row connector (labeled **OS1** and **OS2**) of the camera and the 100-pin connector of the GEN-DIG-BRD/R are as follows:

DALSA CA-C4-1024A/B   **GEN-DIG-BRD/R**

(20-pin dual row connector-OS2)   **(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
D1	13	→	DATA, INPUT, 9+	19
D1B	14	→	DATA, INPUT, 9-	20
D0	15	→	DATA, INPUT, 8+	17
D0B	16	→	DATA, INPUT, 8-	18
Not connected	17			
Not connected	18			
Not connected	19			
Not connected	20			

- Connections between the DB-25 connector on the rear panel of the camera and the 100-pin connector of the GEN-DIG-BRD/R are as follows:

DALSA CA-C4-1024A/B   **GEN-DIG-BRD/R**

(DB-25 male connector)   **(GEN/CBL/OPEN connector)**

Pin name	Pin no.		Pin name	Pin no.
MCLK	06	←	CLOCK, OUTPUT, +	89
MCLKB	19	←	CLOCK, OUTPUT, -	90
EXSYNC	17	←	EXPOSURE, OUTPUT, 1+	95
EXSYNCB	04	←	EXPOSURE, OUTPUT, 1-	96
PRIN	05	←	EXPOSURE, OUTPUT, 2+	97
PRINB	18	←	EXPOSURE, OUTPUT, 2-	98
LVAL	02	→	HSYNC, INPUT, +	33
LVALB	15	→	HSYNC, INPUT, -	34

Application Note:
Interfacing non-standard cameras to Matrox Genesis
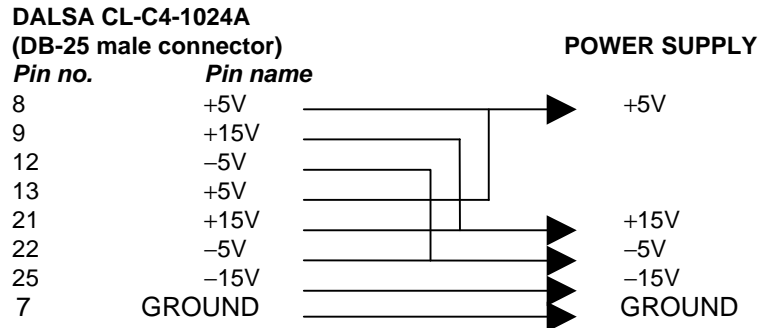
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DALSA CL-C4-1024A

August 24, 1998

| **Cabling Requirements (continued)** | • Connections between the DB-25 connector on the rear panel of the camera and the power supply are as follows: |

DALSA CL-C4-1024A
(DB-25 male connector)   **POWER SUPPLY**

Pin no.	Pin name		
8	+5V		+5V
9	+15V		
12	−5V		
13	+5V		
21	+15V		+15V
22	−5V		−5V
25	−15V		−15V
7	GROUND		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: Variable periodic 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 format.

• TTL external trigger source should be connected to the TTL trigger input of the IMG-7W2-TO-5BNC cable

• Matrox cable kit (GEN-TO-DALSA/32) is available for this mode as an alternative to custom cable development based on the pin-outs listing.

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

Mode 3: Fixed line scan rate with variable frame size

• Matrox cable kit (GEN-TO-DALSA/32) is available for this mode as an alternative to custom cable development based on the pin-outs listing below.

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

The DCF(s) mentioned in this application note can be found on the MIL and Native Library CD, or our FTP site (ftp.matrox.com). 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.

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