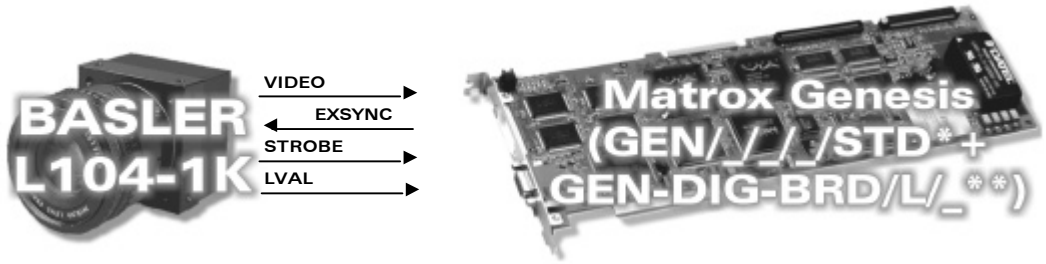
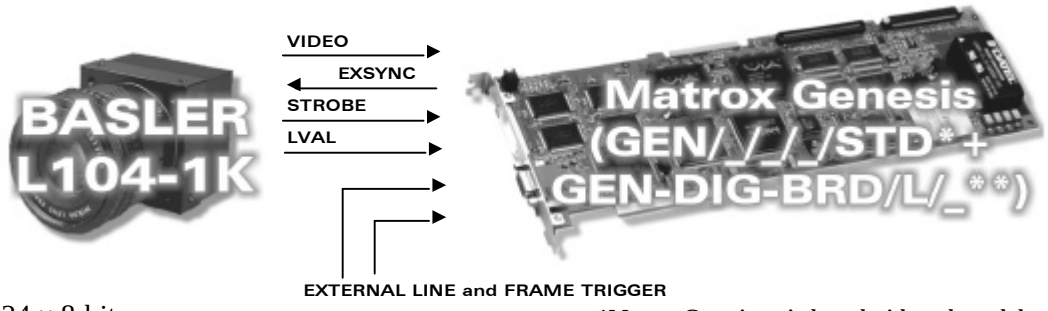
Application Note:
Interfacing non-standard cameras to Matrox Genesis

MATROX GENESIS

BASLER-MVC L104-1K

December 14, 1999

Camera Descriptions	• 1024 × 8-bit. • Single or dual channel LVDS digital video output. • External exposure control. • Pixel Clock: 31.25/62.5 MHz.
Interface mode	• Fixed line scan rate, variable line scan rate with variable frame size.
Camera Interface Briefs	**Mode 1: Fixed line scan rate**  ***Matrox Genesis main board with grab module** ****Matrox LVDS digital data input board** • 1024 × 8-bit. • Dual channel LVDS digital video. • DCF configured for 512 lines per virtual frame. • Line scan rate is fixed and determined by the frequency of the EXSYNC signal. • Matrox Genesis sending EXPOSURE1 (EXSYNC) signals to camera; the EXPOSURE1 (EXSYNC) signal controls line readout and exposure time. • Matrox Genesis receiving PIXEL CLOCK (STROBE @ 31.25 MHz) and HSYNC (LVAL) signals from camera; a high LVAL signal indicates valid pixels. • DCF used: GL160F.DCF (requires GNL 2.07 or higher) **Mode 2: Variable line scan rate with variable frame size**  ***Matrox Genesis main board with grab module** ****Matrox LVDS digital data input board** • 1024 × 8-bit. • Dual channel LVDS digital video. • Number of lines per virtual frame is determined by external frame trigger period; lines are grabbed only when trigger is active. • Matrox Genesis receiving external triggers (line and frame). • Matrox Genesis sending EXPOSURE1 (EXSYNC) signals to camera; the EXPOSURE1 (EXSYNC) signal controls line readout and exposure time. • Matrox Genesis receiving PIXEL CLOCK (STROBE @ 31.25 MHz) and HSYNC (LVAL) signals from camera; a high LVAL signal indicates valid pixels. • DCF used: GL160FV.DCF (requires GNL 2.07 or higher)

Camera Interface Details

Mode 1: Fixed line scan rate mode

- Matrox Genesis sends the periodic EXPOSURE1 (EXSYNC) signal to the camera; camera awaits the rising edge of EXPOSURE1 (EXSYNC) signal and initiates line readout.
- **Line rate**: The EXPOSURE1 (EXSYNC) frequency determines the line rate of the camera. The EXPOSURE1 (EXSYNC) period is currently set to **8000 pixels**. At a **28.636 MHz** crystal clock rate, the line rate is **3.6 kHz**.
- **Exposure time**: There are three modes of exposure time control, which can be selected by programming the EXPOSURE menu tab located in the BASLER Configuration Tool L1x0 (refer to BASLER User Manual for more information).
  - Edge controlled mode- Exposure time is the period between the rising edges of the EXPOSURE1 (EXSYNC) signal. To change the exposure time, modify the active and inactive periods of the EXPOSURE1 (EXSYNC) signal in the DCF.
  - Programmable mode- Exposure time is controlled through the BASLER Configuration Tool L1x0.
  - Level controlled mode- Exposure time is during the inactive period of EXPOSURE1 (EXSYNC) signal. To change the exposure time, modify the next falling edge of the EXPOSURE1 (EXSYNC) signal in the DCF.
- For Edge-controlled mode and Level controlled mode, the width and deployment time of EXPOSURE1 (EXSYNC) signal 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 65536/28.636 MHz = **2.29 ms**. The maximum line rate of the camera is **61.035 kHz**, therefore the minimum exposure time is **32.77** µs.
- **Smallest exposure time increment**: The crystal clock is the reference clock (**28.636 MHz**) that the exposure time is being set by. The smallest increment of exposure time is **34.9 ns**.

Mode 2: Variable line scan rate with variable frame size

- Once it has received the periodic external line trigger signal, Matrox Genesis sends the EXPOSURE1 (EXSYNC) signal to the camera; the camera awaits the rising edge of the EXPOSURE1 (EXSYNC) signal and initiates line readout. Once Matrox Genesis has received the external frame trigger signal, it captures lines only when trigger is active.
- **Line rate**: The line rate is variable and controlled by the frequency of the external trigger signal.
- **Virtual Frame size**: The number of lines per virtual frame is determined by external frame trigger period. The maximum number of lines per virtual frame is 1700.
- **Exposure time**: Since the EXPOSURE1 (EXSYNC) signal is controlled by the ext. 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 dependent on the maximum possible external line trigger period. The maximum line rate of the camera is **61.035 kHz**, therefore the minimum exposure time is **32.77** µs.
- **Smallest exposure time increment**: Same as in Mode 1.

Cabling Requirements

Mode 1: Fixed line scan rate

- DBHD100-TO-OPEN cable and GEN/DIG/BRD/L/_ board required for digital data, synchronization and control signals.
- Connections between the 44-pin HD SUB connector of the camera and the 100-pin connector of the GEN/DIG/BRD/L/_ are as follows:

BASLER L104-1K (44-pin HD SUB connector)			**GEN-DIG-BRD/L/_ (100-pin connector)**	
DOUT0	01	→	DATA, INPUT, 0+	01
DOUT1	02	→	DATA, INPUT, 1+	03
DOUT2	03	→	DATA, INPUT, 2+	05
DOUT3	04	→	DATA, INPUT, 3+	07
DOUT4	05	→	DATA, INPUT, 4+	09
DOUT5	06	→	DATA, INPUT, 5+	11
DOUT6	07	→	DATA, INPUT, 6+	13
DOUT7	08	→	DATA, INPUT, 7+	15
DOUT8	09	→	DATA, INPUT, 8+	17
DOUT9	10	→	DATA, INPUT, 9+	19
DOUT10	11	→	DATA, INPUT, 10+	21
DOUT11	12	→	DATA, INPUT, 11+	23
DOUT12	13	→	DATA, INPUT, 12+	25
DOUT13	14	→	DATA, INPUT, 13+	27
DOUT14	15	→	DATA, INPUT, 14+	29
DOUT15	31	→	DATA, INPUT, 15+	31
/DOUT0	16	→	DATA, INPUT, 0-	02
/DOUT1	17	→	DATA, INPUT, 1-	04
/DOUT2	18	→	DATA, INPUT, 2-	06
/DOUT3	19	→	DATA, INPUT, 3-	08
/DOUT4	20	→	DATA, INPUT, 4-	10
/DOUT5	21	→	DATA, INPUT, 5-	12
/DOUT6	22	→	DATA, INPUT, 6-	14
/DOUT7	23	→	DATA, INPUT, 7-	16
/DOUT8	24	→	DATA, INPUT, 8-	18
/DOUT9	25	→	DATA, INPUT, 9-	20
/DOUT10	26	→	DATA, INPUT, 10-	22
/DOUT11	27	→	DATA, INPUT, 11-	24
/DOUT12	28	→	DATA, INPUT, 12-	26
/DOUT13	29	→	DATA, INPUT, 13-	28
/DOUT14	30	→	DATA, INPUT, 14-	30
/DOUT15	32	→	DATA, INPUT, 15-	32

continued

Cabling Requirements (continued)

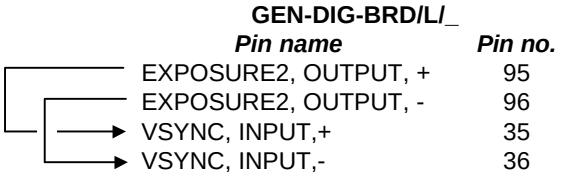
BASLER L104-1K (44-pin HD SUB connector)			GEN-DIG-BRD/L/_ (100-pin connector)	
LVAL	33	→	HSYNC, INPUT,+	33
/LVAL	34	→	HSYNC, INPUT,-	34
PIXEL CLOCK	35	→	CLOCK, INPUT, +	39
/PIXEL CLOCK	36	→	CLOCK, INPUT, -	40
EXSYNC	37	←	EXPOSURE1, OUTPUT, +	95
/EXSYNC	38	←	EXPOSURE1, OUTPUT, -	96
GND	43		GROUND	37
GND	44		GROUND	38

Mode 2: Variable line scan rate with variable frame size

- DBHD100-TO-OPEN cable and GEN/DIG/BRD/L/_ board required for digital data, synchronization and control signals.
- All connections between the 44-pin HD SUB connector of the camera and the 100-pin connector of the GEN/DIG/BRD/L/_ are as in Mode 1 except for the following changes, jumpers, and additions:

BASLER L104-1K (44-pin HD SUB connector)			GEN-DIG-BRD/L/_ (100-pin connector)	
EXSYNC	37	←	EXPOSURE1, OUTPUT, +	95
/EXSYNC	38	←	EXPOSURE1, OUTPUT, -	96
GND	43		GROUND	37
GND	44		GROUND	50

- The follow jumper connections are required on the 100-pin connector of the GEN/DIG/BRD/L/_ board:



continued

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Cabling Requirements (continued)

- Connections between the external hardware trigger (frame and line) and the 100-pin connector of the GEN/DIG/BRD/L/_ are as follow:

External Hardware Trigger	GEN-DIG-BRD/L/_ Pin name	Pin no.
RS-422 Frame Trigger +	USER, INPUT, 0+	41
RS-422 Frame Trigger -	USER, INPUT, 0-	42
	USER, INPUT, 1+	43
	USER, INPUT, 1-	44
RS-422 Line Trigger +	TRIGGER, INPUT, +	47
RS-422 Line Trigger -	TRIGGER, INPUT, -	48

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 Imaging Applications at 514-822-6061 for assistance.

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