Matrox Genesis

Camera Interface Application Note

NED NF5150D

May 27, 2002

Basics about the camera

Camera Descriptions

- 5150 pixels/line × 8-bit.
- Single channel LVDS digital video output.
- External sync.
- External exposure control.
- 20 MHz pixel clock rate.

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

Interface Modes

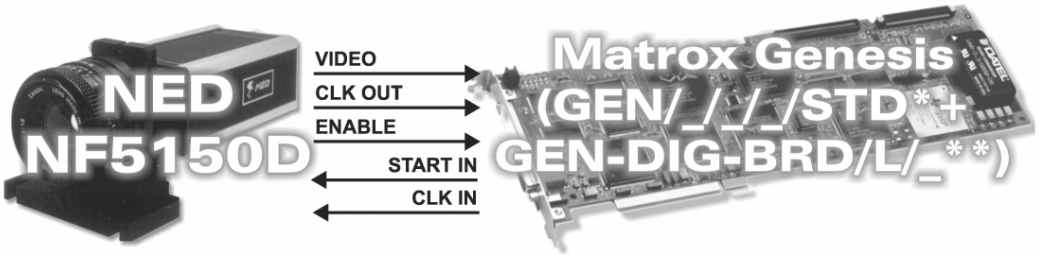
- Fixed line scan
- Variable line scan
- Variable line scan (fixed exposure)
- Variable line scan with variable frame size

Basics about the interface modes

Camera Interface Briefs

Mode 1: Fixed line scan

- 5120 pixels/line × 8-bit.
- Single channel LVDS digital video.
- DCF configured for 800 lines per virtual frame.
- Line scan rate is fixed and determined by EXPOSURE1 (START IN) signal frequency.
- Matrox Genesis sending EXPOSURE1 (START IN) and CLOCK OUT (CLOCK IN on camera @ 20 MHz) signals to camera; EXPOSURE1 (START IN) initiates and controls exposure.
- Matrox Genesis receiving HSYNC (ENABLE), PIXEL CLOCK (CLOCK OUTPUT @ 20 MHz) and video signals from camera.
- DCF used: 5150LP.DCF



Mode 2: Variable line scan

- 5120 pixels/line × 8-bit.
- Single channel LVDS digital video.
- DCF configured for 800 lines per virtual frame.
- Line scan rate is variable and determined by external trigger frequency.
- Matrox Genesis receiving external trigger signal.

Continued…

***Matrox Genesis main board with grab module**
****Matrox LVDS digital input board**

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Basics about the interface modes

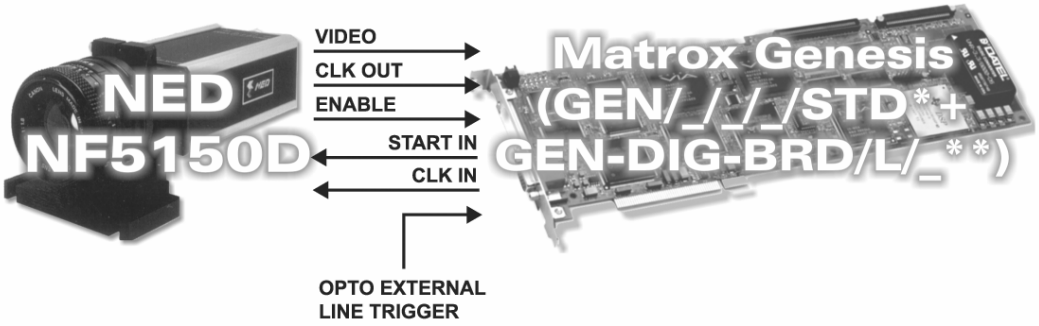
Camera Interface Briefs (continued)

Mode 2: Variable line scan

- Matrox Genesis sending EXPOSURE1 (START IN) and CLOCK OUT (CLOCK IN on camera @ 20 MHz) signals to camera; EXPOSURE1 (START IN) initiate and controls exposure.
- Matrox Genesis receiving HSYNC (ENABLE), PIXEL CLOCK (CLOCK OUTPUT @ 20 MHz) and video signals from camera.
- DCF used: 5150LV.DCF

Mode 3: Variable line scan (fixed exposure)

- 5120 pixels/line × 8-bit.
- Single channel LVDS digital video.
- Line scan rate is variable and determined by the external OPTO line trigger frequency.
- Matrox Genesis receiving external OPTO line trigger signal.
- Matrox Genesis sending periodic HSYNC OUT (START IN) and CLOCK OUT (CLOCK IN on camera @ 20 MHz) signals to camera; HSYNC OUT (START IN) initiates and controls exposure.
- Matrox Genesis receiving DIG TRIGGER IN (ENABLE), PIXEL CLOCK (CLOCK OUTPUT @ 20 MHz) and video signals from camera.
- DCF used: 5150FELV.DCF



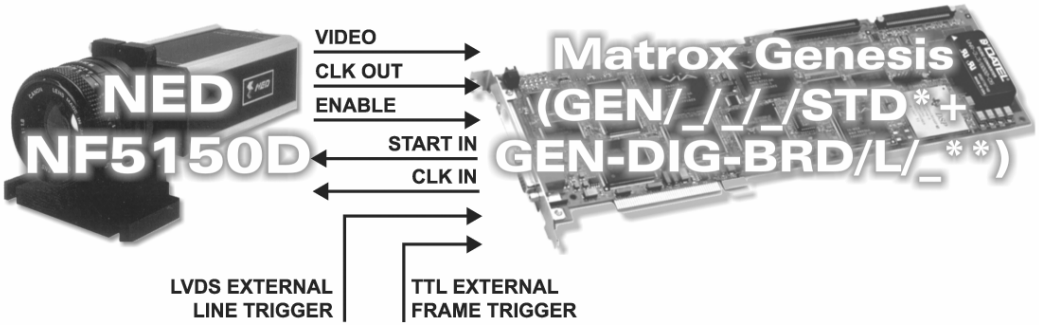
***Matrox Genesis main board with grab module**
****Matrox LVDS digital input board**

Basics about the interface modes

Camera Interface Briefs (continued)

Mode 4: Variable line scan with variable frame size

- 5120 pixels/line × 8-bit.
- Single channel LVDS digital video.
- Number of lines per virtual frame is determined by the TTL external frame trigger period.
- Line scan rate is variable and determined by the LVDS external line trigger frequency.
- Matrox Genesis receiving external frame and line trigger signals.
- Matrox Genesis sending EXPOSURE1 (START IN) and CLOCK OUT (CLOCK IN on camera @ 20 MHz) signals to camera; EXPOSURE1 (START IN) initiate and controls exposure.
- Matrox Genesis receiving HSYNC (ENABLE), PIXEL CLOCK (CLOCK OUTPUT @ 20 MHz) and video signals from camera.
- DCF used: 5150LVFV.DCF



***Matrox Genesis main board with grab module**
****Matrox LVDS digital input board**

Camera Interface Details

Mode 1: Fixed line scan

- **Line rate:** The frequency of the periodic EXPOSURE1 (START IN) signal controls the camera's line rate. The EXPOSURE1 (START IN) signal period is set to **5304 pixels**, with a **20 MHz** pixel clock, this translates to a **3.77 kHz** line rate. Refer to the camera manual for more information.
- **Exposure time:** Exposure time is the period between both rising edges of the EXPOSURE1 (START IN) signal. The default exposure time for this DCF is equal to **260 ms**. The exposure time can be modified in the DCF using Matrox Intellicam, Genesis Native Library (GNL) imCamControl() or with the MIL MdigControl() function. Consult the respective manual for more information.

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Specifics about the interface modes

Camera Interface Details (continued)

Mode 1: Fixed line scan

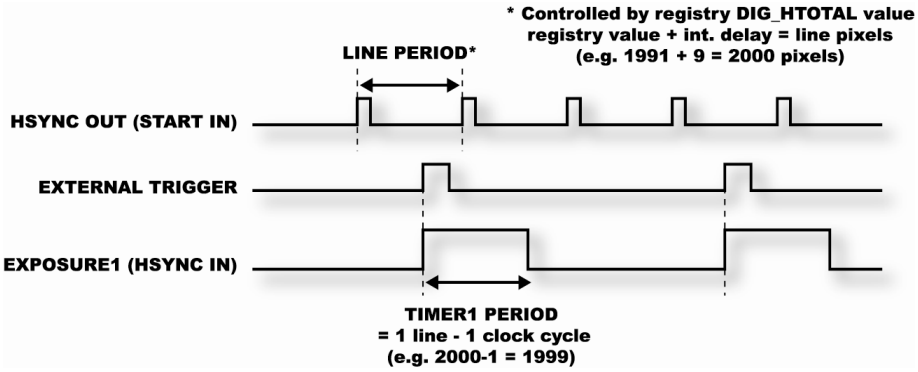
- **Maximum/Minimum exposure times:** Since the Matrox Genesis timer is 16-bit wide, the maximum exposure time is calculated to be 65536/20MHz = **3.28 ms**. The maximum line rate of the camera is **3.88 kHz**; therefore the minimum exposure time is **257.7 µs.**
- **Smallest exposure time increment:** The camera's clock (20 MHz) is the reference clock in which the exposure time is being set by, therefore the smallest exposure time increment is **50 ns**.

Mode 2: Variable line scan

- **Line rate:** The line rate is variable and controlled by the frequency of the external trigger signal.
- **Exposure time:** Exposure time is equal to the external trigger signal period.
- **Minimum exposure times:** Minimum exposure time is **257.7 µs.**
- **Smallest exposure time increment:** Same as in Mode 1: *Fixed line scan.*

Mode 3: Variable line scan (fixed exposure)

- **Line rate:** The line rate is variable and controlled by the frequency of the OPTO line trigger signal.
- **Exposure time:** Exposure time is controlled by the EXPOSURE1 (HSYNC IN) and HSYNC OUT (START IN) signals. To change the exposure time modify the active period of EXPOSURE1 (HSYNC IN) in the DCF using Matrox Intellicam, Genesis Native Library (GNL) imCamControl() or MIL MdigControl() function, and modify the HTOTAL registry value. To edit the HTOTAL registry value, start Matrox Intellicam using –hwreg, open the DCF file, select the DIG menu tab, and enter the desired DIG_HTOTAL value. Contact Matrox Imaging Technical Support for assistance if necessary.
- **Timing diagram:**



Camera Interface Details (continued)

Mode 4: Variable line scan with variable frame size

- **Line rate:** The line rate is variable and controlled by the frequency of the LVDS external line trigger signal.
- **Frame rate:** The maximum number of lines per virtual frame is 800. The frequency of the TTL external frame trigger determines the pseudo-frame rate. NOTE: If a successive frame trigger arrived before 800 lines are captured, the Matrox Genesis will reset the display buffer.
- **Exposure time:** Same as in Mode 2: *Variable line scan.*
- **Minimum exposure times:** Same as in Mode 2: *Variable line scan.*
- **Smallest exposure time increments:** Same as in Mode 1: *Fixed line scan.*

Cabling details for this interface mode

Cabling Requirements

Mode 1: Fixed line scan

- **Cable:** DBHD100-TO-OPEN (open ended) cable required for video, synchronization and control signals.
- **Connection:** Connections between the 36-pin connector of the camera and the 100-pin connectors of the Matrox Genesis are as follows:

NED NF5150D (36-pin connector)			**GEN-DIG-BRD/LI_ (100-pin connector)**	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
D9+	28	→	DATA, INPUT, 9+	19
D9-	29	→	DATA, INPUT, 9-	20
D8+	09	→	DATA, INPUT, 8+	17
D8-	10	→	DATA, INPUT, 8-	18
D7+	26	→	DATA, INPUT, 7+	15
D7-	27	→	DATA, INPUT, 7-	16
D6+	07	→	DATA, INPUT, 6+	13
D6-	08	→	DATA, INPUT, 6-	14
D5+	24	→	DATA, INPUT, 5+	11
D5-	25	→	DATA, INPUT, 5-	12
D4+	05	→	DATA, INPUT, 4+	09
D4-	06	→	DATA, INPUT, 4-	10
D3+	22	→	DATA, INPUT, 3+	07
D3-	23	→	DATA, INPUT, 3-	08
D2+	03	→	DATA, INPUT, 2+	05
D2-	04	→	DATA, INPUT, 2-	06
D1+	20	→	DATA, INPUT, 1+	03
D1-	21	→	DATA, INPUT, 1-	04
D0+	01	→	DATA, INPUT, 0+	01
D0-	02	→	DATA, INPUT, 0-	02

Continued…

Cabling details for this interface mode

Cabling Requirements (continued)

Mode 1: Fixed line scan

NED NF5150D (36-pin connector)			GEN-DIG-BRD/L/_ (100-pin connector)	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
CLOCK OUT+	11	→	CLOCK, INPUT, +	39
CLOCK OUT-	12	→	CLOCK, INPUT, -	40
ENABLE +	13	→	HSYNC, INPUT, +	33
ENABLE -	14	→	HSYNC, INPUT, +	34
START IN +	33	←	EXPOSURE1, OUTPUT +	95
START IN -	34	←	EXPOSURE1, OUTPUT -	96
CLOCK IN +	16	←	CLOCK, OUTPUT, +	89
CLOCK IN -	17	←	CLOCK, OUTPUT, -	90

Mode 2: Variable line scan

- **Cable:** DBHD100-TO-OPEN (open ended) cable required for video, synchronization and control signals.
- **Connection:** Same as in Mode 1: *Fixed line scan*, except for the following additional connections:

GEN-DIG-BRD/L/_ (100-pin connector)			LVDS EXTERNAL LINE TRIGGER SOURCE	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
TRIGGER INPUT+	47	←	--	--
TRIGGER INPUT-	48	←	--	--

Mode 3: Variable line scan (fixed exposure)

- **Cable:** IMG-7W2-TO-5BNC and DBHD100-TO-OPEN (open ended) cables required for video, synchronization and control signals.
- **External Trigger:** TTL external trigger source should be connected to the TTL trigger input (gray BNC) of the IMG-7W2-TO-5BNC cable.
- **Connection:** Connections between the 36-pin connector of the camera and the 100-pin connectors of the Matrox Genesis are as follows:

NED NF5150D (36-pin connector)			GEN-DIG-BRD/L/_ (100-pin connector)	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
D9+	28	→	DATA, INPUT, 9+	19
D9-	29	→	DATA, INPUT, 9-	20
D8+	09	→	DATA, INPUT, 8+	17
D8-	10	→	DATA, INPUT, 8-	18
D7+	26	→	DATA, INPUT, 7+	15
D7-	27	→	DATA, INPUT, 7-	16
D6+	07	→	DATA, INPUT, 6+	13
D6-	08	→	DATA, INPUT, 6-	14
D5+	24	→	DATA, INPUT, 5+	11
D5-	25	→	DATA, INPUT, 5-	12

Continued…

Cabling details for this interface mode

Cabling Requirements (continued)

Mode 3: Variable line scan (fixed exposure)

NED NF5150D (36-pin connector)			GEN-DIG-BRD/L/_ (100-pin connector)	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
D4+	05	→	DATA, INPUT, 4+	09
D4-	06	→	DATA, INPUT, 4-	10
D3+	22	→	DATA, INPUT, 3+	07
D3-	23	→	DATA, INPUT, 3-	08
D2+	03	→	DATA, INPUT, 2+	05
D2-	04	→	DATA, INPUT, 2-	06
D1+	20	→	DATA, INPUT, 1+	03
D1-	21	→	DATA, INPUT, 1-	04
D0+	01	→	DATA, INPUT, 0+	01
D0-	02	→	DATA, INPUT, 0-	02
CLOCK OUT+	11	→	CLOCK, INPUT, +	39
CLOCK OUT-	12	→	CLOCK, INPUT, -	40
ENABLE +	13	→	TRIGGER, INPUT, +	47
ENABLE -	14	→	TRIGGER, INPUT, +	48
START IN +	33	←	HSYNC, OUTPUT +	83
START IN -	34	←	HSYNC, OUTPUT -	84
CLOCK IN +	16	←	CLOCK, OUTPUT, +	89
CLOCK IN -	17	←	CLOCK, OUTPUT, -	90

- **Jumper:** The following are required on the 100-pin connector:

GEN-DIG-BRD/L/_ (100-pin connector)			GEN-DIG-BRD/L/_ (100-pin connector)	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
EXPOSURE1, OUTPUT+	95	→	HSYNC, INPUT+	33
EXPOSURE1, OUTPUT-	96	→	HSYNC, INPUT-	34

- **External trigger:** Connections between the external line trigger source and the 100-pin connectors of the Matrox Genesis are as follows:

Matrox Genesis (BNC connector)			TTL External Trigger Source	
Pin name	***Pin no.***			
GRAY BNC	--	←	SIGNAL	--

Cabling details for this interface mode

Cabling Requirements (continued)

Mode 4: Variable line scan with variable frame size

- **Cable:** IMG-7W2-TO-5BNC and DBHD100-TO-OPEN (open ended) cables required for video, synchronization and control signals.
- **Connection:** Same as in Mode 1: *Fixed line scan*.
- **External trigger:** Connections between the external line trigger source and the 100-pin connectors of the Matrox Genesis are as follows:

GEN-DIG-BRD/L/_ (100-pin connector)			**LVDS EXTERNAL LINE TRIGGER SOURCE**	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
TRIGGER INPUT+	47	←	--	--

- **External trigger:** Connections between the external line trigger source and the 100-pin connectors of the Matrox Genesis are as follows:

GEN-DIG-BRD/L/_ (BNC connector)			**TTL EXTERNAL FRAME TRIGGER SOURCE**	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
GRAY BNC (OPTO TRIG)	--	←	--	--

- **Jumper:** The following jumper connections are required on the 100-pin connector:

GEN-DIG-BRD/L/_ (100-pin connector)			**GEN-DIG-BRD/L/_ (100-pin connector)**	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
EXPOSURE2, OUTPUT+	97	→	VSYNC, INPUT+	35
EXPOSURE2, OUTPUT-	98	→	VSYNC, INPUT-	36

The DCF(s) mentioned in this application note can be found on the MIL, 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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