MATROX GENESIS
CAMERA INTERFACE APPLICATION NOTE
DALSA EC-11-xxx40 JANUARY 11, 2002

Basics about the camera

Camera Descriptions

- Effective resolution: Up to 2048 pixels/line × 8-bit @ up to 17.4K LPS.
- Single channel LVDS digital video output.
- Internal or external exposure control.
- 40 MHz pixel clock rate.

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

Interface Modes

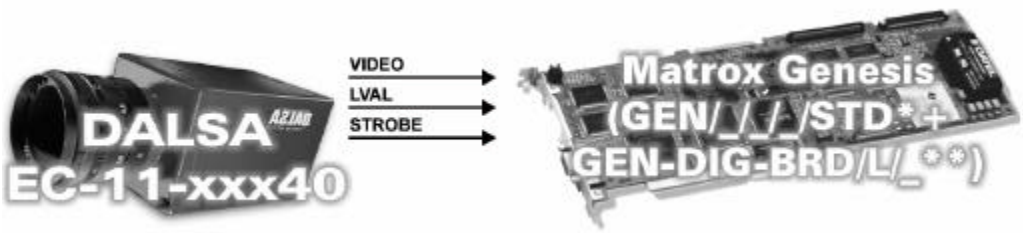
- Fixed line scan (Free Run Mode – Genesis Slave)
- Fixed line scan (Genesis Master)
- Variable line scan (Genesis Master)

Basics about the interface modes

Camera Interface Briefs

Mode 1: Fixed line scan (Free Run mode-Genesis Slave)

- Up to 2048 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 camera.
- Matrox Genesis receiving HSYNC (LVAL), PIXEL CLOCK (STROBE) and video signals from camera.
- DCF used: EC5HFREE.DCF (512 pixels/line @ 64.1K lines/second)
- DCF used: EC1KFREE.DCF (1024 pixels/line @ 34.8K lines/second)
- DCF used: EC2KFREE.DCF (2048 pixels/line @ 17.4K lines/second)



Mode 2: Fixed line scan (Genesis Master)

- Up to 2048 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 (EXSYNC) signal frequency.
- Matrox Genesis sending EXPOSURE1 (EXSYNC) and EXPOSURE2 (FOWARD) signals to camera to initiate and control exposure, and control the scan direction of the CCD (optional).

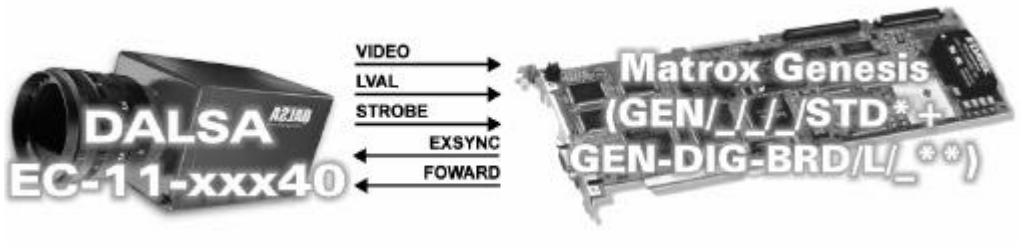
Continued…

Basics about the interface modes

Camera Interface Details (continued)

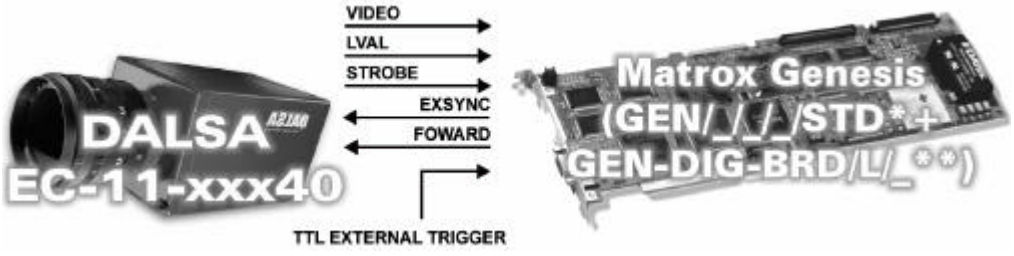
Mode 2: Fixed line scan (Genesis Master)

- Matrox Genesis receiving HSYNC (LVAL), PIXEL CLOCK (STROBE) and video signals from camera.
- DCF used: EC5HDEL.DCF (512 pixels/line @ 43.48K lines/second)
- DCF used: EC1KDEL.DCF (1024 pixels/line @ 21.7K lines/second)
- DCF used: EC2KDEL.DCF (2048 pixels/line @ 14.08K lines/second)



Mode 3: Variable line scan (Genesis Master)

- Up to 2048 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.
- Matrox Genesis sending EXPOSURE1 (EXSYNC) and EXPOSURE2 (FOWARD) signals to camera to initiate and control exposure, and control the scan direction of the CCD (optional).
- Matrox Genesis receiving HSYNC (LVAL), PIXEL CLOCK (STROBE) and video signals from camera.
- DCF used: EC5HDAE.DCF (512 pixels/line)
- DCF used: EC1KDAE.DCF (1024 pixels/line)
- DCF used: EC2KDAE.DCF (2048 pixels/line)



Specifics about the interface modes

Camera Interface Details

Mode 1: Fixed line scan (Free Run mode-Genesis Slave)

- **Line rate:** The frequency of the periodic HSYNC (LVAL) signal controls the line rate. In this mode the line rate is fixed and cannot be changed, and equals **64.1 KHz** (EC-11-05h40)**, 34.8 KHz** (EC-11-01k40) **or 17.4 KHz** (EC-11-02k40).
- **Exposure time:** Exposure time is the duration between the rising edges of the HSYNC (LVAL) signal. The default exposure time for this DCF equals **15.60 µs** (EC-11-05h40)**, 28.74 µs** (EC-11-01k40) **or 57.47 µs** (EC-11-02k40). Exposure time is controlled through the serial port interface. Refer to the camera manual for more information.
- **Camera control:** For this DCF, the EXPOSURE2 (FORWARD) signal is set to a low level, however the readout direction is controlled through the serial port interface. Refer to the camera manual for more information.

Mode 2: Fixed line scan (Genesis Master)

- **Line rate:** The frequency of the periodic EXPOSURE1 (EXSYNC) signal controls the camera's line rate. The EXPOSURE1 (EXSYNC) signal period is set to **456 / 912 / 1424** (EC-11-05h40 / EC-11-1k40 / EC-11-2k40), with a **20 MHz** timer clock, this translates to a **43.48 kHz** / **21.74 kHz / 14.68 kHz** line rate (EC-11-05h40 / EC-11-1k40 / EC-11-2k40).
- **Exposure time:** Exposure time is the duration between the rising edges of the EXPOSURE1 (EXSYNC) signal. The default exposure time for this DCF is equal to **23 µs / 46 µs / 71 µs** (EC-11-05h40 / EC-11-1k40 / EC-11-2k40). The exposure time can be modified in the DCF using Matrox Intellicam, Genesis Native Library (GNL) imCamControl(), MIL MdigControl() function or through the serial port interface. When using the serial port interface, it is only possible to shorten the exposure time. To lengthen, you must modify the EXPOSURE1 (EXSYNC) signal in the DCF. Consult the respective manual for more information.
- **Maximum/Minimum exposure times:** Since the Matrox Genesis timer is 16-bit wide, the maximum exposure time is calculated to be (65536-2048)/20MHz = **3.17 ms**. The maximum line rate of the camera is **18.7 kHz**; therefore the minimum exposure time is ≈ **2.3 µs.** The pixel clock is the reference clock in which the exposure time is being set by, therefore the smallest exposure time increment is **50 ns**.
- **Camera control:** For this DCF, the EXPOSURE2 (FORWARD) signal is set to a low level, however the readout direction is controlled through the serial port interface. Refer to the camera manual for more information.
- **Camera commands:** The Line Sync mode of the camera must be set via the RS-232 Serial Interface.

Command	Short Form	Parameter
set_sync_mode	ssm	1: Externally supplied Sync

Mode 3: Variable line scan

- **Line rate:** The line rate is variable and controlled by the external trigger signal frequency.
- **Exposure time:** Exposure time is the duration between the rising edges of the EXPOSURE1 (EXSYNC) signal. The default exposure time for this DCF is equal to **23 ms / 46 ms / 71 ms** (EC-11-05h40 / EC-11-1k40 / EC-11-2k40). The exposure time can be modified in the DCF using Matrox Intellicam, Genesis Native Library (GNL) imCamControl(), MIL MdigControl() function or through the serial port interface. When using the serial port interface, it is only possible to shorten the exposure time. To lengthen, you must modify the EXPOSURE1 (EXSYNC) signal in the DCF. Consult the respective manual for more information.
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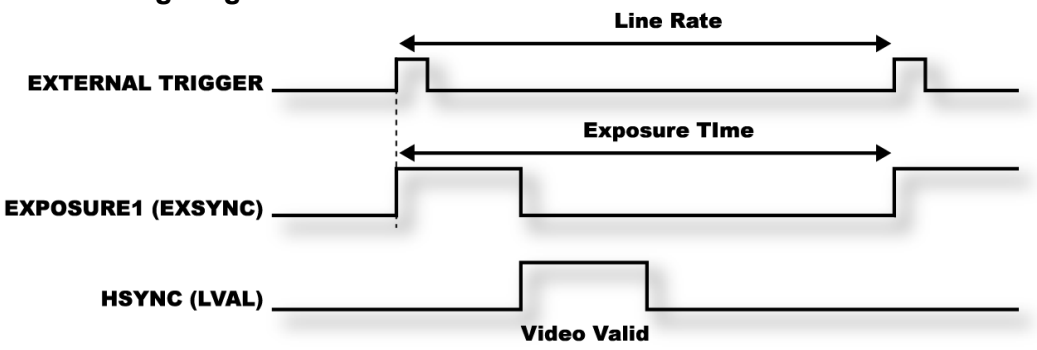
set_sync_mode	ssm	1: Externally supplied Sync

- **Timing diagram**:



Cabling details for this interface mode

Cabling Requirements

Modes 1 and 2: 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:

DALSA EC-11-xxx40 (36-pin connector)			**GEN-DIG-BRD/L/_ (100-pin connector)**	
Pin name	***Pin no.***		***Pin name***	***Pin no.***
D7 (MSB)	09	→	DATA, INPUT, 7+	15
D7B	27	→	DATA, INPUT, 7-	16
D6	10	→	DATA, INPUT, 6+	13
D6B	28	→	DATA, INPUT, 6-	14
D5	11	→	DATA, INPUT, 5+	11
D5B	29	→	DATA, INPUT, 5-	12
D4	12	→	DATA, INPUT, 4+	09
D4B	30	→	DATA, INPUT, 4-	10
D3	13	→	DATA, INPUT, 3+	07
D3B	31	→	DATA, INPUT, 3-	08
D2	14	→	DATA, INPUT, 2+	05
D2B	32	→	DATA, INPUT, 2-	06
D1	15	→	DATA, INPUT, 1+	03
D1B	33	→	DATA, INPUT, 1-	04
D0	16	→	DATA, INPUT, 0+	01
D0B	34	→	DATA, INPUT, 0-	02
STROBE	17	→	CLOCK, INPUT, +	39
STROBEB	35	→	CLOCK, INPUT, -	40
LVAL	18	→	HSYNC, INPUT, +	33
LVALB	36	→	HSYNC, INPUT, +	34
FOWARD	06*	←	EXPOSURE2, OUTPUT +	97*
FOWARDB	24*	←	EXPOSURE2, OUTPUT -	98*
Future use	08	←	USER, OUTPUT, 1+	93
Future use	26	←	USER, OUTPUT, 1-	94
EXRCLK	05	←	CLOCK, OUTPUT, +	89
EXRCLK B	23	←	CLOCK, OUTPUT, -	90
Future use	04	←	USER, OUTPUT, 0+	91
Future use	22	←	USER, OUTPUT, 0-	92
EXSYNC	07*	←	EXPOSURE1, OUTPUT, +	95*
EXSYNCB	25*	←	EXPOSURE1, OUTPUT, -	96*

* These connection is not required for Mode 1, however allows this cable to be used with all modes.

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Cabling details for this interface mode

Cabling Requirements

Mode 3: Variable line scan (Genesis Master)

- **Cable:** IMG-7W2-TO-5BNC and DBHD100-TO-OPEN (open ended) cables required for video, synchronization and control signals.
- **External trigger:** TTL external trigger should be connected to the TTL trigger input of the IMG-7W2-TO-5BNC cable (gray BNC).
- **Connection:** Connections between the 36-pin connector of the camera and the 100-pin connector of the Matrox Genesis are as Mode 1: *Fixed line scan*.

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