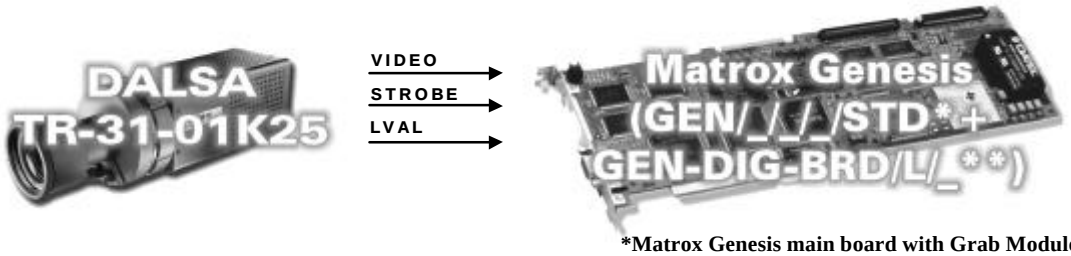
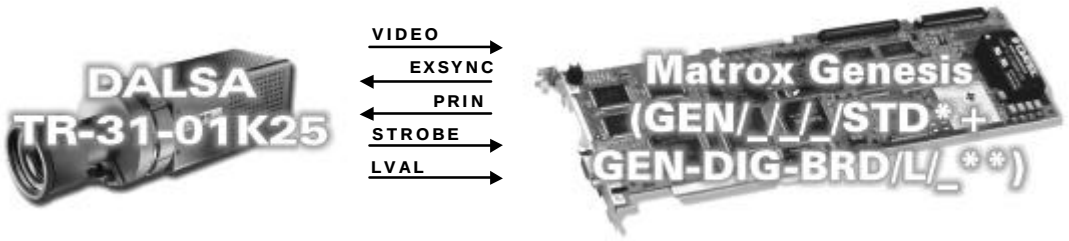
# Application Note:
## Interfacing non-standard cameras to Matrox Genesis

MATROX GENESIS

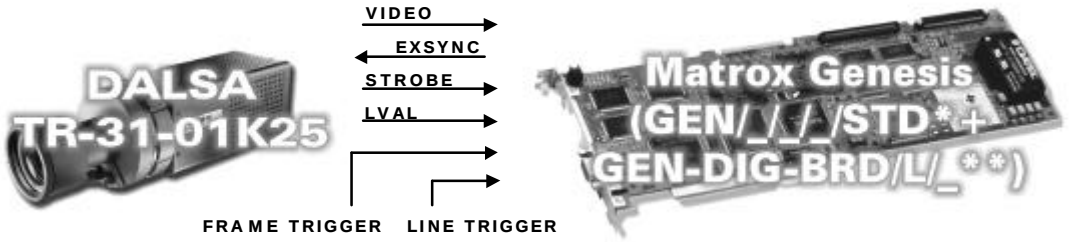
## DALSA TR-31-01k25

**December 8, 2000**

| | |
|---|---|
| **Camera Descriptions** | ▪ 1024 x 8-bit (RGB).<br>▪ 3-channel LVDS digital video output.<br>▪ Internal and external exposure control.<br>▪ Maximum data rate per output: 25 MHz. |
| **Interface mode** | • Fixed line scan rate (free running, programmable exposure control), line scan with frame trigger, variable line scan rate |
| **Camera Interface Briefs** | **Mode 1: Fixed line scan rate (free running mode)**<br>  <br>***Matrox Genesis main board with Grab Module**<br>****Matrox LVDS digital data input board**<br>▪ 1024 x 8-bit (RGB).<br>▪ 3-channels LVDS digital video.<br>▪ DCF configured for 512 lines.<br>▪ Line scan rate is fixed, exposure time controlled by camera serial interface control.<br>▪ Matrox Genesis receiving PIXEL CLOCK (STROBE @ 25MHz), HSYNC (LVAL) and video signals from camera.<br>▪ DCF used: GTR31FI.DCF<br><br>**Mode 2: Fixed line scan rate (programmable exposure mode)**<br>  <br>***Matrox Genesis main board with Grab Module**<br>****Matrox LVDS digital data input board**<br>▪ 1024 x 8-bit (RGB).<br>▪ 3-channels LVDS digital video.<br>▪ DCF configured for 512 lines.<br>▪ Line scan rate is fixed and determined by EXPOSURE2 (PRIN) signal frequency.<br>▪ Matrox Genesis sending EXPOSURE1 (EXSYNC) and EXPOSURE2 (PRIN) signals to camera: EXPOSURE2 (PRIN) initiates exposure and EXPOSURE1 (EXSYNC) initiates line readout and controls exposure time.<br>▪ Matrox Genesis receiving PIXEL CLOCK (STROBE @ 25MHz) and HSYNC (LVAL) signals from camera.<br>▪ DCF used: GTR31FE.DCF |

**Camera Interface Briefs (Continued)**

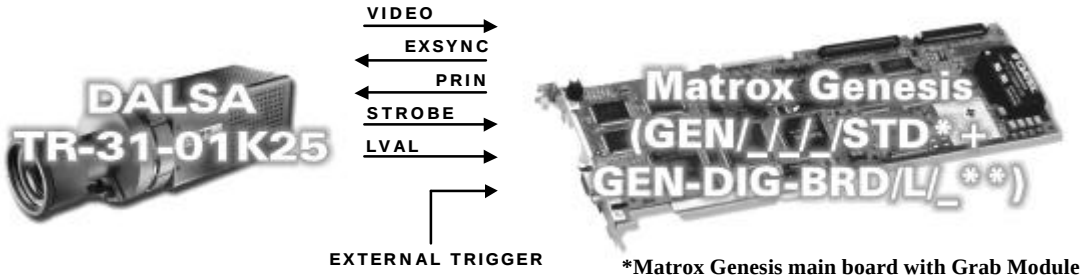
**Mode 3: Line scan with frame trigger**




***Matrox Genesis main board with Grab Module**
****Matrox LVDS digital data input board**

- 1024 x 8-bit (RGB).
- 3-channels LVDS digital video.
- DCF configured for 500 lines per virtual frame.
- Line scan rate is variable and controlled by external line trigger signal frequency.
- Number of lines per virtual frame is fixed and controlled by the vertical timing in Matrox Intellicam, virtual frame rate is determined by the period of the frame trigger.
- Matrox Genesis receiving external LVDS trigger signals (frame and line).
- Matrox Genesis sending EXPOSURE1 (EXSYNC) signal to camera: EXPOSURE1 (EXSYNC) controls the exposure time.
- Matrox Genesis receiving PIXEL CLOCK (STROBE @ 25MHz) and HSYNC (LVAL) signals from camera.
- DCF used: GTR31W.DCF

**Mode 4: Variable line scan rate**




***Matrox Genesis main board with Grab Module**
****Matrox LVDS digital data input board**

- 1024 x 8-bit (RGB).
- 3-channels LVDS digital video.
- DCF configured for 512 lines.
- Line scan rate is variable and controlled by external trigger frequency.
- Matrox Genesis receiving external TTL trigger signal.
- Matrox Genesis sending EXPOSURE1 (EXSYNC) and EXPOSURE2 (PRIN) signals to camera: EXPOSURE2 (PRIN) initiates line readout and EXPOSURE1 (EXSYNC) controls the exposure time.
- Matrox Genesis receiving PIXEL CLOCK (STROBE @ 25MHz) and HSYNC (LVAL) signals from camera.
- DCF used: GTR31V.DCF

**Camera Interface Details**

**Mode 1: Fixed line scan rate (free running mode)**

- Matrox Genesis is operating in a slave mode (free running mode) and receiving PIXEL CLOCK (STROBE @ 25 MHz), HSYNC (LVAL) and video signals from camera. The line rate and exposure period are controlled by camera through the RS-232 serial interface.
- **Line rate**: The line rate is determined by the EXSYNC frequency. In this mode, the EXSYNC signal is internal to the camera and set using the Camera configuration settings (RS-232). The line rate (frequency) can be set between **300 Hz** and **21 000 Hz**.
- **Exposure time**: The exposure time is inversely proportionate to the line rate (EXSYNC) setting (ssf).
- **Maximum/minimum exposure time:** The maximum exposure time is **3.3 ms** and the minimum exposure time is **47.6 µs.**
- **Camera configuration settings (RS-232 settings):** refer to the camera manual for more information.

| Setting Type | RS232 Command |
|---|---|
| ssm (set sync mode) | 6 |
| sa (set aperature) | 100 |
| ssf (set sync frequency) | xxxx (Hz) |

**Mode 2: Fixed line scan rate (programmable exposure mode)**

- Matrox Genesis sends the periodic EXPOSURE2 (PRIN) and EXPOSURE1 (EXSYNC) signals to the camera: EXPOSURE2 (PRIN) initiates exposure and EXPOSURE1 (EXSYNC) controls exposure and initiates line readout.
- **Line rate**: The line rate is determined by the EXPOSURE2 (PRIN) signal frequency. The EXPOSURE2 (PRIN) signal period is currently set to **3110 pixels**. With a **25 MHz** pixel clock, this translates to a **8.04 kHz** line rate.
- **Exposure time**: The time between the rising edge of the EXPOSURE2 (PRIN) and EXPOSURE1 (EXSYNC) signal is the exposure time. The default exposure time for this DCF is **100.4 µs**. In order to change the exposure time, the width and deployment time of EXPOSURE2 (PRIN) and EXPOSURE1 (EXSYNC) signals 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 65536/25 MHz = **2.62 ms**.(**3.3 ms** for camera as per manual). The maximum line rate of the camera is **21 kHz**, therefore the minimum exposure time is **47.6 µs.**
- **Camera configuration settings (RS-232 settings):** refer to the camera manual for more information

| Setting Type | RS232 Command |
|---|---|
| ssm (set sync mode) | 5 |
| sa (set aperature) | 100 |
| ssf (set sync frequency) | xxxx (Hz) |

**Camera Interface Details (continued)**

**Mode 3: Line scan with frame trigger**

- Once it has received the external frame and line triggers, Matrox Genesis sends the EXPOSURE1 (EXSYNC) signal to the camera: EXPOSURE1 (EXSYNC) signal initiates and controls exposure and HSYNC (LVAL) signal initiates line readout.
- **Line rate**: Line scan rate is variable and controlled by external line trigger frequency. Number of lines per virtual frame is fixed and controlled by the vertical timing in Matrox Intellicam.
- **Exposure time**: The time between the falling and rising edge (low level) of the EXPOSURE1 (EXSYNC) signal is the exposure time. The default exposure time for this DCF is **320 µs**. In order to change the exposure time, the width and deployment time of 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 65536/25 MHz = **2.62 ms**.(**3.3 ms** for camera as per manual). The maximum line rate of the camera is **21 kHz**, therefore the minimum exposure time is **47.6 µs.**
- **Camera configuration settings (RS-232 settings):** refer to the camera manual for more information

| Setting Type | RS232 Command |
|---|---|
| ssm (set sync mode) | 3 |
| sa (set aperature) | 100 |
| ssf (set sync frequency) | xxxx (Hz) |

**Mode 4: Variable line scan rate**

- Once it has received the external trigger, Matrox Genesis sends the EXPOSURE2 (PRIN) and EXPOSURE1 (EXSYNC) signal to the camera: EXPOSURE2 (PRIN) initiates exposure and EXPOSURE1 (EXSYNC) controls exposure and initiates line readout.
- **Line rate**: The line rate is variable and determined by the external trigger frequency.
- **Exposure time**: The time between the rising edges of the EXPOSURE2 (PRIN) and EXPOSURE1 (EXSYNC) signals is the exposure time. The default exposure time for this DCF is **100.4 µs**. In order to change 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 65536/25 MHz = **2.62 ms**.(**3.3 ms** for camera as per manual). The maximum line rate of the camera is **21 kHz**, therefore the minimum exposure time is **47.6 µs.**

### Camera Interface Details (continued)

- **Camera configuration settings (RS-232 settings):** refer to the camera manual for more information

| Setting Type | RS232 Command |
|---|---|
| ssm (set sync mode) | 5 |
| sa (set aperature) | 100 |
| ssf (set sync frequency) | xxxx (Hz) |

### Cabling Requirements

**Mode 1: Fixed line scan rate (free running mode)**

- DBHD68-TO-OPEN and DBHD100-TO-OPEN cables, and GEN/DIG/BRD/L/_ board required for digital data, synchronization and control signals.
- Connections between the 68-pin connector (**MDR68F**) of the camera and the 100-pin connector of the GEN-DIG-BRD/L/_ are as follows:

| **DALSA TR-31-01k25 (68-pin connector – MDR68F)** | | | **GEN-DIG-BRD/L/_ (100-pin connector)** | |
|---|---|---|---|---|
| ***Pin name*** | ***Pin no.*** | | ***Pin name*** | ***Pin no.*** |
| G7 (MSB) | 05 | → | DATA, INPUT, 15+ | 31 |
| G7B | 39 | → | DATA, INPUT, 15- | 32 |
| G6 | 06 | → | DATA, INPUT, 14+ | 29 |
| G6B | 40 | → | DATA, INPUT, 14- | 30 |
| G5 | 07 | → | DATA, INPUT, 13+ | 27 |
| G5B | 41 | → | DATA, INPUT, 13- | 28 |
| G4 | 08 | → | DATA, INPUT, 12+ | 25 |
| G4B | 42 | → | DATA, INPUT, 12- | 26 |
| G3 | 09 | → | DATA, INPUT, 11+ | 23 |
| G3B | 43 | → | DATA, INPUT, 11- | 24 |
| G2 | 10 | → | DATA, INPUT, 10+ | 21 |
| G2B | 44 | → | DATA, INPUT, 10- | 22 |
| G1 | 11 | → | DATA, INPUT, 9+ | 19 |
| G1B | 45 | → | DATA, INPUT, 9- | 20 |
| G0 | 12 | → | DATA, INPUT, 8+ | 17 |
| G0B | 46 | → | DATA, INPUT, 8- | 18 |
| B7 (MSB) | 15 | → | DATA, INPUT, 23+ | 65 |
| B7B | 49 | → | DATA, INPUT, 23- | 66 |
| B6 | 16 | → | DATA, INPUT, 22+ | 63 |
| B6B | 50 | → | DATA, INPUT, 22- | 64 |
| B5 | 17 | → | DATA, INPUT, 21+ | 61 |
| B5B | 51 | → | DATA, INPUT, 21- | 62 |
| B4 | 18 | → | DATA, INPUT, 20+ | 59 |
| B4B | 52 | → | DATA, INPUT, 20- | 60 |
| B3 | 19 | → | DATA, INPUT, 19+ | 57 |
| B3B | 53 | → | DATA, INPUT, 19- | 58 |
| B2 | 20 | → | DATA, INPUT, 18+ | 55 |
| B2B | 54 | → | DATA, INPUT, 18- | 56 |

continued

**Cabling Requirements (continued)**

| **DALSA TR-31-01k25 (68-pin connector – MDR68F)** | | | **GEN-DIG-BRD/L/_ (100-pin connector)** | |
|---|---|---|---|---|
| ***Pin name*** | ***Pin no.*** | | ***Pin name*** | ***Pin no.*** |
| B1 | 21 | → | DATA, INPUT, 17+ | 53 |
| B1B | 55 | → | DATA, INPUT, 17- | 54 |
| B0 | 22 | → | DATA, INPUT, 16+ | 51 |
| B0B | 56 | → | DATA, INPUT, 16- | 52 |
| R7 (MSB) | 25 | → | DATA, INPUT, 7+ | 15 |
| R7B | 59 | → | DATA, INPUT, 7- | 16 |
| R6 | 26 | → | DATA, INPUT, 6+ | 13 |
| R6B | 60 | → | DATA, INPUT, 6- | 14 |
| R5 | 27 | → | DATA, INPUT, 5+ | 11 |
| R5B | 61 | → | DATA, INPUT, 5- | 12 |
| R4 | 28 | → | DATA, INPUT, 4+ | 09 |
| R4B | 62 | → | DATA, INPUT, 4- | 10 |
| R3 | 29 | → | DATA, INPUT, 3+ | 07 |
| R3B | 63 | → | DATA, INPUT, 3- | 08 |
| R2 | 30 | → | DATA, INPUT, 2+ | 05 |
| R2B | 64 | → | DATA, INPUT, 2- | 06 |
| R1 | 31 | → | DATA, INPUT, 1+ | 03 |
| R1B | 65 | → | DATA, INPUT, 1- | 04 |
| R0 | 32 | → | DATA, INPUT, 0+ | 01 |
| R0B | 66 | → | DATA, INPUT, 0- | 02 |
| STROBE | 33 | → | CLOCK, INPUT, + | 39 |
| STROBEB | 67 | → | CLOCK, INPUT, - | 40 |
| LVAL | 34 | → | HSYNC, INPUT, + | 33 |
| LVALB | 68 | → | HSYNC, INPUT, + | 34 |

- Connections between the 15-pin connector (**DB15F**) of the camera and the 100-pin connector of the GEN-DIG-BRD/L/_ are as follows:

| **DALSA TR-31-01k25 (15-pin connector – DB15F)** | | | **GEN-DIG-BRD/L/_ (100-pin connector)** | |
|---|---|---|---|---|
| ***Pin name*** | ***Pin no.*** | | ***Pin name*** | ***Pin no.*** |
| EXSYNC | 04 | ← | EXPOSURE1, OUTPUT, + | 95* |
| EXSYNCB | 12 | ← | EXPOSURE1, OUTPUT, - | 96* |
| PRIN | 05 | ← | EXPOSURE2, OUTPUT, + | 97* |
| PRINB | 13 | ← | EXPOSURE2, OUTPUT, - | 98* |
| GND | 08 | -- | GROUND | 50 |

* These connections are not required for this mode, however allows this cable to be used with other modes.

**Cabling Requirements (continued)**

**Mode 2: Fixed line scan rate (programmable exposure mode)**

- DBHD100-TO-OPEN cable and GEN/DIG/BRD/L/_ board required for digital data, synchronization and control signals.
- Connections between the 68-pin connector (**MDR68F**) of the camera and the 100-pin connector of the GEN-DIG-BRD/L/_ are as in Mode 1*: Fixed line scan rate*

**Mode 3: Line scan with frame trigger**

- DBHD100-TO-OPEN cable and GEN/DIG/BRD/L/_ board required for digital data, synchronization and control signals.
- Connections between the 68-pin (**MDR68F**) and 15-pin (**DB15F**) connectors of the camera and the 100-pin connector of the GEN-DIG-BRD/L/_ are as in Mode 1*: Fixed line scan rate* **EXCEPT** that the **PRIN** signal to **EXPOSURE2** must be **disconnected** and the following connections added:

| **EXTERNAL TRIGGER SOURCE** | | | **GEN-DIG-BRD/L/_ (100-pin connector)** | |
|---|---|---|---|---|
| ***Name*** | ***Pin no.*** | | ***Pin name*** | ***Pin no.*** |
| FRAME TRIGGER LVDS+ | -- | → | USER, INPUT, 1+ | 43 |
| FRAME TRIGGER LVDS- | -- | → | USER, INPUT, 1- | 44 |
| LINE TRIGGER LVDS+ | -- | → | TRIGGER, INPUT, + | 47 |
| LINE TRIGGER LVDS- | -- | → | TRIGGER, INPUT, - | 48 |

**Mode 4: Variable line scan rate**

- IMG-7W2-TO-5BNC and DBHD100-TO-OPEN cables, and GEN/DIG/BRD/L/_ board required for digital data, synchronization and control signals.
- TTL external trigger should be connected to the TTL trigger input of the IMG-7W2-TO-5BNC cable.
- Connections between the 68-pin (**MDR68F**) and 15-pin (**DB15F**) connectors of the camera and the 100-pin connector of the GEN-DIG-BRD/L/_ are as in Mode 1*: Fixed line scan rate.*

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