

Application Note:

Interfacing non-standard cameras to Matrox Pulsar



DALSA CL-C3-1024N

June 11, 1997

Camera Descriptions	• 1024 x 1 x 8-bit • 1 channel digital video output (RS-422) • Max. data rate is 20MHz • External sync required • Exposure control
Interface Modes	• Fixed line scan rate and variable line scan rate
Camera Interface Briefs	Mode 1: Fixed line scan rate • 1024 x 1 x 8-bit • Digital video output (RS-422). • DCF configured for 512 lines per virtual frame. • Line scan rate is fixed and is determined by frequency of EXSYNC signal. • Matrox Pulsar sending RS-422 EXPOSURE1 (PRIN), RS-422 EXPOSURE2 (EXSYNC) and RS-422 Reference clock (MCLK) signals to camera; the EXPOSURE1 and EXPOSURE2 signals control the exposure time and initiates line readout. • Matrox Pulsar receiving RS-422 pixel clock (STROBE @ 15 MHz) and RS-422 VSYNC (LVAL) signals from camera; the LVAL signal indicates valid lines (pixels). • DCF used: CLC3NDEL.DCF Mode 2: Variable line scan rate • 1024 x 1 x 8-bit • 1 channel digital video output (RS-422). • DCF configured for 512 lines per virtual frame. • Line scan rate is variable and is controlled by external trigger signal • Matrox Pulsar receiving TTL external trigger. • Matrox Pulsar sending RS-422 EXPOSURE1 (PRIN), RS-422 EXPOSURE2 (EXSYNC) and RS-422 reference clock (MCLK) signals to camera; the EXPOSURE1 and EXPOSURE2 signals control the exposure time and initiates line readout. • Matrox Pulsar receiving RS-422 pixel clock (STROBE @ 15 MHz) and RS-422 vsync (LVAL) signals from camera; the LVAL signal indicates valid lines (pixels). • DCF used: CLC3NDAL.DCF

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Camera Interface Details	Mode 1: Fixed line scan rate - The Matrox Pulsar sends the RS-422 EXPOSURE1 (EXSYNC) signal to the camera; the camera awaits the rising edge of the signal and after a short (constant) delay initiates line readout. The line rate is fixed and is determined by the frequency of the EXSYNC signal. - The HSYNC parameter in the DCF specifies the line rate of the camera and therefore the exposure time. The total line time is currently set to 1045 pixels. The clock rate is 15 Mhz; the line rate is therefore 3.5KHz. The line rate of the camera, and therefore the exposure time, can be modified in the DCF using Matrox Intellicam. Consult the Matrox Intellicam User Guide for more information. - The virtual frame rate for the current settings of the DCF is $287\mu s \times 512 = 146.9\mu s = 6.8\text{Hz}$. In each virtual frame there are 512 active lines. The host buffer of the Matrox Pulsar can grab images of up to 2048×2048 (4MB) and the display buffer can grab images of up to 2048×1024 (2MB) - The time between the rising edge of the EXPOSURE1 and EXPOSURE2 signals is the exposure time. In order to select the exposure time, the width and deployment time of each EXPOSURE 1 and EXPOSURE 2 must be set in Matrox Intellicam. $\text{Line rate} = \frac{1}{287\mu s} = 3.5 \text{ KHz}$ Mode 2: Variable line scan rate - PSG FPGA version 3.01 or newer is required. - Line rate is variable and is controlled by the external trigger signal. - Virtual frame size for this DCF is $1024 \times 1 \times 512$ - Once it has received the external signal to trigger, the Matrox Pulsar sends the RS-422 EXPOSURE1 (PRIN) signal to the camera to initiate exposure. The Matrox Pulsar will send the RS-422 EXPOSURE2 (EXSYNC) signal to the camera following a delay that is equal to the desired exposure time. A short (variable) delay after receiving the EXPOSURE2 pulse, the camera sends the RS-422 LVAL signal to the Matrox Pulsar to indicate line readout (line valid).
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Camera Interface Details (continued)	The maximum possible delay between the EXPOSURE2 pulse and the LVAL pulse is calculated to be: EXSYNC to LVAL = 4μs + 11 MCLK pulses + 4 MCLK pulses + 400ns Maximum = 4μs + (11 x 66.7ns) + (4 x 66.7ns) + 400ns = 4μs + 0.734μs + 0.267μs + 400ns = 5.4μs TTL external trigger EXPOSURE1 (PRIN) EXPOSURE2 (EXSYNC) HSYNC (LVAL) 534ns 200μs variable delay exposure time = 200μs - 534ns 68.27μs shift and readout																																																																																										
Cabling Requirements	Mode 1: Fixed line scan rate • PULSAR/DIG/MOD required for digital data, syncs and control signals in RS-422 format. • The connections between the OS1 20-pin dual row connector of the camera and the 68-pin connector of the PULSAR/DIG/MOD are as follows: <table><tr><th colspan="3">DALSA CL-C3-1024N (20-pin dual row connector - OS1)</th><th colspan="2">PULSAR/DIG/MOD (68-pin connector)</th></tr><tr><th>Pin name</th><th>Pin no.</th><th></th><th>Pin name</th><th>Pin no.</th></tr><tr><td>AD7+</td><td>1</td><td>→</td><td>DATA7+</td><td>10</td></tr><tr><td>AD7-</td><td>2</td><td>→</td><td>DATA7-</td><td>44</td></tr><tr><td>AD6+</td><td>3</td><td>→</td><td>DATA6+</td><td>11</td></tr><tr><td>AD6-</td><td>4</td><td>→</td><td>DATA6-</td><td>45</td></tr><tr><td>AD5+</td><td>5</td><td>→</td><td>DATA5+</td><td>13</td></tr><tr><td>AD5-</td><td>6</td><td>→</td><td>DATA5-</td><td>47</td></tr><tr><td>AD4+</td><td>7</td><td>→</td><td>DATA4+</td><td>14</td></tr><tr><td>AD4-</td><td>8</td><td>→</td><td>DATA4-</td><td>48</td></tr><tr><td>AD3+</td><td>9</td><td>→</td><td>DATA3+</td><td>15</td></tr><tr><td>AD3-</td><td>10</td><td>→</td><td>DATA3-</td><td>49</td></tr><tr><td>AD2+</td><td>11</td><td>→</td><td>DATA2+</td><td>16</td></tr><tr><td>AD2-</td><td>12</td><td>→</td><td>DATA2-</td><td>50</td></tr><tr><td>AD1+</td><td>13</td><td>→</td><td>DATA1+</td><td>19</td></tr><tr><td>AD1-</td><td>14</td><td>→</td><td>DATA1-</td><td>53</td></tr><tr><td>AD0+</td><td>15</td><td>→</td><td>DATA0+</td><td>20</td></tr><tr><td>AD0-</td><td>16</td><td>→</td><td>DATA0-</td><td>54</td></tr></table> (Pin-out continued)	DALSA CL-C3-1024N (20-pin dual row connector - OS1)			PULSAR/DIG/MOD (68-pin connector)		Pin name	Pin no.		Pin name	Pin no.	AD7+	1	→	DATA7+	10	AD7-	2	→	DATA7-	44	AD6+	3	→	DATA6+	11	AD6-	4	→	DATA6-	45	AD5+	5	→	DATA5+	13	AD5-	6	→	DATA5-	47	AD4+	7	→	DATA4+	14	AD4-	8	→	DATA4-	48	AD3+	9	→	DATA3+	15	AD3-	10	→	DATA3-	49	AD2+	11	→	DATA2+	16	AD2-	12	→	DATA2-	50	AD1+	13	→	DATA1+	19	AD1-	14	→	DATA1-	53	AD0+	15	→	DATA0+	20	AD0-	16	→	DATA0-	54
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Cabling Requirements	STROBE+	17	→	CLKIN+	29
	STROBE-	18	→	CLKIN-	63
	LVAL+	19	→	HSYNC+	26
	LVAL-	20	→	HSYNC-	60
	The connections between the DB-25 connector on the rear panel of the camera and the 68-pin connector of the PULSAR/DIG/MOD are as follows:				
	DALSA CL-C3-1024N		PULSAR/DIG/MOD		
	(DB-25 male connector)		(68-pin connector)		
	Pin name	Pin no.		Pin name	Pin no.
	MCLK+	6	←	CLKOUT+	24
	MCLK-	19	←	CLKOUT-	58
	EXSYNC+	17	←	EXPOSURE2+	28
	EXSYNC-	4	←	EXPOSURE2-	62
	PRIN+	5	←	EXPOSURE1+	30
	PRIN-	18	←	EXPOSURE1-	64
	GROUND	7		GROUND	1
	GROUND	11		GROUND	12
	GROUND	20		GROUND	34
	GROUND	24		GROUND	35
	POWER SUPPLY GROUND			GROUND	46
	POWER SUPPLY GROUND			GROUND	68
NOTE: it is very important that all the GROUNDS of the camera be connected together to the POWER SUPPLY GROUND, which in turn must be connected to the GROUND of the Matrox Pulsar The connections between the DB-25 connector on the rear panel of the camera and the power supply are as follows:					
DALSA CL-C3-1024N		POWER SUPPLY			
(DB-25 male connector)					
Pin no.	Pin name				
8	+5V				
9	+15V				
12	-5V				
13	+5V				
21	+15V				
22	-5V				
25	-15V				

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	Mode 2: Variable line scan rate • IMG-7W2-TO-5BNC cable required for TTL external trigger source and PULSAR/DIG/MOD 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 • All other connections between the camera and the Matrox Pulsar are as in Mode 1: fixed line scan rate
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The DCF(s) mentioned in this application note can be found on the MIL and MIL-Lite CD, or our FTP site ([ftp.matrox.com](ftp: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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