



# HD-SDI Express User Training



J.Egri 4/09



## Features

- SDI interface
- Supports 720p, 1080i and 1080p formats.
- Supports SMPTE 292M serial interface operating at 1.485 Gbps.
- Supports SMPTE 274M and 296M framing.
- 75 ohm BNC coaxial connector.
  
- ExpressCard Interface
- 54mm form factor.
- PCIe x1 interface providing 235 Mbytes/sec of throughput.
- Scatter/Gather DMA ( Direct Memory Access ) engine using 4K pages.
- Flow-thru pipelined architecture for low latency.



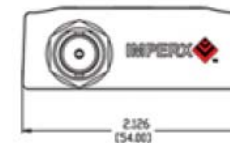
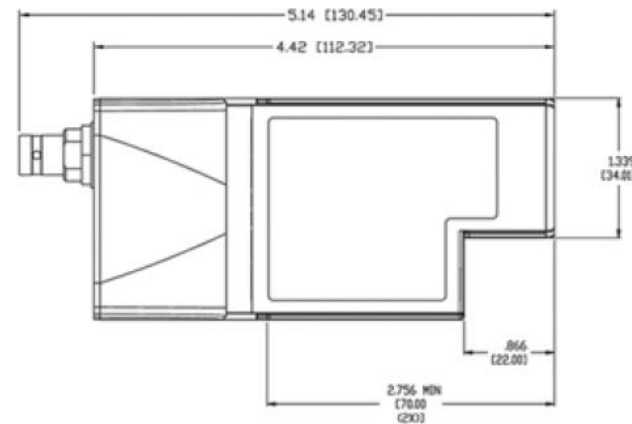
## Features (cont.)

- Features
- Operates in either YCrCb 4:2:2 - 20 bit, YCrCb 4:2:2 - 16 bit or RGB - 24 bit modes.
- Hardware based YCrCb 4:2:2 to RGB-24 color space conversion.
- Hardware based RGB gain/offset with auto-white balance.
- Hardware based RGB Lookup table with Gamma correction.
- Histograms.
- Hex pixel dump.
- Capture single frame, multiple frames or AVI clips.
- Save RAW, BMP, TIFF, JPEG or AVI files.
- Firmware 'Remote Upgrade' capability.

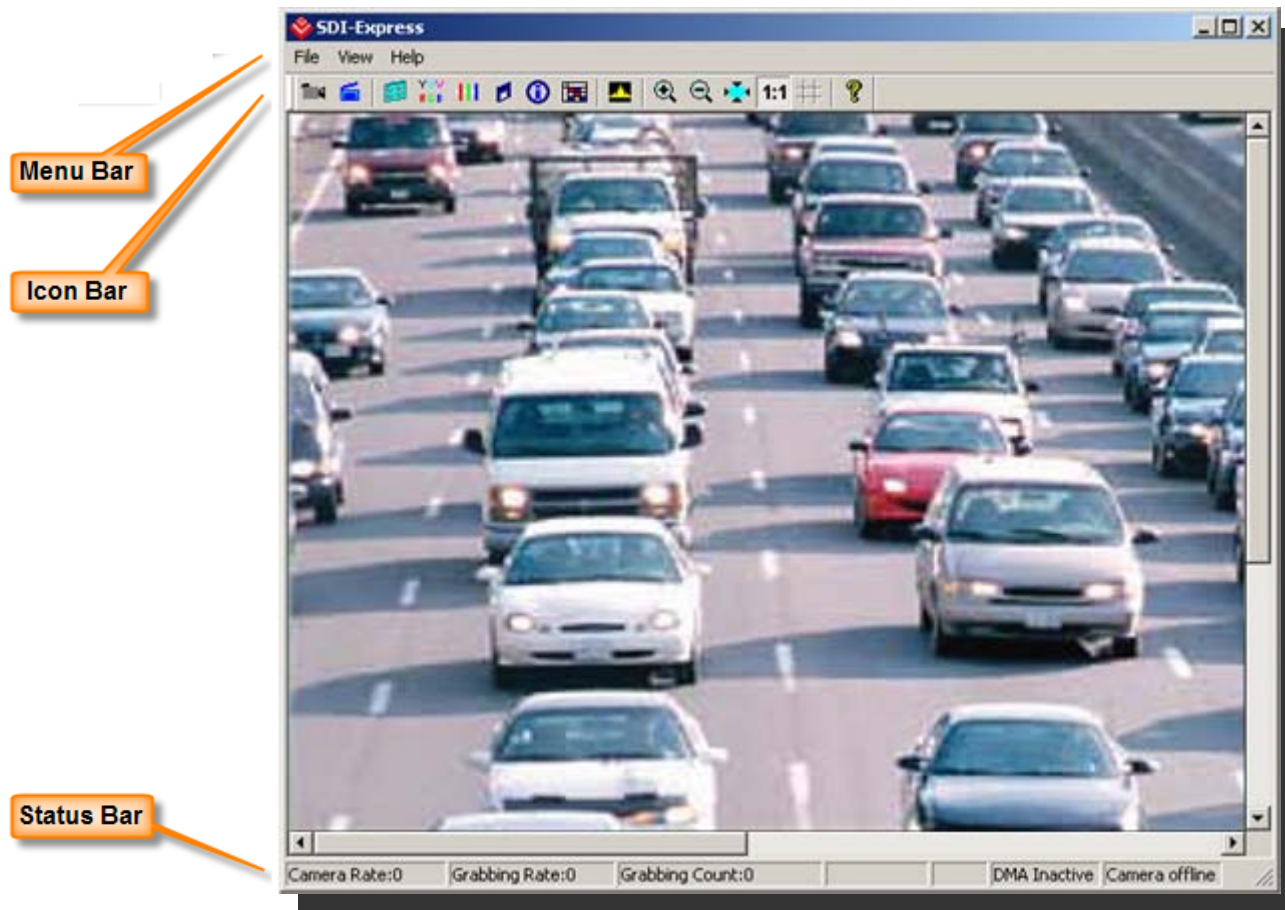


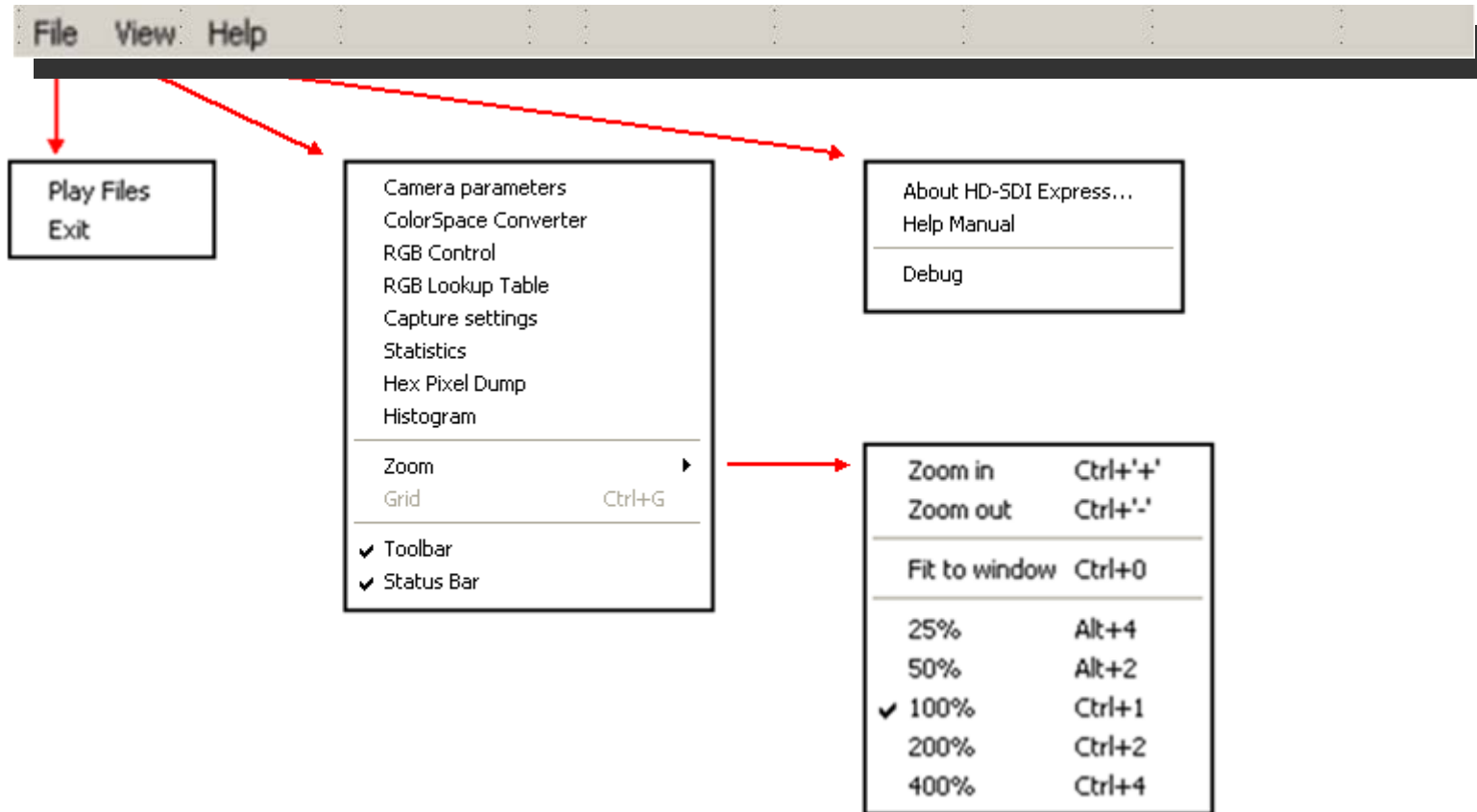
## Features (cont.)

- Mechanical
  - ExpressCard 54mm form factor.
  - 38 mm I/O extension.
  - 5.1" x 2.1" x 0.8" overall size.
  - 1.91 oz. ( 53.6 g ).
- 
- Power
  - 3.3 VDC +/- 5%.
  - 500 mA steady current.
  - 1.65 W constant power.




















- Consists of a Menu bar, an Icon bar and a Status bar.



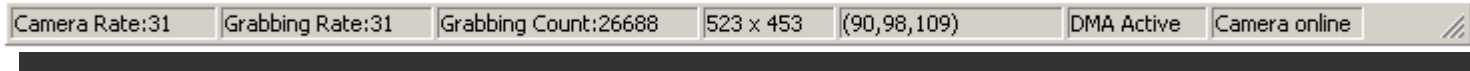




- |   |  |   |                                   |
|---|--|---|-----------------------------------|
|    | Start/stop continuous <b>Grab</b>        |    | Open <b>Hex Pixel Dump</b> dialog |
|    | <b>Snap</b> single frame                 |    | Open <b>Histogram</b> dialog      |
|    | Start/stop <b>Capture</b> to disk        |    | <b>Zoom In</b>                    |
|    | Open <b>Camera Parameters</b> dialog     |    | <b>Zoom Out</b>                   |
|    | Open <b>Color Space Converter</b> dialog |    | <b>Fit to Window</b>              |
|   | Open <b>RGB Control</b> dialog           |   | <b>Zoom 1:1</b>                   |
|  | Open <b>RGB Lookup Table</b> dialog      |  | Turn <b>Grid</b> on/off           |
|  | Open <b>Capture Settings</b> dialog      |  | <b>Help</b>                       |
|  | Open <b>Statistics</b> dialog            |   |                                   |



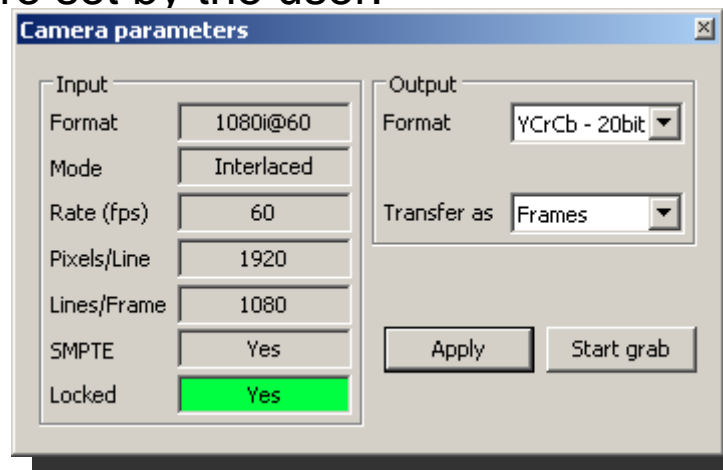
## Status Bar



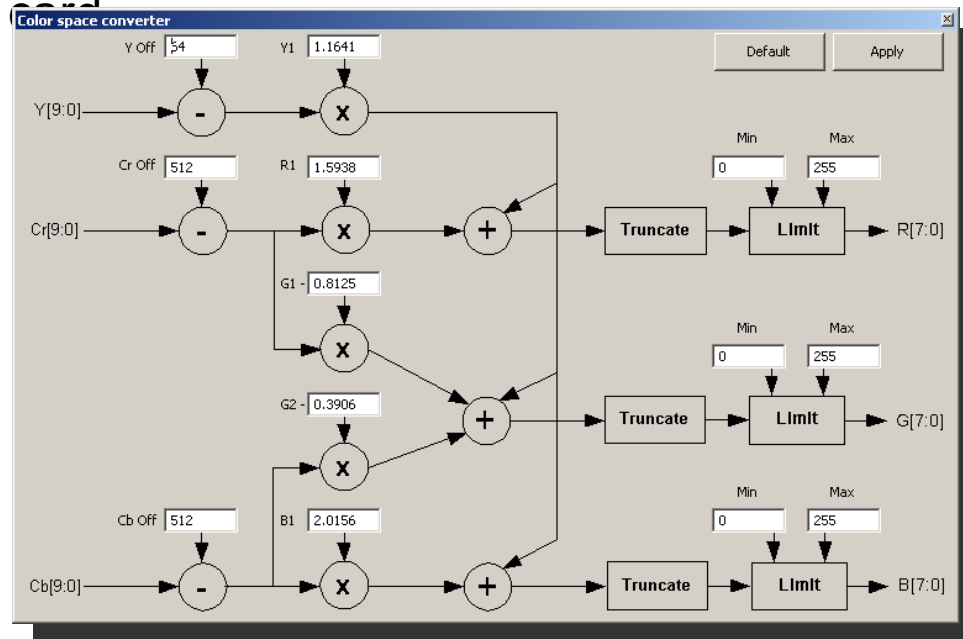
- **Camera Rate** Displays the real-time frame rate of the attached camera as measured at the input of the HD-SDI Express card.
- **Grabbing Rate** Displays the real-time rate at which frames are being transferred from the card into host memory.
- **Grabbing Count** Displays a running count of the total number of frames transferred into system memory. This counter is reset when 'grabbing' is stopped.
- **Pixel Coordinates** Indicates the x,y coordinates of the pixel at the current cursor position.
- **Pixel Value** Indicates the value ( grayscale or RGB ) of the pixel at the current cursor position.
- **DMA Status** Displays the real-time status of the DMA process as being either : '**active**' or '**inactive**'.
  - '**Active**' indicates that the user has commanded the HD-SDI Express to acquire video data by clicking on the 'Start Grab' button and that the camera is providing valid framing.
  - '**Inactive**' indicates that either the user has commanded the HD-SDI Express to stop acquiring video data by clicking on the 'Stop Grab' button or that grabbing is enabled but the camera is not providing valid framing.
- **Camera Status** Displays the real-time status of the attached camera as being either : '**online**' or '**offline**'.
  - '**Online**' indicates that the camera is powered on, attached and providing a video clock via the SDI interface.
  - '**Offline**' indicates that the HD-SDI Express card is not receiving a video clock from the camera either because the camera is powered off or the SDI cable is disconnected.



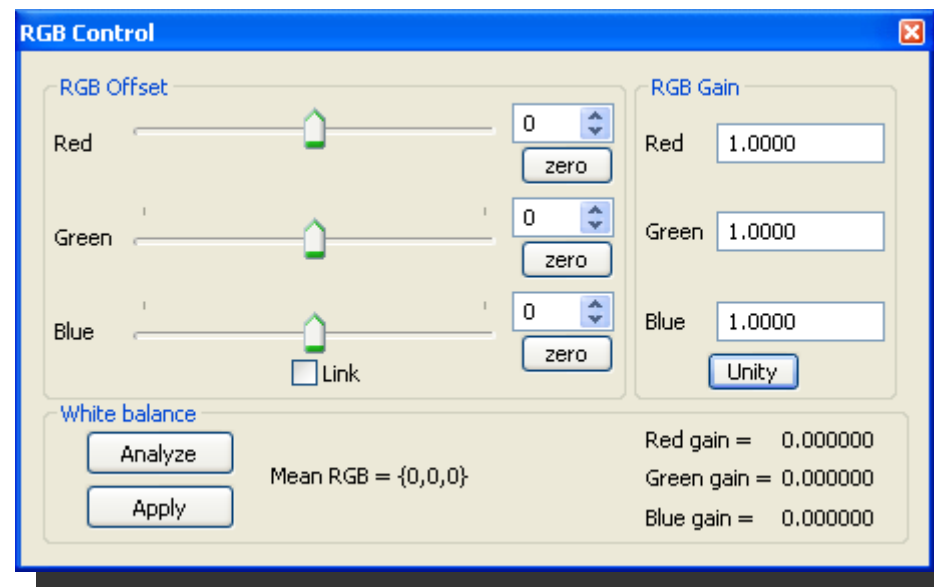
- ‘Input’ section
- Reports the operating parameters of the attached camera.
- Is automatically discovered by the card and populated by the application program.
- ‘Output’ section
- Indicates how the card should format the video data prior to transferring it into host system memory.
- Parameters are set by the user.



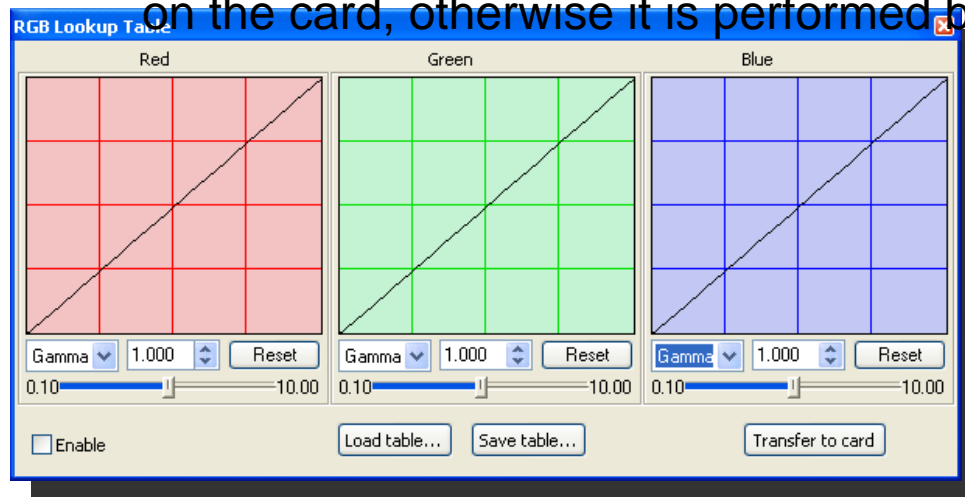
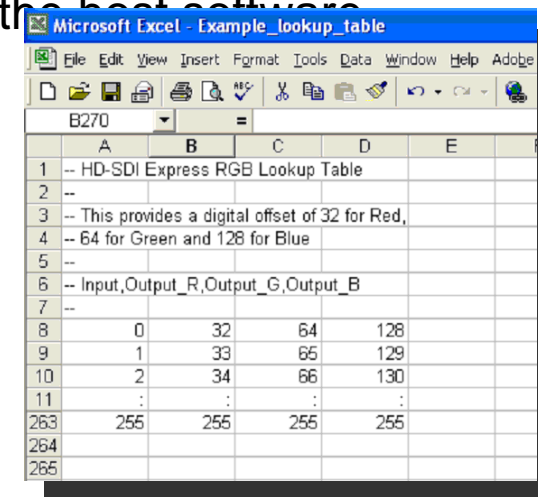
- This function is responsible for converting from YCrCb video data to the RGB-24 format.
- User can adjust the behavior of the color space converter function.
- If RGB-24 mode is selected, then the CSC is performed on the card and RGB-24 data is delivered from the card into host memory.
- If either the YCrCb-20 or YCrCb-16 modes are selected, then YCrCb data is delivered from the card into host memory and the CSC is performed by host software.



- Programmable RGB Gain and Offset.
- Automatic White Balance feature computes RGB gains.
- If RGB-24 mode is selected then the RGB gain and offset are performed on the card, otherwise they are performed by the host software.



- Modifies and transform the original video data into any arbitrary value.
- The 'Gamma' mode allows the user to select Gamma correction values for each of the R, G, B components.
- The 'Pencil' mode allows the user to draw the desired transfer function for each of the R, G, B components.
- LUT files can be created with Excel or any ASCII editor.
- If RGB-24 mode is selected then the RGB lookup table is performed on the card, otherwise it is performed by the host software.

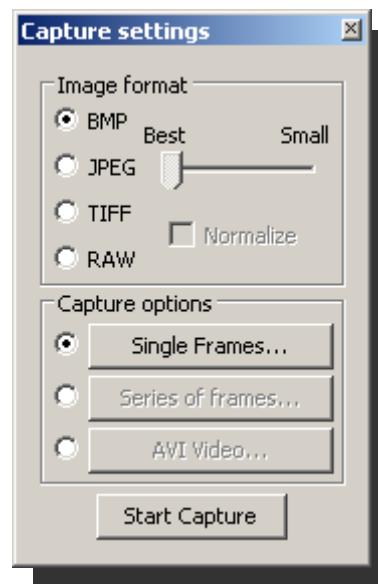



	A	B	C	D	E
1	-- HD-SDI Express RGB Lookup Table				
2	--				
3	-- This provides a digital offset of 32 for Red,				
4	-- 64 for Green and 128 for Blue				
5	--				
6	-- Input,Output_R,Output_G,Output_B				
7	--				
8	0	32	64	128	
9	1	33	65	129	
10	2	34	66	130	
11	:	:	:	:	
263	255	255	255	255	
264					
265					

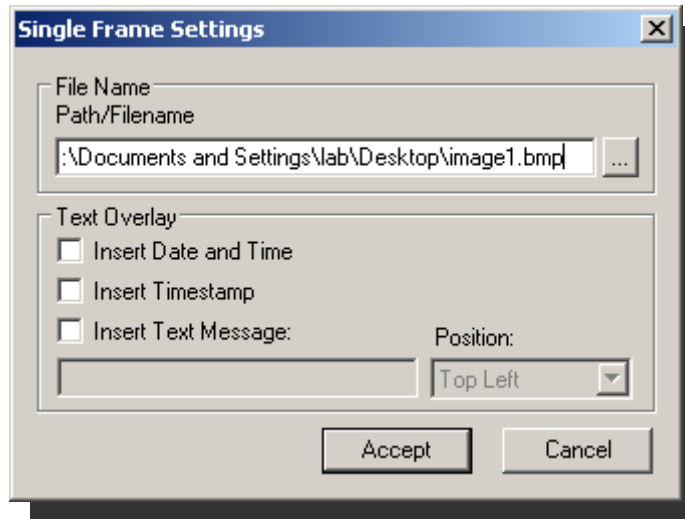


## Capture Settings

- Specifies file format for images saved to disk.
- Specifies capture mode.

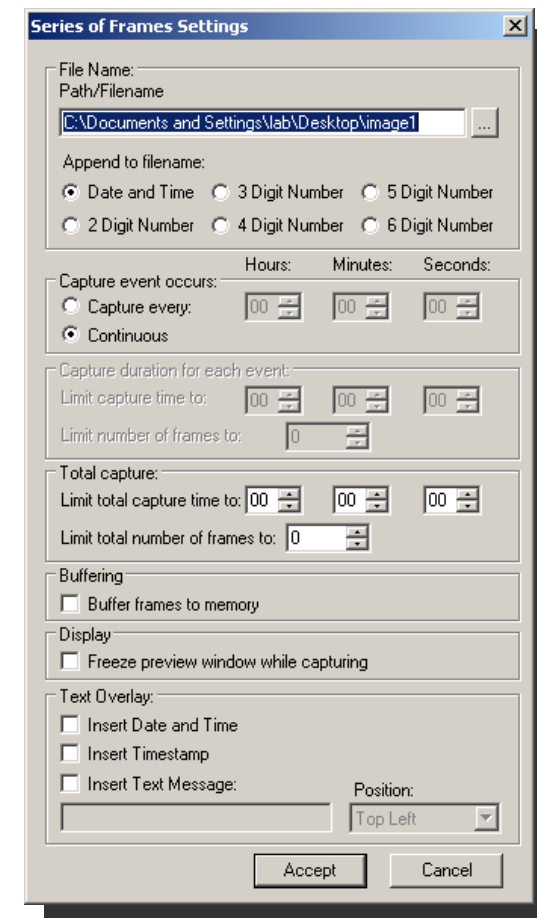


- Used to record one frame only.
- Specify the path and filename for the recorded file.
- Insert optional date/time/timestamp/text to be overlaid on image saved.
- The overlay text is destructive ( i.e. persistent ) to the image saved.



## Series of Frames

- Used to record multiple frames.
- Specify the path and filename for the recorded file.
- Insert optional date/time/timestamp/text to be overlaid on images saved.
- The overlay text is destructive ( i.e. persistent ) to the image saved.
- Specify capture event frequency.
- Specify capture duration for each event.
- Specify capture limits.





# Series of Frames Examples

- **Example #1:** To capture 5 frames, every 1.5 hours, over a 12 hour period.

Capture event occurs: Capture every: 01 Hr 30 Min 00 Sec  
Capture duration for each event: Limit number of frames to: 5  
Total capture: Limit total capture time to: 12 Hr 00 Min 00 Sec

- **Example #2:** To capture 5 minutes worth of images, every 15 minutes and not to exceed a total of 250 images.

Capture event occurs: Capture every: 00 Hr 15 Min 00 Sec  
Capture duration for each event: Limit capture time to: 00 Hr 05 Min 00 Sec  
Total capture: Limit total number of frames to: 250

- **Example #3:** To capture 10 frames, every 1 hour, over a 6 hour period and not to exceed a total of 300 images.

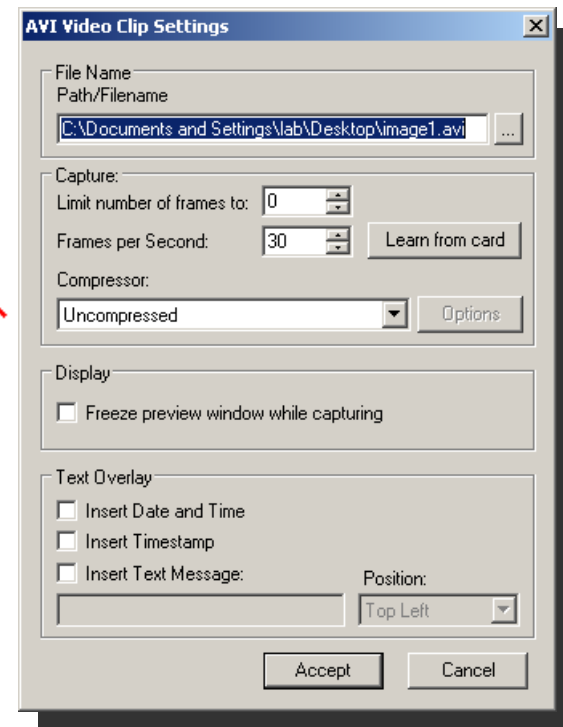
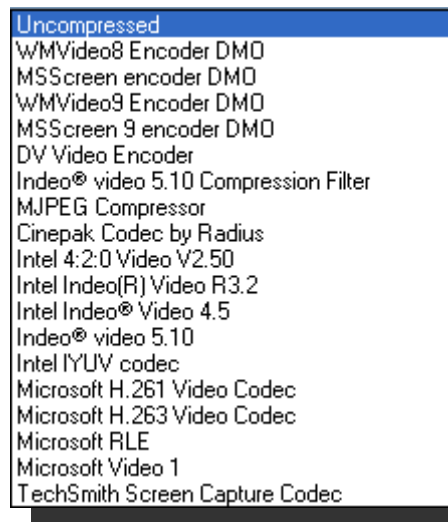
Capture event occurs: Capture every: 01 Hr 00 Min 00 Sec  
Capture duration for each event: Limit number of frames to: 10  
Total capture: Limit total capture time to: 06 Hr 00 Min 00 Sec  
Limit total number of frames to: 300

- **Example #4:** To capture continuously for a period of 2 hours and not to exceed a total of 100 images.

Capture event occurs: Continuous  
Total capture: Limit total capture time to: 02 Hr 00 Min 00 Sec  
Limit total number of frames to: 100



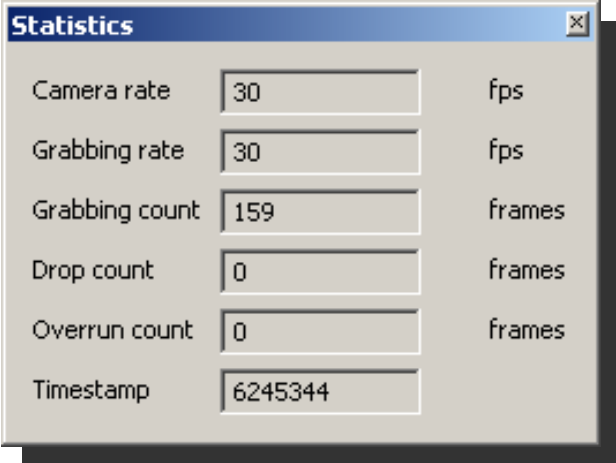
- Used to record AVI movies.
- Specify the path and filename for the recorded file.
- Insert optional date/time/timestamp/text to be overlaid on images saved.
- The overlay text is destructive ( i.e. persistent ) to the image saved.
- Specify capture limits.
- Specify codec compressor.
- Searches hard drive for all installed compressors.





## Statistics

- Displays real time camera performance attributes.
- Displays real time frame grabber performance attributes.
- Useful in determining if frame grabber can keep up with the camera.

A screenshot of a software window titled "Statistics". The window contains a table of performance metrics with input fields and units.

Metric	Value	Unit
Camera rate	30	fps
Grabbing rate	30	fps
Grabbing count	159	frames
Drop count	0	frames
Overrun count	0	frames
Timestamp	6245344	



# Hex Pixel Dump

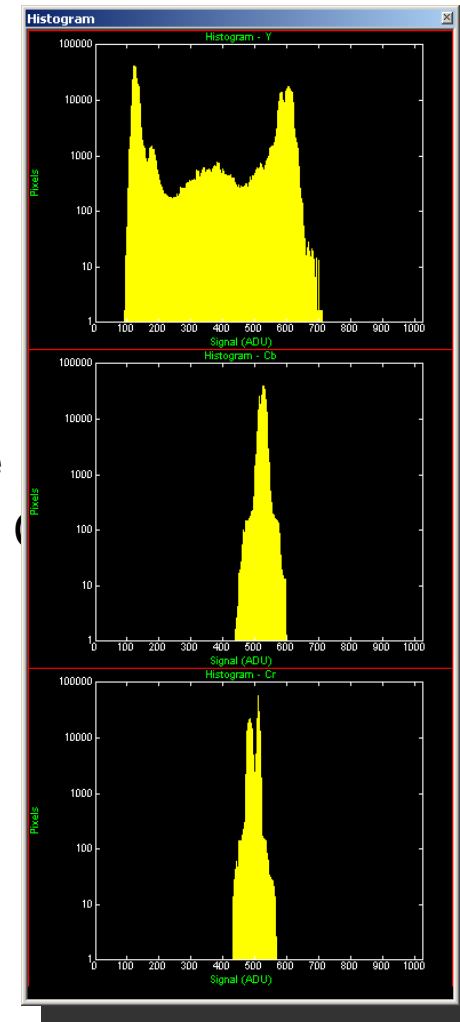
- Displays a two-dimensional table of real-time pixel values, plotting row ( Y ) vs. column ( X ), for a bounded region of pixels.
- The YCrCb or RGB-24 pixel values are displayed depending on the operating mode.
- The background color of each cell is color coded.
- Hovering the mouse over a given pixel reveals both the pixel's hexadecimal and integer component values.

Hex dump	1767	1768	1769	1770	1771	1772	1773	1774	1775	1776	1777	1778	1779	1780
500	Y 179	Y 17D	Y 181	Y 180	Y 17E	Y 184	Y 191	Y 186	Y 168	Y 126	Y 141	Y 136	Y 14A	Y 14C
	Cr 29D	Cr 29D	Cr 293	Cr 293	Cr 284	Cr 284	Cr 260	Cr 223	Cr 18B	Cr 18B	Cr 18B	Cr 1D0	Cr 1D0	
	Cb 201	Cb 201	Cb 213	Cb 213	Cb 22D	Cb 22D	Cb 24D	Cb 26E	Cb 26E	Cb 28A	Cb 28A	Cb 29A	Cb 29A	
501	Y 17A	Y 17A	Y 174	Y 178	Y 17E	Y 18E	Y 17E	Y 109	Y 174	Y 109	Y 123	Y 129	Y 14C	Y 15C
	Cr 29A	Cr 29A	Cr 296	Cr 296	Cr 28A	Cr 28A	Cr 268	Cr 225	Cr 188	Cr 188	Cr 188	Cr 1CD	Cr 1CD	
	Cb 205	Cb 205	Cb 214	Cb 214	Cb 22A	Cb 22A	Cb 248	Cb 26C	Cb 26C	Cb 286	Cb 286	Cb 295	Cb 295	
502	Y 17A	Y 17C	Y 17D	Y 180	Y 180	Y 187	Y 195	Y 188	Y 167	Y 126	Y 138	Y 12A	Y 140	Y 14D
	Cr 29E	Cr 29E	Cr 297	Cr 297	Cr 286	Cr 286	Cr 262	Cr 226	Cr 18C	Cr 18C	Cr 18C	Cr 1CE	Cr 1CE	
	Cb 209	Cb 209	Cb 214	Cb 214	Cb 225	Cb 225	Cb 245	Cb 26A	Cb 26A	Cb 286	Cb 286	Cb 296	Cb 296	
503	Y 179	Y 175	Y 175	Y 186	Y 186	Y 182	Y 167	Y 1C1	Y 176	Y 11B	Y 139	Y 11F	Y 13A	Y 147
	Cr 296	Cr 296	Cr 292	Cr 292	Cr 288	Cr 288	Cr 268	Cr 227	Cr 18B	Cr 18B	Cr 18B	Cr 1D2	Cr 1D2	
	Cb 205	Cb 205	Cb 208	Cb 208	Cb 223	Cb 223	Cb 245	Cb 267	Cb 267	Cb 288	Cb 288	Cb 29E	Cb 29E	
504	Y 16E	Y 17C	Y 17D	Y 179	Y 17D	Y 196	Y 198	Y 18B	Y 169	Y 126	Y 148	Y 134	Y 14D	Y 156
	Cr 29E	Cr 29E	Cr 299	Cr 299	Cr 28C	Cr 28C	Cr 269	Cr 228	Cr 18C	Cr 18C	Cr 18C	Cr 1D0	Cr 1D0	
	Cb 1FF	Cb 1FF	Cb 20F	Cb 20F	Cb 229	Cb 229	Cb 24B	Cb 24B	Cb 272	Cb 272	Cb 288	Cb 288	Cb 29D	Cb 29D
505	Y 181	Y 17F	Y 17E	Y 180	Y 180	Y 18B	Y 197	Y 18E	Y 170	Y 12A	Y 160	Y 137	Y 14A	Y 14C
	Cr 298	Cr 298	Cr 294	Cr 294	Cr 289	Cr 289	Cr 265	Cr 226	Cr 18C	Cr 18C	Cr 18C	Cr 1D5	Cr 1D5	
	Cb 205	Cb 205	Cb 212	Cb 212	Cb 221	Cb 221	Cb 242	Cb 26D	Cb 26D	Cb 28C	Cb 28C	Cb 299	Cb 299	
506	Y 17F	Y 17C	Y 17A	Y 177	Y 179	Y 189	Y 19E	Y 1C7	Y 164	Y 112	Y 141	Y 12B	Y 146	Y 14D
	Cr 29A	Cr 29A	Cr 296	Cr 296	Cr 288	Cr 288	Cr 263	Cr 222	Cr 184	Cr 184	Cr 184	Cr 1C9	Cr 1C9	
	Cb 204	Cb 204	Cb 20F	Cb 20F	Cb 221	Cb 221	Cb 246	Cb 26F	Cb 26F	Cb 28A	Cb 28A	Cb 294	Cb 294	
507	Y 179	Y 17C	Y 17B	Y 178	Y 180	Y 1A0	Y 199	Y 1A1	Y 15F	Y 128	Y 148	Y 119	Y 144	Y 14D
	Cr 29C	Cr 29C	Cr 299	Cr 299	Cr 28D	Cr 28D	Cr 269	Cr 228	Cr 18C	Cr 18C	Cr 18C	Cr 1D5	Cr 1D5	
	Cb 20D	Cb 20D	Cb 21A	Cb 21A	Cb 229	Cb 229	Cb 246	Cb 26D	Cb 26D	Cb 28A	Cb 28A	Cb 298	Cb 298	
508	Y 17E	Y 179	Y 176	Y 17E	Y 179	Y 187	Y 19E	Y 1D4	Y 16A	Y 100	Y 136	Y 124h = 308	Y 142	Y 152
	Cr 29A	Cr 29A	Cr 294	Cr 294	Cr 288	Cr 288	Cr 262	Cr 222	Cr 184	Cr 184	Cr 184	Cr 186h = 486	Cr 1C7	Cr 1C7
	Cb 200	Cb 200	Cb 20C	Cb 20C	Cb 221	Cb 221	Cb 244	Cb 26D	Cb 26D	Cb 288	Cb 288	Cb 28Fh = 655	Cb 292	Cb 292
509	Y 17E	Y 183	Y 187	Y 183	Y 182	Y 18A	Y 1A1	Y 160	Y 106	Y 145	Y 148	Y 148	Y 140	Y 144
	Cr 29A	Cr 29A	Cr 294	Cr 294	Cr 288	Cr 288	Cr 267	Cr 227	Cr 18B	Cr 18B	Cr 18B	Cr 1D4	Cr 1D4	
	Cb 203	Cb 203	Cb 212	Cb 212	Cb 229	Cb 229	Cb 24A	Cb 26D	Cb 26D	Cb 288	Cb 288	Cb 296	Cb 296	

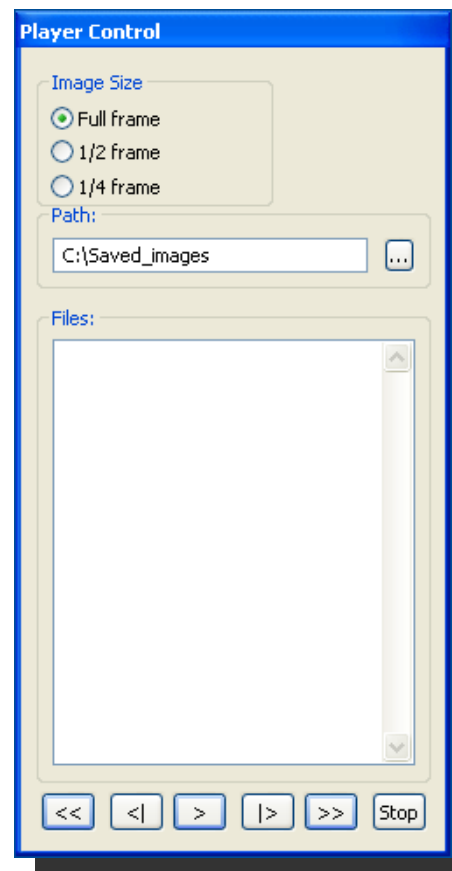
Hex dump	1767	1768	1769	1770	1771	1772	1773	1774	1775	1776	1777	1778	1779	1780
500	R 9A	R 9A	R 99	R 9A	R 93	R 94	R 85	R 8C	R 60	R 45	R 46	R 43	R 3A	R 3A
	G 3A	G 3A	G 3A	G 3B	G 3C	G 3D	G 46	G 4D	G 44	G 2A	G 48	G 46	G 49	G 49
	B 5C	B 5C	B 64	B 64	B 6E	B 6F	B 86	B 8D	B 8D	B 72	B 96	B 93	B 9B	B 9B
501	R 9E	R 9A	R 96	R 97	R 92	R 94	R 87	R 94	R 66	R 4F	R 40	R 35	R 38	R 3B
	G 3F	G 3D	G 3C	G 3D	G 3F	G 41	G 46	G 54	G 49	G 32	G 43	G 38	G 48	G 4B
	B 61	B 60	B 64	B 65	B 6F	B 71	B 83	B 90	B 8F	B 79	B 91	B 86	B 9A	B 9D
502	R 98	R 99	R 97	R 9E	R 97	R 93	R 84	R 97	R 65	R 4D	R 3F	R 44	R 3E	R 3C
	G 3A	G 3E	G 3D	G 40	G 44	G 41	G 42	G 55	G 43	G 2B	G 3E	G 42	G 4A	G 4B
	B 5A	B 5E	B 62	B 66	B 74	B 70	B 80	B 93	B 8D	B 74	B 8C	B 91	B 9A	B 9B
503	R 98	R 9A	R 98	R 97	R 92	R 95	R 89	R 90	R 64	R 51	R 42	R 3C	R 3E	R 3E
	G 39	G 3A	G 3D	G 3C	G 3D	G 41	G 47	G 4F	G 44	G 31	G 40	G 3E	G 47	G 47
	B 5E	B 60	B 66	B 65	B 6E	B 71	B 83	B 8E	B 8A	B 78	B 8D	B 88	B 99	B 99
504	R 96	R 95	R 91	R 94	R 94	R 99	R 8D	R 95	R 66	R 54	R 45	R 3A	R 35	R 3B
	G 37	G 35	G 33	G 36	G 3D	G 43	G 48	G 51	G 41	G 2F	G 40	G 35	G 40	G 46
	B 5D	B 5E	B 61	B 64	B 72	B 78	B 8A	B 92	B 8D	B 7B	B 90	B 85	B 93	B 99
505	R 9E	R 9A	R 96	R 98	R 94	R 96	R 87	R 92	R 62	R 4B	R 43	R 3F	R 3B	R 3A
	G 3C	G 3A	G 36	G 38	G 3B	G 3D	G 42	G 4D	G 41	G 2A	G 41	G 3D	G 48	G 47
	B 61	B 60	B 64	B 66	B 72	B 74	B 84	B 8E	B 8C	B 75	B 92	B 8F	B 9C	B 9B
506	R 97	R 9A	R 9A	R 9A	R 95	R 96	R 86	R 93	R 63	R 51	R 42	R 3F	R 35	R 36
	G 3C	G 3F	G 42	G 42	G 42	G 43	G 43	G 51	G 43	G 30	G 43	G 39	G 43	G 44
	B 5B	B 5D	B 65	B 65	B 71	B 72	B 83	B 91	B 8F	B 7D	B 94	B 8A	B 89	B 9A
507	R 99	R 97	R 95	R 96	R 91	R 93	R 8A	R 9D	R 68	R 4F	R 43	R 38	R 39	R 3A
	G 3E	G 3C	G 3C	G 3C	G 3C	G 3F	G 49	G 5D	G 4B	G 32	G 46	G 3C	G 49	G 4A
	B 60	B 5E	B 67	B 67	B 70	B 72	B 85	B 98	B 8F	B 77	B 93	B 69	B 9E	B 9B
508	R 97	R 9A	R 97	R 96	R 92	R 97	R 84	R 9A	R 67	R 4C	R 46	R 3Ch = 60	R 3A	R 3B
	G 37	G 3A	G 3E	G 3D	G 3E	G 43	G 40	G 57	G 47	G 2C	G 46	G 3Eh = 59	G 4A	G 4A
	B 5A	B 5D	B 63	B 62	B 6E	B 73	B 7E	B 95	B 8E	B 73	B 94	B 8Eh = 142	B 9A	B 9A
509	R 98	R 97	R 96	R 98	R 93	R 94	R 87	R 99	R 63	R 47	R 44	R 43	R 3A	R 3B
	G 3A	G 39	G 3A	G 3C	G 3D	G 3E	G 42	G 54	G 41	G 24	G 43	G 43	G 49	G 49
	B 5F	B 5E	B 65	B 67	B 71	B 73	B 85	B 98	B 8D	B 71	B 92	B 92	B 9A	B 9A

## Histogram

- Plots the histogram of the live image as a function of pixel frequency ( Y-axis ) vs. pixel value ( X-axis ).
- The range of the pixel value, in the X-axis, depends on the mode selected.
- Displays three graphs: one per component.
- When the YCrCb-20 or YCrCb-16 modes are selected, it will display plots for the Y, Cr and Cb components.
- When the RGB-24 mode is selected, it will display plots for the R, G and B components.



- Allows the user to select pre-recorded images to view.
- VCR-like controls are provided.



- Card contains two non-volatile firmware images: 'Factory' and 'Application'.
- Both images are programmed into the card during manufacturing.
- Card loads the 'factory' image on power-on, which then runs and loads the 'application' image ( if a valid 'application' image is present ).
- A 'Remote Upgrade' utility allows the user to upgrade the card's 'application' firmware image in the field.
- User is supplied with a self-executable remote upgrade utility with the 'application' firmware image embedded in it.

