IMPERX™

FrameLink Express User Training

J.Egri 4/09

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Features

- Camera Link interface
- Two independent Base Camera Link inputs using mini-CL connectors.
    - Fully Camera Link compliant.
    - 20 – 85 MHz clock.
    - Bi-directional serial interface (9600 to 115.2K BAUD rates).
    - CC[1:4] discrete signals.
- Medium Camera Link input…can be supported in the future.
- Full Camera Link input…cannot be supported in the future.
- PoCL (Power over Camera Link) is not supported.

- 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.

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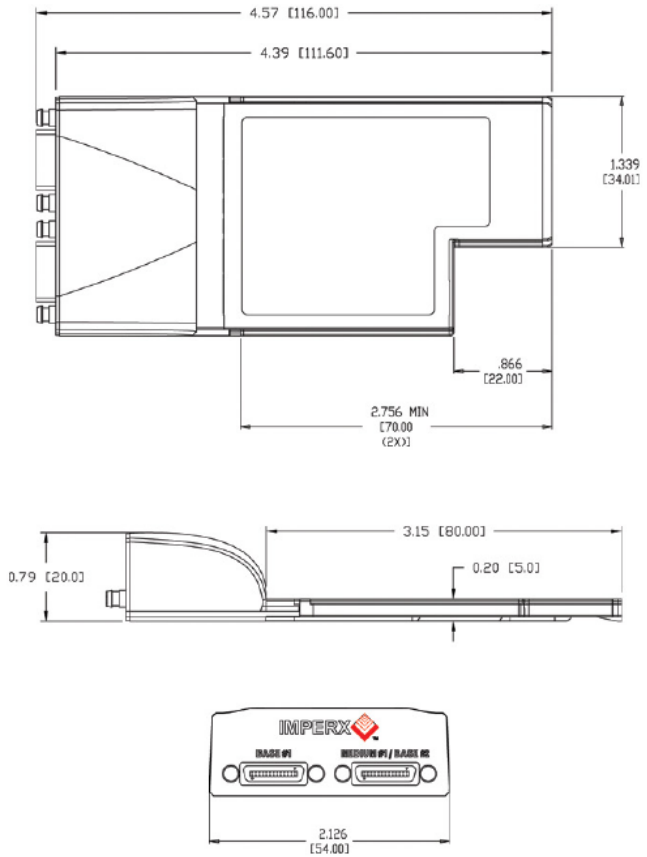
Features (cont.)

- Features
- Master/Slave CC pulse generators with channel cross-coupling.
- Lookup table.
- Histograms.
- RGB gain/offset with auto-white balance.
- Hex pixel dump.
- Capture single frame, multiple frames or AVI clips.
- Save RAW, BMP, TIFF, JPEG or AVI files.
- Unique ‘Auto-Learn’ capability for easy CAM file creation.
- Firmware ‘Remote Upgrade’ capability.

Features (cont.)

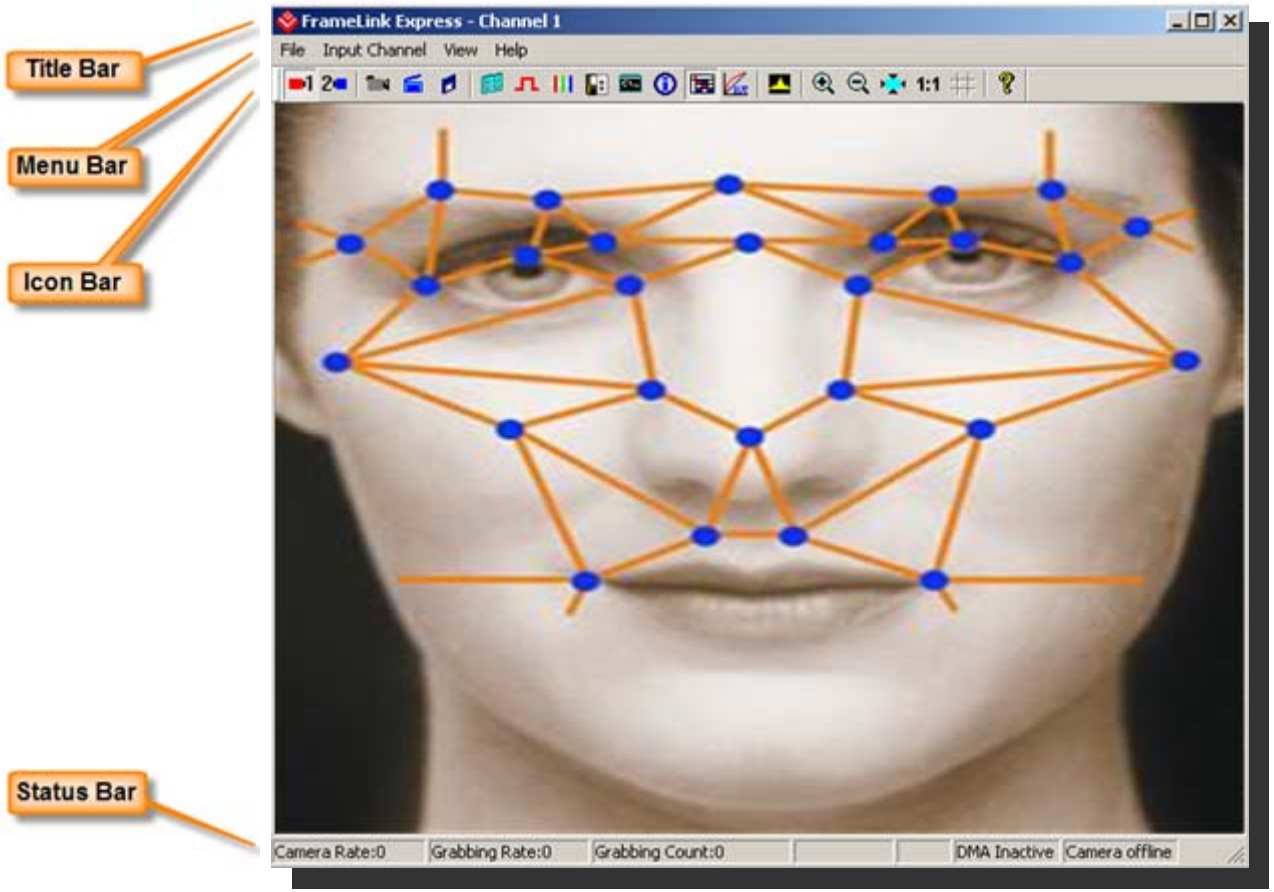
- Mechanical
- ExpressCard 54mm form factor.
- 38 mm I/O extension.
- 4.6” x 2.1” x 0.8” overall size.
- 1.91 oz. (53.6 g).

- Power
- 3.3 VDC +/- 5%.
- 500 mA steady current.
- 1.65 W constant power.



Main Menu

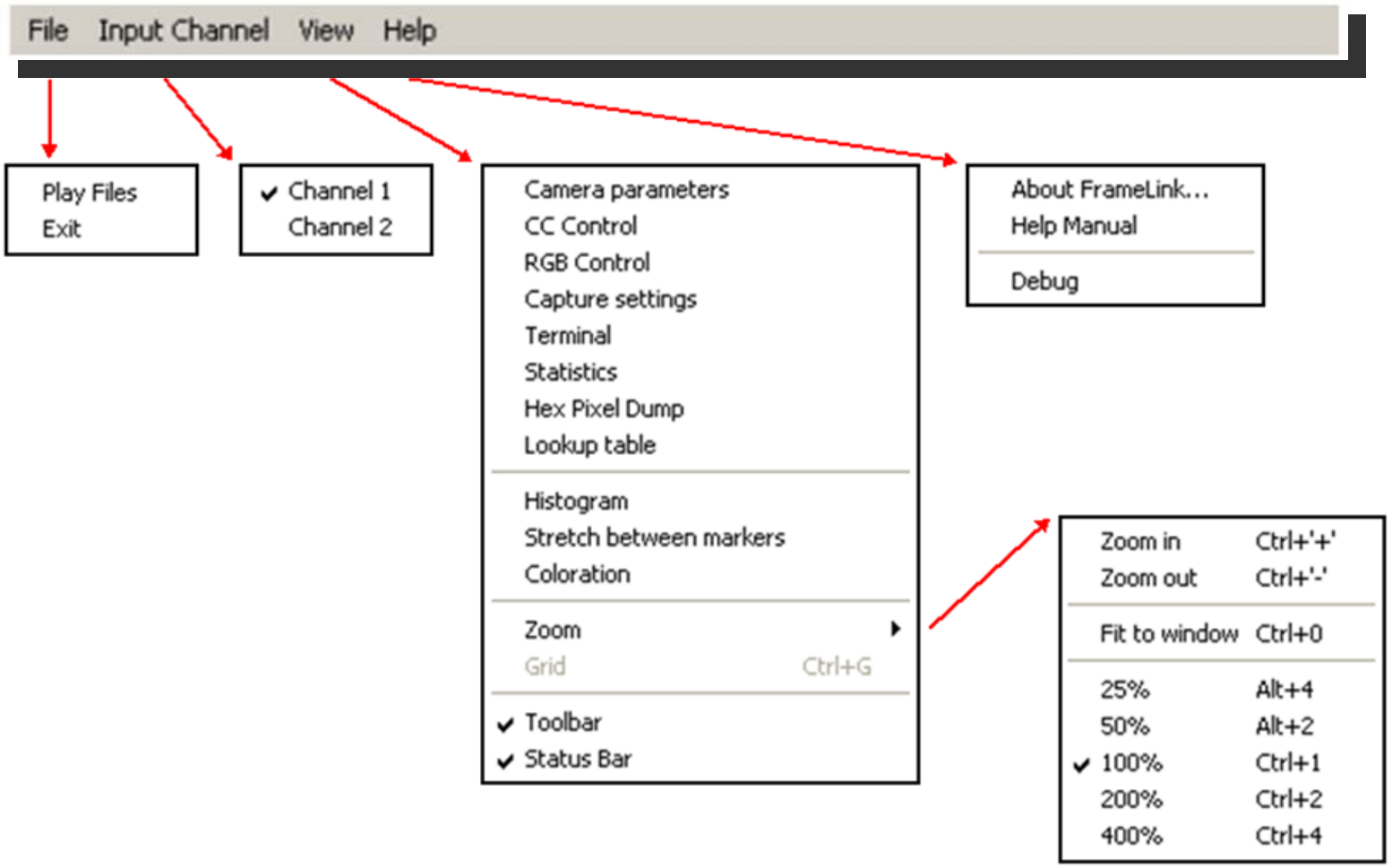
- Consists of a Title bar, a Menu bar, an Icon bar and a Status bar.



Title Bar

- Reflects the name assigned to the Camera Link port that is currently selected.
- A name of ‘Channel 1’ or ‘Channel 2’ is used as a default.
- The user can replace this default name by filling in the ‘Alias’ field in the ‘Camera Parameters’ dialog.

Menu Bar


File
Input Channel
View
Help
Play Files
Exit
Channel 1
Channel 2
Camera parameters
CC Control
RGB Control
Capture settings
Terminal
Statistics
Hex Pixel Dump
Lookup table
Histogram
Stretch between markers
Coloration
Zoom
Grid Ctrl+G
Toolbar
Status Bar
About FrameLink...
Help Manual
Debug
Zoom in Ctrl+'+'
Zoom out Ctrl+'-'
Fit to window Ctrl+0
25% Alt+4
50% Alt+2
100% Ctrl+1
200% Ctrl+2
400% Ctrl+4

Icon Bar

- Select **Channel #1**
- Select **Channel #2**
- Start/stop continuous **Grab**
- **Snap** single frame
- Start/stop **Capture** to disk
- Open **Camera Parameters** dialog
- Open **CC Control** dialog
- Open **RGB Control** dialog
- Open **Capture Settings** dialog
- Open **Terminal** dialog
- Open **Statistics** dialog
- Open **Hex Pixel Dump** dialog
- Enable/disable **Lookup Table** processing
- Open **Histogram** dialog
- **Zoom In**
- **Zoom Out**
- **Fit to Window**
- **Zoom 1:1**
- Turn **Grid** on/off
- **Help**

Status Bar

- **Camera Rate** Displays the real-time frame rate of the attached camera as measured at the input of the FrameLink 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 FrameLink 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 FrameLink Express to stop acquiring video data by clicking on the 'Stop Grab' button or that grabbing is enabled but

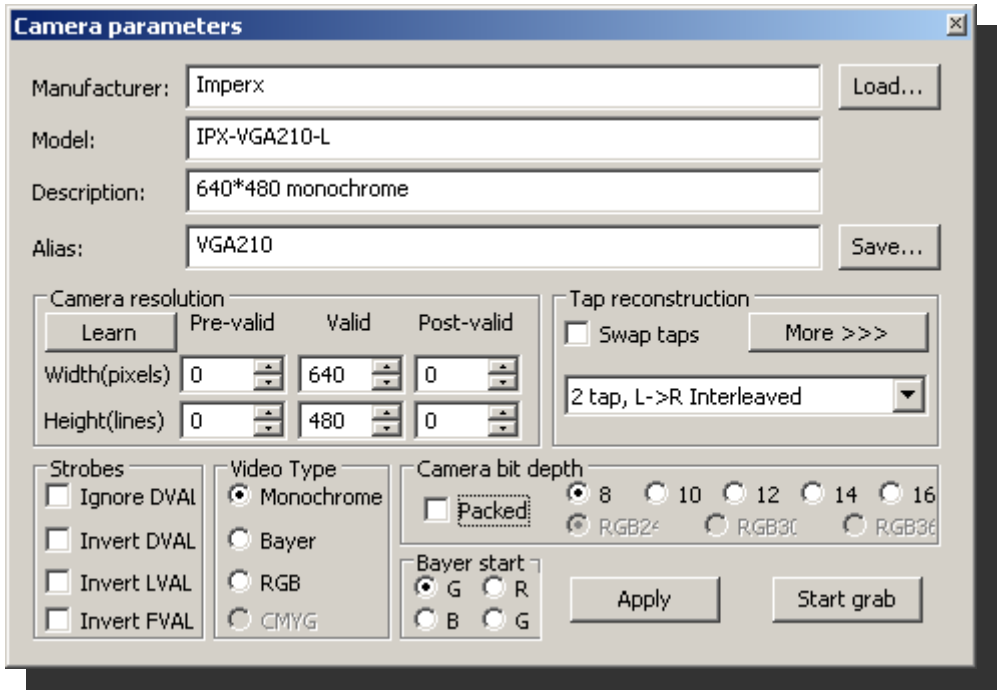
  the camera is not providing valid framing.
- **Camera Status** Displays the real-time status of the attached camera as being either : '**online**' or '**offline**'.

  '**Online**' indicates that the camera is powered on, attached and providing a video clock via the CameraLink interface.

  '**Offline**' indicates that the FrameLink Express card is not receiving a video clock from the camera either because the camera is powered off or the CameraLink cable is disconnected.

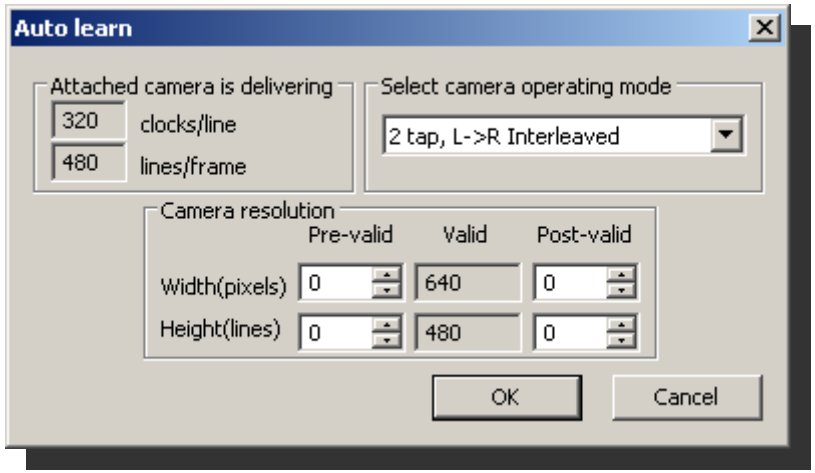
Camera Parameters

- Specifies all camera related parameters.
- Informs the FrameLink Express about how to reconstruct the image.
- Can ‘save’ and ‘load’ CAM files to/from disk.



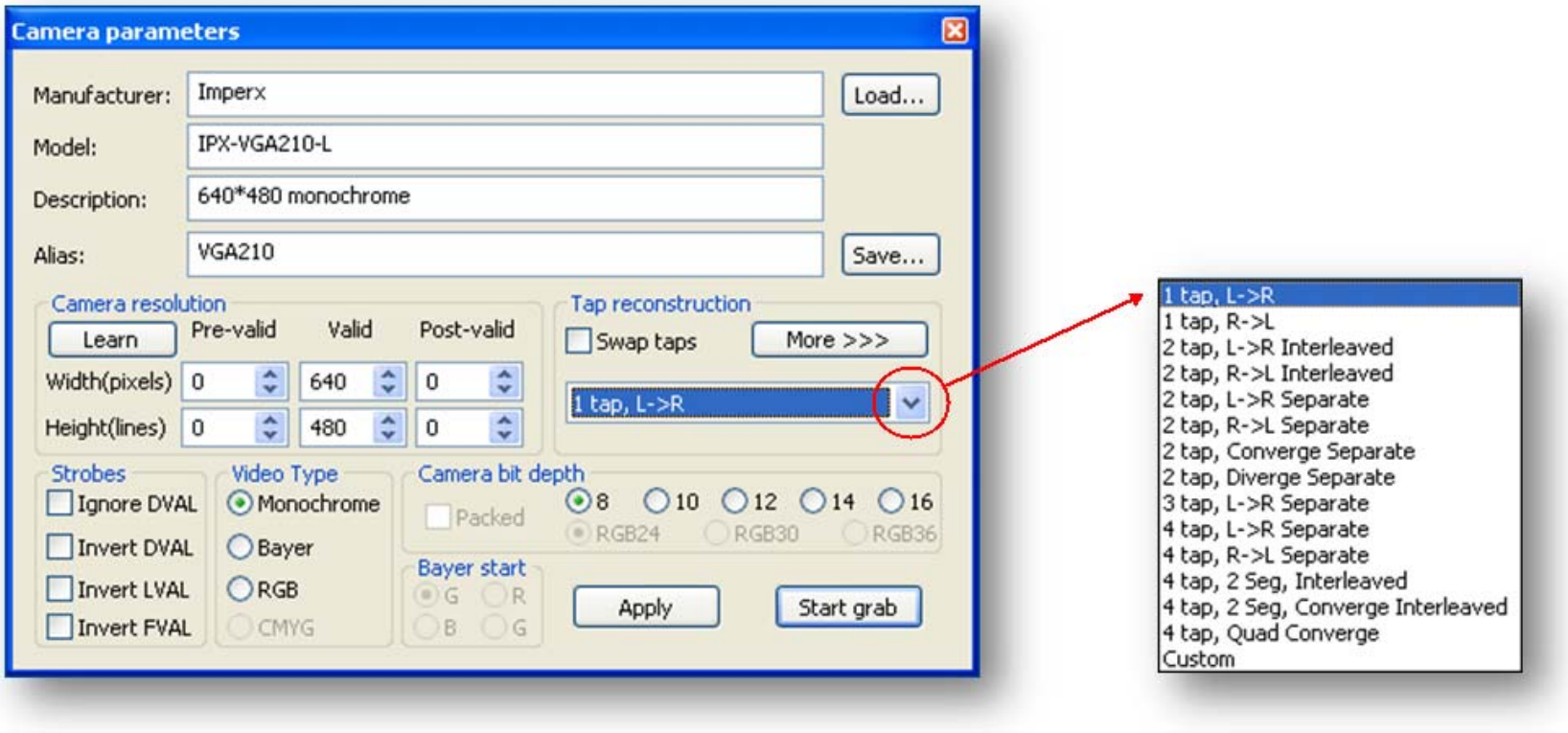
Auto-Learn

- Feature unique to Imperx FrameLink Express frame grabber.
- Simplifies CAM file creation.
- Automatically ‘learns’ camera parameters by measuring Camera Link signals.



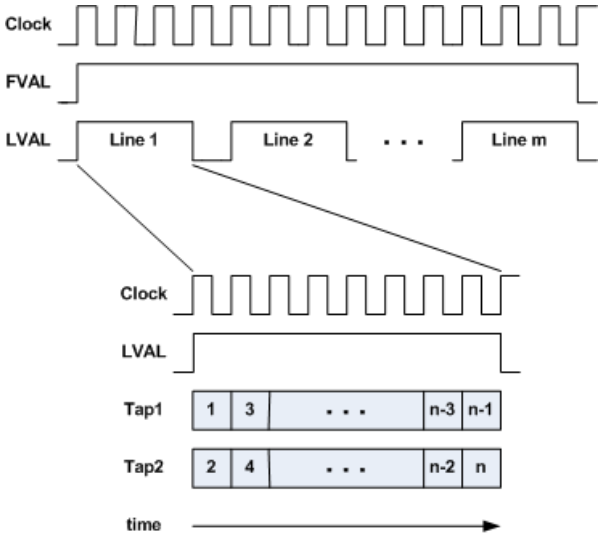
Tap Reconstruction

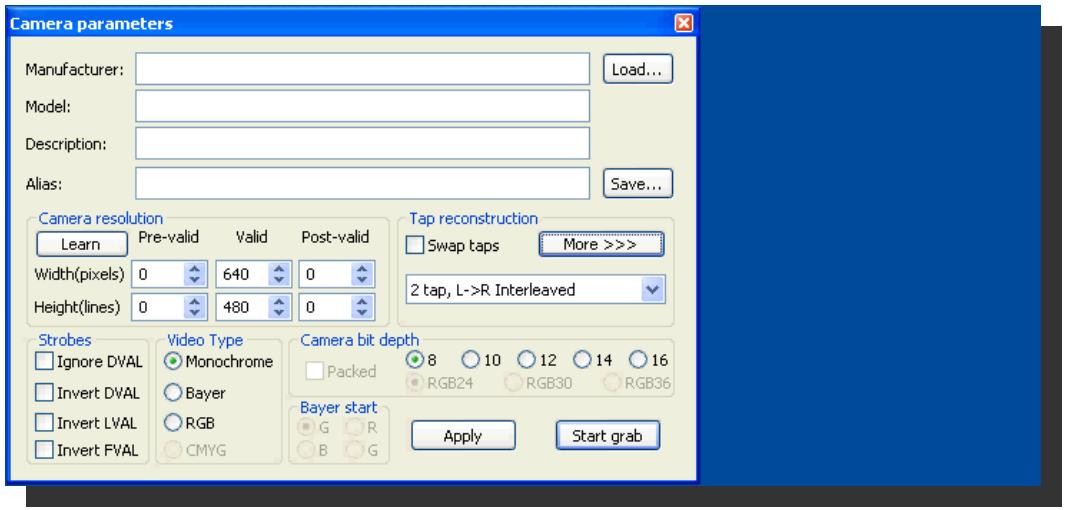
- Specifies the order in which pixels are delivered by the camera.
- Specifies the number of taps utilized to deliver the image.



Tap Reconstruction Example #1

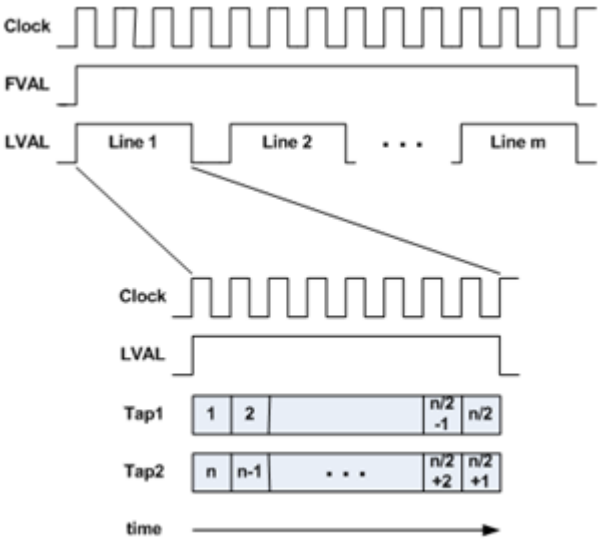
- 2 tap, L->R Interleaved
  - Odd pixels (red) are delivered on Tap1 from Left-to-Right.
  - Even pixels (green) are delivered on Tap2 from Left-to-Right.

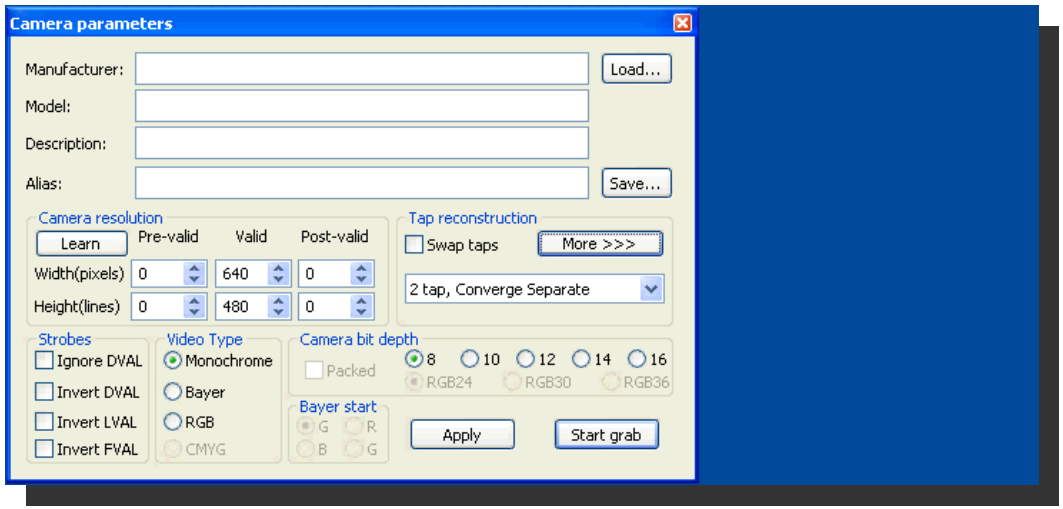




Tap Reconstruction Example #2

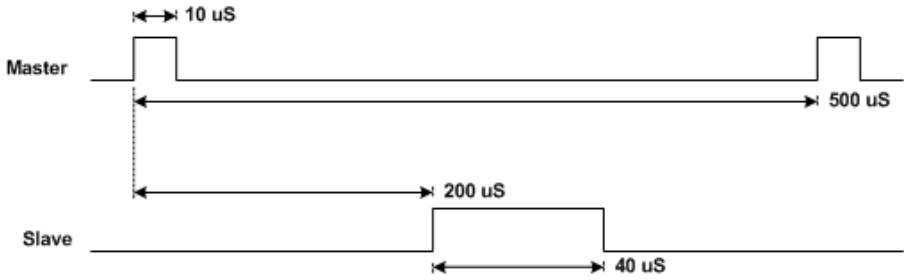
- 2 tap, Converge Separate
  - Left half pixels (red) are delivered on Tap1 from Left-to-Center.
  - Right half pixels (green) are delivered on Tap2 from Right-to-Center.

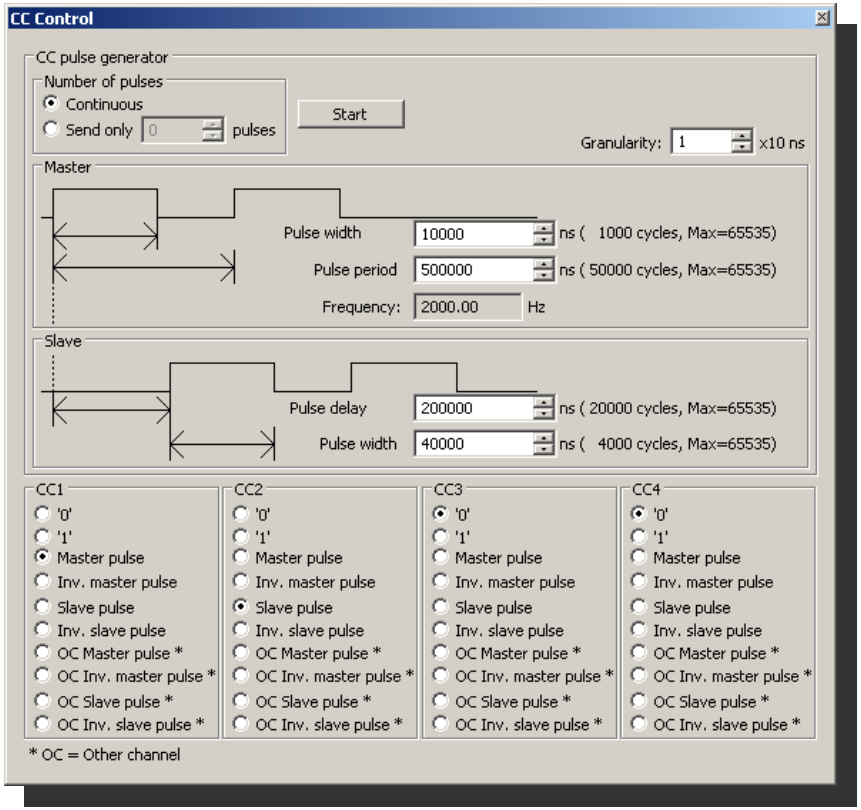




CC Control

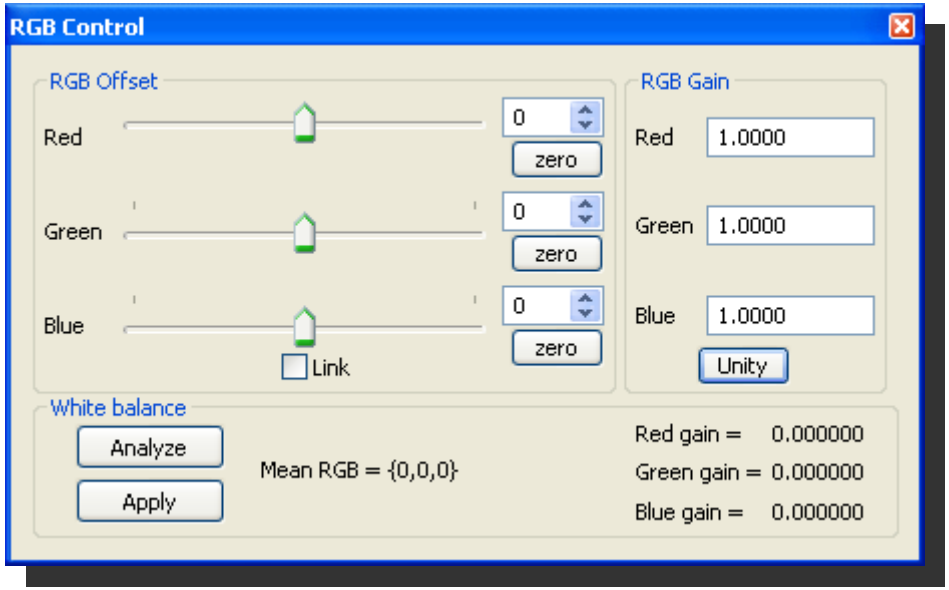
- Dual master-slave pulse generators per channel.
- Continuous or programmable number of pulses.
- Cross coupling between Camera Link channels.





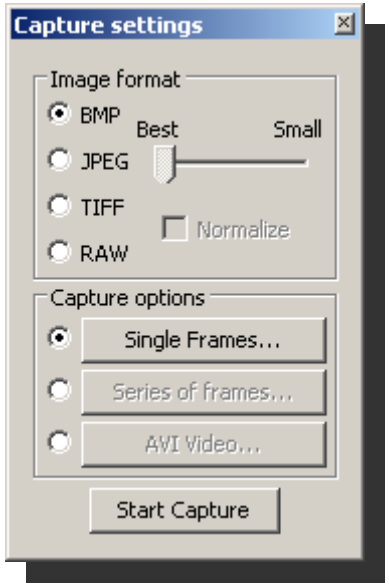
RGB Control

- Programmable RGB Gain and Offset.
- Automatic white balance feature computes RGB gains.



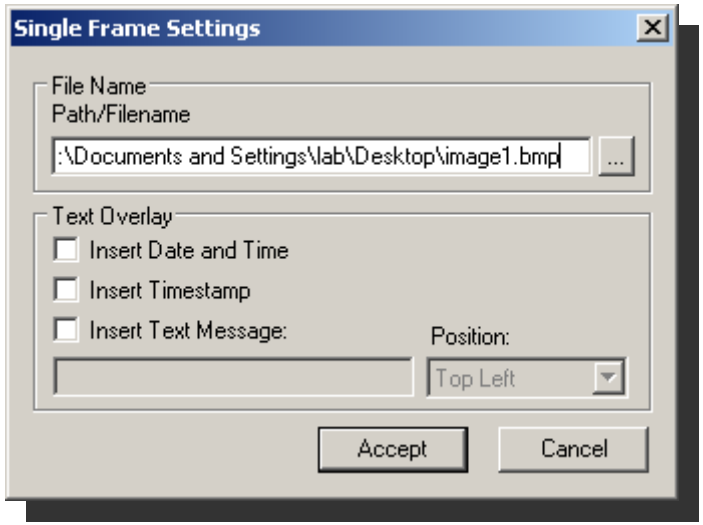
Capture Settings

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



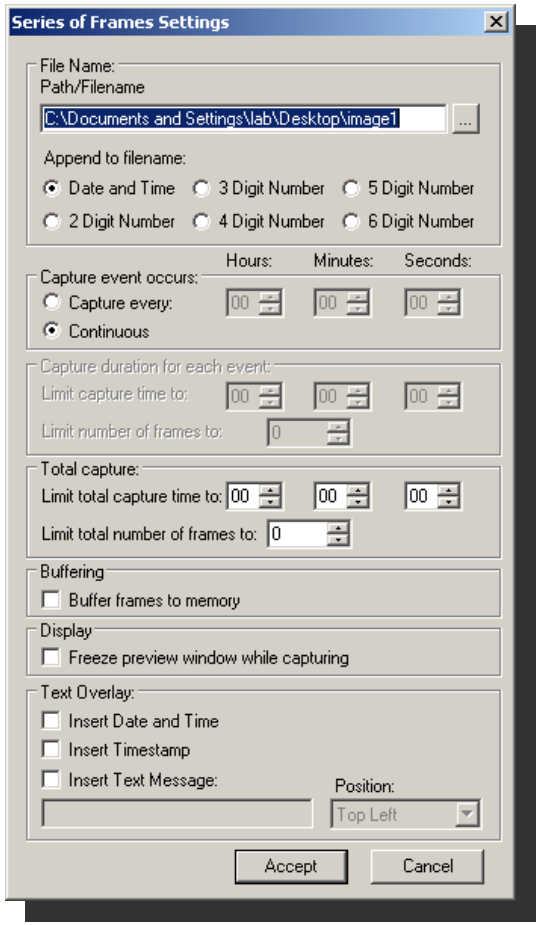
Single Frames

- Used to record one frame only.
- Specify the path and filename for the recorded file.
- Insert optional date/time/timestamp/text to be overlayed 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 overlayed 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.



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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.

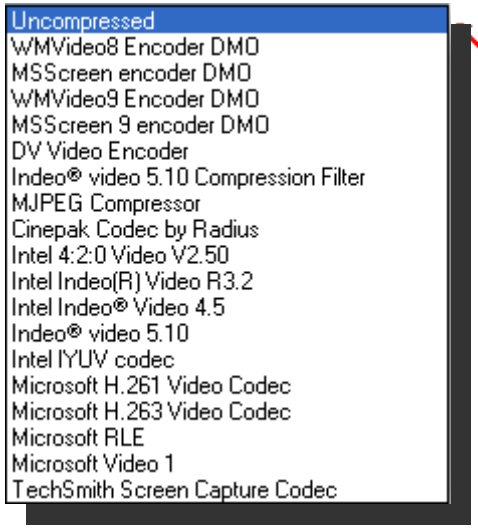
Capture event occurs: Capture every: 01 Hr 00 Min 00 Sec
Capture duration for each event: Limit number of frames to: 10
Total capture: Limit total capture time to: 06 Hr 00 Min 00 Sec
Limit total number of frames to: 300

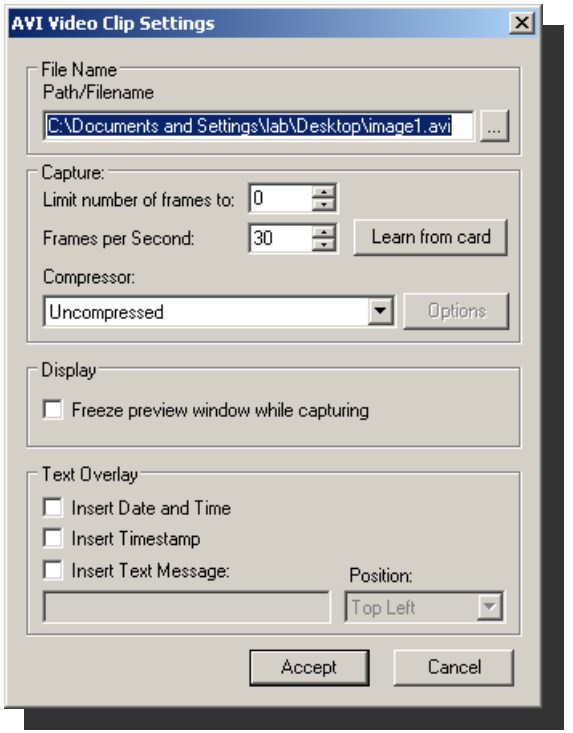
- **Example #4:** To capture continuously for a period of 2 hours and not to exceed a total of 100 images.

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

AVI Capture

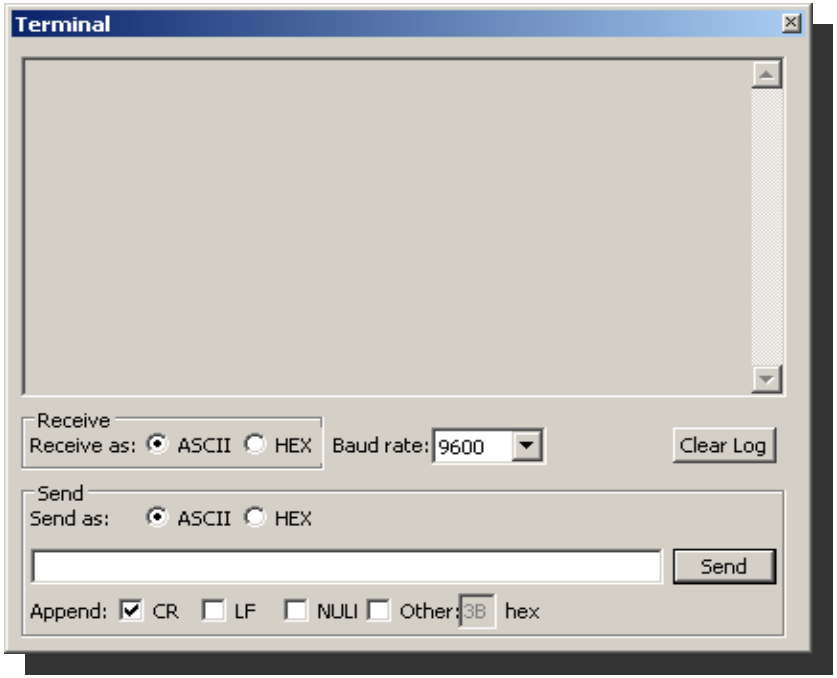
- Used to record AVI movies.
- Specify the path and filename for the recorded file.
- Insert optional date/time/timestamp/text to be overlayed on images saved.
- The overlay text is destructive (i.e. persistent) to the image saved.
- Specify capture limits.
- Specify codec compressor.
- Searches hard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





Terminal

- Terminal emulator for Camera Link serial interface.
- Allows user to send commands and receive responses to/from camera.
- Supports both ASCII and hexadecimal strings with programmable terminators.
- Configures BAUD rate from 9600 to 115.2K bps.



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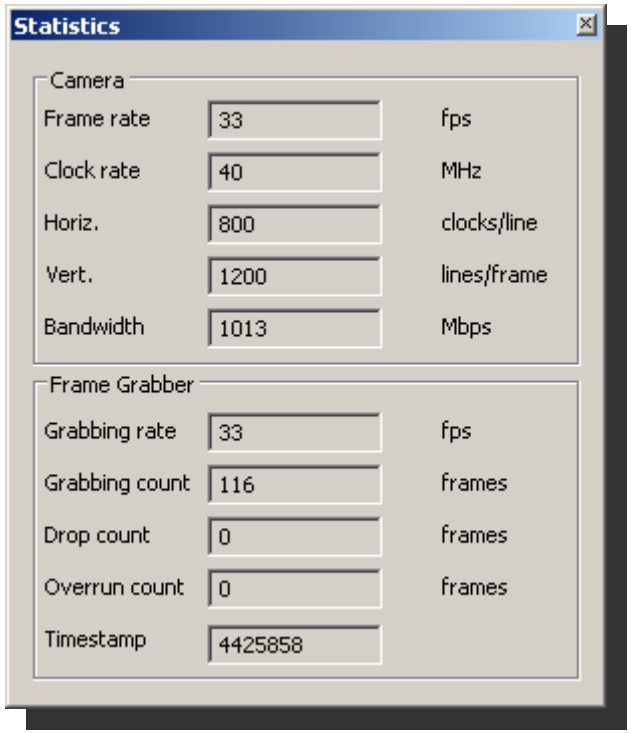
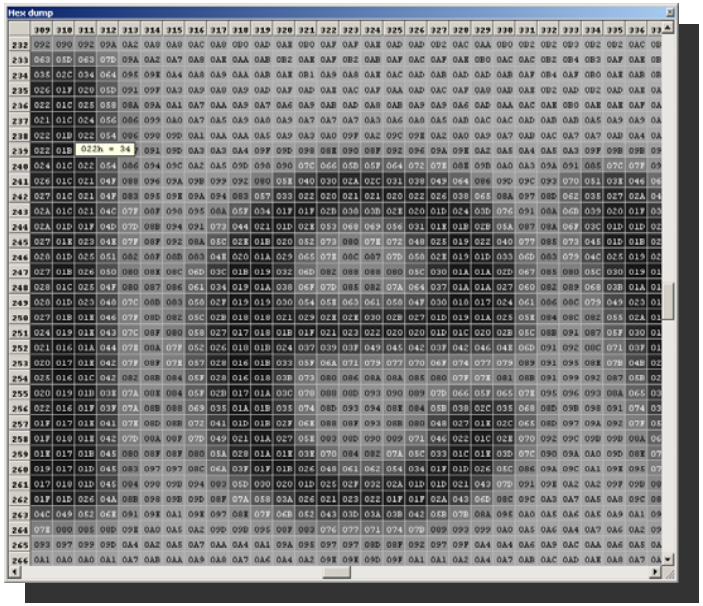
Statistics

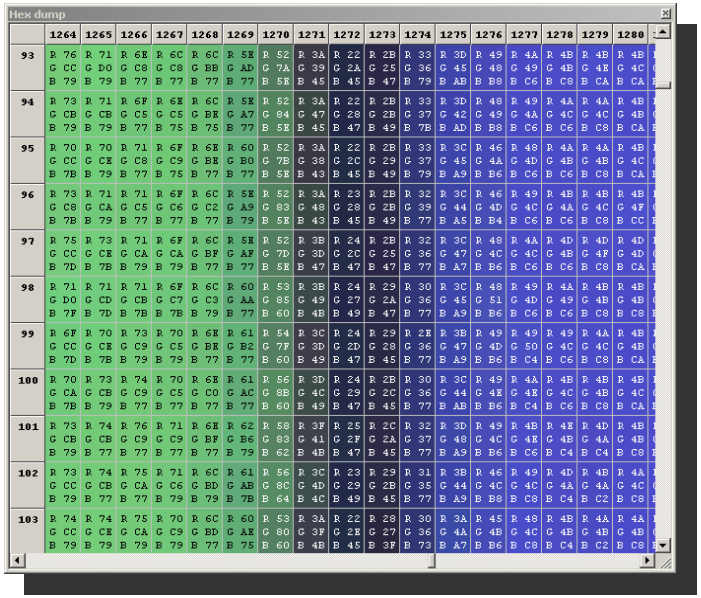
- Displays real time camera performance attributes.
- Displays real time frame grabber performance attributes.
- Useful in determining if frame grabber can keep up with the camera.



Hex Pixel Dump

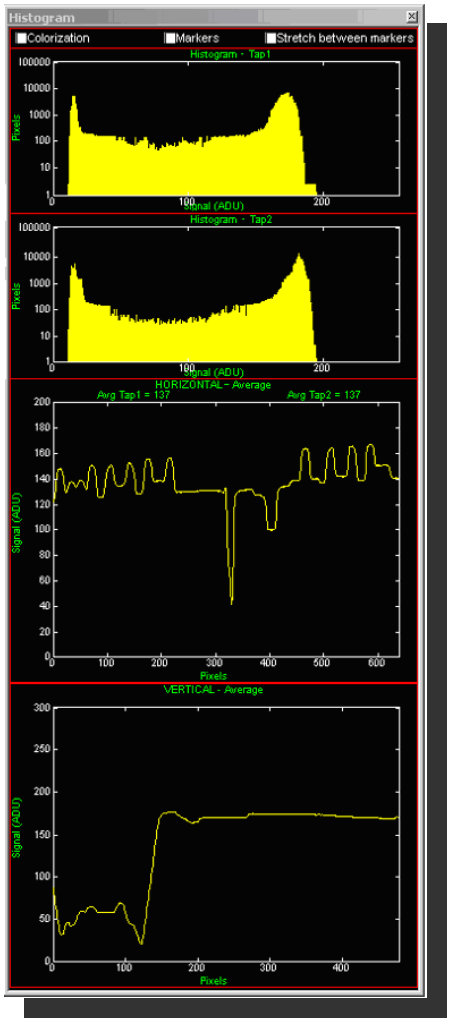
- Displays a two-dimensional table of real-time pixel values, plotting row (Y) vs. column (X), for a bounded region of pixels.
- The background color of each cell is grayscale or color coded.
- Hovering the mouse over a given pixel reveals both the pixel's hexadecimal and integer values.





Histogram Dialog

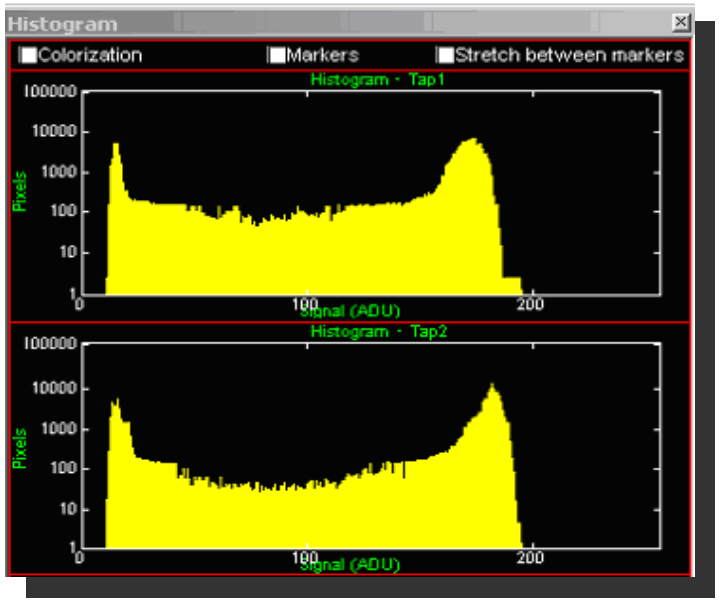
- Displays three graphs of the live image:
  - Histogram plot.
  - Horizontal Average plot.
  - Vertical Average plot.
- Provides advanced features including:
  - Colorization.
  - Markers.
  - Stretching.



Histogram Plot

- Plots the histogram 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 bit depth of the

  camera.
- Plots both taps separately.



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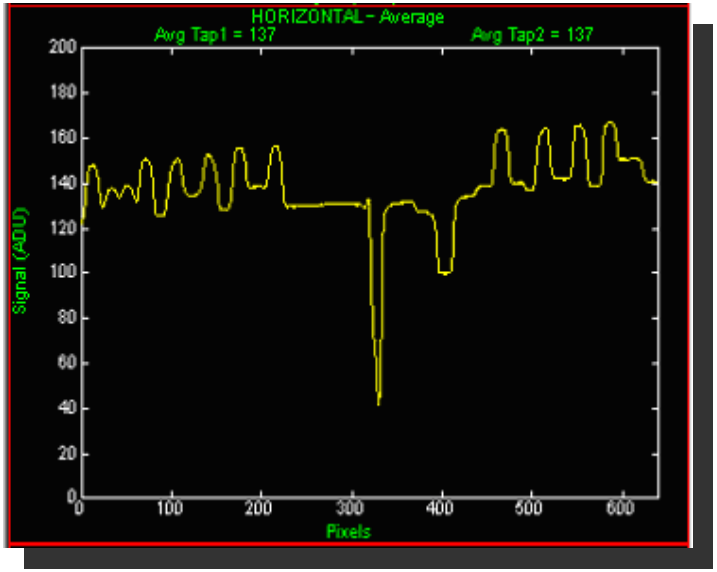
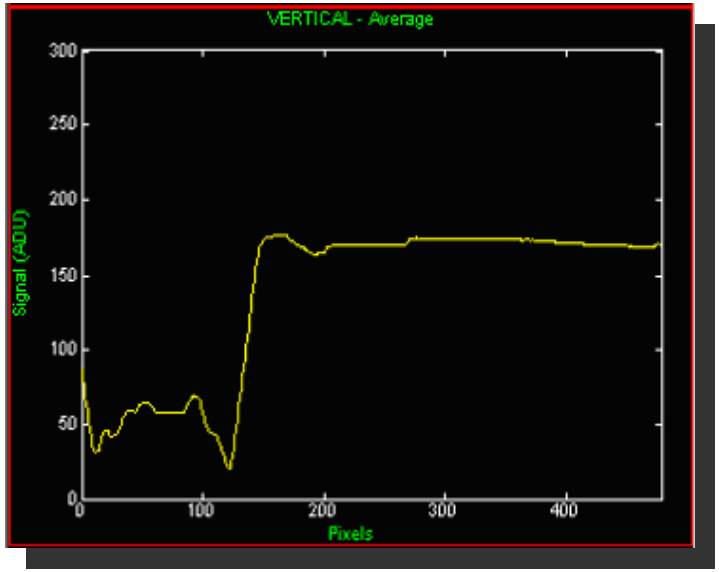
Histogram
Horizontal Average

- Plots the average value as a function of average pixel value (Y-axis) vs. horizontal position (X-axis).
- The average value for all pixels in a given column of the image is plotted on the Y-axis.
- The range of the horizontal positions, in the X-axis, depends on the number of columns in the frame.



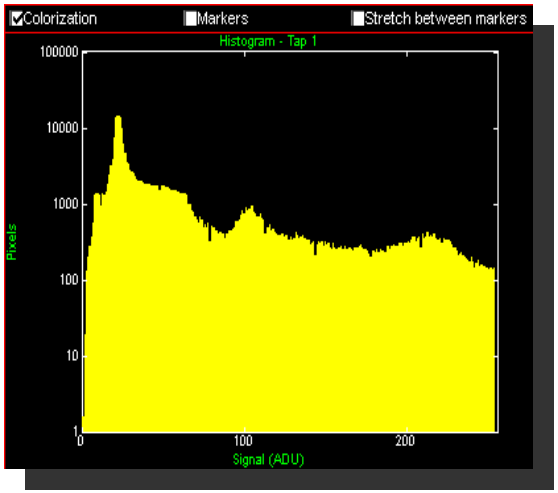
Histogram
Vertical Average

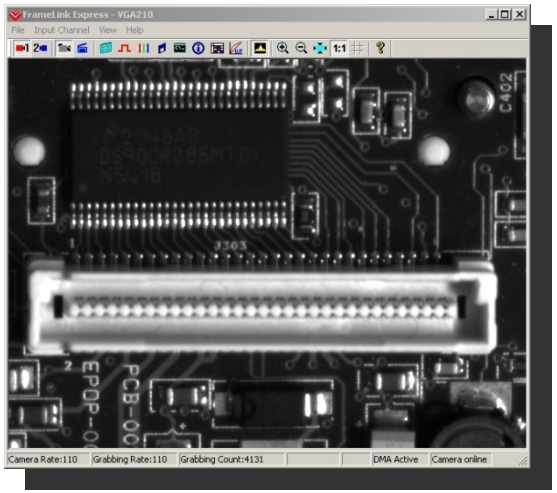
- Plots the average value as a function of average pixel value (Y-axis) vs. vertical position (X-axis).
- The average value for all pixels in a given row of the image is plotted on the Y-axis.
- The range of the vertical positions, in the X-axis, depends on the number of rows in the frame.

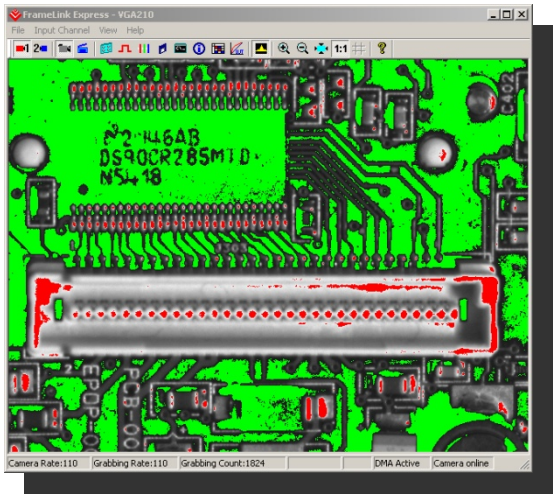


Histogram Example #1

- **Colorization.**
- Replaces dark pixels (a value of 0x00), with green color.
- Replaces saturated pixels (a value of 0xFF), with red color.

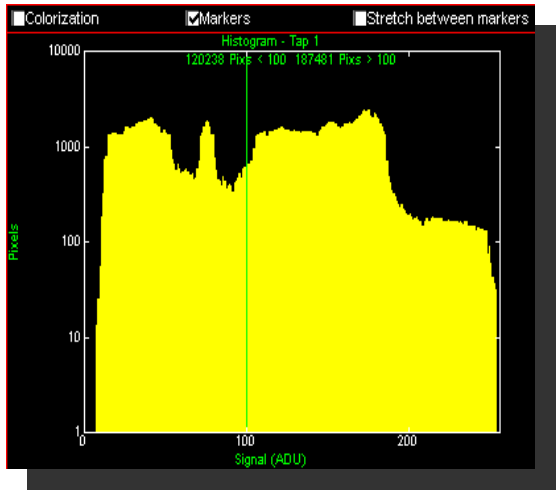


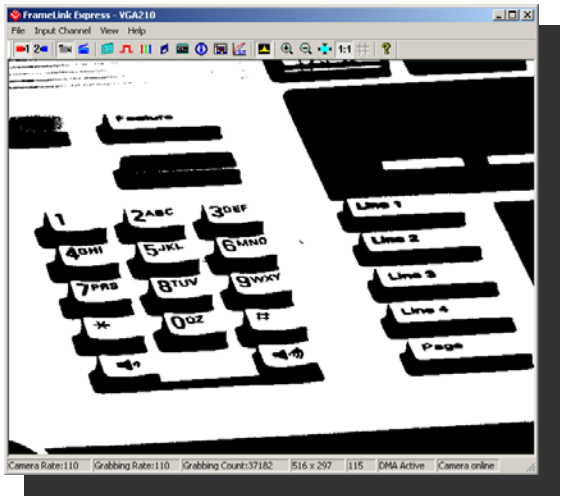




Histogram Example #2

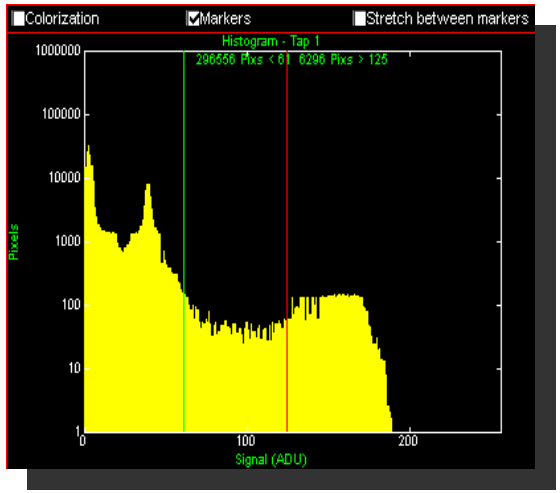
- **Markers – single threshold.**
- Creates an image with only two pixel values: dark (0x00) and saturated (0xFF).
- Replaces all pixel values below the marker with 0x00.
- Replaces all pixel values above the marker with 0xFF.

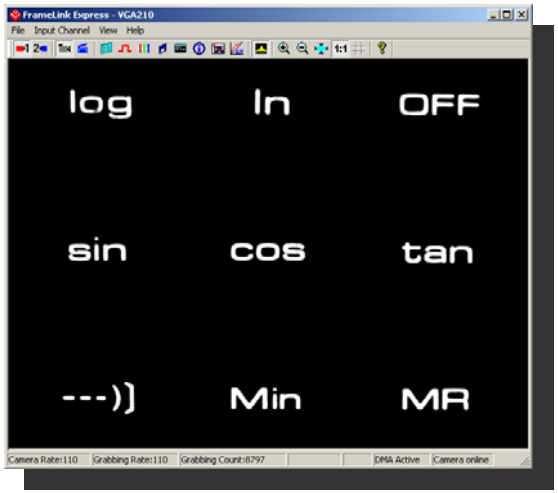




Histogram Example #3

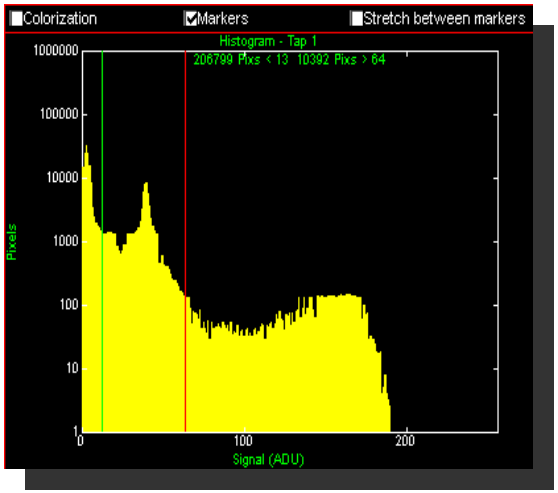
- **Markers – double threshold.**
- Replaces all pixel values below the green marker with 0x00.
- Replaces all pixel values above the red marker with 0xFF.
- All pixel values between the markers are unmodified.

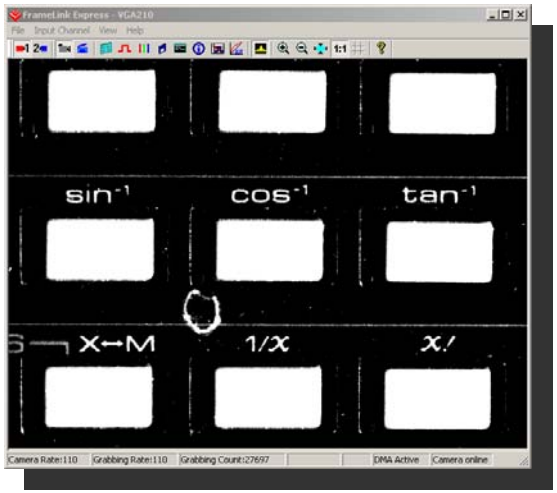




Histogram Example #4

- **Markers – double threshold.**
- Same as Example #3 except that markers are moved lower.





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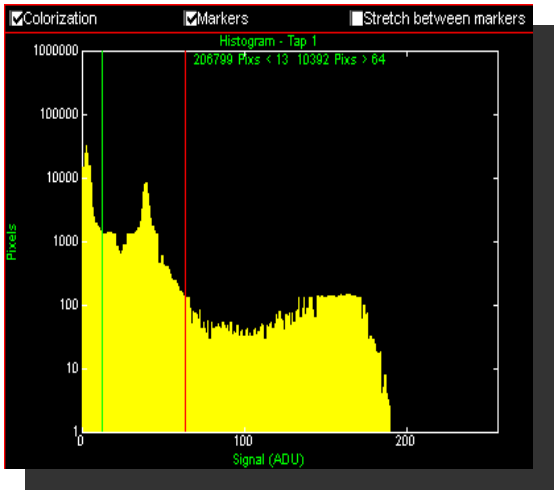
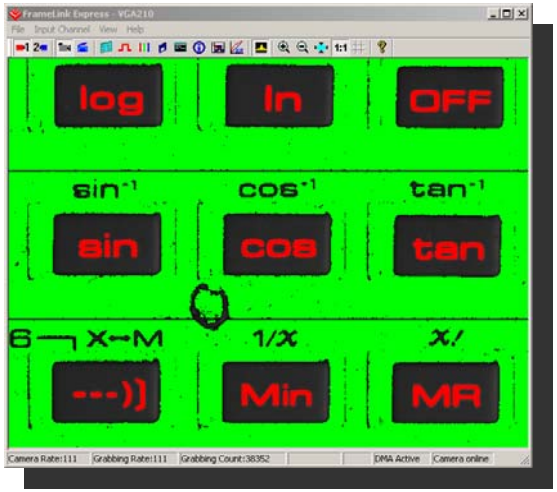
Histogram Example #5

- **Markers – double threshold w/colorization.**
- Same as Example #4 except that colorization is enabled.





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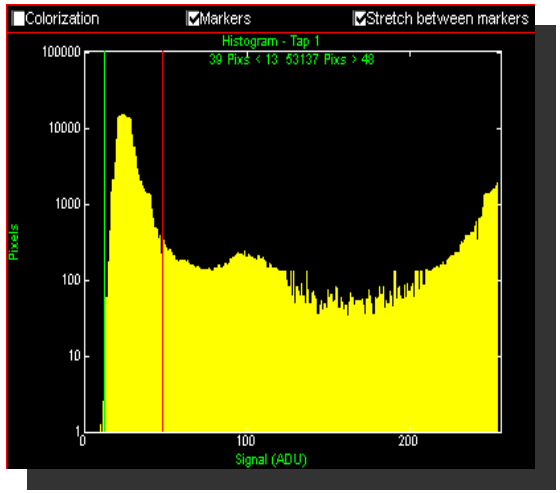
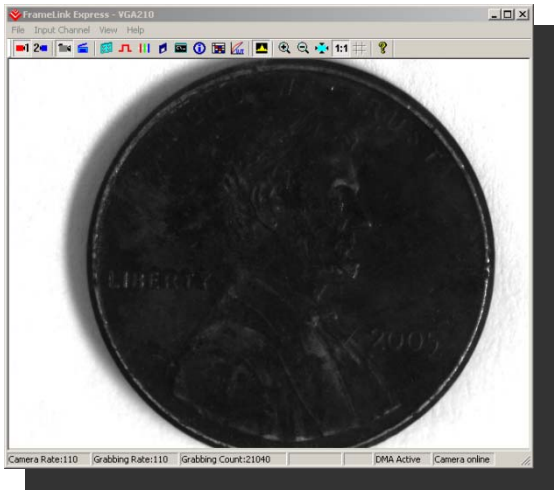
Histogram Example #6

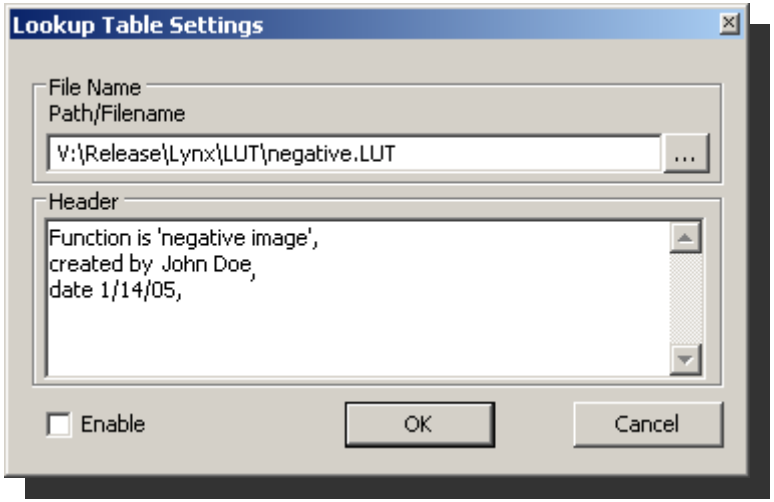
- **Stretch between Markers – contrast enhancement.**
- Replaces all pixel values below the green marker with 0x00.
- Replaces all pixel values above the red marker with 0xFF.
- All pixel values between the markers are ‘stretched’, so that they occupy the entire range from 0x01 to 0xFE, in effect causing contrast enhancement.

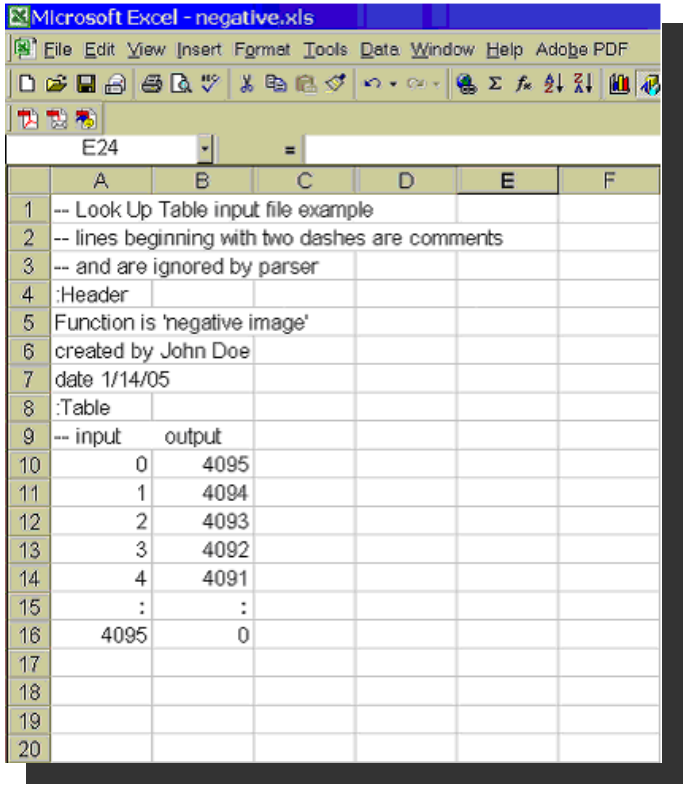




Lookup Table

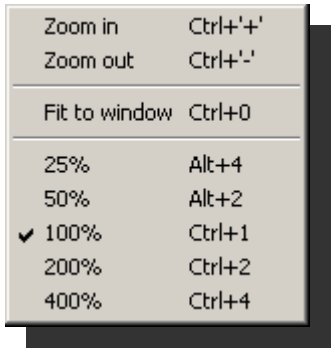
- Allows the user to select and enable a lookup table transfer function.
- Allows the user to modify and transform the original video data into any arbitrary value.
- Useful for Gamma correction, digital gain/offset, thresh-holding, etc.
- Displays header information from the LUT file.
- LUT files can be created with Excel or any ASCII editor.

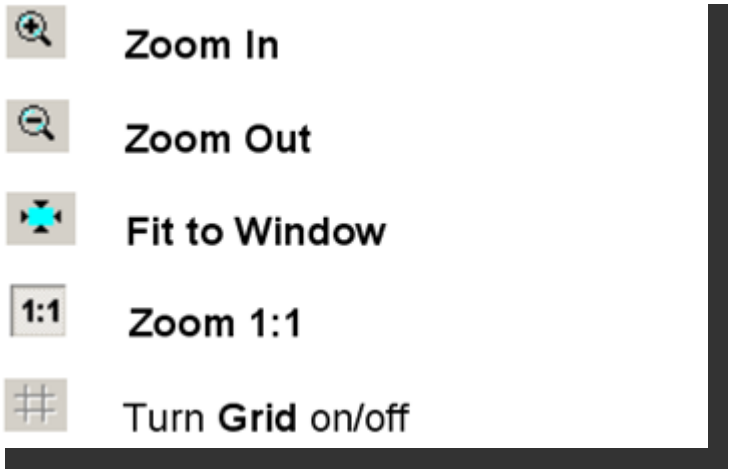




Zoom

- Allows the user to zoom or scale the displayed image.
- Menu can be invoked via the View item on the Menu bar, icons on Icon bar or by right clicking the mouse over the image window.





Remote Upgrade

- 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.