Multi-Video I/O, Text Overlay/Capture/Record

Model 2246 | Rev.M | August 08

SENSORAY | embedded electronics |

Designed and manufactured in the U.S.A.

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Special Handling Instructions

The circuit board contains CMOS circuitry that is sensitive to Electrostatic Discharge (ESD).

Special care should be taken in handling, transporting, and installing circuit board to prevent ESD damage to the board. In particular:

- Do not remove the circuit board from its protective anti-static bag until you are ready to install the board into the enclosure.

- Handle the circuit board only at grounded, ESD protected stations.

- Remove power from the equipment before installing or removing the circuit board.

System Requirements

Normal Operation

- Minimum processor: Pentium III 600 MHz. A Pentium IV 2 GHz or faster is recommended.

- Operating system: Windows 2000, or Windows XP. Windows 98 or NT are not supported.

- Minimum system RAM: 128 Mbytes. 256 Mbytes or more is recommended.

- Video card: A high performance video card is highly recommended. The video card must support Microsoft DirectX and should have at least 64MB of video ram

- DirectX: Version 8.1 or more recent. If you do not already have DirectX installed on your system (Windows XP installations include DirectX), you must obtain a DirectX runtime package from Microsoft. The exact version you need depends on your operating system and can be downloaded directly from Microsoft's web site at the following URL: http://www.microsoft.com/downloads/search.aspx?displaylang=en&categoryid=2

- MPEG2 Decoder: Windows does not come with a default MPEG2 Decoder. For best results, use one of the supported decoders (Intervideo or FFDshow).

- .NET 2003 MFC classes and runtime libraries.

- ffdshow: http://ffdshow-tryout.sourceforge.net/

- DivX Video Decoder
(DivX Video Decoder can be downloaded at www.divx.com

- Microsoft Windows Media Player 8.1 or later
(Can be downloaded at www.microsoft.com/downloads)

Software Development

- Microsoft Visual Studio .NET

- Microsoft Windows Server 2003 DDK (Driver Development Kits)

- Microsoft DirectX SDK version 9.0

- InterVideo WinDVD Creator 2
(The setup is included in the CD InterVideoWCreator\ folder)

Introduction

Sensoray's 2246 Video platform allows users to capture still images, or full motion compressed video from a variety of analog and digital video sources into a host computer. The 2246 is designed to work with HDTV formatted to the 1080i standard plus two analog video sources for real-time display and storage. HDTV from a serial digital (SDI) source is scaled and formatted for high-resolution LCD displays. Scaled data is simultaneously compressed to one of three MPEG or motion JPEG formats for efficient archiving. The 2246's processor adds bit-map images and text to the displayed image. Snapshots from the HDTV stream may be displayed and archived. The 2246 also accepts two audio signals and synchronizes them to the MPEG stream

The 2246 is compatible with the following video standards:

- Analog Composite and S-Video: NTSC-M, NTSC-Japan, PAL-B, PAL-D, PAL-G, PAL-H, PAL-I, PAL-M, PAL-N, SECAM;

- Digital Video: SD-SDI, HD-SDI , SMPTE292M and SMPTE259M.

- Digital Video (Output only): DVI-D

Functional Overview
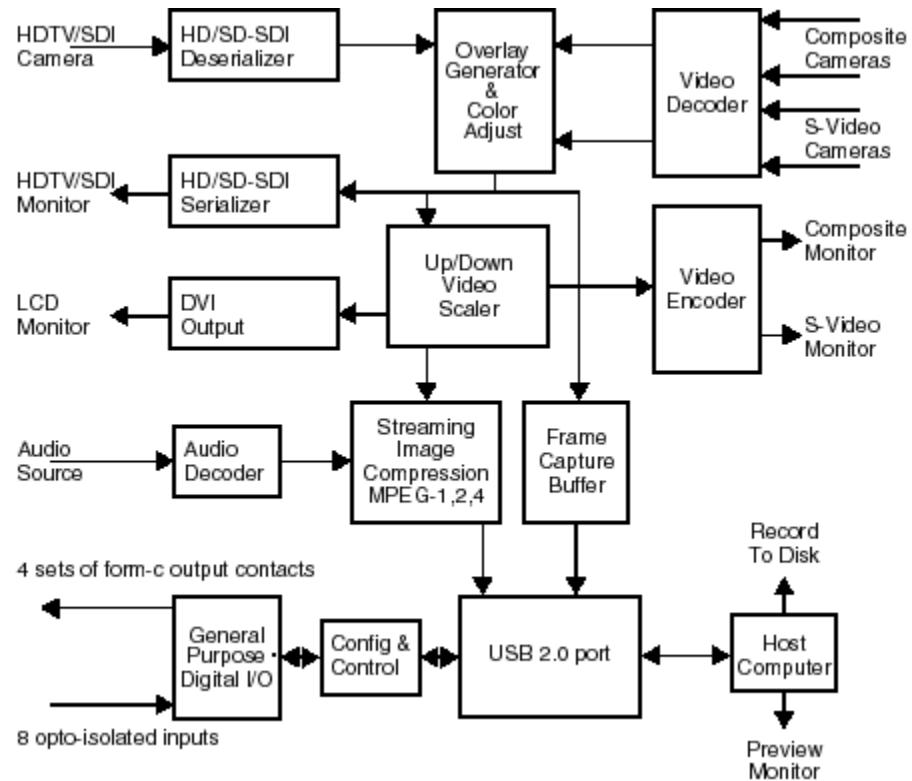
Figure 1

Video inputs

Five types of video inputs are available including; Composite video (PAL and NTSC), S-video (PAL and NTSC), SD-SDI, and HD-SDI.

Video outputs

Five types of video outputs are available including an SDI video stream containing the bit-map image and text overlays. The interface to an LCD display is via a DVI port and the interface to the host computer is via a USB port. Composite video and S-video outputs are also provided.

Audio inputs

Any one of three audio sources may be embedded into the MPEG stream. A high-level microphone signal or stereo audio source is synchronized to the video streaming during MPEG encoding. The audio stream embedded within the ancillary data from the HDTV camera can be added to the MPEG stream in place of the analog sources.

Audio output

Sensoray's MPEG decoding software that runs on the host PC can decompress the video and audio.

The 2246 does not directly produce an analog output.

General purpose digital I/O

There are two electromechanical relays each of which has two form-C contacts. Eight opto-isolated inputs are available for general purpose inputs.

Video Selection

The input's 5:1 multiplexer allows input selection between one SD/HD-SDI digital video input, two composite analog inputs, and two sets of S-Video analog video inputs. This makes it possible to connect up to five video sources to the frame and video capture.

Image processing

The 2246's scan converter guarantees the DVI output is synchronized to LCD displays. Hence, 25 frame/second PAL sources will be displayed at the highest LCD refresh rate. Real-time image down scaling of the HDTV stream prepares it for MPEG compression. A second video scaler is available for up or down scaling of images sent to the LCD display.

Captured images may be annotated with both text and bit-map image sent by the host via the USB port. Annotated image streams can then be displayed and compressed to MPEG or motion JPEG standards.

Once selected, the desired video source streams into the host PC via USB 2.0. The application software allows the capture of color images and video streams into computer storage. The video stream is hardware compressed into MPEG-1, MPEG-2, or MPEG-4.

AGC, contrast, saturation is programmable via software control.

Software control

The 2246 Software SDK is a software development kit that has been developed to allow OEM's to build their own applications for using the 2246 video capture board without knowledge of the driver or DirectX

The 2246 SDK demo or sample application is a working windows application that allows you to display in real-time multiple MPEG-1, MPEG-2, and MPEG-4 video streams from the 2246 board. Additionally, it allows for Disk Space Management, manual and automated recording of the MPEG streams, selectable video input sources, uncompressed frame capture, and playback.

The 2246SDK sample application is a simple MFC (Microsoft Foundation Classes) windows application. The source code for the application is included and demonstrates the usage of the 2246SDK API (application program interface) functions.

Host communication

The 2246's USB interface makes it immune to changing computer bus standards such as the PCI bus. It is well suited for use with single-board computers that do not have a PCI bus. Also, the 2246 may be remotely located and connected to a host computer via its high-speed USB link.

Signal terminations

An optional accessory board, model 2246TA, facilitates signal connections. It breaks out the high-density connectors into commonly used connectors such as BNC's, audio jacks, DVI connector, and the high speed serial digital interface. See the Connectors section below.

Software

The 2246 Demo application showcases the 2246's capabilities.

The Demo application also has the capability to display live video from the 2264 or a 1394/Firewire camera, or from a stored file.
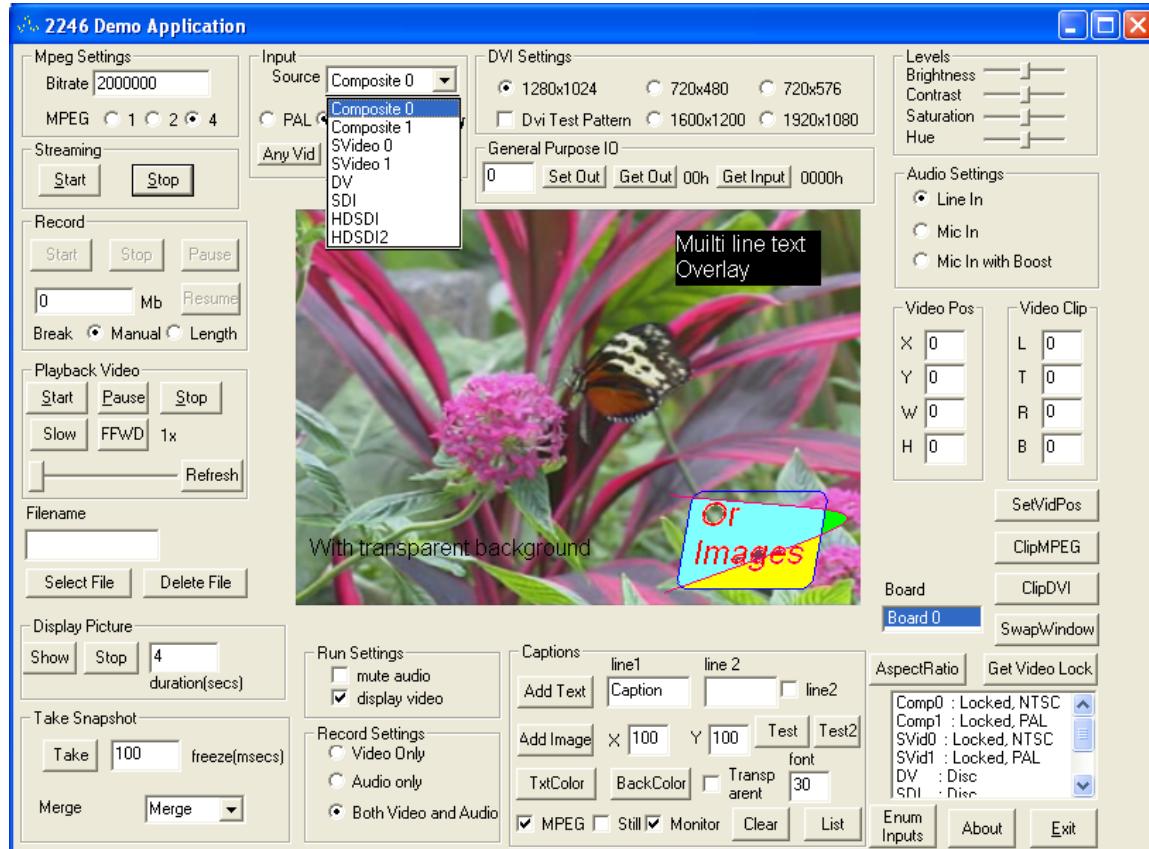
Figure 2

Board

Set to Board 0 if only one 2246 installed. If multiple 2246 boards are installed, this will be a drop-down list box containing the ID of the board the Demo application will send it's messages to.

Input

The video input groupbox allows he user to select the input video stream to be processed.

Once the video input has been selected from the drop down selection box, it can be modified to interpret the input video source as PAL or NTSC. This is done using the PAL and NTSC radio buttons.

In addition, the SDI input selection can also be modified with the Colorbar check box. When this is done, (SDI selected with Colorbar checked), the 2246 will enable a hardware generated colorbar pattern that will flow from the input IC, through the processing elements, to the output.

Composite 0

Select NTSC or PAL composite video from ConnecterJ4 Pin - IN_CVBS0.

Composite 1

Select NTSC or PAL composite video from ConnecterJ4 Pin - IN_CVBS1.

SVideo 0

Select NTSC or PAL SVideo from connecter J4. Pins: IN_Y0 and IN_C0.

SVideo 1

Select NTSC or PAL SVideo from connecter J4. Pins: IN_Y1, and IN_C1.

DV

Display streaming video from an external video source connected to your host computers 1394/Firewire port. (This input is unaffected by the PAL and NTSC radio buttons, and the Colorbar check box.)

SDI

Select the ECL or LVDS serial data input signals containing serial SDTV component digital video conforming to SMPTE 259M.

HDSDI

Select the ECL or LVDS serial data input signals containing serial HDTV component digital video conforming to SMPTE 292M with a frame rate of 59.98Hz.

HDSDI2

Select the ECL or LVDS serial data input signals containing serial HDTV component digital video conforming to SMPTE 292M with a frame rate of 50Hz or 60 Hz.

Output

Once the video input source has been selected, the 2246 will 'echo' the selected analog input source to both the composite output (J5 Pin OUT_CVBS), the SVideo output (J5 Pin OUT_Y and OUT_C), the DVI output (J3 and J7), and the SDI output (J17).

DVI Settings

The DVI settings groupbox allows the user to control the 2246's video scaling hardware. Depending on the input video selection, the video scaling hardware will adjust the frame rate and the horizontal and vertical sizes to match the selected output resolution. This is done via multiple interpolation and decimation techniques.

1280x1024

Output DVI-D video formatted for 1280x1024 resolutions

720x480

Output DVI-D video formatted for 720x480 resolutions

720x576

Output DVI-D video formatted for 720x576 resolutions

1600x1200

Output DVI-D video formatted for 1600x1200 resolutions

1920x1080

Output DVI-D video formatted for 1920x1080 resolutions

DVI Test Pattern

Configure video scaling hardware to output a video test pattern for the DVI-D port. This function is independent of the video inputs and outputs.

Levels

The Levels groupbox allows the user to adjust the 2246 video processing functions.

Brightness

Adjusts the Brightness setting to a value between 0 and 255.
A nominal value equals 128.

Saturation

Adjusts the Cr saturation and the Cb saturation setting to a value between 0 and 255.
A nominal value equals 128.

Contrast

Adjusts the Contrast setting to a value between 0 and 255.
A nominal value equals 128.

Hue

Adjusts the Cr Hue and Cb Hue settings to a value between 0 and 255.

A nominal value equals 128.

MPEG Settings

The Mpeg Settings groupbox allows the user to adjust the type and quality of the hardware MPEG encoder.

Bitrate

The Bitrate variable sets the target bitrate of the constant bitrate algorithm on the hardware MPEG encoder. Only values greater than zero are supported.

MPEG 1

Selects the MPEG 1 encoding standard.

MPEG 2

Selects the MPEG 2 encoding standard.

MPEG 4

Selects the MPEG 4 encoding standard.

Run Settings

The Run Settings groupbox allows the user select what audio/video components are output by the application when the Streaming/Start button is activated.

Mute audio

When checked, this option disables the input audio stream from the 2246 from being played to the host PC's speakers..

Display video

When checked, this option enables the host PC to display the incoming MPEG stream.

Record Settings

Video Only

When selected, this option removes the audio component from the output MPEG stream saved to disk.

Audio Only

When selected, this option removes the video component from the output MPEG stream saved to disk.

Both Video and Audio

When checked, this option records both the audio and video components, of the output MPEG stream, to disk.

Streaming

The controls in the Stream groupbox, allow the user to start and stop the MPEG Audio/Video stream from the 2246 to the host PC.

Selecting a new Input video selection will cancel the current incoming MPEG stream (Same a pressing Stop)

The Level setting may be changed without affecting the current MPEG stream.

The Text and Image Captioning option may be changed without affecting the current MPEG stream.

Start

When pressed, this button initializes and starts an MPEG stream from the 2246 to the host PC using the settings defined in the Input, Run, Record, and Level's groupboxes.

The stream is displayed in the application window in one of two locations depending on the SwapWindow button.

Stop

When pressed, this button stops the MPEG stream from the 2246 to the host PC and clears the video display.

Record

The controls in the Record groupbox, allow the user to start, pause, resume, and stop the recording of the current MPEG Audio/Video stream, from the 2246 to the host PC, to a file.

Start

When pressed, this button begins saving the configured MPEG stream from the 2246 to the host PC's file system. The default file is
```
\test.mpg
```
If this file already exists, an incrementing number, starting with 1, will be appended to the base name 'test'.

Pause

When pressed, this button stops the MPEG stream from the 2246 from being saved to the file, while keeping file open and ready continue recording.

Resume

When pressed, this button resumes recording the MPEG stream from the 2246 to the host PC's current file.

Resume only functions after the Pause button has been pressed.

Stop

When pressed, this button stops recording the MPEG stream from the 2246 to the host PC and then closes the file.

Mb

This field contains the maximum number of Megabytes to record/save to a file. When set to zero, the file size is only limited to by the disk size. When not zero, the action taken when the file size reaches this value depends on the Break radio button setting.

Manual

When selected, this break setting forces recording to continue until stopped by pressing the Record 'Stop' button. If 'Mb' is non-zero, when the file being recorded to reaches the size (in Megabytes) set by 'Mb', then the file is closed, and recording continues to another file with a filename increment number appended. This process continues until Record 'Stop' is pressed or until there is no more Disk space.

Length

When selected, this break setting forces recording to stop after the file size (in Megabytes) set by 'Mb' is reached. In addition, this setting demonstrates the Hardware driver API's ability to notify the calling program, when recording has finished. The calling Demo program showing a recoding finished dialog box signifies this.

Playback Video

The controls in the Playback Video groupbox, allow the user to start, pause, slow, fast forward, and stop the playback of the .MPG or .AVI selected with the Filename input box or the Select File button.

Filename

This field contains the name of the file to be used by the Playback Video controls. It can be set by the Select File button or entered manually.

Select File

This button opens a file open Dialog box that assists the user in selecting an .MPG or .AVI file to be played.

Delete File

This button deletes the file specified by Select File.

Start

When pressed, this button begins displaying the audio/video stream in the designated file to the application window in one of two locations depending on the WindowSwap button.

Pause

When pressed, this button stops the playback of the open files audio/video stream, while keeping the file open and ready to continue.

Slow

When pressed, this button modifies the playback rate of the files audio/video stream.

FFWD

When pressed, this button modifies the playback rate of the files audio/video stream.

Refresh

When pressed, this button updates the Slider Control with the current location playback location. A location at the far left indicates the start of the file/playback. A location at the far right indicates the end of the file/playback.

Stop

When pressed, this button stops playback of the files audio/video stream.

Slider Control

This control displays how much of the files audio/video stream has been displayed when the Refresh button is pressed.

When the user clicks on this control and drag/slides it to a new position, the application will search for the corresponding playback time and begin playback from this new location. Locations at the far left indicate the start, locations at the far right indicate the end, and locations in the middle represent a ratio from start to end times in the file/playback file.

Display Picture

Filename

This field contains the name of the file to be used by the Display Picture controls. It can be set by the Select File button or entered manually.

Select File

This button opens a file open Dialog box that assists the user in selecting a .JPG or .BMP file to be displayed.

Delete File

This button deletes the file specified by Select File.

Show

When pressed, this button overlays the current video window with the selected file for an amount of time set by the Duration control.

Stop

When pressed, this button will stop the file from being overlaid before the time duration expires.

Duration

This control sets the time duration, in seconds, that the selected file will be overlaid onto the current video window.

Take Snapshot

Take

When pressed, this button saves a video frame from the current video stream on the 2246 to the host PC's file system in two formats. The default files are

```
\snapshot.jpg
\snapshot.bmp
```

If these files already exist, an incrementing number, starting with 1, will be appended to the base name 'snapshot'.

Freeze

This control sets the time duration, in milliseconds, that the captured image will be displayed on the 2246's output video streams, before resuming normal video output.

The output file will be created after this time has expired.

Merge

The Merge drop down selection box allows the user to select how the two frames of the still image taken from the 2246 are to be combined into a single image.

None

This selection outputs both frames of the image, one after the other

Duplicate

This selection duplicates each line of Frame 0 twice.

Merge

This selection interlaces Frame 0 and Frame 1 into a single image. Each line of Frame 0 goes to even numbered lines and each line of Frame 1 goes to odd numbered lines.

Interpolate

This selection uses only Frame 0. Each line of Frame 0 is spread across every even numbered line of the output frame. Then, for each odd numbered line, adding the pixels above and below the odd numbered line and dividing the result by 2 calculate the intermediate lines pixels'.

Custom

This selection causes the application to call a user defined sub-routine to combine the two captured frames into one image. The function prototype is as follows:

```
int custmerge_fields( BYTE *newf, int size,  BYTE *f0, int h0,
BYTE *f1, int h1, int w, int *pRetW, int *pRetH);
```

The default behavior of custmerge_fields is the same as the Merge/Merge selection.

Captions

Multi-line text can be created by embedding a new line character (via the Line 2 Check Box see bellow), or by embedding character 30 decimal. The later can be done directly in the Line 1 and 2 input boxes by holding down the 'Alt' key and typing '030' on the numeric keypad.

If a text or graphic already exists at the same X, Y location specified when adding another text or graphic overlay, the old overlay is over written.

Add Text

When pressed, this button starts overlaying the text in the Line 1 box and optionally the Line 2 box with the selected MPEG, Still frame capture, and DVI Monitor output streams, depending on the corresponding user selections.

Line 1

Text entered into this field is overlaid on the selected video and still frame captures when 'Add Text' is pressed.

Line 2

Text entered into this field is overlaid on the selected video and still frame captures as a second text line beneath the first text line when 'Add Text' is pressed and the Line 2 Check Box is selected.

Line 2 Check Box

This check box selects whether to display the text, entered in the Line 2 input box, below the text in the Line 1 input box.
Functionally, this concatenates Line 1 and Line 2 with a line feed character (\n = 10 dec) before calling the add text API.

Add Image

When pressed this button opens a file selection dialog box that allows the user to select an image to be overlaid onto the video stream.

X

This input box determines the horizontal location of the text or image overlay. The distance is measured from the left side of the screen.

Y

This input box determines the vertical location of the text or image overlay. The distance is measured from the top side of the screen.

TxtColor

When pressed, this button opens a color selection dialog box that allows the user to set the color used for the text.

BackColor

When pressed, this button opens a color selection dialog box that allows the user to set the color used for the text background.

Transparent

When checked, this option sets all black colored input text and image data to a transparent color that the video shows through.

Font

This input box controls the font size of the text to be overlaid.

MPEG

When selected, these option overlays the text or image data with the MPEG video stream coming through the USB port to the host computer.

Still

When selected, these option overlays the text or image data with the Still Frame captured through the USB port to the host computer.

Monitor

When selected, these option overlays the text or image data with video stream being output of the 2246 board.

Clear

When pressed, this button removes the text or image overlays. This should be selected before making changes and pressing 'Add Text' or 'Add Image'

List

> When pressed, this button displays a dialog box containing the location and content of all overlay windows..

Test

> When pressed, this button adds a sample text overlay to each of the overlay regions.

Test2

> When pressed, this button continually generates and updates sample text and image overlays to each of the overlay regions. Pressing Test2 while Test2 is running in the background will freeze the overlays.

Audio Settings

The controls in the Audio Settings groupbox, allow the user to select which audio input is selected and sent to the Host PC over the USB connection. These controls are only selectable before data streaming is started.

Line In

> When selected, the 2246 will sample the audio input on the Right and Left Line inputs, and send the digital audio stream to the host PC for monitoring or recording purposes.

Mic In

> When selected, the 2246 will sample the audio input on the Microphone input, and send the digital audio stream to the host PC for monitoring or recording purposes.

Mic In with Boost

> When selected, the 2246 will sample the audio input on the Microphone input with an amplification of 20 dB, and send the digital audio stream to the host PC for monitoring or recording purposes.

Video Positioning and Clipping

The controls in the Video Pos (position) and Video Clip groupbox, allow the user to select where the video is displayed within the video output window, and whether to clip the edges.

SetVidPos

> Reads and applies the Video Pos. X, Y, W, H parameters and the Video Clip L, T, R, B parameters.

ClipMPEG

Reads the Video Clip L and R parameters and writes them to the 2246's MPEG hardware Clip registers.

ClipDVI

Reads the Video Clip L and R parameters and writes them to the 2246's DVI hardware Clip registers.

Video Pos

X

Sets the left most position of the displayed video, relative to the enclosing window handle's position.

Y

Sets the top most position of the displayed video, relative to the enclosing window handle's position.

W

Sets the horizontal Width (in pixels) of the displayed video.

H

Sets the horizontal Height (in pixels) of the displayed video.

Video Clip

L

Sets the number of pixels, at the video's left most position, to be skipped when the video is displayed. (The video is stretched to fill the target size set by X, Y, W, and H).

T

Sets the number of pixels, at the video's top most position, to be skipped when the video is displayed. (The video is stretched to fill the target size set by X, Y, W, and H).

R

Sets the number of pixels, at the video's right most position, to be skipped when the video is displayed. (The video is stretched to fill the target size set by X, Y, W, and H).

B

Sets the number of pixels, at the video's bottom most position, to be skipped when the video is displayed. (The video is stretched to fill the target size set by X, Y, W, and H).

Miscellaneous

SwapWindow

The SwapWindow button showcases the software API's ability to move the video clipping window. When video is being displayed, the Demo application is actually displaying the video to two windows, but is clipping off one of them. By Pressing the SwapWindow button, the user is toggling the clipping region from one video/window location to the other.

Aspect Ratio

When pressed, the application toggles whether the Video Mixing Renderer tries to maintain the original aspect ratio or not.

This setting applied to the displayed video only, and will not affect the recorded video or snapshot images.

Get Video Lock

When pressed, the video status of the 2246's current channel is requested. If the 2246 is locked onto the video signal, a message box indicating 'Video Locked' is displayed. Other wise a message box indicating 'No Video Input' is displayed.

Enum Inputs

When pressed, the each of the video inputs of the 2246 is checks to see whether a video signal is present and locked. A list is built, and the results are displayed in the corresponding list box. See Figure 3.
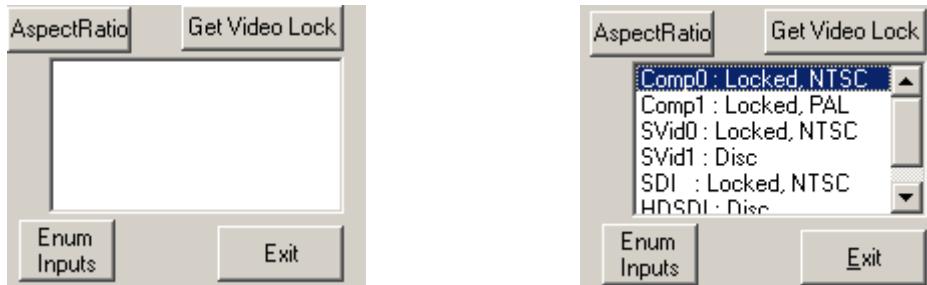
Figure 3

'Locked' indicates a valid video signal is detected.

'Disc' indicates either an invalid video signal or a disconnected input.

'Comp0' through 'HDSDI' indicate the various video inputs of the 2246.

About

When pressed, the application displays a dialog box containing the current version of the Demo Application, the current version of the Middleware API, and the current version of the FPGA firmware..

Exit

When pressed, the application ends. This has the same function as pressing the windows 'X' button in the upper right corner of the window.

Settings

The controls in the Record groupbox, allow the user to start, pause, resume, and stop the recording of the current MPEG Audio/Video stream, from the 2246 to the host PC, to a file.

TLV320.INI

This file, located in xxx, contains.

DEC_NC.INI

Input video NTSC Composite (default to Composite channel 0)

DEC_NS.INI

Input video NTSC S-Video   (defaults to SVideo channel 0)

DEC_PC.INI

Input video PAL Composite (default to Composite channel 0)

DEC_PS.INI

Input video PAL S-Video   (default to SVID   channel 0)

ENC_NC.INI

Output Video NTSC Composite.

ENC_NS.INI –

Output Video NTSC SVideo.

ENC_PC.INI

Output Video PAL Composite.

ENC_PS.INI

Output Video PAL SVideo.

The 2246 software API loads the *.INI files when the application is initialized and when the video mode is changed. Since the input Channel in the ENC*.INI files is

hard coded, the API re-programs the video source register (0x02) after loading the ENC*.INI file.

NOTE: Since the 2246 API uses the xx.INI files for programming the 2246, changes made to DEC_NC.INI and ENC_NC.INI must be restored before running the application (calling the API).

2246 Power On Sequence

The 2246 contains on board LED's that indicate power and status.

LED's D11, D12, D15, D17, and D18 indicate the presence of board voltages 5v, 3.3v, 1.2v, 2.5v, and 1.8v respectively.

After Power on, LED D16 will light up indicating that all power lines are OK.

Following power on, the 2246's USB controller will start looking for a connection to the host computer. LED's D1, D2, D3, D4, D5, D19, D20 on the 2246 indicate the status of the USB and the status of the Host computer's Windows driver's. Table-1 describes the LED sequence seen when Windows loads the 2246 USB drivers.

MPEG USB SYNC D1	MPEG USB ERR D2	FPGA USB SYNC D3	FPGA USB ERR D4	MPEG USB LOAD D5	FPGA PROG LOAD D19	FPGA PROG LOAD D20	
-	-	-	-	-	-	-	No Driver loaded. USB chips -Blank-
-	-	D3	-	-	-	-	Windows Load FPGA USB with USB ID 1
D1	-	D3	-	-	-	-	Windows Load MPEG USB with USB ID 2
D1	-	D3	-	D5	-	-	MPEG ID Program lights D5
-	-	-	-	D5	-	-	Windows re-loading drivers for new USB ID's
-	-	D3	-	D5	-	-	FPGA/Control driver loaded
-	-	D3	-	D5	D19	D20	FPGA initialization done and running
D1	-	D3	-	D5	D19	D20	MPEG/Streaming USB driver loaded

Table-1

Note:
When Windows first sees the 2246 via the USB connection (either when the USB is plugged in for the first time or when the USB cable is moved to a new port),

Windows will prompt the user to install new drivers. See Driver Installation section.

2246 Standby Power

When an optional 5v volt power source is connected to the Standby Power jumper, the 2246 will provide minimal video forwarding from analog video input to analog video output.

Analog video consists of all Composite and S-video signals.

Appendix A - Specifications

Video Inputs	
HDTV	1920 x 1080 SDI
	1080i 25/30 fps (25/29.97/30 fps)
Video formats supported	
HDTV	SMPTE 295M
HDTV	SMPTE 274M
HDTV	SMPTE 296M
SD-SDI	SMPTE 259M
HD-SDI	SMPTE 292M
SDTV	SMPTE 125
SDTV	ITU-R BT 601.5
SDI input specifications	
Serial input data rate (max)	1.485 Gbps
Serial input voltage swing (max)	950 mVpp
Input impedance	75 Ohm, single ended
Composite	
NTSC	720 x 480, 30 fps, +/- 1 Vpp
PAL	720 x 576, 25 fps, +/- 1 Vpp
S-Video	1.18 Vpp (when load - 75 Ohm)
Audio	
Channels	2 stereo
Analog input voltage	1 Vpp
Input resistance	10 K Ohm, single ended

Video Outputs	
DVI Output Specifications	
DVI for LCD displays	60 Hz, 1280 x 1024 display supported at all input

DVI output voltage (max)	3.475 V
DVI output voltage swing	400~600 mVpp
ESD (HBM)	4,000 V
SDI Output Specifications	
Serial output data rate (max)	1.485 Gbps
Serial output voltage swing (max)	880 mVpp
Output impedance	75 Ohm, single ended
Composite	1.25 Vpp (when load - 75 Ohm)
S-Video	1.18 Vpp (when load - 75 Ohm)
Termination impedance	75 Ohm

Additional specifications	
Host Communication	
USB 2.0	Control & compressed audio/video steam
Working speed	480 Mbits/s (SUB 2.0 high-speed)
Data output high voltage	2.4 V
ESD (HBM)	2,000 V
Digital I/O	
Hard contact relay outputs	4 NO/NC contacts
Opto-isolated	8 sets
Image processing	
Compression types	MPEG-1 720 x 480/576 MPEG-2 720 x 480/576
	MPEG-4 720 x 480/576 (480 NTSC, 576 PAL)
Scaling	HDTV to D1 for MPEG compression
Ground	
Digital GND and analog GND are connected on 2246 board	
Four mounting holes are not connected to ground	
Dimensions	6.5" x 5 "
Power requirements	5 V, 2.4 A
Standby Power requirements	3.3 V, 300 mA (optional)
Operating temperature	0ºC to 70ºC

The electrical interface for the 2246 audio channels is shown in Figure 4.
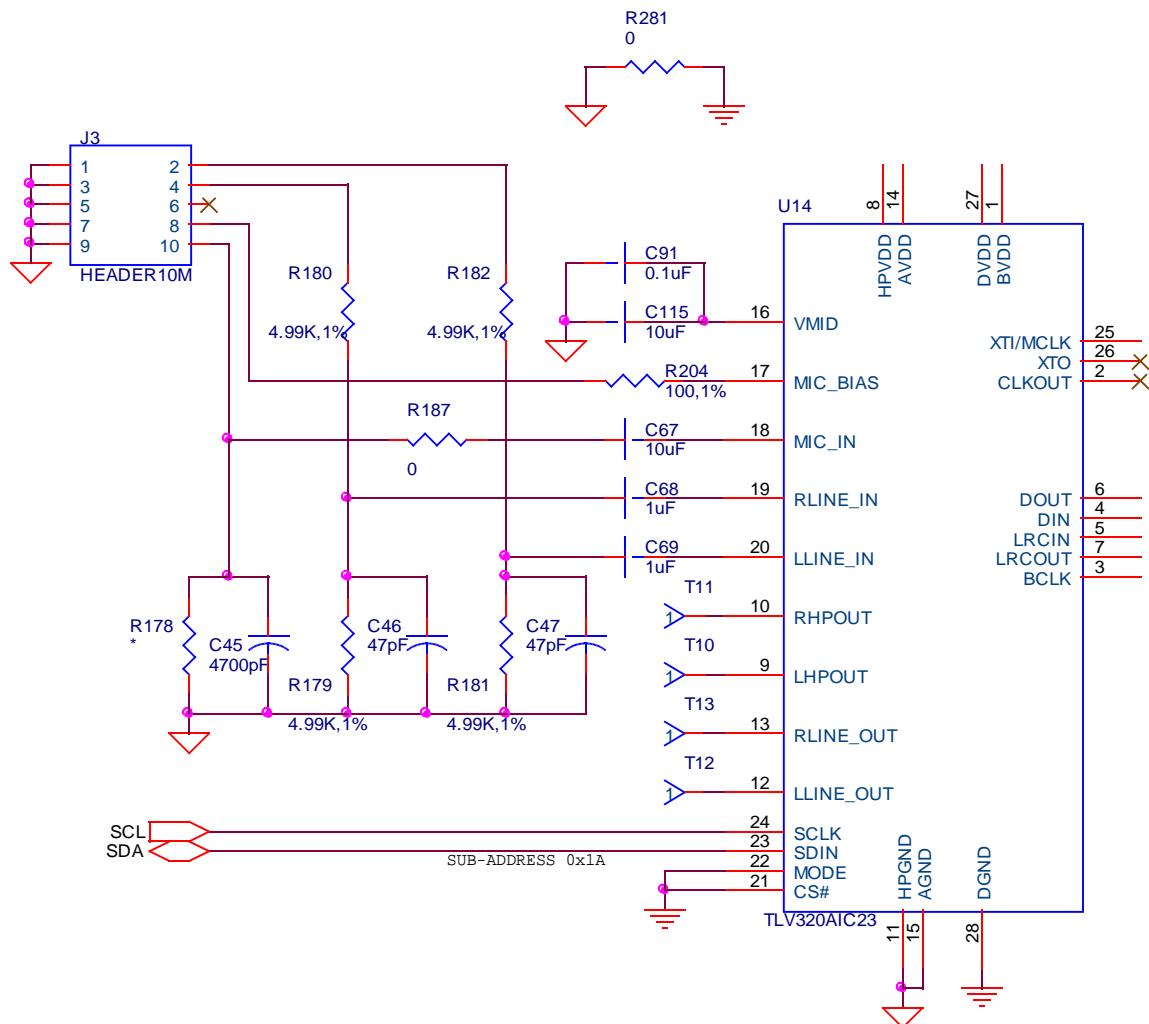
Figure 4

Appendix B - Connectors
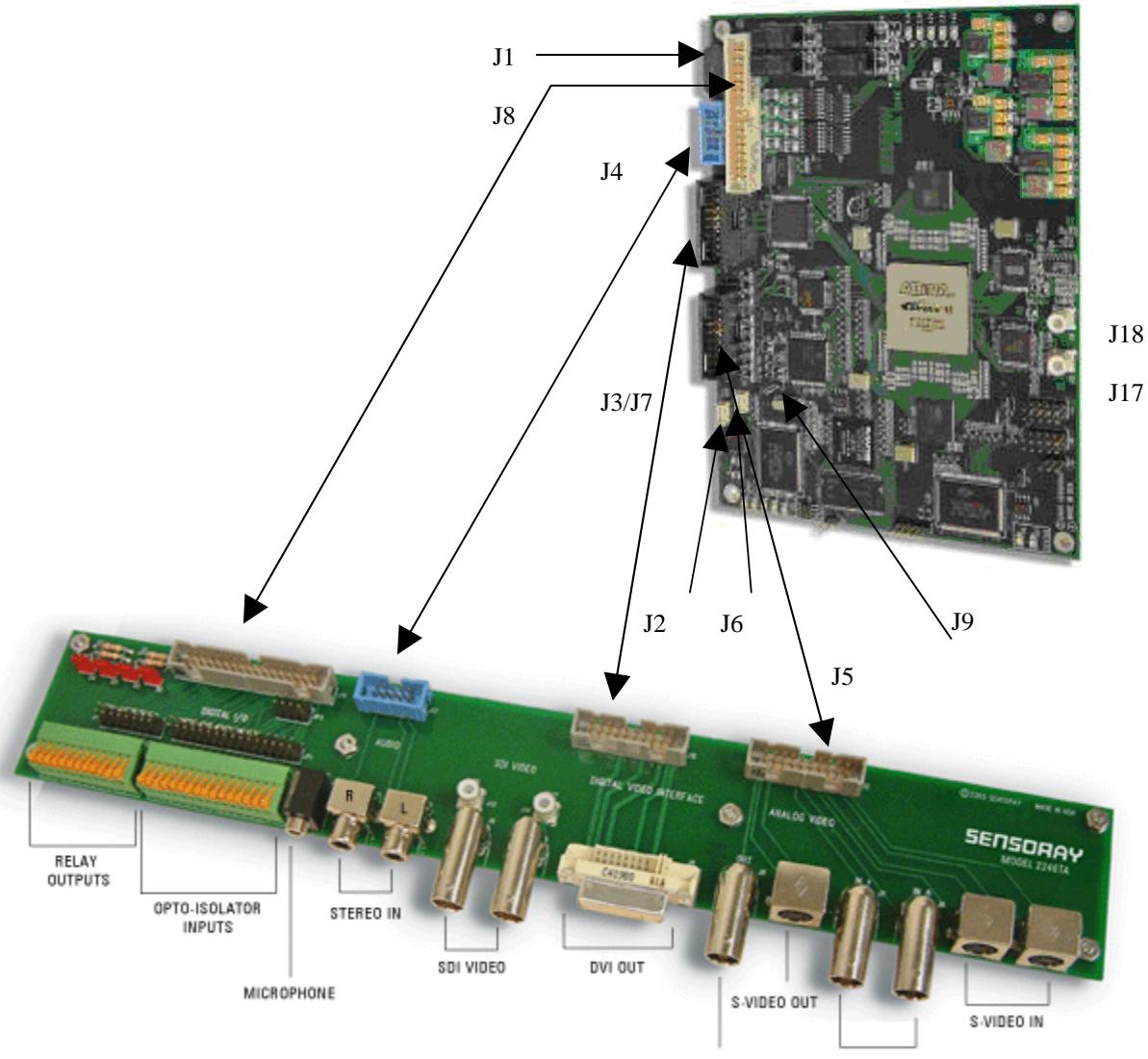
Figure 5

Power (J1)

Pin	Signal
1	VCC5, 5 volts
2	GND
3	GND
4	VCC5, 5 volts

Standby Power (J9) *

Pin	Signal
1	VCC33, 3.3 volts
2	GND

*Note: use of standby power is optional

USB 2.0 (J2)

Pin	Signal
1	GND
2	+Data
3	-Data
4	VCC

USB Link Indicators (J6)

Pin	Signal
1	USB MPEG Driver Loaded Status
2	USB MPEG Channel Status
3	USB FPGA/Control Channel Status
4	VCC33 – (Output! For powering LED indicators)

Digital Video - SD/HD-SDI Input (J18)

Digital Video - SD/HD-SDI Output (J17)

Analog Video I/O (J5)

Pin	Signal	Pin	Signal
1	GND	2	IN_Y0
3	GND	4	IN_C0
5	GND	6	IN_CVBS0
7	GND	8	IN_Y1
9	GND	10	IN_C1
11	GND	12	IN_CVBS1
13	GND	14	NC
15	GND	16	OUT_CVBS
17	GND	18	OUT_Y
19	GND	20	OUT_C

Notes:

IN_Y0 / IN_C0	= Input channel 0 S-Video pair
IN_CVBS0	= Input channel 0 Composite Video
IN_Y1 / IN_C1	= Input channel 1 S-Video pair
IN_CVBS1	= Input channel 1 Composite Video
OUT_Y / OUT_C	= Output S-Video pair
OUT_CVBS	= Output Composite Video

Digital Video Interface Output – DVI (J7)

Pin	Signal	Pin	Signal
1	VCC5	2	GND
3	DVI_TX2+	4	DVI_TX2-
5	GND	6	GND
7	DVI_TX1+	8	DVI_TX1-
9	GND	10	GND
11	DVI_TX0+	12	DVI_TX0-
13	GND	14	GND
15	DVI_TXC+	16	DVI_TXC-
17	GND	18	GND
19	GND	20	GND

Digital Video Interface Output – DVI (J3)

Standard DVI connector interface defined by DDWG DVI Revision 1.0

Audio Input (J4)

Pin	Signal	Pin	Signal
1	GND	2	L_LINE_IN
3	GND	4	R_LINE_IN
5	GND	6	NC
7	GND	8	NC
9	GND	10	MIC_IN

GPIO (J8)

Pin	Signal	Pin	Signal
1	INR0	2	IND0
3	INR1	4	IND1
5	INR2	6	IND2
7	INR3	8	IND3
9	INR4	10	IND4
11	INR5	12	IND5
13	INR6	14	IND6
15	INR7	16	IND7
17	NC	18	NC
19	OUTNO0	20	OUTNC0
21	OUTC0	22	NC
23	OUTNO1	24	OUTNC1
25	OUTC1	26	NC
27	OUTNO2	28	OUTNC2
29	OUTC2	30	NC
31	OUTNO3	32	OUTNC3
33	OUTC3	34	NC

Notes:

The opto-coupled inputs should be connected as shown in Figure 6. The value of R1 must be calculated to limit the current flowing through the LED to approximately 15mA. R1 may not necessary if the internal resistor R3 limits the current enough.
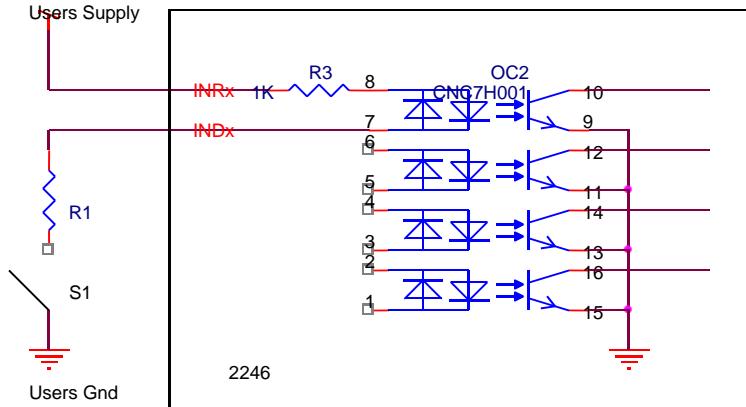

Figure 6

The output relays are configured as shown in Figure 7.
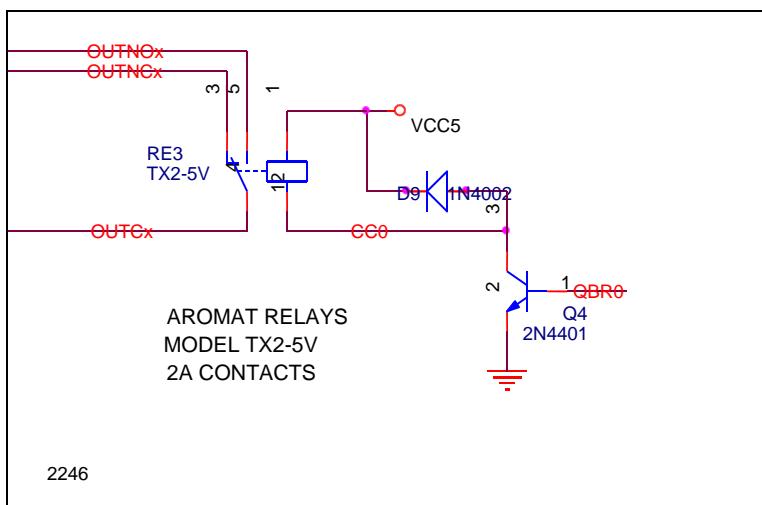
Figure 7

Appendix C - Software Installation

1. Uninstall previous versions of the 2246 Application Demo.
   To do this, go to "Control Panel -> Add or Remove Programs" and remove "2246".

2. Make sure the reference board is NOT connected to your computer when you install software.

3. If not already installed, install the .NET Framework 1.1 on your computer.

   To download the latest version of the .NET Framework 1.1, visit the following Microsoft Developer Network (MSDN) Web site:

   http://msdn.microsoft.com/netframework/downloads/updates/default.aspx

   OR,

   Run 'Windows Update' and select the '.Net Framework 1.1' option.

4. If not already installed, install DirectX Version 8.1 or greater.

   The exact version you need depends on your operating system and can be downloaded directly from Microsoft's web site at the following URL:
   http://www.microsoft.com/downloads/search.aspx?displaylang=en&categoryid=2

5. If not already installed, install FFDSHOW.
   FFDSHOW is a shareware project containing various audio and video codecs. It can be downloaded from:
   http://ffdshow-tryout.sourceforge.net/

6. Run 2246API.exe file on the CD to install the 2246 demo program.
   (See Dialog box figures 1 - 7)
   Dialog figure 5 shows the default installation directory "C:\Program Files\Sensoray\2246"

7. After software installation is completed, connect USB cable to 2246 board and to USB port of the host computer.

   The 2246 multiplexes two USB channels onto one physical USB cable and each channel requires a boot driver and a functional driver. Thus, when the 2246 is detected by the computer for the first time, five drivers will need to be loaded.

   o A USB Hub driver for multiplexing the USB channels

   o A Initialization driver for Channel 1 - 'SENSORAY 2246 EZ LOADER 1' (Optional)

   o A Initialization driver for Channel 2 - 'Sensoray 2246 EZLOADER 2'   (Optional)

   o A functional driver for Channel 1 - 'Sensoray 2246 Control'

   o A functional driver for Channel 2 - 'Sensoray 2246 A/V Capture'

8. Power on the 2246

   WARNING

   Care must be taken to insure the user is ready to install all five drivers as they are asked for. If the user cancels installation before finishing, an invalid default driver will be loaded. If this happens, the entire USB device must be re-installed to allow the Hardware Wizard to again cycle through all five drivers.

9. A "Found New Hardware Wizard" will appear.
   In response to "Can Windows connect to Windows Update to search for software?"
   Please select "No, not this time"

10. "Found New Hardware Wizard" next page.
    In response to "This wizard helps you install software for: Generic Hub on USB 2.0 Bus"
    Please select "Install the software automatically (Recommended)"

11. "Found New Hardware Wizard" next page.
    In response to "Completing the Found New Hardware Wizard"
    "The wizard has finished installing the software for: Generic Hub on USB 2.0 Bus"
    Please select "Finish"

12. A "Found New Hardware Wizard" will appear.
    In response to "Can Windows connect to Windows Update to search for software?"
    Please select "No, not this time"

13. "Found New Hardware Wizard" next page.
    In response to "This wizard helps you install software for: USB Device"
    Please select "Install from a list or specific location (Advanced)"

14. "Found New Hardware Wizard" next page.
    In response to "Please choose your search and installation options."
    Please select "Search for the best driver in these locations."
    Please un-check "Search removable media (floppy, CD-ROM...)"
    Please check "Include this location in the search:"
    Please type or use the Browse button to select the 'Driver' sub-directory in the installation
    directory that was chosen to install the Demo software to.
    (The default is \Program Files\Sensoray\2246\Driver)

15. "Hardware Installation"
    In response to:
    "The software you are installing for this hardware:"
    "SENSORAY 2246 EZ LOADER 1"
    "has not passed Windows Logo testing to verify its compatibility with Windows XP"
    Please select "Continue Anyway"

16. "Found New Hardware Wizard" next page.
    In response to "Completing the Found New Hardware Wizard"
    "The wizard has finished installing the software for: "
    "SENSORAY 2246 EZ LOADER 1"
    Please select "Finish"

17. A "Found New Hardware Wizard" will appear.
    In response to "Can Windows connect to Windows Update to search for software?"
    Please select "No, not this time"

18. "Found New Hardware Wizard" next page.
    In response to "This wizard helps you install software for: USB Device"
    Please select "Install from a list or specific location (Advanced)"

19. "Found New Hardware Wizard" next page.
    In response to "Please choose your search and installation options."
    Please select "Search for the best driver in these locations."
    Please un-check "Search removable media (floppy, CD-ROM...)"
    Please check "Include this location in the search:"
    Please type or use the Browse button to select the 'Driver' sub-directory in the installation
    directory that was chosen to install the Demo software to.
    (The default is \Program Files\Sensoray\2246\Driver)

20. "Hardware Installation"
    In response to:
    "The software you are installing for this hardware:"
    "Sensoray 2246 EZLOADER 2"
    "has not passed Windows Logo testing to verify its compatibility with Windows XP"
    Please select "Continue Anyway"

21. "Found New Hardware Wizard" next page.
    In response to "Completing the Found New Hardware Wizard"
    "The wizard has finished installing the software for: "
    "Sensoray 2246 EZLOADER 2"
    Please select "Finish"

22. A "Found New Hardware Wizard" will appear.
    In response to "Can Windows connect to Windows Update to search for software?"
    Please select "No, not this time"

23. "Found New Hardware Wizard" next page.
    In response to "This wizard helps you install software for: USB Device"
    Please select "Install from a list or specific location (Advanced)"

24. "Found New Hardware Wizard" next page.
    In response to "Please choose your search and installation options."
    Please select "Search for the best driver in these locations."
    Please un-check "Search removable media (floppy, CD-ROM...)"
    Please check "Include this location in the search:"
    Please type or use the Browse button to select the 'Driver' sub-directory in the installation
    directory that was chosen to install the Demo software to.
    (The default is \Program Files\Sensoray\2246\Driver)

25. "Hardware Installation"
    In response to:
    "The software you are installing for this hardware:"
    "Sensoray 2246 Control"
    "has not passed Windows Logo testing to verify its compatibility with Windows XP"
    Please select "Continue Anyway"

26. "Found New Hardware Wizard" next page.
    In response to "Completing the Found New Hardware Wizard"
    "The wizard has finished installing the software for: "
    "Sensoray 2246 Control"
    Please select "Finish"

27. A "Found New Hardware Wizard" will appear.
    In response to "Can Windows connect to Windows Update to search for software?"
    Please select "No, not this time"

28. "Found New Hardware Wizard" next page.
    In response to "This wizard helps you install software for: USB Device"
    Please select "Install from a list or specific location (Advanced)"

29. "Found New Hardware Wizard" next page.
    In response to "Please choose your search and installation options."
    Please select "Search for the best driver in these locations."
    Please un-check "Search removable media (floppy, CD-ROM...)"
    Please check "Include this location in the search:"
    Please type or use the Browse button to select the 'Driver' sub-directory in the installation

directory that was chosen to install the Demo software to.
(The default is \Program Files\Sensoray\2246\Driver)

30. "Hardware Installation"
In response to:
"The software you are installing for this hardware:"
"Sensoray 2246 A/V Capture"
"has not passed Windows Logo testing to verify its compatibility with Windows XP"
Please select "Continue Anyway"

31. "Found New Hardware Wizard" next page.
In response to "Completing the Found New Hardware Wizard"
"The wizard has finished installing the software for: "
"Sensoray 2246 A/V Capture"
Please select "Finish"

32. To verify if the hardware is installed successfully, go to
"Control Panel -> System -> Hardware -> Device Manager -> Sound, video and game
controllers" category.
Devices called "Sensoray 2246 A/V Capture" and "Sensoray 2246 Control" will appear.
(Only when 2246 is connected, powered on, and drivers loaded)

Appendix D - Driver (Re-) Installation

If the USB controller is removed or changed, or if the 2246 USB Cable is moved to another USB port the sequence for installing 2246 driver's need to be followed.

Perform steps 8 – 31 of the software install to re-install the 2246 drivers.

Appendix E – Technical Notes

- Please install SP4 for Win2000 or SP2 for WinXP

- Make sure the video and audio cables are both plugged into the reference board before capturing in order to guarantee correct video and audio output.

- In order to decrease the CPU usage for DivX preview, set the "play quality" to "Minimum Quality" in DivX Player. To do this:
    1. Launch DivX player
    2. Move mouse to the video window and right click the mouse button to bring up the context menu
    3. Select "Options" item to pop up the "Options" dialog
    4. Set the "play quality" to "Minimum Quality" in the "Playback" page.