USBMPEG2-Box DirectX/DirectShow SDK

User Manual Ver. 1.0.1

1. Principles

Inventa USBMPEG2-Box can be custom-programmed through Microsoft DirectX/DirectShow SDK by connecting device-specific filters with Windows' generic filters. A simple DirectShow graph connection is like this:

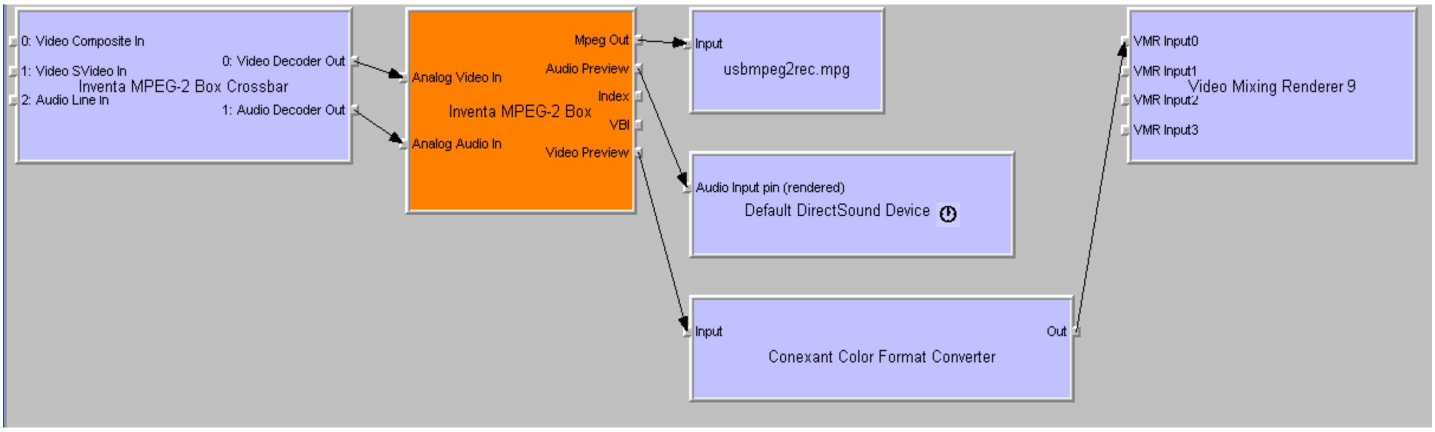


Figure 1. A Simple DirectShow Graph Connection

This graph allows the incoming video & audio through USBMPEG2-Box to be live previewed inside a resizable window, heard through PC's speakers, and recorded in disk file usbmpeg2rec.mpg. Based on this graph, users can add in more filters as needed, e.g., filters dealing with teletext, closed caption, MPEG stream manipulation, frame grabbing, etc. For example, on Windows Vista a graph allowing Teletext and Closed Caption display can be connected like this:

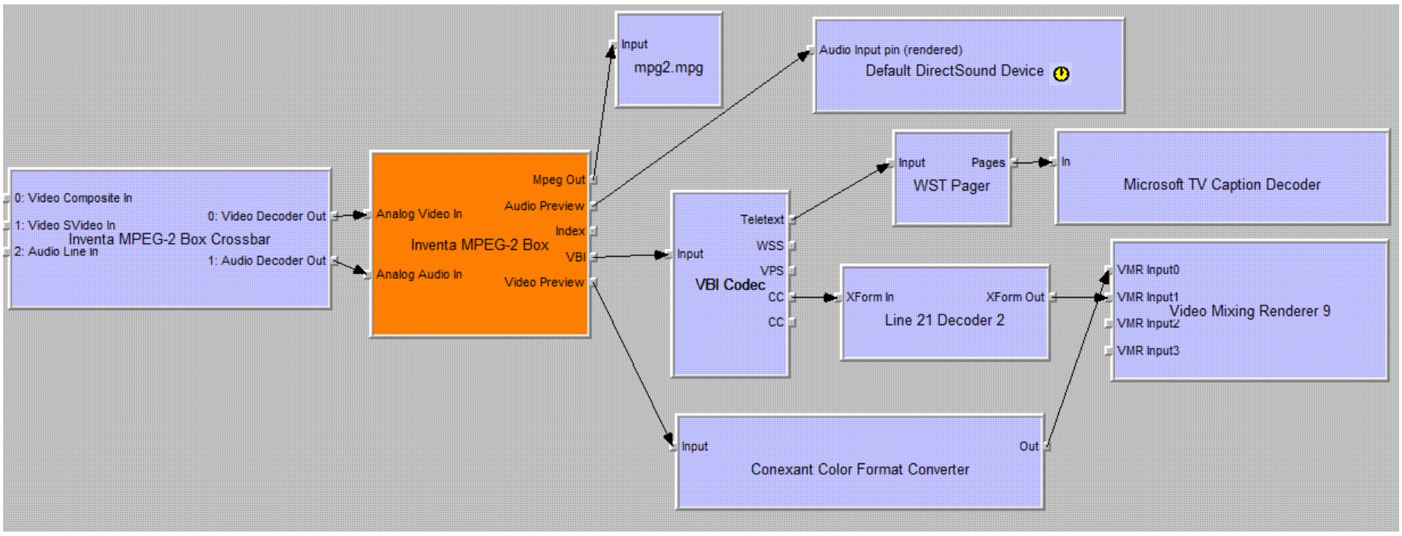


Figure 2. DirectShow Graph Connection for TeleText & Closed Caption Preview on Windows Vista

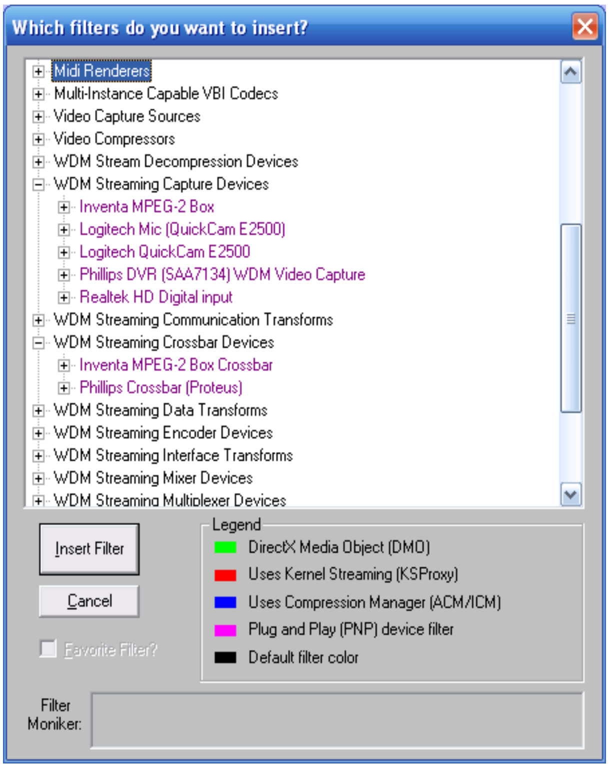
To write custom software for creating these graph connections, knowledge of Microsoft DirectX and DirectShow SDK is needed.

2. SDK Programming Environment

Apart from the Microsoft DirectX9 SDK and DirectShow SDK that can be freely downloaded, the following filters are also needed (and included with USBMPEG2-Box SDK sample code):

- Inventa MPEG2-Box Crossbar Filter
- Inventa MPEG2-Box Capture Filter
- Conexant Color Format Converter Filter

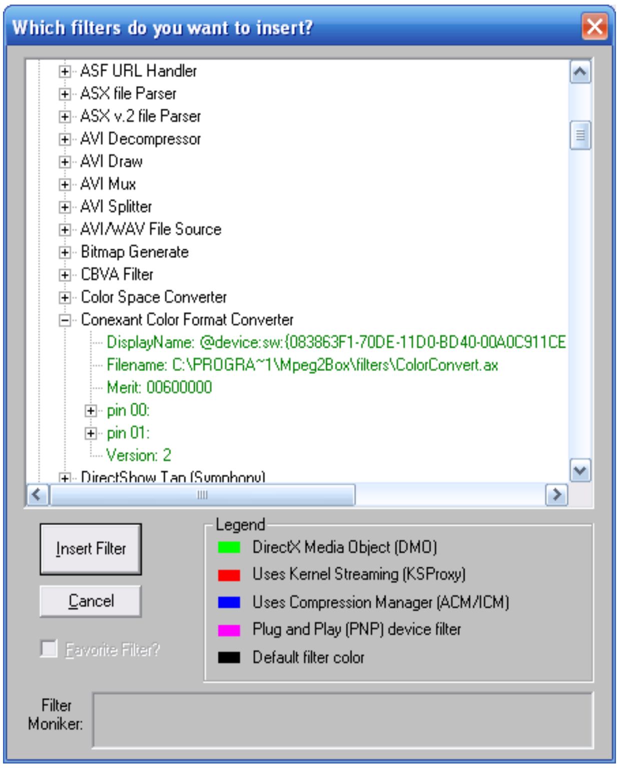
Using Microsoft GraphEdit.exe software(freely available and included here), these filters appear under "WDM Streaming Crossbar Devices", "WDM Streaming Capture Devices", and "DirectShow Filters" categories respectively, as shown here:



- Midi Renderers
- Multi-Instance Capable VBI Codecs
- Video Capture Sources
- Video Compressors
- WDM Stream Decompression Devices
- WDM Streaming Capture Devices
  - Inventa MPEG-2 Box
  - Logitech Mic (QuickCam E2500)
  - Logitech QuickCam E2500
  - Phillips DVR (SAA7134) WDM Video Capture
  - Realtek HD Digital input
- WDM Streaming Communication Transforms
- WDM Streaming Crossbar Devices
  - Inventa MPEG-2 Box Crossbar
  - Phillips Crossbar (Proteus)
- WDM Streaming Data Transforms
- WDM Streaming Encoder Devices
- WDM Streaming Interface Transforms
- WDM Streaming Mixer Devices
- WDM Streaming Multiplexer Devices

Legend

- 🟩 DirectX Media Object (DMO)
- 🟥 Uses Kernel Streaming (KSProxy)
- 🟦 Uses Compression Manager (ACM/ICM)
- 🟪 Plug and Play (PNP) device filter
- ⬛ Default filter color



- ASF URL Handler
- ASX file Parser
- ASX v.2 file Parser
- AVI Decompressor
- AVI Draw
- AVI Mux
- AVI Splitter
- AVI/WAV File Source
- Bitmap Generate
- CBVA Filter
- Color Space Converter
- Conexant Color Format Converter
  - DisplayName: @device:sw:{083863F1-70DE-11D0-BD40-00A0C911CE
  - Filename: C:\PROGRA~1\Mpeg2Box\filters\ColorConvert.ax
  - Merit: 00600000
  - pin 00:
  - pin 01:
  - Version: 2
- DirectShow Tap (Symphony)

Legend

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Custom programming also need the definitions defined in the **chipProps.h** and **chipTypes.h** files.

On any Windows XP-SP2 or Windows Vista PC that has not installed the USBMPEG2-Box's Application Software **Mpeg2.exe**, all the ***.ax** filter files as provided on the USBMPEG2-Box SDK Setup CD must be installed through regsvr32.exe (the included **reg.bat** file can be used) before application program written for USBMPEG2-Box can run properly.

USBMPEG2-Box device driver (located on this SDK's root directory) must be installed – this driver is the same as on USBMPEG2-Box Setup CD version 1.0.3, suitable for both WindowsXP and Vista.

Microsoft DirectX 9 must also be installed; this is part of Windows XP SP2.

Microsoft DirectX9 SDK and DirectShow SDK are only needed on Windows PCs that are used for compiling and linking custom-written software for USBMPEG2-Box. In the VisualC++ project

dxsample.sln included for this sample C++ source code, DirectX9 SDK is assumed to have been installed at "C:\DirectX9 SDK" where DirectShow SDK is at "C:\DirectX9 SDK\Samples\C++\DirectShow".

To program the USBMPEG2-Box with DirectX/DirectShow SDK, C++ will be the most natural and efficient language, although VisualBasic, C# and Delphi etc other languages should also work.

3. Basic Operations through Sample C++ Source Code

The included **dxsample.slh** Microsoft VisualStudio C++ project illustrates how to realize basic functions such as device identification, filter connection, live preview, video source selection, encoding parameter setup, MPEG file recording, still image grabbing, etc.

3.1 **Command Line Parameters for the Compiled dxsample.exe Program**:

dxsample.exe deviceNumber videoSource TVFormat
deviceNumber : 0 for 1st USBMPEG2-Box,1 for 2nd(if available) device, 2 for 3rd, etc
videoSource: 0 for Composite(RCA) input(default), 1 for SVideo input
TVFormat: 0 for NTSC, 1 for PAL(default)

3.2 Searching for the Crossbar and MPEG2-Box Filters:

Call functions GetVideoCrossbar(devNum) and GetMPEG2BoxCapDevice(&m_pCaptureDevice, devNum); where the devNum can be 0, 1, 2 for the 1st, 2nd, 3rd MPEG2-Box if they are connected, devNum default to 0.

If GetVideoCrossbar() returns zero then the Inventa MPEG2-Box cross-bar filter is not available so the program should exit immediately.

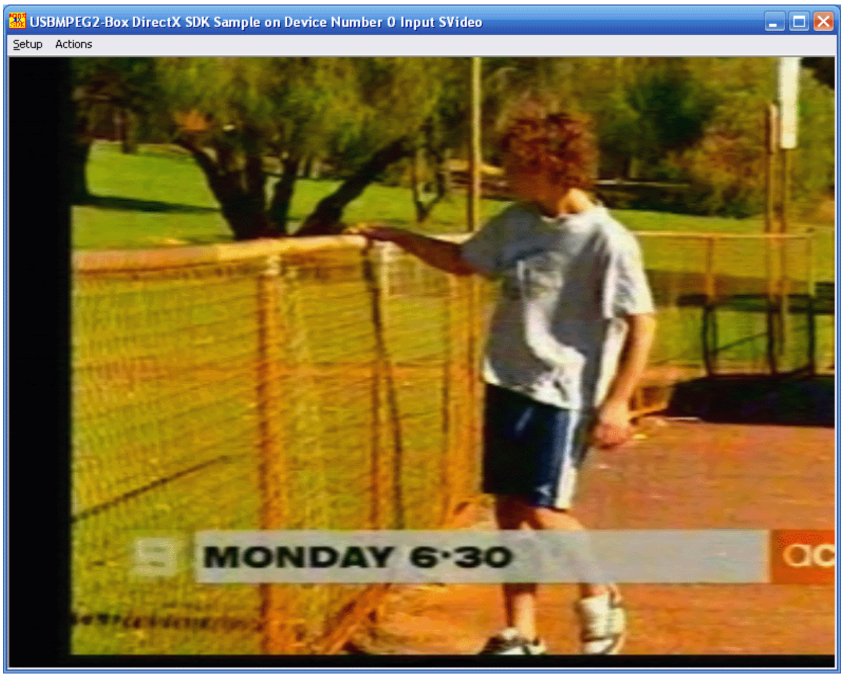
If m_pCaptureDevice returned by GetMPEG2BoxCapDevice() points to NULL then no MPEG2-Box capture filter was found so program should exit immediately.

Call SelectVideoSource(videoSource) to select video input source (videoSource = 0 for NTSC, 1 for PAL).

Call GetCaptureDeviceControls() to obtain various DirectShow interfaces on the Inventa MPEG2 Capture filter pointed to by m_pCaptureDevice.

3.3 Build Graph and Connect Pins

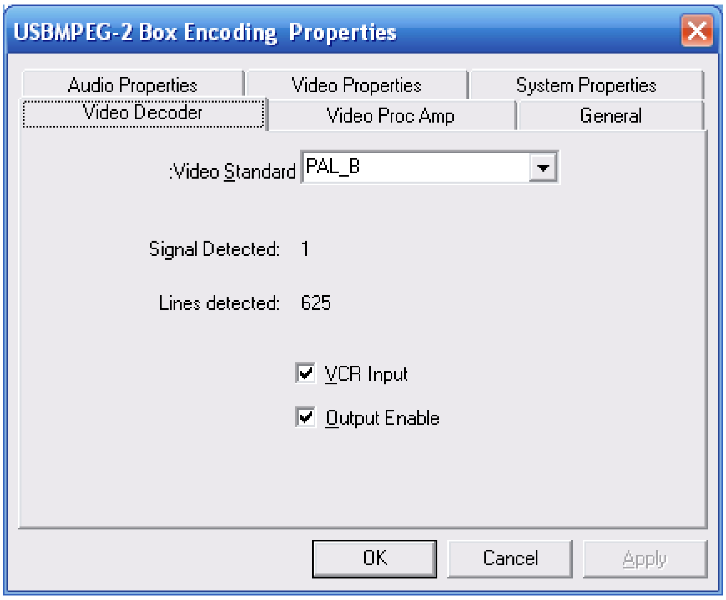
Follow the code example in the CMainWindow() function, the filters connected are the same as in the Figure 1. Once the filters are all connected properly the live video will appear and audio will be heard in the main window like this:


USBMPEG2-Box DirectX SDK Sample on Device Number 0 Input SVideo

If you have Microsoft GraphEdit (a copy is included with this SDK) available, load the “USBMPEG2Box-OnXP.GRF” or “USBMPEG2Box-OnVista.GRF” graph into GraphEdit.exe will connect the same graph as Figure 1 illustrates. (Note you cannot access the same USBMPEG2-Box’s filter simultaneously from more than one DirectX graph).

3.4 Change Video Input and Encoding Parameters

Method 1. Using the **ISpecifyPropertyPages** interface on the MPEG2-Box capture filter, see code inside function OnSetupDeviceparameters(), which is called when the **“Setup->Device Parameters…”** Menu Item is selected. This method always invokes the “USBMPEG-2 Encoding Properties” dialog box for user to select values, as shown here:


USBMPEG-2 Box Encoding Properties

:Video Standard PAL_B

Signal Detected: 1

Lines detected: 625

☑ VCR Input

☑ Output Enable

Method 2. Using **IKsPropertySet** interface on the MPEG2-Box capture filter, see code inside functions OnActionsSetvideobitrateto8mbps(),OnActionsSetencodingtypetodvd(), OnActionsSetencodingtypetovcd(), OnActionsSetencodingtypetosvcd(), OnActionsSetencodingtypetompeg1(), OnActionsSetencodingtypetompeg2(), etc., which are called when Menu Items **Actions-> "Set Video Bit Rate to 8Mbps VBR PS", "Set Encoding Type to DVD"** etc. are selected. This method does not need any user interaction.

3.5 Start & Stop Recording MPEG Video Data to File:

This is implemented through the **IFileSinkFilter** interface on DirectShow **Dump** filter, see function OnActionsStartrecording() and OnActionsStoprecording(). Files are always saved to current system drive (usually C) root directory in the form of usbmpeg2_devNum_time.mpg.

3.6 Grab Still Image Frames:

This is implemented through the **GetCurrentImage** method of the **IBasicVideo** Interface on the **VideoMixingRenderer9** filter, as shown in the OnActionsGrabstill() function which is called when menu item "**Actions->Grab Still**" is selected. Note using the DirectX SampleGrabber filter can also grab still images, but connecting SampleGrabber might result in performance issues and connection failures on different versions of Windows XP and Vista, while the IBasicVideo interface method can always work when VideoMixingRenderer9 filter is used. Files are always saved to current system drive (usually C) root directory in the form of usbmpeg2_devNum_time.bmp.

3.7 Live Manipulate Incoming MPEG Stream:

One easy way of manipulating the live incoming MPEG stream is through the Dump.ax DirectShow filter, which is used in building this USBMPEG2-Box SDK's sample graph, and has its source code and project file listed as part of the DirectShow SDK under folder "DirectX9 SDK\Samples\C++\DirectShow\Samples\C++\DirectShow\Filters\Dump". Changing the various methods inside Dump.cpp file can easily add customized processing such as pause/resume recording, splitting file, encrypting data, streaming video, etc.

4. Download

USBMPEG2-Box Customers who have requested this SDK and signed NDA with Inventa Australia can download this SDK from http://inventaaustralia.zftp.com/USBMPEG2-Box/SDK/USBMPEG2-Box DX SDK Setup Disk.rar with user name & password obtained from Inventa Australia.