USB H.264 720P/1080i MPEG Capture Device

Software Manual (Linux)

SENSORAY │ embedded electronics

Designed and manufactured in the U.S.A

TABLE OF CONTENTS

Software

Installation

The software can be downloaded from the Sensoray's web site at http://www.sensoray.com/2226.

The SDK has been developed on Ubuntu 12.04 LTS and 14.04 LTS and support is provided for this distribution. Sensoray will update the SDK for later versions of Ubuntu (LTS only).

The SDK should work on other Linux versions as long as the kernel version is 2.6.30 or higher.   It is recommended to use kernel 3.10 or higher for best performance (videobuf2 support).

 Setup is performed as follows.

1) untar the tgz file. "tar xvfz s2226_vXYZ.tgz" where XYZ is the version of the SDK.

2) "cd s2226_vXYZ" where XYZ is the version.

3) Type "make all"

4) Type "make modules_install".

5) Make sure 2226 in plugged in and turned on.

6) "modprobe s2226" loads the driver.

Firmware update

Some older boards may not have the latest firmware installed. If you need the newer features in the SDK (for example 720p 24fps or 1080p 24fps), you may want to update the firmware. Updating the firmware should be done very carefully. Do not unplug the board during a firmware update or you may have to send the board to Sensoray for repair.

The firmware is updated as follows:

1. "make fw_customer"

2. ./fw_customer

3. If the board is up to date, it will display a message saying so

4. If not, press "Y" to update the firmware

5. Wait until all steps of the updater are completed.

6. Follow the prompts from the program.

Demo programs

There are 3 demos included with the SDK. A python demo (demo.py), a very basic capture program (capture.c) and a console demo (2226demo). The overlay functionality is shown in the capture program and the preview functionality is shown in the python demo.

Console Demo (2226demo)

1. Make sure video source is connected and turned on.

2. Make demo with command "make demo"

3. "./2226demo" runs the demo application.

4. Type "h" followed by enter for help menu.

5. To change input, view menu for available inputs and select desired connection with the "vinput" command. Eg. "vinput 0".

6. To change bitrate, use vrate command followed by bitrate in kbits/s. Eg. "vrate 2000" for 2Mbps.

7. Other commands and settings such as brightness, contrast, and text overlays are shown in the help menu.

8. To record to file, type "rec filename.mpg"

9. wait 20 seconds to record input

10. Type "stop" to stop record

11. Exit demo with quit command.

Python Demo (demo.py)

The python demo is started by the command "./demo.py".
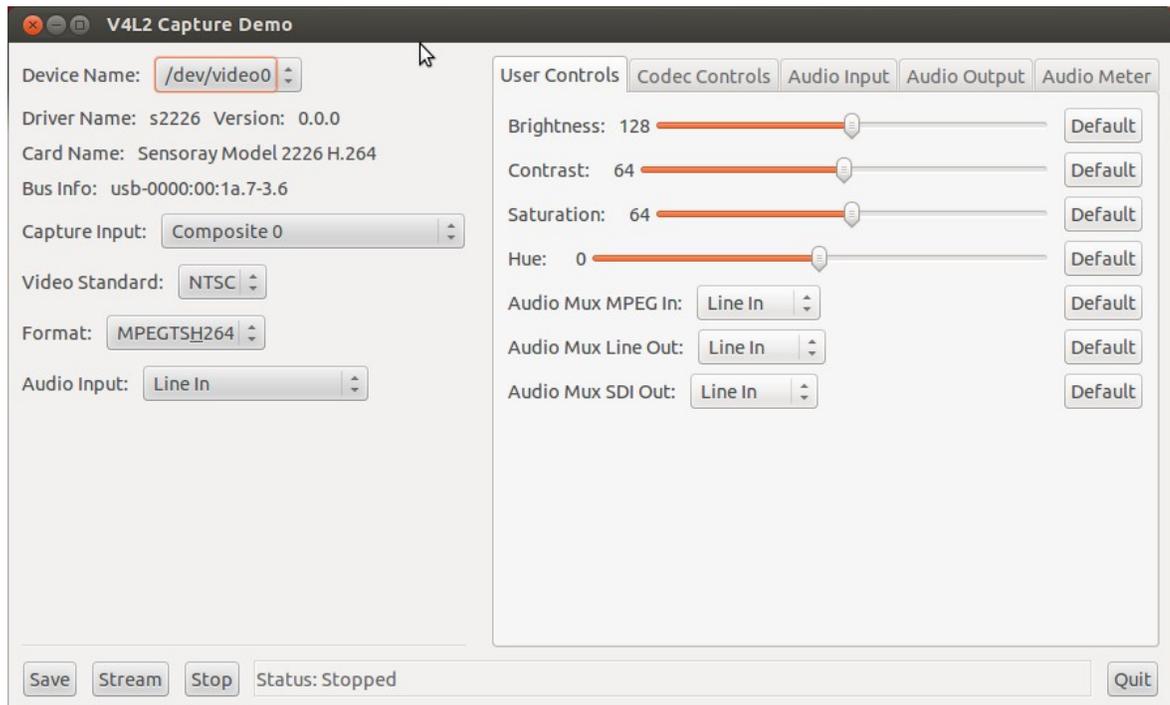
Illustration 1: 2226 H.264 Capture Device

Device Name
video device to use. For H.264 capture select the device with the Card Name: "Sensoray Model 2226 H.264"

Capture Input
The input selection for the device. Please note that some inputs are not applicable to the 2226S (2226 with enclosure). The input may not be changed while the device is running (recording to file, previewing, or streaming).

- Composite 0

- SVideo 0 (not on 2226S)

- Composite 1 (not on 2226S)

- Svideo 1 (not on 2226S)

- SD Colorbars: This is a "test" input. It outputs standard definition colorbars. PAL/NTSC is selected by the video standard selection.

- 720P Colorbars: Test input. Outputs 720P colorbars. If the video standard is set to NTSC, the frequency is 60Hz. If the video standard is set to PAL, the output is 720P @50Hz.

- 1080I Colorbars: Another test input. Outputs 1080I colorbars. 1080I 50Hz (PAL) or 1080I 60Hz(NTSC).

- SDI-SD. Standard definition (480i or 576i input) SDI input. Select PAL or NTSC with the Video Standard dropdown (VIDIOC_S_STD ioctl).

- SDI-720P 50Hz (Video standard VIDIOC_S_STD selection is unused with this input)

- SDI-720P 59.94Hz (Video standard VIDIOC_S_STD selection is unused with this input)

- SDI-720P 60Hz (Video standard VIDIOC_S_STD selection is unused with this input)

- SDI-1080I 50Hz (Video standard VIDIOC_S_STD selection is unused with this input)

- SDI-1080I 59.94Hz (Video standard VIDIOC_S_STD selection is unused with this input)

- SDI-1080I 60Hz (Video standard VIDIOC_S_STD selection is unused with this input)

- SDI-720P 23.98Hz (Video standard VIDIOC_S_STD selection is unused with this input)

- SDI-720P 24Hz (Video standard VIDIOC_S_STD selection is unused with this input)

- SDI-1080I 23.98Hz (Video standard VIDIOC_S_STD selection is unused with this input)

- SDI-1080I 24Hz (Video standard VIDIOC_S_STD selection is unused with this input)

Format:
Format is always H.264 inside MPEG-TS. (MPEGTSH264).

Audio Input:
Selects audio input that will be encoded into the MPEG stream (whether it is saved or streamed).

Save Button:
Save the Video to file. Extension will be .TS. Video may be played back with VLC or mplayer.

Stream Button:
Streams the H.264 stream over UDP. Enter the destination IP address and port.

Stop Button:
Stops file recording or streaming over the network.

User Controls:
- Brightness, Contrast, Saturation, Hue

- Audio Mux MPEG in: Same as audio input. Line-In, Test Tone, SDI

- Audio Mux Line Out: Selects the output source for the audio line-out output connection. Line-In, Mpeg OUT(for decode) or SDI-In.

- Audio Mux SDI Out: Selects the output source for the audio output over SDI. Line-In, Mpeg OUT(for decode), Test Tone, or SDI-In.

Codec Controls:
- Stream Type: Displays as MPEG-2 Transport Stream. Stream type is the container. The codec is H.264 inside the MPEG transport stream. Transport stream is defined in the MPEG-2 standard, which may cause confusion.

- Audio Sampling Frequency: 48Khz

- Audio Encoding: MP2

- Audio Layer II Bitrate: 128kbps, 160kbps, 192kbps, 224kbps, 256kps

- Video Encoding: H.264 (AVC). The video codec in use.

- Video GOP Closure: Whether GOPs are open or not

- Video Bitrate: 1000-20000Mbps. It is recommended to use 2Mbps as a minimum for HD sources.

Audio Input Controls:
- Audio In AGC On Left: Turns on AGC for left audio input channel

- Audio In AGC On Right: Turns on AGC for right audio input channel

- Audio In AGC Gain Left: Sets AGC gain for left audio channel. The range for the gain is from 0 – 118 in steps of 0.5dB. A setting of 0 would be no gain. A setting of 118 would be 118x0.5db = 59.0dB. This setting does not apply if AGC is turned off.

- Audio In AGC Gain Right: Sets AGC gain for right audio channel. The range for the gain is from 0 – 118 in steps of 0.5dB. A setting of 0 would be no gain. A setting of 118 would be 118x0.5db = 59.0dB. This setting does not apply if AGC is turned off.

- Audio In Gain Left: Sets non-AGC gain for left audio channel. The range for the gain is from 0 – 118 in steps of 0.5dB. A setting of 0 would be no gain. A setting of 118 would be 118x0.5db = 59.0dB. This setting does not apply if AGC is turned on.

- Audio In Gain Right: Sets non-AGC gain for right audio channel. The range for the gain is from 0 – 118 in steps of 0.5dB. A setting of 0 would be no gain. A setting of 118 would be 118x0.5db = 59.0dB. This setting does not apply if AGC is turned on.

Audio Output Controls:
These settings are for audio output. The 2226S (with enclosure) only has the "HP Out" output exposed. To change the audio output gain on the 2226S, use the audio HP out settings

- Audio Mono Out Additional Gain: 0-9dB gain for mono audio output channel.

- Audio Mono Out Mute: If set, turns off the mono audio output.

- Audio HP Out Additional Gain Right: 0-9dB gain for right high-power audio output channel.

- Audio HP Out Additional Gain Left: 0-9dB gain for left high-power audio output channel.

- Audio HP Out Mute Left: If set, turns off the left high-power audio output.

- Audio HP Out Mute Right: If set, turns off the right high-power audio output.

- Audio Stereo Out Additional Gain Right: 0-9dB gain for right stereo audio output channel.

- Audio Stereo Out Additional Gain Left: 0-9dB gain for left stereo audio output channel.

- Audio Stereo Out Mute Left: If set, turns off the left stereo audio output.

- Audio Stereo Out Mute Right: If set, turns off the right stereo audio output.

Audio Meter:
The Audio Meter controls implement a VU meter.

- Audio Meter Channel: Line In, Mpeg Out, SDI In.

- Audio Meter Peak Left: peak level for left audio channel.

- Audio Meter Peak Right: peak level for right audio channel.

- Audio Meter Peak Left dB: dB peak level for left audio channel.

- Audio Meter Peak Right dB: dB peak level for right audio channel. Displayed value is dB level times 10 (To get actual value, divide this by 10).

- Audio Meter Hold Release: Enable hold/release feature

- Audio Meter Hold time: None, .5s, 1.0s, 1.5s, 2.0s, 2.5s, 3.0s, 3.5s, infinite

- Audio Meter Hold Left Value dB: Highest value of left channel. Will be held for time in audio meter hold time.

- Audio Meter Hold Right Value dB: Highest value of right channel. Will be held for time in audio meter hold time.

- Audio Meter Left Clipped?: Whether left channel was clipped or not. Will be held for time in audio meter hold time.

- Audio Meter Right Clipped?: Whether right channel was clipped or not. Will be held for time in audio meter hold time.

- Audio Meter Test: Off, 0db, -6db, Clip. Test mechanism for the audio meter. Default is off.

Extra Codec Controls:
- Program Number: Allows changing the default transport stream program number.

Video Preview (Sensoray Model 2226 Preview):
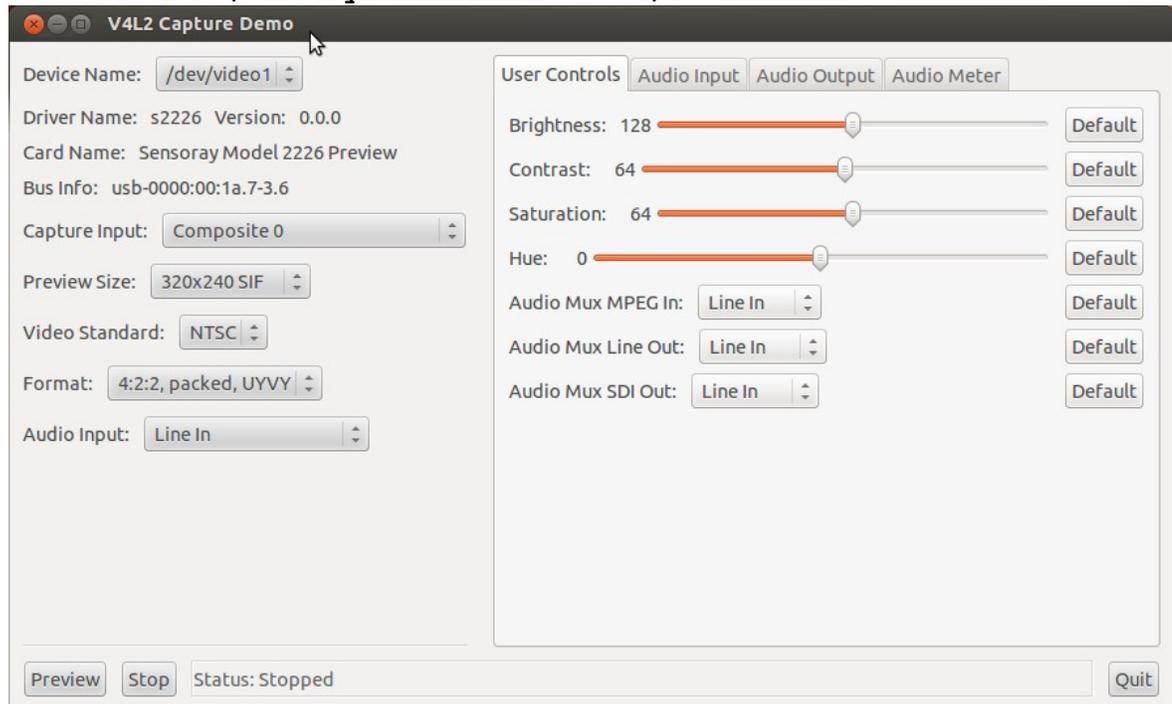
Illustration 2: 2226 Preview Device

Many of the video preview device functions are the same as for the encoding device. There are some devices noted below. Preview is started with the "Preview" button and

stopped with the "Stop" button. During preview, the video input, video system and preview size may not be changed.

Preview Size: 320x240, 352x288, 640x480. Other size are available, but not exposed in the demo application. Please not that sizes larger than 640x480 will not be at full frame rate due to limitations with USB2.0 bandwidth.

Video for Linux API
The driver supports V4L2 ioctls by default. Due to limitations in earlier V4L2 implementations, the SDK requires kernel version 2.6.30 or later. Version 3.10 or higher is preferred.

The V4L2 API is well documented at the LinuxTV website (http://www.linuxtv.org/downloads/video4linux/API/V4L2_API/). Device specific information is included later in this manual.

SDK Reference
Release Notes

V.1.1.0

- More comprehensive V4L2 implementation.

- More configuration options

- Video Preview

- Firmware update support

V.1.0.0

- Initial version

General Notes

Please refer to the demo program for sample operation.

Device is accessed via /dev/videoX where X is the minor number.

Driver Ioctl Reference

`S2226_IOC_SET_INPUT`

deprecated. Use VIDIOC_S_INPUT and optionally VIDIOC_S_STD (if applicable)

`VIDIOC_S_INPUT, VIDIOC_G_INPUT`

struct v4l2_input v4l2input;

Common Inputs (2226S Input)

v4l2input.index value:

0: Composite_0

7: SDI-SD (use VIDIOC_S_STD to change from NTSC to PAL)

8: SDI-720p 59.94Hz

9: SDI-720p 60Hz

10: SDI-1080i 50Hz

11: SDI-1080i 59.94Hz

12: SDI-1080i 60Hz

13: SDI-720p 50Hz

14: SDI-720p 24Hz

15: SDI-720p 23.98Hz

16: SDI-1080i 24Hz

17: SDI-1080i 23.98Hz

Test inputs:

4: Standard definition colorbars (NTSC or PAL, use VIDIOC_S_STD)

5: 720p colorbars (NTSC-60Hz or PAL-50Hz, use VIDIOC_S_STD)

6: 1080i colorbars (NTSC-60Hz or PAL-50Hz, use VIDIOC_S_STD)

Extended inputs

1: S-Video 0

2: Composite 1

3: S-Video 1

VIDIOC_S_STD

The video standard applies to some inputs only. Please see VIDIOC_S_INPUT

S2226_IOC_START_ENCODE

Deprecated. See demo application(s).

S2226_IOC_STOP_ENCODE

Deprecated.

S2226_VIDIOC_START_DECODE

Start video/audio h264 encoding.

start_param

idx : Reserved for future use. Use default value of 0.

S2226_VIDIOC_STOP_DECODE

Stops video/audio h264 decoding.

stop_param

idx : Reserved for future use. Use default value of 0.

S2226_VIDIOC_GET_MODE

Returns current mode setting.

mode

mode parameter (see S2226_IOC_SET_MODE)

`S2226_IOC_SET_LEVEL`

deprecated. Use VIDIOC_S_CTRL with CIDS V4L2_CID_BRIGHTNESS, V4L2_CID_CONTRAST, V4L2_CID_SATURATION and V4L2_CID_HUE

`S2226_IOC_GET_LEVEL`

deprecated. Use VIDIOC_G_CTRL with CIDS V4L2_CID_BRIGHTNESS, V4L2_CID_CONTRAST, V4L2_CID_SATURATION and V4L2_CID_HUE

`VIDIOC_S_AUDIO, VIDIOC_ENUM_AUDIO, VIDIOC_G_AUDIO`

Audio source control. Mirrors S2226_CID_AUDMUX_MPEGIN control. Sets current audio source for encoding. Index = 0-Line In, 1-Test Tone, 2-SDI audio (embedded audio).

`VIDIOC_S_CTRL, VIDIOC_G_CTRL, VIDIOC_QUERYCTRL, VIDIOC_QUERYMENU`

Video controls. Supported controls for 2226 are listed below:

User class controls

V4L2_CID_BRIGHTNESS

V4L2_CID_CONTRAST

V4L2_CID_SATURATION

V4L2_CID_HUE

S2226_CID_AUDIOROUTE : audio routing (optional/advanced, use VIDIOC_S_AUDIO to set current audio source). Default is 0-Line1. Other values are for non-standard hardware configurations and are normally not used. Other values: 1-Line2, 2-Line1 Bypass, 3-Line2 Bypass (same as setting S2226_AUDMUX_MPEGIN to 0 or Line-in).

S2226_CID_AUDMUX_MPEGIN: Same as VIDIOC_S_AUDIO. Selects audio input source for encoding. Inputs are 0-Line-in, 1-Test Tone or 2-SDI-in. Default is 0-Line-In

S2226_CID_AUDMUX_LINEOUT: Multiplexing selection for audio out. 0-Line-in, 1-Mpeg Out, 2-SDI in. Default is 1-Mpeg Out.

S2226_CID_AUDMUX_SDIOUT: Multiplexing selection for SDI output (embedded) audio. 0-Line-in, 1-Mpeg Out, 2-Test Tone, 3-SDI in. Default is 1-Mpeg Out.

Mpeg controls

V4L2_CID_MPEG_STREAM_TYPE: read-only

V4L2_CID_MPEG_STREAM_PID_PMT: change default PMT PID

V4L2_CID_MPEG_STREAM_PID_AUDIO: change default Audio PID

V4L2_CID_MPEG_STREAM_PID_VIDEO: change default Video PID

V4L2_CID_MPEG_STREAM_PID_PCR: change default PCR PID

V4L2_CID_MPEG_AUDIO_SAMPLING_FREQ: read only

V4L2_CID_MPEG_AUDIO_ENCODING: read-only

V4L2_CID_MPEG_AUDIO_L2_BITRATE: 128k, 160k, 192k, 224k, 256k

V4L2_CID_MPEG_VIDEO_ENCODING: read-only

V4L2_CID_MPEG_VIDEO_GOP_CLOSURE: change GOP closure

V4L2_CID_MPEG_VIDEO_BITRATE: 1000-20000Mbps

Audio in controls

S2226_CID_AUDIN_AGC_ON_L: AGC on left channel

S2226_CID_AUDIN_AGC_ON_R : AGC on right channel

S2226_CID_AUDIN_AGC_GAIN_L : AGC gain 0-118, steps of 0.5db (0-59dB)

S2226_CID_AUDIN_AGC_GAIN_R: AGC gain 0-118, steps of 0.5db (0-59dB)

S2226_CID_AUDIN_GAIN_L: gain 0-118, steps of 0.5db (0-59dB)

S2226_CID_AUDIN_GAIN_L: gain 0-118, steps of 0.5db (0-59dB)

Audio out controls

S2226_CID_AUDOUT_DACVOL_L: (0=max to 127=-63.5dB) volume control for decode (left channel)

S2226_CID_AUDOUT_DACVOL_R: (0=max to 127=-63.5dB) volume control for decode (right channel)

S2226_CID_AUDOUT_DACMUTE_L: mute DAC output right channel (decode only)

S2226_CID_AUDOUT_DACMUTE_R: mute DAC output right channel (decode only)

S2226_CID_AUDOUT_MONO_GAIN: extra gain for mono audio channel (0-9dB)

S2226_CID_AUDOUT_MONO_MUTE: Mute Mono out channel

S2226_CID_AUDOUT_HP_GAIN_L: extra gain for high-power left channel (0-9dB)

S2226_CID_AUDOUT_HP_GAIN_R: extra gain for high-power right channel (0-9dB)

S2226_CID_AUDOUT_HP_MUTE_L: mute for high-power left channel

S2226_CID_AUDOUT_HP_MUTE_R: mute for high-power right channel

S2226_CID_AUDOUT_STEREO_GAIN_L: gain for stereo left channel (0-9dB)

S2226_CID_AUDOUT_STEREO_GAIN_R: gain for stereo right channel (0-9dB)

S2226_CID_AUDOUT_STEREO_MUTE_L: mute for stereo left channel

S2226_CID_AUDOUT_STEREO_MUTE_R: mute for stereo right channel

Audio Meter Controls:

S2226_CID_AUDMTR_CHANNEL: audio meter channel selection. 0-LineIn, 1-MpegOut,2-SDI-in

S2226_CID_AUDMTR_LEVEL_L: peak level for left channel (23 bits unsigned)

S2226_CID_AUDMTR_LEVEL_R: peak level for right channel (23 bits unsigned)

S2226_CID_AUDMTR_LEVELDB_L: level for left channel. Value is dB x 10. -2048(-20.48 dB) to 0 (0dB).

S2226_CID_AUDMTR_LEVELDB_R: level for right channel. Value is dB x 10. -2048(-20.48 dB) to 0 (0dB).

S2226_CID_AUDMTR_HOLDREL: audio meter hold release. 1-force release of 'held' output. 0-allow holding of highest db value per the set hold time

S2226_CID_AUDMTR_HOLDTIME: audio meter hold time. 0-(No Hold 1ms update), 1-(0.5s), 2-(1.0s), 3-(1.5s), 4-(2.0s), 5-(2.5s), 6-(3.0s), 7-(Hold high always).

S2226_CID_AUDMTR_HOLD_L: audio meter hold value left channel. Same units as LEVELDB values.

S2226_CID_AUDMTR_HOLD_R: audio meter hold value right channel. Same units as LEVELDB values.

S2226_CID_AUDMTR_CLIP_L: whether left channel was clipped

S2226_CID_AUDMTR_CLIP_R: whether right channel was clipped

S2226_CID_AUDMTR_TEST: 0-(Off), 1-(0dB), 2-(-6dB), 3-(Clip). Test mechanism for the audio meter. Default is off.

Extra Codec Controls:

S2226_CID_CODEC_PROGRAM_NUMBER: change the default transport stream program number. Default 1. Allowed values 1-0x1ffe