

HD/SD H.264 Capture Device
(H.264 Video Encoder + Decoder)
User's Manual

Model 2226 | Rev.A | March 2010

SENSORAY | embedded electronics



Designed and manufactured in the U.S.A

SENSORAY | p. 503.684.8005 | email: info@SENSORAY.com | www.SENSORAY.com

7313 SW Tech Center Drive | Portland, OR 97203

Table of Contents

TABLE OF CONTENTS	2
LIMITED WARRANTY	4
SPECIAL HANDLING INSTRUCTIONS.....	5
INTRODUCTION	6
Feature Summary.....	7
REFERENCE.....	8
Board Picture and Connector Layout.....	8
Connector List.....	9
Connector Pin/Signal Definitions.....	10
Internal Board Test Connector: J1	10
SDI Video Output-1, BNC: J2.....	10
SDI Video Input, BNC: J3.....	10
A/V Break-in and Break-out Connector: J4	10
USB 2.0 HS (High Speed) Connector, 5-Pin Header: J5	10
SDI Video Output-0, BNC: J6.....	10
SD Video Input and Output Connector, 20-Pin: J7	10
SD Composite Video Input, BNC: J8.....	11
SAM-ICE Connector: J9.....	11
JTAG Connector: J10	11
Audio Output Breakout Connector, 10-Pin: J11	11
USB 2.0 HS (High Speed) Connector, 5-Pin Header: J12	11
Stereo Audio Input Connector, 3.5mm TRS AudioJack: J13	12
Microphone Input Connector, XLR3: J14	12
Power Supply Connector, 4-Pin: J15	12

SD Composite Video Output-0, BNC: J16.....	12
SD Composite Video Output-1, BNC: J17.....	12
LEDs	13
Power-OK Indicators: D13 ~ D18	13
USB General Purpose or Status Indicators: D21 ~ D24	13
FPGA General Purpose Indicators: D1, D2, and D30 ~ D32	13
FPGA Status Indicators: D25 ~ D27	13
ARM9 General Purpose or Status Indicators: D7 and D29.....	14
Audio CODEC Status Indicator: D28.....	14
SOFTWARE.....	14
Device Driver and SDK	14
Windows.....	14
Linux	14
SPECIFICATIONS	15

Limited warranty

Sensoray Company, Incorporated (Sensoray) warrants the hardware to be free from defects in material and workmanship and perform to applicable published Sensoray specifications for two years from the date of shipment to purchaser. Sensoray will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty includes parts and labor.

The warranty provided herein does not cover equipment subjected to abuse, misuse, accident, alteration, neglect, or unauthorized repair or installation. Sensoray shall have the right of final determination as to the existence and cause of defect.

As for items repaired or replaced under warranty, the warranty shall continue in effect for the remainder of the original warranty period, or for ninety days following date of shipment by Sensoray of the repaired or replaced part, whichever period is longer.

A Return Material Authorization (RMA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. Sensoray will pay the shipping costs of returning to the owner parts that are covered by warranty. A restocking charge of 25% of the product purchase price will be charged for returning a product to stock.

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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.

Introduction

The Sensoray Model 2226 is a USB 2.0 HD/SD H.264 capture device, and configurable as Encoding or Decoding device. It supports many different NTSC or PAL video inputs/outputs including SDI, Composite Video, and S-Video in/out. The video formats include HD 1080i, HD 720p, and SD 480i/576i.

For the need of combining audio capturing/decoding, the Model 2226 provides different audio inputs/outputs including stereo/mono AudioJack input, XLR3 microphone input, stereo/mono Line-in/out audio input/output, and stereo headphone audio output.

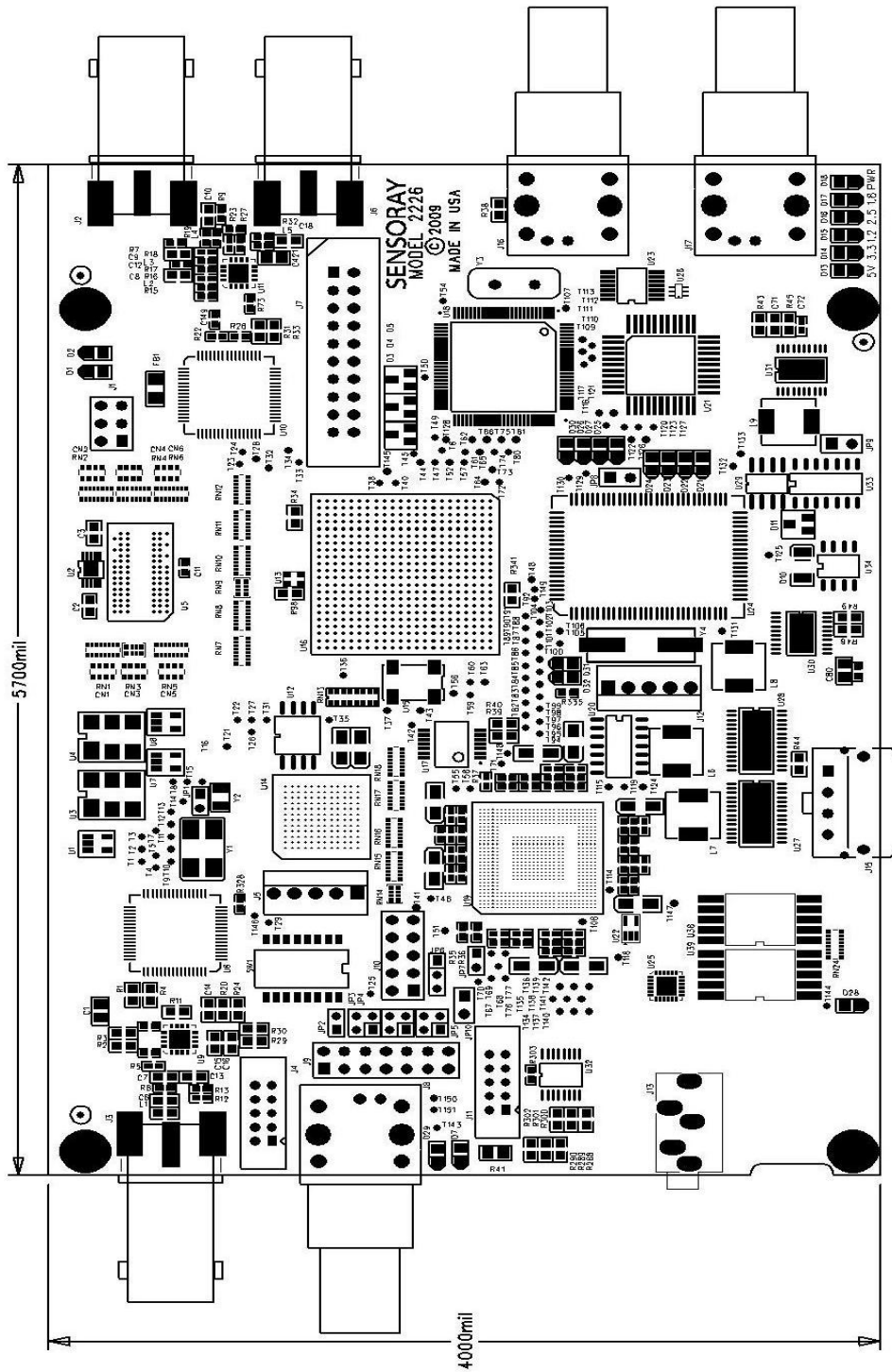
A single +5V power supply through a Molex 43650-0403 connector is required to power the board. (As a reference, the Molex 43645-0400 connector is a mating connector to the the Molex 43650-0403 connector).

Feature Summary

- Host Interface: USB 2.0 (High Speed)
- Video Systems: NTSC and PAL
- Video Inputs & Outputs:
 - SDI, Composite Video and S-Video
- Audio Inputs & Outputs:
 - Stereo/Mono Line-in/out, XLR3 Microphone input, and Headphone output
- H.264 CODEC:
 - HD: ISO/IEC14496-10 (H.264/AVC) High Profile Level 4.0
 - SD: ISO/IEC14496-10 (H.264/AVC) Main Profile Level 3.0
- Video Formats and Bit Rates:
 - HD: 1920x1080i, 30/29.97/25Hz, 2Mbps to 20Mbps
 - 1280x720p, 60/59.94Hz, 2Mbps to 20Mbps
 - SD: 720x480i, 29.97Hz (NTSC), 1Mbps to 10Mbps
 - 720x576i, 25Hz (PAL), 1Mbps to 10Mbps
- Audio CODEC:
 - MPEG-1 Audio Layer 2
- Audio Sampling Rate and Bit Rates:
 - 48 KHz
 - MPEG-1 Layer 2: 64, 96, 112, 128, 160, 192, 224, 256 Kbps
- Stream Format:
 - MPEG-2 TS (Transport Stream),
 - Hardware Multiplexing of Video stream + Audio stream
- Driver and SDK:
 - Windows and Linux
- Applications:
 - DVR (Digital Video Recorder)
 - Streaming Server — H.264 Encoder/Decoder

Reference

Board Picture and Connector Layout



Connector List

J1	TEST[3:0]: (Internal Manufacturing Test Use Only)
J2	SDI Output-1: NBC Connector, 75 Ohms
J3	SDI Input: NBC Connector, 75 Ohms
J4	A/V break-in & break-out Connector: 10-Pin Audio In: Differential; Audio Out: Differential Composite Video In break-out (for 2420 use only) Composite Video Out break-in (for 2420 use only)
J5	USB 2.0 HS Connector (for ARM9 USB Connectivity use only)
J6	SDI Output-0: NBC Connector, 75 Ohms
J7	Video Input and Output Connector: 20-Pin Composite Video In: 2 Channels, 75 Ohms S-Video Inputs: 2 Channels, 75 Ohms Composite Video Out: 1 Channels, 75 Ohms S-Video Output: 1 Channels, 75 Ohms
J8	Composite Video Input: NBC Connector, 75 Ohms
J9	SAM-ICE Connector: 14-Pin (Internal Manufacturing Use Only)
J10	JTAG Connector: 10-Pin (Internal Manufacturing Use Only)
J11	Audio Output Connector: 10-Pin Stereo Line Output: Differential Mono Output: Differential Headphone Output: Single-Ended
J12	USB 2.0 HS Connector (to Host): 5-Pin Header
J13	Audio Input: 3.5mm Stereo AudioJack, Line-In +/-1.0V
J14	MicroPhone Input: XLR3 Connector: 3-Pin, Balanced
J15	Power Supply Connector: 4-Pin, +5V
J16	Composite Video Output-0: NBC Connector, 75 Ohms
J17	Composite Video Output-1: NBC Connector, 75 Ohms

Connector Pin/Signal Definitions

Internal Board Test Connector: J1

It is used for internal/manufacturing test only. Therefore, it is not described in this manual.

SDI Video Output-1, BNC: J2

It is main HD/SD (High Definition / Standard Definition) video output using SDI (Serial Digital Interface). Model 2226 provides two SDI outputs for the multiple monitoring need. The SDI video output-1 duplicates the SDI video output-0.

Pin	Signal	Pin	Signal
Inner	SDI Video Signal	Outer/Ring	Shield, Analog Ground

SDI Video Input, BNC: J3

It is main HD/SD (High Definition / Standard Definition) video input using SDI (Serial Digital Interface).

Pin	Signal	Pin	Signal
Inner	SDI Video Signal	Outer/Ring	Shield, Analog Ground

A/V Break-in and Break-out Connector: J4

It is used for building Sensoray Model 2420, a streaming server product, only. Therefore, it is not described in this manual.

USB 2.0 HS (High Speed) Connector, 5-Pin Header: J5

It is used for connecting the high speed USB 2.0 interface of the ARM9 processor on the Model 2226, off the board.

Pin	Signal
1	VBUS +5V
2	Data-
3	Data+
4	Ground
5	Shield

SDI Video Output-0, BNC: J6

It is main HD/SD (High Definition or Standard Definition) video output using SDI (Serial Digital Interface). Model 2226 provides two SDI outputs for the multiple monitoring need. The SDI video output-0 duplicates the SDI video output-1.

Pin	Signal	Pin	Signal
Inner	SDI Video Signal	Outer/Ring	Shield, Analog Ground

SD Video Input and Output Connector, 20-Pin: J7

This connector breaks-in and breaks-out all the SD (Standard Definition) video inputs and outputs, including Composite Video In/Out and S-Video In/Out.

Pin	Signal	Pin	Signal
1	Ground	2	S-Video Input-0 -- Y
3	Ground	4	S-Video Input-0 -- C
5	Ground	6	Composite Video Input-0
7	Ground	8	S-Video Input-1 -- Y
9	Ground	10	S-Video Input-1 -- C
11	Ground	12	Composite Video Input-1
13	Ground	14	NC (No Connection)
15	Ground	16	Composite Video Output
17	Ground	18	S-Video Output -- Y
19	Ground	20	S-Video Output -- C

SD Composite Video Input, BNC: J8

It is used for main SD (Standard Definition) Composite video input.

Pin	Signal	Pin	Signal
Inner	SDI Video Signal	Outer/Ring	Shield, Analog Ground

SAM-ICE Connector: J9

It is for internal manufacturing/debugging only. Therefore, it is not described in this manual.

JTAG Connector: J10

It is for internal board debugging only. Therefore, it is not described in this manual.

Audio Output Breakout Connector, 10-Pin: J11

It breaks-out all the Audio Outputs.

Pin	Signal	Pin	Signal
1	Headphone Output -- Left	2	Headphone Output -- Right
3	Mono Line Output -- LO+	4	Mono Line Output -- LO-
5	Stereo Line Output -- Left+	6	Stereo Line Output -- Left-
7	Stereo Line Output -- Right+	8	Stereo Line Output -- Right-
9	Analog Ground	10	Analog Ground

USB 2.0 HS (High Speed) Connector, 5-Pin Header: J12

It is Main Interface to the Host PC or CPU Module, via this USB 2.0 HS (High Speed) connector.

Pin	Signal
1	Passive, connected to a 0.1uF decoupling cap to ground
2	Data-
3	Data+
4	Ground
5	Shield

Stereo Audio Input Connector, 3.5mm TRS AudioJack: J13

It is main Audio Input to the board.

Pin	Signal	Pin	Signal	Pin	Signal
Tip	Stereo Line-in Left	Ring	Stereo Line-in Right	Sleeve	Analog Ground

Microphone Input Connector, XLR3: J14

An optional XLR3 connector is used for balanced Microphone Input.

Pin	Signal	Pin	Signal	Pin	Signal
1	Analog Ground	2	Balanced Audio Signal In+	3	Balanced Audio Signal In-

Power Supply Connector, 4-Pin: J15

As a main Power Supply connector, it is used for supplying +5V power to the board.

Pin	Signal
1	+5V
2	Ground
3	Ground
4	+5V

SD Composite Video Output-0, BNC: J16

It is one of the two duplicated SD (Standard Definition) Composite Video Outputs. The Model 2226 provides two SD Composite Video outputs for the multiple monitoring need. The SD Composite Video Output-0 duplicates the SD Composite Video Output-1.

Pin	Signal	Pin	Signal
Inner	SDI Video Signal	Outer/Ring	Shield, Analog Ground

SD Composite Video Output-1, BNC: J17

It is one of the two duplicated SD (Standard Definition) Composite Video Outputs. The Model 2226 provides two SD Composite Video outputs for the multiple monitoring need. The SD Composite Video Output-1 duplicates the SD Composite Video Output-0.

Pin	Signal	Pin	Signal
Inner	SDI Video Signal	Outer/Ring	Shield, Analog Ground

LEDs

Power-OK Indicators: D13 ~ D18

The LED D13 to D18 are used for indicating on-board Power-OK status.

LED	Signal
D13	+5V Power-OK Status
D14	+3.3V Power-OK Status
D15	+1.2V Power-OK Status
D16	+2.5V Power-OK Status
D17	+1.8V Power-OK Status
D18	All On-board +3.3V, +2.5V, and +1.8V Power-OK Status

USB General Purpose or Status Indicators: D21 ~ D24

The LED D21, D22, D23, and D24 are connected to the on-board USB device controller's pin PC0, PC1, PC2, and PA0, respectively. Therefore, they can be used as general purpose indicators or status indicators, and are controllable via EZ-USB FX2 program.

Note that a logic 0 (low) turns the LED on and a logic 1 (high) turns the LED off.

LED	Signal
D21	FX2_PC0
D22	FX2_PC1
D23	FX2_PC2
D24	FX2_PA0

FPGA General Purpose Indicators: D1, D2, and D30 ~ D32

The LED D1, D2, and D30 to D32 are connected to the dedicated on-board FPGA's I/O pins. They can be used as general purpose indicators and are software controllable via internal FPGA register. Note that a logic 0 (low) turns the LED on and a logic 1 (high) turns the LED off.

LED	Signal
D1	EP3C16_LED1
D2	EP3C16_LED0
D30	EP3C16_GPO0
D31	EP3C16_GPO1
D32	EP3C16_GPO2

FPGA Status Indicators: D25 ~ D27

The LED D25, D26, and D27 are used for indicating the on-board FPGA's status. Note that a status signal logic 0 (low) turns the LED on and a logic 1 (high) turns the LED off.

LED	Signal
D30	EP3C16_STATUS8
D31	EP3C16_STATUS9
D32	EP3C16_STATUS10

ARM9 General Purpose or Status Indicators: D7 and D29

The LED D7 and D29 are connected to the on-board ARM9 microcontroller's pin PB14 and PB8, respectively. They can be used as general purpose indicators or status indicators, and are software controllable through ARM9 program. Note that a logic 0 (low) turns the LED on and a logic 1 (high) turns the LED off.

LED	Signal
D7	AT91SAM9R_PB14
D29	AT91SAM9R_PB8

Audio CODEC Status Indicator: D28

The LED D29 is connected to the on-board Audio CODEC's microcontroller's GPIO1 pin, and can be used as the Audio CODEC status indicators. Note that a logic 0 (low) turns the LED on and a logic 1 (high) turns the LED off.

LED	Signal
D28	TLV320AIC33_GIOP0

Software

Device Driver and SDK

Device driver and SDK including driver, DLL, API, and demo application programs are available for both Windows and Linux.

Windows

Refer to the "2226 WinSDK User's Manual" for the Windows SDK, DLL, API, App Demo, and programming details.

Linux

Refer to the "2226 Linux SDK User's Manual" for the Linux SDK, DLL, API, App Demo, and programming details.

Specifications

Host Interface	USB 2.0 (High Speed)
Video Systems	NTSC or PAL
Video Inputs	<p>Composite Videos: SD 1 Channel, NBC Connector, 75 Ohms, 1 Channel, via a 20-Pin Connector, 75 Ohms</p> <p>S-Videos: SD 2 Channels, via a 20-pin Connector, 75 Ohms</p> <p>SDI Video: HD/SD, 1 Channel, compliant with: SMPTE 292M, SMPTE 344M, and SMPTE 259M ITU-R BT.1120, and ITU-R BT.656</p>
Audio Inputs	<p>Stereo/Mono: 1 Channel, 3.5mm AudioJack, Line-in +/- 1.0V signal level</p> <p>XLR: 1 Channel, XLR3 Connector, 3-Pin, Balanced</p>
Video Outputs	<p>Composite Videos: SD 2 Channels, via NBC, 75 Ohms 1 Channel, via a 20-pin Connector, 75 Ohms</p> <p>S-Video: SD 1 Channel, via a 20-pin Connector, 75 Ohms;</p> <p>SDI Videos: HD/SD, 2 Channels, compliant with: SMPTE 292M, SMPTE 344M, and SMPTE 259M ITU-R BT.1120, and ITU-R BT.656</p>
Audio Outputs	<p>Stereo: 1 Channel, via 10-Pin Connector, Differential Left & Right</p> <p>Mono: 1 Channel, via 10-Pin Connector, Differential pair signals</p> <p>HeadPhone: 1 Channel, via 10-Pin Connector, Stereo, COM-mode L/R</p>
H.264 CODEC Conformance	<p>HD: ISO/IEC14496-10 (H.264/AVC) High Profile Level 4.0</p> <p>SD: ISO/IEC14496-10 (H.264/AVC) Main Profile Level 3.0</p>
Audio CODEC Conformance	MPEG-1 Audio Layer 2
Video Formats and Bit Rates	<p>HD: 1920x1080i, 30/29.97/25 Hz, 2Mbps to 20Mbps 1280x720p, 60/59.94, 2Mbps to 20Mbps</p> <p>SD: 720x480i, 29.97 Hz (NTSC), 1Mbps to 10Mbps 720x576i, 25 Hz (PAL), 1Mbps to 10Mbps</p>
Audio Sampling Rate and Bit Rates	<p>48 kHz</p> <p>MPEG-1 Layer 2: 64, 96, 112, 128, 160, 192, 224, 256 Kbps</p>
Stream Format	MPEG2-TS (Transport Stream), Hardware Multiplexing of Video stream + Audio stream
Bus/Interface	USB 2.0: Compliant with Universal Serial Bus Specification 2.0
OS Platform	Windows and Linux
Power	7.5W, +5V @ 1.5A
Temperature	0 – 70 C (TBT)
Board Dimension	5.7" x 4" (145mm x 102mm)
Applications	DVR (Digital Video Recorder) Streaming Server — H.264 Encoder/Decoder