PCI Express 4-Channel Frame Grabber
User's Manual

Model 810 | Rev.A | September 2013

SENSORAY | embedded electronics

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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

Model 810 is a PCI-Express 4-channel frame/video capture device, designed for the applications requiring broadcast-grade video quality and high capture rate from multiple input video channels. It supports capturing from NTSC/PAL/SECAM video sources.

For the need of audio capturing, Model 810 provides four channels of stereo or monochrome audio capturing associated with four channels of video respectively.

Also, as designated as a broadcast grade product, it supports VBI (Vertical Blanking Interval) like used for Closed Caption or Teletext applications.

For each video channel, the capturing frame rate is up to 30 fps for NTSC and 25 fps for PAL. It makes total frame/video capturing rate up to 120 fps for NTSC and 100 fps for PAL. The capturing resolution can be from followings: D1.N (NTSC), D1.P (PAL), VGA, QVGA, QQVGA, SIF, 2SIF, 4SIF, CIF, QCIF, SQCIF, 4CIF.

Associated with each channel, general digital I/O signals are provided, for the control and/or alarming purpose.

A single +3.3V power supply through PCI-Express bus is required to power the board.

Model 810 implements a single-lane (x1) PCI-Express interface. It can be plugged into a PCI Express slot of any width.

Feature Summary

- PCI-Express Video/Audio Capturing

- Video input: 4 individual input video channels (Composite or S-Video per channel)

- Audio input: 4 pair of stereo or 4 mono

- Resolution (Max): Full-D1:

  NTSC: 720 x 480 @ 30 fps x 4   (Total: 120 fps)
  PAL: 720 x 576 @ 25 fps x 4   (Total: 100 fps)

- Other supported video Resolution:

D1.N:	720 x 480	D1.P:	720 x 576	D.5:	480 x 352
SIF:	352 x 240	2SIF:	704 x 240	4SIF:	704 x 480
VGA:	640 x 480	QVGA:	320 x 240	QQVGA:	160 x 112
CIF:	352 x 288	QCIF:	176 x 144	SQCIF:	128 x 96
4CIF:	704 x 576				

- Frame/Video capturing and encoding:

  Raw frame capturing: YCrCb / RGB

  up to 30 fps x 4, for NTSC   (Total: 120 fps)
  up to 25 fps x 4, for PAL   (Total: 100 fps)

  Raw video capturing: YCrCb / RGB

  video up to 30 fps x 4, for NTSC   (Total: 120 fps)
  video up to 25 fps x 4, for PAL   (Total: 100 fps)

  Raw audio capturing:

  audio sampling rate @ 32KHz / 48KHz

  JPEG frame, MPEG-1/2/4, H.264, or MJPEG A/V capturing:

  Can be done with 3rd party software or library,
  or OSS software like FFMPEG, MEncoder, and etc.

- VBI (Vertical Blanking Interval) support: Raw VBI decoding, 27Mhz sampling rate

- 4 digital inputs and/or 4 digital outputs: TTL signals

- Driver and SDK for Windows available

- Linux drive natively supported by kernel.org, complying with V4L and/or V4l2

Reference

Board Picture and Connector Layout
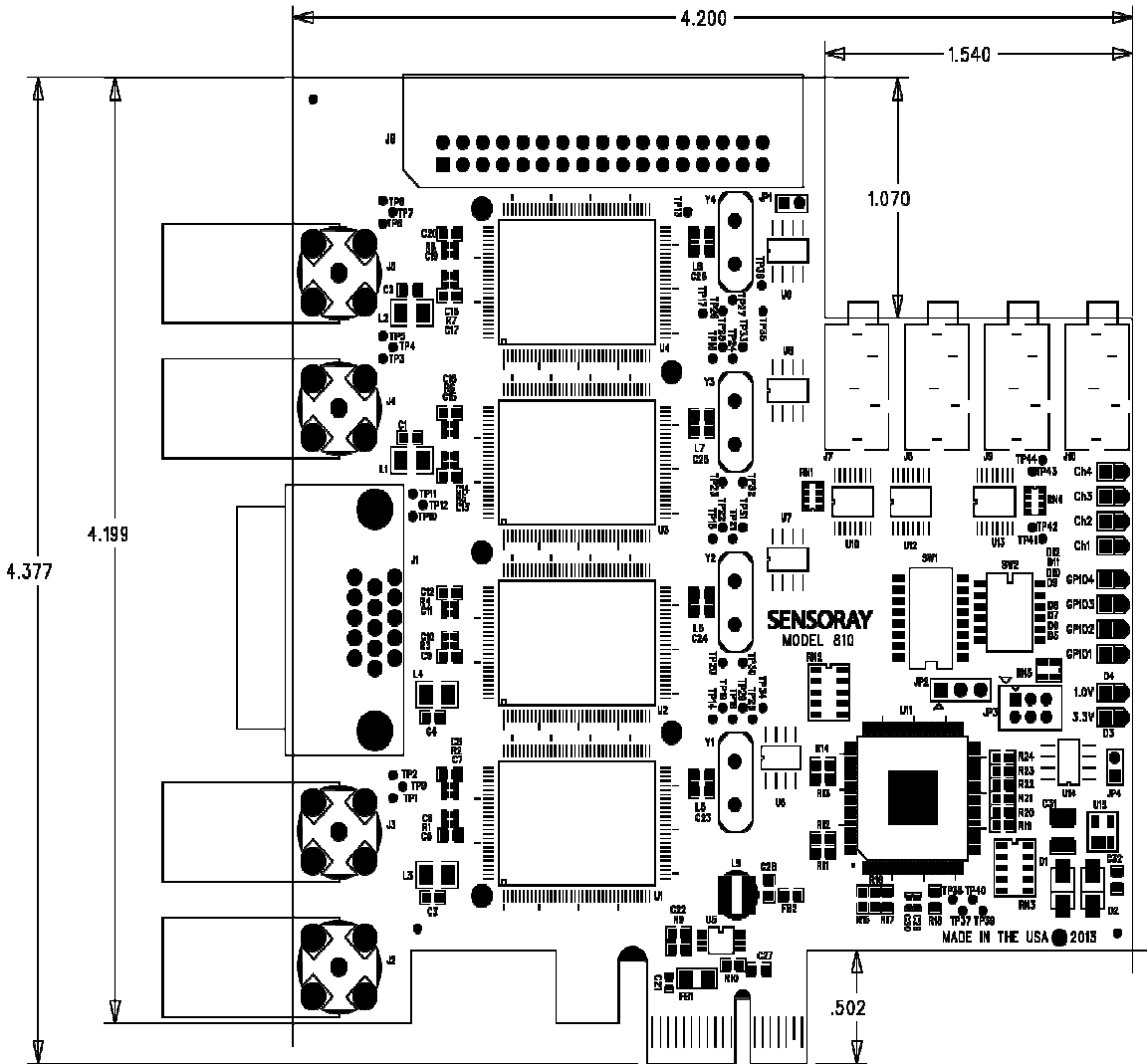
Connector List

P1	PCI-Express Connector
J1	DB-15: Audio Input Breack-in, for all 4 channels of Stereo/Mone, Line-in level
J2	BNC: Composite Video Input for Channel-1
J3	BNC: Composite Video Input for Channel-2
J4	BNC: Composite Video Input for Channel-3
J5	BNC: Composite Video Input for Channel-4

J6	34-pin Connector: break-in/out for
	    Composite Video Input for Channel-1, 2, 3, and 4
	    S-Video Input for Channel-1, 2, 3, and 4
	    Stereo/Mono Audio Input for Channel-1, 2, 3, & 4
	    Digital Inputs for Channel-1, 2, 3, and 4
	    Digital Output for Channel-1, 2, 3, and 4

J7	3.5mm AudioJack: Stereo/Mono Audio Input, Channel-1 (optional -- not populated as default)
J8	3.5mm AudioJack: Stereo/Mono Audio Input, Channel-2 (optional -- not populated as default)
J9	3.5mm AudioJack: Stereo/Mono Audio Input, Channel-3 (optional -- not populated as default)
J10	3.5mm AudioJack: Stereo/Mono Audio Input, Channel-4 (optional -- not populated as default)

JP3	General Purpose Digital I/O: configurable
	    Digital Inputs for Channel-1, 2, 3, and 4
	  or
	    Digital Output for Channel-1, 2, 3, and 4

Connector Signal/Pin Definitions

PCI-Express Bus Connector: P1

Pin – Side B	Signal	Pin – Side A	Signal
B1	+12V	A1	PRSNT#1
B2	+12V	A2	+12V
B3	Reserved *	A3	+12V
B4	Ground	A4	Ground
B5	SMCLK *	A5	TCK
B6	SMDAT *	A6	TDI *
B7	Ground	A7	TDO*
B8	+3.3V	A8	TMS *
B9	TRST# *	A9	+3.3V
B10	+3.3VAUX *	A10	+3.3V
B11	WAKE# *	A11	PWRGOOD
(C-Key)		(C-Key)	
B12	Reserved *	A12	Ground
B13	Ground	A13	REFCLKP
B14	HSOP0	A14	REFCLKN
B15	HSON0	A15	Ground
B16	Ground	A16	HSIP0
B17	PRSNT#2	A17	HSIN0
B18	Ground	A18	Ground

Note:
*   Not connected.
C-Key   Connector Key

Audio Input Connectors, DB15:   J1

Pin	Signal	Pin	Signal	Pin	Signal
1	Audio-In Channel-1 Right	6	Audio-In Channel-4 Right	11	*
2	Audio-In Channel-2 Left	7	Audio-In Channel-4 Left	12	*
3	Audio-In Channel-2 Right	8	GND	13	*
4	Audio-In Channel-3 Left	9	*	14	*
5	Audio-In Channel-3 Right	10	Audio-In Channel-1 Left	15	*

Note:
*   Not Used

Composite Video Input Connector, BNC: J2, J3, J4, and J5

Pin	Signal	Pin	Signal
Inner	Composite Video Signal	Outer/Ring	Shield, Analog ground

Full A/V (Video & Audio) and Digital I/O Connector: J6

Pin	Signal	Pin	Signal
1	Analog Ground	2	Composite Video In / S-Video In – Y for Channel-1
3	S-Video In – C for Channel-1	4	Audio In – L for Channel-1
5	Audio In – R for Channel-1	6	Digital Input for Channel-1
7	Digital Output for Channel-1	8	Digital Ground
9	Analog Ground	10	Composite Video In / S-Video In – Y for Channel-2
11	S-Video In – C for Channel-2	12	Audio In – L for Channel-2
13	Audio In – R for Channel-2	14	Digital Input for Channel-2
15	Digital Output for Channel-2	16	Digital Ground
17	Analog Ground	18	Composite Video In / S-Video In – Y for Channel-3
19	S-Video In – C for Channel-3	20	Audio In – L for Channel-3
21	Audio In – R for Channel-3	22	Digital Input for Channel-3
23	Digital Output for Channel-3	24	Digital Ground
25	Analog Ground	26	Composite Video In / S-Video In – Y for Channel-4
27	S-Video In – C for Channel-4	28	Audio In – L for Channel-4
29	Audio In – R for Channel-4	30	Digital Input for Channel-4
31	Digital Output for Channel-4	32	Digital Ground
33	+3.3V	24	Not Used

Stereo Audio Input Connectors, 3.5mm TRS StereoJack: J7, J8, J9, J10

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

Note:
*   J7 to J10 are optional (as default, they are not populated).

Digital I/O Connectors: JP3

Pin	Signal
	Digital Ground
2	GPIO1 – Digital Input/Output for Channel-1
3	GPIO2 – Digital Input/Output for Channel-2
4	GPIO3 – Digital Input/Output for Channel-3
5	GPIO4 – Digital Input/Output for Channel-4
6	+3.3V

DIP Switches

Manufacturing DIP Switch: SW1

The DIP switch, SW1, is used for manufacturing only. Therefore, it is not described in this manual.

Digital I/O Configuration DIP Switch: SW2

The DIP switch, SW2, is used for configuring Digital I/O routing. Refer to the table below for the routing details:

SW2-1	SW2-2	SW2-3	SW2-4	SW2-5	SW2-6	Description
OFF	X	X	X	X	X	Disconnect all digital I/O to JP3
X	X	OFF	X	X	X	Disconnect all digital inputs from J6
X	X	X	X	OFF	X	Disconnect all digital outputs to J6
X	X	ON	OFF	X	X	Enable connectivity from J6's digital input pins to the board (for all 4 channels)
X	X	X	X	ON	OFF	Enable connectivity from the board to J6's digital output pins (for all 4 channels)
X	X	ON	OFF	ON	OFF	Enable connectivity for both digital inputs & outputs from/to J6 connector
ON	ON	ON	OFF	ON	OFF	Enable connectivity for both digital inputs & outputs from/to J9 connector; And, route the digital inputs connected to the JP3
ON	OFF	ON	OFF	ON	OFF	Enable connectivity for both digital inputs & outputs from/to J6 connector; And, route the digital outputs connected to the JP3
Others						Reserved

LED

Power-OK indicators: D3 and D4

The LED D3 and D4 are used for indicating on-board Power-OK status.

LED	Signal
D3	3.3V Power-OK Status
D4	1.0V Power-OK Status

GPIO Status Indicators: D5 ~ D8:

The LED D5, D6, D7, & D8 are used for indicating the status of the digital input/output signals (pins), labeled as GPIO1 ~ GPIO4 on the board, and directly connected to the TB1 ~ TB4. A logic 0 (low) turns the LED on and a logic 1 (high) turns it off.

LED	Signal
D5	Status of GPIO1 (associated with Channel-1)
D6	Status of GPIO2 (associated with Channel-2)
D7	Status of GPIO3 (associated with Channel-3)
D8	Status of GPIO4 (associated with Channel-4)

Note:
*   The D5 to D8 are optional (as default, they are not populated).

Channel Status Indicators: D9 ~ D12

The LED D1, D2, D3, and D4 can be used for indicating the channel status, respectively.

LED	Signal
D9	Status for Channel-1, the driving signal is connected to the Channel-1 capturing chipset SAA713xHL's GPIO15. A logic low turns the LED on, and a high turns it off
D10	Status for Channel-2, the driving signal is connected to the Channel-2 capturing chipset SAA713xHL's GPIO15. A logic low turns the LED on, and a high turns it off
D11	Status for Channel-3, the driving signal is connected to the Channel-3 capturing chipset SAA713xHL's GPIO15. A logic low turns the LED on, and a high turns it off
D12	Status for Channel-4, the driving signal is connected to the Channel-4 capturing chipset SAA713xHL's GPIO15. A logic low turns the LED on, and a high turns it off

Software

Device Driver and SDK

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

Windows

Sensoray Co. provides Model 810 WDM driver and DirectX filter for Windows platform. The SDK includes the Windows driver, DLL, Demo application & source code, etc. It is packaged in a "s811_v1xx.zip" file for distribution and/or for customer(s) to download from Sensoray's website.

Refer to the "Model 811/810 Windows SDK User's Manual" for the SDK, DLL, API, and programming details.

Since the driver is built and based on the WDM BDA and DirectShow oriented architecture, the Microsoft GraphEdit utility can be used for building live A/V preview and/or capturing application. Also, 3rd party OSS/freeware/shareware like VLC player, AMCap, MPC (Media Player Classic), and VirtualDub software can be used for still/live video capturing and/or preview.

Linux

The device driver for Linux is natively provided by kernel.org and comes with most commonly used or popular Linux distributions. The API complies with standard V4L2 (Video for Linux Version 2), formerly known as V4L (Video for Linux). The API spec and capturing sample program can be downloaded from following websites:

http://v4l2spec.bytesex.org/
http://www.linuxtv.org/downloads/video4linux/API/V4L2_API/spec-single/v4l2.html

In addition to the application samples from V4L/V4L2, Sensoray Co. provides customized capturing sample/demo programs and HOW-TO type of app/instruction notes for the Model 810/811, upon customer's requests.

For live video preview or capturing, commonly used V4L application programs like XawTV and TV-Time can be used for capturing/previewing from each channel of the Model 810/811.

For capturing JPEG frame, MPEG-1/2/4, H.264 or MJPEG video, 3rd party's or OSS libraries or CODECs can be used and integrated in the application programs. As a good example, FFMPEG is a well-know and highly recommended OSS that can be used for the Model 810/811. Sensoray Co. provides an allocation note on how to use command-line based FFMPEG to capture A/V (Video or Audio).

Specifications

Video Formats	NTSC, PAL, SECAM

Video Inputs	4 input channels, simultaneously:
	    4 Composite video via 4 NBC connectors, 75 Ohms; or
	    4 S-Video via a 34-pin breakout connector, 75 Ohms; or
	    combinations up to 4 channels , 75 Ohms

Audio Inputs	4 input channels: associated with 4 separated video channels
	    Stereo or mono for each channel, via four 3.5mm TRS StereoJacsk;
	    Or, break-in stereo/mono signal from a 34-pin connector
	    Signal level: Line-in level, +/- 1.0V

Capturing Mode	Raw: RGB or YUV
Capture Rate	Up to: 120 (30x4) frames/sec for NTSC/RS-170/CCIR 100 (25x4) frames/sec for PAL/SECAM
Frame/Video Encoding	Could be done by software and/or 3rd party CODEC: JPEG, MPEG-1/2/4, MJPEG, and H.264

Resolution	Up to Full-D1:
	    NTSC: 720x480 PAL: 720x576
	Supported:
	    D1.N: 720x480 D1.P: 720x576 D.5: 480x352
	    SIF: 352x240 2SIF: 704x240 4SIF: 704x480
	    VGA: 640x480 QVGA: 320x240 QQVGA: 160x112
	    CIF: 352x288 QCIF: 176x144 SQCIF: 128x96
	    4CIF: 704x576

VBI	Raw VBI decoding, 27Mhz sampling rate

Digital I/O	4 inputs + 4 outputs: TTL signals
	    4 configurable inputs/outputs, via I/O terminals;
	    all 4 inputs + all 4 outputs on breakout 34-pin connector

Bus	PCI-Express x1: Compliant of
	    PCI-Express Base Specification (Revision 1.0/1.1)
	    PCI-to-PCI Bridge Specification (Revision1.2)

OS Platform	Windows and Linux
Power	8.25W, +3.3V @ 2.5A
Temperature	0 – 70 C
Board Size	4.2" x 4.37" (107mm x 111mm)