

PCI Express JPEG Frame Grabber Hardware Manual

Model 817 | Rev.E | April 09

SENSORAY | embedded electronics



Designed and manufactured in the U.S.A

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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.

Introduction

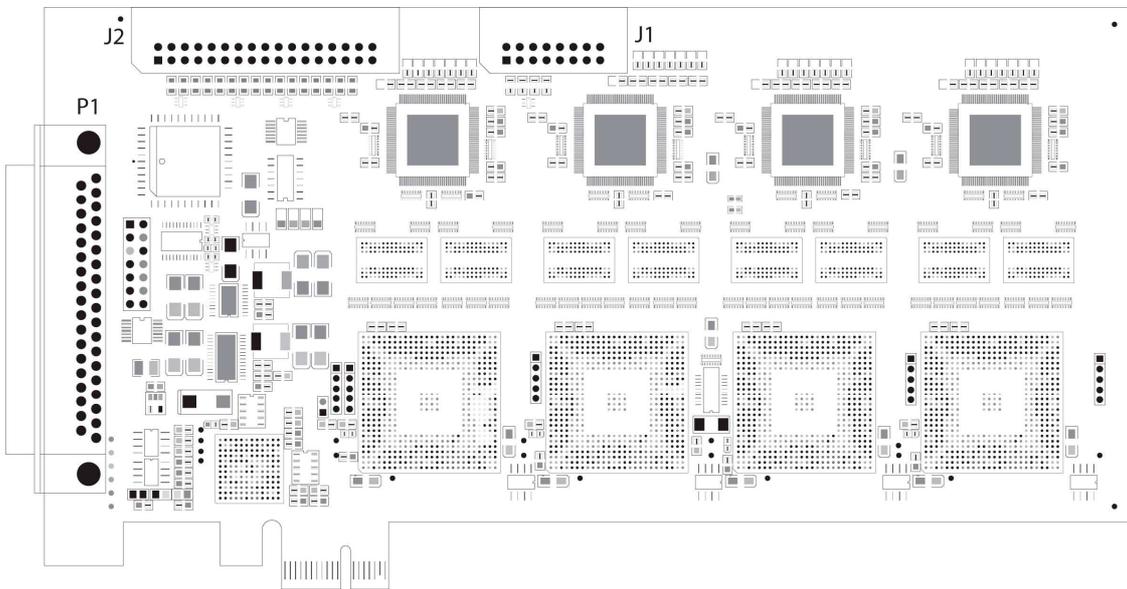
Model 817 is a video capture board designed to be used in applications requiring high capture rate from multiple input video channels. It is capable of capturing full resolution color JPEG-compressed images from 16 channels at full NTSC or PAL frame rates¹.

Along with JPEG images model 817 can capture monochrome uncompressed images (bitmaps) which could be used for monitoring and/or motion detection. The board provides complete capture flexibility: all capture parameters can be set independently for each capture channel. Individual frame capture rates can be set for JPEGs and bitmaps for each channel. All capture options are discussed in more detail in the Software Reference.

An optional single line text caption (up to 80 characters) can be overlaid on captured image (before compression).

A 16x4 analog crosspoint video switch is used to route any combination of four input channels to external video monitors. Each of the four video outputs can be individually turned on or off, which allows connecting the outputs of multiple 817's to the same monitor.

Model 817 implements a single-lane (x1) PCI Express interface. It can be plugged into a PCI Express slot of any width.



¹ Actual capture rate depends on the application software and operating system performance. The application software must empty the capture buffers promptly. Momentary “distractions” of the host computer can cause occasional frame loss, so the resulting capture rate is usually very close, but strictly speaking, slightly lower than full. Usually this difference is not more than a fraction of a percent.

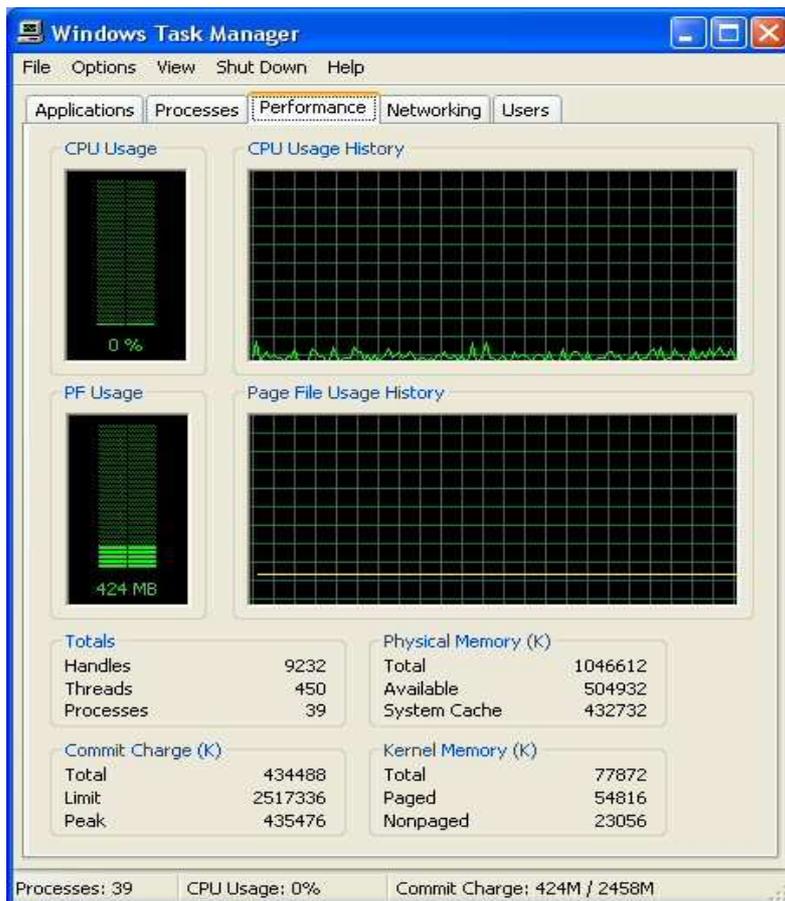
Operation

Video capture

Model 817 contains four identical video capture and processing units (VCPU), each of which handles 4 input video channels. Each VCPU employs a 4-channel video decoder to convert analog video into digital, and a powerful digital signal processor (DSP) to capture digitized video and handle various processing tasks: frame decimation, caption overlay, JPEG compression, status reporting, etc.

The data from each DSP is sent over an internal 66 MHz 32-bit PCI bus to a PCI Express bridge, which connects to the host computer's PCI Express slot.

Each channel is set up independently of the others. Once the capture on a particular channel is enabled, the required data (JPEGs and/or bitmaps, status information) is transferred to the host using DMA, i.e. without any host's intervention. That results in a very low percentage of CPU time taken by capture process alone, and most of the computing resources being available for the application software. Below is a screen capture of the Windows Task Manager window taken while one model 817 board was capturing at a maximum frame rate on all channels (no display of captured images, Pentium D 2.8 GHz).



Once all required data for one frame is transferred, an interrupt is triggered by the DSP and the driver signals the application that data is available. The driver allocates multiple capture buffers on the host side, so the next frame's capture can start right away, if required. However, the application must dispose of the data at the same average rate as the data is coming in, to avoid buffer starvation and frame loss.

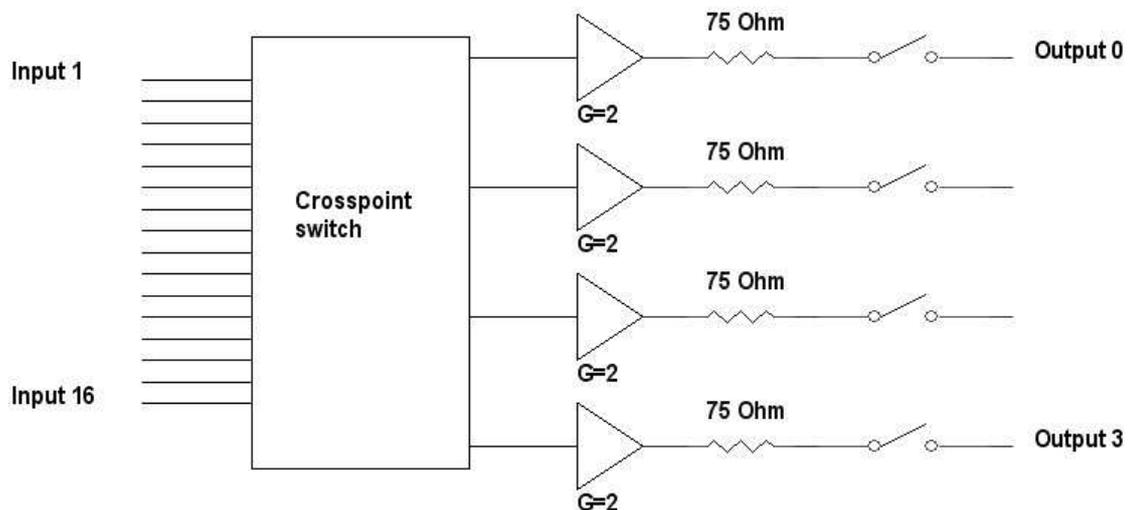
Sensaray provides drivers for Windows and Linux operating systems. For more details, please refer to the corresponding Software Manual.

Deinterlacing

Model 817 performs optional deinterlacing of interlaced video to reduce motion artifacts on captured images. The lines of one of the fields of video are recreated from those of another field by using interpolation. This method provides better visual quality compared to simple line doubling. Since the deinterlacing is performed by the firmware running on the DSPs, it slows the capture rate down slightly.

Video output crosspoint switch

Model 817 provides the means for monitoring analog video input signals on up to 4 monitors. A crosspoint switch connects any combination of 16 inputs to 4 outputs. Each of the outputs has a software controlled on/off switch which allows connecting multiple boards' outputs in parallel.



System Requirements

Computer requirements

As already mentioned, capture with model 817 does not require a lot of CPU attention. Usually any computer with a PCI Express slot is adequate. The application's requirements are a more significant factor in choosing the right system. Different motherboards sometimes exhibit performance variations in areas of memory and bus speeds, depending on chipsets used and other factors. Sensoray therefore recommends testing systems/motherboards with model 817 board before committing to large quantities.

Video source requirements

Model 817 accepts standard NTSC or PAL signals, as well as standard 60 Hz and 50 Hz monochrome TV signals. The video inputs on the 817 board are terminated with a 75 Ohm resistor.

It is not recommended to simultaneously connect the video source to the input of the model 817 and another 75 Ohm terminated input. This may reduce the quality of the captured images and cause synchronization problems.

Because of the specifics of the board's design the 817 works better with the video sources asynchronous relative to each other, which is usually the case. It is not recommended to synchronize the cameras used with the model 817 because it may cause decrease in the performance (capture frame rate).

It is not recommended to switch the input signal from one TV standard to another while the board is capturing. This may result in a lock up requiring software restart.

Specifications

Video sources	NTSC, PAL, RS-170, CCIR
Video inputs	16 analog composite; 75 Ω input impedance
Video outputs	4 analog composite with individual on/off capability; 75 Ω output impedance
Output formats	Compressed: JPEG (ITU-T T.81 ISO/IEC 10918-1), uncompressed: monochrome Y8 (8 bits/pixel).
Output resolutions ²	NTSC: 4CIF: 640x480; 2CIF: 640x240; 1CIF: 320x240. PAL: 4CIF: 704x576, 2CIF: 704x288, 1CIF: 352x288.
Analog-to-digital resolution	8 bit luminance, 8 bit chrominance
Capture rates per channel ^{3,4}	30 fps (NTSC), 25 fps (PAL) for the following modes: <ul style="list-style-type: none"> • JPEG only or bitmap only at any size without deinterlacing; • JPEG and bitmap simultaneously at 2CIF or 1CIF. 24 fps (NTSC), 20 fps (PAL) for all other modes.
Bus requirements	PCI Express rev.1.1, x1 or wider.
Power consumption	15 W (3.3 V)
Operating temperature	0°C to 50°C (with convection cooling)

² Resolution can be set independently for each channel. Resolution setting applies to both JPEG and bitmap images.

³ Since channels can be configured independently, capture rate limitations apply to each channel separately. Also, see footnote 1.

⁴ With JPEG compression quality set at 60.

Connectors

Input video (34-pin ribbon cable), J2.

Pin	Signal	Pin	Signal
1	Ground	2	Video input 1
3	Ground	4	Video input 2
5	Ground	6	Video input 3
7	Ground	8	Video input 4
9	Ground	10	Video input 5
11	Ground	12	Video input 6
13	Ground	14	Video input 7
15	Ground	16	Video input 8
17	Ground	18	Video input 9
19	Ground	20	Video input 10
21	Ground	22	Video input 11
23	Ground	24	Video input 12
25	Ground	26	Video input 13
27	Ground	28	Video input 14
29	Ground	30	Video input 15
31	Ground	32	Video input 16
33	N/C	34	N/C

Output video (16-pin ribbon cable), J1.

Pin	Signal	Pin	Signal
1	Ground	2	Video out 0
3	Ground	4	Video out 1
5	Ground	6	Video out 2
7	Ground	8	Video out 3
9	N/C	10	N/C
11	N/C	12	N/C
13	N/C	14	N/C
15	N/C	16	N/C

Input/output video (DB37 female), P1.

Pin	Signal	Pin	Signal
1	Video out 3	20	Video out 2
2	Ground	21	Video out 1
3	Video out 0	22	Video in 16
4	Ground	23	Video in 15
5	Ground	24	Video in 14
6	Ground	25	Video in 13
7	Ground	26	Video in 12
8	Ground	27	Video in 11
9	Ground	28	Video in 10
10	Ground	29	Video in 9
11	Ground	30	Video in 8
12	Ground	31	Video in 7
13	Ground	32	Video in 6
14	Ground	33	Video in 5
15	Ground	34	Video in 4
16	Ground	35	Video in 3
17	Ground	36	Video in 2
18	Ground	37	Video in 1
19	Ground		

Notes.

1. Please contact Sensoray for a list of available cables, adapters and termination products.
2. In addition to the connectors listed above model 817 may contain a number of headers used for manufacturing and testing purposes. No circuits should be connected to those headers and no shunts should be removed or installed unless advised so by Sensoray.