Model: LT-122-PCIE For PCI Express

Data Sheet

JUNE 2014

INTRODUCTION

The LT-122-PCIE is an HD video dual channel capture board that applies H.264 or VC-1 compression to HDTV video in real-time without the use of host computer's CPU resources. The board is placed in a PCI Express slot.

This board captures video from two (smtpe compliant) 3G/HD/SD SDI. In addition to external video sources, the LT-122-PCIE can compress from host internal video sources such as files or DirectShow devices including USB and FireWire cameras.

Used in 3D mode, the LT-122 can capture synchronize and mix 3D video from 3D SDI-sources.

The LT-122-PCIE compresses video in compliance with the H.264 or with the VC-1 standard.

This high performance board can compress 1080P/I at up to 60 frames per second (fps) (when using only one channel). 2048x2048 can be compressed at 15fps. At lower resolutions the maximum compression frame rate increases. If the frame rate is higher than the board can handle, frame decimation can be enabled allowing high frame rate source to be acquired at a lower frame rate.

Compressed bitrates can vary between 64Kbit/s and 80Mbit/s depending on resolution, frame rate and quality desired.

An uncompressed video capture function is also available for simultaneous snapshots or continuous raw video acquisition.

Main Features

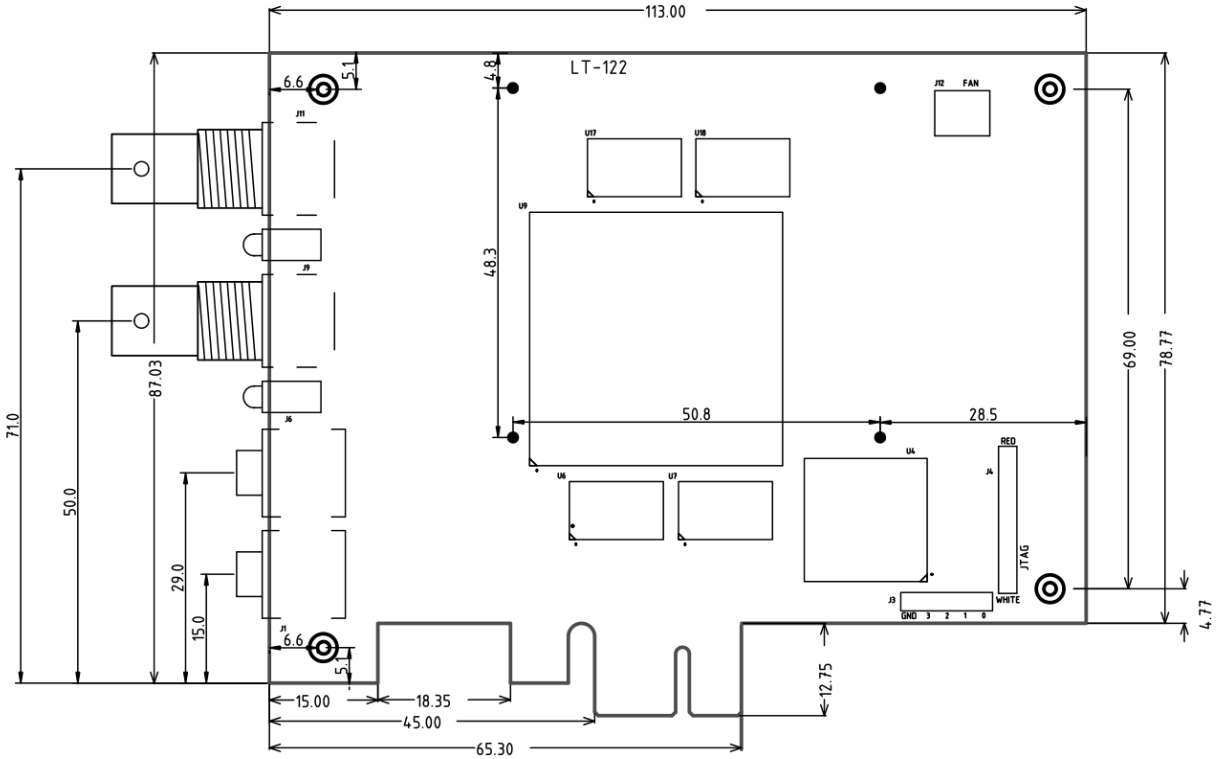
- H.264 High profile level 5.1 video compression
- VC-1/SMPTE-421M advanced profile level 3 video compression
- I or IP encoding with variable GOP size
- VBR (variable) bitrate control
- 1024x512 motion vector search range covered
- Bitrates from 64Kbit/s to 80Mbit/s
- 1 frame maximum latency (can be reduced to a few milliseconds under special circumstances)
- HD/SD-SDI video, video inputs
- Optional HD/SD-SDI loop-through output
- PCI Express x1 host bus interface
- Simultaneous uncompressed video capture
- 2 channel audio capture
- Synchronized audio/video acquisition
- Advanced hardware deinterlacing
- Frame rate reduction feature available
- Video downscaling prior to compression
- Smoothing filter prior to compression
- Text overlay prior to compression
- Bitrate reduction via monochrome mode when color is not needed
- Synchronization to external events
- Extensive Motion statistics for all frames
- Windows 2000/XP/Vista drivers
- DirectShow support as well as simple SDK
- Linux support

Common Applications

- HDTV capture and storage
- Digital video recorders
- Video Medical systems
- Endoscopy DVR
- Video surveillance systems
- Internet broadcasting
- Teleconferencing
- Video over LAN
- Inspection systems
- Machine vision video recorders

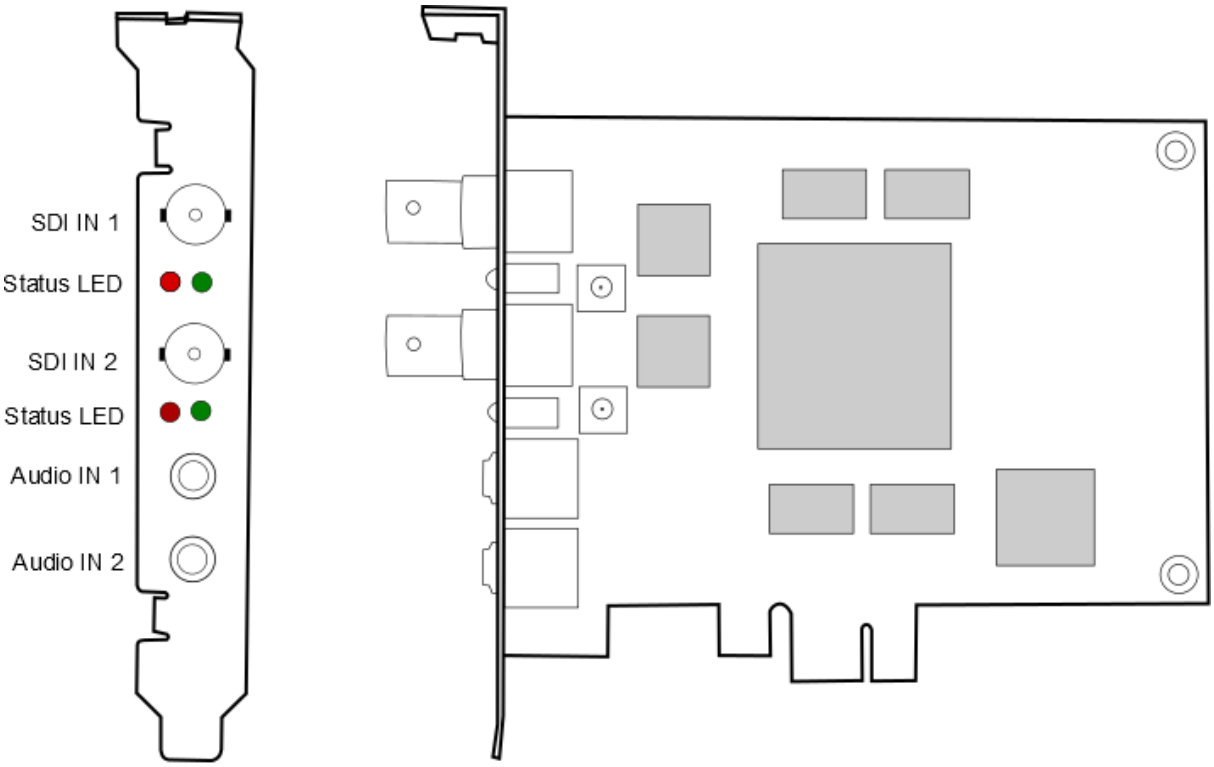
The sections below introduce the many elements of the LT-122-PCIE board and detail their features and operation.

BOARD DIMENSIONS



INPUT VIDEO CONNECTIONS

Many different video sources (SMPTE 425M [Level A and Level B], SMPTE 424M, SMPTE 292M, SMPTE 259M-C and DVB-ASI) are supported by the LT-122-PCIE. The physical connectors are shown below.



The bracket on the left shows the connector configuration

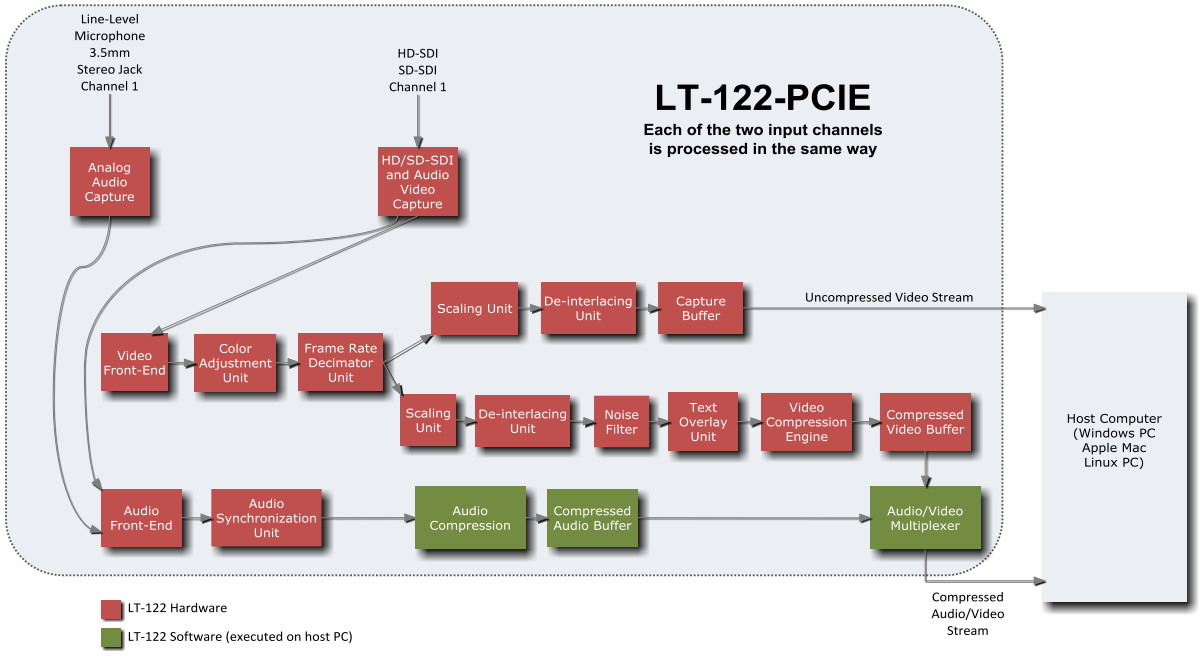
Please refer the document “LT-122_Input_Formats.pdf” for an up to date list of all the video modes supported.

HOST BUS CONNECTIVITY

The LT-122-PCIE is an x1 PCI Express board and can be placed in any available x1, x4 or x16 slot.

The LT-122-PCIE does not rely on the host processor for video compression. The host processor does however use the processor for low CPU usage activities such as audio compression, audio/video multiplexing and data transfer. For an acquisition only system that does to play/decode the compressed or uncompressed audio/video streams, such as a small multimedia server, a 500MHz CPU with 64MB RAM should suffice. If stream decoding is involved, as would be typically required by a DVR or a system with video preview, a 2GHz processor would be recommended.

FUNCTIONAL DESCRIPTION



The LT-102-PCIE is comprised of several functional elements. Their operation as well as their function is described in this section. The diagram above shows the various elements and their interconnections. Note that only one of the two acquisition/compression channels is depicted.

VIDEO FRONT-END

The video front-end can accept captured video at rates of over **150 megapixels** per second. This allows for the acquisition of high resolution and frame rate data such as **WUXGA (1920x1200) at 60 frames per second.**

It must be noted that the compression engine is limited to processing about **63 megapixels per second.** Consequently, either the scaling unit or the frame rate decimator must be activated when the input pixel rate exceeds the 63 megapixels per second limit in order to reduce the pixel rate. If the acquisition rate is too high the driver will report an acquisition overflow error. When using the auto-setup capabilities the LT-122-PCIE will automatically activate the frame rate decimator if required.

In addition to the external video inputs the LT-122-PCIE can also take uncompressed video from the host system. In this configuration the LT-122-PCIE can perform as a compression coprocessor relieving the host CPU resources.

COLOR ADJUSTMENT

The LT-122-PCIE allows for the adjustment of **hue, saturation, brightness and contrast** in real-time.

FRAME RATE DECIMATOR UNIT

The LT-122-PCIE has a flexible frame rate decimator that reduces the frame rate of incoming video to an arbitrary value. This is primarily used to reduce the frame rate for high resolution images to meet the requirements of the compression engine but can also be used to reduce the amount of compressed or uncompressed data. At this time there is only a single frame rate decimator unit for both the compressed and uncompressed video paths.

SCALING UNIT

If scaling is needed, the LT-122 incorporates **two scaling units** that allow the user to reduce the image size. This is primarily used to reduce either or both compressed or uncompressed video bandwidth. The two scaling units can be controlled individually. The first is for the compressed video path and the second is for the uncompressed video path.

In order to have full frame rate uncompressed video data transferred to the host system it may be necessary to reduce the image size. If the size of a very high resolution image is not reduced, the acquisition frame rate will automatically drop to meet the host bus (your PC) bandwidth limitations.

DE-INTERLACING UNIT

This unit performs uses an **adaptive de-interlacing** algorithm to convert interlaced images to progressive images for compression or uncompressed capture. Saw tooth effects are removed, even for high motion interlaced video, without affecting detail.

NOISE REDUCTION FILTER

A pre-compression filter can be enabled to help remove noise and some high frequency components and thus improve the video compression quality. This filter may reduce some image sharpness and its usage should be determined experimentally.

RAW/UNCOMPRESSED VIDEO CAPTURE UNIT

The LT-122-PCIE can simultaneously capture compressed and uncompressed video. The uncompressed video capture unit uses double buffering to allow for efficient video acquisition.

If your host bus or processor does not have sufficient performance to transfer video data at the uncompressed rate, the capture unit cleanly drops frames to meet your host system's limitations. This effectively limits your capture frame rate.

TEXT OVERLAY

Text overlay is available to the compressed video path. The overlay is applied prior to compression and can be used to place a date/time stamp, watermark, or identification label.

The user can arbitrarily place four 16 character text windows within the video frame. If long strings are required, the windows can be placed side by side.

VIDEO COMPRESSION ENGINE

The video compression engine is designed for high quality low latency video compression and is capable of processing up to 247,000 (16x16 pixels) macroblocks, or over 63 megapixels, per second.

Low latency is achieved by beginning compression during the acquisition of the frame itself. Compressed video for the current frame becomes available after about eight macroblock rows have been acquired. This equates to a **latency of about 3ms for 1080p** video. Compressed data can be transferred to the host as soon as there are 2048 (default value) bytes in the buffer. In systems that are using frame based processing (e.g. DirectShow) it is usually more efficient to wait until a whole frame is available before transferring it to the host. Frame based systems have inherently a latency of at least one frame.

There are three primary components to the compression engine. The first is the motion estimation block. The second is the H.264/VC-1 bitstream generation block. And the third is the bitrate control block. The features of the three blocks are described below.

- ***MOTION ESTIMATION***

  The motion estimation block uses an advanced algorithm that gives very high quality block matching with a large search range. The search range is 1024 horizontally and 512 vertically.

- ***COMPRESSED BITSTREAM GENERATOR***

  The LT-122-PCIE produces a H.264 High profile level 5.1 or a VC-1/SMPTE-421M advanced profile level 3 compliant bitstream.

  The video can be encoded either as Intra frame only (I-frame only) or as IP GOP structures. The number of P-frames per I-frame (GOP length) is programmable. The GOP length can vary from 1 (i.e. I-frame only) to 4095.

  The user can reset the GOP counter on the fly when an I-frame is required. This is useful if the GOP structure is long and an entry point into the stream is needed with minimal delay.

  Skipped frames are supported if using VC-1 to reduced bandwidth while the input video stream remain static. If the current image varies imperceptibly from the previous image, it is not compressed and a skip- code is sent to effectively inform the decoder to repeat the previous image.

- ***BITRATE CONTROL***

The bitrate control system uses a VBR (variable bitrate) algorithm. Bitrates can vary from **64Kbits/s to 80MBits/s**. The actual bitrate range will depend on resolution and frame rate. Obtaining very low bitrates on high resolution/frame rate video or very high bitrate on low resolution/frame rate video is generally not possible.

In cases where the compressed video is not evacuated from the LT-122-PCIE sufficiently rapidly, the bitrate control system will automatically reduce the programmed bitrate to prevent buffer overflow. If this action is not sufficient, the system will begin the insertion of forced skip frames until the situation is rectified. Once the buffer level has returned to a normal level the programmed bitrate is reactivated. This feature is useful when sending data over a poorly performing network where the bandwidth is suddenly reduced.

It must be noted that compression latency increases as the compressed video buffer level grows. Low latency systems the data must be evacuated efficiently.

Complete (down to quarter pel) **motion vectors for each macroblock are available** and can be obtained from the compression engine. These motion vectors (giving magnitude and direction) indicate the motion that has occurred between two consecutive frames with macroblock granularity. As a result of our advanced motion estimation algorithm, the vectors generated by the LT-102 tend to reflect true motion. Consequently, interested users can use our motion vectors as a basis for implementing an **advanced motion detection system**. Less sophisticated, but more commonly used, algorithms produce vectors that do not necessarily represent true motion.

AUDIO FRONT-END

Incoming audio from the analog to digital converter (A/D), HDMI source, or SDI source is normalized to 16-bit stereo (2-channel) audio and then forwarded to audio synchronization unit by this block.

AUDIO SYNCHRONIZATION UNIT

This unit synchronizes the audio captured by the LT-122-PCIE to the video. This is done to ensure that the audio does not drift with respect to the video and cause poor lip-sync. Audio leaving this unit can be safely multiplexed with video without the need to resample.

AUDIO COMPRESSION (SOFTWARE)

Audio compression is done on the host processor and not in the LT-122-PCIE hardware. AAC, WMA or any directshow compatible audio compression codec can be used. Uncompressed audio can also be accessed. The audio tools are included in the driver package that comes with the LT-122-PCIE

AUDIO/VIDEO MULTIPLEXER (SOFTWARE)

The multiplexing of audio and video is done by the host processor and not by the LT-122-PCIE hardware. The video elementary stream and compressed audio stream are combined into a single multiplexed stream by this unit. The multiplexed stream can then be saved to a file or sent over a network. ASF and MPEG-TS are used natively but any directshow compatible file format (such as AVI, MKV, MP4 etc…) can be used.

DRIVERS

The table below gives our current driver support for the LT-122-PCIE. Contact us if you have a special driver requirement.

Operating System	Supported Driver Features			
	PCI Express	SDK	Direct Show	Video4Linux
Microsoft				
Windows XP	●	●	●	
Windows Vista 32	●	●	●	
Windows Vista 64	●	●	●	
Windows 7	●	●	●	
Windows 8	●	●	●	
Linux				
Linux (all Kernels)	●	●		

FURTHER INFORMATION

Contact us for further information on this or any other Enciris Product:

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