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of:

Quotation Number:

Friday, December 12, 2014

### The UltraVision Ultrasound Research Platform Specifications

One (1) Ultrasound Research Platform capable of real time ultrasonic examination of two dimensional planes in tissue.

The UltraVision Research Platform is a 128 (or multiplexed 256) element transducer ultrasound imaging system capable of B-mode, Color Flow Doppler-mode, Pulsed Wave Doppler, M-mode and Electrography-mode. The modes can be implemented separately to provide the lowest cost systems.

The Platform physically comprises a console and a personal computer (PC) connected by a high speed bi-directional (400Mbytes/second) Thunderbolt cable. The console is the same size as the Apple Mac Pro 15 inch Retina (14.25 x 9.75 x 1 inch) and weighs less than 4 lbs. A separate ISO 60601-1 desk top power supply supplies the console with 40 watts of power and operates from 95 to 265 volts at 50 or 60 Hertz.

The console houses:

- a) a multiplexer and slave multiplexer housing capable of supporting transducers of up to 256 elements.
- b) 64 14-bit 65 MHz analog to digital converters (ADC's) with low noise amplifiers, preamplifiers and time-gain correction amplifiers interfaced to a large FPGA. The ADCs clocking is de-jittered to 300 femtoseconds and has a full scale dynamic range of over 75 decibels.
- c) 64 +/- 80 volt pulse transmitters provide high voltage wave form excitement of the elements with 5 nanosecond granularity of high, low, high impedance or ground which facilitates steering and focusing of transmit waves. Pulse width methods are available in the software that place Hamming windows over the transmit aperture.
- d) A single large Field Programmable Gate Array (FPGA) interfaces the ADCs to the PCIe interface that interfaces to the Thunderbolt connector to the PC. The FPGA also supports an industry standard laptop SODDIM DDR3 4 Giga Byte memory. The FPGA houses:
  - i) a synthetic array memory that stores Raw data from the ADCs.
  - ii) a delay and sum beamformer which is updated for focus at every clock (25 or 16 ns).
  - iii) a programmable frequency filter capable of optimizing a band pass function from 0.5 to 20 or 30 MHz.
  - iv) a Hilbert transform that derives the complex conjugate which is applied to a sum of the square roots to derive the signal magnitude from a true analytic signal.
- e) a PCIe to Thunderbolt converter and Thunderbolt cable.

The Apple Mac Pro 15 inch Retina is supplied with UltraVision software package that devotes its operation to supporting only ultrasound functions. Upon power up the UltraVision user interface is evoked with prevents any other programs from operating but allows the user to save and export images, cine loops, recordings and measurements to a study folder and from which they can be exported over USB3.

The UltraVision Software Package supports:

- a) An administrative function that authorizes user ID's, and sets certain system settings.
- b) Log in and study setup to initiate an ultrasound examination (secured by password).
- c) Displays Graphical User interface with Control Buttons, image area, Time Gain Virtual Potentiometers, Focus Indicators, a Grayscale, a Color Scale, a thumbnail strip of previously recorded images, a chosen parameter reporting area and a Study identification area.
- d) Single or multiple image views.



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- e) User adjustment of Field of View, Frequency, Line Density, Spatial Compounding, and Frequency Compounding.
- f) Zooming in and out of image area. (-5x to +20x)
- g) Making adjustments of scan geometry, power output, gains over regions of the image and overall gain.
- h) Selection of multiple focal distances (up to 4) for the transmit function. The receive function is automatically dynamically adjusted
- i) Viewing freezing and recording of an ultrasound image as bitmaps, image frames<sup>1</sup>, and AVI images.
- j) Measurements of multiple distances, areas, volumes, and time.
- k) Body Markers and annotation
- l) Channel scope where the ADC values are plotted for all 64 channels simultaneously in color which is intended for verification of ongoing transducer quality assurance.
- m) ADC data (2 byte data of every 14 digitization (4096) from every ADC (64) as a 524,288 binary
- n) A bootable USB memory is supplied with an image of the software to allow the user to return the software state at the factory setup.
- o) Optionally M-Mode functionality and control.
- p) Optionally Color Flow Doppler imaging functionality and controls.
- q) Optionally Pulsed Wave Doppler functionality and controls.
- r) Optionally Elastography functionality and control.
- s) Optionally DICOM functionality.
- t) Optional UltraVision Keyboard.

	\$ 30,000.00
Optional M-Mode functionality	\$ 1,000.00
Optional Color Flow functionality	\$ 5,000.00
Optional Pulsed Wave Doppler functionality	\$ 2,000.00
Optional Elastography Functionality	\$ 8,000.00
Optional DICOM functionality	\$ 1,000.00
Optional UltraVision Keyboard	\$ 3,000.00

If the user's field of inquiry requires access to program the console an Application Programming Interface (API) is available

\$ 10,000.00

If the user's field of inquiry requires access to program the construction of the image from the acoustic vectors a Direct X API is available

\$ 10,000.00

Twenty five (25) hours of telephone or online support is provided with each of the API's after which additional software assistance is available in packages of 10 hours at

\$ 1500.00

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<sup>1</sup> Image Frames comprise 16-bit, beamformed magnitude data of acoustic lines in a frame with the geometry and scale preserved so it can be re-processed to the correct geometric view for reviewing, addition or new measurements and storage.