Verasonics®
The leader in Research Ultrasound™

The Vantage™ Systems

256™, 128™, 64 *LE*™, 64™ and 32 *LE*™

A Revolutionary Approach to Ultrasound System Architecture

The Vantage platform provides high-performance, programmable phased array and multi-channel data-acquisition capabilities with unparalleled flexibility for innovative and translational research. A single Vantage system covers a vast range of applications and needs for academic and industrial ultrasound research and development, with its capabilities expanded for use in NDE/NDT, materials science, earth science, and more. Beyond its advantages in phased array ultrasound (including extremely fast FMC/TFM), the Vantage system is ideal for implementing versatile multi-channel techniques and applications such as guided wave tomography, acoustic trapping, and acoustic emission monitoring.

High-Performance Data Acquisition

- Outstanding signal fidelity
- Complete control of transmit and receive parameters at the channel level
- Online, real-time access to all raw RF data
- Programmable tri-state pulser allows for high-fidelity arbitrary waveform transmission independently per channel, enabling advanced pulse encoding techniques, such as frequency and amplitude modulation, coded excitation, time-reversal, etc.
- Image reconstruction on the order of 40 million pixels per second using a standard, commercially available CPU provided by Verasonics
- Exceptional frequency range, with configurations from 50 kHz to 50 MHz
- Data acquisition into local memory (up to 100,000 FPS) limited only by acoustic travel time
- High-speed data transfer from the data acquisition system to the computer at up to 6.6 GB/s sustained

Unmatched Flexibility for Research Ultrasound

- Intuitive sequence programming model provides a template for programming simple or highly complex scripts, including the ability to call custom-processing functions
- Universal Transducer Adapter (UTA) system and available adapters allow users to connect a broad range of commercially available as well as custom transducers
- Custom transducers of any configuration and geometry are easy to integrate
- Software Simulator enables users to perform verification of custom programming, including acquisition sequences and data processing techniques, and can be utilized with or without the system hardware present. Additionally, the Simulator can improve research lab efficiency by allowing multiple users to utilize the Vantage system software, whether for training or custom programming and data analysis, while others are using the hardware.
- Examples provided allow users to integrate and utilize machine learning and deep learning tools for cutting-edge research using artificial intelligence (AI) techniques
- Verasonics' upgrade program protects your investment, allowing Vantage customers to adapt their systems to meet the needs of changing lab requirements and emerging applications

Verasonics Vantage Research Ultrasound System

Best Customer Support in the Industry

- Multiple software toolboxes and a library of over 500 example scripts make the system easy to use and provide a head start for programming the system
- Compatible with Bristol BRAIN Analysis Software, a free, open-architecture software designed to be used interactively with acquisition hardware for a variety of material evaluation techniques
- Extensive product documentation
- Technical support included with each system purchase allows customers to engage with Verasonics' scientists and engineers for technical questions, e.g. script troubleshooting
- The Verasonics Community website offers an online library of training videos, product documentation, and a repository of contributed scripts from other users
- Multiple live training events at locations around the world

Key Technical Advantages

Phased Array Imaging with Real-Time FMC and TFM Capability

- Supports all possible acquisition and imaging modes, from conventional B-scan, plane wave, virtual source and full matrix capture to cutting-edge ultra-high frame rate imaging and nonlinear imaging
- Combined with industry-leading data transfer rates, the extremely fast, user-programmable image reconstruction of the Vantage system provides users with a generalized high-speed TFM imaging framework
- User-definable phase-delay and amplitude weighting lookup tables make it convenient to implement any arbitrary TFM inspection with industry-leading frame rates
- The wide configurable bandwidth enables phased array imaging up to 50 MHz and down to 50 kHz
- Easy implementation of high-speed multi-mode/multi-view imaging
- Support for asynchronous mode, allowing image reconstruction in parallel to data acquisition. This enables the subsequent data frame to be acquired during the processing of the current frame. Asynchronous mode also enables real-time, processed images to display while the system is acquiring and buffering data at a much faster rate.
- Software supports programming of custom transducers designs of any configuration
- Programmable tri-state pulser allows for phased array imaging using advanced pulse encoding techniques

Versatile Multi-channel Acquisition and Analysis

- Fully-programmable transmit, including arbitrary waveform transmission
- Extended transmit operation: transmit arbitrary signals of many hundreds of cycles in length, independently on each channel
- Online user-defined processing allows real-time custom image reconstruction and display
- The UTA 64 LEMO and UTA 128 LEMO adapters enable various options for connecting large numbers of single-element transducers

Custom Transducer Integration

- Transducer adapters are available for Hypertronics, Ipex, LEMO connectors and others
- Custom transducer interface allowing impedance tuning/matching
- Multiplexer interface/solution
- Support for transducers using modern materials of any configuration and geometry. Examples include CMUT arrays, single-crystal arrays, ring arrays, convex/concave arrays, outward-looking arrays, matrix arrays, row column arrays, and flexible arrays.

Enabling New Innovations in NDE

Ultra-High-Speed Imaging

Ultra-high-speed frame rates enable high-resolution inspection during fabrication processes without the need to compromise line speed. Conversely, for a given line speed, the acquisition and imaging speed of the Vantage platform enables higher resolution and higher sensitivity inspection than is achievable using other systems. Ultra-high-speed imaging allows ultrasound to be used as a tool to achieve effective temporal sampling of slower time-scale dynamic processes within a material, opening up new potential fields of study.

Why use the Vantage system for ultra-high-speed imaging?

- The Vantage platform is the benchmark research system for plane wave imaging and ultra-high-speed imaging. There are more than 1000 research papers published on these topics using Vantage systems.
- The Vantage platform is a practical ultra-high-speed imaging platform that combines ultra-high frame rate data acquisition, ultra-high-speed data transfer and ultra-high-speed image reconstruction.

- The ultra-high-speed imaging can be achieved on the Vantage platform using unfocused beams of all types, including plane waves, diverging waves, weakly focused beams, or other suitable arbitrary wavefronts.

Nonlinear Ultrasound

A recent research trend has been the development of methods utilizing phased arrays to allow imaging of elastic nonlinearity. Elastic nonlinearity is a modality of interest in NDE for its sensitivity to macroscopic defects such as closed cracks and also the micro-structural material changes associated with damage precursors. Cutting-edge developments in nonlinear imaging necessitate high-performance hardware, placing the Vantage platform as an ideal platform for such research.

Why use the Vantage system for nonlinear ultrasound?

- The Vantage platform provides excellent system linearity
- The programmable tri-state pulser allows precise transmit bandwidth control, pulse inversion, and multi-frequency pulse transmission for modulation methods
- Every Vantage system includes programmable analog and digital filters to optimize the receive bandwidth and SNR. Programmable multi-stage gains optimize the receive dynamic range for the weak-signal amplitudes typical in nonlinear measurements.
- The Vantage system supports amplitude modulation and sub-aperture transmission methods, including parallel-sequential field subtraction techniques

3D/Volumetric Imaging

- Provides a high-speed volumetric imaging framework with real-time orthogonal plane displays
- Supports matrix arrays of any configuration and geometry (regular, sparse apertures, random or custom)
- Support for emerging, more-economical transducer technologies
  - Arrays with (random) sparse apertures using multiplexers
  - CMUT technology, a potential solution for high-element count matrix arrays
  - Row-column arrays, which provide high image quality, yet require fewer system channels
- Offers flexible solutions to interface high-element count transducers
  - 4-1 multiplexer UTA adapter
  - Multi-system configurations scalable up to 2048 channels

System Configurations

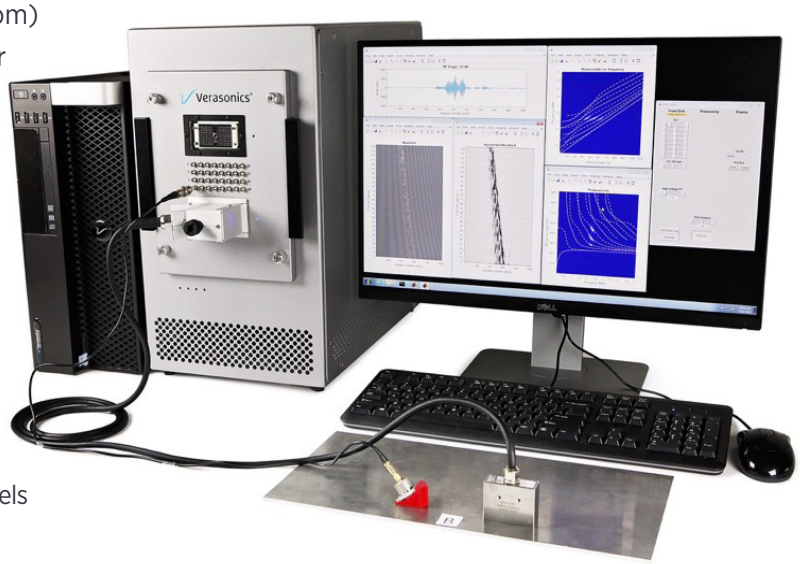
- Vantage 256, with 256 independent transmit and receive channels
- Vantage 128, with 128 independent transmit and receive channels
- Vantage 64 LE, with 128 independent transmit channels and 64 independent receive channels
- Vantage 64, with 64 independent transmit and receive channels
- Vantage 32 LE, with 64 independent transmit channels and 32 independent receive channels

Safety Certifications

- IEC 61010-1 3rd Edition (2010) and EN 61010-1:2010 3rd Edition
- UL 61010-1: 2012 and CAN/CSA-22.2 No. 61010-1-12

Power Requirements and Physical Dimension

- 100V-240V (50-60 Hz)
- Size (Data Acquisition System) L-49cm (+10cm clearance) x W-28cm x H-48cm
- Size (Host Controller) L-42cm x W-18cm x H-47 cm
- Total weight of all components: approx. 35-44 Kg depending on configuration



Key System Specifications of the Vantage Platform

	LF Low Frequency	SF Standard Frequency	HF High Frequency
Transmitters			
Waveform	Tristate (per channel programmable)		
Time Resolution	4 ns (Pulse Width and Delay resolution)		
Pulse Width (min-max)	12 ns - 10 µs	12 ns - 700 ns	12 ns - 700 ns
Focal Delays (per ch)	0 - 45.5 µs (4 ns resolution)		
Frequency Band (MHz)	0.05 – 1.5	0.5 – 20	2 – 42
Voltage Range	2 to 190 Vp-p (0.1 V steps)		
Current (max per ch)	2 A (peak) / 0.4 A (rms)		
Transmit Options			
Arbitrary Waveform	Arbitrary Waveform (independent on each channel)		
Extended Transmit	Extended Transmit bursts (long, high energy emissions)		
Receivers			
Frequency Band (MHz)	0.050 – 1.5	0.5 - 27	1 - 50
Gain (fixed)	24 to 54 dB (6 dB steps)		
Gain (time varying)	0 to -40 dB		
Input Impedance (Ω)	50 - 3000	110 - 3000	110 - 3000
HP Filter (MHz)	0.010 - 0.200	0.050 - 0.250	1 - 20
LP Filter (MHz) (3rd order)	5, 10, 15, 20, 30	5, 10, 15, 20, 30	5, 10, 15, 20, 30, 35, 50
Noise Figure (dB)	1.5 - 3.0 (depending on gain and input impedance)		
Digitizers			
ADC Resolution	14 bits		
Sampling Rate (MHz)	10 - 62.5		
Interleaved Rate (MHz)	125		
Filters	23-Tap and 41-tap FIR filters		
Accumulator	Over 1000 acquisitions, with offset subtraction		
Numerical Gain (*per channel*)	-4.00 to +4.00 (for channel calibration)		
Memory (*per channel)*	64 MB (32 MSamples)		
Data Transfer Rate	6.6 GB/s (over 8 lanes PCIe 3.0)		
External Connectivity and Synchronization			
UTA Modules	**UTA 160-SI/8 LEMO** One IPEX phased array connector 8 LEMO 00 coax connectors		
	UTA 160-SH/8 LEMO One Hypertronics† phased array connector 8 LEMO 00 coax connectors		
	UTA 160-DH/32 LEMO Dual Hypertronics† phased array connectors 32 LEMO 00 coax connectors		
	UTA 128 LEMO / UTA 64 LEMO 128 or 64 LEMO 00 coax connectors		
Input Triggers	2 channels (BNC; LVCMOS; TTL compatible)		
Output Trigger	1 channel (BNC; LVCMOS; TTL compatible)		
Master Clock	250 MHz (HDMI connector)		
External Sync Module	Synchronize up to 2048 channels (± 2 ns accuracy)		
Computer			
Host Controller	Multi-core computer configured and provided with system purchase		
OS	Windows® operating system		
MATLAB® Programming	MATLAB® with Signal Processing Toolbox installed and configured (MATLAB® *user license not included*)		

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Patent References

U.S: 8,287,456, 9,028,411, and 9,384,530
CA: 2604649
CN: ZL200680020886.X, ZL201310053509.8, ZL200980131855.5
KR: 10-1316796
JP: 5511892, 5858783, 5905080
DE, DK, FR, GB, IT, NL: 2303131
Other patents pending

Notes:

Maximum display frame rates may be limited by MATLAB® display software.
*Transmit and Receive performance may be limited at frequency extremes
†Labeled "Hypertac"; Hypertronics is now part of Smiths Connectors.
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Windows® operating system is a registered trademark of Microsoft, Inc.
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