Verasonics®
The leader in Research Ultrasound™

Vantage® NXT
Research Ultrasound System

Vantage® NXT

- The successor to Verasonics' pioneering and industry-leading Vantage Research Ultrasound System.
- **Vantage *NXT*** offers a complete next generation technology update including an advanced, patented transceiver designed to meet and surpass the needs of current and future cutting-edge ultrasound research.

Vantage *NXT* – the Most Flexible, High Performance, Programmable Ultrasound Research System Available

Verasonics, the leader in research ultrasound, offers the Vantage *NXT* research platform to provide our customers with transformative performance across the fields of biomedical ultrasound, materials science, physical acoustics and more.

Vantage *NXT* builds upon the versatility and flexibility sought after by scientists, engineers and developers, while introducing state-of-the-art capabilities and features, making Vantage *NXT* the most advanced, powerful and capable research system on the market.

At the core of our ground-breaking technology is a patented transceiver, delivering enhancements to transmit and receive signal fidelity. This technology enables a single system to deliver optimal performance over a diverse range of applications, from high power transmit for ablative FUS to the highly accurate and linear transmit required for arbitrary waveform generation and signal coding.

The *NXT* level in research ultrasound offers:

- **Patented *NXT* transceiver design** – Engineered to provide the next-level of transmit and receive fidelity required for ultrasound research.
- **Enhanced high frequency imaging** over an operating bandwidth up to 60 MHz with high dynamic range and resolution provides improved performance in applications such as pre-clinical imaging, super-resolution imaging, Doppler and more.
- **Improved arbitrary waveform generation** – Improvements to transmit fidelity and encoding algorithms provide more accurate analog acoustic waveform design, delivered in a new user-friendly graphical interface and command line functions.
- **High power transmit** for a variety of FUS applications over a wide range of frequencies.
- **Volumetric and tomographic imaging** – Built on years of proven experience, Vantage *NXT* enables phase-accurate synchronization of up to 8 systems for 2048-channel data acquisition.
- **Enhanced image quality** – In addition to improvements provided by the platform hardware, over 25 optimized imaging scripts are included for various transducers and targets, specifically designed to achieve image quality comparable to clinical systems.
- **Ultra-high frame rate imaging** enabled through data acquisition into local memory limited only by acoustic travel times, 4x increased channel memory, and fast data transfer, ideal for advanced applications from Shear Wave elastography to super-resolution imaging.
- **Expanded I/O capabilities** with the addition of independently programmable triggers, quadrature encoder inputs and low frequency analog inputs enabling co-registration of ultrasound and position or physiological data.
- **Interactive help system** provides assistance for over 400 structure names, attributes and keywords to facilitate script development and reduce runtime errors. Integrated into MATLAB® Document Editor, it also provides easy access to Structure Visualization and Utility Tools.
- **Built-in simulation software** enables simulation of experiments without connection to acquisition hardware, and facilitates testing and debugging of scripts. Five simulator licenses are included with each system purchase.
- **The Universal Transducer Adapter (UTA)** enables users to quickly convert their system to operate transducers with a variety of connectors. Available in over a dozen options, one UTA is included with each Vantage *NXT* System purchase.

Vantage *NXT* platform upgradability – Every system can be upgraded to any configuration or option to maximize flexibility, extend research options and protect initial investments.

Customer service and support - Verasonics is committed to providing superior product solutions accompanied with comprehensive services to meet your research and development goals, including technical support, training and education resources and access to the Verasonics Community, a portal for helpful training tools and product information.

Commercial licensing options - By working with Verasonics, commercial organizations can achieve substantial savings in development cost and accelerate time to market.

Product Specifications

The Vantage *NXT* Research Ultrasound Platform uses patented software and hardware technologies to provide direct access to raw ultrasound data from all channels in real-time, while preserving the ability to perform high quality imaging.

The platform is designed to provide the researcher/developer with broad flexibility in defining each of the system's functional components. Researcher can conceive, implement, and evaluate a new approach to ultrasonic imaging, and ultrasound therapy monitoring or delivery using the Vantage *NXT* system.

Key Transmit Capabilities:

- Tri-state drive: + high voltage, - high voltage and ground
- Per-channel programmability: center frequency, pulse width, pulse repetition frequency (pulse duty cycle), burst length, polarity, and delay
- Per-channel transmit apodization using pulse width modulation

Key Receive Capabilities:

- 16 bit A/D converters with programmable sample rate up to 125 MHz
- Post-ADC, the system includes a digital multi-rate filter with up to 2048 taps, with programmable decimation determined by non-integer, rational factors. The multi-rate filter is programmable in MATLAB using the Verasonics FilterTool

Vantage *NXT* Transmit & Receive Specifications**

TRANSMIT SPECIFICATIONS	
Low Frequency	25 kHz - 750 kHz*
Mid Frequency	250 kHz - 24 MHz
High Frequency	1.0 MHz - 60 MHz
HIFU Operating Band	250 kHz to 8 MHz
Programmable Pulser Amplitude	3.0 to 192 V p-p
Waveform Duration	Standard: ~microseconds Extended Transmit: ~milliseconds HIFU: ~seconds
Minimum "on" state duration	4 ns
Resolution (clock frequency)	2 ns (500 MHz)
Voltage transition time	2-3 ns
FET technology	GaN
Output monitoring	Yes

RECEIVE SPECIFICATIONS	
Low Frequency	25 kHz - 750 kHz*
Mid Frequency	250 kHz - 60 MHz
High Frequency	250 kHz - 60 MHz
ADC sample rate	125 MHz
ADC Resolution	16-bit
Channel memory	256 MB
Sustained data transfer rate	Up to 52.8 Gbits/s (6.6 GB/s)
Subsampling	Non-integer, rational factors
Data type	16-bit integer, 16-bit float

** Future availability*

*** Transmit and Receive performance is limited near frequency extremes*

Vantage *NXT* Systems include 3 key components:

- The Vantage *NXT* Data Acquisition system, available in several different channel and frequency configurations.
- The Verasonics Data Acquisition Software (SW) package, MATLAB-based interface, application-level SW and additional self-test utilities to verify system performance. Also included is a comprehensive suite of example scripts. Users have the option to select the MATLAB scripting model or the Acquisition SDK for programming.
- The Host Controller, a powerful computer available in Windows or Linux with a PCI express adapter card, the MATLAB application, and other libraries and utilities pre-installed by Verasonics.

The Vantage *NXT* platform can be enhanced through the addition of licensable options, Universal Transducer Adapters (UTAs), a wide variety of transducer offerings and custom transducer connection accessories.

Licensable Options and Accessories

Extended Transmit: Increases the high voltage power supply's capability to support long-duration burst sequences up to several milliseconds.

Arbitrary Waveform Generation Package: A software option for the design of custom, high-fidelity analog acoustic waveforms from the Vantage *NXT* tri-state pulser. Includes propriety algorithms for creating arbitrary acoustic waveforms from tri-level voltage signals, a user-friendly graphical interface and command-line API for programmatic encoding. Includes Extended Transmit option.
GUI-based analog waveform design tool kit included

HIFU Configuration Option: Includes additional hardware and an external power supply for extended transmit operation up to 1000W continuous average RF power output. Includes Extended Transmit option.

Image Reconstruction: A patented software beamforming technology capable of processing >40 million pixels/second for 128 channels (approximately 300 frames per second), from a variety of data acquisition techniques to provide high quality B-mode and color Doppler image displays. Users have the option to develop their own beamforming and image processing methods and compare them to the Verasonics technology.

Synchronization Triggers: Four synchronization triggers, independently programmable as inputs or outputs with user-specified polarity, voltage level and pulse width.

NDE Imaging Software: Provides advanced real-time imaging and convenient data acquisition without the need for advanced MATLAB programming.

Quadrature Encoder Inputs: Option for digital quadrature encoder inputs. Supports three-axis position tagging of ultrasonic data and pulse-on-position operation.

Analog Inputs: Option for two low-frequency analog inputs for acquisition of auxiliary signals. Analog inputs are suitable for the recording of physiological signals, as well as a range of sensor signals. Data capture allows the alignment of analog signal inputs with ultrasound RF data during offline analysis or triggered data acquisition.

GPU Toolkit / GPU Tookit with GPU Direct: Bundled with a Host Controller, NVIDIA GPU card, and software programming tools, GPU Toolkit helps developers make the most of using the GPU to improve research. Additionally, the GPU Toolkit with GPU Direct option allows the user to copy data directly to the GPU, increasing memory copy speed, which can reduce latency and improve frame rate.

Volume Imaging Packages: 1-system, 2-system, or 4-system solutions to acquire real-time data from up to 1024-element transducers.

Multi-System Synchronization Module: Provides ability to synchronize 2-8 Vantage systems (up to 2048 channels) to within 2 ns phase offset.

Acquisition SDK: Software development kit that allows Vantage *NXT* users to program the Vantage *NXT* Platform without any MATLAB® dependencies. The SDK is comprised of a C-API that offers familiar data structures and naming conventions, enabling easy porting of MATLAB scripts.

FUS 2D and 3D GUI Software: FUS 2D or 3D GUI options provide streamlined imaging, advanced therapy planning, and real-time monitoring tools for Ultrasound-Guided Focused Ultrasound (USgFUS) applications.

I/O options available on Vantage *NXT*

	Vantage *NXT*	Applications
Triggers	**4 BNC input/outputs programable pulse width**	HW synch Photoacoustics Script debug
Quadrature Encoder Inputs	**3 quadrature encoders**	Position registration Automated scanning Robotics
Analog Inputs	**2 SMA inputs Signal +/- 5V range Sample rate 4 KHz 12-bit ADC**	Physiological inputs and sensors (ECG, stimuli, etc.)
PCIe	**Gen 3x8 FireFly™ firefly optical connection with 2 m cable (up to 100 m)**	Large distance between host and Vantage *NXT*

Vantage *NXT* I/O Panel

Vantage *NXT* Universal Transducer Adapter (UTA) Options

Universal Transducer Adapters (UTA) enable Vantage NXT System users to quickly convert a system to operate transducers with a variety of connectors. Changing from one UTA to another is simple and takes only a few minutes.

NXT UTA 260-S / NXT UTA 260-D are compatible with Verasonics labeled Transducers and ATL HDI Transducers, including 192- and 256-element probes with high voltage multiplexers.

NXT UTA 260-MUX provides multiplex connectivity for transducers with 128 or fewer directly connected elements. This module includes High Voltage Multiplexing (HVMUX) switching capability, which allows systems to access all of the 128-element signals at the connector.

NXT UTA 408-GE enables compatibility with certain GE and Verasonics transducers that use the 408 contact connector.
The NXT UTA 408-GE is available on the Vantage NXT 64LE, 128, 256.

NXT UTA 408-GE MUX provides multiplex connectivity for transducers with 128 or fewer directly connected elements.
The NXT UTA 408-GE MUX is available on the Vantage NXT 32LE and 64.

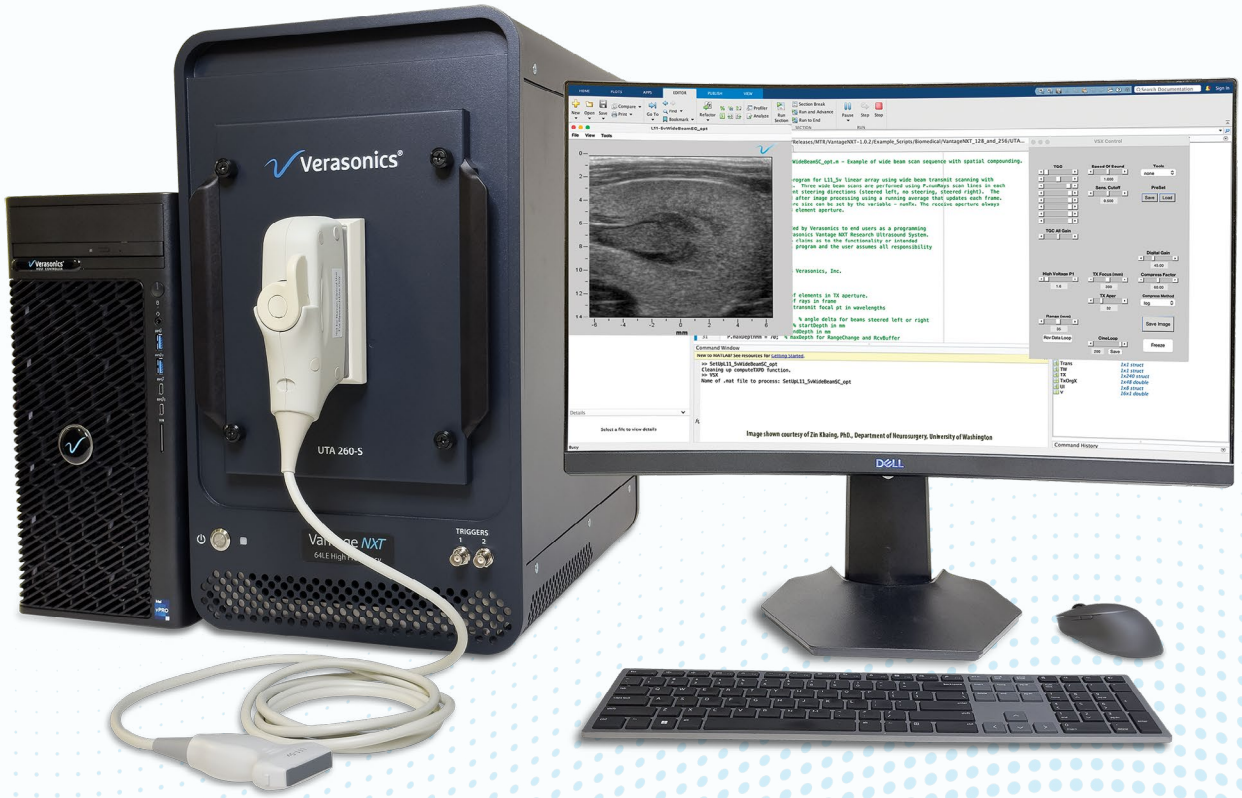
NXT UTA 1024-MUX provides multiplex connectivity for transducers with up to 1024 elements on system configurations with fewer channels.

NXT UTA 256 Direct provides direct connections for custom transducers with up to 256 elements without the use of a multiplexer.

NXT UTA 64 LEMO and NXT UTA 128 LEMO provides 64 or 128 LEMO series 00 connectors for single element transducers.

NXT UTA 160-SH/8 LEMO and NXT UTA 160-DH/32 LEMO with single or dual Hypertronix connectors and LEMO connectors.

NXT UTA 160-SI/8 LEMO (I-PEX) with single I-PEX connector and 8 LEMO connectors.



Vantage *NXT* Research Ultrasound System

Transducer Offerings

Vantage NXT Systems are designed to support a wide variety of transducer technologies. Verasonics has partnered with leading transducer manufacturers to provide cutting-edge specialty transducers.

General Imaging Transducers

- **L11-5gH:** 128-element linear array; requires UTA 408-GE.
- **C5-2gH:** 128-element curved array; requires UTA 408-GE.
- **P4-2gH:** 96-element phased array; requires UTA 408-GE.
- **L11-5v:** 128-element linear array; requires one of the UTA 260 adapters.

Transducers from GE

- **GE L3-12-D:** 256-element linear array with HVMux.
- **GE C1-6-D:** 192-element curved array.
- **GE IC5-9-D:** 192-element intracavitary curved array.
- **GE M5Sc-D:** 80x3 elements, 1.5 D phased array.
- **GE 9L-D:** 192-element linear array.

Specialty Transducers

- **L22-14vX single crystal, high frequency linear array:** 128-element array (also available as the L22-14vX LF Long Focus - for applications requiring a greater elevation focus depth).
- **L35-16vX single crystal, high frequency linear array:** 128-element array.
- **L38-22v CMUT high frequency linear array:** 256-element array with HVMux.
- **FUS transducers:** High-performance transducer pairings enabling low- or high-intensity Ultrasound Guided Focused Ultrasound (USgFUS) research, from 500 kHz to 2 MHz.
- **Matrix Array Transducers:** 1024-element (32x32) matrix arrays at 3 MHz and 8 MHz.
- **Row-Column Array Transducers:** 6 MHz 256-element (128x2) orthogonal and 15 MHz 160-element (80x2) orthogonal arrays.

Custom Transducer Connection Accessories

Verasonics offers a variety of solutions for the transducer developer who needs a flexible means of connecting to the Vantage System, or the researcher who wants to use transducers with other connectors.

Ribbon Cable Break-out Board: Printed circuit board adapter that plugs into the 260-pin system connector and provides 0.1" headers for ribbon cable connection to custom transducers. Also includes space for impedance matching elements. Symmetric boards for left and right connectors on dual 260-pin connector Vantage 256 system.

260-pin Transducer Backshell Kit w/PCBs: Ideal for reserachers who are developing their own transducers, and/or those who want to integrate commercial transducers and have the pin-out information. Available with zero ohm tuning or unpopulated with pads for tuning elements, for up to 128 channels.
Only compatible with 260-pin UTAs.

GE-408-pin Transducer Backshell Kit, w/PCBs: Similar to the 260-pin kits, allows connections for up to 256 channels, plus power supply and digital control signals.

Offset adapter: Connects to the 260-pin ZIF connector and provides I/O pin access inline to evaluate the signals from array transducers. Includes four LEMO connectors for additional configuration options.

Termination Boards Package: For integration of custom, high-element count transducers. Package of 10 boards for use with UTA-256 Direct or UTA-1024 MUX.

Vantage *NXT* System Configurations / Licensable Options

Choose the configuration and options that best meet your research requirements.

	Vantage *NXT* 32LE	Vantage *NXT* 64	Vantage *NXT* 64LE	Vantage *NXT* 128	Vantage *NXT* 256
CHANNELS	64 Tx / 32 Rx	64 Tx / 64 Rx	128 Tx / 64 Rx	128 Tx / 128 Rx	256 Tx / 256 Rx
CONFIGURATIONS					
Low Frequency* (25 kHz - 750 kHz)	✓	✓	✓	✓	✓
Mid Frequency (250 kHz - 24 MHz)	✓	✓	✓	✓	✓
High Frequency (1.0 MHz - 60 MHz)	✓	✓	✓	✓	✓
HIFU (Choice of Windows or Linux OS) (250 kHz - 8 MHz)	N/A	N/A	✓	✓	✓
External Clock	N/A	N/A	N/A	N/A	✓
LICENSABLE OPTIONS					
Extended Transmit	✓	✓	✓	✓	✓
Arbitrary Waveform	✓	✓	✓	✓	✓
Image Reconstruction	✓	✓	Included	Included	Included
Synchronization Triggers	✓	✓	✓	Included	Included
Quadrature Encoder Inputs	✓	✓	✓	✓	✓
Analog Inputs	✓	✓	✓	✓	✓
FUS 2D GUI (HIFU Config)	N/A	N/A	N/A	✓	✓
FUS 3D GUI (HIFU Config)	N/A	N/A	✓	✓	✓
NDE Imaging Software	✓	✓	✓	✓	✓
GPU Toolkit	✓	✓	✓	✓	✓
GPU Toolkit with GPU Direct	✓	✓	✓	✓	✓
Volume Imaging Package – Essential	N/A	N/A	N/A	N/A	✓
Volume Imaging Package – Expansion	N/A	N/A	N/A	N/A	✓

✓= Purchasable configuration or option. All Vantage NXT systems can be reconfigured or upgraded to additional options
** Future availabilty*

Intended use

Vantage *NXT* System is a laboratory research and/or development platform and is intended to be used to acquire, store, display, and analyze ultrasound data. The system as provided by Verasonics is not approved for patient use. Users must perform additional testing to comply with local regulatory requirements for patient use.

Safety Certifications

- IEC 61010-1:2010, IEC 61010-1:2010/AMD1:2016
- CSA C22.2 No. 61010-1-12, UPD1:2015, UPD2:2016, AMD1:2018
- UL 61010-1 3rd ed (2018)

Power Consumption***

- Idle state: 200 W (typical)
- Operating state: Up to 280 W (typical running an imaging script)
- Up to 500 W (HIFU transmit with all 256 channels active)

Dimensions:

- Data acquisition system (L x W x H): 47.6cm (+10cm clearance) x 28cm x 48.9cm
- Host Controller (L x W x H): 61cm x 30.5cm x 67.3cm
- Total weight of a Vantage *NXT* 64LE, 128, or 256 channel configuration with Performance Host Controller: approx. 40.8 Kg.
  - Configuration weight can vary based on number of channels, frequency range, and host controller.

Scientific Database

Researchers across the globe frequently publish groundbreaking advancements made with Verasonics' solutions; these advancements are often referenced in scientific publications.

Access our Scientific Database at:
https://verasonics.com/ scientific-references-database/

**** Power consumption can vary based on configuration. Estimates do not include host controller, display monitor, external HIFU transmit supply, or other peripheral devices.*

Verasonics Inc.
11335 NE 122nd Way, Suite 100, Kirkland, WA 98034
www.verasonics.com | sales@verasonics.com