Vivid E90

Product Description

The Vivid™ E90 combines the proven breadth, quality and performance of the Vivid product line with a new and innovative software image processing platform: cSound.™ The Vivid E90 is GE cardiovascular ultrasound's 2D leadership scanner.

The system is designed to excel in adult 2D cardiac imaging, as well as in the following clinical application areas: pediatric cardiac, fetal/obstetrics, abdominal (including renal, GYN/pelvic), pediatrics, small organ (including breasts, testes and thyroid), adult and neonatal cephalic, peripheral vascular, musculoskeletal conventional, urology/prostate, transesophageal, transrectal, transvaginal and intraoperative (including vascular, thoracic/cardiac and abdominal).

Vivid E90 is delivered with a high-quality 22" high-resolution wide screen OLED monitor for optimal spatial and dynamic resolution.

System Architecture

GE's exclusive, programmable and flexible beamforming technology, cSound, provides exceptional power compared to that conventional GE hardware-based beam forming technology. In 2D, cSound offers true confocal imaging without the limitation of focal zones or sacrifice of frame rate and spatial resolution. Using both coherent and harmonic image processing, the system provides computational power, ease of imaging, workflow flexibility and product upgradeability.

The Vivid E90 is designed to excel in the following areas:

Exceptional image quality is created through the use of True Confocal Imaging. True Confocal Imaging is enabled by the cSound platform taking advantage of advanced software image reconstruction and state-of-the-art graphics computer technology. The Vivid E90 combines Ultra Definition Clarity filtering, HD Imaging (optimal resolution, penetration and image uniformity), Adaptive Contrast Enhancement (ACE) and virtual apex (wide field-of-view) to deliver excellent cardiovascular ultrasound image quality.

Probe Technology – The XDclear™ series of probes are designed to help deliver powerful and efficient sound waves, with high bandwidth and efficiency. The XDclear probe technology provides impressive deep penetration and high sensitivity while maintaining high spatial resolution. The combination of Single Crystal, Acoustic Amplifier and Cool Stack technologies is the core technology of the XDclear series of probes.

Ease of use features are designed to make the Vivid E90 a very productive cardiovascular ultrasound system. The addition of a high-resolution touch panel, combined with the familiar user interface of the Vivid product line helps give both new and existing Vivid users an easy and effortless start to learning this new scanner.

Additional ease of use for the operator in 2D imaging is provided by the cSound technology delivering auto optimized excellent image quality with minimal manipulation along with automated tools like 2D Auto EF, AFI Productivity Package, AFI Stress and Scan Assist Pro.

Ergonomic features include a highly portable user-adaptable design with electronic adjustable height and keyboard, articulating and height adjustable monitor, and lightweight transducers combining to make the Vivid E90 an ergonomic-friendly cardiovascular ultrasound system.

The cSound platform takes GE's **Raw Data** to a new level. For image processing and reconstruction, the Vivid E90 utilizes more than 100 times the data compared to its predecessor.

Additionally, the Vivid E90 uses an innovative data format technology that allows for advanced processing on archived images by applying many of the same scan controls and **advanced quantitative tools** as are available during the original exam.

General Specifications

Dimensions and Weight

- Width: 544 mm, 21 3/4"
- Depth: 844 mm, 33 1/4"

- Height: 1230 mm – 1670 mm, 48 3/8" – 65 3/4" (up/down mechanism + LCD arm)
- Weight: 126 kg, 278 lbs

Electrical Power

- Nominal input voltage: 100-240 VAC, 50/60 Hz
- Typical power consumption: 500 W @ default cardiac preset with M5Sc
- Rated power consumption: 700 W

Operating System

- Windows® 7

Console Design

- Five active probe ports
- ECG port
- Integrated HDD
- Multiple USB ports (front/back)
- Integrated DVD-R multi drive (optional)
- On-board storage for B/W thermal printer
- Integrated speakers for premium sound
- Integrated locking mechanism that provides rolling lock and caster swivel lock
- Integrated cable management
- Easily accessible removable air filters for cleaning
- Front and rear handles
- Side storage trays
- Rear storage trays/baskets
- Hand rest

User Interface

Operator Keyboard

- Floating keyboard adjustable in three dimensions:
  - Height
  - Rotation
  - Extension
- Touch keyboard with support for characters in 12 languages
- Drawer type, lit, A/N keyboard
- Support for international (European) keyboard character sets (ISO 8859)
- Ergonomic hard key layout
- Interactive back lighting
- Integrated gel holders
- User-configurable probe holders
- Easy-to-learn user interface with intelligent keyboard
- Dedicated rotary for overall gain for 2D-mode
- Dedicated gain rotary for M-mode, CFM or Doppler controlled by active mode
- Image manager on the touch screen for quick review of image clipboard contents

Touch Screen

- 12" ultra-high-resolution, wide screen format, color, multi-touch LCD screen
- Interactive user-configurable dynamic software menu
- Backlight adjustment – automatic by light sensor or manual
- Touch-panel controls content can be set to routine or extended usage

Monitor

- 22" wide screen High-Definition (HD) flicker-free, high-contrast OLED display
- 256 shades of gray and 16.7 million simultaneous colors available
- Articulated monitor arm
- Monitor translation (independent of console):
  - 350 mm horizontal bidirectional
  - 150 mm vertical height adjustment
  - Swivel to any viewing direction
- Fold down and rotation lock mechanism for transportation
- Horizontal viewing angle of more than 170°
- Resolution: 1920 x 1080 for 22" screen
- Tint and backlight adjustments
- Separate adjustment for external monitor brightness/contrast

System Overview

Probe Presets

- Cardiac
- Stress (incl. Exercise, QStress and LVO Stress) (optional)
- Abdominal (incl. renal)
- Vascular (incl. carotid, LEA, LEV, UEA, UEV, aorto-Iliac)
- Fetal heart
- Pediatric
- Neonatal
- Neonatal head
- Small parts
- Thyroid
- Breast
- Musculoskeletal
- Intra Operative
- Transcranial
- Scrotal
- Urology (incl. pelvic)
- Rodent (incl. rats and mice for research)
- Transesophageal
- OB/GYN
- Coronary
- Contrast (optional)
- Contrast low MI (optional)
- LVO contrast

Operating Modes

- 2D tissue
- 2D color flow
- 2D angio flow
- Color M-mode
- Tissue velocity M-mode
- Continuous wave Doppler
- Tissue M-mode
- Pulsed wave Doppler
- Anatomical M-mode
- Curved anatomical M-mode
- Tissue velocity imaging

- Tissue tracking
- Tissue synchronization imaging (optional)
- Strain imaging (optional)
- Strain rate imaging (optional)
- Tissue velocity Doppler
- Blood flow imaging
- Blood flow angio flow imaging
- B-flow
- 2D stress (optional)
- AFI Automated Function Imaging (optional)
- Auto EF (optional)
- 2D virtual apex imaging
- Bi-plane/tri-plane (6VT only)
- Bi- and tri-plane with color (6VT only)
- Coded phase inversion and power modulation contrast imaging
- Compound imaging
- Extended field-of-view (LOGIQView)

Scanning Methods

- Electronic sector
- Electronic convex
- Electronic linear
- CW pencil

Transducer Types

- Sector phased array
- Convex array
- Linear array
- Single crystal matrix array
- 2D matrix array

Peripheral Options

- Console protective cover

Internal peripherals

- USB B/W video printer with control from system (optional)

External peripherals

- Direct streaming DVR (Sony® HVO-550MD)
- Network printers
  - USB inkjet printer
  - Color laser printer
  - Color video printer with control from system
- 16 GB memory stick with encryption
- USB hard drive – total disk size 4 TB (2 x 2 TB SATA II hard drive)
- Usable disk size 2 TB (drives are mirror for data redundancy)
- Three-pedal configurable footswitch
- Optical isolation cable – DVI 104 fiber optic extender, can be used to provide isolation when connecting external monitors

External outputs

- DVI-D
- Ethernet – 10 Mbps, 100 Mbps, 1 Gbps
- Multiple USB 2.0 ports

Display Modes

- Live and stored display format: Full size and split screen, both with thumbnails, for still and cine
- Instant-review screen displays 12 simultaneous loops/images for a quick study review
- Selectable display configuration of duplex and triplex modes: side-by-side or top-bottom during live, digital replay and clipboard image recall
- Single, dual and quad-screen view
- Simultaneous capability
  - 2D + PW/CW
  - 2D + CFM/TVI + PW
  - 2D + CFM + CW
  - 2D + CFM/Angio/TVI/SRI/TT/SI/TSI
  - 2D + M/AMM/CAMM
  - 2D + CFM/Angio/TVI/SRI/TT/SI/TSI + M/AMM/CAMM
  - Real-time duplex or triplex mode
  - Compound + M/CFM/PW
  - 2D + bi-plane (6VT only)
  - 2D + bi-plane + CFM/TVI/SRI/TT/SI/TSI/AMM/CAMM (6VT only)
  - 2D + tri-plane (6VT only)
  - 2D + tri-plane + CFM/TVI/SRI/TT/SI/TSI/AMM/CAMM (6VT only)
- Selectable alternating modes
  - 2D or compound + PW
  - 2D + CW
  - 2D or compound + CFM/PW
  - 2D + CFM + CW
- Multi-image (split/quad screen)
  - Live and/or frozen
  - Independent cine playback
- Timeline display
  - Independent 2D (or compound) + PW/CW/M display
  - Display formats
- Top/bottom selectable format
- Side/side selectable format

Display Annotation

- Patient name: First, last and middle
- Patient ID
- Additional patient ID
- Age, sex and birth date
- Hospital name
- Date format: Two types selectable – MM/DD/YY, DD/MM/YY
- Time format: Two types selectable – 24 hours, 12 hours
- Gestational age from LMP/EDD/GA
- Probe name
- Map names
- Probe orientation
- Depth scale marker
- Image depth
- Zoom depth
- B-mode
  - Gain
  - Imaging frequency
  - Frame averaging
- M-mode
  - Gain
  - Frequency
  - Time scale
- Doppler mode
  - Gain
  - Angle
  - Sample volume size and position
  - Wall filter
  - Velocity and/or frequency scale
  - Spectrum inversion

- Time scale
  - PRF
  - Doppler frequency
- Color flow Doppler mode
  - Frame rate
  - Sample volume size
  - Color scale
  - Power
  - Color baseline
  - Color threshold marker
  - Color gain
- Spectrum inversion
- Acoustic frame rate
- CINE gauge, image number/frame number
- Bodymarks: Multiple human anatomical structures
- Application/preset name
- Measurement results
- Operator message
- Displayed acoustic output
  - TIS: Thermal Index Soft Tissue
  - TIC: Thermal Index Cranial (Bone)
  - TIB: Thermal Index Bone
- MI: Mechanical index
- Power output in dB
- Biopsy guide line and zone
- Heart rate
- Trackball-driven annotation arrows
- Active mode display
- Stress protocol parameters
- Parameter annotation follow ASE standard
- Free text with word library
- 4D slice intersection markers
- 4D gauge
- 4D viewing angle arrows
- 4D geometry viewer
- 4D number of cycles
- Scan plane position indicator and probe temperature are displayed with all TEE probes
- Image orientation marker

General System Parameters

System Setup

- Pre-programmable M&A and annotation categories
- User-programmable preset capability with administrator preset protection
- Factory default preset data, protected against modification
- User-defined annotations
- Body patterns
- Customized comment home position

Comprehensive User Manual Available on Board

Available through touch-panel utility page. User manual and service manual are included on a USB memory device with each system. A printed user manual is provided.

- User manual languages: English, French, German, Spanish, Italian, Portuguese (European and Brazilian), Swedish, Danish, Dutch, Norwegian, Japanese, Chinese, Polish, Finnish, Greek, Russian, Hungarian, Slovak, Romanian, Czech, Latvian, Lithuanian, Turkish, Estonian, Korean, Serbian, Bulgarian, Croatian, Indonesian, Kazakh, Ukraine

CINE Memory/Image Memory

- 8 GB of RAM (0.5 GB used for cine memory)
- Selectable cine sequence for cine review
- Measurements/calculations and annotations on cine playback
- Scrolling timeline memory
- Dual-image cine display
- Quad-image cine display
- CINE gauge and cine image number display
- CINE review loop
- CINE review speed

Image Storage

- On-board database of patient information from past exams
- User-selectable ECG and time gated acquisition available on touch panel during live
- User-selectable prospective or retrospective capture in config
- Storage formats:
  - DICOM®-compressed or uncompressed, single/multi-frame, with/without raw data, storage via clipboard and/or seamlessly directly to destination device
  - Transfer/"Save As" JPEG, MPEG, AVI and DICOM formats
- Storage devices:
  - USB memory stick: 16 GB
  - CD-RW storage: 700 MB (DVD option required)
  - DVD storage: -R (4.7 GB) (DVD option required)
  - Hard drive image storage: 0.5 TB
- Compare old images with current exam
- Reload of archived data sets
- Activation control of USB devices (for security)

Connectivity and DICOM
(DICOM optional)

- Ethernet network connection
- DICOM 3.0
- Verify
- Print
- Store
- Modality worklist
- Storage commitment
- Modality Performed Procedure Step (MPPS)
- Media exchange
- DICOM spooler
- DICOM query/retrieve
- Structured reporting – compatible with adult cardiac and vascular
- Media store of structured reporting
- InSite™ ExC capability for remote service/access

- Support of two patients' IDs in DICOM
- Separate DICOM SR and image storage destinations
- Simultaneous transfer of DICOM to multiple destinations

Patient Archive

EchoPAC™/Patient Archive

- Integrated EchoPAC functionality adds connectivity and image analysis capability to scanner
- Data format fully compatible with offline EchoPAC review/reporting stations of same or newer vintage
- Instant access to ultrasound raw data provided by the system
- Advanced post-processing analysis
- Three user levels help organizing data security requirements
- E-signoff compatibility, with clear indications in patient management screens and report screen that a report was signed off, and by whom and at what time. The signed off report and exam cannot be changed. The "Diagnosing Physician" field is automatically assigned to the user that did the sign-off

Image and Data Management

- Exceptional workflow with instant access data management
- DICOM 3.0 support – see DICOM conformance statement for details
- Support for transfer of the proprietary raw data files within the DICOM standard
- 2D, CFM or TVI data at maximum frame rate may be reviewed by scrolling or by running cine loops (can contain more than 1000 images for imaging modes)
- Image clipboard for stamp-size storage and review of stored images and loops
- Built-in patient archive with images/loops, patient information, measurements and reports
- DICOM-SR Standard structured reporting mechanism
- Structured findings report tools support efficient text entries with direct editing of findings text, usability improvements, new configuration options and conclusion section
- User can enter normal values which are then compared to actual measurements
- Configurable HTML-based report function
- Report templates can be customized on board
- ASE-based default text modules (English), user-customizable
- Internal archive data can be exported to removable image storage through DICOM media
- Internal hard disk – for storing programs, application defaults, ultrasound images and patient archive
- All data storage is based on ultrasound raw data, allowing to change gain, baseline, color maps, sweep speeds, etc., for recalled images and loops
- DICOM media – read/write images on DICOM format
- DICOM viewer embedded on media (optional and selectable in Config)
- Alphanumeric data can be exported in XML format
- JPEG export ("Save As") for still frames
- AVI and MPEG export ("Save As") for cineloops

Insite™ Express Connection (ExC)

Enables Remote Service and Training

- Easy, flexible and secure connectivity configuration. The "Contact GE" on-screen button directly generates a real-time service request to the GE online engineering or application specialist. It takes a snapshot of the system at the time of the service request to enable analysis of problem before customer contact
- Virtual Console Observation (VCO) enables the customer to allow desktop screens to be viewed and controlled remotely over the encrypted tunnel to enable real-time training, device configuration and clinical application support
- Operation of Insite Express Connection is dependent on the infrastructure being available – check with your local GE service representative
- File transfer enables the customer (biomed or clinician) to directly transfer system information (e.g., system logs, images, parametric data) to GE product engineering teams
- Software reload provides remote application reconstruction and recovery capabilities in the event of system corruption

Scanning Parameters

- Infinite number of effective channels
- Minimum field-of-view range (depth): 0 – 2 cm (zoom) (probe dependent)
- Maximum field-of-view range (depth): 0 – 50 cm (probe dependent)
- Width range: 10 – 120 degrees
- Continuous dynamic receive focus/ continuous dynamic receive aperture
- Continuous dynamic transmit focus
- Adjustable dynamic range, infinite upper level
- Image reverse: Right/left
- Image rotation of 0,° 180°

Tissue Imaging

General

- Variable transmit frequencies for resolution/penetration optimization
- Display zoom with zoom area control
- High-Resolution (HR) zoom – concentrates all image acquisition power into selected Region of Interest (ROI)
- Variable contour filtering – for edge enhancement
- Depth range up to 36 cm – probe specific

- Selectable grayscale parameters: Gain, reject, DDP, clarity, dynamic range and compress – can be adjusted in live, digital replay and image clipboard recall (probe dependent)
- Automatically calculated TGC curves reduces operator interaction
- Automatically calculated lateral gain

2D Mode

- Sector tilt and width control
- Frame rate in excess of 1000 fps, depending on probe, settings and applications
- Coded octave imaging with coded phase inversion – 3rd generation harmonic tissue imaging providing improved lateral and contrast resolution over conventional fundamental imaging. Features help reduce noise, improve wall definition, and axial resolution, making it well suited for a wide variety of patient groups
- True confocal imaging – ultra narrow focused two-way beam profile throughout the field-of-view, maintaining frame rate, no zone stitching, no multi-line acquisition artifacts and enhanced dynamic contrast resolution throughout field-of-view compared to conventional focal imaging
- Adaptive Contrast Enhancement (ACE) – emphasizing echoes from real structures while reducing noise/haze, resulting in enhanced signal-to-noise ratio
- Automatic tissue optimization – single keystroke optimizes immediately automatically and dynamically different grayscale settings with the goal of signal independent uniform gain and contrast distribution
- UD clarity and UD speckle reduce imaging – an advanced image processing technique to remove speckle in real-time examining the relative difference between neighboring pixel values and determining whether the grayscale variations have a sharp difference, follow a trend, or are random in nature
- HD imaging – real-time simultaneous acquisition at dual frequencies compounded to help reduce speckle and noise while enhancing resolution and contrast
- Multiple-angle compound imaging – multiple co-planar images from different angles combined into a single image in real-time to help enhance border definition and contrast resolution, as well as reduce angular dependence of border or edge as compared to no-compound imaging
- Elevation compounding (4D probes only)
- LOGIQView: provides the ability to construct and view a static 2D image with wider field-of-view of a given transducer. This allows viewing and measurements of anatomy that is larger than what would fit in a single image
- Virtual apex provides a wider field-of-view with phased array probes, effective at certain imaging views where a wide near field may be preferred
- L/R and up/down invert, in live, digital replay or image clipboard recall
- Digital replay for retrospective review or automatic looping of images, allowing for adjustment of parameters such as gain, reject, anatomical M-mode, persistence and replay speed
- Data dependent processing performs temporal processing which helps reduce random noise but leaves motion of significant tissue structures largely unaffected – can be adjusted even in digital replay
- 256 shades of gray
- Colorized 2D-mode, user-selectable in real-time, digital replay
- Optimized presets for further 2D strain analysis on EchoPAC (separate option)

Multi-Dimensional Mode
(optional, 6VT-D probe)

- Bi-plane scanning – two independent simultaneous scan planes where one of them can be rotated and tilted freely
- Bi-plane prepare mode for ease of obtaining biplane views from 4D render data sets
- Tri-plane – three independent simultaneous scan planes that can be rotated freely
- Both bi-plane and tri-plane scanning is possible in all color Doppler modes

M-mode

- Trackball steers M-mode line available with all imaging probes – max steering angle is probe dependent
- Simultaneous real-time 2D- and M-mode
- M-mode PRF 1 kHz – image data acquired is combined to give high-quality recording regardless of display scroll speed
- Digital replay for retrospective review of spectral data
- Several top-bottom formats, side-by-side format and time-motion-only format – can be adjusted in live or digital replay
- Selectable horizontal scroll speed: 1, 2, 3, 4, 6, 8, 12, 16 seconds across display
- Horizontal scroll can be adjusted in live or digital replay

Anatomical M-mode

- M-mode cursor can be adjusted at any plane
- Curved anatomical M-mode – free (curved) drawing of M-mode generated from the cursor independent from the axial plane
- Can be activated from live, digital replay or image clipboard recall
- Anatomical color and tissue velocity M-mode
- M&A capability

Color Doppler Imaging

General

- Steerable color Doppler available with all imaging probes – max steering angle is probe dependent
- Trackball-controlled ROI

- Removal of color map from the tissue during digital replay
- Digital replay for retrospective review of color or color M-mode data allowing for adjustment of parameters such as encoding principle, color priority and color gain even on stored data
- PRF settings – user-selectable
- Advanced regression wall filter gives efficient suppression of wall clutter
- For each encoding principle, multiple color maps can be selected in live and digital replay – variance maps available
- More than 65,000 simultaneous colors processed, providing a smooth display two-dimensional color maps containing a multitude of color hues
- Simultaneous display of grayscale 2D and 2D with color flow
- Color invert – user-selectable in live and digital replay
- Variable color baseline – user-selectable in live and digital replay
- Multi-variate color priority function gives delineation of disturbed flows even across bright areas of the 2D-mode image
- Color Doppler frequency can be changed independently from 2D

Color Flow Imaging

- The cSound platform with its parallel beamformer architecture allows a combination of ultra-high frame rate and increased lateral resolution compared to previous generation GE scanners
- Ultra-high digital signal processing power, maintaining high frame rates with large ROI's even for very low PRF settings
- Frame rate in excess of 150 fps, depending on probe and settings
- Variable ROI size in width and depth
- User-selectable radial and lateral averaging to help reduce statistical uncertainty in the color velocity and variance estimates
- Data Dependent Processing (DDP) performs temporal processing and display smoothing to help reduce loss of transient events of hemo-dynamic significance
- Digital replay for retrospective review or automatic looping of color images, allowing for adjustment of parameters such as DDP, encoding principle, baseline shift, color maps, color priority and color gain even on frozen/recalled data
- Application-dependent, multi-variate motion discriminator helps reduce flash artifacts
- Dedicated coronary flow application
- Multiple-angle compound imaging in 2D mode is maintained while in color Doppler mode

Multi-Dimensional Color Mode
(optional, 6VT-D only)

- Bi-plane and tri-plane scanning with all color Doppler and tissue velocity modes

Color Angio

- Angle-independent mode for visualization of small vessels with increased sensitivity compared to standard color flow of previous GE products

Color M-mode

- Variable ROI length and position – user-selectable
- User-selectable radial averaging to help reduce statistical uncertainty in the color velocity and variance estimates
- Selectable horizontal scroll speed: 1, 2, 3, 4, 6, 8, 12, 16 seconds across display – can be adjusted during live, digital replay or image clipboard recall
- Real-time 2D image while in color M-mode
- Same controls and functions available as in standard 2D color Doppler

Anatomical Color M-mode

- GE-patented, any plane color M-mode display derived from color Doppler cine loop
- Also applicable to tissue velocity Imaging
- M&A capability

B-flow

- B-flow is a digital imaging technique that provides real-time visualization of vascular hemodynamics by directly visualizing blood reflectors and presenting this information in a grayscale display
- Use of GE-patented techniques to boost blood echoes, and to help preferentially suppress non-moving tissue signals
- B-flow is available for most vascular and shared service applications

Blood Flow Imaging

- Combines color Doppler with grayscale speckle imaging
- Helps improve delineation of blood flow without bleeding into tissue or vessel wall

Blood Flow Angio Imaging

- Combines angio with grayscale speckle imaging

Tissue Velocity Imaging

Tissue Velocity Imaging Mode

- Myocardial Doppler imaging with color overlay on tissue image
- Tissue Doppler data can be acquired in background during regular 2D imaging
- The velocity of myocardial segments after entire heart cycle can be displayed in one single image
- Tissue color overlay can be removed to show just the 2D image, still retaining the tissue velocity information
- Quantitative profiles for TVI, tissue tracking, strain and strain rate can be derived
- Time markers for valve events derived from any TM mode help simplify understanding of signals in velocity traces or curved anatomical M-mode

Tissue Tracking Mode (optional)

- Real-time display of the time integral of TVI for quantitative display of myocardial systolic displacement
- Myocardial displacement is calculated and displayed as a color-coded overlay on the grayscale and M-mode image – different colors represent different displacement ranges

Tissue Synchronization Imaging Mode (option, enabled by Advanced QScan)

- Parametric imaging which gives information about synchronicity of myocardial motion
- Myocardial segments colored according to time to peak velocity, green for early and red for late peak
- Waveform trace available to obtain quantitative time to peak measurement from TSI Image
- Available in live scanning, as well as an offline calculation derived from tissue Doppler data
- Additional features in combination with multi-dimensional imaging option
- Simultaneous acquisition of tri-plane TSI images covering all standard in apical views
- Efficient segment specific TSI time measurements
- Immediate bulls-eye report
- Automatic calculated TSI synchrony indexes
- TSI surface mapping
- LV synchronization report template
- CRT programming protocol

Strain/Strain Rate Mode (option, enabled by Advanced QScan)

- Tissue deformation (strain) is calculated and displayed as real-time, color-coded overlay on the 2D image
- Cine compound calculates and displays cineloops generated from a temporal averaging of multiple consecutive heart cycles
- Anatomical M-mode and curved anatomical M-mode displays (SI and SRI)

Spectral Doppler

General

- Operates in PW, HPRF and CW modes
- Trackball steerable Doppler available with all imaging probes – max steering angle is probe dependent
- Selectable Doppler frequency for enhanced optimization
- High-quality, real-time duplex or triplex operation in all Doppler modes, CW and PW, and for all velocity settings
- Frame rate control for optimized use of acquisition power between spectrum, 2D and color Doppler modes in duplex or triplex modes
- Very fast and flexible spectrum analysis with an equivalent DFT rate of 0.2 ms
- Automatic Spectrum Optimization (ASO) provides a single push, automatic, real-time optimization of PW or CW spectrum scale and baseline display
- Dynamic gain compensation for display of flows with varying signal strengths over the cardiac cycle to help improve ease of use
- Dynamic reject gives consistent suppression of background – user-selectable in real-time, digital replay or image clipboard recall
- Digital replay for retrospective review of spectral Doppler data
- Several top-bottom formats, side-by-side format and time-motion-only format – can be adjusted in live or digital replay
- Selectable horizontal scroll speed: 1, 2, 3, 4, 6, 8, 12, 16 seconds across display – can be adjusted in live or digital replay
- Adjustable spectral Doppler display parameters: Gain, reject, compress, color maps – can be adjusted in live or digital replay
- User-adjustable baseline shift – in live, digital replay and image clipboard recall
- Adjustable velocity scale
- Wall filters with range 10-2000 Hz (velocity scale dependent)
- Angle correction with automatic adjustment of velocity scale – in live, digital replay and image clipboard recall
- Auto Doppler angle
- Stereo speakers mounted in the front panel
- Display annotations of frequency, mode, scales, Nyquist limit, wall filter setting, angle correction, acoustic power indices
- Compound in duplex

PW/HPRF Doppler

- Automatic HPRF Doppler maintains its sensitivity even for shallow depths and with the highest PRF's
- Digital velocity tracking Doppler employs processing in range and time for high-quality spectral displays
- Adjustable sample volume size of 1-16 mm (probe dependent)
- Maximum sample volume depth 30 cm

CW Doppler

- Highly sensitive steerable CW available with all phased array probes
- Tissue velocity Doppler

Contrast Imaging

LVO Contrast (standard)

- Enables contrast applications intended for imaging of the left ventricle
- LV contrast (M5Sc-D, 6VT-D) enhances delineation of the LV border in combination with ultrasound contrast agents. The implementation of GE's Coded Phase Inversion (CPI) provides high-resolution detection of contrast in the LV cavity and excellent suppression of myocardial tissue signals
- LVO stress (M5Sc-D) provides enhanced delineation of the LV border when contrast is used as part of an exercise stress exam, preserving an adequately long continuous capture buffer length

Physiological Traces

- Integrated three-lead ECG module
- Automatic QRS complex detection
- External ECG lead input
- Up to three traces display simultaneously
- Internally generated respiratory trace using ECG leads
- ECG trigger
- ECG lead selection
- High-resolution display of the following traces: ECG, respiration, phono, and pressure/AUX
- Adjustable ECG QRS markers

Automatic Optimization

- Dynamic optimization of B-mode image to improve contrast resolution, TGC and grayscale (soft or sharp, user-selectable)
- Auto-spectral optimize – dynamic adjustments of baseline, and PRF (on live image) and angle correction

Measurement and Analysis (M&A)

- Personalized measurement protocols allow individual set and order of M&A items
- Measurements can be labeled seamlessly by using protocols or post assignments
- Measurements assignable to protocol capability
- Parameter annotation follow ASE standard
- Seamless data storage and report creation
- User-assignable parameters
- Comprehensive set of cardiac measurements and calculations to help assess dimensions, flow properties and other functional parameters of the heart
- Comprehensive set of shared service measurements and calculations covering vascular, abdominal, obstetrics and other application areas
- Configuration package to set up a customized set and sequence of measurements to use, defining user-defined measurements and changing settings for the factory-defined measurements
- Stress echo support allowing wall motion scoring and automatic stress level labeling of measurements
- Support for measuring on DVR recordings and DICOM images
- Automatic Doppler trace functionality for use in non-cardiac applications in both live and replay
- Worksheet for review, edit and deletion of performed measurements
- Reporting support allowing a configurable set of measurements to be shown in the exam report
- DICOM SR export of measurement data

Intima Media Thickness (IMT) Measurements (optional)

- Automatic measurements (patent pending) of carotid artery Intima-Media Thickness (IMT) on any acquired frame
- On-board IMT package facilitates non-interrupted workflow – fully integrated with M&A, worksheet, archiving and reporting functions
- Algorithm provides robust, quick, reliable measurements which can be stored to the on-board archive for review and reporting
- IMT measurement can be made from frozen images or images retrieved from archive
- IMT package supports measurements of different regions of the intima in the carotid vessel (e.g., Lt./Rt./CCA/ICA etc.)
- Frame for IMT measurement can be selected in relation to the ECG waveform

Z-Scores

- Limited implementation of z-scores for a set of predefined pediatric dimension measurements

Quantitative Analysis Package (Q-Analysis) (optional)

- Traces for velocity or derived parameters (strain rate, strain, displacement) inside defined regions of interest as function of time
- Contrast analysis with traces for grayscale intensity or angio power inside defined regions of interest as function of time, including post processing ECG trigging and curve fitting for wash in/wash out analysis
- Curved anatomical M-mode display allowing an M-mode along an arbitrary curve in a 2D image
- Sample-area points may be dynamically anchored to move with the tissue when running the cineloop
- Cine compound displays cineloops generated from a temporal averaging of multiple consecutive heart cycles

Automated Function Imaging (AFI) (optional)

- Parametric imaging tool which gives quantitative data for global and segmental wall motion
- Allows comprehensive assessment at a glance by combining three longitudinal views into one comprehensive bulls-eye view
- Integrated into M&A package with specialized report templates
- 2D strain based data moves into clinical practice
- Simplified workflow with fully automated ROI tracing (if configured), quick tips and combined display of traces from all segments
- Peak Strain Dispersion (PSD) (included in AFI and 2D Strain [EchoPAC]). Index, as well as bulls-eye displaying variability in time to peak longitudinal strain. The index is the standard deviation from the average (of all segments) over the whole heart cycle, while the bulls-eye displays the PSD in a color scheme where green color indicates normal contraction with a peak at or around AVC, blue color indicates early contraction and yellow to red indicates late contraction

AFI Stress (optional)

- Dedicated protocol and workflow integrating AFI as part of a stress exam (pharmacological, as well as exercise) – see Stress Echo section

Automated Ejection-Fraction Calculation (AutoEF) (optional)

- Automated EF measurement tool based on 2D-speckle tracking algorithm and on Simpson
- Integrated into M&A package with worksheet summary

Generic Measurements

- BSA (Body Surface Area)
- MaxPG (Maximum Pressure Gradient)
- MeanPG (Mean Pressure Gradient)
- % Stenosis (Stenosis Ratio)
- PI (Pulsatility Index)
- RI (Resistivity Index)
- HR (Heart Rate) – beats/minute
- A/B Ratio (Velocities Ratio)
- TAMAX (Time Averaged Maximum Velocity) – Trace method is Peak or Manual
- TAMIN (Time Averaged Minimum Velocity) – Trace method is Floor
- TAMEAN (Time Averaged Mean Velocity) – Trace method is Mean
- Volume

OB/GYN Application Module

- OB package for fetal growth analysis containing more than 100 biometry tables
- Dedicated OB/GYN reports
- Fetal graphical growth charts
- Growth percentiles
- Multi-gestational calculations (up to four)
- Programmable OB tables
- Expanded worksheets
- User-selectable fetal growth parameters based on European, American or Asian methods charts
- GYN package for ovary and uterus measurements and reporting

OB Measurements/Calculations

- Gestational age by:
  - GS (Gestational Sac)
  - CRL (Crown Rump Length)
  - FL (Femur Length)
  - BPD (Biparietal Diameter)
  - AC (Abdominal Circumference)
  - HC (Head Circumference)
  - APTD x TTD (Anterior/Posterior Trunk Diameter by Transverse Trunk Diameter)
  - LV (Length of Vertebra)
  - FTA (Fetal Trunk Cross-sectional Area)
  - HL (Humerus Length)
  - BD (Binocular Distance)
  - FT (Foot Length)
  - OFD (Occipital Frontal Diameter)
  - TAD (Transverse Abdominal Diameter)
  - TCD (Transverse Cerebellum Diameter)
  - THD (Thorax Transverse Diameter)
  - TIB (Tibia Length)
  - ULNA (Ulna Length)
- Estimated Fetal Weight (EFW) by:
  - AC, BPD
  - AC, BPD, FL
  - AC, BPD, FL, HC
  - AC, FL
  - AC, FL, HC
  - AC, HC
  - EFBW
- Calculations and Ratios
  - FL/BPD
  - FL/AC
  - FL/HC
  - HC/AC
  - CI (Cephalic Index)
  - AFI (Amniotic Fluid Index)
  - CTAR (Cardio-Thoracic Area Ratio)
- Measurements/calculations by: ASUM, ASUM 2001, Berkowitz, Bertagnoli, Brenner, Campbell, CFEF, Chitty, Eik-Nes, Ericksen, Goldstein, Hadlock, Hansmann, Hellman, Hill, Hohler, Jeanty, JSUM, Kurtz, Mayden, Mercer, Merz, Moore, Nelson, Osaka University, Paris, Rempen, Robinson, Shepard, Shepard/Warsoff, Tokyo University, Tokyo/Shinozuka, Yarkoni
- Fetal graphical trending
- Growth percentiles
- Multi-gestational calculations (4)
- Fetal qualitative description (anatomical survey)
- Fetal environmental description (biophysical profile)
- Programmable OB tables
- Over 20 selectable OB calculations
- Expanded worksheets

GYN Measurements/Calculations

- Right ovary length, width, height
- Left ovary length, width, height
- Uterus length, width, height
- Cervix length, trace
- Ovarian volume
- ENDO (endometrial thickness)
- Ovarian RI
- Uterine RI
- Follicular measurements
- Summary reports

Vascular Calculations

- RT ECA (Right External Carotid Artery Velocity)
- RT CCA (Right Common Carotid Artery Velocity)
- RT BIFURC (Right Carotid Bifurcation Velocity)
- RT ICA (Right Internal Carotid Artery Velocity)
- RT ICA/CCA (Right Internal Carotid Artery Velocity/Common Carotid Artery Velocity Ratio)
- LT ECA, LT CCA, LT BIFURC, LT ICA, LT ICA/CCA (same as above, for Left Carotid Artery)
- A/B Ratio (Velocities Ratio)
- % Stenosis (Stenosis Ratio)
- S/D Ratio (Systolic Velocity/Diastolic Velocities Ratio)
- PI (Pulsatility Index)
- RI (Resistivity Index)
- HR (Heart Rate) – beats/minute

Cardiac Measurements

- %FS (LV Fractional Shortening)
- %IVS Thck (IVS Fractional Shortening)
- %LVPW Thck (LV Posterior Wall Fractional Shortening)
- Ao Arch Diam (Aortic Arch Diameter)
- Ao asc (Ascending Aortic Diameter)
- Ao Desc Diam (Descending Aortic Diameter)
- Ao Isthmus (Aortic Isthmus)
- Ao Root Diam (Aortic Root Diameter)
- AR ERO (PISA: Regurgitant Orifice Area)
- AR Flow (PISA: Regurgitant Flow)
- AR PHT (AV Insuf. Pressure Half Time)
- AR Rad (PISA: Radius of Aliased Point)
- AR RF (Regurgitant Fraction over the Aortic Valve)
- AR RV (PISA: Regurgitant Volume Flow)
- AR Vel (PISA: Aliased Velocity)
- AR Vmax (Aortic Insuf. Peak Velocity)
- AR VTI (Aortic Insuf. Velocity Time Integral)
- ARed max PG (Aortic Insuf. End-Diastole Pressure Gradient)
- ARed Vmax (Aortic Insuf. End-Diastolic Velocity)
- AV Acc Slope (Aortic Valve Flow Acceleration)
- AV Acc Time (Aortic Valve Acceleration Time)
- AV AccT/ET (AV Acceleration to Ejection Time Ratio)
- AV EOA I (VTI) (Aortic Valve Effective Orifice Area Index by Continuity Equation VTI)
- AV EOA I Vmax (Aortic Valve Effective Orifice Area Index by Continuity Equation Peak V)
- AV CO (Cardiac Output by Aortic Flow)
- AV Cusp (Aortic Valve Cusp Separation, 2D)
- AV Dec Time (Aortic Valve Deceleration Time)
- AV Diam (Aortic Diameter, 2D)
- AV max PG (Aortic Valve Peak Pressure Gradient)
- AV Mean PG (Aortic Valve Mean Pressure Gradient)
- AV SV (Stroke Volume by Aortic Flow)
- AV Vmax (Aortic Valve Peak Velocity)
- AV Vmean (AV Mean Velocity)
- AV VTI (Aortic Valve Velocity Time Integral)
- AVA (Vmax) (AV Area by Continuity Equation by Peak V)
- AVA (VTI) (AV Area by Continuity Equation VTI)
- AVA Planimetry (Aortic Valve Area)
- AVET (Aortic Valve Ejection Time)
- CO (Teich) (Cardiac Output, M-mode, Teicholtz)
- D-E Excursion (MV Anterior Leaflet Excursion)
- EDV (Cube) (Left Ventricle Volume, Diastolic, 2D, Cubic)
- EF (A-L A2C) (Ejection Fraction 2CH, Single Plane, Area-Length)
- E-F Slope (Mitral Valve E-F Slope)
- EPSS (E-Point-to-Septum Separation, M-mode)
- ERO (Effective Regurgitant Orifice)
- ESV (Cube) (Left Ventricle Volume, Systolic, 2D, Cubic)
- HR (Heart Rate, 2D, Teicholtz)
- IVC (Inferior Vena Cava)
- IVCT (Isovolumic Contraction Time)
- IVRT (Isovolumic Relaxation Time)
- IVSd (Interventricular Septum Thickness, Diastolic, 2D)
- VSs (Interventricular Septum Thickness, Systolic, 2D)
- LA Diam (Left Atrium Diameter, 2D)
- LA Major (Left Atrium Major)
- LA Minor (Left Atrium Minor)
- LA/Ao (LA Diameter to AoRoot Diameter Ratio, 2D)
- LAAd (A2C) (Left Atrium Area, Apical 2C)
- LAEDV (A-L) (LA End Diastolic Volume, Area-Length)
- LAEDV Index (A-L) (LA End Diastolic Volume Index, Area-Length)
- LAESV (A-L) (LA End Systolic Volume, Area-Length)
- LAESV Index (A-L) (LA End Systolic Volume Index, Area-Length)
- LAEDV MOD (LA End Diastolic Volume MOD)
- LAESV MOD (LA End Systolic Volume MOD)
- LIMP (Left Index of Myocardial Performance)
- LVA (s) (Left Ventricular Area, Systolic, 2CH)
- LVAd (A2C) (Left Ventricular Area, Diastolic, 2CH)
- LVAd (sax) (LV area, SAX, Diastolic)
- LVAend (d) (LV Endocardial Area, SAX)
- LVAepi (d) (LV Epicardial Area, SAX)
- LVAs (A4C) (Left Ventricular Area, Systolic, 4CH)
- LVAs (sax) (LV area, SAX, Systolic)
- LVd Mass (LV Mass, Diastolic, 2D)
- LVd Mass (LV Mass, Diastolic, M-mode)
- LVd Mass Index (LV Mass Index, Diastolic, 2D)
- LVEDV (A-L A2C) (LV Volume, Diastolic, 2CH, Area-Length)
- LVESV (A-L A2C) (LV Volume, Systolic, 2CH, Area-Length)
- LVET (Left Ventricle Ejection Time)
- LVIDd (LV Internal Dimension, Diastolic, 2D)
- LVIDs (LV Internal Dimension, Systolic, 2D)
- LVLd (apical) (Left Ventricular Length, Diastolic, 2D)
- LVLs (apical) (Left Ventricular Length, Systolic, 2D)
- LVOT Area (Left Ventricle Outflow Tract Area)
- LVOT CO (Cardiac Output by Aortic Flow)

- LVOT Diam (Left Ventricular Outflow Tract Diameter)
- LVOT max PG (LVOT Peak Pressure Gradient)
- LVOT Mean PG (LVOT Mean Pressure Gradient)
- LVOT SI (Stroke Volume Index by Aortic Flow)
- LVOT SV (Stroke Volume by Aortic Flow)
- LVOT Vmax (LVOT Peak Velocity)
- LVOT Vmean (LVOT Mean Velocity)
- LVOT VTI (LVOT Velocity Time Integral)
- LVPWd (Left Ventricular Posterior Wall Thickness, Diastolic, 2D)
- LVPWs (Left Ventricular Posterior Wall Thickness, Systolic, 2D)
- LVs Mass (LV Mass, Systolic, 2D)
- LVs Mass Index (LV Mass Index, Systolic, 2D)
- LAAd (A2C) (Left Atrium Area, Apical 2C)
- MCO (Mitral Valve closure to Opening)
- MP Area (Mitral Valve Prosthesis)
- MR Acc Time (MV Regurg. Flow Acceleration)
- MR ERO (PISA: Regurgitant Orifice Area)
- MR Flow (PISA: Regurgitant Flow)
- MR max PG (Mitral Regurg. Peak Pressure Gradient)
- MR Rad (PISA: Radius of Aliased Point)
- MR RF (Regurgitant fraction over the Mitral Valve)
- MR RV (PISA: Regurgitant Volume Flow)
- MR Vel (PISA: Aliased Velocity)
- MR Vmax (Mitral Regurg. Peak Velocity)
- MR Vmean (Mitral Regurg. Mean Velocity)
- MR VTI (Mitral Regurg. Velocity Time Integral)
- MV A Dur (Mitral Valve A-Wave Duration)
- MV A Velocity (MV Velocity Peak A)
- MV Acc Slope (Mitral Valve Flow Acceleration)
- MV Acc Time (Mitral Valve Acceleration Time)
- MV Acc/Dec Time (MV: Acc.Time/Decel.Time Ratio)
- MV an diam (Mitral Valve Annulus Diameter, 2D)
- MV CO (Cardiac Output by Mitral Flow)
- MV Dec Slope (Mitral Valve Flow Deceleration)
- MV Dec Time (Mitral Valve Deceleration Time)
- MV E Velocity (MV Velocity Peak E)
- MV E/A Ratio (Mitral Valve E-Peak to A-Peak Ratio)
- MV max PG (Mitral Valve Peak Pressure Gradient)
- MV Mean PG (Mitral Valve Mean Pressure Gradient)
- MV PHT (Mitral Valve Pressure Half Time)
- MV Reg Frac (Mitral Valve Regurgitant Fraction)
- MV SI (Stroke Volume Index by Mitral Flow)
- MV SV (Stroke Volume by Mitral Flow)
- MV Time to Peak (Mitral Valve Time to Peak)
- MV Vmax (Mitral Valve Peak Velocity)
- MV Vmean (MV Mean Velocity)
- MV VTI (Mitral Valve Velocity Time Integral)
- MVA (Mitral Valve Area)
- MVA By PHT (Mitral Valve Area According to PHT)
- MVA by plan (Mitral Valve Area, 2D)
- MVET (Mitral Valve Ejection Time)
- P Vein A (Pulmonary Vein Velocity Peak A) – reverse
- P Vein A Dur (Pulmonary Vein A-Wave Duration)
- P Vein D (Pulmonary Vein End-Diastolic Peak Velocity)
- P Vein S (Pulmonary Vein Systolic Peak Velocity)
- PAEDP (Pulmonary Artery Diastolic Pressure)
- PE(d) (Pericard Effusion, M-mode)
- PEs (Pericard Effusion, 2D)
- PR max PG (Pulmonic Insuf. Peak Pressure Gradient)
- PR mean PG (Pulmonic Insuf. Mean Pressure Gradient)
- PR PHT (Pulmonic Insuf. Pressure Half Time)
- PR Vmax (Pulmonic Insuf. Peak Velocity)
- PR VTI (Pulmonic Insuf. Velocity Time Integral)
- PRend max PG (Pulmonic Insuf. End-Diastole Pressure Gradient)
- PRend Vmax (Pulmonic Insuf. End-Diastolic Velocity)
- Pulmonic Diam (Pulmonary Artery Diameter, 2D)
- PV Acc Slope (Pulmonic Valve Flow Acceleration)
- PV Acc Time (Pulmonic Valve Acceleration Time)
- PV Acc Time/ET Ratio (PV Acceleration to Ejection Time Ratio)
- PV an diam (Pulmonic Valve Annulus Diameter, 2D)
- PV Ann Area (Pulmonic Valve Area)
- PV CO (Cardiac Output by Pulmonic Flow)
- PV max PG (Pulmonic Valve Peak Pressure Gradient)
- PV mean PG (Pulmonic Valve Mean Pressure Gradient)
- PV SV (Stroke Volume by Pulmonic Flow)
- PV Vmax (Pulmonary Artery Peak Velocity)
- PV Vmean (PV Mean Velocity)
- PV VTI (Pulmonic Valve Velocity Time Integral)
- PVA (VTI) (Pulmonary Artery Velocity Time Integral)
- PVein S/D Ratio (Pulmonary Vein SD Ratio)
- PVET (Pulmonic Valve Ejection Time)

- PVPEP (Pulmonic Valve Pre-Ejection Period)
- PVPEP/ET Ratio (PV Pre-Ejection to Ejection Time Ratio)
- Qp/Qs (Pulmonic-to-Systemic Flow Ratio)
- RA Major (Right Atrium Major, 2D)
- RA Minor (Right Atrium Minor, 2D)
- RAA (d) (Right Atrium Area, 2D, Diastole)
- RAA (s) (Right Atrium Area, 2D, Systole)
- RAEDV A2C (Right Atrium End Diastolic Volume, Apical 2 Chamber)
- RAESV A-L (RA End Systole Volume [A-L])
- RALd (Right Atrium Length, Diastole)
- RALs (RA Length, Systole)
- RIMP (Right Index of Myocardial Performance)
- RJA (A4C) (Regurgitant Jet Area)
- RJA/LAA (Regurgitant Jet Area ratio RJA/LAA)
- RV Major (Right Ventricle Major)
- RV Minor (Right Ventricle Minor)
- RVAWd (Right Ventricle Wall Thickness, Diastolic, 2D)
- RVAWs (Right Ventricle Wall Thickness, Systolic, 2D)
- RVET (Right Ventricle Ejection Time)
- RVIDd (Right Ventricle Diameter, Diastolic, 2D)
- RVIDs (Right Ventricle Diameter, Systolic, 2D)
- RVOT Area (Right Ventricle Outflow Tract Area)
- RVOT Diam (RV Output Tract Diameter, 2D)
- RVOT Diam (RV Output Tract Diameter, M-Mode)
- RVOT max PG (RVOT Peak Pressure Gradient)
- RVOT Mean PG (RVOT Mean Pressure Gradient)
- RVOT SI (LV Stroke Volume Index by Pulmonic Flow)
- RVOT SV (Stroke Volume by Pulmonic Flow)
- RVOT Vmax (RVOT Peak Velocity)
- RVOT Vmean (RVOT Mean Velocity)
- RVOT VTI (RVOT Velocity Time Integral)
- RVSP (Right Ventricle Systolic Pressure)
- RVWd (Right Ventricle Wall Thickness, Diastolic, M-mode)
- RVWs (Right Ventricle Wall Thickness, Systolic, M-mode)
- RAA (d) (Right Atrium Area, 2D, Diastole)
- RAA (s) (Right Atrium Area, 2D, Systole)
- SI (A-L A2C) (LV Stroke Index, Single Plane, 2CH, Area-Length)
- SI (A-L A4C) (LV Stroke Index, Single Plane, 4CH, Area-Length)
- SI (Bi-plane) (LV Stroke Index, Bi-Plane, MOD)
- SI (bullet) (LV Stroke Index, Bi-Plane, Bullet)
- SI (MOD A2C) (LV Stroke Index, Single Plane, 2CH, MOD)
- SI (MOD A4C) (LV Stroke Index, Single Plane, 4CH, MOD)
- SI (Teich) (LV Stroke Index, Teicholtz, 2D)
- SI (Teich) (LV Stroke Index, Teicholtz, M-mode)
- SV (A-L A2C) (LV Stroke Volume, Single Plane, 2CH, Area-Length)
- SV (A-L A4C) (LV Stroke Volume, Single Plane, 4CH, Area-Length)
- SV (Bi-plane) (LV Stroke Volume, Bi-plane, MOD)
- SV (bullet) (LV Stroke Volume, Bi-plane, Bullet)
- SV (MOD A2C) (LV Stroke Volume, Single-plane, 2CH, MOD) – Simpson
- SV (MOD A4C) (LV Stroke Volume, Single-plane, 4CH, MOD) – Simpson
- SV (Cube) (LV Stroke Volume, 2D, Cubic)
- SV (Cube) (LV Stroke Volume, M-mode, Cubic)
- SV (Teich) (LV Stroke Volume, 2D, Teicholtz)
- SV (Teich) (LV Stroke Volume, M-mode, Teicholtz)
- Systemic Diam (Systemic Vein Diameter, 2D)
- Systemic Vmax (Systemic Vein Peak Velocity)
- Systemic VTI (Systemic Vein Velocity Time Integral)
- TCO (Tricuspid Valve Closure to Opening)
- TR max PG (Tricuspid Regurg. Peak Pressure Gradient)
- TR mean PG (Tricuspid Regurg. Mean Pressure Gradient)
- TR Vmax (Tricuspid Regurg. Peak Velocity)
- TR Vmean (Tricuspid Regurg. Mean Velocity)
- TR VTI (Tricuspid Regurgitation Velocity Time Integral)
- TV A dur (Tricuspid Valve A-Wave Duration)
- TV A Velocity (Tricuspid Valve A Velocity)
- TV Acc Time (Tricuspid Valve Time to Peak)
- TV Ann Area (Tricuspid Valve Area)
- TV Ann Diam (Tricuspid Valve Annulus Diameter, 2D)
- TV Area (Tricuspid Valve Area, 2D)
- TV CO (Cardiac Output by Tricuspid Flow)
- TV Dec Slope (Tricuspid Valve Flow Deceleration)
- TV E Velocity (Tricuspid Valve E Velocity)
- TV E/A Ratio (Tricuspid Valve E-Peak to A-Peak Ratio)
- TV max PG (Tricuspid Valve Peak Pressure Gradient)
- TV Mean PG (Tricuspid Valve Mean Pressure Gradient)
- TV PHT (Tricuspid Valve Pressure Half Time)
- TV SV (Stroke Volume by Tricuspid Flow)
- TV Vmean (TV Mean Velocity)
- TV VTI (Tricuspid Valve Velocity Time Integral)
- VSD max PG (VSD Peak Pressure Gradient)

- VSD Vmax (VSD Peak Velocity)

Please refer to the Reference Manual for the full list of measurements and calculations for all applications.

Annotations

Body Marks

- Body mark icons for location and position of probe
- Easy selection of body marks from touch panel

Text Annotations

- Easy selection of text annotations from touch panel

Scan Assist Pro

- Customizable automations that assist the user through each step of the scan
- Helps enhance consistency and reduce keystrokes
- Supports selection of all modes, all measurements and dual annotations
- Imaging attributes: Octave, Steer, Dual/Quad screen, Compound, LogiqView, Zoom, Depth, Scale and Baseline
- On-line or off-line protocol editor
- Image acquisition according to predefined protocol templates
- Various factory protocol templates
- User-configurable protocol templates

Stress Echo (optional)

Supported Protocol Examinations

- 2D pharmacological stress echo
- 2D bicycle stress echo
- 2D continuous capture stress echo (treadmill stress echo)
- AFI Stress protocols (separate option) – acquire standard apical 2D views and quantify wall motion (longitudinal segmental and global strain) at all stress levels *(**NOTE:** AFI and Stress options required separately.)*
- Cardiac resynchronization therapy programming protocols (available with the Advanced QScan option)

Protocol Examinations Features (enabled with stress option)

- Wall motion scoring: Analysis by wall motion in individual myocardial segments
- Show reference: Show a reference image from baseline or previous level during acquisition
- Smart stress: Automatically set up various scanning parameters (for instance geometry, frequency, gain, etc.) according to same projection on previous level
- Scan mode settings: Scan mode may be specified for individual views in the protocol
- Preview of store: Show running loops as preview before storing to the examination

Continuous Capture

- Continuously acquire large amounts of 2D image data, and selection of projection views for analysis afterwards
- The entire continuous capture recording may be kept in memory while it is possible to store new images outside the protocol template, or the entire recording can be stored to file
- Selection of projection views on scanner or EchoPAC when the entire recording is stored to file

AFI Stress Echo (option)

- Single or tri-plane acquisition of standard 2D apical views
- Analysis with dedicated AFI stress analysis tool
- Provides longitudinal strain values per segment, as well as globally
- Allows complete assessment at a glance by combining three longitudinal views into one comprehensive bulls-eye view
- Integrated into M&A package with specialized report templates
- Simplified workflow with adaptive ROI, quick tips and combined display of traces from all segments

Wall Motion Scoring

- As part of the measurement and analysis package one can access a wall motion assessment module, providing analysis/scoring of individual myocardial segments
- For use with all stress modalities

Cardiac Resynchronization Therapy (CRT) Programming Protocols

- CRT protocols require Stress and Advanced QScan
- Tailored acquisition protocol for data needed for programming of AV and VV delays in biventricular pacemakers
- Image acquisition of a set of projection views with various scan mode settings
- Template editor
- User-configurable protocol templates
- Configure protocol name, number of levels and views, name of level and views and several other protocol settings (smart stress, show reference, scan mode, preview of store, timer handling, etc.)

Safety Conformance

- The Vivid E90 is built to meet the requirements of:
- IEC60601-2-37
- IEC60601-1
- IEC60601-1-2
- IEC60601-1-6
- UL60601-1
- CAN/CSA-C22.2 No. 60601-1
- NEMA UD3
- The European Medical Devices Directive (MDD) 93/42/EEC (CE Mark)
- Directive 2011/65/EU on the restriction of use of certain hazardous substances
- The Vivid E90 ultrasound unit is a Class I device, type CF, according to IEC60601-1
- The Vivid E90 ultrasound unit meets the EMC requirements in EN55011/A1/A2:2007 Class A

Virus Protection

To reduce virus vulnerability, Vivid E90 is configured with a minimal set of open ports and with all network services not actively used by the system closed down. This helps to significantly reduce the risk of a virus attack on Vivid E90.

GE is continuously judging the need for additional actions to reduce vulnerability of equipment; this includes vulnerability scanning of our products and evaluation of new security patches for the 3rd-party technology used. Microsoft® (and other) security patches that addresses serious issues with Vivid E90 will be made available to customers after GE verification of those patches.

Transducers

M5Sc-D XDclear Active Matrix Single Crystal Phased Array Probe

- Probe presets: Cardiac, pediatric, abdominal, fetal heart, cranial, coronary, stress (exercise, Qstress and LVO stress), LV contrast, renal, contrast now MI (optional)
- Biopsy guide: Multi-angle disposable with a reusable bracket

6S-D Phased Array Probe

- Probe presets: Pediatric, cardiac, coronary, neonatal head, fetal heart, abdominal

12S-D Phased Array Probe

- Probe presets: Pediatric, neonatal, cardiac, coronary, neonatal head, abdominal, rodent

9L-D Linear Array Probe

- Probe presets: Vascular (incl. carotid, LEA, LEV, UEA, UEV), musculoskeletal, thyroid, contrast (optional)
- Biopsy guide: Multi-angle disposable with a reusable bracket

11L-D Linear Array Probe

- Probe presets: Vascular (incl. carotid, LEA, LEV, UEA, UEV), breast, small parts, musculoskeletal, thyroid, scrotal, rodent
- Biopsy guide: Multi-angle disposable with a reusable bracket

C1-6-D XDclear
Curved Array Probe (Convex)

- Probe presets: Abdominal, renal, OB/GYN, urology (pelvic), vascular (incl. aorto-iliac, LEA, LEV), fetal heart, contrast (optional)
- Biopsy guide: Multi-angle, disposable with a reusable bracket

C2-9-D XDclear
Curved Array Probe (Convex)

- Probe presets: Abdominal, renal, OB/GYN, urology (pelvic), fetal heart
- Biopsy guide: Multi-angle, disposable with a reusable bracket

8C Micro Convex Probe

- Probe presets: Abdominal, vascular (incl. carotid, LEA, LEV, UEA, UEV), neonatal-head, musculoskeletal

IC5-9-D Convex (Endocavity) Probe

- Probe presets: OB/GYN, urology (pelvic), fetal heart
- Biopsy guide: Single angle, disposable bracket

L8-18i-D Linear Array Probe

- Probe presets: Cardiac, rodent (incl. mice, rats), vascular, musculoskeletal, small parts

P2D Pencil Probe

- Probe presets: Cardiac

P6D Pencil Probe

- Probe presets: Vascular (LEA)

6Tc TEE Probe

- Probe presets: Cardiac, coronary

6VT-D TEE probe

- Probe presets: Cardiac, LVO contrast, coronary

9T TEE Probe

- Probe presets: Pediatric

(***NOTE:*** *6Tc-RS and 9T-RS supported via probe adapter.*)

Wideband Probes

- Electronic selection between four solid-state and one stand-alone Doppler probe connectors
- Three probe sockets are DLP type plus one parking socket
- One Logiq type connector probe socket for support of TEE and 8C

PROBE	FREQUENCY RANGE	CATALOG #
M5Sc-D (Sector)	1.4 – 4.6 MHz	H44901AE
6S-D (Sector)	2.4 – 8.0 MHz	H45021RR
12S-D (Sector)	4.0 – 12.0 MHz	H45021RT
9L-D (Linear)	2.4 – 10.0 MHz	H40442LM
11L-D (Linear)	4.5 – 12.0 MHz	H40432LN
L8-18i-D (Linear Matrix Array)	5.0 – 15.0 MHz	H40452LL
C1-6-D (Convex)	1.5 – 6.0 MHz	H40472LT
C2-9-D (Convex)	2.3 – 8.4 MHz	H40462LN
8C (Micro Convex)	4.0– 8.0 MHz	H40412LJ
iC5-9-L (Convex Endocavity)	3.3 – 8.6 MHz	H40442LK
P2D (Pencil)	2.0 MHz	H4830JE
P6D (Pencil)	6.3 MHz	H4830JG
6Tc (TEE)[3]	3.0 – 8.0 MHz	H45551ZD[1]
6Tc-RS (TEE)[3]	3.0 – 8.0 MHz	H45551ZE
6VT-D (Volume TEE)[3]	3.0 – 8.0 MHz	H45581BJ[2]
9T (TEE)[3]	3.0 – 10.0 MHz	H45521DY
9T-RS (TEE)[3]	3.0 – 10.0 MHz	H45531YM

1 *6Tc-RS and 9T-RS supported via probe adapter.*

2 *Also 6VT-D with catalog # H45561TA is supported.*

3 *TEE Interface option must be enabled for TEE probes to run.*

Upgrades and Other Options

Vivid E90 can be upgraded with a 4D option and will then obtain the same functionality as Vivid E95 with one exception: 4D LV Mass is not available as a separate option and is only included together with 4D Strain. For detailed specifications on 4D, please see the Vivid E95 datasheet.

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GE Medical Systems Ultrasound & Primary Care Diagnostics, LLC, a General Electric Company, doing business as GE Healthcare.

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