



Keeping pace with the beat of life

Philips iE33 echocardiography system specifications

Keeping pace with the clinical needs of managing patients with cardiac disease, such as heart failure, valvular and coronary artery disease, and congenital heart disease, calls for exceptional levels of image quality, quantification and clinical performance. The iE33 intelligent echo system is addressing this growing requirement with complementary 2D and Live 3D imaging, quantification tools, and connected workflow solutions that help you answer the major questions related to cardiac disease management: structure, efficiency, size, flow, and function.

PHILIPS

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System Specifications

Applications

- Adult echocardiography
- Pediatric echocardiography
- Fetal echocardiography
- Stress echocardiography
- Vascular (peripheral, cerebrovascular, temporal and orbital TCD, and abdominal vascular)
- Transesophageal echocardiography (adult and pediatric)
- Contrast echocardiography (LVO, low MI and high MI detection)
- Perioperative
- Epicardial echocardiography

Imaging Modes

- 2D grayscale imaging with advanced pulse coding, pulse shaping and frequency compounding technologies
- M-mode
- M-mode color Doppler
- M-mode Tissue Doppler
- Live 3D Echo (instantaneous volume rendering of cardiac anatomy)
- Live xPlane imaging (simultaneous display of two live imaging planes)
- Tissue Harmonic Imaging (THI) with pulse inversion technology
- Left Ventricular Opacification (LVO) with pulse inversion and power modulation technologies
- Low MI and high MI contrast detection technology using power modulation
- SonoCT beam-steered real-time compound imaging
- Harmonic SonoCT imaging
- XRES adaptive image processing technology
- iSCAN intelligent scanning for one-button TGC, gain and compression map optimization
- iSCAN with adaptive gain compensation (AGC) for real-time line-by-line TGC optimization
- Simultaneous 2D M-mode
- Color Doppler
- Color Power Angio imaging (CPA)
- High-PRF pulsed wave (PW) Doppler
- Duplex and simultaneous 2D/PW Doppler
- Duplex continuous wave (CW) Doppler
- Duplex color flow and CW Doppler
- Duplex 2D, color flow, PW Doppler
- Duplex 2D, CPA, PW Doppler
- Tissue Doppler Imaging (TDI)
- Adaptive Doppler
- Adaptive broadband color flow
- Color Compare mode

- Independent Triplex for simultaneous 2D, color flow, PW Doppler
- Independent Triplex for simultaneous 2D, CPA, PW Doppler
- Dual imaging with:
 - Choice of independent Philips cine loop buffers or split screen imaging
 - Mixed mode display with one image live while other is frozen, e.g. 2D/2D, 2D/color, color/color, color/CPA
- High Definition Zoom (Write Zoom)
- Reconstructed zoom with pan (Read Zoom)
- Panoramic imaging
- SonoCT panoramic imaging with XRES and harmonic modes
- Chroma imaging in 2D, 3D, QLAB MPR and iSlice, panoramic M-mode and Doppler modes

Imaging Formats

- 2D linear: WideSCAN with SonoCT imaging
- 2D curved: WideSCAN with SonoCT imaging
- 2D sector
- Dual 2D
- Panoramic
- Live 3D volume
- Live 3D zoom
- 3D full volume
- 2D, MPR and volume

Transducers

Transducer Selection

- Electronic switching of transducers using three universal connectors
- Dedicated (Pedoff) continuous wave Doppler connector
- Automatic parameter optimization of each transducer for exam type through Tissue Specific Imaging (TSI) software
- User-customizable imaging presets for each transducer
- Automatic dynamic receive focal optimization
- Transmit focal characteristics automatically controlled through TSI, iFOCUS and DRS functions

S5-1 Sector Array with PureWave Crystal Technology

- Phased array, 80 elements
- 5 to 1 MHz extended operating frequency range
- 2D, steerable PW Doppler, CW Doppler, High PRF Doppler, Color Doppler, Tissue Doppler, advanced XRES and Harmonic Imaging including LVO, low MI and high MI
- Adult, pediatric, and congenital cardiac applications
- TCD, abdominal vascular, and renal applications

System Specifications



S8-3 Sector Array

- Phased array, 96 elements
- 8 to 3 MHz extended operating frequency range
- 2D, steerable PW Doppler, CW Doppler, High PRF Doppler, color Doppler, Tissue Doppler, advanced XRES, and harmonic imaging
- Adult and pediatric cardiac applications; fetal echo

S12-4 Sector Array

- Phased array, 96 elements
- 12 to 4 MHz extended operating frequency range
- 2D, steerable PW Doppler, CW Doppler, High PRF Doppler, color Doppler, Tissue Doppler, advanced XRES, and harmonic imaging
- Pediatric and adult cardiac applications
- Epicardial imaging

X3-1 xMATRIX Array

- xMATRIX phased array with 2,400 elements
- 3 to 1 MHz extended operating frequency range
- 2D, biplane (Live xPlane), triggered full volume, Live 3D Echo, color Doppler with 2D, biplane and 3D, advanced XRES, harmonic imaging, LVO, low MI and high MI
- Adult and pediatric cardiac applications
- Epicardial imaging

X7-2 xMATRIX Array with PureWave Crystal Technology

- 2D matrix array with 2,500 elements
- 7 to 2 MHz extended operating frequency range
- 2D, advanced XRES, harmonic imaging, M-mode, color Mmode, color flow, PW Doppler, CW Doppler, Live xPlane imaging, Live 3D Echo, Live 3D zoom, triggered full volume and triggered 3D color volume
- Neonatal and pediatric cardiac applications
- Epicardial imaging

X 7-2t xMATRIX Array with PureWave Crystal Technology

- Live 3D Echo transesophageal matrix array transducer with 2,500 elements
- 7 to 2 MHz extended operating frequency range
- 2D, advanced XRES, harmonic imaging, M-mode, color Mmode, color flow, PW Doppler, CW Doppler, Live xPlane imaging, Live 3D Echo, Live 3D zoom, triggered full volume and triggered 3D color volume
- Electrocautery suppression
- Rotatable array from 0 to 180 degrees
- Cable length: 82"
- Tip dimensions: .665" W x .53" D x 1.55" H
- TEE applications: patients >30 kg/66 lb

System Specifications

S7-2omni Sector Array

- Transesophageal phased array with 64 elements
- 7 to 2 MHz extended operating frequency range
- Mechanically rotatable array from 0 to 180 degrees
- Electrocautery suppression
- 2D, steerable PW Doppler, CW Doppler, High PRF Doppler, color Doppler, Tissue Doppler, XRES, harmonic imaging, and LVO
- Adult TEE applications

S7-3t Sector Array

- Transesophageal phased array with 48 elements
- 7 to 3 MHz extended operating frequency range
- Manually rotatable array from 0 to 180 degrees
- 2D, steerable PW Doppler, CW Doppler, color Doppler, XRES, and harmonic imaging
- Pediatric and small adult TEE applications

C5-1 Broadband Curved Array with PureWave Crystal Technology

- 5 to 1 MHz extended operating frequency range
- Curved array, 160 elements
- Steerable pulsed, High-PRF and color Doppler; and Color Power Angio, SonoCT, advanced XRES, and harmonic imaging
- Fetal echo, abdominal vascular and renal applications
 - TSI for deep abdominal penetration
 - Tissue aberration correction (speed of sound correction) in 2D and harmonic modes
- Coded beamforming (chirp) for improved simultaneous detail resolution and penetration
- Supports reusable 4-angle plastic biopsy guide (14-23 gauge)

C5-2 Broadband Curved Array

- Curved array with 128 elements
- 5 to 2 MHz extended operating frequency range
- Steerable pulsed Doppler, High PRF Doppler, color Doppler, and Color Power Angio, SonoCT, XRES, and harmonic imaging
- Fetal echo, abdominal vascular, and renal applications

C8-5 Broadband Curved Array

- 8 to 5 MHz extended operating frequency range
- Steerable pulsed Doppler, color Doppler, Color Power Angio, SonoCT, harmonic, and XRES imaging
- Peripheral vascular, cerebrovascular, fetal, abdominal, pediatric abdominal, and neonatal cephalic imaging
- Supports reusable plastic biopsy guide (14-25 gauge)

C9-4 Broadband Curved Array

- 9 to 4 MHz extended operating frequency range
- Steerable pulsed wave and color Doppler, Color Power Angio, SonoCT, XRES and harmonic imaging
- General purpose small adult and pediatric abdominal, obstetrical and gynecological applications
- Supports reusable plastic biopsy guide (dual angle) (16-25 gauge)

L8-4 Broadband Linear Array

- Linear array with 128 elements
- 8 to 4 MHz extended operating frequency range
- Steerable pulsed and color Doppler; Color Power Angio, SonoCT, XRES, and harmonic imaging
- Vascular (carotid, arterial and venous) and internal mammary vessel applications

L11-3 Broadband Linear Array

- Linear array with 288 elements
- 11 to 3 MHz extended operating frequency range
- Steerable pulsed and color Doppler; Color Power Angio, SonoCT, XRES, and harmonic imaging
- Vascular (carotid, arterial and venous) and superficial imaging applications
- Cerebrovascular (carotids, vertebrals), peripheral vascular (venous, arterial), and internal mammary vessels

L9-3 Broadband Linear Array

- Linear array with 160 elements
- 9 to 3 MHz extended operating frequency range
- Steerable pulsed and color Doppler; Color Power Angio, SonoCT, XRES, and harmonic imaging
- Vascular (carotid, arterial and venous) and superficial imaging applications
- Cerebrovascular (carotids, vertebrals), peripheral vascular (venous, arterial), and internal mammary vessels
- Precision Doppler with fine angle steering

L15-7io Compact Linear Array

- 15 to 7 MHz extended operating frequency range
- Steerable pulsed and color Doppler; Color Power Angio, panoramic, and XRES imaging
- High resolution intraoperative vascular applications

D2tcd PW Transducer (Pedoff)

- Dedicated 2 MHz Pulsed Wave Doppler
- Transcranial Doppler applications

System Specifications

D2cwc CW Transducer (Pedoff)

- Dedicated 2 MHz continuous wave Doppler
- Adult cardiology applications

D5cwc CW Transducer (Pedoff)

- Dedicated 5 MHz continuous wave Doppler
- Deep venous and arterial applications

TY-306 Heartsound Pulse Contact Sensor

- Patient heartsound and carotid pulse
- 0.04 to 300 Hz frequency response
- Cardiac and vascular applications

Advanced Imaging Controls

2D Grayscale Imaging

- Smart TGC: pre-defined TGC curves optimized for consistently excellent imaging with minimal adjustment
- AGC (Adaptive Gain Compensation): user can turn on and off during live imaging
- LGC (Lateral Gain Compensation) and Smart LGC
- Adjustable temporal and spatial resolution with DRS control
- Depth: able to adjust from 2.0 to 30 cm depending on transducer and exam
- Select between 1 and 8 transmit focal zones
- Soft Echo Enhance: special 2D optimization setting for soft plaque or masses
- XRES and advanced XRES: ability to eliminate virtually all speckle noise and enhance border definition
- SonoCT: ability to remove virtually all clutter and artifact; available on linear and curved array transducers for B-mode
- Harmonic imaging: available on all transducers
- 16-level digital reconstructed zoom with pan capability
- High Definition zoom concentrates all image processing power into a user-defined area of interest; possible to combine High Definition (HD) Zoom with Pan Zoom
- Cineloop image review
- Selectable 2D compression settings
- Sector size and steering control for sector and curved array image formats
- Selectable 2D line density with DRS control
- Dual imaging with independent cineloop buffers
- Chroma imaging with multiple color maps
- 256 (8 bits) discrete gray levels
- 2D acquisition frame rate up to 500 frames/sec (dependent on field-of-view, depth and angle)

Live 3D Echo

- 3D LVO setting (available on X3-1 transducer)
- Rotation in either absolute or relative trackball motion
- Live 3D Zoom mode
- Live 3D Zoom preview
- Grayscale imaging controls
- 3D vision control
- 3D FV opt control
- 3D home
- 3D swivel
- Up/down invert
- XRES technology
- Magnify
- Show/Hide echo or color
- Reset controls
- Rotate
- Auto crop
- Manual crop
- Brightness
- Smoothing
- Reference images
- Colorize
- Post processing
- Right invert
- Density
- Capture
- Compress
- Gain
- ECG
- ECG trigger
- Cineloop/Live 3D
- Review/Full volume
- Calibrated 3D grid
- 3D volume: Front, Center, Back
- 3D view control: Up, Down, Left, Right
- Elevation width control
- Lateral steer control
- 3D color optimization

XRES Adaptive Image Processing

- Available on S5-1, S8-3, S12-4, C5-1, X3-1, X7-2 and X7-2t transducers with all 2D TSI applications
- Available on sector, linear and xMATRIX array transducers
- Virtually eliminates speckle noise artifact and dynamically enhances tissue margins
- Available in all imaging modes including color flow and Doppler
- Available in contrast mode
- Operates in conjunction with SonoCT real-time compound imaging

System Specifications

Advanced XRES Adaptive Image Processing

- Available on S5-1, S8-3, S12-4, C5-1, X3-1, X7-2 and X7-2t transducers with all 2D TSI applications
- High resolution algorithms for advanced speckle noise reduction, refined tissue pattern displays, and fine border definition
- High speed processing allows 150 frame per second displays
- Available in all imaging modes including color flow and Doppler
- Available in contrast modes
- Operates in conjunction with SonoCT imaging

SonoCT Real-time Compound Imaging

- Available on linear and curved transducers
- Automatic selection of the number of steering angles based on the user-selected Resolution/Frame Rate (Res/Speed) condition
- Up to 9 lines of sight—automatically adjusted via DRS control
- Operates in conjunction with Tissue Harmonic imaging, panoramic imaging, and duplex Doppler
- Operates in conjunction with XRES imaging
- Available in contrast modes
- Available with WideSCAN format during 2D imaging for extended-field-of-view operation with linear and curved array transducers

iSCAN Intelligent Optimization

- One-touch image optimization
 - In 2D mode, one-button automatic adjustment of:
 - TGC and Receiver Gain to achieve optimal uniformity and brightness of tissues
 - Compression curve based on the range of detectable tissue signals
 - In vascular Doppler mode, one-button automatic adjustment of:
 - Doppler PRF based on detected velocity
 - Doppler Baseline based on detected flow direction
- Available on the S5-1, S8-3, S7-2omni, X3-1, X7-2 and X7-2t transducers (2D)
- Available on the L11-3 and L8-4 linear array transducers (PW Doppler)
- Operates in conjunction with SonoCT and XRES imaging
- Adaptive Gain Compensation (AGC) dynamically adjusts (every pixel on every scan line) low level 2D echoes to reduce gain artifacts (shadows/through transmission) and improve image uniformity with 2D

iFOCUS Intelligent Focusing Technology

- Automatic computation of beam characteristics for selected region of interest
- Provides best detail resolution and tissue uniformity for selected area
- Eliminates need for traditional focus controls
- Simplifies exam optimization
- Available on all array transducers

iOPTIMIZE Intelligent Optimization

- Multiple technologies for one-button approach to automatically and instantly adjust system performance for different patient sizes, flow states and clinical requirements
 - *Tissue Specific Imaging*: adjusts nearly 4,000 parameters during transducer/application selection
 - *Patient Optimization*: adjusts 2D performance to instantly adapt to different patient sizes
 - *Flow Optimization*: adjusts broadband flow performance to instantly adapt to different flow states
- Dynamic Resolution System (DRS): one control adjusts nearly 40 parameters simultaneously for user preference of spatial resolution or temporal resolution during clinical procedures. One control optimizes functions such as:
 - Line density
 - Persistence
 - Pulse Inversion Harmonics
 - Power modulation
 - Synthetic aperture
 - Number of lines of sight (SonoCT)
 - RF interpolation
 - Parallel beamforming
 - Frame rate

iCOMMAND Intelligent Voice Control

- Exclusive Philips voice recognition engine
 - Uses intelligence to adapt to user speech patterns and improve performance with use
 - Training creates a database of users for maximum accuracy and flexibility
 - Wireless microphone technology
- Controls most system functions with a simple voice command
 - Mode changes and annotation
- Eliminates many keystrokes and reduces repetitive motion
- Allows hands-free system control during difficult scanning environments
- Voice profiles can be copied to DVD and transferred to other systems of like configuration

System Specifications

Imaging Modes

2D

- Available with all imaging transducers
- Adjustable sector width/position during live imaging
- Able to invert image left/right, top/bottom and 90° depending on transducer and exam
- Receive Gain
- LGC (Lateral Gain Compensation)
- Select between 1 and 8 focal zones
- Dynamic Range
- Echo Compression
- Soft Echo Enhance
- Gray Map
- Chroma Map/Colorize
- Acquisition Zoom (HD Zoom): ability to position the Zoom ROI anywhere within the image, and change the height and width of the Zoom ROI
- Display Zoom/Magnify on live or frozen images up to 16 times
- Ability to select between 3 levels of frame rate
- Supports frame rates of over 300 Hz
- Tissue Optimization
- Contrast Resolution Enhancement (CRE)
- Tissue Harmonic Imaging
- SonoCT imaging
- WideSCAN imaging
- XRES technology
- Persistence (Frame Averaging)
- Grayscale Standard Display
- Auto Optimization

Live xPlane Imaging

- Simultaneous display of two live imaging planes
- Available on X3-1, X7-2 and X7-2t transducers
- Color and grayscale modes
- Lateral, rotational and elevation steering

Live 3D Echo

- Available on X3-1, X7-2 and X7-2t transducers
- Full volume
- 3D zoom
- Half clam shell
- Crop adjust with cropping
- 3D color flow
- ECG display

M-mode

- Available with all imaging transducers except X3-1
- Selectable sweeping rates
- Time markers: 0.1 and 0.2 seconds
- Acquisition zoom capability
- Selectable display format prospective or retrospective (1/3-2/3, 1/2-1/2, 2/3-1/3, side by side, full screen)
- Chroma colorization with multiple color maps
- Cineloop review for retrospective analysis of M-mode data
- 256 (8 bits) discrete gray levels

Pulsed Wave (PW) Doppler

- Available on all imaging transducers except X3-1
- Adjustable sample volume size: 0.5 to 20 mm (transducer dependent)
- Simultaneous or duplex mode of operation
- Simultaneous 2D, color Doppler, pulsed Doppler
- High-PRF capability in all modes including Duplex, Simultaneous Duplex and Triplex
- iSCAN optimization automatically adjusts scale and baseline

Steerable Continuous Wave (CW) Doppler

- Available on all imaging transducers except X3-1 and X7-2
- Steerable through 90° sector
- Maximum velocity range: 19 m/sec (transducer dependent)

Spectral Doppler

- Display annotations including Doppler mode, scale (cm/sec), Nyquist limit, wall filter setting, gain, acoustic output status, sample volume size, normal/inverted, angle correction, grayscale curve
- Ultra-high resolution 1 millisecond spectral FFT rate
- Angle correction with automatic velocity scale adjustment
- Adjustable velocity display ranges
- 9 position shifts (including 0)
- Normal/invert display around horizontal zero line
- Selectable sweep speeds
- Selectable low-frequency signal filtering with adjustable wall filter settings
- Selectable grayscale curve for optimal display
- Selectable Chroma colorization maps
- Selectable display format prospective or retrospective: 1/3-2/3, 1/2-1/2, 2/3-1/3, side-by-side, full screen
- Doppler Review for retrospective analysis of Doppler data
- Digitally enhanced 8-speaker stereo output
- 256 (8 bits) discrete gray levels
- Post-processing in PW frozen mode includes map, baseline, invert and Chroma

System Specifications

Adaptive Broadband Flow Imaging

- Automatically adapts transmit and receive bandwidth processing based on the color box position providing optimal sensitivity and color resolution
- Available on all cardiac imaging transducers
- Cineloop review with full playback control
- Advanced motion suppression with intelligent algorithms; adapts to various application types to selectively eliminate virtually all color motion artifact
- 256 color bins
- Parallelogram steering (3 angles) on linear array transducers
- Trackball-controlled color region of interest: size and position
- Maps, filters, color sensitivity, line density, smoothing, echo write priority, color persistence, gain, and baseline optimized automatically by exam type or is user selectable
- Velocity and variance displays
- Color invert in Live and Frozen imaging
- Color Optimization control for spatial resolution and penetration optimization
- Color/2D line density control

Color Doppler

- Available on all imaging transducers
- Color Gain
- Region of Interest (ROI)
- Adaptive Flow
- 17 selectable baseline positions
- Baseline Invert
- B/W Suppress
- Color Blending
- Colorize
- Color Compare dual display (B/W on left, Color on right)
- Color Map
- Color Persistence
- Flow Optimization
- Hide Color
- Output Power
- Lateral Gain Compensation (LGC)
- Magnify (range from 0.8X to 8X)
- Scale Sector Width/Position on curved and phased array transducers
- Simultaneous mode during PW mode
- Smoothing
- Ability to continuously steer between $\pm 20^\circ$ steer angle on cardiac sector array transducers

- Ability to steer between $\pm 3^\circ$ steer angle on linear array transducers
- Variance
- Wall Filter
- Write Priority
- Zoom

Tissue Doppler Imaging (TDI)

- Available on all cardiac imaging transducers (except X3-1, X7-2, X7-2t and S7-3t)
- Allows high frame rate acquisition of tissue motion (up to 400 fps)
- Color Gain, TGC and LGC compatible
- 8 maps
- Velocity (cm/s)

Contrast Imaging

- System optimized for Left Ventricular Opacification (LVO low MI and high MI technology)
- One-touch solution (one-button access in LVO preset) with settings for bolus and infusion
- 2D, Live xPlane, Live 3D Echo, and full volume 3D
- Incorporates S5-1 broad bandwidth Pulse Inversion and Power Modulation technologies for high sensitivity and high resolution visualization of contrast agent at low MI and high MI power levels
- LVO, low MI contrast and high MI contrast on/off, and contrast optimization choices and transmit power settings can be saved with Gain Save feature for stress echo studies, eliminating setup time for image acquisition at peak stress
- Low MI with Flash
- Low MI with triggered replenishment imaging (TRI) provides excellent 2D image quality on S5-1 transducer
- Supported on the following transducers:
 - S5-1
 - X3-1*
 - S7-2omni
 - X7-2t

Tissue Harmonic Imaging (THI)

- Second harmonic processing to reduce artifacts and improve image clarity
- Incorporates patented pulse inversion phase cancellation technology for maximum detail resolution during harmonic imaging
- Available on all imaging transducers
- Extends high performance imaging capabilities to all patient body types
- Supports SonoCT (Harmonic SonoCT) and XRES modes

* Pulse inversion not included.

System Specifications

Color Power Angio Imaging (CPA)

- Highly sensitive mode for small vessel visualization
- Available on linear array imaging transducers
- Cineloop review
- Multiple color maps
- Individual controls for gain, filters, sensitivity, echo write priority, and color invert
- Dynamic Motion Differentiation
- Adjustable CPA region of interest: size and position
- User-selectable persistence
- User-selectable blending

Live 3D and MPR/iSlice Imaging

- Supported on X3-1, X7-2, and X7-2t xMATRIX transducers
- Volume display with surface rendering (transparency, brightness, and lighting controls)
- Multiplanar reconstruction (MPR) and iSlice view display with QLAB
- Specialized algorithms and maps maximize three-dimensional display
- Cropping tools on volume views
- Supported XRES modes to reduce noise artifacts

Panoramic Imaging

- Real-time extended field-of-view composite imaging, acquired in fundamental and SonoCT modes
- Ability to acquire composite images in XRES mode
- Ability to back up and realign the image during acquisition
- Full zoom, pan, cineloop review and image rotation capabilities
- Auto fit of composite image
- User can measure distance, curved-linear distance and area in review mode with distance marker displayed via skin-line ruler
- User can display or remove skin-line ruler
- Measurements can be made on individual frames during cineloop review
- Scaling information included for connectivity prints allowing for measurements on a workstation
- Available on linear and curved array transducers

Workflow

Stress Echo

- Acquisition of single-frame or full-motion digital clips in any mode (including 2D, color flow, power Doppler, etc.); type of image to be acquired may be changed on-the-fly by the operator as needed
- Gain Save adjusts automatically to different views
 - Automatically saves your preferred control settings: such as MI (Mechanical Index), Gain and Depth: for each view while acquiring resting images
 - At immediate post-exercise, system automatically retrieves saved settings for each view
 - Allows different gain profiles for parasternal LAX and SAX views, AP4 and AP2 views
- Length of acquired images is user-adjustable between 1 and 20 seconds
- Ability to acquire routine cardiac images in timed and/or R-R interval clip (varies with selected compression ratio and available system memory)
- For timed acquisition, the system can start acquisition on the R-wave if the ECG is active and an R-wave is present
- Default stress protocols
 - Factory-provided non-editable default protocols include:
 - Two Stage Exercise Stress
 - Four Stage Pharmacological Stress
 - Three Stage Exercise Stress (Bicycle)
 - Four Stage Quantitative—Wall Motion and Contrast
 - Default protocols may be used as the basis for user-defined versions
- User-defined stress protocols may be defined to do any or all of the following:
 - Support between 1 and 10 stages
 - Support user-defined stage names
 - Support between 1 and 40 views per stage
 - Support user-defined view names
 - Prompt for a particular stage and view
 - Assign stage and view names
 - Set clip length for each image or group of images
 - Set the number of cycles/beats for each image
 - Define prospective, retrospective, or multi-cycle/full-disclosure acquisition
 - Define the capture format of each image or group of images
 - Define the default replay mode for each protocol
 - Enable or Disable Accept prior to store
 - Set Mode Acquisition for each view
 - Support for up to five modes
 - Save user-defined protocols within a preset

System Specifications

- Save user-defined protocols to removable media for import onto other systems at the same software level
- Modify protocols during use
- Add stages at any point after the current stage
- Change the name of a stage at any point up to acquisition of the first image of the stage
- Add views to any non-completed stages
- Change the name of a view at any point up to the acquisition of that view
- Save the modified protocol (not automatically saved)

Protocols with SmartExam

- Exam guide with on-screen display
- Required views based on exam type
- SmartExam—customization
 - Creates a protocol as the user performs an exam
 - Saves all annotations, body markers and labeled measurements defined in each view
 - Records modes used to capture each view
 - Captures the acquisition method (freeze, acquire) in each individual view
 - Provides user ability to pause and resume recording process if needed
 - Allows user to edit views before finalizing the new protocol
- Fully customizable protocol capability for any clinical application supported on the system with flexibility to conduct the examination protocol in any sequence
- Preset protocols for transthoracic and transesophageal cardiac and vascular exams based on industry and accreditation guidelines
- Automatic launching of annotation and body marker icon on required views
- Ability to automatically launch modes (2D, M-modes, color, Doppler, DTI) defined in a protocol
- Ability to pause and resume protocol function at any time
- System analysis capabilities supported in all defined protocols
- Custom protocol transfer between iE33 systems

Display Annotation

- On-screen annotation of all pertinent imaging parameters for complete documentation, including transducer type and frequency, active clinical options and optimized presets, display depth, TGC curve, LGC curve, grayscale, color map, frame rate, compression map value, color gain, color image mode, and hospital and patient demographic data
- User-selectable display of patient birth date or user ID
- Fixed position title area for persistent annotation

- Patient name and ID can be turned off (hidden) for generating images used in publication and presentation
- Scan plane orientation marker
- User-selectable Depth Scale display
- Real-time display of Mechanical Index (MI)
- Real-time display of Thermal Index (TIb, TIc, TIs)
- Multiple trackball-driven annotation arrows
- Pre-defined annotations and body markers (application specific), with two body markers supported in dual imaging format
- User-configurable annotations, based on application
- Doppler baseline Invert in Live and Frozen modes
- TGC curve, LGC curve (user selectable On/Off display)
- TGC values, LGC values (On/Off display)
- Tool Tips provides a brief description of the abbreviated on-screen image parameters
- Informative Trackball arbitration prompts
- Thumbnail display of images printed/stored
- Calculations Results and Analysis labels
- Graphical tabs that allow navigation to other analysis features
- Network and connectivity icons to allow instant feedback about network and printer conditions
- Cineloop frame number display
- Cineloop bar with Trim Markers
- Prompt Region for informational message display
- Frequency icon on screen
 - 2D optimization frequency bandwidth icon
- Contrast specification

Control Panel and User Interface

- Easy-to-learn graphical user interface
- Ergo-centric design of primary controls readily accessible and logically grouped
- Ambient lighting control for optimal image viewing in both light and dark environments
- Two full-color touch screens for mode selection and secondary controls
- Dual-function mode switch and independent gain controls for 2D, Color, CPA, PW, CW and M-mode
- 8-slide pot control adjustment of TGC curve
- 8-slide pot control adjustment of LGC curve
- iSCAN control for 2D/Doppler automatic optimization
- iFOCUS intelligent focusing control
- High Definition Pan/Zoom control
- Freeze control
- Programmable print control
- Transducer selection and Tissue Specific Imaging control
- Report and review controls

System Specifications

Cineloop Review

- Acquisition, storage in local memory, and display in real-time and duplex modes of up to 1,000 frames (up to 20 seconds of information, dependent on imaging parameters) of 2D, color images, Doppler data, and M-mode for retrospective review and image selection
- Acquisition, storage in local memory, and display in real-time and duplex modes of up to 2000 frames (up to 180 seconds of information dependent upon imaging parameters) of 2D, color, Doppler, M-mode, Live 3D, and 3D Zoom for retrospective review and image selection
- Prospective or retrospective loop acquire
 - Accept prior to store or clip store
- Trackball control of image selection
- Variable playback speed
- Trim capability of 2D data
- Available in all imaging modes plus:
 - Panoramic imaging
 - 3D imaging
 - Independent control of 2D image or spectral data in Duplex mode
 - Simultaneous control of 2D and spectral data in Simultaneous mode
- On-screen display of current 2D frame number

QuickSAVE Feature

- The system provides the ability to quickly save preferred system settings as individual exam types
 - Up to 45 QuickSAVE exams can be created per transducer
 - Saved parameters include virtually all imaging parameters as well as color box size
 - QuickSAVE exams can be copied to DVD and transferred to other systems of like configuration

Image Presentation

- Up/down
- Left/right
- Multiple duplex image formats
(1/3-2/3, 1/2-1/2, 2/3-1/3, side-by-side and full screen)
- Depth from 1 cm to 30.5 cm (transducer dependent)

Connectivity

- Standard connectivity features
 - Local Print to on-board or off-board video printers
 - Page Report Print
 - Export of report data to off-line analysis computer programs
 - Append to Study
 - Pixel spacing
- DICOM Print Option
- NetLink Connectivity Option
 - 100 Base-T, 10 Base-T (half or full duplex) ethernet output
 - Static IP addresses or DHCP/DNS
 - DICOM Store of still frame or cineloop images
- DICOM compression options
 - Up to 180 second loops per acquisition
 - Image and waveform export to network storage servers
 - DICOM Worklist with CIS support and automatic patient demographic entry
- Image network display choices (5)
 - Legacy, CRT, LCD, GDSF, CRT2
 - Send on demand
- Native Data and Native Data compression attached to DICOM image, Strain, Strain Rate, TDI, 2DQ (off-line LGC, TGC, gain, border suppress, Color Kinesis, border tracking, threshold control, ROI measures dB vs. time, and 2D quantification)
 - 3D volume data set attached to DICOM image
 - Ability to crop, resize, gain, compression, automated border tracking, color baseline, 3D vision control, colorize, color suppress, B/W suppress, XRES and 3D quantification
 - Scrolling Doppler acquisitions
 - Storage Commit (SC)
 - Structured Reporting (SR) for cardiac and vascular
 - Multiple Archive Server support
 - DICOM Append
 - 3D clips in DICOM format
 - QLAB clips of 2D, TDI, and 3D images
 - Send Images
 - After end of exam (batch send)
 - After each acquire
 - Send on demand
- Digital Media Exchange – CD/DVD (Standard)
 - The system supports specific DVD and CD media, with the following capabilities:
 - Read-only CD formatted specifically for the system
 - Read and Write (single session) to CD (CD+R)
 - DVD Read-only (DVD+R)
 - DVD Read + Write (single session) (DVD+RW)

System Specifications

- Data storage formats include DICOM, JPG (full-frame images) and AVI (motion clips); full-frame images can be compressed (JPG, loss less, lossy low, lossy medium, lossy high)
- User-selectable compression is available for motion clip storage
- DICOM images stored on disk can be recalled on the ultrasound system
- Scaling data is available to allow measurements
- JPG images and AVI clips can be recalled on off-line viewing stations
- 3D DICOM and QLAB clips, and 3D AVI loops
- USB Devices
 - 2 USB ports on top rear and 2 USB ports on bottom rear of the system
 - Export image data, DICOM Dir and PC format files to USB device
 - Import image data and DICOM Dir from USB device to compatible iE33 system
- On-board Patient Exam Storage (Standard)
 - Direct digital storage of B/W and color loops to internal hard disk drives
 - Combined 160 gigabyte storage capacity
 - Storage capacity of approximately 200 patient exams (dependent on exam content)
 - Fully integrated user interface
 - On-screen recall, measurement and text editing
 - Exam directory
- UpLink remote diagnostics capability
 - Remote diagnostics for faster, more accurate equipment evaluation
 - Allows remote system status verification
 - Supports routine preventative maintenance
 - Supports remote upgrade capability
- High Q automatic Doppler analysis (vascular only)
- Doppler values including PI, RI, S/D indices
- Volume flow rate
- 2D volume (2 volume methods)
- Heart rate (intelligent heart rate tool: automatically capture from the Physio trace, or directly measure from M-mode and Doppler traces)
- Trackball-controlled electronic measurement calipers: 8 sets
- User-defined protocols, measurements, and equations
- On-the-fly measurement labels
- Fully editable results data sheet
- Integrated patient exam report
- User-configurable touch panel layout per analysis application
- Simpson's trace methods: traditional trace or 3-point adjustable border
- 2D all points guided workflow
- M-mode all points guided workflow
- PISA methods with automatic aliasing velocity acquisition
- Body surface index calculations
- User-friendly powerful equation editing Wizard
- Set units and precision independently for all measurement and calculations
- Adult echo TDI measurement package
- Vascular graft measurement package
- User-adjustable results box position that is remembered per image display format, and across power cycles
- Export measurement and analysis package to CD or DVD and import onto other iE33 ultrasound systems
- Add images to the report
- Pediatric analysis package—designed for the pediatric cardiologist
 - Pediatric Echo has unique Patient Data Entry study page
 - Pediatric Echo displays QLAB results in the analysis report
 - Collection and Groups for pediatrics: 2D, M-mode and Doppler
 - Touch panel designed by pediatric cardiologists
 - Measurements for Pediatrics
 - Multiple ASD diameter measurements
 - 5 labeled Aorta measurements
 - BSA Weight only
 - Qp/Qs
- Fetal Echo Analysis Package
 - BPD
 - FL
 - HC
 - AC
 - EFW

Measurements and Analysis

Measurement Tools and General Description

- 2D distance
- 2D circumference/area by ellipse, continuous trace, trace by points
- 2D angle: intersection of two lines
- M-mode distance, time, and slope measurements
- Manual Doppler distance for time/velocity
- Manual Doppler trace
- Two methods of manual Doppler trace:
 - Doppler continuous trace and trace by points
- Erases traces by backing up the trackball
- Erases traces segmentally using the Erase control
- Time/slope measurements in Doppler and M-mode

System Specifications

QLAB Advanced Quantification Plug-ins (version 7.0)

- Intima Media Thickness (IMT) Quantification
 - Automated assessment of the IMT on user selected frames
 - For carotid and other superficial arteries
- Region of Interest (ROI) Quantification
 - Up to 10 user-defined regions
 - Thumbnail display of frames for easy trimming
 - Pixel intensity analysis
 - Motion compensation on/off
 - Data types: echo, velocity or power (angio)
 - TDI velocity timing measurements
- Strain Quantification (SQ)
 - For evaluation of regional myocardial function, assessment of synchronicity, and guidance during bi-ventricular pacing procedures
 - Tissue Doppler Imaging (TDI) velocity quantification
 - Measures the myocardial velocity and derives the displacement-strain rate and strain along user-defined M-lines
 - Capable of drawing up to 4 M-lines at a time
 - Point of Interest (POI) tool obtains values from any point on the M-mode display
 - User-defined and automatic M-line motion to follow the myocardial motion
 - Able to present TDI results in two display formats: anatomical M-mode display and graph display
 - User-selectable waveforms for optimal sub-region visualization
 - Curve processing modes
 - TDI timing caliper measurements
 - Ability to overlay pulse/phonocardiogram signal and cardiac mechanical events on TDI waveforms
 - User-selectable waveforms for optimal sub-region visualization
- Tissue Motion Quantification Advanced (TMQA)
 - Driven by speckle tracking technology
 - Tracks speckle motion from PureWave 2D images
 - Ability to visualize translucent speckle tracking points to confirm tracking
 - Displays global and segmental waveforms
 - Displays Color Kinesis tracking and cycle maps
 - Quantify from up to three independent layers of speckle motion
 - 17-segment ASE, ACC of LV
 - Speckle tracking over multiple beats with ability to average
 - Edit speckle tracking points on every frame
 - Advanced edit tool
 - Ability to recompute post editing
 - TMAD: Tissue Motion Annular Displacement
 - Measures valvular annular motion from multiple points
 - Applies to all transducer types
- TMQA parameters
 - Area
 - Speed
 - Radial velocity
 - Radial displacement
 - Volume
 - Global (from all regional curves)
 - Strain longitudinal, circumferential and radial
 - Strain rate longitudinal, circumferential and radial
 - Radial fractional shortening
 - Global, regional and local rotation
 - Wall thickening
 - Direct Strain
 - Display of 2D and Stress Echo ultrasound images
 - Overall, vertical, and horizontal gain controls
 - Semi-automated border detection for cardiac chambers and vessel cavities
 - Color Kinesis (CK) tool for displaying semi-automated borders over time parametrically
 - Transparency control to visualize echo grayscale under a semi-transparent parametric image
 - CK for arbitrary frame rates
 - Color Kinesis (CK) tool for displaying mitral valve annular motion over time parametrically
 - Manual user-editable timing overrides for the onset and duration of the parametric display
 - Single plane volume measurements based on the 5/6 Area-Length method and Simpson's single plane Method of Disks (MOD)
 - Biplane volume measurements based on the Simpson's Biplane Method of Disks (MOD)
- Cardiac 3D Quantification (3DQ)
 - 3D image controls: 3D grayscale render, 3D color render
 - Multiplanar reconstruction (MPR) and iSlice views:
 - 3D slice plane
 - Quad plane display
 - Apical 2 chamber view flip on/off
 - 2x2, 3x3, 4x4 iSlice layout
 - Mix apical/short axis or all short axis in iSlice display
 - Thick slice control
 - Slice interval spacing
 - 3D color depth rendering
 - Absolute vs. relative rotation
 - Auto-view with up, down, left, right
 - Parallel planes
 - Unlimited MPR and iSlice manipulation
 - 3D annotation

System Specifications

- 3D quantification from MPR includes the following measurements:
 - Distance
 - Area
 - LV volume (Simpson's)
 - LV ejection fraction
 - LV mass
- Cardiac 3D Quantification Advanced (3DQ Advanced)
 - Display and manipulation of dynamic three-dimensional rendering and left ventricular (LV) true volumes
 - Supported on X3-1, X7-2 and X7-2t xMATRIX transducers
 - Displays 3D or dynamic 3D renderings in grayscale or pseudo colorization
 - Multiplanar reconstruction (MPR) and iSlice views
 - Measurements of LV endocardial true volume and ejection fraction using a semi-automated 3D border detection
 - Computes global volumes and regional volumes based on 17-segment LV model
 - 3D border tracking based on TMQ tracking points
 - Edit before or after sequence analysis
 - Edit mode adds more flexibility and accuracy for optimal 3D border tracking
 - Displays global LV volume waveforms, all 17 regional volume waveforms or a subset of user-selected regional volume waveforms
 - Normalized regional volume waveform display
 - User-selectable waveforms: single, by wall, by level (ring) modes
 - Provides a bulls-eye visualization of all 17 regional segments or the user-defined and selected regional segments
 - Global and regional reports provide 3D LV global values and regional timing indices from all or a subset of 17 regional segments (3D synchronicity indices)
 - 3D true volume based EDV, ESV, stroke volume and EF
 - Standard deviation and maximal difference of Time to minimum systolic volume (Tmsv) based on all or a subset of 17 regional segments
 - Tmsv values displayed in time (msec) or normalized to the R-R interval (%)
 - Bull's-eye view showing the user-selected segments used for the Tmsv calculation
 - Timing and radial excursion parametric imaging
- Mitral Valve Quantification (MVQ)
 - Quantification of the mitral valve with Live 3D TEE data acquired with the X7-2t transducer
 - Quantification and display of mitral leaflets and leaflet segments, annulus, coaptation lines and distance to papillary muscle
 - 3 Mitral measurement protocols
 - Displays: leaflet, minimum tenting area, surface area
 - Edit measurement points
 - MVQ report pages with images
 - Setup of measurements, protocols, and tracking points
 - MVQ measurements
 - Anterior to posterior diameter
 - Anterolateral to posteromedial diameter
 - Annular height
 - Commissure to commissure diameter
 - 3D annulus perimeter
 - Anterior leaflet total, exposed and coapting lengths
 - Posterior leaflet total, exposed and coapting lengths
 - 2D projected circumference
 - 2D circularity index
 - Projected area in 2D
 - Leaflet and leaflet segment surface areas (total, exposed, coapting)
 - Minimum surface 3D area from annulus
 - Projected circumference ratio 2D to 3D
 - Saddle height to commissure width ratio
 - Planimetered surface area of regurgitation
 - Chordal length
 - Anterior and posterior leaflet angle
 - Non-planar angle
 - Coaptation length 2D to 3D

Clinical Option Analysis Packages

- Cardiac analysis
 - Volume by area/length method
 - M-mode ejection fraction (via Teichholz or cubed method)
 - Novel 3-point adjustable Simpson's template
 - Simpson's biplane and single plane volume and ejection fraction
 - Area, length, volume, and ejection fraction
 - LV mass
 - 2D all points
 - M-mode all points
 - Peak velocity
 - Maximum and mean pressure gradients
 - Pressure half time
 - E/A ratio
 - D/E Slope
 - Continuity equation
 - Diastolic function
 - Cardiac output
 - Acceleration time
 - Heart rate

System Specifications

- Vascular analysis
 - Right and left carotid artery protocols
 - ICA/CCA ratio
 - Bilateral lower extremity arterial and venous labels
 - Bilateral upper extremity arterial and venous labels
 - Percent diameter and area reduction
 - Vascular graft measurement package
 - User comments
 - High Q automatic Doppler analysis
- Pediatric analysis
- Fetal Echo analysis
 - BPD
 - FL
 - HC
 - AC
 - EFW
- TCD analysis
 - Bilateral
 - MCA
 - ACA
 - PCA
 - Orbital
 - Occipital
- Retractable, lighted alphanumeric keyboard
- Palm rest
- Flat panel LCD display monitor
 - 20 in/50 cm wide format, high resolution flat panel TFT/SIPS display
 - High contrast ratio >800:1
 - Extended viewing angle >170° (horizontal and vertical)
 - Response time: <16 ms
 - Virtually flicker-free technology reduces eyestrain
 - Ambient lighting control for optimal image viewing in both light and dark environments
 - Mounted on fully articulating extension arm
 - Four-way articulation with range of height adjustment from 55 to 61 in/140 to 155 cm
 - Side-to-side lateral adjustment
 - Nearly infinite positioning adjustments: height, swivel, and tilt
- Cart accommodates user heights ranging between 60 in/152.4 cm to 78 in/198.12 cm
- Easily accessed transducer connector ports, DVD media drive and USB ports
- Transducer and gel bottle holders (removable for easy cleaning)
- Mobility through high quality shock-absorbing casters with foot pedal controls for:
 - 4-wheel swivel
 - 2-wheel swivel lock
 - 2-wheel brakes
- Digitally enhanced 8-speaker high fidelity stereo output
- Integrated footrest
- 3-position footswitch for stress echo exams
 - Any non-protocol state: Freeze, Print, Record
 - Any protocol state: Acquire, Accept, Record
- On-board storage in convenient side bins and accessory tray
- Universal peripheral bay provides easy access for up to three on-board hardcopy/documentation devices
- Built-in A/C line conditioner provides isolation from voltage fluctuations and electrical noise interference
- Four high-capacity fans with automatic speed adjustment to optimize cooling efficiency with minimal audible noise

High Q Automatic Doppler Analysis

- Automatic real-time and retrospective tracing of:
 - Instantaneous peak velocity
 - Instantaneous intensity weighted mean velocity
- Automatic real-time display of (user-selectable up to 8):
 - Volume flow
 - Time-averaged peak velocity
 - Time-averaged mean velocity
 - Resistive index
 - Pulsatility index
 - Systolic/diastolic ratio
 - Acceleration/deceleration times

System Features

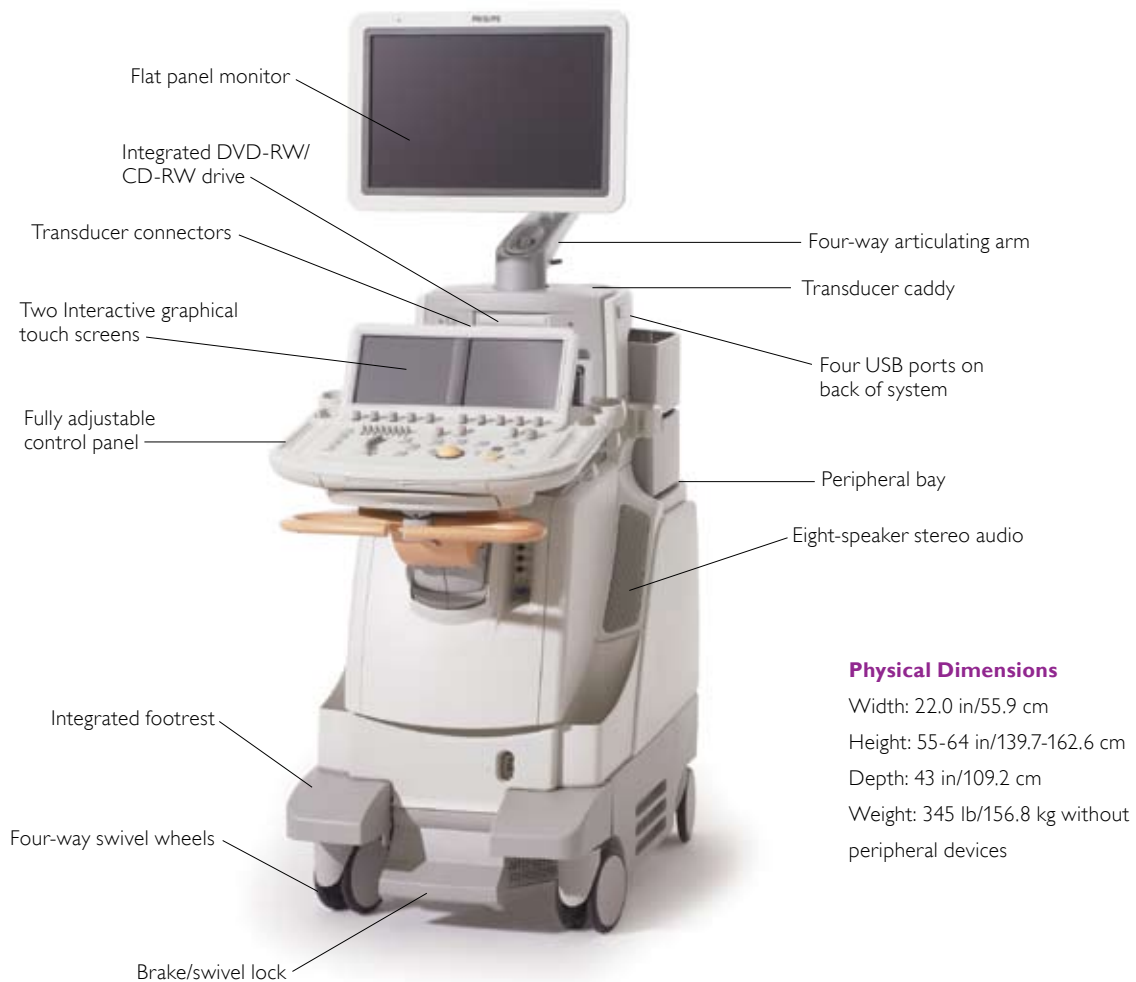
System Cart

- State-of-the-art ergonomic design
- Easy maneuverability and mobility
 - Wheel-lock and monitor adjustments facilitate bedside exams
- Control panel
 - Articulation facilitates optimal positioning
 - Up and down 6.5 in/16.5 cm
 - Rotates 30° (± 15° from center)
 - Side-to-side slide movement, 6 ± 3 in/15.2 ± 7.6 cm

Physio

- One 3-lead ECG input
- Selectable between leads I, II, III
 - Gain, sweep rate and display position controls
 - Automatic Heart Rate calculation and display
 - Fault condition display
 - Cineloop locator displayed on ECG trace
 - Pediatric and disposable leads available

System Specifications



Physical Dimensions

Width: 22.0 in/55.9 cm

Height: 55-64 in/139.7-162.6 cm

Depth: 43 in/109.2 cm

Weight: 345 lb/156.8 kg without peripheral devices

Peripheral Devices/Exam Documentation

- Up to three on-board peripheral devices (excluding report printers)
 - Super VHS VCR (USB controlled via system user interface)
 - Small-format digital color printer (USB)
 - Small-format digital B/W printer (USB)
 - Support for various Hewlett-Packard brand color and monochrome report printers (USB, externally mounted)
 - Export of measurement and analysis data to off-line reporting software packages (USB)
 - Support for external large format color printer (USB)

Electrical Power/Video Parameters

- 100V-127V, 50Hz/60Hz, NTSC
- 220V-240V, 50Hz/60Hz, NTSC and PAL
- Integrated A/C line conditioning
- Power consumption: depends on system configuration

Safety Requirements

- Electromechanical standards met
 - C22.2 No. 601.1, Canadian Standards Association, Standard for Medical Electrical Equipment
 - JIS T0601-1, Japanese Standard for Medical Electrical Equipment
 - EN 60601-1, European Norm, Safety of Medical Electrical Equipment
 - EN 60601-1-2 European Norm, Collateral Standard: Electromagnetic compatibility
 - EN 60601-2-37 European Norm, Particular requirements for the safety of ultrasonic medical diagnostic and monitoring equipment
 - UL 60601-1 Underwriters Laboratories Standard for Medical Electrical Equipment
- Agency approvals
 - Canadian Standards Association (CSA)
 - CE Mark in accordance with the European Medical Device Directive issued by British Standards Institute (BSI)

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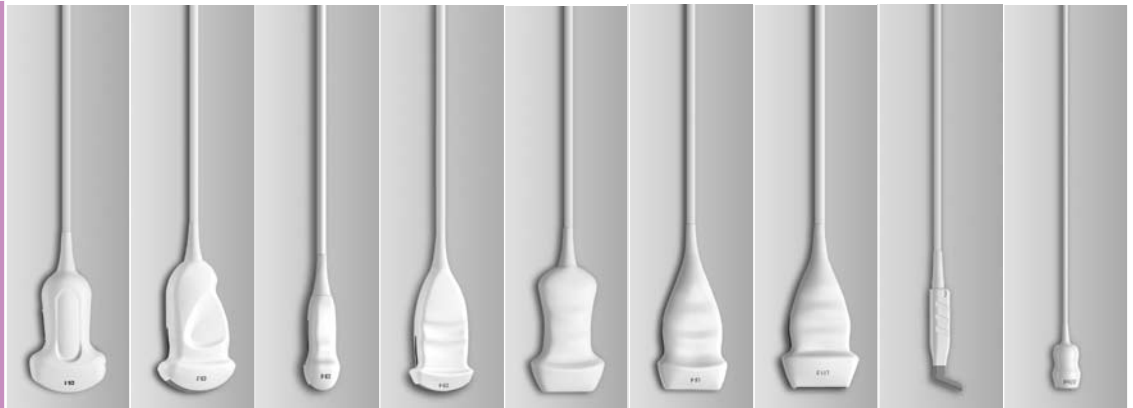
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Transducers



Name		S5-1	S8-3	S12-4	X3-1	X7-2	X7-2t	S7-2omni	S7-3t
Type of array		Sector	Sector	Sector	xMatrix	xMatrix	xMatrix	Sector TEE	Sector TEE
Number of elements		80	96	96	2400	2500	2500	64	48
Scanplane aperture		20.3 mm	15.4 mm	9.8 mm	Proprietary	Proprietary	Proprietary	8.64 mm	7.63 mm
Broadband frequency range		5-1 MHz	8-3 MHz	12-4 MHz	3-1 MHz	7-2 MHz	7-2 MHz	7-2 MHz	7-3 MHz
Frequency									
PureWave crystal technology		●				●	●		
Application	Exam Type								
Cardiac	Adult	●	●		●		●	●	
	Pediatric		●	●	●	●			
	Adult congenital	●				●			
Perioperative	TEE						●	●	●
	Epicardial			●	●	●			
	Intraoperative						●		
Fetal echo									
Vascular	Abdominal	●							
	Cerebrovascular								
	Intraoperative								
	Transcranial	●							

Transducers



Name		C5-1	C5-2	C8-5	C9-4	L9-3	L8-4	L11-3	L15-7io	D2tcd
Type of array		Curved	Curved	Curved	Curved	Linear	Linear	Linear	Linear	PW
Number of elements		128	128	128	192	160	128	288	128	
Scanplane aperture		60°	60°	90°	45 mm	38 mm	38 mm	39 mm	23 mm	
Broadband frequency range		5-1 MHz	5-2 MHz	8-5 MHz	9-4 MHz	9-3 MHz	8-4 MHz	11-3 MHz	15-7 MHz	
Frequency										2 MHz
PureWave crystal technology		●								
Application	Exam Type									
Cardiac	Adult									
	Pediatric									
	Adult congenital									
Perioperative	TEE									
	Epicardial								●	
	Intraoperative								●	
Fetal echo		●	●		●					
Vascular	Abdominal	●	●	●					●	
	Cerebrovascular					●	●	●	●	
	Intraoperative								●	
	Transcranial									●

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