A revolution in premium performance ultrasound

Philips iU22 ultrasound with xMATRIX
system specifications

PHILIPS

sense **and** simplicity

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1. Introduction

In today's busy and demanding healthcare environment, you can rely on the iU22 system for superb image quality for all patient types, advanced volume imaging solutions, innovative workflow tools and exceptional scanning ease.

1.1 Applications

Abdominal

Obstetrical

Fetal echo

Cerebrovascular

Peripheral vascular

Abdominal vascular

TCD: temporal and orbital

Gynecological and fertility

Small parts and superficial

Musculoskeletal

Pediatric general imaging

Prostate

Adult echocardiography

Stress echocardiography

Adult transesophageal echocardiography

Surgical imaging

Interventional imaging

Contrast imaging

Bowel imaging

Elastography

Flat panel monitor

Four-way articulating arm

Four USB ports on back of system

Peripheral bay

Eight-speaker stereo audio

Four-way swivel wheels

Integrated DVD+/RW drive

Interactive graphical touch screen

Fully adjustable control panel

Integrated footrest

Brake/swivel lock footrest
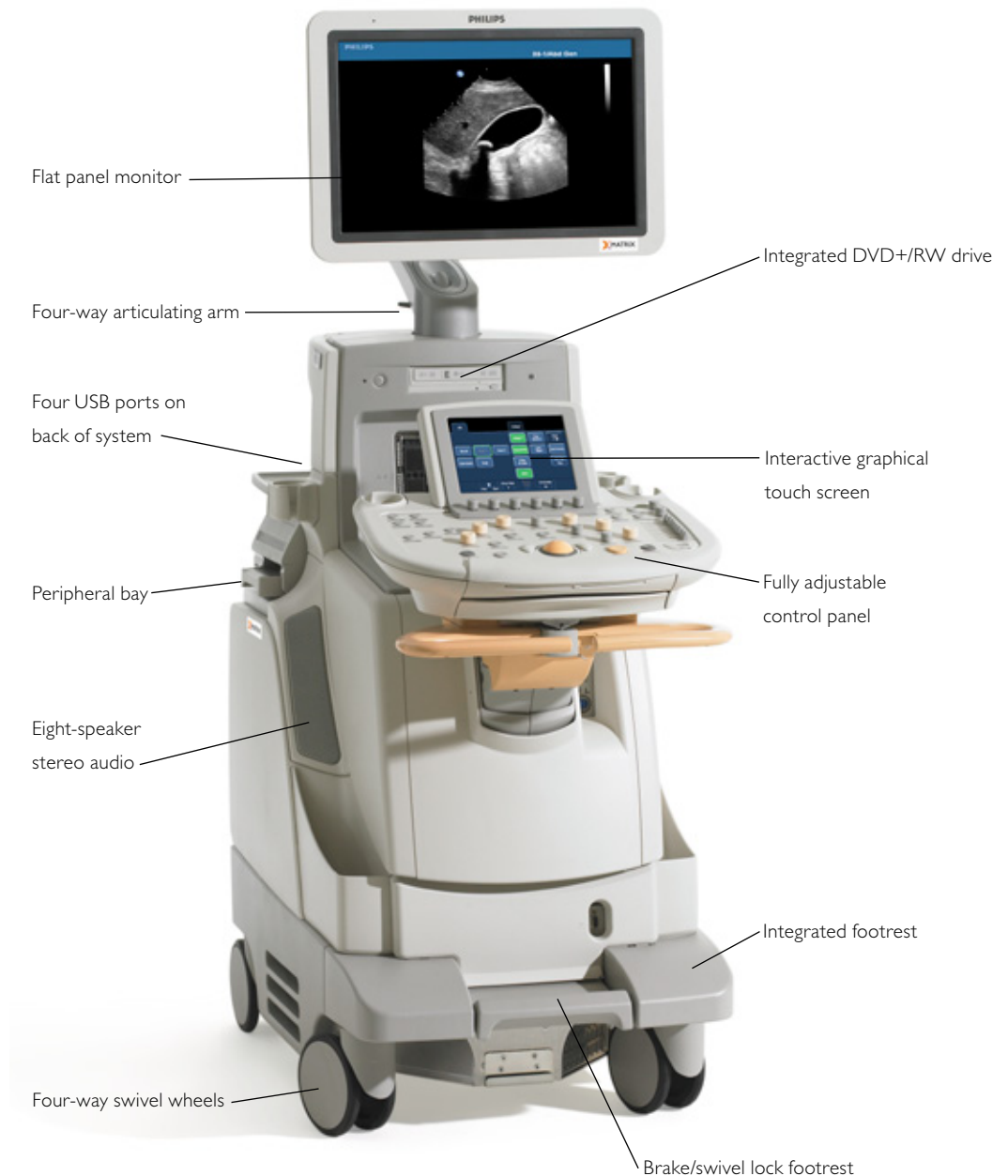
2. System overview

2.1 System architecture

- Powerful Philips xSTREAM imageformer architecture capable of processing multiple data streams simultaneously for structural, functional, and volume imaging
  - Offers up to 442,176 total digital channels (xMATRIX configuration)
  - Offers up to 57,000 total digital channels (non xMATRIX configuration)
  - Built for 2D, dual 2D, Live xPlane, Live volume imaging/Live 3D Echo, 3D/4D (hybrid and all electronic array), MPR (multiplanar reconstruction), and Panoramic imaging capability
  - Provides true real-time volume image forming capability with multiple rendering engines
  - Processes 64 megavoxels per second and renders 300 mega-ray cast samples per second
- Next generation digital broadband acoustic beamforming with custom ASICs
  - Incorporates advanced pulse shaping, pulse coding and multivariant harmonics technologies
  - Supports transducer frequencies up to 17 MHz
- Designed to support virtually any array configuration: linear, curved, tightly curved, sector, hybrid volume array, and xMATRIX electronic volume array
- New high-bit, low-noise, digital circuitry
  - Exclusive adaptive signal-to-noise ratio achieves system dynamic range up to 180 dB for improved 2D performance and increased Doppler sensitivity
- Powerful distributed multiprocessor environment achieves 250 billion operations per second for nearly instantaneous mode changes and support for advanced system functionality and quantification
- Philips next generation SonoCT real-time compound imaging
  - High precision beam-steered image compounding for acquisition of more tissue information and reduction of angle-generated artifacts
  - Up to nine beam-steered lines of sight available on linear, curved and tightly-curved arrays, and hybrid volume arrays
  - WideSCAN capability to expand field of view during SonoCT imaging
  - SonoCT capability available during contrast imaging modes

- Elevation compound imaging on X6-1 transducer which compounds two or more lines of sight in the elevation dimension
- Philips next generation XRES adaptive image processing for noise and artifact reduction that improves tissue conspicuity and margin definition
  - Performs 350 million calculations per frame of image data up to 500 frames per second
  - Operates in 2D and 2D/CFI/Doppler mixed modes up to 500 frames per second
  - Provides XRES capability when in contrast imaging modes
- Philips new adaptive broadband flow imaging
  - Automatically adjusts Doppler bandwidth to enhance flow sensitivity and resolution
  - Reduces flash artifacts with advanced dynamic motion suppression algorithms
- Auto Doppler flow optimization
  - Automatically adjusts color box position and angle
  - Automatically adjusts PW sample volume placement and angle
  - Includes Auto Flow Tracking for automatic angle correction with sample volume movements
- Multi-application SmartExam workflow protocols
  - General imaging and stress echo applications
  - Step by step on-screen guidance
  - Full user customization
  - Automatic mode switching
  - Record function for creation of custom protocols
- Fully independent triplex multiple mode operation for extraordinary ease of use during Doppler procedures
- Fast system boot up, approximately 110 seconds

2.2 Imaging formats
- 2D linear: WideSCAN with SonoCT
- 2D curved and tightly-curved: WideSCAN with SonoCT
- 2D sector
- Dual 2D
- Panoramic
- 2D with 3D volume
- 2D with 4D volume
- 3D volume
- Live 3D volume
- 4D volume
- 2D, MPR, and volume

2.3 Imaging modes

- 2D grayscale imaging with advanced pulse coding, pulse shaping, and frequency compounding technologies
- Multivariate Tissue Harmonic Imaging including pulse inversion technology and coded harmonics
- Tissue aberration correction
- Coded beamforming with chirp transmit
- Next generation SonoCT beam-steered real-time compound imaging
- Harmonic SonoCT imaging
- Next generation XRES adaptive image processing technology
- Shearwave elastography point quantification imaging
- iSCAN intelligent scanning with one-button TGC, gain and compression map optimization
- iSCAN with AGC (adaptive gain compensation) for real-time line-by-line TGC optimization
- Auto Doppler flow optimization for one button angle correction and steering
- Simultaneous 2D M-mode
- Broadband flow imaging
- M-mode
- M-mode Tissue Doppler Imaging
- Live volume imaging/Live 3D Echo (instantaneous volume rendering)
- Live xPlane imaging (simultaneous display of two live imaging planes)
- Advanced volume modes including iSlice and thick slice capabilities
- Philips Color Power Angio imaging (CPA) and directional CPA
- Duplex and simultaneous 2D/pulsed wave (PW) Doppler
- Duplex continuous wave (CW) Doppler

- Duplex color (Doppler) and CW Doppler
- High-PRF PW Doppler
- Duplex 2D, color, PW Doppler
- Duplex 2D, CPA, PW Doppler
- Independent triplex for simultaneous
  2D, color, PW Doppler
- Independent triplex for simultaneous
  2D, CPA, PW Doppler
- Dual imaging with:
  – Choice of independent Philips cineloop
    buffers or split screen imaging
  – Mixed mode display with one image live while
    other is frozen, for example 2D/2D, 2D/color,
    color/color, color/CPA, contrast side-by-side
- Color compare mode
  – Dual live display with grayscale reference
    image and color Doppler image
- Live Compare imaging allows side-by-side display
  where the current live image can be compared
  with a stored image from the same study
- Philips high definition zoom (Write Zoom)
- Reconstructed zoom with pan (Read Zoom)
- Panoramic imaging
- Panoramic imaging with SonoCT,
  XRES, and harmonic modes
- Freehand 3D and MPR imaging with SonoCT,
  XRES, color, CPA, and harmonic modes
- Automated 3D and 4D imaging with SonoCT,
  XRES, color, CPA, and harmonic modes
- Philips Chroma imaging in 2D, 3D, 4D, MPR,
  panoramic, M-mode, and Doppler modes
- Dynamic colorization in Live 3D mode on
  X7-2, and X3-1, freehand 3D on C10-3v,
  and 3D/4D on 3D9-3v and X6-1
- Contrast imaging, including pulse inversion, power
  modulation, PMPI, and coded harmonic sequences
- Live MVI
- Spatio-Temporal Image Correlation (STIC)
- iSTIC on X6-1 transducer
- Elastography

M-mode

- Available on all imaging transducers
- 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

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 millisecond spectral FFT rate
- Angle correction with automatic
  velocity scale adjustment
- Adjustable velocity display ranges
- Nine 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

Pulsed wave (PW) Doppler

- Available on all imaging transducers
- Adjustable sample volume size: 1.0-20 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 that automatically adjusts scale
  and baseline

Auto Doppler

- Auto color Region of Interest placement
- Auto color Region of Interest and pulsed
  wave sample volume steering
- Auto Pulsed Doppler sample volume placement
- Auto Pulsed Doppler angle correction
- Available on L9-3, L12-5, L17-5, and L15-7io transducers

Steerable continuous wave (CW) Doppler

- Available on cardiac sector array transducers only
- Steerable through 90° sector
- Maximum velocity range: 19 m/sec
  (transducer dependent)

Tissue Doppler Imaging (TDI)

- Available on S5-1 and S7-2omni transducers
- High frame rate acquisition of tissue motion
  (up to 400 fps) allowed
- Color gain and TGC
- 8 color maps
- Velocity (cm/s)

Live xPlane imaging

- Available on X6-1, X3-1, and X7-2 xMATRIX transducers
- Simultaneous display of two live imaging planes
- Color Live xPlane
- Rotation, lateral, and elevation steering (rotational
  tilt not available on X6-1 transducer)
- Contrast and interventional modes

Live volume imaging/Live 3D Echo

- Available on X6-1, X3-1, and X7-2 xMATRIX transducers
- Full volume sweep
- Adjustable live volume angle control
- Adjustable X, Y, Z rotation
- Dynamic colorization
- Adjustable vision preset control
- Adjustable center, back, front, volume imaging control
- Contrast and interventional modes
- Support of volume rates up to 90 vps
- 3D Zoom
- 3D color flow
- ECG display on X3-1 and X7-2 transducers

3D/4D and MPR imaging
(all electronic array transducer)

- Available on X6-1 xMATRIX transducer
- Volume display with surface rendering
  (transparency, brightness, and lighting controls)
- Multiplanar reconstruction (MPR) view display
- Cropping tools on both volume and
  multiplanar reconstruction (MPR) views
- Slice control on MPR and volume displays
- Supported by elevation compound imaging and
  XRES modes to reduce noise artifacts
- Full volume sweep
- Adjustable X, Y, Z rotation
- Dynamic colorization
- Adjustable vision preset control
- Contrast mode
- Support of volume rates of at least 156 vps
- Zoom
- 3D color flow

3D/4D and MPR imaging (hybrid transducers)

- Volume display with surface rendering
  (transparency, brightness, and lighting controls)
- Multiplanar reconstruction (MPR) view display
- Specialized algorithms and maps maximize
  three-dimensional display
- Cropping tools on both volume and
  multiplanar reconstruction (MPR) views
- Slice control on MPR and volume displays
- Supported by SonoCT and XRES
  modes to reduce noise artifacts

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 imaging transducers
- Cineloop review with full playback control
- Advanced motion suppression with intelligent algorithms that adapts to various application types to selectively eliminate virtually all color motion artifact
- 256 color bins
- Parallelogram steering on linear array transducers: three angles on L12-5 and L17-5, 5 angles on L9-3 and L15-7io
- 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
- DRS control for spatial resolution and penetration enhancement
- Color/2D line density control

Contrast imaging

- System optimized for detecting contrast agent signatures as they are approved for use
- Contrast modes available on C5-1, C5-2, C9-5ec, C10-3v, C8-4v, S5-1, S4-1, L9-3, L12-5, V6-2, X6-1, and X3-1 transducers
- iOPTIMIZE one-button patient optimization control and dynamic resolution system tuned specifically during contrast studies
- Live microvascular imaging (MVI)
- Pulse inversion contrast imaging available with SonoCT and XRES technologies
- Power modulation (PM), pulse inversion (PI), PMPI, coded harmonic, agent detection imaging (ADI), and flash contrast imaging modes
  - Agent detection imaging (ADI) for quick verification of presence or absence of contrast agents
  - Low MI and high MI modes
  - MID MI mode available on C5-1 and C5-2 transducers

- Touch screen display timer
- Advanced non-linear pulsing schemes with SonoCT and XRES for increased contrast sensitivity
- Low MI color flow contrast
- High frequency contrast capability
- Flash imaging
- Dual imaging mode for simultaneous fundamental and contrast displays
- ECG/timed triggering
- Long loop capture mode during contrast procedures (3-10 minutes)
- QLAB ROI and MVI display

Interventional imaging

- TSI available on selected transducers for optimal performance during interventional and biopsy procedures
- Enhanced needle visualization displays
- CPA and TDI based needle tracking visualization mode
- Biopsy guide selection menus
- Contrast and interventional modes

Tissue Harmonic Imaging (THI)

- Second harmonic processing to reduce artifacts and improve image clarity
- Multivariate pulsing including patented pulse inversion phase cancellation technology for increased detail resolution during harmonic imaging
- Available on all imaging transducers
- High performance imaging capabilities to all patient body types
- Support of SonoCT (Harmonic SonoCT) and XRES modes
- Coded harmonics available with C5-1 in selected modes

Color Power Angio imaging (CPA)

- Highly sensitive mode for small vessel visualization
- Available on all 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
- Directional Color Power Angio (DCPA)

3D, 4D, and MPR imaging (all electronic array X6-1 transducer)

- Quantitative 3D volume acquisition with elevation compound imaging on the X6-1 transducer
- Ability to acquire and display at least 156 volumes/sec in 4D (application dependent)
- High resolution scan and review mode
- Multiple display formats including full screen, 2-up and 4-up for the rendered volume or multiplanar images
- Volume display with surface rendering (transparency, brightness, dynamic colorization, and lighting controls)
- X, Y, Z rotation capability
- Specialized algorithms and maps increase 3D display
- Individual controls for manipulating the on-screen 3D rendering and display options
- Region of Interest (ROI) trim tools on both volume and multiplanar reconstructed (MPR) views
- Support of XRES adaptive image processing to reduce noise artifacts
- Ability to perform distance, curved distance, ellipse, trace, and volume measurements
- On-screen orientation markers

3D, 4D, and MPR imaging (hybrid transducers)

- Quantitative 3D volume acquisition with SonoCT supported on V6-2, 3D9-3v, and VL13-5 transducers
- Ability to acquire and display up to 30 volumes/sec in 4D mode (transducer dependent)
- High resolution scan and review mode
- Multiple display formats including full screen, 2-up and 4-up for the rendered volume or multiplanar images
- Volume display with surface rendering (transparency, brightness, and lighting controls)
- X, Y, Z rotation capability
- Specialized algorithms and maps maximize 3D display
- Individual controls for manipulating the on-screen 3D rendering and display options
- Region of Interest (ROI) trim tools on both volume and multiplanar reconstructed (MPR) views
- Support of SonoCT real-time compound imaging (3D/4D/MPR SonoCT imaging)
- Support of XRES adaptive image processing to reduce noise artifacts
- Ability to perform distance, curved distance, ellipse, trace, and volume measurements
- On-screen orientation markers

Freehand 3D volume and MPR imaging

- Qualitative grayscale volume acquisition supported on all imaging transducers
- Volume display with surface rendering (transparency, brightness, and lighting controls)
- Multiplanar view display
- Specialized algorithms and maps increase 3D display
- Trim tools on both volume and multiplanar reconstructed (MPR) views
- Supported by SonoCT and XRES modes to reduce noise artifacts
- Resize control that adjusts for different sweep speeds
- On-screen orientation markers

Spatio-Temporal Image Correlation (STIC) imaging

- Available on V6-2 transducer
- Automated volume acquisition of fetal cardiac cycle allowed
- Grayscale and 3D Color
- CPA and Directional CPA (DCPA)
- Default 25 degree elevation angle
- User-configurable acquisition time
- Ability to stop acquisition and return to standby
- Ability to accept or reject detected heart rate
- Compatible with QLAB quantification software

iSTIC imaging

- Available on X6-1 transducer
- Automated volume acquisition of fetal cardiac cycle allowed
- Grayscale and color modes
- Automated detection of fetal heart rate
- Acquisition of multiple subvolumes of the fetal heart
- Multiple full volumes in one fetal heart cardiac cycle

Panoramic SonoCT imaging

- Real-time extended field-of-view composite imaging, acquired in fundamental or SonoCT mode
- Ability to acquire composite image 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
- Distance, curved-linear distance and area in review mode can be measured with distance marker displayed via skin-line ruler
- Ability to display or remove skin-line ruler
- Cineloop review that allows measurement on individual frames
- Scaling information included for connectivity prints allowing for measurements on a workstation
- Available on linear and curved array transducers

Strain based elastography

- Strain based elastography for breast and gynecological imaging
- Available for breast imaging on the L17-5 and in the advanced breast TSI on the L12-5 transducer, and on the C10-3v for gynecological imaging
- One-touch entry into elastography mode
- Elastogram applied as a region of interest box with user control of size and location through entire field of view
- Indicator for compression level
- Display options
  - Single screen 2D with elastogram
  - Side-by-side display of 2D image and 2D with elastogram
- Shadow duplication (size compare) and measurement capability in side-by-side display
  - Distance and area tools
  - Duplication from either side of the display
- Eight selectable elastogram display maps
- Ability to hide or show the elastogram display
- Blend capability to increase 2D visibility through elastogram display
- Four smoothing selections
- Five persistence selections
- Two dynamic resolution system (DRS) selections to alternate between elastogram resolution and penetration
- Four dynamic range selections for elastogram display
- Two elastogram optimization settings for different tissue compositions
- AI – anechoic imaging for enhancing areas without ultrasound signals such as cystic and complex cystic structures

Shear wave elastography

- Tissue deformation from special ultrasound push pulses
- Detection pulses used to calculate shear wave velocity
- Available on C5-1 for liver imaging

3. System controls

Philips common user experience provides readily accessible and logically grouped primary controls along with an easy-to-learn graphical user interface.

3.1 Optimization controls

2D Grayscale imaging

- Smart TGC: pre-defined TGC curves optimized for consistently excellent imaging with minimal TGC adjustment
- Adjustable temporal resolution and spatial resolution with DRS control
- 12-level digital reconstructed zoom with pan capability
- High definition zoom that concentrates all image processing power into a user-defined area of interest; possible to combine high definition zoom with pan zoom
- Cineloop image review
- Selectable 2D compression settings
- Tissue aberration correction
- Sector size and steering control for sector and curved array image formats
- Selectable 2D line density with DRS control
- Dual imaging with either independent cineloop buffers or split screen imaging
- Dual imaging with color compare
- Dual imaging with fundamental and contrast optimization
- 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 MVI

Next generation SonoCT real-time compound imaging

- Available on all transducers except sector and xMATRIX arrays
- Virtually all clutter and artifact eliminated
- Automatic selection of the number of steering angles based on the user-selected resolution/frame rate (Res/Speed) condition
- Up to nine lines of sight automatically adjusted via DRS control
- Operates in conjunction with Tissue Harmonic Imaging, volume modes, panoramic imaging, and duplex Doppler
- Operates in conjunction with XRES
- Available in contrast modes
- Available with WideSCAN format during 2D imaging for extended field-of-view operation

Elevation compound imaging

- Available on X6-1 transducer
- Reduces speckle and improves contrast resolution
- Operates with at least two lines of sight
- Operates in 2D in conjunction with fundamental imaging, Tissue Harmonic Imaging, and duplex Doppler
- Operates in conjunction with XRES imaging
- Has no adverse impact on frame rates

XRES adaptive image processing

- Available on all imaging transducers
- Eliminates virtually all speckle noise and enhances border definition
- Available in all imaging modes including color flow and Doppler
- Available in contrast modes
- Operates in conjunction with SonoCT imaging
- Provides high resolution algorithms for advanced speckle noise reduction, refined tissue pattern displays, and fine border definition
- Provides high speed processing that allows up to 500 frame-per-second displays

The C5-1's tissue aberration correction compensates for the speed of sound distortion through adipose layers.

Live volume imaging/Live 3D Echo

- Grayscale imaging controls
- 3D Vision control
- Dynamic volume colorization
- Chroma colorization
- Reset orientation
- Up/down invert
- XRES technology
- Zoom
- Show/hide color
- Reset controls
- Rotate X, Y, Z
- Auto crop
- Plane crop
- Brightness
- Smoothing
- Reference images
- Post processing
- Left/right Invert
- Res/speed control
- Capture
- Compress
- Gain
- ECG
- ECG trigger
- Cineloop/Live volume imaging/Live 3D Echo
- Review/Full volume
- Save volume in native or native loop
- 3D Grid
- 2D optimization settings
- Tissue Harmonic Imaging
- Elevation, rotation, and lateral steer controls
- 3D optimization settings
- Sector width
- Angle

Tissue aberration correction (TAC)

- Automatically enabled when ABD maximum penetration TSI is selected on C5-1 transducer
  - Corrects for speed of sound disturbances due to excessive adipose layer on obese patients
- User selections with the L17-5, L12-5 for advanced breast, superficial, thyroid and testicle TSIs. User selection with VL13-5 for advanced breast TSI
  - Corrects for speed of sound disturbances in fatty tissue

Coded beamforming

- Automatically enabled when ABD, OB or GYN maximum penetration TSI is selected on C5-1 transducer
- Coded excitation using new chirp transmit technology that improves penetration and recovers more tissue information for greater detail resolution at extended depths
- Coded harmonics mode that reduces image degrading artifacts while maintaining penetration qualities

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 Doppler mode, one-button automatic adjustment of:
    - Doppler PRF based on detected velocity
    - Doppler baseline based on detected flow direction
- Available on all imaging transducers
- Operates in conjunction with SonoCT and XRES imaging

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- 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 and 3D imaging

iCOMMAND intelligent voice control

- Exclusive Philips voice recognition engine
  - Uses intelligence to learn user speech patterns and improve performance with use
  - Wireless microphone technology
- Controls many system functions with a simple voice command
  - Offers mode changes and annotation
- Eliminates many keystrokes and reduces repetitive motion
- Allows "hands-free" system control during difficult scanning environments
- Allows voice profiles to be copied to DVD and transferred to other systems of like configuration

iFOCUS intelligent focusing technology

- Provides 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

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 up to 7,473 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
  - Synthetic aperture
  - Number of lines of sight (SonoCT)
  - RF interpolation
  - Parallel beamforming

3.2 Control panel and user interface

- Easy-to-learn graphical user interface
- Ergo-centric design of primary controls readily accessible and logically grouped
- Tri-state control panel lighting (active, available, and unavailable)
- Ambient lighting control for optimal image viewing in both light and dark environments
- Full color touch screen for secondary controls
- Dual function mode switch and independent gain controls for 2D, CPA, M-mode, and color, PW, CW Doppler
- Eight-slide pot control adjustment of TGC 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
- Protocol selection control

4. Workflow

The iU22 combines premium imaging technologies with sophisticated ergonomics and ease-of-use to help keep busy departments on schedule.

4.1 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, grayscale, color map, frame rate, compression map value, color gain, color image mode, hospital name, and patient demographic data
- User-selectable display of patient birth date or user ID
- Fixed position title area for consistent annotation
- Patient name and identification data that can be turned off for export to DICOM devices
- Sector steering icon for endocavitary transducers
- 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 body markers, supported in dual imaging format
- Doppler baseline invert in live and frozen imaging
- TGC curve (On/Off display)
- TGC 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
- Contrast specification
- Protocol procedure list with status

SmartExam protocols

- 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 annotation, body markers, and labeled measurements defined in each view
  - Records modes used to capture each view
  - Captures the acquisition method (print, capture, 3D dataset) 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 abdominal, vascular, and gynecological exams based on industry and accreditation guidelines
- Automatic launching of annotation and body marker icon on required views
- Ability to automatically launch modes (2D, 3D, color modes, Doppler, dual, color compare) defined in a SmartExam
- Ability to pause and resume SmartExam function at any time
- System analysis capabilities supported in all defined protocols
- Custom protocol transfer between iU22 systems stress echo protocols
- Acquisition of single-frame or full-motion digital clips in any mode including 2D, color flow, power Doppler (type of image to be acquired may be changed on the fly by the operator as needed)
- Gain Save that adjusts automatically to different views
- Your preferred control settings automatically saved – such as MI (mechanical index), gain and depth for each view while acquiring resting images
- At immediate post-exercise, saved settings for each view automatically retrieved

- Different gain profiles for parasternal LAX and SAX views, AP4, and AP2 views allowed
- Adjustable length of acquired images between 1 and 20 seconds
- Ability to acquire routine cardiac images in timed and R-R interval clip (varies with selected compression ratio and available system memory)
- For timed acquisition, can start acquisition on the R-wave (if the ECG is active and an R-wave present)
- Default stress protocols
  - May not be edited but may be used as the basis of a user-defined protocol
  - Factory-provided protocols include:
    - Two-stage exercise stress
    - Four-stage pharmacological stress
    - Three-stage exercise stress (bicycle)
    - Four-stage quantitative
    - Wall motion and contrast
- User-defined stress protocols
  - Utility for creation of user-defined protocols and editing of existing protocols for acquisition of stress and routine images, allows protocols to 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
- Save user-defined protocols to removable media for import onto separate 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 (it will not be automatically saved)

Protocols are easy to customize with SmartExam – as easy as performing an exam. You can reduce keystrokes even further by using iCOMMAND voice control to move through your Protocol view list.

Volume imaging solutions for connected radiology departments
- Customizable to your workflow
- Fast, one-button press volume acquisition and on-cart review
- Advanced volume and MPR visualization with QLAB GI 3DQ
  - iSlice and thick slice on cart
- Capability to export freehand, electronic, and hybrid acquired 3D grayscale data for visualization on most PACS in a stacked "fly-through" manner (like CT/MR)
- Off-cart evaluation of volume data on a multimodality ViewForum clinical workstation
- Powerful ViewForum 3D manipulation tools including volume rendering, MPR, MIP, slab viewing (thick slice), 3D orientation graphics
- Advanced 3D visualization with QLAB GI 3DQ on ViewForum including ability to handle 3D color flow and xMATRIX data
- Orientation labels feature for spatial orientation of 3D data sets
  - Adult orientation labels for non-fetal applications
  - Fetal orientation labels for fetal applications
- MPR Export capability
  - Ability to export A, B, and C planes as a multiframe loop for review on a DICOM device
  - Available on all transducers except X7-2 and X3-1, but not supported for any STIC or iSTIC files

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

4.2 Image presentation
- Up/down
- Left/right
- Multiple duplex image formats (1/3-2/3, 1/2-1/2, 2/3-1/3, 50/50 and full screen)
- Depth from 1 cm to 39 cm (transducer dependent)

4.3 Cineloop review
- Acquisition, storage in local memory, and display in real-time and duplex modes of up to 2,200 frames of 2D and color images or up to 48 seconds of Doppler data and M-mode for retrospective review and image selection
- 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

4.4 Exam management features
- Internal storage
- Data export
- Temporary ID feature
  - One-click start of exam from patient data entry screen with system-provided information
  - Storage of images that were created without a patient name with a temporary identification

4.5 Connectivity
- Standard connectivity features
  - Local print to on-board or off-board video printers
  - Page report print
  - DICOM print
  - Image and waveform export to removable media (DVD/CD/USB)
  - Export of report data to off-line analysis computer programs
  - Gigabit ethernet output
  - Append to study
  - Pixel spacing
- De-identification feature
  - Send studies to PACS without identifying information
  - Create demonstration studies or an image for a presentation without identifying information
  - Configurable option to export only the image de-identifed, or export the image totally scrubbed of identifying information, including the DICOM data

- NetLink connectivity option
  – Image and waveform export to network storage servers
  – DICOM Worklist with RIS support and automatic patient demographic entry
  – Performed procedure step (PPS)
  – Storage commit (SC)
  – Structured reporting (SR) includes Ob, Gyn and vascular
  – Append to study
  – DICOM Query/Retrieve (Q/R) for ultrasound images and studies
- DICOM compression options
  – Up to 2,200 frames per acquisition
  – Image and waveform export to network storage servers
  – DICOM Worklist with CIS support and automatic patient demographic entry
- Image network display choices (five)
  – Legacy, CRT, LCD, GDSF, CRT2
- Native data and native data compression attached to DICOM
  – 3D volume data set attached to DICOM image
    - 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 Ob/Gyn, cardiac and vascular
  – Multiple archive server support
  – DICOM append
  – 3D clips in DICOM format
  – 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, and allows 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)
- USB storage
  – Export image data and Ob trending information via USB ports
  – Import image data and Ob trending information via USB ports to compatible iU22 systems
- Data storage formats include DICOM, JPG (full frame images) and AVI (motion clips); full frame images are non-compressed
- Native data storage for TDI and volume exams
- Available user-selectable compression for motion clip storage
- DICOM images stored on disk can be recalled on the ultrasound system
  – Scaling data available to allow measurements
- JPG images and AVI clips available for recall on off-line viewing stations
- On-board patient exam storage (standard)
  – Direct digital storage of B/W and color loops to internal hard disk drives
  – Combined 1 TB storage capacity
  – Storage capacity of approximately 350 patient exams (assuming 40 images, 6 seconds of clips and reports per exam)
  – Fully-integrated user interface
  – User configurable "auto delete" capability
  – On-screen recall, measurement and text editing
  – Exam directory
- DICOM compression options
  – Configurable image size/loop export 640 x 480 or 800 x 600 or 1,024 x 768
  – Configurable JPEG quality factor from 60 to 100

5. Transducers

5.1 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
- Transmission of focal characteristics automatically
  controlled through TSI, iFOCUS, and DRS functions

Explora transducers

- Ergonomic designs with lightweight super flexible cables
- Advanced low-loss lens technology for
  better penetration with less artifacts
- Breakthrough broadband frequency response
- Support for very high frequencies up to 17 MHz
- Advanced micro-electronics in linear,
  curved, tightly-curved, sector, hybrid volume
  array, and xMATRIX configurations
- High precision automated volume transducers

PureWave crystal technology

- Available on the X6-1, S5-1, C10-3v,
  C5-1, and X7-2 transducers
- Breakthrough crystal technology that allows
  greater acoustic efficiency and bandwidth

xMATRIX technology

- Available on the X6-1, X3-1, and X7-2 transducers
- Unique array configuration of fully-sampled elements
  that allows 2D, Live xPlane, and volume imaging

Curved array

C10-3v broadband curved array with PureWave crystal technology

- 10 to 3MHz extended operating frequency range
- End-fire sector, 11.5 mm radius of curvature, 164°
  field of view (wide scan enabled)
- Steerable pulsed wave and color Doppler, Color
  Power Angio, advanced XRES, and harmonic imaging
- Endovaginal applications
- Elastography – strain based
- Contrast applications
- Supports biopsy guide capabilities

C9-5ec broadband curved array

- 9 to 5 MHz extended operating frequency range
- End-fire sector, 8 mm radius of curvature, 173°
  field of view (wide scan enabled)
- Steerable pulsed wave and color Doppler, Color
  Power Angio, SonoCT, XRES, and harmonic imaging
- Endocavitary applications, including vaginal, and rectal
- Contrast application
- Supports biopsy guide capabilities

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 biopsy guide capabilities

C8-5 broadband curved array

- 8 to 5 MHz extended operating frequency range
- Steerable pulsed wave and color Doppler, Color
  Power Angio, SonoCT, and XRES imaging
- Pediatric abdominal and neonatal cephalic imaging
- Supports biopsy guide capabilities

The iU22 system supports a wide array of transducers with cutting edge imaging technologies.

C8-4v broadband curved array

- 8 to 4 MHz extended operating frequency range
- End-fire sector, 11 mm radius of curvature, 135° field of view
- Steerable pulsed wave and color Doppler, Color Power Angio, SonoCT, XRES, and harmonic imaging
- Endovaginal applications
- Contrast application
- Supports biopsy guide capabilities

C5-2 broadband curved array

- 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
- General purpose abdominal, obstetrical, gynecological, and interventional applications
- Contrast application
- Supports biopsy guide capabilities

C5-1 broadband curved array with PureWave Crystal Technology

- 5 to 1 MHz extended operating frequency range
- High density curved array with 160 elements
- Steerable pulsed, High-PRF and color Doppler; and Color Power Angio, SonoCT, and mulitvariate harmonic imaging
- General purpose abdominal, obstetrical, gynecological, and interventional applications
- Discreet TSI for deep abdominal, obstetrical, and gynecology penetration enables:
  - Tissue aberration correction
  - Coded beamforming with chirp transmit and coded harmonics
- Intervention application
- Elastography – shear wave
- Contrast application
- Supports biopsy guide capabilities

Volume array

VL13-5 broadband linear array

- 13 to 5 MHz extended operating frequency range
- Fine pitch, 192 element, high resolution linear array
- Support of high resolution 2D imaging
- Support of high resolution, quantitative, single sweep 3D volume acquisition
- Support of 4D imaging
- Steerable pulsed wave and color Doppler, Color Power Angio, SonoCT, XRES, and harmonic imaging
- High resolution superficial applications including small parts, breast, and vascular imaging
- Tissue aberration correction selection for advanced breast imaging TSI
- Supports biopsy guide capabilities

V6-2 broadband curved array

- 6 to 2 MHz extended operating frequency range
- Steerable pulsed wave, High-PRF, and color Doppler; Color Power Angio/directional CPA, SonoCT, XRES, harmonic imaging, and STIC
- Support of high resolution 2D imaging
- Support of high resolution, quantitative, single sweep 3D volume acquisition
- Support of 4D imaging up to 30 volumes per second
- General purpose abdominal, obstetrical, and gynecological volume applications
- Contrast application
- Supports biopsy guide capabilities

3D9-3v broadband curved array

- 9 to 3 MHz extended operating frequency range
- 164° field of view (wide scan enabled)
- Support of high resolution 2D imaging
- Support of high resolution, quantitative, single sweep 3D volume acquisitions (hybrid and freehand)
- Support of 4D imaging up to 22 volumes per second
- Steerable pulsed wave and color Doppler, Color Power Angio, SonoCT, XRES, and harmonic imaging
- Endovaginal applications
- Interventional applications
- Supports biopsy guide capabilities

Linear array

L17-5 broadband linear array

- 17 to 5 MHz extended operating frequency range
- Ultra-fine pitch, 288 element, high resolution linear array
- Steerable pulsed wave and color Doppler, Color Power Angio, SonoCT, XRES, and harmonic imaging
- High resolution superficial applications including small parts, breast, superficial vascular, and musculoskeletal imaging
- Tissue aberration correction selection for MSK, small parts, and advanced breast imaging TSI
- Auto Doppler flow optimization
- Elastography – strain based
- Supports biopsy guide capabilities

L15-7io broadband compact linear array

- 15 to 7 MHz extended operating frequency range
- Unique lens design allowing high resolution imaging at transducer surface
- Steerable pulsed wave and color Doppler, Color Power Angio, panoramic, and XRES imaging
- High resolution intraoperative vascular and superficial (MSK and small parts) applications
- Tissue aberration correction selection for MSK and small parts
- Auto Doppler flow optimization

L12-5 50 mm broadband linear array

- 12 to 5 MHz extended operating frequency range
- Fine pitch, 256 element, high resolution linear array
- Steerable pulsed wave and color Doppler, Color Power Angio, SonoCT, XRES, and harmonic imaging
- High resolution superficial applications including small parts, breast, vascular, and musculoskeletal imaging
- Tissue aberration correction selection for advanced MSK, small parts, and breast imaging TSI
- Auto Doppler flow optimization
- Contrast application
- Elastography – strain based
- Supports biopsy guide capabilities

L9-3 broadband linear array

- 9 to 3 MHz extended operating frequency range
- Fine angle steering of color and pulsed wave Doppler
- Steerable pulsed wave 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), internal mammary vessels and musculoskeletal imaging
- Interventional application
- Contrast application
- Auto Doppler flow optimization
- Supports biopsy guide capabilities

Sector array

S5-1 broadband sector array with PureWave crystal technology

- 5 to 1 MHz extended operating frequency range
- Phased array, 80 elements
- 2D; CW, steerable pulsed wave, High PRF and color Doppler; tissue Doppler, XRES, and harmonic imaging
- Adult echo, TCD, abdominal vascular and abdominal renal applications
- Contrast application

S4-1 broadband sector array

- 4 to 1 MHz extended operating frequency range
- Steerable pulsed wave, High-PRF Doppler and color Doppler; Color Power Angio, XRES, and harmonic imaging
- Deep abdominal, obstetrical, gynecological, and intervention applications
- Supports biopsy guide capabilities
- Contrast application

S7-2omni sector array

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

xMATRIX array

X7-2 xMATRIX array with PureWave crystal technology

- 7 to 2 MHz extended operating frequency range
- Fully-sampled matrix phased array with 2,500 elements
- Triple-high line density in live volume and full volume modes
- 2D, biplane (Live xPlane), triggered full volume, Live 3D Echo, thick slice imaging, 2D, biplane and 3D imaging color Doppler, pulsed Doppler, XRES, and harmonic imaging
- Pediatric applications: abdomen, neonatal head, and fetal echo

X6-1 xMATRIX array with PureWave crystal technology

- 6 to 1 MHz extended operating frequency range
- Fully-sampled matrix phased array with 9,212 elements
- Dynamic focusing over range in both lateral and elevation dimensions
- Three line densities in 3D and 4D modes
- Supports biopsy guide capabilities
- General purpose abdominal, obstetrical, fetal echo, gynecological, and interventional applications
- Discreet TSI for contrast imaging
- 2D modes including 2D, M-mode, color Doppler, Color Power Angio including directional CPA, pulsed Doppler, elevation compounding, biplane (Live xPlane) with color, 3D with color and CPA, 4D, triggered full volume with color, advanced XRES, and harmonic imaging
- Auto-heart rate detection for triggered full volume fetal echo in grayscale and color

X3-1 xMATRIX array

- 3 to 1 MHz extended operating frequency range
- Fully-sampled matrix phased array with 2,400 elements
- 2D, biplane (Live xPlane), triggered full volume, Live 3D Echo, thick slice imaging, color Doppler, XRES, and harmonic imaging
- Adult (including epicardial) and pediatric cardiology, abdominal, obstetrical, interventional, and contrast applications

Non-imaging

D5cwc CW transducer (Pedoff)

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

D2cwc CW transducer (Pedoff)

- Dedicated 2 MHz continuous wave Doppler
- Adult cardiology applications

D2tcd PW transducer (Pedoff)

- Dedicated 2 MHz pulsed wave Doppler
- Transcranial Doppler applications

Transducers

Transducer		C10-3v	C9-5ec	C9-4	C8-5	C8-4v	C5-2
					Curved array		
Type of array		Tightly curved	Tightly curved	Curved	Tightly curved	Tightly curved	Curved
Number of elements		128	128	192	128	128	128
Field of view		164°	173°	108°	120°	160°	115°
Volume field of view							
Broadband frequency range		10-3 MHz	9-5 MHz	9-4 MHz	8-5 MHz	8-4 MHz	5-2 MHz
Application	**Exam type**						
Abdominal	General			●			●
	Renal			●			●
	Bowel			●			
	Vascular						●
	Difficult						
Obstetrics	Early Ob	●	●	●		●	●
	General Ob	●	●	●		●	●
	Fetal echo	●	●	●		●	●
	NT						
	Difficult						
Gynecology	Pelvis	●	●	●		●	●
	Fertility	●	●			●	●
	Difficult	●					
Cardiology	Adult						
Vascular	Carotid				●		
	Arterial				●		
	Venous				●		
	Abdominal						●
	TCD						
Pediatric	Abdomen			●	●		●
	Hip						
	Neonatal cephalic				●		
	Renal						
Small parts	Superficial						
	Thyroid						
	Testicle						
	Breast						
Musculoskeletal	Superficial						
	General						
Urology	Prostate		●				
	Bladder	●				●	
	Renal						●
Contrast		●	●			●	●
Surgical	Vascular						
Biopsy guide		●	●	●	●	●	

	Volume array			Linear array			
C5-1	**VL13-5**	**V6-2**	**3D9-3v**	**L17-5**	**L15-7io**	**L12-5**	**L9-3**
Curved	Linear	Curved	Tightly curved	Linear	Linear	Linear	Linear
160	192	192	128	288	128	256	160
96°	38 mm	100°	164°	38.9 mm	23 mm	50 mm	38 mm
	38 mm x 30°	100° x 85°	156° x 85°				
5-1 MHz	13-5 MHz	6-2 MHz	9-3 MHz	17-5 MHz	15-7 MHz	12-5 MHz	9-3 MHz

C5-1	VL13-5	V6-2	3D9-3v	L17-5	L15-7io	L12-5	L9-3
●		●					
●		●					
●						●	●
●							
●							
●		●	●				
●		●	●			●	
●		●	●				
●							
●							
●			●				
●			●				
●			●				
	●			●		●	●
				●	●	●	●
				●		●	●
●							
●				●		●	
				●		●	
				●	●	●	
	●			●		●	
	●			●		●	●
				●	●	●	
				●		●	●
			●				
●							
●		●				●	●
					●		
●	●	●	●	●		●	●

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Transducers

Transducer		Sector array			xMATRIX volume array		
		S5-1	**S4-1**	**S7-2omni**	**X6-1**	**X7-2**	**X3-1**
Type of array		Sector	Sector	Sector TEE	xMATRIX	xMATRIX	xMATRIX
Number of elements		80	96	64	9212	2500	2400
Field of view		90°	90°	90°	100°	90°	90°
Volume field of view					90° x 90°	86° x 86°	90° x 90°
Broadband frequency range		5-1 MHz	4-1 MHz	7-2 MHz	1-6 MHz	7-2 MHz	3-1 MHz
Application	**Exam type**						
Abdominal	General		●		●		●
	Renal	●	●		●		
	Bowel				●		
	Vascular	●	●		●		
	Difficult				●		
Obstetrics	Early Ob				●		
	General Ob		●		●		●
	Fetal echo		●		●	●	●
	NT						
	Difficult				●		
Gynecology	Pelvis		●		●		
	Fertility						
	Difficult						
Cardiology	Adult	●		●			●
Vascular	Carotid						
	Arterial						
	Venous						
	Abdominal	●	●				
	TCD	●					
Pediatric	Abdomen					●	
	Hip						
	Neonatal cephalic					●	
	Renal					●	
Small parts	Superficial						
	Thyroid						
	Testicle						
	Breast						
Musculoskeletal	Superficial						
	General						
Urology	Prostate						
	Bladder						
	Renal						
Contrast		●	●		●		●
Surgical	Vascular						
Biopsy guide			●		●		

6. PercuNav image fusion and instrument navigation

Overview
- Used in both interventional and diagnostic settings
- Tracks the tips of flexible and rigid instruments during minimally invasive needle procedures
- Used clinically in biopsies, ablations and drainages in abdominal area
- Displays the instrument position, orientation, and trajectory on pre-procedure, intra-procedure, and fused multimodality images to help guide the instrument, even when the target is hard to see or difficult to reach
- Generates and displays fused multimodality images to leverage the combined advantages of resolution, contrast, and real-time feedback from the following modalities
  - Ultrasound
  - CT
  - MR
  - PET/CT
  - Rotational fluoroscopy
- Synchronizes previously acquired scans with real-time ultrasound images.
- Provides intuitive interface with large, easy-to-read buttons
- Co-registration of two 3D image datasets
- Enables matching of the region of interest on both live and pre-procedure images from multiple modalities
- Multi-planar reconstructed views to plan and track the tips of needles to defined targets in a single display
- Is available as an integrated form*
- Color Doppler support for identifying vascular structures and blood flow
- Cineloop to enable US point and US plane registration by scrolling through images on stored frames
- Manual RF ablation treatment planning
- Easy access to content sensitive help through online help function
- Multi-phase Slice Sorting

Instrument tip tracking
- Instrument tip orientation and location are tracked using minute electro-magnetic sensors
- Supports flexible and rigid instrument tip tracking

- A wide range of tracked instrumentation is available
  - Biopsy devices
  - RFA introducers
  - Ultrasound trackers
  - Probes
  - Patient registraion devices
  - Patient references

Automatic registration (RegPatch fiducial)
- Streamlined automated registration process

Out-of-plane navigation approach
- Ability to track and visualize out-of-plane ultrasound-guided approaches
- Ability to track and visualize oblique CT-guided approaches using axial CT scans

Motion compensation (respiratory gating)
- Provides advanced software algorithms that track and display repiratory motion
- Ensures that the fusion registration is maintained even when the patient or field generator moves

Connectivity
- Network DICOM image transfer
- Extended Brilliance Workspace (EBW) segmented volume input
- Scan import through USB, CD/DVD, or hospital network (ethernet)

Image presentation
- Side by side
- Top and bottom
- Quadrants view
- Full single view
- User defined customizable layout, W/L and workflow

Measurements
- 2D distance and angle on ultrasound images
- 3D distance and angle measurement including measurement in fused ultrasound image
- Respiratory gating used to display positional difference between inspiration and expiration in mm
- Distance between tracked tool tip and user-defined target

*Not available in all geographies. Check with your Philips representative for availability in your area.

Accessories and consumables

Product	Description	Features
Biopsy introducers		
Biopsy introducers	• For Temno/Temno Evolution 18G x 11 cm coaxial biopsy system • For Temno/Temno Evolution 18G x 15 cm coaxial biopsy system • For Easy Core 18G x 21 cm coaxial biopsy system • For Temno/Temno Evolution 20G x 15 cm coaxial biopsy system • For Temno/Temno adjustable 18G x 20 cm coaxial biopsy system • For Temno/Temno adjustable 20G x 20 cm coaxial biopsy system	Introducers include a stylet and cannula pair that is designed to function with specific instruments such as biopsy systems. The stylet is used with the PercuNav system to position the cannula in a specific location. Once in place, the stylet can be removed, and the biopsy system can then be inserted into place via the pre-positioned cannula. The biopsy introducer set includes: 1 cannula and 1 stylet.
RFA introducers		
RFA single pole introducers	• For Valleylab 17G x 10 cm RFA electrode, 2 cm exposure • For Valleylab 17G x 10 cm RFA electrode, 3 cm exposure • For Valleylab 17G x 15 cm RFA electrode, 1 cm exposure • For Valleylab 17G x 15 cm RFA electrode, 2 cm exposure • For Valleylab 17G x 15 cm RFA electrode, 3 cm exposure • For Valleylab 17G x 20 cm RFA electrode, 2 cm exposure • For Valleylab 17G x 20 cm RFA electrode, 3 cm exposure • For Valleylab 17G x 25 cm RFA electrode, 3 cm exposure • RFA Stylet, Tracked Stylet for Boston Scientific 16G x 15 cm CoAccess Introducer Set	Introducers include a stylet and cannula pair that is designed to function with specific instruments such as ablation devices. The stylet is used with the PercuNav system to position the cannula in a specific location. Once in place, the stylet can be removed, and the ablation device can then be inserted into place via the pre-positioned cannula. The RFA introducer set includes: 3 cannulae and 1 stylet.
Other components		
Button probe	• Button probe, 25 mm stem, right hand version	The button probe is an electromagnetically tracked tool used for planning, registration matching and/or verification, or to target desired anatomical locations during diagnostic or interventional procedures.
Patient tracker (DRF)	• Dynamic reference frame • External patient tracker	The patient tracker is used as a dynamic reference frame (DRF) which allows for patient or Field Generator movement during the procedure without invalidating the registration. The patient tracker is also used for applications requiring respiratory gating. *This patient tracker is used in cases where RegPatches are not used.*
RegPatch	• Automatic registration fiducials and dynamic reference frame	RegPatches are automatic registration fiducials that can be placed on the patient prior to CT, PET/CT or rotational fluoroscopy scans for same day procedures. There is a patient tracker embedded in the RegPatches which functions as a DRF. *Please note, this is **not** MRI safe.*
Ultrasound trackers	• Abdominal ultrasound tracker for Philips C5-2 • Abdominal ultrasound tracker for Philips C5-1 • xMATRIX ultrasound tracker for Philips X6-1	For ultrasound procedures, a tracker attached to the ultrasound transducer allows the system to display the position and orientation of the transducer and ultrasound scan data. Each ultrasound tracker is pre-programmed and designed to work with a specific ultrasound transducer. Please note, the *Civco needle-guide clamp needs to be ordered separately.*

7. Measurements and analysis

Measurement tools and general description
- 2D distance
- 2D circumference/area by ellipse,
  continuous trace, trace by points
- Auto conversion of distance to ellipse
- 2D curved-linear distance
- 2D angle: intersection of two lines
- 3D: ellipse and distance on 2 MPR views
- 3D: stacked contours on one MPR
- M-mode distance (depth, time, slope)
- Manual Doppler distance
- Manual Doppler trace
- Time/slope measurements in Doppler and M-mode
- High Q automatic Doppler analysis
  (general imaging only)
  – Doppler values including PI, RI, S/D indices
- Volume flow
- 2D volume (2 volume methods)
- Heart rate
- 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
- Delete last measurement
- Embed image and graphs in report

7.1 Measurement tools and quantification
QLAB quantification software (version 9.0)
- On-cart and off-cart access
- Customize capabilities via optional plug-ins
- General imaging 3D Quantification (GI 3DQ) plug-in
  – 3D/4D viewer for Ob/Gyn and general imaging
    including interventional applications
  – Review of 3D/4D, color 3D, STIC, and iSTIC files
  – Multiplanar reconstruction (MPR)
  – iSlice and curved iSlice precision
    volume slicing capability
    - Display of 2D/color slices from static or live volume
    - User-selectable slice display: 4, 9, 16 or 25
    - User-selectable interval spacing
    - User-selectable slicing depth
    - User-selectable slicing source (x, y or z)

– Free rotation of any source
– Full cineloop review control
– 2D grayscale display adjustments
– Color display adjustments
– Zoom control
– Cine/pan slice control through volume
– User-selectable image storage
– Quick launch to measurements
  - Auto ruler display
– Compatible with freehand, automated
  and xMATRIX volumes
– Thick slice imaging
  - User-adjustable slice thickness and depth
  - Variable thick slice display adjustments
    with present vision settings
– 2D and 3D measurement tool including
  distance, area, angle, auto volume, stacked and
  auto contour and ellipsoid measurements
  - Invert mode
  - Vascularization index, flow index and vascularization
    flow index results on 3D color mode data sets
  - Pixel intensity index
– Contrast timer marker on iU22 data
  sets saved with contrast timer
– Orientation labels display on iU22 data sets
  saved with orientation label marker
– XRES speckle noise reduction of
  MPR and volume displays
– Assisted auto-trace volume measurement tools
  for stacked contours and ellipse methods
– Edge detection selection for hypoechoic
  or high contrast targets
– Auto volume tool
- Intima Media Thickness (IMT) Quantification plug-in
  – Automated assessment of the IMT
    on user selected frames
  – For carotid and other superficial arteries
- MicroVascular Imaging (MVI) plug-in
  – Integration and processing of images in
    contrast specific imaging mode providing
    detection and display of very low velocity
    flows of very low signal amplitude
  – Motion compensation for multiframe objects

Interrogating data at a workstation or on the system provides
you with workflow options for improved efficiencies.

- Region of Interest (ROI) Quantification plug-in
  - Pixel intensity index – pixel intensity
    analysis, data types: echo, velocity
  - Pixel intensity analysis, data types: echo,
    velocity (color) or power (angio)
  - Up to 10 user defined regions
  - Thumbnail display of frames for easy trimming
  - TDI velocity timing measurement
  - Log/linear data display selection
  - Smoothed data display option with
    various curve fitting techniques
  - Vascularization index, flow index
    and vascularization flow index
    results on color mode files
  - Motion compensation for multiframe objects
- Strain Quantification (SQ) plug-in
  - Evaluation of regional myocardial function,
    assessment of synchronicity and guidance
    during bi-ventricular pacing procedures
  - Tissue Doppler Imaging (TDI)
    velocity quantification
  - Measurement of the myocardial velocity
    and derives the strain rate and strain
    along user-defined M-lines
  - User-defined M-line motion to
    follow the myocardial motion

- User-selectable waveforms for optimal
  sub-region visualization
- Curve processing mode
- TDI velocity timing measurement
- Cardiac 3D Quantification (3DQ)
  - Multiplanar reconstruction (MPR) views
  - Distance and area calculations
  - LV mass, LV ED and ES volumes, ejection fraction
    by method of disk using biplane Simpson
- Cardiac motion/Mechanics 2D
  Quantification (CMQ) plug-in
  - Provides objective assessment of left ventricle
    global function and regional wall motion,
    deformation and timing using the next generation
    of 2D speckle tracking technology
  - File compatibility
    - Display 2D native ultrasound DICOM images from
      Philips iE33, iU22, CX50, and HD15 systems
    - Quantify 2D native ultrasound PureWave
      data sets from Philips ultrasound systems for
      S5-1, S5-2, x7-2, and x7-2t transducers
    - Run equivalent of 2DQ plug-in features on
      other iE33, iU22, CX50, HD15, and HD11
      XE non-PureWave 2D data sets
  - Available methods with dedicated preferences settings:
    - CMQ method:
      - AHA/ASE 17 left ventricle segmentation
        templates (three apical view and three
        short axis view templates)
      - Reduction of workflow steps utilizing Smart
        Exam. User interface that auto adapts to display
        the existing user's tailored CMQ Smart Exam
        acquisition protocol, facilitating navigation through
        View Names and auto selecting the ROI template
    - Display
      - Parametric image PI (Hide/show)
      - Transmural, waveforms and values available
        from one single computing step
      - User preference choice of parametric image colors
    - 2D speckle parameters
      - Longitudinal and circumferential strain and strain rate
      - Radial and transversal displacement
      - Radial fractional shortening, radial velocity, speed
        (absolute angle independent velocity), local and
        regional rotation and rotation velocity, global
        rotation, Endo-Epi Mural torsion and local rotation

- Measurement and calculations
  - ▪ Waveform auto-peak detection to report time-to-peak and peak values
- Report
  - ▪ One view and global report pages
  - ▪ Results displayed in AHA/ASE 17 LV segment bull's eye plot format and numerical table
  - ▪ Global longitudinal and circumferential strain per view
– Free strain method:
  - Up to 17 dedicated colors to help differentiate each cord and corresponding waveform
– Tissue motion annular displacement (TMAD) method:
  - Computes valve annular displacement curves over time
  - Uses the color kinesis overlay to visualize valve annular plane motion parametrically
– Complex and Simple CK methods:
  - Area/Simpson volume (single-plane volume measurements based on 5/6 area-length method and Simpson's Single Plane Method of Disks (MOD)
  - Fractional area change (FAC), ejection fraction (EF), peak ejection rate (PER), peak rapid filling rate (PRFR) and atrial filling fraction (AFF)
  - Color kinesis (CK) overlay for color-coded visualization of global and regional wall motion in systolic, diastolic and cycle modes
– Elastography Quantification (EQ)
  - Available in both single screen and side-by-side display modes
  - Ability to generate up to 10 user-defined regions of interest (ROIs)
  - Thumbnail display of frames
  - Measurement results
    - ▪ Strain rate
    - ▪ Total strain
    - ▪ Size comparison between two ROIs
    - ▪ Strain ratio
      - Calculation of maximum strain ratio
      - Calculation of average strain ratio
      - Calculation of ratio between two user-defined ROIs
      - Graphical display

- ▪ Strain ratio parametric image
  - Color-coded display of strain ratios with parametric imaging
• Fetal Heart Navigator
  – Protocol driven workflow
    - Automates the initial ductal arch view
    - Guides user in obtaining view recommended in ISUOG Fetal Cardiac Screening Guidelines
    - Obtains the fetal heart views: 4-Chamber, LVOT, and RVOT
  – Supports X6-1 iSTIC and V6-2 STIC datasets containing eight or more frames
  – Presets supported:
    - OB difficult, OB early, OB fetal echo, OB fetal echo CV, OB general, OB max pen
  – Visualization controls allow users to change display settings at any stage in the protocol
    - Chroma Map
    - Gray Map
    - Slice thickness
    - Brightness
• Vascular Plaque Quantification (VPQ)
  – 3D technology to visualize and quantify vascular plaque
  – Streamlined workflow through a protocol based task guidance
    - Protocol can be turned off or on dependent upon user experience
  – Automatically calculates and displays vessel and plaque boundaries for each frame
    - Outer Wall and Inner Wall ROIs automatically generated for all frames between begin and end frames
    - Plaque Boundary automatically generated
    - Boundaries can be adjusted manually by user
  – Analysis data presented on image
    - Total Plaque Volume calculated (mm3)
    - Maximum % Area Reduction calculated
    - Per-frame values: plaque/lumen/wall areas and plaque echo intensity
    - Tool tips for analysis data explanation
  – Analysis data shown on the graph
    - Lumen Area
    - Plaque Area
    - % Reduction over vessel length
  – Data exported in DICOM SR
  – Supports monochrome, single-volume 3D volumes acquired with the VL13-5

7.2 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 six):
  - Volume flow
  - Time-averaged peak velocity
  - Time-averaged mean velocity
  - Resistive index
  - Pulsatility index
  - Systolic/diastolic ratio
  - Acceleration/deceleration times
  - Illustrated High Q

7.3 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
- 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
- Ob analysis
  - Fetal echo application
  - Fetal biometry (up to quintuplets)
  - Biophysical profile
  - Amniotic fluid index
  - Early gestation
  - Fetal long bones
  - Fetal cranium
  - Other Ob measurements
    - 2D echo
    - Fetal heart M-mode
    - Fetal Doppler
    - Fetal echo
- Gynecology/Fertility
  - Uterine volume
  - Right and left ovary volumes
  - Right and left follicles (10)
  - Endometrial thickness
  - Cervical length
- Abdominal vascular
  - Labels for all major abdominal arteries and veins
  - Left and right segmentation for kidneys
- General imaging
  - General
  - User-defined labels
- Prostate
  - Prostate gland
- Pediatric
  - General
  - d:D radio
- Small parts
  - General
  - Breast with right and left protocols
    for up to five lesions per breast

8. Physical specifications

System cart

- State-of-the-art ergonomic design
  for comfort and convenience
- Easy maneuverability and mobility
  – Wheel-lock and monitor adjustments
    that facilitate bedside exams
- Independent height adjustment of
  control panel and display monitor
- Easily accessed transducer connector
  ports and DVD media drive
- 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
- Integrated footrests
- Digitally-enhanced 8-speaker high fidelity stereo output
- On-board storage in convenient
  side bins and accessory tray
- Universal peripheral bay that provides easy access for up
  to three on-board hardcopy or documentation devices
- Built-in A/C line conditioner that 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

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

Monitor

- Flat panel LCD display monitor
  – 20 inch wide format high resolution
    flat panel TFT/SIPS display
  – High contrast ratio >600:1
  – Extended viewing angle >170°
    (horizontal and vertical)
  – Response time: <16 ms
  – Virtually flicker-free technology
    for reduced 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

Control panel

- 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 inches/15.2 ± 7.6 cm
  – Retractable, lighted alphanumeric keyboard
  – Palm rest

Physio

- One 3-lead ECG input
  – Gain, sweep rate and display position controls
  – Automatic heart rate calculation and display
  – Fault condition display
  – Cineloop locator displayed on ECG trace

Exam documentation

Peripherals

- The system supports up to three on-board
  peripheral devices (excluding report printers)
  – Video-recording peripherals, operated
    via system user interface
    - DVD recorder (cart-dependent) or super VHS VCR
  – Small format digital color printer (USB)
  – Small format digital B/W printer (USB)
- Support for large format external color printer
- Support for various Hewlett-Packard brand color and
  monochrome report printers (USB, externally mounted)

Input/output ports

- Export of measurement and analysis data to
  off-line reporting software packages (USB)
- Power requirements and video parameters
- 100V-127V, 50Hz/60Hz – NTSC
- 220V-240V, 50Hz/60Hz – NTSC and PAL
- Integrated A/C line conditioning and
  battery back-up system
- Power consumption: 750VA – 900VA
  depending on system configuration

Electrical safety standards

- Electromechanical Safety Standards met
  - CAN/CSA 22.2 No. 60601-1, Medical Electrical Equipment: General requirements for basic safety and essential performance
  - IEC 60601-1, Medical Electrical Equipment: General requirements for safety
  - IEC 60601-1-2, Collateral Standard, Electromagnetic compatibility
  - IEC 60601-2-37, Particular Requirements for Safety: Ultrasonic medical diagnostic and monitoring equipment
  - UL 60601-1, Underwriters Laboratories Standard for Medical Electrical Equipment

- Electromechanical Safety Standards met (EU Only)
  - EN60601-2-37, Particular requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment.

- Agency approvals
  - Canadian Standards Association (CSA)
  - CE Mark in accordance with the European Medical Device Directive issued by British Standards Institute (BSI)

9. Maintenance and services

Maintenance

- Proven reliable platform
- Easy customer access to trackball and air filter for cleaning
- Optional service agreements to:
  - Contain risk
  - Maximize uptime
  - Access Philips best-in-class service

Services

- Clinical applications support available
- Philips Remote Services connectivity* allows for many advanced service features, including:
  - Virtual on-site visits for both clinical and technical support in order to provide faster resolution to issues and questions
  - Remote clinical education
  - Remote log file transfer that minimizes downtime by allowing faster diagnosis of problems by call center personnel
- On-line support request:
  - Simplifies support engagement
  - Provides faster response to clinical questions and technical issues
  - Allows user to enter request directly on the ultrasound system
- Proactive monitoring:
  - Helps prevent unscheduled downtime
  - Monitors key system parameters
  - Sends an alert to Philips call center so action can be taken before system operation is affected
- Optional utilization reports provide data to help manage the site's ultrasound assets:
  - System and transducer usage information
  - Data on number and types of studies, as well as study duration
  - Data for staff credentials and accreditation
  - Opportunities for outreach and referral communications identified

*Service agreement required for access to Philips Remote Services. Access to the internet required. Not all remote features available in all countries; contact your Philips representative for details.

Please visit www.philips.com/iU22 for more information

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