



**PHILIPS**

Ultrasound

EPIQ 7

# The **evolution** of premium ultrasound

Philips EPIQ 7 diagnostic ultrasound system specifications

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# 1. Introduction

Unprecedented advances in premium ultrasound performance can help address the strains on overburdened hospitals and healthcare systems, which are continually being challenged to provide a higher quality of care cost-effectively. The goal is quick and accurate diagnosis the first time and in less time.

Premium ultrasound users today demand improved clinical information from each scan and faster and more consistent exams that are easier to perform and allow for a high level of confidence, even for technically difficult patients.

EPIQ 7 is the new direction for premium ultrasound, featuring an exceptional level of clinical performance to meet the challenges of today's most demanding practices.

## 1.1 Applications

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- Abdominal
- Obstetrical
- Fetal echo
- Cerebrovascular
- Vascular (peripheral, cerebrovascular, temporal TCD, and abdominal)
- Abdominal vascular
- Gynecological and fertility
- Small parts and superficial
- Breast
- Musculoskeletal
- Pediatric general imaging
- Prostate
- Echocardiography (adult, pediatric, fetal)
- Stress echocardiography
- Transesophageal echocardiography (adult and pediatric)
- Surgical imaging
- Interventional imaging
- Contrast imaging
- Bowel imaging
- Strain elastography
- Shear wave elastography
  - ElastPQ
  - ElastQ Imaging\*
- Perioperative
- Epicardial echocardiography
- Image fusion and needle navigation



## 2. System overview



### 2.1 System architecture

- Powerful Philips *n*SIGHT Imaging combines a proprietary massive parallel processing architecture and precision beamforming for real-time coherent beam reconstruction. Capable of processing multiple data streams for structural, functional, and Live 3D/4D imaging.
    - Built for 2D, Live xPlane, Live 3D, Live 3D zoom, Live full volume, up to 102° x 101°, high volume rate (HVR) imaging, Live 3D color, MPR (multiplanar reconstruction), electronic rotational echocardiography (iRotate) and panoramic imaging capability; true real-time volume image-forming capability with multiple rendering engines
    - Supports both strain and shear wave elastography
    - Next-generation Live 3D, PureWave xMATRIX transducers, with microbeamforming and single ASIC beamforming architecture
    - Live 3D/4D, high volume rate (HVR) imaging with over 9,200 imaging elements, allowing outstanding 2D and 3D imaging from the single ergonomic transducer, eliminating the need to change between 2D and specialty 3D transducers
    - Offers up to 7,071,744 total digital channels (xMATRIX configuration)
    - Offers up to 4,718,592 total digital channels (non-xMATRIX configuration)
  - Next-generation ultra-low noise, wide dynamic range digital broadband acoustic beamforming with proprietary architecture
    - 3D volume scan conversion that processes 460 megavoxels per second and renders 2300 mega-ray cast samples per second
    - Live full volumes with one-beat, two-beat, four-beat and six-beat options
  - 320 dB maximum dynamic range
  - Powerful distributed multi-core processing architecture capable of achieving 450 x 109 40-bit multiply-accumulates/second; includes three hard drives, 1 TB plus 240 GB SSD
    - Advanced pulse shaping, pulse coding, and multivariant harmonics technologies incorporated
    - Support for transducer frequencies up to 20 MHz
  - Optimized for high definition 21.5 inch LCD display
  - Designed to support virtually any array configuration: sector, linear, curved, tightly curved, TEE, and xMATRIX electronic volume arrays
  - Contrast echo with low MI, mid MI, and LVO modes
    - Pulse inversion and Power modulation technology for low MI Imaging
    - Pulse inversion technology
  - Live 3D color imaging
  - iRotate imaging
    - Electronic rotation available with the X5-1, X7-2, X7-2t, and X8-2t\* transducers
    - Standard 2D views from the same apical or parasternal window without moving scanning hand
    - Part of a stress echo protocol for fast acquisitions and more consistent views between resting phase and stress phase
    - iRotate achieves frame rates up to 290 Hz
  - Philips next generation SonoCT real-time compound imaging
    - High precision beam-steered image compounding that acquires more tissue information and reduces angle-generated artifacts
    - Up to nine lines of sight, obtained by steering the ultrasound beam, available on linear, curved and tightly curved arrays, and mechanical volume arrays
    - WideSCAN capability to expand field of view during SonoCT imaging
    - SonoCT capability available during contrast imaging modes
    - Trapezoid capability
    - Elevation compound imaging on X5-1, X6-1, X7-2, X7-2t, and X8-2t\* transducer which compounds two or more lines of sight in the elevation dimension
- Variable XRES is an extension of Philips exclusive XRES speckle noise reduction feature that allows the user to select progressive amounts of noise reduction, edge enhancement, and textural smoothing. Available with specific transducers under certain tissue-specific presets, users have the option to select the imaging characteristics of their choice from crisp to smooth tissue textures, providing enhanced visualization of target anatomic structures.
- Philips next-generation XRES adaptive image processing for noise and artifact reduction that improves tissue and border definition
    - Performs 350 million calculations per frame of image data over 2800 frames per second
    - Operates in 2D and 2D/CFI/Doppler/TDI mixed modes over 2800 frames per second
    - Offers XRES capability in contrast imaging modes

\*Currently not approved in all countries.

- Provides user-selectable levels of XRES adaptive processing for C5-1, C8-5, C9-2, C10-3v, L12-3, L12-5 50, L15-7io, eL18-4, L18-5, S5-1, S8-3, S8-3t, S12-4, X7-2t\*, and V6-2
- Philips adaptive broadband flow imaging
  - Doppler bandwidth that automatically adjusts for optimal flow sensitivity and resolution
  - Advanced dynamic motion suppression algorithms that reduce flash artifacts
- Fully independent triplex multiple mode operation for extraordinary ease of use during Doppler procedures
- Auto Doppler flow optimization for carotid and arterial applications using linear array transducers
  - 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
- Advanced stress echo applications
  - Stress protocols with up to 10 stages
  - Forty views per stage by five modes
- Multi-application SmartExam workflow protocols
  - Stress echo, echo, abdominal, small parts, Ob/Gyn, and vascular applications
  - Step-by-step on-screen guidance during exam
  - Full user customization
  - Record function for creation of custom protocols
  - Automatic mode switching including 3D
- Fast system boot up: from OFF, approximately 150 seconds
- Two levels of transport mode: from sleep mode to on, approximately 20 seconds
  - Standard battery – 30 minutes before recharge required
  - Extended battery – 60 minutes before recharge required

## 2.2 Imaging formats

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- 2D linear: WideSCAN with SonoCT
- 2D linear: trapezoid with SonoCT
- 2D curved: WideSCAN with SonoCT
- 2D sector
- 2D virtual apex sector imaging with wide field of view
- Dual 2D
- Panoramic
- 3D Panoramic
- Live 3D/4D volume
- Live 3D/4D zoom
- 3D full volume
- 2D, MPR, and volume
- Dual Volume for full volume, 3D Zoom and iCrop
- MaxVue imaging format for full-screen high-definition image display with the push of a button
  - 38% more viewing area
  - Additional 1,179,648 more pixel image data than standard displays

## 2.3 Imaging modes

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- 2D grayscale imaging with advanced pulse coding, pulse shaping, and frequency compounding technologies
- xMATRIX-based 2D elevation compounding
- Hyper2D Imaging for xMATRIX
- M-mode
- M-mode color Doppler
- M-mode tissue Doppler
- Anatomical M-mode
- Live 3D Echo (instantaneous volume rendering of cardiac anatomy)
- 3D imaging
- 3D imaging with color Doppler
- 4D imaging
- Live xPlane imaging (simultaneous display of two live imaging planes)
- Tissue Harmonic Imaging (THI) with pulse inversion technology
- Coded beamforming
- Multivariate Tissue Harmonic Imaging including pulse inversion technology and coded harmonics
- Left ventricular opacification (LVO) with pulse inversion and power modulation technologies
- Contrast detection technology using pulse inversion and power modulation imaging techniques 3D Contrast imaging on the X5-1 and X6-1
- SonoCT beam-steered real-time compound imaging
- Harmonic SonoCT imaging
- Up to five levels of XRES adaptive image processing technology
- 2D post-processing includes gain, dynamic range, up/down invert, right/left invert, zoom, gray map, and Chroma map
- iSCAN intelligent scanning for one-button TGC and gain optimization
- iSCAN with adaptive gain compensation (AGC) for real-time user-initiated frame-by-frame TGC optimization
- AutoSCAN with adaptive gain compensation (AGC) for real-time frame-by-frame TGC optimization
- Simultaneous 2D M-mode
- Color Doppler
- Color Power Angio imaging (CPA) and directional CPA
- MicroFlow Imaging (MFI)
- Strain-based elastography
- Shear wave elastography point quantification imaging (ElastPQ)
- Shear wave elastography imaging for curved array (ElastQ Imaging)\*
- 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
- Auto Doppler optimization: Auto PW Doppler, color Doppler, flow optimization for one-button angle correction and steering

- Tissue Doppler Imaging (TDI)
- Adaptive Doppler
- Adaptive Broadband Color Flow
- MicroCPA imaging
- Color Compare mode
- Independent triplex mode for simultaneous 2D, color flow, PW Doppler
- Independent triplex mode for simultaneous 2D, CPA, PW Doppler
- Dual imaging with:
  - Two work flow choices; single buffer or dual buffer
  - Mixed mode display with one image live while other is frozen, for example, 2D/2D, 2D/color, color/color, color/CPA
- High definition zoom with pan (write zoom)
- Reconstructed zoom with pan (read zoom)
- Panoramic imaging
- SonoCT panoramic imaging with XRES and harmonic modes
- 3D Panoramic imaging for full organ visualization
- Chroma imaging in 2D, 3D, QLAB MPR and iSlice, Panoramic, M-mode, and Doppler modes
- Dynamic colorization in Live 3D mode on X5-1, X7-2, and X7-2t, freehand 3D on C10-3v, and 3D/4D on V6-2, X6-1, X7-2, and X8-2t\*
- Live MVI
- Spatio-Temporal Image Correlation (STIC)
- iSTIC on X6-1 transducer

#### **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

#### **Color Doppler**

- Available on all imaging transducers
- Color gain
- Region of Interest (ROI)
- Freq Opt: Fixed transmit/receive frequencies including adaptive flow
- Seventeen selectable baseline positions for CV; nine selectable baseline positions for GI and WHC
- Baseline invert
- B/W suppress
- Color blending
- Color Doppler flow algorithms provide precise vessel delineation and temporal display
- MicroCPA feature for superb small vessel imaging
- MicroFlow Imaging (MFI)
- Color compare dual display (B/W on left, color on right)

- Color map
- Color persistence
- Flow optimization: GI, WHC
- Output power
- Magnify (range from 0.8X to 8X)
- Scale sector width and position on curved and phased array transducers
- Simultaneous mode during PW mode
- Smoothing
- Ability to steer between  $\pm 3$  steering angles on linear array transducers
- Variance
- Wall filter
- Write priority
- Zoom
- 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
- Post-processing includes baseline, color invert, color map, hide color, write priority, blend, variance, and zoom
- Parallelogram steering on linear array transducers; three angles on L12-5 50 and L18-5, twenty-one angles on L12-3 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
- Frequency optimization control for spatial resolution and penetration optimization
- Color and 2D line density control
- Automatically adapts transmit and receive bandwidth processing based on the color box position, providing optimal sensitivity and color resolution

#### **Color Power Angio imaging (CPA)**

- Automatically adapts transmit and receive bandwidth processing based on the color box position providing excellent sensitivity and color resolution
- MicroCPA, a highly sensitive flow optimization method for small vessel visualization
- Available on all imaging transducers for general imaging and women's healthcare
- Cineloop review
- Multiple color maps
- Individual controls for gain, filters, sensitivity, echo write priority, and color invert
- Adjustable CPA Region of Interest: size and position
- User-selectable persistence
- User-selectable blending on/off

- 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
- Post-processing includes hide CPA, write priority, invert, DCPA map, blend, and zoom
- Parallelogram steering on linear array transducers; three angles on L12-5 50 and L18-5, twenty-one angles on L12-3 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
- Frequency optimization control for spatial resolution and penetration optimization
- Color and 2D line density control
- Automatically adapts transmit and receive bandwidth processing based on the color box position, providing optimal sensitivity and color resolution

#### **MicroFlow Imaging (MFI)**

- Highly sensitive imaging mode designed to detect slow and weak blood flow anatomy in tissue

#### **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
- 256 (8 bits) discrete gray levels
- Post-processing includes invert, baseline, angle correct, Quick angle, display format, sweep speed, reject, compress, and Chroma map
- Post-processing in PW frozen mode includes map, baseline, invert, and Chroma
- 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 color and Auto Doppler**

- In live imaging provides the following capabilities:
  - 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
  - Automatically adjusts PW scale and baseline
- When image is frozen and Doppler is active, automatically adjusts PW scale and baseline
- Auto color and Auto Doppler is available on the linear transducers, L12-3, L12-5 50, L18-5, VL13-5, and L15-7io in carotid and arterial vascular applications
- Auto Doppler is available on the curvilinear transducers, C5-1, C8-5, C9-2, C10-3v, C10-4ec, and V6-2

#### **Steerable continuous wave (CW) Doppler**

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

#### **Tissue Doppler Imaging (TDI/TDI PW)**

- Available on all cardiac imaging transducers (except S7-3t and S8-3t)
- Frame rate control: High frame rate acquisition of tissue motion (up to 240 fps)
- TDI gain, TGC- and LGC-compatible
- TDI Opt: Optimized transmit and receive frequencies
- Eight maps

#### **iRotate echo (X5-1, X7-2, X7-2t, and X8-2t\*)**

- Ability to image in 2D and rotate the image without moving the transducer
- Home rotational key
- High frame rate rotational imaging
- iRotate with stress echo acquire
- iRotate for contrast echo
- iRotate with color flow and CMQ speckle technology

#### **Live xPlane imaging**

- Available on X5-1, X6-1, X7-2, X7-2t, and X8-2t\* xMATRIX transducers
- Simultaneous display of two live imaging planes
- Color and grayscale modes
- Lateral, rotational, and elevation steering
- Contrast and interventional modes

#### **Live 3D echo**

- Available on X5-1, X7-2, X7-2t, and X8-2t\* xMATRIX transducers
- Live full volume imaging



- High volume rate imaging (HVR)
- ECG display
- Live one-beat, two-beat, four-beat and six-beat 3D volume imaging
- Long live volume loop acquire
- Beat-by-beat retrospective 3D loop selection
- Live 3D color flow imaging
- High volume rate (HVR) echo and color
- xMATRIX with LVO, hi MI and low MI, xMATRIX pulse inversion and power modulation
- Contrast and interventional modes
- Live 3D zoom and Live 3D zoom preview
- One-beat focused volume
- Half clam shell
- Left and right clam shell switching
- Two volume viewing display
- Crop adjust with cropping
- QuickVue 3D volume cropping tools
- 3D color flow
- 3D Zoom: 2D and Color
- 3D Zoom: 2D and Color Preview
- Enhanced Live 3D dynamic colorization for enhanced 3D effect
- Full volume sweep
- Adjustable live volume angle control
- Volume rotation using 3D Rotate and Rotate-Z
- Dynamic colorization
- Adjustable vision preset control
- Adjustable center, back, front, volume imaging control
- Maximum 102° by 101° live volume imaging (mode-dependent)
- Support of volume rates up to 100 vps

#### **Live 3D/4D and MPR/iSlice imaging**

- Supported on X5-1, X6-1, X7-2, X7-2t, and X8-2t\* xMATRIX transducers
- Volume display with surface rendering (transparency, brightness, and lighting controls)
- Multiplanar reconstruction (MPR) and iSlice view display with QLAB software, including nine simultaneous views from 3D
- Specialized algorithms and maps that increase 3D display
- QuickVue cropping method for rapid access to anatomy of interest within the volume
- Cropping tools on volume views with image reference red, green, and blue crop planes, arbitrary plane cropping and ROI-directed cropping with iCrop
- Two and three 2D reference planes optionally available Live 3D, full volume and 3D zoom imaging, live and review
- AutoView for one-button access to pre-defined volume cropping anatomic views, up to 3 independent views
- Supported XRES modes to reduce noise artifacts

#### **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
- TrueVue Volume 3D rendering display delivers lifelike image display allowing the user to place the light source anywhere within the 3D volume
- GlassVue 3D rendering goes beyond the surface revealing internal structures
- Adjustable vision preset control
- Contrast mode
- AutoView, one-button volume crop to pre-defined anatomic views
- aReveal<sup>AI</sup>, one-button press to sculpt and remove volume data anterior to the fetal face
- 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 to include TrueVue and GlassVue maps
- Cropping tools on both volume and multiplanar reconstruction (MPR) views
- Slice control on MPR and volume displays
- One-button press to sculpt and remove volume data anterior to the fetal face
- Supported by SonoCT and XRES modes to reduce noise artifacts
- TrueVue Volume 3D rendering display delivers lifelike image display allowing the user to place the light source anywhere within the 3D volume
- GlassVue 3D rendering goes beyond the surface revealing internal structures

#### **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

\*Currently not approved in all countries.

- Supported by SonoCT and XRES modes to reduce noise artifacts
- Resize control that adjusts for different sweep speeds
- On-screen orientation markers
- TrueVue Volume 3D rendering display delivers lifelike image display allowing the user to place the light source anywhere within the 3D volume
- GlassVue 3D rendering goes beyond the surface revealing internal structures

#### **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° 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 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 (not available on endovaginal transducers)

#### **Contrast imaging – cardiovascular**

- System optimized for left ventricular opacification and low MI imaging
- 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
- X5-1 and S5-1 broad bandwidth pulse inversion and power modulation technologies for high sensitivity and high resolution visualization of contrast agent at low MI
- LVO and low MI contrast on and off, and contrast optimization choices and transmit power settings that can be saved with Gain Save feature for stress echo studies, reducing setup time for image acquisition at peak stress
- Low MI with flash
- Low MI with triggered replenishment imaging (TRI) that provides excellent 2D image quality on the S5-1 transducer
- X5-1 with iRotational contrast imaging and iRotational stress contrast imaging
- X5-1 with Live xPlane for contrast imaging
- X5-1 with xMATRIX elevation compounding for contrast imaging
- X5-1 with triggered replenishment imaging
- X5-1 with 3D contrast echo
- Supported on the S5-1 and, X5-1 transducers

#### **Contrast imaging – general imaging**

- System optimized for detecting contrast agent signatures as they are approved for use
- Contrast modes available on C5-1, C9-2, C10-4ec, C10-3v, L12-3, L12-5 50, and X6-1 transducers
- Live MicroVascular Imaging (MVI)
- Mid-MI contrast modes available on C5-1, C9-2, and X6-1 transducers
- Pulse inversion contrast imaging available with SonoCT and XRES technologies
- Power modulation (PM), pulse inversion (PI), and flash contrast imaging modes
- Touchscreen display timer
- Advanced non-linear pulsing schemes with SonoCT and XRES for increased contrast sensitivity
- Contrast iSCAN capability for C5-1 and C9-2
- 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
- Biopsy guide selection menus
- Contrast and interventional modes
- Support of multiple biopsy angles on S5-1, X6-1, C5-1, C9-2, and L12-3

## 2D imaging

- Available with all imaging transducers
- Adjustable sector width and position during live imaging
- Ability to invert image left and right, top, and bottom
- Ability to electronically steer the 2D beam direction with 3D9-3v, tilt
- Receive gain
- LGC (lateral gain compensation) on cardiac sector transducers
- Selection between one and eight focal zones
- Dynamic range or echo compression, transducer and tissue-specific preset (TSP)-dependent
- Gray map
- Chroma imaging providing colorized luminance maps
- Acquisition zoom (HD zoom): ability to position the zoom ROI anywhere within the image, change the height and width of the zoom ROI and pan the position once zoomed
- Display zoom and magnify on live or frozen images up to 16 times
- Three levels of frame rate
- Support of frame rates of over 2800 frames per second
- Tissue optimization
- Contrast resolution enhancement
- Tissue Harmonic Imaging
- SonoCT imaging
- Hyper2D Imaging
- Live Compare imaging; side-by-side comparison of 2D images where the current live image is compared to a stored image from the same study or retrieved multimodality image
- WideSCAN imaging
- Trapezoid capability
- Next-generation XRES technology, including up to five selection levels on some transducers
- Persistence (frame averaging)
- Grayscale standard display
- AutoSCAN with adaptive gain compensation (AGC) for real-time line-by-line TGC optimization

## Tissue Harmonic Imaging (THI)

- Provides 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
- Extends 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

## Strain-based elastography

- Strain-based elastography for breast and gynecological imaging
- Available for breast imaging on the L18-5 and L12-5 50 transducers, and on the C10-3v for gynecological and urology 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
- Anechoic imaging (AI) for enhancing areas without ultrasound signals such as cystic and complex cystic structures

## Shear wave elastography (ElastPQ)

- Tissue deformation from special ultrasound push pulses
- Detection pulses used to calculate shear wave velocity
- Available on C5-1 for liver imaging
- Configurable analysis:
  - Pressure (kPa) and velocity (m/s) options available
  - 8 options for individual stiffness sampling
  - IQR (interquartile range) calculation available

## Shear wave elastography (ElastQ Imaging)\*

- Real-time tissue deformation from special ultrasound push pulses
- Large Region of Interest (ROI) capable of supporting multiple PQ sample points
- Selectable confidence map provides assurance of samples obtained in areas with adequate shear wave propagation

## 3D Panoramic imaging

- Real-time extended field-of-view volume imaging, acquired in echo xPlane imaging mode on the X6-1
- Calibrated grayscale volumes for measurements
- 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(MPR) views

\*Currently not approved in all countries.

## 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
- Lateral gain compensation (LGC) and smart LGC for cardiac sector transducers
- Adjustable temporal resolution and spatial resolution with DRS control
- Depth: adjustment from 1.0 to 40 cm depending on transducer, exam, and system configuration
- Selection between one and eight transmit focal zones
- 16-level digital reconstructed zoom with pan capability
- High definition zoom that concentrates all image processing power into a user-defined area of interest; including HD zoom pan
- 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 over 2800 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 artifacts 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 X5-1, X6-1, X7-2, X7-2t, and X8-2t\* transducers
- 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**

Variable XRES is an extension of Philips exclusive XRES speckle noise reduction feature that allows the user to select progressive amounts of noise reduction, edge enhancement, and textural smoothing. Available with specific transducers under certain tissue-specific presets, users have the option to select the imaging characteristics of their choice from crisp to smooth tissue textures, providing enhanced visualization of target anatomic structures.

- 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 user up to five levels of variable XRES on C5-1, C9-2, X5-1, X7-2t, X8-2t\*, S8-3, S12-4, V6-2, L18-5, L12-5 50 mm, and L12-3
- Provides high resolution algorithms for advanced speckle noise reduction, refined tissue pattern displays, and fine border definition
- Provides high speed processing that allows over 2800 frames-per-second displays

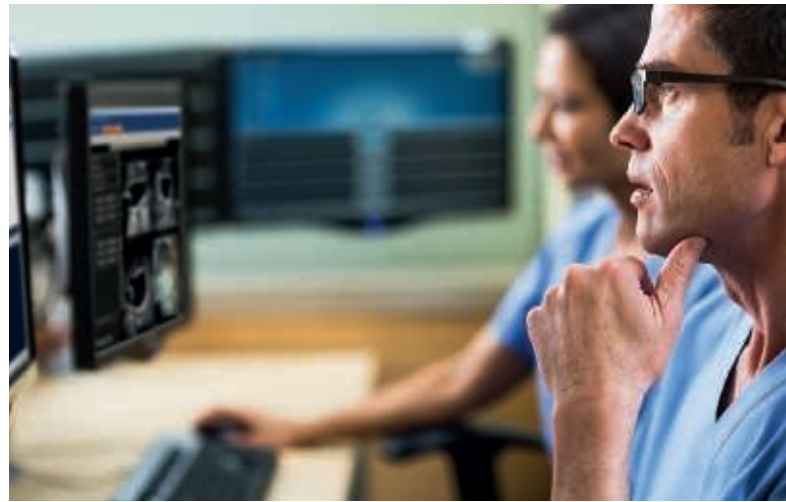
### **Live volume imaging/Live 3D Echo (CV)**

- Grayscale imaging controls
- 3D Vision control
- Dynamic volume colorization
- Chroma colorization
- Reset orientation
- Up/down invert
- XRES technology, including variable selection on X5-1 and X7-2
- Auto View for pre-defined anatomic crop views
- Zoom
- Show/hide color
- Reset controls
- Rotate X, Y, Z
- QuickVue cropping
- Auto crop
- Plane/Manual crop
- Face crop
- Auto View for pre-defined anatomic crop views
- 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
- Distance and area measurements on rendered volumes
- 2D optimization settings
- Tissue Harmonic Imaging
- Density
- 3D optimization settings
- Sector width
- Angle
- Elevation width control
- Lateral width control
- Lateral position control
- Elevation position control
- MPR Rotate
- MPR Tilt
- 3D volume: front, center, back
- 3D view control: up, down, left, right, front, back
- 3D home

- 3D swivel
- Magnify
- 3D LVO setting (available on X5-1 transducer)
- Rotation in either absolute or relative trackball motion
- Live 3D zoom mode with zoom preview
- 3D color optimization
- 3D size and position
- Independent trackball control of lateral and elevation sizing and positioning in live full volume and Live 3D color modes
- iSlice – automated cropping of 3D volume into four MPR views using standard or user-defined slicing protocols
- iCrop: two orthogonal MPR views with volume mode
  - Enables cropping during the exam or from review
  - Separates elevation and lateral rotation of cropping tools
  - Provides variable view directions and view direction color indicator
  - Allows prospective or retrospective long volume loop acquire
- Beat-by-beat 3D loop selection
- Review/full volume
- Calibrated 3D grid
- Generic distance and area measurements available on volume
- Distance and area measurements on MPRs
- Multiple 3D display layouts (volume, volume + 2 MPR, volume + 3 MPR)
- Dual volume display
- 3D color zoom
- 3D rotate and rotate-Z
- X-hair manipulation controls for MPR alignment
- Volume acquisition method (1, 2, 4, and 6 beat, HVR)

#### **Live volume imaging/Live 3D ultrasound (GI/WHC)**

- Single sweep, 4D, STIC, iSTIC, and panoramic 3D
- 3D preview ROI size and position
- 3D preview ROI curve adjust
- Sector width
- Angle
- Res/speed control
- Grayscale imaging controls
- 2D optimization settings
- 2D color optimization settings
- 2D power optimization settings
- Tissue Harmonic Imaging
- Rotate X, Y, Z
- Slice
- ROI size and position
- ROI curve adjust
- Pointer trim adjust
- Pointer xHair move
- Pointer cine
- Edit/accept
- Hide volume
- Up/down invert
- QuickFlip



- 3D rotate: 0, 180, 90, 270
- 3D view control: up, down, left, right, front, back
- aReveal<sup>AI</sup> for one button sculpting to enhance fetal face viewing
- Reset orientation
- Magnify
- 3D vision control
- TrueVue 3D Image rendering maps
- GlassVue 3D Image rendering maps
- TrueVue with TouchVue interface allows direct manipulation of the light source and 3D volume on the touchscreen
- User controllable light source placement within the 3D volume for optimal viewing
- Dynamic volume colorization
- Chroma colorization
- Layout
- Reference
- XRES technology
- Zoom
- Show/hide echo or color
- Reset controls
- Pan
- Sculpt
- Threshold
- Brightness
- Smoothing
- Lighting
- Transparency
- xHair display
- Save volume in native or native loop
- Acquisition sweep save
- MPR sweep save
- Generic distance and area measurements available on rendered volumes
- Distance and area measurements on MPRs
- QLAB plug-ins, including GI 3DQ and FHN

### 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 L18-5, and L12-5 50 for advanced breast, superficial, thyroid, and testicle TSIs
  - 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 chirp transmit technology that improves penetration and recovers more tissue information for detailed 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 system gain and TGC to achieve balanced brightness of tissues
- Available in contrast imaging for selected transducers/applications
  - Independent settings based upon whether the contrast timer is active
- 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
- AutoSCAN continuous automatic optimization
- 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

### AutoSCAN intelligent optimization

- Continuous, real-time adjustment of system gain and TGC to achieve balanced brightness of tissues
  - When activated, applies gain balancing to all grayscale image data including 2D, X-plane, 3D, 4D, and M-mode grayscale data
  - Every image frame has individually adjusted image brightness
  - Available from 2D touchscreen controls

### 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 over 7,500 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

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- Easy-to-learn graphical user interface with reduced number of hard controls
- Primary controls concentrated in cluster around trackball
- Tri-state control panel lighting (active, available, and unavailable)
- Ambient lighting control for exceptional image viewing in both light and dark environments
- Full color 12 inch capacitive touchscreen, complete with swipe technology, enables easy navigation of controls and system interaction
- Dual function mode switch and independent gain controls for 2D, CPA, M-mode, Color, PW, CW Doppler, TDI, and 3D
- Eight-slide pot control adjustment of TGC curve
- iSCAN control for 2D/Doppler automatic optimization
- High definition/pan zoom control
- Dual mode control
- Freeze control
- Two programmable acquire controls
- Pull-out alphanumeric backlit keyboard for text entry

## 3.3 Touchscreen

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- Widescreen touchscreen for dynamic presentation of controls
- Workflow-related controls (Patient, Review, Report, End Exam, Help) always present on touchscreen
- Direct selection of any attached transducer
- Automatic or manual selection of tissue-specific imaging parameters
- Tabbed layout and swipe capability for quick access to hidden controls
- Touchscreen control adjustment of LGC curve
- Touchscreen alphanumeric keyboard for text entry

## 4. Workflow



The EPIQ 7 combines a complete range of premium imaging technologies with superb sophisticated ergonomics, dynamic adaptive software, and ease of use to help keep busy departments on schedule.

### 4.1 Ergonomics

- Advanced control panel design with fewer, clustered controls and easily accessed mode keys to reduce reach
- Tri-state lighting that provides immediate feedback of active, available, and unavailable controls
- Widescreen touchscreen allows more controls to be available at a time
- Touchscreen controls are grouped for quick recognition
- Touchscreen supports easy navigation for commonly manipulated controls via flyout menu selections, reduces button presses
- Many touchscreen controls can also be accessed from the main display, allowing user to maintain consistent visual focus
- Independent adjustment of height, rotation, and lateral movement of monitor and control panel, allowing improved user posture and increasing comfort during exams (meets industry standards recommendation for the prevention of WRMSD)
- Highly mobile cart with single pedal brake operation facilitating portable exams and positioning in confined- space environments



## 4.2 Display annotation

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- 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, patient gender, institution name, system name, and user
- Fixed-position title area for consistent annotation
- Patient name, ID, birth date, gender, and system date that can be turned off (hidden) for generating still images for publication
- Additional patient information can be displayed on demand
- 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 annotations and body markers (application-specific and user-selectable), with two body markers supported in dual imaging format
- Doppler baseline invert in live and frozen imaging
- Compression changes available live or scrolling loop
- Post-processing of 2D gain, compression or dynamic range, and zoom after acquisition on single-frame images
- TGC curve (On/Auto/Off display)
- TGC values (On/Off display)
- Tool Tips provides a brief description of the abbreviated on-screen image parameters
- Trackball icon displaying functions assigned to trackball buttons
- Informative trackball arbitration prompts
- Thumbnail display of images printed/stored
- On-screen selection and display of calculations
- On-screen selection and editing of protocols
- 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
- Icons to display status of and/or allow access to the following functions: print job status, media read/write status, battery level, wireless connectivity, remote service, microphone, HIPAA status indicator icon, iSCAN status, acquisition status, physio status
- Cineloop frame number display
- Cineloop bar with trim markers
- Prompt region for display of informational text and icons
- Trackball icon displaying functions assigned to trackball buttons
- Contrast specification
- Protocol procedure list with status

## 4.3 SmartExam protocols

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- On-screen selection and editing of 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 including but not limited to abdominal, vascular, cardiac, and Ob/Gyn 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

## 4.4 Stress echo

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- Acquisition of echocardiography single frame or loops of the left ventricle in any imaging mode including 2D, color, and spectral Doppler.
- Gain Save that adjusts automatically to different views and automatically saves your preferred control settings, such as gain, depth, ROI, position, and many other parameters:
  - For each view while acquiring resting images
  - At immediate post-exercise, automatic retrieval of saved settings for each view
  - Different gain profiles for parasternal LAX and SAX views, AP4, and AP2 views allowed
- Length of acquired images that is user-adjustable between 1 and 180 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, the ability to start acquisition on the R-wave if the ECG is active and an R-wave is present
- Your preferred control settings automatically saved – such as MI (mechanical index), gain and depth for each view while acquiring resting images
- Live Compare
- Ability to defer selection by stage

- 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 that may be used as the basis for user-defined versions
  - 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
  - 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
- CMQ stress
  - Pre and post data curves
  - Pre and post bullseye maps
  - Pre and post strain comparisons

## 4.5 Volume imaging solutions for connected radiology departments

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- 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 clinical workstation
- Powerful 3D manipulation tools including volume rendering, MPR, MIP, slab viewing (thick slice), 3D orientation graphics
- Advanced 3D visualization with QLAB GI 3DQ 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, but not supported for any STIC or iSTIC files

## 4.6 Anatomical Intelligence for Breast (AI Breast)

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AI Breast is a fully integrated screening, diagnostic and workflow tool for whole breast ultrasound, that utilizes Philips unique Anatomical Intelligence and the new eL18-4 EM ultra-broadband linear transducer. The system provides the ability to automatically track and document the transducer position relative to the patient’s breast during image acquisition.

- Auto Annotate – automatically adds annotation indicating transducer position in relation to the body mark during breast scanning
- Coverage Assistant: unique tracking technology maps 2D projection of breast tissue covered in real time to enable new levels of confidence during breast screening and diagnostic exams
- Bookmark key images during acquisition for quick review
- Find Orthogonal – the system automatically finds images that are orthogonal from the reference point, for fast comparison and diagnosis
- Reverse lookup – the system finds frames near defined targets by clicking on the position in the corresponding breast body mark graphic
- Available with integrated electromagnetic tracking on the eL18-4 and external electromagnetic tracking on the L12-5

## 4.7 QuickSAVE feature

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- The system provides the ability to quickly save preferred system settings as individual exam types
- Over 40 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 USB/DVD and transferred to other systems of like configuration

## 4.8 Image presentation

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- 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 40 cm (transducer-dependent)
- MaxVue image display, high-definition full-screen imaging viewing

## 4.9 Cineloop review

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- 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 64 seconds of pulsed wave Doppler data and M-mode for retrospective review and image selection, or up to 48 seconds CW 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
- 3D iCrop from cineloop review
- 3D iSlice from cineloop review
- Trim capability of 2D data
- Capture of over 20 seconds of Live 3D imaging per loop
- Available in all imaging modes plus:
  - Panoramic imaging
  - 3D 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
- Many controls available in cineloop review for post-processing such as 2D gain, dynamic range/compress, XRES, magnify zoom

## 4.10 Exam management features

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- 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

### Rapid procedure setup

- With a single selection, choose transducer, preset, study type, study description, and optionally gender
- Procedure definitions are built-in for built-in study types
- Additional procedure definitions may be added by the user
- Procedure may be automatically selected based on modality worklist scheduled procedure information

## 4.11 Connectivity

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### Standard connectivity features

- Digital image acquisition and on-board patient exam storage
  - 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
- Append exam
  - To existing study
  - To new study using existing patient information
- Data types
  - 2D, M-mode, Doppler spectral frame acquisition
  - 2D clip acquisition up to 2,200 frames per clip
  - Scrolling M-mode, Doppler acquisition
  - Cartesian volume acquisition: 3D, 4D, STIC, 3D panoramic
  - Cardiac temporal volume acquisition: Live 3D, full volume 3D
  - 3D clips: volume render views and MPR views
  - Q-Apps frames and clips
  - Image fusion frames and clips
- Printing
  - Local print to on-board or off-board video printers
  - Page report print
  - DICOM grayscale or color print
- Media storage and retrieval
  - Export DICOM Image and structured report export to removable media
  - Export PC format image export to removable media
  - Supported media
    - Read and write (single session) to CD (CD-R)
    - DVD read-only (DVD+R)
    - DVD read + write (single session) (DVD+RW, CD-R, and DVD-R)
    - USB storage (flash memory or hard drives)
  - DICOM image import
    - Ultrasound images
    - Multimodality images (CT/MRI/X-Ray/Mammography/PET)
  - OB trending data
    - Export OB trending information via USB storage device
    - Import OB trending information via USB storage device
- RS-232 serial storage
  - Export of report data to off-line analysis computer programs
- Basic networking connectivity
  - Wired gigabit Ethernet
  - Wireless networking 802.11n
    - WPA/WPA2 Personal security
    - WPA/WPA2 Enterprise security
  - Network addressing
    - IPV4 addressing: static or DHCP for system address, static or hostnames (DNS lookup) for server addresses
    - IPV6 addressing: link local, router discovery, or DHCP for system address, hostnames for server addresses
- Compatibility with OmniSphere’s data analytics and connectivity tools (applications sold separately)
  - Scheduled export of log files for use with the Utilization Optimizer application

- On cart service request for use with Remote Technical Connect applications
- In-house technical support tool via the Remote Technical Connect application

### **NetLink connectivity option (standard on premium and high end)**

- Supported DICOM services
  - Image storage
  - Structured Report (SR) storage includes Ob/Gyn, vascular, adult echo, pediatric echo, fetal echo, and congenital cardiology
  - Modality Worklist with automatic patient demographic entry
  - Modality performed procedure step (MPPS)
  - Storage commitment push model
  - Query/retrieve of ultrasound images (study-root)
- Image and structured report export to network storage servers
  - Send images after each Print/Acquire
  - Send images at End of Exam (batch send)
  - Send images and report on-demand during exam
  - Send images or exams manually
  - Send to up to 5 storage SCPs concurrently (at End Exam or after each Print/Acquire)
  - Independently configurable destinations for each acquisition control (e.g., Acquire1, Acquire2, Save 3D, etc.)
- DICOM compression options
  - Uncompressed (Explicit VR Little Endian, Implicit VR Little Endian)
  - JPEG lossy compression (loops) with configurable quality factor 60-100
  - RLE lossless compression
  - JPEG lossless compression (frames)
- Other DICOM export options
  - Monochrome or true color
  - Configurable image size/loop export 640 x 480 or 800 x 600 or 1,024 x 768
  - Secure DICOM configurable
  - Grayscale mapping choices
    - DICOM Grayscale Standard Display Function (GSDF)
    - 25 additional grayscale curves, user-selectable
  - Export optimization tool to aid user in evaluating PACS display monitor calibration and in selecting which grayscale curve to use for exported images
  - Native data attached to DICOM ultrasound images (lossless compressed)
    - 2D native data types: tissue, flow, tissue-Doppler, spectral Doppler, M-mode, and elastography
    - 3D volume data including crop, resize, gain, compression, automated border tracking, color baseline, 3D vision control, colorize, color suppress, B/W suppress, XRES ,and 3D quantification
  - Ultrasound region calibration (standard for ultrasound images)

- Pixel spacing attribute for measurement calibration (optional)
- DICOM query/retrieve of other modality images (CT/MRI/X-ray/Mammography/PET)
- De-identification feature
- Send images to PACS and media without identifying information burned in to the image
- Images exported to media may optionally have patient information removed from DICOM attributes or PC format names
- All pages sent to DICOM printer have patient identification overlay – not configurable
- All pages sent to local printers are configurable to include or exclude patient identification overlay
- DICOM mapping for user-defined measurements, calculations, and OB authors
- Support of the export of user-defined measurements, calculations, and OB authors with standard DICOM structure reporting for:
  - Adult echo           – Vascular
  - Pediatric echo      – TCD
  - Fetal echo           – Abdominal
  - Ob/Gyn               – Small Parts

### **Report**

- Report templates per clinical exam
- User-configurable report
- Off-cart report configuration tool available
- On-cart report configuration

### **Government security option**

Configurable option to provide up-to-date security features while fully hardening the system for patient data protection. Option also fully removes the capability for creating or configuring any VPN functionality.

- Antivirus protection
- Malware protection
- In-memory protection
- USB/DVD protection
- Internet firewall protection
- OS security
- Custom-configurable password

### **SafeGuard security option**

Configurable option for enabling state of the art computer protection against virus or malware for maximum network protection

- Antivirus protection
- Malware protection

### **Security Plus option**

- Hard drive encryption
- LDAP user authentication
- Custom-configurable password policies

# 5. Transducers

## 5.1 Transducer selection

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- Electronic switching of transducers using four universal connectors
- Dedicated (Pedoff) continuous wave Doppler connector is available
- Automatic parameter optimization of each transducer for exam type through Tissue Specific Imaging (TSI) software
- If two transducers are connected that both support the same TSI the system supports instantaneous switching between transducers while maintaining current depth parameter if possible
- User-customizable imaging presets for each transducer
- Automatic dynamic receive focal optimization
- Transmission of focal characteristics automatically controlled through TSI, iFOCUS, and DRS functions

### Compact transducers

- Ergonomic designs with lightweight super flexible cables
- Virtually pinless micro-connectors
- Advanced low-loss lens technology for better penetration with less artifacts
- Breakthrough broadband frequency response
- Support for very high frequencies up to 20 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 X5-1, X6-1, X7-2, X7-2t, X8-2t\*, S5-1, C5-1, C9-2, and C10-3v transducers
- Breakthrough crystal technology that allows greater acoustic efficiency and bandwidth

### xMATRIX technology

- Available on the X5-1, X6-1, X7-2, X7-2t, and X8-2t\* transducers
- Unique array configuration of fully-sampled elements that allows 2D, Live xPlane, and volume imaging

## Curved array

---

### C5-1 broadband curved array with PureWave crystal technology

- 5 to 1 MHz extended operating frequency range
- 111° field of view (wide scan-enabled)
- High density curved array with 160 elements
- 2D, steerable pulsed wave, High PRF, and color Doppler; and Color Power Angio (CPA), directional CPA, SonoCT, variable XRES, and multivariate 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
- Interventional applications
- Elastography – shear wave
- Contrast applications
- Supports biopsy guide capabilities

### C8-5 broadband curved array

- 8 to 5 MHz extended operating frequency range
- 122° field of view (wide scan-enabled)
- 2D, steerable pulsed wave and color Doppler, Color Power Angio (CPA), directional CPA, SonoCT, XRES imaging, and harmonic imaging
- Pediatric abdominal and neonatal cephalic imaging
- Supports biopsy guide capabilities

### C9-2 broadband curved array with PureWave crystal technology

- 9 to 2 MHz extended operating frequency range
- 102° field of view (wide scan-enabled)
- 2D, steerable pulsed wave and color Doppler, Color Power Angio (CPA), directional CPA, SonoCT, variable XRES, and harmonic imaging
- General purpose obstetrical and gynecological, small adult and pediatric abdominal applications
- Contrast applications
- Supports biopsy guide capabilities (4 angle)

### C10-3v broadband curved array with PureWave crystal technology

- 10 to 3 MHz extended operating frequency range
- End-fire sector, 11.5 mm radius of curvature, 163° field of view (wide scan-enabled)
- 2D, steerable pulsed wave and color Doppler, Color Power Angio (CPA), directional CPA, SonoCT, variable XRES, and harmonic imaging
- Endovaginal applications
- Elastography – strain-based
- Contrast applications
- Supports biopsy guide capabilities

### C10-4ec broadband curved array

- 10 to 4 MHz extended operating frequency range
- End-fire sector, 8 mm radius of curvature, 147° field of view (wide scan-enabled)
- 2D, steerable pulsed wave and color Doppler, Color Power Angio (CPA), directional CPA, SonoCT, XRES, and harmonic imaging
- Endocavitary applications, including vaginal, and rectal
- Contrast applications
- Supports biopsy guide capabilities

### **V6-2 broadband curved array**

- 6 to 2 MHz extended operating frequency range
- 100° field of view (wide scan-enabled)
- High-resolution 2D imaging, steerable pulsed wave, High PRF, and color Doppler; Color Power Angio (CPA), directional CPA, SonoCT, variable XRES, harmonic imaging, and STIC
- Support of high resolution, quantitative, single sweep 3D volume acquisition
- Support of 4D imaging up to 36 volumes per second
- General purpose obstetrical volume applications
- Supports biopsy guide capabilities

### **3D9-3v broadband curved array**

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

## Linear array

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### **eL18-4 ultra-broadband linear array with PureWave crystal technology**

- Ultra-broadband PureWave array generates frequencies from 2 to 22 MHz
- Multi-row array with fine elevation focusing
- Optimized diagnostic operating bandwidth: 18-4 MHz
- Fine pitch, 1920 active elements
- Steerable pulsed wave and color Doppler, Color Power Angio (CPA), SonoCT, variable XRES, and harmonic imaging
- High resolution superficial applications including small parts, breast, vascular, musculoskeletal, bowel, pediatric, and OB imaging
- Tissue aberration correction selection for advanced MSK, breast, and vascular venous TSP
- MicroFlow Imaging support
- Full solution elastography support
- Needle visualization support
- Auto Doppler flow optimization
- Contrast mode
- Panoramic Imaging
- High frame rates available
- Precision biopsy support compatible with Civco Verza Guidance System<sup>1</sup>

### **eL18-4 EM ultra-broadband linear array with PureWave crystal technology**

- Ultra-broadband PureWave array generates frequencies from 2 to 22 MHz
- Multi-row array with fine elevation focusing
- Optimized diagnostic operating bandwidth: 18-4 MHz
- Fine pitch, 1920 active elements
- Steerable pulsed wave and color Doppler, Color Power Angio (CPA), SonoCT, variable XRES, and harmonic imaging
- High resolution superficial applications including small parts, breast, vascular, musculoskeletal, bowel, pediatric, and OB imaging
- Tissue aberration correction selection for advanced MSK, breast, and vascular venous TSP
- MicroFlow Imaging support
- Full solution elastography support
- Needle visualization support
- Anatomical Intelligence for Breast (AI Breast) support with optional integrated electro-magnetic tracking
- Auto Doppler flow optimization
- Contrast mode
- Panoramic Imaging
- High frame rates available
- Precision biopsy support compatible with Civco Verza Guidance System<sup>1</sup>

### **L12-3 broadband linear array**

- 12 to 3 MHz extended operating frequency range
- Fine angle steering of color and pulsed wave Doppler
- 2D, steerable pulsed wave and color Doppler, Color Power Angio (CPA), SonoCT, variable XRES, and harmonic imaging
- Vascular (carotid, surgical, arterial, and venous) and superficial imaging applications
- Cerebrovascular (carotids, vertebrales), peripheral vascular (venous, arterial), internal mammary vessels, and musculoskeletal imaging
- Surgical applications
- Contrast applications
- Auto Doppler flow optimization
- Supports biopsy guide capabilities

### **L12-5 50 broadband linear array**

- 12 to 5 MHz extended operating frequency range
- Fine pitch, 256 element, high resolution linear array
- 2D, steerable pulsed wave and color Doppler, Color Power Angio (CPA), SonoCT, variable XRES, and harmonic imaging
- High frame rates available
- Panoramic imaging
- High resolution superficial applications including small parts, breast, vascular, and musculoskeletal imaging
- Tissue aberration correction selection for advanced MSK and breast imaging TSI
- Pediatric applications
- Elastography – strain-based
- Auto Doppler flow optimization
- Supports biopsy guide capabilities

#### **L18-5 broadband linear array**

- 18 to 5 MHz extended operating frequency range
- Ultra-fine pitch, 288 element, high resolution linear array
- 2D, steerable pulsed wave and color Doppler, Color Power Angio (CPA), SonoCT, panoramic, variable XRES, and harmonic imaging
- High resolution superficial applications including small parts, breast, vascular, and musculoskeletal imaging
- Tissue aberration correction selection for MSK and breast imaging TSI
- Elastography – strain-based
- Auto Doppler flow optimization
- Supports biopsy guide capabilities

#### **L15-7io broadband compact linear array**

- 15 to 7 MHz extended operating frequency range
- Fine angle steering of color and pulsed wave Doppler
- Unique lens design allowing high resolution imaging at transducer surface
- 2D, steerable pulsed wave and color Doppler, Color Power Angio (CPA), panoramic, and XRES imaging
- High resolution intraoperative vascular and superficial (MSK and small parts) applications
- Auto Doppler flow optimization

#### **VL13-5 broadband linear array**

- 13 to 5 MHz extended operating frequency range
- Fine pitch, 192 element, high resolution linear array
- High-resolution 2D imaging, steerable pulsed wave and color Doppler, Color Power Angio, SonoCT, XRES, and harmonic imaging
- Support of high resolution, quantitative, single sweep 3D volume acquisition
- Support of 4D 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

## Sector array

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#### **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, variable XRES, AutoSCAN/iSCAN, and harmonic imaging
- Adult echo, pediatric echo, and TCD applications
- Contrast applications

#### **S8-3 sector array**

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

#### **S12-4 sector array**

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

#### **S7-3t sector array TEE**

- 7 to 3 MHz extended operating frequency range
- Transesophageal sector array with 48 elements
- Manually rotatable array from 0 to 180°
- 2D, steerable PW Doppler, CW Doppler, color Doppler, XRES, and harmonic imaging
- Pediatric and adult TEE applications: patients > 3.5 kg (7.7 lb)
- Physical dimensions:
  - Tip: 10.7 x 8 x 27 mm (0.42 x 0.31 x 1.1 in)
  - Shaft: 7.4 mm (0.29 in) diameter, 70 cm (27.6 in) L

#### **S8-3t sector array TEE**

- 8 to 3 MHz extended operating frequency range
- Transesophageal sector array with 32 elements
- Manually rotatable array from 0 to 180°
- 2D, steerable PW Doppler, CW Doppler, color Doppler, XRES, and harmonic imaging
- Pediatric and adult TEE applications: patients > 2.5 kb (5.5 lb)
- Physical dimensions:
  - Tip: 7.5 x 5.5 x 18.5 mm (0.3 x 0.2 x 0.7 in), WHL
  - Shaft: 5.2 mm (0.2 in) diameter, 88 cm (34.6 in) L

## xMATRIX array

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#### **X5-1 xMATRIX array with PureWave technology**

- 5 to 1 MHz extended operating frequency range
- 3,040 elements with microbeamforming
- iRotate – rotatable scan angle from 0 to 360°
- 2D, Live 3D volume, high volume rate (HVR), one-beat, two-beat, four-beat, six-beat, Live volume, color flow, Live 3D color, PW, CW, M-mode, color M-mode, contrast hi MI, contrast low MI, pulse inversion, flash imaging, high 2D frame rate mode, TDI, TDI PW, CMQ quantification, Live xPlane imaging
- 3D color zoom, 3D color zoom preview, high volume rate (HVR) color, and two-volume view display

- Ergonomic xMATRIX handle with lightweight cable
- Shorter length for easy apical fit
- 2D and Live 3D Echo solution with all modes
- Extended cable length
- Single ASIC architecture
- Adult, contrast LVO, pediatric CHD, contrast low MI, cardiology coronary, adult general, and echo PEN
- Physical dimensions:
  - Dimensions: 9.2 x 3.9 x 2.9 cm (3.6 x 1.5 x 1.1 in) LWD with a shallow waist and push ridges for superb scanning comfort; the shortened 3D length helps to fit into the bed for apical views
  - Lens: 1.7 x 2.3 cm (0.67 x 0.9 in)
- Green label approved transducer (environmental improvement measure)

#### **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
- 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 variable XRES, and harmonic imaging
- Auto-heart rate detection for triggered full volume fetal echo in grayscale and color
- Dynamic focusing over range in both lateral and elevation dimensions
- Three line densities in 3D and 4D modes
- General purpose abdominal, obstetrical, fetal echo, gynecological, and interventional applications
- Contrast applications
- Supports biopsy guide capabilities

#### **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, elevation compounding imaging, 2D, biplane and 3D imaging color Doppler, pulsed Doppler, XRES, and harmonic imaging
- Pediatric applications: abdomen

#### **X7-2t xMATRIX array TEE 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
- Adult TEE applications: patients > 30 kg (66 lb)
- Physical dimensions:
  - Tip: 1.7 x 3.8 cm (0.7 x 1.5 in) WxL
  - Shaft: 1 cm (0.4 in) diameter, 1 m (39.4 in) L
  - Electronically rotatable array from 0 to 180°
  - Electrocautery suppression
  - 2D, advanced XRES, harmonic imaging, M-mode, color M-mode, color flow, PW Doppler, CW Doppler, Live xPlane imaging, Live 3D Echo, Live 3D zoom, 3D zoom color, 3D zoom color preview, two-volume view, triggered full volume and triggered 3D color volume

#### **X8-2t\* xMATRIX array TEE with PureWave crystal technology**

- 8 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
- Adult TEE applications: patients > 30 kg (66 lb)
- Physical dimensions:
  - Tip: 1.7 x 3.8 cm (0.7 x 1.5 in) WxL
  - Shaft: 1 cm (0.4 in) diameter, 1 m (39.4 in) L
  - Electronically rotatable array from 0 to 180°
  - Electrocautery suppression
  - 2D, advanced XRES, harmonic imaging, M-mode, color M-mode, color flow, PW Doppler, CW Doppler, Live xPlane imaging, Live 3D Echo, Live 3D zoom, 3D zoom color, 3D zoom color preview, two-volume view, triggered full volume and triggered 3D color volume

## Non-imaging

#### **D2cwc CW transducer (Pedoff)**

- Dedicated 2 MHz continuous wave Doppler
- Adult cardiology applications

#### **D5cwc CW transducer (Pedoff)**

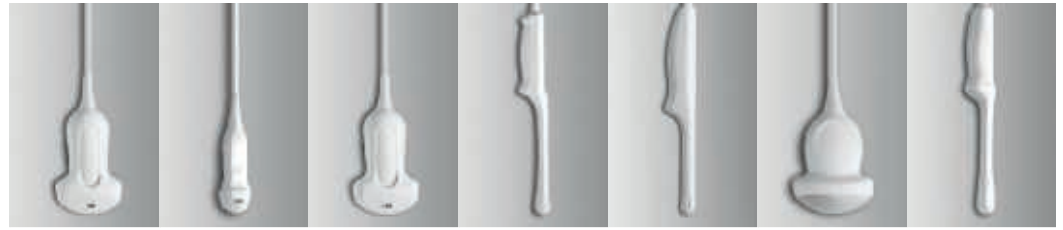
- Dedicated 5 MHz continuous wave Doppler
- Deep venous and arterial applications

#### **D2tcd PW transducer (Pedoff)**

- Dedicated 2 MHz pulsed wave Doppler
- Transcranial Doppler applications



## 5.2 EPIQ transducers, features and presets



<b>Transducer – Curved</b>		<b>C5-1</b>	<b>C8-5</b>	<b>C9-2</b>	<b>C10-3v</b>	<b>C10-4ec</b>	<b>V6-2</b>	<b>3D9-3v</b>
Type of array		Curved	Tightly curved	Curved	Tightly curved	Tightly curved	Curved	Tightly curved
Number of elements		160	128	192	128	128	192	128
Scanplane aperture		55.5 mm	22.4 mm	53.76 mm	26.1 mm	24.3 mm	63.36 mm	26.1 mm
Field of view		111°	122°	102°	163°	147°	100°	164°
Volume field of view							100° x 85°	156° x 85°
Broadband frequency range		5-1 MHz	8-5 MHz	9-2 MHz	10-3 MHz	10-4 MHz	6-2 MHz	9-3 MHz
<b>Features</b>								
PureWave		•		•	•			
xMATRIX								
Number of BX angles		4	1	4	1	1	2	1
HPRF		•		•			•	
Variable XRES		•	•	•	•		•	
MicroCPA		•	•	•	•		•	
2D Opt Inheritance		•		•	•		•	
Pan zoom		•	•	•	•	•	•	•
Contrast								
Elastography		SW			ST			
Image fusion		•		•		•		
Compatible Affiniti 50			•			•	•	•
Compatible Affiniti 70		•	•	•	•	•	•	•
Compatible CX50		•	•		•			
<b>Preset</b>								
<b>Abdominal</b>	Bowel	•		•				
	General	•		•				
	Resolution	•		•				
	Penetration	•						
	Renal	•		•				
	User (China only)	•					•	
	Vascular	•						
	Intervention	•						
	General (1.2)	•						
<b>Obstetrics</b>	General	•		•	•	•	•	•
	Penetration	•						
	Early OB	•		•	•	•	•	•
	NT	•		•				
	Early fetal echo			•				
	OB fetal echo	•		•	•	•	•	•
	OB fetal heart	•		•				
	GYN pelvis	•		•	•	•		•
	GYN fertility	•			•			•
GYN penetration				•			•	
<b>Pediatrics</b>	Abdomen	•	•	•				
	Hip							
	Neonatal head		•					
<b>Small parts</b>	General							
	Superficial							
	Breast							
	Testicular							
	Thyroid							
<b>Urology</b>	Bladder				•	•		•
	Prostate					•		
<b>Musculoskeletal</b>	General							
	Superficial							
<b>Vascular</b>	Arterial		•					
	Carotid		•					
	Superficial							
	Surgical							
	Venous		•	•				
	Intraoperative TCD							
<b>Cardiac</b>	Adult echo							
	Echo penetration							
	Adult general (China only)							
	Pediatric (echo)							
	Cardiac epiaortic							
	Epicardiac							

INF = Infinite Angles ST = Strain Elastography SW = Shear Wave Elastography



<b>Transducer – Linear</b>		<b>eL18-4</b>	<b>eL18-4 EM</b>	<b>L12-3</b>	<b>L12-5 50</b>	<b>L18-5</b>	<b>L15-7io</b>	<b>VL13-5</b>
Type of array		Linear	Linear	Linear	Linear	Linear	Linear	Linear
Number of elements		1920	1920	160	256	288	128	192
Scanplane aperture		50 mm	50 mm	38 mm	50 mm	38.9 mm	23 mm	38 mm
Field of view				NA	NA	NA	NA	
Volume field of view								38 mm x 30°
Broadband frequency range		22-2 MHz	22-2 MHz	12-3 MHz	12-5 MHz	18-5 MHz	15-7 MHz	13-5 MHz
<b>Features</b>								
PureWave		•	•					
xMATRIX								
Number of BX angles		4	4	3	INF	INF		2
HPRF		•	•					
Variable XRES		•	•	•	•	•		
MicroCPA		•	•	•	•	•		
2D Opt Inheritance		•	•	•				
Pan zoom		•	•	•	•	•	•	•
Contrast		•	•					
Elastography		•	•		ST	ST		
Image fusion		•	•		•			
Compatible Affiniti 50		•	•		•	•	•	•
Compatible Affiniti 70		•	•	•	•	•	•	•
Compatible CX50		•	•	•	•		•	
<b>Preset</b>								
<b>Abdominal</b>	Bowel	•	•	•	•			
	General	•	•					
	Resolution							
	Penetration							
	Renal							
	User (China only)							
	Vascular							
	Intervention							
<b>Obstetrics</b>	General (1.2)							
	General	•	•		•			
	Penetration							
	Early OB							
	NT							
	Early fetal echo							
	OB fetal echo							
	OB fetal heart							
	GYN pelvis							
	GYN fertility							
<b>Pediatrics</b>	GYN penetration							
	Abdomen	•	•		•	•		
	Hip	•	•		•	•		
<b>Small parts</b>	Neonatal head							
	General							•
	Superficial			•	•	•		
	Breast	•	•	•	•	•		•
	Testicular	•	•	•	•	•		
<b>Urology</b>	Thyroid	•	•		•	•		•
	Bladder							
<b>Musculoskeletal</b>	Prostate							
	General	•	•	•	•	•		
<b>Vascular</b>	Superficial	•	•		•	•	•	
	Arterial	•	•	•	•	•		
<b>Cardiac</b>	Carotid	•	•	•	•	•		•
	Superficial						•	
	Surgical			•				
	Venous	•	•	•	•	•		
	Intraoperative						•	
<b>Cardiac</b>	TCD							
	Adult echo							
	Echo penetration							
	Adult general (China only)							
	Pediatric (echo)							
<b>Cardiac</b>	Cardiac epiaortic						•	
	Epicardiac						•	

INF = Infinite Angles ST = Strain Elastography SW = Shear Wave Elastography



**Transducer – Sector**

	<b>S5-1</b>	<b>S8-3</b>	<b>S12-4</b>	<b>S7-3t</b>	<b>S8-3t</b>
Type of array	Sector	Sector	Sector	Sector	Sector
Number of elements	80	96	96	48	32
Scanplane aperture	20.3 mm	15.4 mm	9.78 mm	5 mm	4.76 mm
Field of view	90°	90°	90°	90°	90°
Volume field of view					
Broadband frequency range	5-1 MHz	8-3 MHz	12-4 MHz	7-3 MHz	8-3 MHz

**Features**

PureWave	•				
xMATRIX					
Number of BX angles	3				
HPRF	•	•	•		
Variable XRES	•	•	•	•	•
MicroCPA	•	•	•		
2D Opt Inheritance	•	•	•	•	•
Pan zoom	•	•	•	•	•
Contrast	•				
Elastography					
Image fusion	•				
Compatible Affiniti 50		•	•	•	•
Compatible Affiniti 70	•	•	•	•	•
Compatible CX50	•	•	•		

**Preset**

<b>Abdominal</b>	Bowel				
	General	•			
	Resolution				
	Penetration				
	Renal				
	User (China only)				
	Vascular				
	Intervention				
	General (1.2)				
<b>Obstetrics</b>	General				
	Penetration				
	Early OB				
	NT				
	Early fetal echo				
	OB fetal echo				
	OB fetal heart				
	GYN pelvis				
	GYN fertility				
GYN penetration					
<b>Pediatrics</b>	Abdomen				
	Hip				
	Neonatal head			•	
<b>Small parts</b>	General				
	Superficial				
	Breast				
	Testicular				
	Thyroid				
<b>Urology</b>	Bladder				
	Prostate				
<b>Musculoskeletal</b>	General				
	Superficial				
<b>Vascular</b>	Arterial				
	Carotid				
	Superficial				
	Surgical				
	Venous				
	Intraoperative				
	TCD	•			
<b>Cardiac</b>	Adult echo	•	•	•	•
	Echo penetration	•			
	Adult general	•			
	(China only)	•			
	Pediatric (echo)	•	•	•	•
	Cardiac epiaortic				
Epicardiac					



**Transducer – xMATRIX and non-imaging**

	<b>X5-1</b>	<b>X6-1</b>	<b>X7-2</b>	<b>X7-2t</b>	<b>X8-2t*</b>	<b>D2cwc</b>	<b>D5cwc</b>	<b>D2tcd</b>
Type of array	xMATRIX	xMATRIX	xMATRIX	xMATRIX	xMATRIX			
Number of elements	3040	9212	2500	2500	2500			
Scanplane aperture	Proprietary	Proprietary		Proprietary	Proprietary			
Field of view	90°	100°	90°	90°	90°			
Volume field of view	98° x 98°	90° x 90°	86° x 86°	98° x 98°	105° x 105°			
Broadband frequency range	5-1 MHz	6-1 MHz	7-2 MHz	7-2 MHz	8-2 MHz			

**Features**

PureWave	•	•	•	•	•			
xMATRIX	•	•	•	•	•			
Number of BX angles	3	3						
HPRF	•	•	•					
Variable XRES	•	•	•	•	•			
MicroCPA	•	•	•	•	•			
2D Opt Inheritance	•	•	•	•	•			
Pan zoom	•	•	•	•	•			
Contrast	•							
Elastography								
Image fusion		•						
Compatible Affiniti 50						•	•	•
Compatible Affiniti 70				•		•	•	•
Compatible CX50			•	•		•	•	

**Preset**

<b>Abdominal</b>	Bowel		•					
	General		•					
	Resolution							
	Penetration		•					
	Renal		•					
	User (China only)		•					
	Vascular	•	•					
	Intervention		•					
	General (1.2)							
<b>Obstetrics</b>	General		•					
	Penetration		•					
	Early OB		•					
	NT		•					
	Early fetal echo		•					
	OB fetal echo		•					
	OB fetal heart		•					
	GYN pelvis		•					
	GYN fertility							
	GYN penetration							
<b>Pediatrics</b>	Abdomen							
	Hip							
	Neonatal head							
<b>Small parts</b>	General							
	Superficial							
	Breast							
	Testicular							
	Thyroid							
<b>Urology</b>	Bladder							
	Prostate							
<b>Musculoskeletal</b>	General							
	Superficial							
<b>Vascular</b>	Arterial						•	
	Carotid							
	Superficial							
	Surgical							
	Venous						•	
	Intraoperative							
	TCD	•						•
<b>Cardiac</b>	Adult echo	•		•	•	•		
	Echo penetration	•						
	Adult general (China only)							
	Pediatric (echo)	•		•		•		
	Cardiac epiaortic							
	Epicardiac							

\*Only available on EPIQ 7 systems. Currently not approved in all countries.

## 6. Image fusion and interventional navigation



### 6.1 Overview

The image fusion and interventional navigation system provides the operator with the following capabilities:

#### Ultrasound only

- Utilize electromagnetic tracking to define and track a specific target area during live ultrasound-guided interventions
- Fuse an ultrasound sweep (US or CEUS) with live ultrasound, to enhance workflow and visualization before, during, and after ablation procedures
- Needle Navigation via Adaptive Needle Tracker (ANT): plan entry point and trajectory, and track a needle/device during live approach towards multiple targets

#### Image fusion

- Track a variety of ultrasound transducers to fuse ultrasound (US) with CT, MRI, or PET/CT to find Regions of Interest that are easier to see when combining imaging modalities

- Fuse up to two advanced modality images (CT, MRI, or PET) to one another to find Regions of Interest that are easier to see when combining imaging modalities
- Fuse previously acquired (historic) advanced images (CT, MRI, or PET/CT) with live ultrasound
- Perform fusion and navigation procedures using integrated color Doppler controls
- Perform fast, automated fusion setup (image registration) using reusable patient trackers attached to the patient
  - Image fusion patient trackers ensure that fusion accuracy is maintained during unexpected patient motion without the need to perform fusion setup again during a procedure
  - Image fusion patient trackers are used to monitor respiratory motion to ensure consistent interventional access
- Perform fusion and navigation procedures using integrated color Doppler controls
- Perform fusion setup (image registration) using internal landmarks with fast internal plane matching or by selecting corresponding internal landmarks in each imaging modality

- Perform fusion setup (image registration) using external landmarks by manually selecting corresponding external landmarks using an image fusion tracked instrument
- Anatomical Intelligence Ultrasound (AIUS) Auto Registration
  - Perform automatic fusion setup (image registration) to contrast and non-contrast liver CT or liver MRI by performing an ultrasound sweep of the liver
  - Co-registration of two datasets is possible with Auto Registration in the liver
- Acquire a 3D ultrasound sweep and fuse to live 2D ultrasound for pre-/intra-/post-procedural imaging comparison (US-to-US fusion)
- Use the transducer or the control panel trackball for fast fusion adjustment in 3D and 2D, respectively
- Adjust image registration landmarks to achieve optimum fusion accuracy using the control panel trackball and set keys
- Manually adjust the fusion overlay opacity (blend) using the control panel scroll knob or have image fusion automatically scroll through the opacity to verify fusion accuracy
- Adjust image fusion by adding an additional internal landmark point around an area of interest
- Insert annotations or measurements in the fusion mode using the touch panel and/or keyboard/virtual keyboard
- Visualize live Bmode fundamental ultrasound, CEUS, and fusion of CT/MR/PET in quad-screen view

#### **Interventional navigation and planning software**

- Use the trackball and set key to scroll through images and annotate and update targets and points of needle entry to pre-plan procedures and guide to a pre-defined trajectory
- Navigate instruments for diagnostic and therapeutic procedures such as biopsy, ablation, drainages, and injections
- Perform out-of-plane navigation using the image fusion Ultrasound Tracker and image fusion navigation-tracked instrumentation
- Display a tracked instrument position graphic on CT, MRI, or PET/CT images without the use of ultrasound
- Display a tracked instrument position graphic on ultrasound with and without fusion to CT, MRI, or PET/CT.
- Display an ultrasound guidance bar representing the distance between the ultrasound scan plane and the operator-selected target
- Perform live multi-planar (coronal/sagittal/axial) reconstructions on CT, MRI, or PET/CT images
- Live reformatting of CT, MRI, or PET/CT images around the tracked needle to visualize structures
- Use color Doppler or contrast enhanced ultrasound functional imaging to identify areas of interest and guide interventions
- Monitor the status of, and configure, connected image fusion instruments directly from the primary monitor
- Manual ablation parameter entry for treatment planning, and intra-procedural ablation monitoring and navigation

- On-screen help instructions for guidance through various fusion or navigation workflows
- Select layouts or save a customized layout with configurable views from the touchscreen

#### **Interventional navigation tracking instrumentation**

- Track instruments within a large dome-shaped tracking volume generated by the image fusion field generator (FG)
- Connect up to six instruments to the tool connection unit (TCU) for attachment of multiple instruments including image fusion patient trackers, ultrasound trackers, coaxial needle trackers, and the adaptive needle tracker
- Carry and attach the portable TCU with its handle and flexible clip, respectively
- Easily store TCU on the back of the ultrasound system cart
- Two options for tracking interventional devices: the versatile image fusion adaptive needle tracker or the image fusion coaxial needle tracker
- Turn any interventional device (10G-18G) into a tracked instrument by attaching the reusable image fusion adaptive needle tracker
- Use the image fusion adaptive needle tracker and accompanying stylus to locate and match external landmarks during fusion setup (image registration), and to plan interventional trajectories
- Track the exact tip location and orientation using miniature electromagnetic sensors implanted at the tip of the image fusion coaxial needle tracker
- Use the image fusion coaxial needle tracker to guide a wide range of ablation, biopsy or other instruments with gauge compatibility from 13G-20G and length compatibility from 9 cm to more than 20 cm
- Compatible with CIVCO eTRAX™ needle-tip tracking system
- Reusable non-sterile needle handle available in 12G, 14G, 16G, 18G; compatible with CIVCO needle available separately

#### **Anatomical measurements**

- 2D and 3D distance and angle measurements for measurement of skin-to-target, target size, interventional window, distance between multiple trajectories, and other distances







#### **Connectivity**

- Support for network DICOM image transfer from advanced imaging scanners or PACS on a hospital network
- Support for DICOM image import from USB or CD/DVD media
- Support for DICOM image export to external media (USB, CD/DVD) or PACS

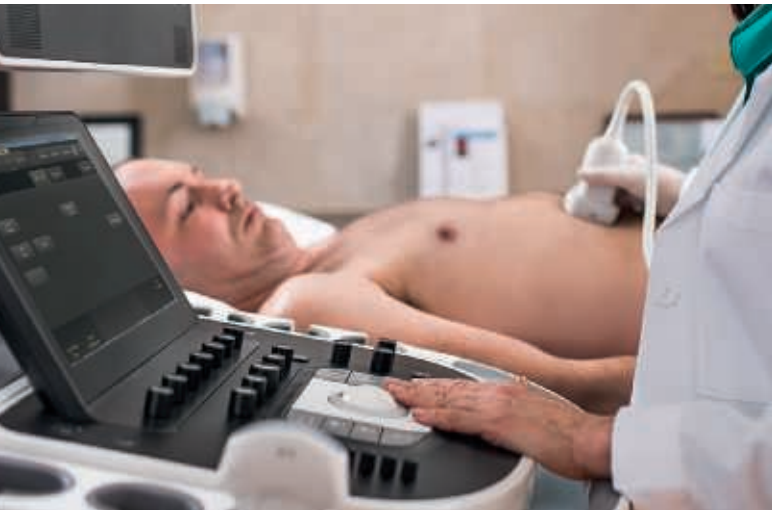
#### **Adaptive Needle Tracker**

- Coaxial needle trackers: 13Gx11 cm, 13Gx16 cm, 16Gx11 cm, 17Gx16 cm, 18Gx8 cm, 18Gx13 cm, 20Gx8 cm, 20Gx13 cm, 20Gx17cm
- eTRAX

## Image fusion accessories

Product	Description	Features
<b>Image fusion adaptive needle tracker</b> 	Attach the image fusion adaptive needle tracker onto a variety of interventional devices for navigation tracking, interventional planning, and fusion setup.	<ul style="list-style-type: none"> <li>• Easily attach and detach from devices by tightening and loosening locking mechanism</li> <li>• Compatible with devices of various gauges (10G-18G) and various lengths</li> <li>• All components reusable in sterile field after reprocessing</li> <li>• 7 cm stylus included for external landmark matching and intervention planning</li> </ul>
<b>CIVCO eTRAX™</b> 	eTRAX needle-tip tracking system tracks the tip of a needle using electromagnetic technology and real-time navigation.	<ul style="list-style-type: none"> <li>• The system allows physicians safe and accurate placement of instruments during interventional procedures by monitoring the real-time trajectory of the needle as it advances through delicate anatomy to the center of a target</li> <li>• Supports: various gauges (12G, 14G, 16G, 18G) and lengths</li> <li>• CIVCO disposable coaxial needle sold separately</li> </ul>
<b>Image fusion coaxial needle tracker</b> 	The image fusion coaxial needle tracker contains a miniature sensor embedded at the tip of a stylet inserted through an image fusion cannula. Use image fusion software to navigate the image fusion coaxial needle tracker to the Region of Interest. Remove the stylet and insert the interventional device through the image fusion cannula to perform the procedure. Example procedures include biopsy, ablation, and drainage.	<ul style="list-style-type: none"> <li>• One sterile stylet and cannula pair are used for interventional procedures</li> <li>• Robust tracking of the tip that provides tip location regardless of needle deflection or obscured tip visualization</li> <li>• Each image fusion coaxial needle tracker pouch contains three sterile cannulas and one sterile stylet for multiple insertions</li> <li>• Supports various gauges (13G-20G) and lengths (9 cm to greater than 20 cm)</li> </ul>
<b>Image fusion ultrasound tracker</b>  <ul style="list-style-type: none"> <li>C5-1 tracking bracket</li> <li>C9-2 tracking bracket</li> <li>L12-5 50 tracking bracket</li> <li>X6-1 tracking bracket</li> <li>S5-1 tracking bracket</li> </ul>	Ultrasound transducer tracking device is compatible with image fusion biopsy guide brackets for: <ul style="list-style-type: none"> <li>• Philips C5-1 transducer</li> <li>• Philips C9-2 transducer</li> <li>• Philips L12-5 50 transducer</li> <li>• Philips X6-1 transducer</li> <li>• Philips S5-1 transducer</li> <li>• Philips eL18-4 EM transducer: integrated tracking technology is provided in this transducer, therefore no external tracking bracket is required</li> </ul>	<ul style="list-style-type: none"> <li>• Easily attach and detach a single device from any of the compatible image fusion biopsy guide brackets</li> <li>• Reusable in sterile field after decontamination, under a sterile drape</li> <li>• Perform 3D tracked sweep and image registration</li> <li>• Track location of ultrasound image relative to targets and tracked interventional devices</li> </ul>
<b>Image fusion endocavity tracker</b> 	Endocavity transducer tracking device is compatible with image fusion biopsy guide brackets for Philips C10-4ec transducer.	<ul style="list-style-type: none"> <li>• Reusable tracking after decontamination, under sheath</li> <li>• Perform image registration to advanced imaging (MRI, CT, PET/CT)</li> <li>• Track location of ultrasound image relative to targets and tracked interventional devices</li> </ul>
<b>Image fusion patient tracker</b> 	The image fusion patient tracker contains multiple miniature embedded sensors and CT-visible markers inside the body of the device. The device is attached to a patient with a sterile-safe adhesive on its own when used for out-of-plane ultrasound navigation, or two or more when used for automated fusion setup.	<ul style="list-style-type: none"> <li>• Rapid fusion setup for CT-guided procedures</li> <li>• Provides fusion accuracy during unexpected patient or field generator motion</li> <li>• Reusable in sterile field after decontamination, under a sterile drape</li> </ul>

# 7. Measurements and analysis



- On-the-fly measurement labels
- Fully editable results data sheet
- Integrated patient exam report
- Delete last measurement
- Embed image and graphs in report
- Doppler peak velocity
- Doppler two calipers tool
- Doppler continue trace
- Doppler trace by points
- Cardiac dP/dt
- Volume flow
- Color aliasing velocity
- Manual data entry
- RA pressure
- 3D stacked ellipses
- 3D auto stacked contours

## 7.1 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
- Auto conversion of distance to ellipse
- 2D trace by points
- 2D distance (micro calipers)
- 2D Simpsons
- Generic angle
- Distance volume
- Distance and ellipse volume
- Diameter percent reduction
- Area percent reduction
- Hip angle
- Ratio
- Size compare
- 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

## 7.2 Measurement tools and quantification

### QLAB quantification software

#### Cardiac 3D Quantification (3DQ)

- On-cart and off-cart access
- Customize capabilities via optional plug-ins
- Capable of performing 2D measurements from 3D volume and, 3D color volume multiplanar reconstruction (MPR) views
- Review and quantification of Live 3D, 3D zoom, 3D full volume, and color full volume files
- 3D image controls: 3D vision map, 3D single or dynamic colorization, 3D color render, 3D color suppress control
- Multiplanar reconstruction (MPR) views
  - 3D slice plane
  - Parallel plane
  - Unlimited MPR manipulation
  - Plane rotation, tilt, movement controls to reduce left ventricle foreshortening
- 3D annotation
- 3D spatial reference icon
- Cardiac 3D measurements, 3D quantification from MPR views includes the following measurements
  - Distance
  - Area
  - Biplane LV volume (Simpson's)
  - Biplane LV ejection fraction
  - Biplane LV mass

#### Cardiac 3D Quantification Advanced (3DQ Advanced)

- Left ventricle global and regional volume and timing analyses with no geometric assumption
- Comprehensive report page with AHA/ASE 17-segment bullseye plots and numeric values
- Image quality index using dedicated color scale for 3D volume quality control



- Display and manipulation of dynamic 3D rendering and left ventricular (LV) true volumes of Live 3D data sets
- Displays of 3D or dynamic 3D renderings in grayscale, single colorization, or dynamic colorization
- Multiplanar reconstruction (MPR) views
- Option to flip LV apical two-chamber display and corresponding septal, anterior, lateral, inferior (SALI) sequence
- iSlice display-compatible
- Measurements of LV endocardial true 3D volumes, LV ejection fraction, and stroke volume using semi-automated 3D border detection
- Computation of regional volumes based on AHA/ASE 17-segment LV model
- Edit mode that adds flexibility for optimal 3D border tracking in four dimensions
- Display of global LV volume waveforms, all 17 regional volume waveforms, or a subset of user-selected regional volume waveforms
- Displays of dyskinetic segments and corresponding volume waveforms in specific color and format
- Display of regional end-diastolic normalized regional volume waveforms
- User-selectable waveforms: single, by wall, by level (ring) modes
- A bullseye visualization of all 17 regional segments or the user-defined and user-selected regional segments
- Global and regional reports that provide 3D LV global values and regional timing indices from all or a subset of 17 regional segments and bullseye-based parametric imaging display
  - 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 (%)
  - Bullseye showing the user-selected segments for time to minimum systolic volume (Tmsv) calculation
  - LV timing and radial excursion parametric images in bullseye format using effective color-coded scales
  - Parametric imaging supporting AHA/ASE 17-segment overlay on the bullseye for direct and rapid visualization
  - Parametric imaging that provides a radial excursion threshold slider for selective visualization of LV segments in the timing parametric display
  - Measurement data exported in Excel or DICOM SR formats

### General Imaging 3D Quantification (GI 3DQ)

- Access to 3D viewing controls
- Simple annotation
- Linear distance measurements
  - Polygon, free-form polygon, spline, free-form spline, rectangle measurements

- Curved distance measurements
- Ellipse measurements
- Area measurements
- Auto area measurements semi-automated tool to simplify measurement of hypoechoic structures
- Angle measurements
- 3D measurement tools
  - Stacked contour measurements
  - Auto-stacked contour measurements semi-automated tool to simplify volume measurements of hypoechoic structures
  - Auto-volume tool
  - 3D distance/curved iSlice
  - Stacked ellipsoid measurements
  - Ellipsoidal measurements
- Calculation of the following color indices using the 2D and/or 3D measurement tools
  - Vascularization index (VI)
  - Flow index (FI)
  - Vascularization flow index (VFI)
  - Pixel intensity index (PII) and echo histogram display
- Support of the display of 3D orientation labels (when enabled)
  - Trending capability (available only on stand-alone PC)
- Display of timer (when enabled )

### Mitral Valve Navigator<sup>AI</sup> (MVN<sup>AI</sup>)

- 3D assessment of mitral valve anatomy and associated structures
- Review and quantification of Live 3D and full volume data sets from X7-2t and xMATRIX transducer (Live 3D TEE)
- Task-driven workflow provides user direction and guidance illustrations
- Automated ES selection
- Automated 3D annulus segmentation and leaflet surface
- Associated 2D, 3D, and projected measurements and calculations sorted by group
  - Annulus
  - Leaflet
  - Aortic-Mitral
  - Coaptation
  - Papillary
- 3D image controls
  - 3D vision map
  - 3D single or dynamic colorization
  - Auto-view
  - Absolute and relative rotation
  - Three 3D render modes: volume, slices, model
- Multiplanar reconstruction (MPR) views
  - 3D slice plane
  - Unlimited MPR manipulation
  - Slice thickness
  - MPR smooth
- 3D mitral labels

- 3D mitral model
  - Model displays: tenting surface, leaflet surface, minimum surface
  - Enhanced coaptation line tracing
  - Leaflet discontinuity traces
  - Leaflet segmentation
  - Up to 53 measurements overlay
  - Exposed and coapted leaflet length and surfaces
  - Continuous display during loop playback
- Mitral valve 3D measurements and 2D/3D quantification from model view include the following measurements
  - Distances
  - Curve distances
  - Areas
  - Projected areas
  - Volumes
  - Angles
  - Ratio
- Measurement and calculation definition and overlay on 3D model
- Comprehensive reporting
- Data exported in Excel or DICOM SR formats
- Measurement data exported in Excel or DICOM SR formats

#### **Automated Cardiac 2D Quantification<sup>A.1</sup> (a2DQ<sup>A.1</sup>) and a2DQ<sup>A.1</sup> LA**

- Left ventricle and left atria global volume analysis from 2D and biplane images
  - Quantification of native and non-native images
  - Quantification of non-ECG images
  - Automated border detection for cardiac chambers and vessel cavities
  - Computation of area, LV volumes, and advanced parameters for LV systolic and diastolic function including fractional area change (FAC), ejection fraction (EF), peak ejection rate (PER), peak rapid filling rate (PRFR), and atrial filling fraction (AFF)
  - Computation of LA area, volumes, and advanced parameters including fractional area change (FAC) and ejection fraction (EF)
  - Single-plane volume measurements based on Simpson's Single Plane Method of Disks (MOD)
  - Biplane volume measurements based on Simpson's Biplane Method of Disks (MOD)
  - Automated Tissue Motion Annular Displacement (aTMAD)
    - Mitral valve and other valve annular motion tracking over time
    - Computation of valve annular displacement curves over time
    - Color Kinesis overlay to visualize valve annular plane motion parametrically
    - Measurement data exported in Excel or DICOM SR formats
    - Simplified workflow with SmartExam
- #### **Automated Cardiac Motion 2D Quantification<sup>A.1</sup> (aCMQ<sup>A.1</sup>)**
- Automated Region of Interest for selected anatomical views
  - 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
    - Quantification of 2D native and non-native ultrasound DICOM images
    - Quantification of non-ECG images
  - Available methods with dedicated preferences settings
    - Global workflow
  - Latest generation of 2D speckle tracking technology
  - Auto ROI can be set either on ED or ES frame
  - Automated border detection for cardiac chambers and vessel cavities
  - Auto aortic valve closure time detection
  - Smooth color transitioned bullseye presentation
    - Multiple cardiac view/images capable
    - 18 or 17 left ventricle segmentation templates (three apical views and three short-axis view templates)
    - Easy-to-edit template position and shape
    - Intuitive step-by-step user interface
    - Tracking quality control by right clicking the segment to remove the poorly tracked segment
    - User-editable post LV segments display consistent display with corresponding waveform and reported values beat-to-beat selection
  - Display
    - Border (hide or show)
    - Image ROI Overlay (hide or show)
    - Cardiac phases (overlay of AVO, AVC, MVO, and MVC mechanical events auto-imported from ultrasound cart analysis via DICOM SR or manual entry)
    - Four up display
  - 2D speckle parameters
    - Volume/EF and area/FAC
    - Longitudinal strain and strain rate
    - Circumferential strain and strain rate
    - Radial and transversal displacement
    - Radial fractional shortening
    - Radial velocity
    - Speed (absolute angle independent velocity)
    - Regional rotation and rotation velocity
    - Global rotation (SAX)
    - Endo-Epi mural torsion and local rotation
  - Measurement and calculations
    - Selectable GLS measurement points: peak, peak systolic and end systolic
    - Time-to-peak and peak values
    - Timing caliper
    - Global result display one view and global result display
    - Results display in 18 or 17 LV segment bullseye plot format and numerical table
    - Layer specific (Endo, Mid and Epi) longitudinal strain per view and global longitudinal strain

- Circumferential strain per view and global circumferential strain
- User-defined workflow for specific local strain analysis
- Up to 18 dedicated colors to help differentiate each cord and corresponding waveform
- Up to three waveform auto peak detections to report time-to-peak and peak values
- Simplified workflow with SmartExam
- Measurement data exported in Excel or DICOM SR formats

### **Cardiac Motion/Mechanics 2D Quantification for Stress (CMQ Stress)**

Designed to help objectify stress echo exam interpretation, CMQ Stress employs a user interface specifically designed for stress echo exams and around stress echo practitioners.

- Automated Region of Interest for selected anatomical views
- 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 and quantification of 2D native ultrasound DICOM Stress Echo images
- Global workflow
  - Latest generation of 2D speckle tracking technology
  - Semi-automated border detection for cardiac chambers and vessel cavities
  - Auto aortic valve closure time detection
  - Smooth color transited bullseye presentation
  - Multiple cardiac view/images capable
  - 18 or 17 left ventricle segmentation templates (three apical views and three short-axis view templates)
  - Easy-to-edit template position and shape
  - Intuitive step-by-step user interface
  - Tracking quality tool editable threshold helps to display various quality tracking
  - User-editable post LV segments display consistent display with corresponding waveform and reported values beat-to-beat selection
- Display
  - Border (hide or show)
  - Image ROI Overlay (hide or show)
  - Cardiac phases (overlay of AVO, AVC, MVO, MVC mechanical events auto-imported from ultrasound cart analysis via DICOM SR or manual entry)
- 2D speckle parameters
  - Volume/EF and area/FAC
  - Longitudinal strain and strain rate
  - Circumferential strain and strain rate
  - Radial and transversal displacement
  - Radial fractional shortening
  - Radial velocity
  - Speed (absolute angle independent velocity)
  - Regional rotation and rotation velocity
  - Global rotation (SAX)
  - Endo-Epi mural torsion and local rotation

- Measurement and calculations
  - Waveform auto peak or systolic peak detection to report time to peak and peak values
  - Timing calipers
  - Global result display one view and global result display
  - Results display in 18 or 17 LV segment bullseye plot format and numerical table
  - Longitudinal strain per view and global longitudinal strain
  - Circumferential strain per view and global circumferential strain
  - User-defined workflow for specific local strain analysis
- Up to 18 dedicated colors to help differentiate each cord and corresponding waveform
- Up to three waveform auto peak detections to report time-to-peak and peak values
- Measurement data exported in Excel formats

### **Elastography Quantification (EQ)**

Provides strain elastography quantification of relative tissue deformation based on an elastogram.

- Ability to generate up to ten user-defined Regions of Interest (ROIs)
- Thumbnail display of frames
- Measurement results
- Calculation and display of strain rate and total strain
- Size comparison between two ROIs
- 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
- Compatible with EPIQ systems using Elastography mode with L12-5, C10-3V, and L18-5 transducers

### **Intima Media Thickness (IMT) measurements**

- Automated measurements of intima media thickness in carotids and other superficial vessels
- Automated measurement technique on user-selected frames
- Selector chart to record location and side of vessel from where IMT is measured
- Report of the IMT values in mean millimeters and standard deviation
- Quick optimization for thin or thick intima media complexes
- User-adjustable Region of Interest
- User-defined measurement capability
- Persistent storage of up to ten measurements with image files for future reference
- Measurement data exported in Excel or DICOM SR formats

### **MicroVascular Imaging (MVI)**

- Review loops including side-by-side display files
- Motion compensation algorithm selectable in Preferences menu
- Export of single frames as BMP, JPG, or TIF file format
- Export of movie files as AVI file format

### Region of Interest (ROI) Quantification

- Vascular, general radiology, and cardiac images
- Trending capability (available only on stand-alone PC)
- Up to ten user-defined regions
- Thumbnail display of frames for easy trimming
- Pixel intensity index (PII) and echo histogram display, supported data types: echo, velocity, or power (angio)
- Custom tools to auto trim relative to ECG trigger on cardiac and other triggered files for quantification of specific parts of cardiac cycle
- Region shaping tools
  - Polygon
  - Free-form polygon
  - Spline
  - Free-form spline
  - Rectangle
  - Square 5 mm
- Single frame tools
  - Angle
  - Annotation
  - Curved distance
  - Distance
  - Ellipse
  - Live xPlane ROI combination
- Auto area for semi-automated quantification of hypoechoic structures
- Adjustable ROI dynamic tool
- Motion compensation algorithm selectable in Preferences menu
- Data display selection
  - Log
  - Linear
- Data display smoothing option
- Mean, median, and standard deviation calculation
- Time-intensity curves
- Curve fitting tools
  - Gamma-variate (wash-in and wash-out)
  - One minus exponential
  - Linear
  - Log normal WI
  - Log normal WIWO
  - LDRW WIWO
- Graphic results with dB, intensity or velocity/frequency, time to peak, “A” value, area under curve, and peak intensity (when a gamma variate curve has been applied) for each frame
- Calculation of the following color indices using the 2D measurement tools
  - Vascularization index (VI)
  - Flow index (FI)
  - Vascularization flow index (VFI)

### Strain Quantification (SQ)

- Used in the evaluation of regional myocardial function
- Measures the myocardial velocity from color TDI data set and derives the displacement, strain, and strain rate along user-defined M-lines

- Includes ability to overlay opening and closing of aortic and mitral valves on SQ curves to display left ventricle mechanical events
- User-selectable waveform display that makes SQ curves easier to read
- Capable of drawing up to four M-lines at a time
- Point of Interest (POI) tool that obtains values from any point on the M-mode display
- M-mode (hide or display) control
- User-defined and automatic (using speckle tracking algorithms) M-line motion compensation to follow myocardial motion
- Able to present TDI results in two display formats
  - Anatomical M-mode display
  - Graph display
- User-selectable waveforms for optimal sub-region visualization
- Curve processing modes
- Cardiac mechanical timing reference overlay
- TDI velocity, displacement, strain, and strain rate timing measurements with dedicated time calipers and labels
- Automatic subdivision of M-line into a customizable number of sub-regions
- Averages up to 20 cardiac beat cycles in both M-mode and graph displays
- Measurement data exported in Excel format

### HeartModel<sup>A.I.</sup>

Philips HeartModelA.I. brings robust 3D quantification to everyday clinical practice. This anatomically intelligent premier cardiac application automatically detects, segments, and quantifies the left ventricle (LV) and left atrium (LA) from a Live 3D volume. HeartModelA.I. provides automated 2D views and reproducible quantification across users and over time, with the workflow efficiency to facilitate faster exams for the robust measurement of cardiac function necessary for management of patients with chronic disease.

- HeartModel<sup>A.I.</sup> automatically segments the heart chambers within a 3D volume
- HeartModel<sup>A.I.</sup> displays the routine 2D apical and short axis views at end-diastole and end-systole for adult hearts
- HeartModel<sup>A.I.</sup> finds the shape of the heart chambers and displays the chamber border in ASE/ESE views for the user to accept, reject, or edit
- Users can adjust the automated border where desired for the end-diastolic (ED) and end-systolic (ES) cardiac phases. Edit capabilities include a global or regional edit function

The following results are exported in DICOM SR and/or .xls formats:

- End diastolic LV length
- End systolic LV length
- End diastolic LV volume
- End systolic LV volume
- End systolic LA volume

- LV ejection fraction
- Heart rate
- Stroke volume
- Default ES and ED border settings
- Current ES and ED border settings

HeartModel<sup>A.I.</sup> is compatible with EPIQ 7C and EPIQ 7G using HeartModel Acquisition Mode with the X5-1 transducer.

### 7.3 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

### 7.4 Clinical option analysis packages

- Cardiac analysis
  - Left atrium
  - Right atrium
  - Right ventricle
  - Left ventricle
  - TAVI (transcatheter aortic valve implantation)
  - Valve stenosis
  - Prosthetic aortic valve
  - Prosthetic mitral valve
  - TAPSE (tricuspid annular plane systolic excursion)
  - MAPSE (mitral annular plane systolic excursion)
  - PCWP (pulmonary capillary wedge pressure or pulmonary artery occlusion pressure)
  - Stress echo measurements in various stages
  - MPI (or TEI index)
- Volume by area/length method
- M-mode ejection fraction (via Teichholz or cubed method)
- Novel three-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 ratio
- Small parts
  - General
  - Breast with right and left protocols for up to five lesions per breast
  - Testicle
    - Testicle volume
    - EPI head, body, tail
  - Urology
  - Prostate, PSA, PSA density

## 8. Physical specifications



### System dimensions

<b>Width</b>	60.6 cm/23.9 in
<b>Height</b>	146-171.5 cm/57.5-67.5 in
<b>Depth</b>	109.2 cm/43 in
<b>Weight</b>	104.3 kg/230 lb without peripheral devices

### 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, USB, and DVD media drive, if equipped
- Transducer and gel bottle holders
- Mobility through high-quality, shock-absorbing casters with foot pedal controls for:
  - 4-wheel swivel
  - 2-wheel swivel lock
  - 2-wheel brakes
- Integrated footrests
- Transducer connector and OEM bay illumination for easy visibility in scanning rooms
- Digitally-enhanced two-speaker high-fidelity stereo output with rear-mounted subwoofer
- On-board storage tray behind control panel touchscreen and in rear bay left and right storage drawers
- Universal peripheral bay that provides easy access for up to two on-board hardcopy or documentation devices
- Built-in A/C line conditioner that provides isolation from voltage fluctuations and electrical noise interference
- Three high-capacity fans with automatic speed adjustment to optimize cooling efficiency with minimal audible noise

## Monitor

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- Flat panel LCD display monitor
  - 54.6 cm/21.5 in wide-format high-definition flat panel TFT/IPS display
  - High contrast ratio >1000:1
  - Extended viewing angle >178° (horizontal and vertical)
  - Response time: <14 ms
  - Virtually flicker-free technology for reduced eyestrain
  - Mounted on fully articulating extension arm
  - Four-way articulation with 87.6 cm/34.5 in lateral and 17.8 cm/7 in vertical adjustment range
    - Nearly infinite positioning adjustments: height, swivel, and tilt

## Control panel

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- Articulation facilitates nearly infinite positioning adjustments for optimum scanning ergonomics: height, swivel, and tilt
  - Up and down 25.4 cm/10 in
  - Rotates 180° from center
  - Complete freedom for side-to-side slide movement, infinite positions
  - Operates on battery for adjustment during mobile exams
  - Retractable, backlit alphanumeric keyboard
  - Palm rest

## Physio

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- One three-lead ECG input
  - Gain, sweep rate, and display position controls
  - Automatic heart rate calculation and display
  - Fault condition display
  - Cineloop locator displayed on one ECG input from an ECG source like stress ECG or ECG monitor

## Peripherals

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

## Input/output ports

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- Export of measurement and analysis data to off-line reporting software packages (USB)
- Display port video export available for either full screen resolution of 1920x1080 (1080p) or display area 1024x768

## Power requirements and video parameters

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- 100V-240 V, 50 Hz/60 Hz – PAL/NTSC
- Integrated A/C line conditioning and battery back-up system
- Power consumption: <600 VA depending on system configuration

## Electrical safety standards

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- 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 basic safety and essential performance
  - IEC 60601-1-2, Collateral Standard, Electromagnetic compatibility – requirements and tests
  - IEC 60601-2-37, Particular Requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment
  - ANSI/AAMI ES60601-1, Medical Electrical Equipment: General requirements for basic safety and essential performance
- 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

- Flexible service agreements to meet varied customer needs and budgets
- Centralized technical and clinical support
- On-site support
- Modular design for rapid repairs
- Easy customer access to trackball and air filter for cleaning
- Remote log file transfer
- On-cart software maintenance tools
  - Optimization
  - Maintenance
  - Repair
  - Configuration management
- Comprehensive diagnostics
  - Hardware
  - Software
  - Network
  - On-cart electronic transducer testing
- First responder access to diagnostics and utilities
- Spare parts availability for seven years from end of production



\* 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.



## Services

### Clinical education\*

- Webinars
- Symposia
- On-site
- Classroom
- Remote

### Philips Remote Connectivity\*

- iSSL and encryption
- Patient de-identify
- Security
- Remote Desktop
  - Remote technical support
  - Remote clinical support
  - Remote clinical education
- On-cart remote support request
- Proactive monitoring with alerting capability
  - Monitors key system parameters
    - Voltage
    - Temp
    - Fan speeds
    - Error conditions
  - Local alert handling and response

### Warranty

- Philips standard product warranty

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Printed in The Netherlands.  
4522 991 29821 \* OCT 2017