A new class of compact ultrasound

Philips CX50 CompactXtreme ultrasound system
specifications

PHILIPS

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1. Introduction

The new CX50 system is built on a new platform and architecture in a small, compact design that is ideal for taking premium performance anywhere you need it. PureWave, a clinically proven imaging technology previously available only on Philips premium systems, captures a broad band of tissue information for exceptional clarity and information. AutoSCAN optimization and Tissue Specific Imaging presets offer a new level of exam automation – transducers are optimized by exam type, providing excellent images with minimal adjustment. Highly configurable portability enables you to study the most difficult-to-image patients across a variety of clinical needs.

Key advantages

- Premium performance anywhere you need it
- Exceptional results on technically difficult patients
- Support for cardiology, general imaging, vascular, pediatrics, surgery, laparoscopic, intraoperative, and OB/GYN exams

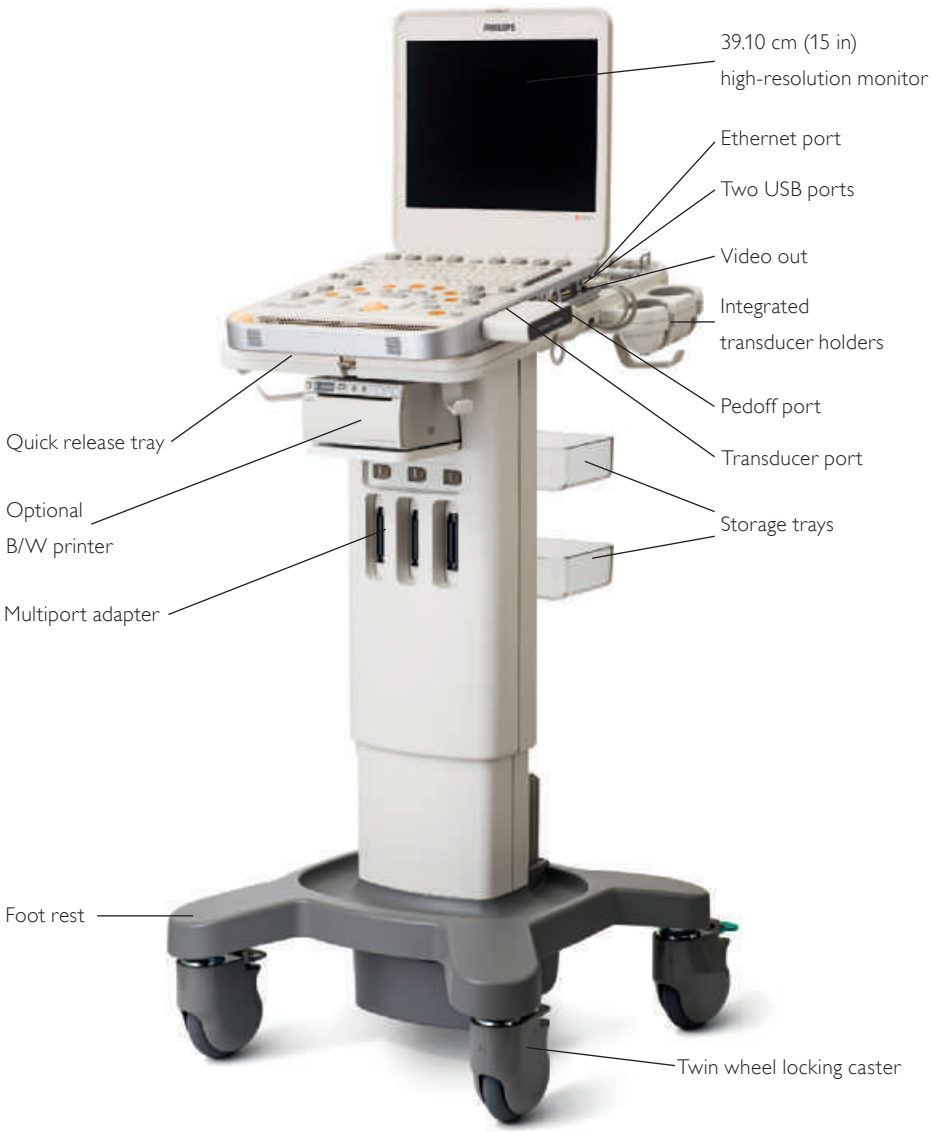
The CX50 is fully configurable, allowing you to select imaging capabilities, transducers, and clinical analysis to support your exam needs. Add supported capabilities at any time as well as upgrades when they become available.

1.1 Applications

Adult cardiac
Adult transesophageal
Stress echo
Abdominal
Pediatric
Vascular – carotid, arterial, venous, abdominal, vascular access, intervention
Transcranial Doppler
Fetal echo
Obstetrical
Gynecological and fertility
Small parts
Breast
Musculoskeletal
Emergency medicine
Regional anesthesia
Intervention
Laparoscopic
Surgery
Intraoperative – vascular, epicardial
Intracardiac echo
Contrast

1.2 Optional portability

Specially designed cart
Wheeled travel case
Additional AC adapter



2. System overview

Philips proprietary technologies are an integral part of the CompactXtreme platform, and provide the basis for its extensive range of imaging capabilities.

2.1 System architecture

- Next-generation all-digital compact broadband beamformer with pulse shaping capability
- High resolution A/D conversion with 170 dB full time system dynamic range
- xMATRIX imaging with PureWave xMATRIX Live 3D TEE imaging
- Up to 504,576 digitally-processed channels
- Supports PureWave technology and high-density array configurations
- Multivariate harmonic imaging including pulse inversion processing
- One-touch 2D optimization with broadband frequency compounding
- SonoCT real-time beam-steered compound imaging
- Advanced XRES adaptive image processing
- Continuously variable steering in 2D, color Doppler, and Doppler modes
- AutoSCAN and AutoSCAN gain yield automatic optimization of images
- iSCAN one-touch intelligent optimization for 2D and Doppler
- Long loop capture for pediatric and contrast imaging up to 420 seconds
- Active native data manipulation
- Tissue specific imaging presets
- Gray shades: 256 levels (8 bit) in 2D, M-mode, and Doppler

2.2 Imaging modes

- 2D
- Live 3D TEE and Live 3D TEE color flow
- M-mode
- Anatomical M-mode
- Live xPlane imaging for 2D and color flow
- Color M-mode
- Color Power Angio (CPA) imaging
- Directional CPA
- Pulsed wave (PW) Doppler
- HPRF PW Doppler
- Continuous wave (CW) Doppler
- Freehand 3D imaging
- Needle visualization
- QLAB advanced quantification software
- Invert and color invert
- Color compare mode
- Dual mode
  - 2D
  - Tissue Doppler imaging
  - Color
  - Color Tissue Doppler imaging
  - Color Power Angio (CPA) imaging
- Duplex for simultaneous 2D and Doppler
- Triplex for simultaneous 2D, Doppler, and color or Color Power Angio
- 2D and flow optimization signal processing
- Intelligent Doppler – automatically maintains pre-selected 0/60° flow angle
- Live compare
- Tissue Harmonic Imaging (THI)
- Zoom imaging – live or in review
- Reconstructed zoom with pan (read zoom)
- HD Zoom – real-time HD zoom increases processing capabilities depending upon 2D zoom size
- HD zoom with adjustable box size and position
- High definition write zoom
- Trapezoidal imaging
- Pulse inversion harmonic imaging
- Contrast imaging
  - Cardiac left ventricular opacification (LVO)
  - General
  - Superficial
- Adaptive Doppler
- Adaptive color Doppler
- Color tissue Doppler imaging
- Pulsed wave tissue Doppler imaging
- Active native data (allows manipulation of raw image data)
- SmartExam system-guided protocol capability

The CX50 system combines premium imaging technologies and advanced optimization for exceptional image clarity results.

2D grayscale

- Smart TGC: pre-defined TGC curves optimized for consistently excellent imaging with minimal TGC adjustment
- User adjustable LGC control
- AutoSCAN automatically and continuously optimizes the brightness of the image at the default gain and TGC settings for the best image display
  – Turn on and off
  – AutoSCAN gain quick key and AutoSCAN ICON display
- High definition zoom concentrates all image processing power into a user-defined area of interest; possible to combine high definition zoom with pan zoom
- Cineloop image review
- Selectable 2D compression settings
- Sector size and steering control for sector and curved array image formats
- Dual imaging with either independent cineloop buffers or split screen imaging
- Live compare
- Chroma imaging with multiple maps
- 256 (8 bits) discrete gray levels
- 2D acquisition frame rate up to 755 frames/sec (dependent on field-of-view, depth and angle)

Live xPlane imaging

- Live xPlane Imaging
- Live xPlane Color Flow imaging
- Live xPlane with Rotate and Tilt with on screen directional ICON

One-button controls are logically placed on the CX50 control panel for easy optimization during every exam.

Live 3D TEE

- Available on X7-2t transducer
- Live full volume imaging
- Target Volume rate imaging for increasing 3D frame rate
- Long live volume loop acquire
- Beat-by-beat retrospective 3D loop selection
- Live 3D color flow imaging
- Live 3D zoom and Live 3D zoom preview
- Full Volume Imaging with autocrop
- 3D front, back, up, down, left, right 3D automatic view control
- Crop adjust with cropping
- Dynamic Face Cropping of Live 3D and Live 3D color imaging
- 3D Markers
- 3D Marker depth control
- 3D Dynamic Anatomic ICON – tracks direction of the 3D image view and correlates to the human icon for a mid-esophageal view
- Basic measurements on 3D image (point to point, area, circumference)
- Basic measurements on Live xPlane
- Live 3D Swivel and Swivel acquire
- ISCAN for Live 3D
- ECG display
- Enhanced Live 3D dynamic colorization for enhanced 3D effect
- Save 3D view and Restore 3D view (remembers cropping)
- Seek angle (multiplane) is available during Live 3D imaging
- Live 3D contrast for LVO with harmonics
- Maximum 90° by 90° Live 3D TEE volume imaging (mode-dependent)

M-mode

- Available on cardiac imaging transducers
- Selectable sweeping rates
- Time markers: 0.2 and 1.0 seconds
- Acquisition zoom capability
- Selectable display format prospective or retrospective (1/3-2/3, 2/3-1/3, side by side, full screen)
- Chroma colorization with multiple color maps
- Cineloop review for retrospective analysis

Anatomical M-mode

- Available for cardiac imaging transducers
- Uses 2D image as a basis for M-mode analysis at a defined line, independent of transducer orientation
- Makes it easier to keep the M-mode line perpendicular to the anatomy, even in abnormally shaped or positioned hearts
- Provides data on direction, position and timing of any single echo received from any point of the tissue for M-mode analysis in any direction, for examining cardiac chamber diameters, LV regional wall motion, and location of accessory pathways
- Anatomical M-mode trace can be generated or modified post Freeze

Tissue Doppler imaging

- Available on S5-1, S8-3, and S12-5 transducers
- Allows high frame rate acquisition of tissue motion
- Color gain, TGC, and LGC
- 8 color maps
- Velocity (cm/s)

Pulsed wave Doppler

- Available on all imaging transducers
- Adjustable sample volume size: 0.8-24.6 mm (transducer-dependent)
- Simultaneous or duplex mode of operation
- Simultaneous 2D, color Doppler or CPA, pulsed Doppler
- iSCAN optimization automatically adjusts scale, baseline, and Doppler gain

Continuous wave Doppler

- Available on cardiac sector array transducers and non-imaging transducers
- Steerable through 90° sector
- Maximum velocity range: 20 m/sec (transducer-dependent)

Spectral Doppler

- Display annotations including Doppler mode, scale (cm/sec) Nyquist limit, wall filter setting, gain, acoustic output status, sample volume size, normal/inverted, angle correction, grayscale curve
- Angle correction with automatic velocity scale adjustment
- Adjustable velocity display ranges
- 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, 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 in PW frozen mode includes map, baseline

Color Doppler

- Adaptive mode adjusts Doppler frequency and sensitivity based on color ROI placement within image
- Available on all imaging transducers
- Cineloop review with full playback control
- Advanced motion suppression with intelligent algorithms; adapts to various application types to selectively eliminate virtually all color motion artifact
- 256 color bins
- 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
- User selectable smoothing control
- User selectable persistence control
- Color/2D line density control

Contrast imaging

- System optimized for detecting contrast agent signatures
- Contrast modes available on the S5-1, C5-1 and L12-3 transducers
  - Long loop captures – up to 420 seconds
- Pulse inversion contrast imaging available with XRES technology
- Power modulation (PM), pulse inversion (PI), coded harmonic, and flash contrast imaging modes
- Low MI mode
- Display timer
- Low MI color flow contrast
- Contrast flash mode
- Contrast flash power mode
- S5-1 left ventricular opacification (LVO) for adult cardiology applications
- ECG/timed triggering
- QLAB ROI display

Contrast side-by-side imaging

- Simultaneous 2D contrast and tissue images displayed side by side
- Image controls, such as depth, focus, left/right sector width, and top/bottom, affect both the contrast image and the tissue image
- Controls can be set independently for the contrast image and the tissue image:
  - Gain
  - 2D opt
  - Res/Spd
  - Gray Map
  - Compress
  - Chroma
  - Persistence
  - 2D PRF
  - Output power
  - XRES
  - Smoothing

Tissue Harmonic Imaging

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

Intelligent Doppler imaging

Automates critical adjustments in color/PW duplex modes

- Automatically determines the 60° angle once the sample volume is placed and maintains that 60° angle as the sample volume is moved along the color flow image as it calculates
- Available during shallow vascular imaging with high-frequency linear transducers (L12-3, L12-5 50 mm and L15-7io) using presets
- Optimization of fine angle steering automatically to 60° steering when possible

Color Power Angio imaging

- Highly sensitive mode for small vessel visualization
- Available on all imaging transducers
- Cineloop review
- Multiple color maps
- Individual controls for gain, PRF, baseline, filters, sensitivity, echo write priority and color invert
- Dynamic motion differentiation
- Adjustable CPA region of interest: size and position
- User-selectable persistence
- User-selectable blending
- Directional Color Power Angio (DCPA) mode

Freehand 3D

- Qualitative grayscale volume acquisition supported on all imaging transducers
- Volume display with surface rendering (transparency, threshold, smoothing, brightness, and opacity controls)
- Multiplanar view display
- Specialized algorithms and maps maximize three-dimensional display
- Trim tools on both volume and multiplanar reconstructed (MPR) views
- Supported by SonoCT and XRES modes to reduce noise artifacts
- Resize control adjusts for different sweep speeds
- Sculpt/erase control of volume
- Advanced QLAB volume analysis tools:
  - 3DQa: MPR, thick slice, and advanced volume rendering capabilities
  - iSlice precision tomographic volume imaging capability

Biopsy display

- Biopsy display guideline provides a guideline to help see the biopsy needle path
- Scan plane orientation marker
- Biopsy quick key, biopsy needle length

Needle visualization

- Available on the L12-3 and L12-5 transducers
- Provides enhanced visualization of the needle position during biopsy procedures when using standard biopsy needles
- Needle visualization displays a dashed line
- Needle path quick key for left, right approach
- Needle path for shallow, medium steep

3. System controls

The CX50 has sophisticated system controls to help you acquire the best possible data on your patients, including many one-button optimization controls that adjust thousands of system parameters.

3.1 Advanced imaging controls

AutoSCAN image optimization

- Continuously optimizes the image depending upon the brightness and TGC controls
- Toggle on or off

iSCAN image optimization

- One-touch image optimization
- In 2D mode, one button automatic adjustment of:
  - TGC and receiver gain to achieve optimal uniformity and brightness of tissues
- In Doppler mode, one button automatic adjustment of:
  - Doppler PRF based on detected velocity
  - Doppler baseline based on detected flow direction
  - Gain to achieve optimal brightness of spectral waveform
- Available on all imaging transducers
- Operates in conjunction with SonoCT and XRES imaging

SonoCT real-time compound imaging

- Available on all curved and linear array transducers
- Eliminates virtually all clutter and artifact
- Automatic selection of the number of steering angles (up to 9) based on the user-selected resolution/frame rate (Res/Speed) condition
- Operates in conjunction with Tissue Harmonic Imaging, volume modes, and duplex Doppler
- Operates in conjunction with XRES imaging
- Available in contrast modes

Advanced XRES adaptive image processing

- Available on all imaging transducers
- Eliminates virtually all speckle noise and enhances border definition
- Available in contrast modes

Expanded field of view

- Trapezoidal imaging
  - Expands field of view on linear array transducers up to 15° on each side in vascular and general imaging applications

Active native data

- 2D image controls that can be changed in review include: gain (overall gain, TGC, LGC), compress, gray map, Chroma map, orientation (L/R, U/D), display zoom/pan, XRES
- PW Doppler and CW Doppler controls that can be changed include: gain, baseline, invert, angle correct, angle 60/0/60, sweep speed, grayscale and Chroma maps compress and reject, PW trace (High Q controls), display format
- Color image controls that can be changed in review include: gain, baseline, color map, invert, write priority, smoothing, suppress, variance, directional Color Power Angio
- Physio controls that can be changed: sweep speed, position, gain
- Can be acquired in prospective and retrospective timing sequences
- Images are acquired at acoustic data frame rate
- Available in cineloop and quick review modes

Live compare

- Allows recall of current or previous exam image data for direct side-by-side comparison with current image data

3.2 Control panel and user interface

- Easy-to-learn graphical user interface
- Ergo-centric design of primary controls readily accessible and logically grouped
- Tri-state control panel lighting (active, available, and unavailable)
- Automatic ambient lighting sensing for optimal image viewing in both light and dark environments
- Dual function mode switch and independent gain controls for 2D, CPA, M-mode and color, PW Doppler, CW Doppler
- Eight-slide pot control adjustment of TGC curve
- Two-slide pot control adjustment of LGC curve
- iSCAN control for 2D/Doppler/color Doppler automatic optimization
- High definition/pan zoom control
- Freeze control
- Programmable print control
- Transducer selection and tissue specific imaging control
- Report and review controls
- Protocol selection control

4. Workflow

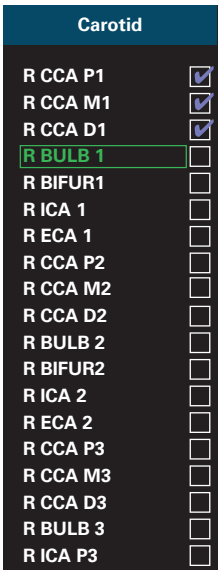
The CX50 system adapts to your workflow, whether you're in a critical care unit, at the bedside, in the emergency department, OR arena, or at a remote location. With easy-to-use tools designed for your needs, you're ready to scan wherever your patients are located.

4.1 Display annotation

- On-screen annotation of all pertinent imaging parameters for complete documentation, including transducer type and frequency, active clinical options and optimized presets, display depth, TGC curve, grayscale, color map, frame rate, compression map value, color gain, color image mode, hospital name, and patient demographic data
- User-selectable display of patient birth date or user ID, institution name, and performed by
- Annotation data and patient name can be turned off (hidden) for generating images used in publication and presentation
- Annotations added via keyboard, quick lists or menus
  - Up to 5 separate lists with 26 annotations per list available
  - Users may add to the lists or move labels in list
  - Users select annotations from the list
  - Default lists provided by presets
  - Home keys for the list
  - Replace words
- Scan plane orientation marker
  - Ability to erase the last word
- User selectable depth scale display
- Real-time display of mechanical index (MI)
- Real-time display of thermal index (TIb, TIc, TIs)
- Multiple trackball-driven annotation arrows
- Pre-defined body markers, supported in single and dual imaging formats
- Doppler baseline invert in live and frozen imaging
- TGC curve (user selectable On/Off display)
- TGC values (On/Off display)
- Tool tips provides a brief description of the abbreviated on-screen image parameters
- Informative trackball arbitration prompts
- Thumbnail display of images printed/stored
- Calculations results and analysis labels
- User friendly menus that allow navigation to other analysis features
- Network and connectivity icons to allow instant feedback about network and printer conditions
- Cineloop frame number display
- Cineloop bar with trim markers
- Prompt region for informational message display
- Protocol procedure list with status

SmartExam protocols

- Exam guide with on-screen display
- Required views based on exam type
- Fully customizable protocol capability for clinical applications supported on the system with flexibility to conduct the examination protocol in any sequence
- Preset protocols for abdominal, vascular, and gynecological exams based on industry and accreditation guidelines
- Automatic launching of annotation and body marker icon on required views
- Automatic launching of calculations
- Ability to pause and resume SmartExam function at any time
- System analysis capabilities supported in all defined protocols
- Custom protocol transfer between CX50 systems



SmartExam's on-screen display provides immediate visibility of exam status.

4.2 Image presentation

- Up/down
- Left/right
- Multiple duplex image formats (1/3-2/3, 2/3-1/3, 50/50, and full screen)
- Depth from 1 cm to 30 cm (transducer-dependent)

4.3 Cineloop review

- Acquisition, storage, and display in real time and duplex modes of up to three minutes in quick review of 2D and color images
- Dual imaging (single and dual buffer)

4.4 Connectivity

- Two USB ports on control panel
- DHCP networking configurable
- 160 GB hard drive space
- Internal slot-load CD/DVD RW drive
- DICOM print, store, and storage commitment
- DICOM structured reporting for
  - Abdominal
  - Cardiac
  - Obstetrics
  - Vascular
  - Pediatric echo
  - GYN structured report

- Performed procedure step (PPS)
- Modality worklist
- DICOM reader saved onto media
- Export data as PC-compatible or DICOM files
- Ethernet at 100 Mb/second
- Wireless "B and G" networking
- TCP/IP properties are stored with the DICOM preset
  - When user changes DICOM presets, the TCP/IP properties are changed to allow the system to be moved between networks
  - DICOM presets can be saved to removable media
- USB to serial converter adapter

Video output

- DVI-I output of digital video to monitors or projectors that support 1600 by 1200 at 60 Hertz
- Brightness control of video output

DICOM Capture

- Format types include:
  - Uncompressed Implicit VR Little Endian (ILE)
  - Uncompressed Explicit VR Little Endian (ELE)
  - RLE lossless compression
  - JPEG lossy compression
- Color formats: RGB, Palette, YBR Full
- Export of Live 3D image in DICOM private tag for review on QLAB or other compatible 3D viewers
- DICOM 3D clips and DICOM QLAB clips for simple review on DICOM PACS of 3D stills and loops
- Support for optional small B/W and color printers
- DICOM test patterns
- Network packet capture
- DICOM verify of connectivity
- Network diagnostics
- 2D and 3D TEE Digital Network Link for future Live review on Philips 3D cath lab software (EchoNavigator). Takes the Live 3D image with minimal latency via a gigabit network.

4.5 Ergonomics

- Philips common user experience control panel with central track ball and easy-access mode keys
- Tri-state lighting allows immediate feedback of active and available controls in all modes
- High-resolution LCD display with wide viewing angle and automatic ambient light compensation
- Quick keys and active mode
- System-guided exam protocol capability

4.6 Stress echo protocols

- Acquisition of single-frame or full-motion digital clips in any mode (including 2D, color Doppler, color TDI); type of image to be acquired may be changed on the fly by the operator as needed through pause protocol feature
- Gain Save adjusts automatically to different views
- Automatically saves your preferred control settings – such as MI (Mechanical Index), gain and depth – for each view while acquiring resting images
- At immediate post-exercise, system automatically retrieves saved settings for each view
- Allows different gain profiles for parasternal LAX and SAX views, AP4 and AP2 views
- Systole or full heart cycle acquisition
- Default stress protocols
  - May not be edited but may be used as the basis of a user-defined protocol
  - Factory-provided protocols include:
    - Two-stage exercise stress
    - Four-stage pharmacological stress
    - Three-stage exercise stress
- User-defined stress protocols
  - Utility for creation of user-defined protocols and editing of existing protocols for acquisition of stress and routine images, allows protocols to be defined to do any or all of the following:
    - Support between 1 and 8 stages
    - Support user-defined stage names
    - Support between 1 and 8 views per stage
    - Support user-defined view names
    - Prompt for a particular stage and view
    - Assign stage and view names
    - Set the number of cycles/beats for each view
    - Define prospective or multi-cycle/full disclosure acquisition
    - Save user-defined protocols within a preset
    - Save user-defined protocols to removable media for import onto other CX50 systems at the same software level
    - Modify protocols during use
    - Add stages at any point after the current stage
    - Change the name of a stage at any point up to acquisition of the first image of the stage
    - Save the modified protocol (it will not be automatically saved)

4.7 Integrated intervention

- Integration capability with Philips Allura X-ray systems for controls and display
- Support for radiology, vascular, and cardiology interventional procedures

5. Transducers

The CX50 ultrasound system offers a full complement of transducer options that extend capabilities to meet a wide range of imaging needs.

5.1 Transducer selection

- Automatic parameter optimization of each transducer for exam type through tissue specific presets software
- User-customizable imaging presets for each transducer
- Dedicated connector for continuous wave Doppler (Pedoff) transducers
- Continuous dynamic receive focusing on all imaging transducers

5.2 PureWave transducer technology

- Proprietary combination of PureWave crystal, impedance matching layers, backing materials, micro-electronics, and cable design
- Achieves breakthrough acoustic broadband response and twice the efficiency of conventional technology for superb image quality and Doppler performance
- Designed for multivariate harmonic imaging capabilities including pulse inversion and coded pulse sequencing
- Supports highly sensitive contrast enhanced ultrasound capabilities
- Available in sector, curved, and xMATRIX array configurations up to 12 MHz in frequency

5.3 IntraCardiac Echocardiography (ICE) imaging

- CX50 imaging of 2D, Color, PW Doppler, CW Doppler, harmonic imaging, TDI, M-mode and Color M-mode
- Bedside, portable, simplified, cleanable user interface for integration with Philips cath labs. Allows for operation of Philips 2D ICE solution
- Excellent suppression of interference artifacts common in interventional rooms
- Structural Heart Disease and EP presets
- 3 MHz to 10 MHz operating frequency
- 64 element phased array imaging
- Operates with St. Jude Medical Systems patient interface module and Viewflex Xtra 9 French, 4 way steering ICE catheter which has easy to handle control and maintains image format during ICE procedure. See St. Jude Medical for details and sales information.

CX50 supports a broad range of exam requirements with sector, curved, and linear array transducers.

Curved arrays

C5-1 curved array with PureWave technology

- 5 to 1 MHz extended operating frequency range
- High density curved array, 160 elements
- 2D, steerable PW Doppler, high PRF and color Doppler; and Color Power Angio, SonoCT, advanced XRES, and multivariate harmonic imaging
- General purpose abdominal, obstetrical, gynecological, interventional, acute care, and regional anesthesia applications
- Contrast application
- Supports reusable, 4-angle, plastic biopsy guide (14-23 gauge)

C8-5 broadband curved array

- 8 to 5 MHz extended operating frequency range
- High density curved array, 128 elements
- Field of view: 90°
- Steerable pulsed Doppler, color Doppler, Color Power Angio, SonoCT, and advanced XRES imaging
- General purpose pediatric and vascular imaging
- Supports reusable, single angle, plastic biopsy guide (8.5FR and 14-23 gauge needles, 19 gauge not available)

C10-3v curved array with PureWave technology

- 10 to 3 MHz extended operating frequency range
- High density curved array, 128 elements
- End-fire sector, 11.5 mm radius of curvature, 130° field-of-view
- Steerable pulsed wave, high PRF, and color Doppler, Color Power Angio, SonoCT, advanced XRES, and multivariate harmonic imaging
- Endovaginal applications
- Supports disposable, plastic biopsy guide (18 gauge) and stainless steel biopsy guide (16-18 gauge)

C9-3io curved array

- 9 to 3 MHz extended operating frequency range
- Biopsy guide with three angles and on-screen graphic display
- 2D, contrast enhanced, color, PW Doppler
- Length of transducer, cable and connector: 10.5 ft/3.2 m
- Length handle to tip: 1.83 in/4.66 cm
- Radius of curvature: 0.984 in/2.5 cm
- General abdominal surgery, general contrast, and abdominal intervention applications

Linear arrays

L12-3 broadband linear array

- 12 to 3 MHz extended operating frequency range
- Fine pitch, high resolution linear array, 160 elements
- 2D, steerable PW, high PRF, and color Doppler, Color Power Angio, SonoCT, advanced XRES, and multivariate harmonic imaging
- Vascular, small parts, musculoskeletal, regional anesthesia, and acute care applications
- Contrast application
- Supports reusable, 3-angle, biopsy guide (14-23 gauge)

L12-5 50 mm linear array

- Fine pitch, 256 element, high resolution linear array
- 12 to 5 MHz extended operating frequency range
- 10° of trapezoidal imaging
- Steerable pulsed wave, color Doppler, and Color Power Angio, SonoCT, XRES, and harmonic imaging
- Intelligent Doppler flow optimization
- Cable length: 78 in/198 cm
- Breast, thyroid and superficial small parts; musculoskeletal tendon, abdomen bowel, and vascular applications
- Biopsy guide available
- AutoSCAN imaging is available on L12-5

L15-7io compact linear array

- 15 to 7 MHz extended operating frequency range
- 8° of trapezoidal imaging
- Steerable PW Doppler, color Doppler, and Color Power Angio imaging, and XRES processing
- Tissue aberration correction selection for MSK and small parts
- Intelligent Doppler flow optimization
- Scanplane aperture: 23 mm linear plus 8° trapezoidal
- Trapezoidal imaging mode
- Unique lens footprint design allowing high resolution imaging at transducer surface
- Transducer length: 3.5 in/89 mm
- Cable length: 96 in/243.84 cm
- Vascular surgical, cardiac epicardial, and superficial vascular, musculoskeletal and small parts applications

L10-4lap linear array

- 10 to 4 MHz extended operating frequency range
- 2D, color, PW Doppler
- Length of transducer, cable and connector: 11.83 ft/360.7 cm
- Length of handle to tip: 12.5 in/51.1 cm
- Radius of curvature: 0.613 in/15.57 mm
- Laparoscopic applications for general abdominal, and abdominal interventional procedures
- Contrast applications

Sector arrays

S5-1 sector array with PureWave technology

- 5 to 1 MHz extended operating frequency range
- Sector array, 80 elements
- 2D, steerable PW Doppler, CW Doppler, high PRF Doppler, color Doppler, tissue Doppler, advanced XRES and multivariate harmonic imaging including contrast LVO
- Adult cardiac, general purpose abdominal, transcranial Doppler (TCD), acute care, and adult LVO applications
- Supports reusable, 3-angle, plastic biopsy guide (14-23 gauge) and 3-angle stainless steel biopsy guide (14-23 gauge)

S8-3 broadband sector array

- 8 to 3 MHz extended operating frequency range
- Phased array, 96 elements
- Scanplane aperture: 15.4; Field of view: 90°
- Steerable PW Doppler, CW Doppler, high-PRF Doppler, color Doppler, tissue Doppler, harmonic imaging, and XRES imaging
- Pediatric and small adult cardiology and pediatric abdominal applications

S12-4 broadband sector array

- 12 to 4 MHz extended operating frequency range
- Phased sector array, 96 elements
- Scanplane aperture: 9.8; field of view: 90°
- Steerable PW Doppler, CW Doppler, high-PRF Doppler, color Doppler, Color Power Angio, XRES, and Tissue Doppler Imaging
- Pediatric and neonatal cardiology, pediatric abdominal, neonatal head applications

X7-2t xMATRIX array TEE with PureWave xMATRIX technology

- Live 3D Echo transesophageal xMATRIX array transducer with 2,500 elements
- 7 to 2 MHz extended operating frequency range
- Physical dimensions:
  - Bi-directional curve on pill shaped tip for easy intubation
  - Slightly elevated imaging lens for easy contact with the esophagus
  - Tip: See specification diagram adjacent
  - Shaft: 0.4 in (1 cm) diameter, 39.40 in (1 m) L
- Thin flexible cable to the connector
- Mechanically 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 Color XPlane imaging, Live 3D Echo, Live 3D zoom, Live 3D color, Live 3D volume, volume rate control imaging, 3D Swivel
- High frame rate 3D imaging via target volume rate control
- Compact connector
- Connects to iE33 via an adapter
- Adult TEE applications: patients >66 lb (30 kg)

Non-imaging

D2cwc CW transducer (Pedoff)

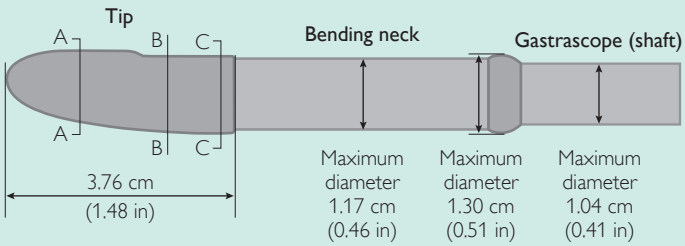
- Dedicated 2 MHz CW Doppler
- Adult cardiac applications

D5cwc CW transducer (Pedoff)

- Dedicated 5 MHz CW Doppler
- Deep venous and arterial applications

The L15-7io transducer is designed for comfort and easy access for high frequency imaging applications.

X7-2T Live 3D TEE specifications



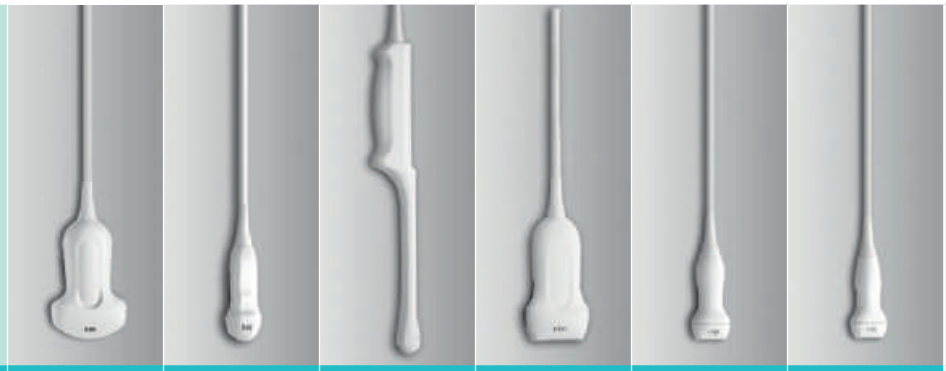
Surface length = minimum trace length around the cross section at A, B, C of the tip.

Surface length at A = 4.83 cm (1.90 in)

Surface length at B = 4.52 cm (1.80 in)

Surface length at A = 4.52 cm (1.80 in)

5.3 Transducer application guide



Name		C5-1	C8-5	C10-3v	L12-3	S5-1	S8-3
Type of array		Curved	Curved	Curved	Linear	Sector	Sector
Number of elements		160	128	128	160	80	96
Scanplane aperture			22.4 mm		38 mm	20.3 mm	15.4 mm
Field of view		70°	90°	130°			90°
Broadband frequency range		5 to 1 MHz	8 to 5 MHz	9 to 3 MHz	12 to 3 MHz	5 to 1 MHz	8 to 3 MHz
PureWave crystal technology		●		●		●	
Application	**Exam type**						
Abdominal	General	●				●	
	Renal	●				●	
	Vascular	●				●	
	Difficult	●					
	Interventional						
Cardiac	Adult transthoracic					●	
	Adult TEE						
	Congenital					●	
	Pediatric						●
Vascular	Carotid		●		●		
	Arterial		●		●		
	Venous		●		●		
	Abdominal	●				●	
	TCD					●	
	Intervention				●		
	Vascular access				●		
Obstetrics	Early OB	●					
	General OB	●		●			
	Fetal echo	●					
Gynecology	Pelvis	●		●			
	Fertility	●		●			
Small Parts	Superficial				●		
	Thyroid				●		
	Testicle				●		
	Breast				●		
Musculoskeletal	Superficial				●		
	Deep				●		
Acute	FAST	●				●	
	Lung	●			●		
	Vascular access				●		
Nerve	Superficial				●		
	Deep	●			●		
Pediatric	Head		●				
	Abdomen		●				●
	Renal		●				

5.3 Transducer application guide

Name		S12-4	X7-2t	L15-7io	L10-4lap	C9-3io	L12-5 50 mm
Type of array		Sector	Sector	Linear	Linear	Curved	Linear
Number of elements		96	2500	128	128	128	256
Scanplane aperture		9.8 mm	Proprietary	23 mm			
Field of view		90°		22 mm			50 mm
Broadband frequency range		12 to 4 MHz	7 to 2 MHz	15 to 7 MHz	10 to 4 MHz	9 to 3 MHz	12 to 5 MHz
PureWave crystal technology			●				
Application	**Exam type**						
Abdominal	General				●	●	
	Renal						
	Vascular						
	Difficult						
	Interventional				●	●	
Cardiac	Adult transthoracic						
	Adult TEE		●				
	Congenital						
	Pediatric	●					
	Perioperative		●				
	Intraoperative		●	●			
Vascular	Carotid						●
	Arterial			●			
	Venous						
	Abdominal						
	TCD						
	Intervention			●			
	Vascular access						
Obstetrics	Early OB						
	General OB						
	Fetal echo						
Gynecology	Pelvis						
	Fertility						
Small Parts	Superficial			●			●
	Thyroid						●
	Testicle						
	Breast						●
Musculoskeletal	Superficial			●			●
	Deep						
Acute	FAST						
	Lung						
	Vascular access						
Nerve	Superficial						
	Deep						
Pediatric	Head	●					
	Abdomen	●					
	Renal						

6. Measurements and analysis

6.1 Comprehensive measurement tools

- Adult echo cardiac analysis
- Dedicated pediatric and adult congenital cardiac analysis
- Simpson's 3 Point Measurement
- Abdominal analysis
- Fetal Echo analysis
- Gyn for studies of the breast, pelvis, ovaries, and uterus
- OB primarily geared toward first, second and third trimester neonatal growth
- Small parts analysis
- Vascular analysis that includes carotid, arteriole, venous
- Transcranial Doppler analysis
- High Q automatic Doppler analysis
- QLAB quantification

6.2 QLAB advanced quantification

Region of Interest (ROI) quantification plug-in

- Pixel intensity analysis, data types: echo, velocity (color), or power (angio)
- Up to 10 user-defined regions
- Thumbnail display of frames for easy trimming
- TDI velocity timing measurement
- Log/linear data display selection
- Smoothed data display option
- Vascularization Index, Flow Index and Vascularization Flow Index results on color mode files
- Motion compensation for multiframe objects

3D Quantification Advanced (3DQa) for cardiac imaging

- Left ventricle global and regional volume and timing analysis with no geometric assumptions on the X7-2T
- Comprehensive report capability with AHA/ASE 17-segment bull's-eye 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
- Displays 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 SALI sequence
- iSlice display capability
- Measurements of LV endocardial true volume, LV ejection fraction and stroke volume using semi-automated 3D border detection
- Regional volume computation based on AHA/ASE 17-segment LV model
- Improved edit mode that adds more flexibility and accuracy for optimal 3D border tracking in four dimensions
- Global LV volume waveforms to display all 17 regional volume waveforms or a subset of user-selected regional volume waveforms
- Dyskinetic segments and corresponding volume waveforms display in specific color and format
- Regional and end-diastolic normalized regional volume display of waveforms
- User-selectable waveforms: single, by wall, by level (ring) modes
- Bull's-eye visualization of all 17 regional segments or the user-defined and selected regional segments
- Global and regional reports providing 3D LV global values and regional timing indices from all or a subset of 17 regional segments and bull's-eye-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 a subset of 17 regional segments
- Tmsv values displayed in time (msec) or normalized to the R-R interval (%)
- Bull's-eye view showing the user-selected segments used for the Tmsv calculation
- LV timing and radial excursion parametric images in bull's-eye format using effective color-coded scales
- Parametric imaging supporting AHA/ASE 17-segment overly on the bull's-eye for direct and rapid visualization

3D Cardiac Quantification (3DQ)

- Provides capability to perform 2D measurements from volume and color volume slices (multiplanar reconstruction views) m Area and Point-to-Point measurements
- Review and quantification of Live 3D, 3D zoom, 3D full volume and Live 3D color files
- Supported on X7-2t xMATRIX transducers
- 3D image controls: 3D single or dynamic colorization, 3D color render, 3D color suppress control
- Multiplanar reconstruction (MPR) and iSlice views
  - 3D slice plane
  - Quad plane display
  - Apical two-chamber view flip on and off
  - 2 x 2, 3 x 3, 4 x 4 iSlice layout
  - Mix apical and short axis or all short axis in iSlice display
  - Slice interval spacing
  - 3D color depth rendering
  - Absolute versus relative location
  - Auto-view with up, down, left, right
  - Plane rotation, tilt and movement controls to reduce left ventricle foreshortening
  - 3D annotation
- 3D quantification from MPR views includes distance and area calculations, biplane LV volume (Simpson), LV ejection fraction by method of disk using biplane Simpson, and LV mass

Cardiac Motion/Mechanics 2D Quantification (CMQ)

- Objective assessment of left ventricle global function and regional wall motion, deformation and timing using the next generation of 2D speckle tracking technology
- Quantification of 2D native ultrasound PureWave data sets from S5-1 and X7-2t transducers
- Available methods with dedicated preferences settings:

Cardiac Motion Quantification (CMQ)

- Next-generation 2D speckle tracking
  - Dense tracking mesh (user-editable mesh density)
  - Multiple cardiac views and images
  - AHA/ASE 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 protocol-driven user interface
  - Tracking quality tool: editable threshold to help display various quality tracking
  - User-editable post LV segments display: consistent display with corresponding waveform and reported values
  - Multiple cardiac-beat cycle capable or beat-to-beat selection
  - Tracking that can be initiated from any frame
- Display
  - Mesh (hide or show)
  - Border (hide or show)
  - Vector velocity field (hide or show)
  - Parametric image PI (hide or show)
  - Transmural, Endo+Epi, Endo, Epi layer waveforms and values available from a single computing step
  - Cardiac phases (overlay of AVO, AVC, MVO, MVC mechanical events auto imported from ultrasound cart analysis via DICOM SR or manual entry)
  - Cardiac cycle average
  - Global curves that toggle on and off
- 2D speckle parameters
  - Longitudinal strain and strain rate
  - Circumferential strain and strain rate
  - Transversal strain and strain rate (apical views only)
  - Radial and transversal displacement
  - Wall thickening (apical views only)
  - Radial fractional shortening
  - Radial velocity
  - Speed (absolute angle independent velocity)
  - Local and regional rotation and rotation velocity
  - Global rotation
  - Endo-Epi mural torsion and local rotation
- Measurement and calculations
  - Waveform auto peak detection-to-report time to peak-and-peak values
  - Timing calipers
- Report
  - One view and global report pages
  - Display of results in AHA/ASE 17 LV segment bull's-eye plot format and numerical table
  - Global longitudinal strain
  - Global circumferential strain
  - Global transversal strain

Free strain method

- For specific local strain analysis
- Up to 17 dedicated colors to help differentiate each cord and corresponding waveform

Tissue Motion Annular Displacement (TMAD) method

- Based on speckle tracking technology
- Tracks mitral valve and other valve annular motion over time
- Computes valve annular displacement curves over time
- Uses the Color Kinesis overlay to visualize valve annular plane motion parametrically

Complex and simple CK methods

- Duplication of 2DQ plug-in functionalities for CMQ users
- Area/Simpson volume: single-plane volume measurements based on 5/6 area-length method and Simpson's Single Plane Method of Disks (MOD)
- Fractional area change (FAC), ejection fraction (EF), peak ejection rate (PER), peak rapid filling rate (PRFR) and atrial filling fraction (AFF)

- Color Kinesis (CK) overlay for color coded visualization of global and regional wall motion in systolic, diastolic, and cycle modes
- Transparency control to visualize echo grayscale under a semi-transparent CK overlay
- CK display for arbitrary frame rates (high frame rate CK display)
- Manual user-editable timing overrides for the onset and duration of the CK parametric display

Other

- Non-cardiac area analysis over time
- Area detection based on complex border algorithm

Mitral Valve Quantification (MVQ) plug-in

- Quantification of the mitral valve with Live 3D TEE data acquired with the X7-2t transducer
- Quantification and display of mitral leaflets and leaflet segments, annulus, coaptation lines and distance to papillary muscle
- 3D Orientation ICOM
- Three mitral measurement protocols
- Displays: leaflet, minimum tenting area, surface area
- Edit measurement points
- MVQ report pages with images
- Setup of measurements, protocols and tracking points
- MVQ measurements:
  - Anterior to posterior diameter
  - Anterolateral to posteromedial diameter
  - Annular height
  - Commissure-to-commissure diameter
  - 3D annulus perimeter
  - Anterior leaflet total, exposed and coapting lengths
  - Posterior leaflet total, exposed and coapting lengths
  - 2D projected circumference
  - 2D circularity index
  - Projected area in 2D
- Vary slice thickness for better resolution

Strain Quantification (SQ) plug-in

- For evaluation of regional myocardial function, assessment of synchronicity and guidance during bi-ventricular pacing procedures
- Tissue Doppler Imaging (TDI) velocity quantification
- Measures the myocardial velocity and derives the strain rate and strain along user-defined M-lines
- User defined M-Line motion to follow the myocardial motion
- User-selectable waveforms for optimal sub-region visualization
- Curve processing mode
- TDI velocity timing measurement

Intima Media Thickness (IMT) measurement plug-in

- Automated assessment of the IMT on user-selected frames
- For carotid and other superficial arteries

MicroVascular Imaging (MVI) plug-in

- Integration and processing of images in contrast specific imaging mode providing detection and display of very low velocity flows of very low signal amplitude
- Motion compensation for multiframe objects

General imaging 3D Quantification (GI 3DQ) plug-in

- 3D/4D viewer for OB/GYN and general imaging
- Review of 3D/4D, color 3D, STIC, and iSTIC files
- Multiplanar reconstruction (MPR)
- iSlice and curved iSlice precision volume slicing capability
  - Display of 2D/color slices from static or live volume
  - User-selectable slice display: 4, 9, 16 or 25
  - User-selectable interval and slice spacing
  - User-selectable slicing source (x, y or z)
- Free rotation of any source
- Full cineloop review control
- 2D grayscale and color display adjustments
- Zoom control
- Cine/pan slice control through volume
- User-selectable image storage
- Auto ruler display
- Compatible with freehand volumes
- Thick slice imaging
  - User-adjustable slice thickness and depth
  - Variable thick slice display adjustments with user-selectable settings
- 2D and 3D measurement tool including distance, area, angle, auto volume, stacked and auto contour and ellipsoid measurements
  - Invert mode
  - Vascularization index, flow index and vascularization flow index results on 3D color mode data sets
  - Pixel intensity index
- XRES speckle noise reduction of MPR and volume displays
- Assisted auto-trace volume measurement tools for stacked contours and ellipse methods
- Edge detection selection for hypoechoic or high contrast targets
- Auto volume tool

7. Physical specifications

System dimensions

Length	14 in/35.6 cm
Width	16.25 in/41.3 cm
Height	3.4 in/8.6 cm
Weight	16.2 lb/7.3 kg
Display	15.4 in/39.1 cm high-resolution display with wide viewing angle

Physical features

- High-resolution display with wide viewing angle
- Laptop style alphanumeric QWERTY keyboard
- Ergonomic integrated carrying handle
- USB footswitch
- Multiple transducer module option multiport adapter connects up to three transducers

The CX50 is a laptop-sized ultrasound system you can hand-carry or use on a specially designed cart.

Mobility cart

- Weight: 104.3 lb/47.4 kg
- Width at base: 22.6 in/57.4 cm
- Depth including handle: 25.0 in/63.5 cm
- Height: adjustable from 35.4 in/90 cm to 42.5 in/108 cm
- Rear-mounted handle
- Casters: 5 in casters provide total locking (directional and rotational) engaged by the foot pedals
- Quick release tray
  - Simple latch system to secure CX50 system in place
  - System's integrated handle accessible from front for secure maneuverability
- Storage
  - Two clear plastic storage trays 24 cm x 16 cm x 6 cm with maximum weight of 2 kg
  - One USB peripheral tray 24 cm x 16 cm x 2.5 cm with straps to secure devices less than 2 kg
  - One handle-mounted clear plastic storage tray
  - Transducer holders accommodate four transducers
  - Multiple transducer, ECG, and power cord cable hooks conveniently positioned to facilitate cable management
  - Rear-mounted USB and Ethernet port panel
  - Optional multiport adapter allows simultaneous connection up to three transducers
  - Optional integrated B/W printer
  - Input power to integrated B/W printer
- Input power to B/W printer and color printer
- USB hub with cables to:
  - B/W printer
  - Color printer
  - CX50 USB

Travel case

- Dimensions: 22.5 in/57 cm x 16.5 in/42 cm x 12.5 in/32 cm (H x W x D)
- Weight: 15.4 lb/7 kg when empty
- Features:
  - Accommodates CX50 system and AC adapter
  - Removable transducer bag stores three transducers and one gel bottle
  - Wheels and retractable handle allow easy transport

Power requirements

System/AC adapter	100-240V, 50/60 Hz, 2.65A MAX
System with cart and peripherals	100-240V, 50/60 Hz, output 100-240Vac AC adapter output 2.65A; OEM peripherals 250VA

Power management

- Internal lithium-ion polymer battery
- Fully charged new battery yields approximate 45-minute battery life under continuous use without AC; actual time varies with age and condition of battery
- Quick-charge battery technology
- Advanced battery/AC monitoring circuitry includes on-screen graphics, and low battery warning
- Suspend mode for instantaneous boot-up between exams

Environmental

Heat dissipation	700-1100 BTUs/hour (fully loaded)
Operation range	10˚C–40˚C operating in 15–95% relative humidity

The easy portability of the CX50 allows premium imaging capabilities at any location, including screening venues.

ECG and physio

- One three-lead ECG input
- One external ECG input
- Two physio input channels (1V, p-p)
- Selectable ECG triggered skipping between 1 and 20
- Respiration
- ECG inputs
  - Low-level ECG input
  - Analog output
  - Pulse/Phono/Aux 2 input
  - External ECG/Aux 1 input

Electrical safety standards

- CSA C22.2 No. 601.1
- IEC 60601-1
- UL 60601-1
- EN 60601-1

Safety requirements

- Electromechanical standards met
  - C22.2 No. 601.1, Canadian Standards Association, Standard for Medical Electrical Equipment
  - JIS T 0601-1, Japanese Standard for Medical Electrical Equipment
  - EN 60601-1, European Norm, Safety of Medical Electrical Equipment
  - EN 60601-1-2 European Norm, Collateral Standard: Electromagnetic compatibility
  - EN 60601-2-37 European Norm, Particular requirements for the safety of ultrasonic medical diagnostic and monitoring equipment
  - UL 60601-1 Underwriters Laboratories Standard for Medical Electrical Equipment
- Agency approvals
  - Canadian Standards Association (CSA)
  - CE Mark in accordance with the European Medical Device Directive issued by British Standards Institute (BSI)
  - Japanese Ministry of Health, Labor and Welfare

Maintenance and serviceability

- Remote access for clinical and technical support*
- SSL secure socket layer for remote service connectivity
- Flexible service agreements
- Clinical application and educational support
- Remote services with technical support, clinical support, pro-active monitoring, and decision support with utilization reports.
- Scheduled preventative maintenance and system optimization

* Remote Services Network – requires Philips service contract and internet access

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