

**SPECIFICATIONS**  
for  
**Diagnostic Ultrasound System**  
**LISENDO 880 LE**



**MODEL: ALOKA LISENDO 880**

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## **LISENDO 880LE**

Recently, Ultrasound Diagnostic Systems is needed for aging society in cardiac application.

LISENDO 880LE is used in critical care medical center. Because it is available to adaptive for various request.

### **1. Pure Image**

It is performed new optical system "Pure Symphonic Architecture". It is available to display high quality image. It is available to receive high quality signal by using optical sector probe for cardiology. And it is used new Tx/Rx focusing method "eFocusing" and then it is available to display clear image from near field to far field. In display, it is implemented OLED Monitor (high contrast ratio), it is supplied cleared image for each medical case.

### **2. Seamless Workflow**

It is needed to measure for each scene on cardiology. It is implemented many kinds of automated system (Measure, Search) through the examination.

It is expected to examine for short time by using automated system.

### **3. Your Application**

It is available to solve for any kinds of scene for cardiology. Vector Flow Mapping is available to grasp hemodynamics, Dual Gate Doppler & R-R navigation is available to detect corrected time phase. And if it is not available to detect regurgitation point, it is useful to use 3D imaging with matrix probe.

## Scanning Method

- Electronic Convex
- Electronic Linear
- Electronic Phased Array Sector

## Operating Modes

- B-mode
- BiPlane-mode
- M-mode
- D: Spectral Doppler mode (PW, CW, HPRF-PW)
- Dual Gate Doppler mode
- Color Flow mode
- Power Doppler mode (Directional Power Doppler)
- eFLOW mode (Directional eFLOW)
- Cardiac 3D mode  
(3D Zoom , Active 3D , Wide Angle 3D) \*

\* Option: SOP-LISENDO880-129

## Image Display Modes

- B: gray-scale imaging
- Dual B
- Quad B
- M
- B and M
- D: Spectral Doppler (PW, HPRF PW, and CW)
- B and D
- B(Color Flow)
- B(Power Doppler)
- B(eFLOW)
- Dual B(Color Flow)
- Quad B(Color Flow)
- Dual B(Power Doppler)
- Quad B(Power Doppler)
- Dual B(eFLOW)
- Quad B(eFLOW)
- M(Color Flow)
- M(Power Doppler)
- M(eFLOW)
- B(Color Flow) and M (Color Flow)
- B(Power Doppler) and M(Power Doppler)
- B(eFLOW) and M (eFLOW)
- B(Color Flow) and D
- B(Color Flow) and Dual
- B(Power Doppler) and D
- B(Power Doppler) and Dual
- B(eFLOW) and D
- B(eFLOW) and Dual
- B(Color Flow) and D simultaneous real-time display (Triplex mode)
- B(Power Doppler) and D simultaneous real-time display

- (Triplex mode)
- B(eFLOW) and D simultaneous real-time display (Triplex mode)
- B and B(Color Flow) simultaneous real-time display (Dual Flow)
- B and B(Power Doppler) simultaneous real-time display (Dual CF)
- B and B(eFLOW) simultaneous real-time display (Dual Flow)
- Dynamic Slow-motion Display  
(Real-time image/Slow-motion image, side by side display)
- Panoramic View
- TDI (Tissue Doppler Imaging)
- DFI(Detective Flow Imaging) \*<sup>1</sup>
- BiPlane mode(Color) \*<sup>2</sup>
- 3D Zoom mode(Color) \*<sup>2</sup>
- Active 3D mode(Color) \*<sup>2</sup>
- Wide Angle 3D mode(Color) \*<sup>2</sup>

\*<sup>1</sup> Option: SOP-LISENDO880-105

\*<sup>2</sup> Option: SOP-LISENDO880-129

## Beam former

### Transmission

CPWG (Compound Pulse Wave Generator)

Programmable waveform transmission

### Reception

12-bit A/D converter (4096 gray levels)

A/D Sampling Frequency: 40[MHz]

Parallel processing: Up to 20 directions

### Transmission/Reception method of Harmonics

Reception frequency: 3.2-22.0 MHz\*<sup>1</sup>

\*<sup>1</sup> 22MHz can be achieved under below conditions.

•Probe: SML44

•Frequency "High"

•Frequency Information "Receive"

### Transmission/Reception method of pulse modulation

- Chirp Pulse modulation

Compound Broadband Pulse transmission

### Tissue Adaptive Technology

Sound speed adjustment: 26 steps

Automated sound speed adjustment

### Focusing

Transmission: Multi-stage transmission focus of up to 4 stages out of 16 stages (probe dependent)

Reception: PixelFocus

eFocusing

## System Dynamic Range

320dB

## System Processing Channels

7,072,000 Channels

## Frame rate

Max. More than 882 frames/s\*

\* Depends on probes and various settings

## B-mode

- Display Gray Scale: 256 levels
- Scanning area:
  - 100% to 25%, 1 degree step
- Line Density : 8 steps
- HI Frame Rate(Multi Parallel Processing)
- Zoom
  - HI zoom (real-time image):
    - Max. Up to 0.5 cm display image
    - The maximum magnification is 8.
  - PAN zoom (real time and frozen image):
    - Max. Up to 0.5 cm display image
    - The maximum magnification is 8.
- Depth range selections:
  - 0.75/1.0/1.5/2.0/2.5/3.0/3.5/4.0/4.5/5.0, 1 cm intervals from 5.0 to 24 cm , and 2cm intervals from 24cm to 40cm (probe dependent)
- Longitudinal and lateral inversion
- Rotation by 90 degrees (probe dependent)
- Gain\*: 80 dB range
- Echo enhancement: 8steps
- Texture: 2 steps(Smooth/Sharp), not available in M-mode
- Enhance / Smoothing : 8 steps for each other
- Persistence: 8steps, including Off  
(Available to change type for adaptive frame rate)
- TGC (time gain control) :
  - Gain versus depth curve control: 8 slide controls
  - TGC curve memory function
- LGC (lateral gain control):
  - Gain versus angle curve control: 8 sectors (Sector probes only)
- Dynamic range: 40-90 dB
- Gray map : 10 types, changeable after frozen
- AGC: 8 steps
- View gamma: 4types
- Spatial Compound Imaging  
(by selected linear and convex sector probes)
- Trapezoidal scan (possible by selected linear probes)
- B steer function : This function enables you to use

oblique function not only Color Flow/ Power Doppler mode but B mode.

- Wide Scanning (possible by selected sector probes)
- Adaptive Imaging
  - : HI REZ function 8 steps / HI REZ Plus
  - Adaptive imaging is the technique to generate optimum image with changing filter characteristic depending on input signal.
  - This technique which installed this ultrasound diagnostic scanner reduces speckle noise on B-mode images and provides uniformly and high contrast images.
- \* Gain and Dynamic range can be changed after freezing
- Border Clear Filter
  - This technique is expanded gray scale so it is reduced noise and emphasized border.
- Acoustic Noise Reduction : 8 steps for 2 types.
  - This technique is reduced acoustic noise (Based on signal level)
- Near field Noise Reduction
  - This technique reduces artifacts and noises in the heart chamber or blood vessel.
- Low Echo Reduction
  - This technique is compressed low gradient echo level.
- Grayscale Enhance
  - This technique is enhanced image which is displayed as grayscale.
- Auto-optimizer (Optimization of gain, sound velocity adjustment)
- Panoramic View
  - It is possible to display an image of an extensive range of the body by moving the probe. An area wider than the scanning width of the probe can be displayed.
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## M-mode

- Sweep method: Moving bar
  - Sweep speed:
    - 300.0, 200.0, 133.3, 100.0, 66.7, 50, 40.0 mm/s
- Gain: B-gain  $\pm 30$  dB
- Dynamic Range: 40 dB-90 dB
- AGC: 8 steps
- Acoustic Noise Reduction
- Low Echo Reduction
- Grayscale Enhance
- FAM (Free Angular M-mode)

## Spectral Doppler

- Display: Power spectrum
- Real-time Doppler Auto Trace

- Doppler methods:
  - PW (Pulsed Wave) Doppler
  - HPRF (High Pulse Repetition Frequency) PW Doppler
  - Dual Gate Doppler
  - CW (Continuous Wave) Doppler \*
- Reference frequencies (probe dependent):
  - Maximum 3 frequencies
  - PW: 1.5, 1.9, 2.0, 2.1, 2.5, 3.0, 3.3, 3.5, 3.8, 4.0, 4.4, 5.2, 6.0, 6.3 MHz
  - CW: 1.7, 1.8, 2.0, 2.1, 2.5, 3.0, 3.3, 3.8, 5.0 MHz
- Analysis rate:
  - PW: 0.05 to 40 kHz
  - CW: 1.1 to 40 kHz
- Max. velocity range:
  - PW/HPRF:  $\pm 1.26$  cm/s to  $\pm 802.08$  cm/s
  - CW:  $\pm 25.07$  cm/s to  $\pm 1600$  cm/s
- Base line shift: Adjustable in real-time and frozen
- Steerable CW Doppler: probe dependent
- Steered linear scanning: Max.  $\pm 30$  degrees changeable at 5 degrees interval
- Auto angle Correction
- Spectrum inversion
- Angle correction: Available up to 80 degrees (Pre-settable, changeable after freezing)  
Auto angle correction, Warning function available
- Sample volume size for PW Doppler:
  - 0.5 – 20 mm, changeable in 0.5mm, 1.0 mm step
- Wall motion filter: 12steps, 1/16 of PRF is Max.
- Doppler gain: 60dB variable, adjustable in real-time and frozen.
- Low Echo Reduction(PW)
- Grayscale enhance
- Echo Enhancement(CW) : 3 steps
- Dynamic Range: 40-90dB 1dB steps  
(Changeable after freezing)
- Auto-Optimizer  
(Optimization of gain, velocity range, baseline shift and sample gate position / size / angle correction)
- Audio output: 2 channels

### Color Doppler Mode

- Color area size: Variable from 100% to 25% continuously
- Steered linear scanning:
  - Max.  $\pm 30$  degrees \*, changeable at 5 degrees interval
  - \* Probe dependent
- Line density: Up to 8 steps  
(Changeable setting independently with B mode)

- Gain: 128 range, changeable after frozen
- Texture: 2 steps(Smooth/Sharp)
- Glossy Level: Off + 4 steps
- HI Frame Rate(Color)(Multi Parallel Processing)
- Auto-Optimizer (Optimization of gain and ROI position)

### • Color Flow Mode

- Display patterns:
  - Velocity (derived from mean Doppler frequency shift), Velocity + variance, Variance, Velocity + intensity, Velocity + variance + intensity)
- Max. velocity range:  $\pm 0.63$ cm/s to  $\pm 458.33$ cm/s
- Reference frequency: (Probe dependent)
  - 1.9, 2.0, 2.1, 2.5, 3.2, 3.3, 3.5, 4.0, 4.4, 5.2, 6.0, 6.3 MHz
- Pulse repetition frequency:
  - 0.03 to 19.8 kHz
- Gradation:
  - $\pm 127$  levels for velocity (red and blue)
  - 64 levels for variance (green)
- Color Inversion: Normal, Invert
- Smoothing: 5 steps, adjustable in real-time and frozen
- Wall filter: 6 steps
- Persistence (Color) : 8 steps
- Wall Motion Reduction: Off + 3 steps, 2 methods
- Packet Size : 3 levels
- Base line shift(Color):
  - Up to double velocity ( $\pm 127$  steps)
- Color coding: 15 kinds
- TGC Enhancement : 2 kinds

### • Power Doppler Mode

- Display patterns: Power Doppler, Directional Power Doppler
- Gradation: 256 levels
- Color coding 15 kinds
- Non-display of B/W image: Possible in ROI
- Smoothing: 5 levels

### • High Resolution Power Doppler(eFLOW) Mode

- One of the Color Flow imaging functions that can display blood flow information in a high spatial and temporal resolution.
- Display patterns:
  - eFLOW, Directional eFLOW
- Pulse repetition frequency:
  - 0.03 to 19.8 kHz
- Gradation: 256 levels ( $\pm 127$  levels for directional)
- Color coding: 15 kinds

- Non-display of B/W image: Possible in ROI
- Advanced wall motion reduction
- Smoothing: 5 levels

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

- Function Available

### **DFI (Detective Flow Imaging) \***

- DFI is a function to detect bloodstream information at high sensitivity and high frame rate with eigen space method.

\* Option: SOP-LISENDO880-105 (Probe dependent)

### **Manual**

It is applicable to browse instruction manual on this system.

- On-board operation manual

### **Protocol Assistant**

This function provides the capability to guide study by displaying protocol list (view name, mode, measure).

It is useful to improve everyday study.

- Available to registered protocol: 128 kinds
- Suspend protocol function
- Available to edit protocol on the system
- Available to register and edit reference image
- Available to import or export like preset

### **Cine Memory**

- Cine search and loop display (in B mode): ECG time phase display is possible
- Capacity
  - B mode: Max. 63,500 frames.
  - M and D modes: Max. approx. 900 seconds.

### **Data Management**

#### 1. Image data

##### 1-1. Format

Multiple-frame (moving) image

DICOM (Raw, MJPEG)

PC Format(WMV, MJPEG, MP4)

Single-frame (still) image

DICOM (Non-compressed, RLE, RGB(Plane/Pixel), JPEG)

PC Format (Tiff, Bmp, JPEG)

##### 1-2. Image acquisition mode

- Real-time multi-frame image acquisition (Raw, Image)
  - Aquiring both RAW and Image at the same time
  - Post ECG: Max. 10 cardiac cycles (R-R)
  - Pre ECG: Max. 10 cardiac cycles (R-R)
  - Post Time: Max. 90 seconds
  - Pre Time: Max. 16 seconds

Manual:

Raw data: Max. 150 seconds

Image data: Max. 180 seconds

- Cine loop high-speed data transfer (Raw, Image)
  - It is possible to selectively store data of arbitrary section in the Cine Memory.
- Simultaneous output to multiple media
  - It is possible to output still image data to multiple of storage media include network and printers at the touch of a button.

#### 1-3 Image data management tool

Image viewer

- Compatible with DICOM and PC-format images
- Simultaneous display of stored and real-time images is possible (Compare mode)
- Thumbnail display of stored images (1-36 images)
- Check mark is put on a transferred image
- Image zoom, rotation, inversion
- 1:1 replay (main unit HDD or DICOM storage data)
- DVD-RAM
- CD-R
- USB memory
- USB HDD
- Re-storing to media, transfer
- Adjustment is possible on the reconstructed Raw-data image (gain, dynamic range, gamma curve type, and color coding in Color flow mapping mode)

#### 2. Measurement data

It is possible to store measurement data in the main unit hard disk

#### 3. Patient data

Displayed information\*

##### Patient information

ID (up to 64 characters), Name (up to 64 characters, including middle name), Birthday, Sex, Age, Height, Weight, Occupation

##### Study information

Procedure ID, Accession, Study ID, Study Description Referring physician, Reporting Phys, Sonographer

\* Conforms to DICOM 3.0 standard

#### 4. Data storage

- Main unit hard disk
  - Capacity: Approx. 1TB
  - \* About 72,000 still images are storable.
- USB memory
- USB HDD
- CD-R
- DVD-RAM
- Network interface(DICOM format): 1Gbps ,BASE/TX, (automatically switched)

#### 5. DICOM network communication

- Conformity to DICOM service class:  
 Ultrasound image storage SCU  
 Ultrasound multi-image storage SCU  
 Storage media FSC/FSR  
 Print management SCU  
 Modality worklist management SCU  
 (For details, please refer to the DICOM Conformance Statement issued by Hitachi, Ltd.)  
 Modality performed procedure step (MPPS) SCU
  - Storage: Possible to store patient information directly to DICOM file server
  - Print: Possible to printout images with DICOM compatible printer directly
  - Work list management: Retrieval of patient and reservation information from hospital information system (HIS)  
 NOTE: The HIS needs to be compatible with DICOM standard supplement 10. The HIS network and the DICOM network need to be linked.
  - Router setting: possible
  - Compatible with SR (Structured Report) for OB, cardiology, vascular and abdominal measurements\*<sup>1</sup>
  - Query/Retrieve\*<sup>2</sup>
  - Compatible with ED(Evidence Documents)
  - Profile
  - IHE (Integrated Healthcare Enterprise)  
 SWF (Scheduled Work Flow)  
 PIR (Patient Information Reconciliation)
- \*<sup>1</sup> Option: SOP-LISEND0880-21
- \*<sup>2</sup> Option: SOP-LISEND0880-59

## 6. Security measures

User authentication function is available.

3 Types of user authority can be set.

It is possible to set whether password is required or not at the start of operation.

Audit logs

Accesses related to user management and patient data are recorded as audit log data.

Handling of these logs is limited to users with Level 1 access.

## 7. Teaching file can be made.

## Measurements and Analysis:

### • Basic measurements

#### On B-mode image

Distance, Dist-trace, Area/Circum, Volume, Hip J Angle, Histogram, Angle, B.Index

#### On M-mode image

Length, Time, Heart Rate, M.VEL, M.Index

#### On spectral Doppler

D.VEL, ACCEL, RI, Time, P1/2T, Heart Rate, D.Caliper, D.Index (Caliper), D.Index (Trace), Mean.VEL., PI, D.Trace, Steno Flow, Regurg Flow, Real-time Doppler auto trace

#### On B/D mode

Blood Flow

#### On B(Flow) mode

Flow Profile\*

\* Option: SOP-LISENDO880-7

## Application measurements

### • Cardiac analysis

#### B mode

LV Volume measurements

Area-length, BP-ellipse, Simpson (Disc), Modified Simpson\*, Bullet, Pombo\*\*, Teichholz\*\*, Gibson\*\*

\*: Automatic heart cavity trace is possible.  
(3-point or full automated method)

\*\*: Automatic measurement is possible.

GLS(Global Longitudinal Strain)\*\*\*

\*\*\*: 3-point or full automated method.

Valve area measurements (AVA, MVA)

LA/AO

Ratio

Right ventricle measurements

LV myocardial mass

LA / RA Volume measurements

Area-length, Simpson\*

\*: Automatic heart cavity trace is possible.  
(3-point or full automated method)

FAC measurements\*

\*: Automatic heart cavity trace is possible. (3-point)

IVC (inferior vena cava) measurements

#### M mode

Pombo (wall), Teichholz (wall), Gibson (wall)

Mitral valve measurements

LA/AO measurements\*

\*: Automatic measurement is possible.

Tricuspid valve measurements

Pulmonary valve measurements

IVC (inferior vena cava) measurements

TAPSE measurements

#### Doppler mode

LVOT (left ventricle outflow tract) flow

RVOT (right ventricle outflow tract) flow

Trans-mitral flow(Full Automated or Automated setting period method)

Regurgitant flow (AR, PR, MR, TR)

Volumetric flow(MR)

Stenotic flow (AS, PS, MS, TS)

Pulmonary vein flow

Coronary flow

TDI PW(Full Automated or Automated setting period method)

#### B(Flow)/D mode

PISA measurements

#### B TDI mode

Asynchrony analysis for CRT

### • Vascular analysis

Carotid artery:

CCA (common carotid artery)

ICA (internal carotid artery)

ECA (external carotid artery)

BIFUR (Bifurcation of carotid artery)

VERT (Vertebral artery)

% Stenosis area

% Stenosis diameter

IMT (Intima-media thickness) Measurements

Automated IMT measurements

Measurements of arteries in extremities:

Lower extremity artery flow

Upper extremity artery flow

Stenotic rate:

% Stenosis area

% Stenosis diameter

Transit time of Vessel Flow measurements(TVF) \*

\* Option: SOP-LISENDO880-47

Measurements of veins in extremities:

Lower extremity venous flow

Upper extremity venous flow

Trans-cranial blood flow measurements

### • Report Functions

– Cardiac function report

※It is possible to add below function for report.

•It is possible to edit measurement values by using Worksheet.

•It is possible to input comment automatically.

•It is possible to convert PDF.

SOP-LISENDO880-70 is required.

– Vascular report

– IMT (Intima-Media Thickness) report



It is possible to recall past measurement reports.  
Examination data history can be plotted on the report.  
Direct printout of each report is possible with an optional PC printer.

Output of measurement values in CSV file is possible.

- Hot Key function: It is possible to assign measuring functions to the alphabet keys on the keyboard
- Measurements on VCR playback image: Possible (manual calibration)
- User's calculation
  - 30 equations can be set for each application
  - User-assignable terms: 60 words possible
- Font size of measurement result: Possible to change in 3 kinds

## Physiological Signal Display

- Displayed information: ECG, PCG\*<sup>1</sup>, Pulse \*<sup>2</sup>, breathing waveform
- ECG synchronized display: Available for one phase
- Detect regular pulse from arrhythmia(RRp/RRpp)
- Automated jumping to most optimized R-R Phase
- Reducing Filter for Tachy or Bradycardia
- Display value for each R-R interval time
- Display position: Continuously variable (both in B and M modes)
- Bar graph display for breathing waveform
- 3 type electrocardiogram ( I , II , III)
- Automated detection end diastole and end systole
  - phase.
- Automated split as end diastole(left) and end systole(right)

\*1 Option: MA-300 (Not available in EU)

\*2 Option: TY-307A (Not available in EU)

## Dual Gate Doppler (Probe dependent)

This is a function which displays Doppler Spectrums of two different sample points simultaneously.

Supported combinations are PW/PW, TDI/TDI, and PW/TDI.\*

This function is beneficial for functional evaluations of heart failures and phase analysis. For example, E/e' measurements can be performed in a single scan.

\* : Automated sample gate setting for each gate.

- iDGD : It is performed below function automatically when it is frozen.
  - Select optimized time phase
  - Measure E/e'

## Automated IMT Measurement

It is possible to automatically extract max IMT, min IMT and mean IMT by simply setting ROI (region of interest) on a long-axis view of the vessel. In addition, the thicknesses at 3 points, i.e. , the point at max IMT, and the points at 1cm on the right and left of the max IMT, can be automatically detected and averaged.

## 2D Tissue Tracking (2DTT)

2DTT enables the evaluations of regional wall motion abnormalities within your region of interest, such as the myocardium and valves automatically by speckle tracking method on a B-mode image. With only minimal angle dependency, analysis from various cross sections have become possible. Multiple analyses, including wall thickness, various strains and rotation angle can be performed.

- Analysis
  - Free use
    - Distance and angular change between 2 points of your choice can be analyzed.
  - SAX: Parasternal short-axis view
    - Circumferential Strain and Strain Rate
    - Global Circumferential Strain , Strain Rate
    - Radial Strain and Strain Rate
    - Angle and Angle Rate
    - Twist (With Overlay function)
  - APEX: Apical long-axis view
    - Apex-S (Strain)
      - i2DTT (Automated Processing for Bull's eye)
      - Longitudinal Strain and Strain Rate
      - Transverse Strain and Strain Rate
      - Global Longitudinal Strain and Strain Rate
      - Volume
      - %EF(Modified Simpson Method)
    - Apex-V (Volume)
      - i2DTT (Automated Processing for Volume Curve)
      - Volume for cavity
      - Single and Biplane EF (With Overlay Function)
      - dV/dt curve (volume rate change)
      - Center of gravity and display tracking
- View
  - SAX
    - Basal SAX
    - Mid SAX
    - Apical SAX
  - APEX-S, -V
    - 2ch, 3ch, 4ch (Inversion view included)
- Graph Type

- Line Graph
- Color Graph
- Line & Color Graph
- Bull's eye (with Overlay function)
- Measurements
  - Point to Point
  - Time to Peak
  - 3 point: One-third point of diastole duration
  - Distance

## Stress Echo analysis

Image display modes in which image acquisition is possible: B, Each Flow modes

- Image acquisition methods:
  - ECG synchronized acquisition
- Compatible frame rate: Up to 75 Hz
- Recalled screen
  - Playback speed: Selectable
  - Image allocation: Possible
  - Scoring: Possible
  - Automatic registration: On/Off
- Protocol: Skip view function is available.
  - Exercise stress protocols:
    - Exercise Stress Echo
    - Treadmill Exercise
    - Bicycle Exercise
  - Pharmacological stress protocols:
    - DSE
    - High-Dose DSE
    - Low-Dose DSE
    - Arbutamine
    - Dipyridamole
  - User's protocol:
    - The user can make a protocol within 8 views X 12 stages in 1 exam.
  - Full disclosure (Multi acquisition): 270 seconds
    - It is available to assign label automatically.
- Scoring screen
  - Playback speed: Selectable
  - Comparison between different stages in the same view is possible
  - Image playback range is selectable
  - Systolic image acquisition
  - Bull's eye display (16 or 17 segmentation selectable)
- Report screen
  - Display format
    - Chart/Stage overview/View overview

## TDI analysis

Tissue Doppler Imaging (TDI) analysis is an echocardiographic technique employing the Doppler principle to measure the velocity of myocardial segments and other cardiac structures.

Strain information analysis is also available.

## B-mode

- Temporal Velocity Profile
  - Velocity, time, acceleration, ratio
- Regional Velocity Profile
  - Velocity, distance
- TDI-Myocardial Thickness (Wall thickness)
  - Distance, time, velocity
- Strain rate
  - Time, strain rate
- Strain
  - Time, strain

## M-mode

- Velocity trace
  - Velocity, time, acceleration, ratio, velocity difference
- TDI-Myocardial Thickness (wall thickness)
  - Distance, time, velocity
- Velocity Profile
  - Velocity, distance

CSV output of analyzed data is possible. CSV is a file format that can be converted into Excel file directly.

## CHI (Contrast Harmonic Imaging)

Contrast agent generates abundant second harmonics when disrupted, which eases detection by Harmonic Echo. Setting for low-pressure type contrast agent is also incorporated.

- Wide-band Contrast Harmonic Imaging (WbC)
  - The wideband pulse inversion method enables retrieval of echoes from the ultrasound contrast agent across a broad spectrum and display them in CHI mode at a high level of sensitivity.
- Tissue Reduction Contrast Harmonic Imaging (TrC)
  - The Amplitude Modulation method makes it possible to reduce signals from tissue to get clearer CHI mode images.
- CHI-eFlow
  - Signals from ultrasound contrast agent are imaged in Power Doppler of CHI mode. By destroying the contrast agent with high acoustic pressure, the contrasted area can be displayed clearer with CHI-eFlow.
- Monitor mode
  - In the Monitor mode, images are available with a low sound pressure during the intermission of high sound pressure transmission.
- Motion-compensated Accumulation Imaging
  - It is possible to display running of fine blood vessels by accumulating contrast echo information.
- Flash
  - This mode sends high acoustic pressure transmissions at set intervals to destroy the ultrasound contrast

agent.

- Frame Rate Limit

It is possible to limit Frame Rate not to break bubbles.

## **Contrast Echo analysis**

- Image Subtraction

Fixed Reference: Subtraction of reference frame from all frames

Any 2 Frame: Subtraction between 2 selected frames

Display modes: All images, arbitrary images

- Time-Intensity Curve display

- Intensity level graphing of average, median, max and mode in the ROI.
- Standard deviation (SD) graphing of intensity in the ROI .
- Accumulation imaging : Possible

- Inflow Time Mapping

The inflow time of contrast medium can be indicated by color map on the multi images recorded by contrast echo inspection.

-Measurement

- Point to point
- SD
- Raising time
- Fitting curve\*
- Distance
- Inflow Time Mapping Measurement

\*: Parameters A, B and Beta can be calculated.

Series: Graphic display in frame sequence or time sequence

By Group: Graphic display with the time of one sequence of intermittent acquisition as the horizontal scale (Graphs of multiple sequences are overlapped.)

Display mode: Image, Graph

ROI type: Square, Draw, Arc, and Circle

CSV output of analyzed data is possible.

## **EyeballEF\***

The EyeballEF function provides the capability to examine the cardiac volume and ejection fraction, GLS(Global Longitudinal Strain) in a short period of time. By using the EyeballEF function, you can check the reference values such as an EF value in real time and check the measurement results immediately after Freeze.

\* Probe dependent

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## Optional Functions

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### PC printer

It is possible to printout OB/GYN, cardiology, PV, small parts and urology report screens including ultrasound images directly with an external PC printer.

### Cardiac 3D (4D)\*

Cardiac 3D(4D) function provides the capability to display Cardiology 3D image and to display dual image(reference image and biplane image) simultaneously by using matrix probe(TTE , TEE)

- Scanning rate: Up to 999 volumes/s
  - Biplane Mode(Color)
  - 3D Zoom Mode(Color)
  - Active 3D Mode(Color)
  - Wide Angle 3D Mode(Color)
  - Live 1,2,3,4,5,6 beat 3D volume imaging
  - Live 1,2,3,4,5,6,7 beat 3D color volume imaging
  - It is possible to display 3 arbitrary sections simultaneously
  - MPR (Multi-planar Reconstruction)
  - Surgeon' s View Display
  - 2 click cropping operation
  - Display Layout(Single , Dual , Quad , MSI)
  - Function to change 3D Imaging Parameter
  - Change MPR View to operate by drag
  - Density (Both Lateral and Elevation)
  - Performance mode(Function to control of rising temperature for 3D TTE and TEE surface part)
  - Function to rotate(Tilt) plane operation (same as probe operation)
- \* Option: SOP-LISENDO880-129(Probe dependent)

### iEF\*

iEF calculates Biplane EF with full automated ED/ES frame detecting and full automated A2C and A4C contour tracing of biplane images acquired from a transthoracic 2D matrix probe.

\* Option: SOP-LISENDO880-120 (Probe dependent)

### 4D LV-Analysis\*

#### • Additional features to 4D LV-Function:

- Polar plot with parametric display for all parameters
- Dynamic (amplitude) and static (time to peak) parametric display for all parameters
- Global LV twist and LV torsion calculation
- Displacement and strain analysis
  - Longitudinal, circumferential and radial

component analysis

- Principal tangential strain and 3D displacement analysis
- Segmental peak, time to peak and global average values in result table
- Segmental parameter over time chart display
- Rotation and twist analysis
  - Basal and apical rotation as well as twist values in result table
  - Segmental parameter over time chart display
- Configurable export of all measurements (single results as well as parameter-time curves) to spreadsheet format

\* Option: PM-LI880-S003(Probe dependent)

\*This option is manufactured by TomTec Imaging System GmbH

### 4D RV-Function\*

#### • Semi-Automated quantification of the Right Ventricle

- Fast and easy Workflow
- Automatic contour proposal - no laborious contour drawing
- RV surface model

#### • 4D Review and Analysis

- Real-time interactive 4D model (Beutel) display of ventricle
- Display of 2D ultrasound slices (SAX and LAX) with Beutel contours as overlay
- Graph displays for global volumes over time
- Display of result window with derived parameters

#### • Measurements

- Global volumes over time
- Calculation of EDV, ESV, EF, SV
- Right ventricular longitudinal strain (RVLS) of
  - free wall
  - septum
- Additional 2D measurements:
  - TAPSE
  - FAC
  - RVDd base (RVD1)
  - RVDd mid (RVD2)
  - RVLd (RVD3)

\* Option: PM-LI880-S004(Probe dependent)

\*This option is manufactured by TomTec Imaging System GmbH

## 4D MV-Assessment\*

### • Semi-Automated Annulus and Leaflet Detection

- Fast and Easy Workflow (20 secs for static model)
- Semi automatic annulus detection
- Automatic and dynamic MV model generation via object segmentation
- Automatic measurements for annulus, leaflets and coaptation
- Morphological and functional analysis views
- Analysis screen for 4D presentation of tissue and annular structures
- Transparence rendering to display all objects within tissue
- Definition and display of surgical and ventricular view orientations
- Display of b/w tissue and Doppler color information in all views
- Adjustable cut plane (D'Art)
- Color texture on leaflet models that represents their topology

### • 4D Reconstruction Mode

- Real-time rendering
- Interactive 4D cube for data presentation and manipulation
- 4D rendering of b/w tissue and color Doppler data
- 3D visualization of automatic measurements
- Hybrid 4D display of measurements and grayscale data
- Interactive display settings for optimum display
- Separate settings for threshold and transparency
- Generic manual measurements

### • Further general features

- On-screen help
- Planimetry layout for individual MPR adjustment
- Carpentier segmentation labels on leaflet surface

### • Measurements

- Manual measurements such as distance, angle, curve and area
- Static and dynamic annular measurements
- Static and dynamic leaflet measurements
- Static and dynamic coaptation measurements

\* Option: PM-LI880-S005(Probe dependent)

\*This option is manufactured by TomTec Imaging System GmbH

## Vector Flow Mapping Analysis( VFM) \*1

VFM detects velocity components perpendicular to the beam, which couldn't be done with the conventional color Doppler technique. Direction and velocity of local blood flow can be displayed as vectors, independent of the angle between the probe and the flow. VFM is expected to be effective for analyzing hemodynamics which could not be evaluated before.

- The blood flow velocity distribution in the scanning section
- Flow volume cutting across the specified lines on the scanning section
- Flow line display and flow volume profile

### VFM Cardiac

- The blood flow velocity distribution in the scanning section (2D Velocity Distribution)
- Vorticity display (Vorticity Line,Vorticity)
- Stream line display (Stream Line Display)
- Energy Loss
- Wall Shear Stress
- Relative Pressure\*2
- Pathline
- Wavefront
- Energy Loss Profile
- Circulation(Profile of Vortex)
- Linear velocity distribution display
- (Local-line Velocity Distribution)
- Linear velocity profile display(Velocity Profile)
- Flow volume (Flow Display)
- Flow volume curve (Time Flow Curve Display)
- Streamline Velocity Profile
- Reliability Mark

### VFM Vascular

- The blood flow velocity distribution in the scanning section (2D Velocity Distribution)
- Wall Shear Stress

\*1 Option:SOP-LISENDO880-64 is necessary (Probe dependent)

\*2 Option:SOP-LISENDO880-77 is necessary

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## Optional Analysis Functions

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### **eTRACKING** (Echo Tracking) \*

It is possible to precisely measure displacement of blood vessel to obtain indices of stiffness of the vessels such as pressure-strain elastic modulus ( $E_p$ ), stiffness parameter ( $\beta$ ), arterial compliance (AC), one-point pulse wave velocity ( $PWV\beta$ ), and augmentation index (AI).

Blood-pressure gauge is necessary for this examination.

\* Option: SOP-LISENDO880-11

### **FMD** (Flow Mediated Dilatation) analysis\*

It is possible to continually record and plot the vessel diameter of the whole processes from baseline through occlusion and vasodilatation to recovery.

\* Option: SOP-LISENDO880-16 (includes eTRACKING software.)

### **WI** (Wave Intensity)\*

The heart and the arterial system are acting, constantly interfering with each other through forward traveling waves and reflected waves. WI is calculated based on changes in blood pressure and blood flow speed obtained at an arbitrary point in a circulatory system. WI is a new indicator of blood flow dynamics, which is expected to help pave the way for analysis of the interference between the heart and the arterial system. The analysis comprises of contraction and dilatation characteristics, influence of reflected waves from peripherals, and an index related to time.

\* Option: SOP-LISENDO880-34 (includes eTRACKING software.)

Blood-pressure gauge is necessary for this examination.

## General Specifications

### Acoustic Power

- 0 to 100%, 1% step

### Preset Function

- 100 kinds (Max. 10 kinds per each probe)
- Preset contents storable in USB memory
- Q.S.S.(Quick Scanning Selector)  
Image modifying parameters (e.g. Gain, frequency, depth) of your choice can be registered. (Up to 4 sets per preset)  
These parameters can immediately be registered and selected by touch panel during examinations.
- Set Preset is booted up in conjunction with ID information(BodyParts or etc,)

### Characters and graphic displays

- Character input area:  
ID\*, name, age, sex, retained text  
\*: Can be corrected after exam
- Input is possible with virtual keyboard on LCD panel
- Automatic Annotation Labeling:  
800 words (User registration is possible.)
- Body mark:  
38 kinds are available per each region.  
8 regions+1 user are able to register.  
Body mark editor to create user's body mark: Available  
Probe mark: 4 kinds  
Display position: changeable  
Fetal body mark: rotatable
- Assist line display (Probe dependent)

### Menu control

- 10.4-inch color TFT LCD touch panel

### Active Probe Ports

- For electronic scanning probes: 6 (4 active, 2 parking)
- For independent probes\*: 1

\*Option: EU-9187B

### Input/Output Signals

- Data Input/Output
  - USB2.0 : 9 channel  
(Main unit 6+ Operation Panel 3)
  - USB3.0 : 1 channel
- Digital Video Input/Output
  - DVI-D digital : 2 channel(Output 1, Input1)  
Resolution: Full HD(1600x900)
- Analog Video Input/Output

### Output

- Color composite (BNC): 1 channel
- Y/C: 1 channels

### Input

- Y/C: 1 channel
- Network
  - LAN (Wired, Wireless)
- Others  
Audio (L/R): 2 channel (Output 1, Input 1)

### Viewing Monitor

- 22 inch OLED display  
Resolution: WXGA++ (1600 x 900)
- Tilt and swivel are possible.
- Height adjustment and swivel together with operation panel

### Safety Regulation

- IEC 60601-1 Ed.3.0: 2005, IEC 60601-1 Ed.3.1: 2012  
Class I, Type BF

### Environmental Requirements

#### In Operation

- Temperature: +10 to +40 degrees C
- Relative Humidity: 30 to 75%  
(non condensing)
- Atmospheric pressure: 700 to 1060 hPa
- Altitude: Up to 3000m

#### In Storage/transportation

- Temperature: -10 to +50 degrees C  
(0 to +50 degrees C for mechanical probes)
- Relative Humidity: 10 to 90%  
(non condensing)
- Atmospheric pressure: 700 to 1060 hPa

### Power Requirement

- 100 to 120/ 200 to 240V  $\pm 10\%$ , 50 or 60 Hz,  
Max. 1300 VA (with optional recorders connected)  
Max. 900 VA (main unit only)
- Shutdown tool  
Hibernation\*  
\*It is possible to remain condition when it is taken off plug.

### Dimensions

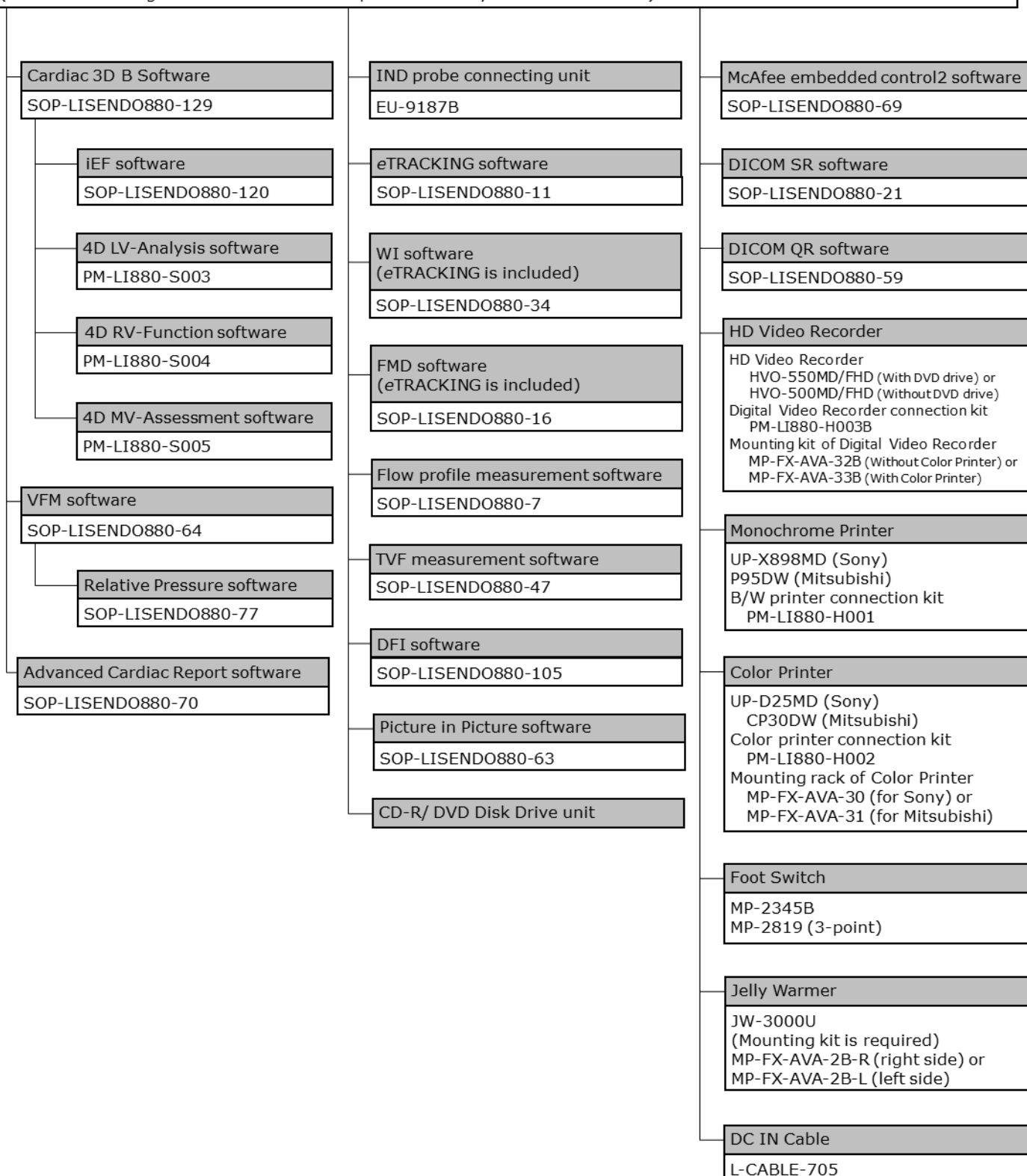
- 55 cm (W)  $\times$  90 cm (D)  $\times$  122 – 169.5cm (H)

### Weight

- 150 kg (main unit only)

## System Configuration

LISENDO 880LE Main unit  
(includes a viewing monitor IPF-2201 and Alphanumeric keyboard unit EU-9186)





## OPTIONAL PROBES

### Electronic convex sector probes

Application (description)	Model	Frequency range (MHz)	Scanning angle (degrees)	Optional accessories
Abdominal	C35	8.0-2.0	70	Needle Guide - Ultra-Pro 644-082 (CIVCO) *
Abdominal	C251	5.0-1.0	70	Needle Guide - Ultra-Pro 644-082 (CIVCO) *
Abdominal	C252	6.0-1.0	70	Needle Guide - Ultra-Pro 644-082 (CIVCO) *
Abdominal	C42	8.0-4.0	80	Puncture Adapter EZU-PA532 Needle Guide - Ultra-Pro 644-077 (CIVCO)*
Intraoperative	C42K	10.0-4.0	65	Puncture Adapter MP-2783, MP-2458

\* Needle Guide Replacement Kit 610-608(CIVCO) is necessary.

### Electronic linear probes

Application (description)	Model	Frequency range (MHz)	Scanning width (mm)	Optional accessories
Small Organ	L34	7.0-3.0	38	Coupler attachment EZU-PA3C1H Other Attachment EZU-PA3C1 EZU-PA3C2
Peripheral Vessel	L441	12.0-2.0	38	-
Small Organ	L64	18.0-5.0	38	Needle guide bracket EZU-PA7L3
Intraoperative	L53K	15.0-3.0	25	Waterproof case WP-001

### Electronic phased array sector probes

Application (description)	Model	Frequency range (MHz)	Scanning angle* (degrees)	Optional accessories
Cardiac Adult	S121	5.0-1.0	120	-
Cardiac Pediatric	S31	9.0-2.0	100	-
Neonatal Cardiology	S42	14.0-3.0	100	-
Cardiac, TEE	S3ESL1	9.0-2.0	100	-
Cardiac Adult, TEE	S3ESEL	8.0-2.0	100	-

\*Wide Scanning ON

### CMUT(linear probes)

Application (description)	Model	Frequency range (MHz)	Scanning width (mm)	Optional accessories
Peripheral Vessel	SML44	22.0-2.0	38	-

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## Matrix 3D(4D) Probes\*

\***SOP-LISENDO880-129** is necessary

Application (description)	Model	Frequency range (MHz)	Scanning angle (degrees)	Optional accessories
Cardiac Adult, TEE	MXS2ESLL	10.0-1.0	90	-
Cardiac Adult, TEE	MXS2ESLL1	10.0-1.0	90	-
Cardiac Adult, TTE	MXS1	5.0-1.0	90	-

## Independent CW Doppler Probes\*

\* Independent probe connection unit **EU-9187B** is necessary.

Application	Model	Frequency range (MHz)	Optional accessories
Cardiac Adult	UST-2265-2	2.0	-
Cardiac Adult	UST-2266-5	5.0	-

## Probes and available functions

### Convex sector

Function Probe	CW	Dual Gate Doppler	Compound	DFI	eFLOW	Panoramic View	TDI	CHI (High)	CHI (Mid)	CHI (Low)	HdTHI	WbT	FmT	HI Framerate(CF)	HI Framerate(B)	eFocusing
C35	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C251	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C252	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C42	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C42K	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

### Linear

Function Probe	VFM Vascular	Dual Gate Doppler	Trapezoid	Compound	CW	ET/FMD/VI	DFI	eFLOW	Panoramic View	TDI	CHI (High)	CHI (Mid)	CHI (Low)	HdTHI	WbT	FmT	HI Framerate(CF)	HI Framerate(B)	eFocusing
L34	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
L441	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
L64	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
L53K	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

### Phased array sector

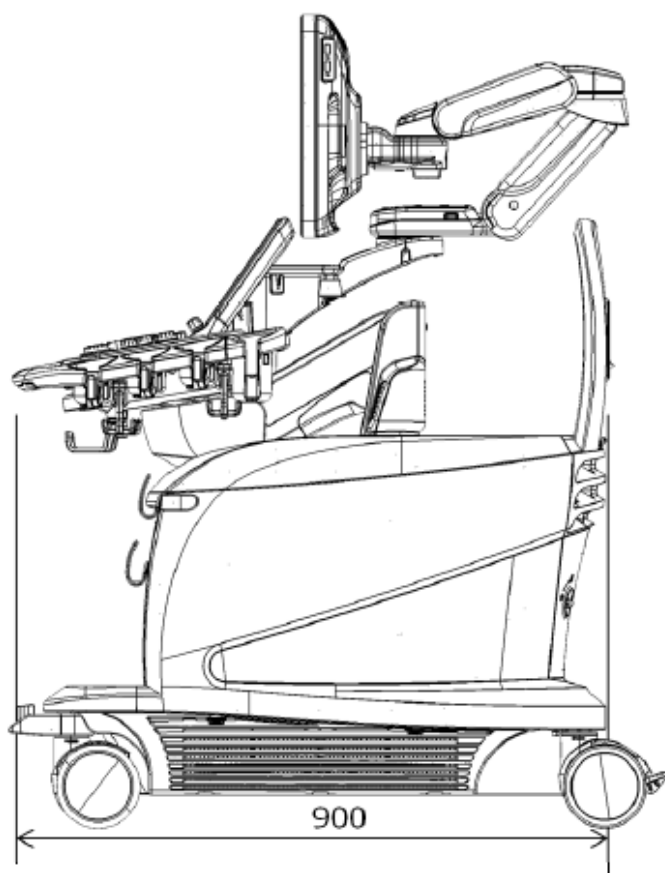
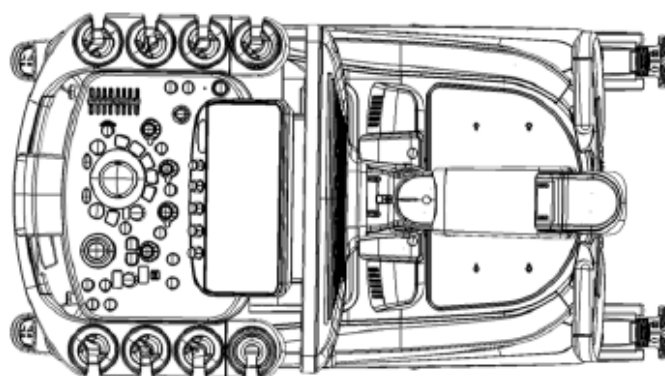
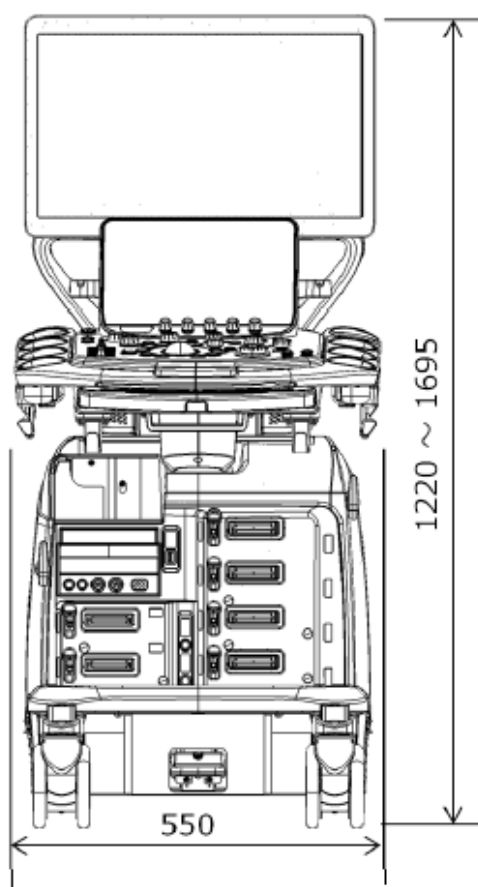
Function Probe	VFM Cardiac	Dual Gate Doppler	CW	eFLOW	TDI	CHI (High)	CHI (Mid)	CHI (Low)	Wide Scanning	HdTHI	WbT	FmT	HI Framerate(CF)	HI Framerate(B)	eFocusing
S121	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S31	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S42	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S3ESL1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S3ESEL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

### CMUT(Linear)

Function Probe	Dual Gate Doppler	Trapezoid	Compound	CW	ET/FMD/VI	DFI	eFLOW	Panoramic View	TDI	CHI (High)	CHI (Mid)	CHI (Low)	HdTHI	WbT	FmT	HI Framerate(CF)	HI Framerate(B)	eFocusing
SML44	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Matrix 3D (4D)/ Independent

Function Probe	eFocusing	HI Framerate(B)	HI Framerate(CF)	FmT	WbT	HdTHI	CHI (Low)	CHI (Mid)	CHI (High)	TDI	eFLOW	CW	Dual Gate Doppler	Biplane	Cardiac 3D B	4D LV-Analysis	4D RV-Function	4D MV-Assessment	IEF	VFM Cardiac
MXS2ESLL	-	✓	-	-	-	-	-	-	-	✓	-	✓	-	✓	✓	✓	✓	✓	-	✓
MXS2ESLL1	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	-	✓	✓	✓	✓	✓	-	✓
MXS1	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
UST-2265-2	-	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-	-
UST-2266-5	-	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-	-



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- The specifications may be different depending on configuration, probe, setting parameter and they are subject to change without notice.
  - The standard components and optional items differ depending on the country.  
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