SmartUs

Color Doppler Digital Ultrasound Diagnostic System

TECHNICAL DATA SHEET

SmartUs EXT-1M - Color Doppler

SmartUs EXT is a new generation of high performance PC-based Color Doppler ultrasound system.
It employs the latest innovations of Telemed research in ultrasound beamforming technology.

The system is capable to drive high density and high frequency transducers delivering detailed, rich and high dynamic range images.
Featured with high sensitivity sector Phased Array, Linear, Convex, Microconvex and Intracavitary transducers, SmartUs is a innovative flexible open architecture ultrasound platform which offers great expansion potential.

Features include spatial compound, trapezoid imaging, B-steer imaging, tissue harmonics, advanced speckle reduction imaging, automatic image optimization, ect.
Telemedicine functions with remote control, for distance consultation, application training and remote support.

SmartUs offers premium performance and uncompromising image quality in all diagnostic ultrasound applications: abdomen, obstetrics, gynecology, cardiology, vascular, urology, andrology, small parts, musculoskeletal, endocrinology, breast, ect.

SmartUs EXT can be configured also as traditional trolley ultrasound system with customized cart, ultrasound consolle, touch-screen display, etc.

Optional software for 3D rendering and Panoramic Imaging.

Technical Specifications

Scanning Methods

- electronic linear
- electronic convex
- electronic microconvex
- electronic phased array
- scanning depth: 2 - 30 cm

Imaging Modes

- B
  - B mode
  - Spatial Compound
  - Trapezoid Imaging - Virtual Convex
  - B-steer Imaging
  - Tissue Harmonic Imaging with Pulse Inversion (ITHI)
- B+B
- 4B
- B+M
- M
- CFM - Color Flow Mapping
- PDI - Power Doppler
- DPDI - Directional Power Doppler
- PWD - Pulsed Wave Doppler
- CWD - Continuous Wave Doppler
- B+PWD/CWD (Duplex)
- B+CFM/PDI/DPDI+PWD/CWD(Triplex)
- High Pulse Repetition Frequency (HPRF)

- PanoView - Panoramic Imaging (option)
- 3DView (option)

Transducers

- Frwquency range: 1,5 - 18,0 MHz
- multifrequency
- automatic transducer recognition
- number of ports: 1

Image Processing

- High Line Density scan mode for better resolution
- TGC Control, 5-10 sliders (customizable) 40 dB
- dynamic range: 120 dB, 8 values
- overall gain control
- M - mode sweep speed control
- acoustic power control

- variable frame averaging
- brightness, contrast controls
- advanced gamma control: 8 fixed curves, 8 user defined (custom)
- scan direction, rotation, up-down controls
- negative / positive control
- bi-linear interpolation
- echo enhancement control
- noise rejection function
- Advanced Speckle Reduction Imaging and structure improvement
  - PureView: 8 algorithms
  - NeatView: 8 algorithms
  - QuickView: 8 algorithms

Focusing

- digital transmit focusing: variable, 8 zones
- digital receive focusing: point to point, dynamic

Color Doppler

- PRF variable: 0.5-15 kHz
- wall filter settings: 3 steps (5%, 10%, 15% PRF)
- gain control: 50 dB
- acustic power control
- steering angle for linear transducers: up to ±30°
- CFM palette: 10 color maps
- PDI/DPDI palette: 14 color maps
- B/Color priority control
- color threshold control
- CFM baseline control
- Doppler frequency selection: 2 frequencies / each transducer
- color frame averaging (persistance): 8 values
- Transparent Color Mapping (TCM): 10 values
- Menu-Options Color Doppler settings controls:
  - Real-time spatial filter: 4 values
  - Line Density: 7 values
  - Pulse length: 7 values
  - CFM Packet size: 4 values
  - PDI/DPDI Packet size: 4 values
  - PDI/DPDI Dynamic Range: 40 dB
  - PDI/DPDI Digital Gain scale

Pulsed Wave Doppler / Continuous Wave Doppler

- PRF variable: 1-20 kHz
- wall filter settings: 16 steps (2.5-20% PRF)
- gain control: 50 dB
- acustic power control
- steering angle for linear transducers: ±30°

- stereo sound: volume control
- correction angle ±85°
- baseline control
- sweep speed control
- PWD/CWD palette: 12 color maps
- Doppler frequency selection: 2 frequencies / each transducer
- PWD/CWD Digital gain control: 5 values
- real-time trace line with automatic calculation of spectrum parameters
- Menu–Options PWD/CWD settings controls:
  - PWD/CWD Dynamic Range: 80 dB
  - PWD/CWD Smoothing
  - Spectral Averaging

Automatic Image Optimization

- single click auto adjustment:
  - B-image: gain, dynamic range, TGC sliders
  - Color Doppler: CFM/PDI/DPDI gain
  - PWD/CWD: baseline, invert, PRF

Ultrasound Imaging

- ultrasound image size: automatically adjustable to screen resolution
- gray scale: 256
- color scale: 256
- full motion and full size real-time ultrasound imaging, up to 120 fps (depends on selected scan depth, scan angle, focus mode, High Line Density setting, computer speed)
- cineloop recording/play: several thousands frames (depends on computer memory size and scan mode)
- zoom mode: from 60% to 600% in all modes (Scan, Freeze, B, B+B, 4B, Doppler modes, M-zoom, cineloop and etc)
- viewing area variable for frame rate maximizing: 6 steps
- thumbnail mode: up to 32 images
- "Freeze" mode
- "Auto Freeze" mode

Functions

- mouse / trackball / keyboard /touch screen operation
- unlimited programmable presets for clinically specific imaging
- body marks, anatomical icons with transducer position indicator
- annotations and drawings
- echo-guided biopsy trace and target settings, calibration
- patient reporting and archiving:
  - Creation of patient folder for archiving patient data, reports, images/video
  - Customization of report: templates, report layout (patient data, diagnostic images, measurements and calculations, curves and diagrams, comments, etc.)
- direct e-mail sending with image / video / report attachment via Internet
- DICOM file push to server
- printing to PC printer or thermal printer

- TV output via computer display adapter
- multi-monitor support
- full screen and window mode
- LB-2 ultrasound consolle (optional) support
- ultrasound scanner monitor and system information
- Telemedicine functions with remote control of the system, for diagnostic consultation, application training and technical support
- software upgrades download link

User Interface Customization

- set of predefined skin schemes for software interface
- set of predefined buttons images
- classic ultrasound interface
- full screen and window mode
- multilanguage support
- ultrasound area size
- font size
- B+M layout position, size

Image and video save / load formats:

- AVI
- JPG
- BMP
- PNG
- TIF
- XLSX
- DCM (DICOM uncompressed)
- DCM (DICOM-JPEG RGB/YBR)
- DCM (DICOM-JPEG RGB/YBR Video)
- TPD (Telemed Picture Data) - Raw Data
- TVD (Telemed Video Data) - Raw Data

  Raw Data formats TPD and TVD allow post-processing functions on saved images/video (measurements, calculations, zoom, speckle reduction, gamma, palette, reporting etc.)

DICOM

- Verification SCU
- Modality Worklist (MWL) SCU
- Modality Performed Procedure Step (MPPS) SCU
- Store SCU (images, video)
- Print SCU (grayscale, color)

Measurements and Calculations

Measurements and calculations: general, abdominal, obstetrics, gynecology, urology, vascular, endocrinology, musculoskeletal, cardiology.
Doppler velocimetry calculations with manual and automatic PW trace line analysis

- **General measurements and calculations**

  B mode measurements and calculations
  - o Distance
  - o Length (method: 1 trace)
  - o Area, Circumference (methods: 1 ellipse, 1 trace, 1 distance)
  - o Volume (methods: 1 distance, 2 distances, 3 distances, 1 ellipse)
  - o Angle (methods: 2 distances, 3 distances)
  - o Stenosis % (methods: 2 distances, 2 ellipse or trace areas)
  - o A/B Ratio (methods: 2 distances, 2 ellipse or trace areas, 2 ellipse or trace circumferences)

  M mode measurements and calculations
  - o Distance, Time, Velocity
  - o Heart Rate (methods: 1 beat, 2 beats)
  - o Stenosis % (method: 2 distances)
  - o A/B Ratio (methods: 2 distances, 2 times, 2 velocities)

  PW/CW Doppler mode measurements and calculations
  - o One-point PWD/CWD measurements and calculations:
    - ▪ Velocity
    - ▪ Pressure Gradient (PG)
  - o Two-points PWD/CWD measurements and calculations:
    - ▪ Velocities difference
    - ▪ Pressure Gradients (PG) difference
    - ▪ Time interval
    - ▪ Acceleration
    - ▪ Resistivity Index (RI)
    - ▪ Heart Rate (methods: 1 beat, 2 beats)
    - ▪ Velocity minimum and maximum
    - ▪ Pressure Gradient (PG) minimum and maximum
  - o Trace-based PWD/CWD measurements and calculations:
    - ▪ Trace Time
    - ▪ Trace Velocity min, max, mean
    - ▪ Trace Pressure Gradient (PG) min, max, mean
    - ▪ Velocity Time Integral (VTI)
    - ▪ Pulsatility Index (PI)
  - o A/B Ratios of one-point PWD/CWD measurements:
    - ▪ Velocities A/B Ratio
    - ▪ Pressure Gradients (PG) A/B Ratio
  - o A/B Ratios of two-point PWD/CWD measurements:
    - ▪ Velocity differences A/B Ratio
    - ▪ Pressure Gradient (PG) differences A/B Ratio
    - ▪ Time differences A/B Ratio
    - ▪ Accelerations A/B Ratio
    - ▪ Resistivity Indexes A/B Ratio
  - o A/B Ratios of trace-based PWD/CWD measurements:
    - ▪ Velocity means A/B Ratio
    - ▪ Pressure Gradient (PG) means A/B Ratio
    - ▪ Pulsatility Indexes A/B Ratio

- Velocity Time Integrals A/B Ratio

PW/CW Doppler mode calculations
- HR, SV using Flow Area, SV using Flow Diameter, SI, CO, CI, Area calculations using Continuity Equation (methods: Area and VTI, Area and Velocity, Diameter and VTI, Diameter and Velocity), Velocity Ratio (S/D, D/S), dP:dt, Flow Volume (methods: Diameter, Area), PHT, MVA

- **Obstetrics (OB) measurements and calculations**

  - Measurements: LMP (entered or from calendar), AC, BPD, FL, HC, FTA, AAPD, ATD, TAPD, TTD, CRL, GS, HL, TL, UL, OFD, BOD, Cereb, Clav, Rad, AFI, FHR, NT
  - Doppler mode measurements:
    - Umbilical Artery (UA): RI, PI, PSV, EDV;
    - Middle Cerebral Artery (MCA): RI, PI, PSV;
    - Ductus Arteriosus (DA): Diam, PSV;
    - Main Pulmonary Artery (MPA): Diam, PSV;
    - Uterine Artery (UtA): RI, PI
  - Doppler mode calculations: Umbilical Artery (UA): PSV/EDV; CPR
  - Estimated date of birth (EDD) calculations: EDD(LMP), EDD(GA), EDD(AUA)
  - Ratios: FL/AC, FL/HC, FL/BPD, HC/AC, CI
  - Estimated Fetal Weight (EFW) calculations: EFW(AC), EFW(AC,BPD), EFW(AC,FL), EFW(AC,HC), EFW(AC,HC,BPD), EFW(FL), EFW(AC,FL,HC), EFW(AC,BPD,FL), EFW(AC,BPD,FL,HC), EFW(BPD,FL,FTA), EFW(BPD,ATD), EFW(BPD,TTD), EFW(BPD,TAPD,TTD), EFW(BPD,FL,TAPD,TTD)
  - Average EFW calculated using selected EFW values
  - Gestational Age (GA) calculations: GA(AC), GA(BPD), GA(CRL), GA(FL), GA(GS), GA(HC), GA(HL), GA(OFD), GA(TL), GA(UL), GA(HC/AC), GA(FTA), GA(ATD), GA(TAPD), GA(TTD), GA(BOD), GA(Cereb), GA(Clav)
  - Fetal Growth estimation (trending): AC(GA), BPD(GA), CRL(GA), FL(GA), GS(GA), HC(GA), HL(GA), OFD(GA), TL(GA), UL(GA), [FL/AC](GA), [FL/HC](GA), [HC/AC](GA), EFW(GA), AAPD(GA), ATD(GA), TAPD(GA), TTD(GA), BOD(GA), Cereb(GA), Rad(GA), Clav(GA), AFI(GA), FHR(GA), NT(CRL)
  - Doppler mode Fetal Growth estimation (trending): UA_RI(GA), UA_PI(GA), UA_RATIO_S_D(GA), MCA_RI(GA), MCA_PI(GA), MCA_PSV(GA), CPR(GA), DA_DIAM(GA), DA_PSV(GA), MPA_DIAM(GA), MPA_PSV(GA), UTA_RI(GA), UTA_PI(GA)

    Selected Growth Tables are visualized as Fetal Growth Curves
    Software supports unlimited number of user-defined Growth Tables

- **Gynecology (Gyn) measurements and calculations**

  - Measurements: length, height, width of uterus, cervix, ovaries, renals, follicles
  - Volume Calculations: volumes of uterus, cervix, ovaries, renals, follicles

- **Abdominal measurements and calculations**

  - Liver: Volume (CC, AP, LL diameters)

- Gallbladder: Volume, Wall Thickness, Extrahepatic Bile Duct (EBD), Common Bile Duct (CBD), Common Hepatic Duct (CHD)
- Pancreas: Head Diameter, Body Diameter, Tail Diameter, Pancreatic Duct Head, Pancreatic Duct Body
- Spleen: Volume (length, width, thickness)
- Gastrointestinal Tract: Appendix Wall Thickness, Appendix Diameter, Bowel Wall Thickness (at Stomach, Small Bowel, Large Bowel)
- Urinary Bladder: Volume (length, height, width)
- Right / Left Kidney: Volume (length, height, width), Pelvis Diameter

- **Urology measurements and calculations**

  - Measurements: length, height, width of kidneys, bladder, prostate, testis
  - Volume Calculations: kidneys, bladder, prostate, testis
  - RUV (Residual Urine Volume)

- **Endocrinology measurements and calculations**

  - Measurements: length, width, thickness of thyroid lobes
  - Volume Calculations: thyroid lobes, thyroid

- **Vascular measurements and calculations**

  - Distance and area-based stenosis calculations: left (right) Subclavian, CCA (Common Carotid Artery), Bulb, ICA (Internal Carotid Artery), ECA (External Carotid Artery), Vertebral vessels at proximal, middle, distal locations
  - PSV/EDV (Peak Systole Velocity / End Diastole Velocity) ratios for each vessel and location
  - Ratios of velocities: ICA PSV/CCA PSV, ICA EDV/CCA EDV, ICA PSV/CCA EDV, ECA PSV/CCA PSV, ECA EDV/CCA EDV, ECA PSV/CCA EDV at Rt.(Lt.) Prox.(Mid., Dist.) locations

- **Musculoskeletal measurements and calculations**

  - Hip Angles (α, β)
  - Femoral Head Coverage (FHC)

- **Cardiology measurements and calculations**

  - Measurements of Left Ventricle, Aortic Valve, Left Atrial: IVSd (Interventricular Septal Thickness, diastole), LVIDd (Left Ventricle Internal Diameter, diastole), LVPWd (Left Ventricle Posterior Wall Thickness, diastole), AOd (Aortic Root Dimension, diastole), IVSs (Interventricular Septal Thickness, systole), LVIDs (Left Ventricle Internal Diameter, systole), LVPWs (Left Ventricle Posterior Wall Thickness, systole), LADs (Left Atrial Dimension, systole).
  - Calculations: HR (Heart Rate), BSA (Body surface Area), Left ventricle volume (methods: Cubed, Teichholz, Gibson, Simpson's LVAM-LVAP, Simpson's single plane, Simpson's biplane, Bullet, Ellipsoid single plane, Ellipsoid biplane), SV (Stroke Volume),

SI (Stroke Volume Index), EF (Ejection Fraction), CO (Cardiac Output), CI (Cardiac Index), STIVS (Interventricular Shortening), FS (Fractional Shortening), STPW (Posterior Wall Shortening), LVM (Left Ventricle Cardiac Mass), CMI (Cardiac Mass Index), LA/AO Ratio

Cardiology measurements package automatically displays hint images that show where and how appropriate measurements must be performed.

PW/CW Doppler mode Cardiology measurements and calculations

- o Left Ventricle: LVOT Diam, LVOT VTI, LVOT Vmax, SV (Stroke Volume), SI (Stroke Volume Index), CO (Cardiac Output), CI (Cardiac Index), dP:dt (Delta Pressure : Delta Time), MPI (Left Ventricle Myocardial Performance Index)
- o Mitral Valve: MVA(PHT) (Mitral Valve Area using Pressure Half Time), MVA using Continuity Equation (LVOT Diam, MV VTI; LVOT Diam, MV Vmax), dP:dt, E/A ratio
- o Aortic Valve: AVA (Aortic Valve Area) using Continuity Equation (LVOT Diam, AV VTI; LVOT Diam, AV Vmax), AVI (Aortic Valve Index), DPI (Dimensionless Performance Index), AV PHT (Aortic Valve Pressure Half Time)
- o Right Ventricle: RVOT Diam, RVOT VTI, RVOT Vmax, dP:dt, RV MPI (Right Ventricle Myocardial Performance Index), MPAP (Mean Pulmonary Artery Pressure)
- o Tricuspid Valve: TVA (Tricuspid Valve Area) using Continuity Equation (RVOT Diam, TV VTI; RVOT Diam, TV Vmax), TV E/A ratio, TV PHT
- o Pulmonic Valve: PVA (Pulmonic Valve Area) using Continuity Equation (RVOT Diam, PV VTI; RVOT Diam, PV Vmax), PVI (Pulmonic Valve Index), DPI (Dimensionless Performance Index), PV PHT (Pulmonic Valve Pressure Half Time)
- o Pulmonary Vein, Hepatic Vein
- o Shunts: Qp:Qs (Pulmonary-Systemic Flow Ratio)
- o Proximal Isovelocity Surface Area (PISA) method for mitral, aortic, tricuspid and pulmonary regurgitation: RFlow (Regurgitant Flow), EROA (Effective Regurgitant Orifice Area), RVol (Regurgitant Volume)

Power Supply

- external power supply, 100~240V AC, 50~60 Hz
- +12V, 2.5A input

Dimension, Weight

- dimension mm: 54 (W) x 220 (D) x 158 (H)
- weight: 1,4 kg

Ultrasound software

- TELEMED Drivers Package (32/64-bit Windows)
- Echo Wave II software (32/64-bit Windows)
- 3DView plug-in (optional, 32-bit Windows only)
- PanoView plug-in (optional, 32-bit Windows only)
- SDK documentation / sample code (available by agreement)
- Free software upgrades

Recommended Computer Requirements

- Windows® based Notebook/Tablet PC/Desktop/All-in-One
- Screen 1024x768 or more, IPS or PLS technology
- CPU Intel i3/i5/i7 1.8 GHz or faster
- 2 Gb of RAM or more
- Nvidia graphic card, 256 Mb, Cuda 2.2 (or higher version) support
- USB 2.0 - USB 3.0 interface
- Windows XP SP3, Windows Vista SP2, Windows 7, Windows 8, Windows 8.1 (all versions 32/64-bit)

Customer Care and Technical Support

Real-time Customer support with remote control via the Internet.
Freeware software upgrades.

SmartUs EXT-1M Kit includes:

- Smart Us EXT-1M beamformer
- USB cable
- 100~240 VAC, 50~60 Hz power supply (EN60601-1, UL2601-1 certified)
- AC power cable
- assembly and set-up manual
- operation manual
- software (CD-ROM)

  Ultrasound transducers are not included