M5
Diagnostic Ultrasound System

Datasheet

SHENZHEN MINDRAY
BIO-MEDICAL ELECTRONICS CO., LTD.

General information

Dimensions and weight

- Height: 75 mm (2.95 inch)
- Width: 361 mm (14.21 inch)
- Depth: 357 mm (14.06 inch) with handle
- Weight (main unit, without battery): less than 6 kg (13.23 lb.)

Electrical power

- AC adapter input
  - Voltage: 100VAC~240VAC
  - Frequency: 50/60 Hz
  - Input current: 2A (maximum)
- AC adapter output
  - Voltage: 12VDC
  - Output current: 10A (maximum)
- Battery
  - Exchangeable li-ion batteries: 11.1VDC, 4500mAh
  - Continuous scanning for more than 1h (normal condition)

User interface

Operator keyboard

- Soft keys for rapid and convenient control
- Home based and grouped design
- Alphanumeric keyboard
- 8-segment TGC, with remapping functionality at any depth
- Interactive backlit keys
- User-centric control panel with homebase design
- Blank keys for user-define functions
- Programmable softkeys

Display screen

- High-resolution color LCD
  - Diagonal dimension: 15 inch
  - Resolution: 1024X768
  - Brightness adjustment
- Integrated speakers
  - Volume adjustment

Ergonomic design

- Operation navigation: logical instructions for most operations
- System hibernation: switch off transducer transmitting, and launch screensaver
- Q-Click: icons to activate most frequently used functions
- Thumbnails for acquired images and cineloops
- Programmable two-pedal footswitch

System overview

Application

- Abdomen
- Cardiology
- Gynecology
- Obstetrics
- Urology
- Small Part
- Pediatrics
- Musculoskeletal
- Orthopaedics
- Intraoperative
- Peripheral Vascular
- Transcranial Doppler

Scanning method

- Electronic convex
- Electronic linear
- Electronic sector

Transducer types

- Convex array
- Microconvex array
- Linear array
- Phased array*

Imaging modes

- B mode
- M mode
- CDFI (Color Doppler Flow Imaging, Color)
- Power (Power Doppler Flow Imaging, including DirPower, directional power Doppler)
- Pulse Wave Doppler (PW)
- Continuous Wave Doppler (CW, option)*

Special imaging features

- Tissue harmonic imaging
- Steer scanning for linear transducers (B, color/power, PW independent)
- Trapezoid imaging for linear transducers
- HPRF for PW
- Multi-frequency in both 2D and Doppler imaging

Display mode

- Quad/dual display (for B, color and power modes)
- B/C Live (B and color simultaneous comparison display)
- Duplex for simultaneous B and PW/CW
- Triplex mode for simultaneous B, color/power, and PW/CW
- Time line display: left/right and top/bottom (1:1, 1:2, full)

Standard configuration

- High resolution 15 inch LCD display
- Pulse Wave Doppler
- HPRF
- Color Doppler Flow Imaging
- Power Doppler Flow Imaging
- Directional Power Doppler Flow Imaging
- Tissue Harmonic Imaging
- Trapezoidal Imaging
- iBeam (Spatial compounding imaging for linear probe)
- iTouch™ (Automatic image optimization by pressing one button)
- 80G integrated hard disk
- iStation™
- USB ports
- Ethernet port
- S-video out port and cable
- Measurement & calculation software packages
- Multi-language screen display
- Convex array transducer 3C5s (2.5/3.5/5.0/H5.0/H6.0MHz)
- Trolley case

Software options

- DICOM 3.0 software
- Free Xros™ Imaging (Anatomical M mode)*
- iScape™ View (Panoramic imaging, or extended field of view)
- Smart3D™ (Freehand 3D)

Hardware options

- Additional transducer connector
- CW*
- Transducers
- Needle guide brackets
- I/O module for data transportation
- USB V/A module for VCR connection
- USB ECG module with electrodes and cables (AHA/IEC)
- External USB DVD-R/W
- Spare battery
- Foot switch with programmable functionality
- Trolley

Peripherals

- Thermal B/W video printer
- Thermal color video printer
- Digital video B/W or color printer
- USB text/graph printer
- VCR
- DVD recorder

Imaging processing and presentation

System architecture

- Powerful Multi-beam Parallel Imaging (MBP)
- Fine Tissue Optimization (FTO)
- Transmitting Spectrum Focusing (TSF)
- Innovative Transmitting Apodization (ITA)
- Accurate Vessel Imaging (AVI)

Intelligent digital imaging process

- iTouch™: automatic image optimization
- IP(image processing): one key for B and color image fast optimization
- Q-click™: quick adjustment for parameters displayed on screen

Imaging platform

- All-digital broadband beam-former
- 1024 digital processing channel technology
- Displayed depth
  - Minimum: 26 mm, transducer dependent
  - Maximum: 308mm, transducer dependent
- Focus

  - 1~4 focus points selectable (depth dependent)
  - Up to 8 focal positions selectable (depth dependent)
- Wideband processing technology
  - Fundamental frequencies: 3 steps
  - Harmonic frequencies: 2 steps
  - Doppler frequencies: 2 steps
- Gray scale: 256 levels
- Total system dynamic range: 160 dB
- Zoom
  - RAZ (regional acoustic zoom)* and pan zoom
  - PIP (picture in picture)
  - Zoom ratio: up to 400%
  - For real-time or frozen images

B mode

- Acoustic power (10~100%，6% step)
- Gain (0-100%)
- TGC (8 segments, with re-mapping functionality at any depth)
- Frame Rate (up to 396f/s, transducer dependent)
- Focus number (1~4)
- Focus position (8 steps)
- Scan range (N, M1, M2, W)
- Line density (L, H)
- Steer (-6°,0,6)
- TSI (Tissue, Muscle, Fat, Fluid) *tissue specific imaging*
- 6
- Display dynamic range (up to 100dB)
- Frame average (0~7)
- 6
- Noise rejection (0~3)
- 6
- Image enhancement (off, 1~4)
- IP (1~8) *image processing*
- Colorize (7 maps)
- Gray map (1~8)
- Gray Transform
- Gray Rejection
- γ correction (0~3)
- Rotate (0°, 90°, 180°, 270°)
- Reverse (left/right, up/down)

M mode

- Display mode: scroll

- Sweep speed (1, 2, 4, 8 s/screen)
- Gain (0-100%)
- Display dynamic range (up to 100dB)
- M soften (0~4)
- Gray map (1~8)
- Colorize (7 maps)
- Time mark (on, off)

Color mode

- Gain (up to 29dB)
- Frequency (2 frequencies)
- Frame Rate (up to 448f/s, transducer dependent)
- Steer (-12º, -6º, 0º, 6º, 12º)
- PRF (1.3kHz~14.5kHz)
- Scale (±2.3cm/s~±246cm/s, up to 492cm/s in one direction, transducer dependent)
- Baseline (17 levels)
- Color map (1~11)
- Wall filter (0~7)
- Line density (L, H)
- Packet size (0-4)
- Flow state(L, M, H)
- Smooth (0~4)
- Persistence (0~4)
- Contrast (0~3)
- Priority (0~100%)
- Map reverse
- Focus position (10 levels)
- B/C wide (on, off) *automatically adjust the 2D image size according to the color ROI*
- ROI color (off, red, green, blue, cyan, MAG, yellow, white)
- B/C dual live (on, off)
- Image display (on, off)

PW/CW* mode

*CW mode is available only with phased array transducers.

- PW frequency (2 frequencies)
- PRF (1.3kHz~11.4kHz)
- PW Scale (±6.1cm/s~±291.7cm/s, up to 583.4cm/s in one direction, transducer dependent)
- CW Scale (±0.61m/s~±15.04m/s, up to 30.08m/s in one direction, transducer dependent)
- Baseline (9 levels)
- Sweep speed (1, 2, 4, 8s/screen)

- Sample volume (0.5~15.0mm)
- Sample depth (up to 308mm)
- Steer (-12º, -6º, 0º, 6º, 12º)
- Angle correlation (-80°~80°)
- Colorize (7 maps)
- Wall filter (7 levels, scale dependent)
- Auto Trace (Vmax, Vmean, Vmode)
- Triplex (on, off)
- Threshold (0~5)
- Trace Area (Below, Above, All)
- Trace smooth (off, 1~4)
- Trace sensitivity (0~5)
- Audio (on, off)
- Full screen(on, off)
- Time mark (on, off)

ECG

- Gain
- Position
- Trigger mode (single, dual, AT, timer)
- HR display

Power/ DirPower mode

- Display dynamic range (up to 70dB)
- Power Map (1~8)
- Line density (L, H)
- Packet size (L, M, H)
- Smooth (0~4)
- Persistence (0~4)
- Contrast (0~3)
- Priority (0~4)
- Reverse (on, off)
- B/C wide (on, off) *automatically adjust the 2D image size according to the ROI*
- LVR (Low velocity resistance) (off, 1~7)
- Focus position (10 levels)
- ROI color (off, red, green, blue, cyan, MAG, yellow, white)
- B/C live (on, off)
- Image display (on, off)

Free Xros™ Imaging (option)*

- Free Xros imaging is also called anatomical M mode.
- Available on all convex, linear and phased array transducers
- Based on real-time imaging or cineloop of 2D mode

- Sweep speed (1, 2, 4, 8 s/screen)
- Image enhance (off, 1~3)
- Gray map (1~8)
- Colorize (7 maps)
- Time mark (on, off)
- Store and review Free Xros™ images
- Store and review cineloop
- All M measurement items available

iScape™ View (option)

- iScape™ view is also called extended field of view imaging, or panoramic imaging.
- Available on all linear array transducers
- Based on real-time imaging of 2D mode (not available in Color or Power mode)
- Displays up to 40cm in length (frame rate and scanning speed dependent)
- Rotate (1º/step)
- Zoom (100%~400%, actual size, fit size)
- Colorize (7 maps)
- Store and review iScape™ images
- Store and review cineloop
- All 2D measurement items available, except depth, profile and histogram

Smart3D™ (option)

- Smart3D™ is also called freehand 3D.
- Available on all convex, linear and phased array transducers without sensor
- Method (linear, fan)
- Distance (1~50cm)
- Angle (10º~80º)
- Render (surface, max, min, X-ray)
- Threshold (0~63)
- Contrast (0~39)
- Brightness (0~39)
- Colorize (7 maps)
- Single or quad display
- Rotate
- Store and review Smart3D™ images
- Cut

Cineloop

- Support 2D, M, Spectral Doppler, Color, Power, DirPower
- Simultaneous and independent review in duplex/triplex mode
- ECG wave for retrospective review
- Capacity:

  - 2D, Color, Power, DirPower: Maximum >1200 frames
  - M, Spectral Doppler: Over 131s
- Variable cine playback speed
- User-define start and end frame of cine storage
- Permanent storage in hard disk and display in real-time and duplex modes
- iVision: Slides show function

iStation™

Intelligent patient information management platform

- Quick image and cine storage
- Auto image review automatic browser, icon review
- Offline analysis system
- Professional clinical reports with images embedded
- Integrated search engine for patient information
- Intelligent data backup
- Support DICOM worklist from server and file transportation in DICOM format on internet (option)

Storage

- 80 GB integrated hard drive
- External DVD-R/W (option)
- USB ports
- Still images storage format: BMP, JPG, DCM and FRM (defined by Mindray, support offline analysis function)
- Cine loops storage format: AVI, DCM and CIN (defined by Mindray, support offline analysis function)

Measurement and calculation

- Software packages for various specific clinical use
- Comprehensive analysis methods
- Clinical analysis reports

General Measurement package

General B mode measurement

- Depth
- Distance
- Angle
- Area
- Volume
- Cross Line
- Parallel Line

- Trace Length
- Ratio
- B Profile
- B Histogram

General M mode measurement

- Distance
- Time
- Slope
- Heart Rate
- General Color mode measurement
- Color velocity

General PW/CW mode measurement

- Velocity
- Acceleration
- Resistance index
- Spectrum trace
- Heart rate

Clinical Analysis Packages

Obstetrics

- Fetal measurement
- Fetal weight calculation
- Calculation items, such as HC/AC, FL/AC, FL/BPD, AXT
- Amniotic fluid index
- Fetal biophysical profile
- Fetus Doppler measurement
- Multi-fetus exam
- Estimated delivery date display
- Growth Curve: Four curves display for comparison
  (GA calculation formulas include but may not be limited to the following: Tokyo, Hadlock, Jeanty, Hohler, Merz, Kurtz, Sabbagha, Hansmann, Rempen, Osaka, Chitty, O"Brien and Warda. EFW formulas include Hadlock1, Hadlock2, Hadlock3, Hadlock4, Shepard, Merz1, Merz2, Hansmann, Tokyo, Osaka and Campell.)

Cardiac

- Left ventricular function measurement
  - Single Plane Ellipse method
  - Biplane Ellipse method
  - Bullet method

  - Simpson's method
  - Simpson's Single Plane Ellipse method
  - Simpson's Biplane Ellipse method
  - Cube method
  - Teichholz method
  - Gibson method
- Left ventricular
- Right ventricular
- Aortic
- Main pulmonary artery
- Mitral valve
- Tricuspid valve
- Pulmonary valve
- Pulmonary vein valve
- Volume flow
- Heart rate
  (Cardiac calculation results include but may not be limited to the following items: HR,EDV, ESV, SV, CO, EF, CI, SI, LV Mass, LVMWI, FS, MVCF, ET, PHT, MV-Area, VTI, MPG, MV-IRT, MV-DcT, RVSP, AoV-Area, RV-ET, RV-AcT, RV-PEP, RV-AcT/ET, RV-STI, PV DcT, PV-SF and Volume Flow.)

Gynecology

- Endometrium
- Uterus
- Uterine cervix
- Uterus/cervix
- Ovary
- Follicle

Small Parts

- Thyroid

Urology

- Prostate
- Left/right Seminal Vesicle
- Left/right Renal
- Left/right Adrenal
- Residual Volume
- Left/right Testicular

Orthopaedics

- Hip angel：BL, IL, ARL, Angle between BL/ARL, Angle between BL/IL

Peripheral Vascular

- Left/right Distal Common Carotid Artery
- Left/right Middle Common Carotid Artery
- Left/right Proximal Common Carotid Artery
- Left/right Distal Internal Carotid Artery
- Left/right Middle Internal Carotid Artery
- Left/right Proximal Internal Carotid Artery
- Left/right Distal External Carotid Artery
- Left/right Middle External Carotid Artery
- Left/right Proximal External Carotid Artery
- Left/right Distal Vertebral Artery
- Left/right Middle Vertebral Artery
- Left/right Proximal Vertebral Artery
- Left/right Distal Subclavian Artery
- Left/right Middle Subclavian Artery
- Left/right Proximal Subclavian Artery
- Left/right Distal Subclavian Vein
- Left/right Middle Subclavian Vein
- Left/right Proximal Subclavian Vein
- Left/right Bulbillate
- Innominate Artery
- Left/right Upper Extremity
- Left/right Lower Extremity
- Volume flow
- Stenosis

System setup

User-define functions

By user-define function, users could

- Customize twenty four user-define exam modes, including but not limited to
  - Exam mode name
  - Imaging parameters
  - General measurement items for each imaging mode
  - Measurement packages
  - Obstetric formula
  - Comment library
  - Body mark library
- Create new measurement items, or new calculations based on measurement results
- Set volume calculating index
- Assign frequently used functions to user-define buttons on control panel and foot switch

- Adjust key volume, key lightness and trackball speed

*Multi-language**

Screen display, keyboard layout and user manuals support

- English
- German
- French
- Spanish
- Portuguese
- Italian
- Russian
- Chinese

Operation system

- Windows™ XP Embedded system
  Windows is a registered trade mark of Microsoft Corporation.

Transducers

Sockets

- One universal array transducer socket
- One dedicated CW Doppler pencil socket
- Optional three universal array transducer sockets (additional transducer connector)

Models

- Convex array transducer 3C5s (2.5/3.5/5.0/T5.0/T6.0MHz)
- Linear array transducer 7L4s (5.0/7.5/10.0MHz)
- Linear array transducer 10L4s (8.0/10.0/12.0MHz)
- Linear array transducer 7L6s (5.0/7.5/10.0MHz)
- Biplanar transducer 6LB7s (5.0/6.5/8.0MHz)
- Convex array transducer 6CV1s (5.0/6.5/8.0MHz)
- Endorectal array transducer 6LE7s (5.0/6.5/8.0MHz)
- Convex array transducer 6C1s (5.0/6.5/8.0MHz)

Inputs and outputs

Main unit

- USB (2)
- Ethernet
- S-video out
- I/O module connector

I/O module

- USB (2)
- Parallel port
- Serial port
- Composite video out
- Audio out (L/R)
- VGA out
- Microphone in

V/A module

- S-video in
- Composite video in
- Audio in (L/R)

*Not available yet.